

## Z-HD+ FM

Tri-Mode HD Radio<sup>™</sup>  
Transmitters

*Unleashing the full power  
of HD Radio<sup>™</sup> with the most cost-effective  
and reliable digital and solid-state technologies*



### *Z-HD+ adds these NEW features!*

- Designed for FlexStar
- Up to 15% more digital + analog output power
- Tri-mode operation, with switching “on-the-fly”!
- No external exciter rack needed —FlexStar mounts IN the Z!

## ***Make these Harris Z-HD+ transmitter benefits yours:***

### **Investment security based on unrivaled digital experience**

HD Radio is more than an investment financially. It's also a whole new ballgame technically. You want to make sure that you make a safe investment, and you can be sure with Harris. As broadcasting's DTV and DAB (Eureka 147) transmission leader, we have developed a solid core competency backed by years of experience in the complex technical areas that are essential for maximum HD Radio performance. And we've put this expertise to the test by providing transmitters for every major HD Radio test, including multicasting, since the beginning.

### **Exclusive precorrection technology for significant cost savings**

Featuring Harris' proprietary RTAC™ Real Time Adaptive Correction precorrection circuitry, Z-HD+ transmitters deliver linear amplification without the need for RF bandpass filters that cost up to \$15,000. And this is only the beginning. Our exclusive RTAC technology also increases efficiency for ongoing power savings – while comfortably exceeding the FCC's RF mask requirements to prevent signal interference.

### **Top functionality with the world's most popular solid-state architecture**

Z-HD+ transmitters are a linearized version of Harris' Z CD solid-state transmitters – the world's most popular with more than 3,000 on the air. With Z-HD+ transmitters, you will get extraordinary reliability with a redundant architecture, a low-maintenance design, and a number of other benefits-at a price that is comparable to vacuum tube technology.

### **A cost-effective and flexible migration path**

ZHD+ transmitters are Tri-Mode. By that, we mean on-the-fly switching between Class C analog operation or linearized common amplifier or digital only modes. Not ready to go HD Radio but need a new transmitter? Purchase a Z-HD+ model today with an analog exciter, and add a Harris FlexStar™ when you wish to commence HD Radio operation.

### **A complete end-to-end solution**

Only Harris can provide everything you need as you plan your transition to digital radio... from source through studio through STL through transmission. And our systems team is available to help you put together the system that makes the most sense for your operation – now and in the future.

## ***Z-HD+ – the industry-reference FM/HD Radio transmitter***

Harris proudly presents its Z-HD+ family of transmitters for amplification. Combined versions allow a single Z-HD+ transmitter to deliver both the FM and HD Radio signal, and HD Radio only versions can be combined with your current FM transmitter.

Z-HD+ transmitters are far more than a linearized version of Harris' Z CD line — the world's most popular solid-state FM transmitters with more than 3,000 on the air. Combining Harris' unmatched expertise in linear and digital systems with an ultra-redundant architecture, Z-HD+ transmitters offer unsurpassed reliability, performance, and proprietary digital technology that will cut your costs significantly.

NOW, Z-HD+ offers HIGHER digital output power than previous Z-HD designs. Thanks to RTAC's added efficiency, up to 15% of additional output power is available in common amplification mode. This added headroom can mean significant savings in transmitter initial sizing, avoiding an upsizing step that may be required in a competitive model.

One of the biggest requirements for FM/HD Radio transmission is linear amplification. To achieve the linearity required for maximum coverage and compliance with the FCC's RF mask requirements to prevent signal interference, the most common technique is to install an RF bandpass filter at the output of the transmitter. As the name implies, the bandpass filter "filters out" distortion products that can result in interference.

Drawing upon Harris's unmatched expertise in digital TV transmission, Z-HD+ transmitters employ proprietary RTAC precorrection circuitry. The circuitry, RTAC (Real Time Adaptive Correction), which prevents intermodulation and other distortion products from occurring in the first place, produces a linear and mask-compliant signal.

RTAC also will reduce your long-term power costs by enabling you to get maximum power from your transmitter, increasing efficiency. The result is outstanding cost-

effectiveness from the time of your initial purchase throughout the life of the Z-HD+ transmitter.

### ***No-compromise FM and Z-HD+ performance***

A key to your station's current success is its ability to deliver a stand-out sound on the dial. And, with HD Radio, which creates a true digital pipeline, you will be able to deliver data as well with its value-adding services and revenue-creation potential. Z-HD+ is designed to provide the performance you need. You will also be able to add the Importer and engage in Multicasting, or broadcasting more than one program stream on HD Radio.

Z-HD+ transmitters utilize the award-winning Harris FlexStar exciter. FlexStar has re-defined FM analog and HD Radio performance and has won several industry awards. With dual RF outputs, FlexStar can drive both your HD Radio transmitter as well as the existing analog transmitter when using separate amplification.

### ***Built-in reliability keeps you on the air***

Based on Harris' ultra-redundant Z CD solid-state FM transmitter design, Z-HD+ transmitters will keep you on the air. Standard features and options can help eliminate single points of failure — from IPA, PA, and power supplies to the exciter — for a true "soft-failure" design.

Unmatched reliability starts with Z Series components. The broadband solid-state RF module used for both the IPA and the PA sections is exceptionally reliable, and this is only the beginning. The RF module is designed to provide built-in redundancy when used in the IPA. And in the PA section, multiple RF modules operate in parallel to produce rated power, replacing the single PA

tube that has traditionally been the most common single point of transmitter failure.

A patented Harris innovation, the "Z-plane" automatically reconfigurable isolation combiner, keeps you on the air at full power even with an RF module removed, giving you full on-air performance and reliability.

### ***Easy operation, unprecedented servicability***

It's no secret that today's radio broadcasters have far fewer engineers, and Z-HD+ transmitters accommodate this reality. These transmitters are very easy to control and monitor— locally and remotely.

Z-HD+ transmitters require less maintenance than previous-generation tube transmitters. Tuning, loading and matching requirements are eliminated, and tube replacements are a thing of the past. What's more, Z-HD+ transmitters with "hot-swappable" RF modules allow a great deal of maintenance to be performed safely while you continue to broadcast.

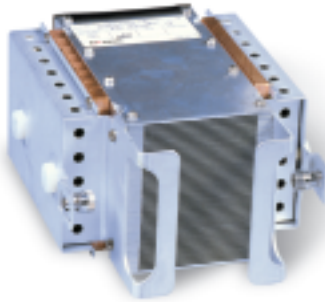
Like other Harris transmitters, Z-HD+ transmitters are backed by the best factory service in the industry-24-hour technical assistance, around-the-clock parts support and our legendary training.

We invite you to take a closer look at Z HD+ transmitters that are so outstanding that they will redefine your expectations.

Upgrade your analog Z today! Upgrade packages are available to convert existing Z-FM and Z-CD transmitters to Z-HD+. And, you may continue to use your DIGIT-CD Exciter as an analog-only mode backup exciter.

## Key Features and Benefits

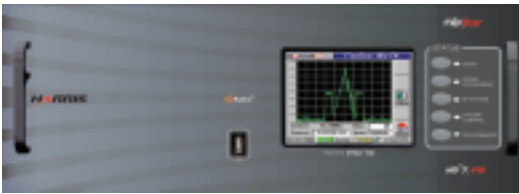
### IPA/PA Modules:



#### Legendary reliability

Harris Z-HD+ IPA/PA modules provide unmatched reliability and a hot-swappable design for on-air servicing. Proprietary "Z-plane" combining keeps the transmitter at full power even if a PA module is removed.

### FlexStar:



#### HD Radio's most functional advanced exciter

You will find that FlexStar has been re-engineered to go far beyond the first and second generation of HD Exciters. No longer an "Exciter PC", this new DSP based solution now generates BOTH the HD and FM signals in a single compact enclosure which mounts inside the transmitter. Used with the companion HDE-100 Exporter, all audio processing and digital stream generation can now be moved to the studio for easy access management. Other important features of FlexStar include a front-panel spectral display for a quick check of sideband spectrum, built-in RBDS and SCA (2) generators, multiple input switching, and an intuitive menu-driven Graphical User Interface (GUI), for setup and extensive diagnostics. It is truly TWO exciters in one compact chassis! Listeners will HEAR the difference as well!

### User Interface:



#### Straight forward operation, locally or remotely

Z-HD+ transmitters put comprehensive information at your fingertips locally or remotely via RS-232 connection. The microprocessor-based controller also makes intelligent decisions based on operating conditions. A pull-out/tilt design provides even greater accessibility.

## Z-HD+

### 1 Main Controller

This microprocessor-based controller monitors more than 100 parameters and makes intelligent decisions based on operating information. It provides automatic power control, VSWR overload protection, VSWR foldback, RF power "soft-start", AC re-start and automatic switching to a back-up exciter and reserve IPA. To aid in troubleshooting, the controller logs the last 32 faults and times of occurrence. It features both serial (RS232) and parallel control.

### 2 Diagnostics Display

Detailed information is accessible on a diagnostic panel. A large, four-line LCD display provides status information for more than 100 parameters and also provides fault alerts. A digital multimeter and LEDs provide additional information.

### 3 Power Supplies

Redundant power supplies are standard in every Z-HD+ transmitter with more than four solid-state modules and optional in transmitters with fewer modules. The non-switching design provides high conversion efficiency and an excellent power factor with very low line harmonics. Power supplies are housed on a roll-out mounting plate for complete accessibility. The transmitter's controller is powered by its own dual power supply.

### 4 'Z-Plane' Combiner

Harris' patented Z-plane automatically re-configurable isolation combiner keeps Z-HD+ transmitters on the air at full (or nearly full) power even if a PA module is removed from service. (Not Shown)

### 5 PA

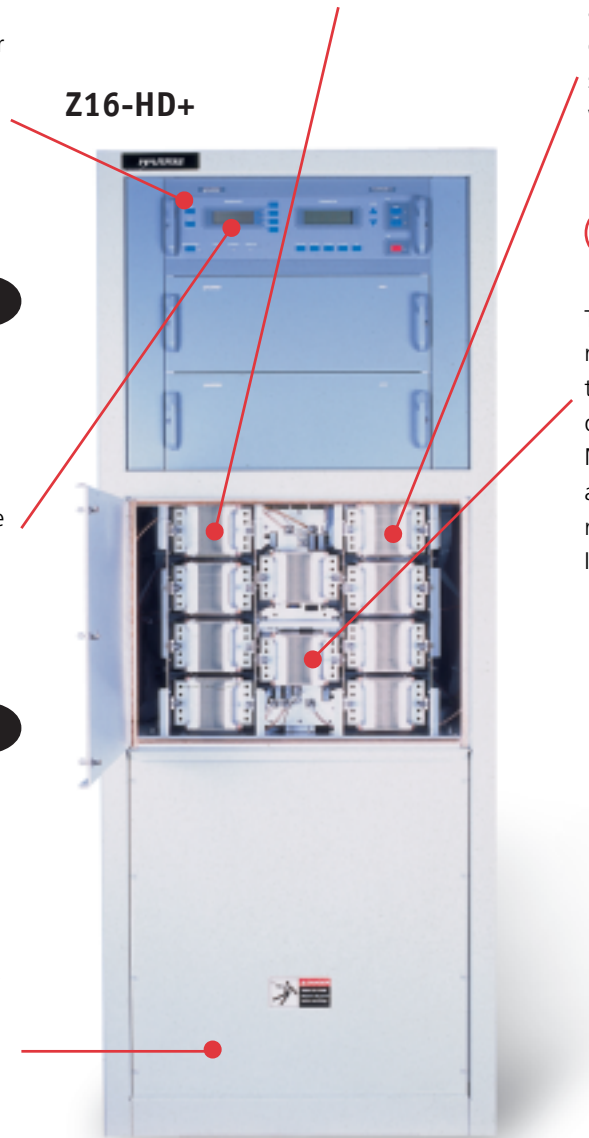
In the PA section, multiple RF modules operate in parallel to produce rated power. Each module is conservatively rated to produce 850W of power into a system VSWR of 1.5:11.

### 6 Solid-State RF Modules

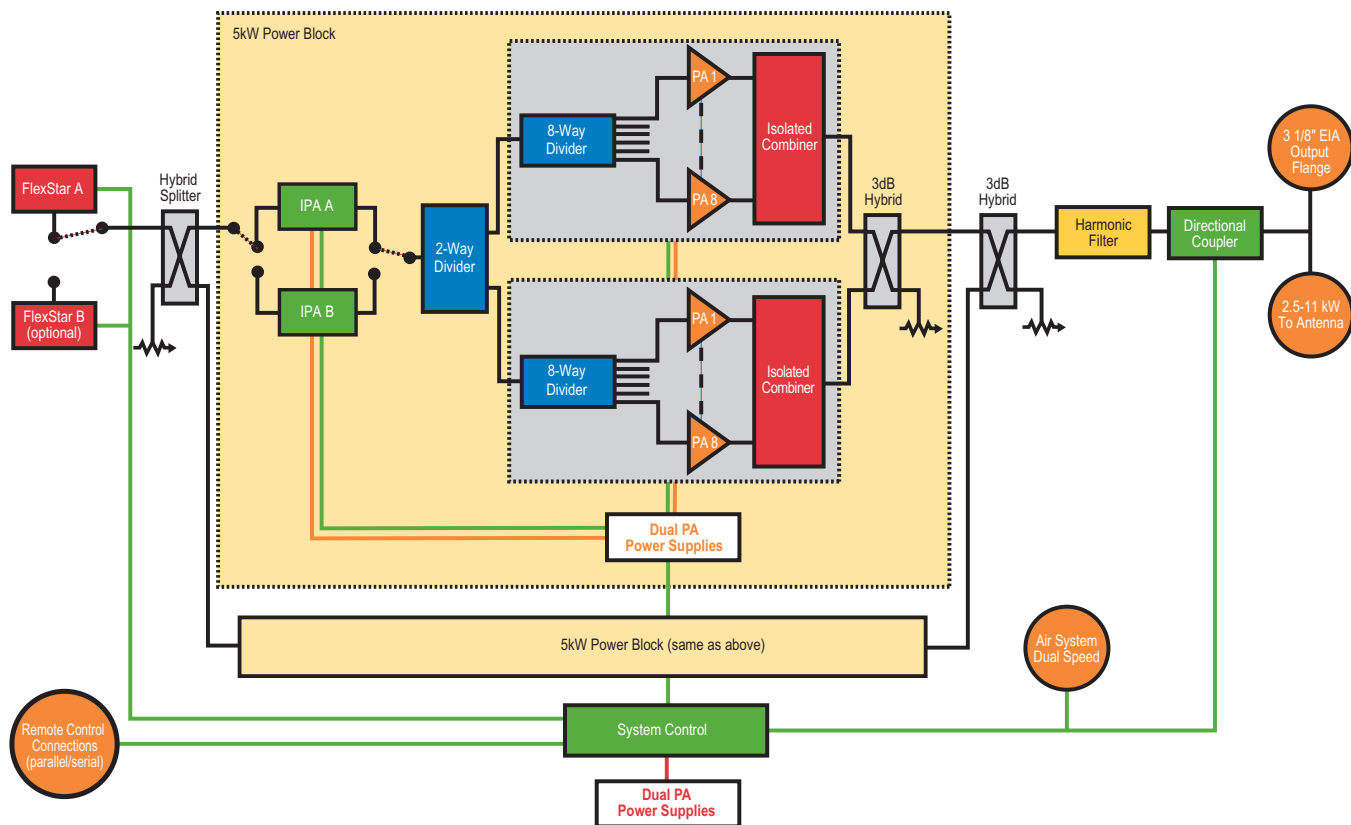
The IPA and PA sections use identical broadband RF modules. Each module is comprised of two MOSFET pairs (four devices). Each MOSFET pair is mounted on a heat spreader and attached to a heat-sink assembly. RF modules plug directly into the combiner. "Hot-swappable" modules can be safely removed or inserted during transmission without removing plugs or cables.

### 7 IPA

The solid-state module design ensures IPA redundancy. Although the IPA module has two MOSFET pairs, only one pair is used during transmission. If the operating MOSFET pair fails, the remaining MOSFET pair automatically replaces it. For even greater reliability, any PA module can be used as an IPA module, with absolutely no modification.



Z16-HD+ Diagram



The Z-HD+ is available for analog operation, for separate or common amplification systems from the Z4HD+ through ZD32HD+. Detailed specifications and power levels are available at [www.broadcast.harris.com](http://www.broadcast.harris.com).

Z-HD+ Transmitter Models

	Common	Separate	FM Only
Z4HD+	1.65 kW	775w	2.2 kW
Z6HD+	2.8 kW	1.35 kW	3.85 kW
Z8HD+	4.0 kW	1.75 kW	5.25 kW
Z12HD+	6.0 kW	2.6 kW	7.8 kW
Z16HD+	8.0 kW	3.5 kW	10.5 kW
ZD24HD+	12.0 kW	5.2 kW	15.6 kW
ZD32HD+	16.0 kW	7.0 kW	21.0 kW

Specifications are subject to change. For a complete listing of the most current specifications, please visit our Website at [www.broadcast.harris.com](http://www.broadcast.harris.com)

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### General (For FM & HD with FlexStar HDx)

#### FM Power Output Range:

Z4HD+:	.3 – 2.2 kW
Z6HD+:	.875 – 3.85 kW
Z8HD+:	1.25 – 5.25 kW
Z12HD+:	1.88 – 7.8 kW
Z16HD+:	2.5 – 10.5 kW
ZD24HD+:	3.76 – 15.6 kW
ZD32HD+:	5 – 21 kW

#### FM+HD Power Output Range: (HD signal injection ratio -20dB)

Z4HD+:	.375 – 1.65 kW
Z6HD+:	.625 – 2.8 kW
Z8HD+:	.875 – 4.0 kW
Z12HD+:	1.25 – 6.0 kW
Z16HD+:	1.75 – 8.0 kW
ZD24HD+:	2.50 – 12.0 kW
ZD32HD+:	3.50 – 16.0 kW

#### HD Power Output Range:

Z4HD+:	.225 – .875 kW
Z6HD+:	.325 – 1.3 kW
Z8HD+:	.435 – 1.75 kW
Z12HD+:	.650 – 2.6 kW
Z16HD+:	.875 – 3.5 kW
ZD24HD+:	1.30 – 5.2 kW
ZD32HD+:	1.75 – 7.0 kW

#### RF Output Connector:

All Models: 3 1/8 Inch EIA, 50 ohms  
1 5/8 inch EIA step reducer supplied on request at no charge

**Excitation:** Harris FlexStar™ HDx digital FM/HD exciter

**Frequency Range:** 87.5MHz to 108MHz programmable in 10kHz steps

**Frequency Stability:** ± 150 Hz, 0° to 50°C using high accuracy internal (59.535MHz) TCXO. 10MHz input for synchronization to external (GPS) reference. Automatic switching to internal oscillator if external reference fails.

**Overall Efficiency:** HD mode greater than or equal to 26% AC to RF, FM+HD (common mode-20dB ratio) mode greater than or equal to 37% AC to RF, FM (analog only) mode greater than or equal to 55% AC to RF. All figures are at model specific nominal output power.

**Harmonic / Spurious Suppression:** Internal harmonic filter meets or exceeds all FCC, IC, CE, CCIR and IEC215 requirements. Meets or exceeds standard NRSC-5A emission limits in all modes.

**VSWR:** For load VSWR exceeding 1.5:1, nominal, transmitter automatically reduces RF output as a function of load VSWR (proportional VSWR foldback). For an instantaneous VSWR of 3:1 or greater, an automatic carrier interruption occurs to extinguish possible arcing conditions in the output load.

**Modulation Types:** FM digitally synthesized direct to channel, HD digital direct to channel, FM+HD digital direct to channel.

**Operating Modes:** “On-the-Fly” switching between FM only, HD only, FM+HD.

**FM Modulation Capability:** Greater than ± 300 kHz.

**Asynchronous AM S/N Ratio:** 55dB minimum below equivalent 100% amplitude modulation by 400Hz using 75µs de-emphasis (no FM modulation present).

**Synchronous AM S/N Ratio:** 50dB minimum below equivalent 100% amplitude modulation with 75µs de-emphasis and 400Hz high-pass filter (FM deviation +/- 75kHz by a 1kHz sine wave). Measured at wideband input.

#### AC Mains Requirement:

197 to 250V, 1-phase, 50 or 60Hz, 2-wire (plus safety ground)  
197 to 250V, 3-phase, 50 or 60Hz, 3-wire Closed Delta or WYE  
380 to 415V, 3-phase, 50 or 60Hz, 4-wire WYE  
437 to 506V, 3-phase, 60 Hz, 3-wire Closed Delta or WYE

Note: Z16 requires two cabinets in single phase configuration  
ZD32 requires four cabinets in single phase configuration

**RF Cabinet Size:** 28.6” (72.6cm) W x 49.72” (126.3cm) D x 72” (183cm) H (with fan and air filter assembly attached)

**Harmonic/Low Pass Filter:** Internal

**Remote Control Connections:** Barrier strip inside upper left sidewall (facing rear of transmitter)

**Additional Remote Control Connection:** RS-232 on system controller supports eCDI or WebRemote

**AC Entrances:** Through top or bottom surface of cabinet

**Fuse/Breaker:** Wall-mounted fused disconnect or breaker is customer-supplied item. An RK5 class fuse such as the Bussman FRN-R(250V), FRS-R (600V) or LittleFuse FLNR (250V), FLSR (600V) is recommended. If a circuit breaker is used it should have a trip curve similar to that of the RK5 fuse trip curve

**AC Power Factor:** 3-phase: 0.95; 1-phase: 0.8

**Refer to individual transmitter ECM sheets for specific specifications regarding power consumption, heat loads, weights, etc.**

#### Input/Output Specifications:

**External Frequency Control:** Parallel I/O control of up to 8 frequencies. Unlimited frequency selection via optional N+1 controller.

**AES3 Audio Inputs:** (2) auto-switching AES3 inputs, female XLR, 110 Ohms balanced; -2.8dBfs nominal; Adjustable level from 0 dBfs to -15 dBfs in 0.1 dB steps for +/- 75 kHz deviation; input sample rate 32 to 96 kHz.

**Analog L/R Inputs:** Female XLR, >10K Ohms, balanced, resistive; default level is +10dBu for +/-75kHz deviation. Level adjustable from -10dBV to +10dBV.

**Analog Composite Input:** (2) BNC inputs (1 balanced, 1 unbalanced); Balanced impedance is 10K Ohms or 50 Ohms (selectable); Unbalanced is 10K Ohms; Input level: 3.5V P-P for +/-75 kHz deviation; Adjustable 2V P-P to 5 V P-P.

**SCA Audio Inputs:** (2) inputs combined on one 5-pin XLRfemale connector (mating male connector supplied); >10K Ohms balanced, resistive; +10dBV nominal for +/- 6kHz of FM sub-carrier.

**External SCA inputs:** (2) BNC female, unbalanced; >10K Ohm; 1.5V p-p nominal for +/-7.5kHz (10%) deviation of main carrier; adjustable from 1V P-P to 4V P-P.

**RBDS Data Input:** Sub-D 9-pin female RS-232.

**External 10MHz Clock Input:** BNC female, unbalanced, 50 Ohm, -10dBm to +10dBm.

**External 1 PPS Clock Input:** BNC female, unbalanced, 50 Ohm, TTL level.

**User Remote Interface:** D 25-pin female

**N+1 Interface:** Sub-D 25-pin female

**RF Sample Out:** BNC jack, -66dBc, post harmonic filter

**19kHz Pilot Sync Output:** BNC female, unbalanced, 50 Ohms resistive, sinewave, AC coupled, 4.5 V P-P nominal, unterminated.

**Exciter Communication Ports:** (2) Sub-D 9-pin female; RS232 protocol, for RBDS or VT-100 data.

**Exciter Ethernet Ports:** (2) RJ-45 on main processor board; (2) RJ-45 on Engine board (HD version only); all Ethernet ports 10/100; supports static or dynamic IP address.

**Exciter USB Port:** Front panel USB type-A connector; USB 1.1 / 2.0 compliant; supports configuration save/restore and software updates via flash drive.

**ZHD+ (For FM & HD with FlexStar HDx) Continued**
**Stereo Generator Performance (AES-3 or analog inputs)**

**Modes:** Stereo, Mono L+R, Mono L, and Mono R; remote controllable.

**Pre-emphasis:** Selectable 0, 25, 50, or 75 microseconds.

**Stereo Pilot Tone:** 19 kHz  $\pm$  0.03 Hz; injection adjustable 0% to 12% in 0.05% steps; Nominal: 9%. 38kHz, 57kHz, 76 kHz, 95 kHz Suppression: 80 dB below  $\pm$ 15 kHz deviation.

**Stereo Separation:** 80 dB\*/60 dB, 10 Hz to 15 kHz.

**Dynamic Stereo Separation:** 80 dB\*/60 dB, 10 Hz to 15 kHz\*.

**Stereo Amplitude Response:**  $\pm$  0.1 dB, 10 Hz to 15 kHz referenced to selected pre-emphasis curve.

**Stereo Signal to Noise Ratio (L or R):** 85dB below 100% modulation at 400Hz; measured in a 10Hz to 22kHz bandwidth with 75 $\mu$ s de-emphasis and DIN "A" weighting.

**Stereo Total Harmonic Distortion:** 0.005%\*/0.02%, any modulating frequency 10 Hz to 15 kHz, in bandwidth 10 Hz to 22 kHz; with 75 $\mu$ s de-emphasis.

**Stereo Intermodulation Distortion (L or R):** CCIF: 0.005%\*/0.02% Note 1; (14/15kHz 1:1), SMPTE: 0.02% (60 and 7000Hz 1:1).

**Transient Intermodulation Distortion (DIM):** 0.008%\*/0.02%; (2.96kHz square wave/14kHz sine wave modulation).

**Linear Crosstalk:** 90dB below 100% modulation reference (AES3 Input); L+R to L-R or L-R to L+R due to amplitude and phase matching of L&R channels (10Hz-15kHz).

**Non-Linear Crosstalk:** 80dB below 100% modulation reference; L+R to L-R or L-R to L+R due to distortion products.

**Audio Overshoot:** Less than 0.16dB.

**Mono Performance (AES-3 or analog input)**

**Pre-emphasis:** Selectable 0, 25, 50 or 75 microseconds.

**FM Mono Signal-to-Noise Ratio:** 94dB below 100% modulation at 400Hz; measured in a 10Hz to 22kHz bandwidth with 75 $\mu$ s de-emphasis and DIN "A" weighting.

**Amplitude Response:**  $\pm$ 0.05 dB, referenced to selected pre-emphasis curve (no low-pass filter).  
Mono Total Harmonic Distortion: 0.002%\*/0.01% THD, 10Hz to 22kHz bandwidth.

**Mono Intermodulation Distortion:** CCIF: 0.005% (14/15kHz 1:1); SMPTE: 0.005% (60/7000Hz 1:1).

**Mono Transient Intermodulation Distortion (DIM):** 0.005% (2.96kHz square wave/14kHz sine wave).

**Wideband Analog Input Performance**

**FM Signal-to-Noise Ratio:** 94dB below  $\pm$ 75kHz deviation at 400Hz; measured in a 10Hz to 100kHz bandwidth with 75 $\mu$ s de-emphasis; DIN "A" weighting.

**Amplitude Response:**  $\pm$ 0.005 dB 20 Hz to 53 kHz;  $\pm$ 0.03 dB, 53 kHz to 100 kHz.

**Total Harmonic Distortion:** 0.002%\*/0.01% THD over stereo sub band (10Hz to 53kHz) with 75 microsecond de-emphasis.

**Intermodulation Distortion:** CCIF: 0.005% (14/15kHz, ratio 1:1); SMPTE: 0.005% (60/7000Hz, Ratio 1:1).

**Transient Intermodulation Distortion (DIM):** 0.005% (2.96kHz square wave/14kHz sine wave modulation).

**Slew Rate:** 11.8V/us - symmetrical.

**Phase Response Variation:**  $\pm$  0.05° from linear phase, 10Hz to 100kHz.

**Group Delay Variation:**  $\pm$  5ns, 10Hz to 53kHz,  $\pm$  30ns, 53kHz to 100kHz.

**External SCA, RBDS Performance**

**SCA Format:** Externally generated, analog FM subcarriers in the range 53-99kHz.

**SCA sub-band Amplitude Response:**  $\pm$ 0.5dB, 40kHz to 100kHz; high-pass filtered.

**SCA Channel FM Signal-to-Noise Ratio:** 80 dB below +6kHz subcarrier deviation at 400Hz with 150  $\mu$ s de-emphasis.

**Harmonic Distortion:** less than 0.2% in audio pass-band of SCA generator.

**Intermodulation Distortion:** SMPTE (60 and 7000Hz, 1:1): 0.2% or less, no pre/de-emphasis, SCA generator low-pass filter bypassed.

**Crosstalk, SCA to Stereo:** 80 dB below 100% modulation, L or R channel with 75 $\mu$ s de-emphasis.

**Crosstalk, Stereo to SCA:** 80 dB below 100% modulation referenced to  $\pm$ 6kHz deviation and 150 $\mu$ s de-emphasis.

**Crosstalk, SCA to SCA:** 80 dB below 100% modulation (referenced to +6kHz deviation and 150 $\mu$ s de-emphasis per channel).

**Dual Internal SCA Performance**

**Pre-emphasis:** Selectable: 150 $\mu$ s, 75 $\mu$ s, none.

**Amplitude Response:**  $\pm$  0.5dB, 10Hz to 7.5kHz; selectable 4.3kHz or 7.5kHz low-pass filter.

**Subcarrier Frequency:** 57kHz to 99kHz in 1kHz steps.

**Signal-to-Noise Ratio:** 80dB with de-emphasis (150  $\mu$ s), 65 dB without de-emphasis at  $\pm$ 6 kHz deviation.  
Total Harmonic Distortion: 0.1% 10Hz to 5kHz.

**SCA Deviation Capability:**  $\pm$ 1kHz to  $\pm$ 12kHz;  $\pm$ 6kHz default.

**Injection Level:** 2 to 20%, adjustable in 0.1% increments.

**Spurious & Harmonic Performance:** 2<sup>nd</sup> Harmonic: better than 40 dB below sub-carrier; 3<sup>rd</sup> Harmonic: better than 45 dB below sub-carrier; All other components: 50 Hz to 100 kHz: better than 80 dB below subcarrier.

**RBDS Generator Performance**

**Subcarrier Frequency:** 57kHz,  $\pm$  0.09 Hz.

**Injection Level:** 2 to 20% in 0.1% increments.

**HD Radio™ Performance**

Compliant with iBiquity and NRSC 5A standards

**NOTE: Specifications marked with asterisk (\*)** were measured using laboratory digital demodulation techniques for product performance verification. All other specifications were measured to the performance limits of currently available production test equipment.

All specifications referenced to any single output frequency (87-108MHz), nominal rated output power, and 50 ohm, isolated, non-reactive load.

Some analog performance specifications may degrade when using alternate excitors.

Specifications subject to change without notice.

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