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Report On

Radio Testing of the
Hughes Network Systems
Land Portable Terminal Model 9202

FCC Part 15 Subpart B

Report No. SC1102725E July 2011

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

REPORT ON	Radio Testing of the Hughes Network Systems Land Portable Terminal
TEST REPORT NUMBER	SC1102725E
	July 2011
PREPARED FOR	Hughes Network Systems 9605 Scranton Road, Suite 500, San Diego, CA 92121
PREPARED BY	Ferdinand S. Custodio **Name** Title: EMC/Wireless Test Engineer
APPROVED BY	Chip R. Fleury **Name** Authorized Signatory
DATED	July 15, 2011

CONTENTS

SECTION 1

REPORT SUMMARY

Radio Testing of the
Hughes Network Systems
Land Portable Terminal

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Radio Testing of the Hughes Network Systems Land Portable Terminal to the requirements of FCC Part 15 Subpart B

Objective	To perform Radio Testing 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)	Model 9202
Serial Number(s)	004401-64-001017-5
Number of Samples Tested	1
Test Specification/Issue/Date	FCC Part 15 Subpart B (October 1, 2010)
Start of Test	July 14, 2011
Finish of Test	July 14, 2011
Name of Engineer(s)	Ferdinand S. Custodio
Related Document(s)	None

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	
§15.109	Radiated Emission Limits	Compliant	

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Hughes Network Systems Land Portable Terminal as shown in the photograph below. The GPS antenna port and the external satellite antenna port will not be available on the final production units.

Equipment Under Test

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1.3.2 EUT General Description

The Hughes 9202 Land Portable terminal operates as an Inmarsat BGAN Class 2 satellite terminal providing packet data and voice communications over Inmarsat's BGAN (Broadband Global Area Network) constellation of three geo-stationary I-4 satellites - *see Figure 2*. The 9202 terminal will also operate with Inmarsat's new Alphasat I-XL extended L-band satellite when launched in 2012. The Alphasat I-XL satellite will operate in parallel with the I-4 satellites, with its coverage centered over Africa and providing additional coverage to Europe, the Middle-East and parts of Asia.

Each I-4 satellite broadcasts: (i) a single Global beam which broadcasts system information; (ii) 19 Regional beams which are used for access control; (iii) around 200 Narrow beams used for data.

- The forward link (from the satellite) is TDM, L-band 1525 to 1559 MHz.
- The return link (to the satellite) is TDMA, L-band 1626.5 to 1660.5 MHz.

The Alphasat I-XL satellite will provide an extended frequency range operating capability:

- Forward: 1518 to 1559 MHz, and
- Return: 1626.5 to 1660.5 MHz, and 1668 to 1675 MHz (there is a gap between 1660.5 and 1668).

The channel plan is controlled by the network which tells the terminal which channel to use. Channels are up to 200 KHz wide and each 200 KHz sub-band can be assigned to one terminal or shared between multiple terminals. The system includes closed loop power control, and the terminal also includes power control to maintain Tx power within ± 1dB. The Tx power EIRP is 15.1dBW. The Hughes 9202 Land Portable terminal has an internal satellite antenna with a gain of 12dBi.

The return link (to the satellite) bearer types available are described in *Figure 1.*

Bearer Type	Modulation Type	Channel Spacing	Burst Length
R20T05Q	QPSK	22.22 KHz	20 ms
R5T1X	16-QAM	44.44 KHz	5 ms
R20T1X	16-QAM	44.44 KHz	20 ms
R20T1Q	QPSK	44.44 KHz	20 ms
R5T2X	16-QAM	88.88 KHz	5 ms
R20T2X	16-QAM	88.88 KHz	20 ms
R5T2Q	QPSK	88.88 KHz	5 ms
R20T2Q	QPSK	88.88 KHz	20 ms
R5T4.5X	16-QAM	200 KHz	5 ms
R20T4.5X	16-QAM	200 KHz	20 ms
R5T4.5Q	QPSK	200 KHz	5 ms
R20T4.5Q	QPSK	200 KHz	20 ms

Figure 1. Return Link Bearer Types

The Hughes 9202 Land Portable terminal is designed as a portable unit. It will operate either from its internal rechargeable Li-Ion battery pack, or from the supplied AC/DC adapter. User connectivity is provided by single Ethernet, ISDN, and POTS ports, and Wi-Fi via an internal 802.11b WLAN card and antenna, The Ethernet port and Wi-Fi access provide connection to a computer or wireless device to allow setup and monitoring actions to be performed. The ISDN and POTS port on the 9202 terminal are for connection to an ISDN telephone handset, and POTS telephone handset or Fax; they do not connect to a Telco line, the connection is made over the satellite.

An integrated SIM carrier enables a user to insert a SIM card to gain access to authorized Inmarsat services. An internal GPS receiver in the terminal provides location information.

To establish a connection with the Inmarsat BGAN network, the user determines the satellite's position from a GPS fix provided by the terminal. The user then points the terminal with its internal satellite antenna to the satellite's position, assisted by audio tones and LCD indicators to determine optimal signal strength. Once locked on, the terminal will register with the BGAN network and communications can proceed. Network connectivity is illustrated in Figure 3

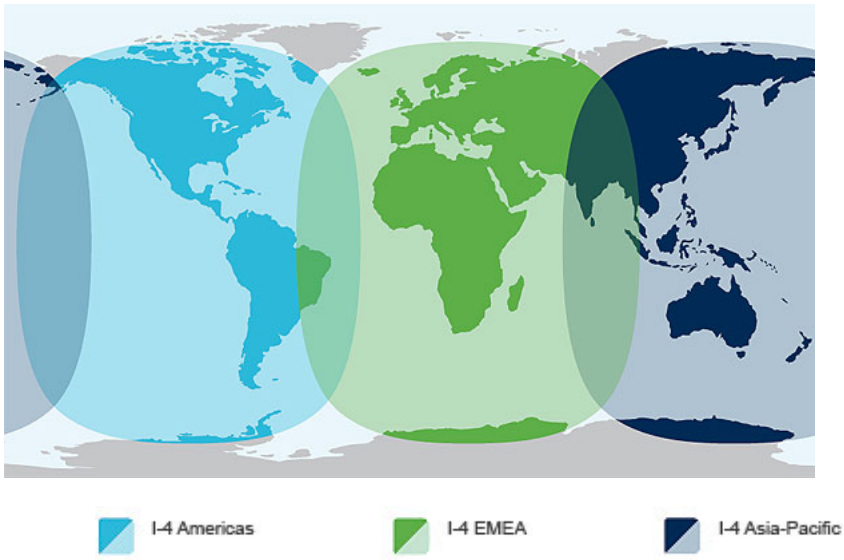


Figure 2. Inmarsat BGAN Global Coverage Map with I-4 Satellites

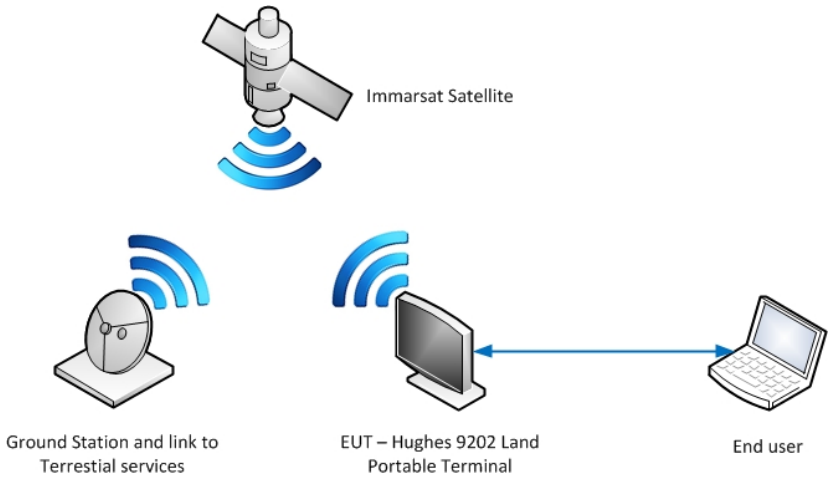


Figure 3. Network Connectivity

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
	Constant communication between the support laptop and the EUT. All standard I/O ports are populated.

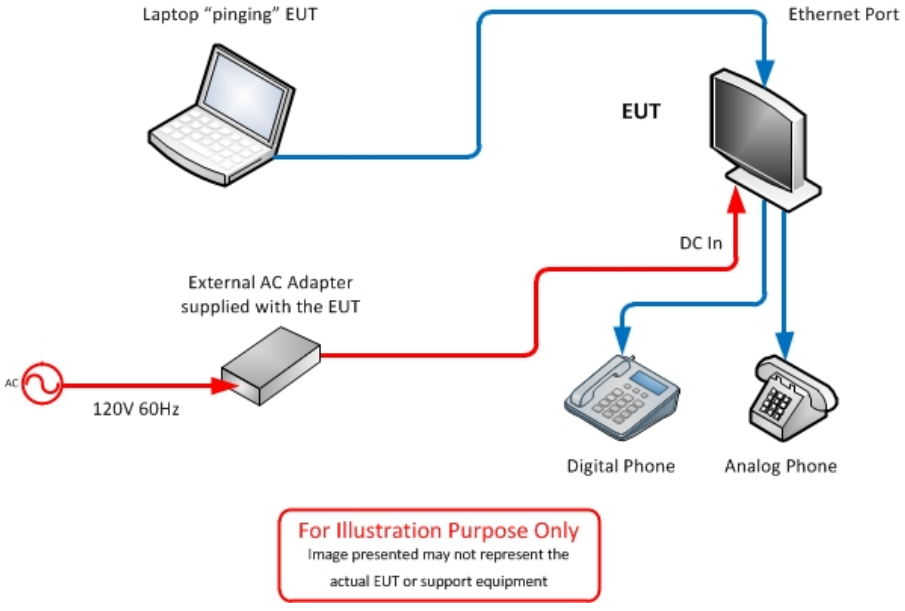
1.4.2 EUT Exercise Software

No special software was used to exercise the EUT during the investigation. The support laptop was configured to constantly "ping" the EUT during testing.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Toshiba	Laptop	Model Satellite Pro 4600 SN91685670PU
Toshiba	Laptop External PSU	Model PA3049U-1ACA SN0184957G
Logitech	Mouse for Laptop	Model M-CAA42 SNLZA21203529
Swisscon	ISDN Telephone	Model A47 SN013930456500203210660000 7
AT&T	Analog Telephone	Model 210 SNY050407003698304
-	Telco cable (analog phone to EUT)	2.1m unshielded RJ11 connector
-	CAT5E (ISDN phone to EUT)	2.1m unshielded RJ45 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: 004401-64-001017-5		
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.
The equipment under test (EUT) was configured to measure its highest possible emission level. 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.: US5281

TUV SUD America Inc. (San Diego), a §2.498 listed test firm operates the EMC Laboratory registered under Sony Electronics Inc. Product Quality Division EMC. This laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is US5281.

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.

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SECTION 2

TEST DETAILS

Radio Testing of the
Hughes Network Systems
Land Portable Terminal

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

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 µH/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 (dBµV)	
	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: 004401-64-001017-5

2.1.4 Date of Test

July 14, 2011

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	24°C
Relative Humidity	42%
ATM Pressure	1002 mbar

2.1.7 Additional Observations

- The EUT is a portable battery powered device. A provision however is provided to charge the battery using an external AC adapter.
- The EUT was verified while charging at the same time “pinging’ continuously with the support laptop.

- Measurement was done using EMC32 V8.51 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.1.8 Test Results

Compliant. See attached plots and tables.

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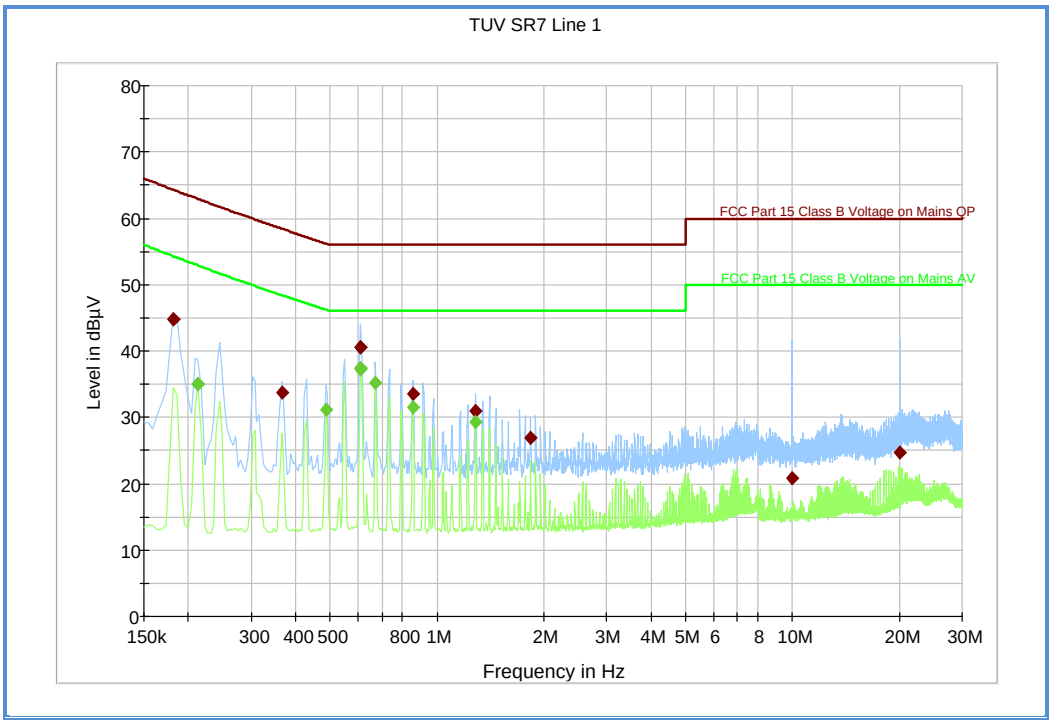
2.1.9 Line 1 (Hot 120VAC/60Hz)



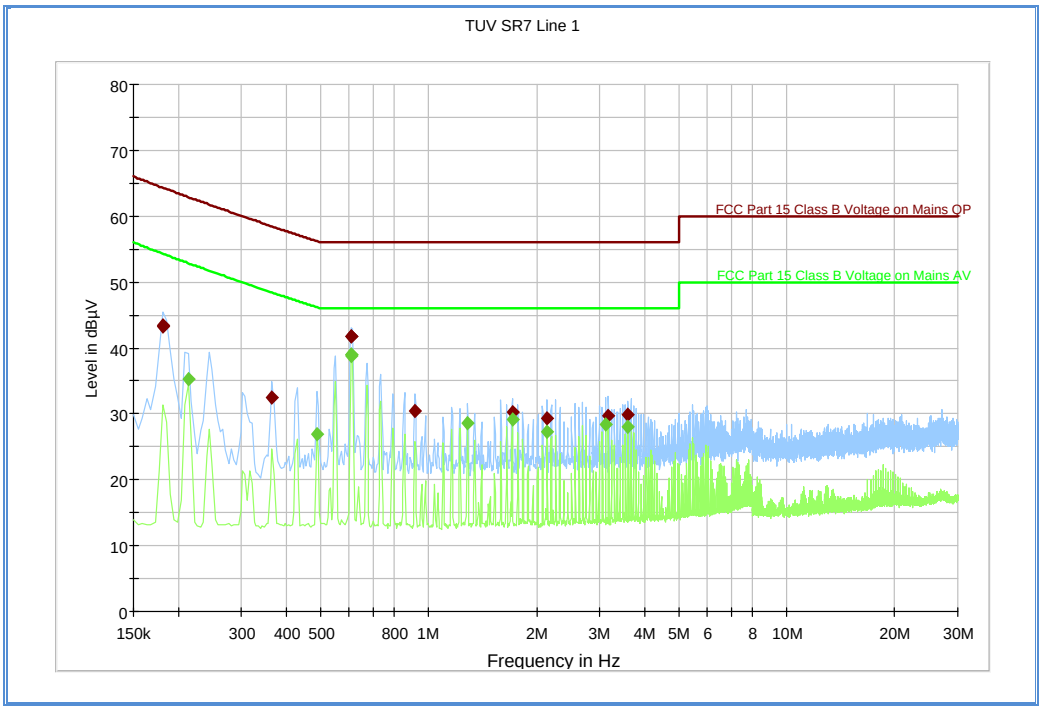
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.181500	44.8	1000.0	9.000	Off	L1	19.9	19.5	64.3
0.181500	44.7	1000.0	9.000	Off	L1	19.9	19.6	64.3
0.366000	33.7	1000.0	9.000	Off	L1	20.2	24.7	58.4
0.609000	40.6	1000.0	9.000	Off	L1	20.3	15.4	56.0
0.609000	40.6	1000.0	9.000	Off	L1	20.3	15.4	56.0
0.856500	33.6	1000.0	9.000	Off	L1	20.3	22.4	56.0
1.284000	31.0	1000.0	9.000	Off	L1	20.3	25.0	56.0
1.833000	27.0	1000.0	9.000	Off	L1	20.3	29.0	56.0
10.005000	20.9	1000.0	9.000	Off	L1	20.6	39.1	60.0
20.008500	24.7	1000.0	9.000	Off	L1	20.5	35.3	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.213000	34.9	1000.0	9.000	Off	L1	20.0	17.9	52.9
0.213000	34.9	1000.0	9.000	Off	L1	20.0	17.9	52.9
0.213000	34.9	1000.0	9.000	Off	L1	20.0	17.9	52.9
0.487500	31.1	1000.0	9.000	Off	L1	20.3	15.1	46.2
0.609000	37.4	1000.0	9.000	Off	L1	20.3	8.6	46.0
0.609000	37.3	1000.0	9.000	Off	L1	20.3	8.7	46.0
0.609000	37.3	1000.0	9.000	Off	L1	20.3	8.7	46.0
0.672000	35.2	1000.0	9.000	Off	L1	20.3	10.8	46.0
0.856500	31.6	1000.0	9.000	Off	L1	20.3	14.4	46.0
1.284000	29.3	1000.0	9.000	Off	L1	20.3	16.7	46.0

2.1.10 Line 2 (Neutral 120VAC/60Hz)



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.181500	43.3	1000.0	9.000	Off	L2	19.9	21.0	64.3
0.181500	43.3	1000.0	9.000	Off	L2	19.9	21.0	64.3
0.366000	32.6	1000.0	9.000	Off	L2	20.2	25.9	58.4
0.609000	41.8	1000.0	9.000	Off	L2	20.3	14.2	56.0
0.609000	41.8	1000.0	9.000	Off	L2	20.3	14.2	56.0
0.915000	30.4	1000.0	9.000	Off	L2	20.3	25.6	56.0
1.711500	30.3	1000.0	9.000	Off	L2	20.3	25.7	56.0
2.139000	29.3	1000.0	9.000	Off	L2	20.4	26.7	56.0
3.178500	29.7	1000.0	9.000	Off	L2	20.5	26.3	56.0
3.606000	29.9	1000.0	9.000	Off	L2	20.5	26.1	56.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.213000	35.3	1000.0	9.000	Off	L2	20.0	17.6	52.9
0.487500	26.9	1000.0	9.000	Off	L2	20.3	19.3	46.2
0.609000	38.9	1000.0	9.000	Off	L2	20.3	7.1	46.0
0.609000	38.9	1000.0	9.000	Off	L2	20.3	7.1	46.0
0.609000	38.8	1000.0	9.000	Off	L2	20.3	7.2	46.0
1.284000	28.6	1000.0	9.000	Off	L2	20.3	17.4	46.0
1.711500	29.1	1000.0	9.000	Off	L2	20.3	16.9	46.0
2.139000	27.4	1000.0	9.000	Off	L2	20.4	18.6	46.0
3.115500	28.4	1000.0	9.000	Off	L2	20.5	17.6	46.0
3.606000	28.0	1000.0	9.000	Off	L2	20.5	18.0	46.0

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 Date of Test

July 14, 2011

2.2.4 Test Equipment Used

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

2.2.5 Environmental Conditions

Ambient Temperature	24°C
Relative Humidity	42%
ATM Pressure	1002 mbar

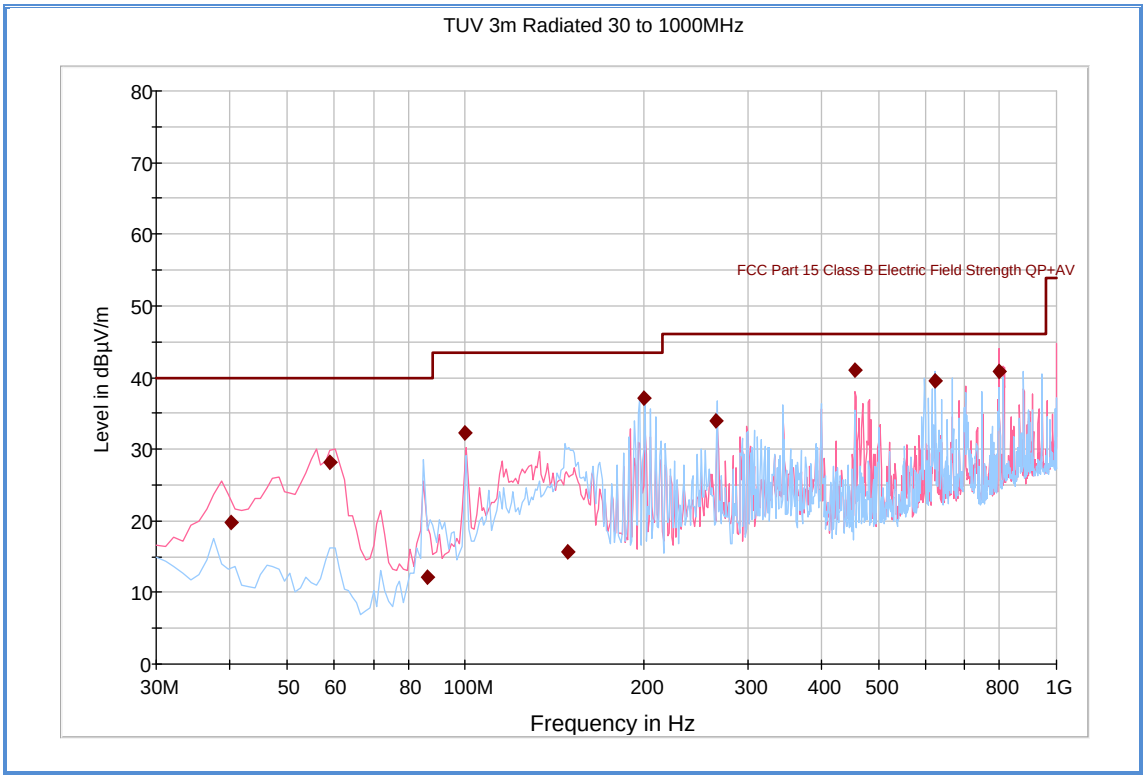
2.2.6 Additional Observations

- This is a radiated test.
- The spectrum was searched from 30MHz to 6GHz and verified to Class B limits.
- The EUT is a portable battery powered device. A provision however is provided to charge the battery using an external AC adapter.
- The EUT was verified while charging at the same time “pinging’ continuously with the support laptop.
- Measurement was done using EMC32 V8.51 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.2.7 Test Results

See attached plots.

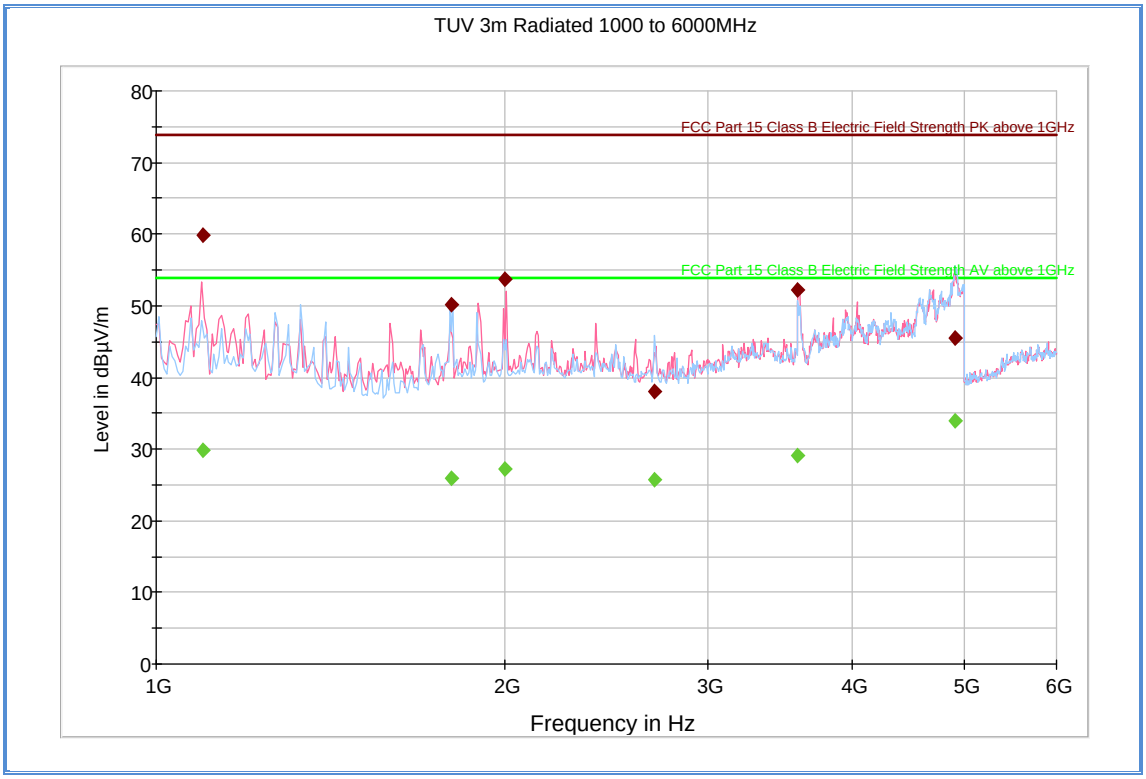
2.2.7.1 Below 1GHz Radiated Emission Test (120VAC/60Hz)



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)
40.102222	19.8	1000.0	120.000	106.0	V	315.0	-17.9	20.2	40.0
59.106667	28.1	1000.0	120.000	123.0	V	280.0	-22.4	11.9	40.0
86.326667	12.1	1000.0	120.000	370.0	H	22.0	-22.2	27.9	40.0
99.975556	32.3	1000.0	120.000	108.0	V	279.0	-20.8	11.2	43.5
149.157778	15.7	1000.0	120.000	195.0	H	40.0	-20.0	27.8	43.5
200.686667	37.1	1000.0	120.000	121.0	H	332.0	-17.8	6.4	43.5
266.031111	33.9	1000.0	120.000	132.0	H	102.0	-14.6	12.1	46.0
455.160000	41.0	1000.0	120.000	183.0	V	351.0	-9.5	5.0	46.0
621.977778	39.6	1000.0	120.000	113.0	H	359.0	-4.6	6.4	46.0
799.813333	40.8	1000.0	120.000	103.0	V	270.0	-2.9	5.2	46.0

2.2.7.2 Above 1GHz Radiated Emission Test (120VAC/60Hz)



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)
1097.664444	59.8	100.0	1000.000	187.0	V	194.0	1.3	14.1	73.9
1798.415556	50.1	100.0	1000.000	106.0	H	3.0	4.1	23.8	73.9
1999.895556	53.8	100.0	1000.000	106.0	V	268.0	5.2	20.1	73.9
2697.904444	38.0	100.0	1000.000	122.0	H	355.0	9.2	35.9	73.9
3585.228889	52.2	100.0	1000.000	100.0	V	2.0	14.5	21.7	73.9
4908.175556	45.4	100.0	1000.000	247.0	H	344.0	20.3	28.5	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)
1097.664444	29.9	100.0	1000.000	187.0	V	194.0	1.3	24.0	53.9
1798.415556	25.9	100.0	1000.000	106.0	H	3.0	4.1	28.0	53.9
1999.895556	27.2	100.0	1000.000	106.0	V	268.0	5.2	26.7	53.9
2697.904444	25.8	100.0	1000.000	122.0	H	355.0	9.2	28.1	53.9
3585.228889	29.0	100.0	1000.000	100.0	V	2.0	14.5	24.9	53.9
4908.175556	34.0	100.0	1000.000	247.0	H	344.0	20.3	19.9	53.9

SECTION 3

TEST EQUIPMENT USED

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

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
1002	Bilog Antenna	3142C	00058717	EMCO	11/04/10	11/04/11
1043/1044	EMI Test Receiver	ESMI	848926/003	Rhode & Schwarz	07/15/10	07/15/11
1016	Pre-amplifier	PAM-0202	187	PAM	01/04/11	01/04/12
08628	Pre-amplifier	QLJ01182835-JO	8986002	Quinstar Tech. Inc.	07/14/11	07/14/12
08543	High-Freq cable	Micropore 19057793	147650/4	United Microwave Products	07/14/11	07/14/12
6528	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	02/25/11	02/25/12
8633	20dB Attenuator	CAT-20	N/A	MCL HAT-20	07/14/11	07/14/12
1171	LISN	FCC-LISN-50-25-2	0871	Fischer Custom Comm.	03/03/11	03/03/12
	Test Software	EMC32	V8.51	Rhode & Schwarz	N/A	

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3.2 MEASUREMENT UNCERTAINTY

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

3.2.1 Conducted Measurements

	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	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	0.67
				Coverage Factor (k):	2
				Expanded Uncertainty:	1.39

3.2.2 Radiated Measurements

	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	0.41	0.24	0.06
5	Site	Rectangular	2.00	1.15	1.33
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	1.38
				Coverage Factor (k):	2
				Expanded Uncertainty:	2.79

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SECTION 4

PHOTOGRAPHS

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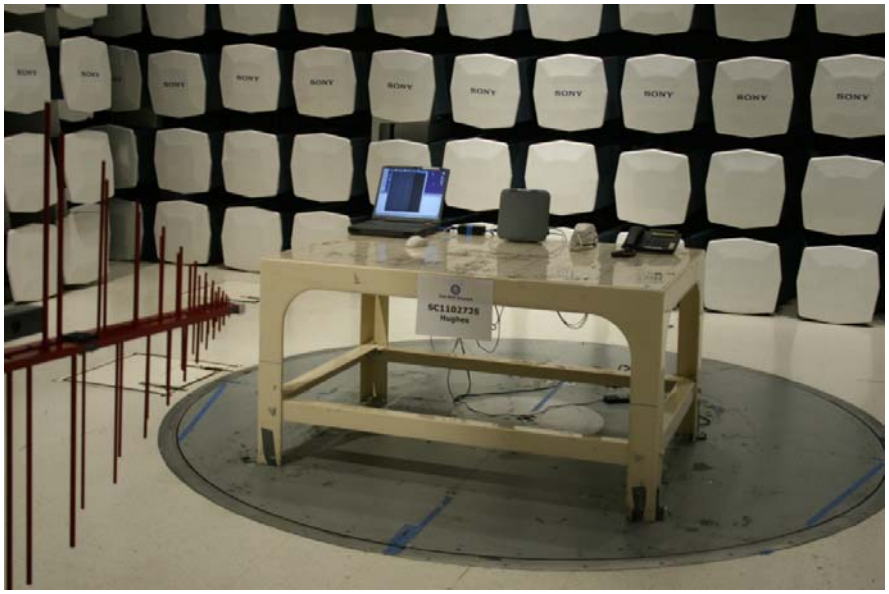
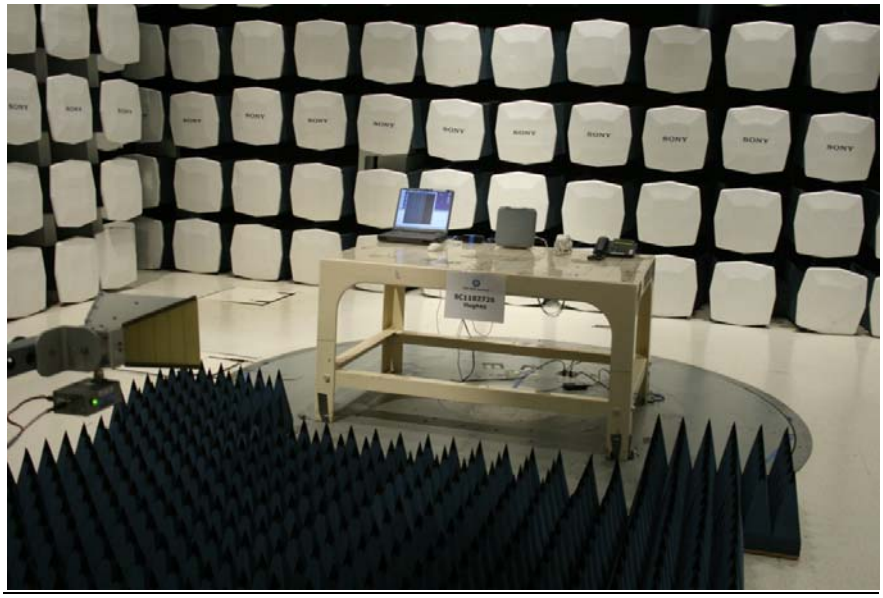
4.1 RADIATED EMISSIONS TEST SETUP



Below 1GHz Test Setup



Above 1GHz Test Setup

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4.2 CONDUCTED EMISSIONS TEST SETUP

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SECTION 5

DIAGRAM OF TEST SETUP

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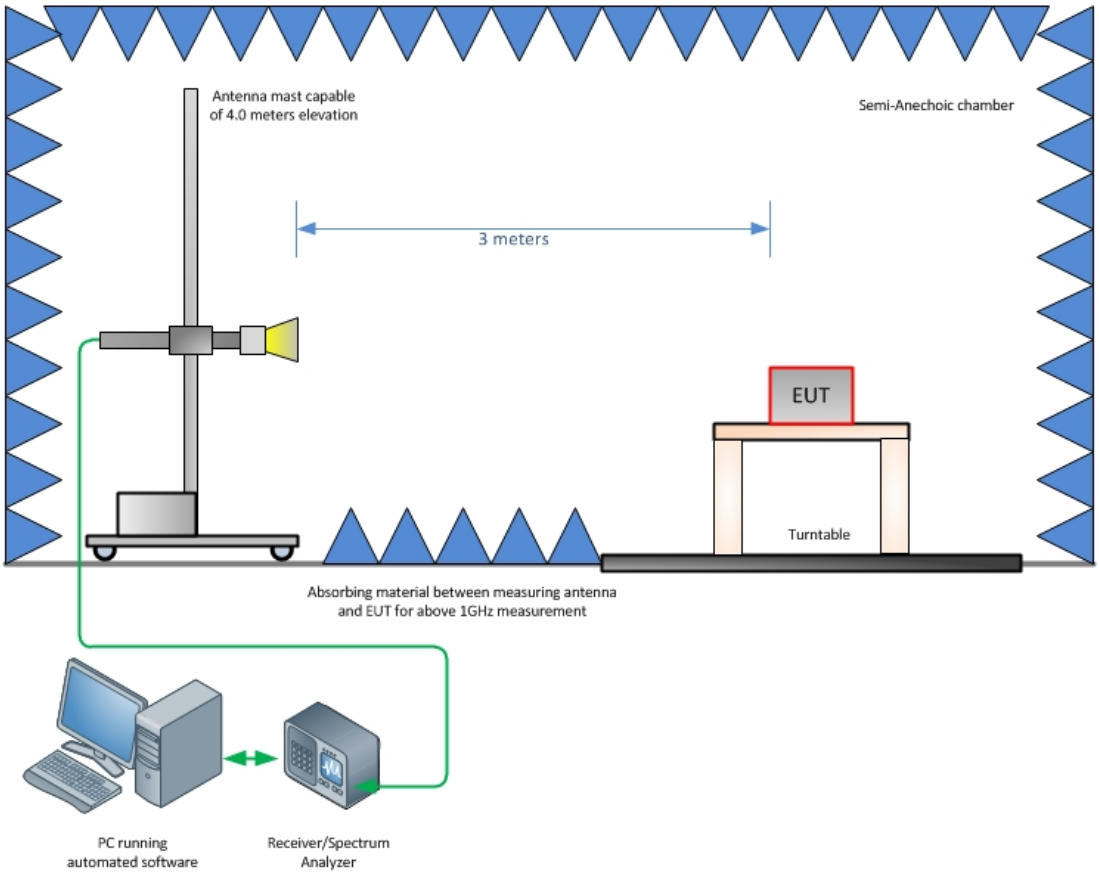
5.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup

SECTION 6

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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