Modern FM Transmission Technologies

An Application using Harris’ Flexiva Line of Solid-State FM Amplifiers

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Featuring GatesAir’s Rich Redmond
Chief Product Officer
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Richard Redmond
Vice President Product Management & Strategy
INTRODUCTION

- FM infrastructure needs to meet the needs of today and tomorrow
  - Long useful life
  - Cost effective purchase and operation
  - Support analogue and digital standards
  - Compact footprint

- New FM RF power amplifier technology offering major improvements over what is current available
  - Significantly higher output power density
  - More compact, space efficient transmitters
  - Greater power and cooling efficiency
  - Lower purchase and operating costs
  - Improved RF performance
  - Excellent COFDM performance
Comparison - Purchase Cost versus Power Output of VHF FM+HD Tube and Solid State Transmitters

- Tube Transmitter Cost ($000)
- VMOS Solid State Transmitter Cost ($000)
- LDMOS Solid State Transmitter Cost ($000)
Amplifier power density is the key to reducing both the size of the transmitter and the cost of manufacturing and purchase.

- Contemporary solid-state 10kW FM transmitter designs can achieve about 625 Watts per cubic foot at a cost of around $8.00/Watt in a single 19” rack.
- 50 Volt LDMOS makes possible fewer devices in a more compact and lower cost transmitter package.
- New transmitter systems designed around these higher per-device power levels can now achieve 20 kW in the same 19” rack or around 1250W per cubic foot at a cost of less than $5.00/Watt.
Several LDMOS devices evaluated for the new high-power FM module.

Selection criteria: Power Density, Gain, Efficiency & Robustness, COFDM performance

In addition to DTV transmission use, LDMOS is used in industrial, scientific and medical (ISM) markets such as CO² lasers, plasma generators and magnetic resonance imaging (MRI) scanners

The LDMOS device ultimately selected for incorporation into Harris’ next generation FM module passed all of stress tests and performed flawlessly.
Part of the new highly successful LDMOS Family used in all current TV and DMB products

**New RF Device**
- 50V LDMOSFET
- 1275W / Device
- 82% Efficiency
- 21.5 dB Gain

**New RF Module**
- Conservative
- 1720 Watts
Power Supply Modules

- Over-temperature warning and protection
- Redundant, parallel operation with active load sharing and redundant +5V Aux power
- Remote ON/OFF
- Hot insertion/removal (hot plug)
- Four front panel LED indicators
- UL* Recognized to UL60950-1, CAN/CSA† C22.2 No. 60950-1, and VDE‡ 0805-1 Licensed to IEC60950-1
- CE mark meets 2006/95/EC directive§
- Internally controlled Variable-speed fan
- RoHS 6 compliant

Compact Power Line

CP2725AC54TE High Efficiency Front End PS
Input: 100-120/200-277 Vac; Default Output: ±54 Vdc @ 2725W; 5 Vdc @ 4W

- 2725 Watt Switching Power Supply Modules
- 1 Power supply per dual PA Module
- 96% Efficiency
- Wide operating voltage range
Introducing Flexiva™
A New Family of Air-Cooled FM Transmitter for Worldwide Analog and Digital Standards

Highest efficiency >70% AC > RF
Most Compact – 10 kW in 16 RU
Flexiva™ Value

- **Lowers the Total Cost of Ownership**
  - Highest power density, Watts per dollar of any transmitter available today
  - Most Compact 10,000 Watt transmitter available today, only 16RU - Light weight compact design allows for simple upgrade in space restricted sites, and is ideal for portable/back up use. About half the weight and volume of competitive models. Lower shipping costs
  - Latest in solid-state power amplifier technology provides highest AC-to-RF efficiency approaching 70% 
  - High Efficiency Switch-mode Power Supplies > 96%
  - Use of a common modules simplifies spares stocking

- **Highest Reliability**
  - High level of redundancy in all systems with no single point-of-failure.
  - Hot-pluggable PA modules and power supply from front panel for ease of serviceability.
  - Field Proven variable-speed, DC fans (only 5 Fans in the 10kw)
  - Bullet-proof Hardware Control architecture

- **Feature Rich**
  - Quad-mode operation. Simple upgrade from analog to digital. On the fly switching between FM analog, FM+HD, HD only and DRM+ modes (with the addition of digital exciter)
  - Full remote control and supervision via standard IP interfaces
  - Ability to interface to multiple exciter types Not locked in to special exciter
Flexiva™ Low Power FM

- 2RU x12” Deep
  - FAX 50  75 W
  - FAX 150 165 W

- 3RU x 20” Deep
  - FAX 300 350 W
  - FAX 500 550 W
  - FAX 1K  1,100 W

- 5RU x 20 “ Deep
  - FAX 2K  2,200 W
  - FAX 3K  3,500 W
  - FAX 3.5K 3,850 W
Features

- Integrated direct-to-carrier digital modulator
- Auto-Switching Analog, AES, Composite audio inputs
- Feature-rich Web GUI
- Simple front panel control & status
- HD Radio or DRM+ ready
- Optional internal Orban 5500 Audio Processing
- Optional Audio over IP and USB audio playback
- Optional SFN w GPS, Receiver/Translator
High Power 10 KW

- 16 RU Compact Transmitter
  - FAX 5K  6,200 W
  - FAX 10K 11,000 W
- AC-RF Efficiency > 70%
- Optional Internal Flexiva Exciter
  - Self contained
  - Input for External Exciter
  - Auto switching Main/Alt Exciters
- 10 kW Block - Scalable up to 40kW
High-Power - FAX 20K / FAX 40K

- **FAX 20K**
  - 22,000 W
  - 44 RU
  - 2 x FAX 10K
  - 10kW Power Blocks

- **FAX 40K**
  - 42,000 W
  - 2 x 44 RU
  - 4 x FAX 10K
  - 10kW Power Blocks

- **Flexstar HD Radio™ Exciter**
- **Power Block Control w/ optional FAX300 Exciter**
Summary

- **Look for low Total Cost of Ownership**
  - High efficient RF amplifiers
  - Best in class Power Supplies
  - Compact footprint

- **Require Highest Reliability**
  - High level of redundancy in all systems with no single point-of-failure.
  - Hot-pluggable PA modules and power supply from front panel for ease of serviceability.
  - No PC type controllers

- **Flexibility - “future proof”**
  - Quad-mode operation. Simple upgrade from analog to digital.
  - Full remote control and supervision via standard IP interfaces
  - Ability to interface to multiple exciter types Not locked in to special exciter
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