EMC Test Report

Project Number: 3564654

Report Number: 3564654EMC01 **Revision Level:** 1

Client: Paul Raley and Associates

Equipment Under Test: Wireless Audio Device

Model: WIC1

Hardware Version: Rev D

Applicable Standards: FCC Part 15 Subpart C, § 15.247
RSS-210, Issue 8, December 2010
558074 D01 DTS Meas Guidance v03r02
ANSI C63.4:2009

Report issued on: 9 April 2015

Test Result: Compliant

Tested by: _____
Jeremy O. Pickens, Senior EMC Engineer

Reviewed by: _____
David Schramm, EMC/RF/SAR/HAC Manager

Remarks:
This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

Table of Contents

1 Summary of Test Results

Test Description	Test Specification		Test Result
6dB Bandwidth	15.247(a)(2)	RSS-210 A8.2(a)	Compliant
Peak Power Output	15.247(b)(1)	RSS-210 A8.4(4)	Compliant
Conducted Spurious Emissions	15.247(d)	RSS-210 A8.5	Compliant
Band Edge	15.247(d)	RSS-210 A8.5	Compliant
Spectral Density	15.247(e)	RSS-210 A8.2(b)	Compliant

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name:	Paul Raley and Associates
Address:	1825 Eagle Summit Court
City, State, Zip, Country:	Lawrenceville GA 30043 USA

2.2 *Test Laboratory*

Name:	SGS North America, Inc.
Address:	620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country:	Suwanee, GA 30024, USA

2.3 *General Information of EUT*

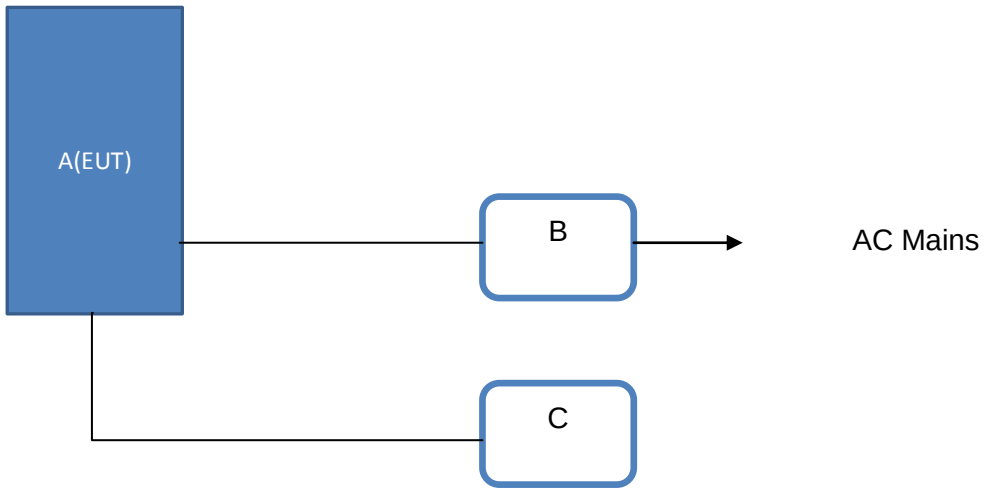
Marketing Name:	WIC1 Transmitter
Model:	WIC1
Serial Number:	2014-07-18_0001
Build Version:	Rev D
FCC ID:	2AC2L-WIC1
IC ID	12285A-WIC1
Frequency Range:	2406 to 2470 MHz
Modulation type:	Q-QPSK
Channel spacing:	4 MHz
Antenna:	Integral
Rated Voltage:	3.7 VDC Internal Battery
Sample Received Date:	18AUG2014
Dates of testing:	18 – 21 AUG 2014

Operating Modes and Conditions

Modulations used: For fundamental and spurious measurements, the EUT was configured to operate continuously with modulation enabled.

- The software allowed configuration and operation on all available unlicensed wireless device channels.
- The software allowed configuration and operation using all available modulations and data rates
- The software allowed configuration and operation on all available power out levels

2.4 *EUT Connection Block Diagram*



2.5 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Paul Raley and Associates	EUT	WIC1	2014-07-18_0001
B	Paul Raley and Associates	Power adapter	DUAL USB	2014-07-18_0018
C	--	Resistor	27k	--

3 6dB Bandwidth

3.1 *Test Result*

Test Description	Basic Standards	Test Result
6 dB bandwidth	15.247(a) (2)	Compliant

3.2 *Test Method*

558074 D01 DTS Meas Guidance v03r02, Clause 8
The 6dB bandwidth must be greater than 500 kHz.

3.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 24.4 °C
Relative Humidity: 47.8 %

3.4 *Test Equipment*

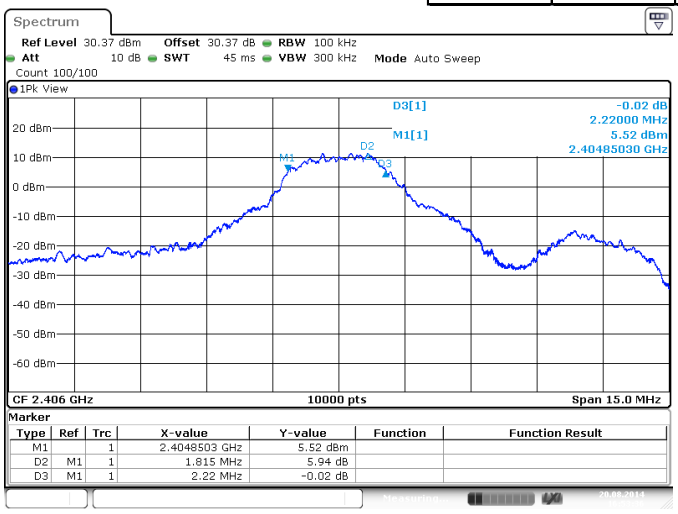
The EUT was directly connected to the receiver. The manufacturer's declared offset of 0.2 dB was incorporated into the final measurement. No other test equipment was used for this measurement.

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV	R&S	B085749	28 SEP 2014

Note: The calibration period equipment is 1 year.

3.5 *Test Data*

Frequency MHz	Bandwidth MHz	Limit MHz	Result
2406	2.2200	0.5	PASS
2442	2.2380	0.5	PASS
2470	2.2293	0.5	PASS



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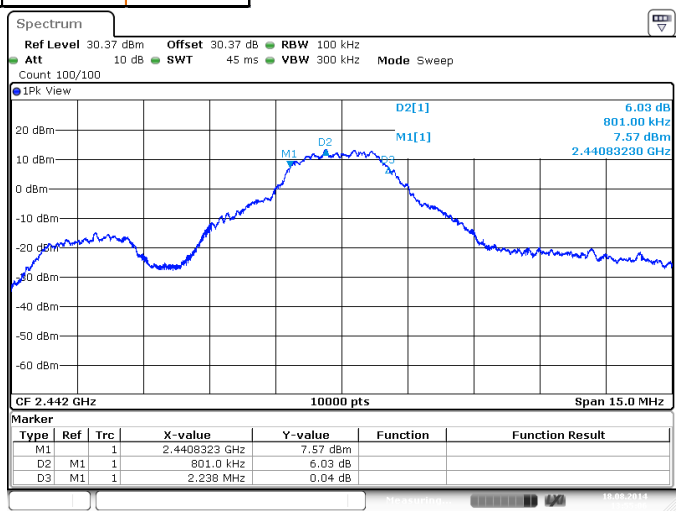

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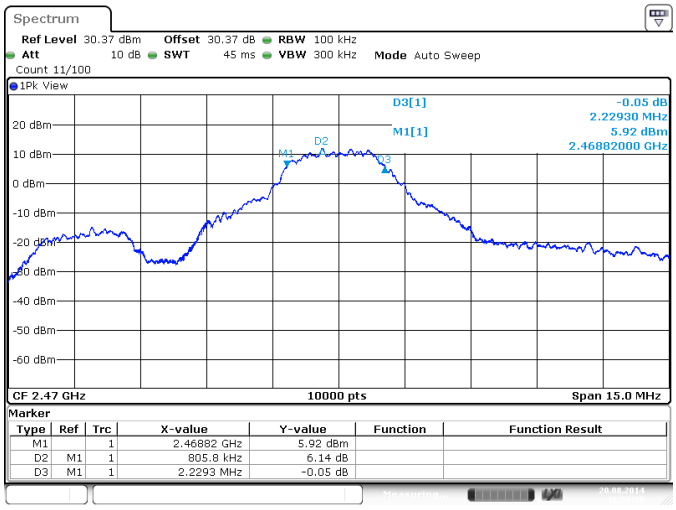

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4 Peak Output Power

4.1 *Test Result*

Test Description	Test Specification	Test Result
Peak Output Power	15.247(a) (1)	Compliant

4.2 *Test Method*

KDB 558074 D01 DTS Meas Guidance v03r02, Clause 9.2.2.2

Limit
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

4.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 21.1 °C
Relative Humidity: 46.4 %

4.4 *Test Equipment*

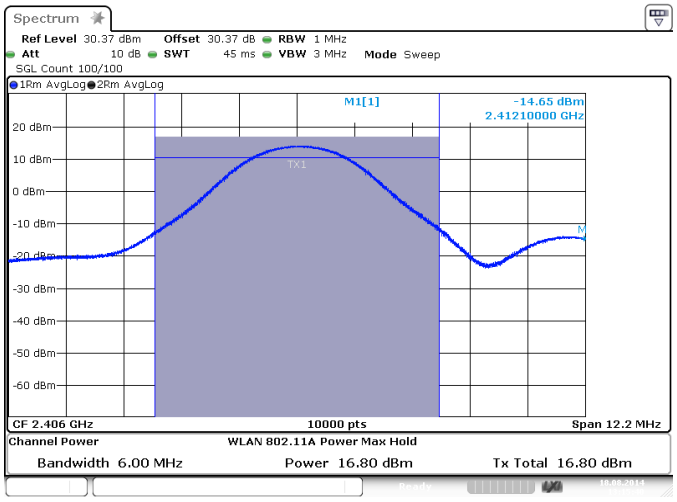
The EUT was directly connected to the receiver. The manufacturer's declared offset of 0.2 dB was incorporated into the final measurement. No other test equipment was used for this measurement.

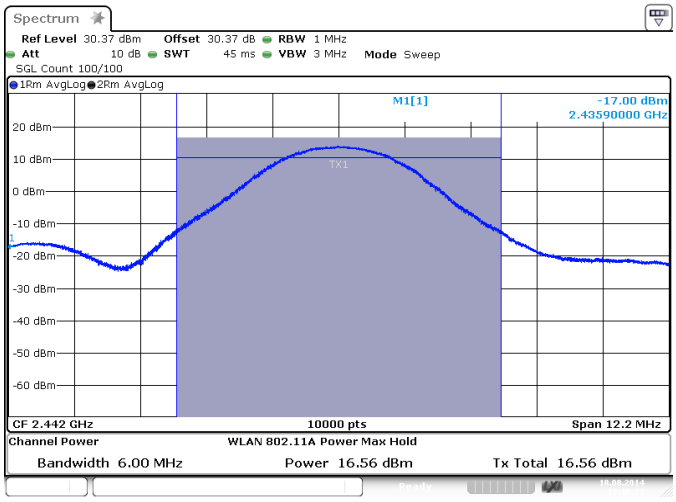
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV	R&S	B085749	28 SEP 2014

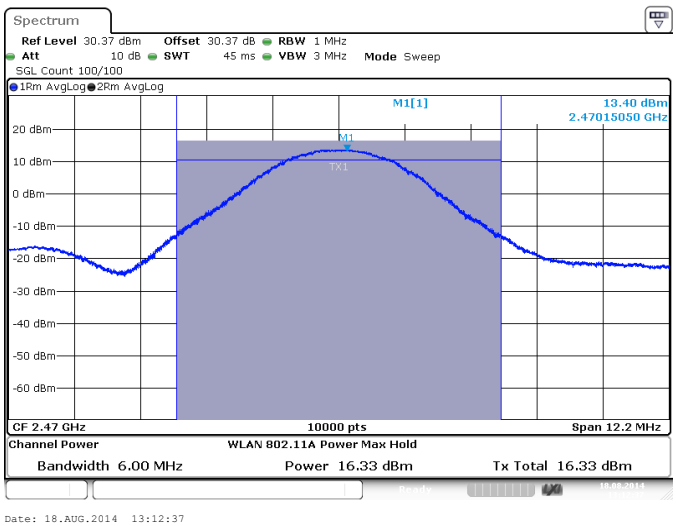
Note: The calibration period equipment is 1 year.

4.5 *Test Data*

Frequency MHz	Power dBm	Limit dBm	Margin dBm
2406	16.8	30	-13.2
2442	16.56	30	-13.44
2470	16.33	30	-13.67







5 Conducted Spurious Emissions

5.1 *Test Result*

Test Description	Test Specification	Test Result
Conducted Spurious Emissions	15.247(d)	Compliant

5.2 *Test Method*

558074 D01 DTS Meas Guidance v03r02 Clause 12.2.4 and/or Clause 12.2.2

The test data was measured using a spectrum analyzer with

- Peak detector, max hold
- Resolution bandwidth of at least 100 kHz, 30 MHz to 1000 MHz
- Resolution bandwidth of at least 1 MHz, above 1000 MHz
- Video bandwidth at least 3x RBW
- Frequency range: 30 MHz to 25 GHz

Low, middle, and high channels were investigated. Plots show Peak data compared to the 15.209 average limits.

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 25.1 °C
Relative Humidity: 41.0 %

5.4 *Test Equipment*

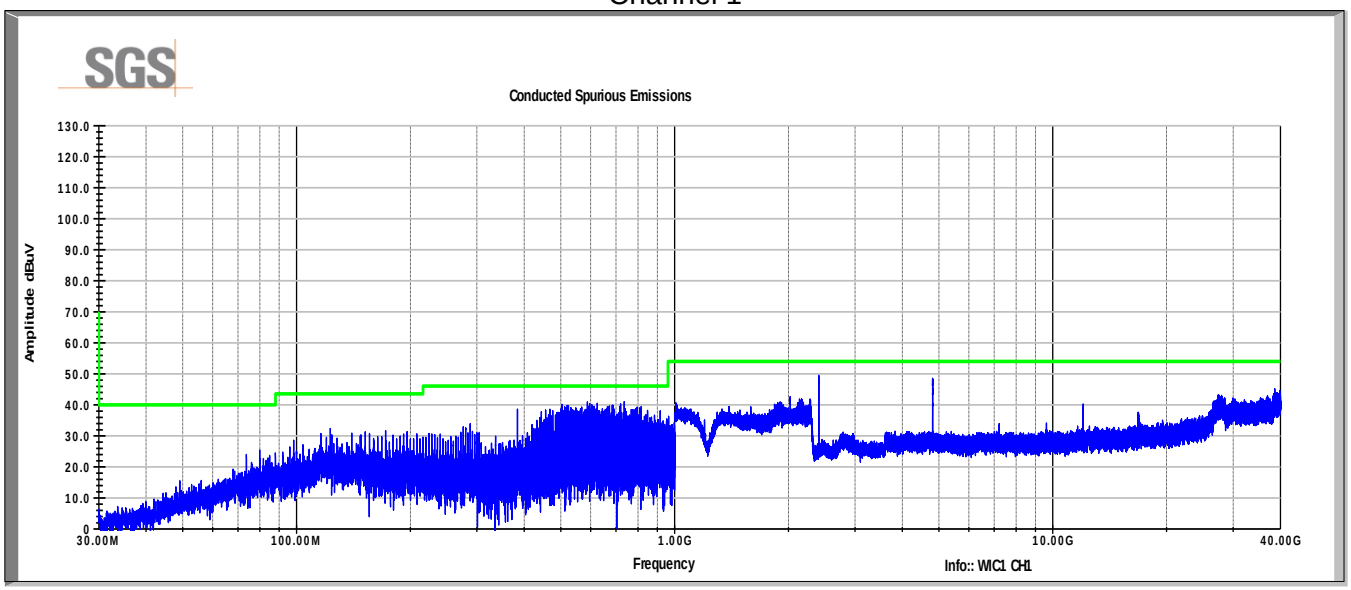
The EUT was directly connected to Band Reject Filter and then the receiver. All correction factors are reflected in the final measurement. No other test equipment was used for this measurement.

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV	R&S	B085749	28 SEP 2014
Band Reject filter	BRM50702	Micro-Tronics	B079791	8 AUG 2015

Note: The calibration period equipment is 1 year.

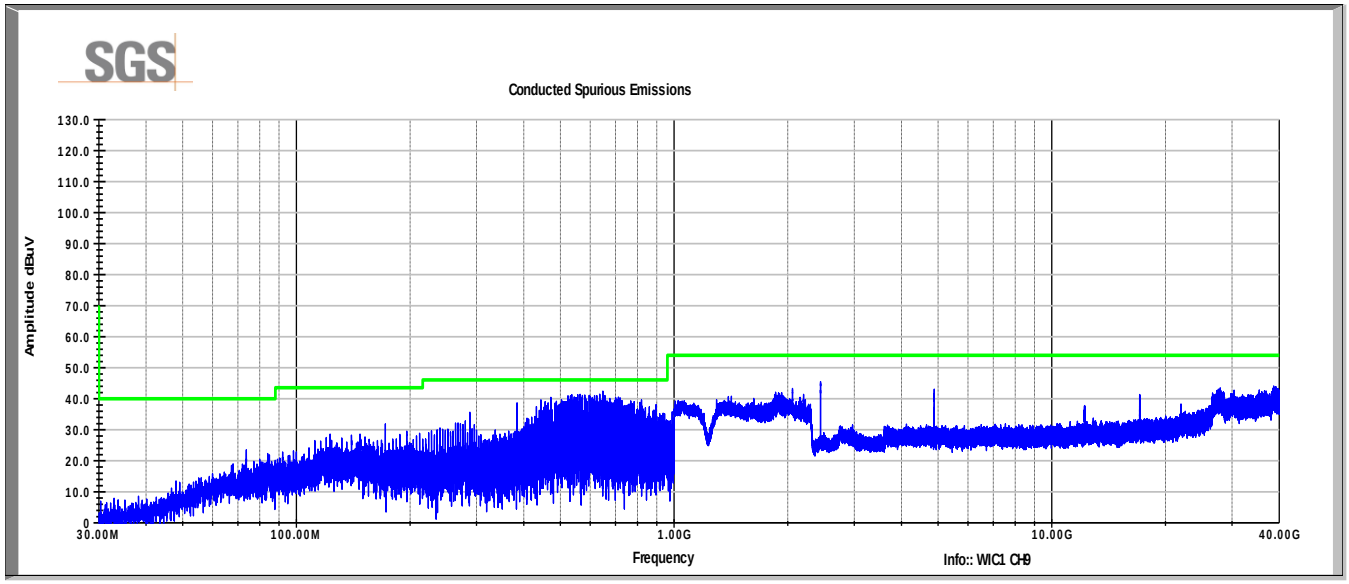
5.4.1 Test Data

Channel 1



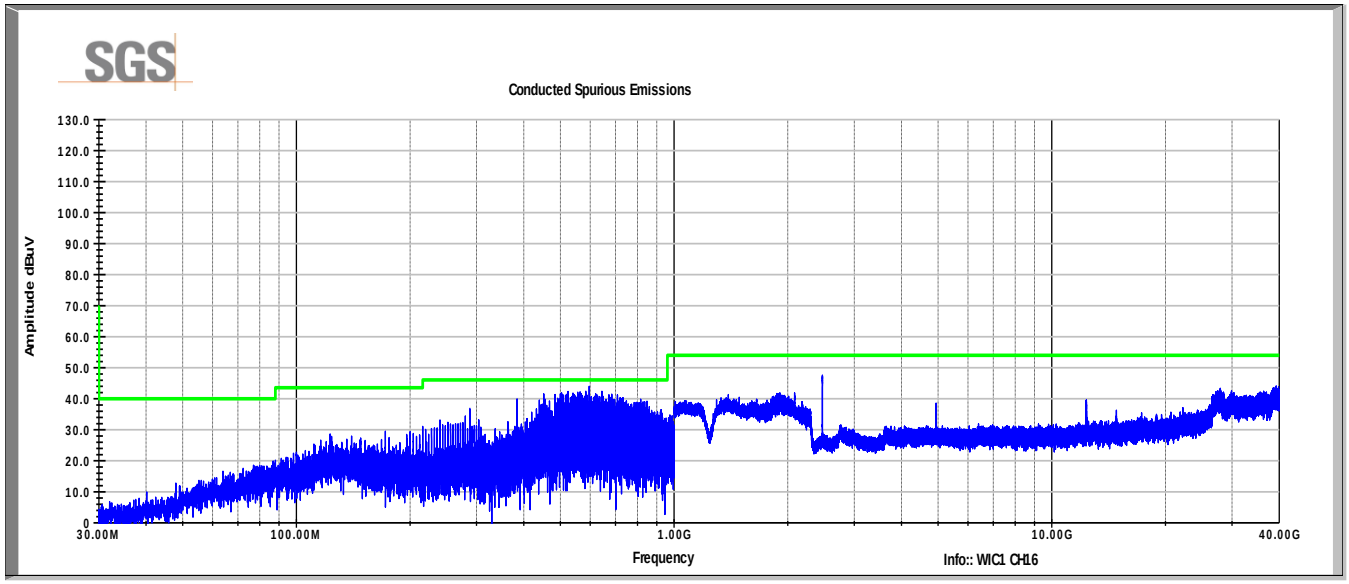
Frequency MHz	Measurement dBuV/m	Limit dBuV/m	Margin dB
588.0	40.9	46.0	-5.1
4811.6	48.5	54.0	-5.5
12032.0	40.1	54.0	-13.9

Channel 9



Frequency MHz	Measurement dBuV/m	Limit dBuV/m	Margin dB
648.01	42.3	46.0	-3.7
4884.8	42.7	54.0	-11.3
17092.7	41.2	54.0	-12.8

Channel 16



Frequency MHz	Measurement dBuV/m	Limit dBuV/m	Margin dB
596.0	43.9	46.0	-2.1
4940.73	38.6	54.0	-15.4
12344.88	39.4	54.0	-14.6

6 Power Spectral Density

6.1 *Test Result*

Test Description	Test Specification	Test Result
Power Spectral Density	15.247(e)	Compliant

6.2 *Test Method*

558074 D01 DTS Meas Guidance v03r02, Clause 10.3

The limit is +8 dBm.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.4 °C
Relative Humidity: 47.8 %

6.4 *Test Equipment*

The EUT was directly connected to the receiver. The manufacturer's declared offset of 0.2 dB was incorporated into the final measurement. No other test equipment was used for this measurement.

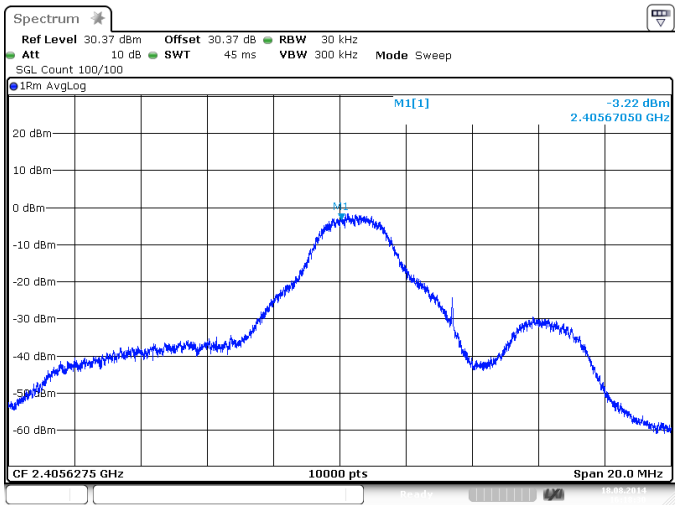
Test date: 18 August 2014

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV	R&S	B085749	28 SEP 2014

Note: The calibration period equipment is 1 year.

6.5 *Test Data*

Channel	PSD (dBm)	Limit (dBm)	Margin (dB)
1	-3.22	8	-11.22
9	-2.17	8	-10.17
16	-2.08	8	-10.08



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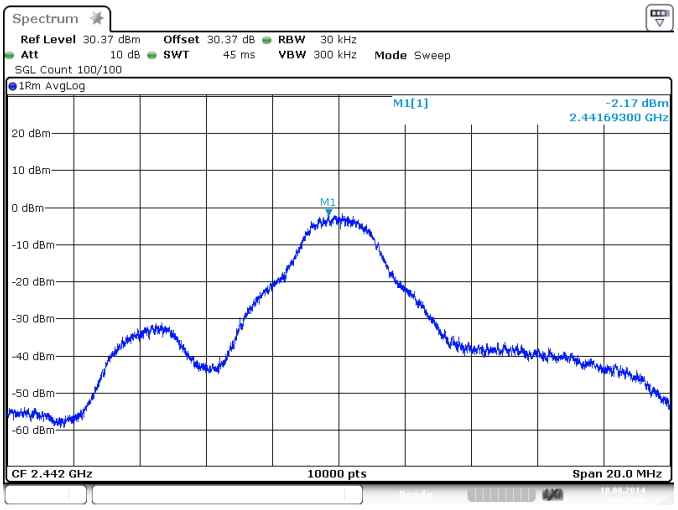

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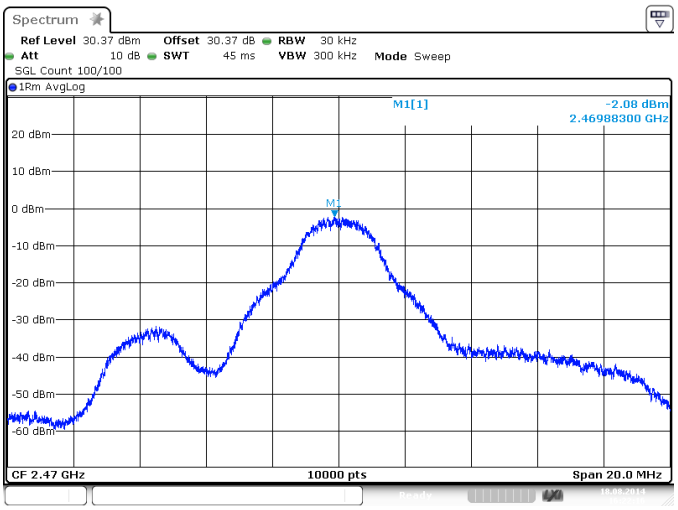


Date: 18.AUG.2014 16:22:16

7 Band Edge Summary Results

7.1 *Test Result*

Test Description	Test Specification	Test Result
Radiated Band Edges	15.247 (d) and 15.209	Compliant

7.2 *Test Method*

Peak and average field strength measurements were performed at the restricted band edges of 2390MHz and 2483.5MHz. Measurements were made using the conducted methods defined in Section 13 of FCC publication D01 DTS Meas Guidance v03r02. The measurements were recorded and using the equation E = EIRP – 20log D + 104.8, the readings were converted to a radiated field strength equivalent. The resultant data were compared to the average limit of 54 dBµV/m and peak limit of 74 dBµV/m

7.3 *Test Site*

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions
Temperature: 24.8 °C
Relative Humidity: 30.7 %

7.4 *Test Equipment*

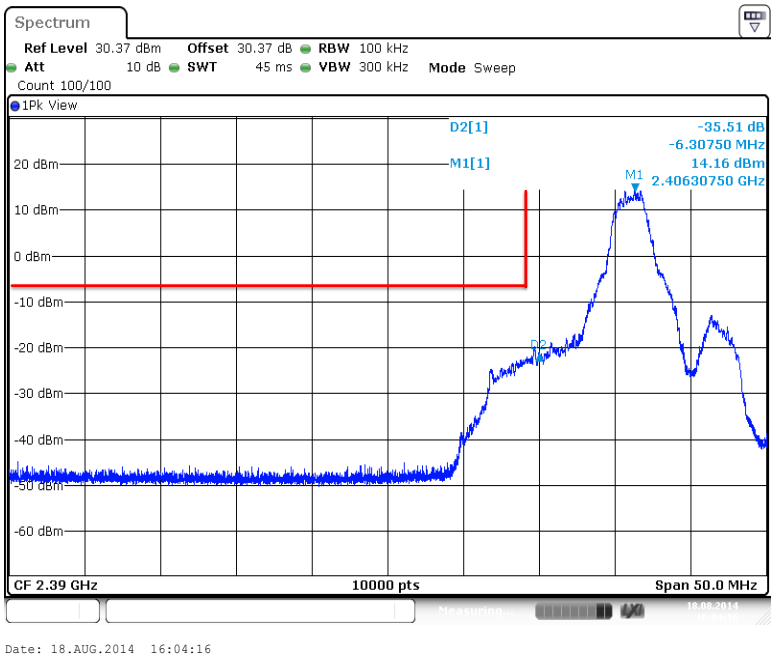
The EUT was directly connected to the receiver. The manufacturer's declared offset of 0.2 dB was incorporated into the final measurement. No other test equipment was used for this measurement.

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	7-Oct-2014

Note: The calibration period equipment is 1 year.

7.5 *Test Data*

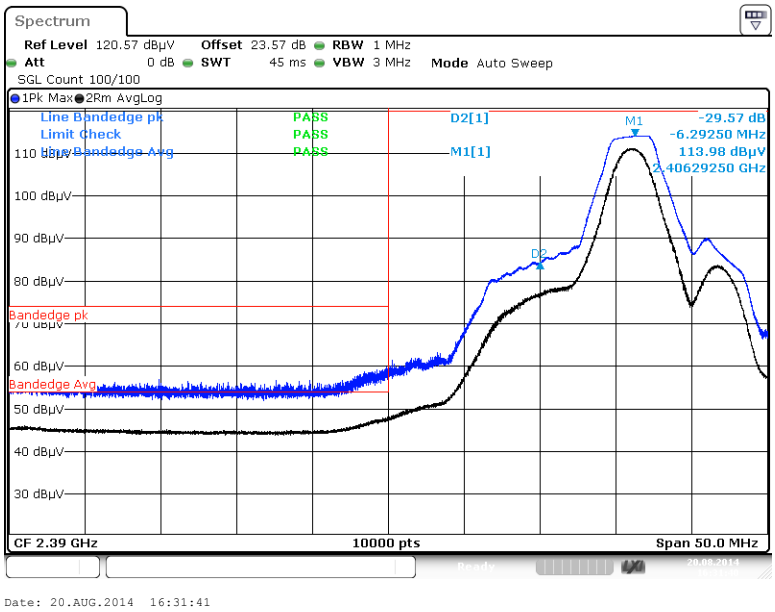
Conducted band edges



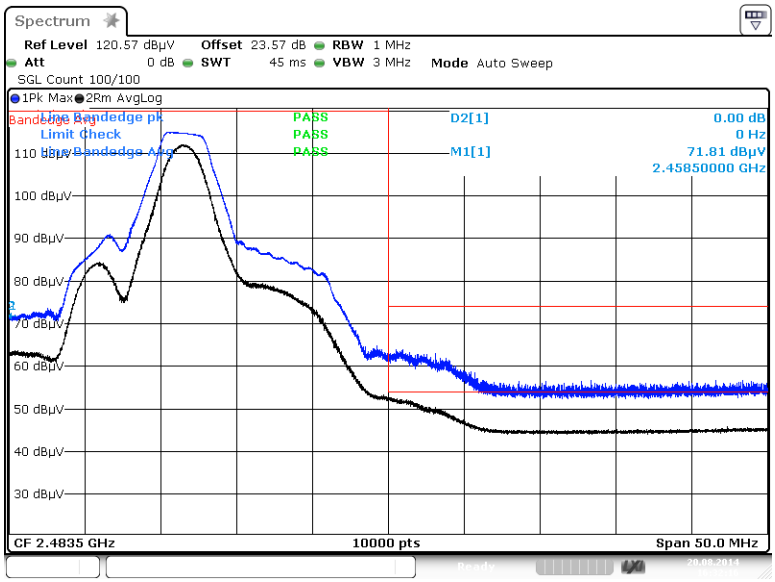
Frequency MHz	Measurement dBc	Limit dBc	Margin dB
2400	-35.1	-20	-15.1
2484.46	-50.5	-20	-30.5

Note: Upper band edge plot was not available.
The same settings were used as for the lower band edge.

Radiated Band Edges



Frequency MHz	Measurement dBuV/m	Limit dBuV/m	Margin dB
2390	48.1	54.0	-5.9
2390	59.5	74.0	-14.5



Frequency MHz	Measurement dBuV/m	Limit dBuV/m	Margin dB
2483.5	53.0	54.0	-1.0
2484.0	63.7	74.0	-10.3

8 Radiated Emissions – Cabinet radiation

8.1 *Test Result*

Test Description	Test Specification	Test Result
Radiated Emissions	15.247 (d) and 15.209 ANSI C63.4:2009	Compliant

8.2 *Test Method*

Measurements were made using the methods defined in ANSI C63.4:2009. Exploratory scans were performed over the frequency range as indicated in the tables below using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Quasi-Peak detector below 1GHz and a Peak and Average detector above 1GHz. The receivers resolution bandwidth was set to 120 kHz for measurements taken in the 30MHz to 1GHz frequency range and 1MHz for measurements for 1GHz and higher. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

8.3 *Test Site*

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 22.8 °C
Relative Humidity: 35.4 %

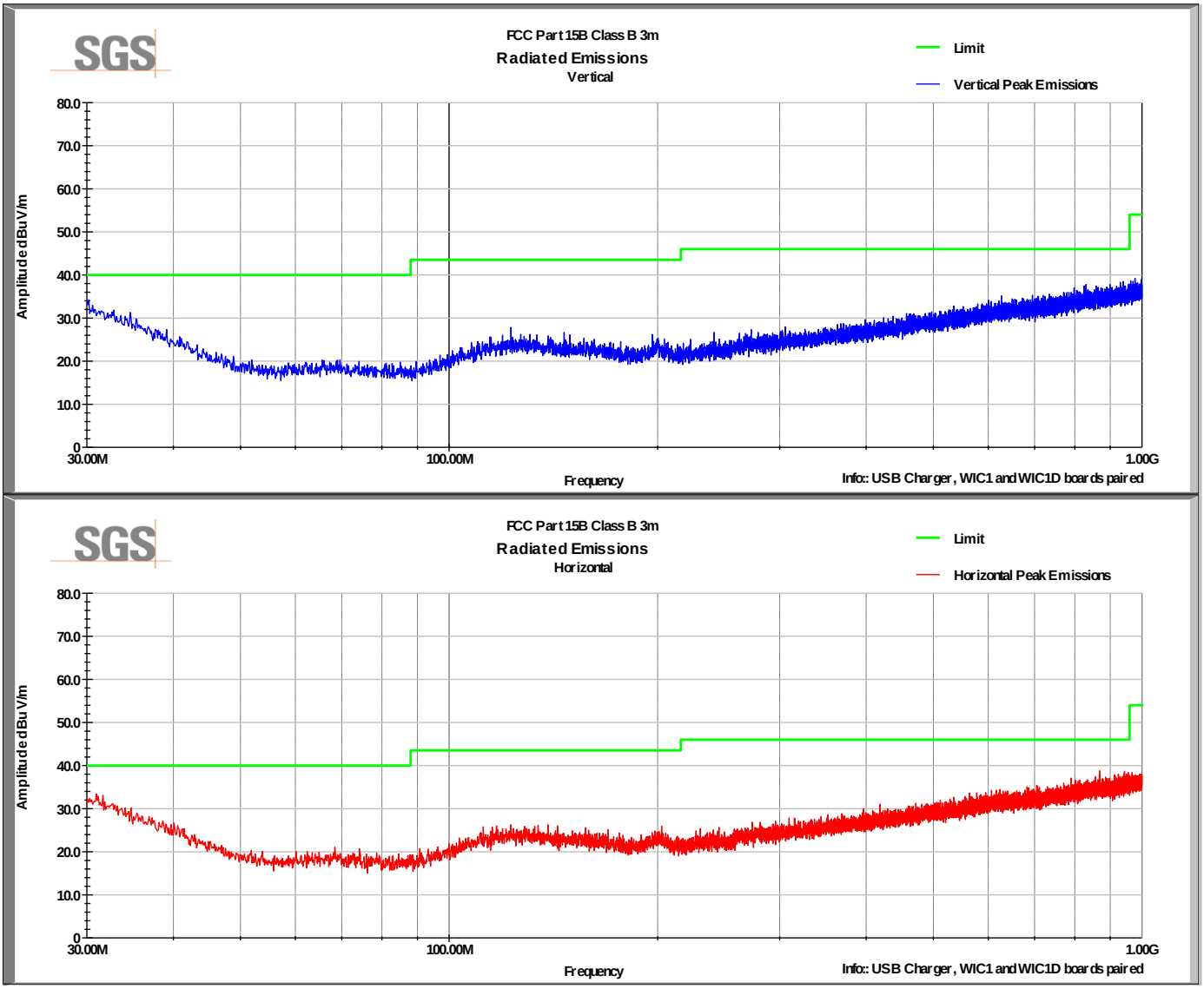
8.4 *Test Equipment*

Test Date: 23-Feb-2015 Tester: DJS

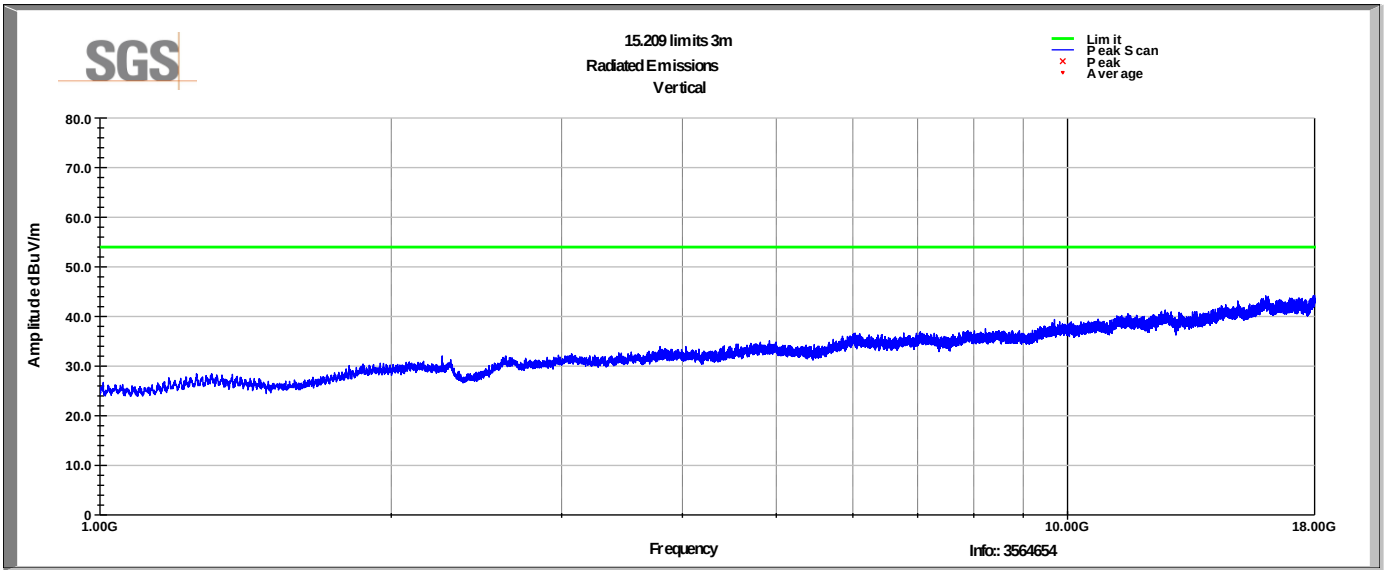
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2016
ANTENNA, BILOG	JB6	SUNOL	B079690	7-Oct-2015
RF CABLE - 7500MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079711	4-Aug-2015
RF CABLE - 7500MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079713	4-Aug-2015
RF CABLE	SF106	HUBER&SUHNER	B085892	5-Aug-2015
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079691	24-Jun-2015
DRG HORN (SMALL)	3116B	ETS-LINDGREN	B079695	13-Mar-2015
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079822	6-Aug-2015
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079823	6-Aug-2015
FIXED GAIN AMPLIFIER	NSP1840-HG	MITEQ	B087572	14-Oct-2015
BAND REJECT FILTER	BRM50709	MICRO-TRONICS	B079790	8-Aug-2015

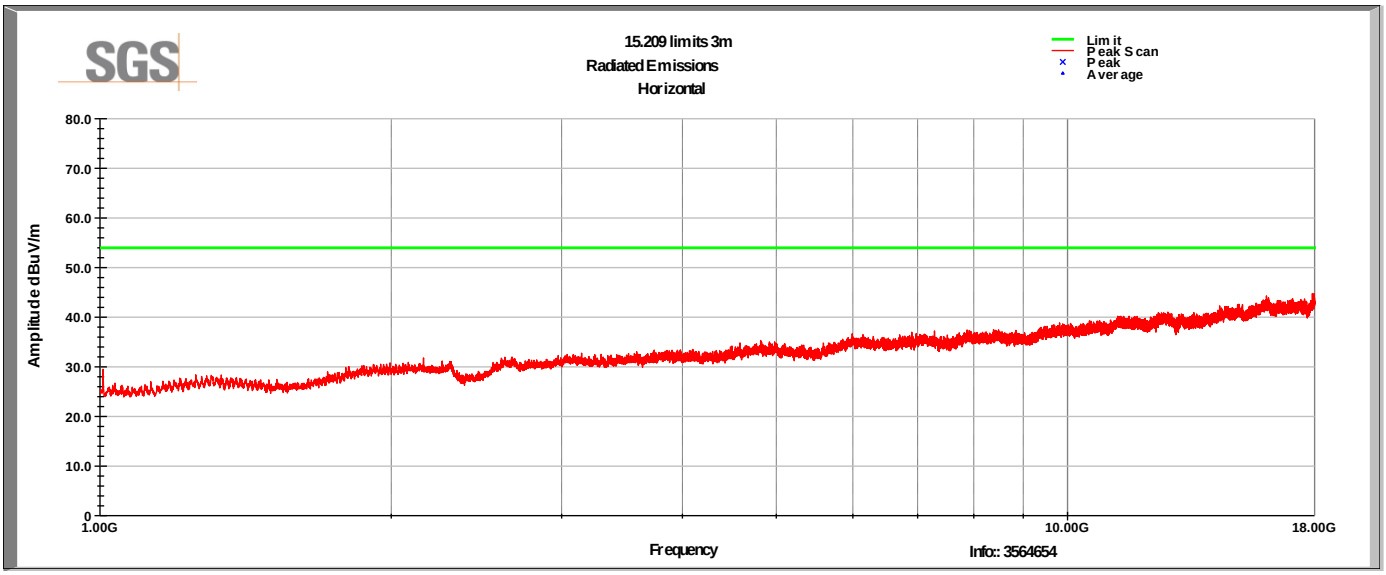
Note: The calibration period equipment is 1 year.

8.5 *Test Data*



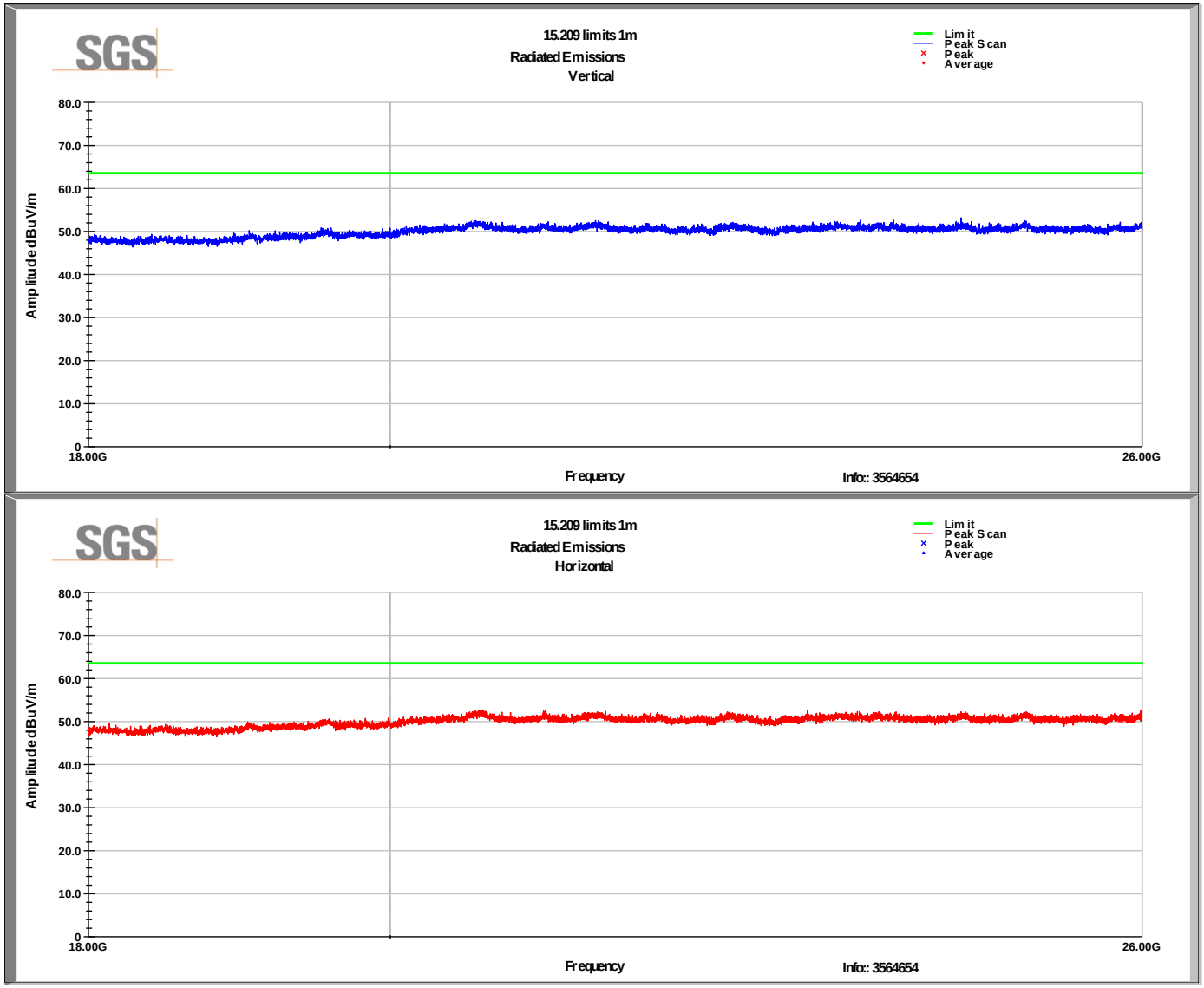
X axis, Mid channel shown. All three axes (X, Y and Z) were investigated. Low, Mid and High channels were investigated. There were no emissions detected.





X axis, Mid channel shown. All three axes (X, Y and Z) were investigated. Low, Mid and High channels were investigated. There were no emissions detected.

Note: The fundamental emission was suppressed through the use of a notch filter.



X axis, Mid channel shown. All three axes (X, Y and Z) were investigated. Low, Mid and High channels were investigated. There were no emissions detected.

9 AC Mains Conducted Emissions

9.1 *Test Result*

Test Description	Basic Standards	Test Result
Conducted Emissions Class B	ANSI C63.4:2009, Class B	Compliant

9.2 *Test Method*

With the receiver's resolution bandwidth was set to 9 kHz, exploratory scans were performed over the measuring frequency range (0.15MHz to 30MHz) using a max hold mode incorporating a Peak detector and Average detector and using the TILE! software. The final test data was measured using a Quasi-Peak detector and Average detector and compared against the limits indicated in the table below.

Frequency Range	Class A Limits (dBuV)	Class B Limits (dBuV)
0.15 to 0.5 MHz	Avg 66 QP 79	Avg 56 to 46 QP 66 to 56
0.5 to 5 MHz	Avg 60 QP 73	Avg 46 Pk 56
5 to 30 MHz	Avg 60 QP 73	Avg 50 Pk 60

9.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 23.1°C
Relative Humidity: 49.3 %

9.4 *Test Equipment*

Test Date: 24-Jun-2014

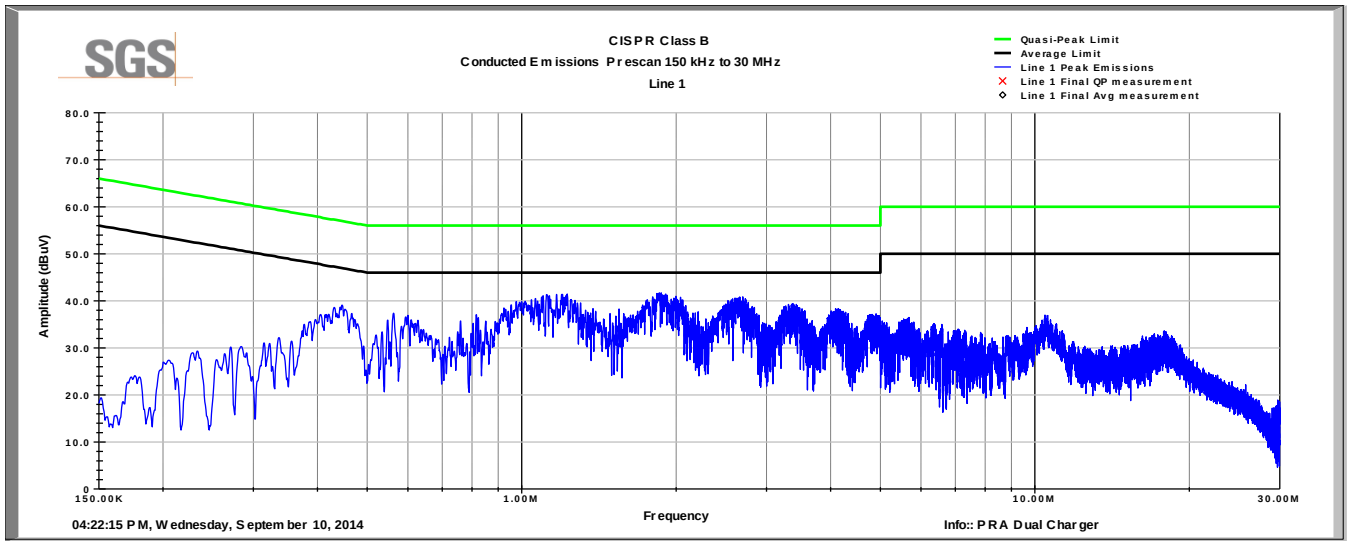
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079716	4-Aug-2015
TWO-LINE V-NETWORK	NNB 51	TESEQ	B085882	23-Sep-2015

Note: The calibration period equipment is 1 year.

Software:
"Conducted Emissions_2013" TILE! profile dated 06 MAR 2013

9.5 *Test Data*

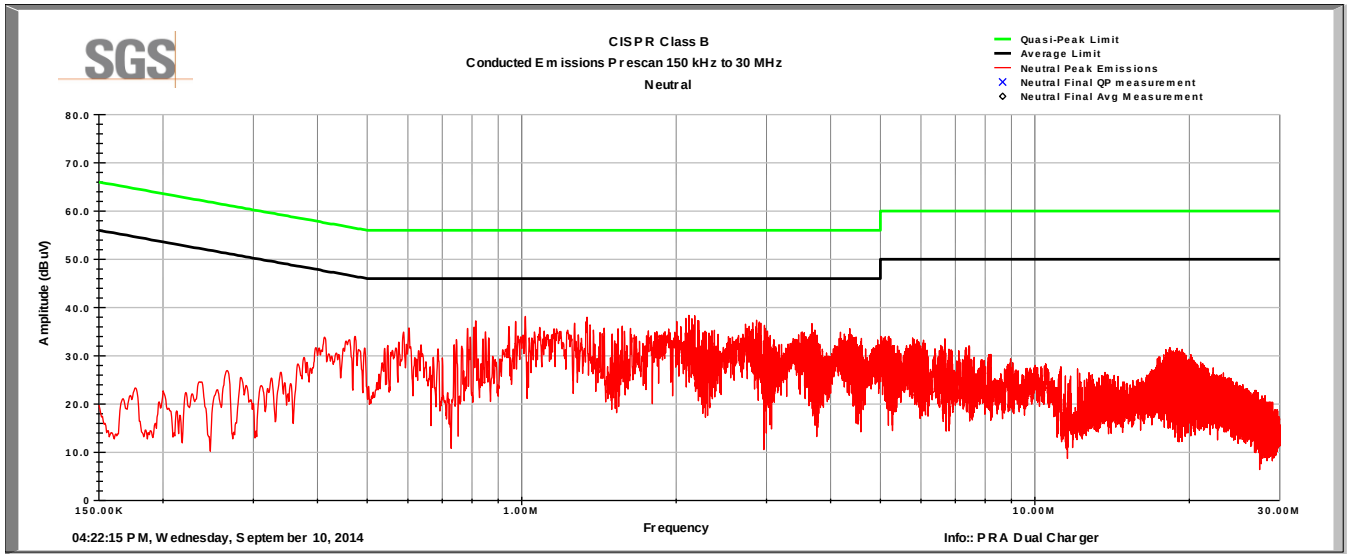
Line 1 Conducted Emissions Plot



Line 1 Conducted Emissions Data

Frequency MHz	Peak Value dBuV	Avg Limit dBuV	Margin dB
0.447	39.1	47.0	-7.9
1.226	41.4	46.0	-4.6
1.377	38.3	46.0	-7.7
1.548	38.3	46.0	-7.7
1.855	41.7	46.0	-4.3
2.040	40.8	46.0	-5.2
2.697	40.9	46.0	-5.1
3.376	39.4	46.0	-6.6
3.562	37.9	46.0	-8.1
4.143	38.3	46.0	-7.7

Neutral Conducted Emissions Plot



Neutral Conducted Emissions Data

Frequency MHz	Peak Value dBuV	Avg Limit dBuV	Margin dB
0.603	35.8	46.0	-10.2
0.814	37.2	46.0	-8.8
1.016	38.2	46.0	-7.8
1.341	38.0	46.0	-8.0
1.570	36.1	46.0	-9.9
2.118	38.4	46.0	-7.6
2.374	35.3	46.0	-10.7
2.868	37.4	46.0	-8.6
3.678	36.7	46.0	-9.3
4.358	35.6	46.0	-10.4

10 20 dB Bandwidth

10.1 *Test Result*

Test Description	Basic Standards	Test Result
20 dB bandwidth	--	Compliant

10.2 *Test Method*

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

10.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 24.4 °C
Relative Humidity: 47.8 %

10.4 *Test Equipment*

The EUT was directly connected to the receiver. The manufacturer's declared offset of 0.2 dB was incorporated into the final measurement. No other test equipment was used for this measurement.

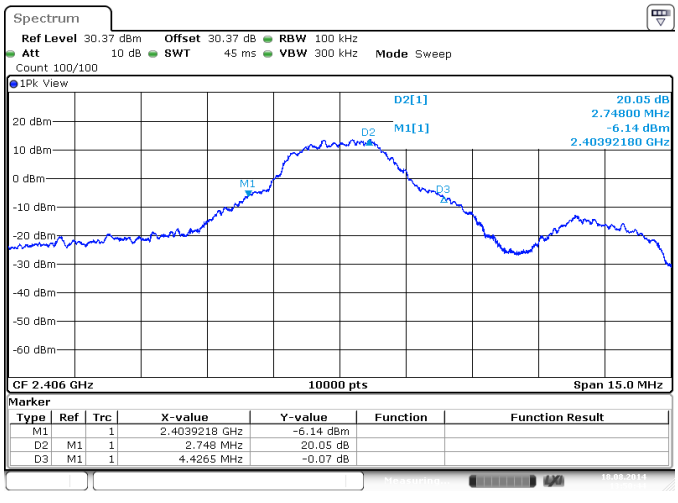
Test Date: 4-Nov-2014 Tester: BKF

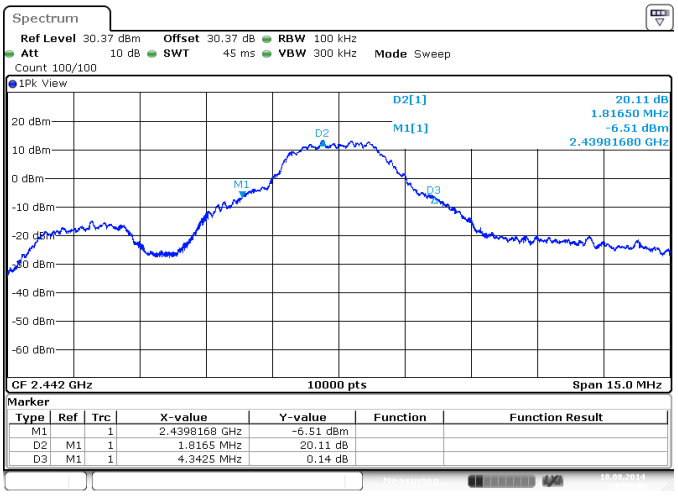
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015

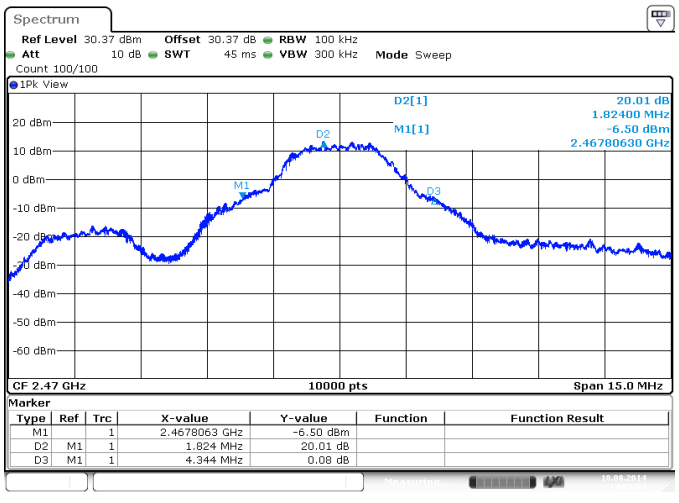
Note: The calibration period equipment is 1 year.

10.5 *Test Data*

Channel	Center Frequency MHz	Measurement kHz
1	2406	4426
9	2442	4342
16	2470	4344







11 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	28OCT2014
1	Added reference to ANSI 63.4:2009 – page 1 Updated Sections 2.4 and 2.5, Block diagram and System Configuration. Added Cabinet Radiation Section 8 Added AC Mains conducted emissions Section 9 Added 20 dB bandwidth Section 10	9 April 2015