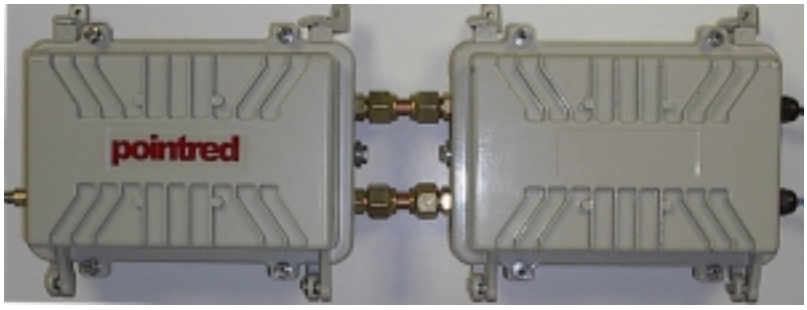
PointRed MMDS Base Station Transmitter

General Overview

The Base Station



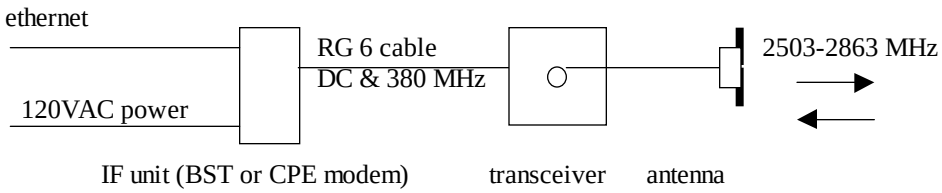
The BASE STATION (BST) IF Unit contains an RF modem operating at 380 MHz, as both a receive and transmit device. The BST is a lightweight, robust ODU (outdoor unit) and is typically mounted on a structure or radio tower. The BST modem provides the interface to the Internet, Router, or other media types. The BST is combined with a transceiver unit to generate the pico cell base station.

The Transceiver Unit

The Transceiver unit functions as the RF interface. The Transceiver can be configured with various antenna gain combinations and models and is powered with DC provided from the BST unit.

The transceiver (radio unit) can be configured as either customer premises equipment (CPE) or as a base station unit The transciever is identical for both applications. The BST and subscriber (CPE) modem have different housings and power supplies, and the BST has an optional T1 interface board, but the IF output signals are the same and the transceiver used with them is identical.

Fig.1



A description of the theory of operation and product configuration is found in an attachment to this application and report.

SPECIFICATIONS

TRANSCEIVER

Frequency range:	2503 - 2683 MHz
Channelization:	4 MHz channels, 1 MHz spacings
Power output:	20 - 24 dBm, +/- 1.1 dBm, software configurable
Modulation type:	FSK

IF Unit

Frequency range:	380 MHz IF
Power Output, RF:	4 dBm nominal, 5 dBm for maximum output power

Data transfer rate, air link: Up to 4 Mbps

Block diagram and theory of operation is provided in a separate attachment.

FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part 2.

1.1307(b) RF exposure information is provided in a separate attachment in the form of maximum permissible exposure (MPE) data.

2.1033(c)1 Applicant: PointRed Technologies Inc.
1283 Old Mountain View Alviso Road
Suite B
Sunnyvale, CA 94089

2.1033(c)2 FCC ID: QDU-MCRD-BASE-2R5

2.1033(c)3 Installation instructions are found in separate document.

2.1033(c)4 Emission type: FSK
Up to 4 Mbps

Emission designator: 3M40F1D

2.1033(c)5 Frequency range: 2503 - 2683 MHz (6 MHz channel, 1 MHz spacings)

2.1033(c)6 Range of Operating Power

20 - 24 dBm nominal, +/1.1 dBm

2.1033(c)7 Maximum Power Rating

25.1 dBm measured

Maximum allowed per 21.909(g)2: 2 watts (33 dBm)

2.1033(c)8 Applied voltages and currents into the final transistor elements

Refer to schematics, separate submission accompanying this application

2.1033(c)9 Tune-up procedure

Refer to installation instructions. RF channel and power level selection are achieved via control and set-up PC software via GUI.

2.1033(c)10 Circuit and Functional Block Diagram, Description of Circuitry

Complete product schematics are provided in separate attachments.
Circuit description and theory of operation are found in separate attachment.

2.1033(c)11 FCC ID Label

Refer to separate attachment.

2.1033(c)12 Product Photographs

Refer to separate attachment.

2.1033(c)13 Description of Modulation System

Refer to theory of operation, separate attachment

2.1033(c)14 Test Data per 2.1046 – 2.1057

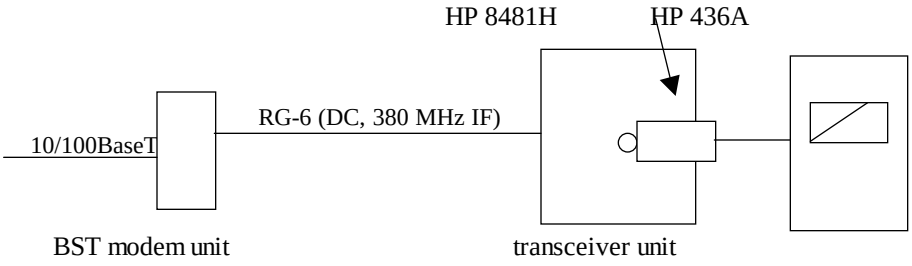
(2) RF Output Power Measurements

Measurement equipment used:

HP 436A Power Meter
HP 8481H 3.5 watt Power sensor (average power detector)

Test set-up:

Figure 2



Test Procedures

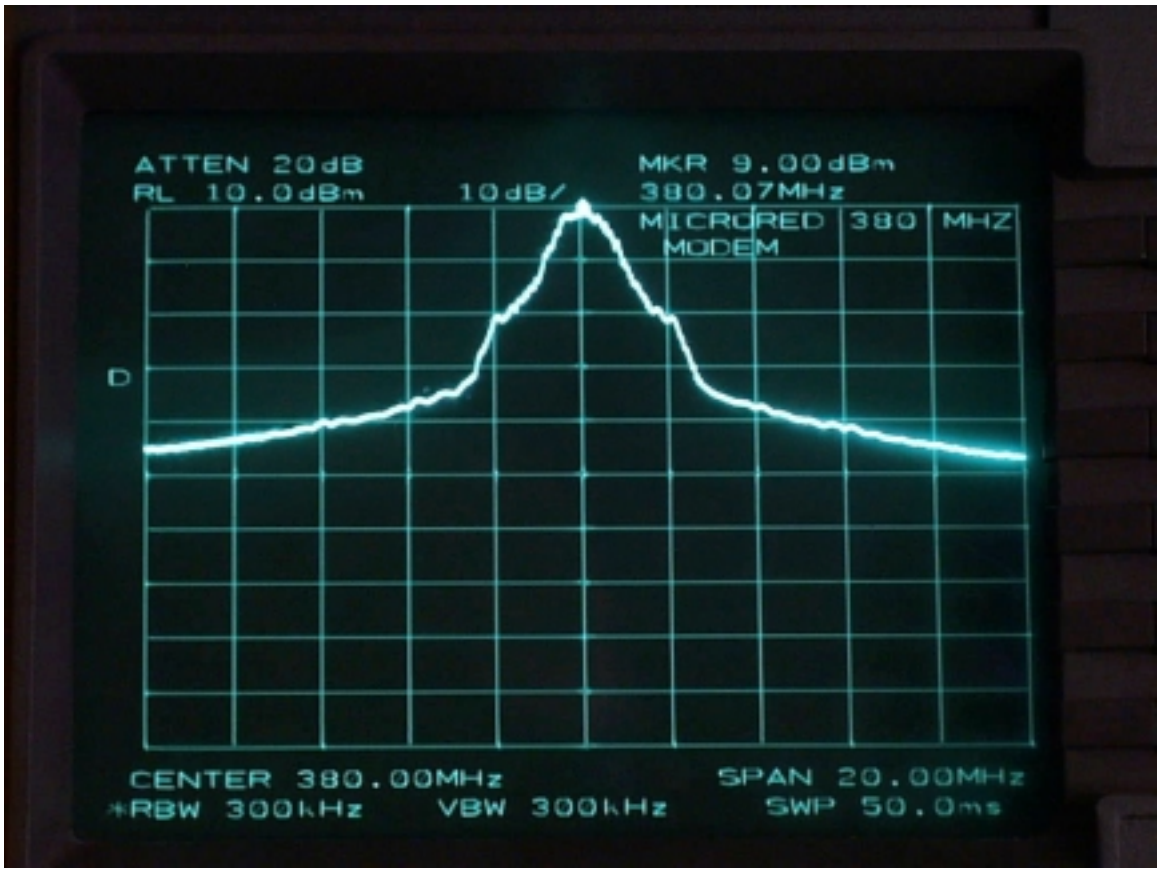
1. Set indoor unit to send continuous packets to outdoor unit.
2. Read mean channel power directly from HP36A

Test Results

F(MHz)	P out
2503	24.31 dBm
2579	24.35 dBm
2683	25.11 dBm

IF output signal to transceiver input port is shown below.

IF Output, 380 MHz



Section 2.1047 Modulation Characteristics
Requirement/Limit: 21.908(a)

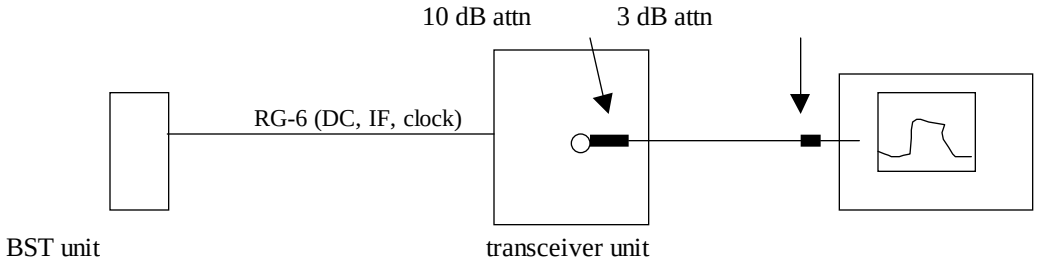
Maximum out of band emission:
At 6 MHz channel bandedge: -25 dB relative to average 6 MHz channel power level
Then linear slope of -40 dB for next 250 kHz
Then linear slope of -60 dB to 3MHz removed from highest or lowest 6 MHz channel edge
Then -60 dB beyond that

Measurement equipment used:

HP 8563E Spectrum Analyzer
Coaxial attenuators (3dB and 10 dB)
Coaxial cable, 3ft

Test set-up:

Figure 3



Test Procedures

Software was run to produce a continuous pseudo random bit stream (prbs).

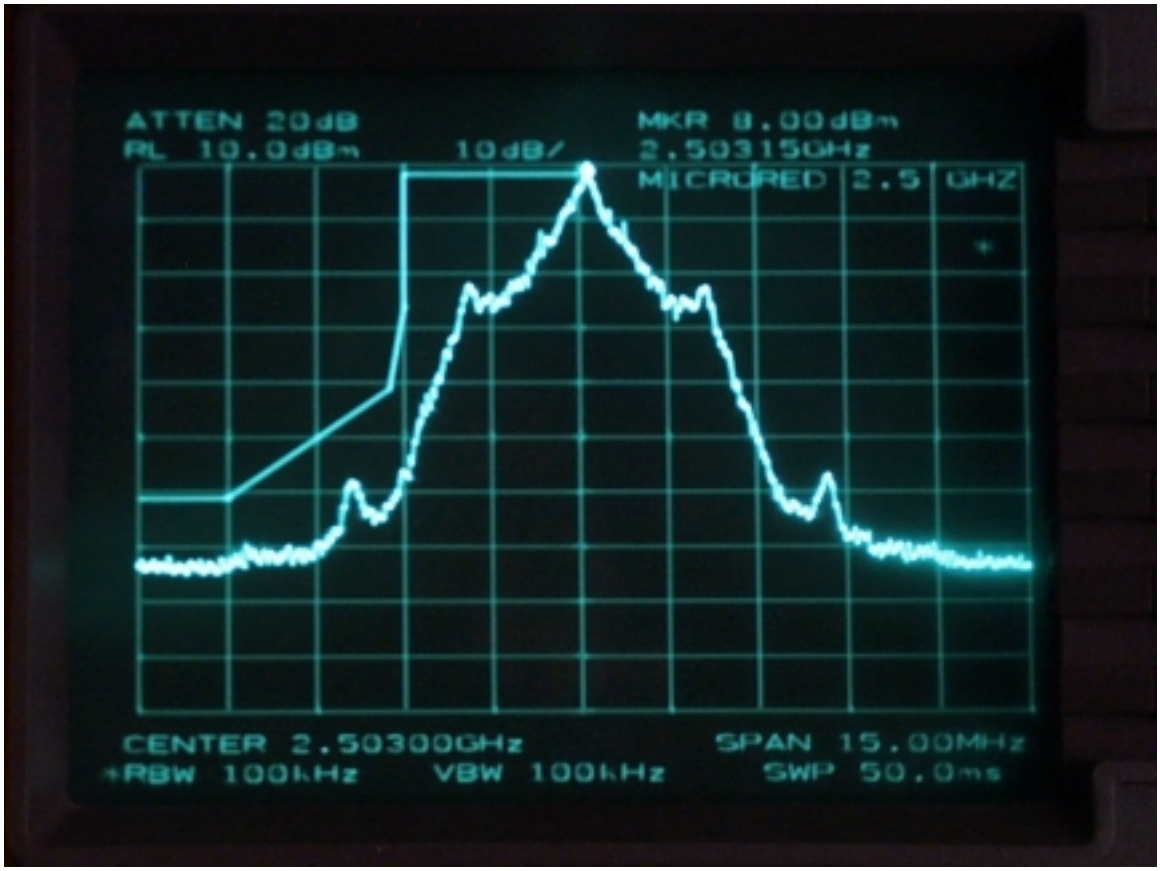
Test Results

PASS. Refer to attached spectrum analyzer charts for two channels:

Lowest: 2503 MHz
Highest: 2683 MHz

Emissions masks at Lowest and Highest channels are shown with mask lines superimposed on spectrum analyzer charts.

Channel Mask for fo = 2503 MHz (lowest channel)



Channel mask for fo = 2683 MHz (highest channel)

Section 2.1049 Occupied Bandwidth
Requirement/Limit: 21.905(a,c)

6 MHz standard, 12 MHz allowed

Measurement equipment used:

HP 8563E Spectrum Analyzer
Coaxial attenuators (3dB and 10 dB)
Coaxial cable, 3ft

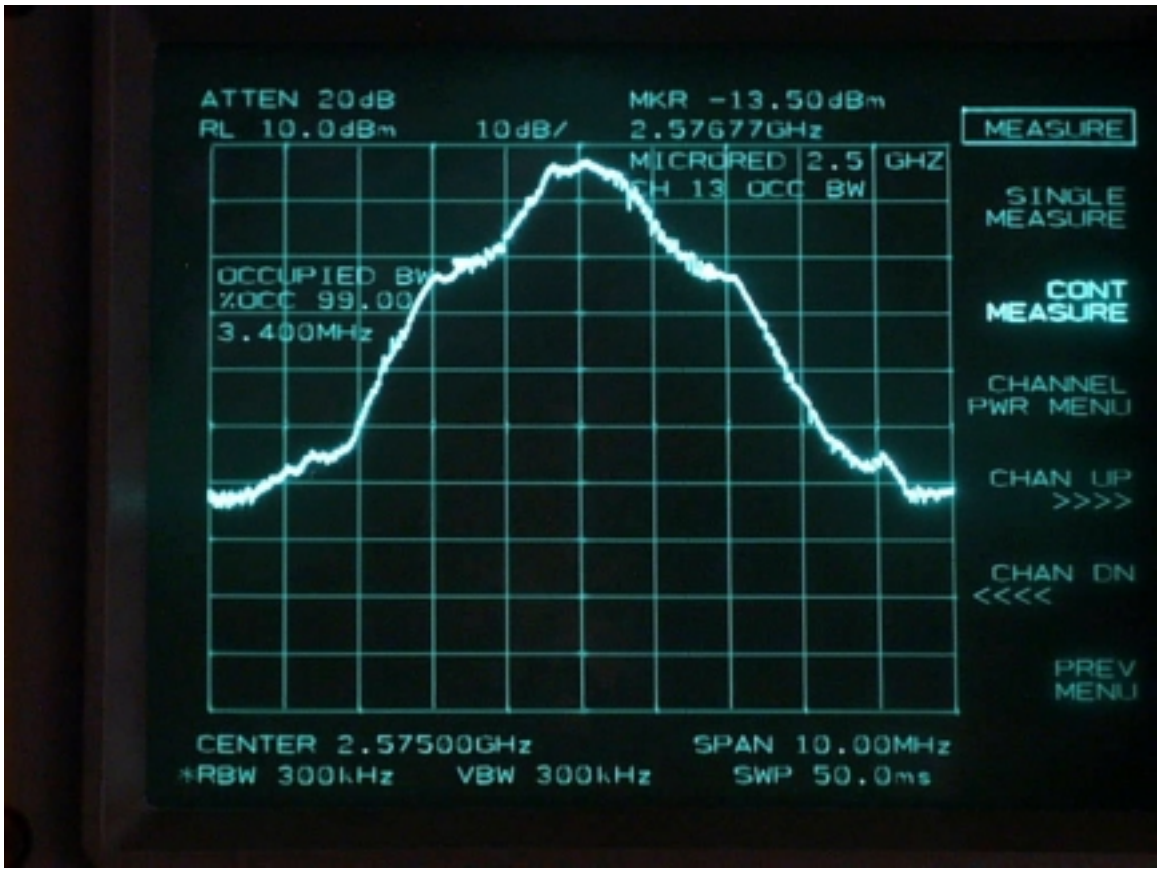
Test set-up:

Refer to Fig. 3

Test Procedures and Results:

The analyzer OCCUPIED BW function was activated. Refer spectrum analyzer plots below showing occupied bandwidth. Measured 99% occupied bandwidth is 3.4 MHz.

Occupied Bandwidth, Channel 13 (midband)



Section 2.1051 Spurious and Harmonic Emissions at Antenna Terminals
Requirement/Limit: 21.908(a)

All emissions -60 dBc.

Measurement equipment used:

HP 8563E Spectrum Analyzer
Coaxial attenuator, 20 dB
Coaxial cable, 3ft

Test set-up:

Refer to Figure 3 above

Test Procedures

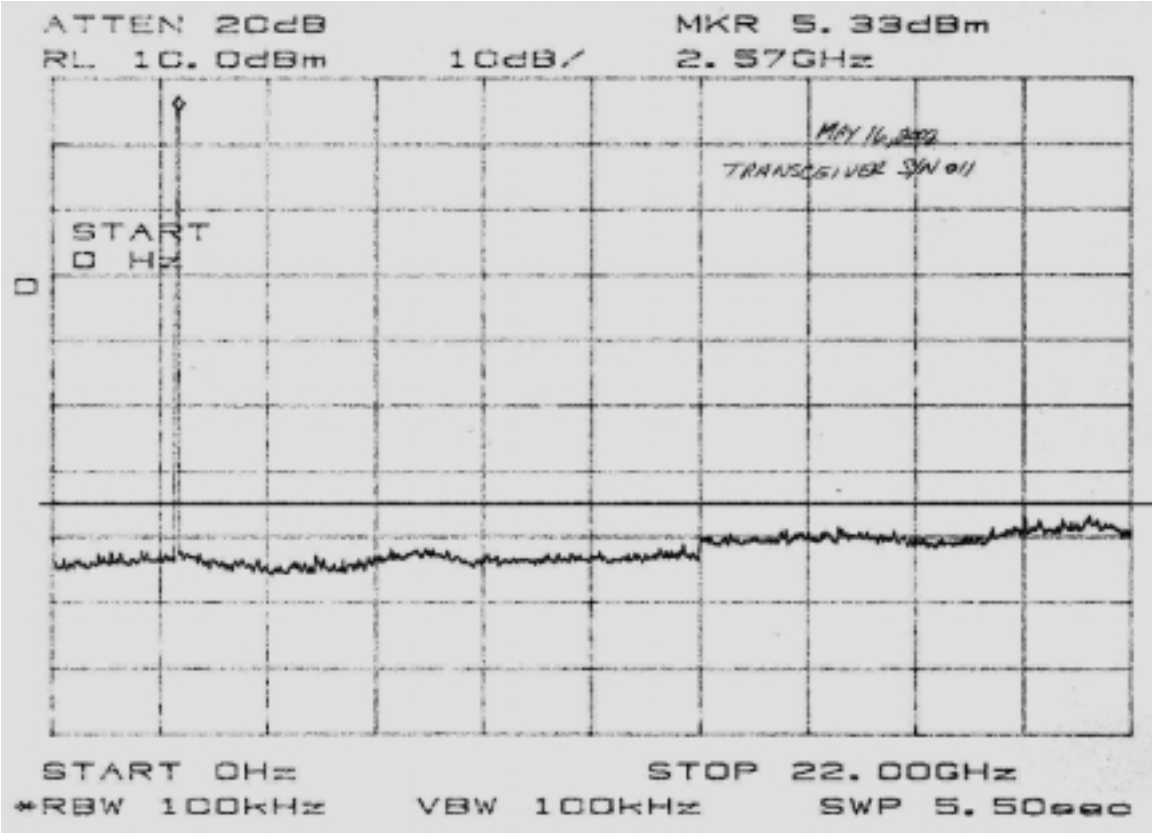
Section 21.908(e) requires that for a 100 kHz measurement bandwidth, all emissions removed from the channel edge by more than 3 MHz must be attenuated at least 60 dB below the channel emission flat top.

1. Set spectrum analyzer to TX output center frequency, RES BW = 100 kHz, VID BW = 100 kHz Hz.
2. Set spectrum analyzer to record Average reading.
3. Set DISPLAY LINE to a level 60 dB below flat top peak
4. Record transmitter output spectrum from 1 MHz to 10^{th} harmonic of TX output frequency
5. Plot spectrum analyzer output traces.

Test Results

PASS. Refer to data plots below.

Spurious Emissions, Antenna Conducted Output Spectrum Analyzer Graph



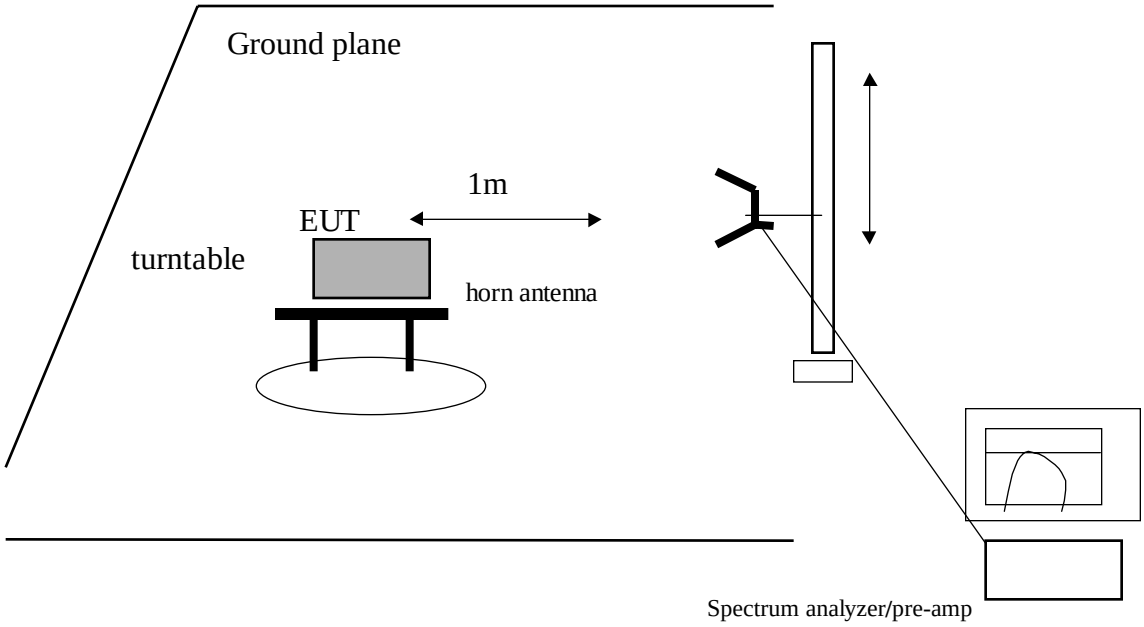
Display line: 5.33 dBm - 60 dB = -54.67 dBm

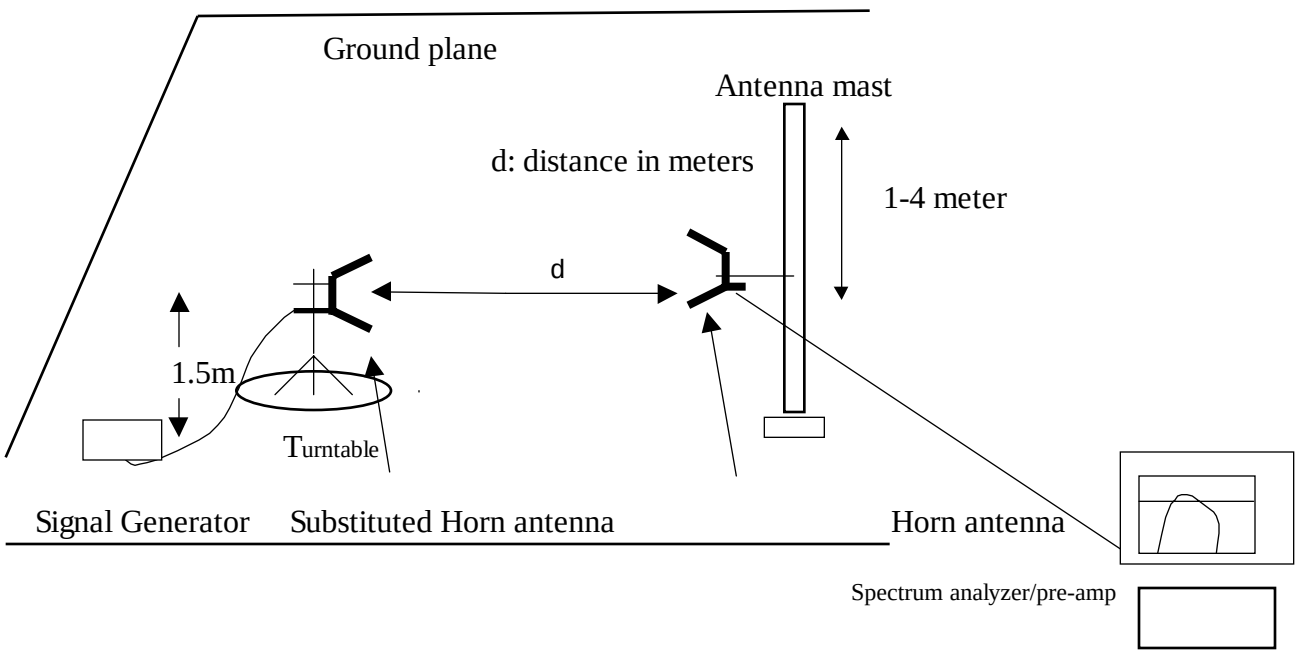
Section 2.1053 Field Strength of Spurious and Harmonic Radiation
Requirement/Limit: 21.909(e)

Measurement Equipment Used:

HP 8595EM Spectrum Analyzer
EMCO 3115 Horn antenna, 1- 18 GHz
Antenna Research Associates MWH 1826/B, 18 - 26.5 GHz
HP 8449D pre-amplifier
HP 83732B synthesized signal generator

Test Set-Up





Minimum Requirement

The magnitude of each spurious and harmonic emission detected as being radiated from the EUT must be at a level more than 60 dB below channel output power.

Output power: 25.11 dBm
Limit: (25.11 - 60) dBm = 34.89 dBm

Test Method

The antenna output port of the EUT was terminated with a 50 ohm load. With the transmitter operating at full power, the EUT was rotated 360° and the search antenna was raised and lowered in both polarities, all in an attempt to maximize the levels of the received emission for each harmonic and spurious emission up to 10 fo.

Test Results

Pass. All emissions detected were at least 2.74 dB below limits. Refer to test data below.

Date: 5/2/2002
Client : Redpoint Technologies, Inc
Project Number : 02U1250-1
High Freq Data (Substitution Method)
Tester : Frank Ibrahim

Freq (GHz)	Antenna Pol.	SG reading (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
5.15	V	-49.6	8.7	1.6	-44.65	-34.89	-9.76
7.725	V	-42.7	9.1	1.88	-37.63	-34.89	-2.74
5.15	H	-50.6	8.7	1.6	-45.65	-34.89	-10.76
7.725	H	-44.2	9.1	1.88	-39.13	-34.89	-4.24

Note : There were no harmonics beyond the 3rd harmonic, readings of the analyzer were for noise floor, and there were no spurious
EUT tested up to the 10th harmonic which is 25.75 GHz

2.1055 Frequency Stability

Requirement/Limit: Section 21.101

Frequency Tolerance, 2596 - 2680 MHz: .001% (10 parts per million)
Temperature Range: -30C to +50 C
Supply Voltage Range: 85% - 115% nominal (102 - 138 VAC)

Temperature v Frequency, -30C to +50C

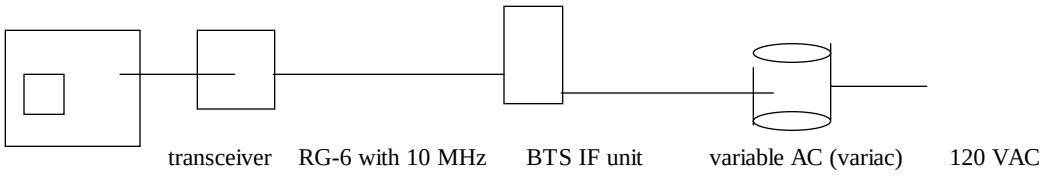
The OCXO in the transceiver establishes a phase lock that maintains transmitter frequency over temperature within approximately 1.7 ppm.. Temperature-frequency data for the OCXO is presented in a separate document.

Operating Voltage v Frequency

Measurement Equipment Used

HP 8563E Spectrum analyzer
Coaxial cable (worst case 1.9 dB attenuation at 26 GHz)

Test Set-up



Test Procedures

Operating voltage was varied from 100 - 140 VAC while monitoring 2683 MHz output.

Test Results

No detectable variation. over voltage excursion.

Conclusion: Mean reference oscillator variation over temperature is 1.63 ppm, well within the 10 ppm maximum allowed for base station transmitters. At 2683 MHz this represents a maximum frequency shift of approximately

1.63 x 2683 = 4373 Hz

Based on transmitter emissions mask data, transmitter emission will be well within the required frequency mask at all times over operating ranges of temperature and supply voltage.

Part 15 Digital Device Emissions

Tests were performed on the BST IF unit to measure radiated and conducted emissions per Part 15 of the Rules. The BST meets class A limits; a separate verification report is being held on file at PointRed Networks.

Test Site

All testing was performed at PointRed Technologies (antenna conducted measurement) and at Compliance Certification Services (radiated emissions) either by me or under my supervision. Conducted and radiated emissions were performed using test equipment with calibration traceable to NIST, and following test procedures accepted by the industry.

THOMAS N. COKENIAS
Consultant, EMC&Radio Type Approvals
Agent for PointRed Technologies