SPARTA RA-4 Remote Amplifier

Preliminary Description/Specifications

SPARTA RA-4 Remote Amplifier

Preliminary Description/Specifications

SPARTA RA-4 Remote Amplifier

Preliminary Description/Specifications

The RA-4 is a four-channel remote mixer providing a choice of either low-level microphone or high-level program input to each channel. A program-line amplifier plus Master gain control delivers up to 10 dbm nominal program level into a 600 ohm line.

Either 150-250 or 50 ohm microphones may be used for low-level inputs, while high-level inputs may be either 600 ohm terminated or high-impedance bridged. The unit is supplied with terminating resistors which, when removed, allow the RA-4 to be operated with "semi-pro" tape units, tuners or similar sources which require a high-impedance load.

Both AC line and DC battery supplies are internal, with automatic battery operation in the event of AC line failure. During AC operation there is no load upon the batteries, as indicated by a front-panel lamp.

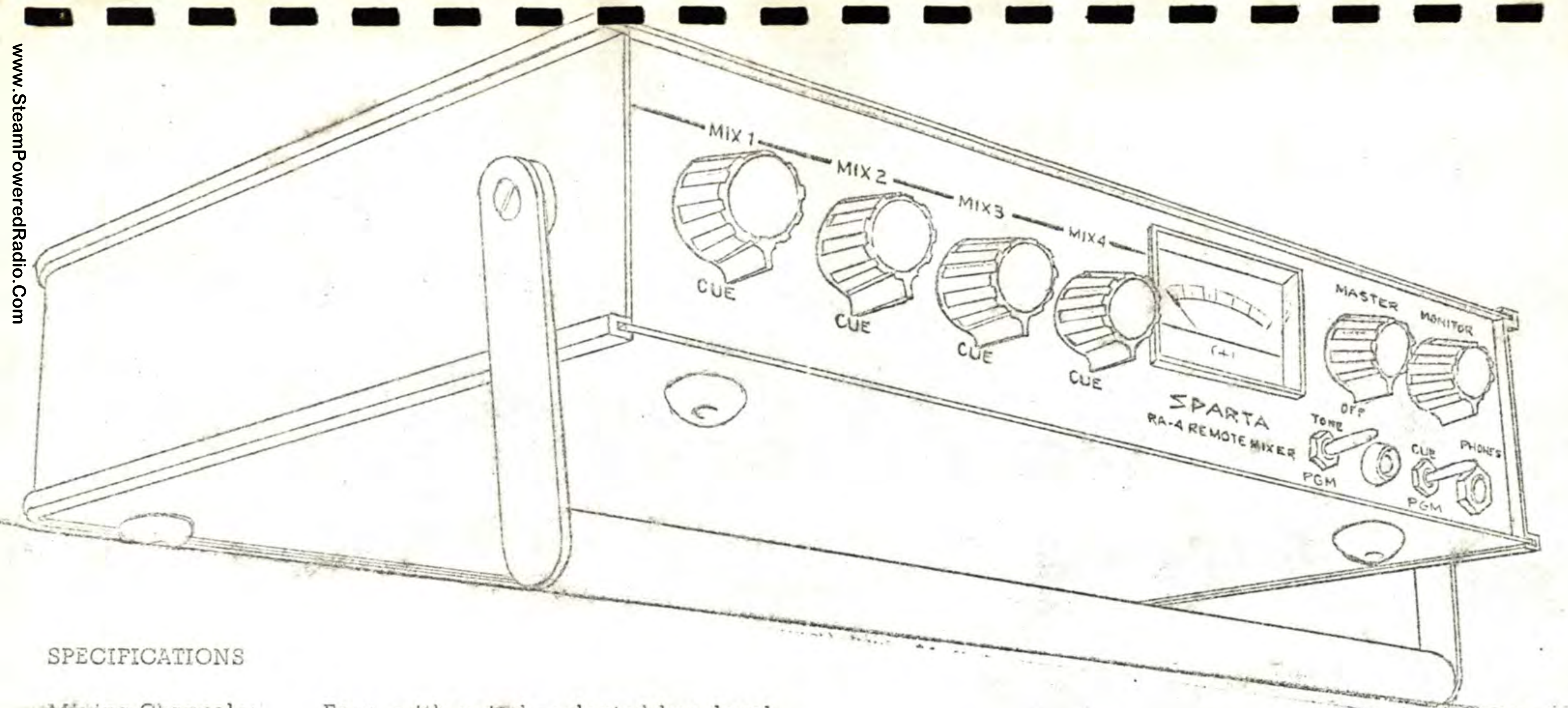
Extremely long battery life results from a unique line amplifier operating at very high efficiency. The no-signal current drain is so low that significant current is required only for actual program output. This allows long life to be obtained with a relatively small and inexpensive pair of 9v transistor batteries.

A built-in test-tone oscillator at 700 Hz operates independently from the Mixer level controls, permitting the oscillator to be used for setting Master gain without changing preset Mixer positions.

A novel headphone circuit with front-panel jack and gain-control operates via its own amplifier directly from the line output so that both program and/or talkback material may be monitored. Either high or low impedance phones may be used, wired for stereo or mono, without internal changes. Monitor output is also available on the rear panel for use with an external monitor amplifier.

Mixer bus access is also provided to allow "stacking" of two or more units for multiple-mixing applications and multiple line feed.

over



SPECIFICATIONS

Mixing Channels:	Four, with switch-selected low-level inputs (150-250 or 50 ohm microphones) or high-level inputs (balanced; choice of 600 ohm terminated or high-Z bridging).
Input Levels:	-55 db nominal (low-level) or -20 dbm nominal (high-level).
Output Level:	10 DBM at Ø vu into 600 ohm. 24 dbm max, AC line; 18 dbm max, battery.
Freq. Response:	Within + or - 2db from 50 Hz to 15 kHz at all operating levels.
Distortion:	Less than 0.5% THD at all operating levels. Typically 0.2%.
Noise Level:	-125 dbm or better, referred to input.
Gains:	Low-level, 95 db; Hi-level, 60 db.

Misc:

Test-tone osc; 700 Hz; sets output level (Ø vu at 10 dbm) via Master gain control.
Headphone monitor for program or talkback; Hi or Lo Z phones.
Monitor output for external monitor power amp
Mixer bus access for stacking two or more units.
Battery-test sw., spring-loaded for auto return to line VU.
Soft-Case option; Black vinyl or leatherette with reinforced bottom panel. RA-4 handle serves as carry-handle.
Cue Bus, each Mixer, monitors via phone circuit.
Size, 12 x 9 x 2-1/2 inches, plus handle.
Weight, Approx. 7 lbs.
Rack-mount option (handle removable)

WARRANTY

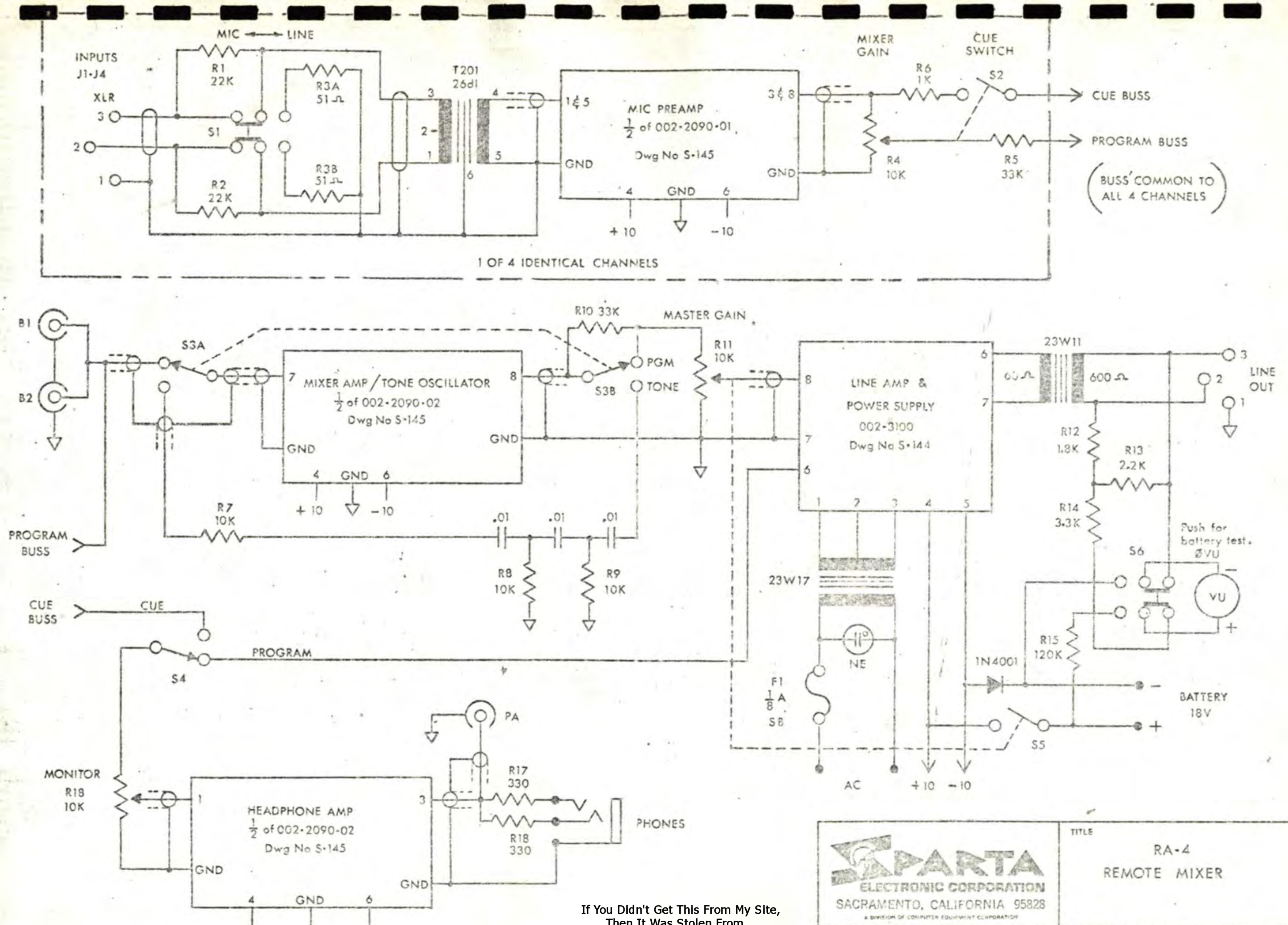
SPARTA ELECTRONIC CORPORATION warrants to the purchaser of SPARTA Electronic Products that any part thereof, which proves to be defective within one year from the date of shipment, will be repaired or replaced free of charge if returned to the factory prepaid. All returns must be specifically authorized by the factory prior to shipment.

SPARTA reserves the right to make changes in design and improvements upon its products without assuming any obligation to install the same upon any of its products theretofore manufactured.

High voltage transformers, modulation transformers, reactors and filter chokes carry an extended warranty of 50% of the replacement cost being allowed should failure occur during the second year. Electron tubes and silicon rectifiers bear only the warranty of the manufacturer thereof in effect at the time of shipment to Purchaser.

Accessories supplied by, but not manufactured by SPARTA ELECTRONIC CORPORATION, shall carry only such manufacturer's standard warranty and are specifically excluded from SPARTA ELECTRONIC CORPORATION's warranty.

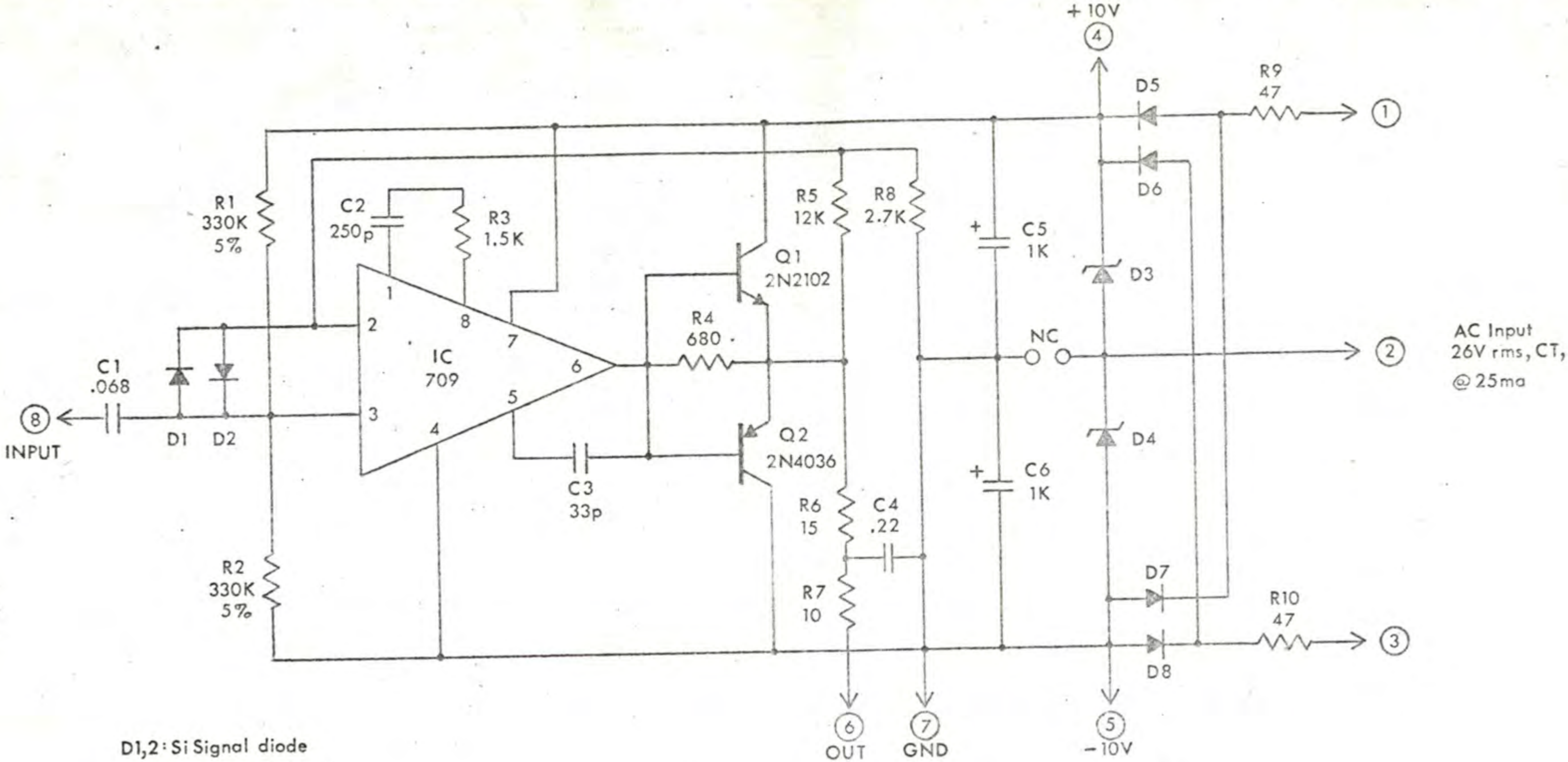
This warranty is expressly in lieu of all other warranties express or implied and does not apply to normal wear and tear or damage resulting from shipment, misuse, unauthorized modifications, or any other modifications, or any other cause or condition except normal usage. Replacement parts supplied under this warranty carry only the unexpired portion of the original warranty.



SPARTA ELECTRONIC CORPORATION
SACRAMENTO, CALIFORNIA 95828
A DIVISION OF COMPUTER EQUIPMENT CORPORATION

DWN SMK	DATE 13-OCT-71	SCALE	SHT 1 OF 1	DWG NO. S-143
APPD CWB	DATE 10-13-71			

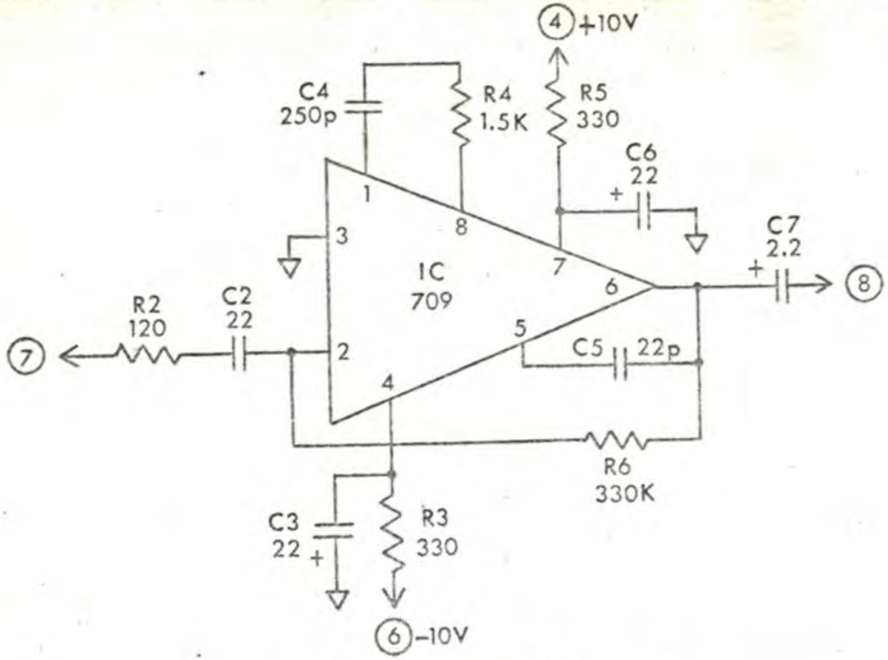
TITLE: RA-4 REMOTE MIXER



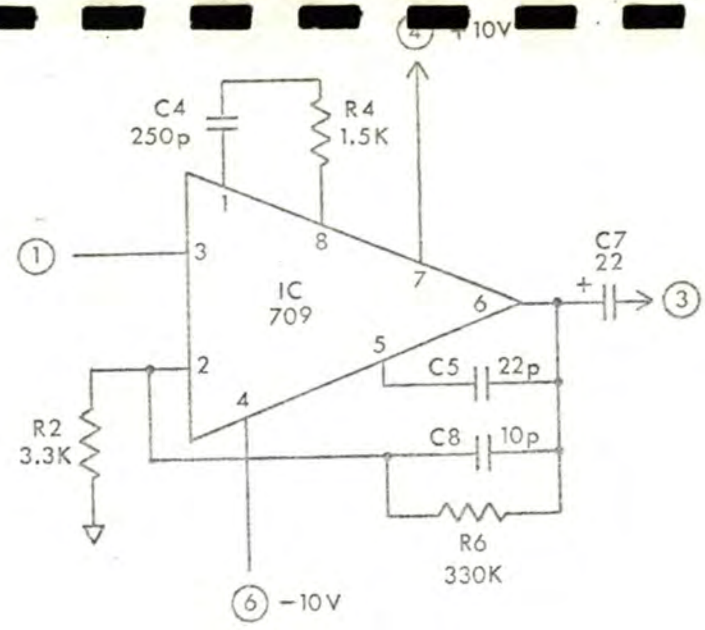
D1,2 : Si Signal diode
D3,4 : 10V, 1W, 5 % Zener
D5,6,7,8 : 50 ma, 50V Si

CAUTION : Do not operate without DC return path between (6) & (7)

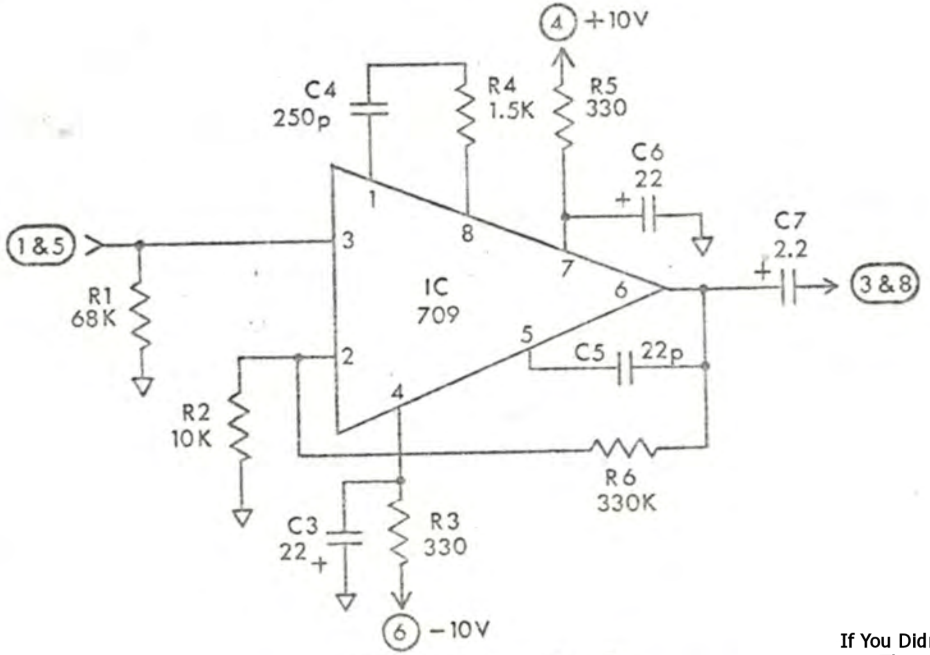
SPARTA ELECTRONIC CORPORATION, SACRAMENTO, CALIFORNIA 95828 (A Division of Computer Equipment Corporation)			TITLE: RA-4 Line Amp & Power Supply, ckt. brd. 065-3100		
DWN SMU.	DATE 13 OCT 71	SCALE	SHT 1	DWG NO. S-144	
APPD DWE	DATE 10-13-71		OF 1		



MIXER AMP/TONE OSCILLATOR
(sub-assy #002-2090-02; 1/2 of board #065-2090)



HEADPHONE AMP
(sub-assy #002-2090-02; 1/2 of board #065-2090)



MICROPHONE PREAMP
(sub-assy #002-2090-01; 2 per board #065-2090)

SPARTA ELECTRONIC CORPORATION
SACRAMENTO, CALIFORNIA 95828
A DIVISION OF COMPUTER EQUIPMENT CORPORATION

TITLE: RA-4 AMPLIFIER MODULES				
DWN SMU	DATE 13 OCT 71	SCALE	SHT 1 OF 1	DWG NO. S-145
APPD DWE	DATE 10-13-71			

RFI

ELIMINATION

Radio frequency interference, or RFI, is always a possibility when audio equipment is operated in the presence of RF fields. It can be particularly troublesome in solid-state systems containing low-level program lines and high-gain preamplifiers because less RF voltage or current is needed in such systems to cause interference.

With properly-designed audio equipment, particularly that intended for use by radio broadcasters, the incidence of RFI is relatively low provided proper installation practices have been followed, yet RFI does occur in even the best of installations because of its virtually unpredictable nature. It does not necessarily require a strong field for RFI to result, and it is not uncommon for an audio system to be unaffected by a nearby high-power transmitter, yet be ridden with RFI from a distant source at a different frequency.

The obvious question, of course, is "Why can't audio equipment be made RFI-proof?" The answer, unfortunately, cannot be so obvious for although normal gain and frequency response of an amplifier can easily be limited to the audio range, this is not the case for individual components and conductors. Capacitors, resistors, inductors, wires and transistors continue to function as such at frequencies far beyond the bounds of the audio spectrum. The wire that is a simple conductor at audio frequencies may become a highly efficient antenna or inductor at radio frequencies: The insignificant stray capacitance at audio frequencies can become a very effective coupling or tuning capacitor at radio frequencies: The semiconductor junction that is a linear control element at audio levels will become an excellent diode detector or modulator if sufficient RF energy reaches it.

The task of RFI suppression, then, is just that -- suppression rather than elimination. No matter what pains are taken at the design and manufacturing levels to minimize susceptibility to RF, the possibility will still exist simply because there is no way to force a component such as a semiconductor to recognize the difference between a change of voltage or current at audio frequencies and a similar or greater change at some higher frequency. Fortunately, there are many effective preventative measures that can be taken, and the ultimate solution to RFI becomes that of providing reasonable suppression during initial design and manufacture followed by additional effort during subsequent installation, if required by an unusually severe environment. It is well to note that the best of built-in suppression can be undone by improper or careless installation.

The symptoms of RFI are varied, depending upon the strength of the field, how it is entering the system, where and how it is being detected, and what kind of modulation it carries. An AM carrier may enter a system, be partially or completely detected by a non-linear element (more on this later) and produce the modulation superimposed over the normal program. If the two programs are different, the intruder is usually recognized as such quite readily; if they are the same, the symptoms may appear as hum, noise, raspiness or similar distortion. Also, if the RFI is strong enough, the result may be a completely blocked amplifier stage with only noise or perhaps silence as a symptom.

An audio system normally does not contain the necessary elements for FM detection, so when the intruding carrier is frequency modulated the symptom is usually that of an un-modulated carrier; hum, noise, distortion of the normal program, or again the silence of a blocked amplifier stage. If the offender is a VHF FM carrier, however, it will most often be entering the audio system via a conductor or cable that is resonant or "tuned" at or near the frequency of the interfering carrier; quite literally a tuned antenna. In such a case the FM can be converted to AM by riding the slope of the tuned element and subsequently be detected by a non-linear element so as to exhibit the symptoms of AM RFI.

When RFI is due to a TV transmitter, the symptoms will most often, though not always, be characterized by a raucus 60 Hz. buzz due to the AM frame-rate sync-pulse. Since two carriers may be involved, one AM and one FM, the symptoms may also become involved, even to the extent of including those of a completely separate carrier from another source. No matter how complex the symptoms, however, there are two factors common to all forms of RFI. First, RF energy is entering the system by a path or paths that can be located and interrupted. Second, the RF is being detected by a non-linear element or rectifier that can be located and suppressed.

The process of eliminating or suppressing RFI, then, involves two basic steps; preventing or minimizing the transfer of RF into the system, and preventing detection of the RF. The first step is simplified considerably by identifying the source and particularly the frequency of the interfering carrier, and the second requires locating the point at which it is being detected.

When considering the means whereby RF energy can enter an audio system, one must be constantly aware that stray capacitances may be excellent conductors for RF and that any wire or metal structure will be resonant at many different frequencies. The most prevalent example, of course, is the twisted-pair shielded audio cable feeding a console which may act as a quarter-wave stub antenna at one frequency and as a multi-wavelength long-wire antenna at a much higher frequency. Of nearly equal importance are instances where turntable tone-arm leads act as VHF antennas -- particularly troublesome because of their locations in very low-level, high impedance circuits -- and AC power-lines, which can be very efficient long-wire antennas at the lower radio frequencies.

The search for the route of RFI is generally a process of eliminating, one by one, the connecting cables by which RF may be entering the system. At the same time, judicious use of operating switches and potentiometers will provide positive clues as to the source. For example, if reducing a turntable mixer control to zero will stop the interference it is a near certain indicator that both injection and detection are taking place in that channel and prior to the mixer control, perhaps in another part of the system.

If a connecting cable is found to be an offender, the first step is to examine the connections at both ends and particularly the way the shield is connected. In most instances best operation will be obtained when the shield is connected at the load or console end and left open at the source end. This is because the equipment at each end of the connecting cable will always have some sort of return to a common ground, and connecting the shield at both ends completes a loop which quite often will respond to magnetic fields. There is no hard and fast rule, however, and it is wise to try various combinations.

When the interference is in the VHF range, it will often be found that shortening or lengthening a cable will eliminate RFI by "detuning" it. Also, it may be found that simply moving or re-routing will accomplish the same effect. In such cases it most often found that touching cables or connections will result in a change of level or symptoms of the RFI. Needless to say, connecting cables should never be coiled and tied in loops. If one must be shortened but not cut, fold it back and forth upon itself and tie it securely.

The next step, if cable-dress and shielding techniques are insufficient, is to bypass program-carrying conductors to ground or shield terminals with suitable capacitors. Since the reactance of a capacitor decreases as frequency increases, the procedure is to choose a capacitor value which will have no significant effect at program-line impedances and frequencies, yet form a low reactance shunt path to ground for the radio frequencies. For the typical 600 ohm system, a value of 0.001 mfd to 0.002 mfd is nearly ideal since the reactance is about 5 K ohms at the higher audio frequencies, falls to 100 ohms at the middle of the AM broadcast band, and is close to 1 ohm at the middle of the FM-TV bands.

The capacitors used should be low-inductance types, such as disc ceramics, and lead-lengths should be kept short: Otherwise the capacitor and leads could become resonant at a frequency which could add rather than cure RFI. The preceding given values can be extrapolated to other impedance levels simply by following the reciprocal relationship; if the audio line impedance is higher, the capacitor should be proportionally smaller, and visa-versa.

In severe circumstances RF chokes may be inserted in series with the audio lines, and with bypass capacitors to ground at each end a very effective filter section will result, if lead lengths are kept short. The Ohmite Z-50 and Z-144 chokes are typical and quite popular for suppression at the higher frequencies. Alternately, passing audio leads through ferrite beads is very effective and space-saving at VHF frequencies. Chokes are generally not too practical at AM broadcast frequencies, however, since those with high enough reactance usually have enough DC resistance to affect audio levels in low-impedance lines. When filtering AC power lines, 0.01 to 0.1 mfd, 600 volt capacitors may be used, although it may be simpler and more effective to employ a commercial filter designed for the purpose.

The suggestions so far have dealt with means of preventing RF from entering the audio system. Of equal importance and often the most effective approach is to isolate and suppress the point of detection. Even though it may require going into the circuitry of equipment in the audio system, it often requires less effort than adding multiple filters to prevent the RF from entering in the first place. As an aid in locating points at which RF can be detected, it will help to consider some circumstances that can result in a non-linear junction, or rectifier.

Considering one of the earliest known forms of an RF detector, the galena crystal and cat's whisker, we can see the effects of RF detection resulting from point-contact of two dissimilar metals. The significant factor is that a junction of any two dissimilar metals or metal compounds is potential detector. Now, we cannot prevent such junctions in an audio system because they exist virtually every time a connection is made. What we can do, however, is assure that every connection is secure and tight so there is no possibility of introducing a voltage-drop -- audio <u>or</u> RF.

In this context we must also consider a very common cause of RFI in turntable systems. Connections to the tone-arm cartridge are made with small push-on clips because soldering to the cartridge pins directly would likely destroy the cartridge. The combination of a loose clip, particularly if oxidized, plus the tone arm lead (an excellent VHF antenna) and the following high-gain amplifiers is an excellent invitation to RFI. Also, the usual tone arm with plug-in cartridge-shell and plug-in connecting cable provides two additional sets of contacts at which RFI detection can take place.

Within the circuitry of individual equipments of an audio system, the most common offender is the emitter-to-base junction of a transistor. This junction is a forward-biased diode, with bias set so that a change of base current with signal will produce a linear but amplified change of collector current. Should RF energy reach such a junction, the bias could shift to a non-linear area and result in distortion of the normal program material. If the RF is amplitude modulated, it is likely that partial or full detection would take place, resulting in audible recognition of the AM component along with normal program. A sufficiently high level of RF, however, could completely block a transistor causing complete loss of any audible symptom, so it becomes quite necessary to allow for varying symptoms with varying levels of interference when attempting to locate an offending junction.

Once the point of detection is determined, the solution is much the same as earlier described; shunt capacitors with short leads, and series inductors in severe instances. It is usually easiest and most effective to add a capacitor directly across the emitter-to-base junction. The most effective value of capacitor will vary with particular circuit parameters but a value of 100 pf is a good starting-point. As a general guide, the capacitor should be as large as practical without causing a loss at the highest audio frequencies.

The input impedance at the base of a transistor is usually measured in thousands of ohms, and the signal current is generally quite small. If it is found that a capacitor reduces but does not adequately suppress the RFI, it will often suffice to then add a series resistor of perhaps 100 to 1 K ohms in series with the signal path immediately preceding the shunt capacitor, and substituting an inductor for the resistor in particularly severe instances. These latter extremes are rarely necessary, however, since most audio equipment designs include equivalent suppression at the most-likely points of RFI detection.

We can conclude that RFI is always a possibility in an audio system and can appear unexpectedly when a change or addition is made to the system or when another transmitter goes on the air. We can also conclude that RFI suppression is a logical process of eliminating or minimizing RF paths into the audio system, or locating and suppressing the points at which detection is taking place, or both. Most important, we can conclude that all instances of RFI can be suppressed by systematic application of one or more of the foregoing suggestions.

SPARTA ELECTRONIC CORPORATION
Remote Amp. Model RA-4.

Dear Customer:
Careful attention to Quality Control is another important element in our daily effort to provide you with excellence of product and service. At SPARTA each piece of equipment and sub-assembly receives numerous inspections and tests in the process of production. The final results must measure within our exacting requirements before it is shipped to you. Listed below are just a few of the major check points and tests this particular piece of equipment has received before being prepared for shipment. Should you note any discrepancy in the appearance or operation of your SPARTA Product or if you have any general comments as to how we might be of greater service, your suggestions will be greatly appreciated.

Customer KUFS-FM Calib. By JR Date 3/1/73 Serial # 180

Power Supply Voltage + 10V - 10V

1 KHZ for Response Reference Inputs Low Level -55db High Level Ø db.

Mix #1 Low Level Output +10 dbm dist. .15% S/N -68
Response 20Hz -1.4 500Hz -.4 10KHz 0 20KHz +.3
High Level Output +10 dbm dist. .18% S/N -68
Response 20Hz -2.2 500Hz -.4 10KHz -.7 20KHz -1.4
Mix #2 Low Level Output +10 dbm dist. .16% S/N -69
Response 20Hz -1.5 500Hz -.4 10KHz 0 20KHz +.2
High Level Output +10 dbm dist. .17% S/N -68
Response 20Hz -2.2 500Hz -.3 10KHz -.6 20KHz -1.2
Mix #3 Low Level Output +10 dbm dist. .16% S/N -69
Response 20Hz -1.4 500Hz -.3 10KHz 0 20KHz +.3
High Level Output +10 dbm dist. .17% S/N -68
Response 20Hz -2.1 500Hz -.4 10KHz -.8 20KHz -1.5
Mix #4 Low Level Output +10 dbm dist. .16% S/N -68
Response 20Hz -1.4 500Hz -.4 10KHz 0 20KHz +.2
High Level Output +10 dbm dist. .17% S/N -67
Response 20Hz -1.7 500Hz -.2 10KHz -.4 20KHz -1.1

Test Tone ✓ Monitor Pgm. ✓ Cue ✓
PA Output ✓ Phones ✓ Cue ✓
AC Indicator ✓ Battery Test ✓