ENGINEERING TEST REPORT

M1
Model: M1
FCC ID: Z3FM1

Applicant:

PRS TECHWARE INC.
322 Lakeshore Rd W Suite 7
Mississauga, Ontario
Canada L5H 1G8

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.249
Low Power Transmitters Operating in the Frequency Band 2400 – 2483.5 MHz

UltraTech's File No.: PRST-001F15C249

This Test report is Issued under the Authority of
Tri M. Luu
Vice President of Engineering
UltraTech Group of Labs

Date: November 7, 2011

Report Prepared by: Dan Huynh	Tested by: Mr. Hung Trinh
Issued Date: November 7, 2011	Test Dates: September 27-29, 2011

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

TABLE OF CONTENTS

EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.249
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15
Purpose of Test:	Equipment Certification for for Low Power Licensed-Exempt Transmitters operating in the Frequency Band 2400–2483.5 MHz.
Test Procedures:	American National Standards Institute ANSI C63.10 - American National Standard for Testing Unlicensed Wireless Devices
Environmental Classification:	[x] Commercial, industrial or business environment [x] Residential environment

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2010	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Parts 0 to 15
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
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
CISPR 22 & EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	PRS TECHWARE INC.
Address:	322 Lakeshore Rd W Suite 7 Mississauga, Ontario Canada L5H 1G8
Contact Person:	Mr. Paul Amariutei Phone #: 905-271-0802 Fax #: N/A Email Address: inquiries@prstechware.com

MANUFACTURER	
Name:	PRS TECHWARE INC.
Address:	322 Lakeshore Rd W Suite 7 Mississauga, Ontario Canada L5H 1G8
Contact Person:	Mr. Paul Amariutei Phone #: 905-271-0802 Fax #: N/A Email Address: inquiries@prstechware.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	PRS TECHWARE INC.
Product Name:	M1
Model Name or Number:	M1
Serial Number:	Test Sample
Type of Equipment:	Low Power Communication Device Transmitter
Input Power Supply Type:	External power supply
Primary User Functions of EUT:	Digital communications

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	• Portable • Mobile • Base Station (fixed use)
Intended Operating Environment:	Residential, Commercial, industrial or business
Power Supply Requirement:	1.6 to 3.6VDC
RF Output Power Rating:	52.77 dBµV/m Average at 3 m
Operating Frequency Range:	2402 – 2481 MHz
RF Output Impedance:	50 Ω
Duty Cycle:	100%
Modulation Type:	GFSK
Antenna Connector Types:	Integral

2.4. ASSOCIATED ANTENNA DESCRIPTION

Antenna:	
Manufacturer:	PRS TECHWARE INC.
Type:	printed pattern on the module printed circuit board
Model:	M1
Frequency Range:	2400-2483 MHz
Impedance:	50 Ohm
Gain (dBi):	-1.1

2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
None.				

2.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Test Jig
Brand name:	PRS TECHWARE INC.
Model Name or Number:	N/A
Serial Number:	N/A
Connected to EUT's Port:	Module pin signals

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21 to 23 ^{o}C
Humidity:	45 to 58%
Pressure:	102 kPa
Power Input Source:	3 VDC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	EUT was configured to transmit continuously for emissions measurements at of lowest, middle and highest channel frequencies.
Special Test Software:	Test software and hardware provided by the Applicant to operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of the lowest, middle and highest frequencies individually continuously during testing.
Special Hardware Used:	Test Jig.
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	2402 - 2481 MHz
Frequency(ies) Tested: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	2402, 2441 and 2481 MHz
RF Power Output: (measured maximum field strength at 3 m)	52.77 dBµV/m Average
Normal Test Modulation:	GFSK
Modulating Signal Source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2014-04-04.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	Yes
15.207(a)	AC Power Line Conducted Emissions	Yes
15.215(c)	20 dB Bandwidth	Yes
15.249(a)&(d), 15.209, 15.205	Transmitter Radiated, Harmonics and Out of Band Emissions	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

5.1. AC POWER LINE CONDUCTED EMISSIONS [§15.207(a)]

5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

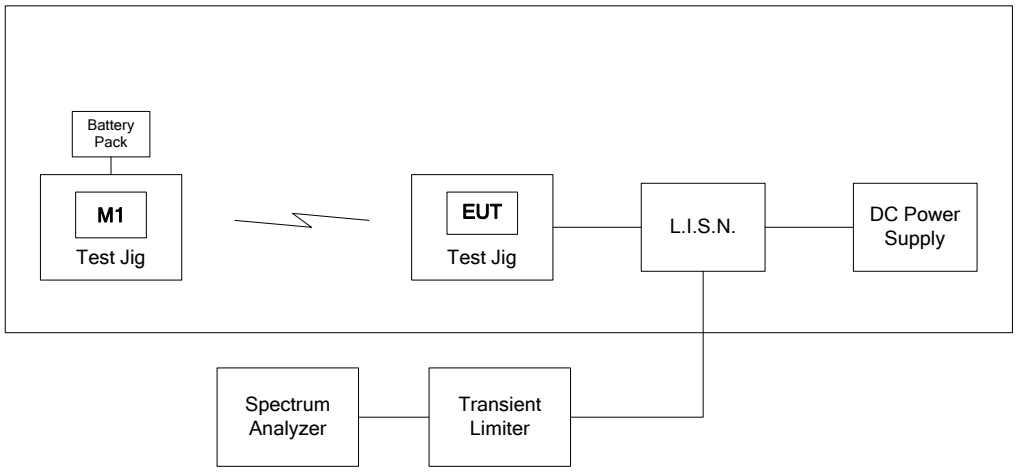
Frequency of emission (MHz)	Conducted Limits (dBμV)	
	Quasi-peak	Average
0.15–0.5 .....……..	66 to 56*	56 to 46*
0.5–5 .....……..	56	46
5-30 ……..	60 ...……..	50

*Decreases linearly with the logarithm of the frequency

5.1.2. Method of Measurements

ANSI C63.4.

5.1.3. Test Arrangement

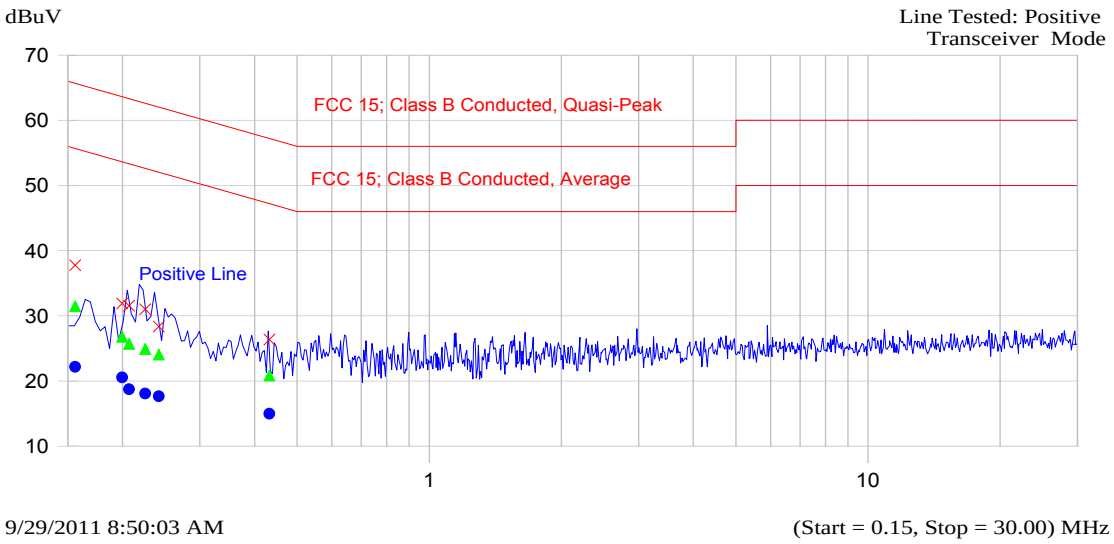


5.1.4. Test Data

Plot 5.1.4.1. Power Line Conducted Emissions, 3 VDC Input

Line Voltage:	3 VDC
Line Tested:	Positive

Current Graph



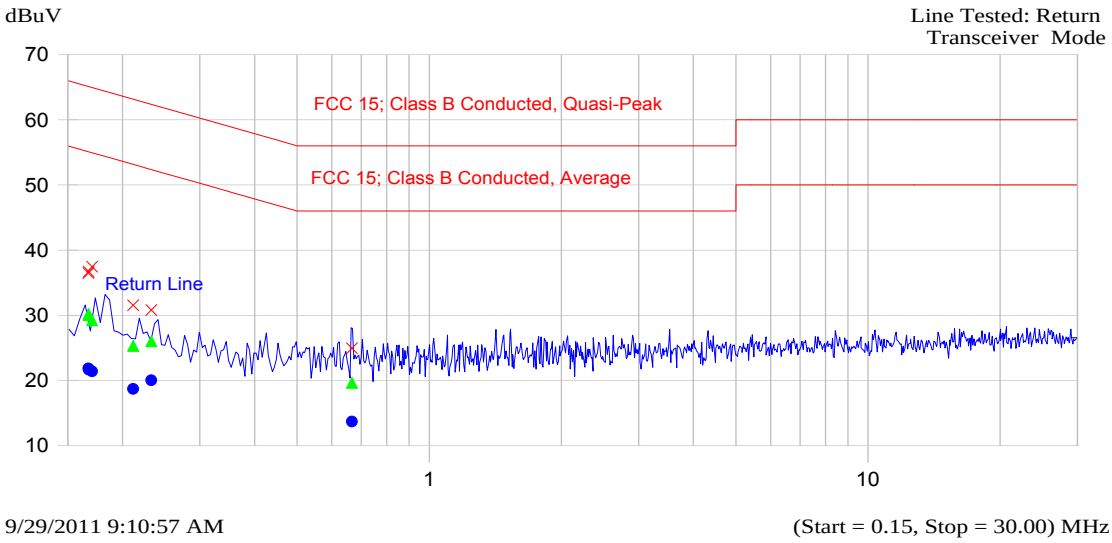
Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.156	37.7	31.5	-34.4	22.2	-33.7	Positive Line
0.200	31.9	26.8	-37.8	20.6	-34.0	Positive Line
0.207	31.6	25.7	-38.6	18.7	-35.6	Positive Line
0.225	31.0	24.9	-38.9	18.1	-35.7	Positive Line
0.242	28.4	24.1	-39.3	17.6	-35.7	Positive Line
0.432	26.4	20.8	-37.0	15.0	-32.9	Positive Line

Plot 5.1.4.2. Power Line Conducted Emissions, 3 VDC Input

Line Voltage:	3 VDC
Line Tested:	Return

Current Graph



Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.167	36.7	30.0	-35.5	21.7	-33.8	Return Line
0.167	36.5	30.2	-35.3	21.9	-33.6	Return Line
0.170	37.5	29.2	-36.2	21.4	-34.0	Return Line
0.212	31.5	25.3	-38.9	18.7	-35.5	Return Line
0.232	30.8	26.0	-37.6	20.0	-33.6	Return Line
0.667	24.9	19.6	-36.4	13.7	-32.3	Return Line

5.2. 20 dB BANDWIDTH [§ 15.215(c)]

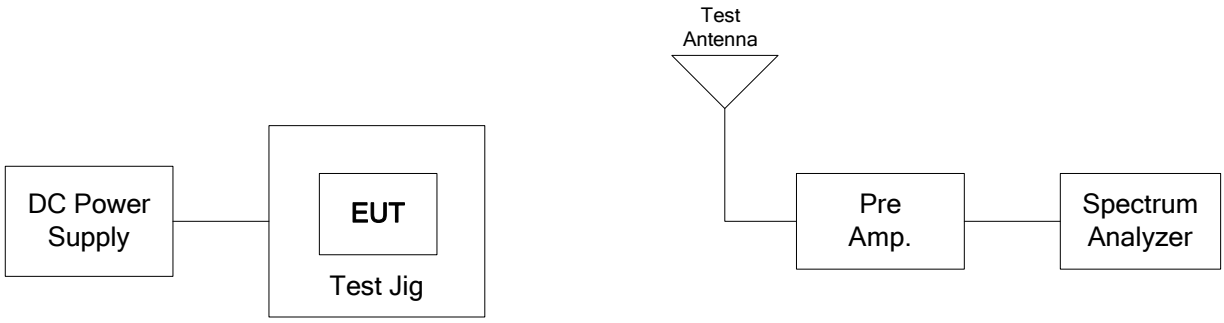
5.2.1. Limit(s)

The fundamental emission must be in the authorized bandwidth.

5.2.2. Method of Measurements

ANSI C63.10.

5.2.3. Test Arrangement

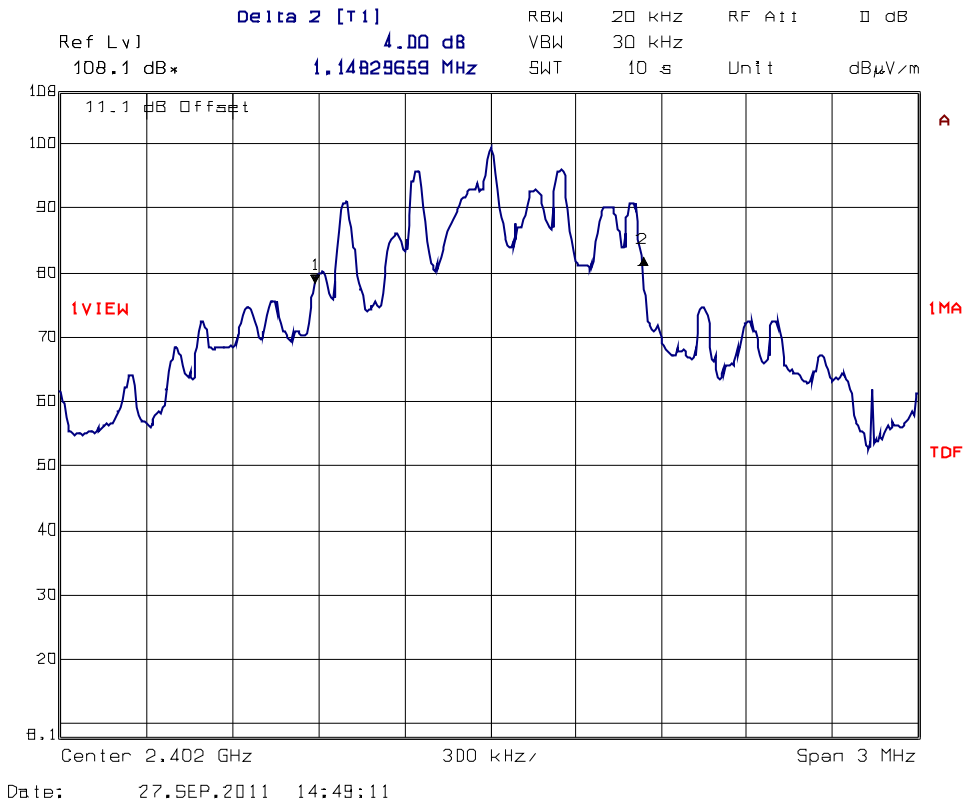


5.2.4. Test Data

Frequency (MHz)	20 dB Bandwidth (MHz)
2402	1.15
2441	1.36
2481	1.75

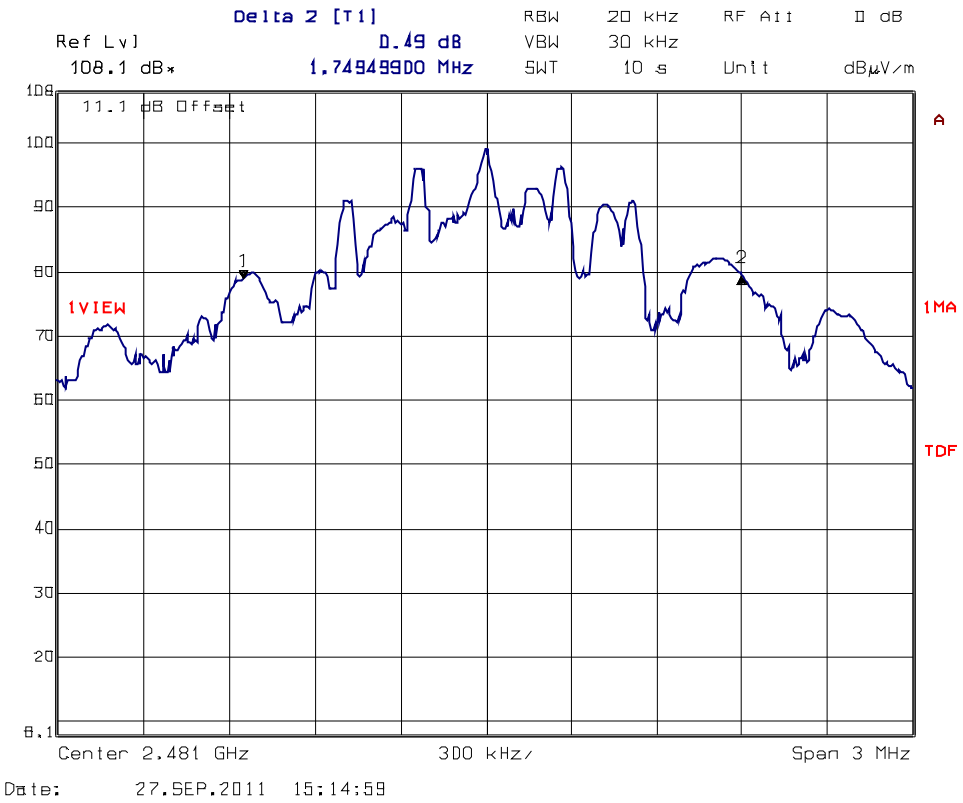
See the following plots for detailed measurements.

Plot 5.2.4.1. 20 dB Bandwidth
Test Frequency: 2402 MHz



Plot 5.2.4.2. 20 dB Bandwidth
Test Frequency: 2441 MHz

Plot 5.2.4.3. 20 dB Bandwidth
Test Frequency: 2481 MHz



5.3. FUNDAMETAL FIELD STRENGTH, HAROMICS AND OUT OF BAND EMISSIONS (RADIATED AT 3m) [47 CFR §§ 15.249, 15.209 & 15.205]

5.3.1. Limits

(a) The Field Strength of emissions from intentional radiators operated within 2400–2483.5 MHz band shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (mV/m)	Field Strength of Harmonics (μV/m)
2400–2483.5 MHz	50	500

(c) Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

(e) As shown in § 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

- The fundamental frequency shall not fall within any restricted frequency band specified in 15.205. All rf other emissions that fall in the restricted bands shall not exceed the general radiated emission limits specified in at 15.209(a).

47 CFR 15.205 – Restricted Bands of Operation

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	(2)
13.36–13.41.			

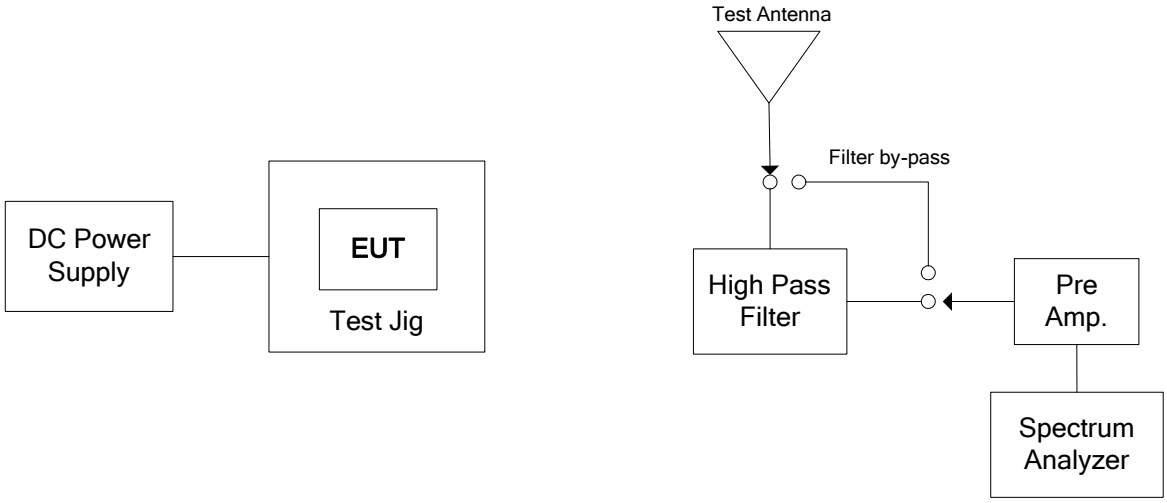
[1]Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2]Above 38.6

47 CFR 15.209(a) - Field Strength Limits within Restricted Frequency Bands		
Frequency (MHz)	**Field Strength Limits (μV/m)**	**Distance (Meters)**
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

5.3.2. Method of Measurements

ANSI C63.10 and ANSI C63.4 for measurement methods.

5.3.3. Test Arrangement



5.3.4. Test Data

Remarks:

- EUT shall be tested in three orthogonal positions.
- The following test results are the worst-case measurements.
- The emissions were scanned from 30 MHz to 25 GHz and spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.

5.3.4.1. Fundamental, Harmonics and Out of Band Radiated Emissions

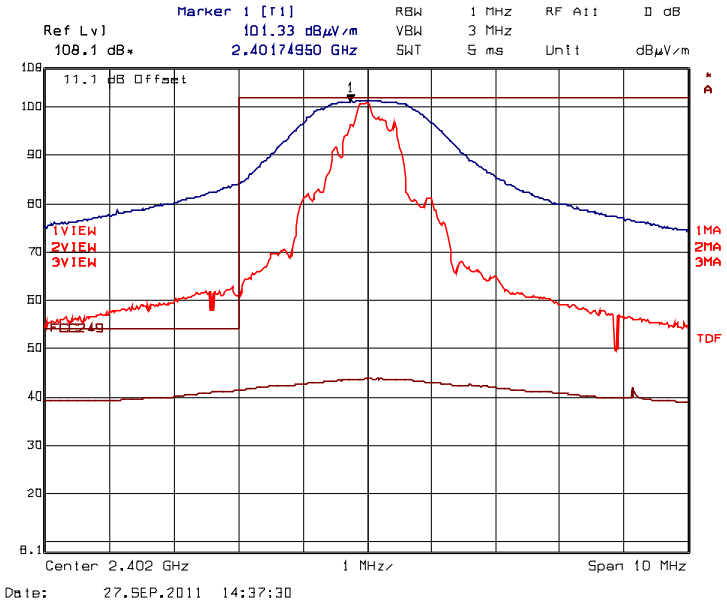
Test Frequency: 2402 MHz						
Frequency (MHz)	Peak E-Field @3m (dBµV/m)	Average E-Field @3m (dBµV/m)	Antenna Plane (H/V)	Field Strength Limit of Fundamental/Harmonic (dBµV/m)	Field Strength Limit of 15.209(a) (dBµV/m)	Margin (dB))
2402	97.08	43.23	V	94.0	--	-50.7
2402	101.26	43.61	H	94.0	--	-50.4
7206	58.29	39.39	V	54.0	54.0	-14.6
7206	57.60	38.79	H	54.0	54.0	-15.2
9608	59.85	40.54	V	54.0	54.0	-13.4
9608	58.63	40.42	H	54.0	54.0	-13.6

Test Frequency: 2441 MHz						
Frequency (MHz)	Peak E-Field @3m (dBµV/m)	Average E-Field @3m (dBµV/m)	Antenna Plane (H/V)	Field Strength Limit of Fundamental/Harmonic (dBµV/m)	Field Strength Limit of 15.209(a) (dBµV/m)	Margin (dB))
2441	97.75	51.75	V	94.0	--	-42.2
2441	100.20	52.77	H	94.0	--	-41.2
7323	59.82	39.74	V	54.0	54.0	-14.2
7323	57.43	39.52	H	54.0	54.0	-14.5
9764	56.49	40.55	V	54.0	54.0	-13.4
9764	58.73	40.94	H	54.0	54.0	-13.0

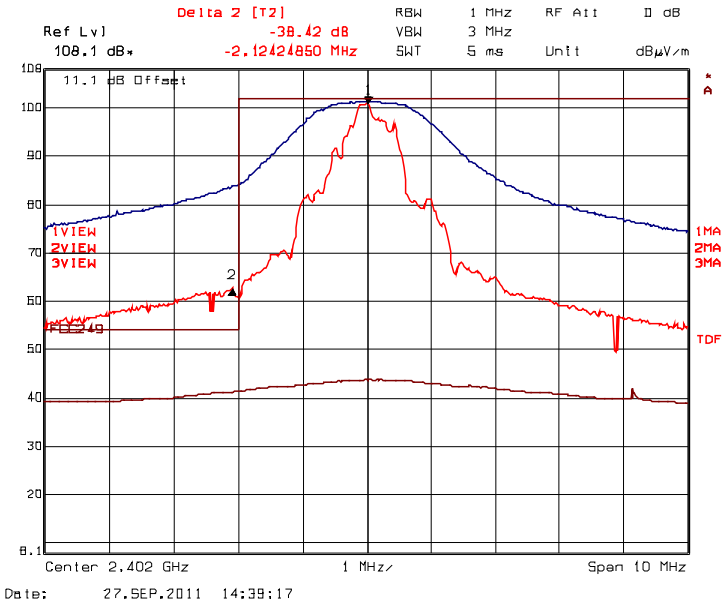
Test Frequency: 2481 MHz						
Frequency (MHz)	Peak E-Field @3m (dBµV/m)	Average E-Field @3m (dBµV/m)	Antenna Plane (H/V)	Field Strength Limit of Fundamental/Harmonic (dBµV/m)	Field Strength Limit of 15.209(a) (dBµV/m)	Margin (dB))
2481	97.50	43.34	V	94.0	--	-50.6
2481	101.18	43.42	H	94.0	--	-50.6
7443	64.25	40.20	V	54.0	54.0	-13.8
7443	61.96	40.21	H	54.0	54.0	-13.8
9924	57.50	41.11	V	54.0	54.0	-12.9
9924	57.79	41.30	H	54.0	54.0	-12.7

5.3.4.2. Band-Edge RF Radiated Emissions

Plot 5.3.4.2.1. Band-Edge RF Radiated Emissions @ 3 m, Horizontal Rx Antenna Orientation
Low End of Frequency Band

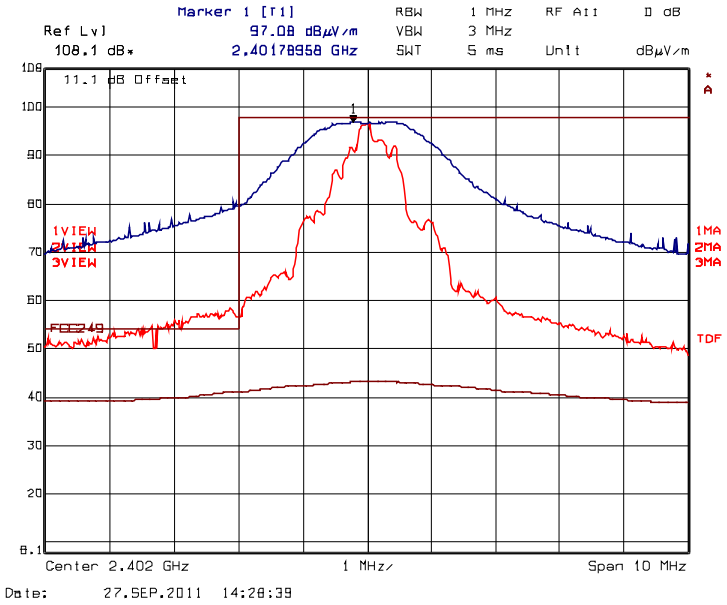


Plot 5.3.4.2.2. Band-Edge RF Radiated Emissions @ 3 m, Horizontal Rx Antenna Orientation
Low End of Frequency Band

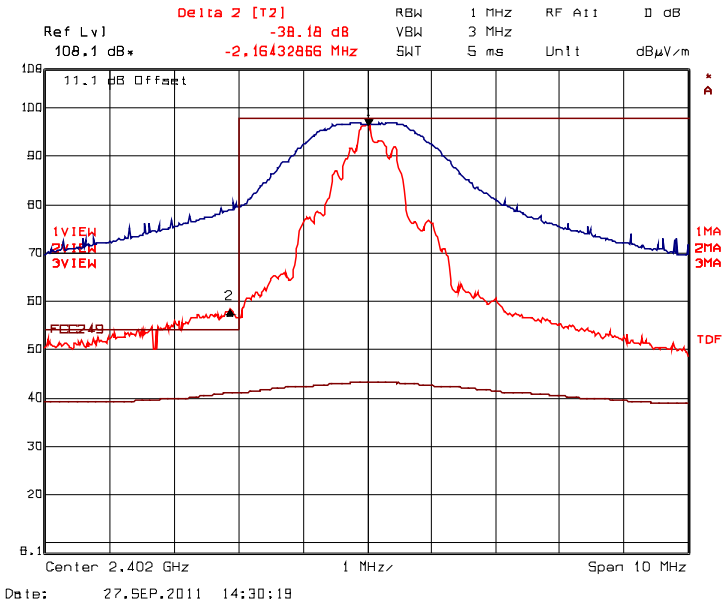


Trace 1: RBW = 1 MHz, VBW = 3 MHz
Trace 2: RBW = 100 kHz, VBW = 300 kHz, Delta (Peak to Band-Edge): 38.42 dB
Trace 3: RBW = 1 MHz, VBW = 10 Hz
Peak Band-Edge at 2483.5 MHz: Peak = 101.33 dBµV/m – 38.42dB = 62.91 dBµV /m

Plot 5.3.4.2.3. Band-Edge RF Radiated Emissions @ 3 m, Vertical Rx Antenna Orientation
Low End of Frequency Band

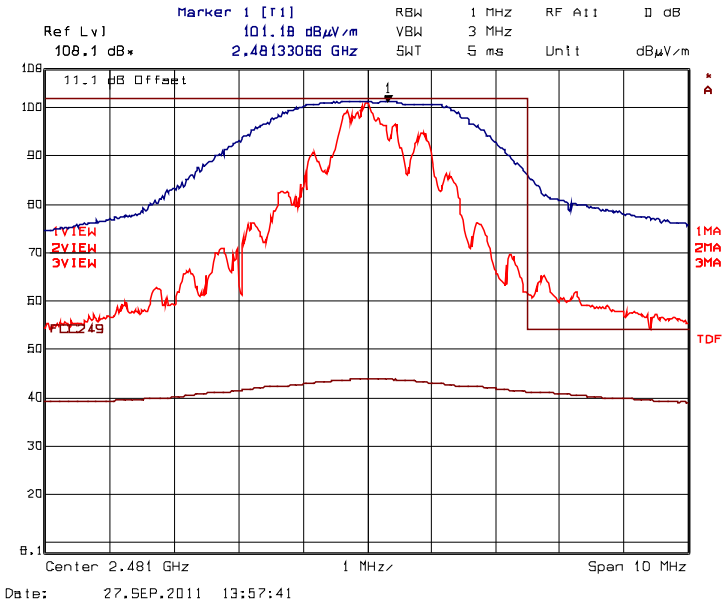


Plot 5.3.4.2.4. Band-Edge RF Radiated Emissions @ 3 m, Vertical Rx Antenna Orientation
Low End of Frequency Band

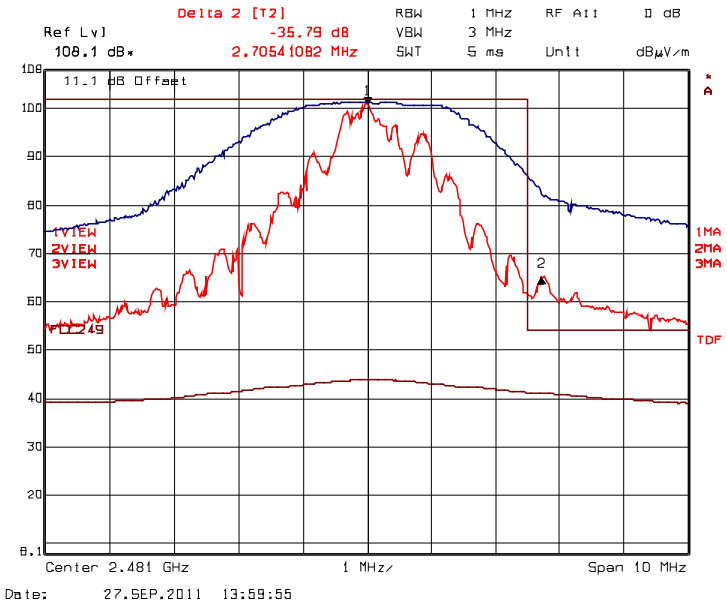


Trace 1: RBW = 1 MHz, VBW = 3 MHz
Trace 2: RBW = 100 kHz, VBW = 300 kHz, Delta (Peak to Band-Edge): 38.18 dB
Trace 3: RBW = 1 MHz, VBW = 10 Hz
Peak Band-Edge at 2483.5 MHz: Peak = 97.08 dBµV/m – 38.18dB = 58.90 dBµV/m

Plot 5.3.4.2.5. Band-Edge RF Radiated Emissions @ 3 m, Horizontal Rx Antenna Orientation
High End of Frequency Band

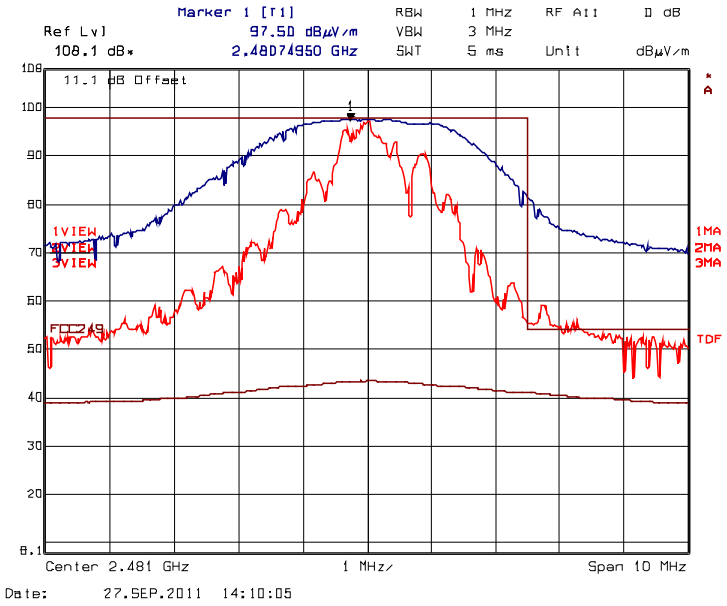


Plot 5.3.4.2.6. Band-Edge RF Radiated Emissions @ 3 m, Horizontal Rx Antenna Orientation
High End of Frequency Band,

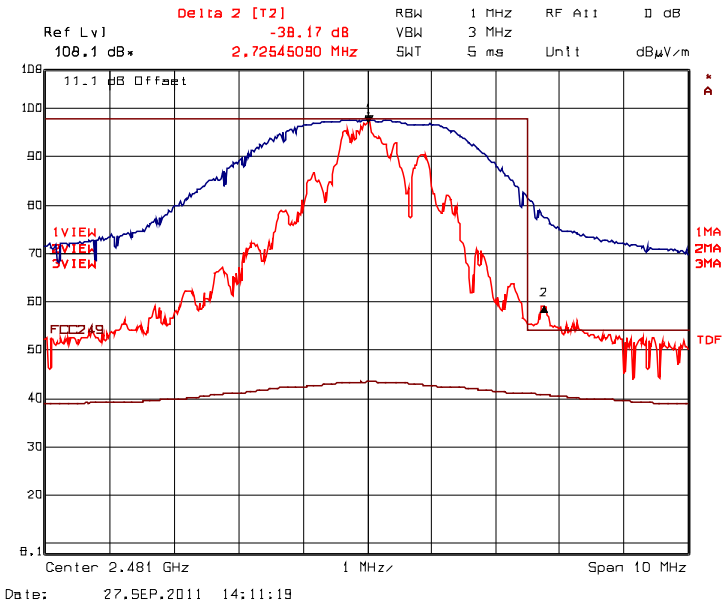


Trace 1: RBW = 1 MHz, VBW = 3 MHz
Trace 2: RBW = 100 kHz, VBW = 300 kHz, Delta (Peak to Band-Edge): 35.79 dB
Trace 3: RBW = 1 MHz, VBW = 10 Hz
Peak Band-Edge at 2483.5 MHz: Peak = 101.18 dBµV/m – 35.79 dB = 65.39 dBµV/m

Plot 5.3.4.2.7. Band-Edge RF Radiated Emissions @ 3 m, Vertical Rx Antenna Orientation
High End of Frequency Band



Plot 5.3.4.2.8. Band-Edge RF Radiated Emissions @ 3 m, Vertical Rx Antenna Orientation
High End of Frequency Band



Trace 1: RBW = 1 MHz, VBW = 3 MHz
Trace 2: RBW = 100 kHz, VBW = 300 kHz, Delta (Peak to Band-Edge): 38.17 dB
Trace 3: RBW = 1 MHz, VBW = 10 Hz
Peak Band-Edge at 2483.5 MHz: Peak = 97.50 dBµV/m – 38.17dB= 59.33 dBµV/m

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Agilent	E7401A	US40240432	9 kHz - 1.5 GHz	10 Jan 2012
L.I.S.N.	EMCO	3825/2	8907-1531	10 kHz – 100 MHz	30 Mar 2012
Transient Limiter	Pasternack	PE7010-20	--	DC – 2 GHz 20 dB attenuation	18 Jan 2012
Spectrum Analyzer	R/S	FSEK	834157/005	9 KHz – 40 GHz	18 Jul 2012
High Pass Filter	K&L	11SH10-4000T12000-0/0	4	Cut off 4000 MHz	Cal. on use.
RF Synthesized signal Generator	HP	8648C	3343U00391	100K-3200M Hz AM/ FM/ PM	16 Dec 2011
Power supply	Tenma	72-7295	490300297	1-40V DC 5A	Cal. on use.
Biconi-Log Antenna	Emco	3142C	00034792	26 – 3000 MHz	26 April 2012
Horn antenna	ETS-LINDGREN	3117	119425	1-18GHz	15 Feb 2012
Preamplifier	Hewlett Packard	8449B	3008A00769	1-26.5GHz	17 Feb 2012
Attenuator	Aeroflex/Weinschel	23-20-34	BH7876	DC-18 GHz	Cal. on use.
Attenuator	Inmet Corporation	12N-10		DC-12.4GHz	Cal. on use.
Attenuator	Narda	4768-10	702	DC-40GHz	Cal. on use.

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (150 kHz – 30 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 1.57**	**± 1.8**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.14**	**± 3.6**

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 2.15**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.30**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.78**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 1.87**	Under consideration
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.75**	Under consideration