DAR Plus

Analog or Digital Microwave System

Applications

- Studio-to-Transmitter Links and Transmitter-to-Studio Links
- Satellite backhauls
- Analog news gathering backhauls
  Intercity Relays (ICR)
- Cable Headend Feeds
- Multi-Hop Networks

Features

- High Capacity up to 120 Mbps
- Architecture supports FCC and ITU channel plans from 1.9 to 15.4 GHz
- Proprietary implementation of MRC Broadcast's extremely stable, low-noise YiG oscillator technology
- Built-in diagnostics through front panel controls and display
- Analog or digital-ready
- AC or DC Versions

Options

- Analog: FMT/FMR 70 MHz, IF, 4 audio subcarriers, high-power output options
- Digital: Internal or external modem QM2 19.39 Mbps modulator/demodulator. Variable Rate Modem modulator/demodulator for data rates of 20 to 120 Mbps

Overview

The DAR Plus radio is a versatile solution for carrying conventional video and audio, or a digital transport with rates up to 120 Mbps. The DAR Plus is field switchable between analog to digital requiring only to change a few switch settings in the RF shelf, and is easily reconfigured using the DAR Plus Menu System. The DAR Plus Menu System provides full control of the radio with alarm reporting and status.

The DAR Plus provides both video and audio modulation for NTSC and PAL formats with four audio channels. The analog video and audio components are all contained on two plug-in modules for easy swap out and service.

Perhaps DAR Plus's greatest feature is the variety of digital transport options. The radio can be configured for ATSC using MRC's QM2 internal or external modems. When used with MRC's Variable Rate Modem, four user selectable IF carriers can can multiplexed into one datastream with data rates up to 120 Mbps.

To protect your signal path. DAR Plus can be configured for hot standby on both the transmit and receive ends. In addition, the MRC Hot Standby Diversity Shelf provides "errorless" switching on the receive end for maintaining data integrity.

MICROWAVE RADIO COMMUNICATIONS

Analog NTSC/PAL Modulation

70 MHz FM Modulator (FMT): The 70 MHz FM Modulator provides a full-performance video/baseband interface, with three possible inputs. The video-in can be lowpass filtered before modulation. The baseband input is wideband (15 MHz) for composite signal insertion. The subcarrier input allows the independent insertion of subcarriers carrying alarm, telephone and orderwire information.

Audio Subcarrier Modulators: When the FMT is ordered, a 4-channel audio motherboard can be installed as a slide-in board within the DAR chassis. The motherboard can accommodate up to 4 optional audio subcarrier generators. Each generator features a 600 ohm balanced audio input and a selection of subcarrier frequencies at either 75 or 50 microsecond pre-emphasis (Figure 1).

Baseband Demodulator (FMR): The second 70 MHz signal from the IF module is routed through an independent group delay equalizer to the optional baseband demodulator. The demodulator contains the limiter-discriminator, de-emphasis, video amplifier and provides two baseband outputs (one squelched and one unsquelched) and a squelched video output. This configuration is commonly referred to as a heterodyne receiver with baseband drop or a remodulating receiver (Figure 1).

Audio Subcarrier Demodulators: A 4-channel audio motherboard can be installed as a slide-in board within the receiver chassis. The motherboard can accommodate up to 4 optional audio subcarrier demodulators. Each demodulator features a 600 ohm balanced audio output and a selection of subcarrier frequencies at either 75 or 50 microsecond pre-emphasis.

Analog Options

PAC-10/PAC-12 Audio Subcarrier System: The PAC-10/PAC-12 system inserts additional FM audio subcarriers above the video channel. In addition to transmitting and receiving program audio sources, it can carry telephone channels, engineering orderwire, remote control and alarm signals. Each single-rack unit chassis can accommodate up to four subcarriers.

DigiPro™ Digital Audio System: The DigiPro System conveys high-quality program material over video microwave radios. The DigiPro Encoder and DigiPro Decoder comprise a digital audio codec (coder/decoder) which converts audio material into a shaped digital signal suitable for transmission over the PAC-10WB wideband subcarrier modulator and PAC-12WB wideband subcarrier demodulator. The complete DigiPro System is supplied with the Encoder, Decoder, PAC-10WB and PAC-12WB; it can be configured for two program audio channels, or left and right discrete stereo channels and one data channel.

The DataQ Modem adds E1/T1 capability above the video signal. This features lets you multiplex engineering orderwire, alarm and status monitoring with up to 24 FDM telephony channels. (Figure 3)

Backup Protection

The MRC Hot Standby Shelf provides complete redundancy for the system for one to three analog audio/video channels. MRC also offers baseband and IF space diversity protection with the DS-2 IF Diversity Switch.

For “errorless” switching, the MRC Diversity Shelf provides an uninterupted datastream for digital ATSC paths.

Figure 1: Internal Analog Audio & Video Modulation

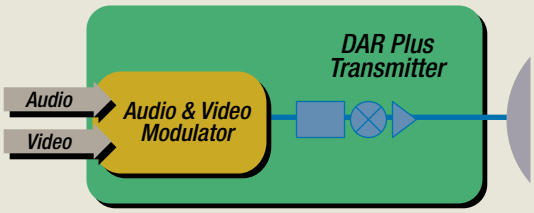


Figure 2: ATSC Internal or External Modem Options

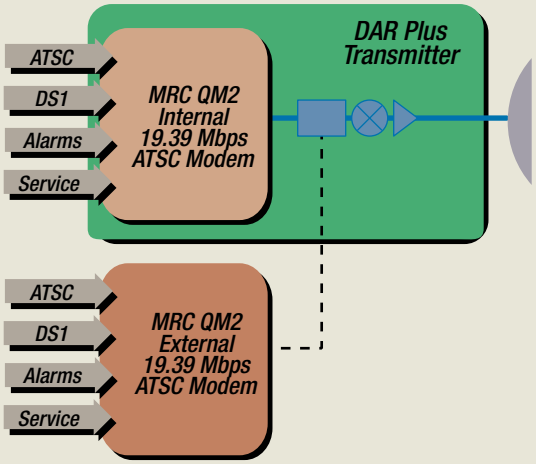


Figure 3: E1/T1 with DataQ Modem

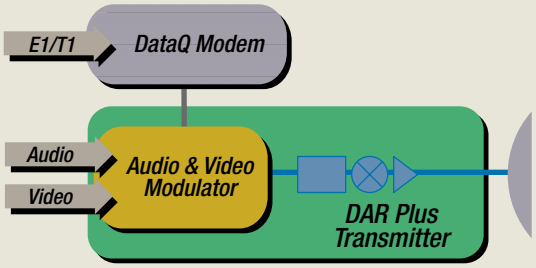
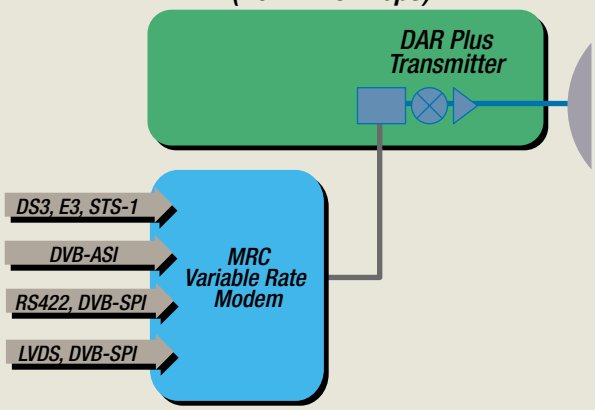


Figure 4: MRC Variable Rate Modem Options (20 – 120 Mbps)



High Power Options

High-Power Amplifier: 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.

ATSC DTV Transport

For the DTV transition, use the DAR Plus radio as a single carrier solution to transport ATSC digital data. MRC offer the QM2 Modulator and QM2 Demodulator in external 1 Rack Unit, or as a plug-in internal version. The plug-in version is easily accessed from the front panel (Figure 2).

QM2 External Modulator/Demodulator

Variable Rate Multiplexing

The MRC Variable Rate Modem (Figure 4) provides a flexible solution for current and future requirements. Rated at a carrier load of 120 Mbps, the VRM can multiplex four data 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
- Reed Solomon Forward Error Correction

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

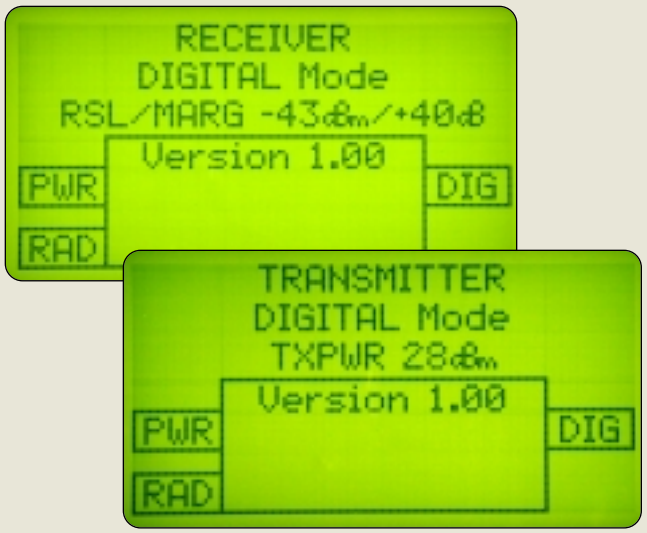
- Adaptive Equalizer
- Space Diversity Option
- Remote Control from Network or Serial Interface

DAR Plus & Variable Rate Modem

Front Panel Controls and Display

The DAR Plus Menu System provides full control over all radio functions. Setup menus allow easy transition of the radio between analog and digital operation. System parameters are set using the Learn menus.

Modulator menus auto detect installation of internal or external modulators or demodulators. Alarms are displayed on the Main Menu and the system module affected.



DAR Plus Front Panel Display (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, Pilot Status
Digital Modem Status (Internal)	IF Level, Synchronization, Phase Lock Loop, Bit Error Rate, T1 Status
Digital Modem Status (External)	Summary Alarm

SPECIFICATIONS

GENERAL
Standard Frequency Bands:.....6.8 to 7.1 GHz, 12.7 to 13.2 GHz
Optional Frequency Bands:.....Contact MRC for information on other bands from 1.99 to 15.4 GHz
Capacity, Analog: .....525 or 625 line video, up to 4 audio channels pilot carrier or video signal plus data above video
Capacity, Digital: .....70 MHz modem interface

TRANSMITTER
Type:.....Single conversion
Local Oscillators: .....Ultra-low phase noise, phase-locked sources
Frequency Stability: .....±0.0005%
Power Output:.....See Operating Specifications Summary

RECEIVER
Type:.....Single conversion
Local Oscillators: .....Ultra-low phase noise, phase-locked sources
Noise Figure:.....See Specifications Summary
IF Bandwidth:.....30 MHz
Threshold: .....See Operating Specifications Summary

VIDEO PERFORMANCE (OPTIONAL FMT)
(Back-to-Back with CCIR Emphasis)

FREQUENCY RESPONSE
10 kHz to 4.5 MHz (525 line):.....±0.25 dB
10 kHz to 5.0 MHz (625 line):.....±0.25 dB
5 MHz to 8 MHz (Baseband Output): .....±0.5 dB
Field Tilt: .....3 IRE max
Line Tilt: .....0.5 IRE max
Baseband Chroma Delay: .....±20 nS max
Baseband Chroma Gain:.....±2 IRE max
Differential Phase: .....±0.5° max
Differential Gain:.....2% max
Signal-to-Noise Ratio: .....Meets or exceeds RS-250C; 67 dB (See Analog Specifications Summary)
Signal-to-Hum (p-p/RMS): .....60 dB min
Video Input Level: .....1 Vp-p
Video Input Return Loss: .....+26 dB min, reference to 75 Ω

ANALOG RADIO PERFORMANCE
Signal to Noise: .....Meets or exceeds RS-250C; 67 dB
Signal to Hum: .....60 dB min
Signal to Discrete Tones: .....65 dB min
Differential Gain:.....1% max
Differential Phase:.....±0.2° max
Note: .One-hop, 525 or 625 line video per CCIR; -40 dBm receiver carrier level; excludes modem.

DIGITAL SPECIFICATIONS (OPTIONAL QM2 MODEM)
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)

INTERCONNECTION
RF Connections
1.71 to 4.90 GHz:.....Type "N" female connector
5.925 to 7.125 GHz:.....Type WR137; CPR @ top of rack
7.10 to 8.50 GHz:.....Type WR112; CPR @ top of rack
10.70 to 13.25 GHz.....Type WR75
14.4 to 15.35 GHz:.....Type WR62
IF/Baseband Connectors: .....BNC

POWER, AUDIO & ALARM CONNECTIONS:
Audio.....Barrier strip, screw terminals
Network Management Control:.....9-pin D connector

DIGITAL Specifications Summary

Model	Frequency Range (GHz)	TX	RX		
		Output Power (dBm) (Note 1)	Noise Figure (dB) (Note 2)	BER3 (10^{-6}) (dBm) (Note 3)	System Gain (dB) (Note 2)
DAR 2	1.7 to 2.7	+31	2.5	–85	117
DAR 4	3.3 to 4.9	+28	3.5	–84	113
DAR 6	5.9 to 7.1	+28	3.5	–85	113
DAR 6HP	5.9 to 7.1	+31	3.5	–85	116
DAR 7	7.1 to 8.5	+26	3.5	–84	109
DAR 7HP	7.1 to 8.5	+29	3.5	–84	112
DAR 12	10.5 to 13.2	+24	4.0	–84	108
DAR 12HP	10.5 to 13.2	+27	4.0	–84	111

Analog Specifications Summary

Model	Frequency Range (GHz)	TX	RX			
		Output Power (dBm) (Note 1)	Noise Figure (dB) (Note 2)	Thresh-hold (dBm) (Note 3)	System Gain (dB) (Note 2)	Signal/ Noise (dBm) (Note 3)
DAR 2	1.7 to 2.7	+37	2.5	–88	123	–75
DAR 4	3.3 to 4.9	+33	3.5	–84	118	–73
DAR 6	5.9 to 7.1	+33	3.5	–85	118	–73
DAR 6HP	5.9 to 7.1	+37	3.5	–85	122	–73
DAR 7	7.1 to 8.5	+30	3.5	–84	115	–73
DAR 7HP	7.1 to 8.5	+34	3.5	–84	119	–70
DAR 12	10.5 to 13.2	+30	4.0	–84	114	–70
DAR 12HP	10.5 to 13.2	+33	4.0	–84	117	–70
DAR 15	14.4 to 15.35	+30	4.0	–84	114	–70

Notes:
1 Transmitter output values calculated prior to branching. Digital operation assumes 3 dB back-off QPSK, 6dB @ 16QAM
2 Does not include branching filter.
3 For one-hop, NTSC video; EIA/CCIR weighting.
4 Contact factory for other modulation power output
5 "HP" suffix indicates high power option.

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