



Test Report

Prepared for: Southfork Solutions, Inc.

Model: Gen 3

Description: Electronic Ear Tag

To

FCC Part 15.247 DTS

Date of Issue: July 1, 2012

On the behalf of the applicant: **Southfork Solutions, Inc.**
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Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	July 1, 2012	Greg Corbin	Original Document
2.0	March 6, 2013	Greg Corbin	Provided new output power data in a 1 MHz RBW on page 9



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

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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 an 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 (° C)	Humidity (%)	Pressure (mbar)
22.5 – 33.5	30.4 – 59.2	963.1 - 969

EUT Description

Model: Gen 3

Description: Electronic Ear Tag

Firmware: N/A

S/N: 80293 (conducted sample)

S/N: 82976 (radiated sample)

Additional Information

The electronic ear tag transmits a S/N that has been programmed into the tag during the manufacturing process. The tag information is sent to the reader once the reader transmits a wake up signal detected by the tag, the tag wakes up and determines the request is specifically intended for the tag and then transmits the signal back to the reader. The ear tag is capable of sending stored information, temperature and voltage level of the onboard battery.

EUT Operation during Tests

The radiated sample was tested in its final configuration.

The conducted sample (modified by the manufacturer) had the trace cut at the antenna input and an mmcx connector installed on the board.

The manufacturer provided a tag reader that communicates with the EUT to wake it up and make it start transmitting.

The tag reader interfaces with a PC via the USB port.

The PC communicates with the tag reader using an application software package, titled: Southfork Tag Reader, version: 2.1.0.3. The Tag Reader ID: 130.

The EUT operates on a single transmit frequency at 902.5 MHz and receives information from the tag reader at 927.5 MHz.

The EUT operates on a 3.0 v coin cell battery, (CR2032).



Accessories:

Qty	Description	Mfg	Model	S/N
1	Tag Reader	Southfork Solutions	N/A	130
1	Laptop PC	HP	NC6400	N/A

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
1	USB, PC to tag reader interface	2	Y	N	N

Modifications: None

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



Test Reports Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(d)	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a)	Emissions At Band Edges	Pass	
15.205	Restricted Band Emissions	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 is battery powered and never connects to the AC powerline.



Peak Output Power

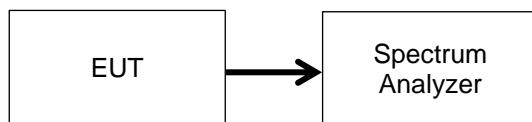
Name of Test: Peak Output Power
Test Equipment Utilized: i00379

Engineer: Greg Corbin
Test Date: 6/29/2012

Test Procedure

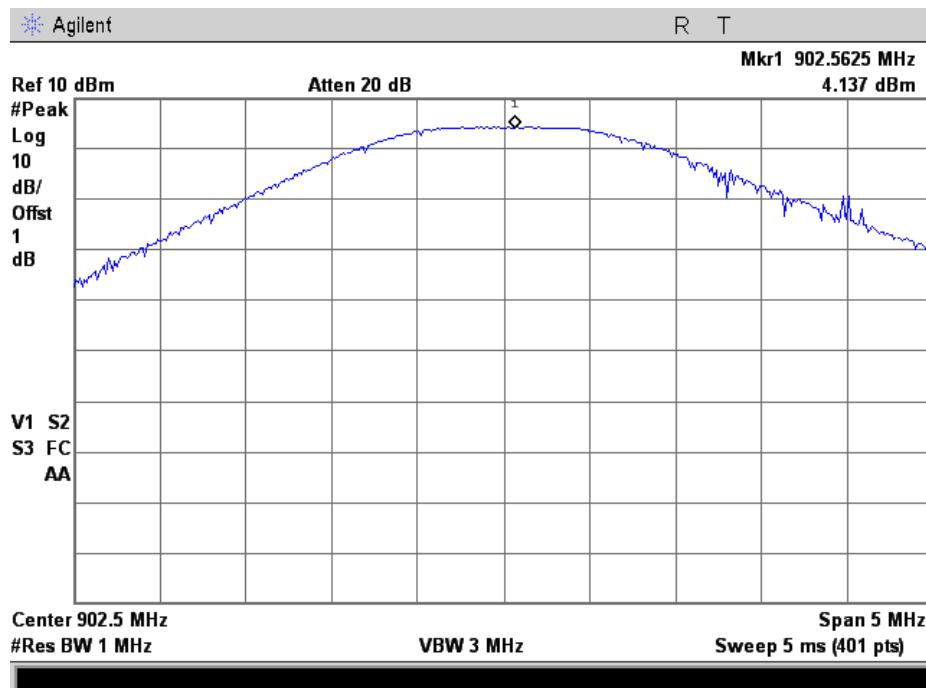
The EUT was connected directly to a spectrum analyzer.
The cable insertion loss was added to the spectrum analyzer as a reference level offset before recording the peak output power.
The peak readings were taken and the result was then compared to the limit.

Test Setup



Transmitter Peak Output Power

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
902.5	4.14	1 W (30 dBm)	Pass





Conducted Spurious Emission

Name of Test:

Conducted Spurious Emissions

Engineer: Greg Corbin

Test Equipment Utilized:

i00364, i00379

Test Date: 6/29/2012

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 10th harmonic of the fundamental transmitter was observed. Only detectable spurious emissions were recorded and plotted. The peak output power is added to the recorded measurement to provide the corrected spurious level dBc.

Only the worst case is recorded in the Conducted Spurious Emissions Summary Test Table.

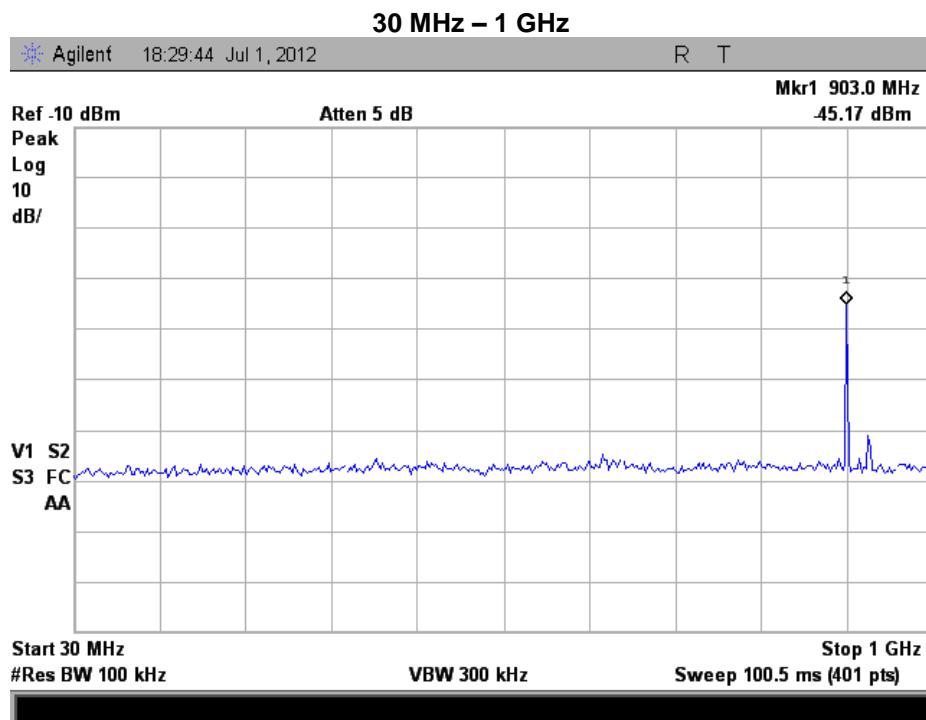
Test Setup



Conducted Spurious Emissions Summary Test Table

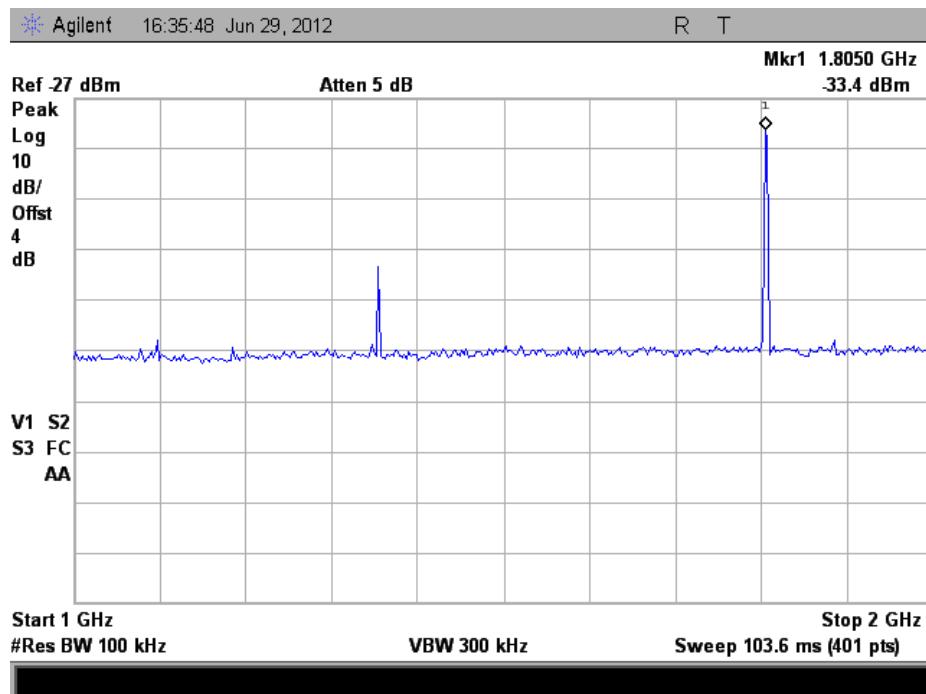
Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Value (dBm)	Reference Level (dBm)	Corrected Measurement (dBc)	Specification Limit (dBc)	Result
902.5 MHz	1805	-33.4	3.5	-36.9	-20	Pass

Conducted Spurious Emission Plots

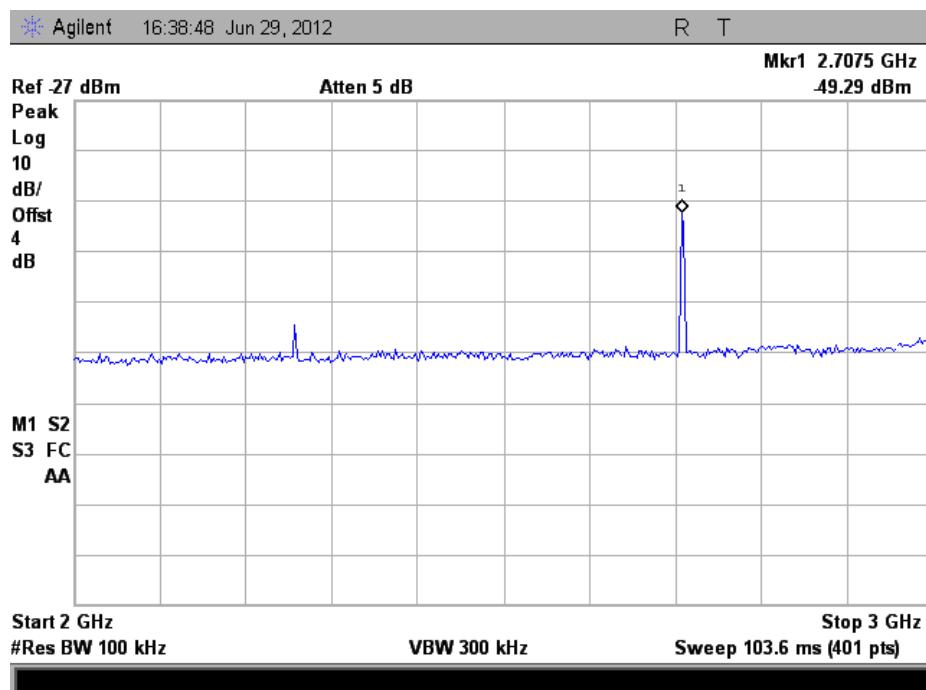




1 – 2 GHz

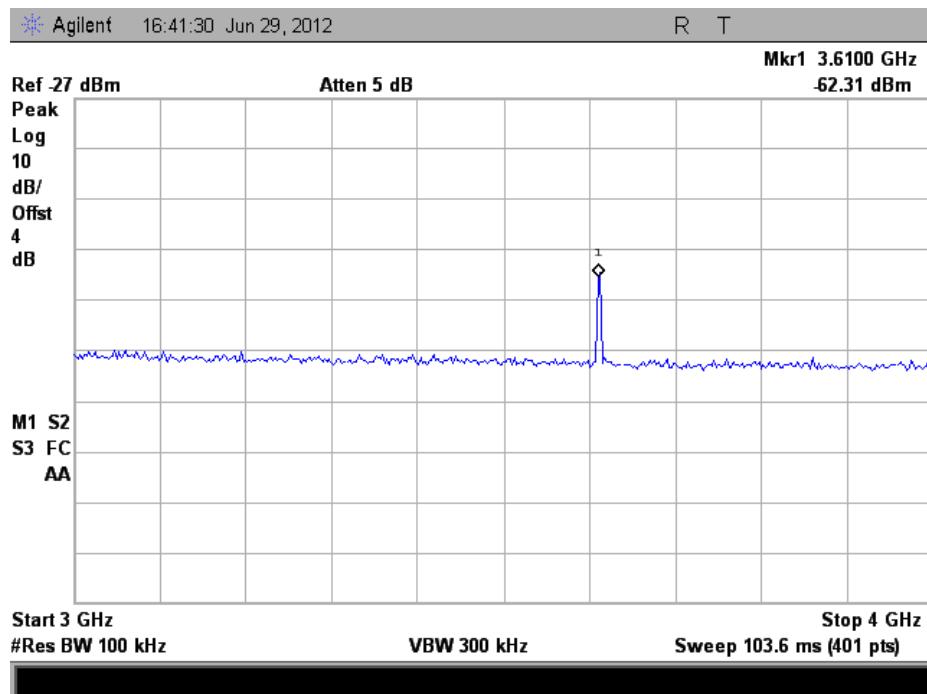


2 – 3 GHz

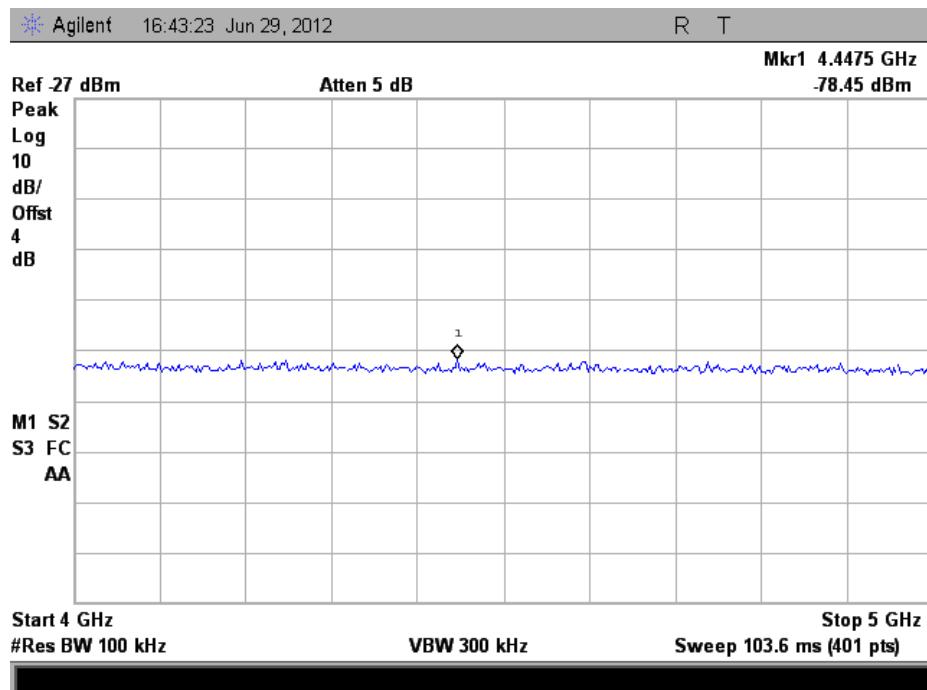




3 – 4 GHz

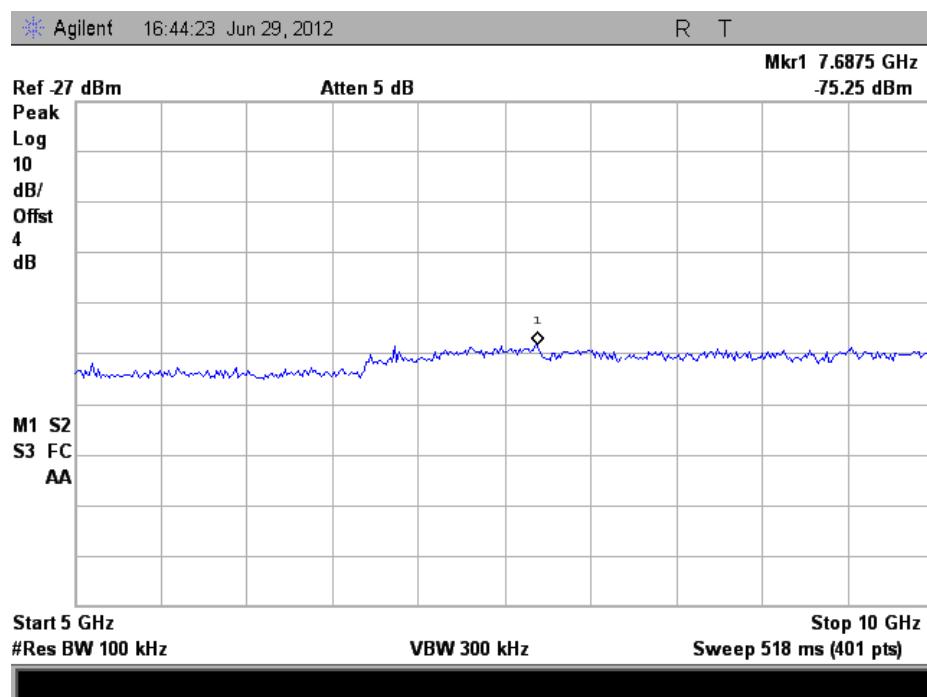


4 – 5 GHz





5 – 10 GHz





Radiated Spurious Emissions

Name of Test:

Radiated Spurious Emissions

Engineer: Greg Corbin

Test Equipment Utilized:

i00267, i00271, i00364, i00379

Test Date: 7/1/2012

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. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized. All emissions from 30 MHz to 1 GHz were examined.

Measured Level includes antenna and receiver cable correction factors.

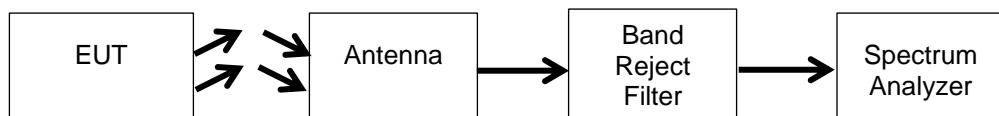
Correction factors were input into the spectrum analyzer before recording "Measured Level".

RBW = 100 KHz

VBW = 300 KHz

Detector – Quasi Peak

Test Setup



Radiated Spurious Emissions Test Data: 30 MHz – 1000 MHz

No Emissions above the noise floor of the spectrum analyzer were observed from 30 – 1000 MHz other than the fundamental transmitter frequency at 902.5 MHz.

The noise floor of the spectrum analyzer was > 10 dB below the limit.

No emissions were observed so none were recorded.



**Test Procedure:
Radiated Spurious Emissions above 1 GHz**

The EUT was tested on an OATS set 3 meter 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 10th harmonic.

To determine the average value of the spurious emission, the peak value was measured and the Duty Cycle Correction Factor (DCCF) was applied using the method outlined in C63.10:2009, section 7.5 (Procedure for determining the average value of pulsed emissions).

$$\text{DCCF} = 20 \log(T1/T2)$$

T1 (Total transmitter on time in any 100 ms window)

T2 is the period of the pulse train or 100 ms if the pulse train length is greater than 100 ms

T1 = 2.438 ms

T2 = 100 ms

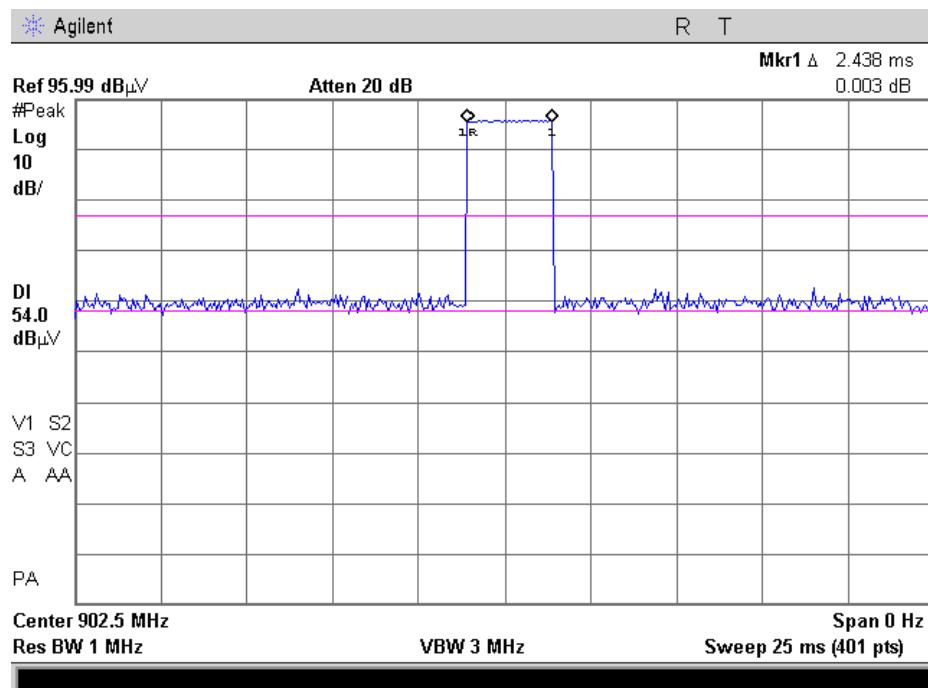
$$\text{DCCF} = 20 \log(2.438/100) = -32.2 \text{ dB}$$

The EUT sends out 2 pulses, each pulse is 2.438 ms wide separated by 108 ms.

This set of pulses is repeated every 1.9 seconds as shown in the measurements below.

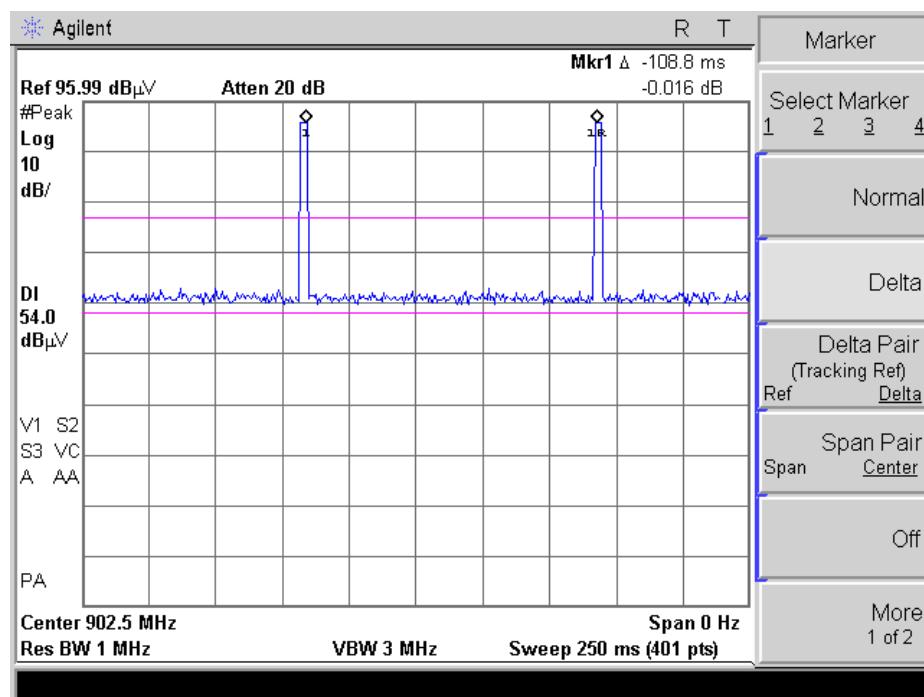
For the purpose of calculating the duty cycle only a single pulse occurs in any 100 ms period.

Single pulse

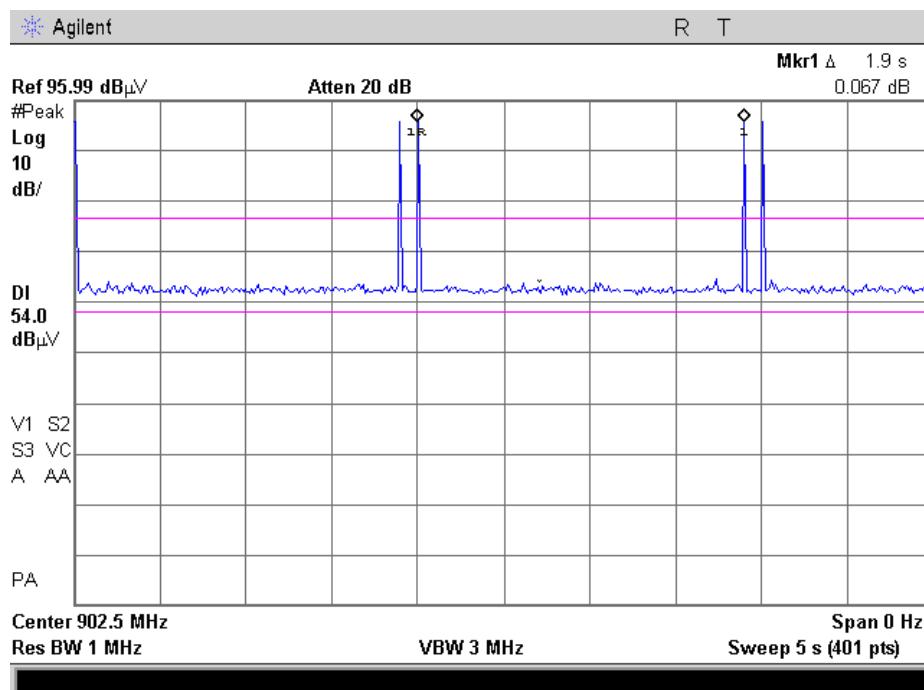




1 set of pulses separated by 108 ms

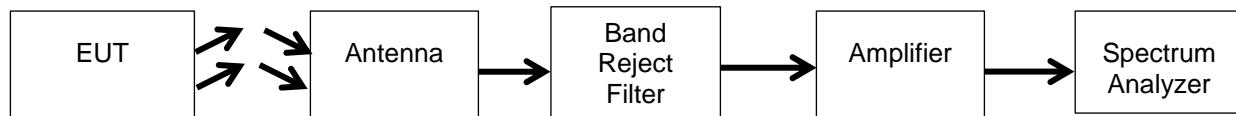


2 sets of pulses separated by 1.9 seconds





Test Setup



Detector Settings	RBW	VBW	Span
Peak	1 MHz	3 MHz	As Necessary

The average value of the radiated spurious emission was calculated as outlined above.

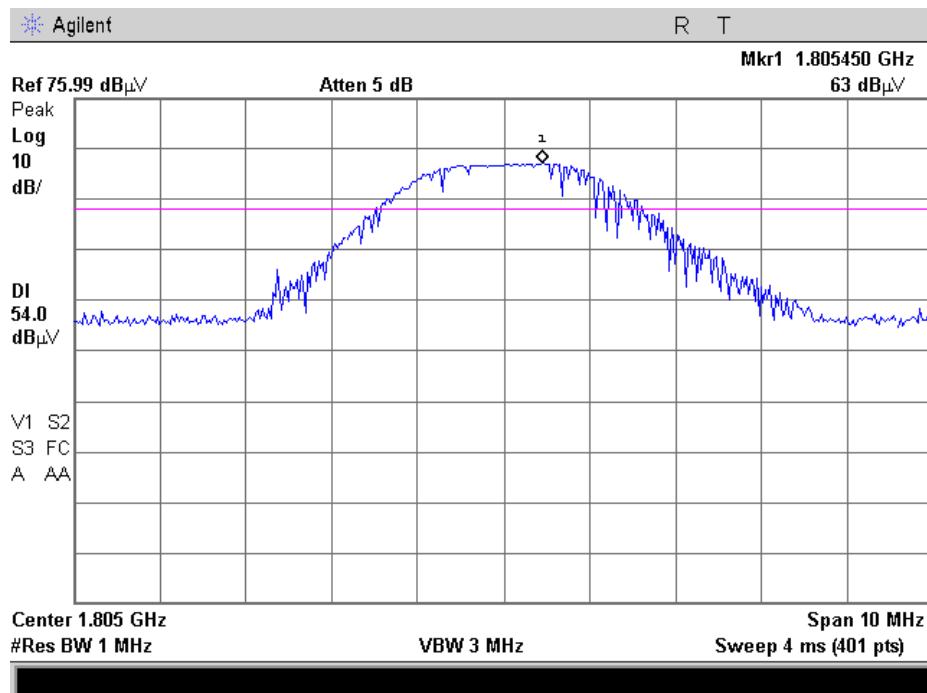
Radiated Spurious Emissions

Tuned Freq. (MHz)	Emission Freq. (MHz)	Peak Measured Value (dBuV/m)	Peak Limit (dBuV/m)	Duty Cycle Corr. Factor (dB)	Average Measured Value (dBuV/m)	Average Limit (dBuV/m)	Result
902.5	1805.0	63.0	74.0	-32.2	30.8	54.0	Pass
902.5	2707.5	62.6	74.0	-32.2	30.4	54.0	Pass
902.5	3610	35.7	74.0	-32.2	3.5	54.0	Pass
902.5	4512.5	43.0	74.0	-32.2	10.8	54.0	Pass

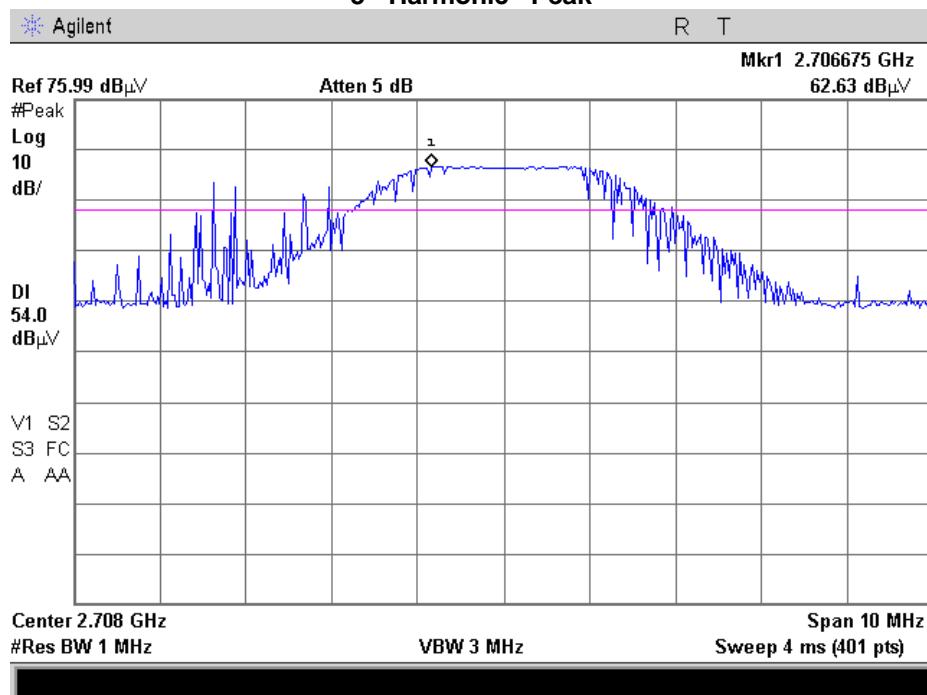
No other emissions were detectable. All emissions were greater than -20 dBc.



**Tuned Frequency = 902.5 MHz
2nd Harmonic - Peak**

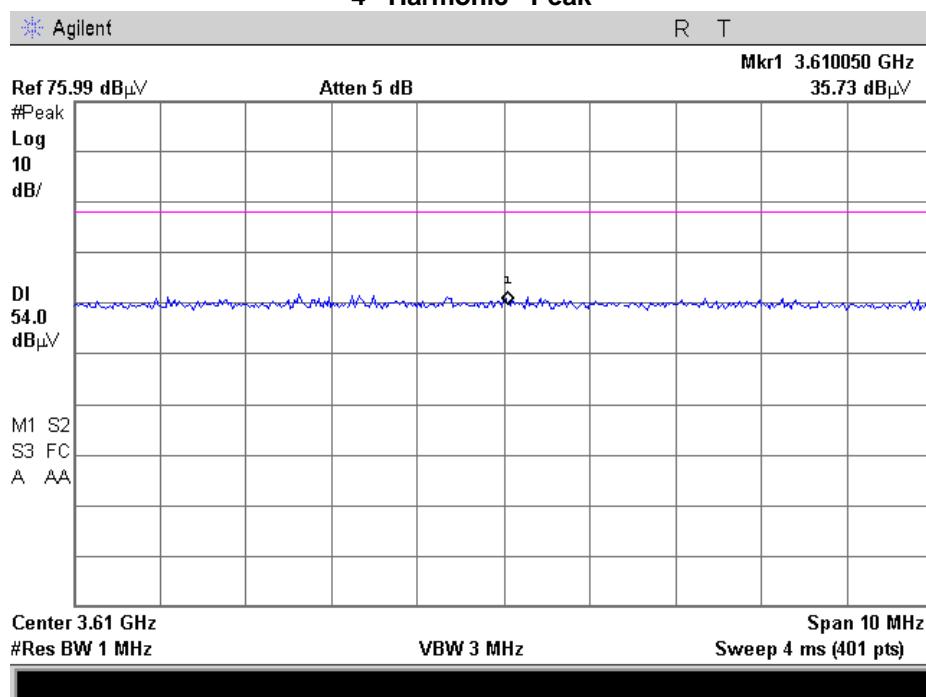


**Tuned Frequency = 902.5 MHz
3rd Harmonic - Peak**

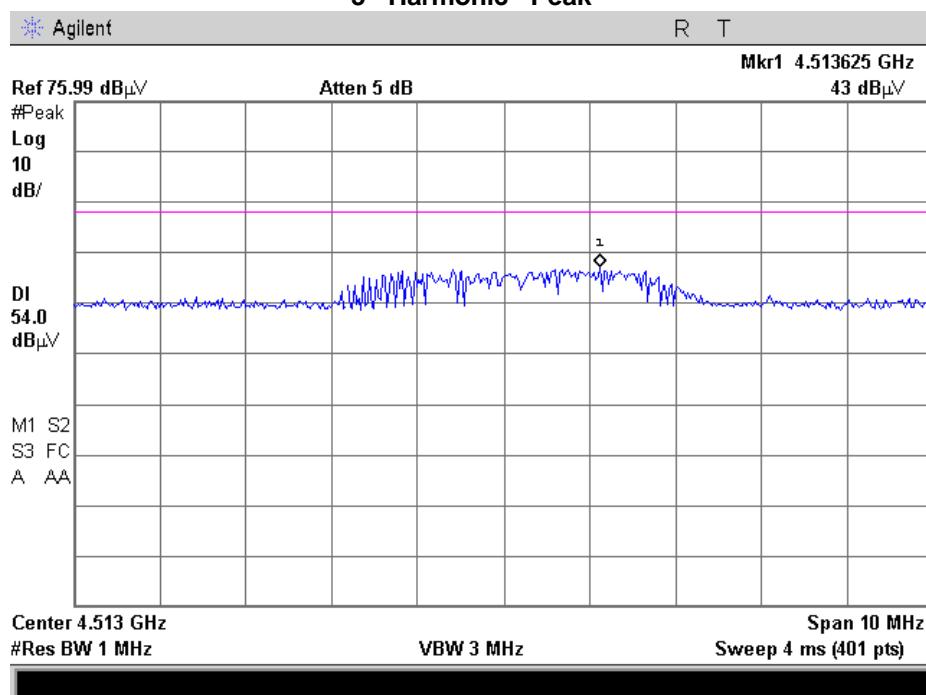




Tuned Frequency = 902.5 MHz
4th Harmonic - Peak



Tuned Frequency = 902.5 MHz
5th Harmonic - Peak





Emissions at Band Edges

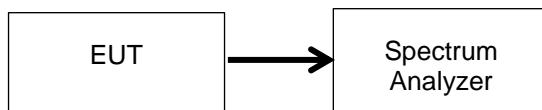
Name of Test: Emissions at Band Edges
Test Equipment Utilized: i00379

Engineer: Greg Corbin
Test Date: 6/29/2012

Test Procedure

For the Band Edge test, the EUT was connected directly to the spectrum analyzer. The cable correction factor was input into the analyzer as a reference level offset to ensure accurate readings were obtained

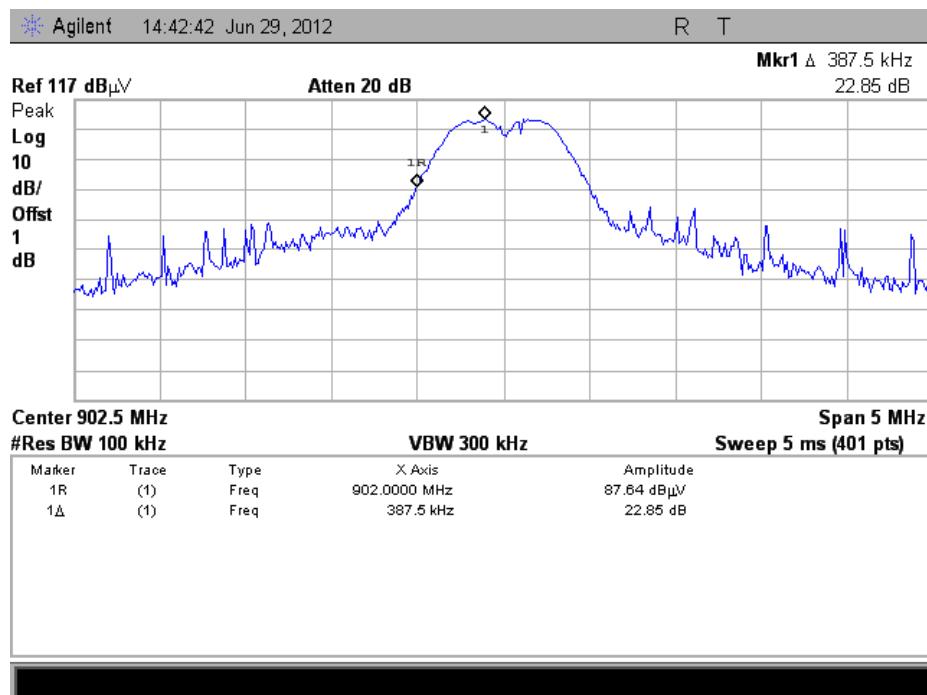
Band Edge Test Setup



Band Edge Emissions Summary

Tuned Freq (MHz)	Emission Freq (MHz)	Measured Value (dBc)	Detector	Limit (dBc)	Result
902.5	902	-22.85	Peak	-20 dBc	Pass

Band Edge 902 MHz Tuned Freq = 902.5 MHz





Restricted Band Spurious Emissions

Name of Test: Restricted Band Emissions
Test Equipment Utilized: i00271, i00364, i00379

Engineer: Greg Corbin
Test Date: 6/29/2012

For restricted band measurements, the EUT was tested in a OATS (Open Area Test Site) set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for restricted band for both peak and average measurements. The cable, antenna, amplifier, and band reject filter correction factors were input into the analyzer as a reference level offset to ensure accurate readings were obtained.

The Duty Cycle Correction Factor described in the Radiated Spurious Emissions section of this report, was added to the peak value in this section to determine the average value of the spurious emission in the restricted bands.

To determine the average value of the spurious emission, the peak value was measured and the Duty Cycle Correction Factor (DCCF) was applied using the method outlined in C63.10:2009, section 7.5 (Procedure for determining the average value of pulsed emissions).

The supporting documentation for calculating the DCCF is included in the Radiated Spurious section of this report and is not repeated here.

$$\text{DCCF} = 20 \log(T_1/T_2)$$

T1 (Total transmitter on time in any 100 ms window)

T2 is the period of the pulse train or 100 ms if the pulse train length is greater than 100 ms

T1 = 2.438 ms

T2 = 100 ms

$$\text{DCCF} = 20 \log(2.438/100) = -32.2 \text{ dB}$$

Restricted Band Test Setup



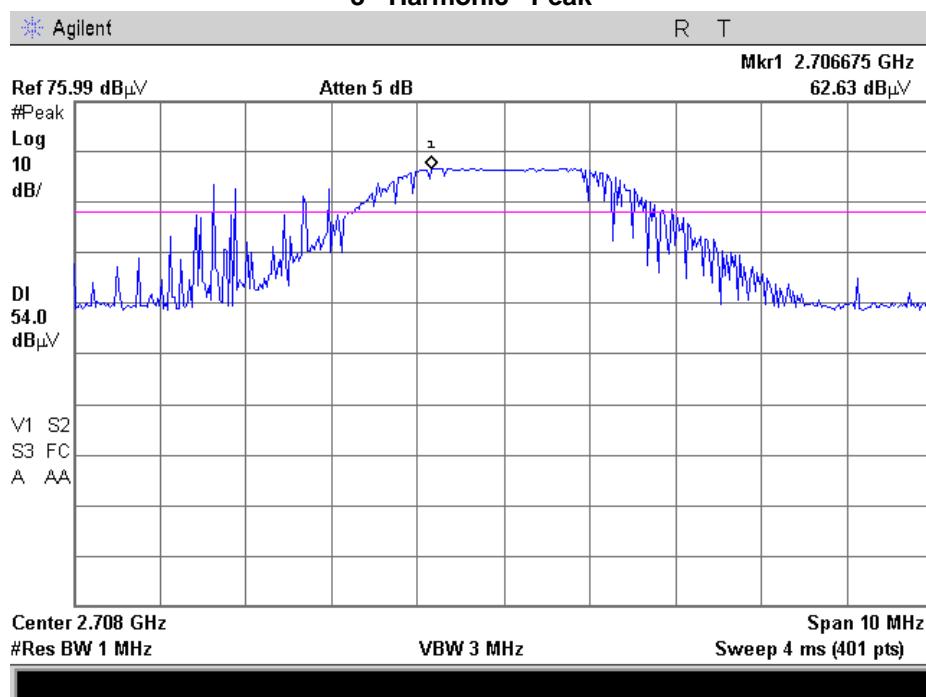
Restricted Band Emissions Summary

Only harmonics of the fundamental were observed in the restricted bands and are recorded here. No other spurious signals were observed in the restricted bands.

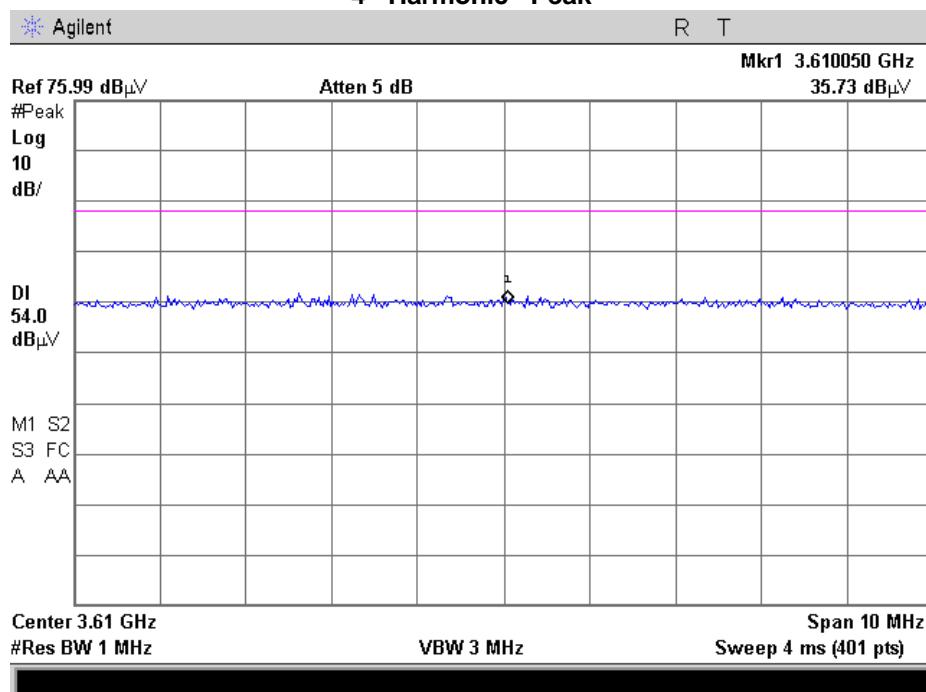
Restricted Band (MHz)	Tuned Freq. (MHz)	Emission Freq. (MHz)	Peak Measured Value (dBuV/m)	Duty Cycle Corr. Factor (dB)	Final Value (dBuV/m)	Detector	Limit (dBuV/m)	Result
2690 - 2900	902.5	2707.5	62.6	N/A	62.6	Peak	74	Pass
2690 - 2900	902.5	2707.5	62.6	-32.2	30.4	Average	54	Pass
3600 - 4400	902.5	3610	35.7	N/A	35.7	Peak	74	Pass
3600 - 4400	902.5	3610	35.7	-32.2	3.5	Average	54	Pass
4500 - 5150	902.5	4512	43	N/A	43	Peak	74	Pass
4500 - 5150	902.5	4512	43	-32.2	10.8	Average	54	Pass



Restricted band 2690 – 2900 MHz
3rd Harmonic - Peak

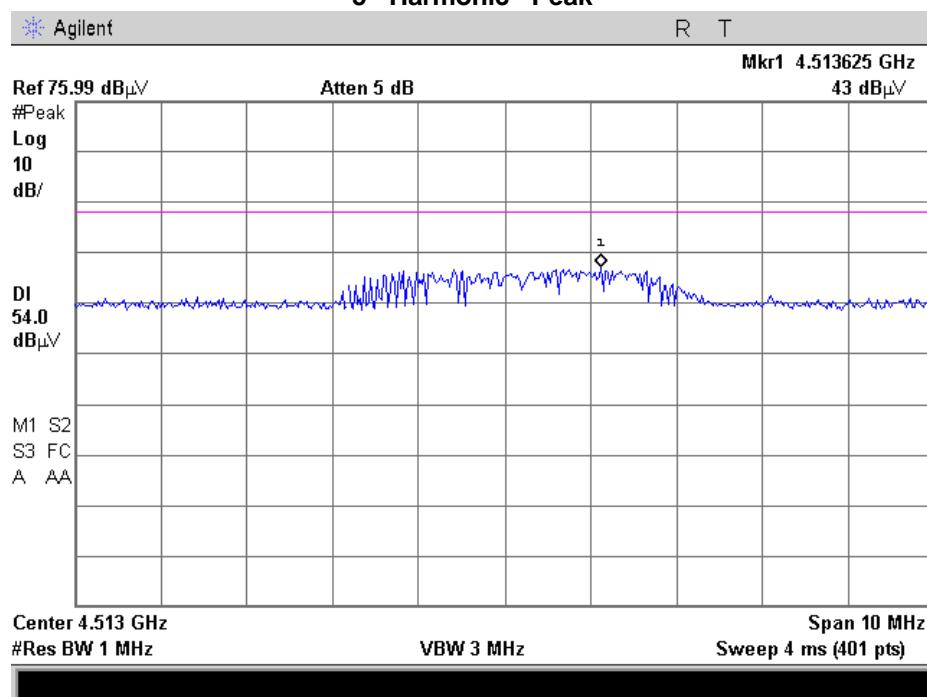


Restricted Band 3600 – 4400 MHz
4th Harmonic - Peak





Restricted Band 4500 - 5150 MHz
5th Harmonic - Peak





Occupied Bandwidth

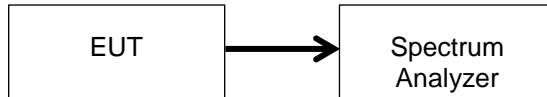
Name of Test: Occupied Bandwidth
Test Equipment Utilized: i00379

Engineer: Greg Corbin
Test Date: 6/29/2012

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 bandwidth was measured to verify the bandwidth met the specification.

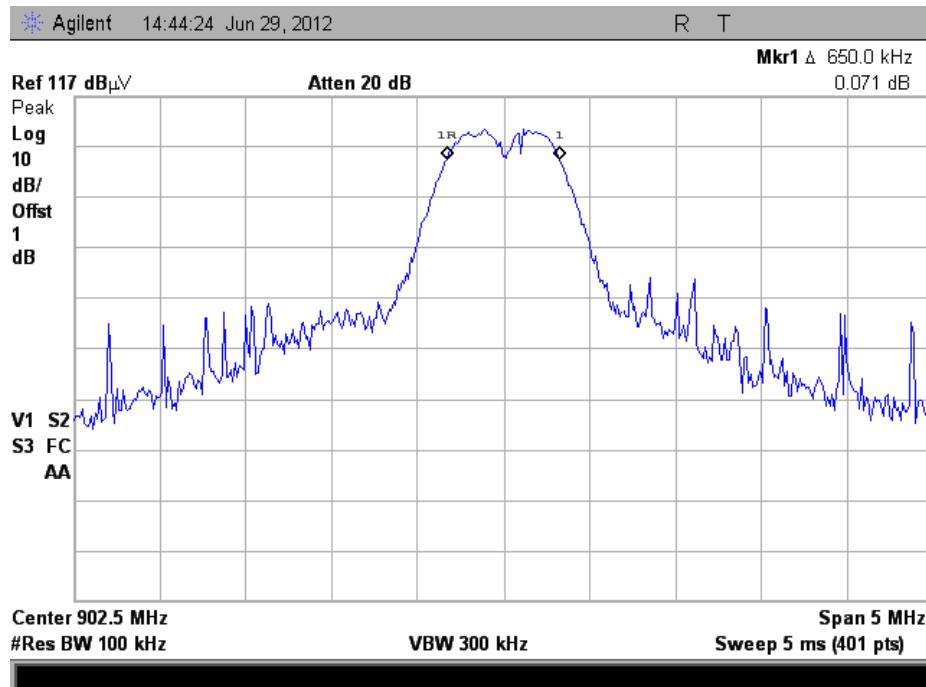
Test Setup



6 dB Occupied Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (kHz)	Specification Limit (kHz)	Result
902.5	650.0	≥ 500	Pass

6dB Bandwidth





Transmitter Power Spectral Density (PSD)

Name of Test: Transmitter Power Spectral Density (PSD)
Test Equipment Utilized: i00379

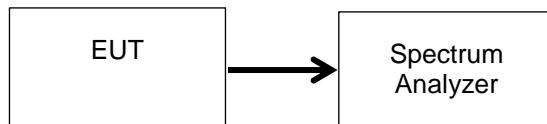
Engineer: Greg Corbin
Test Date: 6/29/2012

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".

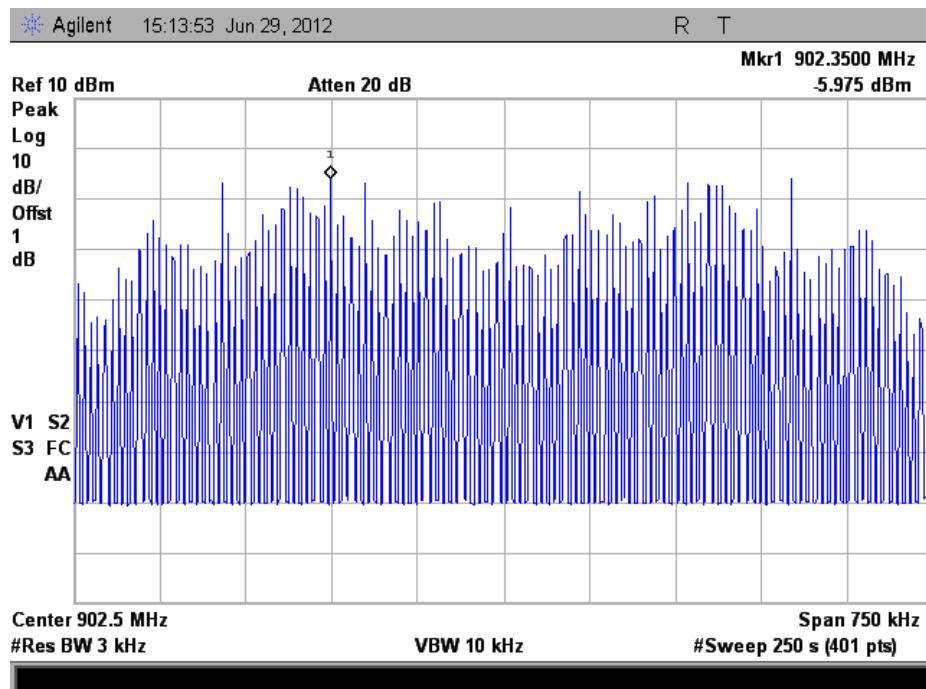
Test Setup



Power Spectral Density Summary

Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
902.5	-5.98	8	Pass

Power Spectral Density Tuned frequency = 902.5 MHz





Test Equipment Utilized

Description	Manufacturer	Model Number	CT Asset #	Last Cal Date	Cal Due Date
Bi-Log Antenna	Schaffner	CBL611C	i00267	12/19/11	12/19/13
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	4/19/12	4/19/14
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	11/5/11	11/5/12
Humidity / Temp Meter	Control Company	4189CC	i00355	1/11/12	1/11/13
Tunable Notch Filter	Eagle	TNF-240MFMF	i00364	Verified on: 7/1/2012	
Spectrum Analyzer	Agilent	E7405A	i00379	12/14/11	12/14/12

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