



# HARRIS

## 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
- Multipurpose SCA generator to meet the expanded needs of today's aural and data services.
- Available as an FCC type accepted 15 watt transmitter

\* Patented



# HARRIS MX-15 . . .

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 .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 nonlinearities, 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  $\pm 100$  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



The Harris MX-15 Exciter features modular construction for maximum versatility and ease of maintenance.

# 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  $\pm 10$  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 maximum modulation density.

## MULTIPURPOSE SCA OPERATION

The MX-15 multipurpose SCA generator is designed to meet the expanded needs of today's SCA service requirements, and is ideal for high quality aural service or for accurate transmission of digital data.

The MX-15 multipurpose SCA generator can be user programmed to operate on 67 kHz or 92 kHz by simply positioning a jumper plug. Other

operating frequencies can be easily accommodated upon request. Two SCA generators, one on 67 kHz and the other on 92 kHz, can simultaneously operate with stereo. The MX-15 exciter accommodates additional SCA channels through the composite input.

The transformerless audio input stage improves aural performance in comparison with other designs. Stations will note lower harmonic distortion for improved SCA fidelity.

The transformerless input stage is low pass filtered to meet the technical needs of the SCA information transmitted. A 4.5 kHz low pass response is provided as standard. This can be easily changed for 3 kHz, 5 kHz or 7.5 kHz response, or may be defeated if desired.

The MX-15 multipurpose SCA generator meets the transmission requirements of stations transmitting digital information. A rear mounted BNC input connector DC couples the digital data to the SCA generator's FM modulator for transmission quality.

SCA operators recognize that abrupt muting of the SCA carrier may cause an annoying "pop" in the SCA receivers. Harris has incorporated a carrier mute decay circuit to eliminate this objectionable noise.

In addition to the mute decay circuit, stations may select the mute delay time constant they desire—anywhere between 0.5 seconds and 20 seconds. Automatic mute threshold level can also be adjusted between 0 and -30 dBm in order to meet varying input levels.

The MX-15 exciter and multipurpose SCA generator work as an effective patented system to automatically maintain maximum main channel modulation at all times. Here's how: When the SCA generator is activated, the composite level is automatically lowered to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation when SCA is not used continuously.

Whether you are planning to use your SCA channel for conventional aural services (such as background music), or are looking at some of the new expanded applications possible today, the Harris MX-15 multipurpose SCA generator meets your needs.

## POWER AMPLIFIER

The power amplifier module is con-



The Harris DSM Stereo Generator, with Digitally Synthesized Modulation (DSM) and DTR filter, provides 50 dB stereo separation minimum, 30-15,000 Hz, and overshoot no greater than 2%.

servatively 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:**  $\pm 300$  Hz  $0^\circ$  to  $50^\circ\text{C}$  temperature compensated reference oscillator.  
**TYPE OF MODULATION:** Direct carrier frequency modulation (DCFM).  
**MODULATION CAPABILITY:**  $\pm 100$  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:**  $0^\circ$  to  $50^\circ\text{C}$  (operational to  $-20^\circ\text{C}$ ).  
**OVERALL CABINET SIZE:** 17.7" Wide (44 cm)  $\times$  14" High (35 cm)  $\times$  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. RFI 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  $\pm 75$  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 @  $\pm 75$  kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).  
**COMPOSITE HARMONIC DISTORTION:** .08%.  
**COMPOSITE INTERMODULATION DISTORTION:** .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:**  $\pm 0.1$  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 modulation +75 kHz @ 400 Hz).

## 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,  $\pm 1$  dB for 100% modulation at 400 Hz.  
**AUDIO FREQUENCY RESPONSE:** Standard 75 microsecond FCC pre-emphasis curve  $\pm 0.5$  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:** .045%, 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 @  $\pm 75$  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,  $\pm 1$  dB for 100% modulation.  
**AUDIO FREQUENCY RESPONSE:** (Left and right) standard 75 microsecond FCC pre-emphasis curve  $\pm 0.5$  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 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,  $\pm 75$  kHz deviation, measured 30 Hz to 15 kHz bandwidth.  
**PILO OSCILLATOR:** Crystal controlled.  
**PILOT PHASE:** Harris patented automatic pilot phasing circuit.  
**PILOT STABILITY:** 19 kHz  $\pm 1$  Hz  $0^\circ$  to  $50^\circ\text{C}$ .  
**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:**  $\pm 500$  Hz.  
**MODULATION CAPABILITY:**  $\pm 7.5$  kHz.  
**AUDIO FREQUENCY RESPONSE:** 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis  $\pm 1$  dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz  $\pm 0.5$  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,  $\pm 1$  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  $\pm 5$  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 =  $\pm 5$  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  $\pm 5$  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).

Harris maintains a policy of continuous improvement on its equipment, and therefore reserves the right to change specifications without notice.

## ORDERING INFORMATION

MX-15 Exciter for wideband composite operation, 19-inch rack mounted .....	994-7950-004
Mono option (add for mono operation) .....	994-8019-001
DSM Stereo Generator with DTR Filter (add one for stereo operation) .....	994-8020-002
SCA Generator (add one for each SCA service, specify 67 kHz or 92 kHz) .....	994-7992-001
External SCA Generator Jumper Card (for use with externally mounted SCA Generator) .....	994-8377-001

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