ENGINEERING TEST REPORT

InReach
Model: DeLorme inReach for DeLorme GPS
FCC ID: UTNINRCHZB3

Applicant:

DeLorme
Two DeLorme Drive
P.O. Box 298
Yarmouth, Maine 04096

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.: DELO-004QF15C249

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

Date: September 16, 2011

Report Prepared by: Dan Huynh	Tested by: Hung Trinh
Issued Date: September 16, 2011	Test Dates: August 17, 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.*

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FCC	VCCI	Industry Canada Approved Test Facility	NVLAP	BSMI	Korea KCC-RRL
91038	1309	46390-2049	NvLap Lab Code 200093-0	SL2-IN-E-1119R	CA2049

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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 400–2483.5 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 C63.10	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:	DeLorme
Address:	Two DeLorme Drive P.O. Box 298 Yarmouth, Maine 04096 USA
Contact Person:	Noah Dionne Phone #: 207-846-7044 Fax #: 207-847-5044 Email Address: Noah.dionne@delorme.com

MANUFACTURER	
Name:	GlobalSat Technology Corporation
Address:	16F., No. 186, Jian-Yi Road, Chung-Ho City, Taipei Hsien 235, Taiwan
Contact Person:	Donald Tseng Phone #: 02-8226-3799 Fax #: 02-8226-3899 Email Address: donald.tseng@globalsat.com.tw

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:	DeLorme
Product Name:	InReach
Model Name or Number:	DeLorme inReach for DeLorme GPS
Serial Number:	Test Sample
Type of Equipment:	Low Power Communication Device Transmitter
Input Power Supply Type:	3V (2) AA Lithium batteries
Primary User Functions of EUT:	Provide wireless communication to ZigBee devices.

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable
Intended Operating Environment:	Residential Commercial, industrial or business
Power Supply Requirement:	1.8 Vdc
RF Output Power Rating:	60.01 dBµV/m at 3m distance
Operating Frequency Range:	2405 – 2480 MHz
RF Output Impedance:	50 Ω
Channel Spacing:	5 MHz
Duty Cycle:	100%
Modulation Type:	OQPSK
Antenna Connector Types:	SMT

2.4. ASSOCIATED ANTENNA DESCRIPTION

Antenna:	
Manufacturer:	Pulse
Type:	Ceramic Chip
Model:	W3008
Frequency Range:	2400 – 2483.5 MHz
Impedance:	50 Ohm
Gain (dBi):	1.7 (peak)

2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Micro-USB	1	Micro-USB	Shielded

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:

None.

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:	3V (2) AA Lithium batteries

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 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:	None.
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use.

Transmitter Test Signals	
Frequency Band(s):	2405 - 2480 MHz
Frequency(ies) Tested: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	2405, 2445 and 2480 MHz
RF Power Output: (measured maximum output power):	60.01 dBµV/m at 3m distance
Normal Test Modulation:	OQPSK
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.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada Site No.: 2049A-3, Expiry Date: May 1, 2011)

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	N/A
15.215(c)	20 dB Bandwidth	Yes
15.249(a), 15.209, 15.205	Transmitter Radiated Emissions, Harmonic Emissions	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.10.

5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

5.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1-1.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER

Provide wireless communication to ZigBee devices.

5.5. 20 dB BANDWIDTH [§ 15.215(c)]

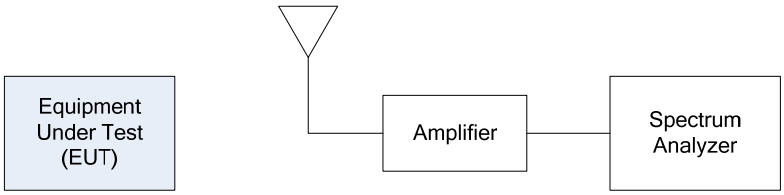
5.5.1. Limit(s)

The fundamental emission must be in the authorized bandwidth.

5.5.2. Method of Measurements

ANSI C63.10.

5.5.3. Test Arrangement

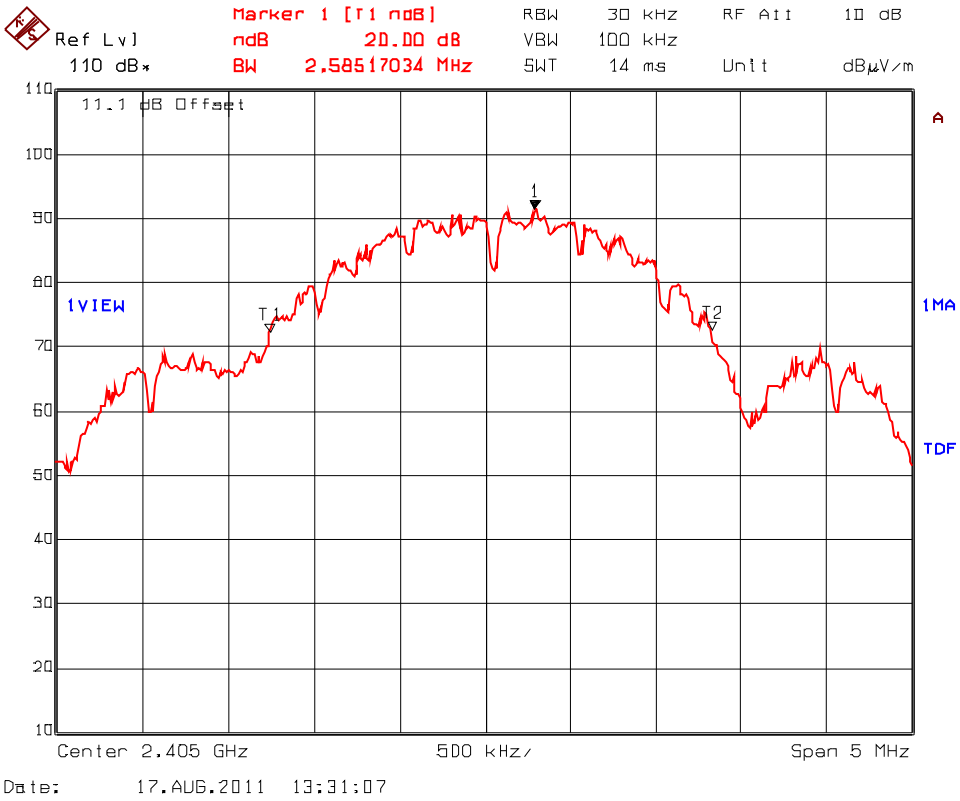


5.5.4. Test Data

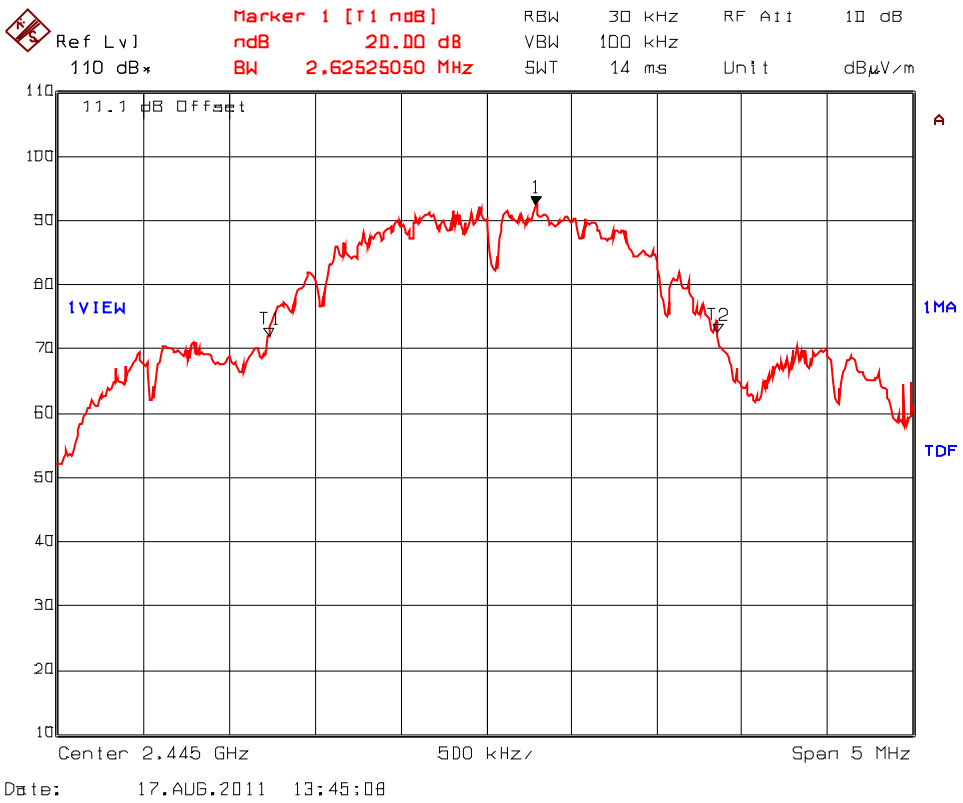
Frequency (MHz)	20 dB Bandwidth (MHz)
2405	2.59
2445	2.63
2480	2.63

See the following plots for detailed measurements.

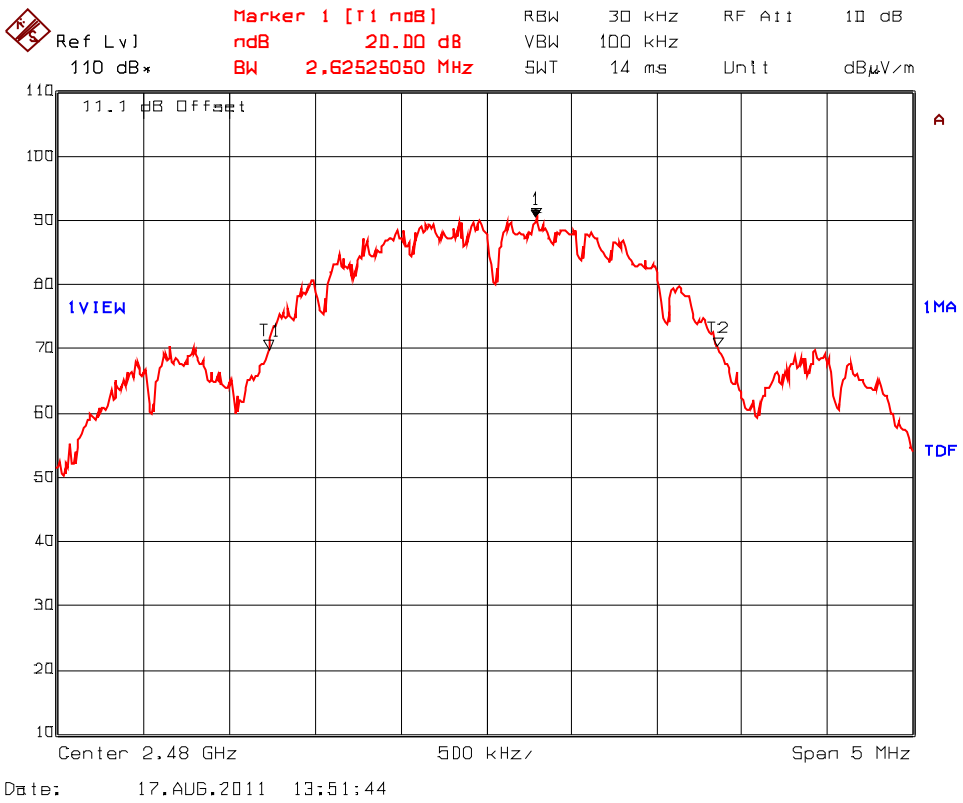
Plot 5.5.4.1. 20 dB Bandwidth
Test Frequency: 2405 MHz



Plot 5.5.4.2. 20 dB Bandwidth
Test Frequency: 2445 MHz



Plot 5.5.4.3. 20 dB Bandwidth
Test Frequency: 2480 MHz



5.6. FUNDAMETAL FIELD STRENGTH AND HAROMIC EMISSIONS (RADIATED AT 3m) [47 CFR §§ 15.249(a), 15.209 & 15.205]

5.6.1. 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.			

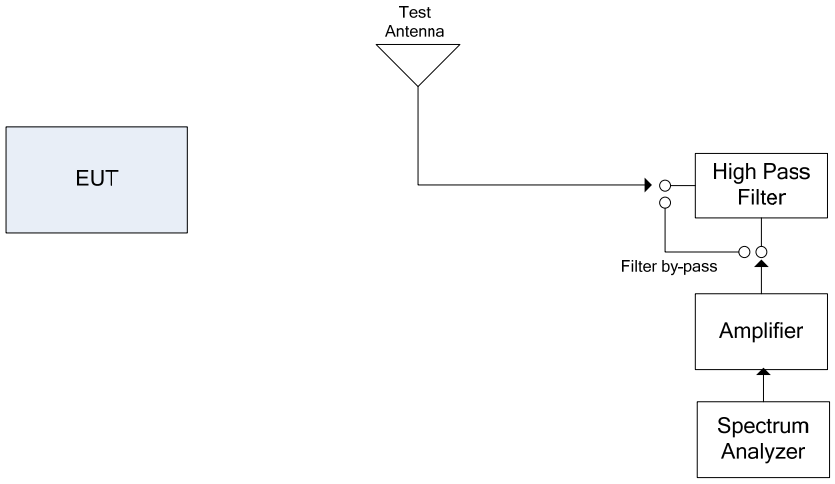
[1]Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2]Above 38.6

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

5.6.2. Method of Measurements

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

5.6.3. Test Arrangement



All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.6.4. Test Data

Remarks:

- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT shall be tested in three orthogonal positions.
- The following test results are the worst-case measurements.

Test Frequency:: 2405 MHz
Test Frequency Range: 30 MHz – 25 GHz

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 (dBµV/m)	Margin (dB)
2405	95.91	56.92	V	94.0	--	-37.1
2405	98.87	60.01	H	94.0	--	-34.0
4810	54.57	34.56	V	54.0	54.0	-19.4
4810	52.13	34.34	H	54.0	54.0	-19.6

Test Frequency:: 2445 MHz
Test Frequency Range: 30 MHz – 25 GHz

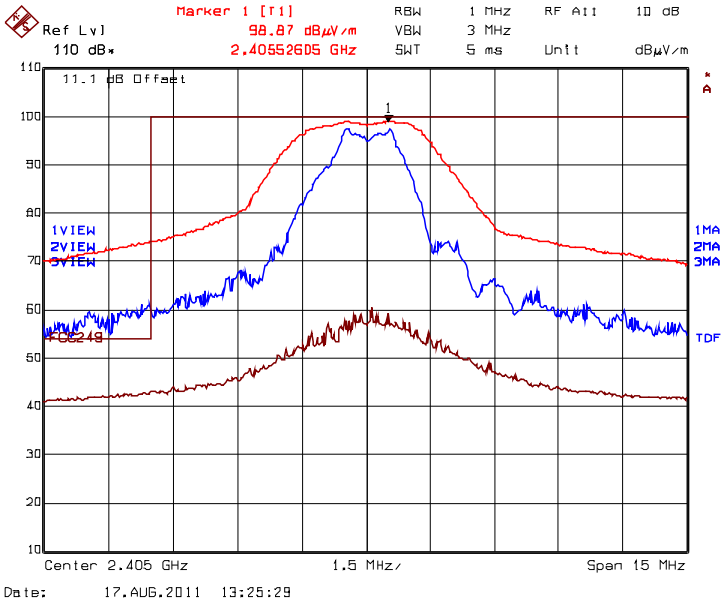
Frequency (MHz)	Peak E-Field @3m (dBµV/m)	Average E-Field @3m (dBµV/m)	Antenna Plane (H/V)	Field Strength Limit of Fundamental/Harmonic (dBµV/m)	Field Strength Limit of § 15.209 (dBµV/m)	Margin (dB)
2445	97.14	57.79	V	94.0	--	-36.2
2445	98.55	58.58	H	94.0	--	-35.4
4890	55.41	34.18	V	54.0	54.0	-19.8
4890	52.39	35.04	H	54.0	54.0	-18.9

Test Frequency:: 2480 MHz
Test Frequency Range: 30 MHz – 25 GHz

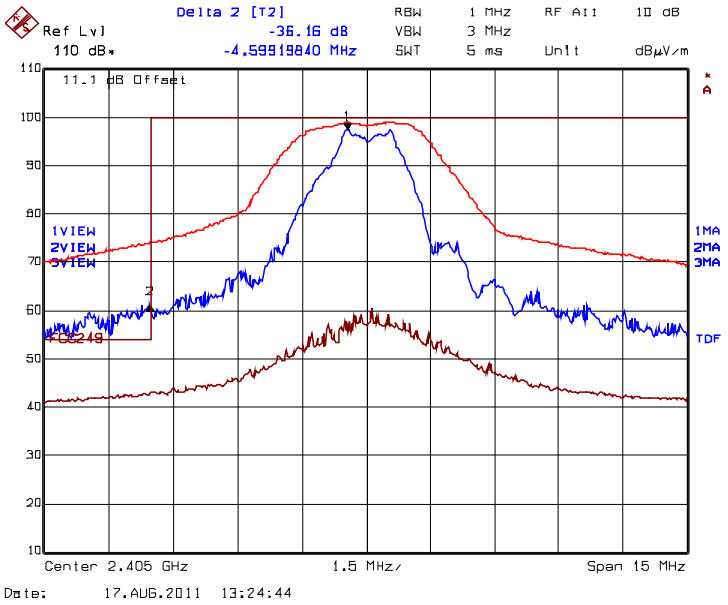
Frequency (MHz)	Peak E-Field @3m (dBµV/m)	Average E-Field @3m (dBµV/m)	Antenna Plane (H/V)	Field Strength Limit of Fundamental/Harmonic (dBµV/m)	Field Strength Limit of § 15.209 (dBµV/m)	Margin (dB)
2480	94.58	57.26	V	94.0	--	-36.7
2480	98.42	59.88	H	94.0	--	-34.1
4960	52.85	34.74	V	54.0	54.0	-19.2
4960	52.81	34.21	H	54.0	54.0	-19.8

See the following test data plots for band-edge emissions.

Plot 5.6.4.1. Band-Edge RF Radiated Emissions @ 3 m
Low End of Frequency Band, 2405 MHz, Rx Antenna Orientation: Horizontal

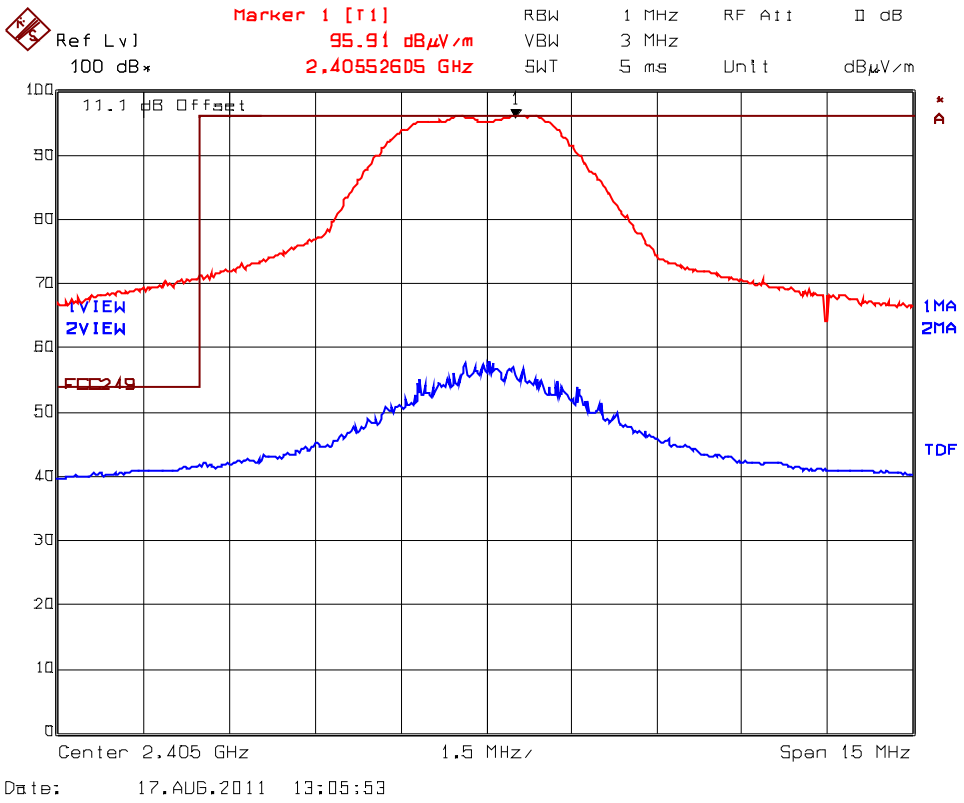


Plot 5.6.4.2. Band-Edge RF Radiated Emissions @ 3 m
Low End of Frequency Band, 2405 MHz, Rx Antenna Orientation: Horizontal



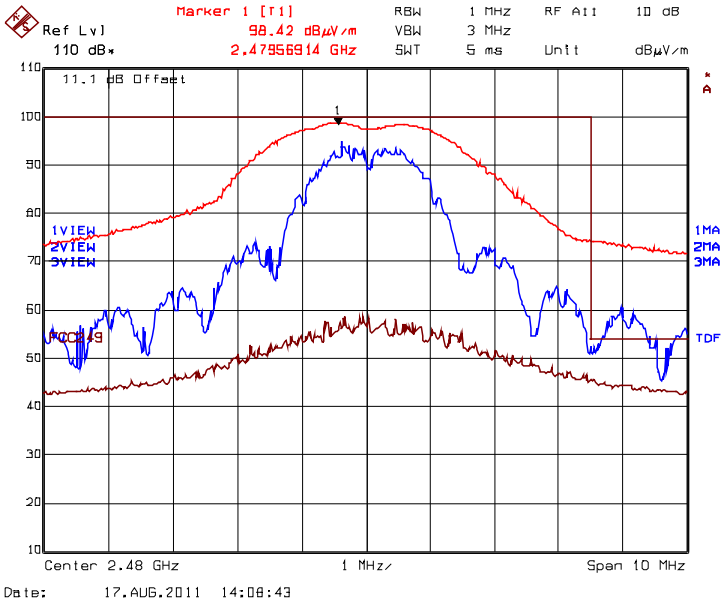
Trace 1: RBW = 1 MHz, VBW = 3 MHz
Trace 2: RBW = 200 kHz, VBW = 300 kHz, Delta (Peak to Band-Edge): 36.16 dB
Trace 3: RBW = 1 MHz, VBW = 10 Hz
Peak Band-Edge at 2400 MHz: Peak = 98.87 dBµV/m – 36.16dB = 62.71 dBµV/m

Plot 5.6.4.3. Band-Edge RF Radiated Emissions @ 3 m
Low End of Frequency Band, 2405 MHz
Rx Antenna Orientation: Vertical

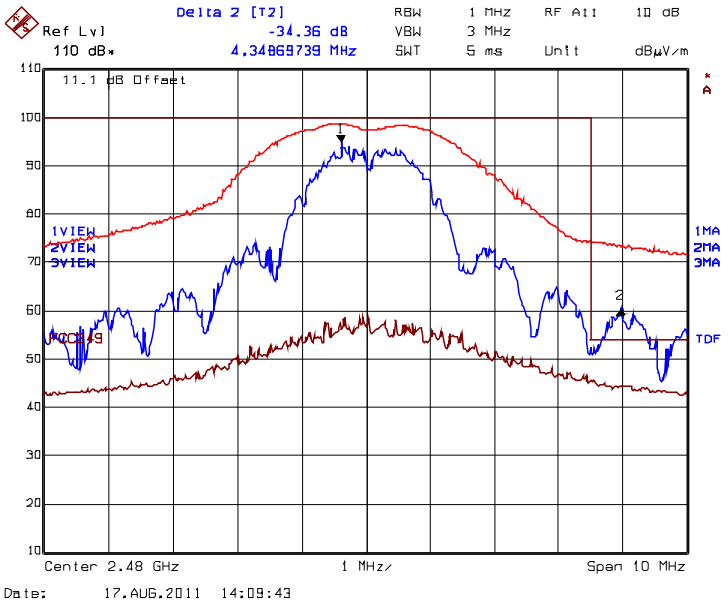


Trace 1: RBW = 1 MHz, VBW = 3 MHz
Trace 2: RBW = 1 MHz, VBW = 10 Hz

Plot 5.6.4.4. Band-Edge RF Radiated Emissions @ 3 m
High End of Frequency Band, 2480 MHz, Rx Antenna Orientation: Horizontal

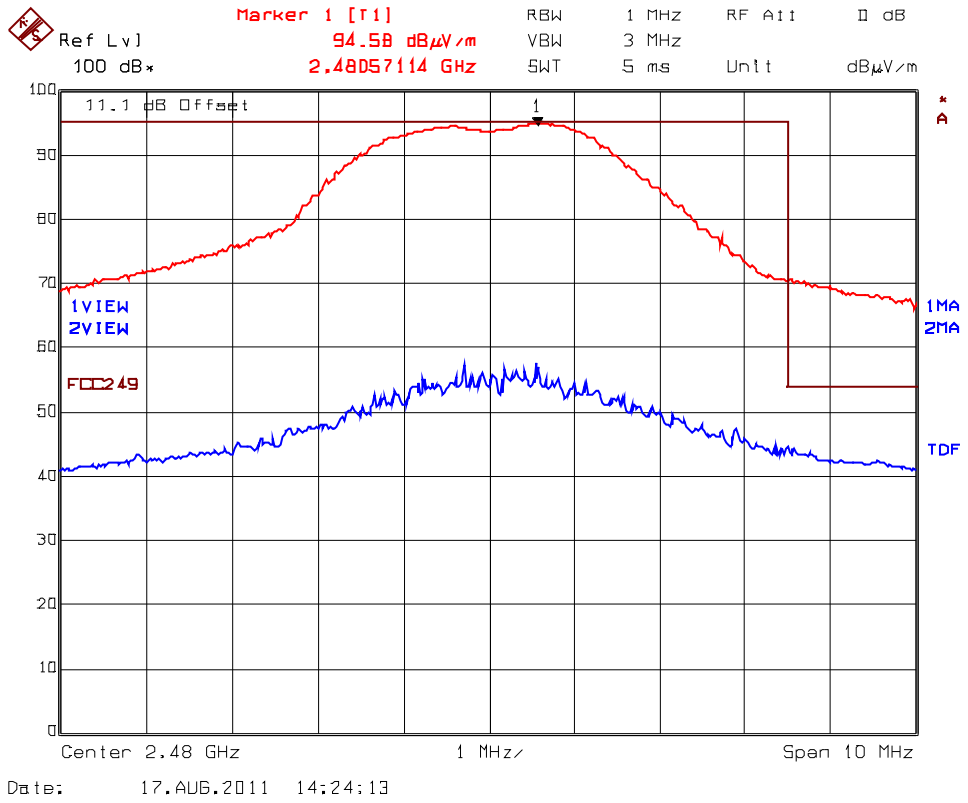


Plot 5.6.4.5. Band-Edge RF Radiated Emissions @ 3 m
High End of Frequency Band, 2480 MHz, Rx Antenna Orientation: Horizontal



Trace 1: RBW = 1 MHz, VBW = 3 MHz
Trace 2: RBW = 100 kHz, VBW = 300 kHz, Delta (Peak to Band-Edge): 34.36 dB
Trace 3: RBW = 1 MHz, VBW = 10 Hz
Peak Band-Edge at 2483.5 MHz: Peak = 98.42 dBµV/m – 34.36 dB = 64.06 dBµV /m

Plot 5.6.4.6. Band-Edge RF Radiated Emissions @ 3 m
High End of Frequency Band, 2480 MHz
Rx Antenna Orientation: Vertical



Trace 1: RBW = 1 MHz, VBW = 3 MHz
Trace 2: RBW = 1 MHz, VBW = 10 Hz

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	15 Mar 2012
Spectrum Analyzer	Rohde & Schwarz	FSEK20/B4/B2	834157/005	9 kHz – 40 GHz	18 Jul 2012
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	4 Aug 2012
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	15 Mar 2012
RF Amplifier	Com-Power	PA-103A	161243	10 MHz – 1 GHz	23 Feb. 2012
Signal Generator	Hewlett Packard	8648C	3443U00391	100 kHz – 3200 MHz	16 Dec, 2011
Signal Generator	Hewlett Packard	83752B	3610A00457	0.01 – 20 GHz	19 Oct , 2011
Horn Antenna	ETS-Lindgren	360-09	00118385	18 – 26.5 GHz	30 May 2012
Horn Antenna	Emco	3115	5955	1 – 18 GHz	09 Jan 2012
Horn Antenna	Emco	3115	6570	1 – 18 GHz	22 Feb 2012
Biconi-Log Antenna	Emco	3142C	00034792	26 – 3000 MHz	26 April 2012
Log Periodic	ETS-Lindgren	93148	1101	200 – 2000 MHz	04 Jan 2012
Attenuator	Narda	4768-20	-	DC – 40 GHz (2w)	Cal. on use
Attenuator	Narda	4768-10	-	DC – 40 GHz (2w)	Cal. on use
DC-Block	Hewlett Packard	11742A	12460	0.045-26.5 GHz	Cal. on use
High Pass Filter	K & L	11SH10-3000/T18000	4	Cut off 1600 MHz	Cal. on use
High Pass Filter	K & L	11SH10-4000/1200	4	Cut off 2400 MHz	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