HARRIS FM-300K
Solid-State 300-Watt FM Transmitter

FM-300KD
Solid-State Main/Alternate 300-Watt FM Transmitter

- Advanced solid-state design
- Final Power Amplifier modular design allows continued operation should a PA module fail
- Advanced MX-15 Exciter yields minimum distortion for maximum signal clarity
- Digitally Synthesized Modulation (DSM) Stereo Generator provides 50 dB minimum separation (typically 60 dB at midband) for increased stereo realism
- Dynamic Transient Response (DTR*) stereo generator filter delivers 2 to 6 dB increase in loudness without overmodulating
- Extensive status and monitoring indicators and metering functions minimize costly maintenance and troubleshooting
- Modular construction permits rapid repairs, minimizing down time
- FM-300KD available in three configurations to meet your operational requirements

*Patented

Harris' 300 watt FM transmitter is available in two configurations—the standard model (FM-300K) or the dual FM-300KD which can be equipped for one of three configurations.

1. Separate 300 watt transmitters operating on different frequencies for two program channels.
2. Main/alternate main configuration where one transmitter acts as a full backup to the other transmitter permitting uninterrupted program service should one unit fail.
3. Combined operation yielding 600 watts of power for program services requiring increased coverage area.

Both the FM-300K and the FM-300KD are housed in a single 24 inch wide cabinet. Since the FM-300K only contains one transmitter, the extra cabinet space may be used for monitoring and test equipment.

Both transmitters are 100% solid state for top reliability and represent one of the first all-solid state 300 watt broadband transmitters ever developed. Harris was the first equipment manufacturer to introduce an all solid state radio broadcast transmitter—the MW-1, one kilowatt AM transmitter. The same solid state transmitter engineering experience that has given the MW-1 an excellent reliability and performance track record brings you the Harris FM-300K/KD.

The transmitters also incorporate such Harris-developed features as Digitally Synthesized Modulation (DSM) for the very finest stereo signal available; and the Dynamic Transient Response (DTR) filter, which holds overshoot on any program material to 2% or less. Additional features include automatic recycling; an air cooling system with replaceable dust filter; availability of multiple SCA channels; a wideband input for use with microwave studio-transmitter links; and modular design for ease of maintenance.
Power Amplifiers in a Highly Efficient Band

The power amplifier consists of four modules, each module containing two transistor amplifiers in a highly efficient broadband amplifier circuit. Each module has an individual current protection circuit and voltage regulator. LED status lights indicate the condition of each amplifier. A front panel test point allows a measurement of relative RF power output with a DC voltmeter. The PA RF broadband output combiner network allows the failure of an amplifier module without causing an off-air condition. Each module is rated at 100 watts, with transmitter power output 300 watts nominal.

Intermediate Power Amplifier (IPA)
The IPA is identical to the PA modules, and can be interchanged with a PA module in the event of an IPA failure for operation at reduced power. Optimum broadband matching of the input provides a low VSWR to the FM exciter over the entire FM band.

Control Circuits
Control function circuits are provided for transmitter turn on, AFC lock, RF mute, air flow, PA overload, and VSWR protection. Remote control interface is also provided. Status lights with memory are provided for VSWR and amplifier overloads. The transmitters are equipped for AC restart in case of a power failure while on the air.

Automatic Recycling
The recycle circuitry is self-clearing and uncomplicated. Should a momentary overload occur, the transmitter will recycle automatically. If the overload occurs in excess of the number of times pre-set, the transmitter will remain off the air until it is reset, either manually or by remote control.

Harmonic Filter
An internal (self-contained) harmonic filter is provided which assures compliance with RF harmonic output requirements. It allows coverage of the entire FM band.

Directional Coupler
An internal directional coupler provides local and remote indication of both forward output power and reflected power. The reflected power section is connected to the control circuit for the purpose of initiating amplifier shutdown in the event of excessive VSWR.

Power Supply
The DC power supplies for the control circuits and amplifier modules are capable of operation from any conventional 200-260 VAC, 50/60 Hz single phase AC power supply. The PA RF amplifier modules are supplied by a feedback-type integrated circuit voltage regulator whose output is adjustable with a single front panel control. Each voltage regulator can operate with a continuous short on its output safely, without causing further damage, due to its current foldback capability. The IPA voltage regulator is also adjustable. Cooling is provided for regulator devices. Silicon power rectifiers are used throughout.

Metering
Ample transmitter metering is provided for functions including RF output, VSWR, PA DC input voltages and currents, IPA DC input voltage and current, and unregulated supply voltage. LED indicators on the IPA module and PA module front panels give indication of correct RF output for easy fault location.

Quality Components
Every transmitter component is conservatively operated and chosen to give optimum performance in continuous duty service.

Plug-in Mono, Stereo and SCA Generators
The FM-300K and FM-300KD transmitters
separation through 15 kHz (60 dB typical at mid band) and an exceptionally clean baseband, promoting minimal interaction between stereo and SCA service. Also, pilot phase is automatically controlled so that high separation can be maintained under varying operating conditions.

OVERSCHOOT COMPENSATION
A Dynamic Transient Response (DTR) filter has been developed and patented by Harris for FM stereo, with overshoot no greater than 2% on any program material processed by any limiter. As a result, from 2 to 6 dB increased loudness can be achieved without degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk, and low intermodulation distortion are all maintained with increased loudness. For monaural stations wishing to protect SCA channels, a defeatable linear phase low pass filter is provided for optimal linear control of overshoot.

SCA OPERATION
Multiple SCA operation can be accommodated by the FM-300K/KD transmitters. The ultra linear modulation quality of the Harris MX-15 FM Exciter yields minimum interaction and degradation between mono/stereo signals and the SCA channels.

Up to two standard SCA generators can be housed within the exciter. The simple plug-in modular construction permits easy incorporation of SCA at time of order or at a later date in the field. Additional external SCA generators are accommodated through baseband input ports.

The standard SCA generator can operate at either 67 kHz or 92 kHz with other frequencies available upon request. Pre-emphasis is selectable for 150, 75, 50 or 0 microseconds. The audio input is applied to a programmable low pass filter and the output of the SCA generator filtered. 150 microseconds pre-emphasis can be used with no degradation of SCA to main channel crosstalk.

Each SCA module has a pair of modulation inputs, one balanced and AC coupled for audio, and the other DC coupled for data and video transmission.

The subcarrier level is adjustable to provide from 1% to 30% composite baseband SCA injection. When an SCA subcarrier is turned on or off, a patented automatic composite level switcher noiselessly compensates for the change in baseband injection level. 100% peak modulation is maintained independent of SCA status.

ADDITIONAL EXCITER FEATURES
The MX-15 exciter RF output power is 3 to 15 watts into 50 ohms, continuously adjustable by one control. A directional coupler samples and meters forward and reflected power, with remote metering capability. A harmonic filter is placed at the RF module output, reducing harmonics to a low level. The balanced 600 ohm audio input is trans-
formerless to give maximum common mode rejection and excellent transient response. Inputs will withstand high transients or steady voltages above or below ground reference. The transmitters can be quickly and easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. Carrier frequencies are generated through a digital synthesizer which is locked to 10 MHz TCXO high stability frequency standard. The TCXO has improved crystal aging characteristics and does not require an oven. The TCXO output may be conveniently and directly compared with any one of several worldwide frequency standards.

**EASE OF MAINTENANCE**

The transmitters are modular for ease of trouble-shooting and maintenance. An extension card is provided to allow easy servicing. Extensive metering is provided, and LED status lights on the exciter modules indicate various performance features.

**FM-300K/FM-300KD SPECIFICATIONS**

**GENERAL**

**POWER OUTPUT:** 300 watts.
**FREQUENCY RANGE:** 87.5 to 108 MHz. Exciter programmable in 50 kHz increments. IPA and PA wideband.
**RF OUTPUT IMPEDANCE:** 50 ohms.
**OUTPUT TERMINATION:** Type N female.
**FREQUENCY STABILITY:** ±300 Hz 0° to 45°C TCXO.
**TYPE OF MODULATION:** Direct Carrier Frequency Modulation (DCFM).
**MODULATION CAPABILITY:** ±100 kHz.
**AC INPUT POWER:** 208 to 245 VAC, 50 to 60 Hz. Single phase, ±5% variation.
**RF HARMONICS:** 60 dB or better.
**ALTITUDE:** 12,000 ft. (3658 meters) maximum at rated ambient.
**AMBIENT TEMPERATURE RANGE:** 0°C to +50°C.
**HUMIDITY:** Up to 95% non-condensing.
**MAXIMUM VSWR:** 1.2 to 1.
**OVERALL CABINET SIZE:** Approx. 27¾" W x 17¾" H x 29¾" D (70.5 cm x 182.3 cm x 75.6 cm).
**FINISH:** White, blue, and black.

**WIDEBAND COMPOSITE OPERATION**

**COMPOSITE INPUT:** One balanced floating input.
**COMPOSITE INPUT IMPEDANCE:** 2000 ohms resistive.
**COMPOSITE INPUT CONNECTOR:** Female BNC.
**COMPOSITE INPUT LEVEL:** 1.0 volt RMS nominal for ±75 kHz deviation.
**EXTERNAL SCA GENERATOR INPUTS:** Up to two unbalanced inputs (optional).
**COMPOSITE FM SIGNAL TO NOISE:** 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
**COMPOSITE HARMONIC DISTORTION:** 0.8%.
**COMPOSITE INTERMODULATION DISTORTION:** 0.02% (60 Hz/7 kHz 1:1 tone pairs).
**COMPOSITE CCIF INTERMODULATION DISTORTION:** All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
**COMPOSITE AMPLITUDE RESPONSE:** ±0.1 dB, 30 Hz-53 kHz.
**ASYNCHRONOUS AM SIGNAL TO NOISE:** 65 dB below reference carrier amplitude modulation 100% output power: (300 watts).

**MONOURAL OPERATION**

**AUDIO INPUT IMPEDANCE:** 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
**INPUT FILTER:** Controlled response low pass filter, defeatable.
**AUDIO INPUT LEVEL:** ±10 dBm ± 1 dB for 100% modulation at 400 Hz.
**AUDIO FREQUENCY RESPONSE:** Standard: 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
**HARMONIC DISTORTION:** 0.15%, 30 Hz to 15 kHz de-emphasized.
**INTERMODULATION DISTORTION:** 0.01%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
**CCIF INTERMODULATION DISTORTION:** All distortion products down to 70 dB (reference 14 kHz/15 kHz test tone pair).
**FM SIGNAL TO NOISE RATIO:** 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

**STEREO OPERATION**

**TYPE OF MODULATION:** Digitally Synthesized Modulation (DSM).
**AUDIO INPUT IMPEDANCE:** Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
**AUDIO INPUT LEVEL:** ±10 dBm, ±1 dB for 100% modulation.

**AUDIO FREQUENCY RESPONSE:** (Left and right) standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
**INPUT FILTERING:** 15 kHz low pass filter, 45 dB rejection at 19 kHz.
**OVERSHEAR PROTECTION:** Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
**AUDIO TRANSIENT RESPONSE:** 2% overshoot overshoot beyond steady state.

**HARMONIC DISTORTION:** (Left or right) 0.2% or less, 30-15,000 Hz.
**INTERMODULATION DISTORTION:** (Left or right) 0.1% 60 Hz/7 kHz test tone pair, 4:1 ratio.
**CCIF INTERMODULATION DISTORTION:** (Left or right) all distortion products down 80 dB (reference 14 kHz/15 kHz test tone pair).
**STEREO SEPARATION:** 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
**DYNAMIC STEREO SEPARATION:** 48 dB under normal programming conditions.

**LINEAR CROSSTALK:** –52 dB.
**NON-LINEAR CROSSTALK:** –60 db.
**7.6 kHz SUPPRESSION:** –68 dB.
**38 kHz SUPPRESSION:** –73 dB.
**FM NOISE:** (Left or right) –74 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.

**PILOT OSCILLATOR:** Crystal controlled.
**PILOT PHASE:** Harris patented automatic pilot phasing circuit.
**PILOT STABILITY:** 19 kHz ± 1 Hz 0 to 50°C.
**OPERATIONAL MODES:** Stereo, mono (left and right), mono (left), mono (right) — remote.

**SCA OPERATION**

**MODULATION:** Direct FM
**FREQUENCY OF OPERATION:** 67 or 92 kHz programmable, other frequencies available on special order.
**FREQUENCY STABILITY:** ±500 Hz.
**MODULATION CAPABILITY:** ±7.5 kHz.
**AUDIO FREQUENCY RESPONSE:** 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis ±1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ±0.5 dB.
**AUDIO INPUT IMPEDANCE:** 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
**AC INPUT LEVEL:** +10 dBm, ±1 dB for 100% modulation at 400 Hz @ 600 ohms.
**DC INPUT LEVEL:** 1.0 volt peak for 5 kHz deviation.
**INPUT FILTERING:** Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
**HARMONIC DISTORTION:** 0.5%, 30-4,500 Hz ±5 kHz deviation.
**INTERMODULATION DISTORTION:** 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
**FM NOISE:** (Main channel not modulated) –63 dB (reference: 100% modulation = ±5 kHz deviation at 400 Hz).
**CROSSTALK:** SCA to main or stereo sub-channel) –60 dB or better.
**CROSSTALK:** (Mono or stereo sub-channel to SCA) 57 dB below ±5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz. SCA demodulated with 150 microsecond de-emphasis.
**CROSSTALK:** SCA to SCA (67 kHz/92 kHz) 50 dB demodulated with 150 microsecond de-emphasis.
**AUTOMATIC MUTE LEVEL:** Variable from 0 to –30 dBm.
**MUTE DELAY:** Adjustable from 0.5 to 20 seconds.
**INJECTION LEVEL:** 1% to 30% of composite level (adjustable).

**Specifications subject to change without notice**

**ORDERING INFORMATION**

FM-300K, 300 Watt All Solid-State Transmitter—mounted in a 24" cabinet, for 50/60 Hz operation. 50 ohm type N female connector, equipped for wide band operation.......................... 994-8296-001
FM-300KD, Basic, Two Identical 300 Watt All Solid-State Transmitters—mounted in a single 24" cabinet, for 50/60 Hz operation, 50 ohm type N female output connectors. Equipped for wide band operation with STL ........................................... 994-8297-001

HARRIS CORPORATION

BROADCAST GROUP

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Two separate configurations give the Harris FM-100K flexibility to meet the needs of low power, Class D Educational broadcasters and International broadcasters requiring low power FM stations for broadcasting or program relay.

The standard FM-100K is a complete transmitter, incorporating the solid-state 100 watt broadband amplifier and the high-performance MX-15 exciter. The FM-100K 100 watt amplifier is available as a separate unit and can be driven with virtually any 10 watt exciter.

The FM-100K amplifier and MX-15 exciter both mount in a standard 19-inch equipment rack. Tolerating temperatures from 0°C to 50°C, the complete transmitter is uniquely suitable for broadcasting environments and eliminates the need for heating or air conditioning equipment to maintain operating stability.

The amplifier can be driven with the MX-15 exciter or with most other exciters delivering 10 watts of power. Low power educational broadcasters desiring a power increase to Class A channel requirements will find this unit superbly suited to their needs. A simple connection to the existing 10 watt exciter/transmitter is all that's required.

**PLUG-IN POWER AMPLIFIER MODULE**

The heart of the FM-100K transmitter is the plug-in 100 watt amplifier module. This power module, providing reliable service in hundreds of worldwide installations, is the same one used in the field-proven Harris FM-300K and FM-25K transmitters. The module contains two RF transistors along with a common solid-state voltage regulator. The regulator controls collector voltage of the transistor stage, permitting continuous transmitter output power variance over a 10 to 100 watt range. By varying the collector voltage of the transistor stage rather than the RF drive, high PA efficiency is maintained over a wide output power adjustment range.

**EXTENSIVE AMPLIFIER PROTECTION**

The solid-state regulator performs several other important functions, including automatic current fold-back. Should a short develop in one of the transistors, the regulator senses excessive current draw and shuts down the amplifier. Should a fault occur, the automatic current fold-back feature limits excessive current and minimizes dissipation and resultant damage. The solid-state
Harris’ FM-100K Transmitter with Feed Forward Amplification

Front view of the FM-100K Amplifier showing easy to read meter and plug-in wide band amplifier module.

regulator also implements VSWR protection. Should a high antenna VSWR be detected by the built-in directional coupler, the voltage regulator automatically turns down the supply voltage to the amplifier.

FEED FORWARD AMPLIFICATION
The FM-100K utilizes a circuit called Feed Forward Amplification. Figure 1 shows in detail how the Feed Forward Amplifier works. The left block diagram depicts a conventional combiner configuration. Here a 20 watt input signal is split into equal 10 watt signals, which are amplified by PA stages into two 50 watt signals. These 50 watt signals are then combined to yield 100 watts. Unfortunately, in this conventional configuration 20 watts of drive signal is required for 100 watts output, precluding the use of most exciters as drivers.

Harris has devised a unique RF amplifier which resolves the problems of conventional combining, the Feed Forward Amplifier, shown in the right portion of figure 1. Here a 10 watt signal is amplified by PA stage “B” to yield 55 watts. The 55 watts is asymmetrically split into a 45 watt and 10 watt signal. The 10 watt signal is further amplified by PA stage “A”, while the 45 watt signal is fed forward through a delay compensation network to the output combiner. Hence the term “Feed Forward”. Phase error between the two signals is eliminated by the delay compensation network, assuring proper output combining. The Harris Feed Forward Amplifier obtains 100 watts output power from 10 watts of drive signal.

BUILT-IN REDUNDANCY
Built-in redundancy gives the FM-100K amplifier a fail-safe capability. If an RF transistor fails, you can remain on the air at a reduced power of 55 watts by simply patching around the defective stage. Just unplug the printed circuit combiner board, rotate it 90°, and plug it back in. No clip leads to install; no wires to reposition.

CONTROL AND STATUS INDICATORS
From the large 4" front panel meter, you can quickly read five major operating parameters: PA collector voltage; PA collector current; forward power; VSWR; and input drive level. The RF amplifier module also incorporates two LED "go/no-go" status indicators monitoring each PA transistor.

Remote control provisions are built-in. Samples are provided for remote indication of collector voltage, collector current, and forward power. Remote on/off, along with raise and lower power, requires only momentary low current contact closure. This permits direct connection to most remote control systems, eliminating the cost of interface panels.

Figure 1

FEED FORWARD COMBINER

![Diagram of Feed Forward Amplification](image-url)
Continuing in its trend-setting tradition, Harris has incorporated state-of-the-art refinements in exciter technology to introduce the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter provides the broadcaster with new levels of excellence in audio performance.

**ULTRA-LINEAR VCO**
The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low .02%, with all CCIF Intermodulation distortion products down at least 80 dB. This important criterion shows the quality of the VCO—the heart of any exciter. Distortion, as a result of non-linearities, severely limits stereo and SCA performance. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ±100 kHz.

Equally impressive is the MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the exciter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise provides your station with maximum signal clarity.

**BALANCED FLOATING COMPOSITE INPUT**
Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

**DIGITAL SYNTHESIZER**
The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system.

The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison against WWV transmissions on these frequencies. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ±10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

**DIGITALLY SYNTHESIZED MODULATION**
The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike older technology, still on the market, that suffers from degraded separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk, Harris' DSM technique has neither of these shortcomings. DSM stereo generation is essentially transparent to the program material. Separation is specified at 50 dB over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

**OVERSHOOT COMPENSATION**
A patented Dynamic Transient Response (DTR) filter, developed by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

**SCA OPERATION**
Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation all the time. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation head room when the SCA is not being transmitted.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

**POWER AMPLIFIER**
The MX-15 power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

**STATUS AND MONITORING**
Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

**ADDITIONAL BENEFITS**
The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.
FM-100 TRANSMITTER SPECIFICATIONS

AMPLIFIER ONLY
FREQUENCY RANGE: 87.5-108 Mhz.
POWER OUTPUT: 100 watts.
DRIVE REQUIREMENT FOR 100 WATT TPO: 10 watts.
LINE VOLTAGE: 110-125 Vac (230 Vac 50-60 Hz available) 250 watts.
PA EFFICIENCY: 55%.
ALTITUDE: 3658 meters (12,000 feet).
TEMPERATURE: 0°C - 50°C ambient @ sea level (derate maximum operating temperature 2°C/1000 feet).
DIMENSIONS: 17" wide x 5½ high x 15 deep.
SHIPPING WEIGHT: Domestic - apx. 45 lbs (21 kg). Export - apx. 57¼ lbs (26 kg).

HARMONIC SUPPRESSION: Better than 66 db.
REMOTE CONTROL: Standard.
FM NOISE CONTRIBUTION: 1 dB Maximum.
AM NOISE CONTRIBUTION: 3 dB Maximum.
OUTPUT IMPEDANCE: 50 ohms (1.2-1 for full performance VSWR protected)
CONNECTORS: PA input and mod amplifier sample - BNC Output-N Connector.

ACTIVE STAGES: 2 PA transistors, 1 regulator.

1 To FCC type accepted 10 watt transmitter.

WIDEBAND COMPOSITE OPERATION
COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: <0.8%
COMPOSITE INTERMODULATION DISTORTION: <0.02% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: 0 ± 1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 73 dB below reference carrier AM modulation 100% output power: 15 watts.

MONOURAL OPERATION
AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm +1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve +0.5 dB, 30 Hz-15 kHz Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.045%, 60 Hz/7 kHz test tone pair, 41 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products below 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: +10 dBm. ±1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: [Left and right] standard 75 microsecond FCC pre-emphasis curve +0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT PROTECTION: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1% 60 Hz/7 kHz test tone pair, 4.1 ratio.
CCF INTERMODULATION DISTORTION: (Left or right) all distortion products down 80 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 db, 30 Hz-15 kHz; typically 60 db at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 db under normal programming conditions.
LINEAR CROSSTALK: ~52 db.
NON-LINEAR CROSSTALK: ~60 db.
76 kHz SUPPRESSION: ~68 db.
38 kHz SUPPRESSION: ~73 db.
FM NOISE: (Left or right) 74 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, +75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50°C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.

SCA OPERATION
MODULATION: Direct FM.
FREQUENCY OF OPERATION: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: ±50 Hz.
MODULATION CAPABILITY: ±7.5 kHz.
AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz AC coupled input, 150 microsecond pre-emphasis +1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ±5.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm. ±1 dB for 100% modulation at 400 Hz @ +7.5 kHz deviation.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ±5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) ~63 dB (reference: 100% modulation = ±5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) ~60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ±5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 kHz/67 kHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to ~30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION
FM-100K Transmitter with MX-15 exciter for wideband operation .................. 994-8453-001
100 Watt FM Amplifier .................. 994-8453-002
Mono Module for mono operation .................. 994-8019-001
DSM Stereo Generator for stereo operation .................. 994-8020-001
SCA Generator for SCA operation (specify 41 and/or 67 kHz) .................. 994-7992-001

HARRIS CORPORATION BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

CP-2M-383 © Harris Corporation 1983
ADV. 572A PDT. IN U.S.A.
**MX-15**

**Maximum Signal FM Exciter**

- Improved ultra linear VCO yields – 80 dB FM S/N, and .02% Intermodulation Distortion for maximum signal clarity
- DSM (Digitally Synthesized Modulation) Stereo Generator provides 50 dB separation minimum—typically 60 dB midband—for increased stereo realism
- DTR* (Dynamic Transient Response) stereo generator filter maximizes modulation level without overmodulating
- Automatic stereo pilot phase control* and digital circuitry provide long term adjustment-free performance
- Balanced floating composite input minimizes system interface problems
- Available as an FCC type accepted 15 watt transmitter

*Patented*
Continuing in its trend-setting tradition, Harris has incorporated state-of-the-art refinements in exciter technology to introduce the MX-15 FM Exciter. Using various advanced techniques, such as DRT (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter provides the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO
The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low 0.02%, with all CCIF Intermodulation distortion products down at least 80 dB. This important criterion shows the quality of the VCO—the heart of any exciter. Distortion, as a result of non-linearities, severely limits stereo and SCA performance. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ±100 kHz.

Equally impressive is the MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the exciter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise provides your station with maximum signal clarity. The unique VCO of the MX-15 features superb linearity not found in conventional modulated oscillator designs.

BALANCED FLOATING COMPOSITE INPUT
Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

DIGITAL SYNTHESIZER
The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase.
NEW LEVELS OF EXCELLENCE IN FM AUDIO PERFORMANCE

locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison against WWV transmissions on these frequencies. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ±10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC pass-band is narrowed, maximizing FM signal to noise.

DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike older technology, still on the market, that suffers from degraded separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk, Harris' DSM technique has neither of these shortcomings. DSM stereo generation is essentially transparent to the program material. Separation is specified at 50 dB over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION

A Dynamic Transient Response (DTR) filter, developed by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximim modulation density.

SCA OPERATION

Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation all the time. Here's how: when the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER

The power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL BENEFITS

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.
MX-15 SPECIFICATIONS

GENERAL
POWER OUTPUT: 3 watts to 15 watts continuously variable.
FREQUENCY RANGE: 87.5 MHz to 108 MHz tested to one specified frequency. (Exciter programmable to 50 kHz channel spacing).
RF OUTPUT IMPEDANCE: 50 ohms, open and short circuit proof.
OUTPUT CONNECTION: Female BNC.
FREQUENCY STABILITY: ±300 Hz 0° to 50°C temperature compensated reference oscillator.
TYPE OF MODULATION: Direct carrier frequency modulation (DFCM).
MODULATION CAPABILITY: ±100 kHz.
AC INPUT POWER: 100 to 130 VAC or 200 to 250 VAC, 60 Hz or 50 Hz, 150 watts.
RF HARMONICS: Suppression meets all FCC requirements for 10 watt and 15 watt educational transmitter requirements.
ALTITUDE RANGE: 15,000 feet.
AMBIENT TEMPERATURE RANGE: 0° to 50°C (operational to -20°C).
OVERALL CABINET SIZE: 17.7” Wide (44 cm) x 14” High (35 cm) x 12” Deep (30 cm). 19” EIA rack mounting standard.
FINISH: Black.
CONSTRUCTION: Main printed circuit boards individually enclosed, plug-in modules. Module service extender board included.
AUDIO/CONTROL CONNECTIONS: Two 18 terminal barrier strips paralleled by 36 pin and socket connectors. RF bypassing on input/output lines.
MODULATION METER: 10 position, fast rise time AC metering (adjustable to meet FCC ballistics).
MULTIMETER: 10 position, DC metering.
TOTAL METERING FUNCTIONS: 20.
REMOTE METERING PROVISIONS: PA voltage, PA current, forward power, reflected power.
STATUS INDICATION: 27 independent LED indicators (when equipped with all options).

WIDEBAND COMPOSITE OPERATION
COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (referenced 400 Hz @ ±75 kHz with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: 0%.
COMPOSITE INTERMODULATION DISTORTION: 0.02% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CClF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ±0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 73 dB below referenced carrier AM modulation: 100% output power: 15 watts.
SYNCHRONOUS AM SIGNAL TO NOISE: 51 dB below referenced carrier with 100% AM modulation @ 400 Hz, 75 microsecond de-emphasis (FM deviation +75 kHz @ 400 Hz).

MONOURAL OPERATION
AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm, ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.45%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CClF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
AUDIO INPUT LEVEL: ±10 dBm, ±1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter; 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CClF INTERMODULATION DISTORTION: (Left or right) all distortion products down 80 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: —52 dB.
NON-LINEAR CROSSTALK: —60 dB.
76 KHZ SUPPRESSION: —88 dB.
38 KHZ SUPPRESSION: —73 dB.
FM NOISE: (Left or right) —74 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 kHz deviation, measured 30 Hz-15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ±1 Hz 0° to 50°C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—removable.

SCA OPERATION
MODULATION: Direct FM.
FREQUENCY OF OPERATION: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: ±500 Hz.
MODULATION CAPABILITY: ±7.5 kHz.
AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz AC coupled input, 150 microsecond pre-emphasis +1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis. DC to 4 kHz ±0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ±1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ±5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) —63 dB (reference: 100% modulation = ±5 kHz deviation at 400 Hz).
CROSSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ±5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz. SCA demodulated with 150 microsecond de-emphasis.
CROSSSTALK: SCA to SCA (41 kHz/67 kHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to —30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

ORDERING INFORMATION
MX-15 Exciter for wideband composite operation, 19-inch rack mounted 994-7850-003
Mono option (add for mono operation) .................................................. 994-8019-001
DSM Stereo Generator with DTR Filter (add one for stereo operation) 994-8020-001
SCA Generator (add one for each SCA service, specify 41 kHz or 67 kHz) 994-7992-001
External SCA Generator Jumper Card (for use with externally mounted SCA Generator) 994-8377-001

HARRIS CORPORATION
BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

CP-2M-683 © Harris Corporation 1983
ADV. 621A PTD. IN U.S.A.
The MS-15R stereo generator is an exclusive Harris development that features Digitally Synthesized Modulation (DSM) and Dynamic Transient Response (DTR). This generator offers the quality-minded FM broadcaster the first real advancement in stereo generation in a decade—and obsoletes switching and balanced modulator forms of stereo generation.

While these earlier types of stereo generation suffer from degraded separation at the lower and upper frequency limits (30 Hz and 15 kHz), and/or poor harmonic rejection resulting in degraded crosstalk, DSM has neither of these trade-offs. This results in the cleanest-sounding stereo performance of any stereo generator. Minimum separation is 45 dB from 30 to 15,000 Hz and typical separation will exceed 30 dB over this entire band. Since this exceeds the guaranteed accuracy of most modulation monitors, carefully calibrated test equipment is required to measure the actual performance of the MS-15R.

The high performance characteristics of the DSM generator are easy to maintain year after year. The digital circuitry reduces user adjustments to a minimum, and these adjustments are relatively non-critical in nature. An "automatic" pilot phase control assures long-term stability of this critical parameter.

OVERSHOOT COMPENSATION. The Dynamic Transient Response filter, developed by Harris for FM stereo, holds overshoot on any program material to 2% or less, and can be used with any FM limiter. As a result, from 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness.

GENERAL. The modular MS-15R is ruggedly constructed and designed for rack mounting. A positive guidance system permits easy removal and reinsertion of modules, which can be serviced from the front of the generator.

**MS-15R**

**FM STEREO GENERATOR**

- Drives composite Studio-Transmitter Links or wideband input of any FM exciter
- Uses the same Digitally Synthesized Modulation (DSM) and Dynamic Transient Response (DTR) plug-in modules as Harris' MS-15 FM exciter
- Output module features a true peak reading Light-Emitting Diode (LED) display of all stereo functions
- Active transformerless inputs for best transient response
- Low output impedance for driving lengths of coaxial cable
- Digital circuitry design reduces adjustments to a minimum
- Unique compensation circuit for use with STL's
- All operating controls are on the front panel
- Modular construction for ease of maintenance
- Standard 19-inch rack mounting
Audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent transient and frequency response. Inputs will withstand high transients or steady state voltages above or below ground level. LED status indicators are used throughout to aid in troubleshooting. A peak-reading audio LED display aids in setting up the stereo generator, and also serves as an accurate peak program indicator.

The MS-15R can be used with any FM exciter that will accept a wideband input, and is FCC type accepted for use with the Harris MS-15 exciter.

**MS-15R SPECIFICATIONS**

**AC INPUT POWER:** 100 to 130 VAC or 200 to 260 VAC, 60 Hz or 50 Hz, 25 W.

**HUMIDITY RANGE:** 0 to 95% relative humidity, non-condensing.

**ALTITUDE:** 15,000 feet A.M.S.L.

**AMBIENT TEMPERATURE RANGE:** 0°C to +50°C (operational) to −20°C (storage).

**OVERALL CABINET SIZE:** 17.6 in. wide (44.7 cm) x 3.5 in. high (8.9 cm) x 15.8 in. deep (40.1 cm). (19-inch rack mounting standard). Net weight: 18 pounds (8.2 kg).

**FINISH:** Black with white lettering.

**AUDIO/CONTROL CONNECTIONS:** 12-position barrier strip.

**MODULATION METERING:** Output module features a true peak reading LED display of Left, Right, L+R, L-R, Pilot Injection and Composite Levels.

**COMPOSITE OUTPUT LEVEL:** Adjustable from less than 1 V RMS to greater than 4.5 V RMS for 100% modulation.

**COMPOSITE OUTPUT IMPEDANCE:** 150 ohms unbalanced, resistive (BNC connector).

**EXTERNAL COMPOSITE INPUT FOR ADDITIONAL SCA’S OR TELEMETRY:** 10X resistive, unbalanced, BNC connector. Amplitude response ±0.25 dB, 30 Hz to 75 kHz.

**COMPOSITE BASEBAND COMPENSATION:** Compensator provides separate amplitude and phase compensation for STL or modulated oscillator deficiencies. (Defeatable.)

**RFI PROTECTION:** All inputs filtered from 100 kHz through 1000 MHz.

**TYPE OF MODULATION:** Digitally synthesized modulation (DSM).

**AUDIO INPUT IMPEDANCE:** (left and right) 600 ohms balanced, resistive. Adaptable to other impedances.

**AUDIO INPUT LEVEL:** (left and right) +10 dBm ±1 dB for 100% modulation at 400 Hz.

**AUDIO FREQUENCY RESPONSE:** (left and right) standard 75 microsecond, FCC pre-emphasis curve ±0.5 dB, 30-15,000 Hz. Selectable: flat, 25 or 50 microsecond pre-emphasis.

**INPUT FILTERING:** 15 kHz LPF, 50 dB minimum rejection at 19 kHz and above.

**OVERSHOOT PROTECTION:** Dynamic transient response (DTR) filter.

**AUDIO TRANSIENT RESPONSE:** 2% maximum overshoot beyond steady state. Defeatable for test purposes.

**HARMONIC DISTORTION:** (left or right) 0.4% or less, 30-15,000 Hz.

**IMD:** 0.4%, 60/7000 Hz, 4:1 ratio.

**NOISE:** (left or right) 75 dB minimum below 100% modulation. Reference: (400 Hz, 75 microsecond de-emphasis, 1 V RMS output, measured 30 Hz to 15 kHz).

**PILOT OSCILLATOR:** Crystal controlled.

**PILOT STABILITY:** 19 kHz ±1 Hz, 0º to 50º C.

**PILOT PHASE:** Automatically controlled.

**STEREO SEPARATION:** 45 dB minimum, 30-15,000 Hz.

**DYNAMIC STEREO SEPARATION:** 40 dB minimum under normal programming conditions.

**CROSSTALK:** (main to stereo sub-channel or stereo sub-to-main channel) 45 dB below 90% modulation.

**SUB-CARRIER SUPPRESSION:** 60 dB minimum below 100% modulation.

**76 KHZ SUPPRESSION:** 60 dB minimum below 100% modulation.

**MODES:** Stereo, mono (L+R), mono (L), mono (R). Remoteable.

**ORDERING INFORMATION**

MS-15R Stereo Generator ................................................................. 994-8140-001

_**HARRIS CORPORATION**_ Broadcast Products Division
P.O. Box 290, Quincy, Illinois 62301 U.S.A.

JK-6M-1177

ADV. 521 PTD. IN U.S.A.
MSG-95
Remote SCA Generator

- Isolated AC coupled input provides line isolation and common mode rejection
- DC coupled input for superb slow scan video applications
- Built-in low pass filter with selectable cut-off
- Selectable pre-emphasis
- Selectable or automatic muting minimizes objectionable receiver noise
- Front panel LED indicators supply quick operational status

Recognizing the increasing flexibility and demands of SCA service, Harris has developed the MSG-95 remote SCA generator to meet the most demanding requirements. The MSG-95 is designed for use with most exciters or STL links, and is an ideal companion unit to the Harris MSP-95 FM audio composite processing unit.

INPUTS. The MSG-95 is equipped with two input terminals. One is an AC coupled input for general SCA programming needs. The other is a DC coupled input which handles the demands of SCA broadcasters programming slow scan television data.

AUDIO FILTERING. Since SCA programming needs vary considerably, Harris has included a standard low pass filter in the MSG-95. The programmable low pass filter provides the necessary bandwidth protection for stations operating one or two SCA's or stereo programming.

SELECTABLE PRE-EMPHASIS AND MUTING. Again providing the station operator with maximum flexibility to meet operating criteria, the MSG-95 incorporates selectable pre-emphasis of 150, 75, 50 microsecond or flat response. Lengthy bursts of noise in background music or other SCA applications, such as quotation services, can be distracting. To address the wide ranging muting requirements, the MSG-95 muting delay can be adjusted anywhere from ½ second to 20 seconds. It is triggered by a drop in audio level, the threshold of which is adjustable from 0 to -30 dBm.

OPERATIONAL CONTROLS/STATUS DISPLAY. At a glance, station personnel can quickly determine the operating mode of the MSG-95 SCA generator. Color-keyed status indicators are positioned adjacent to the "On", "Automatic", and "Off" pushbutton selector switches. Technicians will find the front panel injection level and subcarrier adjust potentiometers convenient. Troubleshooting is also aided by the front panel power supply status LED.
## MSG-95 SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency Range:</strong></td>
<td>41 kHz or 67 kHz</td>
</tr>
<tr>
<td><strong>Frequency Stability:</strong></td>
<td>±500 Hz (±0.7%)</td>
</tr>
<tr>
<td><strong>Type of Modulation:</strong></td>
<td>DCFM</td>
</tr>
<tr>
<td><strong>Harmonic Content of Subcarrier:</strong></td>
<td>less than 1%</td>
</tr>
<tr>
<td><strong>FM Noise:</strong></td>
<td>−55 dB for 5 kHz deviation</td>
</tr>
<tr>
<td><strong>Modulation Response:</strong></td>
<td>±1 dB, 150 usec pre-emphasis (30 Hz to 4 kHz)</td>
</tr>
<tr>
<td><strong>Modulation Distortion:</strong></td>
<td>less than 1% (measured at 200 Hz and 3.5 kHz)</td>
</tr>
<tr>
<td><strong>Modulation Capability:</strong></td>
<td>±5 kHz</td>
</tr>
<tr>
<td><strong>Pre-emphasis:</strong></td>
<td>150, 75, 50 usec or flat</td>
</tr>
<tr>
<td><strong>Subcarrier Status:</strong></td>
<td>LED indicators</td>
</tr>
<tr>
<td><strong>Program Input Impedance:</strong></td>
<td>will accept 600 ohm or 150 ohm source</td>
</tr>
<tr>
<td><strong>Audio Input Low Pass Filter:</strong></td>
<td>4.5 kHz standard; 3 kHz, 5 kHz, 7.5 kHz selectable</td>
</tr>
<tr>
<td><strong>Program Input Level:</strong></td>
<td>+2 dBm; ±1 dB for 100% modulation</td>
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<tr>
<td><strong>Telemetry Input Connector:</strong></td>
<td>BNC female</td>
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<tr>
<td><strong>Telemetry Input Level:</strong></td>
<td>1 volt for 5 kHz carrier deviation</td>
</tr>
<tr>
<td><strong>Subcarrier Output Impedance:</strong></td>
<td>less than 1000 ohms</td>
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<tr>
<td><strong>Subcarrier Output Level:</strong></td>
<td>100 mV across 10k ohms (adjustable to 300 mV)</td>
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<tr>
<td><strong>Muting Delay:</strong></td>
<td>0.5 Sec. to 20 Sec., adjustable</td>
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<tr>
<td><strong>Subcarrier Output Connector:</strong></td>
<td>BNC female</td>
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<tr>
<td><strong>Operating Temperature Range:</strong></td>
<td>−20°C to +45°C</td>
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<tr>
<td><strong>Power Requirements:</strong></td>
<td>105-129 VAC, 50/60 Hz</td>
</tr>
<tr>
<td><strong>Size:</strong></td>
<td>1¾” H × 19” W × 16” D</td>
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<tr>
<td><strong>Weight:</strong></td>
<td>6 pounds</td>
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</tbody>
</table>

### ORDERING INFORMATION

MSG-95 stand-alone SCA Generator .................................................. .994-8492-001

**HARRIS CORPORATION** Broadcast Products Division
P. O. Box 4290, Quincy, Illinois 62301 U.S.A. 217/222-8200
MS-15 SPECIFICATIONS

GENERAL

POWER OUTPUT: 3W to 15W, continuously variable.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency (programmable, 50 kHz channel spacing).
RF OUTPUT IMPEDANCE: 50 ohms, open and short circuit proof.
OUTPUT CONNECTOR: BNC.
FREQUENCY STABILITY: ±200 Hz, 0°C to 50°C, TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation (DCFM).
MODULATION CAPABILITY: ±100 kHz.
AC INPUT POWER: 100 to 135 VAC or 200 to 260 VAC, 60 or 50 Hz, 150VA.
RF HARMONICS: Suppression meets all FCC requirements for 10 watt educational (103 dB).
POWER SUPPLY RECTIFIERS: Silicon.
ALTITUDE: 15,000 ft.
AMBIENT TEMPERATURE RANGE: 0°C to 50°C (operational to -20°C).
OVERALL CABINET SIZE: 11.7" x (44 cm) x 14" x (25 cm) x 12" x (30 cm).
FINISH: Black.
AUDIO/CONTROL CONNECTIONS: 2 x 16 pin barrier strips parallel by 36 pin and socket connector.
MODULATION METER: 10 position, fast rate A/C metering (adjustable to meet FCC ballistic).
MULTIMETER: 10 position, DC metering.

MONOURAL MODE

AUDIO INPUT IMPEDANCE: 600 ohms balanced, resistive, adaptable to other impedances.
INPUT FILTER: Controlled response LPF, defeatable.
AUDIO INPUT LEVEL: -10 dBm ± 1 dB for 100% modulation at 400 kHz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30-15,000 Hz. Selectable flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.2% or less, 30-15,000 Hz.
FM IMD: 0.4%, 60/7000 Hz, 4:1 ratio.
FM NOISE: (left or right) 65 dB minimum below 100% modulation. Reference (400 Hz, 75 microsecond de-emphasis) ±75 kHz deviation, measured 30 Hz to 15 kHz.
FM PILOT OSCILLATOR: Crystal controlled.
FM PILOT STABILITY: ±1 kHz, ±1°, ±5°.
FM PILOT PHASE: Automatically controlled.
STEREO SEPARATION: 40 dB minimum, 30-15,000 Hz.
DYNAMIC STEREO SEPARATION: 40 dB minimum under normal programming conditions.
CROSSTALK: (main to stereo sub-channel or stereo sub-to-main channel) 45 dB below 90th modulation.
SUB-CARRIER SUPPRESSION: 60 dB below 100% modulation.
87.5 to 108 MHz, tuned to specified operating frequencies.
FM NOISE: (left or right) 65 dB minimum below 100% modulation.
FM IMD: 0.4%, 60/7000 Hz, 4:1 ratio.
FM MODULATION: ±300 Hz 0° to 50°C, TC XO.
FM FREQUENCY STABILITY: ±500 Hz.
FM MODULATION CAPABILITY: ±1.5 kHz, ±2°, ±5°.
FM INPUT FILTERING: Programmable LPF, 4.5 kHz standard.
FM FREQUENCY RESPONSE: 41 kHz and 67 kHz, 150 microsecond de-emphasis ±1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis.
FM CROSSTALK: (SCA to main or stereo sub-channel) ±40 dB or better.
FM CROSSTALK: (Main or stereo sub-channel to SCA), 50 dB below ±5 kHz deviation of SCA, with mono or stereo tonal channels modulated by frequencies 30-15,000 Hz, SCA demodulated with 150 microsecond de-emphasis.
FM CROSSTALK: SCA to SCA (at kHz) 50 dB demodulated with 150 microsecond de-emphasis.
FM AUTOMATIC MUTE LEVEL: Variable from 0 to 30 dBm.
FM MUTE DELAY: Adjustable 0.5 to 60 seconds.
FM INJECTION LEVEL: 1% to 10% of composite. Adjustable.

STEREOPHONIC MODE

TYPE OF MODULATION: Digitally synthesized modulation (DSM).
AUDIO INPUT IMPEDANCE: (left and right) 600 ohms balanced, resistive. Adaptable to other impedances.
AUDIO INPUT LEVEL: (left and right) -10 dBm ± 1 dB for 100% modulation at 400 kHz.
AUDIO FREQUENCY RESPONSE: (left and right) Standard 75 microsecond, FCC pre-emphasis curve ±0.5 dB, 30-15,000 Hz. Selectable flat, 25 or 60 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz LPF, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Dynamic transient response (DTR) filter.

STereo INPUT FILTERING: Selectable 15 kHz, 45 dB rejection at 19 kHz.
STereo PROCESSOR: Dynamic transient response (DTR) filter.

STereo FREQUENCY RESPONSE: 2% maximum overshoot beyond steady state. Defeatable for test purposes.
HARMONIC DISTORTION: (left or right) 0.4% or less, 30-15,000 Hz.
FM IMD: 0.4%, 60/7000 Hz, 1:1 ratio.
FM NOISE: (left or right) 65 dB minimum below 100% modulation. Reference (400 Hz, 75 microsecond de-emphasis) ±75 kHz deviation, measured 30 Hz to 15 kHz.
FM PILOT OSCILLATOR: Crystal controlled.
FM PILOT STABILITY: ±1 kHz, ±1°, ±5°.
FM PILOT PHASE: Automatically controlled.
STEREO SEPARATION: 45 dB minimum, 30-15,000 Hz.
DYNAMIC STEREO SEPARATION: 40 dB minimum under normal programming conditions.
CROSSTALK: (main to stereo sub-channel or stereo sub-to-main channel) 45 dB below 90th modulation.
SUB-CARRIER SUPPRESSION: 60 dB below 100% modulation.
87.5 to 108 MHz, centered to specified operating frequencies.
FM NOISE: (left or right) 65 dB minimum below 100% modulation.
FM IMD: 0.4%, 60/7000 Hz, 1:1 ratio.
FM MODULATION: ±300 Hz 0° to 50°C, TC XO.
FM FREQUENCY STABILITY: ±500 Hz.
FM MODULATION CAPABILITY: ±1.5 kHz, ±2°, ±5°.
FM INPUT FILTERING: Programmable LPF, 4.5 kHz standard.
FM FREQUENCY RESPONSE: 41 kHz and 67 kHz, 150 microsecond de-emphasis ±1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis.
FM CROSSTALK: (SCA to main or stereo sub-channel) ±40 dB or better.
FM CROSSTALK: (Main or stereo sub-channel to SCA), 50 dB below ±5 kHz deviation of SCA, with mono or stereo tonal channels modulated by frequencies 30-15,000 Hz, SCA demodulated with 150 microsecond de-emphasis.
FM CROSSTALK: SCA to SCA (at kHz) 50 dB demodulated with 150 microsecond de-emphasis.
FM AUTOMATIC MUTE LEVEL: Variable from 0 to 30 dBm.
FM MUTE DELAY: Adjustable 0.5 to 60 seconds.
FM INJECTION LEVEL: 1% to 10% of composite. Adjustable.

WIDEBAND MODE

INPUT CONNECTOR: BNC.
INPUT IMPEDANCE: Greater than 5000 ohms resistive, unbalanced.
INPUT LEVEL: 1.0 V RMS nominal for ±75 kHz deviation.
AMPLITUDE RESPONSE: ±0.25 dB, 30 Hz to 75 kHz.
PHASE LINEARITY: ±2°, 30 Hz to 75 kHz.

ORDERING INFORMATION:

MS-15 exciter, for wildband operation, 19 inch rack mounted. 1994-7602-001
Mono option (add for mono operation) 1994-7619-001
DSM stereo generator with DTR (add for stereo operation) 1994-8002-001
SCA generator (add for SCA operation, specify 41 or 67 kHz) 1994-7632-001

HARRIS CORPORATION Broadcast Products Division
P. O. Box 4290, Quincy, Illinois 62301 U. S. A.

- Patented DSM Stereo Generator provides separation exceeding accurate measurement capability of most monitors
- DTR filter technique permits 2 to 6 dB loudness increase by eliminating overshoot
- Ultra linear VCO for minimum distortion
- Ovenless TCXO provides maximum stability
- System design virtually eliminates crosstalk into L-R and SCA channels under dynamic and steady state conditions
- Automatic pilot phase control and digital circuitry give long-term high performance
- MS-15—the first significant advance in FM exciters in over a decade.
A few years ago, Harris introduced PDM to the AM broadcaster and sent hundreds of conventional AM transmitters to standby service.

The MS-15 FM exciter now makes all other AM excitors as obsolete as the plate modulated AM transmitter. Using patented DSN (Digitally Synthesized Modulation) and DTR (Dynamic Transient Response) techniques, the MS-15 exciter is the first modular exciter designed for ultimate flexibility and ease of maintenance.

The power amplifier module is conservatively rated at 15 watts output, and requires no tuning across the entire FM band. A lowpass filter with one tuning adjustment keeps RF harmonics to less than -53 dB. The output is VSWR protected to prevent accidental damage to the PA.

The basic exciter audio response is wideband and flat, and can be used, without interface, directly with a studio-transmitter link.

The exciter is configured to accept a plug-in quadraphonic FM generator and provides metering of Left and Right rear audio inputs. All of the five competing quadraphonic systems currently under consideration by the FCC can be accommodated by the MS-15.

Status LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 20 functions. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator.

The Harris DSM stereo generator, with digitally synthesized modulation, provides 45 dB stereo separation minimum, 30,000 to 15,000 Hz, and overhead no greater than 2%.
HARRIS

FM-2.5K

2.5-Kilowatt
FM Broadcast
Transmitter

- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Digitally Synthesized Modulation stereo generator provides 50 dB separation, offering new stereo realism
- Dynamic Transient Response (DTR*) stereo generator filter maximizes modulation level without overmodulating
- Single phase power supply eliminates the need for costly three phase AC service
- Stable, quarter wave PA cavity minimizes tuning adjustments
- Extensive metering and status displays for ease of operation and service
- Standard filament voltage regulator increases tube life

*Patented
The FM-2.5K employs Harris' exclusive, advanced-design MX-15 solid state exciter, with Digitally Synthesized Modulation (DSM), to provide the very finest stereo signal available. Technical specifications are exceptional compared to other 2.5 kilowatt FM transmitters on the market. And DSM with overshoot compensation allows a 2 to 6 dB increase in loudness with no degradation of audio quality!

The transmitter consumes only 4.8 kilowatts at full output—and will provide 3000 watts effective radiated power in both horizontal and vertical planes when used with a Harris 3-bay FML-3E Circularly Polarized FM antenna. This assumes a coaxial cable efficiency of 82%.

The FM-2.5K uses single phase power...in areas where this is the only type of power available, no additional lines are required.

Two tubes are employed in the FM-2.5K—the 4X150A intermediate power amplifier, and the 5CX1500A single-ended final power amplifier.

**PLUG-IN MONO, STEREO AND SCA GENERATORS**
The FM-2.5K may be equipped for mono or stereo operation, with or without SCA. The design versatility of the exciter allows you to order for mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter. Since the SCA generators have spectrally pure filtered outputs, 41 and 67 kHz SCA channels may be operated simultaneously while in the mono mode without harmonic interference.

**STABLE, EASY OUTPUT TUNING**
Plate tuning of the final amplifier is stable and easily adjusted. The plate circuit is a shorted, one-quarter wavelength configuration, with the plate line operated at DC ground potential. Coarse plate tuning is pre-set for the operating frequency on the plate line. Fine adjustment is made with the plate tuning knob on the front panel. Amplifier loading is changed by a variable output loading control.

**AUTOMATIC RECYCLING**
The recycle circuitry in the FM-2.5K is adjustable, self-clearing and uncomplicated. Should a momentary overload occur, the transmitter will recycle automatically. If the overload occurs in excess of the number of times pre-set, the transmitter will remain off the air until it is reset, either manually or by remote control.

**POWER OUTPUT CONTROL**
The transmitter has a built-in motor-operated rheostat connected to the screen supply for adjusting the power output. A built-in reflectometer with a VSWR power meter makes adjustments of the power output easy and accurate.

**REMOTE CONTROL**
The FM-2.5K features built-in remote metering for the plate voltage, plate current and power output. This FM-2.5K feature simplifies remote control interface.

**PUSHBUTTON OPERATION**
Manual operation of the transmitter is simple. On-Off functions are controlled by lighted, dual pushbuttons at the top left of the cabinet. They are clearly marked Filament On and Off, Plate On and Off. After the filaments of the tubes are turned on, a time delay relay allows the cathodes to reach operating temperatures before the plate power can be turned on.

**COMPLETE TESTING**
Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-2.5K. The transmitter is capable of operating at altitudes to 7500 feet, in an ambient temperature range of -20° to +45°C.

In addition, your FM-2.5K is fully tuned and operationally tested on your frequency before shipment.

**HARMONIC FILTER STANDARD**
Supplied with a Harris-designed harmonic filter, the transmitter fully meets FCC requirements for spurious radiation. All filtering is mounted inside the transmitter cabinet and provides rapid cut-off of second and higher order harmonics.

**QUALITY COMPONENTS**
Every transmitter component is conservatively operated and chosen to give optimum performance in continuous duty service. In Harris' MX-15 exciter, only performance-proven solid-state devices and precision temperature compensated components are used throughout.

**STYLING**
Handsome yet functionally styled, the transmitter cabinet is finished in white and blue, with a black meter panel. The FM-2.5K is completely self-contained in one cabinet, and simplicity of design allows easy access to all components.

**TYPE ACCEPTANCE**
The FM-2.5K is FCC type accepted for mono or stereo broadcasting in the 87.5 to 108 MHz band.
Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

**ULTRA-LINEAR VCO**
The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion through the FM-2 5K is an exceptionally low 0.05%, with all CCIF Intermodulation distortion products down at least 75 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ±100 kHz.

Equally impressive is the FM-2 5K/MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

**BALANCED FLOATING COMPOSITE INPUT**
Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the probability of ground loops and other system interface problems.

**DIGITAL SYNTHESIZER**
The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct frequency comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ±10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

**DIGITALLY SYNTHESIZED MODULATION**
The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Stereo separation typically exceeds 50 dB from 30 to 15,000 Hz.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

**OVERSHOOT COMPENSATION**
A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

**SCA OPERATION**
Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation continuously. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

**POWER AMPLIFIER**
The MX-15 power amplifier module is solid-state, conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

**STATUS AND MONITORING**
Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick 'go/no-go' service checks.

**ADDITIONAL EXCITER FEATURES**
The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.
FM-2.5K TRANSMITTER SPECIFICATIONS

GENERAL
POWER OUTPUT: 800 W to 2.5 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 1/4" EIA flange.
FREQUENCY STABILITY: ±300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation (DCFM).
MODULATION CAPABILITY: ±100 kHz.
AC INPUT POWER: 197/250 V, 60 or 50 Hz, single phase, two wire. Power consumption: 4800 watts (approx.), 115/230 V, 60 or 50 Hz, 150 watts for MX-15.
RF HARMONICS: Suppression meets all FCC requirements.
POWER SUPPLY RECTIFIERS: Silicon.
ALTITUDE: 7,500 feet.
AMBIENT TEMPERATURE RANGE: −20°C to +45°C.
MAXIMUM VSWR: 1.7 to 1.
OVERALL CABINET SIZE: 29" W (74 cm) x 78" H (198 cm) x 33" D (84 cm).
FRONT DOOR SWING: 29" (74 cm).
FINISH: White, blue and black.

WIDEBAND COMPOSITE OPERATION
COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: 0.08%.
COMPOSITE INTERMODULATION DISTORTION: ±0.05% (60 Hz/7 kHz 1:1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 75 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ±0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below reference carrier AM modulation 100% output power.

MONAURAL OPERATION
AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.015%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.15%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: +10 dBm, ±1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1% 60 Hz/7 kHz test tone pair: 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: —50 dB.
NON-LINEAR CROSSTALK: —60 dB.
75 kHz SUPPRESSION: ±6 dB.
38 kHz SUPPRESSION: —73 dB.
FM NOISE: (Left or right) 72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
Pilot OSCILLATOR: Crystal controlled.
Pilot PHASE: Harris patented automatic pilot phasing circuit.
Pilot STABILITY: 19 kHz ±1 Hz 0° to 50°C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.
SCA OPERATION
MODULATION: Direct FM.
FREQUENCY OF OPERATION: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: ±500 Hz.
MODULATION CAPABILITY: ±7.5 kHz.
AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz AC coupled input, 150 microsecond pre-emphasis ±1 dB, standard. Selectable: flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ±0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ±1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: ±0.5%, 30-4,500 Hz ±5 kHz deviation.
INTERMODULATION DISTORTION: ±1%, 60 Hz/7 Hz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) —63 dB (reference: 100% modulation ±5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) —60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 55 dB below ±5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 kHz/67 kHz) —50 dB modulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to —30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION
FM-2.5K 2500 watt FM broadcast transmitter with MX-15 exciter, for wideband operation, 60 Hz ............... 994-8047-001
As above, except 50 Hz .......... 994-8047-003
100% spare tube kit .......... 990-0587-001
Mono generator (add for mono operation) ............... 994-8019-001
DSM stereo generator with DTR (add for stereo operation) ............... 994-8020-001
SCA generator (add for SCA operation, specify 41 or 67 kHz) ............... 994-7992-001

HARRIS CORPORATION BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

CP-2M-383 © Harris Corporation 1983

ADV. 4898 PTD. IN U.S.A.
• MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity

• Digitally Synthesized Modulation stereo generator provides 60 dB midband separation for increased stereo realism

• Dynamic Transient Response (DTR*) stereo generator filter maximizes modulation level without overshoot

• Single phase power supply eliminates the need for costly three phase AC service

• Stable quarter wave PA cavity minimizes tuning adjustments

• Extensive metering and status displays for ease of operation and service

*Patented
The FM-1K employs Harris' advanced design MX-15 solid-state exciter to provide the cleanest and the loudest FM signal of any one-kilowatt FM transmitter available today. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide stereo separation of 50 dB minimum, 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a 2 to 6 dB increase in loudness, with no degradation of audio quality, by limiting overshoot to 2% or less.

ONE TUBE DESIGN
Just one tube—a 4CX1000A tetrode—is all that is needed to supply 1000 watts output in the FM-1K. Driven directly by the MX-15 exciter, the 4CX1000A serves as the power amplifier and is operated well within its ratings for long tube life.

PLUG-IN MONO, STEREO AND SCA GENERATORS
The FM-1K may be equipped for mono or stereo operation, with or without SCA. The design versatility of the exciter allows you to order for mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter.

STABLE, EASY OUTPUT TUNING
Plate tuning of the final amplifier is stable and easily adjusted. The plate circuit is a shorted one-quarter wavelength configuration, with the plate-line operated at DC ground potential. Coarse plate tuning is preset for the operating frequency on the quarter-wave tank circuit. Fine adjustment is made with the plate tuning knob on the front panel. Amplifier loading is changed by a variable output loading capacitor.

POWER OUTPUT CONTROL
The transmitter's output loading control is motor-driven for smooth power adjustments, either locally or from a remote point. This feature allows the screen voltage of the 4CX1000A to be Zener-diode regulated for exceptional operating stability and tube life.

HARMONIC FILTERS STANDARD
Supplied with a Harris-designed multi-section harmonic filter, the transmitter fully meets FCC requirements for spurious radiation. The second harmonic shorting stub is mounted inside the transmitter cabinet, leaving the easy-to-install low-pass in-line filter as the only external component.

AUTOMATIC RECYCLING
In case of momentary overload, the transmitter recycles automatically. Should the overload reoccur in excess of the desired number of times preset in the transmitter, the FM-1K will then remain off the air until it is reset, either locally or by remote control.

REMOTE CONTROL
All necessary operating functions can be remote controlled. No additional equipment is required to adapt a Harris remote control system to the transmitter. Connections are easily and simply made at a terminal strip in the cabinet.

TESTING
Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-1K. The transmitter is capable of operating at altitudes up to 10,000 feet (3000 meters), in an ambient temperature range of -20° to +45°C.

In addition, your FM-1K is fully tuned and operationally tested on your frequency before shipment.

FULL METERING
Six meters, including four large, front-panel meters, provide full monitoring of the transmitter's operating parameters. Included is a power indicator that permits direct reading of both power output and standing wave ratio.

GENERAL
There are many other operational and convenience features incorporated into the FM-1K. These include:

Pushbutton Operation—On-off functions are controlled by lighted pushbuttons at the top left of the transmitter. These are clearly marked "Filament On-Off", "Plate On-Off".

High-Capacity Blower—backed up by a precision air-pressure switch, gives complete protection to the final amplifier tube.

Straightforward Design—allows easy accessibility to all components.

Handsome Styling—the transmitter cabinet is attractively yet functionally styled, and features a white and blue finish, with a black meter panel.

FCC Type Acceptance—the FM-1K is FCC type accepted for mono or stereo broadcasting in the 87.5 to 108 MHz FM band.
Harris MX-15 Exciter... new levels of excellence in FM audio performance

Continuing in its trend-setting tradition, Harris has incorporated state-of-the-art refinements in exciter technology to introduce the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter provides the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO
The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low 0.1%, with all CCIF intermodulation distortion products down at least 77 dB. This important criterion shows the quality of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 KHz will not be slew limited even at maximum modulation capability of ±100 kHz.

Equally impressive is the MX-15’s -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the exciter to achieve this low noise floor. The MX-15’s exceptionally low distortion and noise provides your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT
Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

DIGITAL SYNTHESIZER MODULATION

DIGITALLY SYNTHESIZED MODULATION
The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike older technology still on the market, that suffers from degraded separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk, Harris’ DSM technique has neither of these shortcomings. DSM stereo generation is essentially transparent to the program material. Separation is specified at 50 dB (typically 60 dB at mid-frequencies) over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION
A patented Dynamic Transient Response (DTR) filter, developed by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION
Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation all the time. Here’s how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation head room when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER
The MX-15 power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING
Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick “go/no-go” service checks.

ADDITIONAL BENEFITS
The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.
FM-1K TRANSMITTER SPECIFICATIONS

GENERAL
POWER OUTPUT: One kilowatt.
FREQUENCY STABILITY: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 1/4" EIA flange.
FREQUENCY STABILITY: ±300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation (DCFM).
MODULATION CAPABILITY: ±100 kHz.
AC INPUT POWER: 208/240 V, 60 or 50 Hz, single phase, three wire. Power consumption: 2100 watts (approx.). 115/230 V, 60 or 50 Hz, 150 watts for MX-15.
RF HARMONICS: Suppression meets all FCC requirements.
POWER SUPPLY RECTIFIERS: Silicon.
ALTITUDE: 10,000 feet (3000 meters).
AMBIENT TEMPERATURE RANGE: -20°C to +45°C.
MAXIMUM VSWR: 1.7 to 1.
OVERALL CABINET SIZE: 29" W (74 cm) x 78" H (198 cm) x 33" D (84 cm).
FRONT DOOR SWING: 29" (74 cm).
FINISH: White, blue and black.
WEIGHT & CUBAGE: Export: 1300 lbs. (590 kg). Domestic: 1050 lbs. (476 kg). 104 cu. ft. (2.9 cu. m).

WIDEBAND COMPOSITE OPERATION
COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms, resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: 15%.
COMPOSITE INTERMODULATION DISTORTION: 0.1% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 77 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ±0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below reference carrier AM modulation 100% output power: 15 watts.

MONOAURAL OPERATION
AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products below 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: +10 dBm, +1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.

HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1% 60 Hz/7 kHz test tone pair, 4:1 ratio.

CGF INTERMODULATION DISTORTION: (Left or right) all distortion products down 80 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.

LINEAR CROSSTALK: –50 dB.
NON-LINEAR CROSSTALK: –60 dB.

76 kHz SUPPRESSION: –68 dB.
38 kHz SUPPRESSION: –73 dB.

FM NOISE: (Left or right) –70 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ±1 Hz 0° to 50°C.

OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.

SCA OPERATION
MODULATION: Direct FM.
FREQUENCY OF OPERATION: 67 or 92 kHz programmable, any frequency between 25 and 92 kHz on special order.
FREQUENCY STABILITY: ±500 Hz.
MODULATION CAPABILITY: ±7.5 kHz.

AUDIO FREQUENCY RESPONSE: 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis ±1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis. DC to 4 kHz ±0.5 dB.

AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ±1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ±5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) –63 dB (reference: 100% modulation = ±5 kHz deviation at 400 Hz).

CROSSTALK: (SCA to main or stereo sub-channel) –60 dB or better.

CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ±5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.

CROSSTALK: SCA to SCA (67 kHz/92 kHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to –30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).
CARRIER MUTE DECAY: Greater than 30 milliseconds.

Specifications subject to change without notice.

ORDERING INFORMATION
FM-1K, 1 kW FM transmitter with MX-15 exciter, for wideband operation, 50/60 Hz. 994-8046-003
Mono generator (add for mono operation) 994-8019-001
DSM stereo generator with DTR (add for stereo operation) 994-8020-001
SCA generator (add for SCA operation, specify 67 or 92 kHz) 994-7992-002

HARRIS CORPORATION BROADCAST GROUP
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

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ADV. 508C PTD. IN U.S.A.
DIGITAL SYNTHESIZED MODULATION

The Harris S660 digital synthesizer technique does not suffer from the audio spectrum and/or frequency modulation syncr...
When considering 3.5 kW FM transmitters, local service FM broadcasters generally have two major requirements: long-term reliability and stable performance. Without question, the Harris FM-3.5K meets these POWER TO MEET YOUR TRANSMISSION SYSTEM REQUIREMENTS. The Harris FM-3.5K transmitters have a powerful output of 3.5 kW. However, input power of 800 to 3800 watts. This full range allows you to select the most effective antenna system, tower height and transmission. The Harris FM-3.5K meets your requirement.

The PM-3.5K incorporates a single FM amplifier at 3.5 kW output. Based on a 10-hour broadcast day and a typical power charge of 80 per broadcast hour, this represents an operating cost of about 808.58 per hour. From an allowable 5.5 kW output, the PM-3.5K requires only single-phase AC power. Unlike conventional linear power amplifiers, the PM-3.5K system has no need for a bias supply. It can be used in any network: 3-Phase, Single-Phase or to your facility.

HIGHEST RELIABILITY. LONG LIFE POWER AMPLIFIED LINEAR SYSTEMS. The Harris FM-3.5K utilizes a modern power amplifier chain that provides you with many years of dependable service. The high-gain feature for the FM-3.5K ensures that the FM-3.5K is high-efficiency. A single stage will operate at reduced power operation will provide you with a surprisingly good signal even on the maintenance lines.

BANDPASS OUTPUT NETWORK. Broadcast transmitter designers are concerned with all aspects of the broadcast chain to reduce signal interference from other RF services.

TRANSMITTER CONTROL AND STATUS AT A GLANCE. The PM-3.5K control section shows that the receiver and monitors all vital areas to maximize top performance. Operation and performance can be determined at a glance by the status of the PM-3.5K.

Automatic Power Control. With a Harris FM-3.5K, a station is able to maintain its power level in most areas, as well as reduce the potential for interference. Power is automatically reduced or increased as required, without any noticeable decrease in performance at the station.

Remote Control Interface. Included. Unlike other FM transmitters, remote control interfaces are an integral part of the Harris FM-3.5K. The Harris transmitter control panel can be used as a complete control system, or as an additional control system for remote operation.

REMOTE CONTROL INTERFACE. Unlike other transmitter systems, remote control can be provided in an integrated multi-channel system. The Harris FM-3.5K transmitter can be controlled from a remote location. The Harris FM-3.5K transmitter can be controlled from a remote location. The Harris FM-3.5K transmitter can be controlled from a remote location.

ATTENTION TO DETAIL. Harris FM-3.5K transmitters have been used extensively in the design of Harris FM-3.5K transmitters. For example, all FM-FM transmitters are designed to meet the highest known reliability standards. All Harris FM-3.5K transmitters are carefully calibrated to meet the highest requirements.

These are just a few examples of Harris FM-3.5K transmitters that are available for your use and many years to come.
• Combines two 25-kilowatt amplifiers for highest on-air reliability

• Only two low stress PA tubes, yielding low operating cost and long tube life

• Wide RF bandwidth for maximum stereo and SCA performance

• Solid-state control logic and automatic power control minimize adjustments

• Featuring the superior MS-15 maximum signal FM exciter

• DSM stereo generator typically yields 50 dB separation for increased stereo realism

• DTR overshoot filter maximizes modulator level
The FMD-50K dual 50-kilowatt transmitter offers real protection against off-air time through redundancy, and through extensive use of solid-state circuitry. Only two tubes are employed in the entire FMD-50K... high-gain, highly efficient 8990 tetrodes used as the final power amplifiers. The 8990 uses a wave fin radiator which provides exceptional cooling at reduced air requirements, for quiet operation. The quarter-wave PA cavity design eliminates troublesome sliding contacts for tuning, and assures wide RF bandwidth. This results in a signal path that is transparent to the MS-15 exciter.

The basic FMD-50K transmitter consists of two 25-kilowatt amplifiers, and a center control cabinet. It provides redundancy in all areas except the exciters. In case emergency operation is required, you stay on the air at one-quarter normal power output. An even higher level of redundancy is achieved in the complete FMD-50K through an optional arrangement of switches, sensors and circuits that make the FMD-50K totally redundant from audio input to RF output.

The FMD-50K with the RF output switching option provides the capability of automatically switching either transmitter directly to the antenna, thus providing one-half normal operating power in the event of a transmitter malfunction.

With the addition of the automatic exciter switching option, automatic backup exciter protection is provided. Also, an optional RF input patch panel is available to connect either exciter directly to either transmitter by bypassing all of the automatic exciter switching equipment.

SOLID-STATE IPA'S
The redundancy of the dual FMD-50K is heightened when the IPA in each 25-kilowatt amplifier is considered. The IPA stages are multiple solid-state amplifiers combined in such a manner that failure of one amplifier stage will not cause a total loss of IPA RF power. The IPA solid-state modules in the PA are identical to those used in the booster amplifier for the MS-15. The wide use of solid-state RF power circuits means that the FMD-50K uses only two tubes!

LOW OPERATING COST
With today's mounting energy costs, transmitter efficiency must be a major consideration in any purchase. 77% efficiency in the final power amplifiers, high efficiency in all amplifier circuits, and conservatively rated components result in comparatively low power consumption and low operating stress on heat generating components in the FMD-50K. This adds up to very impressive savings in operating and maintenance costs.

FINEST STEREO PERFORMANCE
Featuring the advanced-design MS-15 exciter, Harris' FMD-50K provides the cleanest and the loudest stereo signal of any 50-kilowatt FM transmitter available today. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide stereo separation of 40 dB minimum (50 dB typical), 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a 2 to 6 dB increase in loudness, with no degradation of audio quality, by limiting overshoot to 2% or less.

The FMD-50K may be equipped for mono or stereo operation, with or without SCA.

The design versatility of the MS-15 exciter allows you to order mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter. The FMD-50K is equipped for wideband composite input in its standard configuration.

AUTOMATIC POWER CONTROL
The FMD-50K automatically monitors power output, and maintains the output at the desired level. This standard feature insures against out-of-tolerance power conditions. Furthermore, the power set point can be remotely adjusted independently of the limit points to allow operator control of power output. During maintenance periods, the automatic power control may be switched off.

VSWR PROTECTION
VSWR protection is mandatory in any high-power transmitter—therefore, Harris has incorporated this as a standard feature in the FMD-50K. A high VSWR condition will cause the transmitter to recycle...if three overloads occur within a given time period, the transmitter will shut down until manually restarted. The transmitter may also be programmed for single VSWR overload shutdown.

CONTROL CIRCUITRY
The FMD-50K is controlled by solid-state logic circuitry. The logic circuitry not only controls basic On/Off functions, but also monitors critical stages for overload conditions. Should an overload occur, the transmitter will recycle automatically.

The control logic used in the FMD-50K interfaces directly with most remote control systems, eliminating the need for an additional remote control interface. The control signals are momentary low current contacts. The transmitter output parameters are buffered, and all status indicators can be remoted.

METERING AND VISUAL AIDS
Major functions, including combined output power, VSWR and reject load power are displayed on easy-to-read 4-inch meters in the center cabinet. Complete monitoring of operating functions of the individual 25-kilowatt amplifiers are also displayed. Low-level parameters of each amplifier are displayed on a multimeter, and IPA RF output and reflected power are indicated on another meter. Filament voltage is measured by a true RMS circuit.

The FMD-50K provides a variety of indicators as troubleshooting aids and quick
complete redundancy...only two tubes

references. These include illuminated On/Off pushbuttons and numerous LED status indicators.

HV POWER SUPPLIES
The two high voltage power supplies are housed in separate cabinets, and provide the plate and screen voltage. The conservatively-rated three-phase plate supplies use silicon rectifiers with AC line transient protection.

COMPACT SIZE
The trim FMD-50K cabinet configuration measures only 90.2" wide, 72" high and 30.5" deep. Additionally, the HV power supplies may be located in any convenient spots remote from the PA cabinets.

GENERAL
There are many other operational and convenience features incorporated into the FMD-50K. These include:

Line Loss Protection—Built-in protection against total AC failure and loss of phase is provided. The FMD-50K will restart automatically following a total power failure, while loss of a single phase will shut down the transmitter.

High Altitude Rating—High capacity, direct-drive blowers deliver sufficient air to cool the transmitter at altitudes up to 10,000 feet (3048 meters).

Additional Protection—Magnetic circuit breakers are utilized to protect the blower motors, the filament supplies, the IPA supplies and the bias supplies. A safety interlock system and a drop solenoid system discharge power supplies to safe levels.

Automatic Transmitter System Compatibility—The simple control logic interface and full metering in the FMD-50K permit ATS operation.

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HARRIS' FMD-50K DUAL FM TRANSMITTER CONFIGURATIONS

BASIC FMD-50K DUAL SYSTEM
- Two FM-25K transmitters, less exciters.
- One MS-15 exciter.
- One dual RF booster amplifier with low power hybrid coupler and reject load.
- One 19-inch center cabinet with control and metering circuitry.
- One high power hybrid coupler with interconnecting transmission line components.
- One 12.5-kilowatt reject load.

FMD-50K WITH AUTOMATIC RF OUTPUT SWITCHING
- Two FM-25K transmitters, less exciters.
- One MS-15 exciter.
- One dual RF booster amplifier with low power hybrid coupler and reject load.
- One 19-inch center cabinet with control metering and RF control logic assembly.
- One floor-mounted frame assembly with three high power coaxial switches, one high power hybrid combiner, and one 12.5-kilowatt reject load.
- All necessary interconnecting transmission line components.

OPTIONAL AUTOMATIC EXCITER SWITCHING
- One automatic RF control logic assembly.
- One coaxial transfer switch.
- One test load for exciter.
- All necessary cabling for system interconnect.
- (Requires second exciter, which is not included in this option package).

ADDITIONAL OPTIONS FOR FMD-50K
- Mono generator(s).
- Stereo generator(s).
- SCA generator(s).
- RF input manual patch panel for use with exciter switching option.
- 80-kilowatt water-cooled test load.
- Heat exchanger for test load.
WEIGHT AND CUBAGE (Approximate): Export: 7000 lbs. (3178 kg).
Domestic: 6800 lbs (3087 kg). Cubage: 400 cubic feet (11.3 cubic meters).

MONAURAL MODE

AUDIO INPUT IMPEDANCE: 600 ohms balanced, resistive, adaptable to other impedances.
INPUT FILTER: Controlled response LPF, defeatable.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.

RF FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30-15,000 Hz. Selectable: flat, 25 or 50 microsecond pre-emphasis.

FMD-50K SPECIFICATIONS

GENERAL

POWER OUTPUT: 20 kW to 50 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequencies.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 6/8" EIA flange.
FREQUENCY STABILITY: ±100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 50/60 Hz. 350/415 V, 3-phase, 50/60 Hz. Power consumption: 80,000 watts (approx.) 115 V as available.
RF HARMONICS: Suppression meets all FCC requirements.
ALTITUDE: 10,000 feet (3048 meters).
AMBIENT TEMPERATURE RANGE: —20°C to +45°C
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter: 90.2"W (229 cm) x 72"H (183 cm) x 30.5"D (77.5 cm). HV power supply cabinets: (each) 48"W (122 cm) x 60.2"H (153 cm) x 24.2"D (61.5 cm).
FINISH: White, blue and black.
WEIGHT AND CUBAGE (Approximate): Export: 7000 lbs. (3178 kg).
Domestic: 6800 lbs (3087 kg). Cubage: 400 cubic feet (11.3 cubic meters).

MONAURAL MODE

AUDIO INPUT IMPEDANCE: 600 ohms balanced, resistive, adaptable to other impedances.
INPUT FILTER: Controlled response LPF, defeatable.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.

RF FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30-15,000 Hz. Selectable: flat, 25 or 50 microsecond pre-emphasis.

FMD-50K, dual 50-kilowatt FM transmitter, with automatic RF output switching, for wideband operation .......................................................... 994-8455-001
FMD-50K, dual 50-kilowatt FM transmitter, basic system, for wideband operation .......................................................... 994-8455-002
Automatic exciter switching option (does not include second exciter) .......................................................... 994-8456-001
MS-15 exciter (does not include generator modules) .......................................................... 994-7950-002
Monaural generator (add for monaural operation) .......................................................... 994-8019-001
DSM stereo generator with DTR (add for DSM operation) .......................................................... 994-8020-001
SCA generator (add for SCA operation, specify 41 or 67 kHz) .......................................................... 994-7982-001
RF input patch panel ........................................................................................................ 994-8473-001
80-kilowatt water-cooled test load ...................................................................................... 700-0241-000
Heat exchanger for test load .............................................................................................. 432-0257-000

HARRIS CORPORATION Broadcast Products Division
P.O. Box 4290, Quincy, Illinois 62301 U.S.A. 217/222-8200

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

ORDERING INFORMATION

FMD-50K, dual 50-kilowatt FM transmitter, with automatic RF output switching, for wideband operation
FMD-50K, dual 50-kilowatt FM transmitter, basic system, for wideband operation
Automatic exciter switching option (does not include second exciter)
MS-15 exciter (does not include generator modules)
Monaural generator (add for monaural operation)
DSM stereo generator with DTR (add for DSM operation)
SCA generator (add for SCA operation, specify 41 or 67 kHz)
RF input patch panel
80-kilowatt water-cooled test load
Heat exchanger for test load

HARMONIC DISTORTION: 0.2% or less, 30-15,000 Hz.
IMD: 0.2%, 60/7000 Hz, 4:1 ratio.
FM NOISE: 68 dB below 100% modulation (ref. 400 Hz @ ±75 kHz deviation).
AM NOISE: 50 dB below reference carrier AM modulation 100%.

STEREOPHONIC MODE

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: (left and right) 600 ohms balanced, resistive. Adaptable to other impedances.
AUDIO INPUT LEVEL: (left and right) 410 dBm ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: (left and right) standard 75 microsecond, FCC pre-emphasis curve ±0.5 dB, 30-15,000 Hz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz LPF, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Dynamic transient response (DTR) filter.
AUDIO TRANSIENT PROTECTION: 2% maximum overshoot beyond steady state. Defeatable for test purposes.
HARMONIC DISTORTION: (left or right) 0.4% or less, 30-15,000 Hz.
INPUT IMPEDANCE: 600 ohms balanced, resistive. Adaptable to other impedances.
FM NOISE: (left or right) 65 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 kHz deviation.
PILOT OSCILLATOR: Crystal controlled.
PILOT STABILITY: ±0.1 kHz ±1 Hz, ±1 Hz, ±6000 Hz.
PILOT PHASE: Automatically controlled.
STEREO SEPARATION: 40 dB minimum 30-15,000 Hz.
CROSSTALK: (main to stereo sub-channel or stereo sub-to main channel) 45 dB below 90% modulation.
SUB CARRIER SUPPRESSION: 50 dB below 90% modulation.
76 kHz SUPPRESSION: 60 dB minimum below 100% modulation.
MODES: Stereo, mono (L + R), mono (L), mono (R). Removable.

SCA SPECIFICATIONS

MODULATION: Direct FM.
FREQUENCY: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: ±500 Hz.
MODULATION CAPABILITY: ±7.5 kHz.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled) and 2000 ohms unbalanced (DC coupled).
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz, 150 microsecond pre-emphasis ±1 dB standard. Selectable: flat, 50 or 75 microsecond pre-emphasis.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard.
DISTORTION: Less than 1%, 30-5000 Hz, ±5 kHz deviation.
FM NOISE: (main channel not modulated) 55 dB minimum (ref: 100% = ±5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel): —60 dB or better.
CROSSTALK: (main or stereo sub-channel to SCA): 50 dB below 90% modulation ±5 kHz deviation of SCA, with mono or stereo channels modulated by frequencies 30-15,000 Hz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 kHz/67 kHz), 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to —30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite. Adjustable.
WIDEBAND MODE

INPUT IMPEDANCE: Greater than 5000 ohms resistive, unbalanced.
INPUT LEVEL: 1.0 RMS nominal for ±75 kHz deviation.
AMPLITUDE RESPONSE: ±0.25 dB, 30 Hz to 75 kHz.
PHASE LINEARITY: ±2°, 30 Hz to 75 kHz.
HARRIS

FM-40K

40-Kilowatt
FM
Broadcast
Transmitter

- Combines two high efficiency FM-20K transmitters for highest reliability and low operating cost
- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Digitally Synthesized Modulation stereo generator yields 48 dB minimum separation for increased stereo realism
- Dynamic Transient Response (DTR*) stereo generator filter maximizes modulation level without overmodulating
- Stable "VARI-LINE" output tuning requires fewer adjustments
- VSWR circuitry provides fault protection to your costly antenna and transmission line equipment

*Patented
Reliability through redundancy—that's the story on Harris' FM-40K, 40-kilowatt transmitter.

The basic FM-40K transmitter system consists of two 20-kilowatt amplifiers, and a center control cabinet containing the MX-15 exciter—and provides redundancy in all areas except the exciter and isolation amplifier. In case emergency operation is required, you stay on the air at one-quarter normal power output.

The complete 40-kilowatt FM transmitter system includes an optional Automatic Exciter Switching Kit and RF Output Switching Kit—and provides total redundancy! Should a malfunction occur anywhere in the system, you are still on the air at one-half normal power!

In the basic system, outputs of each amplifier are coupled through harmonic filters to the output combining network. This hybrid network sums the two 20-kilowatt signals to produce a 40-kilowatt output to the transmission line. However, the two amplifiers remain isolated from each other.

With the addition of the Automatic Exciter Switching Kit, automatic backup exciter protection is provided. And with the further addition of the RF Output Switching System, power output becomes one-half the normal output during emergency operation. Either or both of these options may be included in the FM-40K at the time you order—or added later in the field.

FINEST STEREO PERFORMANCE

Featuring the advanced-design MX-15 exciter, Harris' FM-40K provides the cleanest and the loudest stereo signal of any 40-kilowatt FM transmitter available today. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide stereo separation of 48 dB minimum (typically 60 dB midband), 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a 2 to 6 dB increase in loudness, with no degradation of audio quality, by limiting overshoot to 2% or less.

The FM-40K may be equipped for wideband, mono or stereo operation, with or without SCA. The design versatility of the MX-15 exciter allows you to order for mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter.

LOWEST OPERATING COST

In the FM-40K, each of the 20-kilowatt amplifiers operates at 80% efficiency or better. Add to this conservatively rated components and you have the lowest operating cost of any FM transmitter in the 40-kilowatt power range. The 4CX15,000A output tube in each 20-kilowatt amplifier assures excellent performance—and runs at only one-third its dissipation rating for maximum service life.

VARI-LINE SILVER-PLATED TANK

Vari-Line is an advanced, Harris-developed method of tuning a single-ended FM amplifier for optimum output efficiency. A portion of a parallel tubular 2-1/4-inch copper transmission line (silver plated for efficient RF service) is made variable in order to inductively tune the line to operating frequency. This reduces the complexity of sliding contacts and consequent maintenance problems.

With Vari-Line tuning, greater reliability is possible. Mica capacitors are not used in the tank circuit.

DUAL HV POWER SUPPLIES

Two separate three-phase HV power supplies are used for each 20-kilowatt amplifier. With each amplifier one HV supply—for PA plate voltage—is housed in a separate enclosure; the other supply, which powers the IPA plate and screen circuit, and the PA screen, is housed in the amplifier cabinet.

The FM-40K employs a special power supply protective circuit to assure that transient voltages or on-off power surges will not damage the power transformer and related components.

AUTOMATIC RECYCLING

In case of momentary overload, the transmitter recycles automatically. Should the overload recur in excess of the number of times preset in the transmitter, the FM-40K will then remain off the air until reset, either locally or by remote control.

TESTING

Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-40K. The transmitter is capable of operating at altitudes up to 7500 feet (2286 meters), in an ambient temperature range of -20° to +45° C (4° to +113° F).

In addition, your FM-40K is fully tuned and operationally tested on your frequency before shipment.

REMOTE CONTROL

All basic remote control metering samples and control connections are standard in the Harris FM-40K transmitter. This permits easy interface with Harris and other remote control systems.
ADDITIONAL FEATURES

There are many other operational and convenience features incorporated into the FM-40K. These include:

PUSHBUTTON OPERATION. Daily operation of the FM-40K is simple, with on-off functions controlled by lighted pushbuttons, which are clearly marked "Filament On-Off" and "Plate On-Off".

HIGH CAPACITY BLOWERS. (one in each 20-kilowatt amplifier). Backed up by precision air-pressure switches, these blowers provide complete protection to the IPA and PA tubes.

EASE OF MAINTENANCE. The FM-40K is designed to allow quick accessibility to all components for easier maintenance and troubleshooting.

HANDSOME STYLING. Transmitter cabinets are attractively yet functionally styled, with double front doors on each 20-kilowatt amplifier. The finish is white, blue and black.

TYPE ACCEPTANCE. Harris' FM-40K is FCC type accepted for composite, mono, stereo and SCA broadcasting in the 87.5 to 108 MHz band.

FM-40K BLOCK DIAGRAM

HARRIS' FM-40K FM TRANSMITTER CONFIGURATIONS

Basic Dual System
- Two FM-20K transmitters, each with individual VSWR protection and status light panels (less individual exciters)
- One MX-15 exciter
- One isolation amplifier with power supply
- One center cabinet
- One high-power hybrid coupler (combiner) with plumbing to interconnect two transmitters
- One low-power hybrid coupler
- One 10-kilowatt reject load
- One 50-kilowatt reject load

Automatic Exciter/Isolation Amplifier Switching Kit (Optional)

For exciter redundancy, the following additional equipment (included in this kit) should be added to the basic system:
- One MX-15 exciter
- One isolation amplifier with power supply
- One test load for exciter
- One automatic changeover contact panel (mounts in center cabinet)

RF Output Switching (Optional)

For RF switching of the high-power output amplifiers, the following equipment (included in this kit) should be added to the basic system:
- One control panel (mounts in center cabinet)
- Three coaxial transfer switches
- One kit consisting of rigid coaxial line, elbows and flanges
- One 50-kilowatt test load required (not included in kit)

Optional Equipment For FM-40K
- Mono generator module
- Stereo generator module
- SCA generator module(s)
- 50-kilowatt air-cooled load
- 50-kilowatt water-cooled load
GENERAL
POWER OUTPUT: 20 kW to 40 kW.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 3/4" EIA flange.
FREQUENCY STABILITY: ±300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 60 Hz. (50 Hz available on special order.) Power consumption: 60,000 watts (approx.) 115/230 V, 60 or 50 Hz, 150 watts for MX-15, for an overall efficiency of approx. 68%.
RF HARMONICS: Suppression meets all FCC requirements.
ALTITUDE: 7500 feet (2266 meters).
AMBIENT TEMPERATURE RANGE: -20°C to +45°C (—4° to +113°F).
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter: 115"W (287cm) x 76"H (198cm) x 33"D (84cm). HV power supply cabinets (2): each 30"W (76cm) x 49"H (125cm) x 30"D (76cm).
FRONT DOOR SWING: 21" (53cm).
FINISH: White, blue and black.

WIDEBAND COMPOSITE OPERATION
COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 200 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: ± 1 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 2000 Hz bandwidth).
COMPOSITE HARMONIC DISTORTION: 0.8%
COMPOSITE INTERMODULATION DISTORTION: ± 1% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 75 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below reference carrier AM modulation 100% output power.

MONAURAL OPERATION
AUDIO INPUT IMPEDANCE: 600 ohms balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: ± 10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%±0.35 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: ±5%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 60 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 2000 Hz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM)

FM-40K SPECIFICATIONS

AUDIOPACK IMPEDANCE: Left and right channels: 600 ohms balanced, resistive, transformerless, adaptable to other impedances.
AUDIO INPUT LEVEL: ±10 dBm ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ±0.5 dB 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 2% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 48 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: ±50 dB.
NON-LINEAR CROSSTALK: ±60 dB.
76 KHZ SUPPRESSION: ±86 dB.
38 KHZ SUPPRESSION: ±73 dB.
FM NOISE: (Left to right): -74 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ±1 Hz 0° to 50°C.
OPERATIONAL MODES: Stereo, mono (left to right), mono (left), mono (right) - remoteable.

S C A O P E R A T I O N
MODULATION: Direct FM.
FREQUENCY OF OPERATION: 67 or 92 kHz programmable. Any frequency between 25 and 95 kHz is available on special order.
FREQUENCY STABILITY: ±500 Hz.
MODULATION CAPABILITY: ±7.5 KHz.
AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz AC coupled input, 150 microsecond pre-emphasis ±3 dB, standard. Selectable: flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 KHz ±0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: ±10 dBm, ±1 dB for 100% modulation at 400 Hz @600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 KHz standard. 3 KHz, 5 KHz, 7.5 KHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ±5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 KHz kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB. (reference: 100% modulation ± 5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel): -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA): -52 dB below ±5 KHz deviation of SCA. with mono or stereo channels modulated by frequencies 30 Hz-15 kHz. SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 KHz/67 KHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to ±30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

ORDERING INFORMATION

FM-40K, 40-kilowatt FM transmitter, basic system, for wideband operation, 60 Hz ........................................ 994-8053-002
Automatic exciter/isolation amplifier switching kit .................................................. 994-6876-001
RF output switching package .............................................................................. 994-6877-001
Monaural generator (add for mono operation) .......................................................... 994-8019-001
DSM stereo generator with DTR (add for stereo operation) ....................................... 994-8020-001
SCA generator (add for SCA operation, specify 67 or 92 kHz) .................................. 994-7992-001
50-kilowatt air-cooled test load ............................................................................. 700-0317-000
50-kilowatt water-cooled test load ........................................................................ 700-0239-000

HARRIS CORPORATION BROADCAST GROUP
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

CP-2M-083 ©Harris Corporation 1983
ADV. 510B PTD. IN U.S.A.
FM-25K
25-Kilowatt
FM Broadcast
Transmitter

- Advanced single tube design offers maximum reliability
- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Solid state IPA with built-in backup protection helps minimize down time
- Wide RF bandwidth does not degrade MX-15's exceptional audio performance
- Digitally Synthesized Modulation stereo generator yields 50 dB minimum separation for increased stereo realism
- Dynamic Transient Response (DTR*) stereo filter maximizes modulation level without overmodulating
- Automatic power control eliminates routine operator adjustment
- Quarter wave PA cavity has no troublesome fingerstock at high current points

*Patented

Harris' technology has combined advances in both tube and transistor designs, to bring you a major step forward in high-power FM transmitters. Transistors are now available which provide 50 watts of RF power at reasonable gain and low junction temperatures. By combining several of these transistors in wideband RF circuits, enough power can be generated to drive an advanced high-gain Eimac tetrode tube, the 8990. This tube, when grid driven in a grounded cathode, quarter-wave cavity, can produce 25 kilowatts with 350 watts of drive at nearly 80% plate efficiency!

The FM-25K, twenty-five kilowatt FM transmitter reflects Harris' design philosophy that FM transmitters should deliver RF power efficiently, should not limit exciter performance, and should integrate dependable solid-state control logic. In the FM-25K, these features are teamed with efficient, single-tube design, and with the high performance MX-15 exciter.

The FM-25K was designed for applications with tower limitations or specific coverage requirements. The higher RF power output reduces the number of antenna bays required for a given ERP; and fewer bays mean a reduction in windloading and mounting area, so that tower size and/or height may be reduced. Also, fewer antenna bays, with less gain, can mean improved close-in coverage and the elimination of null fills.

**SINGLE TUBE DESIGN**

The FM-25K is the first high-power FM transmitter to utilize a single-tube design. A high-gain, highly efficient 8990 tetrode is the only tube in the entire transmitter, and is used as the final power amplifier. The tube uses a wavy fin radiator which provides excep-
Harris FM-25K...high efficiency...wide RF bandwidth...only one tube

LOW OPERATING COST
With today's mounting energy costs, transmitter efficiency must be a major consideration in any purchase. Efficiency in the final power amplifier circuits approaches 77%. Conservatively rated components result in comparatively low power consumption and low operating stress on heat generating components in the FM-25K. This adds up to very impressive savings from reduced operating and maintenance costs.

AUTOMATIC POWER CONTROL
The FM-25k automatically monitors RF power output, and maintains the output at the desired level. This standard feature insures against out-of-tolerance power conditions. Furthermore, the power set point can be remotely adjusted independently of the limit points to allow operator control of power output. During maintenance periods, the automatic power control may be switched off.

VSIR PROTECTION
VSIR protection is mandatory in any high power transmitter—therefore, Harris has incorporated this as a standard feature in the FM-25K. A high VSIR condition will cause the transmitter to automatically recycle...if three overloads occur within a given time period, the transmitter will shut down until manually restarted. The transmitter may also be programmed for single VSIR overload shutdown.

CONTROL CIRCUITRY
The FM-25K is controlled by solid-state logic circuitry. The logic circuitry not only controls basic On/Off functions, but also monitors critical stages for overload conditions. Should an overload occur, the transmitter will recycle automatically, according to the number of times pre-set (one or three).

The control logic used in the FM-25K interfaces directly with most remote control systems, eliminating the need for an additional remote control interface. The control signals are momentary low current contact closures. The transmitter output parameters are buffered, and all status indicators are remoted. This FM-25K feature allows stations to remote a wealth of diagnostic information to the remote control point.

METERING AND VISUAL AIDS
Major functions, including RF output, VSIR and PA parameters are displayed on easy-to-read four-inch meters. Low-level parameters are displayed on a multimeter, and IPA RF output and reflected power are indicated on another meter. Filament voltage is measured by a true RMS circuit to help achieve long tube life. The FM-25K provides a variety of indicators as trouble shooting aids and quick references. These include four illuminated On/Off pushbuttons and 26 LEDs, not including those on the MX-15 Exciter.

HV POWER SUPPLY
The high voltage power supply is housed in a separate cabinet, and provides the plate and screen supplies. The conservatively rated three-phase plate supply uses silicon rectifiers with AC line transient protection.

COMPACT SIZE
The trim PA cabinet can fit as a replacement for most older 20- to 25-kilowatt transmitters. The cabinet is only 35 inches wide, 72 inches high and 31 inches deep. Additionally, the HV power supply may be located in any convenient spot remote from the PA cabinet.

ADDITIONAL FEATURES
There are many other standard operational and convenience features incorporated into the FM-25K. These include:

Line loss protection—built-in protection against total AC failure and loss of phase is provided. The FM-25K will restart automatically following a total power failure, while loss of a single phase will shut down the transmitter.

High altitude rating—a high capacity, direct-drive blower delivers sufficient air to cool the transmitter at altitudes up to 10,000 feet (3048 meters).

Additional protection—four magnetic circuit breakers are utilized to protect the blower motor, the filament supply, the IPA supply and the bias supply. A wide-ranging interlock system and a drop solenoid system quickly discharge power supplies to safe levels.

ATS compatibility—the simple control logic interface and full metering in the FM-25K permit ATS operation.

Unlike other FM transmitters that use 90% hybrid networks, the Harris FM-25K IPA section utilizes an "in-phase" power splitting/combiner configuration that presents equal loads to each amplifier. This Harris technique minimizes IPA stress to insure reliable operation. The solid-state, modular IPA affords back-up capability for greatly improved reliability, and reduces overall transmitter tuning requirements.

SOLID-STATE IPA
Five solid-state power amplifier modules (2 amplifiers per module) are combined to produce 350 watts of drive power, with plenty of reserve. One module functions as the IPA driver, and the other four as driver power amplifiers. All of these modules are identical, so that in case the IPA driver should fail, one of the power amplifier modules may be inserted in its place. Loss of one of the four driver amplifier modules will not result in an 'in-air' condition, as these solid-state amplifiers are isolated from each other. All five solid-state amplifier modules are broadbanded, and require no individual tuning over the entire 88-108 MHz band.
Harris MX-15 Exciter... new levels of excellence in FM audio performance

Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low .02%, with all CCIF Intermodulation distortion products below 80 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ±100 kHz.

Equally impressive is the FM-25K/MX-15’s -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15’s exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

DIGITAL SYNTHESIZER

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase-locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ±10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crossstalk. DSM stereo generation is essentially transparent to the program material. Stereo separation typically exceeds 50 dB from 30 to 15,000 Hz.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION

A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION

Not only does the MX-15 Exciter’s SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation continuously. Here’s how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter’s SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER

The power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick “go/no-go” service checks.

ADDITIONAL BENEFITS

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.
GENERAL
POWER OUTPUT: 10 kW to 25 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency. Exciter programmable in 50 kHz increments.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 3¼" EIA flange.
FREQUENCY STABILITY: ±300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ±100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 50/60 Hz and 360/415 V, 3-phase, 50/60 Hz, 4-wire. Power consumption: 40 kW typical.
RF HARMONICS: Suppression meets all FCC requirements.
ALTITUDE: 10,000 feet (3048 meters).
AMBIENT TEMPERATURE RANGE: −20°C to +50°C. Maximum temperature 50°C @ sea level, decreasing 2°C per 1000 feet (305 meters) to 30°C maximum at 10,000 feet (3048 meters).
MAXIMUM VSWR: 1.7:1.
SIZE: Transmitter cabinet, 34.6" W (87.8 cm) × 71.7" H (182.1 cm) × 31.0" D (78.7 cm). HV power supply cabinet: 48.0" W (121.9 cm) × 80.2" H (152.9 cm) × 24.2" D (61.5 cm).
WEIGHT: White, blue and black.
FINISH: Product Only.
WIDEBAND COMPOSITE OPERATION
COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTION: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: 0.8%.
COMPOSITE INTERMODULATION DISTORTION: 0.02% (60 Hz/7 kHz 1:1 tone pair).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ±0.1 dB, 30 Hz to 53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 55 dB below reference carrier AM modulation 100% output power.
MONOaural Operation
AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).
STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

FM-25K TRANSMITTER SPECIFICATIONS

FM-25K 25,000 watt FM broadcast transmitter with MX-15 exciter.

ORDERING INFORMATION

FM-25K 25,000 watt FM broadcast transmitter with MX-15 exciter, for wideband operation, 50/60 Hz (Specify 50 or 60 Hz)
Spare tube
Mono generator (add for mono operation)
DSM stereo generator with DTR (add for stereo operation)
SCA generator (add for SCA operation, specify)
Extended Control Panel for FM-25K

HARRIS CORPORATION
BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

CP-2M-383 © Harris Corporation 1983

ADV. 5408 PDT. IN U.S.A.
• MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity

• Digitally Synthesized Modulation stereo generator yields 48 dB minimum separation for increased stereo realism

• Dynamic Transient Response (DTR*) stereo generator filter maximizes modulation level without overmodulating

• 80% final PA efficiency yields long tube life and low power consumption for direct operating cost savings

• Standard VSWR protection provides fault protection to antenna and transmission line equipment

• Convenient operation—full metering, status lights and remote control termination are just a few of the standard features which minimize maintenance and installation time

*Patented
The FM-20K employs Harris' advanced-design MX-15 solid-state exciter, with Digitally Synthesized Modulation (DSM), to provide the very finest stereo signal available. Technical specifications are exceptional compared to other 20 kilowatt FM transmitters on the market. And DSM with overshoot compensation allows a 2 to 6 dB increase in loudness with no degradation of audio quality.

LOW OPERATING COST
80% efficiency in the final amplifier, plus high efficiency in all amplifier circuits, plus conservatively rated components combine to give the FM-20K the lowest operating cost of any transmitter in its power range. As amplifier tubes are operated at only a fraction of their actual rating, maximum service life is assured. You save both on power bills and on tube costs.

THREE TUBES
Only three tubes (two tube types) are used in the FM-20K. The MX-15 drives the intermediate power amplifier, consisting of two parallel 4CX250B's. The final single-ended power amplifier is a 4CX15000A ceramic tetrode, which provides excellent performance, and runs at only one-third its dissipation capability.

"VARI-LINE" SILVER PLATED TANK
Vari-Line is an advanced, Harris-developed method of tuning a single-ended FM amplifier for optimum output efficiency. A portion of a parallel tubular 2% inch copper transmission line (silver plated for efficient RF service) is made variable in order to inductively tune the line to operating frequency.

With Vari-Line tuning, greater reliability is possible. Mica capacitors are not used in the tank circuit. This reduces the complexity of sliding contacts and consequent maintenance problems.

PLUG-IN MONO, STEREO AND SCA GENERATORS
The FM-20K may be equipped for mono or stereo operation, with or without SCA. The design versatility of the exciter allows you to order for mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter. Since the SCA generators have spectrally pure filtered outputs, 41 and 67 kHz SCA channels may be operated simultaneously, while in the mono mode, without harmonic interference.

DUAL HV POWER SUPPLY
Two separate three-phase power supplies are used for the FM-20K—both featuring protection against transient voltages or on-off power surges.

One HV power supply—for PA plate voltage—is housed in a separate enclosure, while the supply powering the IPA plate and screen circuit, and the PA screen, is housed in the main transmitter cabinet.

AUTOMATIC RECYCLING
In case of momentary overload, the transmitter recycles automatically. Should the overload reoccur in excess of the desired number of times preset in the transmitter, the FM-20K will then remain off the air until it is reset, either locally or be remote control.

TESTING
Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-20K. The transmitter is capable of operating at altitudes to 7500 feet, in an ambient temperature range of -20° to +45°C.

In addition, your FM-20K is fully tuned and operationally tested on your frequency before shipment.

REMOTE CONTROL
All remote control provisions are built-in. No additional transmitter kits or options are needed.

FULL METERING
Eight easy-to-read meters, including a multimeter, provide full monitoring of the seventeen parameters of the operating tubes and exciter. There is also a directional coupler which measures forward power and VSWR, and an elapsed time meter.

ADDITIONAL FEATURES
There are many other operational and convenience features incorporated into the FM-20K. These include:

Pushbutton Operation—On-off functions are controlled by lighted pushbuttons at the top left of the transmitter. These are clearly marked "Filament On-Off", "Plate On-Off".

High-Capacity Blower—backed up by a precision air-pressure switch gives complete protection to the IPA and PA tubes.

Straightforward Design—allows easy accessibility to all components.

Front Panel Test Points—permit fast checking of exciter circuit conditions.

Handsome Styling—the transmitter cabinet is attractively yet functionally styled, with double front doors. The finish is white and blue, with black meter panel.

FCC Type Acceptance—the FM-20K is FCC type accepted for mono or stereo broadcasting in the 87.5 to 108 MHz FM band.
Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

**ULTRA-LINEAR VCO**
The unique VCO (Voltage Controlled Oscillator) of the MX-15 features outstanding linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low 0.1%, with all CCIF Intermodulation distortion products down at least 75 dB as measured through the FM-20K transmitter. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be limited even at maximum modulation capability of ±100 kHz.

Equally impressive is the FM-20K/MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the exciter and transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

**BALANCED FLOATING COMPOSITE INPUT**
Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the probability of ground loops and other system interface problems.

**DIGITAL SYNTHESIZER**
The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct frequency comparison against WWW transmissions. The synthesizer can be easily programmed to any carrier frequency in the 85.5 to 108 MHz band in 50 KHz increments. The dual-state AFC will acquire the VCO over a ±10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal-to-noise.

**DIGITALLY SYNTHESIZED MODULATION**
The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Separation through the FM-20K readily exceeds an impressive 48 dB specification over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

**OVERSHOOT COMPENSATION**
A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low cross-talk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

**SCA OPERATION**
Not only does the MX-15 Exciter’s SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise their stereo separation. Stations using the SCA can maintain a fixed level and then make all their SCA programming noise-controlled.

**POWER AMPLIFIER**
The power amplifier module is solid-state, conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

**STATUS AND MONITORING**
Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

**ADDITIONAL EXCITER FEATURES**
The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure. A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the external card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used directly, without interface, with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.
FM-20K TRANSMITTER SPECIFICATIONS

GENERAL
POWER OUTPUT: 10 kW to 20 kW (type accepted to 21.5 kW).
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 3/4" EIA flange.
FREQUENCY STABILITY: ±300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ±100 kHz
AC INPUT POWER: 208/240 V, 3-phase, 60 Hz. (50 Hz available on special order.) Power consumption: 30,000 watts (approx.). 115/230 V, 60 or 50 Hz, 150 watts for MX-15.
RF HARMONICS: Suppression meets all FCC requirements.
POWER SUPPLY RECTIFIERS: Silicon.
ALTITUDE: 7500 feet.
AMBIENT TEMPERATURE RANGE: -20°C to +45°C.
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter cabinet, 42"W (107 cm) x 78"H (198 cm) x 33"D (84 cm). HV power supply cabinet: 30"W (76 cm) x 45"H (125 cm) x 30"D (76 cm).
FRONT DOOR SWING: 21" (53 cm).
FINISH: White, blue and black.
WEIGHT & CUBAGE: Export: 2800 lbs. (1270 kg). Domestic: 2300 lbs. (1043 kg), 141 cubic feet.
WIDEBAND COMPOSITE OPERATION
COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE Input CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis [200 kHz bandwidth]).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .1% (60 Hz / 7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 75 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ±0.5dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 52 dB below reference carrier AM modulation 100% output power: 15 watts.

MONOURAL OPERATION
AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.2%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products below 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).
STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: +10 dBm, ±1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz.Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.2% 60 Hz / 7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 48 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: —48 dB.
NON-LINEAR CROSSTALK: —60 dB.
76 kHz SUPPRESSION: —68 dB.
38 kHz SUPPRESSION: —73 dB.
FM NOISE: (Left or right) 72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ±1 Hz 0° to 50°C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—removable.

SCA OPERATION
MODULATION: Direct FM.
FREQUENCY OF OPERATION: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: ±500 Hz.
MODULATION CAPABILITY: ±7.5 kHz.
AUDIO FREQUENCY RESPONSE: ±4 kHz and 67 kHz AC coupled input, 150 microsecond pre-emphasis ±1 dB, standard. Selectable: flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis. DC to 4 kHz ±0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ±1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4500 Hz ±5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) —63 dB (reference: 100% modulation = ±5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) —60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 55 dB below ±5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSKILL: SCA to SCA (41 kHz/67 kHz) —50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to —30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION
FM-20K 20,000 watt FM broadcast transmitter with MX-15 exciter, for wideband operation, 60 Hz
Mono generator (add for mono operation) .994-8052-002
Mono generator (add for mono operation) .994-8019-001
DSM stereo generator with DTR (add for stereo operation) .994-8029-001
SCA generator (add for SCA operation, specify 41 or 67 kHz) .994-7992-001

HARRIS CORPORATION BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

CP-2M-583 © Harris Corporation 1983
ADV. 487C PTD. IN U.S.A.
- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Digitally Synthesized Modulation (DSM) stereo generator yields 48 dB minimum separation (60 dB typical at midband) for increased stereo realism
- Dynamic Transient Response (DTR*) stereo filter maximizes modulation level without overmodulating
- Stable "Vari-Line" output tuning requires fewer adjustments
- Standard VSWR protection—provides fault protection to your costly antenna and transmission line equipment
- Convenient operation—full metering, status lights and remote control termination are just a few of the standard features which minimize installation and maintenance time

*Patented
ONLY TWO TUBES. Just two tubes are employed in the FM-10K—a 4CX10,000J PA and a 4CX300A IPA. The ceramic-type 4CX10,000J is a high-gain tetrode that operates with a 2-to-1 dissipation safety margin, and was selected as the power amplifier because of its proven longer useful life.

Featuring the advanced-design MX-15 exciter, Harris' FM-10K provides the cleanest and loudest stereo signal of any 10 kilowatt FM transmitter available today. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide stereo separation of 48 dB minimum, 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a 2 to 6 dB increase in loudness, with no degradation of audio quality, by limiting overshoot to 2% or less. Add to this high efficiency plus conservatively rated components and you have a really exceptional FM transmitter—the Harris FM-10K.

"VARI-LINE" SILVER PLATED TANK. Vari-Line is a Harris-developed method of tuning a single-ended FM amplifier for optimum output efficiency. A portion of a parallel tubular 1½ inch copper transmission line (silver plated for efficient RF service) is made variable in order to inductively tune the line to operating frequency.

VSWR PROTECTION. To protect the transmitter PA, a VSWR overload circuit has been incorporated. The VSWR circuit monitors the reflected power from the output directional coupler and interrupts the high voltage power supply when the VSWR exceeds a pre-determined level. The transmitter will attempt to restart, and if the VSWR clears, return to air. Multiple VSWR trips within a given period will cause the transmitter to shut down.

AUTOMATIC RECYCLING. In case of momentary overload, the transmitter recycles automatically. Should the overload reoccur in excess of the desired number of times preset in the transmitter, the FM-10K will then remain off the air until it is reset, either locally or by remote control.

HV POWER SUPPLY. One three-phase HV power supply is used in the FM-10K. It provides the PA plate voltage, PA screen voltage, and powers the IPA plate and screen circuits. The bias supply for the PA is a bridge circuit of four rectifiers. The transmitter employs a special power supply protective circuit to assure protection from transient voltages or on-off power surges.

BUILT-IN REMOTE CONTROL. Connect the transmitter control unit to the transmitter, tie in the telephone line to the studio control unit, and you are ready for complete remote control operation. All necessary functions can be controlled remotely—and no additional equipment is required for a Harris control system.

TESTING. Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-10K. The transmitter is capable of operating at altitudes up to 10,000 feet (3000 meters), in an ambient temperature range of -20° to +45° C.

In addition, your FM-10K is fully tuned and operationally tested on your frequency before shipment.

METERING AND VISUAL AIDS. Six easy-to-read meters, including four multimeters, provide full monitoring of twenty-eight parameters in the transmitter and the exciter. To aid in fault location, a system of indicator lights provides status display of important transmitter parameters.

ADDITIONAL FEATURES. There are many other operational and convenience features incorporated into the FM-10K. These include:

Pushbutton Operation—On-off functions are controlled by lighted pushbuttons at the top left of the transmitter. These are clearly marked "Filament On-Off", "Plate On-Off".

High-Capacity Blower—backed up by a precision air-pressure switch gives complete protection to the IPA and PA tubes.

Straightforward Design—allows easy accessibility to all components.

AC Interruption Restart—this feature provides for automatically returning the transmitter "on air" after a temporary or indefinite outage of the AC power source. A front panel override switch is also provided.

FCC Type Acceptance—the FM-10K is FCC type accepted for mono or stereo broadcasting in the 87.5 to 108 MHz FM band.
Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO. The unique VCO (Voltage Controlled Oscillator) of the MX-15 features outstanding linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs. Wideband Composite Intermodulation Distortion through the FM-10K is an exceptionally low .05%, with all CCIF Intermodulation distortion products down at least 75 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ±100 kHz.

Equally impressive is the FM-10K/MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT. Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the probability of ground loops and other system interface problems.

DIGITAL SYNTHESIZER. The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct frequency comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ±10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

DIGITALLY SYNTHESIZED MODULATION. The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technology does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Separation through the FM-10K is specified at an impressive 48 dB over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION. A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION. Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER. The MX-15 power amplifier module is solid-state, conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING. Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL EXCITER FEATURES. The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure. A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference. The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator. The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.
FM-10K SPECIFICATIONS

GENERAL
POWER OUTPUT: 10 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 3/4" EIA Range.
FREQUENCY STABILITY: ±100 kHz.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ±100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 60 Hz (50 Hz available.) Power consumption: 17,000 watts (approx.).
RF Harmonics: Suppression meets all FCC requirements.
POWER SUPPLY Rectifiers: Silicon.
ALTITUDE: 10,000 feet (3000 meters).
AMBIENT TEMPERATURE RANGE: -20°C to +45°C.
MAXIMUM VSWR: 1.2 to 1.
SIZE: Transmitter cabinet, 42" W (107 cm) x 78" H (198 cm) x 33" D (84 cm).
FRONT DOOR SWING: 21" (53cm).
FINISH: White, blue and black.

WIDEBAND COMPOSITE OPERATION
COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: 0.8%.
COMPOSITE INTERMODULATION DISTORTION: 0.02% (60/70 KHz 1:1 tone pairs).
COMPOSITE CIIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 Khz/15 Khz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ±0.1 dB, 30 Hz-53 KHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below reference carrier AM modulation 100% output power.

MONOAURAL OPERATION
AUDIO INPUT IMPEDANCE: 600 ohms balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defetable.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 Khz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 2% 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 1% 30 Hz/7 Khz test tone pair, 4:1 ratio.
CIIF INTERMODULATION DISTORTION: All distortion products below 70 dB (reference 14 Khz/15 Khz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).

FM-10K, 10,000 watt FM transmitter with MX-15 exciter, for wideband operation, 60 Hz...

AUDIO INPUT IMPEDANCE: Left and Right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
AUDIO INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and Right) standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 Khz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 Khz.
OVERSLOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or Right) 0.1%, 60 Hz/7 Khz test tone pair, 4:1 ratio.
CIIF INTERMODULATION DISTORTION: (Left or Right) all distortion products below 70 dB (reference 14 Khz/15 Khz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 KHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSSTALK: -50 dB.
NON-LINEAR CROSSSTALK: -60 dB.
76KHZ SUPPRESSION: -68 dB.
38 KHZ SUPPRESSION: -73 dB.
FM NOISE: (Left or right) 70 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 kHz deviation, 30 Hz to 15 Khz bandwidth.
Pilot oscillator: Crystal controlled.
Pilot phase: Harris patented automatic pilot phasing circuit.
Pilot stability: 19 Khz ± 1 Hz, 0°C to 50°C.
Operational modes: Stereo, mono (left and right), mono (left), mono (right) - remotes.

SMOKE SPECIFICATIONS
MODULATION: Direct FM.
FREQUENCY OF MODULATION: 41 or 67 Khz programmable, any frequency between 25 and 75 Khz on special order.
FREQUENCY STABILITY: ±500 Hz.
MODULATION CAPABILITY: ±7.5 kHz.
AUDIO FREQUENCY RESPONSE: 41 Khz and 67 Khz coupled input, 150 microsecond pre-emphasis ±1 dB, standard Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input. No pre-emphasis. DC to 4 Khz ±0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 Khz deviation.
INPUT FILTERING: Programmable UPF, 4.5 KHz standard. 3 Khz, 5 Khz, 7.5 Khz selectable. Low pass filter defetable.
HARMONIC DISTORTION: 0.5%, 40-4,500 Hz ± 5 Khz deviation.
INTERMODULATION DISTORTION: 1% 60 Hz/7 Khz 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) 63 dB (reference: 100% modulation = ± 5 Khz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) -55 dB below ±5 Khz deviation of SCA with mono or stereo channels modulated by frequencies 30 Khz-15 Khz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 Khz/67 Khz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION
FM-10K, 10,000 watt FM transmitter with MX-15 exciter, for wideband operation, 60 Hz...
As above, except for 50 Khz operation...
Monogenerator (add for mono operation)...
DSM stereo generator with DTR (add for stereo operation)...
SCA generator (add for SCA operation, specify 41 or 67 Khz)...

HARRIS CORPORATION
P.O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

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ADV. 501B PTD. IN U.S.A.
• MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
• Digitally Synthesized Modulation stereo generator yields 48 dB minimum separation for increased stereo realism
• Dynamic Transient Response (DTR*) stereo generator filter maximizes modulation level without overmodulating
• Stable “Vari-Line” output tuning requires fewer adjustments
• Standard VSWR protection provides fault protection to antenna and transmission line equipment
• Convenient operation—full metering, status lights and remote control termination are just a few of the standard features which minimize maintenance and installation time

*Patented
Featuring the advanced-design MX-15 exciter, the Harris 5 kW FM-5K provides the cleanest and the loudest stereo signal of any FM transmitter in its power range. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide stereo separation of 50 dB minimum, 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a 2 to 6 dB increase in loudness, with no degradation of audio quality, by limiting overshoot to 2% or less. Add to this high efficiency plus conservatively rated components and you have a truly exceptional FM transmitter.

**ONLY TWO TUBES.** Just two tubes are employed in the transmitter. A type 4CX-250B tube amplifies the solid-state exciter output and supplies a nominal 250 watts to drive the ceramic 4CX5000A final amplifier. This power tetrode operates as a single ended amplifier to produce 5 kilowatts of RF power.

**"VARI-LINE" SILVER PLATED TANK.**  
Vari-Line is a Harris-developed method of tuning a single-ended FM amplifier for optimum output efficiency. A portion of a parallel tubular 1% inch copper transmission line (silver plated for efficient RF service) is made variable in order to inductively tune the line to operating frequency.

**AUTOMATIC RECYCLING.** In case of momentary overload, recycling takes place automatically. Should an overload reoccur in excess of the number of times preset, the transmitter will then remain off the air until it is reset, either locally or by remote control.

**VSWR PROTECTION.** To protect the transmitter PA, a VSWR overload circuit has been incorporated. The VSWR circuit monitors the reflected power from the output directional coupler and interrupts the high voltage power supply when the VSWR exceeds a predetermined level. The transmitter will attempt to restart, and if the VSWR clears, return to air. Multiple VSWR trips within a given period will cause the transmitter to shutdown.

**HV POWER SUPPLY.** All power supplies are housed inside the transmitter cabinet. One three-phase supply provides the PA plate voltage, and powers the IPA plate and screen circuits. The transmitter employs a special power supply protective circuit to assure maximum protection from transient voltages or on-off power surges.

**REMOTE CONTROL.** The FM-5K features built-in remote metering for the plate voltage, plate current and power output. No interface components are required to adapt a Harris remote control system to the transmitter. The transmitter's remote control circuitry can also be interfaced easily to other manufacturers' remote systems.

**TESTING.** Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-5K. The transmitter is capable of operating at altitudes up to 7,500 feet (2250 meters), in an ambient temperature range of -20° to +45° C.

In addition, your transmitter is fully tuned and operationally tested on your frequency before shipment.

**METERING AND VISUAL AIDS.** Six meters, including four large, front-panel meters, provide full monitoring of the transmitter's operating parameters. Included is a power indicator that permits direct reading of both power output and standing wave ratio. To aid in fault location, a system of indicator lights provides status display of important transmitter parameters to minimize service time.

**MORE FEATURES.** There are many other operational and convenience features incorporated into the FM-5K transmitter. These include:

- **Pushbutton Operation—** On-off functions are controlled by lighted pushbuttons at the top left of the transmitter. These are clearly marked "Filament On-Off", "Plate On-Off".
- **High-Capacity Blower—** backed up by a precision air-pressure switch gives complete protection to the IPA and PA tubes.
- **Straightforward Design—** allows easy accessibility to all components.
- **AC Interruption Restart—** this feature provides for automatically returning the transmitter "on air" after a temporary or indefinite outage of the AC power source. A front panel override switch is also provided.
- **FCC Type Acceptance—** The transmitter is FCC type accepted for mono, stereo and SCA broadcasting in the 87.5 to 108 MHz FM band.
Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

**ULTRA-LINEAR VCO.** The unique VCO (Voltage Controlled Oscillator) of the MX-15 features outstanding linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs. Wideband Composite Intermodulation Distortion is an extremely low 0.2%, with all CCIF intermodulation distortion products down at least 80 dB as measured through the FM-5K. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ±100 kHz.

Equally impressive is the FM-5K/MX-15’s -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the exciter and transmitter to achieve this low noise floor. The MX-15’s exceptionally low distortion and noise performance provide your station with maximum signal clarity.

**BALANCED FLOATING COMPOSITE INPUT.** Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the probability of ground loops and other system interface problems.

**DIGITAL SYNTHESIZER.** The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct frequency comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 KHz increments. The dual-state AFC will acquire the VCO over a ±10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

**DIGITALLY SYNTHESIZED MODULATION.** The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Separation through the FM-5K readily exceeds an impressive 48 dB specification over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

**OVERSHOOT COMPENSATION.** A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

**SCA OPERATION.** Not only does the MX-15 Exciter’s SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation. Here’s how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter’s SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

**POWER AMPLIFIER.** The MX-15 power amplifier module is solid-state, conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

**STATUS AND MONITORING.** Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick “go/no-go” service checks.

**ADDITIONAL EXCITER FEATURES.** The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used directly, without interface, with a composite stereo studio/transmitter link (STL) or external stereo generator. The exciter is configured to accept a plug-in quadrophonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.
FM-5K SPECIFICATIONS

GENERAL
POWER OUTPUT: 1.0 to 5.1 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 3" EIA flange.
FREQUENCY STABILITY: ±300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ±100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 60 Hz (50 Hz available). Power consumption (approx): 10 kW consumption at 5 kW output. 115/230 V, 60 or 50 Hz, 150 watts for MX-15.
RF HARMONICS: Suppression meets all FCC requirements.
POWER SUPPLY RECTIFIERS: Silicon.
ALTITUDE: 7,500 feet (2250 meters).
AMBIENT TEMPERATURE RANGE: -20°C to +45°C.
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter cabinet, 42"W (107cm) x 78"H (198cm) x 33"D (84cm).
FRONT DOOR SWING: 21" (53cm).
FINISH: White, blue and black.

WIDEBAND COMPOSITE OPERATION
COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: 0.8%.
COMPOSITE INTERMODULATION DISTORTION: 0.2% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 KHz/15 KHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ±0.1 dB, 30 Hz-33 KHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below reference carrier AM modulation 100% output power: 15 watts.

MONOURAL OPERATION
AUDIO INPUT IMPEDANCE: 600 ohms balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 KHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 KHz de-emphasized.
INTERMODULATION DISTORTION: 0.15%, 60 Hz/7 KHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 KHz/15 KHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and Right channels, 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and Right) standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 KHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 KHz low pass filter. 45 dB rejection at 19 KHz.
OVERSPECTRUM PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1%, 60 Hz/7 KHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 80 dB (reference 14 KHz/15 KHz test tone pair).
STEREO SEPARATION: 48 dB, 30 Hz-15 KHz, typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSSTALK: -50 dB.
NON-LINEAR CROSSSTALK: -60 dB.
76KHz SUPPRESSION: -68 dB.
38 KHz SUPPRESSION: -73 dB.
FM NOISE: (Left or right) 74 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 KHz deviation, measured 30 Hz to 15 KHz bandwidth.
Pilot Oscillator: Crystal controlled.
Pilot Phase: Harris patented automatic pilot phasing circuit.
Pilot Stability: 19 KHz ±1 Hz, 0° to 50°C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right) remoteable.

SCA OPERATION
MODULATION: Direct FM.
FREQUENCY OF OPERATION: 41 or 67 KHz programmable, any frequency between 25 and 75 KHz on special order.
FREQUENCY STABILITY: ±500 Hz.
MODULATION CAPABILITY: ±7.5 kHz.
AUDIO FREQUENCY RESPONSE: 41 KHz and 67 KHz AC coupled input, 150 microsecond pre-emphasis ±1 dB, standard. Selectable: flat, 50 or 75 microsecond pre-emphasis. DC coupled input. No pre-emphasis. DC to 4 KHz ±0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 KHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 KHz standard. 3 KHz, 5 KHz, 7.5 KHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ±5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 KHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation ±5 KHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel). -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA). 55 dB below ±5 KHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 KHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 KHz/67 KHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dB.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite output (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION
FM-5K, 5 KHz FM transmitter with MX-15 exciter, for wideband operation, 60 Hz. 994-8049-003
As above, except for 50 Hz operation 994-8049-006
Mono generator (add for mono operation) 994-8019-001
DSM stereo generator with DTR (add for stereo operation) 994-8020-001
SCA generator (add for SCA operation, specify 41 or 67 KHz) 994-7992-001

HARRIS CORPORATION
BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290, U.S.A. 217/222-8200

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ADV. 507B PTD. IN U.S.A.
FMD-50K

50-kilowatt dual FM broadcast transmitter
HARRIS FMD-50K . . . DUAL CONFIGURATION FOR COMPLETE REDUNDANCY . . . ONLY TWO TUBES

The FMD-50K dual 50-kilowatt transmitter offers real protection against off-air time through redundancy, and through extensive use of solid-state circuitry. Only two tubes are employed in the entire FMD-50K... high-gain, highly efficient 8990 tetrodes used as the final power amplifiers. The 8990 uses a wavy fin radiator which provides exceptional cooling at reduced air requirements, for quiet operation. The quarter-wave PA cavity design eliminates troublesome sliding contacts for tuning, and assures wide RF bandwidth. This results in a signal path that is transparent to the MX-15 exciter.

The basic FMD-50K transmitter consists of two 25-kilowatt amplifiers, and a center control cabinet. It provides redundancy in all areas except the excitors. In case emergency operation is required, you stay on the air at one-quarter normal power output. An even higher level of redundancy is achieved in the complete FMD-50K through an optional arrangement of switches, sensors and circuits that make the FMD-50K totally redundant from audio input to RF output.

The FMD-50K with the RF output switching option provides the capability of automatically switching either transmitter directly to the antenna, thus providing one-half normal operating power in the event of a transmitter malfunction.

With the addition of the automatic exciter switching option, automatic backup exciter protection is provided. Also, an optional RF input patch panel is available to connect either exciter directly to either transmitter by bypassing all of the automatic exciter switching equipment.

**SOLID-STATE IPA'S**
The redundancy of the dual FMD-50K is heightened when the IPA in each 25-kilowatt amplifier is considered. The IPA stages are multiple solid-state amplifiers combined in such a manner that failure of one amplifier stage will not cause a total loss of IPA RF power. The IPA solid-state modules in the PA are identical to those used in the booster amplifier for the MX-15. The wide use of solid-state RF power circuits means that the FMD-50K uses only two tubes.

**LOW OPERATING COST**
With today's mounting energy costs, transmitter efficiency must be a major consideration in any purchase. 77% efficiency in the final power amplifiers, high efficiency in all amplifier circuits, and conservatively rated components result in comparatively low power consumption and low operating stress on heat generating components in the FMD-50K. This adds up to very impressive savings in operating and maintenance costs.

**FINES STEREO PERFORMANCE**
Featuring the advanced-design MX-15 exciter, Harris' FMD-50K provides the cleanest and the loudest stereo signal of any 50-kilowatt FM transmitter available today. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide stereo separation of 50 dB minimum (60 dB typical midband), 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a 2 to 6 dB increase in loudness, with no degradation of audio quality, by limiting overshoot to 2% or less.

The FMD-50K may be equipped for mono or stereo operation, with or without SCA. The design versatility of the MX-15 exciter allows you to order mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter. The FMD-50K is equipped for wideband composite input in its standard configuration.

**AUTOMATIC POWER CONTROL**
The FMD-50K automatically monitors power output, and maintains the output at the desired level. This standard feature insures against out-of-tolerance power conditions. Furthermore, the power set point can be remotely adjusted independently of the limit points to allow operator control of...
power output. During maintenance periods, the automatic power control may be switched off.

**VSQR PROTECTION**

VSQR protection is mandatory in any high-power transmitter—therefore, Harris has incorporated this as a standard feature in the FMD-50K. A high VSQR condition will cause the transmitter to recycle...if three overloads occur within a given time period, the transmitter will shut down until manually restarted. The transmitter may also be programmed for single VSQR overload shutdown.

**CONTROL CIRCUITRY**

The FMD-50K is controlled by solid-state logic circuitry. The logic circuitry not only controls basic On/Off functions, but also monitors critical stages for overload conditions. Should an overload occur, the transmitter will recycle automatically.

The control logic used in the FMD-50K interfaces directly with most remote control systems, eliminating the need for an additional remote control interface. The control signals are momentary low current contacts. The transmitter output parameters are buffered, and all status indicators can be remote.

**METERING AND VISUAL AIDS**

Major functions, including combined output power, VSQR and reject load power are displayed on easy-to-read 4-inch meters in the cabinet. Complete monitoring of operating functions of the individual 25-kilowatt amplifiers is also displayed. Low-level parameters of each amplifier are displayed on a multimeter, and IFP RF output and reflected power are indicated on another meter. Filament voltage is measured by a true RMS circuit.

The FMD-50K provides a variety of indicators as troubleshooting aids and quick references. These include illuminated On/Off pushbuttons and numerous LED status indicators.

**HV POWER SUPPLIES**

The two high voltage power supplies are housed in separate cabinets, and provide the plate and screen voltage. The conservatively-rated three-phase plate supplies use silicon rectifiers with AC line transient protection.

**COMPACT SIZE**

The trim FMD-50K cabinet configuration measures only 90.2" wide, 72" high and 30.5" deep. Additionally, the HV power supplies may be located in any convenient spots remote from the PA cabinets.

**GENERAL**

There are many other operational and convenience features incorporated into the FMD-50K. These include:

- Line Loss Protection—Built-in protection against total AC failure and loss of phase is provided. The FMD-50K will restart automatically following a total power failure, while loss of a single phase will shut down the transmitter.

- High Altitude Rating—High capacity, direct-drive blowers deliver sufficient air to cool the transmitter at altitudes up to 10,000 feet (3048 meters).

Additional Protection—Magnetic circuit breakers are utilized to protect the blowers motors, the filament supplies, the IPA supplies and the bias supplies. A safety interlock system and a drop solenoid system discharge power supplies to safe levels.

Automatic Transmitter System Compatibility—The simple control logic interface and full metering in the FMD-50K permit ATS operation.

**HARRIS’ FMD-50K DUAL FM TRANSMITTER CONFIGURATIONS**

**BASIC FMD-50K DUAL SYSTEM**
- Two FM-25K transmitters, less exciters.
- One MX-15 exciter.
- One RF booster amplifier with low power hybrid coupler and reject load.
- One 19-inch center cabinet with control and metering circuitry.
- One high power hybrid coupler with interconnecting transmission line components.
- One 12.5-kilowatt reject load.

**FMD-50K WITH AUTOMATIC RF OUTPUT SWITCHING**
- Two FM-25K transmitters, less exciters.
- One Mex-15 exciter.
- One dual RF booster amplifier with low power hybrid coupler and reject load.
- One 19-inch center cabinet with control metering and RF control logic assembly.
- One floor-mounted frame assembly with three high power coaxial switches, one high power hybrid combiner, and one 12.5-kilowatt reject load.
- All necessary interconnecting transmission line components.

**OPTIONAL AUTOMATIC EXCITER SWITCHING**
- One automatic RF control logic assembly.
- One coaxial transfer switch.
- One test load for exciter.
- All necessary cabling for system interconnect.
- (Requires second exciter, which is not included in this option package).

**ADDITIONAL OPTIONS FOR FMD-50K**
- Mono generator(s).
- Stereo generator(s).
- SCA generator(s).
- RF input manual patch panel for use with exciter switching option.
# FMD-50K SPECIFICATIONS

**GENERAL**
- **Power Output:** 20 kW to 50 kW.
- **Frequency Range:** 87.5 to 108 MHz, tuned to specified operating frequency. Exciter programmable in 50 kHz increments.
- **RF Output Impedance:** 50 ohms.
- **Output Termination:** 6/4" EIA flange.

**Modulation**
- **Composite Input Connector:**
  - **Size:** Transmitter: 90.2 W (229 cm) x 72" H (183 cm) x 30.5" D (77.5 cm).
- **Ambient Altitude:** 10,000 feet (3048 meters).
- **Composite Input Level:**
  - **Size:** Transmitter: 90.2 W (229 cm) x 72" H (183 cm) x 30.5" D (77.5 cm).
- **Harmonic Distortion:** .08%.
- **Finish:** White, blue and black.
- **Weight and Cubage:**
  - Approximate: Export: 7000 lb. (3178 kg).
  - Domestic: 8900 lb. (3987 kg).
  - Cubage: 400 cubic feet (113 cubic meters).

**Wideband Composite Operation**
- **Composite Input:** One balanced floating input.
- **Composite Input Impedance:** 2000 ohms resistive.
- **Composite Input Connector:** Female BNC.
- **Composite Input Level:** 1.0 volts RMS nominal ±.75 kHz deviation.
- **External SCA Generator Inputs:** Up to two unbalanced inputs.
- **Composite FM Signal to Noise:** 80 dB below 100% modulation (reference 400 Hz @ ±.75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
- **CrossHarmonic Distortion:** .08%.
- **Composite Intermodulation Distortion:** .02% (60 Hz/7 kHz 1:1 tone pairs).
- **Composite CCF Intermodulation Distortion:** All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
- **Composite Amplitude Response:** ±0.1 dB, 30 Hz, 53 kHz.
- **Asynchronous AM Signal to Noise:** 55 dB below referenced carrier AM modulation 100% output power.

**Monaural Operation**
- **Audio Input Impedance:** 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
- **Input Filter:** Controlled response low pass filter, defeatable.
- **Audio Input Level:** +10 dBm ±1 dB for 100% modulation at 400 Hz.
- **Audio Frequency Response:** Standard 75 microsecond FCC pre-emphasis curve ±.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
- **Harmonic Distortion:** .15%, 30 Hz to 15 kHz de-emphasized.
- **Intermodulation Distortion:** 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
- **CCF Intermodulation Distortion:** All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
- **FM Signal to Noise Ratio:** 80 dB below 100% modulation (reference 400 Hz @ ±.75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

**Stereo Operation**
- **Type of Modulation:** Digitally Synthesized Modulation (DSM).
- **Audio Input Impedance:** Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
- **Audio Input Level:** +10 dBm, ±1 dB for 100% modulation.

**Audio Frequency Response:**
- **Standard 75 microsecond FCC pre-emphasis curve ±.5 dB, 30 Hz-15 kHz.** Selectable: flat, 25 or 50 microsecond pre-emphasis.
- **Intermodulation Distortion:** (Left or right) ±0.5% or less, 30-15,000 Hz.
- **Harmonic Distortion:** (Left or right) ±0.2% or less, 30-15,000 Hz.
- **CrossTalk:** (Left or right) —68 dB.

**Ordering Information**

<table>
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HARRIS CORPORATION  BROADCAST TRANSMISSION DIVISION  P.O. BOX 4290, QUINCY, ILLINOIS 62305-4290  U.S.A. 217/222-8200

CP-2M-984  © 1984 Harris Corporation

ADV. 659C PTD. IN U.S.A.
Advanced single tube design offers maximum reliability

MX-15 Exciter features ultra linear modulated oscillator for minimum distortion, maximum signal clarity

Solid state RF driver with built-in backup protection helps minimize down time

Wide RF system bandwidth guarantees exceptional stereo and expanded SCA channel performance

Automatic power control eliminates routine operator adjustment

Automatic VSWR Foldback safely keeps station on the air despite heavy antenna icing condition

Quarter wave PA cavity has no troublesome fingerstock at high current points

Composite input standard. Optional high performance mono, stereo, and SCA generation available

Harris' technology has combined advances in both tube and transistor designs, to bring you a major step forward in high-power FM transmitters. Transistors are now available which provide 50 watts of RF power at reasonable gain and low junction temperatures. By combining several of these transistors in wideband RF circuits, enough power can be generated to drive an advanced high-gain Eimac tetrode tube, the 4CX20,000A. This tube, when grid driven in a grounded cathode, quarter-wave cavity, can produce 25 kilowatts with 350 watts of drive at nearly 80% plate efficiency!

The FM-25K, twenty-five kilowatt FM transmitter reflects Harris' design philosophy that FM transmitters should deliver RF power efficiently, should not limit exciter performance, and should integrate dependable solid-state control logic. In the FM-25K, these features are teamed with efficient, single-tube design, and with the high performance MX-15 exciter.

The FM-25K was designed for applications with tower limitations or specific coverage requirements. The higher RF power output reduces the number of antenna bays required for a given ERP; and fewer bays mean a reduction in windloading and mounting area, so that tower size and/or height may be reduced. Also, fewer antenna bays, with less gain, can mean improved close-in coverage and the elimination of null fills.

SINGLE TUBE DESIGN
The FM-25K was the first high-power FM transmitter to utilize a single-tube design. A high-gain, highly efficient 4CX20,000A tetrode is the only tube in the entire transmitter, and is used as the final power amplifier. The tube uses a wavy fin radiator which
Harris FM-25K...high efficiency...wide RF bandwidth...only one tube

provides exceptional cooling at reduced air requirements, for quiet operation. The quarter-wave PA cavity design eliminates troublesome sliding contacts for tuning, and assures wide RF bandwidth. This results in a signal path that is transparent to the MX-15 Exciter.

SOLID-STATE IPA
Five solid-state power amplifier modules (2 amplifiers per module) are combined to produce 350 watts of drive power, with plenty of reserve. One module functions as the IPA driver, and the other four as driver power amplifiers. All of these modules are identical, so that in case the IPA driver should fail, one of the power amplifier modules may be inserted in its place. Loss of one of the four driver amplifier modules will not result in an off-air condition, as these solid-state amplifiers are isolated from each other. All five solid-state amplifier modules are banded, and require no individual tuning over the entire 88-108 MHz band.

Unlike other FM transmitters that use 90% hybrid networks, the Harris FM-25K IPA section utilizes an "in-phase" power splitting/combining configuration that presents equal loads to each amplifier. This Harris technique minimizes IPA stress to insure reliable operation. The solid-state, modular IPA affords back-up capability for greatly improved reliability, and reduces overall transmitter tuning requirements.

LOW OPERATING COST
With today’s mounting energy costs, transmitter efficiency must be a major consideration in any purchase. Efficiency in the final power amplifier circuits is typically 77%. Conservatively rated components result in comparatively low power consumption and low operating stress on heat generating components in the FM-25K. This adds up to very impressive savings from reduced operating and maintenance costs.

AUTOMATIC POWER CONTROL
The FM-25K automatically monitors RF power output, and maintains the output at the desired level. This standard feature insures against out-of-tolerance power conditions. Furthermore, the power set point can be remotely adjusted independently of the limit points to allow operator control of power output. During maintenance periods, the automatic power control may be switched off.

AUTOMATIC VSWR FOLDBACK AND VSWR PROTECTION
In certain areas, heavy antenna icing conditions occur frequently causing antenna VSWR to increase and transmitters to shut down. Recognizing this, Harris has included as standard equipment a VSWR foldback protection circuit into the FM-25K that permits continued on-air operation at the safest operating power level.

This automatic circuit eliminates the need to call the station’s engineer to make drastic reductions in operating power level. This circuit does not simply switch the transmitter to a fixed low power. Instead, it automatically reduces power to a level that permits continued safe operation. Further power reductions are made should the icing condition grow more severe. Likewise, when the ice begins to clear and the antenna VSWR decreases, the FM-25K's output power is automatically increased to the highest level at which the transmitter can be operated until normal operation is restored.

Instantaneous VSWR protection remains standard in the Harris FM-25K. Should the load VSWR increase dramatically, the FM-25K will shut down and automatically recycle. If the high load VSWR should be detected three times within 30 seconds, the FM-25K will remain off until a manual restart command is received.

The FM-25K’s automatic VSWR protection circuit and instantaneous VSWR overload protection are designed to keep your station on the air at the safest operating level.

CONTROL CIRCUITRY
The FM-25K is controlled by solid-state logic circuitry. The logic circuitry not only controls basic On/Off functions, but also monitors critical stages for overload conditions. Should an overload occur, the transmitter will recycle automatically, according to the number of times pre-set (one or three).

The control logic used in the FM-25K interfaces directly with most remote control systems, eliminating the need for an additional remote control interface. The control signals are momentary low current contact closures. The transmitter output parameters are buffered, and all status indicators are remoted. This FM-25K feature allows stations to remote a wealth of diagnostic information to the remote control point.

METERING AND VISUAL AIDS
Major functions, including RF output, VSWR and PA parameters are displayed on easy-to-read four-inch meters. Low-level parameters are displayed on two multimeters. IPA RF output and reflected power are indicated on another meter. Filament voltage is measured by a true RMS circuit to help achieve long tube life. The FM-25K provides a variety of indicators as trouble shooting aids and quick references. These include four illuminated On/Off pushbuttons and 26 LEDs, not including those on the MX-15 Exciter.

HV POWER SUPPLY
The high voltage power supply is housed in a separate cabinet, and provides the plate and screen supplies. The conservatively rated three-phase plate supply uses silicon rectifiers with AC line transient protection.

COMPACT SIZE
The trim PA cabinet can fit as a replacement for most older 20- to 25-kilowatt transmitters. The cabinet is only 35 inches wide, 72 inches high and 31 inches deep. Additionally, the HV power supply may be located in any convenient spot remote from the PA cabinet.

ADDITIONAL FEATURES
There are many other standard operational and convenience features incorporated into the FM-25K. These include:

Line loss protection—built-in protection against total AC failure and loss of phase is provided. The FM-25K will restart automatically following a total power failure, while loss of a single phase will shut down the transmitter.

High altitude rating—a high capacity, direct-drive blower delivers sufficient air to cool the transmitter at altitudes up to 10,000 feet (3048 meters).

Additional protection—four magnetic circuit breakers are utilized to protect the blower motor, the filament supply, the IPA supply and the bias supply. A wide-ranging interlock system and a drop solenoid system quickly discharge power supplies to safe levels.

ATS compatibility—the simple control logic interface and full metering in the FM-25K permit ATS operation.
Harris MX-15 Exciter... new levels of excellence in FM audio performance

Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO
The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low 0.2%, with all CCIF Intermodulation distortion products below 80 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ±100 kHz.

Equally impressive is the FM-25K/MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hysteresis (cancellation) circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT
Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

DIGITAL SYNTHESIZER
The MX-15 uses a 50 MHz high-stability TCXO (Temperature Compensated Referenced Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ±10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

DIGITALLY SYNTHESIZED MODULATION
The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Stereo separation typically exceeds 50 dB from 30 to 15,000 Hz.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION
A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION
Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation continuously. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER
The power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING
Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL BENEFITS
The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extension card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.
FM-25K TRANSMITTER SPECIFICATIONS

GENERAL
POWER OUTPUT: 10 kW to 25 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency. Exciter programmable in 50 kHz increments.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 3/4" EIA flange.
FREQUENCY STABILITY: ±300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation. MODULATION CAPABILITY: ±100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 50/60 Hz and 360/415 V. 3 phase, 50/60 Hz, 4-wire. Power consumption: 40 kW typical.
RF HARMONICS: Suppression meets all FCC requirements.
ALITUDE: 10,000 feet (3048 meters).
AMBIENT TEMPERATURE RANGE: −20°C to +50°C. Maximum temperature 50°C @ sea level, decreasing 2°C per 1000 feet (305 meters) to 30°C maximum at 10,000 feet (3048 meters).
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter cabinet, 34.6" W (87.8 cm) x 31.0" D (78.7 cm). HV power supply cabinet: 48.0" W (121.9 cm) x 60.2" H (152.9 cm) x 24.2" D (61.5 cm).
FINISH: White, blue and black.

WIDEBAND COMPOSITE OPERATION
COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: 0.8%.
COMPOSITE INTERMODULATION DISTORTION: 0.2% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ±0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 55 dB below reference carrier AM modulation 100% output power.

MONOURAL OPERATION
AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: ±10 dBm, ±1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: Left and right standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.12% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: −50 dB.
NON-LINEAR CROSSTALK: −60 dB.
76 kHz SUPPRESSION: −68 dB.
38 kHz SUPPRESSION: −73 dB.
FM NOISE: (Left or right) 72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ±1 Hz 0’ to 50°C.
OPERATIONAL MÖDES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.

SCA OPERATION
MODULATION: Direct FM.
FREQUENCY OF OPERATION: 67 or 92 kHz programmable, any frequency between 25 and 92 kHz on special order.
FREQUENCY STABILITY: ±500 Hz.
MODULATION CAPABILITY: ±7.5 kHz.
AUDIO FREQUENCY RESPONSE: 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis ±1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ±0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear panel connector.
AC INPUT LEVEL: ±10 dBm, ±1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5.7 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4500 Hz, ±4.5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) −63 dB (reference: 100% modulation − ±5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) −60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ±5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (67 kHz/92 kHz) −50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to −30 dBm.
MUTE DELAY: Adjustable 0.5 to 2 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).
CARRIER MUTE DECAY: Greater than 30 milliseconds.

Specifications subject to change without notice.

ORDERING INFORMATION

FM-25K 25,000 watt FM broadcast transmitter with MX-15 exciter for wideband operation, 50/60 Hz (Specify 50 or 60 Hz) Sparc tube ...

HARRIS CORPORATION BROADCAST GROUP
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

CP-1M-386 © Harris Corporation 1986

ADV. 540E PTD. IN U.S.A.
**A Dynamic Transient Response (DTT) filter, jectio resulting in degraded crosstalk.**

**Digital Synthesized Audio Spectrum and/or Poor Harmonic Response**

**Digital Synthesized Modulation**

**TX0** (Temperature Corrected Reference)

...achieves this low noise floor. The MX-15's reduced separation at the upper and lower 5 kHz...
The Harris FM-3.5K, 3.5 kW FM broadcast transmitter — even more than you bargained for in a high performance transmitter.

- 300 to 3000 watt output power range
- 800 to 4000 watts output power range
- High power output from 800 to 4000 watts
- Sine wave AC eliminates need for costly 3-phase service
- Single phase AC eliminates need for costly 3-phase service
- Broadband solid state 150 watt HF drive with 3.5 kW output capability
- Front panel block diagram display helps isolate problems, minimizes down time
- Full remote control interface included

When considering 3.5 kW FM transmitters, local screen FM broadcasts are growing. Here are two major requirements that were identified:
- Reliability
- Audio performance

Without these two major requirements, even a high power FM broadcast transmitter will be unsatisfactory to your coverage requirements.

The Harris FM-3.5K covers both requirements. The FM-3.5K is a versatile solid state direct coupled transmitter. It is designed to provide high quality audio and reliability. The Harris FM-3.5K covers two major areas: audio and reliability.

Audio Performance

The Harris FM-3.5K covers both requirements. The FM-3.5K is a versatile direct coupled transmitter. It is designed to provide high quality audio and reliability. The Harris FM-3.5K covers two major areas: audio and reliability.

- Highly Reliable Power Amplifier Design
  - Harris FM-3.5K allows a modest power amplifier design that provides you with many years of dependable service
  - High performance Harris FM-3.5K FM transmitter begins the HF chain by delivering 25 watts of power
  - The FM-3.5K is followed by an all solid state drive/linear amplifier, which has been carefully selected to provide the optimum performance. The Harris FM-3.5K will service any hard condition from spars to cities. Typically, required to produce only 75 watts of drive, the amplifier has been designed to provide 300 watts of drive, thus allowing for future expansion.

- Emergency Power Failure
  - The Harris FM-3.5K features a redundant power amplifier design that provides you with many years of dependable service
  - The high performance Harris FM-3.5K FM transmitter begins the HF chain by delivering 25 watts of power
  - The FM-3.5K is followed by an all solid state drive/linear amplifier, which has been carefully selected to provide the optimum performance. The Harris FM-3.5K will service any hard condition from spars to cities. Typically, required to produce only 75 watts of drive, the amplifier has been designed to provide 300 watts of drive, thus allowing for future expansion.

Remote Control Interface Included

Harris FM-3.5K interfaces, remote control sections are an integral part of the FM-3.5K as an operating system. The remote control sections, suitable for all popular remote control systems, are all self-contained. They can be operated independently, thus avoiding the need for separate power supplies or remote control panels. All control signals are transmitted to the FM-3.5K through a single channel. Operator interfaces and status are available for remote control.

Advanced In Details

Quality standards have been achieved in every Harris FM-3.5K to operate with reliable performance. For example, the complete FM-3.5K system is designed to operate within a very tight tolerances. These are just a few examples of Harris performance standards at your own and for easy steps to cover.

Operational and equipment performance as a function of the FM-3.5K line to line input signal levels. Harris engineers have designed the FM-3.5K to operate within a very tight tolerances.
Continuing in its trend-setting tradition, Harris has utilized its world-renowned design engineers and state-of-the-art design tools to produce a new generation of AM and FM transmitters, truly setting the standard for today's audio/visual market. The VMX-15 is a high-performance, solid-state AM/FM stereo transmitter that is ideally suited for AM broadcast, satellite uplink, and FM broadcast applications.

The VMX-15's advanced design incorporates a combination of the latest in digital signal processing and high-power amplifiers to provide outstanding performance. The transmitter is designed to meet the demanding requirements of today's broadcast industry and is capable of delivering exceptional audio quality and stability.

Key Features:
- Advanced digital signal processing for superior audio quality and stability.
- High-power amplifiers for maximum output and reliability.
- Complimentary AM/FM modulation for enhanced performance.
- Built-in diagnostics and monitoring for easy maintenance.
- User-friendly interface for simple operation.

The VMX-15 is the perfect choice for broadcasters looking for a high-performance, reliable AM/FM transmitter.

Harris Corporation
Broadcast Division
P.O. Box 4290, Quincy, Illinois 62355-4290
U.S.A. 212/722-8300

Harris maintains a policy of continuous improvement in its products. For the latest specifications and features, please visit our website at www.harris.com.
Harris FM-25K1
high efficiency . . . wide RF bandwidth
single tube design

- Single tube, 25 KW high efficiency, high power FM transmitter
- Advanced 4X20,000A PA stage achieves 77% or greater efficiency for low operating costs, longer tube life
- Wide RF bandwidth provides signal transparency to the exciter’s audio performance
- Broadband solid state 1200 watt RF preamp and 800 watt PA stages with PLEX®-HD capability
- High performance MKS-Exciter for maximum signal clarity
- Automatic VSWR feedback keeps station on the air during antenna icing conditions

The Harris FM-25K1 utilizes a novel broadband transmission circuit design which maximizes maximum signal carry, operates efficiently and minimizes the external hardware to practically achieve these goals. The Harris FM-25K1 achieves these goals by utilizing a highly efficient, single tube power amplifier.

Power To Next Year's Transmission System Requirements
The Harris FM-25K1 not only effectively provides any output power from 7.5 kw to 25 kw. The full screen allows you to select the sine wave, sine wave with digital preemphasis, or transmit power to optimize your coverage area.

Stable, Reliable, Efficient PA Stage
Every PA in this efficiency improvement represents thousands of hours of power saved over a single year. This translates to a savings of millions of dollars savings to your transmitter. The 77% operating efficiency provides you with a trustworthy, high-efficiency, single tube power amplifier.

Wide RF System Bandwidth
The Harris FM-25K1 incorporates the FM transmitter as a major factor in meeting your transmission requirements. The maximum low T1S2000A noise figure is 0.50 in its entire tuning range, while optimum output signal-to-noise ratio is also provided. The output power delivered by this 4X20,000A is 100%, of its rated output, on all frequencies. The Harris FM-25K1 is designed to provide maximum efficiency and high audio performance, while delivering outstanding performance at the highest level at which the transmitter can be operated without degradation of performance.

Automatic Power Control
With a Harris FM-25K1 in-service, operator input power adjustments predictably are automatic. The transmitter's automatic control system monitors the RF power output with a high degree of stability, while providing the operator with the capability to adjust the FM-25K1 output level to the desired level simply and rapidly.

Completely Solid State Keying Driver
For maximum protection against RF leakage, the exciter's audio power is amplified by a solid state circuit which is designed to retain excellent audio quality along with the high frequency output and noise reduction needed.

Complete Solid State High Fidelity FM Exciter
The FM-25K1 high fidelity FM exciter is a fully integrated RF exciter unit designed specifically for transmitting high-fidelity audio signals to the FM-25K1. The exciter's audio power is amplified by a high degree of stability, while providing the operator with the capability to adjust the FM-25K1 output level to the desired level simply and rapidly.

Automatic VSWR Feedback And VSWR Protection
In the event high antenna return loss causes occur frequency tuning anomalies, the FM-25K1 is designed to reduce power to the antenna to the level at which the power source is maximized and the transmitter will remain operating automatically, allowing the operator to recover control of the transmitter without endangering the radio equipment.

Complete Automatic Control
The FM-25K1 is controlled by automatic control logic which is only activated when the input source exceeds some defined range. Should an overload occur, the transmitter will automatically reduce the output power to a safe level.

Mains Supplied Input Power
The high voltage power supply is designed to a reliable, efficient, and provides the power and current supplies. The power supply and output power supplies to all internal circuits.

VSWR Protection
- Provides immediate action on overload to the FM transmitter to prevent power surges that could damage the operating power levels.
- Prevents overloads from being applied to the transmitter.
- Provides automatic protection against power surges that could damage the operating power levels.
- Provides automatic protection against power surges that could damage the operating power levels.

VSWR protection is automatically restored to the transmitter, if the source of the overload is removed. Once the overload is removed, the transmitter automatically returns to the operating level at which the transmitter can be operated without degradation of performance.

System Design
- The system is designed to provide maximum efficiency, while providing the operator with the capability to adjust the FM-25K1 output level to the desired level simply and rapidly.
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The system is designed to provide maximum efficiency, while providing the operator with the capability to adjust the FM-25K1 output level to the desired level simply and rapidly.
To the program material. Stereo separation resulting in degraded cross talk. DSM provides a clean stereo composite signal.

Digital Synthesizer

2.5, 5, 10, 15, 20 and 25 MHz, permitting wideband composite intermodulation not found in conventional modulated oscillator) of the MX-15 feature superb the broadcaster with new levels of ex-

Digital Synthesized Modulation (DSM), the threshold level can also be adjusted between through the composite input. Harmonic distortion for improved SCAs proves auroral performance in comparison operating with stereo. The MX-15 exciter another on 92 kHz, can simultaneously exciting in one on 67 kHz and the

The MX-15 multipurpose SCA generator is for stations whose formats do not require loudness. The DTR filter can be switched off when SCA is not used continuously.

Additional Benefits

The Power amplifier module is conservative-approaching that of a modulation monitor. Monitoring is provided to monitor 10 DC and 10 ly rated at 15 watts output, and requires no possible to today, the Harris MX-15 multipurpose transmitter.

Ambient Temperature: 100°F (38°C)

Asynchronous AM Signal to Noise:

Composite Amplitude Response:

External SCA Generator Inputs:

Composite Input Impedance:

Humidity:

RF Output Spurious and Harmonic:

Typically 52.2 kW (.95 PF) @ 35 kW.

All distortion products down 70 dB.

208V, 240V, (VERNIER: -10V, O, +10V).
transmitter power to accomplish your bination of tower height, antenna gain, and range allows you to select the best high performance FM transmitters.

Exclusive STATUSUAL controller memory records and stores exact date and time of troubles to help isolate problems.

When considering high power FM transmitters, all transmitters generally consider these major requirements—long service life, operating costs, and output powers. Harris FM-35K meets these major requirements and more.

POWER TO MEET YOUR TRANSMISSION SYSTEMS REQUIREMENTS

The Harris FM-35K can be integrated as a simple output power stage of a board or as a complete RF system. The 35K allows you to select the best combination of high power, antenna gain, and transmitter power to accomplish your coverage requirements in the most efficient way.

ADVANCED EFFICIENT INPUT

Every pair of FM efficiency improvement removes thousands of high power station hours from every kilowatt of input power. Harris is a leader in developing the efficiency of high power FMs. The Harris FM-35K is still another example of Harris efficiency improvement and Harris commitment to developing an efficient high power FM transmitter.

The cooling air system used in the Harris FM-35K has been developed to achieve major strides in the transmitter—thoroughly designed, engineered, and tested. A single direct drive 500 HP blower provides sufficient air to cool the power stage and its associated controls to keep the air system at the best temperature.

CONVENIENT ACCESSIBILITY

All small signal input and output connections are made in a panel on the front of the unit. Connections for power supplies, time, and various inputs and outputs can be further detailed to suit your equipment, and installation and operational manual.

CONVENIENT REFERENCES

Harris FM-35K PowerStar

The right choice in high power, high performance FM transmitters.

Harris FM-35K PowerStar...

- Single tube, 10 - 35 kW high efficiency, high performance FM transmitter
- Advanced 4CX20,000 PA stage efficiency for low operating costs, long life tube
- Wide RF bandwidth provides signal transparency to exciter's audio performance
- Broadbroad test 150 watt RF preamp and 600 watt IFA stages with FLEXX-capability
- High performance MK-15 exciter for maximum clarity
- Automatic VSWR feedback keeps station on the air
- Exclusive STATUSUAL controller memory records and stores exact date and time of troubles to help isolate problems.

One of the main benefits of using the Harris FM-35K is the high performance FM transmitter. The Harris FM-35K is designed to provide the best possible performance in terms of power, efficiency, and reliability. It is a high power FM transmitter that is designed to meet the needs of modern broadcast stations. The Harris FM-35K is designed to provide the best possible performance in terms of power, efficiency, and reliability. It is a high power FM transmitter that is designed to meet the needs of modern broadcast stations.
A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds signal. Unlike conventional technology, the WWV transmissions.

The MX-15 uses a 10 MHz high-stability Overshoot Compensation putting at 2.5, 5, 10, 15, 20 and 25 MHz, permitting a floating composite input as a standard feature.

BNC input connection provides a shielded, low-impedance interface to the rear panel.
When considering 5 kW FM transmitters, FM broadcast station engineers are looking for a power amplifier that can produce the necessary output power while maintaining high efficiency and reliability. Harris FM-5K1 meets the stringent requirements—long term reliability and audio performance. Without question the Harris FM-5K1 is the ideal choice for any FM broadcast station.

POWER TO NEXT FM TRANSMISSION DEVICE REQUIRED

The Harris FM-5K1 can provide you with the output power of 5000 watts, and it is a reliable solution for your broadcast needs. The FM-5K1 features a number of important functions, such as remote control and monitoring capabilities, which are essential for the smooth operation of your FM broadcast station.

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HARRIS FM-5K1...even more than you bargained for in a high-performance FM transmitter

- 1500 to 5000 watts output power range
- MX-16 exciter for minimum distortion, maximum signal clarity
- Single phase AC eliminates need for costly 3-phase service
- Automatic power control minimizes operator adjustment
- Automatic VSWR foldback helps keep transmitter on air during antenna icing conditions
- Front panel block diagram displays help isolate problems, minimize down time
- Full remote control interface included

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The FM-5K1 uses only VHF amplifiers at high power level. Harris FM-5K1 uses only one stage from RF amplifier to PA, with no output control amplifier, guaranteeing a clean, high performance signal.

HARRIS FM-5K1—another major step in Harris' leadership in FM broadcast systems.

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