

EMC Test Report

Project Number: 3564654

Report Number: 3564654EMC03

Revision Level: 1

Client: Paul Raley and Associates

Equipment Under Test: Wireless Audio Device

Model: WIC1D

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: 02 March 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.

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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
R			

Note 1: Since the Conducted power was lower than the PSD limit, the EUT is compliant without additional testing.

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: WIC1D Transmitter
Model: WIC1D
Serial Number: 2014-07-18_0001
Build Version: Rev D
FCC ID: 2AC2L-WIC1D
IC ID: 12285A-WIC1D
Frequency Range: 2406 to 2470 MHz
Modulation type: Q-QPSK
Channel spacing: 4 MHz
Antenna: Integral
Rated Voltage: 3.7 VDC Internal Battery

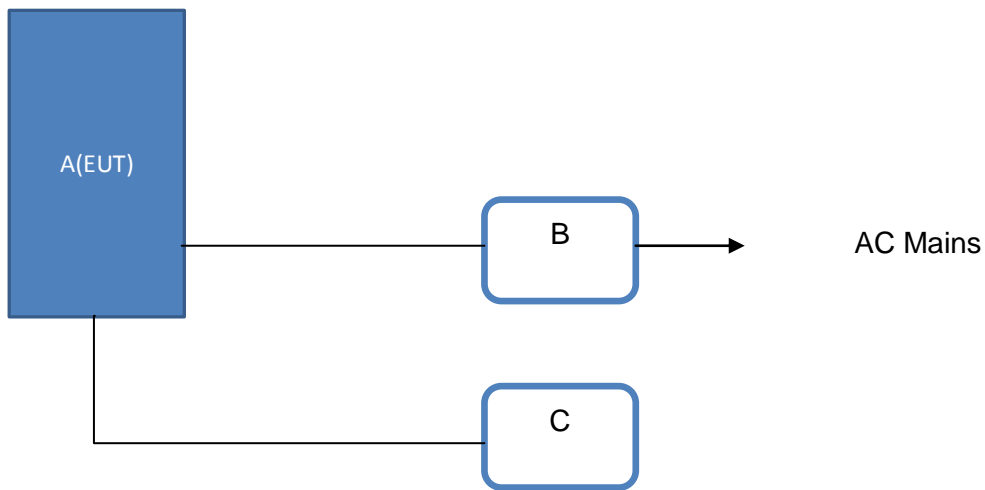
Sample Received Date: 18AUG2014
Dates of testing: 18AUG to 04NOV2014

Operating Modes and Conditions

Modulations used: For fundamental and spurious measurements, the EUT was configured to operate continuously 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	WIC1D	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.

Test Date: 4-Nov-2014

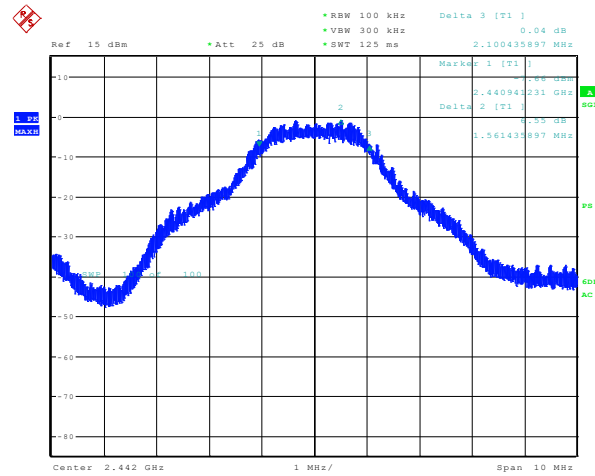
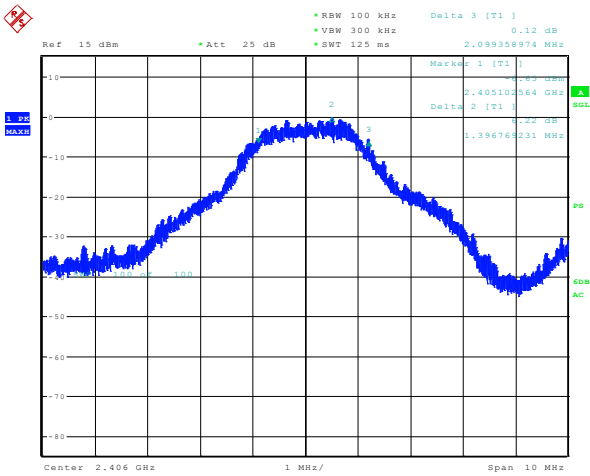
Tester: BKF

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.

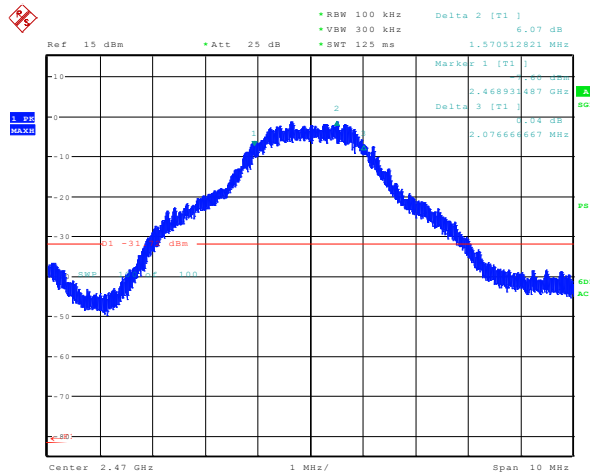
3.5 Test Data

Frequency MHz	Bandwidth MHz	Limit MHz	Result
2406	2.10	0.5	PASS
2442	2.10	0.5	PASS
2470	2.08	0.5	PASS



Date: 4.NOV.2014 11:27:01

Date: 4.NOV.2014 11:25:11



Date: 4.NOV.2014 11:21:56

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.

Test Date: 4-Nov-2014

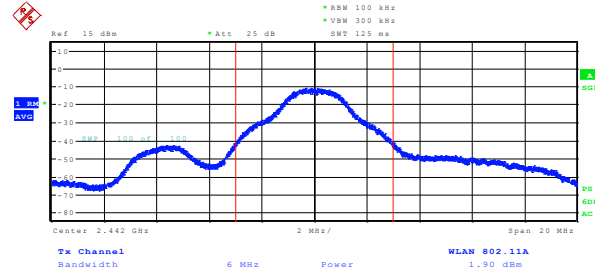
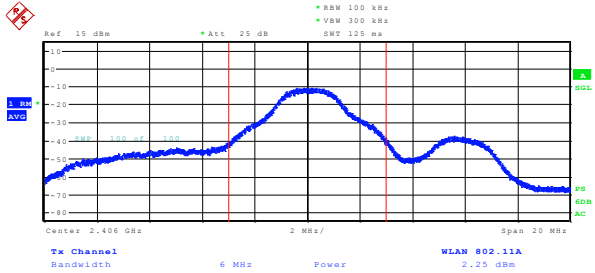
Tester: BKF

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.

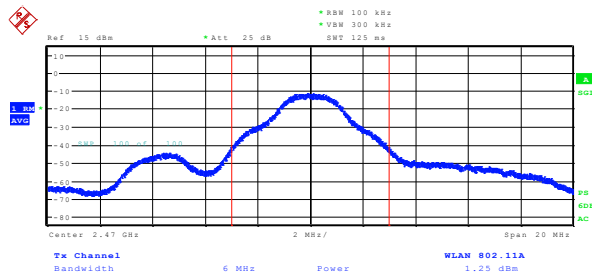
4.5 Test Data

Frequency MHz	Power dBm	Limit dBm	Margin dBm
2406	2.25	30	-27.75
2442	1.9	30	-28.1
2470	1.25	30	-28.75



Date: 4.NOV.2014 11:42:50

Date: 4.NOV.2014 11:44:29



Date: 4.NOV.2014 11:45:53

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 40 GHz

Low, middle, and high channels were investigated converted to radiated measurements with worst case antenna gain included. 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 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

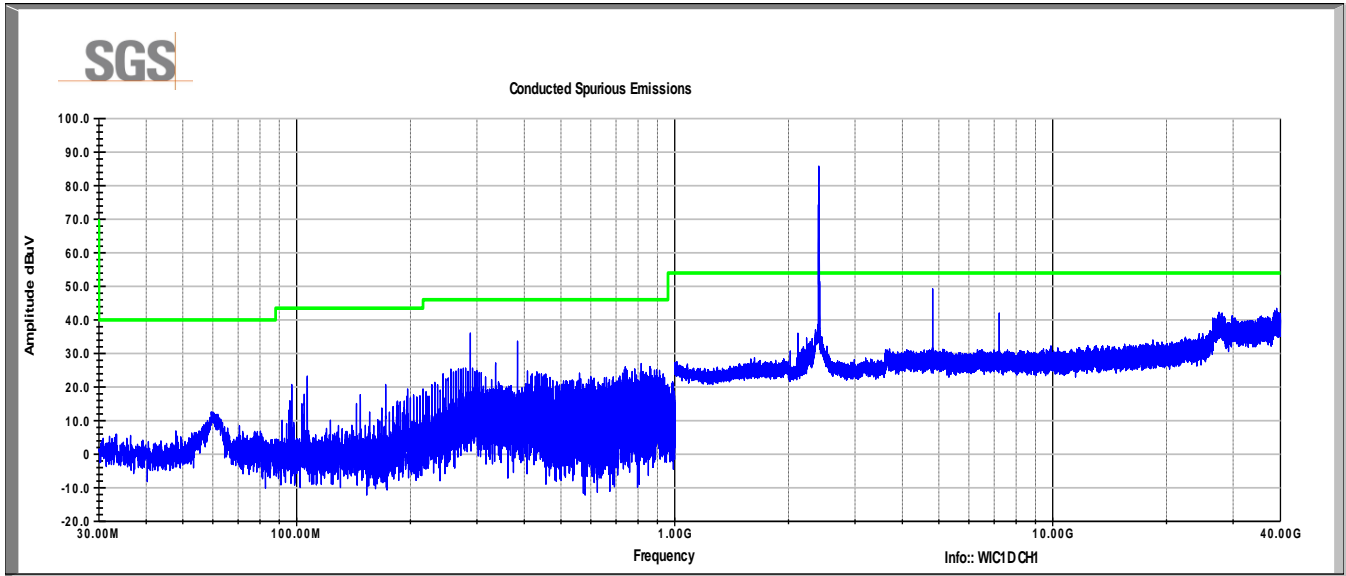
Tester: BKF

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.

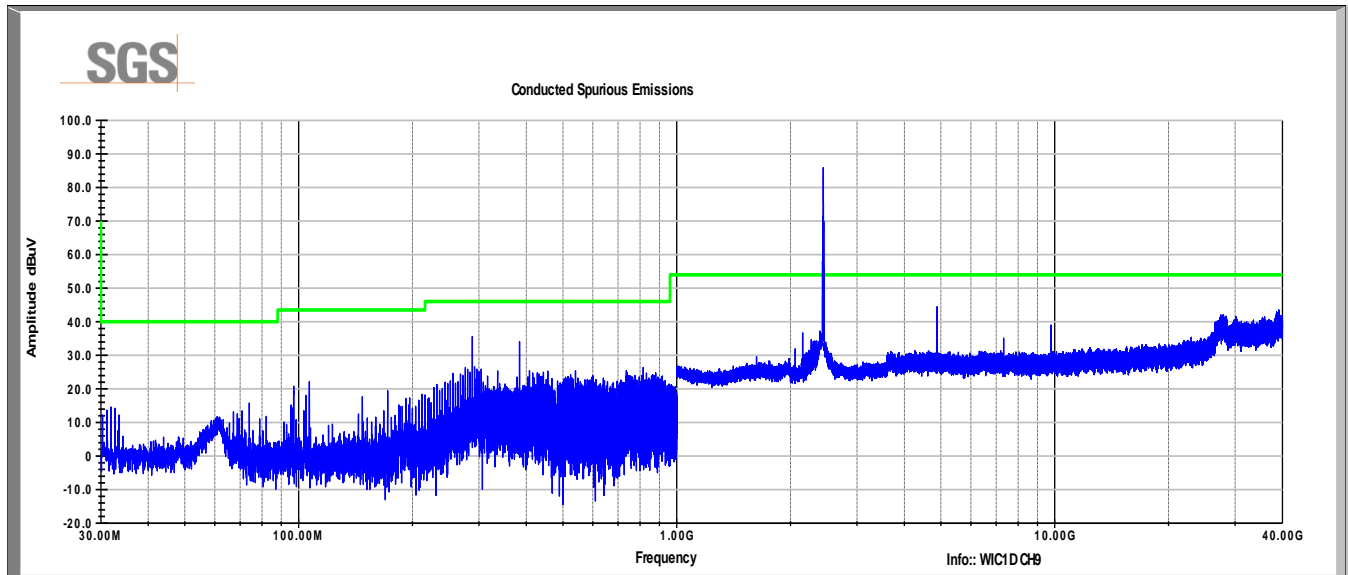
5.5 Test Data

Channel 1



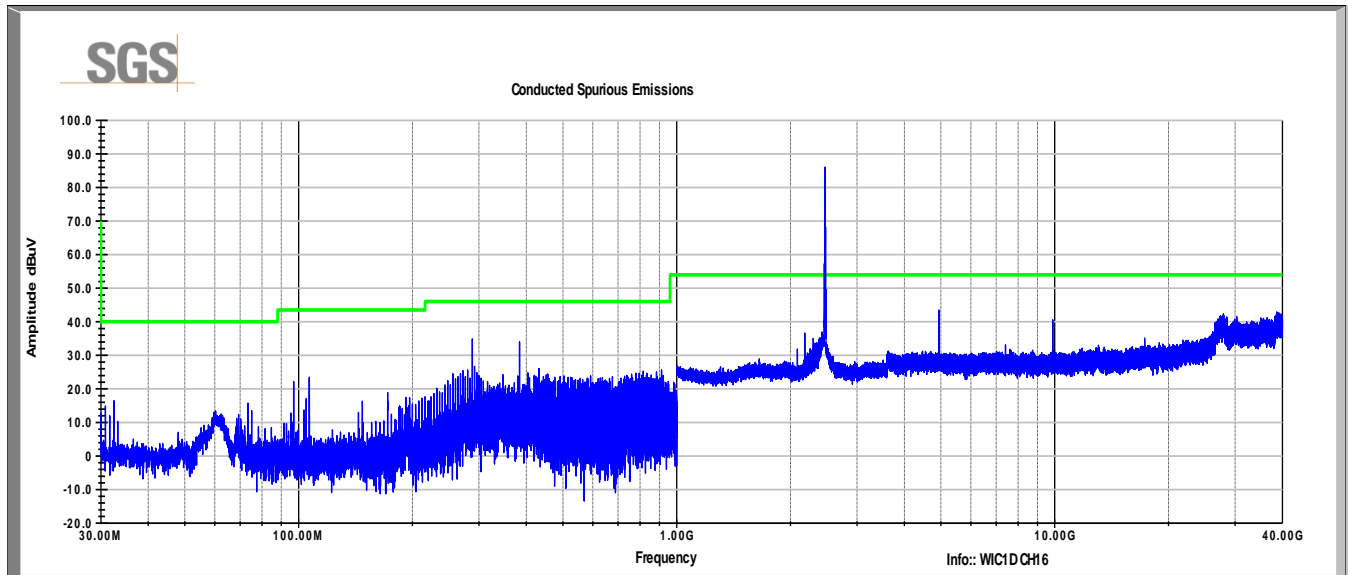
Frequency MHz	Measurement dBuV/m	Limit dBuV/m	Margin dB
287.99	36.1	46.0	-9.9
4811.82	49.2	54.0	-4.8
7217.90	42.0	54.0	-12.0

Channel 9



Frequency MHz	Measurement dBuV/m	Limit dBuV/m	Margin dB
287.99	36.1	46.0	-9.9
4883.97	44.4	54.0	-9.6
9768.07	38.9	54.0	-15.1

Channel 16



Frequency MHz	Measurement dBuV/m	Limit dBuV/m	Margin dB
287.99	34.9	46.0	-11.1
4939.87	43.3	54.0	-10.7
9880.08	40.4	54.0	-13.6

6 Band Edge Summary Results

6.1 Test Result

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

6.2 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 12 of FCC publication D01 DTS Meas Guidance v03r02. The measurements were recorded and using the equation $E = EIRP - 20\log D + 104.8$, the readings were converted to a radiated field strength equivalent. The resultant data were compared to the average limit of 54 dB μ V/m and peak limit of 74 dB μ V/m

6.3 Test Site

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

Environmental Conditions

Temperature: 24.8 °C

Relative Humidity: 30.7 %

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: 4-Nov-2014

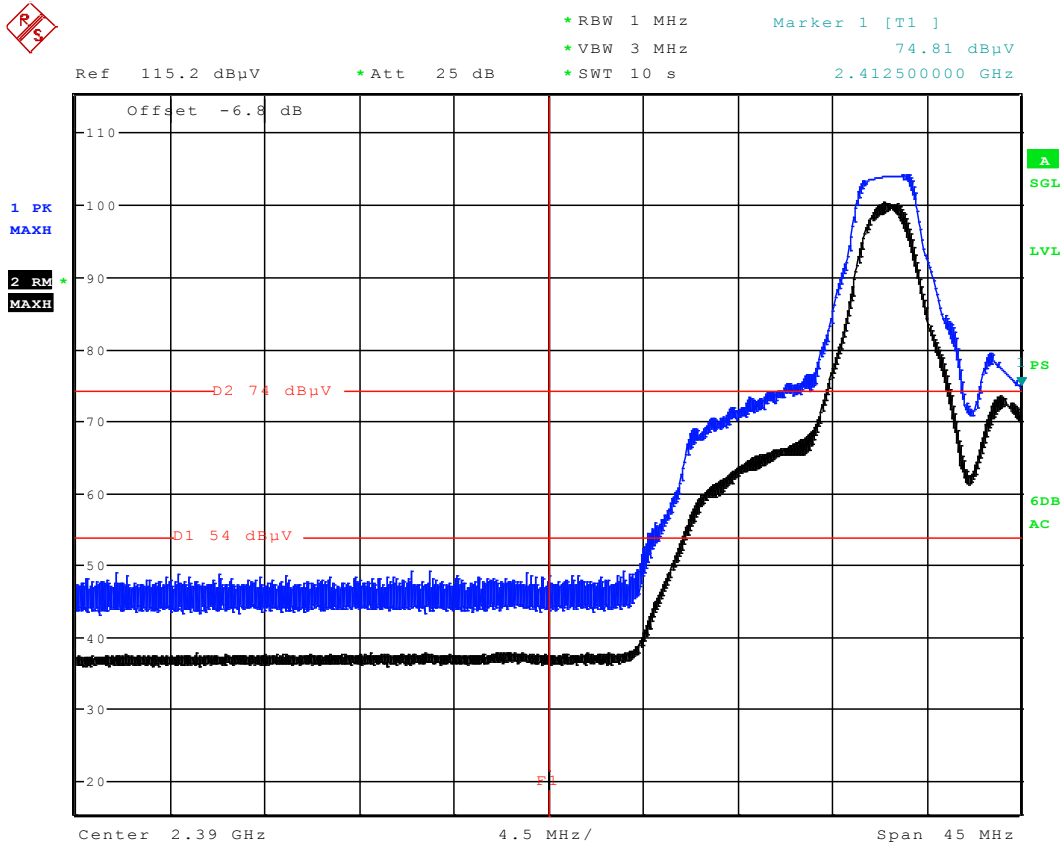
Tester: BKF

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.

6.5 Test Data

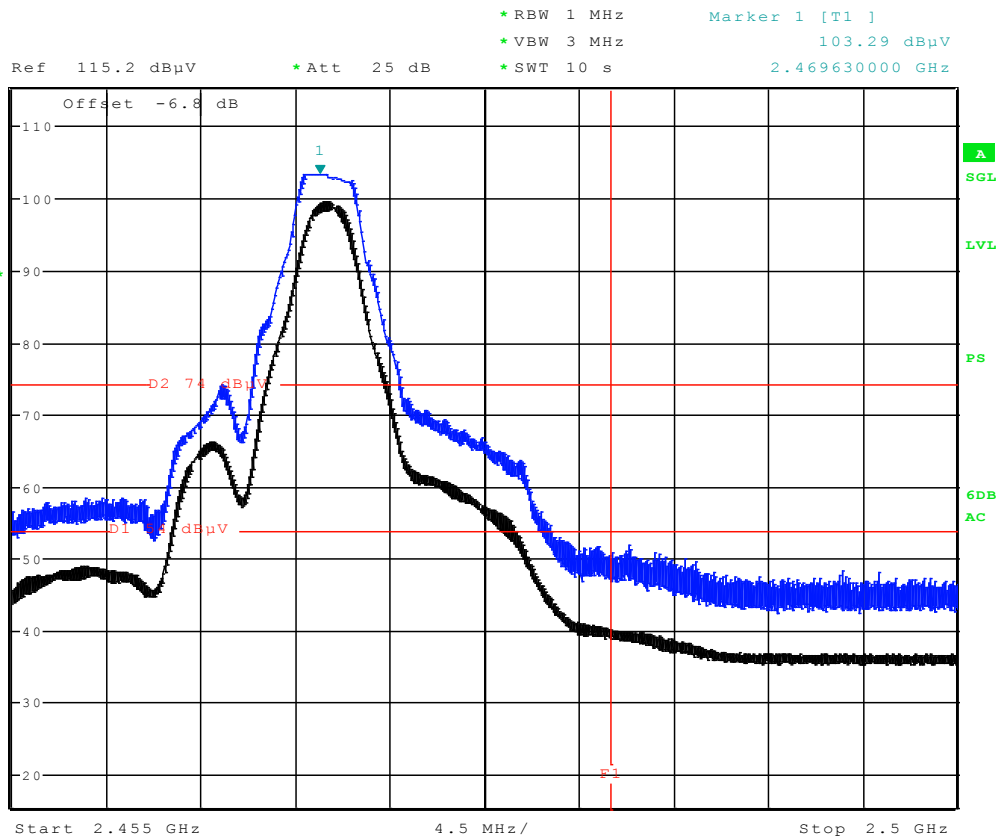
Restricted Bandedges



Date: 4.NOV.2014 10:52:15

Frequency MHz	Peak Measurement dBuV/m	Peak Limit dBuV/m	Margin dB
2390.00	49.8	74.0	-24.2

Frequency MHz	Average Measurement dBuV/m	Average Limit dBuV/m	Margin dB
2390.00	37.1	54.0	-16.9



Date: 4.NOV.2014 10:49:22

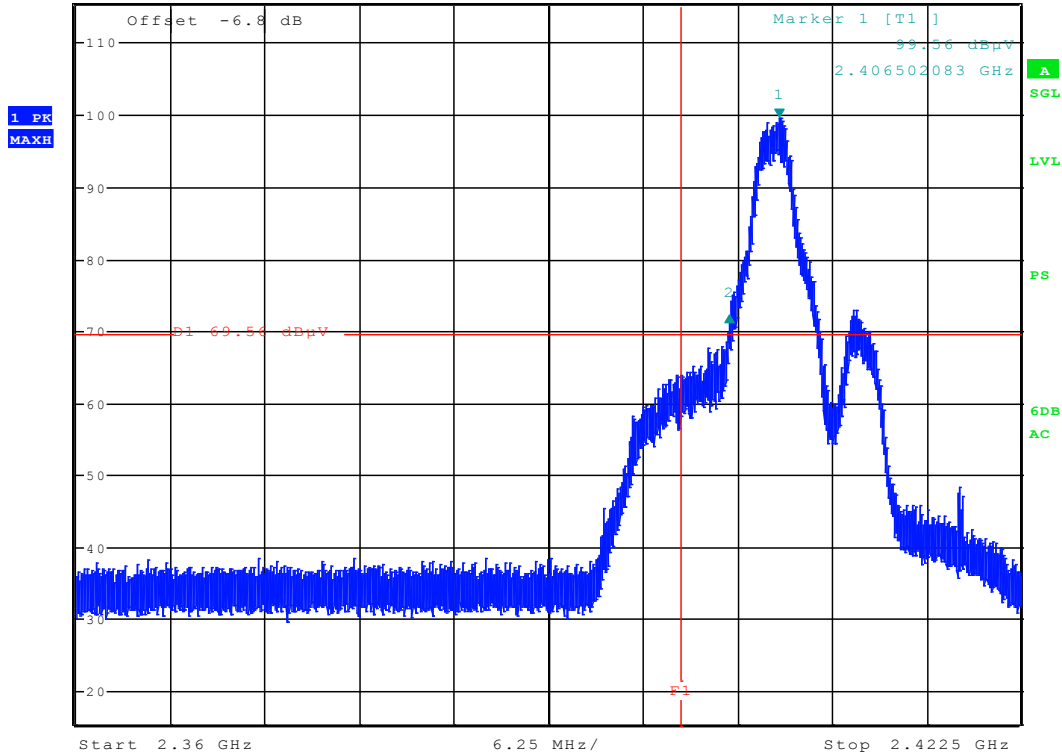
Frequency MHz	Peak Measurement dBuV/m	Peak Limit dBuV/m	Margin dB
2483.50	52.4	74.0	-21.6

Frequency MHz	Average Measurement dBuV/m	Average Limit dBuV/m	Margin dB
2483.50	40.1	54.0	-13.9

Conducted Bandedges

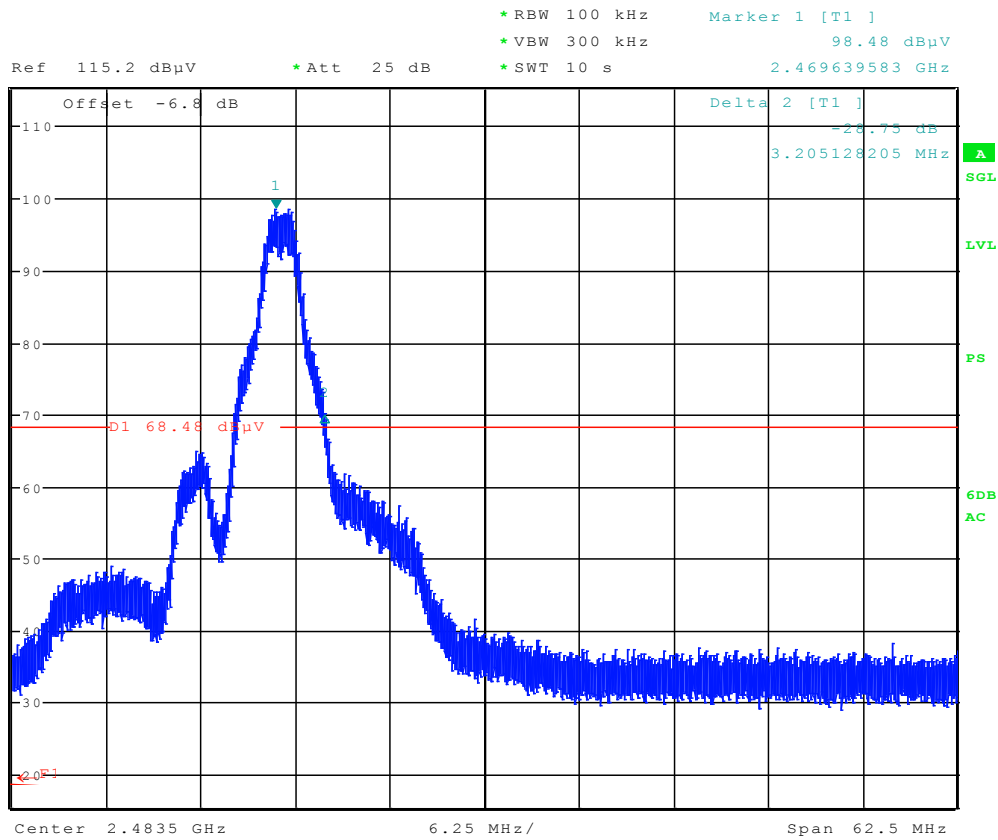


*RBW 100 kHz Delta 2 [T1]
 *VBW 300 kHz -27.50 dB
 *SWT 10 s -3.350160256 MHz
 Ref 115.2 dBuV *Att 25 dB



Date: 4.NOV.2014 10:56:43

Frequency MHz	Peak Measurement dBuV/m	Peak Reference dBuV/m	Delta dBc	Limit dBc	Margin dB
2400.00	64.1	99.6	-35.5	-20.0	-15.5



Date: 4.NOV.2014 11:05:45

Frequency MHz	Peak Measurement dBuV/m	Peak Reference dBuV/m	Delta dBc	Limit dBc	Margin dB
2483.50	40.1	98.5	-58.4	-20.0	-38.4

7 Radiated Emissions – Cabinet radiation

7.1 Test Result

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

7.2 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.

7.3 Test Site

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

Environmental Conditions

Temperature: 22.8 °C

Relative Humidity: 35.4 %

7.4 Test Equipment

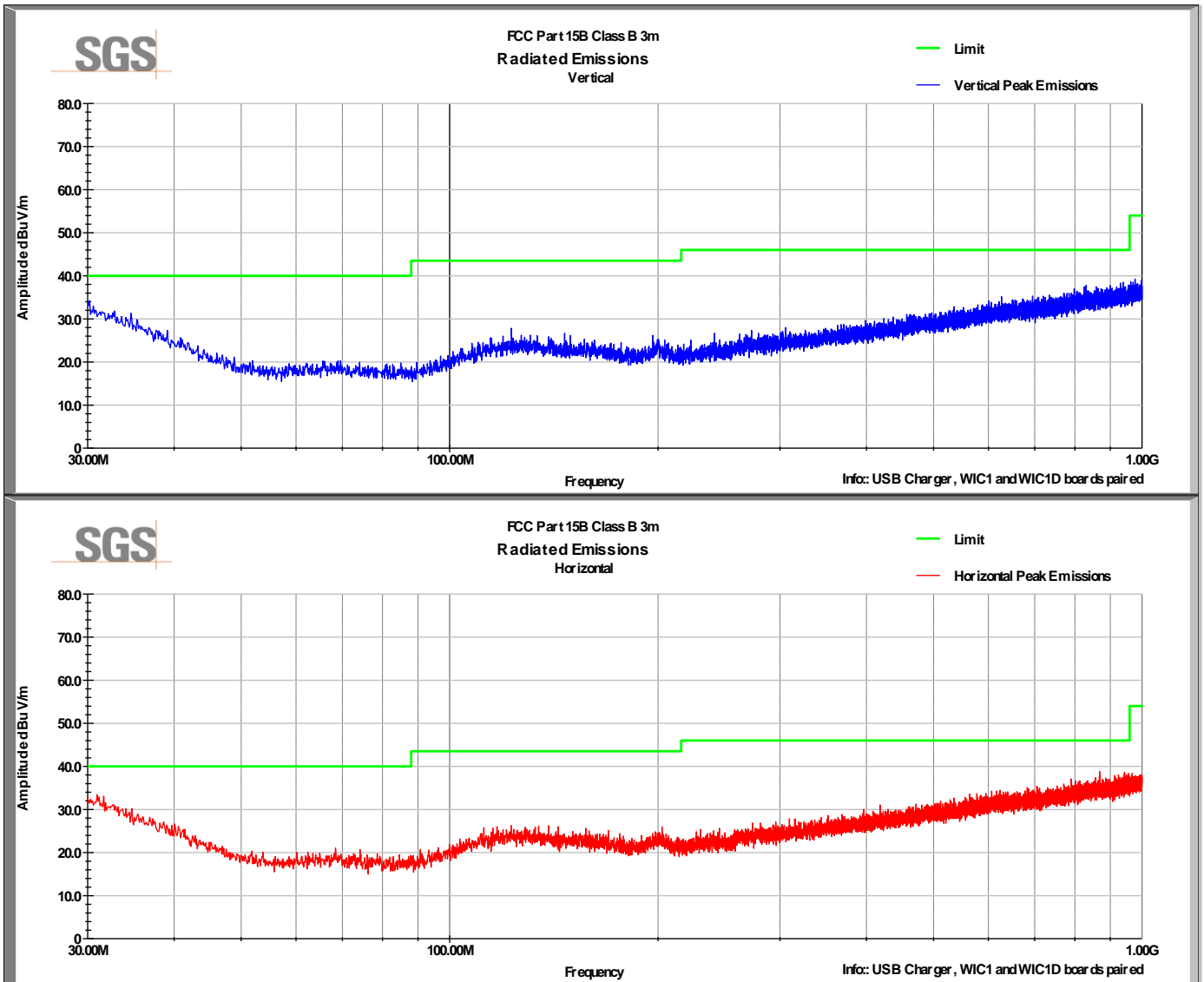
Test Date: 23-Feb-2015

Tester: DJJ

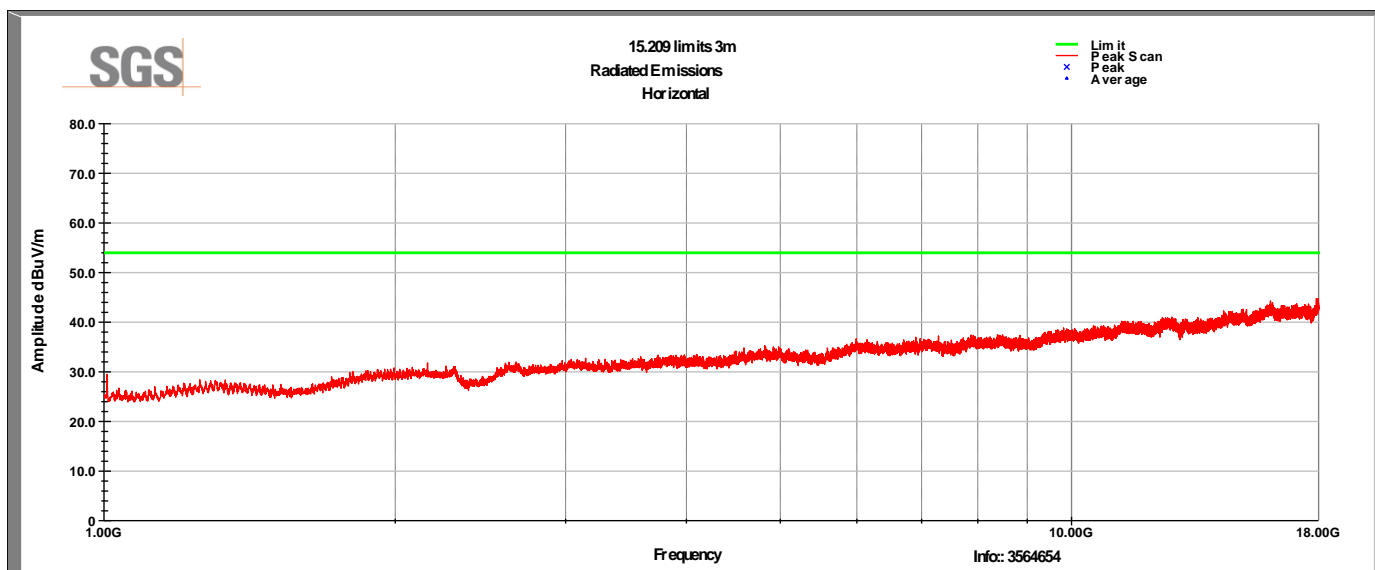
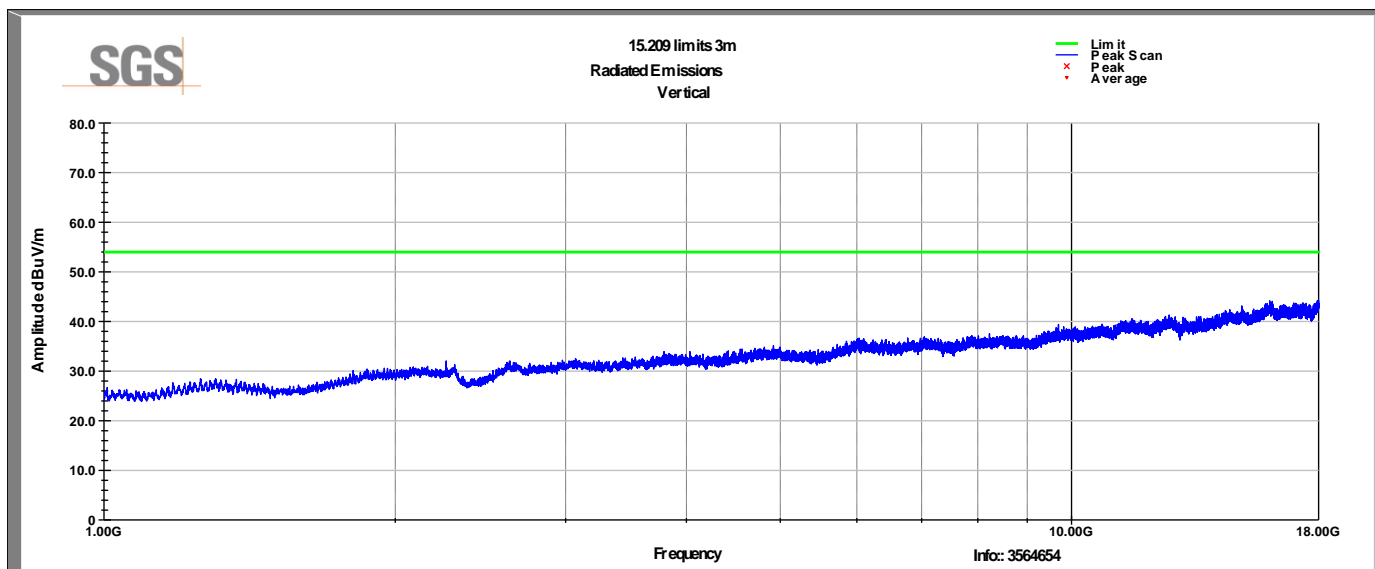
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2016
ANTENNA, BILOG	JB6	SUNOL	B079690	7-Oct-2015
RF CABLE - 7500MM (10KHZ - 18GHz)	SF106	HUBER&SUHNER	B079711	4-Aug-2015
RF 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.

7.5 Test Data

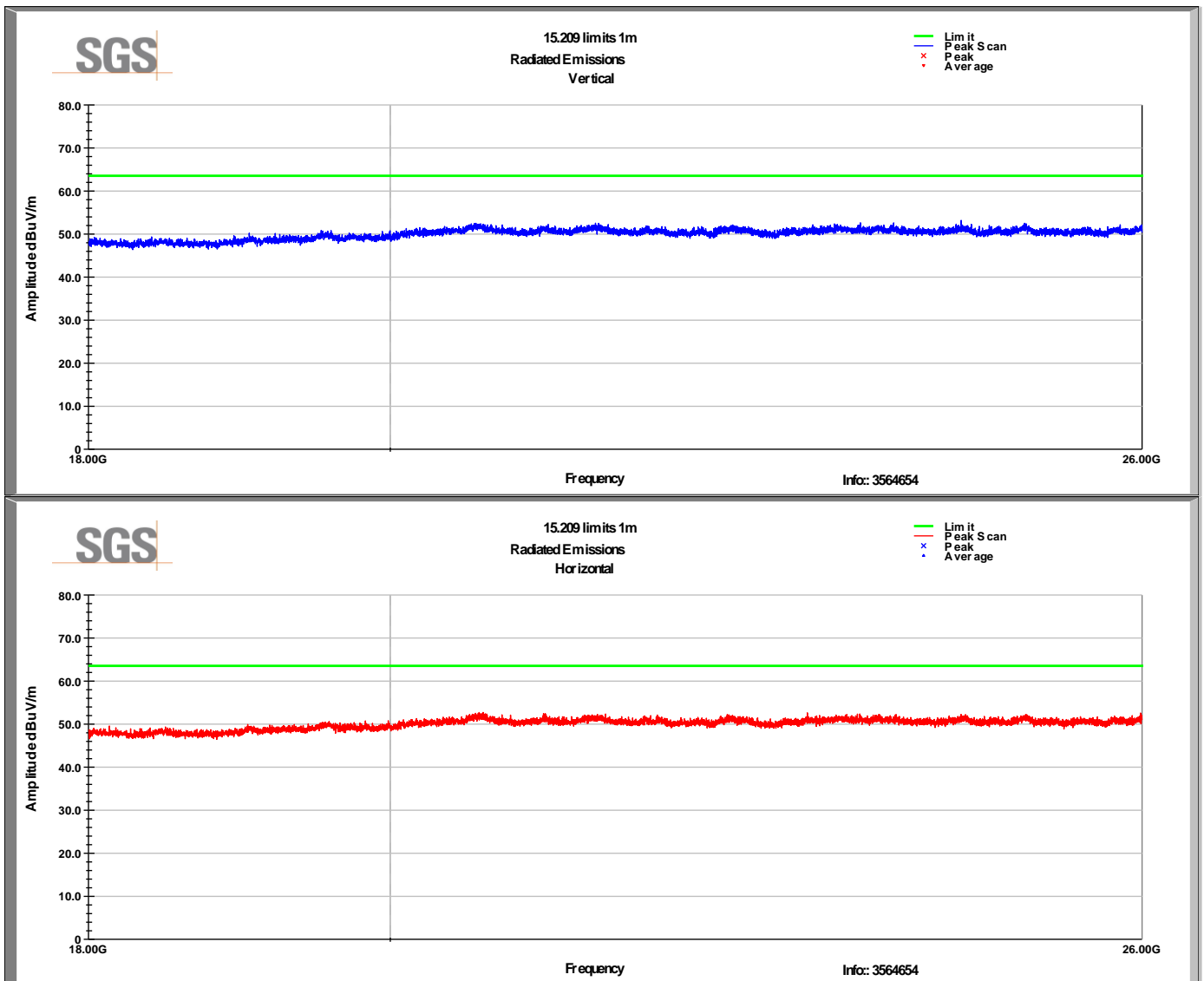


X axis, Mid channel shown. All three axes (X, Y and Z) were investigated. Low, Mid and High channels were investigated. There were no emissions detected.



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.

8 AC Mains Conducted Emissions

8.1 Test Result

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

8.2 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

8.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.1°C

Relative Humidity: 49.3 %

8.4 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

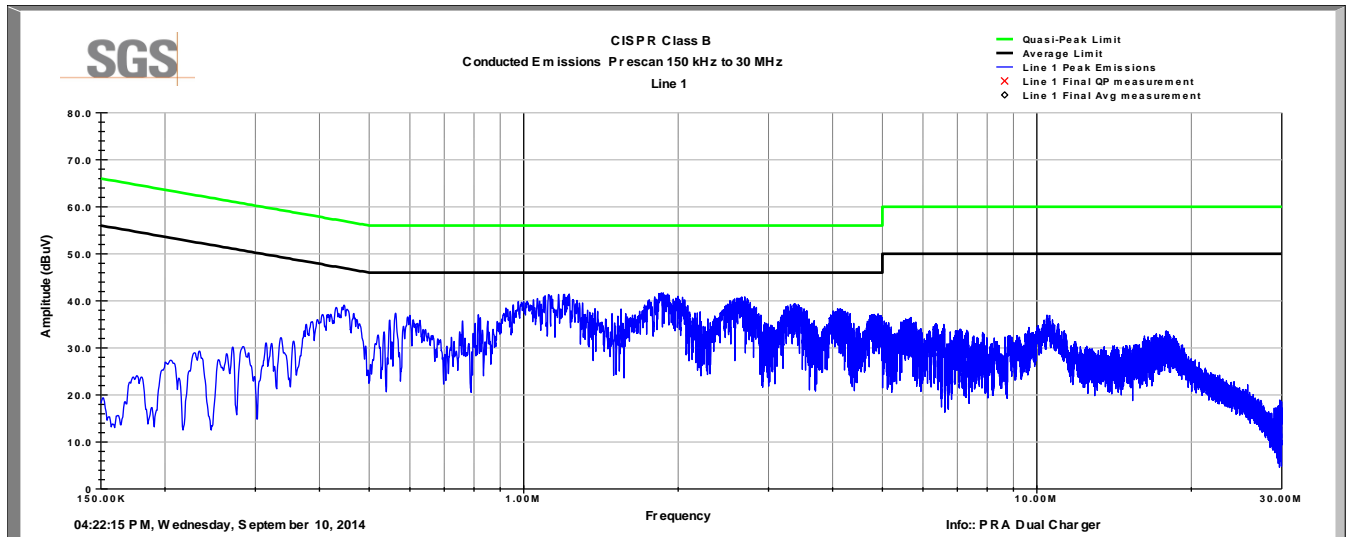
Note: The calibration period equipment is 1 year.

Software:

"Conducted Emissions_2013" TILE! profile dated 06 MAR 2013

8.5 Test Data

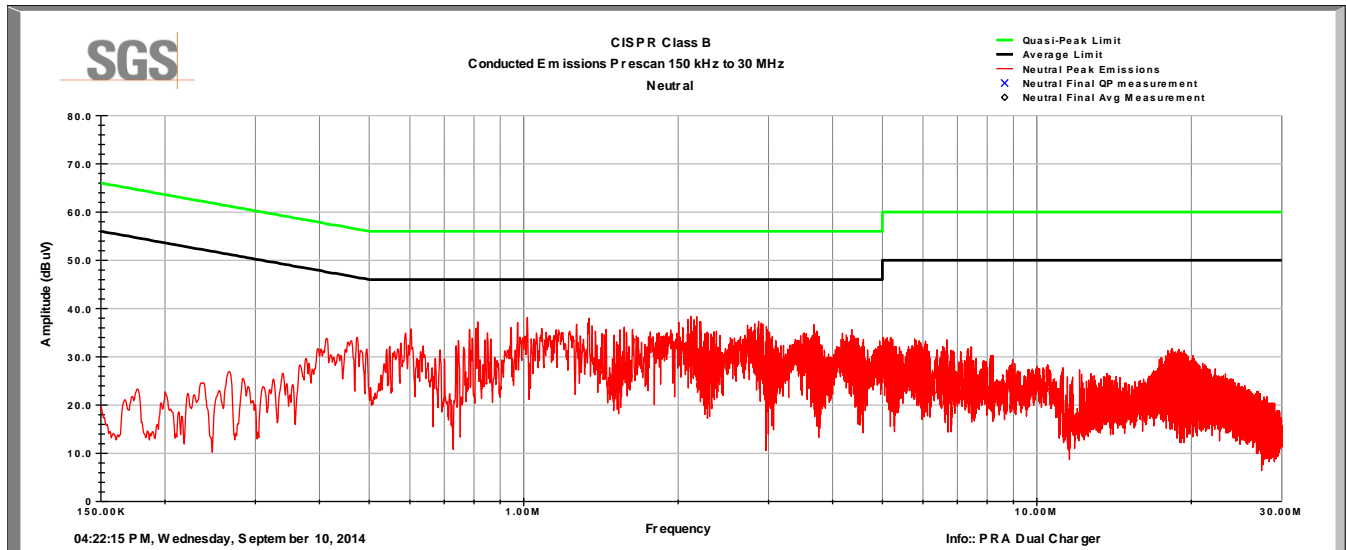
Line 1 Conducted Emissions Plot



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

9 RF Exposure Assessment

The following assessment was performed according to FCC KDB 447498 D01 General RF Exposure Guidance v05r02.

Reported Maximum Power: 2.25 dBm
Tune-up Tolerance: +1/-2 dB
Adjusted Maximum Power: 3.25 dBm
Separation distance: 5 mm
SAR Exclusion Threshold: 10 mW (10 dBm) at 2450 MHz
Verdict: SAR testing is excluded

10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	02OCT2014
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 7 Added AC Mains conducted emissions – Section 8 Added RF Exposure Assessment – Section 9 Clarified test equipment used – See test equipment sections.	02 March 2015