TRANSMITTERS
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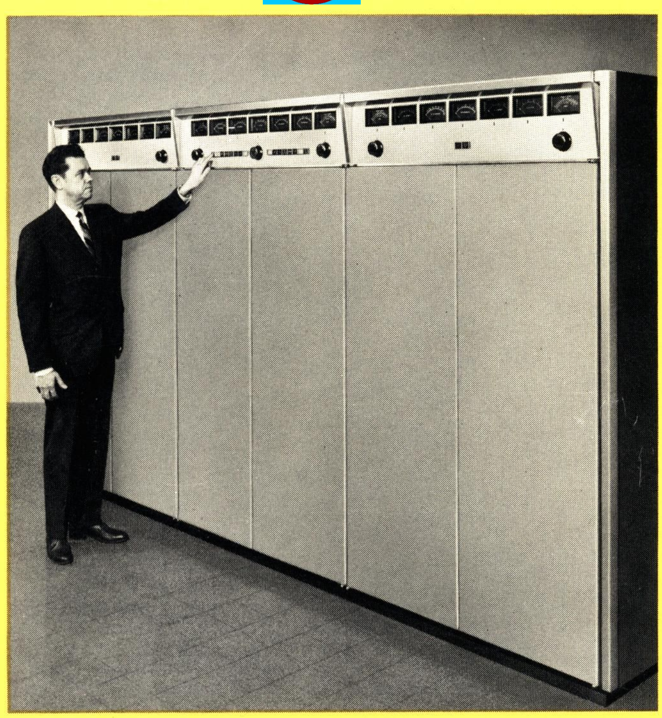
Transmitting VHF-TV Equipment



About This Catalog

This is one of several catalogs published by RCA Broadcast Systems Department. It describes RCA products that serve the VHF-television broadcast plant.

Other catalogs in this series describe equipment for the TV studio such as cameras, film and tape equipment; terminal and switching gear; audio items; UHF-TV transmitters; AM-FM transmitters; transmission line, towers and antennas.

These catalogs are available at RCA regional offices. Each office is staffed by a sales representative with broad experience in the broadcast business. He can help you plan your equipment facilities and supply the information you need.

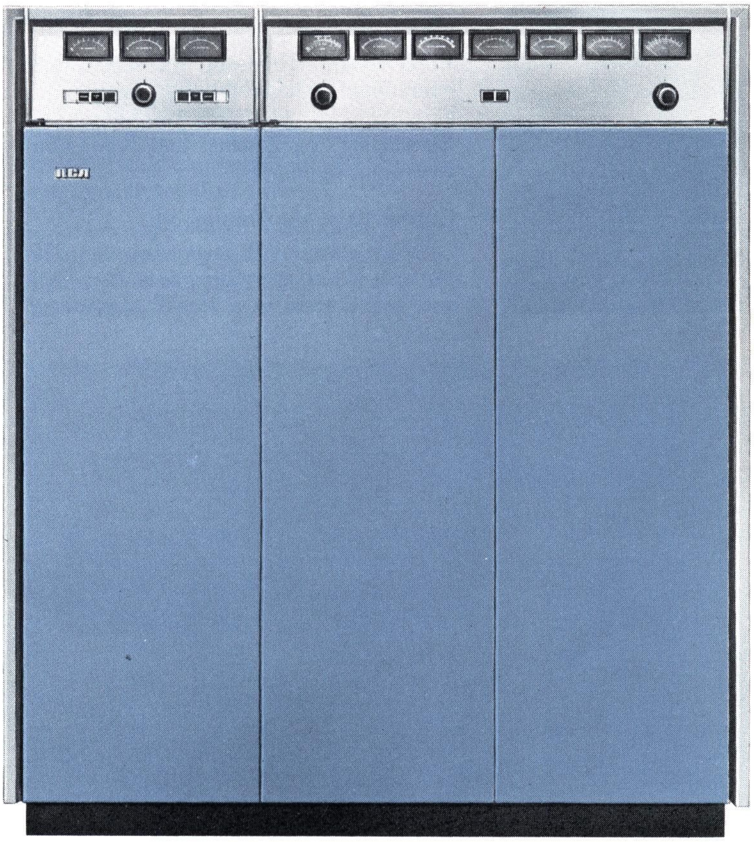
Contents

RCA

catalog B.4022

PRELIMINARY

Solid State VHF Transmitter, Type TT-15FL



- Economy, stability and reliability
- Uses but five tubes of only three types
- New standard for color fidelity
- Ready for remote or computer control
- Solid-state electronics to IPA level
- Extra installation flexibility

1VB

Solid State Reliability

Five-watt exciter fully solid state

Visual modulator fully solid state

Driver Amplifiers fully solid state

Description

As new as technology allows, the TT-15FL is a 15-kilowatt lowband-VHF transmitter offering solid-state circuitry in all stages except for the visual and aural finals and drivers. There are but five electron tubes in the entire transmitter and of only three types. It delivers the sharpest, highest quality television signals of any contemporary TV transmitter.

Highest TV-Broadcast Standards

Designed so far ahead of present-day transmitters, a design that won't be outdated for years to come, most of the TT-15FL published specifications are at least twice as good as those of previous models. And this is with stability so solid that the transmitter holds specifications for 30 days and longer without readjustment.

Full Remote Control

Featuring full remote control provision with a generous complement of remote indicators and meter outputs, the TT-15FL makes diagnosis, corrections and operational changes simpler than ever. It also includes provisions for automatic log-keeping equipment and computer-controlled operation.

Conservatively Designed

From a technical viewpoint, the TT-15FL is about everything a station engineer might want in a 15-kW transmitter. For example, the TT-15FL uses every practicable design technique to increase transmitter reliability in that all electronic devices operate well below maximum ratings; a unique cavity design increases tube life and, thus, reliability through improved cooling while quick-acting overload relays automatically prevent component damage.

Low-Pressure Air Cooling

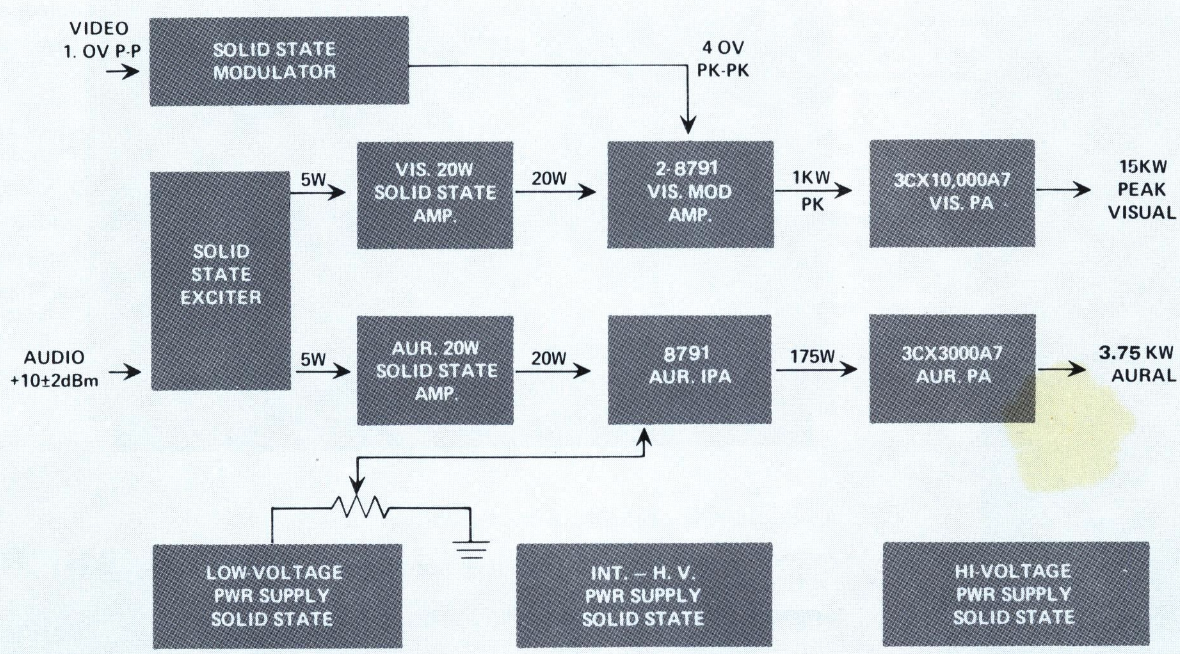
Because the transmitter uses only five electron tubes operating in very efficient circuitry, its requirements for cooling air are considerably less than those of other transmitters. As a result, the TT-15FL needs only *low*-pressure air as the cooling medium. This fact reduces blower capacity, air velocity, blower motor size as well as reducing noise, vibration and mechanical wear. This extends system reliability.

Solid-State Circuitry

All TT-15FL circuitry up to the 20-watt level—on both the visual and aural channels—is solid state. Arranged in a series of plug-in modules, the solid state electronics use glass-filled epoxy circuit boards with gold-plated, etched-wiring connectors for extra stability and long life.

Push-Pull Visual Modulation

One of the reasons for the TT-15FL transmitter's excellent picture quality is its visual modulator. The solid state mod-



15kW in only five tubes of only three types.

ulator swings driver-amplifier grid bias in a heavily loaded circuit which improves both stability and drive regulation while modulating the carrier.

Sideband Filter Included

In keeping with RCA policy, the TT-15FL includes a high-level sideband filter at no extra cost. High level sideband shaping assures compliance with adjacent-channel attenuation requirements.

Circuit Details

Five-Watt Exciter System

Consisting of seven plug-in modules, the exciter unit houses the aural and visual exciter system, their associated power supplies and appropriate metering facilities (see illustration and block diagram).

The aural exciter uses a frequency-modulated oscillator in an AFC feedback loop, operating at one-half carrier frequency. A buffer amplifier isolates the oscillator from the doubler stage and the two subsequent power amplifiers which raise the power level to five watts.

The AFC system maintains oscillator center frequency by comparing it with the frequency of a crystal controlled oscillator operating at 150 kHz above the aural oscillator. When this difference frequency varies, the AFC system develops a d-c error signal which, through a solid-state reactance circuit controls the aural oscillator accordingly. The end result is an aural carrier accurate to within 250 Hz (see *Specifications*).

Like the aural, the visual oscillator operates at one-half carrier frequency, crystal controlled. This output is doubled to carrier frequency before amplification to a five-watt power level in a pair of cascaded amplifiers capable of twice that power level.

Solid-State Driver Amplifiers

Identical 20-watt amplifier modules are used in the aural and visual r-f chains following the 5-watt exciter. These modules and their power supply and metering circuits consist of five plug-in modules in one standard frame.

The driver amplifiers operate at about one half of capacity for increased reliability and expected life.

Solid-State Visual Modulator

Consisting of four modules, the visual modulator subassembly contains its own power supply and uses some 38 transistors (of only eight types) and 25 diodes (of six types) to develop the push-pull grid-bias needs of the modulated amplifier.

Featuring motorized *Video Gain, Sync Gain,* and *Pedestal* controls, the modulator raises the 1-volt video level (from the line) to the 40 volts (p-p) the modulated amplifier ordinarily needs. The modulator's output capability exceeds 70 volts . . . another illustration of conservative design.

Separate circuits correct differential gain and phase with negligible interaction between the two. A feedback clamp restores the d-c level relative to modulator output or a demodulated sample of r-f output. The clamp tends to maintain constant transmitter output even with power line voltage variations.

Visual Modulated Amplifier

The visual modulated-amplifier design assures excellent linearity-amplitude-vs.-frequency-response and response-variation-with-brightness level as a result of the push-pull grid-bias system of modulation and the linearity characteristics of the 8791 ceramic-insulated tubes.

The power amplifier uses a 3CX10,-000A7 triode in a zero-bias arrangement with cathode drive. The PA cathode circuit is part of a double-tuned overcoupled plate circuit in the modulated amplifier. The result is a coupling circuit with extremely wide bandwidth which makes PA tuning simpler than ever.

Operating without neutralization as a result of the d-c grounded grid, the visual PA stage is extremely simple, stable and serviceable.

Aural IPA and PA

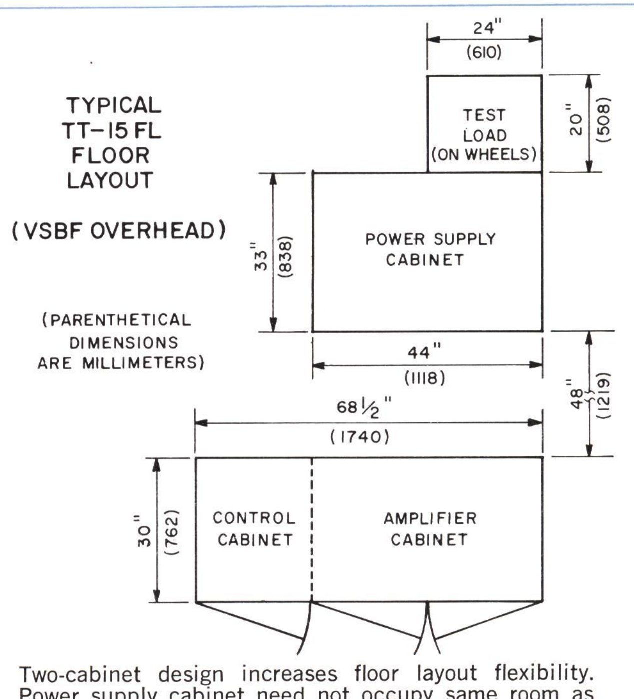
Operating in a Class C condition, the aural IPA uses an 8791 *Cermalox* tube in a circuit with heavy damping in the input. This system makes the IPA an excellent impedance match for the solid-state driver amplifier. As a result of the broadbanded input, routine tube change requires no retuning. A *pi* network couples and matches the IPA plate to the PA cathode circuit.

Using a 3CX3,000A7 triode in a grounded-grid, Class-C circuit, the aural PA requires no bias power and requires no neutralization. This adds much to its long-term stability and operational simplicity.

Motorized Tuning Controls

Since the transmitter is built for remote control, most of its tuning controls are motor driven. As a result, transmitter tuneup is a simple matter of front-panel button pushing. This is how it works:

Each control motor—there are ten of them—connects to a front panel two-way pushbutton. Pushing the topmost portion of the rectangular button actuates the motor in a direction that *increases* whatever function the motor drives. Similarly, pushing the lower portion of the pushbutton *decreases* the value of the variable component. The effects of these adjustments show up on the 20-circuit multimeter mounted on the same panel.



Two-cabinet design increases floor layout flexibility. Power supply cabinet need not occupy same room as Control and Amplifier cabinet.

Specifications

Performance

Type of Emission:
- Visual ... A5
- Aural ... F3

Frequency Range ... Ch 2-6

Rated Power Output:
- Visual ... 7.5 to 15 kW[1]
- Aural ... 0.75 to 3.75 kW

RF Output Impedance ... 50 ohms

Input Impedance:
- Visual ... 75 ohms
- Aural ... 600/150 ohms

Input Level:
- Visual ... 1.0 volts p-p min.
- Aural (for ±25 kHz dev.) ... +10 ±2 dBm

Amplitude vs. Frequency Response, Aural ... ±1 dB, 30 Hz to 15 kHz, of 50 μsec or 75 μsec pre-emphasis response curve

Visual Sideband Response:
- At Carrier +0.5 MHz to 2.0 MHz ... +1.0, −1.5 dB[2]
- At Carrier +3.58 MHz ... +1.0, −3.0 dB[3]
- At Carrier −0.5 MHz ... +1.0, −1.5 dB[2]
- Between +2.0 MHz to 4.18 MHz with respect to 3.58 MHz response ... +1.0. −1.8 dB[3]

Variation in Frequency Response with Brightness[4] ... ±0.75 dB

Carrier Frequency Stability[5]:
- Visual ... ±250 Hz
- Aural ... ±250 Hz

Modulation Capability:
- Visual ... 10%
- Aural ... ±50 kHz

Audio Frequency Distortion ... 0.5% max.[6] (30-15,000 Hz)

FM Noise (below ±25 kHz deviation) ... −60 dB

AM Noise r.m.s.:
- Visual ... −50 dB below sync level
- Aural ... −50 dB

Amplitude Variation over one picture frame ... Less than 2%[7]

Regulation of Output ... 3%

Burst vs. Subcarrier Phase[8] ... ±2°

Subcarrier Amplitude[8] ... 0.7 dB

Subcarrier Phase vs. Brightness[9] (diff. phase) ... ±2°

Linearity (diff. gain)[10] ... 0.5 dB

Linearity (Low Frequency) ... 1.0 dB

Envelope Delay vs. Frequency[11]:
- 0.2 to 2.0 MHz ... ±60 ns
- at 3.58 MHz ... ±30 ns
- at 4.18 MHz ... ±60 ns

Harmonic and Spurious Radiation[12] ... −80 dB

Electrical

AC Line Input ... 208/240 volts, 3 phase, 50/60 Hz (power consumption given below), and 115 volts single phase 50/60 Hz (100 watts)

Slow Line Variations ... ±5% max.

Rapid Line Variations ... ±3% max.

Phase Unbalance ... 2% max.

Regulation ... 3% max.

Power Consumption (at 15 kW peak visual, & 3.75 kW aural output):
- Average Picture ... 24 kW
- Black Picture ... 33 kW

Power Factor (approx.) ... 90%

Mechanical

Transmitter Cabinet:
- Width (front line cabinets) ... 68½″ (1740 mm)
- Height (cabinets) ... 77″ (1956 mm)
- Depth ... 30″ (762 mm)

Power Supply Cabinets:
- Width ... 44″ (1118 mm)
- Height ... 77″ (1956 mm)
- Depth ... 33″ (838 mm)

Finish ... Two-tone blue, brushed aluminum trim

Environmental

Maximum Altitude ... 7,500 feet (2286 m)

Ambient Temperature ... −20°C to 45°C

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1 Measured at output of sideband filter or filterplexer.
2 With respect to response at carrier plus 200 kHz, as measured by the BW-5 sideband response analyzer at transmitter mid-characteristic.
3 Measured at output of VSBF with respect to response at carrier +3.58 MHz. Add −0.75 dB at +4.18 MHz if filterplexer or notch diplexer is employed.
4 Measured at 65% and 25% of sync peak level with respect to response at transmitter mid-characteristic.
5 Maximum variation without circuit adjustment over a period of 30 days and over an ambient temperature range of 0°C to 45°C.
6 Including harmonics up to 30 kHz and measured with standard de-emphasis network.
7 Measured at blanking level.
8 Maximum departure from the theoretical when reproducing saturated primary colors and their complements at 75% amplitude.
9 Maximum phase difference with respect to burst, measured after the VSBF, for any brightness level between 75% and 15% of the sync peak using 10% (peak-to-peak) modulation.
10 Maximum variation in the amplitude of a 3.58 MHz sine wave modulating signal as the brightness level is varied between 75% and 15% of sync peak. The gain shall be adjusted for 10% (peak-to-peak) modulation of the 3.58 MHz signal when the brightness is at pedestal level. This is equivalent to 5% (peak-to-peak) modulation as indicated by a conventional diode demodulator connected after the VSBF.
11 Maximum departure from standard curve using TTS-1A. The tolerances vary linearly between 2.1 and 3.58 MHz and between 3.58 and 4.18 MHz.
12 Ratio of any single harmonic or spurious frequency to peak visual power.

Ordering Information

TT-15FL TV Transmitter, with tubes, solid-state color correction filters (including low pass filter), harmonic filters and motorized coaxial switches. Requires VSBF (MI-19085A-L) or Filterplexer (MI-19179A-L). For 208/240-volt 3-phase, 50/60-Hz input ... ES-560616

Communications Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

RCA Broadcast Systems

catalog B.4030

RCA "Maxim-Air" 30-KW VHF-TV Transmitter, Type TT-30FL

30-kW visual and 7.5-kW aural
Channels 2 thru 6

- Designed for the future
- New standard for color broadcasting
- Eliminates off-air time
- Solid-state circuitry . . . reliable
- Parallel redundant system
- Automated exciter switching . . . more redundancy
- Full remote control

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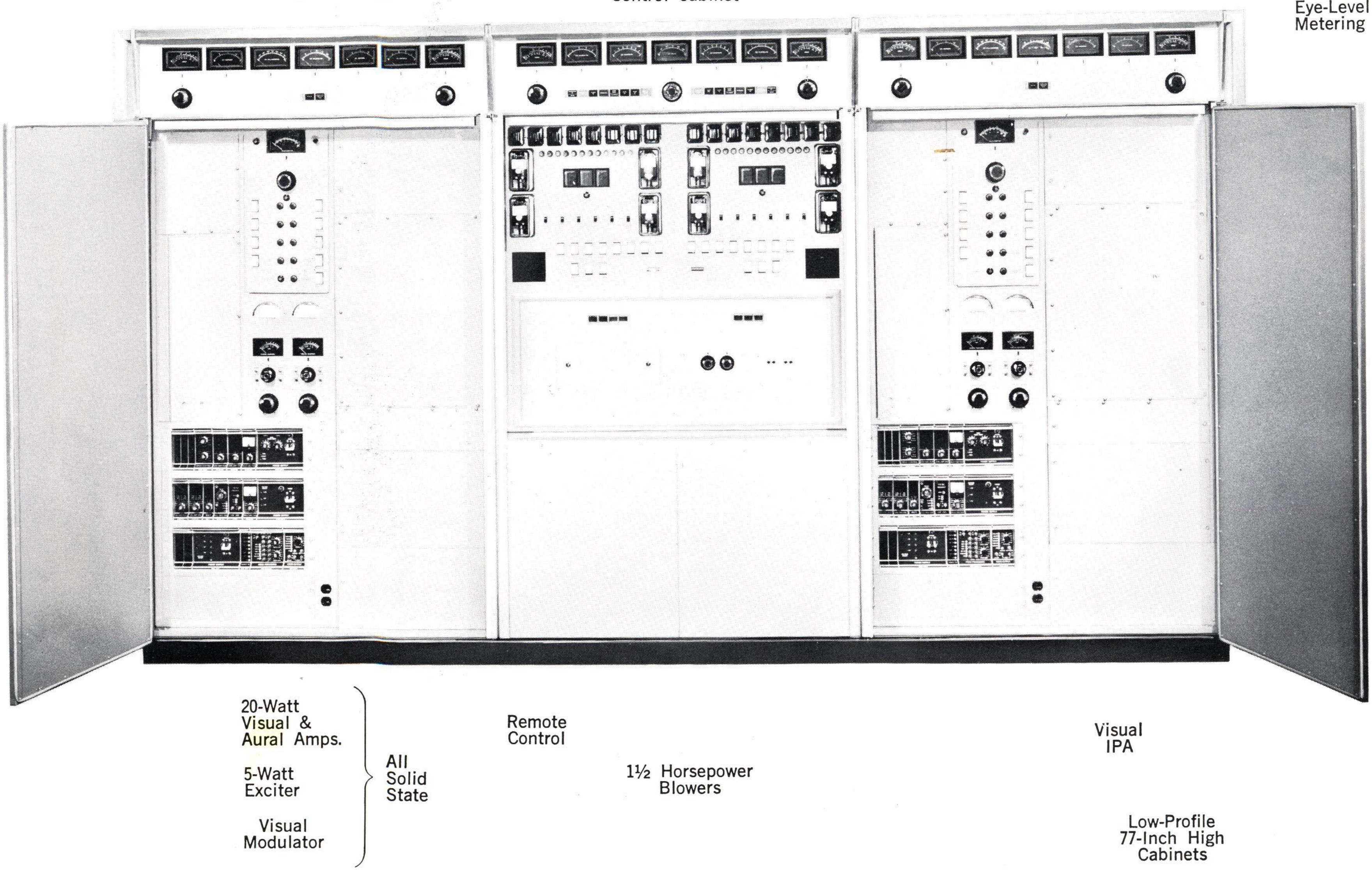
"MAXIM-AIR" TT-30FL VHF-TV TRANSMITTER

— Channels 2 through 6 —



"Maxim-Air" TT-30FL VHF TV Transmitter

The TT-30FL represents a major breakthrough in VHF-TV transmitter design. Its totally new solid-state circuitry makes maximum utilization of the newest advances in broad-band techniques. Inherently, the solid-state design requires fewer components, runs cooler and provides exceptional reliability.

The "Maxim-Air" is designed for high quality color or monochrome picture transmission and for high-fidelity sound transmission on Channels 2 through 6. The peak visual power is 30 kW, and the aural power is 7.5 kW. These power levels are attained by operating two 15-kW units in parallel, an arrangement that provides maximum on-air time.

The transmitter is packaged into three cabinets, making it possible to use space more efficiently. Because of the solid-state design and the use of only 10 vacuum tubes, the transmitter requires minimum floor space, consumes less operating power and requires an extremely small cooling system.

Motor-driven controls and remote metering of all major adjustments are features provided for unattended/remote control.

Description

Designed for the Future

The RCA "Maxim-Air" is a major breakthrough in VHF-TV transmitters . . . new high quality solid-state designs are used to achieve a sharp, clear and stable color signal . . . the best color signal transmission available to the home TV screen.

New Standard for Color Broadcasting

A transmitter designed so far ahead of other current models that you don't have to worry about being outdated for years to come. Compare specifications . . . it's designed with specifications twice as good as previous models. Ours are so good you only have to adjust the TT-30FL once a month to stay within specifications!!

Eliminates Off-Air Time with Solid-State Circuitry

No corners were cut . . . RCA designed the TT-30FL to be reliable . . . it wasn't just put together with solid-state components that someone said were reliable . . . we designed new and reliable solid-state circuits for your needs . . . circuits that just cruise along in daily operation . . . they're not overstressed. What can you expect from this new solid-state circuitry? It's the first step taken to eliminate your off-air time!!

There's more . . .

Eliminates Off-Air Time with a Parallel Redundant System

The big second step is a transmitter system comprised of two identical 15-kW units . . . this adds up to 30-kW of visual power into your antenna using only 10 tubes. If one transmitter unit fails . . . the other keeps you on the air . . . your audience in the primary coverage area doesn't even notice a change.

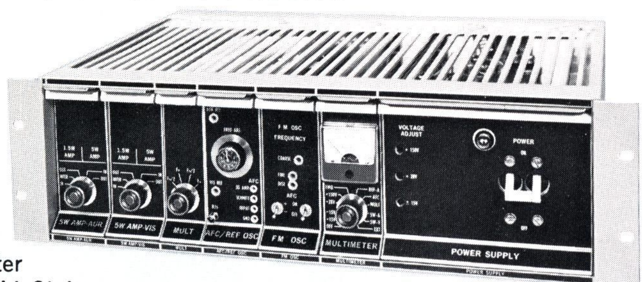
Eliminates Off-Air Time with Automated Exciter Switching

The third big step is a standby exciter that will automatically switch unnoticed if the operating exciter fails—while providing an indication that the exciters have switched.

Full Remote Control

"Maxim-Air" is designed for the future . . . with built-in transmitter operating and mode controls, metering points, status reporting devices and motorized tuning . . . it is ready for full remote control and automatic logging . . . and, eventually computer control.

SOLID-STATE CIRCUITRY



5-Watt Exciter
. . . All Solid State.

Visual Modulator
. . . All Solid State.

Visual and Aural 20-Watt Amplifiers
. . . All Solid State.

A Technical Description . . . For the Eyes of Engineering

The "Maxim-Air" TT-30FL is the first major breakthrough in VHF-TV transmitter design in 15 years . . . let's take a look at some of the design concepts and the resulting avalanche of benefits . . .

- Maximum Solid-State Use
- Long-Term Stability
- Increased Reliability
- Installation Flexibility
- Minimum Floor Space
- High Efficiency
- No Neutralizing
- Fewer Parts
- Low Blower Noise
- Only 10 Tubes
- Improved Specifications
- Simplified Tuning
- Easy Maintenance
- Economic Operation
- Grounded-Grid Triode
- No Bias Supplies
- Improved Cooling
- Standardized Modules

Conservative Design

"Maxim-Air" is designed using components that are capable of operating at ratings well above those used . . . the components aren't "pushed" to their limits . . . they operate at a more "reserved" pace. When you "push" a single component, its chances of failure increase . . . when you "push" many components, failure can become a way of operation. The TT-30FL is designed for reliable operation —its components are in no way "pushed".

In transmitters, a failure causes excessive stresses to be applied to parts in the failed circuit . . . causing additional failures to occur immediately, or later. Because the TT-30FL does not "push" components to their operating limits, the chances of excessive part stresses are greatly reduced . . . again, the TV broadcaster has greater reliability.

Solid-State Design

"Maxim-Air" was designed from the ground up with maximum utilization of solid-state devices—it was the only way to reach our conservative-design goals. A glance at the transmitter block diagram shows that only the IPA and PA stages use tubes . . . we couldn't find solid-state devices that would give the required power, reliability and operating economy so we did the next best thing . . . we applied our conservative design concept and selected tubes that would just coast along while they operate. Only 10 tubes of 3 different types are used . . . superior performance with 182 less tubes than its former version.

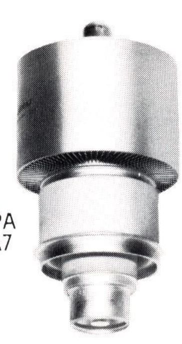
The solid-state design requires fewer components and consumes less operating power. Fewer components mean greater reliability . . . and, a smaller parts inventory . . . high-efficiency circuits mean less power and a cooler running transmitter. Superior mechanical design enables the use of a small 1½-horsepower blower motor for adequate cooling . . . the result is a transmitter with small blowers and low blower noise . . . and less cabinet vibration . . . and a cleaner cabinet interior because of lower air circulation.

Superior Performance – Only 3 Tube Types

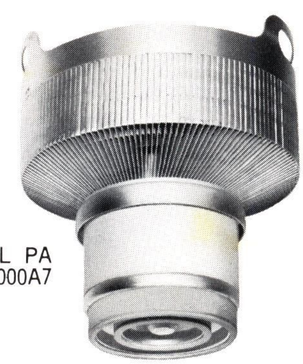
Tube Complement for a Single 15-kW Transmitter Unit— Total Only 5.

AURAL IPA
8791

AURAL PA
3CX3000A7



VISUAL PA
3CX10,000A7



"Maxim-Air" System Operation

Paralleled 15-kW Transmitter Units

Two identical 15-kW transmitter units are operated in a parallel system . . . their outputs add up to 30-kW peak visual power and 7.5-kW aural power. The operation of each transmitter unit is completely independent of the other . . . should a failure occur in one unit, the other continues to provide a non-distorted signal into the antenna system.

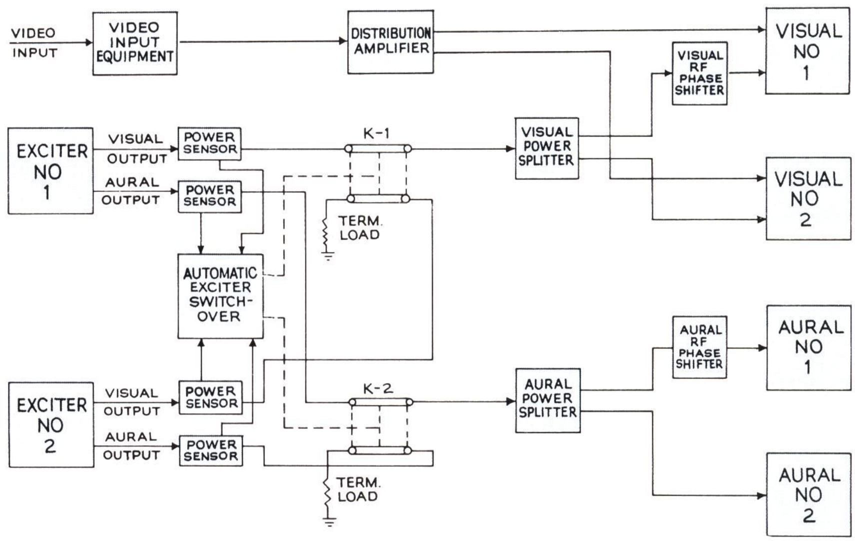
Redundant Solid-State Exciters

Two identical exciters feed into an automatic exciter switchover circuit . . . the circuit terminates the output of the standby exciter while the output of the operating exciter feeds the visual and aural stages. If the operating exciter output degrades or fails, it is automatically replaced by the standby exciter. The switchover circuit operates so quickly and smoothly that the video and audio are not interrupted.

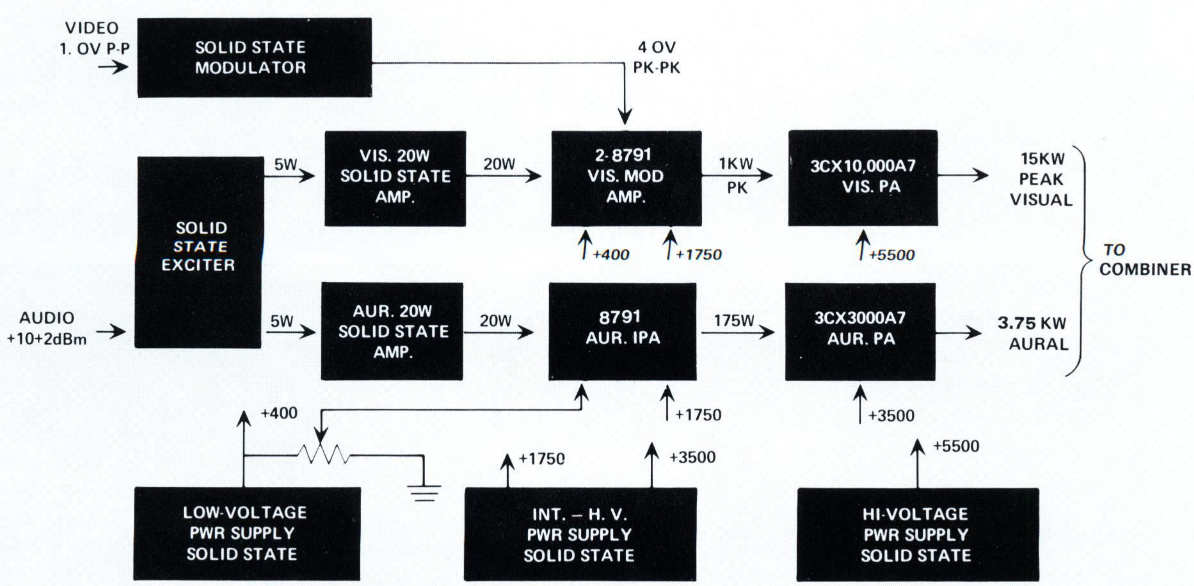
Hybrid Combiner Network

The output from each 15-kW transmitter unit is combined to provide antenna input powers of 30-kW visual and 7.5-kW aural. If a failure occurs in a transmitter unit, a 6 dB reduction in signal power occurs in the combining network . . . it is not even noticed within the primary coverage area. The full power of the operating transmitter can be switched directly into the antenna to reduce the power loss to only 3 dB.

The entire switching arrangement is initiated from a single pushbutton switch, at an appropriate program time, and requires less than 3 seconds.



Automatic Exciter Switchover.



Block Diagram of one 15-kW Transmitter Unit.

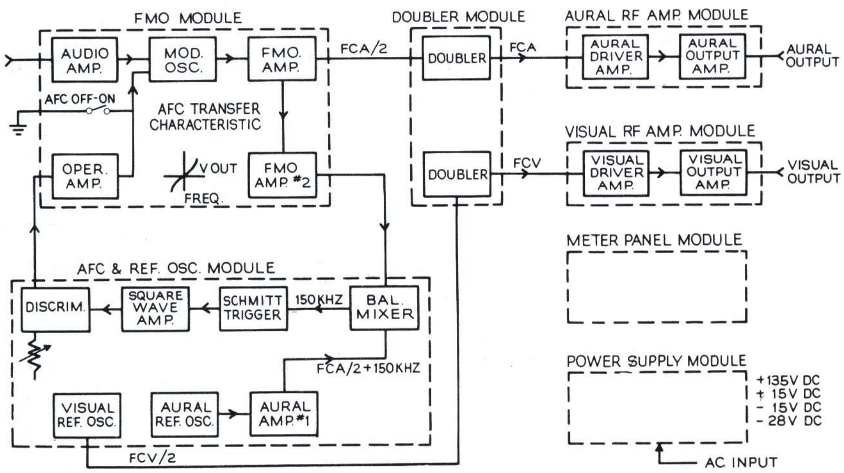
Circuit Details — 15-KW Transmitter Unit

Solid-State 5-Watt Exciter

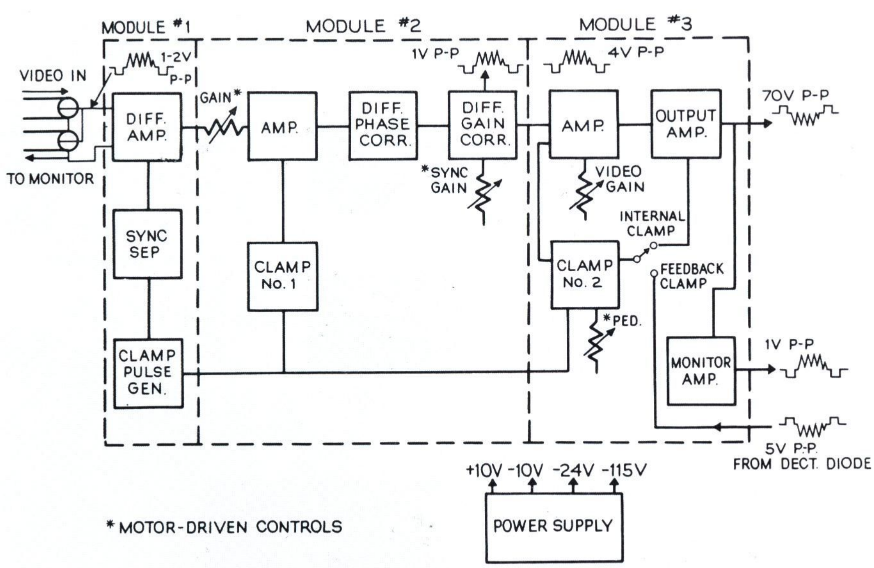
The 5-Watt aural/visual exciter, its power supply and metering circuits consist of seven plug-in modules in one standard frame.

The aural exciter circuitry uses an FM oscillator in an AFC feedback loop followed by a buffer amplifier, doubler and two amplifiers to reach the 5-Watt output level at carrier frequency. The center frequency of the oscillator is accurately maintained by a reference frequency that is 150 kHz above the FM oscillator. A DC error voltage that represents the difference between the center frequency and the reference corrects for any oscillator drift.

The visual exciter circuitry consists of a temperature-controlled visual oscillator followed by a doubler and two amplifiers to reach the 5-Watt output level at carrier frequency.



Solid-State 5-Watt Exciter Block Diagram.



Solid-State Visual Modulator Block Diagram.

Solid-State Aural and Visual 20-Watt Amplifiers

Identical 20-Watt amplifier modules are used in the aural and visual RF chains following the 5-Watt exciter. These modules, and their power supply and metering circuits consist of five plug-in modules in one standard frame.

The aural and visual amplifiers provide the drive power necessary for the visual modulated amplifier and the aural IPA. As an example of conservative design, the 20-Watt amplifiers are required to deliver only about 10 Watts.

Solid-State Visual Modulator

The visual modulator and its power supply consist of four standard plug-in modules. A total of 38 transistors of 8 types and 25 diodes of 6 types are used. Motorized controls are furnished for VIDEO GAIN, SYNC GAIN and PEDESTAL adjustments.

The output of the visual modulator is a 70-Volt peak-to-peak video level that is applied to the visual modulated amplifier. As another example of conservative design . . . only about 40 Volts peak-to-peak is needed for 100-percent modulation.

Differential phase and gain correction are accomplished in separate circuits with negligible interaction between the two functions. DC restoration is provided by a feedback clamp circuit that operates from the modulator output or the detected RF output of the transmitter. The clamp circuit tends to hold the transmitter output constant . . . even with power line variations.

Visual Modulated Amplifier and PA

The design of the visual modulated amplifier circuits provides excellent modulation specifications . . . such as linearity amplitude versus frequency response, and change in response versus brightness level.

The amplifier uses two RCA Type 8791 Cermolox tubes in a push-pull grid-bias modulated circuit. The input circuit is heavily loaded to provide excellent stability and drive regulation . . . and the Type 8791 has extremely linear transfer characteristics.

The visual PA uses a zero-biased high-mu 3CX10,000A7 triode in a cathode drive circuit. The cathode circuit is a part of the double-tuned overcoupled output circuit of the visual modulated amplifier . . . providing a circuit with an extremely wide bandwidth. Therefore, tuning of the overcoupled output circuit determines the transmitter bandwidth . . . this simplified PA tuning also reduces phase distortion.

The use of a zero-biased triode makes the PA circuitry extremely simple, dependable and easy to service. The grid is at DC ground . . . eliminating bypass capacitors and a bias supply . . . and no neutralization is required!!

Aural IPA and PA

The aural IPA uses a single RCA Type 8791 Cermolox tube operating as a Class C amplifier. The input circuit is heavily damped to present an excellent match to the aural 20-Watt solid-state amplifier. Because of the broad bandwidth of the circuitry, it is not necessary to retune the input circuit when changing tubes. The plate circuit of the aural IPA is tuned and matched to the PA cathode by using a pi-network.

The aural PA uses a 3CX3000A7 zero-biased, high-mu triode operating as a grounded-grid Class C amplifier. It requires no fixed bias . . . and does not need neutralization.

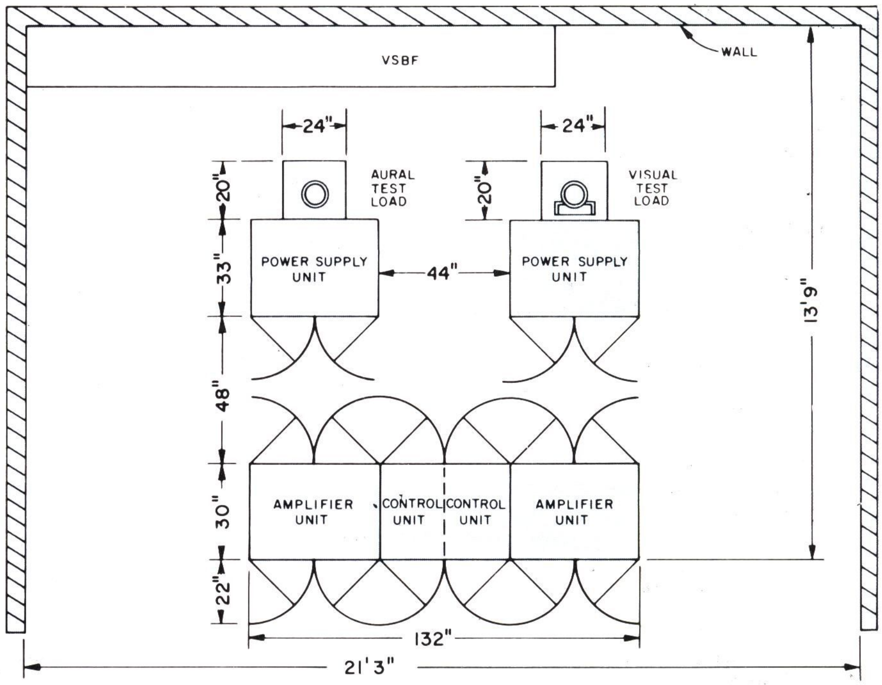
Motorized Transmitter Tuning

Motor-driven adjustments are provided on a tuning control panel located in each 15-kW transmitter unit. To select a function to be adjusted, you simply depress the pushbutton associated with the function. The pushbutton lights, giving an indication of your selection. Associated with each selection pushbutton is an INCREASE/DECREASE switch which, when depressed, operates a 24-Volt tuning control motor. Metering is accomplished by rotating a 20-position selector switch to the appropriate position . . . and all tuning adjustments are read on the meter provided.

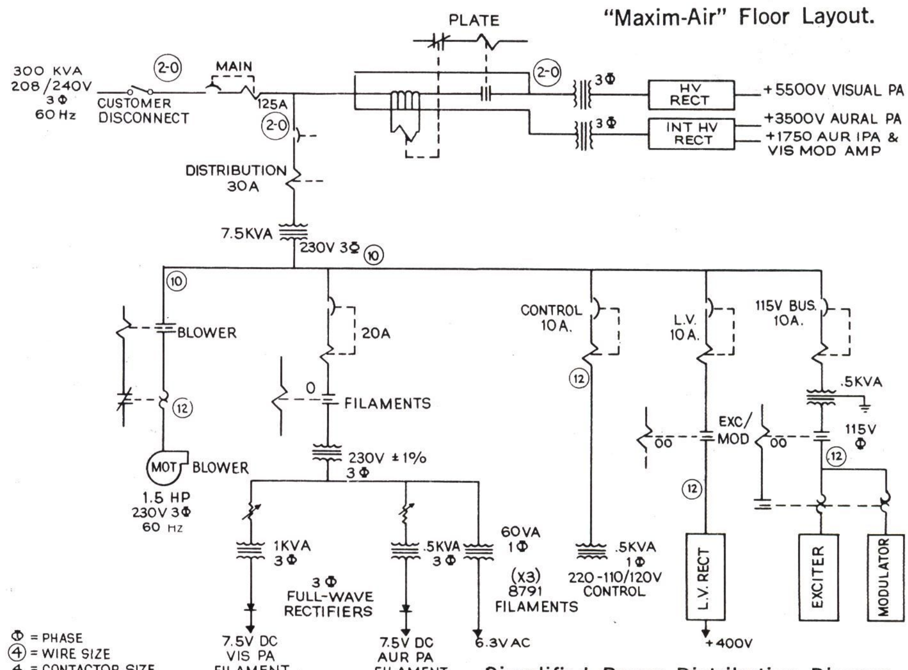
The transmitter control circuits and metering can be located at a console or at a remote location . . . the circuits are ready for full remote control and automatic logging . . . and as can be seen, eventual computer control.

Power, Distribution and Control Circuits

The power supplies for each 15-kW transmitter use silicon rectifiers which are well protected against surges, transients and overloads. The control circuits provide a choice of single button sequential starting or a step-by-step startup procedure, and automatic or manual reset following an overload.



"Maxim-Air" Floor Layout.



Simplified Power Distribution Diagram.

The high voltage and intermediate high voltage supplies both employ three-phase full-wave rectifier circuits and furnish plate potentials for all tubes in the transmitter. Screen potentials for the RCA Type 8791 tubes are obtained from a single-phase full-wave regulated supply. No bias supplies are required. The three-phase, 60-Hertz main power line to each 15-kW transmitter should be capable of delivering a minimum of 50 KVA and a maximum of 300 KVA at 208/240 Volts ±5%. Two high-voltage transformers are provided with primary taps and are operated from the power line voltage. Power to the remaining components of the transmitter is supplied through a distribution transformer equipped with primary taps so that the output voltage is always 230 Volts. No taps are necessary on any other transformers. Constant voltage transformers are employed to maintain all filament voltages constant to within one percent.

Specifications

Performance

Type of Emission:
- Visual A5
- Aural F3

Frequency Range ..... Ch 2-6

Rated Power Output:
- Visual ..... 15 to 30 kW[1]
- Aural ..... 1.5 to 7.5 kW

RF Output Impedance ..... 50 ohms

Input Impedance:
- Visual ..... 75 ohms
- Aural ..... 600/150 ohms

Input Level:
- Visual ..... 1.0 volts p-p min.
- Aural (for ±25 kHz dev.) ..... +10 ±2 dBm

Amplitude vs. Frequency Response, Aural ..... ±1 dB, 30 Hz to 15 kHz, of 50 μsec or 75 μsec pre-emphasis response curve

Visual Sideband Response:
- At Carrier +0.5 MHz to 2.1 MHz ..... +0.5, −0.75 dB[2]
- At Carrier +3.58 MHz ..... +0.5, −0.75 dB[2]
- Between +2.1 MHz to 4.18 MHz with respect to 3.58 MHz response ..... +0.5, −0.75 dB[3]
- At Carrier −0.5 MHz ..... +0.5, −0.75 dB[2]

Variation in Frequency Response with Brightness[4] ..... ±0.75 dB

Carrier Frequency Stability[5]:
- Visual ..... ±250 Hz
- Aural ..... ±250 Hz

Modulation Capability:
- Visual 10%
- Aural ..... ±50 kHz

Audio Frequency Distortion ..... 0.5% max.[6] (30-15,000 Hz)

FM Noise (below ±25 kHz deviation) ..... −60 dB

AM Noise r.m.s.:
- Visual ..... −50 dB below sync level
- Aural ..... −50 dB

Amplitude Variation over one picture frame ..... Less than 2%[7]

Regulation of Output 3%

Burst vs. Subcarrier Phase[8] ..... ±2°

Subcarrier Amplitude[8] ..... 0.7 dB

Subcarrier Phase vs. Brightness[9] (diff. phase) ..... ±2°

Linearity (diff. gain)[10] ..... 0.5 dB

Linearity (Low Frequency) ..... 1.0 dB

Envelope Delay vs. Frequency[11]:
- 0.2 to 2.0 MHz ..... ±60 ns
- at 3.58 MHz ..... ±30 ns
- at 4.18 MHz ..... ±60 ns

Harmonic and Spurious Radiation[12] ..... −80 dB

Electrical

AC Line Input ..... 208/240 volts, 3 phase, 50/60 Hz (power consumption given below), and 115 volts single phase 50/60 Hz (100 watts)

Slow Line Variations ..... ±5% max.

Rapid Line Variations ..... ±3% max.

Phase Unbalance ..... 2% max.

Regulation ..... 3% max.

Power Consumption (at 30 kW peak visual, & 7.5 kW aural output):
- Average Picture ..... 50 kW
- Black Picture ..... 75 kW

Power Factor (approx.) 90%

Mechanical

Overall Length (front line cabinets) ..... 136″ (3350 mm)

Overall Height (cabinets) ..... 77″ (1956 mm)

Depth ..... 30″ (762 mm)

Power Supply Cabinets ..... 2 required
- Width ..... 44″ (1118 mm)
- Height ..... 77″ (1956 mm)
- Depth ..... 33″ (838 mm)
- Finish ..... Two-tone blue, brushed aluminum trim

Environmental

Maximum Altitude ..... 7,500 feet (2286 m)

Ambient Temperature ..... −20°C to 45°C

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1 Measured at output of sideband filter or filterplexer.

2 With respect to response at carrier plus 200 kHz, as measured by the BW-5 sideband response analyzer at transmitter mid-characteristic.

3 Measured at output of VSBF. Add −0.75 dB at +4.18 MHz if filterplexer or notch diplexer is employed.

4 Measured at 65% and 25% of sync peak level with respect to response at transmitter mid-characteristic.

5 Maximum variation without circuit adjustment over a period of 30 days and over an ambient temperature range of 0°C to 45°C.

6 Including harmonics up to 30 kHz and measured with standard de-emphasis network.

7 Measured at blanking level.

8 Maximum departure from the theoretical when reproducing saturated primary colors and their complements at 75% amplitude.

9 Maximum phase difference with respect to burst, measured after the VSBF, for any brightness level between 75% and 15% of the sync peak using 10% (peak-to-peak) modulation.

10 Maximum variation in the amplitude of a 3.58 MHz sine wave modulating signal as the brightness level is varied between 75% and 15% of sync peak. The gain shall be adjusted for 10% (peak-to-peak) modulation of the 3.58 MHz signal when the brightness is at pedestal level. This is equivalent to 5% (peak-to-peak) modulation as indicated by a conventional diode demodulator connected after the VSBF.

11 Maximum departure from standard curve using TTS-1A. The tolerances vary linearly between 2.1 and 3.58 MHz and between 3.58 and 4.18 MHz.

12 Ratio of any single harmonic or spurious frequency to peak visual power.

Ordering Information

The TT-30FL TV Transmitter, 30 kW visual, 7.5 kW aural with tubes, solid-state color correction filters, including low pass filter, harmonic filters, vestigial sideband filter and motorized coaxial switches complete. For 208/240-volt 3-phase, 50/60-Hz input ES-560615

Commercial Electronic Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

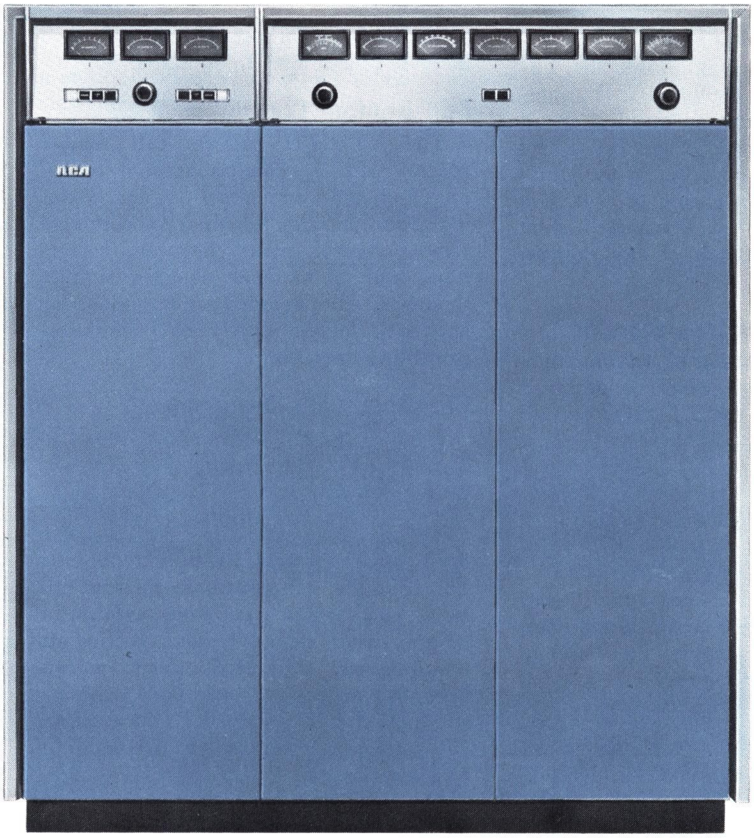
RCA Broadcast Equipment

RCA

catalog B.4048

PRELIMINARY

Solid-State 25 kW VHF Transmitter, Type TT-25FH



- Designed for the future
- New standard for color broadcasting
- High-level sideband shaping—signal integrity
- Reliable solid-state circuitry
- Expandable to 50 kW visual power
- Full remote control

3VB

Solid-State 25 kW VHF Transmitter, Type TT-25FH

Maximum air time, maximum performance and maximum return on investment. These are the main attributes of the all new TT-25FH Transmitter. Its design is an astute combination of state-of-the-art technology and years of transmitter engineering experience.

The TT-25FH conserves occupied floor space without compromising accessibility. The solid-state circuitry enhances reliability and performance, reduces operating cost and includes features that reduce the possibility of obsolescence.

A special feature of the TT-25FH is its expandability to twice the power output by adding another TT-25FH Transmitter and certain combining equipment. This results in a totally redundant, 50-kW transmitter (actually an RCA Type TT-50FH) that virtually eliminates even the possibility of transmitter outage. (See *Catalog B.4050* for a description on the Type TT-50FH.)

Description

Designed for the Future

As new as technology allows, the TT-25FH is a 25-kW highband-VHF transmitter offering solid-state circuitry in all stages except for the IPA and PA. There are but three electron tubes in the entire transmitter and these are of but two types. It delivers the sharpest, highest quality television signals of any present-day transmitter.

Highest TV-Broadcast Standards

Designed so far ahead of its contemporaries that its design won't be outdated for years to come, the TT-25FH specifications are up to twice as good as those of previous models with stability so solid that it holds specifications for 30 days longer under normal operating conditions.

Solid-State Exciter

The exciter unit contains a 10-watt aural, a 15-watt visual section and a common-to-both power supply. Each section is a plug-in module for easy access to all components.

The visual exciter uses a crystal-controlled oscillator operating at one-sixth carrier frequency. A constant-temperature oven maintains the accuracy of the crystal frequency. The power level of this signal is increased to 15 watts in two multiplier stages and two amplifier stages.

The aural exciter uses a direct-FM modulated oscillator locked to a crystal-referenced oscillator through an AFC system. The reference crystal, too, operates in a constant temperature oven. The aural carrier is a mixture of the modulated oscillator and a multiple of the reference oscillator. Two solid-state amplifiers then increase power level to 10 watts.

Full Remote Control

The TT-25FH features full remote control with a generous amount of remote indicators and meter outputs. Status indication facilities, essential for complete remote control, make diagnosis, corrections and operational changes simpler than ever. Also included are provisions for automatic logging and future computer-controlled operation.

Conservatively Designed

From a technical viewpoint, the TT-25FH is all a chief engineer could want in a television transmitter.

The TT-25FH uses every practicable design technique to increase reliability. For example, all electronic devices operate well below maximum ratings; a unique cavity design reduces cooling-air requirements. Filament-contact assemblies use space-age "heat-pipe" cooling to eliminate high-pressure air cooling. All components require a minimum of maintenance.

Low-Pressure Air-Cooling

Because the transmitter uses only three electron tubes operating in very efficient circuitry, its demands for cooling air are considerably less than those of similar transmitters. As a result, the TT-25FH requires only low-pressure air cooling. Low-pressure air cooling reduces noise, vibration and mechanical wear which, in turn, extends system reliability. Only one direct-drive blower is required.

Solid-State Circuitry

All TT-25FH circuitry through the 40-watt level on the visual side is solid state while the aural section is solid state to the 80-watt IPA stage.

Diode Visual Modulation

Another engineering innovation is the diode visual modulator. Capable of operation to a 20-watt level, this modulator delivers excellent linearity and increases the transmitter visual modulation capability to three percent.

The modulator uses a new advance in technology: "hot carrier diodes". This technology reduces noise, increases power capability and avoids the disadvantages of microwatt-level modulators. Visual modulation is performed at carrier frequency to avoid the spurious signals inherent in the "up-conversion" process essential to modulation at some intermediate frequency.

Circuit Details
25-kW Transmitter Unit

The discussion to follow describes the transmitter from the exciter output to the output of the 25-kW visual and the 5.5-kW aural PA stages.

The aural carrier from the exciter is amplified to a 60-watt level in two solid-state, broadband amplifiers. It then drives the aural final amplifier which increases the power level to 5500 watts with a single Type 8890 tetrode power tube, identical to that used in the visual IPA stage.

The visual carrier is first amplified to a 20-watt level in a solid-state, broadband amplifier and then fed through a ferrite isolator to the visual modulator. Another ferrite isolator couples the modulated carrier to a pretuned broadband amplifier which raises the power level to a nominal 40 watts. A third ferrite isolator couples this signal to the linear, tube-type IPA stage and then through another isolator to the 25-kW final. The tube here is a high-performance, high-power tetrode (A-2908) developed by RCA specifically for TV broadcast service. It is important to note that the visual IPA tube is identical to the aural final tube to reduce "spares" inventories.

Ferrite Interstage Isolators

The TT-25FH transmitter offers operational simplicity and long-term stability as the result of a special design effort to use solid state devices wherever practical. The ferrite interstage isolator is such a device (see block diagram). It provides such a high degree of isolation between successive r-f stages that tuning of one stage causes practically no reaction on the stages ahead or following. This simplifies tuneup and increases long-term transmitter stability.

New Cavity Design

The cavities which contain the power tubes are designed to provide the best possible environment for the tubes. A unique air-flow system channels cooling air in a most efficient manner while modern "heat pipe" techniques reduce temperatures within the cavity to increase tube life. The transmitter uses but one 5-hp blower. As the result of low pressure drop, air noise is significantly lower than usual in a transmitter of this power level.

High-Level Sideband Shaping

To assure picture-output integrity, the TT-25FH uses only two tuned linear amplifiers following the visual modulator. This drastically reduces the possibility of out-of-channel radiation. In addition, the transmitter uses a sideband filter at the output to assure proper sideband attenuation.

The sideband filter included with the TT-25FH transmitter is a new, high-reliability design that features temperature compensation. As a result, the device remains precisely tuned at all rated power levels over the ambient temperature range between —20 and +50°C.

Self-Reset Power Supplies

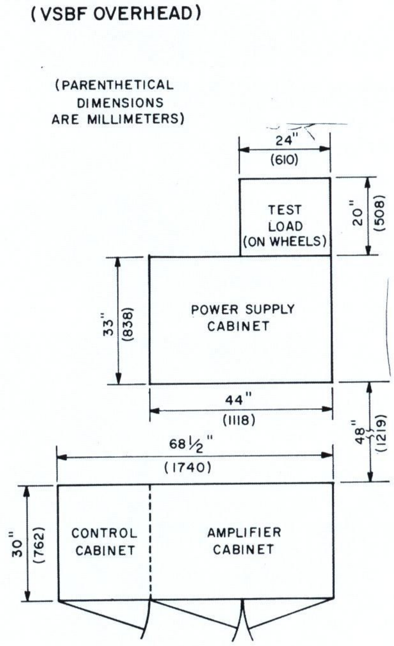
All TT-25FH power supplies (except PA-plate) are automatic current limiting. In the event of overload, the power supplies limit current to a "safe" value until the overload passes.

The high-voltage, PA-plate supplies are conventional, solid-state systems consistent with the specification criteria of the TT-25FH Transmitter.

Solid-State Control

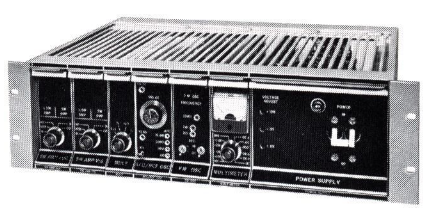
To assure almost limitless possibility for future remote-control and automatic status-logging, the TT-25FH employs solid-state logic circuitry in the major portion of the transmitters control system. For example, few electromechanical relays are used and solid-state devices perform many relay functions. Where electromechanical devices are essential, the units selected are computer-type, wire contact, high-reliability relays. They interface the solid-state logic circuitry with the power-handling components of the transmitter.

The TT-25FH anticipates most of the special requirements of unattended transmitter operation via remote control. For example, the air-cooling system includes an analog readout of air flow through the transmitter with warning of inadequate air flow so that action can be taken at the next maintenance period. Should the air flow drop below a safe operating level, an interlock facility "dumps" the transmitter section having air trouble. Similar sensing circuitry and facilities are included throughout the transmitter to provide valuable warning of impending malfunction and to speed the diagnosis and location of problems should they occur.



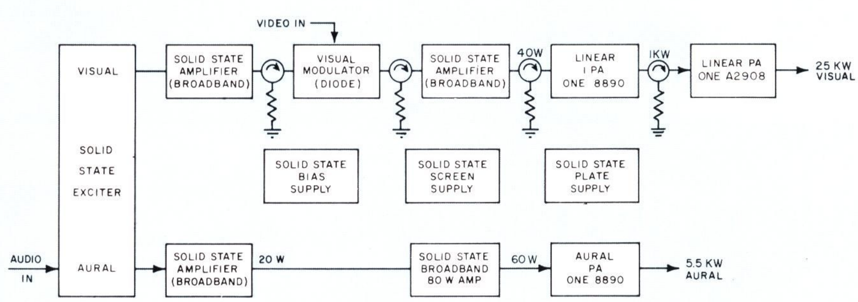
Space-Saving Floor Layout

Solid State Reliability



Exciter . . . All Solid State

Visual Modulator . . . All Solid State



TT-25FH Block Diagram

Specifications

Performance

Type of Emission:
- Visual ... A5
- Aural ... F3

Frequency Range ... Channels 7-13

Rated Power Output:
- Visual ... 25 kW[1]
- Aural ... 5.5 kW

RF Output Impedance ... 50 ohms

Input Impedance:
- Visual ... Bridging
- Aural ... 600/150 ohms

Input Level:
- Visual ... 0.5 to 2.0 volts p-p
- Aural (for ±25 kHz dev.) ... +10 ±2 dBm

Amplitude vs. Frequency Response:
- Aural ... ±1 dB, 30 Hz to 15 kHz, of 50 μsec or 75 μsec pre-emphasis response curve

Visual Sideband Response:[1]
- At Carrier −0.5 MHz ... +0, −1.5 dB[2]
- At Carrier −0.75 MHz ... +0, −2.5 dB[2]
- At Carrier +0.5 MHz to +3.58 MHz ... +0.5, −1.0 dB[2]
- Between +2.1 MHz to 4.18 MHz with respect to 3.58 MHz response ... +0.5 dB, −1.0 dB[3]

Variation in Frequency Response with Brightness[4] ... ±1.0 dB

Carrier Frequency Stability[5]:
- Visual ... ±250 Hz
- Aural ... ±500 Hz

Modulation Capability:
- Visual ... 3%
- Aural ... ±50 kHz

Audio Frequency Distortion ... 0.5% max.[6] (30-15,000 Hz)

FM Noise (below ±25 kHz deviation) ... −60 dB

AM Noise r.m.s.:
- Visual ... −50 dB below sync level
- Aural ... −50 dB

Amplitude Variation over one picture frame ... Less than 2.0%[7]

Regulation of Output ... 3%

Burst vs. Subcarrier Phase[8] ... ±3°

Subcarrier Amplitude[8] ... 0.7 dB

Subcarrier Phase vs. Brightness[9] (diff. phase) ... ±3°

Linearity (diff. gain)[10] ... 0.5 dB

Linearity (Low Frequency) ... 1.0 dB

Envelope Delay vs. Frequency[11]:
- 0.2 to 2.0 MHz ... ±60 ns
- at 3.58 MHz ... ±30 ns
- at 4.18 MHz ... ±60 ns

Harmonic and Spurious Radiation[12] ... −80 dB

Spurious Radiation[13] ... −100 dB

"K" Factor:[14]
- 2T Pulse ... 2%
- 20T Pulse ... 3%

Electrical

AC Line Input ... 480 volts, 3-phase, 50/60 Hz (power consumption given below), and 115 volts, single phase, 50/60 Hz (100 watts)

Slow Line Variations ... ±5% max.

Rapid Line Variations ... ±3% max.

Phase Unbalance ... 2% max.

Regulation ... 3% max.

Power Consumption (at 25 kW peak visual, & 5.5 kW aural output):
- Average Picture ... 53 kW
- Black Picture ... 63 kW

Power Factor (approx.) ... 90%

Mechanical

Overall Length (front line cabinets) ... 68″ (1727 mm)

Overall Height (cabinets) ... 77″ (1956 mm)

Depth ... 30″ (762 mm)

Power Supply Cabinet:
- Width ... 44″(112 mm)
- Height ... 77″ (1956 mm)
- Depth ... 33″ (838 mm)
- Finish ... Two-tone blue, textured vinyl and brushed-aluminum trim

Environmental

Maximum Altitude ... 7,500 feet (2287 m)

Ambient Temperature ... 0°C to 45°C

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1 Measured at output of sideband filter or filterplexer.

2 With respect to response at carrier plus 200 kHz, as measured by the BW-5 sideband response analyzer at transmitter mid-characteristic.

3 Measured at output of VSBF. Add −1.5 dB at +4.18 MHz if filterplexer is employed. (Load must be 1.05 to 1.0 VSWR or better.)

4 Measured at 65% and 25% of sync peak level with respect to response at transmitter mid-characteristic.

5 Maximum variation without circuit adjustment over a period of 30 days and over an ambient temperature range of 0°C to 45°C aural referenced to 4.5 MHz from visual carrier.

6 Including harmonics up to 30 kHz and measured with standard de-emphasis network.

7 Measured at blanking level.

8 Maximum departure from the theoretical when reproducing saturated primary colors and their complements at 75% amplitude.

9 Maximum phase difference with respect to burst, measured after the VSBF, for any brightness level between 75% and 15% of the sync peak using 10% (peak-to-peak) subcarrier modulation and modulation depth of 10%.

10 Maximum variation in the amplitude of a 3.58 MHz sine wave modulating signal as the brightness level is varied between 75% and 15% of sync peak. The gain shall be adjusted for 10% (peak-to-peak) modulation of the 3.58 MHz signal when the brightness is at pedestal level. This is equivalent to 5% (peak-to-peak) modulation as indicated by a conventional diode demodulator connected after the VSBF.

11 Maximum departure from standard curve using TTS-1A. The tolerances vary linearly between 2.1 and 3.58 MHz and between 3.58 and 4.18 MHz.

12 Ratio of any single harmonic or spurious frequency to peak visual power.

13 Not related to wanted carriers or modulation to within 3 MHz of operating channel. Channel edge to 3 MHz limit, better than −54 dB.

14 Measured at 50% peak modulation to minimize demodulator distortion.

Ordering Information

The TT-25FH TV Transmitter, 25-kW visual, 5.5-kW aural with tubes, solid-state color correction filters, including low pass filter, harmonic filters, and sideband filter. For 480-volt, 3-phase, 50/60-Hz power ... ES-560669

Communications Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

RCA Broadcast Systems

PRINTED IN U.S.A.

RCA

catalog B.4040

PRELIMINARY

Max-OnAir 35-kW VHF-TV Transmitter, Type TT-35FH

35-kW visual and 7.75-kW aural
Channels 7 thru 13

- Designed for the future
- New standard for color broadcasting
- Eliminates off-air time
- Reliable solid-state circuitry
- Parallel redundant system
- Automated exciter switching
- Full remote control

5UB

Max-OnAir TT-35FH VHF-TV Transmitter

Maximum air time, maximum performance and maximum return on investment. These are the main attributes of the all new TT-35FH Transmitter. Its design is an astute combination of state-of-the-art technology and years of transmitter engineering experience.

Actually two, complete, 17.5-kW transmitters combined to deliver a 35-kW visual power output plus 7.75 kW of aural power, the TT-35FH transmitter is a fully redundant facility that virtually eliminates transmitter outage.

The TT-35FH conserves occupied floor space without compromising accessibility. The solid-state circuitry enhances reliability and performance, reduces operating cost and practically eliminates obsolescence.

Description

Designed for the Future

As new as technology allows, the TT-35FH is a 35-kW highband-VHF transmitter offering solid-state circuitry in all stages except for the IPA and PA. There are but six electron tubes in the entire transmitter and these are of but two types. It delivers the sharpest, highest quality television signals of any present-day transmitter.

Highest TV-Broadcast Standards

Designed so far ahead of its contemporaries that its design won't be outdated for years to come, the TT-35FH specifications are at least twice as good as those previous models with stability so solid that it holds specifications for 30 days and longer without readjustment.

Full Transmitter Redundancy

Because the TT-35FH is actually two 17.5-kW units operating in "parallel" to deliver the 35-kW visual power output, a failure in either transmitter merely reduces output power and keeps the station on-the-air with little or no noticeable change in the primary coverage area.

Automatically Switched Exciters

The TT-35FH includes two, complete r-f exciters with fully automatic signal sensing and switching. Should the "on-air" exciter fail, the switcher senses the failure and puts the "hot spare" on the line. This takes place so quickly that there isn't the slightest loss of program. A status light indicates switchover.

Full Remote Control

The TT-35FH features full remote control with a generous amount of remote indicators and meter outputs. Status indication facilities, essential for complete remote control, make diagnosis, corrections and operational changes simpler than ever. Also included are provisions for automatic logging and computer-controlled operation.

Conservatively Designed

From a technical viewpoint, the TT-35FH is about all a chief engineer might want in a television transmitter.

The TT-35FH uses every practicable design technique to increase reliability. For example, all electronic devices operate well below maximum ratings; a unique cavity design reduces cooling-air requirements. Filament-contact assemblies use space-age "heat-pipe" cooling to eliminate high-pressure air cooling. All components require a minimum of maintenance.

Low-Pressure Air-Cooling

Because the transmitter uses only six electron tubes operating in very efficient circuitry, its demands for cooling air are considerably less than those of similar transmitters. As a result, the TT-35FH requires only low-pressure air cooling. Low-pressure air cooling reduces noise, vibration and mechanical wear which, in turn, extends system reliability.

Solid State Circuitry

All TT-35FH circuitry below the 25-watt level on the visual side is solid state while the aural section is solid state to the 80-watt IPA stage.

Diode Visual Modulation

Another TT-35FH engineering innovation is the diode visual modulator. Performed at the 12-watt level, the passive modulator increases modulation linearity and extends modulation capability to 5 percent.

Paralled 17.5-kW Units

Two identical 17.5-kW transmitter units are operated in a parallel system . . . their outputs add up to 35-kW peak visual power and 7.75-kW aural power. The operation of each transmitter unit is completely independent of the other . . . should a failure occur in one unit, the other continues to provide a non-distorted signal into the antenna system.

Redundant Solid-State Exciters

Two identical exciters feed into an automatic exciter switchover circuit . . . the circuit terminates the output of the standby exciter while the output of the operating exciter feeds the visual and aural stages. If the operating exciter output degrades or fails, it is automatically replaced by the standby exciter.

Hybrid Combiner Network

The output from each 17.5-kW transmitter unit is combined to provide antenna input powers of 35-kW visual and 7.75-kW aural. If a failure occurs in a transmitter unit, a 6 dB reduction in signal power occurs in the combining network . . . it is not even noticed within the primary coverage area. The full power of the operating transmitter can be switched directly into the antenna to reduce the power loss to only 3 dB. This co-axial switching system is included at no extra cost. Being motor-driven, instead of manual, switching via remote control is easily arranged. The entire switching arrangement requires less than three seconds.

Circuit Details: 17.5-kW Transmitter Unit

Solid State Exciter

The aural exciter combines an extremely stable crystal oscillator with the high fidelity capabilities of direct-FM modulation, through the use of a frequency-modulated oscillator locked to a crystal through an AFC system.

The visual oscillator is a temperature-compensated, crystal-controlled oscillator also operating at one-quarter carrier frequency. Mutiplied to carrier frequency and amplified to a 5-watt level in two solid-state amplifiers, the visual-carrier signal then goes to a 20-watt solid-state visual power amplifier.

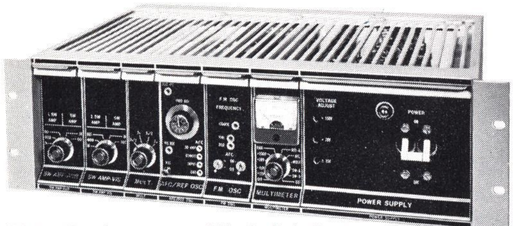
Low-Power R-F Amplifiers

The visual- and aural-carrier signals are separately amplified in essentially identical, 20-watt solid-state amplifiers. The amplified visual carrier goes to the first of three ferrite interstage isolators while the aural carrier feeds a second power amplifier. Capable of an 80-watt power output, this amplifier raises the aural carrier to a 50-watt level for driving the aural PA.

Ferrite Interstage Isolators

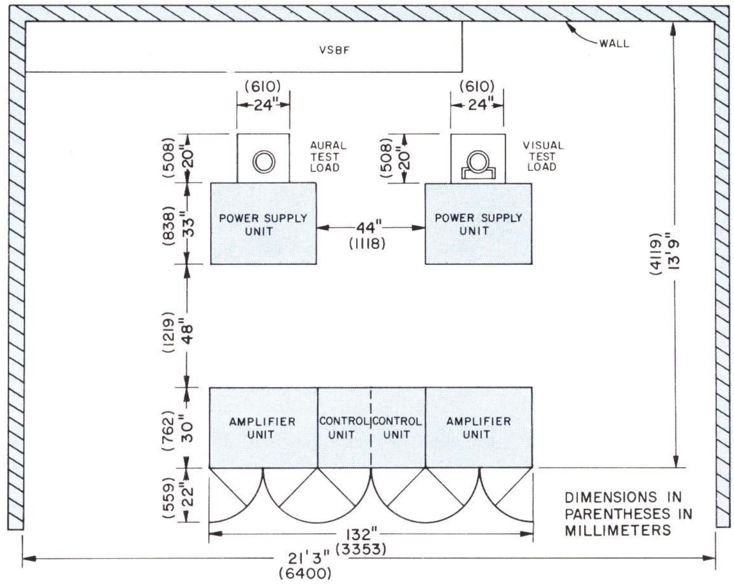
The TT-35FH Transmitter's r-f stability is enhanced through the use of ferrite interstage isolators, a solid state device which maintains input and output impedances to close limits. Three such devices are used in the TT-35FH (see block diagram). Because the isolators hold the loads for each stage to close limits, each stage maintains a high level of performance for long terms.

Solid State Circuitry



10-Watt Exciter . . . All Solid State

Visual Modulator . . . All Solid State



Max-OnAir Floor Layout

Visual Pre-Intermediate Amplifier

Since the gain through the diode modulator is less than unity, the visual chain uses a broadband solid state amplifier following the modulator. Like all of the other solid state power amplifiers in the TT-35FH, this stage is untuned and operates at but a fraction of its power capability. The result is vastly improved gain-vs.-bandwidth stability.

High-Power Amplifiers

The 25-watt visual carrier signal is amplified to a 1-kW power level in the linear IPA. The cavity amplifier uses a new Type 8890 power tetrode. The aural PA uses the same tube type to develop the 4.5-kW power output. However, the aural amplifier operates class C instead of linear. The visual PA uses a Type 8891 high-power tetrode in a cavity.

High-Level Sideband Shaping

To assure picture-output integrity, the TT-35FH uses only two tuned linear amplifiers following the visual modulator. This drastically reduces the possibility of out-of-channel radiation. In addition, the transmitter uses a sideband filter at the output to assure proper sideband attenuation.

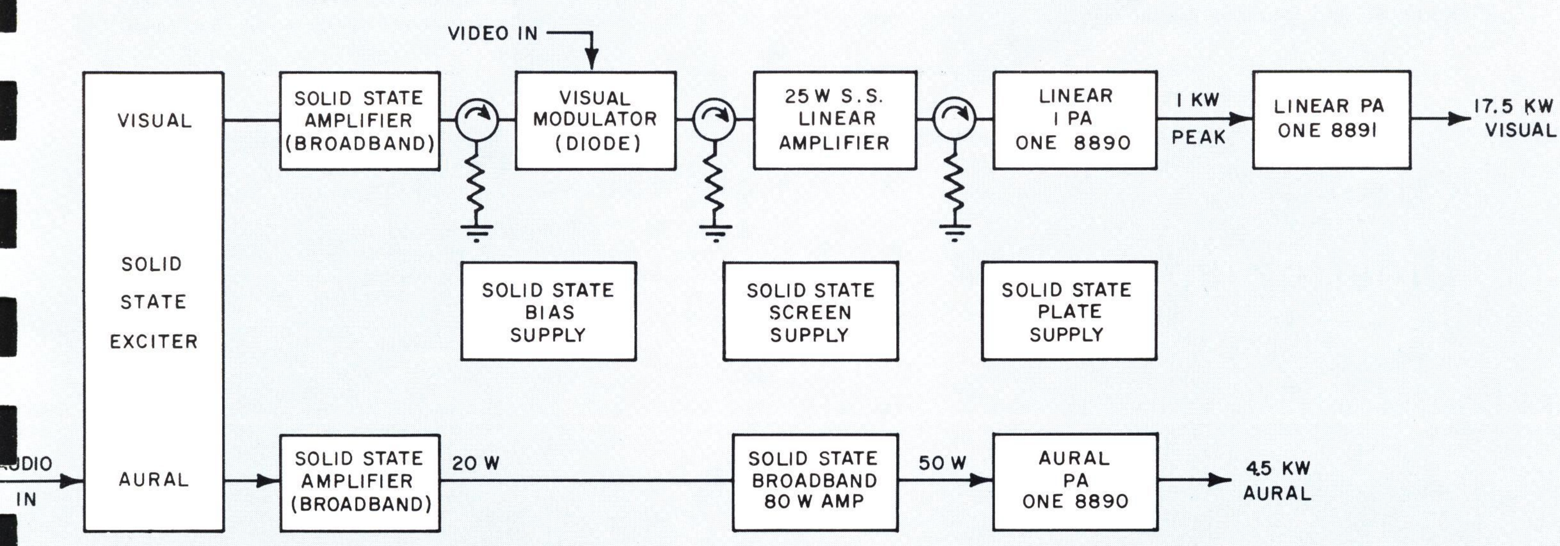
Self-Reset Power Supplies

All TT-35FH power supplies (except PA-plate) are automatic current limiting. In the event of overload, the power supplies limit current to a "safe" value until the overload passes.

The high-voltage, PA-plate supplies are conventional, solid-state systems consistent with the "twice-up" specification criteria of the TT-35FH Transmitter.

Technical Features

- Solid-state amplifiers self-protected against open or short-circuited load
- Ferrite interstage isolators eliminate stage interaction
- Generous metering and status indication
- Reserve PA gain —no bandwidth vs. gain compromises
- Broadband, untuned solid-state amplifiers
- High-power sideband filter —no sideband re-establishment
- But two tubes types in entire transmitter
- Automatic current-limiters in power supply
- Solid-state "three-try" overload reset
- Nearly 100% reserve in all solid-state power amplifiers
- Solid-state overload relays —no "reset" buttons
- CW amplifier gain stability within 0.1 dB over temperature range
- Feedback clamp for black-level stability



TT-35FH Block Diagram (one of two transmitter units)

Specifications

Performance

Type of Emission:
- Visual A5
- Aural F3

Frequency Range ..... Channels 7-13

Rated Power Output:
- Visual ..... 17.5 to 35 kW[1]
- Aural ..... 1.5 to 7.75 kW

RF Output Impedance ..... 50 ohms

Input Impedance:
- Visual ..... Bridging
- Aural ..... 600/150 ohms

Input Level:
- Visual ..... 0.5 to 2.0 volts p-p
- Aural (for ±25 kHz dev.) ..... +10 ±2 dBm

Amplitude vs. Frequency Response, Aural ..... ±1 dB, 30 Hz to 15 kHz, of 50 μsec or 75μsec pre-emphasis response curve

Visual Sideband Response:
- At Carrier −0.5 MHz to +2.1 MHz ..... ±0.75 dB[2]
- At Carrier +3.58 MHz ..... ±0.75 dB[2]
- Between +2.1 MHz to 4.18 MHz with respect to 3.58 MHz response ..... ±0.75 dB[3]

Variation in Frequency Response with Brightness[4] ..... ±0.75 dB

Carrier Frequency Stability[5]:
- Visual ..... ±250 Hz
- Aural ..... ±250 Hz

Modulation Capability:
- Visual 5%
- Aural ..... ±50 kHz

Audio Frequency Distortion ..... 0.5% max.[6] (30-15,000 Hz)

FM Noise (below ±25 kHz deviation) ..... −60 dB

AM Noise r.m.s:
- Visual ..... −50 dB below sync level
- Aural ..... −50 dB

Amplitude Variation over one picture frame ..... Less than 2.0%[7]

Regulation of Output 3%

Burst vs. Subcarrier Phase[8] ..... ±3°

Subcarrier Amplitude[8] ..... 0.7 dB

Subcarrier Phase vs. Brightness[9] (diff. phase) ..... ±2°

Linearity (diff gain) [10] ..... 0.5 dB

Linearity (Low Frequency) ..... 1.0 dB

Envelope Delay vs. Frequency[11]:
- 0.2 to 2.0 MHz ..... ±60 ns
- at 3.58 MHz ..... ±30 ns
- at 4.18 MHz ..... ±60 ns

Harmonic and Spurious Radiation[12] ..... −80 dB

Electrical

AC Line Input ..... 208/240 volts, 3 phase, 50/60 Hz (power consumption given below), and 115 volts, single phase, 50/60 Hz (100 watts)

Slow Line Variations ..... ±5% max.

Rapid Line Variations ..... ±3% max.

Phase Unbalance ..... 2% max.

Regulation ..... 3% max.

Power Consumption (at 35 kW peak visual, & 7.75 kW aural output):
- Average Picture ..... 55 kW
- Black Picture ..... 75 kW

Power Factor (approx.) 90%

Mechanical

Overall Length (front line cabinets) ..... 136″ (3.46 m)

Overall Height (cabinets) ..... 77″ (1.95 m)

Depth ..... 30″ (762 mm)

Power Supply Cabinets ..... 2 required
- Width ..... 44″ (112 mm)
- Height ..... 77″ (1.95 m)
- Depth ..... 33″ (838 mm)
- Finish ..... Two-tone blue, textured vinyl and brushed-aluminum trim

Environmental

Maximum Altitude ..... 7,500 feet (2287 m)

Ambient Temperature ..... 0°C to 45°C

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1 Measured at output of sideband filter or filterplexer.

2 With respect to response at carrier plus 200 kHz, as measured by the BW-5 sideband response analyzer at transmitter mid-characteristic.

3 Measured at output of VSBF. Add −0.75 dB at +4.18 MHz if filterplexer or notch diplexer is employed.

4 Measured at 65% and 25% of sync peak level with respect to response at transmitter mid-characteristic.

5 Maximum variation without circuit adjustment over a period of 30 days and over an ambient temperature range of 0°C to 45°C.

6 Including harmonics up to 30 kHz and measured with standard de-emphasis network.

7 Measured at blanking level.

8 Maximum departure from the theoretical when reproducing saturated primary colors and their complements at 75% amplitude.

9 Maximum phase difference with respect to burst, measured after the VSBF, for any brightness level between 75% and 15% of the sync peak using 10% (peak-to-peak) subcarrier modulation and modulation depth of 10%.

10 Maximum variation in the amplitude of a 3.58 MHz sine wave modulating signal as the brightness level is varied between 75% and 15% of sync peak. The gain shall be adjusted for 10% (peak-to-peak) modulation of the 3.58 MHz signal when the brightness is at pedestal level. This is equivalent to 5% (peak-to-peak) modulation as indicated by a conventional diode demodulator connected after the VSBF.

11 Maximum departure from standard curve using TTS-1A. The tolerances vary linearly between 2.1 and 3.58 MHz and between 3.58 and 4.18 MHz.

12 Ratio of any single harmonic or spurious frequency to peak visual power.

Ordering Information

The TT-35FH TV Transmitter, 35-kW visual, 7.75-kW aural with tubes, solid-state color correction filters, including low pass filter, harmonic filters, vestigial sideband filter and motorized coaxial switches complete. For 208/240-volt, 3-phase, 50/60-Hz input ES-560674

RCA

catalog B.4050

PRELIMINARY

Highband 50-kW VHF-TV Transmitter, Type TT-50FH

- Designed for unattended operation
- Carrier frequency modulation
- Solid-state control circuits
- Long-term stability—30 days without adjustment
- High-level sideband shaping—no field adjustments

3VB

Description

Maximum air time, maximum performance and maximum return on investment. These are the main attributes of the all new TT-50FH Transmitter. Its design is an astute combination of state-of-the-art technology and years of transmitter engineering experience.

Actually two, complete, 25-kW transmitters combined to deliver a 50-kW visual power output plus 11 kW of aural power, the TT-50FH transmitter is a fully redundant facility that virtually eliminates transmitter outage.

The TT-50FH conserves occupied floor space without compromising accessibility. The solid-state circuitry enhances reliability and performance, reduces operating cost and includes features that reduce the possibility of obsolescence.

Designed for the Future

As new as technology allows, the TT-50FH is a 50-kW highband-VHF transmitter offering solid-state circuitry in all stages except for the IPA and PA. There are but six electron tubes in the entire transmitter and these are of but two types. It delivers the sharpest, highest quality television signals of any present-day transmitter.

Highest TV-Broadcast Standards

Designed so far ahead of its contemporaries that its design won't be outdated for years to come, the TT-50FH specifications are at least twice as good as those previous models with stability so solid that it holds specifications for 30 days and longer under normal operating conditions.

Full Transmitter Redundancy

Because the TT-50FH is actually two 25-kW units operating in "parallel" to deliver the 50-kW visual power output, a failure in either transmitter merely reduces output power and keeps the station on-the-air with little or no noticeable change in the primary coverage area.

Automatic Exciter Switchover

The transmitter includes two independent, solid-state exciters and an automatic switchover system. One exciter or the other normally drives both 25-kW transmitters to develop the 50-kW power level. The second exciter stays in "hot" standby and is automatically switched into operation should the "first" exciter fail.

Each exciter unit contains a 10-watt aural, a 15-watt visual section and a common-to-both power supply. Each section is a plug-in module for easy access to all components.

The visual exciter uses a crystal-controlled oscillator operating at one-sixth carrier frequency. A constant-temperature oven maintains the accuracy of the crystal frequency. The power level of this signal is increased to 15 watts in two multiplier stages and two amplifier stages.

The aural exciter uses a direct-FM modulated oscillator locked to a crystal-referenced oscillator through an AFC system. The reference crystal, too, operates in a constant temperature oven. The aural carrier is a mixture of the modulated oscillator and a multiple of the reference oscillator. Two solid-state amplifiers then increase power level to 10 watts.

Full Remote Control

The TT-50FH features full remote control with a generous amount of remote indicators and meter outputs. Status indication facilities, essential for complete remote control, make diagnosis, corrections and operational changes simpler than ever. Also included are provisions for automatic logging and future computer-controlled operation.

Conservatively Designed

From a technical viewpoint, the TT-50FH is all a chief engineer could want in a television transmitter.

The TT-50FH uses every practicable design technique to increase reliability. For example, all electronic devices operate well below maximum ratings; a unique cavity design reduces cooling-air requirements. Filament-contact assemblies use space-age "heat-pipe" cooling to eliminate high-pressure air cooling. All components require a minimum of maintenance.

Low-Pressure Air-Cooling

Because the transmitter uses only six electron tubes operating in very efficient circuitry, its demands for cooling air are considerably less than those of similar transmitters. As a result, the TT-50FH requires only low-pressure air cooling. Low-pressure air cooling reduces noise, vibration and mechanical wear and extends system reliability. Only two direct drive blowers are required; one for each 25 kW transmitter unit.

Solid State Circuitry

All TT-50FH circuitry through the 50-watt level on the visual side is solid state while the aural section is solid state through the 80-watt IPA stage.

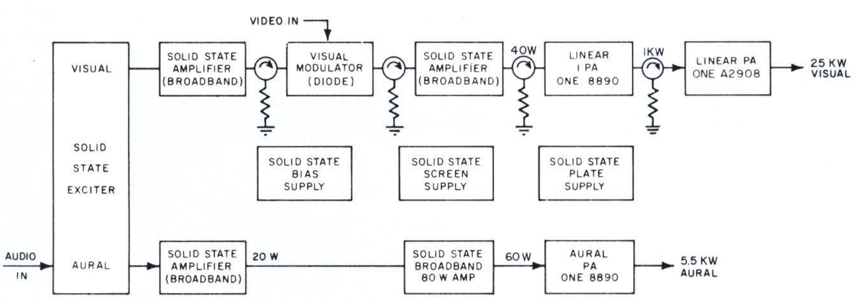
Diode Visual Modulation

Another engineering innovation is the diode visual modulator. Capable of operation to a 20-watt level, this modulator delivers good linearity and increases the transmitter visual-modulation capability to three percent.

The modulator uses a new advance in technology: "hot carrier diodes". This technology reduces noise, increases power capability and avoids the disadvantages of microwatt-level modulators. Visual modulation is performed at carrier frequency to avoid the spurious signals inherent in the "up-conversion" process essential to modulation at some intermediate frequency.

Hybrid Combiner Network

The output from each 25-kW transmitter unit is combined to provide antenna input powers of 50-kW visual and 11-kW aural. If a failure occurs in a transmitter unit, a 6 dB reduction in signal power occurs in the combining network . . . it is not even noticed within the primary coverage area. The full power of the operating transmitter can be switched directly into the antenna to reduce the power loss to only 3 dB. The entire switching function requires less than three seconds. The necessary co-axial switching system is included at no extra cost. Being motor-driven, instead of manual, switching may be remotely controlled.



TT-50FH Block Diagram (one of two 25 kW transmitter units)

Circuit Details

25-kW Transmitter Unit

The TT-50FH Transmitter is, actually, two complete and independent 25-kW transmitters with combined outputs. The discussion to follow describes one-half of the transmitter from the exciter output to the output of the 25-kW visual and the 5.5-kW aural PA stages.

The aural carrier from the exciter is amplified to a 60-watt level in two solid-state, broadband amplifiers. It then drives the aural final amplifier which increases the power level to 5500 watts with a single Type 8890 tetrode power tube, identical to that used in the visual IPA stage.

The visual carrier is first amplified to a 20-watt level in a solid-state, broadband amplifier and then fed through a ferrite isolator to the visual diode modulator. Another ferrite isolator couples the modulated carrier to a pretuned broadband amplifier which raises the power level to a nominal 40 watts. A third ferrite isolator couples this signal to the linear, tube-type IPA stage and then through another isolator to the 25-kW final. The tube here is a high-performance, high-power tetrode developed by RCA specifically for TV broadcast service. It is important to note that the visual IPA tube is identical to the aural final tube to reduce "spares" inventories.

Ferrite Interstage Isolators

The TT-50FH transmitter offers operational simplicity and long-term stability as the result of a special design effort to use solid state devices wherever practical. The ferrite interstage isolator is such a device (see block diagram). It provides such a high degree of isolation between successive r-f stages that tuning of one stage causes practically no reaction on the stages ahead or following. This simplifies tuneup and increases long-term transmitter stability.

New Cavity Design

The cavities which contain the power tubes are designed to provide the best possible environment for the tubes. A unique air-flow system channels cooling air in a most efficient manner while modern "heat pipe" techniques reduce temperatures within the cavity to increase tube life. The transmitter uses but one 5-hp blower in each 25-kW transmitter section. As the result of low pressure drop, air noise is significantly lower than usual.

High-Level Sideband Shaping

To assure picture-output integrity, the TT-50FH uses only two tuned linear amplifiers following the visual modulator. The transmitter uses a filter at the output to assure proper sideband attenuation. This reduces the possibility of out-of-channel radiation.

The sideband filter included with the TT-50H transmitter is a new, high-reliability design that features temperature compensation. As a result, the device remains precisely tuned at all rated power levels over the ambient temperature range between —20 and +50°C.

Self-Reset Power Supplies

The TT-50FH features two, completely separate, identical power supply units, each supplying its "own" 25-kW transmitter unit (see floor layout).

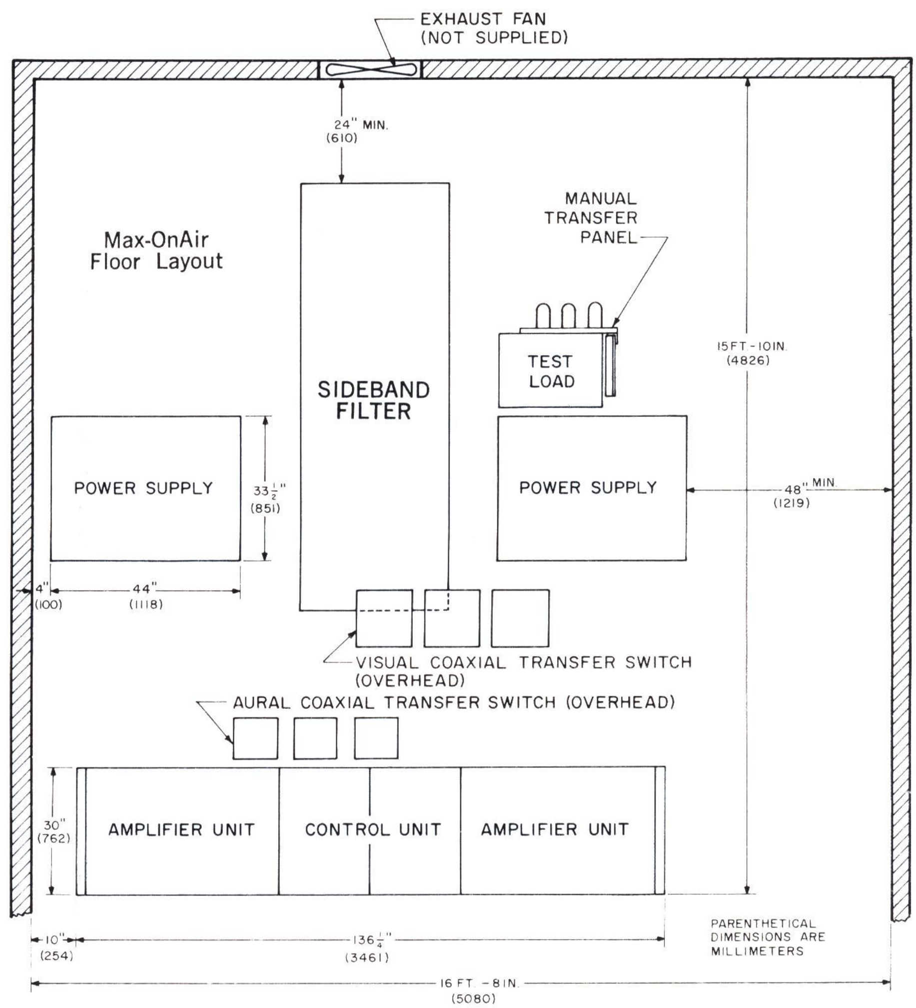
All TT-50FH power supplies (except PA-plate) are automatic current limiting. In the event of overload, the power supplies limit current to a "safe" value until the overload passes.

The high-voltage, PA-plate supplies are conventional, solid-state systems consistent with the specification criteria of the TT-50FH Transmitter.

Solid State Control

To assure almost limitless possibility for future remote-control and automatic status-logging, the TT-50FH employs solid-state logic circuitry in the major portion of the transmitters control system. For example, few electromechanical relays are used and solid-state devices perform many relay functions. Where electromechanical devices are essential, the units selected are computer-type, wire-contact, high-reliability relays. They interface the solid-state logic circuitry with the power-handling components of the transmitter.

The TT-50FH anticipates most of the special requirements of unattended transmitter operation via remote control. For example, the air-cooling system includes an analog readout of air flow through the transmitter (an indication of filter clog). Should the air flow drop below a safe operating level, an interlock facility "dumps" the transmitter section having air trouble. Similar sensing circuitry and facilities are included throughout the transmitter to provide valuable warning of impending malfunction and to speed the diagnosis and location of problems when they do occur.



Specifications

Performance

Type of Emission:
- Visual ... A5
- Aural ... F3

Frequency Range ... Channels 7-13

Rated Power Output:
- Visual ... 50 kW[1]
- Aural ... 11 kW

RF Output Impedance ... 50 ohms

Input Impedance:
- Visual ... Bridging
- Aural ... 600/150 ohms

Input Level:
- Visual ... 0.5 to 2.0 volts p-p
- Aural (for ±25 kHz dev.) ... +10 ±2 dBm

Amplitude vs. Frequency Response:
- Aural ... ±1 dB, 30 Hz to 15 kHz, of 50 μsec or 75 μsec pre-emphasis response curve

Visual Sideband Response:[1]
- At Carrier +0.5 to 3.58 MHz ... ±0.75 dB[2]
- At Carrier −0.5 MHz ... +0.5, −0.75 dB[2]
- At Carrier −0.75 MHz ... +0, −1.5 dB[2]
- Relative to Response at +3.58 MHz:
  - Between +2 and +4.18 MHz ... +0.5, −0.75 dB[3]

Variation in Frequency Response with Brightness[4] ... ±0.75 dB

Carrier Frequency Stability[5]:
- Visual ... ±250 Hz
- Aural ... ±500 Hz[5]

Modulation Capability:
- Visual ... 3%
- Aural ... ±50 kHz

Audio Frequency Distortion ... 0.5% max.[6] (30-15,000 Hz)

FM Noise (below ±25 kHz deviation) ... −60 dB

AM Noise r.m.s.:
- Visual ... −50 dB below sync level
- Aural ... −50 dB

Amplitude Variation over one picture frame ... Less than 2.0%[7]

Regulation of Output ... 3%

Burst vs. Subcarrier Phase[8] ... ±3°

Subcarrier Amplitude[8] ... 0.7 dB

Subcarrier Phase vs. Brightness[9] (diff phase) ... ±2°

Linearity (diff. gain)[10] ... 0.5 dB

Linearity (Low Frequency) ... 1.0 dB

Envelope Delay vs. Frequency[11]:
- 0.2 to 2.0 MHz ... ±60 ns
- at 3.58 MHz ... ±30 ns
- at 4.18 MHz ... ±60 ns

Harmonic and Spurious Radiation[12] ... −80 dB

Spurious Radiation[13] ... −100 dB

"K" Factor:
- 2T Pulse ... 2%[14]
- 20T Pulse ... 3%[14]

Electrical

AC Line Input ... 480 volts, 3-phase, 50/60 Hz (power consumption given below), and 115 volts, single phase, 50/60 Hz (100 watts)

Slow Line Variations ... ±5% max.

Rapid Line Variations ... ±3% max.

Phase Unbalance ... 2% max.

Regulation ... 3% max.

Power Consumption (at 50 kW peak visual, & 11 kW aural output):
- Average Picture ... 106 kW
- Black Picture ... 126 kW

Power Factor (approx.) ... 90%

Mechanical

Overall Length (front line cabinets) ... 136″ (3.46 m)

Overall Height (cabinets) ... 77″ (1.95 m)

Depth ... 30″ (762 mm)

Power Supply Cabinets ... 2 required
- Width ... 44″ (112 mm)
- Height ... 77″ (1.95 m)
- Depth ... 33″ (838 mm)
- Finish ... Two-tone blue, textured vinyl and brushed-aluminum trim

Environmental

Maximum Altitude ... 7,500 feet (2287 m)

Ambient Temperature ... 0°C to 45°C

---

1 Measured at output of sideband filter or filterplexer.

2 With respect to response at carrier plus 200 kHz, as measured by the BW-5 sideband response analyzer at transmitter mid-characteristic.

3 Add −0.75 dB for soundnotch characteristic if filterplexer is employed.

4 Measured at 65% and 25% of sync peak level with respect to response at transmitter mid-characteristic.

5 Maximum variation without circuit adjustment over a period of 30 days and over an ambient temperature range of 0°C to 45°C aural referenced to 4.5 MHz from visual carrier.

6 Including harmonics up to 30 kHz and measured with standard de-emphasis network.

7 Measured at blanking level.

8 Maximum departure from the theoretical when reproducing saturated primary colors and their complements at 75% amplitude.

9 Maximum phase difference with respect to burst, measured after the VSBF, for any brightness level between 75% and 15% of the sync peak using 10% (peak-to-peak) subcarrier modulation and modulation depth of 10%.

10 Maximum variation in the amplitude of a 3.58 MHz sine wave modulating signal as the brightness level is varied between 75% and 15% of sync peak. The gain shall be adjusted for 10% (peak-to-peak) modulation of the 3.58 MHz signal when the brightness is at pedestal level. This is equivalent to 5% (peak-to-peak) modulation as indicated by a conventional diode demodulator connected after the VSBF.

11 Maximum departure from standard curve using TTS-1A. The tolerances vary linearly between 2.1 and 3.58 MHz and between 3.58 and 4.18 MHz.

12 Ratio of any single harmonic or spurious frequency to peak visual power.

13 Not related to wanted carriers or modulation to within 3 MHz of operating channel. Channel edge to 3 MHz limit, better than −54 dB.

14 Measured at 50% peak modulation to minimize demodulator distortion.

Ordering Information

The TT-50FH TV Transmitter, 50-kW visual, 11-kW aural with tubes, solid-state color correction filters, including low pass filter, harmonic filters, filterplexer and motorized coaxial switches. For 480-volt, 3-phase, 50/60-Hz input ... ES-560670

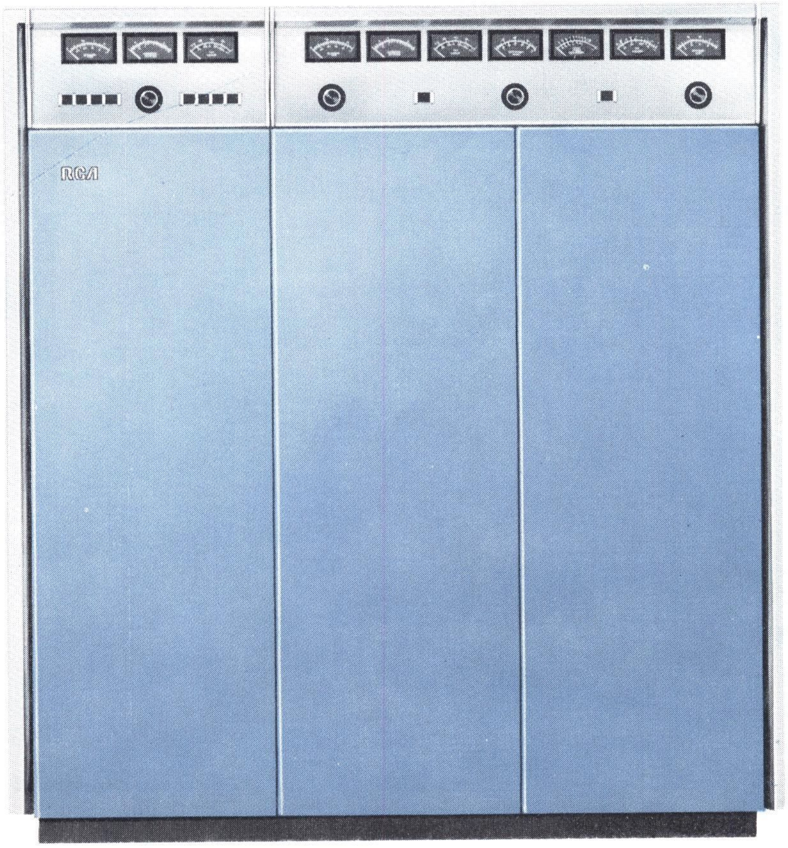
Communications Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102
RCA Broadcast Systems

PRINTED IN U.S.A.

RCA

catalog B.4009

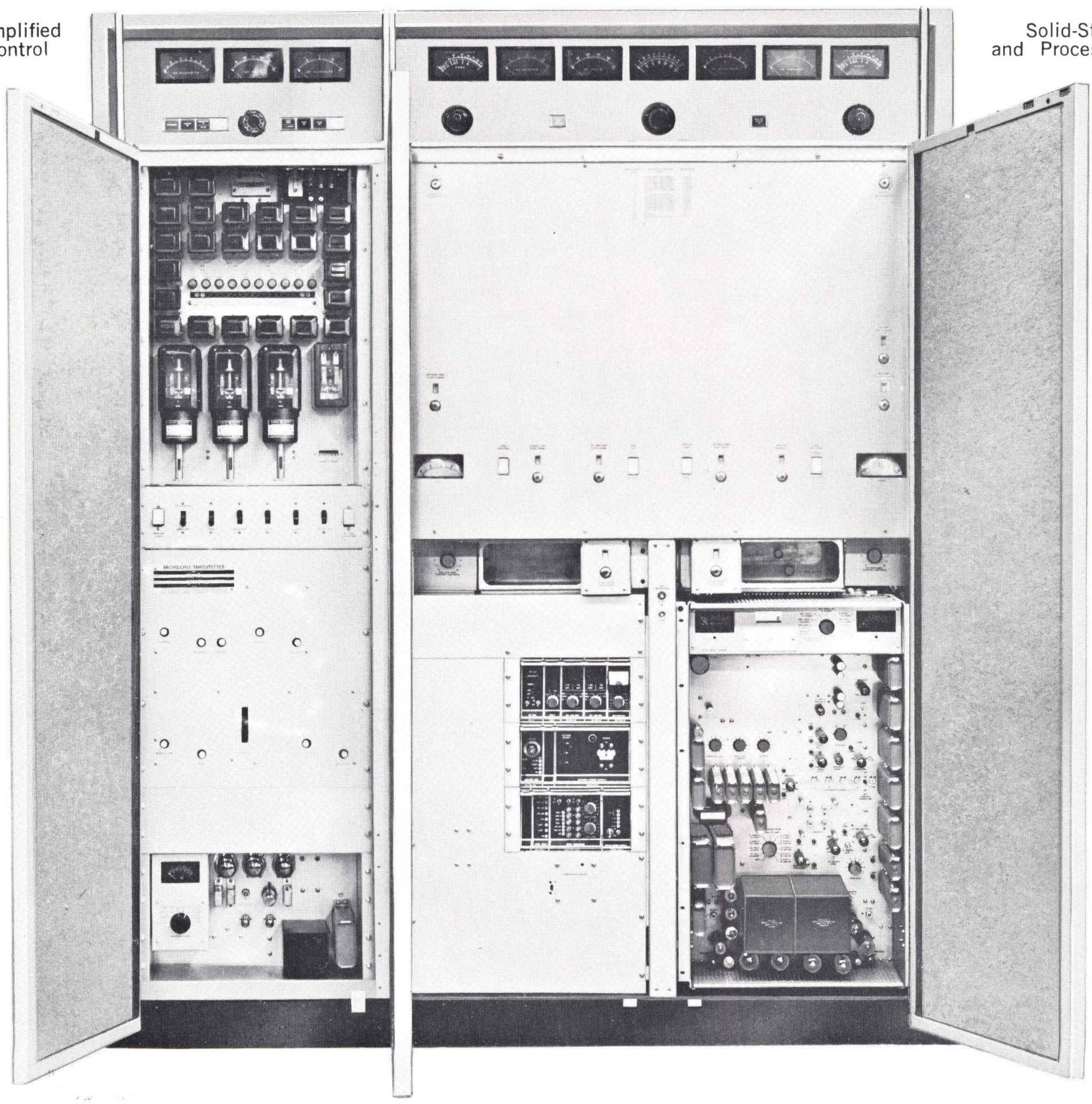
5 kW VHF-TV Transmitter, Type TT-5EH1S



- Solid state exciter
- Solid state video proc amplifier
- Added indicator circuits
- Easier Maintenance
- Compact cabinet
- Superior color performance

3VB

Select Features



5 kW VHF-TV Transmitter, Type TT-5EH1S

RCA's Type TT-5EH1S VHF Transmitter provides a nominal peak visual power output of 5 kW (4.5 kW CCIR) as measured at the output of the sideband filter or filterplexer and 5.5 kW aural power for stations operating in the 174-216 MHz band (Channels 7-13). It is designed to provide the finest possible performance and reliability. In combination with a modern antenna, the TT-5EH1S achieves effective radiated power of up to approximately 90 kW while conforming to all FCC, CCIR "M" and EIA Standards.

Newly styled powder and midnight blue cabinets with silver gray panels house the transmitter's simple, straightforward circuits of proven performance. Stability and reliability of operation have been raised to a new, high level by the incorporation of a new, totally solid state aural and visual exciter. Tuning is simple as only one broadband amplifier stage is used. All other RF stages are operated as Class "C" amplifiers. This efficiency, together with the use of silicon rectifiers, offers a considerable reduction in power that is reflected in lower operating costs.

Improved linearity, built-in correction circuits in the modulator, provisions for 5.5 kW aural power capability, long-life PA tubes, and air-cooling add up to improved reliability and finest color performance. A special feature is a solid state video processing amplifier built into the transmitter. In addition, the TT-5EH1S is ready for remote control, and has many other features that make it easy to operate and maintain:

Description

Outwardly, the TT-5EH1S is marked by its eye-arresting color, new look meters on new lift-up meter panels, indicator lamps on meter panels, and illuminated switches. These together with added indicator circuits and dual purpose metering switches provide new ease of operation and improved control over transmitter operation. The new full height doors, and walk-in enclosure offer complete accessibility and ease of maintenance.

Walk-in Enclosure

The transmitter is housed in a compact cabinet having only one access door. This cabinet can be broken down for shipping into racks and panels of various sizes for easy handling. All RF circuits and control circuits are located at the front of the enclosure. The control unit is at the left front corner of the transmitter in a separate cabinet with status lights and control switches grouped on a panel above the door. The auxiliary switches, breakers, overload and auxiliary relays, etc. are in the control unit behind a non-interlocked door. Overload indicating lights for the circuits of the transmitter are grouped on a single strip also located in the control unit. Located on the panel above the door are all the operating controls such as the transmitter start switch, plate switch, and metering switch.

To the right of the control unit is the RF rack. It contains aural and visual RF power stages, the exciter and modulator units. The modulator and exciter units are located at the bottom of the rack, hinged at the bottom to facilitate servicing from the front of the transmitter. All important meters are mounted in a sloping panel at the top of the RF rack. The meters are tilted 10 degrees for easy observation. All tuning controls are located behind double doors. Tuning controls are operated by a crank which is removable to prevent accidental misadjustment of the circuits during operation. Easily read counter dials make possible accurate logging of all the control settings.

A single access door on the left end of the transmitter provides access to the rear of the control rack and RF rack as well as the solid state rectifiers mounted on the rear wall of the enclosure. All heavy units such as the plate transformers and large reactors are mounted on a base plate on the floor.

Designed for Remote Control

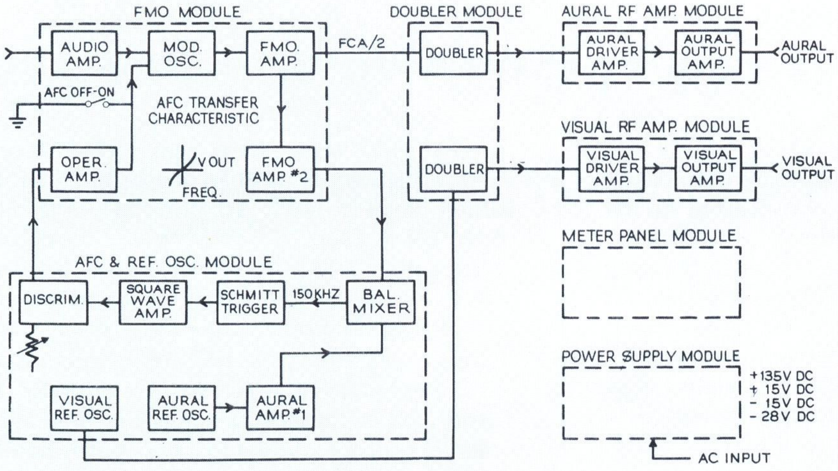
With suitable terminal equipment the TT-5EH1S can be operated remotely. All the necessary operating functions such as starting and stopping the transmitter, resetting overloads, switching in the spare crystal oscillator, metering all power circuits and reflectometers, controlling power output (including black level, video gain, and excitation) can be performed at the remote location. Even when the transmiter is not remotely controlled, these built-in features make it very easy to obtain fingertip control of the transmitter from a single local position such as a transmitter console.

Solid-State 5-Watt Exciter

The 5-watt aural/visual exciter, its power supply and metering circuits consist of seven plug-in modules in one standard frame.

The aural exciter circuitry uses an FM oscillator in an AFC feedback loop followed by a buffer amplifier, doubler and two amplifiers to reach the 5-watt output level at one-third carrier frequency. The center frequency of the oscillator is accurately maintained by a reference frequency that is 150 kHz above the FM oscillator. A DC error voltage that represents the difference between the center frequency and the reference corrects for any oscillator drift.

The visual exciter circuitry consists of a temperature-controlled visual oscillator followed by a doubler and two amplifiers to reach the 5-watt output level at one-third carrier frequency.



Solid-State 5-Watt Exciter Block Diagram.

Proven RF Circuitry

The RF circuits employ a chain of multipliers and amplifiers. In the visual chain a 7034 operates as a tripler driving a 4CX300A amplifier which in turn drives a type 4CX5000A grid modulated power amplifier. The aural chain consists of a 7034 tripler tube driving a type 4CX-300A amplifier driving a type 4CX5000A class "C" power amplifier. Excitation control for the visual modulated amplifier is accomplished by varying the screen voltage on the 4CX300A amplifier stage. Power output of the aural transmitter is adjusted by varying the screen voltage on the 4CX5000A stage. Both these controls are operated by motors and therefore can be adjusted from a remote position.

Solid-state Video Input and Processing Amplifiers

A new feature of the proven "E" line of transmitters is the use of two solid-state video modules consisting of a video-input module and a video-processing module.

Video Input Module

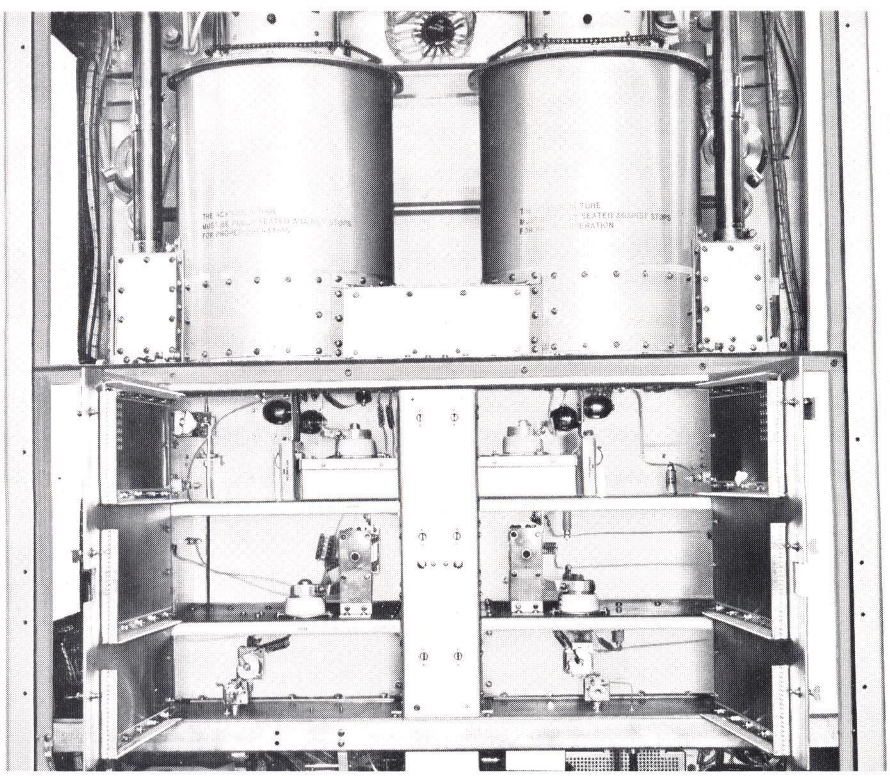
The input module, utilizing NPN-, PNP-, and FET-type transistors, provides a high impedance input to insure a loop-through arrangement in the video-input circuit.

The input module generates a negative (—) clamp signal for the video amplifier and a positive (+) clamp signal for the video processing module which follows it in the video path. The input module operates with a nominal input level of one volt (peak-to-peak) video. A differential input circuit is provided to suppress as much as eight volts of common-mode signal appearing at the input due to a difference in potential between power-line neutrals at the opposite ends of the video line. The video is amplified in the first transistor stage and fed to a video gain control located in the video processing module. Another output from that amplifier feeds a sync amplifier which is followed by a sync separator and a clamp-pulse generator. The resulting positive (+) clamp pulse is applied to the video processing module clamp circuit. When the clamp circuit in the video processor is unnecessary, this signal is short-circuited to ground to make the sync amplifier inoperative.

Video Processing Modules

The video processing modules include a motor-driven video-gain and a sync-gain

RF Amplifier Unit for the TT-5EH1S showing intermediate RF stages together with visual (left) and aural (right) PA Cavities.



control, a video amplifier, differential-phase and gain-correction circuits, a clamp circuit and an output impedance-matching amplifier.

The video input signal, after passing through the video gain control, is fed to an amplifier with a gain of approximately 4.5. A positive clamp pulse (+) from the video input module is applied to the clamp amplifier. When the clamp switch is in the "on" position, d-c information is restored to the video signal. Output from the video amplifier is fed to a differential phase circuit using four gated capacitors and one voltage-variable capacitor (*Varicap*). Approximately ±2 degrees of correction is available from each gated capacitor and +8 degrees of phase correction is available from the *Varicap* capacitor. The four diodes, associated with the four gated capacitors, may be easily reversed to provide positive (+) or negative (—) correction.

The output of this stage feeds a differential amplifier. Four diodes are gated by transistors to provide an increase in gain of the differential amplifier. The level at which gating takes place is determined by front-panel differential gain controls. Correction of up to 11 dB is possible. The output of the video processing amplifier feeds the visual modulator.

Video Modulator

The video modulator further processes the video signal and amplifies it to an output of approximately 200 volts, peak to peak, for full modulation of the 4CX5000A modulated amplifier. A linearity (differential gain) amplifier is also included as part of the modulator. Its action is similar to that described in the processing amplifier. The modulator uses conventional video circuitry to the output stage. The modulator output stage functions as a shunt-regulated cathode-follower. Three Type 6146 tubes are connected in a circuit similar to a conventional cathode follower, except that the cathode resistor is replaced by four Type 6146 tubes operating in parallel. The grids of these four tubes are fed with a signal from the plate load of the cathode follower tubes.

The circuit is essentially a feedback amplifier of high efficiency capable of video modulating the five-kilowatt amplifier with a video signal of approximately 200 volts, peak-to-peak.

Video Monitoring

A monitor amplifier is provided for monitoring the modulator output signal. Numerous test jacks are also provided to simplify troubleshooting and modulator alignment.

Solid State Power Supplies

Wherever possible in this transmitter, the same DC power supplies were used for both the visual and aural amplifiers. This greatly reduces the number of components in the transmitter and allows operation of the complete equipment with only five power supplies. An exciter supply is built into the common exciter unit using stacked germanium diodes. The other four supplies, all using silicon diodes, are located on the rectifier panel at the rear of the enclosure. An 800-volt supply furnishes all screen voltages as well as the 7034 plate voltage. The high-voltage supply has a 5500-volt output for the 4CX5000A plates. The intermediate high voltage supply furnishes 2000 volts output for the 4CX300A plates. All voltages for the visual modulator are furnished by the remaining two supplies. One has an output of +350 volts, and the other has several outputs, all negative with respect to ground, which supply the high-level video stages as well as bias for the modulator and RF stages.

Improved Control Equipment

A single integrated control circuit is provided for both the visual and aural transmitters. The blower, filaments, and each rectifier is protected by thermal overloads which can be adjusted to reset automatically. In addition, a main line breaker and an auxiliary breaker are provided. Each incorporates both thermal and magnetic trips. All rectifiers and RF stages following the exciter are protected by instantaneous overload relays which automatically recycle twice. If the fault continues on the third try the overload circuit will remain tripped until reset. Overload indicator lights are provided for each circuit. These lights have a separate reset and will remain on after the first overload thus providing a record of the circuit giving trouble even though it may be intermittent.

Power Regulation

The equipment includes an automatic line voltage regulator which provides a stable line voltage to the filament primaries, the exciter, the modulator and the low voltage power supplies. A low voltage regulator is included which provides screen voltage regulation to both visual and aural RF stages.

Special Protective Circuits

The transmitter has reflectometer units for use in the output transmission lines of both the aural and visual amplifiers. Each unit contains a 6AL5 diode detector. The transmission line probes are installed so as to give an indication of the amount of power on meters on the front panel. Reflected power can be checked by manually rotating the reflectometer heads.

A carrier-off monitor is available as optional equipment. It acts in conjunction with the reflectometer units and is particularly useful for remote control. This unit will remove the plate voltage from all the RF stages if the output level drops below a predetermined value, such as would be the case if an RF arc occurred in any of the RF stages. Sometimes such an arc does not change the plate current sufficiently to trip the DC overload relays.

Harmonic Filter

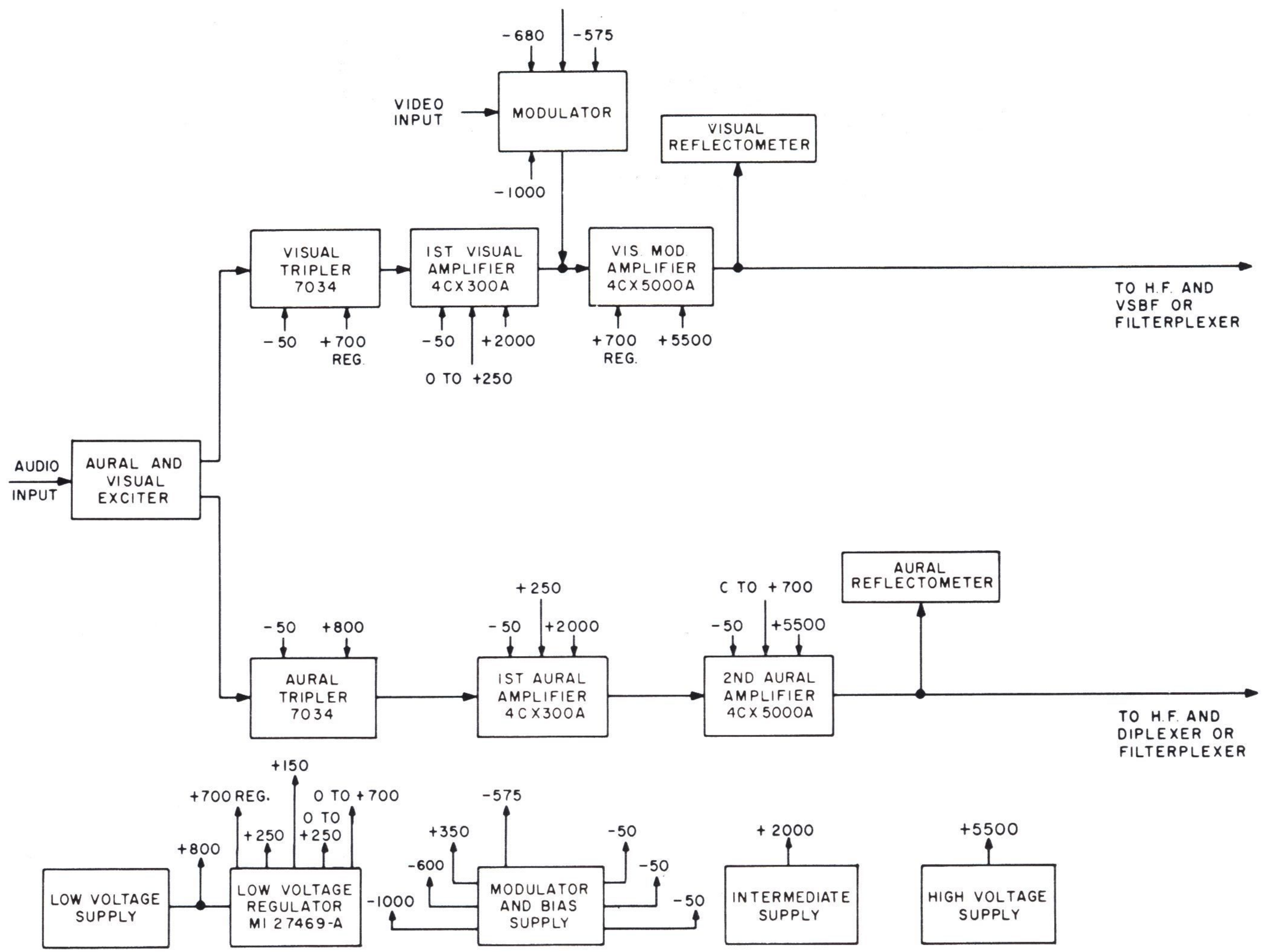
Harmonic filters are supplied for insertion in the output transmission line. When operated in conjunction with the TT-5EH1S Transmitter these filters are designed to attenuate all harmonics to a value at least 60 dB below the peak carrier level. Electrically, each filter consists of an M-derived half-T section, several low pass filter sections, and a constant-K half-T section. The M-derived section provides rapid cut-off in the second harmonic region and a termination impedance of 51.5 ohms at one end of the filter. Attenuation of the harmonics is accomplished by a low pass filter section, while the constant-K section serves to give termination impedance of 51.5 ohms at the other end of the unit.

Low Pass Filter

A low pass filter is provided for insertion in the video input circuit. This filter attenuates all video frequencies above 4.75 MHz (5.75 MHz CCIR) at least 20 dB. An all-pass phase equalizer is also included as part of the low pass filter. This equalizer corrects the phase distortion which is introduced as a result of the sharp cut-off.

Vestigial Sideband Filter

A vestigial sideband filter is available completely assembled and adjusted for any one of the high band VHF television channels. This filter is an integral unit designed for floor, ceiling, or wall mounting near the visual transmitter so that the input transmission line is as short as possible. The filter sections consist of lengths of coaxial line (resonant cavities), which are adjustable for tuning purposes. As the filter is pre-tuned at the factory, no operating adjustments are necessary.



Simplified Block Diagram of TT-5EH1S VHF TV Transmitter.

Specifications

Performance

Type of Emission:
- Visual A5
- Aural F3

Frequency Range .... Ch 7-13

Rated Power Output:
- Visual .... 5.0 kW[1]
- Aural .... 5.5 kW

RF Output Impedance .... 50/51.5 ohms

Input Impedance:
- Visual .... 75 ohms
- Aural .... 600/150 ohms

Input Level:
- Visual .... 1.0 volts p-p min.
- Aural (for ±25 kHz dev.) .... +10 ±2 dBm

Amplitude vs. Frequency Response, Aural .... ±1 dB, 50 Hz to 15 kHz, of 50 μsec or 75 μsec pre-emphasis response curve

Visual Sideband Response:
- At Carrier +0.5 MHz to 2.1 MHz .... +0.5, −1.0 dB[2]
- At Carrier +3.58 MHz .... +0.5, −1.0 dB[2]
- Between +2.1 MHz to 4.18 MHz with respect to 3.58 MHz response .... +0.5, −1.0 dB[3]
- At Carrier −0.5 MHz .... +0.5, −1.0 dB[2]

Variation in Frequency Response with Brightness[4] .... ±1.0 dB

Carrier Frequency Stability[5]:
- Visual .... ±250 Hz
- Aural .... ±250 Hz

Modulation Capability:
- Visual 10%
- Aural .... ±50 kHz

Audio Frequency Distortion .... 0.5% max.[6] (50-15,000 Hz)

FM Noise (below ±25 kHz deviation) .... −60 dB

AM Noise r.m.s.:
- Visual .... −50 dB (below sync level)
- Aural .... −50 dB

Amplitude Variation over one picture frame .... Less than 4%[7]

Regulation of Output 4%

Subcarrier Amplitude[8] .... 0.7 dB

Subcarrier Phase vs. Brightness[9] (diff. phase) .... ±3°

Linearity (diff. gain)[10] .... 0.7 dB

Linearity (Low Frequency) .... 1.0 dB

Envelope Delay vs. Frequency[11]:
- 0.2 to 2.0 MHz .... ±60 ns
- at 3.58 MHz .... ±30 ns
- at 4.18 MHz .... ±60 ns

Harmonic and Spurious Radiation[12] .... −60 dB

K Factor:
- 2T .... 2%[13]
- 20T .... 3%[13]

Electrical

AC Line Input .... 208/240 volts, 3 phase, 50/60 Hz (power consumption given below), and 115 volts single phase 50/60 Hz (100 watts)

Slow Line Variations .... ±5% max.

Rapid Line Variations .... ±3% max.

Regulation .... 3% max.

Power Consumption
- Rated Visual; 1.1 kW aural .... 18.3 (black pix) 14.3 kW (average pix)
- Rated Visual; 5.5 kW aural .... 24.6 kW (black pix) 20.6 kW (average pix)

Power Factor (approx.) 90%

Mechanical

Dimensions:
- Overall Length (front line cabinets only) .... 72″ (1829 mm)
- Overall Height (front line cabinets only) .... 84″ (2134 mm)
- Depth (front line cabinets only) .... 20″ (508 mm)
- Overall Depth .... 78 13/16″ (2 m)

Weight .... 5000 lbs. (2268 kg)

Finish .... Two-tone blue, polished stainless steel trim

Environmental

Maximum Altitude[14] .... 7500 ft. (2286 m)

Ambient Temperature .... 0°C to 45°C

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1 Measured at output of sideband filter or filterplexer.

2 With respect to response at carrier plus 200 kHz, as measured by the BW-5 sideband response analyzer at transmitter mid-characteristic.

3 Measured at output of VSBF. Add −0.75 dB at +4.18 MHz if filterplexer or notch diplexer is employed.

4 Measured at 65% and 25% of sync peak level with respect to response at transmitter mid-characteristic.

5 Maximum variation without circuit adjustment over a period of 30 days under normal operating conditions.

6 Including harmonics up to 30 kHz and measured with standard de-emphasis network.

7 Measured at blanking level.

8 Maximum departure from the theoretical when reproducing saturated primary colors and their complements at 75% amplitude.

9 Maximum phase difference with respect to burst, measured after the VSBF, for any brightness level between 75% and 15% of the sync peak using 10% (peak-to-peak) modulation with proc. amplifier.

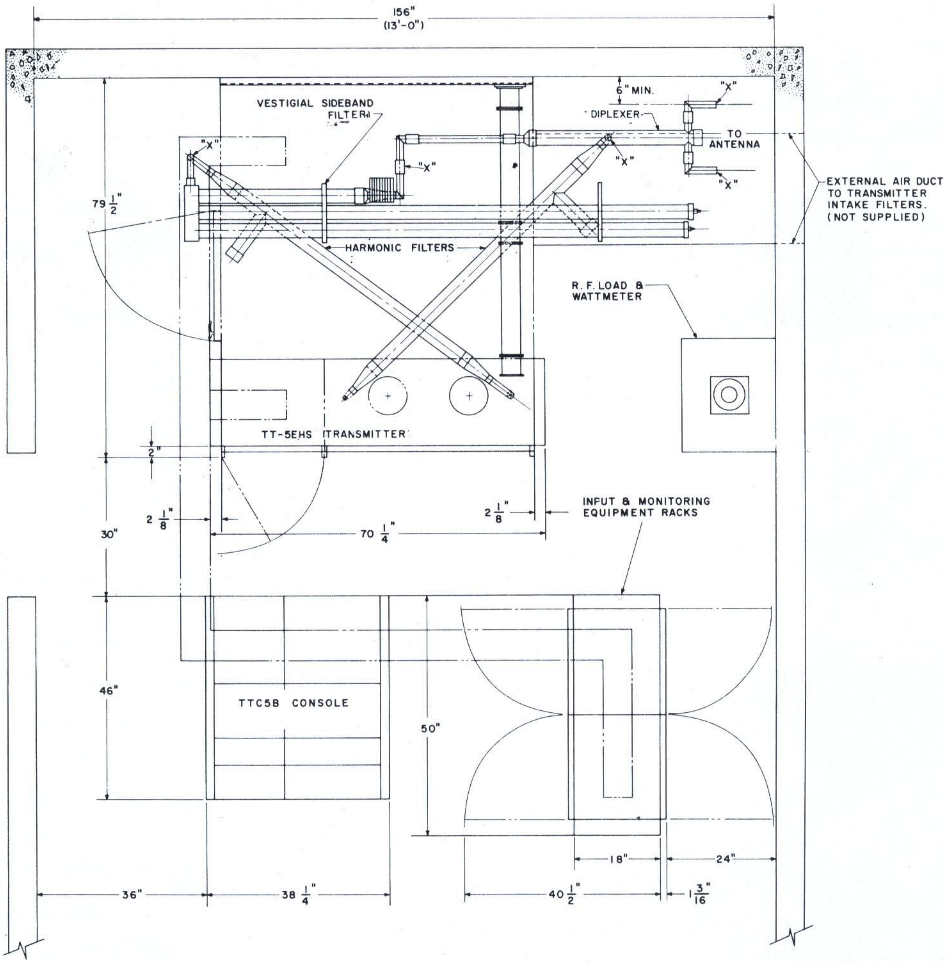
10 Maximum variation in the amplitude of a 3.58 MHz sine wave modulating signal as the brightness level is varied between 75% and 15% of sync peak. The gain shall be adjusted for 10% (peak-to-peak) modulation of the 3.58 MHz signal when the brightness is at pedestal level. This is equivalent to 5% (peak-to-peak) modulation as indicated by a conventional diode demodulator connected after the VSBF with proc. amplifier.

11 Maximum departure from standard curve using TTS-1A. The tolerances vary linearly between 2.1 and 3.58 MHz and between 3.58 and 4.18 MHz as measured with an RCA BW-8 Envelope Delay Measurement Instrument.

12 Ratio of any single harmonic or spurious frequency to peak visual power.

13 Measured at 50% peak modulation to minimize demodulator distortion and with TTS-1 in use.

14 For operation at rated power and normal plate voltage.



(Not certified for construction use. Please request installation drawing.)

Typical Floor Plan for the TT-5EH1S Transmitter.

Ordering Information

TT-5EH1S TV Transmitter, 5 kW visual, 5.5 kW aural with tubes, low pass, harmonic and sideband filter. For 208/240 V, 3-phase, 50/60 Hz power ES-560900

TT-5EH1S TV Transmitter, 4.5 kW visual, 5.5 kW aural with tubes. For 208/230 V, 3 phase, 50/60 Hz input. (Output power and required filters to be determined in accordance with required standards) ....Specify CCIR or other standards

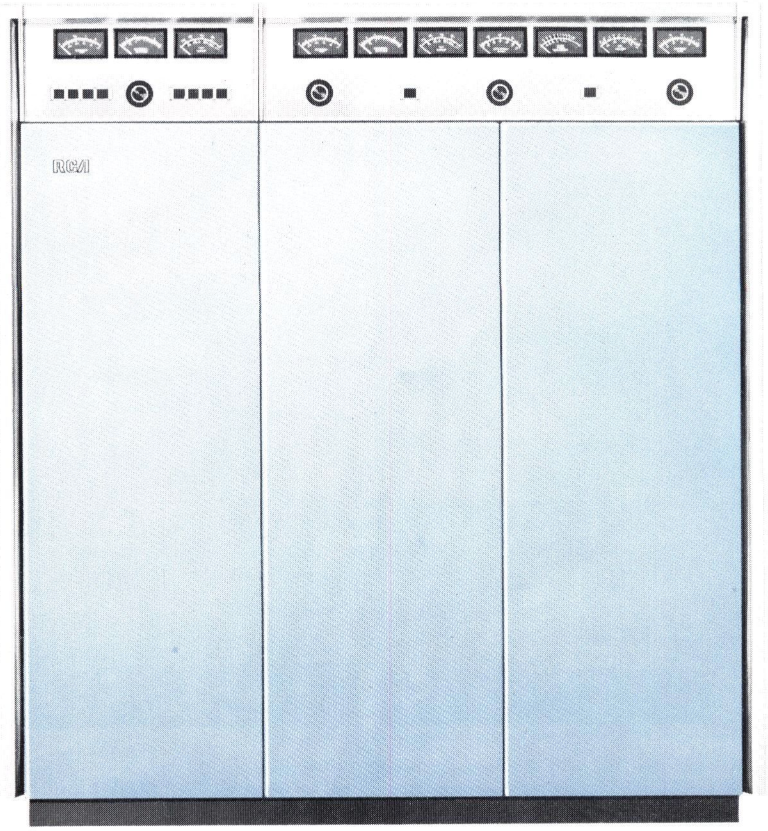
Communications Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

RCA Broadcast Systems

RCA

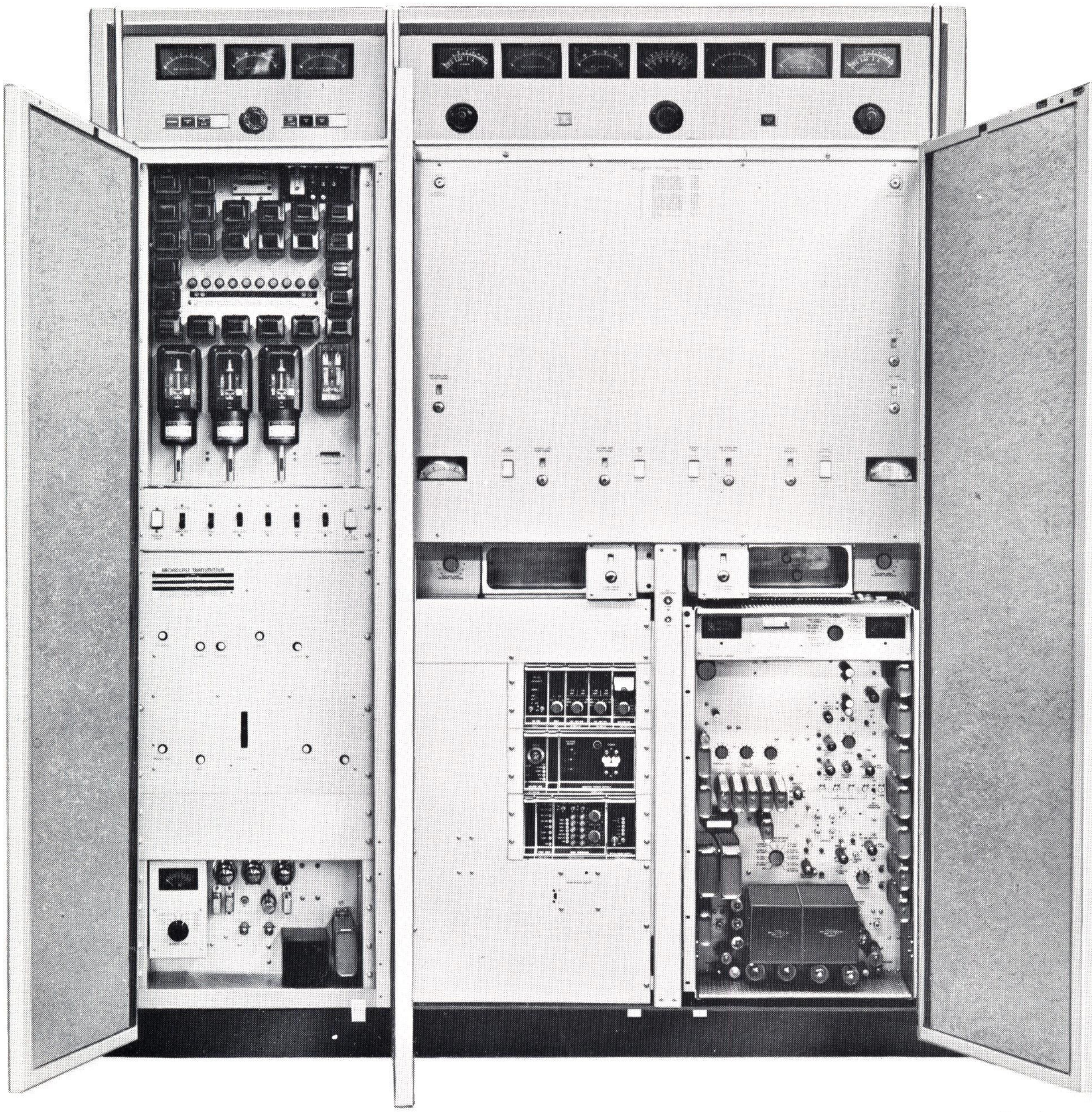
catalog B.4012

6 kW VHF TV Transmitter, Type TT-6ELS



- Solid state exciter
- Solid state proc amplifier
- Superior color performance
- Added indicator circuits for easier maintenance

3VB


Lift-up Meter Panels
Indicator Lights
Solid-State Exciter and Video Processing Amplifier
Simplified Control
Ready for Remote Control
Overload Protection
Full Length Doors
Low-Voltage Regulation
Walk-in Cabinet Design
Air Pressure Meters Cooling Activity
Tilt-Out Modulator
Front and Rear Accessibility

6 kW VHF Transmitter, Type TT-6ELS

The RCA Type TT-6ELS is an outstanding TV transmitter designed for color and for ease of operation—manual or remote. This low band CH 2-6 (47-88 MHz) VHF Transmitter when used in combination with one of the current VHF antennas achieves effective radiated power of up to approximately 50 kilowatts while conforming to all FCC, and CCIR "M" standards. It provides a nominal peak visual power output of 6 kW (5 kW CCIR) as measured at the output of the sideband filter or filterplexer and 5.5 kW aural power.

Improved color picture quality is achieved through the simple, straight-forward circuits of proven performance, reliable long-life PA tubes, the solid-state rectifiers and stable air-cooling system. Color performance has been enhanced by linearity correction circuits built into the modulator and by a new video processing amplifier. Vertical construction and complete accessibility simplify installation and maintenance. Built-in remote control features are provided.

Description

Outwardly, the TT-6ELS is marked by its eye-arresting color, black face meters on new lift-up meter panels, indicator lamps on meter panels, and illuminated switches. These together with added indicator circuits and dual purpose metering switches provide new ease of operation and improved control over transmitter operation. The new full height doors, and walk-in enclosure offer complete accessibility and ease of maintenance.

Walk-in Enclosure

The transmitter is housed in a compact cabinet having only one access door. The cabinet can be broken down for shipping into racks and panels of varying size for easy handling. All RF circuits and control circuits are located at the front of the enclosure. The control unit is at the left front corner of the transmitter in a separate cabinet with status lights and control switches grouped on a panel above the door. The auxiliary switches, breakers, overload and auxiliary relays, etc. are in the control unit behind a non-interlocked door. Overload indicating lights for the circuits of the transmitter are grouped on a single strip also located in the control unit. Located on the panel above the doors are all the operating controls such as the transmitter start switch, plate switch, and metering switches.

To the right of the control unit is the RF rack. It contains aural and visual RF power stages, the exciter and modulator units. The modulator and exciter units are located at the bottom of the rack. The visual modulator is hinged at the bottom to facilitate servicing from the front of the transmitter. All important meters are mounted in a sloping panel at the top of the RF rack. The meters are tilted 10 degrees for easy observation. All tuning controls are located behind double doors. Tuning controls are operated by a crank which is removable to prevent accidental misadjustment of the circuits during operation. Easily read counter dials make possible accurate logging of all the control settings.

A single access door on the left end of the transmitter provides access to the rear of the control rack and RF rack as well as the solid state rectifiers mounted on the rear wall of the enclosure. All heavy units such as the plate transformers and large reactors are mounted on a base plate on the floor.

Designed for Remote Control

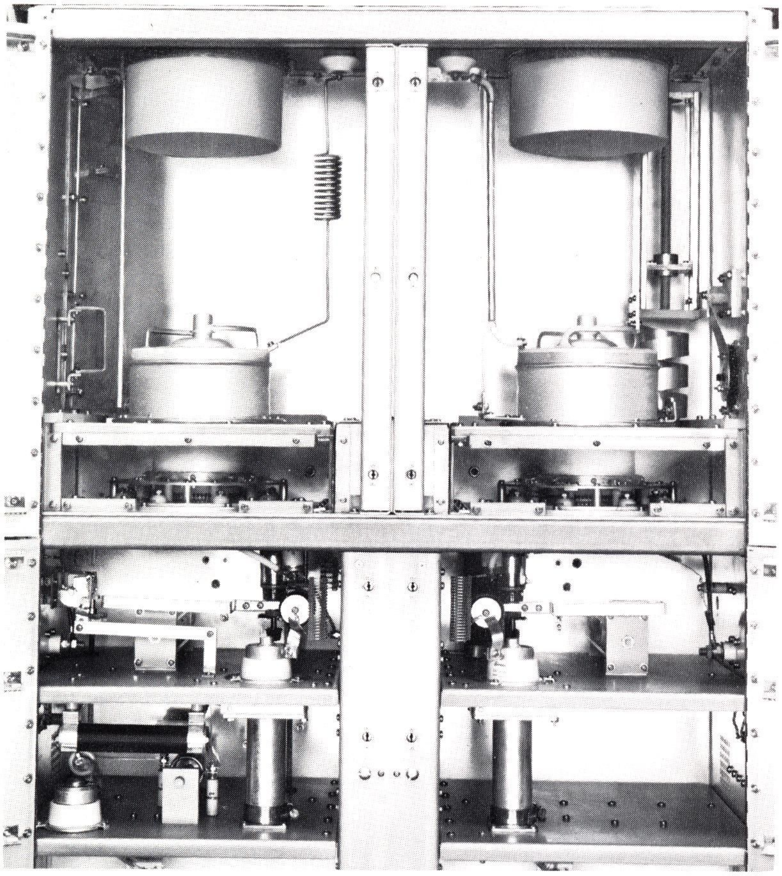
With suitable terminal equipment the TT-6ELS can be operated remotely. All the necessary operating functions such as starting and stopping the transmitter, resetting overloads, metering all power circuits and reflectometers, controlling power output (including black level, video gain, and excitation) can be performed at the remote location. Even when the transmitter is not remotely controlled, these built-in features make it very easy to obtain fingertip control of the transmitter from a single local position such as a transmitter console.

Solid-State 5-Watt Exciter

The 5-watt aural/visual exciter, its power supply and metering circuits consist of seven plug-in modules in one standard frame.

The aural exciter circuitry uses an FM oscillator in an AFC feedback loop followed by a buffer amplifier, doubler and two amplifiers to reach the 5-watt output level at carrier frequency. The center frequency of the oscillator is accurately maintained by a reference frequency that is 150 kHz above the FM oscillator. A DC error voltage that represents the difference between the center frequency and the reference corrects for any oscillator drift.

The visual exciter circuitry consists of a temperature-controlled visual oscillator followed by a doubler and two amplifiers to reach the 5-watt output level at carrier frequency.



Visual (left), Aural (right) RF Amplifier Unit for the TT-6ELS.

Proven RF Circuitry

The RF circuits employ a chain of multipliers and amplifiers. In the visual chain a 7034 amplifier drives a 4CX300A amplifier which in turn drives a type 4CX5000A grid modulated power amplifier. The aural chain consists of a type 4CX300A amplifier driving a type 4CX-5000A class "C" power amplifier. Excitation control for the visual modulated amplifier is accomplished by varying the screen voltage on the 4CX300A amplifier stage. Power output of the aural transmitter is adjusted by varying the screen voltage on the 4CX5000A stage. Both these controls are operated by motors and therefore can be adjusted from a remote position.

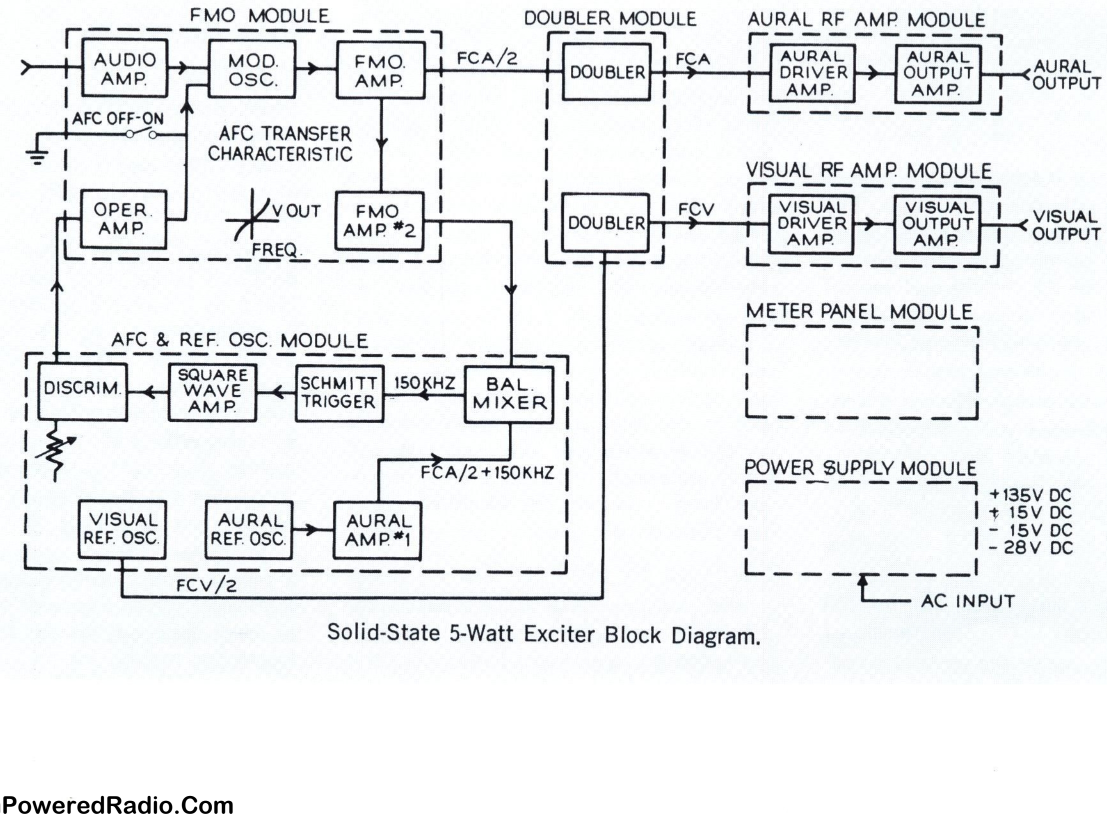
Solid-State Video Input and Processing Amplifiers

A new feature of the proven "E" line of transmitters is the use of two solid-state video modules consisting of a video-input module and a video-processing module.

Video Input Module

The input module, utilizing NPN-, PNP-, and FET-type transistors, provides a high impedance input to insure a loop-through arrangement in the video-input circuit.

The input module generates a negative clamp signal for the video amplifier and a positive clamp signal for the video processing module which follows it in the



Solid-State 5-Watt Exciter Block Diagram.

video path. The input module operates with a nominal input level of one volt (peak-to-peak) video. A differential input circuit is provided to suppress as much as eight volts of common-mode signal appearing at the input due to a difference in potential between power-line neutrals at the opposite ends of the video line. The video is amplied in the first transistor stage and fed to a video gain control located in the video processing module. Another output from that amplifier feeds a sync amplifier which is followed by a sync separator and a clamp-pulse generator. The resulting positive clamp pulse is applied to the video processing module clamp circuit. When the clamp circuit in the video processor is unnecessary, this signal is short-circuited to ground to make the sync amplifier inoperative.

Video Processing Modules

The video processing modules include a motor-driven video-gain and a sync-gain control, a video amplifier, differential-phase and gain-correction circuits, a clamp circuit and an output impedance-matching amplifier.

The video input signal, after passing through the video gain control, is fed to an amplifier with a gain of approximately 4.5. A positive clamp pulse from the video input module is applied to the clamp amplifier. When the clamp switch is in the "on" position, d-c information is restored to the video signal. Output from the video amplifier is fed to a differential phase circuit using four gated capacitors and one voltage-variable capacitor (*Varicap*). Approximately ±2 degrees of correction is available from each gated capacitor and +8 degrees of phase correction is available from the *Varicap* capacitor. The four diodes, associated with the four gated capacitors, may be easily reversed to provide positive or negative correction.

The output of this stage feeds a differential amplifier. Four diodes are gated by transistors to provide an increase in gain of the differential amplifier. The level at which gating takes place is determined by front-panel differential gain controls. Correction of up to 11 dB is possible. The output of the video processing amplifier feeds the visual modulator.

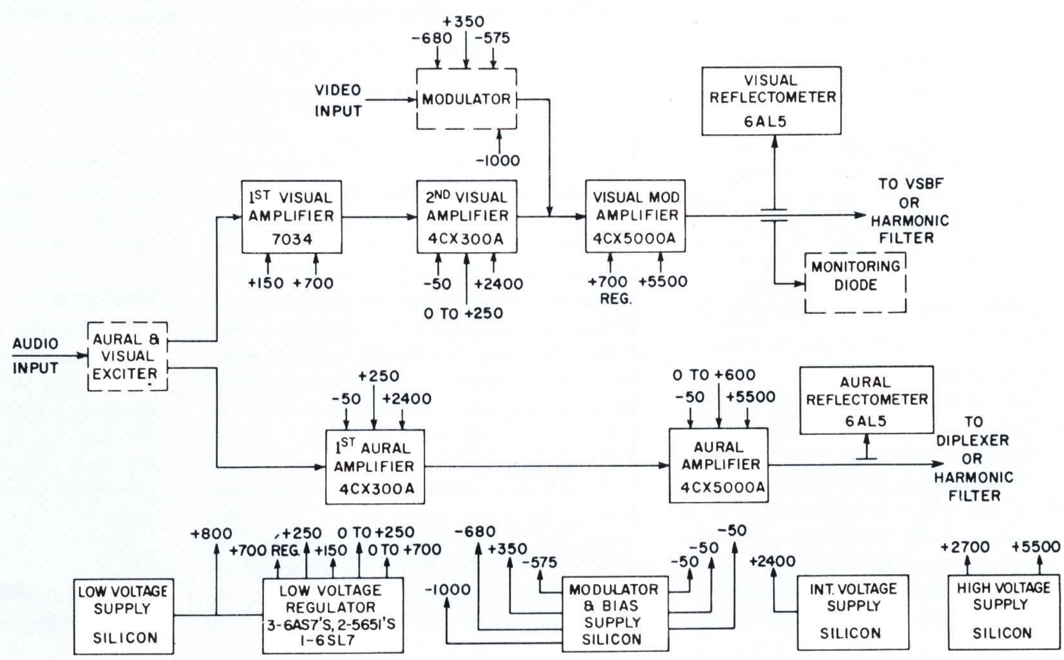
Video Modulator

The video modulator further processes the video signal and amplifies it to an output of approximately 200 volts, peak to peak, for full modulation of the 4CX5000A modulated amplifier. A linearity (differential gain) amplifier is also included as part of the modulator. Its action is similar to that described in the processing amplifier. The modulator uses conventional video circuitry to the output stage. The modulator output stage functions as a shunt-regulated cathode-follower. Three Type 6146 tubes are connected in a circuit similar to a conventional cathode follower, except that the cathode resistor is replaced by four Type 6146 tubes operating in parallel. The grids of these four tubes are fed with a signal from the plate load of the cathode follower tubes.

The circuit is essentially a feedback amplifier of high efficiency capable of video modulating the five-kilowatt amplifier with a video signal of approximately 200 volts, peak-to-peak.

Solid State Power Supplies

Wherever possible in this transmitter, the same DC power supplies were used for both the visual and aural amplifiers. This greatly reduces the number of components in the transmitter and allows operation of the complete equipment with only five power supplies. The power supplies, all using silicon diodes, are located on the rectifier panel at the rear of the enclosure. An 800-volt supply furnishes all screen voltages as well as the 7304 plate voltage. An intermediate supply provides 2400 volts for the 4CX300A plates. The high-voltage supply has a 5500-volt output for the 4CX5000A plates. When low aural power is desired, half voltage may be obtained from the high voltage supply for the 4CX5000A aural amplifier plate. All voltages for the visual modulator are furnished by the remaining two supplies. One has an output of +350 volts, and the other has several outputs, all negative with respect to ground, which supply the high-level video stages as well as bias for the modulator and RF stages.



Block Diagram of the TT-6ELS VHF Television Transmitter.

Improved Control Equipment

A single integrated control circuit is provided for both the visual and aural transmitters. The blower, filaments, and each rectifier is protected by thermal overloads which can be adjusted to reset automatically. In addition, a main line breaker and an auxiliary breaker are provided. Each incorporates both thermal and magnetic trips. All rectifiers and RF stages following the exciter are protected by instantaneous overload relays which automatically recycle twice. If the fault continues on the third try the overload circuit will remain tripped until reset. Overload indicator lights are provided for each circuit. These lights have a separate reset and will remain on after the first overload thus providing a record of the circuit giving trouble even though it may be intermittent.

Power Regulation

The equipment includes an automatic line voltage regulator which provides a stable line voltage to the filament primaries, the modulator and the low voltage power supplies. A low voltage regulator is included which provides screen voltage regulation to both visual and aural RF stages.

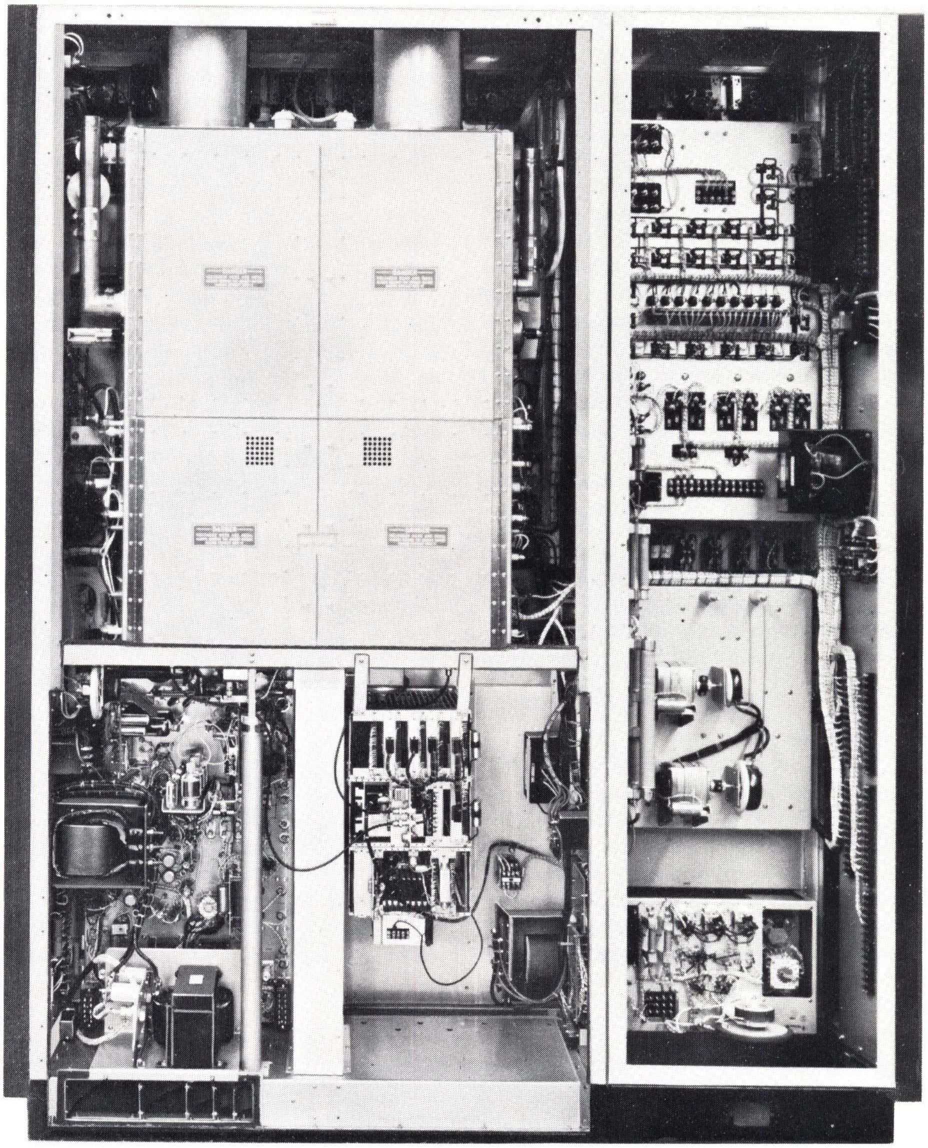
Special Protective Circuits

The TT-6ELS has reflectometer units for use in the output transmission lines of both the aural and visual amplifiers. Each unit contains a 6AL5 diode detector. The transmission line probes are installed so as to give an indication of the amount of power on meters on the front panel. Reflected power can be checked by manually rotating the reflectometer heads.

A carrier-off monitor is available as optional equipment. It acts in conjunction with the reflectometer units and is particularly useful for remote control. This unit will remove the plate voltage from all the RF stages if the output level drops below a predetermined value, such as would be the case if an RF arc occurred in any of the RF stages. Sometimes such an arc does not change the plate current sufficiently to trip the DC overload relays.

Harmonic Filter

Harmonic filters are supplied for insertion in the output transmission line. When operated in conjunction with the TT-6ELS Transmitter these filters are designed to attenuate all harmonics to a value at least 60 dB below the peak carrier level. Electrically, each filter consists of an M-derived half-T section, several low pass filter sections, and a constant-K half-T section. The M-derived section provides rapid cut-off in the second harmonic region and a termination impedance of 51.5 ohms at one end of the filter. Attenuation of the harmonics is accomplished by a low pass filter section, while the constant-K section serves to give termination impedance of 51.5 ohms at the other end of the unit.



Rear view of the TT-6ELS showing 6-kW power amplifier cabinet (left) and control cabinet (right) showing vertical construction and complete accessibility to transmitter circuits and components. Solid-state sections at lower center.

Low Pass Filter

A low pass filter is provided for insertion in the video input circuit. This filter attenuates all video frequencies above 4.75 MHz (5.75 MHz CCIR) at least 20 dB. An all-pass phase equalizer is also included as part of the low pass filter. This equalizer corrects the phase distortion which is introduced as a result of the sharp cut-off.

Vestigial Sideband Filter

A vestigial sideband filter is included completely assembled and adjusted for any one of the low band VHF television channels. This filter is an integral unit designed for floor, ceiling, or wall mounting near the visual transmitter so that the input transmission line is as short as possible. The filter sections consist of lengths of coaxial line (resonant cavities), which are adjustable for tuning purposes. As the filter is pretuned at the factory, no operating adjustments are necessary.

Specifications

Performance

Type of Emission:
- Visual A5
- Aural F3

Frequency Range .... Ch 2-6

Rated Power Output:
- Visual .... 6 kW[1]
- Aural .... 5.5 kW[1]

RF Output Impedance .... 50/51.5 ohms

Input Impedance:
- Visual .... 75 ohms
- Aural .... 600/150 ohms

Input Level:
- Visual .... 1.0 volts p-p min.
- Aural (for ±25 kHz dev.) .... +10 ±2 dBm

Amplitude vs. Frequency Response:
- Aural .... ±1 dB, 50 Hz to 15 kHz, of 50 μsec or 75 μsec pre-emphasis response curve

Visual Sideband Response:
- At Carrier +0.5 MHz to 2.1 MHz .... +0.5, −1.0 dB[2]
- At Carrier +3.58 MHz .... +0.5, −1.0 dB[2]
- Between +2.1 MHz to 4.18 MHz with respect to 3.58 MHz response .... +0.5, −1.0 dB[3]
- At Carrier −0.5 MHz .... +0.5, −1.0 dB[2]

Variation in Frequency Response with Brightness[4] .... ±1.0 dB

Carrier Frequency Stability[5]:
- Visual .... ±250 Hz
- Aural .... ±250 Hz

Modulation Capability:
- Visual 10%
- Aural .... ±50 kHz

Audio Frequency Distortion .... 0.5% max.[6] (50-15,000 Hz)

FM Noise (below ±25 kHz deviation) .... −60 dB

AM Noise r.m.s.:
- Visual .... −50 dB (below sync level)
- Aural .... −50 dB

Amplitude Variation over one picture frame .... Less than 4%[7]

Regulation of Output 4%

Subcarrier Amplitude[8] .... 0.7 dB

Subcarrier Phase vs. Brightness[9] (diff. phase) .... ±3°

Linearity (diff. gain)[10] .... 0.7 dB

Linearity (Low Frequency) .... 1.0 dB

Envelope Delay vs. Frequency[11]:
- 0.2 to 2.0 MHz .... ±60 ns
- at 3.58 MHz .... ±30 ns
- at 4.18 MHz .... ±60 ns

Harmonic and Spurious Radiation[12] .... −60 dB

K Factor[13]:
- 2T 2%
- 20T 3%

Electrical

AC Line Input .... 208/240 volts, 3 phase, 50/60 Hz (power consumption given below), and 115 volts single phase 50/60 Hz (100 watts)

Slow Line Variations .... ±5% max.

Rapid Line Variations .... ±3% max.

Regulation .... 3% max.

Power Consumption (at 1.2 kW Aural, 6 kW Visual Output):
- Average Picture .... 14.3 kW
- Black Picture .... 18.3 kW

Power Factor (approx.) 90%

Mechanical

Overall Length (front line cabinets) .... 72″ (1829 mm)

Overall Height (cabinets) .... 84″ (2134 mm)

Depth (front line cabinets only) .... 20″ (508 mm)

Overall Depth .... 78⅞″ (2000 mm)

Weight (approx.) .... 5000 lbs (2268 kg)

Finish .... Two-tone blue, brushed aluminum trim

Environmental

Maximum Altitude .... 7,500 feet (2286 m)

Ambient Temperature .... 0°C to 45°C

---

1 Measured at output of sideband filter or filterplexer.

2 With respect to response at carrier plus 200 kHz, as measured by the BW-5 sideband response analyzer at transmitter mid-characteristic.

3 Measured at output of VSBF. Add −0.75 dB at +4.18 MHz if filterplexer or notch diplexer is employed.

4 Measured at 65% and 25% of sync peak level with respect to response at transmitter mid-characteristic.

5 Maximum variation without circuit adjustment over a period of 30 days under normal operating conditions.

6 Including harmonics up to 30 kHz and measured with standard de-emphasis network.

7 Measured at blanking level.

8 Maximum departure from the theoretical when reproducing saturated primary colors and their complements at 75% amplitude.

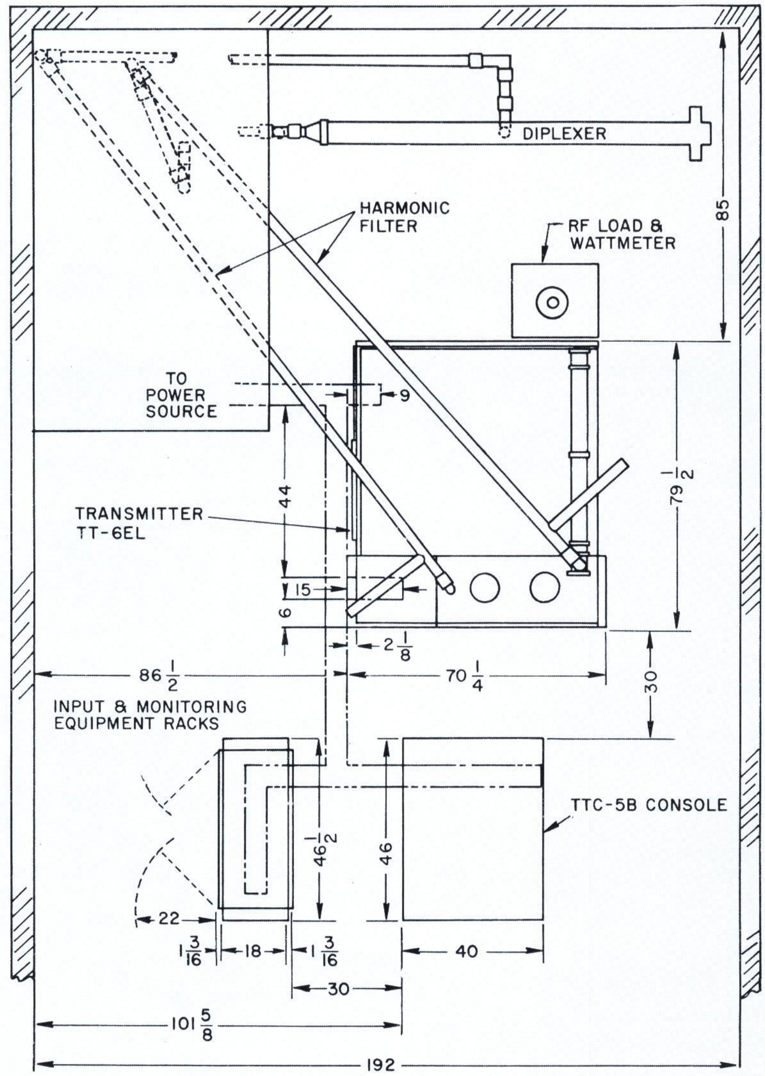
9 Maximum phase difference with respect to burst, measured after the VSBF, for any brightness level between 75% and 15% of the sync peak using 10% (peak-to-peak) modulation with proc amplifier.

10 Maximum variation in the amplitude of a 3.58 MHz sine wave modulating signal as the brightness level is varied between 75% and 15% of sync peak. The gain shall be adjusted for 10% (peak-to-peak) modulation of the 3.58 MHz signal when the brightness is at pedestal level. This is equivalent to 5% (peak-to-peak) modulation as indicated by a conventional diode demodulator connected after the VSBF with proc amplifier.

11 Maximum departure from standard curve using TTS-1A. The tolerances vary linearly between 2.1 and 3.58 MHz and between 3.58 and 4.18 MHz, as measured with RCA BW-8 Envelope Delay Instrument.

12 Ratio of any single harmonic or spurious frequency to peak visual power.

13 Measured at 50% peak modulation to minimize demodulator distortion and with TTS-1 in use.



Typical floor plan for the TT-6ELS Transmitter.

(Not certified for construction use. Please request installation drawing.)

ACCESSORIES

R.F. Load and Wattmeter (10 kW) MI-561739
100% Spare Tubes ES-34298-B
Minimum Spare Tubes ES-34260-A
Controle Console, Type TTC-5B ES-561900
Sideband Response Analyzer, Type BW-5C1 .... MI-34000-C1
Sync and Blanking Adder ES-597267-B
Sideband Demodulator, Type BW-4C1 .... MI-34048-C
Envelope Delay Measuring Set, Type BW-8A MI-34063
Solid-State Phase Equalizers, Type TTS-1 .... ES-560651
Precise Frequency Control, Type TFC-1B ES-560242
Spare Aural Reference Oscillator MI-560539-CH
Spare Visual Oscillator MI-560540-CH

Ordering Information

TT-6ELS TV Transmitter, for FCC standards, 6 kW visual, 5.5 kW aural with tubes, low pass filter, harmonic filters and sideband filter. For 208/230 V, 3-phase, 50/60 Hz power ES50903

TT-6ELS TV Transmitter, for CCIR standards, 5 kW visual, 5.5 kW aural with tubes. For 208/230 V, 3 phase, 50/60 Hz power. (Output power and required filters to be determined in accordance with required standards) ......Specify CCIR or other standards

Communications Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

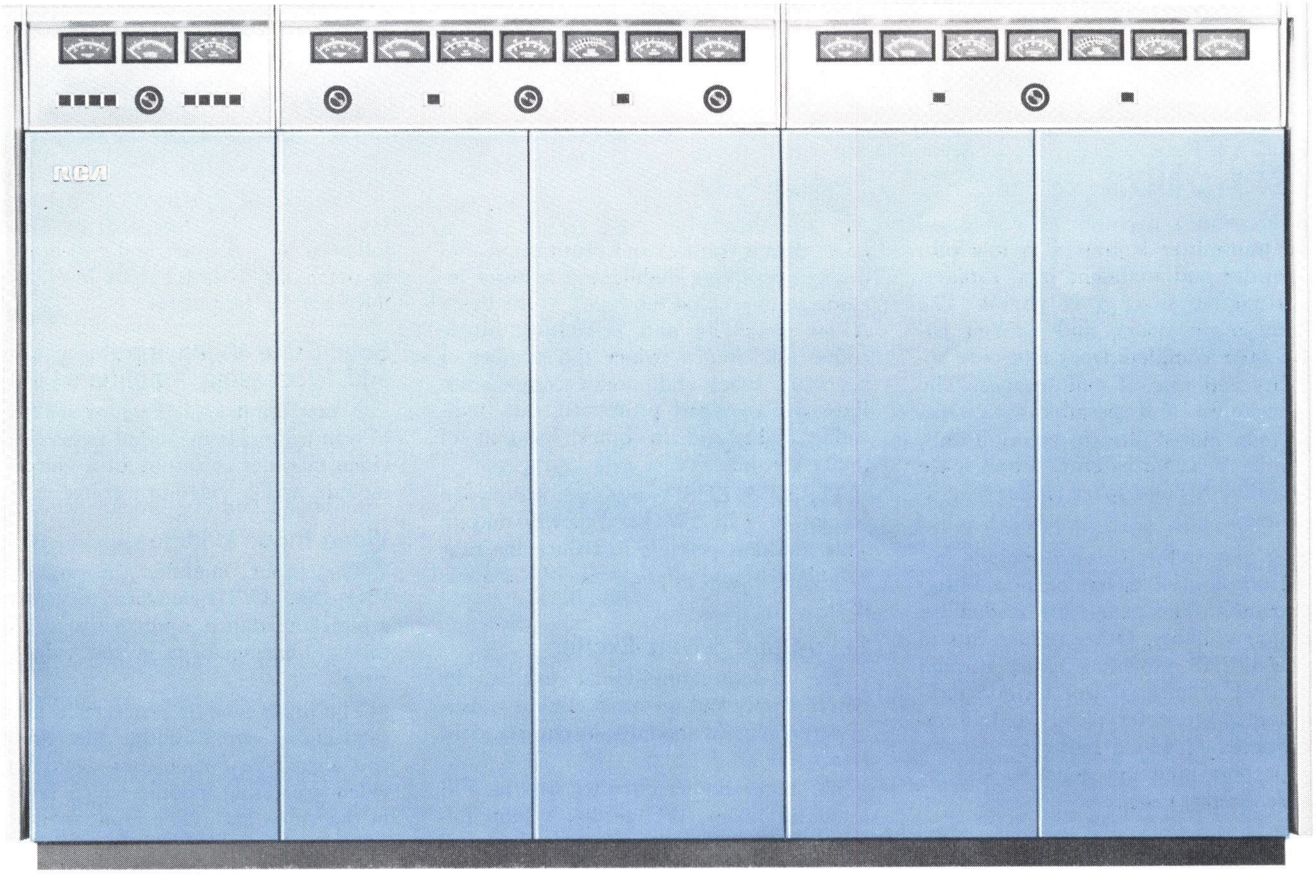
RCA Broadcast Systems

PRINTED IN U.S.A.

RCA

catalog B.4020

12.5 kW VHF-TV Transmitter, Type TT-12EHS



- Solid-state exciter
- Solid-state proc amplifier
- Remote control provision
- Completely air-cooled
- Designed for 5:1 aural power ratio

3VB

12.5 kW VHF-TV Transmitter Type TT-12EHS

The TT-12EHS Television Transmitter operates on VHF channel 7 through 13 or 174-216 MHz on FCC & CCIR "M" standards, with a peak visual power output of 12.5 kW (11 kW CCIR). When used with one of the current VHF antennas, it is possible to obtain over 200,000 watts of effective radiated power.

The TT-12EHS incorporates a new, all solid-state aural and visual exciter and video processor for stability and ease of color operation. Simplicity and high reliability have been achieved through simple, straightforward circuits of proven performance, reliable long-life PA tubes, solid-state rectifiers and stable air-cooling system. Color performance has been enhanced by linearity correction circuits built into the modulator.

Description

The transmitter is housed in low profile, powder and midnight blue cabinets with attractive silver gray panels. The new full-height doors, and walk-in enclosure offer complete front and rear accessibility and ease of maintenance. The rear enclosure also permits the transmitter to be placed directly against a wall, eliminating need for external access space and rear doors. Floor space is thus held to a minimum.

Other new styling features include improved black-faced meters on new lift-up meter panels. The panels are angled for maximum visibility. Other refinements in the TT-12EHS providing easier manual and tighter remote control include indicator lamps on meter panels and illuminated switches, added indicator circuits, multi-purpose metering switches, and air pressure meter gauges.

The transmitter has three in-line cabinets housing the control circuits, the exciter-driver cabinet, and final amplifier cabinet. The transmitter can be broken down for shipment into racks and panels of various sizes for easy handling. The rear enclosure allows rectifiers to be mounted on the rear wall, and the heavy power components on the floor.

Economic Design

The TT-12EHS circuits employ the latest design features and represent economy in operation. Highlighted features include an air-cooled tube such as the 6166-A for long life and reliability. Single ended RF circuits reduce the number of necessary tubes and circuit components. Extensive overload protection with indicating lights aid in quick location of faulty circuits.

The TT-12EHS Transmitter is designed for up to 2.75 kW aural power output. This makes it possible to reduce the tube complement and physical size of the transmitter.

Solid-State 5-Watt Exciter

The 5-watt aural/visual exciter, its power supply and metering circuits consist of seven plug-in modules in one standard frame.

The aural exciter circuitry uses an FM oscillator in an AFC feedback loop followed by a buffer amplifier, doubler and two amplifiers to reach the 5-watt output level at one-third carrier frequency. The center frequency of the oscillator is accurately maintained by a reference frequency that is 150 kHz above the FM oscillator. A DC error voltage that represents the difference between the center frequency and the reference corrects for any oscillator drift.

The visual exciter circuitry consists of a temperature-controlled visual oscillator followed by a doubler and two amplifiers to reach the 5-watt output level at one-third carrier frequency.

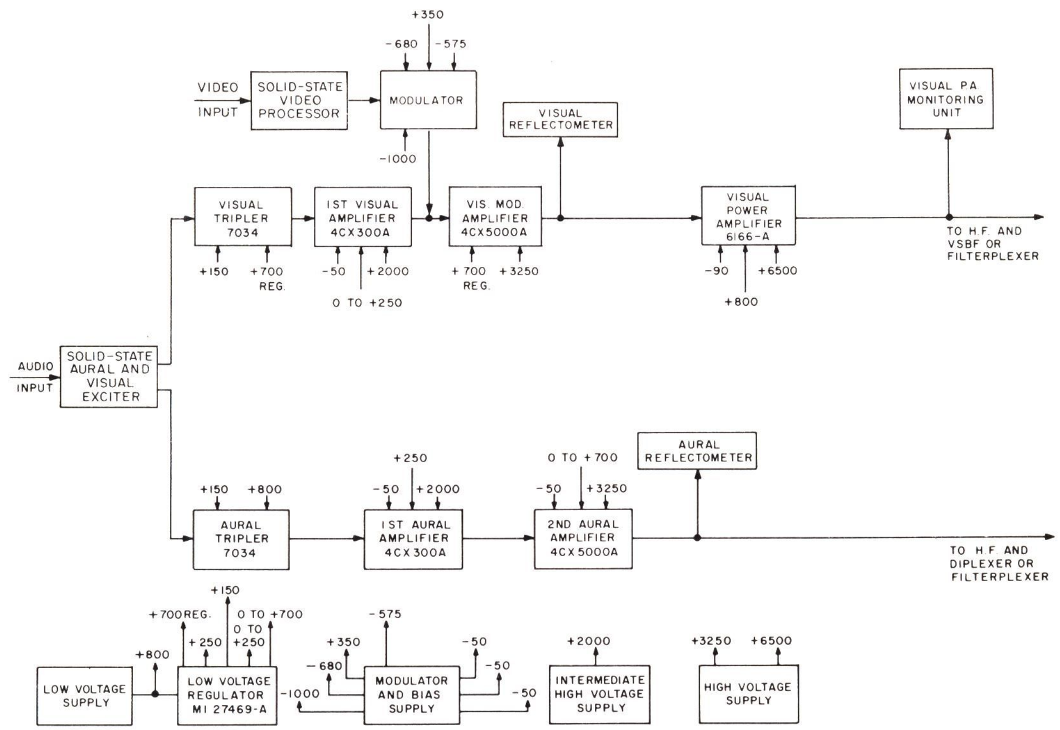
Solid-State Video Input and Processing Amplifiers

A new feature of the proven "E" line of transmitters is the use of two solid-state video modules consisting of a video-input module and a video-processing module.

Video Input Module

The input module, utilizing NPN-, PNP-, and FET-type transistors, provides a high impedance input to insure a loop-through arrangement in the video-input circuit.

The input module generates a negative (—) clamp signal for the video amplifier and a positive (+) clamp signal for the video processing module which follows it in the video path. The input module operates with a nominal input level of one volt (peak-to-peak) video. A differential input circuit is provided to suppress as much as eight volts of common-mode signal appearing at the input due to a difference in potential between power-line neutrals at the opposite ends of the video line. The video is amplified in the first transistor stage and fed to a video gain control located in the video processing module. Another output from that amplifier feeds a sync amplifier which is fol-



Block diagram of TT-12EHS VHF Transmitter.

lowed by a sync separator and a clamp-pulse generator. The resulting positive (+) clamp pulse is applied to the video processing module clamp circuit. When the clamp circuit in the video processor is unnecessary, this signal is short-circuited to ground to make the sync amplifier inoperative.

Video Processing Modules

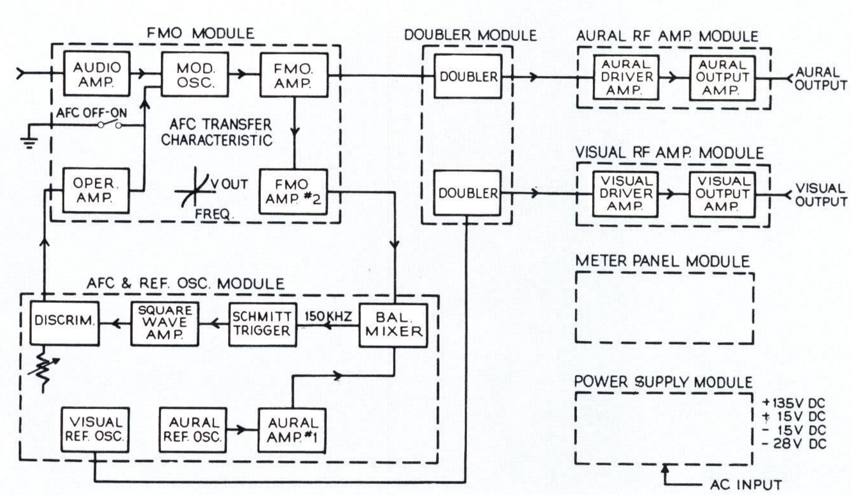
The video processing modules include a motor-driven video-gain and a sync-gain control, a video amplifier, differential-phase and gain-correction circuits, a clamp circuit and an output impedance-matching amplifier.

The video input signal, after passing through the video gain control, is fed to an amplifier with a gain of approximately 4.5. A positive clamp pulse (+) from the video input module is applied to the clamp amplifier. When the clamp switch is in the "on" position, d-c information is restored to the video signal. Output from the video amplifier is fed to a differential phase circuit using four gated capacitors and one voltage-variable capacitor (*Varicap*). Approximately ±2 degrees of correction is available from each gated capacitor and +8 degrees of phase correction is available from the *Varicap* capacitor. The four diodes, associated with the four gated capacitors, may be easily reversed to provide positive (+) or negative (—) correction.

The output of this stage feeds a differential amplifier. Four diodes are gated by transistors to provide an increase in gain of the differential amplifier. The level at which gating takes place is determined by front-panel differential gain controls. Correction of up to 11 dB is possible. The output of the video processing amplifier feeds the visual modulator.

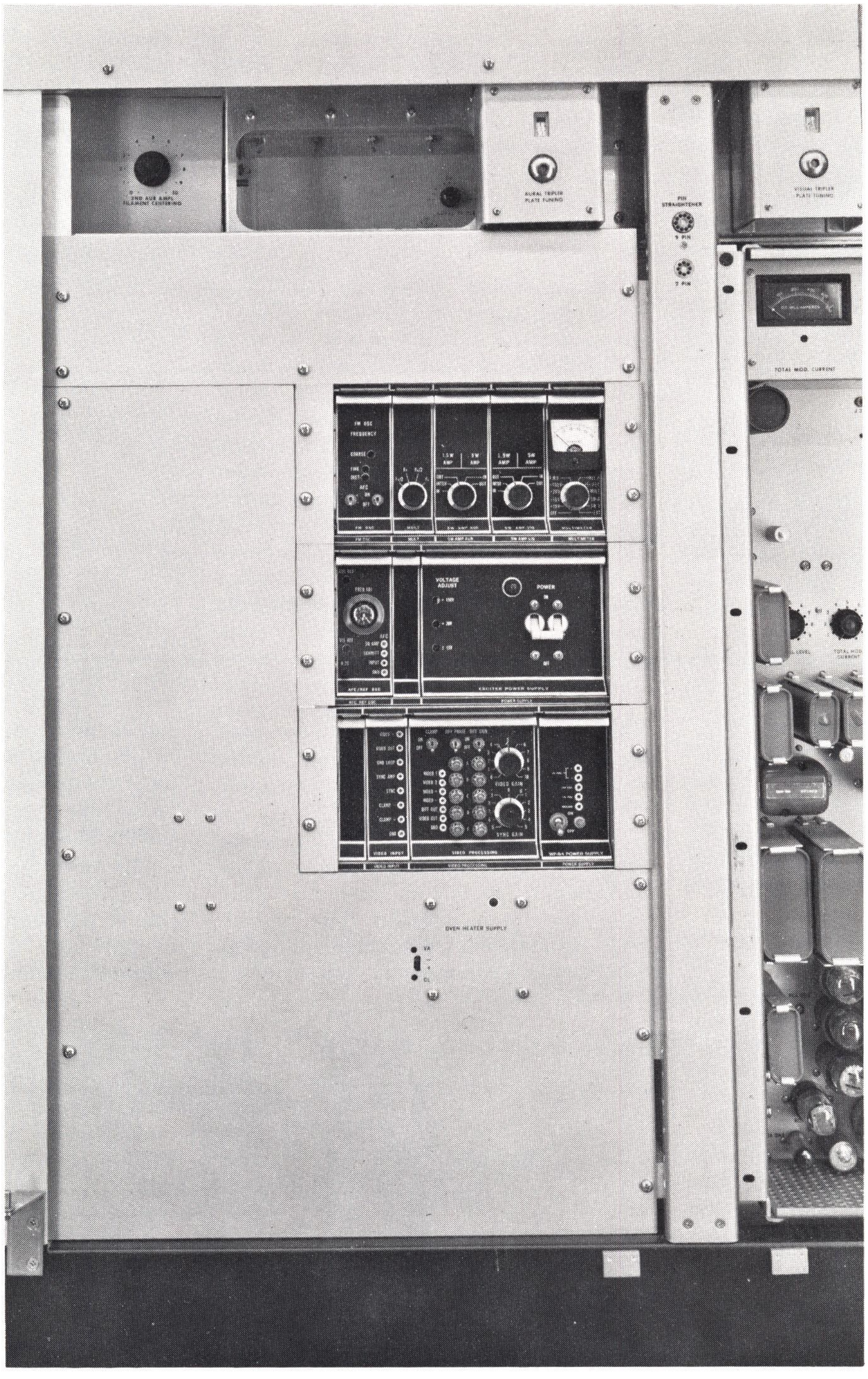
Video Modulator

The video modulator further processes the video signal and amplifies it to an output of approximately 200 volts, peak to peak, for full modulation of the 4CX5000A modulated amplifier. A linear-

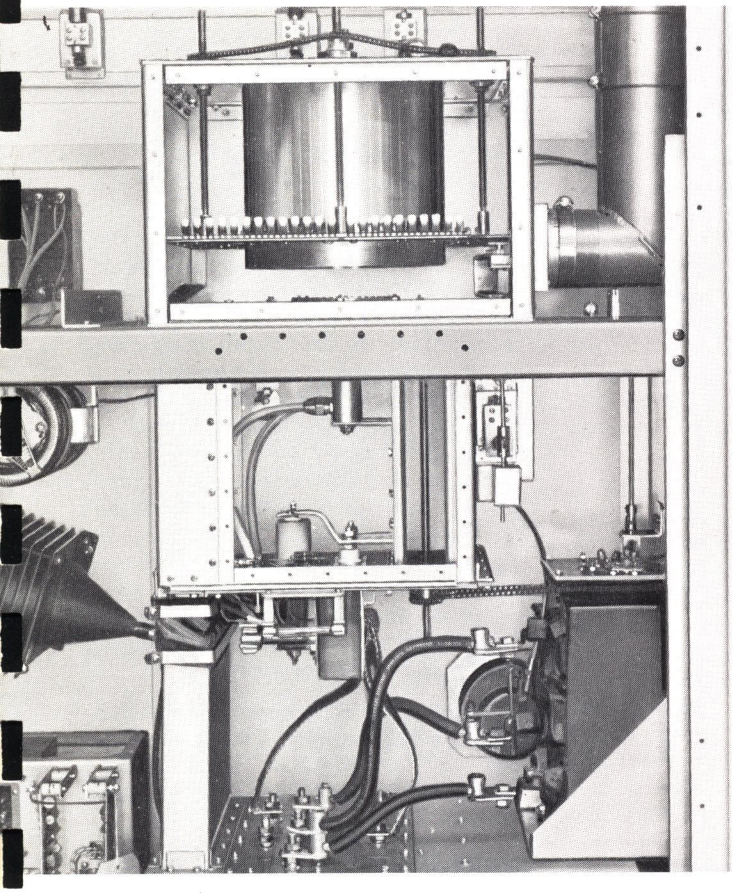


Solid-State 5-Watt Exciter Block Diagram.

Select Features

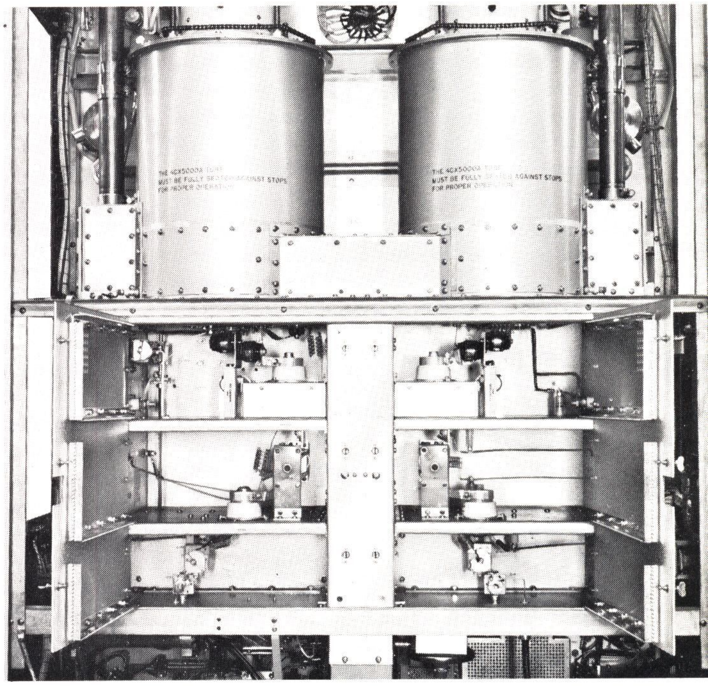


Entirely solid-state, the aural and visual exciters are contained in three sub-assemblies comprising seven plug-in modules, including the power supply module. Three additional modules comprise the video input and processing amplifier and their power supply.

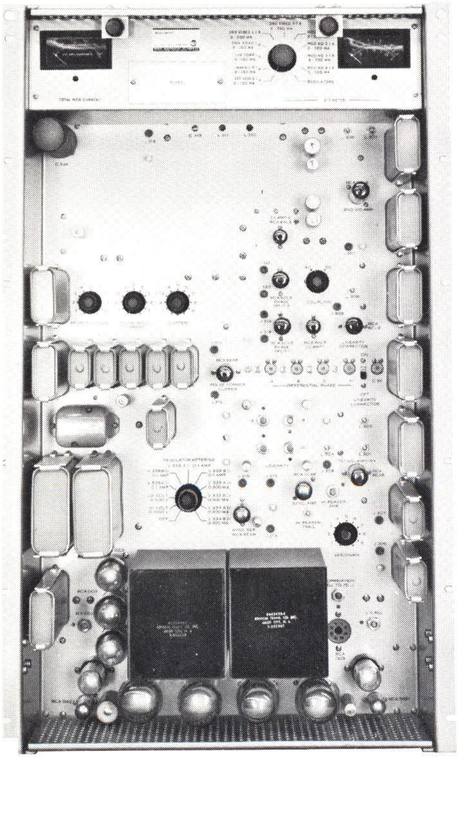


12½ kW Visual Amplifier with covers removed to show DC filament circuit, input cathode and power amplifier output tuning circuits.

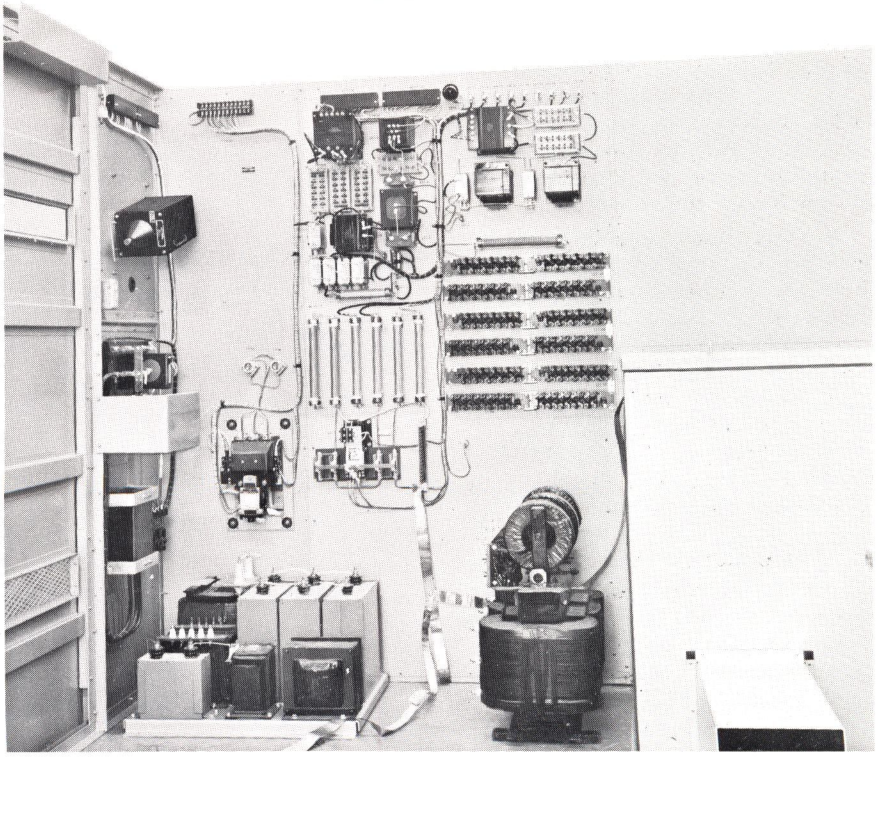
Rear view of RF cabinet showing aural PA on right and visual 5-kW modulated amplifier on left. Driver and IPA tubes are below in shielded compartments.



Modulator Unit providing high fidelity color and monochrome picture performance.



Rear enclosure panel for TT-12EHS showing the resistor panel and high voltage rectifier units. Note all heavy components such as filter supply, transformer and blower are floor mounted.



ity (differential gain) amplifier is also included as part of the modulator. Its action is similar to that described in the processing amplifier. The modulator uses conventional video circuitry to the output stage. The modulator output stage functions as a shunt-regulated cathode-follower. Three Type 6146 tubes are connected in•a circuit similar to a conventional cathode follower, except that the cathode resistor is replaced by four Type 6146 tubes operating in parallel. The grids of these four tubes are fed with a signal from the plate load of the cathode follower tubes.

The circuit is essentially a feedback amplifier of high efficiency capable of video modulating the five-kilowatt amplifier with a video signal of approximately 200 volts, peak-to-peak.

Video Monitoring

A monitor amplifier is provided for monitoring the modulator output signal. Numerous test jacks are also provided to simplify trouble-shooting and modulator alignment.

RF Circuits

The RF circuits employ a chain of multipliers and amplifiers. In the visual chain a 7034 tube operates as a tripler, driving a 4C300A amplifer which in turn drives a type 4CX5000A grid modulated power amplifier. Excitation control for the visual transmitter is accomplished by varying the screen voltage on the 4CX-300A stage. The aural chain consists of a 7034 tripler stage driving a 4CX300A amplifier followed by a type 4CX5000A class "C" power amplifier. Power output of the aural transmitter is adjusted by varying the screen voltage on the 4CX-5000A stage. Both of these controls are operated by motors and therefore can be adjusted from a remote position.

The visual linear amplifier following the modulated stage employs a 6166-A tetrode in a grounded-grid, grounded-screen circuit. Circuit design is simplified, since the grid and screen may be by-passed to a common ground plane. Input and output circuits are then constructed on opposite sides of the ground plane. DC is used for filaments of the 6166-A to reduce hum modulation to a level well below the usual requirement.

Power and Control Equipment

Wherever possible in this transmitter, the same DC power supplies were used for both the visual and aural amplifiers. This greatly reduces the number of components in the transmitter. The power supplies, all using silicon diodes, are located on the rectifier panels at the rear of the enclosure. An 800-volt supply furnishes all screen voltages as well as the 7034 plate voltage. The intermediate voltage supply has a 2000-volt output for the 4CX300A plates. The high-voltage supply uses silicon diodes. This supply provides 6500 volts for the plate of the Type 6166-A power tube and 3250 volts for the plates of the two 4CX5000A tubes. High-voltage switching allows independent operation of visual and aural final amplifiers as well as cut back of the visual modulated amplifier. A shunt regulated bias supply maintains the visual PA grid voltage constant as the grid current varies with modulation.

A single integrated control circuit is provided for both the visual and aural transmitters. The blower, filaments, and each rectifier is protected by thermal overloads which can be adjusted to reset automatically. In addition, a main line breaker and an auxiliary breaker are provided. Each incorporates magnetic trips. All rectifiers and RF stages following the exciter are protected by instantaneous overload relays which automatically recycle twice. If the fault continues on the third try the overload circuit will remain tripped until reset. Overload indicator lights are provided for each circuit. These lights have a separate reset and will remain on after the first overload thus providing a record of the circuit giving trouble even though it may be intermittent.

The equipment includes an automatic line voltage regulator which provides a stable line voltage to the filament primaries, the exciter, the modulator, and the low voltage power supply. Automatic regulators capable of handling the complete transmitter are available as optional items.

Special Protective Circuits

Included as part of the TT-12EHS is a monitoring unit for connecting into the output transmission line of the visual amplifier. This unit contains two 6AL5 diode detectors as reflectometers. The transmission line probes are installed so as to give an indication of the amount of incident or reflected power. A meter on the front panel can be switched between the two diode circuits. Power output is read in percent peak power which can be calibrated to read 100 percent for licensed power. The standing wave ratio is read directly on a specially calibrated scale. In the monitoring unit a type 2D21 thyratron tube operates in conjunction with a relay to remove the high voltage plate power from the transmitter when the SWR exceeds a predetermined value.

A single head reflectometer is provided for the aural amplifier. This normally is connected to read power output. Standing wave ratio can be measured by manually rotating the reflectometer head.

Vestigial Sideband Filter (FCC Specifications)

The Vestigial Sideband Filter is completely assembled and adjusted for any one of the high band VHF television channels. The filter is an integral unit designed for floor, ceiling, or wall mounting near the visual transmitter so that the input transmission line is as short as possible.

ACCESSORIES

Control Console TTC-5B	ES-561900
100% Spare Tubes	ES-34259-C
Minimum Spare Tube Set	ES-34260-A
R.F. Load & Wattmeter (10 kW)	MI-561739
BW-5C1 Sideband Analyzer	MI-34000-C1
Sync & Blanking Adder	ES-597267-B
BW-4C1 V.S.B. Demodulator	MI-34048-C
BW-8A Envelope Delay Measuring Set	MI-34063
TTS-1 Phase Equalizer	ES-560651
TTS-1B Precise Frequency Control	ES-560242
Spare Aural Reference Oscillator	MI-560539-CH
Spare Visual Crystal Oscillator	MI-560540-CH

Specifications

Performance

Type of Emission:
- Visual A5
- Aural F3

Frequency Range .... 174-216 MHz (Ch 7-13)

Rated Power Output:
- Visual .... 12.5 kW[1]
- Aural .... 2.75 kW

RF Output Impedance .... 50/51.5 ohms

Input Impedance:
- Visual .... 75 ohms
- Aural .... 600/150 ohms

Input Level:
- Visual .... 1.0 volts p-p min.
- Aural (for ±25 kHz dev.) .... +10 ±2 dBM

Amplitude vs. Frequency
Response, Aural .... ±1 dB, 50 Hz to 15 kHz, of 50 μsec or 75 μsec pre-emphasis response curve

Visual Sideband Respnse:
- At Carrier +0.5 MHz to 2.1 MHz .... +0.5, –1.0 dB[2]
- At Carrier +3.58 MHz .... +0.5, –1.0 dB[2]
- Between +2.1 MHz to 4.18 MHz with respect to 3.58 MHz response .... +0.5, –1.0 dB[3]
- At Carrier –0.5 MHz .... +0.5, –1.0 dB[2]

Variation in Frequency Response
with Brightness[4] .... ±1.0 dB

Carrier Frequency Stability[5]:
- Visual .... ±250 Hz
- Aural .... ±250 Hz

Modulation Capability:
- Visual 10%
- Aural .... ±50 kHz

Audio Frequency Distortion .... 0.5% max.[6] (50-15,000 Hz)

FM Noise (below ±25 kHz deviation) .... –60 dB

AM Noise r.m.s.:
- Visual .... –50 dB below sync level
- Aural .... –50 dB

Amplitude Variation over
one picture frame .... Less than 4%[7]

Regulation of Output 4%

Subcarrier Amplitude[8] .... 0.7 dB

Subcarrier Phase vs. Brightness[9]
(diff. phase) .... ±3°

Linearity (diff. gain)[10] .... 0.7 dB

Linearity (Low Frequency) .... 1.0 dB

Envelope Delay vs. Frequency[11]:
- 0.2 to 2.0 MHz .... ±60 ns
- at 3.58 MHz .... ±30 ns
- at 4.18 MHz .... ±60 ns

Harmonic and Spurious Radiation[12] .... –60 dB

K-Factor[13]:
- 2T 2%
- 20T 3%

Electrical

AC Line Input .... 208/240 volts, 3 phase, 50/60 Hz (power consumption given below), and 115 volts single phase 50/60 Hz (100 watts)

Slow Line Variations .... ±5% max.

Rapid Line Variations .... ±3% max.

Regulation .... 3% max.

Power Consumption
(at 12.5 kW peak visual, & 2.75 kW aural output):
- Average Picture .... 32 kW
- Black Picture .... 43 kW

Power Factor (approx.) 90%

Mechanical

Overall Length (front line cabinets) .... 72″ (1829 mm)

Overall Height (cabinets) .... 84″ (2134 mm)

Depth (front line cabinets) .... 20″ (508 mm)

Overall Depth .... 78⅞″ (200 mm)

Finish .... Two-tone blue, brushed aluminum trim

Environmental

Maximum Altitude .... 7,500 feet (2286 mm)

Ambient Temperature .... 0°C to 45°C

----

1 Measured at output of sideband filter or filterplexer.

2 With respect to response at carrier plus 200 kHz, as measured by the BW-5 sideband response analyzer at transmitter mid-characteristic.

3 Measured at output of VSBF. Add –0.75 dB at +4.18 MHz if filterplexer or notch diplexer is employed.

4 Measured at 65% and 25% of sync peak level with respect to response at transmitter mid-characteristic.

5 Maximum variation without circuit adjustment over a period of 30 days under normal operating conditions.

6 Including harmonics up to 30 kHz and measured with standard de-emphasis network.

7 Measured at blanking level.

8 Maximum departure from the theoretical when reproducing saturated primary colors and their complements at 75% amplitude.

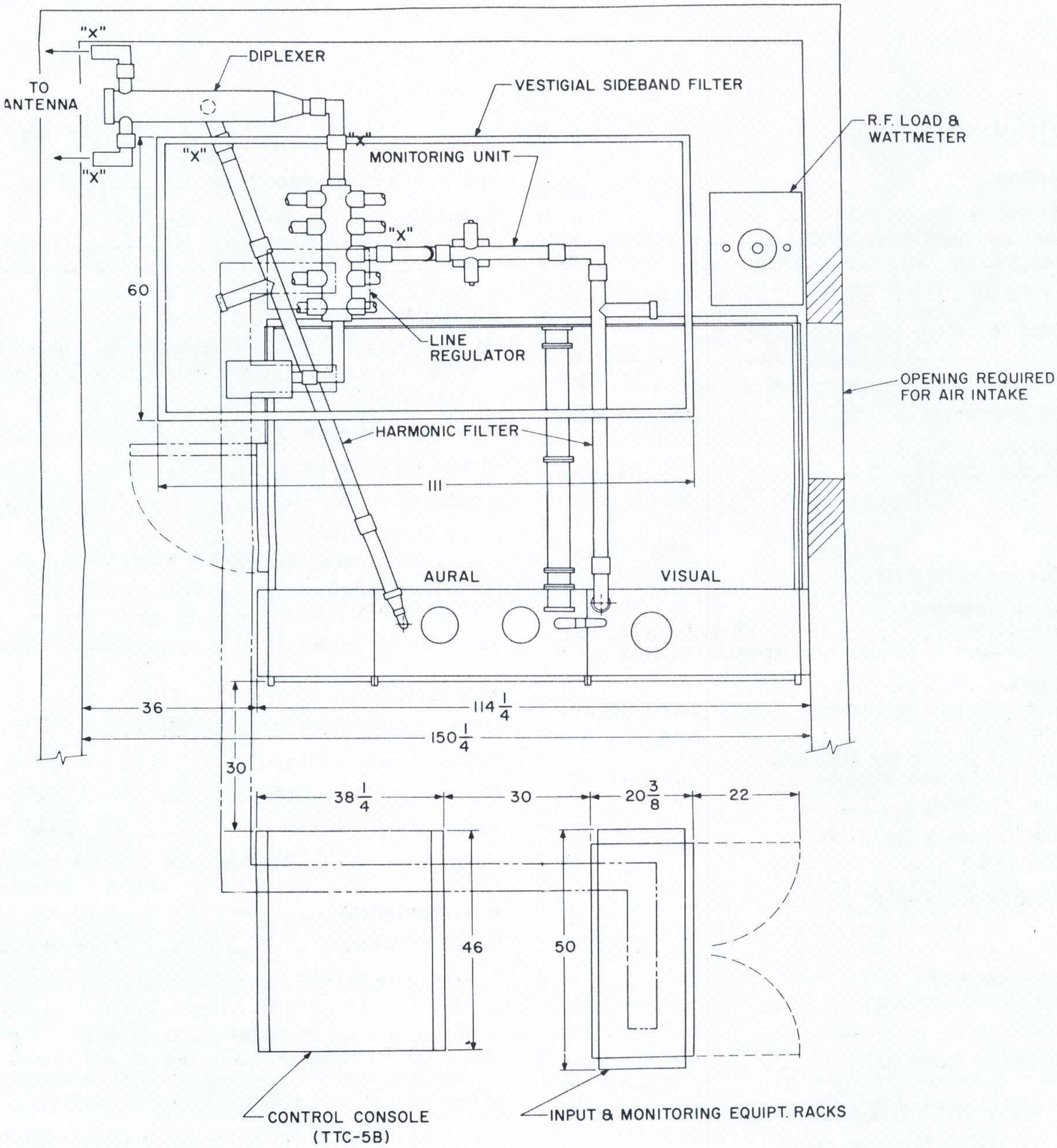
9 Maximum phase difference with respect to burst measured after the VSBF, for any brightness level between 75% and 15% of the sync peak using 10% (peak-to-peak) modulation with proc. amplifier.

10 Maximum variation in the amplitude of a 3.58 MHz sine wave modulating signal as the brightness level is varied between 75% and 15% of sync peak. The gain shall be adjusted for 10% (peak-to-peak) modulation of the 3.58 MHz signal when the brightness is at pedestal level. This is equivalent to 5% (peak-to-peak) modulation as indicated by a conventional diode demodulator connected after the VSBF with proc. amplifier.

11 Maximum departure from standard curve using TTS-1A. The tolerances vary linearly between 2.1 and 3.58 MHz and between 3.58 and 4.18 MHz as measured with RCA BW-8 Envelope Delay Instrument.

12 Ratio of any single harmonic or spurious frequency to peak visual power.

13 Measured at 50% peak modulations to minimize demodulator distortion and with Type TTS-1 Phase Equalizer in use.



Typical floor plan of the TT-12EHS Transmitter.

Ordering Information

TT-12EHS TV Transmitter, 12.5 kW visual, 2.75 kW aural with tubes, low pass, harmonic filters and VSBF. For 208/240 volt, 3 phase, 50/60 Hz power ES-560901

TT-12EHS TV Transmitter, 11.0 kW visual, 2.75 kW aural with tubes. For 380/415 volt, 3 phase, 50 Hz input. (Output power and required filters to be determined in accordance with required operating standards) ....Specify CCIR or other operating standards

Communications Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

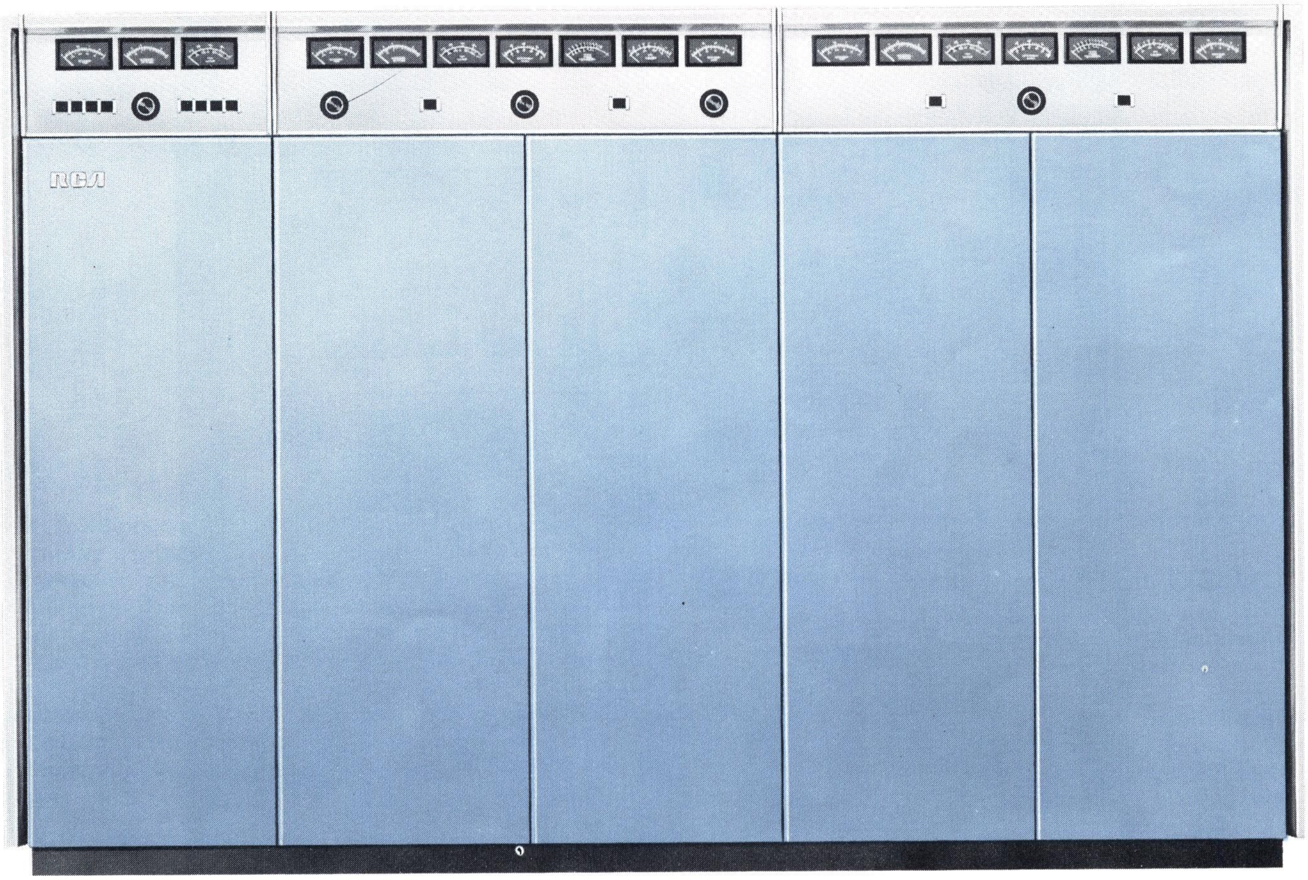
RCA Broadcast Systems

PRINTED IN U.S.A.

RCA

catalog B.4023

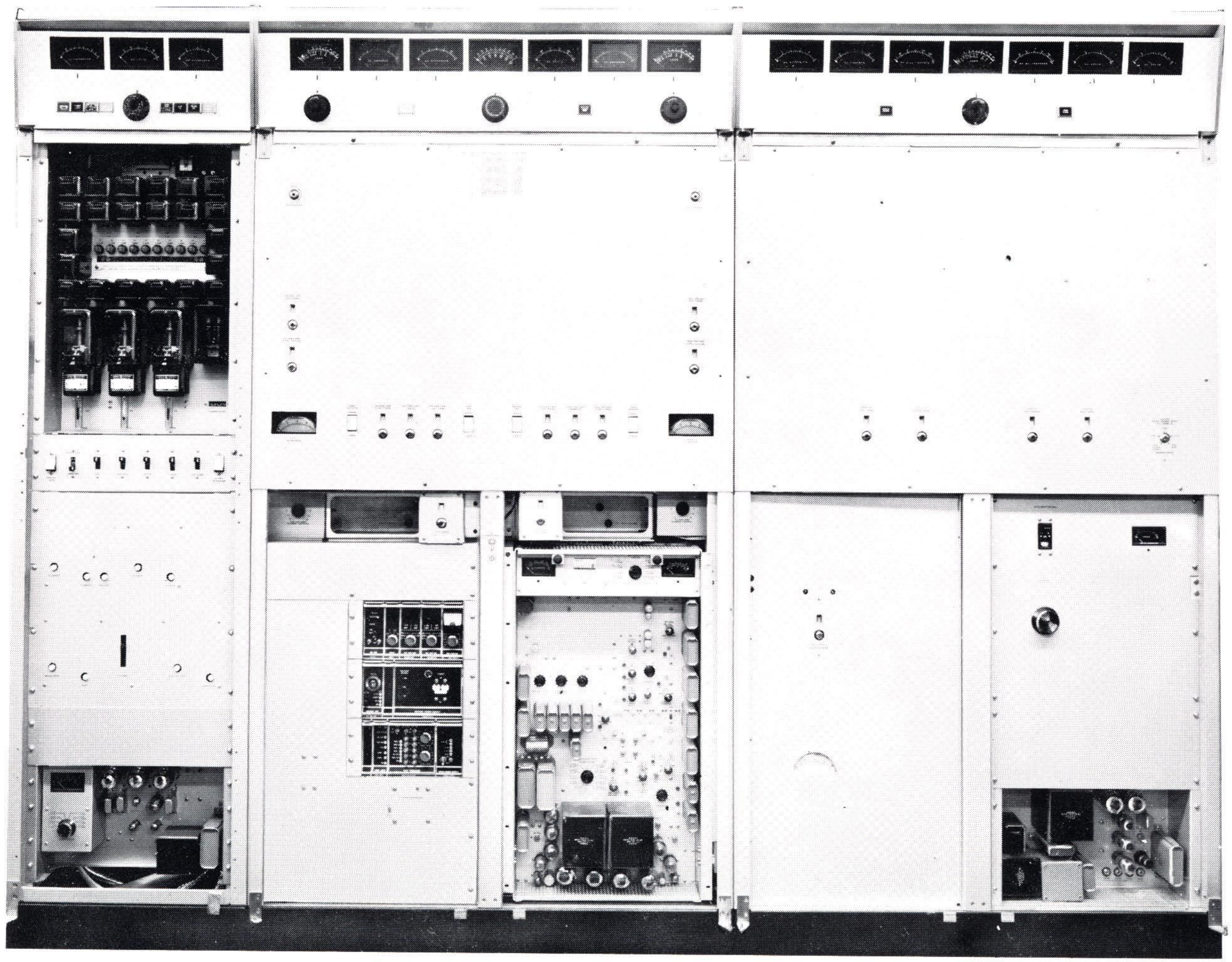
12.5 kW VHF Transmitter, Type TT-12ELS



- Solid-state exciter
- Solid-state proc amplifier
- Remote control provision
- Completely air-cooled
- Designed for 5:1 aural power ratio

3VB

Select Features



12.5 kW VHF Transmitter, Type TT-12ELS

The TT-12ELS Television Transmitter operates on VHF channel 2 through 6 or 47-88 MHz on FCC or CCIR "M" standards, with a peak visual power output of 12.5 kW (11 kW CCIR). When used with one of the current VHF antennas, it is possible to obtain maximum allowable 100,000 watts of effective radiated power.

The TT-12ELS VHF transmitter is specifically designed for reliability and ease of color operation. Improved color picture quality is achieved through the simple, straightforward circuits of proven performance, reliable long-life PA tubes, solid-state rectifiers and stable air-cooling system. Color performance has been enhanced by linearity correction circuits built into the modulator and a solid-state video-input module and video processing amplifier.

Description

The transmitter is housed in compact powder and midnight blue cabinets with attractive silver gray panels. The new full-height doors, and walk-in enclosure offer complete front and rear accessibility and ease of maintenance. The rear enclosure also permits the transmitter to be placed directly against a wall eliminating need for external access space and rear doors. Floor space is thus held to a minimum.

Other improved styling features include black-faced meters on new lift-up meter panels. The panels are angled for maximum visibility. Other refinements in the TT-12ELS providing easier manual and tighter remote control include indicator lamps on meter panels and illuminated switches, added indicator circuits, dual purpose metering switches, and air pressure meter gauges.

The transmitter has three in-line cabinets housing the control circuits, the exciter-driver cabinet, and final amplifier cabinet. The cabinets can be broken down for shipment into racks and panels of varying size for easy handling. The rear enclosure allows rectifiers to be mounted on the rear wall, and the heavy power components on the floor.

Economic Design

The TT-12ELS circuits employ the latest design features and represent economy in operation. Highlighted features include air-cooled tubes such as the 6166-A for long life and reliability. Single ended RF circuits reduce the number of necessary tubes and circuit components. Extensive overload protection with indicating lights aid in quick location of faulty circuits.

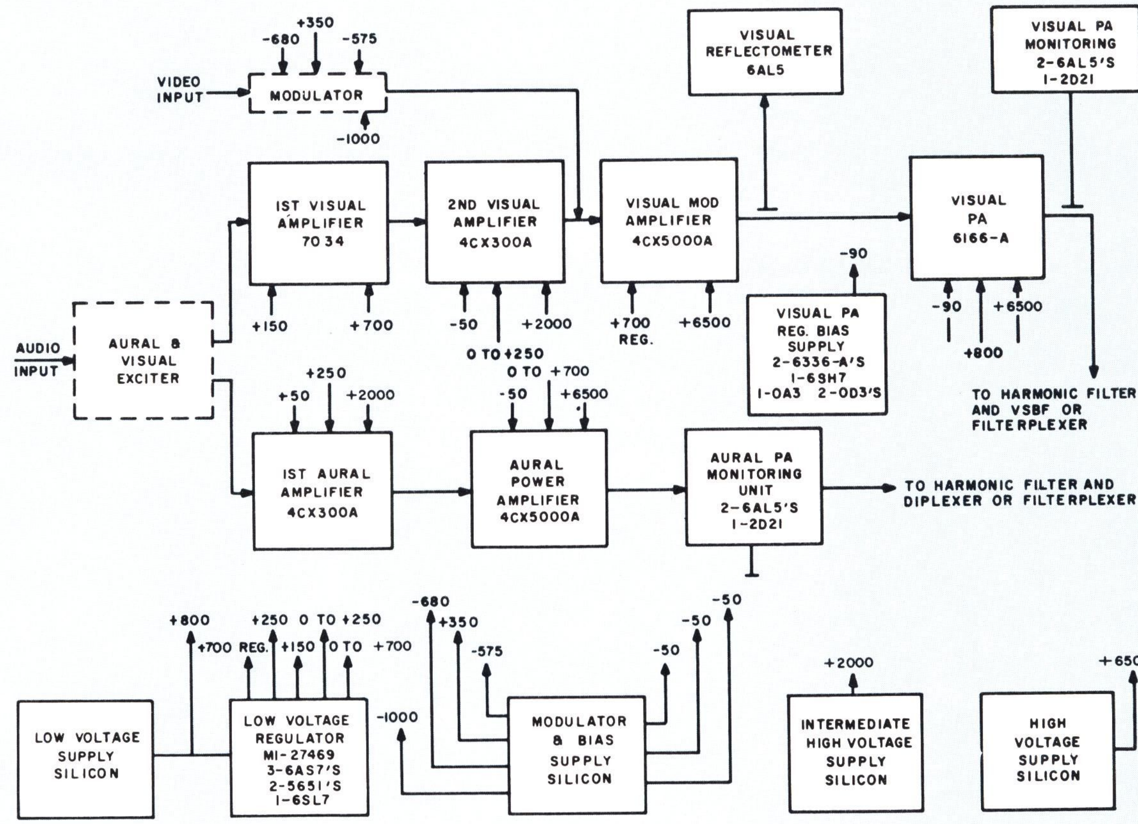
The TT-12ELS Transmitter is designed for up to 2.75 kW aural power output. This makes it possible to reduce the tube complement and physical size of the transmitter.

Solid-State 5-Watt Exciter

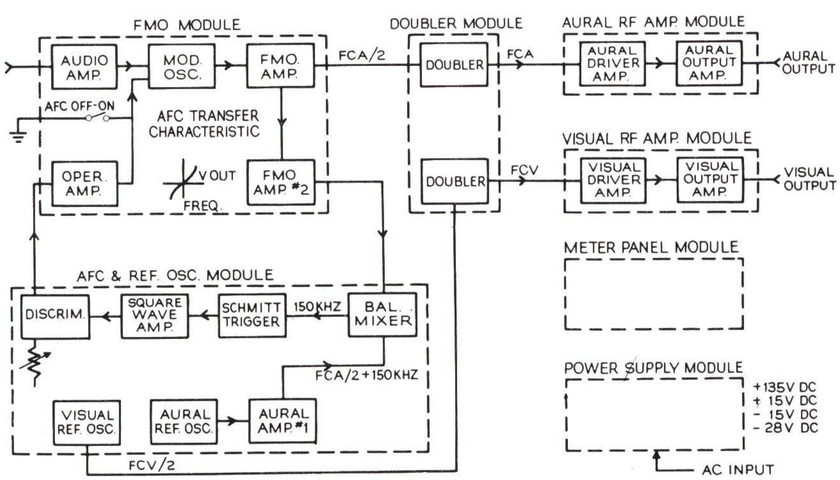
The 5-watt aural/visual exciter, its power supply and metering circuits consist of seven plug-in modules in one standard frame.

The aural exciter circuitry uses an FM oscillator in an AFC feedback loop followed by a buffer amplifier, doubler and two amplifiers to reach the 5-watt output level at carrier frequency. The center frequency of the oscillator is accurately maintained by a reference frequency that is 150 kHz above the FM oscillator. A DC error voltage that represents the difference between the center frequency and the reference corrects for any oscillator drift.

The visual exciter circuitry consists of a temperature-controlled visual oscillator followed by a doubler and two amplifiers to reach the 5-watt output level at carrier frequency.



Simplified block diagram of TT-12ELS VHF TV Transmitter.



Solid-State 5-Watt Exciter Block Diagram

Solid-State Video Input and Processing Amplifiers

A new feature of the proven "E" line of transmitters is the use of two solid-state video modules consisting of a video-input module and a video-processing module.

Video Input Module

The input module, utilizing NPN-, PNP-, and FET-type transistors, provides a high impedance input to insure a loop-through arrangement in the video-input circuit.

The input module generates a negative (—) clamp signal for the video amplifier and a positive (+) clamp signal for the video processing module which follows it in the video path. The input module operates with a nominal input level of one volt (peak-to-peak) video. A differential input circuit is provided to suppress as much as eight volts of common-mode signal appearing at the input due to a difference in potential between power-line neutrals at the opposite ends of the video line. The video is amplified in the first transistor stage and fed to a video gain control located in the video processing module. Another output from that amplifier feeds a sync amplifier which is followed by a sync separator and a clamp-pulse generator. The resulting positive (+) clamp pulse is applied to the video processing module clamp circuit. When the clamp circuit in the video processor is unnecessary, this signal is short-circuited to ground to make the sync amplifier inoperative.

Video Processing Modules

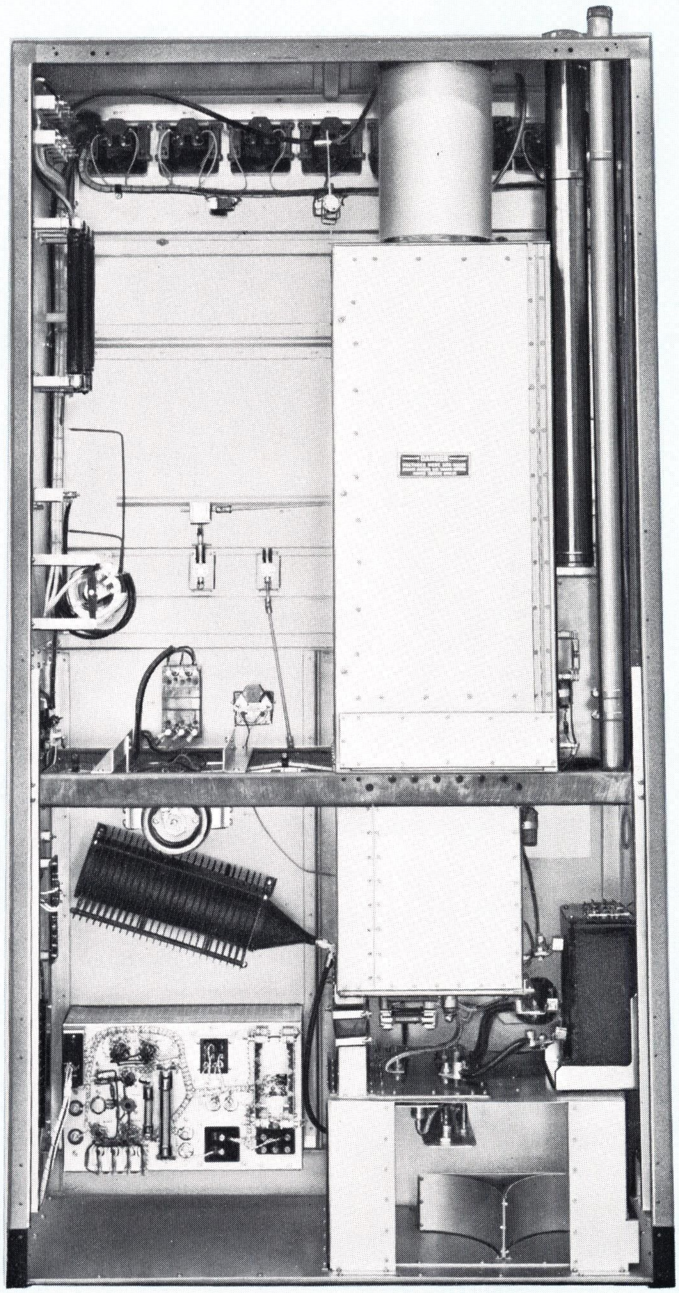
The video processing modules include a motor-driven video-gain and a sync-gain control, a video amplifier, differential-phase and gain-correction circuits, a clamp circuit and an output impedance-matching amplifier.

The video input signal, after passing through the video gain control, is fed to an amplifier with a gain of approximately 4.5. A positive clamp pulse (+) from the video input module is applied to the clamp amplifier. When the clamp switch is in the "on" position, d-c information is restored to the video signal. Output from the video amplifier is fed to a differential phase circuit using four gated capacitors and one voltage-variable capacitor (*Varicap*). Approximately ±2 degrees of correction is available from each gated capacitor and +8 degrees of phase correction is available from the *Varicap* capacitor. The four diodes, associated with the four gated capacitors, may be easily reversed to provide positive (+) or negative (—) correction.

The output of this stage feeds a differential amplifier. Four diodes are gated by transistors to provide an increase in gain of the differential amplifier. The level at which gating takes place is determined by front-panel differential gain controls. Correction of up to 11 dB is possible. The ouput of the video processing amplifier feeds the visual modulator.

Video Modulator

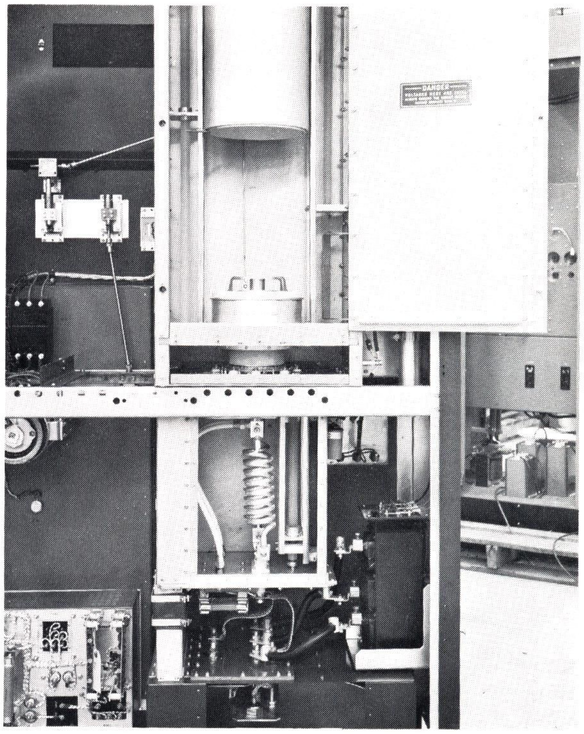
The video modulator further processes the video signal and amplifies it to an output of approximately 200 volts, peak to peak, for full modulation of the 4CX5000A modulated amplifier. A linearity (differential gain) amplifier is also included as part of the modulator. Its action is similar to that described in the processing amplifier. The modulator uses conventional video circuitry to the output stage. The modulator output stage functions as a shunt-regulated cathode-follower. Three Type 6146 tubes are connected in a cir-



Rear view of 12½ kW Visual RF Amplifier showing visual bias supply and filament control circuits.

ACCESSORIES

R.F. Load and Wattmeter	MI-561739
100% Spare Tubes	ES-34295-B
Minimum Spare Tubes	ES-34214-B
Controle Console Type TTC-5B	ES-561900
Sideband Response Analyzer, Type BW-5C1	MI-34000-C1
Sync and Blanking Adder	ES-597267-B
Sideband Demodulator, Type BW-4C1	MI-34048-C
Envelope Delay Measuring Set Type BW-8A	MI-34063
Solid-State Phase Equalizers, Type TTS-1	ES-560651
Precise Frequency Control, Type TFC-1B	ES-560242
Spare Aural Reference Oscillator	MI-560539-CH
Spare Visual Oscillator	MI-560540-CH



TT-12ELS Visual RF Amplifier showing easy accessibility of 6166A tube socket.

cuit similar to a conventional cathode follower, except that the cathode resistor is replaced by four Type 6146 tubes operating in parallel. The grids of these four tubes are fed with a signal from the plate load of the cathode follower tubes.

The circuit is essentially a feedback amplifier of high efficiency capable of video modulating the five-kilowatt amplifier with a video signal of approximately 200 volts, peak-to-peak.

RF Circuits

The RF circuits employ a chain of multipliers and amplifiers. In the visual chain a 7034 tube operates as the first visual amplifier, driving a 4CX300A amplifier which in turn drives a Type 4CX5000A grid modulated power amplifier. Excitation control for the visual transmitter is accomplished by varying the screen voltage on the 4CX300A stage. The aural chain consists of a 4CX300A amplifier followed by a Type 4CX5000A class "C" power amplifier. Power output of the aural transmitter is adjusted by varying the screen voltage on the 4CX5000A stage. Both these controls are operated by motors and therefore can be adjusted from a remote position.

The visual linear amplifier following the modulated stage employs a 6166-A tetrode in a grounded-grid, grounded-screen circuit. Circuit design is simplified, since the grid and screen may be by-passed to a common ground plane. Input and output circuits are then constructed on opposite sides of the ground plane. DC is used for filaments of the 6166-A to reduce hum modulation to a level well below the usual requirement.

Power and Control Equipment

Wherever possible in this transmitter, the same DC power supplies were used for both the visual and aural amplifiers. This greatly reduces the number of components in the transmitter. Power supplies, all using silicon diodes, are located on the rectifier panels at the rear of the enclosure. An 800-volt supply furnishes all screen voltages as well as the 7034 plate voltage. The intermediate voltage supply has 2000-volt output for the 4CX300A plates. The high-voltage supply uses silicon diodes. This supply provides 6500 volts for the plates of the Type 6166-A power tube and the 4CX5000 visual modulator amplifier.

High-voltage switching allows independent operation of visual and aural final amplifier as well as cut back of the visual modulated amplifier. All voltages for the visual modulator are furnished by the remaining supplies. One has an output of +350 volts, and the other has several outputs, all negative with respect to ground, which supply the high-level video stages as well as bias for the modulator and RF stages.

A single integrated control circuit is provided for both the visual and aural transmitters. The blower, filaments, and each rectifier is protected by thermal overloads which can be adjusted to reset automatically. In addition, a main line breaker and an auxiliary breaker are provided. Each incorporates magnetic trips. All rectifiers and RF stages following the exciter are protected by instantaneous overload relays which automatically recycle twice. If the fault continues on the third try the overload circuit will remain tripped until reset. Overload indicator lights are provided for each circuit. These lights have a separate reset and will remain on after the first overload thus providing a record of the circuit giving trouble even though it may be intermittent.

The equipment includes an automatic

line voltage regulator which provides a stable line voltage to the filament primaries, the exciter, the modulator, and the low voltage power supply. Automatic regulators capable of handling the complete transmitter are available as optional items.

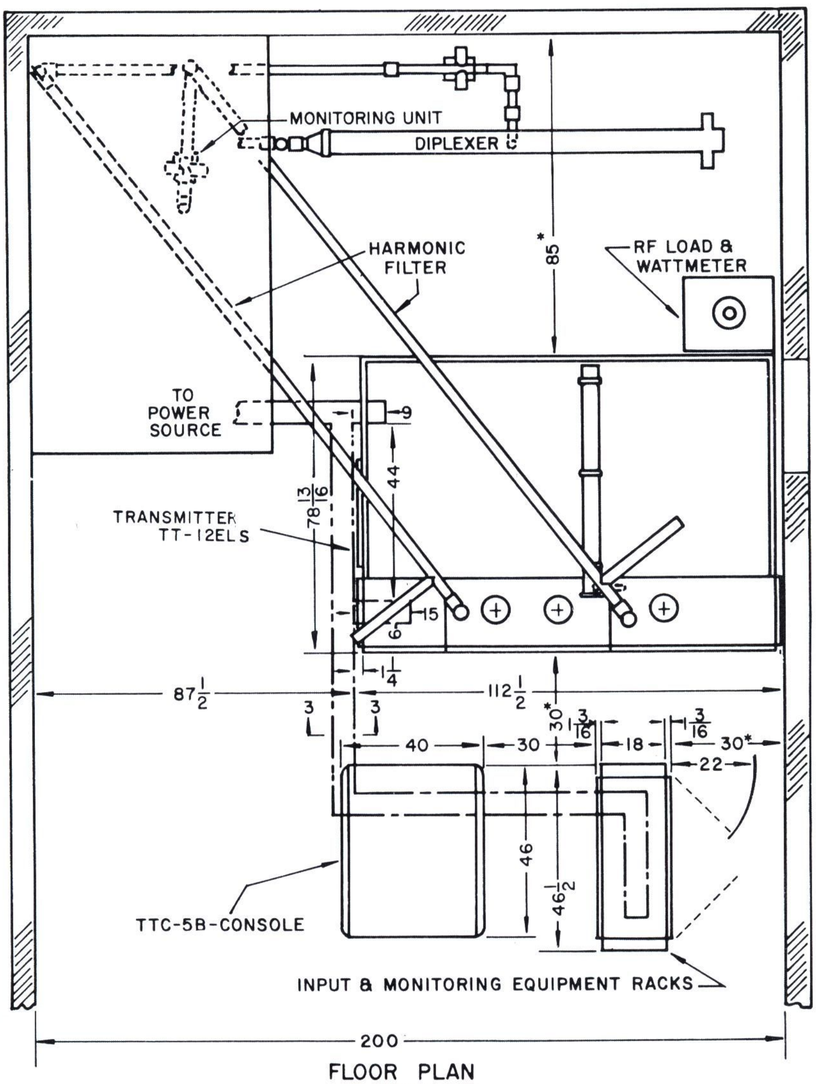
Special Protective Circuits

Included as part of the TT-12ELS is a monitoring unit for connecting in the output transmission line of the visual amplifier. This unit contains two 6AL5 diode detectors as reflectometers. The transmission line probes are installed so as to give an indication of the amount of power or reflected power. A meter on the front panel can be switched between the two diode circuits. Power output is read in percent peak power which can be calibrated to read 100 percent for rated power. The standing-wave ratio is read directly on a specially calibrated scale. In the monitoring unit a Type 2D21 thyratron tube operates in conjunction with a relay to remove the high voltage plate power from the TT-12ELS when the SWR exceeds a predetermined value.

A single unit reflectometer is provided for the aural amplifier. This normally is connected to read power output. Standing wave ratio can be measured by manually rotating the reflectometer head.

Vestigial Sideband Filter (FCC Specifications)

The Vestigial Sideband Filter is furnished completely assembled and adjusted for any one of the low band VHF television channels. The filter is an integral unit designed for floor, ceiling, or wall mounting near the visual transmitter so that the input transmission line is as short as possible.



FLOOR PLAN

(Not certified for construction use. Please request installation drawing.)

Specifications

Performance

Type of Emission:
- Visual A5
- Aural F3

Frequency Range .... Ch 2-6

Rated Power Output:
- Visual .... 12.5 kW[1]
- Aural .... 2.75 kW

RF Output Impedance .... 50/51.5 ohms

Input Impedance:
- Visual .... 75 ohms
- Aural .... 600/150 ohms

Input Level:
- Visual .... 1.0 volts p-p min.
- Aural (for ±25 kHz dev.) .... +10 ±2 dBm

Amplitude vs. Frequency Response, Aural .... ±1 dB, 50 Hz to 15kHz, of 50 μsec or 75μsec pre-emphasis response curve

Visual Sideband Response:
- At Carrier +0.5 MHz to 2.1 MHz .... +0.5, −1.0 dB[2]
- At Carrier +3.58 MHz .... +0.5, −1.0 dB[2]
- Between +2.1 MHz to 4.18 MHz with respect to 3.58 MHHz response .... +0.5, −1.0 dB[3]
- At Carrier −0.5 MHz .... +0.5, −1.0 dB[2]

Variation in Frequency Response with Brightness[4] .... ±1.0 dB

Carrier Frequency Stability[5]:
- Visual .... ±250 Hz
- Aural .... ±250 Hz

Modulation Capability:
- Visual 10%
- Aural .... ±50 kHz

Audio Frequency Distortion .... 0.5% max.[6] (50-15,000 Hz)

FM Noise (below ±25 kHz deviation) .... −60 dB

AM Noise r.m.s.:
- Visual .... −50 dB (below sync level)
- Aural .... −50 dB

Amplitude Variation over one picture frame .... Less than 4%[7]

Regulation of Output 4%

Subcarrier Amplitude[8] .... 0.7 dB

Subcarrier Phase vs. Brightness[9] (diff. phase) .... ±3°

Linearity (diff. gain)[10] .... 0.7 dB

Linearity (Low Frequency) .... 1.0 dB

Envelope Delay vs. Frequency[11]:
- 0.2 to 2.0 MHz .... ±60 ns
- at 3.58 MHz .... ±30 ns
- at 4.18 MHz .... ±60 ns

Harmonic and Spurious Radiation[12] .... −60 dB

K Factor[13]:
- 2T 2%
- 20T 3%

Electrical

AC Line Input .... 208/240 volts, 3 phase, 50/60 Hz (power consumption given below), and 115 volts single phase 50/60 Hz (100 watts)

Slow Line Variation .... ±5% max.

Rapid Line Variations .... ±3% max.

Regulation .... 3% max.

Power Consumption (at 12.5 kW peak visual, & 2.75 kW aural output):
- Average Picture .... 28 kW
- Black Picture .... 43 kW

Power Factor (approx.) 90%

Mechanical

Overall Length (front line cabinets) .... 116″ (2947 mm)

Overall Height (cabinets) .... 84″ (2134 mm)

Depth (front line cabinets) .... 20″ (508 mm)

Overall Depth .... 78¾″ (2000 mm)

Weight .... 8000 lbs (3600 kg) approx.

Finish .... Two-tone blue, brushed aluminum trim

Environmental

Maximum Altitude .... 7,500 feet (2286 m)

Ambient Temperature .... 0°C to 45°C

---

1 Measured at output of sideband filter or filterplexer.

2 With respect to response at carrier plus 200 kHz, as measured by the BW-5 sideband response analyzer at transmitter mid-characteristic.

3 Measured at output of VSBF. Add −0.75 dB at +4.18 MHz if filterplexer or notch diplexer is employed.

4 Measured at 65% and 25% of sync peak level with respect to response at transmitter mid-characteristic.

5 Maximum variation without circuit adjustment over a period of 30 days and over an ambient temperature range of 0°C to 45°C under normal operating conditions.

6 Including harmonics up to 30 kHz and measured with standard de-emphasis network.

7 Measured at blanking level.

8 Maximum departure from the theoretical when reproducing saturated primary colors and their complements at 75% amplitude.

9 Maximum phase difference with respect to burst, measured after the VSBF, for any brightness level between 75% and 15% of the sync peak using 10% (peak-to-peak) modulation with proc. amplifier.

10 Maximum variation in the amplitude of a 3.58 MHz sine wave modulating signal as the brightness level is varied between 75% and 15% of sync peak. The gain shall be adjusted for 10% (peak-to-peak) modulation of the 3.58 MHz signal when the brightness is at pedestal level. This is equivalent to 5% (peak-to-peak) modulation as indciated by a conventional diode demodulator connected after the VSBF with proc. amplifier.

11 Maximum departure from standard curve using TTS-1A. The tolerances vary linearly between 2.1 and 3.58 MHz and between 3.58 and 4.18 MHz as measured with Type BW-8 Envelope Delay Instrument.

12 Ratio of any single harmonic or spurious frequency to peak visual power.

13 Measured at 50% peak modulation to minimize demodulator distortion and with Type TTS-1 in use.

Ordering Information

TT-12ELS TV Transmitter, 12.5 kW visual, 2.75 kW aural with tubes, low pass, harmonic and sideband filters complete. For 208/240 Volt, 3 phase, 50/60 Hz input........	ES-560266
TT-12ELS TV Transmitter, 12.5 kW visual, 2.75 kW aural with tubes. For 380/415 Volt, 3 phase, 50 Hz input. (Output power and required filters to be determined in accordance with required operating standards)....	Specify CCIR or other operating standards

Communications Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

RCA Broadcast Systems

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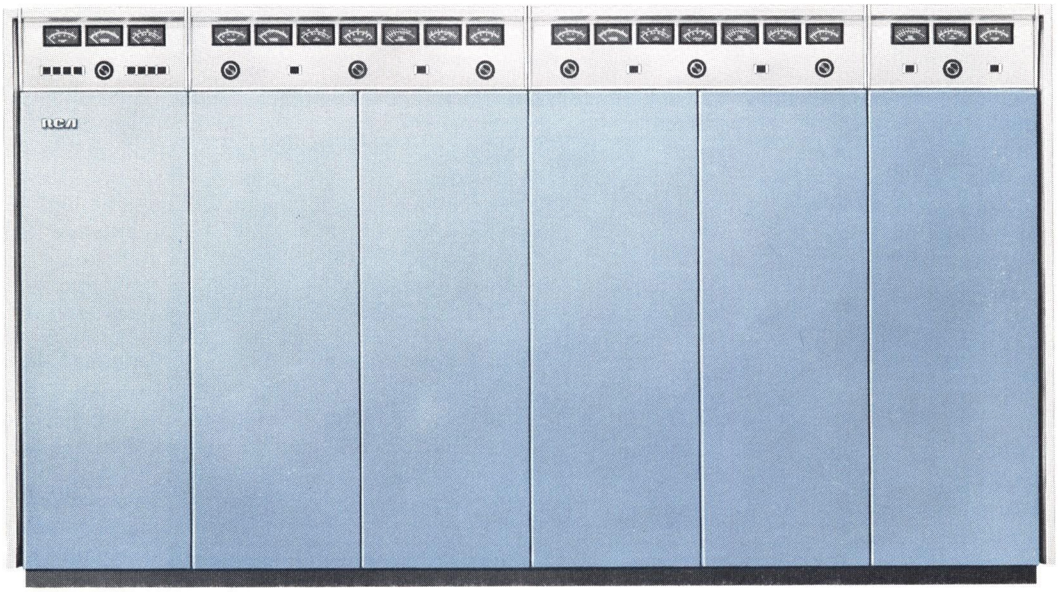
RCA

catalog B.4026

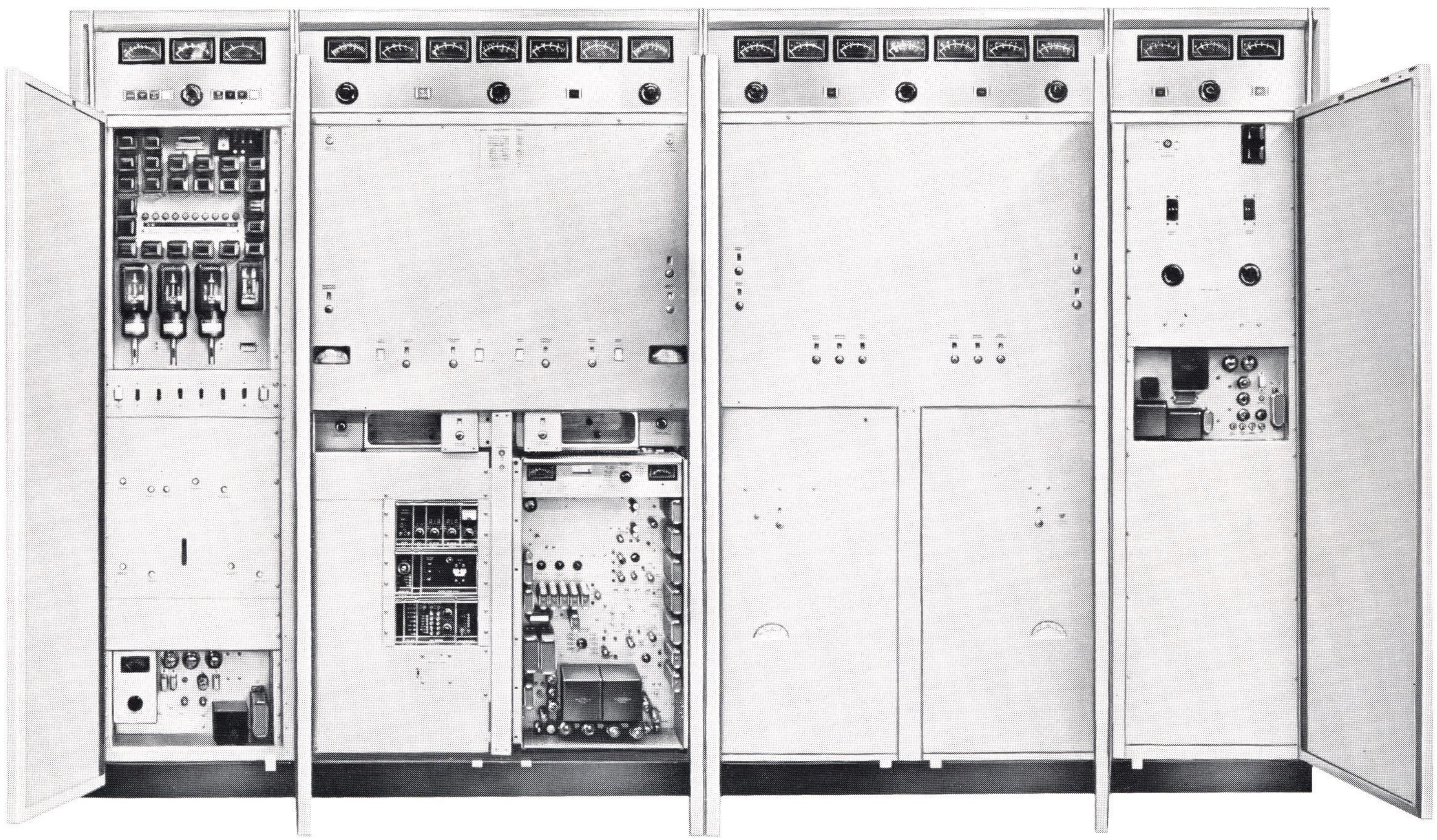
25 kW VHF Transmitter, Type TT-25ELS



- Solid state exciter
- Solid state proc amplifier
- Economical installation
- Low Profile styling
- Superior reliability through diplexed circuitry

3VB

Select Features



25 kW VHF TV Transmitter, Type TT-25ELS

The RCA Type TT-25ELS is an outstanding TV transmitter designed for color and for new ease of operation—manual or remote. This low band ch 2-6 (47-88 MHz) VHF transmitter when used with one of the current VHF antennas provides maximum allowable effective radiated power. Peak visual power output is a full 25 kW (22.5 kW CCIR) and aural power capability of 7 kW.

Improved color picture quality is achieved largely through the simple, straight-forward circuits of proven performance; reliable long-life PA tubes, the solid-state rectifiers and stable air-cooling system. Color performance has been enhanced by linearity correction circuits built into the modulator and a new solid-state video processing amplifier. The paralleled PA system assures superior reliability through its diplexed circuitry.

Description

The TT-25ELS is designed for reliability and ease of operation. Black face meters on new lift-up meter panels are angled for easy viewing. Indicator lamps on meter panels, and illuminated switches, added indicator circuits, dual purpose metering switches and air pressure meter gauges are other refinements in the transmitter providing easier manual and tighter remote control.

An Economical Transmitter

The TT-25ELS circuits employ the latest design features that spell economy in operation. Highlighted features include air-cooled tubes such as the 6166-A for long life and reliability. Single ended RF circuits reduce the number of necessary tubes and circuit components. Extensive overload protection with indicating lights aid in quick location of faulty circuits. The TT-25ELS is designed for up to 7-kW aural power output. This makes it possible to reduce the tube complement and physical size of the transmitter.

Building-Block Construction

The transmitter is housed in compact in-line cabinets that can be broken down for shipping into racks and panels of varying size for easy handling. These cabinets from left to right house the 25kW Control unit, the 6-kW Driver unit, the 25-kW Amplifier unit, and the auxiliary control unit. A single access door on the left end of the transmitter provides access to the rear of the control and RF racks as well as the rectifiers and components mounted on the rear wall of the enclosure. All heavy units such as the plate transformers and large reactors are mounted on a base on the floor. Since all operating controls and important adjustments are brought out to the front of the transmitter, it should not be necessary to enter the enclosure while power is on.

Minimum Floor Space

Reduction of required floor space is effected by the walk-in enclosure design of the TT-25ELS. This type of construction eliminates the need for external access space at the rear of the enclosure. The enclosure may be placed directly against a wall or even in a corner of the room if an air intake opening is provided. Access to all components of the transmitter is possible from within the enclosure. The modulator and exciter may be serviced by tilting the chassis forward, without removal from the cabinet.

Solid-State 5-Watt Exciter

The 5-watt aural/visual exciter, its power supply and metering circuits consist of seven plug-in modules in one standard frame.

The aural exciter circuitry uses an FM oscillator in an AFC feedback loop followed by a buffer amplifier, doubler and two amplifiers to reach the 5-watt output level at carrier frequency. The center frequency of the oscillator is accurately maintained by a reference frequency that is 150 kHz above the FM oscillator. A DC error voltage that represents the difference between the center frequency and the reference corrects for any oscillator drift.

The visual exciter circuitry consists of a temperature-controlled visual oscillator followed by a doubler and two amplifiers to reach the 5-watt output level at carrier frequency.

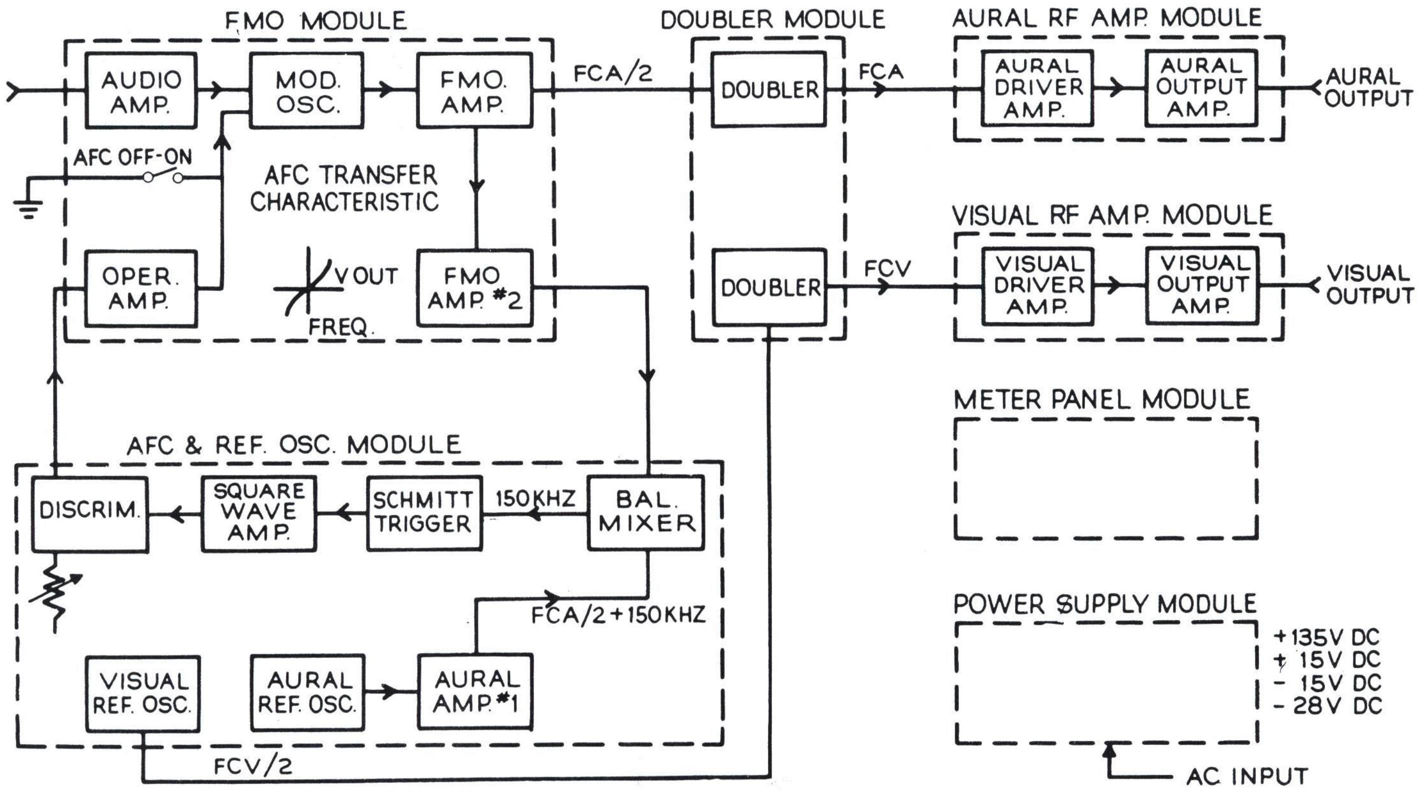
Solid-State Video Input and Processing Amplifiers

A new feature of the proven "E" line of transmitter is the use of two solid-state video modules consisting of a video-input module and a video-processing module.

Video Input Module

The input module, utilizing NPN-, PNP-, and FET-type transistors, provides a high impedance input to insure a loop-through arrangement in the video-input circuit.

The input module generates a negative (—) clamp signal for the video amplifier and a positive (+) clamp signal for the video processing module which follows it in the video path. The input module operates with a nominal input level of one volt (peak-to-peak) video. A differential



Solid-State 5-Watt Exciter Block Diagram.

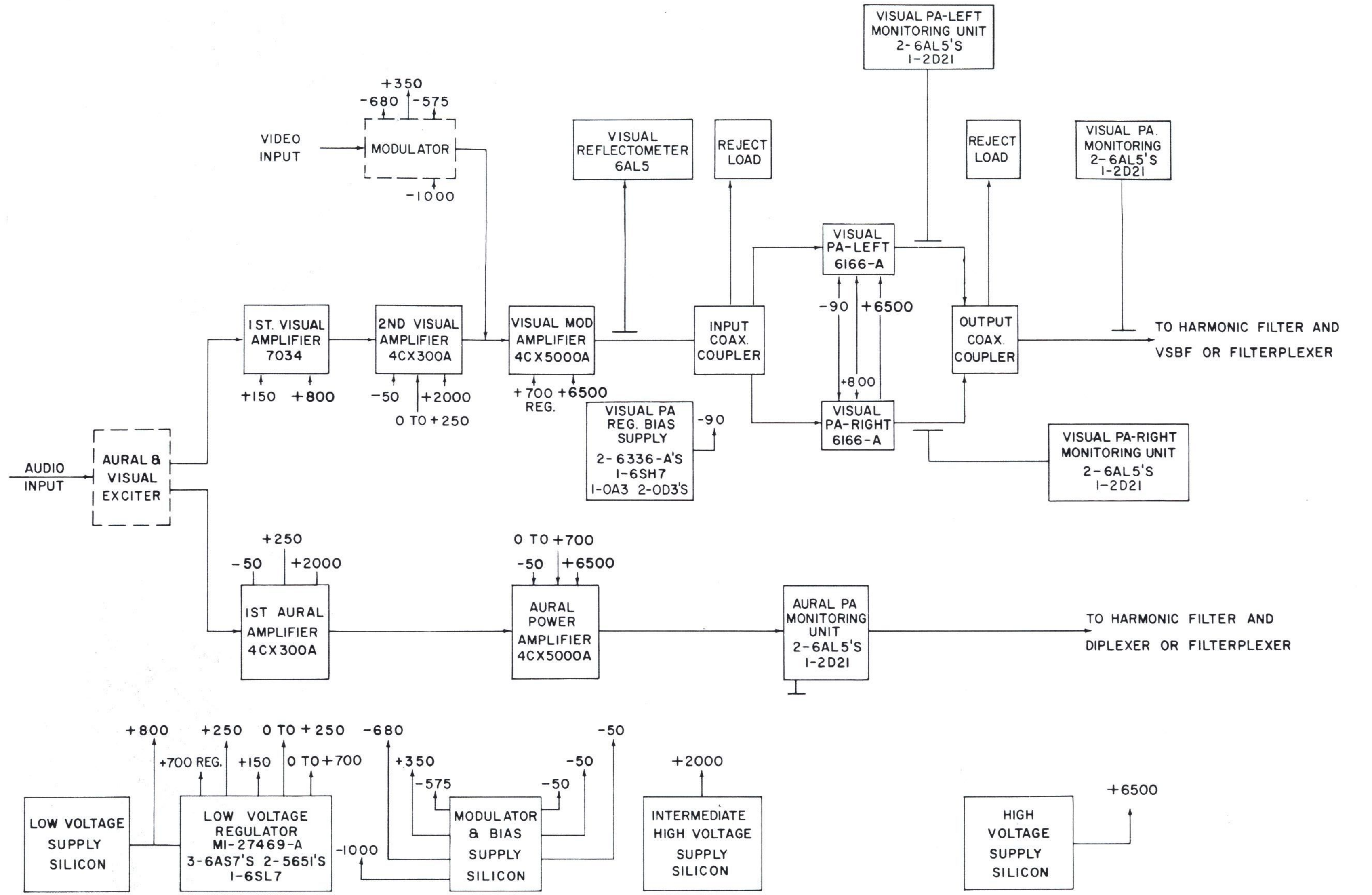
input circuit is provided to suppress as much as eight volts of common-mode signal appearing at the input due to a difference in potential between power-line neutrals at the opposite ends of the video line. The video is amplified in the first transistor stage and fed to a video gain control located in the video processing module. Another output from that amplifier feeds a sync amplifier which is followed by a sync separator and a clamp-pulse generator. The resulting positive (+) clamp pulse is applied to the video processing module clamp circuit. When the clamp circuit in the video processor is unnecessary, this signal is short-circuited to ground to make the sync amplifier inoperative.

Video Processing Modules

The video processing modules include a motor-driven video-gain and a sync-gain control, a video amplifier, differential-phase and gain-correction circuits, a clamp circuit and an output impedance-matching amplifier.

The video input signal, after passing through the video gain control, is fed to an amplifier with a gain of approximately 4.5. A positive clamp pulse (+) from the video input module is applied to the clamp amplifier. When the clamp switch is in the "on" position, d-c information is restored to the video signal. Output from the video amplifier is fed to a differential phase circuit using four gated capacitors and one voltage-variable capacitor (*Varicap*). Approximately ±2 degrees of correction is available from each gated capacitor and +8 degrees of phase correction is available from the *Varicap* capacitor. The four diodes, associated with the four gated capacitors, may be easily reversed to provide positive (+) or negative (—) correction.

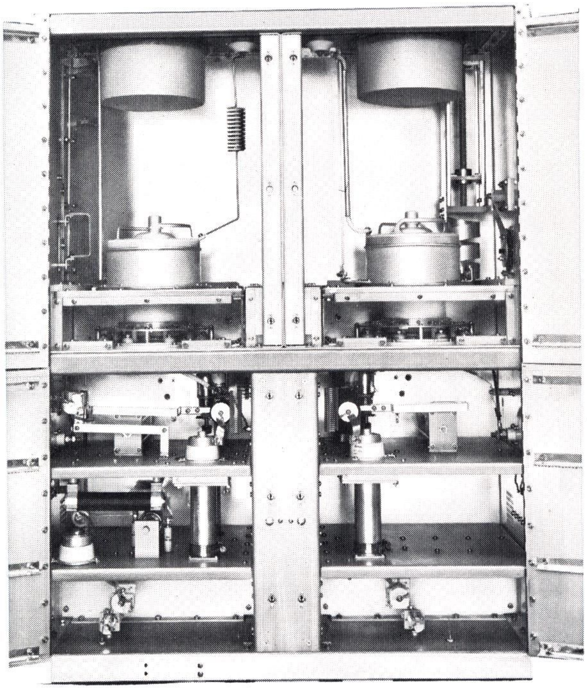
The output of this stage feeds a differential amplifier. Four diodes are gated by transistors to provide an increase in gain of the differential amplifier. The level at which gating takes place is determined by front-panel differential gain controls. Correction of up to 11 dB is possible. The output of the video processing amplifier feeds the visual modulator.



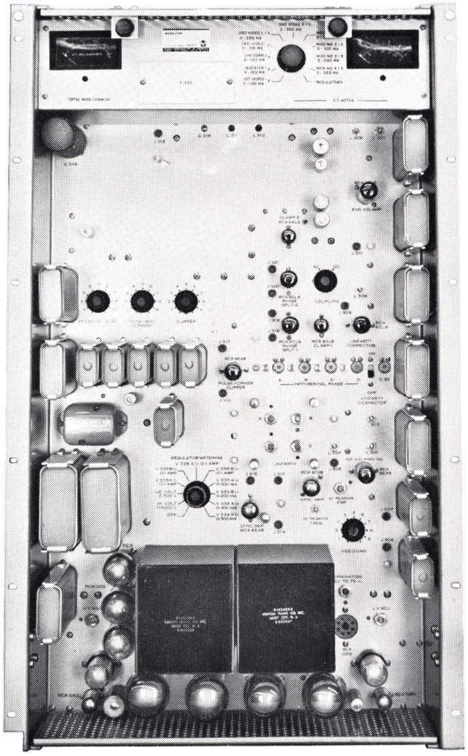
Simplified Block Diagram of TT-25ELS VHF TV Transmitter.

B.4026-5

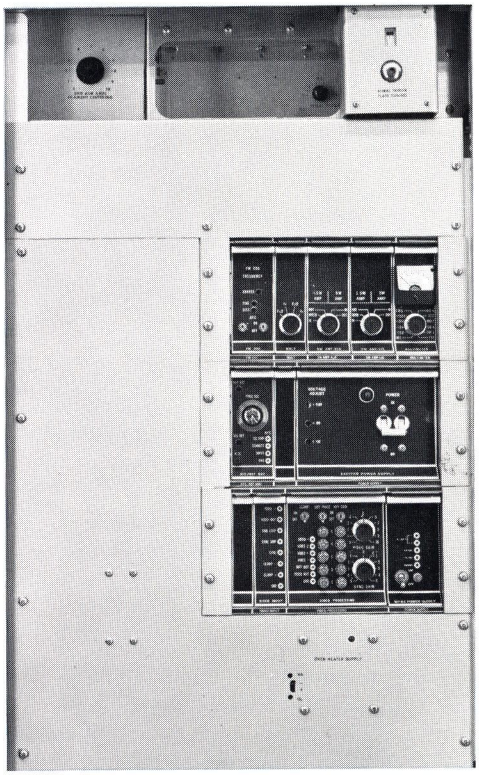
Select Features



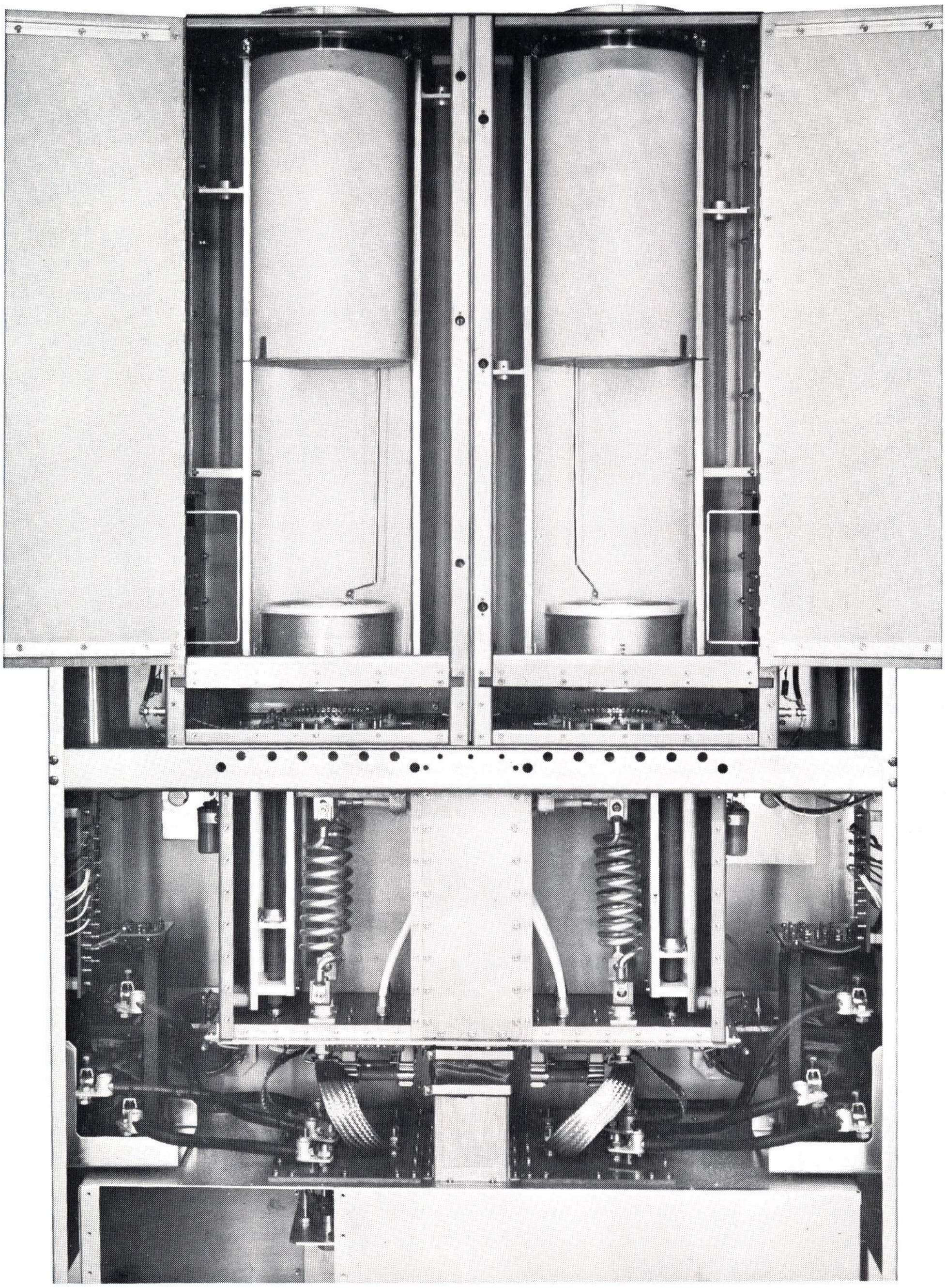
COMPLETE ACCESS and straight forward construction as reflected in the Visual (left), Aural (right) RF driver unit of the TT-25ELS Transmitter.



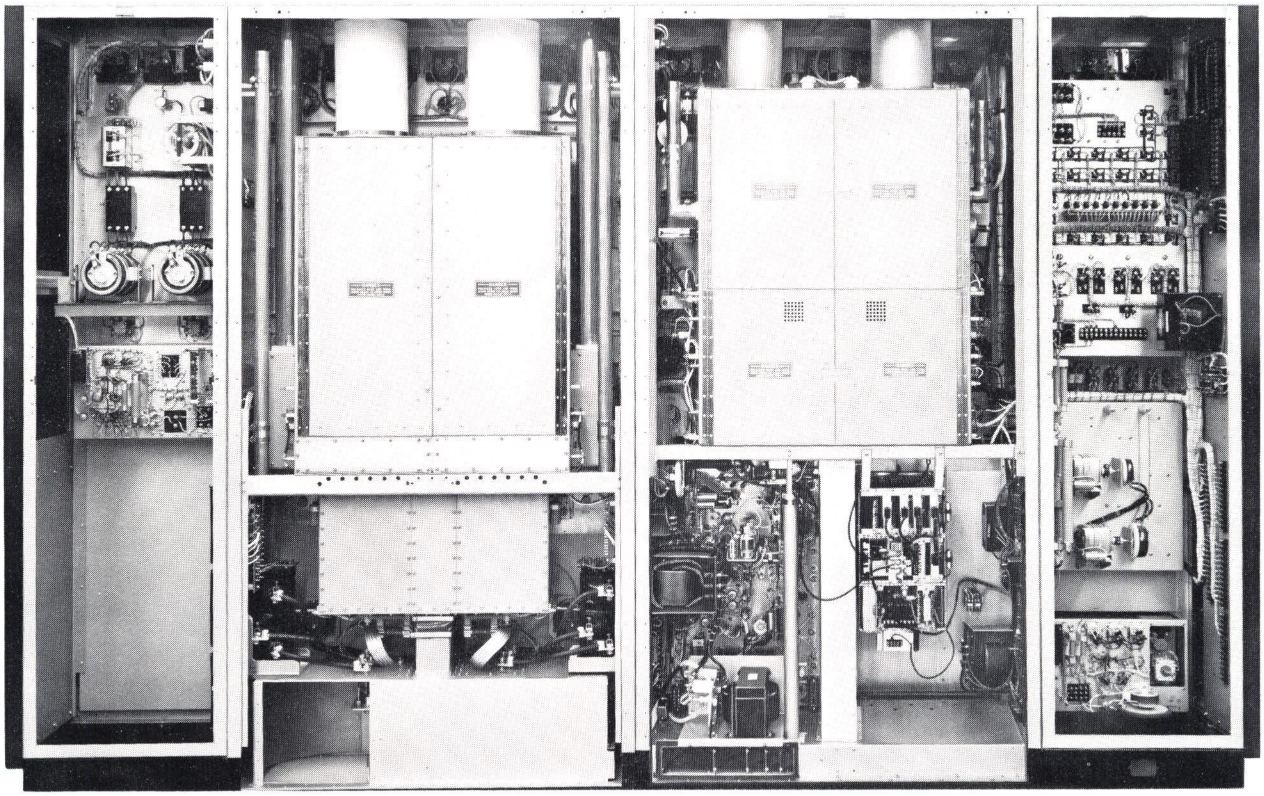
BUILT-IN LINEARITY CIRCUITS for improved color performance are feature of TT-25ELS Modulator Unit.



Entirely solid-state, the aural and video exciter are contained in three subassemblies comprising seven plug-in modules, including the power supply module. Three additional modules comprise the video input and processing amplifier and their power supply.



SUPERIOR RELIABILITY is assured by paralleled PA system of the TT-25ELS. Shown above is the visual RF amplifier with its diplexed PA tube socket cavities.



Rear view of the TT-25ELS VHF Transmitter showing from left to right the auxiliary control, diplexed 25 kW power amplifiers, 6 kW driver and transmitter control cabinets. Note the compact vertical construction which is completely accessible from the walk-in transmitter enclosure.

Video Modulator

The video modulator further processes the video signal and amplifies it to an output of approximately 200 volts, peak to peak, for full modulation of the 4CX5000A modulated amplifier. A linearity (differential gain) amplifier is also included as part of the modulator. Its action is similar to that described in the processing amplifier. The modulator uses conventional video circuitry to the output stage. The modulator output stage functions as a shunt-regulated cathode-follower. Three Type 6146 tubes are connected in a circuit similar to a conventional cathode follower, except that the cathode resistor is replaced by four Type 6146 tubes operating in parallel. The grids of these four tubes are fed with a signal from the plate load of the cathode follower tubes.

The circuit is essentially a feedback amplifier of high efficiency capable of video modulating the five-kilowatt amplifier with a video signal of approximately 200 volts, peak-to-peak.

RF Circuits

The RF circuits employ a chain of multipliers and amplifiers. In the visual chain a 7034 tube operates as the first visual amplifier, driving a 4CX300A amplifier which in turn drives a type 4CX-5000A grid modulated power amplifier. The output of the modulated amplifier is equally divided by a power-splitting coax coupler to drive two 12.5-kW linear amplifiers. The outputs of these two amplifiers are then combined in a coax coupler to provide 25-kW (22.5-kW CCIR) of peak visual power. Excitation control for the visual transmitter is accomplished by varying the screen voltage on the 4CX300A stage. The aural chain consists of a 4CX300A amplifier followed by a type 4CX5000A class "C" power amplifier. Power output of the aural transmitter is adjusted by varying the screen voltage on the 4CX5000A stage. Both these controls are operated by motors and therefore can be adjusted from a remote position.

The visual linear amplifiers following the modulated stage each employ a 6166-A tetrode in a grounded-grid, grounded-screen circuit. Circuit design is simplified, since the grid and screen may be by-passed to a common ground plane. Input and output circuits are then constructed on opposite sides of the ground plane. DC is used for filaments of the 6166-A to reduce hum modulation to a level well below the usual requirement.

Power and Control Equipment

Wherever possible in this transmitter, the same DC power supplies were used for both the visual and aural amplifiers. This greatly reduces the number of components in the transmitter. The supplies, all using silicon diodes, are located on the rectifier panels at the rear of the enclosure. An 800-volt supply furnishes all screen voltages as well as the 7034 plate voltage. The intermediate voltage supply has a 2000-volt output for the 4CX300A plates. The high-voltage supply uses silicon diodes. This supply provides 6500 volts for the plates of the two Type 6166-A power tubes and the two 4CX5000A. High-voltage switching allows independent operation of visual and aural final amplifiers. In addition, this feature permits removal of plate voltage from either visual amplifier in the event of tube failure which results in a minimum of lost air time. All voltages for the visual modulator are furnished by the remaining supplies. One has an output of +350 volts, and the other has several outputs, all negative with respect to ground, which supply the high-level video stages as well as bias for the modulator and RF stages.

Overload Protection

A single integrated control circuit is provided for both the visual and aural transmitters. The blower, filaments, and each rectifier is protected by thermal overloads which can be adjusted to reset automatically. In addition, a main line breaker and an auxiliary breaker are provided. Each incorporates magnetic trips. All rectifiers and RF stages following the exciter are protected by instantaneous overload relays which automatically recycle twice. If the fault continues on the third try the overload circuit will remain tripped until reset. Overload indicator lights are provided for each circuit. These lights have a separate reset and will remain on after the first overload thus providing a record of the circuit giving trouble even though it may be intermittent.

Voltage Regulator

The equipment includes an automatic line voltage regulator which provides a stable line voltage to the filament primaries, the exciter, the modulator, and the low voltage power supply. Automatic regulators capable of handling the complete transmitter are available as optional items.

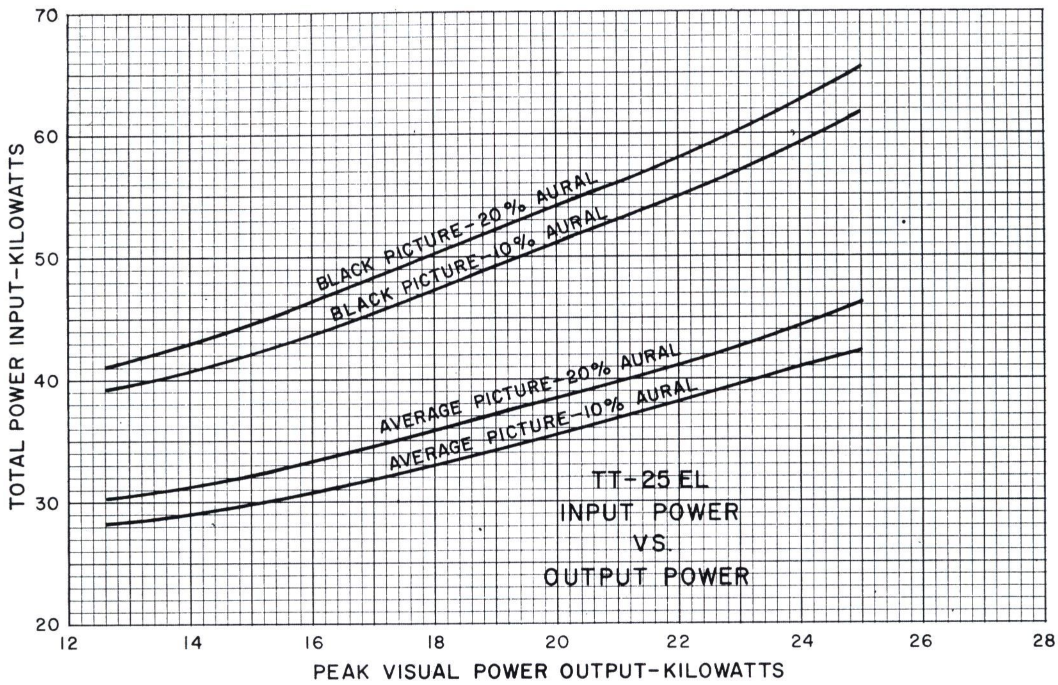
Special Protective Circuits

Included as part of the TT-25ELS is a monitoring unit for connecting in the output transmission line of the visual and aural amplifiers. Each unit contains two 6AL5 diode detectors as reflectometers. The transmission line probes are installed so as to give an indication of the amount of power or reflected power. A meter on the front panel can be switched between the two diode circuits. Power output is read in percent peak power which can be calibrated to read 100 percent for rated power. The standing-wave ratio is read directly on a specially calibrated scale. In the monitoring unit a type 2D21 thyratron tube operates in conjunction with a relay to remove the high voltage plate power from the TT-25ELS when the SWR exceeds a predetermined value.

Vestigial Sideband Filter (FCC Specifications)

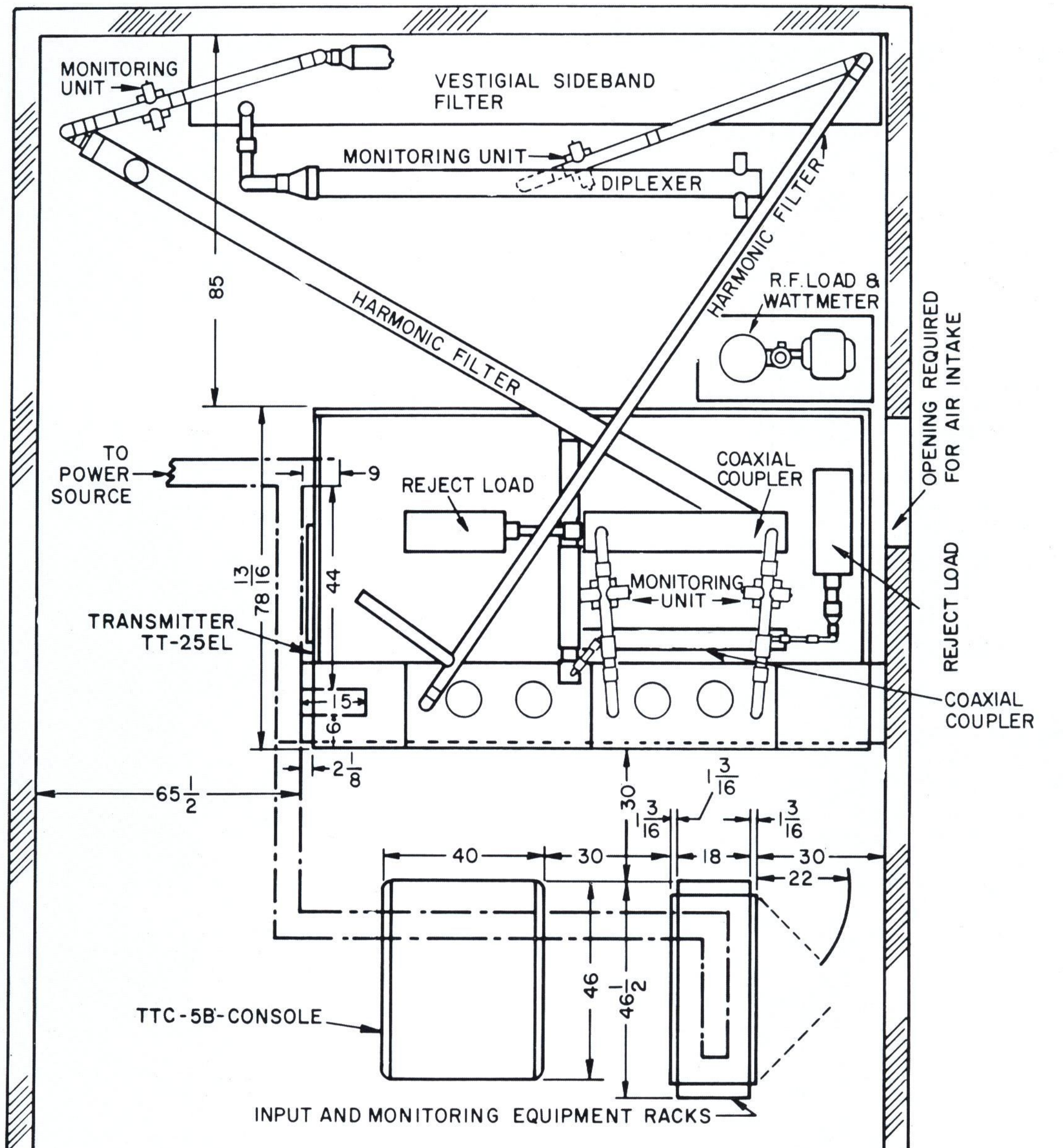
The Vestigial Sideband Filter is furnished completely assembled and adjusted for any one of the low band VHF television channels. The filter is an integral unit designed for floor, ceiling, or wall mounting near the visual transmitter so that the input transmission line is as short as possible.

RCA Type 6166-A Ceramic Power Tube which serves as a long-life class "B" linear power amplifier in the RCA TT-25ELS Transmitter.



ACCESSORIES

R.F. Load and Wattmeter (25 kW)	MI-19267-L/H
100% Spare Tubes	ES-34292-B
Minimum Spare Tubes	ES-34214-B
Control Console Type TTC-5B	ES-561900
Sideband Response Analyzer, Type BW-5C1	MI-34000-C1
Sync and Blanking Adder	ES-597267-B
Sideband Demodulator, Type BW-4C1	MI-34048-C
Envelope Delay Measuring Set, Type BW-8A	MI-34063
Solid State Phase Equalizers, Type TTS-1	ES-560651
Precise Frequency Control, Type TFC-1B	ES-560242
Spare Aural Reference Oscillator	MI-560539-CH
Spare Visual Oscillator	MI-560540-CH



FLOOR PLAN

(Not certified for construction use. Please request installation drawing.)

Typical Floor Plan of the TT-25ELS Transmitter.

Specifications

Performance

Type of Emission:
- Visual A5
- Aural F3

Frequency Range .... Ch 2-6

Rated Power Output:
- Visual .... 25 kW[1]
- Aural .... 7.0 kW[1]

RF Output Impedance .... 50/51.5 ohms

Input Impedance:
- Visual .... 75 ohms
- Aural .... 600/150 ohms

Input Level:
- Visual .... 1.0 volts p-p min.
- Aural (for ±25 kHz dev.) .... +10 ±2 dBm

Amplitude vs. Frequency Response:
- Aural .... ±1 dB, 50 Hz to 15 kHz, of 50 µsec or 75 µsec pre-emphasis response curve

Visual Sideband Response:
- At Carrier +0.5 MHz to 2.1 MHz .... +0.5, −1.0 dB[2]
- At Carrier +3.58 MHz .... +0.5, −1.0 dB[2]
- Between +2.1 MHz to 4.18 MHz with respect to 3.58 MHz response .... +0.5, −1.0 dB[3]
- At Carrier −0.5 MHz .... +0.5, −1.0 dB[2]

Variation in Frequency Response with Brightness[4] .... ±1.0 dB

Carrier Frequency Stability[5]:
- Visual .... ±250 Hz
- Aural .... ±250 Hz

Modulation Capability:
- Visual 10%
- Aural .... ±50 kHz

Audio Frequency Distortion .... 0.5% max.[6] (50-15,000 Hz)

FM Noise (below ±25 kHz deviation) .... −60 dB

AM Noise r.m.s.:
- Visual .... −50 dB (below sync level)
- Aural .... −50 dB

Amplitude Variation over one picture frame .... Less than 4%[7]

Regulation of Output 4%

Subcarrier Amplitude[8] .... 0.7 dB

Subcarrier Phase vs. Brightness[9] (diff. phase) .... ±3°

Linearity (diff. gain)[10] .... 0.7 dB

Linearity (Low Frequency) .... 1.0 dB

Envelope Delay vs. Frequency[11]:
- 0.2 to 2.0 MHz .... ±60 ns
- at 3.58 MHz .... ±30 ns
- at 4.18 MHz .... ±60 ns

Harmonic and Spurious Radiation[12] .... −60 dB

K Factor:
- 2T 2%
- 20T 3%

Electrical

AC Line Input .... 208/240 volts, 3 phase, 50/60 Hz (power consumption given below), and 115 volts single phase 50/60 Hz (100 watts)

Slow Line Variations .... ±5% max.

Rapid Line Variations .... ±3% max.

Regulation .... 3% max.

Power Consumption (at 25 kW peak visual, & 7.0 kW aural output):
- Average picture (see curve) .... 46 kW
- Black Picture (see curve) .... 65 kW

Power Factor (approx.) 90%

Mechanical

Overall Length (front line cabinets) .... 136¼″ (3461 mm)

Overall Height (cabinets) .... 84″ (2134 mm)

Depth (front line cabinets only) .... 20″ (508 mm)

Overall Depth .... 79½″ (2020 mm)

Weight (approx.) .... 9000 lbs. (4082 kg)

Finish .... Two-tone blue, brushed aluminum trim

Environmental

Maximum Altitude .... 7,500 feet (2286 m)

Ambient Temperature .... −20°C to 45°C

1 Measured at output of sideband filter or filterplexer.
2 With respect to response at carrier plus 200 kHz, as measured by the BW-5 sideband response analyzer at transmitter mid-characteristic.
3 Measured at output of VSBF. Add −0.75 dB at +4.18 MHz if filterplexer or notch diplexer is employed.
4 Measured at 65% and 25% of sync peak level with respect to response at transmitter mid-characteristic.
5 Maximum variation without circuit adjustment over a period of 30 days and over an ambient temperature range of 0°C to 45°C.
6 Including harmonics up to 30 kHz and measured with standard de-emphasis network.
7 Measured at blanking level.
8 Maximum departure from the theoretical when reproducing saturated primary colors and their complements at 75% amplitude.
9 Maximum phase difference with respect to burst measured after the VSBF, for any brightness level between 75% and 15% of the sync peak using 10% (peak-to-peak) modulation with proc amplifier.
10 Maximum variation in the amplitude of a 3.58 MHz sine wave modulating signal as the brightness level is varied between 75% and 15% of sync peak. The gain shall be adjusted for 10% (peak-to-peak) modulation of the 3.58 MHz signal when the brightness is at pedestal level. This is equivalent to 5% (peak-to-peak) modulation as indicated by a conventional diode demodulator connected after the VSBF with proc amplifier.
11 Maximum departure from standard curve using TTS-1A. The tolerances vary linearly between 2.1 and 3.58 MHz and between 3.58 and 4.18 MHz as measured with RCA BW-8 Envelope Delay Instrument.
12 Ratio of any single harmonic or spurious frequency to peak visual power.
13 Measured at 50% peak modulation to minimize demodulator distortion and with Type TTS-1 in use.

Ordering Information

TT-25ELS VHF Television Transmitter, for FCC standards, 25 kW visual, 7 kW aural with tubes, low pass, harmonic and sideband filters complete. For 208/240-volt, 3-phase 50/60 Hz power ES-560905

TT-25ELS VHF Television Transmitter, for CCIR standards, 22.5 kW visual, 7 kW aural with tubes. Output power and required filters to be determined in accordance with required operating standards. For 380/415 volt, 3-phase, 50 Hz power .... Specify CCIR or other operating standard

Communications Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

RCA Broadcast Systems

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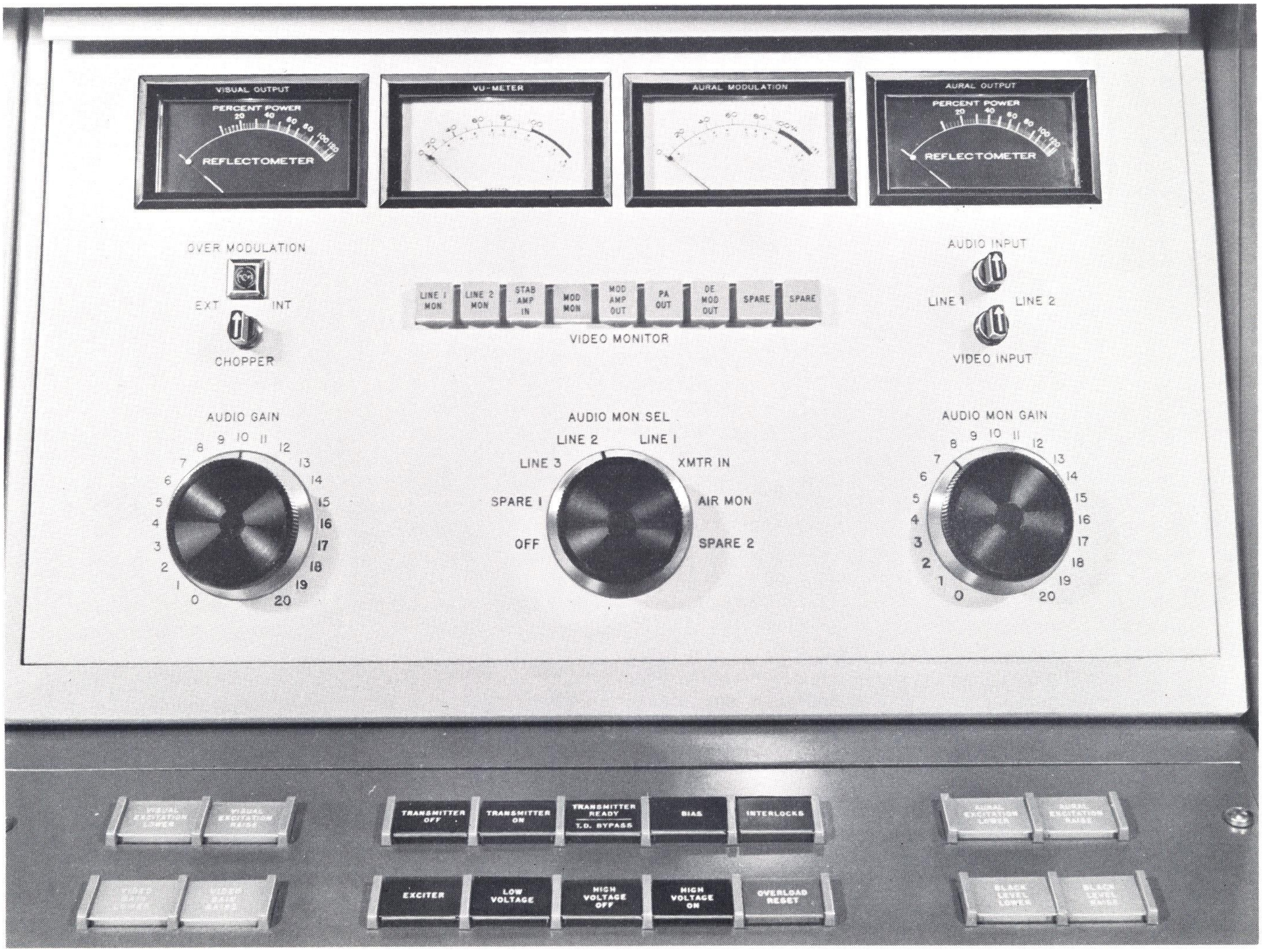
RCA

catalog B.4304

Transmitter Control Console, Type TTC-5B

- Centralized control center
- Transistorized waveform monitor
- Wide band picture monitor
- Remote metering

5VB



Major transmitter controls and status indicators can be extended to TTC-5B including transmitter ON/OFF, Ready/By-pass, bias, interlocks, exciter, low voltage, high voltage on/off, and overload reset. Raise/lower controls for visual and aural excitation, video gain and black level are grouped separately.

On the monitor control panel above, four remote meters provide continuous indication of visual power output, aural power output, aural transmitter input level and aural percentage modulation when properly interconnected to the transmitter. There are also controls for meter circuits, video and aural monitor circuits, and aural input signal level indication and control.

RCA Transmitter Control Consoles afford a complete monitoring and operating center for broadcast transmitters. Assembled at the time of installation from standard console housings, panels and metering and monitoring units, the console provides custom planned control exactly suited to each transmitter.

A basic console, the Type TTC-5B, contains audio and video gain and monitoring circuits, and necessary indicating lights, switches and meters for normal transmitter operation. It includes transistorized picture and waveform monitors, for viewing the picture and the video signal at various points throughout the transmitter. There are provisions for switching between two program channels, aural as well as visual. It permits previewing of the unused program line, or both lines when neither is in use. The audio lines can be monitored at any time.

TTC-5B Combines Versatility and Simplicity of Operation

Description

The TTC-5B Transmitter Control Console is a custom equipment made up of four major units: a set of panels and accessories that must be ordered according to type of transmitter and including a transmitter control and indicator panel; an 8-inch picture monitor; a waveform monitor and monitor control panel. The console proper is made up of two 22-inch base and turret sections and related assembly plates, angles, etc. Other features include a program line selector, an aural modulation monitor meter for use with the TV station monitor, and assembly hardware.

Centralized Transmitter Control

The transmitter control and indicator panels contain finger-tip switches and pushbuttons for transmitter supervisory control and operation. All necessary control functions can be extended to the console such as Transmitter On/Off, PA Plate, Aural Driver Plate, Visual Driver Plate and Overload Reset functions. Tally lights that operate on 115 Volts AC obtained from the transmitter, indicate functional status. A 115-Volt step-down transformer supplies 6.3 Volts for the meter lights and chopper.

Transistorized Monitors

The TTC-5B is equipped with an eight-inch picture monitor, model TM-19, and a five-inch Tektronix Waveform Monitor, Model 529. Both of these units mount in the left console housing. Both have self-contained power supplies, thus eliminating any need for external sources of DC power. The video signal is fed from the TTC-5B control panel to the waveform monitor and is looped through to the picture monitor where it is terminated with a 75-Ohm termination. Either the picture monitor or waveform monitor may be pulled forward in the mounting for rapid inspection or adjustment. The waveform monitor is supplied with a graticule calibrated for indicating video depth of modulation as required for transmitter monitoring. The TTC-5B may be used for monitoring either FCC or CCIR standards.

Remote Metering Facilities

The Monitor Control Panel is designed to work in conjunction with standard input and monitoring equipment racks. It requires one set of these racks or equivalent components, for full use of its facilities. The Monitor Control Panel includes four major circuit functions and other related ones, namely, meter circuits, audio monitor circuits, video monitor circuits, and aural input signal level indication and control.

The four meters provide continuous indication of visual power output, aural power output, aural transmitter input level and aural percentage modulation. The power output functions are provided by meters which duplicate the reflectometer meters on the transmitter. The aural transmitter input level is indicated by a VU meter with a suitable multiplier pad connected to the input line of the aural transmitter; and the aural modulation percentage is indicated by a meter which matches the VU meter but repeats the indication of the aural monitor in the racks.

7-Point Pushbutton Monitoring

In addition to the audio metering, aural monitoring circuits provide means for connecting the input of an audio monitoring amplifier through adjustable bridging networks to any of seven points in the aural system from input line to off the air monitor. Two of these positions are spares which may be used for any desired auxiliary function. The video monitoring circuits permit connection of any one of eight monitoring points in the visual transmitter system to the inputs of both the picture and waveform monitors. One of these is a spare, and like the audio monitoring spares, may be used as desired. Potentiometers in every monitor termination insure proper termination and level adjustments.

Aural Master Gain Control

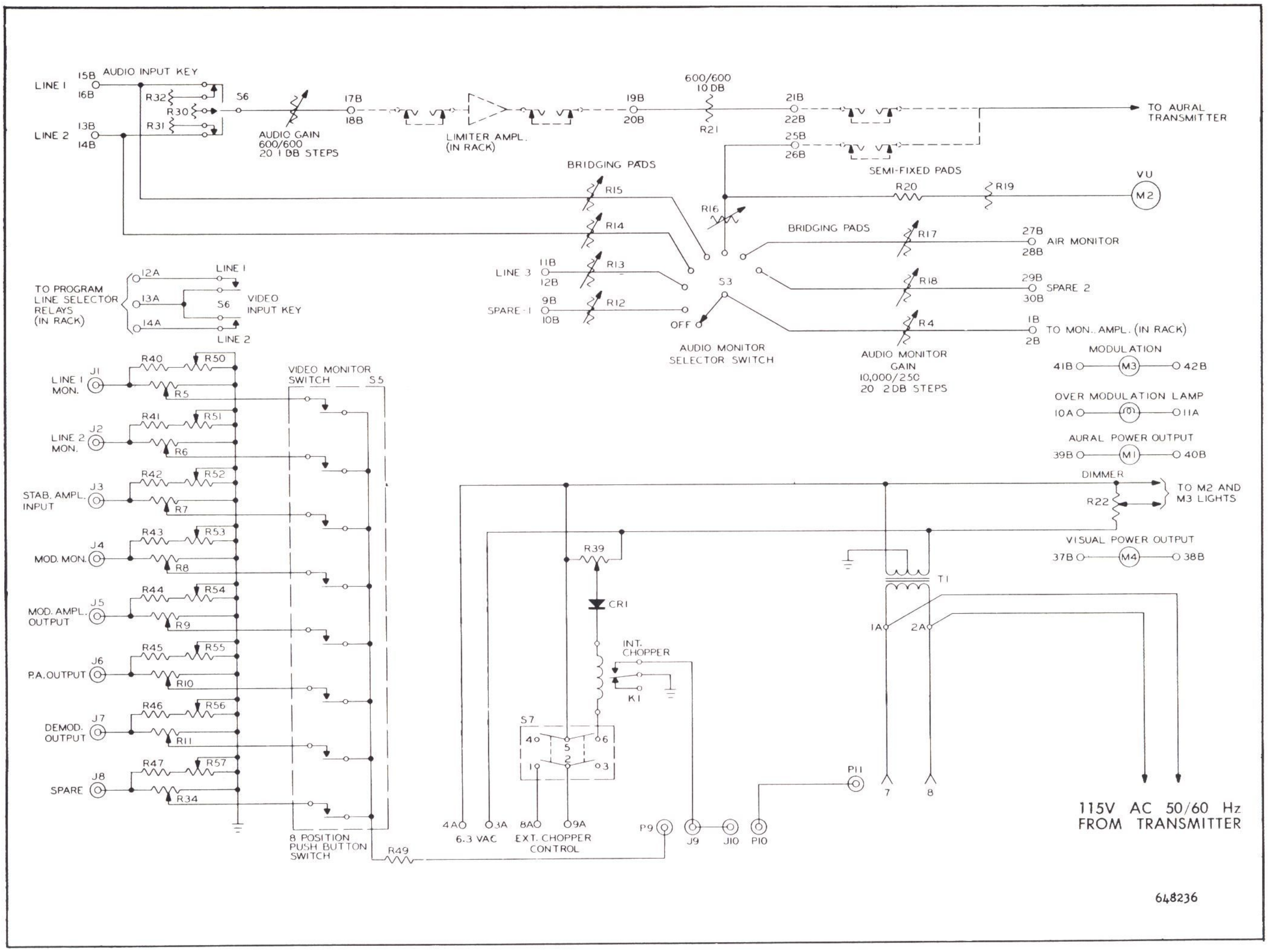
In order to make the monitoring facilities more useful, an audio gain control with twenty 1-dB steps is provided for connection ahead of the program amplifier (usually a limiting amplifier) so that the aural input to the transmitter can be controlled. In addition, a lamp in parallel with the overmodulation flasher of the aural monitor and a switch to control the chopper of the visual monitor are provided with a rheostat to dim the lights in the meters to suit the ambient light around the console.

Modular Console Units

Two basic modular console units make up the standard housing of the TTC-5B. Each console unit includes a 20-inch base section, a single-height turret top, and appropriate end bells and trim. A remote control section is included in one of the console sections. The modular design permits numerous configurations that meet practically any station requirement. The TTC-5B is finished in the new RCA shadow blue and midnight blue finish and styled to be compatible with RCA transmitters.

Though the above-mentioned control, metering and monitoring units are supplied with the standard TTC-5B console, many variations are possible. The console housings can provide additional panel and internal space so that special requirements for custom switching, monitoring, amplifying or indicating devices can be added. It is also possible to integrate the basic components of the TTC-5B console with other video console equipment where a combination transmitter and studio console is desired.

FUNCTIONAL DIAGRAM



Impedances:
- Audio Line Input (2) ....600 Ohms, balanced
- Audio Line Output ....600 Ohms, balanced
- Audio Monitor Input ....10,000 Ohms, balanced
- Audio Monitor Output ....250 Ohms, balanced
- Master Monitor Inputs (6) ....75 Ohms, unbalanced
- VU Meter Circuit (across transmitter input) ....7,500 Ohms

Volume Controls:
- Audio Gain ....600 to 600 Ohms, 20 steps, 1 dB per step; initial insertion loss zero
- Audio Monitor Gain ....10,000 to 250 Ohms, 20 steps, 2 dB per step; tapered; last step infinite; insertion loss 38 dB

Power Requirements:
- Indicator Lights ....115 Volts AC, from transmitter
- Meter Lights ....115 Volts AC, 50/60 Hz

Dimensions (overall):
- Width...41″ (104.1 cm)
- Depth...44½″ (113 cm)
- Height...45¼″ (115 cm)

Weight (approximately)..500 lbs. (226.8 kg.)

Ordering Information

TTC-5B Transmitter Control Console Equipment ES-561900

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RCA Broadcast Systems

Planning for TV Transmitter Remote Control

Planning of remote control facilities for a television transmitter should be based on a careful review of applicable FCC regulations as well as the specific needs of the individual station. RCA broadcast field sales representatives are qualified to assist in planning remote control facilities for current model RCA television transmitters. Exact equipment requirements will vary with the type of television transmitter to be controlled. The following information is intended to provide an introduction to TV transmitter remote control systems rather than a specific equipment list for any one type transmitter or station.

Equipment required for television transmitter remote control includes not only the remote control units but also equipment for remote monitoring of the visual and aural signals and for generation of vertical interval test signals in accordance with applicable regulations.

A brief description of the requirements of each family of equipment is provided in the following paragraphs.

Remote Control System

This is the equipment which handles the basic command functions for operation of the transmitter and the means of returning the necessary metering and alarm signals. The regulations require a sufficient number of remote control functions to perform all transmitter adjustments normally required on a daily basis to insure strict compliance with the technical requirements of the FCC rules. Remote metering is required for all parameters which must be entered in the TV transmitter operating log. Means are required for determining that any required obstruction lighting of the antenna and supporting tower is operating normally.

Fail-safe protection is required to assure that any fault or failure which results in loss of control will cause the transmitter to cease operation. Loss of metering of any of the parameters which are required for transmitter logging must activate an automatic device which will terminate operation of the transmitter not more than one hour after the loss.

Individual stations may wish to provide more control and metering functions than the minimum required. For this reason, and to allow for added functions that may be desired in the future, it is recommended that provision be made for spare control and metering functions.

Interconnection between the transmitter and remote control point is available by a choice of methods. Figure 1 is a simplified block diagram showing an RCA BTR-30A1 30-function remote control system with interconnection between the studio and transmitter by means of a voice quality telephone circuit. A maximum of 20 dB of line attenuation is allowable between the transmitter and remote control location.

Figure 1. Remote Control Via Voice Quality Wire Line

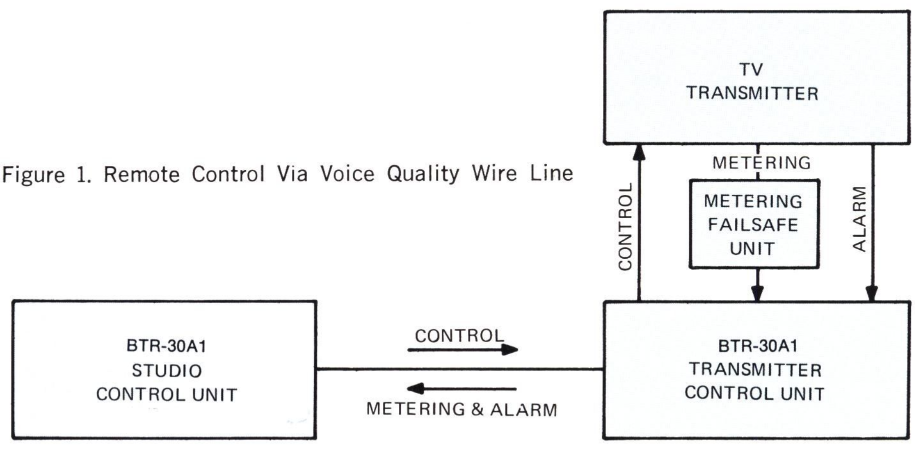


Figure 2. Control Via Microwave and Metering Via Aural Subcarrier

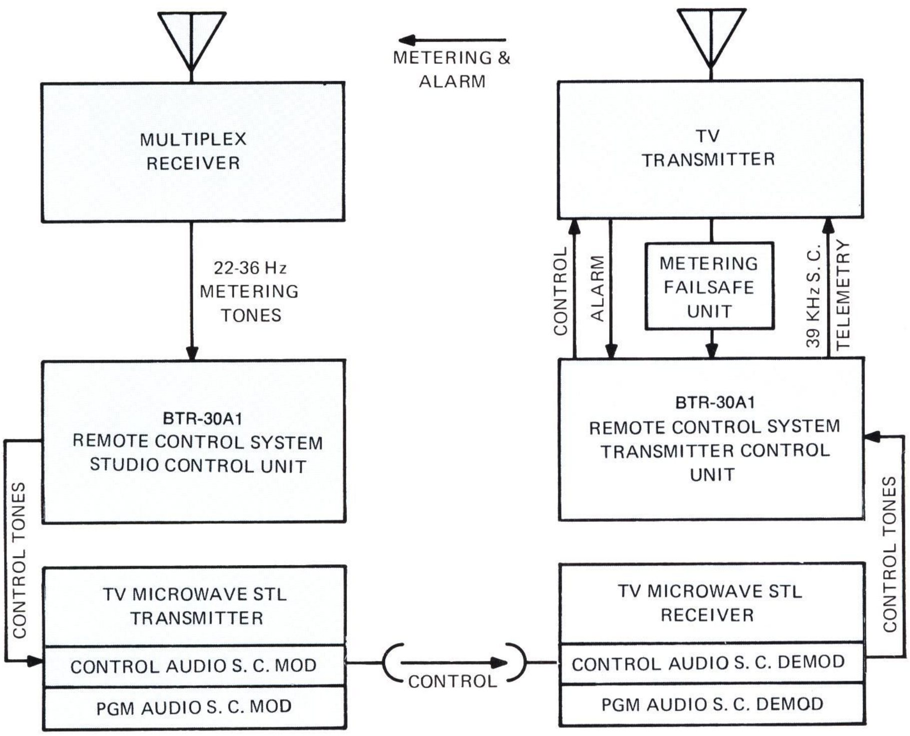


Figure 2 is a block diagram showing interconnection by means of a TV microwave STL link from the remote control point to the transmitter. A separate audio subcarrier modulator and demodulator are required in the TV microwave system to carry the audio control tones to the transmitter site. Metering and alarm signals are returned to the remote control point by means of a subcarrier on the aural channel of the TV transmitter. The audio tones containing the metering information are modulated on a 39 kHz subcarrier generated within the BTR-30A1 transmitter control unit and introduced into the TV transmitter aural channel. At the remote control point, the subcarrier is recovered from the transmitted aural signal at the output of an off-air multiplex receiver containing a subcarrier demodulator. The recovered metering tones are then introduced to the BTR-30A1 studio control unit.

The wireless interconnection system has the obvious disadvantage that metering and status information will be lost in the event of failure of the TV aural transmitter. On the other hand, in some transmitter locations it may be difficult to obtain a telephone circuit with sufficient reliability for transmitter remote control purposes, and in this case wireless interconnection will be preferred.

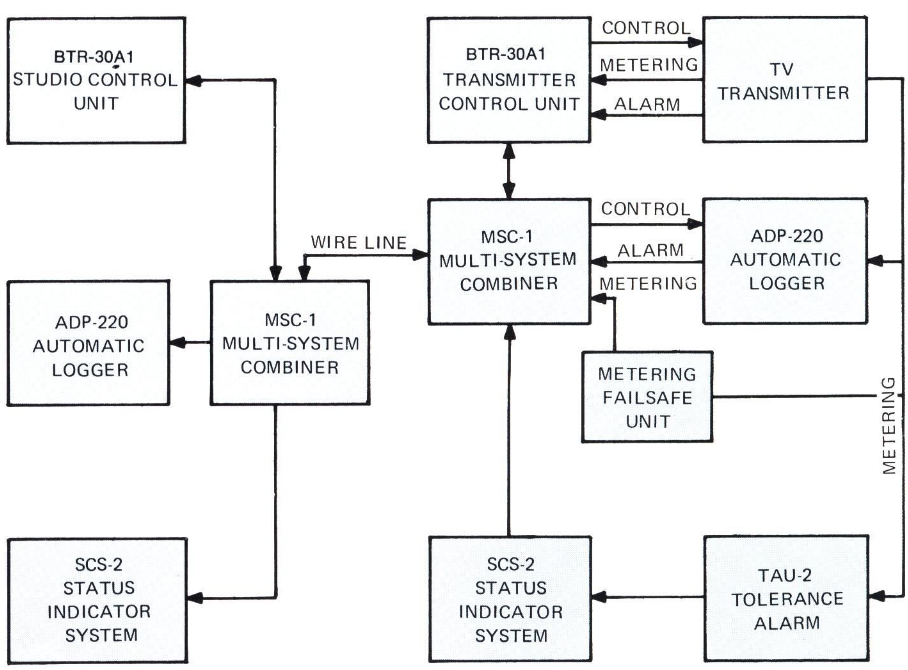
For parallel TV transmitters, consideration should be given to the use of duplicate BTR-30A1 remote control units and telephone lines for 100% redundance of the control system as well as the transmitter. An alternate method of achieving system redundancy would be to have one control system interconnected by wire line and another by TV relay and aural channel subcarrier.

Automatic Logging System (Optional)

Automatic logging equipment increases the benefits of remote control of the television transmitter by relieving the studio operating personnel of the manual logging task except for observation of the VIT signals and logging of the observations. In the event that automatic logging is provided, the functions which must be logged are the same as those which must be logged in a manually operated transmitter.

Automatic tolerance alarms must be provided for those parameters which are subject to tolerance limitations in accordance with FCC regulations, i.e., visual

Figure 3. Remote Control and Automatic Logging Via Voice Quality Wire Line



output power and aural final amplifier plate voltage and current. Transmitter visual and aural carrier frequency need only be checked once daily to assure operation within frequency tolerance and need not be alarmed if logged manually. If logged automatically these parameters must be alarmed.

Figure 3 shows a Moseley ADP-220 Automatic Logging System and TAU-2 Tolerance Alarm Unit used in conjunction with a BTR-30A1 remote control system. Also included is a Model SCS-2 Status Indicator System to provide 14 status or alarm channels in addition to the 5 alarm channels provided in the basic BTR-30A1 control equipment. The Automatic Logging equipment uses a separate series of audio tones to transmit metering and alarm information to the remote control location where the logged digital information is printed by an electric typewriter. Logging is initiated automatically by a clock at half hour intervals.

The remote control and logging tones may be transmitted over separate voice quality telephone circuits. With the use of an MSC-1 Combiner, the remote control and automatic logging tones as well as the Status Indicator tones may be transmitted automatically over a single telephone circuit. If preferred, this unit may be used to combine the remote control reporting, automatic logging and status indicating data on a 39 kHz subcarrier on the aural channel of the TV transmitter.

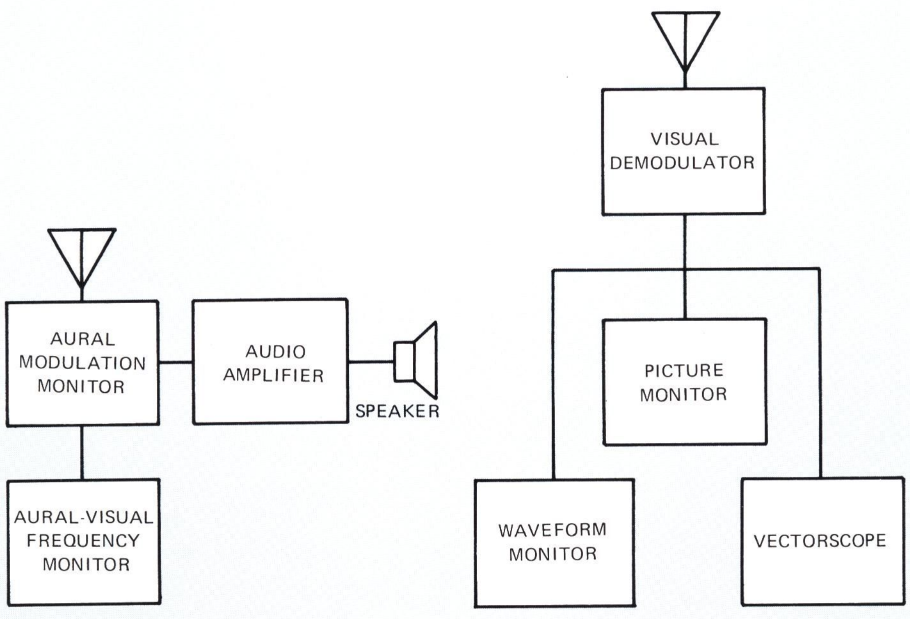
Remote Monitoring Equipment

A block diagram indicating the monitoring equipment items required at the remote control location is shown in Figure 4. A type-approved aural modulation monitor is required with continuous indication of peak and quasi-peak percentage of modulation of the aural signal. Equipment for measuring aural and visual frequency is required and may be located at either the remote location or at the transmitter site. If located at the transmitter, provision must be made for remote metering of the frequency readings. Aural modulation monitors and frequency monitors are available with sufficient sensitivity for off-air monitoring of the transmitted signal. Older monitors intended for use at the transmitter location may not have sufficient RF gain for off air monitoring service. An audio amplifier and loudspeaker are needed for aural monitoring of the received audio signal.

An off-air visual demodulator is required at the remote control location to permit continuous monitoring of the waveform and other characteristics of the transmitted visual signal. As a practical requirement, a separate visual demodulator is needed at the transmitter site for use in making measurements of transmitter performance and for making transmitter setup adjustments.

A video waveform monitor is required for continuous monitoring of the transmitted visual signal. This monitor must be capable of both full field displays and displays of test signals inserted on selected lines in the vertical blanking interval. In addition a vectorscope is required if any portion of the transmission is in color. A picture monitor is recommended for a visual display of the received signal. A color monitor should be provided if color program material is transmitted. It is suggested that both a monochrome and a color picture monitor be provided if space permits.

Figure 4. Monitoring At Remote Location



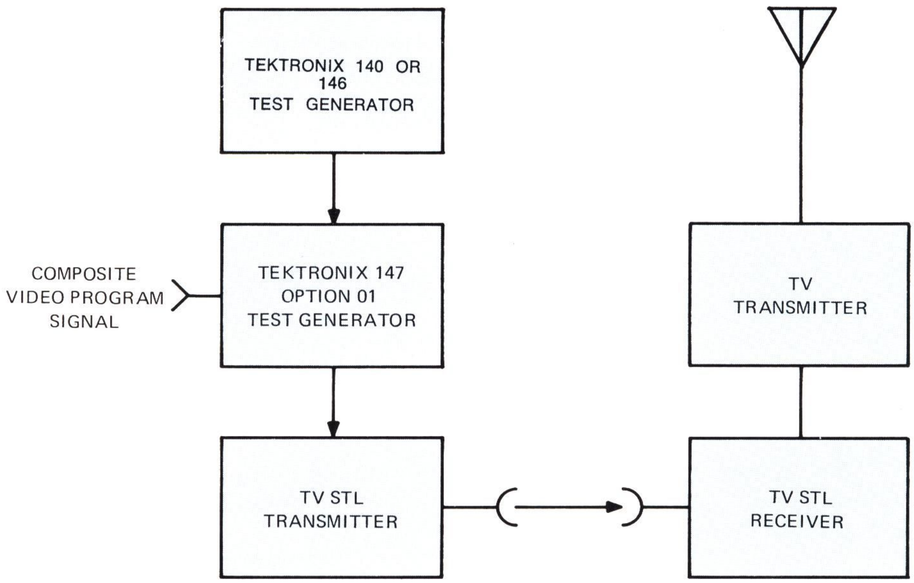
Vertical Interval Test Generating Equipment

The FCC rules governing remote control require that a series of test signals be generated and inserted in the vertical interval of the visual signal at the remote control point in the feed to the transmitter. The signal must be observed at the remote control point after extraction from the received RF signal. This signal is normally obtained at the output of the off-air visual demodulator and viewed on a video waveform monitor and vectorscope (see *Monitoring Equipment*).

The required test signals consist of multiburst on Field 1, Line 18, color bars on Field 2, Line 18 and a composite signal on Field 1, Line 19. The composite signal contains a stair step with superimposed color subcarrier frequency, a 2T sine squared pulse, a 12.5T sine squared pulse and white bar. Normally the composite signal is also fed to Field 2, Line 19 at the remote control point. However, FCC regulations permit insertion of the composite test signal of field 2 to be inserted at the transmitter to provide a comparison of the degradation of the signal caused by the microwave up-link against that contributed by the transmitter. Alternatively, a licensee may insert any suitable test signal on Field 2, Line 19, either at the transmitter or at the remote control point. The alternate test signal should have approximately the same APL as the composite test signal.

A block diagram of a representative vertical interval test signal generating system is shown in Figure 5. The composite video output signal from Studio Master Control is fed to a Tektronix Model 147 Option 01 television signal generator. This unit genlocks to the incoming signal and is capable of deleting an incoming VITS signal. It inserts all of the required test signals with the exception of color bars which are provided by the Tektronix Model 146 Generator. In the event that the composite test signal of Field 2 is inserted at the transmitter input, a second Tektronix 147 Option 01 signal generator is needed at the transmitter location. The monitoring equipment required for observation of the vertical interval test signal at the remote control point is described above under Remote Monitoring Equipment.

Figure 5. Vertical Interval Test Signal Generating System



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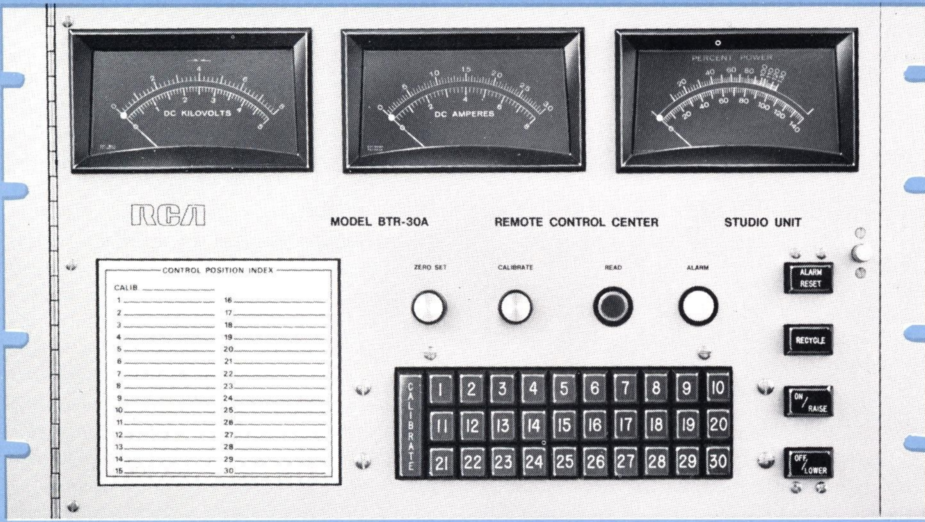


- Fail-safe design
- Meets TV remote control requirements
- Thirty metering channels
- Sixty control functions
- Computer-type logic circuitry

RCA Remote Control System, Type BTR-30A1

Description

With 30 metering channels and 60 individual control functions the all solid-state BTR-30A1 Remote Control System handles most of today's remote control requirements. This catalog sheet describes in particular the television application of the BTR-30A1 system. A choice of system options permit interconnection between the television transmitter and the remote control location either by a voice quality wire line or by an audio channel on the microwave STL system with telemetry returned via a sub-carrier multiplexer on the TV aural channel. Fail-safe facilities are provided in accordance with FCC regulations, including a one hour delayed action fail-safe timer which is activated automatically by the loss of telemetry of any of the required transmitter parameters.

All Solid State

The circuitry of the BTR-30A1 is of modular contruction, using carefully chosen combinations of integrated circuits and discrete components. Only one stepper relay is used in the transmitter unit. Separate switching decks are provided on the stepper to provide complete isolation between controlled circuits and between metered circuits in the transmitter. Solid-state, computer-type logic circuitry is used in the studio unit in place of a stepper relay or mechanical logic devices thus increasing reliability. The studio unit is essentially noiseless.

Quick Access to Circuitry

Some features of the Model BTR-30A1 are of special interest. An indication of the stepper relay position is provided on the front panel of the transmitter unit. This is especially useful during calibration. Color-coded push-button switches on the transmitter unit are used for local control. The LOCAL/REMOTE buttons are illuminated red and green for quick indication of system status. Swing-away front panels on both units provide access to all printed circuit modules, and all initial and routine adjustments are made from the front of the equipment. An extension board is provided for testing each module.

Five-Input Alarm System

Included with the BTR-30A1 is a five-input alarm system. A contact closure is used to activate any one of the five inputs. This can be utilized for continuous surveillance, sensing such things as illegal entry, temperature, flooding and the like. The alarm signals are returned to the studio as part of the telemetry information. When an alarm condition exists, a visual indication is given at the control point by the amber ALARM lamp.

Audio Tones for Control and Metering

The Model BTR-30A1 requires one two-way, communications-grade signal circuit between the studio and the transmitter site. Two functions, designated ON/RAISE and OFF/LOWER, can be performed on each of thirty control channels selected by individually numbered push-buttons. A metered indication of the function being controlled can be observed simultaneously. The frequencies used are FAIL/SAFE 920 Hz, ON/RAISE 790 Hz, and OFF/LOWER 670 Hz. High-Q temperature-stabilized toroidal inductors and capacitors are used in all oscillator and tone detector circuits to assure drift-free operation. Control outputs are available from the BTR-30A1 in the form of normally open contact closures. Contacts in the BTR-30A1 are rated for 50-watt non-inductive loads.

Linear, Voltage-Controlled Oscillator

Telemetry is accomplished by converting the DC sample voltages from the transmitter to a frequency in the 22 Hz to 36 Hz spectrum by means of a linear voltage-controlled oscillator. This signal is relayed to the studio unit and converted back to a DC voltage proportional to the input sample for display on one of the 4″ panel-mounted meters. Multiturn calibration controls are provided on the transmitter unit.

Fail-Safe Design

Fail-safe provisions meet FCC regulations for both control and telemetry.

Fail-safe protection will be activated

with the loss of primary power or control information reception to the transmitter unit or malfunction of the equipment itself. The 920 Hz fail-safe tone generated in the studio unit also activates the stepper relay at the transmitter unit. The tone is momentarily interrupted, creating, in effect, short-duration pulses which control the stepper. An interruption of approximately 20 seconds trips the fail-safe circuitry and places the transmitter in a non-radiating mode.

Failure of the electronics associated with the telemetry system will be detected in the studio unit. This will then activate a separate signal which will then be conveyed over the control circuit to the transmitter unit. Upon receipt of this signal, a command will be applied to the BRF-1 fail-safe unit. The BRF-1 is a separate rack mounting unit normally installed directly beneath the transmitter unit. The BRF-1 contains an electronic one-hour clock which, when fully cycled, will activate a relay whose contacts will place the transmitter in a non-radiating mode.

In addition to the input from the transmitter unit of the BTR-30A1 system, the BRF-1 has four separate inputs for the sample voltages from the metering sensors within the transmitter. The voltage from each of these sensors, after amplification when required for the parameter being metered, is applied to the BRF-1 and included in the fail-safe loop. A failure of a sensor or a failure in the electronics of the metering system will then activate the one-hour timer. A switch on the BRF-1 enables an operator at the transmitter to revert to local manual control.

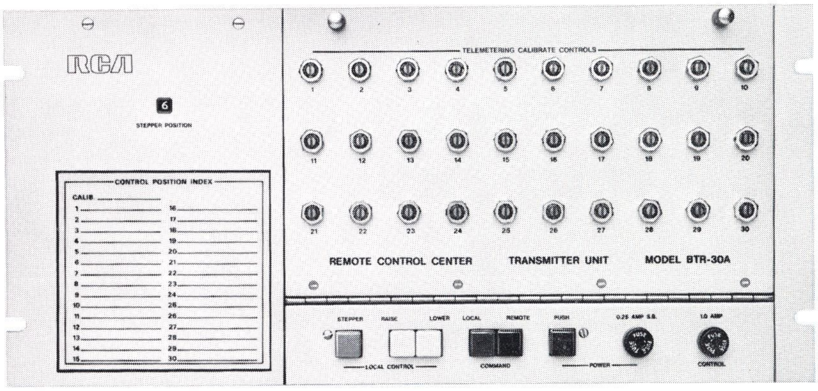
Restoration of a defective sensor or of the telemetry system within the one-hour time interval will reset the clock. To permit normal transmitter startup, the BRF-1 contains the necessary logic so that the start command to the one-hour timer is gated off when the transmitter has been purposely turned off.

For Wire or Radio Link

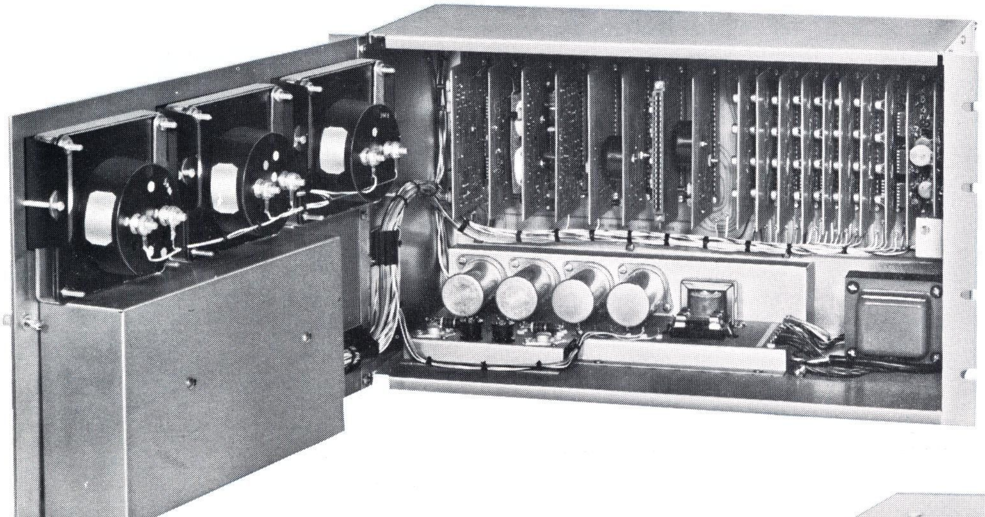
Two basic versions of the Type BTR-30A1 are available; one for wire interconnection and one for radio (STL) service.

Wire Service

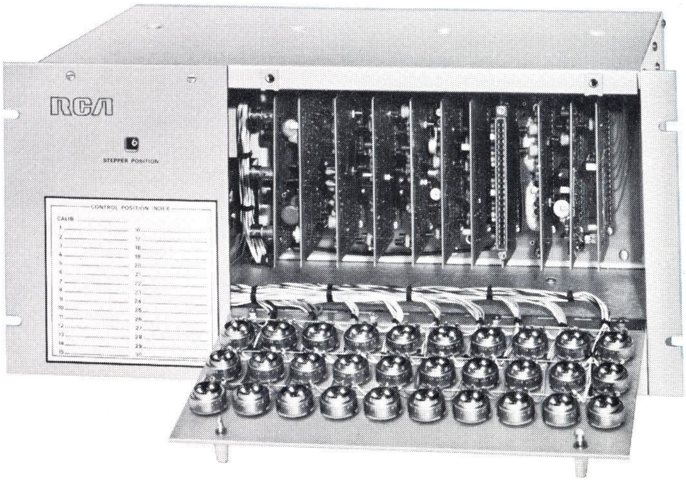
For wire service, only a single voice-grade telephone circuit (full duplex) is required for interconnection. DC continuity is *not* required. The 22 Hz to 36 Hz telemetry information is returned to the studio unit by means of an amplitude-modulated 1280 Hz signal. Thus, all audio signals appearing on the telephone line are confined to the 670 Hz to 1280 Hz spectrum.



Transmitter-control unit, Type BTR-30A1. Note window at upper left which displays position of stepper relay.



Swing-aside front panel exposes the largely integrated circuitry of the Studio Unit. Note modularized construction and neat layout.



Fold-down front panel in transmitter-control unit provides quick access to all modules. Note 10-turn potentiometers on panel.

STL Service

For wireless interconnection, the tones carrying control and fail-safe information from the studio to the transmitter unit may be introduced into a separate audio subcarrier channel on the TV microwave STL system. The return path for the telemetry information can be via a 39 kHz subcarrier inserted into the aural channel of the televison transmitter and recovered by a Type TMR-2 VHF Multiplex Receiver at the remote control point. The Multiplex Receiver contains a subcarrier demodulator which recovers the 22 Hz to 36 Hz telemetry information for use by the BTR-30A1 Studio unit.

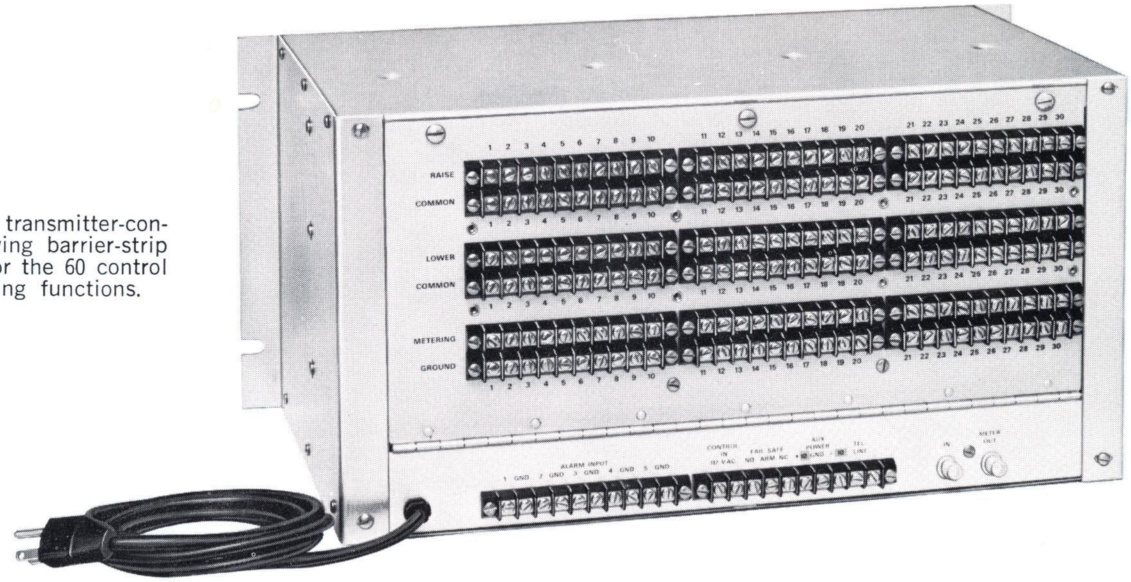
Accessories

Meter extension panels are available to add one, two or three meters to the basic 3-meter complement of the BTR-30A1 or to provide duplicate meter display at an observation point away from the studio control unit. The meter extension panel occupies 3-½ inches of rack mounting space.

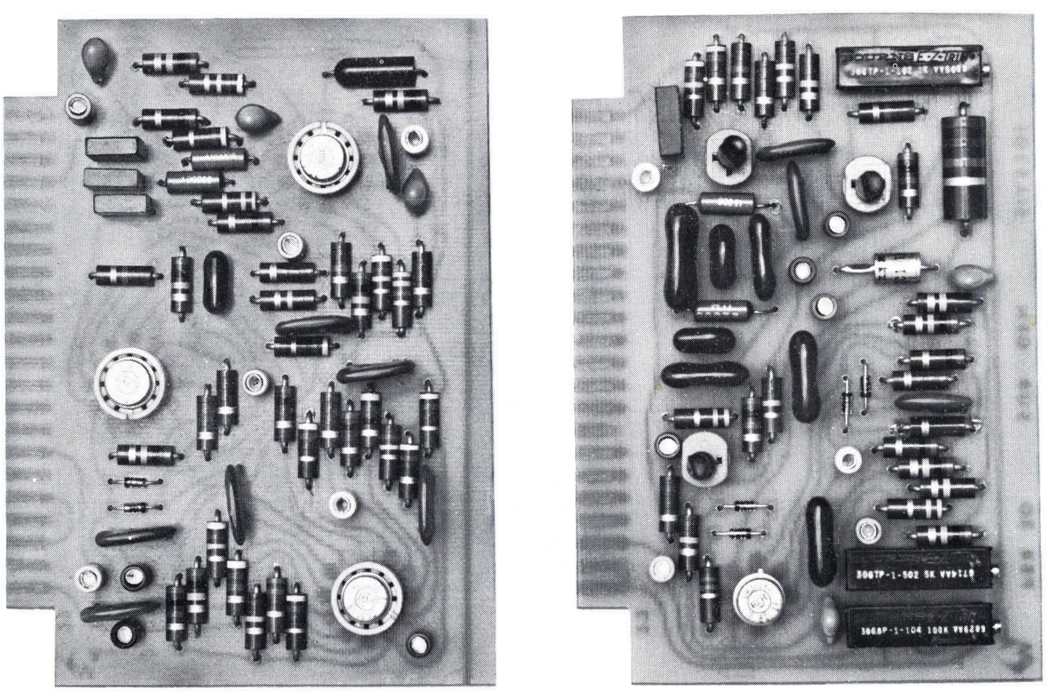
An SCS-2 Status Indicator System augments the basic remote control system and provides status indication or quick acting fault alarm for 14 functions. The SCS-2 consists of two units; a transmitter unit located at the transmitter and a receiver unit at the remote control point. Each unit occupies 3-½ inches of rack mounting space. The SCS-2 transmits status information by means of a three-level, frequency shift keyed signal. A 2700 Hz signal is shifted to either 2500 Hz or 2300 Hz. The signal consists of a sync pulse followed by 14 pulses to indicate the status of each channel. Since the pulse train is transmitted every 400 milliseconds, the response time for indication of an alarm is less than 0.5 second.

Normal condition is indicated by the SCS-2 when an external pair of normally closed contacts is attached to each of the 14 input circuits. Simple restrapping of any channel allows a pair of normally open contacts to be used. Fourteen status lights provide visual indication at the studio unit. A switch on the front panel allows selection between automatic reset or latching operation. In automatic reset, the light remains on for the duration of the alarm. In the latching mode, the light stays on until manually reset. One pair of SPDT relay contacts terminated at the rear of the receiver unit is available for triggering an external alarm to indicate when an alarm condition exists on any channel.

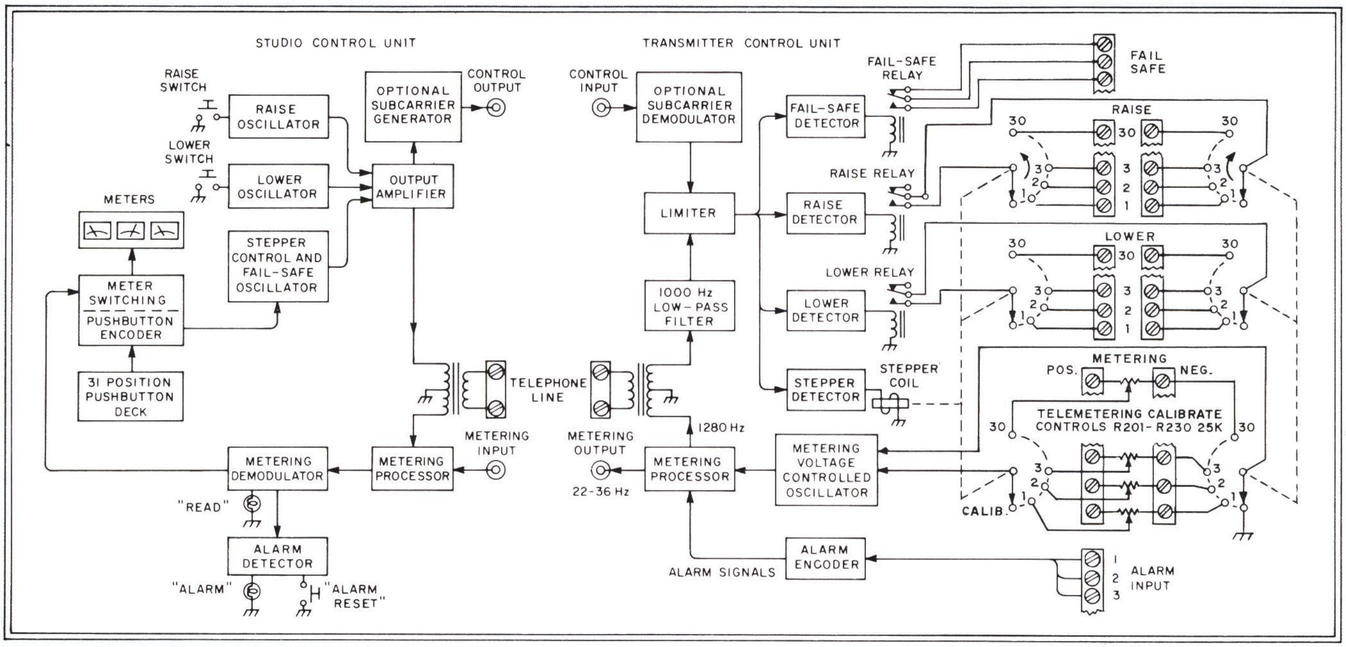
The SCS-2 may be operated over a separate one way audio circuit. If desired, the BTR-30A1 and SCS-2 can be operated over a common circuit by using an HLT-1 Hybrid Line Termination Panel at each end of the interconnecting circuit. The insertion loss of each HLT-1 is 6 dB.



Rear view of transmitter-control unit showing barrier-strip connections for the 60 control and 30 metering functions.



Typical BTR-30A1 printed-circuit modules. Note integrated circuit devices and uncrowded layout.



Specifications

Metering..........................30 telemetry channels, plus calibration
Control Functions....................60; 30 ON/RAISE, 30 OFF/LOWER
Meters.............3, taut-band with carefully controlled ballistics. Provisions for 7 external meters
Metering Stability ....Better than 1% with weekly checks
Telemetry Input Requirements ....1V-10V DC for full-scale deflection. Input impedance 20,000 ohms
Telemetry Frequencies:
 Audible ....1280 Hz
 Subaudible ....22 Hz-36 Hz
Control Frequencies.........................FAIL-SAFE—920 Hz; ON/RAISE—790 Hz; OFF/LOWER—670 Hz
Interconnection Requirements:
 Wire ....Ordinary voice-grade two-way telephone line, 600 ohms, 20 dB allowable loss from 650 Hz-1350 Hz. (DC continuity not required)
 Radio (STL)
  Control Circuit ....separate audio subcarrier channel on TV STL system, 600 ohm input and output
  Telemetry Circuit ....Telemetry return path capable of handling 22-36 Hz, sinusoidal
  Transmitter Control Unit Output ....0 dBm, 500 ohms
  Studio Unit Input ....0 dBm, 8,000 ohms nominal
Calibration Reference ....Zener diode
Semiconductor Devices..................All silicon diodes, integrated circuits and JEDEC registered transistors

Operating Temperature Range............................—10°F to +140°F (—12°C to 60°C)
Power Requirements............120/240 V, 50/60 Hz, Studio Control Unit—15W, Transmitter Control Unit—25W
Dimensions:
 Studio Unit ....10½″ (267mm) H, 19″ (483mm) W, 8½″ (216mm) D
 Transmitter Unit ....8¾″ H, 19″ W, 10½″ D (222 x 483 x 267 mm)
Weight (shipping, approx.)..60 lbs. (27kg)
Shipping Volume (approx.)..................................2.2 cu ft. (0.67 m³)

Accessories

SCS-2 Status Indicator System, 14 Channel
 Studio Unit MI-561467
 Transmitter Unit MI-561468
HLT-1 Hybrid Termination Unit..........................MI-561466
Meter Extension Panel for 1 Meter..........................MI-561445-1
Meter Extension Panel for 2 Meters..........................MI-561445-2
Meter Extension Panel for 3 Meters..........................MI-561445-3
Meters for Extension Panel...................................MI-561444 Series
TMR-2 VHF Multiplex Receiver for Telemetry via 39 kHz Aural Subcarrier MI-561183

Ordering Information

BTR-30A1 Remote Control System
 For Voice Quality Wire Line Service................ES-561466-ATV-1
 For Control via TV Relay Audio Channel and Telemetry via Subcarrier or TV Aural Channel..ES-561446-ATV-12

BRF-1 TV Transmitter Remote Control Fail-Safe Unit..MI-561484

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TV Remote Control Interfacing Equipment

Requirements for interfacing to allow operation and metering via remote control will be determined by the type of transmitter in use. Generally, the basic remote control system provides a single contact closure for a control function and terminals for a nominal one volt sample for each metering point. If transmitter control and metering points are not compatible with this requirement, it will be necessary to use interfacing relays and/or metering samplers.

Reference to the following description of remote control accessories will allow selection of required items for implementing a new system or expansion of an existing one.

Relays & Socket MI-561448*

The following relays are available to provide isolation or interfacing logic between the remote control unit and the controlled equipment. They may also be used to provide increased current handling capacity of the control system.

*MI	COIL	CONTACTS	TYPE
561448-1	24V. DC	DPDT @ 5 Amp.	Momentary Contact
561448-2	115V. AC	DPDT @ 5 Amp.	Momentary Contact
561448-3	24V. DC	DPDT @ 5 Amp.	Latching Type
561448-4	24V. DC	DPDT @ 5 Amp.	Time Delay 0.1 to 2.0 sec.

Relay Panel MI-561449

Each panel requires 3½ inches of 19-inch rack space and will hold up to eight relays of the MI-561448 type.

DC Amplifier MI-561461

A DC chopper stabilized amplifier is used where voltage amplification and/or isolation is required. It allows sampling of sensitive DC meter circuits in such equipment as a frequency monitor and reflectometer. As the input is floating, the circuit to be sampled can be positive, negative or isolated from ground. Gain of the MI-561461 amplifier is such that 15 micro-amperes flowing through a 2200 ohm resistor will produce an output of 1.5 volts DC.

Amplifier Mounting Panel MI-561480

Each panel requires 5¼ inches of standard 19-inch rack space and provides mounting for two DC amplifiers MI-561179 or MI-561461.

Power to Linear Convertor MI-561179

The MI-561179 is comprised of two sections. The first section is essentially the same as MI-561461 DC amplifier and performs the same function of providing an output voltage proportional to the input sample for remote metering. A sample of this output is fed to a second section consisting of a linearizing circuit to provide a second output voltage which is proportional to the anti-log of the input sample. This linear output may be used for feeding the ADP-220 Automatic Logging System. A typical use for this device would be to both meter and automatically log a TV power output sample at a remote location.

Plate Current Metering Unit MI-561481

This device is to be installed in series with the plate voltage line of a TV transmitter when required, to provide a plate current sample for remote metering.

These units are available as follows:

MI-561481-1	0-1.0 Amp.
MI-561481-2	0-2.0 Amp.
MI-561481-3	0-5.0 Amp.
MI-561481-4	0-10.0 Amp.
MI-561481-5	0-20.0 Amp.

Plate Voltage Metering Unit MI-561482/561483

This unit consists of a well insulated resistor network to obtain a meterinig sample directly proportional to the plate voltage and may be used in circuits up to 10,000 volts DC.

These units are available as follows:

MI-561482-1	1 KV to 3 KV Typical, 4.5 KV max.
MI-561482-2	3 KV to 5 KV Typical, 7.5 KV max.
MI-561482-3	5 KV to 7 KV Typical, 10 KV max.
MI-561482-4	7 KV to 10 KV Typical, 15 KV max.
MI-561483	10 KV to 20 KV Typical, 25 KV max.

Line Voltage Kit MI-561463

This kit includes a packaged unit containing a transformer, rectifier and filtering units for samplng 120 volt or 240 volt AC single phase line voltages.

Tower Light Monitor Kit MI-561462

This accessory unit is designed to monitor AC line currents between 2 and 20 amperes in a tower lighting circuit. Since current is sampled, the remote metering may be calibrated to indicate the number of obstruction lights in operation and the flash rate of a beacon.

Note Tower lighting systems vary widely depending on tower height and location. Compliance with SCC requirements for determining correct operation of tower lighting may require a more elaborate monitoring system.

Hybrid Multi Systems Combiner MI-561479

Provides hybrid line units to combine three equipments (control and metering, automatic logging and status alarm signals) on a single telephone line.

Temperature Sensing Kit MI-561465

This unit provides an accurate means of measuring temperatures of the transmitter building, air inlet, air outlet or similar temperatures over a range of 0°F to 140°F. A well regulated power source of + and − 10 volts D.C. at 50 mA is required.

1WB

RCA

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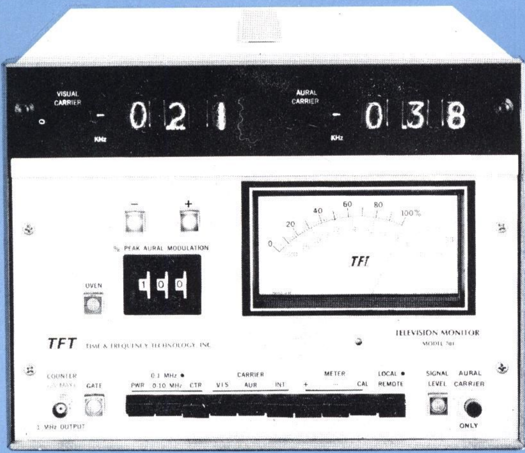


- **Covers any VHF or UHF channel**
- **Off-the-air monitoring of visual and aural frequency**
- **Up to 18 months between calibrations**
- **Built-in aural modulation calibrator**
- **Portable or rack-mount**

TV Frequency/Modulation Monitor, Type TFT-701

Description

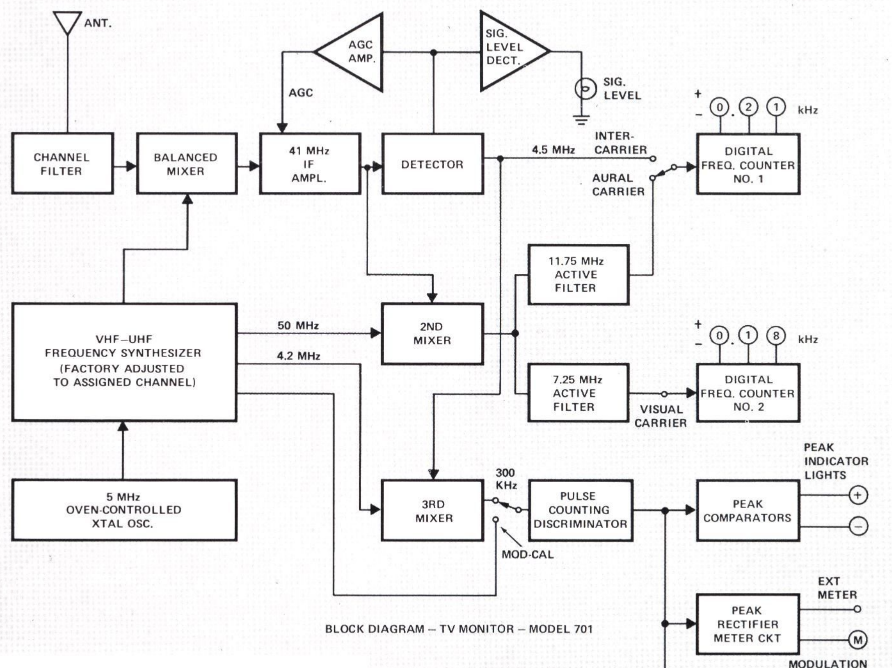
The TFT-701 is a solid state VHF-UHF TV monitor for monitoring aural and visual frequency and per cent aural modulation. Because of its built-in sensitivity and selectivity, the 701 can remotely monitor transmitters up to 30 miles away, using a rooftop antenna.

What's more, the TFT-701 requires frequency calibration only every six months for UHF and every 18 months for VHF. This is accomplished by the use of a precision 5 MHz oven-controlled crystal oscillator which synthesizes the local oscillators and has a typical aging rate of 1 PPM/year.

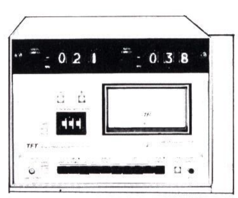
In addition to a peak reading modulation meter, the TFT-701 incorporates two peak flashers which measure and display plus and minus peak modulation simultaneously. Flashers are calibrated from 50% to 129%, in one per cent increments, with front panel thumbwheel switches. Calibration accuracy can be checked at any time with the front panel pushbutton modulation calibrator.

Additional features include:

- Digital display of frequency errors
- IC and silicon transistor design
- Provision for automatic logging
- Usable as a 6-digit precision frequency counter to 10 MHz



BLOCK DIAGRAM – TV MONITOR – MODEL 701



Patent Pending

12VB

Specifications

RF Input

Frequency range .... Channels 2 through 69

Sensitivity .... Approx 250 μv, 60 dB automatic gain control range and 40 dB fixed attenuator for monitoring at transmitter site

Image rejection .... –60 dB

Spurious response .... –80 dB

Local oscillator radiation .... Conforms to FCC rules

Input impedance .... 75 ohms

Input connector .... BNC

Aural and Visual Frequency Measurement

Digital display .... Zero to ±9.99 kHz in 10 Hz increments from assigned center frequency

Accuracy:
- Channels 2 through 13 .... ±500 Hz/18 months
- Channels 14 through 69 .... Hz/6 months

Frequency standard
- Internal .... Uses a high precision, oven-controlled 5 MHz crystal oscillator. One MHz output is provided on the front panel, for calibration against WWVB or a precision frequency source
- External .... 5 MHz input connector on rear panel

Inter-Carrier Spacing Frequency Measurement

Digital display .... Zero to ±9.99 kHz in 10 Hz increments from 4.5 MHz

Accuracy .... ±100 Hz/5 years

Frequency standard .... Same as Aural and Visual Frequency measurement

Aural Modulation Meter

Modulation range .... Meter reads full scale on 33.3 kHz deviation. Scale calibrated to 100% at 25 kHz deviation, 133% at 33.3 kHz deviation. Also includes dB scale (0 dB= 100%)

Frequency response .... ±0.1 dB, 50 Hz to 15 kHz

Accuracy .... ±4% over entire scale for modulation frequencies between 50 Hz and 15 kHz

Meter characteristics .... True peak reading scale and ballistics conform to FCC requirements

Remote metering .... Output provided

Aural Modulation Peak Indicators

Peak flasher lights indicate plus and minus peaks simultaneously. Peak levels are digitally set by thumbwheel switches, in 1 percent increments from 50% to 129%

Response time .... 5 μsec pulse with 1 μsec rise and fall time

Modulation Calibrator

Built-in aural modulation calibrator indicates ±100% modulation

Accuracy .... ±2%

Audio Output

Output level .... Two volt RMS minimum into 600 ohms at 100% modulation and 1 kHz. Distortion is 0.25% at 100% modulation. Residual noise at least 65 dB below two volts RMS. 75 μs de-emphasis network provided

SCA Output

Available as an option

Physical and Environmental Specifications

Size .... 11" w x 8" h x 15" d

Weight .... 22 pounds (approx.)

Power .... 115/230 V, 50-400 Hz, 45 watts max.

Cabinet .... Portable or rack mount (with adaptor)

Operating temperature .... 0° C to 50° C

Ordering Information

TFT-701 TV Frequency and Modulation Monitor (Specify desired channel)

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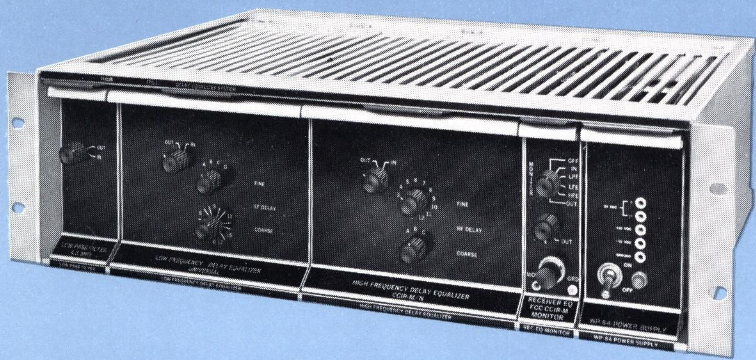
PRELIMINARY



- Corrects transmitter delay characteristic
- More than 100 equalization "curves"
- Provides independent "high", "low" and "receiver" equalization
- Integrated-circuit isolation amplifiers

Video Delay Equalizer System, Type TTS-1

Description

The Type TTS-1 Delay Equalizer System is designed to provide envelope-delay corrections to the tolerance required for all known television transmitter systems. It consists of five, separate, plug-in modules in a standard module-frame assembly. The entire unit requires but 5¼ inches (133 mm) of rack space and connects at any point in the program line between Master Control and transmitter input.

Improves Air Picture Sharpness and Color Registration

Precision contact of the equalization applied to program video before it goes to the transmitter input counteracts the distortions introduced in modulating the video onto a carrier and the bandshaping that the vestigial sideband filter imparts. Without delay equalization, the "air" picture of a television transmitter lacks sharpness in the luminance and color information fails to register with the luminance information. Also, an unequalized signal prevents proper demodulation of the chrominance information in the color receiver. With a Type TTS-1 in the program line to the transmitter, the "air" picture is sharp and well-registered with better color fidelity at the edges of picture elements.

More than 100 Equalization "Curves"

The Equalizer provides 72 *low*-frequency (18 "coarse"; 4 "fine") delay correction values and 39 *high*-frequency (3 "coarse"; 13 "fine") correction values. This range of control assures equalization of the many operational systems involved.

The delay adjustment in the low-frequency equalizer ranges from zero to 350 ns delay in 25-ns steps with prime break points at 800 kHz, 1.5, 2.0, 2.5, and 3.0 MHz. The range of high-frequency equalization extends from zero to 1000 ns at 4.2 MHz in 39 steps.

Built-in Fault Detection

Since the equalizer is an active element in the program line, there is always the possibility of malfunction that could interrupt the signal to the transmitter. So that the TTS-1 cannot be responsible for lost program time in the extremely rare event of malfunction, it contains a fault-detector system that automatically bypasses the entire equalizer system from input to output. Whenever output level drops 4 dB below input level, this system switches to bypass in less than 200 milliseconds following signal loss. And, the signal level difference between input and output is the only condition that initiates automatic bypass.

Convenient Operational Check

Included as part of the Receiver Equalizer module is a cumulative monitor facility. Through appropriate switching, it connects the monitor test point to any of five internal points: input amplifier, low-pass filter output, low-frequency equalizer output, high-frequency equalizer output and the receiver equalizer output. Such monitor facilities make signal tracing for equalizer checking fast and easy.

Integrated-Circuit Isolation Amplifiers

One of the reasons for the Delay Equalizer's high performance level is the isolation amplifier used in the signal path between the filter and each of the three equalizers. These seven amplifiers use integrated-circuit devices for extra dependability and long life. The filter and equalizer networks are passive, all-pass, constant resistance circuits.

Specifications (CCIR, M or N, FCC)*

Input

- Connector ... BNC Coaxial
- Impedance ... 75 ohms (adjustable)
- Level ... 1.0 V p-p

Gain Change Between Settings ... Less than 0.5 dB

Frequency Response (0 to 4.18 MHz) ... ±0.5 dB
at 4.75 MHz (with filter in) ... −20 dB

Differential Gain (10 to 90% APL) ... 1% or less

Differential Phase ... 1° or less

Delay Correction ... Independent hi, lo and receiver correction (see below)

Square Wave Tilt (50 Hz to 100 kHz) ... 1% or less

Fault Detector Subsystem
- Reaction Time ... 200 milliseconds
- Switching Threshold ... Output level 4 dB below input level

Power Requirements ... 95-125 or 190-250V, 50/60 Hz, 60W.

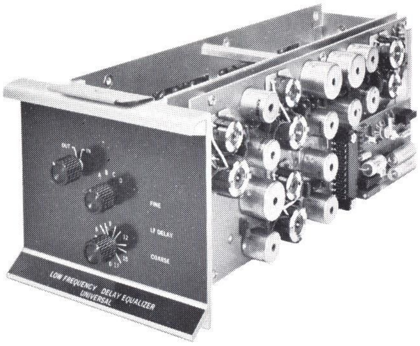
Output

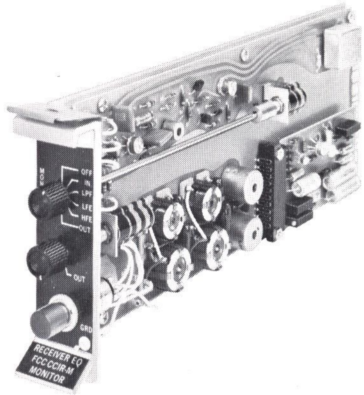
- Connector ... BNC Coaxial
- Impedance Level ... 75 ohms (source)
  - At Main Output (Aux Outputs unterminated) ... 1.1V p-p max.
  - At Main & Aux 1 (Aux 2 unterminated) ... 1.0V p-p max.
  - At All Outputs (all terminated) ... 0.75 V p-p max.

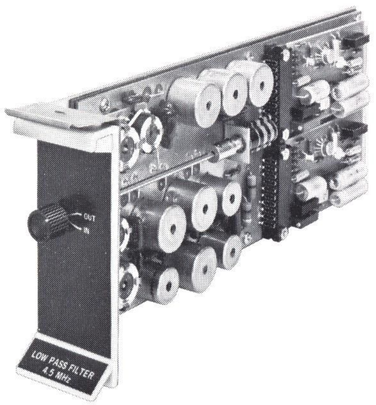
Low Frequency Delay Correction
- Coarse ... 18 levels
- Fine ... 4 levels
- (curves on request)

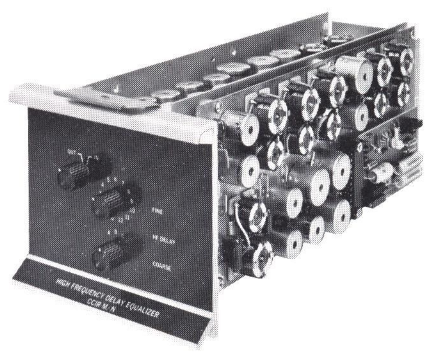
High Frequency Delay Correction
- Coarse ... 3 levels
- Fine ... 13 levels
- (curves on request)

*Systems for other standards available on special order









Ordering Information

Type TTS-1 Delay Equalizer System (Includes 4.75 MHz low-pass filter, for rack mount) ... ES-560651

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Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

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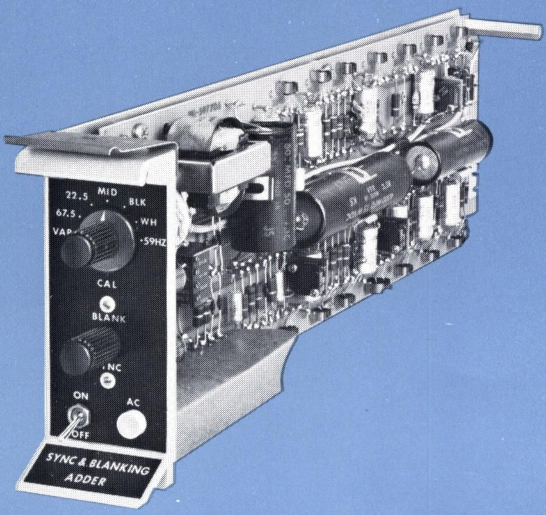

- Facilitates TV transmitter tests
- Mounts in standard module frame
- Self-contained power supply
- Regenerated pulses—bridging inputs

RCA Sync and Blanking Adder

Description

The ES-597267 Sync and Blanking Adder unit is designed to generate a composite video signal from a continuous AC type input signal. It is designed primarily as an aid for testing television transmitters.

The Sync and Blanking Adder module adds the following capabilities to an RCA Type BW-5/BWU-5 Sideband Response Analyzer: it allows sideband response to be conveniently measured with the transmitter modulator clamp circuit in normal operation; it provides switched selection to mid-characteristic or 22.5 or 67.5 percent modulation levels permitting rapid frequency response vs. brightness level measurements; and it provides switched selection of standard black and standard picture level for observation of output regulation and blanking level stability. Furthermore, when used with an external audio oscillator set at 59 Hertz, it provides test for low frequency dynamic video characteristics.

Plug-In Modularized Construction

The Sync and Blanking Adder may be mounted in a standard module frame along with other modularized equipment such as TA-33 Video Amplifiers or TA-34 Pulse Amplifiers, etc. It contains its own solid state power supply.

Sync and blanking are regenerated within a black and background adder before they are used. This makes the unit insensitive to variations of pulse input levels and eliminates distortion which may be present on the input pulses.

AC coupling is provided at the sync and blanking inputs. The impedance of each pulse input is greater than 6000 Ohms, and therefore a loop-through connection may be made to other equipment.

Specifications

Input Characteristics:
- Video Input ....0.25 V peak-to-peak to 0.50 V peak-to-peak nominal of video sweep from Sideband Response Analyzer

Input Impedances:
- Video Connection ....75 Ohms
- Sync Connection ....Greater than 6000 Ohms
- Blanking Connection ....Greater than 6000 Ohms

Sync Level ....4 Volts peak-to-peak nominal
Blanking Level ....4 Volts peak-to-peak nominal
Audio Input Level ....0 to 1 Volt peak-to-peak nominal (59 Hz)
Audio Input Impedance ....600 Ohms (unbalanced)

Output Characteristics:
- Output Level ....1 Volt peak-to-peak composite, Video nominal (100 IEEE units video and 40 IEEE units sync)

Other Characteristics:
- AC Power Input ....115 V AC, 60 Hz, 2 Watts

Dimensions Overall:
- Module ....4.7″ high, 1.8″ wide, 13.2″ deep (11.9 cm, 4.6 cm, 33.5 cm)
- Mounting Frame ....5¼″ high, 19″ wide, 14.9″ deep (13.3 cm, 48.2 cm, 37.9 cm)

Weight:
- Module ....2 lb. (0.91 kg.)
- Mounting Frame ....14 lb. (6.35 kg.)

Semi-Conductor Complement:
- Transistors ....8—2N3646, 5—2N3640, 1—2N3638, 1—2N2102
- Diodes ....4—UT112, 1—UZ815, 1—1N752, 1—1N747, 1—1N4372

Accessories

Mounting Frame (One required) MI-557300
Power Control Module, 115 V AC MI-556648-1
Module Extender MI-557301
Blank Modules MI-557302
Termination, 75 Ohms, 1.0% MI-26759-45

Ordering Information

Sync and Blanking Adder ES-597267-B
Complete including:
- 1 Sync and Blanking Adder Module MI-597706
- 1 Connector Plate Assembly (UHF Connectors) MI-556641

3TB

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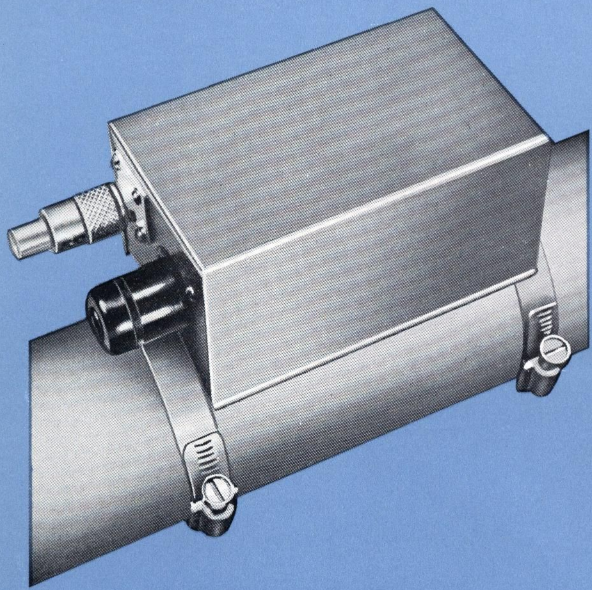
RCA Broadcast Equipment



- Requires No external power supply
- No maintenance or periodic adjustment
- Fits either 3⅛- or 1⅝-inch line
- Input circuit compensated for uniform RF pickup

VHF Monitoring Diode, MI-19051-B

Description

The Type MI-19051-B Monitoring Diode is completely self-contained and designed to mount on the transmission line between the output of a visual transmitter and a sideband filter. The video output of the Monitoring Diode, when fed to a master monitor (or equivalent), permits quantitative and qualitative evaluation of the "air" picture. The diode unit offers excellent linearity and frequency response and is useful at all VHF TV channels.

MI-19051-B consists of a double diode with its cathodes capacitively coupled, by probe, to the transmission line's inner conductor. The diode plates connect through a load resistor network to a 75-ohm output circuit. The output network's 75-ohm impedance matches coaxial-cable impedance and provides optimum performance in color systems. Filament power for the diodes comes from a built-in transformer which requires a 115-volt AC power source. The unit fits 3⅛- and 1⅝-inch rigid transmission line.

Specifications

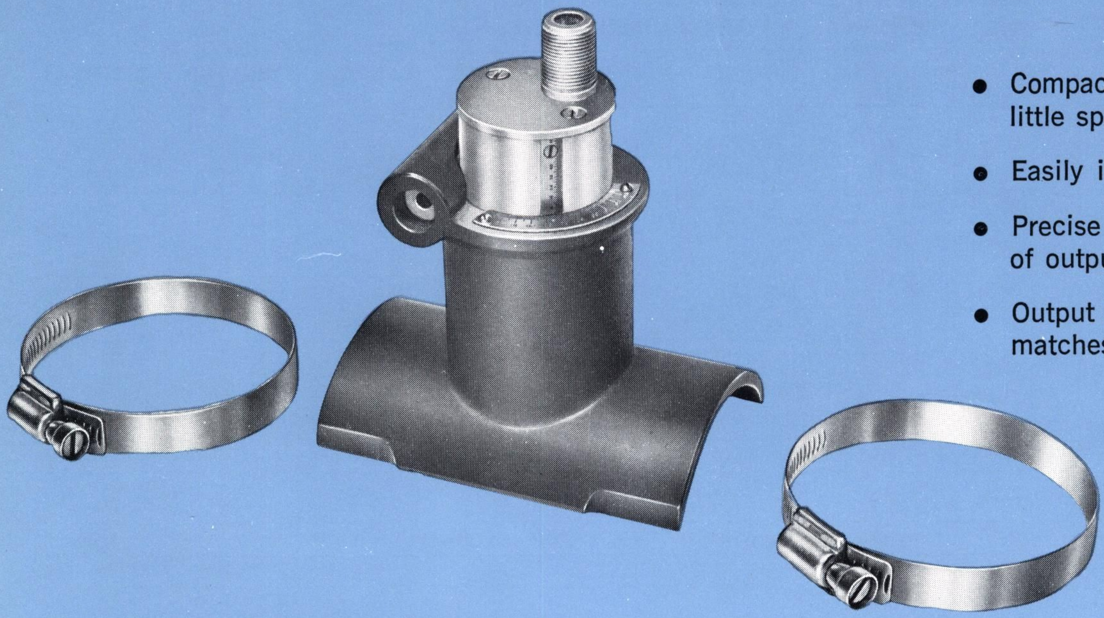
Frequency Range	41-223 MHz
Output Impedance	75 ohms
Output Voltage	0.75 volt—1.0 volt (adjustable)
Dimensions (overall)	7-5/16″ long, 3⅛″ wide, 3-3/16″ high (184 x 79 x 81 mm)
Weight	3 lbs. (1.4 kg.)
Tube Complement	1 RCA 6AL5

Ordering Information

VHF Monitoring Diode	MI-19051-B

7UB

catalog B.4726



- Compact—requires little space
- Easily installed
- Precise adjustment of output voltage
- Output impedance matches test equipment

RCA UHF/VHF Directional Couplers

Description

The RCA VHF/UHF Directional Couplers are designed to afford a means for coupling external monitoring equipment to the outputs of both VHF or UHF television transmitters to facilitate measurements required in conjunction with tuning, operating and maintenance of the transmitter. By installing several couplers in the output transmission lines, it is possible to couple measuring or monitoring equipment to the transmitter output at either side of the sideband filter (or Filterplexer), or at the Diplexer output.

RCA Directional Couplers, MI-19396-1B, MI-27389 and MI-27390 which contain a coupling loop, are designed for mounting in a section of 6⅛- or 3⅛-inch transmission line respectively. Angle and penetration scales on the coupler assembly enable precise adjustments to be made of the loop position. The coupler includes etched scales for accurately setting the depth of penetration of the RF coupling loop, and the angular position of the coupling loop for calibration of the output voltage at the particular channel desired. The unit is capable of coupling adequate signal voltages with a VSWR of 1.03/1.0 or less.

The directional property of the coupler permits sampling on a transmitter output line without any of the attendant variations in frequency response observed with non-directional couplers. The monitor voltage obtained with a directional coupler in a transmitter output line is a sample voltage of the amplitude desired of either the incident or reflected wave, as chosen. In addition, the directional coupler presents a source impedance to the monitor cable essentially equal to the characteristic impedance of the monitor cable and independent of cable length.

Units such as the Sideband Response Analyzer (BW-5B, or BWU-5B), Demodulators (BW-4B or BWU-4B) and Monitoring Diodes utilize directional couplers to provide signal sampling for these instruments. Reflectometers for VSWR and power output measurements require a coupler for incident and one for reflected wave readings.

The Directional Couplers are easily affixed to transmission line when proper holes are cut. A 12-inch section of various flanged or unflanged 3⅛- and 6⅛-inch transmission lines with hole for the coupler mounting can be provided by RCA for more convenient installation as shown in the table. When proper holes are cut in the existing transmission line, MI-27389 may be mounted in any type 6⅛-inch transmission lines while the MI-27390 coupler is designed for all 3⅛-inch lines. The ungassed directional coupler for 3⅛-inch line is MI-19396-1B. The directional couplers are 4½ inches long and extend approximately 3¾ inches above the coupler housing. The overall height is slightly more than 4½ inches and the diameter approximately 1¾ inches. The coupler has a ⅝-24 thread by ¾-inch deep to fit an "N" type plug connector with dust cap. They are provided with allen head locking screw (which may be on either side) and both horizontal and vertical scales to indicate angle and penetration settings. Both have a fixed composition resistor rated 50 Ohms ±1 percent which may be renewed when necessary.

6TB

DIRECTIONAL COUPLERS AND LINE SECTIONS FOR USE WITH RCA TYPE TRANSMISSION LINES

Transmission Line Type	MI-19089	MI-19313 (unflanged)	MI-19314-C (unflanged)	MI-19387	MI-27791-D	MI-27792-D	MI-561566-D	MI-27793-D	MI-27791-K
Mounted Coupler Drawing	Fig. 1	Fig. 2	Fig. 2	Fig. 1	Fig. 3	Fig. 3	Fig. 3	Fig. 3	Fig. 2
Diameter "A"	5 3/16″	3⅛″	6⅛″	8⅛″	4½″	7⅝″	10 5/16″	11½″	3⅛″
Length "B"	12″	12″	12″	12″	12″	12″	12″	12″	12″
"C" Dimension (max.)	6 13/16″	6 13/16″	8 5/16″	8 5/16″	6 13/16″	8 5/16″	9 7/32″	9 7/32″	6 13/16″
Coupler "D"	*MI-19396-1B	MI-19396-1B	MI-27389	MI-27389	*MI-19396-1B	MI-27389	MI-561577	MI-561578	MI-19396-1B
Connector "E"	MI-19089-10A	—	—	MI-19387-10A	MI-27791-D4D	MI-27792-D4D	MI-561566-D4D	MI-27793-D4D	—
Coupling "F"	—	MI-19313-8	MI-19314C-7	—	—	—	—	—	MI-27791-K4A
Flange "G"	MI-19089-11	—	—	MI-19387-11	MI-27791-D4B	MI-27792-D4B	MI-561566-D4B	MI-27793-D4B	—
Flange "H"	MI-19089-11	—	—	MI-19387-11	MI-27791-D4A	MI-27792-D4A	MI-561566-D4A	MI-27793-D4A	—
Line Section	MI-19089-22	MI-19396-3	MI-19314C-25	MI-19387-20	MI-27791-D9A	MI-27792-D9A	MI-561566-D9A	MI-27793-D9A	MI-27791-K9A
Impedance (Ohms)	50	51.5	51.5	75	50	75	75	75	50
TV Service	VHF and UHF	VHF	VHF	VHF and UHF	VHF and UHF	VHF and UHF	VHF and UHF	VHF and UHF	VHF
Pressurization	*No	No	No	Yes	*No	Yes	Yes	Yes	No

*Specify Coupler MI-27390 if pressurization is required.

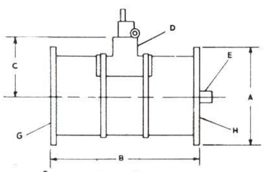


Fig. 1

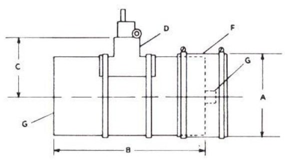


Fig. 2

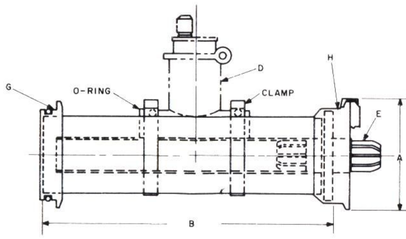
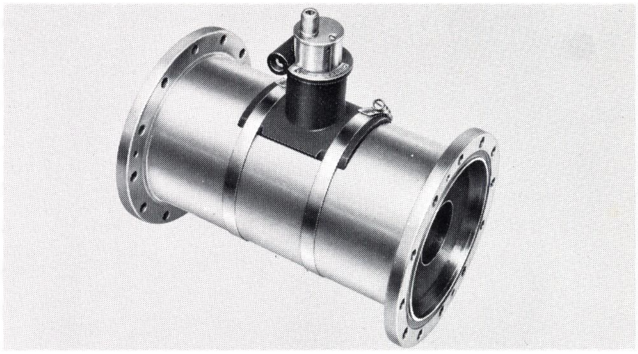
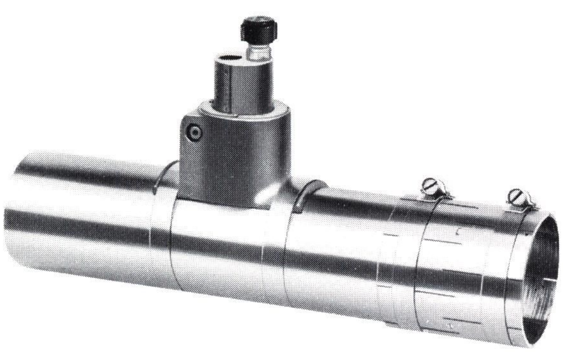


Fig. 3



Directional Coupler MI-27389 mounted on 6⅛″ line.



Directional Coupler MI-19396-1B mounted on 3⅛″ line.

Specifications

VSWR ....1.03/1.0 or less, for normal voltage coupling ranges
Dimensions ....See diagrams and tables
Ambient Temperature ....45°C
Weight ....5 lbs.

Stock Identification:
- Directional Coupler (for 3⅛″ ungassed transmission line) MI-19396-1B
- Directional Coupler (for 6⅛″ transmission line) MI-27389
- Directional Coupler (for 3⅛″ pressurized transmission line) MI-27390
- UHF Transmission Line Section (12″ long, 50 Ohm, 3⅛″ MI-19089 Series of Line) for mounting either 3⅛″ Directional Coupler MI-19089-22
- VHF Transmission Line Section (12″ long, 51.5 Ohm, 3⅛″, MI-19113-NF Series of Line) for mounting MI-19396-1B Directional Coupler MI-19396-3
- Coupler and 12-inch Transmission Line Housings ....See Table

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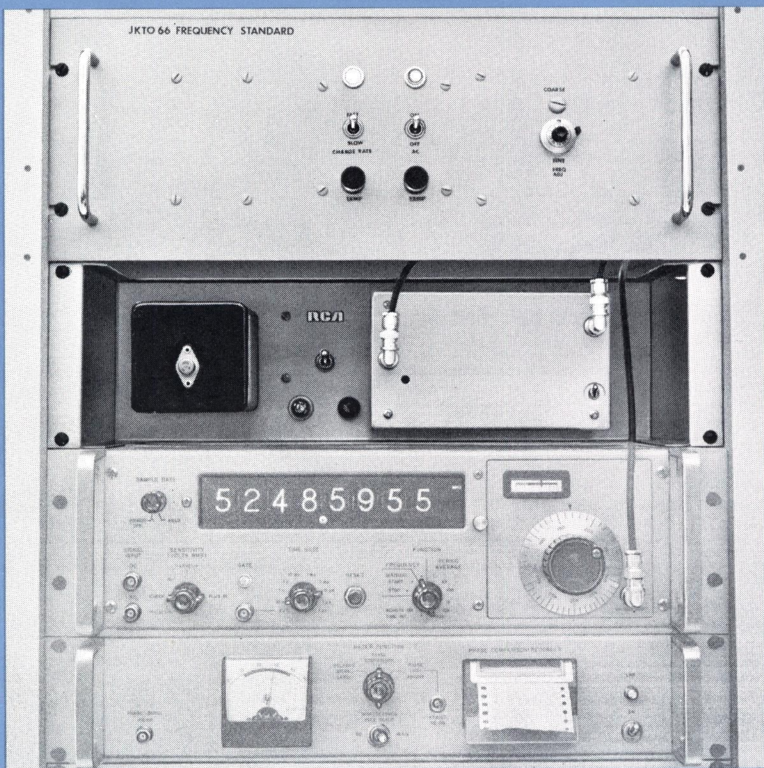
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

RCA Broadcast Equipment

RCA

catalog B.4410



- Reduces co-channel interference
- Extends effective coverage area
- For VHF and UHF transmitters
- Easy, inexpensive installation
- Stability: five parts in 10 billion

Precise Carrier Frequency Control System, Type TFC-1B

Description

The Type TFC-1 Precise Frequency Control System controls the visual carrier frequency of any television broadcast transmitter to an accuracy of five parts in ten billion*. Arranged so that it connects to the transmitter exciter via the crystal socket, the system fits all RCA-built VHF- or UHF-TV transmitters and, with certain adaptations, transmitters carrying brands other than RCA.

The basic system consists of an electronic frequency standard, an r-f amplifier, a harmonic generator and an r-f coupling head. Two package options include the basic system plus equipment that allows measurement of the controlled frequency either against the co-channel station (Option I) or against the carrier frequency of NBS station WWVB (Option II). (See *Accessories*).

Reduces Co-Channel Interference

Precise carrier frequency control minimizes the familiar fringe-area picture-destroying random beatnote between two or more TV stations operating in different markets on the same channel assignment. The system maintains a fixed frequency "offset" between the two carriers. For optimum results, the frequency offset should be an even multiple of the TV-frame frequency, nominally 10 or 20 kHz. Carefully maintained at a variation of less than 5 Hz, the two carriers form 10 or 20 kHz beatnote that minimizes mutual interference.

Improve Fringe Area Service

Since co-channel interference affects the audience in the coverage fringes, reducing or eliminating the main element of co-channel interference improves the picture quality in these areas and extends coverage.

For VHF or UHF Transmitters

Adaptable to any transmitter, RCA or otherwise, the Precise Frequency Control system generates a super-stable sinusoidal waveform at a frequency near 5 MHz. This time base is then multiplied to the assigned carrier frequency. Transmitter

*Specification actually ± 5 parts x 10^{-10} per day following 30 days of continuous operation. (see **Specifications**) operation procedures are unchanged from before precise frequency control.

Easy Inexpensive Installation

Except for a connection to the transmitter (via the transmitter's crystal socket) the Precise Frequency Control system is completely independent for easy, inexpensive installation. It requires but a few watts of commercial power for operation (see *Specifications*). The frequency-standard unit houses a ni-cad battery power supply kept on "floater" charge, which powers the super-stable oscillator and its ovens. In the event of power interruption this battery supply operates the unit for 24 hours and longer. Thus, in the event of power failure, stability is maintained and no warm-up process is required when power is restored.

Replaces Crystal in Visual Exciter

The only electrical bond between the system and the transmitter is a coaxial connection to the transmitter's crystal socket. The connector supplied with the system merely plugs into the crystal socket. As a result, return to "normal" exciter operation is quick and easy, should need ever arise, with a simple interchange of plug and crystal holder.

Measuring Equipment Options

The basic system includes no measurement equipment so that those who already possess the instruments involved (a field intensity meter, an audio oscillator, a frequency counter and an oscilloscope) need not duplicate them. For those who need the measurement apparatus, there are two options: one that compares the "local" VHF oscillator frequency with that of the co-channel carrier. The second compares the "local" oscillator with the carrier frequency of NBS station WWVB. There are two versions of the second option: one for VHF and another for UHF frequencies.

Specifications

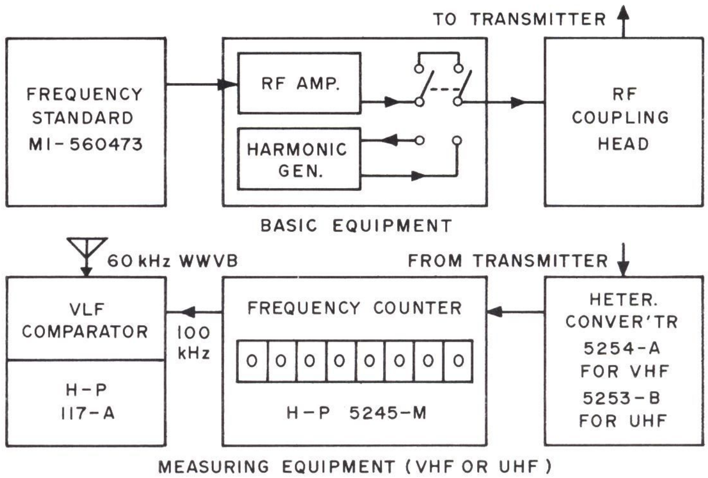
Frequency Stability
Guaranteed .... ±5 x 10^-10 Hz per day after 30 days continuous operation
Typical .... ±4 x 10^-9 over 30-day period
Output .... More than adequate to drive transmitter crystal stage to full output
Dimensions .... Requires 10½" (267 mm) rack space
Weight .... 25 lbs.
Power Requirements .... 115V ±10%, 50/60 Hz, 25W

Accessories

Option I
Co-Channel Frequency Comparator Option (VHF Only)
Field Intensity Meter .... RCA Type BW-107
Audio Oscillator .... Hewlett-Packard, Type 200AB
Frequency Counter .... Hewlett-Packard, Type 521A
Oscilloscope .... RCA Type WO-91B
Selective Amplifier MI-34056

Option II (VHF)
WWVB Frequency Comparator Option (VHF Only)
Very Low Frequency Comparator .... Hewlett-Packard, Type 117-A
Frequency Counter .... Hewlett-Packard, Type 5245-M
VHF Heterodyne Converter .... Hewlett-Packard, Type 5253-B

Option II (UHF)
WWVB Frequency Comparator Option (UHF Only)
Very Low Frequency Comparator .... Hewlett-Packard, Type 117A
Frequency Counter .... Hewlett-Packard, Type 5245-M
UHF Heterodyne Converter .... Hewlett-Packard, Type 5254-B



Precise Frequency Control System Block Diagram. Measuring equipment is optional.

R-f Coupling Head for RCA TV transmitters plugs into transmitter crystal socket.

Ordering Information

Precise Frequency Control System, Type TFC-1B ES-560242

Communications Systems Division
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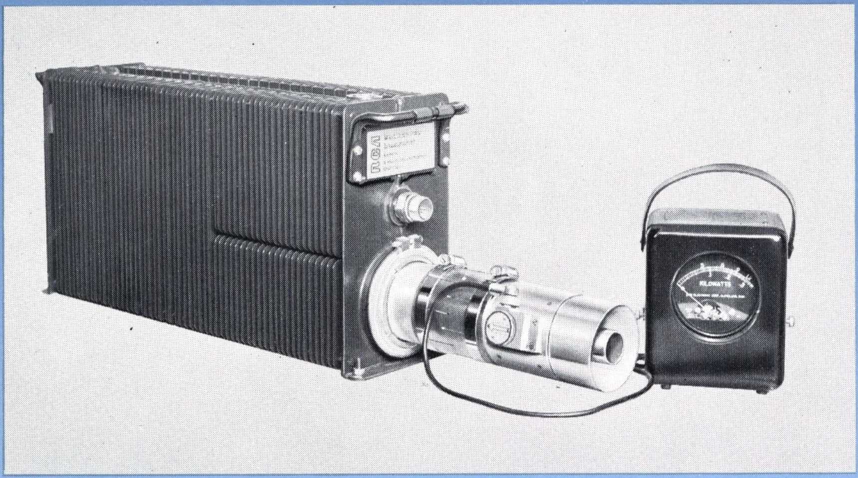
RCA Broadcast Systems

RCA

catalog B.4518



- Combines dummy TV antenna and RF power-measurement functions
- Easily installed—occupies little space
- Power indications given directly in Watts
- Wide choice of ratings (1.2 to 50 kW) from 54 to 223 MHz

VHF RF Loads and Wattmeters

Description

VHF RF Loads and Wattmeters are designed for use in measuring the power output of the aural and visual sections of VHF television transmitters. The load properly terminates the output of either the visual or aural transmitter and gives a measurement of the average RF power. It may also be used as a dummy antenna for transmitter tuning. A choice of ratings is available for any frequency between 54 MHz and 223 MHz and for any power level.

The RCA Series of RF Loads and Wattmeters consist of a resistor element for terminating a transmission line in its characteristic impedance, a Thruline Unit, and a meter for measuring power dissipated.

The elements for loads of 5 kW and less are non-inductive resistors immersed in a liquid coolant which carries the heat to the air via cooling fins. The loads with capacities greater than 10 kilowatts use elements in which the coolant, ordinary tap water, flows within the element. To prevent accidental or inadvertent overheating for lack of water, suitable protective interlocks are provided.

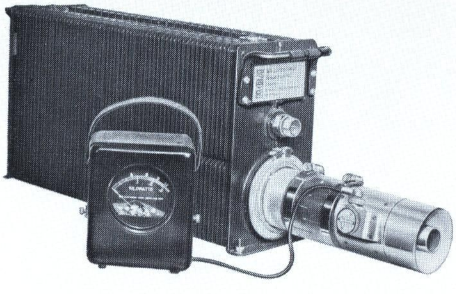
The power measuring section consists of a short length of transmission line (Thruline), a meter, and a wattmeter element. A socket is provided on the side of the transmission-line-coupling section to accommodate a calibrated wattmeter element, which, when coupled to the transmission line, develops a DC current proportional to the forward wave voltage across the load resistor. This current is supplied to a meter calibrated to indicate directly the power dissipated in the load.

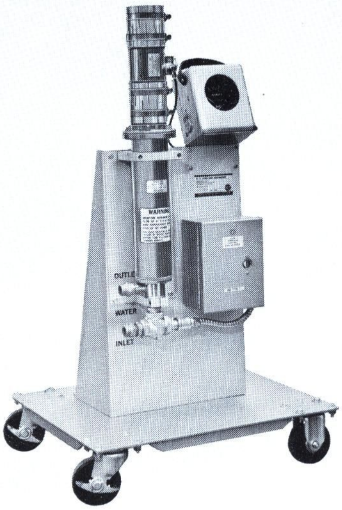
The wattmeter element is a reflectometer which consists of a coupling loop, a crystal detector, and a filter network. The wattmeter element may be rotated 180 degrees in the transmission line housing. This permits it to indicate the incident power to the load, or the reflected power from the load.

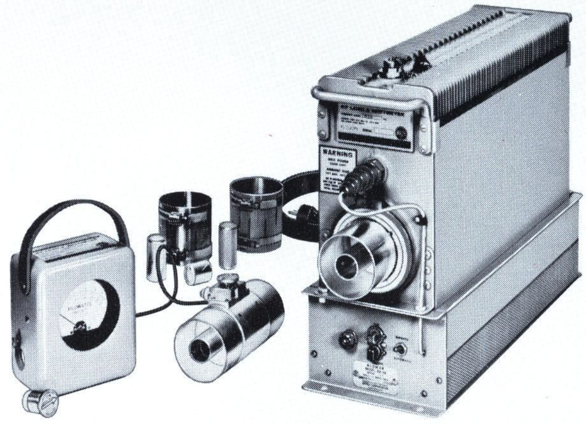
Accessories

Inner Connector for MI-27791K Ungassed Line	MI-27791K-4B
Inner Connector for MI-19313 Coaxial Line	MI-19313-10
Coupling, Straight	MI-191136-8
Coupling, Straight	MI-19314C-7
Reducer, 3⅛″ to 1⅝″ Coaxial Line	MI-19113C-7
Reducer, 6⅛″ to 3⅛″ for MI-19113 Transmission Line	MI-19314C-13
Water Saver (replacement)	MI-27349

8VB







These three photographs represent the entire line of loads and wattmeters. At left is the 300/1200-watt, air-cooled unit; in the center, the caster-equipped, water-cooled unit available in three power-handling capabilities: 10-, 25- and 50-kW. At far right is the 5-kW air-cooled load shown with its several accessories. All loads except one are available from stock; the 50-kW load is built to order.

Specifications

	MI-19196-L/H	MI-561422-L/H	MI-561739-L/H	MI-19267-L/H	
Frequency Range	54 to 108 MHz 108 to 216 MHz	54 to 108 MHz 108 to 216 MHz	50 to 108 MHz 108 to 216 MHz	50 to 125 MHz 100 to 250 MHz	54 to 108 MHz 108 to 216 MHz
Power Rating (Ave.) (5000 ft. max. elev.)	1200 watts	5 kilowatts	10 kilowatts	25 kilowatts	50 kilowatts
RF Input Impedance	50/51.5 ohms	50/51.5 ohms	50/51.5 ohms	50/51.5 ohms	50/51.5 ohms
AC Power Input	None req'd	110 V, 50/60 Hz	115 V, 50/60 Hz	115 V, 50/60 Hz	115 V, 50/60 Hz
Power Consumption	None req'd	27 watts	Negligible	Negligible	Negligible
Ambient Air Temperature:					
Maximum	45°C	45°C	60°C	60°C	60°C
Minimum	15°C	40°C	5°C	5°C	5°C
Mounting	Horizontal	Horizontal, vent plug upward	Floor (fixed or portable)	Floor (fixed or portable)	Floor (fixed or portable)
Coolant Capacity	1.7 gallons (6.5 l)	2 gallons (7.6 l) dielectric coolant	——	——	——
Water Required	Air cooled	Air cooled	3.5 gpm (8°C) 8 gpm (60°C)	6 gpm (5°C max.) to 8 gpm (60°C)	8 gpm (5°C) to 10 gpm (60°C)
Water Connections	None	None	¾″ pipe	¾″ pipe	¾″ pipe
Weight	48 lbs. (22 kg)	62 lbs. (28.12 kg)	100 lbs. (45 kg)	110 lbs. (50 kg)	110 lbs. (50 kg)
Dimensions, Overall:					
Depth	32⁹⁄₁₆″ (837 mm)	31-29/32″ (810 mm)	20″ (508 mm)	20″ (508 mm)	20″ (508 mm)
Width	6⅜″ (162 mm)	7¾″ (197 mm)	24″ (609 mm)	24″ (609 mm)	24″ (609 mm)
Height	10¾″ (273 mm)	15⅝″ (397 mm)	44″ (1040 mm)	44″ (1040 mm)	44″ (1040 mm)

Ordering Information

300/1200-Watt RF Load & Wattmeter for VHF Transmitter up to 2-kW picture rating; load is air-cooled and equipped with 3⅛″, 50/51.5-ohm unflanged fitting MI-19196-L/H

5-kW RF Load & Wattmeter for VHF Transmitter up to 6-kW picture rating; load is air-cooled and equipped with 3⅛″, 50/51.5-ohm unflanged fitting MI-561422-L/H

10-kW RF Load & Wattmeter for VHF Transmitter up to 17.5-kW picture rating; load is water-cooled and equipped with 3⅛″, 50/51.5-ohm unflanged fitting. Includes MI-27349 Water Saver MI-561739-L/H

25-kW RF Load & Wattmeter for VHF Transmitter up to 40-kW picture rating; load is water-cooled and equipped with 3⅛″, 50/51.5-ohm unflanged fitting MI-19267-L/H

50-kW RF Load & Wattmeter for VHF Transmitter up to 84-kW picture rating; load is water-cooled and equipped with 3⅛″, 50/51.5-ohm unflanged fitting .... Custom Built

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RCA Broadcast Systems

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- Convenient and simple to operate
- Single frequency method of measurement
- Direct reading dial
- Excellent performance—Envelope delay 0 to 0.67 microseconds; accuracy ±3 percent, ±0.01 microseconds
- Choice of rack or portable mountings

RCA Envelope Delay Measuring Equipment, Type BW-8A/8A1

Description

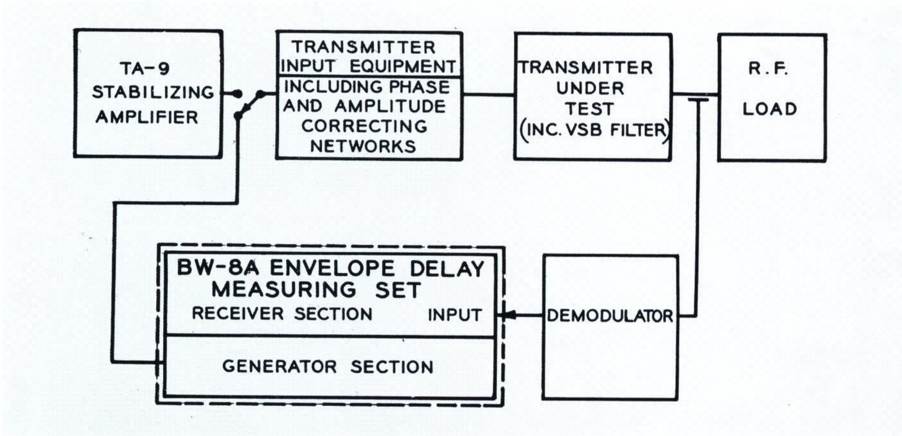
The BW-8A/8A1 Envelope Delay Measuring Equipment is designed for field measurement of the incremental slope of the phase-versus-frequency characteristic (usually referred to as envelope delay) of television transmitter systems. It can also be used to measure the absolute delay of video equipment. By maintaining proper phase relationship between the various frequencies in the TV system, such effects as leading white, trailing smear, ringing and misregristration can be corrected.

The BW-8 equipment is a small chassis mounted unit, easy to use. It provides a low frequency phase reference in order to measure the relative envelope delay in the region from 1.3 MHz to 4.3 MHz or 1.3 to 6.0 MHz as referred to the average delay between 0 and 189 kHz or 187.5 kHz(F_A). The instrument is direct reading. All operating controls are located on the front panel for ease of operation. The unit may be housed in a standard rack mounting where it occupies only 10½ inches.

When measuring a video amplifier or any other equipment having input and output at video frequencies, no auxiliary equipment is required. When a complete transmitter is being measured the only auxiliary unit required is an RF demodulator to feed the video signal to the receiver portion of the BW-8. The RCA BW-4 Series of Visual Sideband Demodulators or MI-19051-B/19364 Diode Demodulator can be used for this purpose. When sync and blanking are desired, they may be obtained from a studio sync generator, fed to the BW-8 generator section and combined with the BW-8 generator signal components to supply a composite test signal.

Built-in Power Supply

The BW-8 Envelope Delay Measuring consists of a generator that feeds the system to be measured, and a receiver section which evaluates the envelope delay of the signals after they have passed through the system under test. The generator section provides two signal sources. One is a reference frequency (F_A) derived from an internal crystal oscillator or from the twelfth harmonic of the horizontal sync frequency supplied from an external source. The second is a carrier signal (F_C) which may be varied. The receiver section contains two amplifier-limiter chains to detect and amplify video from the unit under test. A phase shifter consisting of an RLC network may be switched into either amplifier chain to permit compensation of either positive or negative time delay. It is calibrated to read delay in microseconds. The generator section occupies the left section of the chassis, the receiver chains are on the right. An electronically regulated power supply is built in on the rear of the chassis.



Front Panel Control

All controls of the BW-8 Envelope Delay Measuring Set are located on the front panel, those of the generator being on the left side and those of the receiver on the right. The output and input connectors, as well as the external sync input, the power connector and the fuse holder, are located on the rear of the chassis. The dial on the left controls the carrier frequency F_C and is directly calibrated. The right-hand dial drives a precision 3-turn potentiometer that controls the phase shifter. The dial is calibrated in delay, from 0.01 to 0.68 microseconds and may be measured with an accuracy of ±3 percent ±0.01 microseconds.

The VTVM (null indicator) is connected to a 5-position switch. Position 1 measures peak amplitide of the output test signal fed to the transmitter. Position 2 measures the amplitude of the signal at the input of the receiver. Position 3 is for balancing the VTVM and positions 4 and 5 are for use as a null indicator for the phase detector. Position 4 is of lower sensitivity for initial balancing of the phase detector. By means of another switch, the phase shifter network can be introduced into either one of the two receiver chains, allowing compensation of positive or negative phase delay.

Other controls located on the front panel include an AC line switch; "Sync Amplitude" which regulates the amount of sync incorporated in the test signal; a "Zero Set" used to balance the VTVM when its switch is in position 3; and a "Delay Set", used to balance the delay of the measuring set when the operation switch is in the "direct" position.

Specifications

Performance

Envelope Delay	0 to ±0.67 microseconds
Frequency Range:	
BW-8A	1.3 to 4.3 MHz
BW-8A1	1.3 to 6.0 MHz
Reference Frequency:	
BW-8A	Average Envelope Delay between 0 and 0.189 kHz
BW-8A1	Average Envelope Delay between 0 and 187.5 kHz
Delay Accuracy	±3% ±0.01 microseconds
Carrier Frequeny Accuracy	±2% ±0.05 MHz
Output Test Signal	0 to 2 Volt, peak-to-peak
Output Impedance	75 Ohms
Input Test Signal	0.1 Volt, peak-to-peak min.
Input Impedance	75 Ohms ±2%
Horizontal Sync and Blanking	1 Volt peak-to-peak, min.
Input Impedance (Sync)	75 Ohms ±1%
Power Requirements:	
BW-8A	105-125 Volts AC, 50/60 Hz, 180 Watts
BW-8A1	115/230 Volts, 50/60 Hz, 180 Watts

Tube and Semi-Conductor Complement:
4—6U8, 1—6BA7, 1—5687, 2—6AN8, 2—6AW8, 1—5R4-GY, 1—6AS7-G, 1—6AG5, 1—OC3, 1—2N585, 2—1N100, 3—1N90

Mechanical

Mounting	Standard 19″ rack
Operating Conditions	5°C to 45° C (41°F to 113°F), 0-95% relative humidity
Dimensions (Overall)	19″ wide, 10½″ high, 14½″ deep (48.26 cm, 26.67 cm, 36.83 cm)
Weight	35 lbs. (16.33 kg.)

Accessories

Type BW-4C1 VHF Visual Sideband Demodulator	ES-34048-A
Type BW-4C1 VHF Visual Sideband Demodulator (CCIR)	MI-826557
Type BWU-4C1 UHF Visual Sideband Demodulator	ES-34049-C
Type BWU-4C1 UHF Visual Sideband Demodulator (CCIR)	MI-826559
VHF Monitoring Diode	MI-19051-B
UHF Monitoring Diode	MI-19364

Ordering Information

Type BW-8A Envelope Delay Measuring Set (1.3 to 4.3 MHz)	MI-34063
Type BW-8A1 Envelope Delay Measuring Set (1.3 to 6.0 MHz)	MI-34068

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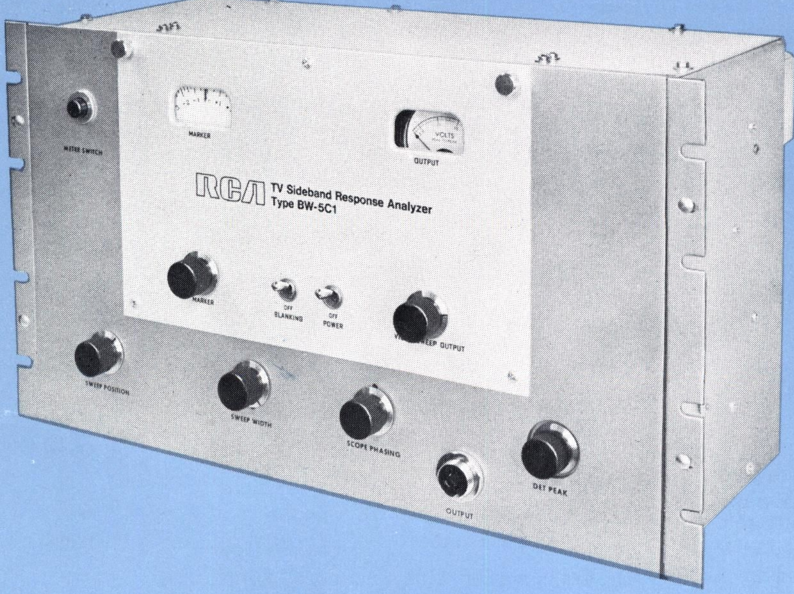
RCA Broadcast Equipment

catalog B.4722



- Accurately measures TV transmission facility amplitude vs. frequency response
- Indispensable for aligning visual transmitter broadband RF circuits
- Continuously variable marker can be positioned on either sideband
- When used with optional Sync and Blanking Adder, ES-597267-B, measures frequency response at predetermined brightness levels with transmitter clamp circuits operating

RCA TV Sideband Response Analyzers, BW-5C1/BWU-5C1

Description

The TV Sideband Response Analyzer BW-5C1/BWU-5C1 measures the overall amplitude-versus-frequency characteristic of a television transmitter. In conjunction with an oscilloscope it separates and visually presents the upper and lower sideband response. Its primary use is for tuning the over-coupled broadband RF circuits of television transmitters and measuring their amplitude response characteristic. Since it includes a video sweep oscillator, it can also be used in adjusting video amplifiers, modulators, etc. The Type BW-5C1 Analyzer is required for a VHF TV station and Type BWU-5C1 Analyzer for a UHF station.

The Sideband Response Analyzers provide for the display, on a suitable oscilloscope, of the entire sideband frequency response capabilities of any TV transmitter including its sideband filter. Such visual presentation permits immediate evaluation of transmitter adjustment without laborious point-to-point curve plotting, and facilitates the adjustments by indicating the effectiveness of the adjustments as they are made.

Quality Video Sweep Oscillator

The BW-5C1 Analyzer consists of video sweep generating circuits to provide transmitter modulation; calibrated marker circuits to develop a continuously variable frequency marker; synchronized receiver circuits to develop vertical deflection for the oscilloscope and to insure a narrow passband for a high definition sideband response presentation; sweep generating circuits, which include retrace, blanking, and phasing facilities, to develop horizontal deflection for the oscilloscope; and power supply circuits all assembled on a recessed box chassis suitable for assembly in a relay rack. Operating controls for the unit are all mounted on the front panel which is held in position by two captive knurled screws at the top edge.

Complete Accessibility

The panel can be swung down to give access to the interior for ease of maintenance. A three-contact connector on the panel provides connection to an oscilloscope. Other connections to the unit are made at the rear of the chassis. The necessary output cables, power cord, and connectors are all supplied with the equipment.

BWU-5C1 Analyzer

The BWU-5C1 includes all the equipment furnished by the BW-5C1 and in addition has an RF input section, MI-34005-C, built on a 5¼-inch panel and chassis designed to mount in a standard 19-inch rack. The RF unit with tubes in place, power cord, and output cable, are required to modify the BW-5C1 for operation on UHF television channels. Except for the frequency ranges covered, the equipments function similarly.

Specifications

Electrical (BW-5C1)

SIDEBAND RESPONSE ANALYZER, MI-34000-C1

RF Input
- Frequency ....55.25-83.25 MHz (channels 2 to 6) 175.25-211.25 MHz (channels 7 to 13)
- Voltage ....0.5 to 1.0 Volt
- Impedance ....50/51.5 Ohms

Outputs
- Receiver Signal
  - Output Termination......High impedance oscilloscope input
  - Linearity ....Error referred to 14-Volt carrier pip

Indicated	Actual Response
–25 dB	–24 dB
–30 dB	–28 dB
–35 dB	–33 dB

  - Noise Level ....Greater than 50 dB below 14 Volts
  - Receiver Gain Control Range ....10 dB
- Video Sweep
  - Voltage ....0 to 2 Volts peak-to-peak
  - Frequency....10-0-10 MHz sweep width continuously adjustable
  - Center Frequency....Adjustable ±2 MHz
  - Sweep Rate....Power line frequency
  - Repetition Rate....2 times power line frequency
  - Frequency Response ....±0.5 dB 10 kHz to 5 MHz ±1.0 dB 50 kHz to 7 MHz
  - Distortion ....Less than 3% at 2 Volts pp
- Oscilloscope Sweep
  - Open Circuit Voltage ....4.5 Volts pp
  - Frequency....Same as power line
  - Wave Form....Same as power line
  - Internal Impedance ....12,000 Ohms
  - Phase Adjustment ....±70°

Operating Conditions....5°C to 45°C ambient temperature 0-95% relative humidity

Supply Voltage ....105-125/208-250 Volts AC

Supply Frequency....50-60 Hz

Power Consumption ....200 Watts

Power Receptacle....1″ male motor-plug (power cord supplied)

Power Supply ....Internal (260 Volts DC regulated)

Mounting—Relay Rack....10½″ high, 19″ wide, 14½″ deep (26.67 cm, 48.26 cm, 36.83 cm)

Color ....Silver gray

Weight ....58 lbs. (26.7 kg)

Electrical (BWU-5C1)

R-F INPUT UNIT, MI-34005-C

Input and Output Impedances ....50 Ohms

Frequency Range....450 to 900 MHz (channels 14 to 83)

Overall Bandwidth....20 MHz

Response ....±1 dB within 10 MHz of center frequency ±½ dB within 5 MHz of center frequency

Linearity ....Within ±1 dB for input signals to the attenuator ranging from 0.1 to 3.0 Volts. (Normal converter input is 1 Volt with input of 2.0 Volts to the attenuator).

Output ....0.3 Volt across 50 Ohm load with 2.0 Volt rms input to attenuator (channel 2)

Power Supply ....110/220 Volts, 50/60 Hz single phase, 35 Watts

UHF Converter
- Dimensions....19″ wide, 5¼″ high, 7¾″ deep (48.26 cm, 13.34 cm, 19.68 cm)
- Weight....14 lbs. (6.35 kg)

Accessories

Directional Coupler for 3⅛″ Line MI-19396-1B

Directional Coupler for Pressurized 3⅛″ Line MI-27390

Directional Coupler for 6⅛″ Line MI-27389

VHF Transmission Line Section 12″ Long (For mounting MI-193961B Coupler in MI-19113NF Line) MI-19396-3

UHF Transmission Line Section 6″ Long (For mounting either MI-198961B or MI-27390 in MI-19089 Line) MI-19089-22

VHF-UHF 6⅛″ Transmission Line Section (For mounting MI-27389 Coupler in MI-19387 Line) MI-19387-20

Refer to Catalog B.4726 for details and other combinations of the above.

Sync and Blanking Adder ES-597267-B

(Permits use of BW-5C1 - BWU-5C1 with transmitter in composite video mode) Refer to Catalog B.4720

Ordering Information

Type BW-5C1, Sideband Response Analyzer—Channel 2-13 ....MI-34000-C1

(Includes 10 ft. power cord, 35 ft. output cable, input and output connectors and 6 dB pad.)

Note: Directional coupler required, but is not furnished—see accessories.

Type BWU-5C1, Sideband Response Analyzer—Channel 14-83 ....ES-34009-C

(Includes MI-34000-C1 Analyzer and MI-34005-C crystal controlled converter. Specify operating channel when ordering.)

Note: Directional coupler required, but is not furnished—see accessories.

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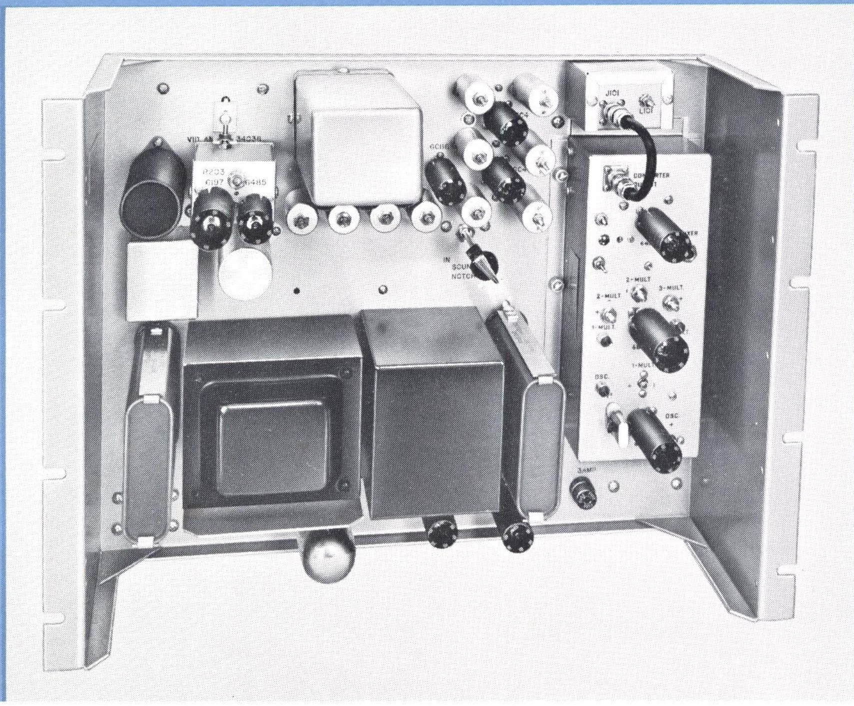
RCA Broadcast Equipment



- Provides video source for high quality monitoring
- High quality envelope detector—linear phase-and-amplitude characteristics
- Built-in, integrated-circuit, vertical interval chopper
- Makes possible accurate measurements for system evaluation
- Available for any channel (54-890 MHz)

Visual Sideband Demodulator, Types BW-4C1/BWU-4C1

Description

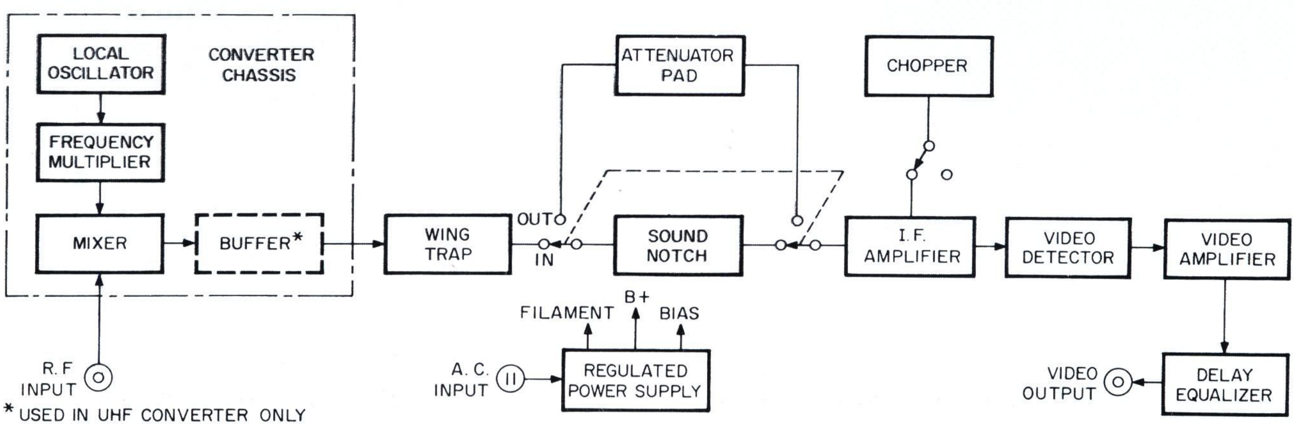
The RCA BW-4C1/BWU-4C1 Visual Demodulator is designed for use at the television transmitter location as a means of obtaining a video signal. This signal can be regarded as an accurate representation of the video information contained in the modulated picture carrier as it exists in the feed line to the antenna system. The demodulator is used as a measuring instrument to allow vestigial sideband amplitude and delay measurements (including differences at various luminance levels) on transmitter facility; as a video source for continuous accurate waveform monitoring; and as a video source for driving a color monitor to provide a high quality color receiver for viewing the transmitted signal.

The Models BW-4C1 and BWU-4C1 Demodulators are identical with the exception of the built-in converters used for VHF or UHF channels. They are basically superheterodyne receivers with controlled IF and RF characteristics. A sound notch is provided for monitoring the transmitted signal with aural carrier present in the transmission line. Insertion of the notch provides delay characteristics compatible with industry standard receiver delay characteristics. With the notch operating, the aural carrier is rejected to 50 dB and inter-modulation products with 75% saturated colors are typically better than 40 dB down.

For FCC/CCIR Standards

The IF frequency is 25.0 MHz for visual carrier and 20.5 MHz for sound carrier (FCC standards). The maximally flat IF amplifier cascade (FCC standard) provides uniform frequency response. Low and high frequency video delay errors introduced in the lower skirt and nyquist slope regions of the IF passband are delay corrected in an allpass network

12VB



in the video output circuitry. Units can be supplied using an IF frequency of 26.0 MHz visual carrier for CCIR standards B, G and H.

Series Tuned Wing Trap

A series tuned trap is adjusted to provide maximum skew symmetry on the nyquist slope. This allows optimum frequency response in the video frequency region around 0.75 MHz, the frequency at which the vestigial sideband recedes. The wing trap, as this circuit is named, precedes the IF amplifier and sound rejection circuits and is drive by the mixer output of either the VHF or UHF converter.

Each converter contains a crystal controlled oscillator, multipliers, and mixer. The converter receives power from the main IF power chassis on which the regulated DC supply is located. A single-phase, full-wave bridge rectifier utilizing silicon diodes is employed.

A vertical interval electronic chopper provides reference information synchronously in the vertical blanking interval.

Standard Rack Mounting

The BW-4C1/BWU-4C1 is designed for rack mounting in a standard BR77 or BR84 equipment rack. It connects to the transmission line through a directional coupler (not supplied, use RCA catalog number MI-19396B or equivalent). The coupler must be compatible with the transmission line used. Normally, the coupler is installed at a point following the vestigial sideband filter or filterplexer, where the lower sideband attenuation has been established.

The video output of the demodulator is adjustable by the use of an attenuator located on the delay equalizer assembly at the rear of the unit. In the OUT position, 2.0 volts of video is obtained for use with measuring equipment such as the BW-8A or BW-8A1 Envelope Delay Measuring Set. For routine monitoring, (when the unit is used as a high quality receiver with the sound notch turned on) the video attenuator switch is placed in the "in" position to provide 0.8 to 1 volt peak-to-peak output.

Excellent Detection Linearity

The demodulator can be used for accurate measurements of transient response, amplitude and delay response of the transmission system. With the sound notch in the OUT position, the delay equalized characteristic is typically +40 −0 ns between 20 kHz and 1.5 MHz referenced to the lower frequency. It is typically ±20 ns from 1.5 to 4.3 MHz when used to measure FCC standards. Amplitude response is typically ±0.3 dB from 50 kHz to 4.3 MHz. Due to excellent detection linearity, accurate measurements can be made on television waveforms intended for system evaluation.

Ideal for Rapid Transmission Tests

The sine squared performance with K factor is better than 2% (sound notch "out") on both the T pulse and the 2T pulse on a standard transmitter. This makes the demodulator ideal for rapid transmission tests. Inherent system limitation can be readily observed. Quadrature distortion limitations of the transmission system can be readily seen by modulating the transmitter with a sinusoidal signal in the single sideband region (0.75 MHz to 4.18 MHz) and a high modulation depth. Differential gain is less than 1 dB to 12½% reference white modulation. Differential phase is typically 1.5°. Low frequency tilt is typically better than 1%. Output hum and noise are more than 50 dB below standard output.

Specifications

Electrical (FCC Standards)*

Frequency Range:
- BW-4C1 .... Channels 2 to 13 (54-216 MHz)
- BWU-4C1 .... Channels 14 to 83 (470-890 MHz)

RF Input Required .... Approximately 1.0 Volt (rms) into 20 dB attenuator

Video Output .... 2.0 volt max. peak-to-peak across 75 ohms from chopper zero reference to sync peak (sync negative)

Amplitude vs. Frequency Response
- With sound notch out .... ±0.5 dB from 0.20 MHz to 4.5 MHz
- With sound notch in .... ±0.7 dB from 0.20 MHz to 4.0 MHz

Differential Gain .... 10% between reference white, 12.5% and peak of sync, 100%

Phase vs. Amplitude .... Three (3.0) degrees or less for modulating signals having luminance levels from 12.5% to 75% of sync peak

Low Frequency Response .... Less than 2% tilt on 50 Hz square wave

Envelope Delay
- With sound notch out .... Flat within ±30 ns up to 4.18 MHz compared to the average delay between 0.05 MHz and 0.20 MHz
- With sound notch in .... Follows within ±30 ns of standard receiver curve over chrominance sideband frequencies to 3.8 MHz. The tolerance increases linearly with respect to frequency to +200, −0 ns at 4.0 MHz. Fixed low frequency delay of 50 ±15 ns present

Output Hum and Noise .... 50 dB rms below 2 volts peak-to-peak output

Intermodulation .... 40 dB below 2 volts peak-to-peak output

Sound Rejection .... More than 50 dB aural signal rejection at ±25 kHz deviation from carrier frequency

Power Source Required .... 105 to 125 volts AC, 50/60 Hz, 250 Watts (3 A slo-blo fuse)

*For various CCIR Standards, on request.

Mechanical

IF, Video and Power Supply Chassis:
- Dimensions (overall) .... 19″ wide, 14″ high, 14″ deep (483 x 356 x 356 mm)
- Weight .... 43 lbs. (19.5 kg)

Environment:
- Ambient Temperature .... 15°C to 45°C
- Relative Humidity .... 0 to 95%

Ordering Information

VHF Visual Sideband Demodulator, Type BW-4C1
Requires directional coupler and coupler mounting. Specify type of transmission line used, channel number (7-13) and offset, if any ES-34048-C

UHF Visual Sideband Demodulator, Type BWU-4C1
Requires directional coupler and coupler mounting. Specify type of transmission line used, channel number (14-82) and offset, if any ES-34049-C

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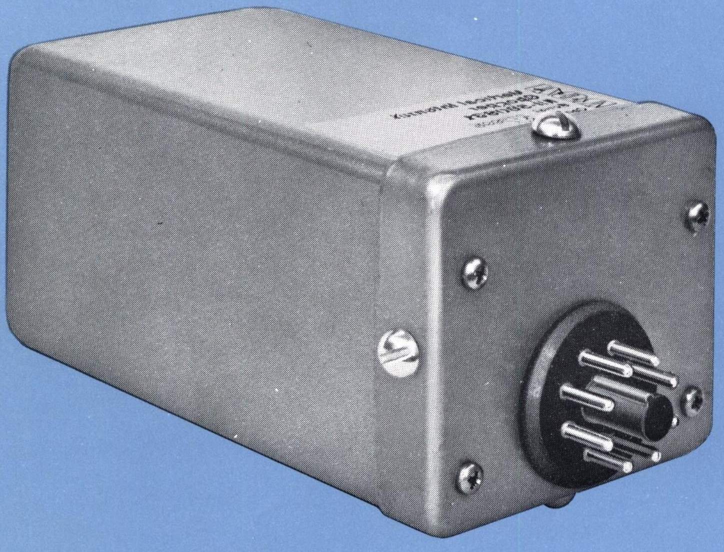


- Aids in modulation-depth measurement
- For demodulator, diode or tuner systems
- Establishes accurate zero-modulation level
- Short-term chop unobtrusive yet precise
- Mounts in BW-4 (and BWU-4) demodulators

Vertical Interval Electronic Chopper

$314.00

Description

The Vertical Interval Electronic Chopper (VIEC) is an all-electronic device used to establish a "zero-modulation" reference point in the measurement of television-transmitter modulation depth. It replaces the mechanical chopper (previously included as standard equipment) in the RCA Type BW-4 and BWU-4 Precision Sideband Demodulators. For use with monitoring diodes and TV tuner systems, the VIEC requires a power-supply unit (see *Ordering Information*) which mounts on transmission line or outboard on a tuner chassis.

Aids in Modulation-Depth Measurement

In effect, the VIEC creates three successive "white" pulses—one on each of three lines—near the end of the vertical blanking interval. Displayed on a CRO, the three white "pulses" serve as a zero-modulation (or zero-signal) reference point on the CRO screen (see drawing and off-CRO-screen photo). With such a reference, the relationship of various modulation parameters become quantitative.

Chops Only During Vertical Blanking

Unlike mechanical choppers, the VIEC chops a video waveform but three times during each picture field, between successive H-sync pulses, just prior to the end of the vertical blanking interval (see drawing). Since the chopper short-circuits the demodulated video waveform, it generates — in effect — a *zero*-modulation, "white" pulse some 7 microseconds long during three successive lines in each field during blanking. However, because the chopper affects only *demodulated* video, the "white" test pulse never gets on-air.

Chop Unobtrusive Yet Precise

As a result of the chopper's short duty cycle in the blanking interval, its use has no effect on the demodulator's sync-triggering or sync-tip and backporch-clamp circuits. This increases measurement precision demonstrably.

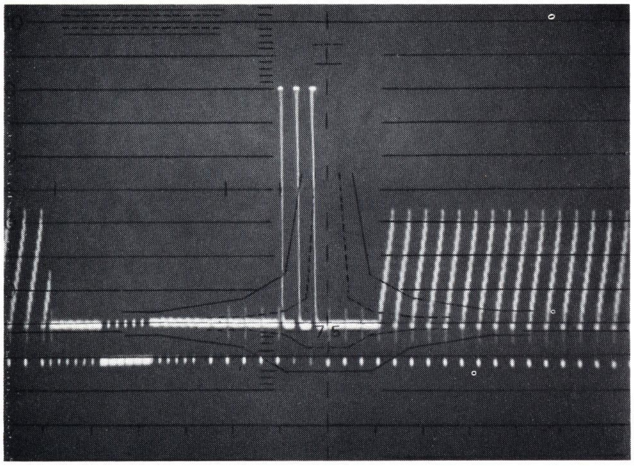
Adjustable Chopper Timing

Ordinarily adjusted so that the three pulses fall on the last three lines of vertical blanking, the timing adjustment range allows placement of the pulses somewhat "earlier" than usual for whatever occasion warrants it. This control is a so-called "screwdriver" adjustment as opposed to a "front-panel" control.

All Electronic—Fully Solid State

A far cry from the 60-Hz mechanical chopper it replaces, the VIEC uses electronic techniques with solid-state devices to generate the chopper action. As a result, the VIEC avoids the drawbacks of mechanical devices — contact bounce, wear, noise (electrical and acoustical) vibration and mass — and generates a far more usable function.

2VB



Oscillographic reproduction of vertical interval with chopper in operation. See drawing below.

Specifications

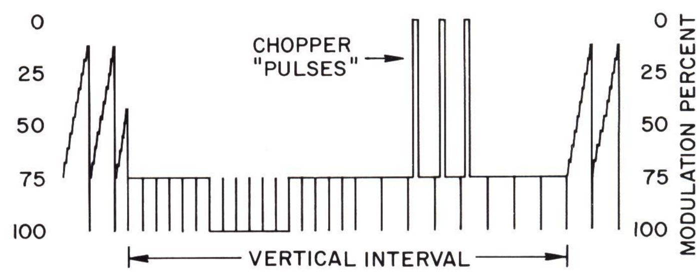
Number of Pulses per Cycle	3
Pulse Duration (nominal)	7 μs
Pulse Timing (nominal)	7 μs later than trailing edge of H-sync pulse
Power Requirements	117 V, 60 Hz, 5 W

Ordering Information

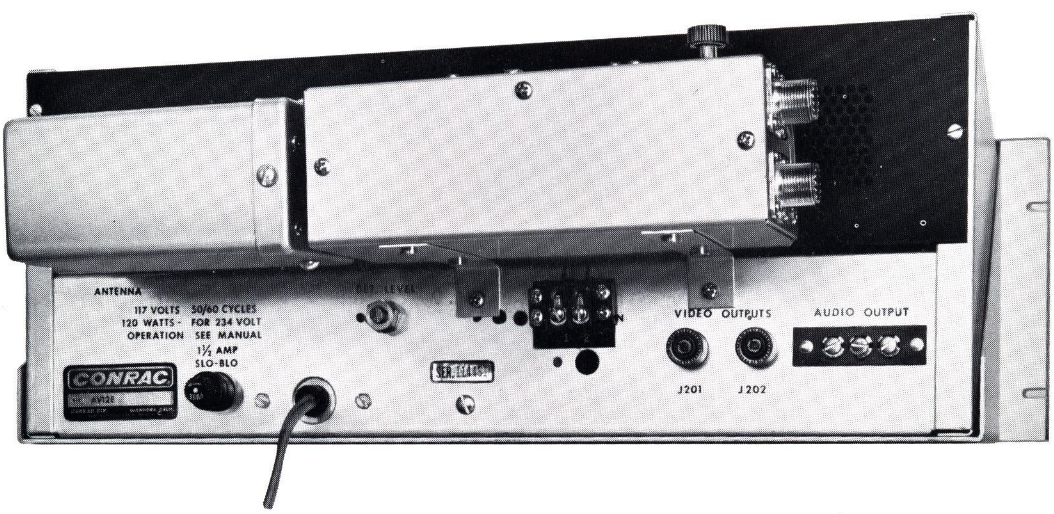
Vertical Interval Electronic Chopper:

- For use with BW/BWU-4 Sideband Demodulator ES-560564
- For use with monitoring diodes or Conrac AV-12E Tuner (includes power-supply assembly) ES-560563

Line representation of "chopped" vertical interval.



VIEC installed at rear of Conrac AV-12E Tuner. Chopper unit at left; power supply unit at right.



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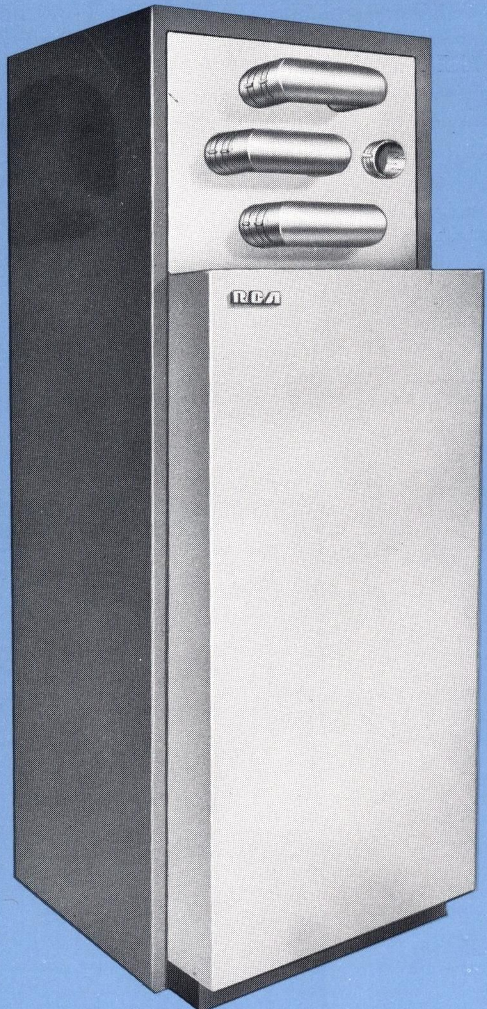

- Lowers VSWR, improves picture quality
- Switches parallel transmitter outputs with minimum load change
- Factory assembled, optimized and tested
- Reduces transmitter system installation cost
- Styled to match RCA transmitters

OPTO Switcher for Paralleled VHF Transmitters

Description

The RCA OPTO Switcher (*O*ptimized *P*arallel *T*ransmitter *O*utput switching system) is an attractively packaged assembly of output combiners, motorized coaxial switches and a manual patch panel designed especially for use with RCA parallel highband and lowband "F"-Line VHF television transmitters. OPTO Switcher components are optimized for best VSWR across the channel and shipped to the installation site as a simple, integrated unit with no further adjustment required.

Versatility

As can be seen in the block diagram, the OPTO Switcher provides extreme versatility for switching outputs in a typical two-transmitter system. The visual and aural outputs of each individual transmitter are switched as a unit. Basic switching modes are as follows:

1. Normal paralleled mode (combined visual and combined aural into antenna).
2. Transmitter #1 aural and visual on the air, Transmitter #2 aural and visual into separate test loads.
3. Transmitter #2 aural and visual on the air, Transmitter #1 aural and visual into separate test loads.
4. Manual patching.
   Variety of options depending upon antenna combinations, i.e., split-fed antennas, spare antennas, quadrature-fed antennas, etc.

3VB

Superior VSWR Performance

Since the OPTO Switcher components are assembled and optimized at the factory and not in the field, statistical addition of component VSWR's, normal with on-site installations, no longer exists. As a result, the VSWR through any switching mode is reduced to 1.02:1 or less.* This low VSWR minimizes the effect of transmitter loading changes with mode switching. Also, it minimizes the need for transmitter retuning with mode switching, a feature of particular value with remote control operation. Field installation of switching facilities and cutting of connecting line sections is minimized.

Reliability

Motorized coaxial switches in the OPTO Switcher provide simple, fast and reliable switching of r-f energy, with operations in excess of 100,000 cycles possible before failure.

Powered Through Transmitter

Power for the OPTO Switcher motors is provided through RCA "F"-Line Transmitters which are also equipped with controls for operation of the unit. When the OPTO Switcher is used with other transmitters, some custom work is necessary to interface the unit with transmitter power and control circuits.

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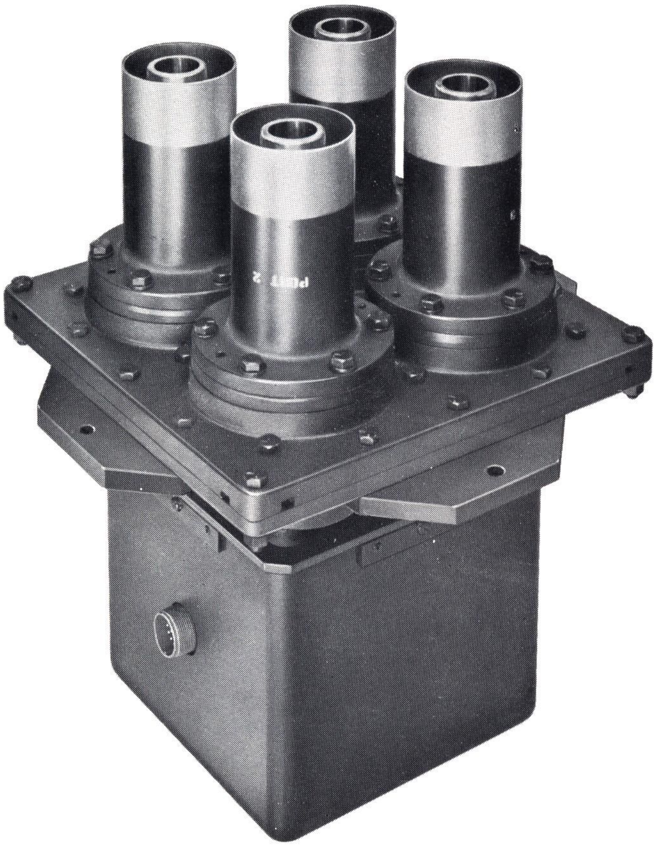
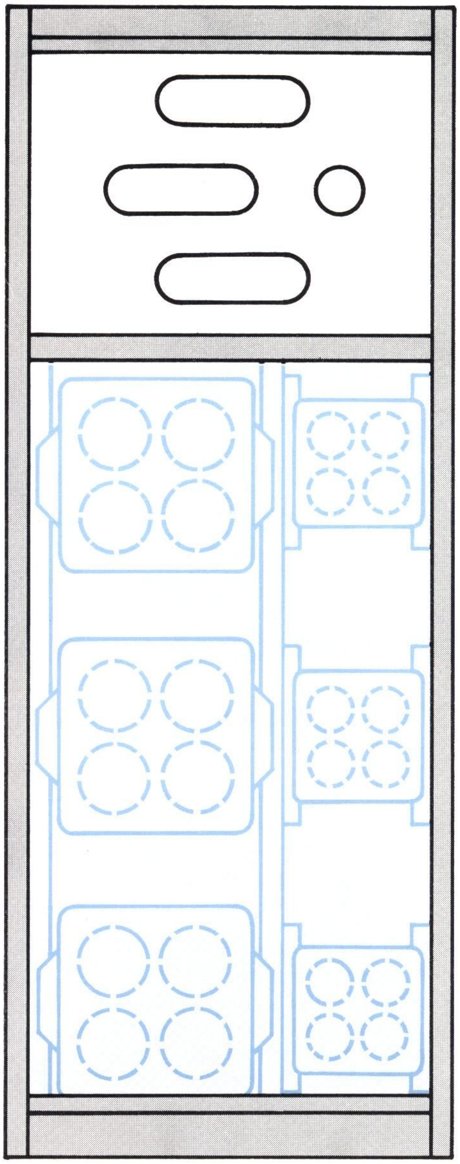
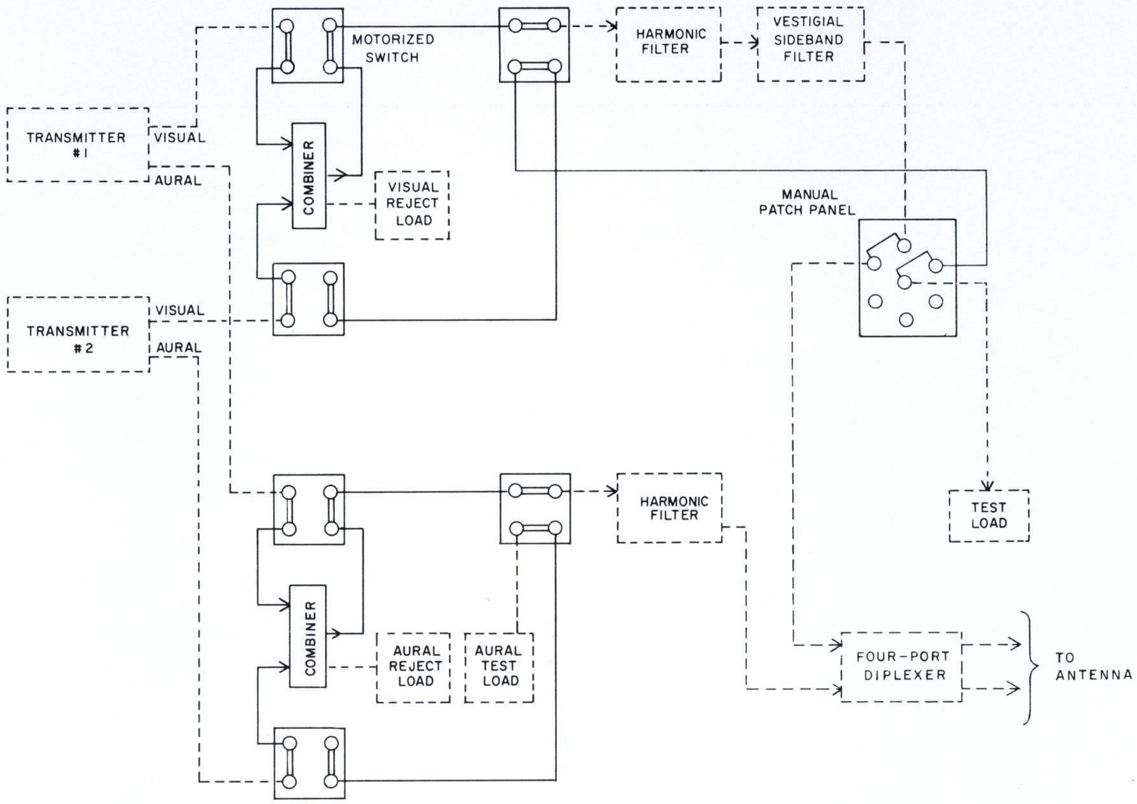
*Reflections of components, shown in dotted lines, which are external to the OPTO Switcher are not included in this figure.

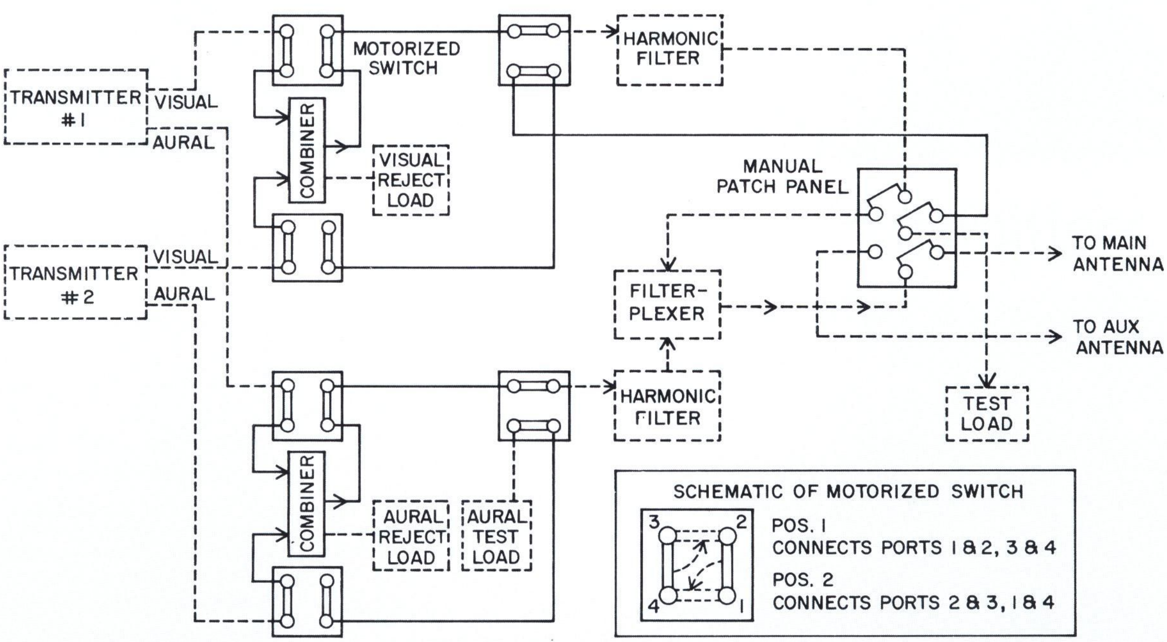
Typical motor-driven coaxial switch used in the OPTO Switcher. This is 3⅛-inch size; the OPTO Switcher uses three 1⅝-inch and three 3⅛-inch switches arranged as shown in drawing at right.







Typical OPTO Switcher scheme for quadrature-fed antenna systems using sideband filters. Components shown in solid lines are within OPTO Switcher cabinet.



Typical OPTO Switcher scheme for single-line antenna system. Scheme shown uses a filterplexer for combining aural and visual signals.

Specifications

R-f Connections:
- Visual input and output connections ....50-ohm, 3⅛″ Line (MI-27791K)
- Aural input and output connections ....50-ohm, 1⅝″ Line (MI-561565)

Power Requirements ....115V 50/60 Hz from RCA "F"-Line transmitter; other transmitters require custom consideration.

Interlocking ....Interfaces with "F"-Line transmitters; other transmitters require custom interfacing

VSWR ....1.02:1 or less, any input to any output, when terminated in a perfect match

Dimensions ....30″ W x 44″ D x 77″ H (762 mm x 1118 mm x 1956 mm)

Weight ....1200 lbs. (approx.) (543 kg)

Shipping Dimensions ....34″ W x 48″ D x 85″ H (864 mm x 1219 mm x 2159 mm)

Shipping Weight ....1300 lbs. (approx.) (590 kg)

Ordering Information

OPTO Switcher:
- For low-band "F"-Line Transmitters only* ES-561802
- For high-band "F"-Line Transmitters only* ES-561803

*OPTO Switcher uses certain coaxial components ordinarily supplied as part of the transmitter. When an OPTO Switcher is part of the transmitter order, these components are deleted from the transmitter equipment, incorporated into the OPTO Switcher unit, optimized and tested as a unit before shipment.

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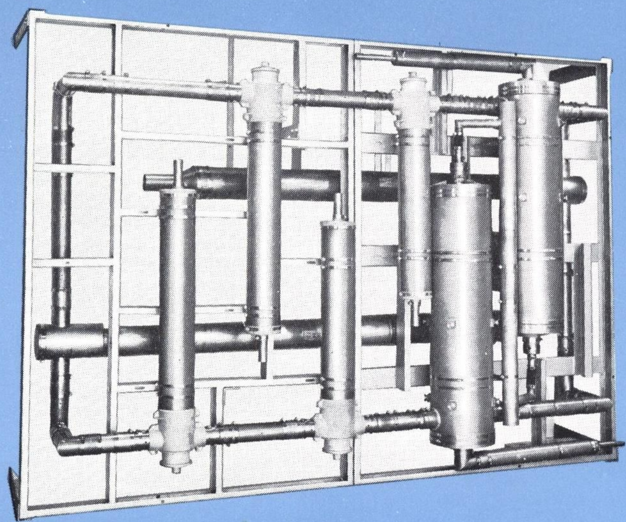

- Requires only a single transmission line to the antenna
- Economical—combines functions of vestigial sideband filter and constant-impedance notch diplexer
- Insertion loss less than 0.5 dB
- Pre-tuned at factory
- Choice of ceiling or wall mounting

RCA 25/30-KW VHF Low & Mid-Band Filterplexer

Description

RCA's VHF Filterplexer, MI-19179, represents a combination vestigial sideband filter and constant-impedance notch diplexer. It is used to attenuate the lower sideband of a double sideband visual transmitter and to feed the outputs from the visual transmitter and the aural transmitter simultaneously through a single coaxial line to an antenna.

The filterplexer consists essentially of two bridge-baluns connected by two equal lengths of interconnecting coaxial transmission line and three filter circuits (cavities) on each of the two interconnecting coaxial transmission lines. The first and second cavities are used to obtain the vestigial response characteristics of the visual input while the third is tuned to the sound frequency. As in the constant-impedance notch diplexer and the vestigial sideband filter, the visual signal is fed into the bridge-balun circuit and travels directly to the antenna input terminals. On antennas using a two line feed such as the Superturnstile this filterplexer will permit the use of a single line which may result in a considerable saving in line cost. The single line also reduces the wind load on the tower.

The insertion loss is less than 1 dB out to a point 4 MHz above the picture carrier frequency. The vestigial sideband characteristics are also maintained by having the lower sideband frequencies attenuated to more than 20 dB from the low edge of the channel 1.25 MHz to 4.25 MHz below the picture carrier.

The unit is designed for either ceiling or wall mounting. However, mounting requirements must be specified before assembly.

Specifications

Frequency ....VHF channels 2 to 6 as specified, pre-tuned and tested at the factory

Maximum Power:
- MI-19179/19179A ....25-kW peak visual, 15-kW peak aural, at 7500 feet elevation
- MI-19179B ....30-kW peak visual, 6-kW peak aural, at 7500 feet elevation

Efficiency:
- Aural ....95% (0.2 dB)
- Visual ....95% (0.2 dB)
- (Visual losses included in RCA transmitter peak power rating)

Connections:
- Input Impedance (aural and visual) ....50/51.5 Ohms 3⅛″ unflanged coaxial line (MI-19113)
- Output Impedance ....50/51.5 Ohms 3⅛″ unflanged coaxial line (MI-19113)

Mounting ....Ceiling or wall (specify)

Isolation:
- Visual Input to Aural Input at Visual Carrier ....30 dB
- Aural Input to Visual Input at Aural Carrier ....30 dB

Maximum Visual Input Standing Wave Ratio 1.1:1

Minimum Input Bandwidth (both sidebands) ....9 MHz

Ambient Temperature ....−10°C min. to 45°C max.

Blower ....230 Volts, 0.8 Amp., 60 Hz, connect in parallel with aural PA blower

Interlock Actuator ....100μA with 4000 Ohm load

Interlock, Air ....5 A, 230 Volts, aural transmitter connection

Weight (max.) ....1200 lbs. (544.3 kg)

Dimensions:
- (maximum for channel 2) ....130″ long, 100″ wide, 35″ high (330.3 cm, 254 cm, 88.9 cm)

Ordering Information

25-kW VHF Low Band Filterplexer, 51.5-Ohm MI-19179*

25-kW, VHF Low Band Filterplexer, 50-Ohm (for use with TT-15FL) MI-19179A*

30-kW, VHF Low Band Filterplexer, 50-Ohm (for use with TT-30FL) MI-19179B*

* Specify channel frequency and desired mounting.

6TB

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RCA Broadcast Equipment

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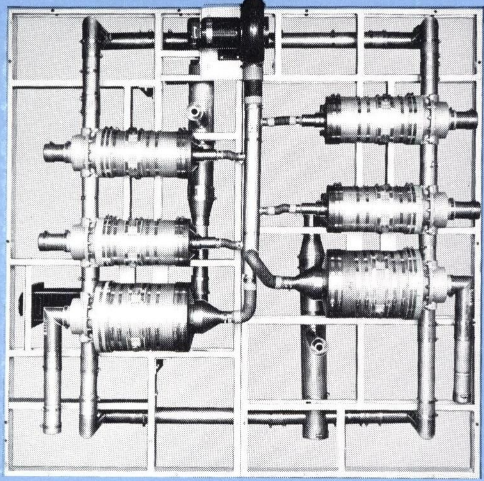

- Requires only a single transmission line to the antenna
- Economical—combines functions of vestigial sideband filter and constant-impedance notch diplexer
- Insertion loss less than 0.5 dB
- Pre-tuned at factory
- Choice of ceiling or wall mounting

RCA 35-KW VHF High-Band Filterplexer

Description

RCA's 35-kW VHF High-Band Filterplexer, MI-561530, is designed to properly attenuate the lower sideband of a double sideband visual transmitter and to combine the outputs of the visual transmitter into a single output. It thus combines the functions of a vestigial sideband filter and a constant-impedance notch diplexer in a single complete unit. The filterplexer may be used with 35-kW transmitters or with lower powered transmitters. It is especially recommended for use with the newer antennas requiring a single line input, such as the RCA Traveling Wave types.

The 35-kW Filterplexer consists essentially of two bridge-baluns connected by two equal lengths of interconnecting coaxial transmission line each incorporating three filter circuits or cavities. The first and second cavities are used to obtain the vestigial response characteristics of the visual input while the third is tuned to the sound frequency. As in the constant-impedance notch diplexer and the vestigial sideband filter, the visual signal is fed into the bridge-balun circuit and travels directly to the antenna input terminals.

The insertion loss is less than 1 dB out to a point 4 MHz above the picture carrier frequency. No operating adjustments are necessary as the unit is pre-tuned at the factory.

The unit is designed for either ceiling or wall mounting. However, mounting requirements must be specified before assembly.

Specifications

Frequency ....VHF channels 7 to 13 as specified, pre-tuned and tested at the factory

Power Rating ....35 kW (peak visual), 7 kW (aural) or 25 kW (peak visual), 12.5 kW (aural) at 8000 ft. elevation

Efficiency:
- Aural ....92% (0.4 dB)
- Visual ....96% (0.2 dB)
- (Visual losses included in RCA transmitter peak power rating)

Connections:
- Input Impedance (aural and visual) ....50/51.5 Ohms, 3⅛" unflanged, coaxial line (MI-19113, MI-19313)
- Output Impedance ....50/51.5 Ohms, 3⅛" unflanged, coaxial line (MI-19113, MI-19313)

Maximum Visual Input Standing Wave Ratio 1.1:1

Aural Carrier Standing Wave Ratio 1.3:1

Ambient Temperature ....–10°C min. to 45°C max.

Isolation:
- Visual Input to Aural Input at Visual Carrier ....30 dB
- Aural Input to Visual Input at Aural Carrier ....30 dB

Blower ....230 Volts, 50/60 Hz, 0.8 Amp. ⅓ HP

Dimensions:
- (max. for channel 7) ....90" long, 87½" wide, 24" high (228.6 cm, 222.25 cm, 60.96 cm)

Mounting ....Wall or ceiling (specify)

Weight ....1000 lbs. (453.6 kg) max.

Ordering Information

35-kW VHF Filterplexer (Channels 7 to 13) MI-561530*

* Specify channel frequency and desired mounting.

6TB

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RCA Broadcast Equipment

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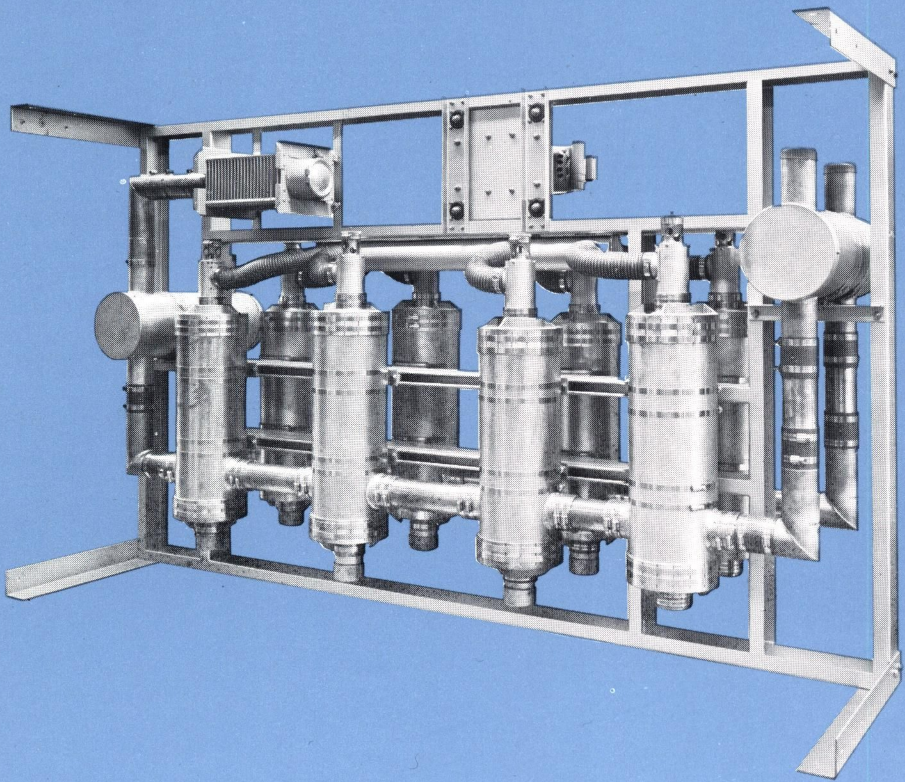
PRELIMINARY



- Combine visual and aural carriers to the antenna
- Economical— combine functions of VSBF and constant-impedance notch diplexer
- Visual insertion loss less than 0.27 dB
- Pretuned to your channel at factory
- Choice of ceiling or wall mounting
- Eight-cavity filter for optimum lower-sideband shaping

35- and 50-kW VHF High-Band Filterplexers

Description

The 35- and 50-kW VHF High-Band Filterplexers described here are designed to properly attenuate the lower sideband of a double-sideband visual transmitter output and to combine the outputs of the visual and aural transmitters into a single output. They thus combine the functions of a vestigial sideband filter (VSBF) and a constant-impedance notch diplexer in a single complete unit. The filterplexers may be used with 35-, 50-kW or with lower-powered transmitters. They are especially recommended for use with antennas requiring a single transmission-line input, such as RCA Traveling Wave or "Butterfly" types.

The filterplexers consist essentially of two bridge-baluns connected by two equal lengths of coaxial transmission line each incorporating four filter circuits or cavities. The first three cavities obtain the vestigial sideband response characteristics of the visual while the fourth is tuned to the aural carrier frequency. As in the constant-impedance notch diplexer and the vestigial sideband filter, the visual signal is fed into the bridge-balun circuit and travels directly to the antenna input terminals.

The insertion loss relative to picture carrier is less than 0.5 dB from 0.75 MHz below to 4.0 MHz above. No operating adjustments are necessary as the unit is pretuned at the factory.

The unit is designed for either ceiling or wall mounting. If wall mounted, the unit's long dimension should be parallel to the floor (as shown in illustration above).

6VB

Specifications

Frequency .... VHF channels 7 to 13 as specified, pretuned and tested at factory

Power Rating:
- 50-kW Filterplexer .... 50 kW (peak visual), 10 kW (aural) up to 8,000 ft. (2438m) above sea level
- 35-kW Filterplexer .... 35 kW (peak visual), 7 kW (aural) up to 8,000 ft. (2438m) above sea level

Efficiency:
- Aural .... 90% (0.46 dB)
- Visual .... 94% (0.27 dB)
- (visual losses included in RCA transmitter peak power rating)

Connections:
- Input Impedance (aural and visual) .... 50 ohms (3⅛″ unflanged coaxial line, MI-27791K)
- Output Impedance:
  - 50-kW Filterplexer .... 50 ohms (6⅛″ unflanged coaxial line, MI-561579)
  - 35-kW Filterplexer .... 50 ohms (3⅛″ unflanged coaxial line, MI-27791K)

Maximum Visual Input Standing Wave Ratio 1.06:1

Aural Carrier Standing Wave Ratio 1.2:1

Ambient Temperature .... 0°C min. to 45°C max.

Isolation:
- Visual Input to Aural Input at Visual Carrier .... 30 dB
- Aural Input to Visual Input at Aural Carrier .... 30 dB

Blower .... 230 volts, 50/60 Hz, 1.7 amp., ⅓ HP

Dimensions:
- (max., for channel 7) .... 96 x 57 x 34¼ inches (2438 x 1445 x 870 mm)

Mounting .... Wall or ceiling

Weight .... 1200 lbs. (544 kg) approx.

Shipping Data:
- Dimensions .... 104 x 68 x 45″ (2640 x 1725 x 1140 mm)
- Weight .... 1400 lbs. (635 kg) approx.

Ordering Information

50-kW VHF Filterplexer (Channels 7 to 13) MI-561702*

35-kW VHF Filterplexer (Channels 7 to 13) MI-561703*

*Specify channel frequency.

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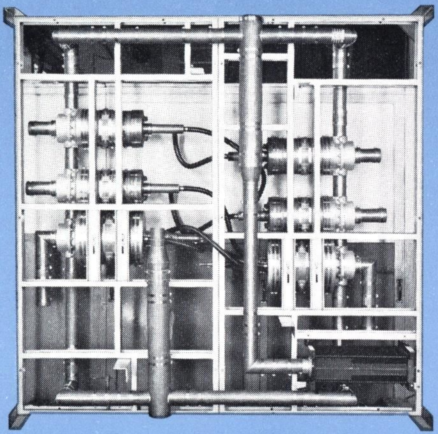


- Combines functions of vestigial sideband filter and constant impedance notch diplexer
- Especially engineered for each channel
- No operating adjustments—pre-tuned in factory
- Economical—requires only a single transmission line to the antenna

RCA 50-KW VHF High-Band Filterplexer

Description

RCA's 50-kW VHF High-Band Filterplexer, MI-27316-H, combines the vestigial sideband filter and constant-impedance notch diplexer function in a single complete unit. It is used to properly attenuate the lower sideband of a double sideband visual transmitter and to feed the outputs from the visual transmitter and the aural transmitter simultaneously through a single coaxial line to an antenna.

The filterplexer may be used with 50-kW transmitters or with lower powered transmitters. The MI-27316-H is recommended for use with the newer antennas requiring a single line input, such as the RCA Traveling Wave type.

Appreciable savings are realized where long transmission runs are needed to reach tower or antenna, since only one line is required. The single line also greatly reduces wind load on the tower.

The filterplexer combines the high quality performance characteristics of both a sideband filter and a diplexer. The insertion loss is less than 1 dB out to a point 4 MHz above the picture carrier frequency. The inputs are designed to have a constant input impedance over the band of frequencies produced. No operating adjustments are necessary as the unit is pre-tuned at the factory.

This unit is designed for either ceiling or wall mounting. However, mounting requirements must be specified before factory assembly and test is completed.

Specifications

Frequency ———VHF channels 7-13, as specified, pre-tuned and tested at the factory

Maximum Power ....50 kW (peak visual) 30 kW (aural) at 8000 ft. elevation

Efficiency:
- Aural ....92% (0.4 dB)
- Visual ....94% (0.3 dB)
- (Visual losses included in RCA transmitter power rating)

Connections:
- Input Impedance (aural and visual)
  - 50/51.5 Ohms ....Unflanged coaxial line (MI-19113)
- Reject Load
  - 50/51.5 Ohms ....Unflanged coaxial line (MI-19113)
- Output Impedance
  - 50/51.5 Ohms ....Unflanged coaxial line (MI-19314)

Maximum Visual Input Voltage Standing Wave Ratio:
- Lower band edge to 5.25 MHz above lower band edge 1.1:1
- 5.25 MHz above lower band edge to 5.43 MHz above lower band edge 1.15:1

Maximum Aural Input VSWR at Aural Carrier 1.3:1

Isolation:
- Visual Input to Aural Input at Visual Carrier ....30 dB
- Aural Input to Visual Input at Aural Carrier ....30 dB

Weight:
- Filterplexer ....955 lbs. (433.2 kg)
- Fluid Cooler ....210 lbs. (95.25 kg)

Dimensions (maximum for Channel 7) ....90″ long, 87½″ wide, 33″ high (228.6 cm, 222.25 cm, 83.82 cm) (incl. heat exchanger)

Power Requirements:
- Fan Motor ....230 V, 60 Hz, 2.1 Amp.
- Pump Motor ....230 V, 60 Hz, 2.1 Amp.

Fluid Cooler ....Uses distilled water in a closed system (capacity approximately 7 gallons)

Ambient Temperature ....−10°C min. to 45°C max.

Ordering Information

50-kW VHF Filterplexer MI-27316*

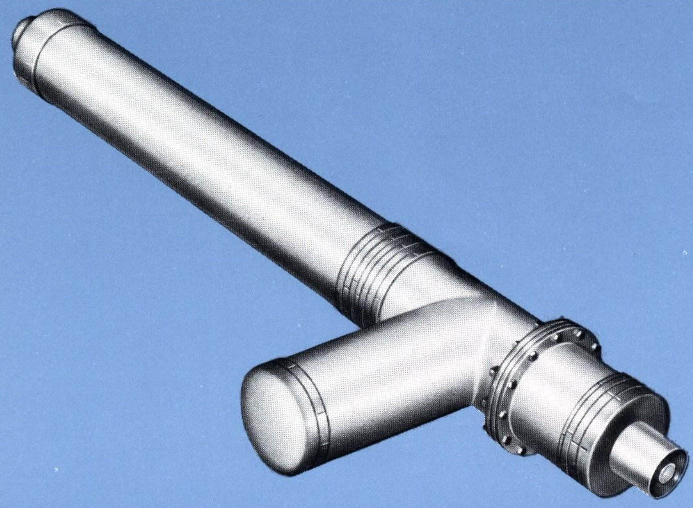
* Specify channel frequency and desired mounting.

6TB

Commercial Electronic Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

RCA Broadcast Equipment

catalog B.4514



- Effective suppression of harmonic radiation when used with RCA VHF transmitters
- Performance complies with all FCC requirements
- Pre-tuned at factory for optimum VSWR
- Attenuation 30 dB or greater 2nd thru 4th harmonics of channel, 20 dB or greater 5th thru 7th harmonics of channel

RCA VHF Harmonic Filters

Description

The VHF Harmonic Filter in conjunction with other RF components, suppresses all harmonic radiation, 3 MHz above VHF channel limits to −60 dB or more in conformity with FCC requirements. The MI-27317-L/H filter is used with all RCA transmitters with a TV peak power output of 12.5 kW or less, the MI-27318-A-L/H filter is specified for RCA transmitters of more than 12.5 kW TV peak power rating. Two filters are required for VHF transmitters, one for the aural, and one for the visual output.

The VHF Harmonic Filters, MI-27317 and 27318-A consist of a series of transmission line elements with a uniform outer diameter conductor, a stepped inner conductor, and one shunt stub. The conductors are both fabricated of copper. The terminals are the same as unflanged transmission line. Attenuation of all harmonic radiation 3 MHz above channel limits is accomplished by means of an M-derived half T-section, several low-pass filter sections and a constant-K half-T section. This type of design provides a broadband within the desired pass band with a sharp high frequency cutoff and high attenuation of frequencies above the pass band. The harmonic filters are of the reflective rather than dissipative type, and should be inserted in series with the transmission system.

Specifications

	FCC Channel	Frequency Band
Frequency	CH. 2-13	54-216 MHz
Maximum Power (7500 ft. max. Altitude):		
MI-27317-L	Cr. 2-6	54-88 MHz 12.5 kW peak
MI-27317-H	Ch. 7-13	174-223 MHz 12.5 kW peak
MI-27318-A-L	Ch. 2-6	54-88 MHz 50 kW peak
MI-27318-A-H	Ch. 7-13	174-216 MHz 50 kW peak

Input and Output .... 50/51.5 Ohms, 3⅛″ unflanged coaxial line, MI-19113

VSWR .... 1.10 max.

Attenuation .... 30 dB or greater, 2nd thru 4th harmonics of the channel; 20 dB or greater, 5th thru 7th harmonics of the channel

Mounting .... Horizontal position recommended

Recommended Location .... Between power amplifier and monitor unit

Alternate Locations .... Visual output filter may be located between vestigial sideband filter and diplexer

Ambient Temperature .... 45°C. maximum

Dimensions:
- MI-27317-L/H .... 56 to 175″ long (depending on channel) x 3⅛″ O.D. with 11″ to 26½″ stub approx. 8″ from one end
- MI-27318-A-L/H .... 56 to 176″ long (depending on channel) x 6⅛″ O.D. with 14″ to 27″ stub 11$\frac{3}{16}$″ from one end

Accessories

Coupling, Straight, 3⅛″ coaxial line MI-19113-8

Adaptor, Inner Conductor, for MI-19313 coaxial line MI-19313-10

Ordering Information

12.5 KW RATING

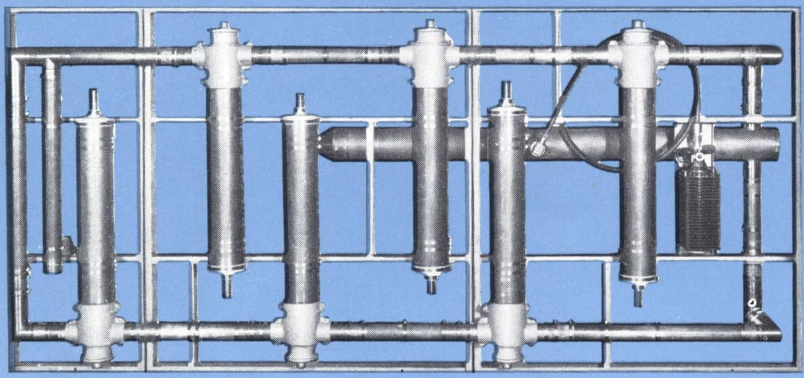
FCC Channel	Frequency Band	Designation
2	54-60 MHz	MI-27317-2
3-4	60-72 MHz	MI-27317-3
5-6	76-88 MHz	MI-27317-5
7-9	174-192 MHz	MI-27317-7
10-13	192-216 MHz	MI-27317-10

50 KW RATING

FCC Channel	Frequency Band	Designation
2	54-60 MHz	MI-27318-A2
3-4	60-72 MHz	MI-27318-A3
5-6	76-88 MHz	MI-27318-A5
7-9	174-192 MHz	MI-27318-A7
10-13	192-216 MHz	MI-27318-A10

6TB

Commercial Electronic Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102
RCA Broadcast Equipment



- Factory tuned and adjusted for the specified operating TV channel
- Designed to provide the proper side-band shaping for color transmission
- Provides constant load impedance to the visual transmitter
- Results in desired side-band characteristic, independent of transmitter tuning

RCA VHF Vestigial Sideband Filters

Description

An RCA Vestigial Sideband Filter is an integral part of each VHF Television Transmitter. It serves to attenuate the lower sidebands of the visual transmitter and provides a constant impedance load for the output stage of the visual power amplifier. The filter also protects the services in the frequency band below the television channel against interference. Several type sideband filters are designed for the various power ratings of transmitters; they are specially engineered for each channel. These fixed-tuned, factory adjusted filters eliminate many operating adjustments on the transmitter.

The vestigial sideband filter passes the visual upper sideband signal energy of the television channel from the power amplifier to the antenna feed system. The small amount of energy that falls below the assigned visual carrier is dissipated in an absorbing resistor. Several types of filters are now in use. MI-19114-B, ES-27233, ES-27234 and MI-27799 are a combination of a low pass and a high pass filter to give constant impedance characteristics, while MI-19085-L, and MI-27315-H use a bridge arrangement with balanced high pass filters. The combination of the high pass and the low pass filters in parallel presents a constant input impedance to the radio frequency energy.

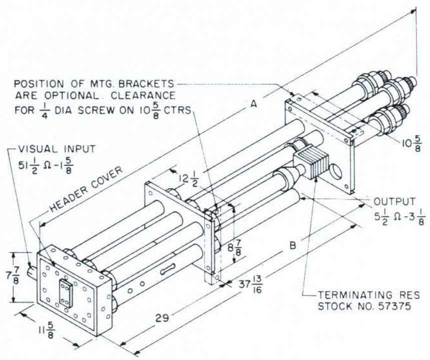
The filters are coaxial transmission line networks. The input and output connections have standard dimensions for 3⅛-inch and 1⅝-inch unflanged transmission lines. The units have a characteristic impedance of 50/51.5 Ohms. The power amplifier of the visual transmitter is matched with a standing wave ratio of 1.1 to 1 or better. The sidebands that fall below the television channel are attenuated by 20 dB or more when used with RCA transmitters. The sideband filters may be mounted in various positions, but should be located near the transmitter. The ambient temperature of the air about the filter should not exceed a maximum of 45 degrees C. Blowers provide cooling air for filters operating in the higher power ratings.

Ordering Information

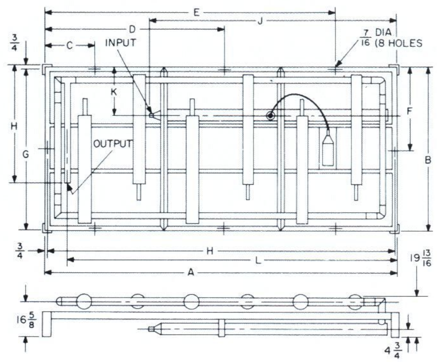
Stock No.	Power	Chan.	Part of RCA Transmitter
ES-27233-*	2 kW	2-6	TT-2BL
MI-19114-B*	5 kW	7-13	TT-5EH1
ES-27234-*	12½ kW	2-6	TT-6EL, TT-12EL
ES-27234A*	15 kW	2-6	TT-15FL
MI-19085-L*	25 kW	2-6	TT-12-EL, TT-25EL
MI-27799-*	25 kW	7-13	TT-12EH, TT-12/12EH, TT-25EH1
MI-19085A-L*	30 kW	2-6	TT-30-FL
MI-27315-H*	50 kW	7-13	TT-25/25EH1, TT-25/25L

* Sales order must add customer's assigned channel number following letter or dash.

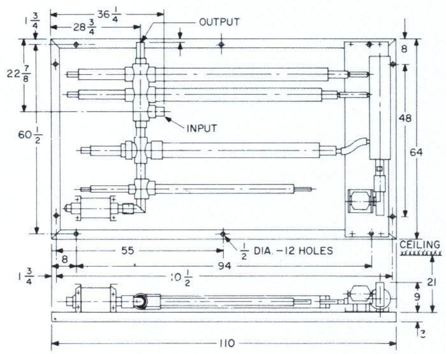
6TB



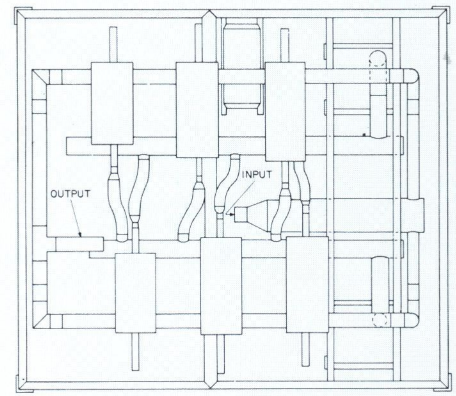
MI-19114-B Vestigial Sideband Filter



MI-19085-L/19085A-L
Vestigial Sideband Filter



ES-27233/27234/27234-A/MI-27799
Vestigial Sideband Filter

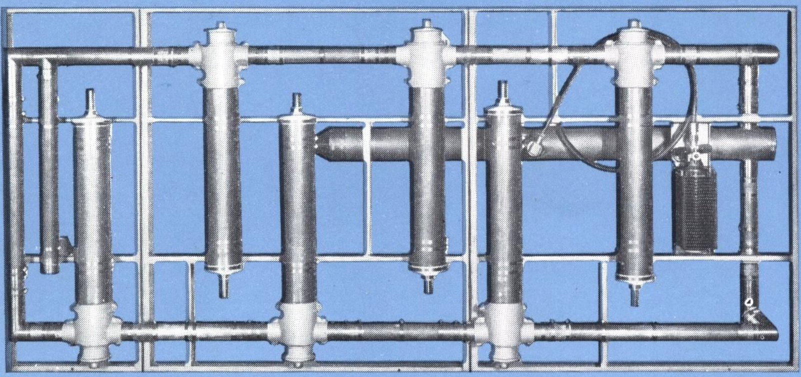


MI-27315-H Vestigial Sideband Filter

Specifications

	MI-19114-B	ES-27233	ES-27234	ES-27234-A	MI-19085-L	MI-19085-A-L	MI-27799	MI-27315-H
ELECTRICAL								
Frequency	174-216 MHz	54 to 88 MHz	54 to 88 MHz	54 to 88 MHz	54 to 88 MHz	54 to 88 MHz	174 to 216 MHz	174 to 216 MHz
Maximum Power	5 kW	2 kW	12.5 kW	15 kW	12.5 kW/25 kW	30 kW	25 kW peak of sync	50 kW
Input and Output Impedance	51.5 Ohms, 1⅝″ unflanged coaxial input 3⅛″ unflanged coaxial output	51.5 Ohms, 3⅛″ unflanged coaxial line	51.5 Ohms, 3⅛″ unflanged coaxial line	50 Ohms, 3⅛″ unflanged (MI-27791-K) line	51.5 Ohms, 3⅛″ unflanged coaxial line	50 Ohms, 3⅛″ unflanged (MI-27791-K) line	50 Ohms, 3⅛″ unflanged coaxial line	51.5 Ohms, 3⅛″ unflanged coaxial line
VSWR	1.1 or better	1.1 or better	1.1 or better	1.1 or better	1.1 or better	1.1 or better	1.1 or better	1.1 or better
Blower	—	—	230 V, ¼ h.p., 2850 rpm, 50/60 Hz	230 V, ¼ h.p., 2850 rpm, 50/60 Hz	—	115 V, 3 A.	230 V, ¼ h.p., 2850 rpm, 50/60 Hz	230 V, 1.6 A., 60 Hz
Interlock	—	—	5 Amp. @ 250 V AC	5 Amp. @ 250 V AC	—	5 Amp. @ 250 V AC	5 Amp. @ 250 V AC	5 Amp. @ 230 V AC
MECHANICAL								
Overall Dimensions, Max.:								
Length	105″ (266.70 cm)	110″ (279.4 cm)	110″ (279.4 cm)	110″ (279.4 cm)	165″ (429.1 cm)	165″ (429.1 cm)	111″ (281.94 cm)	150″ (381.00 cm)
Width	12½″ (32.75 cm)	64″ (162.56 cm)	64″ (162.56 cm)	64″ (162.56 cm)	79″ (300.66 cm)	79″ (300.66 cm)	60″ (152.4 cm)	89″ (226.06 cm)
Height	8⅞″ (22.54 cm)	12″ (30.48 cm)	12″ (30.48 cm)	12″ (30.48 cm)	12″ (30.48 cm)	12″ (30.48 cm)	9⅝″ (24.45 cm)	31⅞″ (80.23 cm)
Net Weight, Approx.	200 lbs. (90.72 kg)	300 lbs. (136.08 kg)	300 lbs. (136.08 kg)	300 lbs. (136.08 kg)	930 lbs. (422 kg)	955 lbs. (433.13 kg)	532 lbs. (241.32 kg)	1600 lbs. (725.76 kg)
Mounting	Ceiling or horiz.	Ceiling or horiz.	Ceiling or horiz.	Ceiling or horiz.	Ceiling or horiz.	Ceiling or horiz.	Wall or ceiling	Ceiling or horiz.
Ambient Temperature	45° C. max.	45° C. max.	45° C. max.	45° C. max.	45° C. max.	45° C. max.	45° C. max.	45° C. max.

catalog B.4516



- Factory tuned and adjusted for the specified operating TV channel
- Designed to provide the proper side-band shaping for color transmission
- Provides constant load impedance to the visual transmitter
- Results in desired side-band characteristic, independent of transmitter tuning

RCA VHF Vestigial Sideband Filters

Description

An RCA Vestigial Sideband Filter is an integral part of each VHF Television Transmitter. It serves to attenuate the lower sidebands of the visual transmitter and provides a constant impedance load for the output stage of the visual power amplifier. The filter also protects the services in the frequency band below the television channel against interference. Several type sideband filters are designed for the various power ratings of transmitters; they are specially engineered for each channel. These fixed-tuned, factory adjusted filters eliminate many operating adjustments on the transmitter.

The vestigial sideband filter passes the visual upper sideband signal energy of the television channel from the power amplifier to the antenna feed system. The small amount of energy that falls below the assigned visual carrier is dissipated in an absorbing resistor. Several types of filters are now in use. MI-19114-B, ES-27233, ES-27234 and MI-27799 are a combination of a low pass and a high pass filter to give constant impedance characteristics, while MI-19085-L, and MI-27315-H use a bridge arrangement with balanced high pass filters. The combination of the high pass and the low pass filters in parallel presents a constant input impedance to the radio frequency energy.

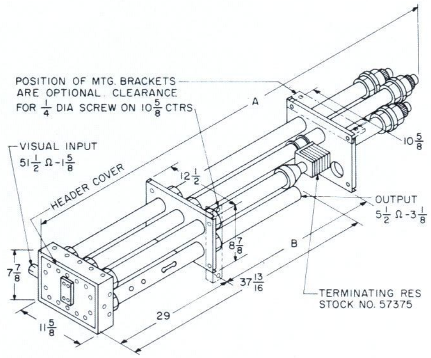
The filters are coaxial transmission line networks. The input and output connections have standard dimensions for 3⅛-inch and 1⅝-inch unflanged transmission lines. The units have a characteristic impedance of 50/51.5 Ohms. The power amplifier of the visual transmitter is matched with a standing wave ratio of 1.1 to 1 or better. The sidebands that fall below the television channel are attenuated by 20 dB or more when used with RCA transmitters. The sideband filters may be mounted in various positions, but should be located near the transmitter. The ambient temperature of the air about the filter should not exceed a maximum of 45 degrees C. Blowers provide cooling air for filters operating in the higher power ratings.

Ordering Information

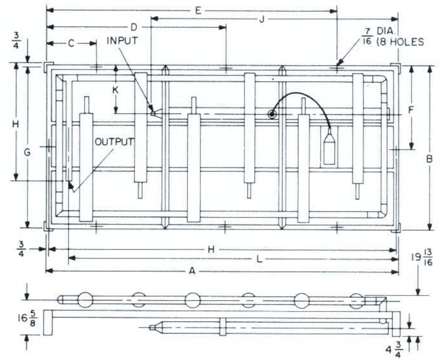
Stock No.	Power	Chan.	Part of RCA Transmitter
ES-27233-*	2 kW	2-6	TT-2BL
MI-19114-B*	5 kW	7-13	TT-5EH1
ES-27234-*	12½ kW	2-6	TT-6EL, TT-12EL
ES-27234A*	15 kW	2-6	TT-15FL
MI-19085-L*	25 kW	2-6	TT-12-EL, TT-25EL
MI-27799-*	25 kW	7-13	TT-12EH, TT-12/12EH, TT-25EH1
MI-19085A-L*	30 kW	2-6	TT-30-FL
MI-27315-H*	50 kW	7-13	TT-25/25EH1, TT-25/25L

* Sales order must add customer's assigned channel number following letter or dash.

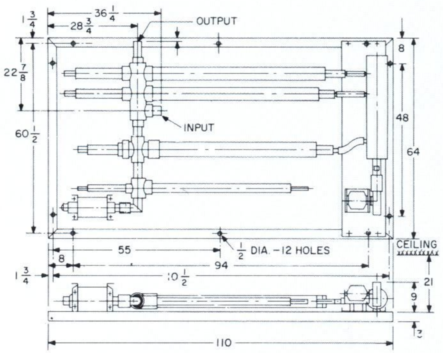
6TB



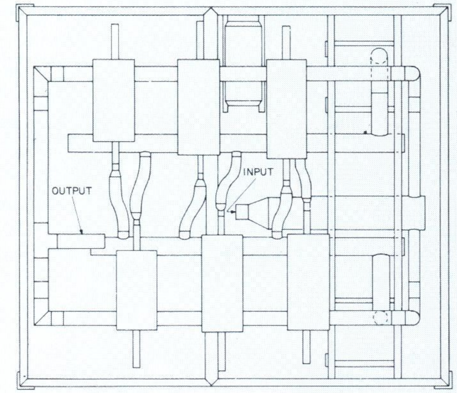
MI-19114-B Vestigial Sideband Filter



MI-19085-L/19085A-L
Vestigial Sideband Filter



ES-27233/27234/27234-A/MI-27799
Vestigial Sideband Filter



MI-27315-H Vestigial Sideband Filter

Specifications

	MI-19114-B	ES-27233	ES-27234	ES-27234-A	MI-19085-L	MI-19085-A-L	MI-27799	MI-27315-H
ELECTRICAL								
Frequency	174-216 MHz	54 to 88 MHz	54 to 88 MHz	54 to 88 MHz	54 to 88 MHz	54 to 88 MHz	174 to 216 MHz	174 to 216 MHz
Maximum Power	5 kW	2 kW	12.5 kW	15 kW	12.5 kW/25 kW	30 kW	25 kW peak of sync	50 kW
Input and Output Impedance	51.5 Ohms, 1⅝″ unflanged coaxial input 3⅛″ unflanged coaxial output	51.5 Ohms, 3⅛″ unflanged coaxial line	51.5 Ohms, 3⅛″ unflanged coaxial line	50 Ohms, 3⅛″ unflanged (MI-27791-K) line	51.5 Ohms, 3⅛″ unflanged coaxial line	50 Ohms, 3⅛″ unflanged (MI-27791-K) line	50 Ohms, 3⅛″ unflanged coaxial line	51.5 Ohms, 3⅛″ unflanged coaxial line
VSWR	1.1 or better	1.1 or better	1.1 or better	1.1 or better	1.1 or better	1.1 or better	1.1 or better	1.1 or better
Blower	—	—	230 V, ¼ h.p., 2850 rpm, 50/60 Hz	230 V, ¼ h.p., 2850 rpm, 50/60 Hz	—	115 V, 3 A.	230 V, ¼ h.p., 2850 rpm, 50/60 Hz	230 V, 1.6 A., 60 Hz
Interlock	—	—	5 Amp. @ 250 V AC	5 Amp. @ 250 V AC	—	5 Amp. @ 250 V AC	5 Amp. @ 250 V AC	5 Amp. @ 230 V AC
MECHANICAL								
Overall Dimensions, Max.:								
Length	105″ (266.70 cm)	110″ (279.4 cm)	110″ (279.4 cm)	110″ (279.4 cm)	165″ (429.1 cm)	165″ (429.1 cm)	111″ (281.94 cm)	150″ (381.00 cm)
Width	12½″ (32.75 cm)	64″ (162.56 cm)	64″ (162.56 cm)	64″ (162.56 cm)	79″ (300.66 cm)	79″ (300.66 cm)	60″ (152.4 cm)	89″ (226.06 cm)
Height	8⅞″ (22.54 cm)	12″ (30.48 cm)	12″ (30.48 cm)	12″ (30.48 cm)	12″ (30.48 cm)	12″ (30.48 cm)	9⅝″ (24.45 cm)	31⅞″ (80.23 cm)
Net Weight, Approx.	200 lbs. (90.72 kg)	300 lbs. (136.08 kg)	300 lbs. (136.08 kg)	300 lbs. (136.08 kg)	930 lbs. (422 kg)	955 lbs. (433.13 kg)	532 lbs. (241.32 kg)	1600 lbs. (725.76 kg)
Mounting	Ceiling or horiz.	Ceiling or horiz.	Ceiling or horiz.	Ceiling or horiz.	Ceiling or horiz.	Ceiling or horiz.	Wall or ceiling	Ceiling or horiz.
Ambient Temperature	45° C. max.	45° C. max.	45° C. max.	45° C. max.	45° C. max.	45° C. max.	45° C. max.	45° C. max.

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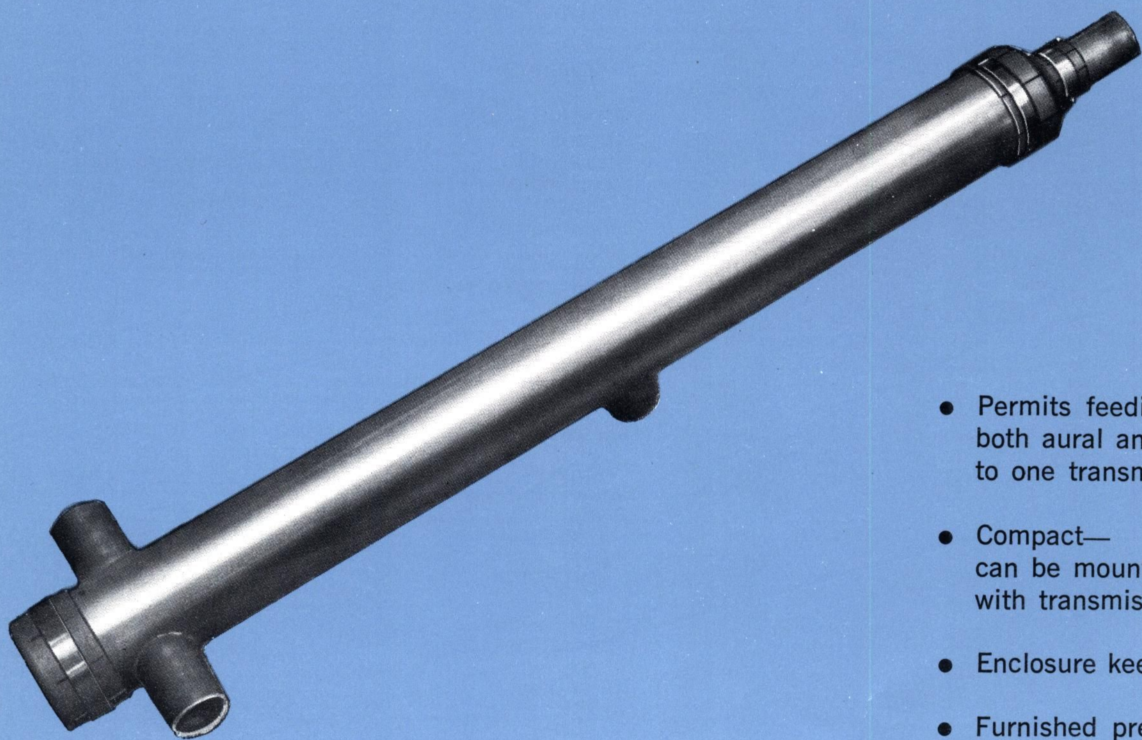
RCA Broadcast Equipment

catalog B.4719



- Permits feeding both aural and visual signals to one transmitting antenna
- Compact— can be mounted overhead with transmission line
- Enclosure keeps out dust
- Furnished precut to channel— no adjustment required

RCA VHF Television Diplexers

Description

The Diplexer is a device constructed of transmission line sections which permits feeding both the aural and visual counterparts of the television signal to the same antenna without detrimental crosstalk. This permits use of one antenna for radiating both aural and visual signals. The Diplexer is designed particularly for use in transmission lines for Superturnstile and Super-Gain antennas; however, it can be used with any TV antenna which utilizes a quadrature phased dual transmission line.

The diplexing systems vary in size and weight dependent upon the frequency band used. The input and output impedances of each system matches the standard transmission line characteristic impedance. It has a low insertion loss—less than 0.1 percent because it uses no tuned traps or other circuits carrying high circulating current. The power handling capacity is correspondingly high because the power dissipated is roughly equivalent to that of an equal length of transmission line of the same dimensions.

The following diplexers are recommended for use with the various type RCA television transmitters:

MI-19390—TT-2BL, TT-5EH1, TT-6EL, TT-12EH, TT-12EL

MI-19390-A—TT-15FL

MI-19391—TT-25EL

MI-19391-A—TT-30FL

MI-19394—TT-25EH1

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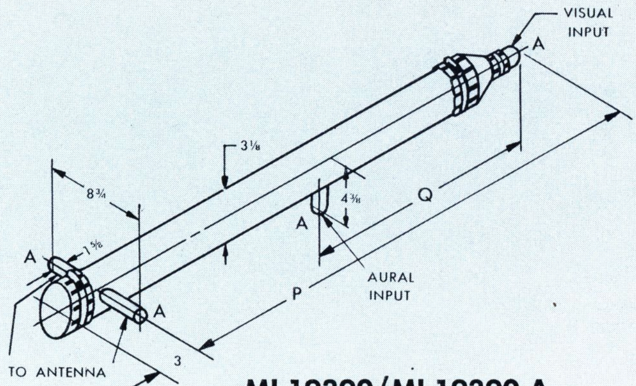
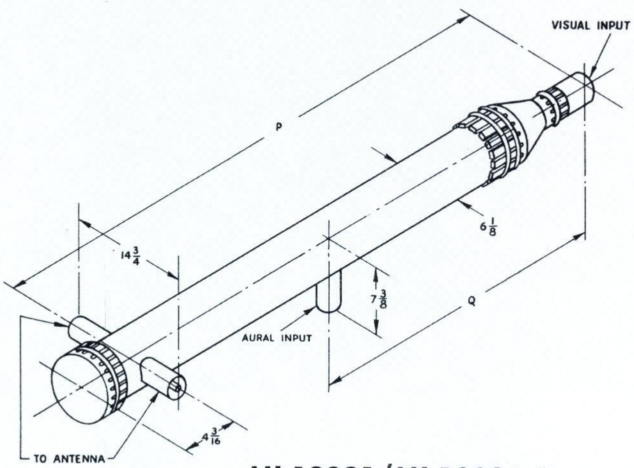


MI-19390/MI-19390-A

CHANNEL	P	Q
2	107 7/16	55 5/8
3	97 9/16	50 11/16
4	89 7/16	46 5/8
5	78 9/16	41 3/16
6	73 5/16	38 9/16
7	37 9/16	20 11/16
8	36 5/16	20 1/16
9	35 5/16	19 9/16
10	34 5/16	19 1/16
11	33 9/16	18 11/16
12	32 9/16	18 3/16
13	31 13/16	17 13/16



MI-19391/MI-19391-A

CHANNEL	P	Q
2	109 7/16	57 5/8
3	99 9/16	52 11/16
4	91 7/16	48 5/8
5	80 9/16	43 3/16
6	75 5/16	40 9/16

MI-19394

CHANNEL	P	Q
7	39 9/16	22 11/16
8	38 5/16	22 1/16
9	37 5/16	21 9/16
10	36 5/16	21 1/16
11	35 9/16	20 11/16
12	34 9/16	20 3/16
13	33 13/16	19 13/16

Outline drawings with dimensions shown in inches.

Specifications

MI-19390/19390-A

Frequency .... 54-216 MHz
Maximum Power .... 15 kW
RF Input and Output:
MI-19390 .... 51.5 Ohms, 1⅝" unflanged coaxial line (MI-19112)
MI-19390-A .... 50 Ohms, 1⅝" unflanged coaxial line (MI-561565)
RF Efficiency 99.9%
Attenuation .... 0.004 dB
Visual Input .... VSWR less than 1.05
Aural Input .... VSWR less than 1.15
Weight .... 12 to 30 lbs. (5.4 to 13.6 kg.)
Mounting .... Any position
Dimensions .... See outline drawing

Ordering Information

15 kW VHF TV Diplexer MI-19390-*
15 kW VHF TV Diplexer (for use with TT-15FL) MI-19390-A-*

* MI number to include channel, i.e.: MI-19390-2 for FCC channel #2, etc. For non-FCC assignments—specify visual and aural carrier frequencies.

MI-19391/19391-A

Frequency .... 54-88 MHz
Maximum Power .... 50 kW
RF Input and Output:
MI-19391 .... 50/51.5 Ohms, 3⅛" unflanged coaxial line (MI-19113)
MI-19391-A .... 50 Ohms, 3⅛" unflanged coaxial line (MI-27791-K)
RF Efficiency 99.9%
Attenuation .... 0.004 dB
Visual Input .... VSWR less than 1.05
Aural Input .... VSWR less than 1.15
Weight .... 120 to 175 lbs. (55 to 80 kg.)
Mounting .... Any position
Dimensions .... See outline drawing

Ordering Information

Low Band 50 kW Diplexer MI-19391-*
Low Band 50 kW Diplexer (for use with TT-30FL) MI-19391-A-*

Accessories

Adaptor, Inner for MI-19313 Coaxial Line MI-19313-10
Coupling, Straight MI-19113-C8
Reducer, 6⅛" to 3⅛" Coaxial Line MI-19314-C13

* MI number to include channel, i.e.: MI-19391-6 for FCC channel #6, etc. For non-FCC assignments—specify visual and aural carrier frequencies.

MI-19394

Frequency .... 174-216 MHz
Maximum Power .... 50 kW
RF Input and Output .... 50/51.5 Ohms, 3⅛" unflanged coaxial line (MI-19113)
RF Efficiency 99.9%
Attenuation .... 0.004 dB
Visual Input .... VSWR less than 1.05
Aural Input .... VSWR less than 1.15
Weight .... 48 to 60 lbs. (22 to 27 kg.)
Mounting .... Any position
Dimensions .... See outline drawing

Ordering Information

High Band 50 kW TV Diplexer MI-19394-*

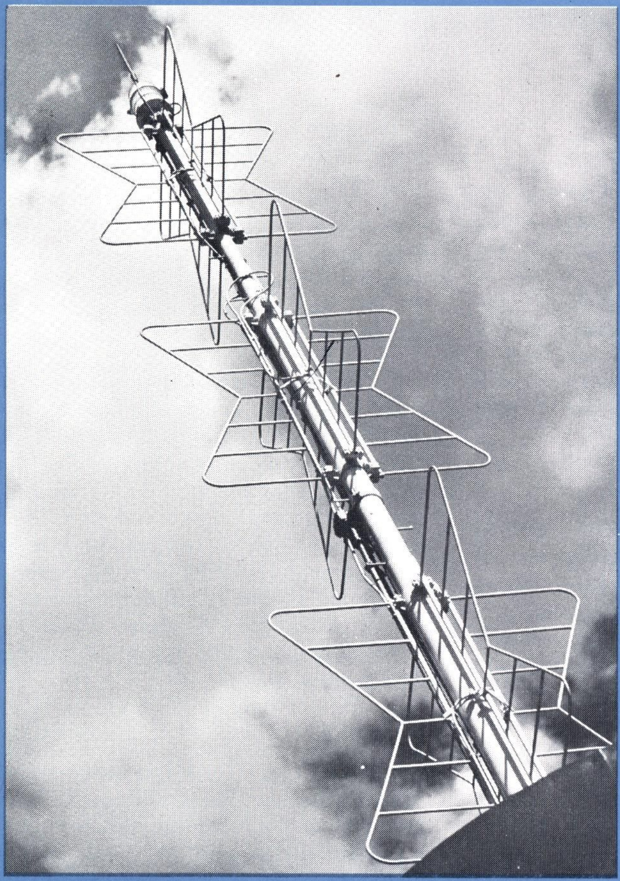
Accessories

Adaptor, Inner for MI-19313 Coaxial Line MI-19313-10
Coupling, Straight MI-19113-C8
Reducer, 6⅛" to 3⅛" Coaxial Line MI-19314-C13

* MI number to include channel, i.e.: MI-19394-7 for FCC channel #7, etc. For non-FCC assignments—specify visual and aural carrier frequencies.

RCA

catalog B.4104



- Complete line of VHF antennas for Channels 2-13
- Gains from 2 to 18
- Tailored vertical patterns where required
- Input power ratings up to 100 KW
- Grounded for lightning protection
- Electrical beam tilting for optimum performance
- Multiple station operation by means of stacking and diplexing
- Directional patterns obtainable

VHF Superturnstile Antennas

Description

The RCA Superturnstile Antenna because of its excellent characteristics, fine performance record and low cost is the most widely used VHF antenna in the television industry. The detailed electrical and mechanical characteristics of 19 antennas having gains from 2 to 18 are listed in the Tables I and II. These will provide data needed for:

1. The choice of the proper antenna for a given terrain situation and also to obtain the proper ERP
2. Data for filing purposes
3. Data for tower design
4. Information with regard to accessory equipment
5. Shipping and rigging data

The antennas are made in three bands designated L, M, and H in the type number as follows:

L—Low band channels 2, 3

M—Medium band channels 4-6

H—High band channels 7-13

The pole, radiators, and the junction boxes including the three section transformer are the same for each band group. The only change made for individual channels are the spacer plates which change the spacing between the pole and the radiator, and the feedline lengths.

Radiators

The radiator is the typical batwing which is about 0.6 wavelength in height. One pair of radiators mounted in line on the pole have a tip to tip spacing of about 0.5 wavelength. Exact dimensions are given in Table II. The special shape provides excellent bandwidth. Two radiators mounted in line (N-S) have the approximate horizontal pattern of a dipole. When two pairs of such radiators (N-S and E-W) are placed in a 90-degree space and phase relationship they produce a pattern which is essentially omnidirectional.

The electrical equivalent of two pairs of radiators mounted at right angles to each other (N-S and E-W) is that of two crossed dipoles with a vertical separation of approximately one-half wavelength. This minimizes upward and downward radiation so that the mutual inductance between adjacent radiators is quite low which facilitates the stacking of radiators.

Feed System

The Superturnstile feed system is of the branching type in which each radiator is fed with a separate Styroflex cable. The radiators are carefully matched to maintain a minimum VSWR on the cables. The Styroflex cables from each radiator are brought together in a junction box. For antennas of six stacked sections or less, two junction boxes are normally used, one for the North-South system of radiators and another for the East-West system. The impedance of the combined cables in the junction box is stepped up to 51½ Ohms by means of a three-section transformer which has very wide band characteristics.

A twelve section antenna consists substantially of two six section antennas as far as the feed system is concerned. Hence a twelve section antenna has four junction boxes with associated transformers. Four 3⅛-feed-lines are brought down below the tower top. These four lines are combined into two by means of a combining network which is usually located in the tower top. Space must be provided in the tower top for this network. The dimension "T" in Table II is the distance below the tower top to the point of connection of the main feeder to the combining network.

Gain

The gain of one section of the antenna consisting of four radiators is approximately one over a dipole. The gain increases roughly by one for each added section. For instance, a six section antenna will have a gain over a dipole of about six. Exact values are given in Table I. Gains from 2 to 12 are provided for the low and medium bands and from 2 to 18 for the high band. Antennas with gains between 12 and 18 are custom antennas.

Vertical Patterns

The vertical pattern is the relative field strength transmitted in a given vertical plane. Since vertical stacking always produces pattern nulls unless special provisions are made, it becomes necessary to fill these especially for the high gain antennas. Experience has shown that pattern "fill" is usually not required for antennas with gains up to six for height above the terrain of about 1000 feet. For antennas having a gain of twelve and above, several alternate means are provided. Typical patterns are shown on the last page.

1. The standard antenna provides a 70/30 power split which fills in the odd nulls (first, third, etc.). The remaining nulls will be in the same general location as for a six bay antenna discussed above and usually will not require special treatment.

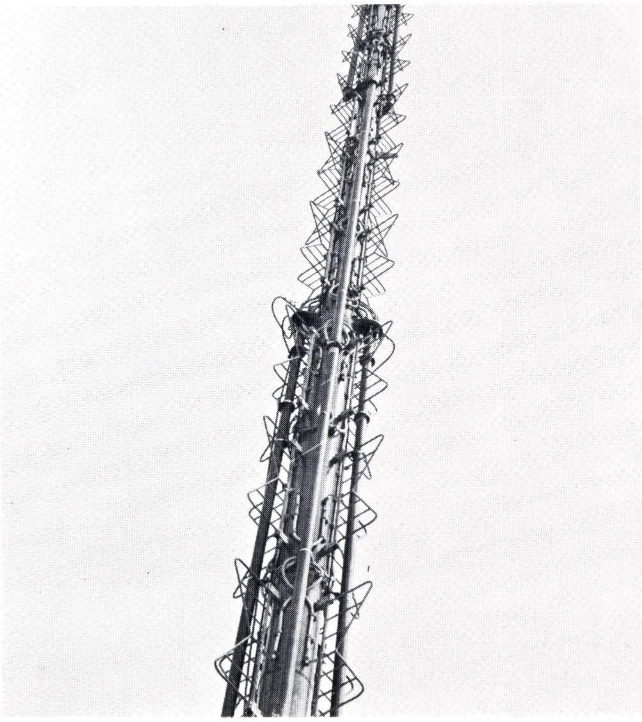
Antennas having a power split of both 50/50 and 70/30 are available for all antennas with a gain of 12 for all channels. Typical vertical patterns for these conditions are shown.

2. For the high band only, the TF-12BH provides an exceptionally heavy fill. Such a fill may be desirable when the service area starts at the base of the antenna and for heights over terrain substantially greater than 1000 feet. The large amount of fill reduces the gain of the antenna approximately 20 percent under that of the 12AH antenna with a 70/30 power division. Exact values are given in Table I and a vertical pattern for Channel 10.

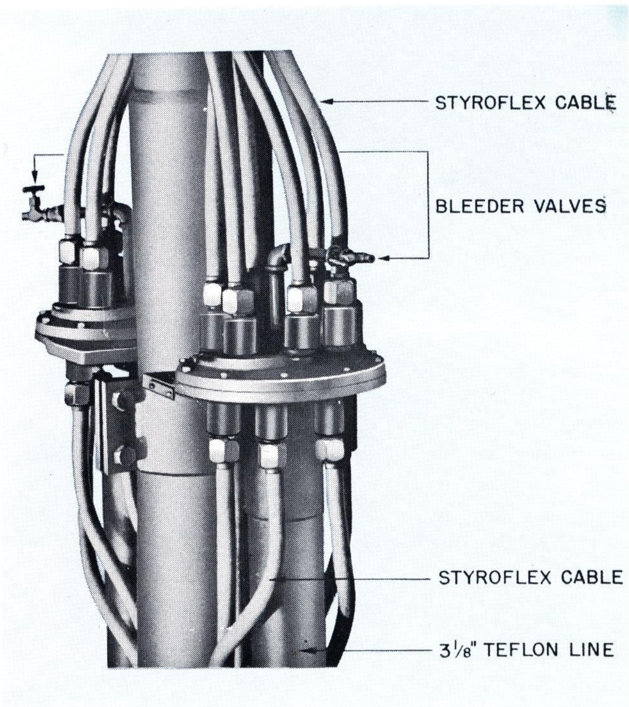
Beam Tilt

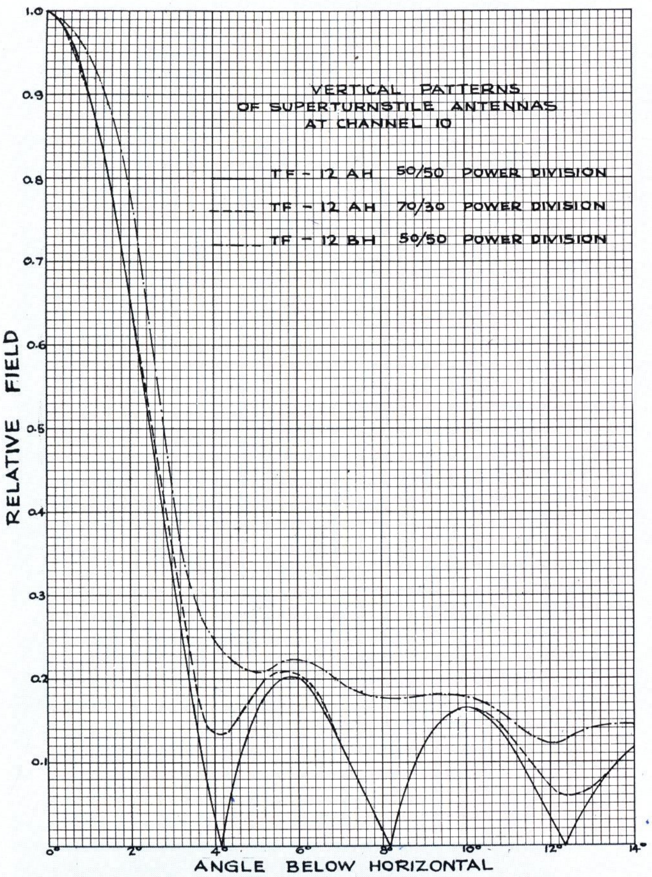
Beam tilt can be provided in the twelve section antennas. Beam tilt can be both electrical and mechanical. When electrical beam tilt is used, the phase of the upper six layers is advanced beyond the

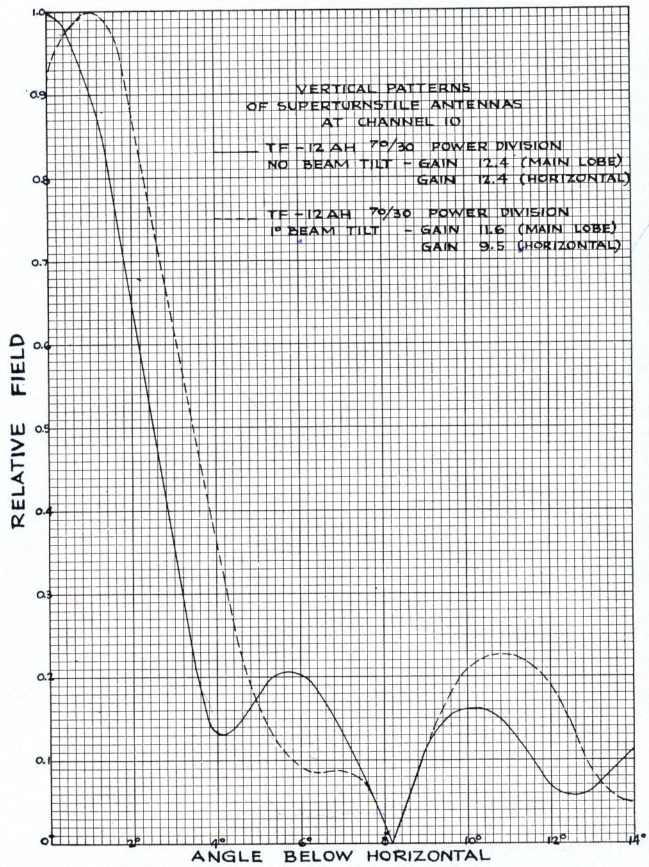
Closeup of Superturnstile showing typical feedline dress.



View of Junction Box Assembly.







lower six by changing the relative feed line length in the combining network. This produces the same beam tilt in all directions at the expense of approximately 7 percent gain in the main lobe. Exact values can be obtained on request. For great heights over the terrain, beam tilt may be valuable in increasing the local field while reducing it slightly above the horizontal. A graph shows the regular and one degree beam tilt pattern for a 12AH antenna at Channel 10. The MI number of the beam tilting section is listed in Table II (E and F) for the 12-section antennas.

TV Power Rating

The superturnstile antenna ratings given are based on the visual power at the peak of the synchronizing pulse which is known as the TV power rating.

This is based on the fact that the black level power is 0.6 of the peak visual power and that the aural power according to present standards is 0.2 of the peak visual power. For conditions other than assumed, the total average power should not exceed 0.8 times the peak visual power or the ratings will be exceeded. The rating is based on an ambient temperature of 104 degrees F. in still air.

Impedance

The antenna proper has been designed to meet a voltage standing wave specification of 1.1. In the light of recent investigations it seems desirable as an alternate to change the nature of this specification in the interest of obtaining the best picture. Variable transformers located below the junction box transformers can be installed and optimized for picture quality. In this process the VSWR will become higher at the band edges but the overall result may be more desirable.

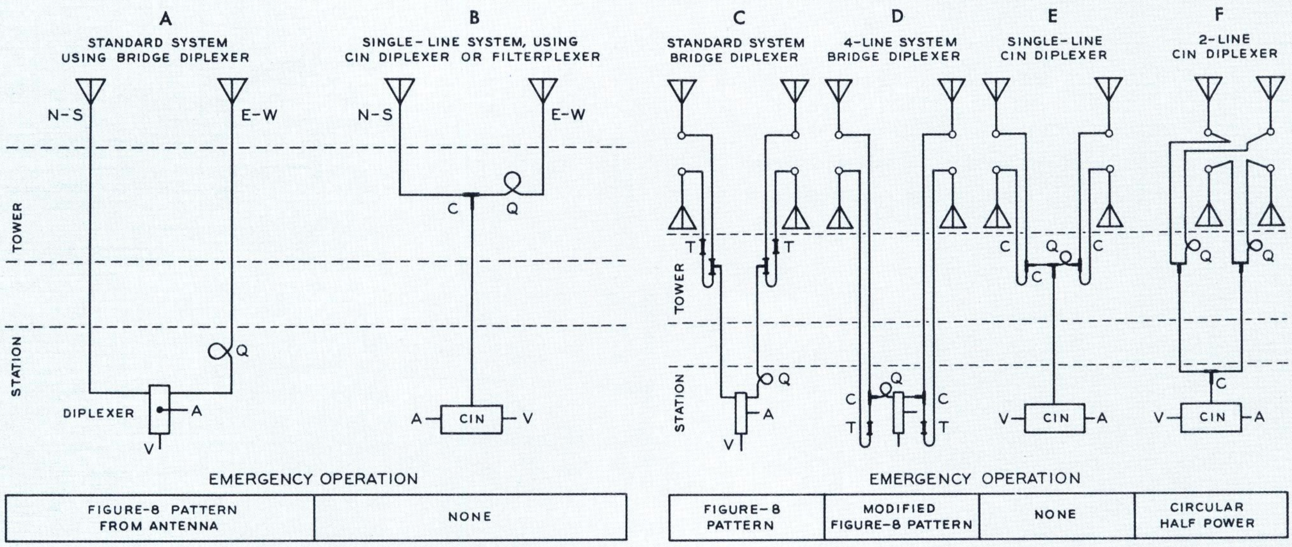
Emergency Features

The Superturnstile Antenna has built-in emergency features. This is not generally true of other antenna types.

The standard system is used in most cases since it provides for emergency operation and uses the bridge diplexing system for combined visual and aural operation into the antenna. For emergency operation in case of failure of the E-W transmission line (for instance), the E-W transmission line is replaced at the diplexer by a RF Load and Wattmeter, so that the N-S side of the antenna continues to radiate with a figure-8 coverage pattern. The bridge diplexer is the least expensive type of diplexer. See detailed information in this catalog.

The single-line system is used where the transmission line length is very great. Systems (A) and (B) are shown on the following page.

LEGEND:
CIN....................Constant impedance notch diplexer or filterplexer
C....................Combining tee
A....................Aural input
V....................Visual input
Q....................Quadrature phasing length
Filterplexer....................Combination vestigial sideband filter and constant impedance notch diplexer.



Transmission line systems for feeding antennas of six or less layers of radiators.

Transmission line systems for feeding antennas of more than six layers.

The (C) standard system is used in most cases since it provides for emergency operation and uses the bridge diplexing system for combined visual and aural operation into the antenna. If one line fails it is replaced at the diplexer by a RF Load and Wattmeter.

The (D) system provides greater flexibility by the addition of two more transmission lines.

The (E) system can be used where the transmission line length is very great and where other emergency antenna facilities are available.

The (F) system results in a half-power circular pattern for emergency operation.

LEGEND:

C........Combining tee
T........Beam tilting adjustment
Q........Quadrature phasing length
A........Aural input
V........Visual input
CIN........Constant impedance notch diplexer. A filterplexer (combined vestigial sideband filter and diplexer) may also be used.

Mechanical Characteristics

The pole is made of steel tubing. Sections of various diameters are telescoped and joined by swaging. For shipping purposes, the poles are made in convenient lengths which are assembled by means of welded field joints using rest collars for positive seating. The number of sections in which the pole is shipped (N) and the weight of the heaviest section (P) is given in Table II to assist the erector. The pole is shipped with one coat of red lead.

The radiators are made of steel tubing and solid round stock, and are hot dip galvanized. They are spaced from the pole by hot dip galvanized steel spacer plates and are thus firmly grounded.

Feed System

The junction boxes are made from a brass forging which eliminates the porosity often associated with castings. Each box can accommodate twelve styroflex feed-lines, six below and six above. The junction box and the three section transformer is made to precise mechanical dimensions. The design represents many years of accumulated experience. Great care has been taken to avoid electrolysis at the junction points of dissimilar metals. Supporting brackets, and some hardware is hot dip galvanized. The balance of the hardware is stainless steel. The feedlines are iridited styroflex cable cut to the precise length required for each channel. Complete instructions for assembling the feed system should be closely followed so as to obtain optimum performance. The design and assembly details which have been accumulated over many years have an important bearing on performance.

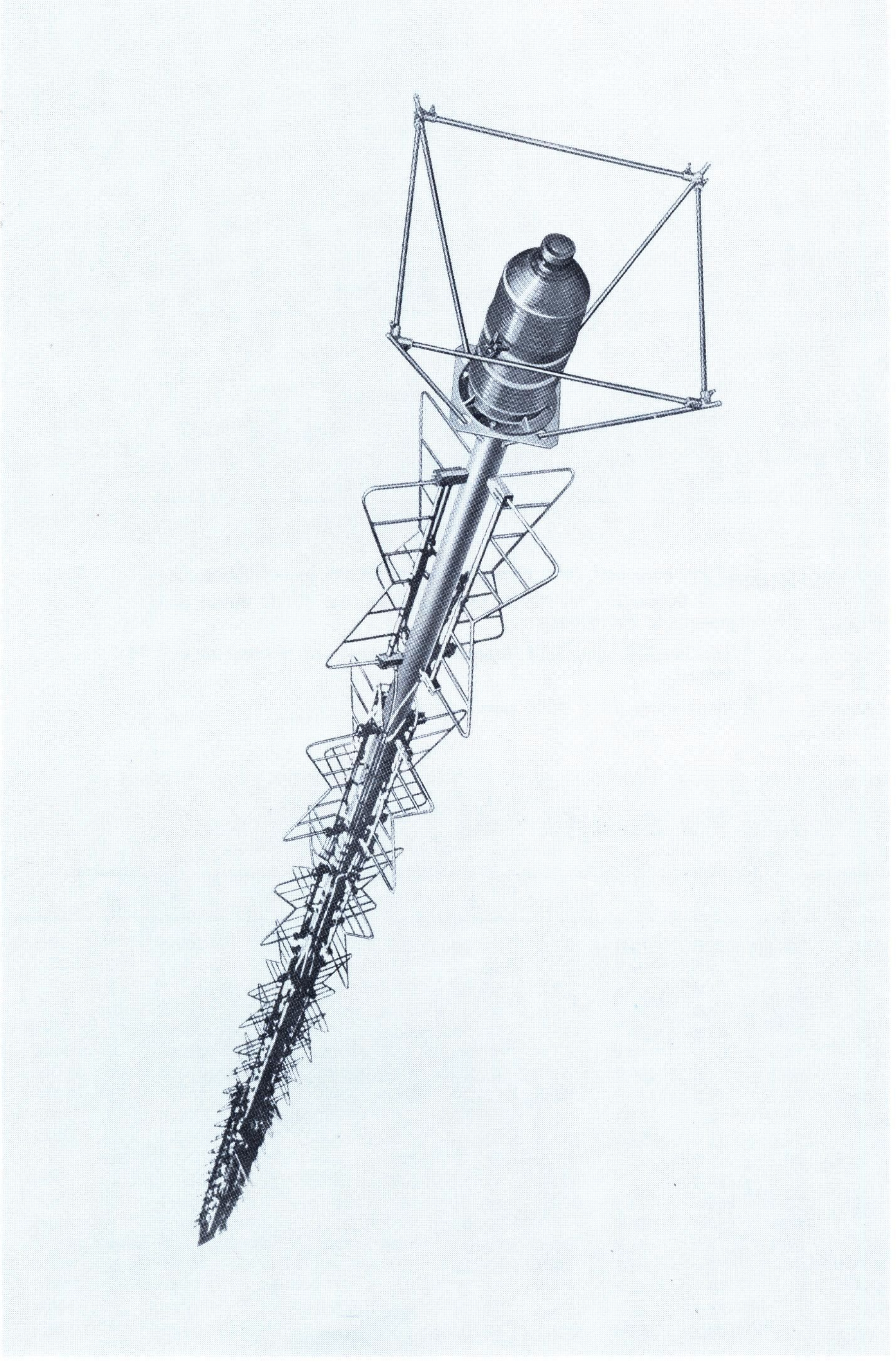
Lighting Provisions

A plate is provided for mounting the 300-millimeter beacon which, however, is not furnished with the antenna. A beacon cable which comes out of the bottom of the pole is also provided. Installation inside the pole avoids complications in the feed system. For the TF-12AM and 12AL only, additional obstruction lights are provided. A separate cable is provided which goes through the center of the pole and comes out of the bottom.

Deicing

The Superturnstile antenna has a low impedance feed point and is not too critical to ice. In geographical regions where ice does form, it is advisable to deice the area between the vertical member of the radiator and the pole. This is accomplished by a heater constructed of a resistánce unit mounted in a high nickel steel casing which mounts inside the vertical member. Each radiator requires heating power as follows: Ch. 2-3, 750 Watts; Ch. 4-6, 500 Watts; and Ch. 7-13, 200 Watts. The MI number of the deicer required is given in Table I. Each MI number includes four heaters, a junction box, connecting cables, and necessary hardware. The quantity of MI's required correspond to the number of sections in the antenna. The total number of kilowatts required for deicing is also given in Table I. The deicers may be operated automatically by a unit located at the level of the antenna which operates in the temperature range where ice is known to form. The Control Unit is identified as MI-27369.

RCA Superturnstile antennas include a lightning protector, feedlines and beacon.



Wind Load

Table II lists the wind reactions R_1, R_2, R_3, the moment arms D_1, and D_2, and overturn moment M in kip feet (thousands of foot pounds). The symbols are explained in the Definition of Mechanical Symbols. All values for gains of 2 to 12 are based on 50 pounds per square foot (psf) on flats and 30 psf on rounds (50/30). Antennas designed for higher wind loads can be obtained on request.

Custom Superturnstile Antennas

The Superturnstile antenna is very versatile and can be furnished for many special applications. Some of these are as follows:

Gain: Other gains than those listed can be furnished if required. Single section antennas are available for standby use.

Vertical Patterns: The various standard choices are shown. Patterns for special conditions can be achieved by amplitude and phase variations on request.

Horizontal Patterns: Peanut shape and figure eight patterns can be obtained. Their use will require a notch diplexer instead of the bridge diplexer normally used.

Power Handling: Antennas can be built for greater power ratings within limits.

Wind Load: Antennas can be built for greater wind loads for hurricane areas or other special situations if desired. This can be done without altering electrical performance or mechanical dimensions in Table II.

Emergency Provisions: Antennas having gains of less than 12 can be split to provide emergency antennas so that the upper half, lower half, or both can be used.

Stacking: Within certain limits antennas for several channels can be stacked above each other. This can be done rather easily for two six section antennas if the channels are in the same band group—low, medium or high since the antenna is practically a standard unit. Stacking can also be accomplished for antennas in different bands. In some cases the Superturnstile can be combined with other types such as the traveling wave or UHF antennas.

Diplexed Antenna Systems

As TV stations multiply and restrictions on the number and height of towers

Table I—Electrical Data For RCA Superturnstile Antennas

Type No.	ES No.	Power Gain for Channels 2	3	4	5	6	7	8	9	10	11	12	13	Circularity Within ± dB	Antenna Max. VSWR
TF-2BL	27246	1.9	2.1	—	—	—	—	—	—	—	—	—	—	2	1.1
TF-2BM	27269	—	—	1.9	2.1	2.2	—	—	—	—	—	—	—	2	1.1
TF-2BH	27270	—	—	—	—	—	2.1	2.1	2.2	2.2	2.2	2.3	2.4	2	1.1
	Gain dB	2.79	3.22	2.79	3.22	3.42	3.22	3.22	3.42	3.42	3.42	3.62	3.80		
TF-3EL	27265	2.9	3.1	—	—	—	—	—	—	—	—	—	—	2	1.1
TF-3EM	27266	—	—	2.9	3.1	3.3	—	—	—	—	—	—	—	2	1.1
	Gain dB	4.62	4.91	4.62	4.91	5.18	—	—	—	—	—	—	—		
TF-4BL	27267	4.0	4.1	—	—	—	—	—	—	—	—	—	—	2	1.1
TF-4BM	27268	—	—	4.0	4.2	4.4	—	—	—	—	—	—	—	2	1.1
	Gain dB	6.02	6.12	6.02	6.23	6.43	—	—	—	—	—	—	—		
TF-5CL	27264	4.9	5.1	—	—	—	—	—	—	—	—	—	—	2	1.1
TF-5CM	27245	—	—	4.9	5.3	5.4	—	—	—	—	—	—	—	2	1.1
	Gain dB	6.90	7.08	6.90	7.24	7.32	—	—	—	—	—	—	—		
TF-6AL	19292	5.9	6.1	—	—	—	—	—	—	—	—	—	—	2	1.1
TF-6BM	19291	—	—	6.0	6.4	6.5	—	—	—	—	—	—	—	2	1.1
TF-6AH	19213-C	—	—	—	—	—	6.2	6.3	6.7	6.7	6.8	6.8	6.9	2	1.1
	Gain dB	7.71	7.85	7.78	8.06	8.13	7.92	7.99	8.26	8.26	8.33	8.33	8.39		
TF-12AL[5]	19294	11.4	11.5	—	—	—	—	—	—	—	—	—	—	2	1.1
TF-12AM[5]	19295	—	—	11.8	12.0	12.1	—	—	—	—	—	—	—	2	1.1
TF-12AH[5]	19296	—	—	—	—	—									
or 12AH-P	19296-M	—	—	—	—	—	11.5	11.7	12.1	12.4	12.1	11.8	11.7	2	1.1
	Gain dB	10.57	10.61	10.72	10.79	10.83	10.61	10.68	10.83	10.93	10.83	10.72	10.68		
TF-12BH	19297	—	—	—	—	—									
or 12BH-P	19297-H	—	—	—	—	—	9.6	9.6	10.0	10.5	10.5	9.8	9.8	2	1.1
	Gain dB	—	—	—	—	—	9.82	9.82	10.0	10.21	10.21	9.91	9.91	2	1.1
TF-18AH[6]		—	—	—	—	—	—	—	—	—	—	—	—	—	—

[1] Quantity of MI's required corresponds to number given in Type Number as for instance 2 for TF-2BL

[2] Power Supply: Under 12 kW 230V 1 phase or 3 phase; 460V 1 phase or 3 phase
12 kW or over 230V 3 phase; 460V 1 phase or 3 phase

[3] 50 kW each half. Total power limited to 50 kW by combining network

[4] 35 kW each half, total power limited to 50 kW by combining network

[5] Gain figures are for 70/30 power division. For 50/50 power division gains are 4% higher

[6] Gain for Channels 7-13 depends on channel and amount of null fill desired

[7] Based upon using 20% aural power

Table II—Mechanical Data For Superturnstile Antennas

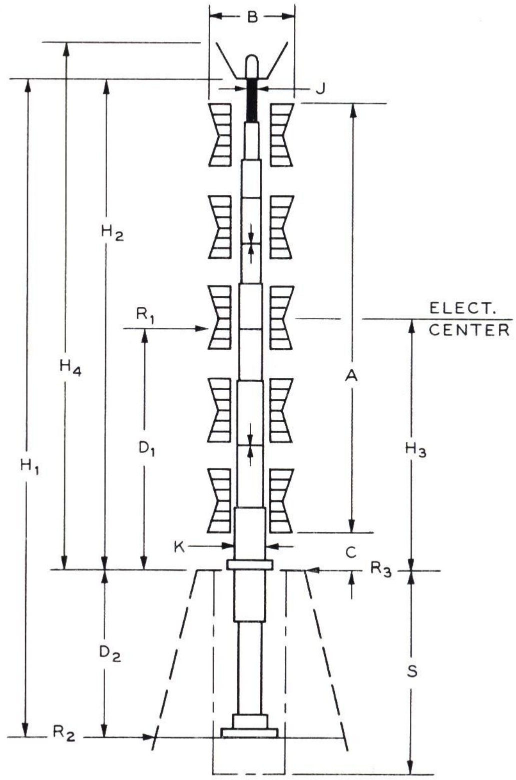
Type	A	B	C	D_1	D_2	E	F	H_1	H_2	H_3*	H_4	I	J	K	L	M	N	P
TF-2BL	27.6	9.0	2.7	18.0	6.0	—	—	38.0	32.0	16.5	37.5	50/30	7⅝	8⅝	20.0	29.2	2	880
TF-2BM	22.6	6.9	2.7	12.0	8.0	—	—	34.7	26.8	14.0	31.1	50/30	5.0	7⅝	21.5	16.4	2	384
TF-2BH	9.3	3.2	3.0	6.0	6.0	—	—	19.8	13.8	7.6	16.8	50/30	5.0	5.0	19.8	3.9	2	252
TF-3EL	44.6	9.0	3.7	21.0	8.0	—	—	58.0	50.0	26.0	55.6	50/30	5.0	11¾	32.0	54.2	3	1754
TF-3EM	36.7	6.9	3.7	18.0	8.0	—	—	49.8	41.8	22.0	46.1	50/30	5.0	9⅝	28.7	33.4	3	790
TF-4BL	61.6	9.0	2.7	27.0	12.0	—	—	78.0	66.0	33.5	71.5	50/30	5.0	14.0	32.0	100.4	4	3048
TF-4BM	50.7	6.9	2.7	25.0	10.0	—	—	64.8	54.8	28.0	59.1	50/30	5.0	11¾	28.7	69.0	4	1112
TF-5CL	78.6	9.0	2.7	37.0	16.0	—	—	99.0	83.0	42.0	88.5	50/30	5.0	18.0	31.0	190.9	5	3048
TF-5CM	64.7	6.9	2.7	31.0	16.4	—	—	85.2	68.8	35.0	73.1	50/30	5.0	14.0	31.0	115.3	5	2279
TF-6AL	95.6	9.0	3.7	43.3	20.0	—	—	121.0	101.0	51.5	106.5	50/30	5.0	20.0	26.2	287.7	6	2760
TF-6BM	78.7	6.9	2.7	36.5	16.4	—	—	99.2	82.8	42.0	87.1	50/30	5.0	16.0	29.0	173.0	6	2588
TF-6AH	33.2	3.2	2.6	18.6	10.0	—	—	47.3	37.3	19.3	40.3	50/30	5.0	8⅝	26.7	31.2	6	996
TF-12AL	197.6	9.0	2.7	85.0	30.0	19395-C	19395-D	232.0	202.0	121.9	207.5	50/30	5.0	26½	26.0	1428.0	12	6982
TF-12AM	162.7	6.9	2.7	68.5	24.0	19395-E	19395-F	190.8	166.8	100.8	171.1	50/30	5.0	25.0	28.7	860.0	12	5648
TF-12AH	68.5	3.2	3.0	32.2	11.5	19395-A	19395	84.4	72.9	44.3	75.9	50/30	5.0	12¾	26.7	127.0	12	2213
TF-12AH-P	68.5	3.2	5.5	34.0	—	19395-A	19395	—	75.4	46.8	78.4	50/30	5.0	12¾	26.7	132.7	12	1749
TF-12BH	68.5	3.2	3.0	32.2	—	27395-A	27395	84.4	72.9	44.3	75.9	50/30	5.0	12¾	26.7	127.0	12	2213
TF-12BH-P	68.5	3.2	5.5	34.0	—	27395-A	27395	—	75.4	46.8	78.4	50/30	5.0	12¾	26.7	132.7	12	1749
TF-18AH	108.7	3.2	3.0	48.7	20.0	—	—	128.2	108.2	54.9	111.2	50/33.3	5.0	16.0	30.6	349.0	18	7104

*H_3 for 70-30 power division. For 50-50 power division; the dimensions become TF-12AL 101.5; TF-12AM 84.0; TF-12AH 37.3; TF-12AH-P 39.8

TV Power Rating kW	dBk	Dual RF Input Lines MI No. or type	kW Required[2] for Deicers	Deicers[1] MI No.
12.3[7]	10.89	7/8-50 Ohm Styroflex	6	19009-B1
10.6[7]	10.25	7/8-50 Ohm Styroflex	4	19009-C1
6.5[7]	8.12	7/8-50 Ohm Styroflex	1.6	19009-J2
34.4[7]	15.36	19313	9	19009-B1
34.4[7]	15.36	19313	6	19009-C1
45.8[7]	16.60	19313	12	19009-B1
45.8[7]	16.60	19313	8	19009-C1
50.0[7]	16.99	19313	15	19009-B1
50.0[7]	16.99	19313	10	19009-C1
50	16.99	19313	18	19009-B1
50	16.99	19313	12	19009-C1
48.1[7]	16.82	19313	4.8	19009-J2
50[3]	16.99	19313	36	19009-B1
50[3]	16.99	19313	24	19009-C1
50[4]	16.99	19313	9.6	19009-J2
50	16.99	19313	9.6	19009-J2
50	16.99	19313		19009-J2

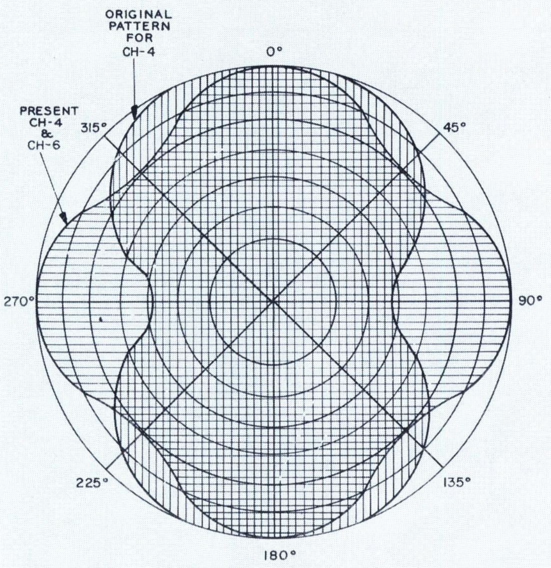
R_1	R_2	R_3	S	T	W
1620	4860	6480	—	—0.5	2.2
1370	2055	3425	—	—0.5	.85
660	660	1320	—	—0.5	.38
2580	6772	9352	—	—11.6	2.3
1860	4185	6045	—	—9.6	1.5
3720	8370	12,090	—	+3.8	3.6
2760	6900	9660	—	+3.3	2.4
5160	11,932	17,092	—	+0.9	5.2
3720	7030	10,750	—	—2.7	3.7
6630	14,380	21,010	—	+1.9	7.0
4740	10,540	15,280	—	—6.7	5.0
1680	3125	4805	—	+1.0	1.5
16,800	47,600	64,400	63.5	—24.9	40.0
12,540	35,800	48,340	44.2	—12.2	22.0
3950	11,070	15,020	30.2	—16.3	4.0
3900	—	—	18.8	—4.8	3.8
3950	11,070	15,020	30.2	—16.3	4.0
3900	—	—	18.8	—4.8	3.8
7165	17,446	24,611	37.0	—4.2	10.7

MECHANICAL SYMBOLS FOR SUPERTURNSTILE ANTENNAS

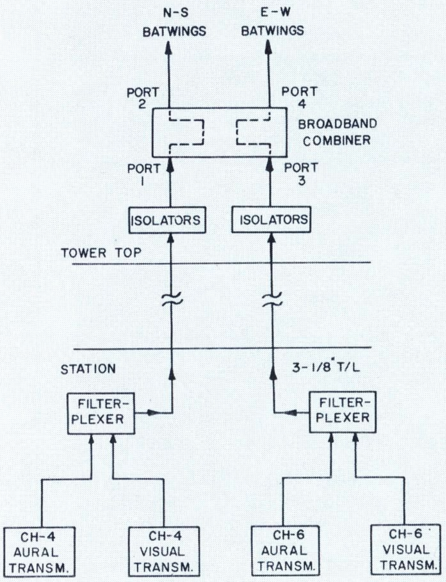


Definition of Mechanical Symbols

Symbol	Units	Definition
A	feet	Antenna aperture length
B	feet	Tip to tip radiator dimension
C	feet	Distance from lowest portion of lowest radiator to tower top
D_1	feet	Distance from tower top to center of wind loaded area of antenna
D_2	feet	Distance from tower top to bottom of bury section
E		MI number for Beam Tilting Section for 1 degree
F		MI number for Beam Tilting Section for 0.5 degree
H_1	feet	Overall pole length including bury section and pole socket plate
H_2	feet	Height of pole (only) above tower top
H_3	feet	Height of Electrical Center above tower top
H_4	feet	Height of Antenna above tower top including lightning protector
I	psf	Wind pressure for which the antenna is designed
J	inches	Pole diameter top section
K	inches	Pole diameter bottom section
L	feet	Shipping Length of longest pole section
M	Kip-feet	Overturn moment—$R_1 D_1$ (thousands of foot-pounds)
N		Number of sections in which pole is shipped
P	pounds	Weight of heaviest pole section
R_1	pounds	Wind reaction at center of wind loaded area
R_2	pounds	Wind reaction at lower end of bury section
R_3	pounds	Wind reaction at tower top ($R_1 + R_2$)
S	feet	Vertical height required below tower top for combining network
T	feet	Location of transmission line input connection to antenna below (—) or above (+) tower top
W	tons	Weight of complete antenna including bury section if used
Y	inches	Clearance hole diameter required in tower top for antenna or feed systems. Consult Instruction Book for clearance hole and drilling for guide flange and pole socket.

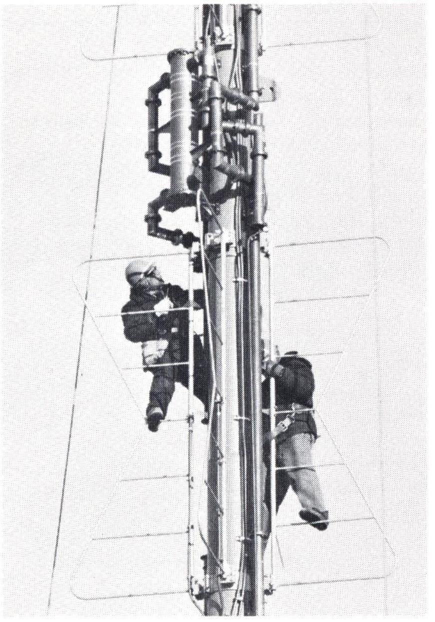


Dual radiation pattern capability of the Superturnstile Antenna. Peanut pattern was obtained by a relatively simple phase adjustment of one of the two diplexed signals.



Block diagram of diplexed antenna system.

Diplexed Superturnstile serving channels 4 and 6, showing rigid 3⅛-inch transmission lines feeding the combiner, and ⅞-inch Styroflex lines that feed batwing elements.



increases, antenna-sharing may become common practice in the near future. The RCA Superturnstile has proved ideal for diplexed operation in Rochester, Dallas, Mexico City and other cities.

Experience has shown that neither station sacrifices performance, effective antenna height, power gain, coverage or picture quality. All important aspects will be the same for both stations as if individual antennas and towers were used.

Components of a diplexed Superturnstile System are illustrated in the block diagram. Filterplexers accept both the aural and visual signals from two transmitters and diplex them onto individual insulated copper transmission lines. At the tower top, the signals are then fed through isolators to a broadband combiner that diplexes both channels on the feedlines to the East-West and North-South antenna elements of the Superturnstile.

This technique is applicable to any two high band channels found in a given market or channels 4 and 5 or channels 4 and 6.

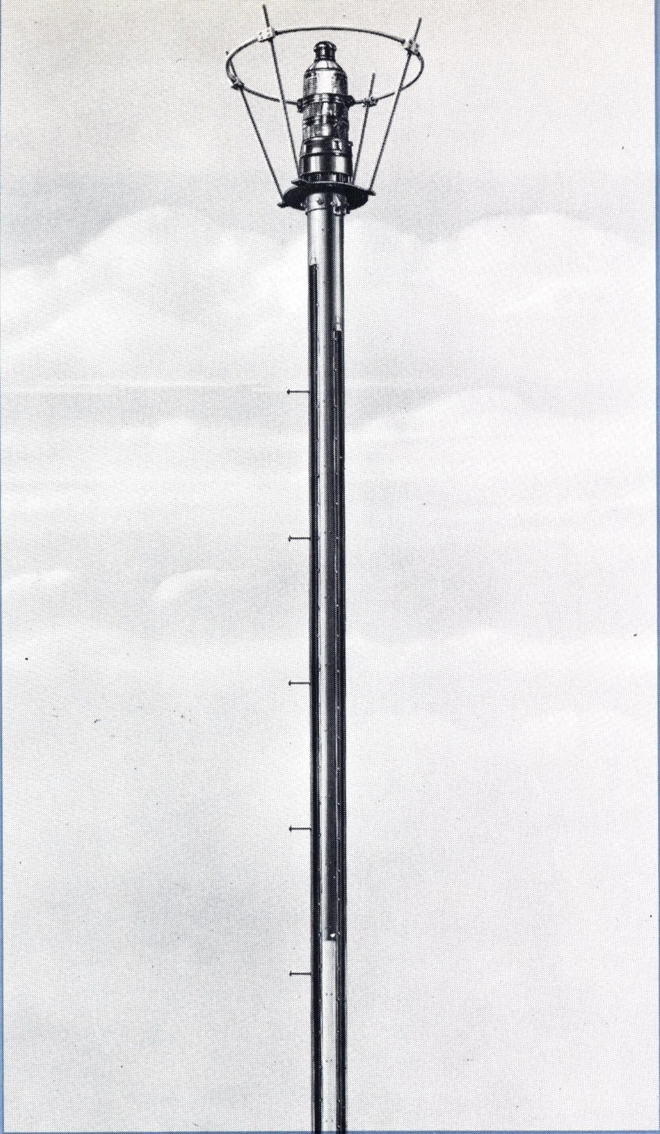
Equipment Supplied

RCA Standard Superturnstile antennas are shipped unassembled. The equipment supplied will consist of the following: antenna pole, radiators (4 per section), necessary hardware for assembly, lightning protector, feed-lines, junction boxes, pole socket and guide flange (except for the TF-12AM and 12AL where they are a part of the tower) and combining networks for 12-section antennas, and complete assembly instructions.

The assembly and erection of the antenna are not included as part of the services supplied, however, assembly supervision and electrical checkout by a qualified RCA Service Company engineer is included. This will includes tests before the antenna is raised to the tower top. The services of the RCA Service Company engineer assure the customer of minimum assembly time, correct installation and a comprehensive final test.

Communications Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102
RCA Broadcast Systems
PRINTED IN U.S.A.

catalog B.4108



- Available in gains of 9, 12, 15 and 18 on VHF channels 7 through 13
- "High-fill" null-free vertical pattern
- Excellent horizontal pattern circularity
- Directional patterns available
- High power-handling capacity
- Rugged, simple design
- Single feed point
- Inherently low standing wave ratio
- Low wind load

RCA VHF Traveling Wave Antenna

Description

The Traveling Wave Antenna provides an answer for the need of a VHF high-band antenna which combines appreciable improvements of electrical characteristics with mechanical simplicity and economy, especially in high-gain, high-power applications.

The RCA Traveling Wave Antenna is designed for operation on VHF channels 7 through 13 and is supplied with power gains of 9, 12, 15 and 18. Other gains can be supplied on a custom basis. At the higher gains this antenna provides an economical means to achieve 316 kW ERP when using a 25 kW transmitter. In the lower gains, because of its high power-handling capability it meets the requirements of broadcasters who prefer to use less gain in the antenna and higher transmitter power to achieve 316 kW ERP.

Because of its inherently null-free vertical pattern, the Traveling Wave Antenna provides excellent close-in coverage, with uniformly high field strength throughout the service area. Beam-tilt can be provided if desired with no change in the null-fill. Its horizontal pattern, with a specification of ±1 dB or better, is truly omnidirectional. Various types of directional patterns are also available. Power rating of the antenna is 50 kW at all channels and gains.

The RCA Traveling Wave Antennas are designed for tower mounting by means of a flange attached to the bottom of the antenna. In all antennas the same proven methods and materials are used, giving high quality service and long-time durability.

All antennas are furnished with inputs to match the customer's transmission line. When ordering, inputs should be specified as 6⅛-inch—75 Ohm, 3⅛-inch—50 Ohm Universal, 3⅛-inch—51.5 Ohm Teflon, etc.

12RB

Principles of Operation

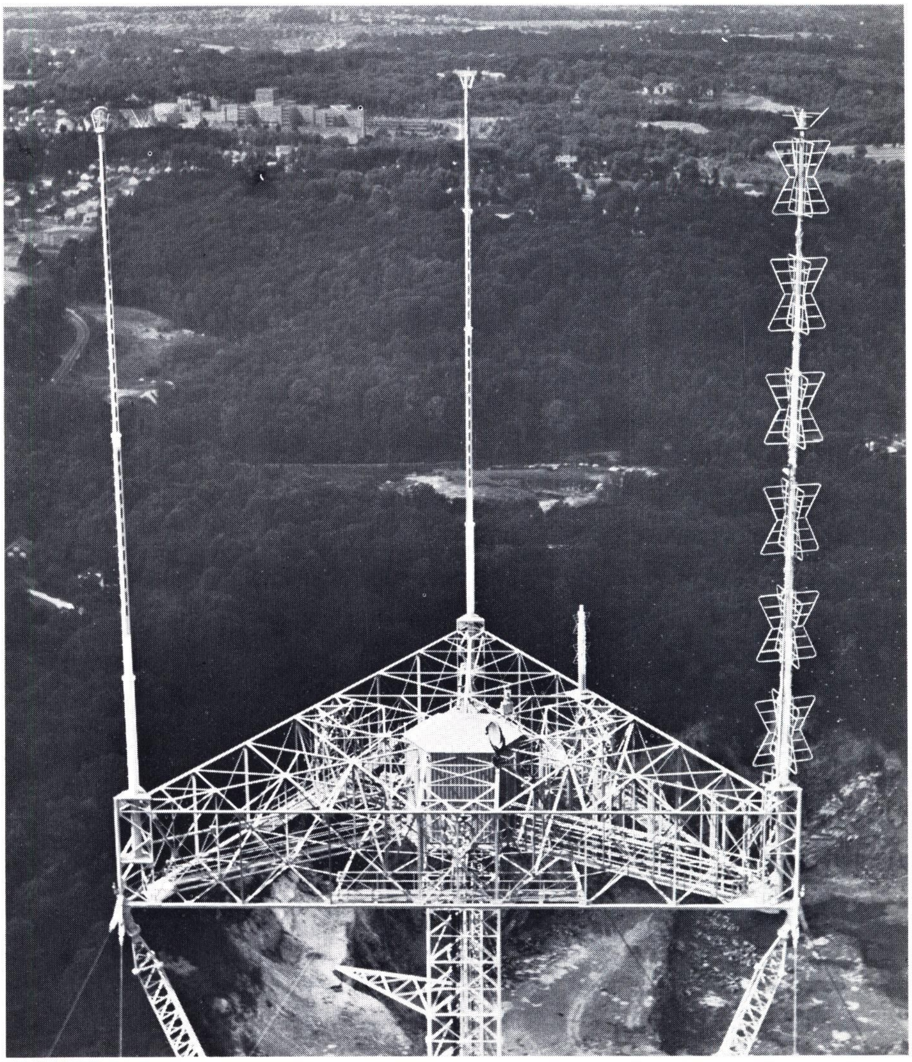
The RCA Traveling Wave Antenna is essentially a large coaxial transmission line having its outer conductors slotted. Currents on the outer conductor produced by the energized slots result in the desired radiation characteristics. The steel shell comprising the outer conductor, provides the needed mechanical strength as well as acting as the radiating surface. Large diameter copper tubing, supported by a plate across the bottom of the steel shell and shorted at the top, acts as the inner conductor.

The signal, entering from the side, near the base, turns upward through a broadband tee connection, and is extracted across the successive slots through the action of capacitive probes projecting radially inward from one side of each slot. An equal percentage of the power arriving at each pair of slots is extracted and radiated by the pair. The result is the exponential decrease along the length which produces a null free pattern. To simulate the ideal action of an infinitely long antenna, in which no energy would be reflected toward the source to form echos or distortion in the pattern, and to limit the length to a practical value, two pairs of "top loading" slots are used at the upper end. These absorb the small amount of power remaining and radiate it.

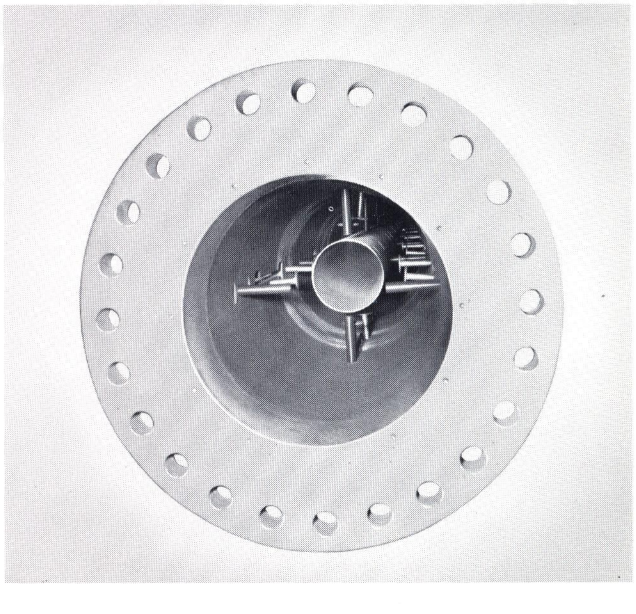
The slots are arranged in pairs at each level, with the pairs separated by a quarter wavelength along the length of the antenna. Successive pairs occupy planes at right angles to each other. Orientation of pickup probes is such that all slot pairs in a given plane are fed in phase.

The quarter wavelength separation of pairs accomplishes two results. In conjunction with the space-quadrature arrangement of successive pairs of slots, it affects a turnstile type feed which operates to give a truly circular pattern. Also, in the same fashion that insulators spaced each quarter wave in a transmission line tend to cancel each other, so the slot pairs tend to cancel reflections of energy from other slot pairs, resulting in an inherently low VSWR at the input to the antenna.

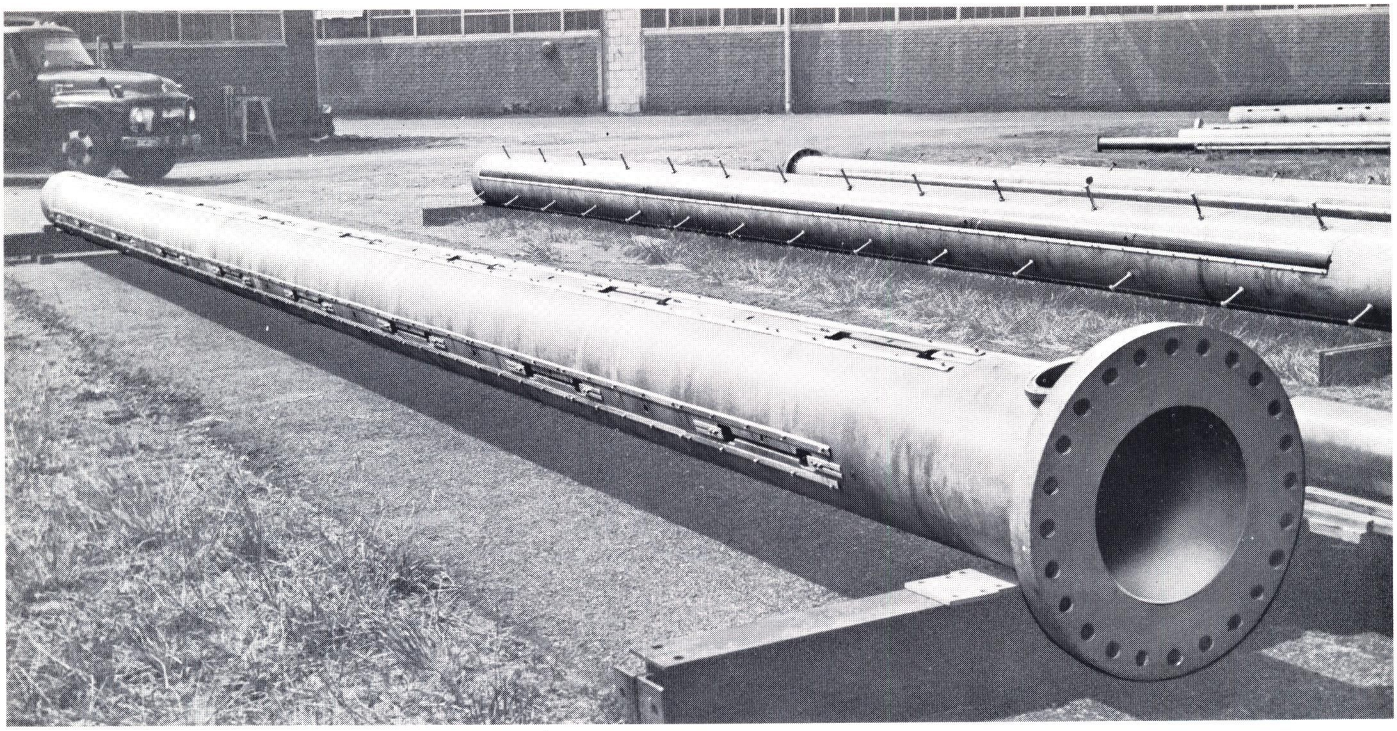
The potentially serious impedance discontinuity at the point where the signal enters the input connection and turns upward into the antenna is eliminated by the design of the T-connection which introduces practically no mismatch between 174 and 220 MHz.



Two RCA Traveling Wave and one Custom Superturnstile Antenna shown installed on world's first three-antenna candelabra which overlooks entire city of Baltimore.



End view of Traveling Wave Antenna showing method for supporting inner conductor with maximum number of slots. When half as many slots are employed, the dielectric pins extend from the wall.



Sections of pedestal type Traveling Wave Antenna showing slot patterns and tuning plates uncovered and covered with protective plastine covers.

Absence of external feedlines or other protruding members, in addition to the shape of the radiating surface also aid in the obtaining of the excellent circularity of radiated pattern.

Pattern bandwidth is achieved by proper design of the slots and their effect on the wave traveling inside the tube. The compensation which takes place maintains constant electrical spacing between slot pairs for all frequencies across the channel. The radiated beam may be tilted downward by any chosen amount by control of the spacing between slot pairs and by the design and setting of the pick-up probes and of coupling capacitors.

For certain combinations of channel, gain, and diameter of pipe it has been found preferable to use only half the number of slots. This is done by omitting alternate groups of N-S and E-W slots. Thus in one plane the pairs are one wavelength apart instead of one half wavelength. This configuration retains the traveling wave type of feed and does not affect either the pattern or the impedance characteristics of the antenna.

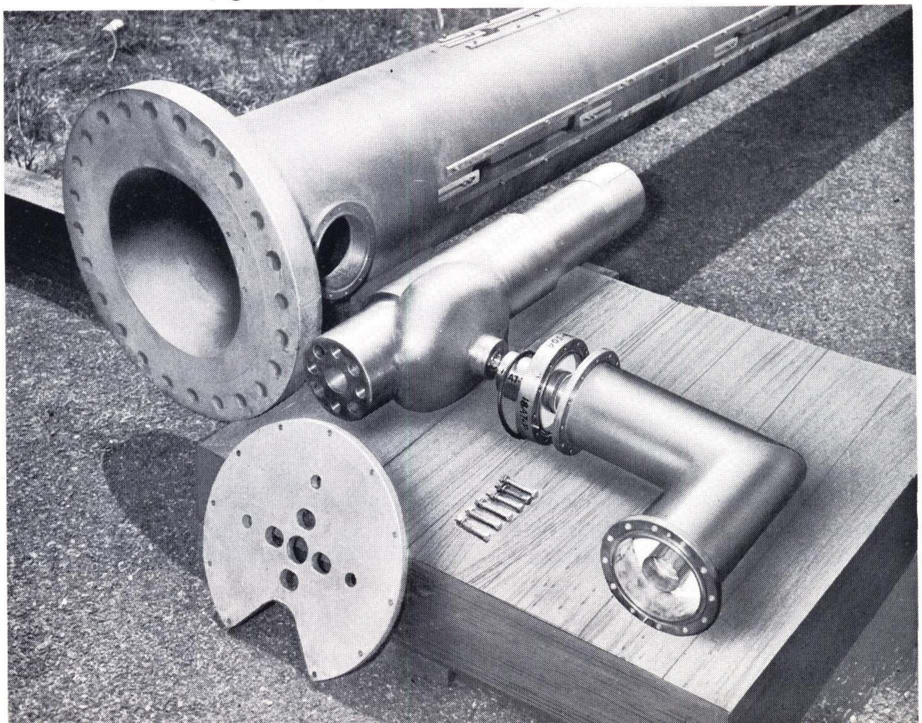
The simple construction, coupled with large safety factors used in the design of coupling probes and slot width insures that the 50-kilowatt power rating is highly conservative.

Mechanical Design

The steel outer conductor consists of two, three or four pipe sections, depending on the length of the antenna. The number of sections in which the pole is shipped (N) and the weight of the heaviest section (P) is given in Table II. The sections are bolted together with appropriate flanges welded to the ends of the tubes. All welding is done by certified welders and all welds on the pole are subject to X-ray examination in order to eliminate any bad welds.

The inner conductor, of copper, is sectionalized in the same manner as the outer shell. Connection is made between the sections by means of large bullets. The inner conductor is supported at the bottom by a steel plate and at the top by a plate clamped to the conductor and

View showing input of Traveling Wave Antenna with inner conductor, gas seal, miter elbow coupling and end plate.



bolted to the inside of the shell. Relative expansion between copper and steel is taken care of by suitable clearance between the inner conductors at the junction points.

Concentricity and mechanical restraint of the inner conductor is obtained by use of dielectric centering pins bearing radially against it. Where the full number of slots is used, these pins are inserted in and are extensions of the pickup probes. Where only half the possible number of slots are employed, the pins extend inward from the steel wall at points between co-linear slots.

Pole steps projecting from the outer shell provide a means of reaching the beacon or any part of the antenna. In addition a shackle affixed to an ear on the base of the lightning protector provides a means for supporting tackle for a bosun's chair.

Cable to supply power to the beacon runs inside the copper inner conductor.

Accessories for this antenna include a top beacon and a radome if the antenna is to be installed in an area subject to icing conditions.

WEATHER PROTECTION

Corrosion Resistance

Materials used in the antenna are hot dip galvanized steel for the outer slotted tube, copper for the inner conductor, iridited aluminum for the coupling probes, stainless steel hardware, and teflon or Enrad II for the centering pins. All of these materials have proven their worth over the years. A cross section of a portion of the antenna containing these materials was placed on a tower where the severest conditions of salt fog were experienced. After three years no changes were noted in the materials. These matrials are also used in a manner to insure that no corrosive effects occur from electrolysis or chemical action in industrial areas.

Wind

The antennas are designed according to EIA specifications of 50 pounds per square foot (psf) on flats and 33 psf on cylindrical surfaces. This is equivalent to a true extreme velocity of 110 miles per hour with no ice. Reactions for various antenna sizes based on 50/33 loading are shown in Table II. Loadings with ice must be calculated with consideration given to weather records, highest wind velocity and maximum ice coating experienced or anticipated. Custom antennas can be designed for special requirements.

One such design for extreme conditions of wind of 231-mile velocity and 2-inch radial ice is the Mount Washington antenna for station WMTW. No deicing was required since the radome in connection with a specially designed antenna remained stable under extreme icing conditions.

Rain

Slot covers are fastened to the pole over each vertical row of slots. They are made of a special polyethylene material that is not affected by ultra-violet rays from the sun, nor made brittle by the cold. To take care of condensation inside the antenna, provisions are made for drainage.

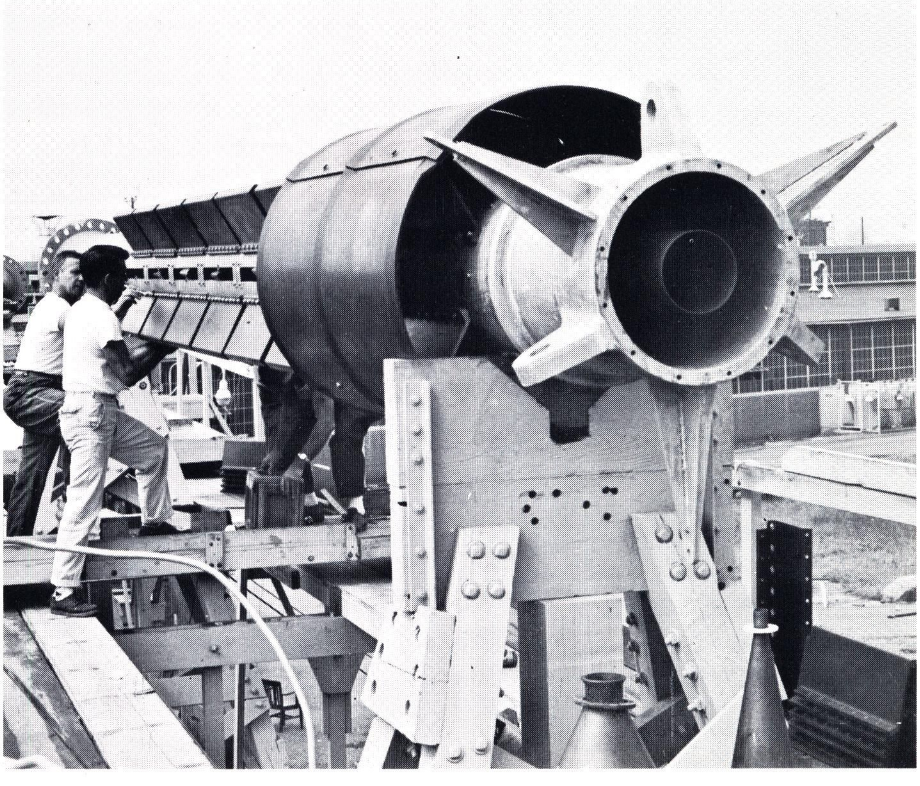
Ice or Snow

If ice collects on the slot covers, it lowers the resonant frequency of the slots thus affecting the performance of the antenna, mainly at aural carrier. Therefore, in areas where ice is likely to form a radome is recommended for stable performance of the antenna under these conditions. Table II provides the mechanical data for the Traveling Wave Antennas when equipped with a radome. This is an optional item and must be ordered concurrently with the antenna.

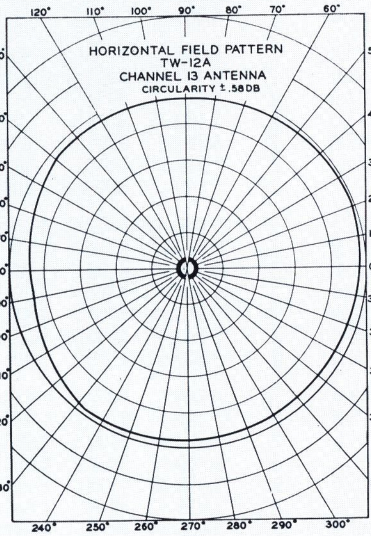
Lightning

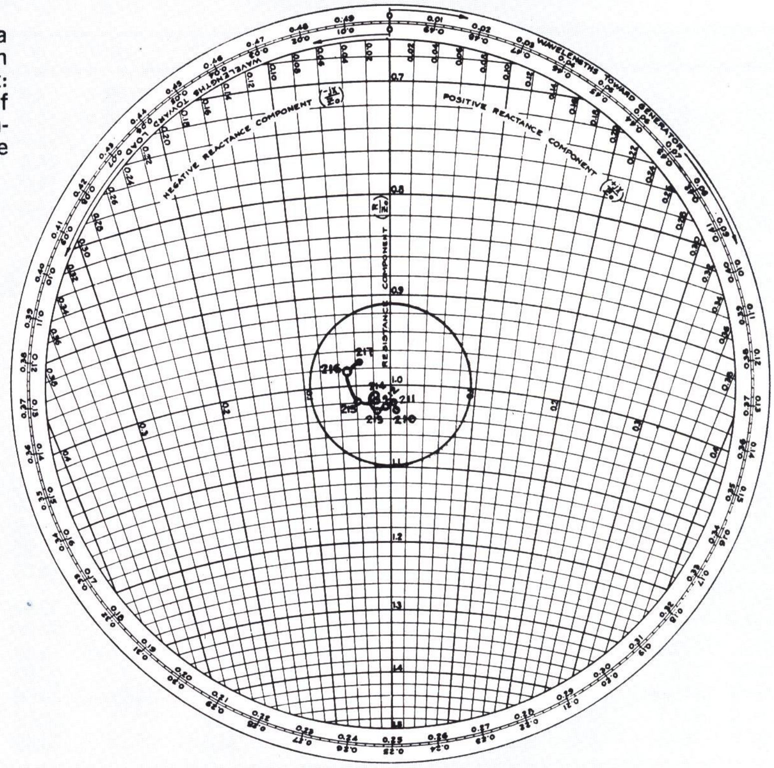
Since the antenna consists basically of a slotted cylinder which is firmly grounded to the tower, and since the inner conductor is also grounded to the outer at the top and bottom, it is highly improbable that lightning will damage the antenna. To protect the 300 mm beacon at slotted cylinder which is firmly gorunded the top of the antenna, a branching type lightning protector is furnished.

Mt. Washington antenna undergoing development. View shows section of the Traveling Wave Antenna being enclosed with plastic radome through which projects the upper end of the antenna providing three lugs for the guy cables and three ears for supporting tackle for the bosun's chair.



Below: Measured horizontal field pattern of a TW-12A (gain of 12) Channel 13 Antenna. Pattern is typical of RCA Traveling Wave Antennas. Right: Measured input impedance of a TW-18A (gain of 18) Channel 13 Antenna. This impedance plot indicates that impedances across the channel are well below the 1.1 circle.





SPECIAL APPLICATIONS

The Traveling Wave Antenna can be furnished for various special applications as follows:

Gains: Special gains can be furnished if required.

Vertical Patterns: Vertical patterns can be varied to meet special requirements.

Horizontal Patterns: Various directional patterns can be achieved. See Custom Antenna Catalog for information.

Wind Load: Higher wind load ratings can be obtained for special situations. The antenna as shown was designed for 231 mph.

Ice: For unusually severe icing conditions, a radome design is available.

Specifications

Electrical Specifications

Channel Range 7-13
Vertical Pattern .... See Typical patterns
Beam Tilt .... Available as desired. Specify at time of ordering
Circularity .... Within ±1.0 dB
Max. VSWR Ratio* 1.1/1.0
TV Power Rating .... 50 kW—16.99 dBK
TV Power Rating .... 50 kW—16.99 dBk
Input Terminal .... 6⅛"—50 Ohms, flange connection

* The antenna itself has been designed to meet a voltage standing wave specifications of 1.1 or better. In the light of recent investigations it seems desirable as an alternate to change the nature of this specification to one that is more closely related to the quality of the picture. This is the RF Pulse Specification which closely simulates transient picture transmission conditions. The pulse specifications can be substituted for the VSWR specifications.

Transformation Furnished to .... 3⅛"—50 Ohms, MI-27991-D
3⅛"—51.5 Ohms, MI-19313
6⅛"—75 Ohms, MI-27992-D
(Please specify requirements)

Radomes: Order concurrently with antenna when required.

Power Gain Over Dipole:

Type	Channel 7	8	9	10	11	12	13
TW-9A-P	9.4	9	9	9	9	9	9
TW-12A-P	12	12	12	12	12	12	12.4
TW-15A-P	15	15.8	15	15*	15.8	15*	15
TW-18A-P	18	18	18	18	18	18	18

* A standard design with a gain of 16 is also available for these channels.

TABLE I MECHANICAL DATA FOR TRAVELING WAVE ANTENNA (SLOT COVER TYPE)

Type	A	D_1	H_2	H_3	H_4	I	J	K	L	M	N	P	R_1	T	U
TW-9A7	69.3	37.5	76.0	40.0	79.0	50/33.3	10.75	14.0	44.0	110.0	2	7,700	2950	.312	20.25
TW-9A8	66.1	38.0	73.0	38.0	76.0	50/33.3	14.00	14.0	38.0	118.0	2	6,500	3100	.312	20.25
TW-9A9	63.0	36.0	69.0	36.0	72.0	50/33.3	14.00	14.0	36.0	106.0	2	6,100	2950	.312	20.25
TW-9A10	61.0	35.0	68.0	35.5	71.0	50/33.3	14.00	14.0	34.0	102.0	2	5,800	2900	.312	20.25
TW-9A11	60.4	35.0	66.0	35.0	69.0	50/33.3	14.00	14.0	31.0	102.0	2	5,300	2900	.312	20.25
TW-9A12	58.7	34.5	66.0	34.5	69.0	50/33.3	14.00	14.0	33.0	98.0	2	5,800	2850	.312	20.25
TW-9A13	54.6	32.0	62.0	31.5	65.0	50/33.3	14.00	14.0	31.5	87.0	2	5,500	2700	.312	20.25
TW-12A7	88.1	43.5	95.0	49.0	98.0	50/33.3	10.75	18.00	45.0	178.0	2	9,400	4100	1.937	24.75
TW-12A8	85.3	42.0	92.0	47.5	95.0	50/33.3	10.75	18.00	45.0	168.0	2	9,400	4000	1.937	24.75
TW-12A9	79.8	41.5	88.0	46.0	91.0	50/33.3	10.75	14.00	43.0	137.0	2	9,000	3300	.312	20.25
TW-12A10	80.1	42.5	87.0	45.0	90.0	50/33.3	14.00	14.00	42.0	141.0	2	7,100	3300	.312	20.25
TW-12A11	75.3	40.0	82.5	43.0	85.5	50/33.3	10.75	14.00	44.8	128.0	2	6,700	3200	.312	20.25
TW-12A12	71.3	41.5	80.0	42.0	83.0	50/33.3	14.00	14.00	41.0	141.0	2	7,200	3400	.312	20.25
TW-12A13	71.2	38.5	78.0	40.5	81.0	50/33.3	10.75	14.00	45.0	116.0	2	5,800	3000	.312	20.25
TW-15A7	109.5	54.0	116.0	60.0	119.0	50/33.3	10.75	18.00	45.0	292.0	3	9,000	5400	1.937	24.75
TW-15A8	108.6	53.0	115.0	59.0	118.0	50/33.3	10.75	18.00	44.0	280.0	3	8,600	5300	1.937	24.75
TW-15A9	102.7	50.0	110.0	56.5	113.0	50/33.3	10.75	18.00	45.0	230.0	3	8,500	4600	1.937	24.75
TW-15A10	100.6	48.5	106.0	55.0	109.0	50/33.3	10.75	18.00	45.5	215.0	3	9,900	4450	1.937	24.75
TW-15A11	102.5	50.0	109.0	56.5	112.0	50/33.3	10.75	18.00	45.0	250.0	3	7,300	5000	1.937	24.75
TW-15A12	91.7	44.0	97.0	50.5	100.0	50/33.3	10.75	18.00	39.5	180.0	3	8,600	4100	1.937	24.75
TW-15A13	91.0	44.5	98.0	50.5	101.0	50/33.3	10.75	18.00	53.8	200.0	2	9,600	4500	1.937	24.75
TW-18A7	131.0	61.5	137.5	70.0	140.5	50/33.3	10.75	20.00	48.2	418.0	3	19,600	6800	1.937	27.00
TW-18A8	126.2	59.5	133.0	68.0	136.0	50/33.3	10.75	20.00	50.8	375.0	3	17,300	6300	1.937	27.00
TW-18A9	119.4	60.0	126.0	64.5	129.0	50/33.3	10.75	18.00	45.0	324.0	3	9,400	5400	1.937	24.75
TW-18A10	116.5	56.5	123.0	63.0	126.0	50/33.3	10.75	20.00	45.0	316.0	3	9,800	5600	1.937	27.00
TW-18A11	115.0	54.5	122.0	62.5	125.0	50/33.3	10.75	20.00	45.0	305.0	3	9,500	5550	1.937	27.00
TW-18A12	111.7	54.0	117.0	60.0	120.0	50/33.3	10.75	18.00	46.5	267.0	3	8,000	4950	1.937	24.75
TW-18A13	106.6	52.0	113.0	58.0	116.0	50/33.3	10.75	18.00	45.0	242.0	3	7,400	4650	1.937	24.75

TABLE II MECHANICAL DATA FOR TRAVELING WAVE ANTENNA (RADOME TYPE)

Type	A	D_1	H_2	H_3	H_4	I	J	K	L	M	N	P	R_1	T	U
TW-9A7-R	69.3	35.0	76.0	40.0	79.0	50/33.3	10.75	14.00	44.0	160.0	2	8,200	4600	.312	20.25
TW-9A8-R	66.1	34.0	73.0	38.0	76.0	50/33.3	14.00	14.00	38.0	150.0	2	7,000	4400	.312	20.25
TW-9A9-R	63.0	33.5	69.0	36.0	72.0	50/33.3	14.00	14.00	36.0	148.0	2	6,600	4400	.312	20.25
TW-9A10-R	62.2	33.0	68.0	35.5	71.0	50/33.3	14.00	14.00	35.5	138.0	2	6,600	4200	.312	20.25
TW-9A11-R	60.4	32.0	66.0	35.0	69.0	50/33.3	14.00	14.00	33.5	132.0	2	6,200	4100	.312	20.25
TW-9A12-R	58.7	32.5	66.0	34.5	69.0	50/33.3	14.00	14.00	33.0	130.0	2	6,100	4000	.312	20.25
TW-9A13-R	57.1	31.0	62.0	31.5	65.0	50/33.3	14.00	14.00	33.0	120.0	2	6,000	3900	.312	20.25
TW-12A7-R	88.1	41.0	95.0	49.0	98.0	50/33.3	10.75	18.00	51.5	234.0	2	10,300	5700	1.937	24.75
TW-12A8-R	85.3	41.0	92.0	47.5	95.0	50/33.3	10.75	18.00	48.0	236.0	2	9,800	5800	1.937	24.75
TW-12A9-R	82.6	40.5	88.0	46.0	91.0	50/33.3	10.75	14.00	45.0	207.0	2	8,400	5100	.312	20.25
TW-12A10-R	80.1	44.0	87.0	45.0	90.0	50/33.3	14.00	14.00	45.0	220.0	2	8,200	5000	.312	20.25
TW-12A-R	75.3	39.0	82.5	43.0	85.5	50/33.3	10.75	14.00	44.8	175.0	2	7,200	4500	.312	20.25
TW-12A12-R	71.4	40.0	80.0	42.0	83.0	50/33.3	14.00	14.00	45.0	200.0	2	8,200	5000	.312	20.25
TW-12A13-R	71.2	36.0	78.0	40.5	81.0	50/33.3	10.75	14.00	45.0	155.0	2	6,100	4300	.312	20.25
TW-15A7-R	110.7	50.0	116.0	60.0	119.0	50/33.3	10.75	18.00	48.5	345.0	3	9,200	6900	1.937	24.75
TW-15A8-R	108.6	49.5	115.0	59.0	118.0	50/33.3	10.75	18.00	49.0	342.0	3	9,100	6900	1.937	24.75
TW-15A9-R	103.8	48.5	110.0	56.5	113.0	50/33.3	10.75	18.00	45.0	330.0	3	9,000	6800	1.937	24.72
TW-15A10-R	100.6	49.0	106.0	55.0	109.0	50/33.3	10.75	18.00	45.0	320.0	3	10,400	6500	1.937	24.75
TW-15A11-R	102.5	47.5	109.0	56.5	112.0	50/33.3	10.75	18.00	45.6	314.0	3	8,600	6600	1.937	24.75
TW-15A12-R	94.9	47.0	97.0	50.5	100.0	50/33.3	10.75	18.00	52.0	300.0	3	9,100	6400	1.937	24.75
TW-15A13-R	91.0	42.0	98.0	50.5	101.0	50/33.3	10.75	18.00	53.8	252.0	2	10,000	6000	1.937	24.75
TW-18A7-R	130.9	58.0	137.5	70.0	140.5	50/33.3	10.75	20.00	48.2	493.0	3	20,200	8500	1.937	27.00
TW-18A8-R	126.2	56.5	133.0	68.0	136.0	50/33.3	10.75	20.00	50.8	463.0	3	20,100	8200	1.937	27.00
TW-18A9-R	119.7	53.0	126.0	64.5	129.0	50/33.3	10.75	20.00	50.0	395.0	3	20,100	7500	1.937	27.00
TW-18A10-R	116.5	46.0	123.0	63.0	126.0	50/33.3	10.75	20.00	50.0	385.0	3	19,800	7400	1.937	27.00
TW-18A11-R	115.0	52.0	122.0	62.5	125.0	50/33.3	10.75	20.00	48.0	380.0	3	19,500	7300	1.937	27.00
TW-18A12-R	111.7	50.5	117.0	60.5	120.0	50/33.3	10.75	18.00	46.3	354.0	3	9,300	7000	1.937	24.75
TW-18A13-R	106.6	50.0	113.0	58.0	116.0	50/33.3	10.75	18.00	50.0	340.0	3	10,000	6800	1.937	24.75

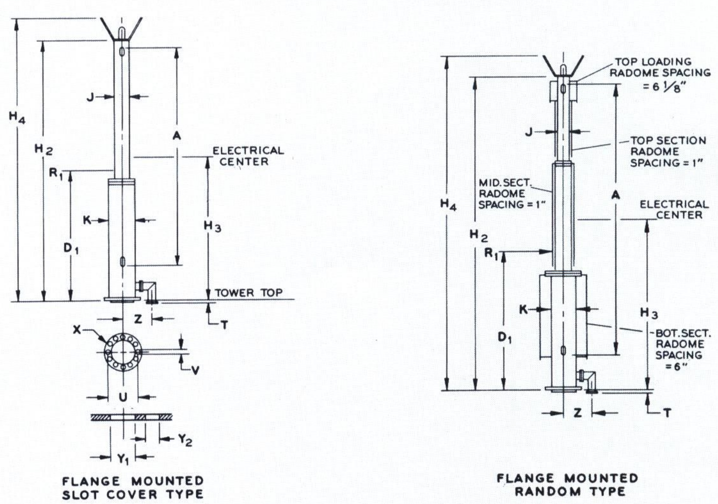
	X	Y_1	Y_2	Z
[illegible]	20	14.38	8.5	22.03
6.4	20	14.38	8.5	22.03
6.0	20	14.38	8.5	22.03
[illegible]	20	14.38	8.5	22.03
[illegible]	20	14.38	8.5	22.03
[illegible]	20	14.38	8.5	22.03
5.5	20	14.38	8.5	22.03
[illegible]	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
[illegible]	20	14.38	8.5	22.03
6.4	20	14.38	8.5	22.03
6.0	20	14.38	8.5	22.03
[illegible]	20	14.38	8.5	22.03
[illegible]	20	14.38	8.5	22.03
10.7	24	18.38	8.5	24.00
10.9	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
7.8	24	18.38	8.5	24.00
8.0	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
10.7	24	18.38	8.5	24.00
14.8	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00

W	X	Y_1	Y_2	Z
[illegible]	20	14.38	8.5	22.03
[illegible]	20	14.38	8.5	22.03
[illegible]	20	14.38	8.5	22.03
6.3	20	14.38	8.5	22.03
6.1	20	14.38	8.5	22.03
[illegible]	20	14.38	8.5	22.03
[illegible]	20	14.38	8.5	22.03
8.5	24	18.38	8.5	24.00
8.3	24	18.38	8.5	24.00
[illegible]	20	14.38	8.5	22.03
[illegible]	20	14.38	8.5	22.03
[illegible]	20	14.38	8.5	22.03
7.5	20	14.38	8.5	22.03
6.0	20	14.38	8.5	22.03
[illegible]	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
10.2	24	18.38	8.5	24.00
10.0	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
18.2	24	18.38	8.5	24.00
17.5	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
[illegible]	24	18.38	8.5	24.00
16.0	24	18.38	8.5	24.00
10.4	24	18.38	8.5	24.00
10.0	24	18.38	8.5	24.00

DEFINITION OF MECHANICAL SYMBOLS

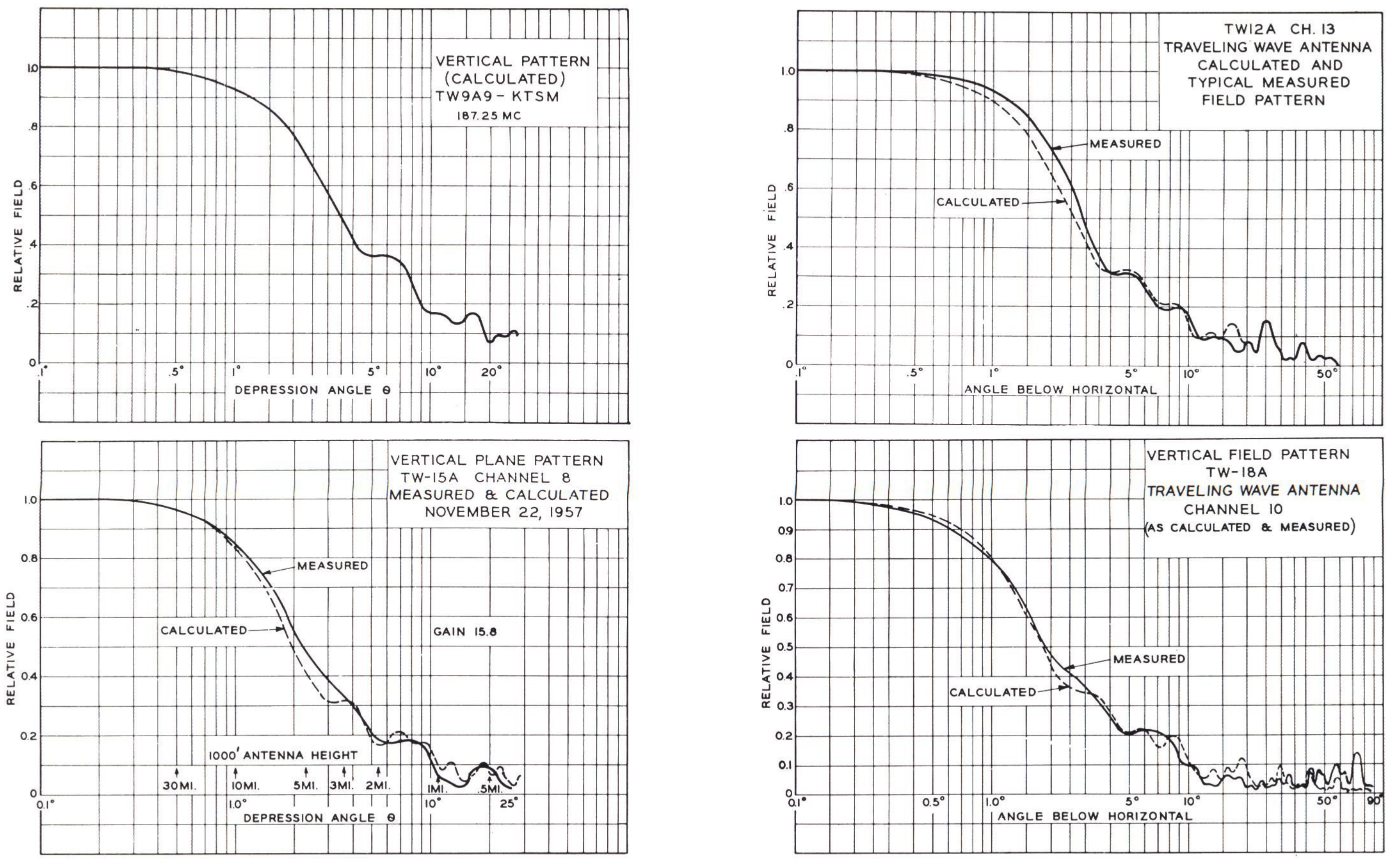
Symbol	Unit	Definition
A	Feet	Antenna Aperture Length
D_1	Feet	Distance from tower top to center of wind loaded area of Antenna
H_2	Feet	Height of Antenna (only) above tower top
H_3	Feet	Height of Electrical center above tower top
H_4	Feet	Height of antenna above tower top including lightning protector
I	PSF	Wind pressure for which the antenna is designed
J	Inches	Pole diameter—top section, excluding slot covers
K	Inches	Pole diameter—bottom section, excluding slot covers
L	Feet	Shipping length of longest pole section
M	Kip-feet	Overturn moment—R_1 D_1 (thousands of foot pounds)
N		Number of sections in which pole is shipped
P	Lbs.	Weight of heaviest pole section
R_1	Lbs.	Wind reaction at center of wind loaded area
T	Inches	Location of transmission line input connection to antenna below (—) or above (+) tower top
U	Inches	Diameter of bolt circle of base flange
V	Inches	Bolt diameter used in base flange
W	Tons	Weight of complete antenna including inner conductor
X		Number of equally spaced bolts used in base flange
Y_1	Inches	Clearance hole diameter required in tower top for antenna bottom plate
Y_2	Inches	Clearance hole diameter required in tower top for transmission line to the antenna input
Z	Inches	Center to center distance between Y_1 & Y_2

Outline drawing of Traveling Wave Antennas, Flange mounted type (left) and Bury mounted type (right).

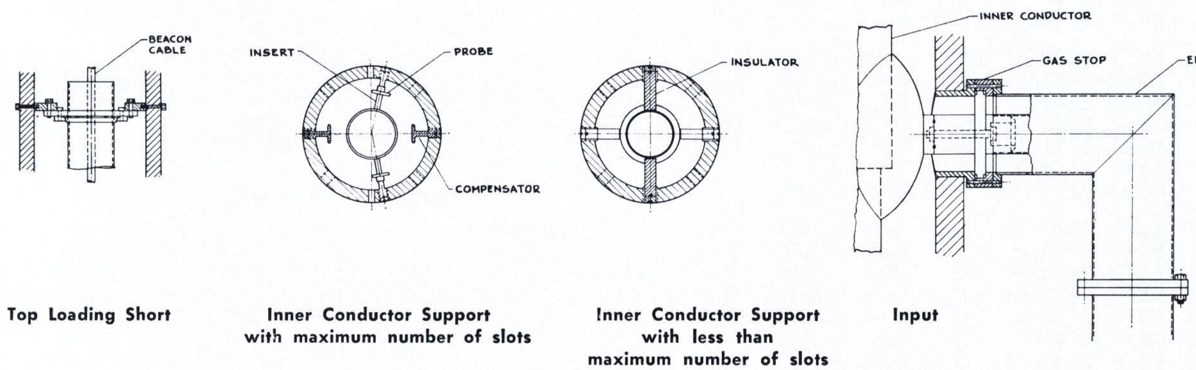


Mechanical Specifications

Mechanical Table I covers the Slot Cover Type. Table II covers the mechanical data for Traveling Wave Antennas when equipped with a radome. This combination has a "R" added to the type number. The sketch delineates the various dimensions and reactions. Sufficient data is provided for the tower designer including the top plate clearance holes. The symbols in the table are defined in the key listed.



Typical Traveling Wave vertical field patterns for the four nominal values of gain obtained in RCA Traveling Wave Antennas are shown here for comparison.



Construction details of RCA Traveling Wave Antenna showing (left to right) top loading short, inner conductor support with maximum number of slots, inner conductor support with less than maximum number of slots, and antenna input.

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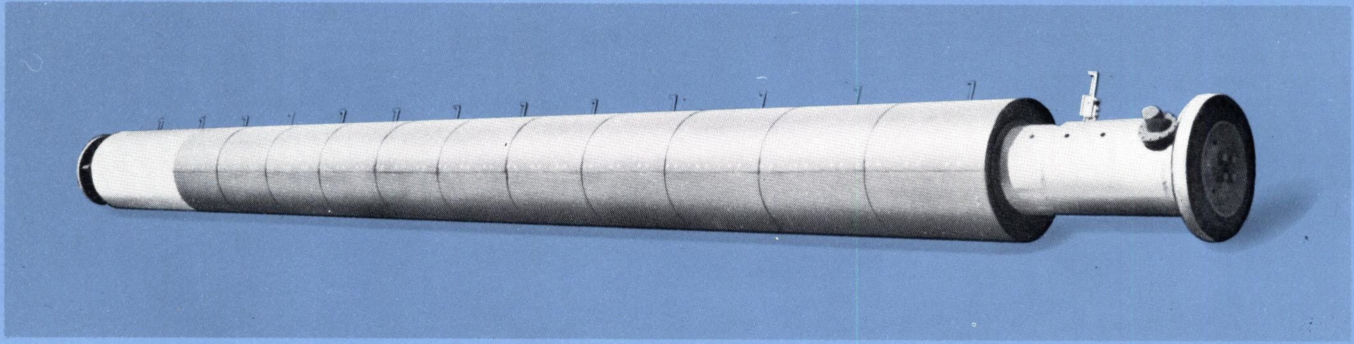
RCA Broadcast Equipment



- Stabilizes antenna performance during adverse weather conditions
- Requires no power
- Eliminates need for deicers
- Rugged, trouble free— Easily maintained

RCA Traveling Wave Antenna Radomes

Description

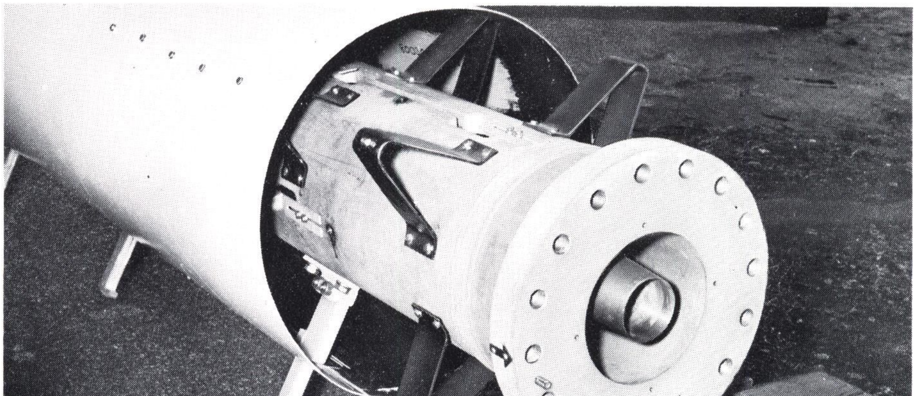
Radomes are recommended for use with RCA Traveling Wave Antennas in those areas subject to freezing rain, soft snow or ice accumulation. Its purpose is to prevent these elements from accumulating on the slots of the antenna and detuning them. This often results in a high VSWR of the system with subsequent ghosting and, in some cases, requires a reduction in power.

Extensive field experience has proven that operation of Traveling Wave Antennas protected by radomes result generally in ghost free operation and stable system VSWR under adverse climatic conditions.

The radome is a rugged, heavy duty cylinder of Fiberglass reinforced Polyester resin, that acts as a cover to protect RCA Traveling Wave Antennas. It is especially designed to withstand extremes of wind, temperature, ice and snow. In addition, its efficiency at frequencies between 174 and 216 MHz is calculated to be 99.9991 percent.

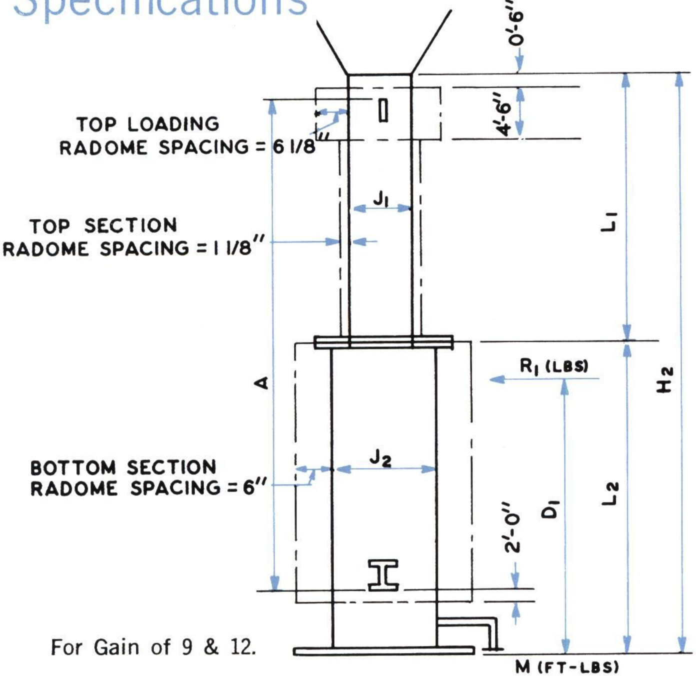
The diameter of this cylinder varies depending upon the pipe sizes comprising a particular Traveling Wave Antenna. For instance, an antenna consisting of an 18-inch bottom section would have a cylinder 30 inches in diameter; a middle pipe section of 14 inches would have a cylinder 16 inches in diameter and a top pipe section 10¾ inches in diameter would have a cylinder 12¾ inches in diameter. In addition, the top loading portion of this particular antenna would be enclosed in a cylinder 23 inches in diameter.

The individual panels are 180 degree segments 32 inches long and are attached to the steel pole by means of Fiberglass brackets. As finally installed in the field the joints between panels are caulked resulting in a weather-proof installation.

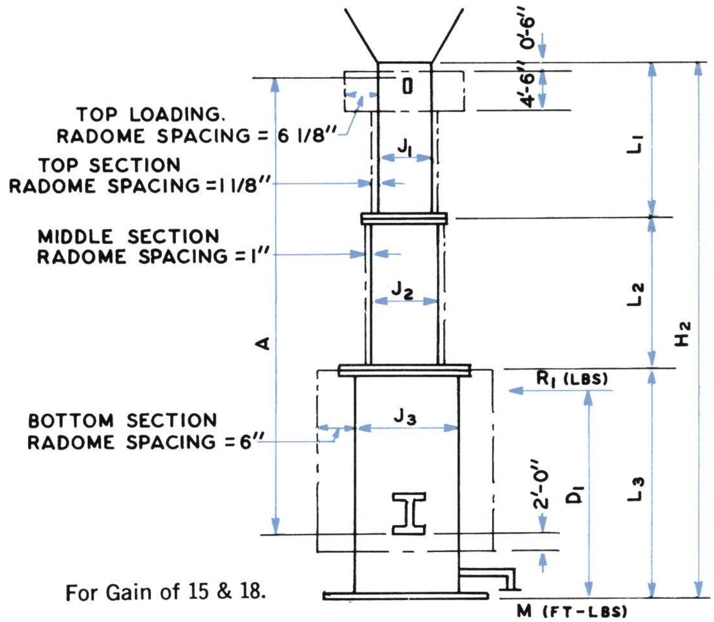


NO NEED FOR DEICERS when a rugged RCA Radome of heavy duty fiberglass protects Traveling Wave Antennas. This end view taken at factory site clearly shows simplicity of construction. Radomes require no power and are easily maintained.

Specifications



For Gain of 9 & 12.



For Gain of 15 & 18.

Type	H-2	J-1	J-2	J-3	L-1	L-2	L-3	R-1	M
TW-9A7-R	76	10.75	14	—	32	44	—	4510	157.8
TW-9A8-R	73	14	14	—	37	36	—	4380	149
TW-9A9-R	69	14	14	—	30.5	38.5	—	4380	148
TW-9A10-R	68	14	14	—	29.5	38.5	—	4300	144
*TW-9A11-R	67	14	14	—	29.5	37.5	—	4260	140
TW-9A12-R	66	14	14	—	33	33	—	3960	129.1
TW-9A13-R	62	14	14	—	31.5	30.5	—	3830	117
*TW-12A7-R	95	10.75	18	—	42.3	52.6	—	6100	253.5
*TW-12A8-R	92	10.75	18	—	42.3	49.7	—	5860	235.5
TW-12A9-R	87	10.75	14	—	42.3	44.7	—	4930	195.5
TW-12A10-R	83	10.75	18	—	46	37	—	4960	178.3
TW-12A11-R	82	10.75	14	—	45	37	—	4470	164
TW-12A12-R	80	14	14	—	39	41	—	4960	193.2
TW-12A13-R	78	10.75	14	—	45	33	—	4205	149.3
TW-15A7-R	116	10.75	18	18	48.5	26.5	41	6890	344
TW-15A8-R	115	10.75	18	18	44	31	40	6910	342
TW-15A9-R	110	10.75	10.75	18	28	32.3	49.7	6515	321
TW-15A10-R	107	10.75	10.75	18	29.5	31.0	46.5	6225	287.5
TW-15A11-R	109	10.75	18	18	45	30.7	33.3	6475	307
TW-15A12-R	97	10.75	10.75	18	25.7	31.9	39.5	5630	234
TW-15A13-R	98	10.75	10.75	18	29	33	36	5440	234
TW-18A7-R	137.5	10.75	14	20	45	40.8	51.7	8300	477
TW-18A8-R	133	10.75	18	20	50.75	36.25	46	8200	463
TW-18A9-R	126	10.75	14	20	45	37.5	43.5	7420	392
TW-18A10-R	123	10.75	14	20	44	34.4	44.6	7340	378
*TW-18A11-R	122	10.75	14	20	46.5	31.5	44	7230	370
TW-18A12-R	117	10.75	14	18	46.5	22.5	43	6750	340.5
TW-18A13-R	113	10.75	14	18	45	27	41	6520	317.5

* Estimated, subject to actual design being completed.

Symbol	Units	Symbol	Units	Symbol	Units
H-2	Feet	J-3	Inches	L-3	Feet
J-1	Inches	L-1	Feet	R-1	Lbs.
J-2	Inches	L-2	Feet	M	KIP Feet

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Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

RCA Broadcast Equipment

catalog B.4120

- Antenna systems for special coverage needs
- Common-site antenna projects
- Special structures for multiple systems
- Project coordination—prime contracting
- Backed by largest amount of experience

RCA Custom VHF Antenna Systems

Description

RCA Custom VHF Antenna Systems generally are of two classifications: Systems that solve unusual coverage or allocation requirements and those especially designed for installation on a multi-antenna structure capable of supporting several individual TV (and FM) antennas all serving a single market. The *Candelabra** tower is such a structure.

Four Antenna Types

The RCA antenna line includes the *Superturnstile, Traveling-Wave, Zee-Panel* and *Butterfly* antenna designs. Special versions of these four basic products satisfy virtually any antenna requirement. The versatility of these four types as custom antennas is contained in the material following.

Common-Site Antenna Projects

RCA's experience in the design, construction and installation of multiple-antenna projects dates back to 1951 when the antennas of five New York TV stations first shared the Empire State Building. Since that time, RCA has supplied antennas for eight *Candelabra** towers, expanded the Empire State Building antenna complex, installed the new John Hancock twin-tower facility in Chicago and erected tens of stacked-antenna tower arrays.

Superturnstile Antennas

The RCA Superturnstile is a highly refined antenna for all VHF channels. The Superturnstile lends itself installation on a *Candelabra** platform or as the topmost antenna in a "stack". Equipped with a reinforced pole, the Superturnstile antenna serves as a supporting antenna in a stacked arrangement.

Where weather conditions require, the Superturnstile's "batwings" are de-iced electrically with resistive heaters inside the batwing "spine". The heat keeps the space between the pole and spine ice-free for stable performance.

The Superturnstile design lends itself

***Candelabra** is the registered trademark of Dresser-Ideco Co.

3UB

RCA engineered, planned, tested, built a
go's John Hancock Center (left). Above is
at RCA's Gibbsboro Antenna Center. At rig
tenna on the Empire State Building tower.

to antenna diplexing where a single antenna serves two stations simultaneously. WHEC and WROC (Rochester, N. Y.) were first to use a single Superturnstile Antenna in common during 1963. There are several subsequent diplexed projects now on-the-air. The Superturnstile Antenna in its "standard" form is described in detail in Catalog Sheet B.4104 which is available from any RCA Broadcast Field Office.

Traveling-Wave Antennas

Ideally suited to multiple-antenna applications where several antennas mount on a *Candelabra** platform, the Traveling-Wave Antenna's relatively small cross section reflects little energy to interfere with the radiation of adjacent antennas. TW antennas also lend themselves well to vertically stacked arrangements either as topmost or a supporting member.

For duty in icing locations, the TW antenna is fitted with a protective radome which keeps ice from altering antenna performance.

Traveling-Wave Antennas are available for the highband channels (7-13).

For general information regarding the TW antenna please consult Catalog Sheet B.4108. The basic antenna is described in detail.

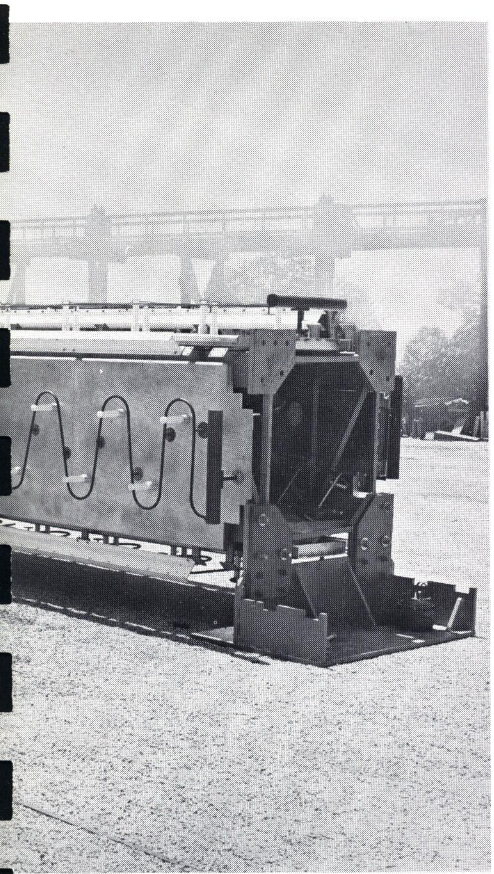
Zee-Panel Antennas

The Zee-Panel is a panel-type antenna for highband VHF channels and is for face-mount on a tower.

Each Zee-Panel Antenna uses zig-zag radiating elements branching from a central feedpoint. Insulators maintain spacing between the radiating element and the panel which serves as a reflector.

The radiating element uses exponentially tapered illumination with continuous compensation along the element. The small amount of energy reaching the end of the element is radiated by an end-loading element.

Four Zee-Panels in a square configuration comprise a single layer. The design of the Zee-Panel Antenna is quite flex-



ed the five-antenna system atop Chica-
Zee-Panel Antenna during construction
close-up of the WABC-TV Zee-Panel An-
York City.

ible and adapts to meet various requirements in horizontal pattern, power gain, null-fill values, etc. Mounted on a typical (30″ on a side) tower section, the Zee-Panel Antenna delivers a horizontal circularity of better than ±2 dB. The antenna is ordinarily totally enclosed in a cylindrical radome. However, where windload limitations exist, partial radomes, extending only over the feedpoints and adjacent areas, are used.

The end-loading elements on each panel are connected directly to the reflecting panel, hence the radiating element is at ground potential. This tends to make the antenna immune to lightning damage.

Butterfly Panel Antennas

Butterfly Panel Antennas are a relatively new approach to VHF antenna design. They fill a need for a flexible panel antenna, either directional or omni directional, that serves singly or in stacked arrays.

The basic unit of the antenna consists of a pair of batwings mounted in "backward" butterfly-wing fashion against a reflector. The "backward" mounting improves impedance match and directivity characteristics. Fig. 5 shows a portion of the WDBO (Orlando, Fla.) Butterfly Antenna mounted on all three sides of a triangular cross-section tower. The horizontal directivity is controlled through power distribution among the elements on each tower face. The antenna is ordinarily fed with a single transmission line. On the other hand, the antenna may be split into two separate sections fed with individual transmission lines.

For the best omni-directional circularity, the antenna should be mounted three-around with all faces fed in-phase. When quadrature feed is desired, a four-around panel arrangement can be used. The choice of three- or four-around for directional antenna is influenced by pattern requirements.

The panel is made in three basic sizes, one each for the 54-66 MHz, 66-88 MHz and 174-216 MHz bands. The Butterfly

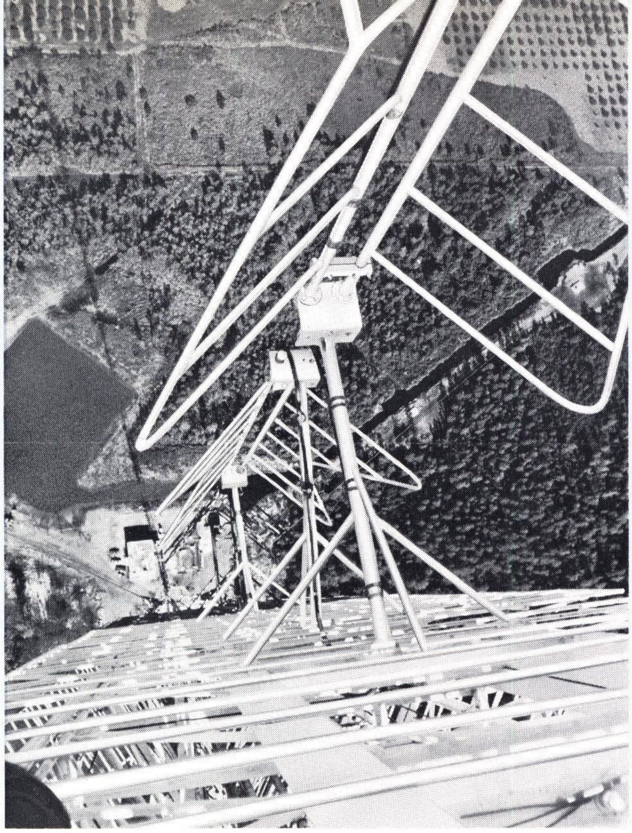


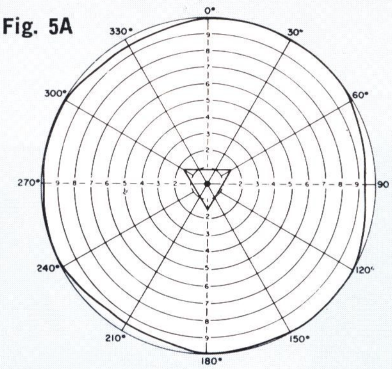
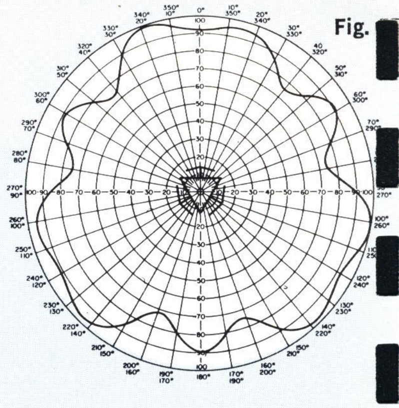
Fig. 5A


Fig.


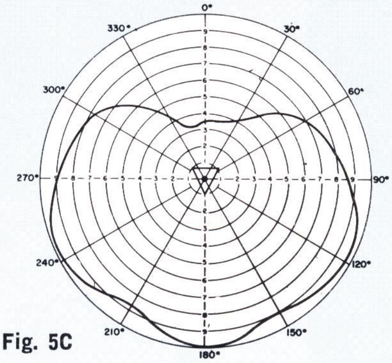


Fig. 5C

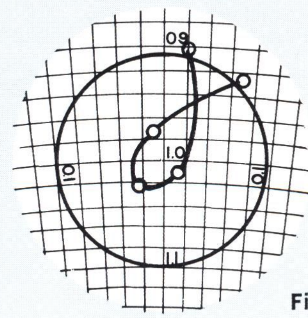


Fig. 5D

FIG. 5. Orlando's WDBO uses RCA Butterfly Antennas mounted on three sides of a triangular cross-section tower. The drawings at right illustrate various patterns possible with an RCA Butterfly Antenna. At lower right is a smith chart representation of impedance match.

Panel Antenna employs a feed system similar to the well known RCA Superturnstile Antenna. Styroflex feedlines ¾- or ⅞-inch feed each panel out of a junction box feeding up to twelve individual panels or four antenna sections. Use of ¾-inch Styroflex results in a power handling capability of 5.25 kW per section and the ⅞-inch size, 6.75 kW per section at channel 13.

Excellent Pattern Circularity

Pattern and gain flexibility are outstanding features of this antenna. For example, in a stacked antenna array the basic panels mount on the faces of a triangular tower for excellent horizontal circularity at any of the VHF channels. Fig. 5A illustrates a pattern obtained by means of model measurements simulating a triangular tower 7′ 6″ on a side, operation on channel 4 resulting in a horizontal circularity of ±0.25 dB. Highband VHF performance on a 7′ 6″ tower face results in a horizontal circularity of better than ±2.0 dB as illustrated by the model measurements shown by Fig. 5B. Reducing the tower-face dimension for high band VHF operation results in improved horizontal circularity.

Pattern Shaping

Directional horizontal pattern shaping is achieved by controlling the power fed to the three faces of panels comprising the antenna. Fig. 5C shows a cardiod pattern with 10 dB of suppression achieved by this technique.

Vertical pattern shaping to introduce null-fill and beam tilting is achieved by either phasing, power division, or a combination of both, depending upon the customer's requirement.

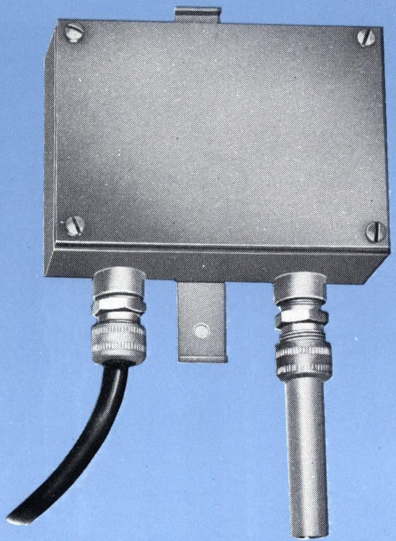
Power gain is a function of aperture height and is closely related to the power gain achieved by comparable Superturnstile antennas of a given number of sections, operating frequency and vertical-pattern characteristics.

Natural Impedance Bandwidth

The impedance characteristics of the Butterfly Panel Antenna are excellent. The individual panels have a natural impedance bandwidth of 20 percent. When combined by means of the junction boxes developed for the Superturnstile antenna, this results in an antenna input VSWR more than adequate for TV requirements. See Fig. 5D for a typical smith chart plot of a single layer.

Deicing, where necessary, is accomplished by heating elements in the spine of each batwing element. Power requirements are relatively low, amounting to about three kW per layer for the midband panels.

catalog B.4750



- Automatic temperature monitoring at actual antenna location
- Adjustable temperature ranges to suit local weather conditions
- Water-proof aluminum housing
- Antenna deicing prevents severe damage to transmission systems

RCA Automatic Sleet Melter Control Unit

Description

The Automatic Sleet Melter Control Unit, MI-27369-A, is designed to prevent severe damage to transmission equipment as a result of inadequate manual control of antenna deicers. The control allows deicers to be left unattended at all times and proper operation will be assured. Furthermore the antenna will be free of ice and in condition for immediate operation following possible icing conditions during the night when the transmitter is normally unattended.

The deicer control has been designed with adjustable temperature ranges so that it can cut off above and below the temperatures chosen to conserve power when temperatures are not within the ice-forming range. A "stay-on" Control has been incorporated for added protection where "rime" ice is a problem.

The control unit is designed for mounting at the top of the tower, or preferably at the midpoint of the antenna pole on the larger antennas. Considerable temperature variations often exist between the antenna location at the top of the tower and the ground level, so that ice may be forming on the antenna while the temperature on the ground remains above freezing.

The control unit is housed in a small cast aluminum box. A waterproof cover, sealed by a neoprene gasket, and a convenient mounting bracket is furnished with the unit. Adjustable terminal connections for selection of temperature ranges have been provided in this model.

The Control Unit is furnished with a 4-conductor cable, six feet long. The cable should be terminated in an appropriate junction box where connections may be made for the main cable running down the tower. Two conductors are to be connected to 110 Volts AC for the relay coils and the remaining two are for the control circuit. The station is required to furnish the connecting cable from the transmitter building to the termination of the six-foot cable furnished with the control unit, as well as the actual relay contactors to switch power to the sleetmelters.

Various types of antennas, methods of deicer connections, etc., make it impractical to furnish the power relay contactors required with the MI-27369-A Control Unit. The contacts of the MI-27369 are rated for 10 Amperes.

Specifications

Automatic Temperature Limits (Adjustable):

Upper Limit	32° or 40°F (0°C or 4.5°C)
Lower Limit	10° or 20° F, or no-cut-off (–12.6°C or –6.6°C)
Power Line Requirements	110 V, 60 Hz
Deicer Control Relay Contact Rating	10 A
Dimensions	6½″ by 4½″ by 3″ (16.5 cm, 11.43 cm, 7.62 cm)
Weight	5 lbs. (approx.) (2.27 kg)
Finish	Weatherproof aluminum box

Ordering Information

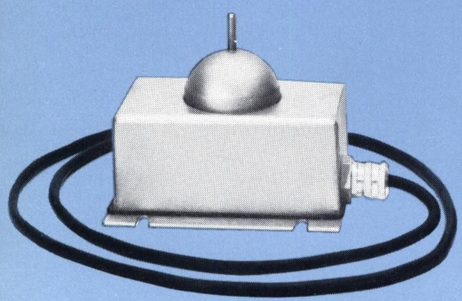
Automatic Sleet Melter Control	MI-27369-A

6TB

Commercial Electronic Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102
RCA Broadcast Equipment

RCA

catalog B.4752



- Dependable ice detection
- Active only when icing conditions exist
- Anticipates antenna ice formation
- Improves deicer economy and efficiency
- Detects end of icing conditions

Rosemount Antenna Ice Detector

Description

Active only during antenna-icing weather, the Rosemount Antenna Ice Detector senses buildup of broadcast-antenna ice and generates a signal which, with appropriate power-contactor equipment (not supplied), automatically energizes an antenna's sleetmelters.. At the conclusion of icing conditions, the device automatically de-energizes the heaters after an adjustble time-delay period expires. This period may be eight to 150* minutes long.

Dependable Ice Detection

Insensitive to almost everything but ice formation, the detector ignores cold, wind, rain, dry snow, soot, grease, insects and birds. As a result, the detector prevents unnecessary de-icer operation and thus increases the useful life of de-icer equipment by operating it only when necessary.

Active Only When Icing Conditions Exist

Since antenna ice cannot form under any weather condition at temperatures above 50°F. (10°C.), the Antenna Ice Detector ceases to operate. As soon as the ambient temperature drops below 50°F., a thermostat puts the system into operation, automatically.

*180 on 50 Hz power.

Anticipates Ice-Forming Conditions

Because the ice-sensing element bears low thermal mass, it cools faster and begins to collect ice earlier than the larger thermal mass of the antenna it protects. As a result, the detector "sees" ice before it begins to form on the antenna surfaces. Because the heaters are warm before ice begins to form, they get a "head start" on the ice and avoid the burden of a "backlog" ice accumulation. Only completely still air—extremely rare during icing weather—can shorten materially the detector's ice anticipation.

Improves De-Icer Economy and Efficiency

Since the ice detector ignores all conditions except icing conditions, it never operates de-icer heaters unnecessarily in the way a thermostatic control does. Consequently, the ice detector eliminates needless use of kilowatt hours which increase power costs. Further, because the heater operates only when really required, the device materially extends heater life.

Detects End of Icing Conditions, Too

Unlike most other deicer control systems, the Rosemount Antenna Ice Detector senses the *end* of ice-forming conditions and sends out an electrical command that ceases de-icer power. This, of course, eliminates wasted kWh.

Magnetostrictive Sensor

The sensing element—the probe—of the detector is a ¼-inch (6 mm) diameter tube precisely 1.10 inches (28 mm) long of a nickel alloy which responds, physically, to a magnetic force in an increase or decrease in axial length. Under the influence of an alternating magnetic field, the tube vibrates at a frequency proportionate to its physical length—its resonant frequency. If the frequency of the alternating field is adjusted to coincide with the resonant frequency of the little nickel tube, a form of tuned circuit results.

In the ice detector circuitry, the probe serves as a link in the feedback circuit of an oscillator. Consequently, the circuit oscillates at the resonant frequency of the probe, a rate near 40 kHz.

As ice forms on the sensing element, it restricts the magnetostrictive motion and lowers the resonant frequency of the little nickel tube. This, in turn, reduces the oscillator frequency. As the frequency

10UB

approaches a pre-determined value, solid-state circuitry detects the changes in frequency and energizes a relay which, in turn, controls a de-icing heater-current contactor. This relay "holds" for a period of eight to 150* minutes (adjustable manually).

Self-Recycling

During the "hold" period, the ice detector probe de-ices itself and its supporting dome. Because of the low mass of the probe, de-icing takes but a few seconds. Once de-iced, the probe begins the sensing cycle again. If the ice coating accumulates to a thickness of a half millimeter or more, it issues a "sustaining" command for antenna de-icing. This sequence repeats until ice no longer forms on the probe. At this point, plus the preset time delay, the contactor handling antenna de-icer current opens and de-icing operations cease until ice again forms on the probe whereupon the entire sequence of events starts again.

Fail-Safe Design

In the extremely unlikely event of probe damage or failure, the system automatically issues a continuous de-icing command. Thus, the system cannot fail to perform its function even when inoperative.

Specifications

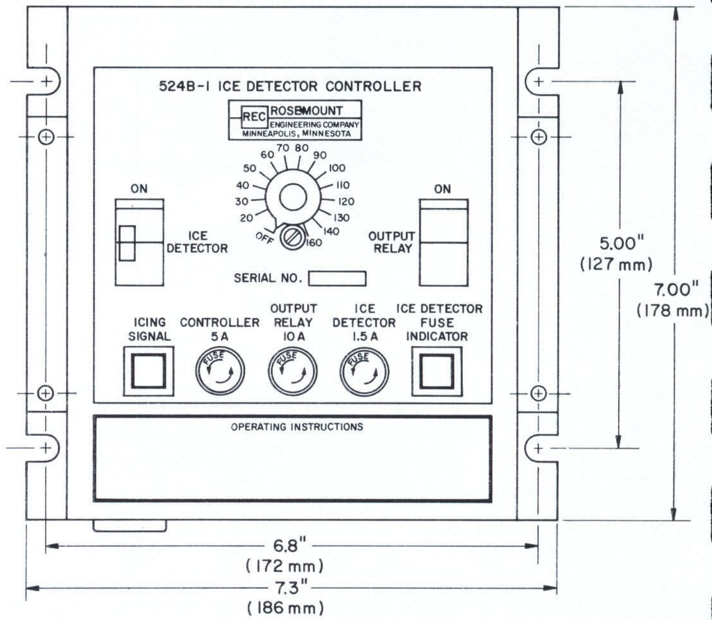
Ice Detector Unit

Ice Sensing Range ....0.02 to 0.25 inches on probe (0.5 to 6 mm)
Sensing Element Material ....Ni-Span C
Maximum Length of Interconnecting Cable ....Unlimited
Power Requirements:
  Sensing ....115 V, 50/60 Hz 10W
  Signalling ....115 V, 50/60 Hz, 1.5A
Output Signal ....115 V, 50/60 Hz, 60W max.
Sensing Element De-Ice Time ....90 seconds, nominal
Ambient Temperature:
  Operating ....–40 to 50°F (–40 to +10°C)
  Storage ....–50 to 160°F (–45 to 72°C)
Ambient Electromagnetic Field Intensity ....50V/m max.
Physical Dimensions ....See drawing
Weight ....3.5 lbs. (1.6 kg)

Detector Control Unit

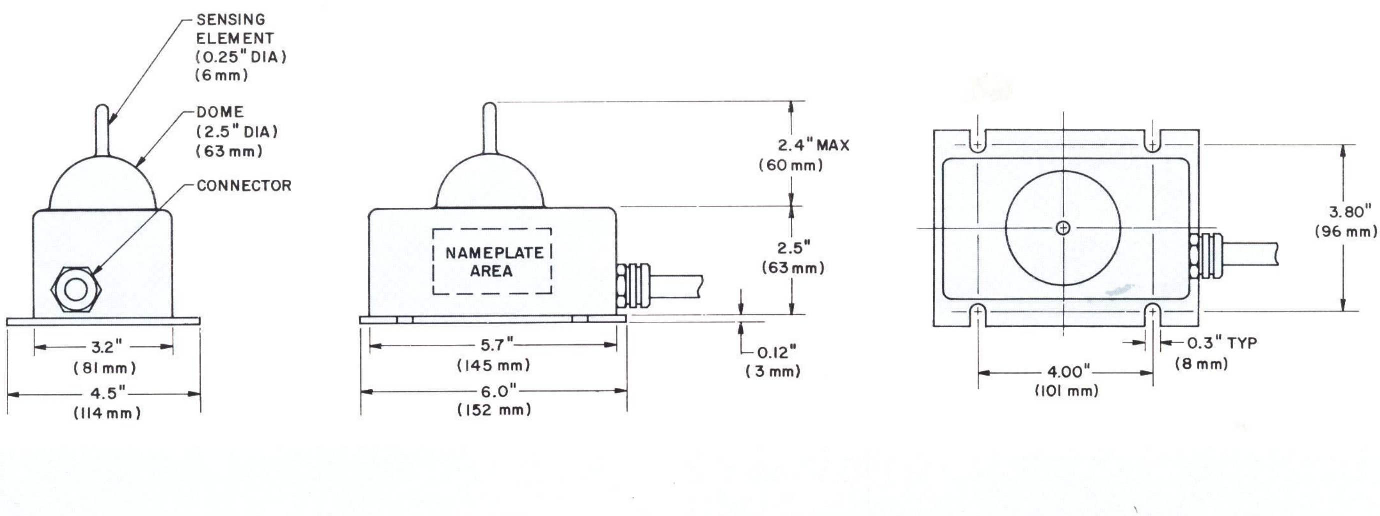
Power Requirements:
  Sensing ....115 V, 50/60 Hz, 5 W
  Signalling ....115 V, 50/60 Hz, 15 W
Output Signal ....115 V, 50/60 Hz, 500 W
Time-Delay Timer ....8 to 150* min., adj.
Power Relay Current Capacity ....10 A, max. non-inductive load
Ambient Operation Temperature ....40 to 120°F. (4.4 to 49°C.)
Connections ....Barrier strip and connector
Physical Dimensions ....See drawing
Weight ....4 lbs. (1.8 kg)

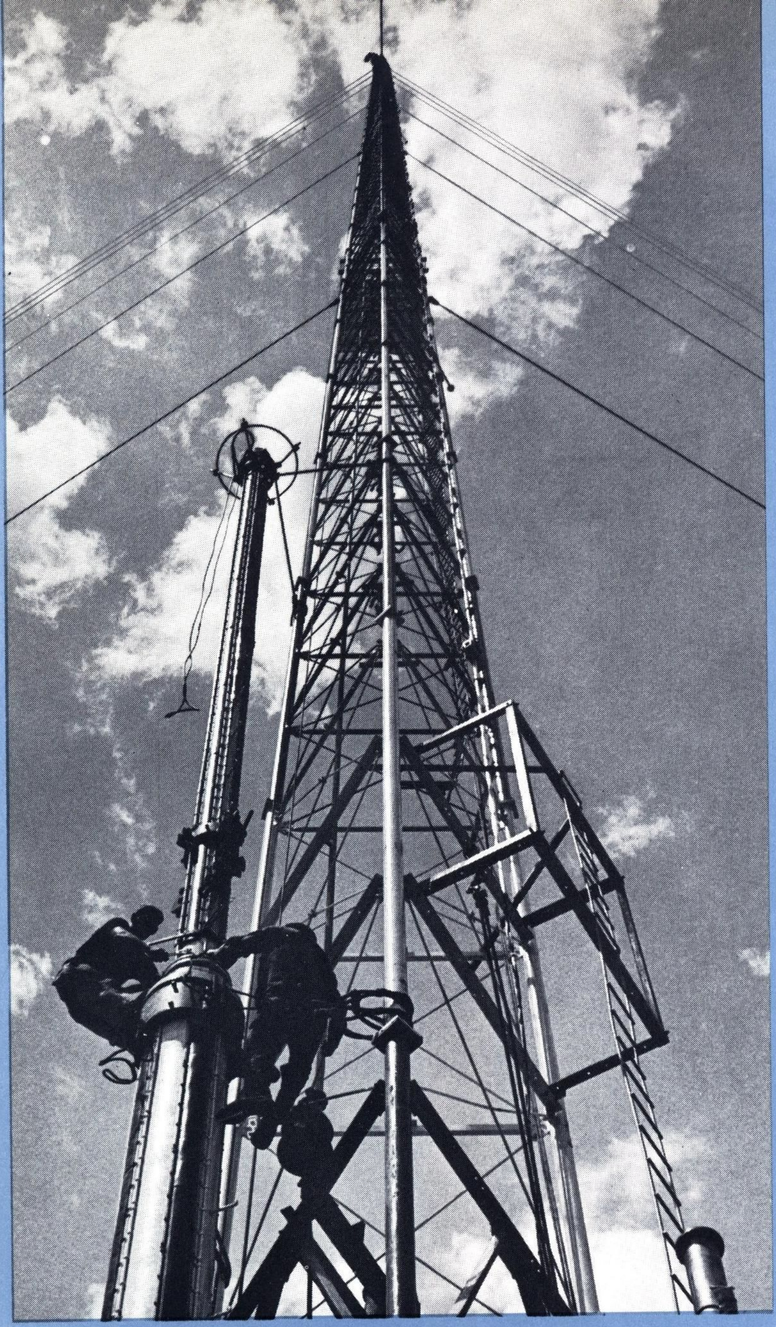
*180 on 50 Hz power.



Ordering Information

Rosemount Antenna Ice Detector System
(for 115 V, 50/60 Hz Power) MI-561572
(Interconnecting cable and contactor not supplied)





catalog B.5800

- Designs by experienced tower engineers
- Single contract service—complete tower planning, design, fabrication, installation and inspection, one responsibility
- Variety of types and heights to fit site, antenna, accessory and load requirements
- Custom designed structures to meet special or unusual requirements
- Complete tower accessories

RCA Television Antenna Towers

Description

A wide selection of towers to support the various type RCA UHF and VHF Television Antennas is available for all applications. Included are self-supporting and guyed designs. Custom towers for multiple antenna applications are also available.

RCA, as a representative of tower manufacturers, is qualified to assist the Broadcaster in the planning and selection of the proper tower and a qualified erector. A popular, one contract, one responsibility, service is available.

8TB

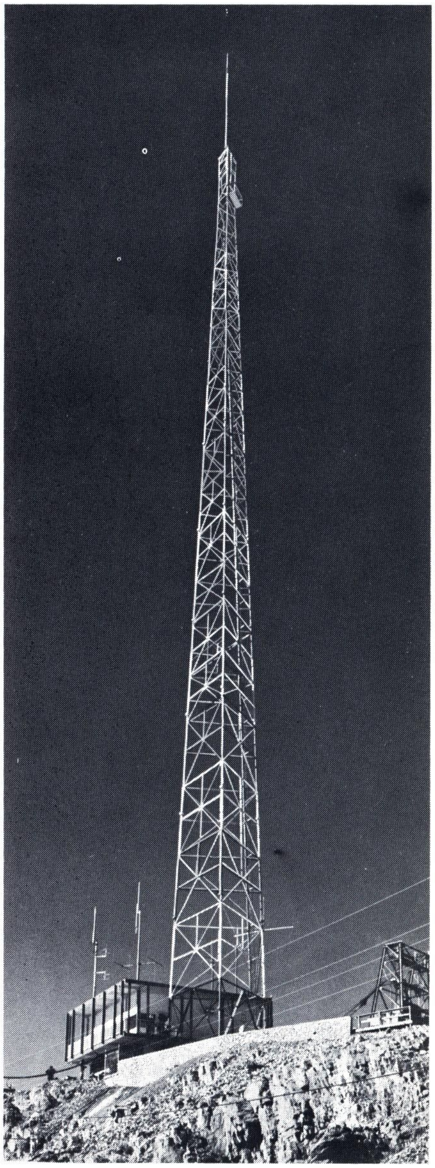
Design Considerations

Relatively flat country with low surrounding hills lends itself well to the installation of tall supporting structures. Towers over 500 feet in height are usually guyed and the usual cross sectional shape is triangular so that three point guying can be used. Guyed tower costs are lower than for self-supporting structures because less steel is used and erection is less costly. The availability of land and the area involved for guy anchorage however increase costs of this type of tower. A useful method for estimating the land required for a guyed structure is to consider the distance to the farthest guy anchorage as being approximately 70 percent the tower height. For self supporting tower the distance between tower legs is usually 10 percent of the height.

Guyed Towers

Guyed towers normally are constant in cross-section along their entire height. They are supported by steel guy cables which span out to steel reinforced concrete anchors buried in the earth. Such towers are available with either fixed or pivoted bases. Each has certain advantages. A pivoted base tower tapers to a point at the bottom. The tower and the foundation are connected at this single point. The tower will remain upright and plumb even if the foundation shifts unevenly. Because of this feature, pivoted base towers are normally used when the soil at the site may have unknown load-bearing qualities. Each leg of a fixed base tower is bolted to the foundation making the tower-to-foundation connection a rigid one. Fixed base towers permit direct installation of transmission lines at the ground level. They also permit installation of the elevator bottom landing closer to the ground.

Guyed television towers can achieve great height at less cost than self-supporting structures where land value is not a determining factor. Towers are triangular and are available with either fixed or pivoted base.



Ranger Peak, 1900 feet above average terrain, near El Paso, Texas is an ideal site for KTSM-TV's self-supporting type antenna tower.

Self-Supporting Towers

Self-supporting towers are wide at the base and taper gradually to the top. They are not supported by guy cables but depend upon their tapered configuration for stability. Such towers are especially advantageous in city and congested districts where availability of land is limited.

The use of towers upon tall buildings is often quite practical. This normally results in smaller towers and shorter transmission lines, especially if the building is high enough to conform to the desired antenna height. Building frameworks must be reinforced and erection problems sometimes become quite complex.

Mountain-top sites in general do not lend themselves to guyed towers due to limited land area available for guy points. As a result, most of the mountain top installations are of the self-supporting type. Since coverage is proportional to height a strategically located mountain top site is desirable. On a mountain top, a short tower is acceptable to mount the antenna away from close-in reflecting objects.

Multiple Antenna Towers

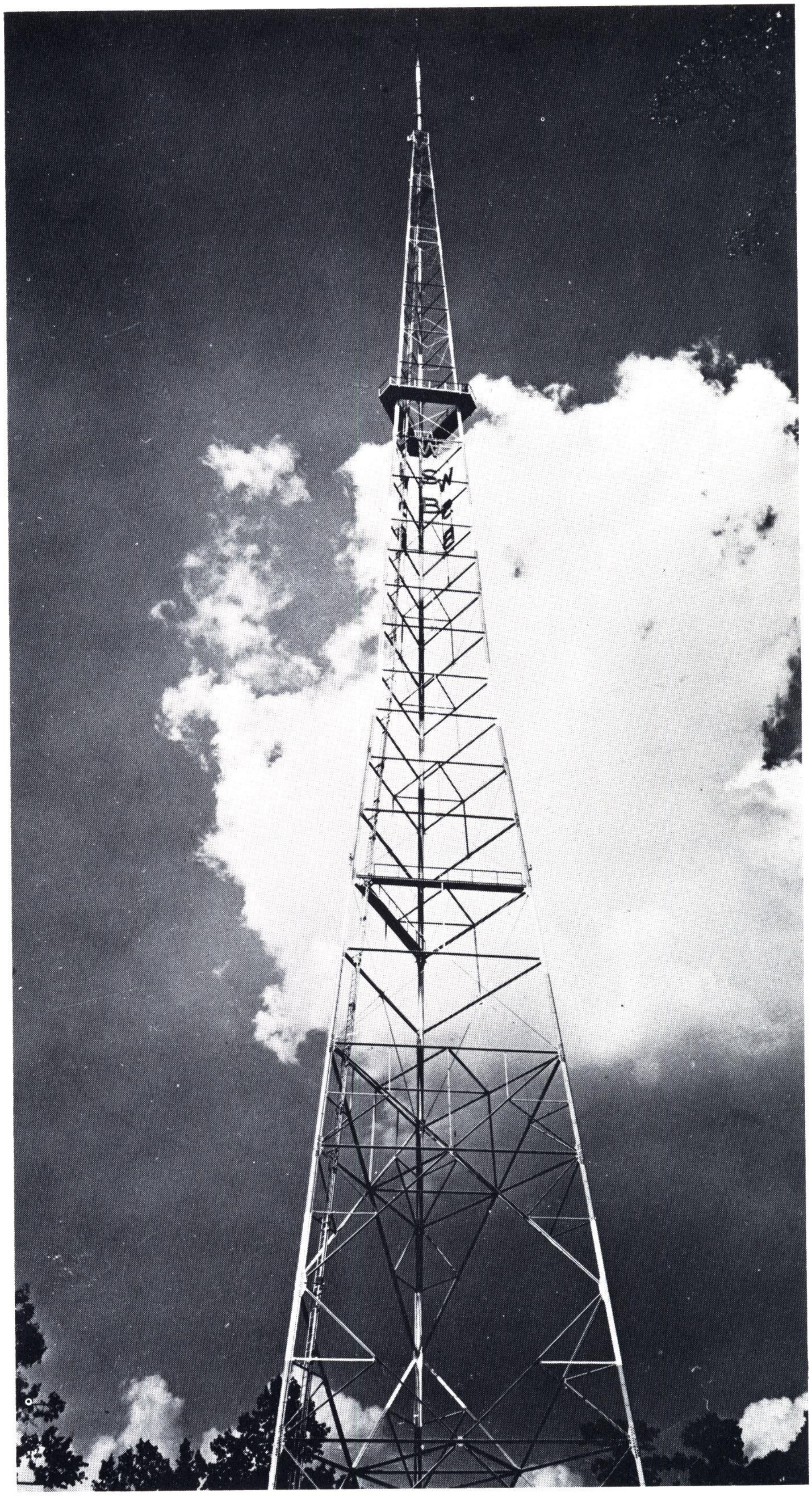
Towers carrying a number of antennas, either in a stacked arrangement or with all antennas at the same height on a top platform, or with a combination of platform and side mounted antennas can be supplied. Multiple antenna towers save each station on land cost, enable each station to utilize the area's best site, simplify air-space clearance problems, and greatly reduce receiving antenna orientation problems.

Tower Foundations

Tower foundation design is based upon a laboratory analysis of the load bearing capacity of the soil in which the foundation will be placed, together with a determination of the uplift the foundation will be required to withstand. It is sometimes necessary to reinforce foundations with steel, wood or concrete piling. Swampy land provides a poor foundation base. Sand, gravel and clay soils are normally satisfactory. Shale or rock are good. A steel reinforced concrete foundation supports and fixes the base of most towers. Anchor bolts for the tower are cast right into the foundation with just the threaded ends protruding.

Weather Protection

The steel superstructure may be hot dip galvanized steel where corrosive



Station WSB's triangular self-supporting tower rises skyward to support a pylon antenna. Such towers are recommended where sites are in congested areas or where a tower is designed for erection on a roof-top.

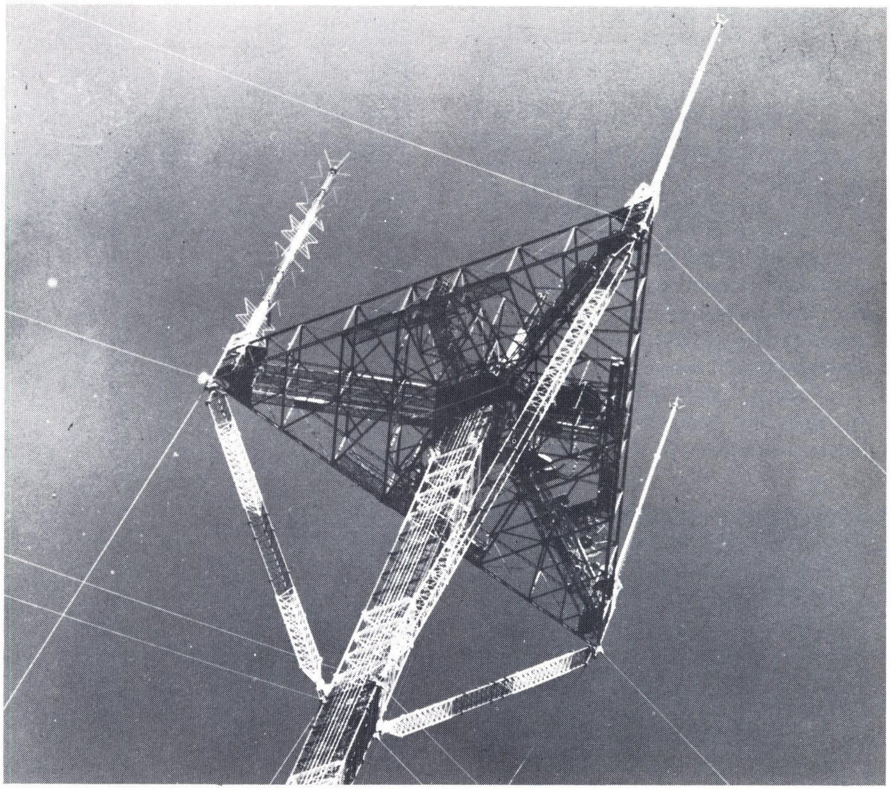
action due to fumes, salt air, etc. are known to exist. Galvanizing can be omitted if the tower sections are heavy and painting is done frequently. Climbing ladders should be located inside the tower if at all possible and preferably near the tower legs. By placing the ladder within the tower, the lattice braces form a safety cage for the serviceman. Rungs are spaced for easy climbing or descent.

Tower Elevators

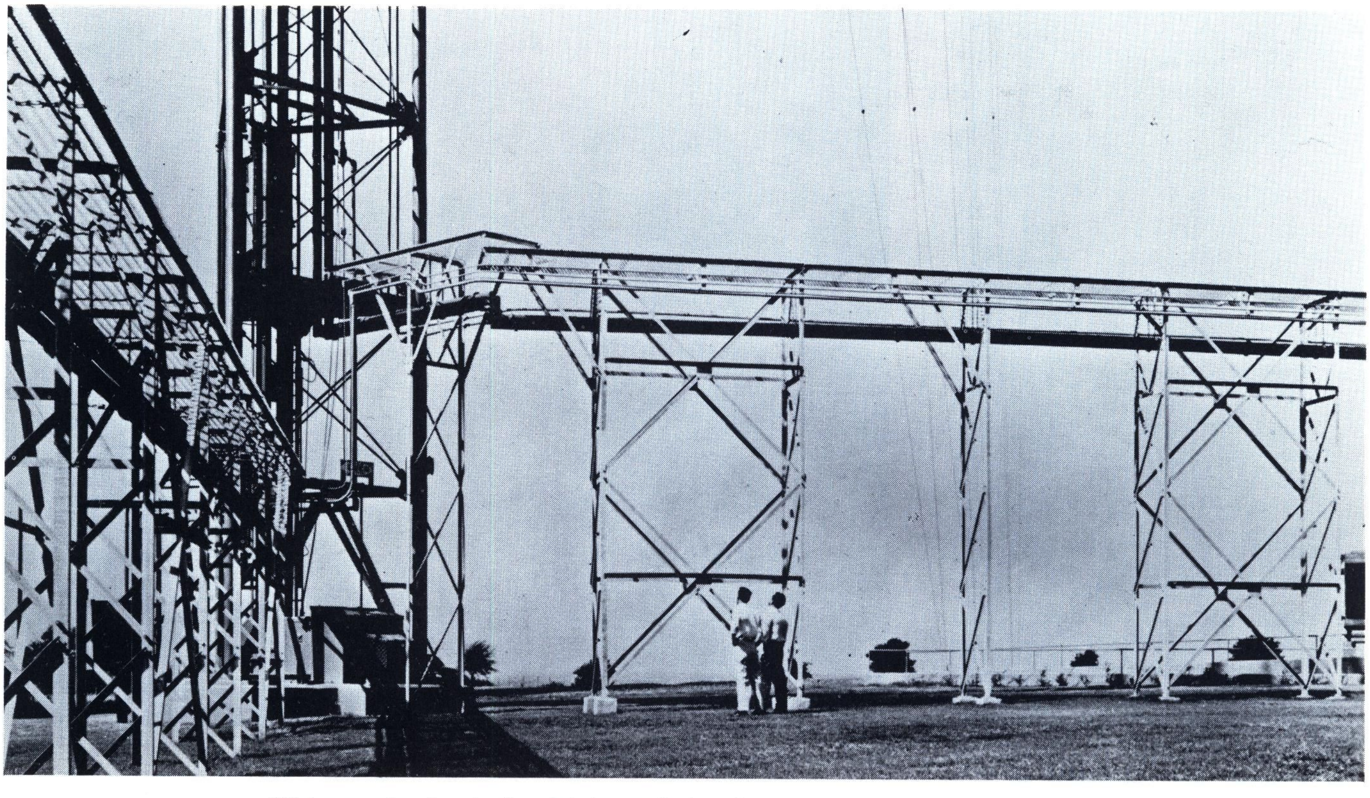
Tower elevators are recommended on towers of 1000 feet or more in height. They eliminate the danger of long periods of interrupted service through making it possible for a technician to get up the tower fast in any kind of weather. They also enable the engineer or station manager to give on-the-spot supervision to work performed on the tower, without climbing. Finally, elevators greatly simplify routine maintenance. Conventional passenger elevator safety devices should be a part of every tower elevator system.

Service Platforms

Tower platforms are featured in most tower designs. Inside platforms are located at each light level to provide a safe rest and work area for the tower



1500-foot top platform multiple antenna support tower affords substantially increased coverage for Stations KCRA, KOVR and KXTV in Stockton-Sacramento area. The economies afforded through a single tower, as opposed to three separate structures, are obvious.



TV tower showing horizontal transmission line runs protected by ice shields.

maintenance workers. Outside platforms with railings can be installed at any level required to provide convenient access to side mounted equipment. Top platforms to carry multiple antenna installations are fitted with catwalks, railings and ladders to provide easy access to antennas and transmission lines.

Telephone lines and jack boxes can be installed on the tower to provide quick communication between maintenance workers on the tower and the ground.

Lightning Protection

All RCA antennas mounted on the top of a tower are provided with branching type lightning protectors. These consist of four rods disposed symmetrically about the 300mm beacon and extend above it. The parts are ruggedly built and are hot dip galvanized. The branching type initiated by RCA have been used on hundreds of antennas and have been highly effective on tall towers in areas having the highest incidence of lightning in the country.

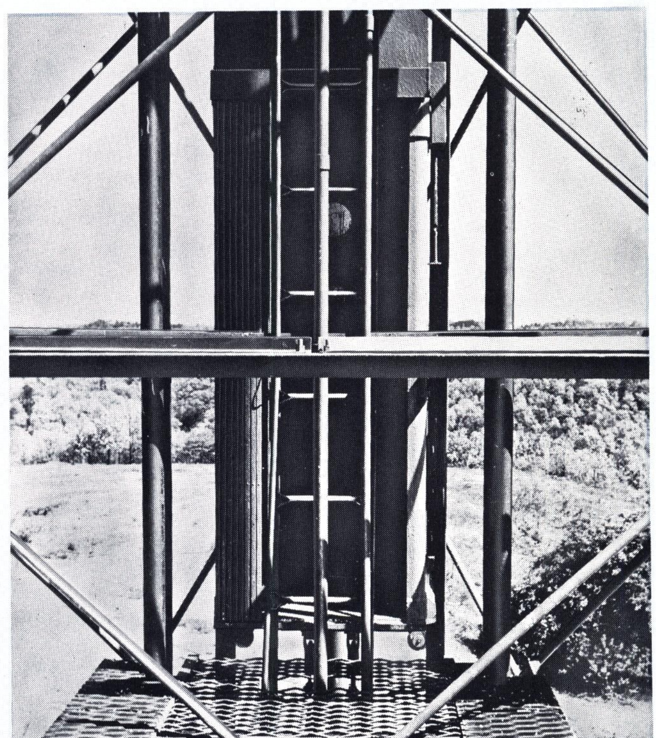
Tower Lighting

Complete tower lighting systems, designed in accordance with FCC and FAA requirements, are supplied with each tower. Lighting systems contain a series of flashing beacons and obstruction lights at intermediate levels. The number of beacons and lights required varies with the tower height. A photo-electric lighting control, to automatically turn the tower lights on at sunset, off at sunrise, is supplied as a part of each lighting system. A lamp failure indicator panel can be installed in the transmitter building as auxiliary equipment.

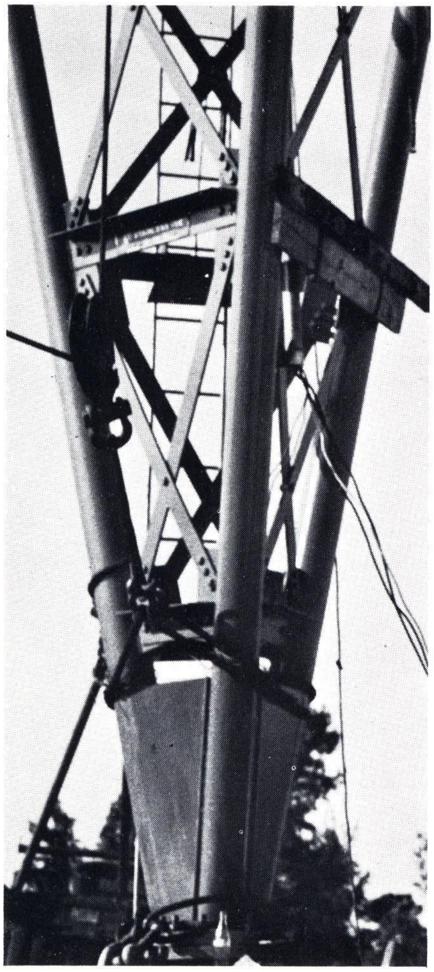
A pole socket and guide flange is used to support and steady superturnstile antennas of the usual "bury" type. The guide flange is mounted at the tower top to keep the antenna perpendicular to the ground. The pole socket receives the weight of the antenna. It is mounted fifteen percent of the pole length below the tower top. RCA furnishes the pole socket and guide flange with each superturnstile antenna except the Models TF-12AM and TF-12AL. For these two types, the tower manufacturers fabricate the pole socket and guide flange.

Where necessary, arrangements may be made to provide a pedestal type mount that effectively mounts the antenna on the tower top and eliminates the "bury" section.

By placing a service ladder within the tower, the lattice braces form a safety cage for the servicemen.



Tower elevators greatly simplify maintenance and should be considered for all towers of great height.



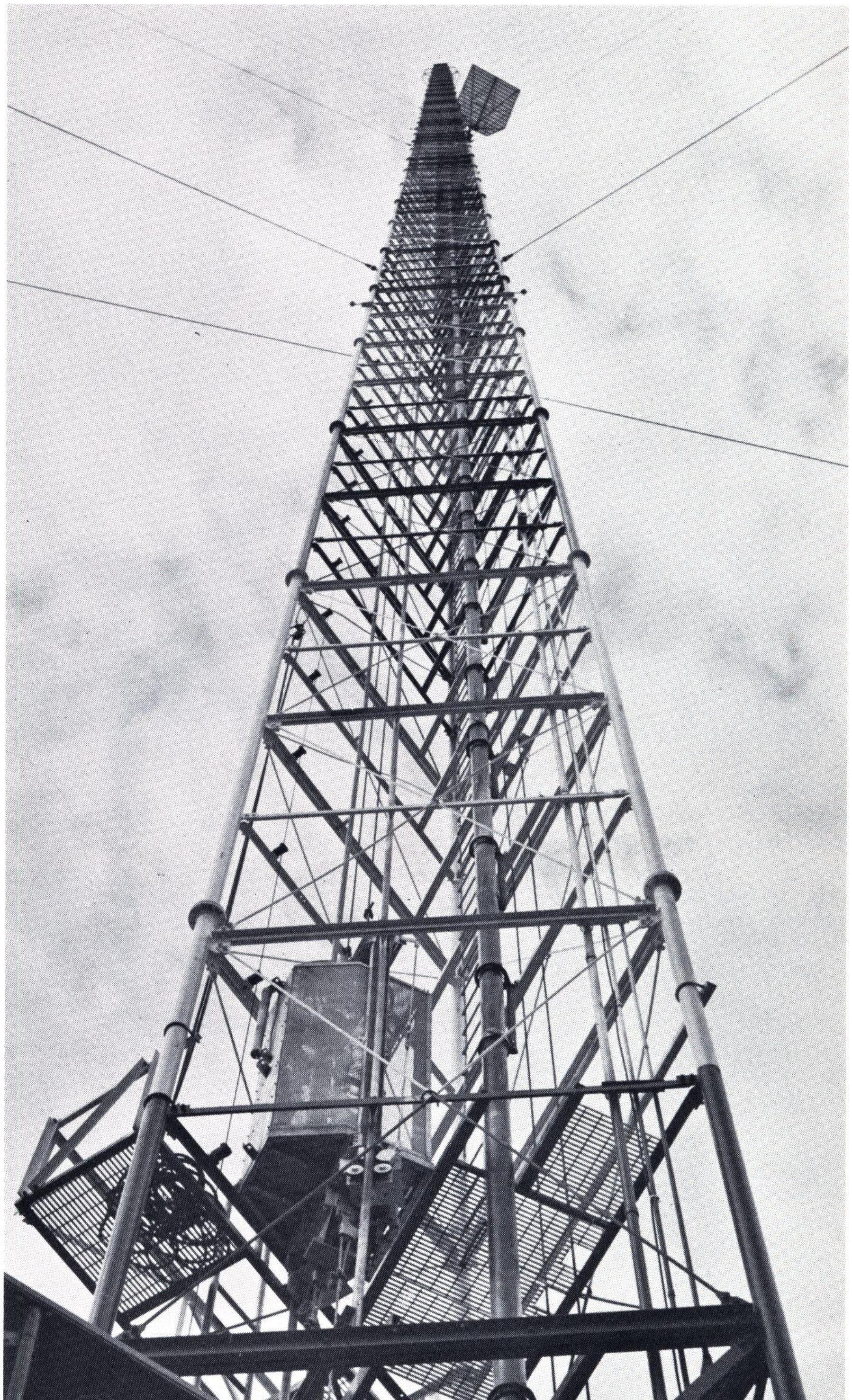
Typical anchorage for pivoted base type of guyed tower. Connected at a single point, the tower will remain upright and plumb even if the foundation shifts unevenly.

The twelve-section superturnstiles have an RF combining network which is accommodated below the tower top. Provisions are made so that tower cross bracing does not interfere. Mounting provisions are supplied for hangers to support this network.

Traveling wave antennas are furnished with a flange at the base for mounting on the tower top.

UHF Antenna Mountings

The standard UHF transmitting antenna is the UHF Pylon. It is flange mounted directly to the tower top plate. Tapered wedges are supplied to obtain mechanical beam tilting of the antenna where specified.



Vertical run of transmission line inside a triangular cross-section tower. Spring-tensioned hangers allow movement of the line due to thermal expansion and contraction.

Transmission Lines

Careful consideration is given to the layout and support of transmission line on the tower to allow for expansion and contraction of line and ease of maintenance. The tower manufacturer will consult with RCA engineers to be sure there is adequate support for the line and that a minimum number of elbows are used between the antenna input and the vertical run down the tower. The tower company will supply supports for spring hangers from the top to the base of the tower. Outline drawings with dimensions are available for all types of transmission lines and will be used in making a layout. These are shown in the RCA Transmission Line Catalog.

Wind Load

Most towers are currently built to 50/33 pound loading. This means that tower members are designed to resist a horizontal wind pressure of 50 pounds per square foot of projected area on all flat surfaces and 33 pounds on round surfaces.

Provision is made for all additional loadings caused by antenna, ladders, transmission and power lines, etc. and is applied to the projected area of the structure. The total load specified is applied in the direction which will cause the maximum stress in the various members. Where high winds or heavy icing is prevalent higher loading is often specified.

Wind Velocity and Corresponding Wind Pressure on Towers

EIA Standard Specification

Actual Wind Velocity MPH	Wind Pressure on Flat Surfaces $P = .004\ V^2$	Wind Pressure on Round Surfaces	Estimated Survival Velocities F. S. 1.65
10	.4	.266	12.9
20	1.6	1.067	25.8
30	3.6	2.4	38.6
40	6.4	4.27	51.5
50	10.0	6.67	64.4
60	14.4	9.6	77.3
70.7	20.0	13.33	91.1
80	25.6	17.1	103.0
86.6	30.0	20.0	111.5
90	32.4	21.6	115.9
100	40.0	26.7	128.8
110	48.4	32.3	141.7
111.8	50.0	33.3	144.0
120	57.6	38.5	154.6
122.5	60.0	40.0	157.8
130	67.6	45.0	167.4
132.3	70.0	46.67	170.4
140	78.4	52.33	180.3
141.4	80.0	53.33	182.1
150	90.0	60.0	193.2
160	102.2	68.2	206.1
170	115.6	77.0	219.0
180	129.6	86.6	231.8
190	144.4	96.3	244.7
200	160.0	106.66	257.6

Factor of Safety

2.5	Guy cables proof tested hardware
1.65	Tension and bending
1.70-1.94	Compression

NOTE: Cables made up with safety clip connections are derated to 85% of breaking strength.

Every tower is custom built to meet station requirements. RCA is equipped to supply a tower completely designed to meet station requirements. By specifying RCA you are assured a satisfactory installation.

Towers are designed in accordance with EIA Specifications.*

Consultation with RCA Broadcast Representatives will help to determine every requirement. Call or write your nearest representative. In order to facilitate selection of the tower most suitable, and as an aid to the station in determining specific requirements, a sample questionnaire is included here.

Tower Considerations

The following procedure may be helpful as a check list in considering tower requirements.

1. Determine station location with respect to service area. This study which will involve among other things joint operation with other stations, FAA approval, cost of land, zoning restrictions, local regulations, etc., will result in a decision to use:
   a. A self-supporting tower when land is unavailable as in city limits or on top of a building.
   b. Or a guyed tower where land is available and a greater height is desired.
   c. Or a multiple antenna tower.

2. Determine design parameters:
   a. Wind load for area in which tower is located.
   b. Deflection at tower top for type of service required.
   c. Type of antenna which is to be supported.

3. Determine tower accessories such as:
   a. Ladders.
   b. Platforms.
   c. Railings.
   d. Lighting.
   e. Microwave dishes.

4. Determine method of routing transmission line taking into account:
   a. Accessibility.
   b. Location of structural members.
   c. Location of special networks below tower top.

Accessories

RCA can furnish in addition to the antenna supporting tower, tower lighting equipment and installation and erection assistance.

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* EIA Standard "Structure Standards for Steel Transmitting Antennas, Supporting Steel Towers" RS-222.

Self-supporting 135-foot microwave tower at Station WAVE-TV showing two receiving dishes on platform—one fixed and one rotatable. The reflector handles a 7000 MHz STL microwave and also a 2000 MHz STL, both with roof-mounted antennas.

Antenna Tower Questionnaire

LOCATION

City .... State ....

QUOTATIONS TO BE FURNISHED

(Check those required)

Tower — Guyed ....( )
Self-supporting ....( )
Multiple ....( )

Tower Lighting Equipment..................................( )

Tower Erection:
Antenna and Assembly Installation..........................( )
Transmission Line Installation..............................( )

SPECIFICATIONS

Tower Height: Ground to top of tower..............................
Ground to top of base insulator...............

Tower Use: Antenna support...

Channel or Frequency..

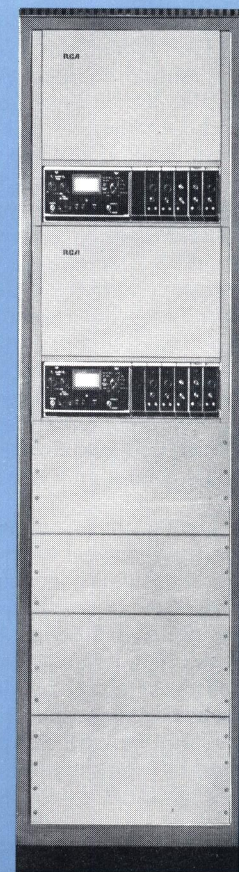
TV Antenna: Type..
Description...

Transmission Lines:
Size — No.

Design Load: ....

Remarks:
(Special requirements, site accessibility, etc.)

- "New Look" solid state design
- Excellent color and monochrome performance
- Unusual flexibility in fixed and portable applications
- Exclusive high quality off-air video/audio monitoring
- Multiple, quality audio channels



RCA TV Relay Systems, Type TVM-6A/13A

Description

The RCA TVM-6A and TVM-13A Television Relay Systems are designed to provide the performance, versatility, and reliability required for the transmission of high quality color and monochrome television signals for broadcast studio-transmitter links, remote TV pickups, and common-carrier, closed circuit and operational fixed applications. The TVM-6A provides coverage of the 5.925 to 7.425 GHz bands, and the TVM-13A covers the 10.550 to 13.250 GHz bands. The equipment meets the rigid requirements for fixed station, single or multiple-hop, as well as portable and remote application. It is capable of the simultaneous transmission of three full-range aural program channels with the video signal.

A full line of accessory items is available to provide hot standby, frequency or space diversity, reversible or two-way systems, and complete fault sensing and alarm equipment.

Design Features

The TVM-6A and TVM-13A design offers exceptional reliability, technical performance capability, and economy of operation through the use of the latest solid state devices and techniques in both the transmitter and receiver. Both the transmitter and receiver are completely solid state except for the transmitter klystron. The use of high quality components and stabilized circuitry provides excellent transmission performance characteristics under extremes of temperatures, humidity, and AC power variations.

Amplitude-frequency response and differential phase and gain errors are held to the extremely close tolerances demanded for color TV transmission. Preemphasis of the video signal is in accordance with the CCIR recommendation.

Operational Features

The functional design of the TVM-6A and TVM-13A equipment combined with the many exclusive built-in test and metering facilities, and centralized controls, permit rapid and easy set up and check out of performance. Color coded metering and a multi-function metering switch provide a check on performance quickly and easily. Built-in test signals and remote tuning of both the transmitter and receiver enable adjustment with a minimum of external test equipment. Convenient test points on each module are provided for voltage measurement and waveform observation. A directly calibrated variable wavemeter is provided that is removable for use in either the transmitter or the receiver.

The power supply may be operated from a power source of 117/234 Volts, 50/60 Hertz, meeting the requirements of broadcasters and common carriers in both the domestic and export markets.

Packaging

The TVM-6A and TVM-13A Systems are attractively packaged in the tradition of the RCA "New Look" products, for both portable and rack-mounted applications. Each of the four basic system units —transmitter control, transmitter RF chassis, receiver RF chassis, and receiver control—can be directly mounted in a standard EIA rack, or can be housed in compact carrying cases for portable operation. The portable RF cases fit standard TV relay tilt heads, tripods, and reflector mounts. Control units may be located at a convenient distance, up to 500 feet, from their respective RF chassis, and interconnected by the appropriate control and video cables.

The rack-mounted units may be stacked for multi-channel or two way operation. Any combination of four complete transmitters or receivers can be mounted in the RCA BR-Series of Cabinets. All necessary waveguide components are installed out of sight within the cabinet. A removable front panel and trim kit is available for each RF chassis, making its appearance compatible with other RCA rack mounted equipment.

In the remote application, the control units are rack mounted in a readily accessible location, while the RF chassis are housed in weatherproof cases and located on a tower or building roof, as required.

Intercom Facilities

Intercom circuitry is provided for communication between the control unit and its associated RF chassis. A standard headset and external battery is used. The intercom circuit may be interconnected with the studio or other communication facility.

Transmitter

The TVM-6A and TVM-13A transmitters are identical except for RF components in the transmitter RF chassis. Transmitter control units are interchangeable between the two systems. The Transmitter Control Unit consists of a nest and up to seven slide-in modules. Two of these modules are the Low Voltage Supply, which contains metering and control circuits, and the Klystron Control Unit. The remaining five spaces are occupied by either Video Patch Modules, or optional accessory modules. All external connections are made to connectors on the rear plate of the control unit. The Transmitter RF Chassis contains the modulating amplifier, Klystron beam and repeller supplies, and the RF components. Modular construction techniques are employed and all modules are easily accessible. Long life klystrons are utilized, and the klystron body and heat sink is at ground potential, eliminating any shock hazard and the necessity for protective shielding. A waveguide ferrite isolator in the transmitter output provides load isolation and contributes to the excellent modulation linearity.

Off-Air Monitor

The optional off-air monitor accessory consists of a cross-guide coupler, a waveguide discriminator with a high Q variable cavity, and a video amplifier and de-emphasis unit. This accessory provides a high quality video output for monitoring purposes which is derived from demodulation of the transmitter RF output. This exclusive feature provides a performance check on the entire transmitter. The video specifications are the same as those for the receiver. Equipment may also be added to provide audio off-air monitoring.

Input Amplifier

The optional Input Amplifier is a slide-in module installed in the Transmitter Control Unit. This unit provides adjustable gain to compensate for different video input levels, a sawtooth signal generator to aid in set up, a peak reading voltmeter circuit for front panel metering of video level, a cable equalizer for up to 500 feet of video cable, and a choice of 75 Ohm unbalanced or 124 Ohm balanced input impedances. The Input Amplifier also contains the low-pass filter required in conjunction with the aural program channels when transmitted with the video signals.

Transmitter AFC Unit

The optional Transmitter AFC Unit is available in module form for the TVM-6A and TVM-13A transmitters. Its input is derived from the transmitter waveguide discriminator and improves the frequency stability of the transmitter to ±.02 percent.

Receiver

As in the case with the TVM-6A and TVM-13A Transmitters, the receivers are identical except for the RF components in the Receiver RF Chassis. In the receiver, a solid state signal generator is used in place of the conventional klystron as a local oscillator. This signal source completely eliminates the requirement for high voltage power supplies, and results in a total solid state receiver of greatest stability and tuning ease. The Receiver RF Chassis utilizes a balanced mixer and an IF amplifier with gain controlled stages and lumped filtering and

Receiver control unit shown mounted in convenient portable carrying case. The packaging of the TVM-6A makes it well suited to any of three modes of operation —portable, remote or rack mounted.

equalization. The receiver noise figure and IF group delay are exceptionally low. Provision is made for attaching the variable wavemeter for adjustment of the local oscillator frequency.

The Receiver Control Unit consists of a nest and up to seven slide-in modules. It contains the Low Voltage Power Supply, the Local Oscillator Control Module, and, optionally, five Video Patch Modules, or a combination of accessory modules.

The TVM-6A and TVM-13A receiver is equipped with AFC circuitry which effectively maintains receiver tuning at the point of best system performance, compensating for any tendency of frequency drift in the transmitter or receiver local oscillator.

Tunnel Diode Amplifier

An optional tunnel diode amplifier can be added to the TVM-6A Receiver, as an RF preamplifier. This unit will improve the receiver noise figure to 7 dB, and is recommended for use on extremely long paths, or under difficult transmission conditions to improve system performance.

Output Amplifier

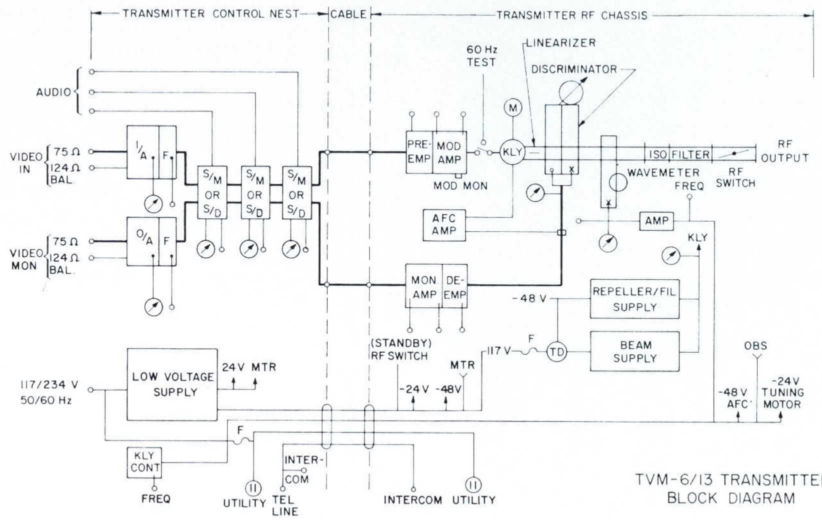
The optional Output Amplifier is a slide-in module which can be inserted in the Receiver Control Nest. This unit provides adjustable gain, video level metering, and cable equalization similar to the functions of the Input Amplifier associated with the transmitter. It also provides two unbalanced 75 Ohm video outputs and one 124 Ohm balanced output. The Output Amplifier contains the low pass filter used in conjunction with the aural program channels, and is required when one or more of these is selected. The Output Amplifier is also utilized in the Transmitter Control Unit, when off air audio monitoring is desired in addition to off air video monitoring.

Diplexed Sound Channels

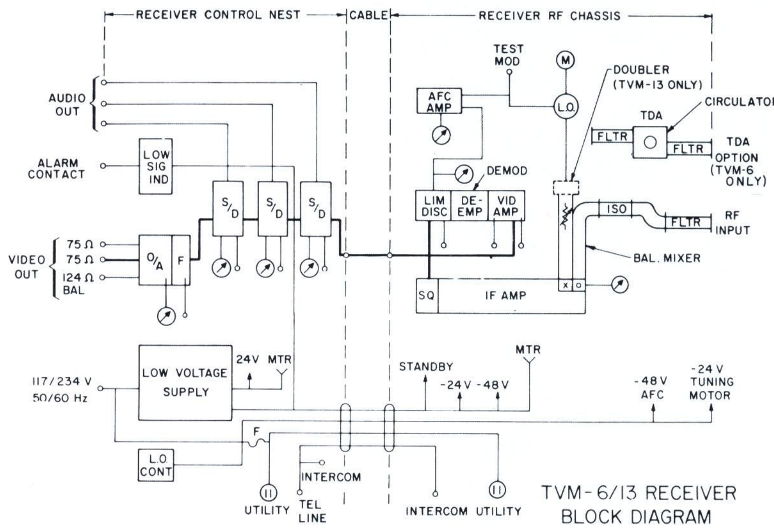
Sound Diplexer Modulators and Demodulators are available for use with the TVM-6A and TVM-13A systems to provide multiple broadcast quality program audio channels to be transmitted simultaneously with the video. These units are slide-in modules which can be readily inserted in the appropriate position in the control nest.

Accessory Units

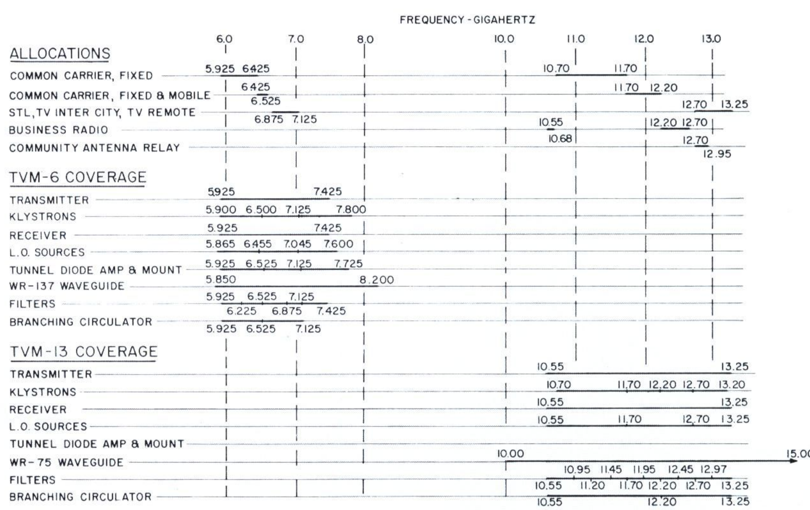
RCA offers a comprehensive line of parabolic antennas, passive reflectors, waveguide components, and engineering assistance in the planning and design of Television Relay Systems.



TVM-6/13 TRANSMITTER BLOCK DIAGRAM



TVM-6/13 RECEIVER BLOCK DIAGRAM



TVM-6/13 FREQ. COVERAGE

Specifications

Transmitter

Frequency Range:
- TVM-6A .... 5.925-7.425 GHz
- TVM-13A .... 10.550-13.250 GHz

Power Output .... 1.0 Watt min.
Primary Power .... 117/234 V, 48-62 Hz, 190 Watts
Ambient Temperature .... −30° to +50°C
FM Deviation .... 8.0 MHz p/p
Frequency Stability:
- With AFC .... ±0.02%
- Without AFC .... ±0.05%

Pre-Emphasis (Per CCIR Rec. 405) .... 13.4 dB
Off-Air Video Monitor .... Same as System Specs.
Off-Air Audio Monitor .... Same as System Specs.

Receiver

Frequency Range:
- TVM-6A .... 5.925-7.425 GHz
- TVM-13A .... 10.550-13.250 GHz

Local Oscillator Frequency—Signal Frequency .... ±70 MHz
Noise Figure:
- TVM-6A with TDA .... 7.0 dB max.
- TVM-6A without TDA .... 11.0 dB max.
- TVM-13A .... 12.0 dB max.

IF Bandwidth @ 3 dB points .... 24 MHz
FM Threshold:
- TVM-6A .... −79 dBm (−83 dBm with TDA)
- TVM-13A .... −78 dBm

Ambient Temperature .... −30° to +50°C
Primary Power .... 117/234 V, 48-62 Hz, 90 Watts

System Video

Input Impedance:
- Unbalanced .... 75 Ohms
- Balanced .... 124 Ohms

Input Level .... 0.5-1.5 V p/p
Output Impedance:
- Unbalanced .... 75 Ohms
- Balanced .... 124 Ohms

Output Level .... 0.7-1.5 V p/p
Differential Gain @ 3.58 MHz:
- 50% APL .... 0.1 dB
- 10 & 90% APL .... 0.25 dB

Differential Phase @ 3.58 MHz:
- 50% APL .... 0.3°
- 10 & 90% APL .... 1.0°

Amplitude-Frequency Response:
- 50 Hz-7 MHz with Sound Ch. .... ±0.25 dB
- 50 Hz-4.5 MHz with Sound Ch. .... ±0.25 dB

15 kHz Square Wave Tilt .... 0.5% max.
50 Hz Square Wave Tilt .... 2.0% max.
Sin^2 Pulse Response (.125 μ sec. T Pulse):
- Without Sound Ch. .... 5% max. p/p ringing
- With Sound Ch. .... 20% max. p/p ringing

Signal to Hum .... 50 dB p/p-p/p

System Audio

Input Impedance .... 150/600 Ohms Bal.
Output Impedance .... 150/600 Ohms Bal.
Input Level .... 0 to +18 dBm
Output Level .... +18 dBm max.
Pre-Emphasis .... 75 Microseconds
Subcarrier Frequency .... 6.8, 7.5, 8.3 MHz
Subcarrier Deviation .... ±100 kHz
Amplitude-Frequency Response:
- 50 Hz to 13 kHz .... +0, −0.8 dB
- To 15 kHz .... −1.5 dB max.

Harmonic Distortion .... 1% max.
Signal to Noise (Hum & Crosstalk) .... 62 dB min. with normal video loading

Mechanical

Power Requirements:
- Transmitter .... 116/234 V AC 50/60 Hz, 190 Watts
- Receiver .... 117/234 V AC 50/60 Hz, 85 Watts

Dimensions:
- Rack-Mounted Transmitter .... 10½″ x 19″ rack space (26.67 cm, 48.26 cm)
- Rack-Mounted Receiver .... 10½″ x 19″ rack space (26.67 cm, 48.26 cm)
- Transmitter Control Unit .... 5¼″ x 19″ (13.34 cm, 48.26 cm)
- Receiver Control Unit .... 5¼″ x 19″ (13.34 cm, 48.26 cm)

Weight:
- Transmitter in Portable Case .... 40 lbs. (18.2 kg.)
- Receiver in Portable Case .... 40 lbs. (18.2 kg.)
- Transmitter Control Unit in Portable Case .... 40 lbs. (18.2 kg.)
- Receiver Control Unit in Portable Case .... 40 lbs. (18.2 kg.)

Accessories

Input Amplifier MI-44535-A-2
Output Amplifier .... MI 44533-A-2
Transmitter Monitor ES-48304
Transmitter AFC ES-48305
Tunnel Diode Amplifier (TVM-6A) ES-48309
Single Channel Sound Diplexing Transmitter MI-44534-A-2
Single Channel Sound Diplexing Receiver MI-44539-A-2
Front Panel and Trim Strip MI-48222
Headset MI-11743
Low Power/Signal Indicator MI-48239
Power Detector MI-48240
Video Presence Detector MI-48241-1
Module Extender—Rigid MI-48263-1
Module Extender—Flexible MI-48263-2

Ordering Information

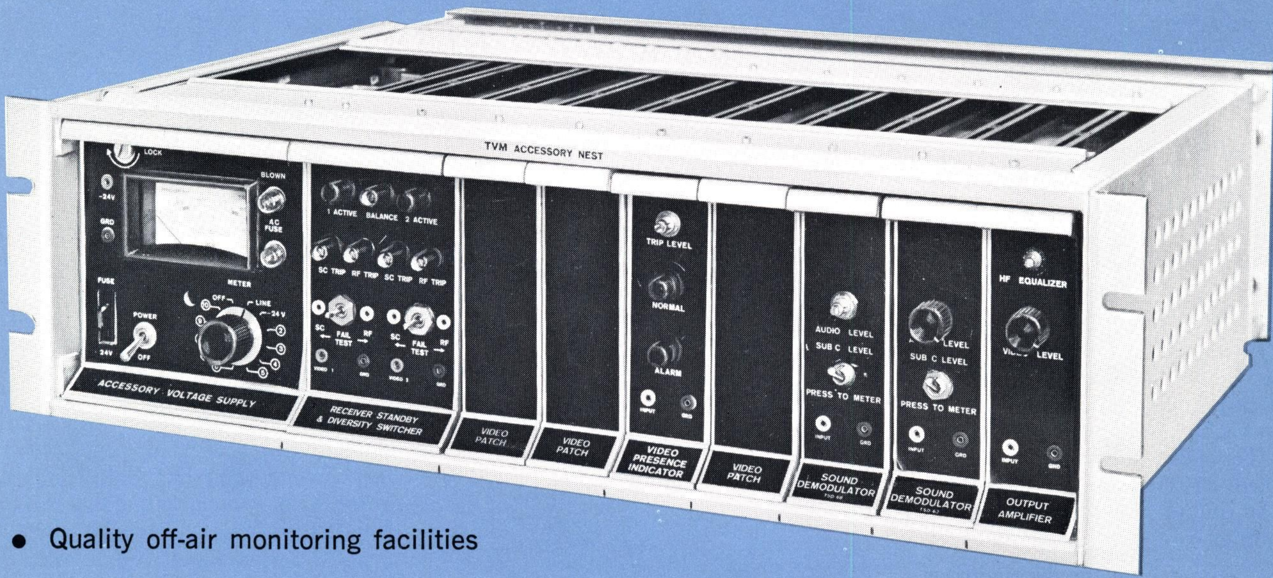
TVM-6A System:
- TVM-6A Rack Mounted Transmitter ES-48300
- TVM-6A Rack Mounted Receiver ES-48301
- TVM-6A Portable Transmitter ES-48302
- TVM-6A Portable Receiver ES-48303

TVM-13A System:
- TVM-13A Rack Mounted Transmitter ES-48320
- TVM-13A Rack Mounted Receiver ES-48321
- TVM-13A Portable Transmitter ES-48322
- TVM-13A Portable Receiver ES-48323

Commercial Electronic Systems Division
Front and Cooper Streets, Camden, New Jersey, U.S.A. 08102

RCA Broadcast Equipment

catalog B.8008



- Quality off-air monitoring facilities
- Complete remote and local fault and alarm reporting systems
- Versatile transmitter and receiver switching
- Solid state reliability
- Plug-in modular convenience

RCA TV Relay Accessory Equipment

Description

New accessories for the RCA TVM-6A and TVM-13A TV Relay Systems now enable the user to more fully realize the versatility and adaptability of this equipment in any application.

Functions which the accessories perform include quality off-air monitoring of radiated signal, fault sensing and fault reporting, automatic switchover to standby equipment, diversity reception, reversal of direction of transmission, automatic shutdown, and many more. A full complement of equipment is provided for multi-channel, multi-hop, one and two way or reversible systems.

All RCA TV Relay Accessory Equipment is fully compatible with the parent equipment· both in appearance and in technical and operational features. In many cases, the TVM equipment is equipped to receive the accessory modules without additional wiring or mounting facilities. Each item has been designed for ease of integration into existing systems to further system expansion, or to increase the reliability and maintenance efficiency of new or existing systems.

All units in the accessory equipment line utilize the latest solid-state design techniques and state of the art components. The absence of vacuum tubes and other thermionic devices contributes to the reliability and life of the equipment. The use of mechanical relays has been held to a minimum and are used only where their spatial and operating efficiency is not exceeded by other devices.

RCA is prepared to offer assistance in the planning and implementation of TV Relay systems to provide the quality and reliability demanded in specific applications.

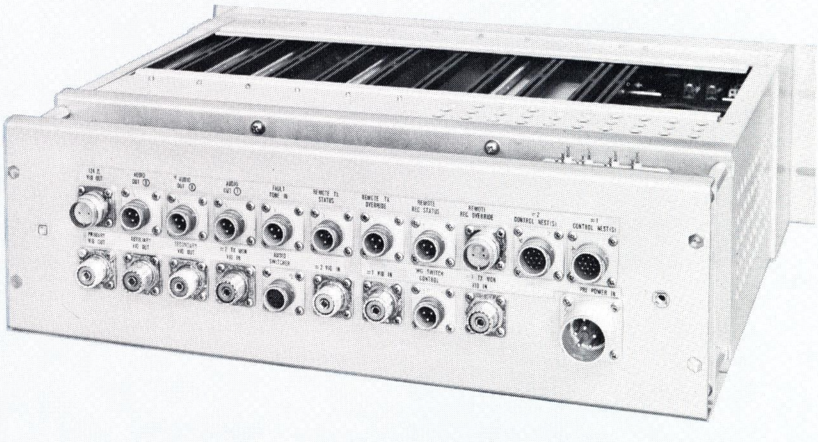
Transmitter AFC and Off-Air Video Monitoring

The TVM-6A or the TVM-13A TV Relay Transmitters may be optionally equipped with Transmitter AFC, Transmitter Off-Air Video Monitoring, or a combination of both.

The basic accessory unit to both AFC and monitoring is the Transmitter Waveguide Discriminator. This unit consists of a cross-guide coupler and a high-Q variable cavity, comprising an RF discriminator with excellent linearity and stability. The video output from this unit is amplified, de-emphasized, and is available at an output connector for display on monitoring equipment.

The DC output from the discriminator is utilized as the reference voltage for control of transmitter output frequency by means of the AFC Amplifier. The frequency stability of the TVM-6A and TVM-13A Transmitter is improved from ±.05 percent to ±.02 percent with AFC.

The video performance specifications for the transmitter off-air monitor option are the same as those for the TVM-6A or TVM-13A receiver. This high-quality feature provides a reliable performance check on the entire transmitter. On transmitters incorporating the off-air video monitor, audio monitoring may be added by incorporating a Sound Diplexer Demodulator, MI-44539-A( ), in the transmitter control unit.



Rear view of TVM Accessory Nest, MI-48255, showing input, output, and control connectors. Mating cable connectors are supplied with accessory equipment.

ORDERING INFORMATION

Transmitter AFC (For TVM-6A)	ES-48305
Transmitter AFC (For TVM-13A)	ES-48325
Transmitter Off-Air Monitoring (For TVM-6A)	ES-48304
Transmitter Off-Air Monitoring (For TVM-13A)	ES-48324
Combined Off-Air Monitoring and AFC (For TVM-6A)	ES-48306
Combined Off-Air Monitoring and AFC (For TVM-13A)	ES-48326

TVM Accessory Nest, MI-48255

The TVM Accessory Nest is similar in appearance and rack space requirements to the TVM-6A and TVM-13A Transmitter Control Nest and Receiver Control Nest. It is normally mounted in the same rack immediately beneath either of the above units, but can be mounted in any standard relay rack, or in the MI-44548 TVM Control Carrying Case for portable use.

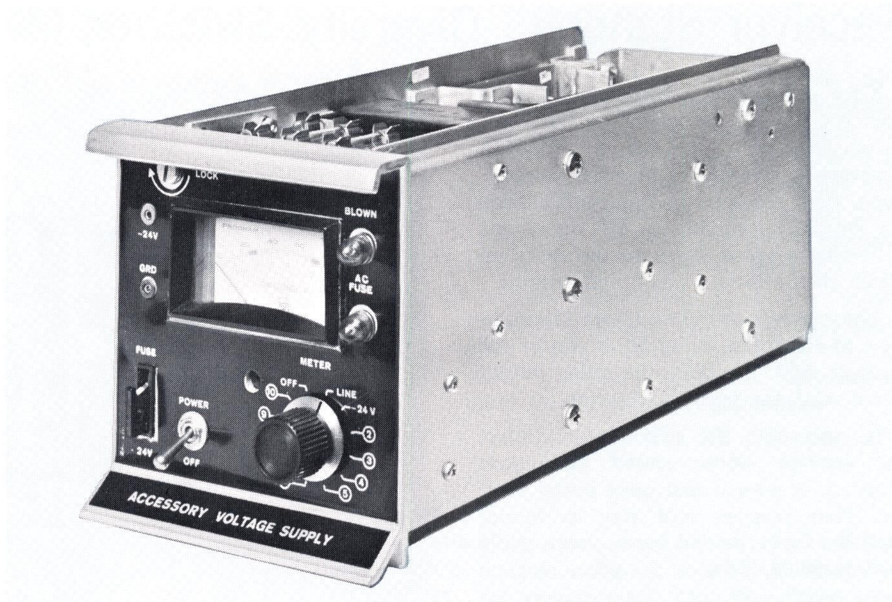
The function of the Accessory Nest is to provide a mounting location for the various slide-in modules used in the applications listed below, and provides the necessary video, audio, control, and power connections required by the accessories used in a particular application. Both 75 Ohms unbalanced and 124 Ohms balanced video input and output impedance connections are provided.

The Accessory Nest provides mounting space for the MI-48261 Accessory Power Supply, and the necessary modules for the following applications; Transmitter Standby Terminal, Receiver Standby Terminal, Receiver Diversity Terminal, Sound Modulator Terminal, Sound Demodulator Terminal, Sound Modulator-Demodulator Terminal, Standby-Diversity Repeater.

External Connections to the Accessory Nest are made through cable plugs on the rear plate of the nest. Plug and cable connectors are compatible with equivalent connectors on the TVM transmitter and receiver control nest.

SPECIFICATIONS

Input Voltage	117 or 234 V, 48-62 Hz
Dimensions (Overall):	
Width	19″ (48.26 cm)
Height	5¼″ (13.34 cm)
Depth	15⅝″ (39.69 cm)
Weight (Nest only)	8 lb. (3.6 kg.)



Accessory Power Supply, MI-48261

The Accessory Power Supply is a companion unit to the Accessory Nest, MI-48255. It operates from a 117/234 Volt, 48/62 Hertz power line, and furnishes 24 Volts, DC, to power the accessory modules. A front panel meter and meter function selector switch are provided to selectively observe readings on the accessory units housed in the nest.

SPECIFICATIONS

Input Voltage	117 or 234 V, 48-62 Hz
Output Voltage	–24 V DC
Mechanical	Mounts in Accessory Nest, MI-48255

Transmitter Standby Switcher, MI-48256

The Transmitter Standby Switcher functions as an automatic fault sensing and switchover unit for hot standby application of the TVM-6A or TVM-13A transmitters. It can also be used with combinations of this equipment and RCA TV Relay equipment of earlier design.

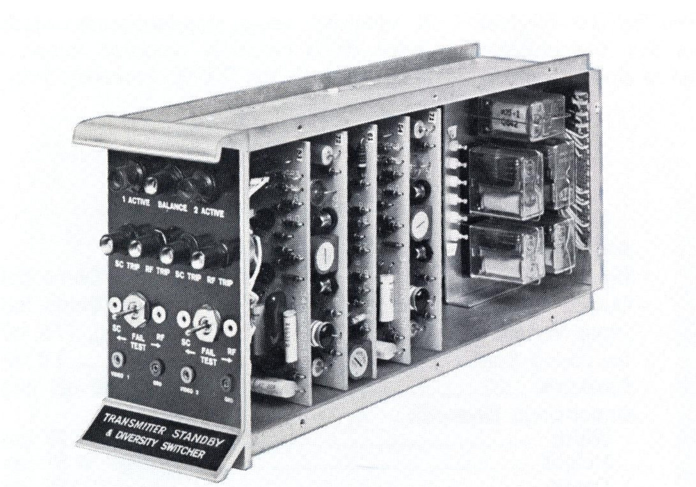
The standby switcher can sense the video signal from the transmitter off-air monitor, as well as DC voltages derived from the transmitter RF power output, and the sound channel subcarriers.

The video signals from each transmitter are amplified, rectified in opposite polarity, and fed to a trigger circuit through interlock circuits controlled by the presence of transmitter output power and the sound subcarriers. The presence of all these signals results in a zero bias at the final trigger circuit, maintaining a switching status-quo.

The absence of any of the sensed signals will result in a switch to the other transmitter if the failed transmitter was on the air, or will inhibit a switch if the failed transmitter is in standby.

The switcher provides panel light indication of the active transmitter and contacts to extend status indication to a remote location, or to the alarm system, if used.

If the transmitters are not equipped with the off-air monitor accessory, the Transmitter Standby Switcher may be equipped to sense only the transmitter RF power. In this case it will not respond to a fault causing loss of video modulation.



SPECIFICATIONS

Input Voltage	24 V, DC, 250 mA
Video Input Impedance	15 K Ohms bridging
Video Sense Level	0.25 to 1.5 V p-p
Video Output Impedance	75 Ohms
Switching Speed:	
On RF Output Fail	300 mS
On Video Fail	400 mS
On Subcarrier Fail	200 mS
Mechanical	Mounts in Accessory Nest, MI-48255

Receiver Standby - Diversity Switcher, MI-48259

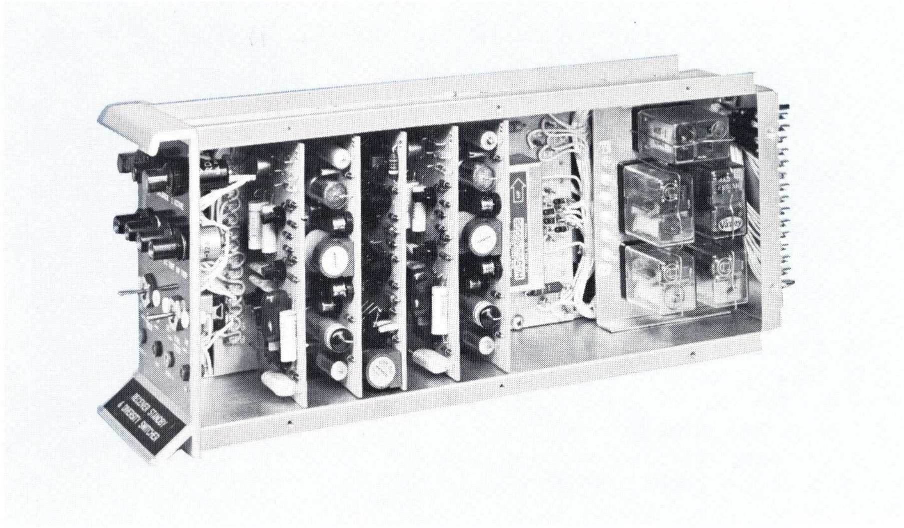
The Receiver Standby-Diversity Switcher is used for switching the video output from two TVM-6A or TVM-13A receivers in standby or diversity arrangement. Both receivers in this configuration are normally receiving an RF signal and delivering a video signal to the switcher, which then selects a non-failed output.

The receiver switcher senses the presence of RF input signal by means of the receiver AGC Voltage, the video output signal, and the sound subcarrier.

In operation, the switcher will select the receiver whose sensed parameters come up to normal first upon initial turn-on. That receiver will stay in service until one of its sensed levels drops while the equivalent level in the other receiver holds steady, or until the receivers are switched manually. A power failure to the switching equipment will result in the selection of the number one receiver output. No switching occurs when the same fault occurs in both receivers, such as would be caused by a propagation fade or complete failure of the transmitted signal. A remote override switch connection is available at the rear of the Accessory Nest.

The operation of the Receiver Standby-Diversity Switcher is similar to that of the Transmitter Standby Switcher. A DC voltage is derived from the video output of each receiver, in opposing polarities, and appears at the final trigger.

These voltages are routed through interlocks controlled by the receiver AGC voltage and the sound subcarrier. Sensing of the sound subcarrier provides an important additional advantage in protecting against receiver detuning. Excessive receiver frequency drift is accompanied by loss of high frequency response, and as a consquence, loss of the sound channel subcarrier.



SPECIFICATIONS

Input Voltage	24 V, DC, 250 mA
Video Input Impedance	15 K Ohms bridging
Video Sense Level	0.25 to 1.5 V p-p
RF Sense Input	–2.0 to –14.0 V DC
RF Sense Impedance	25 K Ohms
Video Crosstalk (1.0 V p-p ref.)	–54 dB @ 4.0 MHz
Switching Speed:	
On RF Input Fail	1.5 mS
On Video Fail	200 mS
On Subcarrier Fail	15 mS
Mechanical	Mounts in Accessory Nest, MI-48255

Sound Channel Standby Switcher, MI-48260

The Sound Channel Standby Switcher is an auxiliary unit to the Receiver Standby-Diversity Switcher. This unit provides automatic switching of the program audio output from two TV Relay Receivers. It is driven by the receiver switcher. It provides for simultaneous audio switching of one to three channels, and permits the use of separate audio channel equipment on main and standby TV Relay equipment.

The Sound Channel Standby Switcher is mounted on a standard rack width panel. It is normally mounted immediately beneath the TVM Accessory Nest.

SPECIFICATIONS

Input Impedance	600 Ohms bal.
Output Impedance	600 Ohms bal.
Input Voltage	24 V, DC, 17.5 mA
Switching Speed	1.0 mS
Crosstalk	–70.0 dB min.
Dimensions (Overall):	
Width	19″ (48.26 cm)
Height	3½″ (8.89 cm)
Depth	5½″ (13.99 cm)
Weight	3 lb. (1.4 kg.)

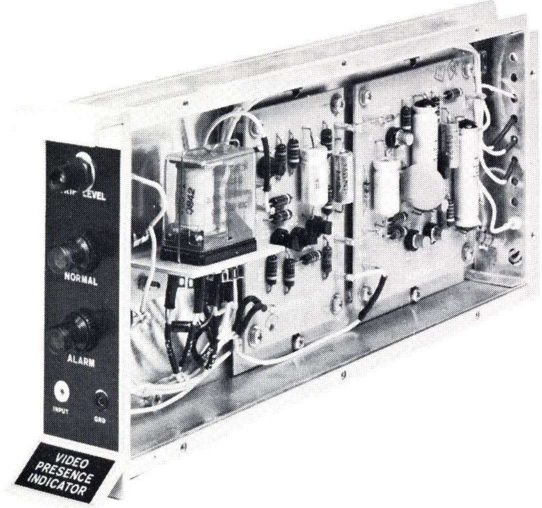
Video Presence Indicator, MI-48241-1

The Video Presence Indicator is a slide-in module which may be installed in the Transmitter Control Nest, the Receiver Control Nest, or the Accessory Nest. Its function is to sense the presence of video information on the video line which is looped through the unit on a bridging basis, and to provide an indication to external equipment by means of relay contacts in the event the sensed video level falls below a predetermined value. The trigger level is adjustable, and is normally adjusted to a value below sync amplitude to prevent false triggering on black level.

When used in the TVM-6A or TVM-13A Transmitter, the Video Presence Indicator senses video on the output of the Transmitter Off-Air Monitor. Since this signal is derived by demodulating the transmitter RF output signal, the Video Presence Indicator will warn of either a loss of modulation or failure of the RF output from the transmitter.

In the TVM-6A or TVM-13A Receiver application, the Video Presence Indicator senses video output from the receiver and will provide an alarm if a failure occurs in the video amplifier circuits. In conjunction with the receiver squelch, it will also indicate a receiver failure in the RF and IF areas.

Alarm information from the Video Presence Indicator can be used to program the TV Relay Alarm Encoder, or other external equipment, depending upon specific system requirements.



SPECIFICATIONS

Video Input Level	0.1 to 1.5 V, p-p
Trip Level Range	0.05 to 0.5 V, p-p
Input Impedance	10 K Ohms min.
Sensed Bandwidth	50 Hz to 4.0 MHz
Input Voltage	–24 V, DC, 75 mA
Relay Contact Rating	117 V, AC, 1.0 A
Mechanical	Mounts in Accessory Nest, MI-48255 or TVM-6A/13A Transmitter or Receiver Control Nest

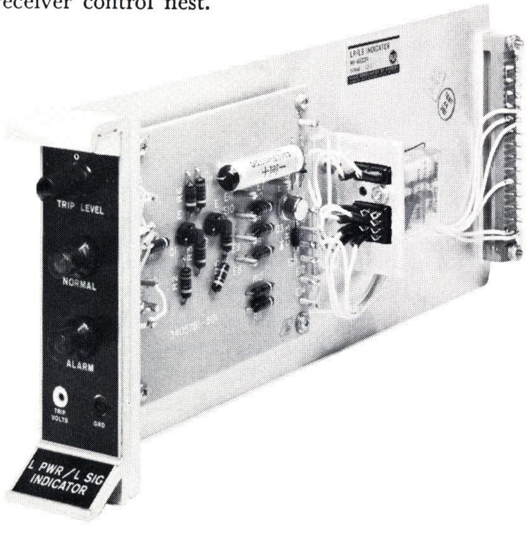
Low Power/Low Signal Indicator, MI-48239

The Low Power/Low Signal Indicator is provided for use in the TVM-6A and TVM-13A System to monitor RF input signal level in the receiver and transmitter output power and to provide an indication by means of relay contacts to external equipment if the monitored parameter falls below a predetermined trigger level. It is a slide-in module which may be installed in either the transmitter or receiver control nest.

In the receiver application, the unit senses the magnitude of developed AGC voltage, and will provide an alarm when this voltage, as a result of a decrease or failure of the RF input signal, falls below the preset value.

In the transmitter application, the Low Power/Low Signal Indicator is used in conjunction with the Power Detector Amplifier to sample detected RF energy from the output waveguide, which is then used as an indicator of relative transmitter power output. As in the receiver case, the decrease or failure of this voltage will result in an alarm indication.

This alarm information can be used to program the TV Relay Alarm Encoder, or other equipment.



SPECIFICATIONS

Low Power/Low Signal Indicator

Input Level	0 to –14 V DC
Trip Level Range	–2.2 to –14 V DC
Relay Contact Rating	117 V AC, 1 A
Input Voltage	24 V DC, 60 mA
Mechanical	Mounts in Accessory Nest, MI-48255 or TVM-6A/13A Transmitter or Receiver Control Nest

Power Detector

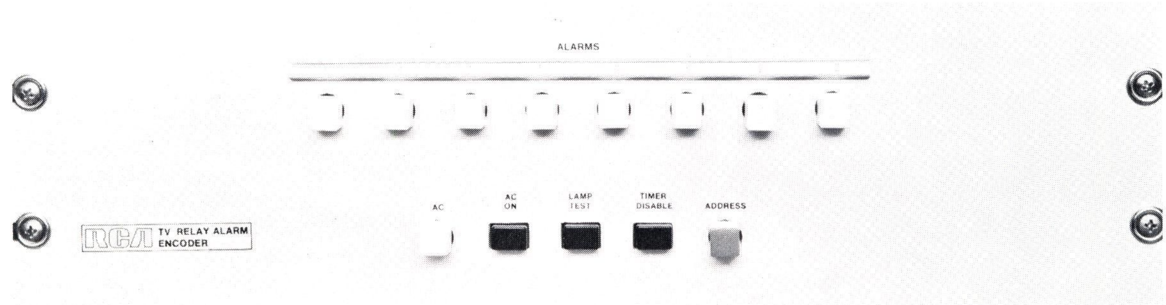
Input Level	0 to –0.3 V DC
Output Level	–1.0 to –16.5 V DC
Trip Level	–0.05 to –0.3 V DC
Trigger Output:	
Normal	–14 V DC
Fault	–1.0 V DC
DC Amplifier Gain	x 50 nom.
Power Requirements	38 V DC, 65 mA

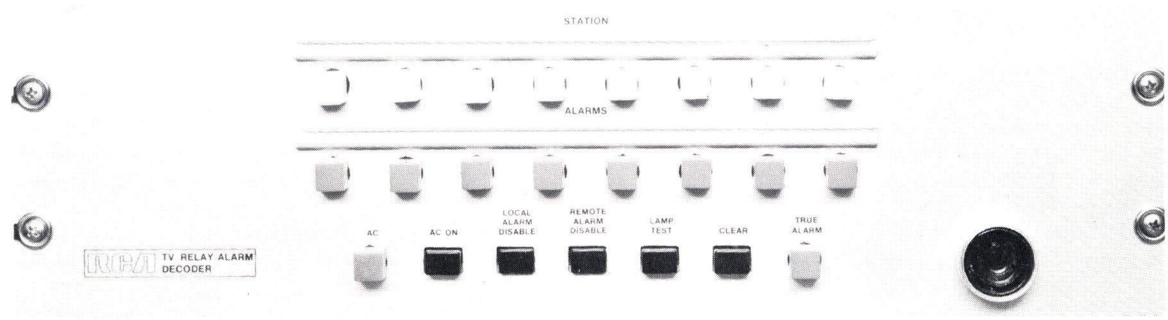
TV Relay Alarm System

The TV Relay Alarm System is an automatic alarm transmission and display system designed to provide monitoring of off-normal or fault conditions from one or more remote locations. It may be equipped to report up to a maximum of eight alarm conditions from each of eight remote locations.

The basic TV Relay Alarm System consists of an Alarm Encoder at each remote reporting location, and an Alarm Decoder at one or more attended supervisory locations. Alarm and identification signals are transmitted sequentially on a time-sharing basis from the remote locations, initiating a light panel readout at the Decoder. Reporting cycles are electronically timed. Encoders in cascade are triggered to report upon a signal from the preceding location, or upon a preset time cycle in the event the trigger signal is not received.

The TV Relay Alarm System, used in conjunction with the MI-48256 Transmitter Standby Switcher, the MI-48259 Receiver Standby-Diversity Switcher, the MI-48241-1 Video Presence Indicator, and the MI-48239 Low Power/Low Signal Indicator in a TVM-6A or TVM-13A TV Relay System will provide complete and automatic alarm and status surveillance of the equipment. Additionally, optional alarms external to the radio equipment, such as tower light failure, illegal entry, commercial power failure, and the like, may be selected for reporting.





TV Relay Alarm Encoder, MI-48502

The TV Relay Alarm Encoder is housed in a panel for standard rack mounting. The front panel contains eight local fault readout lamps, a power indicator lamp and switch, and an address indicator lamp to indicate operation of the address oscillator. A lamp test switch, and a timer disable switch are also provided. Access to standard and optional slide-in modules, and terminals for external connections, are at the rear of the unit.

The alarm information is transmitted by means of audio tones in the 5 kHz to 14 kHz range. These tones, corresponding to the station identification and up to eight alarm conditions, are applied to an 8.3 MHz subcarrier and transmitted via the microwave system along with the normal television program material. Optionally, the alarm tones may be directly applied to a telephone line or other transmission medium external to the microwave system.

When a single encoder is used in a system, station identification and any alarm information present will be transmitted at ten minute intervals. In a system of several encoders in cascade, as in a multi-hop relay system, the first encoder will transmit, followed in sequence at 20 second intervals (5 second transmit, 15 second delay) by the other encoders in the system, with the cycle being repeated at ten minute intervals.

Power for the encoder is supplied by an internal 24 Volt supply.

TV Relay Alarm Decoder, MI-48503

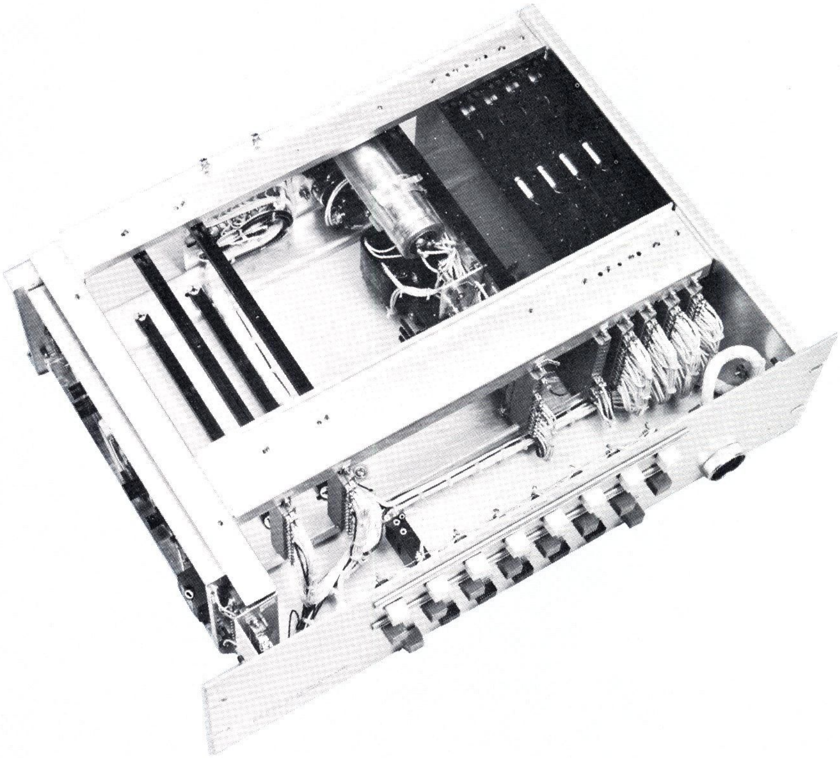
The TV Relay Alarm Decoder is housed in a panel for standard rack mounting. The front panel contains eight alarm readout lamps and eight station identification lamps in two rows. Switches are provided for power, local and remote alarm disable, lamp test, and display clearance. An annunciator is incorporated to provide audible warning of a fault condition.

Access to slide-in modules and to terminals for external connections is from the rear of the unit.

Tone signals from the alarm encoders are received and decoded in sequence and displayed on the lamp banks indicating the station number and alarm designation when an alarm condition exists. If no alarm condition is present, only the station identification lamp will be on. The station identification lamp bank is erased upon receipt of the signal from the next encoder.

The receipt of alarm tones will lock up the alarm lamp bank and start the audible warning. Both must be reset manually by means of the front panel pushbuttons.

Contacts can be provided by means of an optional module for extending the readout information by means of cable pairs.



Top view of TV Relay Alarm Decoder, MI-48503; front view is shown on opposite page.

SPECIFICATIONS

Encoder, MI-48502

Fault Inputs	8
Station Identification	1
Tone Frequencies	9
Subcarrier Frequency	8.3 MHz
Subcarrier Deviation	10 kHz per tone
Power Requirements	117 V AC, 48-62 Hz, 20 Watts
Dimensions Overall	19″ wide, 5¼″ high, 14″ deep (48.26 cm, 13.34 cm, 35.56 cm)
Weight	18 lbs. (8.2 kg.)

Decoder, MI-48503

Station Inputs	8
Fault Inputs	8
Tone Frequencies	16 max.
Power Requirements	115 V AC, 48-62 Hz, 26 Watts
Dimensions Overall	19″ wide, 5¼″ high, 14″ deep (48.26 cm, 13.34 cm, 35.56 cm)
Weight	18 lbs. (8.2 kg.)

Special Waveguide Assemblies

Special Waveguide Assemblies, including the required specialized components, ferrite devices, waveguide filters, couplers, switching devices, and mounting hardware kits are available for the TVM-6A and TVM-13A TV Relay Equipment, to provide complete custom installation applications. These assemblies eliminate the necessity for waveguide fitting and fabrication in the field, and are designed to mount within the equipment cabinet with the TV Relay Equipment.

Waveguide assemblies are available for the following TVM-6A and TVM-13A station configurations:

Main and Standby Transmitters
Main and Standby Receivers
Frequency or Space Diversity Receivers
Two-Way Terminal
One-Way Repeater
Two-Way Repeater
2-4 Channel Transmit Terminal
2-4 Channel Receive Terminal
Two Channel Repeater
Reversible Repeater and Terminal

Ordering Information

Transmitter AFC (For TVM-6A)	ES-48305
Transmitter AFC (For TVM-13A)	ES-48325
Transmitter Off-Air Monitoring (For TVM-6A)	ES-48305
Transmitter Off-Air Monitoring (For TVM-13A)	ES-48324
Combined Off-Air Monitoring and AFC (For TVM-6A)	ES-48306
Combined Off-Air Monitoring and AFC (For TVM-13A)	ES-48326
TVM Accessory Nest (TVM-6A/13A)	MI-48255
Tee Patch Module (TVM-6A/13A)	MI-48262-1
Video Patch Module (For TVM-6A/13A)	MI-44536-1
Accessory Power Supply (TVM-6A/13A)	MI-48261
Transmitter Standby Switcher (TVM-6A/13A)	MI-48256
Receiver Standby-Diversity Switcher (TVM-6A/13A)	MI-48259
Sound Channel Standby Switcher (TVM-6A/13A)	MI-48260
Video Presence Indicator (TVM-6A/13A)	MI-48241-1
Low Power/Low Signal Indicator (TVM-6A/13A)	MI-48239
Power Detector Amplifier (TVM-6A/13A)	MI-48240
TV Relay Alarm Encoder (TVM-6A/13A)	MI-48502
TV Relay Alarm Decoder (TVM-6A/13A)	MI-48503
Tunnel Diode Amplifier (For TVM-6A)	ES-48309
Klystron Linearizer (For TVM-6A)	MI-44547
Klystron Linearizer (For TVM-13A)	MI-43413
Wavemeter (For TVM-6A)	MI-48236
Power Cable, 10-feet (For TVM-6A/13A)	MI-48229-1
Rigid Module Extender (For TVM-6A/13A)	MI-48263-1
Flexible Module Extender (For TVM-6A/13A)	MI-48263-2

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3J5531 TMK(S) Printed in U.S.A.