DRS4000 Receiver

RF & Low Latency HD Diversity Receiver

MRC
VISLINK GROUP

User and Technical Manual

Manual Part No. 400545-1 Rev. A November 2008

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Notices

About This Manual

Part number **400555-1**

Revision A **November 2008**

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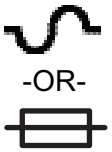 -OR-	Fuse - Identifies fuses or their location.
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Contents

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1 Introduction

1.1 Chapter Overview

This chapter introduces you to the DRS4000 Receiver User and Technical Manual – what it covers, how it is organized, and for whom it is written. Other sections explain how to order manuals, request service, or submit product feedback.

1.2 How to Use This Manual

A CD-ROM, delivered with each DRS4000 Receiver, contains PDF files for the User and Technical Manual and the Quick Reference Card.

The User and Technical Manual and the Quick Reference Card are also available for download through the MRC E-Synergy Customer Portal. For more information or to obtain a user name and password, please go to:

http://www.mrcglobalsolutions.com/support/e_synergy_portal

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1.3 What This Manual Covers

This manual describes how to operate and maintain the DRS4000 Receiver. The DRS4000 is a diversity receiver system (DRS) that comprises a rack-mounted, digital, microwave receiver that supports multiple antenna inputs, SD and optional HD decoding, MaxRC diversity techniques, and optional packet switching features.

1.4 How It Is Organized

The major topics are covered in the following order:

Chapter	Description
1	Introduction
2	Product description
3	Routine operation
4	Troubleshooting basic problems
5	Installation
6	Replacement parts
7	Theory of operation
App. A	Channels and frequencies supported
App. B	Glossary of technical terms
App. C	Specifications
App. D	Maximal Ratio Combining

1.5 For Whom It Is Written

This manual is intended for use by trained microwave equipment operators assigned to operate the DRS4000 Receiver. Users of this manual should already be familiar with basic concepts of radio, video, and audio.

1.6 Related Documents

- *DRS4000 Quick Reference Card* (part no. 400547-1)

1.7 Ordering Documentation

Any of the above manuals may be ordered by contacting MRC Customer Service:

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E-mail customerservice@mrcbroadcast.com

When contacting Customer Service, please have the following information available:

- Model number and serial number of the unit. This is located on a label on the bottom of each unit.
- Approximate purchase date.
- Firmware revisions (depending upon the options contained in your DRS4000 Receiver), which appear on the control panel. To access this information:
  - Go to the Hardware Configuration screen as follows: From the control panel, select **SETUP** and then select **Hardware Configuration**.
  - Press **OK** to display the next screen, which lists all installed hardware and software components and revision levels.

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When contacting Technical Support, please have the following information available:

- Model number and serial number of the unit. This is located on a label on the bottom of each unit.
- Approximate purchase date.
- Firmware revisions (depending upon the options contained in your DRS4000 Receiver), which appear on the control panel. To access this information:
  - Go to the Hardware Configuration screen as follows: From the control panel, select **SETUP** and then select **Hardware Configuration**.
  - Press **OK** to display the next screen, which lists all installed hardware and software components and revision levels.

1.9 Supported Repairs

The DRS4000 Receiver is designed to be compact, rugged, and reliable.

The DRS4000 Receiver requires specialized test equipment and software to calibrate amplitude and frequency characteristics after repair.

There are NO supported field repairs to the DRS4000 Receiver.

Return the entire unit for factory repair.

If you attempt field repair, you risk damaging your equipment. If your equipment is under warranty, you may also affect your warranty coverage.

1.10 Tell Us What You Think

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2 Product Description

2.1 Chapter Overview

This chapter provides an overall description of the DRS4000 Receiver, its components, and its capabilities.

Here are the topics covered:

2.2 Description

The DRS4000 Diversity Receiver System (DRS4000) is a high performance, cost-effective COFDM receiver suitable for sports, news, and outside broadcasts from ground-based or aircraft-based transmitters. The DRS4000 Receiver is ideal for Electronic News Gathering (ENG), Digital Video Broadcast (DVB), mobile communication, wireless airborne networks, and Outside Broadcast (OB) systems, as well as for applications that require hands off antenna diversity or deploy multiple units for up to a four site cellular system. The receiver consists of a 2RU rack-mountable, digital, microwave receiver that supports four antenna inputs. All functions can be operated from the front control panel.

The DRS4000 Receiver uses the latest maximal ratio combining (MaxRC) technology to optimize the quality of the transmitted signal. The DRS4000 supports Coded Orthogonal Frequency Division Multiplexing (COFDM) demodulation, Link Modulation System (LMS-T) demodulation, MPEG decoding in either standard definition or high definition (SD/HD), and optional spectrum viewing, making it an excellent solution for expanding and extending your remote capabilities.

The DRS4000 Receiver exhibits more sensitivity, provides a cleaner video image, and minimizes multipath effects when

compared to other microwave receivers.

The receiver operates on 100 to 260 VAC at 50 to 60 Hz. An autosensing circuit detects actual line voltage.

You can readily change system parameters from the front panel using a keypad and the control screen or by using a studio-based master controller. Frequently used settings can be saved in one of 50 presets. A video monitor offers a display of live video as well as an optional overlay of the RF spectrum.

In a typical DRS4000 system, each antenna is connected to a low-noise block downconverter (BDC) by a short cable or direct N-Type connector. The converters output a UHF signal through coaxial cable to UHF input ports at the rear of the receiver. The receiver and downconverters may be separated by up to 600 feet (183 m) depending on frequency and cable type.

Incoming signals and downconverter power travel on the same cable using Bias-T interfaces in both the converter and the DRS4000 Receiver. The DRS4000 Receiver samples the signal-to-noise ratio (SNR) from all antennas, constructing an optimized signal from one or more of the signals. High quality 75-ohm coaxial cable (RG6 or RG11) should be used to connect the receiver to the downconverters.

The COFDM demodulator and SD/HD MPEG decoder support standard Digital Video Broadcast-Terrestrial (DVB-T) 2K operation as well as the highly advanced Link Modulation System-Terrestrial (LMS-T). LMS-T employs COFDM technology in a proprietary format that utilizes powerful LDPC error correction codes to achieve a 30% increase in throughput with a corresponding increase in robustness over DVB-T. All MRC and Link SD/HD ENG transmitters and wireless camera systems also support LMS-T.

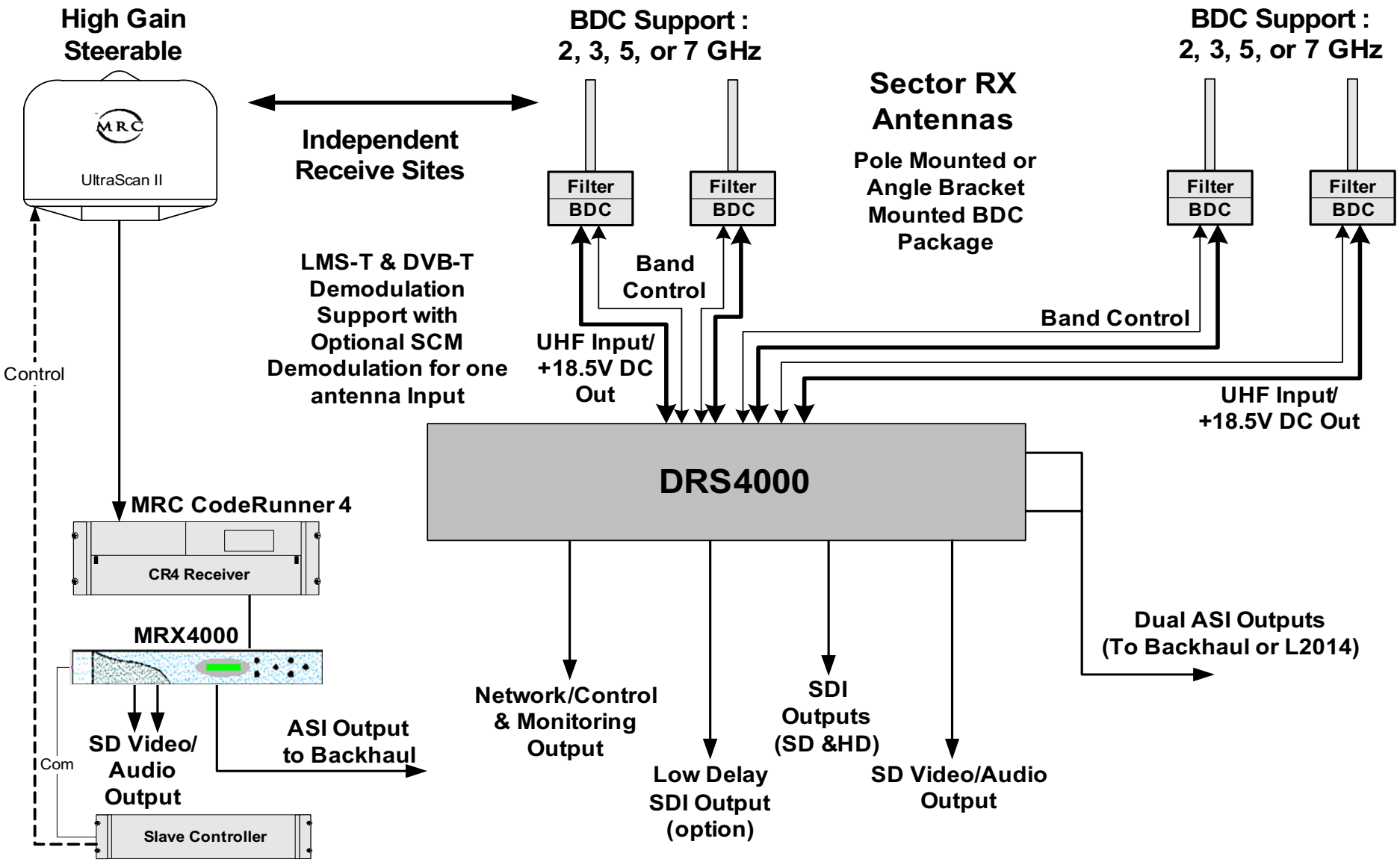
Figure 2-1 on page 2-3 depicts a typical configuration.

2.3 Features

The DRS4000 Receiver offers the following features:

- Two or four antenna inputs (DVB-T/LMS-T)
- Maximal ratio combining diversity technology
- ASI packet switching technology
- Supports DVB-T and LMS-T demodulation technology
- Front panel live video monitor
- Real-time front panel monitoring for Signal-to-Noise (SNR), Link Quality signal integrity (LQ), Receive Carrier Level (RCL), and Bit Error Rate (BER)
- Embedded real-time operating system accessible via front panel control screen
- Up to 50 programmable presets (saved settings) using the DRS4000 front panel
- Rack Mountable, compact (EIA 19-inch rack, 2RU height)
- Supports 6, 7, and 8 MHz COFDM/DVB-T pedestals, and 10 and 20 MHz COFDM/LMS-T pedestals
- Internal web server for remote management via any networked computer
- Controlling/configuring a remote camera
- Compatible with MRC and Link Research low-noise block downconverters (see Section 2.11.1 on page 2-5)
- Interfaces with MRC CodeRunner4 and MRX4000 Plus products at the 70 MHz IF level
- Spectrum viewer option that overlays the video signal with an RF spectrum (future option)

Figure 2-1: DRS4000 Receiver Typical 4-Input SD Configuration



2.4 Hardware Components

A typical installation consists of a receiver, antennas, low-noise block downconverters, filters, and cables.

2.4.1 Receiver

The DRS4000 Receiver accepts 2 or 4 antenna inputs and incorporates MaxRC diversity technology, COFDM demodulation, SD/HD MPEG decoding, and DVB-T and LMS-T demodulation modes. With a front panel video monitor and control screen, the receiver takes up only 2 RU of space in a 19-inch rack. The receiver can be operated locally or remotely via a master controller.

Base models include:

- DRS4000 4-input receiver with MaxRC, SD, and LMS-T
- DRS4000 4-input receiver with MaxRC, SD, LMS-T, and ASI Packet Switcher

2.4.2 Antennas

MRC offers several types of antennas and several models within some antenna types. See Section 2.11.3 on page 2-6 for more information.

2.4.3 Low Noise Block Downconverters

The DRS4000 Receiver is compatible with several MRC and Link Research downconverters (LNBs). The downconverters transform the incoming RF signal into UHF for input to the receiver. See Section 2.11.1 on page 2-5 for more information.

2.5 Firmware Components

The DRS4000 Receiver is controlled by software installed on programmable read-only memory (PROM). You can access this firmware via the front control screen, and use it to monitor the incoming signal and control settings such as channel, frequency, and RF band.

The firmware also provides a web browser interface that you can access via a web browser on any PC or laptop computer as long as both the DRS4000 Receiver and the computer are connected to the same Local Area Network (LAN). You can also access the web browser interface via a direct Ethernet connection. To learn about this utility, refer to Chapter 3.

2.6 Frequency Bands

The DRS4000 Receiver can operate in one of several factory-programmed frequency bands. You can select the band via the front control screen or via a master controller interface at the studio or command center.

MRC offers a range of block downconverters and antennas designed for each frequency range. The downconverters transform the incoming RF signal to a 110 to 860 MHz VHF/UHF signal while the DRS4000 Receiver is capable of accepting a signal in the range of 70 to 860 MHz.

The following frequency bands are supported:

- 2 GHz
- 3 GHz (non-U.S.)
- 5 GHz
- 7 GHz
- 1.9 to 2.5 GHz / 6.4 to 7.1 GHz (dual band support option)

2.7 Standard/High Definition MPEG Decoding

The DRS4000 Receiver incorporates a Standard Definition (SD) MPEG decoder. High Definition (HD) decoding is an option. The SD decoder includes the following features:

- 4:2:2 or 4:2:0 chroma support
- NTSC or PAL color television standard compliance with four analog audio channels
- SD-SDI output
- AES/EBU Digital Audio
- Wayside Data Channel
- DVB-ASI Output

2.8 COFDM Demodulation

The DRS4000 Receiver incorporates a COFDM demodulator that offers the following features:

- DVB-T Compliant
- LMS-T support
- 6, 7, 8, 10, and 20 MHz selectable pedestal bandwidth
- QPSK, 16QAM, or 64QAM modulation
- Bandwidth of 6 MHz, 7 MHz, 8 MHz, or Auto

2.9 Applications

The DRS4000 Receiver has several applications:

- Electronic News Gathering (ENG)
- Central receive sites
- Outside Broadcasting (OB)
- Portable Broadcasting

2.10 Compatibility

The DRS4000 Receiver is compatible with the following transmitters:

- MRC STRATA Portable Transmitter
- PTX PRO Transmitter
- MTX5000 Transmitter
- LINK XP
- LINK XP HD (future)

2.11 Options

You can customize the DRS4000 Receiver by choosing any of the following options.

2.11.1 Block Downconverter Options

The following block downconverters are available as options:

Link Models The following LNBs and filters are supported:

- L3070 LNB base unit
- L3030 Input filter for L3070 1.95 to 2.7 GHz
- L3033 input filter for L3070 2.2 to 2.3 GHz
- L3034 input filter for L3070 2.3 to 2.4 GHz
- L3037 input filter for L3070 2.5 to 2.7 GHz

- L3060 input filter for L3070 3.4 to 3.6 GHz
- L3080 input filter for L3070 6.425 to 7.125 GHz

MRC Models The following LNBs are supported:

- MRC 908149 LNB, 1.99 to 2.5 GHz
- MRC 908149 LNB, 3.4 to 3.8 GHz

MRC Outdoor Unit This module contains an MRC 908144 LNB, Multi-point Microwave Distribution System (MMDS), also known as Multi-channel Multi-point Distribution System, lightning protection, Personal Communications Service (PCS) filter, and other electronics in a weatherproof box. Input range is 1.99 to 2.5 GHz.

2.11.2 HD Decoding Upgrade

The DRS4000 base models include an SD MPEG decoder as described in Section 2.7 on page 2-5. The HD option includes the following features:

- 4:2:2 or 4:2:0 chroma support
- HD-SDI Output
- Four analog audio channels
- AES/EBU digital audio
- ASI output

2.11.3 Antenna Options

To take advantage of diversity combining, you need to select either 2 or 4 antennas. MRC works with you to select the proper antennas for your receive site, including your legacy antennas where feasible.

The following types of antennas are available:

- ***Omnidirectional*** These antennas are vertically polarized and nonsteerable. Models include the Omni-Directional Antenna and OmniPole Antenna.
- ***Sector Scan*** These antennas include fixed-position antennas such as sector panels. Models include SectorScan.
- ***Steerable (pan only)*** These antennas offer full 360-degree rotation in azimuth. Models include ProScan and UltraScan DR.
- ***Steerable (pan and tilt)*** These antennas offer full rotation in azimuth as well as tilt (elevation) control. Models include MicroScan and Ellipse DR.

2.11.4 RF Filter Options

The following RF filters are available as options for mounting on the foregoing blockdown converters:

- PCS / MMDS filter
- BAS relocation filter

2.11.5 Mounting Options

The DRS4000 Receiver is designed to mount in a standard EIA 19-inch rack, making it suitable for fixed mounting at a receive site or for portable mounting in a vehicle. Only 2 rack units (RU) of height are required.

2.11.6 Power Options

A voltage auto-sense feature detects input voltage, which can be 100 to 260 VAC at 50 to 60 Hz. A 3-prong power cable is included.

The rear power connector includes a removable fuse holder with a pair of 2-amp glass fuses.

The DRS4000 Receiver does not currently support DC input.

2.11.7 Decryption Options

The receiver supports the Basic Interoperable Scrambling System (BISS) and the Advanced Encryption Standard (AES):

- BISS-1
- BISS-E
- AES-128 bit

2.11.8 SCM Single Input Demodulation Support

The receiver supports the MTX5000 Single Carrier Modem (SCM) functionality.

2.11.9 Packet Switching Option

The packet switching option enables the addition of feature-rich enhancements, including cellular diversity hubs and support for existing central receivers through an ASI interface.

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3 Routine Operation

3.1 Chapter Overview

This chapter provides basic information that will enable you to operate your DRS4000 Receiver.

Here are the topics covered:

3.2 Front Panel Displays and Connectors

The front panel provides a power switch, USB and Ethernet connectors, LCD video monitor, LCD control screen, and keypad. Figure 3-1 on page 3-2 shows details of the front panel.

POWER is controlled by a front panel On/Off switch.

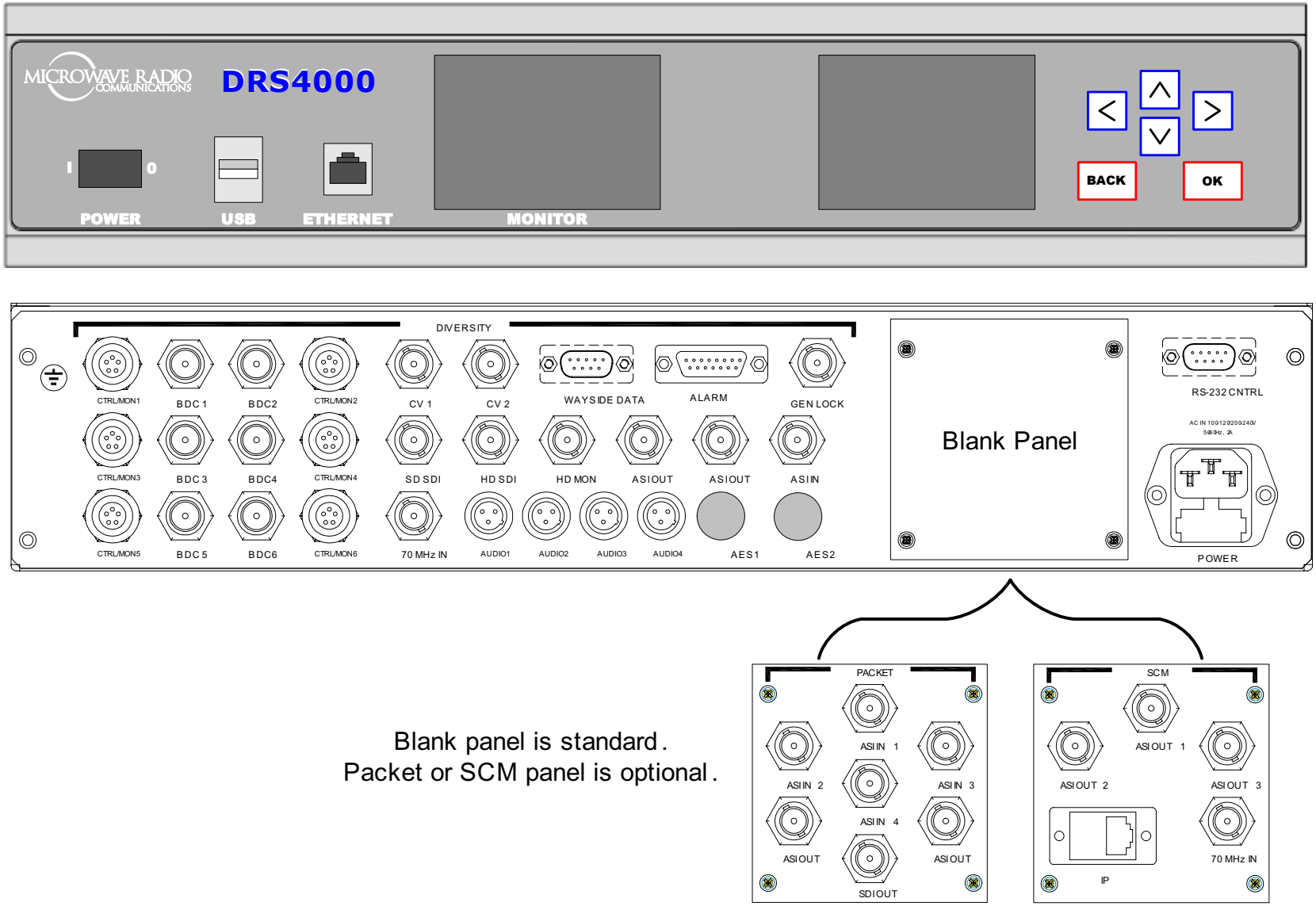
The **USB** 2.0 connector allows you to install firmware updates from MRC via a flash drive.

The RJ-45 **ETHERNET** connector allows you to connect the receiver to a computer and use the DRS4000 web browser interface to control the receiver.

The **VIDEO MONITOR** provides a live view of the video signal. With the spectrum viewer option installed, the monitor also displays the RF spectrum as an overlay to the video picture.

The **Control Screen** reports real-time data for the video signal and shows current RF settings.

Figure 3-1: DRS4000 Front and Rear Panels



Blank panel is standard.
Packet or SCM panel is optional.

The **Keypad** consists of easy-to-use push buttons that give access to all system parameters and settings.

3.3 Rear Panel Connectors

The rear panel contains the connectors for power, diversity inputs and outputs, audio outputs, and networking. If the packet switching subsystem is installed, the blank panel is replaced by the **PACKET** connector panel. If the SCM subsystem is installed, the blank panel is replaced by the SCM connector panel.

Figure 3-1 on page 3-2 shows the layout of the rear panel. For more details, refer to the Installation chapter of the *DRS4000 Receiver Technical Reference Manual*.

The rear panel provides numerous inputs to and outputs from the receiver. These inputs and outputs can be grouped as follows.

3.3.1 DIVERSITY Connectors

The following connectors provide inputs and outputs for the optional diversity subsystem.

CNTL/MON 1 to CTRL/MON 6 The Control/Monitor connectors are 5-pin Lemo sockets that provide control inputs and monitor outputs for the adjacent downconverter. For example, CTRL/MON 4 controls and monitors BDC 4.

BDC 1 to BDC 6 The Block Downconverter (BDC) connectors are 50 ohm, TNC connectors that accept the UHF signals from the downconverters and their corresponding antennas.

To power each downconverter, +20 VDC is applied to the coaxial cable that runs from the BDC connector to the downconverter.

CV 1, CV 2 The Composite Video (CV) connectors are 75 ohm, female, BNC connectors that output an analog video signal.

WAYSIDE DATA This RS-232, 9-pin female connector is the wayside channel, used for transfer of data such as global positioning satellite (GPS) data or meta data from the MPEG decoder. By using a standard RS-232 cable, you can connect the receiver's **WAYSIDE DATA** connector to a computer or an auto-tracking antenna system.

ALARM This DB-15 female connector connects to single-pole single throw (SPST) switches for summary alarm data for common faults and events and for site management control. One SPST switch is for a minor alarm, one SPST switch is for a major alarm, and four SPST switches are for site management.

GEN LOCK This 75 ohm, female, BNC connector enables the decoder output to lock to an external frame lock input. This can either be SD Black & Burst or HD Tri-level input into the rear panel BNC connector.

The Frame Sync function must be turned on via the Set Frame Sync Menu in order to use **GEN LOCK**.

SD SDI / HD SDI The Standard Definition (SD) Serial Digital Interface (SDI) connector is a 75 ohm, female, BNC connector that outputs a video data stream from the MPEG module that is compliant with SMPTE 259M.

The High Definition (HD) SDI connector is a 75 ohm, female, BNC connector that outputs a video data stream from the MPEG module that is compliant with SMPTE 292M and SMPTE 299M.

Using a standard RG59 75-ohm video cable, you can connect the receiver's SDI output to a monitor that has an SDI input or you can use an SDI-to-analog video converter to connect the signal to a video monitor.

HD MON The HD Monitor connector is a 75 ohm, female, BNC connector that provides a second output for monitoring the video data stream.

ASI OUT The two Asynchronous Serial Interface (ASI) connectors are 75 ohm, female, BNC connectors that provide ASI outputs for digital video and audio distribution. Using a standard RG59 75-ohm video cable, you use the receiver's ASI output to backhaul the video/audio from a remote site.

ASI IN This 75 ohm, female, BNC connector accepts an ASI signal input from another component. It is used for local decoding of a SD/HD ASI stream when the receiver is placed in external ASI mode. The outputs are on the HD SDI and HD MON connectors only.

70 MHz IN This connector is a 75 ohm, female, BNC connector that accepts input from another receiver. This is an alternative input to BDC 1 and is selectable from the control screen menu.

AUDIO 1 to AUDIO 4 These mini-XLR connectors output analog audio derived from the incoming RF signal. They can be used as four monaural outputs or two stereo pairs depending on how the remote transmitter is configured.

AES 1, AES 2 The two Audio Engineering Society (AES) connectors are not currently implemented. AES audio is compliant with SMPTE 299M and SMPTE 337M. AES 1 audio output is available on the Audio 1 connector, and AES 2 audio output is available on the Audio 3 connector.

3.3.2 PACKET Connectors

The following connectors provide inputs and outputs for the optional packet switching subsystem.

ASI IN 1 to ASI IN 4 These 75 ohm, female, BNC connectors allow up to four ASI inputs from different receive sites, effectively acting as a diversity switch. They can also be used as an ASI multiplexer. The maximum bit rate is adjustable up to 40 Mbps.

ASI OUT These connectors are 75 ohm, female, BNC connectors that provide a diversity ASI output or a multiplexed ASI output according to the mode set for the packet.

SDI OUT This connector is a 75 ohm, female, BNC connector that outputs a digital video stream.

3.3.3 SCM Connectors

The following connectors comprise a future option. They will provide inputs and outputs for the Single Carrier Modem (SCM) subsystem.

ASI OUT 1 to ASI OUT 3 These connectors are 75 ohm, female, BNC connectors that provide ASI outputs.

70 MHz IN This connector is a 75 ohm, female, BNC connector that accepts input from a local receiver.

IP This Ethernet connector outputs simplex Ethernet data from the transmitter.

3.3.4 Other Connectors

RS-232 CRNTL This connector is an RS-232, a DB-9 female connector that can be used to remotely control the DRS4000 Receiver via a slave controller.

Power connector This connector accepts a standard 3-prong cable for AC power. An auto-sense circuit accepts either 110 to 130 VAC or 205 to 260 VAC @ 2 amps. The 3-prong male end must be modified for non-U.S. applications.

3.4 Powering the Receiver

The following subsections explain procedures for powering up and powering down. If the receiver is installed at an unattended central receive site, then it typically stays powered up for extended periods of time.

3.4.1 Powering Up

To power up the receiver follow these steps.

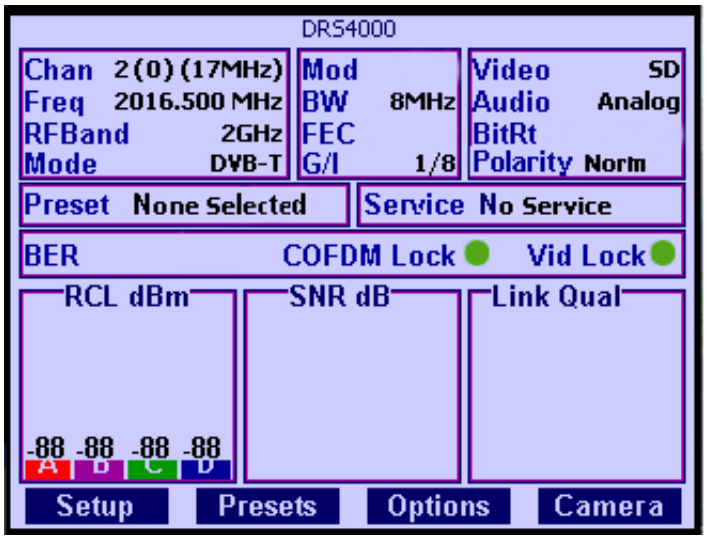
1. Verify that the power cable is connected to the power connector on the rear panel of the DRS4000 Receiver and is connected to an AC power source.
2. Verify that all other cables are properly connected to the receiver's rear panel connectors.
3. Verify that the AC power source is turned on.
4. Set the power switch on the front panel to On (**1**). The video monitor displays a blank screen and the control screen goes through a power-up cycle: color bars, a product ID screen, and finally the initial control screen as shown in Figure 3-2.

   The settings displayed will be those in effect when the receiver was powered down. If there is no incoming signal, the RCL, SNR, and Link Quality meters will display their lowest values.

3.4.2 Powering Down

To power down the receiver, set the power switch on the front panel to Off (**0**).

Figure 3-2: Initial Control Screen



3.5 Learning the Regions of the Control Screen

The control screen is a 3.5-inch diagonal LCD color monitor that provides access to the receiver and all its functions. This screen is the graphical user interface (GUI), the window into the settings and functions of the receiver.

When you operate the receiver via the control screen, you can monitor receive carrier level (RCL), signal-to-noise ratio (SNR), and link quality for all incoming video signals. You can also change receiver settings such as channel, frequency, and RF band, and save them as presets as needed.

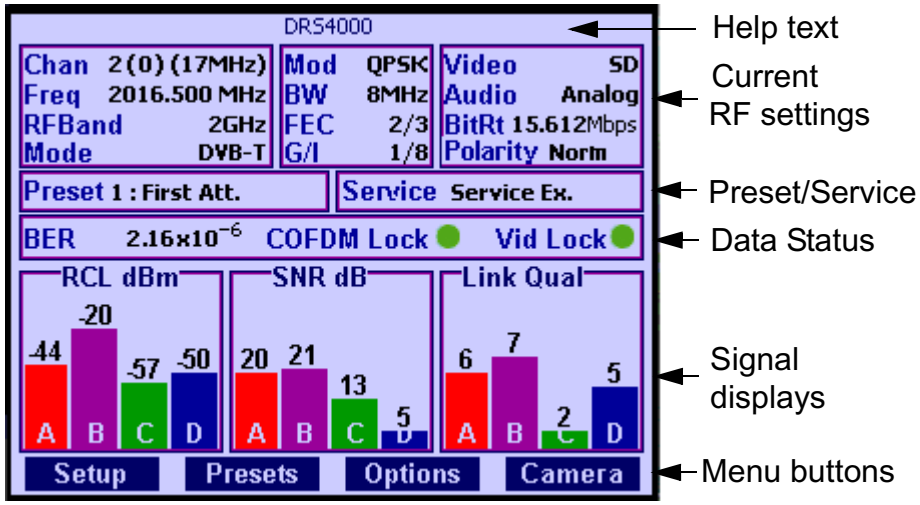
The control screen always displays the last saved settings.

For ease of use, the control screen is organized into the following regions:

- Help text
- RF settings
- Presets (up to 50)
- Service (transmitter ID)
- Data status
- Signal displays
- Menu buttons

These regions are identified in Figure 3-3 and explained in the subsections that follow.

Figure 3-3: Regions of the Control Screen



3.5.1 Help Text Region

This region provides a brief description of each setting and menu on the control screen. For example, when **Chan** is highlighted, the help text says, “Change the current channel settings.”

3.5.2 RF Settings Region

This region groups together the settings for the incoming RF signal including channel, frequency, and RF band.

3.5.3 Preset Region

This region displays the current preset (a collection of settings you previously stored) as a number and a text label.

3.5.4 Service Region

This read-only setting displays the ID of the transmitter.

3.5.5 Data Status Region

This region displays the following information:

- **BER** (Bit Error Rate)
- **COFDM Lock**
- **Vid Lock** (video lock)

3.5.6 Signal Displays Region

This region displays real-time readings for all antenna inputs as a set of animated vertical bars.

The **RCL** group of readings displays receive carrier levels (RCL) in dBm units.

The **SNR** group displays signal-to-noise ratios (SNR) in dB units.

The **Link Qual** group displays link quality as a derived number (0 to 9).

3.5.7 Menu Buttons Region

This region contains the buttons that lead to extensive menus and settings screens by which you can adjust the way the receiver operates.

Menus An overlay screen containing collections of similar options that allow you to fine tune the operation of the receiver.

Settings Screens An overlay screen containing a title and one or more settings that you can modify.

3.6 Using the Keypad

The control screen and keypad are shown in Figure 3-4. The keypad consists of membrane type switches that provide momentary contact closure when pressed. The layout and function result in an intuitive, easy to use operation of the control screen.

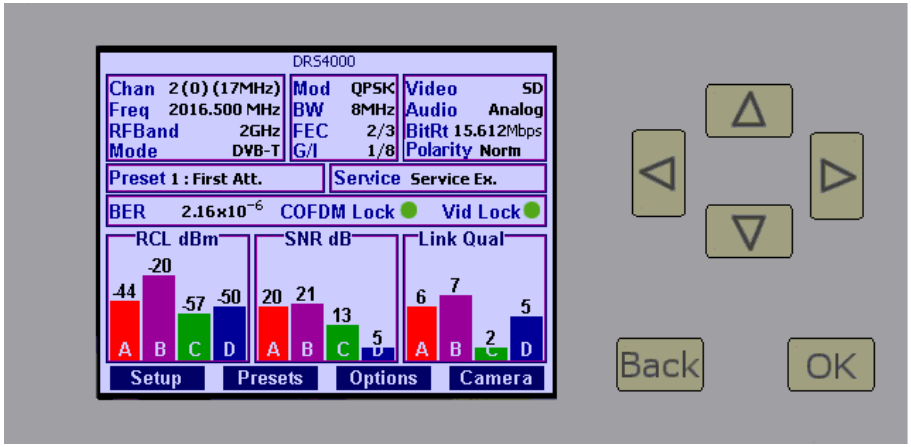
The keypad keys have the following functions:

Arrow Keys On the control screen, the arrow keys move the highlighting cursor around the screen. Press the left or right arrows to move across the screen, and press the up or down arrows to move up or down the screen. For example, press the down arrow and Chan becomes highlighted (selected).

On a settings screen, use the up or down arrow to move to another setting, and use the left or right arrows to change a value for a setting.

On a menu, use the up or down arrow to move to another menu option.

Figure 3-4: Control Screen and Keypad



Back From a menu, the **Back** button displays the previous menu. From a settings screen, **Back** cancels any changes you just made and displays the starting control screen or previous menu. **Back** has no function at the starting control screen.

OK From the control screen, **OK** displays a settings screen for the highlighted parameter or opens a submenu if a menu button (**Presets**, **Setup**, **Options**, or **Monitor**) is highlighted. From a settings screen, **OK** saves the current values.

Note When you see the instruction “Select [function]” it means you should use the arrow keys to move the cursor to the desired function, and then press **OK**.

3.7 Using the Video Monitor

The video monitor is a 3.5-inch diagonal LCD color monitor that provides a live view of the incoming video signal. With the spectrum viewer option, the monitor overlays the video picture with an RF spectrum of the signal.

The video monitor is typically blank when there is no incoming video signal.

If, for any reason, the receiver should lose the incoming signal, the monitor will display either a freeze frame or a blue screen. This setting is controlled by the Video Fail Mode menu under the Setup menu.

3.8 Using the Control Screen

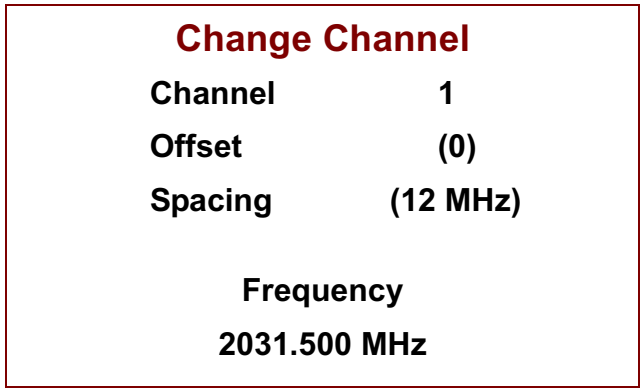
For day-to-day operations, the control screen offers convenient access to the most frequently used settings. Prior to acquiring an incoming video signal, you can quickly set any or all of the following settings to match the settings of the remote transmitter:

Note Starting with Diversity Receiver board V3.5, the receiver can autodetect transmitter bandwidth, guard interval, and polarity.

Channel (Chan) Follow these steps:

1. To select a channel in the current RF band, select **Chan**. This opens the menu as shown in Figure 3-5.
2. Press the left/right arrows to select a channel number.
3. Press the down arrow to move to the **Offset** setting. Select an offset of **0** (zero), **+** (plus), or **-** (minus).
4. Move to the **Spacing** setting. If you are in the 1.9 to 2.5 GHz band, select a spacing (bandwidth) of **12 MHz** (BAS) or **17 MHz** (pre-BAS). The **Frequency** changes as you adjust any of these settings.

Figure 3-5: Change Channel Menu



If you have set up a custom channel plan via the Factory Setup Menu, select a **Spacing** of **(Cust)**. This displays a password screen (to prevent unauthorized changes to the signal bandwidth).

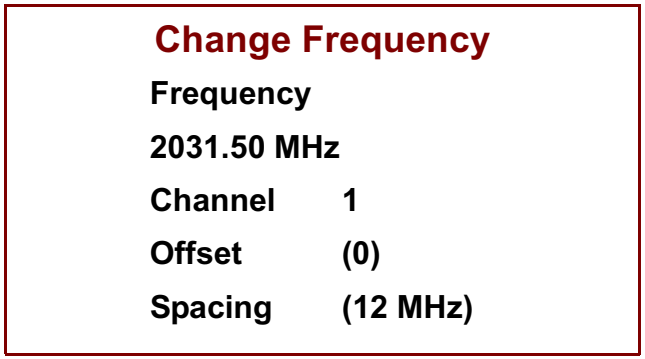
5. Enter the password (default is 0000) and press **OK** to save these settings. This takes you to the control panel.

Note To prevent unauthorized access, change this password by going to the **Factory Test** screen via the **Factory Setup Menu**. The **Factory Test** screen is also password protected. The default password is DRS4K. Change this password also.

Frequency (Freq) Follow these steps:

1. To select a frequency that is not in a standard band plan, select **Freq** to open the **Change Frequency** screen as shown in Figure 3-6.

Figure 3-6: Change Frequency



2. Press the up/down arrows to change the value of each digit, and press the right/left arrows to select another different digit. The right-hand digit can contain 0 or 5 only. The frequency is always reported in MHz.

   The lower half of the screen reports the channel, offset, and spacing only if you select a frequency for an assigned channel. This is an alternative method for selecting a frequency.
3. Press **OK** to save this frequency.

RF Band Follow these steps:

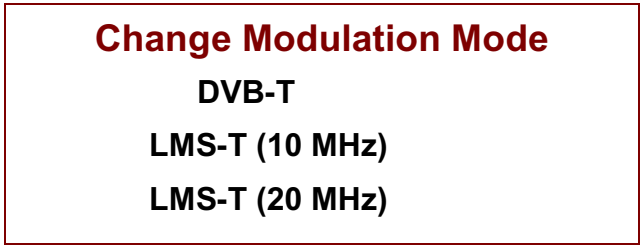
1. Select **RF Band** to open the **Change RF Band** menu (display only).
2. Press OK to return to the control screen.

Note To change the RF band, you must install a different set of BDCs and identify them via the **Factory Menu** (see Section 3.9.3 on page 3-24).

Mode Follow these steps:

1. Select **Mode** to open the menu shown in Figure 3-7.

Figure 3-7: Change Modulation Mode Menu



2. Select the desired mode for the demodulator and press **OK** to save this setting.

Modulation Type (Mod) This read-only setting displays the modulation type of the transmitter, either **QPSK** (most robust), **16QAM**, or **32QAM** (least robust).

Bandwidth (BW) This read-only setting displays the bandwidth of the signal pedestal. For DVB-T mode, the setting is either **6 MHz** (most robust), **7 MHz**, **8 MHz** (least robust), or **Auto**. For LMS-T mode, the setting is **10 MHz** or **20 MHz**.

Forward Error Correction (FEC) This read-only setting displays the forward error correction calculated in the receiver. Possible readings are **7/8** (most robust), **5/6**, **3/4**, **2/3**, or **1/2** (least robust).

Guard Interval (GI) This read-only setting displays the guard interval for the COFDM pedestal. Values can be either **1/32** (least robust), **1/16**, **1/8**, or **1/4** (most robust) and press **OK** to save this setting.

Video Follow these steps:

1. Select **Video** to open the **Change Decoder Mode** menu.
2. Choose **SD (PAL)**, **SD (NTSC)**, or **HD** mode (if the HD option is installed). The receiver then auto-detects the video line standard. PAL stands for Phase Alternation Line and NTSC stands for National Television System Committee.
3. Press **OK** to save this setting.

Audio Follow these steps:

1. Select **Audio** to open the **Select Audio Output** menu.
2. Select either channel **A** or **B** and select either **Analog** or **Digital** audio mode. The default values are channel **A** and **Analog** mode.
3. Press **OK** to save this setting.

Bit Rt Bit rate is a read-only display of the data rate for the incoming signal, reported as Mbps (megabits per second).

Polarity This read-only setting displays the OFDM polarity, either **Normal** or **Inverted**.

Preset Follow these steps:

1. Select **Preset** to open the **Load Preset** screen, which contains any presets you have created.
2. Select a preset to use for the current incoming signal.
3. Press **OK** to save this setting.

Service This read-only setting displays the ID of the remote transmitter.

BER (Bit Error Rate) This read-only setting displays the ratio of bits of data containing errors (error bits) divided by the total number of bits received in the signal, reported in real time.

Ideally a rate of 0.00×10^{-6} indicates a signal without any error bits. As the signal degrades, the BER increases until the MPEG decoder can no longer compensate for the errors and the signal is lost. If the BER exceeds 1.0×10^{-4}, take action to improve signal quality.

COFDM Lock A green indicator means that the receiver is demodulating the signal. A red indicator means that the receiver cannot demodulate the signal.

Vid Lock A green indicator means that the receiver is decoding the video signal. A red indicator means that the receiver cannot decode the video signal.

Signal Displays This region displays real-time readings for all antenna inputs as a set of animated vertical bars.

The **RCL** group of readings displays receive carrier levels (RCL) in dBm units.

The **SNR** group displays signal-to-noise ratios (SNR) in dB units.

The **Link Qual** group displays link quality as a derived number (0 to 9).

Colors and letters identify the specific antenna being measured. In preceding Figure 3-3 on page 3-6, there are four antenna inputs labeled A to D. The actual number or readings depends on the number of antennas installed. The assignment of letters to antenna inputs is controlled through the **RF Switch Matrix** screen, an option on the **Setup Menu**.

With no incoming signal, the **RCL** readings may be as low as -88 dBm. The **SNR** and **Link Qual** regions will be blank.

3.9 Using the Menus

The bottom region of the control screen displays four buttons that lead to menus: **Setup**, **Presets**, **Options**, and **Camera**. To open any of these menus, press the down arrow until you highlight one of the menu names, then press **OK** to open the menu.

The **Setup** menu provides options for configuring operating parameters. The **Presets** menu allows you to store a group of settings and quickly recall them for later use. The **Options** menu provides additional features. The **Camera** menu is an optional feature for controlling certain parameters of a broadcast camera operating in wireless mode.

As a convention, “Select the XYZ option” means press the arrow keys until that option is highlighted, then press **OK**.

Technical Tip To quickly open the **Setup** menu (if nothing is highlighted), press the up arrow until the Setup button is highlighted.

The following sections explain how to use each menu.

3.9.1 Using the Setup Menu

The **Setup Menu** is intended for configuring parameters that need to remain in effect for the long term, such as IP address, downconverter and filter types, and number of inputs.

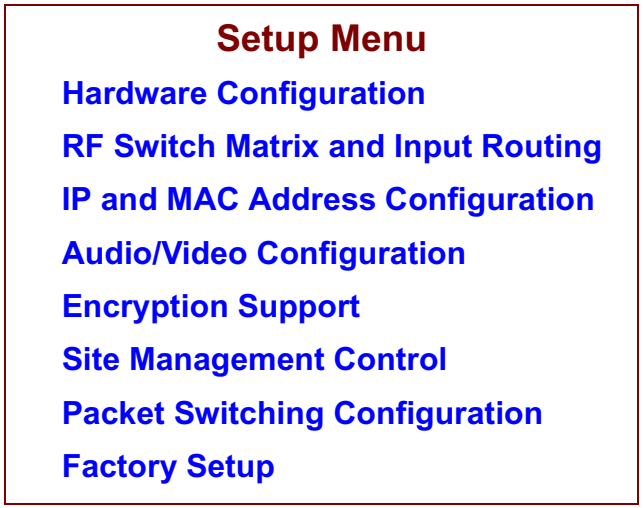
With the **Setup Menu**, you can do any of the following tasks:

- Configure hardware within the receiver
- Select a downconverter RF band
- Select a downconverter
- Calibrate a downconverter
- Route a downconverter signal to the appropriate decoder
- Set up Internet Protocol (IP) addressing
- Select audio and video settings
- Set up encryption support
- Turn site management switches on or off
- Set up packet switching controls (optional)
- Reset or recalibrate factory settings

To perform any of these tasks, select the **Setup** button on the Control Screen. This displays the menu show in Figure 3-8. This menu groups the setup features into several categories.

Note When viewing the PDF file for this manual, click on any of the following menu options to jump to the section that describes that option.

Figure 3-8: Setup Menu



Viewing the Hardware Configuration

To view the hardware configuration and a list of installed hardware and revision levels, follow these steps:

1. Select the **Hardware Configuration** option from the **Setup** Menu to open the **Hardware Configuration** screen. This screen lists the installed hardware and software. For each component, the list includes the component name, software revision level, and serial number.

   For the Processor Board, the software revision is 1.0 or higher. For the Diversity Receiver board, the software revision is 3.5.
2. Press the **OK** button to return to the control screen.

Setting Up the RF Switch Matrix

The **RF Switch Matrix** screen, shown in Figure 3-9, displays the antenna/block downconverter inputs #1 to #4, and the corresponding tuner inputs A to D. These tuner inputs correspond to vertical color bars A to D in the signal display regions of the control screen.

The benefit of this screen is that you can quickly reroute your antenna inputs in any order that is needed at your site. For example, suppose that four sector scan antennas are installed on the corners of a tower and randomly connected to the DRS4000 Receiver at connectors BCD1 to BDC4. During testing, you identified the antennas as shown in the Initial Input column of Table 3-1.

If you need the vertical color bars on the control screen to display the north, east, south, and west antennas as color bars A to D, then use the New Inputs column to help set up the RF Switch Matrix screen.

Table 3-1: Switching Antenna Inputs

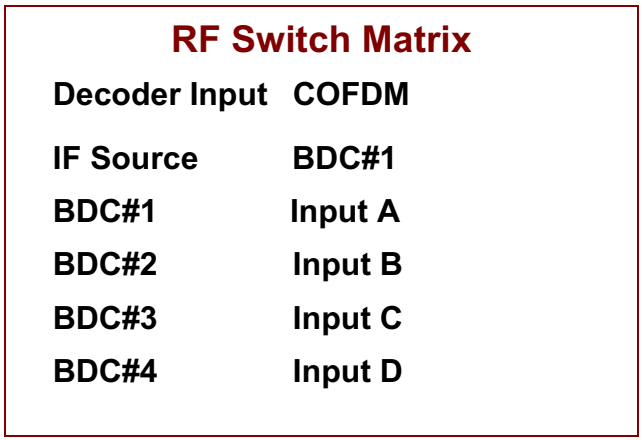
BDC#	Antenna	Initial Input	New Input
BDC#1	South	A	C
BDC#2	West	B	D
BDC#3	North	C	A
BDC#4	East	D	B

To set up the RF Switch Matrix, follow these steps:

1. Select the **RF Switch Matrix and Input Routing** option from the **Setup** Menu to open the **RF Switch Matrix** screen shown in Figure 3-9. With this screen you can map the antenna inputs (connected to BDC

#1 to #4 on the rear panel of the receiver) to internal tuners.

Figure 3-9: RF Switch Matrix Screen



2. For **Decoder Input**, select **COFDM** or **ASI**.
3. For **IF Source**, select **BDC#1** or **External**. If you select **External**, then the **BDC#1** item name changes to **External**. This also places the receiver in 70 MHz IF mode and only **Input A** (tuner A) is functional.
4. Select each BDC number and press the left/right arrows to change the input letter.

Note Be sure to use each input letter only once. An error box displays if you try to use the same letter more than once.

5. Press **OK** to save the changes.

Configuring TCP/IP Properties

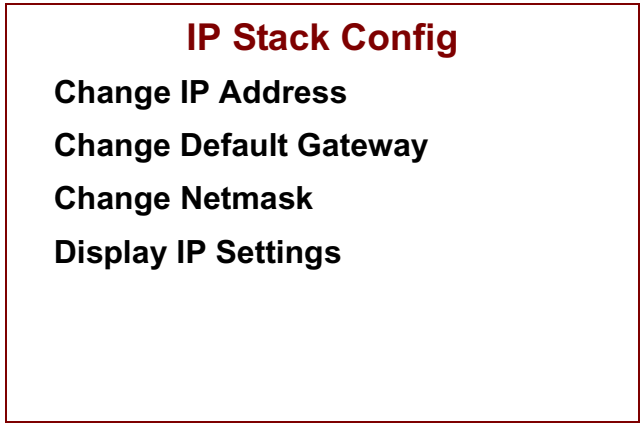
If the receiver is connected to your local area network, you need to configure it with an IP address, default gateway, and netmask. Obtain this information from your IT staff and then use the instructions on the following pages.

Configuring an IP Address

To configure the receiver's IP address, follow these steps:

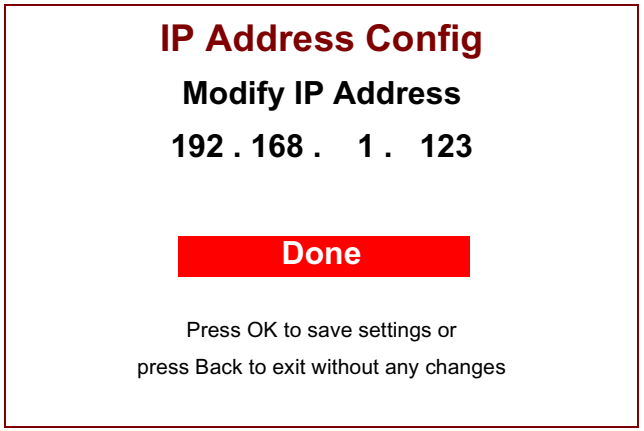
1. From the **Setup Menu**, select the **IP and MAC Address Configuration** option to open the IP Stack Config menu as shown in Figure 3-10.

Figure 3-10: IP Stack Config Menu



2. Select **Change IP Address** to open the screen shown in Figure 3-11.

Figure 3-11: IP Address Config Screen



3. Select the **Change IP Address** option.The highlighted cursor moves to the first digit on the left and new instructions appear at the bottom of the screen.
4. Enter the IP address obtained from your IT staff. Use the up-down arrows to change a value. The allowed values vary from digit to digit. Use the left-right arrows to move to a different digit.
5. Press **OK** to save the new IP address and press **Back** to return to the **Configure IP Stack** menu.

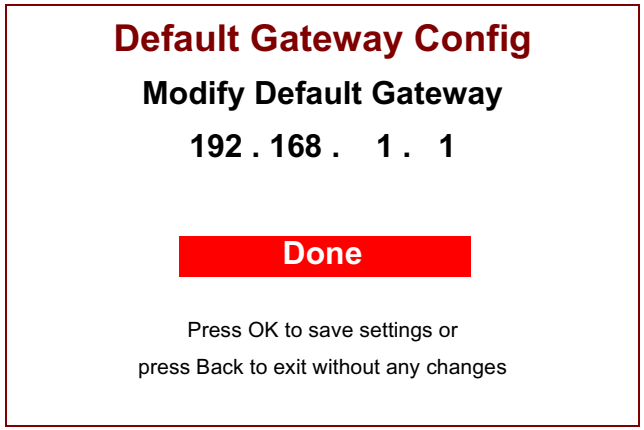
CAUTION *Be sure to enter an IP address that is valid for your local area Network (LAN), otherwise the receiver will be unable to communicate with your network.*

Configuring a Default Gateway

To configure the receiver's default gateway, follow these steps:

1. From the **Setup Menu**, select the **IP and MAC Address Configuration** option to open the IP Stack Config menu as shown in Figure 3-10 on page 3-13.
2. Select **Change Default Gateway** to open the screen shown in Figure 3-12.

Figure 3-12: Change Default Gateway Screen



3. Select the **Modify Default Gateway** option. The highlighted cursor moves to the first digit on the left and new instructions appear at the bottom.
4. Enter the default gateway obtained from your IT staff. Use the up-down arrows to change a value. The allowed values vary from digit to digit. Use the left-right arrows to move to a different digit.
5. Press **OK** to save the new gateway and press **Back** to return to the **Configure IP Stack** menu.

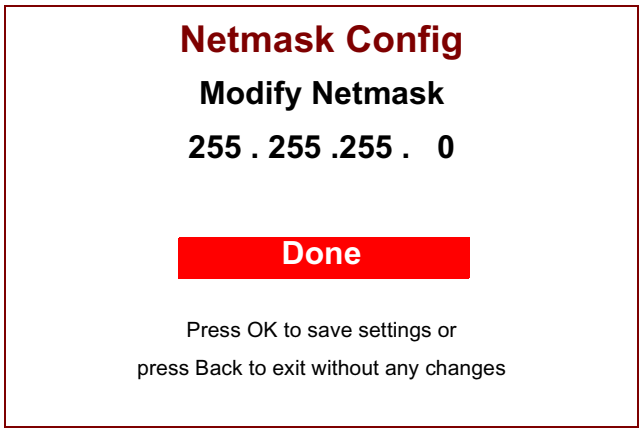
CAUTION *Be sure to enter a default gateway that is valid for your LAN, otherwise the receiver will be unable to communicate with your network.*

Configuring a Netmask

To configure the receiver's netmask gateway, follow these steps:

1. From the **Setup Menu**, select the **IP and MAC Address Configuration** option to open the IP Stack Config menu as shown in Figure 3-10 on page 3-13.
2. Select **Change Netmask** to open the screen shown in Figure 3-13.

Figure 3-13: Netmask Config Screen



3. Select the **Modify Netmask** option. The highlighted cursor moves to the first digit on the left and new instructions appear at the bottom.
4. Enter the netmask obtained from your IT staff. Use the up-down arrows to change a value. The allowed values vary from digit to digit. Use the left-right arrows to move to a different digit.
5. Press **OK** to save the new netmask and press **Back** to return to the **Configure IP Stack** menu.

CAUTION *Be sure to enter a netmask that is valid for your LAN, otherwise the receiver will be unable to communicate with your network.*

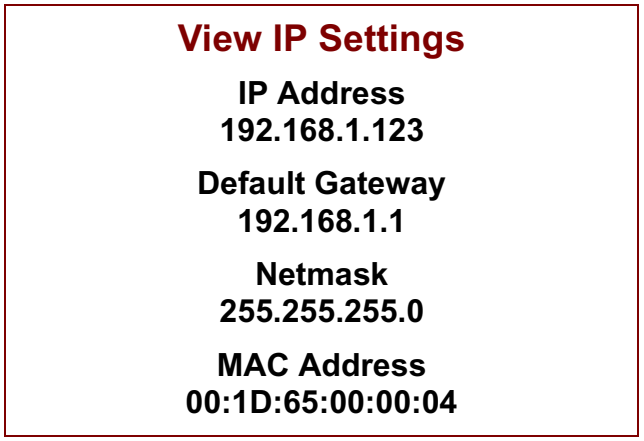
Displaying IP Settings

To display the receiver's network settings, follow these steps:

1. From the **Setup Menu**, select **IP and MAC Address Configuration** to open the **IP Stack Config** menu.
2. Select **Display IP Settings** to open the screen shown in Figure 3-14.

   The MAC address, which is a unique identifier for each receiver, was factory installed and can be modified by MRC personnel only.

Figure 3-14: View IP Settings Screen



3. Press **OK** to return to the **Configure IP Stack** menu.

Configuring Audio and Video Settings

The receiver provides a two-part menu for configuring audio and video settings. The following video line standards are auto-detected and require no operator intervention.

SD: 625 PAL/SECAM color television format with 625 horizontal lines.

SD: 525 NTSC color television format with 525 horizontal lines.

HD: 720p50 An ATSC video format for HDTV with 720 horizontal lines, "p" stands for progressive scan, 50 frames per second (fps).

HD: 720p59 An ATSC video format with 720 horizontal lines, progressive scan, 59 fps.

HD: 720p60 An ATSC video format with 720 horizontal lines, progressive scan, 60 fps.

HD: 1080i25 An ATSC video format with 1080 horizontal lines, "i" stands for interlaced scan, 25 fps.

HD: 1080i29 An ATSC video format with 1080 horizontal lines, interlaced scan, 29 fps.

HD: 1080i30 An ATSC video format with 1080 horizontal lines, interlaced scan, 30 fps.

To configure audio and video settings, select the **Audio/Video Configuration** option from the **Setup** menu to open the menu shown in Figure 3-15.

Figure 3-15: Configure Audio/Video Menu 1

Use SI Service Information

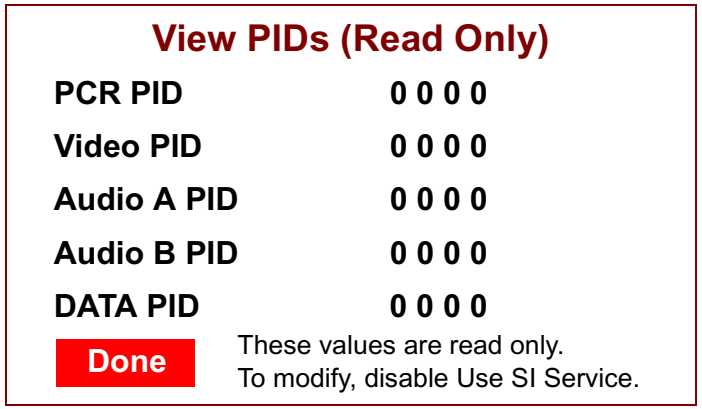
1. Select this option to open the **Use SI Service Information** screen.
2. Select **On** or **Off**, where **On** enables the setting of the service that the receiver will automatically lock onto.

View PIDs

1. Select this option to open the screen shown in Figure 3-16 on page 3-17. This screen enables the viewing of the video audio program identification (PID) that the receiver is locked onto.

Note If "Use SI Service Information" is turned on, then the Manual PID Selection Menu is read-only. To modify a PID, first go to the Use Service Information menu and set it to **Off**.

Figure 3-16: View PIDs Screen



2. Select an entry and then use the left-right arrows to move from one digit to another and use the up-down arrows to change the value of a digit. Valid PIDs can range from 0000 to 9999.
3. Press **OK** to stop modifying a value.
4. Press **OK** again to save your new settings or **Back** to cancel.

Set Frame Sync

1. Select this option to open the **Set Frame Sync** menu where the choices are **On** or **Off**. This function must be set to **On** if you need to use the **GEN LOCK** connector on the rear panel.

2. Press **OK** to save the setting.

Set Frame Sync Offset

1. Select this option to open the **Edit Frame Sync Offset** screen. This offset allows a delay or advance of the framelock in the range of 0000 to 9999, where 5000 is the center of the range.
2. Enter the offset in pixels. One pixel is approximately 74.63 nanoseconds.

Set Video Output

1. Select this option to open the **Set Video Output** screen, which controls the SD Video Source Color Bar Generator.
2. Set the color bar generator to **On** or **Off** as needed and then press **OK** to save the settings.

Adjust SD Video Output Level

1. Select this option to open the **Adjust SD Video Output Level** screen. This screen allows you to set the proper video sync level (40 IRE is the default). IRE (Institute of Radio Engineers) is a unit of measurement for the video level in which 1 IRE equals 7.14 mV.
2. Press **OK** to save the setting.

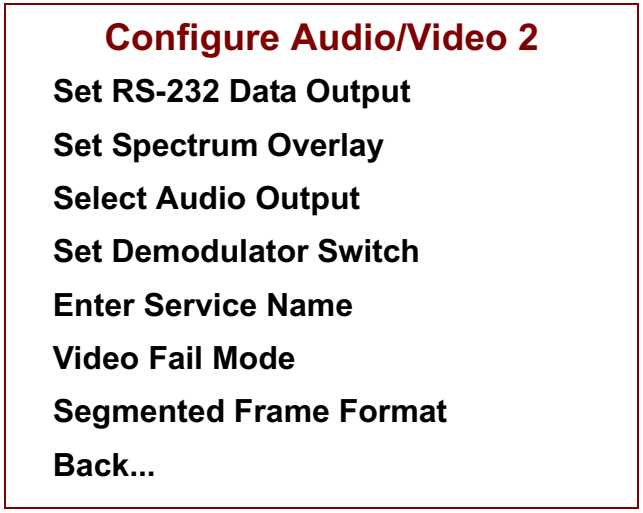
Adjust Audio Output Level

1. Select this option to open the Adjust Audio Output Level screen. This screen adjusts the SD audio output level in tenths of a decibel. The highest value and default is 6.0 which equals +8 dBm output level. This affects all audio inputs.
2. Press **OK** to save the setting.

More

Select this option to display more audio/video options as shown in Figure 3-17.

Figure 3-17: Configure Audio/Video Menu 2



Set RS-232 Data Output

1. Select this option to open the **Set RS232 Data Output** screen.
2. Select either **On** or **Off**. When set to on, the receiver can output wayside data.
3. Press **OK** to save the setting.

Set Spectrum Overlay

1. Select this option to open the **Set Spectrum Overlay** screen.
2. Select either **On** or **Off**. When set to on, this option enables the video monitor to overlay the video picture

with an RF spectrum of the signal.

3. Press **OK** to save the setting.

Select Audio Output

1. Select this option to open the **Select Audio Output** screen. This screen allows you to select between an **Analog** and AES/EBU **Digital** audio output. AES/EBU represents the digital audio signal developed by the Audio Engineering Society (AES) and the European Broadcasting Union (EBU).
2. Select either channel **A** or **B**, and either **Analog** or **Digital** audio. The default values are channel **A** and **Analog** output.
3. Press **OK** to save the settings.

Set Demodulator Switch

1. Select this option to open the **Set Demodulator Switch** screen.
2. Select the input source to be decoded:

   ASI In Allows for the decoding of an external SD/HD ASI signal connected to the ASI Input BNC connector on the rear panel.

   COFDM Out Demodulates a 70MHz IF input.

   SCM Out Enables the unit to decode an ASI stream from the internal SCM option, but only if the SCM option is installed.
3. Press **OK** to save the setting.

Enter Service Name

1. Select this option to open the **Enter Service Name** screen. If you are receiving a multiplexed signal, you can use this field to identify the specific signal you are monitoring.
2. Use the up or down arrow keys to enter a name. Valid characters include upper and lower case letters, 0 to 9, and punctuation. Press and hold the up or down arrow key to rapidly scroll through the list.
3. Press **OK** to save the service name.

Video Fail Mode

1. Select this option to open the **Video Fail Mode** menu.
2. Select either **Freeze** or **Blue**.

   Freeze The monitor displays a freeze frame if the signal is lost.

   Blue The monitor displays a blue screen of death if the signal is lost.
3. Press **OK** to save the setting.

Segmented Frame Format

1. Select this option to open the **Segmented Frame Option** menu. This option determines whether video output is displayed as progressive or interlaced.
2. Select either **On** or **Off**.
3. Press **OK** to save the setting.

Back

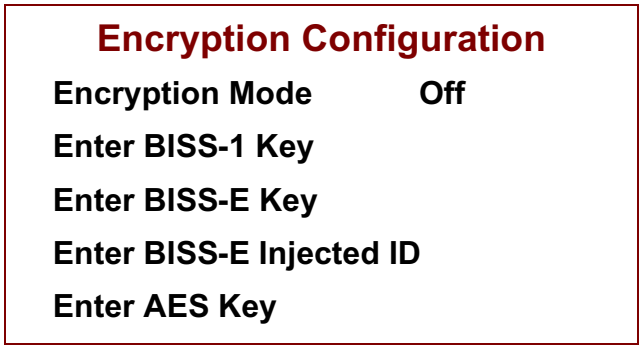
Select this option to display the **Configure Audio/Video 1** menu.

Setting Up Encryption Support

To set up encryption support, follow these steps:

1. Contact the remote video crew and determine the type of encryption being transmitted as well as the key.
2. Select the **Encryption Support** option from the **Setup** menu to open the **Encryption Configuration** menu as show in Figure 3-18.

Figure 3-18: Encryption Configuration Screen



3. Use the left-right arrow keys to select an **Encryption Mode** of either **Off**, **ABS**, **BISS-1**, **BISS-E, or AES**.

Note AES encryption is currently not supported.

4. Depending on the mode you selected, move down to the corresponding option and press **OK** to open its Change ... Key screen.
5. For **BISS-1**, enter a 12-digit hexadecimal key. For **BISS-E**, enter a 16-digit hexadecimal key. For **BISS-E Injected ID**, enter a 14-digit hexadecimal key.
6. Use the up/down arrow keys to change the value of each character. Press and hold the up/down arrow key to rapidly scroll through the list.
7. Press the right arrow to move to the next character.
8. Press **OK** to save your changes.

Setting Up Site Management Switches

Site management switches are located with the receiver and consist of normally open single-pole-single throw (SPST) relays. These can be used to control external equipment or devices at the receive site.

To set up these switches, select the **Site Management Control** option from the **Setup** menu to open the **Site Management Menu** as shown in Figure 3-19.

Figure 3-19: Site Management Menu

Edit Site Management

1. Select this option to open the menu as shown in Figure 3-20 on page 3-21. This menu lets you relabel any of the four site management switches.

Figure 3-20: Site Management Configuration Menu

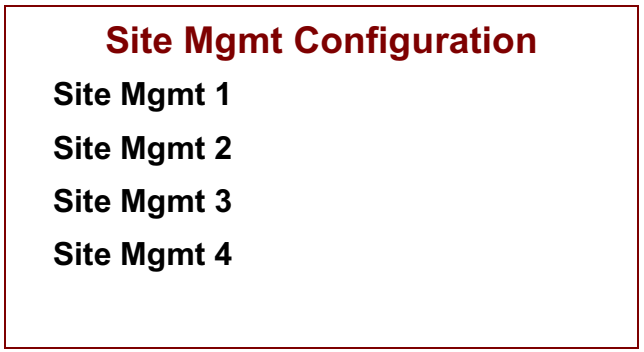
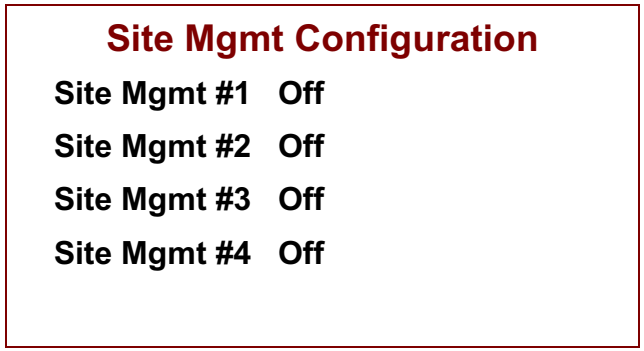


Figure 3-21: Site Management Configuration Screen



2. Select each **Site Mgmt** switch in turn to open a name field.
3. Use the up/down arrow keys to change the value of each character. Press and hold the up/down arrow key to rapidly scroll through the list. Valid characters include upper and lower case letters, 0 to 9, and punctuation.
4. Press the right arrow to move to the next character.
5. Press **OK** to save the switch name.
6. Press **Back** to return to the **Site Management Menu** as shown in Figure 3-19 on page 3-20.

Activate Site Management

1. Select this option to open the screen as shown in Figure 3-21.
2. For each switch, press the right arrow to turn it **On** or **Off**. Press the down arrow to move to the next switch.
3. Press **OK** to save the changes.

3.9.2 Configuring Packet Switching

The following information describes Packet Switching, an optional feature.

The DRS4000 Receiver incorporates a four-input decoder for four-input diversity and remuxing applications. The decoder accepts standard 270 MHz ASI streams operating in either burst or packet mode and can decode signals from all Link encoders giving ultra-low delay.

The decoder is compatible with most other encoders, with some restrictions (B Frames and field encoding are not accepted). The unique diversity feature automatically selects the best signal from the receiver's four inputs. Outputs include SD with embedded audio.

You can operate the decoder in the following ways:

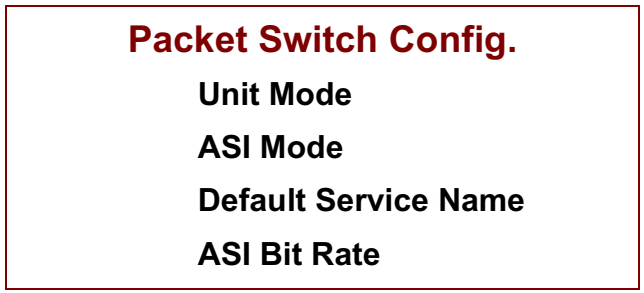
- As a four-channel diversity decoder
- As a remux system remuxing four channels onto one ASI stream

In all modes of operation only one service can be decoded.

To set up packet switching for the receiver, follow these steps:

1. Select **Packet Switch Configuration** option from the **Setup** menu to open the menu shown in Figure 3-22. Use these options to configure the decoder.

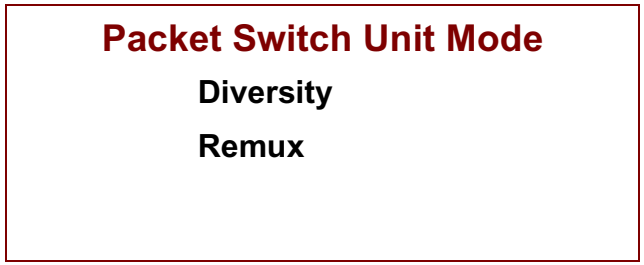
Figure 3-22: Packet Switch Config Menu



Unit Mode

1. Select this option to open the menu shown in Figure 3-23.

Figure 3-23: Packet Switch Unit Mode Menu

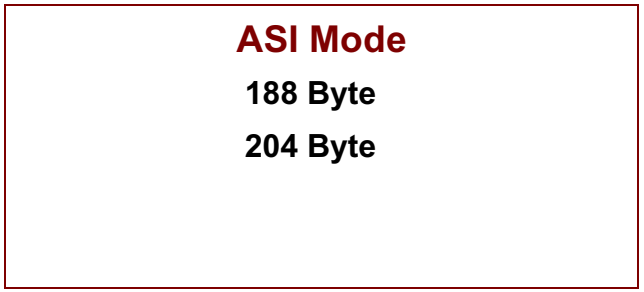


2. Select **Diversity** to operate as a four-channel diversity decoder. Select **Remux** to operate as a remux system.
3. Press **OK** to save the setting.

ASI Mode

1. From the **Packet Switch Config** menu, select **ASI Mode** to display the menu shown in Figure 3-24.

Figure 3-24: ASI Mode Menu



2. Select **188 Byte** or **204 Byte** to specify the packet length of the ASI stream. This value is determined by the transmitter.
3. Press **OK** to save the setting.

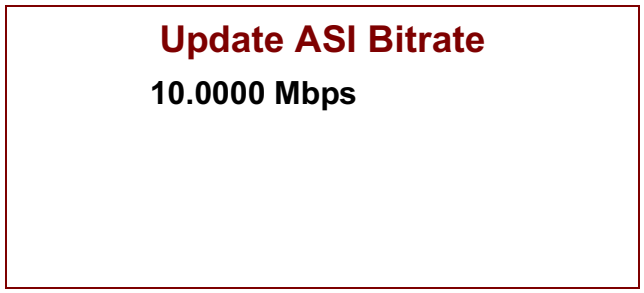
Default Service Name

1. From the **Packet Switch Config** menu, select **Default Service Name** to display a screen with a single line of spaces.
2. Enter a service name using the up/down arrow keys to change the value of each character and the left/right arrow keys to move from character to character.
3. Press **OK** to save the setting.

ASI Bit Rate

1. From the **Packet Switch Config** menu, select **ASI Bit Rate** to display the menu shown in Figure 3-25.

Figure 3-25: Update ASI Bit Rate



2. Enter the overall bit rate for the receiver (default value is 10 Mbps and maximum bit rate is 40 Mbps). This number must be set to accommodate the data stream passing through. It does not matter if the bit rate is set too high. Use this setting to limit the ASI output bit rate where the output signal is being fed to a downstream multiplexer.
3. Use the up/down arrow keys to change the value of each character and the left/right arrow keys to move from character to character.
4. Press **OK** to save the setting.

3.9.3 Using the Factory Setup Menu

Prior to shipment, MRC configures each receiver to operate with a predefined suite of settings, or to customized settings. The **Factory Setup Menu**, available from the **Setup Menu**, is primarily for use by MRC Technical Support personnel.

If, however, you replace a component or change the configuration in any way, you need to reset or recalibrate certain settings. To change the factory settings, follow these steps:

1. Select **Setup** from the control screen to open the **Setup** menu.
2. Select **Factory Setup** to open the menu shown in Figure 3-26.

Note When viewing the PDF file for this manual, click on any of the following menu options to jump to the section that describes that option.

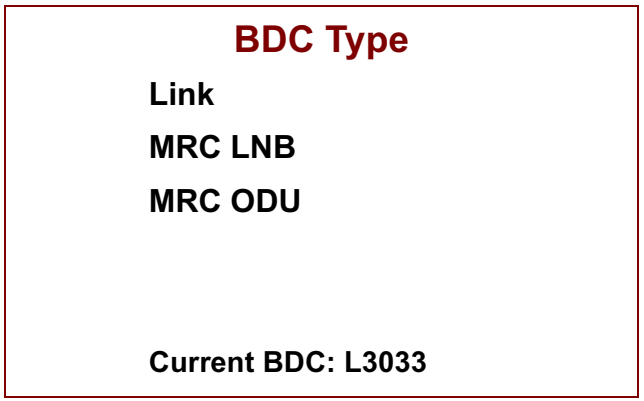
Figure 3-26: Factory Setup Menu

Selecting the BDC Type

Depending on the RF band in which you must operate, you need to identify the type of BDCs installed. Follow these steps:

1. Select the **BDC Type and Band Control** option from the **Factory Setup Menu** to display a menu of downconverter types as shown in Figure 3-27.

Figure 3-27: BDC Type and Band Control Menu



2. Determine the model number of the downconverters that ares connected to the receiver and select the appropriate menu option. This displays a list.
3. Select your model number. This returns you to the **Factory Setup** menu.

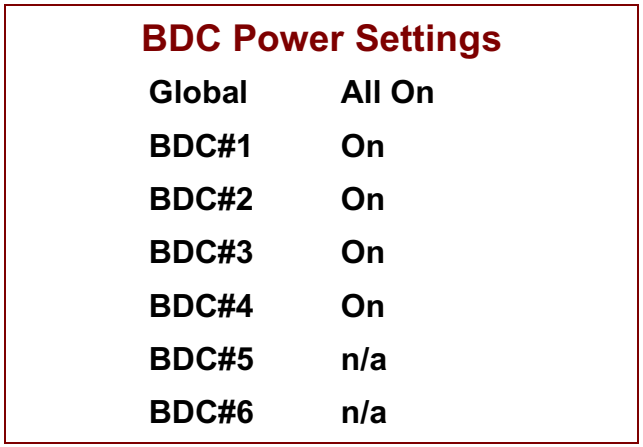
CAUTION *All downconverters connected to the receiver must come from the same manufacturer and be of the same frequency range. Do not mix manufacturers or frequencies. Improper voltage from the receiver could damage the BDC.*

Setting BDC Power

At the factory, power is set to **On** for all BDCs. To set power on or off for each BDC, follow these steps:

1. Select the **BDC Power** option from the **Factory Setup Menu**. A confirmation box displays, telling you to make sure the correct BDC is selected because improper voltage could damage the BDC.
2. Press **OK** to continue or **Back** to select a different BDC type. If you press **OK**, the menu shown in Figure 3-28 displays. With this menu, you can set power **On** or **Off** for all BDCs or for individual ones.

Figure 3-28: BDC Power Settings Menu



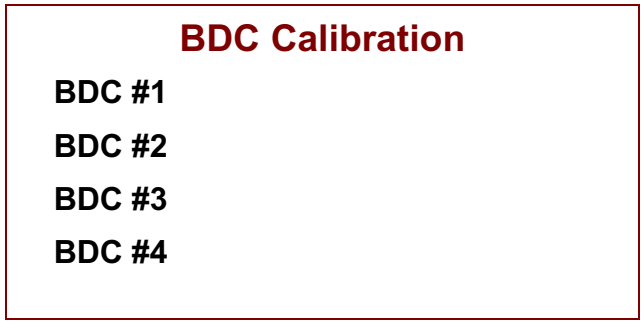
3. For **Global** select **All Off**, **All On**, or **Individual**.
4. If you select **All On** or **All Off**, press **OK** to save the setting, which will be updated when you reopen this menu. If you select **Individual**, you can move to any BDC number, set it to **On** or **Off** as needed, and press **OK** to save all settings.

Calibrating RCL

To calibrate RCL for each BDC, follow these steps:

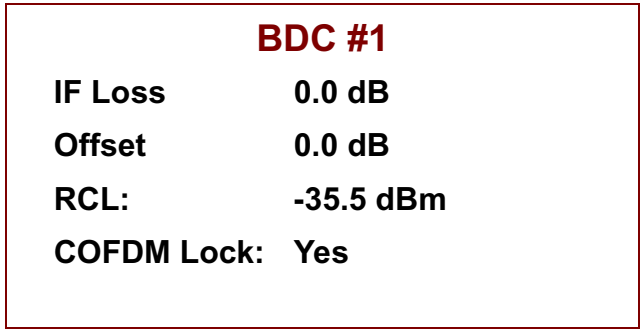
1. Select **RCL Calibration** from the **Factory Setup Menu** to display the menu shown in Figure 3-29.

Figure 3-29: BDC Calibration Menu



2. Select **BDC #1** to open the **BDC #1** calibration screen as shown in Figure 3-30. This screen reports the current receive carrier level (RCL) in real time and also displays the status of the COFDM Lock.

Figure 3-30: Downconverter Calibration Screen



3. For **IF Loss** and enter the cable loss that you have calculated for the cable you are using. The default value is 0.00 dB. Use the left/right arrows to change the value, and use the down arrow to move to the next setting.
4. Note the **Offset**. This is a factory setting and should not be changed.
5. Press **OK** to save this setting and return to the **BDC Calibration** menu.
6. Select another BDC to calibrate and repeat steps 3 to 5 for each additional downconverter.

Upgrading Firmware

This feature allows you to install the latest firmware from a standard USB flash drive. MRC will periodically provide updates via its E-Synergy Customer Portal. You can also install a previous version of firmware should that become necessary.

To upgrade the firmware, follow these steps:

1. Install a USB flash drive in your computer.
2. Open a web browser and go to the MRC web site (http://www.mrcbroadcast.com/).
3. Select the **E-Synergy Portal** link and enter your user name and password.
4. Locate the firmware for this product and download it to the flash drive.
5. Remove the flash drive from the computer.
6. At the DRS4000 front panel, Select **Upgrade Firmware** from the **Factory Setup Menu**. An information box instructs you to insert the flash drive.
7. Insert the flash drive into the USB connector on the front panel. The **Firmware Upgrade** menu displays one or more versions of firmware.
8. Select the version you downloaded. For example, the firmware may be named:
   Artillery_v_2_65_4000_2008_12_25.srec
   where,
   v_2_65 indicates the version,
   4000 indicates the DRS model, and
   2008_12_25 indicates year, month, and day released.

   The screen will display a series of messages as it installs the firmware. The final message "**Verify complete...**" indicates that the firmware was successfully installed.
9. Remove the flash drive, power down the receiver, wait a few seconds, and then power up the receiver.
10. If the Preset field on the control panel shows **No memory**, reset the memory as explained in the next section, Initializing the EEPROM.

Initializing the EEPROM

You can erase all presets from memory by using this feature, which affects only the stored presets and RCL calibrations.

CAUTION *This feature erases from memory all the presets you have set up. It also erases the RCL calibrations you performed, so you may want to record those settings first.*

If you need to restore the presets after erasing memory, you should first manually record the name and settings for each one, then recreate them via the Presets menu, as described in Section 3.9.4 on page 3-29.

To initialize memory, follow these steps:

1. Select **EEPROM Initialization** from the **Factory Setup Menu**.
2. Read the instructions on the screen, press **OK** to continue, and press **OK** to complete the procedure.
3. Press **OK** to return to the **Factory Setup Menu**.

Editing a Custom Band Plan

This feature allows non-U.S. users to customize the frequencies assigned to each channel in the 2, 3, 5, or 7 GHz channel plans. For each channel, you can specify a unique frequency for the minus (-) offset, center frequency (0), and plus (+) offset. After customizing all frequencies, you can activate them via the **Change Channel** menu.

This feature is password-protected and the initial password is 0000. For security reasons, your IT staff should reset the password as soon as possible after installation to prevent unauthorized changes to the channel plans.

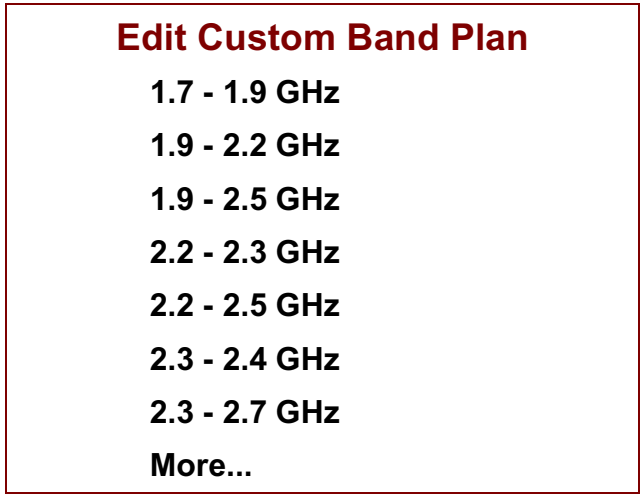
Note The initial values for each channel and offset are placeholders, so you must revise all of them to your unique frequencies before activating them.

Since the procedure for all band plans is virtually the same, only the 2 GHz band plan is explained.

To customize one or more frequencies, follow these steps.

1. From the **Setup Menu**, select the **Factory Setup** option.
2. From the **Factory Setup Menu**, select **Edit Custom Plan** to open the password screen.
3. Enter the password (default is 0000) and press **OK** to display the menu shown in Figure 3-31.

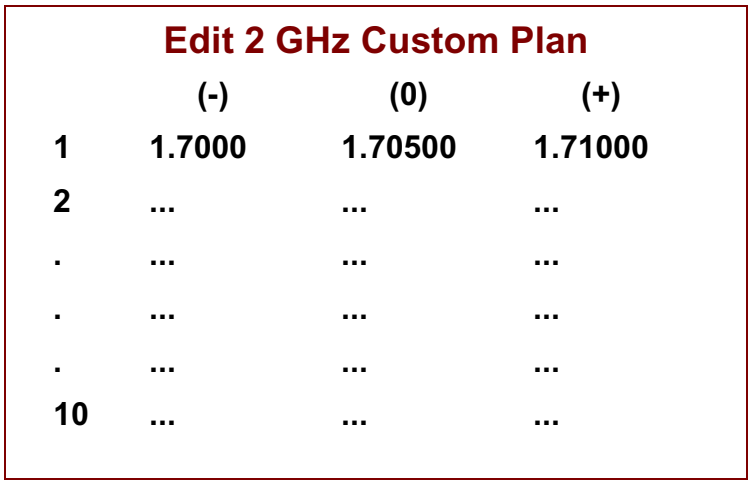
Figure 3-31: Edit Custom Band Plan



4. Select the band plan that you need to modify or select **More** to display more RF bands. This opens the **Edit N GHz Custom Plan** menu similar to Figure 3-32 on page 3-28, where “N” is the RF band you selected.

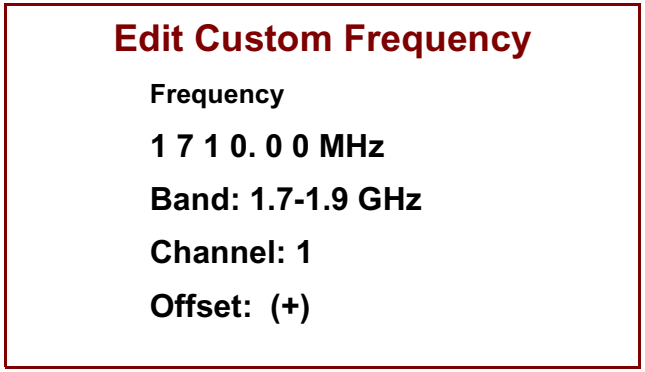
   This screen consists of channel numbers down the left side and three columns of frequencies (for the minus offset, center frequency, and plus offset). Since these are to be custom frequencies, the task is to change all the values to match your operating conditions.

Figure 3-32: Edit 2 GHz Custom Plan



5. Select a frequency to be modified, for example channel **1**, plus **(+)** offset. This opens a screen similar to Figure 3-33.

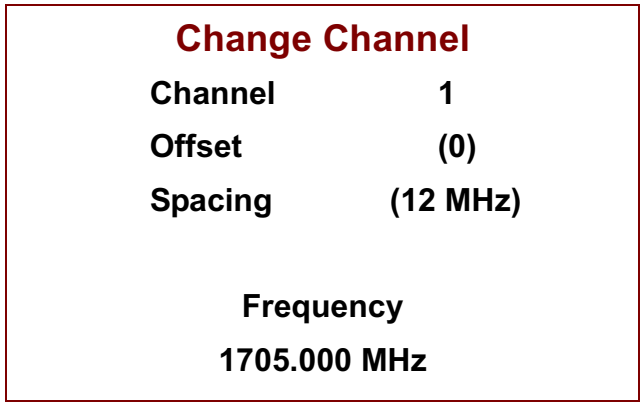
Figure 3-33: Edit Custom Frequency Screen



6. Use the up/down arrows to change each digit, and use the left/right arrows to select another digit.

7. Press **OK** to save the new frequency.
8. Repeat steps 4 to 7 until you have customized all frequencies that you need.
9. Press **Back** several times until the Control Screen displays.
10. Select **Chan** to open the menu shown in Figure 3-34.

Figure 3-34: Change Channel Menu



11. Select **Spacing** and use the right arrow to select a value of **(Cust)**.
12. At the Password screen, enter 0000 (the initial password). At the **Change Channel** screen, the customized frequency for the current channel and offset will appear on the screen.
13. Select **Channel** and use the right arrow to scroll through the channels. Your custom frequencies will display as you scroll through the list.
14. Select the channel you need to monitor and press **OK**.

Upgrading the Tuner

Some DRS4000 systems may have tuner boards older than version 5. Use the Hardware Configuration options on the Setup menu to check your tuner version. If it is earlier than version 5, use the **Upgrade Tuner** option to load the latest version from the firmware.

Follow these steps:

1. From the Setup menu, select **Upgrade Tuner**. A screen displays with a single line of spaces.
2. Enter the tuner code (2736) using the up/down arrows to change the value, and the right arrow to move to the next space.
3. Press **OK** and read the warning before continuing.
4. Press **OK** to save the continue or **Back** to cancel.

Factory Testing

The **Factory Setup Menu** provides a **Factory Test** option for use by MRC personnel only. This option is password protected to prevent accidental use by unauthorized personnel.

3.9.4 Using the Preset Menu

A preset is a collection of data stored in firmware that contains all the receiver settings for a given situation that you need to reuse frequently. The Preset Menu allows you to save a group of settings with a unique name, quickly set the receiver to those specific settings by loading a preset, and delete a preset if it is no longer needed.

The DRS4000 Receiver supports up to 50 presets. Each preset stores all the settings you can change from the control screen.

Creating and Saving a Preset

To create a preset, follow these steps:

1. Adjust all the settings on the receiver for a particular incoming video signal.
2. Select the **Presets** button on the bottom of the Control Screen to display the menu shown in Figure 3-35.

Figure 3-35: Preset Menu

3. Select **Save Preset** to open a screen consisting of one line of spaces on which you can enter a description of this preset.
4. For each space, the available characters are A to Z, a to z, 0 to 9, and punctuation – in that order. Press and hold the up/down arrow key to rapidly scroll through the characters. Press the right arrow key to move to the next character.

   For example, if you frequently set the receiver to channel 10 at 7 GHz, the preset name might be CH10_7GHZ.
5. Press **OK** to save the preset. A confirmation screen reports the preset name and number.

6. Press **OK** to confirm or press **Back** to cancel. Note that the current preset is still in effect.
7. At the control screen, adjust the receiver settings for the next preset.
8. Repeat steps 2 to 6 to create another preset. When you get to the **Save Preset** screen, the previously saved preset name displays.

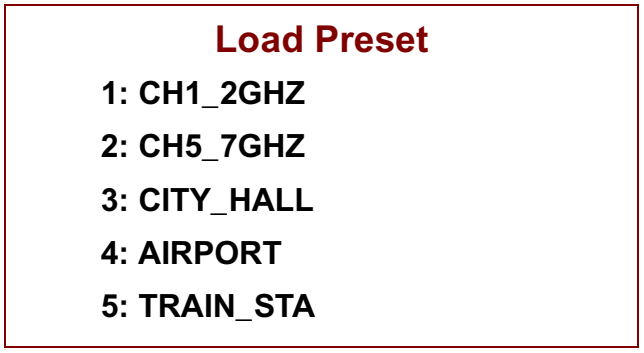
Loading a Preset

To quickly change receiver settings to match the incoming video signal, you can load a preset (that you previously saved) instead of manually changing each setting. After loading a preset, the new settings will display on the control screen.

To load a preset, follow these steps:

1. Select the **Preset** button from the control screen to open the **Preset Menu** as shown in Figure 3-35 on page 3-29.
2. Select **Load Preset** to open the menu similar to the one shown in Figure 3-36.

Figure 3-36: Load Preset Menu



3. Select the desired preset and press **OK**. This activates all the settings stored in the preset and returns you to the control screen.

Deleting a Preset

If you decide that you no longer need a preset, you can delete it using the following steps:

1. Select the **Presets** button fro the control screen to display the **Preset Menu** as show in Figure 3-35 on page 3-29.
2. Select **Delete Preset** to open the **Delete Preset** menu which looks very similar to the **Load Preset** menu in Figure 3-36.
3. Select a preset and press **OK** to delete it.
4. At the confirmation screen, press **OK** to confirm or press **Back** to cancel.

Note After you delete a preset, the remaining presets will be renumbered with new sequence numbers.

3.9.5 Using the Options Menu

The **Options Menu** provides additional features.

Entering a License Code

After operating the receiver for a length of time, you may decide to upgrade some of the features. MRC will supply a new license code, which will activate the new features.

To enter a license code, follow these steps:

1. Select the **Options** button from the control screen. This opens the **Options Menu**.
2. Select the **Enter License Code** option. This opens a screen consisting of one line of spaces for the code.

CAUTION *If the license code is entered incorrectly, various features could become deactivated.*

3. Follow the on-screen instructions. For each space, the available characters are A to Z, a to z, 1 to 0, and punctuation – in that order.
4. Press and hold the up or down arrow key to rapidly scroll through the character list. Press the right arrow to move to the next character.
5. Press **OK** to save the new license code.
6. At the confirmation screen, press **OK** to confirm or press **Back** to cancel. Pressing **OK** returns you to the **Options Menu**.

3.9.6 Using the Camera Menu

Note This menu is not yet implemented. You can examine the menu options and values but they have no effect on any remote cameras.

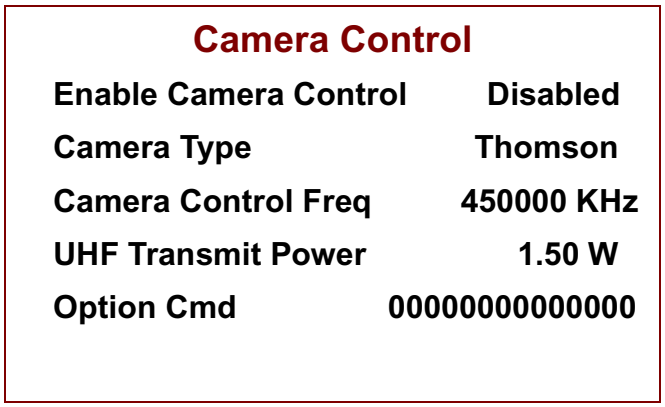
If you obtained a Link camera control system, you can use the DRS4000 Receiver to control the Link wireless CCU interface. Additional equipment is required, such as a UHF transmitter and Operator Control Panel (OCP) configured with the receiver, and a UHF receiver mounted on the camera.

This **Camera** menu allows an operator – usually working at a portable studio near the remote camera crew – to set up the receiver so it can transmit commands via a UHF transmitter to a specific remote camera. The commands, which emanate from the OPC module connected the receiver, control certain camera features that would be difficult for the camera operator to adjust during a live shoot.

To use the **Camera** menu, follow these steps:

1. Select the **Camera** button from the control screen. This opens the menu shown in Figure 3-37. Notice that only the first item is active and is set to **Disabled**.
2. Select the first item to open the **Camera Control Enable** menu.
3. Select **Enabled**. This returns you to the previous menu but now several items are active.
4. Select **Camera Type** to open the **Camera Control Enable** menu. Select either the **Thomson**, **Sony**, or **Ikgami** camera. This returns you to the previous menu.

Figure 3-37: Camera Menu



5. Select **Camera Control Freq** to open the **Camera Control Frequency** screen. The default value is 450,000 KHz (450 MHz) and the valid range is from 450,000 to 470,000 KHz.
6. Use the up/down arrow keys to change the value of a digit (excluding the leftmost digit). Use the left/right arrow keys to move to another digit. Press **OK** to save the setting and return to the **Camera Control** menu.
7. Select **UHF Transmit Power** to open the **Camera UHF Power** screen. The default value is 1.5 W and the valid range is from 0.1 to 2.0 W.
8. Use the up/down arrow keys to change the value of a digit (excluding the leftmost digit). Use the left/right arrow keys to move to another digit. Press **OK** to save the setting and return to the **Camera Control** menu.
9. Do not select **Option Cmd**. This item is for future use and has no current function.

3.10 Operating the Receiver Remotely

If the receiver is installed so that it can be conveniently connected to your local area network, then you do not need to be in front of the actual receiver to adjust its settings. You can control and maintain it from any computer on the network via the built-in DRS4000 web server.

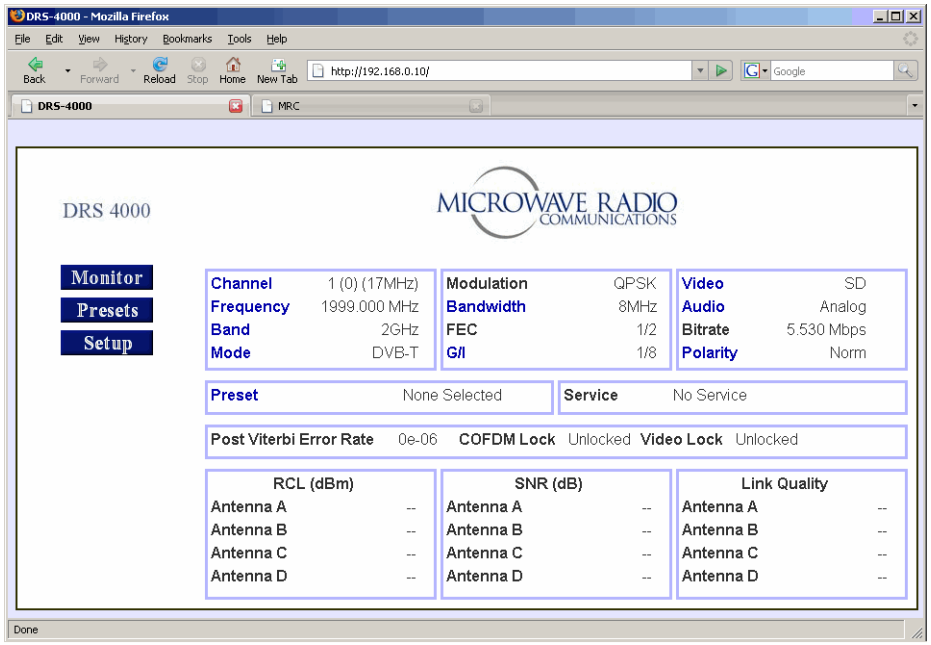
The web server is designed to serve up web pages in a networked computer's web browser. This web browser interface mimics the menus and screens you can access from the receiver's control panel. Internet Explorer, Firefox, and Safari are web browsers that can be used to connect remotely to the receiver.

3.10.1 Starting the Web Browser Interface

To access the receiver from a networked computer, follow these steps:

1. Verify that the receiver is connected to the network. There must be an Ethernet cable connected from the receiver's front panel to a nearby LAN connection.
2. Obtain the IP address for the receiver. This is important in configurations where more than one DRS4000 Receiver is connected to the network.
3. At the networked computer, open a web browser and enter the receiver's IP address into the browser's address field and press the Enter key. This opens the DRS4000 web browser interface's Monitor page as shown in Figure 3-38 on page 3-33.

Figure 3-38: DRS4000 Web Interface: Monitor Page



3.10.2 Common Features

Each web page provides navigation buttons at the upper left.

The **Monitor** button returns you to the main control page from anywhere in the web interface. The Monitor page contains the same information as on the receiver's control panel.

The **Presets** button opens the page for loading, saving, viewing, and deleting presets.

The **Setup** button opens the page that contains all the receiver parameters you can set up and modify.

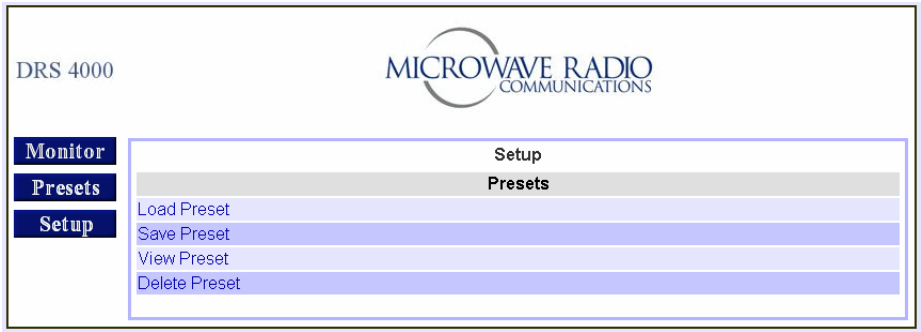
If a page contains links, each link opens a page on which you can select or change a value. For pages that require you to select a value for a setting, you select from a pulldown menu or click on a radio button.

3.10.3 Using the Web Browser Interface

Each link on the Monitor page opens a page that allows you to modify that setting. For example, the Channel link opens a page for changing the channel, offset, and spacing. Refer to "Using the Control Screen" on page 3-8 for instructions on modifying these settings.

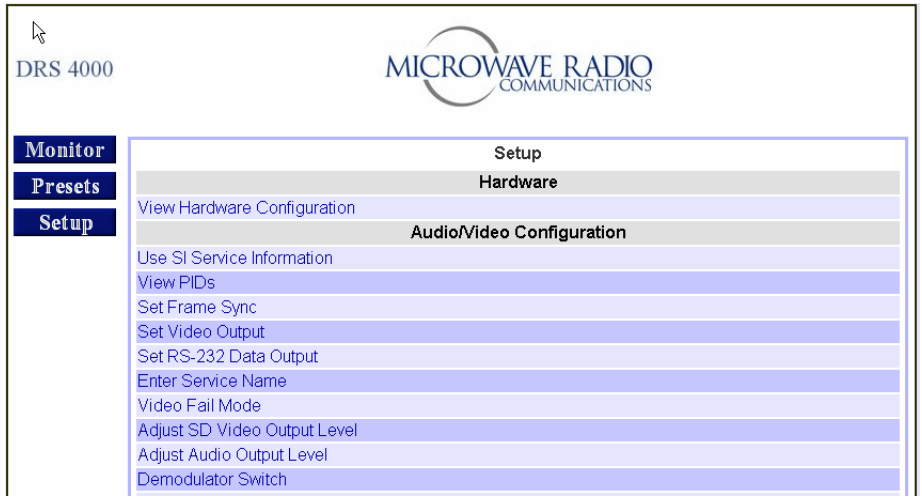
The **Presets** page, shown in Figure 3-39, provides the same features as found on the control panel's **Preset** menu. Refer to "Using the Preset Menu" on page 3-29 for instructions on using presets.

Figure 3-39: DRS4000 Web Interface: Presets Page



The **Setup** page, shown partially in Figure 3-40 on page 3-34, provides the same features as found on the control panel's **Setup** menu. Refer to "Using the Setup Menu" on page 3-11 for instructions on modifying these settings.

Figure 3-40: DRS4000 Web Interface: Setup Page



4 Troubleshooting

4.1 Chapter Overview

This chapter provides troubleshooting procedures for technical problems that an operator may encounter. The problems are organized into the following categories: video, audio, and general system.

For each component, a problem-cause-action table states one or more possible causes. For each possible cause, the table provides one or more suggested actions that you can use. Perform the suggested actions until you either fix the problem or determine that you need technical support from MRC.

The following troubleshooting topics are discussed. Whenever the suggested action requires more than a few steps, a link takes you to a separate procedure.

4.2 Video Problems

The following table describes video problems.

Table 4-1: Video Problems

Problem	Possible Cause	Suggested Actions
No video	• Loose or disconnected UHF cables at receiver. Loose cable at camera or transmitter. • Receiver set to the wrong RF band, channel, or other setting. • Wrong preset is selected. • All the antennas or BDCs are disconnected or damaged. • UHF cables connected to BDC5 or BDC6 connector.	• Verify that all UHF cables are securely fastened to BDC connectors at rear of receiver. • Verify that all camera and transmitter cables are securely fastened. • Verify the transmitter's settings and compare them to the receiver's settings. Correct any settings as needed. See Section 3.8 on page 3-8. • Select the preset that matches the transmitted signal. • Check condition of all antennas, BDCs, and the cables connected to them. • These connectors are currently non-functional. Use any of the other four connectors.

Table 4-1: Video Problems

Problem	Possible Cause	Suggested Actions
No video in monitor and no control panel display	• Power cable for receiver is loose or disconnected. • No power or insufficient power to receiver. • Fuses are blown.	• Make sure power cable is firmly connected at both ends. • Check line voltage with voltmeter. Voltage must be 100 to 130 VAC (U.S.) or 205 to 240 VAC (non-U.S.). • Unplug power cable, remove fuse holder from connector, and replace fuses. Use 2A glass fuses.
Poor video quality	• Signal strength is low due to interference or a weak signal. • Receive antennas in use are not in the transmitter's line of sight. • Wrong preset selected.	• Determine whether the remote crew can relocate or reposition the transmitter, switch to another channel, or boost power. • Determine whether the remote crew can relocate or reposition the transmitter. • Select the preset that matches the transmitted signal.
No receive signal level on receiver's RCL meter.	• The transmitter is in Standby mode. • The wrong preset is selected. • A cable is loose or disconnected.	• Contact the remote crew and verify that the transmitter is running. • Select the correct preset. • Check all cables for secure connections.

Table 4-1: Video Problems

Problem	Possible Cause	Suggested Actions
Receive signal level OK but no video at receiver.	• No video feed. • Loose or disconnected video cable between camera and transmitter. • Incorrect video format specified (for example, SD vs. HD).	• Contact the remote crew and verify that the camera and transmitter are powered up and connected. • Verify the connections between camera and transmitter. • Verify the video settings for the receiver. From the control screen, select **SETUP**, select **Audio/Video Configuration**, and select and review any of the video related menu options. See the section on “Configuring Audio and Video Settings” on page 3-16.

4.3 Audio Problems

The following table describes audio problems.

Table 4-2: Audio Problems

Problem	Possible Cause	Suggested Actions
No audio at studio/command center.	• No audio input. • Loose or disconnected audio cables. • Incorrect audio settings at receiver (for example, Channel A vs. Channel B).	• Check the audio source. • Verify with the remote crew that the audio cables are securely connected to the transmitter. • Verify the audio settings for the receiver. From the control screen, select **SETUP**, select **Audio/Video Configuration**, and select and review any of the audio related menu options. See the section on"Configuring Audio and Video Settings" on page 3-16.
Audio received at studio/command center at a very low level.	• A microphone level signal is being transmitted. • Incorrect audio settings at receiver (for example, Digital vs. Analog)	• Verify that the transmitter's audio outputs are at a line level. • Verify the audio settings for the receiver. From the control screen, select **SETUP**, select **Audio/Video Configuration**, and select and review any of the audio related menu options. See the section on"Configuring Audio and Video Settings" on page 3-16.

4.4 General System Problems

The following table describes general system problems.

Table 4-3: General System Problems

Problem	Possible Cause	Suggested Actions
Cannot connect to the DRS4000 web server.	Receiver is powered down or disconnected from the network.	Verify that the receiver is powered up and that it is connected to the network.
	Receiver IP address is incorrect.	From the control screen, select **Setup,** select **IP and MAC Address Configuration**, and enter the correct IP address.
Receiver does not power up.	Power cable not connected.	Verify that the power cable is fully connected at both ends.
	Fuse is blown.	1. Set the power switch to off and remove the power cable from the receiver. 2. Remove the fuse holder from the connector block and inspect the fuses. 3. Replace fuses if needed. 4. Reinstall the fuse holder and power cable. 5. Set the power switch to on.

5 Installation

5.1 Chapter Overview

This chapter provides instructions on unpacking and inspecting the components, preparing the site, and installing the components of the DRS4000 Receiver.

These instructions are written for technically-trained customer installers (that is, for customers who have an IT staff or other technical personnel responsible for installing electronic equipment), and for MRC Technical Services personnel who install such systems.

Here are the topics covered:

5.2 Reviewing Customer Specifications

Before installing any components, you, the customer, need to review several details so that the installation can proceed in a timely fashion. Use the following steps.

1. Verify with the MRC Inside Sales representative that all components for the customer order have been shipped.
2. Set up an installation date and resolve with MRC any open issues or questions about the customer order.
3. Verify that your site complies with all infrastructure requirements (such as power and communications lines).
4. If you require that Accepted Test Procedures must be performed, identify the procedures and the person who is to sign off the completed procedures.

5.3 Unpacking the Components

Each system is shipped after factory testing with all components ready to install at your site. Components are packaged in appropriate shipping containers.

CAUTION *Verify that all packing material has been removed from any included antennas.*

Adhere to the following guidelines when unpacking your new equipment:

- Unpack the equipment carefully to avoid accidental damage.
- Locate all parts and accessories in each container.
- Verify that the items shipped agree with those listed on the packing list.
- DO NOT discard the container or packing material until you have inspected the equipment and are sure there is no shipping damage. The container and packing must be available in case you need to file a damage claim with the shipping carrier.

5.4 Inspecting the Components

After unpacking the equipment, MRC recommends that you inspect all components and cabling using the following checklist:

- Check for any dents or scratches. If the equipment is dented or scratched, it may have suffered internal damage as well.
- Check that the equipment is clean and dry.
- Check that no cables or connectors are broken, damaged, or loose.
- Check that no switches or LED indicators are broken, damaged, or loose.

5.5 Reporting Any Damage

Should you discover any damage after unpacking the system, report the damage by following these steps:

- Immediately file a claim with the shipping carrier.
- Contact MRC Customer Service to determine the disposition of the equipment. See Chapter 1 for contact information.
- Forward a copy of the damage report to MRC Customer Service.

When contacting Customer Service, please have the following information available:

- Sales order number
- Model number and serial number of all damaged items

5.6 Preparing the Site

The following requirements make initial installation easier and allow room for future access and servicing. These requirements focus on the equipment rack, ventilation, moisture, cabling, power supply, and grounding.

Equipment Rack

The DRS4000 Receiver fastens to the mounting rails of a standard EIA 19-inch (48.3 cm) equipment rack.

CAUTION *Do not overload the rack or load it unevenly. Secure the rack to a solid surface.*

- Make certain that the rack and mounting rails are strong

and rigid enough to support all the equipment in the rack.

- The rack should be securely attached to a solid surface such as a floor or wall to prevent movement or tipping over.
- Position the rack to allow easy access to the front and rear of the equipment. MRC recommends at least 18 inches (45.7 cm) clearance at the rear of the rack and at least 36 inches (91.4 cm) clearance in front of the rack.
- The cables at the rear of the rack should not be pressed against the rear of the equipment when closing doors. This can stress the cables and may shorten their life.

Ventilation

Heat generated from components in the rack needs to be ventilated. Proper ventilation is important for preventing excessive hot spots from developing within the rack and adversely affecting the components.

CAUTION *Temperatures inside a closed mounting area can be significantly higher than the ambient temperature. Always allow adequate ventilation.*

- If possible, install components in a climate-controlled area.
- Installation should allow adequate airflow around the equipment. Exhaust air from the rack should be circulated and mixed with room air, not trapped in a closed space.
- When mounting components in an enclosed rack, it is good practice to allow 1 RU (1.75 inches or 4.45 cm) of space between each component. You can fill those spaces with optional grillwork instead of blank panels.

Moisture

Locate the equipment in an area protected from dripping water or excessive humidity.

WARNING Indoor equipment is not designed to withstand water or moisture. If water does penetrate the chassis, it could cause equipment damage and/or create a safety hazard.

Cabling

MRC recommends the following general practices be performed at all installations.

- Secure all cables at close intervals along their entire lengths.
- Protect cabling with added sheathing or padding anywhere cabling passes through a hole or lies against an obstruction.
- Provide flex relief at any location where the cable must change direction sharply, to maintain a smooth bend and prevent kinking.
- Provide strain relief at each connector to absorb any pulling forces on the cable and prevent damage to the connector.

Power Supply

Check the onsite electrical supply to be sure it can provide all the power needed at the site without overloading. Power ratings for equipment can be found on a rating plate, usually on the rear panel. If necessary, consult a licensed electrician.

CAUTION *Be sure the power being supplied matches the power required by the equipment.*

CAUTION *Power supply cords and cables must be protected. Do not run cords where they can be stepped on. Protect cables against pinching and chafing. Pay special attention to locations where the cables enter or exit an enclosure or make a sharp bend.*

CAUTION *Ensure that the electrical supply is protected by overcurrent protection devices as required by the applicable electrical codes.*

Grounding

For safe operation, all equipment must be properly grounded.

- Connect all equipment on a rack to a common ground.
- Connect the common ground to a site ground.
- The ground wire should be as short as possible, and follow the straightest path possible.

CAUTION *Be sure the equipment grounding follows applicable electrical codes.*

CAUTION *Never modify a grounded power plug to connect to an ungrounded receptacle.*

5.7 Testing the Antennas

All antennas for your configuration are tested at the factory to ensure proper operation. Before installing them on a tower, mast, or building at the receive site, you should test them on the ground to ensure that they are still operating properly.

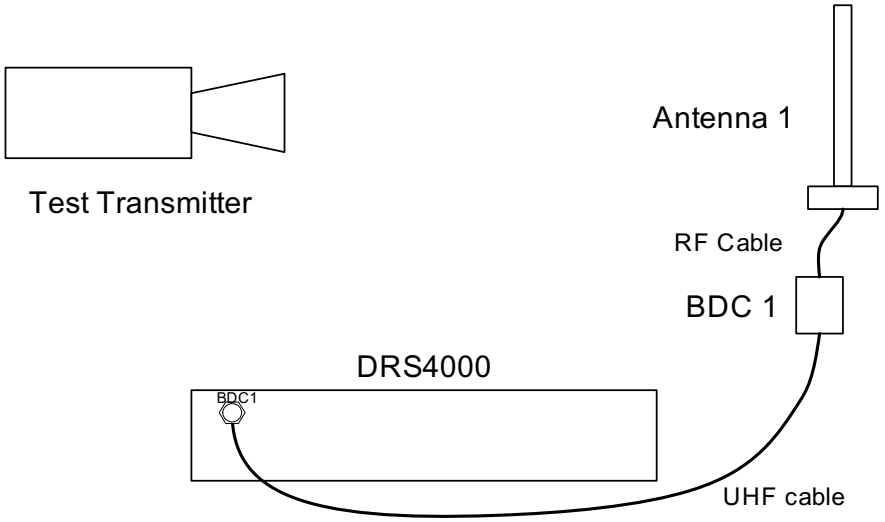
CAUTION *Test each antenna on the ground before mounting it on a tower or building.*

CAUTION *Verify that all packing material has been removed from the antenna.*

To test one or more antennas on the ground, follow these steps.

1. Set each antenna, the block downconverters BCDs), and the DRS4000 Receiver on a worktable.
2. Connect a spare RF cable between an antenna and a BCD. Repeat this until all antennas and BCDs are connected. Refer to Figure 5-1 on page 5-5 for connections details.
3. Connect a spare UHF cable from each BCD to an BCD connector at the rear of the receiver. For example, for a four antenna system, use the BCD1, BCD2, BCD3, and BCD4 connectors.

Figure 5-1: Testing the Antennas



4. Set up a test transmitter near the receive antennas. Power it up and set it to standby mode.
5. Configure the transmitter for the settings you typically use and record them for use with the receiver:
   - RF Band: 2 or 7 GHz
   - Channel
   - Modulation mode: DVB-T, LMS-T, or SCM
   - Modulation type: QPSK, 16QAM, or 32QAM
   - Bandwidth: 6 MHz or Auto
   - Guard interval: 1/32, 1/16, 1/8, or 1/4
   - SD or HD decoding
   - Video line standard
   - Audio: Analog or Digital
6. Power up the receiver and use the Setup menu to configure it to the same settings as for the transmitter. Refer to Chapter 3, Using the Setup Menu, of the *DRS4000 Receiver Operator's Guide* for details.
7. For the receiver, also verify the Factory Setup menu. Make sure that the Number of Inputs and BCD Type are correctly set for your configuration.
8. Set the transmitter to Low Power Transmit mode.
9. Verify that the control screen on the receiver displays a receive carrier level (RCL), signal-to-noise ratio (SNR), and Link Quality reading for each antenna. This indicates that the antenna is feeding the signal to the receiver.
10. At the end of testing, power down all equipment and disconnect all cables in preparation for installation.

5.8 Installing the Receiver

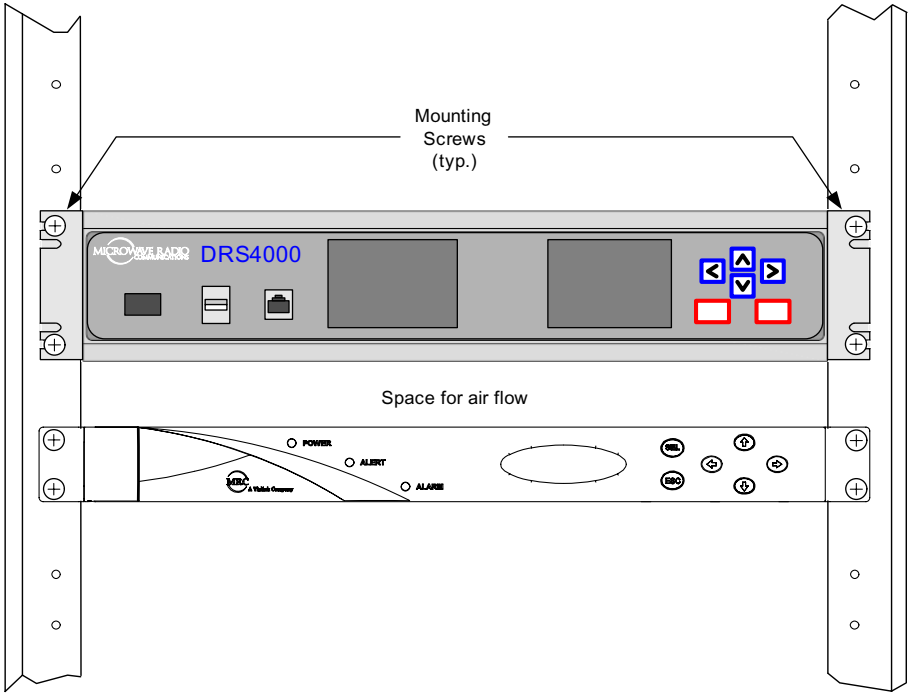
At the receive site, you can use an existing standard EIA 19-inch rack or a rack ordered specifically for this configuration. Before installing the receiver, identify the rack mounting holes you intend to use.

Note	1. When installing components, leave 1 RU of space between them for ventilation. 2. Installation is easier if one person holds the component in place while another person fastens the mounting screws. 3. If MRC installs the system, the installer provides the mounting hardware; otherwise, you, the customer, must supply these parts.

Use the following steps to set up the components at each receive site.

1. Unpack the cartons containing the DRS4000 Receiver, the antennas, and the BCDs.
2. Line up the mounting holes on the component's front panel with the selected mounting holes on the rack as shown in Figure 5-2.
3. Insert the mounting screws and tighten them securely. Be sure to provide about 1 RU of space above and below the receiver for air flow.

Figure 5-2: Example of Rack Installation



4. Make sure the POWER switch is set to the Off (0) position. Connect the power cable to the POWER connector on the rear panel and connect the other end to an AC receptacle.

5.9 Installing Antennas and Downconverters

To feed the incoming signal to the receiver, you need to properly install the antennas, downconverters, and associated cabling.

5.9.1 Cabling Practices

To install cabling for optimum performance and ensure minimal maintenance, MRC recommends the following general practices:

- Secure the cabling at close intervals along its entire length.
- Protect the cabling with added sheathing or padding if it passes through a hole or lays against an obstruction.
- Provide flex relief at any location where the cable must change direction sharply, to maintain a smooth bend and prevent kinking.
- Provide strain relief at each connector to absorb any pulling forces on the cable and prevent damage to the connector.

CAUTION *Do not run cables where they can be walked on. Protect cables against pinching and chafing, especially at locations where the cables enter or exit an enclosure or make a sharp bend.*

5.9.2 Selecting Coaxial Cables

For applications where you must connect the downconverters via coaxial cables, use high quality UHF cable and use the shortest lengths possible to prevent UHF signal loss. If long lengths of cable are required, a UHF amplifier or gain block may be required. Contact MRC for specific cable types and lengths to use in your application.

If you do not connect the antennas directly to the downconverters, you will have to fabricate your own antenna mounting bracket. Remember that the distance between each pair of antennas is critical for optimum performance.

5.9.3 Aligning Omnidirectional Antennas

For applications using omnidirectional antennas, proper installation of the antennas will result in optimum performance. In all installations, the minimum distance between any two antennas is important.

Table 5-1 provides minimum separation distances for several frequency ranges available with the DRS4000 Receiver. This is the minimum recommended distance between any two antennas.

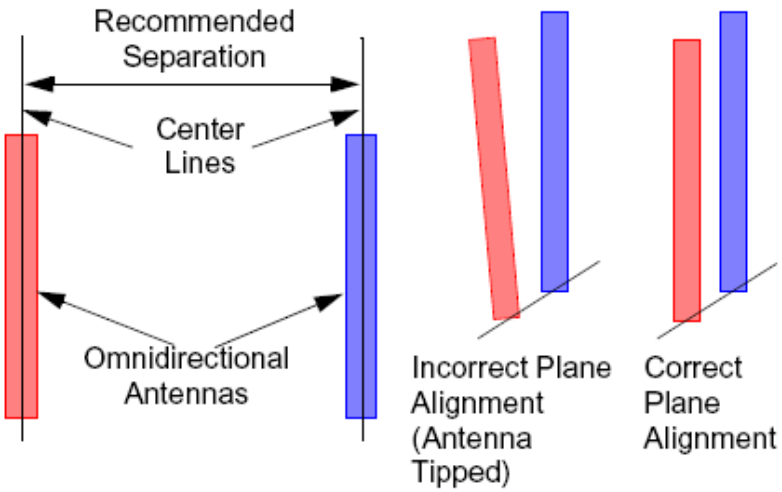
Table 5-1: Minimum Separation Distances for Antennas

Frequency Band (Reference Freq.) MHz	Recommended Separation (cm)	(inch)	Adjustment by 1/4 Wavelength (mm)	(inch)
1700 to 1850 (1700)	52.94	20.84	44.12	1.74
1900 to 2200 (1900)	47.37	18.65	39.47	1.55
2200 to 2500 (2200)	40.91	16.11	34.09	1.34
2300 to 2700 (2300)	39.13	15.41	32.61	1.28
4400 to 4700 (4400)	20.45	8.05	17.05	0.67
4800 to 5000 (4800)	18.75	7.38	15.63	0.62
6400 to 6500 (6400)	14.06	5.54	11.72	0.46

Also, the antennas must be plumb (vertical) for best performance. The relative height of the antennas should be the same but is not critical. For example, if the antennas are mounted on a tower or a mast, the antennas must be mounted vertically (all parallel to each other) and mounted at a similar height on the tower or mast.

The separation distance between the antennas must be measured from the center lines of the antennas as shown in Figure 5-3. You should initially install the antennas at the recommended minimum separation distance. If necessary, increase the distance by quarter wavelengths.

Figure 5-3: Antenna Separation and Alignment



5.9.4 Installing Downconverters and Antennas

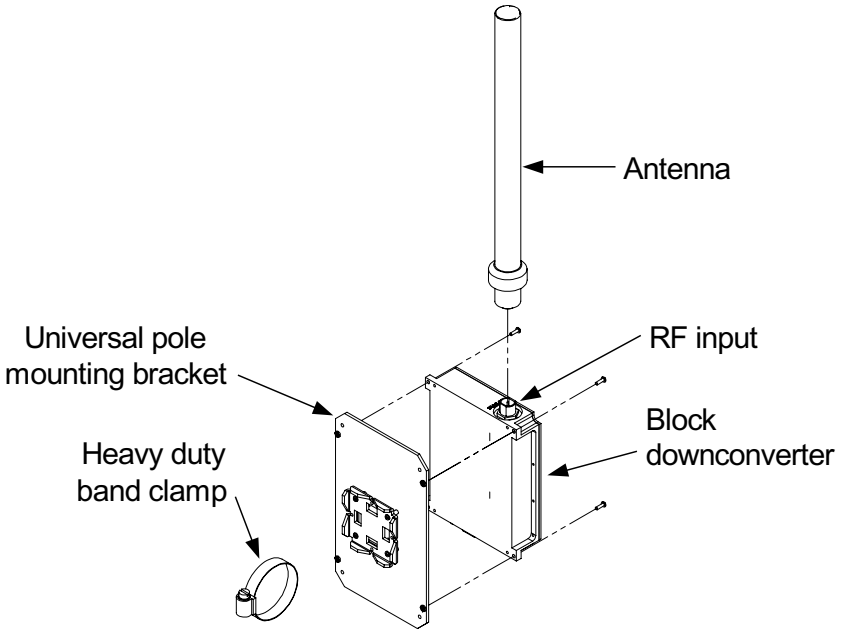
Each low-noise block downconverter (BCD) assembly includes a block downconverter, universal pole mounting bracket, and a heavy duty band clamp. The BCDs can be installed either on a horizontal or a vertical pole assembly.

MRC recommends attaching the downconverter directly to the antenna. When you attach the antennas directly to the **BCD RF INPUT** connectors, then you must mount the antennas in the same physical plane, that is, one antenna should not be tilted with respect to the other antenna. See Figure 5-3.

To install the BCDs on a mounting pole when the antennas are connected directly to the BCDs, perform the following steps for each pair of antennas and BCDs:

1. Fasten the first BCD onto the mounting pole and secure it firmly in position using the mounting bracket and heavy duty band clamp. See Figure 5-4.

Figure 5-4: Mounting Downconverter on Pole



2. Connect the first antenna securely to the BCD **RF INPUT** connector.
3. Determine the minimum separation distance between the two antennas per Table 5-1 on page 5-7.
4. Loosely fasten the second BCD to the mounting pole using the heavy duty band clamp. Make sure that the BCD is approximately at the correct separation distance.
5. Connect the second antenna securely to the second BCD's **RF INPUT** connector.
6. Adjust the second antenna so it is parallel to the other antenna and separated by the minimum recommended distance.

7. Securely fasten the second BCD to the mounting pole.
8. Connect each BCD to the receiver using high quality UHF cables.
9. Repeat these steps for the next pair of antennas.

Note Signal quality will degrade if the antennas are installed closer than the recommended minimum separation distance.

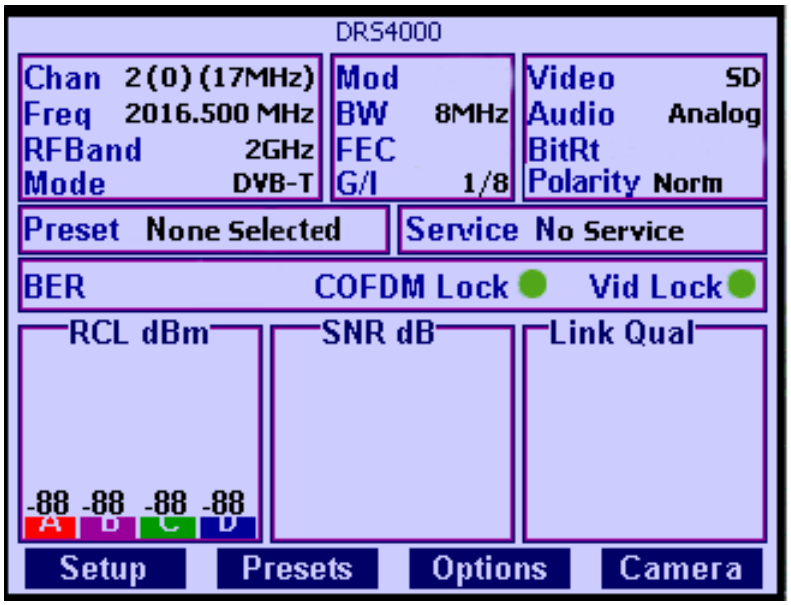
The separation distance between the antennas will require fine tuning for optimum performance. Always start at the minimum recommended distance the antennas should be adjusted in quarter wavelength increments, as shown in Table 5-1 on page 5-7.

5.10 Powering Up the First Time

After installing the receiver, downconverters, antennas, and associated cables, the system is ready to be powered up.

1. Verify that the power cable is securely connected to the power connector on the rear panel of the DRS4000 Receiver.
2. Verify that all other cables are properly connected to the receiver's rear panel connectors.
3. Verify that the AC power source is turned on.
4. Connect the power cable to the AC power source.
5. Set the power switch to On (1). The receiver will quickly power up and display the initial control panel as shown in Figure 5-5. The receiver also powers up the downconverters.

Figure 5-5: Initial Control Panel



5.11 Audio Connections

The mini-XLR connectors labeled **AUDIO 1** to **AUDIO 4** output analog audio derived from the incoming RF signal. They can be used as four monaural outputs or two stereo pairs depending on how the remote transmitter is configured. Pinout information is shown in Figure 5-6 on page 5-10 and Table 5-2 on page 5-10.

Figure 5-6: Audio Connector

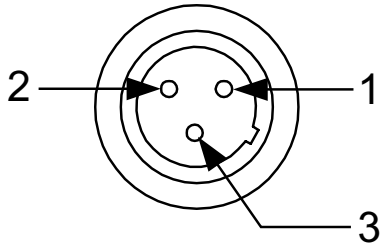


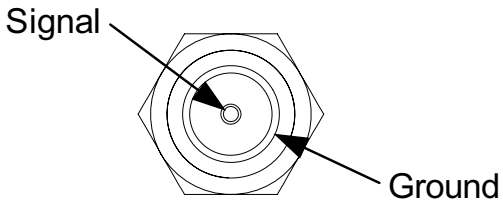
Table 5-2: Pinouts for Audio Connector

Pinout	Signal Description
1	Ground
2	+
3	-

5.12 Video Connections

For all TNC connectors, the signal is carried on the center pin and voltage to the block downconverters is carried on the outer ring as shown in Figure 5-7.

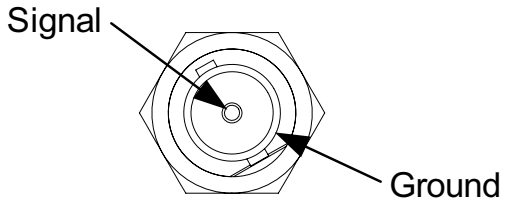
Figure 5-7: Typical TNC Connector



BDC 1 to BDC 6 The Block Downconverter (BDC) connectors are 50 ohm, TNC connectors that accept the UHF signals from the downconverters and their corresponding antennas.

For all BNC video connectors, the signal is carried on the center pin as shown in Figure 5-8.

Figure 5-8: Typical BNC Connector



CV 1, CV 2 The Composite Video (CV) connectors are 75 ohm, female, BNC connectors that output an analog video signal.

SD SDI / HD SDI The Standard Definition (SD) Serial Digital Interface (SDI) connector is a 75 ohm, female, BNC connector that outputs a video data stream from the MPEG module that is compliant with SMPTE 259M.

The High Definition (HD) SDI connector is a 75 ohm, female, BNC connector that outputs a video data stream from the MPEG module that is compliant with SMPTE 292M and SMPTE 299M.

ASI OUT The two Asynchronous Serial Interface (ASI) connectors are 75 ohm, female, BNC connectors that provide ASI outputs for digital video and audio distribution.

ASI IN This 75 ohm, female, BNC connector accepts an ASI signal input from another component. It is used for local decoding of a SD/HD ASI stream when the receiver is placed in external ASI mode. The outputs are on the HD SDI and HD MON connectors only.

70 MHz IN This connector is a 75 ohm, female, BNC connector that accepts input from another receiver. This is an alternative input to BDC 1 and is selectable from the control screen menu.

5.13 Monitor and Control Connectors

CNTL/MON 1 to CTRL/MON 6 The 7-pin circular Lemo connectors provide control inputs and monitor outputs for the adjacent downconverter (BDC1 to BDC6). Pinout information is shown in Figure 5-9 and Table 5-3.

Figure 5-9: Control/Monitor Connector

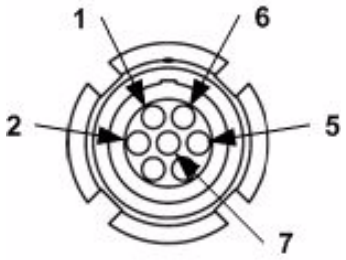


Table 5-3: Pinouts for Control/Monitor Connector

Pinout	Signal Description
1	Power On Detect
2	Lock Detect A
3	Lock Detect B
4	H/L Band Select
5	Band Select 1
6	Band Select 2
7	Ground

HD MON The HD Monitor connector is a 75 ohm, female, BNC connector that provides a second output for monitoring the video data stream. The control signal is carried on the center pin.

GEN LOCK This 75 ohm, female, BNC connector enables the decoder output to lock to an external frame lock input. This can either be SD Black & Burst or HD Tri-level input into the rear panel BNC connector. The control signal is carried on the center pin.

5.14 Data Connections

For the following connectors, the USB and Ethernet connectors are on the front panel.

The **USB** 2.0 connector allows you to install firmware updates from MRC via a flash drive. Pinout information for this connector is shown in Figure 5-10 and Table 5-4.

Figure 5-10: USB Connector

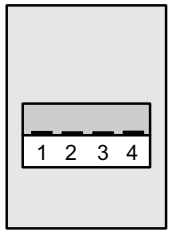


Table 5-4: Pinouts for USB Connector

Pinout	Name	Signal Description
1	VCC	+5 VDC
2	D-	Data -
3	D+	Data +
4	GND	Ground

The RJ-45 **ETHERNET** connector allows you to connect the receiver to a computer and use the DRS4000 web browser interface to control the receiver. Pinout information for this connector is shown in Figure 5-11 and Table 5-5.

Figure 5-11: ETHERNET Connector

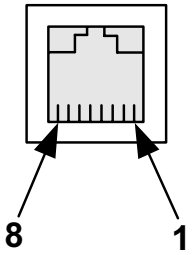


Table 5-5: Pinouts for ETHERNET Connector

Pinout	Signal Description
1	TX+
2	TX-
3	RX+
4	not used
5	not used
6	RX-
7	not used
8	not used

ALARM This DB-15 female connector connects to single-pole single throw (SPST) switches for summary alarm data for common faults and events and for site management control. One SPST switch is for a minor alarm, one SPST switch is for a major alarm, and four SPST switches are for site management.

Pinout information for this connector is shown in Figure 5-12 and Table 5-6 on page 5-13.

Figure 5-12: ALARM Connector

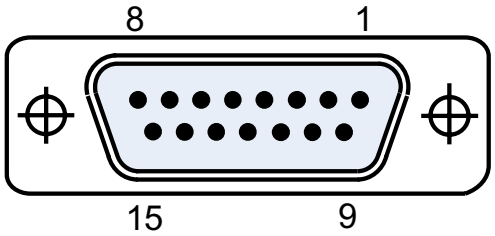


Table 5-6: Pinouts for ALARM Connector

Pinout	Signal Description
1	SM1-COM
2	SM1-NO
3	SM2-COM
4	SM2-NO
5	SM3-COM
6	SM3-NO
7	SM4-COM
8	SM4-NO
9	ALM-MNR-COM
10	ALM-MNR-NO
11	ALM-MJR-COM
12	ALM-MJR-NO
13	not used
14	not used
15	not used

WAYSIDE DATA This RS-232, 9-pin female connector is the wayside channel, used for transfer of data such as global positioning satellite (GPS) data or meta data from the MPEG decoder.

Pinout information for this connector is shown in Figure 5-13 and Table 5-7.

Figure 5-13: WAYSIDE DATA Connector

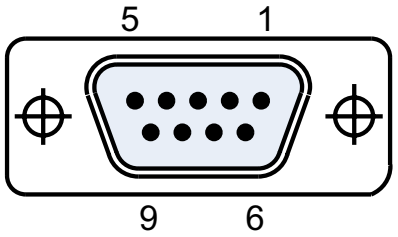


Table 5-7: Pinouts for WAYSIDE DATA Connector

Pinout	Signal Description
1	not used
2	TX OUT
3	RX IN
4	not used
5	GND
6	not used
7	not used
8	not used
9	not used

RS-232 CRNTL This connector is an RS-232, a DB-9 female connector that can be used to remotely control the DRS4000 Receiver via a slave controller.

Pinout information for this connector is shown in Figure 5-14 on page 5-14 and Table 5-8 on page 5-14.

Figure 5-14: RS-232 CRNTL Connector

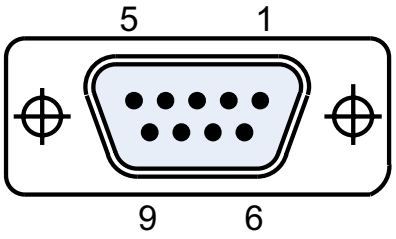


Table 5-8: Pinouts for RS-232 Connector

Pinout	Signal Description
1	not used
2	RX CNTRL
3	TX CNTRL
4	not used
5	GND
6	not used
7	TX Data
8	RX Data
9	not used

5.15 Power Connections

The **POWER** connector accepts a standard 3-prong cable for AC power. An auto-sense circuit accepts either 110 to 130 VAC or 205 to 260 VAC @ 2 amps. The 3-prong male end must be modified for non-U.S. applications.

5.16 Optional Packet Connectors

The following connectors provide inputs and outputs for the optional packet switching subsystem. For all BNC connectors, the signal is carried on the center pin as shown in Figure 5-8 on page 5-10.

ASI IN 1 to ASI IN 4 These 75 ohm, female, BNC connectors allow up to four ASI inputs from different receive sites, effectively acting as a diversity switch. They can also be used as an ASI multiplexer. The maximum bit rate is adjustable up to 40 Mbps.

ASI OUT These connectors are 75 ohm, female, BNC connectors that provide a diversity ASI output or a multiplexed ASI output according to the mode set for the packet.

SDI OUT This connector is a 75 ohm, female, BNC connector that outputs a digital video stream.

6 *Replacement Parts*

6.1 Chapter Overview

This chapter describes the replacement parts that are available for the DRS4000 Receiver.

Since there are no supported field repairs on the DRS4000 Receiver, the only parts available are external cables and fuses.

6.2 Replacements

The replacements parts for the DRS4000 Receiver are listed in Table 6-1. If you need something that is not listed, ask your MRC Sales Representative or consult the factory.

Table 6-1: Replacements Parts

Description	Comments
AC Power Cable	Connects AC power to the DRS4000 Receiver.
Fuses	(2) 2A 250 VAC

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7 Theory of Operation

This chapter provides technical information about the design and function of the DRS4000 Receiver. This includes descriptions of the functional modules that make up the system architecture.

If you are not familiar with the product information presented in Chapter 2, we recommend that you review that chapter first.

Here are the topics covered:

7.1 System Architecture

The DRS4000 Receiver is a two-channel or four-channel input, COFDM diversity system that can support DVB-T and LMS-T COFDM signals. The receiver is designed to support Standard Definition (SD) and High Definition (HD) decoding.

Within the system architecture for the DRS4000 Receiver, there are several key components as shown in the block diagram in Figure 7-1 on page 7-2. The standard version product consists of the following functional modules:

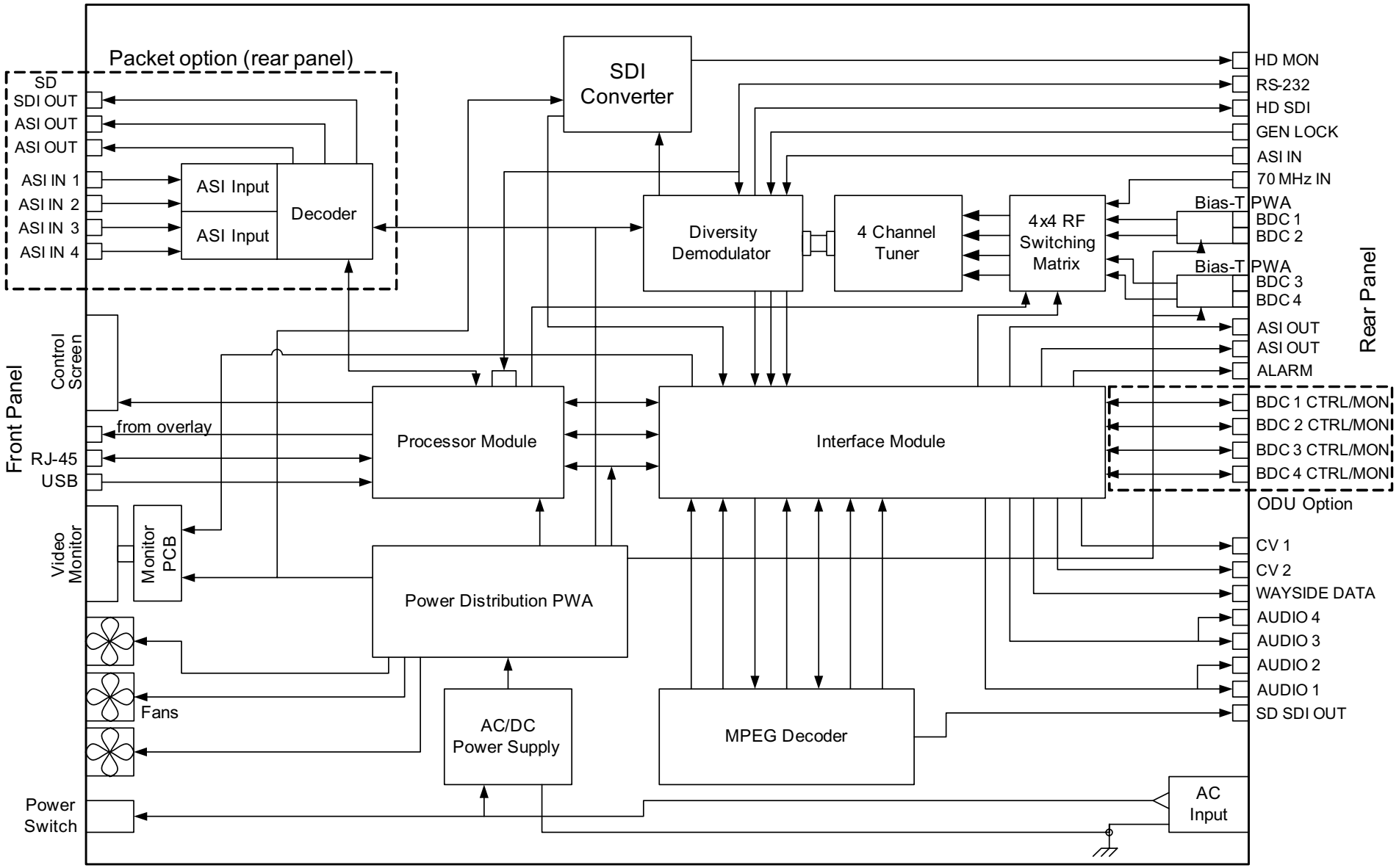
- Block downconverters
- RF switching module
- Four-input channel tuner module
- COFDM diversity module
- MPEG decoder module
- Processor module
- Interface module
- AC to DC power supply

The following sections discuss the technical aspects of each of these modules.

7.1.1 Block Downconverters

The DRS4000 Receiver can operate with either two or four block downconverters (BDCs). These block downconverters can be mounted on towers or buildings and can be directly connected to antennas. The receiver supports either 2 GHz (1.99 to 2.5 GHz) or 7 GHz (6.4 to 7.1 GHz). Options are available that support other frequency bands such as 3 GHz and 4 GHz.

Figure 7-1: DRS4000 Receiver Block Diagram



Each BDC operates by mixing a Local Oscillator (LO) signal together with the incoming RF signal and producing a UHF output signal in the range of 110 to 860 MHz. The incoming signal is filtered and then amplified by a Low Noise Amplifier (LNA) and is sent along to the mixer. See Figure 7-2 for a functional block diagram of the block downconverter circuitry.

The LO generates either a lower or a higher frequency (depending upon the BDC's operating band) using a Phase Lock Loop (PLL) synthesizer. The 2 GHz BDCs use a low-side local oscillator (its frequency is on the low side of the RF band) while the 7 GHz BDCs use a high-side local oscillator. The synthesizer's frequency is fixed and programmed via the on-board micro-controller. This LO frequency is then amplified and filtered to reduce spurious signals before being applied to the mixer.

In the mixer, the incoming RF signal is mixed with the LO signal resulting in a signal equal to the difference between the two signals. This signal is then amplified and low-pass filtered to remove the signal representing the sum of the two signals.

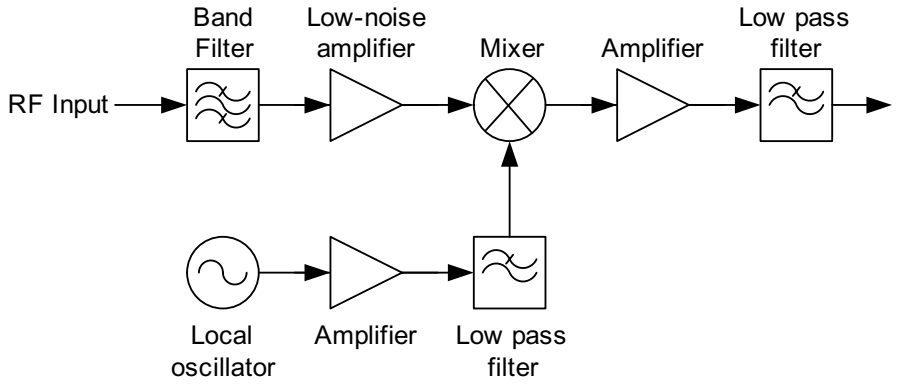
Regulated DC power (+18.5 VDC) for the BDCs is supplied via the BDC connectors on the same UHF cable that carries output from the BDCs.

7.1.2 RF Switching Module

The RF switching module, which is controlled by the processor module, provides a 4x4 switching matrix and allows selective switching of antenna input ports to the four-channel input tuner module. This allows users to customize their antenna input selections.

The 4x4 RF switching module uses BCD controls for the selection lines that are driven from the processor module.

Figure 7-2: Block Diagram of Downconverter



7.1.3 Four-Channel Input Tuner Module

The four-channel input tuner module is based on solid state technology for commercial applications support using a common tuner module. Embedded in this module are capabilities for 10 MHz and 20 MHz filtering. The 10 MHz filtering is to support DVB-T signals and the 20 MHz filtering is used to support LMS-T signals.

The tuner module translates the UHF frequency of the tuners (110 to 860 MHz) to IF frequencies of either 70 MHz or 36.2 MHz. The tuner produces 70 MHz core (for LMS-T) or 36.2 MHz (for DVB-T), which is digitally down-sampled into the Maximal Ratio Combining (MaxRC) cores within the COFDM diversity module.

Automatic gain control (AGC) is integrated in to the tuner module providing approximately 65 dB of dynamic range.

7.1.4 COFDM DiversityModule

The COFDM Diversity Module contains the Coded Orthogonal Frequency Division Multiplexing (COFDM) demodulation and diversity reception circuitry.

The IF signal is processed by the main demodulator integrated circuits (ICs). The COFDM demodulator automatically detects the key parameters of the incoming signal via the TPS information and configures it accordingly.

These parameters include Modulation Type, Forward Error Correction (FEC), Guard Interval (GI), and Spectrum Inversion (SI). Only the bandwidth of the signal (6, 7, or 8 MHz) and the receive channel and frequency need to be specified by the user.

In the DRS4000 Receiver, there are four COFDM demodulation ICs. Each IC is responsible for demodulating the signal. The four signals are combined using the Maximal Ratio Combining (MaxRC) technique to produce one MPEG transport stream signal with enhanced characteristics that provide an overall diversity improvement factor. That improvement factor can be about 4 to 5 dB for a two-input system and about 8 to 9 dB for a four-input system, depending on channel characteristics.

This signal is subsequently output as two ASI streams, one for driving the SD/HD MPEG decoder module, and one to be used as the monitor output. See Appendix D for additional information on MaxRC techniques.

Each COFDM demodulator IC, once locked on to an incoming signal, can provide important signal performance measurements such as:

- Received Carrier Level (RCL)
- Link Quality (LQ)
- Bit Error Ratio (BER)
- Modulation Error Ratio (MER)
- Signal to Noise Ratio (SNR)

You can view these measurements in real-time via the receiver's control panel.

7.1.5 MPEG Decoder Module

The MPEG decoder module supports SD and HD video. It has two composite video output ports, one SD output port, and two HD SDI output ports (one is for monitoring and the other is for the standard signal).

From the MPEG Module, an SDI monitor output is run through an SDI composite converter and is used to drive the video monitor on the front panel.

The decoder module accepts a digital ASI signal from the COFDM diversity board and recovers the compressed video (either NTSC or PAL) and/or audio signals. The analog audio outputs are used for four-channel audio; the digital audio outputs are supported at the 75 ohm layer with multiple embedded AES/EBU audio outputs. The module is also capable of linear pass-thourough mode.

Additional features provided by the MPEG decoder module include a serial wayside data channel and BISS decryption capabilities.

7.1.6 Processor Module

The Processor Module is an embedded computer that manages OAM&P (Operations, Administration, Maintenance, and Provisioning) functionality within the DRS4000 Receiver. The Processor Module receives user input via a keypad on the front panel of the receiver and through a network interface.

Software running on the Processor Module's microprocessor interprets user commands and relays them to the receiver's internal subsystems. Replies to user commands and system status are output via an LCD screen on the front panel of the receiver and through a network interface. Connections to other DRS4000 internal subsystems are made by serial communications channels.

The Processor Module contains an integrated USB 2.0-compliant Host controller that supports low- and full-speed data transfers for firmware upgrade purposes only. High-speed transfer is not supported, nor are USB On-the-Go (OTG) devices (USB devices that do not need a PC to communicate). A USB connector on the front panel allows for firmware upgrades via a flash drive.

This module also contains a web server for remote management via a PC's web browser. The web server is accessed through the RJ-45 Ethernet connector.

7.1.7 Interface Module

The Interface Module provides a communication interface between the DRS4000 Processor Module and the Block Downconverters/Outdoor Units (BDCs/ODUs) attached to the receiver. The Interface Module also provides an interface for external alarms mechanisms attached to the DRS.

The Interface Module accepts a composite video signal from the MPEG Decoder and generates two copies of it. The Interface Module also provides the following functionality:

- Accepts two audio streams and switches between them to generate one audio stream output
- Accepts two composite video signals and switches between them to generate one video stream output
- Accepts four ASI signals, switches among them, and generates four copies of the selected signal.

The Interface Module also contains an independent, dual-channel RS-232 transceiver.

7.1.8 Power Supply

The power supply accepts a range of AC input voltages from 105 to 260 VAC at 50 to 60 Hz. The power supply provides the DC voltages required by the rest of the receiver's hardware. Typical output voltages are +24 VDC, +5 VDC, +12 VDC, and -12 VDC.

The AC receptacle is protected by a pair of 2 amp fuses.

7.1.9 Packet-Based Switch Module

The Packet-Based Module is an option that can select the best signal from four ASI inputs (with the same content) and generate the best possible ASI stream on two outputs. It can be used to gang multiple receive sites together using a cellular diversity technique at the ASI level. The ASI output stream bitrate is adjustable up to 40 Mbps.

The Packet-Based Module can also decode the ASI stream if it is in an SD format. The ability to decode an HD signal is not provided. Individual channels can also be remuxed.

Note	When remultiplexing ASI signals it is essential that each encoded service has a unique Program Identification (PID). The unit does not dynamically re-allocate PID values.

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A Channels and Frequencies

A.1 Appendix Overview

This appendix describes the channels and frequencies that were programmed into your DRS4000 Receiver at the factory. It also provides details about the 2 GHz Relocation Project affecting Broadcast Auxiliary Service (BAS) users.

Here are the topics covered:

A.2 Initial Factory Settings

This section lists the channels and frequencies for each RF band covered by the DRS4000 Receiver. These frequencies are preset at the factory, but can be modified using the DRS4000 Receiver Configuration Utility software.

Note These frequency settings should be changed by qualified technical personnel only.

Refer to the Society of Broadcast Engineers (SBE) web site (http://www.sbe.org) for up-to-date information on local frequency plans for Electronic News Gathering (ENG) and Remote Pickup (RPU) operations.

A.2.1 Pre-BAS 2 GHz Channel Plan (U.S.)

The pre-BAS 2 GHz channel plan (17 MHz bandwidth), covering 1.9 to 2.5 GHz), is shown in Table A-1.

Table A-1: Pre-BAS 2 GHz (17 MHz Bandwidth)

Pre-BAS Channel	(-) Offset* (MHz)	(0) Center (MHz)	(+) Offset* (MHz)
1	1994.750	1999.000	2003.250
2	2012.250	2016.500	2020.750
3	2029.250	2033.500	2037.750
4	2046.250	2050.500	2054.750
5	2063.250	2067.500	2071.750
6	2080.250	2084.500	2088.750
7	2097.250	2101.500	2105.750
8	2450.000	2458.500	2467.000
9	2467.000	2475.250	2483.500
10	2483.500	2491.750	2500.000

*For channels 1 to 7, offsets are ± 4.25 MHz. For channels 8 to 10, offsets vary as shown.

A.2.2 2 GHz Upper Channel Plan (non-U.S.)

The 2 GHz upper channel plan for non-U.S. products, covering 2.3 to 2.7 GHz), is shown in Table A-2.

Table A-2: 2 GHz Upper Channel Plan

Channel	(-) Offset (MHz)	(0) Center (MHz)	(+) Offset (MHz)
1	2300.000	2313.333	2326.666
2	2339.999	2353.332	2366.665
3	2379.998	2393.331	2406.664
4	2419.997	2433.330	2446.663
5	2459.996	2473.329	2486.662
6	2499.995	2513.328	2526.661
7	2539.994	2553.327	2566.660
8	2579.993	2593.326	2606.659
9	2619.992	2633.325	2646.658
10	2659.991	2673.324	2686.657
11	---	---	---
12	---	---	---
13	---	---	---
14	---	---	---

A.2.3 3 GHz Channel Plan

The 3 GHz channel plan, covering 3.4 to 3.8 GHz, shown in Table A-3.

Table A-3: 3 GHz Channel Plan

Channel	(-) Offset (MHz)	(0) Center (MHz)	(+) Offset (MHz)
1	3406.250	3418.250	3431.250
2	3443.250	3455.250	3467.250
3	3480.250	3492.250	3504.250
4	3506.250	3518.750	3531.250
5	3543.750	3556.250	3568.750
6	3581.250	3593.750	3606.250
7	3610.000	3620.000	3630.000
8	3640.000	3650.000	3660.000
9	3670.000	3680.000	3690.000
10	3700.000	3710.000	3720.000
11	3730.000	3740.000	3750.000
12	3760.000	3770.000	3780.000
13	3790.000	3800.000	3800.000
14	3800.000	3800.000	3800.000

A.2.4 7 GHz Lower Channel Plan (U.S.)

The 7 GHz channel plan, covering 6.4 to 7.1 GHz), is shown in Table A-4. Note that channels 11 to 14 provide the lower frequencies in this range.

Table A-4: 7 GHz Lower Channel Plan

Channel	(-) Offset (MHz)	(0) Center (MHz)	(+) Offset (MHz)
1	6881.250	6887.500	6893.750
2	6906.250	6912.500	6918.750
3	6931.250	6937.500	6943.750
4	6956.250	6962.500	6968.750
5	6981.250	6987.500	6993.750
6	7006.250	7012.500	7018.750
7	7031.250	7037.500	7043.750
8	7056.250	7062.500	7068.750
9	7081.250	7087.500	7093.750
10	7106.750	7112.500	7118.750
11	6431.250	6437.500	6443.750
12	6456.250	6462.500	6468.750
13	6481.250	6487.500	6493.750
14	6506.250	6512.500	6518.750

A.3 US 2 GHz Relocation Project

The FCC has mandated that users who operate within the 1990 to 2110 MHz spectrum band (pre-BAS channels 1-7 shown in Table A-1 on page A-2) must upgrade their equipment to operate in the narrower 2025 to 2110 MHz range (BAS channels 1-7 only). The frequencies for the BAS 2 GHz channel plan are shown in Table A-5 on page A-4.

As you upgrade your equipment to the new BAS 2 GHz channel plan, you can easily reprogram your receiver using the DRS4000 Receiver Configuration Utility software.

Note This relocation affects channels 1-7 only; channels 8, 9, and 10 remain the same.

For more information, see the FCC Web site, document #FCC 03-280:

http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-03-280A1.pdf

Table A-5: 2 GHz BAS Channel Plan

BAS Channel	(-) Offset* (MHz)	(0) Offset (MHz)	(+) Offset* (MHz)
1	2028.500	2031.500	2034.500
2	2040.500	2043.500	2046.500
3	2052.500	2055.500	2058.500
4	2064.500	2067.500	2070.500
5	2076.500	2079.500	2082.500
6	2088.500	2091.500	2094.500
7	2100.500	2103.500	2106.500
8	2450.000	2458.500	2467.000
9	2467.000	2475.250	2483.500
10	2483.500	2491.750	2500.000

*For channels 1 to 7, offsets are ± 3.0 MHz. For channels 8 to 10, offsets vary as shown. When using channels 1 to 7, the pedestal width cannot be more than 6 MHz.

B Glossary

This section describes acronyms and abbreviations used in communications, broadcasting, and in our products and documentation.

Table B-1: Useful Terms

1RU	1 Rack Unit (1.75 inches in height)
1080i	1080i is a standard HDTV video mode. 1080 represents *1080* lines of vertical resolution and the letter *i* represents “interlaced” or non-progressive scan. 1080i usually assumes a wide screen aspect ratio of 16:9, implying a horizontal resolution of 1920 pixels and a frame resolution of 1920 x 1080, or 2.07 million pixels.
16QAM	16-state Quadrature Amplitude Modulation The signal (video + audio) is imposed onto the 70 MHz carrier by varying both the phase and the amplitude of the signal while keeping the frequency constant. There are 16 possible combinations of phase and amplitude that can be used to carry information.
2 FSK	2-state Frequency Shift Keying
2RU	2 Rack Unit (3.5 inches in height)
3RU	3 Rack Unit (5.25 Inches in height)

Table B-1: Useful Terms (Continued)

32QAM	32-state Quadrature Amplitude Modulation The signal (video + audio) is imposed onto the 70 MHz carrier by varying both the phase and the amplitude of the signal while keeping the frequency constant. There are 32 possible combinations of phase and amplitude that can be used to carry information.
4 FSK	4-state Frequency Shift Keying
8 PSK	8-Phase Shift Keying
8QAM	8-state Quadrature Amplitude Modulation The signal (video + audio) is imposed onto the 70 MHz carrier by varying both the phase and the amplitude of the signal while keeping the frequency constant. There are 8 possible combinations of phase and amplitude that can be used to carry information.
64QAM	64-state Quadrature Amplitude Modulation The signal (video+audio) is imposed onto the 70 MHz carrier by varying both the phase and the amplitude of the signal while keeping the frequency constant. There are 64 possible combinations of phase and amplitude that can be used to carry information.
720p	720 represents *720* lines of vertical resolution and the letter *p* represents non-interlaced or progressive scan. When broadcast at 60 frames per second, 720p features the highest temporal (motion) resolution possible under the ATSC standard. Progressive scanning reduces the need to prevent flicker by filtering out fine details, so spatial (sharpness) resolution is much closer to 1080i than the number of scan lines would suggest.

Table B-1: Useful Terms (Continued)

A & C	Alarm and Control
ACU	AC to DC Converter Unit
ADPCM	Adaptive Differential Pulse Code Modulation
AES	Advanced Encryption Standard
AES	Audio Engineering Society
AES/EBU	Unofficial name for a digital audio standard developed as a joint enterprise of the AES and the EBU.
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
AIS	Alarm Indication Signal (all one's)
AMI	Alternate Mark Inversion, line code format for traffic data.
AVG	Average
ASI	Asynchronous Serial Interface A serial communications interface operating up to 270 Mbit/sec. Generally used in field news-gathering operations.
ASYNC	Asynchronous Digital communication in which there is no timing requirement for transmission and in which the start of each character is individually signaled by the transmitting device.
ATSC	Advanced Television Systems Committee The group that developed the ATSC digital television standard for the US and other countries.

Table B-1: Useful Terms (Continued)

Baseband	A composite signal in which video and audio signals are combined together, with video occupying approximately 0-4.5 MHz and audio modulated onto subcarriers in the 5-6 MHz range.
BB	Baseband
BDC	Block Downconverter
BER	Bit Error Ratio The Bit Error Rate is the percentage of bits that have errors relative to the total number of bits in the signal. The rate is an indication of how often a packet or other data unit has to be retransmitted because of an error.
BiasT	A type of interconnection between the IDU and the ODU. In Bias T wiring, IF and DC are combined and carried on the coax cable up the ODU; blocking circuitry prevents the DC from entering the IDU.
BISS	Basic Interoperable Scrambling System A means of encrypting and decrypting a digital signal to prevent unauthorized reception. The encryption and decryption are controlled by a digital key, which is shared at both the transmitting and receiving location.
BISS-1	BISS encryption that uses a fixed key.
BISS-E	BISS encryption that uses an encrypted key.
BNC	Bayonet lock coaxial connector
BPF	Band Pass Filter
bps or b/sec	Bits per second
BPSK	Binary Phase Shift Keying
BW	Bandwidth

Table B-1: Useful Terms (Continued)

CCITT	International Telegraph and Telephone Consultative Committee A telecommunications standardizing committee of the ITU.
CCPS	Command & Control Power Supply
CENELEC	European Committee for Electrotechnical Standardization
CNR	Carrier-to-Noise Ratio
COFDM	Coded Orthogonal Frequency Division Multiplexing
Composite (Baseband)	A band or grouping of frequencies and/or subcarriers, including video, occupied by the signal in a radio transmission system. Also called Baseband.
Co-channel interference	Interference caused by two video transmitters broadcasting on the same channel of the same frequency (for example, on channel 2 in the 2 GHz band).
CR4	Code Runner 4
Crossover cable	A Category 5 (CAT5) network cable used to connect two computers. The cable crosses over (reverses) pins 1 and 3 and pins 2 and 6 of the cable's RJ-45 connectors. The transmitter (TX) pins are therefore connected to the corresponding receiver (RX) pins, plus to plus and minus to minus.
CSI	Channel-State Information
CV	Composite Video Video signal in which the chrominance (color) and luminance (brightness) information are combined in one signal. S-Video separates the chrominance and luminance into individual signals.
CW	Carrier Wave

Table B-1: Useful Terms (Continued)

DAB	Digital Audio Broadcasting
dB	Decibel A logarithmic measurement of power or voltage, applied to audio and RF signals.
dBm	A measure of RF signal strength defined as "decibels relative to one milliwatt (mW)." A 1 mW signal has a signal strength of 0 dBm. A signal weaker than 1 mW has a negative dBm value, and a signal stronger than 1 mW has a positive dBm value.
DCC	Distribution Command and Control
DCE	Data Communications Equipment A device that communicates with a DTE device. In practical terms, the DCE is usually a modem and the DTE device is usually a computer.
De-emphasis	Reducing the amplitude of high frequency components of an analog audio signal. Done on the receive end of an analog link to take out emphasis added on the transmit side.
DFT	Discrete Fourier Transform
DHCP	Dynamic Host Configuration Protocol A protocol for automating the configuration of computers that use TCP/IP.
DMUX, DEMUX	Demultiplexer
DQPSK	Differential Quadrature (Quaternary) Phase-Shift Keying
DRL	Data Return Link

Table B-1: Useful Terms (Continued)

DS3	Digital Signal 3 44.736 Mbps data rate.
DTE	Data Terminal Equipment A device that communicates with a DCE device. In practical terms, the DTE is usually a computer and the DCE device is usually a modem.
Duplex	A channel capable of transmitting information simultaneously in both directions.
DVB	Digital Video Broadcasting
DVB-ASI	Digital Video Broadcasting - Asynchronous Serial Interface A widely-used MPEG-2 digital transport interface. Physically the connection is made either with optical fiber or 75 ohm coax with a BNC connector. Interface can support data rates up to 270 Mb/sec.
DVB-C	Digital Video Broadcasting - Cable
DVB-S	Digital Video Broadcasting - Satellite
DVB-T	Digital Video Broadcasting - Terrestrial
E1	2.048 Mbps data rate.
E3	34.368 Mbps data rate
EIA	Electronic Industries Association An industry association that establishes various standards.
EBU	European Broadcasting Union In addition to other activities, EBU produces technical statements and recommendations for PAL television systems.

Table B-1: Useful Terms (Continued)

EMC	Electromagnetic compatibility.
Emphasis	Boosting the amplitude of high frequency components of an analog audio signal. Done on the transmit side of an analog link to improve signal-to-noise ratio.
ENG	Electronic News Gathering
ERRS	Errors
ESD	Electrostatic Discharge
ET	Eastern Time (US)
ETSI	European Telecommunications Standards Institute
EVM	Error Vector Magnitude
FCC	Federal Communications Commission The United States communications regulatory agency.
FDM	Frequency Division Multiplexing
FEC	Forward Error Corrections
FFT	Fast Fourier Transform
FIFO	First In, First Out buffer
FIR	Finite Impulse Response
FMT	FM Video Modulator or FM Transmitter
FPGA	Field Programmable Gate Array
FSK	Frequency-Shift Keying
FTP	File Transfer Protocol
FW	Firmware
GHz	Gigahertz (10^9 Hz)
GI	Guard Interval
GND	Ground

Table B-1: Useful Terms (Continued)

GPS	The Global Positioning System is a set of 24 satellites that are in 10,600-mile orbits above the Earth. Owned and operated by the U.S. Department of Defense, GPS enables people with ground receivers to pinpoint their geographic location.
GUI	Graphic User Interface
Hashed	A visual cue on a graphical user interface consisting of diagonal lines across the surface of a button. This indicates that a button is not currently functional.
HD	High Definition (video)
HDB3	High Density Bipolar 3 line code format for traffic data.
HD-SDI	High Definition Serial Data Interface A serial communications interface operating at 1.5 Gbit/sec.
HPF	High Pass Filter
HPU	High Power Unit
H/W or HW	Hardware
Hz	Hertz Hz is a unit of frequency of one cycle per second. Hz replaces the earlier term of “cycles per second” (CPS).
ICI	Inter-Carrier Interference
ICR	Inter-City Relay
ID	Identification
IDU	Indoor Unit
IF	Intermediate Frequency
IMD	Inter-Modulation Distortion
I/O	Input/Output

Table B-1: Useful Terms (Continued)

IP Address	An Internet Protocol (IP) address is a 32-bit number (for example, 123.45.67.89 for IP version 4) or a 128-bit number (for IP version 6) that identifies the network device that is sending or receiving information that is transmitted across a local area network (LAN) or the Internet.
IRD	Integrated Receiver Decoder
IRE	1. Institute of Radio Engineers, an international professional radio engineering association that establishes various standards. 2. A unit of measurement, established by the IRE, in which 1 IRE Unit =.00714 volts peak-to-peak (Vp-p) and 140 IRE units equals 1 Vp-p.
ISI	Inter-Symbol Interference
ISO	International Standards Organization
Kbps	Kilobits per second
KHz	Kilo (1,000) Hz
LAN	Local Area Network
LBO	Line Build Out
LCD	Liquid Crystal Display
Lcl	Local
LED	Light Emitting Diode
LIU	Line Interface Unit
LMS-T	Link® Modulation System - Terrestrial A proprietary algorithm system for modulation.
LNA	Low Noise Amplifier
LNB	Low Noise Block Downconverter
LNC	Low Noise Converter
LO	Local Oscillator

Table B-1: Useful Terms (Continued)

LOS	Loss of Signal
LPF	Low Pass Filter
LQ	Link Quality
MAC Address	The Media Access Control (MAC) address is a unique identification number for a network device on a local area network (LAN) or other network. This number (a physical address such as 00-A1-B2-C3-D4-5F) is stored in the device's network adapter and is used to acquire an IP address for the device.
MaxRC	Maximal Ratio Combining
Mbps	Megabits per second
MER	Modulation Error Ratio Modulation error ratio is a measure used to quantify the performance of a digital radio transmitter or receiver using digital modulation, such as QAM.
MHz	Million (1,000,000) Hz
MPEG	Moving Picture Experts Group
M-QAM	M-order of Quadrature Amplitude Modulation
MRC	Microwave Radio Communications
Multipath	An unpredictable set of reflections and/or direct waves, each with its own degree of attenuation and delay. Due to obstacles and reflectors in the signal's path, transmitted signals arrive at the receive antenna from various directions over multiple paths at slightly different times.
MUX	Multiplexer
NC	Normally Closed (Relay or switch contacts)
N/C	No Connection
NICAM	Near-Instantaneous Companding and Multiplexing

Table B-1: Useful Terms (Continued)

NO	Normally Open (Relay or switch contacts)
NRZ	Non-Return-to-Zero (Modulation)
NTSC	National Television System Committee Color television standard used in the US. Provides 525 horizontal lines of resolution. Not compatible with PAL or SECAM.
Null modem cable	An RS-232 cable designed to connect two computers (or other data sources) together. It has male DB9 connectors on each end, to mate with the DB9 female connectors on the PCs. With a null modem connection, the transmit and receive connections are crosslinked so that transmit (pin 3) on one end connects to the receive (pin 2) on the other. The term can also be applied to similar Ethernet cables. Also called a "Crossover Cable".
OB	Outside Broadcast
ODU	Outdoor Unit
OFDM	Orthogonal Frequency Division Multiplexing
OOK	On-Off Keying
PA	Power Amplifier
PAL	Phase Alternation Line Color television standard used in many European countries. Provides 625 horizontal lines of resolution. Not compatible with NTSC or SECAM.

Table B-1: Useful Terms (Continued)

PAL-M	Phase Alternation Line Color television standard used in many European countries. Provides 625 horizontal lines of resolution with 50 lines per field. Not compatible with NTSC or SECAM.
PAL-N	Phase Alternation Line Color television standard used in many European countries. Provides 525 horizontal lines of resolution with 60 lines per field. Not compatible with NTSC or SECAM.
PC	Personal Computer
PCR	Program Clock Reference
PCS	Personal Communication Services, for example, for cell phones and beepers.
PER	Parity Error Rate
ØLK	Phase Lock
PID	Program Identification
PLL	Phase Lock Loop
POTS	Plain Old Telephone System. Refers to standard analog phone service sometimes used as a back up method for communications.
PRBS	Pseudo Random Bit Sequence
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying The signal (video+audio) is imposed onto the 70 MHz carrier by varying the phase of the signal while keeping the amplitude and frequency constant. There are 4 possible values of phase that can be used to carry information.

Table B-1: Useful Terms (Continued)

RCL	Received Carrier Level The strength of a received RF signal in dBm.
RCU	Receiver Control Unit
Rcvr	Receiver
RD	Receive Data
RDS	Radio Data System
RF	Radio Frequency
RF Level	RF Power from the transmitter.
RFU	Radio Frequency Unit
RMA	Return Material Authorization
RPU	Remote Pickup
R-S	Reed-Solomon
RSSI	Receiver Signal Strength Indicator
RX	Receiver
RXU	Receiver Unit
RZ	Return to Zero
SBE	Society of Broadcast Engineers
SC	Service Channel
SC	Single Carrier
SCM	Single Carrier Modem or Single Carrier Modulation
SD	Standard Definition
SD EMB	Synchronous Digital Interface Embedded
SDI	Serial Digital Interface A serial communications interface operating at 270 Mbit/sec. SDI can operate at 1.5 Gbit/sec for HD.

Table B-1: Useful Terms (Continued)

SECAM	Sequence de Couleur Avec Memoire Color television standard used in France, Russia, and other countries. Provides 625 horizontal lines of resolution. Not compatible with NTSC or PAL. Not supported by this product.
SER	Symbol Error Rate
Setpt	Set point
SFN	Single-Frequency Network
SG	Signal Ground
SI	Service Information
Simplex	A channel capable of transmitting information in only one direction.
Site ID	A physical location where any number of modems, transmitters, or receivers are installed.
SMPTE	Society of Motion Picture and Television Engineers
SNR	Signal-to-Noise Ratio
Spectral regrowth	A phenomenon that occurs if a signal of limited bandwidth is passed through an odd-order nonlinear circuit. In this case, the output spectrum is wider than the input spectrum and may interfere with signals on adjacent frequencies.
SR16	Symbol Rate 16
STDBY	Standby
STL	Studio-to-Transmitter Link
Subcarrier	An electromagnetic signal that is used as a medium for placing an information channel above another information channel.

Table B-1: Useful Terms (Continued)

S-Video	Video signal in which the chrominance (color) and luminance (brightness) information are separated into individual subcarrier signals. Also called Y/C Video. Composite Video combines them into one signal.
S/W or SW	Software
SYNTH	Synthesizer
T1	1.544 Mbps data rate
TC	Transmitter Control
TCP/IP	Transmission Control Protocol/Internet Protocol A set of protocols, developed in the 1970s for the Internet, used to get data from one network device to another.
TCU	Transmitter Control Unit
TD	Transmit Data
TFT	Thin film transistor, a type of LCD flat-panel display.
TSL	Transmitter-to-Studio Link
TX	Transmitter
TXU	Transmitter Unit
USB	Universal Serial Bus A serial connection that allows transfer rates of 480 Mbps for USB 2.0 and a 12 Mbps transfer rate for the older USB 1.x version.
VAC	Volts Alternating Current
VCO	Voltage Controlled Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VDC	Volts Direct Current
VF	Voice Frequency

Table B-1: Useful Terms (Continued)

VFD	Vacuum Fluorescent Display. A low cost, voltage-controlled device for displaying text and graphics with high brightness and wide viewing angles.
VI	Video Input
Video	A term pertaining to the bandwidth and spectrum of the signal that results from television scanning and which is used to reproduce a picture.
VPN	A Virtual Private Network uses a public telecommunication infrastructure, like the Internet, to allow remote users to "tunnel into" an organization's private network via security measures.
Vpp	Volts peak-to-peak
WAN	Wide Area Network
WEEE	Waste Electrical and Electronic Equipment

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C Specifications

This section provides the RF, electronic, physical, safety, and power specifications for the DRS4000 Receiver.

Note MRC reserves the right to make changes to specifications of products described in this section at any time without notice and without obligation to notify any person of such changes.

RF INPUT

RF Inputs 2, 4

RF Band Support . . . . . .1.9 to 2.5 GHz
2.3 to 2.7 GHz
6.4 to 7.1 GHz
1.9 to 2.5 GHz/6.4 to 7.1 GHz (dual band support)
4.4 to 5.0 GHz (HS version only)

RF Input Range . . . . . –20dbm to –100dbm

Noise Figure . . . . . .4db max.

COFDM Bandwidth Support . . . . . .
6, 7, and 8 COFDM/DVB-T pedestals
10 and 20 MHz COFDM/LMS-T pedestals

IF Linearity . . . . . .>45 db

COFDM Compatibility . . . . . .ETSI EN 300 – 744 DVB-T

Modulation support . . . . . DVB-T and LMS-T

C/N Threshold . . . . . C/N – within 1 db of ETSI standard for Gaussian & Rayleigh channel

COFDM Auto Sense Parameters . . . . . .FEC, G/I, modulation, spectrum polarity

RF/IF Stability . . . . . .+/– 2 ppm

RF/IF Bandwidth . . . . . 8MHz SAW, 10MHz SAW, 20MHz SAW

COFDM DIVERSITY

COFDM Diversity Technique . . . . . Maximal Ratio Combining . . . . . and Packet Switching

COFDM Diversity C/N improvement(@16QAM gaussian):. . . . . 2 RF Inputs: –5 db typical / 4 RF Inputs: –8 db typical

Doppler Frequency Increase . . . . . .2X improvement

DVB – ASI Output . . . . . Monitor port

ASI Output Packet Length. . . . . 188 byte

ASI Output Driver . . . Able to drive 200 ft. of Belden 8281 cable

ASI Output Level . . . . . .800 mv pp +/– 10 %

MPEG DECODER

MPEG Decoding . . . . . Decoding of one video channel

Video Decoding . . . . . Autodetect decoding

Chroma support. 4:2:0/4:2:2

Line Standard . . . . . 525/625 lines

GOP Structure . . . . . Variable GOP support

Horizontal resolution (SD) . . . . . Autodetect – 720, 704, 544

Horizontal resolution (HD) . . . . . .1280x720p 50/59.94/60 Hz
1920x1080i 25/29.97/30 Hz
1920x1080p 24/25/30/23.976/29.97 Hz
1920x1080pSf 24/25/30/23.976/29.97 Hz
Vertical Resolution (SD) . . . . . 576 (625 lines)/480 (525 lines)
Bit rate support (SD) . . . . . Same as DVB-T table
4:2:0: 3 to 15 Mbits
4:2:2: 3 to 31 Mbits
Bit Rate Support (HD) . . . . MPEG-2 4:2:0MP@HL 8 to 80 Mbits
MPEG-2 4:2:2MP@HL 8 to 80 Mbits
Aspect Ratio 4:3/16:9
Composite Video Output. . . . . NTSC (w/wo pedestal)/PAL
Video Specification . . . . . Rec. ITU-R BT.470-4+

WAYSIDE CHANNEL

Embedded Data Channel on MPEG Module . . . . . .
Using connectors on the RS-232 Port for DCE Path
Data Rate: 1200/2400/4800/9600/19200/38400 autodetect

SDI OUTPUT

Serial Digital Output (SDI) . . . . . ANSI/SMPTE 259M Level C;
270 Mb/s, 525/625 Component;
2 Stereo Audio embedded output
SDI Output (HD) SMPTE292M
Audio Output. . . . . Analog & digital AES/EBU support
Audio Mode Support . . . . . .Dual mono (4), 2 stereo pairs
Audio Output Impedance. . . . . .600 ohms – balanced
Audio Clip Level . . . . . .+17 dbm
BISS (Basic Interoperable Scrambling System) . . . . . .
BISS-1 BISS-E, AES-128 Bit
Latency (Ultra Low Delay Software Licensable for 4 inputs) – SD
Standard Mode approx. 380 msec
Low Delay Mode approx. 100 msec
(MPEG mode and encoder dependent)
Latency (Low Delay Mode – Link technology – HD. . . . . .
Low delay mode – less than 65 msec
max. for all resolution formats

PHYSICAL

Mechanical Package . . . . . 2 RU 19-inch Rack Mount
Operating Temperature . . . . . –10 to +50 degrees C
Storage Temperature. . . . . –40 to +70 degrees C
Vibration . . . . . .Meets RTCA/DO-160D section 8.5.2
Random Test Procedure figure 8.1
Category B, 0.7g rms.

SAFETY COMPLIANCE

Meets CE EN60950-Safety CE Compliance Standard:
ETSI EN 301-751 – Harmonized European Standard
ETSI EN 301-390 – Spurious Emissions

ETSI EN 302-064-1 – RX Immunity Electromagnetic Compatibility, part 1 & 2

FCC Compliance . . . . . Part 15, Class A

POWER REQUIREMENTS

AC Power Input: . . . Auto sense 100 to 130 VAC (110 nominal)/
205 to 240 VAC (220 VAC nominal)
50 to 60 Hz

Power Consumption (Less BDC power): . . . . . 28 Watts

Power Input (AC) . . . . . Standard U.S. 3-prong connector

Fuses . . . . . 2 glass fuses rated at 2A each

FRONT PANEL CONTROLS

Keypad:. . . . . Up, Left, Right, Down, Back, OK keys

FRONT PANEL DISPLAYS

RF Controls (Dependent on configuration):

Preset number, channel frequency, channel offset

Digital (COFDM):

Diversity (COFDM): COFDM bandwidth, S/N, previterbi/
post viterbi BER, LQ, FEC, guard interval, bit rate, modulation

Digital (MPEG):

ASI bit rate, wayside baud rate, chroma delay mode,
BISSkey/ID, video type, audio type, audio mode, video condition,
w/o pedestal, locked, audio condition – bit rate, locked

CONNECTIONS

Packet:

ASI Output (2) . . . . . .75 Ohm BNC Female

SDI Output. . . . . .75 Ohm BNC Female

ASI Input (4) . . . . . .75 Ohm BNC Female

RS-232 . . . . . DB-9 Female

MaxRC Diversity:

BDC Input (4) . . . . . 50 Ohm TNC

Composite Video Output (2) . . . . . .75 Ohm BNC Female

SDI Output (SD) . . . . . .75 Ohm BNC Female

SDI Output (HD) . . . . . .75 Ohm BNC Female

HD Monitor Output . . . . . .75 Ohm BNC Female

Frame Lock . . . . . .75 Ohm BNC Female

ASI Input . . . . . .75 Ohm BNC Female

Audio Output (4) . . . . . mini-XLR

Optical Fiber Ports (4) . . . . . Optional

RS-232 . . . . . DB-9 Female

Summary Alarm. . . . . DB-9 Female

Network/System Control RJ45/USB

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D Maximal Ratio Combining

D.1 Appendix Overview

This section provides a general overview of the Maximal Ratio Combining (MaxRC) diversity implemented within the DRS4000 Receiver.

D.2 Antenna Correlation

For spatial diversity, one key assumption is that the receive antennas are spaced far enough apart that the received signals at each antenna are experiencing independent fading characteristics to help the MaxRC diversity technique achieve optimal performance. A MaxRC Diversity block diagram is shown in Figure D-1 on page D-2.

The concept of correlation is easier to comprehend by looking at the two figures below. Figure D-2 on page D-3 shows two signals with low correlation and Figure D-3 on page D-4 shows two signals with high correlation. Each figure has two channels plotted after a fading channel.

When the two received channels have a low correlation factor, this equates to the signals received experiencing dissimilar fading characteristics that ultimately provide the best performance for a diversity system. This is what you should be aiming to achieve during the installation of the receive antennas.

D.3 MaxRC Diversity Technique

Any receiver utilizing the MaxRC diversity technique will have a dedicated tuner on the input from each antenna, which then gets fed into individual demodulators designed to support MaxRC diversity.

Each individual demodulator performs both the FFT and the channel estimation process on the incoming signals. Then by using the pilot carriers embedded within the COFDM signal along with other information, each demodulator is able to assess each of the individual 2k carriers within the received signal and assign a mathematical value associated with the level of confidence relating to the degradation of that carrier and how erroneous the data within is perceived to be.

Then by using a diversity bus between each of the demodulators, a diversity algorithm looks at each carriers confidence value and decides the ratio of which each input is combined on a per-carrier basis.

This makes it possible to physically re-construct each of the individual carriers enabling the receiver to provide the best possible signal before applying the error correction.

The benefits of using the MaxRC diversity technique is its ability to make use of the signal being received by any antenna in part or full combination to reconstruct a damaged signal.

Figure D-1: MaxRC Diversity Block Diagram

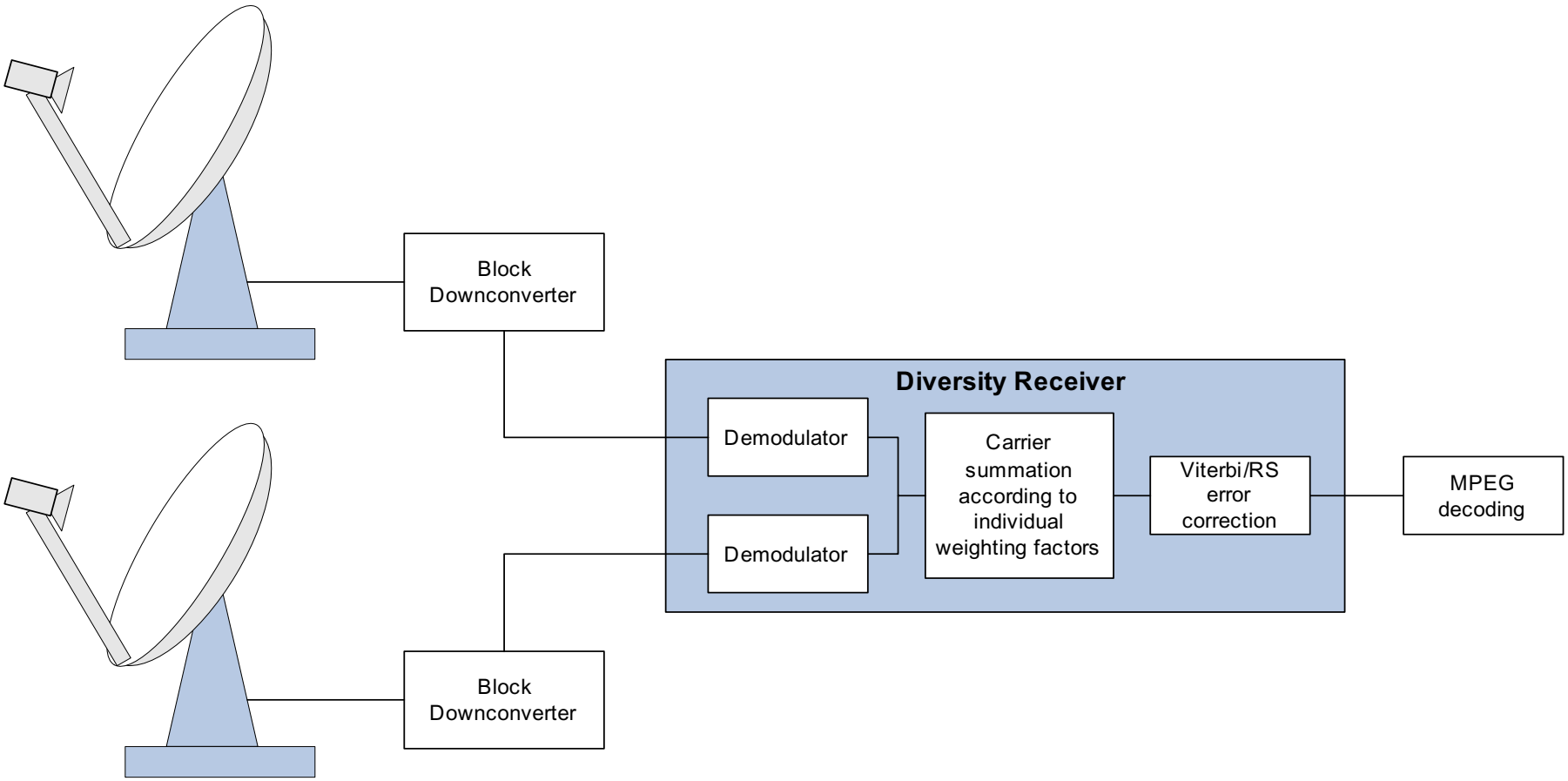


Figure D-2: Two Signals with Low Correlation

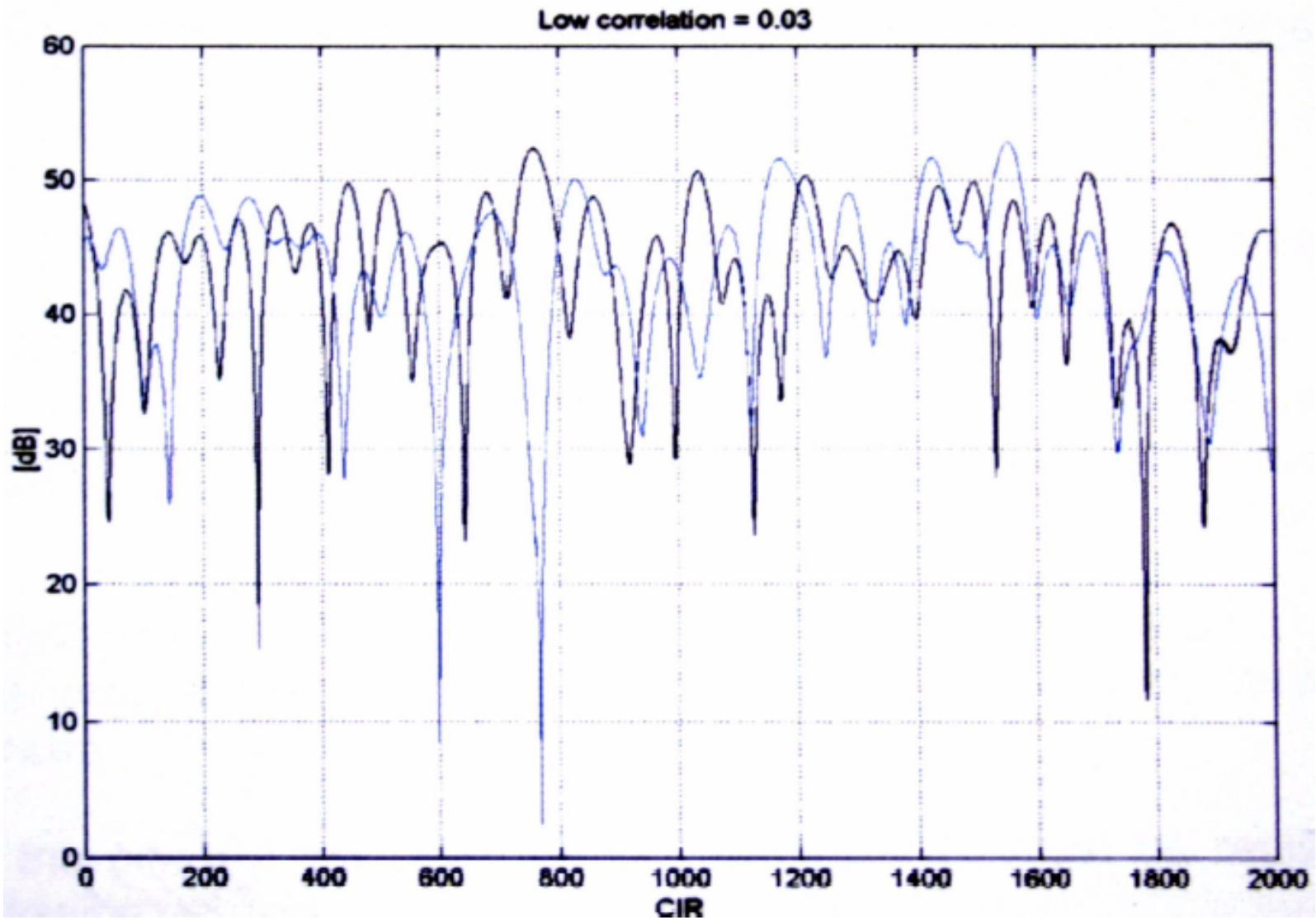
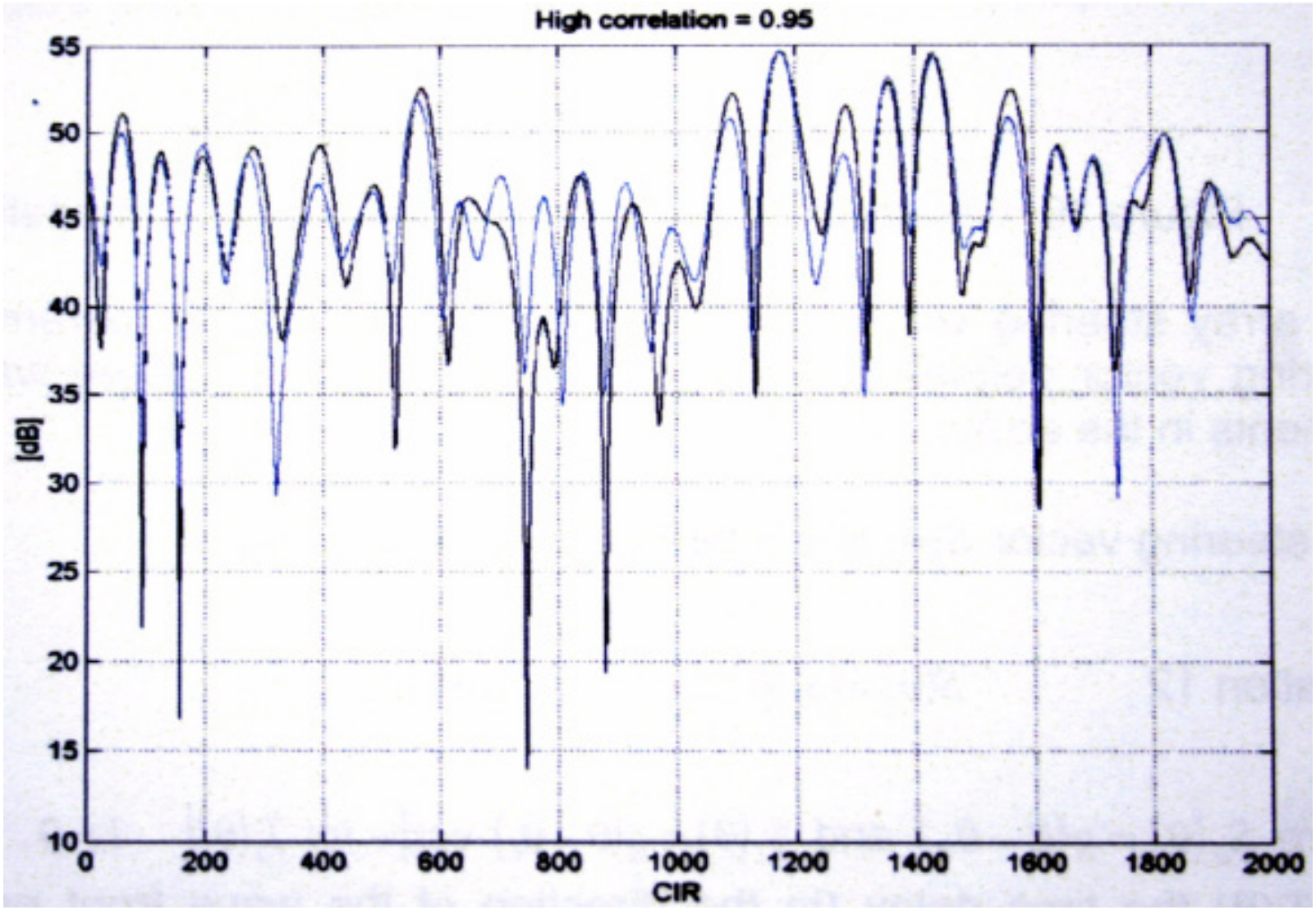


Figure D-3: Two Signals with High Correlation



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