

TwinStream

Dual Carrier Analog/Digital Microwave System



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, it's 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.

Several modem options are available:

- MRC QV2 19.39 Mbps SMPTE 310M J or fixed data rate ASI PLug-in Modem Module.
- SCM4000 Single Carrier Modem
- VRM Variable Rate Modem

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.

Applications

- Single and Dual-Carrier Applications, including Analog and Digital Modems
- Studio-to-Transmitter Links and Transmitter-to-Studio Links
- Satellite Backhails
- Analog plus Digital News Gathering Backhails
- 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
- Choice of single-oscillator (Series 1) or dual-oscillator (Series 2) versions

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 QV2 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.

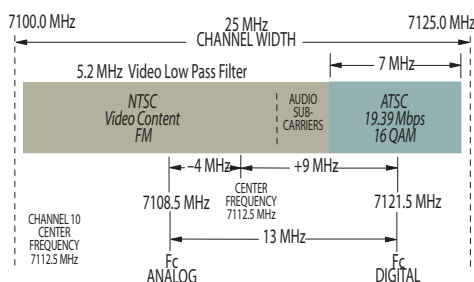
In the receiver, the incoming RF signal uses a low noise downconverter module to produce two IF outputs, one digital IF at 83 MHz and one analog IF at 70 MHz. A low side local oscillator is used to drive the downconversion process and supply the appropriate offset IF frequency. Two IF demodulators are 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.

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 Channel Spectrum

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

QV2 Modem

The QV2 offers maximum interface flexibility for data transport requirement up to 19.39 Mbps. It allows the User to select either SMPTE 310M, fixed data rate ASI, or variable data rate ASI connections by selecting jumper settings on the modem cards. Further, the QV2 also helps to reduce jitter that accumulates in SMPTE-310M transport systems.

In the variable data rate mode, the QV2 will detect any data rate between 4.9 Mbps and 19.39 Mbps and automatically adjust to accommodate that data rate. The QV2 provides an embedded T-1 or E-1 data channel that can be multiplex for ancillary data services. In addition, a 9.6 Kbps RS232 asynchronous wayside service channel is a standard feature.

The QV2 modems are a 3 RU card that slide-in to DAR Plus and TwinStream radios and



QV2 Modem Plug-in Module

interconnect at a 70 MHz IF level. The compact, space efficient design makes them an ideal upgrade option to SMPTE 310M only QM2 modems.

QV2 demodulator modems include adaptive equalization circuitry to help minimize the effects of frequency selective multipath fading commonly associated with terrestrial digital microwave systems. This circuitry also helps to compensate for antenna or waveguide deficiencies that may exist in older systems.

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:

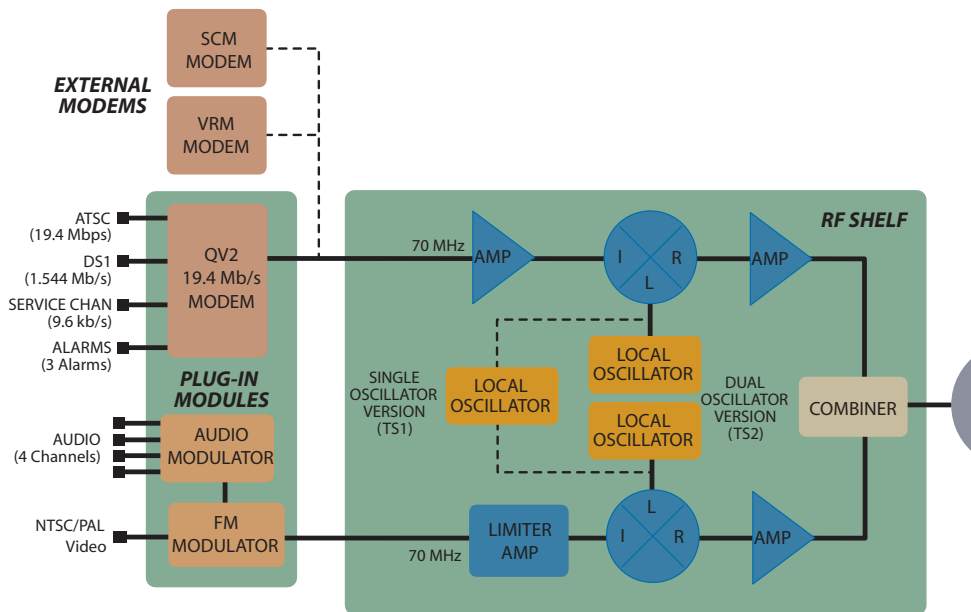
- DS3, E3, STS-1
- DVB-ASI
- RS422 Parallel, DVB-SPI Parallel, M2P
- LVDS Parallel, DVB-SPE Parallel, M2P
- T1/E1 Wayside
- SMPTE 310M
- Adaptive Equalizer

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



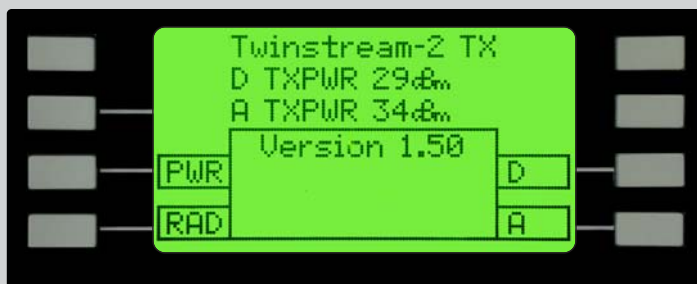
TwinStream Transmitter System Diagram
TwinStream 1 (TS1) Single Oscillator Version and TwinStream 2 (TS2) Dual Oscillator Version

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

SCM4000

The SCM4000 is a robust, variable rate, single carrier modem that provides a variety of modulation and data rate settings to allow aggregate data rates up to 105 Mbps. The choice of a single carrier system provides a simple, flexible architecture that allows a greater variety of interface options, with no sacrifice in performance at the supported data rates.

As an modulator/encoder, the SCM4000 accepts a wide variety of inputs and multiplexes up to four of them into the output stream.

As a demodulator/decoder, the SCM4000 recovers the individual streams and connects them to the selected interface connectors.

The SCM4000 can be configured for simplex, duplex, or diversity applications. The figure below shows a typical simplex

Features

- Single carrier for optimizing data rate and spectrum efficiency for use in 25 or 12 MHz bandwidths
- Data rates up to 105 Mbps
- Adaptive Modulation Formats
- PRBS/BER & S/N
- Flexible system design using building block modules:
 - IF Modulator / Demodulator
 - MPEG Encoder / Decoder
- Simplex, Duplex, and Diversity applications
- Seamless integration with MRC's heterodyne radio
- Four individual programmable channels supporting the following interfaces:
 - T1
 - E1
 - DS3
 - E3
 - DVB-ASI SMPTE310M
 - RS-232
 - RS-485
 - 10/100Base-T

Modulator / Demodulator Module

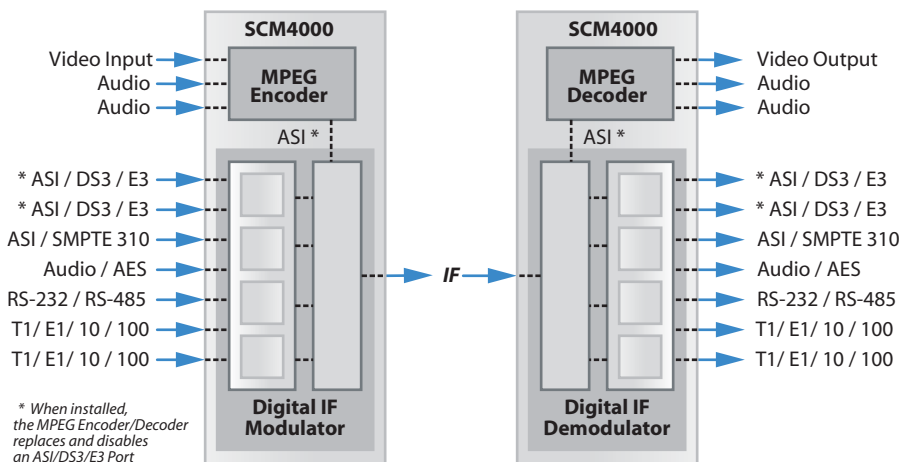
- DS3/ASI (2 ports)
- SMPTE310M/ASI
- T1, E1, 10/100 Base-T
- RS-232
- Summary Alarm

MPEG Encoder / Decoder Module

- Video
- Analog Audio
- AES/EBU Audio



SCM4000 Single Carrier Modem



GENERAL

Standard Frequency Bands,
 TwinStream 68:..... 6.8 to 7.1 GHz
 TwinStream 127:..... 12.7 to 13.2 GHz
 RF Carriers, One analog: approximately 15 MHz wide
 One digital:..... approximately 7.5 MHz wide

TRANSPORT CAPACITY

Carrier #1, Analog:
 525 line video (NTSC) or 625 line video (PAL)
4 FM subcarriers (normally, audio)
 Optional Carrier #1: Analog IF input containing
 525 line video, Plus 2 FM subcarriers,
 not to exceed 6.8 MHz bandwidth
 with input return loss of 26 dB min
 Carrier #2, Digital:
 19.39 Mbps ATSC transport stream
 1.544 Mbps DS1 data channel 9.6 kbps
 asynchronous service channel (plus three alarm
 inputs for the transmitter and four NC/NO relay
 contact closures for the receiver)

Note: The above is one example of many available system configurations.

TRANSMITTER

Type... Single conversion at microwave, both carriers
 IF upconversion, proprietary
 Local Oscillators:..... Ultra-low phase noise,
 phase-locked sources
 Frequency Stability:..... ±0.0005%, both carriers
 Power Output: See Operating Specifications Summary

RECEIVER

Type... Single conversion at microwave, both carriers
 IF downconversion, proprietary
 Local Oscillators:..... Ultra-low phase noise,
 phase-locked sources
 Noise Figure: 3.5 dB max
 IF Bandwidth: 15 MHz Analog, 10 MHz Digital
 Threshold:..... See Operating Specifications Summary

ANALOG CHANNEL, VIDEO PERFORMANCE

(Internal FM modulator and demodulator)
 Deviation: 8 MHz P-P
 Video Signal/Noise:..... 67 dB min
 Video Signal/Hum:..... 60 dB min
 Frequency Response:.. ±0.25 dB, 10 kHz to 4.5 MHz
 ±0.75 dB, 4.5 to 7.5 MHz
 Field Tilt: 3 IRE max
 Line Tilt: 0.5 IRE max
 Differential Phase: ±0.75° max
 Differential Gain: 3% max

ANALOG CHANNEL, AUDIO PERFORMANCE

(Internal FM modulator and demodulator)
 Capacity: 4 FM subcarriers up to 7.5 MHz max
 Frequency Response: ±1.0 dB, 40 Hz to 12 kHz
 -1.5 dB, 12 to 15 kHz
 Audio Signal/Noise: 66 dB min
 Distortion:..... 1% max
 Input/Output Levels:..... 0 to +9 dBm, adjustable
 Input/Output Impedance:..... 600 Ω

DIGITAL SPECIFICATIONS

Digital Video Channel
 Data Rate:..... 19.39 Mbps (ATSC transport stream)
 Interface: SMPTE 310M, typical
 Wayside Data Channel
 Data Rate (DS1):..... 1.544 Mbps
 Interface:..... G.703
 Asynchronous Service Channel
 Data Rate: 9.6 kbps
 Interface: RS-232
 Modulation: 16 QAM
 FEC: Reed-Solomon (204/188)
 and depth 12 interleaving

ELECTRICAL

Power Consumption
 Transmitter, unprotected terminal: ... 75 Watts typical
 Receiver, unprotected terminal: 55 Watts typical
 Power Supply Voltages:..... 110/240 Vac

ENVIRONMENTAL

Operating Temperature Range:..... 0° to +50°C
 Relative Humidity: 0 to 95%, non condensing

PHYSICAL

Height: 3 rack units: 5.25" (13.34 cm)
 Depth: 15.0" (38.1 cm)
 Weight:..... 22 lbs (10 kg)

INTERCONNECTIONS

RF
 6.8 to 7.1 GHz:..... WR137
 12.7 to 13.2 GHz: WR75
 Video:..... 75 Ω coax, female
 Baseband: 75 Ω coax, female
 Audio: 600 Ω barrier strip with screw terminals
 ATSC Data:..... 75 Ω coax, female
 Wayside DS1: DB9, female
 Service Channel:..... DB9, female
 Transmitter & receiver specifications
 Notes:
 1. HP = High Power Model

TRANSMITTER & RECEIVER SPECIFICATIONS

Frequency	Transmitter		Receiver	
	Analog Standard/HP (Note 1)	Digital Standard/HP (Note 1)	Analog	Digital
6.8 to 7.1 GHz	+33/+37 dBm	+27/+31 dBm	-86 dBm 37 dBm S/N	-83 dBm @ 1x10 ⁻⁶ BER
12.7 to 13.2 GHz	+30/+33 dBm	+24/+27 dBm	-86 dBm 37 dBm S/N	-83 dBm @ 1x10 ⁻⁶ BER

Notes:

1. HP = High Power Model



Microwave Radio Communications
 101 Billerica Avenue, Building #6
 North Billerica, MA USA 01862-1256
 Tel: +1.978.671.5700
 Fax: +1.978.671.5800
 e-mail: info@mrcbroadcast.com



www.mrcbroadcast.com