Overview

The DAR Digital-Analog Microwave Radio System is designed to provide a cost effective, highly reliable, microwave link for long and medium haul applications, including: STL and TSL, multi-hop and multi-channel broadcast, CATV, SDTV and ATV video system networks.

The DAR radios are designed to provide broadcast quality video transmission and will accept compressed digital video modulation or analog composite modulation formats when equipped with appropriate modems. The equipment can be configured as either a simplex or a duplex system. Protection options, such as hot standby including space and frequency diversity, are also available. A high-power “HP” option is available for additional fade margin protection.

The transmitter and receiver incorporate a phase stabilized microwave source which is capable of field alignment across the RF sub-band. This feature, combined with the broadband linear RF amplifier, provides the performance required for digital video transmission. The use of broadband microwave components significantly reduces system sparing, thus minimizing potential downtime.

These compact, integrated units (including the terminal equipment, power amplifier, and either AC or DC power supply) only occupy three vertical rack units (5 1/4", 13.34 cm), thus minimizing the number of racks required in a multi-channel system.

Applications

- Studio-to-Transmitter Links and Transmitter-to-Studio Links

Features

- Advanced, high-performance design meets EIA and ITU requirements
- Digital or analog video modulation
- Analog Option:
  - Transmitter: optional internal 70 MHz FM modulator with up to four program audio channels
  - Receiver: optional internal 70 MHz FM demodulator with up to four program audio channels
- Digital Option:
  - 45 Mbps/16 QAM Modem with QM2 Modem
  - 20-90 Mbps(QPSK to 128 QAM) with MRC Variable Rate Modem.
  - 105 Mbps Single Carrier with SCM4000 Modem
- Optional high output power versions
- “SMART” System Monitor & Alarm Recording Terminal, with direct-reading dBm metering on front panel
- Configurations include simplex, full duplex, and hot standby (space or frequency diversity protection)
- FCC and ITU approved bands from 1.7 to 15.4 GHz

www.mrcbroadcast.com
**Alarm Monitors**

Alarms and monitoring features are available through front panel display or remotely using the optional System Monitor Alarm & Recording Terminal (SMART) either co-located or remotely accessed. The radio will supply switching signals and data to hot standby and fault reporting equipment. Hinged front panels allow easy access to all modules and assemblies, including the power supply, for service and maintenance.

**Converting to Digital**

The DAR is designed to be readily convert to digital operation—with easy jumper and dip switch changes in one transmitter module and two receiver modules. Just add the optional QM2 or QM4 modulator and demodulator, and the DAR becomes a fully digital DAR20 or DAR45 radio.

**DAR Transmitter 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.

**DAR Digital Options**

Digital Performance: The DAR Series of radios are fully compatible with QM2 19 Mbps and QM4 45 Mbps digital modulator and demodulator.

**DAR Analog Options**

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.

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.

**Accessories**

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 capability allows the user to multiplex engineering orderwire, alarm and status monitoring with up to 24 FDM telephony channels.

Hot Standby Protection System: The HS-1 Hot Standby Switching System provides complete redundancy for the system. It is composed of two one-rack unit shelves, one transmit and one receive.

**Other Accessories**

MRC also offers baseband and IF space diversity protection with the DS-2 diversity switch.
**SCM4000 Single Carrier Modem**

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 application using both the IF Modem and MPEG Encoder modules.

![SCM Single Carrier Modem](image)

**VRM Modem**

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](image)
GENERAL PERFORMANCE
Frequency Bands: .................. Standard Choices (GHz):
  DAR 2: .......................... 1.9 to 2.3 or 2.3 to 2.5
  DAR 4: .......................... 3.3 to 3.9 or 4.4 to 4.9
  DAR 6: .......................... 5.9 to 6.4 or 6.4 to 6.8 or 6.8 to 7.1
  DAR 7: .......................... 7.1 to 7.7 or 7.7 to 8.1 or 8.1 to 8.5
  DAR 12: ........................ 10.5 to 12.1 or 12.7 to 13.2
  DAR 15: ........................ 14.4 to 15.35
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 Oscillator: ............... Phase-locked source
Frequency Stability (-30°C to +50°C): ±0.001% std
Output Power: .................. (See Analog / Digital Summary)
IF Input Frequency: ............ 70 MHz
IF Return Loss: .................. 26 dB min. ±10 MHz
IF Bandwidth: .............. 30 MHz (other bandwidths optional)
IF Output Level: ............... +3 dBm ±1 dB

Note: All measurements made in accordance with EIA specifications or CCIR recommendations, unless noted.

SYSTEM CONTROL & ALARM
Status Report: .............. Local and optional remote
Monitoring: ................. Transmit power (dBm), receive carrier
Status Report: .............. Local and optional remote

ANALOG 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 modems.

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 ±2 max
Differential Phase: ............. ±0.5° max
Differential Gain: ............. 2% max
Signal-to-Noise Ratio: ............. Meets or exceeds RS-250C; 67 dB

Audio Performance (optional FMT)
Capacity: .............. Up to four channels included internally
Subcarrier Frequencies: Standard ITU-R or EIA frequency plan
Frequency Response, 40 Hz to 12 kHz: ±1.0 dB
12 kHz to 15 kHz: ±1.5 dB
Signal-to-Noise Ratio: (at 75 kHz Peak Deviation):
Meets or exceeds RS-250C; 66 dB
Distortion: .............. 1.0% max at 75 kHz peak deviation
Input Level: ................. 0 to +9 dBm adjustable; set +8 dBm
Output Level: .............. 0 to +9 dBm adjustable; set +8 dBm
Input Impedance: .......... 600 ohms balanced
Output Impedance: .......... 600 ohms balanced standard
less than 30 dB optional

DIGITAL Specifications Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency Range (GHz)</th>
<th>Output Power (Note 1)</th>
<th>Noise Figure (dB)</th>
<th>BER3 (10^-6) (Note 2)</th>
<th>System Gain (dB)</th>
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<tbody>
<tr>
<td>DAR 2</td>
<td>1.7 to 2.7</td>
<td>+31</td>
<td>2.5</td>
<td>-85</td>
<td>117</td>
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<tr>
<td>DAR 4</td>
<td>3.3 to 4.9</td>
<td>+28</td>
<td>3.5</td>
<td>-84</td>
<td>113</td>
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<tr>
<td>DAR 6</td>
<td>5.9 to 7.1</td>
<td>+31</td>
<td>3.5</td>
<td>-85</td>
<td>116</td>
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<tr>
<td>DAR 6HP</td>
<td>5.9 to 7.1</td>
<td>+28</td>
<td>3.5</td>
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<tr>
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<td>3.5</td>
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<tr>
<td>DAR 12</td>
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<td>-84</td>
<td>111</td>
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</tbody>
</table>

Notes:
1. Transmitter output values calculated prior to branching.
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.

ANALOG SPECIFICATIONS SUMMARY

<table>
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<tr>
<th>Model</th>
<th>Frequency Range (GHz)</th>
<th>Output Power1 (dBm)</th>
<th>Noise Figure2 (dB)</th>
<th>RX Threshold3 (dB)</th>
<th>System Gain2 (dB)</th>
<th>Typical Signal/Noise 3 (dB)</th>
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<tr>
<td>DAR 15</td>
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<td>-84</td>
<td>114</td>
<td>70</td>
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</tbody>
</table>

Notes:
1. “HP” suffix indicates high power option
2. Minimum power to branching network
3. Does not include branching filter
4. For one-hop, NTSC video; EIA/CCIR weighting

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