CELLMetric

Intelligent infrastructure

Radius 5 DVB-T /IP Transmitter Installation Guide

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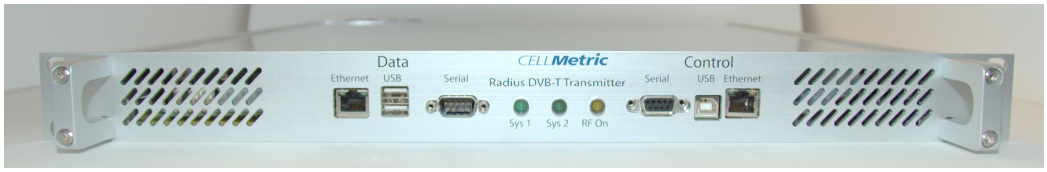
Introduction

Radius 5 is a DVB-T/H Transmitter station with Gigabit Ethernet Internet protocol input, DVB-T receiver input and ASI input. The IP Input data format is ProMPEG CoP 3 encoded.

The Radius 5 is designed to be rack mounted in an internal air conditioned environment. The unit is rated for operation in an ambient temperature range of 0 C to +40 C.
RF output power is +36 dBm (4 Watt COFDM) which provides a transmission range of several Km when used with a high gain transmit antenna mounted at a suitable location.



Getting Started

Objectives

The objectives of this guide are as follows:

- To provide an overview of Radius 5 Transmitter Station.
- To explain how to install and use the Radius 5 for correct and safe operation.
- To describe the physical and electrical features of the Radius 5 to a level necessary for routine maintenance.
- To describe the functions available in Radius 5 Remote Operation and how to access and use them via the web server graphical user interface (GUI).

Layout and Content

The user guide has a hierarchical structure of sections and sub-sections. It is suggested that after taking note of the safety advice, sections on the Radius 5 Unit, Power Supply, Connector Panel and DVB-T/H operation are read before attempting to operate the unit.

Documentation Conventions & Safety advice

Warning or Caution

This caution symbol is used to mark procedural information that could prevent damage to equipment or personnel or which is important to the equipment's correct operation.
Failure to understand and implement the information given may result in equipment failure or injury to personnel.

Electric Shock

This sign indicates safety procedures or advice relating to the presence of high voltages.

Advice & Suggestions

This information direction symbol is used to mark important non-safety critical advice and suggestions for operation of the Radius 5.

Radius 5 installation Manual

Warnings

Mains

The Radius 5 contains a mains voltage power supply. The mains supply must be disconnected from the Radius 5 prior to any work being carried out on the unit.

The Radius 5 requires a 220-240 Mains supply with earth, neutral and live at a current rating of 3A.

Casing Earth

The Radius 5 requires a safety earth strap from its earth stud on the rear panel to a hard earth point on the mounting rack.

RF

The Radius 5 generates RF energy at levels of up to +36 dBm in the band 470 MHz to 860 MHz. While RF burns from the output are unlikely, precautions should be taken to ensure that the Radius 5 is correctly grounded and that you do not touch the central conductor of the Output RF BNC type socket.

Antenna

The Modus 5 should always be connected to a 50 Ω antenna system before the mains power to the system is applied. Failure to comply with this requirement may result in damage to the Radius power amplifier. The Radius 5 power amplifier is not protected against high VSWR which will damage the output stage of the amplifier.

RF Transmission

The radius 5 is supplied with a 50Ω BNC Type antenna connector. In many countries it is illegal to transmit RF signals without an appropriate broadcast transmission licence. CellMetric strongly recommend that before undertaking any free to air transmission you obtain an appropriate broadcast licence.

No user serviceable parts

Radius 5 has no user serviceable parts internally. The casing should not be opened by untrained personnel. If the Radius 5 is believed to have malfunctioned then CellMetric should be consulted at support@cellmetric.co.uk or +44 1223 265571.

Overview of Radius 5 Capability

Radius 5 is a DVB-T Micro Transmitter with a 10/100/1000BaseT Ethernet IP interface.

Radius 5 is a self contained micro transmitter and contains the following:

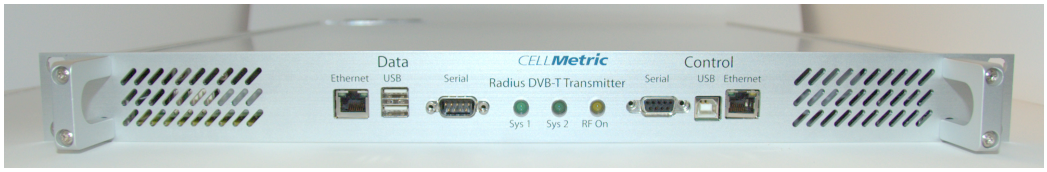
- ❒ Mains power supply
- ❒ IP Interface card with ProMPEG CoP 3 Transcoder
- ❒ COFDM Modulator
- ❒ RF Up converter
- ❒ RF Power Amplifier
- ❒ System controller card
- ❒ Air distribution fan
- ❒ Temperature Sensor

The Modus 5 takes an IP feed from its Ethernet input and transcodes this to DVB transport Stream format. It then modulates the transport stream to the EN300 477 standard for DVB-T or DVB-H. The modulated signal is then up-converted to the UHF band from 470 MHz to 860 MHz and the level amplified to +36 dBm (4 Watt).

Interfaces

The Radius has five key interface connectors:

❒ Mains Input	IEC Input
❒ IP Input data	RJ45 Input
❒ IP Control input	RJ45 Input
❒ RF Input	50 Ohm BNC Output
❒ ASI Input	75 Ohm BNC Input
❒ RF Output	BNC Type RF Connector



The Radius 5 has two IP one for control and one for data.

Control IP Port

The Control port is a 10/100 BaseT Ethernet port from which the Radius 5 web server can be accessed.

Data IP Port

The IP data interface is a Gigabit Ethernet port:

Contribution Feed of Transport Stream over IP using UDP, RTP and ProMPEG CoP 3 . Maximum transport stream bit rate for the feed to the Radius 5 is 30 Mbit/s.

Installation Instructions

Kit of parts

Each Radius 5 comes with the following components.

- ❒ Radius 5 1U enclosure
- ❒ Radius 5 mains cable
- ❒ Installation guide

Mounting the Radius 5

The Radius 5 is designed to be back mounted. The procedure for mounting the Radius 5 should be as follows:

- ❒ Unpack the Radius 5 system from its shipping carton
- ❒ Read the installation manual fully

- ❒  Mount the Radius 5 in a 19" rack mount enclosure. The Radius 5 must be mounted with support from the four mounting bolts at the front and also be mounted and supported from the rear.
- ❒  The Modus 5 is force air cooled from the front panel to the back of the unit. The rear of the unit must have a clear path for the exhaust cooling air. The air intake vents at the front of the unit must not be blocked.
- ❒  Fit an earth strap from the radius earthing point on the rear mounting bar to a suitable earth point on the mounting tower.
- ❒ Connect the transmit antenna to the BNC Type RF output connector
- ❒  A 50Ω antenna load must be connected to the Radius 5 RF output BNC connector before power is applied to the unit. The Radius 5 is not protected against high VSWR conditions which may damage the unit.

- Connect the IP input data feed to the RJ45 data connector
- Connect the IP input control feed to the RJ45 control connector
- Connect the mains lead the rear IEC mains input connector
- Switch on the mains supply.
- Connect a laptop pc with Ethernet connection to the Radius base station and open a web browser. CellMetrics preferred web browser is Firefox.
- Type in the default IP address for the Radius 5 of 192.168.0.50 . The Radius web server will then provide the configuration page for the Radius RF parameters.
- Configuration parameters are:
  - Transmit frequency
  - Channel bandwidth
  - FFT Mode
  - Constellation
  - Guard Interval
  - Code rate
  - Power level

Radius 5 Control

The Radius 5 has a non volatile configuration store in FLASH memory which is used to store both its receiver and transmitter setup parameters.

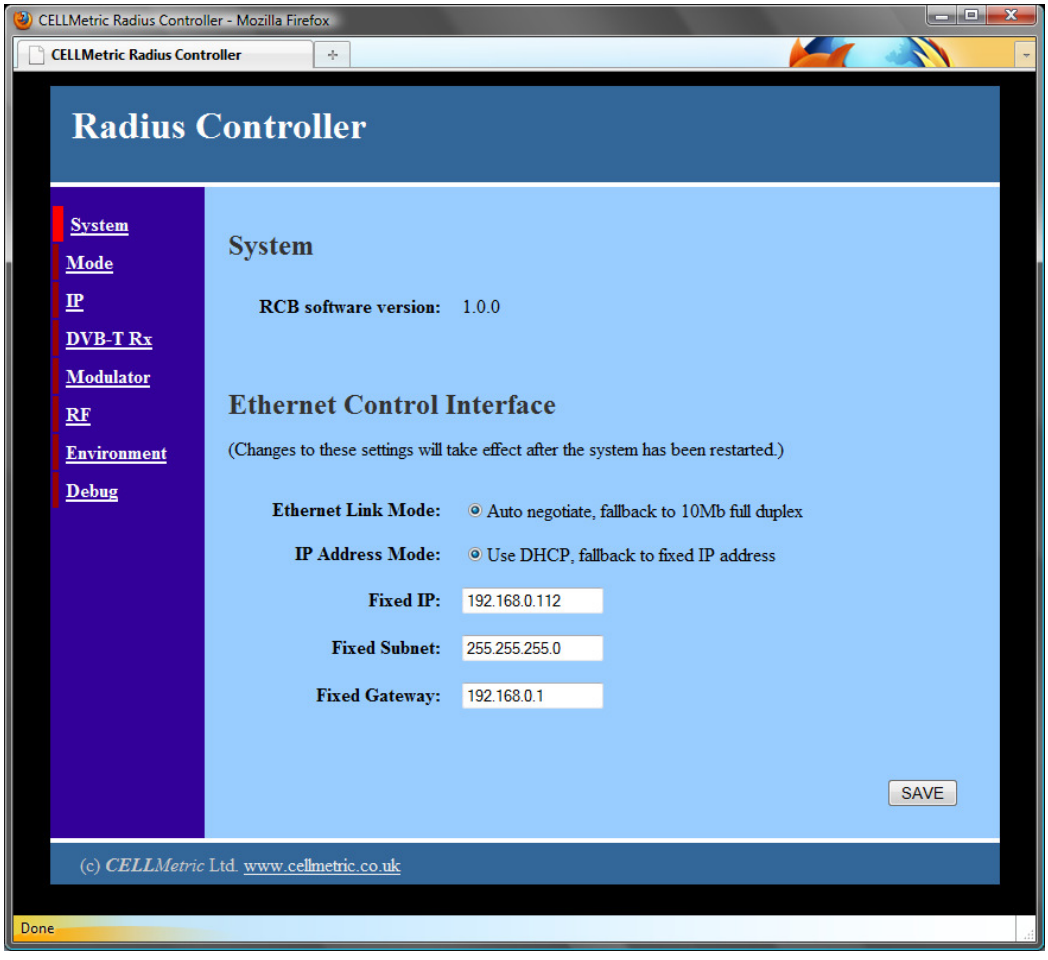
This configuration is performed via the Control Ethernet interface situated on the right hand side of the Radius unit, which should be connected to the local network. The CellMetric Radius 5 web server interface permits the setting of the IP, DVB-T receive and transmit configuration of the system. Whenever a parameter is changed, it is important that the SAVE button is pressed in order to programme the Radius.

The IP address of the web server is normally assigned by the local network's DHCP server. If this is not present, then the IP address will default to 192.168.0.112 (this default may be changed).

System

The System page shows the software version of the controller card.

It also permits the Control Ethernet IP address to be configured. Currently the only mode permitted is to use DHCP and to fall back to a fixed IP address if there is no DHCP server on the local network. The fixed IP address is configured using this screen.



Mode

The Mode page configures the overall mode of the system. Currently the system only supports non-hierarchical DVB-T modulation, so there are no options to be set here.

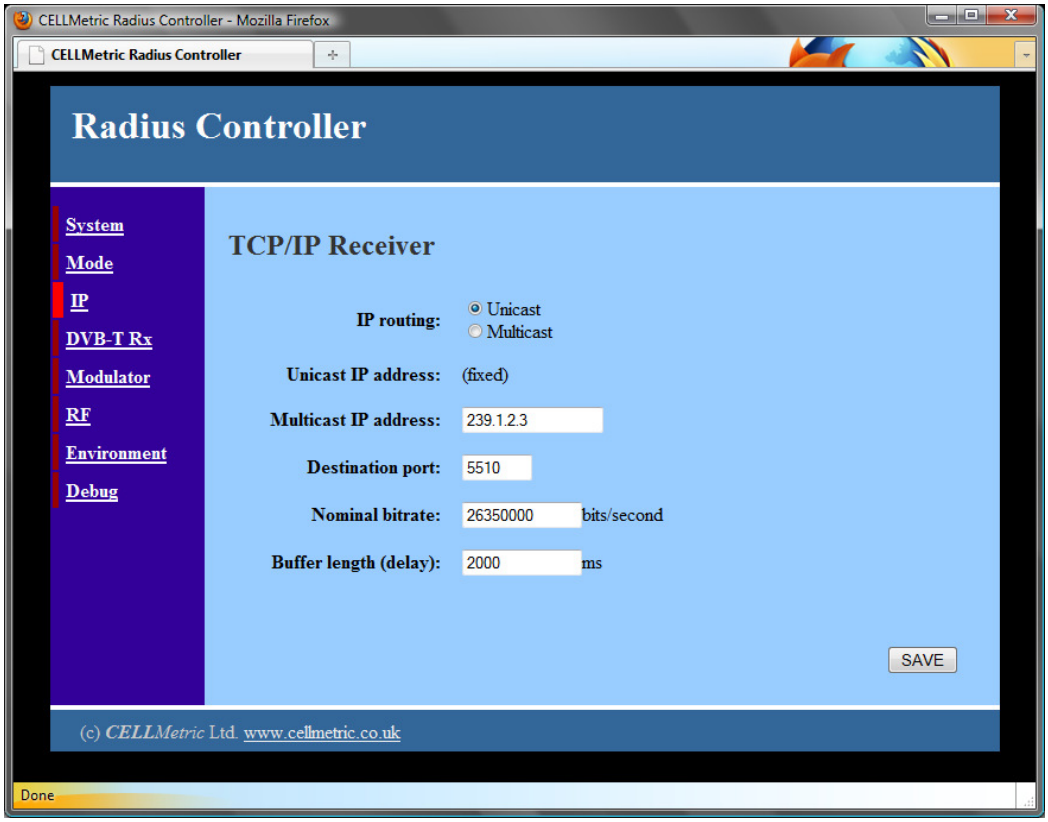
TCP/IP Receiver

The TCP/IP Receiver page configures the ProMPEG CoP3 receiver. The IP data will be received on the Gigabit Data Ethernet port, which is normally connected to a separate network from the control port.

Unicast or multicast addressing may be configured. The unicast IP address of the data port is fixed as 192.168.0.50 (it can be changed, but currently not by using the web interface). The multicast IP address and destination port may be configured here.

Although Radius 5 can adjust automatically to the incoming data stream bitrate, by specifying the nominal bitrate here, the performance of Radius 5 is improved. Specifically, Radius 5 will lock onto the correct data rate rapidly.

The buffer length specification determines the pass through delay. A larger value, however, will allow more packet errors to be corrected.



DVB-T RF Receiver Configuration

The Radius 5 receiver is auto detecting and only requires to be configured for the bandwidth and the frequency of the incoming RF signal. All other receiver modulation parameters are deduced.

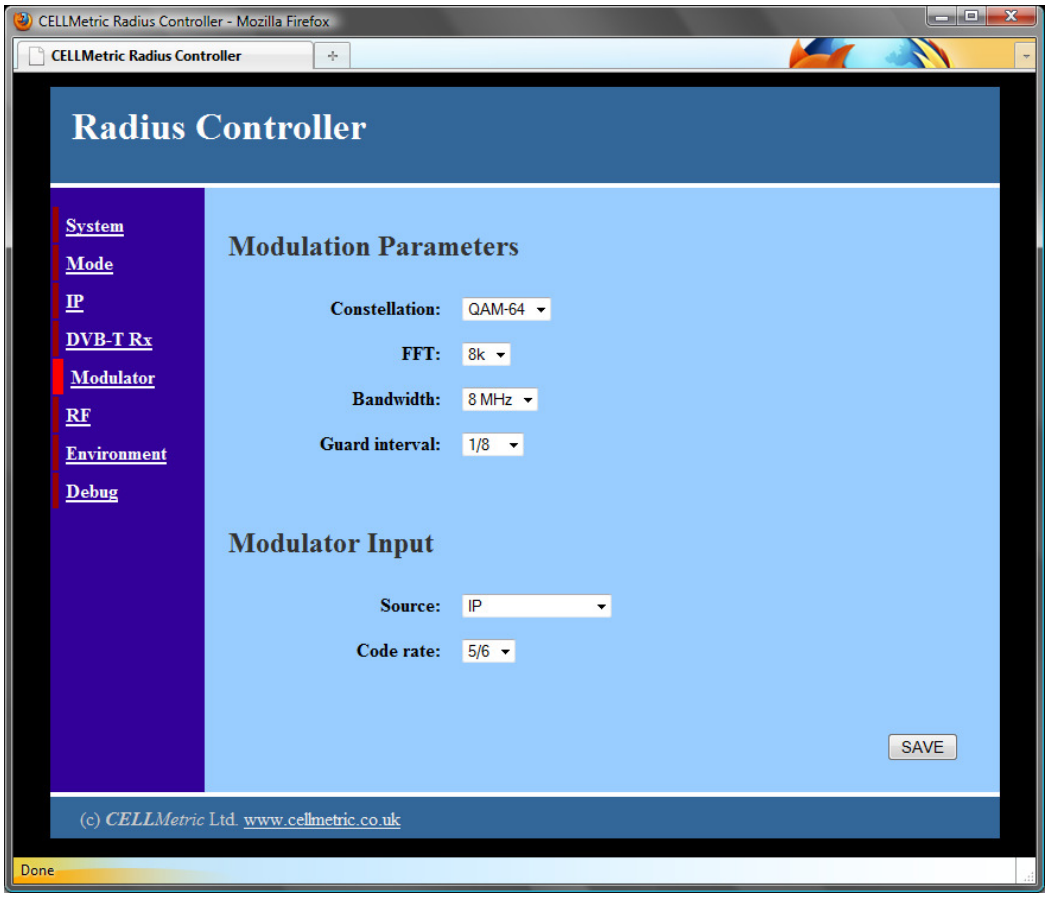
Radius 5 can receive in both the VHF and UHF TV bands. The receiver has a programmable 31 dB attenuator built into the input allowing use with high power received signal.

Transmit Modulation Parameters

This page permits the source of the modulation to be specified:

- IP input (ProMPEG CoP 3).
- DVB-T receiver
- ASI 1 input.
- ASI 2 input.

The Radius 5 supports the standard DVB-T modulation modes specified by EN 300 744. The user interface allows selection of all modulation parameters.

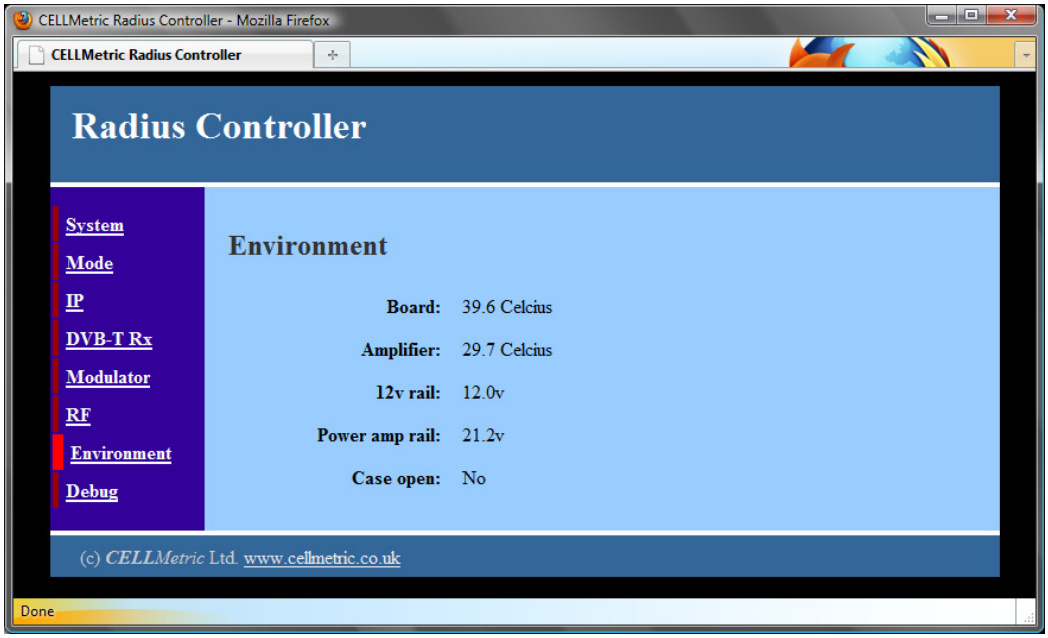


RF Channel Selection

RF Channel selection, channel bandwidth and output power can be user selected.

Environment

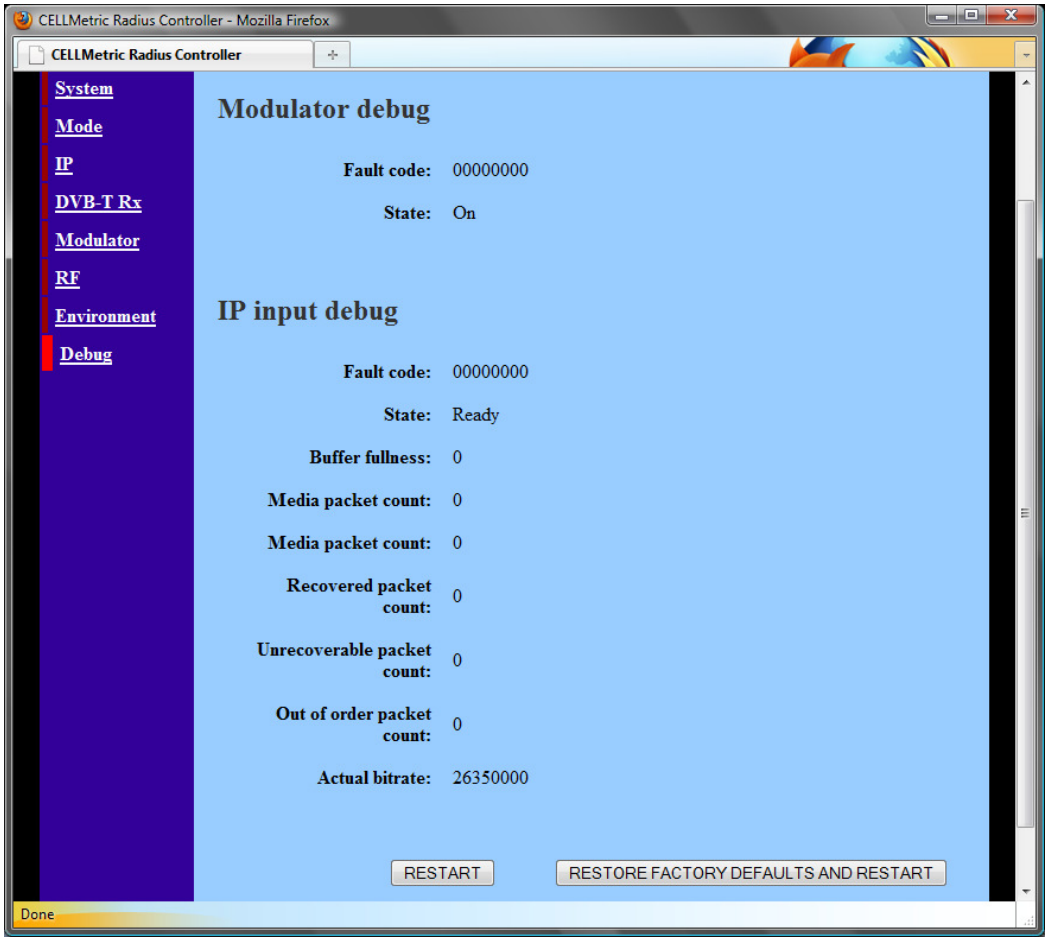
Basic voltage and temperature values are displayed.



Debug

The debug pages are provided to assist with product support.

The page includes a button that resets all internal settings to their factory defaults, and restarts the device.



Testing the installation

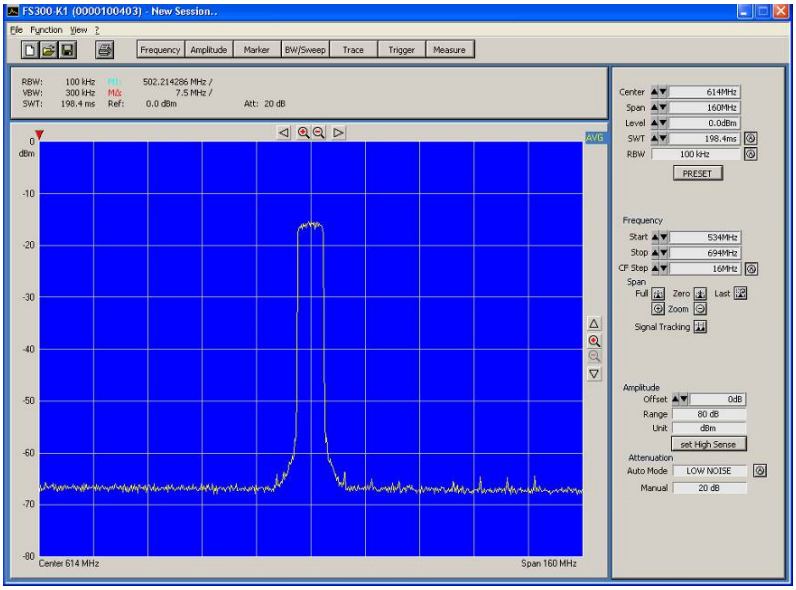
Monitor the RF output with a spectrum analyser and check that a COFDM spectrum is generated at the correct centre frequency and bandwidth and that the shoulders on the transmission are at least 35dB down on the peak power.

- ❒ Monitor the RF output with a DVB measurement receiver and check that the received signal can be demodulated.
- ❒ Check the RF power output is at a suitable level.
- ❒ Demodulate the transmit signal with a digital TV to ensure pictures and audio are received.

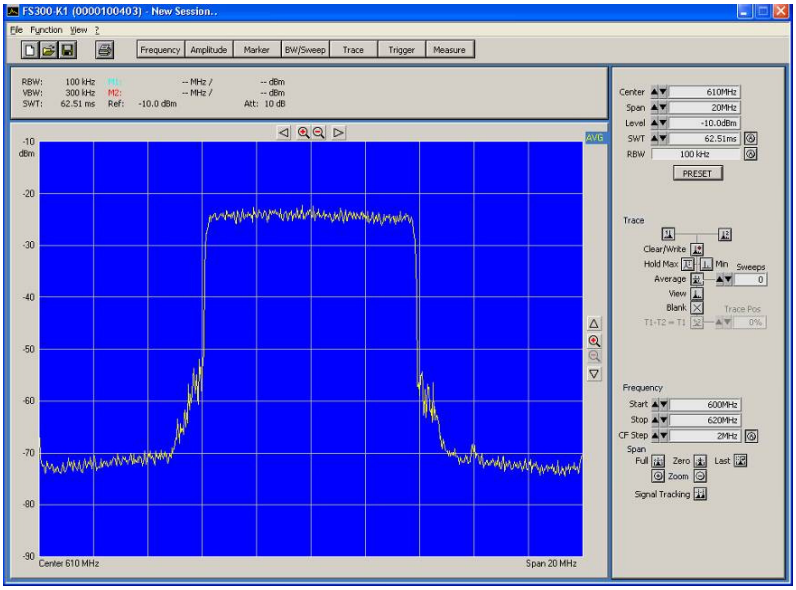
Radius 5 Typical RF Performance

The following plots give indicative results of the RF performance that can be expected from the Radius 5 Transmitter Station.

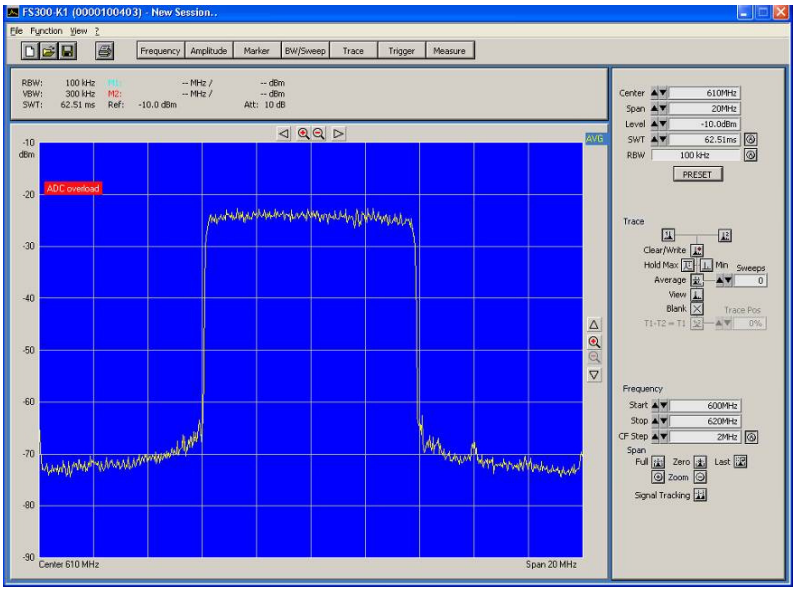
Modulated Broadband Spectrum pre Power Amplifier



2K Modulated DVB COFDM



8K Modulated DVB COFDM



Appendix C – RF Specification

Technical Specification

Operating Conditions:

Power Supply voltage	100 to 260V 47-400 Hz AC
Operating Temperature range (Ambient)	0 to +40^{o}C

Outputs:

RF output	470MHz to 862MHz resolution 1KHz
Output offset	62.5kHz minimum (with +/- 166.66kHz offset capability)
Output frequency accuracy	better than +/- 3ppm over temperature range
Signal output level	34dBm nominal to -80dBm
Output Impedance	50 Ω
Resolution	1dB typ
Repeatability	±1dB typ
Output RLR	Better than 10dB typ
Spectral flatness	Better than +/- 0.5dB typ. across any 8MHz channel
Gain Taper	Better than +/- 2dB typ. Across the UHF band
Intermodulation products	Better than -45dBc typ. in channel, -60dBc typ. out of channel

Modulation:

DVB-T/H	EN 300 744
FFT Mode	2k, 8k
Modulation	QPSK, 16 QAM, 64 QAM
Guard interval	1/4,1/8,1/16,1/32
FEC	1/2, 2/3, 3/4, 5/6, 7/8
Bandwidth	6, 7, 8MHz
Hierarchical modes	None
Spectral Polarity	Normal only
Transport Stream Max Bitrate	31.67Mbits/sec maximum usable rate

Interfaces:

RF Out	BNC Type Connector 50Ω
Ethernet In	RJ45