MICROWAVE RADIO
COMMUNICATIONS

CodeRunner 2

Analog+Digital
Portable
Microwave Transmitter

Operator's Guide

Notices

About This Manual

Part number **400437-1**

Revision **N**

March 2004

The information in the manual applies to the MRC CodeRunner 2 Transmitter, **firmware revision 4.03.**

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To allow for the introduction of design improvements, specifications are subject to change without notice.

Regulatory Status

This product is certified to conform to CENELEC standards EN 55020, EN 55013, EN 50082-1 and EN 60950 and carries the CE mark.

CE

Authorized EU representative: Vislink PLC.

Microwave Radio Communications is ISO 9001 certified.

RF Exposure Warning

The CodeRunner 2 is a radio transmitter. It is designed to permit, produce and emit RF radiation into an antenna for the purpose of delivering a digital or FM modulated signal to an appropriate receiving device.

For equipment such as the CodeRunner 2, the Maximum Permissible Exposure (MPE) limit is 1.0 mW/cm2. The CodeRunner 2 is a low-powered device, and by itself will generally not create RF exposure in excess of the MPE limits for RF radiation (OET Bulletin 65, Addition 97-01) issued by the U.S. Federal Communications Commission (FCC). However, when properly connected to an antenna, the radiated power can exceed the MPE limits.

The purchaser and/or user of the CodeRunner 2 is solely and exclusively responsible for determining the level of RF exposure when connecting the CodeRunner 2 to an antenna or other equipment, taking all appropriate steps to limit RF exposure and for ensuring compliance with all FCC requirements set forth in OET Bulletin 65.

Conventions

Pay special attention to information marked in one of the following ways:

CAUTION	*Follow CAUTIONS closely to prevent personal injury or death.*
WARNING	Follow WARNINGS to prevent damage to the equipment.
Note	Notes provide additional information to assist you in using and maintaining the equipment.

On-Line Viewing

Text displayed as **blue** contains a hypertext link. Click on the **hypertext** to jump to that destination. Click on the **blue destination** to return.
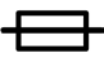
Viewing this manual on-line requires Adobe Acrobat, version 4.0 or above.

Click on this icon to download your FREE copy of Adobe Acrobat Reader.

Symbols Used

The following symbols are used on the equipment:

Symbol	Meaning
⚡	CAUTION: Risk of Electric Shock
⚠	WARNING: General Warning. Risk of Danger
	WARNING: Electrostatic Discharge. Possible Damage to Equipment
	Fuse - Identifies fuses or their location.
	Frame or Chassis Ground - Identifies the frame or chassis terminal.
	Earth Ground - Identifies the earth Ground Terminal
	Protective Earth Ground - Identifies any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal on a protective earth electrode.

Warranty Information

Product Manufactured by MRC:

a. Products manufactured by MRC are warranted against defects in material and workmanship for a period of two (2) years from date of delivery as evidenced by MRC's packing slip or other transportation receipt (unless otherwise noted).

b. MRC's sole responsibility under this warranty will be to either repair or replace, at its option, any component which fails during the applicable warranty period because of a defect in material or workmanship, provided Buyer has promptly reported same to MRC in writing. All replaced products and parts will become MRC's property.

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Contents

1 *Introduction*

1.1 Chapter Overview

This chapter will introduce you to the Operator's Guide: what it covers, how it's organized, and who it's written for.

1.2 What This Manual Covers

This manual describes how to operate the MRC CodeRunner 2 Transmitter.

For information on Installation, Repair, and Theory of Operation, refer to the **MRC CodeRunner 2 Technical Reference Manual**.

1.3 How It's Organized

The manuals for the CodeRunner 2 are organized as follows:

Chapter	Operator's Guide	Technical Reference Manual
Introduction	☑	☑
Product Description	☑	☑
Routine Operation	☑	☑
Advanced Operation		☑

Chapter	Operator's Guide	Technical Reference Manual
Installation		☑
Troubleshooting		☑
Repair		☑
Replacement Parts		☑
Theory of Operation		☑
Appendix A - Channels & Frequencies	☑	☑
Appendix B - Glossary	☑	☑
Appendix C - Module Reference		☑
Appendix D - Color Bar Generator		☑
Appendix E - Installing Triax Connectors		☑
Appendix F - Menu Reference		☑

Note   The **Technical Reference Manual** contains everything in the **Operator's Guide**, plus additional technical content.

1.4 Who It's Written For

This manual is intended for use by personnel assigned to operate the CodeRunner 2. Users of this manual should already be familiar with basic concepts of radio, video and audio.

1.5 Related Documents

- MRC CodeRunner 2 Quick Reference Guide (part no. 400453)
- MRC CodeRunner 2 Technical Reference Manual (part no. 400465)
- MRC CodeRunner 2 Helicopter Remote Control (part no. 400461)

1.6 Ordering documentation

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

Business Hours:	Monday - Friday
	8:00 AM - 7:00PM Eastern Time (US)
	(0800 - 1900 hrs US ET)
Telephone:	800-490-5700
	978-671-5700
Fax:	978-671-5800

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

- Model number and serial number of the unit. This is located in two places:
  - label on the rear panel
  - label inside the front panel.
- Approximate purchase date.
- Firmware revision, found in two places:
  - displays on screen at startup
  - label inside the front panel.

1.7 Calling for Service

MRC Technical Support is available 24 hours a day, 7 days a week. During regular business hours you can reach our expert staff directly. After hours, your call will be forwarded to the on-call technical support specialist.

Business Hours:	**Monday**
	8:00 AM - 5:00PM Eastern Time (US)
	(0800 - 1700 hrs US ET)
	Tuesday - Friday
	8:00 AM - 7:00PM Eastern Time (US)
	(0800 - 1900 hrs US ET)
Telephone:	800-490-5700
	978-671-5700
Fax:	978-671-5800
Email:	support@mrcbroadcast.com

When contacting Technical Support, please have the following

information available:

- Model number and serial number of the unit. This is located in two places:

  - on a label on the rear panel
  - on a label inside the front panel.

- Approximate purchase date.

- Firmware revision, found in two places:

  - displays on screen at startup
  - on a label inside the front panel.

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2 *Product Description*

2.1 Chapter Overview

This chapter provides a overall description of the product, its components, and its capabilities.

Here are the topics covered:

2.2 System Description

The MRC CodeRunner 2 transmitter is designed to be both an analog and digital transmitter for ENG portable applications. CodeRunner 2 can accommodate a variety of analog and digital inputs, and apply either analog or digital modulation.

CodeRunner 2 is an integrated, flexible solution consisting of:

- A rack mounted Indoor Unit (IDU), typically mounted inside an ENG vehicle.

- A mast mounted Outdoor Unit (ODU), also called the RF Unit (RFU).

A typical installation is shown in Figure 2-1.

Power Options The CodeRunner 2 can be operated from 115 V / 220 V AC mains power, or from 18-36 V DC vehicle power. Power is supplied to the IDU, which in turn powers the ODU via the cable harness between them.

Analog/Digital Options The CodeRunner 2 is digital-ready, which means it can be ordered and installed as a full-featured analog radio. Then later, it can be upgraded just by adding the digital MPEG/COFDM Module.

Band & Frequency Options The CodeRunner 2 is designed to cover the bands below. It can be ordered as a single-band unit or in a dual-band configuration to cover any two of these bands.

- 2-3 GHz

- 6-7 GHz

- 12-13 GHz

Band and frequency information is stored in the ODU, which means switching bands after installation is very simple: just plug in the RFU for the new band, and the IDU will automatically configure itself for the new band.

Within these bands, channels can be preprogrammed at the factory to match either the US broadcast channel plan, or a plan specified by the customer. Channel frequencies can be reprogrammed in the field using the keypad and display on the IDU.

Color Bar Generator Options For analog operation, an optional analog color bar generator is available, either at time of purchase or for later upgrade in the field. The digital MPEG/COFDM Module has a built-in digital color bar generator. Either the analog or digital generators are field configurable for functions such as auto-standby (mute the transmitter on loss of video) and auto-generate (provide tones and bars on loss of video).

Connection Options The CodeRunner 2 is designed to make upgrading from an older radio as painless as possible. The IDU and ODU can be ordered with a variety of connectors to plug into an existing wiring harness. The connectors available for the cable harness between the IDU and ODU are:

- Triax
- Type 'N'
- TNC

The ODU comes with a standard Type N connector for the antenna connection.

Antenna Options The CodeRunner 2 is fully compatible with a variety of antennas, including:

- MRC ProStar, models
  - 2A20 and 2A20SS (2 GHz)
  - 7A30 and 7A30SS (7 GHz)
  - 2A20/7A30 (dual band 2 & 7 GHz)
  - 2A20/7A30SS (dual band 2 & 7 GHz, solid state switching)

- MRC Ellipse 2000
- MRC OmniPole Omnidirectional

Switching functions for band and antenna polarization are controlled from the front panel of the IDU.

If your installation involves more than one antenna, this can be easily accommodated by using the MRC RF Switch. The RF Switch is also controlled from the front panel of the IDU.

Figure 2-1: Typical CodeRunner 2 System

Antenna

Pan & Tilt Assembly

Outdoor Unit (ODU)

Conduit (Nycoil)

Indoor Unit (IDU)
(inside vehicle)
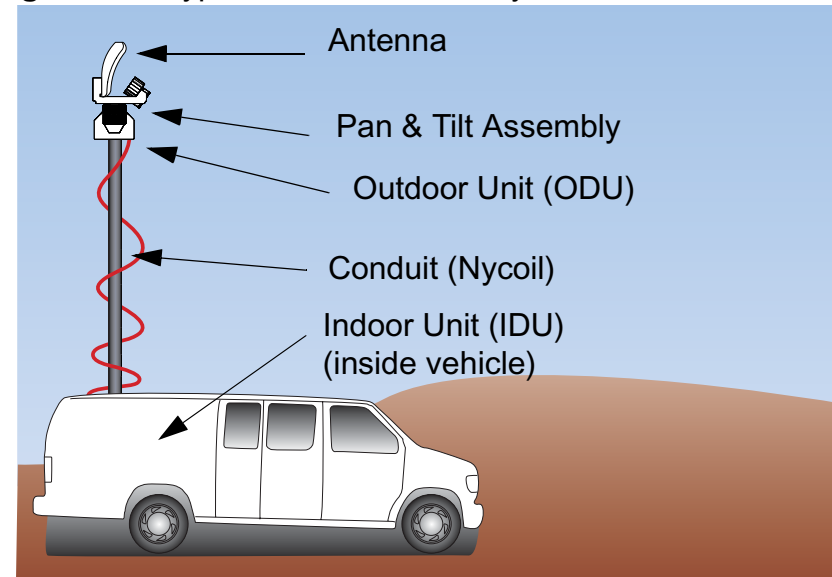
2.3   System Components

An MRC CodeRunner 2 system is made up of the following components:

- A rack mounted Indoor Unit (IDU), typically mounted inside an ENG vehicle.

- A mast mounted Outdoor Unit (ODU), also called the RF Unit (RFU).

A typical system is shown in Figure 2-2.

The IDU contains the baseband circuitry, power supply, and control modules. It accepts a variety of audio and video inputs, both digital and analog, and generates a 70 MHz IF output. It also accepts IF input from external modulators.

For digital operation, the IDU can be equipped with an optional internal MPEG/COFDM Module. Or, the IDU can be used with existing external digital encoders and modulators.

The ODU contains the upconvertors and power amplifier. The ODU accepts the 70 MHz IF, converts it to the operating band chosen, and amplifies it.

Every installation will include an antenna, either directional or omnidirectional, or both. An MRC RF Switch can be mounted up on the mast to select the antenna desired.

When using a mast mounted antenna, a Nycoil conduit sheath covers the wiring harness between the IDU to the ODU. This harness carries the power, IF, and antenna band and polarization switching. Addition wiring is added for controlling the pan & tilt mechanism, and for implementing additional functions such as off-air monitors, mast lights, etc.

Figure 2-2: CodeRunner 2 System Components

Directional Antenna
(MRC 2A20, 7A30, Ellipse 2000)

OmniPole Antenna

Outdoor RF Unit
(Upconvertor,
Power Amp)

Pan & Tilt Assembly

RF Switch

Conduit (Nycoil)

CodeRunner 2 Indoor Unit
(Baseband, Audio/Video Modules)

TRANSMITTER

Internal
MPEG Encoder &
COFDM Modulator
(Optional)

External
Modulator
(Optional)

MODULATOR

External
Encoder
(Optional)

ENCODER
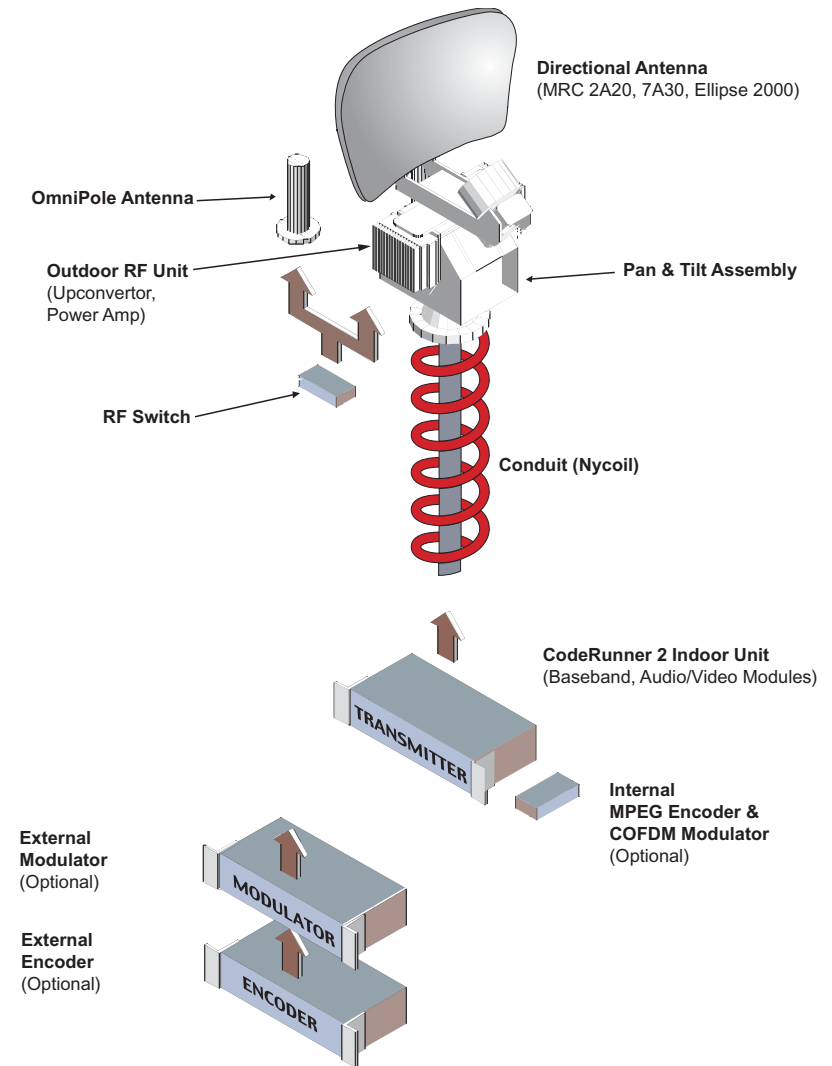
2.4   Operating Controls

All controls are on the front panel of the IDU. There are no controls or adjustments on the ODU (RFU).

All transmitter functions are controlled using an LCD display with 8 button keypad, and a set of 3 function switches. See Figure 2-3 on page 2-4.

The LCD display and keypad are used to toggle through control and diagnostic menus for both the IDU and ODU.

Functions switches directly control antenna polarization, band selection, and antenna selection.

Figure 2-3: Front Panel Controls
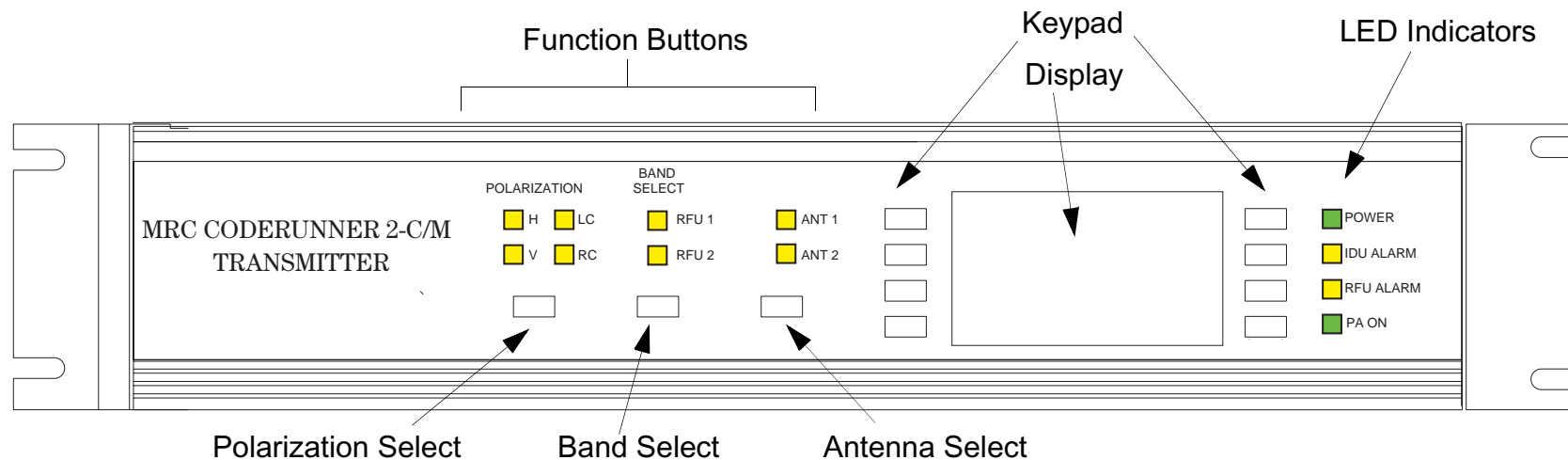
2.5   External Connectors

All transmitter connections are made at the rear panel of the IDU. The panel layout is shown in Figure 2-4.

Brief descriptions of the connections are found in Table 2-1. For more detailed information, see the *MRC CodeRunner 2 Technical Reference Manual*.

Figure 2-4: Rear Panel Connectors
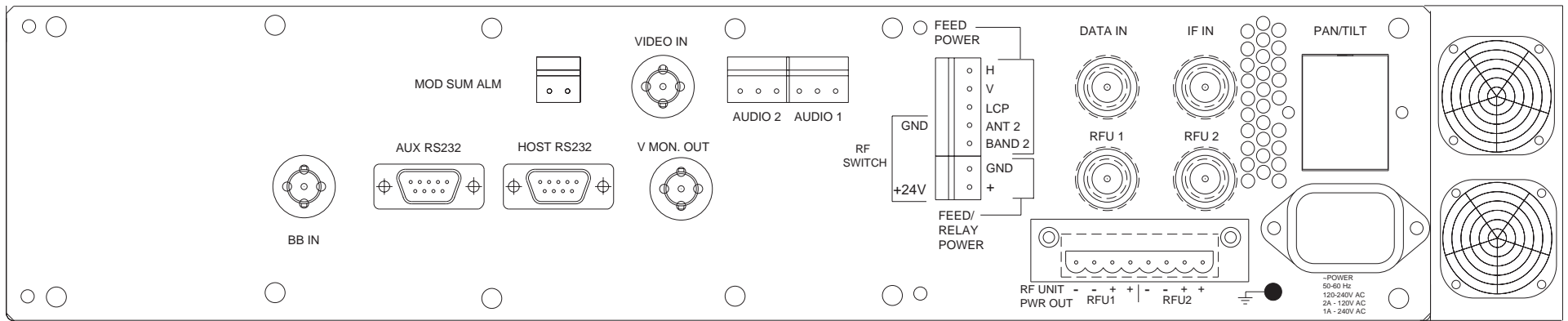
Table 2-1: IDU Rear Panel Connections

Connector	Function
Summary Alarm Input	Alarm input from external device such as a modulator.
Analog Video Input	Input for analog video.
Baseband Input	Input from external baseband source.
Audio Input	Line level analog audio input.
Data In/Out	Can be used as either input or output for digital video (DVB-ASI). Configured via menus on front panel display.
IF Input	IF input from external modulator
RF Outputs 1 and 2	• IF + DC Power + Control to RFU (Triax Connector option) • IF + Control to RFU (Type 'N' and TNC connector option)
Pan & Tilt Control	Not Used
Power Input	Supply power to CodeRunner 2 system (both IDU and RFU).
Grounding Lug	Connection to chassis ground
RFU Power Output	DC Power to RFU 1 and RFU 2 (only present with Type 'N' and TNC connection options).

Table 2-1: IDU Rear Panel Connections (Continued)

Connector	Function
Antenna Control • FEED POWER • FEED/RELAY POWER	• Control for antenna polarization, antenna band, and RF Switch. • Power for antenna and RF Switch.
Video Monitor Output	Analog video output to monitor the analog Color Bar Generator. Does not contain program video.
Host Serial Port	RS-232 data
Auxiliary Serial Port	RS-232 data

2.6   IDU/ODU (RFU) Interconnection

The IDU connects to the Outdoor RF Unit through a wiring harness inside a coiled conduit (Nycoil) sheathing.

The wiring harness will contain power, RF and control for all components mounted at the top of the mast. The harness is specific to a particular installation, and is designed to support all the desired functions. These functions would typically include:

- IF, control, and alarms between the IDU and ODU.

- DC Power to the ODU.

- Power and control for an RF Switch to select antennas.

- Power and control for antenna switching functions (band, polarization).

- Power for mast top lights.

- Control and power for the Pan and Tilt assembly.

- RF and control for an off-air antenna.

- Mast top safety sensors for proximity, high voltage, etc.

Since each installation is different, the harness must be specified for each installation. The harness can be supplied by MRC, or is often supplied by the van integrator.

For more detailed information, see the *MRC CodeRunner 2 Technical Reference Manual*.

2.7 System Configurations

The CodeRunner allows several antenna configurations for transmitting with either an OmniPole or directional antenna, in either single-band or dual-band operation.

2.7.1 Single Band/Dual Antenna Configuration

Figure 2-6 shows the antenna configuration for single-band transmitting using one Indoor Unit with one RF Unit.

The RFU could be operating on the 2 GHz, 7 GHz, or 13 GHz bands.

In addition, an RF Switch allows switching between an OmniPole and a directional antenna.

Figure 2-5: Single Band Operation with 2 Antennas
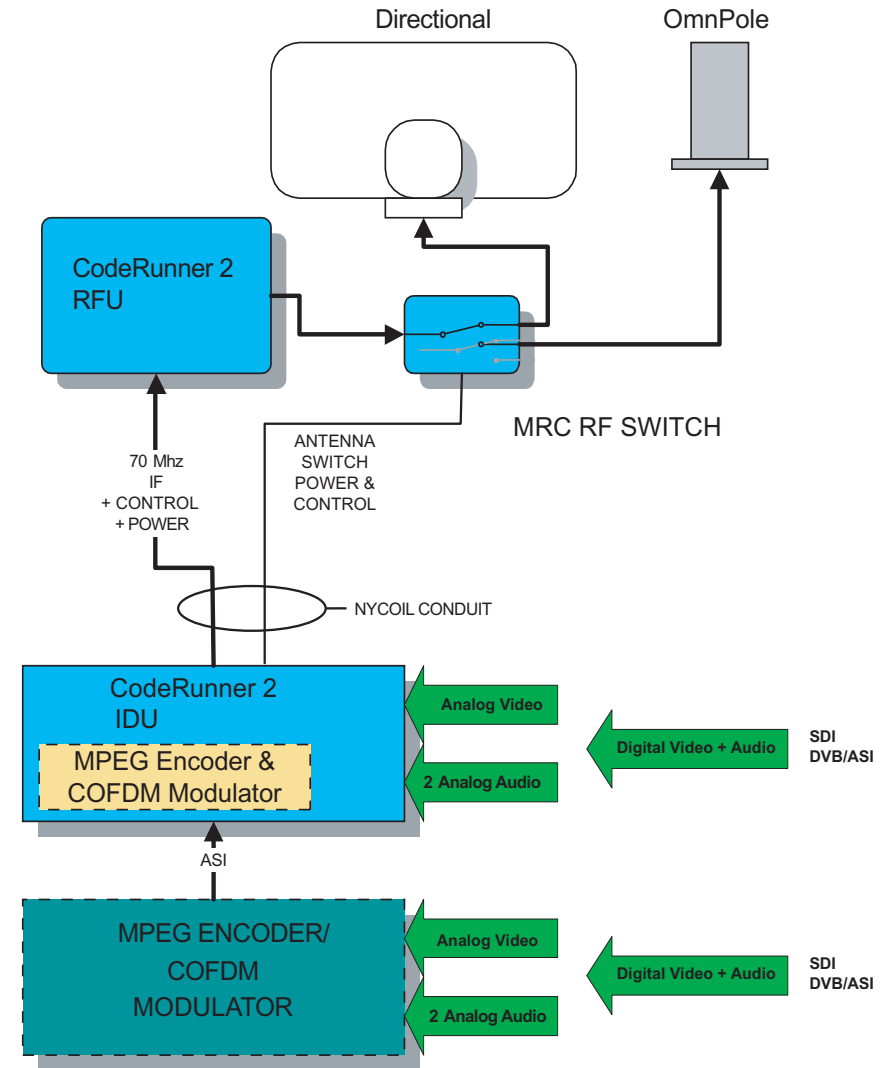
2.7.2   Dual Band Non-Simultaneous Transmitting

Figure 2-6 shows the antenna configuration for non-simultaneous transmitting using one Indoor Unit with two RF Units.

In this example the RFUs are operating on 2 GHz and 7 GHz bands, but the 13 GHz band is also available as one of the two bands.

In addition, an RF Switch allows switching one of the RF Units between an OmniPole and a directional antenna.

Figure 2-6: Dual Band, Non-Simultaneous Operation
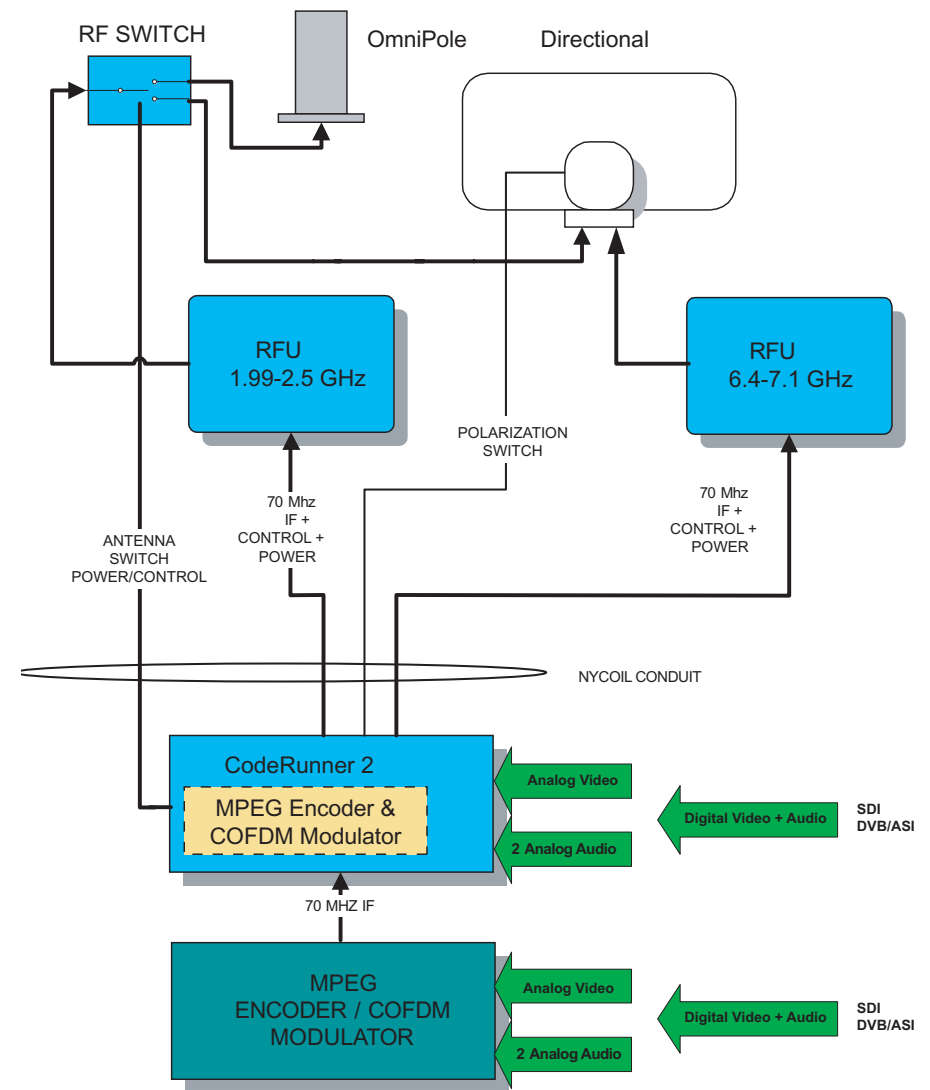
2.7.3   Dual Band Simultaneous Transmitting

Figure 2-7 shows the antenna configuration for simultaneous transmitting using two Indoor Units with two RF Units.

In this example the RFUs are operating on 2 GHz and 7 GHz bands, but the 13 GHz band is also available as one of the two bands.

In addition, an RF Switch allows switching one of the RF Units between an OmniPole and a directional antenna.

Figure 2-7: Dual Band Simultaneous Operation
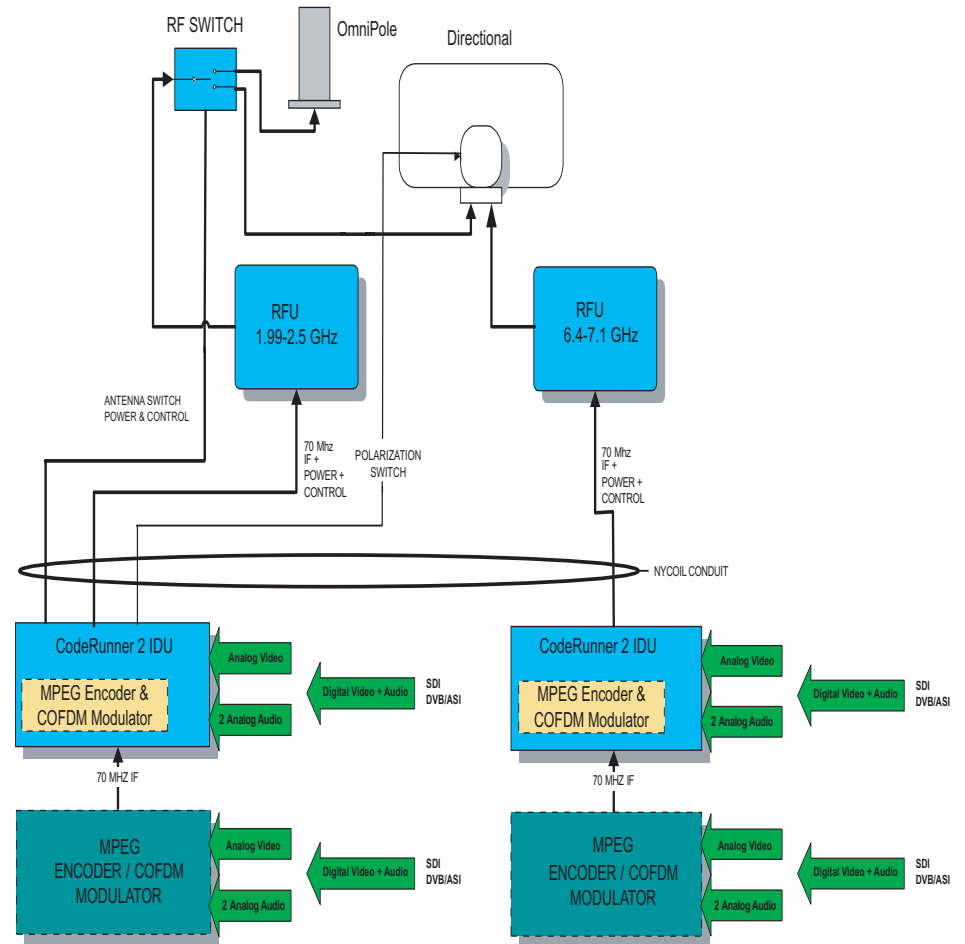
2.8   For More Information

More detailed technical information about the CodeRunner 2 can be found in the *CodeRunner 2 Technical Reference Manual*. Specific topics are listed below:

Topic	Chapter
IDU	
Block Diagram	*Theory of Operation*
Operating Controls	*Basic Operation*
Screen Menus	*Advanced Operation*
Rear Panel Connections	*Installation*
Supported Repairs	*Repair*
Repair Parts	*Replacement Parts*
ODU	
Block Diagram	*Theory of Operation*
Connections	*Installation*
Supported Repairs	*Repair*

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3 *Routine Operation*

3.1 Chapter Overview

This chapter provides basic information that will enable you to operate your CodeRunner 2. More detailed information can be found in the **CodeRunner 2 Technical Reference Manual**.

Here are the topics covered:

3.2 Overview of Controls

The CodeRunner 2 front panel has the following controls and indicators:

- Function Buttons
- Status LEDs
- Display and Keypad

Each of these is described in more detail in the sections that follow. See Figure 3-1 on page 3-4 for the layout of the front panel.

3.3 Function Buttons

The CodeRunner 2 provides three function buttons that control three specific functions:

- Polarization Select
- Band Select
- Antenna Select

Each also has an LED which illuminates to show which choice is currently selected. See Figure 3-1 on page 3-4.

Automatic Lockout To prevent accidental activation, all function buttons and keypad keys become locked out after approximately 30 seconds of inactivity. This time period is fixed and not selectable by the user.

This time period is also independent of the Backlight Delay setting, which controls how long the display backlight stays on before automatically turning off. The Backlight Delay is set under the Configuration menu.

To unlock the buttons and keys, press any button or key once. Then press the desired button or key to make your selection.

3.3.1   Polarization Select

If your installation includes an antenna with selectable polarization (such as the MRC 2A20/7A30 or Ellipse 2000), this function button will allow you to make that selection.

Pressing the Polarization Select button toggles through the four choices in sequence. As each choice is selected, the corresponding LED illuminates. The four choices are:

- H (Horizontal Polarization)
- V (Vertical Polarization)
- RC (Right Circular Polarization)
- LC (Left Circular Polarization)

3.3.2   Band Select

If your CodeRunner 2 has dual band capability, and your installation includes more than one RF Unit (RFU), this function button allows you to select which RFU is active.

Pressing the Band Select button toggles back and forth between the two choices. As each choice is selected, the corresponding LED illuminates. The two choices are:

- RFU1
- RFU2

The IDU will automatically detect which RFU is on which band, and configure the IDU menus to match that band.

3.3.3   Antenna Select

If your installation includes more than one antenna (such as an MRC OmniPole and an MRC Ellipse 2000) and an MRC RF Switch, this function button will allow you to select which antenna is in use.

Pressing the Antenna Select button toggles back and forth between the two choices. As each choice is selected, the corresponding LED illuminates. The two choices are:

- ANT1 (Antenna 1)
- ANT2 (Antenna 2)

3.4 Status LEDs

The CodeRunner 2 has four Status LEDs to keep you informed about the status of the system (See Figure 3-1 on page 3-4). Those LEDs are described in Table 3-1.

Table 3-1: Status LEDs

Panel Label	Description	Color
POWER	Indicates IDU is powered up.	Green
IDU Alarm	Fault condition in Indoor Unit (IDU).	Yellow
RFU Alarm	Fault condition in RF Unit (ODU).	Yellow
PA On	Power Amplifier section of RFU is powered up (actively transmitting).	Green

Figure 3-1: Front Panel Controls

POLARIZATION

BAND SELECT

MRC CODERUNNER 2-C/M
TRANSMITTER

H LC RFU 1 ANT 1
V RC RFU 2 ANT 2

Function LEDs

Keypad

Display

Status LEDs

POWER
IDU ALARM
RFU ALARM
PA ON

Polarization Select   Band Select   Antenna Select

Function Buttons
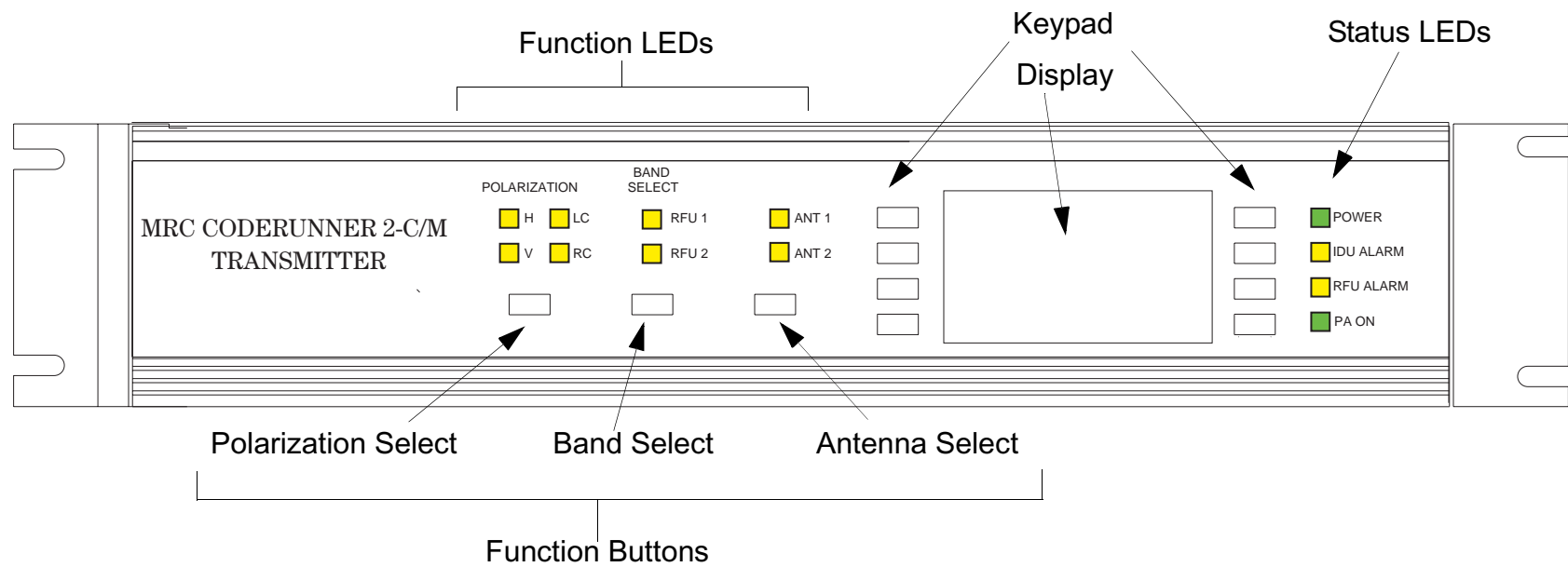
3.5   Display and Keypad

The CodeRunner 2 has an LCD display and an 8-key keypad (see Figure 3-1 on page 3-4). You will use the display and keypad to set configurations, monitor status, and troubleshoot problems.

Details of the individual menus are found in the *CodeRunner 2 Technical Reference Manual*.

3.5.1   Display Layout

The display is organized into five areas that are used for specific purposes (see Figure 3-2 on page 3-6):

Heading Area This is generally used for the title of the current menu screen, such as "Configuration Menu". It is also sometimes used for displaying data or status information when the display is crowded.

Message Area The Message Area is used for displaying alarm and error messages, and for general status information.

Status Area This area is used for displaying the current settings for the available menu choices.

Menu Areas There are two menu areas, one on the right of the display and one on the left. Each can accommodate 4 menu choices, which correspond to the four keys on each side of the display.

3.5.2   Navigating using the display and keypad

Making a Selection The eight keypad keys correspond to the eight fields in the menu areas. To select an available menu item, just press the key corresponding to that menu item.

- If you selected a menu, that menu will now appear on the display.

- If you changed a setting, the Status Area will change to show the new setting.

Accessing the Main Menu The most commonly used choices and settings are available from the Main Screen. These are the choices an operator might need while using the CodeRunner 2. Choices and settings more typically performed by the technical staff are all grouped in menus accessible only through the Main Menu.

To access the Main menu from the Main Screen, press the Menu key TWICE.

Automatic Lockout To prevent accidental activation, all function buttons and keypad keys become locked out after approximately 30 seconds of inactivity. This time period is fixed and not selectable by the user.

This time period is also independent of the Backlight Delay setting, which controls how long the display backlight stays on before automatically turning off. The Backlight Delay is set under the Configuration menu.

To unlock the buttons and keys, press any button or key once. Then press the desired button or key to make your selection.

Backlight Delay The display includes a backlight for easy viewing in a variety of lighting conditions. The backlight can be configured to remain on, or to automatically turn off after a time delay. This Backlight Delay is set under the Configuration menu.

Default to Main Screen To help prevent accidental activation of the keypad keys, the display will automatically default to the Main Screen when the Backlight turns off. If the Backlight is configured to remain on, the display continues to shown the last screen used.

Figure 3-2: Display and Keypad Layout

Message Area · Heading Area · Status Area · Menu Areas · Keypad
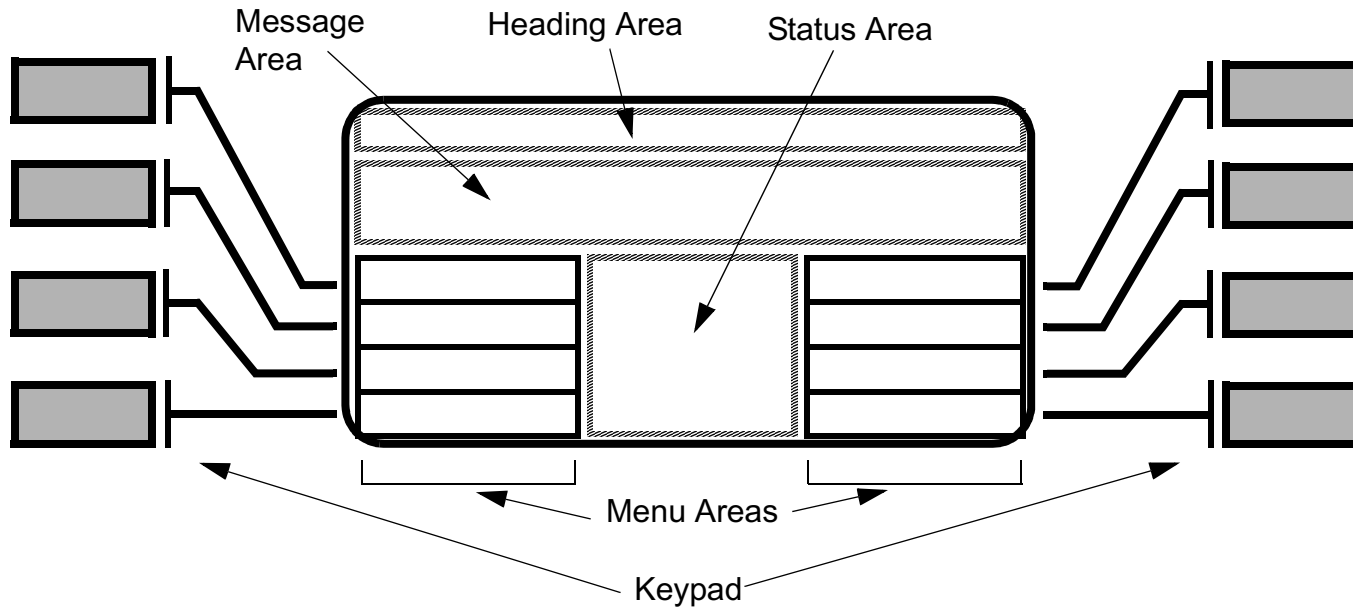
Figure 3-3: Main Screen Display


```
          CodeRunner.2 Rel.4.03

               RFU1   Rev B


 Di/An    ANALOG          STDBY    PA

 Chnl     1       17M        HI   Hi/Lo

 Offst    0      2 GHz             Rem

 Menu     Pwr 0.0 dBm
```
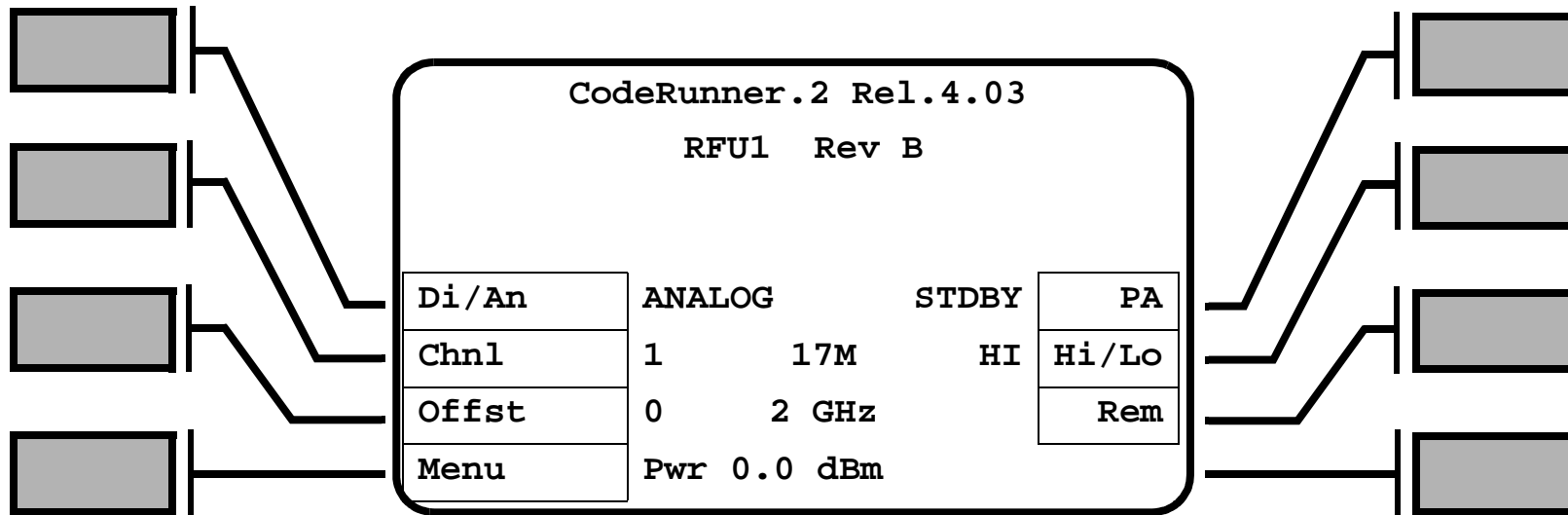
3.6 Frequently Performed Tasks

This chapter describes how to perform many common tasks with the CodeRunner 2. Here are the tasks described:

Topic	Page
Turning the power ON and OFF	3-7
Activating and deactivating the transmitter	3-7
Switching between HI and LOW power	3-7
Selecting Channel and Offset	3-8
Switching between antennas	3-8
Switching antenna polarization	3-8
Switching bands	3-8
Switching between Analog and Digital modes	3-8
Setting for Remote operation	3-9

Refer to the Main Screen display in Figure 3-3, and the menu maps in Figure 3-4 and Figure 3-5 to follow along with these instructions.

3.6.1 Turning the power ON and OFF

1. Open the front panel of the Indoor Unit by loosening the 2 large screws and letting the panel swing down.
2. Press the Power switch.
3. Close the front panel by swinging it up and tightening the two screws.

3.6.2 Activating and deactivating the transmitter

1. Make sure the power to the CodeRunner 2 is on.
2. **On the Main Screen,**
   - To **activate** the transmitter: press `PA` until the Status Area displays `XMIT`.
   - To **deactivate** the transmitter: press `PA` until the Status Area displays `STDBY.`

3.6.3 Switching between HI and LOW power

1. Make sure the power to the CodeRunner 2 is on.
2. **On the Main Screen,**
   - To switch the transmitter to **High** power: press `Hi/Lo` until the Status Area displays `High`.
   - To switch the transmitter to **Low** power: press `Hi/Lo` until the Status Area displays `LOW`.

3.6.4 Selecting Channel and Offset

1. Make sure the power to the CodeRunner 2 is on.
2. **On the Main Screen,**
   - To change the **channel** on which the radio will transmit: press `Chnl` until the Status Area displays the channel desired.
   - To change the frequency **offset** above or below the selected channel: press `Offst` until the Status Area displays the offset desired.

3.6.5 Switching between antennas

1. Make sure the power to the CodeRunner 2 is on.
2. Press the Antenna Select function button until the LED illuminates next to the desired antenna.

3.6.6 Switching antenna polarization

1. Make sure the power to the CodeRunner 2 is on.
2. Press the Polarization Select function button until the LED illuminates next to the desired polarization.

3.6.7 Switching bands

Which band(s) the CodeRunner 2 operates on is set by the RFU(s) connected to the IDU. Switching bands in accomplished by switching between RFUs:

1. Make sure the power to the CodeRunner 2 is on.
2. Press the Band Select function button until the LED illuminates next to the desired RFU covering the desired band.

3.6.8 Switching between Analog and Digital modes

1. Make sure the power to the CodeRunner 2 is on.
2. **On the Main Screen,**
   - To switch the transmitter to **Digital** mode: press `Di/An` until the Status Area displays `DIGITAL`.
   - To switch the transmitter to **Analog** mode: press `Di/An` until the Status Area displays `ANALOG`.

3.6.9 Setting for Remote operation

The MRC Remote Control Panel allows control of the CodeRunner 2 from the passenger compartment regardless of where in the vehicle or aircraft the CR2 is physically located.

The Remote uses vehicle or aircraft power, and communicates with the IDU via an RS-232 serial interface.

To set up the CR2 to operate with the Remote Control, perform the following steps on the IDU:

1. **Enable remote control operation.**
   - Make sure the CodeRunner 2 has power and is turned on.
   - Make sure the Remote Control Panel has power, is turned on, and is connected to IDU.
   - On the Main Screen, press `Menu` twice to access the Main Menu.
   - On the Main Menu screen, select `Remote Menu`.
   - On the Remote Control Menu screen, press `Rmt Cntrl` until the Status Area displays `ENABLED`.

     If there is a problem with the communication between the Remote Control and the IDU, the IDU Alarm LED will illuminate, and the screen will display `Serial Comm Failure`. See the "Troubleshooting" chapter of the *CR2 Technical Reference Manual* for help resolving the problem.

2. **Turn off the Modem in the Remote Control menu.**
   - On the Remote Control Menu screen, press `Modem` until the Status Area displays `OFF`.

3. **Set both Transmit and Receive baud rates to 9600.**
   - On the Remote Control Menu screen, press `TxBaud` until the Status Area displays `9600`.
   - On the Remote Control Menu screen, press `RxBaud` until the Status Area displays `9600`.

4. **Set Remote Control to Remote.**
   - On the Remote Control Menu screen, select `Menu`.
   - On the Main Menu screen, select `Main Screen`.
   - On the Main Screen, press `Rem` until the Status Area shows `RMT`.

Once the radio is set to `RMT`, the front panel controls will be partly disabled:

- Navigation from one menu screen to another will work normally.

- Any keys that make menu selections or change settings will be disabled.

- The Function Buttons will be disabled.

All these functions will be controlled by the Remote Control Panel.

To restore normal front panel operation:

   - On the Main Screen, press `Rem` until the Status Area displays `LCL`.

3.7   Menu Maps

Following are one-page menu maps to help you navigate through the many features and capabilities of your CodeRunner 2.

For more detail about any of these menus or the settings available, see the **CodeRunner 2 Technical Reference Manual**, in the chapter "Advanced Operation".

Figure 3-4: Analog Menu Map
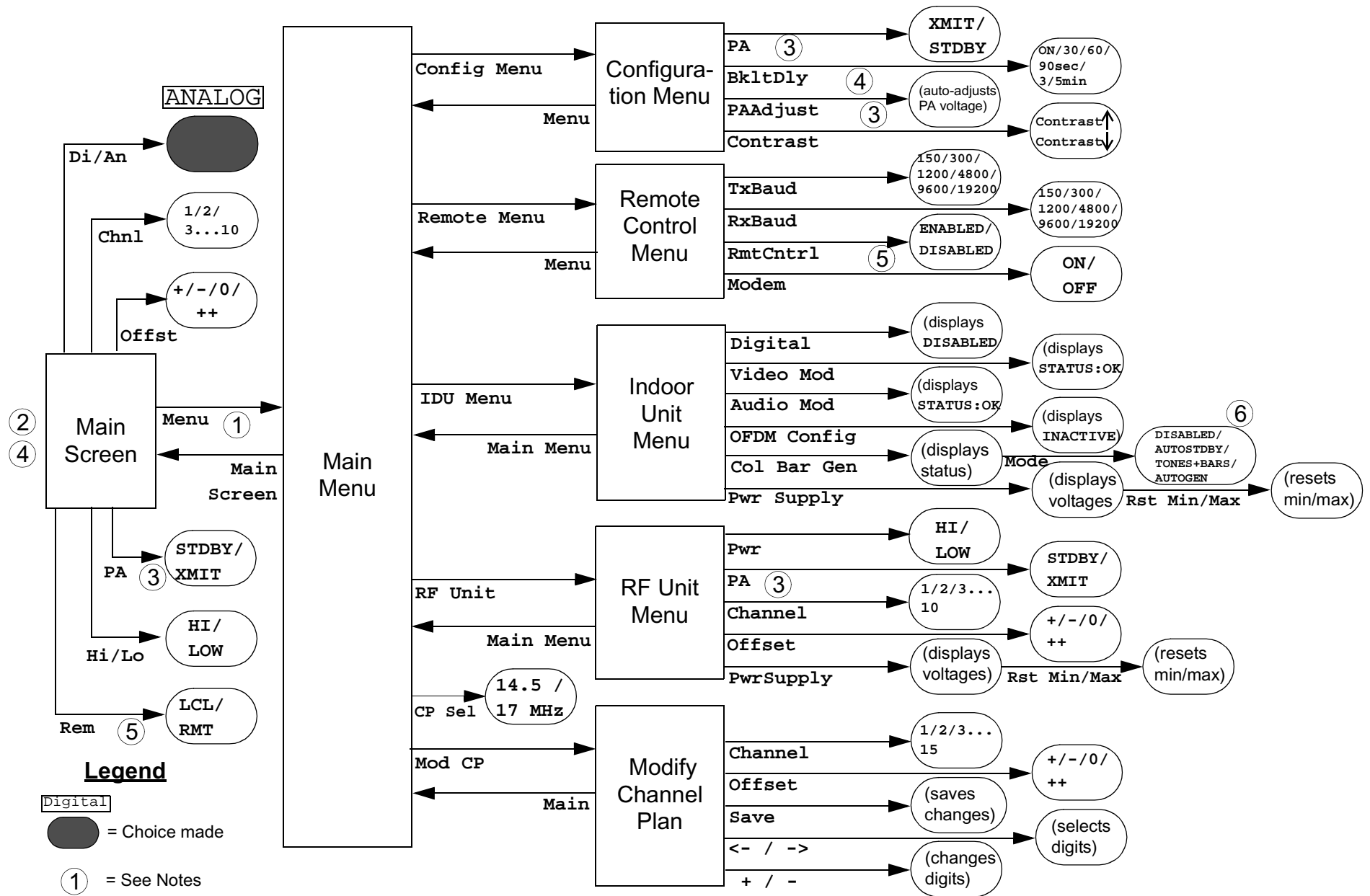
Figure 3-5: Digital Menu Map
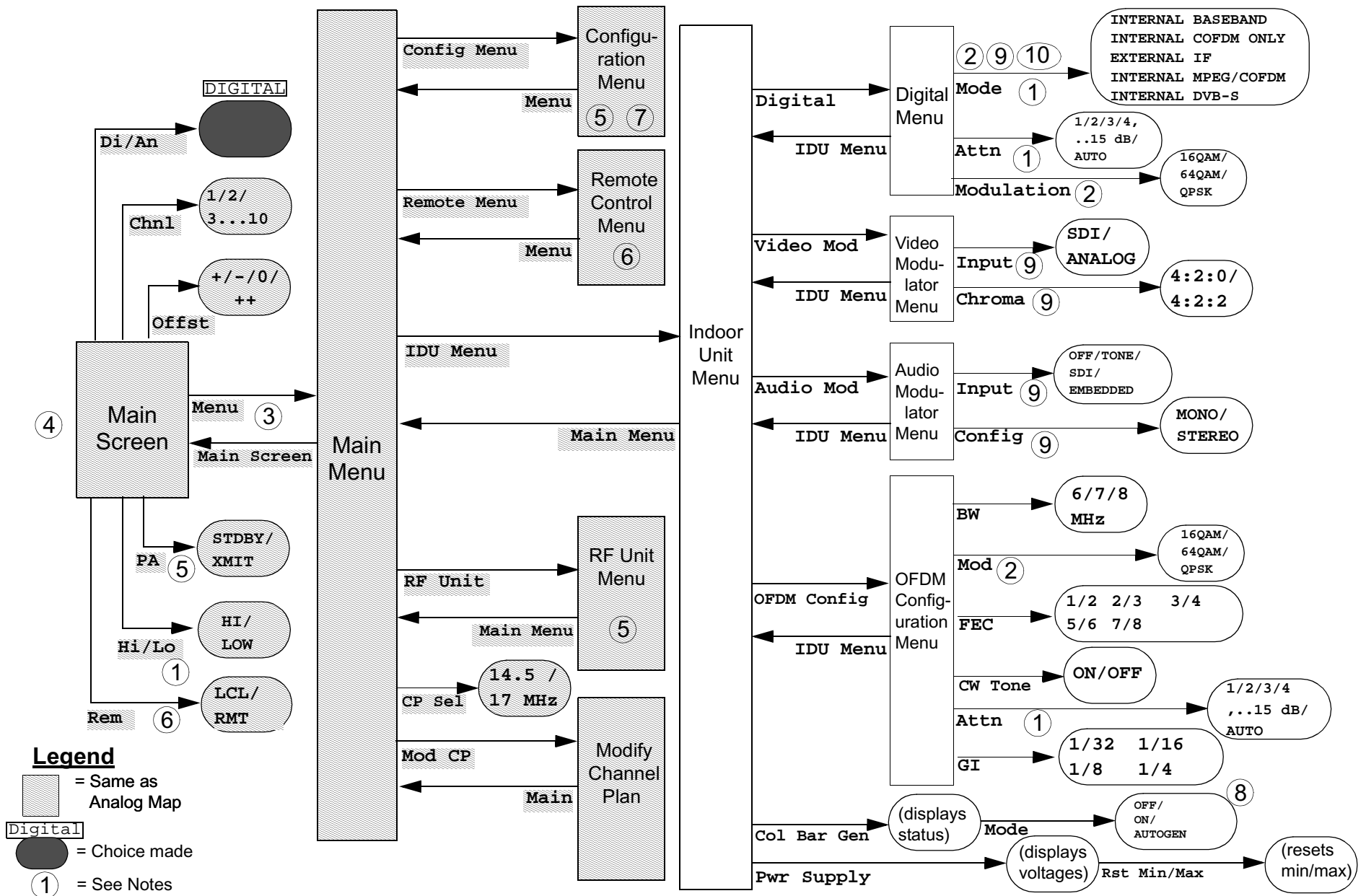
Notes - Menu Maps

Analog

1. To access the Main Menu, press the `Menu` key twice.

2. To prevent accidental activation, all menu keys and function buttons will become locked out after 30 sec. of inactivity. To unlock, press the first desired key or button twice.

3. `PA Adjust` only operates when `PA` is set to `XMIT`.

4. `BkltDly` (Backlight Delay) also controls whether the display defaults to the Main Screen or not.

   If `BkltDly` is set to `ON`
      - backlight stays on continuously
         AND
      - display does not default to the Main Screen

   Any other setting of `BkltDly` will cause the backlight to turn off and the display to default to the Main Screen after the selected period of time.

5. `REM` menu option only appears on Main Screen if `RmtCntrl` is set to `ENABLED`.

6. `Col Bar Gen` controls the **Analog** Color Bar Generator.

Digital

1. `HI/LOW` power selection only operates if
      - `Attn` (Attenuation) is set to `AUTO`
         AND
      - `Mode` is set to
         `INTERNAL MPEG/COFDM`

2. The menu options for modulation are only available when
      - `Mode` is set to
         `INTERNAL MPEG/COFDM`

   Otherwise the menu options will not appear. Selecting any of the modulation menus will cause the display to show `Disabled` or `Inactive`.

3. To access the Main Menu, press the `Menu` key twice.

4. To prevent accidental activation, all menu keys and function buttons will become locked out after 30 sec. of inactivity. To unlock, press the first desired key or button twice.

5. `PA Adjust` only operates when `PA` is set to `XMIT`.

6. `REM` menu option only appears on Main Screen if `RmtCntrl` is set to `ENABLED`.

7.   **BkltDly** (Backlight Delay) also controls whether the
        display defaults to the Main Screen or not.

        If **BkltDly** is set to **ON**
             - backlight stays on continuously
                  AND
             - display does not default to the Main Screen

        Any other setting of **BkltDly** will cause the backlight
        to turn off and the display to default to the Main Screen
        after the selected period of time.

8.   **Col Bar Gen** controls the **Digital** Color Bar
        Generator.

9.   The menu choices in the Video Modulator and Audio
        Modulator menus only appear if **Mode** is set to
        INTERNAL MPEG/COFDM.

10.   The only options that are implemented and functional
        are:
             - **INTERNAL MPEG/COFDM**
             - **EXTERNAL IF**

        The remaining options:
             - **INTERNAL BASEBAND**
             - **INTERNAL COFDM ONLY**
             - **INTERNAL DVB-S**
        are not implemented and are not functional.

A   *Channels & Frequencies*

A.1   Appendix Overview

This Appendix presents the channels and frequencies that were programmed into your CR2 at the factory. It also provides the frequencies set by the latest US frequency reallocation plan.

Here are the topics covered:

Topic	Page
Initial Factory Presets	A-1
US 12 MHz Channel Plan	A-6

A.2   Initial Factory Presets

This section lists the channels and frequencies for each RF band covered by the CodeRunner 2. These frequencies are preset at the factory, but can be modified using the Channel Plan Menu, found under the "`Mod CP`" option on the Main Menu screen. See the "Advanced Operation" chapter of the *CR2 Technical Reference Manual*.

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

Table A-1: 2 GHz RF Channel Guide (U.S. Broadcast) - 17 MHz Channel Plan

Channel	(-) Offset (MHz)	(0) Center (MHz)	(+) Offset (MHz)	(++) Offset (MHz)
	-4.25 MHz	*17.0 MHz spacing*	*+4.25 MHz*	
1	1994.75	1999.0	2003.25	00000.000
2	2012.25	2016.5	2020.75	00000.000
3	2029.25	2033.5	2037.75	00000.000
4	2046.25	2050.5	2054.75	00000.000
5	2063.25	2067.5	2071.75	00000.000
6	2080.25	2084.5	2088.75	00000.000
7	2097.25	2101.5	2105.75	00000.000
8	2454.25	2458.5	2462.75	00000.000
9	2471.25	2475.5	2479.75	00000.000
10	2487.75	2492.0	2496.25	00000.000
11	00000.000	00000.000	00000.000	00000.000
12	00000.000	00000.000	00000.000	00000.000
13	00000.000	00000.000	00000.000	00000.000
14	00000.000	00000.000	00000.000	00000.000
15	00000.000	00000.000	00000.000	00000.000

Table A-2: 2 GHz RF Channel Guide (U.S. Broadcast) - 14.5 MHz Channel Plan

Channel	(-) Offset (MHz)	(0) Center (MHz)	(+) Offset (MHz)	(++) Offset (MHz)
	-4.25 MHz	*14.5 MHz spacing*	*+4.25 MHz*	
1	2012.00	2015.50	2019.00	00000.000
2	2026.75	2030.25	2033.75	00000.000
3	2041.25	2044.75	2048.25	00000.000
4	2055.75	2059.25	2062.75	00000.000
5	2070.25	2073.75	2077.25	00000.000
6	2084.75	2088.25	2091.75	00000.000
7	2099.25	2102.75	2106.25	00000.000
8	2454.25	2458.50	2462.75	00000.000
9	2471.25	2475.50	2479.75	00000.000
10	2487.75	2492.00	2496.25	00000.000
11	00000.000	00000.000	00000.000	00000.000
12	00000.000	00000.000	00000.000	00000.000
13	00000.000	00000.000	00000.000	00000.000
14	00000.000	00000.000	00000.000	00000.000
15	00000.000	00000.000	00000.000	00000.000

Note   As of the publication of this manual, the 14.5 MHz channel plan was not approved for use in the US.

Table A-3: 6/7 GHz RF Channel Guide (U.S. Broadcast)

Channel	(-) Offset (MHz)	(0) Center (MHz)	(+) Offset (MHz)	(++) Offset (MHz)
	-6.25 MHz	*25.0 MHz spacing*	*+6.25 MHz*	
1	6881.25	6887.50	6893.75	00000.000
2	6906.25	6912.50	6918.75	00000.000
3	6913.25	6937.50	6943.75	00000.000
4	6956.25	6962.50	6968.75	00000.000
5	6981.25	6987.50	6993.75	00000.000
6	7006.25	7012.50	7018.75	00000.000
7	7031.25	7037.50	7043.75	00000.000
8	7056.25	7062.50	7068.75	00000.000
9	7081.25	7087.50	7093.75	00000.000
10	7106.25	7112.50	7118.75	00000.000
11	00000.000	00000.000	00000.000	00000.000
12	00000.000	00000.000	00000.000	00000.000
13	00000.000	00000.000	00000.000	00000.000
14	00000.000	00000.000	00000.000	00000.000
15	00000.000	00000.000	00000.000	00000.000

Table A-4: 12/13 GHz RF Channel Guide (U.S. Broadcast)

Channel	(-) Offset (MHz)	(0) Center (MHz)	(+) Offset (MHz)	(++) Offset (MHz)
	-6.25 MHz	*25.0 MHz spacing*	*+6.25 MHz*	*-----*
1	12706.25	12712.50	12718.75	00000.000
2	12731.25	12737.50	12743.75	00000.000
3	12756.25	12762.50	12768.75	00000.000
4	12781.25	12787.50	12793.75	00000.000
5	12806.25	12812.50	12818.75	00000.000
6	12831.25	12837.50	12843.75	00000.000
7	12856.25	12862.50	12868.75	00000.000
8	12881.25	12887.50	12893.75	00000.000
9	12906.25	12912.50	12918.75	00000.000
10	12931.25	12937.50	12943.75	00000.000
11	12956.25	12962.50	12968.75	00000.000
12	12981.25	12987.50	12993.75	00000.000
13	13006.25	13012.50	13018.75	00000.000
14	13031.25	13037.50	13043.75	00000.000
15	13056.25	13062.50	13068.75	00000.000
16	13081.25	13087.50	13093.75	00000.000
17	13106.25	13112.50	13118.75	00000.000
18	13131.25	13137.50	13143.75	00000.000
19	13156.25	13162.50	13168.75	00000.000
20	13181.25	13187.50	13193.75	00000.000
21	13206.25	13212.50	13218.75	00000.000
22	13231.25	13237.50	13243.74	00000.000

A.3   US 12 MHz Channel Plan

Here are the frequencies that will be used in the new US 12 MHz channel plan. Your CR2 is pre-programmed with the frequencies listed in Section A.2 on page A-1. However, as your station migrates to the new channel plan, you can easily reprogram your CR2 using the Channel Plan Menu, found under the "`Mod CP`" option on the Main Menu screen. See the "Advanced Operation" chapter of the *CR2 Technical Reference Manual*.

Information below was obtained from the FCC Web site, document # FCC 03-280:

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

Table A-5: US 12 MHz Channel Plan

Frequencies (MHz)		Channel Width	Description
Lower	Upper		
2025.0	2025.5	500 kHz	Lower Data Return Link (DRL) Band
2025.5	2037.5	12 MHz	Channel A1r
2037.5	2049.5	12 MHz	Channel A2r
2049.5	2061.5	12 MHz	Channel A3r
2061.5	2073.5	12 MHz	Channel A4r
2073.5	2085.5	12 MHz	Channel A5r
2085.5	2097.5	12 MHz	Channel A6r
2097.5	2109.5	12 MHz	Channel A7r
2109.5	2110.0	500 kHz	Upper Data Return Link (DRL) Band

B   *Glossary*

This section describes acronyms and abbreviations used in communications, broadcasting, and in MRC Products and documentation.

Table B-1: Useful Terms

Term	Explanation
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.
3RU	3 Rack Unit height.
4FSK	4-state Frequency Shift Keying
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.
A & C	Alarm and Control.
ADPCM	Adaptive Differential Pulse Code Modulation.
AFC	Automatic Frequency Control.
AGC	Automatic Gain Control.
AIS	Alarm Indication Signal (all one's).

Table B-1: Useful Terms (Continued)

AMI	Alternate Mark Inversion, line code format for traffic data.
AVG	Average.
ASI	Asynchronous Serial Interface A serial communications interface operating at 270 Mbit/sec., generally used in field news-gathering operations.
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 5-6MHz range. Also called Composite.
B8ZS	Bipolar 8 Zero Substitution, line code format for traffic data.
BB	Baseband.
BER	Bit Error Rate.
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.
BNC	Bayonet lock coaxial connector.
BPF	Band Pass Filter.
BPS	Bits per second.
BPSK	Binary Phase Shift Keying
CCITT	International Telegraph and Telephone Consultative Committee, a telecommunications standardizing committee of the ITU.
CNR	Carrier-to-Noise Ratio
COFDM	Coded Orthogonal Frequency Division Multiplexing

Table B-1: Useful Terms (Continued)

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.
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 separate signals.
CSI	Channel-State Information
CW	Carrier Wave
DAB	Digital Audio Broadcasting
dB	Decibel. A logarithmic measurement, applied to audio and RF signals.
dBm	A unit of measurement referenced to one milliwatt.
DFT	Discrete Fourier Transform
DMUX, DEMUX	Demultiplexer
DQPSK	Differential Quadrature (Quaternary) Phase-Shift Keying
Duplex	A channel capable of transmitting information simultaneously in either direction.
DVB	Digital Video Broadcasting
DVB-S	Digital Video Broadcasting - Satellite
DVB-T	Digital Video Broadcasting - Terrestrial
E1	2.048 Mbps traffic rate.
EIA	Electronic Industries Association, an industry association that establishes various standards.
EMC	Electromagnetic compatibility.
ERRS	Errors.
ESD	Electrostatic discharge.

Table B-1: Useful Terms (Continued)

ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission, the United State's communications regulatory agency.
FDM	Frequency Division Multiplexing
FFT	Fast Fourier Transform
FIFO	First in, first out buffer.
FIR	Finite Impulse Response.
FLR	MRC's model designation for frequency modulated (FM) remodulating radio systems from 2 to 15 GHz. FLR2 is the 2 GHz band version; FLR4, the 4 GHz band version, etc.
FMT	FM Video Modulator
FPGA	Field Programmable Gate Array.
FSK	Frequency-Shift Keying
GND	Ground.
H/W	Hardware.
HDB3	High Density Bipolar 3 line code format for traffic data.
HPF	High Pass Filter.
I	In phase
ICI	Inter-Carrier Interference
ID	Identification.
IDU	Indoor Unit
IF	Intermediate Frequency.

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
Kbps	Kilobits per second.
KHz	Kilo (1,000) cycles per second.
LCD	Liquid Crystal Display
Lcl	Local
LED	Light emitting diode.
LO	Local Oscillator
LOS	Loss of Signal.
LPF	Low Pass Filter.
Mbps	Megabits per second.
MHz	Million (1,000,000) cycles per second.
MUX	Multiplexer.
NICAM	Near-Instantaneous Companding and Multiplexing
NRZ	Near Return to Zero.
ODU	Outdoor Unit - also called RF Unit or RFU
OFDM	Orthogonal Frequency Division Multiplexing
ØLK	Phase Lock.
PER	Parity Error Rate.
PLL	Phase Lock Loop.
Q	Quadature phase.
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.
RCL	Received Carrier Level.
Rcvr	Receiver.
RDS	Radio Data System
RF	Radio Frequency, any frequency of electromagnetic radiation or alternating currents in the range from 3 kHz to 300 GHz; as in RF Signal or RF Transmission.
RF Level	RF Power from the transmitter.
RFU	Radio Frequency Unit - also called ODU
R-S	Reed-Solomon
Rx	Receiver.
S/W	Software.
SC	Service Channel.
SC	Single Carrier
SDI	Synchronous Digital Interface A serial communications interface operating at 270 Mbit/sec., generally used for in-studio news operations.
SER	Symbol Error Rate
Setpt	Set point.
SFN	Single-Frequency Network
Simplex	A channel capable of transmitting information in only one direction.

Table B-1: Useful Terms (Continued)

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
STDBY	Standby.
Subcarrier	An electromagnetic signal that is used as a medium for placing an information channel above another information channel.
S-Video	Video signal in which the chrominance (color) and luminance (brightness) information are separated into separate subcarrier signals. Also called Y/C Video. Composite Video combines them into one signal.
SYNTH	Synthesizer
T1	1.544 Mbps traffic rate.
Tx	Transmitter.
VCO	Voltage Controlled Oscillator.
VCXO	Voltage Controlled Crystal Oscillator.
VDC	Volts Direct Current.
VF	Voice Frequency.
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.
Xmitr	Transmitter.
Xmtr	Transmitter.
Y/C	Video signal in which the chrominance (color) and luminance (brightness) information are separated into separate subcarrier signals. Also called S-Video. Composite Video combines them into one signal.

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