

# TwinStream

## Dual Carrier Analog/Digital Microwave System



### Applications

- Single and Dual-Carrier Applications, including Analog and Digital Modems
- Studio-to-Transmitter Links and Transmitter-to-Studio Links
- Satellite Backhauls
- Analog plus Digital News Gathering Backhauls
- Cable Headend Feeds

### Features

- Dual-carrier: NTSC analog plus ATSC digital
- Support of channel plans from 10 to 28 MHz
- Architecture supports FCC and ITU channel plans from 1.9 to 15.4 GHz
- Proprietary implementation of MRC's extremely stable, low-noise YiG oscillator technology
- RF amplifiers and power supplies for each RF carrier
- Built-in diagnostics through front panel controls and display
- Separate power supplies and power amplifiers for each carrier
- Choice of single-oscillator (Series 1) or dual-oscillator (Series 2) versions

### Overview

TwinStream was first introduced in 1998 as the dual carrier solution for transporting legacy NTSC format combined with digital ATSC for DTV. Since then, its the overwhelming choice of broadcasters with over 1000 installations worldwide.

The analog side of the radio is NTSC and PAL compatible with four audio subcarriers available. Each audio subcarrier is a fully synthesized frequency agile channel allowing for future re-tuning of the audio frequencies.

The digital side of the shelf uses the MRC QM2 ATSC (19.39 Mbps) Modulator and Demodulator. The QM2 can be ordered in either the external rack version (1RU), or as a plug-in module.

The TwinStream supports non-protected, hot standby, or receive diversity configurations. The MRC Hot Standby Shelf is used for standard hot standby for analog and digital configurations. For "errorless" switching on the digital side, order the MRC Hot Standby Diversity Shelf.

To maximize your investment, TwinStream offers several upgrade paths. The analog side of the shelf can be upgraded to a digital carrier, or convert the radio into single carrier. In the single carrier configuration, MRC's Variable Rate Modem offers a diverse choice of transport options.

### Single or Dual Oscillator

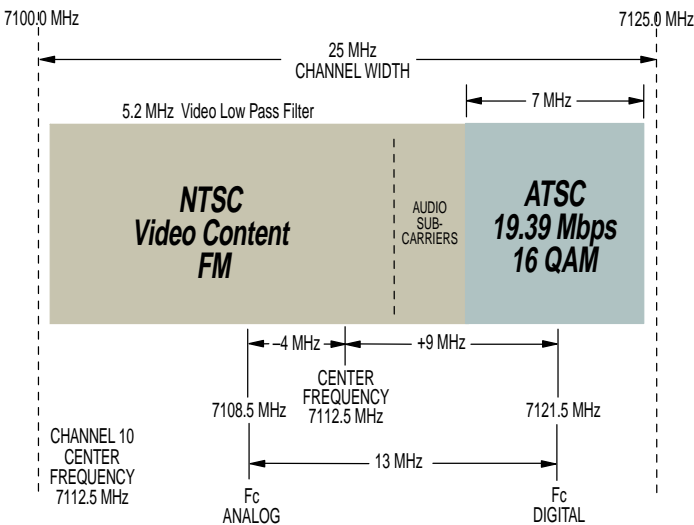
Both the TwinStream Transmitter and Receiver are offered in single or dual oscillator configurations. The dual oscillator version offers an added protection from losing signal on either the analog or digital path.

The transmitter uses the MRC QM2 Digital Modulator (19.39 Mbps), and an FM NTSC modulator that each produces a separate 70MHz IF outputs. The digital path uses an IF translator (TS1 only) which offsets the IF frequency by 13 MHz. A low side local oscillator feeds both RF upconverters for proper channel frequency translation. The RF output of each upconverter is used to drive two independent amplifiers, digital (linear operation), analog (compressed operation) which correlates to a 6 dB difference.

In the receiver, the incoming RF signal uses a low noise downconverter module to produce two IF outputs, one digital IF at 83 MHz and one analog IF at 70 MHz. A low side local oscillator is used to drive the downconversion process and supply the appropriate offset IF frequency. Two IF demodulators are used, one for NTSC video demodulation and another for the ATSC (19.39 Mbps) data stream. The ATSC demodulator provides the necessary synchronous serial interfaces to meet SMPTE 310 M input for the HDTV 8-VSB modulator.

### Spectrum Efficiency

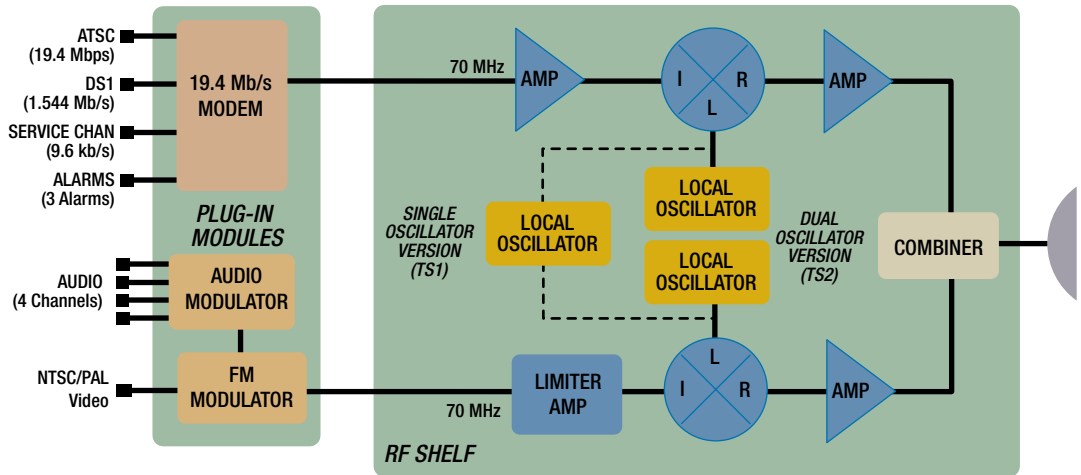
The following RF spectrum diagram shows the benefits of efficiently utilizing the spectrum to best maintain the original NTSC signal content thus allowing the co-existence of both analog and digital signals.



TwinStream Channel Spectrum

### High Power Options

High-power amplifiers are available in many frequency bands. These amplifiers are mounted internally and powered from the standard transmitter power supply. These GaAs FET amplifiers use microstrip transmission line techniques to provide broadband high-power outputs.

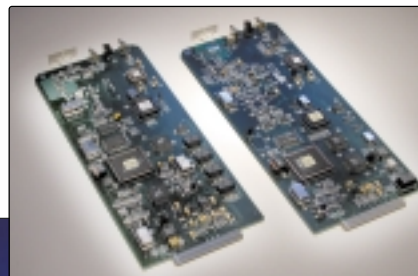


TwinStream Transmitter System Diagram  
TwinStream 1 (TS1) Single Oscillator Version and TwinStream 2 (TS2) Dual Oscillator Version

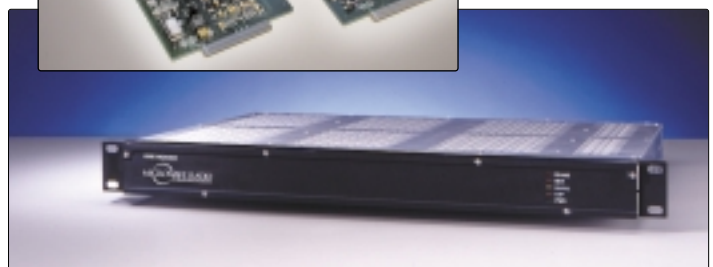
### ATSC DTV Transport

MRC offers the QM2 Modulator and Demodulator with 19.39 Mbps ATSC data stream with SMPTE 310M interface in both internal Plug-in or Rack mounted versions. The QM2 rack mounted version is offered in option DVB-ASI format. The QM2 uses 16QAM modulation with Reed Solomon (204/188) Forward Error Correction with depth 12 interleaving. In addition, QM2 provides a 1.544 Mbps DS1 data channel, with G.703 interface,

The QM2 Demodulator utilizes Adaptive Equalization using fractionally spaced, feed-forward and decision feedback algorithms to minimize degrading effects of multipath fades.



QM2 Modem in Plug-in and Rack Mounted Versions

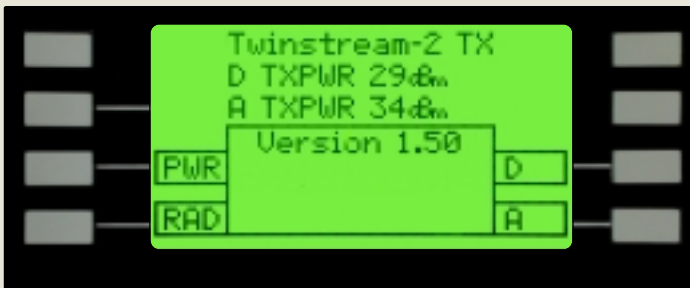
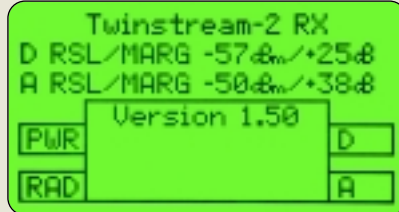


### Front Panel Controls and Display

The TwinStream Menu System provides full control over all radio functions. The TwinStream menus provide easy access to all radio functions and settings. See the Transmitter and Receiver Menu configurations on this page.

The display screen reports all active system levels. Alarms are displayed along with the system module menu affected.

*TwinStream Front Panel Active Displays (Transmitter & Receiver)*



### Transmitter Menu Configurations

Setup and Configuration	Transmitter/Receiver Select, Analog/Digital Power Level
Main Menu	Output Power (dBm)
Power Supply (+15,-15,+5 Vdc)	Current, minimum, and maximum voltage levels
Radio menu	Current, Minimum, and Maximum readings for: Threshold, Phase Lock Loop, Transmit power (dBm)
Analog Alarm	FMT Phase Lock Loop, Sub-Carrier Status, Carrier Insert Status
Digital Modem Status (Internal)	All 1s Inserted, Carrier Level, Phase Lock Loop Status, Loss of Signal Status, T1/All 1s Inserted Status ,T1/Loss of Signal Status
Digital Modem Status (External)	Summary Alarm

### Receiver Menu Features

Setup and Configuration	Transmitter/Receiver Select, Analog/Digital Threshold, Analog/Digital, Receive Carrier Level
Main Menu	Receive Signal Level, Fade Margin, Scrolling Alarm Window
Power Supply (+15,-15,+5 Vdc)	Current, minimum, and maximum voltage levels
Radio menu	Current, minimum, and maximum readings for: Phase Lock Loop Status, Receive Signal Level (Current, minimum, and maximum), Fade Margin
Analog Channel	Sub Carrier Status IF Squelch Status
Digital Modem Status (Internal)	IF Level, Synchronization, Phase Lock Loop, Bit Error Rate, T1 Status
Digital Modem Status (External)	Summary Alarm

### Variable Rate Multiplexing

The MRC Variable Rate Modem (VRM) provides a flexible solution for current and future requirements. Rated at a carrier load of 200 Mbps, the VRM can multiplex four separate IF channels:

- DS3, E3, STS-1
- DVB-ASI
- RS422 Parallel, DVB-SPI Parallel, M2P
- LVDS Parallel, DVB-SPE Parallel, M2P
- T1/E1 Wayside
- SMPTE 310M
- Adaptive Equalizer

The VRM can be configured for 4, 16, 32, 64, or 128 QAM modulation with these additional options:

- Reed Solomon Forward Error Correction
- Space Diversity Option
- Remote Control from Network or Serial Interface



*MRC Variable Rate Modem*

### Upgrade Options

TwinStream offers the following upgrade options:

- Digital to Dual Carrier Digital/Digital: (20/20 Mbps or 20/45 Mbps or NTSC/45 Mbps or PAL/45 Mbps)
- Convert Dual Carrier to Single Carrier High Capacity (Up to 90 Mbps)
- Single Carrier to Dual Carrier

*TwinStream Single and Dual Carrier Configurations*

	Single Carrier			Dual Carrier					
	NTSC / PAL Analog only	Digital Only (QM2 External Modem )	Digital Only (QM2 Plug-in Modem)	Digital Only VAR Modem (External)	Analog/Digital (QM2 External Modem)	Analog/Digital (QM2 Plug-in Modem)	Dual Digital QM2 Plug-In & QM2 External)	Dual Digital QM2 Plug-In & MRC VAR	Dual Digital QM2 External & MRC VAR
Analog Audio/Video Modulator (NTSC/PAL)	•				•	•			
QM2 ATSC Modem – External (1RU)		•				•	•		•
QM2 ATSC Modem – (Plug-In)			•		•		•	•	
Variable Rate Modem (20–90 Mbps) Single Carrier 20–90 Mbps Dual Carrier 20–45 Mbps				•				•	•

