HARRIS

Digital Radio Solutions

DX

extreme digital... from HARRIS

drm

Quick, easy and cost-effective conversion to DRM

Why DX is DRM-ready

Not all transmitters that are in use today are capable of DRM performance, which requires many individual DRM carriers (up to 450) to accurately transport digital bits over the allocated bandwidth. This is because a transmitter must be able to meet stringent bandwidth, group delay and noise specifications — and also must offer a wide-range output matching networking — to be DRM-capable.

Let's look at how DX transmitters meet these requirements:

DX transmitters are inherently wideband

They provide both the wide RF bandwidth and the wide AF (Audio Frequency) bandwidth essential for digital transmission.

Wide RF Bandwidth: DX transmitters use multiple stages of Class D RF amplifiers for high efficiency. A bandpass filter between each stage converts the square wave into a sine wave for the next stage. By carefully choosing low Q networks, Harris has designed the entire DX RF chain to be extremely wideband, from the external RF input to the RF output.

Wide AF (Audio Frequency) Bandwidth: DX transmitters replace the traditional transmitter modulator with a full 12-bit Analog-to-Digital converter (A/D). The A/D converts the analog input signal to digital at either the carrier frequency rate or 1/2 the carrier frequency rate (depending on the transmitter's operating frequency). Multiple low-power Read-Only-Memory (ROM) ICs (Integrated Circuits) decode the digital signal from the A/D and provide "turn-on/turn-off" signals to multiple RF amplifiers whose output is combined in a series combiner. The DX system of multiple ROMs and RF amplifiers form a high-speed "Digital-to-RF" converter to create the modulated RF output.

Additionally, the DX modulation scheme eliminates the traditional bandwidth-limiting low pass filter (and added group delay) used between the PA and the modulator in a PDM transmitter.

DX transmitters provide low group delay

Using a combination of techniques to achieve wide RF and AF bandwidth, DX transmitters are highly linear. This is the most important characteristic of a transmitter that is well suited for digital broadcasting.

The DRM signal is complex. It contains both amplitude and phase modulation. In order to amplify this signal in a high efficiency AM transmitter, the DRM modulator breaks the DRM signal into two components. One is an amplitude component that is fed into the AF input of the transmitter. The other is a phase modulated RF signal that is fed into the RF input of the transmitter in place of the usual RF source. In order to have a low Bit Error Rate (BER) and a clean occupied bandwidth, the amplitude and phase signals must arrive at the PA at the same time and with the correct amplitude for all frequencies in the total occupied bandwidth. To accomplish this, it is necessary to delay the modulation of the phase modulated RF signal.

Some modulators do not have a constant delay over the complete frequency range, which could make them unsuitable for DRM. However, the modulator in the DX transmitter has very little delay and is essentially constant.

DX transmitters maintain superior SNR performance

Because DX transmitters "turn on" (i.e., send voltages to) well-designed solid-state RF amplifiers in a "thermometer approach" (i.e., RF amplifier #1 is always #1; RF amplifier #2 is always #2, etc.) with sufficient cooling, module rotation is not required to prevent over-dissipation. Superior noise figures are preserved even at low percentages of modulation. This is important because a high SNR can corrupt the digital signal and increase the Bit Error Rate, eventually affecting coverage.

DX transmitters include an exceptional wide-range output matching network

Designed to withstand VSWR conditions that will significantly compromise digital performance, Harris DX transmitters contain a full wide-range "Pi" (shunt capacitor, series inductor, and shunt capacitor) output matching network with variable vacuum capacitors and front-panel tuning and loading.

Converting DX to DRM — it doesn't get much easier!

The world's most popular solid-state MW transmitter family also provides a quick, easy and low-cost migration path to DRM.

If you are operating a Harris DX Transmitter, you've already experienced the efficiency, the reliability and the performance that have made DX the choice of well over 1,000 AM broadcasters worldwide.

But now there's another advantage worth shouting about — the peace of mind that comes with knowing that you'll be able to migrate to high-quality DRM performance quickly, easily and cost-effectively when you are ready.

Harris verified the speed and simplicity of the conversion process at our transmitter factory in Quincy, modifying a typical DX transmitter (in this case, a DX200) and retuning the transmission system. Then we conducted real-time audio tests to hear the results.

The bottom line? You can modify and retune your DX transmitter in only a matter of hours using common hand-tools, and your DX DRM transmitter will deliver superb performance.

What's more, it really doesn't matter whether your DX transmitter was installed last week or many years ago. With DX, you are ready for your future.

Converting DX to DRM — it doesn't get much easier!

A qualified transmitter engineer can make actual modifications to the transmitter in less than an hour — most likely in between 15 to 30 minutes. Including preparation and checks, the entire conversion process can be completed in about five hours.

The Simple Seven-Step Process

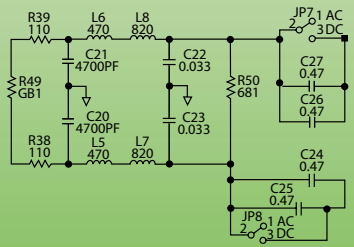
Step #1: Remove the Analog Input Board from the Transmitter

The Process:

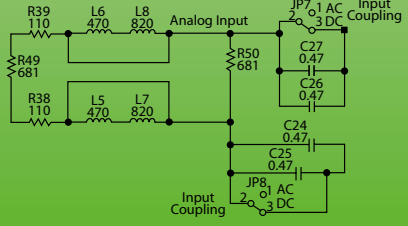
- Locate the Analog Input Board
- Remove the interconnecting cables
- Remove screws from the support standoffs

Step #2: Bypass the Modified Bessel Filter

Analog Input Board Modifications:



The Modified Analog Input Board:



The Principle:

The Analog Input Board provides analog signal input filtering, DC (carrier) power level control, and dither. For digital broadcasting, the modified Bessel filter must be bypassed. The transmitter is jumpered for DC coupled input since the exciter controls the DC (carrier power level) input.

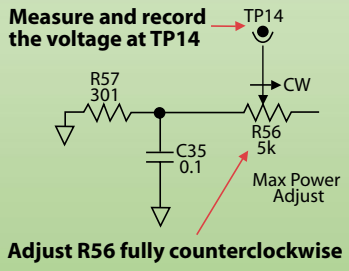
The Process:

- Place the board on the bench and check the transmitter schematic to identify the parts to change.
- Find the parts on the circuit board, and verify the parts to remove.
- Un-solder the parts from the circuit board, and replace them with the identified parts.
- Solder the new components into the circuit board and verify the correct components are in place.

Step #3: Remount the Analog Input Board

- Remount the Analog Input Board and prepare to set up the DC Control Level and the Dither Level

Step #4: Adjust the transmitter for DRM modulator DC control



The Principle:

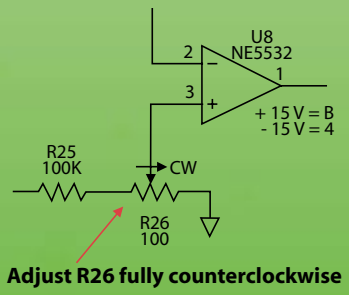
Since the exciter provides the DC input that controls carrier power, the DC level normally supplied by the Analog Input Board must be reduced.

The Process:

Voltage at TP14 is measured with a voltmeter and recorded because the test point will need to be reset if the transmitter is returned to analog mode.

- Voltage at TP14 is minimized by adjusting R56 fully counterclockwise.

Step #5: Remove 72kHz dither to improve spectral performance



The Principle:

A small amount of a 72kHz "dither" triangle wave is added to the modulated audio signal for normal analog operation. To meet DRM spectrum requirements, this signal must be removed.

The Process:

- Adjust R26 fully clockwise to minimize the dither signal. This completes Analog Input Board Modifications.

Step #6: Provide the DRM signal to the transmitter

There are two ways to provide the modulated DRM signal to the transmitter:

1. Installing the DRM modulator board in the transmitter:

The DRM modulator board is mounted in place of the oscillator board. The DRM modulator board serves as the RF source for the transmitter and provides OFDM modulation of the transmitter with the DRM signal.

– or –

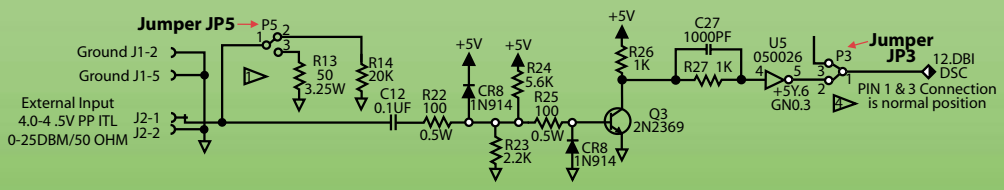
2. Connecting the external DRM modulator to the transmitter:

The Principle:

The oscillator board, which normally provides the carrier frequency signal used by the transmitter, is replaced by the DRM modulator, which is connected to the external RF input on the oscillator board.

The Process:

- Move jumper P3 from 1-3 (internal oscillator) to 1-2 to select the external RF input.
- Jumper P3 can be used to provide a 50-Ohm (or higher) resistance load for the DRM modulator output.



Step #7: Final transmitter setup

With the DRM signal now available, the DX transmitter is now ready for final set-up and retuning.

Harris Corporation, Broadcast Communications Division: Leading the world in end-to-end systems for digital broadcasting

Since its foundation in 1922, Harris Corporation's Broadcast Communications Division has set the pace in the development of world-standard products and in enabling technologies for broadcasting. Over the years, Harris has introduced more than 70 major innovations — including many world standards that have literally changed the way in which our world sees and hears itself.

Today, Harris is at the forefront of broadcasting's transition from analogue to digital technology. Through its ITIS operation in Rennes, France, Harris is leading the industry in the development of advanced modulation, encoding products and technologies for DAB digital radio and DVB digital television.

In addition, the acquisition of the Hirschmann broadcast business in 2001 significantly expanded the Harris transmitter line with DAB, DVB-T and analogue TV transmitter systems as well as cable headend systems. These leadership products enjoy strong market positions — for instance, Hirschmann DAB transmitters are used by well over 60 percent of all DAB broadcasters.

Now, with the technology foundation and products from ITIS, Hirschmann, and its own product development, Harris offers a complete range of transmission systems for DAB and DVB-T, as well as AM, FM and analogue TV. Already established as the leader in analogue and U.S.-standard digital transmitters, Harris also offers cable headend systems, automation control and management systems, studio products, integrated systems and network-level broadcast management systems. Harris serves broadcasters in more than 125 countries.

ISO 9001

Specifications are subject to change. For a complete listing of the most current specifications, please visit our Website at ***www.broadcast.harris.com****.*

HARRIS

Broadcast Communications Division | 4393 Digital Way | Mason, OH USA 45040
phone: +1 513-459-3400 | email: broadcast@harris.com | **www.broadcast.harris.com**

Printed in USA on Recyclable Paper HMC 15383 PP ADV. 1203 8/03