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Report On

EMC Evaluation of
OnRamp Wireless
GE KV2C Meter equipped with On-Ramp Wireless TRN-2014
communication module Model TRN-2014

FCC Part 15 Subpart B
ICES-003 Issue 5


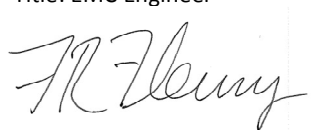
Report No. SC1300586A

June 27 2013



America

TÜV SÜD America Inc., 10040 Mesa Rim Road, San Diego, CA 92121
Tel: (858) 678-1400. Website: www.TUVamerica.com

REPORT ON	EMC Evaluation of the OnRamp Wireless TRN-2014 GE KV2C Meter equipped with On-Ramp Wireless TRN-2014 communication module
TEST REPORT NUMBER	SC1300586A
TEST REPORT DATE	June 27 2013
PREPARED FOR	OnRamp Wireless 10920 Via Frontera #200 San Diego, CA 92127 USA
CONTACT PERSON	Alain Charles Hardware Engineer Alain.Charles@onrampwireless.com (858) 592-6008
PREPARED BY	 _____ Juan Manuel Gonzalez Name Authorized Signatory Title: EMC Engineer
APPROVED BY	 _____ Chip R. Fleury Name Authorized Signatory
DATED	_____ June 27, 2013



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Revision History

SC1300586A OnRamp Wireless GE KV2C Meter equipped with On-Ramp Wireless TRN-2014 communication module					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
06/27/13	Initial Release				Juan M Gonzalez

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SECTION 1

REPORT SUMMARY

EMC Evaluation of the
OnRamp Wireless
GE KV2C Meter equipped with On-Ramp Wireless TRN-2014 communication module



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the OnRamp Wireless GE KV2C Meter equipped with On-Ramp Wireless TRN-2014 communication module to the requirements of FCC Part 15 Subpart B and Industry Canada ICES-003.

Objective To perform EMC Evaluation to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.

Manufacturer OnRamp Wireless

Model Number(s) TRN-2014

Meter Forms included in this test report

Meter Form	Class	Rating
KV2C Form 1S	CL200	120-480 VAC
KV2C Form 2S	CL200, CL320	120-480 VAC
KV2C Form 3S	CL20	120-480 VAC
KV2C Form 4S	CL20	120-480 VAC
KV2C Form 9S	CL20	120-480 VAC
KV2C Form 12S	CL200, CL320	120-480 VAC
KV2C Form 16S	CL200, CL320	120-480 VAC
KV2C Form 36S	CL20	120-480 VAC
KV2C Form 45S	CL20	120-480 VAC

Serial Number(s) x000022A5(Radiated Measurements)

Number of Samples Tested 1

Highest Frequency Generated or Used 2475.63 MHz

Test Specification/Issue/Date

- FCC Part 15 Subpart B (October 1, 2011)
- Spectrum Management and Telecommunications Interference-Causing Equipment Standard ICES-003 Information Technology Equipment (ITE) — Limits and methods of measurement (Issue 5 August 2012).

Start of Test June 26, 2013

Finish of Test June 27, 2013

Name of Engineer(s) Juan Manuel Gonzalez

Related Document(s)



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart B is shown below. Test results from these tests are deemed satisfactory evidence of compliance with Industry Canada Interference-Causing Equipment Standard ICES-003.

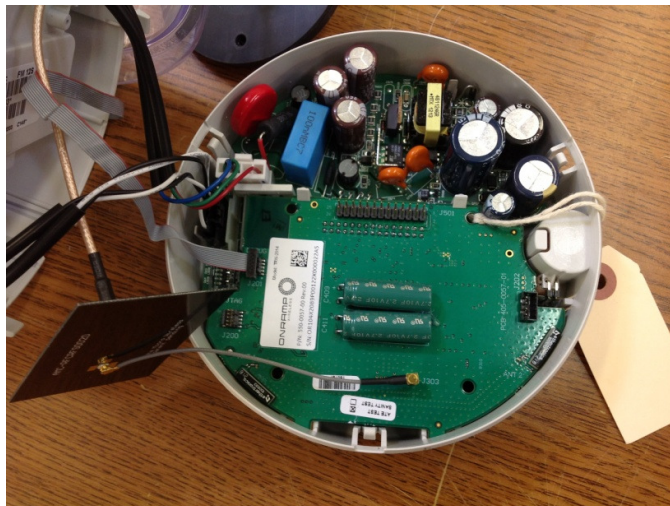
Part 15	Test Description	Result	Comments/Base Standard
§15.107	Conducted Limits	Compliant	Class B requirement
§15.109	Radiated Emission Limits	Compliant	Class B requirement

1.3 PRODUCT INFORMATION

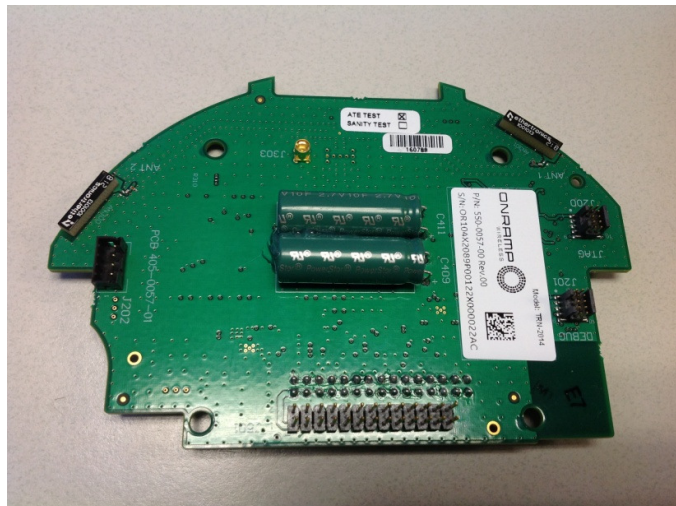
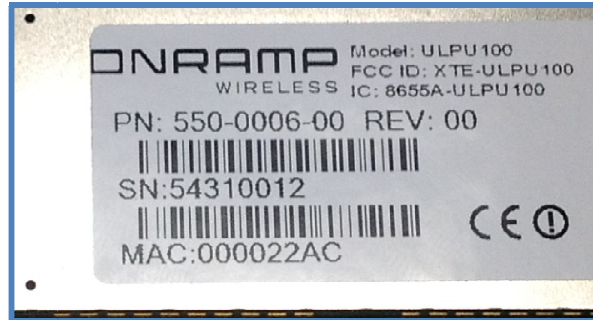
1.3.1 EUT General Description

The Equipment Under Test (EUT) was a GE KV2C Meter equipped with On-Ramp Wireless TRN-2014 communication module as shown in the photograph below.

The communication module of the EUT is a wireless module primarily used for smart grid and remote monitoring applications. The communication module's transceiver is already approved under FCC ID XTE-ULPU100 and IC 8655A-ULPU100, it is being reassessed due to addition of integration into the GE KV2C electric meter with an external antenna.



Equipment Under Test



Equipment Under Test

[On-Ramp Wireless TRN-2014 communication module]

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	Typical normal install configuration and operation (unintentional radiator configuration – EUT in receive mode). EUT powered by 240V-60Hz Isolated Transformer

1.4.2 EUT Exercise Software

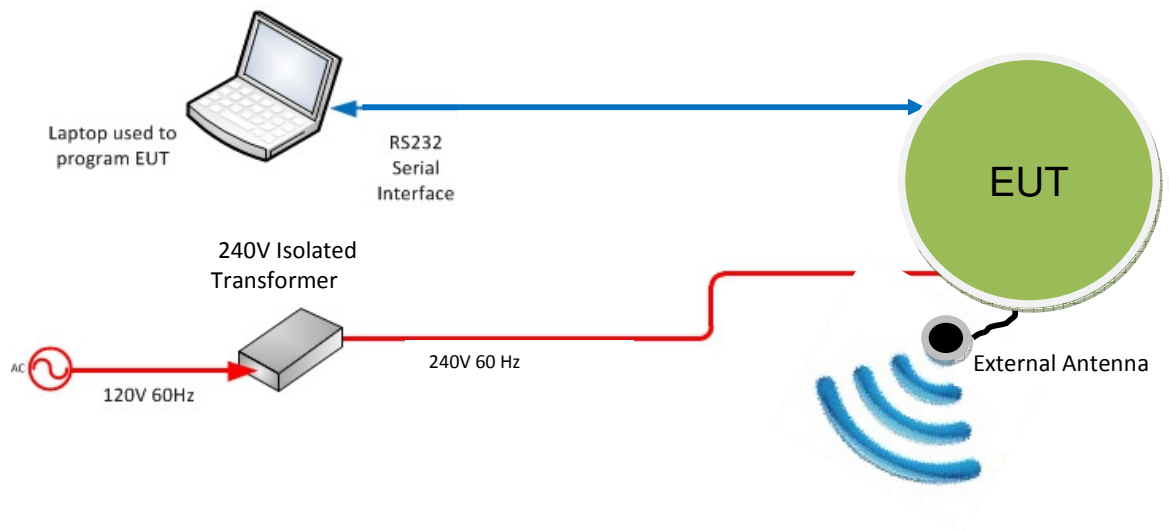
Client provided “CertTools_0.4.1.exe” was used to configure the EUT communication module. The tool runs on a Windows platform and uses a serial port to communicate with the EUT debug port. Because the EUT ground is isolated and can float at high voltage potential, an USB-to-USB isolator is used between the test Laptop and the EUT.

The tool provide for means of selecting the channel, the transmission gain and selecting Rx, Tx or Idle modes. On Tx mode, the communication module transmits a modulated waveform to the selected antenna. The mode selected is maintained after the tool is disconnected from the EUT.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Dell	Test Laptop	Windows based laptop (Model E6520)
FTDI	USB to Serial cable	USB to serial converter
-	Isolator	USB to USB Isolator
Philmore	240V Isolated Transformer	Model ST-100 (120VAC->240VAC)
ORW	Adapter cable	Ribbon adapter cable
HP	Power Supply	DC Power Supply used to verify the Peak Output Power from the TRN-2014

1.4.4 Simplified Test Configuration Diagram



1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number: x000022A5(Radiated Measurements)		

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

For radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.4-2009. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY

1.8.1 FCC – Registration No.: US5296

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.498 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US5296.

1.8.2 Industry Canada (IC) Registration No.: 3067A

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego), has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No. 3067A.



SECTION 2

TEST DETAILS

EMC Evaluation of the
OnRamp Wireless
GE KV2C Meter equipped with On-Ramp Wireless TRN-2014 communication module

2.1 CONDUCTED LIMITS

2.1.1 Specification Reference

Part 15 Subpart B §15.107(a)

2.1.2 Standard Applicable

Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

**Decreases with the logarithm of the frequency.*

2.1.3 Equipment Under Test and Modification State

Serial No: x000022A5(Radiated Measurements) /Default Test Configuration

2.1.4 Date of Test/Initial of test personnel who performed the test

June 26, 2013/JMG

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions

Ambient Temperature 23.0°C
Relative Humidity 50.6%
ATM Pressure 99.5 kPa

2.1.7 Additional Observations

Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.1.8 for sample computation.

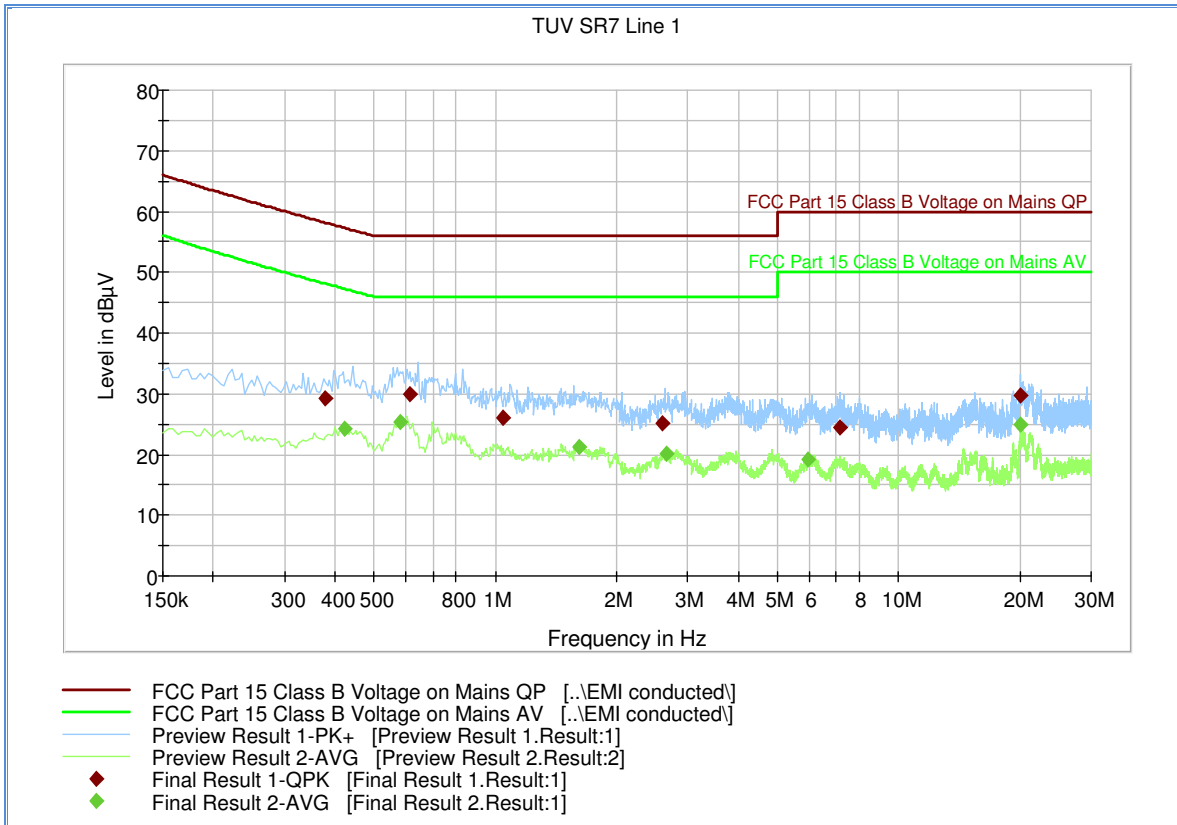
2.1.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (db μ V) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7568 (LISN)	0.30	
Reported QuasiPeak Final Measurement (dbμV) @ 150kHz			26.2

2.1.9 Test Results

Compliant. See attached plots and tables.

2.1.10 Line 1 (Phase A)



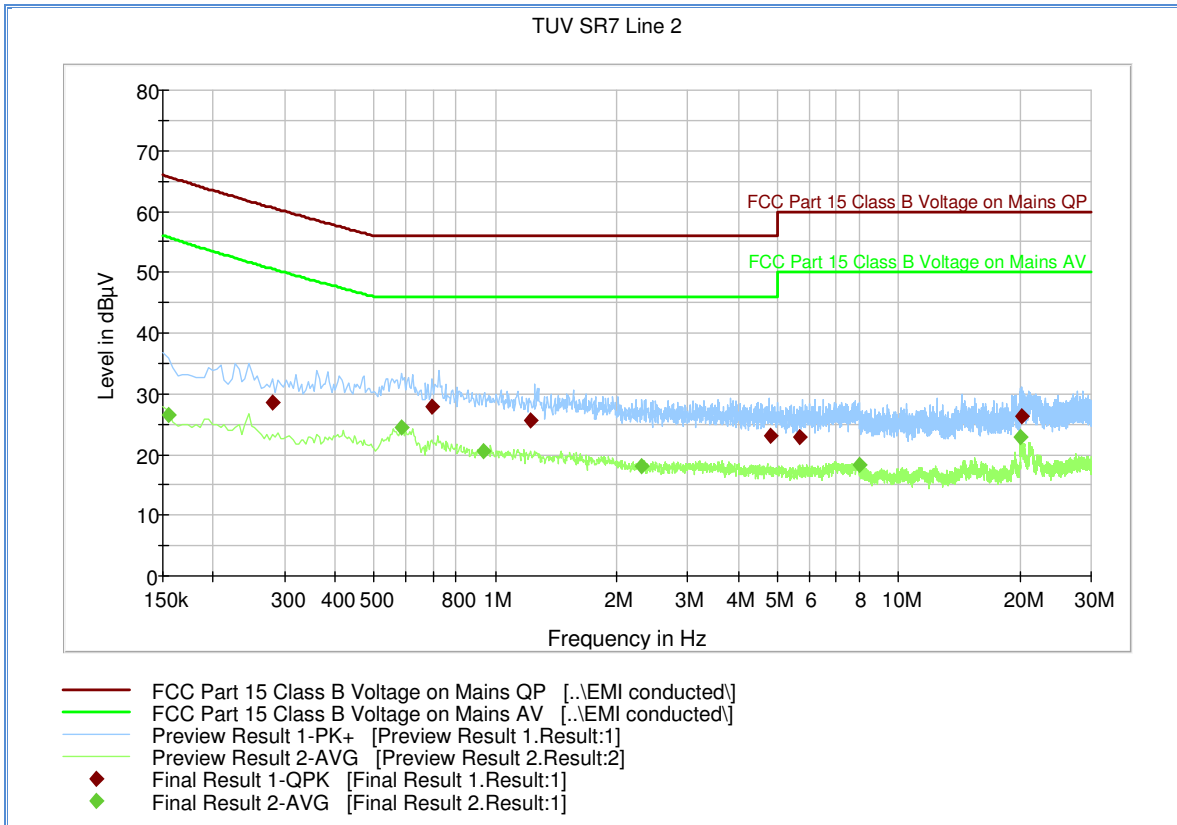
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.379500	29.2	1000.0	9.000	Off	L1	20.2	29.0	58.1
0.613500	30.1	1000.0	9.000	Off	L1	20.2	26.0	56.0
1.041000	26.1	1000.0	9.000	Off	L1	20.2	29.9	56.0
2.598000	25.2	1000.0	9.000	Off	L1	20.3	30.8	56.0
7.143000	24.4	1000.0	9.000	Off	L1	20.4	35.6	60.0
19.999500	29.7	1000.0	9.000	Off	L1	21.0	30.4	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.424500	24.3	1000.0	9.000	Off	L1	20.2	22.9	47.2
0.582000	25.4	1000.0	9.000	Off	L1	20.2	20.6	46.0
1.617000	21.3	1000.0	9.000	Off	L1	20.3	24.7	46.0
2.652000	20.1	1000.0	9.000	Off	L1	20.3	25.9	46.0
5.977500	19.1	1000.0	9.000	Off	L1	20.4	30.9	50.0
19.999500	24.8	1000.0	9.000	Off	L1	21.0	25.2	50.0

2.1.11 Line 2 (Phase B)



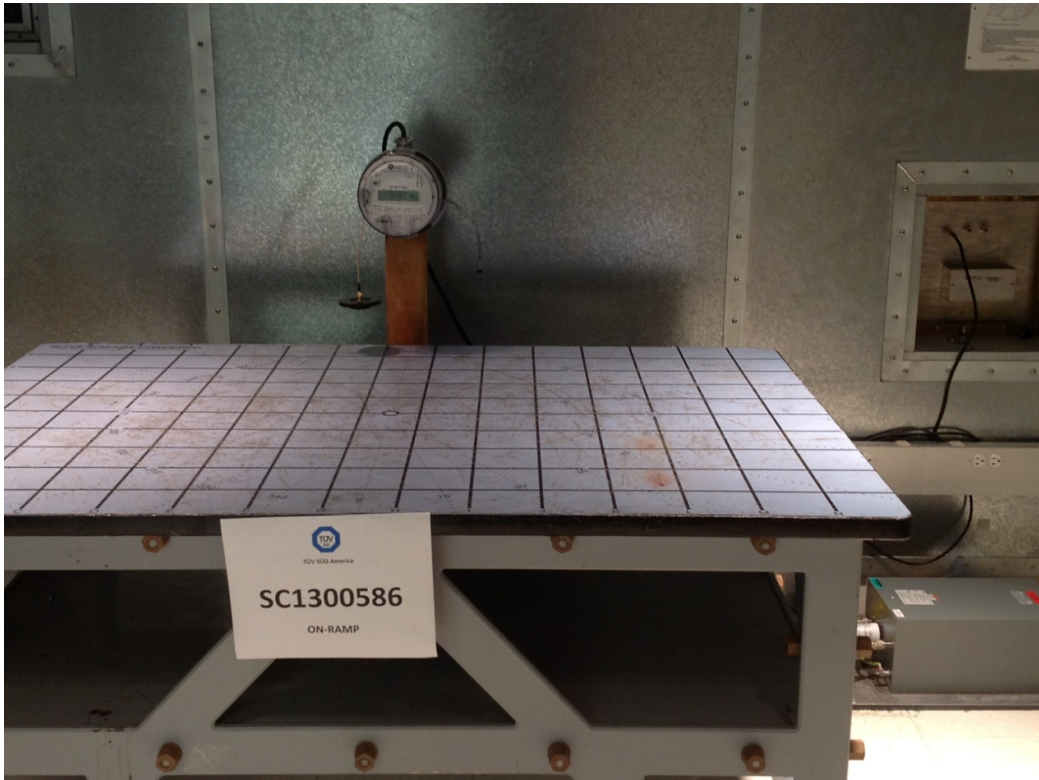
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.280500	28.6	1000.0	9.000	Off	N	21.1	32.0	60.6
0.699000	27.9	1000.0	9.000	Off	N	21.1	28.1	56.0
1.221000	25.6	1000.0	9.000	Off	N	21.1	30.4	56.0
4.812000	23.0	1000.0	9.000	Off	N	21.2	33.0	56.0
5.707500	22.9	1000.0	9.000	Off	N	21.2	37.1	60.0
20.238000	26.4	1000.0	9.000	Off	N	21.7	33.6	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.154500	26.6	1000.0	9.000	Off	N	21.2	29.2	55.7
0.586500	24.4	1000.0	9.000	Off	N	21.1	21.6	46.0
0.937500	20.5	1000.0	9.000	Off	N	21.1	25.5	46.0
2.310000	18.0	1000.0	9.000	Off	N	21.1	28.0	46.0
7.975500	18.3	1000.0	9.000	Off	N	21.2	31.7	50.0
19.999500	22.9	1000.0	9.000	Off	N	21.7	27.1	50.0

2.1.12 Test Setup Photo (Front)



2.1.13 Test Setup Photo (Back)



2.2 RADIATED EMISSION LIMITS

2.2.1 Specification Reference

Part 15 Subpart B §15.109(a)

2.2.2 Standard Applicable

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field Strength (microvolts/meter)
30-88	100
88-216	150
216-960	200
Above 960	500

2.2.3 Equipment Under Test and Modification State

Serial No: x000022A5(Radiated Measurements) /Default Test Configuration

2.2.4 Date of Test/Initial of test personnel who performed the test

June 26, 2013/JMG

2.2.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.6 Environmental Conditions

Ambient Temperature 23.0°C
Relative Humidity 50.6%
ATM Pressure 99.5 kPa

2.2.7 Additional Observations

- The spectrum was searched from 30MHz to 18GHz and verified to Class B limits.
- There are no emissions observed above 1GHz, all points presented are noise floor measurements.
- Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.2.8 for sample computation.

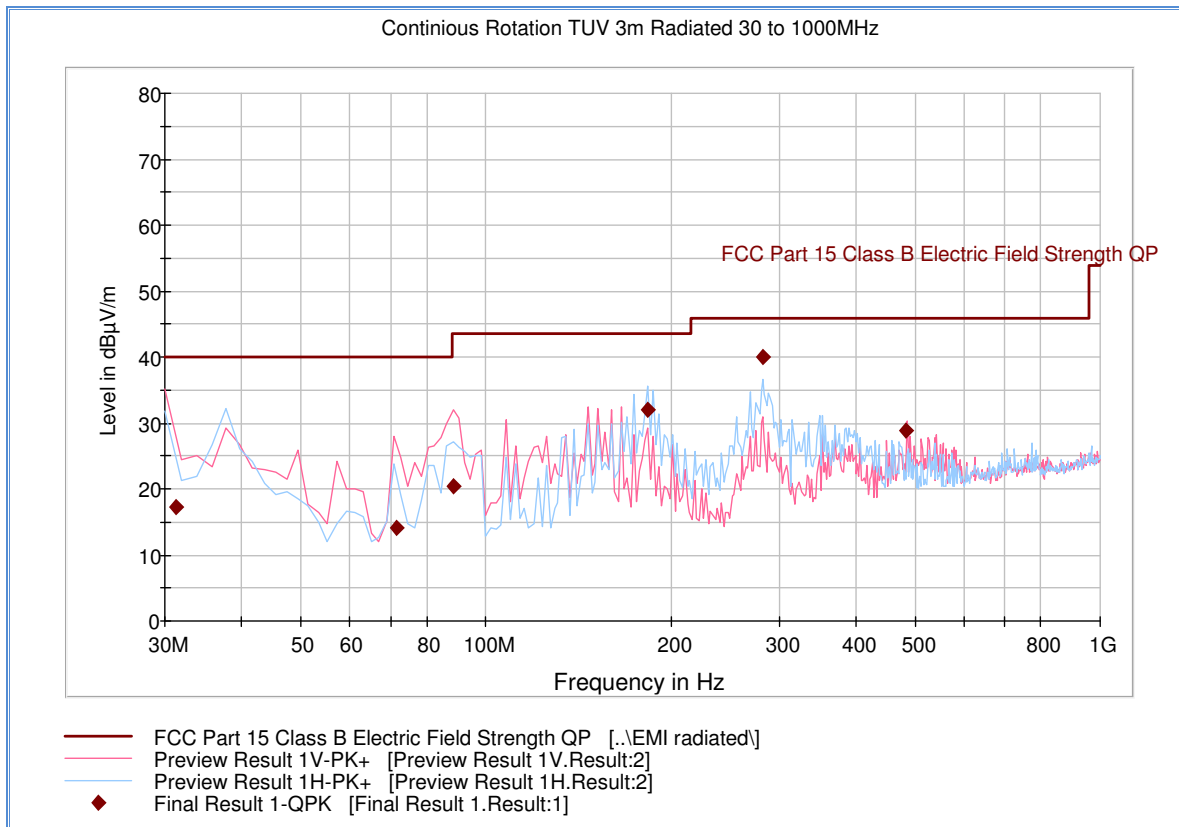
2.2.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (db μ V) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1016 (preamplifier)	-30.7	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (db μ V/m) @ 30MHz			11.8

2.2.9 Test Results

See attached plots.

2.2.9.1 Below 1GHz Radiated Emission Test

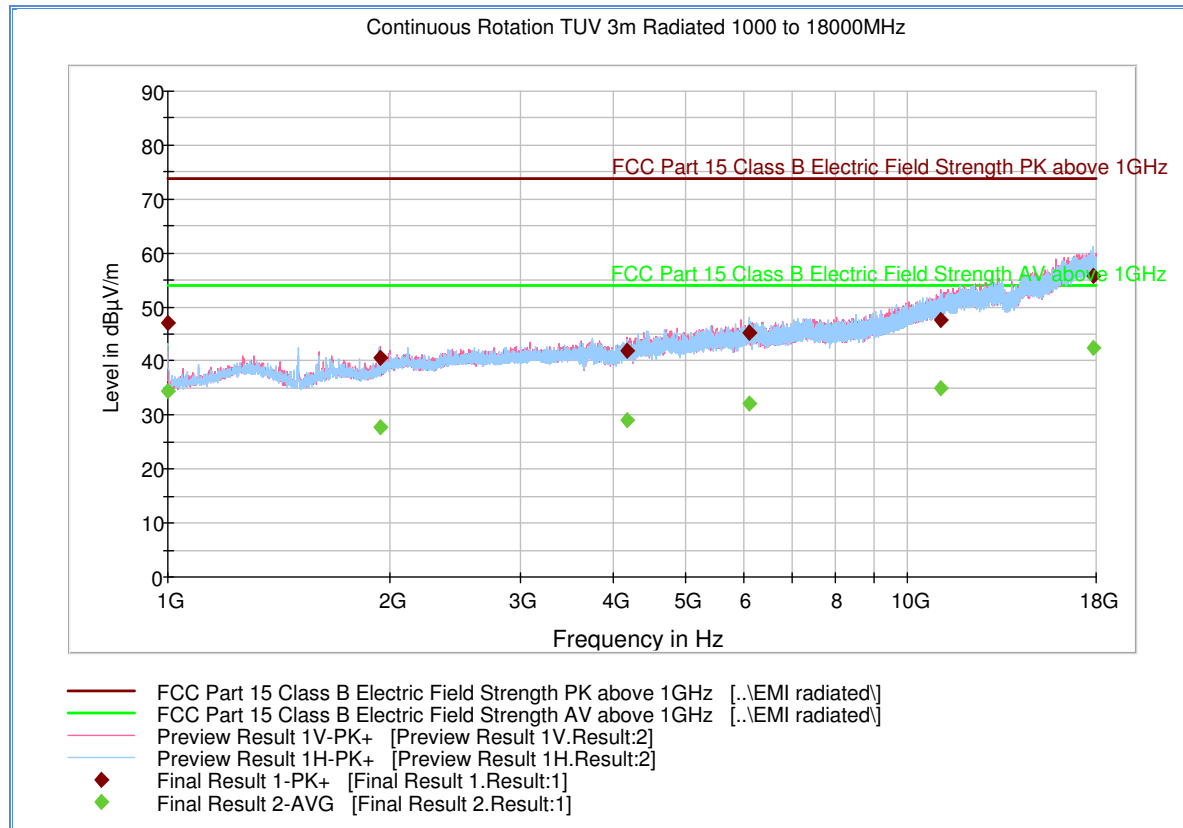


Quasi-Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
31.320000	17.2	1000.0	120.000	150.0	V	309.0	-11.6	22.8	40.0
71.501643	14.1	1000.0	120.000	105.0	V	230.0	-21.7	25.9	40.0
88.492745	20.4	1000.0	120.000	400.0	V	11.0	-20.3	23.1	43.5
183.727134	32.0	1000.0	120.000	150.0	H	15.0	-15.9	11.5	43.5
282.265411	40.0	1000.0	120.000	100.0	H	82.0	-12.3	6.0	46.0
483.869739	28.8	1000.0	120.000	105.0	V	96.0	-5.7	17.2	46.0

Test Notes:

2.2.9.2 Above 1GHz Radiated Emission Test



Peak Data

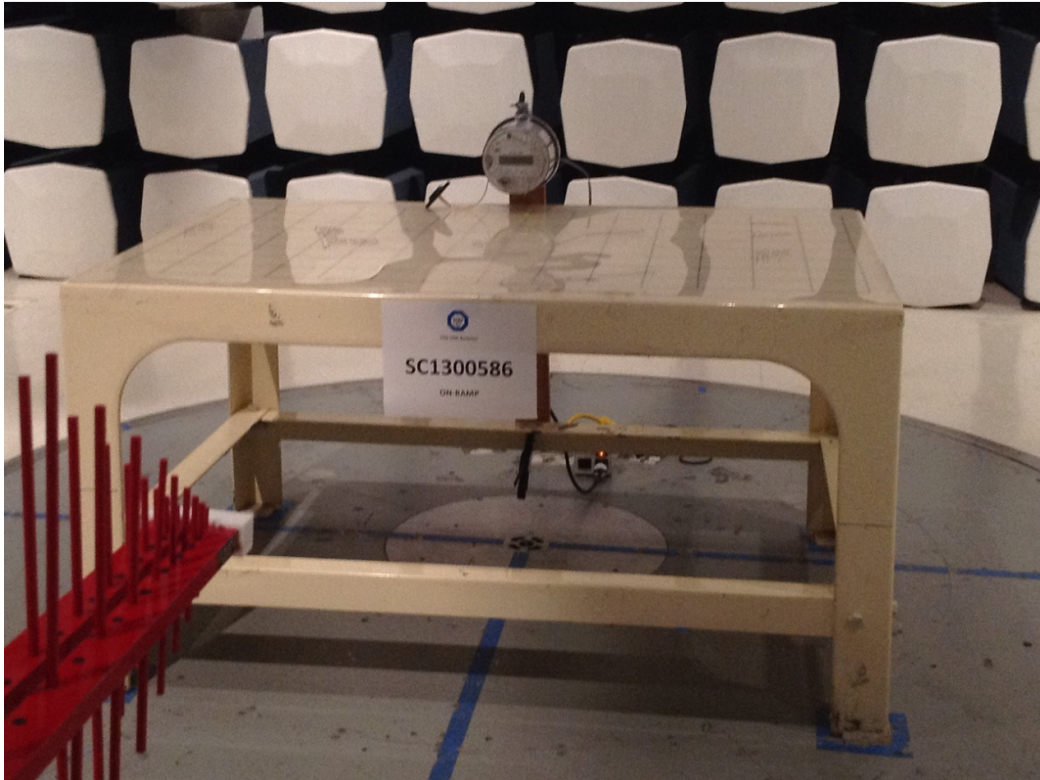
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	47.0	1000.0	1000.000	248.3	H	10.0	-6.3	26.9	73.9
1938.053333	40.7	1000.0	1000.000	333.1	V	212.0	-2.0	33.2	73.9
4187.160000	41.9	1000.0	1000.000	302.6	V	232.0	3.8	32.0	73.9
6118.560000	45.3	1000.0	1000.000	300.6	H	57.0	8.1	28.6	73.9
11091.46000	47.5	1000.0	1000.000	402.6	V	20.0	14.6	26.4	73.9
17880.21333	55.9	1000.0	1000.000	157.5	H	53.0	22.4	18.0	73.9

Average Data

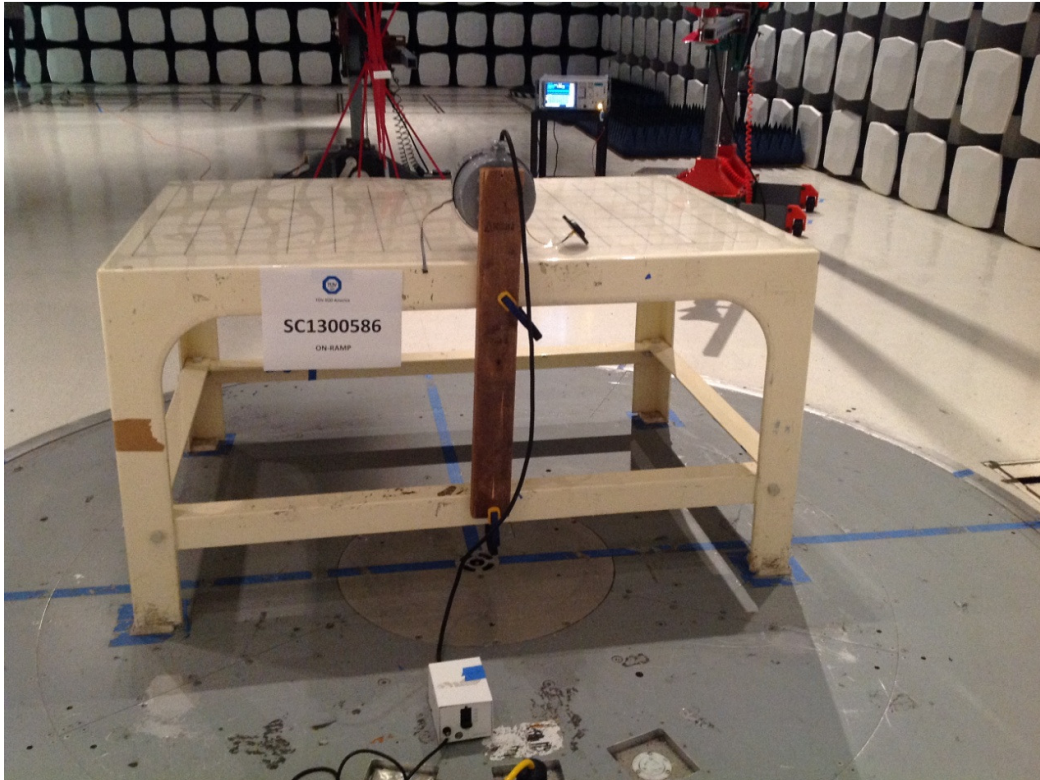
Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	34.5	1000.0	1000.000	248.3	H	10.0	-6.3	19.4	53.9
1938.053333	27.7	1000.0	1000.000	333.1	V	212.0	-2.0	26.2	53.9
4187.160000	29.0	1000.0	1000.000	302.6	V	232.0	3.8	24.9	53.9
6118.560000	32.2	1000.0	1000.000	300.6	H	57.0	8.1	21.7	53.9
11091.46000	35.0	1000.0	1000.000	402.6	V	20.0	14.6	18.9	53.9
17880.21333	42.5	1000.0	1000.000	157.5	H	53.0	22.4	11.4	53.9

Test Notes:

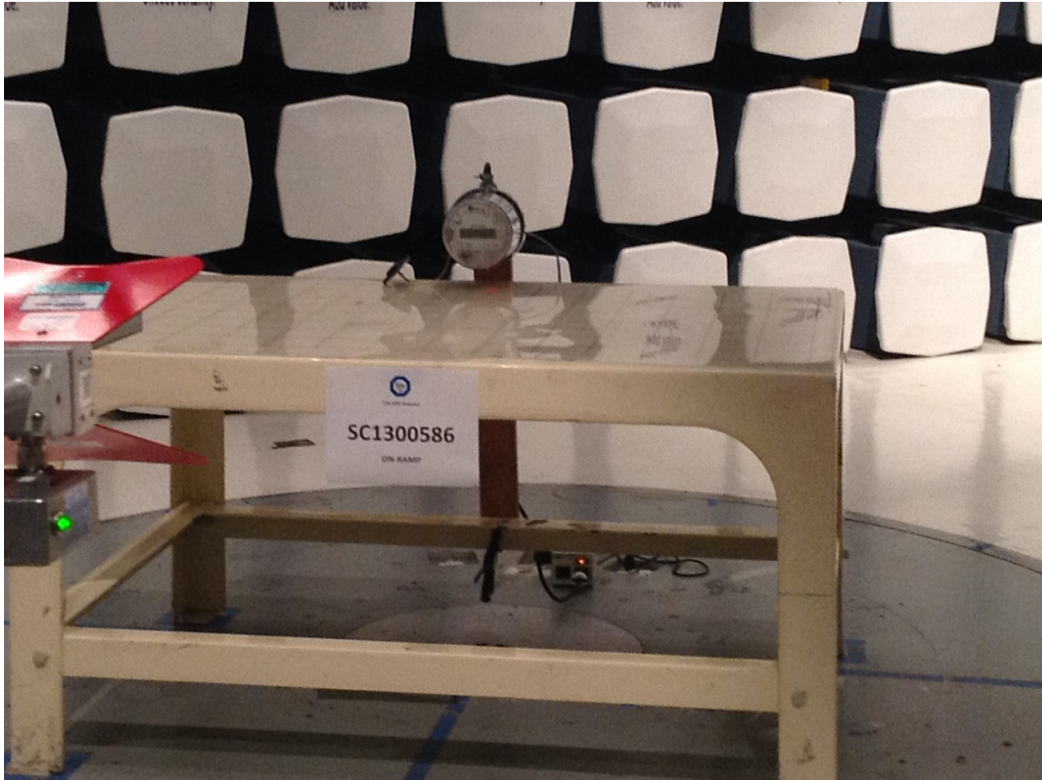
2.2.10 Test Setup Photo (Below 1GHz Front)



2.2.11 Test Setup Photo (Below 1GHz Back)



2.2.12 Test Setup Photo (Above 1GHz Front)



2.2.13 Test Setup Photo (Above 1GHz Back)





SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Conducted Emissions Test Setup						
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	06/13/12	07/13/13
7567	LISN	FCC-LISN-50-25-2-10	120304	Fischer Custom Comm.	01/11/13	06/11/14
8607	20dB Attenuator	CAT-20	N/A	MCL HAT-20	08/21/12	08/21/13
8609	20dB Attenuator	CAT-20	N/A	MCL HAT-20	08/21/12	08/21/13
Radiated Test Setup						
1002	Bilog Antenna	3142C	000058717	EMCO	01/21/13	01/21/14
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	03/25/13	03/25/14
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	09/21/12	09/21/13
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	09/21/12	09/21/13
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	08/10/12	08/10/13
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	06/13/12	07/13/13
1016	Pre-amplifier	PAM-0202	187	PAM	09/24/12	09/24/13
Miscellaneous						
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	08/12/12	08/12/13
6452	Multimeter	3478A	2911A52177	Hewlett Packard	07/16/12	07/16/13
	Test Software	EMC32	V8.52	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Radiated Emission Measurements (Below 1GHz)

Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					2.41
Coverage Factor (k):					2
Expanded Uncertainty:					4.82

3.2.2 Radiated Emission Measurements (Above 1GHz)

Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					2.40
Coverage Factor (k):					2
Expanded Uncertainty:					4.81

3.2.3 AC Mains Conducted Emissions Measurement

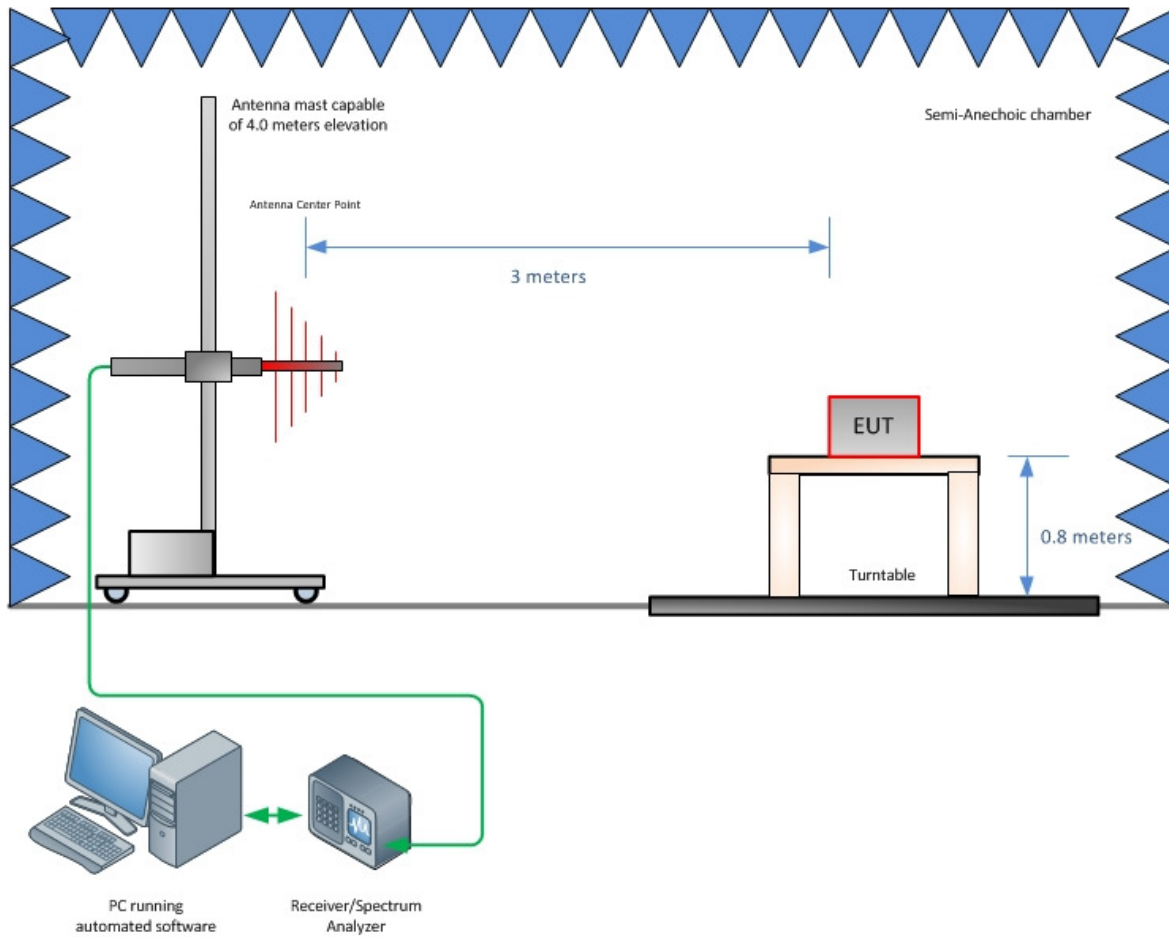
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.36	0.21	0.04
2	Cables	Rectangular	0.50	0.29	0.08
3	LISN	Rectangular	0.66	0.38	0.15
4	Attenuator	Rectangular	0.30	0.17	0.03
5	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					0.80
Coverage Factor (k):					2
Expanded Uncertainty:					1.59



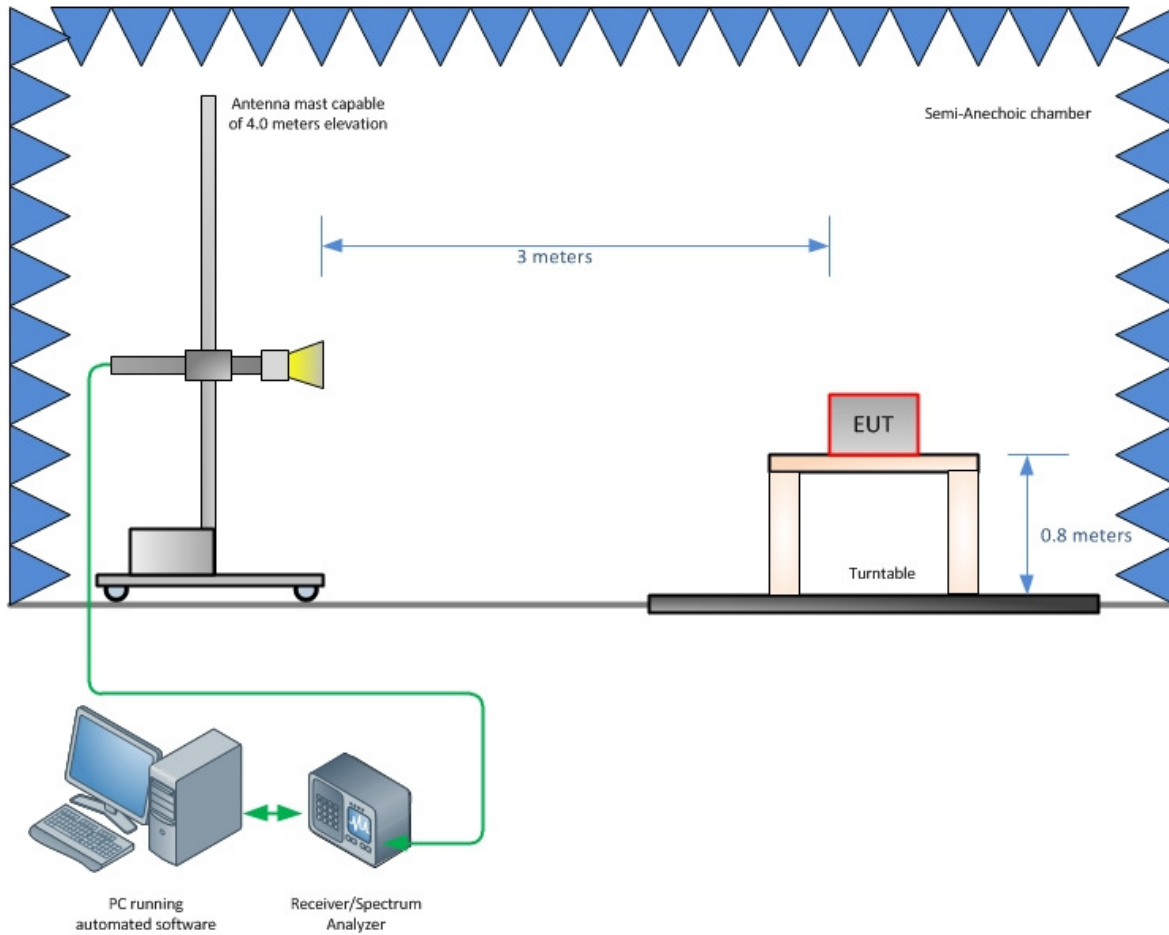
SECTION 4

DIAGRAM OF TEST SETUP

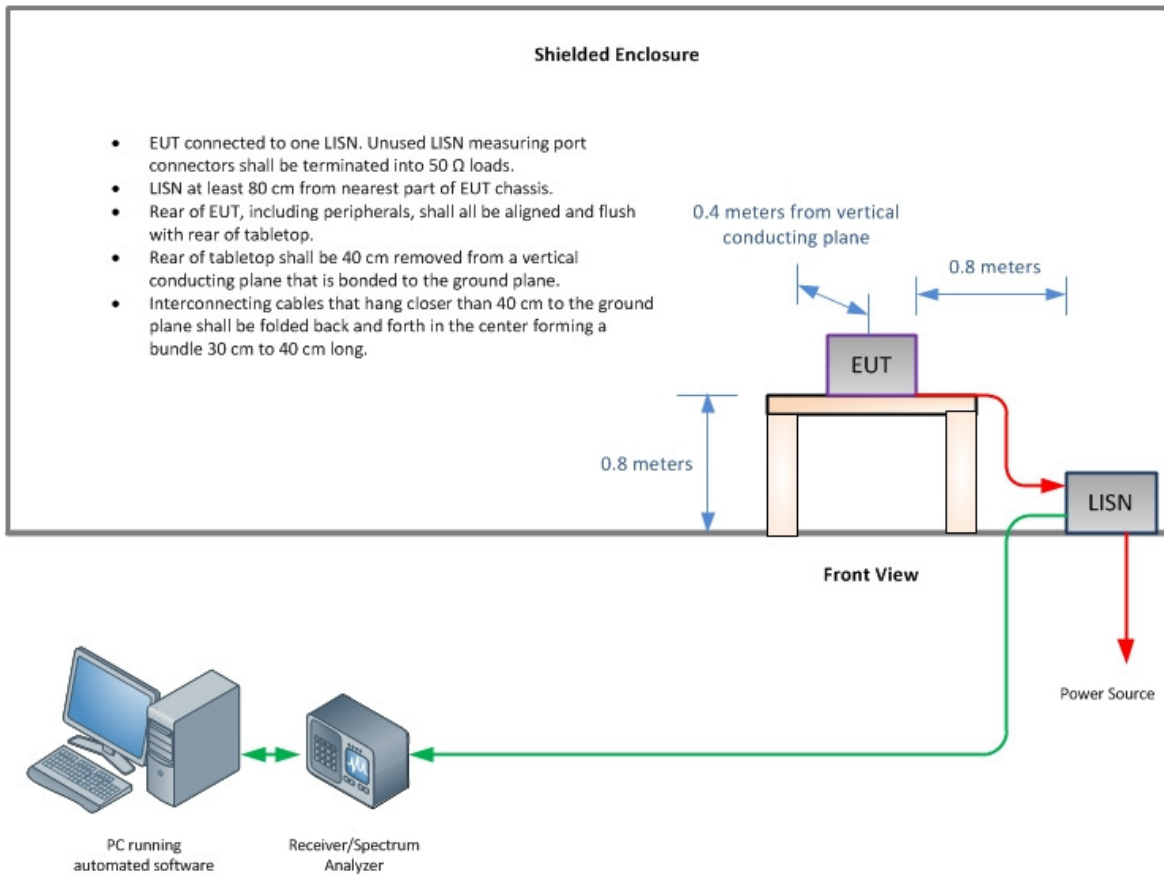
4.1 RADIATED EMISSION TEST SETUP (BELOW 1GHZ)



4.2 RADIATED EMISSION TEST SETUP (ABOVE 1GHZ)



4.3 CONDUCTED EMISSION TEST SETUP





SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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NVLAP Lab Code: 100268-0