WHAT'S THE MYSTERY ABOUT FM STEREO?

Use the Collins approach and . . .

. . . there's no mystery

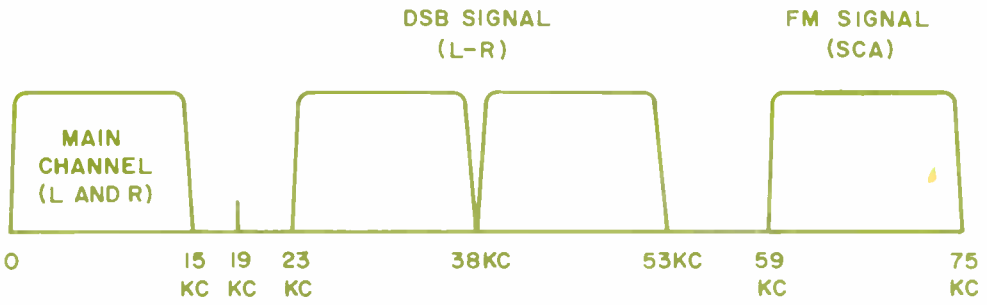
The mystery of stereophonic FM broadcasting is wiped away with the new, straightforward Collins approach

Not only does Collins equipment faithfully reproduce "live" sound in both direction and dimension, it also assures the stereo broadcaster a stable system of transmission. The Collins method of composite signal generation does away with the costly and unstable equipment needed in the conventional double-injection system of stereo broadcasting.

It has been long established that the directional information is contained in the amplitude and time differences between the sound reaching each ear from the same source. The amplitude differences result from the directional characteristics of the human ear and the baffle effect produced by the head. The time differences result from the difference in path length to each ear from a sound source which is off to one side.

time division. More of this later. Basically, then, the stereo FM receiver gets two signals, an L + R and an L − R. To feed the left channel and the receiver's left speaker, the receiver adds the L + R and L − R signals and derives 2L. The same process by subtraction yields 2R in the right speaker. Since the figure 2 represents a volume control setting, the receiver in effect recovers the L and R sound originally produced at the left and right microphones on the program stage.

Returning to the time division principle, it is this factor which makes the Collins Stereo Generator a standout unit in operation and maintenance. In the conventional stereo generation system, two channels are required to feed L + R and L − R to the exciter. This technique, known as matrixing, requires gain and phase



Stereo Multiplex Spectrum

To provide a realistic stereo effect, the time delay and amplitude differences between the signal received by the left and right ears must be maintained from the original sound source to the ear of the listener. The problem becomes one of maintaining amplitude and phase differences to provide adequate channel separation.

Left and right channels must have proper *balance* to give the listener faithful reproduction of a live presentation. If the source of sound moves to the left on the program stage, the left channel's volume must increase and the right channel's volume decrease proportionately to convey accurately the change of direction of the sound source.

Adequate channel separation — at least 30 db — must be maintained. Lack of adequate *separation* would permit "bleeding" of one channel's sound into the other, thus moving the sound source to an apparent center from the listener's point of view.

Finally, *compatibility* is required. The transmitted stereo signal must be capable of being received not only by the stereo FM receiver, but by existing monaural receivers as well.

To comply with FCC requirements, a signal which can be received by monaural receivers must be transmitted. This signal is the combination of the left and right channels, or L+R. To achieve stereo broadcasting, a subcarrier FM signal provides the vehicle for the third dimensional sound. This is the L − R channel.

The Collins 786M-1 FM Stereo Multiplex Generator achieves this L − R signal by a mathematical system of shift between the two channels be maintained within close tolerances to maintain adequate channel separation throughout the system.

Collins' new approach eliminates the need for continual surveillance of time delay shifting between the two channels by eliminating the double-injection system entirely.

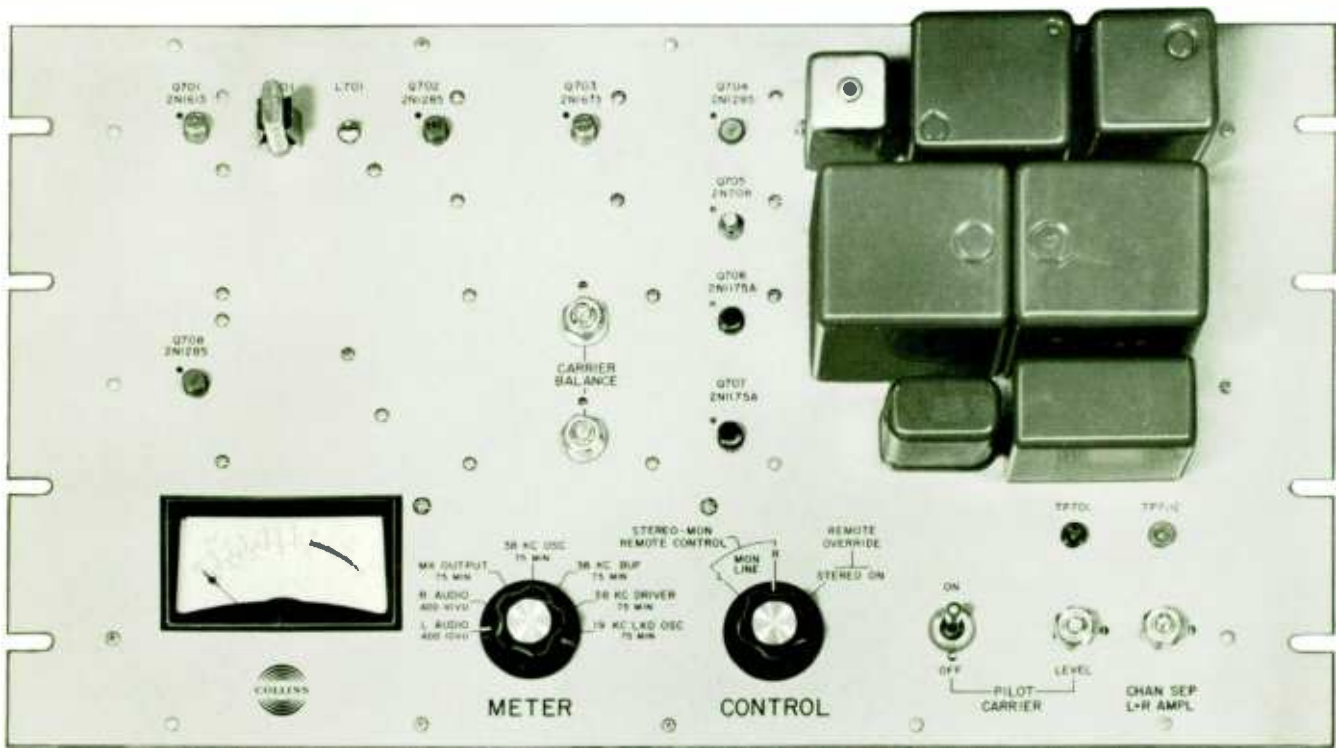
Instead, the direct FM wide band exciter is fed a *single, composite signal on one wire*. Any shift in gain or phase will affect both channels equally, thus maintaining the 30 db channel separation. Not only does this assure the broadcaster an inherently stable method of stereo transmission, but greatly simplifies both operation and maintenance.

The rather expensive matrix networks needed in the dual channel system are eliminated as are the time delay switches needed to match the channels when a shift in gain or phase occurs.

The Collins time division system of stereo signal generation is nothing more than a sampling at a 38 kc rate of left and right audio inputs. The output from the switch is equivalent to L + R plus the L − R double sideband components centered on the switching frequency (38 kc) and its odd harmonics.

The composite wide band spectrum accepted by the exciter would include the L+R signal, a 10% 19 kc pilot carrier inserted for phasing reference, the L − R DSB components centered on the 38 kc subcarrier, and the 67 kc SCA channel when an auxiliary SCA generator is installed.

786M-1 FM STEREO MULTIPLEX GENERATOR



A stable and reliable method of stereophonic FM broadcasting is now available through the new time division system where both stereo channels are integrated into a composite signal which is fed to a wide band exciter (Collins A830-2) on a single line.

The Collins 786M-1 FM Stereo Multiplex Generator does away with the inherent instability of the conventional dual channel method of stereo injection.

Instead, the Collins 786M-1 feeds monaural audio and the subchannel, required for stereo operation, to the exciter on a single, composite signal. The time division system eliminates the costly and unstable dual channels which require matrix networks. L + R and L − R outputs of the matrix networks must be compensated to make up time differences in the two channels. Also, accurate amplitude balance between the two channels must be maintained. In the Collins system, this problem is eliminated by using a wide band direct FM exciter. With a system of this type, any gain changes or time delays will affect the main and subchannels equally.

The Collins time division system is nothing more than a sampling at a 38 kc rate of the left and right audio inputs. After transmission, a corresponding component in the FM receiver demodulates the composite signal in synchronism with the sampling, converting it to left and right audio through the respective speakers.

The composite stereo signal (L + R and L − R) is achieved by filtering out unwanted harmonics created in the function of the four-diode time division switching circuit. The resulting spectrum shows only the main channel (L + R) which is the monaural signal; a 10% 19 kc pilot carrier; the subchannel (L − R) which is the stereo signal on a 38 kc carrier. An SCA channel may be placed on a 67 kc carrier by addition of an auxiliary SCA generator.

Features of the 786M-1 are:

SIMPLE CIRCUITS — The single line, time division system eliminates matrixing components, greatly simplifying circuitry.

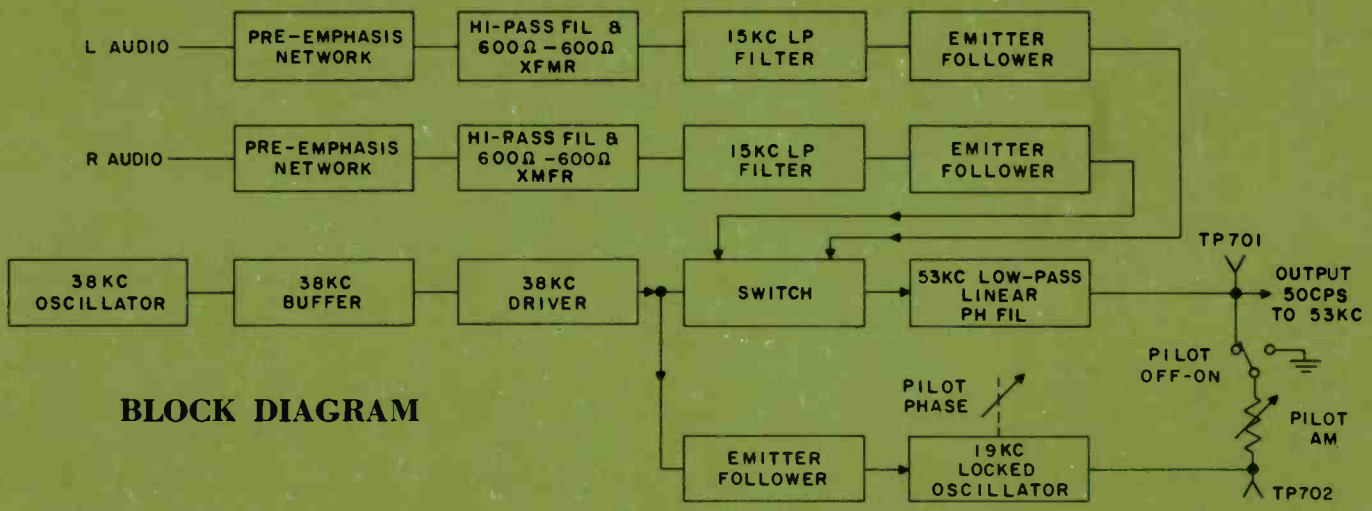
STABLE — All components are temperature-compensated to provide long-term stability. The unit is completely transistorized.

SELF-METERED — An audio VU meter monitors both audio inputs and interior circuit points for rapid maintenance.

EASILY INSTALLED — The Collins 786M-1 may be installed in the 830B-1A, 830D-1A or 830E-1A FM Transmitters in a matter of minutes.

SPECIFICATIONS

DISTORTION (either channel): Less than 1%, 50-15,000 cps.
CHANNEL SEPARATION: 35 db or greater, rising to 38 db at approx. 5 kc.
PILOT CARRIER STABILITY: ±2 cps at 19,000 cps.
OUTPUT IMPEDANCE: 600 ohms unbalanced.
SIZE: 19" W, 8¾" H, 3⅛" D.
WEIGHT: 14 lbs.



BLOCK DIAGRAM

Pre-emphasis networks are plug-in type; can be replaced with 20 db flat pad for testing. *Hi-pass filter and 600 ohm-600 ohm transformers* prevent interference with exciter AFC circuits by any 5 cps components in input. Transformers convert from balanced to unbalanced inputs. *15 kc low pass filters* limit bandwidth to 15 kc to prevent cross-talk between main and subchannels. Filters provide over 60 db attenuation for frequencies above 19 kc. *Emitter followers* provide isolation between left and right audio inputs and stereo switch. *38 kc oscillator, buffer and driver* provide 38 kc drive signal to the stereo switch. When 38 kc carrier goes positive, upper pair of diodes in *switch* conduct and connect left channel to output; when carrier goes negative, lower pair of diodes connect right channel to output. L+R correction is obtained by feeding left and right signals around switch through two resistors. *The 53 kc low pass linear phase filter* removes high frequency switching components which would fall outside the assigned bandwidth. The filter meets the requirement of constant time delay for all frequencies up to 53 kc. Main channel audio and subchannel DSB crossings thus occur simultaneously. The filter also has flat frequency response to 53 kc. These two factors are held to tolerances which provide over 35 db channel separation for 50-15,000 cps audio input frequencies rising to 38 db at 5 kc. *The emitter follower* and *19 kc locked oscillator* provide a 19 kc pilot carrier in phase with the 38 kc subcarrier at the output of the linear phase filter.

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