



## **FCC CFR47 Part 15.247 DTS Test Report**

**Prepared for: Xtreme Power Systems**

**Model: DivBee**

**Description: Zigbee Transceiver (2.4 GHz)**

**To**

**Federal Communications Commission**

**Rule Part(s) 15.247**

**Date of Issue: July 7, 2011**

**On the behalf of the applicant:**

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**John Erhard  
Project Test Engineer**

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### Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	July 7, 2011	John Erhard	Original Document
2.0	August 8, 2011	John Erhard	Add antenna type information
3.0	August 8, 2011	Amanda Reed	Modify customer phone number



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## ILAC / A2LA

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The tests results contained within this test report all fall within our scope of accreditation, unless noted in the table below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

Testing Certificate Number: **2152.01**



FCC OATS Reg, #933597

IC Reg. #2044A-1

**Non-accredited tests contained in this report:**

N/A



**The applicant has been cautioned as to the following:**

**15.21 - Information to User**

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**15.27(a) - Special Accessories**

Equipment marked to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.



## Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing.

In accordance with ANSI C63.10-2009 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature	Humidity	Pressure
26.50	40.20	969.40

## EUT Description

The EUT is a ZigBee transmitter meeting the requirements of full modular certification.

## EUT Operation during Testing

The EUT is controlled by a test PCB allowing for operation on any channel at various power levels.

### Accessories:

Qty	Type	Make, Model	S/N
	None		

### Cables:

Qty	Type	Length (m)	Shield	Shielded Hood	Ferrite
	None				



## Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(b)	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Emissions At Band Edges	Pass	
15.247(a)(2)	Occupied Bandwidth	Pass	
15.247(e)	Transmitter Power Spectral Density	Pass	
15.207	A/C Powerline Conducted Emissions	N/A	The EUT does not connect to the AC mains
RSS GEN6(b)	Receiver Spurious Emissions	Pass	

### 15.203: Antenna Requirement:

- ☐ The antenna is permanently attached to the EUT
- ☒ The antenna uses a unique coupling
- ☐ The EUT must be professionally installed
- ☐ The antenna requirement does not apply

A 2.15 dBi Monopole antenna was used for testing. It attached through a UFL connector.



## Peak Output Power

**Name of Test:** Peak Output Power

**Specification:** 15.247(b)

**Engineer:** John Erhard

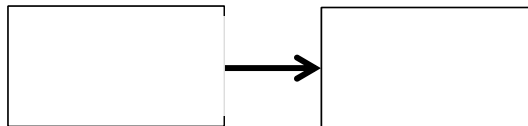
**Test Equipment Utilized:** i00379

**Test Date:** 7/6/2011

### Test Procedure

The EUT was connected directly to a Spectrum analyzer and the peak readings were taken and the result was then compared to the limit.

### Test Setup



### Transmitter Peak Output Power

Tuned Frequency MHz	Measured Value dBm	Specification Limit	Result
2405	17.69	1 W (30 dBm)	Pass
2440	20.17	1 W (30 dBm)	Pass
2480	-2.278	1 W (30 dBm)	Pass





## Conducted Spurious Emission

**Name of Test:** Conducted Spurious Emissions

**Specification:** 15.247(d)

**Engineer:** John Erhard

**Test Equipment Utilized:** i00379

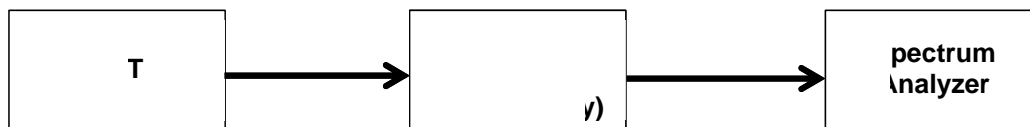
**Test Date:** 7/6/2011

### Test Procedure

The EUT was connected to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The Frequency range from 30 MHz to the 10<sup>th</sup> harmonic of the fundamental transmitter was observed. The recorded value was summed with the peak output power to provide the correct value –dBc. If necessary a 10 dB attenuator is utilized to ensure that the spectrum analyzer is not driven into compression thus ensuring accurate readings.

Only the worst case emission for each frequency is recorded in the Conducted Spurious Emissions Summary Test Table.

### Test Setup

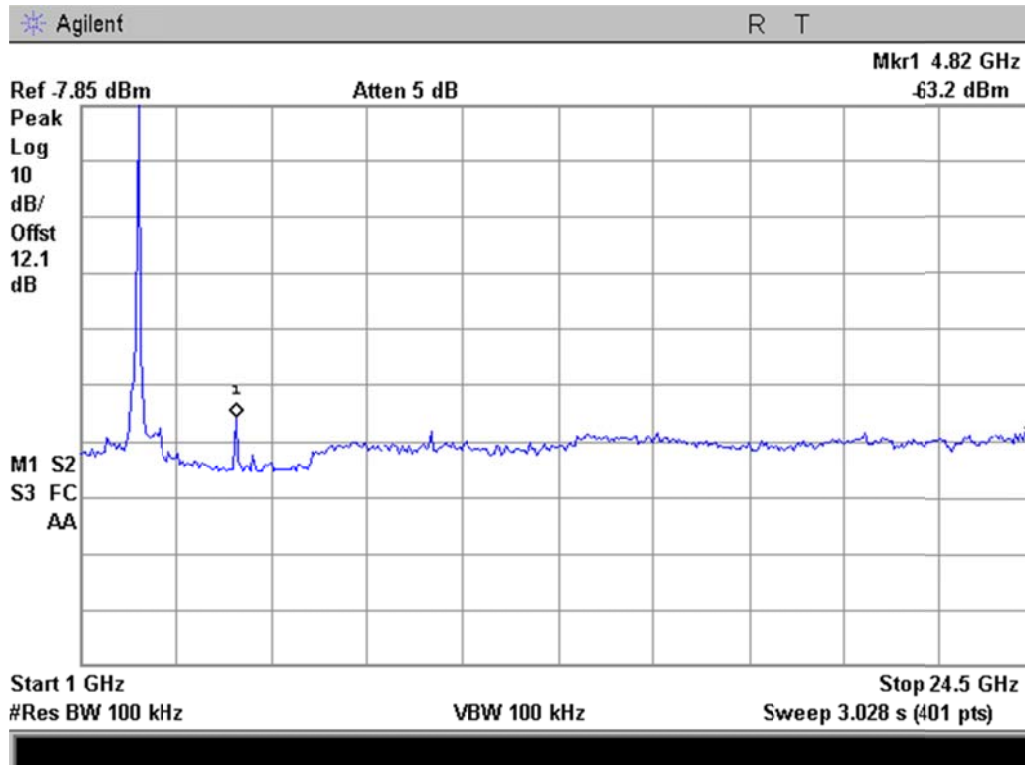
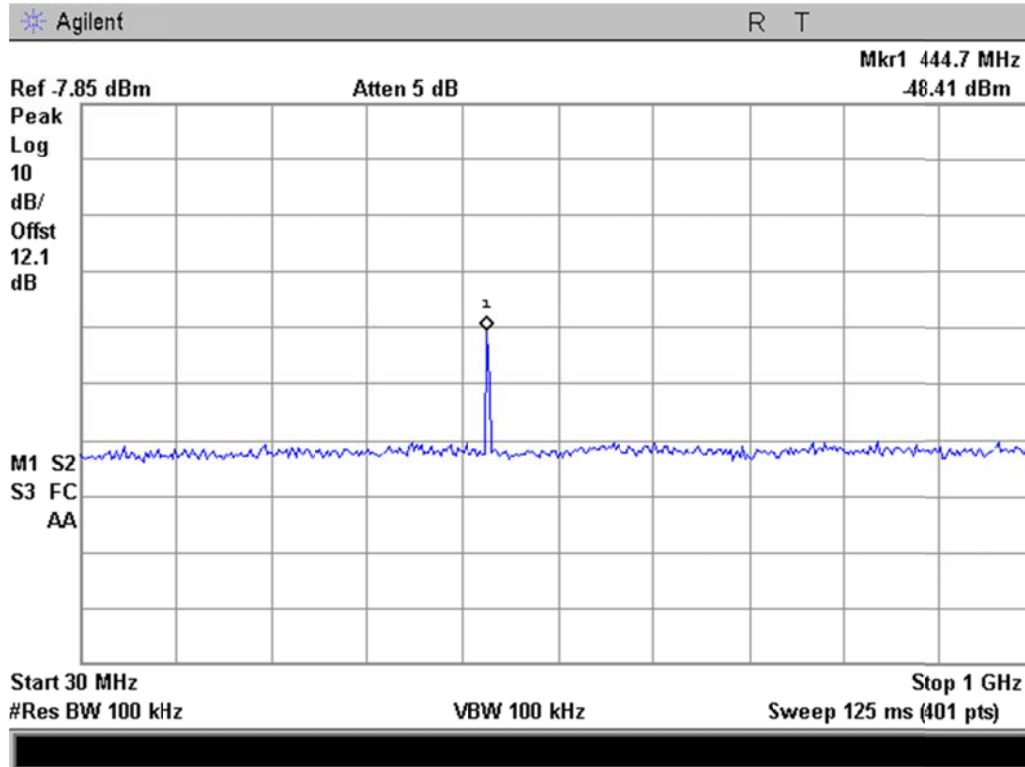


**Conducted Spurious Emissions Summary Test Table**

Tuned Frequency MHz	Emission Frequency MHz	Measured Value dBm	Peak Output Power dBm	Corrected Value dBc	Specification Limit dBc	Result
2405	444.7	-48.41	17.69	-66.10	-20	Pass
2440	447.6	-47.60	20.17	-67.77	-20	Pass
2480	4967.5	-66.06	-2.27	-63.78	-20	Pass

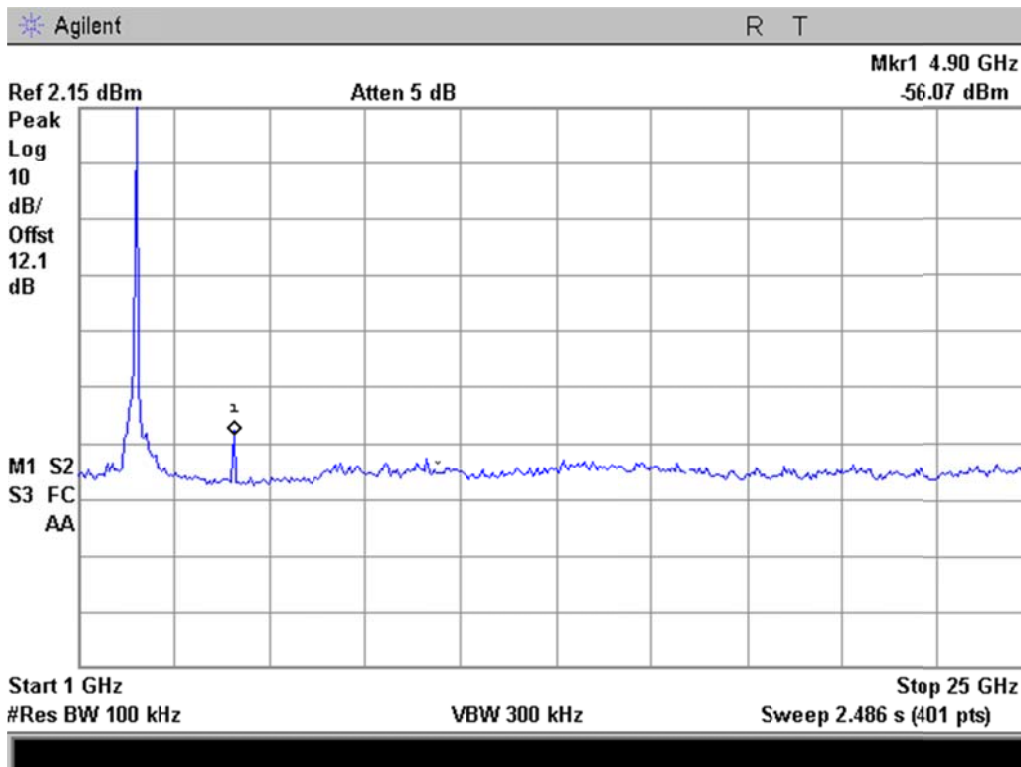
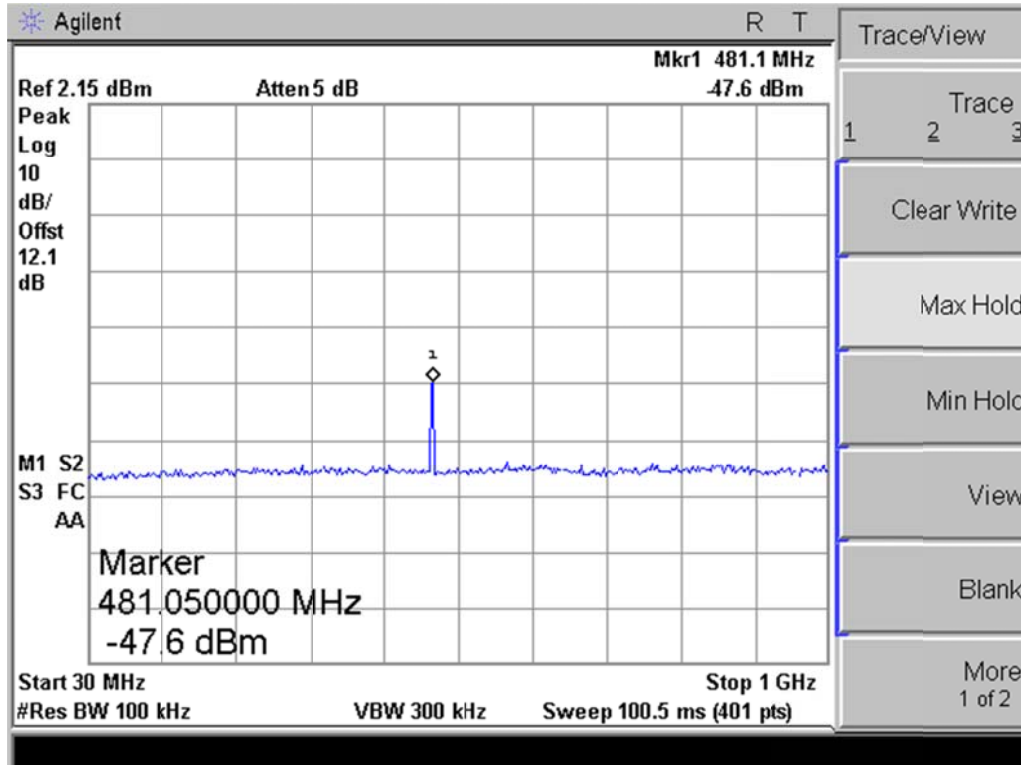


# Conducted Spurious Emissions Tuned Frequency=2405 MHz



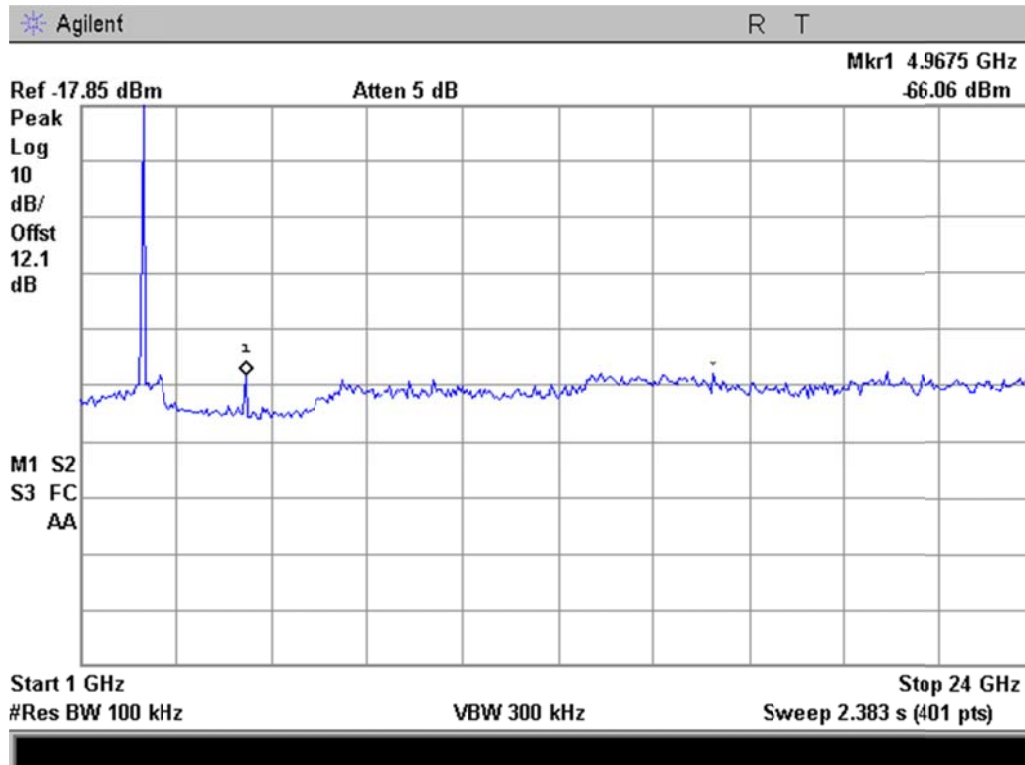
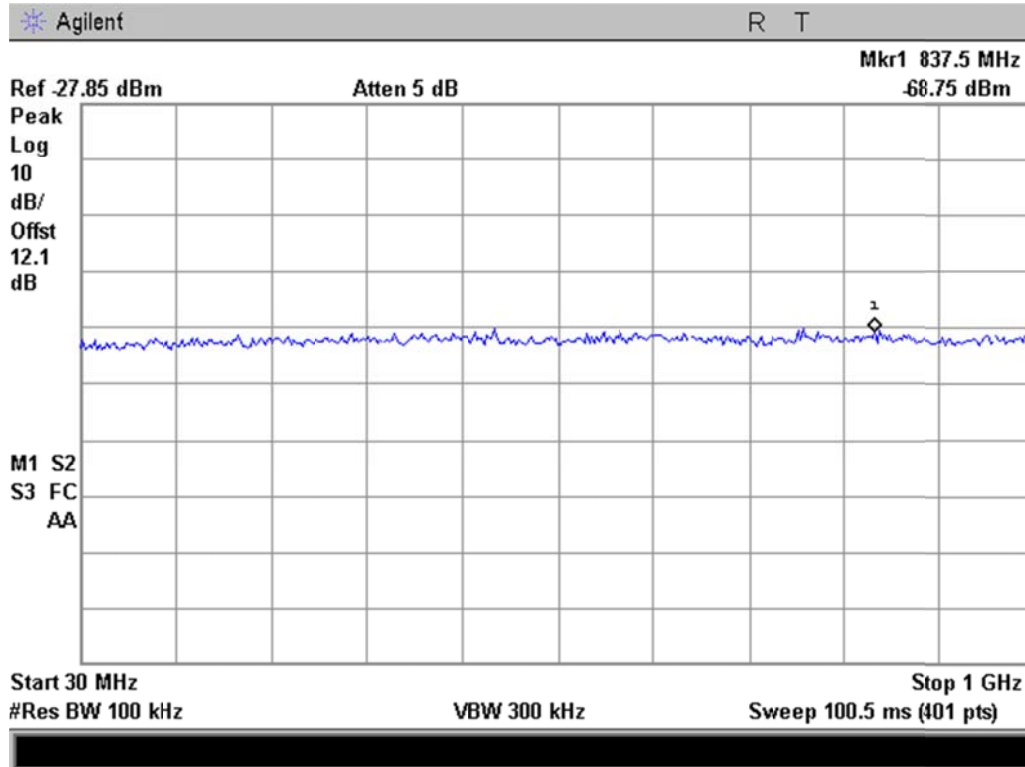


# Conducted Spurious Emissions Tuned Frequency=2440 MHz





# Conducted Spurious Emissions Tuned Frequency=2480 MHz





## Radiated Spurious Emissions

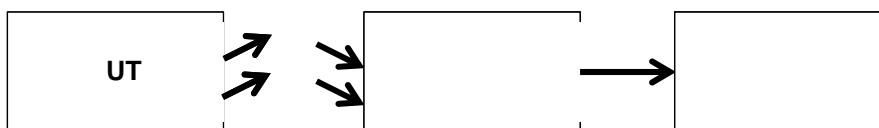
**Name of Test:** Radiated Spurious Emissions  
**Specification:** 15.247(d), 15.209(a), 15.205 **Engineer:** John Erhard  
**Test Equipment Utilized:** i00028, i00331, i00103, i00267, i00379 **Test Date:** 7/6/2011

### Test Procedure Radiated Spurious Emissions: 30 – 1000 MHz

The EUT was tested in an Open Area Test Site (OATS) set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions by rotating it 360° with the receiving antenna in both the vertical and horizontal orientation while being raised from 1 to 4 meters to maximize the TX signal level. All emissions from 30 MHz to 1 GHz were examined.

RBW = 120 KHz  
VBW = 300 KHz  
Detector – Quasi Peak

#### Test Setup



#### Radiated Spurious Emissions Test Data: 30 MHz – 1 GHz

Emission Frequency (MHz)	Measured Value (dBuV/m)	Correction Factor (dB)	Corrected Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
38.750	10.010	15.508	25.518	40.000	-14.482
157.475	7.640	12.389	20.029	43.500	-23.471
329.050	5.720	16.095	21.815	46.000	-24.185
468.150	9.110	19.462	28.572	46.000	-17.428
648.675	5.530	22.434	27.964	46.000	-18.036
847.975	6.000	25.584	31.584	46.000	-14.416



### Test Procedure for Radiated Spurious Emissions above 1 GHz

The EUT was tested in a semi anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions. The antenna, band reject filter, amplifier and cable correction factors were input into the spectrum analyzer before recording the Measured Level to ensure accurate readings. The spectrum for each tuned Frequency was examined to the 10<sup>th</sup> harmonic.

#### Test Setup



Detector Settings	RBW	VBW	Span
Peak	1 MHz	3 MHz	As necessary
Average	1 MHz	3 MHz	As necessary

#### Radiated Spurious Emissions

Tuned Frequency (MHz)	Emission Frequency (MHz)	Peak Measured Data (dBuV/m)	Peak Limit (dBuV/m)	Average Measured Data (dBuV/m)	Average Limit (dBuV/m)	Result
2405	4809.1	52.98	74.0	44.4	54.0	Pass
2405	7214.1	57.81	74.0	48.9	54.0	Pass
2405	9619.1	61.14	74.0	51.94	54.0	Pass
2440	4881.25	55.12	74.0	49.01	54.0	Pass
2440	7321.25	57.54	74.0	50.29	54.0	Pass
2440	9757.75	64.43	74.0	52.70	54.0	Pass
2480	4959.52	42.85	74.0	39.91	54.0	Pass
2480	7439.52	47.38	74.0	41.93	54.0	Pass
2480	9919.52	53.82	74.0	48.53	54.0	Pass

No other emissions were detectable. All emissions were greater than -20 dBc.



## Emissions at Band Edges

**Name of Test:** Emissions At Band Edges

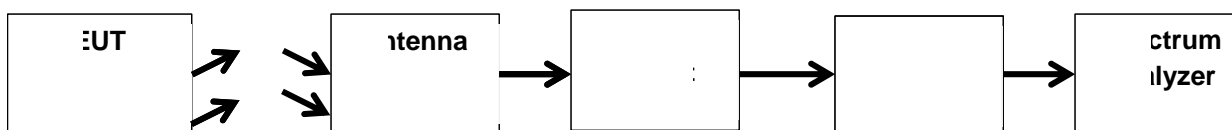
**Specification:** 15.247(d), 15.209(a), 15.205 **Engineer:** John Erhard

**Test Equipment Utilized:** i00028, i00331, i00385, i00103 **Test date:** 7/6/2011

### Test Procedure

The EUT was tested in a semi-anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for band edge and restricted band for both peak and average measurements. The cable and antenna correction factors were input into the analyzer as a reference level offset to ensure accurate readings were obtained. For the restricted band the amplifier and band reject filter correction factors were also input to the spectrum analyzer.

### Band Edge Test Setup



### Band Edge Emissions Summary

Tuned Frequency (MHz)	Measured Data (dBc)	Detector	Limit (dBc)	Result
2405	39.96	Peak	-20 dBc	Pass
2480	34.52	Peak	-20dBc	Pass

### Restricted Band Test Setup



### Restricted Band Emissions Summary

Restricted Band (MHz)	Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Data (dBuV/m)	Detector	Limit (dBuV/m)	Result
2300 – 2390	2405	2387.75	69.15	Peak	74	Pass
2300 – 2390	2405	2387.75	53.76*	Average	54	Pass
2483.5 - 2500	2480	2483.54	63.3	Peak	74	Pass
2483.5 - 2500	2480	2483.54	53.93*	Average	54	Pass

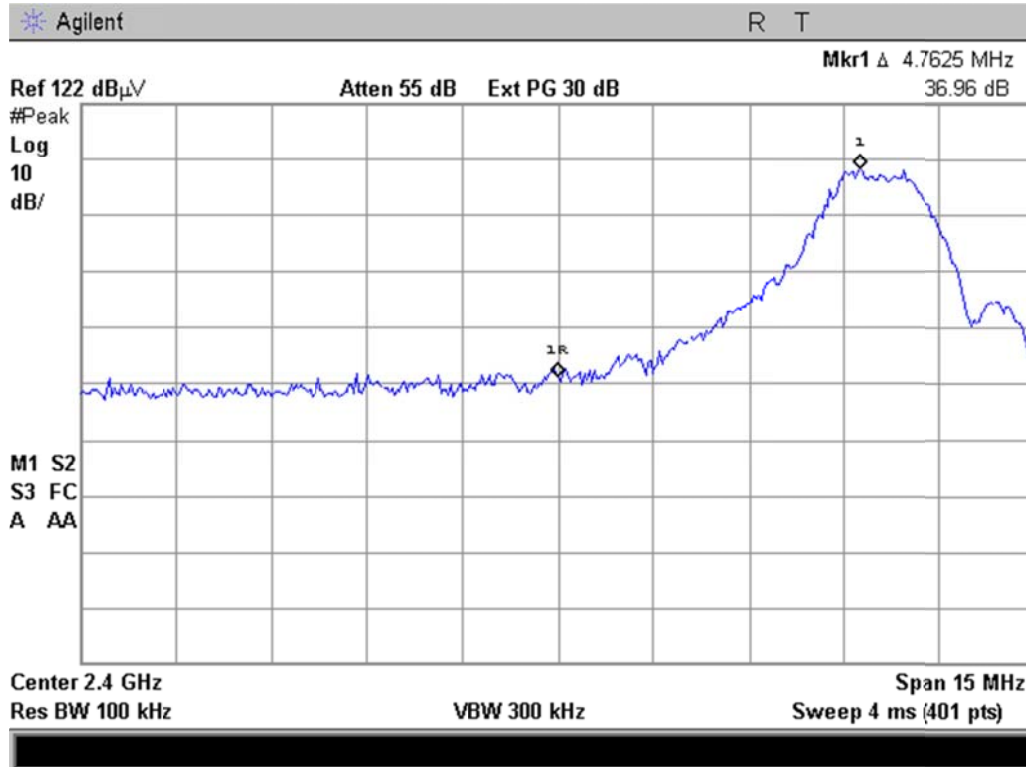
Note\* these average values are calculated from peak measurements and a duty cycle correction factor applied.

2405 Duty Cycle = 17% CF = 15.39 dB

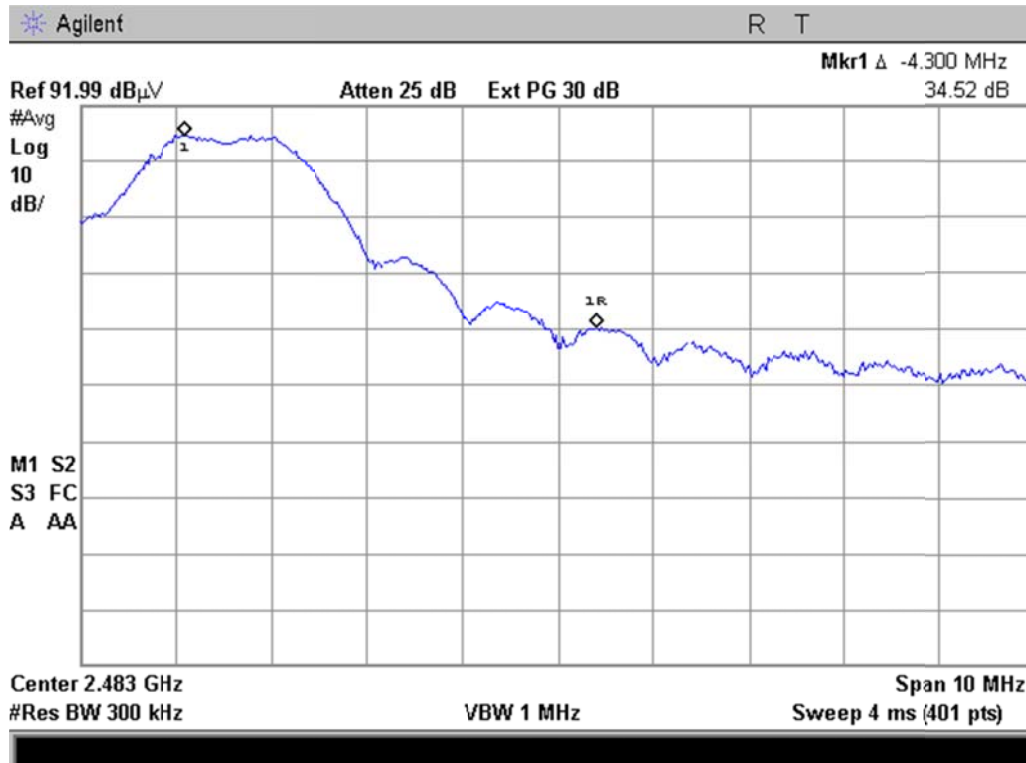
2480 Duty Cycle = 34% CF = 9.37 dB



Band Edge 2400 MHz  
Tuned Frequency = 2405 MHz



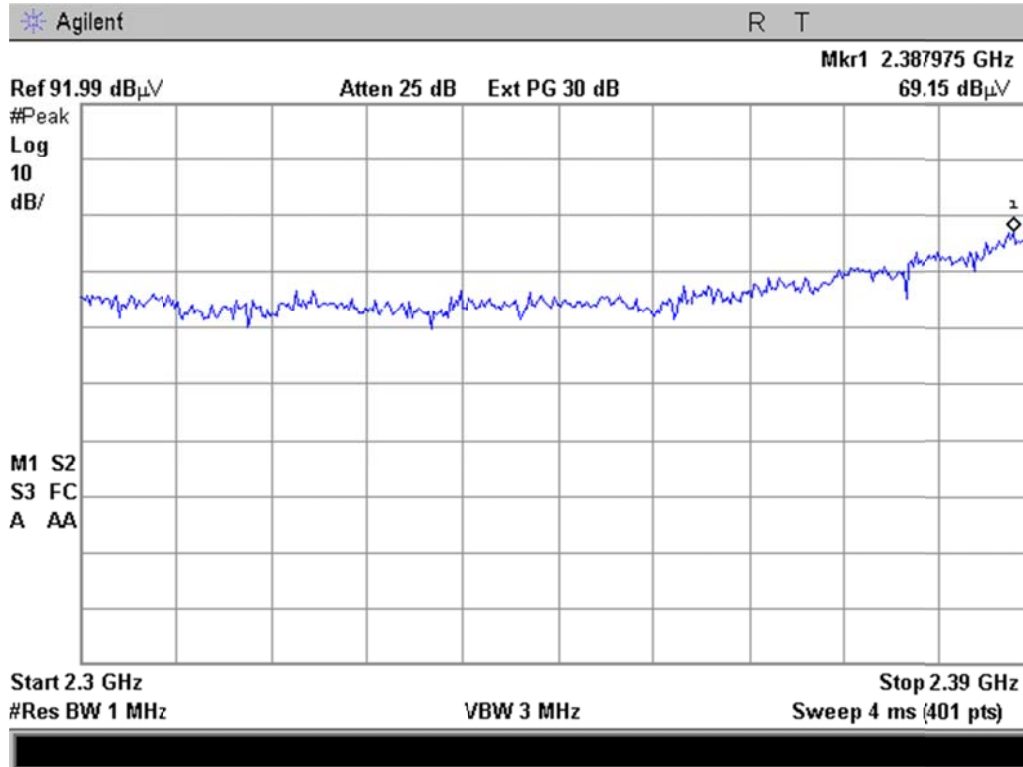
Band Edge 2483.5 MHz  
Tuned Frequency = 2480 MHz



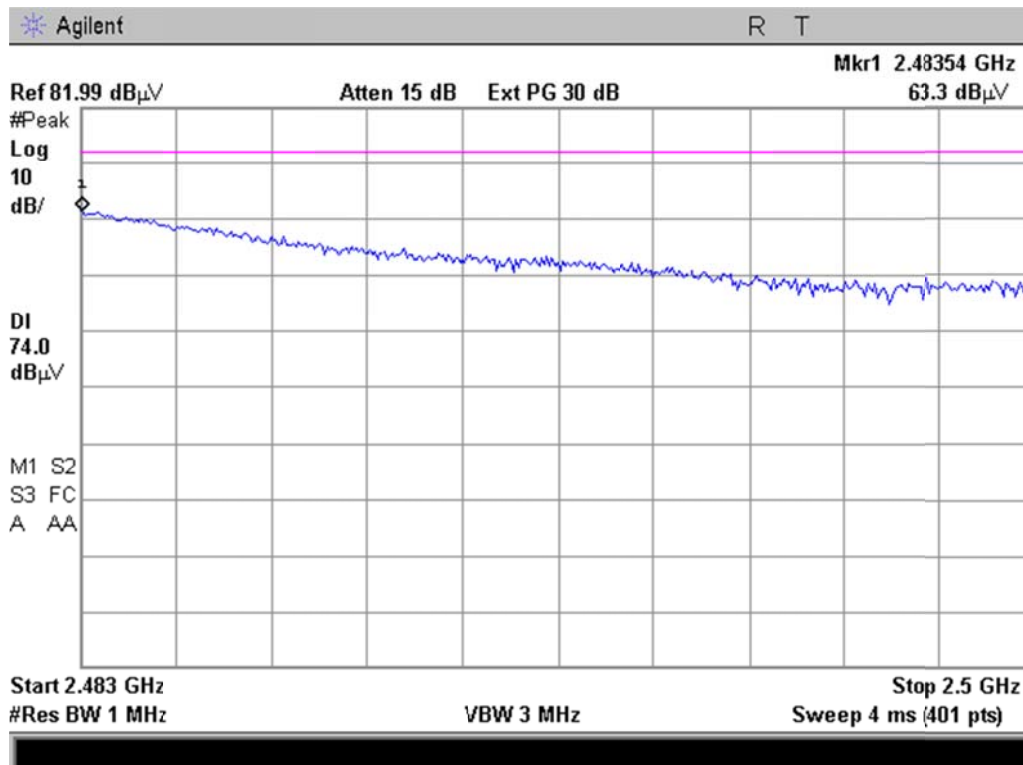




Restricted Band 2300 – 2390 MHz – Peak  
Tuned Frequency = 2405 MHz



Restricted Band 2483.5 – 2500 MHz – Peak  
Tuned Frequency = 2480 MHz





## Occupied Bandwidth

**Name of Test:** Occupied Bandwidth

**Specification:** 15.247(a)(2)

**Engineer:** John Erhard

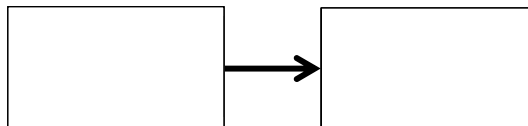
**Test Equipment Utilized:** i00028, i00331, i00385, i00103

**Test Date:** 7/6/2011

### Test Procedure

The EUT was connected directly to a spectrum analyzer. The Span was set wide enough to capture the entire transmit spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold and when the entire spectrum was captured the 6dB and 99% bandwidths were measured to verify the bandwidth met the specification.

### Test Setup



### 6 dB Occupied Bandwidth Summary

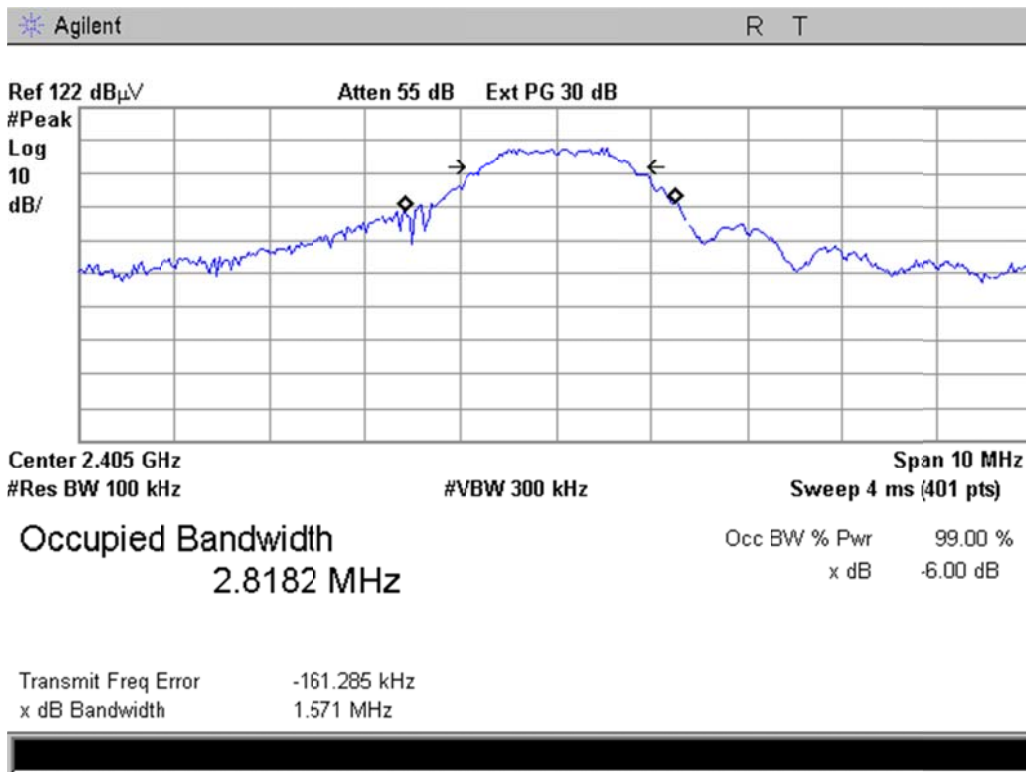
Frequency MHz	Measured Bandwidth MHz	Specification Limit kHz	Result
2405	1.517	$\geq 500$	Pass
2440	4.482	$\geq 500$	Pass
2480	1.602	$\geq 500$	Pass

### 99% Bandwidth Summary

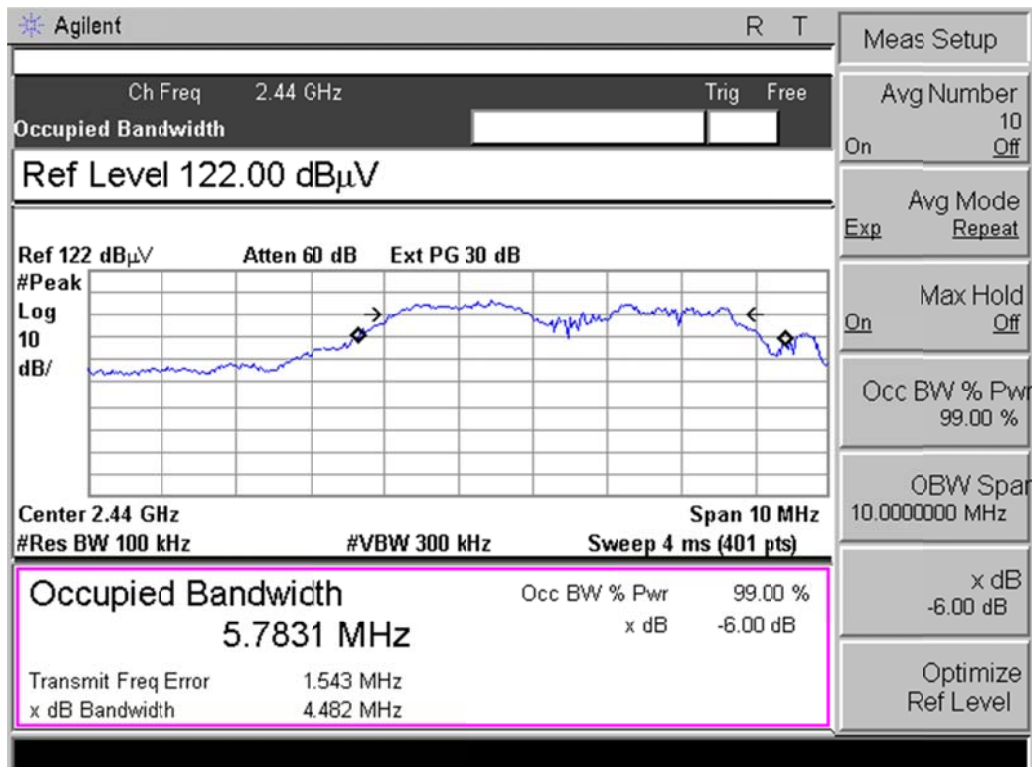
Frequency MHz	Measured Bandwidth MHz	Result
2405	2.8182	Pass
2440	5.7831	Pass
2480	3.0731	Pass



### Bandwidth 2405 MHz



### Bandwidth 2440 MHz

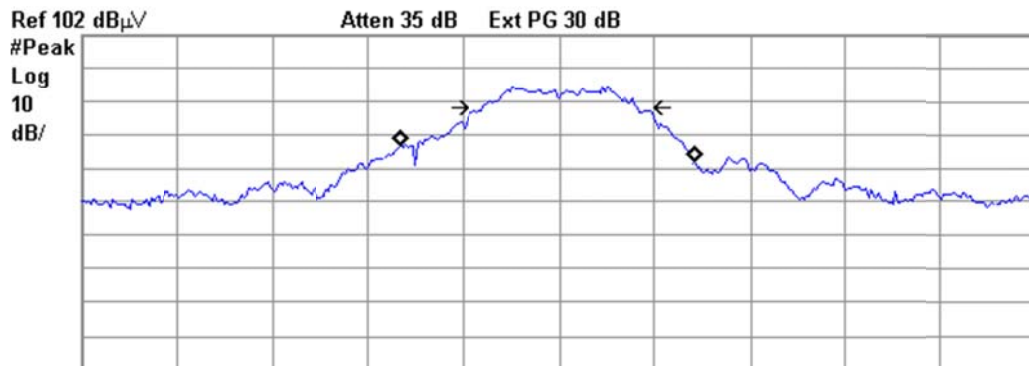




## Bandwidth 2480 MHz

Agilent

R T



Center 2.48 GHz  
#Res BW 100 kHz

#VBW 1 MHz

Span 10 MHz  
Sweep 4 ms (401 pts)

Occupied Bandwidth  
3.0731 MHz

Occ BW % Pwr	99.00 %
x dB	-6.00 dB

Transmit Freq Error	-115.069 kHz
x dB Bandwidth	1.602 MHz



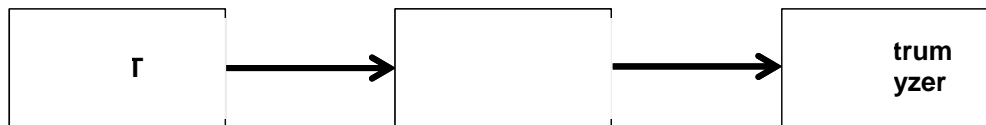
## Transmitter Power Spectral Density (PSD)

**Name of Test:** Transmitter Power Spectral Density (PSD)  
**Specification:** 15.247(e) **Engineer:** John Erhard  
**Test Equipment Utilized:** i00379 **Test Date:** 7/6/2011

### Test Procedure

The EUT was connected directly to a spectrum analyzer.  
The test was performed per section 6.11.2.3 of C63.10 - 2009 "Procedure for determining PSD for DTS devices".

### Test Setup

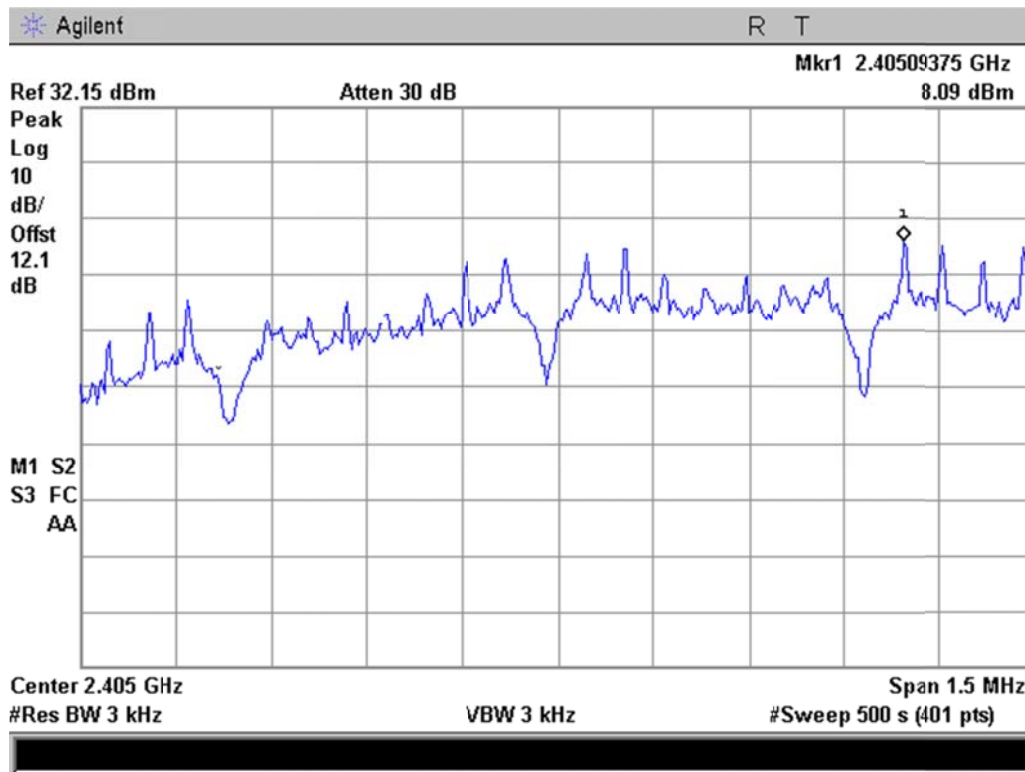


### PSD Summary

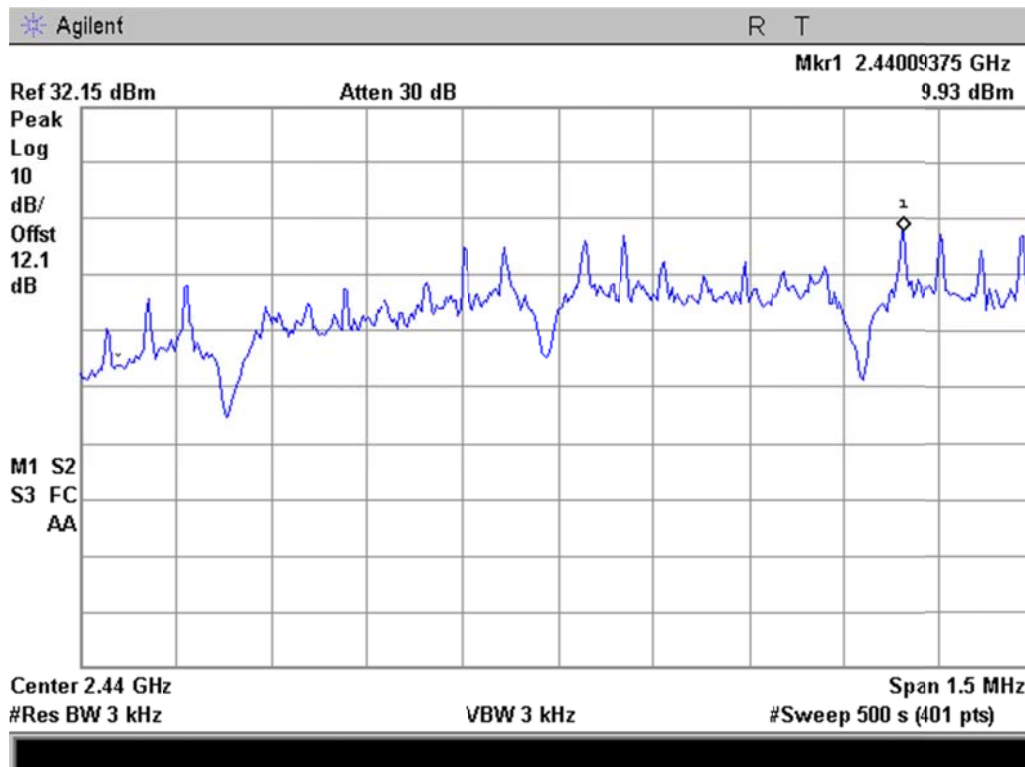
Frequency MHz	Measured Data dBm	Specification Limit dBm	Result
2405	8.09	8	Pass
2440	9.93	8	Pass
2480	-12.75	8	Pass



## PSD 2405 MHz

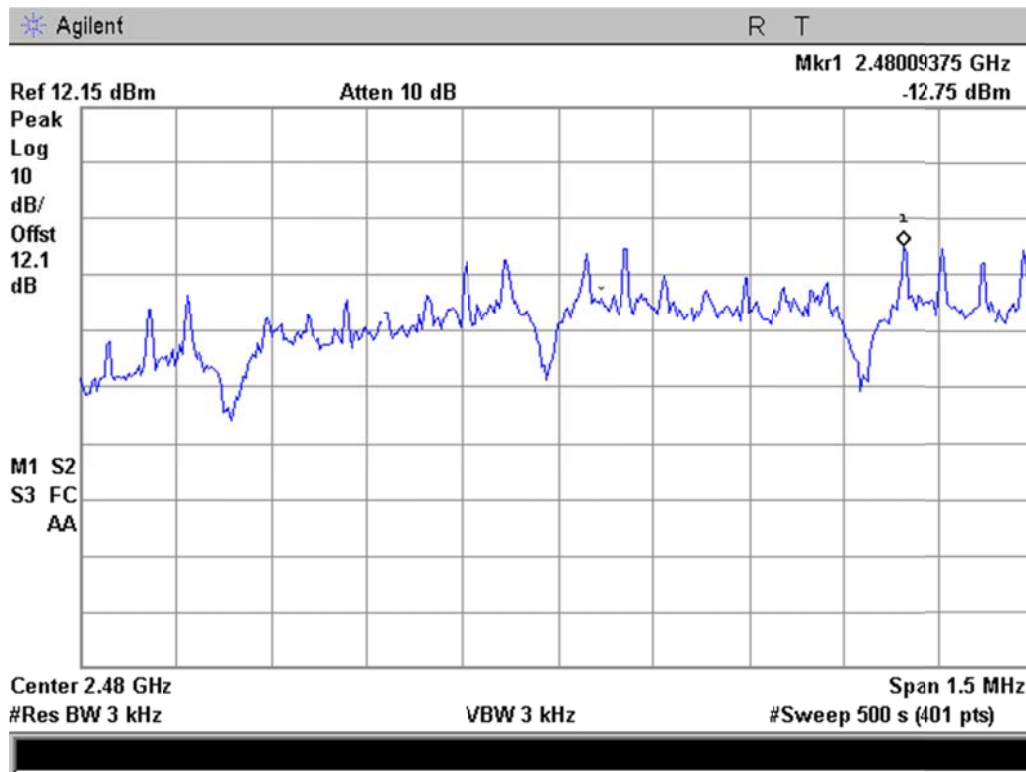


## PSD 2440 MHz





# PSD 2480 MHz





## Receiver Spurious Emissions

**Name of Test:** Receiver Spurious Emissions

**Specification:** RSS-GEN-6(b)

**Engineer:** John Erhard

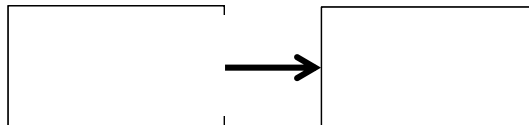
**Test Equipment Utilized:** i00379

**Test Date:** 7/6/2011

### Test Procedure

The EUT was connected directly to a spectrum analyzer. The receiver spurious emissions were measured from 30 MHz to greater than 3 times the highest tunable Frequency.

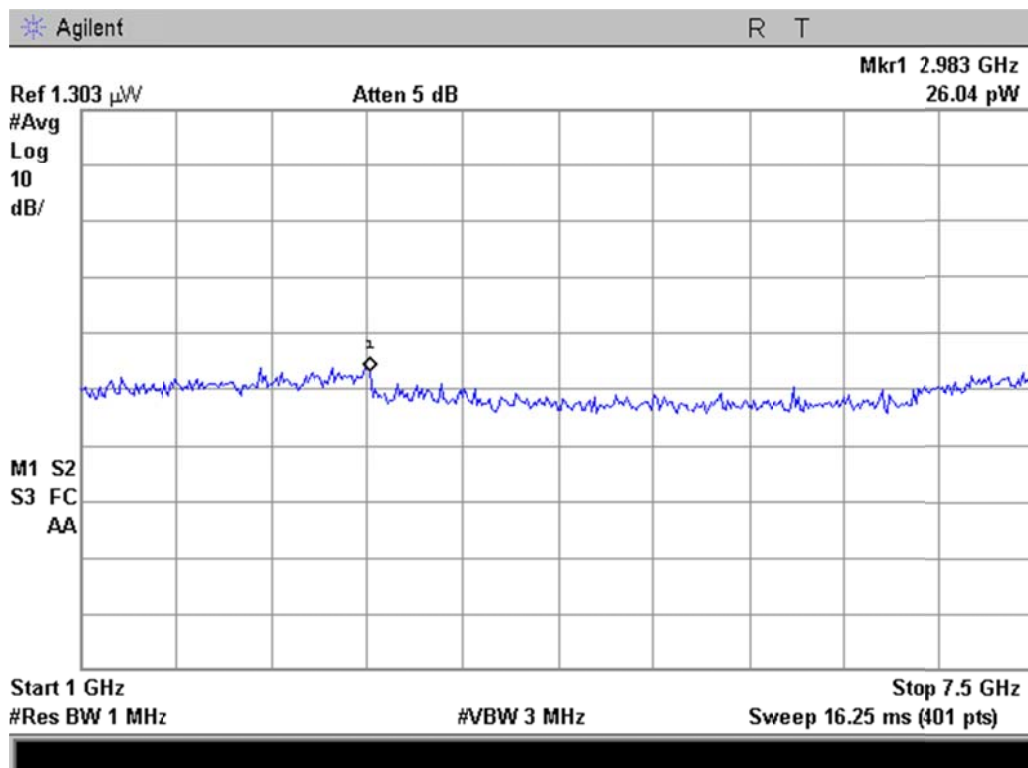
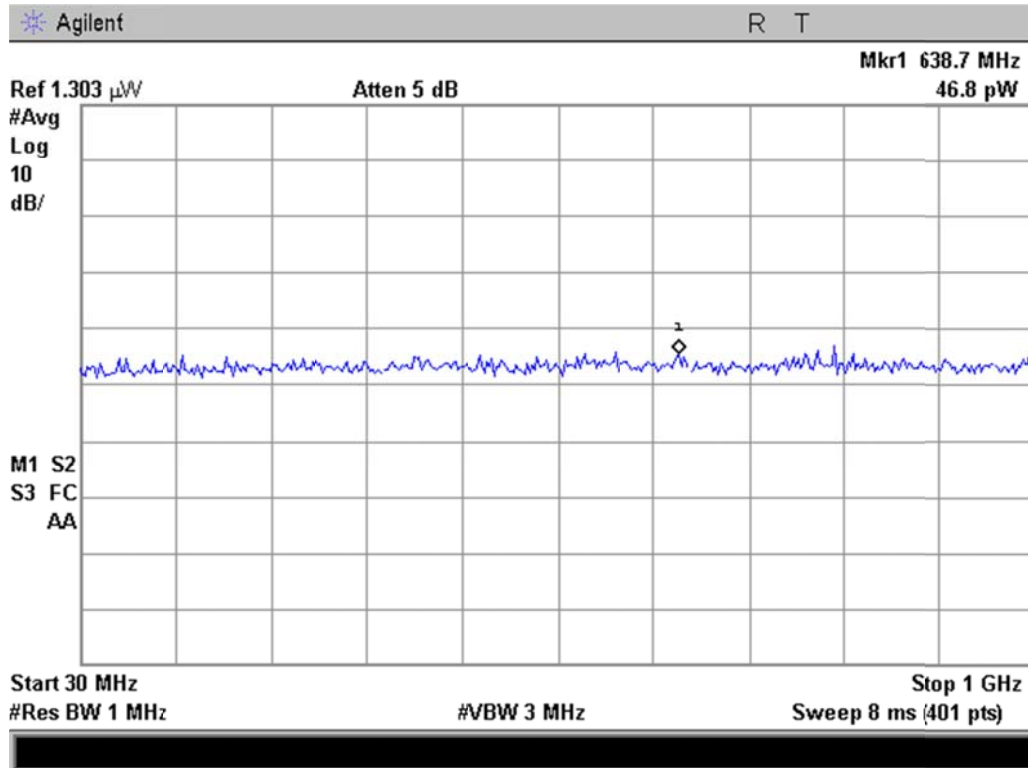
### Test Setup



### Receiver Spurious Emissions Summary

Frequency Range MHz	Recorded Measurement	Specification Limit	Result
30 – 1000	46.8 pW	2 nW (-57 dBm)	Pass
1000 - 8000	26.04 pW	5 nW (-53 dBm)	Pass







## Test Equipment Utilized

Description	MFG	Model Number	CT Asset Number	Last Cal Date	Cal Due Dates
RF Pre-Amplifier	HP	8449	i00028	09/21/2010	09/21/2011
Spectrum Analyzer	Agilent	E4407B	i00331	05/24/2011	05/24/2012
Band Reject Filter	Wainwright	WRCTF2402/2480–2399/2483.35	i00385	NCR	NCR
Horn Antenna	EMCO	3115	i00103	11/05/2010	11/05/2012
Spectrum Analyzer	HP	8546A	i00033	10/03/2010	10/03/2011
Bilog Antenna	Schaffner	CBL6111C	i00267	11/21/2009	11/21/2011
Spectrum Analyzer	Agilent	7405A	i00379	11/22/2010	11/22/2011

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

End of Test Report