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Report On

EMC Evaluation of
Hughes Network Systems
9211 Land Portable Satellite Terminal

FCC Part 15 Subpart B

Report No. SC1311930A Rev.1

September 2014



America

TÜV SÜD America Inc., 10040 Mesa Rim Road, San Diego, CA 92121
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REPORT ON	EMC Evaluation of the Hughes Network Systems 9211 Land Portable Satellite Terminal
TEST REPORT NUMBER	SC1311930A Rev.1
TEST REPORT DATE	September 2014
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DATED	<u>September 11, 2014</u>



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Revision History

SC1311930A Rev.1 Hughes Network Systems 9211 Land Portable Satellite Terminal					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
08/13/2014	Initial Release				Ferdinand Custodio
09/11/2014	Initial Release	Rev. 1	Removed EUT photos as per requested Short-Term Confidentiality		Juan M Gonzalez
			Reference to the FCC ID of the EUT added in the report		



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SECTION 1

REPORT SUMMARY

EMC Evaluation of the
Hughes Network Systems
9211 Land Portable Satellite Terminal



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Hughes Network Systems 9211 Land Portable Satellite Terminal to the requirements of

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	Hughes Network Systems
Model Number(s)	9211
Serial Number(s)	EUT#1-EMC
FCC ID	K3YHNS9211
Number of Samples Tested	1
Highest Frequency Generated or Used	2.472 GHz
Test Specification/Issue/Date	• FCC Part 15 Subpart B (October 1, 2013) • 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	May 22, 2014
Finish of Test	June 4, 2014
Name of Engineer(s)	Kathy MacKenzie
Related Document(s)	• Hughes Network Systems, LLC. Antenna, L-Band Transportable, Cage Code 3L0W2 No. 3500648, May 02, 2014. • Hughes 9211-HDR User Guide (Revision Draft 15 July 2013)



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.

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 Technical Description

The Equipment Under Test (EUT) was a Hughes Network Systems 9211 Land Portable Satellite Terminal. The EUT provides satellite connectivity over the Inmarsat BGAN satellite network. The EUT can send and receive IP packets via Ethernet and WLAN interface and also supports circuit switched voice and fax call via standard POTS interface.



1.3.2 Labelling Requirement for Part 15 (Verification) Device

See FCC Publication Number: 784748 for details:

<https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=27980&switch=P>

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	EUT in standby mode

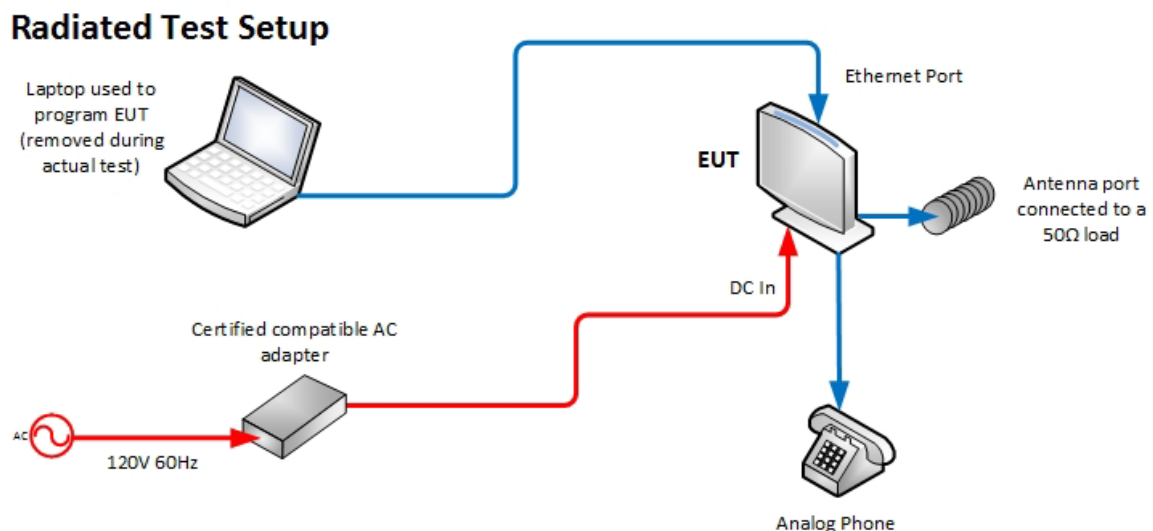
1.4.2 EUT Exercise Software

“Perl Command” software provided by the client was used to exercise the EUT. A file containing commands to change channels and modulation was also provided. Specific channel/modulation combination is copied from this file and transferred to the test software, once executed the EUT will transmit at max power (default setting if TX) at that channel.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Hughes	AC Adapter for EUT	Model: ATS065-A190 S/N N/A
Toshiba	Laptop	Model Satellite Pro 4600 S/N 91225670PU
Toshiba	Laptop External PSU	Model PA3049U-1ACA S/N 0008A0184957G
HP	Mouse for Laptop	Model M-UD43 S/N LZA03401471
GFM	Analog Telephone	Model: KT-887 S/N 7-19263-81663-4
-	Telco cable (analog phone to EUT)	2.1m unshielded RJ11 connector
-	CAT6 (Laptop to EUT)	2.1m unshielded RJ45 connector

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: EUT#1-EMC		
N/A		

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 LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 Fax: 858 546 0364.

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

Sony Electronics Inc., Building #8, 16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 942 5542 Fax: 858 546 0364.

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Registration No.: US1146

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 §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.



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

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

1.9.3 BSMI – Laboratory Code: SL2-IN-E-028R (US0102)

TÜV Product Service Inc. (San Diego) is a recognized EMC testing laboratory by the BSMI under the MRA (Mutual Recognition Arrangement) with the United States. Accreditation includes CNS 13438 up to 6GHz.

1.9.4 VCCI – Registration No. A-0132

TÜV SÜD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.



SECTION 2

TEST DETAILS

EMC Evaluation of the
Hughes Network Systems
9211 Land Portable Satellite Terminal

2.1 CONDUCTED EMISSIONS

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: EUT#1-EMC /Default Test Configuration

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

June 4, 2014/KAM

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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	24.0 °C
Relative Humidity	46.4 %
ATM Pressure	99.1 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.



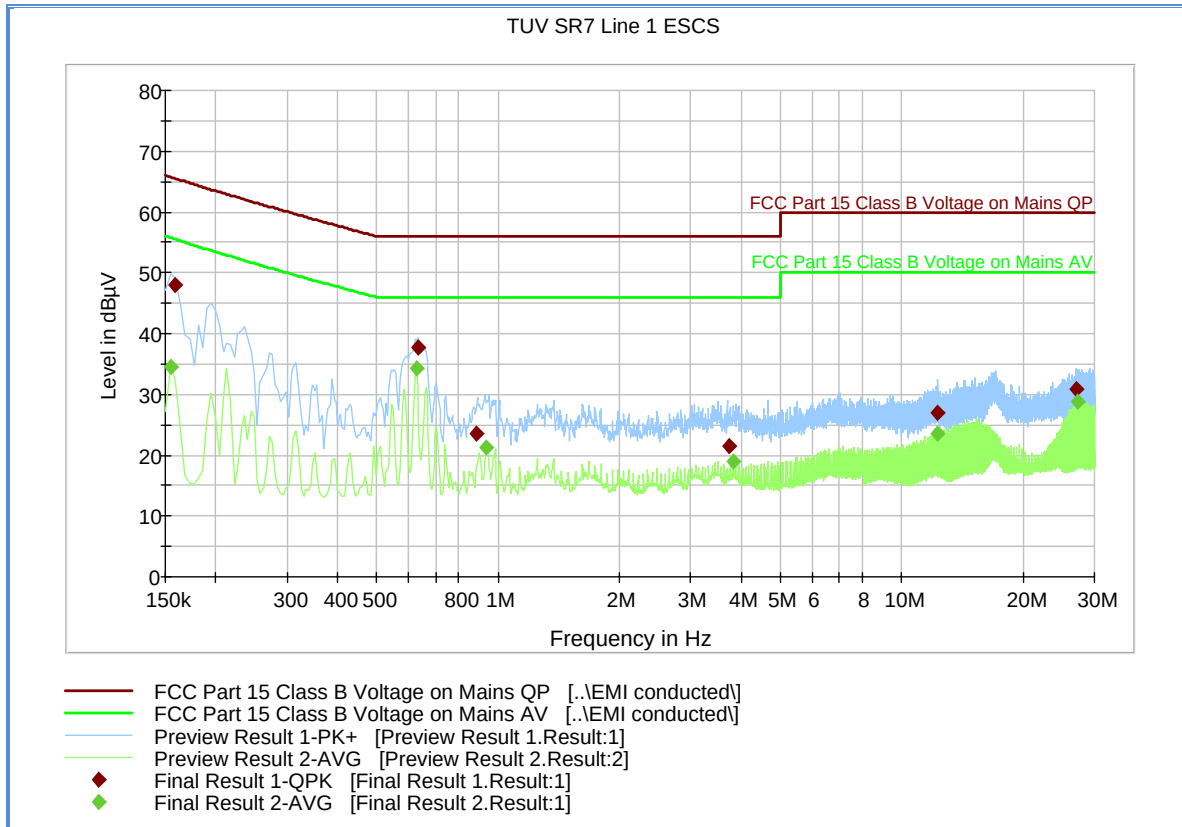
2.1.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (db μ V) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8822(20 dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7567(LISN)	0.30	
Reported QuasiPeak Final Measurement (db μ V) @ 150kHz			26.2

2.1.9 Test Results

Compliant. See attached plots and tables.

2.1.10 FCC Class B 120V 60Hz (Line 1)



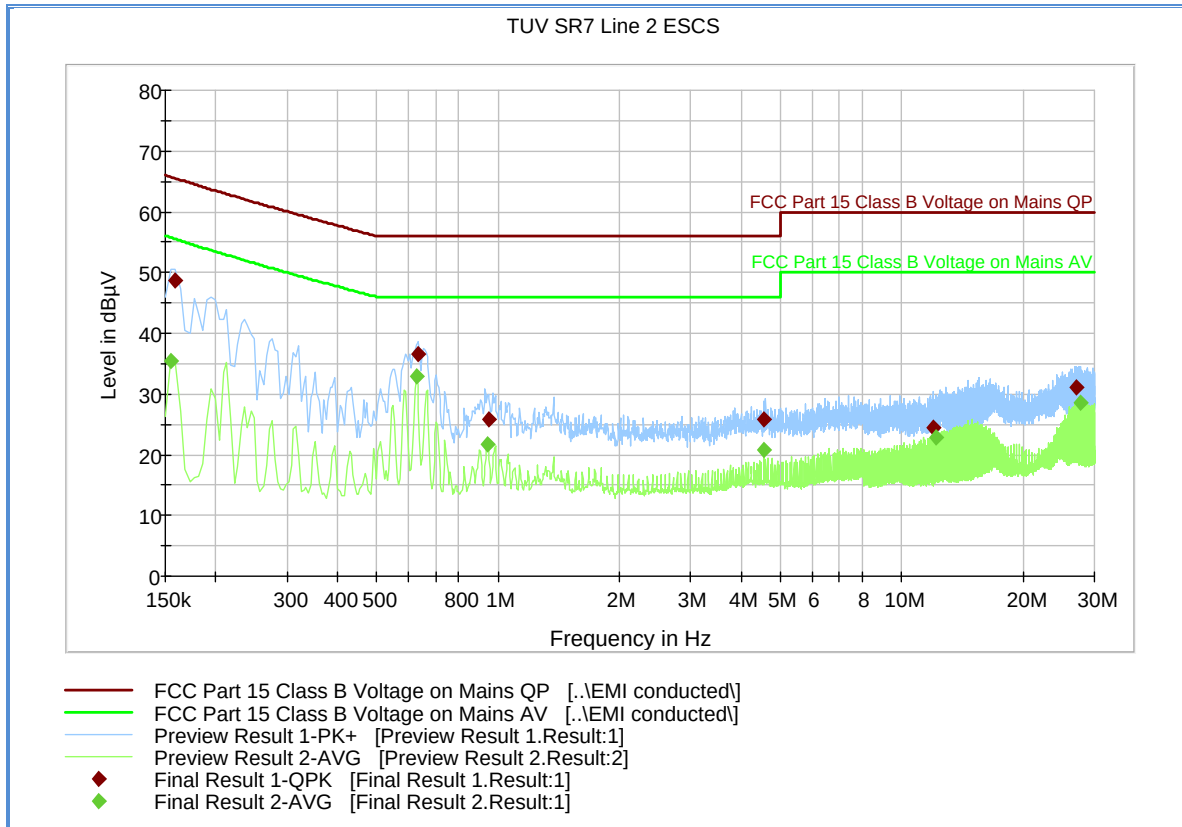
Quasi Peak

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)
0.159000	48.0	1000.0	9.000	Off	L1	20.1	17.5	65.5
0.631500	37.7	1000.0	9.000	Off	L1	20.1	18.3	56.0
0.883500	23.6	1000.0	9.000	Off	L1	20.0	32.4	56.0
3.732000	21.5	1000.0	9.000	Off	L1	20.4	34.5	56.0
12.241500	26.9	1000.0	9.000	Off	L1	20.7	33.1	60.0
27.019500	30.7	1000.0	9.000	Off	L1	20.9	29.3	60.0

Average

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBμV)
0.154500	34.6	1000.0	9.000	Off	L1	20.1	21.1	55.7
0.627000	34.3	1000.0	9.000	Off	L1	20.1	11.7	46.0
0.937500	21.3	1000.0	9.000	Off	L1	20.1	24.7	46.0
3.817500	18.9	1000.0	9.000	Off	L1	20.4	27.1	46.0
12.304500	23.6	1000.0	9.000	Off	L1	20.7	26.4	50.0
27.204000	28.7	1000.0	9.000	Off	L1	20.9	21.3	50.0

2.1.11 FCC Class B 120V 60Hz (Line 2)



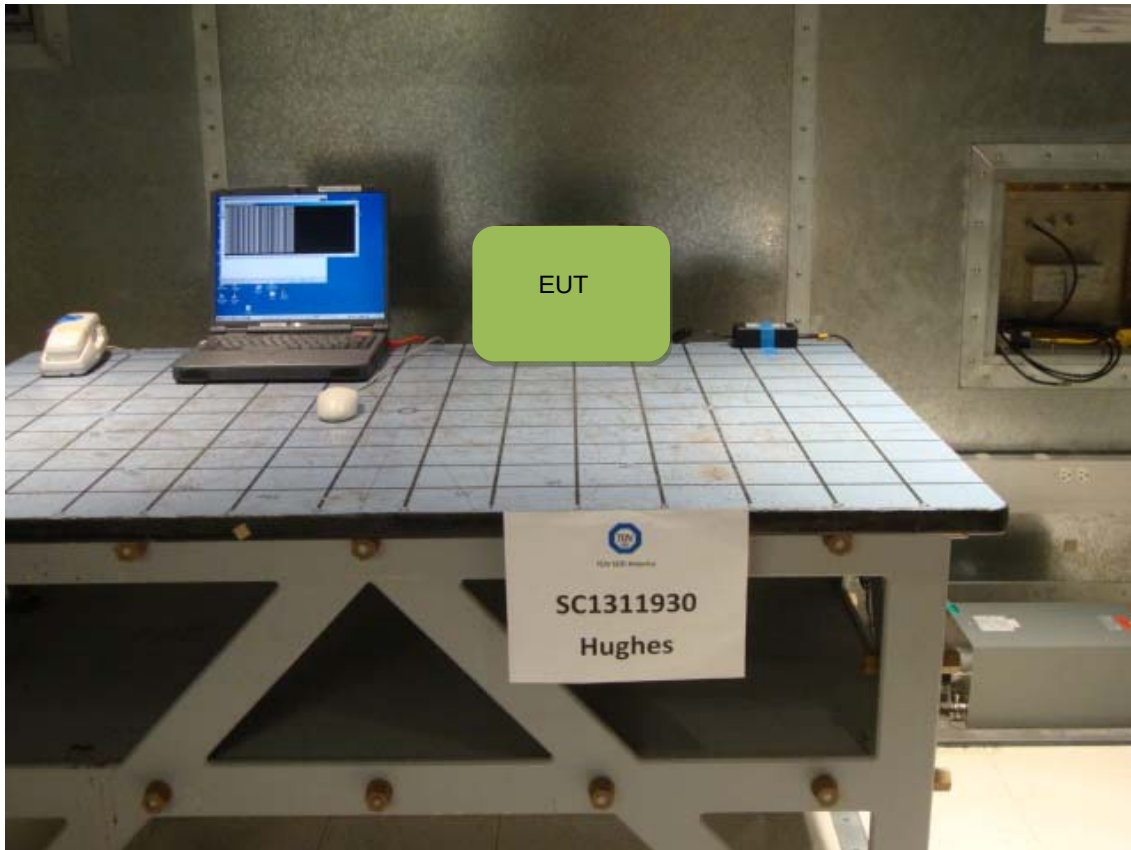
Quasi Peak

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV)
0.159000	48.8	1000.0	9.000	Off	N	20.1	16.7	65.5
0.631500	36.6	1000.0	9.000	Off	N	20.0	19.4	56.0
0.951000	25.8	1000.0	9.000	Off	N	20.0	30.2	56.0
4.551000	25.7	1000.0	9.000	Off	N	20.4	30.3	56.0
11.953500	24.4	1000.0	9.000	Off	N	20.5	35.6	60.0
27.082500	31.0	1000.0	9.000	Off	N	20.8	29.0	60.0

Average

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBμV)
0.154500	35.4	1000.0	9.000	Off	N	20.1	20.3	55.7
0.627000	33.0	1000.0	9.000	Off	N	20.0	13.0	46.0
0.942000	21.7	1000.0	9.000	Off	N	20.0	24.3	46.0
4.551000	20.7	1000.0	9.000	Off	N	20.4	25.3	46.0
12.183000	22.9	1000.0	9.000	Off	N	20.5	27.1	50.0
27.631500	28.6	1000.0	9.000	Off	N	20.8	21.4	50.0

2.1.12 Test Setup Photo (Front)



2.1.13 Test Setup Photo (Back)



2.2 RADIATED EMISSION

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: EUT#1-EMC /Default Test Configuration

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

May 21, 2014/KAM

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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	24.1 °C
Relative Humidity	43.9 %
ATM Pressure	99.2 kPa

2.2.7 Additional Observations

- The spectrum was searched from 30MHz to 18GHz
- Verification was performed at 3 meters.
- 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.



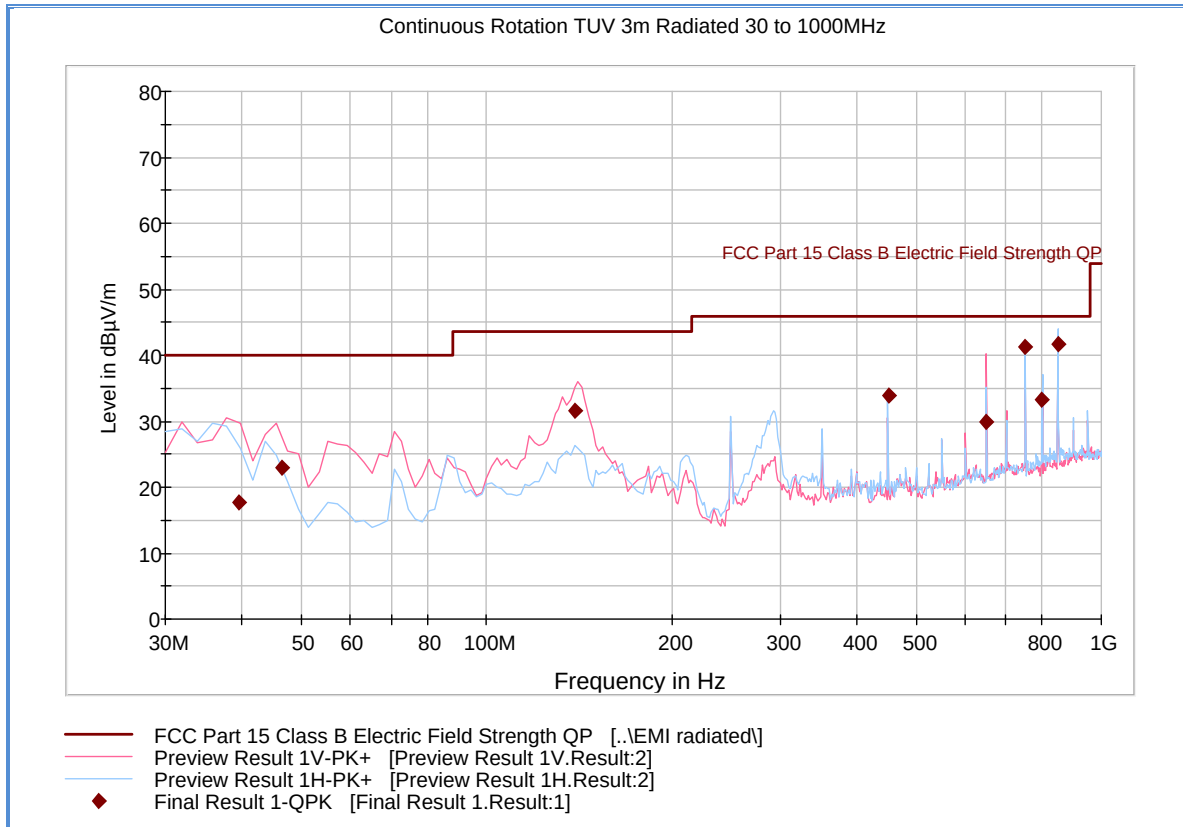
2.2.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbμV) @ 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# 1033 (antenna)	17.2	
Reported QuasiPeak Final Measurement (dbμV/m) @ 30MHz			11.8

2.2.9 Test Results

See attached plots.

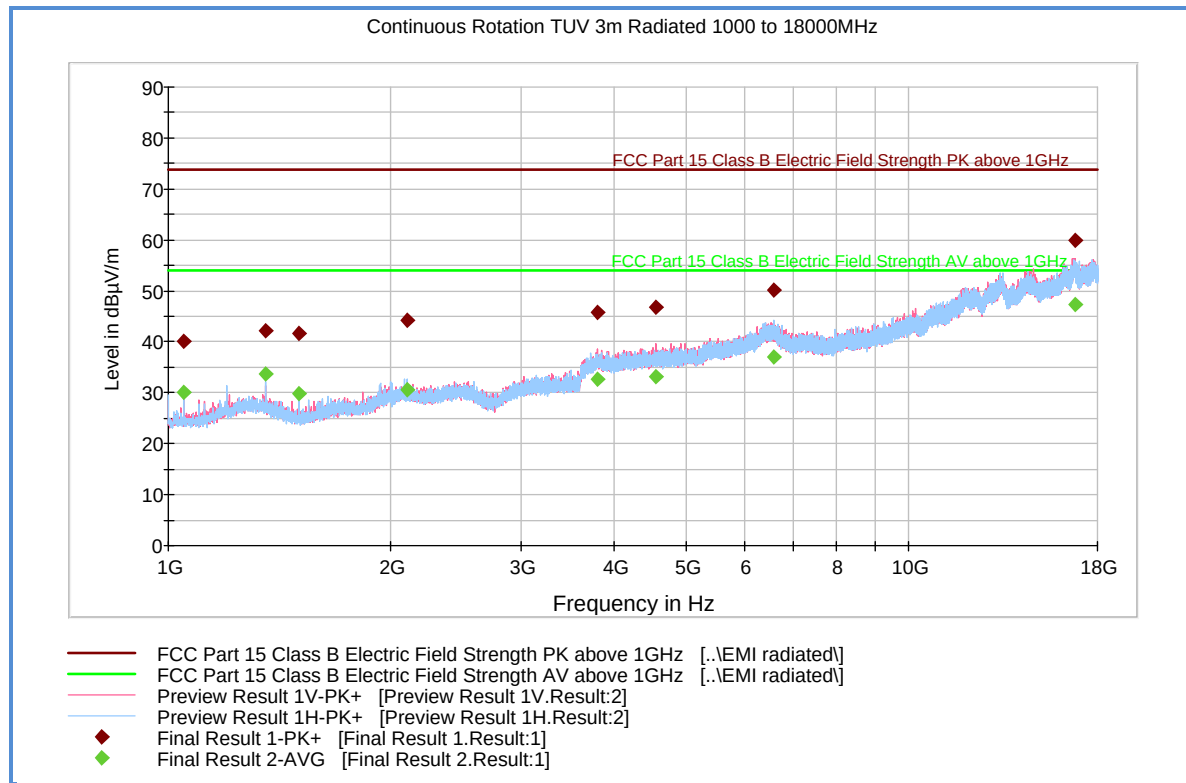
2.2.9.1 Below 1GHz Radiated Emission Test



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)
39.455551	17.7	1000.0	120.000	150.0	V	342.0	-15.5	22.3	40.0
46.471102	22.9	1000.0	120.000	100.0	V	189.0	-17.9	17.1	40.0
139.361603	31.5	1000.0	120.000	100.0	V	10.0	-19.1	12.0	43.5
449.999760	33.9	1000.0	120.000	100.0	H	185.0	-7.0	12.1	46.0
650.020200	29.8	1000.0	120.000	250.0	V	190.0	-2.7	16.2	46.0
750.022365	41.2	1000.0	120.000	109.0	H	27.0	-0.8	4.8	46.0
800.043447	33.3	1000.0	120.000	110.0	H	178.0	-0.5	12.7	46.0
850.040641	41.6	1000.0	120.000	100.0	H	279.0	0.7	4.4	46.0

2.2.9.2 Above 1GHz Radiated Emission Test



Peak Data

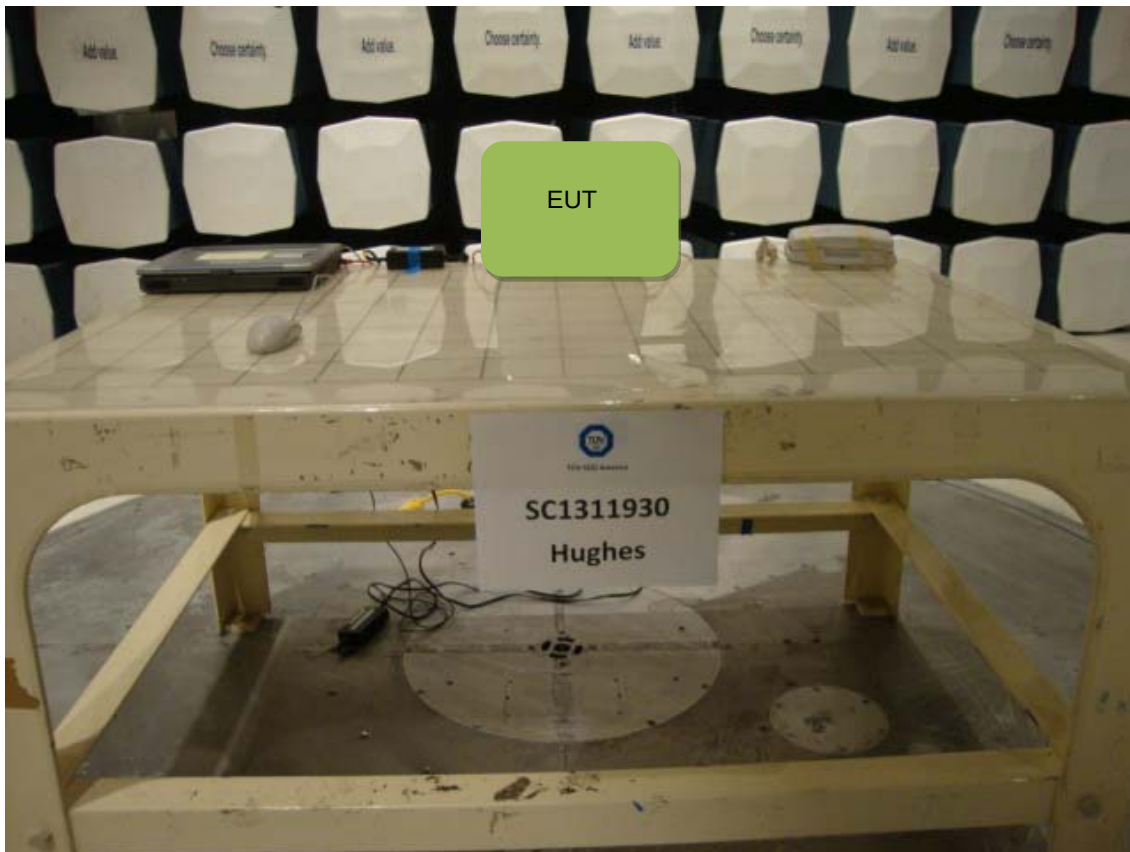
Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1050.466667	40.0	1000.0	1000.000	152.7	H	177.0	-6.8	33.9	73.9
1354.000000	42.2	1000.0	1000.000	99.7	H	266.0	-5.0	31.7	73.9
1500.000000	41.7	1000.0	1000.000	139.7	H	218.0	-5.1	32.2	73.9
2098.733333	44.2	1000.0	1000.000	267.3	H	96.0	-1.0	29.7	73.9
3798.400000	45.9	1000.0	1000.000	143.7	V	20.0	5.9	28.0	73.9
4549.166667	46.9	1000.0	1000.000	379.1	V	207.0	7.0	27.0	73.9
6581.100000	50.1	1000.0	1000.000	401.7	H	266.0	12.8	23.8	73.9
16790.36666	59.9	1000.0	1000.000	280.2	V	330.0	25.9	14.0	73.9

Average Data

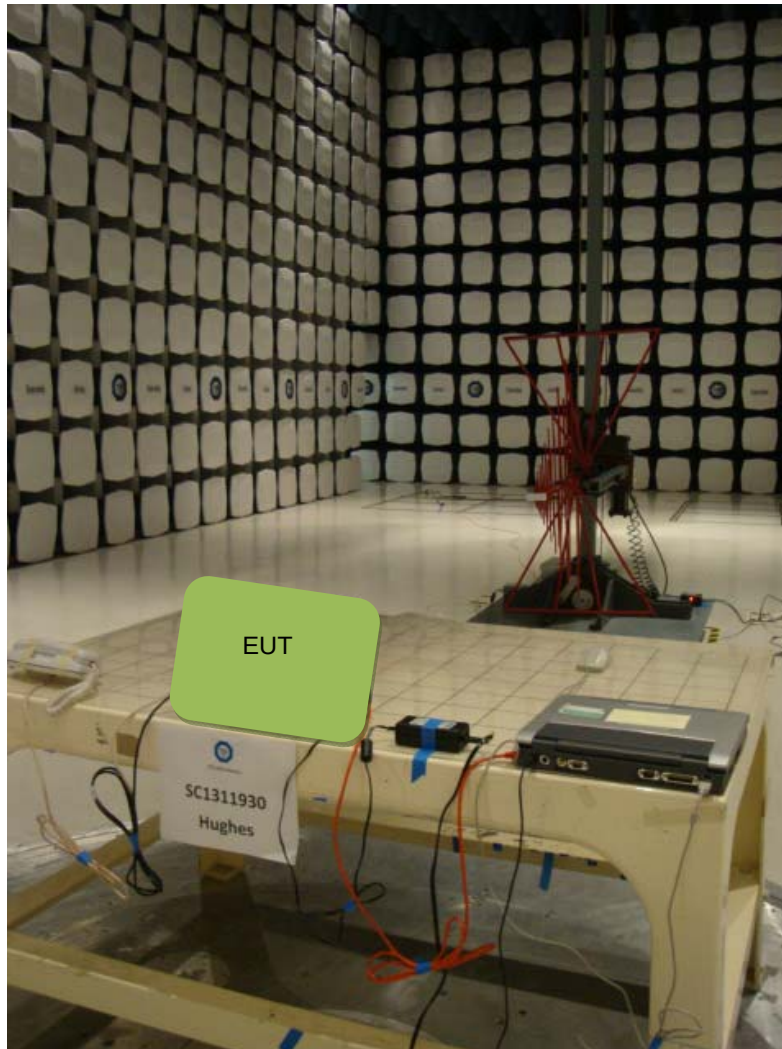
Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1050.466667	30.1	1000.0	1000.000	152.7	H	177.0	-6.8	23.8	53.9
1354.000000	33.8	1000.0	1000.000	99.7	H	266.0	-5.0	20.1	53.9
1500.000000	29.7	1000.0	1000.000	139.7	H	218.0	-5.1	24.2	53.9
2098.733333	30.6	1000.0	1000.000	267.3	H	96.0	-1.0	23.3	53.9
3798.400000	32.7	1000.0	1000.000	143.7	V	20.0	5.9	21.2	53.9
4549.166667	33.3	1000.0	1000.000	379.1	V	207.0	7.0	20.6	53.9
6581.100000	37.1	1000.0	1000.000	401.7	H	266.0	12.8	16.8	53.9
16790.36666	47.2	1000.0	1000.000	280.2	V	330.0	25.9	6.7	53.9

Test Notes: Support laptop turned off before the start of the test no minimize radiated emissions coming from support equipment. All radios are in "standby" mode.

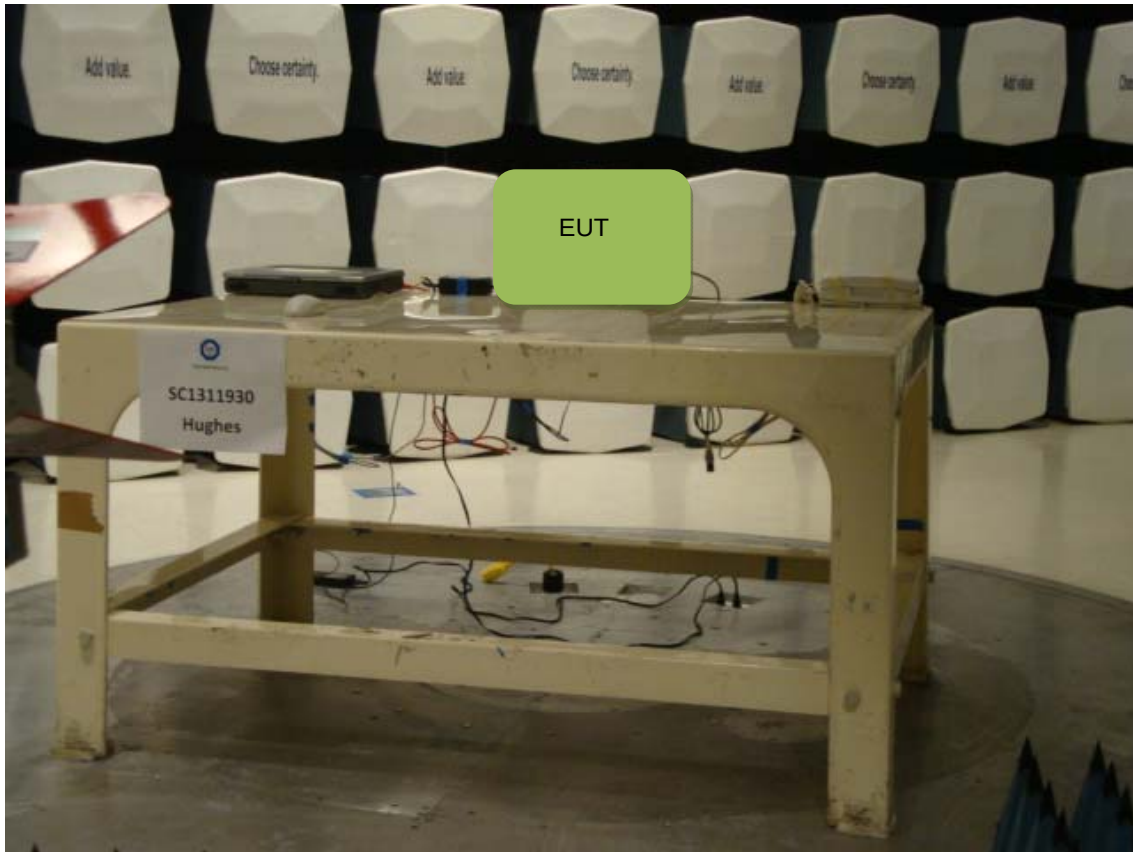
2.2.9.3 Test Setup Photo (Below 1GHz Front)



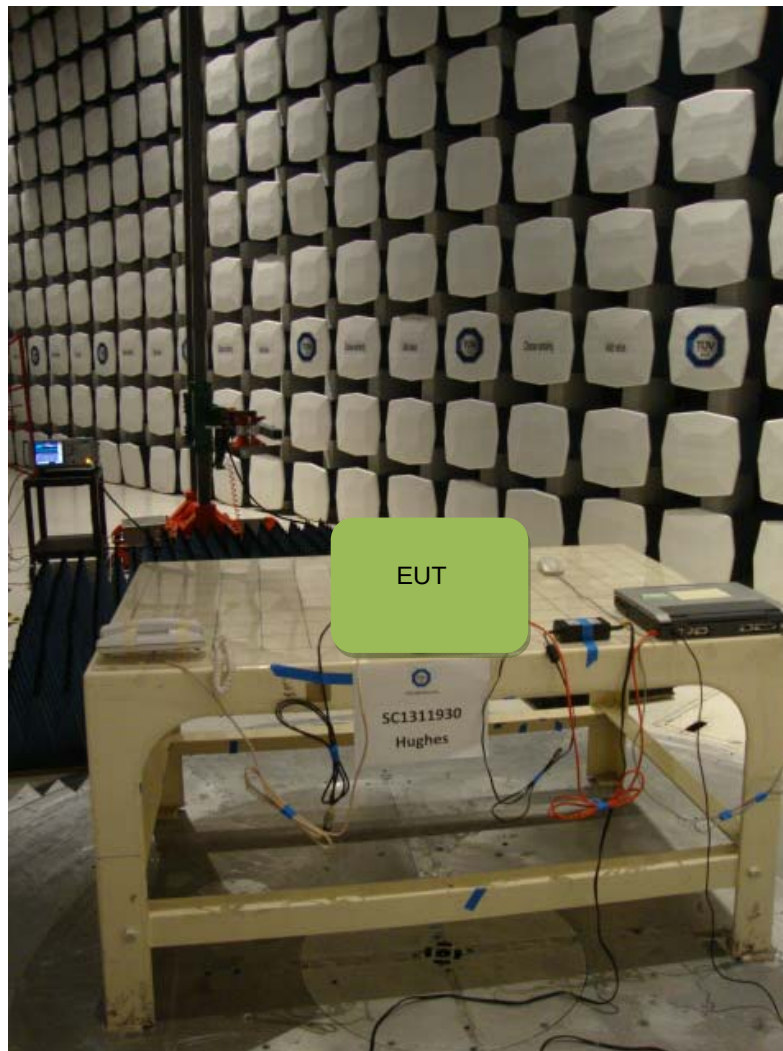
2.2.9.4 Test Setup Photo (Below 1GHz Back)



2.2.9.5 Test Setup Photo (Above 1GHz Front)



2.2.9.6 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						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	04/05/14	04/05/15
7568	LISN	FCC-LISN-50-25-2-10	120305	Fischer Custom Comm.	07/10/13	07/10/14
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	01/30/14	01/30/15
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	01/30/14	01/30/15
Radiated Emissions						
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	07/31/13	07/31/14
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
1016	Pre-amplifier	PAM-0202	187	PAM	10/08/13	10/08/14
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	04/08/14	04/08/15
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	04/03/14	04/03/15
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	04/03/14	04/03/15
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/14	03/17/15
Miscellaneous						
6452	Multimeter	3478A	2911A52177	Hewlett Packard	08/02/13	08/02/14
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	01/30/14	01/30/15
	Test Software	EMC32	V8.53	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 Conducted Emissions Measurement

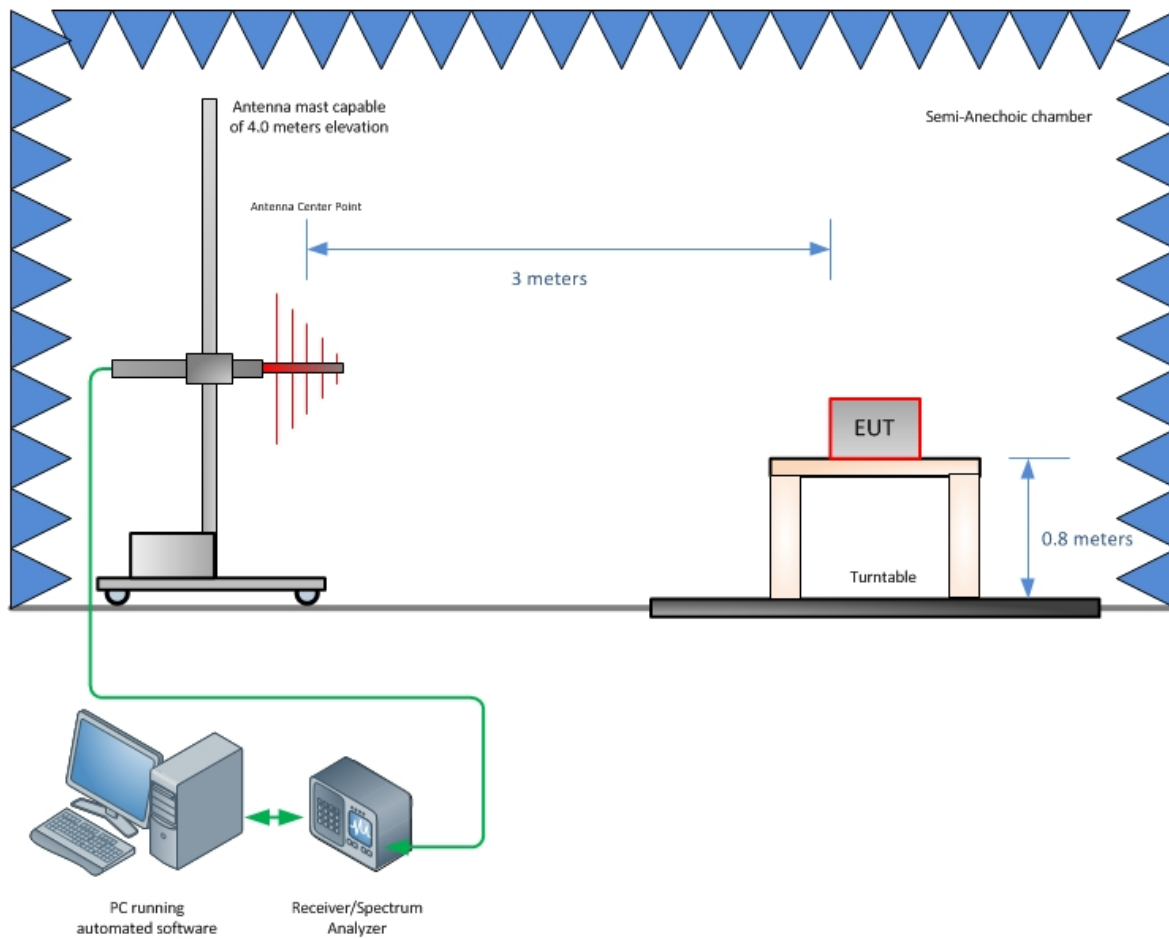
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.36	0.21	0.04
2	Cables	Rectangular	0.50	0.29	0.08
3	LISN	Rectangular	0.66	0.38	0.15
	Attenuator	Rectangular	0.30	0.17	0.03
Combined Uncertainty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



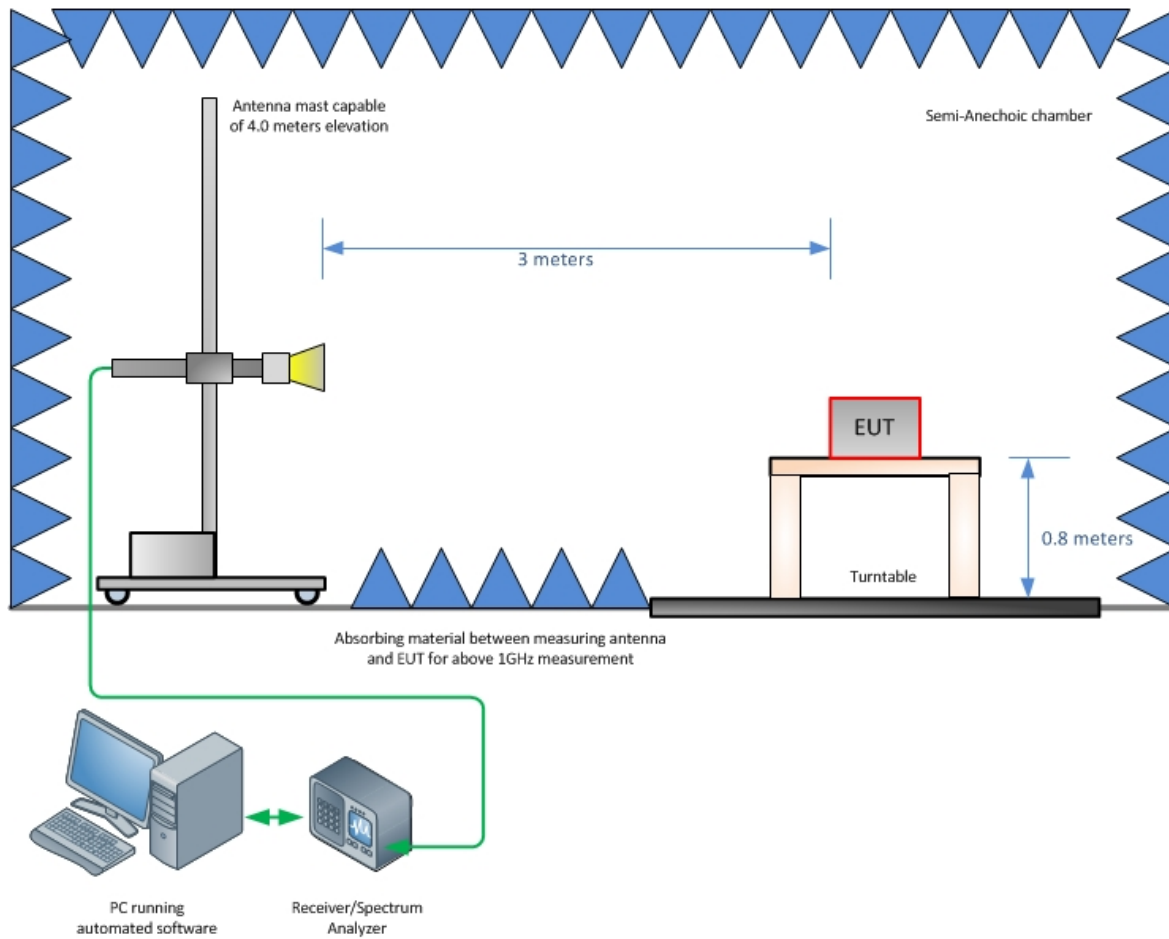
SECTION 4

DIAGRAM OF TEST SETUP

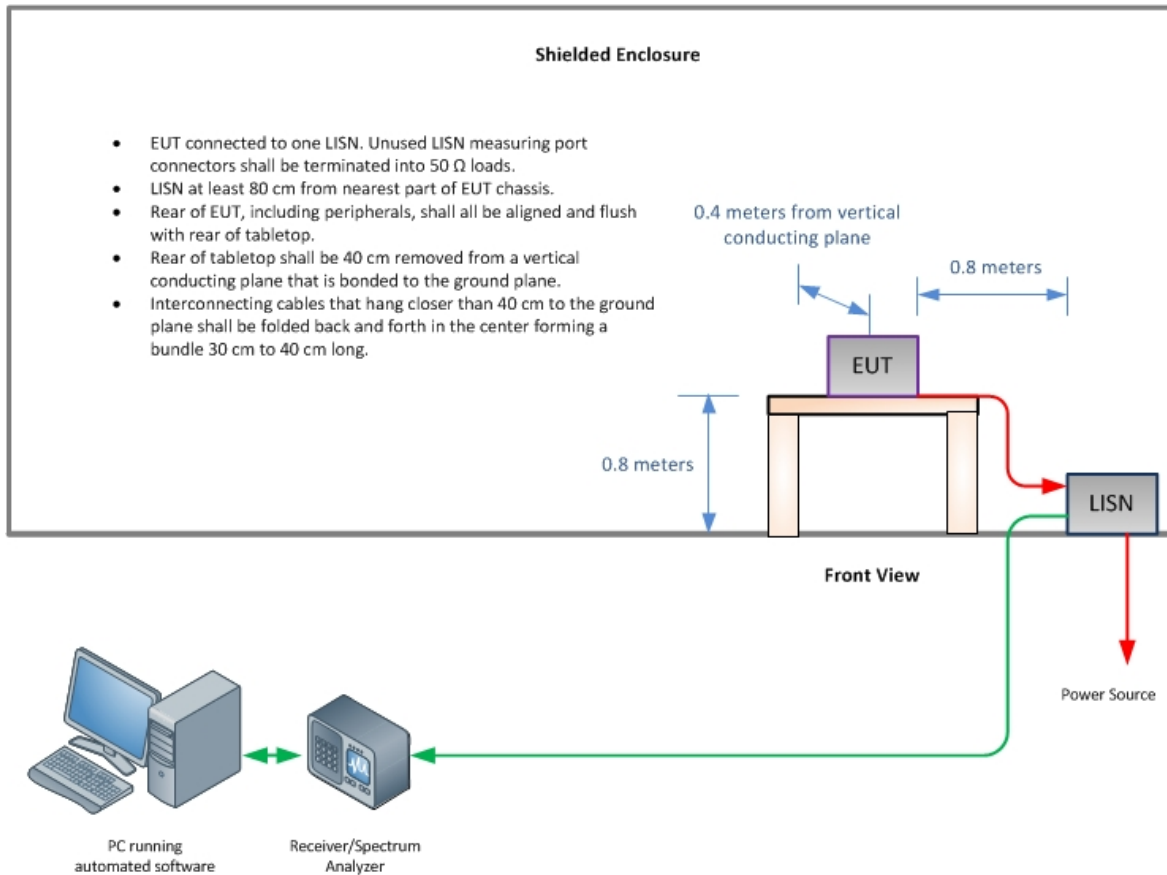
4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)



Conducted Emission Test Setup



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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