MOSELEY ASSOCIATES, INC.
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Technical Notes 225

AM STEREO STL SERVICE

The impending advent of AM stereo broadcasting will place many of the requirements and responsibilities experienced by the FM stereo broadcaster upon the AM operator. Stereo discs, tape, mixing console and transmission facilities will demand anywhere from slight modifications to doubling of monaural facilities. In keeping with the anticipated mandatory monaural receiver compatibility criteria, all AM stereo transmission systems will utilize an audio matrix scheme providing a sum (L+R) and difference (L-R) components. As is common to FM stereo, AM stereo operators will be confronted with maintaining proper stereo phase tracking to minimize mono sum (L+R) "dropout." This criterion is one leading factor in the selection of stereo facilities.

In addition, the classical concerns of audio fidelity, reliability and cost-effectiveness will lead many remote AM stereo broadcasters to consider stereo aural studio-transmitter link facilities. The present FCC Rules and Regulations, Part 74, Subpart E, allots ten 500 kHz channels between 947 MHz and 952 MHz for aural studio-transmitter link and intercity relay station service. As additional AM stereo STL applications are received, the FCC will be faced with a severe shortage of currently-available spectrum. Presently, approximately the top twenty-five markets in the United States are critically over-crowded in this service. With additional spectrum a necessity, the following guidelines presented in these notes can be used for AM stereo STL service system selection.

In the present 500 kHz channelization, there are two approaches to stereo service. The "dual-monaural" approach, pioneered by Moseley Associates, Inc., shortly after the advent of FM stereo service (early 1960's), utilizes separate L and R channel transmission systems. Symmetrical channel spacing of ±125 kHz from center frequency, providing 250 kHz carrier spacing is utilized. Moseley Associates, Inc. Models PCL-505 and PCL-101 Aural Studio-Transmitter Link systems are recom-

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mended for FM and AM/intercity relay users, respectively. In contemplating the dual system, the need for four antennas must be considered. A 70 dB TX-to-TX isolation between solid-state, broadcast-quality transmitters is recommended when combining two transmitters to a common transmit antenna. A hybrid ring combiner, by itself, does not provide adequate isolation for spectrum protection and reliable operation. The cost of proper isolation generally exceeds that of a separate transmit antenna system. A power divider, such as the Model PD-1000, can be utilized to facilitate the coupling of two STL receivers to a common receive antenna. This device has a maximum per-leg attenuation (including one-half power division) of 3.8 dB per leg at 950 MHz.

The "dual-monaural" approach affords a degree of redundancy in that monaural operation continues in the event of a link failure. For a single hop, AM stereo STL, where mono backup is sufficient, Moseley Associates, Inc. suggests two Model PCL-101 Aural Studio-Transmitter Link systems in this "dual-monaural" configuration.

The second approach to stereo aural studio-transmitter link service was also pioneered by Moseley Associates, Inc., later in the 1960's. This approach is referred to as the "composite" aural studio-transmitter link system. With this scheme, the stereo generator is located at the broadcast studio and the wideband (matrixed) stereo signal is transmitted over a single STL carrier, demodulated back to wideband composite, and applied directly to the FM exciter. In this configuration, the FM stereo broadcaster realizes the advantages of the multiplex-encoded signal between his studio and transmitter that the listener enjoys between the station and his home receiver. This approach heralded many advantages and, currently, the majority of Moseley Associates, Inc., FM stereo aural studio-transmitter link systems. The overall simplicity of the system, afforded by the fact that the wideband composite signal is not demodulated at the transmitter, makes this approach ideal. With the stereo generator located at the studio, the remote FM broadcast transmitter becomes mainly a "RF plant." All audio processing equipment, and stereo generating equipment, is located at the broadcast studio away from strong RF fields and most convenient for installation, operation and maintenance. Virtually, a one-man proof-of-performance for a remote broadcast transmitter becomes reality. The secret of composite aural studio-transmitter link success is the critical amplitude and phase

requirements of the wideband link. The Model PCL-505/C Composite Aural Studio-Transmitter Link guarantees phase linearity to less than 0.7° and amplitude linearity to 0.07 dB over the main to subchannel spectrum.

The concern over lack of standby capability, with a single RF carrier as the aural studio-transmitter link, is valid when qualified with all the facts. When contemplating a Moseley Associates, Inc., STL system for an FM stereo operation, we suggest the Model PCL-505/C. The selling price of a Model PCL-505/C Composite system is approximately $400.00 more than the monaural version. Together with the Models TPT-2 and TPR-2 Automatic Transfer Panels, a completely redundant, automatic switchover composite aural studio-transmitter link system can be installed for approximately 20% additional investment over two monaural Model PCL-505 systems. When considering the aforementioned criteria for combining two transmitters to a common transmitting antenna, or separate transmitting antennas required for "dual-mono" operation, this percentage figure is even less. When operating the Model TPT-2 Transfer Panel Transmitter, only one transmitter is transmitting at a time. This reduces the transmitting antenna/transmitter combination requirements to that of one single antenna system. Another major consideration is that a redundant, composite aural studio-transmitter link system has two transmitters and two receivers operating on the same frequency. A dual-monaural system has two transmitters and two receivers operating on two different frequencies. Thus, a dual-monaural failure of the left transmitter and right receiver would leave the station completely off the air. A similar incident with a redundant, composite system leaving one transmitter and one receiver inoperative, would not only have the station yet on the air, but in full stereo.

These above points, although pertaining to FM stereo operation, are a key to proper understanding and usage of the composite approach for AM stereo service. All the advantages of redundant capability still hold true. The major point to be considered in utilizing the wideband composite approach is that AM stereo transmission itself is not adaptable as a wideband service. It is a requirement to supply the AM stereo transmitter with "audio" (15 kHz) components, either in separate left and right channels or a combination of sum (L+R) and difference (L-R) channels. Because of this criterion, the wideband stereo "repeating", as enjoyed in FM wideband transmission, is not possible. If the sum and difference

signals were transmitter oscillators in the STL (both transmitter modulated oscillators), it would affect the operating frequency of the AM transmitter. The composite wideband signal thus would have to be demodulated to separate audio components. To do so would involve a precision stereo demodulator at the STL composite receiver. In this configuration, you now have a stereo encoder, wideband composite STL system, and a stereo decoder. For a single hop AM stereo system, the cost involved here would be greater than using two monaural systems in the "dual-monaural" mode. This dual-monaural operation would afford two carriers and their subsequent backup capabilities that the single composite would not.

If the station is interested in completely redundant stereo AM STL service, the composite approach may be cost-effective. A single stereo encoder, main/backup composite STL's, and single stereo decoder would be less expensive than a dual-monaural system with complete backup which would consist of four STL's and four transfer panels. Also, the transmitter combination and overall installation requirements of the composite system would be simpler. Another instance where the composite STL approach would be of interest would be a multi-hop system. In this case, the investment in stereo encoders and decoders would be well justified to reduce interconnect requirements to a single RF carrier. It has been Moseley Associates, Inc. experience that the standard, 19 kHz pilot tone system, as used in FM stereophonic transmission, is, at this time, the best way to provide single carrier AM stereo STL service. Equipment availability and price structures are leading factors in this matter. Precision stereo demodulators are easily accommodated by existing FM stereo modulation monitors. Again, these units are available with existing price structures.

General information on aural studio-transmitter link and intercity relay service equipment selection, path planning and price structures are available from many industry sources as well as the Marketing Department of Moseley Associates, Inc. A recent article appearing in Broadcast Engineering magazine (August and September 1977) highlights aural studio-transmitter link operating basics. Reference to this article should prove most timely to those considering STL service. Consulting radio engineers, specializing in such systems, are also a good source of information and assistance in such projects.

In keeping with the pressing industry demands for additional

spectrum for aural studio-transmitter link and intercity relay service heralded by such facilities as AM stereo transmission, FM quadraphonic transmission and broadcast audio programming being distributed via satellite communications, Moseley Associates, Inc. is pursuing new techniques and methods for STL systems in the future. A combination of varied spectrum assignments and narrow band operation are currently being investigated. Improved market RF utilization planning and geographically conservative antenna systems are also among considerations available to the future interest of this industry.