ENGINEERING TEST REPORT

InReach
Model No.: DeLorme inReach for Android OS
FCC ID: UTNINRCHBT3

Applicant:

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

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, Parts 2 and 25 (Subpart C)

UltraTech's File No.: DELO-003QF25

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: September 21, 2011	
Report Prepared by: Dan Huynh Issued Date: September 21, 2011	Tested by: Hung Trinh Test Dates: August 17 & 19, 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 Parts 2 and 25
Title:	Code of Federal Regulations (CFR), Title 47 Telecommunication – Parts 2 & 25
Purpose of Test:	To obtain FCC Certification Authorization for Radio operating in the Frequency Band 1616.0-1626.5 MHz.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - 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.

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

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19	2010	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Parts 0 to 15
47 CFR Part 25	2010	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 25 – Satellite Communications
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
TIA/EIA 603, Edition C	2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

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

Brand Name:	DeLorme
Product Name:	InReach
Model Name or Number:	DeLorme inReach for Android OS
Serial Number:	Test Sample
Type of Equipment:	Licensed Non-Broadcast Transmitter Worn on Body
Power Supply Requirement:	3V (2) AA Lithium batteries
Transmitting/Receiving Antenna Type:	Integral
Primary User Functions of EUT:	Two-way satellite GPS communicator

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable
Intended Operating Environment:	Residential Commercial, industrial or business
Power Supply Requirement:	+5 Vdc +/- 0.5V @ 190 mA (average)
RF Output Power Rating:	0.67 W
Operating Frequency Range:	1616.0 – 1626.5 MHz
RF Output Impedance:	50 Ω
Channel Spacing:	41.667 kHz
Emission Designation:	41K7V7D

2.4. 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

2.5. GENERAL TEST SETUP

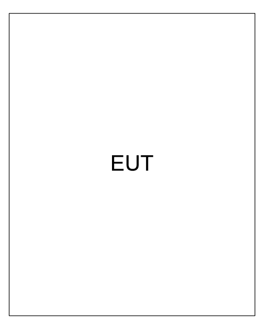


EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

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 TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	N/A
Special Hardware Used:	N/A
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):	1616.0 – 1626.5 MHz
Test Frequencies: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	1616.01 MHz and 1625.69 MHz
Transmitter Wanted Output Test Signals:	
Transmitter Power (measured maximum output power):	28.22 dBm
Normal Test Modulation:	V7D
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.

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.

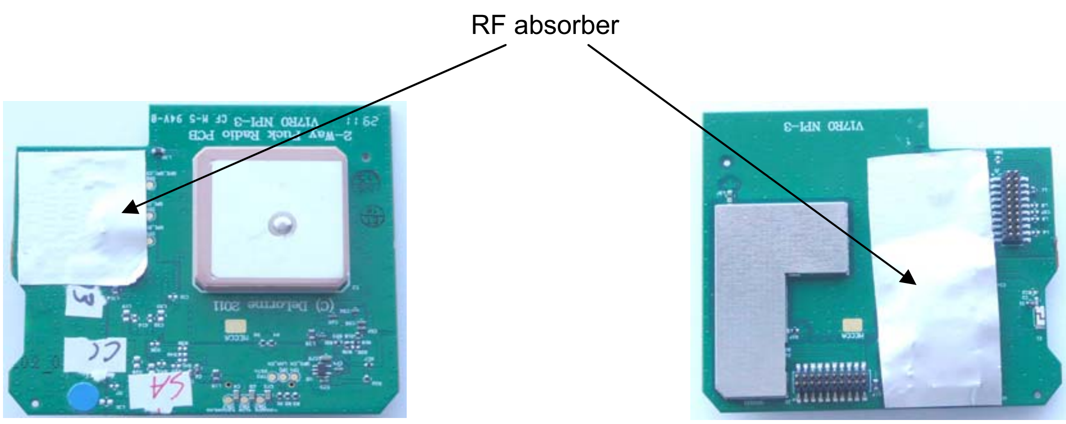
4.2. APPLICABILITY & SUMMARY OF EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Applicability (Yes/No)
2.1046 & 25.204(a)	RF Power Output	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes (See Note 1)
2.1049 & 25.202(f)	Occupied bandwidth, Emission Limitation	Yes (See Note 2)
2.1051, 2.1057, 25.202(f) & 25.213	Emission Limits - Spurious Emissions at Antenna Terminal	Yes (See Note 2)
2.1053, 2.1057, 25.202(f) & 25.213	Emission Limits - Field Strength of Spurious Emissions	Yes
2.1055 & 25.202(d)	Frequency Stability	Yes (See Note 2)

Note 1: See SAR test report.
Note 2: See original module test report.

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

The RF PCB board required to have RF absorber installed on top and bottom of BT device portion.



4.3.1. DEVIATION OF STANDARD TEST PROCEDURES

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 EXHIBIT 8 of this report.

5.2. MEASUREMENT UNCERTAINTIES

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.
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 MANUFACTURER

Two-way satellite GPS communicator.

5.5. RF POWER OUTPUT [§§ 2.1046 & 25.204(a)]

5.5.1. Limits

§ 25.204(a) - In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (c) of this section:

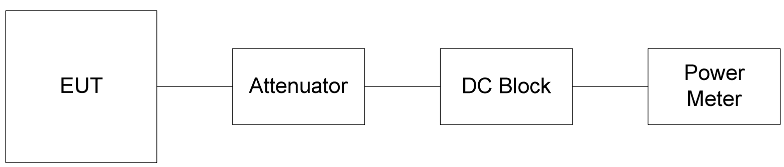
+40 dBW in any 4 kHz band for $\Theta \le 0°$
+40 + 3 Θ dBW in any 4 kHz band for $0° < \Theta \le 5°$

where Θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

5.5.2. Method of Measurements

Refer to Section 8.1 (Conducted) and 8.2 (Radiated) of this report for measurement details

5.5.3. Test Arrangement



5.5.4. Test Data

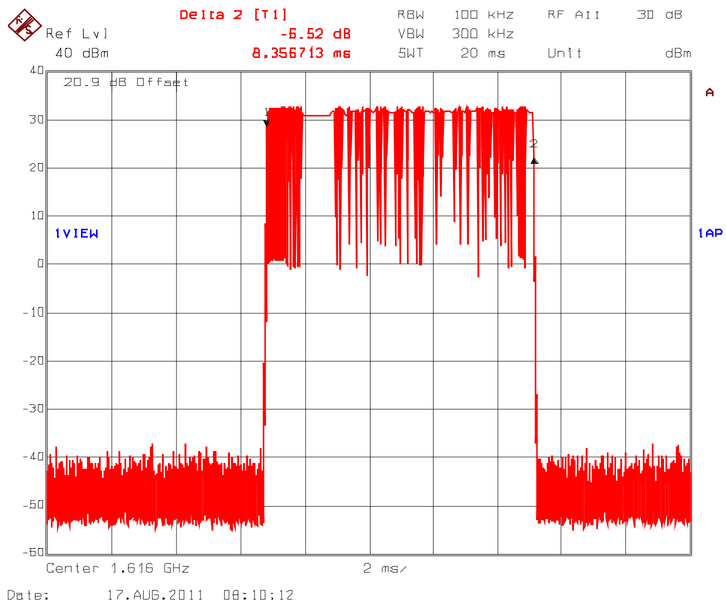
Frequency (MHz)	Attenuator & Cable Loss (dB)	Level at Power Meter (dBm)	Max. Antenna Gain (dBi)	Mean Carrier Power (dBm)	*Duty Cycle Factor (dB)	Peak EIRP Power (dBm)	Peak EIRP Power (dBW)	Limit (dBW)
1616.02	20.87	-3.53	2.5	19.84	10.50	30.34	0.34	40
1625.69	20.87	-3.15	2.5	20.22	10.50	30.72	0.72	40

*Duty Cycle Factor = 10*log(1/x), where x = (Ton /(100 ms or period), whichever is less.

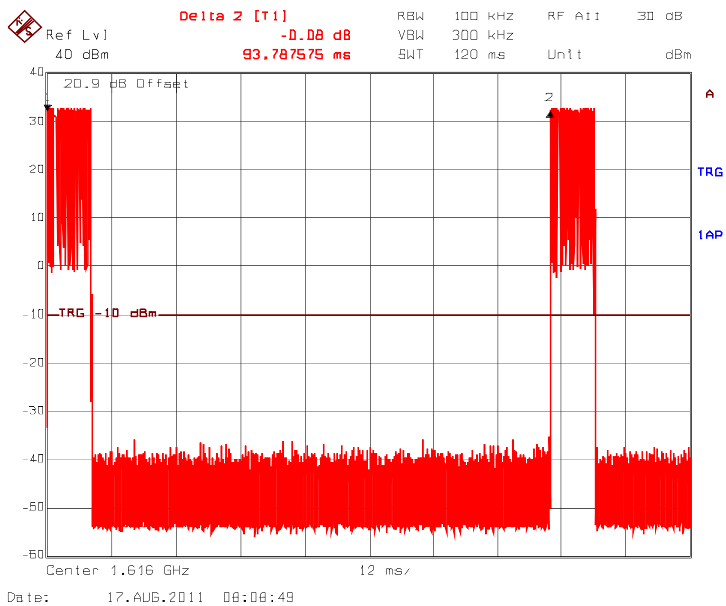
Duty Cycle Factor = 10*log (1/(8.36 ms / 93.79 ms)) = 10.50 dB

See the following duty cycle plots for details.

Plot 5.5.4.1. Duty Cycle, Ton (8.36 ms)



Plot 5.5.4.2. Duty Cycle, Period (93.79 ms)



5.6. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§§ 2.1053, 2.1057, 25.202(f)(3)]

5.6.1. Limits

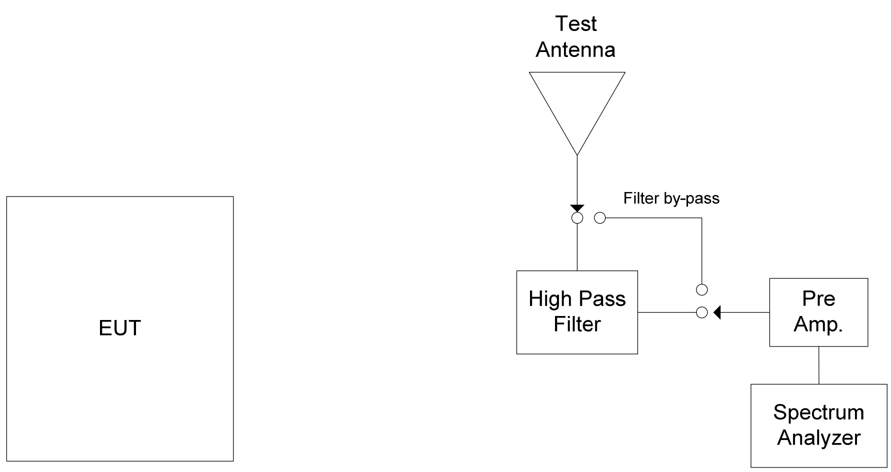
25.202(f)(3) - The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule: In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts;

In any event, when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f) (1), (2) and (3) of this section.

5.6.2. Method of Measurements

The spurious/harmonic ERP measurements are using substitution method specified in Section 8.2 of this report.

5.6.3. Test Arrangement



5.6.4. Test Data

Remark(s):

- The emissions were scanned from 30 MHz to 10th harmonics; all spurious emissions that are in excess of 20dB below the specified limit shall be recorded.

5.6.4.1. Near Lowest Frequency (1616.01 MHz)

Test Frequency (MHz): 1616.01
Power $_{conducted}$ (dBm): 27.84
Limit (dBm): -13

Frequency (MHz)	E-Field (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP Measured (dBm)	Limit (dBm)	Margin (dB)
3232.02	79.22	Peak	V	-20.99	-13	-8.0
3232.02	80.91	Peak	H	-19.30	-13	-6.3
4848.03	76.28	Peak	V	-23.26	-13	-10.3
4848.03	74.19	Peak	H	-25.35	-13	-12.4
6464.04	72.45	Peak	V	-29.44	-13	-16.4
6464.04	76.41	Peak	H	-25.48	-13	-12.5
All other spurious emissions are more than 20dB below the specified limit.						

5.6.4.2. Near Highest Frequency (1625.69 MHz)

Test Frequency (MHz): 1625.69
Power $_{conducted}$ (dBm): 28.22
Limit (dBm): -13

Frequency (MHz)	E-Field (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured (dBm)	Limit (dBm)	Margin (dB)
3251.38	80.41	Peak	V	-16.67	-13	-3.7
3251.38	81.79	Peak	H	-15.29	-13	-2.3
4877.07	78.67	Peak	V	-17.11	-13	-4.1
4877.07	76.70	Peak	H	-19.08	-13	-6.1
6502.76	72.93	Peak	V	-24.13	-13	-11.1
6502.76	71.62	Peak	H	-25.44	-13	-12.4
8128.45	67.28	Peak	H	-30.84	-13	-17.8
All other spurious emissions are more than 20dB below the specified limit.						

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
Power Meter	Hewlett Packard	436A	2347A17246	10 kHz – 50 GHz, sensor dependent	15 Aug 2012
Power Sensor	Hewlett Packard	8481A	1550A15143	10 MHz – 18 GHz	15 Aug 2012

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. RADIATED EMISSION MEASUREMENT UNCERTAINTY

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

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

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

EXHIBIT 8. MEASUREMENT METHODS

8.1. CONDUCTED POWER MEASUREMENTS

- The following shall be applied to the combination(s) of the radio device and its intended antenna(e).
- I f the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
- The following method of measurement shall apply to both conducted and radiated measurements.
- The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.
- The measurement shall be performed using normal operation of the equipment with modulation.

Test procedure shall be as follows:

Step 1: Duty Cycle measurements if the transmitter's transmission is transient

- Using a EMI Receiver with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;
- The duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with $0<x<1$, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.

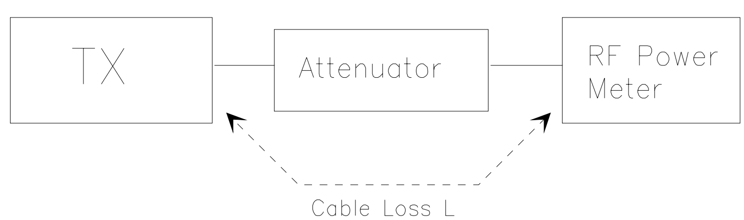
Step 2: Calculation of Average EIRP. See Figure 1

- The average output power of the transmitter shall be determined using a wideband, calibrated RF average power meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
- The e.i.r.p. shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

EIRP = A + G + 10log(1/x)

{X = 1 for continuous transmission => 10log(1/x) = 0 dB}

Figure 1.



8.2. RADIATED POWER MEASUREMENTS (ERP & EIRP) USING SUBSTITUTION METHOD

8.2.1. MAXIMIZING RF EMISSION LEVEL (E-FIELD)

(a) The measurements were performed with full rf output power and modulation.
(b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The BICONILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
(e) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBμV/m) = Reading (dBμV) + Total Correction Factor (dB/m)

(f) Set the EMI Receiver and #2 as follows:

Center Frequency:	test frequency
Resolution BW:	100 KHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(h) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
(l) Repeat for all different test signal frequencies.

8.2.2. Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method

(a) Set the EMI Receiver (for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:

Center Frequency:	equal to the signal source
Resolution BW:	100 KHz
Video BW:	VBW > RBW
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

(b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

(c) Select the frequency and E-field levels obtained in the Section 8.2.1 for ERP/EIRP measurements.
(d) Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):
- ♦ DIPOLE antenna for frequency from 30-1000 MHz or
- ♦ HORN antenna for frequency above 1 GHz }.

(e) Mount the transmitting antenna at 1.5 meter high from the ground plane.
(f) Use one of the following antenna as a receiving antenna:
- ♦ DIPOLE antenna for frequency from 30-1000 MHz or
- ♦ HORN antenna for frequency above 1 GHz }.

(g) If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.
(h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.
(i) Tune the EMI Receivers to the test frequency.
(j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(k) The transmitter was rotated through 360^o about a vertical axis until a higher maximum signal was received.
(l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
(n) Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:

P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1
EIRP = P + G1 = P3 + L2 - L1 + A + G1
ERP = EIRP – 2.15 dB
Total Correction factor in EMI Receiver # 2 = L2 – L1 + G1

Where:	P:	Actual RF Power fed into the substitution antenna port after corrected.
	P1:	Power output from the signal generator
	P2:	Power measured at attenuator A input
	P3:	Power reading on the Average Power Meter
	EIRP:	EIRP after correction
	ERP:	ERP after correction

(o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
(p) Repeat step (d) to (o) for different test frequency
(q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(r) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.

Figure 2

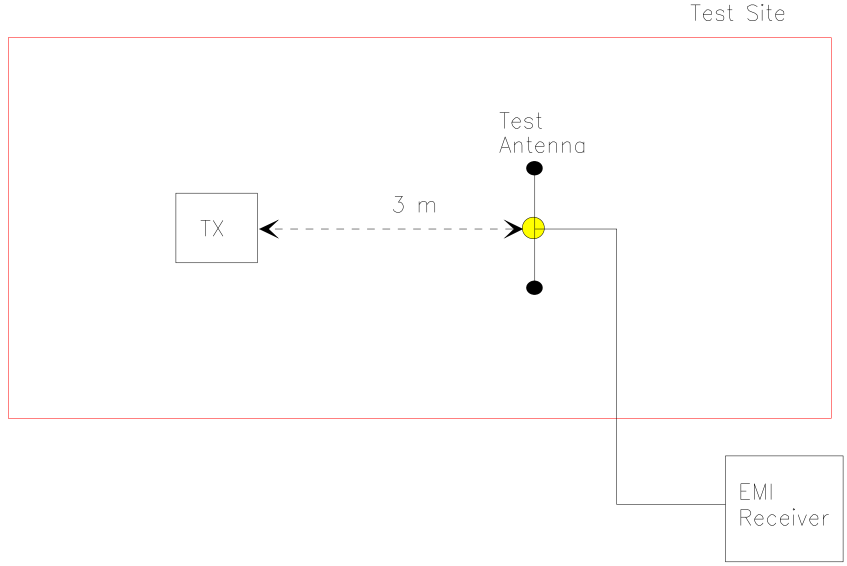


Figure 3