ENGINEERING TEST REPORT

XTend
Model: XT09B
FCC ID: MCQ-9XTENDB

Applicant:

Digi International Inc.
11001 Bren Road East
Minnetonka, MN 55343

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247 Frequency Hopping Spread Spectrum (FHSS)
Operating within 902-928 MHz Band

UltraTech's File No.: DIGI-082F15C247

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: January 13, 2014	
Report Prepared by: Dan Huynh Issued Date: January 13, 2014	Tested by: Mr. Hung Trinh Test Dates: October 16 & 18, 2013

- *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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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.247
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15 – Radio Frequency Devices
Purpose of Test:	Class II Permissive Change for Frequency Hopping Spread Spectrum Transceiver Operating within the Frequency Band 902-928 MHz.
Test Procedures:	ANSI C63.4 ANSI C63.10 FCC Public Notice DA 00-705
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	2013	Code of Federal Regulations (CFR), Title 47 – Telecommunication
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
FCC Public Notice DA 00-705	2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
FCC ET Docket No. 99-231	2002	Amendment to FCC Part 15 of the Commission's Rules Regarding to Spread Spectrum Devices

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Digi International Inc.
Address:	11001 Bren Road East Minnetonka, MN 55343 USA
Contact Person:	Mr. Paul Dahl Phone #: 801-765-9885 Fax #: 801-765-9895 Email Address: paul.dahl@digi.com

MANUFACTURER	
Name:	Digi International Inc.
Address:	11001 Bren Road East Minnetonka, MN 55343 USA
Contact Person:	Mr. Paul Dahl Phone #: 801-765-9885 Fax #: 801-765-9895 Email Address: paul.dahl@digi.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:	Digi International Inc
Product Name:	XTend
Model Name or Number:	XT09B
Serial Number:	Test Sample
Type of Equipment:	Spread Spectrum Transmitter
Input Power Supply Type:	External Regulated DC Sources
Primary User Functions of EUT:	Long range drop-in wireless solution for embedded systems in 902-928MHz band

2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	▪ Mobile ▪ Base Station (fixed use)
Intended Operating Environment:	▪ Commercial, industrial or business environment ▪ Residential environment
Power Supply Requirement:	2.8V to 5.5V DC
RF Output Power Rating:	0.001 to 1 W
Operating Frequency Range:	902.9- 927.1 MHz
RF Output Impedance:	50 Ohm
Duty Cycle:	Continuous
Modulation Type:	FSK, GFSK
Antenna Connector Type:	RPSMA or MMCX

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

Antenna Type	Maximum Gain (dBi)
Monopole antenna	2.1
Multi-path antenna	3.0
Omni-directional antenna	8.1
Yagi antenna	15.1
Refer to user manual for antennas list information.	

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	RF IN/OUT Port	1	RPSMA/MMCX	Shielded
2	DC Supply & I/O Port	1	Pin Header	No cable, direct connection

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 Cable
Brand name:	Digi International 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°C
Humidity:	51%
Pressure:	102 kPa
Power Input Source:	5.5 VDC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements.
Special Test Software:	Special software provided by the Applicant to operate the EUT at each channel frequency continuously and in the range of typical modes of operation.
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 non-integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	902.9-927.1 MHz
Frequency(ies) Tested: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	902.9, 915.2 and 927.1 MHz
RF Power Output: (measured maximum output power at antenna terminals)	29.38 dBm (0.867 W)
Normal Test Modulation:	FSK, 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)	Power Line Conducted Emissions Measurements	N/A
15.247(a)(1)	Provisions for Frequency Hopping Systems	N/A
15.247(b)	Peak Output Power	Yes
15.247(d)	Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	Yes
15.247(i), 1.1307, 1.1310, 2.1091	RF Exposure	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

5.1. PEAK OUTPUT POWER & EQUIVALENT ISOTROPIC RADIATED POWER (EIRP) [§ 15.247(b)]

5.1.1. Limit

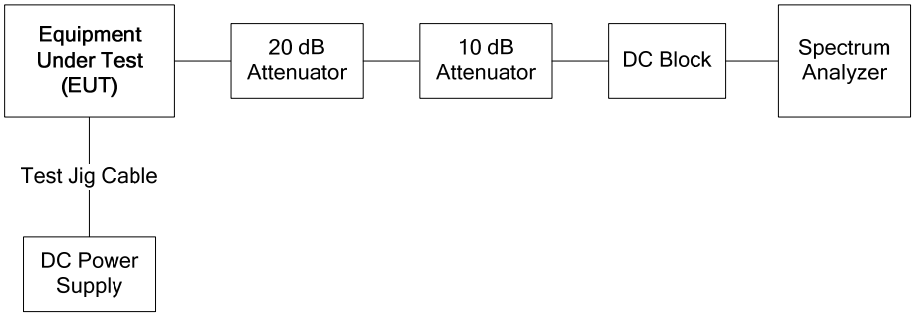
§15.247(b)(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

§15.247(b)(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1.2. Method of Measurements

FCC Public Notice DA 00-705 and ANSI C63.10-2009

5.1.3. Test Arrangement



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

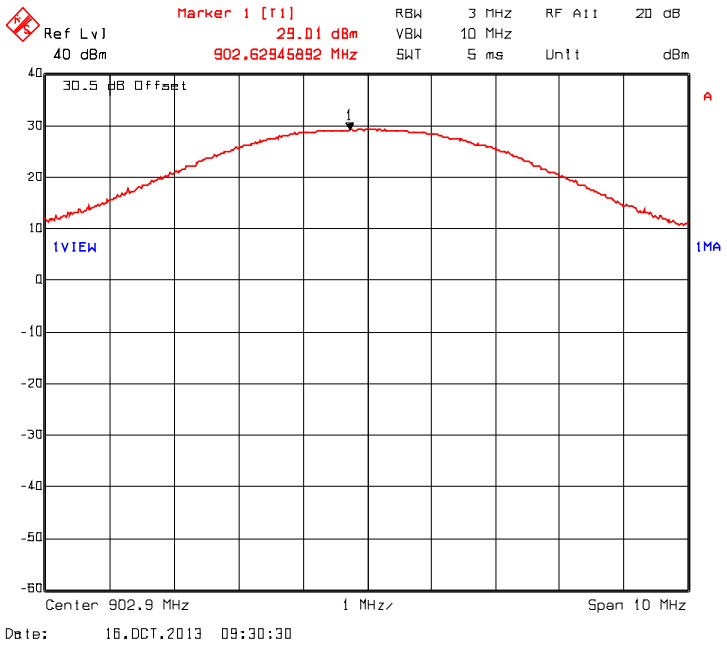
5.1.4. Test Data

Operation Mode	Frequency (MHz)	Peak Output Power at Antenna Terminal (dBm)	Calculated EIRP (dBm)	Peak Output Power Limit (dBm)	EIRP Limit (dBm)
FSK 10 kbps High power setting (30 dBm, 1 W)	902.9	29.01	See Notes below	30	36
	915.2	29.38	See Notes below	30	36
	927.1	29.38	See Notes below	30	36
GFSK 125 kbps High power setting (30 dBm, 1 W)	902.9	28.99	See Notes below	30	36
	915.2	29.38	See Notes below	30	36
	927.1	29.38	See Notes below	30	36

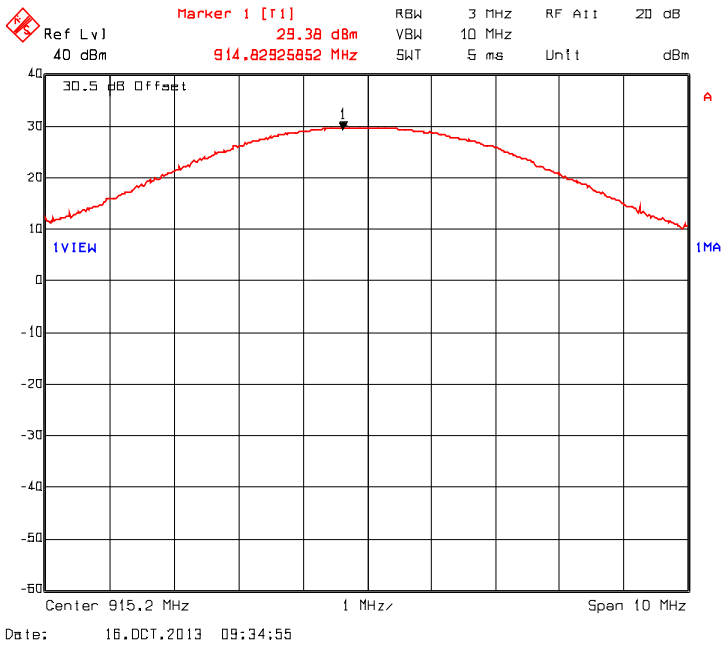
Notes: 1. The EIRP shall be calculated based on the transmitter antenna gain (G_{dBi}), cable loss (CL_{dB}) and peak output power at antenna terminal (P_{dBm}). Calculated EIRP = $P_{dBm} + G_{dBi} - CL_{dB}$
2. EIRP shall not exceed 36 dBm limit (Power Setting = 36 dBm - $G_{dBi} + CL_{dB}$).

See the following plots for details.

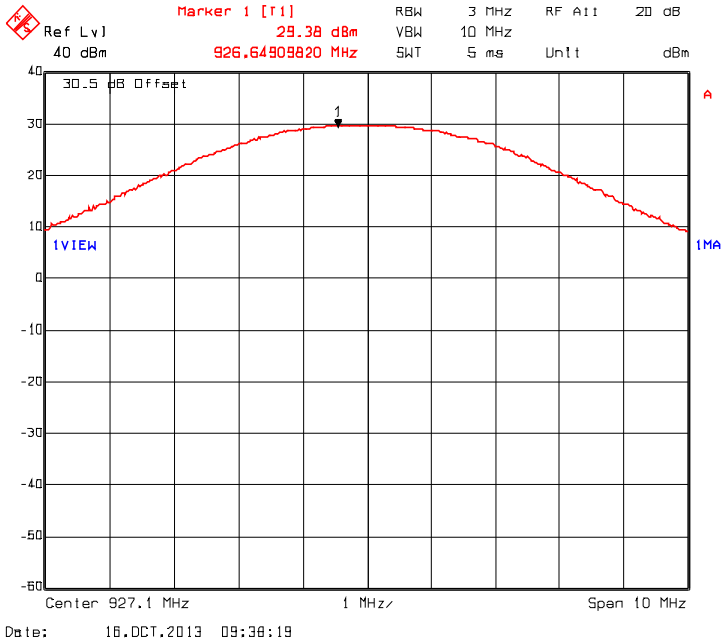
Plot 5.1.4.1. Peak Output Power, 902.9 MHz, FSK 10 kbps, High Power Setting



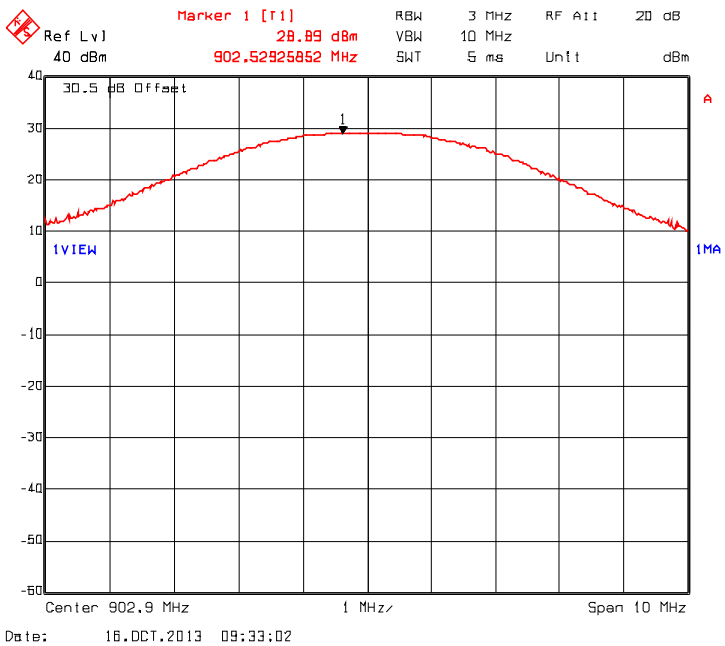
Plot 5.1.4.2. Peak Output Power, 915.2 MHz, FSK 10 kbps, High Power Setting



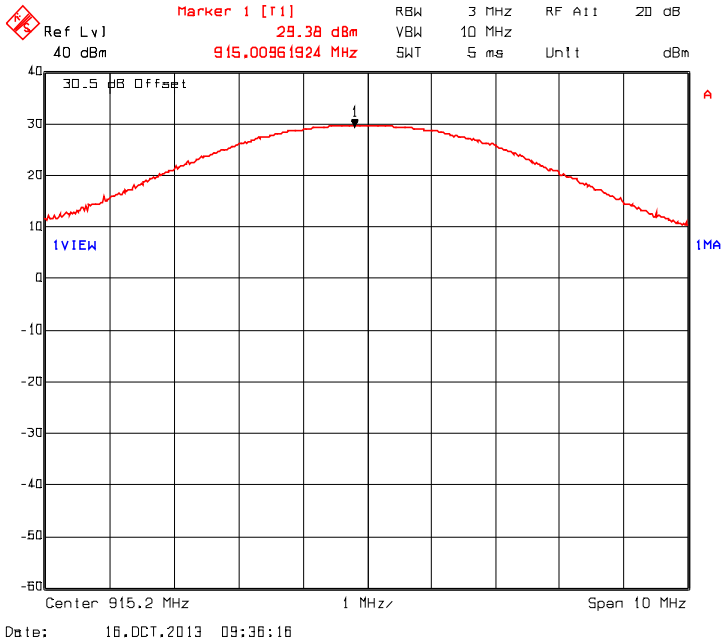
Plot 5.1.4.3. Peak Output Power, 927.1 MHz, FSK 10 kbps, High Power Setting



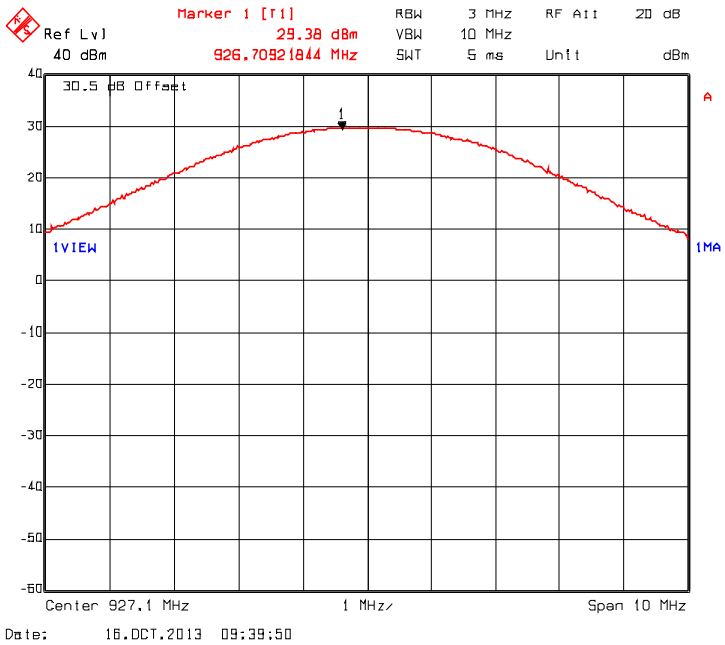
Plot 5.1.4.4. Peak Output Power, 902.9 MHz, GFSK 125 kbps, High Power Setting



Plot 5.1.4.5. Peak Output Power, 915.2 MHz, GFSK 125 kbps, High Power Setting



Plot 5.1.4.6. Peak Output Power, 927.1 MHz, GFSK 125 kbps, High Power Setting



5.2. RF EXPOSURE REQUIRMENTS [§§ 15.247(b)(5), 1.1310 & 2.1091]

The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation.

FCC 47 CFR § 1.1310:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

5.2.1. Method of Measurements

Refer to Sections 1.1310, 2.1091.

In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

(1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
(2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
(3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
(4) Any other RF exposure related issues that may affect MPE compliance

Calculation Method of RF Safety Distance:

$$S = \frac{P \cdot G}{4 \cdot \pi \cdot r^2} = \frac{EIRP}{4 \cdot \pi \cdot r^2}$$

Where: P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

5.2.2. RF Evaluation

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum calculated separation distance between antenna and persons required: **23 cm (see note)**	Manufacturer' instruction for separation distance between antenna and persons required: **30 cm.**
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement.	Antenna installation and device operating instructions shall be provided to installers to maintain and ensure compliance with RF exposure requirements.
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits.	Refer to User's Manual for RF Exposure Information.
Any other RF exposure related issues that may affect MPE compliance	None.

NOTE: The minimum separation distance between the antenna and bodies of users are calculated using the following formula:

RF Exposure Distance Limits

$$r = \sqrt{\frac{P \cdot G}{4 \cdot \pi \cdot S}} = \sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}}$$

S = 902.9/1500 mW/cm^2 = 0.602 mW/cm^2
EIRP = 36 dBm = $10^{36/10}$ mW = 3981 mW (Worst Case)

(Minimum Safe Distance, r) = $\sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}} = \sqrt{\frac{3981}{4 \cdot \pi \cdot (0.602)}} \approx 23cm$

5.3. TRANSMITTER SPURIOUS RADIATED EMISSIONS AT 3 METERS [§§ 15.247(d), 15.209 & 15.205]

5.3.1. Limit

§ 15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

§ 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
12.51975–12.52025	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

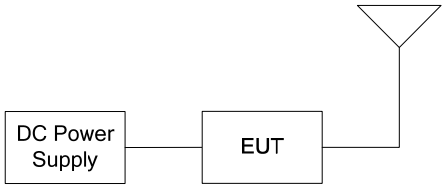
§ 15.209(a) Radiated Emission Limits; General Requirements

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement 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

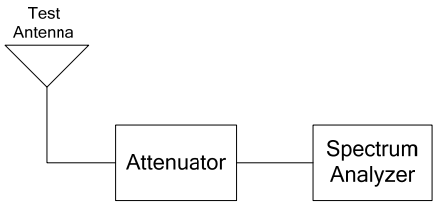
5.3.2. Method of Measurements

ANSI C63.10-2009

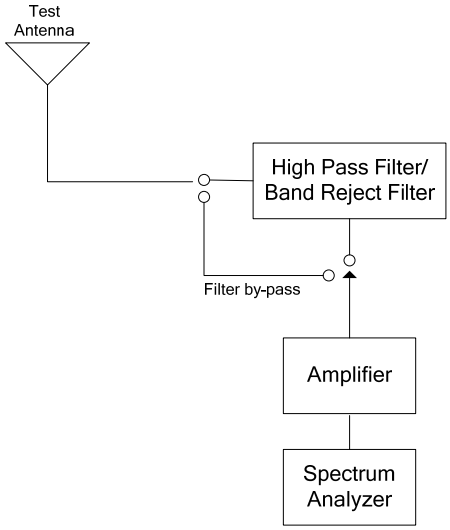
5.3.3. Test Arrangement



For Fundamental and Band-edge



For Spurious and Harmonics



5.3.4. Test Data

Remark(s):
- 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.
- Exploratory tests were performed to determined final test configuration, the following test results at the highest data rate (125kbps, GFSK modulation) represent the worst-case.

5.3.4.1. EUT with 15.1 dBi Yagi Antenna, 10.25 dB Assembly Cable Loss at 1 W Output Power

5.3.4.1.1. Spurious RF Radiated Emissions Test Results

Fundamental Frequency:	902.9 MHz						
Frequency Test Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
902.9	**130.27**	**--**	**V**	**--**	**--**	**--**	**--**
902.9	**130.95**	**--**	**H**	**--**	**--**	**--**	**--**
2708.7	52.09	48.11	V	54.0	111.0	-5.9	Pass*
2708.7	48.18	42.26	H	54.0	111.0	-11.7	Pass*
3611.6	47.23	37.29	V	54.0	111.0	-16.7	Pass*
3611.6	49.93	39.75	H	54.0	111.0	-14.3	Pass*
4514.5	49.13	40.41	V	54.0	111.0	-13.6	Pass*
4514.5	53.79	48.61	H	54.0	111.0	-5.4	Pass*
5417.4	51.09	41.80	V	54.0	111.0	-12.2	Pass*
5417.4	56.25	50.24	H	54.0	111.0	-3.8	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

* Emission within the restricted frequency bands.

Fundamental Frequency: 915.2 MHz
Frequency Test Range: 30 MHz – 10 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
915.2	**130.55**	**--**	**V**	**--**	**--**	**--**	**--**
915.2	**131.02**	**--**	**H**	**--**	**--**	**--**	**--**
2745.6	57.23	47.95	V	54.0	111.0	-6.1	Pass*
2745.6	47.65	41.06	H	54.0	111.0	-12.9	Pass*
3660.8	53.83	50.90	V	54.0	111.0	-3.1	Pass*
3660.8	47.65	39.98	H	54.0	111.0	-14.0	Pass*
4576.0	50.23	41.44	V	54.0	111.0	-12.6	Pass*
4576.0	52.80	48.26	H	54.0	111.0	-5.7	Pass*
7321.6	55.69	47.13	V	54.0	111.0	-6.9	Pass*
7321.6	52.12	47.29	H	54.0	111.0	-6.7	Pass*

All other spurious emissions and harmonics are more than 20 dB below the applicable limit.

* Emission within the restricted frequency bands.

Fundamental Frequency: 927.1 MHz
Frequency Test Range: 30 MHz – 10 GHz

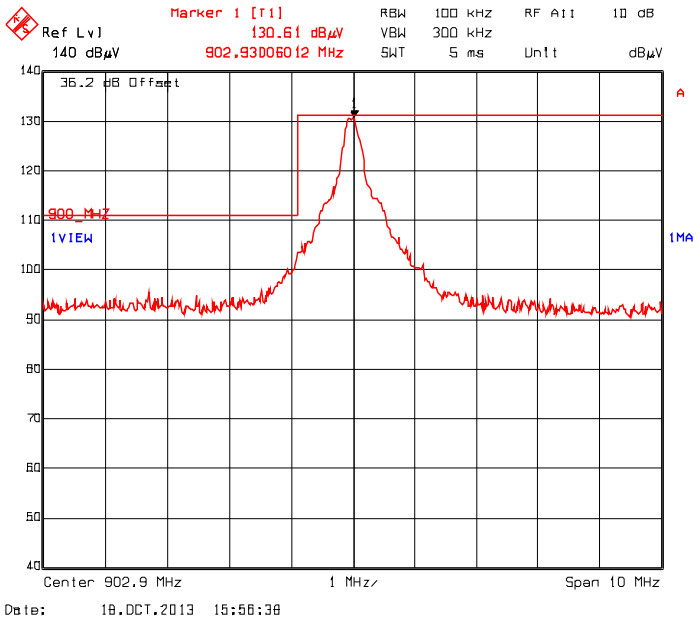
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
927.1	**130.14**	**--**	**V**	**--**	**--**	**--**	**--**
927.1	**131.05**	**--**	**H**	**--**	**--**	**--**	**--**
2781.3	48.59	44.06	V	54.0	111.1	-9.9	Pass*
2781.3	46.16	39.86	H	54.0	111.1	-14.1	Pass*
3708.4	49.93	42.89	V	54.0	111.1	-11.1	Pass*
3708.4	49.08	40.54	H	54.0	111.1	-13.5	Pass*
4635.5	49.27	40.09	V	54.0	111.1	-13.9	Pass*
4635.5	53.03	46.54	H	54.0	111.1	-7.5	Pass*
7416.8	53.02	45.96	V	54.0	111.1	-8.0	Pass*
7416.8	54.39	43.09	H	54.0	111.1	-10.9	Pass*

All other spurious emissions and harmonics are more than 20 dB below the applicable limit.

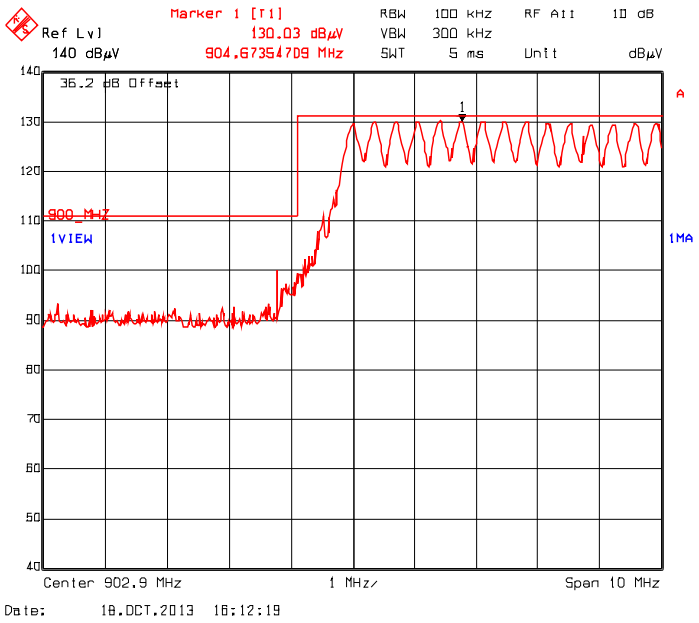
* Emission within the restricted frequency bands.

5.3.4.1.2. Band-Edge RF Radiated Emissions Test Results

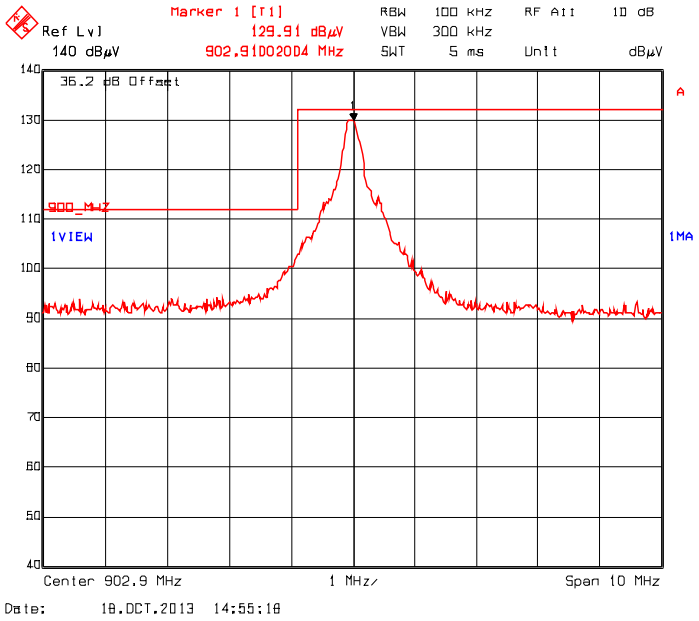
Plot 5.3.4.1.2.1. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, High Power, Horizontal



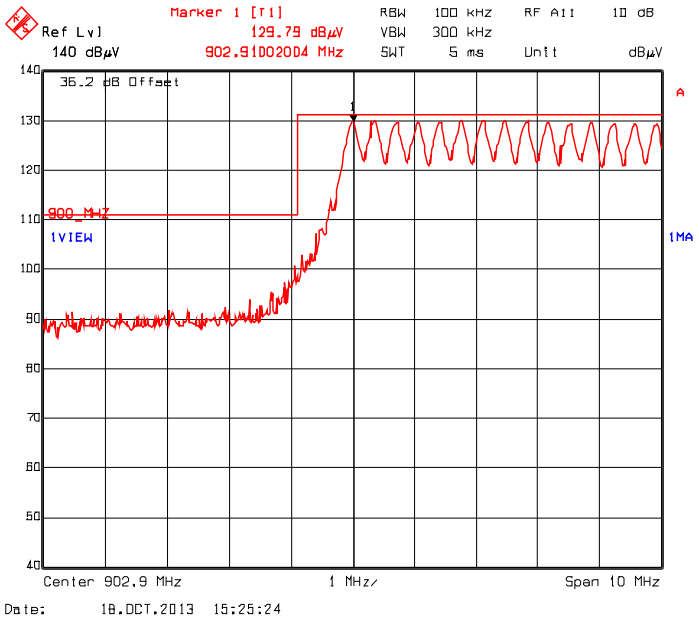
Plot 5.3.4.1.2.2. Radiated Band-Edge, Low End of Frequency Band, Pseudorandom Hopping Mode, High Power, Horizontal



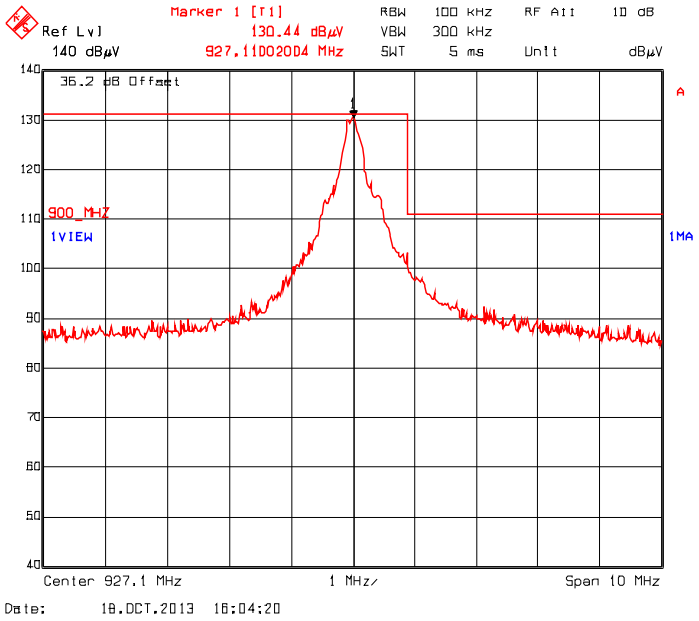
Plot 5.3.4.1.2.3. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, High Power, Vertical



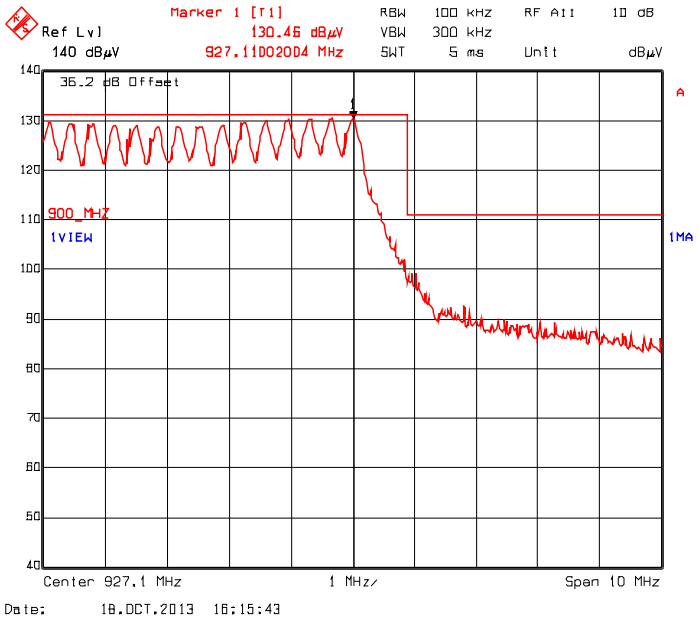
Plot 5.3.4.1.2.4. Radiated Band-Edge, Low End of Frequency Band, Pseudorandom Hopping Mode, High Power, Vertical



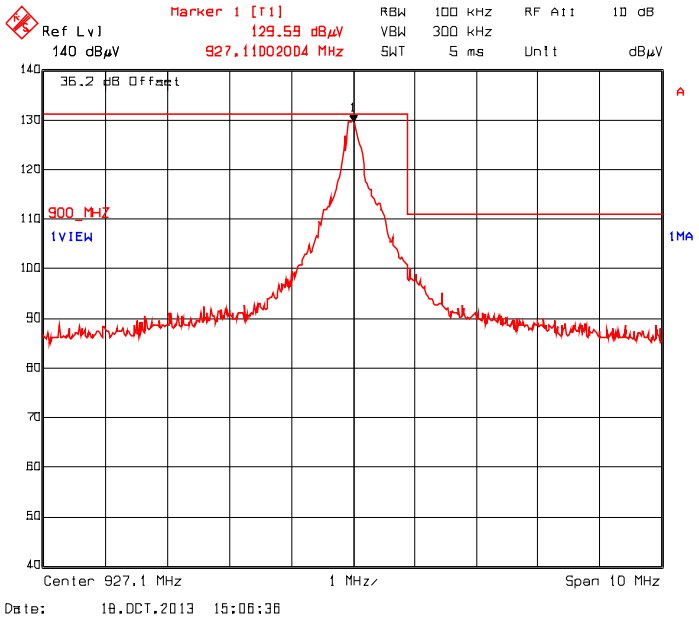
Plot 5.3.4.1.2.5. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, High Power, Horizontal



Plot 5.3.4.1.2.6. Radiated Band-Edge, High End of Frequency Band, Pseudorandom Hopping Mode, High Power, Horizontal



Plot 5.3.4.1.2.7. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, High Power, Vertical



Plot 5.3.4.1.2.8. Radiated Band-Edge, High End of Frequency Band, Pseudorandom Hopping Mode, High Power, Vertical

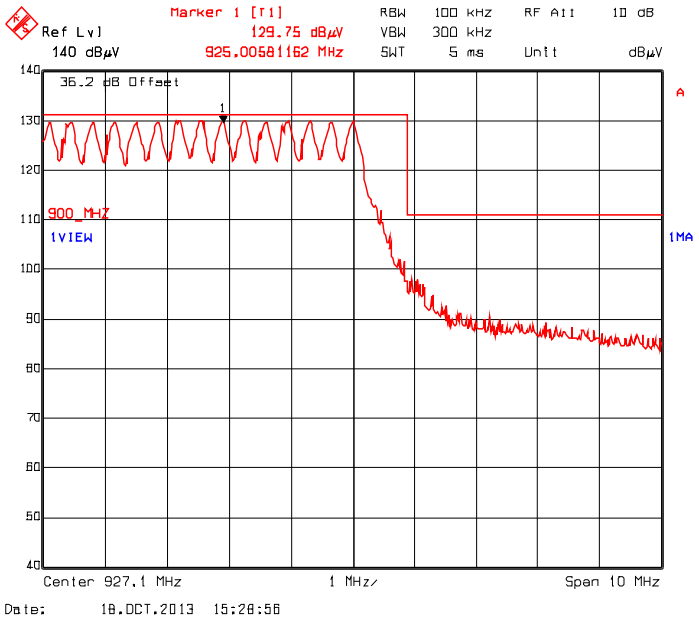


EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20Hz–40 GHz	02 Nov 2013
Attenuator	Pasternack	7024-20	-	DC–26.5 GHz	Cal on use
DC Block	Hewlett Packard	11742A	12460	0.045–26.5 GHz	Cal on use
DC Power Supply	Tenma	72-7295	490300270	1 – 40 Vdc	Cal on use
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	07 Mar 2014
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	25 Jun 2014
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	25 Mar 2014
Attenuator	Pasternack	PE7024-10	4	DC–26.5 GHz	Cal on use
High Pass Filter	K & L	11SH10-1500/T8000	2	Cut off 900 MHz	Cal on use
Horn Antenna	EMCO	3155	6570	1 – 18 GHz	07 Jun 2014
Biconi-Log Antenna	EMCO	3142C	34792	26 – 3000 MHz	26 Jun 2014
Band Reject Filter	Micro-Tronics	BRC50722	001	Cut off 902-928 MHz	Cal on use
DC Power Supply	Tenma	72-7295	490300270	1 – 40 Vdc	Cal on use
Log Periodic Antenna	ETS Lindgren	93148	1101	200–2000 MHz	02 May 2014
Attenuator	Pasternack	PE7024-10	4	DC–26.5 GHz	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 (9 kHz – 30 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 1.44**	**± 1.8**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 2.89**	**± 3.6**

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
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:** $U = 2u_c(y)$	**± 4.79**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
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 (dB)**	**Limit (dB)**
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**