ENGINEERING TEST REPORT

Armour Antenna Unit
Model No.: SLAU-279MR
FCC ID: YUU-SLAU279MR

Applicant:

SCAN-LINK Technologies Inc.
6-1500 Upper Middle Rd. Suite #255
Oakville, ON
Canada L6M 0C2

In Accordance With

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

UltraTech's File No.: MARL-006F15C247

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

Date: November 18, 2010

Report Prepared by: Dan Huynh	Tested by: Mr. Hung Trinh
Issued Date: November 18, 2010	Test Dates: October 8, 13 & 14, 2010

- *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.*

UltraTech

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FCC	VCCI	Industry Canada / Industrie 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 15.247
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15
Purpose of Test:	To gain FCC Equipment Authorization for Frequency Hopping Spread Spectrum Transceiver Operating in the Frequency Band 902 - 928 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 [ ] Residential environment

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

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC 47 CFR 15	2009	Code of Federal Regulations – Telecommunication
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
ANSI C63.4	2003	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
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:	SCAN-LINK Technologies Inc.
Address:	6-1500 Upper Middle Rd. Suite #255 Oakville, ON Canada L6M 0C2
Contact Person:	Mr. Uwe Schaible Phone #: 289-439-8218 Fax #: 905-304-6209 Email Address: uschaible@scan-link.com

Manufacturer	
Name:	MARLEX Engineering Inc.
Address:	1374 Sandhill Drive Ancaster, ON Canada L9G 4V5
Contact Person:	Mr. Uwe Schaible Phone #: 905-304-6208 Fax #: 905-304-6209 Email Address: uschaible@marlexeng.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:	SCAN-LINK Technologies Inc.
Product Name:	Armour Antenna Unit
Model Name or Number:	SLAU-279MR
Serial Number:	Test Sample
Type of Equipment:	Spread Spectrum Transmitter
Input Power Supply Type:	External Regulated DC Sources
Primary User Functions of EUT:	The Antenna Unit transmits and receives digital RFID signals over the 902MHz-928MHz frequency band to search for Armour safety apparel within its detection range. The Antenna Unit processes information from the responding tags to identify if any genuine Armour vests and/or safety hats are in the range. If Armour safety apparel is detected, the Antenna Unit transmits a separate signal in the 2.4GHz frequency band to the Display Unit to activate an audible and visual warning.

2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	Mobile
Intended Operating Environment:	Commercial, industrial or business environment
Power Supply Requirement:	12VDC to 28VDC Nominal
RF Output Power Rating:	29.08 dBm, (0.809 W), conducted
Operating Frequency Range:	902.3 - 927.7 MHz
RF Output Impedance:	50 Ω
Channel Spacing:	200 kHz typical
Duty Cycle:	Continuous
Modulation Type:	FHSS
Antenna Connector Type:	SMA

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

Manufacturer:	Custom (MARLEX Engineering Inc.)
Type:	Dual PCB Loop
Model:	N/A
Frequency Range:	900MHz to 930MHz optimized
Impedance:	50 Ω
Gain (dBi):	6.15

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	Power Cable with Trigger Wire	1	Free Wire Ends	Non-shielded
2	Wired Communication Cable	1	Weathertight Circular Panel Mount	Non-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:

Ancillary Equipment # 1	
Description:	Display Unit for receiving tag information from Antenna Box
Brand name:	SCAN-LINK Technologies Inc.
Model Name or Number:	Indicator Box
Connected to EUT's Port:	Power/Com Port

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:	13 VDC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	▪ Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements. ▪ The EUT operates in normal Frequency Hopping mode for occupancy duration, and frequency separation.
Special Test Software & Hardware:	Special software provided by the applicant was installed to allow the EUT to operate in hopping mode or at each channel frequency continuously. For example, the transmitter will be operated at each of lowest, middle and highest frequencies individually continuously during testing.
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):	902.3– 927.7 MHz
Frequency(ies) Tested: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	902.3, 915 and 927.7MHz
RF Power Output: (measured maximum output power at antenna terminals)	29.08 dBm, (0.809 W), conducted
Normal Test Modulation:	See test data
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: 2011-05-01.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.207(a)	AC Power Line Conducted Emissions Measurements	N/A
15.247(a)(1)	Provisions for Frequency Hopping Systems	Yes
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	Band-Edge and Spurious Radiated Emissions	Yes
15.247(i), 1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	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 the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement. Please refer to Exhibit 7 for Measurement Uncertainties.

5.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements contained in ANSI C63.10 and CISPR 16-1-1.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER

Upon receiving a reverse input signal, the SCAN~LINK system will begin rapid rate transmission with the SkyeTek M10 RFID module to detect RFID tags. The reverse input signal can be received at the ARMOUR ANTENNA UNIT containing the RFID reader/antenna, or at the DISPLAY UNIT. In this reverse state, the SkyeTek M10 RFID module will transmit at pseudo random intervals. Each read (tag select) attempt is approximately 60ms in duration. These tag select events are spaced by a pseudo random dead time ranging between 60ms and 600ms. This cycle is repeated continuously until the vehicle has exited its reverse state. In the non-reverse state, the SCAN~LINK system will begin transmission with the SkyeTek M10 RFID module to detect tags at a slower rate of approximately one transmission per second.

5.5. COMPLIANCE WITH FCC PART 15 – GENERAL TECHNICAL REQUIREMENTS

FCC Section	FCC Rules	Manufacturer's Clarification
15.31	The hoping function must be disabled for tests, which should be performed with the EUT transmitting on the number of frequencies specified in this Section. The measurements made at the upper and lower ends of the band of operation should be made with the EUT tuned to the highest and lowest available channels.	The hoping function was disabled for tests
15.203	Described how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT. The exception is in those cases where EUT must be professionally installed. In order to demonstrate that professional installation is required, the following 3 points must be addressed: ➢ The application (or intended use) of the EUT ➢ The installation requirements of the EUT ➢ The method by which the EUT will be marketed	The EUT must be professionally installed.
15.204	Provided the information for every antenna proposed for use with the EUT: ➢ type (e.g. Yagi, patch, grid, dish, etc…), ➢ manufacturer and model number ➢ gain with reference to an isotropic radiator	See section 2.4 of this test report.
15.247(a)	Description of how the EUT meets the definition of a frequency hopping spread spectrum, found in Section 2.1. Based on the technical description.	See Operational Description
15.247(a)	Pseudo Frequency Hopping Sequence: Describe how the hopping sequence is generated. Provide an example of the hopping sequence channels, in order to demonstrate that the sequence meets the requirements specified in the definition of a frequency hopping spread spectrum system, found in Section 2.1	See Operational Description

FCC Section	FCC Rules	Manufacturer's Clarification
15.247(a)	Equal Hopping Frequency Use: Describe how each individual EUT meets the requirement that each of its hopping channels is used equally on average (e.g. that each new transmission event begins on the next channel in the hopping sequence after final channel used in the previous transmission events).	See Operational Description
15.247(g)	Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.	See Operational Description
15.247(h)	Describe how the EUT complies with the requirement that it not have the ability to coordinated with other FHSS is an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters	See Operational Description
Public Notice DA 00-705	System Receiver Input Bandwidth: Describe how the associated receiver(s) complies with the requirement that its input bandwidth (either RF or IF) matches the bandwidth of the transmitted signal.	See Operational Description
Public Notice DA 00-705	System Receiver Hopping Capability: Describe how the associated receiver(s) has the ability to shift frequencies in synchronization with the transmitted signals	See Operational Description

5.6. PROVISIONS FOR FREQUENCY HOPPING SYSTEMS [§ 15.247(a)(1)]

5.6.1. Limit

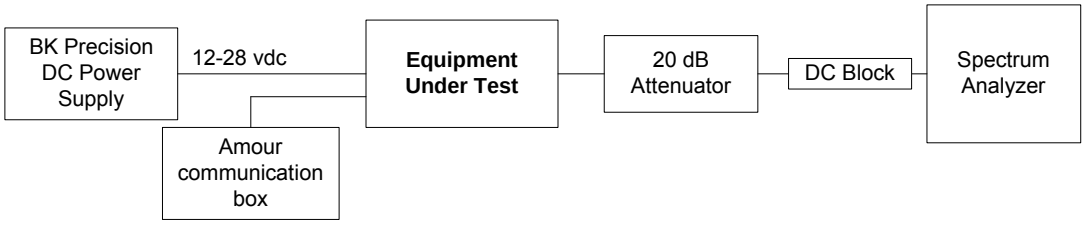
§ 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

§ 15.247(a)(1)(i): For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

5.6.2. Method of Measurements

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

5.6.3. Test Arrangement



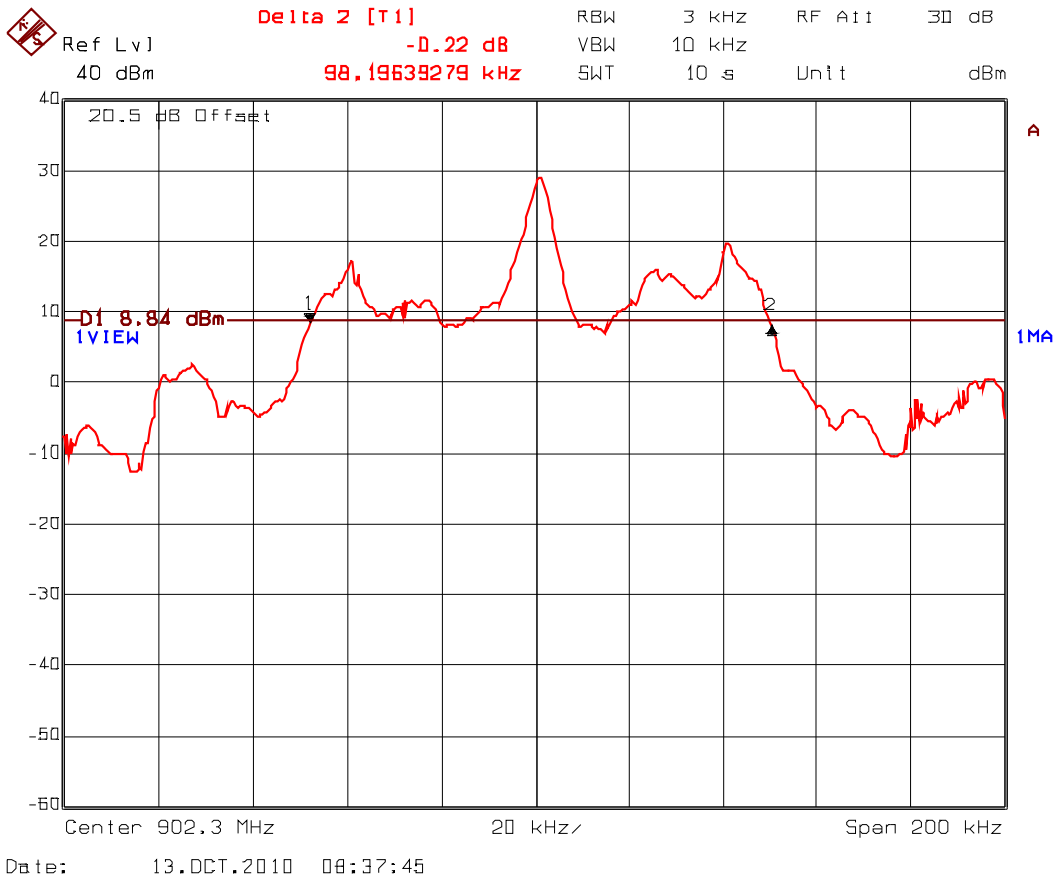
5.6.4. Test Data

Test Description	FCC Specification	Measured Values	Comments
Receiver Input Bandwidth and Hopping Capability	The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.	--	See Note 1
20 dB BW of the hopping channel	The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.	98.19 kHz	See Note 2
Channel Hopping Frequency Separation	Minimum of 25 kHz or 20dB BW whichever is greater.	200 kHz	See Note 2
Number hopping frequencies	If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.	128 hopping frequencies	See Note 2
Average Time of Occupancy	If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period	0.209 s within a 20 second period	See Note 2
Note 1: See operational description exhibit for details. **Note 2**: See the following plots for detail.			

5.6.4.1. 20 dB BW of the Hopping Channel

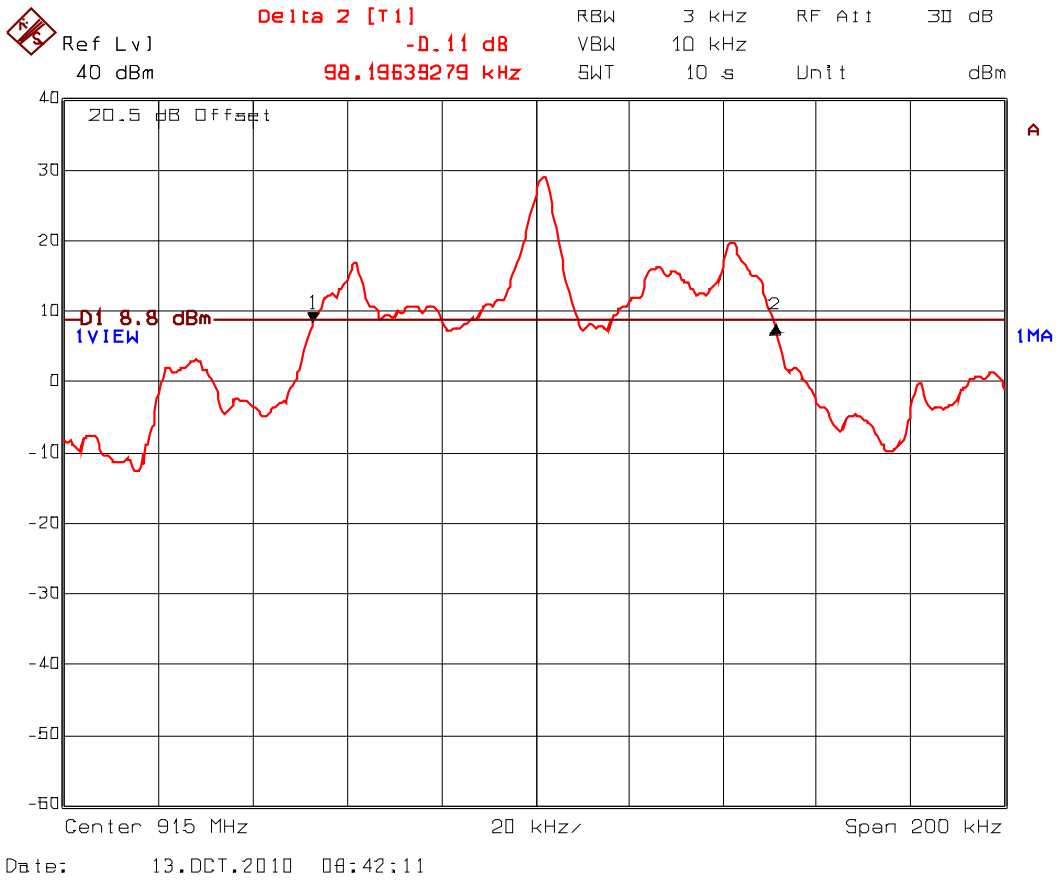
Plot 5.6.4.1.1. 20 dB Bandwidth

Test Frequency:	902.3 MHz
Power Setting:	27.90 dBm



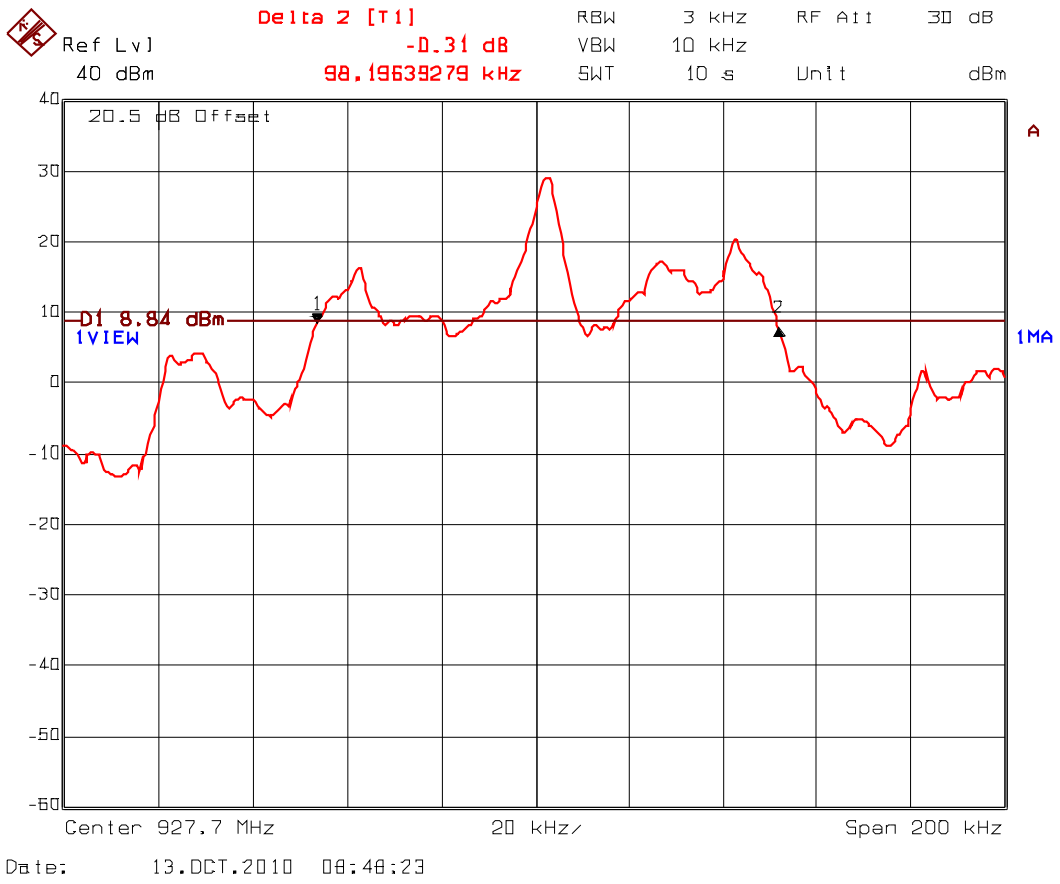
Plot 5.6.4.1.2. 20 dB Bandwidth

Test Frequency:	915 MHz
Power Setting:	27.90 dBm



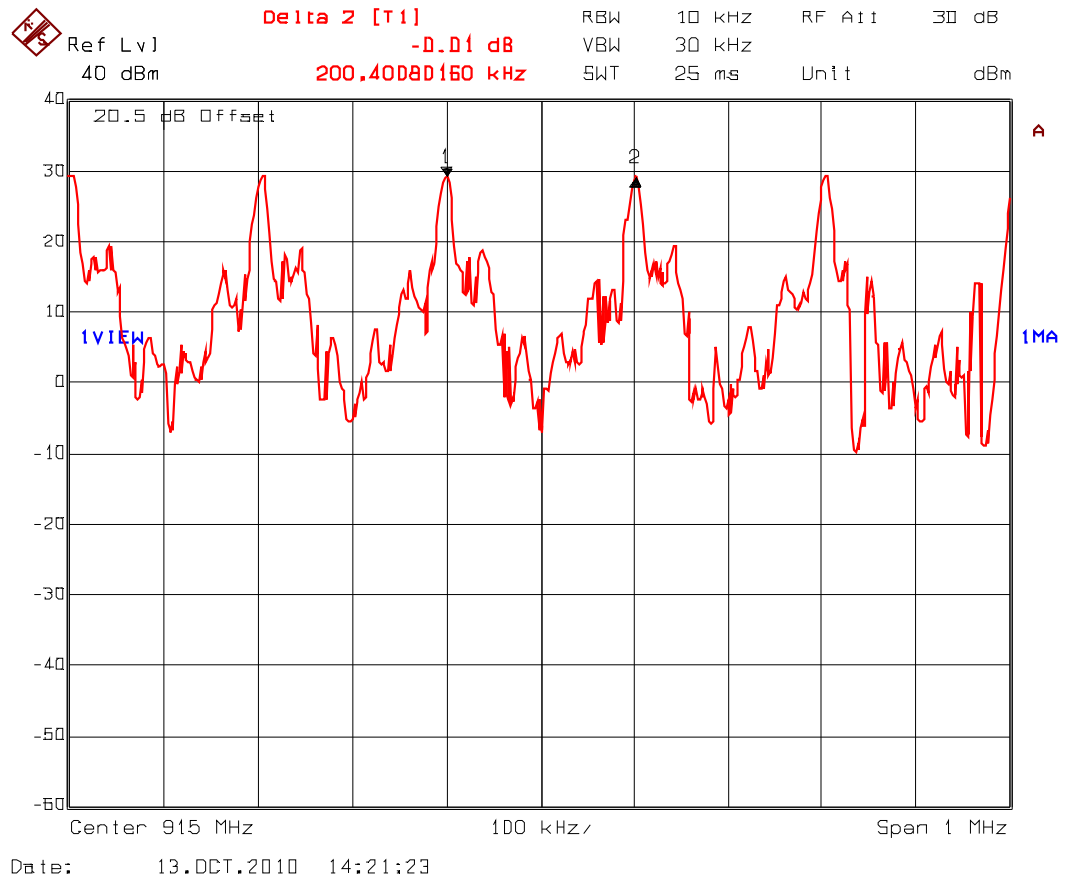
Plot 5.6.4.1.3. 20 dB Bandwidth

Test Frequency:	927.7 MHz
Power Setting:	27.90 dBm



5.6.4.2. Channel Hopping Frequency Separation

Plot 5.6.4.2.1. Carrier Frequency Separation

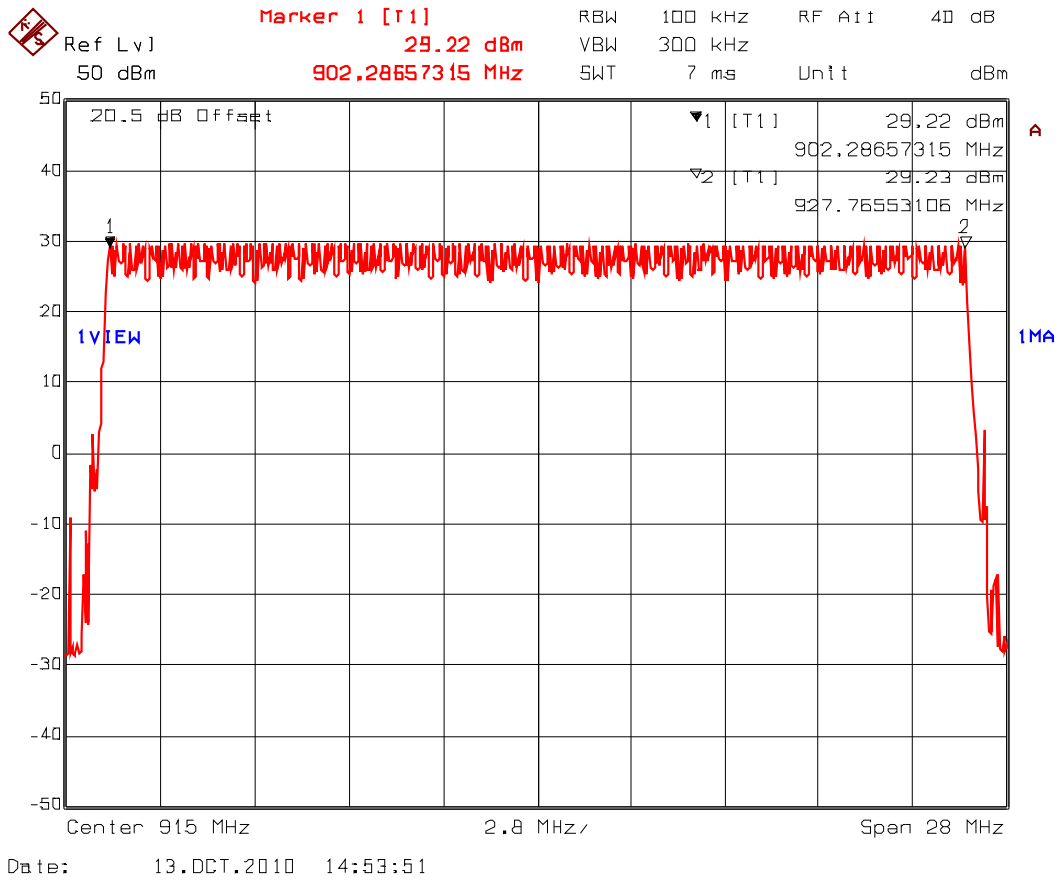


All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.6.4.3. Number of Hopping Frequencies

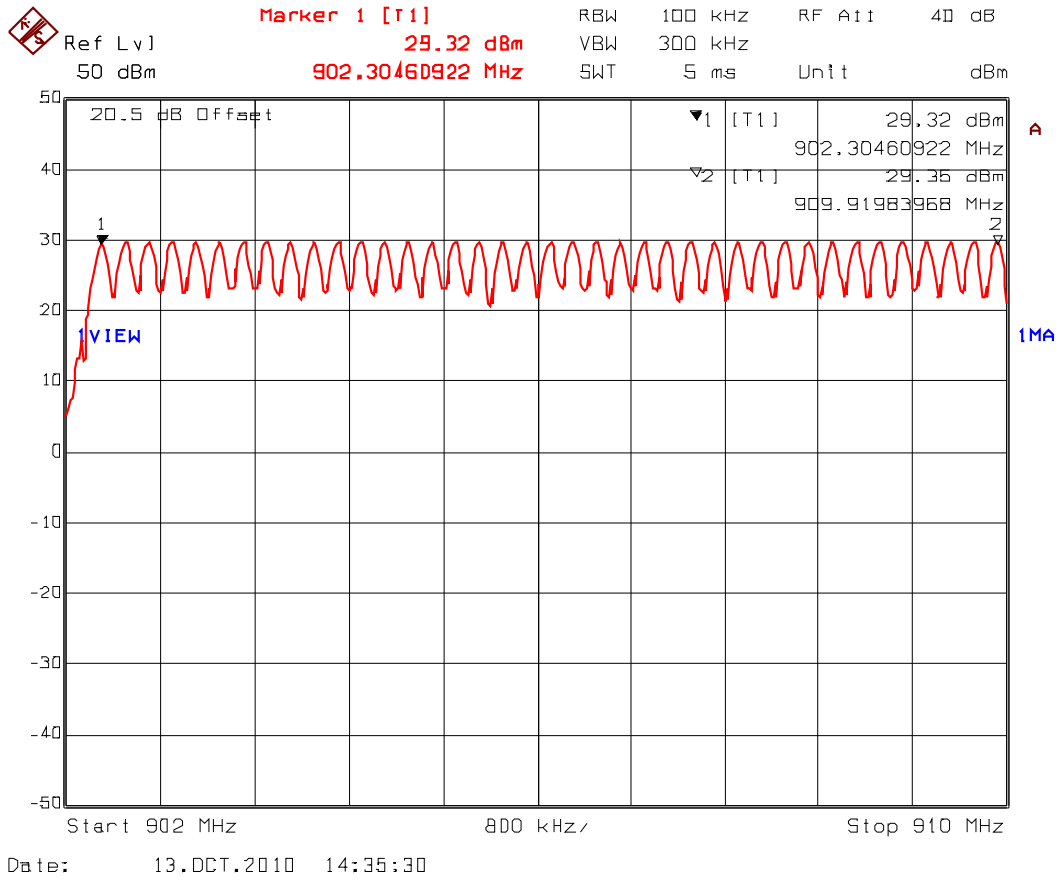
Plot 5.6.4.3.1. Number of Hopping Frequencies

Comment(s): 902-928 MHz, total 128 hopping channels



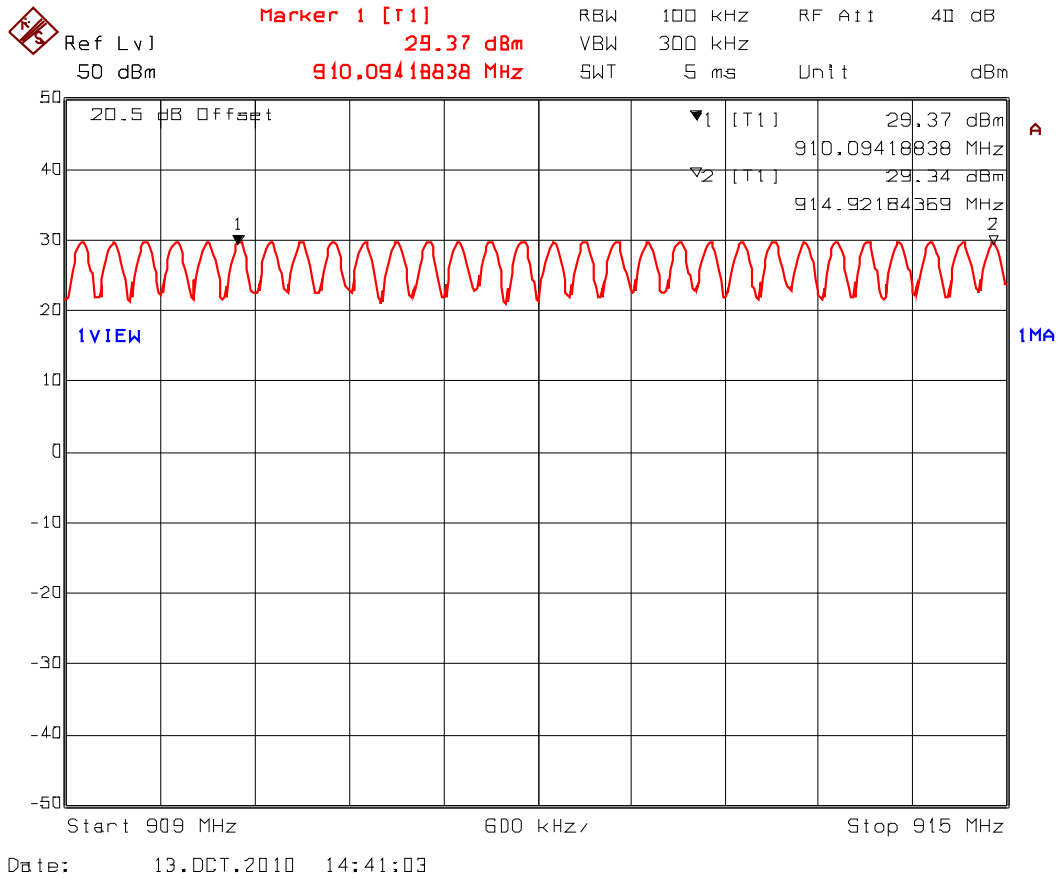
Plot 5.6.4.3.2. Number of Hopping Frequencies

Comment(s): 902-910 MHz, total 39 hopping channels



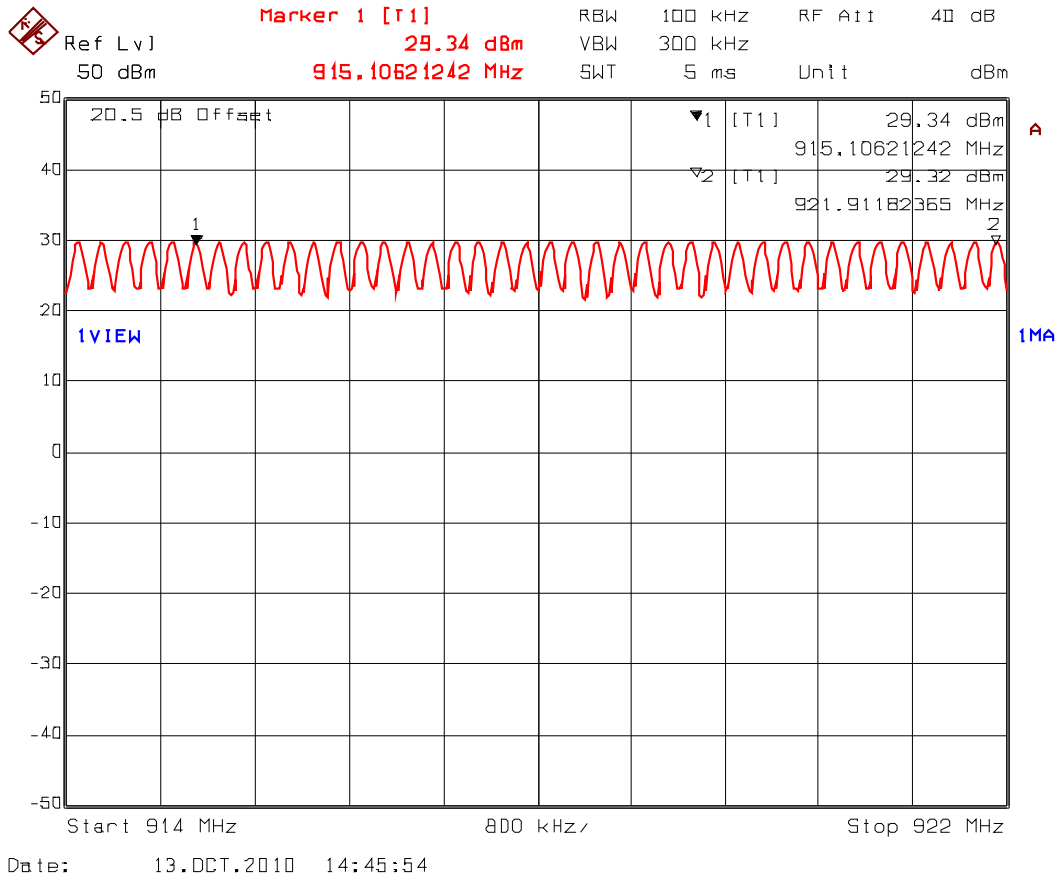
Plot 5.6.4.3.3. Number of Hopping Frequencies

Comment(s): 909-915 MHz, total 25 hopping channels



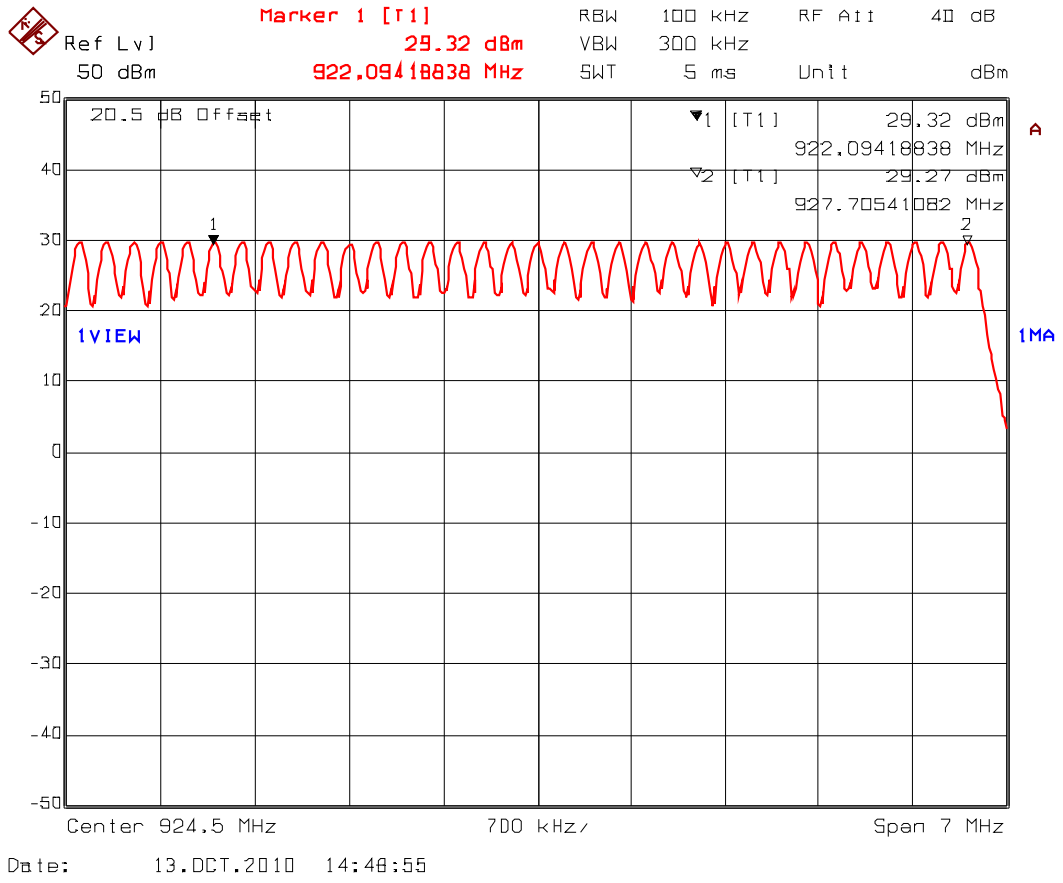
Plot 5.6.4.3.4. Number of Hopping Frequencies

Comment(s): 914-922 MHz, total 35 hopping channels



Plot 5.6.4.3.5. Number of Hopping Frequencies

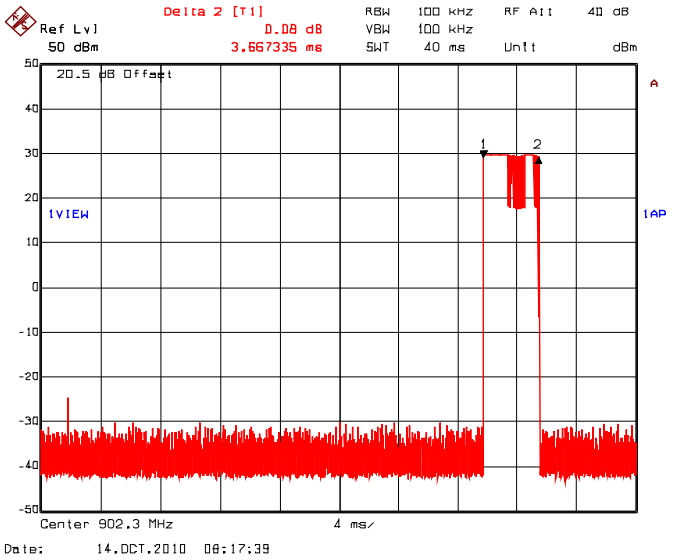
Comment(s): 921-928 MHz, total 29 hopping channels



5.6.4.4. Average Time of Occupancy

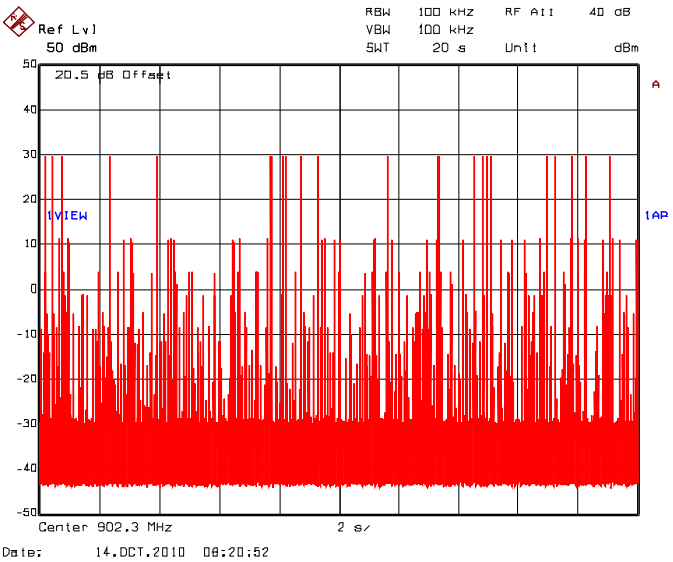
Plot 5.6.4.4.1. Time of Occupancy

Test Frequency:	902.3 MHz
Dwell Time:	3.667335 ms



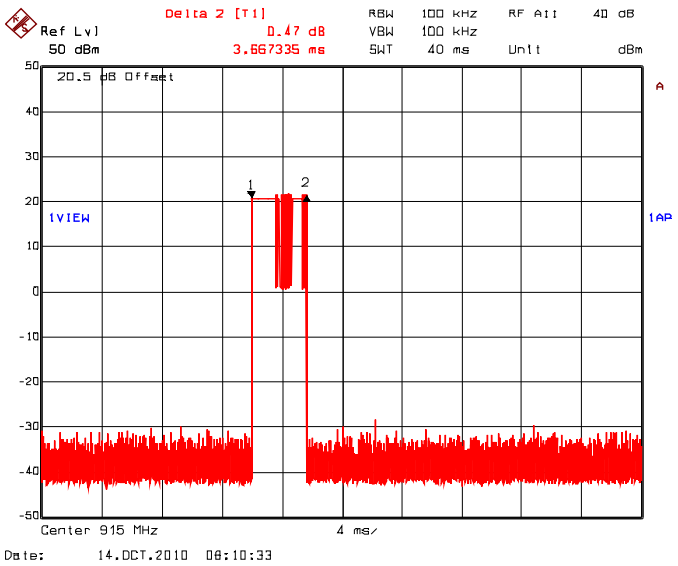
Plot 5.6.4.4.2. Time of Occupancy

Test Frequency:	902.3 MHz
Average Time of Occupancy in 20 s:	= (Dwell Time @ 902.3 MHz) x (number of hops in 20 s) = 3.667335 ms x 21 = 77.014035 ms



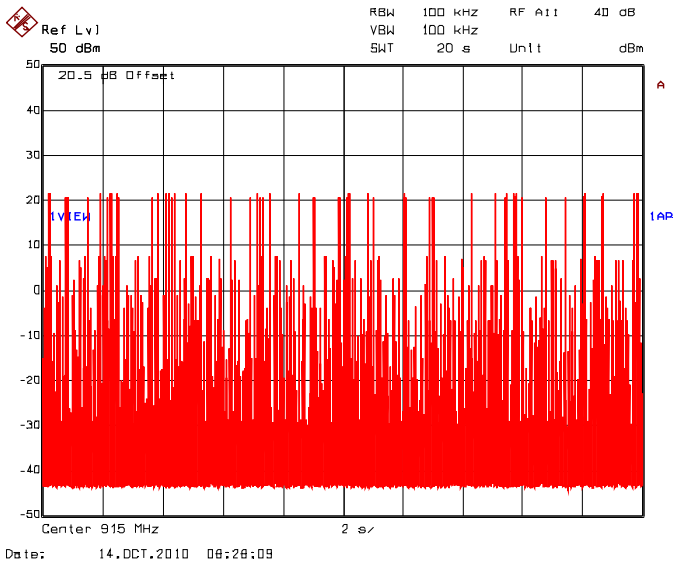
Plot 5.6.4.4.3. Time of Occupancy

Test Frequency:	915 MHz
Dwell Time:	3.667335 ms



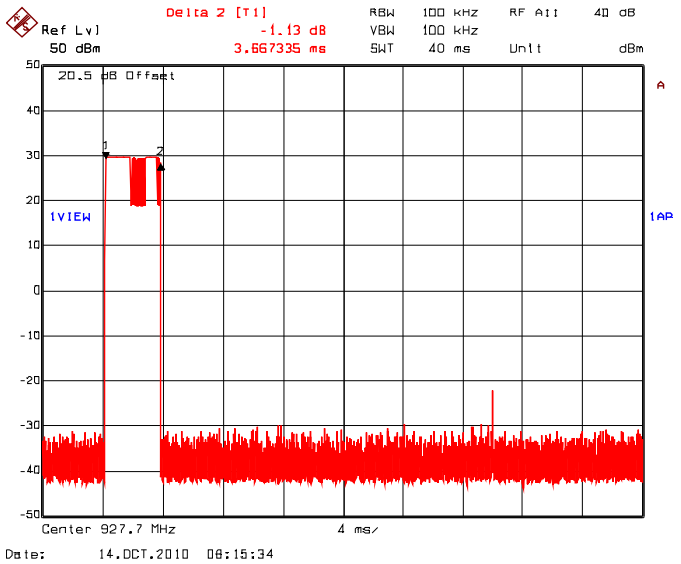
Plot 5.6.4.4.4. Time of Occupancy

Test Frequency:	915 MHz
Average Time of Occupancy in 20 s:	= (Dwell Time @ 915 MHz) x (number of hops in 20 s) = 3.667335 ms x 57 = 209.038095 ms



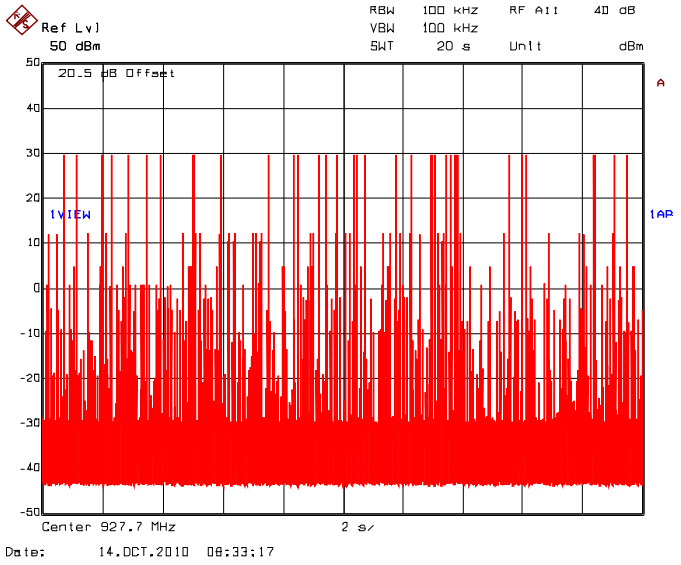
Plot 5.6.4.4.5. Time of Occupancy

Test Frequency:	927.7 MHz
Dwell Time:	3.667335 ms



Plot 5.6.4.4.6. Time of Occupancy

Test Frequency:	927.7 MHz
Average Time of Occupancy in 20 s:	= (Dwell Time @ 927.7 MHz) x (number of hops in 20 s) = 3.667335 ms x 36 = 132.024060 ms



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

5.7.1. Limit(s)

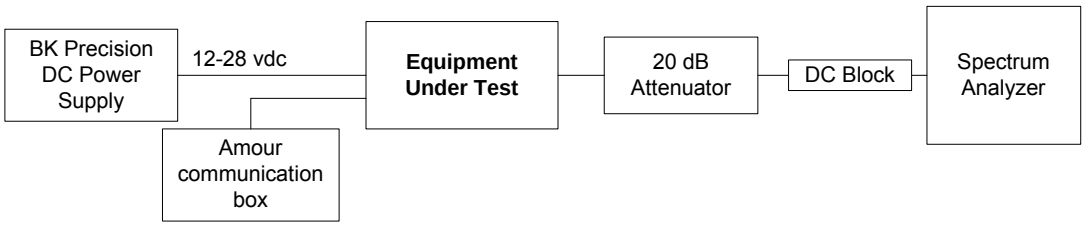
§15.247(b)(2): For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

§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.

5.7.2. Method of Measurements

ANSI C63.10-2009

5.7.3. Test Arrangement



5.7.4. Test Data

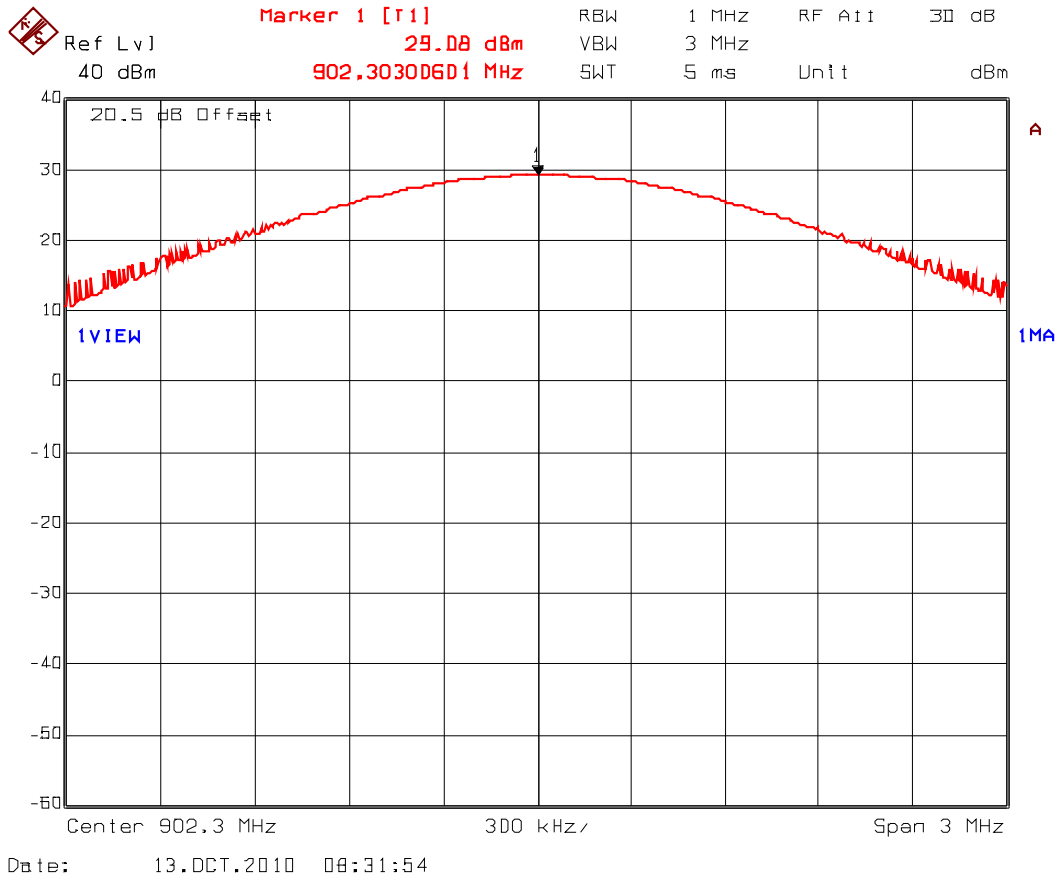
Transmitter Channel	Frequency (MHz)	Peak Output Power at Antenna Terminal (dBm)	Calculated EIRP (dBm)	Peak Output Power Limit (dBm)	EIRP Limit (dBm)
Power Setting: 27.90 dBm (617 mW)					
Lowest	902.3	29.08	35.23	30.0	36.0
Middle	915.0	29.01	35.16	30.0	36.0
Highest	927.7	29.06	35.21	30.0	36.0
Power Setting: 10 dBm (10 mW)					
Lowest	902.3	14.61	20.76	30.0	36.0
Middle	915.0	14.22	20.37	30.0	36.0
Highest	927.7	13.28	19.43	30.0	36.0

Note 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 = $P_{dBm} + G_{dBi} - CL_{dB}$

Note 2: Transmitter antenna gain is 6.15 dBi.

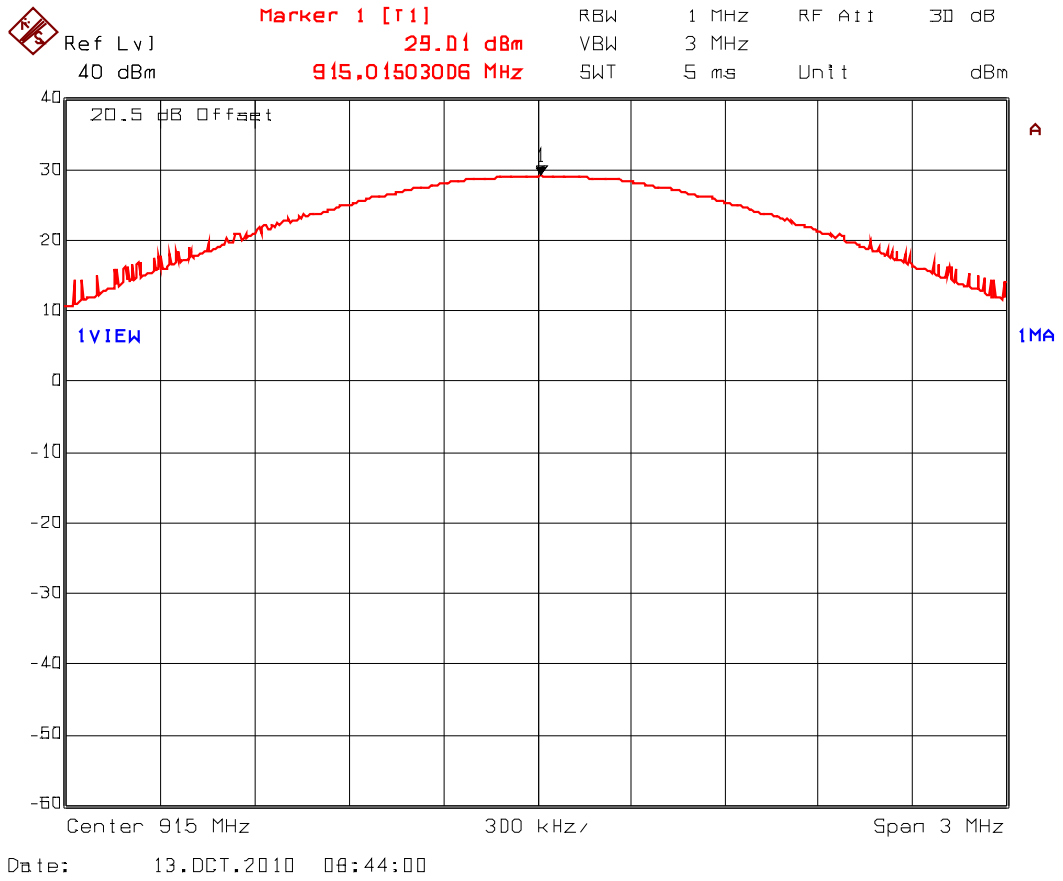
Plot 5.7.4.1. Peak Output Power

Test Frequency:	902.3 MHz		
Power Setting:	27.90 dBm	**Measured Peak Power:**	29.08 dBm



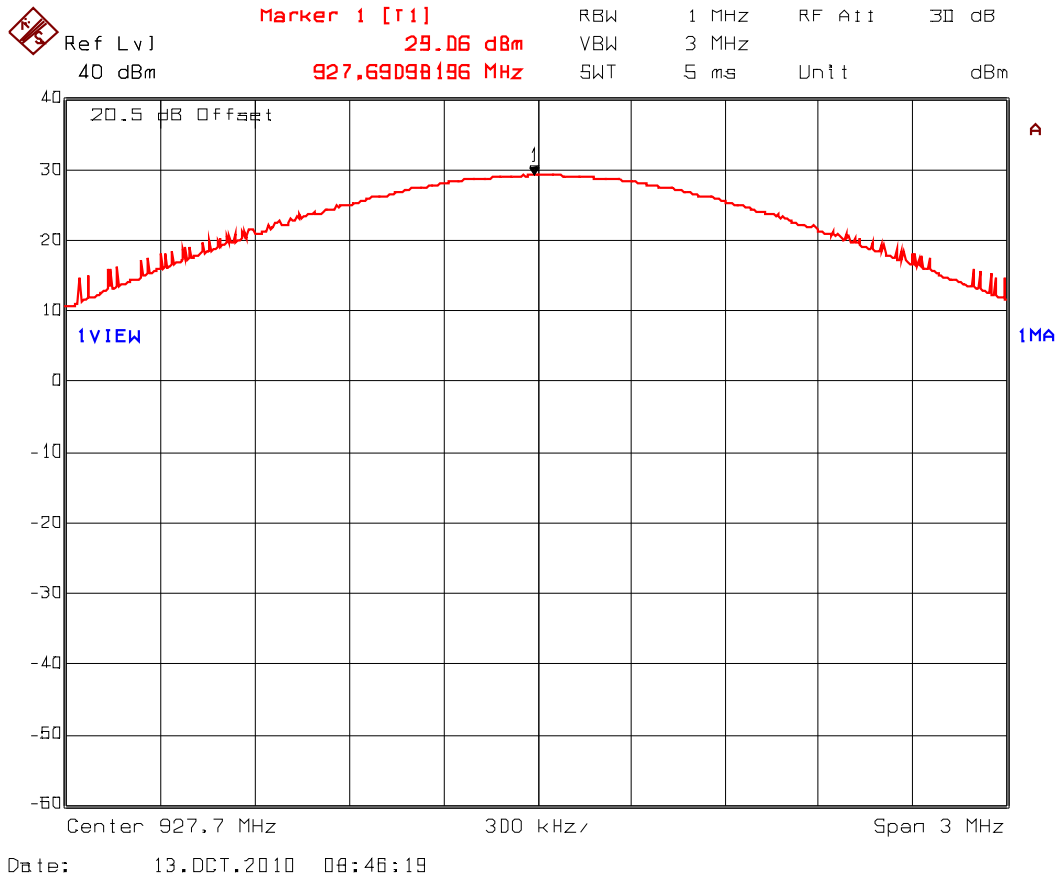
Plot 5.7.4.2. Peak Output Power

Test Frequency:	915 MHz		
Power Setting:	27.90 dBm	**Measured Peak Power:**	29.01 dBm



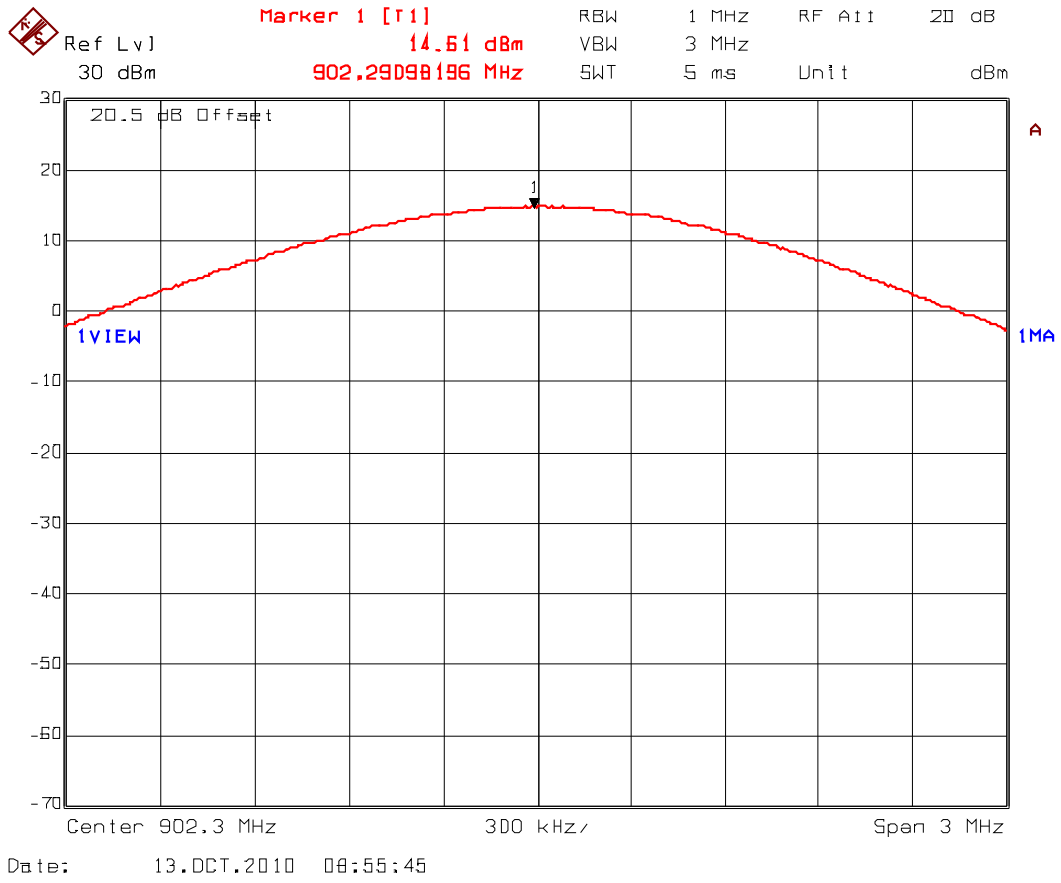
Plot 5.7.4.3. Peak Output Power

Test Frequency:	927.7MHz		
Power Setting:	27.90 dBm	**Measured Peak Power:**	29.06 dBm



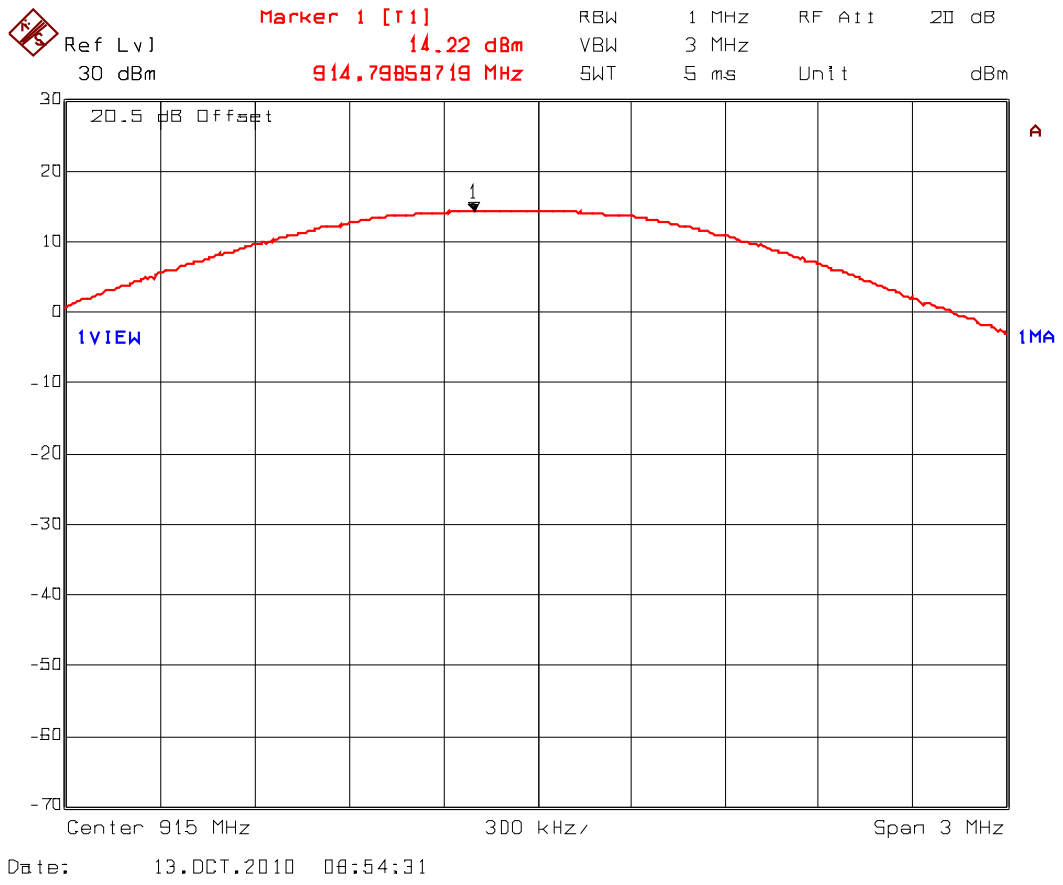
Plot 5.7.4.4. Peak Output Power

Test Frequency:	902.3 MHz		
Power Setting:	10 dBm	**Measured Peak Power:**	14.61 dBm



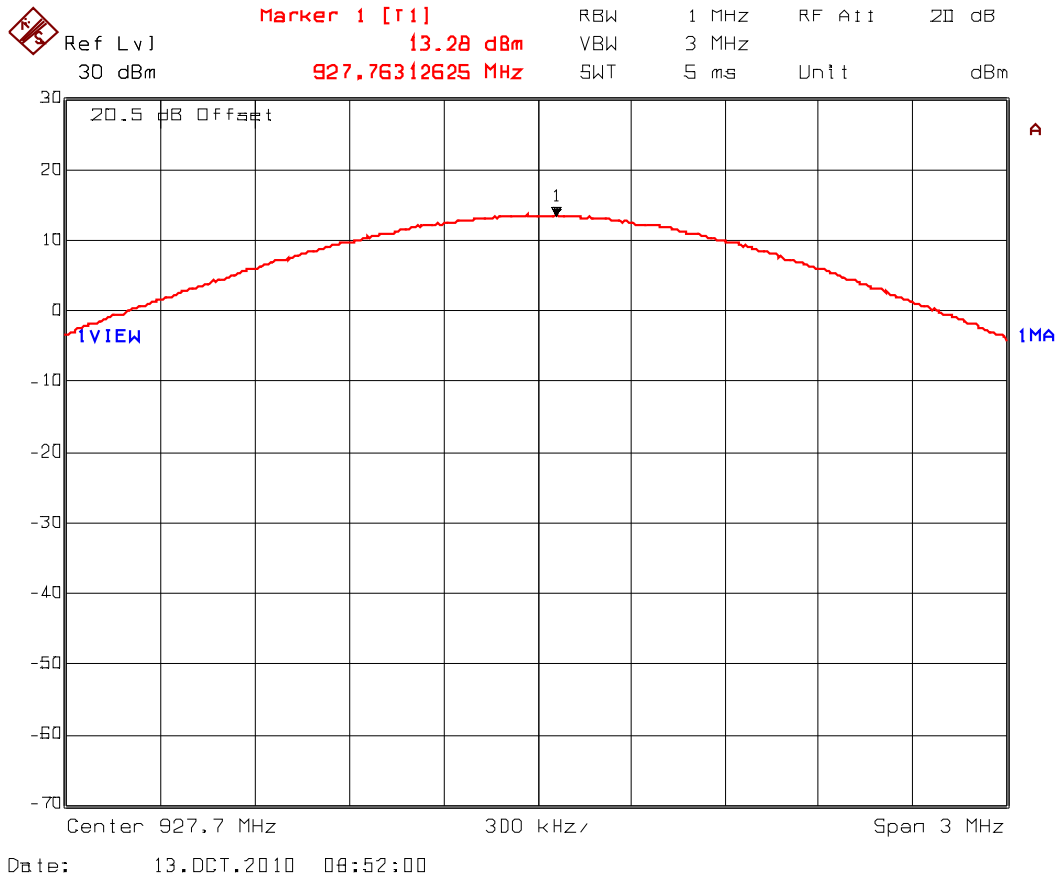
Plot 5.7.4.5. Peak Output Power

Test Frequency:	915 MHz		
Power Setting:	10 dBm	**Measured Peak Power:**	14.22 dBm



Plot 5.7.4.6. Peak Output Power

Test Frequency:	927.7 MHz		
Power Setting:	10 dBm	**Measured Peak Power:**	13.28 dBm



5.8. 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.

5.8.1. 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

5.8.2. RF Evaluation

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum calculated separation distance between antenna and persons required: **21 cm (see note)**	Manufacturer' instruction for separation distance between antenna and persons required: **21 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 = 902.3/1500 mW/cm^2
EIRP = 35.23 dBm = $10^{35.23/10}$ mW = 3334.26 mW (Worst Case)

(Minimum Safe Distance, r) = $\sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}} = \sqrt{\frac{3334.26}{4 \cdot \pi \cdot (902.3/1500)}} \approx 21cm$

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

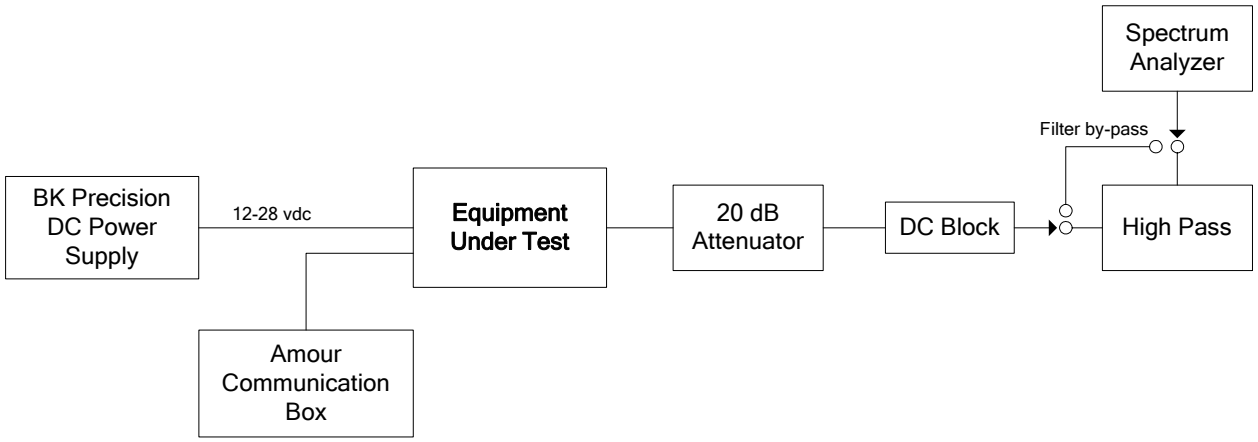
5.9.1. Limit

§ 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)).

5.9.2. Method of Measurements

ANSI C63.10-2009

5.9.3. Test Arrangement

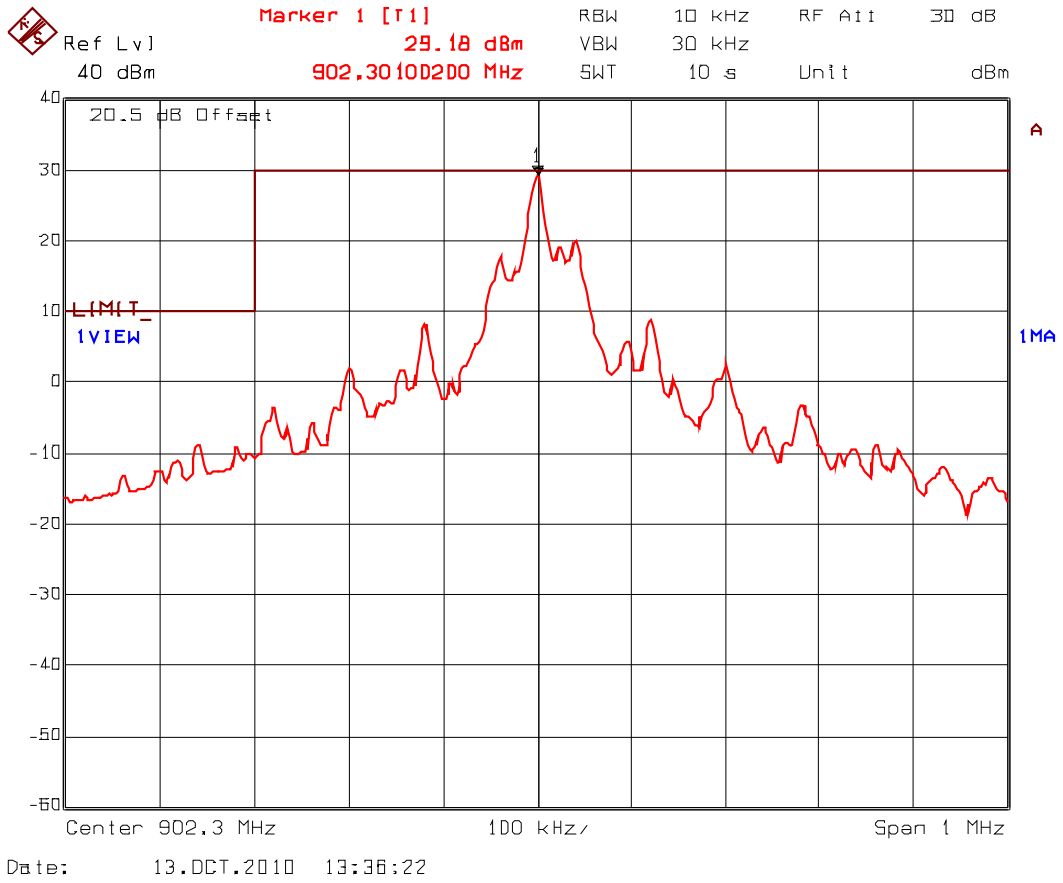


5.9.4. Test Data

5.9.4.1. Band-Edge RF Conducted Emissions

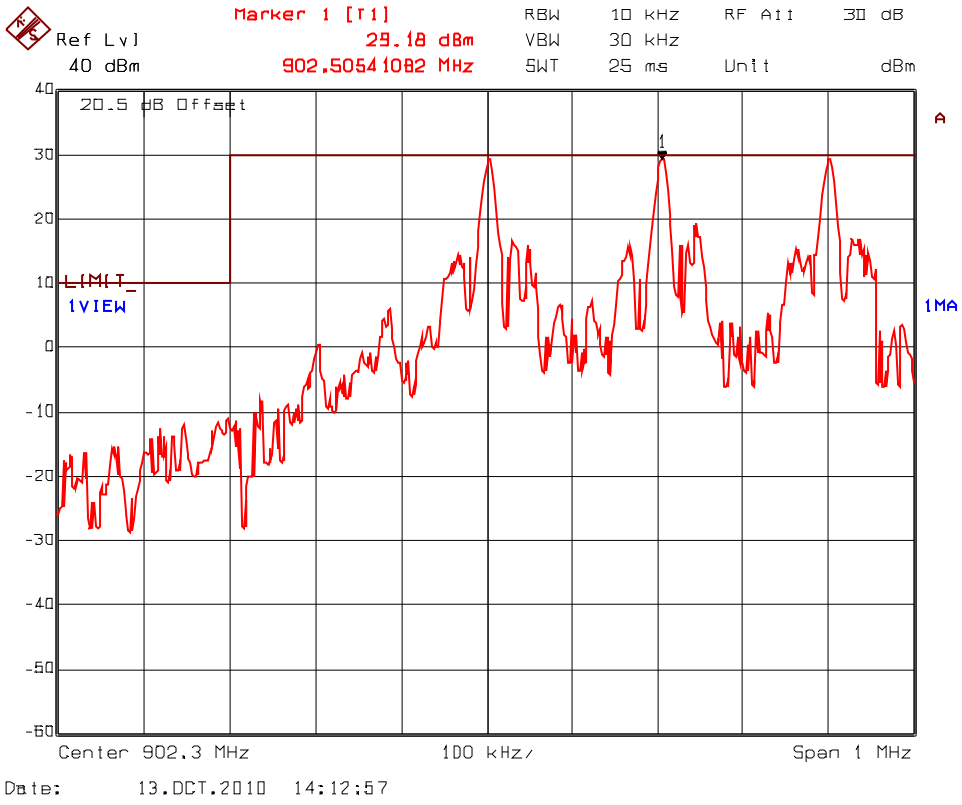
Plot 5.9.4.1.1. Band-Edge RF Conducted Emissions

Test Conditions:	Low end of frequency band, single frequency mode, high power



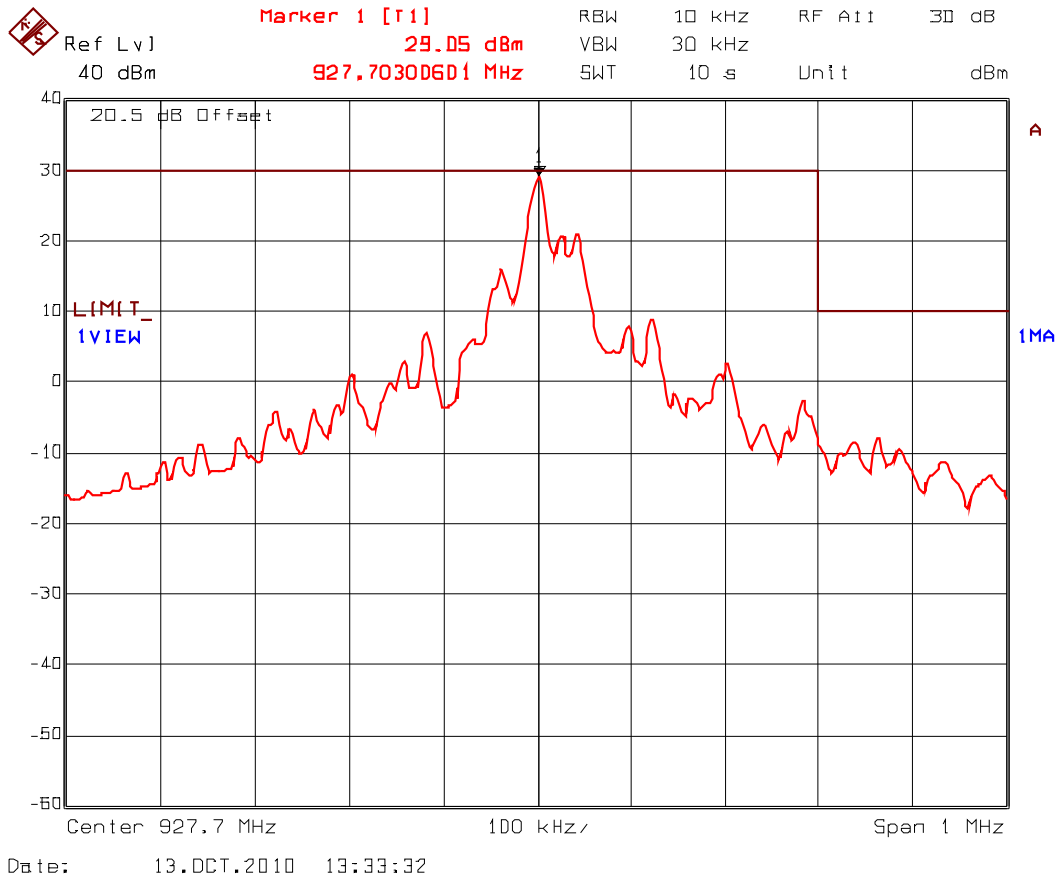
Plot 5.9.4.1.2. Band-Edge RF Conducted Emissions

Test Conditions:	Low end of frequency band, pseudorandom channel hopping mode, high power



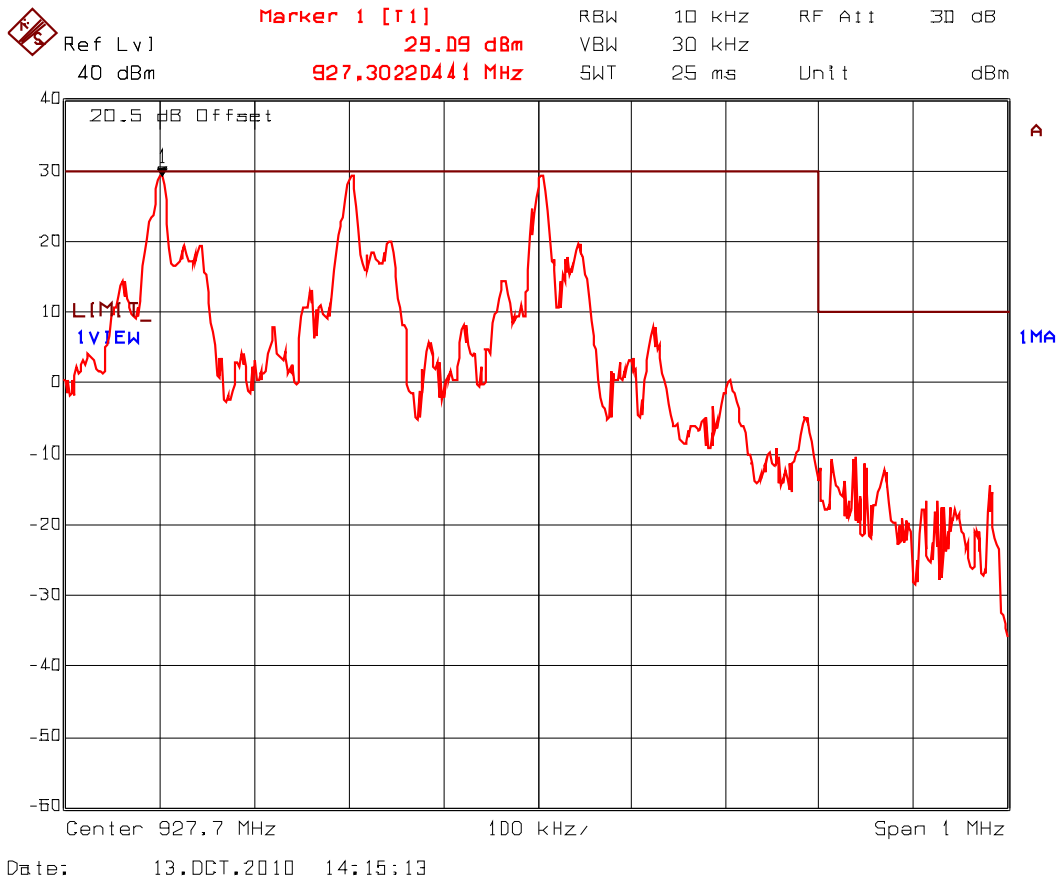
Plot 5.9.4.1.3. Band-Edge RF Conducted Emissions

Test Conditions:	High end of frequency band, single frequency mode, high power



Plot 5.9.4.1.4. Band-Edge RF Conducted Emissions

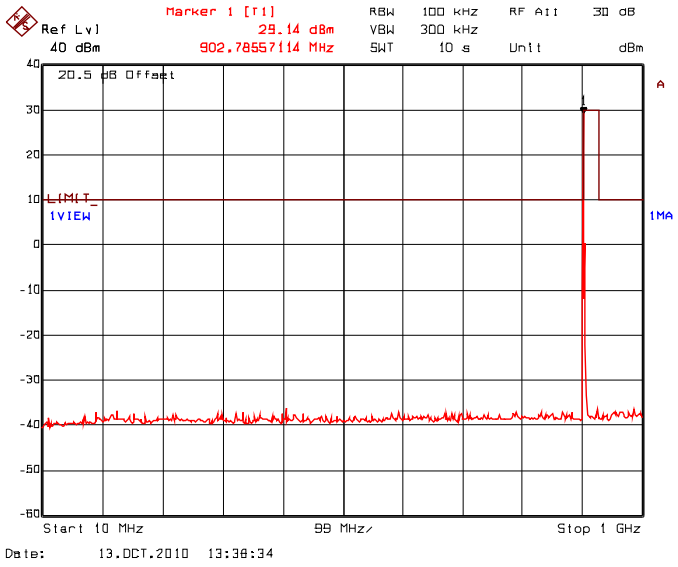
Test Conditions: High end of frequency band, pseudorandom channel hopping mode, high power



5.9.4.2. Spurious RF Conducted Emissions Test Results

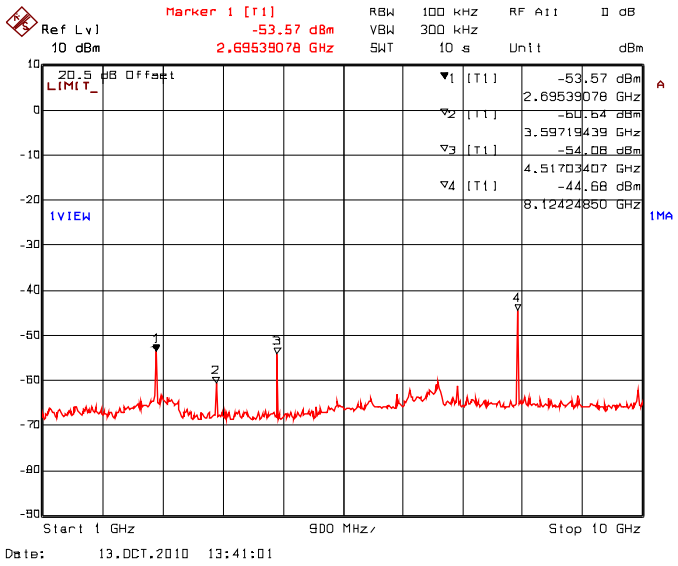
Plot 5.9.4.2.1. Spurious RF Conducted Emissions, High Power

Test Frequency:	902.3 MHz		
Start Frequency:	10 MHz	**Stop Frequency:**	1GHz



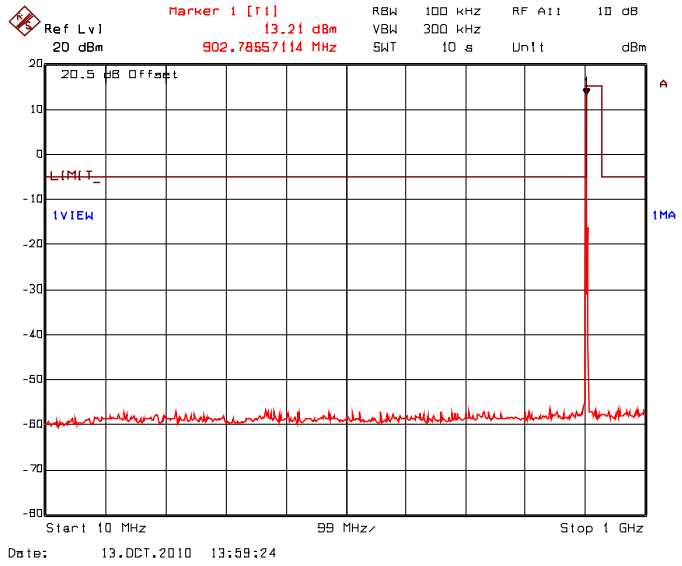
Plot 5.9.4.2.2. Spurious RF Conducted Emissions, High Power

Test Frequency:	902.3 MHz		
Start Frequency:	1 GHz	**Stop Frequency:**	10 GHz



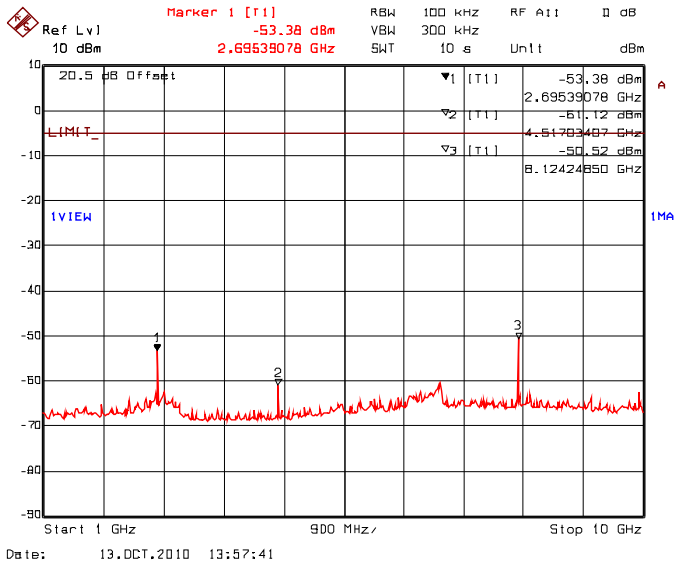
Plot 5.9.4.2.3. Spurious RF Conducted Emissions, Low Power

Test Frequency:	902.3 MHz		
Start Frequency:	10 MHz	**Stop Frequency:**	1GHz



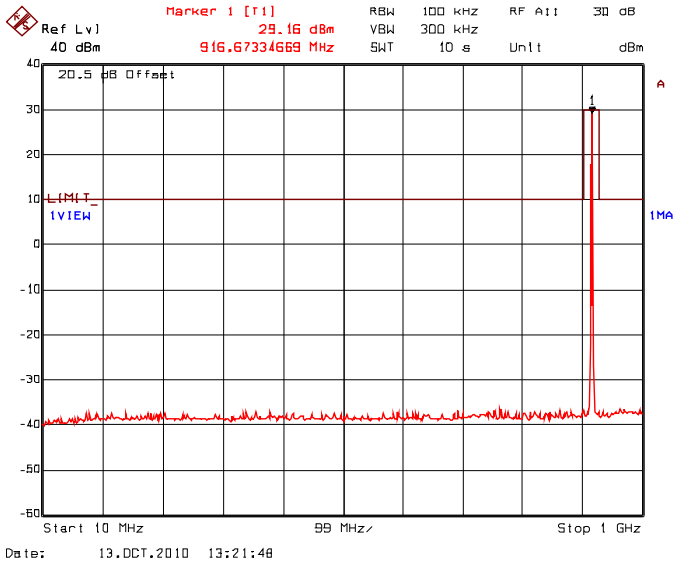
Plot 5.9.4.2.4. Spurious RF Conducted Emissions, Low Power

Test Frequency:	902.3 MHz		
Start Frequency:	1 GHz	**Stop Frequency:**	10 GHz



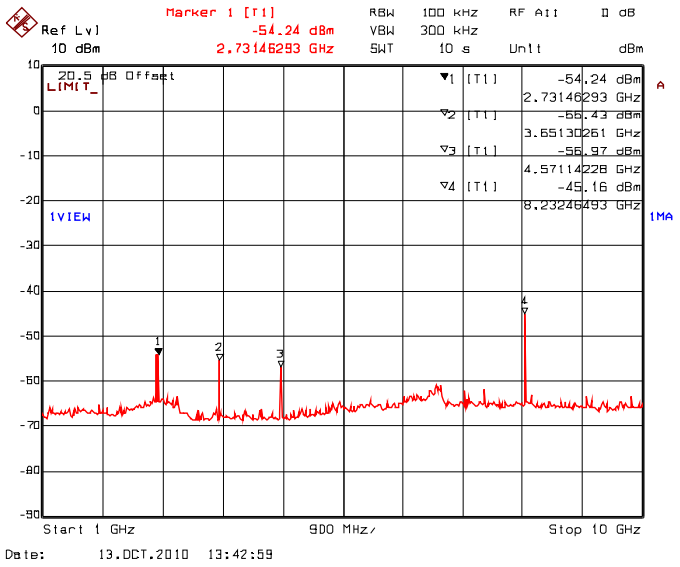
Plot 5.9.4.2.5. Spurious RF Conducted Emissions, High Power

Test Frequency:	915 MHz		
Start Frequency:	10 MHz	**Stop Frequency:**	1GHz



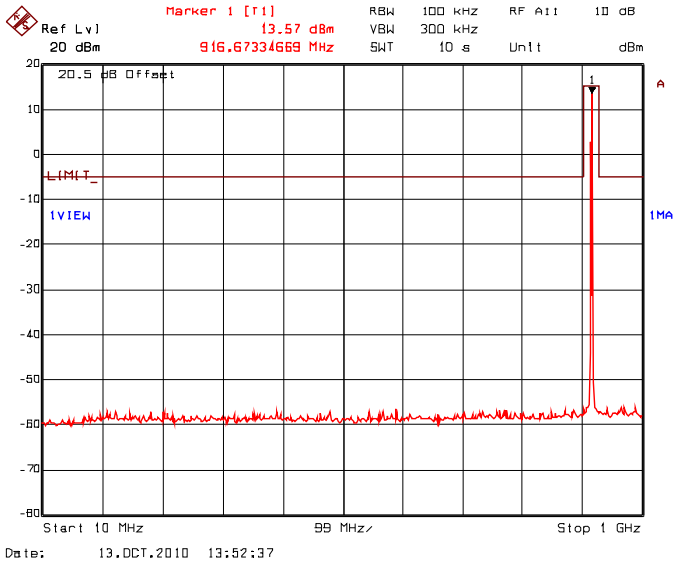
Plot 5.9.4.2.6. Spurious RF Conducted Emissions, High Power

Test Frequency:	915 MHz		
Start Frequency:	1 GHz	**Stop Frequency:**	10 GHz



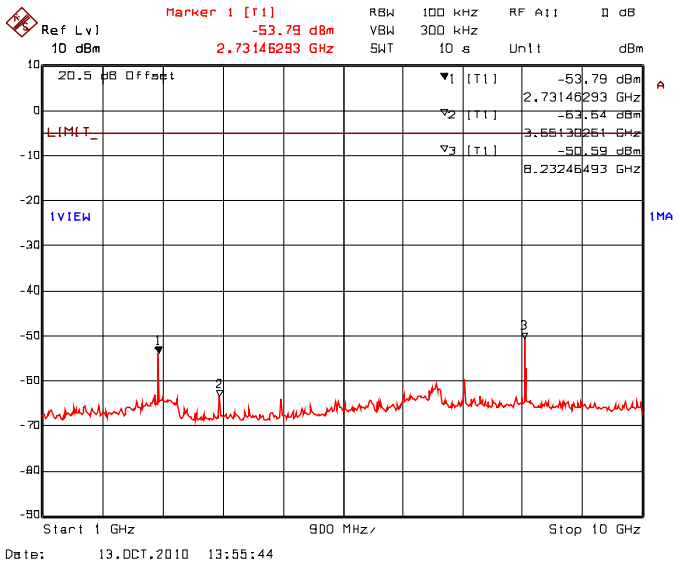
Plot 5.9.4.2.7. Spurious RF Conducted Emissions, Low Power

Test Frequency:	915 MHz		
Start Frequency:	10 MHz	**Stop Frequency:**	1GHz



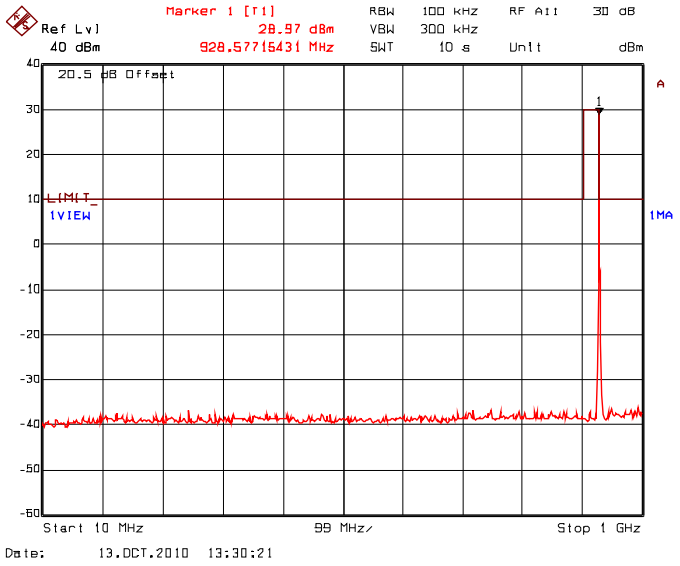
Plot 5.9.4.2.8. Spurious RF Conducted Emissions, Low Power

Test Frequency:	915 MHz		
Start Frequency:	1 GHz	**Stop Frequency:**	10 GHz



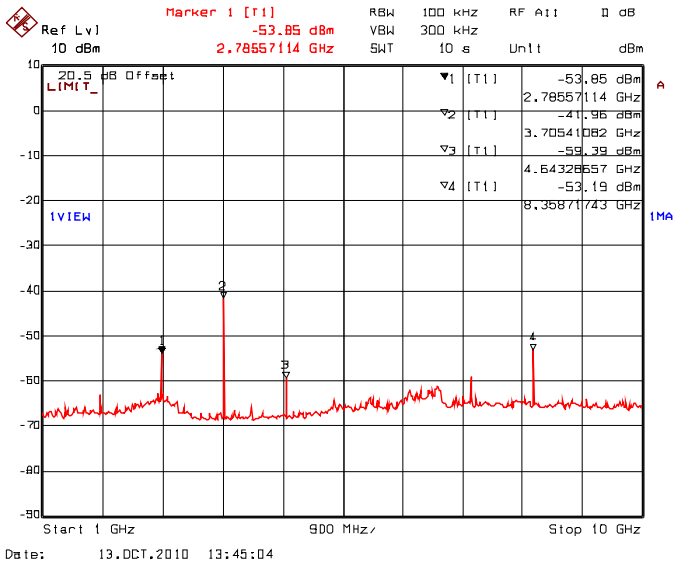
Plot 5.9.4.2.9. Spurious RF Conducted Emissions, High Power

Test Frequency:	927.7 MHz		
Start Frequency:	10 MHz	**Stop Frequency:**	1GHz



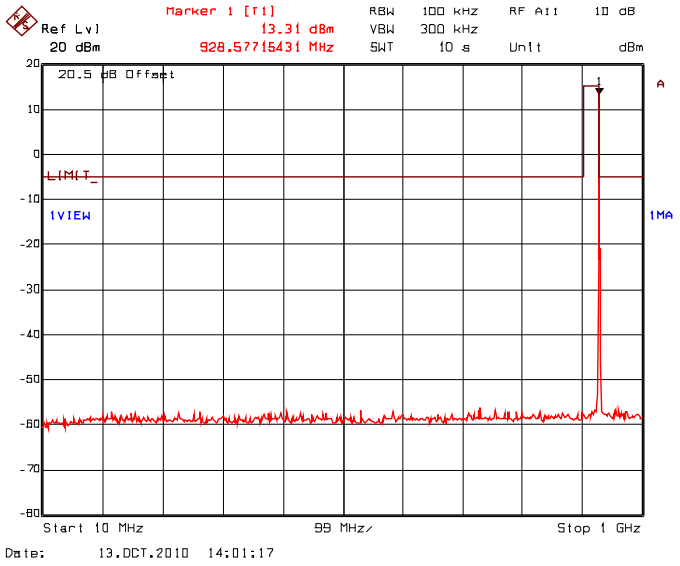
Plot 5.9.4.2.10. Spurious RF Conducted Emissions, High Power

Test Frequency:	927.7 MHz		
Start Frequency:	1 GHz	**Stop Frequency:**	10 GHz



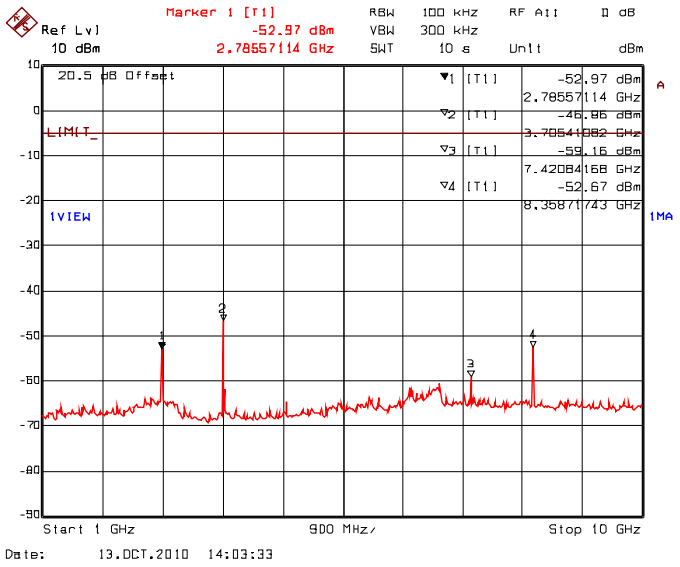
Plot 5.9.4.2.11. Spurious RF Conducted Emissions, Low Power

Test Frequency:	927.7 MHz		
Start Frequency:	10 MHz	**Stop Frequency:**	1GHz



Plot 5.9.4.2.12. Spurious RF Conducted Emissions, Low Power

Test Frequency:	927.7 MHz		
Start Frequency:	1 GHz	**Stop Frequency:**	10 GHz



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

5.10.1. 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

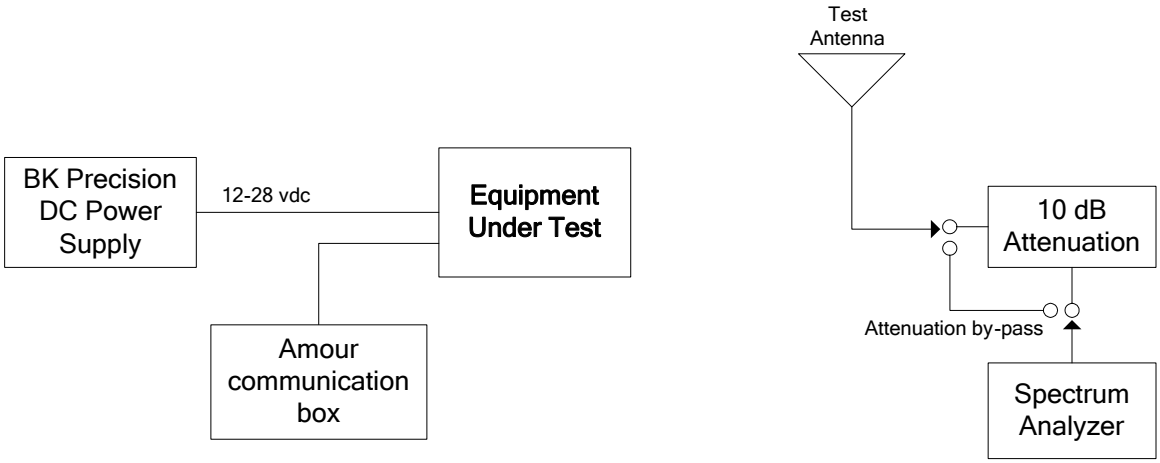
§ 15.209(a) Radiated Emission Limits; General Requirements

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

5.10.2. Method of Measurements

ANSI C63.10-2009

5.10.3. Test Arrangement

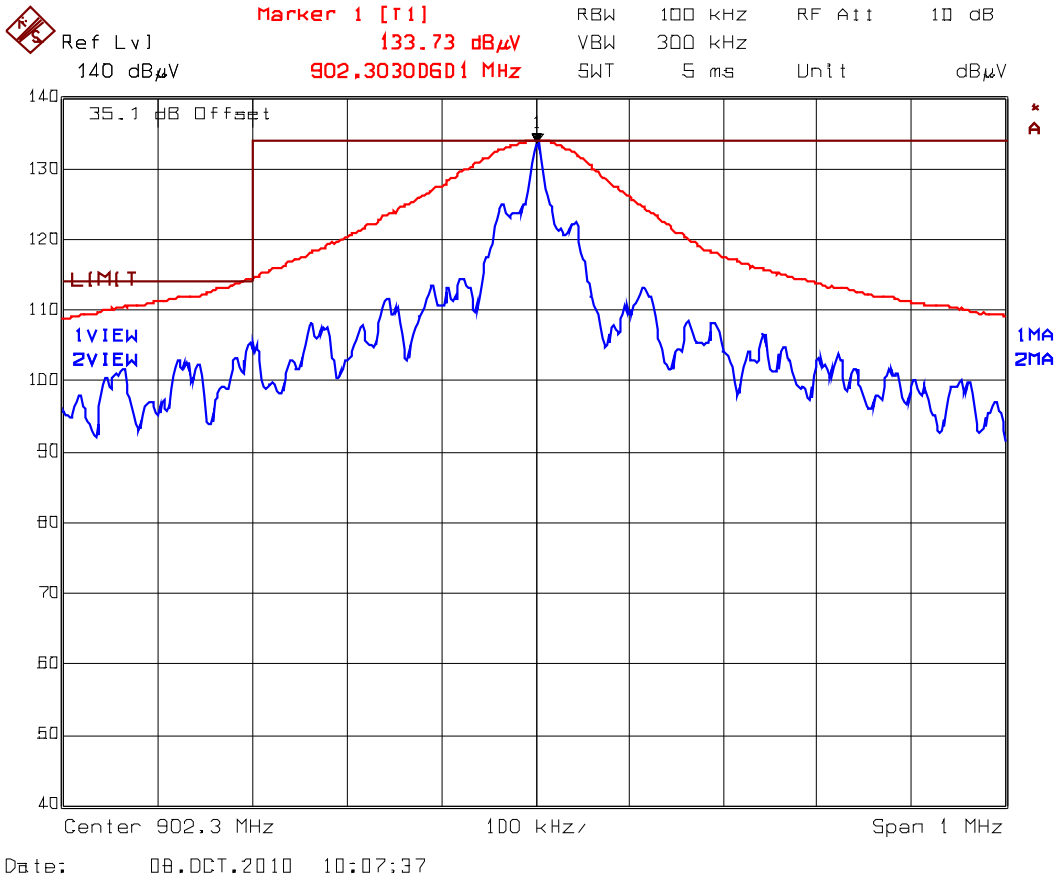


5.10.4. Test Data

5.10.4.1. Band-Edge RF Radiated Emissions Test Results

Plot 5.10.4.1.1. Band-Edge RF Radiated Emissions

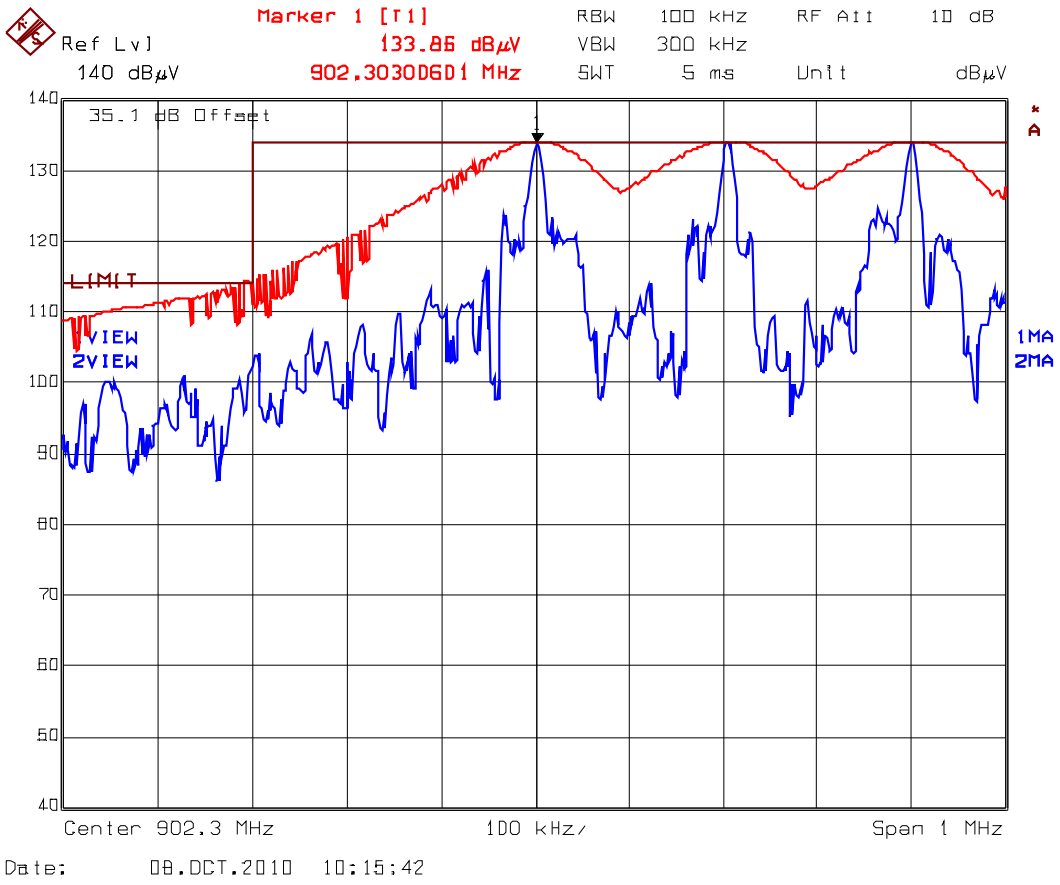
Test Conditions:	Low end of frequency band, single frequency mode, high power
Rx Antenna Orientation:	Horizontal



Trace 1: RBW = 100 kHz, VBW = 300 kHz Trace 2: RBW = 10 kHz, VBW = 30 kHz

Plot 5.10.4.1.2. Band-Edge RF Radiated Emissions

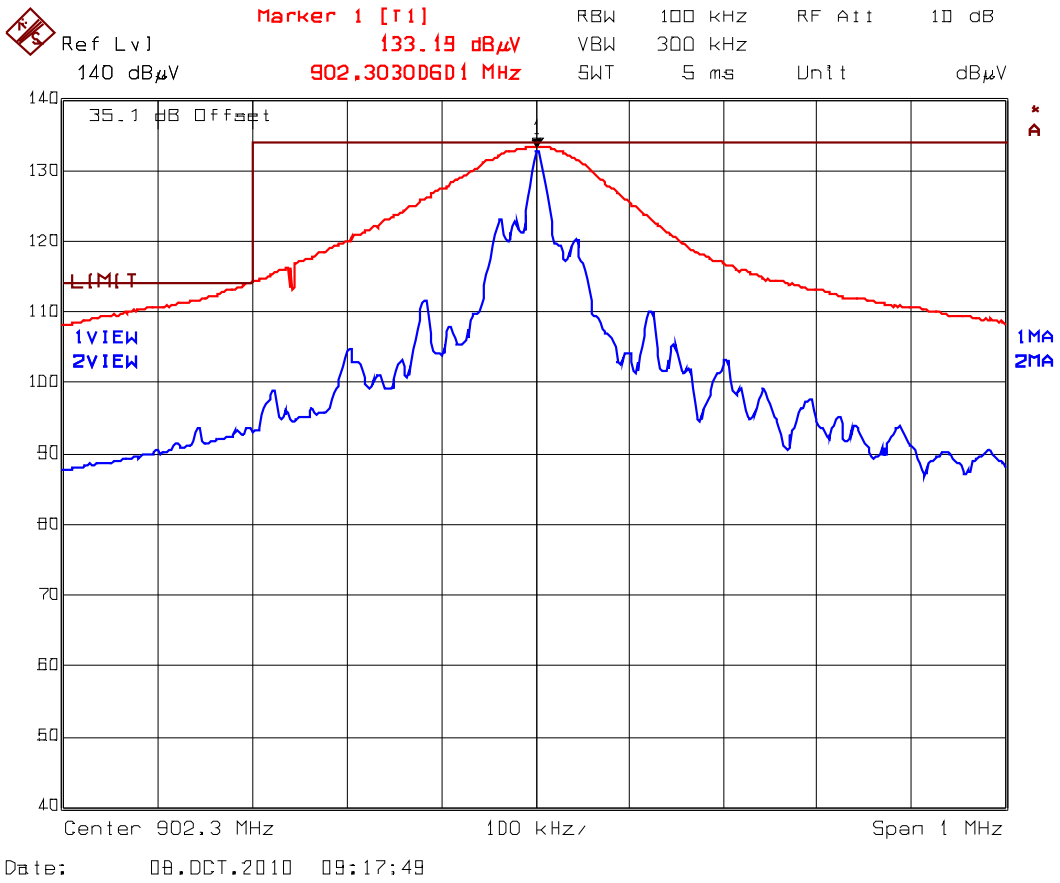
Test Conditions:	Low end of frequency band, pseudorandom channel hopping mode, high power
Rx Antenna Orientation:	Horizontal



Trace 1: RBW = 100 kHz, VBW = 300 kHz Trace 2: RBW = 10 kHz, VBW = 30 kHz

Plot 5.10.4.1.3. Band-Edge RF Radiated Emissions

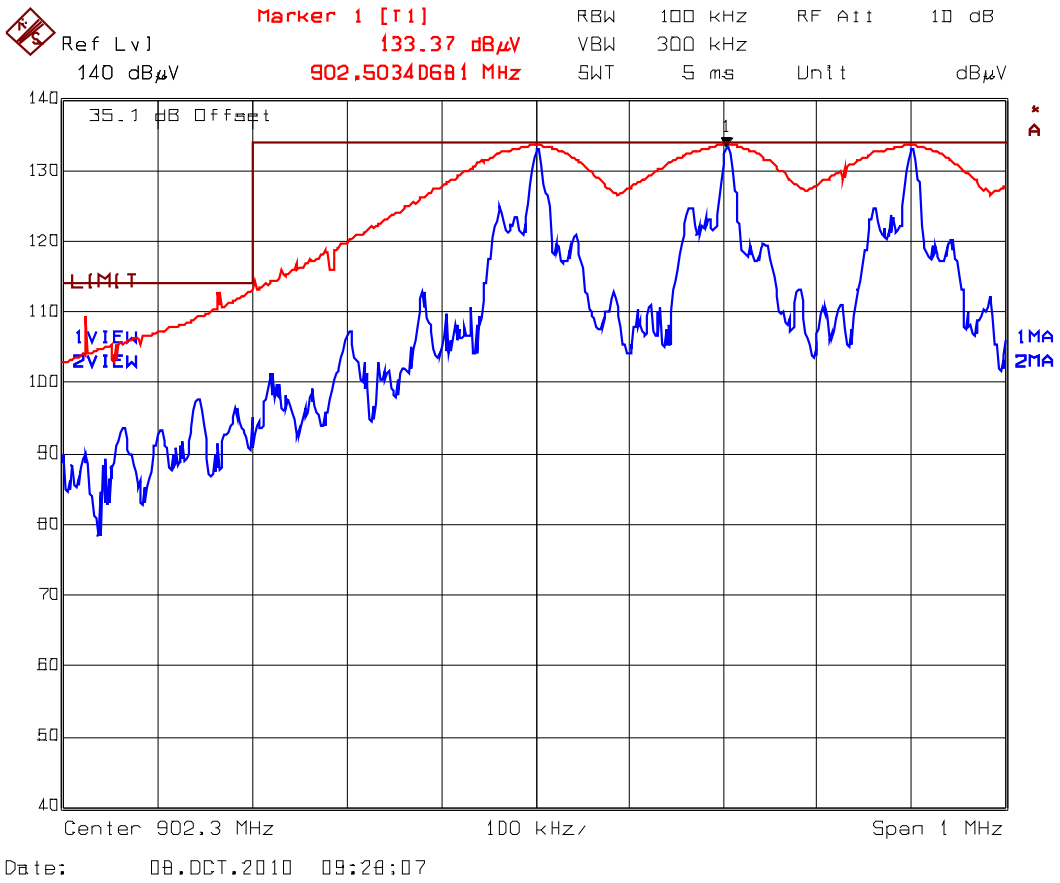
Test Conditions:	Low end of frequency band, single frequency mode, high power
Rx Antenna Orientation:	Vertical



Trace 1: RBW = 100 kHz, VBW = 300 kHz Trace 2: RBW = 10 kHz, VBW = 30 kHz

Plot 5.10.4.1.4. Band-Edge RF Radiated Emissions

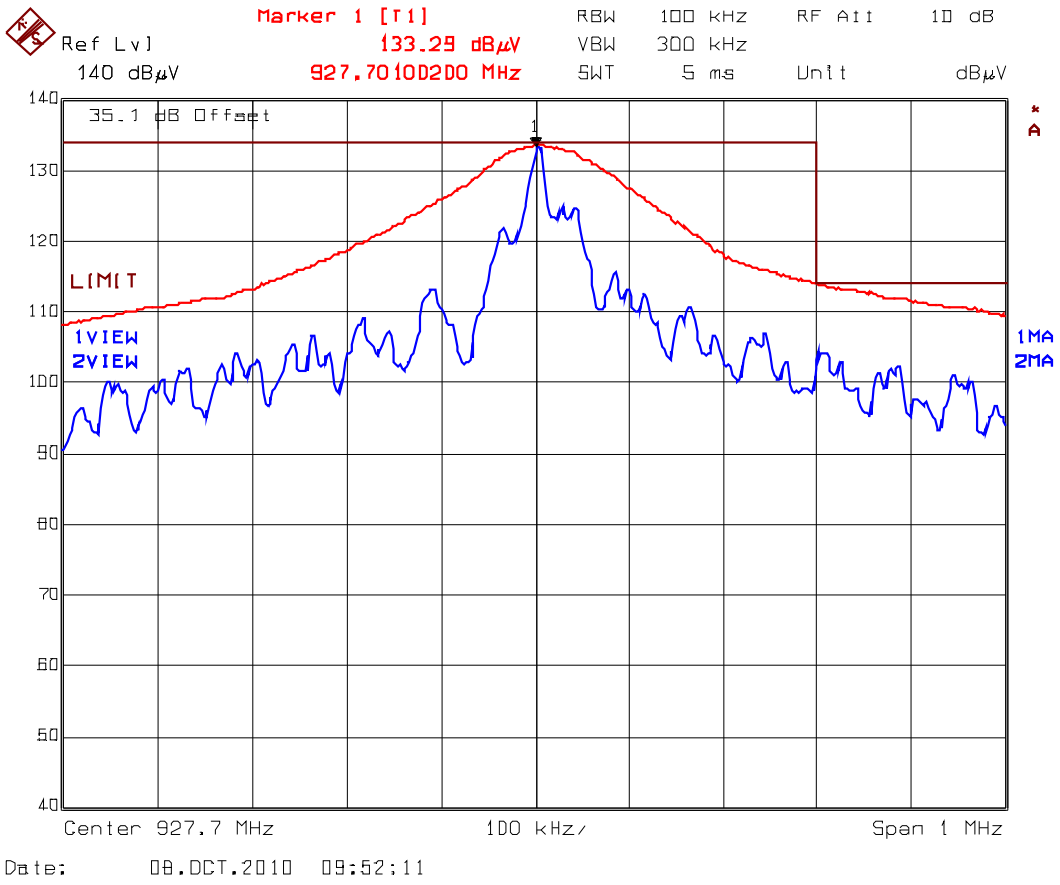
Test Conditions:	Low end of frequency band, pseudorandom channel hopping mode, high power
Rx Antenna Orientation:	Vertical



Trace 1: RBW = 100 kHz, VBW = 300 kHz Trace 2: RBW = 10 kHz, VBW = 30 kHz

Plot 5.10.4.1.5. Band-Edge RF Radiated Emissions

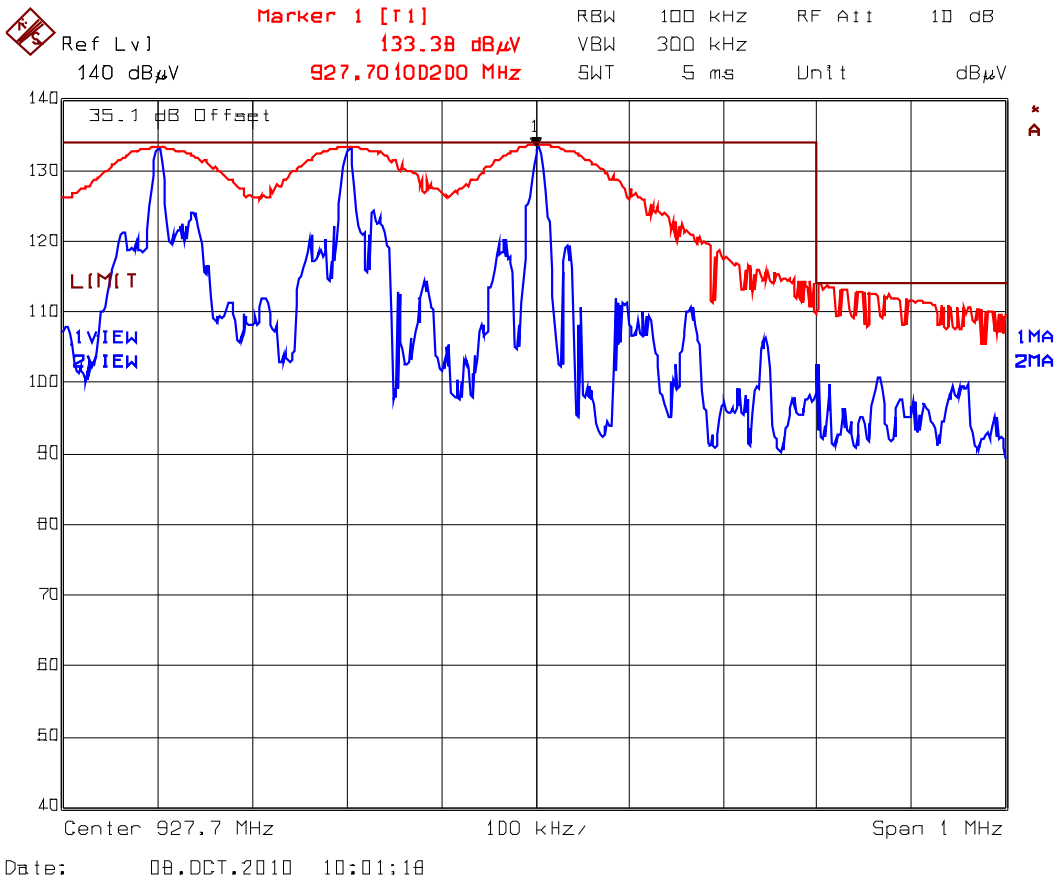
Test Conditions:	High end of frequency band, single frequency mode, high power
Rx Antenna Orientation:	Horizontal



Trace 1: RBW = 100 kHz, VBW = 300 kHz Trace 2: RBW = 10 kHz, VBW = 30 kHz

Plot 5.10.4.1.6. Band-Edge RF Radiated Emissions

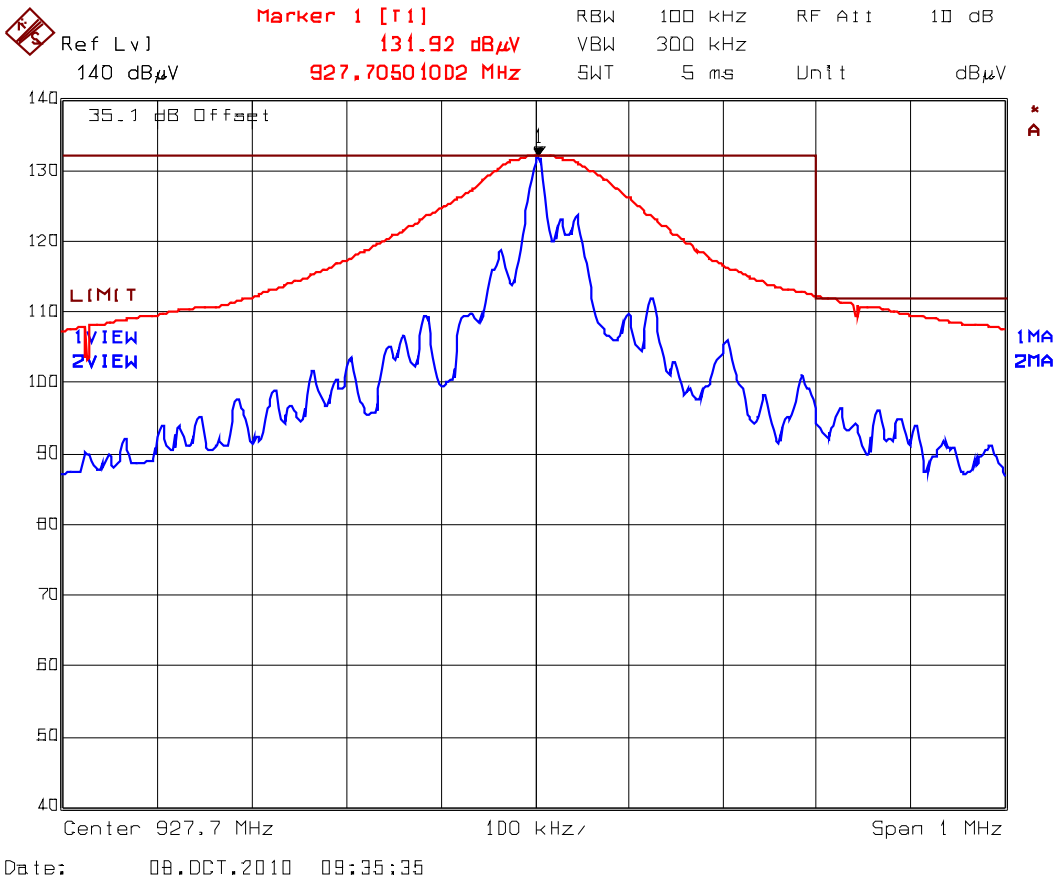
Test Conditions:	High end of frequency band, pseudorandom channel hopping mode, high power
Rx Antenna Orientation:	Horizontal



Trace 1: RBW = 100 kHz, VBW = 300 kHz Trace 2: RBW = 10 kHz, VBW = 30 kHz

Plot 5.10.4.1.7. Band-Edge RF Radiated Emissions

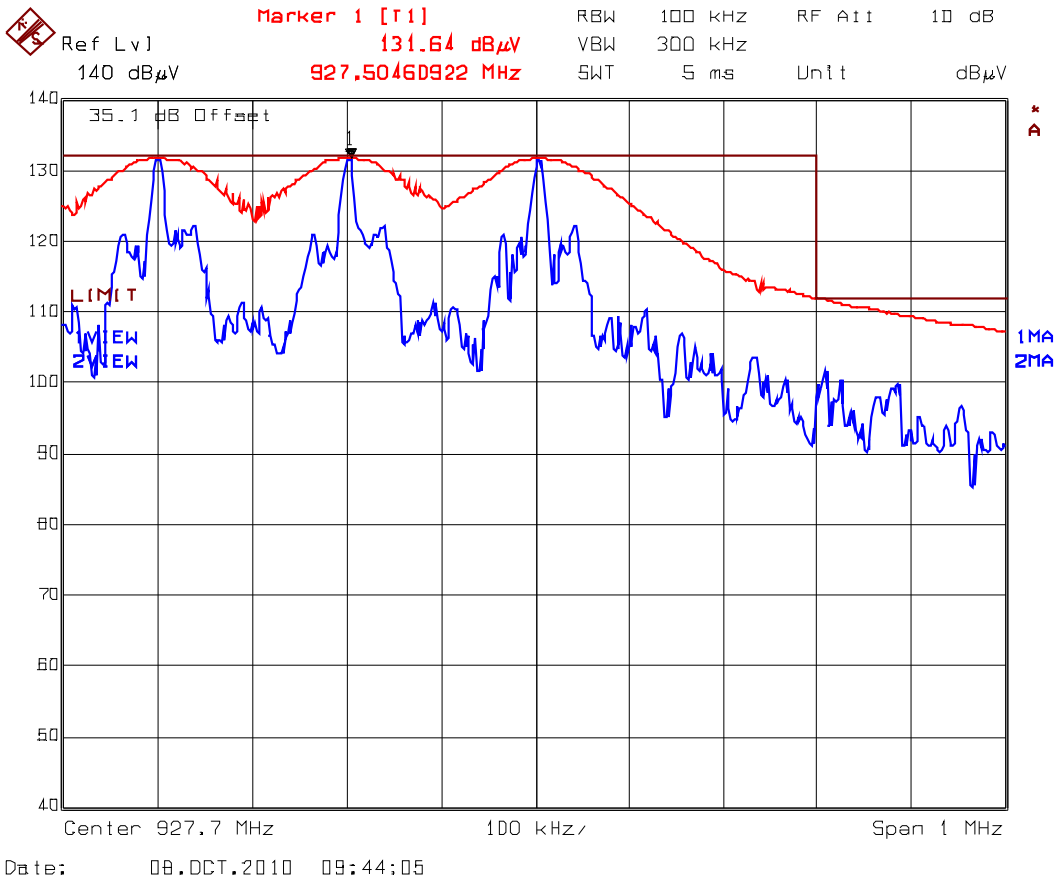
Test Conditions:	High end of frequency band, single frequency mode, high power
Rx Antenna Orientation:	Vertical



Trace 1: RBW = 100 kHz, VBW = 300 kHz Trace 2: RBW = 10 kHz, VBW = 30 kHz

Plot 5.10.4.1.8. Band-Edge RF Radiated Emissions

Test Conditions:	High end of frequency band, pseudorandom channel hopping mode, high power
Rx Antenna Orientation:	Vertical



Trace 1: RBW = 100 kHz, VBW = 300 kHz Trace 2: RBW = 10 kHz, VBW = 30 kHz

5.10.4.2. Spurious RF Radiated Emissions Test Results

The following test results are the worst-case measurements.

Test Frequency:	902.3 MHz						
Power Setting:	High Power						
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**
902.3	133.37	--	V	--	--	--	--
902.3	133.86	--	H	--	--	--	--
2706.9	52.66	45.75	V	54.0	113.9	-8.3	Pass*
2706.9	51.82	47.43	H	54.0	113.9	-6.6	Pass*
3609.2	51.30	43.12	V	54.0	113.9	-10.9	Pass*
3609.2	53.37	46.41	H	54.0	113.9	-7.6	Pass*
4511.5	49.04	38.48	V	54.0	113.9	-15.5	Pass*
4511.5	49.15	38.59	H	54.0	113.9	-15.4	Pass*
8120.7	56.54	49.54	V	54.0	113.9	-4.5	Pass*
8120.7	54.21	45.05	H	54.0	113.9	-9.0	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

* Emission within the restricted frequency bands.

Test Frequency:	915 MHz						
Power Setting:	High Power						
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**
915.0	133.36	--	V	--	--	--	--
915.0	133.74	--	H	--	--	--	--
2745.0	53.00	46.48	V	54.0	113.7	-7.5	Pass*
2745.0	54.35	46.17	H	54.0	113.7	-7.8	Pass*
3660.0	48.01	38.23	V	54.0	113.7	-15.8	Pass*
3660.0	49.24	38.76	H	54.0	113.7	-15.2	Pass*
4575.0	48.28	37.08	V	54.0	113.7	-16.9	Pass*
4575.0	48.74	38.45	H	54.0	113.7	-15.6	Pass*
8235.0	54.47	46.77	V	54.0	113.7	-7.2	Pass*
8235.0	56.50	51.19	H	54.0	113.7	-2.8	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

* Emission within the restricted frequency bands.

Test Frequency:	927.7 MHz						
Power Setting:	High Power						
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**
927.7	131.92	--	V	--	--	--	--
927.7	133.38	--	H	--	--	--	--
2783.1	57.99	53.63	V	54.0	113.4	-0.4	Pass*
2783.1	56.37	51.73	H	54.0	113.4	-2.3	Pass*
3710.8	53.17	45.18	V	54.0	113.4	-8.8	Pass*
3710.8	53.35	47.82	H	54.0	113.4	-6.2	Pass*
4638.5	49.37	40.92	V	54.0	113.4	-13.1	Pass*
4638.5	48.21	38.06	H	54.0	113.4	-15.9	Pass*
8349.3	52.61	43.35	V	54.0	113.4	-10.7	Pass*
8349.3	55.66	48.24	H	54.0	113.4	-5.8	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

* Emission within the restricted frequency bands.

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Semi-Anechoic Chamber	TDK	FCC: 91038 IC: 2049A-3	--	--	1 May 2011
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz	14 Aug 2011
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	09 Mar 2011
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	2 Nov 2011
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	18 Apr 2011
Biconi-Log Antenna	Emco	3142C	00026873	26 – 3000 MHz	18 Apr 2011
Horn Antenna	Emco	3155	9701-6570	1 – 18 GHz	20 Nov 2010
Tunable Band Reject Filter	K & L	3TNF-500/1000	470	500-1000 MHz	Cal. on use
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Cal. on use
Attenuator	Narda	4768-20	-	DC - 40 GHz	Cal. on use
DC Power Supply	BK Precision	1735A	17351057405111524	0-30V, 3A	Cal. on use
High Pass Filter	K & L	11SH10-1500/T8000	2	Cut off 900 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