RAD-FCSPT-01
Full C-Band Single Package Transceiver + SSPA

Installation & Operation Manual

Rev. 3 Sep 2011

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Chapter 1 System Overview

1.1 About this Solution

The RADITEK inc. VSAT RAD-FCSPT-01 solution integrates 3 main components into a single package to provide you with a powerful and cost effective solution for your system. The 3 components include a Full C-band Single Package Transceiver, a Solid State Power Amplifier (SSPA), and a Power Supply Unit (PSU).

This solution is designed to achieve high performance bi-directional satellite communication with high speed transmission capability, making it suitable for telephony and high speed data communication. The RAD-FCSPT-01 component can be operated with different modulation formats such as BPSK, QPSK and FM, making this solution suitable for the following applications:

- Single Carrier Per Channel (SCPC)
- Multi-Carrier Per Channel (MCPC)

1.2 System Functionalities

This solution has 2 main functions. It up-converts IF input from an indoor modulator to a C-band signal (RF output) for transmission via the antenna. The system also down-converts RF input C-band signal received from the antenna to an IF signal which is then fed into a demodulator. This section looks at the various system function modules and its functional block diagrams.

1.2.1 System Block Diagrams

The figure below shows the system's functional block diagram.

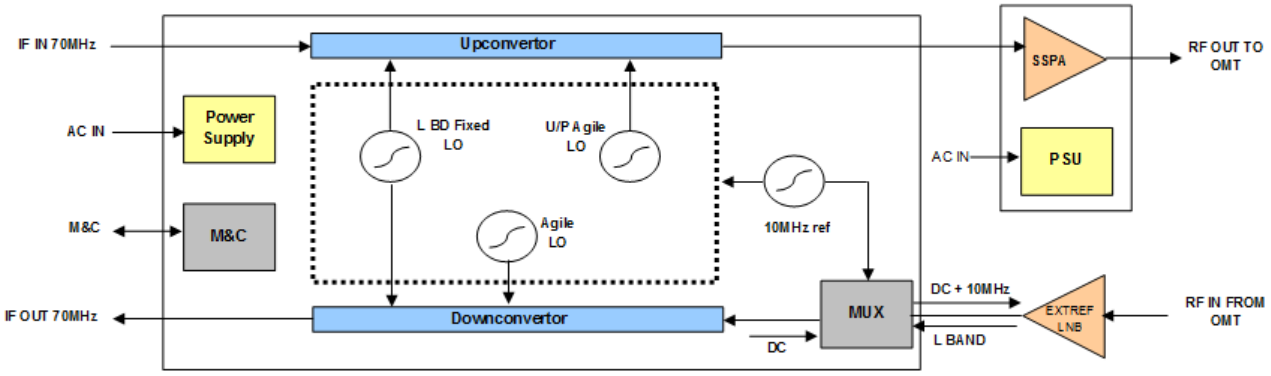

Figure 1.1 The RAD-FCSPT-01 Solution functional block diagram

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1.2.2 Transmit / Receive Frequency Bands

Table 1-1 RAD-FCSPT-01 Transmit Frequency Range

Type	Input Frequency (MHz)	Output Frequency Range (GHz)
Full C-band	70/140 ± 18 or 70/140 ± 36 (Optional)	5.850 – 6.725

Table 1-2 RAD-FCSPT-01 Receive Frequency Range (Including PLLNB)

Type	Input Frequency Range (GHz)	Output Frequency (MHz)
Full C-band	3.400 – 4.200	70/140 ± 18 or 70/140 ± 36 (Optional)

1.2.3 Full C-BAND Single Package Transceiver

The Full C-band Single Package Transceiver (RAD-FCSPT-01) consists of two types of signal flow, receive and transmit.

The receive end consists of an external Phase Lock Low Noise Block (PLLNB) and an internal single down-converter. This flow takes in a 36MHz signal with a range of 3.400 GHz to 4.200 GHz and down converts it to a 70/140 MHz IF signal. This IF signal is then sent to an indoor unit (IDU) system for demodulation.

The transmit end consists of a dual up-converter and amplifier. A 70/140 MHz IF modulated signal is sent from an IDU to the RAD-FCSPT-01. Internally, this signal is up-converted twice and amplified to a frequency range of 5.850 GHz to 6.725 GHz. The converted signal is then passed to the external SSPA to be amplified for transmission via the antenna.

1.2.4 Up Converter

An indoor unit (IDU) sends an IF signal, with a frequency of 70 MHz or 140 MHz, into the IF input port of the RAD-FCSPT-01. The RAD-FCSPT-01's dual up converter then converts this signal in 2 stages. First, it mixes this signal with a LO signal to produce an L-band signal. The signal is then passed through a bandpass filter (to filter LO and harmonics) into the 2nd stage, where it is mixed with an agile LO to achieve the required RF frequency in C-band.

This signal is passed into the SSPA module to be amplified for transmission.

1.2.5 Down Converter

RF signals received are first passed into a LNB and an image reject filter. Here, the signals are mixed with an agile LO frequency to be down-converted. Internally, the RAD-FCSPT-01 then filters and amplifies this signal before down converting it a 2nd time. This produces a 70 ± 18 MHz or 140 ± 36 MHz IF signal which is once again amplified and filtered before it is sent to the IDU for demodulation.

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1.2.6 Synthesizer

The synthesizers are referenced to a highly stable 10 MHz oven-controlled crystal oscillator (OCXO) with very low phase noise and high stability. 4 independent frequency synthesizers are built into the RAD-FCSPT-01. These synthesizers generate the LO signals required for up/down conversion of signals.

You can select transmit and receive frequencies in step size of 2.5 MHz over an 875 MHz transmit and an 800 MHz receive band.

1.2.7 Oven-Controlled Crystal Oscillator (OCXO)

The OCXO used in the RAD-FCSPT-01 equipment is a highly stable frequency oscillator reference that warms up to $\pm 10^{-7}$ within 2.5minutes at 25ºC. The OCXO is factory tuned to ±0.01ppm after an hour's warm-up.

1.2.8 Monitor & Control

The RAD-FCSPT-01 includes an internal Monitor & Control (M&C) module built on an embedded micro-controller within the ODU. This module allows the ODU to be managed via a terminal workstation (such as a PC) using the appropriate software.

Using the M&C module, you can

- Adjust frequency, upconverter gains and down converter gains settings.
- Monitor the operating of the ODU in real-time
- Switch SSPA on or off

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1.2.9 Solid State Power Amplifier (SSPA)

Signals need to be amplified to a suitable power level for satellite transmission. The ODU feeds up-converted signals into the SSPA which then amplifies it through multiple gain stages based on high performance microwave power GaAs FET. All power GaAs FET are housed in different partitions for EMI isolation, eliminating any interference from the DC component and other gain stages.

This system consists of an external SSPA booster. This design boosts the amplified power of the signals to be transmitted via the antenna, providing high gain, high power and low distortion of the signals used in high power satellite communication. The functional block diagram for the external SSPA is shown in the figure below.

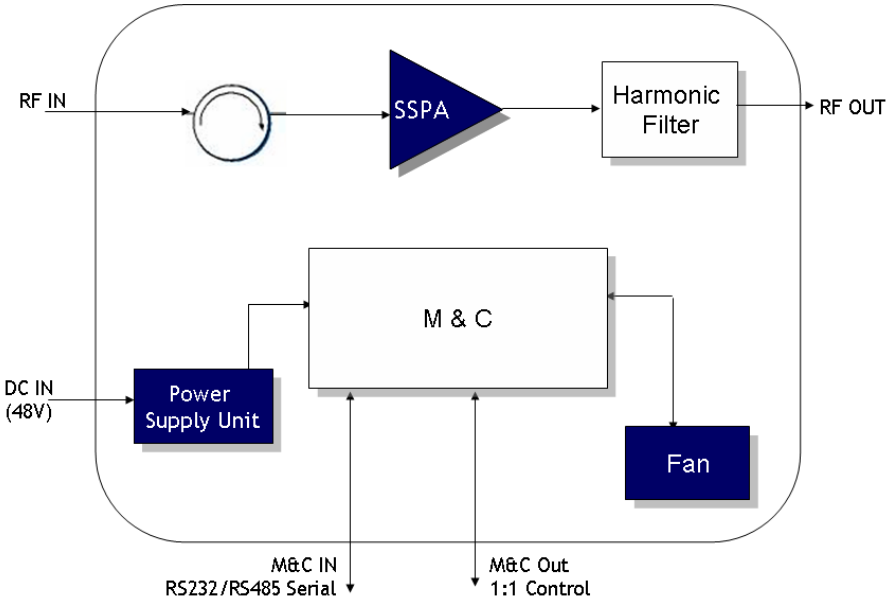

Figure 1.2 SSPA functional block diagram

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1.2.10 Power Supply System

WARNING: Please ensure that the power source is turned OFF before connecting the power cable from the power source to the C-band RAD-FCSPT-01.

This solution includes 2 separate power supply systems, the transceiver has an in-built power supply unit (PSU) and an external PSU which provides power to the SSPA.

INTERNAL PSU

Depending on the product model you purchased, your RAD-FCSPT-01 can be either AC-powered or DC-powered.

- For AC-powered devices:

  The internal PSU is directly connected to an AC power source via a 3-pin connector. The connector includes transient protection to prevent damage to the ODU due to power surges. The pin-out configuration is given in the table below.

  Table 1-3 Full C-band SPT AC IN pin-out configuration

Pin	Description
A	Earth
B	Live
C	Neutral

  The ODU requires AC power at 220V or 110V which is filtered to prevent EMI, rectified and smoothened before being converted to various DC voltages. The power supply system further regulates each of these DC voltages for the different function modules for high ripple rejection and stability. DC power is used to:

  - Generate required internal DC operating voltages
  - Operate the cooling fans
  - Transmit 12V DC power to the LNB via the RF cable.

  A protective mechanism designed into the power supply system cuts the power supplied to the internal SSPA when LO is unlocked. This prevents the system from sending out corrupted signals.

- For DC-powered devices:

  DC power is fed into the device via an external converter.

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EXTERNAL PSU

The external PSU is a 48V AC-DC converter that is used to provide power to the external SSPA. This unit is connected to an AC input with a voltage of 110V or 230V. The AC input connector includes transient protection to prevent damage to the ODU due to power surges. The pin-out configuration for AC input is given in the table below:

Table 1-4 External PSU AC IN pin-out configuration

Pin	Description
A	Earth
B	Live
C	Neutral

The PSU converts AC power into a 48V DC current, which is then fed into the external SSPA. The table below gives the pin-out configuration for the DC OUT connector on this unit.

Table 1-5 External PSU DC OUT pin-out configuration

Pin	Description
A	Positive
B	Negative
C	Not Connected

1.2.11 Phase Lock Low Noise Block (PLLNB)

Weak downlink signals are fed into a LNB and converted to L-band. The LNB then amplifies this L-band signal to an appropriate transmission level. This amplified signal can then be sent to the transceiver to be down-converted. PLLNB uses High Electron Mobility Transistor (HEMT) devices to achieve low noise, high gain and low distortion amplification.

The external LNB is powered with DC power sent to the equipment via the RF output cable connected to the RAD-FCSPT-01. The internal bias-T of the LNA along with the down converter of the transceiver separates DC and RF signals, allowing both to be transmitted via a single cable.

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1.3 RAD-FCSPT-01 Solution Components Interfaces

This section explains the details of each interface found on the panels of the 3 main components in this system, the RAD-FCSPT-01, the SSPA and the external PSU.

1.3.1 RAD-FCSPT-01 Transceiver Interfaces

FRONT VIEW

The figure below shows the front panel of the RAD-FCSPT-01. Each of the interfaces on this panel is explained in the table below.

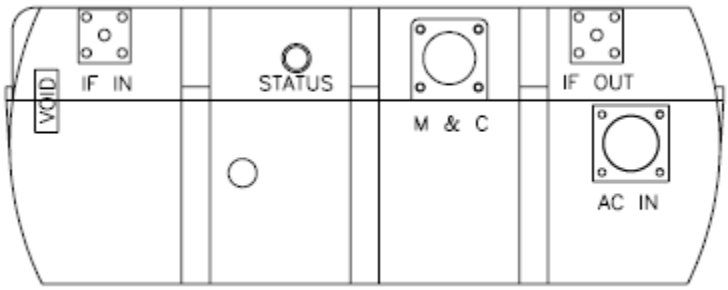

Figure 1.3 Front panel view for the RAD-FCSPT-01

Table 1-6 Interfaces present on the front of the RAD-FCSPT-01

Port Reference	Connector Type	Signal Details
IF OUT	50-Ω female N-type connector.	Transmits 70/140 MHz signal to indoor units. Connects to the IF IN interface of an IDU modem.
M&C	8-pin connector	For connection between the RAD-FCSPT-01 and a terminal workstation (such as PC).
IF IN	50-Ω female N-type connector.	Receives 70/140 MHz signals from indoor units. Connects to the IF OUT interface of an IDU modem.
AC IN	Circular 3 pin male connector	Connects the RAD-FCSPT-01 to a 220V or 110V AC power source.

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The table below describes the pin and wire connection for the M&C connector.

Table 1-7 PIN and wire connection for the M&C Connector

Pin #	Function
Pin A	+12V DC output
Pin B	Ground
Pin C	Rx link status
Pin D	Tx link status
Pin E	Receive Data (RxD) RS232
Pin F	Transmit Data (TxD) RS232
Pin G	RF out voltage (RFV)
Pin H	Form 'C' relay common

The table below describes the pin and wire connection for the AC Connector.

Table 1-8 PIN and wire connection for the AC Connector

Pin #	Function
Pin A	Earth (Green / Yellow)
Pin B	Live (Brown)
Pin C	Neutral (Blue)

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REAR VIEW

The figure below shows the rear panel of the RAD-FCSPT-01. Each of the interfaces on this panel is explained in the table below.

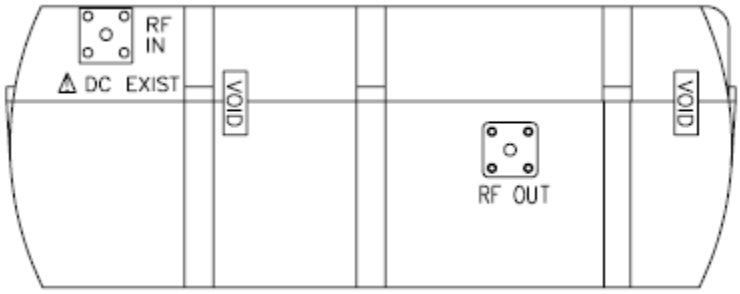

Figure 1.4 Rear panel view of the RAD-FCSPT-01

Table 1-9 Interfaces present on the rear panel of the RAD-FCSPT-01

Port Reference	Connector Type	Signal Details
RF OUT	50-Ω female N-type connector.	This is connected to the external SSPA for further amplification. The signals are then sent from the external SSPA to the antenna OMT for transmission.
RF IN DC EXIST	50-Ω female N-type connector.	This is connected to the N-type female RF OUT connector on the LNB. The LNB receives signals from the antenna which it then passes into the transceiver through this connection. This connection also carries a DC power of 15V from the transceiver to the LNB.

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1.3.2 SSPA Interfaces

This section explains the front and side views of the SSPA and the interfaces.

FRONT VIEW

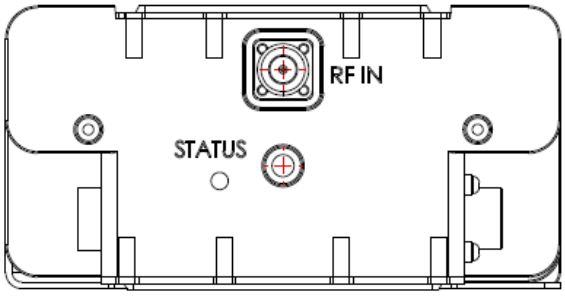

Figure 1.5 Front panel view of a 20W SSPA

Table 1-10 Interfaces present on the front panel of the SSPA

Port Reference	Connector Type	Signal Details
RF IN	50-Ω female N-type connector.	This is connected to the RF OUT interface of the RAD-FCSPT-01.

SIDE VIEW 1

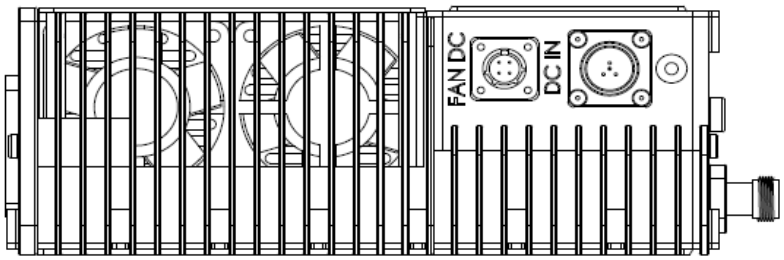

Figure 1.6 Side 1 panel view of the SSPA

Table 1-11 Interfaces present on the rear panel of the SSPA

Port Reference	Connector Type	Signal Details
DC IN	Circular 3 pin female connector	Connects the SSPA to a PSU (AC to DC converter).

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The table below describes the pin and wire connection for the DC IN connector.

Table 1-12 PIN and wire connection for the DC IN connector

Pin #	Function
Pin A	Positive (Red)
Pin B	Negative (Blue)
Pin C	Not Connected

SIDE VIEW 2

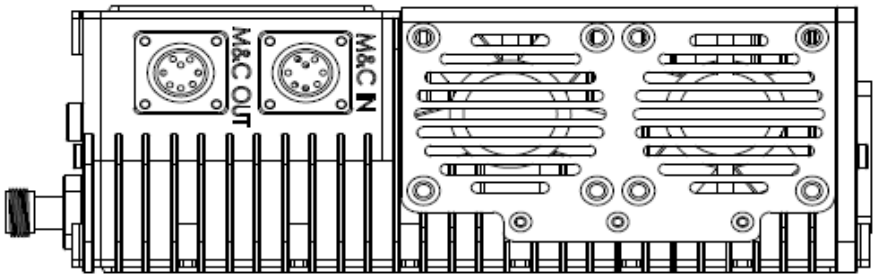

Figure 1.7 Side 2 panel view of a SSPA

Table 1-13 Interfaces present on the rear panel of the SSPA

Port Reference	Connector Type	Signal Details
M&C IN	8-pin connector	For connection between the SSPA and the RAD-FCSPT-01.
M&C OUT	8-pin connector	For connection between the SSPA and a terminal workstation (such as PC).

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The table below describes the pin and wire connection for the M&C IN connector.

Table 1-14 PIN and wire connection for the M&C IN connector

Pin #	Function
Pin A	N/A
Pin B	Ground
Pin C	3.3V
Pin D	Tx link status
Pin E	Transmit Data (TxD) RS232
Pin F	Receive Data (RxD) RS232
Pin G	Data
Pin H	Clk

1.4 System Configuration

The configuration of the system that the RAD-FCSPT-01 Solution can be integrated into is illustrated in the diagram below.

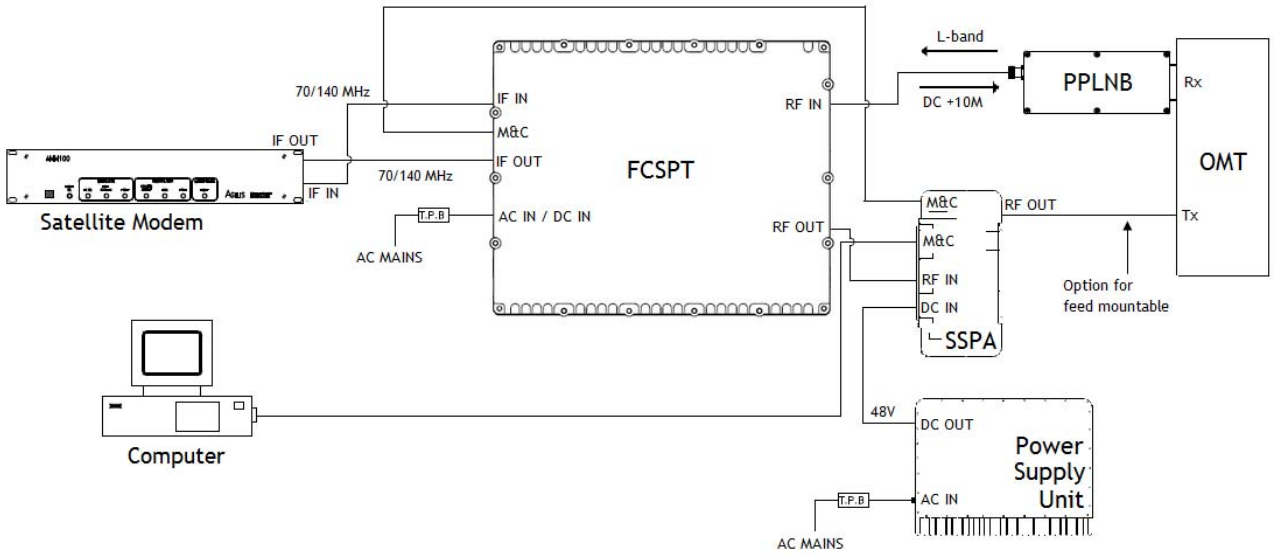

Figure 1.8 RAD-FCSPT-01 solution system configuration (AC option)

The above illustrates the system configuration for a RAD-FCSPT-01 operating on AC power. If you have purchased the RAD-FCSPT-01 with DC IN option instead, simply connect the RAD-FCSPT-01's DC IN interface to an external converter instead of to the transient protection box (TPB).

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1.5 Product Models

This manual is suitable for the following models:

Table 1-15 Product series models

ODU	Model Type	Model #
Full C-band Single Package Transceiver	FCSPT	RAD-FCSPT-01
SSPA		
PSU		

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Chapter 2 Installation

This chapter explains a step-by-step process to safely mount and install your RADITEK inc. product.

WARNING: Handle all ODUs with care. Shock from dropping or knocking ODUs against other objects may cause damage to the units. Please note that RADITEK inc.' warranty agreement does not extend to defects in the units caused by excessive shock or vibration.

2.1 Unpacking the Box

Before unpacking the box, check if it had been damaged or opened. If the shipment may have been tempered with, open the box in front of a representative from the shipping company.

Upon opening the box, carefully remove the items in the package and check them against the packing list. If any of the items are damaged or missing, please contact RADITEK inc. or your local RADITEK inc. representative before proceeding. Please refer to ***Error! Reference source not found.*** for the packing list.

We recommend that you keep the original packing materials until you have completed the checks and confirmed that the unit is in working order.

If you need to repack the product for shipping, please use the original shipping container and packing materials whenever possible. Alternatively, you may also use high quality commercial packing materials to repack the unit. Wrap the units with shock-absorbing materials to provide a firm cushion and prevent movement within the container. Please seal the container firmly and clearly mark "**FRAGILE Electronic Equipment"** on the exterior.

2.2 Pre-Installation Preparations

2.2.1 Environmental Considerations

All components in this solution are weatherproof, outdoor units mounted directly onto the orthogonal mount transducer (OMT) of the antenna. This design allows the transmitter (power amplifier) to be installed close to the transmitter antenna. The unit's aluminium chassis is coated with white, enamelled epoxy for environmental protection. All interface connectors are sealed to prevent air and moisture from entering the unit.

Before proceeding with the mounting process, please ensure that the environmental conditions in the area where the components are to be mounted is appropriate for its optimal operation. These include:

- Temperature: -20ºC to +60ºC
- Relative Humidity: 0 to 90%

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2.2.2 Tools Required

We highly recommend having the following tools on hand before starting the installation:

- 1 set of socket wrench
- 1 Phillips head screwdriver
- 1 cutter
- 1 bag of cable ties (Long and medium)
- 2 rolls of insulator tape
- 1 roll of 3M tape
- 1 multimeter
- 1 hand drill
- 1 tube of silicon compound (MS4)

2.2.3 Site Preparation Checklist

The following table provides a simple checklist to help you ensure that your site is adequately equipped to perform the installation.

Table 2-1 Site Preparation Checklist

Checklist Item	Quantity	Y/N
220 / 110 VAC power source at 50-60Hz	2	
Are there adequate grounding capabilities on the site?	-	
Is the antenna sufficiently stable to minimize swaying of the ODUs due to strong winds?	-	
Are the lengths of the cables sufficient to connect the outdoor units to the indoor units?	-	

2.2.4 Pre-Installation Test

Performing a pre-installation test prior to the actual field installation helps you to:

- Confirm that the unit has not been damaged during shipment.
- Check that the unit is in working order before performing a tiring and costly mounting procedure on your antenna.

Hence, we strongly recommend that you perform the testing as detailed below.

📖 Note: Ensure that no alarm or fault appears on the RAD-FCSPT-01 before performing any test.

There are 2 main test procedures for this system, uplink test and downlink test.

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📖 Note: The test procedures detailed below explains how to test all 3 components the system as a whole, including the RAD-FCSPT-01, SSPA, PSU and PLLNB. If you wish to isolate each component for separate testing, please refer to the operator manual for each product separately to perform the testing procedures.

UPLINK TEST PROCEDURE

⚠ **WARNING:** Please connect a 30dB, 200W power attenuator to the RF OUT connector on the RAD-FCSPT-01 to avoid damaging the ODU accidentally.

Step 1 Connect the ODU interfaces as follows:

1. Connect the RAD-FCSPT-01 IF IN port to the IF OUT port of a modem.
2. Connect the RAD-FCSPT-01 RF OUT port to the SSPA RF IN port.
3. Connect the SSPA RF OUT port to a spectrum analyzer.
4. Connect the ODUs to AC power supply as required.

Step 2 From the modem, input a 70 MHz or 140 MHz pure carrier. Adjust the modem output power so that the IF input to the RAD-FCSPT-01 is -40 dBm.

Step 3 Using the spectrum analyzer, measure the RF OUT from the SSPA at C-band. Calculate the transmit gain using the formula below. You should obtain a minimum gain of 25dB.

Transmit gain = RF OUT power – IF IN power + Attenuation

Check that the channel setting is correct if no signal is shown on the spectrum analyzer.

DOWNLINK TEST PROCEDURE

Step 1 Connect the ODU interfaces as follows:

1. Connect a waveguide adapter to the input port of the PLLNB.
2. Connect RAD-FCSPT-01 RF IN port to the output port of the PLLNB.
3. Connect the RAD-FCSPT-01 IF OUT to a spectrum analyzer.
4. Connect the ODUs to AC power supply as required.

Step 2 Input a -100 dBm C-band signal to the PLLNB that is of the correct channel.

Step 3 Using the spectrum analyzer, measure the IF OUT from the RAD-FCSPT-01 at 70 MHz or 140MHz. Calculate the receive gain using the formula below. You should obtain a minimum gain of 80dB.

Receive gain = RF IN power – IF OUT power

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2.3 Installing the Components

All components in this solution package are outdoor mounted equipments designed to withstand most weather conditions. The PLLNB is to be flanged mounted to the OMT of the dish antenna while the RAD-FCSPT-01 should be mounted just under the antenna. An overview of the system when mounted is shown in the figure below.

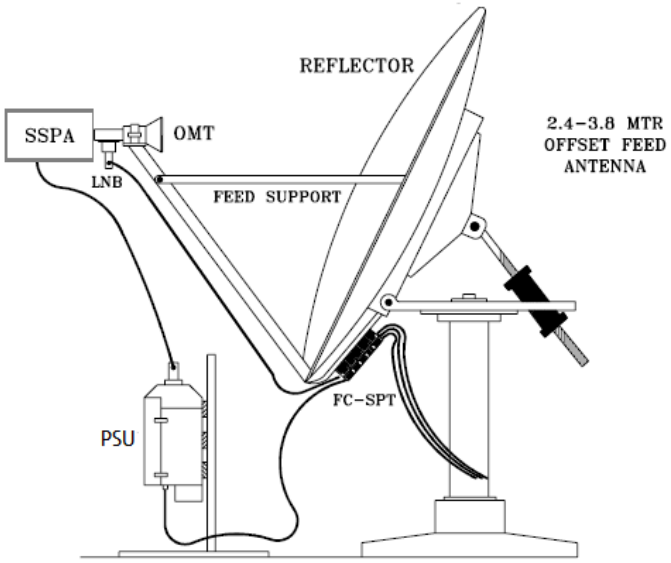

Figure 2.1 Overall view of mounted components

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MOUNTING PROCEDURE

Step 1 Mounting the ODUs

Multiple ODUs need to be mounted to the outdoor antenna including the PLLNB, the RAD-FCSPT-01, the SSPT and the Transient Protection Box (TPB)

1. Mounting the FPST

We recommend mounting the RAD-FCSPT-01 directly below the antenna. Use the mounting brackets provided to mount the ODU to the mounting pole as shown in the figure below.

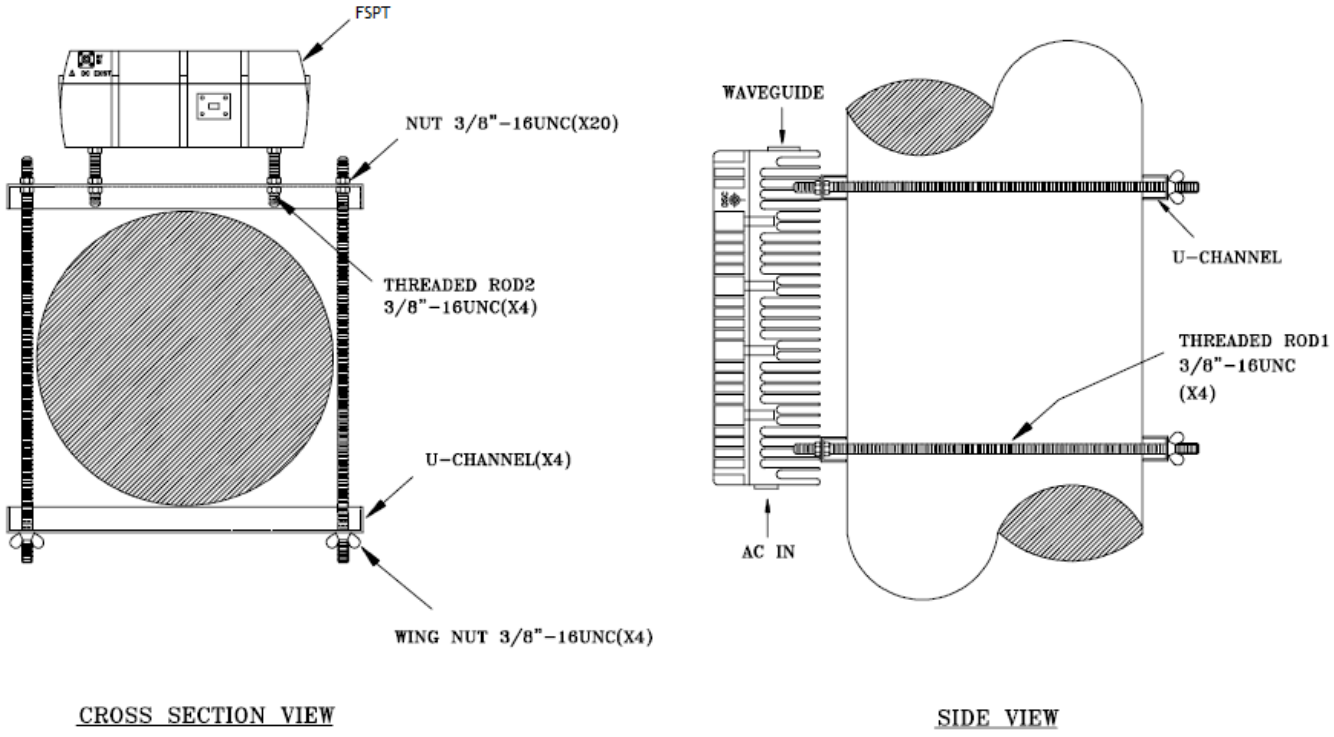

Figure 2.2 RAD-FCSPT-01 mounting diagram

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2. Mounting the PPLNB

   Mount the PPLNB onto the waveguide flange of the transmit rejection filter. You must install the weather gasket to prevent water from leaking through the waveguide joint.

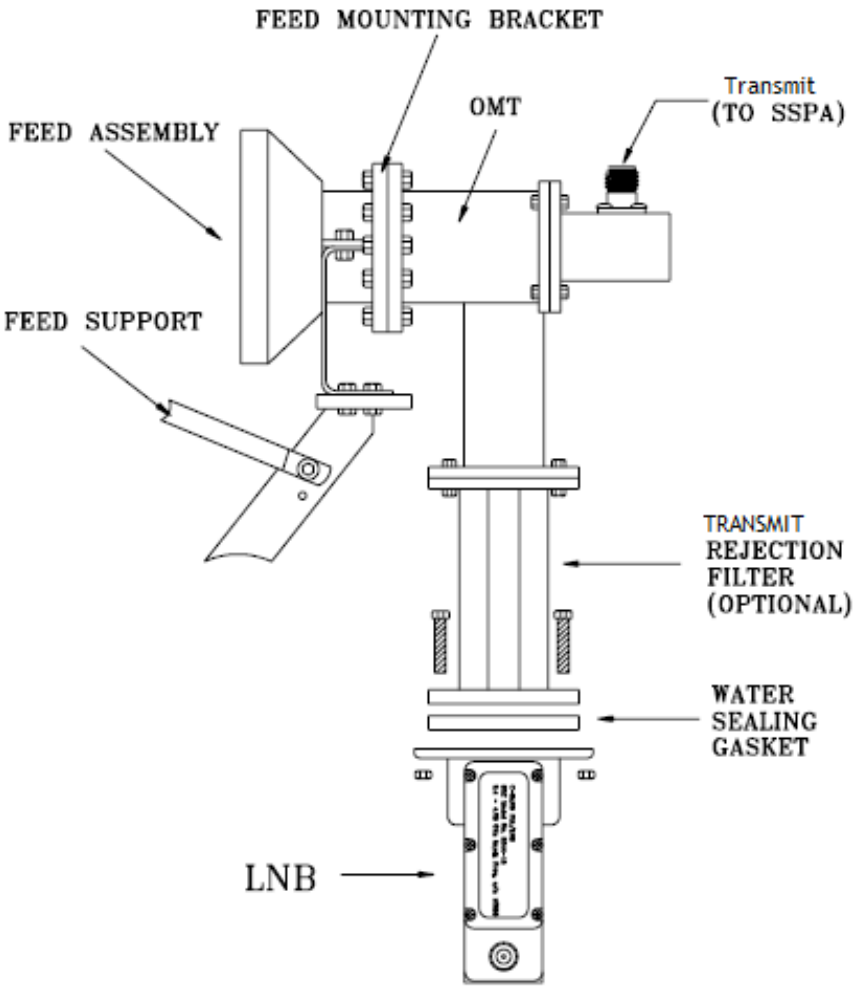

Figure 2.3 PLLNB mounting diagram

3. Mounting the SSPA

   The SSPA can be mounted on the antenna frame close to the OMT using a low loss cable.

4. Mounting the Transient Protection Box (TPB)

   The TPB is to be mounted close to the RAD-FCSPT-01. Please make sure to earth the TPB once mounted.

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Step 2 Interconnect the outdoor units

Now that all units have been mounted onto the antenna, they must be connected correctly for operation.

When cabling, please note the following:

- Do not cut the DC power cables provided by RADITEK inc.
- Cables should not have any sharp turnings or bends
- Tighten all cable connections by holding the cable with one hand and ONLY turning the head of the connector with the other.
- Ensure that all cables are connected correctly. Any wrong connections may damage the unit.

The connection between all outdoor units is illustrated in the figure below. The table that follows provides details including the type of cable (part number) used and which connectors are involved.

🕮 Note: The figure and table below illustrates the connection if you are using an AC-powered RAD-FCSPT-01. If you are using a DC-powered RAD-FCSPT-01, connect the DC IN interface directly to a DC power converter instead of the TPB.

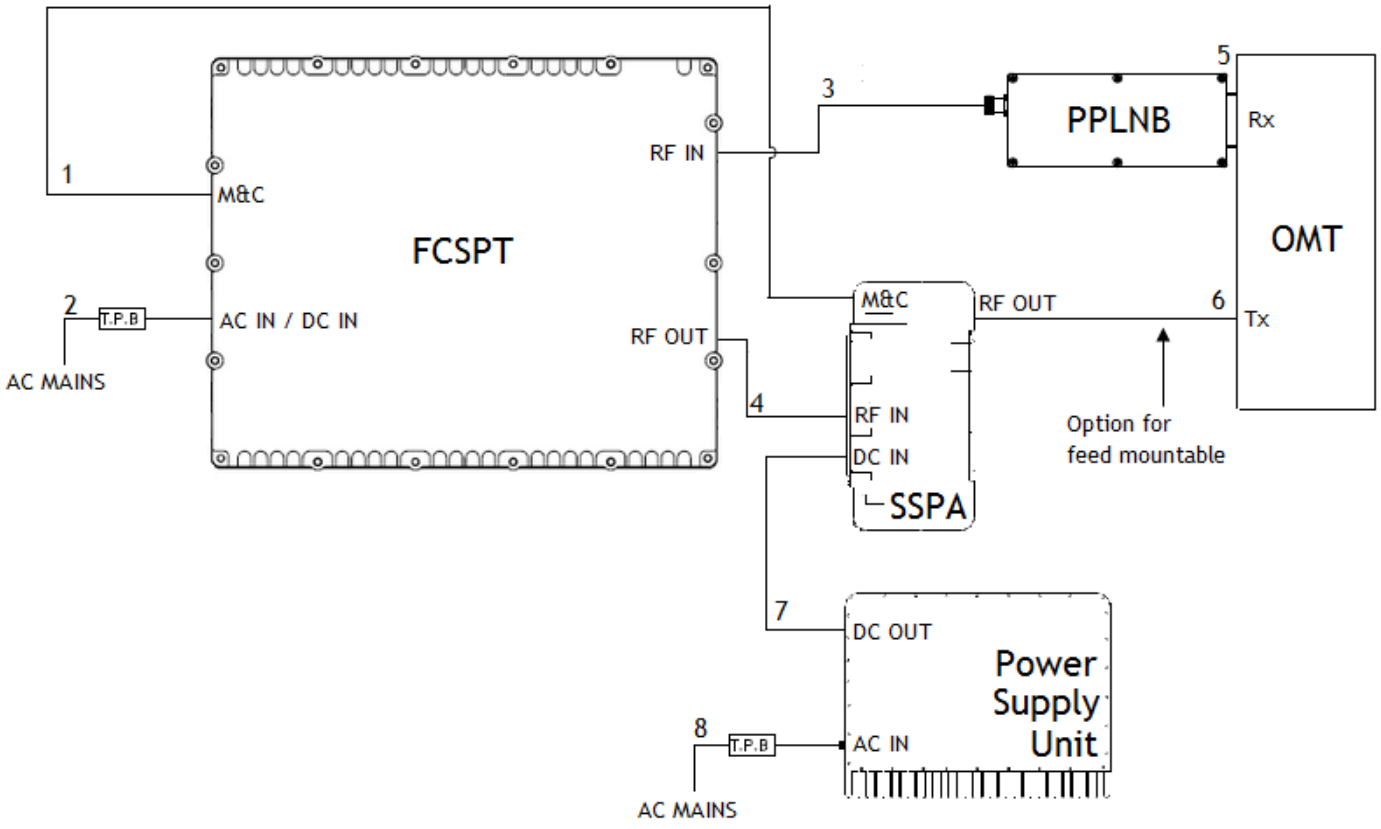

Figure 2.4 Basic cabling between the outdoor units

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Table 2-2 Basic cable and connector details for ODU connection

No.	Connect from Port	Connect to Port	Cable Part No., Length
1	RAD-FCSPT-01 M&C	SSPA M&C OUT	2 meters
2	RAD-FCSPT-01 AC IN	AC power source	2 meters
3	RAD-FCSPT-01 RF IN	PPLNB Output	3 meters
4	RAD-FCSPT-01 RF OUT	SSPA RF IN	2502040137, 1meter
5	PPLNB Input	OMT Rx	Feed mounted
6	SSPA RF OUT	OMT Tx	Feed mounted
7	PSU DC OUT	SSPA DC IN	1 meter
8	PSU AC IN	AC power source	2 meters

Step 3 Connecting the ODU system to the IDU equipment

The next step is to connect the equipment in the ODU system to those in the indoor units. IDU equipment includes a satellite modem and a terminal workstation (such as a PC) for monitoring and control purposes.

The required connections between all outdoor units and indoor units are illustrated in the figure below. The table that follows provides details including the type of cable (part number) used and which connectors are involved.

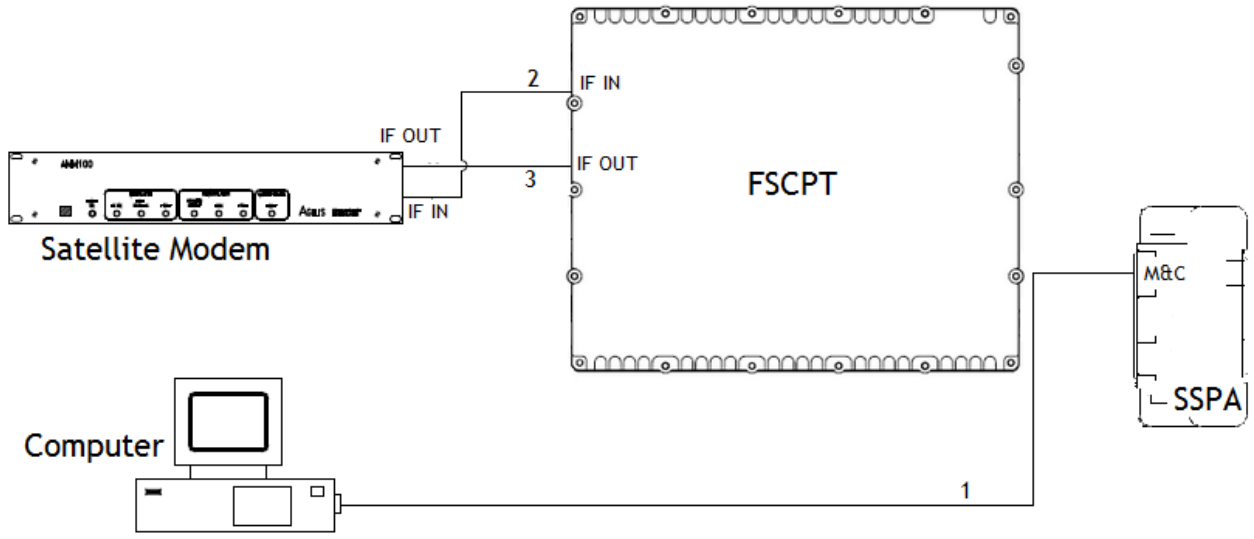

Figure 2.5 Basic cabling between the outdoor units and indoor units

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Table 2-3 Basic cable and connector details for ODU connection

No.	Connect from Port	Connect to Port	Cable Part Number
1	SSPA M&C IN	PC COM Port	
2	RAD-FCSPT-01 IF IN	Modem IF IN	NA, Arranged by customer
3	RAD-FCSPT-01 IF OUT	Modem IF OUT	NA, Arranged by customer

Step 4 Grounding the installation

This process provides a conductive path for static electrical charges to be discharged safely from the equipment to the ground. This prevents a build up of static charges that may cause the equipment to spark.

1. Locate an appropriate grounding spot. Most soil has sufficient conductivity to allow for an efficient grounding connection. Soils that are mainly rock may need to be treated with additional minerals like rock salt, copper sulphate or magnesium sulphate to increase their conductivity.

2. Drive a 3m lightning rod into the ground about 30cm from the antenna pole. Bolt an aluminium wire, minimum 9mm in diameter, to the ground pole. A tight clamp is used to make contact at the top end. Avoid sharp bends when routing the wire as these may impede current flow.

WARNING: Please ensure that the wire is tightly connected between the rod and the equipment to prevent sparks.

3. Connect the TPB's and PSU's "Earth" stud to the grounding rod. Please ensure that the "clean" power lines (supplying power to the ODUs) are kept away from the "dirty" lines (connected to the earth).

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Step 5 Sealing the cables

To complete the physical installation, all connectors and important joints in the system must be sealed. Note that the sealing must begin from the chassis of the ODUs up to the heatshrink of the cable.

All unused connections must be sealed to prevent water ingress. Please ensure that all connectors are tightened before sealing.

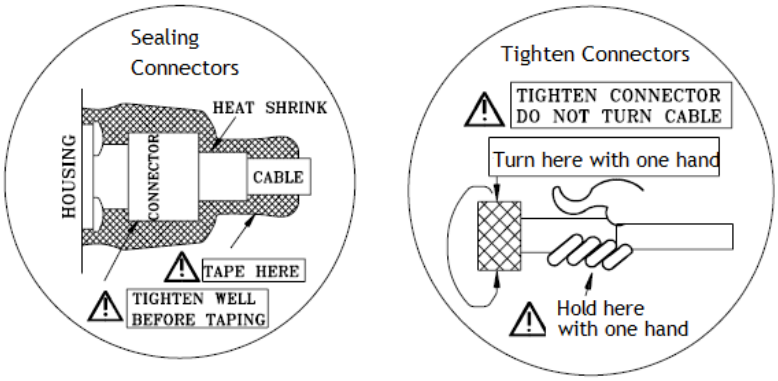

Figure 2.6 Sealing the connectors

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Chapter 3 Set Up and Management

3.1 Monitor & Control

Monitoring and control for this system can be made using the software provided by RADITEK inc..
The RAD-FCSPT-01 is connected to the external SSPA which is in turn connected to an indoor workstation (such as a PC) where this software is installed.

3.2 Understanding the RM&C

RM&C software was developed to monitor its products including the various BUC, SSPAs, and RCUs etc. This software is able to monitor units deployed in either a stand alone or a redundancy configuration.

The RM&C software comes packaged with all compatible models. In this manual, we shall concentrate on the operations of the RM&C catered to the RAD-FCSPT-01 unit.

3.2.1 Connecting the PC to the System

Connecting the system to your PC involves connecting the RAD-FCSPT-01 transceiver to the SSPA and the SSPA to your PC via the RS485 cable. Please refer to step 3 in 2.3 Installing the Components for details on this connection.

3.2.2 Installing the RM&C Software

The RM&C software must be installed into a PC terminal to be used to monitor your RADITEK inc. ODUs.

MINIMUM SYSTEM REQUIREMENTS

Your PC must meet the following minimum requirements to install the RM&C software:

- A Pentium computer or higher version with a SVGA card installed
- Windows 95 operating system

SOFTWARE INSTALLATION

Here, we provide a step-by-step installation guide to help you install the RM&C software into your PC.

Step 1 Ensure that your Windows operating system is working in English.

The software will only launch in an English operating system environment. From your system's "Control Panel", check your language settings.

Select an "English" region (Format). Click [OK] to save the settings. You may need to restart your PC for the change to take effect.

📖 Note: The instructions above may differ according to your Windows operating system version.

Step 2 Insert USB Flash memory into the USB port.

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Step 3 Install the USB-RS485 converter driver into your PC.

Step 4 Click the folder named RMC201-Release-v102.

Step 5 Double-Click the file named, “Setup.exe”

Step 6 Follow the on-screen instructions of the installer to install the software.

3.2.3 Launching the Software

You can launch the software in 2 ways:

- Click **“Start > All Programs > RMC201(Win) 1.0.2”**.
- Double-click the short-cut icon of the RM&C software on your desktop.

📖 Note: This short-cut icon should be automatically created at the end of the installation. You may also create a short-cut icon and move it to the desktop or quick launch bar manually.

By default, the software displays the “Monitor” screen as shown in the figure below when launched. In this screen, the status of the ODU currently being monitored is shown. You may not modify any ODU settings under this mode.

The default screen remembers some of the last configured state when the software was last closed. It doesn’t auto detect which device is connected to the software. We recommend to perform a configuration fresh on re-starting the software

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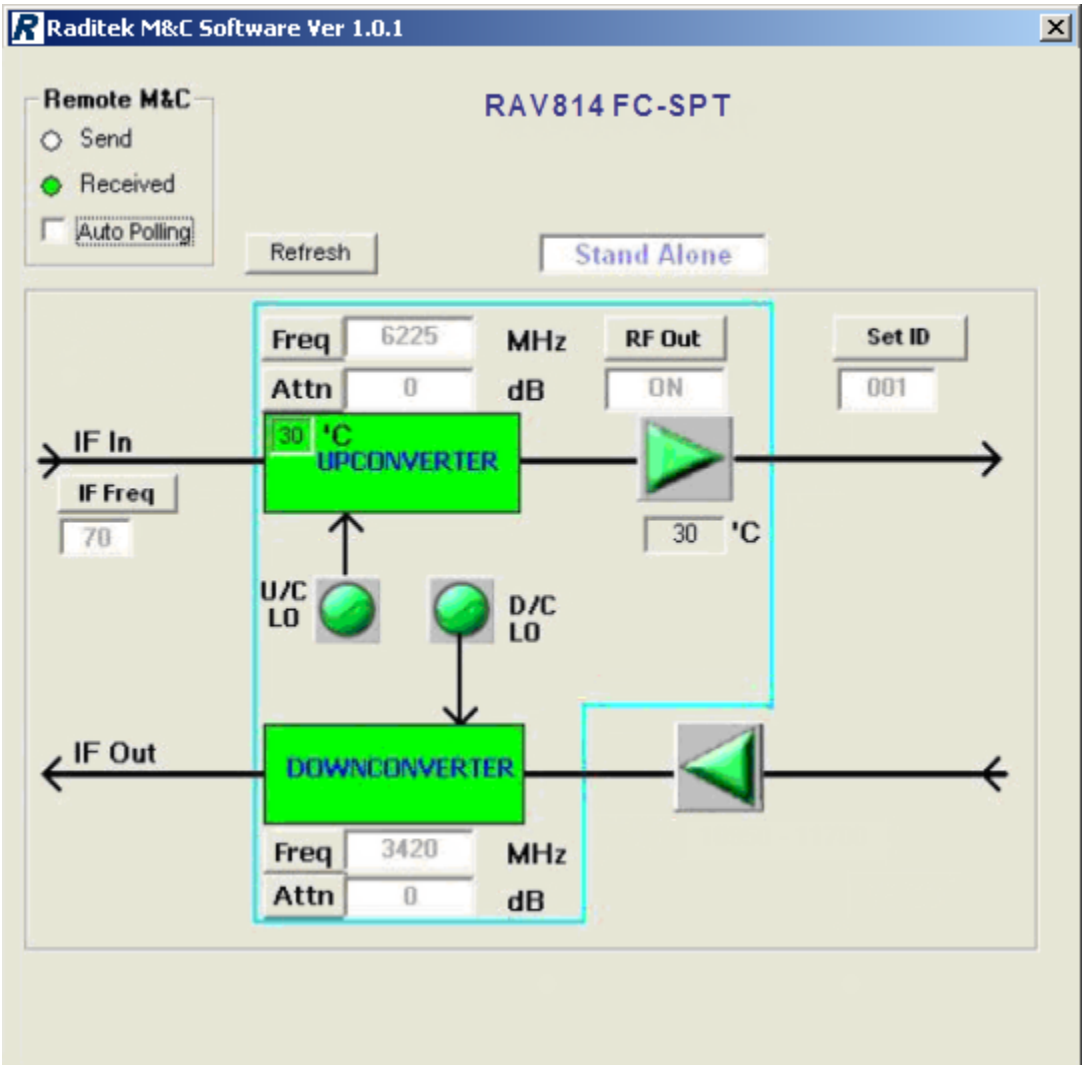

Figure 3.1 Default “Monitor” screen

3.2.4 Understanding the Monitoring Screen

The software displays the monitoring screen when it is launched. On this screen, you can view the following information:

- Up Converter: Views operating status and alarms raised by the Up Converter.
- Down Converter: Views operating status and alarms raised by the Down Converter.
- LNB: Views operating status and alarms raised by the LNB.
- IF Mode: Displays the IF frequency that is used by the RAD-FCSPT-01.
- Unit Comm: Indicates whether the PC and the RAD-FCSPT-01 are communicating properly.

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- Unit ID: Displays the ODU ID.

3.2.5 Modifying the Operating Parameters of the ODU

In "Command" mode, you can modify the operating parameters of the ODU to adjust its operation according to your requirements.

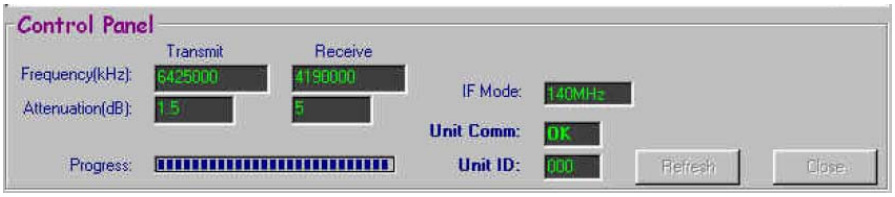

Figure 3.2 Modifying ODU parameters

The values shown in the textboxes are the current operating parameters of the unit. To modify any of these parameters, click the button corresponding to the parameter to be modified. The configurable parameters are described in the table below.

Table 3-1 Configurable parameters

Parameter	Description
Frequency (kHz)	This refers to the transmit and receive frequencies use in the RAD-FCSPT-01.
Attenuation	This refers to the attenuation value that is applied to the transmitter and receiver of the RAD-FCSPT-01.

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Chapter 4 Maintenance & Troubleshooting

This chapter details various system maintenance operations to help ensure that your system works under optimal conditions.

WARNING: Disconnect all power sources before performing any system maintenance and repair.

4.1 Maintenance

This section explains the various maintenance checks that should be routinely carried out to ensure that the system is working correctly and in optimal condition.

Ideally, you should perform a complete maintenance on the system at least twice a year and record all updates and changes made to each ODU in a “SETUP RECORD”. Notify all users that may be affected of a system down time of roughly 2 hours prior to maintenance.

4.1.1 Primary AC Power Test

This test checks that the ODU is receiving AC power correctly. Measure the AC power that is sent into the ODU. The power measurement should fall within the range of 110-220VAC and 50-60Hz.

If your AC measurement falls outside of this range, please check the power source.

4.1.2 Environmental Wear & Tear

Clean and check the outer chassis and all connectors and openings for damage due to environmental wear and tear. These include:

- Cleaning the exterior of each ODU with a mild detergent and water. Do not use any solvents on any part of the ODU.
- Ensure all connectors are free from dust and water.
- Check all connectors and replace if necessary.

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4.1.3 Gains Testing

The test procedure is as follows:

Step 1 Look at the demodulator status and check that is “LOCKED” to the receive signal

Step 2 Record the modem’s configuration including transmit and receive frequencies, power and BER reading.

Step 3 Ensure that the IF frequency is identical to the record in your “SETUP RECORD”.

Step 4 Turn on the pure carrier of the modem

Step 5 Switch off the ODU

WARNING: Please be careful when connecting/disconnecting any cables.

Step 6 Mark the IF cable connected to the IF IN interface of the RAD-FCSPT-01.

Step 7 Switch on the ODU

Step 8 Setup a spectrum analyzer with the following:

- SPAN = 5MHz (or to the value recorded in your “SETUP RECORD”)
- Center Freq. = IF frequency of the modem
- Power level = 5dB/div (or to the value recorded in your “SETUP RECORD”)

Step 9 Connect the spectrum analyzer to the IF output of the modem and compare the result to your “SETUP RECORD”.

If the result differs from the “SETUP RECORD”, tune the modem’s transmit power till they match.

Step 10 Connect the IF OUT of the modem to the RAD-FCSPT-01’s IF IN interface and check the RAD-FCSPT-01’s RF OUT power level.

WARNING: Please connect a 30dB, 200W power attenuator to the RF OUT connector on the RAD-FCSPT-01 to avoid damaging the ODU accidentally.

Compare the result with your “SETUP RECORD”.

Step 11 Connect the RAD-FCSPT-01’s IF IN interface to the spectrum analyzer. Compare the power level reading to your “SETUP RECORD”.

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4.1.4 Completing the Maintenance

Completing each maintenance service requires the following actions:

- Tighten and re-seal all connections and important joints.
- Ensure that the RAD-FCSPT-01 window access panel is tightened with the O-ring installed.
- Cover all unused connectors with a cap and seal.
- Update the maintenance record.

4.2 Understanding Faults in the System

The table below lists the faults that may arise in the system. The following information can be found in this table:

- Fault Indication: How do you tell that a fault has occurred?
- Possible Causes: What may have caused the fault and how do you check?
- Solution: How do you resolve the fault?

Table 4-1 Troubleshooting faults in the system

Fault Indication	Possible Causes	Solution
Frequency Drift	Frequency drift occurs when the OCXO age over a period of time. The OCXO will drift ±0.5e-7 over a year. This translates to ±300 Hz at 6GHz over a year.	If this figure is unacceptable for your network, you can fine tune the OCXO. 1) Open the OSC cover 2) Using a trimmer, tune the OCXO's frequency.
Ground Loop	When two grounding points which offer slightly different ground resistance are present, a ground loop occurs. This may occur in installations where the length of the cable between the antenna and indoor equipment is sufficiently long such that there is a substantial difference in the ground resistance.	If a ground loop occurs, you may need to "float" indoor components from the wall outlet and use only a single common ground at the antenna.

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Appendix A Customer Service

RADITEK inc. provides a variety of after-sales services. This chapter explains some of the services offered including warranty information, the Return Material Authorization process, parts replacement etc.

A.1 Warranty Information

If the unit fails due to defects in materials or workmanship, RADITEK inc. will, at its sole discretion, repair or replace the defective parts, free of charge, within one year from the date of its shipment from the RADITEK inc. production factory.

Note that shipping cost to and from RADITEK inc. will not be covered under this warranty guarantee.

This warranty will be voided, freeing RADITEK inc. from any liability or obligation to the Purchaser with respect to the product in the following situations:

- The product has been damaged during shipment
- Failure caused by products not supplied by RADITEK inc. or its authorized contractors and agents.
- Failure caused by operation of the product outside of its published electrical and environmental specifications or any causes other than ordinary use.
- Water ingress due to improper installation.

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A.2 Problem Checklist

Shipping the unit to and from your supplier or the factory for repair is a costly and time consuming procedure that may cause disruption in your system for a prolonged period of time. Hence, please inspect your system thoroughly using the checklist below to help us determine if return shipping is necessary.

Table A-1 Pre-RMA Request Checklist

Please check	
Company from which the unit was purchased:	
Product brand and model:	
When did the unit fail:	☐ Initial start-up ☐ Unit worked normally before failure
Initial Fault Symptom:	
Unit has been operating in the field for:	
Are fans working normally?	☐ Yes ☐ No
Is the airflow path blocked?	☐ Yes ☐ No
IF input level at failure:	
Output power at failure:	
LED status:	
Consistent or intermittent fault	☐ Consistent ☐ Intermittent
Is the ODU and setup properly grounded?	☐ Yes ☐ No
Weather conditions just before failure	Air Temperature: _____ Heavy rain/snowfall/storms: _____
Changes made to power supply before failure	
AC-DC converter working status	
Is the primary power source working and free of power spikes?	☐ Yes ☐ No
Were there any recent power outages that affected the ODU?	☐ Yes ☐ No
Are connectors properly sealed and free from debris/water?	☐ Yes ☐ No
Replace the ODU with a working one (if available) and check if the system works.	☐ Works with the new ODU ☐ Does not work with the new ODU
Detail the diagnosis performed that localized the fault to the unit as the point of failure	

If you need to return the ODUs or any components to RADITEK inc. for repair, please contact us to obtain a Return Material Authorization (RMA) number by filling in our RMA Request form. Once you receive a RMA number, carefully repack the unit and attach this number to the unit to be shipped to RADITEK inc..

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RADITEK inc. provides repair services for products both under or out of warranty.

A.3 Additional Technical Support

If you require further technical support, please contact RADITEK inc. using the contact information below:

Address:	RADITEK inc 1702L Meridian Ave, Suite 127 San Jose, CA 95125, USA
Service Hotline:	408 266 7404
Fax:	408 266 4483
Email:	Sales@raditek.com

Appendix B Unit Specifications & Outline

B.1 1mW/20W/40W/60W RAD-FCSPT-01 Specifications

Table B-1 RAD-FCSPT-01 Specification Tables

Full C-Band Frequency Range (GHz)	
Transmit	5850MHz ~ 6725MHz
Receive	950MHz ~ 1750MHz (Exclude PLLNB) 3400MHz ~ 4200MHz (Include PLLNB)

Transmit					
		1mW	20W	40W	60W P_{SAT}
Output Power P1dB(dBm) min		0	43	46	48
Min Gain (dB)		28	66	70	73
Typical AC Power Consumption (VA)		25	120	230	300
Input Frequency		70 ± 18 MHz			
Output Frequency		5850MHz ~ 6725MHz			
Frequency Step Size		2.5 MHz			
IF Input Power Range		-25 to -5 dBm			
Gain flatness	875Hz BW	±2.0 dB max			
	36MHz BW	±1.0 dB max			
Gain Stability (-40ºC to +60ºC)		±2.0 dB max			
Gain Adjustment		20 dB @ 1 dB step			
Intermodulation product (with 2 carriers at 3dB at OPBO composite power)		-27 dBc max			
Spurious (36 MHz BW)		-60 dBc max			
Phase Noise	100Hz offset	-63 dBc/Hz max.			
	1kHz offset	-73 dBc/Hz max.			
	10kHz offset	-80 dBc/Hz max.			
	100kHz offset	-90 dBc/Hz max.			
IF Input Interface		50Ω N-Type Female			

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Transmit				
	1mW	20W	40W	60W P_{SAT}
RF Output Interface	50Ω N-Type Female			
Frequency Stability	±0.5 x 10-9/day			
Tx in VSWR	1.5:1 max			
Tx out VSWR	1.5:1 max			

Receive (exclude LNB)		
Input Frequency		950 to 1750 MHz
Output Frequency		70 ± 18 MHz
Output Power @ P1dB		0 dBm min
Frequency Step Size		2.5 MHz
Gain		27 dB min
Gain Adjustment		20 dB @ 1 dB steps
Gain Flatness (36MHz BW)		±1.25 dB max
Gain Stability (-40ºC to +60ºC)		±2.0 dB max
Intermodulation product		-35 dBc max
Spurious (36 MHz BW)		-55 dBc max
Phase Noise	100Hz offset	-60 dBc/Hz max.
	1kHz offset	-70 dBc/Hz max.
	10kHz offset	-80 dBc/Hz max.
	100kHz offset	-90 dBc/Hz max.
Input Interface		50Ω N-Type Female
Output Interface		50Ω N-Type Female
Tx in VSWR		1.5:1 max
Tx out VSWR		1.5:1 max
Frequency Stability		±0.5 x 10-9/day

Power Supply	
Input Voltage (Factory Preset)	220 Vac ±15% (47Hz ~ 63Hz) 48V DC for feed mount SSPA
DC Output Voltage to LNB	+13Vdc at RF IN connector

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Phase Locked Low Noise Block (PLL LNB)	
Input Frequency	3400 ~ 4200MHz
Output Frequency	950 to 1750 MHz
Noise Figure / Temperature at +25ºC	1.0 dB/75ºK
Gain	58 dB typ
Gain Flatness (36MHz BW)	±0.25 dB max
External Reference	10 MHz
Input Interface	50ohms WR229/G
Output Interface	50ohms N-Type Female

Monitor And Control	
Interface	RS232/485
Optional Interface	Ethernet (SNMP) with optional External Module
Form 'C' Relay Contacts	Optional

Compliance Standard	
IEC 60950	International Safety Standard for Information Technology Equipment
ETSI EN 300 673	Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) Standard for Very Small Aperture Terminal (VSAT)
ETSI EN 301 489-1	Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Electro Magnetic Compatibility Standard for Radio Equipment and Services

Environmental	
Operating Temperature	-40ºC to +60ºC
Relative Humidity	Up to 100%

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Mechanical		
	1mW	20W / 40W / 60W SSPA
Dimensions LxWxH (mm)	310x240x98	235x175x90
Weight	7.5kg	3.9kg
Color	White Powder Coat	

B.2 *SSPA Specifications*

Table B-2 SSPA Specifications

Characteristics	Specifications	
Frequency Range	5.850 GHz – 6.725 GHz	
Output Power @ P1dB	20W	43 dBm min
	40W	46 dBm min
	50W	47 dBm min
Output Power @ Saturation	20W	43.5 dBm min
	40W	46 dBm min
	50W	47.5 dBm min
	60W	47.8 dBm min
Gain	20W	46.0 dB min
	40W	46.0 dB min
	50W	47.0 dB min
	60W	48.0 dB min
Gain Flatness (5.850 - 6.725 GHz BW)	± 1.50 dB max	
Gain Slope	2 dB max	
Gain Stability	± 2.0 dB	
3rd order Intermodulation distortion for 2 tones with composite power	1 dB below rated P1dB	-40 dBc max
	6 dB below rated P1dB	-25 dBc max
AM/PM @ rated P1dB	3 °/dB typ.	
Spurious @ rated P1dB	-60 dBc max.	
Harmonics @ rated P1dB	-30 dBc Max.	
Input / Output VSWR	1.5:1 max	

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Characteristics	Specifications
Noise Temperature	10 dB typ.

B.3 PSU Specifications

Table B-3 PSU Specifications

Characteristics	Specifications
Output Voltage	48V DC
Output Power	350W
AC Mains Input Voltage	90V – 264V AC, 220V typical
Operating Temperature	-40ºC to 60ºC
Relative Humidity	Up to 100%
Dimensions	190mm (L) x 189mm (W) x 108mm (H)
Weight	3kg

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