ENGINEERING TEST REPORT

900 MHz OEM DTS / FHSS Module
Model: NX915
FCC ID: E5MDS-NX915

Applicant:

GE MDS LLC
175 Science Parkway
Rochester, NY
USA, 14620

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247 Digital Modulation Systems (DTS)

UltraTech's File No.: MIC-185F15C247DTSR01

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Engineering Labs Inc. Date: November 15, 2013	
Report Prepared by: Dan Huynh Issued Date: November 15, 2013	Tested by: Mr. Hung Trinh Test Dates: October 7 - 10, 2013 November 14, 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 software change to incorporate a wider bandwidth for higher speed modem operating in the DTS rules.
Test Procedures:	▪ ANSI C63.4-2009 ▪ ANSI C63.10 ▪ FCC KDB Publication No. 558074 D01
Environmental Classification:	[x] Commercial, industrial or business environment [ ] 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 KDB Publication No. 558074 D01 DTS Meas Guidance v03r01	2013	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	GE MDS LLC
Address:	175 Science Parkway Rochester, NY USA, 14620
Contact Person:	Mr. Dennis McCarthy Phone #: 585 242-8440 Fax #: 585 241-5590 Email Address: McCarthy2@GE.com

MANUFACTURER	
Name:	GE MDS LLC
Address:	175 Science Parkway Rochester, NY USA, 14620
Contact Person:	Mr. Dennis McCarthy Phone #: 585 242-8440 Fax #: 585 241-5590 Email Address: McCarthy2@GE.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:	GE MDS LLC
Product Name:	900 MHz OEM DTS / FHSS Module
Model Name or Number:	NX915
Serial Number:	Test sample
Type of Equipment:	Digital Transmission System (DTS)
Input Power Supply Type:	External Regulated DC Sources
Primary User Functions of EUT:	OEM Transceiver Industrial Wireless Data applications

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Base Station (fixed use)
Intended Operating Environment:	Commercial, industrial or business environment
Power Supply Requirement:	4.5V DC, <1 amp
RF Output Power Rating:	+30 dBm (1 watt) Conducted
Operating Frequency Range:	902 - 928 MHz
RF Output Impedance:	50 Ohm
Duty Cycle:	Continuous
Modulation Type:	CPFSK, Multiple BW
Antenna Connector Type:	TNC

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

There are two antenna types:

1. Yagi Antenna with Max Gain of 12.15 dBi
2. Omni Directional Antenna with Max Gain of 9.15 dBi

The highest gain antenna from each of the above antenna types were selected for testing to represents the worst-case. Refer to antennas list exhibit for detailed specifications.

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	UMC alternate RF Connector	1	TNC	Shielded coaxial cable
2	SMT PCI express card edge	1	PCI	No

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:	GE MDS LLC
Model Name or Number:	N/A
Connected to EUT's Port:	I/O Port

Ancillary Equipment # 2	
Description:	DC Power Supply
Brand name:	Tenma
Model Name or Number:	72-7295
Connected to EUT's Port:	Test Jig of the EUT

Ancillary Equipment # 3	
Description:	Laptop
Brand name:	Dell
Model Name or Number:	PPL
Connected to EUT's Port:	Test Jig of the EUT

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:	4.7 V DC

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 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 non-integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	903.315 - 926.685 MHz
Frequency(ies) Tested:	903.315 MHz, 915.000 MHz and 926.685 MHz
RF Power Output: (Maximum output power at antenna terminals)	29.99 dBm (0.998 W)
Normal Test Modulation:	4-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 Engineering Labs Inc. 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	N/A
15.247(a)(2)	6 dB Bandwidth	Yes
15.247(b)(3)	Peak Conducted Output Power - DTS	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(e)	Power Spectral Density	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. OCCUPIED BANDWIDTH [§ 15.247(a)(2)]

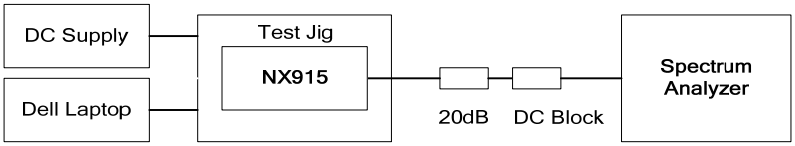
5.1.1. Limit(s)

Systems using digital modulation techniques may operate in the 902–928 MHz, 902-928 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.1.2. Method of Measurements

KDB 558074 D01 v03r01, Section 8.1 DTS Bandwidth Option 1

5.1.3. Test Arrangement

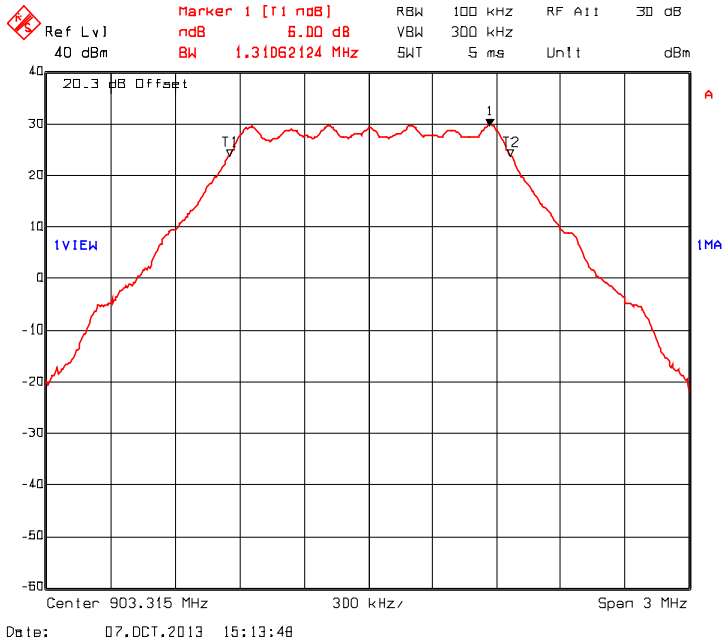


5.1.4. Test Data

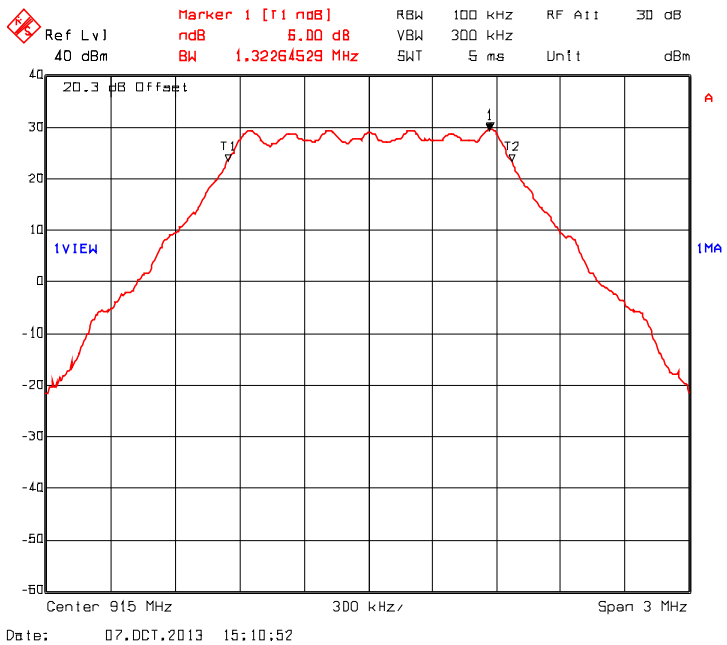
Modulation Mode	Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
4-GFSK at 1250 kbps	903.315	1.31	1.48
	915.000	1.32	1.48
	926.685	1.32	1.49

See the following plots for detailed measurements.

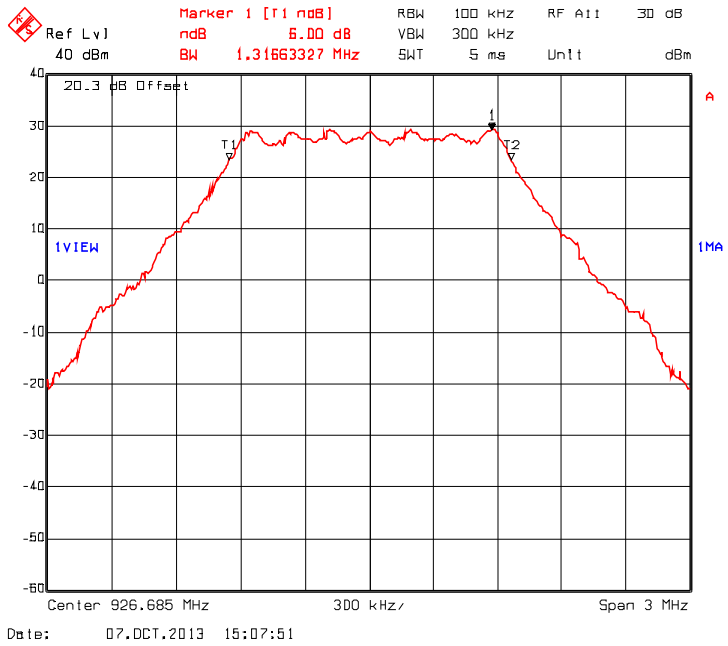
Plot 5.1.4.1. 6 dB Bandwidth, 903.315 MHz



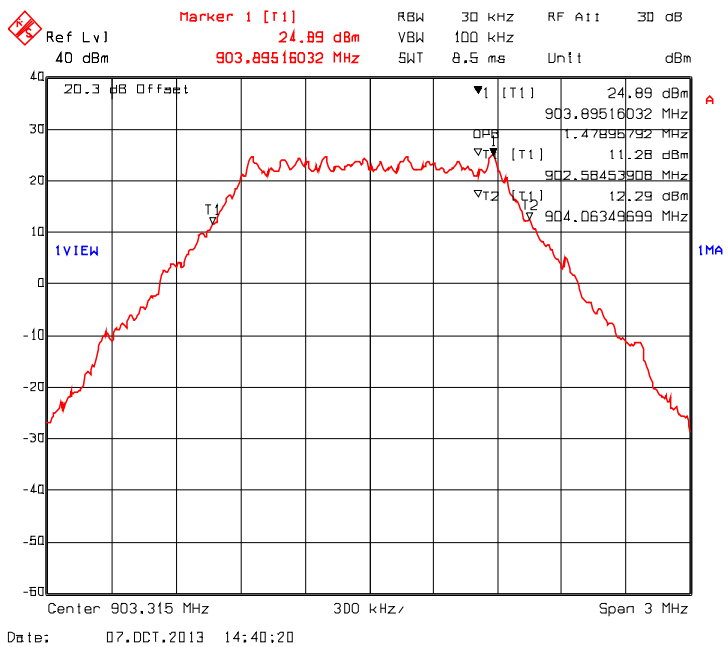
Plot 5.1.4.2. 6 dB Bandwidth, 915.000 MHz



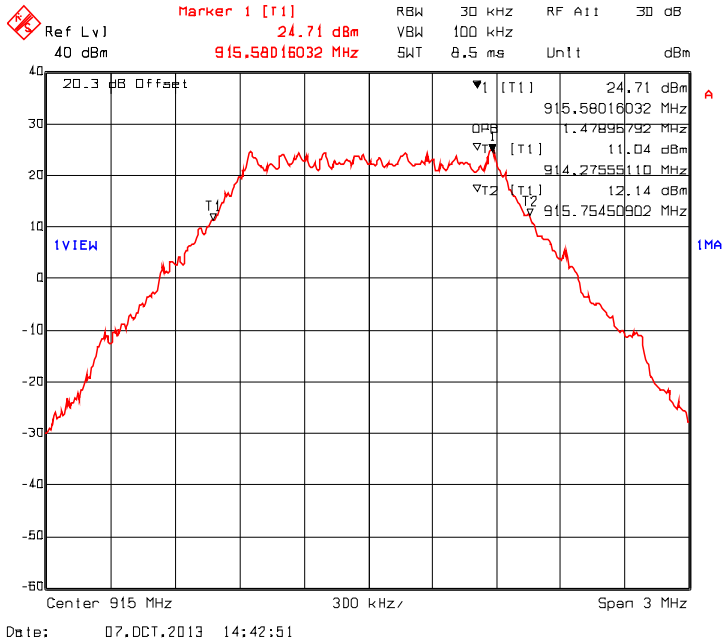
Plot 5.1.4.3. 6 dB Bandwidth, 926.685 MHz



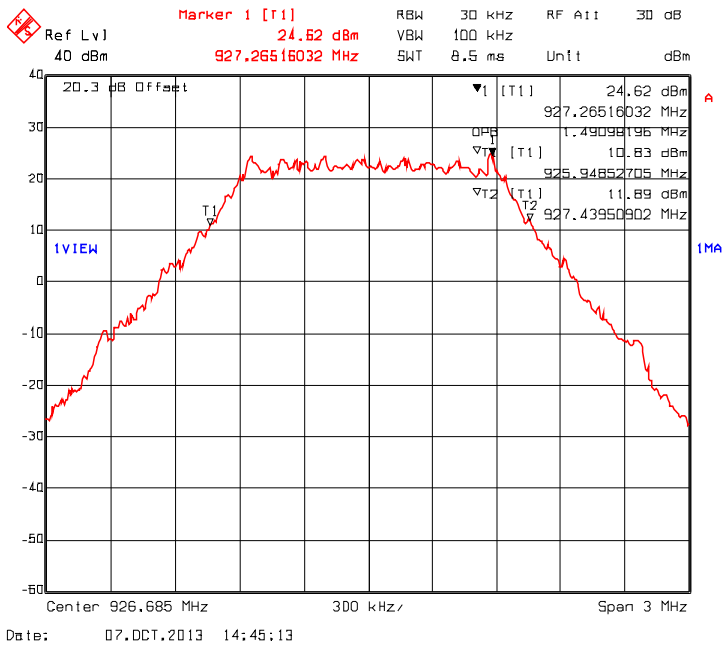
Plot 5.1.4.4. 99% Occupied Bandwidth, 903.315 MHz



Plot 5.1.4.5. 99% Occupied Bandwidth, 915.000 MHz



Plot 5.1.4.6. 99% Occupied Bandwidth, 926.685 MHz



5.2. PEAK CONDUCTED OUTPUT POWER - DTS [§ 15.247(b)(3)]

5.2.1. Limit(s)

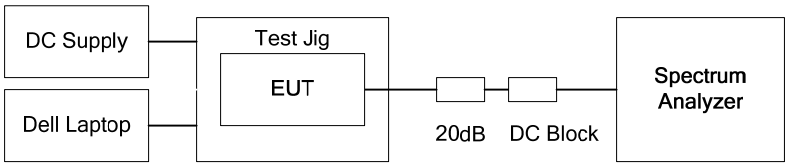
§ 15.247(b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

§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.

5.2.2. Method of Measurements & Test Arrangement

KDB Publication No. 558074 D01 v03r01, Section 9.2.2.2 Method AVGSA-1

5.2.3. Test Arrangement



5.2.4. Test Data

Remark(s):

1) The EIRP shall be calculated based on the transmitter antenna gain (G_{dBi}), cable loss (CL_{dB}) and maximum conducted output power (P_{dBm}). Calculated EIRP = $P_{dBm} + G_{dBi} - CL_{dB}$
2) The following power settings, measured powers and antenna assembly gains are conditions required for compliance with band-edge radiated emissions.

Peak Conducted Output Power for High and Low Power Settings

Modulation Mode	Operating Power Setting	Frequency (MHz)	Maximum Conducted (Average) Output Power (dBm)	Peak Conducted Output Power Limit (dBm)
4-GFSK at 1250 kbps	High Power	903.315	29.98	30
		915.000	29.99	30
		926.685	29.95	30
	Low Power	903.315	19.43	30
		915.000	19.65	30
		926.685	19.50	30

Peak Conducted Output Power and EIRP for 12.15 dBi Yagi Antenna with 6.86 dB Insertion Loss

Modulation Mode	Frequency (MHz)	Maximum Conducted (Average) Output Power (dBm)	Calculated EIRP (dBm)	Limit (dBm)	
				Peak Conducted Output Power	EIRP
4-GFSK at 1250 kbps	903.315	29.98	35.3	30	36
	915.000	29.99	35.3	30	36
	926.685	29.95	35.2	30	36

Peak Conducted Output Power and EIRP for 9.15 dBi Omni Directional Antenna with 3.86 dB Insertion Loss

Modulation Mode	Frequency (MHz)	Maximum Conducted (Average) Output Power (dBm)	Calculated EIRP (dBm)	Limit (dBm)	
				Peak Conducted Output Power	EIRP
4-GFSK at 1250 kbps	903.315	29.98	35.3	30	36
	915.000	29.99	35.3	30	36
	926.685	29.95	35.2	30	36

5.3. TRANSMITTER BAND-EDGE & SPURIOUS CONDUCTED EMISSIONS [§ 15.247(d)]

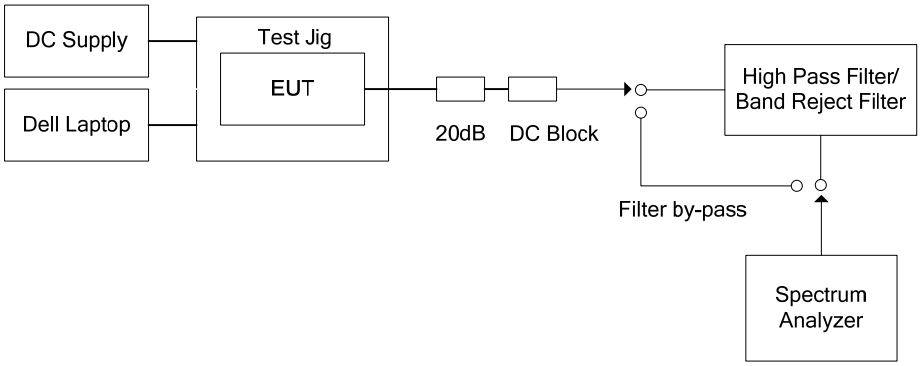
5.3.1. Limit(s)

§ 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.

5.3.2. Method of Measurements

ANSI C63.10

5.3.3. Test Arrangement

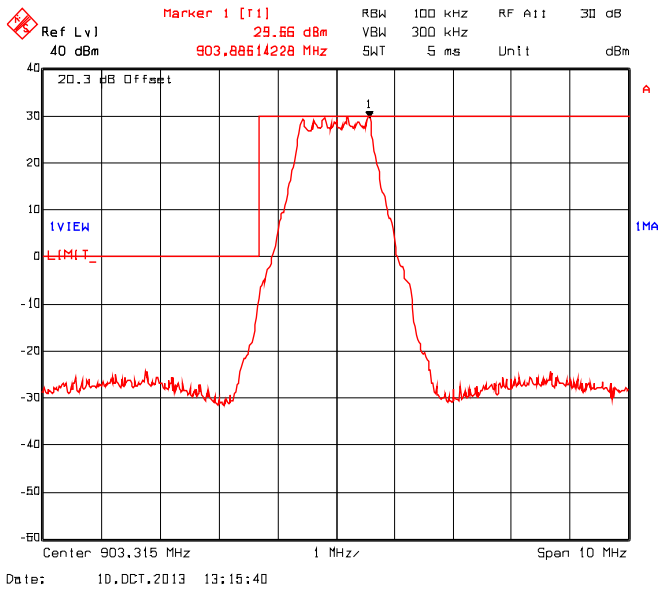


5.3.4. Test Data

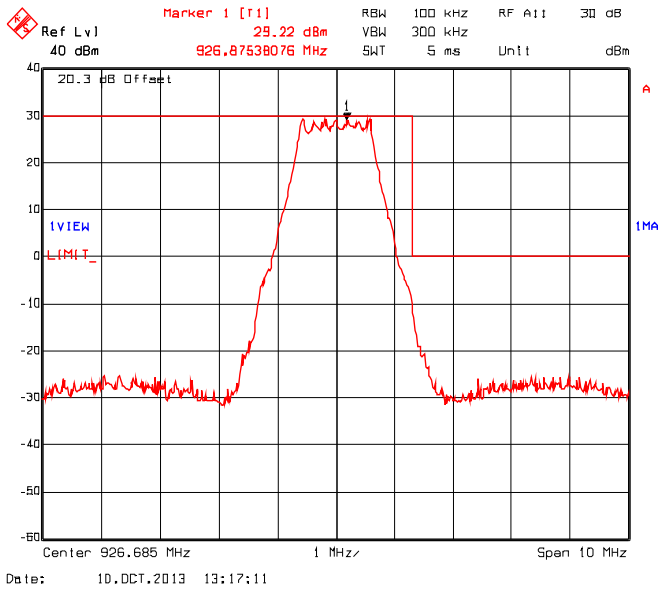
5.3.4.1. Band-Edge RF Conducted Emissions

Remark(s): The following test results at high power setting represent the worst-case.

Plot 5.3.4.1.1. Band-Edge RF Conducted Emissions, Low End of Frequency Band, 903.315 MHz,



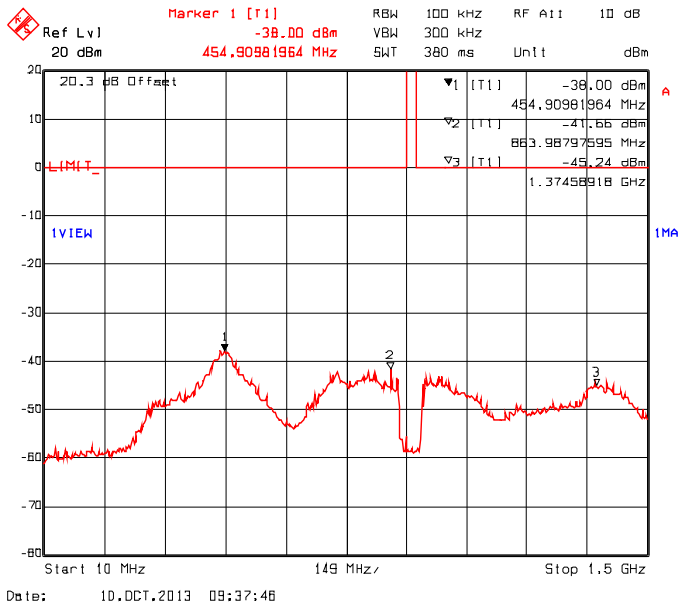
Plot 5.3.4.1.2. Band-Edge RF Conducted Emissions, High End of Frequency Band, 926.685 MHz



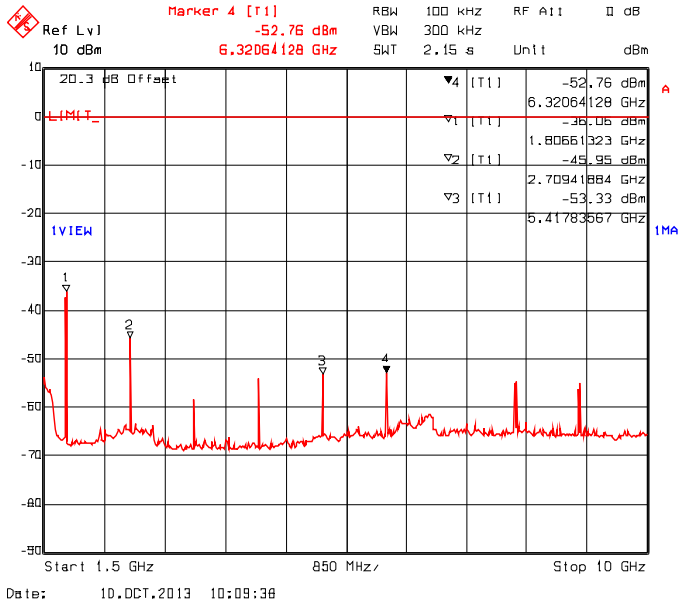
5.3.4.2. Conducted Spurious Emissions

Remark(s): The following test results at high power setting represent the worst case.

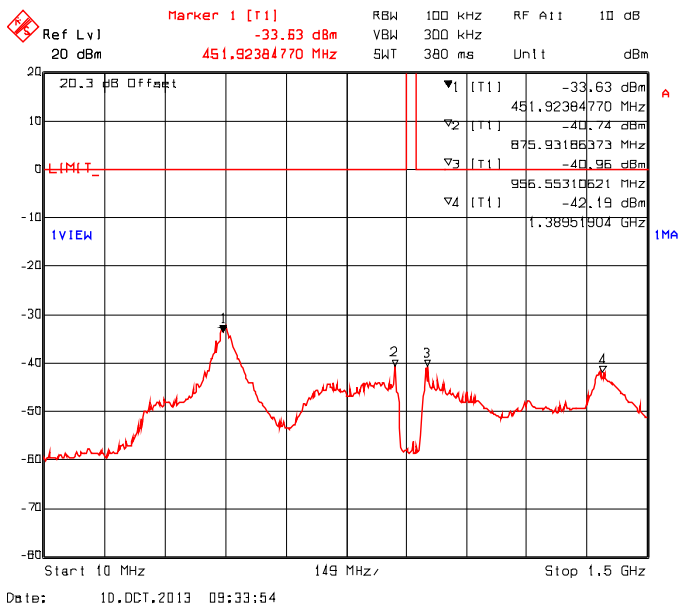
Plot 5.3.4.2.1. Conducted Spurious Emissions, High Power, 903.315 MHz, 10 MHz - 1.5 GHz



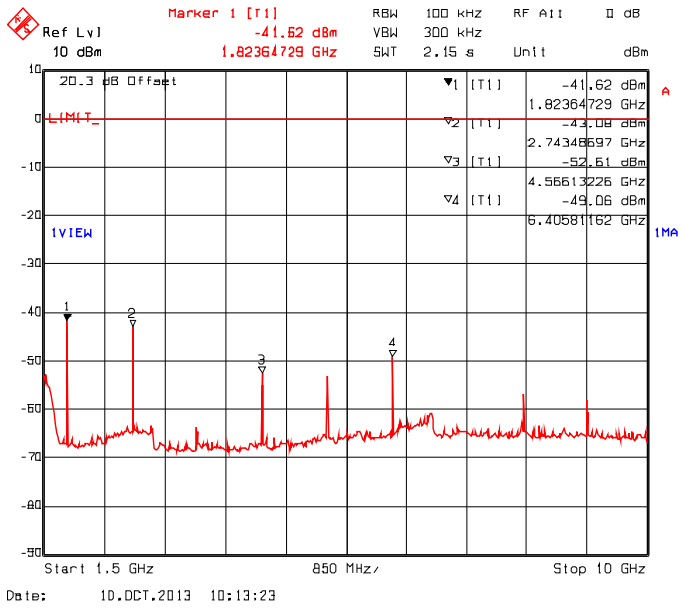
Plot 5.3.4.2.2. Conducted Spurious Emissions, High Power, 903.315 MHz, 1.5 GHz - 10 GHz



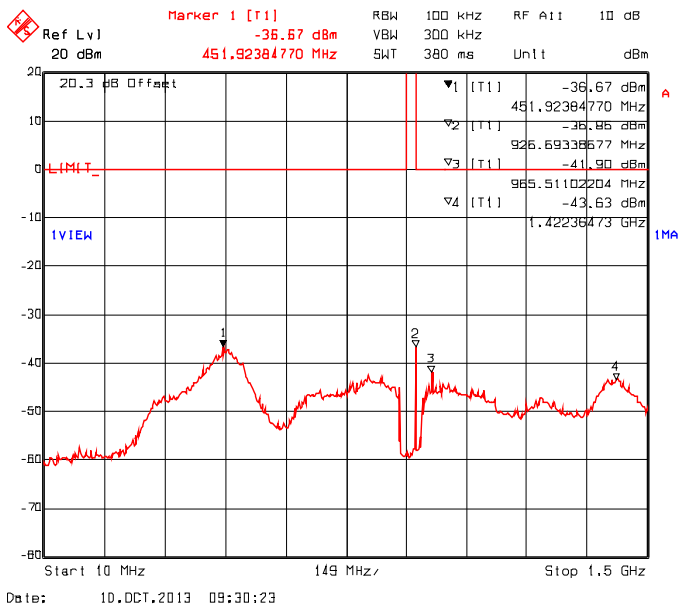
Plot 5.3.4.2.3. Conducted Spurious Emissions, High Power, 915.000 MHz, 10 MHz - 1.5 GHz



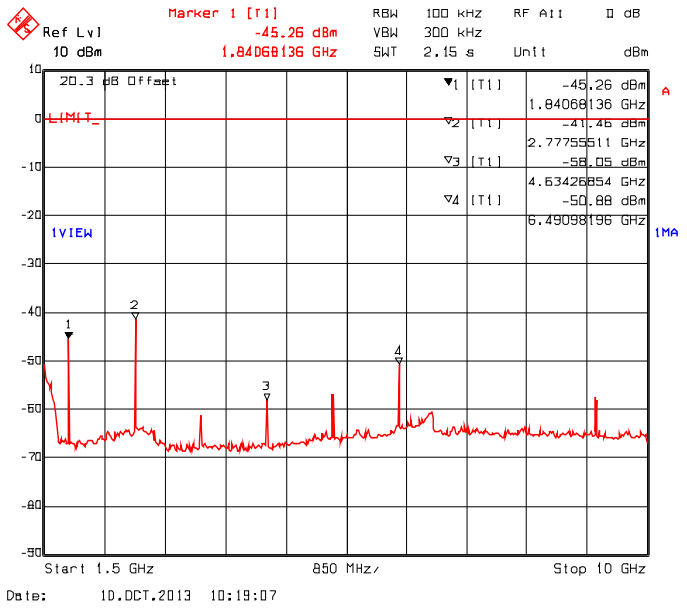
Plot 5.3.4.2.4. Conducted Spurious Emissions, High Power, 915.000 MHz, 1.5 GHz - 10 GHz



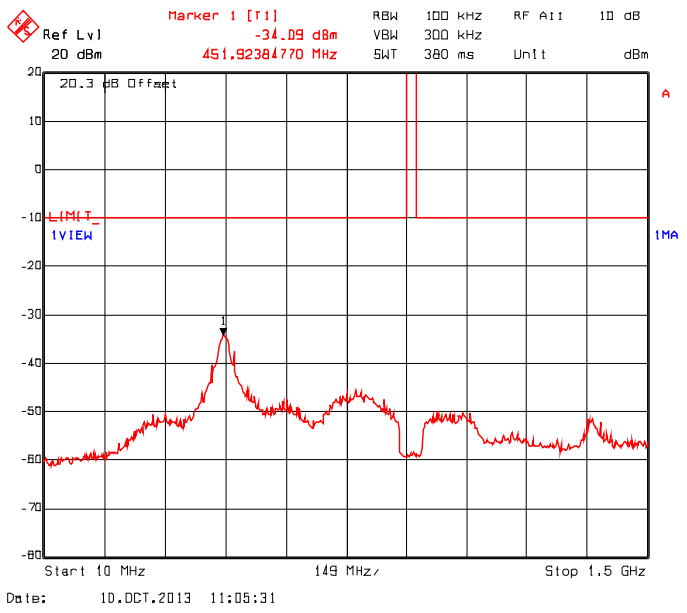
Plot 5.3.4.2.5. Conducted Spurious Emissions, High Power, 926.685 MHz, 10 MHz - 1.5 GHz



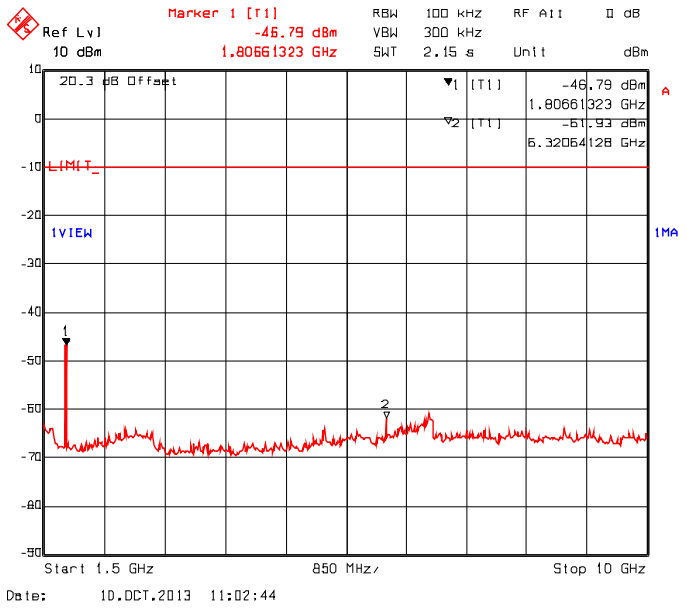
Plot 5.3.4.2.6. Conducted Spurious Emissions, High Power, 926.685 MHz, 1.5 GHz - 10 GHz



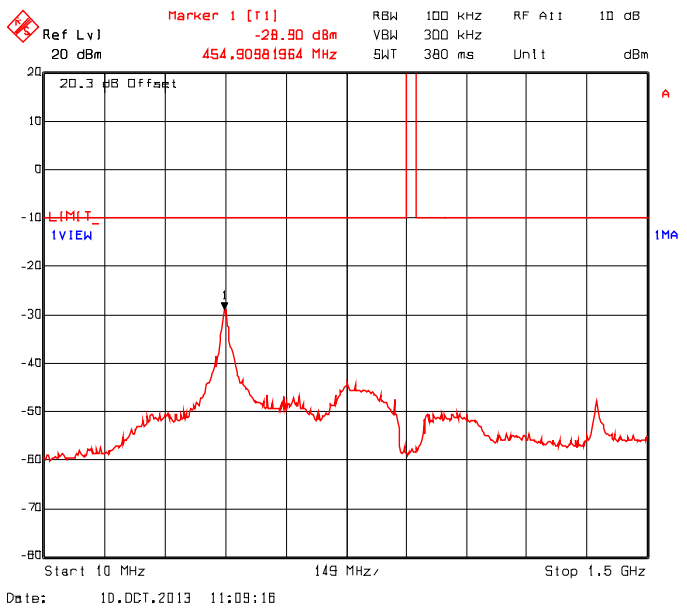
Plot 5.3.4.2.7. Conducted Spurious Emissions, Low Power, 903.315 MHz, 10 MHz - 1.5 GHz



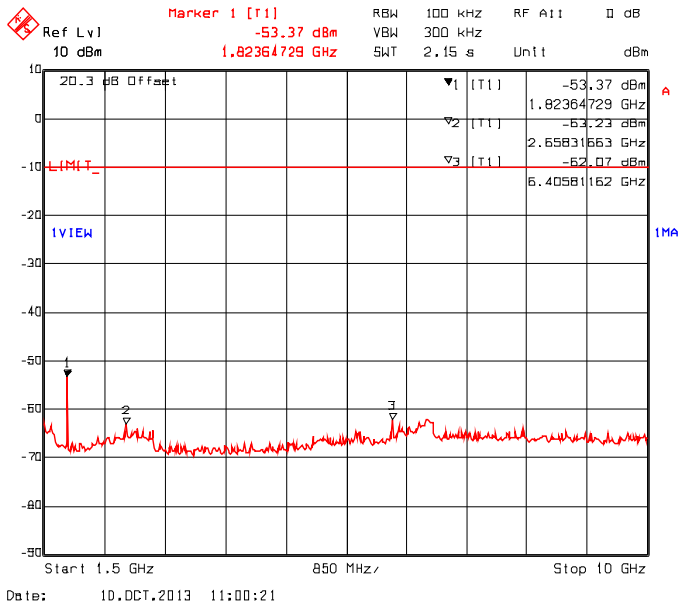
Plot 5.3.4.2.8. Conducted Spurious Emissions, Low Power, 903.315 MHz, 1.5 GHz - 10 GHz



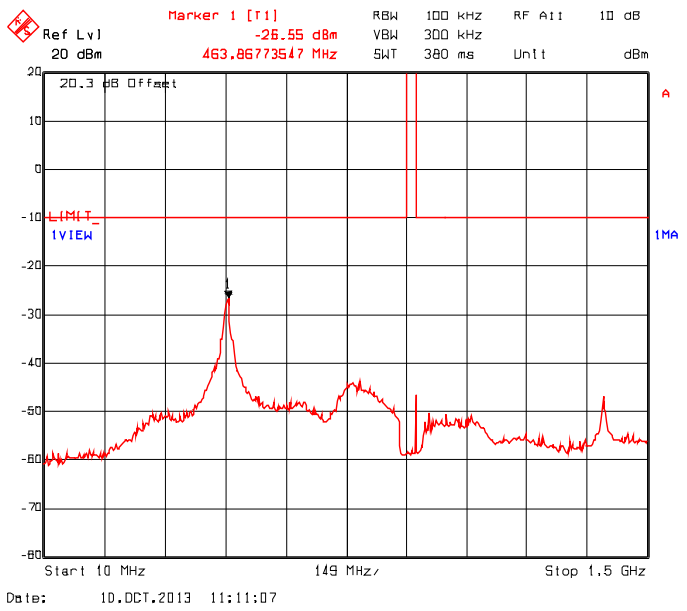
Plot 5.3.4.2.9. Conducted Spurious Emissions, Low Power, 915.000 MHz, 10 MHz - 1.5 GHz



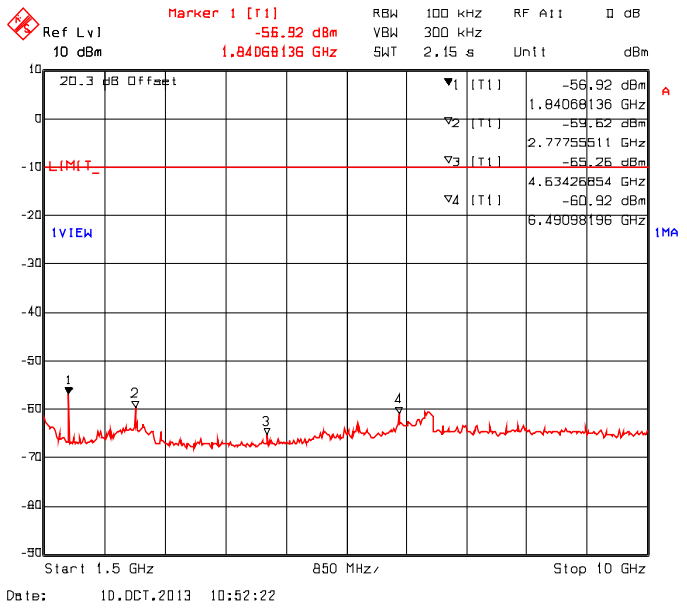
Plot 5.3.4.2.10. Conducted Spurious Emissions, Low Power, 915.000 MHz, 1.5 GHz - 10 GHz



Plot 5.3.4.2.11. Conducted Spurious Emissions, Low Power, 926.685 MHz, 10 MHz - 1.5 GHz



Plot 5.3.4.2.12. Conducted Spurious Emissions, Low Power, 926.685 MHz, 1.5 GHz - 10 GHz



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

5.4.1. 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Section 15.205(a) - 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	2655–2900	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

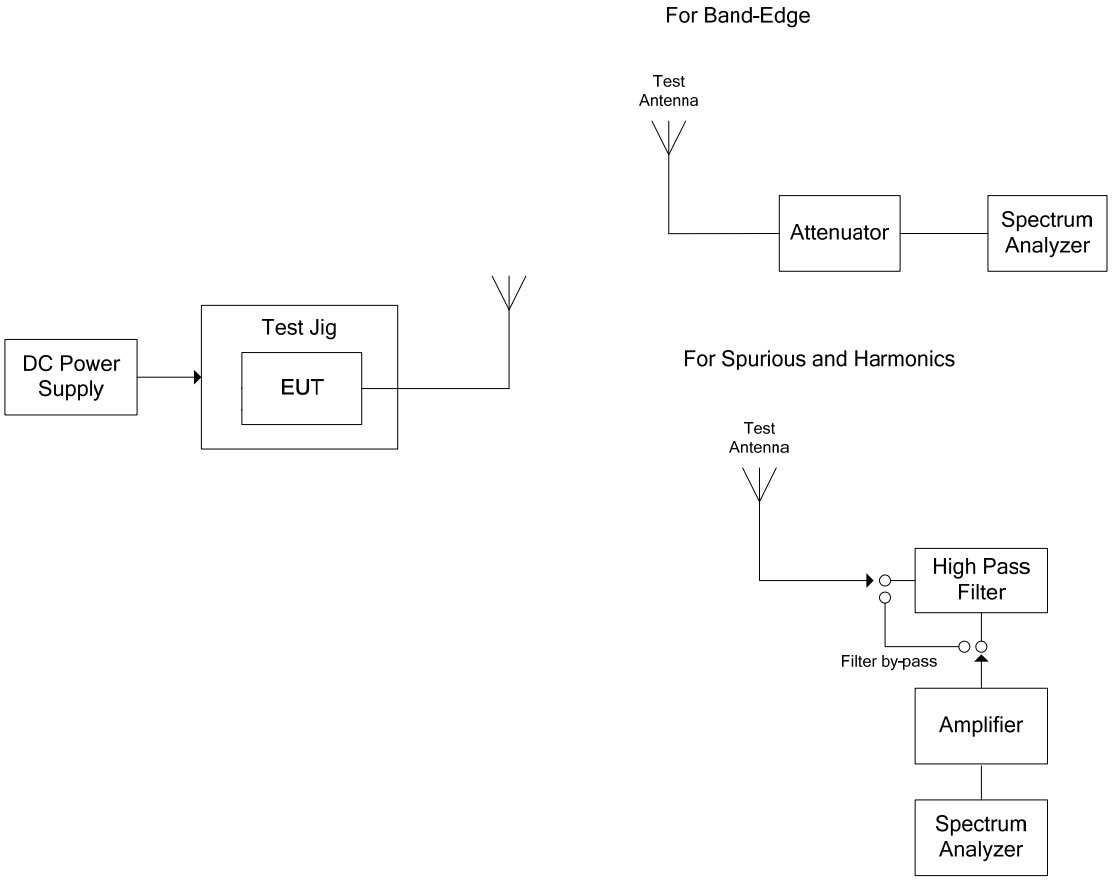
Section 15.209(a) - Field Strength Limits within Restricted Frequency Bands

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

5.4.2. Method of Measurements

ANSI C63.10

5.4.3. Test Arrangement



5.4.4. 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.
- The following results are the worst-case measurements at high Power setting.

5.4.4.1. EUT Connected to 12.15 dBi Yagi Antenna with 6.86 dB Insertion Loss

5.4.4.1.1. Spurious Radiated Emissions

Fundamental Frequency:	903.315 MHz						
Test Frequency 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**
903.315	130.17	--	V	--	--	--	--
903.315	130.52	--	H	--	--	--	--
2709.945	53.36	42.79	V	54.0	100.5	-11.2	Pass*
2709.945	53.91	42.44	H	54.0	100.5	-11.6	Pass*
3613.260	48.24	35.08	V	54.0	100.5	-18.9	Pass*
3613.260	47.59	34.45	H	54.0	100.5	-19.6	Pass*
4516.575	50.67	36.99	V	54.0	100.5	-17.0	Pass*
4516.575	49.38	36.59	H	54.0	100.5	-17.4	Pass*
5419.890	51.47	37.35	V	54.0	100.5	-16.7	Pass*
5419.890	51.58	37.33	H	54.0	100.5	-16.7	Pass*
8129.835	55.97	41.35	V	54.0	100.5	-12.7	Pass*
8129.835	56.33	41.31	H	54.0	100.5	-12.7	Pass*
9033.150	56.53	42.97	V	54.0	100.5	-11.0	Pass*
9033.150	57.75	43.79	H	54.0	100.5	-10.2	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	915.000 MHz						
Test Frequency 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**
915.000	130.14	--	V	--	--	--	--
915.000	130.19	--	H	--	--	--	--
2745.000	53.23	41.56	V	54.0	100.2	-12.4	Pass*
2745.000	53.98	42.15	H	54.0	100.2	-11.9	Pass*
3660.000	48.94	38.63	V	54.0	100.2	-15.4	Pass*
3660.000	48.49	37.05	H	54.0	100.2	-17.0	Pass*
4575.000	53.29	38.46	V	54.0	100.2	-15.5	Pass*
4575.000	49.96	36.58	H	54.0	100.2	-17.4	Pass*
7320.000	53.63	40.90	V	54.0	100.2	-13.1	Pass*
7320.000	55.72	41.50	H	54.0	100.2	-12.5	Pass*
8235.000	53.72	41.33	V	54.0	100.2	-12.7	Pass*
8235.000	55.55	41.17	H	54.0	100.2	-12.8	Pass*
9150.000	56.32	43.30	V	54.0	100.2	-10.7	Pass*
9150.000	58.05	44.48	H	54.0	100.2	-9.5	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

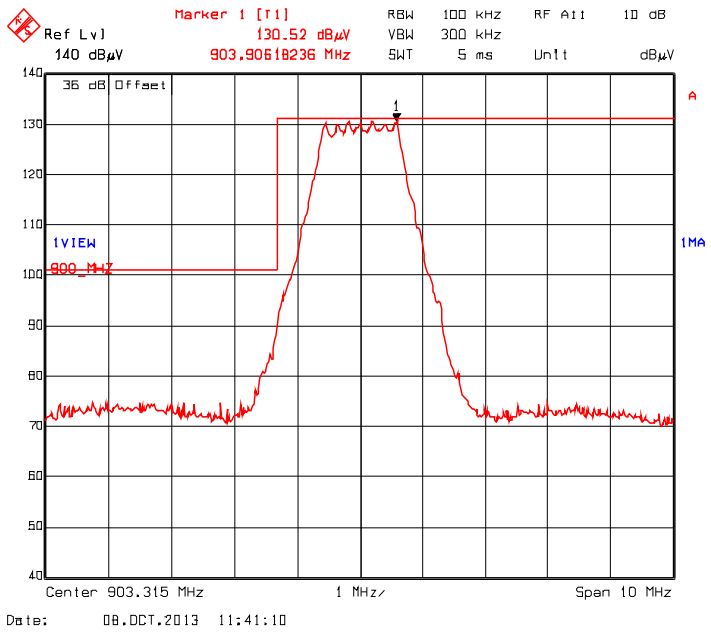
Fundamental Frequency:	926.685 MHz						
Test Frequency Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
926.685	129.46	--	V	--	--	--	--
926.685	129.77	--	H	--	--	--	--
2780.055	51.76	40.26	V	54.0	99.8	-13.7	Pass*
2780.055	52.09	41.70	H	54.0	99.8	-12.3	Pass*
3706.740	49.18	35.94	V	54.0	99.8	-18.1	Pass*
3706.740	48.61	35.96	H	54.0	99.8	-18.0	Pass*
4633.425	49.36	36.36	V	54.0	99.8	-17.6	Pass*
4633.425	49.17	36.13	H	54.0	99.8	-17.9	Pass*
7413.480	54.01	40.55	V	54.0	99.8	-13.5	Pass*
7413.480	54.33	40.81	H	54.0	99.8	-13.2	Pass*
8340.165	55.07	41.73	V	54.0	99.8	-12.3	Pass*
8340.165	54.70	40.96	H	54.0	99.8	-13.0	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

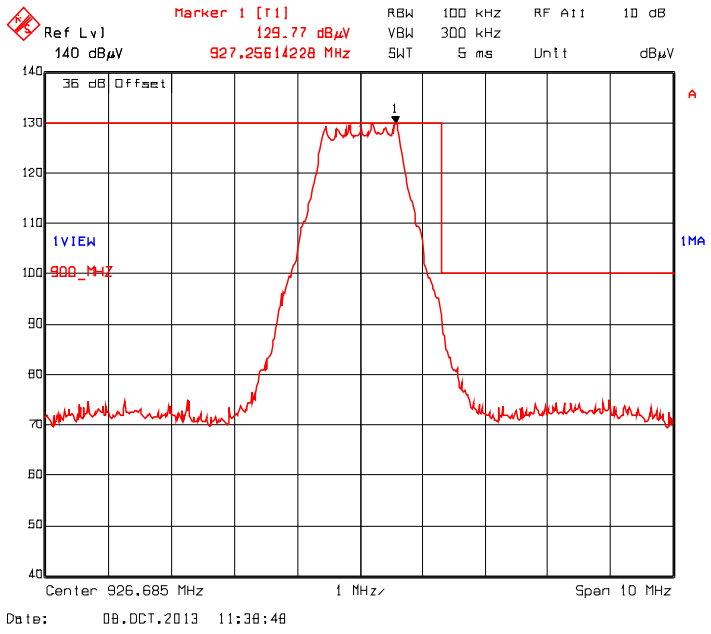
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: http://www.ultratech-labs.com

5.4.4.1.2. Band-Edge RF Radiated Emissions

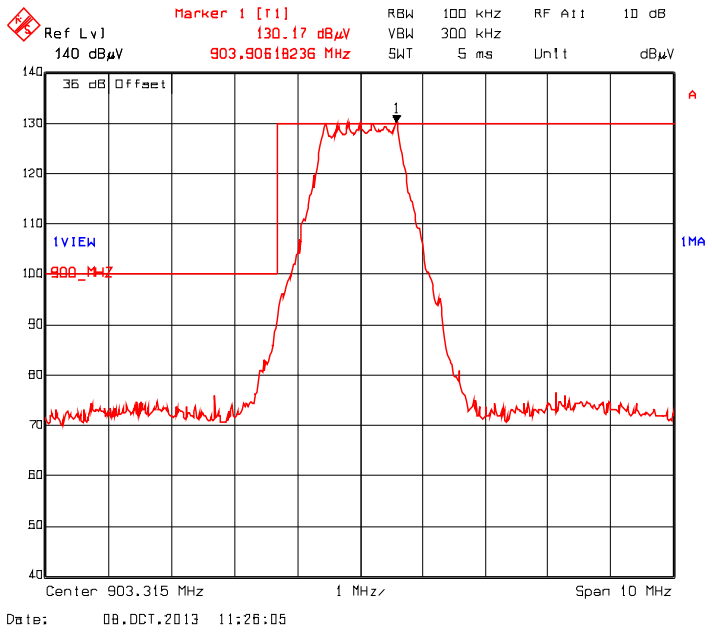
Plot 5.4.4.1.2.1. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization, Low End of Frequency Band



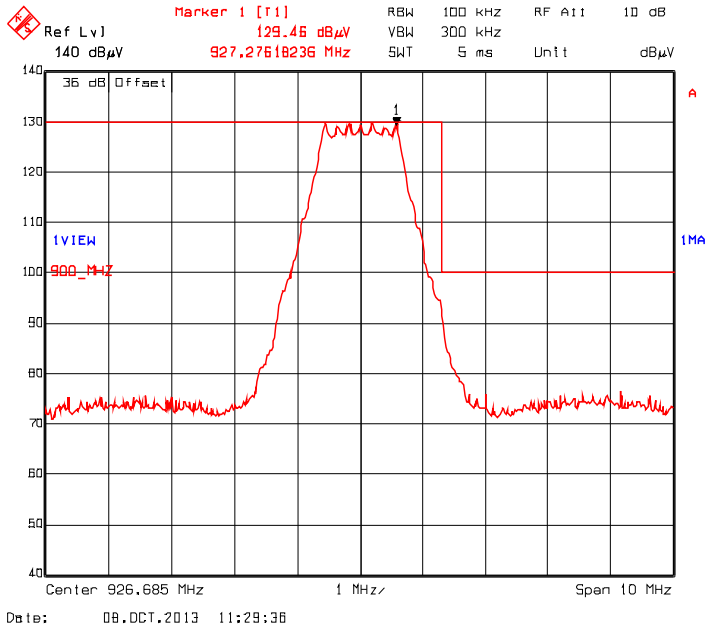
Plot 5.4.4.1.2.2. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization, High End of Frequency Band



Plot 5.4.4.1.2.3. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization, Low End of Frequency Band



Plot 5.4.4.1.2.4. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization, High End of Frequency Band



5.4.4.2. EUT Connected to 9.15 dBi Omni Directional Antenna with 3.86 dB Insertion Loss

5.4.4.2.1. Spurious Radiated Emissions

Fundamental Frequency:	903.315 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**
903.315	131.04	--	V	--	--	--	--
903.315	127.83	--	H	--	--	--	--
2709.945	55.05	43.31	V	54.0	101.0	-10.7	Pass*
2709.945	56.17	44.30	H	54.0	101.0	-9.7	Pass*
3613.260	50.14	36.44	V	54.0	101.0	-17.6	Pass*
3613.260	47.88	34.68	H	54.0	101.0	-19.3	Pass*
4516.575	50.18	36.98	V	54.0	101.0	-17.0	Pass*
4516.575	48.47	35.71	H	54.0	101.0	-18.3	Pass*
5419.890	51.32	37.27	V	54.0	101.0	-16.7	Pass*
5419.890	50.59	37.14	H	54.0	101.0	-16.9	Pass*
8129.835	54.55	41.28	V	54.0	101.0	-12.7	Pass*
8129.835	54.05	41.22	H	54.0	101.0	-12.8	Pass*
9033.150	55.54	42.56	V	54.0	101.0	-11.4	Pass*
9033.150	56.31	43.51	H	54.0	101.0	-10.5	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	915.000 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**
915.000	127.42	--	V	--	--	--	--
915.000	125.86	--	H	--	--	--	--
2745.000	54.01	41.30	V	54.0	97.4	-12.7	Pass*
2745.000	52.87	40.40	H	54.0	97.4	-13.6	Pass*
3660.000	50.10	37.91	V	54.0	97.4	-16.1	Pass*
3660.000	50.18	36.83	H	54.0	97.4	-17.2	Pass*
4575.000	50.62	38.68	V	54.0	97.4	-15.3	Pass*
4575.000	50.94	37.24	H	54.0	97.4	-16.8	Pass*
7320.000	52.97	40.74	V	54.0	97.4	-13.3	Pass*
7320.000	55.84	42.18	H	54.0	97.4	-11.8	Pass*
8235.000	54.58	41.43	V	54.0	97.4	-12.6	Pass*
8235.000	54.78	41.26	H	54.0	97.4	-12.7	Pass*
9150.000	56.97	43.47	V	54.0	97.4	-10.5	Pass*
9150.000	57.02	43.58	H	54.0	97.4	-10.4	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

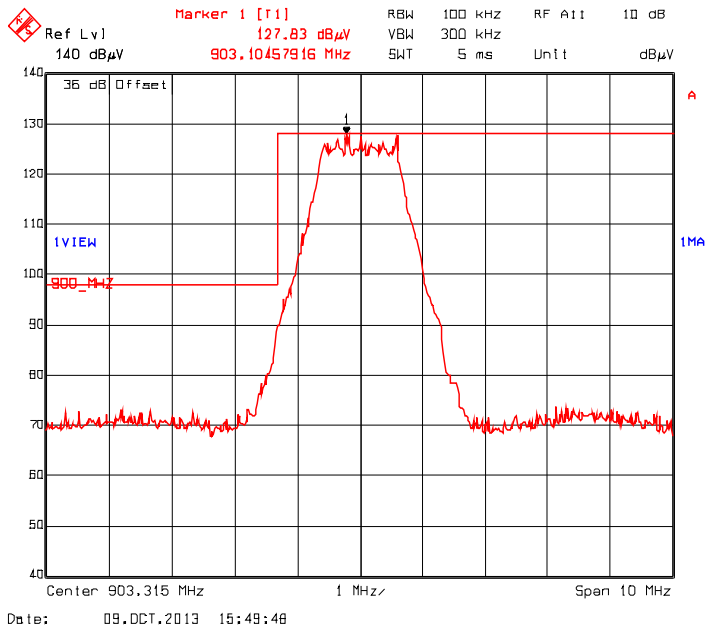
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	926.685 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**
926.685	126.10	--	V	--	--	--	--
926.685	124.02	--	H	--	--	--	--
2780.055	50.41	38.88	V	54.0	96.1	-15.1	Pass*
2780.055	52.65	39.98	H	54.0	96.1	-14.0	Pass*
3706.740	49.48	35.59	V	54.0	96.1	-18.4	Pass*
3706.740	49.20	35.50	H	54.0	96.1	-18.5	Pass*
4633.425	49.03	36.08	V	54.0	96.1	-17.9	Pass*
4633.425	49.89	36.71	H	54.0	96.1	-17.3	Pass*
7413.480	57.38	42.47	V	54.0	96.1	-11.5	Pass*
7413.480	53.61	41.46	H	54.0	96.1	-12.5	Pass*
8340.165	55.44	41.69	V	54.0	96.1	-12.3	Pass*
8340.165	54.21	41.86	H	54.0	96.1	-12.1	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

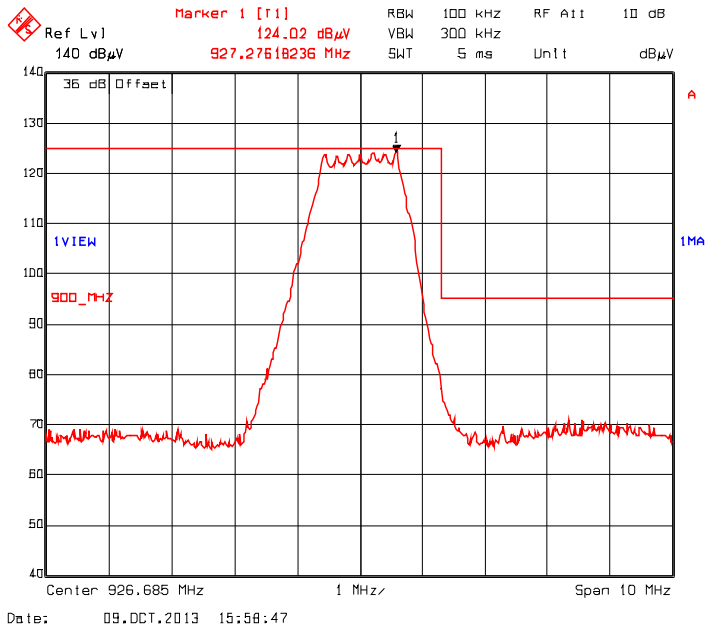
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.4.4.2.2. Band-Edge RF Radiated Emissions

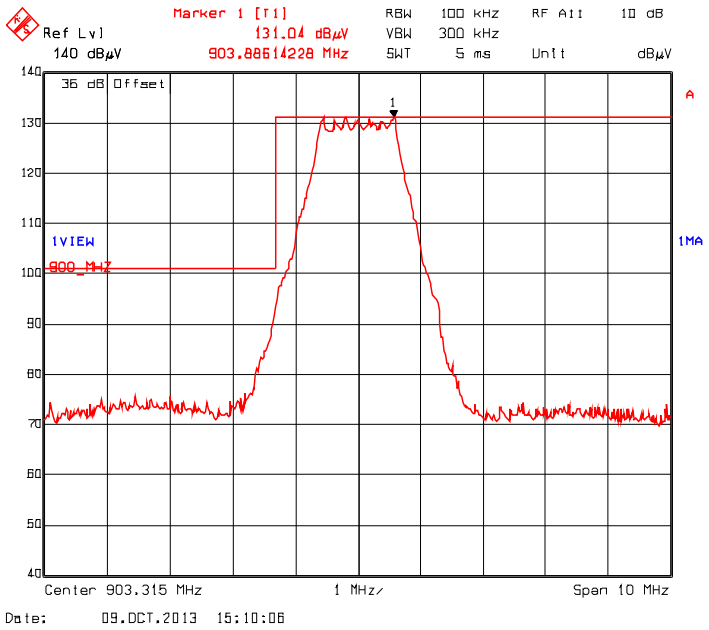
Plot 5.4.4.2.2.1. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization, Low End of Frequency Band



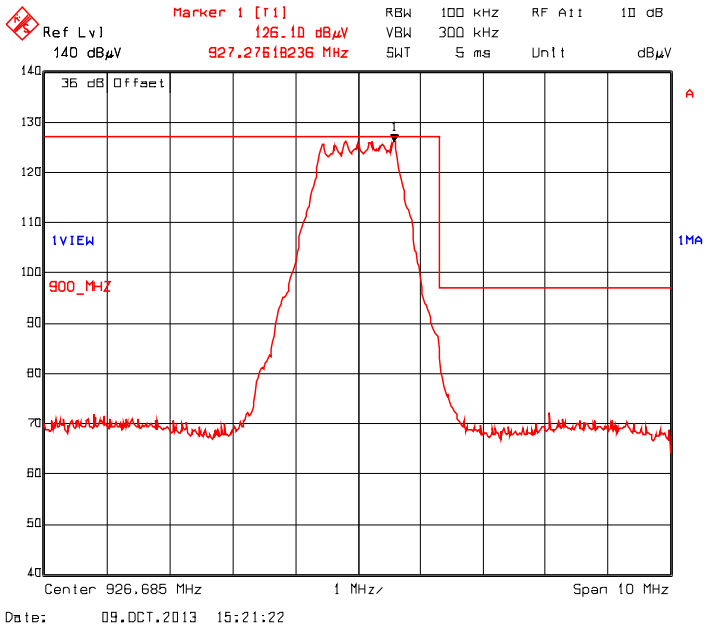
Plot 5.4.4.2.2.2. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization, High End of Frequency Band



Plot 5.4.4.2.2.3. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization, Low End of Frequency Band



Plot 5.4.4.2.2.4. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization, High End of Frequency Band



5.5. POWER SPECTRAL DENSITY [§ 15.247(e)]

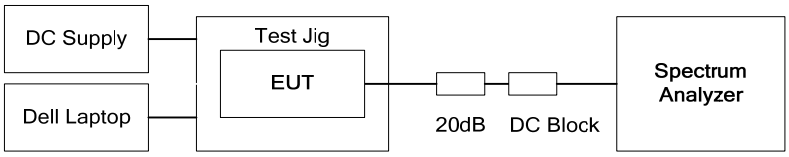
5.5.1. Limit(s)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.5.2. Method of Measurements

KDB 558074 D01 v03r01, Section 10.3 Method AVGPSD-1

5.5.3. Test Arrangement

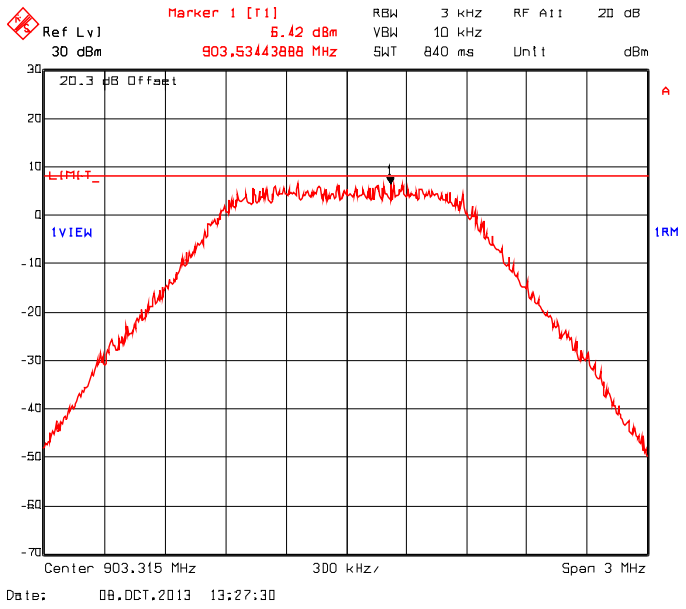


5.5.4. Test Data

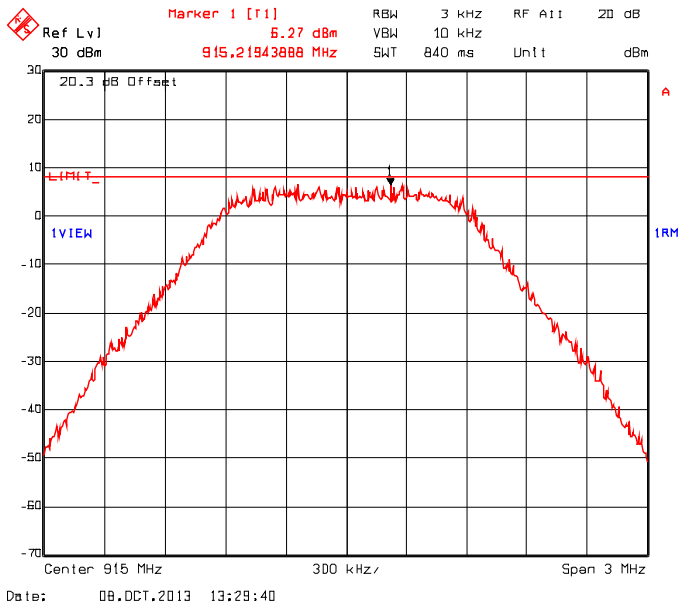
Modulation Mode	Frequency (MHz)	*PSD in 3 kHz BW (dBm)	Limit (dBm)	Margin (dB)
4-GFSK at 1250 kbps	903.315	6.42	8	-1.58
	915.000	6.27	8	-1.73
	926.685	6.37	8	-1.63

See the following plots for measurement details.

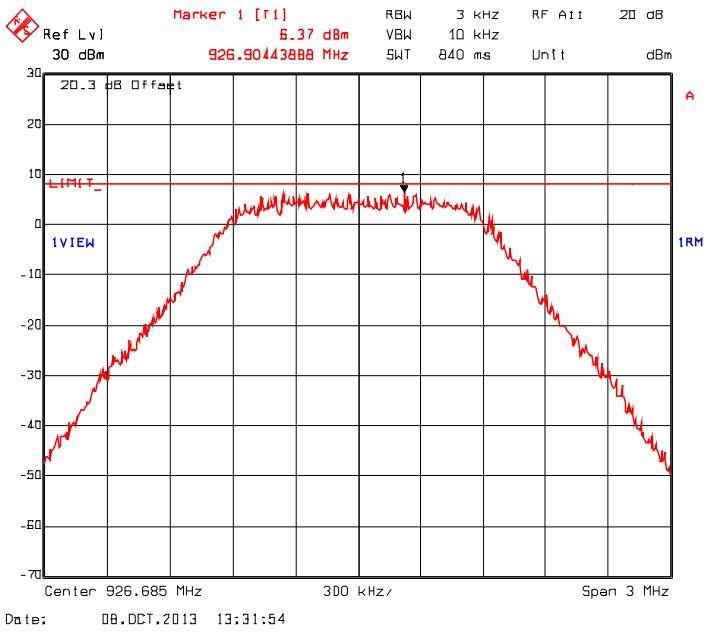
Plot 5.5.4.1. Power Spectral Density
903.315 MHz, High Power, Detector RMS, Video Trace Averaging with 100 traces



Plot 5.5.4.2. Power Spectral Density
915.000 MHz, High Power, Detector RMS, Video Trace Averaging with 100 traces



Plot 5.5.4.3. Power Spectral Density
926.685 MHz, High Power, Detector RMS, Video Trace Averaging with 100 traces



5.6. RF EXPOSURE REQUIRMENTS [§§ 15.247(i), 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.

5.6.1. 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

5.6.2. RF Evaluation

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum separation distance between antenna and persons required: **23 cm**	Manufacturer' instruction for separation distance between antenna and persons required: **23 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.

*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 = 903.315/1500 = 0.6 mW/cm^2
EIRP = 36.0 dBm = $10^{36/10}$ mW = 3981 mW (Worst Case)

(Minimum Safe Distance, r) = $\sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}} = \sqrt{\frac{3981}{4 \cdot \pi \cdot (0.6)}} \approx 23cm$

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY51250575	9 kHz to 7 GHz	02 Nov 2015
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 H z– 40 GHz	02 Nov 2013
Attenuator	Pasternack	PE7024-20	6	DC – 26.5 GHz	Cal on use
DC Block	Hewlett Packard	11742A	12460	0.045 –2 6.5 GHz	Cal on use
DC Power Supply	Tenma	72-7295	490300270	1 – 40 Vdc	Cal on use
High Pass Filter	K & L	11SH10-1500/T8000	2	Cut off 900 MHz	Cal on use
Band Reject Filter	Micro-Tronics	BRC50722	001	Cut off 902-928 MHz	Cal on use
Log Periodic Antenna	ETS Lundgren	93148	1101	200–2000 MHz	02 May 2014
Attenuator	Pasternack	PE7024-10	4	DC – 26.5 GHz	Cal on use
Spectrum Analyzer	Rohde & Schwarz	ESU40	100033	20 Hz – 40 GHz	07 Mar 2014
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	25 Mar 2014
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	25 Jun 2014
Biconi-Log Antenna	ETS Lindgren	3142B	1575	26 – 3000 MHz	26 Jun 2014
Horn Antenna	ETS Lindgren	3115	5061	1 - 18 GHz	08 Oct 2014

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**