EMISSIONS TEST REPORT FOR A LOW POWER TRANSMITTER

I. GENERAL INFORMATION

Requirement: Federal Communications Commissions

Test Requirements: 15.205, 15.207, 15.209, 15.247

Applicant: Pointred Technologies Inc.
397 Trimble Road
San Jose, CA

Product ID: **FCC ID:** QDU-MCRD-2R4

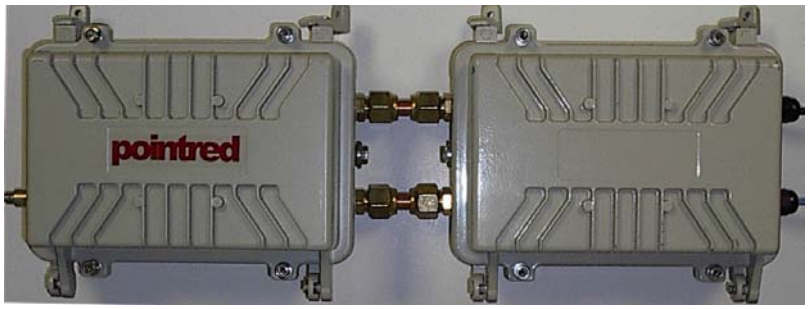
This product is not sold directly to end users. Systems will be sold only to Point Red Authorized Resellers.

II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

RF Specifications

RF Frequency Band	2.405 to 2.475 GHz
RF Channels	Programmable in 1 MHz steps
RF Signal Bandwidth	12 MHz (6 non overlapping channels)
Modulation Type	FSK
Data rate	4 Mbps
Transmitter Output Power	26 dBm, variable
Antennas	24 dBi dish antenna
	15 dBi yagi antenna
	16 dBi flat panel antenna
	9 dBi omni antenna

The Base Station Modem



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 radio base station.

The CPE Modem

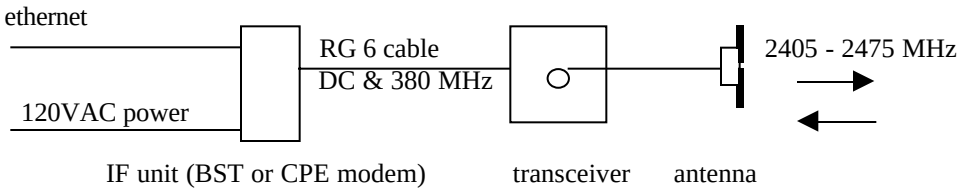
The Customer Premise Equipment (CPE) Modem IF Unit functions as the endpoint users interface to the Internet or other media types. The CPE is an easily configurable subscriber Modem unit. That provides a 10BASET connection type for multiple applications such as Data, Voice, or Video. The CPE is partnered with a Power supply that operates at 110vdc or 220vdc. The CPE modem is connected via coaxial cable to the transceiver unit mounted outdoors.

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 unit. The transceiver (radio unit) can be configured as **either customer premises**

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

Fig.1



III. TEST LOCATION

All output power, radiated, and AC line conducted emissions tests were performed at:

Compliance Certification Services
571F Monterey Road
Morgan Hill, CA 95037

Antenna output conducted emissions were performed at Pointred Technologies.

T.N. Cokenias 13 April 2003
EMC Consultant/Agent for Pointred Technologies

TEST PROCEDURES

Measurement Equipment Used:

TEST EQUIPMENTS LIST			
Name of Equipment	**Manufacturer**	**Model No.**	**Serial No.**
Line Filter	Lindgren 10k - 10GHz	LMF-3489	497
LISN	Fischer 9k - 100MHz	FCC-LISN-50/250-25-2	114
EMI Test Receiver	Rohde & Schwarz	ESHS 20	827129/006
Quasi Peak Adapter	HP9K - 1GHz	85650A	2811A01155
Spectrum Display	HP	85662A	2816A16696
Spectrum Analyzer	HP 0.1K - 1.5GHz	8568B	2732A03661
RF Preselector	HP20Hz-2GHz	85685A	2817A00756
Pre-Amplifier,25 dB	HP0.1 - 1300MHz	8447D (P8)	2944A06589
Antenna, Bilog	Schaffner-Chase30M-2GHz	CBL6112B	2586
Pre-Amplifier	MITEQ1-26GHz	NSP2600-44	646456
Horn Antenna(1 - 18GHz)	EMCO	3115	6717
Spectrum Analyzer	HP	8593EM	3710A00205
Filter 4.5GHz	FSY Microwave	FM-4570-9SS	3
Power Meter	Aglient	e441	gb41291160

Radiated Emissions
Test Requirement: 15.109, 15.205, 15.209, 15.247

Test Procedures, 1- 26 GHz:

1. The EUT was placed on a wooden table resting on a turntable on the open air test site. The search antenna was placed 3m from the EUT. The EUT antenna was mounted vertically as per normal installation.

2. The turntable was slowly rotated to locate the direction of maximum emission at each emission falling in the restricted bands of 15.205.

3. Radiated emissions were investigated for a LOW channel, a MID channel, and HIGH channel. Emissions were investigated to the 10^{th} harmonic.

4. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations. The maximum readings so obtained are recorded in the data listed below.

Radiated Test Set-up, 1-40 GHz

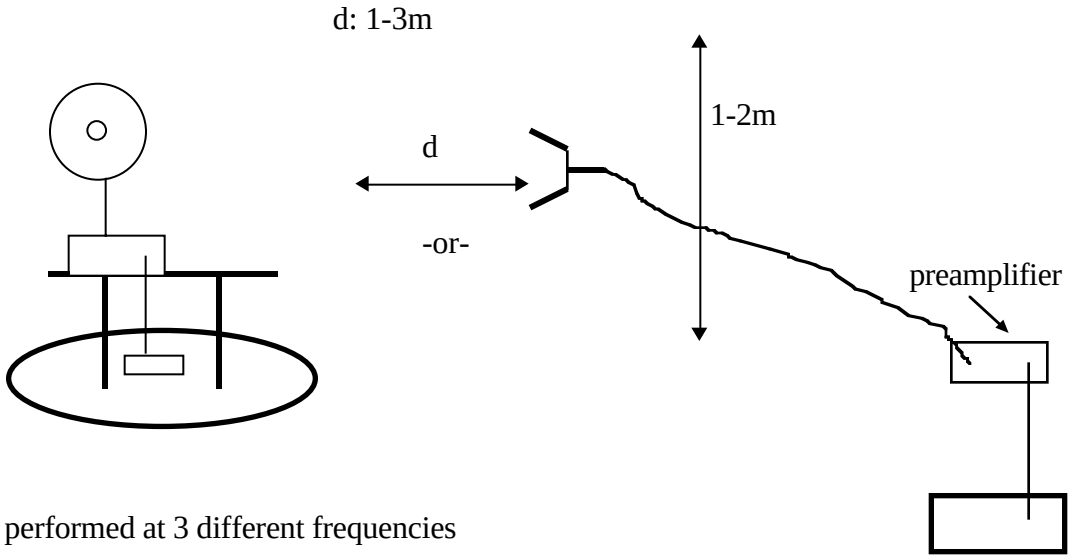


Figure 2

Testing was performed at 3 different frequencies

Channel	**Frequency, MHz**
Low	2405
Mid	2440
High	2475

Radiated emissions were performed at each frequency for 2 different transmitter antennas.

Antennas tested:

Antenna Type	**Gain**	**Antenna Manufacturer**	**Model Number**
omni	9 dBi	Mobilemark	OD9-2400
dish	24 dBi	Pacific Wireless	PAWDC24
yagi	15 dBi	Cushcraft	PC2415N
flat panel	16 dBi	MTI	MT364023/n

Test Results: Worst case results are presented. Refer to separate Excel spread sheet files.

Radiated Test Set-up, 30 - 1000 MHz

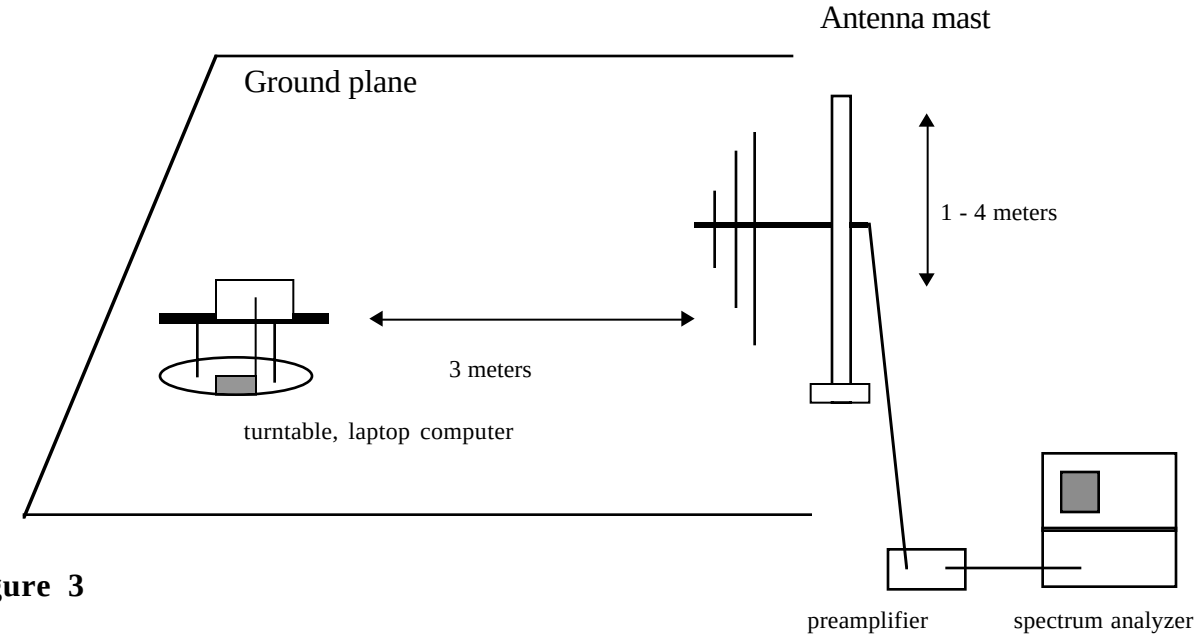


Figure 3

Test Procedures, 30 -1000 MHz

The EUT was set to RECEIVE/TRANSMIT mode. Radiation emissions from the digital portion of the EUT were measured according to the dictates of ANSI C63.4.

Test Results

Refer to separate attachment.

Radiated Emissions, Band Edge

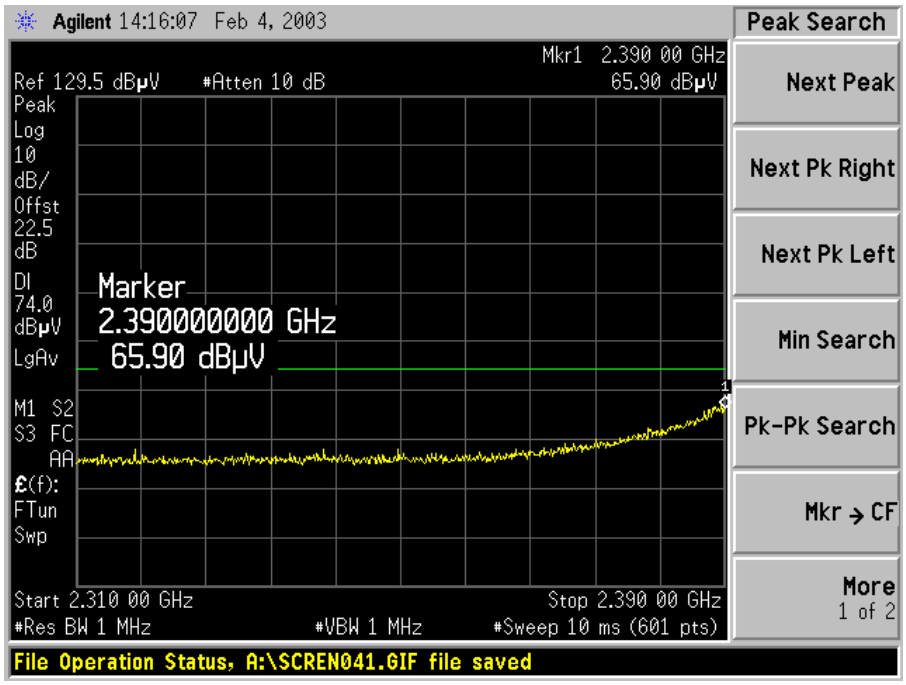
Investigations were performed in the 2310 - 2390 MHz and 2483.5 – 2500 MHz restricted bands at the edges of the operating band.

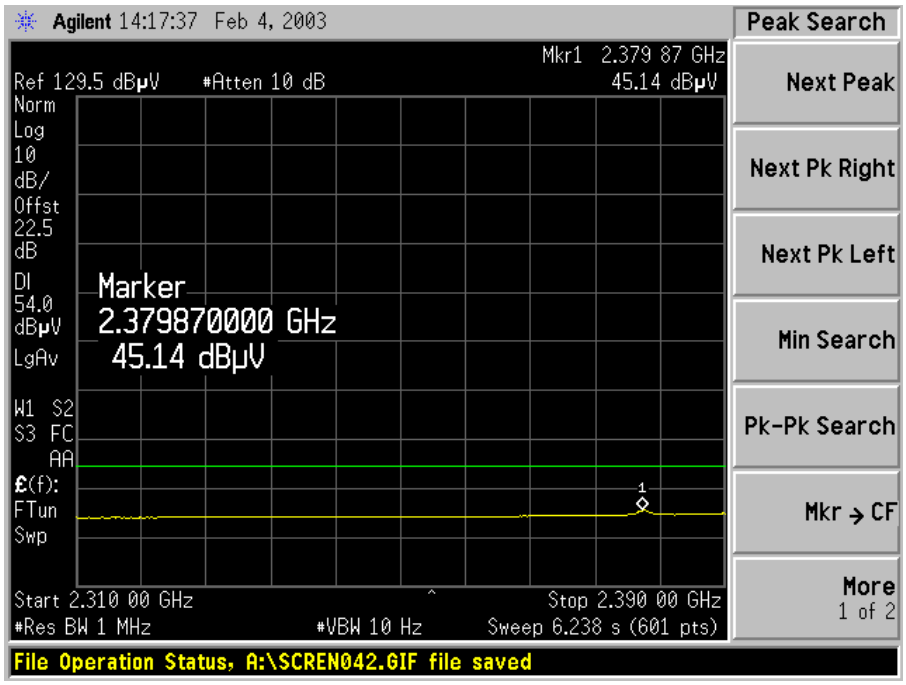
The EUT was set up with transmit antenna as shown in Figure 2 above, except that the high pass filter and pre-amplifier were not used. The search antenna was raised and lowered, and the turntable was rotated, to maximize received emissions, which were compared against the limits for radiated emissions in the restricted bands.

The 24 dBi dish antenna and the 15 dBi panel antenna exhibited worst case emissions. Transmitter was set to 2405 MHz for 2310-2390 MHz investigation. Transmitter was set to 2475 MHz for 2483.5 – 2500 MHz investigation.

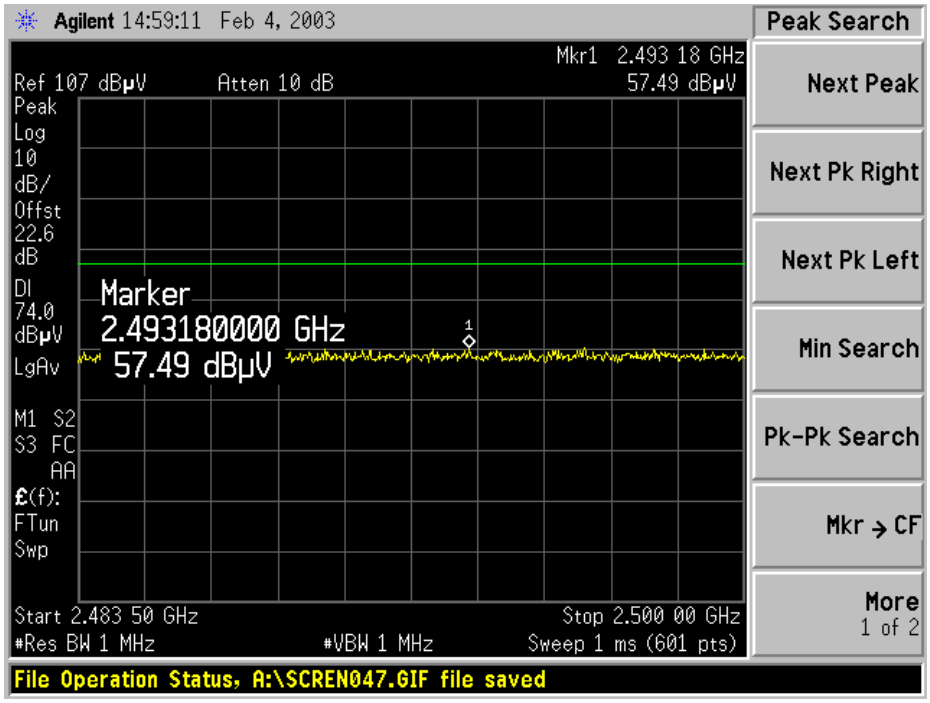
The EUT was well within limits, as would be expected for the type modulation used with this EUT (FSK, basically simple FM modulation).

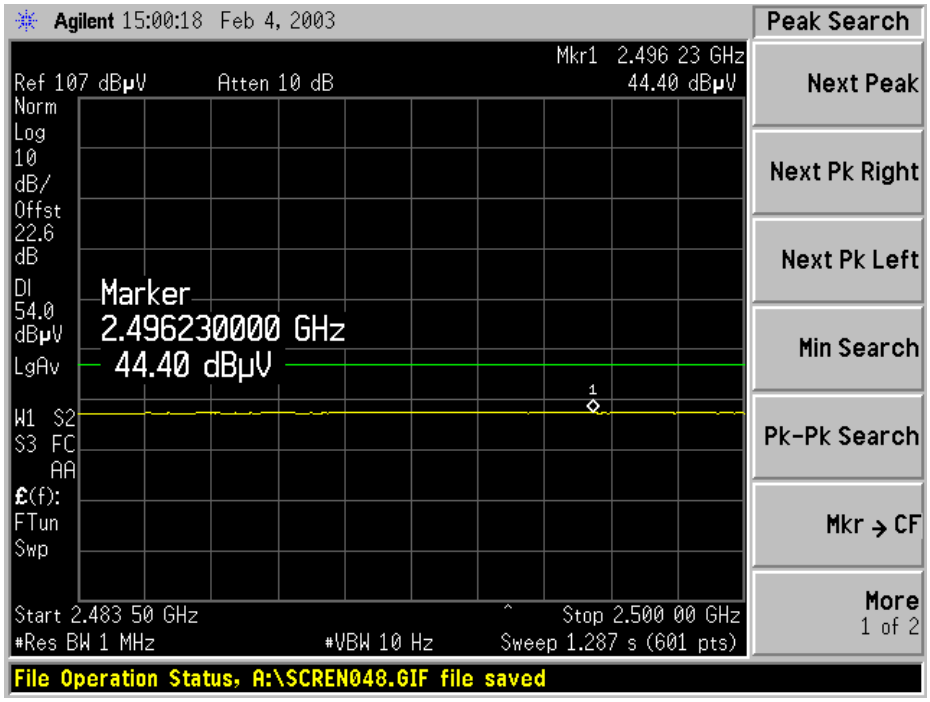
FLAT PANEL ANTENNA, 2310-2390 MHz, Peak and Average Field Strength



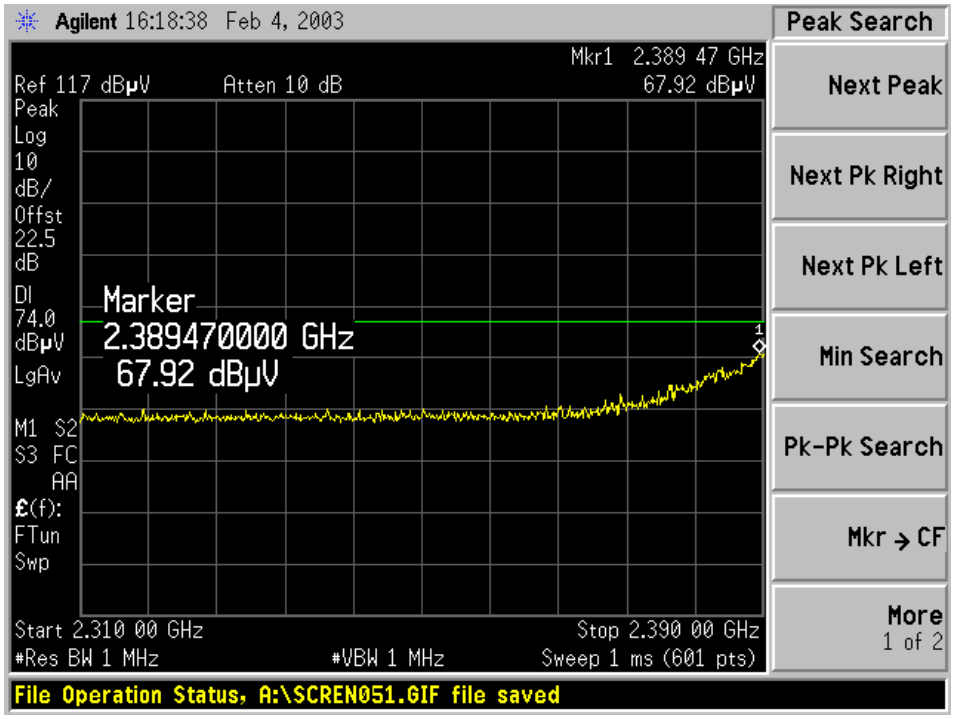


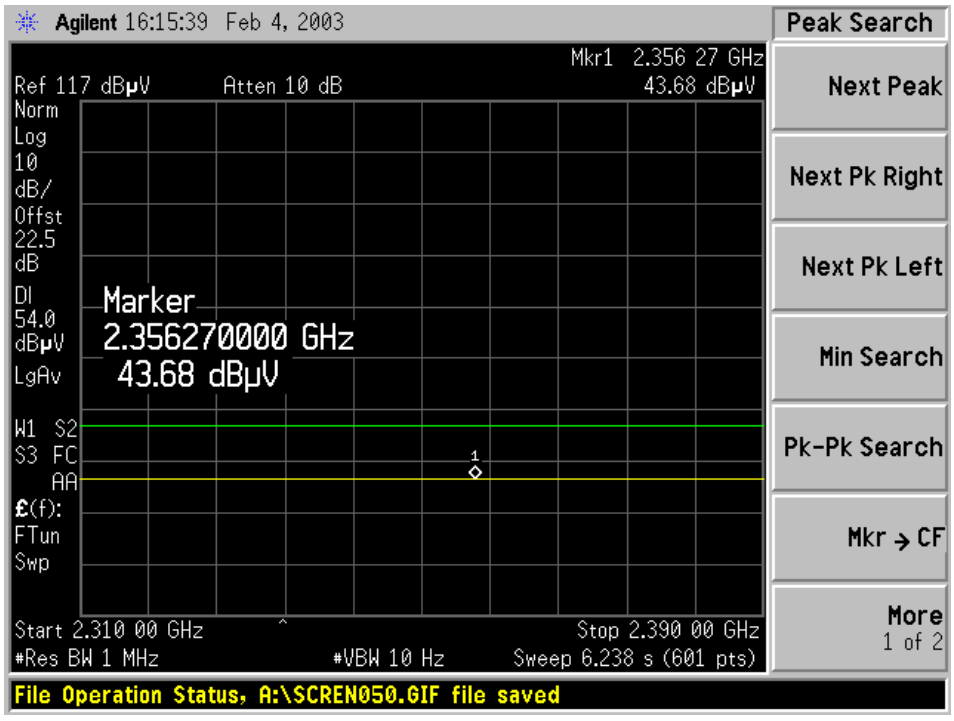
FLAT PANEL ANTENNA, 2483.5-2500 MHz, Peak and Average Field Strength



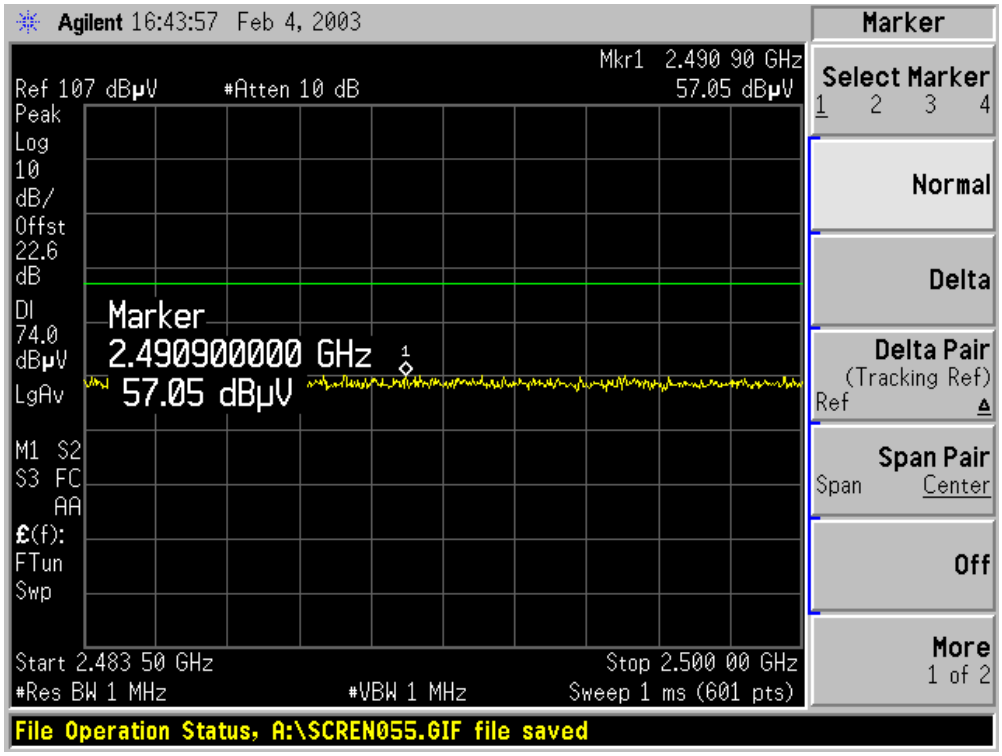


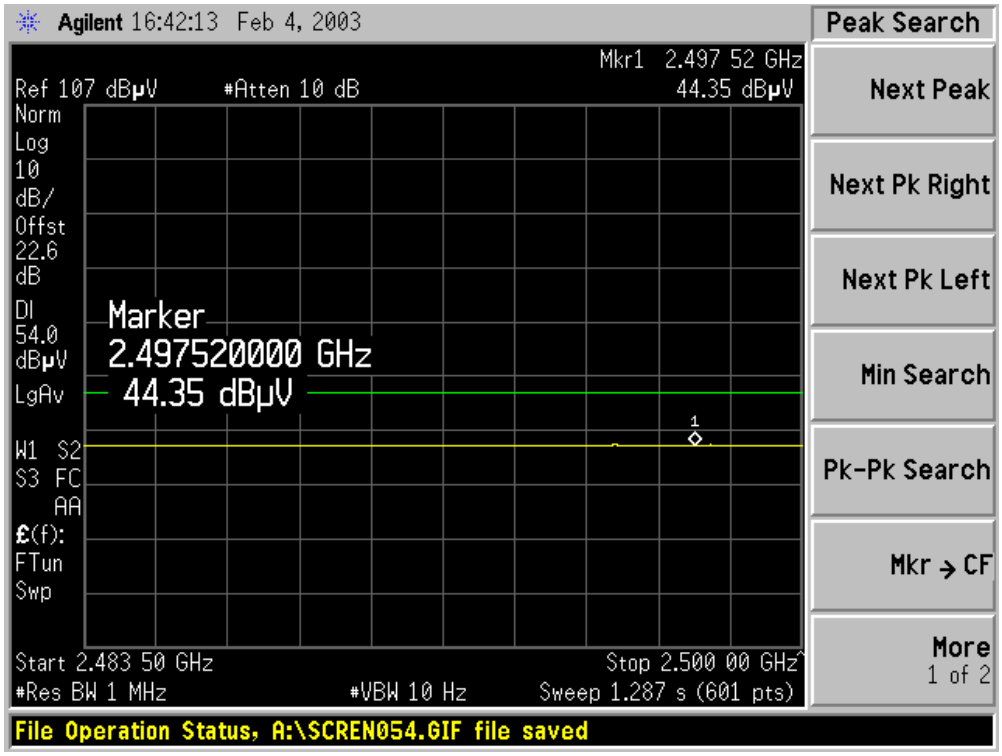
DISH ANTENNA, 2310-2390 MHz, Peak and Average Field Strength





DISH ANTENNA, 2483.5-2500 MHz, Peak and Average Field Strength





AC Line Conducted Emissions
Test Requirement: 15.107, 15.207

Measurement Equipment Used:

Rohde & Schwarz EMI Receiver ESHS-20
Fischer Custom Communication LISN, FCC-LISN-50/250-25-2

Test Procedure

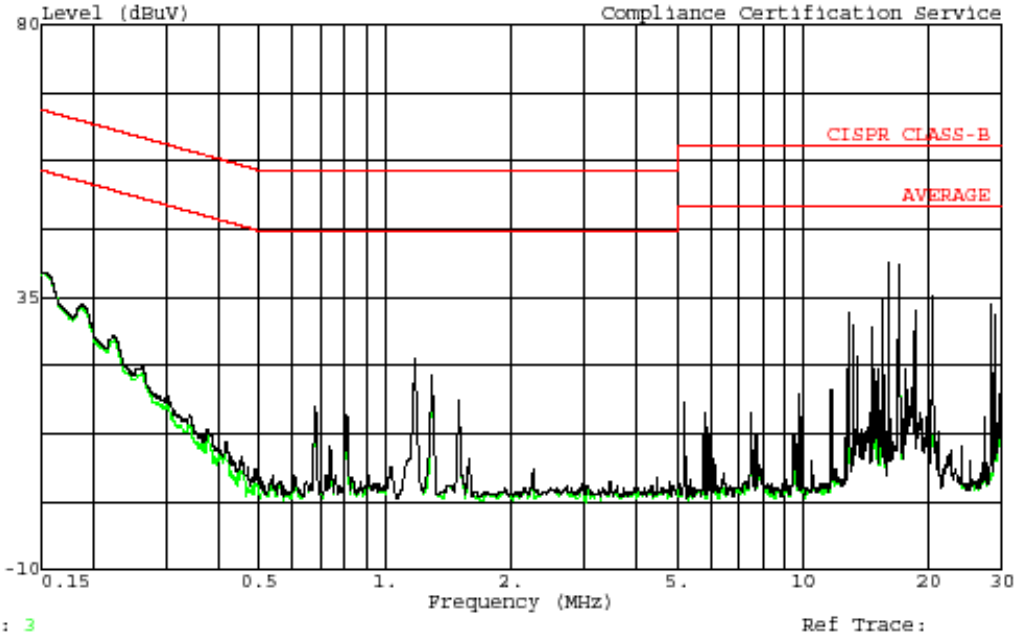
1. The EUT was placed on a wooden table 40 cm from a vertical ground plane and approximately 80 cm above the horizontal ground plane on the floor. The EUT was set to transmit in normally.
2. Line conducted data was recorded for both NEUTRAL and HOT lines.

Test Results

PASS. Refer to data sheet below.

561F Monterey Road,
San Jose, CA 95037 USA
Tel: (408) 463-0885
Fax: (408) 463-0888

Data#: 8 File#: POINTRED.EMI Date: 02-04-2003 Time: 17:17:52



Trace: 3 Ref Trace:
Project # : 03U1821-1
Test Engineer : Chin Pang
Company : PointRed
EUT : Transceiver
Test Config. : EUT/Modem
Test of Target: FCC Class B
Mode of Op. : Transmitting
: L1: Peak (Black), L2: Peak (Green)
: 115VAC/60Hz

Minimum 6 dB Bandwidth
Test Requirement: 15.247(a)2

Measurement Equipment Used:

HP 8563 Spectrum Analyzer (Pointred Technologies)
20 dB attenuator
3ft length coaxial cable (2 dB loss)

Test Procedures

The EUT was configured on a test bench. The EUT was set for continuous operation . Frequency was set to LOW channel. While the transmitter broadcast a steady stream of digital data, the analyzer MAX HOLD function was used to capture the envelope of the transmission occupied bandwidth.

The test was repeated at MID channel and at HIGH channel.

Test Results: Refer to attached spectrum analyzer charts. Data taken with RES BW of 100 kHz shows minimum 6 dB BW of 1.117 MHz. Minimum requirement: 500 kHz

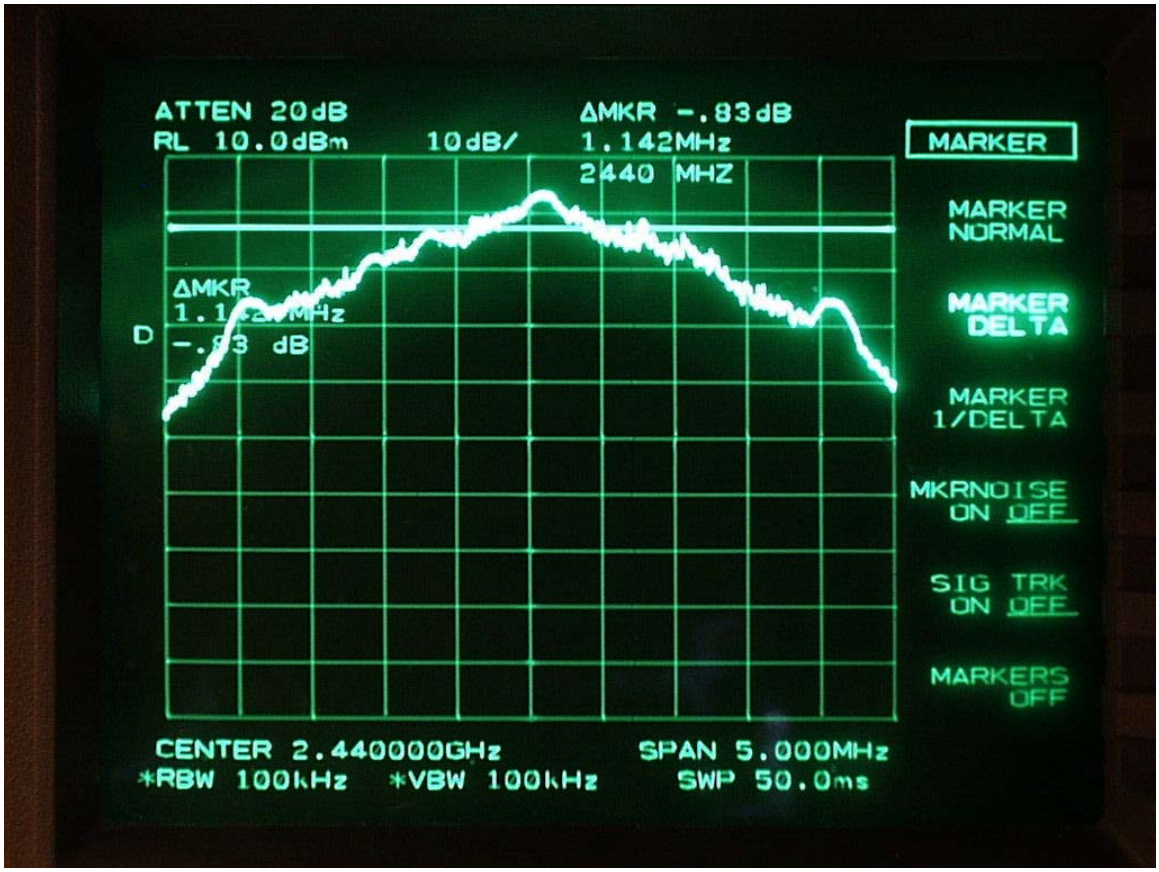
Channel	**Frequency, MHz**
Low	2405
Mid	2440
High	2475

15.247(a)2: Minimum 6 dB Bandwidth

LOW Channel

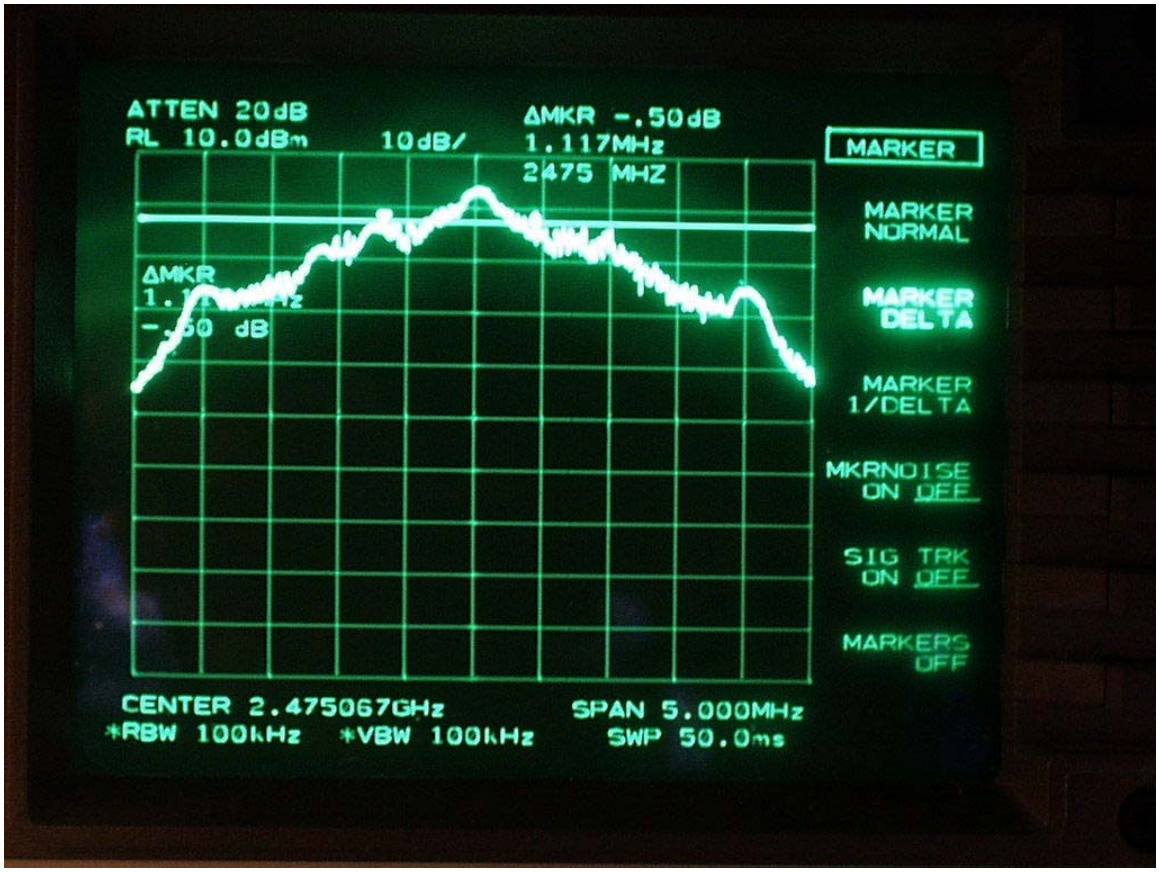
Minimum 6 dB BW

MID Channel



Minimum 6 dB BW

HIGH Channel



RF Power Output
Test Requirement: 15.247(b)

Measurement Equipment Used:

Agilent E4416A power meter
Agilent E9327A peak RF power sensor
20 dB attenuator

Test Procedures

1. The EUT was configured on a test bench. The power meter was zeroed and calibrated. The control software was activated and power was set to produce highest output level.
2. The 20 dB attenuator was connected to the antenna port of the EUT. The power meter head was connected to the other end of the attenuator. Peak power was read directly off the meter, accounting for the 20 dB attenuator.

3. The process in (1) and (2) was repeated for MID channel and HIGH channel.

Test Results

Power level readings converted to dBm are shown below. Refer also to spectrum analyzer graphs. Reference level offset corrects for external attenuation and cable loss.

Channel	Frequency, MHz	Output Power, dBm
1 LOW	2405	26.35
3 MID	2440	25,05
5 HIGH	2475	25.73

Maximum output power output variation within 0.4 dBm of design maximum 26 dBm output.

Spurious Emissions, Conducted
Test Requirement: 15.247(c)

Measurement Equipment Used:

HP 8563 Spectrum Analyzer (Pointred Technologies)
20 dB attenuator
3ft length coaxial cable (2 dB loss)

Test Procedure

1. The EUT was configured on a test bench. The cable was connected between the EUT antenna port and the spectrum analyzer input port.

Spectrum analyzer RES BW was set to 100 kHz. While the transmitter broadcast a steady stream of digital data, the analyzer MAX HOLD function was used to capture the envelope of the transmission.

Readings were taken out to 10fo.

2. The process in (1) was repeated for MID channel and HIGH channel.

Test Results

Refer to attached data sheets. Data shows out of band emissions are suppressed well below the -20 dBc minimum required by the Rules.

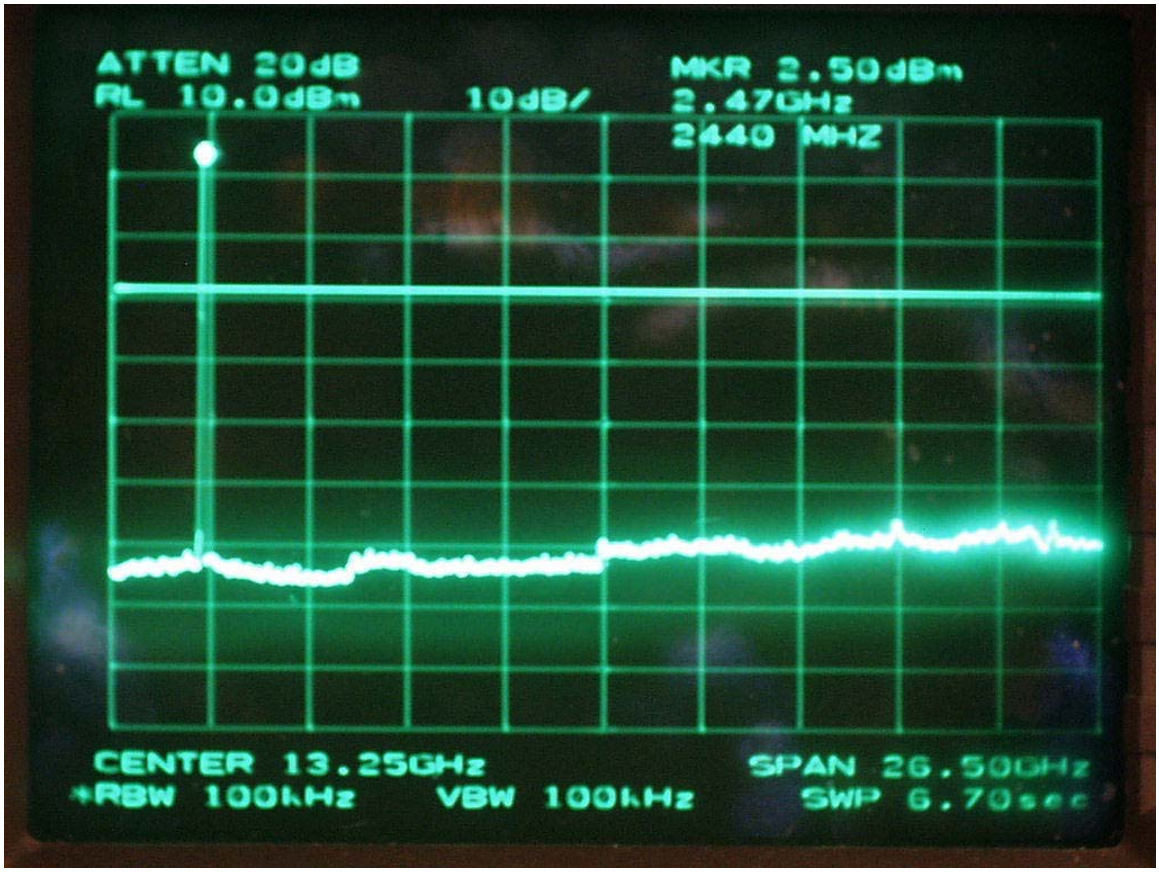
Channel	Frequency, MHz
1 LOW	2405
4 MID	2440
5 HIGH	2475

15.247(c): Spurious Emissions, Conducted, -20 dBc

LOW Channel

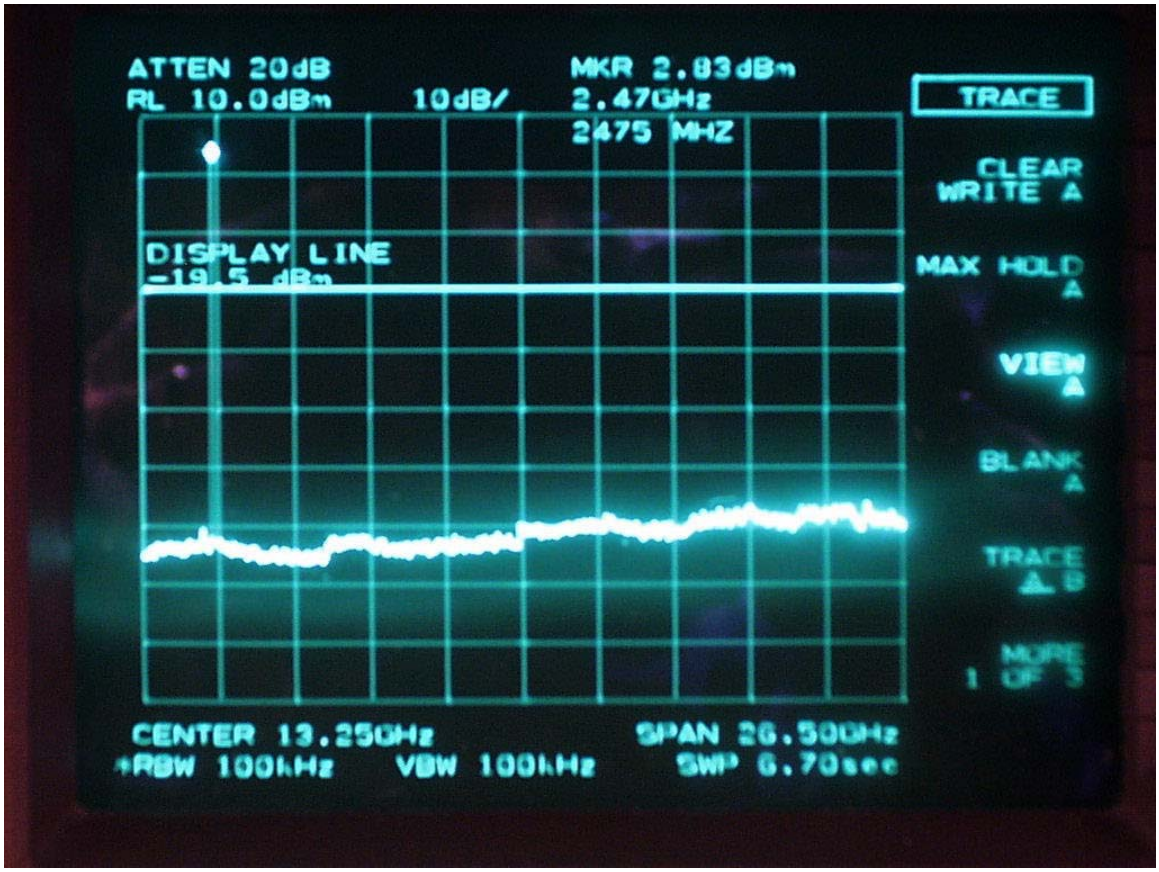
15.247(c): Spurious Emissions, Conducted, -20 dBc

MID Channel



15.247(c): Spurious Emissions, Conducted, -20 dBc

High Channel



Power Spectral Density
Test Requirement: 15.247(d)

Measurement Equipment Used:

HP 8563 Spectrum Analyzer (Pointred Technologies)
20 dB attenuator
3ft length coaxial cable (2 dB loss)

Test Procedure

For the LOW channel, the emission peak was set to the center of the display. The SPAN was set to 300 kHz, the RES BW and VID BW were set to 3 kHz, and SWEEP TIME was set to 100 seconds. The maximum trace was recorded and compared to the 8 dBm limit.

The test was repeated for MID and HIGH channel.

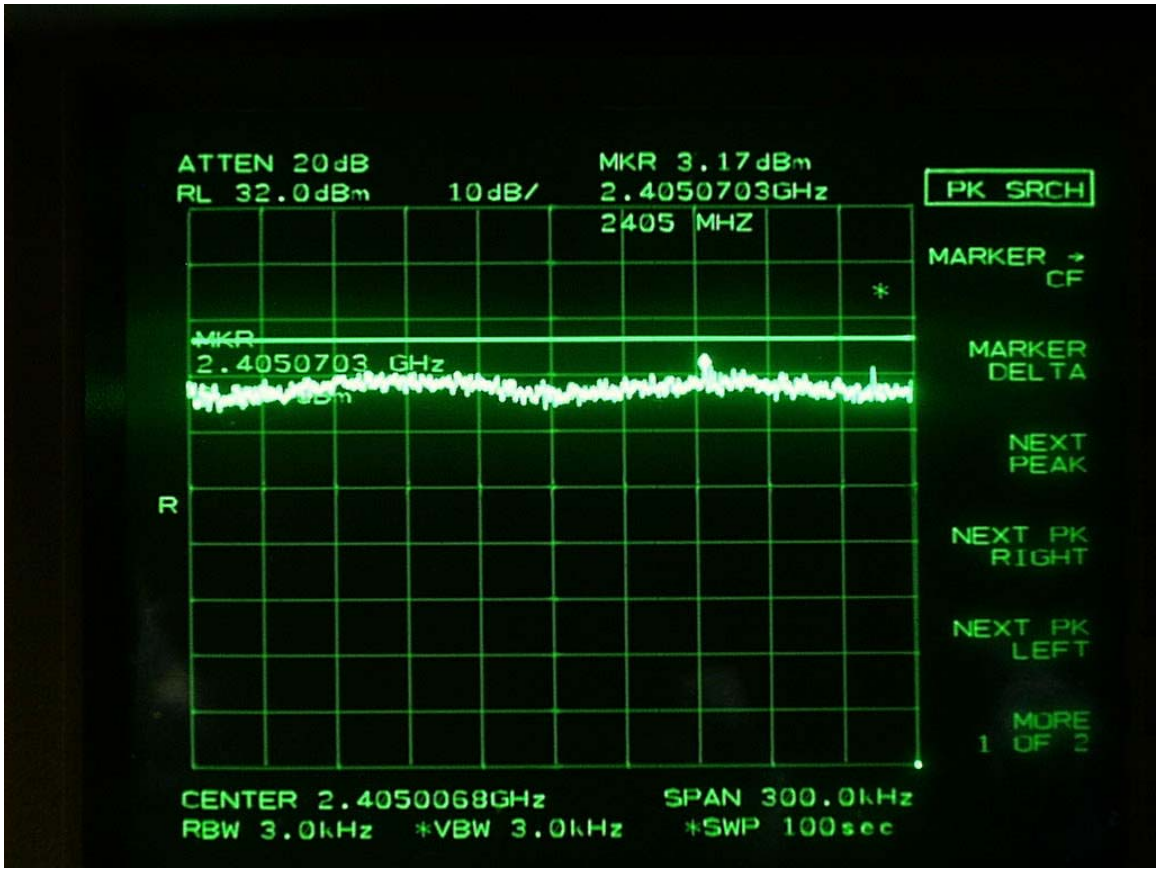
Test Results

Maximum measured PSD was approximately 3.3 dBm. Maximum allowed psd is 8 dBm. Refer to attached spectrum analyzer charts.

Channel	Frequency, MHz
1 (Low)	2405
4 (Mid)	2440
5 (High)	2475

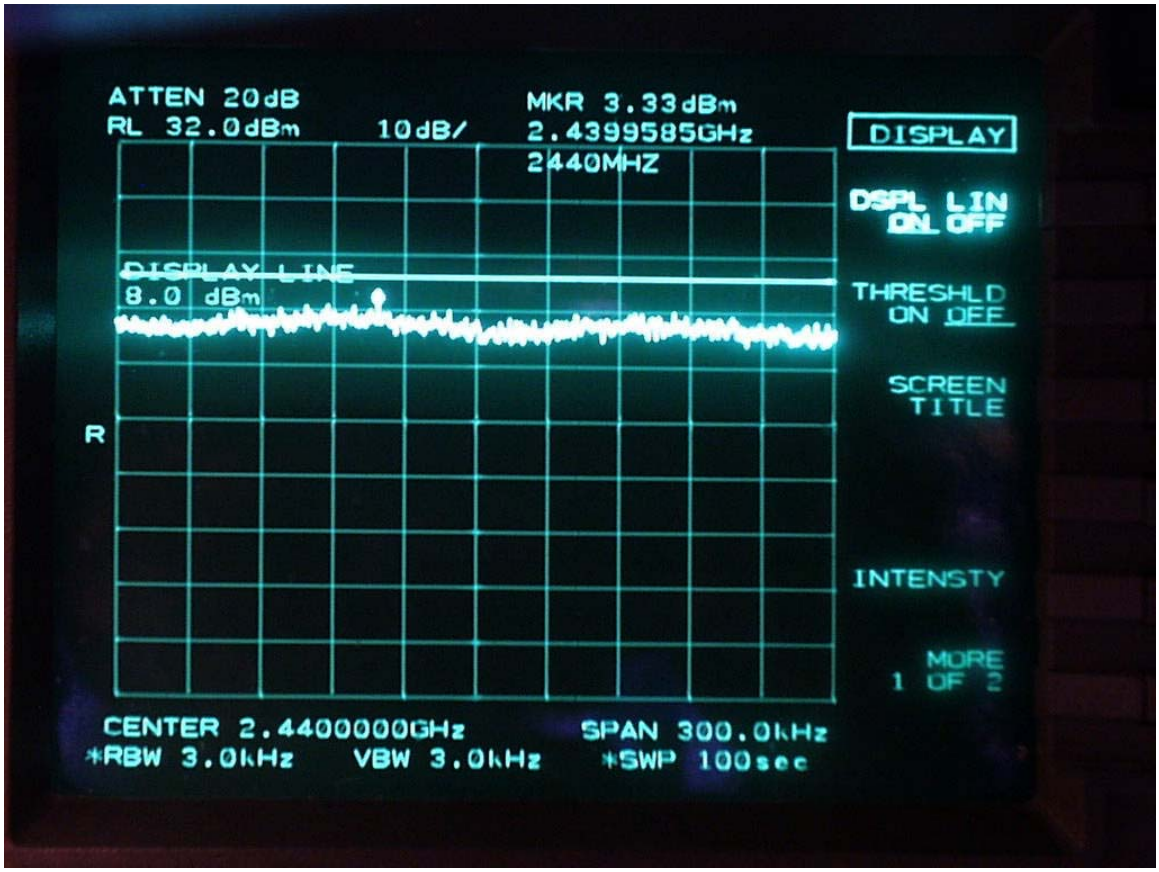
15.247(d): Power Spectral Density

LOW Channel



15.247(d): Power Spectral Density

MID Channel



15.247(d): Power Spectral Density

HIGH Channel