

TEST REPORT

Report Number: 100900227DEN-002

Project Number: G100900227

Report Issue Date: 10/10/2012

Product Designation: Model ID:058

Standards: FCC 47 CFR Part 15.247

Tested by:
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Client:
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1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded **the product tested complies with the requirements of the standard(s) indicated**. The results obtained in this test report pertain only to the item(s) tested.

1.1 Test Report Scope

This specific test report applies to the Bluetooth Radio transceiver.

The product was fully tested and passed all radio transceiver requirements. Refer to the following Intertek test reports for details:

- RF4CE Radio, 2.4GHz (Intertek Report 100900227DEN-001)
- Bluetooth Radio, 2.4GHz (Intertek Report 100900227DEN-002)
- Wi-Fi Radio IEEE 802.11b/g/n HT20/HT40, 2400 – 2483.5 MHz, IEEE 802.11a/n HT20/HT40, 5725 – 5850 MHz (Intertek Report 100900227DEN-003)
- Wi-Fi Radio IEEE 802.11a/n HT20/HT40, 5150 – 5250 MHz:
(Intertek Report 100900227DEN-004)
- Unintentional/ Receiver Mode of Operation (Intertek Report 100900227DEN-005)

1.2 Test Methodology

Both RF conducted port and radiated emissions measurements were performed according to the procedures in ANSI C63.10:2009 and the general procedures of FCC Parts 2 and 15 of CFR47. In addition, specific testing utilized the FCC Guidance documents defined in each specific test section. Radiated emissions tests were formed at an antenna-to-product distance of 3-meters.

1.3 Test Facility

Intertek Denver's testing facilities are located at 1795 Dogwood St. Suite 200 Louisville, CO 80027. The testing facility is ISO17025:2005 accredited by A2LA, our lab code is 2506.02, our VCCI registration numbers are. R-1643, C-1752 and T-1558, our FCC designation no. US1121 and our IC lab no. 2042N.

Testing contained in this test report may not be covered under the laboratories scope of accreditation. A note will be placed in the specific test section for testing not covered under the laboratories scope.

2 Test Summary

Section	Test full name	Test date	Result
5	Radiated Emissions – Field Strength of the Fundamental & Harmonics of the Fundamental – FCC 247(b)(3)(d)/15.205/209	9/17/2012	Pass
6	Conducted Port Spurious Emissions - FCC 15.209/15.247(d)/15.205	9/13/2012	Pass
7	Radiated Emissions – Band Edge FCC 15.209/15.247(d)/15.205	9/18/2012	Pass
8	6dB Bandwidth – FCC 15.247(a)(2)	9/13/2012	Pass
9	Power Spectral Density (PSD) – FCC 15.247(e)	9/13/2012	Pass
10	Occupied Bandwidth – NA	-	NA
11	AC Conducted Emissions – FCC 15.207	9/25/2012	Pass

General Radio Remarks:

FCC CFR Part 15.31(e): For a product with an ac voltage supply, the ac voltage was varied between 85% and 115% of the nominal rated supply voltage to determine worst-case fundamental frequency level.

FCC CFR Part 15.35: Measurement Detector Functions and Bandwidths: FCC Part 15.35 was utilized when performing measurements within this report.

When the field strength (or envelope power) is not constant or when it pulses, and an average detector/limit is specified to be used, a duty cycle correction factor may be utilized to determine the pulsed “average” of the field strength or power.

For optional peripheral device operation the set top box also has a front panel mounted Bluetooth 2.4GHz radio. The Bluetooth radio does not have an external antenna port. For testing purposes a SMA connector will be fitted to bypass the antenna.

Product-Specific Radio Remarks:

- Product:
 1. Lowest Frequency used: 60kHz
 2. Highest Frequency used : 3GHz
- Onboard Bluetooth antenna (front panel)
 1. Antenna gain – 0dbi
 2. Modulation details: The solution contains an RF transceiver designed to operate in a Bluetooth wireless system in the 2.4 GHz ISM band in 79 channels that are 1 MHz wide. These channels are centered from 2402 MHz to 2480 MHz spaced at 1 MHz. The transceiver supports data modulation and demodulation of GFSK, 8PSK and QPSK signals for data rates up to 1Mbps, 2 Mbps, and 3 Mbps, respectively. The solution is configured to operate as a Class 2 Bluetooth radio with a maximum transmit power of +4 dBm.

Duty Cycle Correction Factors were not utilized in this testing and report per client request.

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3 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Advanced Satellite Receiver Set-Top Box	Echostar Technologies, LLC	ID:058	EMC1

Receive Date:	09/11/2012
Received Condition:	Good
Type:	Production Samples

Description of Equipment Under Test (provided by client)
<p>The ID:058 is a satellite set-top box incorporating Sling place shifting technology designed to operate as a server in the whole home DVR system. The ID:058 has a RF4CE 2.4GHz Synkro solution to interface to a remote control , a Bluetooth Class 2 transceiver for supported accessories, and an 802.11a/b/g/n Wi-Fi transceiver for connection to the customer's internet wirelessly.</p> <p>The RF4CE radio is located on the main board and uses a detachable antenna located on the back panel of the set-top box. The Bluetooth transceiver is on a separate PCB that is located within the front panel plastics. The Bluetooth transceiver uses a printed antenna. The 802.11a/b/g/n transceiver is located on the same PCB as the Bluetooth transceiver. The 802.11a/b/g/n transceiver uses two antennas that are attached via U.FL connectors and two different lengths of mini coax cable. These antennas are located within the front bezel assembly.</p> <p>Removal of the Bluetooth and 802.11a/b/g/n transceivers does not alter the RF characteristics of the RF4CE transceiver. The ID:058 provides HDMI, Composite and Component A/V outputs as well as Ethernet, USB and eSATA.</p>

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
100-120VAC	0.5A	60Hz	1

Operating modes of the EUT: Intentional Tx Testing

No.	Descriptions of EUT Exercising
1	Product configured in transmit mode at full power, CW signal.
2	Product configured for continuous transmission, full power with modulation/data transfer enabled.
3	Product set up with all signal and I/O cable ports populated and terminated with either active or passive loads. Wi-Fi radio enabled, Ethernet data transfer, USB data transfer, and eSATA data transfer. Video output to all A/V connections.

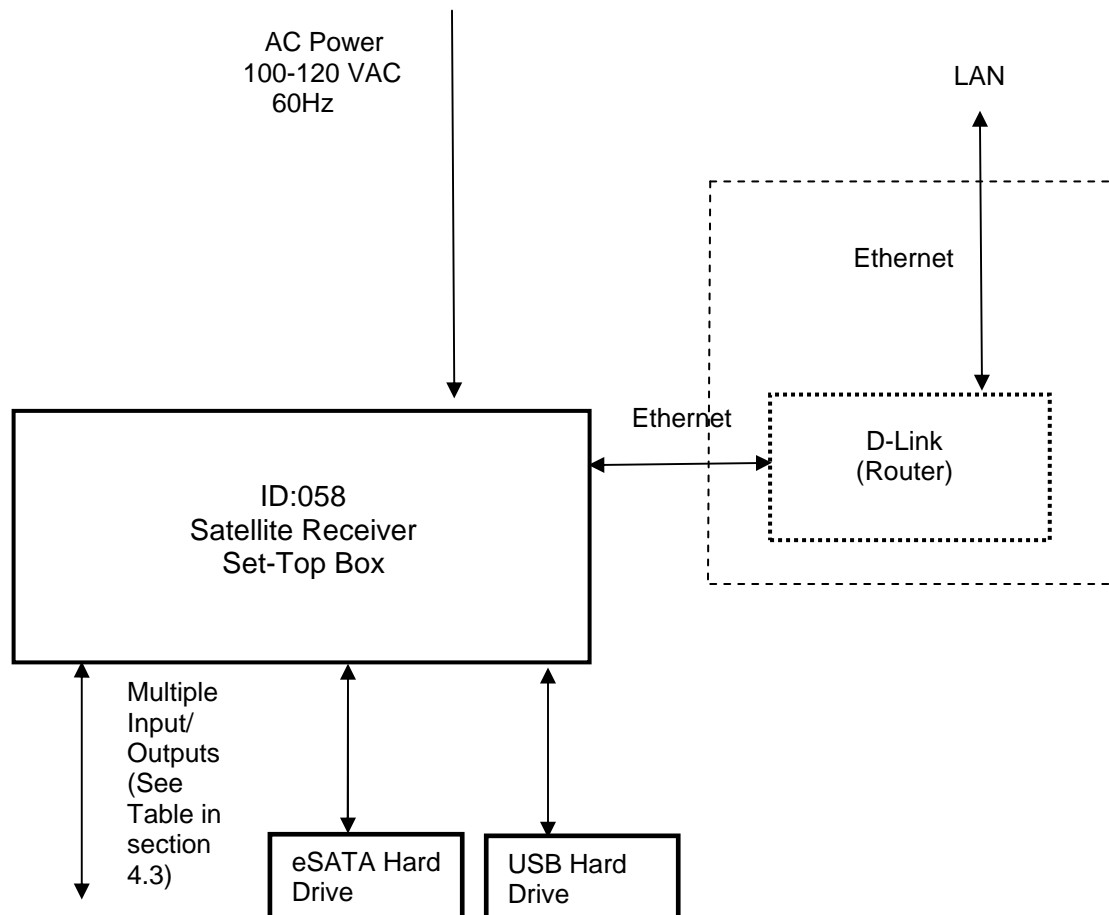
Note: The chosen mode of operation described above is dependent upon the specific test to be performed.

4 System setup including cable interconnection details, support equipment and simplified block diagram

4.1 Method:

Record the details of EUT cabling, document the support equipment, and show the interconnections in a block diagram.

4.2 EUT Block Diagram:



Note: Dashed lines indicate auxiliary/support equipment outside the test area

4.3 Support Data:

ID	Description/ Function	Shield Type	Length	Connector	Connection	Ferrites
1	AC Power	None	1 meter	AC	DE51 Power In	No
2	2x Ethernet	None	> 3 meter	RJ-45	Router/Switch	No
3	USB	Foil	< 1 meter	USB	USB Drive	No
4	Front Panel USB	Foil	< 1 meter	USB	Terminator	No
5	USB	Foil	< 1 meter	USB	Terminator	No
6	RCA A/V Outputs	Braid	1 meter	RCA	Matched Impedance Loads	No
7	HDMI Digital Video Out	Foil	1 meter	HDMI	EDIDI Simulation Box	No
8	RF Coax Cable	Braid	> 3 meter	Type F	Terminator	No
9	eSATA Cable	Braid	< 1 meter		eSATA Drive	No
10	Composite Video Out	Braid	< 1 meter	RCA	Terminator	No
11	Phone Cable	None	< 1 meter	RJ-11	Unterminated	No

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Router/Switch	D-Link	EBR-2310	-----

Note: All product ports were fully populated with appropriate cables. All cables were terminated with an active load or typical device/peripheral.

5 Radiated Emissions – Fundamental Power & Harmonics of the Fundamental

5.1 Method

The test methods used comply with ANSI C63.10. Unless otherwise stated no deviations were made from **FCC CFR47 15.247**.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

5.2 Test Equipment Used:

<u>Asset ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Serial</u>	<u>Cal Date</u>	<u>Cal Due</u>
DEN-073	EMI Receiver	RHODE & SCHWARZ	ESU 26	100265	1/11/2012	1/10/2013
18887	Horn Antenna 1-18GHz	EMCO	3115	9205-3886	2/28/2012	2/27/2013
18900	RF Pre-Amplifier (4-8 GHz)	Avantek	AFT97-8434-10F	1007	6/7/2012	6/7/2013
18901	RF Pre-Amplifier (8-16 GHz)	Avantek	AWT-18037	1002	6/7/2012	6/7/2013
18906	Amplifier (1-4 GHz)	Mini-Circuits Lab	ZHL-42	N052792-2	6/7/2012	6/7/2013
18912	9 kHz- 1.3GHz Pre Amp	Hewlett-Packard	8447F	3113A05545	6/6/2012	6/6/2013
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	11/15/2011	11/14/2012
SW-6	Software for Radiated and Conducted emissions.	Intertek	OATS vba	V. 3.0	VBV	VBV
18913	Spectrum Analyzer	Hewlett-Packard	E7405A	My44211889	7/16/2012	7/16/2013
18660	Spectrum Analyzer Display Section (set 1)	Hewlett Packard	85662A	2318A04983	1/24/2012	1/24/2013

5.3 Results:

The sample tested was found to comply with the requirements of:

- FCC 247(b)(3) (d)/15.205/15.209

5.4 Setup Photographs:

Test setup – Field Strength Measurements (Front View)



Test setup – Field Strength Measurements (Rear View)

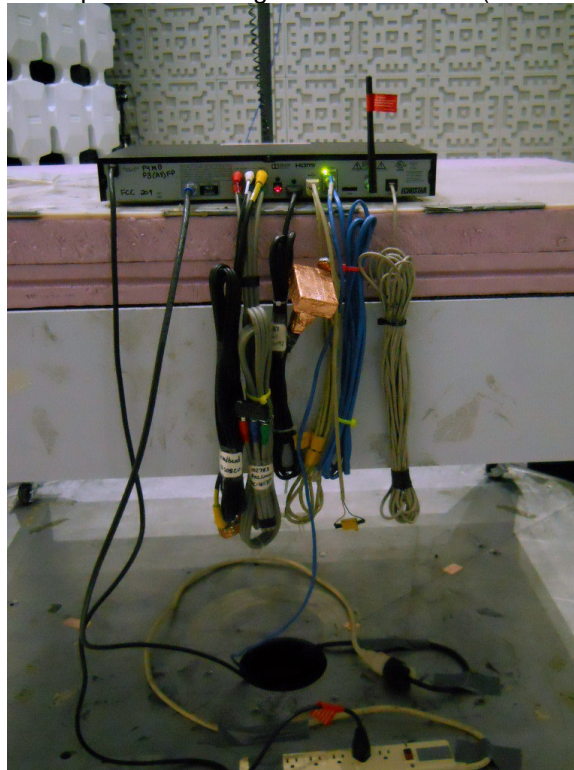
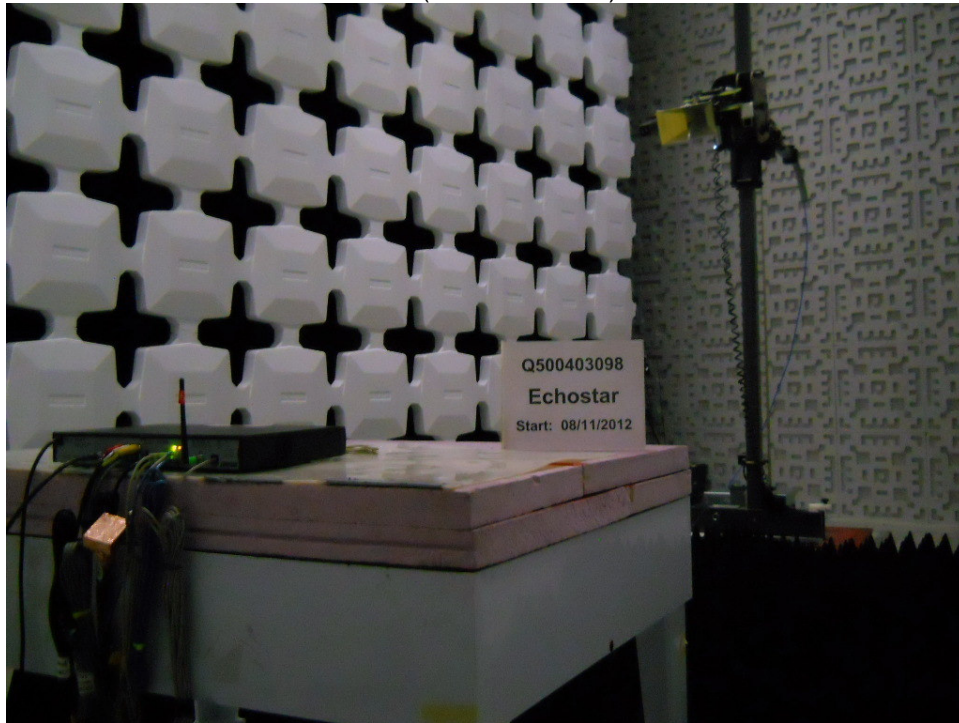


Photo: Antenna Setups

Horn (1GHz – 18GHz)



HF Active Antenna/Harmonic Mixer (18GHz – 26.5GHz)

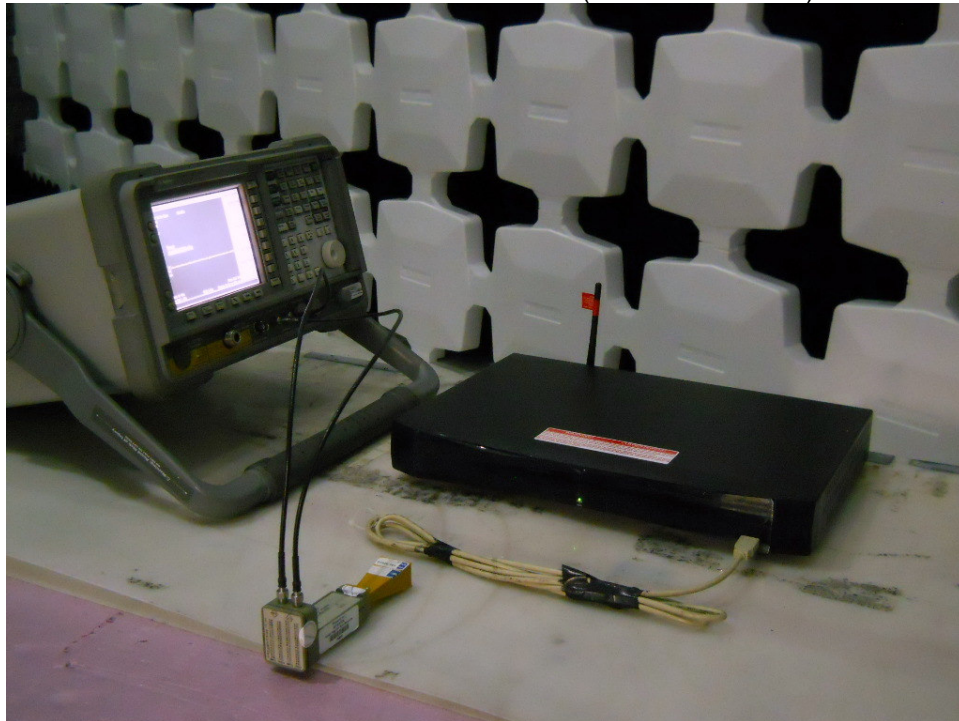
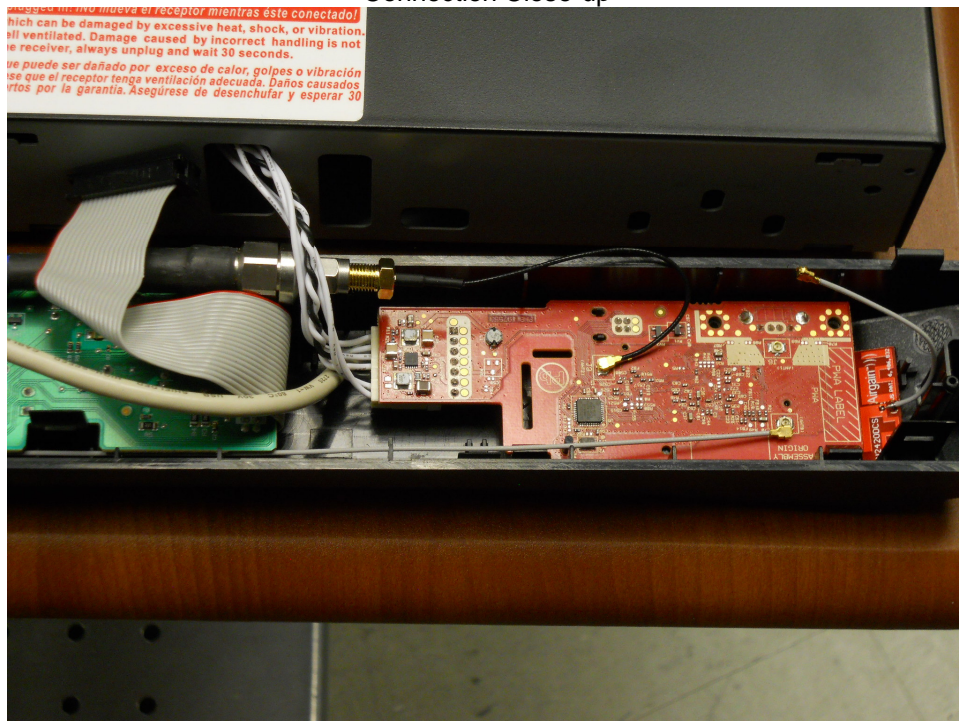


Photo: Conducted Port

Bluetooth port



Connection Close-up



5.5 Test Data: AC Variation – Fundamental Frequency

5.6

AC Variance – Fundamental Frequency

Test Report #: 100900227DEN-002	Test Area: CC1 Radiated	Temperature: 24.1 °C
Test Method: FCC Part 15.31(e)	Test Date: 9/14/2012	Relative Humidity: 35.9 %
EUT Model #: ID:058	EUT Power: See Below	Air Pressure: 83.1 kPa
EUT Serial #: EMC1		
Manufacturer: Echostar		
EUT Description: Advanced Satellite Receiver		
Notes:		

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	DET	CABLE	ANT	PREAMP	ATTEN	FINAL	Meas. Method	Duty Cycle Correction	Final Corrected	RBW
MHz	dBuV	Qp Av Pk	+ [dB]	+ [dB/m]	- [dB]	+ [dB]	= [dBuV]		(dB)	(dBuV)	(MHz)

AC Variance

Bluetooth Conducted Port

AC @ Nominal Voltage - 120V / 60Hz

2441.0	102.90	Pk	0.85	0.00	0.00	0.00	103.75	Cond Port	0.0	103.8	0.100
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AC @ 115% of Normal Voltage - 138V / 60Hz

2441.0	102.80	Pk	0.85	0.00	0.00	0.00	103.65	Cond Port	0.0	103.7	0.100
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AC @ 85% of Nominal Voltage - 102V / 60Hz

2441.0	102.90	Pk	0.85	0.00	0.00	0.00	103.75	Cond Port	0.0	103.8	0.100
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Conclusion:

There is no significant difference in the radiated field strength of the fundamental frequency with respect to varying the ac voltage. Therefore, all measurements will be taken using the nominal rated voltage of the product.

5.7 Worst Case Modulation

5.7.1 Test Measurements

PRBS9

Channel	2402	2441	2480
GFSK	106.7dBuV	107 dBuV	107.1 dBuV
8PSK	108 dBuV	108.4 dBuV	108.6 dBuV
QPSK	107.7 dBuV	108.3 dBuV	108.4 dBuV

PRBS15

Channel	2402 dBuV	2441 dBuV	2480 dBuV
GFSK	106.7 dBuV	107 dBuV	107.1 dBuV
8PSK	108 dBuV	108.4 dBuV	108.6 dBuV
QPSK	107.7 dBuV	108.4 dBuV	108.4 dBuV

No significant different seen between PRBS9 and PRBS15.
Worst modulation scheme was found to be 8PSK

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5.8 Test Data: Fundamental Power & Harmonics of the Fundamental

5.8.1 Bluetooth Transmitter

Peak Conducted Output Power of the Fundamental & Harmonics of the Fundamental (Spurious of the Transmitter)

Test Report #:	100900227DEN-002	Test Area:	RF Conducted Port Cable	Temperature:	22.0	°C
Test Method:	FCC 15.247(b)(3) FCC 15.247(d)	Test Date:	9/18/2012	Relative Humidity:	34.1	%
EUT Model #:	ID:058	EUT Power:	120VAC/60Hz	Air Pressure:	84.49	kPa
EUT Serial #:	EMC1					
Manufacturer:	Echostar					
EUT Description:	Advanced Satellite Receiver Set-Top Box					
Notes:	This data sheet assumes no duty cycle correction					
	Fundamental Measurements: RBW = 3MHz					
	Harmonics of the Fundamental Measurements: RBW = 100kHz					
	Measurements made per ANSI C63.10 section 6.10.2.1.					

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av – Average	

FREQ	LEVEL	DET	CABLE	ANT	PREAMP	ATTEN	FINAL	Measurement Method	Duty Cycle Correction	Final Corrected	Limit FCC 15.247(d)	Delta	RBW
MHz	dBuV	Qp Av Pk	+ [dB]	+ [dB/m]	- [dB]	+ [dB]	(dBuV)		(dB)	(dBuV)	(dBuV/m)	(dB)	(MHz)

The following Duty Cycle was utilized in this test data sheet:

100%

Averaging method for pulsed signals and calculation in accordance to FCC CFR47 Part 15.35 utilized to calculate emissions.

The testing performed in accordance to 15.247(b)(3) and 15.247(d) emissions and delta limits were calculated as follows:

Final Corrected Peak Measurement – Duty Cycle Correction Factor* = Final Calculated Emission

The Final Calculated Emission was then compared to the Limits in CFR47 Part 15.247 and the emission/limit delta was calculated.

the DTCF is calculated as follows $20 \cdot \log_{10}(\text{duty cycle in } 100\text{ms})$.

Fundamental Power

RBW = 3MHz

Fundamental - Low Channel

2402.0	108.9	Pk	0.84	0.00	0.00	0.00	109.8	RF Cond Port	0.0	109.77	137.0	-27.2	3.0
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Fundamental - Mid Channel

2441.0	108.8	Pk	0.85	0.00	0.00	0.00	109.6	RF Cond Port	0.0	109.62	137.0	-27.4	3.0
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Fundamental - High Channel

2480.0	109.1	Pk	0.86	0.00	0.00	0.00	110.0	RF Cond Port	0.0	109.96	137.0	-27.0	3.0
--------	-------	----	------	------	------	------	-------	--------------	-----	--------	-------	-------	-----

Limit: Output Power of the Fundamental: 137 dBuV

Worst-Case Fundamental – High Channel @ 2480 MHz: 27.0 dBuV below the limit

Results: Pass

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The following calculations convert the measured signal in dBuV to power in Watts for comparison to the limit:

For a 50 ohm measurement system: 1 dBuV = -106 dBm

$$1 \text{ dBm} = .0012589 \text{ W}$$

Worst-case Fundamental (High-Channel):

$$109.96 \text{ dBuV} = 2.96 \text{ dBm}$$

$$-3.94 \text{ dBm} = 0.00198 \text{ W}$$

Limit per FCC 15.247(b)(3): 1W

Therefore, Delta from Limit: $1 \text{ W} - 0.00198 \text{ W} = \mathbf{0.998 \text{ W (below the limit)}}$

Bluetooth – Harmonics of the Fundamental Conducted Port Measurements

Test Report #:	100457282	Test Area:	CC1 Radiated	Temperature:	22	°C
Test Method:	FCC 15.247(d) 15.205/ 15.209	Test Date:	9/18/2012	Relative Humidity:	31.1	%
EUT Model #:	ID:058	EUT Power:	120VAC/60Hz	Air Pressure:	84.49	kPa
EUT Serial #:	EMC1					
Manufacturer:	Echostar					
EUT Description:	Advanced Satellite Receiver					
Notes:						

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av – Average	

FREQ	LEVEL	DET	CABLE	ANT	PREAMP	ATTEN	FINAL	Measurement Method	Duty Cycle Corr.	Final Corrected	Limit FCC 15.247(d)	Delta	RBW
MHz	dBuV	Qp Av Pk	+ [dB]	+ [dB/m]	- [dB]	+ [dB]	(dBuV)		(dB)	(dBuV)	(dBuV/m)	(dB)	(MHz)

The following Duty Cycle was utilized in this test data sheet:

100%

Averaging method for pulsed signals and calculation in accordance to FCC CFR47 Part 15.35 utilized to calculate emissions.

The testing performed in accordance to 15.247(b)(3) and 15.247(d) emissions and delta limits were calculated as follows:

Final Corrected Peak Measurement – Duty Cycle Correction Factor* = Final Calculated Emission

The Final Calculated Emission was then compared to the Limits in CFR47 Part 15.247 and the emission/limit delta was calculated.

the DTCF is calculated as follows $20 \cdot \log_{10}(\text{duty cycle in 100ms})$.

Bluetooth Conducted Port

Limit of the Harmonics Measurement

2402.0	106.2	Pk	0.85	0.00	0.00	0.00	107.1	RF Cond Port	0.0	107.05			0.1
2441.0	104.8	Pk	0.85	0.00	0.00	0.00	105.7	RF Cond Port	0.0	105.69			0.1
2480.0	104.8	Pk	0.35	0.00	0.00	0.00	105.2	RF Cond Port	0.0	105.15			0.1

Harmonics of the Fundamental - Low Channel

4804.0	36.1	Pk	1.44	0.00	0.00	0.00	37.5	RF Cond Port	0.0	37.53	87.05	-49.5	0.1
7206.0	36.2	Pk	1.82	0.00	0.00	0.00	38.0	RF Cond Port	0.0	38.01	87.05	-49.0	0.1
9608.0	34.1	Pk	2.98	0.00	0.00	0.00	37.1	RF Cond Port	0.0	37.10	87.05	-50.0	0.1
12010.0	35.2	Pk	3.66	0.00	0.00	0.00	38.8	RF Cond Port	0.0	38.84	87.05	-48.2	0.1
14412.0	34.5	Pk	3.36	0.00	0.00	0.00	37.9	RF Cond Port	0.0	37.90	87.05	-49.2	0.1
16814.0	35.0	Pk	7.19	0.00	0.00	0.00	42.2	RF Cond Port	0.0	42.21	87.05	-44.8	0.1
19216.0	33.5	Pk	9.20	0.00	0.00	0.00	42.7	RF Cond Port	0.0	42.68	87.05	-44.4	0.1
21618.0	34.5	Pk	8.79	0.00	0.00	0.00	43.2	RF Cond Port	0.0	43.24	87.05	-43.8	0.1
24020.0	33.4	Pk	8.79	0.00	0.00	0.00	42.2	RF Cond Port	0.0	42.21	87.05	-44.8	0.1

Mid Channel

4882.0	35.7	Pk	1.46	0.00	0.00	0.00	37.1	RF Cond Port	0.0	37.13	85.69	-48.6	0.1
7323.0	32.5	Pk	1.90	0.00	0.00	0.00	34.4	RF Cond Port	0.0	34.44	85.69	-51.3	0.1
9764.0	35.0	Pk	3.12	0.00	0.00	0.00	38.1	RF Cond Port	0.0	38.14	85.69	-47.6	0.1
12205.0	33.9	Pk	3.00	0.00	0.00	0.00	36.9	RF Cond Port	0.0	36.94	85.69	-48.8	0.1
14646.0	34.2	Pk	4.89	0.00	0.00	0.00	39.1	RF Cond Port	0.0	39.08	85.69	-46.6	0.1
17087.0	36.0	Pk	7.70	0.00	0.00	0.00	43.7	RF Cond Port	0.0	43.68	85.69	-42.0	0.1
19528.0	34.5	Pk	5.38	0.00	0.00	0.00	39.9	RF Cond Port	0.0	39.87	85.69	-45.8	0.1

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21969.0	34.4	Pk	8.79	0.00	0.00	0.00	43.2	RF Cond Port	0.0	43.16	85.69	-42.5	0.1
24410.0	35.5	Pk	8.79	0.00	0.00	0.00	44.3	RF Cond Port	0.0	44.33	85.69	-41.4	0.1
High Channel													
4960.0	35.4	Pk	1.48	0.00	0.00	0.00	36.8	RF Cond Port	0.0	36.84	85.92	-49.1	0.1
7440.0	34.6	Pk	2.08	0.00	0.00	0.00	36.7	RF Cond Port	0.0	36.70	85.92	-49.2	0.1
9920.0	34.5	Pk	2.93	0.00	0.00	0.00	37.5	RF Cond Port	0.0	37.47	85.92	-48.5	0.1
12400.0	34.5	Pk	2.98	0.00	0.00	0.00	37.5	RF Cond Port	0.0	37.47	85.92	-48.5	0.1
14880.0	34.54	Pk	6.04	0.00	0.00	0.00	40.58	RF Cond Port	0.0	40.58	85.92	-45.3	0.1
17360.0	35.13	Pk	5.14	0.00	0.00	0.00	40.27	RF Cond Port	0.0	40.27	85.92	-45.7	0.1
19840.0	35.4	Pk	8.79	0.00	0.00	0.00	44.19	RF Cond Port	0.0	44.19	85.92	-41.7	0.1
22320.0	34.78	Pk	8.79	0.00	0.00	0.00	43.57	RF Cond Port	0.0	43.57	85.92	-42.4	0.1
24800.0	35.56	Pk	8.79	0.00	0.00	0.00	44.35	RF Cond Port	0.0	44.35	85.92	-41.6	0.1

Limit: Harmonics of the Fundamental: maximum -20 dBc

Worst-Case Harmonic: High Channel @ 24800.0 MHz, Horizontal Polarization: -41.6 dBc

Results: Pass

Example calculation for Intentional Emissions:

Measured Level	+	Transducer, Cable Loss Pre-Amplifier	=	Corrected Reading	-	Duty Cycle Correction	=	FINAL Measurement	-	Specification Limit	=	Delta from Specification Limit
(dBμV)		(dB)		(dBμV/m)		(dBμV/m)		(dBμV/m)		(dBμV/m)		
24.0		14.9		38.9		10.0		28.9		40.0		-11.1

Notes:

- 1) All measurements taken using a peak detector – no duty cycle correction is applicable to this product.

Deviations, Additions, or Exclusions: None

Intertek

Report Number: 100900227DEN-002

Issued:10/10/2012

Bluetooth – Restricted Band Harmonics of the Fundamental (Spurious of the Transmitter – Radiated Measurements)

Test Report #:	100900227DEN-002	Test Area:	CC1 Radiated	Temperature:	22.0	°C
Test Method:	FCC 15.247(d) 15.205/ 15.209	Test Date:	9/17/2012	Relative Humidity:	34.1	%
EUT Model #:	ID:058	EUT Power:	120VAC/60Hz	Air Pressure:	84.49	kPa
EUT Serial #:	EMC1					
Manufacturer:	Echostar					
EUT Description:	Advanced Satellite Receiver					
Notes:	Measurements made per ANSI C63.10 section 5.9.					

Level Key

Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	DET	CABLE	ANT	PREAMP	ATTEN	FINAL	POL	HGT	AZ	Duty Cycle Corr.	Final Corrected	Limit	DELTA2	RB W
MHz	dBuV	Qp Av Pk	+ [dB]	+ [dB/m]	- [dB]	+ [dB]	= [dBuV]	(V/H)	(m)	(DEG)	(dB)	(dBuV/m)	15.209 >1GHz	15.209 >1GHz	MHz

The following Duty Cycle was utilized in this test data sheet:

100%

Averaging method for pulsed signals and calculation in accordance to FCC CFR47 Part 15.35 utilized to calculate emissions.

The testing performed in accordance to 15.247(b)(3) and 15.247(d) emissions and delta limits were calculated as follows:

Final Corrected Peak Measurement – Duty Cycle Correction Factor* = Final Calculated Emission

The Final Calculated Emission was then compared to the Limits in CFR47 Part 15.247 and the emission/limit delta was calculated.

the DTCF is calculated as follows $20 \cdot \log_{10}(\text{duty cycle in 100ms})$.

BT Radiated

Part 15.205 / 15.209

Harmonics of the Fundamental - FCC Restricted Bands

Low Channel

4801.6	33.78	Pk	5.16	33.43	38.97	0.00	33.40	H	1.00	25.0	0.0	33.4	74.00	- 40.60	1.0
4801.6	20.47	Av	5.16	33.43	38.97	0.00	20.09	H	1.00	25.0	0.0	20.1	54.00	- 33.91	1.0
4801.6	43.18	Pk	5.16	33.43	38.97	0.00	42.80	V	1.00	54.0	0.0	42.8	74.00	- 31.20	1.0
4801.6	30.07	Av	5.16	33.43	38.97	0.00	29.69	V	1.00	54.0	0.0	29.7	54.00	- 24.31	1.0
12010.0	41.99	Pk	8.71	39.65	45.60	0.00	44.75	H	1.47	36.0	0.0	44.8	74.00	- 29.25	1.0
12010.0	28.06	Av	8.71	39.65	45.60	0.00	30.82	H	1.47	36.0	0.0	30.8	54.00	- 23.18	1.0
12010.0	42.98	Pk	8.71	39.65	45.60	0.00	45.74	V	1.21	360.0	0.0	45.7	74.00	- 28.26	1.0
12010.0	28.05	Av	8.71	39.65	45.60	0.00	30.81	V	1.21	360.0	0.0	30.8	54.00	- 23.19	1.0
19216.0	35.09	Pk	0.00	22.27	0.00	0.00	57.36	V	1.00	0.0	0.0	57.4	74.00	- 16.64	1.0
19216.0	0.23	Av	0.00	22.27	0.00	0.00	22.50	V	1.00	0.0	0.0	22.5	54.00	- 31.50	1.0
19216.0	31.14	Pk	0.00	22.27	0.00	0.00	53.41	H	1.00	0.0	0.0	53.4	74.00	- 20.59	1.0
19216.0	0.33	Av	0.00	22.27	0.00	0.00	22.60	H	1.00	0.0	0.0	22.6	54.00	- 31.40	1.0

High Channel

4960.0	49.54	Pk	5.24	33.73	38.69	0.00	49.83	V	1.00	8.00	0.0	49.8	74.00	-24.17	1.0
4960.0	39.35	Av	5.24	33.73	38.69	0.00	39.64	V	1.00	8.00	0.0	39.6	54.00	-14.36	1.0
4960.0	49.82	Pk	5.24	33.73	38.69	0.00	50.11	H	1.00	40.00	0.0	50.1	74.00	-23.89	1.0
4960.0	40.35	Av	5.24	33.73	38.69	0.00	40.64	H	1.00	40.00	0.0	40.6	54.00	-13.36	1.0
7440.0	43.98	Pk	6.53	36.79	39.24	0.00	48.06	V	1.45	123.00	0.0	48.1	74.00	-25.94	1.0

Intertek														
Report Number: 100900227DEN-002								Issued:10/10/2012						

7440.0	29.74	Av	6.53	36.79	39.24	0.00	33.82	V	1.45	123.00	0.0	33.8	54.00	-20.18	1.0
7440.0	43.43	Pk	6.53	36.79	39.24	0.00	47.51	H	1.25	223.00	0.0	47.5	74.00	-26.49	1.0
7440.0	29.8	Av	6.53	36.79	39.24	0.00	33.88	H	1.25	223.00	0.0	33.9	54.00	-20.12	1.0
12400.0	41.9	Pk	8.93	42.32	45.74	0.00	47.42	V	1.00	0.00	0.0	47.4	74.00	-26.58	1.0
12400.0	27.8	Av	8.93	42.32	45.74	0.00	33.32	V	1.00	0.00	0.0	33.3	54.00	-20.68	1.0
12400.0	41.28	Pk	8.93	42.32	45.74	0.00	46.8	H	1.00	227.00	0.0	46.8	74.00	-27.20	1.0
12400.0	27.81	Av	8.93	42.32	45.74	0.00	33.33	H	1.00	227.00	0.0	33.3	54.00	-20.67	1.0
19840.0	36.6	Pk	0.00	21.76	0.00	0.00	58.36	V	1.00	0.00	0.0	58.4	74.00	-15.64	1.0
19840.0	0.17	Av	0.00	21.76	0.00	0.00	21.93	V	1.00	0.00	0.0	21.9	54.00	-32.07	1.0
19840.0	35.35	Pk	0.00	21.76	0.00	0.00	57.11	H	1.00	227.00	0.0	57.1	74.00	-16.89	1.0
19840.0	0.72	Av	0.00	21.76	0.00	0.00	22.48	H	1.00	227.00	0.0	22.5	54.00	-31.52	1.0
22320.0	33.51	Pk	0.00	21.08	0.00	0.00	54.59	V	1.00	227.00	0.0	54.6	74.00	-19.41	1.0
22320.0	0.384	Av	0.00	21.08	0.00	0.00	21.46	V	1.00	227.00	0.0	21.5	54.00	-32.54	1.0
22320.0	37.89	Pk	0.00	21.08	0.00	0.00	58.97	H	1.00	227.00	0.0	59.0	74.00	-15.03	1.0
22320.0	0.589	Av	0.00	21.08	0.00	0.00	21.67	H	1.00	227.00	0.0	21.7	54.00	-32.33	1.0

Mid Channel

4882.0	52.85	Pk	5.20	33.60	38.83	0.00	52.83	H	2.14	9.0	0.0	52.8	74.00	-21.17	1.0
4882.0	44.21	Av	5.20	33.60	38.83	0.00	44.19	H	2.14	9.0	0.0	44.2	54.00	-9.81	1.0
4882.0	50.53	Pk	5.20	33.60	38.83	0.00	50.51	V	1.52	360.0	0.0	50.5	74.00	-23.49	1.0
4882.0	40.33	Av	5.20	33.60	38.83	0.00	40.31	V	1.52	360.0	0.0	40.3	54.00	-13.69	1.0
7323.0	43.70	Pk	6.47	36.75	39.20	0.00	47.71	H	2.13	349.0	0.0	47.7	74.00	-26.29	1.0
7323.0	29.77	Av	6.47	36.75	39.20	0.00	33.78	H	2.13	349.0	0.0	33.8	54.00	-20.22	1.0
7323.0	43.78	Pk	6.47	36.75	39.20	0.00	47.79	V	1.19	0.0	0.0	47.8	74.00	-26.21	1.0
7323.0	30.30	Av	6.47	36.75	39.20	0.00	34.31	V	1.19	0.0	0.0	34.3	54.00	-19.69	1.0
12205.0	41.86	Pk	8.82	40.68	45.62	0.00	45.74	H	1.00	9.0	0.0	45.7	74.00	-28.26	1.0
12205.0	27.91	Av	8.82	40.68	45.62	0.00	31.79	H	1.00	9.0	0.0	31.8	54.00	-22.21	1.0
12205.0	41.61	Pk	8.82	40.68	45.62	0.00	45.49	V	1.00	328.0	0.0	45.5	74.00	-28.51	1.0
12205.0	27.90	Av	8.82	40.68	45.62	0.00	31.78	V	1.00	328.0	0.0	31.8	54.00	-22.22	1.0
19528.0	34.24	Pk	0.00	22.07	0.00	0.00	56.31	H	1.00	0.0	0.0	56.3	74.00	-17.69	1.0
19528.0	3.78	Av	0.00	22.07	0.00	0.00	25.86	H	1.00	0.0	0.0	25.9	54.00	-28.14	1.0
19528.0	34.64	Pk	0.00	22.07	0.00	0.00	56.71	V	1.00	0.0	0.0	56.7	74.00	-17.29	1.0
19528.0	1.93	Av	0.00	22.07	0.00	0.00	24.00	V	1.00	0.0	0.0	24.0	54.00	-30.00	1.0

Average Limit for FCC Restricted Bands per 15.209: 54 dBuV/m at 3-meter test distance

Peak Limit for FCC Restricted Bands per 15.209: 74 dBuV/m at 3-meter test distance

Worst-Case Harmonic - Mid-Channel: 4882.0 MHz, 44.19 dBuV/m (9.81 dB below limit)

Result: Pass

Example calculation for Intentional Radiated Emissions:

Measured Level	+	Transducer, Cable Loss Pre-Amplifier	=	Corrected Reading	-	Duty Cycle Correction	=	FINAL Measurement	-	Specification Limit	=	Delta from Specification Limit
(dBuV)		(dB)		(dBuV/m)		(dBuV/m)		(dBuV/m)		(dBuV/m)		
24.0		14.9		38.9		10.0		28.9		40.0		-11.1

Notes:

Deviations, Additions, or Exclusions: None

Intertek	
Report Number: 100900227DEN-002	Issued:10/10/2012

6 Conducted Port Spurious Emissions

6.1 Method

The test methods used comply with ANSI C63.10. Unless otherwise stated no deviations were made from **FCC 15.247**.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

6.2 Test Equipment Used:

<u>Asset ID:</u>	<u>Description:</u>	<u>Manufacturer:</u>	<u>Model:</u>	<u>Serial:</u>	<u>Cal Date</u>	<u>Cal Due</u>
18913	Spectrum Analyzer	Hewlett-Packard	E7405A	My44211889	7/16/2012	7/16/2013

6.3 Results:

The sample tested was found to comply with the requirements of:

- FCC 15.209/ 15.247(d)

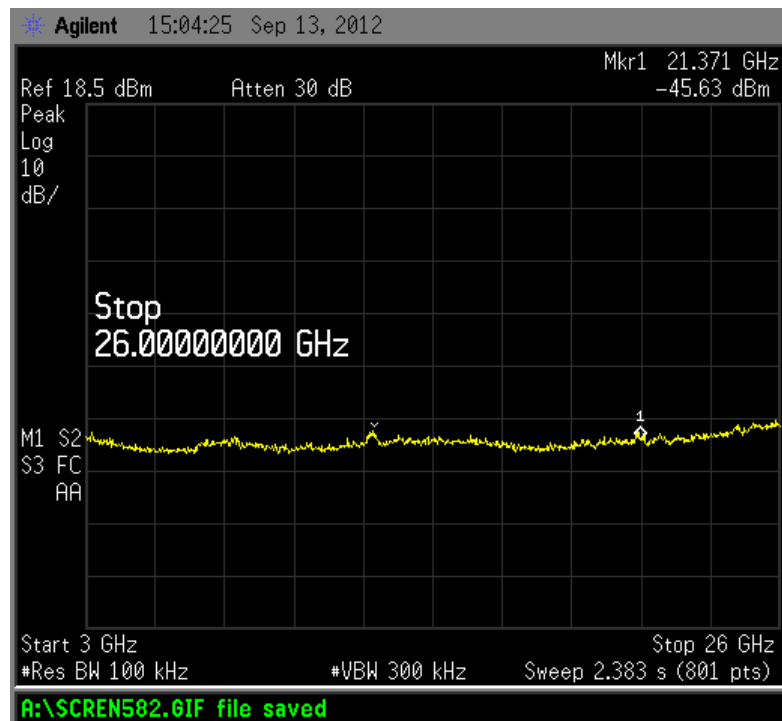
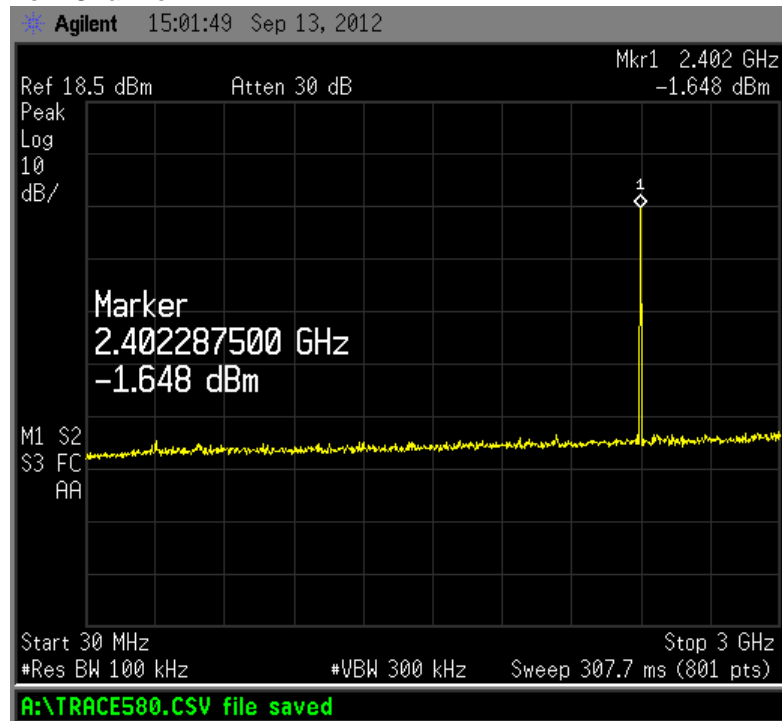
6.4 Setup Photographs:

Test setup

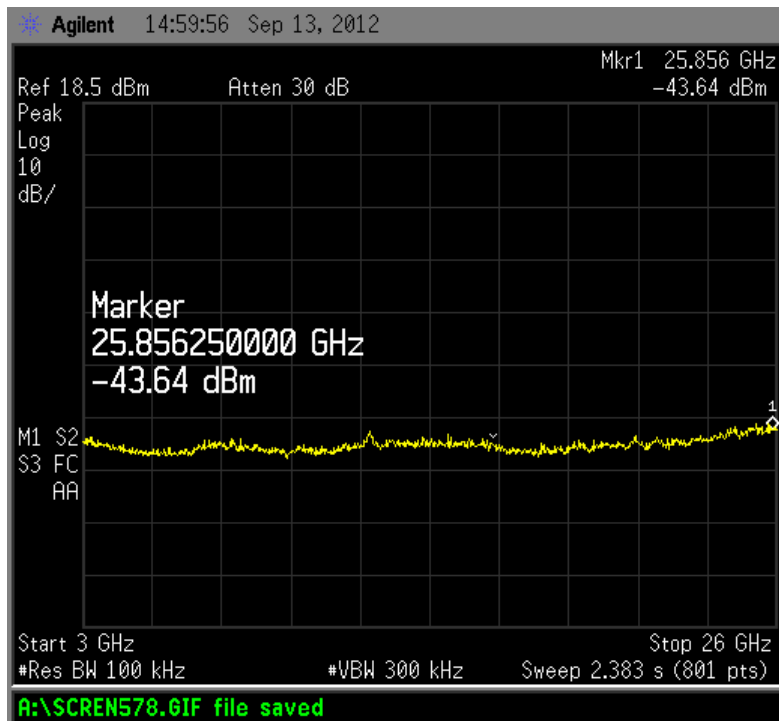
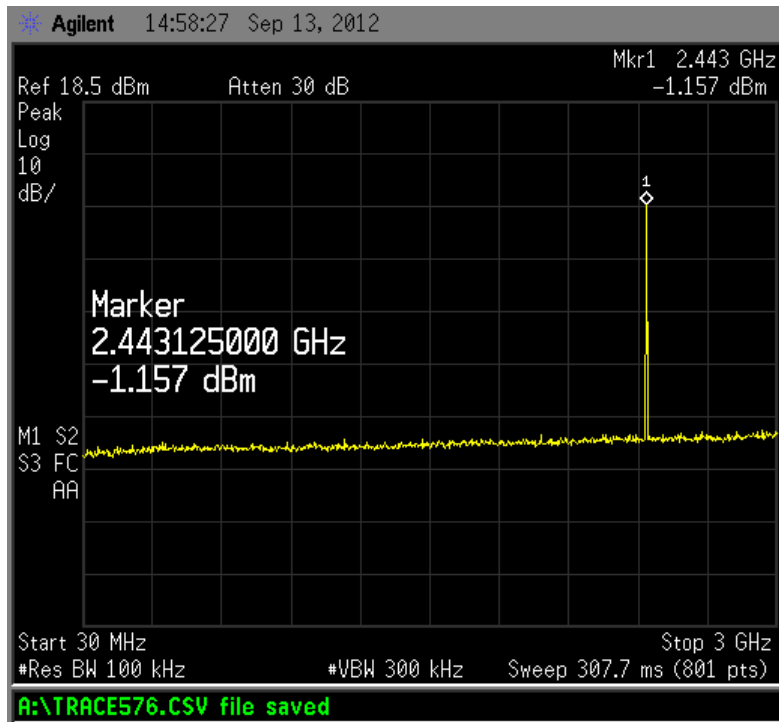


6.5 Plots: Tx Low Channel

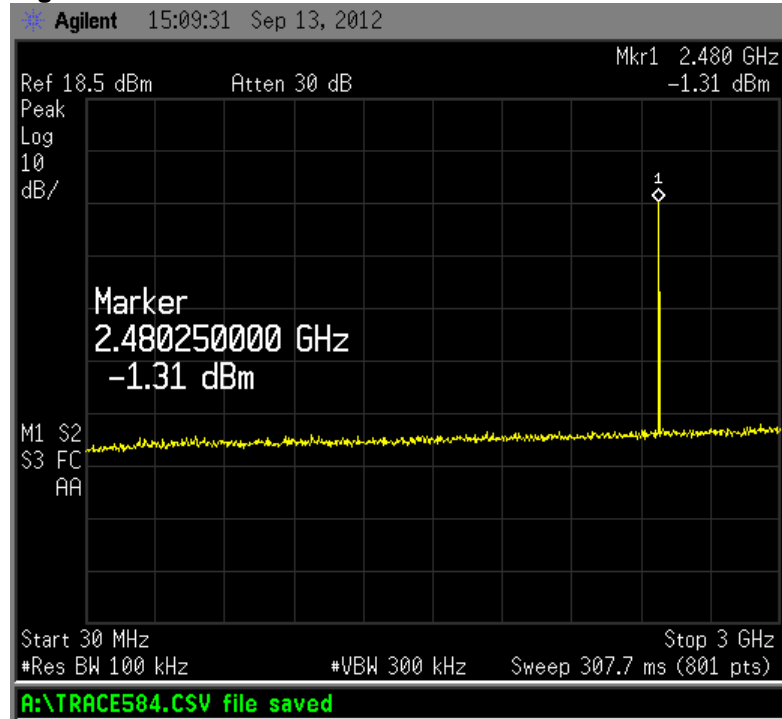
Low Channel



Mid Channel



High Channel



7 Band Edge Measurements

7.1 Method

The test methods used comply with ANSI C63.10. Unless otherwise stated no deviations were made from **FCC 15.247**.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

7.2 Test Equipment Used:

<u>Asset ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Serial</u>	<u>Cal Date</u>	<u>Cal Due</u>
DEN-073	EMI Receiver	RHODE & SCHWARZ	ESU 26	100265	1/11/2012	1/10/2013
18887	Horn Antenna 1-18GHz	EMCO	3115	9205-3886	2/28/2012	2/27/2013
18900	RF Pre-Amplifier (4-8 GHz)	Avantek	AFT97-8434-10F	1007	6/7/2012	6/7/2013
18901	RF Pre-Amplifier (8-16 GHz)	Avantek	AWT-18037	1002	6/7/2012	6/7/2013
18906	Amplifier (1-4 GHz)	Mini-Circuits Lab	ZHL-42	N052792-2	6/7/2012	6/7/2013
18912	9 kHz- 1.3GHz Pre Amp	Hewlett-Packard	8447F	3113A05545	6/6/2012	6/6/2013
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	11/15/2011	11/14/2012
SW-6	Software for Radiated and Conducted emissions.	Intertek	OATS vba	V. 3.0	VBU	VBU

7.3 Results:

The sample tested was found to comply with the requirements of:

- FCC 15.209/ 15.247(d)

7.4 Setup Photographs:

Test setup – Field Strength Measurements (Front View)



Test setup – Field Strength Measurements (Rear View)

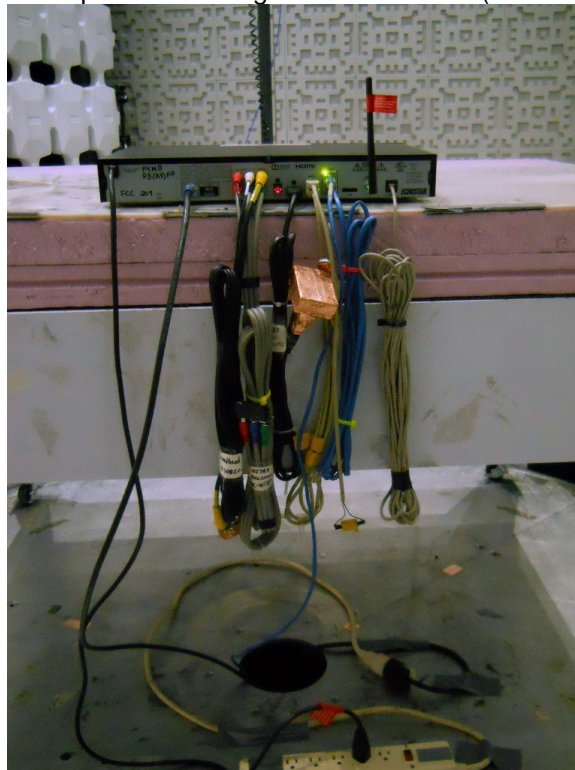
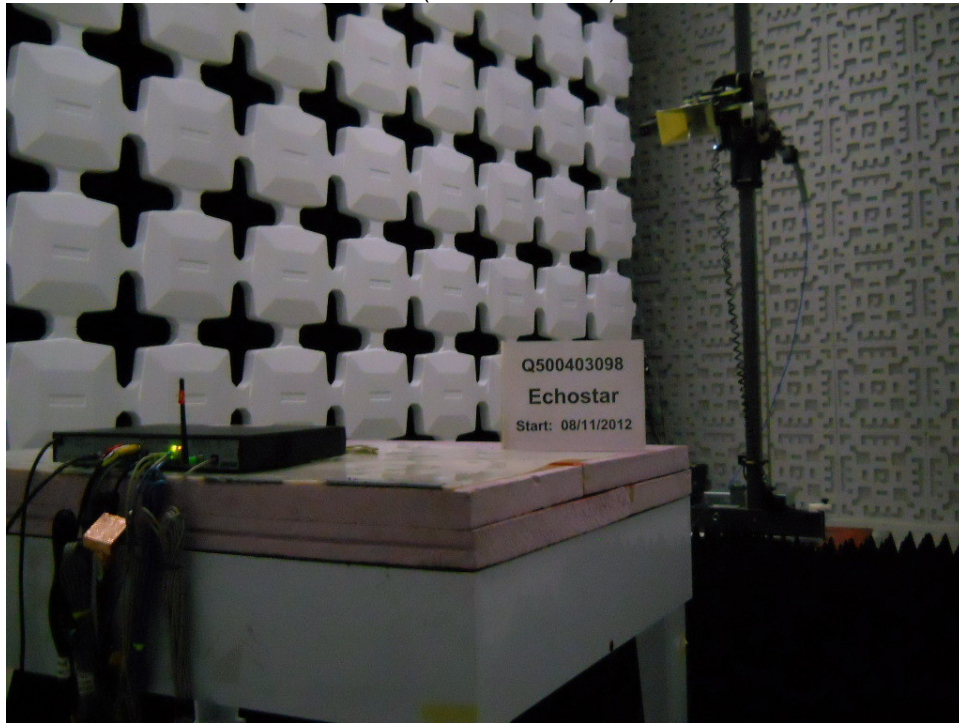


Photo: Antenna Setups

Horn (1GHz – 18GHz)



HF Active Antenna/Harmonic Mixer (18GHz – 26.5GHz)

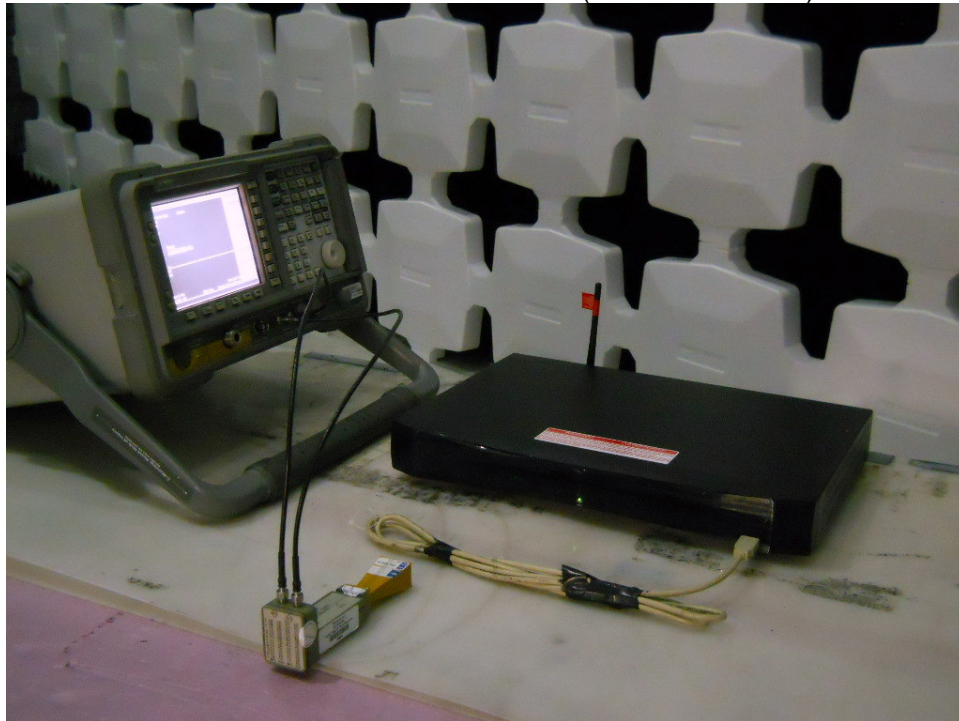


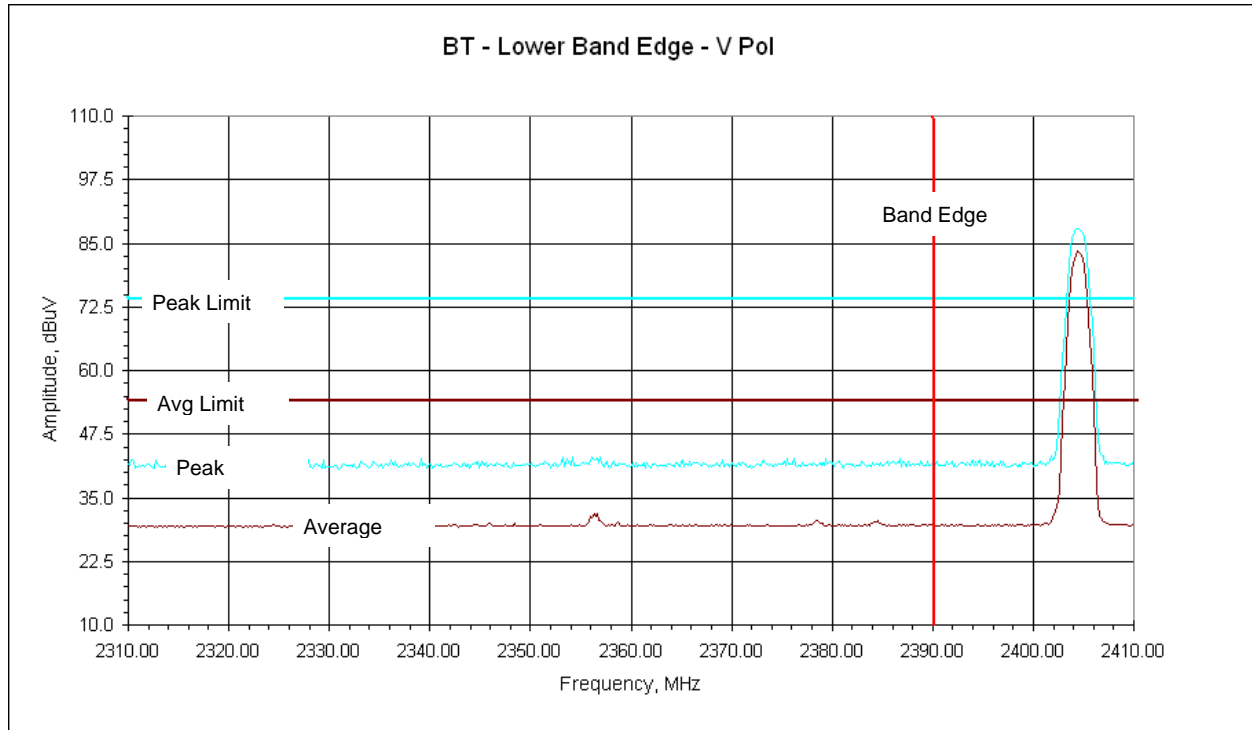
Photo: Conducted Port

Bluetooth port

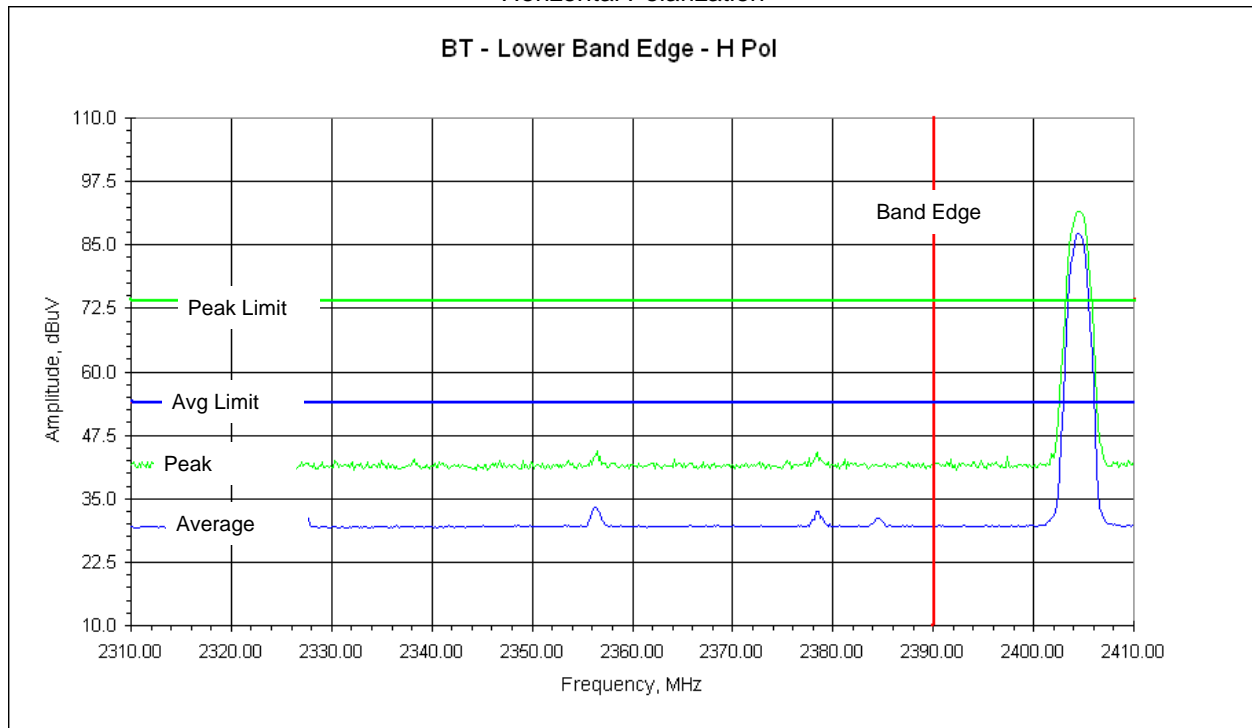


7.5 Radiated Band Edge Plot – Low Channel**FCC 15.247(d) / 15.205/209/ RSS-210 A8.5**

Vertical Polarization

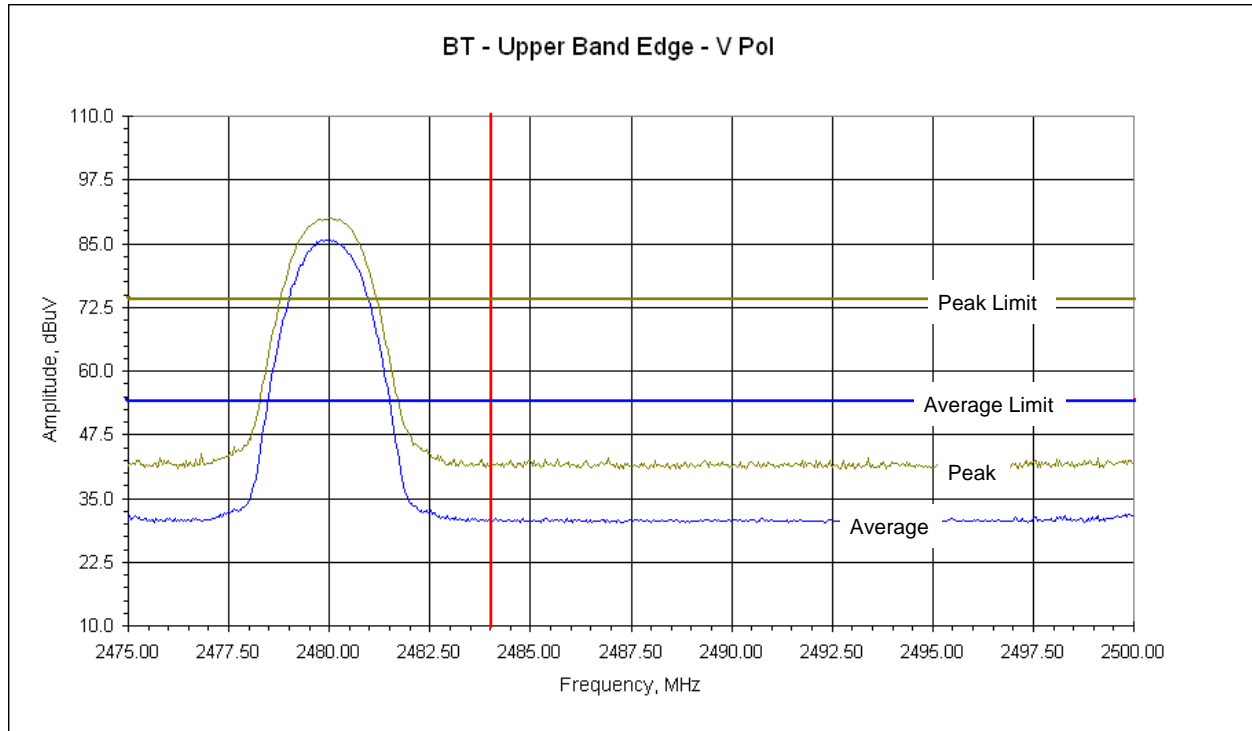


Horizontal Polarization

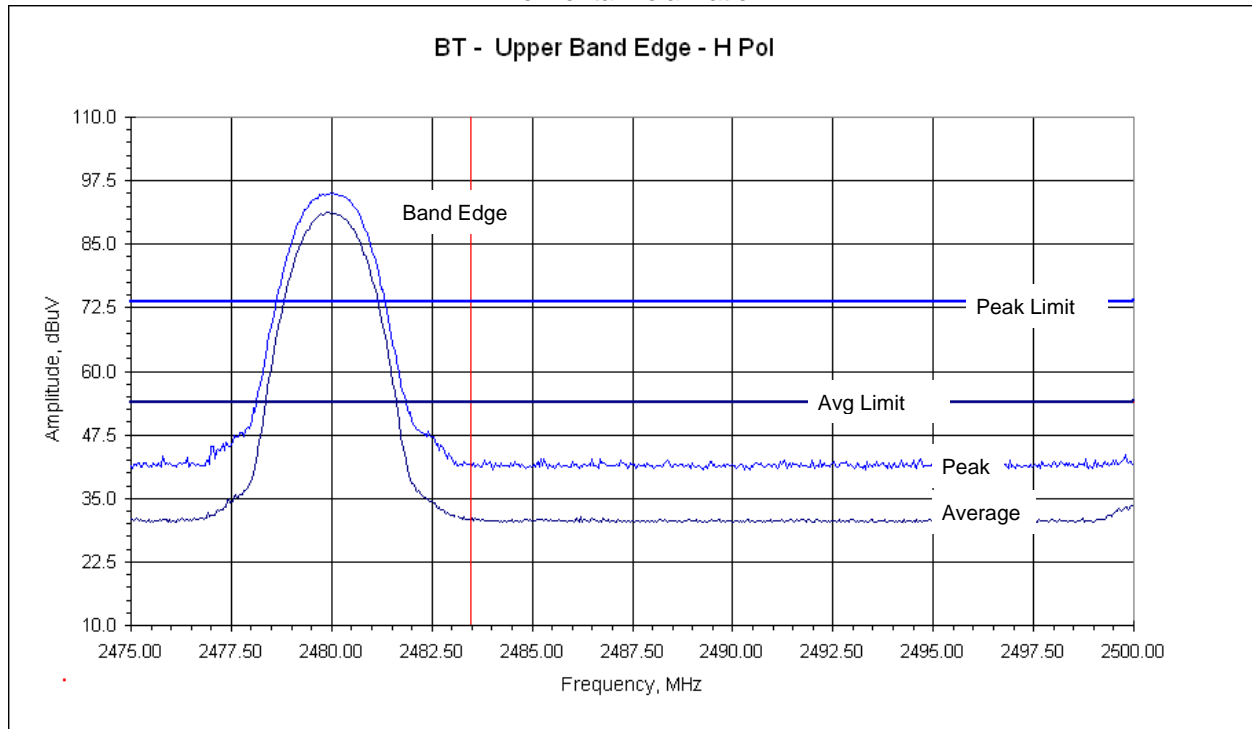


7.6 Band Edge Plot – High Channel**FCC 15.247(d) / 15.205/15.209/ RSS-210 A8.5**

Vertical Polarization



Horizontal Polarization



Intertek	
Report Number: 100900227DEN-002	Issued:10/10/2012

8 6dB Bandwidth

8.1 Method

The test methods used comply with ANSI C63.10. Unless otherwise stated no deviations were made from **FCC 15.247**.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

8.2 Test Equipment Used:

<u>Asset ID:</u>	<u>Description:</u>	<u>Manufacturer:</u>	<u>Model:</u>	<u>Serial:</u>	<u>Cal Date</u>	<u>Cal Due</u>
18913	Spectrum Analyzer	Hewlett-Packard	E7405A	My44211889	7/16/2012	7/16/2013

8.3 Results:

The sample tested was found to comply with the requirements of:

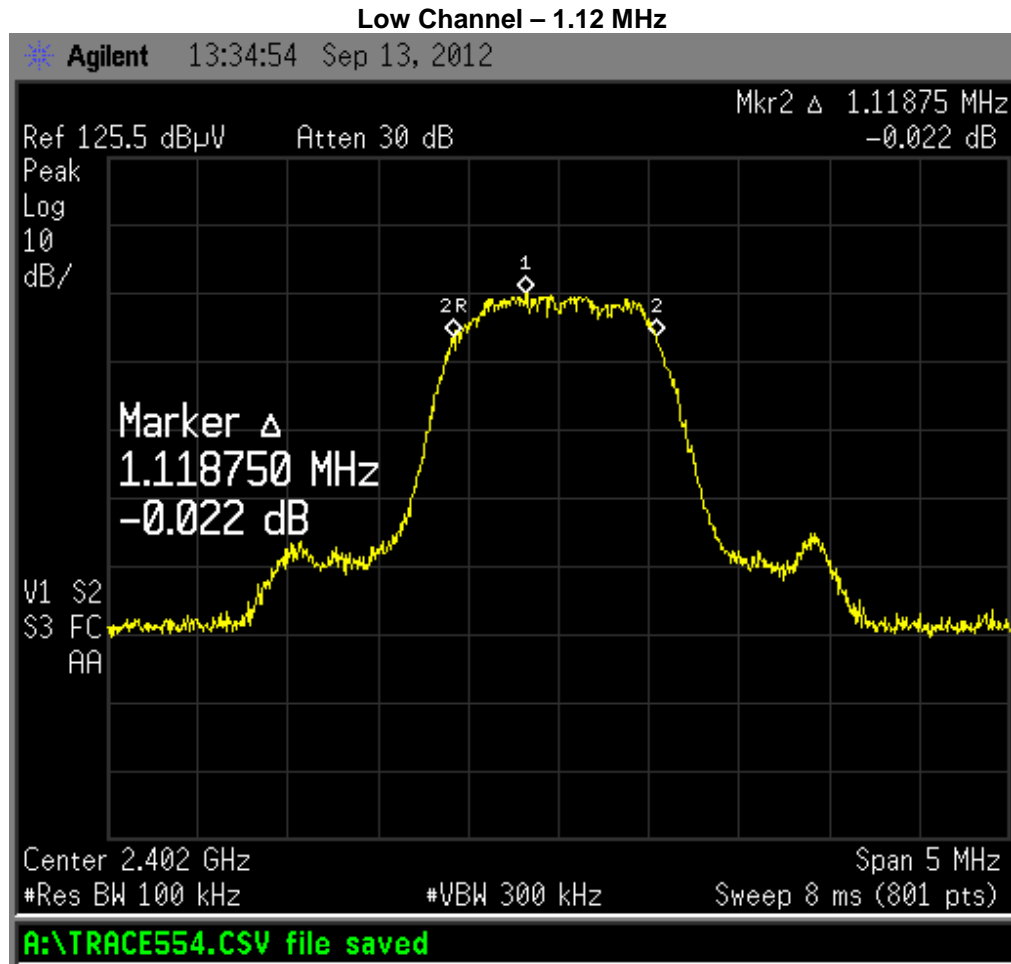
- FCC 15.247 (a)(2)

8.4 Test Data:

8.4.1 Bluetooth Transmitter

6 dB Bandwidth

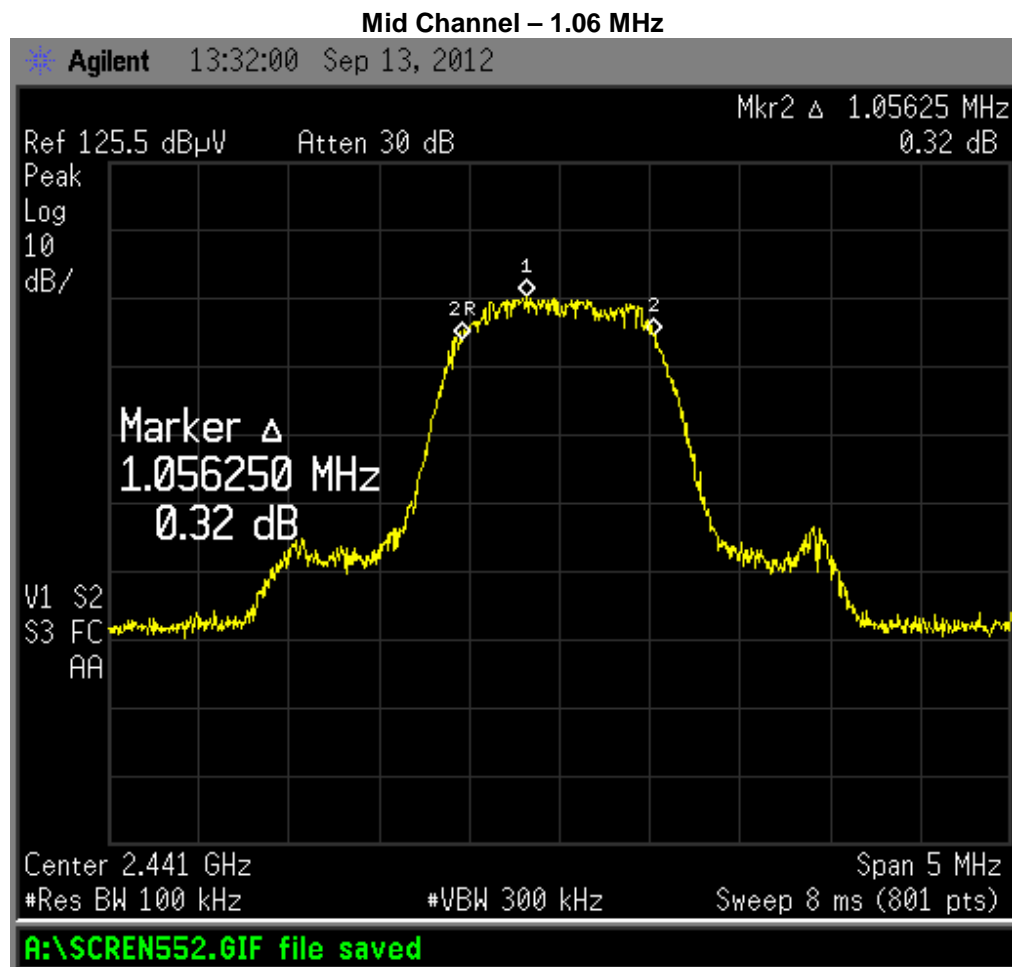
FCC 15.247(a)(2)



Specification: 6dB Bandwidth > 500 kHz

6 dB Bandwidth

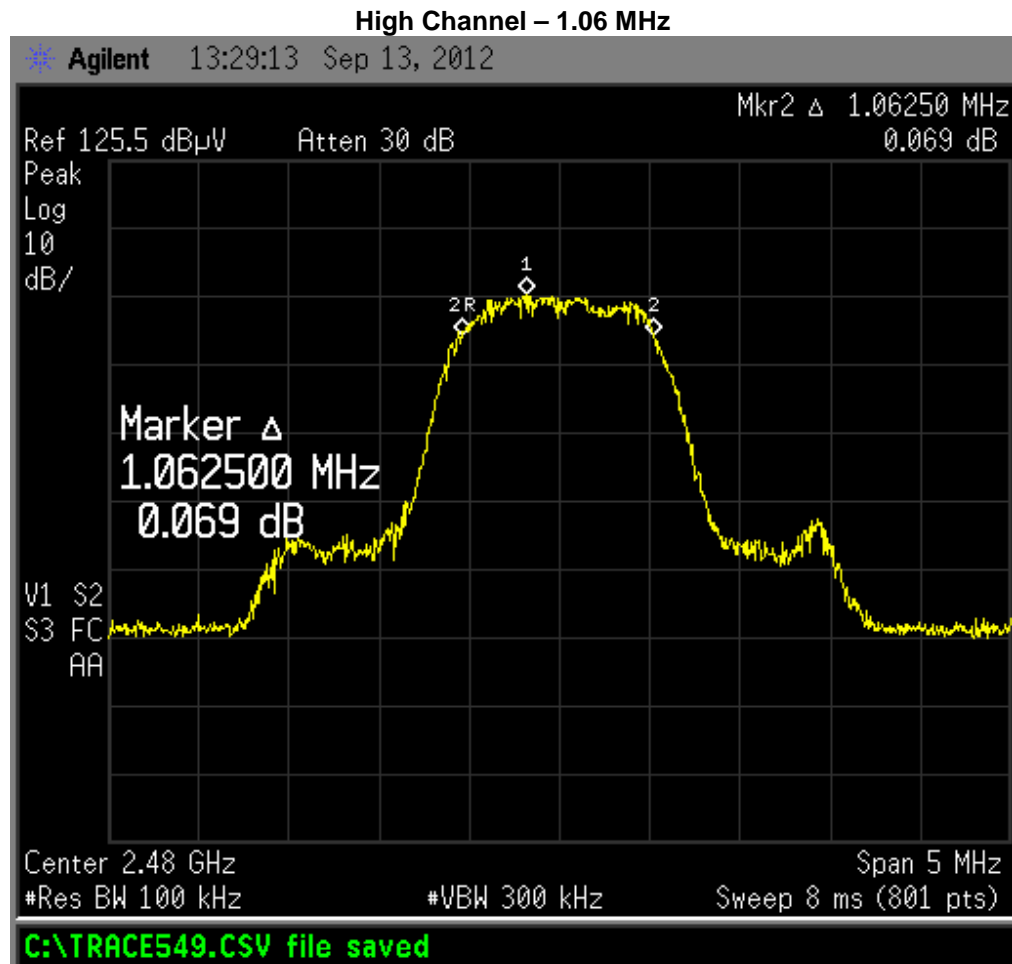
FCC 15.247(a)(2)



Specification: 6dB Bandwidth > 500 kHz

6 dB Bandwidth

FCC 15.247(a)(2)



Specification: 6dB Bandwidth > 500 kHz

Notes:

- (1) All measurements are RF Conducted Port.
- (2) Worst-case Mid and High Channels – (6dB Bandwidth 1.06 MHz)**

Deviations, Additions, or Exclusions: None

Intertek	
Report Number: 100900227DEN-002	Issued:10/10/2012

9 Power Spectral Density (PSD)

9.1 Method

The test methods used comply with ANSI C63.10. Unless otherwise stated no deviations were made from **FCC 15.247**.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

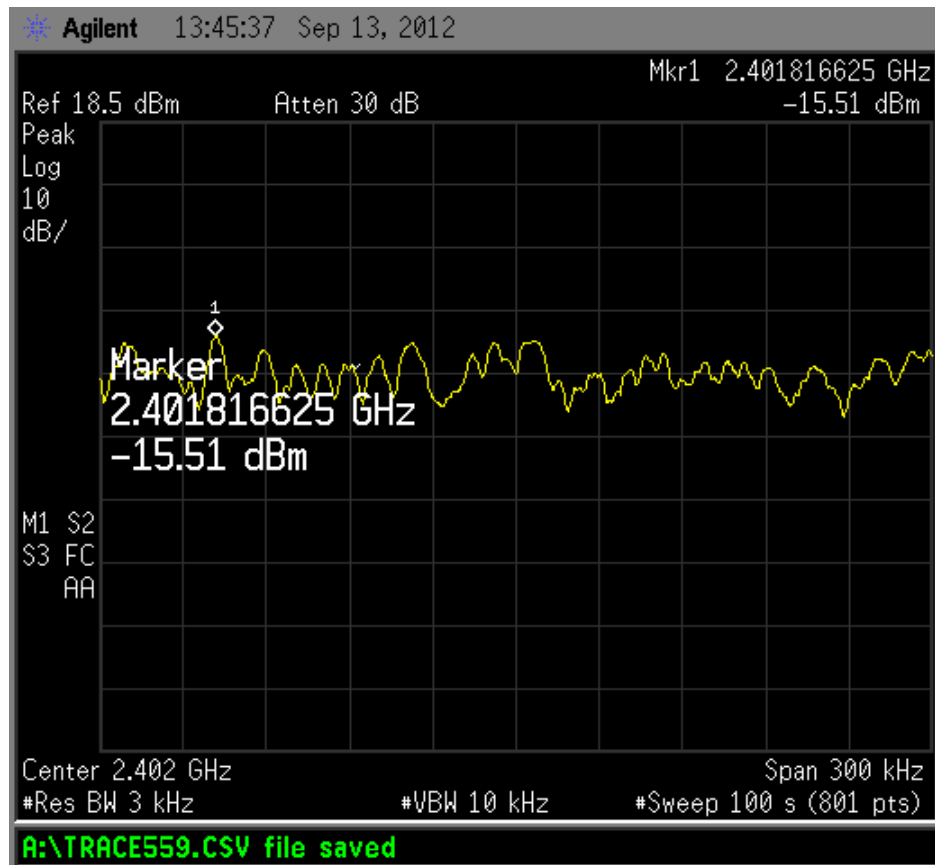
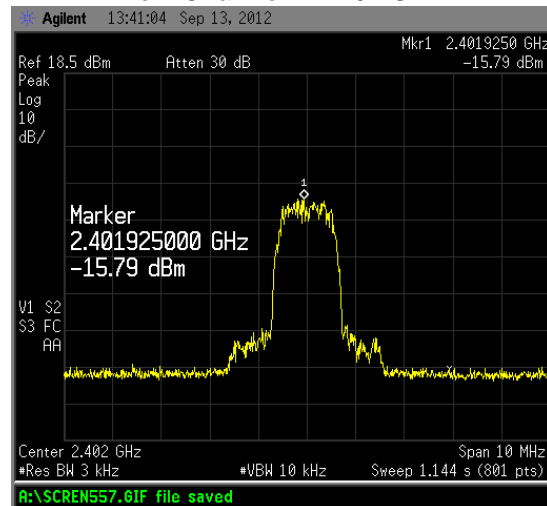
9.2 Test Equipment Used:

<u>Asset ID:</u>	<u>Description:</u>	<u>Manufacturer:</u>	<u>Model:</u>	<u>Serial:</u>	<u>Cal Date</u>	<u>Cal Due</u>
18913	Spectrum Analyzer	Hewlett-Packard	E7405A	My44211889	7/16/2012	7/16/2013

9.3 Results:

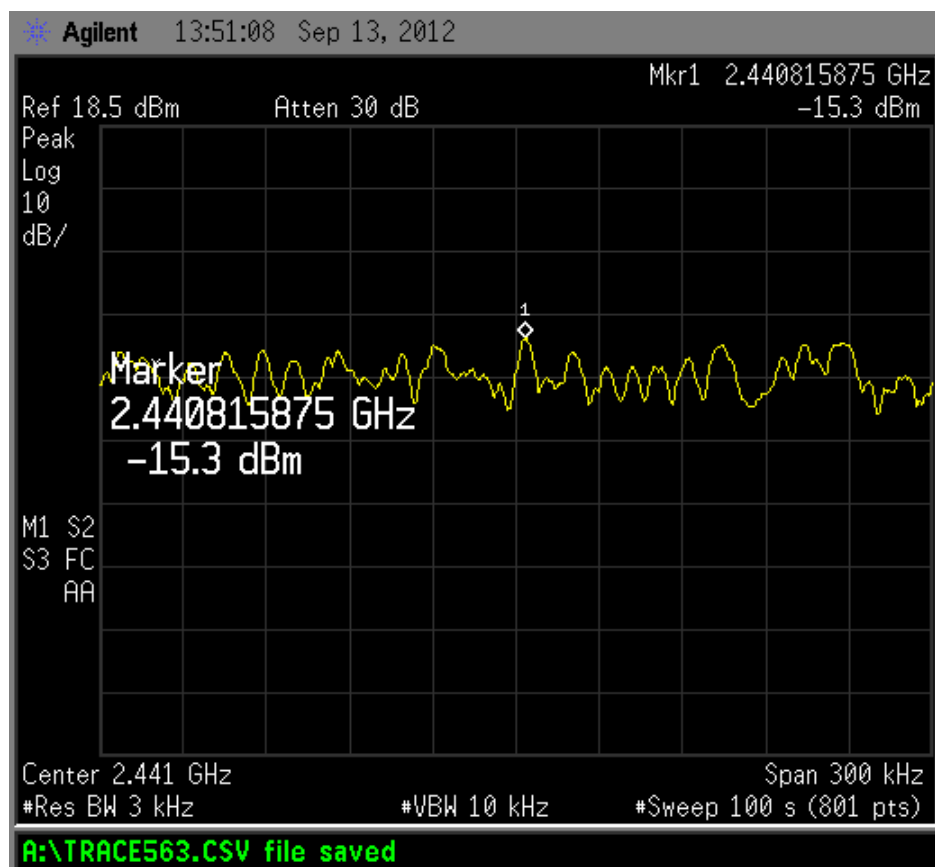
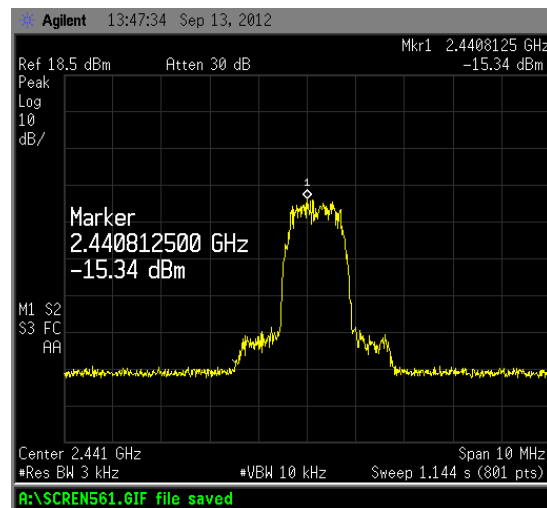
The sample tested was found to comply with the requirements of:

- FCC 15.247(e)

9.4 Test Data:**9.4.1 PSD – Bluetooth Transmitter****Power Spectral Density (PSD)
FCC 15.247(e)****Low Channel – 2.402 GHz****Specification: PSD < +8 dBm**

**Power Spectral Density (PSD)
FCC 15.247(e)**

Mid Channel – 2.441 GHz

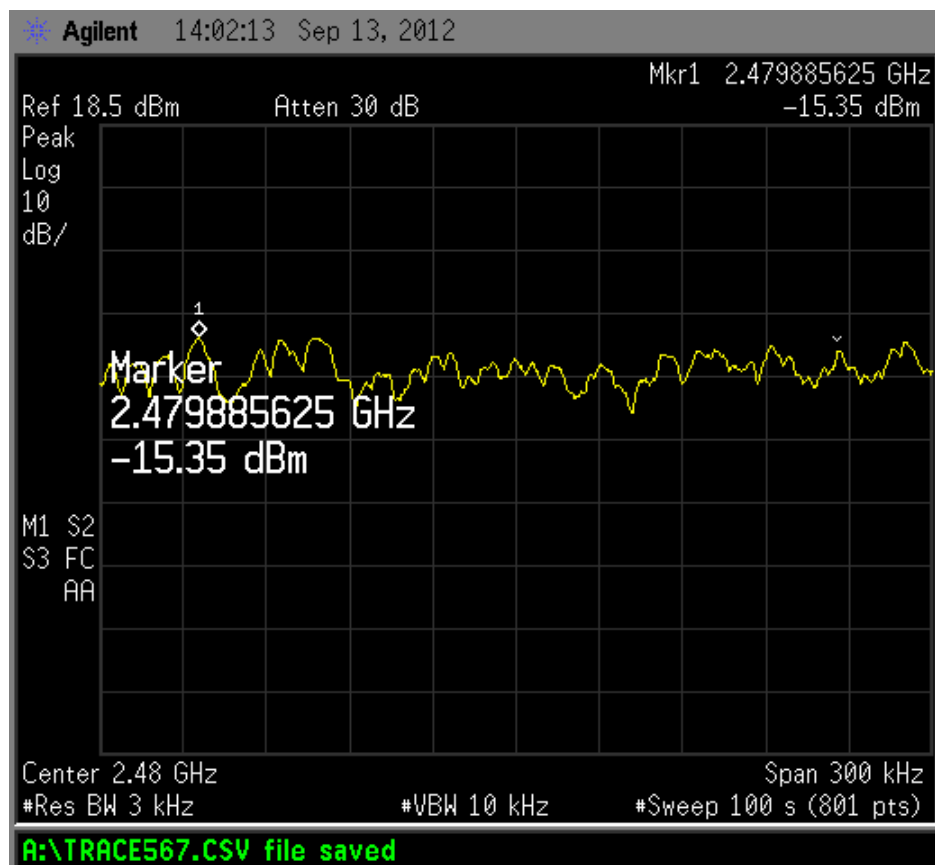
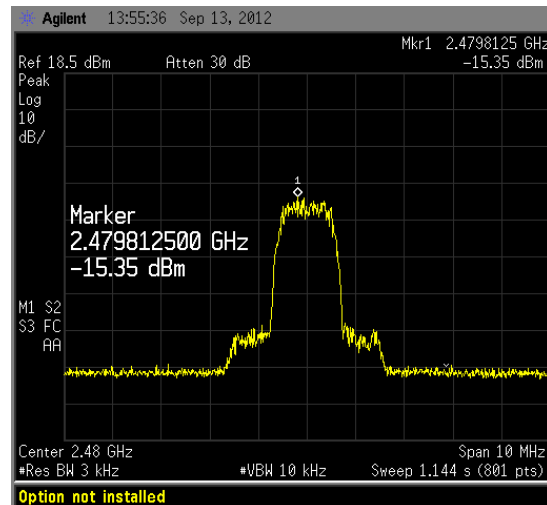


Specification: PSD < +8 dBm

Power Spectral Density (PSD)

FCC 15.247(e)

High Channel – 2.480 GHz



Specification: PSD < +8 dBm

Intertek	
Report Number: 100900227DEN-002	Issued:10/10/2012

PSD Notes:

- (1) All measurements are RF Conducted Port.
- (2) **Worst-case PSD: Mid Channel (-15.3 dBm)**

Deviations, Additions, or Exclusions: None

Intertek	
Report Number: 100900227DEN-002	Issued:10/10/2012

10 Occupied Bandwidth (OBW) - NA

10.1 Method - NA

10.2 Test Equipment Used: NA

10.3 Results: NA

10.4 Test Data: NA

11 AC Mains Conducted Emissions

11.1 Method

The test methods used comply with ANSI C63.10 and CISPR 16. Unless otherwise stated no deviations were made from **FCC 15.207**.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

11.2 Test Equipment Used:

<u>Asset ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Serial</u>	<u>Cal Date</u>	<u>Cal Due</u>
18885	Transient Limiter	Hewlett-Packard	11947A	3107A00700	5/3/2012	5/3/2013
DEN-073	EMI Receiver	RHODE & SCHWARZ	ESU 26	100265	1/11/2012	1/10/2013
18914	Single Phase LISN	EMCO	3816/NM	9408-1003	4/5/2012	4/5/2013
SW-6	Software for Radiated and Conducted emissions.	Intertek	OATS vba	V. 2.0	VBU	VBU

11.3 Results:

The sample tested was found to comply with the requirements of:

- **FCC 15.207/15.107 Class B**

11.4 Setup Photographs:

Test Setup – Conducted Emissions (Front View)

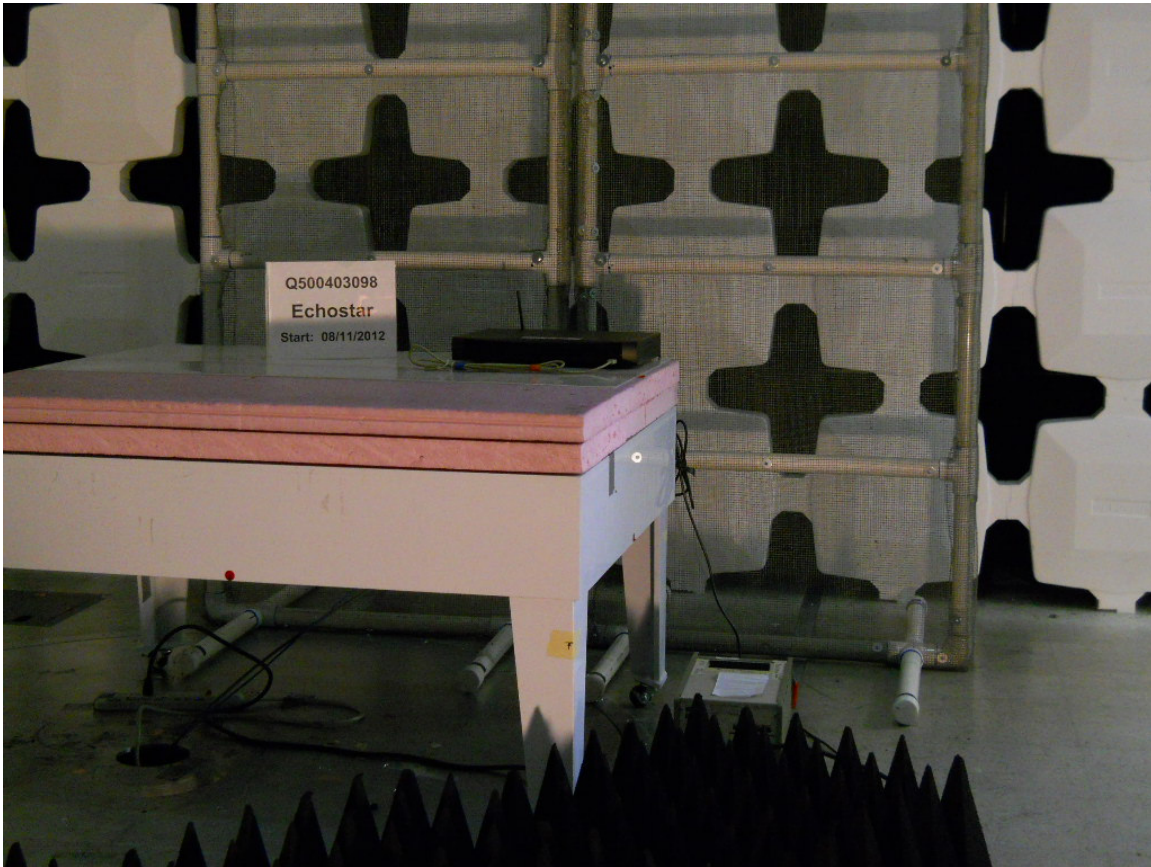
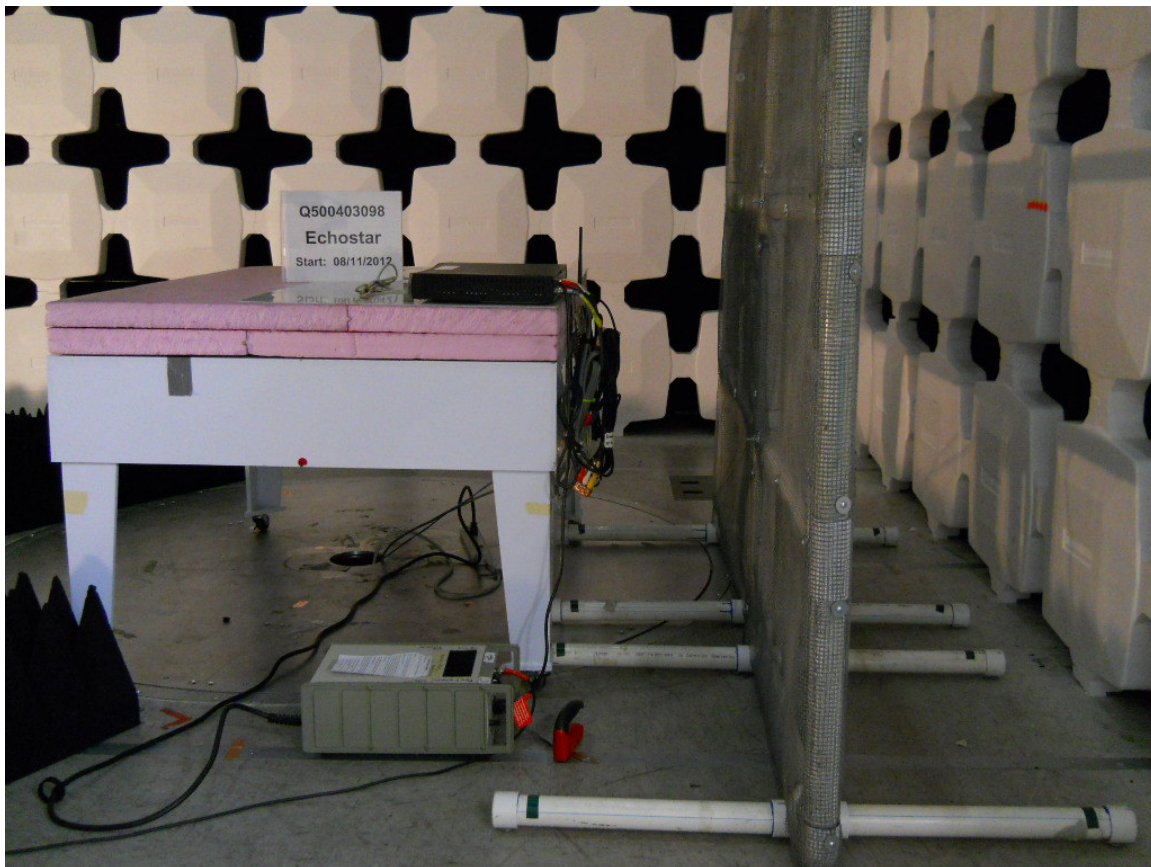


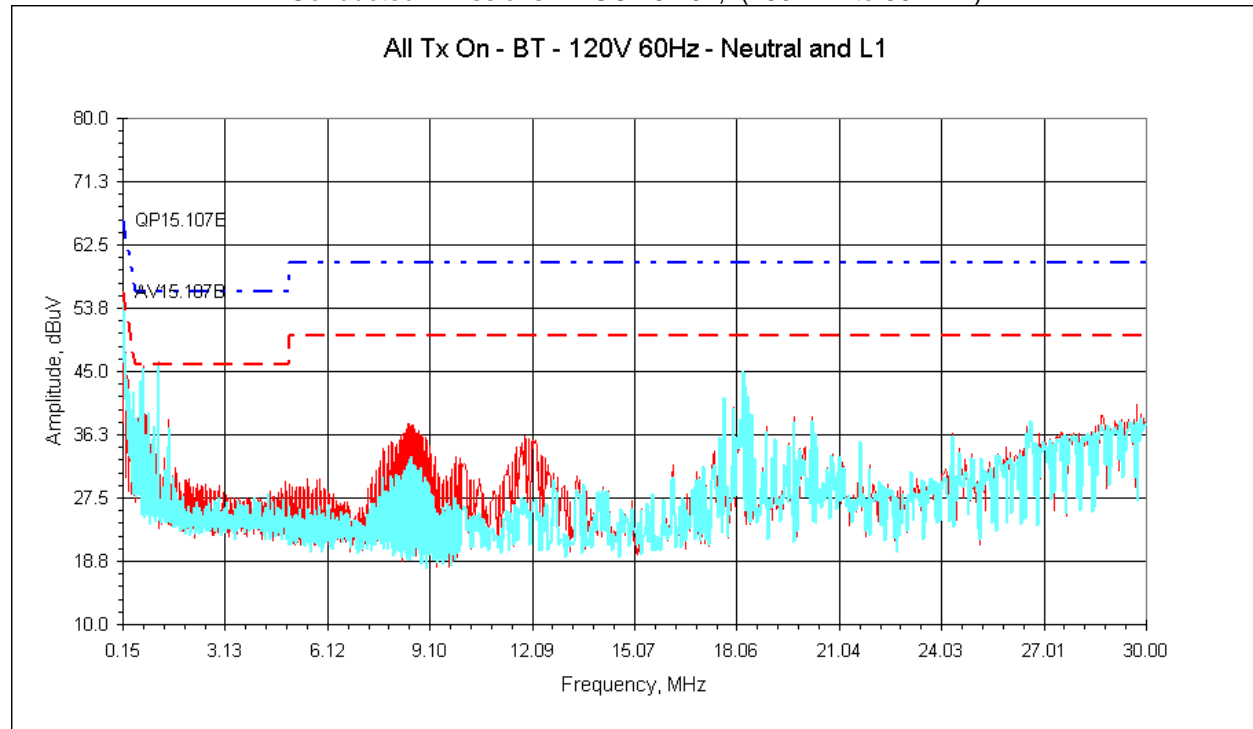
Photo:

Test Setup – Conducted Emissions (Side View)



11.5 Plots: Pre-Scan Peak Measurements - Not Final Data**11.5.1 Tx Enabled Conducted Emissions**

Conducted Emissions – FCC 15.207, (150 kHz to 30 MHz)

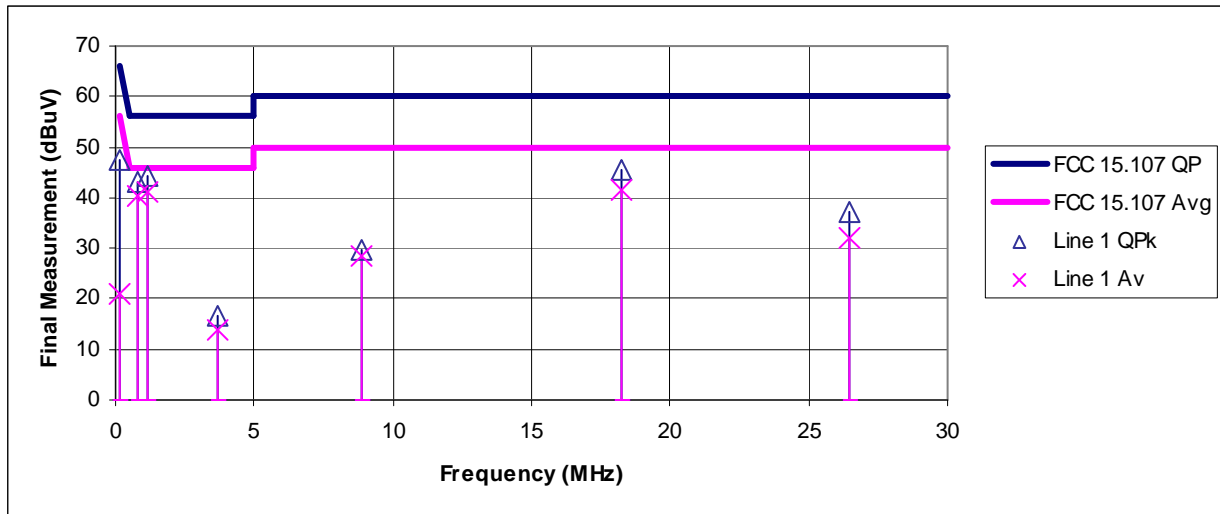


Note: Peak measurements plotted against FCC 15.207 Average & Quasi-Peak Limit

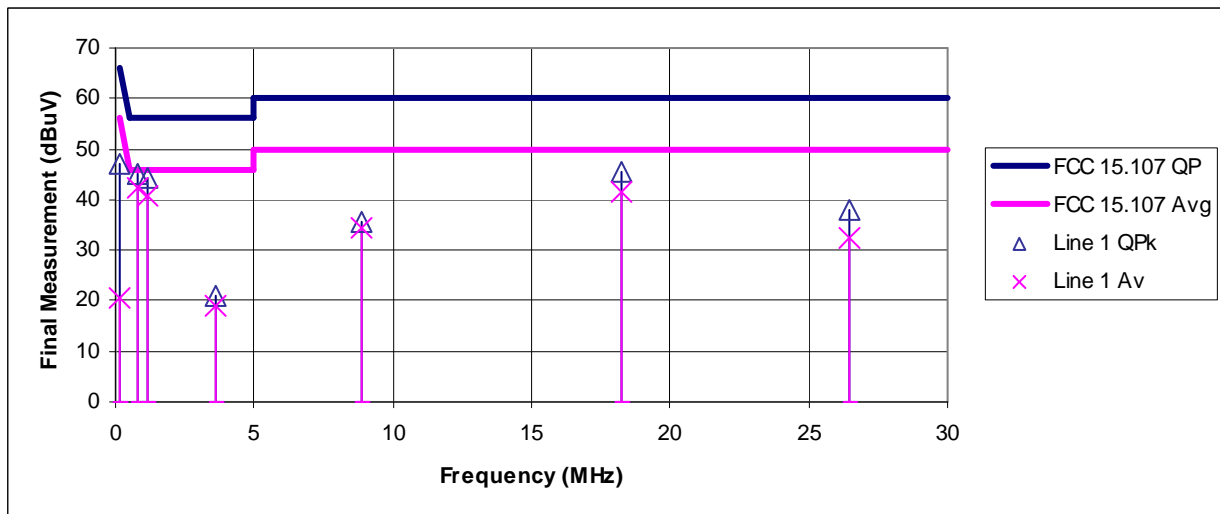
Plots: Final Quasi-Peak and Average Measurements

Conducted Emissions – FCC 15.207, (150 kHz to 30 MHz)

Line 1



Neutral



11.6 Test Data: 150kHz to 30MHz

11.6.1 Tx Enabled Conducted Emissions

Conducted Electromagnetic Emissions

Test Report #:	100900227DEN-002	Test Area:	CC1 Conducted	Temperature:	22.0	°C
Test Method:	FCC Part 15.207	Test Date:	9/25/2012	Relative Humidity:	34.1	%
EUT Model #:	ID:058	EUT Power:	120V / 60Hz	Air Pressure:	84.49	kPa
EUT Serial #:	EMC1					
Manufacturer:	Echostar					
EUT Description:	Advanced Satellite Receiver					
Notes:	Product configured for Tx mode - modulated - worst-case data					

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av – Average	

FREQ	LEVEL	DET	CABLE	LISN	PREAMP	ATTEN	FINAL	TEST POINT	DELTA1	DELTA2	RBW
		Qp Av Pk		+			=	Other - N - L1 - L2 - L3		AV	
MHz	dBuV		+ [dB]	[dB/m]	- [dB]	+ [dB]	[dBuV]		QP 15.107B	15.107B	(MHz)
0.151	37.43	Qp	0.10	0.04	0.00	9.95	47.52	Line 1	- 18.41	NA	0.009
0.151	10.92	Av	0.10	0.04	0.00	9.95	21.01	Line 1	NA	- 34.92	0.009
0.760	33.00	Qp	0.21	0.03	0.00	9.97	43.21	Line 1	- 12.79	NA	0.009
0.760	30.10	Av	0.21	0.03	0.00	9.97	40.31	Line 1	NA	- 5.69	0.009
1.189	34.16	Qp	0.20	0.03	0.00	9.97	44.36	Line 1	- 11.64	NA	0.009
1.189	31.07	Av	0.20	0.03	0.00	9.97	41.27	Line 1	NA	- 4.73	0.009
3.684	6.45	Qp	0.30	0.04	0.00	9.97	16.76	Line 1	- 39.24	NA	0.009
3.684	3.63	Av	0.30	0.04	0.00	9.97	13.94	Line 1	NA	- 32.06	0.009
8.848	19.15	Qp	0.50	0.10	0.00	9.99	29.74	Line 1	- 30.26	NA	0.009
8.848	17.88	Av	0.50	0.10	0.00	9.99	28.47	Line 1	NA	- 21.53	0.009
18.243	34.12	Qp	1.10	0.19	0.00	10.02	45.42	Line 1	- 14.58	NA	0.009
18.243	30.06	Av	1.10	0.19	0.00	10.02	41.36	Line 1	NA	- 8.64	0.009
26.488	25.89	Qp	1.20	0.17	0.00	10.04	37.30	Line 1	- 22.70	NA	0.009
26.488	20.76	Av	1.20	0.17	0.00	10.04	32.17	Line 1	NA	- 17.83	0.009
0.151	36.93	Qp	0.10	0.04	0.00	9.95	47.02	Line 2	- 18.91	NA	0.009
0.151	10.44	Av	0.10	0.04	0.00	9.95	20.53	Line 2	NA	- 35.40	0.009
0.760	34.72	Qp	0.21	0.02	0.00	9.97	44.92	Line 2	- 11.08	NA	0.009
0.760	32.09	Av	0.21	0.02	0.00	9.97	42.29	Line 2	NA	- 3.71	0.009
1.189	33.94	Qp	0.20	0.02	0.00	9.97	44.14	Line 2	- 11.86	NA	0.009
1.189	30.54	Av	0.20	0.02	0.00	9.97	40.74	Line 2	NA	- 5.26	0.009
3.624	10.77	Qp	0.30	0.03	0.00	9.97	21.08	Line 2	- 34.92	NA	0.009
3.624	8.76	Av	0.30	0.03	0.00	9.97	19.07	Line 2	NA	- 26.93	0.009
8.848	24.88	Qp	0.50	0.11	0.00	9.99	35.47	Line 2	- 24.53	NA	0.009
8.848	23.91	Av	0.50	0.11	0.00	9.99	34.50	Line 2	NA	- 15.50	0.009
18.243	34.11	Qp	1.10	0.19	0.00	10.02	45.42	Line 2	- 14.58	NA	0.009
18.243	30.02	Av	1.10	0.19	0.00	10.02	41.33	Line 2	NA	- 8.67	0.009
26.488	26.35	Qp	1.20	0.26	0.00	10.04	37.85	Line 2	- 22.15	NA	0.009
26.488	21.06	Av	1.20	0.26	0.00	10.04	32.56	Line 2	NA	- 17.44	0.009

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Example calculation:

Measured Level	+	Transducer, Cable Loss & Amplifier corrections	=	Corrected Reading	Specification Limit	-	Corrected Reading	=	Delta Specification
(dBμV)		(dB)		(dBμV/m)	(dBμV/m)		(dBμV/m)		
14.0		14.9		28.9	40.0		28.9		-11.1

Notes:

- (1) All measurements taken with both Quasi-Peak and Average detectors.

Deviations, Additions, or Exclusions: None

12 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of $k = 2$, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement uncertainty Table

Parameter	Uncertainty \pm	Notes
Radiated emissions, 10kHz to 1000 MHz	4.4 dB	
Radiated emissions, 1 to 18 GHz	4.7 dB	
AC mains Conducted emissions, 9kHz to 30 MHz	3.14 dB	

13 Duty Cycle Correction Factor

No duty cycle correction factor was applied during this testing – therefore, no product Duty Cycle verification was applicable.

Intertek	
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14 Revision History

Revision Level	Date	Report Number	Notes
0	10/10/2012	100900227DEN-002	Original Issue