User Manual

Tektronix

RFM210
DVB-T Measurement Receiver

071-1098-00

This document applies to firmware version FW0722 Rev04 and above.

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Symbols and Terms

Terms in this Manual. These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product. These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product. The following symbols may appear on the product:

CAUTION
Refer to Manual

WARNING
High Voltage

Protective Ground
(Earth) Terminal

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Do Not Service Alone. Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect Power. To avoid electric shock, switch off the instrument power, then disconnect the power cord from the mains power.

Use Care When Servicing With Power On. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Preface

This manual describes the functions and use of the Tektronix RFM210 DVB-T Measurement Receiver. The manual is organized into the following sections:

- *General Information.*

  This section provides a product description, identifies front panel controls, rear panel connectors and instrument options.

- *Installation.*

  This section describes how to install the RFM210.

- *Introduction.*

  This section provides a functional description of the RFM210, DVB-T transmission principles and a number of application notes.

- *Measurement.*

  This section explains COFDM signal analysis and BER (Bit Error Ratio).

- *Operation.*

  This section describes how to set up the RFM210, the menu structure and how to set menu selections.

- *Specifications.*

  This section lists the electrical, physical, and environmental specifications for your instrument. This section also describes the safety and EMC standards with which the RFM210 complies.

- *Appendices.*

  This section is comprised of the following appendices:

  - *Appendix A: RFM210 Functional Check Procedure*. This appendix provides a brief procedure to check if the RFM210 is operating properly.

  - *Appendix B: RS232 Remote Control.* This appendix provides serial interface requirements and commands for controlling the RFM210 over the RS232 serial interface.

- *Appendix C: Ethernet Setup and Operation*. This appendix describes how to connect and setup the ethernet connection on the RFM210.
- *Appendix D: RFM210 MIB*. This appendix describes the MIB (Management Interface Base) for interacting with the RFM210 over a TCP/IP network.
- *Appendix E: Channel Tables*. This appendix describes the instrument Channel Table.
- *Appendix F: Firmware Upgrade Procedure*. This appendix describes how to perform a firmware upgrade procedure.
- *Appendix G: Cleaning and Maintenance*. This appendix describes how to perform periodic user maintenance. This section does not include repair or replacement procedures.
- *Appendix H: DIP Switch Settings*. This appendix describes the instrument DIP switch settings.

Contacting Tektronix

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Address	Tektronix, Inc. Department or name (if known) 14200 SW Karl Braun Drive P.O. Box 500 Beaverton, OR 97077 USA
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Sales support	1-800-833-9200, select option 1*
Service support	1-800-833-9200, select option 2*
Technical support	Email: techsupport@tektronix.com 1-800-833-9200, select option 3* 6:00 a.m. - 5:00 p.m. Pacific time

* **This phone number is toll free in North America. After office hours, please leave a voice mail message.**
Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.

General Information

General Information

Product Description

The RFM210 DVB-T Measurement Receiver operates in accordance with the ETSI EN 300 744 standard. The RFM210 provides both 2K and 8K carrier mode options, and supports all DVB modulation options, guard intervals and FEC rates. Different versions support VHF, UHF, and for 6/7/8 MHz bandwidths.

The RFM210 accepts a standard RF or baseband input and demodulates the COFDM signal to give both SPI and ASI MPEG transport streams. BNC connectors on the rear of the unit enable display of constellation and channel state diagrams on a standard oscilloscope. A range of status and alarm outputs are also available. A built-in Digital Signal Processor enables real-time monitoring and measurement of the baseband modulating signals (I, Q) in accordance with TR 101 290, including Modulation Error Ratio (MER) measurement.

The RFM210 can be controlled from the front panel or from a PC using the rear panel RS232 port. Selected parameters can be monitored and controlled via the Ethernet port using Tektronix Network Monitoring software or other compatible SNMP supervisory system.

Front Panel Controls and Indicators

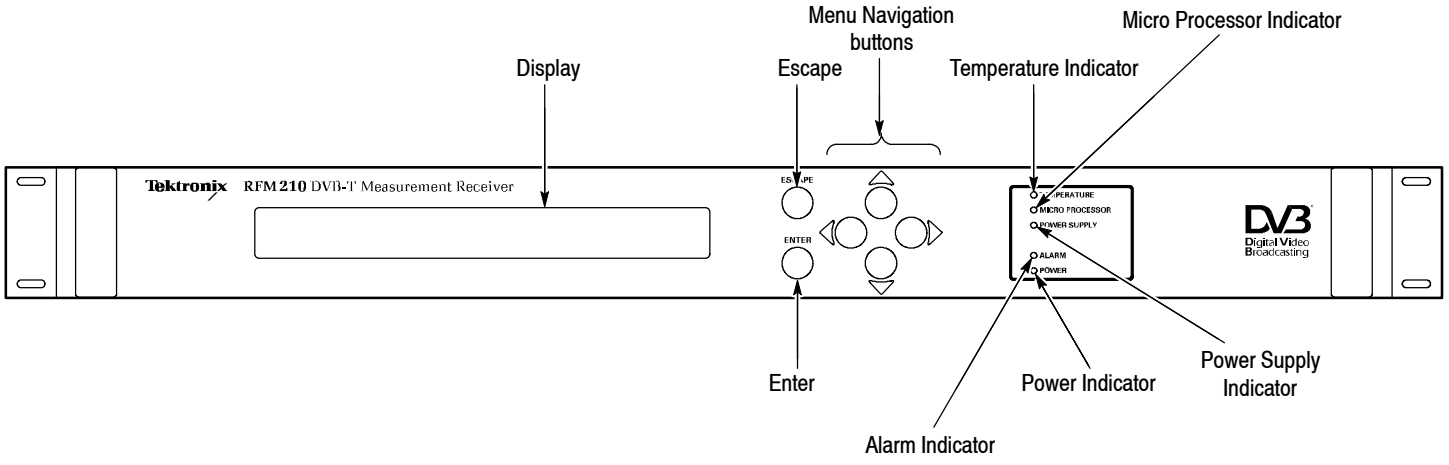


Figure 1-1: RFM210 DVB-T Measurement Receiver front panel display, controls and indicators

Display The LCD display presents menus and measurement readouts.

Escape Used to move up a level within the menus.

Enter Used to select choices within menus.

Menu Navigation Buttons Used to change levels and select options within menus.

The following table describes the function of the front-panel LED indicators.

Table 1-1: Front-panel LED indicators

Indicator	Meaning when lit
Temperature	The RFM210 internal temperature exceeds normal parameters. Ensure that proper clearance around the unit is provided for cooling. If LED remains lit with proper clearance, contact your local Tektronix Service representative.
Micro Processor	A micro processor fault has occurred. Contact your local Tektronix Service representative.
Power Supply	A power supply fault has occurred. Contact your local Tektronix Service representative.
Alarm	An Alarm condition has occured. See *Alarm Setup Menu* on page 5-31 for more information on alarms.
Power	Power is applied to the RFM210

Rear Panel Connectors

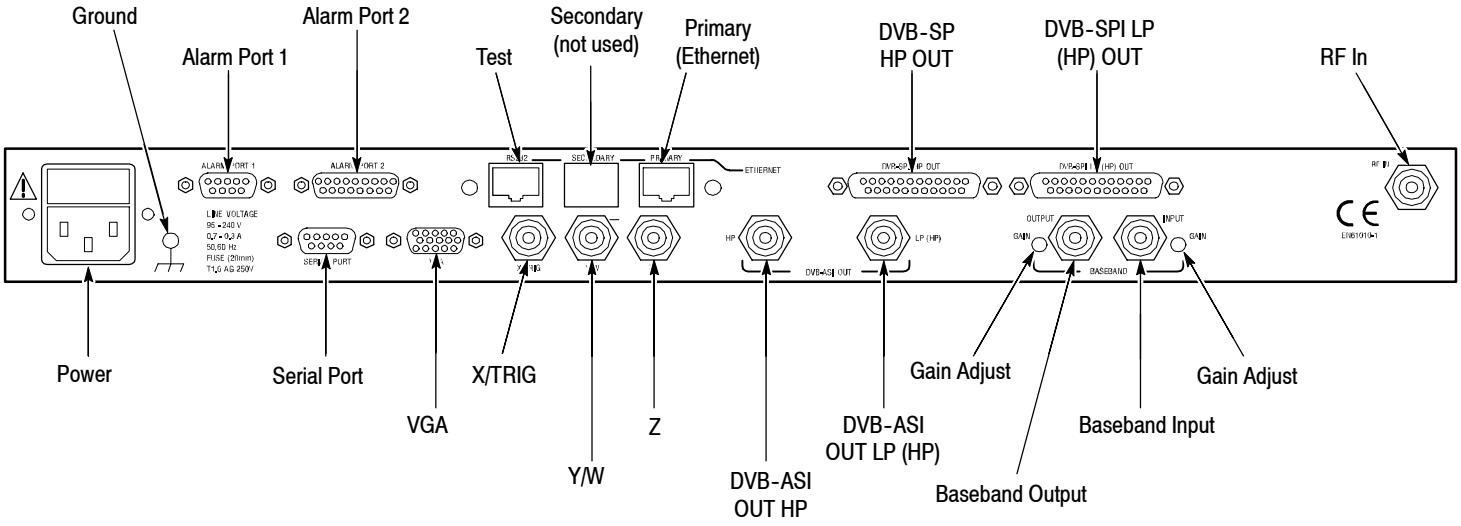


Figure 1-2: RFM210 DVB-T Measurement Receiver rear panel connectors

Descriptions of the rear panel connectors are located in Table 6–2 on page 6–4.

Options

Table 1–2 describes the configuration options available for the RFM210.

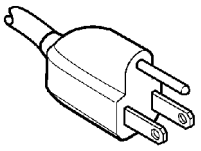
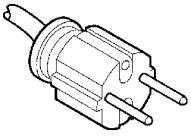
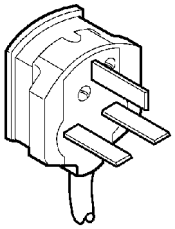
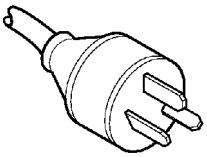
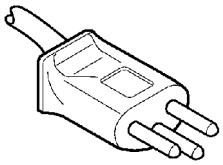
Table 1-2: Instrument bandwidth/attenuation options

Option	Description	Default channel table
B6	6 MHz bandwidth	USA008
B7	7 MHz bandwidth	AUS013
B8	8 MHz bandwidth	UK010
TN	No attenuator	n/a

Alternate channel tables can be loade provided they are for the same bandwidth. See Appendix E, *Channel Tables* for more information.

Table 1–3 describes the power cord options available for the RFM210. The standard power cord is a Universal European plug configuration

Table 1-3: Power cords available

Plug configuration	Normal usage	Option number
	North America 125 V/15 A Plug NEMA 5-15P	A0
	Europe 230 V	Standard
	United Kingdom 230 V	A2
	Australia 230 V	A3
	Switzerland 230 V	A5
	No power cord supplied	A99

Installation

Installation

This chapter covers installation of the RFM210.

Checking the Environment Requirements

Read this section before attempting any installation procedures. This section describes site considerations, power requirements, and ground connections for your RFM210.

Site Considerations

The RFM210 requires no assembly and is designed to operate in standard 19-inch instrumentation rack. Always allow approximately 100 mm (4 inches) of rear panel clearance for cable and power cord connections. Ensure that ventilation slots on the sides on the product are not obstructed and provide a free airflow path.

CAUTION. *Keep the sides of the RFM210 clear of obstructions to ensure proper cooling.*

Operating Requirements

The specifications in *Technical Specifications*, on page 6–1, list the operating requirements for the RFM210. Power source, temperature, humidity, and altitude are listed.

The unit is designed to operate from a single-phase power source having one of its current-carrying conductors at or near earth ground (the neutral conductor). Only the line conductor is fused for over-current protection.

Systems that have both current-carrying conductors live with respect to ground (such as phase-to-phase on multiphase systems) must not be used as power sources. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

The mains outlets intended to supply the unit, should either be close to the unit and easily accessible to the user or the unit mains inlet should be easily accessible in the final installation.

Powering On the RFM210

Perform the following step to power on the RFM210.

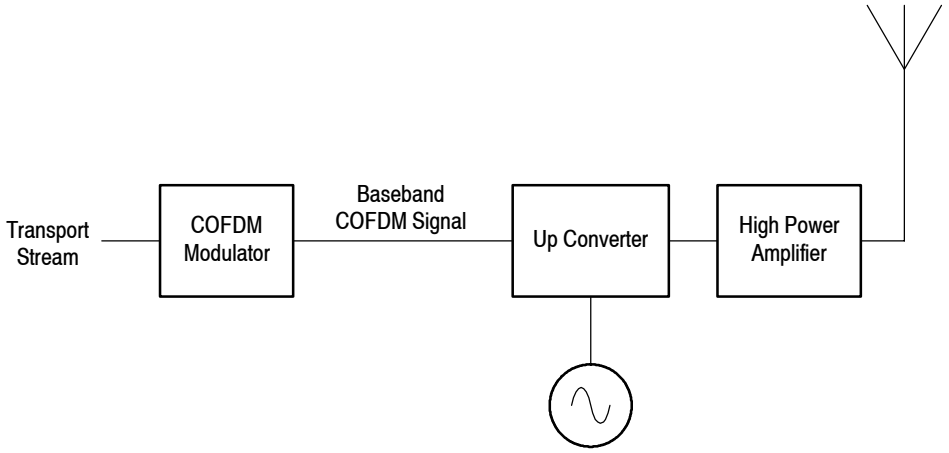
- Connect the power cord to the RFM210 and to the mains supply.

The RFM210 does not have a power switch. It will power up as soon as it is connected to the mains supply.

The RFM210 connects the chassis to the power cord safety ground. The chassis is not designed to be “floated”. A rear-panel chassis ground screw is fitted, to bond the product to a functional system ground if desired. This can be used to improve chassis ground connections to other equipment.

Introduction

DVB-T Transmission Principles



Coded Orthogonal Frequency Division Multiplexing (COFDM) is based on phase / amplitude modulation using SINE / COSINE (Orthogonal) centered carrier. The SINE / COSINE components are referred to as I / Q, (real / imaginary). This system is an adaptation of I / Q data modulation.

Encoded onto the I / Q data are two sets of complex waveforms containing 1705 carriers in 2K IFFT (Inverse Fast Fourier Transform) mode and 6819 carriers in 8k IFFT mode. The amplitude and phase of all the carriers can be modulated. In the 2K IFFT, there are 2048 I samples and 2048 Q samples sequentially modulated on to a center carrier. This is referred to as a SYMBOL.

The 2048 I / Q samples are totally isolated (ORTHOGONAL) from each other, because of the SINE / COSINE modulation. (In 2K mode, there are theoretically 2048 carriers available, however, in practice only 1705 carriers are used.) An Inverse fast Fourier transform is calculated on both I and Q separately, providing 1705 separately generated carriers throughout the 2048 symbol period.

Each modulated I / Q carrier is described as a CONSTELLATION. (Thus, using a 2048 I / Q sample system, 1705 different constellations conveying phase & amplitude data can be modulated.) The data encoded onto the carriers is randomized and spread throughout the frequency spectrum. In addition to this FORWARD ERROR CORRECTION data is added to correct for data corruption.

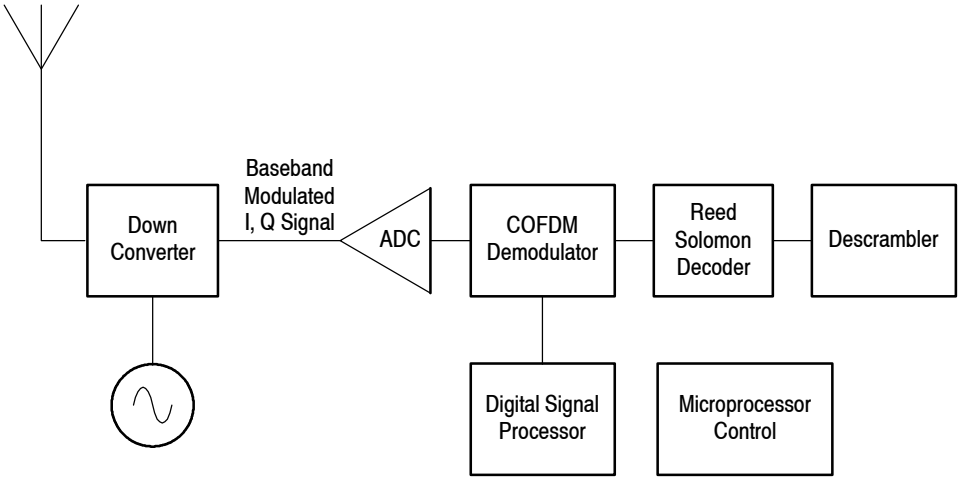
RFM210 DVB-T Measurement Receiver

The RFM210 fulfills a variety of roles for professional users in transmitter performance monitoring or off-air signal monitoring of DVB-T services. It has application in transmitter monitoring, field surveys, digital communications, network performance monitoring, and as a general high quality off-air source of MPEG transport streams (TS).

The RFM210 features include comprehensive TR 101 290 (formerly ETR290) measurement, Constellation and Channel State display outputs and associated Alarm outputs.

The receiver operates in accordance with ETSI EN 300 744. It provides both 2K and 8K carrier options, supports all DVB-T modulation options, including the hierarchical modes, and all guard interval options and FEC rates.

Functional Block Diagram



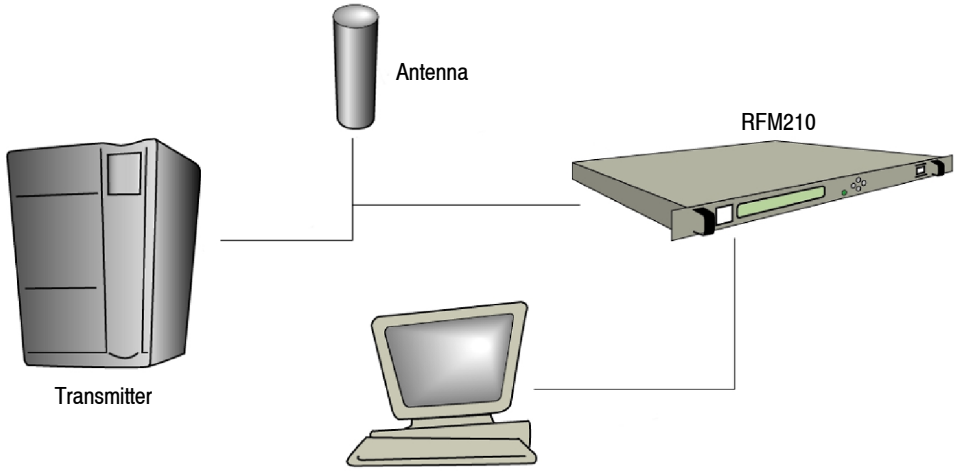
The receiver accepts a UHF, VHF or external baseband input and demodulates the COFDM signal to give an MPEG2 transport stream(s) output. The receiver operates as a stand–alone system containing an embedded controller and DSP (Digital Signal Processor), Alphanumeric display and keypad.

Application Examples

Using the RFM210 in the Measurement and Monitoring of DVB-T Transmissions

This information provides a brief operational overview of the RFM210 Receiver for three typical applications. Should you need advice for your DVB-T Measurement or Monitoring application please contact your local Tektronix representative.

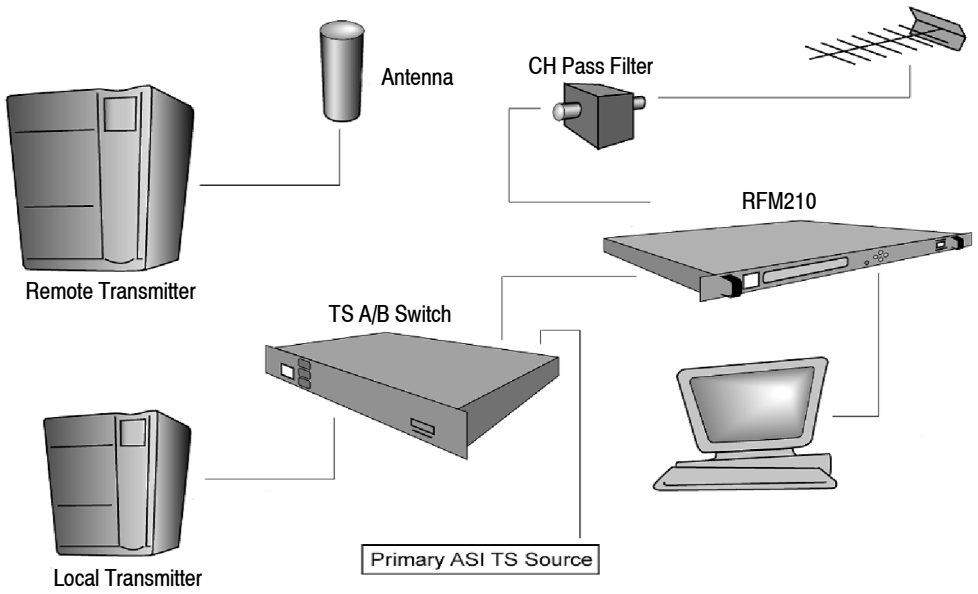
Application A - Direct Measurement and Monitoring of Transmitters for Performance and Fault Diagnosis



To operate in this way a transducer fitted to the wave-guide provides a small RF signal direct to the unit. (This signal level is required to match the specified input level).

The RFM210 constantly monitors the performance of the transmission chain in line with ETSI TR 101 290, and reports errors through the comprehensive Alarm handling facilities and Windows support software.

Application B - Provision of Standby Transport Stream (TS) at Transmitter Site Through the Reception of Secondary Transmitted DVB-T Service

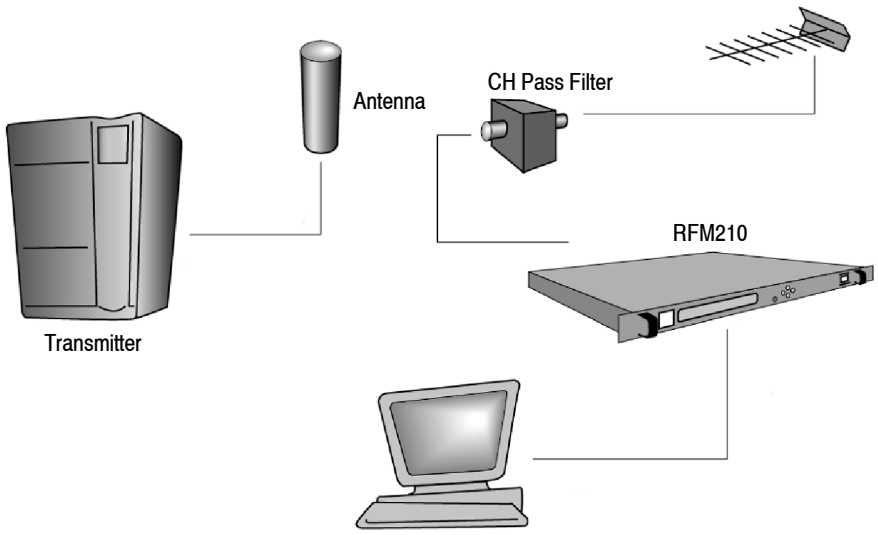


For the RFM210 to operate correctly, we need to consider two points. One is the presence and magnitude of other carriers in the VHF/UHF spectrum, and the second is the signal input level. It is assumed that for this application the primary function is the reliability of the standby path.

We recommend the receiving antenna be a high-gain directional design suitable to provide the standby receiver with sufficient input level even if the transmitted signal is low power for any reason, for example, maintenance. Consideration must be given to the operational measurement window of the receiver in acquiring reliable MER results.

Next, we need to consider other carriers that could cause a disruption to the receiver. The simplest way to ensure that the RFM210 responds only to the required channel is to insert a channel pass filter at the RF input. Be sure to use a quality filter, as a poor filter at this point can affect the measurement performance of the receiver.

Application C - Reception Field Trials for the Collating of Measurement and Coverage Data



The following paragraphs detail the considerations and approach to off-air measurement and monitoring when using the RFM210 Receiver.

There are two important issues to consider in the acquisition of coverage data:

1. The application requires the measurement functions of the RFM210 and therefore it requires sufficient input signal level in order to ensure that the measurements are completed within the required ‘window’ of the receiver.

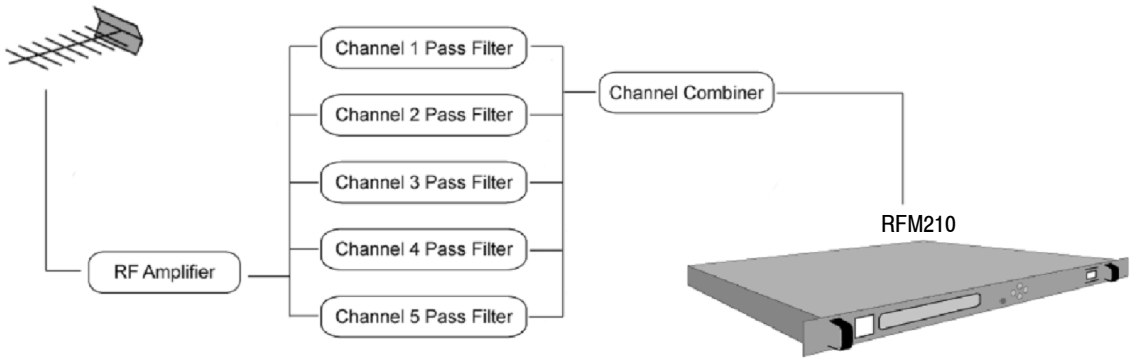
2. As a receiver is moved around a country its tuner will see a dynamic change of RF carriers and strengths. In some localities and transmission networks this issue of interfering carriers is more pronounced than others. Both receivers in standard form have a wide band front end to the tuner. This means that there is a potential for the automatic gain control (AGC) on the tuner to be affected by the largest carrier that appears. This does not happen with transmitter monitoring i.e. Application A.

   This means that in the same way as in Application B, where we use channel pass filtering to provide a safer environment for receiving a standby signal, we need to do the same in this application to ensure the reliability and repeatability of measurement data.

Application Solutions for the RFM210 in Off-air Measurement and Monitoring

Solution 1 For the measurement and/or monitoring of one channel a single, quality, channel pass filter is suitable. This filter should be positioned in series with the antenna and any gain amplifier.

Solution 2 Suppose, for example, we are required to monitor approximately five DVB-T Transmissions in a region. The best method is to use an RF amplifier driving the five channel pass filters followed by a combiner. In this way the selective filtering and the receiver may be moved to any area and once the input signal level is assured, measurements can be taken with a high degree of integrity.



Measurement

COFDM IQ Signal Analysis

The data transmitted using the COFDM modulation techniques are influenced by distortions, which can cause irreparable errors in the modulator or in the transmission link. Such errors are insufficient carrier suppression, phase and amplitude errors within the baseband signals or noise, echoes or reflections and multipath. In a real network, all of these effects coexist together, however, the dominant impairments, in a DVB system, are noise and reflections.

Constellation diagrams allow baseband-modulating signals (I,Q) to be observed. These show I amplitude versus Q amplitude at the symbol decision thresholds. Normally a significant amount of symbols are used to produce such a diagram. Many effects can be observed in a constellation diagram, such as noise, interfering tone, IQ level imbalance, and others.

The noise and phase jitter, for instance, can be clearly recognized on the constellation diagram but other interference contained in the signal can be only recognize after precise evaluation of the transmission parameters. That is the reason why several new measures have been introduced to quantify signal quality and they are described in the ETSI Technical Report TR 101 290. The RFM210 makes many of these measurements as part of its IQ analysis. These measurements are performed in 5 to 20 seconds, depending on the DVB-T parameters of the received signal.

The measurements calculated by the DSP are described in the following paragraphs.

Modulation Error Ratio

The Modulation Error Ratio (MER) provides a single “figure of merit” analysis.

MER can be thought of as baseband SNR (Signal to Noise Ratio) in analog TV systems. MER includes all type of signal impairment (not just noise), such as, the effects of noise, carrier leakage, and IQ level and quadrature imbalance. The MER is expressed as an average value in dB and percentage, and a peak value in dB.

Signal to Noise Ratio

When the only error in the channel is noise, the ideal signal positions are expanded to circular clouds. The difference between SNR and MER lies in which perturbations of the received signal are included in the computation, so when the only significant impairment is noise, SNR and MER are equivalent. SNR does not account for modulation problems such as non-linearity, group delay and flatness variation, filter mismatch and ingress. The unit of SNR is in dB.

System Target Error (Mean and Deviation)

The displacement of the centers of the clouds in a constellation diagram from their ideal symbol point reduces the noise immunity of the system and indicates the presence of special kinds of distortions such as Amplitude Imbalance and Quadrature Error. STE gives a global indication about the overall distortion present on the raw data received by the system. System Target Error is a unitless measure.

Amplitude Imbalance

In the constellation diagram, an amplitude inequality is expressed as the expansion of a signal component and compression of the other signal component. The Amplitude Imbalance separates the distortions of the I and Q signal in amplitude from all other kind of distortions. The unit of Amplitude Imbalance is in percentage (%).

Quadrature Error

The phase error is the phase angle between the cosine and sine components of the carrier at 90° in the modulator. If the two carriers that modulate the I and Q signals are not orthogonal, a Quadrature error results. The unit of Quadrature Error is in degrees (°).

Carrier Suppression

The received channel should be flat across the band. For a 2K system, TPS (Transmission Parameter Signalling) carriers are sent at the edge of band where a transmitters output filter is not optimal.

For an 8K system, it is important that carrier suppression is good at the center carrier, which is where the TPS carriers are sent.

A residual carrier is an unwanted coherent signal added to the center carrier of the COFDM signal. It can be thought of as a special form of interference having a frequency in the RF channel corresponding exactly to the carrier frequency. It could be produced by DC offset voltages of the modulating I and/or Q signal or by crosstalk from the modulating carrier within the modulator.

Phase Jitter

The Phase Jitter of an oscillator is due to fluctuations of its phase or frequency. The phase jitter or phase noise is generated by converters in the transmission path or by the I/Q modulator. In contrast to phase errors, phase jitter acts simultaneously on the I and Q paths and its effect is that the carrier regeneration cannot follow the phase fluctuations. The Phase Jitter is in degrees (°).

Bit Error Measurement

Pre-Viterbi Bit Error Ratio

This is calculated from the number of bits corrected by the Viterbi decoder in each second. The methodology for calculation defines the maximum pre-Viterbi BER value as 1.67×10^{-2}, even though the real BER could be greater in value.

Post-Viterbi Bit Error Ratio

This value is calculated from the number of bits corrected by the Reed-Solomon decoder in each second, and is the most commonly quoted BER figure. A BER as great as 2×10^{-4} will still give a good decoded picture, and this rate is known as the Quasi Error Free (QEF) point.

UCE Error Rate (Post Reed Solomon)

This gives the number of uncorrectable Errors (UCE) currently being detected in each second. A poor RF channel results in too many errors for the Viterbi and Reed Solomon decoders to correct. If UCEs are present, the MPEG decoded pictures will become severely corrupted or completely lost.

Uncorrectable Errors (UCE)

This provides an accumulated count of all the Un-correctable errors (UCE) since the error counter was last reset manually. The UCE count display within the Monitoring Menu provides a Date Time stamp at the point of the last count reset.

Remote BER logging

The receiver can also provide BER data, via the **Serial Port**, for remote logging on a PC or terminal. The current values of pre and post Viterbi BER, and the UCE are available on demand.

Operation

Initial Set-up

In general, the two front panel switches labelled with up and down arrows ▲▼ select the different screens, while the two front panel switches labelled with the left and right arrows ◀▶ allow the various options within the screen to be highlighted (where applicable). Having highlighted an option, it is then necessary to press the **ENTER** key to actually implement the selection. The **ESCAPE** key is used to go up a menu level or to cancel parameter level settings. Under some menu options, pressing **ENTER** allows setting of a parameter level. While setting levels, the user is unable to scroll through the menu options until level setting is complete by pressing **ENTER** (or **ESCAPE** to cancel). The following section will give details of each displayed screen and their meaning.

Menu Operation

The RFM210 receiver operates a number of Menu driven options. These are classified into seven Menu headings and provide access to the vast majority settings and control options of the unit.

Main Screen

On power-up the Main Screen displays the primary information of Channel selection, Carrier Level, and UCE Count. In addition, the primary TR 101 290 measurements of MER and SNR are displayed, and alternated with the BER measurement. The delay between display of MER/SNR and BER is 8 seconds. Pressing the left and right arrows ◀▶ at any time allow the alternative measurement to be displayed without waiting for the display timer. Normally when BER is displayed the pre-Viterbi BER measurement will be shown. If the signal quality degrades to such an extent that post-Viterbi BER is greater than zero it is the post_viterbi BER level that is displayed. If baseband input is selected, this is indicated on the main screen and the Channel selection and Carrier Level indications are removed. If the unit is not synchronized for any reason, this is indicated on the main screen and in this case the measurements are not displayed. You access the receiver's available menus from this screen with up and down arrows ▲▼ .

Security Menu

Options available within the Security Menu allows you to:

1. Lock
2. Unlock

The lock facility prevents an operator from changing DVB-T or System parameters while the unit is locked. In order to select or change settings within the following menus it is required to unlock the unit. The lock status is stored so that unlocking is not required every time the unit is powered up.

DVB Options Menu

Options available within the DVB Options menu are:

1. Select Channel
2. Modulation Options
3. FEC Settings
4. Hierarchical Mode
5. No of Carriers
6. Guard Interval
7. Select Programmed Channel

System Options Menu

Options available within the System Options Menu:

1. Phase Correction
2. Equalizer Window
3. COFDM Spectrum
4. Time Date Setting
5. Set LCD Contrast
6. Remote Comms Setting
7. IP Address
8. Program Channels

Input/Output Options Menu

Options available within the Input/Output Options Menu:

1. Input Source
2. ASI Output Mode
3. Transport Stream Setting (188/204 bytes)
4. Monitor Output
5. Constellation Mode
6. Single Carrier Setting

Monitoring Menu

Options available within the Monitoring Menu:

1. I/Q Measurements*
2. Frequency Response Measurements
3. Pre/Post-Viterbi BER
4. Channel State Information (CSI)
5. Carrier Level**
6. Sync Lock Status
7. UCE, UCE Total Measurements
8. Fault History Select*
9. System Status Select*

*** Pressing ENTER in these menu options selects lower level menus as described below.**
**** Not displayed if set to Baseband Input**

Alarm Setup Menu

Options within the Alarm Setup Menu:

1. Set Alarm Relays 1 and 2*
2. Set Open Collector Alarms 1 to 8*
3. Set Warning/Fault logs*

***Pressing ENTER under any of these options allows detailed setup of the selected alarm.**

DSP Setup Menu

Selected when ENTER is pressed under the measurement menu, IQ measurement option.

Options within the DSP Setup Menu:

1. Low/High Carrier Setting
2. Symbols Setting
3. END Calibration Setup
4. Transmitter/Receiver Setting

Fault History Menu

Selected when ENTER is pressed under the measurement menu, Fault History option.

Options within the Fault History Menu:

1. View Log
2. Clear Log

System Status Menu

Selected when ENTER is pressed under the measurement menu, System Status option.

Options within the System Status Menu:

1. View Alarm Status
2. View Power Supply Status
3. View Internal Temperature
4. View Product Information

Output to VGA Monitor

You can get a quick view of the instrument settings and measurements by connecting a monitor to the VGA connector on the rear panel. An example readout is shown in Figure 5–1.

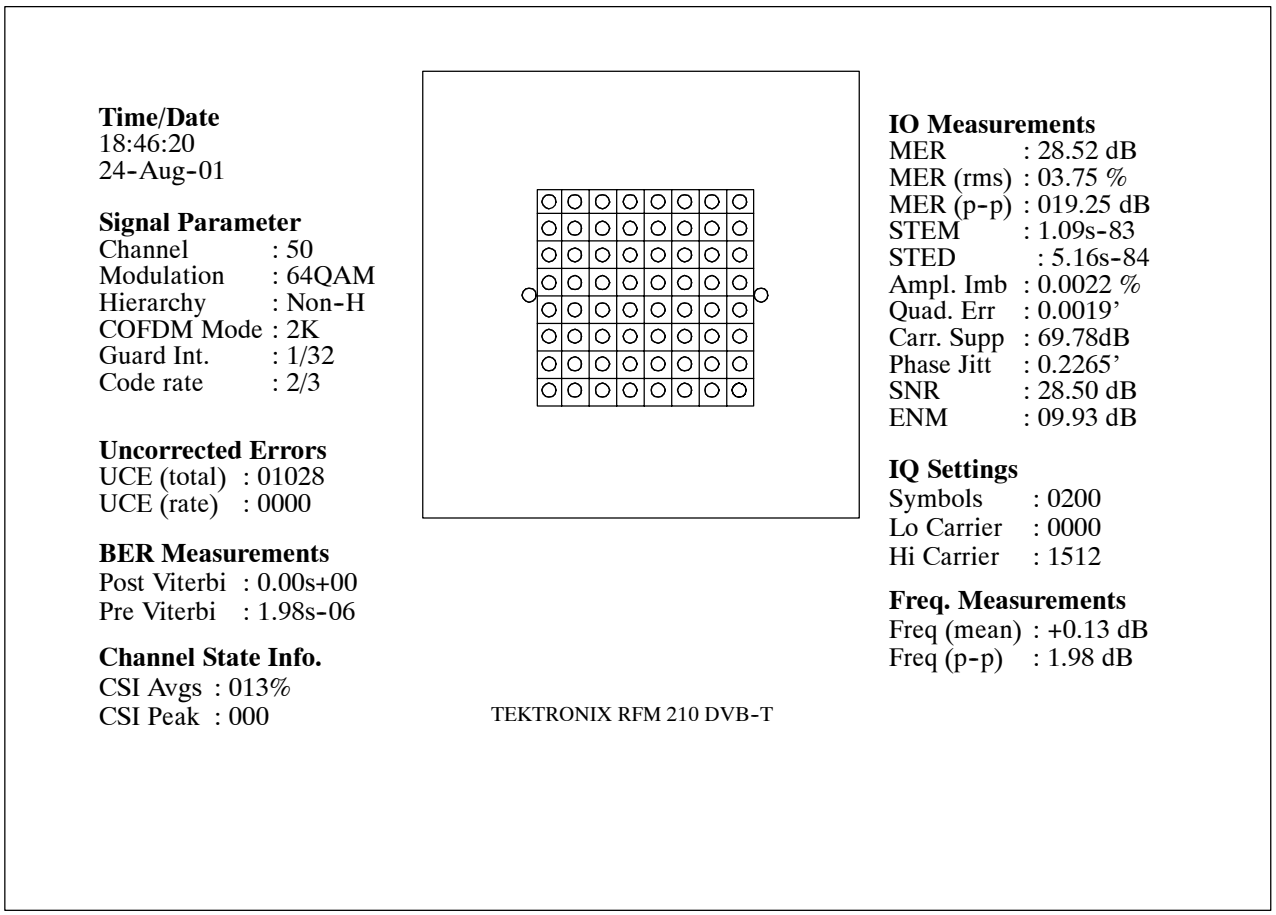


Figure 5- 1: Example of output to VGA monitor

Main Screen

The main screen provides the values of the most important parameter measurements, as well as the current channel setting and signal strength. A scrolling display, (8 second delay) alternates between the Pre- or Post-Viterbi BER value, and MER and SNR. It is possible to toggle between the measurement displays without waiting for the delay to time out by pressing the **ENTER** key.

```
Channel: 28L  Carrier Level:          ■■■■□□□
BER > Viterbi: 3.40e-05               UCE: 0000

Channel: 28L   Carrier Level:         ■■■■□□□
MER: 28.5dB SNR: 29.1dB               UCE: 0000
```

In the case of the BER display, whether Pre- or Post-Viterbi BER is shown depends on the value of Post-Viterbi BER. With a good signal, Post-Viterbi BER will be zero, and the Pre-Viterbi BER value is shown. If the signal degrades to such an extent that you start to get Post-Viterbi errors, this is what will be displayed on the Front Panel.

If the unit is set to External Baseband input, this is indicated on the Main Screen and the channel setting and Carrier Level indications are not shown, as they do not apply for baseband input signals. If the unit is not in sync this is also indicated on the front panel. Measurements are not valid if the sync is lost and are therefore not shown.

Pre-Viterbi BER is calculated from the number of bits corrected by the Viterbi decoder each second and post-Viterbi BER is calculated from the number of bits corrected by the Reed-Solomon decoder in each second. Post-Viterbi BER is generally the most useful BER figure. This screen also shows the number of UnCorrectable Errors (UCE) currently being detected in each second. If there are uncorrected errors present, then the BER cannot provide a true measure. A Post-Viterbi BER as great as 2×10^{-4} (displayed as 2.00e-04) will still give a good decoded picture, and this is known as the Quasi Error Free (QEF) point.

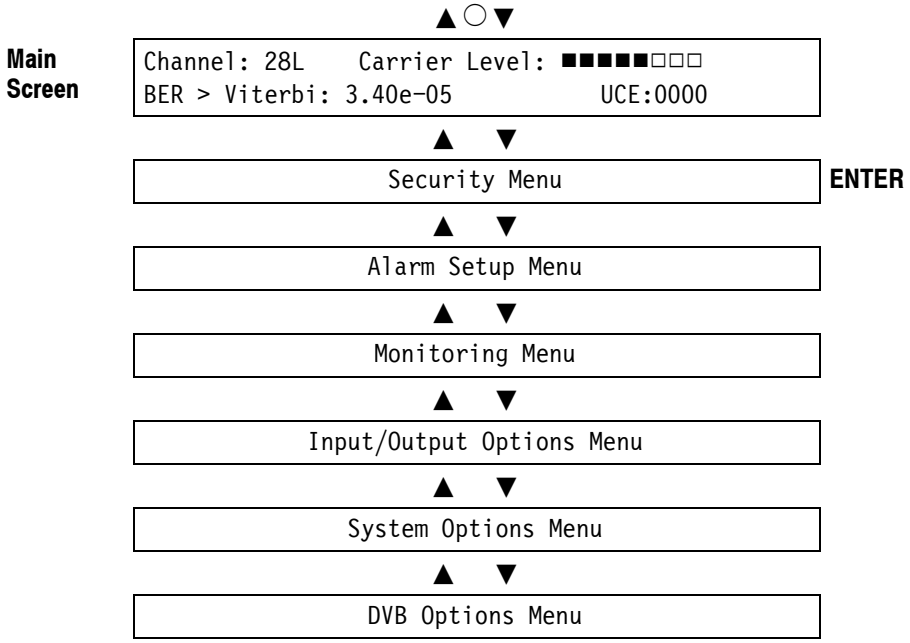
The carrier level bargraph gives an indication of received signal strength. The first or left bar indicates >35 dBµV when filled, with each following bar a further 5 dB step. When 65 dBµV is reached, all bars are filled. Note the signal strength refers only to the signal applied to the RF input connection and not the baseband input source.

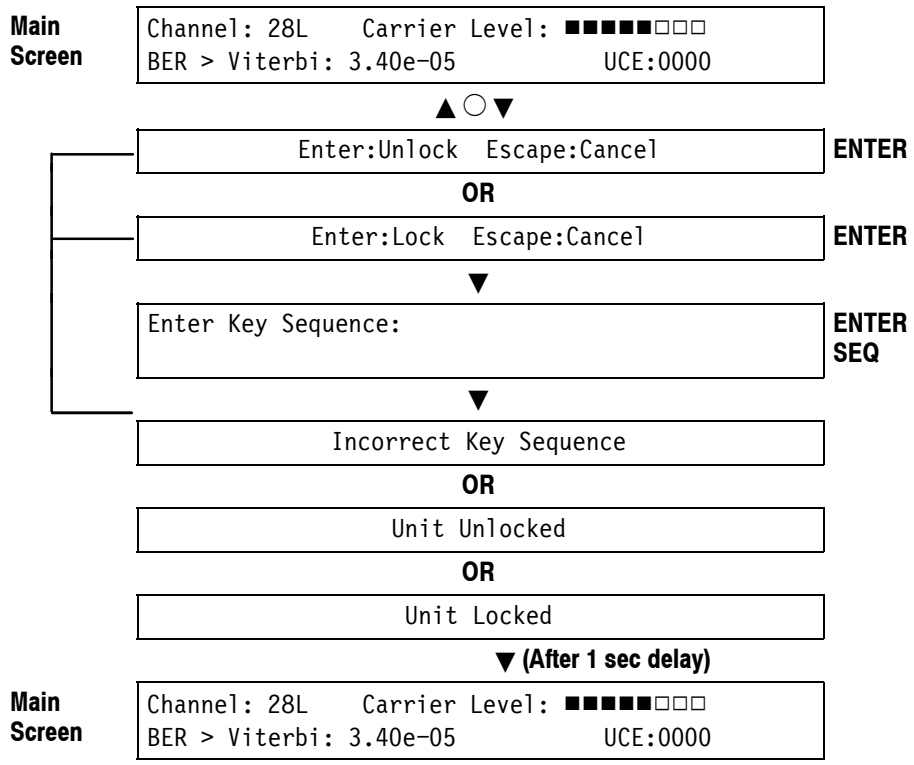
If the unit is set to show any other screen (except any screen under the monitoring menu), it will return to the main menu if no key is pressed within 60 seconds.

Security Menu

The Security screen allows the user to unlock or lock the unit. When the unit is locked the user will be unable to change any of the parameters via the front panel, although it is still possible to change parameters through the remote comms. It is possible to change the channel via the front panel when the unit is locked, either through the main screen, the channel change screen or the pre-programmed channel screen. The locked status is stored.

Main Screen to Security Menu





Procedure to Lock or Unlock the Receiver

Depending on the current condition, the user is presented with one of the following screens:

```
Enter: Unlock    Escape: Cancel
```

```
Enter: Lock      Escape: Cancel
```

Pressing **ENTER** changes the display to the following screen allowing the user to enter the required four key sequence to Lock/Unlock the unit.

```
Enter Key Sequence:
```

The user must enter the correct key sequence (using the ▲, ▶, ◀, ▼ and **ENTER** keys) to lock/unlock the unit. As each key is pressed an asterisk '*' is displayed to acknowledge the key pressed.

If the incorrect key sequence is entered the following message is displayed for a short period before being returned to the Lock/Unlock option above.

```
Incorrect Key Sequence
```

If the correct key sequence was entered one of the following messages is displayed (whichever is appropriate) for a short period before returning to the main menu.

```
Unit Unlocked
```

```
Unit Locked
```

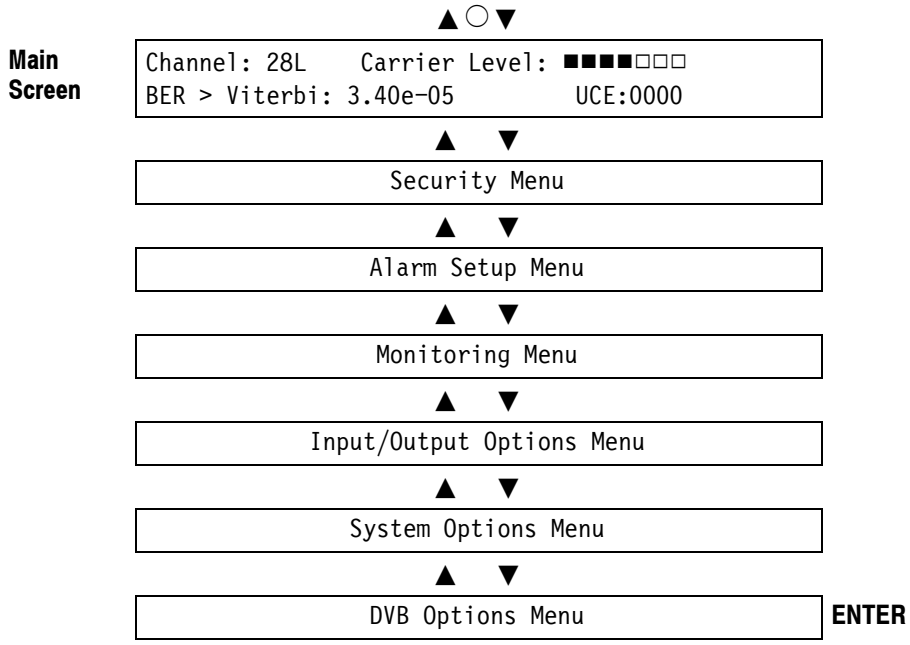
The **ESCAPE** key can be used at any time to abort the unlocking sequence and return to the main menu.

The required key sequence for all units is ▲, ▶, ◀, ▼.

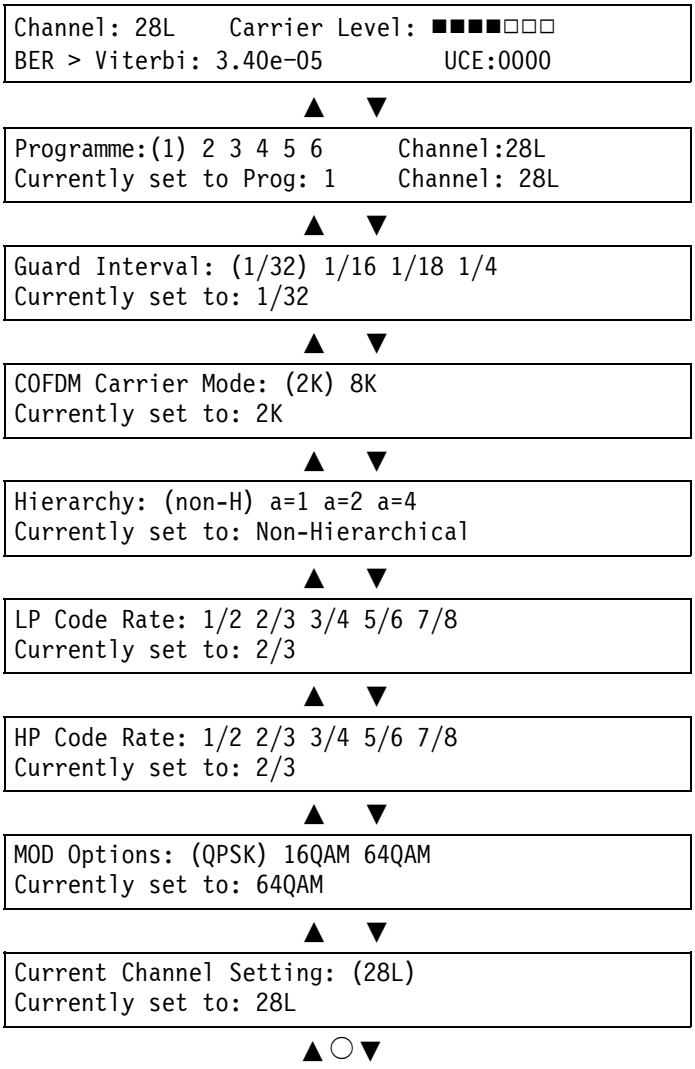
DVB Options Menu

Main Screen to DVB Options Menu

To access the DVB Options menu, press the front-panel navigation buttons to display the DVB Options menu and then press the **ENTER** key.



Main Screen



```
Current Channel Setting: (28L)
Set to Channel: 28L
```

Pressing **ENTER** allows the channel to be changed. The high bit of the channel indication starts flashing when **ENTER** is pressed indicating that the channel can be incremented or decremented in steps of 10. Pressing the Left & Right arrows ◀ ▶ moves the cursor position allowing adjustment of the low bit and offset. Pressing the Up and Down arrows increments or decrements the channel at the cursor position. If the channel is adjusted above the maximum or below the minimum allowable, the channel will scroll over accordingly.

Once the required channel and offset has been selected on this screen, pressing **ENTER** will set the new channel. The Current Channel Setting indication will update on completion of the channel change.

If channel offsets are not available these are not displayed and cannot be set.

```
Programme: (1) 2  3  4  5  6          Channel: 28L
Currently set to Prog:    1           Channel: 28L
```

The unit stores 6 pre-programmed channels. Left & right arrows ◀ ▶ highlight the option 1 to 6 and the channel setting of the highlighted option is displayed on the right. **ENTER** selects the highlighted option and after successful setting the display is updated. If the channel had previously been set via the serial communications or through the main screen or channel setting screen, the current program setting indication will be blank. See Configuration Menu section for details of how to change the 6 programme settings.

```
Guard Interval:  (1/32)  1/16  1/8  1/4
Currently set to: 1/32
```

The guard interval is a parameter of the transmitted signal and therefore the receiver must be set accordingly. Left & right arrows ◀ ▶ highlight the option, while **ENTER** makes the selection.

```
COFDM Carrier Mode:  (2K)  8K
Currently set to: 2K
```

The carrier mode (2K or 8K) is a parameter of the transmitted signal and therefore the receiver must be set accordingly. Left & right arrows ◀ ▶ highlight the option, while **ENTER** makes the selection.

```
Hierarchy: (Non-H)  a=1  a=2  a=4
Currently set to: Non-Hierarchical
```

The receiver is capable of receiving hierarchical modulation modes. The “a” parameter in the Hierarchy screen refers to the scaling factor. Left & right arrows ◀▶ highlight the option, while **ENTER** makes the selection.

```
LP Code Rate:   1/2  2/3  3/4  5/6  7/8
Currently set to: 2/3
                ▲   ▼
HP Code Rate:   1/2  2/3  3/4  5/6  7/8
Currently set to: 2/3
```

The Forward Error Correction (FEC) rate is also a parameter of the transmitted signal and therefore the receiver must be set accordingly. Normally the unit will automatically detect and set these parameters from the received TPS carriers, but it can be set manually through this menu option. In non-hierarchical mode the LP Code Rate setting has no effect. Left & right arrows ◀▶ highlight the option, while **ENTER** makes the selection.

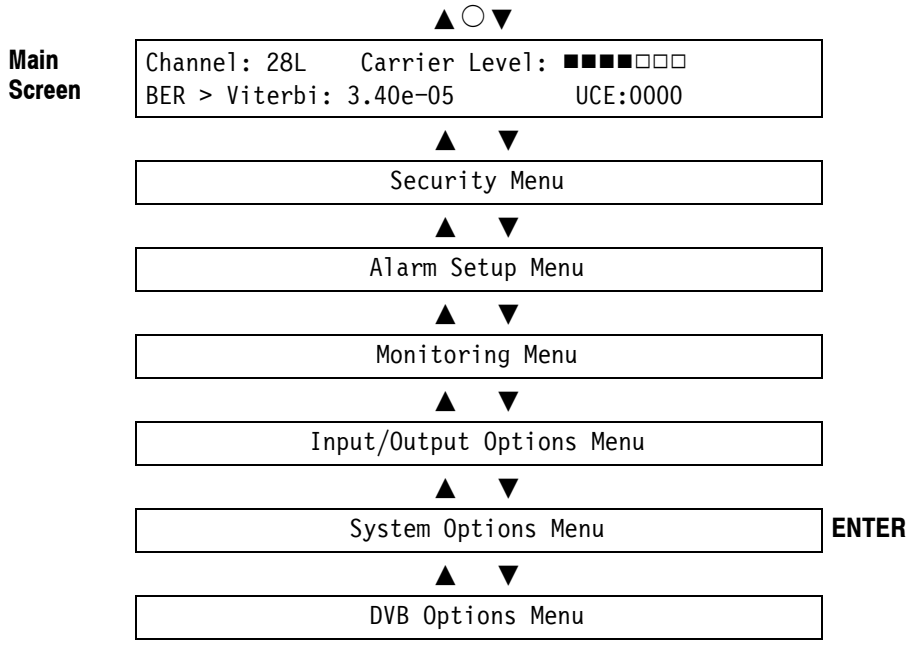
```
MOD Options:    (QPSK) 16QAM  64QAM
Currently set to: 64QAM
```

The modulation option is a parameter of the transmitted signal and therefore the receiver must be set accordingly. Normally the unit will automatically detect and set this parameter from the received TPS carriers, but it can be set manually through this menu option. Left & right arrows ◀▶ highlight the option, while **ENTER** makes the selection.

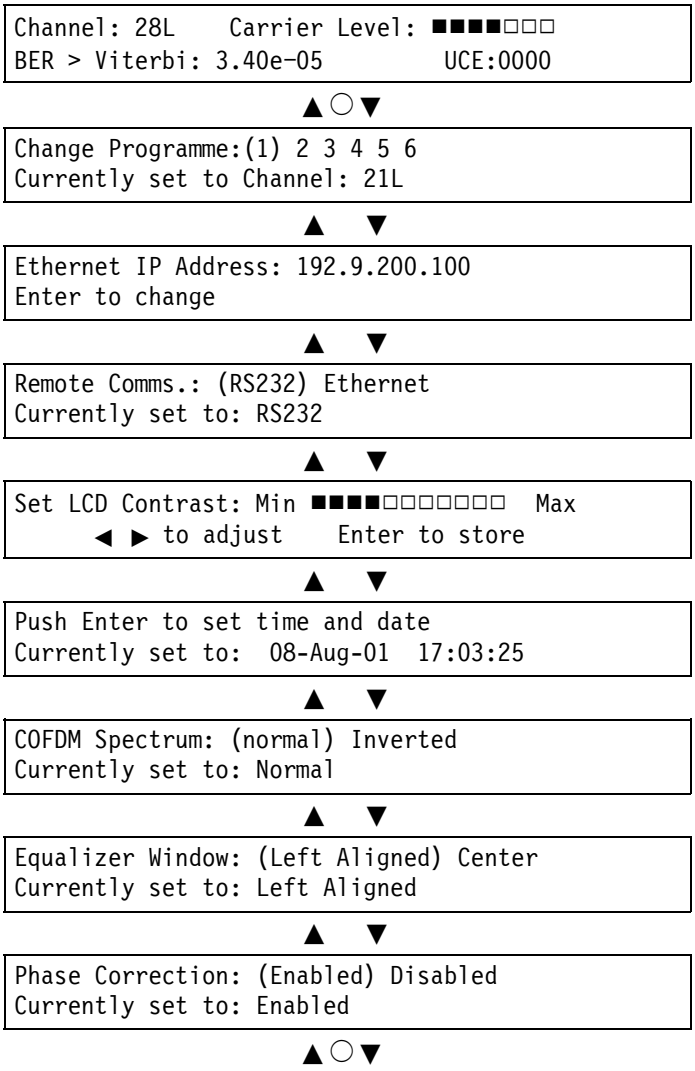
System Options Menu

Main Screen to System Options Menu

To access the System Options menu, press the front-panel navigation buttons to display the System Options menu and then press the **ENTER** key.



Main Screen



```
Change Programme: (1) 2 3 4 5 6
Currently set to Channel: 21L
```

This option allows setting of the 6 pre-programmed channels. Left & right arrows ◄► scroll through the 6 settings and the current setting for the high-lighted programme is shown. ENTER allows the highlighted selection to be adjusted. The high bit of the channel indication starts flashing indicating that the channel can be incremented or decremented in steps of 10. Pressing the Left & Right arrows ◄► moves the cursor position allowing adjustment of the low bit and offset. Pressing the Up and Down arrows increments or decrements the channel at the cursor position. If the channel is adjusted above the maximum or

below the minimum allowable, the channel will scroll over accordingly. Pushing **ENTER** again sets the channel for the highlighted preset programme.

```
Ethernet IP Address: 192.9.200.100
Enter to change
```

This screen displays the IP address of the Ethernet module. The IP address is read by the RFM210 on power up. This menu option also provides the ability to change the IP address. Pressing **ENTER** changes the display and causes the first character of the first segment of the IP address to flash. The up down arrows ▲▼ change the value of the selected character, with values for each segment ranging from 0 to 255. The left and right arrows ◀▶ move the cursor to set other segments. Press **ENTER** set the IP address. Pressing **ESCAPE** cancels the configuration change and reverts back to the original setting.

```
Remote Comms.: (RS232)  Ethernet
Currently set to:  RS232
```

This menu selects whether the RS232 serial port or Ethernet Interface is active. Left and right arrows ◀▶ highlight the option, while **ENTER** makes the selection.

```
Set LCD Contrast: Min ■■■■□□□□□□□□  Max
      ◀▶ to adjust    Enter to store
```

Use this option if the contrast of the LCD display is too light or too dark. The left and right arrows ◀▶ change the setting (left to make the screen lighter, right to make the screen darker). Once the required contrast is achieved, press **ENTER** to store this setting. If the menu is changed (by either the up down arrows ▲▼, or the **ESCAPE** key) without first storing the setting, the contrast will revert to the previous setting.

```
Push Enter to set time and date
Currently set to:    08-Aug-01       17:03:25
```

The receiver incorporates a real-time clock, primarily for use during automated logging via the Remote Comms. Pushing **ENTER** allows the time and date to be reset. The flashing item indicates the current selection and this can be adjusted using the up down arrows ▲▼, while the left and right arrows ◀▶ change the

selected item. Note that the clock stops while adjustment is being carried out to allow accurate setting of the seconds. Pushing **ENTER** again starts the clock and allows scrolling of the menu.

```
COFDM Spectrum:  (Normal)  Inverted
Currently set to:  Normal
```

If the COFDM signal is spectrally inverted during the up-conversion it will be necessary to set this option to Inverted, otherwise Normal must be selected. Left & right arrows ◀ ▶ highlight the option, while **ENTER** makes the selection.

```
Equalizer Window:  (Left Aligned)  Centered
Currently set to:  Left Aligned
```

This option selects the range, over which echoes can be equalized. Normally the centered aligned option is selected. The option positions the window for best results in the tolerance to delayed echoes. Left & right arrows ◀ ▶ highlight the option, while **ENTER** makes the selection.

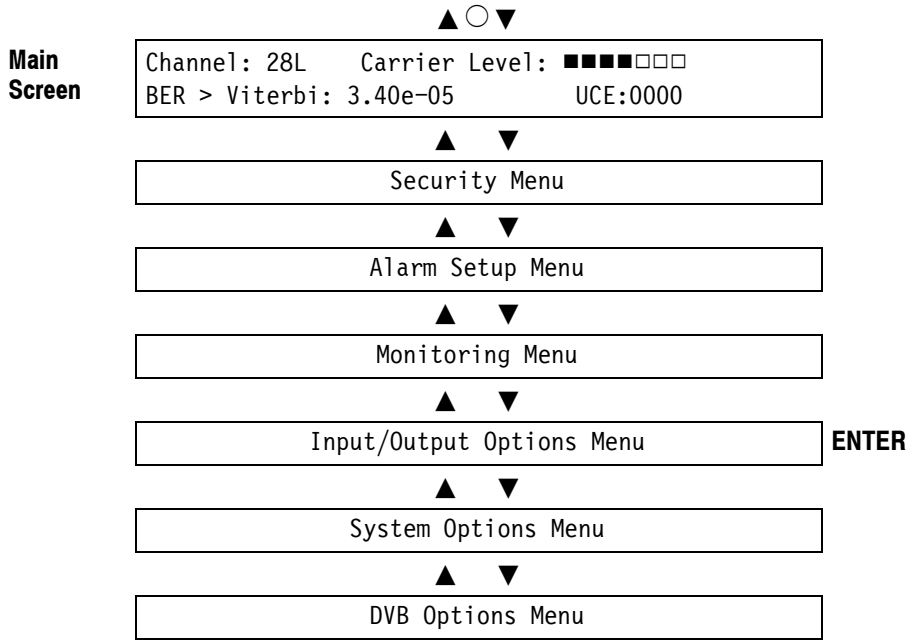
```
Phase Correction: (Enabled)  Disabled
Currently set to: Enabled
```

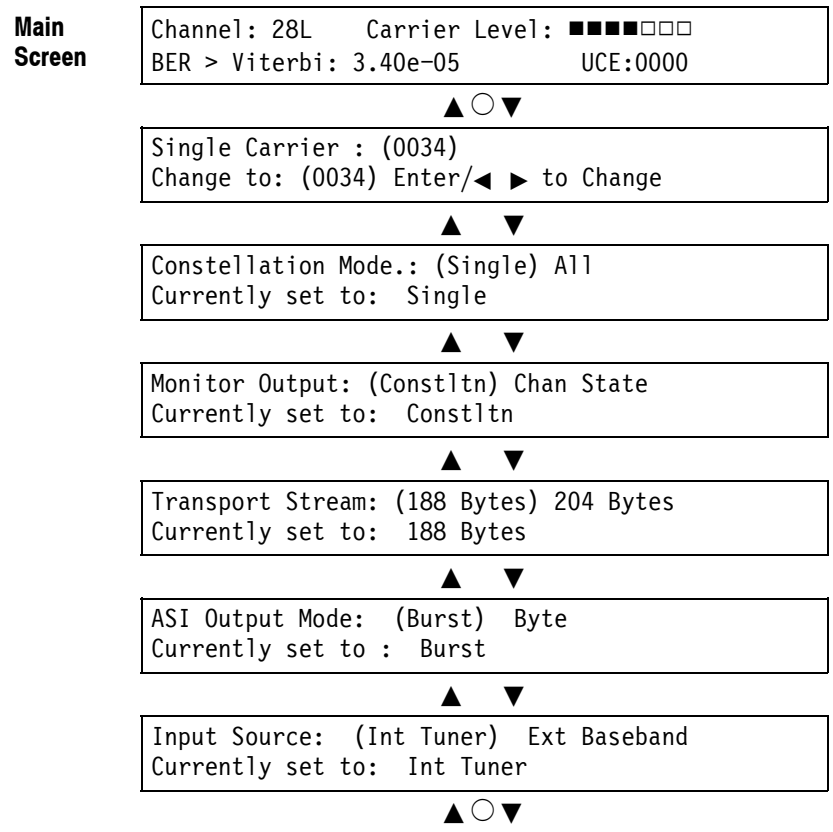
This option enables or disables the common phase correction capability of the COFDM demodulator devices. Left & right arrows ◀ ▶ highlight the option, while **ENTER** makes the selection.

Input/Output Options Menu

Main Screen to Input/Output Options Menu

To access the Input/Output Options menu, press the front-panel navigation buttons to display the Input/Output Options menu and then press the **ENTER** key.





```
Single Carrier: (0034)
Change to: 0034    Enter/◄► to change
```

When the single carrier constellation display option is selected, this screen enables a particular carrier to be chosen. In 2K carrier modes, the carriers are numbered from 0 to 1704 (1705 in total); in 8K modes, the carriers are numbered from 0 to 6816 (6817 in total). **ENTER** allows the selected carriers to be changed. The flashing digit indicates which bit will be incremented or decremented by the Up and Down arrows. The Left & right arrows ◄► move the cursor position. Pushing **ENTER** once more makes the selection. If the number is adjusted above the maximum allowable value or below 0 the value will scroll over.

Pressing the Left & Right arrows ◄► without pressing **ENTER** is a convenient method of selecting between adjacent carriers (◄ decrements the carrier number

and ▶ increments the carrier). If the number is adjusted above the maximum allowable value or below 0 the value will scroll over.

```
Constellation Mode.: (Single) All
Currently set to:  Single
```

When the constellation diagram is selected, the receiver shows either the superimposed constellations of all the carriers, or the constellation of a specific single carrier. This is applicable only to the oscilloscope output and not the constellation display on the VGA output. Left & right arrows ◀▶ highlight the option, while **ENTER** makes the selection.

```
Monitor Output: (Constltn) Chan State
Currently set to:  Constltn
```

The receiver provides the option of displaying either the constellation diagram or the channel state information display. To view either type, an oscilloscope must be connected to the X/TRIG, Y/W outputs of the receiver. See page 5-43 for connection information. The above screen allows selection of the required option. This selection also affects the display shown on the VGA output. Left & right arrows ◀▶ highlight the option, while **ENTER** makes the selection.

```
Transport Stream: (188 Bytes) 204 Bytes
Currently set to: 188 Bytes
```

This screen allows the user to select packet lengths of 188 or 204 bytes. Left & right arrows ◀▶ highlight the option, while **ENTER** makes the selection.

```
ASI Output Mode:  (Burst)  Byte
Currently set to :  Burst
```

This option selects whether of the ASI transport stream Output is in Burst or Byte format. Note that the LVDS outputs are not affected by the setting of the ASI Output mode. Left & right arrows ◀▶ highlight the option, while **ENTER** makes the selection.

```
Input Source:  (Int Tuner)  Ext Baseband
Currently set to:  Int Tuner
```

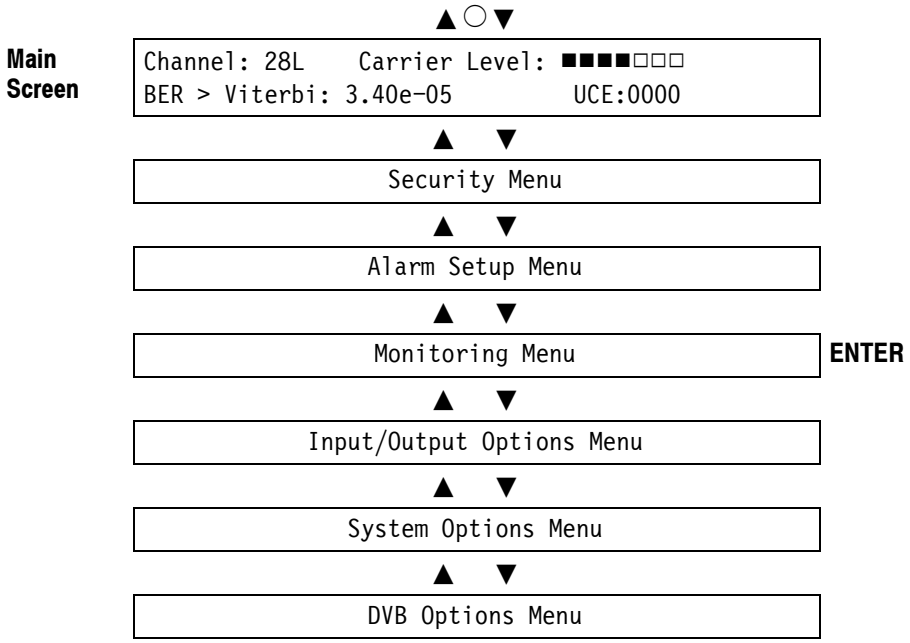
This option selects the input signal source. If the unit is set to Int Tuner, the output is derived from the signal applied to the RF input connection via the internal UHF/VHF tuner. If the unit is set to Ext Baseband, the output is derived from the signal applied to the Baseband input connection. Left and right arrows ◀▶ highlight the option, while pressing **ENTER** makes the selection.

Monitoring Menu

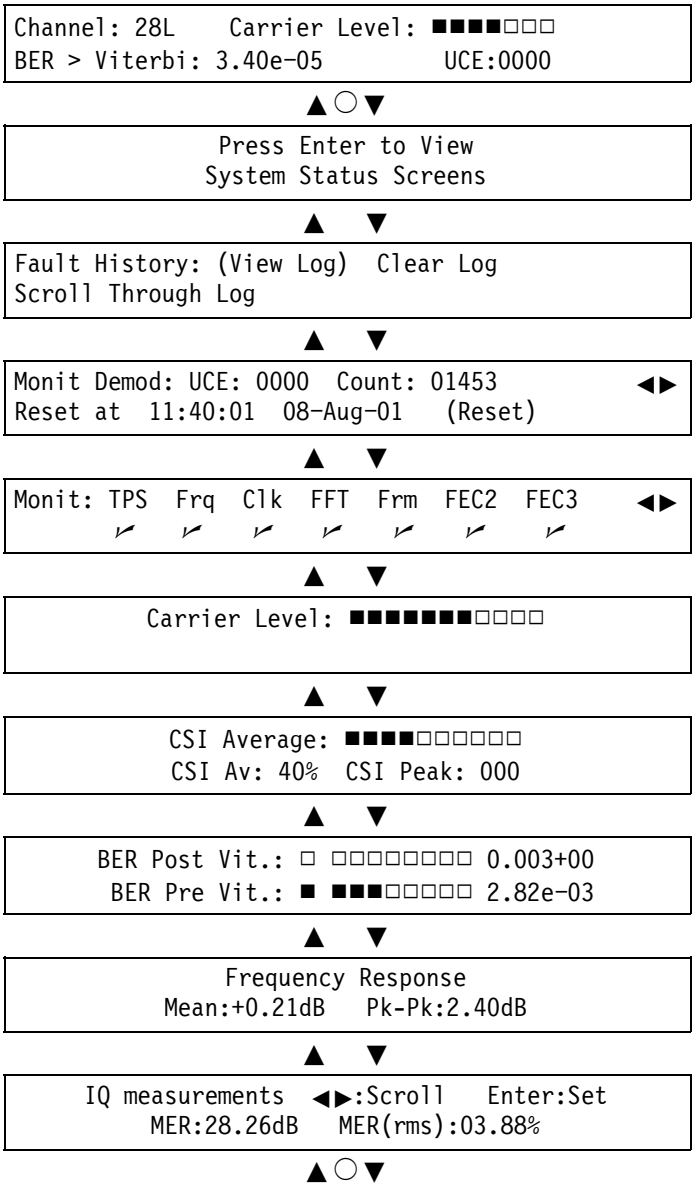
The monitoring screens allow the user to view the status of the receiver and the quality of the signal being received.

Main Screen to Monitoring Menu

To access the Monitoring menu, press the front-panel navigation buttons to display the Monitoring menu and then press the **ENTER** key.



Main Screen



```
Press Enter to View
System Status Screens
```

Pressing the **ENTER** key enters the System Status menu.

```
Fault History: (View Log)  Clear Log
Scroll Through Log
```

This menu option allows the user to View or Clear details of the 100 logged faults as determined by the setup of the logging parameters.

Use the left & right arrows ◀▶ to select the required option and **ENTER** to view/clear the log.

When 'View Log' is selected, details of the latest log are shown. An example is given below:

```
4448   S/N Ratio    Status:  Failure   Alarmed
Level: 27.1dB             15:05:27     07-Aug-01
```

The screen shows the following:

The log number (0000 – 9999);
The parameter for which the log was made;
Whether the log is for a Warning or Failure alarm;
Whether the log is made for an alarm occurrence or an alarm clear;
The Level of the parameter at the time of the log event;
The Time and Date of the Log.

If no Log events are stored the message "No Faults Logged" is displayed.

Use the up down arrows ▲ ▼ to scroll through the stored log events. If the up arrow ▲ is pressed while details of the latest Log are shown, the earliest Log event is shown. Similarly, if the down arrow ▼ is pressed while details of the earliest Log are shown, the latest Log event is shown. If further Log events occur whilst in this menu option, the display is not updated unless the earliest log event is being viewed and becomes overwritten.

Pressing **ENTER** returns to the latest stored log event.

Pressing **ESCAPE** returns to the Monitoring Menu option.

When 'View Log' is selected the following screen is displayed:

```
Confirm Clear Fault Log:
Enter: Clear          Escape: Cancel
```

Pressing **ENTER** clears the stored Log and returns to the Monitoring Menu option.

Pressing **ESCAPE** cancels the clear Log option and returns to the Monitoring Menu option.

```
Monit Demod:  UCE:0000   Count:01453   ◄►
Reset at  11:40:01    08-Aug-01    (Reset)
```

This screen shows the number of UnCorrectable Errors (UCE) per second; that is, the post Reed-Solomon error rate. The screen also provides a running count of the number of UCEs since it was last reset.

Use the left & right arrows ◄► to view the UCE and Total Error count of the three Demodulator devices in the unit.

When hierarchical modes are being received the UCE monitoring applies to the high priority (HP) stream for the Monitoring and HP Demodulator devices and the LP stream for the LP Demodulator.

ENTER resets the UCE counter for all 3 devices.

```
Monit: TPS  Frq  Clk  FFT  Frm FEC2  FEC3   ◄►
       ✓    ✓    ✓    ✓    ✓    ✓    ✓
```

This screen shows the current status of various synchronization parameters of the demodulator devices:

TPS	Transmission Parameter Signalling is correct.
Frq	The receiver is frequency-locked to the received signal.
Clk	The sampling frequency synchronization is locked to the received signal.
FFT	The Start FFT window synchronization is OK.
Frm	The Frame synchronization in the demodulator is OK.
FEC2	Deinterleaver/R-S decoder is synchronized.
FEC3	Descrambler is synchronized.

Use the left & right arrows ◄► to view sync status of the three Demodulator devices in the unit.

```
Carrier Level: ■■■■■■■□□□□
```

This screen gives an indication of the strength of the received RF signal, and is similar to the bargraph displayed on the main screen. When the received signal is greater than -65 dBµV the first bar is filled. More bars are filled as the signal strength increases and all bars are filled when a signal strength of -35 dBµV is reached. Note that this is only applicable to signals applied to the internal tuner. When baseband input is selected this menu option is not available.

```
CSI Average: ■■■■□□□□□□
CSI Av: 40%   CSI Peak: 000
```

The Channel State Information (CSI) score is a measure of the amount of noise and interference present in the ensemble. For a Gaussian channel, the CSI Av is related to the system Equivalent Noise Floor (ENF) by the empirical formula.

```
ENF = 20(K-C),
Where K = 2.676 and C = log10 (CSI Av %).
```

For example, 10% CSI Av is equivalent to -33.5 dBc ENF.

The CSI Average bargraph scale is calibrated such that each bar is equivalent to 10% but offset to show the average. Thus, with three bars filled the CSI average is greater than 25% but less than 35%. The CSI score is calculated by averaging the CSIs of all the data carriers over a symbol period.

The 'CSI peak' refers to the number of carriers, which exceed a CSI score of 62.5%.

```
BER Post Vit.: □ □□□□□□□□ 0.003+00
BER Pre Vit.: ■ ■■■□□□□□ 2.82e-03
```

This screen provides a simple display of the pre- and post-Viterbi BER. The first (separated) bar on the bargraph display indicates that pre- or post-Viterbi errors are present.

The post-Viterbi bargraph scale has high sensitivity and is centered about a BER of 2×10^{-4} (displayed as 2.00e-04) which is the QEF point. If the bars are unfilled, then the BER is below the QEF point; if they are filled, then the BER exceeds the QEF point. The BER monitoring applies to the high priority (HP) stream when hierarchical modes are being received.

The pre_Viterbi bargraph is scaled linearly from 0 to a BER of 1.67×10^{-2} (displayed as 1.67e-02). Due to the way the pre-Viterbi BER is calculated the maximum possible value is 1.67×10^{-2} even though the real BER could be greater than this.

```
Frequency Response
Mean: +0.21dB          Pk-Pk: 2.40dB
```

This screen displays the latest frequency response measurement. The measurement is taken once every 5 measurements of IQ data. A frequency response measurement results in a momentary break-up on the constellation output on the

VGA monitor and X-Y outputs as the demodulator device needs to change modes in order to take this measurement.

It is possible to do an immediate frequency response measurement by pressing the **ENTER** key whilst on this menu option.

```
IQ measurements   ◀▶: Scroll     Enter: Set
MER: 28.26dB MER(rms): 03.88%
```

This screen displays the latest IQ measurements calculated by the DSP. Use the left & right arrows ◀▶ to scroll through the measurements. The measurements are updated every time a new set of calculations is received from the DSP. The measurements available to view on this menu option are as follows:

MER (dB);	MER (rms);
MER (pk-pk);	STEM;
STEM;	Amplitude Imbalance;
Quadrature Error;	Carrier Suppression;
Phase Jitter;	Signal/Noise Ratio;
Estimated Noise Margin	

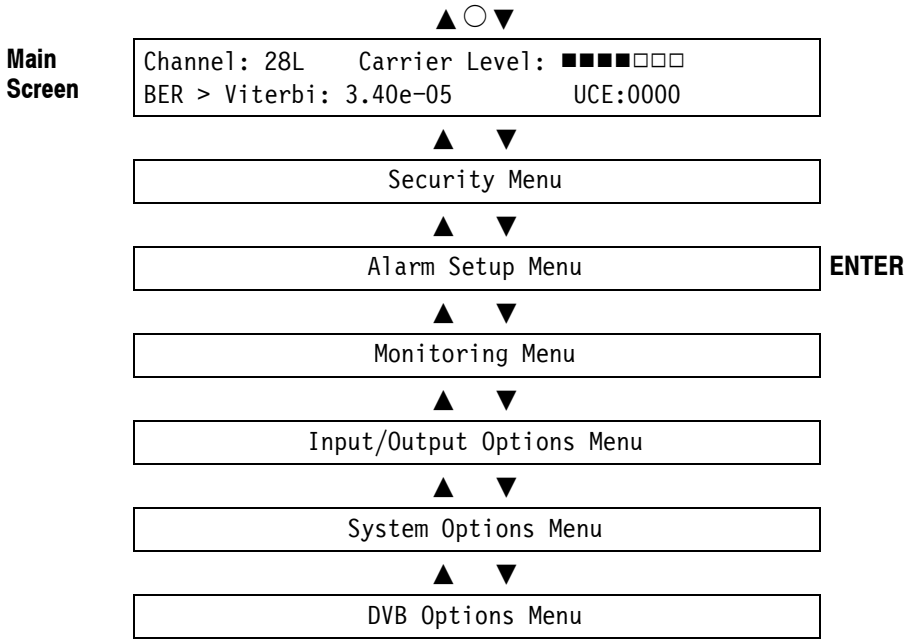
Pressing the **ENTER** key enters the DSP setup menu.

Alarm Setup Menu

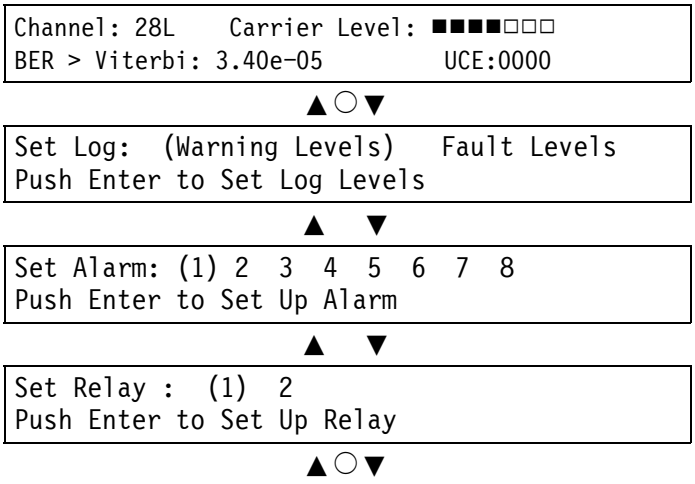
The alarm option screen allows the user to set the parameter on which each of the 2 alarm indicating relays operate.

Main Screen to Alarm Setup Menu

To access the Alarm Setup menu, press the front-panel navigation buttons to display the Alarm Setup menu and then press the **ENTER** key.



Main Screen



```
Set Log : (Warning Levels) Fault Levels
Push Enter to Set Log Levels
```

This menu option allows setup of the Warning and Fault Logging parameters. The left & right arrows ◀▶ make the selection and **ENTER** changes the display to the Log setup screen.

Setting of the logging parameters is described in the *Setting Up Relays, Open Collector Alarms and Logging Parameters* section below.

```
Set Alarm : (1) 2 3 4 5 6 7 8
Push Enter to Set Up Alarm
```

This menu option allows setup of the 8 Open Collector. The left & right arrows ◀▶ select which alarm to set and pressing **ENTER** changes the display to the Alarm setup screen.

Setting of the alarms is described in the *Setting Up Relays, Open Collector Alarms and Logging Parameters* section below.

```
Set Relay : (1) 2
Push Enter to Set Up Relay
```

This menu option allows setup of the 2 configurable volt-free relays. The left & right arrows ◀▶ select which relay to set and pressing **ENTER** changes the display to the Relay setup screen.

Setting the relays is described in the *Setting Up Relays, Open Collector Alarms and Logging Parameters* section below.

Setting Up Relays, Open Collector Alarms and Logging Parameters

Relay Setup Screen (example):

```
Relay 1 Set - MER (dB)    Disabled
(Enable) Disable          Level:       27.0
```

Alarm Setup Screen (example):

```
Alarm 1 Set - Post Vit. BER           Enabled
(Enable) Disable          Level:      0.00e+00
```

Logging Setup Screen (example):

```
Warning Lev. - Phase Jitter           Enabled
(Enable) Disable          Level:      0.2
```

Each of the alarms can be set to indicate failure of up to 18 parameters, with the level of each parameter independently set for each alarm. The current setup of all alarms can be viewed and changed here.

On entering this menu, the setup of the first parameter for the selected alarm is shown. Use the up down arrows ▲▼ to scroll through parameters. Details of the 18 parameters available are as follows:

Parameter type	Adjustment range
MER (dB)	15.0 - 35.0
MER (rms)	00.0 - 15.0
MER (pk-pk)	000.0 - 200.0
Amplitude Imbalance (%)	0.00e+00 - 5.00e-01
Quadrature Error (°)	0.00e+00 - 5.00e-01
Carrier Suppression (dB)	45.0 - 85.0
Phase Jitter (°)	0.0 - 2.0
S/N Ratio (dB)	15.0 - 35.0
System Target Error Mean	0.00e+00 - 2.50e-02

Parameter type	Adjustment range
System Target Error Deviation	0.00e+00 - 1.00e-02
Frequency (pk-pk)	0.0 - 9.9
Frequency (mean)	0.00e+00 - 3.00e+00
Pre-Viterbi BER	0.00e+00 - 1.75e-02
Post-Viterbi BER	0.00e+00 - 5.32e-03
Sync. Loss	N/A
Uncorrected Errors	00 - 99
Over Temperature (°C)	00 - 99
PSU Failure	N/A

Each screen displays the following information:

The Alarm type and number currently being viewed/set up (e.g. relay1);
The parameter name currently being viewed;
Whether the alarm is Enabled or Disabled on that parameter;
The level at which the alarm is set to trip on this parameter.

To set up the alarm on the selected parameter use the left & right arrows ◀▶ to move the cursor to the 'Enable', 'Disable', or 'Level' position. Move the cursor to the 'Enable' or 'Disable' position and press **ENTER** to enable or disable the alarm of the selected parameter. The change of status of the alarm will be indicated on the screen.

To set the level, press ENTER while the cursor is over the 'Level' position. The first character of the level will flash indicating that level setting is in progress. Use the up down arrows ▲▼ to set the required level and the left & right arrows ◀▶ to move the cursor position. When an exponential level is being set, the mantissa and exponent are set independently. Pressing **ENTER** stores and enables the new level. Pressing **ESCAPE** will cancel the level setting and revert back to the original value.

For the 'Sync Loss' and 'PSU fail' parameters, level setting is not applicable and the level setting option is not available.

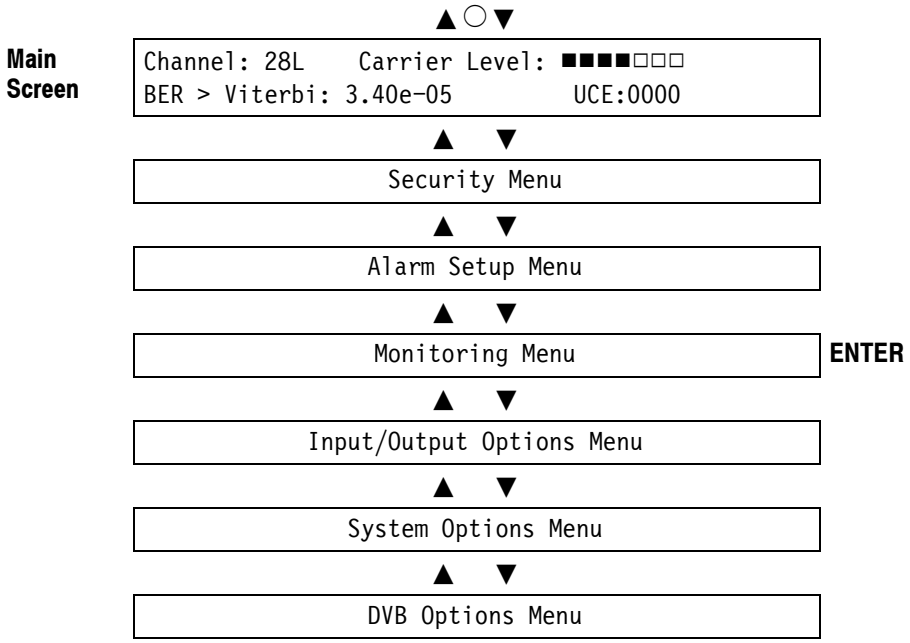
Pressing **ESCAPE** returns to the Alarm Setup Menu.

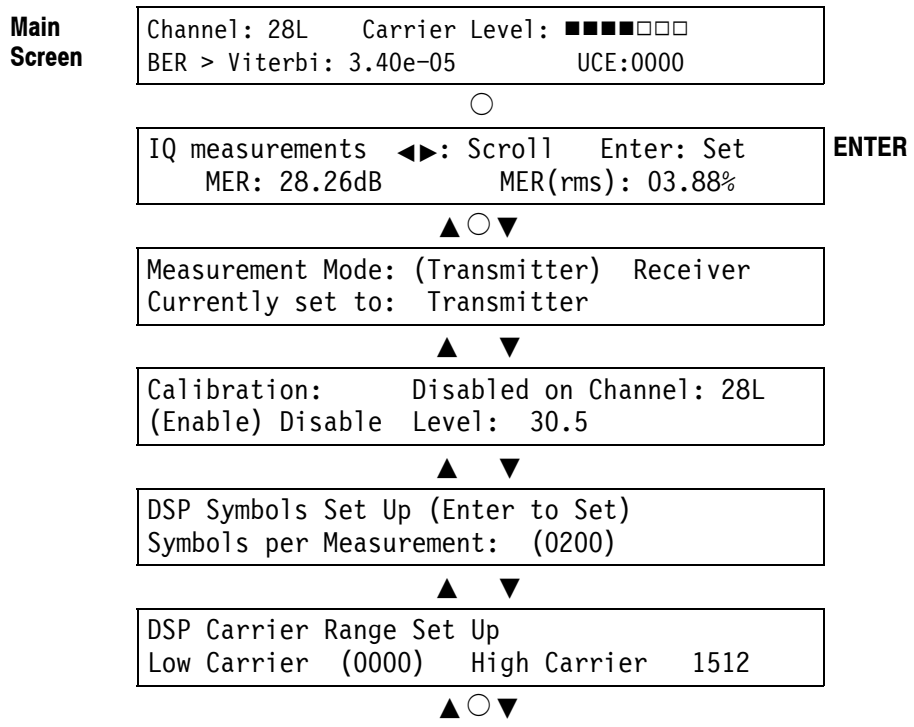
DSP Setup Menu

The DSP Setup menu allows the user to set parameters relating to the DSP measurements.

Main Screen to DSP Setup Menu

To access the DSP Setup menu, press the front-panel navigation buttons to display the DSP Setup menu and then press the **ENTER** key.





```
Measurement Mode: (Transmitter)  Receiver
Currently set to:   Transmitter
```

When the unit is set to Transmitter mode, IQ and frequency response measurements will only be made when full synchronization is achieved. If results are requested via the remote comms when the unit is not in sync, the Loss of Sync reply will be sent. In Receiver mode, measurements will be taken whether or not synchronization is achieved. Left & right arrows ◄► highlight the option, while **ENTER** makes the selection.

Pressing **ESCAPE** will return to the Monitoring Menu.

```
Calibration: Disabled on Channel: 28L
(Enable)   Disable        Level:  30.5
```

This Menu allows viewing and setup of the END (Equivalent Noise Degradation) calibration for correction of MER and SNR Measurements. The screen shows the correct status of the END calibration (Whether it is enabled or disabled, the channel on which END was calibrated, and the END calibration

level). If the END has not yet been set, this is indicated by the word ‘None’ for the calibrated channel indication.

To set up END use the left & right arrows ◀▶ to move the cursor to the ‘Enable’, ‘Disable’, or ‘Level’ position. Move the cursor to the ‘Enable’ or ‘Disable’ position and press **ENTER** to enable or disable the END. The change of status of END calibration will be indicated on the screen. The calibrated channel will be automatically updated to the current channel setting.

To set the END level, press **ENTER** while the cursor is over the ‘Level’ position. The first character of the level will flash indicating that level setting is in progress. Use the up down arrows ▲▼ to set the required level and the left & right arrows ◀▶ to move the cursor position. Pressing ENTER stores and enables the new END level. Pressing **ESCAPE** will cancel the level setting and revert back to the original value.

Pressing **ESCAPE** will return to the Monitoring Menu.

```
DSP Symbols Set Up (Enter to Set)
Symbols per Measurement:  (0200)
```

This menu option sets the number of symbols on which IQ measurements are taken. **ENTER** enables setting of the number of symbols. When setting is enabled, the first character of the highlighted option flashes. Use the up down arrows ▲▼ to set the number of symbols, and the left & right arrows ◀ ▶ to change the cursor position. Pressing **ENTER** stores and enables the number of symbols. Pressing **ESCAPE** will cancel the level setting and revert back to the original setting.

If the number of symbols is adjusted above 9999 or below 0000, the level will scroll over accordingly.

Pressing **ESCAPE** will return to the Monitoring Menu.

```
DSP Carrier Range Set Up
Low Carrier  (0000)        High Carrier   1512
```

This menu option sets the upper and lower carrier numbers on which IQ measurements are taken. Left & right arrows ◀▶ highlight whether to set the Low carrier or High Carrier, while **ENTER** enables setting. When setting is enabled, the first character of the highlighted option flashes. Use the up down arrows ▲▼ to set the carrier number, and the left & right arrows ◀▶ to change the cursor position. Pressing **ENTER** stores and enables the new carrier number. Pressing **ESCAPE** will cancel the level setting and revert back to the original setting.

If setting the Low carrier, the maximum value allowed is the value of the High carrier. If this is exceeded, the carrier number will scroll over to zero. If the carrier number is adjusted below zero, the value will scroll over to the setting of the High carrier.

If setting the High carrier, the minimum value allowed is the value of the Low carrier. If this is exceeded, the carrier number will scroll over to the maximum carrier number. If the High carrier number is set above the maximum carrier number, the value will scroll over to the setting of the Low carrier. The maximum carrier number is 1512 in 2K mode and 6048 in 8K mode.

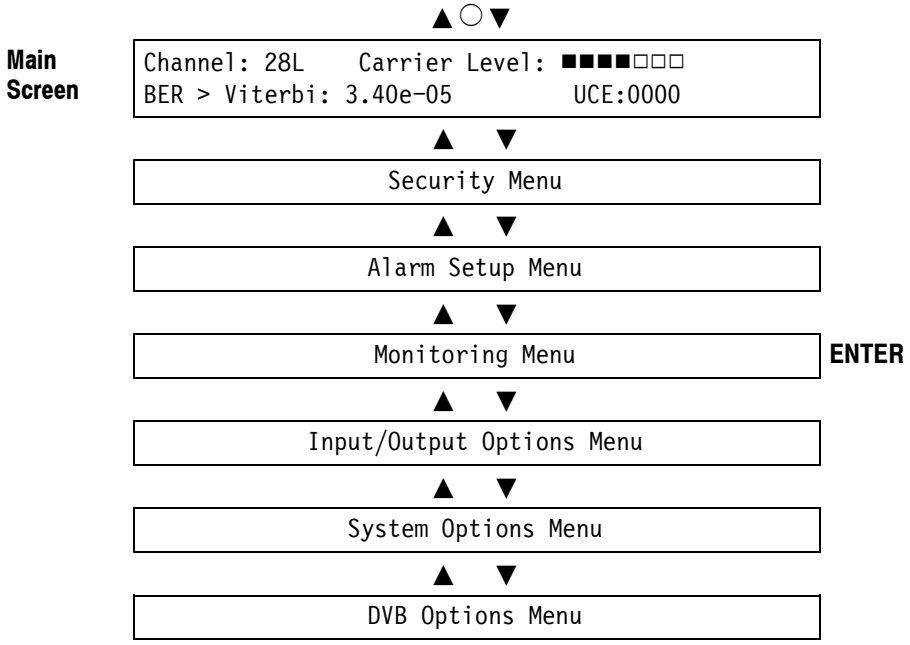
Pressing **ESCAPE** will return to the Monitoring Menu.

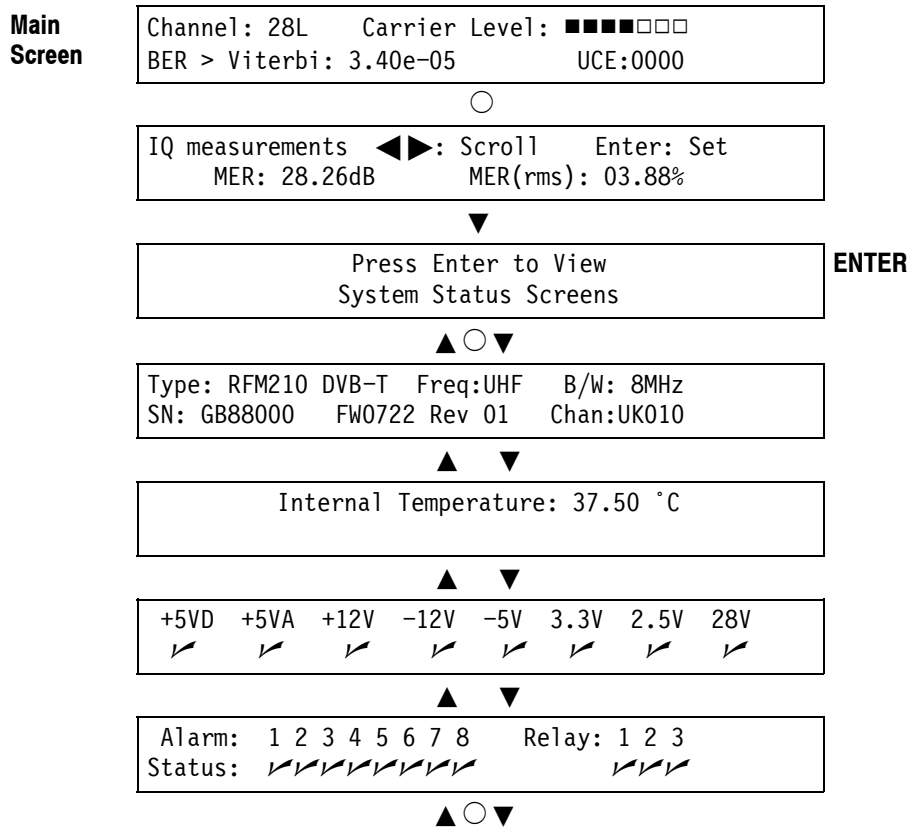
System Status Menu

The System Status screens allow the user to view the status and details of the unit

Main Screen to System Status Menu

To access the System Status menu, press the front-panel navigation buttons to display the System Status menu and then press the **ENTER** key.





```
Type: RFM210 DVB-T    Freq:UHF   B/W: 8MHz
SN: GB88000   FW0722 Rev 01  Chan: UK010
```

This screen gives a summary of the unit details. Included on this menu option is the following information:

Unit Type;
Frequency (UHF, VHF, Wideband, or Cable);
Bandwidth (6 MHz, 7 MHz, or 8 MHz);
Unit Serial Number
Main Micro firmware number and revision status;
Selected Channel plan.

Pressing **ESCAPE** will return to the Monitoring Menu.

```
Internal Temperature: 37.50 °C
```

This screen shows the internal temperature of the unit. The value is updated every second.

Pressing **ESCAPE** will return to the Monitoring Menu.

```
 Alarm:  1 2 3 4 5 6 7 8    Relay: 1 2 3
Status: ✓✓✓✓✓✓✓✓✓          ✓✓✓
```

This screen shows the status of the 8 open collector alarms and the 3 alarms relays. A tick under the alarm number indicates a healthy state and a cross indicates a fail state. Failure of any of these alarms will cause the alarm LED on the front panel to flash as a warning to the user.

Pressing **ESCAPE** will return to the Monitoring Menu.

```
+5VD  +5VA  +12V  −12V  −5V  3.3V  2.5V  28V
 ✓     ✓     ✓     ✓     ✓    ✓     ✓     ✓
```

This screen shows the status of the 8 power supplies within the unit. A tick under the appropriate label indicates a healthy power supply. If the level of any power rail drops below a pre-determined level this is indicated by a cross under the failed power rail label. Failure of any power rail will also result in the red power supply LED on the front panel being illuminated.

Pressing **ESCAPE** will return to the Monitoring Menu.

Constellation Mode

The Constellation Mode provides the user with an analog display of the magnitude and phase of each of the data points, along with the continual and TPS pilots. The scattered pilots that are used for equalization appear as zero value.

To view the Constellation, the **Monitor Output** in the **Input/Output Options** menu must be set to **Constltn**. See page 5–23 for instructions on setting the Monitor Output.

Viewing on a VGA Display

Connect a standard VGA monitor to the rear panel 15-pin VGA connector. The Constellation will appear in the top center portion of the display. See Figure 5–2.

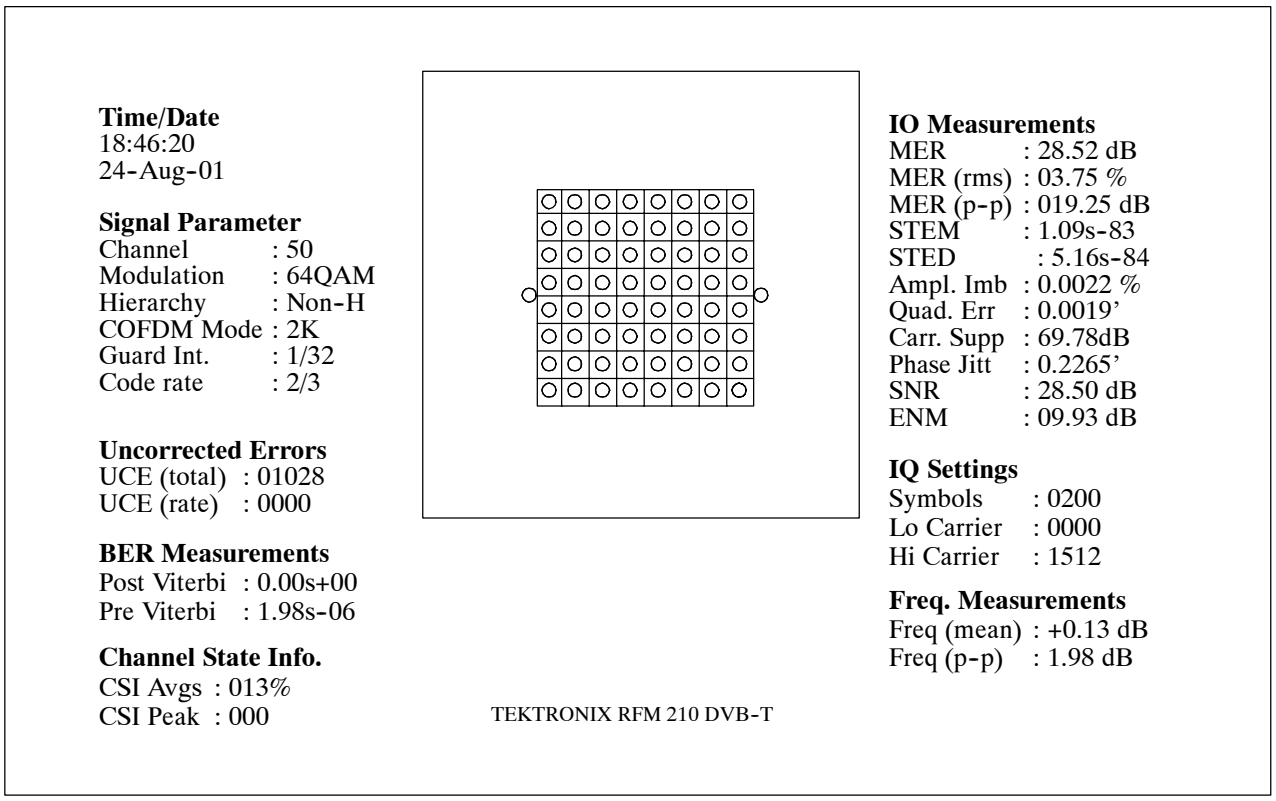


Figure 5-2: Example of output to VGA monitor

Viewing on an Oscilloscope

To view a constellation display, the receiver should be connected to an oscilloscope operating in X-Y mode (that is, time base off) as shown in the following table.

RFM210	Oscilloscope
BNC X/TRIG output	X input at 500 mV/div
BNC Y/W output	Y input at 500 mV/div
BNC Z output	Z input

The oscilloscope should have a Y and X-axis bandwidth of at least 1 MHz to avoid distorting the constellation.

When using an oscilloscope, the user has the option of displaying the constellation from either one particular carrier or the ensemble of carriers. This is selected using the **Single** or **All** settings under the **Constellation Mode** in the **Input/Output Options** menu. See page 5–23. The single carrier option is particularly useful when investigating frequency selective channel impairments.

Channel State Mode

The Channel State Mode displays the amount of noise and interference present on each carrier within the ensemble. This display is particularly useful when investigating the effect of co-channel interference.

To view the Channel State, the **Monitor Output** in the **Input/Output Options** menu must be set to **Chan State**. See page 5–23 for instructions on setting the Monitor Output.

Viewing on VGA Display

Connect a standard VGA monitor to the rear panel 15-pin VGA connector. The Channel State will appear in the top center portion of the display. The display shows the ensemble span along the horizontal axis (Carrier 0 appears on the left-hand side and the highest-numbered carrier on the right-hand side). The degradation is shown on the vertical axis.

Viewing on an Oscilloscope

To view channel state, the RFM210 should be connected to an oscilloscope as follows:

RFM210	Oscilloscope
BNC Y/W output	Channel 1 input at 50 mV/div
BNC X/TRIG output	Channel 2 input at 500 mV/div

The oscilloscope vertical mode should be set to CH 1 only. The time base should be set to 20 μs/div in 2K mode, and 50 μs/div in 8K mode. Time base triggering should be from channel 2.

The display will show the ensemble span along the horizontal axis. (Carrier 0 appears on the left-hand side, and the highest numbered carrier on the right-hand side). The degradation level is shown on the vertical axis.

Remote Operation

You can control the RFM210 via the RS232 port on the rear panel or you can use SNMP networking via the rear-panel Ethernet port.

To establish the communication between a PC and the RFM210 via the RS232 port, it is necessary to use a 1 to 1 RS-232 cable and set up serial communication as described in the *Appendix B* of this manual. Full definition of serial control commands are provided in *Appendix B*, which provides the user the option to design a custom serial program or to interface the receiver to an existing control package or system.

To communicate with the RFM210 over an SNMP network, you will need to refer to the MIB Table information in *Appendix D*.

Alarms

The RFM210 offers an extremely versatile range of Alarm features. Detail on configuring the Alarm features of this unit is available in *Alarm Setup* on page 5-31, while connection detail is given under *Technical Specifications* on page 6-1 of this manual.

Alarm 1	Relay	Configurable for Alarm on 18 measurement Parameters including IQ Analysis
Alarm 2	Relay	Configurable as Alarm 1
Alarm 3	Relay	Critical Alarm for PSU fail
Alarm 1-8	Open collector outputs	Configurable for Alarm on 18 measurement Parameters including IQ Analysis

All Alarms are configurable via the front panel.

Calibration Mode

Transmission system monitoring is usually accomplished by observing changes to the MER. The absolute reading is typically not as important as the variation in the reading. For those situations where it is desired to match the RFM210 MER reading to that of a laboratory-grade reference receiver, a Calibration Mode is provided.

When Calibration Mode is enabled, the RFM210 displays an MER that is calculated from the actual MER measurement and a special calibration offset, called Equivalent Noise Degradation or END. The END value represents the difference in receiver noise floor between the RFM210 and the laboratory receiver. Over a limited range of MER variation, proper selection of the END value results in both receivers giving comparable measurements.

Enabling Calibration Mode

Go into the DSP Setup Menu by scrolling down to the Monitoring Menu and pressing **ENTER** twice. Scroll down until the Calibration menu is displayed. Select Calibration ENABLE. See page 5-36. The END level must be set before accurate MER readings are displayed.

Setting the END Level

The END level is set in the Calibration menu, using the cursor keys. To set the END Level, both the RFM210 and the reference receiver must be connected to the DVB-T signal being monitored, so that MER readings are available from both instruments. The END Level may be determined in two ways: by calculation, or by trail and error.

Calculating END

END is determined from the following formula:

$$END = 10\log\left\{10^{\left(\frac{-MERa}{10}\right)} - 10^{\left(\frac{-MERb}{10}\right)}\right\}$$

where:

MERa is the uncorrected RFM210 MER reading in dB.

MERb is the reference receiver MER reading in dB.

END is the END Level that should be entered into the RFM210 LEVEL field.

Example END Calculation

As an example, suppose the RFM210 MER measurement is 29.18 dB (calibration DISABLEd) and the Reference receiver MER measurement is 35.0 dB. The calculation of the END level would be:

$$END = 10\log\left\{10^{\left(\frac{-29.18}{10}\right)} - 10^{\left(\frac{-35.0}{10}\right)}\right\} = 30.5\,dB$$

Now enter **30.5** under Calibration **LEVEL**, and select Calibration **ENABLE**. Exit the DSP Setup menu. The RFM210 MER will now read approximately 35 dB.

Trial and Error Determination of END

In this method, repeated trial values of END LEVEL are entered until the RFM210 corrected MER reads identically to that of the Reference receiver. Select Calibration **ENABLE**, and choose a trial END LEVEL. Selecting the starting trial value is simplified by noting that LEVEL is always greater than the RFM210 uncorrected MER value. Press the ESCAPE key once, and observe the MER reading. If it is lower than the reference receiver value, re-enter the Calibration menu and lower the LEVEL. If the MER is higher than the reference receiver, raise the LEVEL. This procedure converges quite quickly and has the advantage of requiring no calculation.

Note that the END value is specific to a given RF channel. Calibration mode is individually set on each channel, and the unique END Value for that channel must be determined if Calibration is to be used.

When Calibration is enabled, the MER reading may drift more, especially if there is a substantial difference between the reference receiver and uncorrected RFM210 MER readings. To get the same measurement stability as when Calibration is disabled, the number of symbols should be increased. For example, for 2K systems, if 200 symbols are selected with Calibration disabled, then between 300 and 400 symbols should be used with Calibration enabled.

Specifications

Technical Specifications

Table 6-1: RFM210 technical specifications

Subject	Rear panel label	Function	Specification
Mains	Line Voltage	Mains AC supply	95 - 240 VAC, 0.7 - 0.3 A, 50/60 Hz, 35 W Fuse Rating 1.6 A,, slow blow type
Tuner	RF IN	Frequency Range*	46 - 860 MHz (VHF-UHF)
		RF Input Level*	-10 to -77 dBm (-20 to -55 dBm Optimum)
		Frequency Accuracy	Double Conversion
		Channel Bandwidth (Specific to version)	6, 7 or 8 MHz
		Typical Noise Figure	9 dB
		Input Impedance	75 Ω
		Typical Input Return Loss	10 dB
Baseband Signals	BASEBAND INPUT	Low IF input available to accept external input	3.429 MHz (6 MHz BW) 4.0 MHz (7 MHz BW) 4.571 MHz (8 MHz BW) Input level -10 dBm 50 Ω
	BASEBAND INPUT GAIN	Baseband Input Gain adjustment potentiometer	Input level -10 dBm 50 Ω Input gain adjustment range -5 dBm to -20 dBm
	BASEBAND OUTPUT	Low IF output available for external monitoring	3.429 MHz (6 MHz BW) 4.0 MHz (7 MHz BW) 4.571 MHz (8 MHz BW)
	BASEBAND OUTPUT GAIN	Baseband Output Gain adjustment potentiometer	Output level typically -10 dBm 50 Ω Output gain adjustment range -5 dBm to -20 dBm
MPEG2 Transport Streams (TS)	DVB-ASI OUT HP	DVB - ASI TS High Priority	ASI Transport Stream 75Ω, 800 mV signal
	DVB-ASI OUT LP (HP)	DVB - ASI TS Low Priority or HP Priority in non-hierarchical mode	
	DVB-SPI HP OUT	DVB - SPI (LVDS) TS High Priority	SPI Transport Stream Low Voltage Differential Signalling Output
	DVB-SPI LP (HP) OUT	DVB - SPI (LVDS) TS Low Priority or HP Priority in non-hierarchical mode	

Table 6-1: RFM210 technical specifications (Cont.)

Subject	Rear panel label	Function	Specification
COFDM Demodulator		Modulation Systems	QPSK 16QAM 64QAM
		Carriers Supported	2K/ 8K DVB-T
		Viterbi FEC Rates	1/2, 2/3, 3/4, 5/6, 7/8
		Guard Intervals	1/32, 1/16, 1/8,1/4
		Hierarchical Modes	Non-Hierarchical and Hierarchical Modes supported with simultaneous HP and LP TS available
		Error Correction	Reed Solomon (204, 188) and Viterbi Correction
		Synchronization Monitoring	Status of TPS, FEC
		DVB-T input level Max	Interfering PAL Analog Carrier
Channel Monitoring 1. Constellation Mode 2. Channel State Mode	X/TRIG	Constellation (X Axis) Channel State Synchronization	75 Ω, 3.5 V peak typical 75 Ω, 3.5 V logic signal
	Y/W	Constellation (Y Axis) Channel State	75 Ω, 3.5 V peak typical 300 mV signal typical
	Z	Modulation Intensity (Z Axis)	75 Ω, 3.5 V peak typical
VGA Monitor	VGA	VGA Output	75 Ω, 0.5 V peak typical
Ethernet	PRIMARY	10base-T Ethernet	100 Ω, 5 V peak typical
	TEST	Ethernet Monitor	100 Ω, 5 V peak typical
TR 101 290 Measurement		MER Modulation Error Ratio	MER dB MER Average % MER Peak dB
		BER Bit Error Ratio	BER Pre Viterbi BER Post Viterbi
		S/N Signal to Noise	Ratio in dBs
		STE System Target Error	Mean and Deviation
		AI Amplitude Imbalance	Imbalance in %
		QE Quadrature Error	Error in º
		CS Carrier Suppression	In dBs
		PJ Phase Jitter	In º RMS
		SF Sync Failure	Loss of TX Sync
		UCE Uncorrectable Errors	Errors remaining post-Reed Solomon
		Channel Response	Frequency Response, Group Delay, Impulse Response via PC application

Table 6-1: RFM210 technical specifications (Cont.)

Subject	Rear panel label	Function	Specification
Mechanical		Height	Standard 1U (44 mm)
		Depth	400 mm
		Width	Standard 19 inch Rack Mounting
		Weight	4.5 kg
Environmental Ratings		Operating Temperature	+5° C to +35° C
		Operating Humidity	20% to 80% non-condensing
		Operating Altitude	2000 m (6500 ft.) maximum
		Equipment Class	Environmental testing as per Equipment Class 5

* **See following Notes**

Notes

Tuner Frequency Range

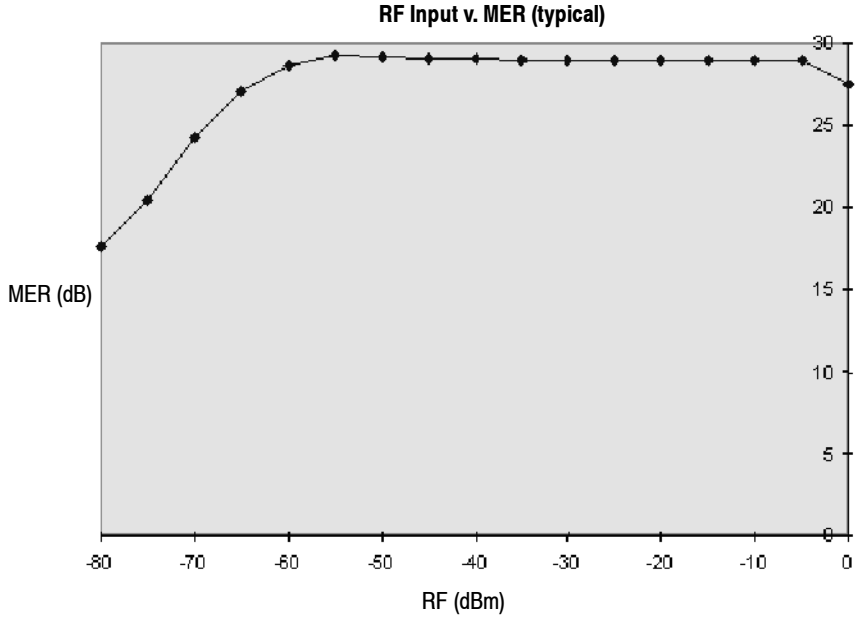
The COFDM tuner accepts RF signals in bands VHF and UHF (470 MHz to 860 MHz). The channel plan held within each unit is specific and therefore will determine the channels the receiver will demodulate. Where the allocated channel plan includes upper or lower offsets to the standard channels, these are selectable as defined channels. Offsets may include 1/6 MHz or 1/8 MHz.

RF Input Level

The RFM210 receiver has a wide input range of over the VHF/UHF bands from –10 to –77 dBm. The front-panel Carrier level display is derived from the Input AGC of the receiver and all bars should be completely full for best measurement.

The RF input level should be within the range –20 to –55 dBm, to ensure reliable MER measurements. This requirement is illustrated in the graph below. The measured MER in this application was approximately 29 dB.

***NOTE**. Under some applications source input levels exceeding the specification can be accepted by fitting an internal dB attenuator pad to the receiver. Contact your local Tektronix representative for advise.*



Baseband output

Baseband output level is –7 dBm typical Baseband input.
Baseband input level is –10 dBm, 50 Ω (typical).

Table 6-2: Connectors technical specifications

Subject	Rear panel label	Function	IN/OUT	Connector type
Mains	Line Voltage	Mains AC supply	IN	IEC
RF Input	RF IN	Analog DVB-T COFDM signal as allocated in channel plan	IN	75 Ω BNC Female
Baseband Signals	BASEBAND INPUT	Low IF input available to accept external input	IN	50 Ω BNC Female
	BASEBAND INPUT GAIN	Baseband Input Gain adjustment potentiometer	N/A	
	BASEBAND OUTPUT	Low IF output available for external monitoring	OUT	
	BASEBAND OUTPUT GAIN	Baseband Output Gain adjustment potentiometer	N/A	
MPEG2 Transport Streams (TS)	DVB-ASI OUT HP	DVB - ASI TS High Priority	OUT	75 Ω BNC Female
	DVB-ASI OUT LP (HP)	DVB - ASI TS Low Priority or HP Priority in non-hierarchical mode		
	*DVB-SPI HP OUT	DVB - SPI (LVDS) TS High Priority	OUT	DB25 Female Socket
	*DVB-SPI LP (HP) OUT	DVB -SPI (LVDS) TS Low Priority or HP Priority in non-hierarchical mode		

Table 6-2: Connectors technical specifications (Cont.)

Subject	Rear panel label	Function	IN/OUT	Connector type
Channel Monitoring 1. Constellation Mode 2. Channel State Mode	X/TRIG	Constellation (X Axis) Channel State Synchronization	OUT	50 Ω BNC Female
	Y/W	Constellation (Y Axis) Channel State		
	Z	Modulation Intensity (X-Z Axis)		
Monitor and Control Interfaces	SERIAL PORT[1]	RS232 Serial Control Interface	IN/OUT	DB9 Female Socket
	ALARM PORT 1[1]	Alarm port for Relay 1 and Relay 2 outputs	OUT	DB9 Female Socket
	ALARM PORT2[1]	Alarm monitor port for 8 open collector outputs and Relay 2 outputs	OUT	DB15 Female Socket
VGA Monitor	VGA	VGA Monitor Connector	OUT	DB15 High Density Female
Ethernet	PRIMARY	Primary Ethernet Interface (10base-T)	IN/OUT	RJ-45
	TEST	Test and Monitoring Port	IN/OUT	RJ-45
Ground[2]		Functional grounding point for signal integrity and noise reduction	N/A	M5 Screw

1 Notes on connector pin outs follow

2 Either symbol can be present on the rear panel next to the grounding point

Remote Access Connector Functions

Connector	Function
SERIAL PORT	RS232 Serial Control Interface and Upgrade RFM210 firmware
TEST PORT	Upgrade RFM210 ethernet firmware
PRIMARY	Access the RFM210 by SNMP and TCP/IP

DVB-SPI (LVDS) TS Output Connectors

HP (high priority) and LP (low priority) Outputs

Pin	Description
1	CLK A
2	0V
3	DA7
4	DA6

DVB-SPI (LVDS) TS Output Connectors (Cont.)

HP (high priority) and LP (low priority) Outputs

Pin	Description
5	DA5
6	DA4
7	DA3
8	DA2
9	DA1
10	DA0
11	DVALIDA
12	PSYNCA
13	0V
14	CLKB
15	0V
16	DB7
17	DB6
18	DB5
19	DB4
20	DB3
21	DB2
22	DB1
23	DB0
24	DVALIDB
25	PSYNCB

Serial Port Connector

RS232 Interface to PC

Pin	Function
1	NC
2	RX (to the equipment)
3	TX (from the equipment)
4	NC
5	GND
6	NC
7	CTS

Serial Port Connector (Cont.)

RS232 Interface to PC

Pin	Function
8	RTS
9	NC

Alarm Port 2 Connector

8 open collector alarms and 1 dry reed relay

Pin	Function
1	Relay alarm 2 contact NO
2	Relay alarm 2 contact NC
3	Open collector OP 1
4	Open collector OP 3
5	Open collector common
6	Open collector OP 6
7	Open collector OP 8
8	OV
9	Relay alarm 2 common
10	NC
11	Open collector OP 2
12	Open collector OP 4
13	Open collector OP 5
14	Open collector OP 7
15	Open collector common

Maximum operating characteristics of the open collector outputs are as follows:

Maximum collector–emitter voltage – 80 V
Maximum collector current – 50 mA
Relay contact ratings are: 30 VDC, 0.25 A, 8 VA max.

The Open collector alarms are programmed via association tables through the RS232 port, Ethernet port or via the front panel. Alarm 2 is configured via the front panel or remotely through the RS232 port or Ethernet port.

Alarm Port 1 Connector

Pin	Function
1	Common
2	Relay alarm 3 common contact
3	Relay alarm 1 contact NO
4	Relay alarm 1 contact NC
5	System reset common
6	Relay alarm 3 contact NO
7	Relay alarm 3 contact NC
8	Relay alarm 1 common contact
9	System reset input

Alarm 3 is a critical alarm failure and activates on loss of any power rail. Alarm 1 is configured via the front panel or RS232 port or Ethernet port.

Alarm relay contacts. Dry reed relay. Contact ratings are: 30 VDC, 0.25A, 8VA max.

System Reset Input. Requires NO volt-free contact.

VGA Monitor Connector

Pin	Function
1	Red
2	Green
3	Blue
4	NC
5	NC
6	NC
7	NC
8	NC
9	NC
10	NC
11	NC
12	NC
13	Horizontal Sync

VGA Monitor Connector (Cont.)

Pin	Function
14	Vertical Sync
15	NC

A standard VGA monitor connected to this connector displays the current setup and measurements as well as a real-time constellation/channel state diagram.

Description

This section provides a brief description of the hardware as it applies to the user.

Tuner

The RFM210 tuner covers all UHF or VHF channels, including channel offsets of ± 1/6 MHz or ± 1/8 MHz (depending on model). Channel configuration, with or without offsets is selectable via the front panel or by remote RS232/Ethernet control. The channels available depend on the selected channel plan within the receiver (see Appendix E, *Channel Tables*). This may be specific to VHF or UHF or a combination of both bands.

RF Input

The RF input signal from the user's antenna is connected to the BNC socket labelled "RF IN". The COFDM signal is converted down to baseband (or "low IF") format (with the signal centered on 4.57 MHz (at 8 MHz bandwidth)). No other IF signal stages are available either internally or externally.

Baseband

The baseband signal from the tuner is filtered, buffered, and output at the BNC connector labelled **BASEBAND OUTPUT**. This output allows independent monitoring and measurement. An output gain potentiometer allows adjustment of the baseband output.

It is also possible to feed an external baseband signal to the unit through the BNC connector labelled **BASEBAND INPUT**. This approach gives several advantages. Some applications require an external tuner and it would be connected at this point. A baseband signal from a modulator can be directly connected, by-passing all RF stages. An input gain potentiometer is used to match the external baseband source to the correct input level required at the **BASEBAND INPUT**.

Use the front-panel keypad or the RS232/Ethernet ports to switch between the baseband signal from the internal tuner and a baseband signal connected to the BASEBAND INPUT.

A- D Conversion

The baseband signal from the internal tuner or external baseband source passes to the analogue-to-digital converters. This is a 12-bit ADC with an effective resolution of 10 bits.

Demodulation

The COFDM demodulator is configurable to any modulation option allowed by the DVB–T specification.

Modulation options are set from the front panel or by remote RS232/Ethernet control. A feature of the COFDM demodulator is that many modulation settings of the received signal can be determined from the TPS carriers and the configuration of the demodulator can be automatically updated to suit the signal. However, two settings that cannot be automatically updated are the Carrier mode and Guard interval, which must always be set manually. Any changes to Modulation scheme, FEC code rates, and hierarchy modes will be detected automatically and the system configuration updated accordingly.

Hierarchical Modes

The RFM210 can provide hierarchical demodulation. It can provide two different MPEG transport streams with different FEC rates simultaneously from the same COFDM input signal. In Non-Hierarchical mode, the secondary ASI and SPI Transport Stream outputs provide the same HP (high priority) out. When the unit is set to receive a Hierarchical transmission, the HP and LP Transport streams will be output at their respective ASI and SPI output connectors.

Transport Stream (TS) Output

Once the transport stream has been error-corrected and descrambled by the FEC chip, it is routed via the output drivers to the rear 25-pin D-type connectors for SPI (LVDS) outputs and BNC connectors for ASI Outputs. The transport stream outputs are presented on the LVDS outputs as parallel data in SPI format, allowing simple connection to a variety of equipment.

Two pairs of outputs are available: In a hierarchical mode, the HP stream appears at the sockets labelled HP and the LP stream appears simultaneously at the sockets labelled LP. When the receiver is operating in a non-hierarchical mode, both outputs provide the same (HP) transport stream.

Forward Error Correction (FEC)

The RFM210 provides (inner) Viterbi decoding, de-interleaving, energy dispersal (de-scrambling) and (outer) Reed-Solomon decoding.

BER

The RFM210 provides a measure of errors, via the various BER indications on the front panel display. The BER and UCE monitoring applies to the high priority (HP) stream when hierarchical modes are being used. The receiver can also provide BER data, via the remote control RS232/Ethernet port, for remote logging on a PC or terminal. The data is in the form of easily readable ASCII characters.

Channel Monitoring

The receiver provides channel-monitoring information derived from internal processing. BNC sockets on the rear of the receiver labelled “X/TRIG”, “Y/W”, and “Z” provide analog outputs for connecting to an oscilloscope for display of either constellation diagram when the unit is configured for Constellation Mode or channel state information when configured in Channel State Mode. Specify the Constellation Mode or Channel State Mode using the front panel or remotely via the RS232/Ethernet control port.

Measurement Facilities

The RFM210 receiver provides measurement of the COFDM carriers in the RF domain. These are essentially I and Q parameters defined by the ETSI Report, TR 101 290 and are achieved through DSP analysis. Further information is available in *COFDM IQ Signal Analysis* on page 4-1.

Remote Control RS232 Serial Port

The receiver provides a 9-pin D-type socket for RS232 connection to interface with the software running on a PC (or terminal) for data logging and unit configuration. Handshaking can be enabled or disabled by the setting of an internal switch.

Ethernet Port

An Ethernet port provides remote control and data reporting over an Ethernet network. This has the advantage of remote access capability without the need for a dedicated RS232 serial connection. For further information, see *Appendix C, Ethernet Setup* on page C-1.

***NOTE**. The RS232 serial port and Ethernet interface cannot both be active at the same time. The remote communications option under the* System Configuration *menu option on the front panel is used to select whether to enable RS232 or Ethernet communication.*

Alarm Inputs/Outputs

Alarm monitoring capability is provided through the rear panel Alarm ports. See *Alarms* on page 5-49 for more information.

Certifications and Compliances

Table 6-3: Certifications and compliances

Category	Standards or description	
EC Declaration of Conformity - EMC	Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:	
	EN 55103	Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use.
	Environment	E2 - commercial and light industrial
	Part 1 Emission	
	EN 55022	Class B radiated and conducted emissions
	EN 55103-1, Annex A	Radiated magnetic field emissions
	EN 55103-1, Annex B	Inrush current
	Part 2 Immunity	
	IEC 61000-4-2	Electrostatic discharge immunity
	IEC 61000-4-3	RF electromagnetic field immunity
	IEC 61000-4-4	Electrical fast transient / burst immunity
	IEC 61000-4-5	Power line surge immunity
	IEC 61000-4-6	Conducted RF Immunity
	IEC 61000-4-11	Voltage dips and interruptions immunity
	EN 55103-2, Annex A	Radiated magnetic field immunity
	EN 61000-3-2	AC power line harmonic emissions
Australia / New Zealand Declaration of Conformity - EMC	Complies with EMC provision of Radiocommunications Act per the following standard(s):	
	AS/NZS 2064.1/2	Industrial, Scientific, and Medical Equipment: 1992
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits.	
EC Declaration of Conformity - Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:	
	Low Voltage Directive 73/23/EEC, amended by 93/68/EEC	
	EN 61010-1/A2:1995	Safety requirements for electrical equipment for measurement control and laboratory use.
U.S. Nationally Recognized Testing Laboratory Listing	UL3111-1	Standard for electrical measuring and test equipment.
Canadian Certification	CAN/CSA C22.2 No. 1010.1	Safety requirements for electrical equipment for measurement, control, and laboratory use.

Table 6-3: Certifications and compliances (cont.)

Category	Standards or description	
Additional Compliance	UL3111-1	Standard for electrical measuring and test equipment.
	ISA S82.02.01:1999	Safety standard for electrical and electronic test, measuring, controlling, and related equipment.
	IEC61010-1/A2:1995	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Installation (Overvoltage) Category Descriptions	Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:	
	CAT III	Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location.
	CAT II	Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected.
	CAT I	Secondary (signal level) or battery operated circuits of electronic equipment.
Pollution Degree Descriptions	A measure of the contaminates that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.	
	Pollution Degree 1	No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
	Pollution Degree 2	Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
	Pollution Degree 3	Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
	Pollution Degree 4	Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.
Equipment Type	Test and measuring	
Safety Class	Class 1 (as defined in IEC 61010-1, Annex H) - grounded product	
Overvoltage Category	Overvoltage Category II (as defined in IEC 61010-1, Annex J)	
Pollution Degree	Pollution Degree 2 (as defined in IEC 61010-1). Note: Rated for indoor use only.	

Appendices

Appendix A: RFM210 Functional Check Procedure

This procedure provides a quick confidence check that the RFM210 is operating properly.

Part A – Local Operation

1. Connect the RFM210 to a suitable mains power supply, observing correct safety grounding.
2. For the following tests, ensure that the DVB-T Test RF Source channel bandwidth matches the RFM210 channel bandwidth. This means that an RFM210 Option B6 needs a 6 MHz source, an RFM210 Option B7 needs a 7 MHz source, and an RFM210 Option B8 needs an 8 MHz source. The RFM210 will not operate with the wrong bandwidth source.
3. If the DVB-T Test RF Source is driven by an external MPEG Transport Stream (TS) ensure that the TS rate matches that required by the modulator. This is very important. Refer to operator instructions for the specific modulator.
4. Set the DVB-T Test Source RF output level to meet the RFM210 RF input operational window of –45 dBm to –70 dBm. This can be done either by adjusting the Test Source output level or by adding external attenuation pads.
5. Connect the DVB-T RF Test Source to the RFM210 RF Input. Select **Int Tuner** on the RFM210 **Input/Output Options Menu**. See the *Input/Output Options Menu* on page 5–21.
6. DVB-T allows many different parameter settings. The RFM210 will sense and automatically adjust for most of these. Three manual settings must be made, however:
   a. Channel number, observing offsets if appropriate (for example Ch 50, 50L, or 50U);
   b. Guard Interval (GI): 1/32, 1/16, 1/8, or ¼;
   c. COFDM Carrier Mode: 2K or 8K

   The settings may be made either on the test source or on the RFM210. It is only important that the Test Source and the RFM210 are set the same. Refer to the *DVB Options Menu* on page 5–13 for information on how to change these parameters in the RFM210.
7. Check that the **END Calibration** mode is disabled. Enter the **Monitoring Menu**, and the **IQ Measurements** screen will appear. Press **ENTER**; this

will bring up the DSP setup menu. Scroll down (up/down arrows) until a screen appears **Calibration – Disabled on CHxx**. If it says **Calibration – Enabled** select the disable mode.

***NOTE**. END (Equivalent Noise Degradation) Calibration allows the MER and SNR readings to be adjusted to match a reference receiver. It does not uncalibrate the RFM210 in any way. The purpose of disabling this mode is to allow comparison to a typical RFM210. For more information on END Calibration, see page 5-51 in* Calibration Mode*.*

---

8. Return to the main screen by pressing the **ESCAPE** key one or more times. A properly operating RFM210 should show:

a. Selected Channel number.

b. The **Carrier Level** bar graph should have one or more of the seven squares filled solid. If all of the squares are empty, check that the RF source output level is on, that is it connected to the RFM210 "RF Input", that the proper RF signal level is applied to the RFM210 (see step 4 above), that both the test source and the RFM210 are set to the same channel (including offsets), and that the RFM210 is set to the "Internal Tuner" mode (see step 5 above). Try increasing the RF signal level by 20 dB (not to exceed –10 dBm). If there is still no reading, the RF tuner section may be faulty.

c. The bottom line of the screen will alternate between MER, SNR, and BER. Typical readings for a properly functioning RFM210 are:

Good - If MER ≈32dB and BER ≈2.0e-05 then operation is normal.

Concern - If MER ≈32dB and BER ≈1.67e-02, this implies the system has an incorrect signal level or possibly a small number of interfering carriers.

Concern - If MER ≪32dB check for improper input signal level or interfering carriers.

***NOTE**. The MER and SNR readings are strongly affected by the quality of the RF Test Source. The figures given above are for a laboratory grade modulator, such as the Rohde and Schwarz SFQ. Lower quality sources, or operational feeds from HPAs will provide lower MER values.*

If a **Unit not in Sync** readout appears, check that:

- All DVB-T parameters are properly set on the Test Source and RFM210 (see step 6 above);

- A proper rate MPEG TS is feeding the modulator/test source (see step 3 above);
- An RF signal is applied to the **RF input** and that a proper "Carrier Level" is indicated on the RFM210 display (see step 8**b** above).

9. (Optional) Connect a standard VGA monitor to the RFM210 rear panel **VGA** connector. A display similar to that shown in Figure A-1 should appear.

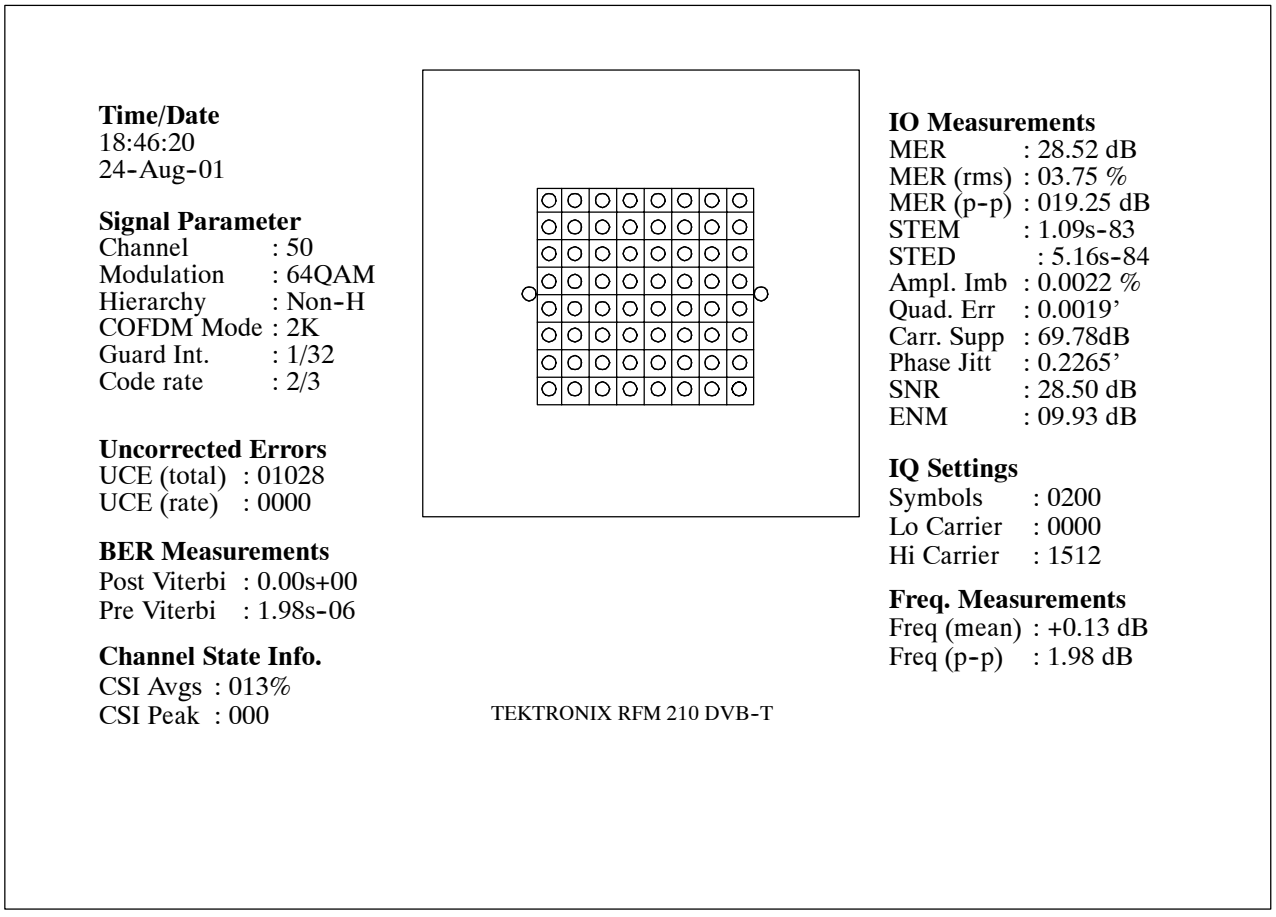


Figure A-1: Example of output to VGA monitor

10. (Optional) If possible, connect an MPEG decoder and picture monitor to the HP ASI output of the RFM210. Verify that a proper picture sequence (no blocking artifacts or decoder freezes) is observed.

11. If proper operation cannot be achieved, the RFM210 may be faulty. Contact your Tektronix Service Support specialist for assistance.

Part B – Remote Operation

The RFM210 is designed for remote operation using SNMP Protocol. Physical connections to the RFM210 are by the rear panel 10base-T ethernet port.

Problems in interoperating with the RFM210 are often caused by:

- Mis-matched IP addresses, between the supervisor and RFM210
- Remote communications set to RS232 port instead of Ethernet

To check and adjust the RFM210 IP address, see Appendix C *Ethernet Setup and Operation*. The IP address can also be checked and adjusted from the RFM210 front panel, using the **System Options** menu, as described on page 5-19.

To check that the RFM210 ethernet port is enabled for remote communications:

- Enter the **System Options Menu**. Scroll down until the **Remote Comms** screen is active. Check that **Ethernet** is selected.

If difficulty is still encountered with remote operation, please contact your Tektronix Service Support Specialist for assistance.

Appendix B: RS232 Remote Control

To control the receiver remotely, connect a straight through serial cable between the **Serial Port** (see Figure B–1) on the rear of the receiver and the RS232 port (COM port) of a PC or other terminal. The communications protocol is: 38400-baud, no parity, 8 data bits, 1 stop bit (38400,N, 8, 1).

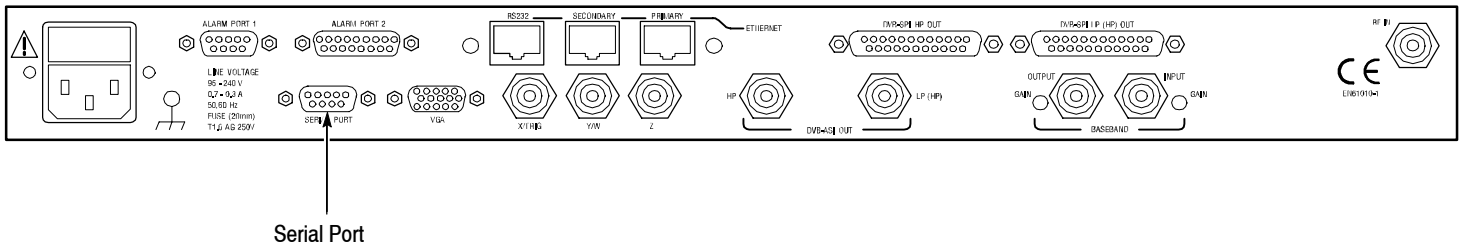


Figure B-1: Location of RS232 serial port on rear panel

Serial Commands

All of the serial commands begin with an ASCII 2 character <STX> and end with an ASCII 3 character <ETX>. The command itself is a three-character string (in UPPER CASE).

The commands divide into two broad types.

Get commands	Interrogate the unit to obtain information on configuration and operational status, or to obtain measurements of signal quality.
Set commands	Tell the unit the required configuration to be adopted.

The following is a list (in alphabetical order) of the commands available:

Get command functions	**Command Trigram**
Get open collector alarms setting	GAL
Get open collector alarm status	GAT
Get BER > Viterbi Measurement	GAV
Get BER results command	GBR
Get BER < Viterbi Measurement	GBV
Get Bandwidth Setting	GBW

Get command functions	Command Trigram
Get CSI average command	GCA
Get MER corrected channel	GCC
Get constellation response command	GCD
Get COFDM setting command	GCF
Get current channel setting	GCH
Get clock setting command	GCL
Get constellation setting command	GCN
Get common phase on/off setting command	GCP
Get channel response measurement command	GCR
Get configuration setup command	GCS
Get DVB settings command	GDB
Get correction enabled command	GDF
Get DSP settings command	GDS
Get DSP firmware version command	GDV
Get equalizer window setting command	GEQ
Get correction factor command	GFF
Get change flag command	GFL
Get mean & pk-pk frequency command	GFR
Get Flash setting command	GFS
Get fault log entry command	GFT
Get guard interval setting command	GGI
Get high carrier setting command	GHC
Get HP FEC setting command	GHP
Get hierarchy setting command	GHR
Get Unit ID command	GID
Get Input Source command	GIP
Get IQ measurement command	GIQ
Get low carrier setting command	GLC
Get lock status	GLK
Get LP FEC setting command	GLP
Get carrier level command	GLV
Get modulation command	GMD
Get MER measurement loop setting	GML
Get monitor output setting command	GMO

Get command functions	Command Trigram
Get open collector alarm trip values	GOC
Get current IQ data command	GOD
Get ASI output mode	GOP
Get all preset channels command	GPC
Get preset channel used command	GPR
Get preset channel setting command	GPS
Get power supply status	GPW
Get receiver/monitor mode command	GRX
Get single carrier setting command	GSC
Get serial number command	GSN
Get spectrum setting	GSP
Get synchronization command	GSS
Get number of symbols command	GSY
Get tuning scheme command	GTN
Get temperature command	GTP
Get transport stream setting command	GTS
Get unit cumulative UCE command	GUC
Get UCE measurement	GUE
Get unit identification command	GUI
Get firmware version command	GVS

Set command functions	Command Trigram
Set open collector alarms configuration	SAL
Set clear fault log command	SCA
Set COFDM setting command	SCF
Set current channel setting command	SCH
Set clock command	SCL
Set constellation setting command	SCN
Set common phase correction on/off command	SCP
Set LCD contrast command	SCT
Set correction enabled command	SDF
Set unit to download mode command	SDN
Set equalizer setting command	SEQ

Set command functions	Command Trigram
Set correction factor value command	SFF
Set guard interval command	SGI
Set high carrier setting command	SHC
Set HP FEC setting command	SHP
Set hierarchy setting command	SHR
Set input source command	SIP
Set low carrier setting command	SLC
Set unit locked/unlocked command	SLK
Set LP FEC setting command	SLP
Set mod option setting command	SMD
Set MER measurement loop	SML
Set monitor output setting command	SMO
Set open collector alarm trip values	SOC
Set ASI output mode command	SOP
Set to preset channel command	SPR
Set preset channel setting command	SPS
Set reset UCE counter command	SRS
Set receiver/monitor mode command	SRX
Set single carrier number command	SSC
Set spectrum command	SSP
Set number of symbols command	SSY
Set tuning scheme command	STN
Set transport stream setting command	STS
Set unit identification command	SUI
Set XY output setup command	SXY

Command String Format

Command with data

<STX><CMD><(><DATA><)><XSM><ETX>

Command without data

<STX><CMD><!><XSM><ETX>

Where:

Item	Description	No. bytes	ASCII	Dec	Hex
STX>	Command start	1 byte		02	02h
<CMD>	Command	3 bytes	See note 1		
<(>	Data field start	1 byte	(	40	28h
<DATA>	Data fields	1 – 15 bytes			
<)>	Data field terminator	1 byte	)	41	29h
<!>	No data fields	1 byte	!	33	21h
<XSM>	Checksum	3 bytes	See note 2		
<ETX>	Command end	1 byte		03	03h

Note:

1. **Command is a 3 byte ASCII character string.**
2. **Checksum is a 3 byte ASCII decimal representation of the computed checksum value (Refer to *Checksum Calculation* procedure for further details), e.g. Checksum 123 decimal is sent as ASCII characters '1' '2' '3'.**

Reply String Format

Reply with data

<STX><CMD><(><DATA><)><XSM><ETX>

Reply without data

<STX><CMD><REP><XSM><ETX>

Where:

Item	Description	No. bytes	ASCII	Dec	Hex
<STX>	Command start	1 byte		02	02h
<CMD>	Command	3 bytes	See note 1		
<(>	Data field start	1 byte	(	40	28h
<DATA>	Data fields	1 bytes			
<)>	Data field terminator	1 byte	)	41	29h
<REP>	Acknowledge reply	1 byte	&	33	21h
	Invalid command		*	42	2Ah
	Invalid checksum		%	37	25h
	Invalid data		$	36	24h
<XSM>	Checksum	3 bytes	See note 2		
<ETX>	Command end	1 byte		03	03h

Note:

1. **Command is a 3 byte ASCII character string.**
2. **Checksum is a 3 byte ASCII decimal representation of the computed checksum value (Refer to *Checksum Calculation* procedure for further details), e.g. Checksum 123 decimal is sent as ASCII characters '1' '2' '3'.**

Checksum Calculation

The command and reply string checksum is the 2's complement of the 8-bit addition of the string bytes from command start ("!") up to and including the data field terminator (either or "!"). The checksum is appended to the string as a 3 byte ASCII decimal representation of the computed checksum value.

Example 1: Set Channel to 50 with no offset

Item	ASCII Character	Hex Value
Command starts	<STX>	02h
Command byte 1	S	53h
Command byte 2	C	43h
Command byte 3	H	48h
Data field start	(	28h
Data field 1	5	35h
Data field 2	0	30h
Data field 3	2	32h
Data field terminator	)	29h
Addition of string bytes		1C8h
Only want lsb of addition (AND FF)		C8h
2's complement (Invert + 1)		38h
Decimal equivalent		56

Therefore complete command string is:

```
<STX> S C H ( 502 ) 0 5 6 <ETX>
```

Bypassing Checksum Calculation

Because most communication protocols incorporate checksums into the transmission protocol, you can send commands to the RFM210 without calculating a checksum as part of the command string while maintaining a high degree of confidence that the command is transmitted properly.

To send a command to the RFM210 without calculating a checksum, substitute three question marks (? – ASCII $3F_h$) for the checksum string in the command string.

Creating Command Files

You can save time sending remote commands to the RFM210 by saving command strings in files which you then transfer to the RFM210. You will need to use a text editor that can edit the file in hex mode.

To create a command string file:

1. Launch your text/hex editor.
2. Change editor mode to hex.
3. Enter the STX character, “0x2”.
4. Switch the editor to text mode.
5. Enter the desired command (a three-byte ASCII command, for example GCR - Get channel response measurement).
6. Switch the editor to hex mode.
7. Enter the ETX character, “0x3”.
8. Save the file.

Once you have saved the file, you can use a program such as HyperTerminal to send the file to the RFM210 instead of typing the command string from your terminal program.

Operator Command Descriptions

The following section lists the RFM210 serial control commands. The commands are listed in alphabetical order with the following format:

Command Command description

Data fields (Data field list)
Data field descriptions and permissible values

Reply data fields (If command requests data, reply data fields are listed here)
Reply data field descriptions and permissible values

Example

Command	Command string with example data fields
Reply	If command requests data, reply string with example data fields
Description	Details on the outcome of sending the command or reply
Note	Any additional notes.

GAL Get open collector alarms setting

Data fields (A, B)

Reply data fields (A , B , C D E F G H I J K L M N O P Q R S T)

A = Alarm Type 0 – relays
1 – O/C Alarms
2 – Log Alarms

B = Alarm Number 1 – 2 Relays, Log Alarms
1 – 8 O/C Alarms

C = 1/0 – Alarm set/not set to indicate on MER failure.
D = 1/0 – Alarm set/not set to indicate on MER(rms) failure.
E = 1/0 – Alarm set/not set to indicate on MER(peak) failure.
F = 1/0 – Alarm set/not set to indicate on AI failure.
G = 1/0 – Alarm set/not set to indicate on QE failure.
H = 1/0 – Alarm set/not set to indicate on CS failure.
I = 1/0 – Alarm set/not set to indicate on phase jitter failure.
J = 1/0 – Alarm set/not set to indicate on Signal to noise failure.
K = 1/0 – Alarm set/not set to indicate on STEM failure.
L = 1/0 – Alarm set/not set to indicate on STED failure.
M = 1/0 – Alarm set/not set to indicate on Frequency (pk-pk) failure.
N = 1/0 – Alarm set/not set to indicate on Frequency (mean) failure.
O = 1/0 – Alarm set/not set to indicate on pre-viterbi BER ratio failure.
P = 1/0 – Alarm set/not set to indicate on post-viterbi BER ratio failure.
Q = 1/0 – Alarm set/not set to indicate on loss of sync.
R = 1/0 – Alarm set/not set to indicate on UCE failure.
S = 1/0 – Alarm set/not set to indicate on Unit Over temperature.
T = 1/0 – Alarm set/not set to indicate on Power Supply failure.

Example

Command	<STX> G A L (0 , 1) <Xsm> <ETX>
Reply	<STX> G A L (0 , 1 , 010100101000100100) <Xsm> <ETX>
Description	Relay 1 is set to activate on either MER(rms) fail, AI fail, phase jitter fail, STEM fail, pre-viterbi BER fail, or UCE fail.
Note	The levels at which each alarm fails are set independently using the command SOC (see below).

GAT Get alarm trip status

Data fields (A , B)

Reply data fields (A , B , C D E F G H I J K L M N O P Q R S T)

A = Alarm Type
- 0 – Relays
- 1 – O/C Alarms
- 2 – Log Alarms

B = Alarm Number
- 1 – 2 Relays, Log Alarms
- 1 – 8 O/C Alarms

C = 1/0 – MER above/below failure threshold.
D = 1/0 – MER (rms) above/below failure threshold.
E = 1/0 – MER (peak) above/below failure threshold.
F = 1/0 – Amplitude Imbalance above/below failure threshold.
G = 1/0 – Quadrature Error above/below failure threshold.
H = 1/0 – Carrier Suppression above/below failure threshold.
I = 1/0 – Phase Jitter above/below failure threshold.
J = 1/0 – SNR above/below failure threshold.
K = 1/0 – STEM above/below failure threshold.
L = 1/0 – STED above/below failure threshold.
M = 1/0 – Frequency (pk-pk) above/below failure threshold.
N = 1/0 – Frequency (mean) above/below failure threshold.
O = 1/0 – Pre-viterbi BER ratio above/below failure threshold.
P = 1/0 – Post-viterbi BER ratio above/below failure threshold.
Q = 1/0 – Loss of sync/sync OK.
R = 1/0 – Uncorrected errors above/below failure threshold.
S = 1/0 – Unit Over temperature above/below failure threshold.
T = 1/0 – One or more power rails has failed.

Example

Command	<STX> G A T (0 , 1) <Xsm> <ETX>
Reply	<STX> G A T (0 , 1 , 010100101000100100) <Xsm> <ETX>
Description	The following parameters are outside the limits set in Relay 1: MER(rms) fail, AI, phase jitter, STEM, pre-viterbi BER, and UCE.
Note	A failure indication will be given only if the alarm is enabled.

GAV Get BER after Viterbi

Data fields None

Reply data fields (A)
A – BER after Viterbi Measurement (or “Lost Sync”)

Example

Command	<STX> G A V ! <Xsm> <ETX>
Reply	<STX> G A V (1.32e-07) <Xsm> <ETX>
Description	BER After Viterbi = 1.32×10^{-7}

GBR Get Current BER & other measurements

Data fields (A.AAe-AA , B.BBe-BB , CCC , DDD , EEEE, FFFFF, G)
A.AAe-AA = Pre-Viterbi BER
B.BBe-BB = Post-Viterbi BER
CCC = CSI Average Measurement
DDD = CSI Peak Measurement
EEEE = UCE Measurement
FFFFF = Cumulative UCE Measurement
G = Carrier Level (0 – 8)

Example

Command	<STX> G B R ! <Xsm> <ETX>
Reply	<STX> G B R (9.39e-04,0.00e+00,015,000,0000,12034,8) <Xsm> <ETX>
Description	Pre-Viterbi BER = 9.39e-04; Post-Viterbi BER = 0; CSI Average = 15; CSI Peak = 0; UCE = 0; Cumulative Errors = 12034; Carrier Level = 8

GBV Get BER before Viterbi

Data fields None

Reply data fields (A)
A – BER before Viterbi Measurement (or “Lost Sync”)

Example

Command	<STX> G B V ! <Xsm> <ETX>
Reply	<STX G B V (1.67e-02) <Xsm> <ETX>
Description	BER Before Viterbi = 1.67×10^{-2}

GBW Get Bandwidth Command

Data fields None

Reply data fields (A)
A = 6 – bandwidth is 6 MHz.
A = 7 – bandwidth is 7 MHz.
A = 8 – bandwidth is 8 MHz.

Example

Command	<STX> G B W ! <Xsm> <ETX>
Reply	<STX> G B W (8) <Xsm> <ETX>
Description	Bandwidth setting is 8 MHz.

GCA Get CSI average

Data fields None

Reply data fields (AAA)
AAA = CSI average (in %)

Example

Command	<STX> G C A ! <Xsm> <ETX>
Reply	<STX> G C A (055) <Xsm> <ETX>
Description	CSI average reading is 55%.

GCC Get Corrected Channel for MER measurements

Data fields None

Reply data fields (AAB)
AA = Channel on which calibration has been done
B = 1 – calibrated channel has lower offset
B = 2 – calibrated channel has no offset
B = 3 – calibrated channel has upper offset

Example

Command	<STX> G C C ! <Xsm> <ETX>
Reply	<STX> G C C (502) <Xsm> <ETX>
Description	MER calibration was done when set to channel 50 with no offsets.
Note	If calibration has not yet been done the unit will respond with the data field (XXX).

GCD Get Constellation measurement

Data fields None

Reply data fields (A)
A = 2 – Channel response measurement already in progress – command ignored
A = 3 – Constellation measurement started
A = 4 – Loss of sync occurred – measurement aborted (monitor mode only)
A = 5 – DSP Time out error occurred
A = 6 – Error in reply string from DSP
A = 7 – Unit set to Channel State – command ignored

Example

Command	<STX> G C D ! <Xsm> <ETX>
Reply	<STX> G C D (3) <Xsm> <ETX>

Description	Constellation measurement started
Note	Unit will reply immediately with A = 2 or A = 3. If in monitor mode and sync is lost when command is sent the unit will reply with A = 4. If in monitor mode and sync is lost at any time before measurements are complete, unit will reply with A = 4. If a timeout error occurs (i.e. DSP does not respond within the expected time period, unit will reply with A = 5. If the reply string from the DSP is corrupted, unit will reply with A = 6. On successful measurement the unit will transmit a series of 6096 bytes without the command and checksum structure. The first 4 bytes of this stream are check bytes, ASCII value CC(hex).

GCF Get COFDM mode setting

Data fields None

Reply data fields (A)
A = 1 - COFDM carrier mode 2K
A = 2 - COFDM carrier mode 8K

Example

Command	<STX> G C F ! <Xsm> <ETX>
Reply	<STX> G C F (1) <Xsm> <ETX>
Description	COFDM carrier mode set to 2K

GCH Get channel setting

Data fields None

Reply data fields (AAB)
AA – Current channel setting
B – Offset (1 (L) , 2 (None) , or 3 (U))

Example

Command	<STX> G C H ! <Xsm> <ETX>
Reply	<STX> G C H (5 0 2) <Xsm> <ETX>
Description	Channel Setting = 50 Offset = No offset
Note	If the selected channel table does not allow offsets, the offset indication will be 2

GCL Get clock setting

Data fields None

Reply data fields (AA : BB : CC DD – EEE – FF)
AA – hours (24 hour clock) 00 to 23
BB – minutes 00 to 59
CC – seconds 00 to 59
DD – day 01 to 31 (max value depends on month setting)
EEE – month (Jan, Feb, Mar, etc.)
FF – year 00 to 99

Example

Command	<STX> G C L ! <Xsm> <ETX>
Reply	<STX> G C L (11:57:00 07-Sep-01) <Xsm> <ETX>
Description	Time - 11:57 exactly Date - 7 September 2001

GCN Get constellation setting

Data fields None

Reply data fields (A)
A = 1 – Constellation mode single carrier
A = 2 – Constellation mode all carriers

Example

Command	<STX> G C N ! <Xsm> <ETX>
Reply	<STX> G C N (2) <Xsm> <ETX>
Description	Constellation mode set to all carriers

GCP Get common phase correction setting

Data fields None

Reply data fields (A)
A = 1 – Common phase correction off
A = 2 – Common phase correction on

Example

Command	<STX> G C P ! <Xsm> <ETX>
Reply	<STX> G C P (2) <Xsm> <ETX>
Description	Common phase correction on.

GCR Get Channel response measurement

Data fields None

Reply data fields (A)
A = 2 – Channel response measurement started
A = 3 – Constellation measurement already in progress – command ignored
A = 4 – Loss of sync occurred – measurement aborted (monitor mode only)
A = 5 – DSP Time out error occurred
A = 6 – Error in reply string from DSP
A = 7 – Unit set to Channel State – command ignored

Example

Command	<STX> G C R ! <Xsm> <ETX>
Reply	<STX> G C R (2) <Xsm> <ETX>
Description	Channel response measurement started
Note	Unit will reply immediately with A = 2 or A = 3. If in monitor mode and sync is lost when command is sent the unit will reply with A = 4. If in monitor mode and sync is lost at any time before measurements are complete, unit will reply with A = 4. If a timeout error occurs (i.e. DSP does not respond within the expected time period, unit will reply with A = 5. If the reply string from the DSP is corrupted, unit will reply with A = 6. On successful measurement the unit will transmit a series of 4788 bytes without the command and checksum structure. The first 4 bytes of this stream are check bytes, ASCII value BB(hex).

Channel Response Stream = Start word = BBBBBBBB (in hexadecimal) + 1196 words, where each word is four inverted bytes with the following relationship:

```
Word = (first_byte + 256*second_byte + 65536*third_byte
fourth_byte*16777216)/10^6.
```

The first 341 words of the Channel Response Stream (after the start word) form the sampled Frequency Response for 7.6MHz of bandwidth. The next 341 words of the Channel Response Stream form the sampled Group Delay for 7.6MHz of bandwidth. The next 512 words after the Group Delay conform the Impulse Response for a period of time of 35.7us. And the last two words are the Mean Value of the frequency Response and the Peak-to-Peak Value of the Frequency Response in dB.

To transform the Mean Value into dB apply the following formula:

```
Mean Value (dB) = 20*Log10 (Mean Value)
```

To transform the Frequency Response into dB apply the following formula:

```
Frequency response (dB) = 20*Log10 (Normalized Frequency
Response)

Normalized Frequency Resp = Frequency Resp/Normalization
Factor
```

Modulation Scheme	Hierarchical	Normalization Factor
QPSK		sqrt(2)
16-QAM	a = 1	sqrt(10)
	a = 2	sqrt(20)
	a = 4	sqrt(52)
64-QAM	a = 1	sqrt(42)
	a = 2	sqrt(60)
	a = 4	sqrt(108)

GCS Get Configuration Settings

Data fields

(A, B, C, D, E, F, G, H)
A = Phase Correction Enabled/Disabled;
B = Equalizer Window Setting;
C = Spectrum Setting;
D = Tuner/Baseband Setting;
E = TS O/P setting (188/204 byte);
F = Burst/Byte Mode;
G = Get Monitor O/P setting (constellation/channel state);
H = Lock Status

Example

Command	<STX> G C S ! <Xsm> <ETX>
Reply	<STX> G C S (2, 2, 2, 1, 2, 1, 1, 0) <Xsm> <ETX>
Description	Common Phase Enabled; Equalizer Window Centered; Inverted Spectrum; Tuner Input; 204 Byte Output; Burst Output; Constellation Monitoring; Unit Not Locked.

GDB DVB Setting

Data fields

(AAA , B , C , D , E , F, G)
AAA = Channel Setting
B = Modulation Setting
C = HP FEC Setting
D = LP FEC Setting
E = Hierarchy FEC Setting
F = COFDM Mode Setting
G = Guard Interval Setting

Example

Command	<STX> G D B ! <Xsm> <ETX>
Reply	<STX> G D B (502, 3, 2, 2, 1, 1, 1) <Xsm> <ETX>
Description	DVB Settings As Follows: Channel 50, no offset; 64QAM; HP FEC rate 2/3; LP FEC rate 2/3; Non - Hierarchical;2K; 1/32 GI.
Note	See Individual 'Get' commands for values and meanings of parameters

GDF Get MER correction enable setting

Data fields

None

Reply data fields

(A)
A = 0 – Correction off
A = 1 – Correction on

Example

Command	<STX> G D F ! <Xsm> <ETX>
Reply	<STX> G D F (1) <Xsm> <ETX>
Description	MER Correction enabled.
Note	If correction has been enabled but the channel is tuned away from the calibrated channel, correction will be disabled and the command will return 0.

GDS Get DSP Setup

Data fields (AAAA, BBBB, CCCC, D, EEE, FFFF, G)
AAAA = Lo Carrier Setting
BBBB = Hi Carrier Setting
CCCC = No. Symbols Setting
D = Calibration Enabled/Disabled
EEE = Calibrated Channel
FFFF = Correction Factor
G = Rx/Tx Mode

Example

Command	<STX> G D S ! <Xsm> <ETX>
Reply	<STX> G D S (0000 , 1512 , 0200, 1, 433, 30.5, 1) <Xsm> <ETX>
Description	Lo Carrier = 0, Hi Carrier = 1512, No. Symbols = 200; Calibrated on channel 43U, factor 30.5, Receiver Mode.

GDV Get DSP firmware version

Data fields None

Reply data fields (FWAAAA Rev BB)
AAAA = Firmware number
BB = Revision number

Example

Command	<STX> G D V ! <Xsm> <ETX>
Reply	<STX> G D V (FW0721 Rev 01) <Xsm> <ETX>
Description	DSP firmware number FW0721 Rev 01.

GEQ Get equalizer window setting

Data fields None

Reply data fields (A)
A = 1 - equalizer window left aligned
A = 2 - equalizer window centered

Example

Command	<STX> G E Q ! <Xsm> <ETX>
Reply	<STX> G E Q (1) <Xsm> <ETX>
Description	Equalizer window left aligned

GFF Get correction factor setting

Data fields None

Reply data fields (AA.A)
AA.A = Correction factor to 1 decimal place

Example

Command	<STX> G F F ! <Xsm> <ETX>
Reply	<STX> G F F (30.0) <Xsm> <ETX>
Description	Correction factor = 30.0

GFL Get Change Flag Value

Data fields (AA)
AA = Change Flag (Hex Format)
Bit 0 : DVB parameter changed (Channel, Modulation, HP/LP FEC rate, Hierarchy, COFDM Mode, Guard Interval)
Bit 1 : Configuration Change (Phase Correction Enabled/Disabled, Equalizer Window setting, Spectrum Setting, Clock setting)
Bit 2 : I/O Change (Tuner/Baseband Input, 188/204 byte TS, Packet/ Burst mode change)
Bit 3 : DSP Setup Change (Number of symbols, Hi/Lo carrier setting, Calibration enabled/disabled or level changed, Rx/Tx mod change)
Bit 4 : Relay Setup Change
Bit 5 : Open collector alarm Setup Change
Bit 6 : Log Setup Change

Example

Command	<STX> G F L ! <Xsm> <ETX>
Reply	<STX> G F L (17) <Xsm> <ETX>
Description	Following Changes since last GFL command: DVB Change; Configuration Change; I/O Change; Relay Setup Change.
Note	Flag is reset on power up and after each GFL command

GFR Get mean & pk-pk frequency values

Data fields None

Reply data fields (A.A , BB.BBB)
A.A – Pk–Pk frequency value
BB.BBB – Mean frequency value

Example

Command	<STX> G F R ! <Xsm> <ETX>
Reply	<STX> G F R (3.0 , -0.100) <Xsm> <ETX>
Description	Pk-Pk frequency = 3.0dB Mean frequency = -0. 1 dB
Note	The frequency values are updated each time a channel response measurement is done. If the command is sent before a channel response measurement has been completed the command returns zero for both values.

GFS Get Flash Setting

Data fields None

Reply data fields (A)
A = 1 – Current firmware running from LO Flash
2 – Current firmware running from HI Flash

Example

Command	<STX> G F S ! <Xsm> <ETX>
Reply	<STX> G F S (2) <Xsm> <ETX>
Description	Firmware running from HI Flash

GFT Get logged fault details

Data fields (AA)
AA = 00 – 99 – Selected fault. 00 returns the latest fault logged.
99 returns the 100th most recent fault.

Reply data fields (BBBB , CC , D , E , FFFFFFFFF, GGGGGGGG , HHHHHHHHH)

BBBB = 0000 – 9999.
Logged fault number. When the fault number reaches 9999, the next fault will cause it to scroll back to 0000.

CC = Alarm type, values follow the same format as those for the open collector alarm outputs. See command SAL.
01 – MER.
02 – MER(rms).
03 – MER(peak).
04 – Amplitude Imbalance.
05 – Quadrature Error.
06 – Carrier suppression.
07 – Phase Jitter.
08 – SNR.
09 – STEM.
10 – STED.
11 – Frequency (pk–pk).
12 – Frequency (mean).
13 – Pre-viterbi BER.
14 – Post-viterbi BER.
15 – Loss of sync.
16 – Uncorrected Errors.
17 – Unit Over temperature.
18 – Power supply failure.

D = 0 – fault logged because fault cleared.
1 – fault logged because of parameter limit failure.

E = 0 – Parameter Warning occurred/cleared.
1 – Parameter Failure occurred/cleared.

FFFFFFFFFFF – Indicates the value of the parameter at the time the fault is logged. The string varies according the type of fault but is always 11 characters in length.

GGGGGGGG – Time fault was logged (HH:MM:SS)

HHHHHHHHH – Date fault was logged (DD–MMM–YY)

Example

Command	<STX> G F T (00) <Xsm> <ETX>
Reply	<STX>G F T(1032 , 14 , 1 , 1 , 5.88e-03, 11:18:21, 21-Aug-01) <Xsm> <ETX>

Description	Fault Log Number - 1032; Type of Fault - post-viterbi out of limits, critical fault; Parameter Value - 5.88×10^{-3}; Time - 11:18:21; Date - 21 Aug 01.
Note	The trip levels at which a fault is logged is determined by the current settings of the warning and fault alarm levels. The logged faults are stored in non-volatile memory so the stored results are not lost after power down. If no faults have been logged at the selected fault number, (for instance if the fault log has recently been cleared) the reply data field is "(No Fault Logged)".

GGI Get guard interval setting

Data fields None

Reply data fields (A)
A = 1 - Guard Interval = 1/32
A = 2 - Guard Interval = 1/16
A = 3 - Guard Interval = 1/8
A = 4 - Guard Interval = 1/4

Example

Command	<STX> G G I ! <Xsm> <ETX>
Reply	<STX> G G I (1) <Xsm> <ETX>
Description	Guard interval = 1/32

GHC Get high carrier setting

Data fields None

Reply data fields (AAAA)
AAAA = high carrier setting

Example

Command	<STX> G H C ! <Xsm> <ETX>
Reply	<STX> G H C (1512) <Xsm> <ETX>
Description	High carrier set to 1512

GHP Get HP FEC setting

Data fields None

Reply data fields (A)
A = 1 – HP FEC = 1/2
A = 2 – HP FEC = 2/3
A = 3 – HP FEC = 3/4
A = 4 – HP FEC = 5/6
A = 5 – HP FEC = 7/8

Example

Command	<STX> G H P ! <Xsm> <ETX>
Reply	<STX> G H P (1) <Xsm> <ETX>
Description	HP FEC setting – 1/2

GHR Get Hierarchy setting

Data fields None

Reply data fields (A)
A = 1 – Non Hierarchical
A = 2 – Alpha = 1
A = 3 – Alpha = 2
A = 4 – Alpha = 4

Example

Command	<STX> G H R ! <Xsm> <ETX>
Reply	<STX> G H R (1) <Xsm> <ETX>
Description	Set to non hierarchical

GID Get Unit Type

Data fields None

Reply data fields (RFM210 DVB-T)

Example

Command	<STX> G I D ! <Xsm> <ETX>
Reply	<STX> G I D (RFM210 DVB-T) <Xsm> <ETX>
Description	Product name.

GIQ Get IQ measurement

Data fields None

Reply data fields (A)
A = 1 - IQ measurement started
A = 2 - Channel response measurement already in progress -command ignored
A = 3 - Constellation measurement already in progress - command ignored
A = 4 - Loss of sync occurred - measurement aborted (monitor mode only)
A = 5 - DSP Time out error occurred
A = 6 - Error in reply string from DSP
A = 7 - Unit is set to Channel State mode - command ignored

Example

Command	<STX> G I Q ! <Xsm> <ETX>
Reply	<STX> G I Q (1) <Xsm> <ETX>

Description	IQ measurement started
Note	Unit will reply immediately with A = 1, A = 2 or A = 3. If in monitor Mode and sync is lost when command is sent the unit will reply with A = 4. If in monitor mode and sync is lost at any time before measurements are complete, unit will reply with A = 4. If a timeout error occurs (i.e. DSP does not respond within the expected time period, unit will reply with A = 5. If the reply string from the DSP is corrupted, unit will reply with A = 6. After a successful measurement a further reply string with the following format is send containing the results of the measurement as detailed: <STX> G I Q (BB.BBBBBB, CC.CCCCCC, DD.DDDDDD, EE.EEEEEE, FF.FFFFFF, GG.GGGGGG, HH.HHHHHH, II.IIIIII, JJ.JJJJJJ, KK.KKKKKK, LLLLLLLL, MMMMMMMM, NNNNNNN) <Xsm> <ETX> BB.BBBBBB - Modulation Error Ratio - dB CC.CCCCCC - Modulation Error Ratio - rms DD.DDDDDD - Modulation Error Ratio - pk-pk EE.EEEEEE - System Target Error - mean FF.FFFFFF - System Target Error - deviation GG.GGGGGG - Amplitude Imbalance HH.HHHHHH - Quadrature Error II.IIIIII - Carrier Suppression JJ.JJJJJJ - Phase Jitter KK.KKKKKK - Signal to Noise Ratio LL.LLLLLL - Equivalent Noise Margin MMMMMMMM - Current Pre-Viterbi BER value (Scientific format) NNNNNNNN - Current Post-Viterbi BER value (Scientific format)

GLC Get low carrier setting

Data fields None

Reply data fields (AAAA)
AAAA = low carrier setting

Example

Command	<STX> G L C ! <Xsm> <ETX>
Reply	<STX> G L C (0000) <Xsm> <ETX>
Description	Low carrier set to 0

GLK Get unit lock status

Data fields None

Reply data fields (A)
A = 0 – Unit unlocked
A = 1 – Unit locked

Example

Command	<STX> G L K ! <Xsm> <ETX>
Reply	<STX> G L K (1) <Xsm> <ETX>
Description	Unit is locked

GLP Get LP FEC setting

Data fields None

Reply data fields (A)
A = 2 – LP FEC = 1/2
A = 3 – LP FEC = 2/3
A = 4 – LP FEC = 3/4
A = 5 – LP FEC = 5/6
A = 6 – LP FEC = 7/8

Example

Command	<STX> G L P ! <Xsm> <ETX>
Reply	<STX> G L P (1) <Xsm> <ETX>
Description	LP FEC setting - 1/2

GLV Get Carrier Level

Data fields None

Reply data fields (A)
A = 0 – 8 (indication of the number of bars filled on front panel carrier level display)

Example

Command	<STX> G L V ! <Xsm> <ETX>
Reply	<STX> G L V (6) <Xsm> <ETX>
Description	6 bars filled on front panel carrier level display (~-65 dBμV)

GMD Get modulation setting

Data fields None

Reply data fields (A)
A = 1 – modulation set to QPSK
A = 2 – modulation set to 16QAM
A = 3 – modulation set to 64QAM

Example

Command	<STX> G M D ! <Xsm> <ETX>
Reply	<STX> G M D (3) <Xsm> <ETX>
Description	modulation setting - 64QAM

GML Get MER measurement loop

Data fields None

Reply data fields (AAA , BBB , CCC)
AAA – Number of consecutive MER measurements (000 – 999).
BBB – Number of consecutive Channel Response Measurements (000 – 999).
CCC – Number of consecutive MER measurements with phase correction disabled (000 – 999).

Example

Command	<STX> G M L ! <Xsm> <ETX>
Reply	<STX> G M L (100 , 001 , 001) <Xsm> <ETX>
Description	Unit set to do 100 consecutive MER measurements with phase correction, followed by 1 Channel Response and 1 MER measurement with phase correction disabled.

GMO Get monitor output setting

Data fields None

Reply data fields (A)
A = 1 – Constellation
A = 2 – Channel State

Example

Command	<STX> G M O ! <Xsm> <ETX>
Reply	<STX> G M O (1) <Xsm> <ETX>
Description	monitor output setting – constellation

GOC Get Alarm Values Command

Data fields (A , B , CC)

Reply data fields (A , B , CC, DDDDDD)
AA – Alarm Number (01 – 10)
BB – Alarm parameter number (01 – 17)
CCCCCC – Current setting of parameter BB of alarm A. String length and format will vary according to parameter type and follows the format of the alarm setting command SOC.

Example

Command	<STX> G O C (0, 1 , 08) <Xsm> <ETX>
Reply	<STX> G O C (0 , 1 , 08 , 30.0) <Xsm> <ETX>
Description	Relay 1, parameter 8 (signal to noise ratio) currently set to 30dB.
Note	Alarm parameters 15 (sync status) and 18 (power supply status) are not settable. If these values are entered the command will return an invalid data response.

GOD Get Current IQ data command

Data fields None

Reply data fields (AA.AAAAAA, BB.BBBBBB, CC.CCCCCC, DD.DDDDDD, EE.EEEEEE, FF.FFFFFF, GG.GGGGGG, HH.HHHHHH, II.IIIIII, JJ.JJJJJ, KK.KKKKKK)
AA. AAAAAA – Modulation Error Ratio – dB
BB.BBBBBB – Modulation Error Ratio – rms
CC.CCCCCC – Modulation Error Ratio – pk – pk
DD.DDDDDD – System Target Area – mean
EE.EEEEEE – System Target Area – deviation
FF.FFFFFF – Amplitude Imbalance
GG.GGGGGG – Quadrature Error
HH.HHHHHH – Carrier Suppression
II.IIIIII – Phase Jitter
JJ.JJJJJ – Signal to Noise Ratio
KK.KKKKKK – Equivalent Noise Margin

Example

Command	<STX> G O D ! <Xsm> <ETX>
Reply	<STX> G O D (...) <Xsm> <ETX>
Description	Current IQ data
Note	If MER calibration is enabled and an invalid value for MER and Signal to Noise Ratio is calculated, the command returns the string "-1.000000" in the positions for MER and Signal to Noise Ratio.

GOP Get ASI output mode setting

Data fields None

Reply data fields (A)
A = 1 – ASI output in burst mode
A = 2 – ASI output in byte mode

Example

Command	<STX> G O P ! <Xsm> <ETX>
Reply	<STX> G O P (1) <Xsm> <ETX>
Description	ASI output set to burst mode

GPC Get all preset channels

Data fields None

Reply data fields (A , BBB , CCC , DDD , EEE , FFF , GGG)
A = Preset used setting (0 if current channel is not a preset channel, 1–6 if current channel is a preset channel)
BBB = Preset channel 1 setting
CCC = Preset channel 2 setting
DDD = Preset channel 3 setting
EEE = Preset channel 4 setting
FFF = Preset channel 5 setting
GGG = Preset channel 6 setting

Example

Command	<STX> G P C ! <Xsm> <ETX>
Reply	<STX> G P C (4 , 212 , 303 , 433 , 502 , 403 , 601) <Xsm> <ETX>
Description	Current channel is preset 4; Preset 1 is channel 21; Preset 2 is channel 30U; Preset 3 is channel 43U; Preset 4 is channel 50; Preset 5 is channel 40U; Preset 6 is channel 60L.

GPS Get preset channel setting

Data fields (A)
A = 1 to 6 – Get setting of selected preset channel

Reply data fields (A , B B C)
A = 1 to 6 – Selected preset channel
BB = Channel number
C = 1 – Channel set to lower offset
C = 2 – Channel set with no offset
C = 3 – Channel set to upper offset

Example

Command	<STX> G P S (1) <Xsm> <ETX>
Reply	<STX> G P S (1 , 502) <Xsm> <ETX>
Description	Preset channel 1 set to 50, no offset

GPW Get power supply status

Data fields None

Reply data fields (A B C D E F G H)
A – +28 V power rail status
B – +5 V power rail status
C – –12 V power rail status
D – +12 V power rail status
E – +5 V (analogue) power rail status
F – –5 V power rail status
G – +3.3 V power rail status
H – +2.5 V power rail status

Example

Command	<STX> G P W ! <Xsm> <ETX>
Reply	<STX> G P W (0 1 1 1 1 1 1 1) <Xsm> <ETX>
Description	+28 V rail fail, all others OK

GRX Get receiver mode setting

Data fields None

Reply data fields (A)
A = 0 – Unit set to monitoring mode
A = 1 – Unit set to receiver mode

Example

Command	<STX> G R X ! <Xsm> <ETX>
Reply	<STX> G R X (0) <Xsm> <ETX>
Description	Receiver set to monitor mode

GSC Get single carrier setting

Data fields None

Reply data fields (AAAA)
AAAA – Carrier number (0000 – 1704 – 2K)
(0000 – 6816 – 8K)

Example

Command	<STX> G S C ! <Xsm> <ETX>
Reply	<STX> G S C (1000) <Xsm> <ETX>
Description	carrier number 1000 selected

GSN Get serial number

Data fields None

Reply data fields (GB8CDDD)
C - unit bandwidth; either 6, 7 or 8
DDD – unit serial number

Example

Command	<STX> G S N ! <Xsm> <ETX>
Reply	<STX> G S N (GB88001) <Xsm> <ETX>
Description	unit serial number is GB88001

GSP Get Spectrum Setting

Data fields None

Reply data fields (A)
A = 1 – Spectrum Setting Normal
A = 2 – Spectrum Setting Inverted

Example

Command	<STX> G S P ! <Xsm> <ETX>
Reply	<STX> G S P (2) <Xsm> <ETX>
Description	Inverted Spectrum

GSS Get sync status

Data fields

(A)
A = 0 – Monitor Demodulator IC sync
1 – OP1/HP Demodulator IC sync
2 – OP2/LP Demodulator IC sync

Reply data fields

(ABCDEFG)
A = TPS 0 – not locked, 1 – locked
B = Frequency 0 – not locked, 1 – locked
C = Clk 0 – not locked, 1 – locked
D = FFT Window 0 – not locked, 1 – locked
E = Frame Sync 0 – not locked, 1 – locked
F = RS Decoder 0 – not locked, 1 – locked
G = Descrambler Sync 0 – not locked, 1 – locked

Example

Command	<STX> G S S ! <Xsm> <ETX>
Reply	<STX> G S S (111110) <Xsm> <ETX>
Description	TPS, Frequency, Clk, COFDM, and HP stream locked. LP stream not locked

GSY Get number of symbols setting

Data fields

None

Reply data fields

(AAAA)
AAAA – number of symbols – (0 – 9999)

Example

Command	<STX> G S Y ! <Xsm> <ETX>
Reply	<STX> G S Y (0200) <Xsm> <ETX>
Description	Number of symbols set to 200

GTN Get channel table setting

Data fields None

Reply data fields (AA)
AA = channel table setting

Example

Command	<STX> G T N ! <Xsm> <ETX>
Reply	<STX> G T N (01) <Xsm> <ETX>
Description	Channel table 1 is used.
Note	See the channel table section of the appendices for more details.

GTP Get unit temperature

Data fields None

Reply data fields (AA.A)
AA.A – temperature to 1 decimal place

Example

Command	<STX> G T P ! <Xsm> <ETX>
Reply	<STX> G T P (45.5) <Xsm> <ETX>
Description	Unit temperature is 45.5°C

GTS Get transport stream setting

Data fields None

Reply data fields (A)
A = 1 – transport stream set to 188 bytes
A = 2 – transport stream set to 204 bytes

Example

Command	<STX> G T S ! <Xsm> <ETX>
Reply	<STX> G T S (1) <Xsm> <ETX>
Description	Transport stream set to 188 bytes

GUC Get cumulative uncorrected error rate

Data fields

(A)
A = 0 – Monitor Demodulator IC cumulative errors
1 – OP1/HP Demodulator IC cumulative errors
2 – OP2/LP Demodulator IC cumulative errors

Reply data fields

(AAAAA)
AAAAA – total uncorrected errors

Example

Command	<STX> G U C (0) <Xsm> <ETX>
Reply	<STX> G U C (20353) <Xsm> <ETX>
Description	Number of uncorrected errors since last reset (or power up) on Monitor Demodulator IC is 20353.

GUE Get uncorrected error rate

Data fields

(A)
A = 0 – Monitor Demodulator IC error rate
1 – OP1/HP Demodulator IC error rate
2 – OP2/LP Demodulator IC error rate

Reply data fields

(AAAA)
AAAA – uncorrected error rate (updated every second)

Example

Command	<STX> G U E (0) <Xsm> <ETX>
Reply	<STX> G U E (0173) <Xsm> <ETX>
Description	Uncorrected error rate on Monitor Demodulator IC is 173 blocks per second.

GUI Get unit identification

Data fields None

Reply data fields (AAAAAAAAAA)
AAAAAAAAAA – Unit identification string (10 characters long).

Example

Command	<STX> G U I ! <Xsm> <ETX>
Reply	<STX> G U I (ABCDEFGHIJ) <Xsm> <ETX>
Description	Unit identification string is 'ABCDEFGHIJ'.
Note	The unit identification is set using command SUI. If no unit identification has been set the reply string is 10 spaces inside the brackets.

GVS Get microprocessor firmware version

Data fields None

Reply data fields (FWAAAA Rev BB)
AAAA = Firmware number
BB = Revision number

Example

Command	<STX> G V S ! <Xsm> <ETX>
Reply	<STX> G V S (FW0700 Rev 01) <Xsm> <ETX>
Description	Microcontroller firmware number is FW0700 Rev 01.

SAL Set Alarms Command

Data fields

(A , B , C D E F G H I J K L M N O P Q R S T)

A – Alarm Type
- 0 – relays
- 1 – O/C Alarms
- 2 – Log Alarms

B – Alarm Number
- 1 – 2 Relays, Log Alarms
- 1 – 8 O/C Alarms

C – Set Alarm to indicate on MER failure.
D – Set Alarm to indicate on MER(rms) failure.
E – Set Alarm to indicate on MER(peak) failure.
F – Set Alarm to indicate on AI failure.
G – Set Alarm to indicate on QE failure.
H – Set Alarm to set to indicate on CS failure.
I – Set Alarm to indicate on phase jitter failure.
J – Set Alarm to indicate on Signal to noise failure.
K – Set Alarm to indicate on STEM failure.
L – Set Alarm to indicate on STED failure.
M – Set Alarm to indicate on Frequency (pk-pk) failure.
N – Set Alarm to indicate on Frequency (mean) failure.
O – Set Alarm to indicate on pre-viterbi BER ratio failure.
P – Set Alarm to indicate on post-viterbi BER ratio failure.
Q – Set Alarm to indicate on loss of sync.
R – Set Alarm to indicate on UCE failure.
S – Set Alarm to indicate on Unit Over temperature.
T – Set Alarm to indicate on Power Supply failure.

Example

Command	<STX> S A L (01 , 010100101000100100) <Xsm> <ETX>
Description	Set alarm 1 to activate on either MER(rms) fail, AI fail, phase jitter fail, STEM fail, pre-viterbi BER fail, or UCE fail.
Note	The levels at which each alarm fails are set independently using the command SOC (see below).

SCA Set clear fault log

Data fields

None

Example

Command	<STX> S C A ! <Xsm> <ETX>
Description	Clear stored fault log.
Note	The first fault logged subsequent to entering this command will have the fault number 0000.

SCF Set COFDM Setting

Data fields

(A)
A = 1 – COFDM Setting 2K
A = 2 – COFDM Setting 8K

Example

Command	<STX> S C F (1) <Xsm> <ETX>
Description	Set COFDM mode to 2K.

SCH Set Channel

Data fields

(AAB)
AA – Channel Number
B – Offset (1 (L) , 2 (None) , 3 (U))

Example

Command	<STX> S C H (502) <Xsm> <ETX>
Description	Set Channel to 50, no offset.
Note	If the first 2 characters of the channel string entered do not match a channel in the selected channel table and invalid command is returned. If the selected channel table does not allow channel offsets the 3rd character in the string must be 2.

SCL Set Clock

Data fields

(YYYY,MM,DD,HH,MM,SS)
YYYY – year
MM – Month
DD – Day
HH – Hours (24 hour)
MM – Minutes
SS – Seconds

Example

Command	<STX> S C L (2001,04,06,17,09,00) <Xsm> <ETX>
Description	Set Clock to 17.09.00 on 6 April 2001.

SCN Set Constellation setting command

Data fields (A)
A = 1 – Single carrier
A = 2 – All carriers

Example

Command	<STX> S C N (1) <Xsm> <ETX>
Description	Set to single carrier

SCP Set phase correction on/off

Data fields (A)
A = 0 – phase correction disabled
A = 1 – phase correction enabled

Example

Command	<STX> S C P (1) <Xsm> <ETX>
Description	Enable phase correction

SCT Set LCD contrast

Data fields (AA)
AA = 0 – 50 LCD contrast setting

Example

Command	<STX> S C T (00) <Xsm> <ETX>
Description	Set contrast to 00 (maximum)
Note	Does not apply to units fitted with a vacuum-fluorescent display.

SDF Set enable IQ measurement correction

Data fields

(A)
A = 0 – correction disabled
A = 1 – correction enabled

Example

Command	<STX> S D F (1) <Xsm> <ETX>
Description	Enable correction of IQ measurements

SDN Set unit to download mode

Data fields

None

Example

Command	<STX> S D N ! <Xsm> <ETX>
Description	Entering this command sets the unit to download mode allowing firmware updates to be downloaded via the serial port. For more information about operating in the download mode and updating firmware via the serial port, refer to Appendix F.

SEQ Set equalizer setting

Data fields

(A)
A = 1 – Set equalizer to left–aligned
A = 2 – Set equalizer to centered

Example

Command	<STX> S E Q (1) <Xsm> <ETX>
Description	Set equalizer to left-aligned

SFF Set correction value

Data fields

(AA.A)
A = 25.0 – 35.0 – correction factor to 1 decimal place

Example

Command	<STX> S F F (30.0) <Xsm> <ETX>
Description	Set correction factor to 30.0
Note	Correction of MER and SNR will only be carried out when the unit is set to the same channel as when this command is entered.

SGI Set guard interval

Data fields

(A)
A = 1 – Set guard interval to 1/32
A = 2 – Set guard interval to 1/16
A = 3 – Set guard interval to 1/8
A = 4 – Set guard interval to 1/4

Example

Command	<STX> S G I (1) <Xsm> <ETX>
Description	Set Guard Interval to 1/32

SHC Set high carrier

Data fields

(AAAA)
AAAA = 0 – 5012 (2K mode)
AAAA = 0 – 6048 (8K mode)

Example

Command	<STX> S H C (1000) <Xsm> <ETX>
Description	Set high carrier setting to 1000
Note	High carrier setting must always be greater than low carrier setting.

SHP Set HP FEC

Data fields

(A)
A = 1 – HP FEC Set to 1/2
A = 2 – HP FEC Set to 2/3

A = 3 – HP FEC Set to 3/4
A = 4 – HP FEC Set to 5/6
A = 5 – HP FEC Set to 7/8

Example

Command	<STX> S H P (1) <Xsm> <ETX>
Description	Set HP to 1/2

SHR Set hierarchy

Data fields (A)
A = 1 – hierarchy set to non – hierarchical
A = 2 – hierarchy set to alpha = 1
A = 3 – hierarchy set to alpha = 2
A = 4 – hierarchy set to alpha = 4

Example

Command	<STX> S H R (1) <Xsm> <ETX>
Description	Set Hierarchy to non hierarchical

SIP Set input signal source

Data fields (A)
A = 1 – Input source – Internal Tuner
A = 2 – Input Source – External Baseband

Example

Command	<STX> S I P (1) <Xsm> <ETX>
Description	Set to internal tuner

SLC Set low carrier

Data fields (AAAA)
AAAA = 0 – 5012 (2K mode)
AAAA = 0 – 6048 (8K mode)

Example

Command	<STX> S L C (1000) <Xsm> <ETX>
Description	Set low carrier setting to 1000
Note	Low carrier setting must always be less than high carrier setting.

SLK Lock/Unlock Unit

Data fields

(A)
A = 0 – Set unit to unlocked
A = 1 – Set unit to locked

Example

Command	<STX> S L K (1) <Xsm> <ETX>
Description	Set Unit Status to Locked

SLP Set LP FEC

Data fields

(A)
A = 1 – LP FEC Set to 1/2
A = 2 – LP FEC Set to 2/3
A = 3 – LP FEC Set to 3/4
A = 4 – LP FEC Set to 5/6
A = 5 – LP FEC Set to 7/8

Example

Command	<STX> S L P (1) <Xsm> <ETX>
Description	Set LP to 1/2

SMD Set Modulation Setting

Data fields

(A)
A = 1 – Set modulation to QPSK
A = 2 – Set modulation to 16QAM
A = 3 – Set modulation to 64QAM

Example

Command	<STX> S M D (3) <Xsm> <ETX>
Description	Set modulation to 64QAM

SML Set MER measurement loop

Data fields

(AAA , BBB , CCC)
AAA – Number of consecutive MER measurements (000 – 999).
BBB – Number of consecutive Channel Response Measurements (000 – 999)
CCC – Number of consecutive MER measurements with phase correction disabled (000 – 999).

Example

Command	<STX> S M L (100,001,001) <Xsm> <ETX>
Description	Do 100 consecutive MER measurements with phase correction, followed by 1 Channel Response and 1 MER measurement with phase correction disabled.
Note	To disable the measurement loop enter 000 in each position. Each time the command is sent the loop resets to the beginning.

SMO Set monitor output

Data fields

(A)
A = 1 – Set monitor output to Constellation
A = 2 – Set monitor output to Chan State

Example

Command	<STX> S M O (1) <Xsm> <ETX>
Description	Set monitor output to constellation.

SOC Set Alarm Values Command

Data fields

(A , B , CC , DDDDDD)

A – Alarm Type
- 0 – relays
- 1 – O/C Alarms
- 2 – Log Alarms

B – Alarm Number
- 1 – 2 Relays, Log Alarms
- 1 – 8 O/C Alarms

CC – Parameter Number (01–17)

DDDDDD – New alarm level setting.

String type and range of valid values depends on the parameter to be set.

CC = 01 – valid range is 15.0 to 35.0
CC = 02 – valid range is 00.0 to 15.0
CC = 03 – valid range is 000.0 to 200.0
CC = 04 – valid range is 0.00e–01 to 5.00e–01
CC = 05 – valid range is 0.00e–01 to 5.00e–01
CC = 06 – valid range is 45.0 to 85.0
CC = 07 – valid range is 0.0 to 2.0
CC = 08 – valid range is 15.0 to 35.0
CC = 09 – valid range is 0.00e–00 to 2.50e–02
CC = 10 – valid range is 0.00e–00 to 1.00e–02
CC = 11 – valid range is 0.0 to 9.9
CC = 12 – valid range is 0.00e–00 to 3.00e–04
CC = 13 – valid range is 0.00e–00 to 5.32e–02
CC = 14 – valid range is 0.00e–00 to 1.75e–02
CC = 15 – parameter cannot be set
CC = 16 – valid range is 00 to 99
CC = 17 – valid range is 00 to 99

Example

Command	<STX> S O C (1 , 08 , 30.0) <Xsm> <ETX>
Description	Set alarm 1, parameter 8 (signal to noise ratio) to 30 dB.
Note	To enable/disable individual parameters of the open collector alarms use command SAL described above.

SOP Set ASI output mode

Data fields (A)
A = 1 – Set ASI output to packet mode
A = 2 – Set ASI output to burst mode

Example

Command	<STX> S O P (1) <Xsm> <ETX>
Description	Set ASI output to packet mode

SPR Set to preset channel

Data fields (A)
A = 1 – Set to preset channel 1
A = 2 – Set to preset channel 2
A = 3 – Set to preset channel 3
A = 4 – Set to preset channel 4
A = 5 – Set to preset channel 5
A = 6 – Set to preset channel 6

Example

Command	<STX> S P R (1) <Xsm> <ETX>
Description	Set unit to preset channel 1.

SPS Set Preset Channel

Data fields (A , BBC)
A = 1 – 6 – preset channel number
BB – channel number
C – Channel offset setting (1–L, 2–none, 3–U)

Example

Command	<STX> S P S (1 , 502) <Xsm> <STX>
Description	Set preset channel 1 to channel 50 with no offset.

SRS Reset UCE Counter

Data fields None

Example

Command	<STX> S R S ! <Xsm> <ETX>
Description	Reset UCE Counter.

SRX Set receiver/monitor mode

Data fields (A)
A = 0 – Set to monitor mode
A = 1 – Set to receiver mode

Example

Command	<STX> S R X (1) <Xsm> <ETX>
Description	Set to receiver mode.

SSC Set Single Carrier

Data fields (AAAA)
AAAA – Single Carrier Setting (0000 to 1704 – 2K),
(0000 to 6816 – 8K)

Example

Command	<STX> S S C (0999) <Xsm> <ETX>
Description	Set single carrier to 999.

SSP Set Spectrum Command

Data fields (A)
A = 1 – Normal Spectrum
A = 2 – Inverted Spectrum

Example

Command	<STX> S S P (2) <Xsm> <ETX>
Description	Set Spectrum to Inverted

SSY Set number of symbols

Data fields (AAAA)
AAAA – number of symbols (maximum 9999)

Example

Command	<STX> S S Y (0200) <Xsm> <ETX>
Description	Set number of symbols to 200.

STN Set channel table

Data fields (AA)
AA = channel table setting

Example

Command	<STX> S T N (01) <Xsm> <ETX>
Description	Set unit to use channel table 1.
Note	See the channel table section of the appendices for more details. If a table is selected that is not compatible with the hardware settings (as determined by the internal DIP switches), an invalid command response is returned.

STS Set transport stream setting

Data fields (A)
A = 1 – set output to 188 bytes
A = 2 – set output to 204 bytes

Example

Command	<STX> S T S (1) <Xsm> <ETX>
Description	Set transport stream to 188 bytes

SUI Set unit identification

Data fields (AAAAAAAAAA)

Example

Command	<STX> S U I (ABCDEFGHIJ) <Xsm> <ETX>
Description	Set unit identification to 'ABCDEFGHIJ'.
Note	The input string must always be 10 characters long and all characters must be printable ASCII characters. If the unit identification name is less then 10 characters the string should be padded out with spaces. The unit identification can be read back using command GUI

SXY Set XY Output

Data fields (A)
A = 0 – Set monitor output to Normal
A = 1 – Set monitor output to Disable

Example

Command	<STX> S M O (1) <Xsm> <ETX>
Description	Disable XY output to allow setup.
Note	This command is intended to help set the oscilloscope attached to the XY outputs or for set-up of the internal potentiometers to set zero offset. This command will not work if the unit is set to channel state mode.

Appendix C: Ethernet Setup and Operation

The RFM210 Ethernet Controller allows local area network control and monitoring over a 10base-T Ethernet connection. The control options include a sockets interface and SNMPv1.

Built-in facilities allow for local status monitoring of the Ethernet Controller and adjustment of several operating parameters.

Connection to the Ethernet controller network port is made by an RJ-45 socket, with a second RJ-45 socket for the RS232 Configuration and Monitoring Port.

The following sections of this appendix describe the basic essentials for connecting to and configuration of the Ethernet Controller.

How to Connect

Located on the RFM210 rear panel are two RJ-45 sockets. The primary Ethernet port is for connection to a 10base-T Ethernet network, using CAT-5 shielded cable. The second RJ-45 socket on the rear of the RFM210, labeled “Test”, is the Configuration and Monitoring port, which is an asynchronous serial port conforming to RS232 standards. Connection to this port is optional and provides access for setting the IP address, application monitoring, and firmware upgrades.

Connector pin assignments for the two ports appears in Figures C-1 and C-2. The connector pin wiring for the two ports is detailed in Tables C-1 and C-2. The primary Ethernet port conforms to 10base-T standards. The Test port implements a standard RS232 interface. There are no universal conventions for RJ-45 connectivity in RS232 applications, so a custom adaptor cable will likely need to be built.

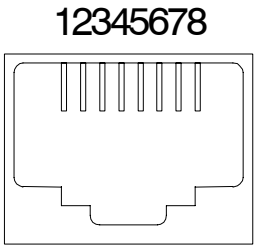


Figure C-1: Ethernet Port Pin Numbering

Table C-1: Primary Ethernet Port Pin Assignment

Pin	Description	Direction
1	TxD+	Output
2	TxD-	Output
3	RxD+	Input
4		
5		
6		
7		
8	TxD-	Input

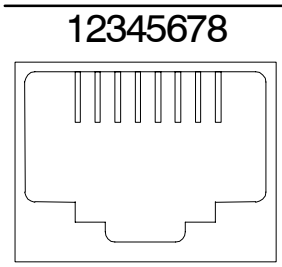


Figure C-2: Test Port Pin Numbering

Table C-2: Test Port Pin Assignment

Pin	Description	Direction
1	DCD	Output
2	TxD	Output
3	RxD	Input
4		
5	SGnd	Ref
6	DTR	Output
7	CTS	Input
8	RTS	Output

Using the Application Monitor

The Application Monitor is built-in function of the RFM210. The Application Monitor allows the current state of the Ethernet Controller to be monitored and allows various settings to be adjusted, for example the IP Address.

The Application Monitor is accessed via the **Test Port**, using a standard communications package (for example, Windows HyperTerminal) set to 38400 baud, no parity, 8 data bits, 1 stop bit, XON/XOFF handshake. This port is a standard asynchronous serial port conforming to RS232 standards. For connection details refer to *How to Connect* earlier in this appendix.

Once connection is established, pressing <enter> (ASCII character 13) will display the prompt **EC01>**. Typing "help" at the prompt followed by pressing <enter> returns a list of general commands, shown below:

```
EC01>

EC01> help

SNMP Station: general commands:

   help     - help with menus

   state    - show current station setup

   delay    - set milliseconds to wait between pings

   host     - set default active IP host

   length   - set default ping packet length

   quit     - quit station program

   trap     - send a test trap

   nvset    - set non-volatile parameters

   nvedit   - edit non-volatile parameters

   setip    - set interface IP address

   version  - display version information

   !command - pass command to OS shell

Also try ´help [general|diagnostic|net186|vfs|ping]´

EC01>
```

The "state" command is useful for determining the current IP address setting for the RFM210. Typing "state" at the prompt will return values similar to those shown below:

```
EC01> state

Station IP address for iface 0: 128.181.140.223

subnet mask       255.255.0.0

ping delay time:  1000 ms.

ping host:        0.0.0.0

current tick count 2299281

EC01>
```

Changing the IP Address with the Application Monitor

The IP address is used to uniquely identify each system connected to a network. It is more than likely that the IP address will need to be changed to suit the target network. Use the “state” command to determine the current IP address setting.

You can change the IP address two ways. One is to use the System Options menu, as described on page 5-19. The second way to change the IP address is to use the application monitor as detailed previously.

To change the IP address using the Application Monitor:

1. At the **EC01>** prompt enter **setip 111.111.111.111**↵
   where 111.111.111.111 is the required IP address.
2. At the **EC01>** prompt enter **nvset**↵
   this writes the new IP address into the non-volatile (NV) parameters data structure.
3. At the **EC01>** prompt enter **vfssync**↵
   this updates the new NV parameter settings in the virtual file system (VFS) held in flash memory.

To check the new IP address entered or to check the current setting:

- At the **EC01>** prompt enter **state**↵

The complete sequence of events for setting and checking the IP address is shown below.

```
EC01> setip 168.5.20.1

WARNING: ´setip´ will kill all current net connections!!!!

replacing net et1 IP address 192.9.200.100 with 168.5.20.1 in
RAM variables
```

```
Use "nvset" to back up to flash or disk

EC01> nvset

EC01> vfssync

VFS sync initiated

Erasing flash sector at 000D0000...

VFS sync completed

EC01> state

Station IP address for iface 0: 168.5.20.1

subnet mask       255.255.0.0

ping delay time:  1000 ms.

ping host:        0.0.0.0

current tick count 39473

EC01>
```

Upgrading Firmware

Occasional upgrades to the Ethernet controller may be made over the lifetime of the RFM210. Contact Tektronix for the availability of upgrades and for the upgrade procedure.

Appendix D: RFM210 MIB

This chapter describes the elements of the RFM210 MIB. Before adding your RFM210 to your network, check with your network administrator to ensure the TCP port 10005 and SNMP port 161 are available.

To access the RFM210, it must be set to Ethernet mode. If the RFM210 is not set to Ethernet mode, you will not be able to access the unit remotely.

For making SNMP Get requests, ensure that the SNMP software is configured as "public". When making SNMP Set requests, you must ensure that the SNMP software is set as "private".

RFM210 MIB Definitions

The following imports are included:

Module-Identity, Object-Type, Notification-Type, Integer 32, enterprises from SNMPv2-SMI

Textual-Conventions, RowStatus, DisplayString from SNMPv2-TC

Module-Compliance, Object Groups from SNMPv2-Conf

Object Descriptions

Descriptions for Group and Table are as follows:

tek	OBJECT IDENTIFIER ::= { enterprises 128 }
rfm	OBJECT IDENTIFIER ::= { tek 100 }
rfmproducts	OBJECT IDENTIFIER ::= { rfm 1 }
rfmmibs	OBJECT IDENTIFIER ::= { rfm 2 }
rfm210	OBJECT IDENTIFIER ::= { rfmproducts 1 }

The MIB module tables describe the control statements for the RFM210. The management information base tables begin with the MIB Definitions

Group Descriptions

Descriptions for Groups are as follows:

rfm210Objects	OBJECT IDENTIFIER ::= { rfm210MIB 1 }
infoGroup	OBJECT IDENTIFIER ::= { rfm210Objects 1 }
measurementGroup	OBJECT IDENTIFIER ::= { rfm210Objects 2 }
dvbSettingsGroup	OBJECT IDENTIFIER ::= { rfm210Objects 3 }
dspSettingsGroup	OBJECT IDENTIFIER ::= { rfm210Objects 4 }
devSettingsGroup	OBJECT IDENTIFIER ::= { rfm210Objects 5 }
presetsGroup	OBJECT IDENTIFIER ::= { rfm210Objects 6 }

```
statusGroup          OBJECT IDENTIFIER ::= { rfm210Objects 7 }
```

Object Type Definitions

Definitions of object type are as follows:

```
ASIOutputOptions     ::= INTEGER {burst(1), byte(2) }
BandWidthOptions     ::= {six_MHz(6), seven_MHz(7), eight_MHz(8) }
CarrierLevel         ::= INTEGER (0 . . 8)
CarrierOptions       ::= INTEGER { two_K(1), eight_K(2) }
ChannelNumber        ::= INTEGER (0 . . 99)
ChannelOffset        ::= INTEGER { lower(1), none(2), upper(3) }
EqualiserOptions     ::= INTEGER { left(1), centered(2) }
FECOptions           ::= INTEGER { fec_1-2(1), fec_2-3(2), fec_3-4(3), fec_5-6(4),
                     fec_7-8(5) }
FPLockOptions        ::= INTEGER { unlocked(0), locked(1) }
GuardIntervalOptions::= INTEGER { gi_1-32(1), gi_1-16(2), gi_1-8(3), gi_1-4(4) }
HierarchyOptions     ::= INTEGER { non-hierarchical(1), alpha_1(2), alpha_2(3), alpha_4(4) }
InputSourceOptions   ::= INTEGER { internal_tuner(1), external_baseband(2) }
ModulationOptions    ::= INTEGER { qpsk(1), qam16(2), qam64(3) }
MonitorOptions       ::= INTEGER { constellation(1), channel_state(2) }
PCOptions            ::= INTEGER { enabled(1), disabled(2) }
MERCorrOptions       ::= INTEGER { disabled(0), enabled(1) }
OperationalStatus    ::= INTEGER { fail(0), ok(1) }
PresetOptions        ::= INTEGER { no_preset(0), preset_1(1), preset_2(2), preset_3(3),
                      preset_4(4), preset_5(5), preset_6(6) }
ReceiverOptions      ::= INTEGER { monitoring(0), receiver(1) }
SpectrumOptions      ::= INTEGER { normal(1), inverted(2) }
SyncStatusOptions    ::= INTEGER { not_locked(0), locked(1) }
TSOptions            ::= INTEGER { ts_188_bytes(1), ts_204_bytes(2) }
InfoString           ::= OCTET STRING (SIZE(0 . . 25))
RealString           ::= OCTET STRING (SIZE(0 . . 9))
TimeDateString       ::= OCTET STRING (SIZE(0 . . 20))
```

Table D-1: RFM210 Information group

Object identifier	Object type
InfoGroup OBJECT IDENTIFIER ::= { rfm210Objects 1)	
mpuFirmware	
SYNTAX	InfoString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	MPU firmware number and revision
::= { infoGroup 1 }	
dspFirmware	

Table D- 1: RFM210 Information group (Cont.)

Object identifier	Object type
SYNTAX	InfoString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	DSP firmware number and revision
::= { infoGroup 2 }	
bandWidth	
SYNTAX	BandWidthOptions
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Bandwidth setting
::= { infoGroup 3 }	
modelNumber	
SYNTAX	InfoString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Unit model number
::= { infoGroup 4 }	
serialNumber	
SYNTAX	InfoString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Unit serial number
::= { infoGroup 5 }	
unitID	
SYNTAX	InfoString
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Unit identification string
::= { infoGroup 6 }	
unitTimeDate	
SYNTAX	TimeDateString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Unit time and date
::= { infoGroup 7 }	
enetFirmware	
SYNTAX	InfoString

Table D-1: RFM210 Information group (Cont.)

Object identifier	Object type
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Ethernet module firmware number and revision
::= { infoGroup 8 }	
buildStatus	
SYNTAX	InfoString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	RFM210 build status
::= { infoGroup 9 }	

Table D-2: RFM210 Measurement group

Object identifier	Object type
InfoGroup OBJECT IDENTIFIER ::= { rfm210Objects 2)	
modErrorRatioDB	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Modulation error ratio (dB) measurement
::= { measurementGroup 1 }	
modErrorRatioRMS	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Modulation error ratio (RMS) measurement
::= { measurementGroup 2 }	
modErrorRatioPP	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Modulation error ratio (p-p) measurement
::= { measurementGroup 3 }	
sysTgtErrorMean	
SYNTAX	RealString

Table D- 2: RFM210 Measurement group (Cont.)

Object identifier	Object type
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	System target error (mean) measurement
::= { measurementGroup 4 }	
sysTgtErrorDev	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	System target error (deviation) measurement
::= { measurementGroup 5 }	
ampImbalance	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Amplitude imbalance measurement
::= { measurementGroup 6 }	
quadError	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Quadrature error measurement
::= { measurementGroup 7 }	
carrierSuppression	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Carrier suppression measurement
::= { measurementGroup 8 }	
phaseJitter	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Phase jitter measurement
::= { measurementGroup 9 }	
signalToNoise	
SYNTAX	RealString
MAX-ACCESS	read-only

Table D- 2: RFM210 Measurement group (Cont.)

Object identifier	Object type
STATUS	current
DESCRIPTION	Signal to noise measurement
::= { measurementGroup 10 }	
equivNoiseMargin	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Equivalent noise margin measurement
::= { measurementGroup 11 }	
berPreViterbi	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	BER before Viterbi measurement
::= { measurementGroup 12 }	
berPostViterbi	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	BER after Viterbi measurement
::= { measurementGroup 13 }	
csiAverage	
SYNTAX	Integer (0 . . 99)
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Channel state information average reading
::= { measurementGroup 14 }	
csiPeak	
SYNTAX	Integer (0 . . 255)
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Channel state information peak reading
::= { measurementGroup 15 }	
cumulativeErrors	
SYNTAX	Integer
MAX-ACCESS	read-only
STATUS	current

Table D-2: RFM210 Measurement group (Cont.)

Object identifier	Object type
DESCRIPTION	Cumulative uncorrected error rate
::= { measurementGroup 16 }	
uncorrectedErrors	
SYNTAX	Integer
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Uncorrected error rate
::= { measurementGroup 17 }	
carrierLevel	
SYNTAX	CarrierLevel
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Nominal carrier level indication (0 = weak signal, 8 = strong signal)
::= { measurementGroup 18 }	
pkFrequency	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Peak-peak frequency measurement
::= { measurementGroup 19 }	
meanFrequency	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Mean frequency measurement
::= { measurementGroup 20 }	

Table D-3: RFM210 DVB Settings group

Object identifier	Object type
dvbSettingsGroup OBJECT IDENTIFIER ::= { rfm210Objects 3)	
channelNumber	
SYNTAX	ChannelNumber
MAX-ACCESS	read-write

Table D- 3: RFM210 DVB Settings group (Cont.)

Object identifier	Object type
STATUS	current
DESCRIPTION	Channel Number
::= { dvbSettingsGroup 1 }	
channelOffset	
SYNTAX	ChannelOffset
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Channel offset
::= { dvbSettingsGroup 2 }	
modulationMode	
SYNTAX	ModulationOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Modulation setting
::= { dvbSettingsGroup 3 }	
hpFECMode	
SYNTAX	FECOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	HP FEC setting
::= { dvbSettingsGroup 4 }	
lpFECMode	
SYNTAX	FECOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	LP FEC setting
::= { dvbSettingsGroup 5 }	
hierarchyMode	
SYNTAX	HierarchyOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Hierarchy setting
::= { dvbSettingsGroup 6 }	

Table D-3: RFM210 DVB Settings group (Cont.)

Object identifier	Object type
carrierMode	
SYNTAX	CarrierOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	COFDM carrier mode setting
::= { dvbSettingsGroup 7 }	
guardIntervalMode	
SYNTAX	GuardIntervalOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Guard Interval setting
::= { dvbSettingsGroup 8 }	

Table D-4: RFM210 DSP Settings group

Object identifier	Object type
dspSettingsGroup OBJECT IDENTIFIER ::= { rfm210Objects 4)	
lowCarrier	
SYNTAX	Integer (0 . . 6048)
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Low carrier setting
::= { dspSettingsGroup 1 }	
highCarrier	
SYNTAX	Integer (0 . . 6048)
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	High carrier setting
::= { dspSettingsGroup 2 }	
numberSymbols	
SYNTAX	Integer (0 . . 50000)
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Number of symbols setting
::= { dspSettingsGroup 3 }	

Table D- 4: RFM210 DSP Settings group (Cont.)

Object identifier	Object type
correctedChannel	
SYNTAX	Integer
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Corrected channel number for MER measurements
::= { dspSettingsGroup 4 }	
correctedOffset	
SYNTAX	ChannelOffset
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Corrected channel offset for MER measurements
::= { dspSettingsGroup 5 }	
correctionFactor	
SYNTAX	RealString
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Correction factor setting
::= { dspSettingsGroup 6 }	
merCorrectionMode	
SYNTAX	MERCorrOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	MER measurement correction setting
::= { dspSettingsGroup 7 }	
receiverMode	
SYNTAX	ReceiverOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Receiver mode
::= { dspSettingsGroup 8 }	

Table D- 5: RFM210 Device Settings group

Object identifier	Object type
devSettingsGroup OBJECT IDENTIFIER ::= { rfm210Objects 5)	
phaseCorrectionMode	
SYNTAX	PCOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Phase correction setting
::= { devSettingsGroup 1 }	
equaliserWindowMode	
SYNTAX	EqualiserOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Equaliser window setting
::= { devSettingsGroup 2 }	
spectrumMode	
SYNTAX	SpectrumOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Spectrum setting
::= { devSettingsGroup 3 }	
inputSourceMode	
SYNTAX	InputSourceOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Input signal source
::= { devSettingsGroup 4 }	
tsMode	
SYNTAX	TSOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Transport stream mode
::= { devSettingsGroup 5 }	
asiOutputMode	
SYNTAX	ASIOutputOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	ASI output mode
::= { devSettingsGroup 6 }	

Table D- 5: RFM210 Device Settings group (Cont.)

Object identifier	Object type
monitorMode	
SYNTAX	MonitorOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Monitor output mode
::= { devSettingsGroup 7 }	
fpLockMode	
SYNTAX	FPLockOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Front panel lock status
::= { devSettingsGroup 8 }	
merMeasurementCon	
SYNTAX	Integer (0 . . 999)
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	MER measurements (consecutive)
::= { devSettingsGroup 9 }	
merMeasurementCR	
SYNTAX	Integer (0 . . 999)
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	MER measurements (channel response)
::= { devSettingsGroup 10 }	
merMeasurementPC	
SYNTAX	Integer (0 . . 999)
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	MER measurements (phase correction)
::= { devSettingsGroup 11 }	

Table D- 6: RFM210 Presets group

Object identifier	Object type
presetsGroup OBJECT IDENTIFIER ::= { rfm210Objects 6)	
activePreset	
SYNTAX	PresetOptions
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Active preset channel
::= { presetsGroup 1 }	
preset1Channel	
SYNTAX	ChannelNumber
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 1 channel number
::= { presetsGroup 2 }	
preset1Offset	
SYNTAX	ChannelOffset
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 1 channel offset
::= { presetsGroup 3 }	
preset2Channel	
SYNTAX	ChannelNumber
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 2 channel number
::= { presetsGroup 4 }	
preset2Offset	
SYNTAX	ChannelOffset
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 2 channel offset
::= { presetsGroup 5 }	
preset3Channel	
SYNTAX	ChannelNumber
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 3 channel number
::= { presetsGroup 6}	

Table D- 6: RFM210 Presets group (Cont.)

Object identifier	Object type
preset3Offset	
SYNTAX	ChannelOffset
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 3 channel offset
::= { presetsGroup 7 }	
preset4Channel	
SYNTAX	ChannelNumber
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 4 channel number
::= { presetsGroup 8 }	
preset4Offset	
SYNTAX	ChannelOffset
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 4 channel offset
::= { presetsGroup 9 }	
preset5Channel	
SYNTAX	ChannelNumber
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 5 channel number
::= { presetsGroup 10 }	
preset5Offset	
SYNTAX	ChannelOffset
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 5 channel offset
::= { presetsGroup 11 }	
preset6Channel	
SYNTAX	ChannelNumber
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 6 channel number
::= { presetsGroup 12 }	

Table D-6: RFM210 Presets group (Cont.)

Object identifier	Object type
preset6Offset	
SYNTAX	ChannelOffset
MAX-ACCESS	read-write
STATUS	current
DESCRIPTION	Preset 6 channel offset
::= { presetsGroup 13 }	

Table D-7: RFM210 Status group

Object identifier	Object type
statusGroup OBJECT IDENTIFIER ::= { rfm210Objects 7)	
psuStatus5VD	
SYNTAX	OperationalStatus
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	+5 V (digital) power supply status
::= { statusGroup 1 }	
psuStatus5VA	
SYNTAX	OperationalStatus
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	+5 V (analog) power supply status
::= { statusGroup 2 }	
psuStatus12V	
SYNTAX	OperationalStatus
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	+12 V power supply status
::= { statusGroup 3 }	
psuStatusN12V	
SYNTAX	OperationalStatus
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	-12 V power supply status
::= { statusGroup 4 }	

Table D-7: RFM210 Status group (Cont.)

Object identifier	Object type
psuStatusN5V	
SYNTAX	OperationalStatus
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	-5 V power supply status
::= { statusGroup 5 }	
psuStatus3V3	
SYNTAX	OperationalStatus
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	+3.3 V power supply status
::= { statusGroup 6 }	
psuStatus2V5	
SYNTAX	OperationalStatus
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	+2.5 V power supply status
::= { statusGroup 7 }	
psuStatus28V	
SYNTAX	OperationalStatus
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	+28 V power supply status
::= { statusGroup 8 }	
unitTemperature	
SYNTAX	RealString
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Unit temperature
::= { statusGroup 9 }	
syncstatusTPS	
SYNTAX	SyncStatusOptions
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Sync status (TPS)
::= { statusGroup 10 }	

Table D- 7: RFM210 Status group (Cont.)

Object identifier	Object type
syncStatusFrq	
SYNTAX	SyncStatusOptions
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Sync status (Frequency)
::= { statusGroup 11 }	
syncStatusClk	
SYNTAX	SyncStatusOptions
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Sync status (Clock)
::= { statusGroup 12 }	
syncStatusFft	
SYNTAX	SyncStatusOptions
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Sync status (FFT)
::= { statusGroup 13 }	
syncStatusFrm	
SYNTAX	SyncStatusOptions
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Sync status (Frame)
::= { statusGroup 14 }	
syncStatusFec2	
SYNTAX	SyncStatusOptions
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Sync status (FEC2)
::= { statusGroup 15 }	
syncStatusFec3	
SYNTAX	SyncStatusOptions
MAX-ACCESS	read-only
STATUS	current
DESCRIPTION	Sync status (FEC3)
::= { statusGroup 16 }	

Appendix E: Channel Tables

The RFM210 is usually supplied with the channel scheme setting applicable to the country in which the unit will be used. The RFM210 includes a number of channel tables which can be selected by using the serial command STN as described in the serial command description section of the manual.

To view the current channel table setting, go to the menu option under the Status Menu, which shows a summary of the unit configuration. The channel table is identified by a string (usually depicting the country of use) followed by a unique number.

The serial command GTN can also be used to obtain the current channel table selected and the reply cross-referenced to the list below.

A new channel table can only be selected by using the serial command STN. If the command attempts to set a channel table that is not fully compatible with the unit hardware an invalid command reply will be returned. In particular, the internal DIP switch SW1 settings for Channel Offsets and Band need to match the settings for the specific channel table. See Appendix H for information on setting the DIP switches.

Below is a description of the channel tables available. The list is subject to expansion with future firmware releases and customers specific requirements.

Serial Identifier	Channel Identifier	Channel Range	Tuner Band	Bandwidth	Offsets
01	UK010	21-69	UHF	8 MHz	167 kHz
02	UK011	21-69 + IF	UHF	8 MHz	167 kHz
03	AUS012	06-12	VHF	7 MHz	125 kHz
04	AUS013	28-69	UHF	7 MHz	125 kHz
05	USA008	02-69	UHF	6 MHz	No Offsets
06	IRE007	ID-IJ + 21-69	UHF	8 MHz	167 kHz

Appendix F: Firmware Upgrade Procedure

Firmware Upgrades for this product are available from Tektronix. If an upgrade is free, it is posted to the Tektronix website at http://www.tektronix.com/ . Please contact Tektronix for further download information.

Remote Download of Firmware

The unit has the ability to be upgraded in the field quickly and easily using the RS232 serial port. The main code is stored in Flash memory, which is divided into 2 sectors, HI and LO. The updated code is written to the currently unused sector while the current version retains its integrity. This means if any problems are encountered while downloading the new version of firmware (such as a loss of power or corrupted data) the unit will restart using the old firmware version. The new version will only be enabled after successful download. The new software can be downloaded using a commonly available serial communication package such as Windows HyperTerminal. On successful completion, the unit will reset and proceed as normal, using the new software version.

Procedure to download firmware update

1. First send the download command (SDN) as detailed in the following section to put the unit in download mode. The unit will respond with the message 'ERASE FLASH TO UPGRADE'. At this stage it is possible to abort the upgrade and return to normal operation using the serial command SFL. Alternatively it is possible to revert to a previous firmware version stored in the Flash. If the current firmware version is stored in the LO Flash and a previous version exists in the HI Flash, using the serial command SFL enables the previous version to be used if required. An alternative method of setting the unit to download mode is to hold down the four cursor keys on the front panel while powering up the unit. If this is done, the unit will give the option of confirming whether to enter download mode (by pressing **ENTER**), or cancel and run in normal mode (by pressing **ESCAPE**).

2. Once the erase command is entered (SER), the unit will respond with the message 'ERASING FLASH, PLEASE WAIT'. While this is displayed the unit is erasing either the HI or LO Flash, as appropriate. After a few seconds the display reads 'WAITING FOR DOWNLOAD', 'READY...', and the message 'WAITING FOR DOWNLOAD' is sent via the RS232 port.

3. At this stage the unit is ready to receive the new version of firmware. The file is of the Intel HEX format, which allows for error checking of the data as it is received. Any errors detected during download will be reported back as

detailed below. From Hyper terminal select the 'Transfer' pull down menu and then click on 'Send Text File'. Use the window to search for the 'XXX.Hex' file to download. The receivers display indicates the file is being downloaded with the message 'DOWNLOADING...', and a progress meter showing percentage complete. The LCD also indicates if the code is being written to the LO or HI Flash. If any errors are encountered during programming, the display will indicate the address and nature of the fault. After the file has been downloaded, the unit will reset using the new version of firmware.

4. If there were any errors during the download, the unit will reboot running the original version. At this stage it is possible to try the download again. If an error does occur during download, to save time it is possible to abort the procedure by cycling the power or activating the reset input on the status port. Alternatively the serial command (SRE), described below can be entered to activate the reset. The unit will boot up as normal running the original firmware at which stage the download procedure can be retried.

Remote Control of DVB-T receiver in Download Mode via RS232 connection

To control the receiver remotely, connect a 1 to 1 serial cable between "Serial Port" on the rear of the receiver and the RS232 port (COM port) of a PC or other terminal.

The communications protocol used: 38400-baud, no parity, 8 data bits, 1 stop bit (38400,N,8,1)

Serial Commands

All of the serial commands begin with an ASCII 2 character <STX> and end with an ASCII 3 character <ETX>. The command itself is a three-character string (in UPPER CASE).

The serial command structure in download mode is the same as for those in normal mode.

Command String Format

Command with data

```
<STX><CMD><(><DATA><)><XSM><ETX>
```

Command without data

```
<STX><CMD><!><XSM><ETX>
```

Where:

Item	Description	No. bytes	ASCII	Dec	Hex
STX>	Command start	1 byte		02	02h
<CMD>	Command	3 bytes	See note 1		
<(>	Data field start	1 byte	(	40	28h
<DATA>	Data fields	1 - 15 bytes			
<)>	Data field terminator	1 byte	)	41	29h
<!>	No data fields	1 byte	!	33	21h
<XSM>	Checksum	3 bytes	See note 2		
<ETX>	Command end	1 byte		03	03h

Note:

1. **Command is a 3 byte ASCII character string.**
2. **Checksum is a 3 byte ASCII decimal representation of the computed checksum value (Refer to *Checksum Calculation* procedure for further details), e.g. Checksum 123 decimal is sent as ASCII characters '1' '2' '3'.**

Reply String Format

Reply with data

<STX><CMD><(><DATA><)><XSM><ETX>

Reply without data

<STX><CMD><REP><XSM><ETX>

Where:

Item	Description	No. bytes	ASCII	Dec	Hex
<STX>	Command start	1 byte		02	02h
<CMD>	Command	3 bytes	See note 1		
<(>	Data field start	1 byte	(	40	28h
<DATA>	Data fields	1 bytes			
<)>	Data field terminator	1 byte	)	41	29h
<REP>	Acknowledge reply	1 byte	&	33	21h
	Invalid command		*	42	2Ah
	Invalid checksum		%	37	25h
	Invalid data		$	36	24h
<XSM>	Checksum	3 bytes	See note 2		
<ETX>	Command end	1 byte		03	03h

Note:

1. **Command is a 3 byte ASCII character string.**
2. **Checksum is a 3 byte ASCII decimal representation of the computed checksum value (Refer to *Checksum Calculation* procedure for further details), e.g. Checksum 123 decimal is sent as ASCII characters '1' '2' '3'.**

Checksum Calculation

The command and reply string checksum is the 2's complement of the 8 bit addition of the string bytes from command start ("!") up to and including the data field terminator (either ')' or '!'). The checksum is appended to the string as a 3 byte ASCII decimal representation of the computed checksum value.

Example 1: Set Channel to 50 with no offset

Item	ASCII Character	Hex Value
Command starts	<STX>	02h
Command byte 1	S	53h
Command byte 2	C	43h
Command byte 3	H	48h
Data field start	(	28h
Data field 1	5	35h
Data field 2	0	30h
Data field 3	2	32h
Data field terminator	)	29h
Addition of string bytes		1C8h
Only want lsb of addition (AND FF)		C8h
2's complement (Invert + 1)		38h
Decimal equivalent		56

Therefore complete command string is:

```
<STX> S C H ( 502 ) 0 5 6 <ETX>
```

The following is a list of the commands available applicable to upgrading of Firmware:

Normal Mode	Set unit to download mode command	SDN
	Get Current Flash Sector Setting	GFS
Download Mode	Get Current Flash Sector Setting	GFL
	Get Bootload Version	GVS
	Erase Flash Sector (opposite to current Sector)	SER
	Set flash command	SFL
	Erase Flash Sector	SSE

SDN Set unit to download mode

Data fields None

Example

Command	<STX> S D N ! <Xsm> <ETX>
Description	Entering this command sets the unit to download mode allowing firmware updates to be downloaded via the serial port.
Note	This command is entered in normal mode to set the unit to download mode.

GFS Get current flash sector command (Normal Mode)

Data fields None

Reply data fields (A)
A = 1 – Unit running on LO flash sector
A = 2 – Unit running on HI flash sector

Example

Command	<STX> G F L ! <Xsm> <ETX>
Reply	<STX> G F L (1) <Xsm> <ETX>
Description	Current firmware version is stored in LO Flash sector.
Note	In this example, new firmware will be written to HI flash. This command is only applicable in normal mode. In download mode use command GFL.

GFL Get current flash sector command (Download Mode)

Data fields None

Reply data fields (A)
A = 0 – Unit not yet configured.
A = 1 – Unit running on LO flash sector
A = 2 – Unit running on HI flash sector

Example

Command	<STX> G F L ! <Xsm> <ETX>
Reply	<STX> G F L (1) <Xsm> <ETX>
Description	Current firmware version is stored in LO Flash sector.
Note	This means the new version to be downloaded will be written to HI Flash. This command is only applicable in download mode. In normal mode use command GFS.

GVS Get bootload firmware version

Data fields None

Reply data fields (FWAAAA Rev BB)
AAAA = Firmware number
BB = Revision number

Example

Command	<STX> G V S ! <Xsm> <ETX>
Reply	<STX> G V S (FW0722 Rev 02) <Xsm> <ETX>
Description	Bootload firmware number is FW0722 Rev 04.
Note	This command returns the bootload firmware and revision in download mode. In normal mode, the same command will return the Main micro firmware and revision.

SER Set Erase Flash command

Data fields None

Example

Command	<STX> S E R ! <Xsm> <ETX>
Reply	(none)
Note	Entering this command Erases the flash in the opposite sector to the current firmware sector. For example, in the current firmware is stored in the LO sector, this command will result in the HI sector being erased. It is necessary to use this command before downloading new firmware. This ensures the integrity of the previous version is preserved in case the user wants to use the old version rather that download a new version.

SFL Set Flash Sector Erase command

Data fields (A)
A = 1 – Set to LO Flash
2 – Set to HI Flash

Example

Command	<STX> S F L (1) <Xsm> <ETX>
Description	Set to run code in LO flash.
Note	This command will return the unit to normal mode using code in the specified sector.

SSE Set Flash Sector Erase command

Data fields (A)
A = 1 – Erase LO Flash
2 – Erase HI Flash

Example

Command	<STX> S S E (1) <Xsm> <ETX>
Reply	(none)
Description	Erase LO flash sector.
Note	This command will not normally be required. For normal download use the command SER. This command is required when for example, it is desired to erase the current firmware version while retaining the integrity of a previous version.

Appendix G: Cleaning and Maintenance

This appendix describes general care for the RFM210 DVB-T Measurement Receiver.

- *Preventative Maintenance* provides cleaning instructions.
- *Repacking for Shipment* gives instructions for packing and shipping the RFM210.

General Care

Protect the instrument from adverse weather conditions. The instrument is not waterproof.

CAUTION. *To avoid damage to the instrument, do not expose it to sprays, liquids, or solvents.*

Do not use chemical cleaning agents; they may damage the instrument. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

WARNING. *To avoid personal injury due to electric shock, power down and disconnect the RFM210 from the mains power source before performing any preventative maintenance. Disconnect all cables from the rear panel before performing maintenance.*

Preventive Maintenance

Preventive maintenance mainly consists of periodic cleaning. Periodic cleaning reduces instrument breakdown and increases reliability. You should clean the instrument as needed, based on the operating environment. Dirty conditions may require more frequent cleaning than computer room conditions.

Cleaning the Exterior

Clean the exterior surfaces of the instrument with a dry, lint-free cloth or a soft-bristle brush. If dirt remains, use a cloth or swab dampened with a 75% isopropyl alcohol solution. A swab is useful for cleaning in narrow spaces around the controls and connectors. Do not use abrasive compounds on any part of the instrument.

CAUTION. *Avoid getting moisture inside the instrument during external cleaning and use only enough solution to dampen the cloth or swab. Use a 75% isopropyl alcohol solution as a cleanser and rinse with deionized water.*

Repacking for Shipment

If an instrument is to be shipped to a Tektronix field office for repair, attach a tag to the instrument showing the following:

- Owner's name and address
- Serial number
- Description of the problem(s) encountered and/or service required.

The RFM210 DVB-T Measurement Receiver is shipped in cartons designed to provide it with the maximum protection. If you ship the instrument subsequently, you will need to use the original shipping material to provide adequate protection.

CAUTION. *To prevent the loss of your instrument's warranties, Tektronix strongly recommends that you use an actual RFM210 DVB-T Measurement Receiver shipping carton (that is in good condition) when you ship your instrument to another location or when you return the instrument to a Tektronix service center for repair.*

Tektronix cannot honor the instrument's warranties if the RFM210 arrives at the service center damaged and it was not shipped in its original carton or in a replacement carton (and its supporting packaging material) purchased from Tektronix. If you lose your original packaging material, contact your Tektronix representative to obtain replacement packaging.

Replacement Packaging

New packaging material is available from Tektronix. To obtain these items, contact your nearest Tektronix office or representative.

WARNING

The following servicing instructions are for use only by qualified personnel. To avoid injury, do not perform any servicing other than that stated in the operating instructions unless you are qualified to do so. Refer to all safety summaries before performing any service.

Appendix H: DIP Switch Settings

Some RFM210 settings are controlled by DIP switches located on the main circuit board. These settings cannot be accessed through the menu system and can only be changed by changing the DIP switch settings.

DIP Switch Function

Various semi-permanent hardware options are set via two 8-way DIP switches, SW1 and SW2, located on the main circuit board. The switch settings must be compatible with the particular channel table being used. The SW1 and SW2 switch functions are identified in Tables H–1 and H–2.

Table H-1: SW1 Switch Settings

Switch 1	**Switch 2**	**Tuner Bandwidth**
Off	Off	6 MHz
On	Off	7 MHz
Off	On	8 MHz
Switch 3	**Switch 4**	**Channel Offsets**
Off	Off	No Offsets
On	Off	167 kHz
Off	On	125 kHz
Switch 5	**Switch 6**	**Band**
Off	Off	UHF
On	Off	VHF
Off	On	wideband
On	On	Cable
Switch 7	**Switch 8**	**Attenuator**
Off	Off	No Attenuator
On	Off	10 dB Attenuator
Off	On	20 dB Attenuator

Table H-2: SW2 Switch Settings

Switch	On	Off	Function
1	38400	9600	Select serial baud rate
2			Reserved for Tektronix use
3			Reserved for Tektronix use
4	Enable	Disable	RS232 Handshaking
5			Reserved for Tektronix use
6			Reserved for Tektronix use
7			Reserved for Tektronix use
8			Reserved for Tektronix use

How to Change DIP Switch Settings

To change the RFM210 DIP switch settings:

WARNING. *To prevent injury from electrical shock, disconnect the RFM210 from its power source and all external cables before performing any service.*

1. If the RFM210 is installed in an instrument rack, remove it from the rack.
2. Remove the instrument cover.
3. Locate the switches on the main circuit board. See Figure H-1.

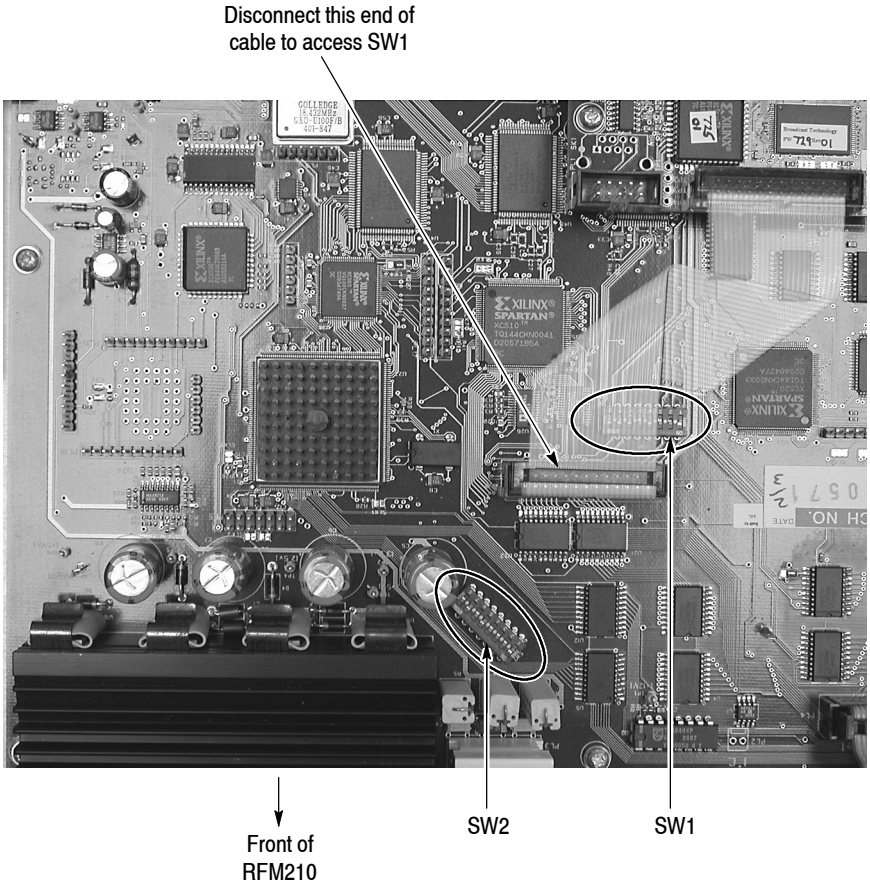


Figure H-1: Location of SW1 and SW2

4. To access SW1, disconnect the ribbon cable next to SW1 from the Main circuit board.
5. Set the SW1 and SW2 DIP switches as needed, according to Tables H–1 and H–2.
6. Reconnect the ribbon cable to the Main circuit board.
7. Reinstall the instrument cover.
8. Reinstall RFM210 in instrument rack if necessary.
9. Reconnect cables and power cord.