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 Frequency Hopping Spread Spectrum (FHSS)

UltraTech's File No.: MIC-165Q_F15C247DSS

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

Date: April 12, 2013

Report Prepared by: Dharmajit Solanki Issued Date: April 12, 2013	Tested by: Mr. Hung Trinh Test Dates: February 5 - March 5 & April 12, 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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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

TABLE OF CONTENTS

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:	Equipment Certification for Frequency Hopping Spread Spectrum (FHSS) Transmitter.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
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	2012	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:	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:	2285191
Type of Equipment:	Spread Spectrum Transmitter (FHSS)
Input Power Supply Type:	External Regulated DC Sources
Applications of EUT:	OEM Transceiver Industrial Wireless Data applications

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Base Station (fixed use) or Mobile Station
Intended Operating Environment:	Commercial, Industrial or Business environments
Power Supply Requirement:	4.5Vdc, <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. MODULE MODULATION CHARACTERISTICS (FHSS)

Modem 125 Mode:

Mod. Format: 2-GFSK
Symbol Rate (bps): 125000
RX Channel BW (Hz): 277777

Modem 250 Mode:

Mod. Format: 2-GFSK
Symbol Rate (bps): 249999
RX Channel BW (Hz): 333333

2.5. 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.

2.6. 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

2.7. 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:	Kenwood
Model Name or Number:	PD65-10, 3010008
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:	4.7V DC

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

Transmitter Test Signals	
Frequency Band(s):	902 - 928 MHz
Frequency(ies) Tested: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	902.7, 915.0 and 927.3 MHz
RF Power Output: (measured maximum output power at antenna terminals)	1 Watt (conducted)
***Normal Test Modulation:**	GFSK (Modem 125 & 250)
Modulating Signal Source:	Internal

*See Operational Description exhibit supplied by the manufacturer for details of the data rates for FHSS.

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	Yes
15.247(a) & (f)	Provisions for Frequency Hopping Systems	Yes
15.247(b)(1)	Peak Conducted 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. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. POWER LINE CONDUCTED EMISSIONS [§15.207(a)]

5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

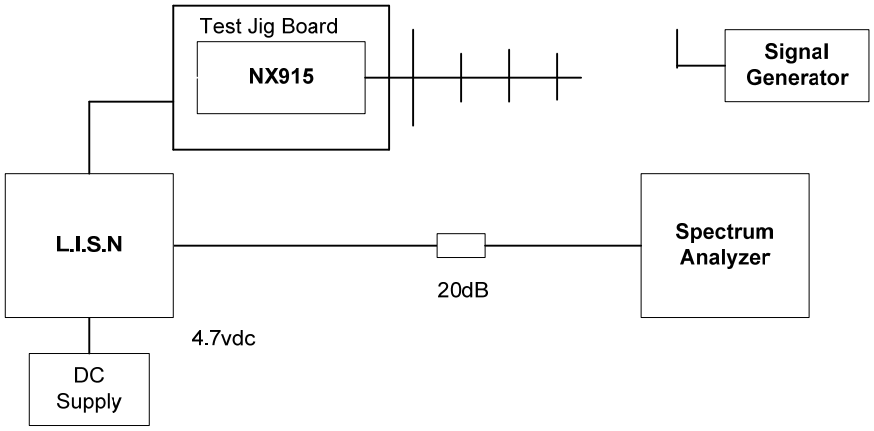
Frequency of emission (MHz)	Conducted Limits (dBμV)	
	Quasi-peak	Average
0.15–0.5 .....……..	66 to 56*	56 to 46*
0.5–5 .....……..	56	46
5-30 ……..……..	60 ……..……..	50

*Decreases linearly with the logarithm of the frequency

5.1.2. Method of Measurements

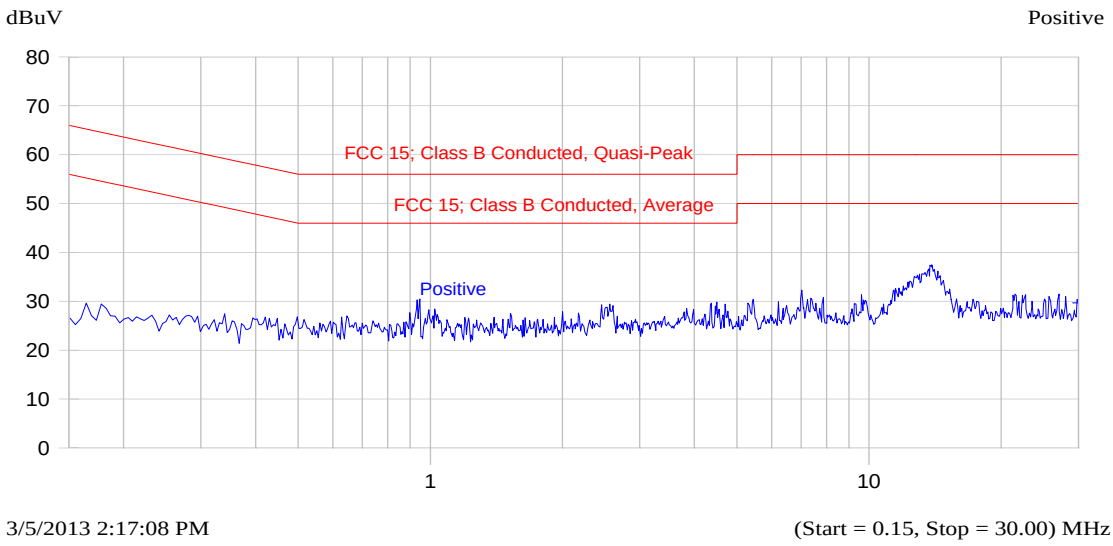
ANSI C63.4-2009

5.1.3. Test Arrangement



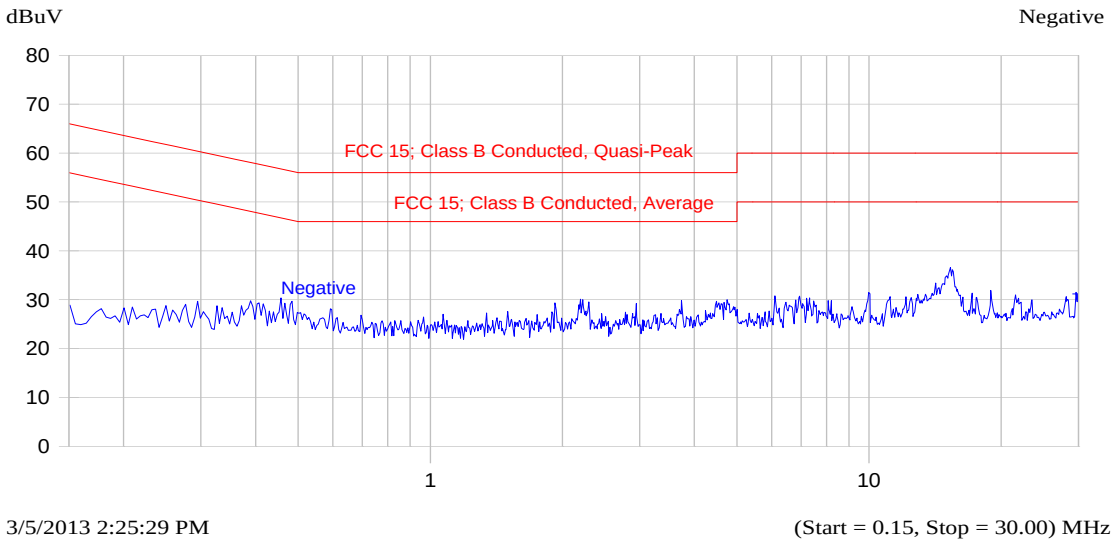
5.1.4. Test Data

Plot 5.1.4.1. Power Line Conducted Emissions, Tx Mode, Line Voltage: 4.7 VDC, Line Tested: Positive



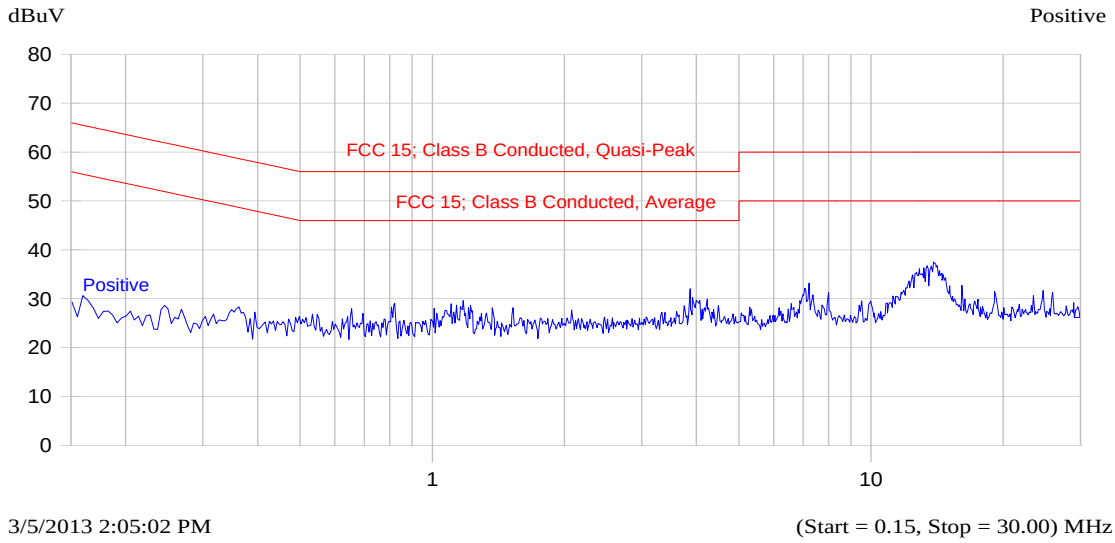
Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.941	25.8	19.6	-36.4	12.9	-33.1	Positive
7.031	31.3	25.7	-34.3	16.3	-33.7	Positive
13.760	36.1	32.1	-27.9	20.9	-29.1	Positive

Plot 5.1.4.2. Power Line Conducted Emissions, Tx Mode, Line Voltage: 4.7 VDC, Line Tested: Negative



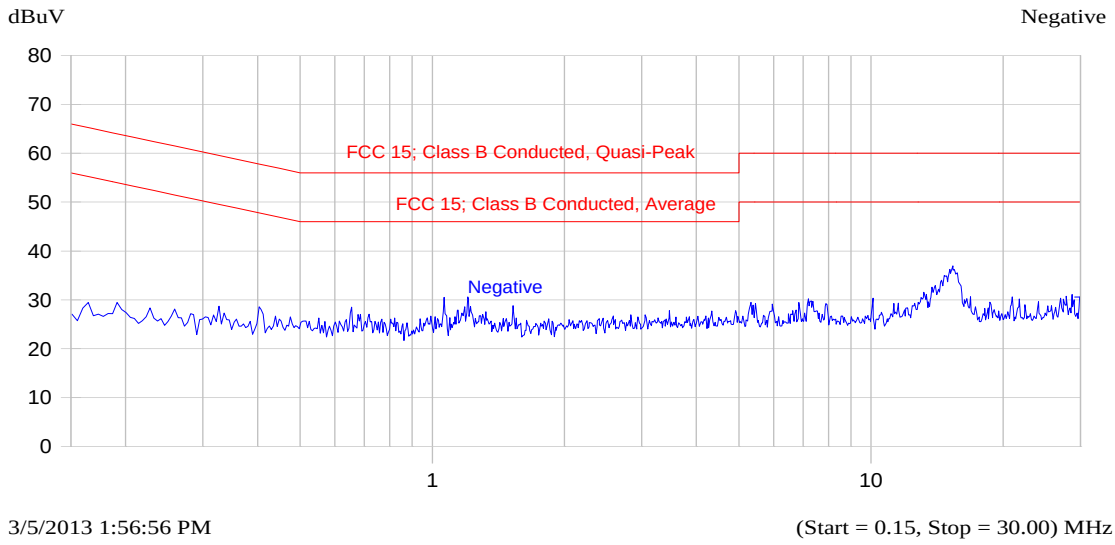
Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
2.225	26.9	20.3	-35.7	12.9	-33.1	Negative
6.104	27.2	19.6	-40.4	12.8	-37.2	Negative
15.229	36.0	31.5	-28.5	22.4	-27.6	Negative

Plot 5.1.4.3. Power Line Conducted Emissions, Rx Mode, Line Voltage: 4.7 VDC, Line Tested: Positive



Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.161	29.2	24.7	-41.0	18.3	-37.4	Positive
3.873	29.3	22.9	-33.1	14.3	-31.7	Positive
7.211	30.6	24.2	-35.8	16.0	-34.0	Positive
13.879	36.1	32.7	-27.3	20.6	-29.4	Positive

Plot 5.1.4.4. Power Line Conducted Emissions, Rx Mode, Line Voltage: 4.7 VDC, Line Tested: Negative



Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
1.056	29.3	20.7	-35.3	13.0	-33.0	Negative
1.202	26.9	19.8	-36.2	12.9	-33.1	Negative
15.115	36.3	31.5	-28.5	21.6	-28.4	Negative

5.2. 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.	Refer to sec 3.2
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 module employs a standard antenna connector, hence professional installation sought. Please refer to the applicant LMA request letter for details to demonstrate the compliance.
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 proposed antenna list in the Integrator's user manual and sec 2.5 of this 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)	Describe how the EUT complies with the requirement that it be designed to be capable of operating as a true frequency hopping system	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

5.3. PROVISIONS FOR FREQUENCY HOPPING SYSTEMS [§ 15.247(a)(1) & (f)]

5.3.1. 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.

§ 15.247(f): For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

5.3.2. Method of Measurements

FCC Public Notice DA 00-705

Carrier Frequency Separation:

The hopping function of the EUT is enabled. Use the spectrum analyzer setting as follows:

- Span = wide enough to capture the peaks of two adjacent channels
- RBW = 1% of the span
- VBW ≥ RBW
- Sweep = Auto
- Detector = peak
- Trace = max hold

Number of hopping frequency:

The hopping function of the EUT is enabled. Use the spectrum analyzer setting as follows:

- Span = the frequency band of operation
- RBW = 1% of the span
- VBW ≥ RBW
- Sweep = Auto
- Detector = peak
- Trace = max hold

Time of Occupancy (Dwell Time):

The hopping function of the EUT is enabled. Use the spectrum analyzer setting as follows:

- Span = 0 Hz centered on a hopping channel
- RBW = 1 MHz
- VBW ≥ RBW
- Sweep = as necessary to capture the entire dwell time per hopping channel
- Detector = peak
- Trace = max hold

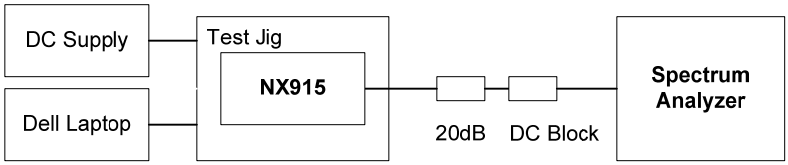
If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g. date rate modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). An oscilloscope may be used instead of a spectrum analyzer.

20 dB Bandwidth:

Use the spectrum analyzer setting as follows:

- Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
- RBW = 1% of the 20 dB bandwidth
- VBW ≥ RBW
- Sweep = auto
- Detector = peak
- Trace = max hold
- The transmitter shall be transmitting at its maximum data rate.
- Allow the trace to stabilize.
- Use the marker-to-peak function to set the marker to the peak of the emission.
- Use the marker-delta function to measure 20 dB down on both sides of the emission.
- The 20 dB BW is the delta reading in frequency between two markers.

5.3.3. Test Arrangement

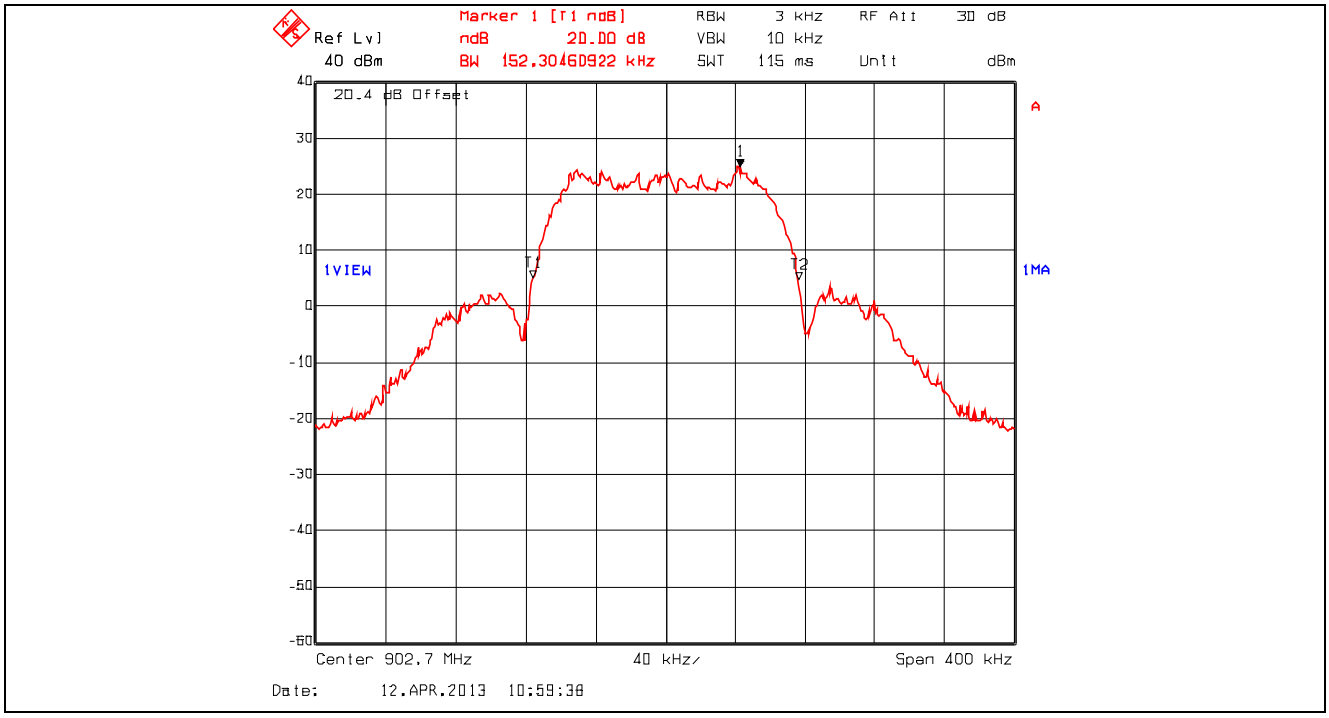


5.3.4. Test Data

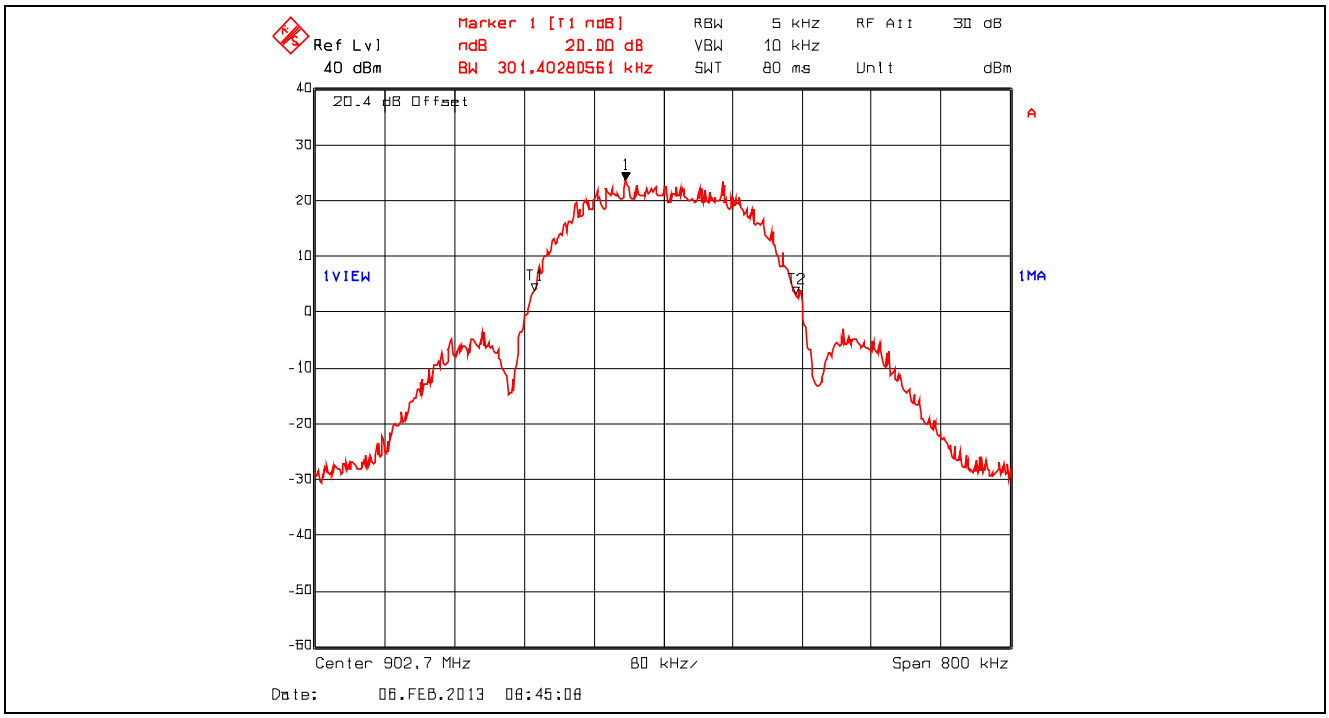
Test Description	FCC Specification	Measured Values	Comments
Receiver Input Bandwidth and Hopping Capability	The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.	--	See Note 1
20 dB BW of the hopping channel	If the 20dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.	1. 152.3 kHz(Modem 125) -81 & 50 hopping frequencies options 2. 303.0 kHz(Modem 250) -81 & 50 hopping frequencies options Both measurements are well below 500 kHz.	See Note 2
Channel Hopping Frequency Separation	Minimum of 25 kHz or 20dB BW, whichever is greater.	1.304.6 kHz > 152.3 kHz (Modem 125) 2.307.6 kHz > 303.0 kHz (Modem 250)	See Note 2
Number of 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.	Both modem modes offers multiple options ranging from a minimum of 50 to a maximum of 81 hopping frequencies.	See Note 1 and 2
Average Time of Occupancy	The average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.	Modem 125: 355.91 ms (81 Channel Option 1) & 346.32 ms (50 Channel Option 2) Modem 250: 355.91 ms (81 Channel Option 1) & 346.32 ms (50 Channel Option 2)	See Note 2

Note 1: See operational description exhibit for details.
Note 2: See the following plots for details.

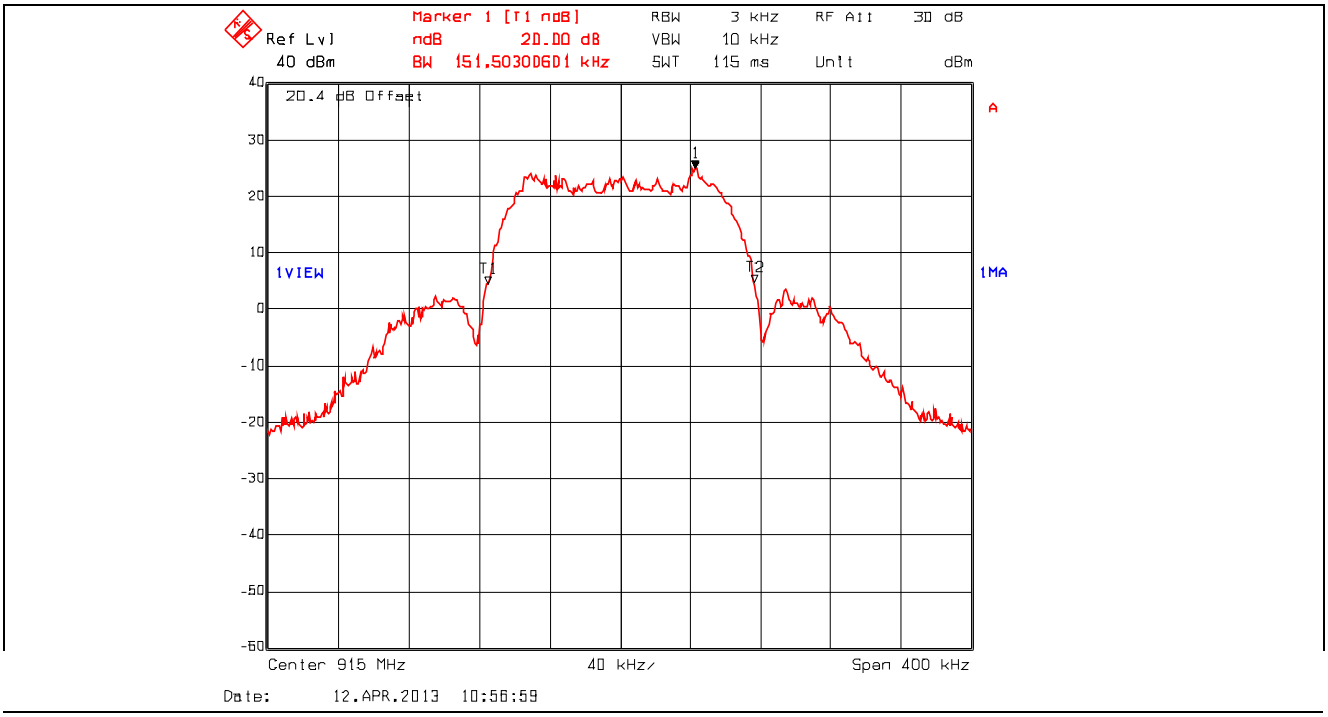
Plot 5.3.4.1. 20 dB Bandwidth, 902.7 MHz, MODEM 125



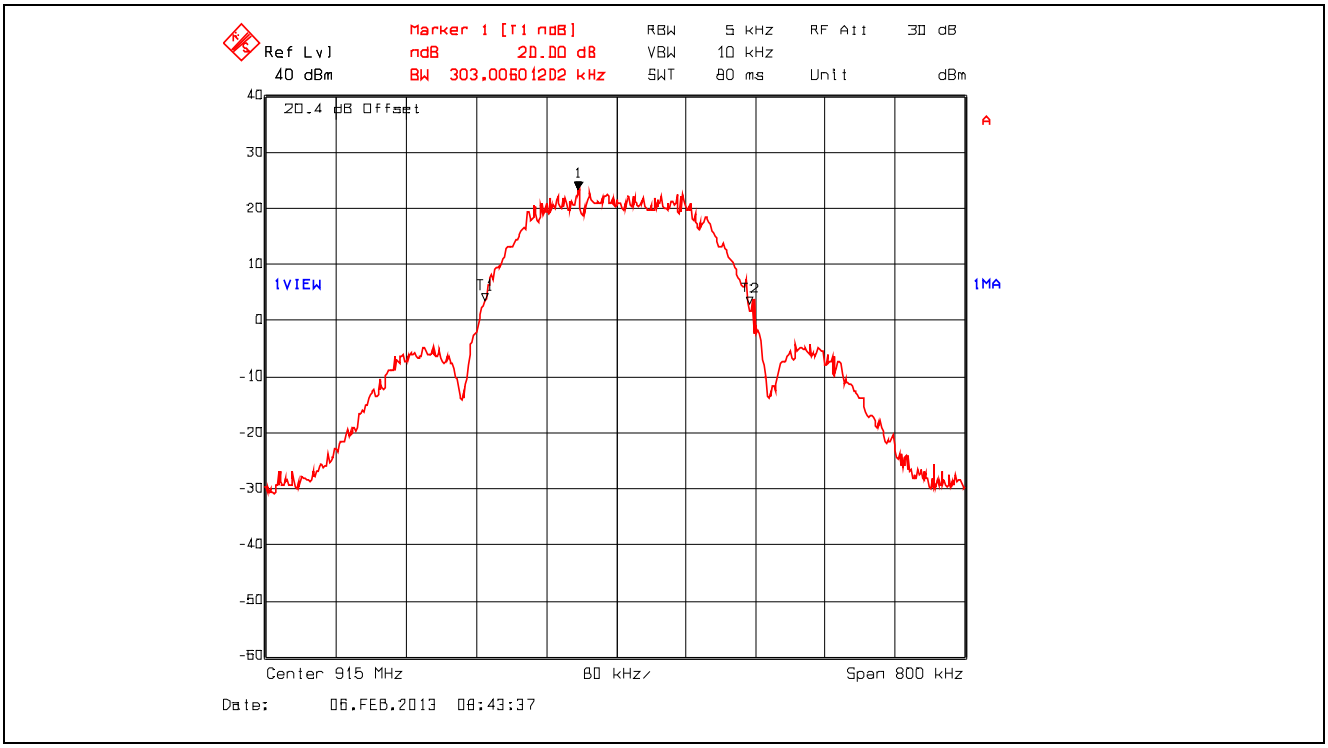
Plot 5.3.4.2. 20 dB Bandwidth, 902.7 MHz, MODEM 250



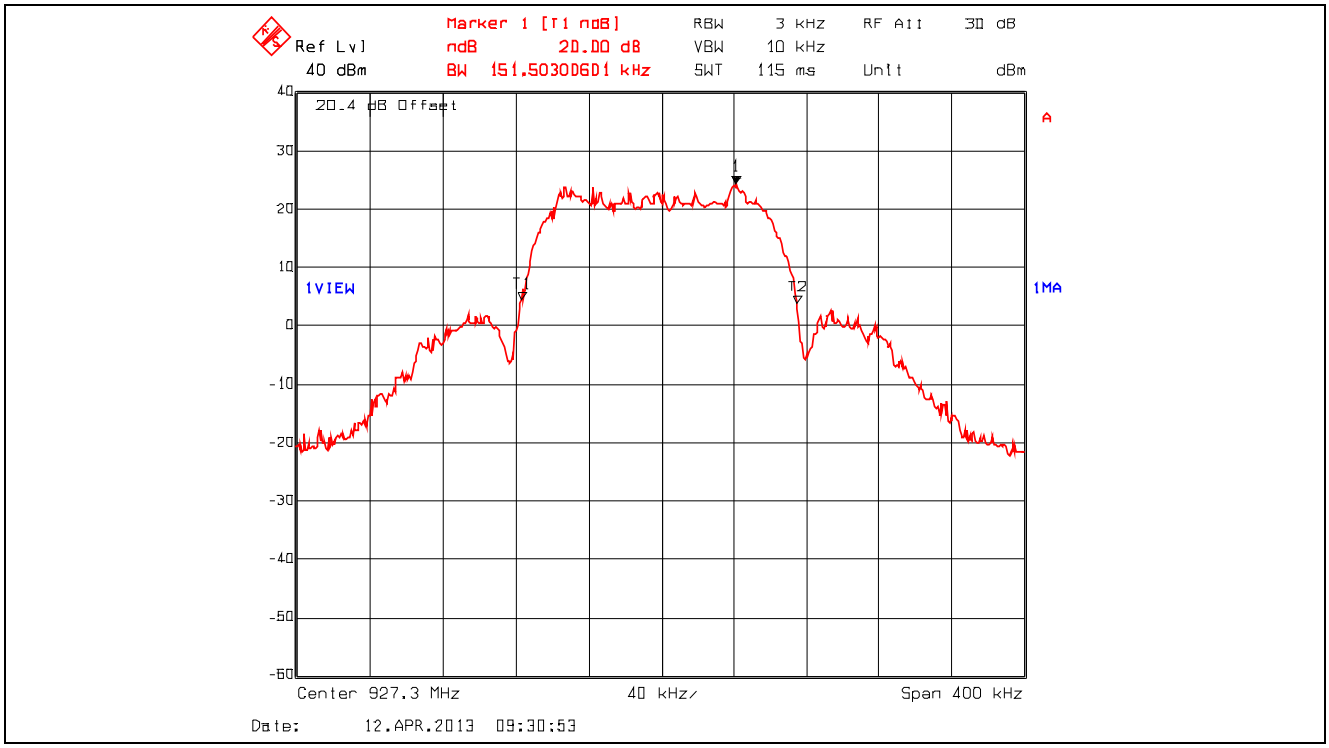
Plot 5.3.4.3. 20 dB Bandwidth, 915.2 MHz, MODEM 125



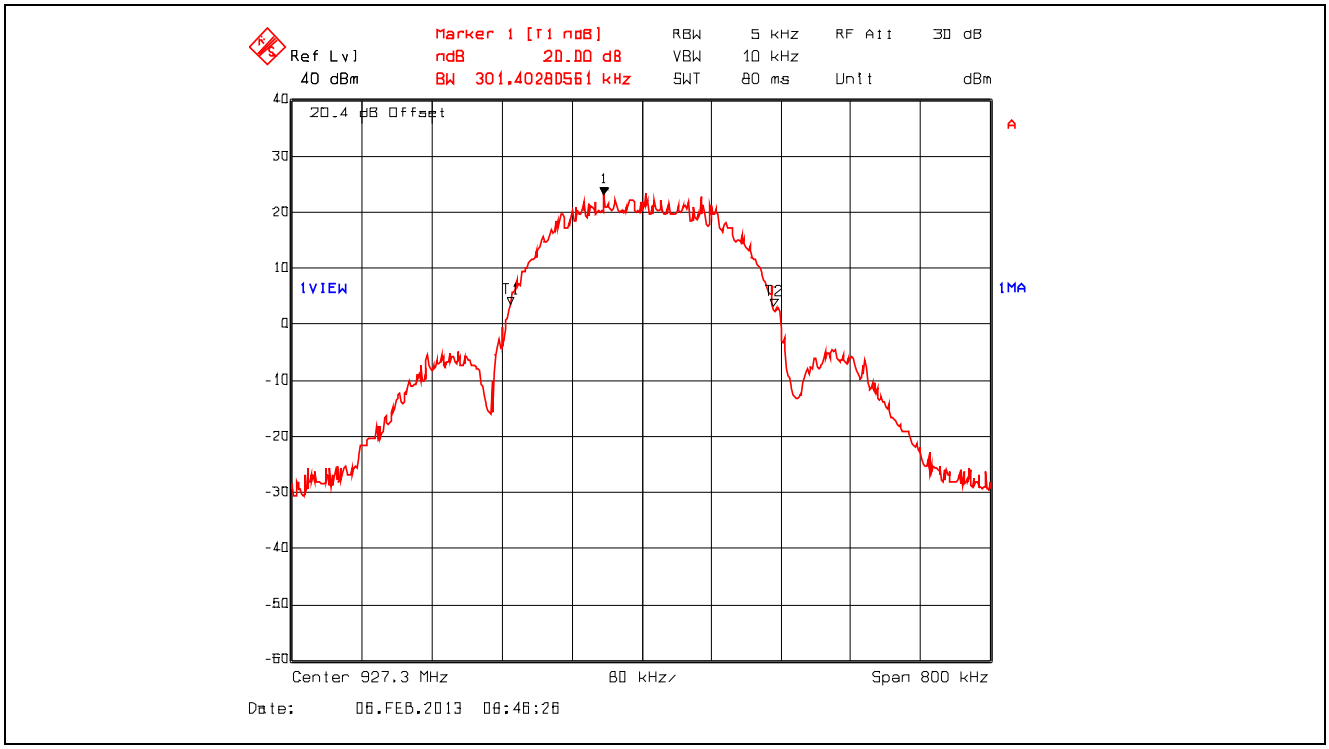
Plot 5.3.4.4. 20 dB Bandwidth, 915.2 MHz, MODEM 250



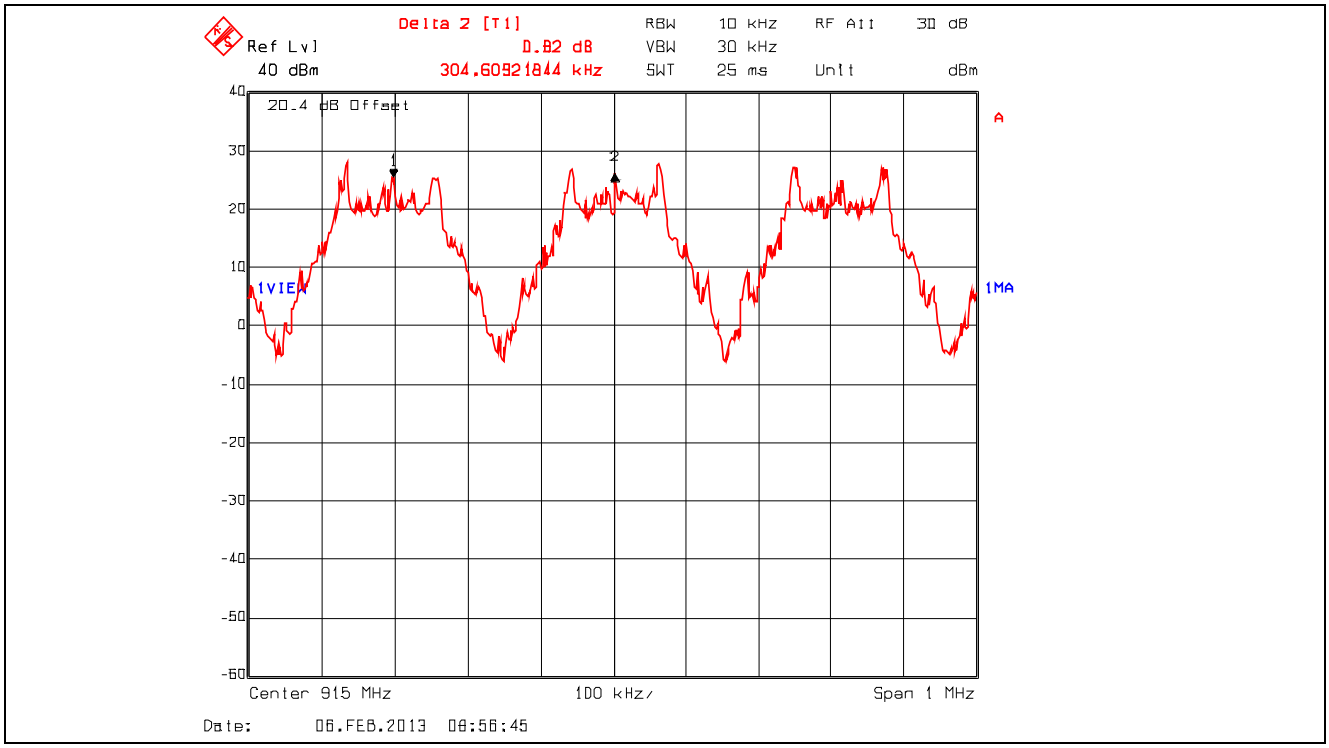
Plot 5.3.4.5. 20 dB Bandwidth, 927.1 MHz, MODEM 125



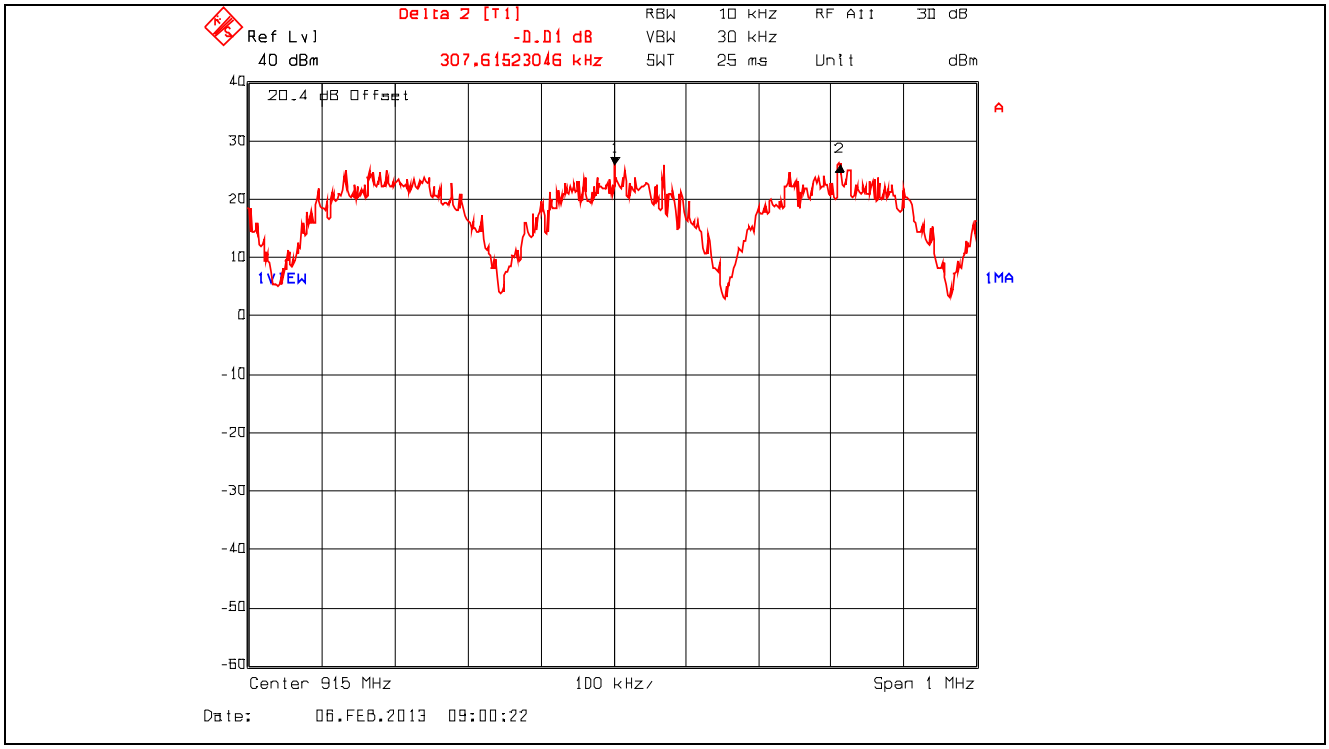
Plot 5.3.4.6. 20 dB Bandwidth, 927.1 MHz, MODEM 250



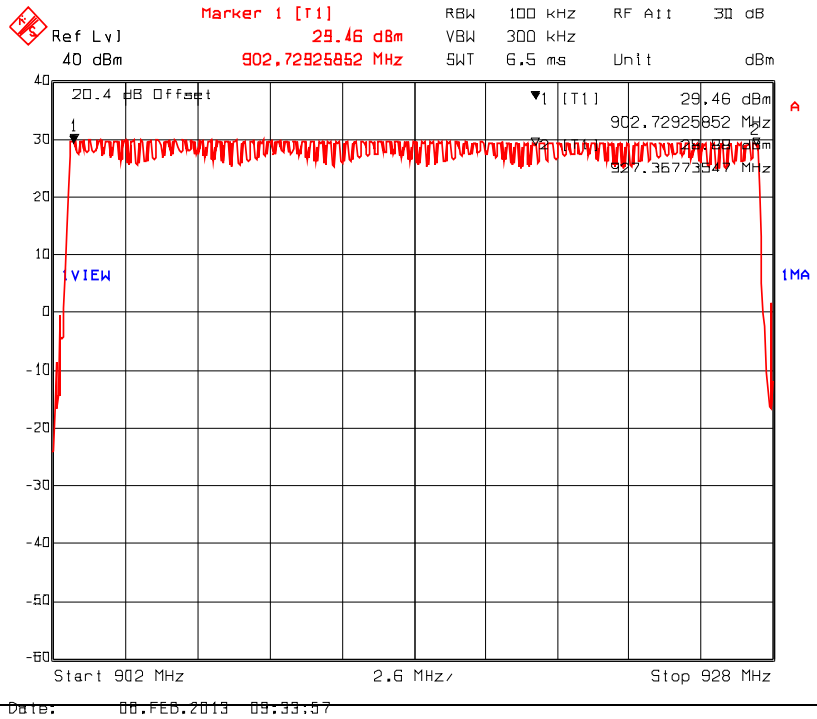
Plot 5.3.4.7. Carrier Frequency Separation, MODEM 125



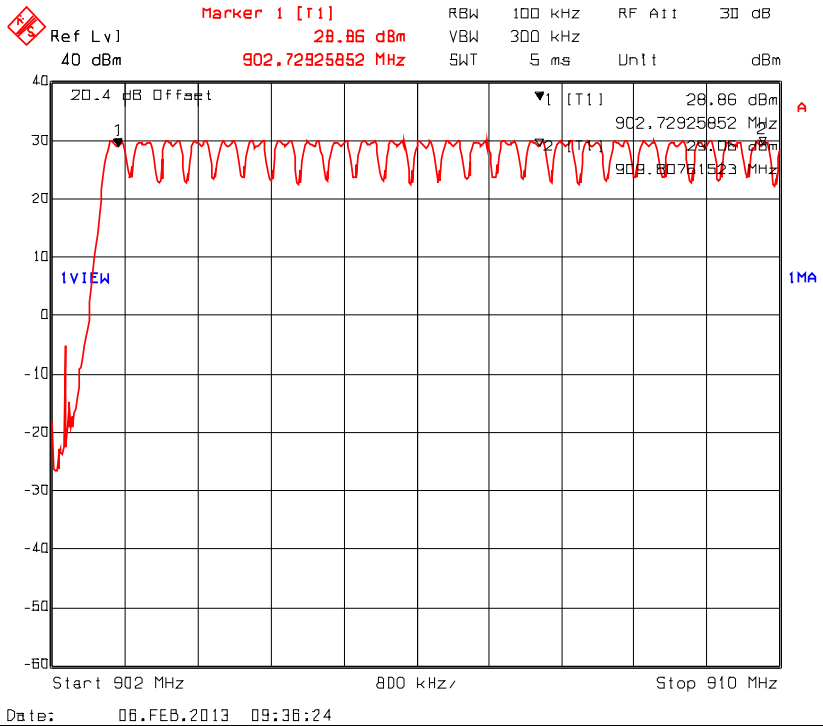
Plot 5.3.4.8. Carrier Frequency Separation, MODEM 250



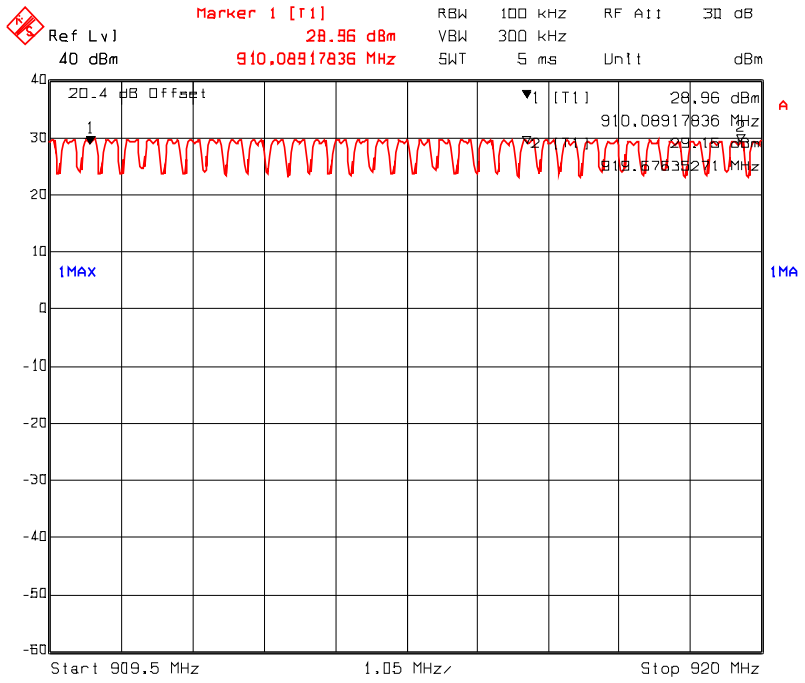
Plot 5.3.4.9. Number of Hopping Frequencies, MODEM 125, (Option 1) 81 Hopping Channels from 902-928 MHz



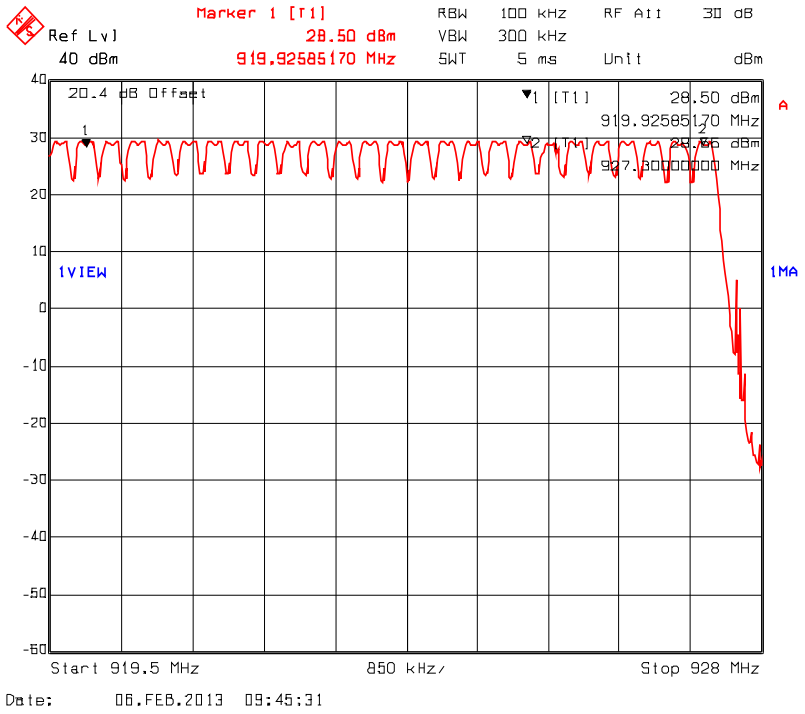
Plot 5.3.4.10. Number of Hopping Frequencies, MODEM 125, 24 Hopping Channels from 902 – 909.5 MHz



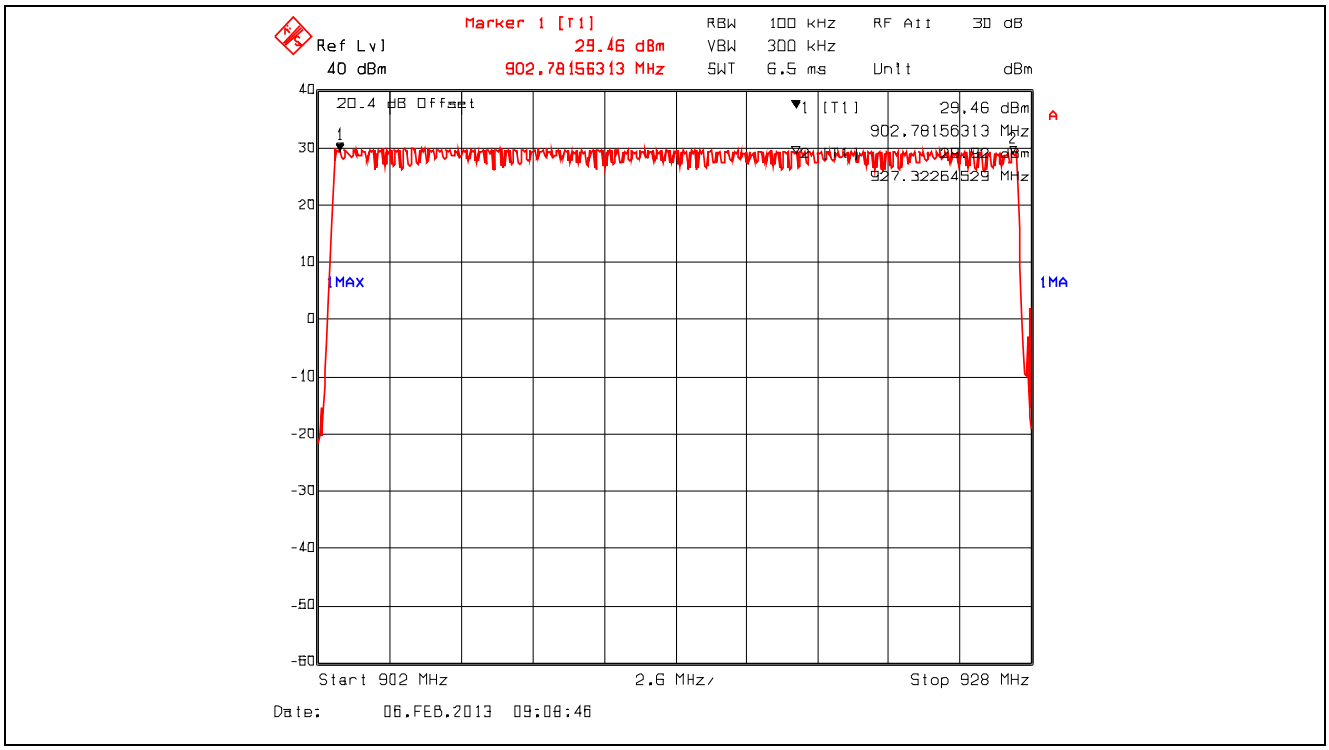
Plot 5.3.4.11. Number of Hopping Frequencies, MODEM 125, 32 Hopping Channels from 909.5 – 919.5 MHz



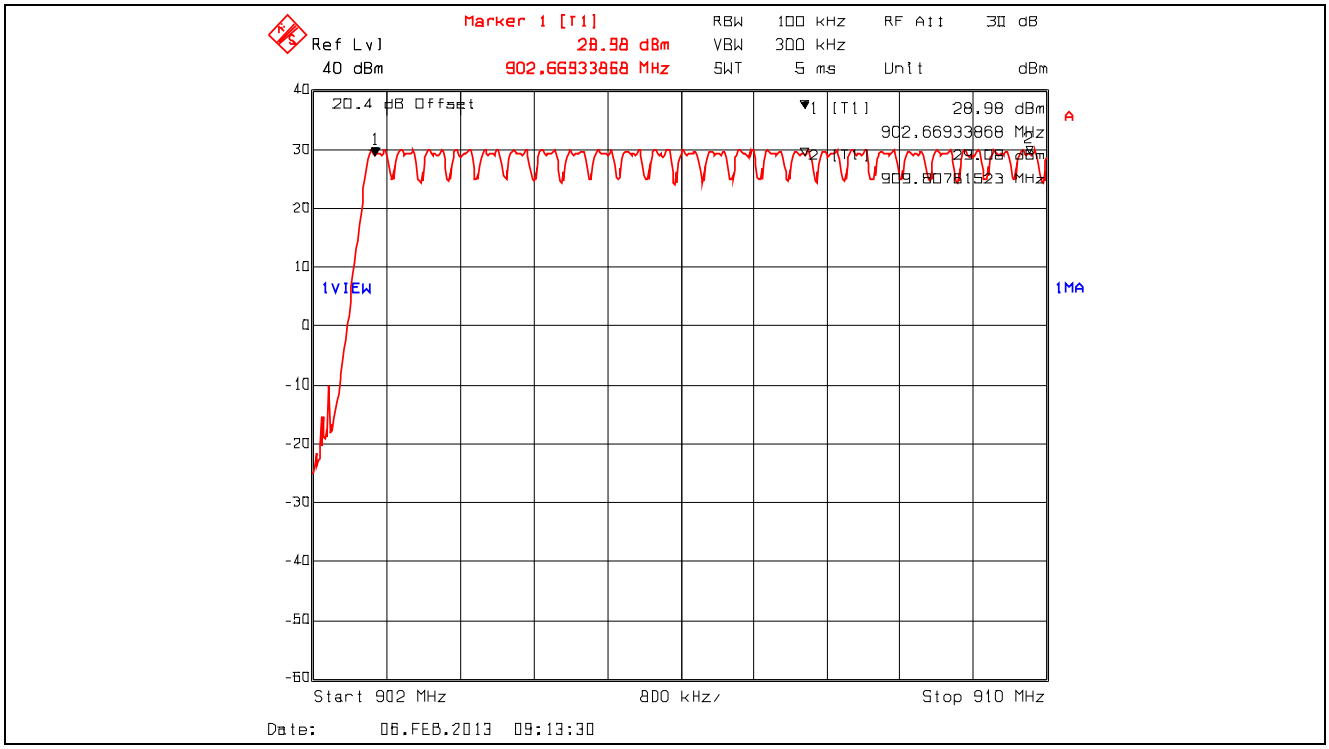
Plot 5.3.4.12. Number of Hopping Frequencies, MODEM 125, 25 Hopping Channels from 919.5 – 928 MHz



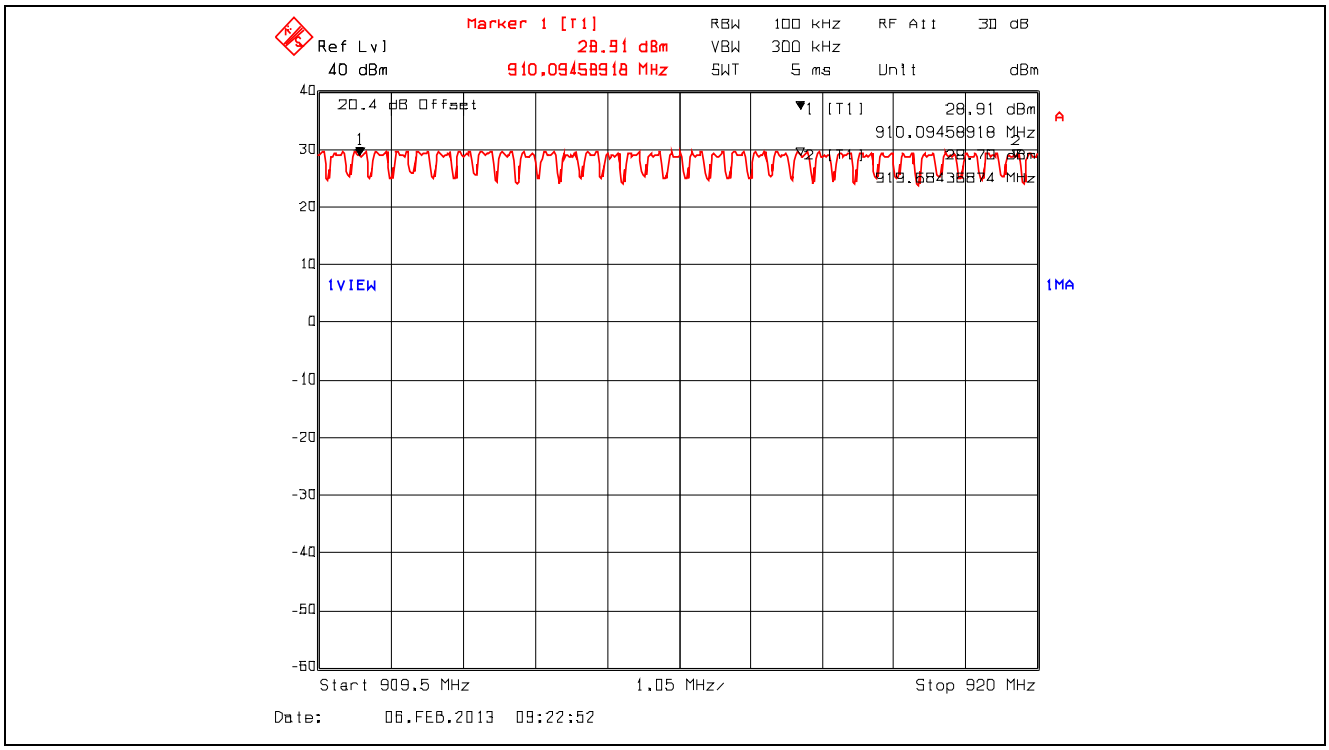
Plot 5.3.4.13. Number of Hopping Frequencies, MODEM 250, (Option 1) 81 Hopping Channels from 902-928 MHz



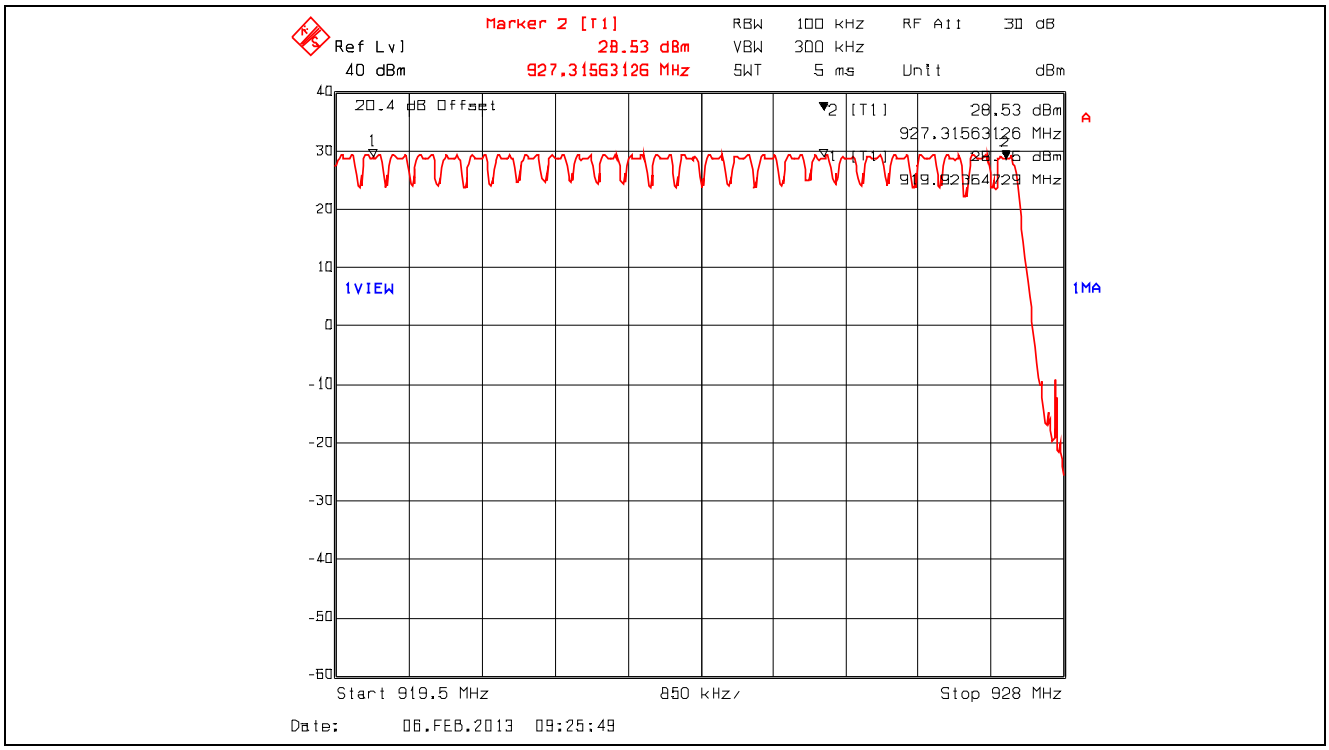
Plot 5.3.4.14. Number of Hopping Frequencies, MODEM 250, 24 Hopping Channels from 902 – 909.5 MHz



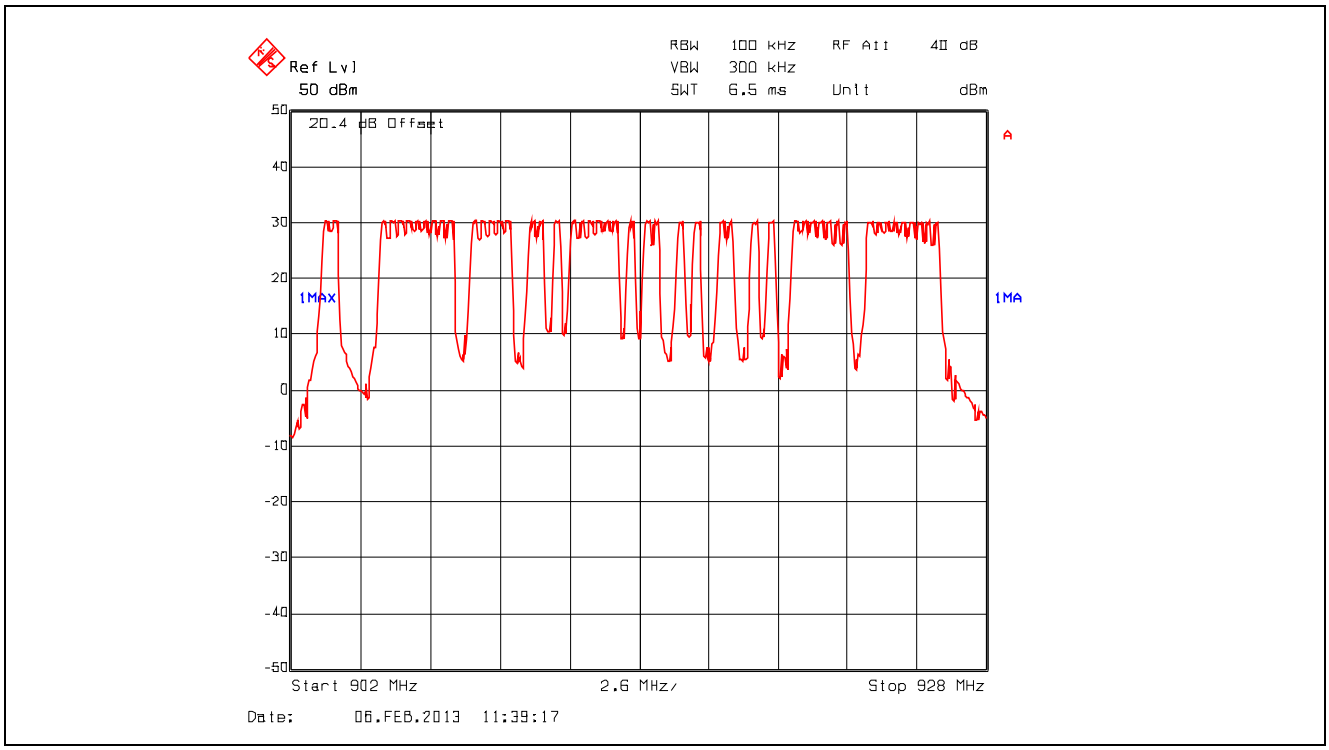
Plot 5.3.4.15. Number of Hopping Frequencies, MODEM 250, 32 Hopping Channels from 909.5 – 919.5 MHz



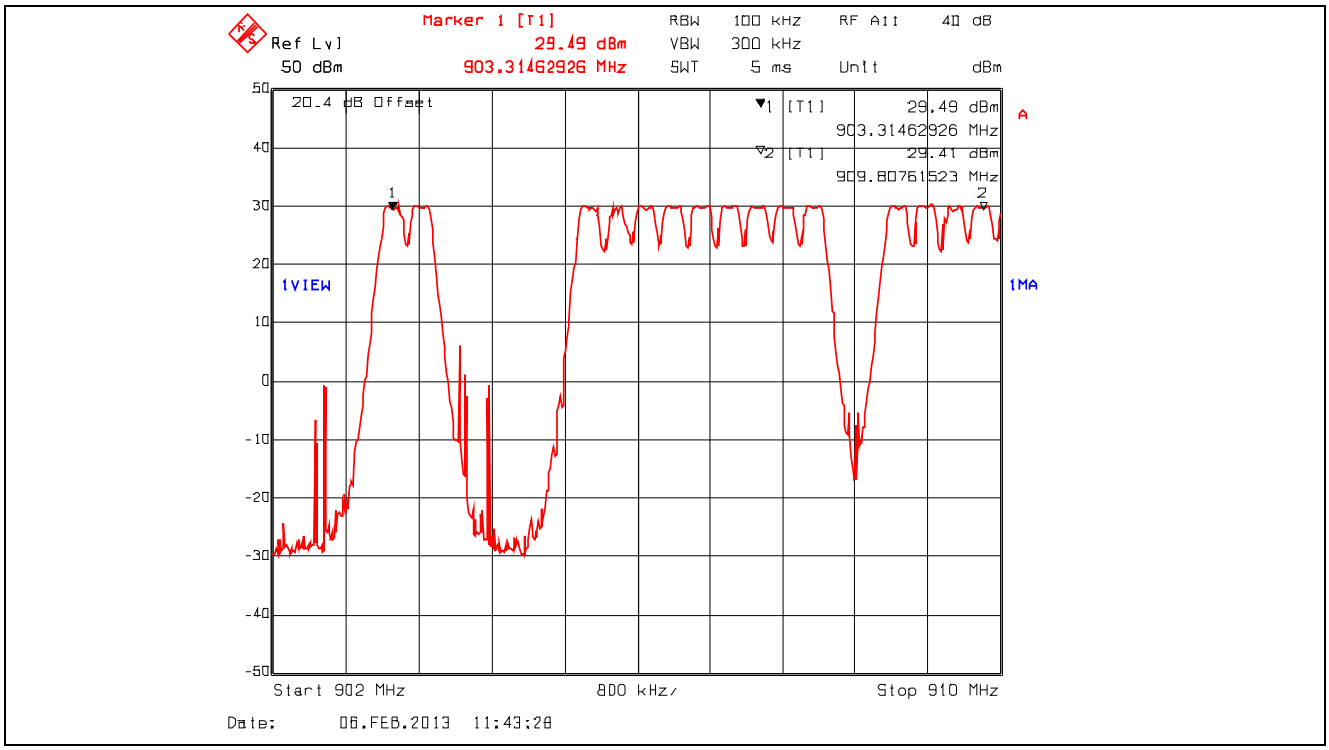
Plot 5.3.4.16. Number of Hopping Frequencies, MODEM 250, 25 Hopping Channels from 919.5 – 928 MHz



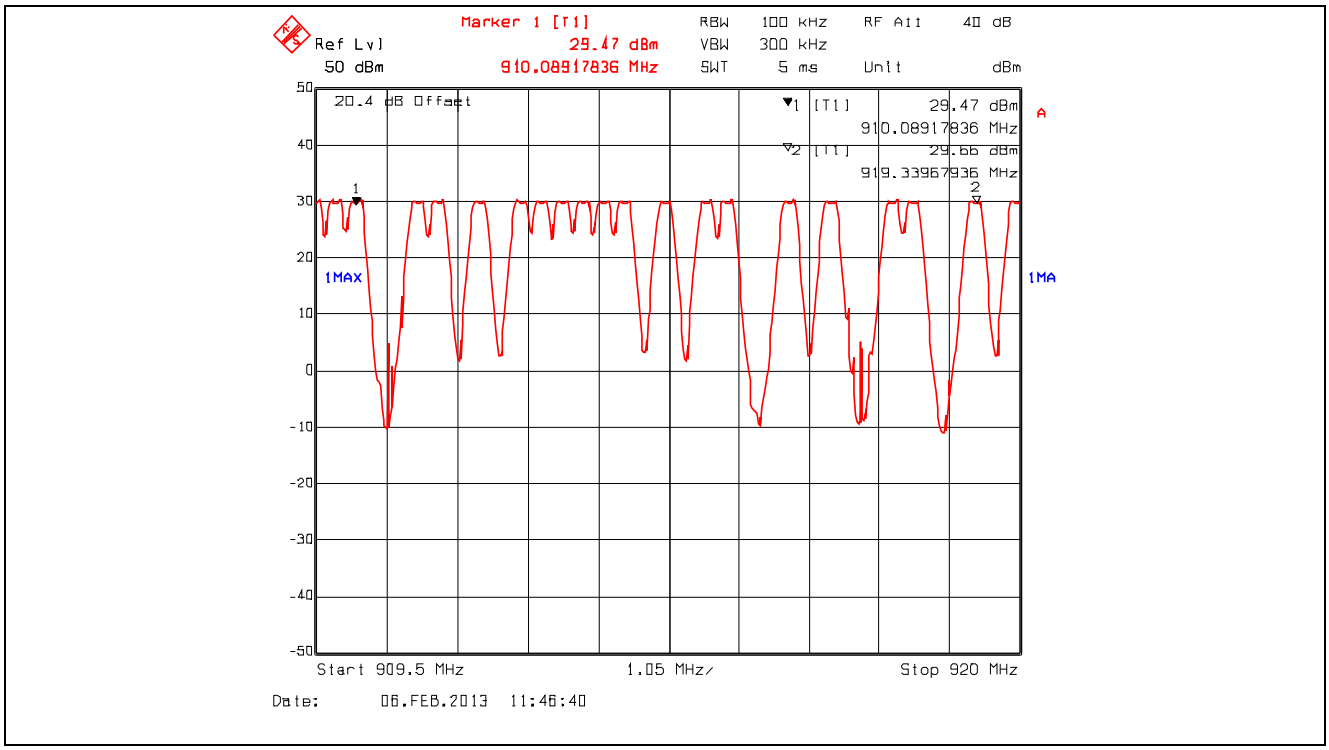
Plot 5.3.4.17. Number of Hopping Frequencies, MODEM 125, (Option 2) 50 Hopping Channels from 902-928 MHz



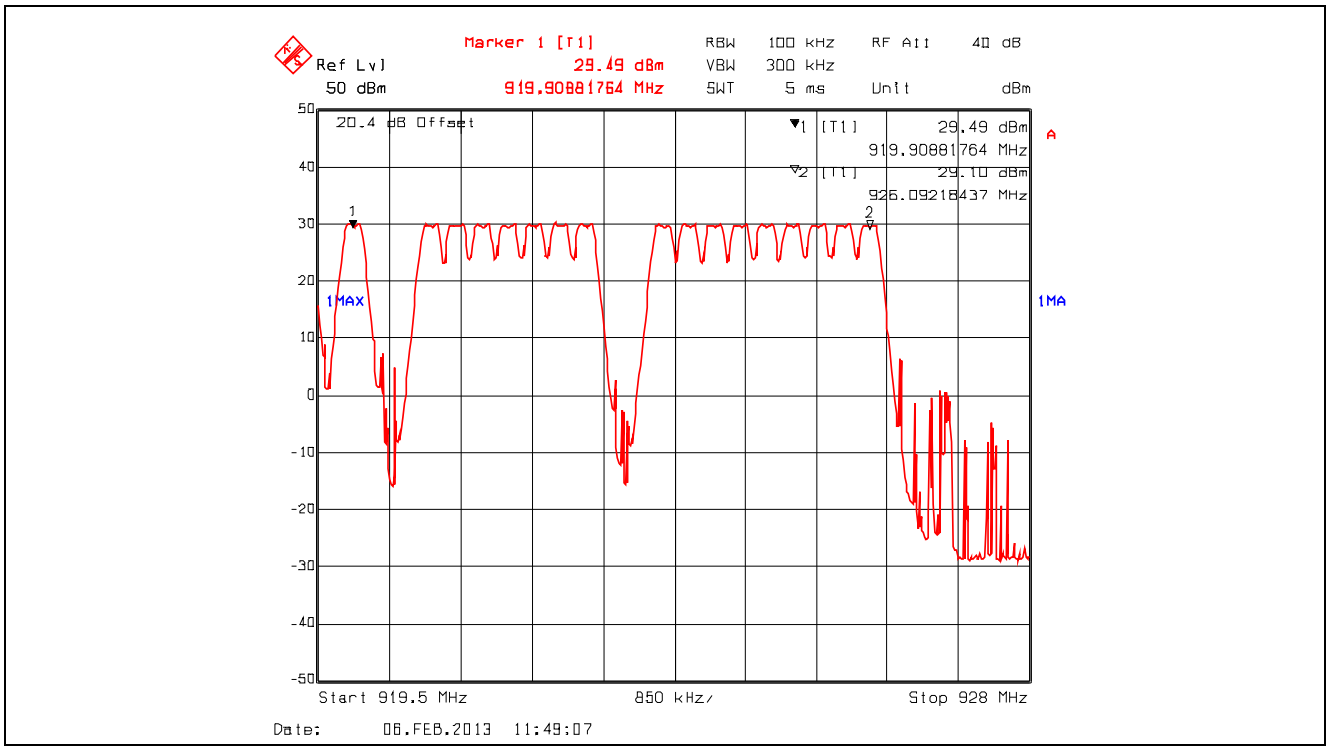
Plot 5.3.4.18. Number of Hopping Frequencies, MODEM 125, 15 Hopping Channels from 902 – 909.5 MHz



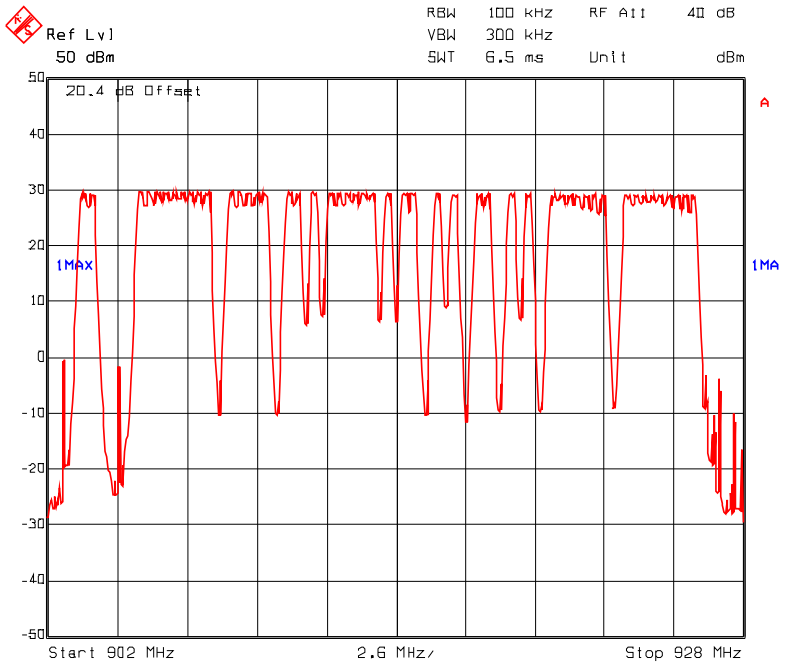
Plot 5.3.4.19. Number of Hopping Frequencies, MODEM 125, 18 Hopping Channels from 909.5 – 919.5 MHz



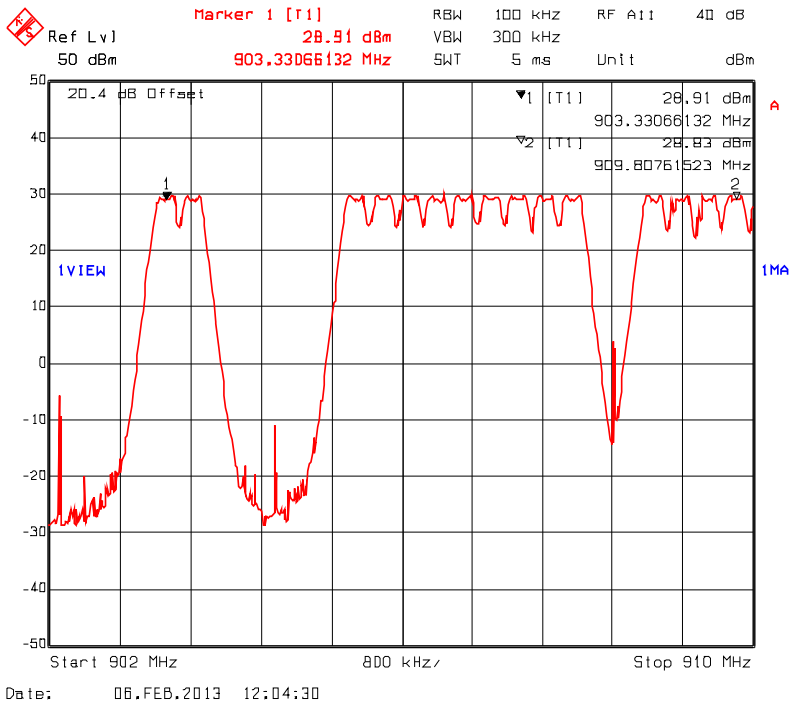
Plot 5.3.4.20. Number of Hopping Frequencies, MODEM 125, 17 Hopping Channels from 919.5 – 928 MHz



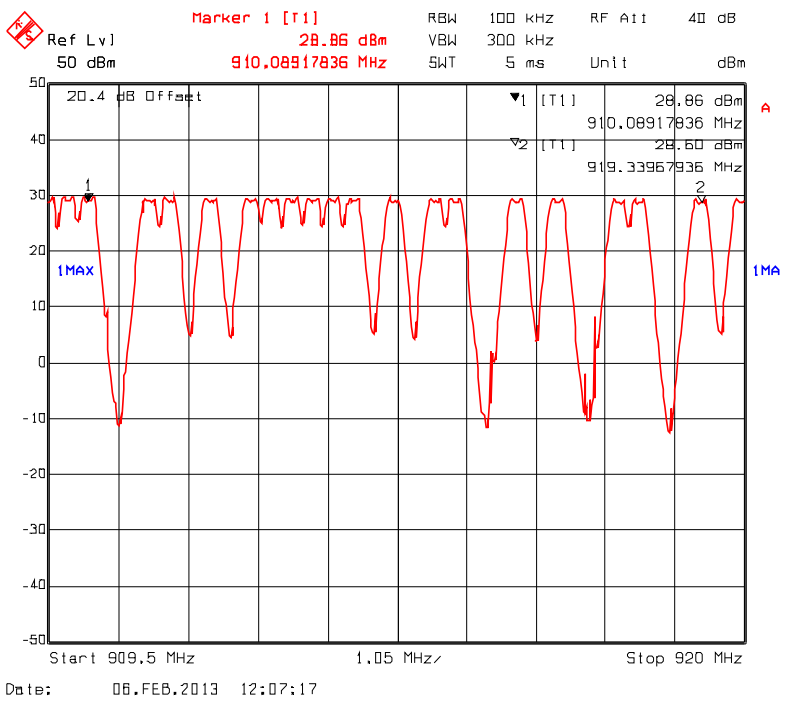
Plot 5.3.4.21. Number of Hopping Frequencies, MODEM 250, (Option 2) 50 Hopping Channels from 902-928 MHz



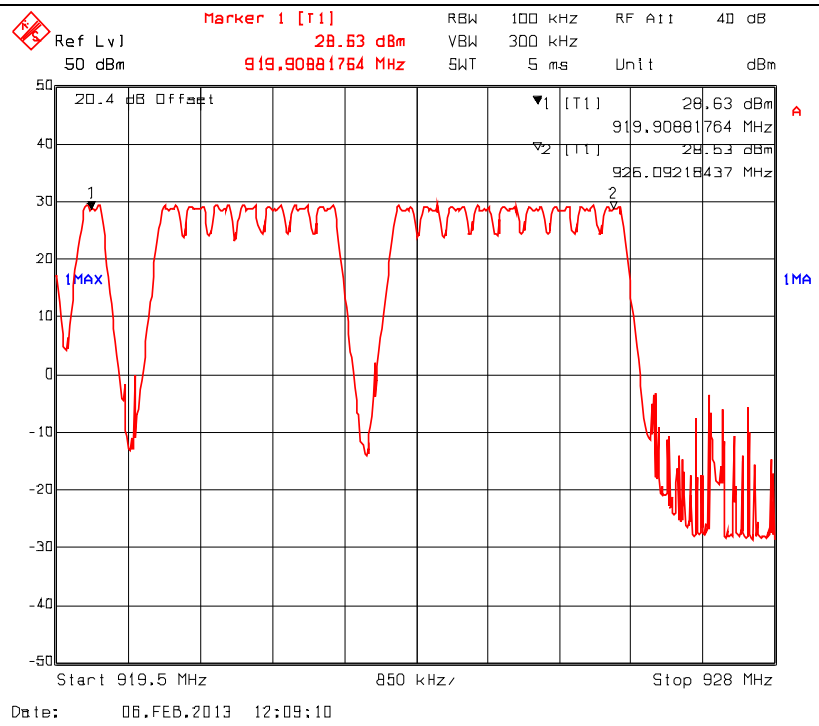
Plot 5.3.4.22. Number of Hopping Frequencies, MODEM 250, 15 Hopping Channels from 902 – 909.5 MHz



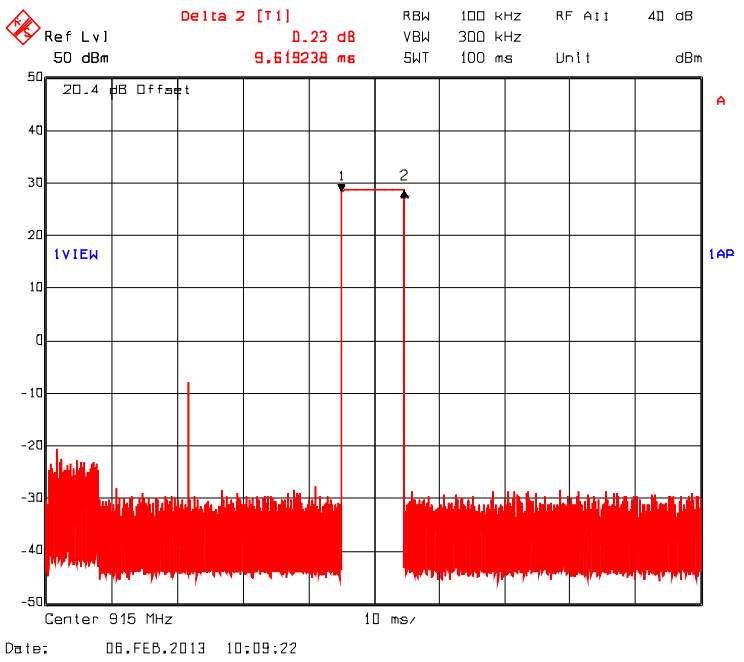
Plot 5.3.4.23. Number of Hopping Frequencies, MODEM 250, 18 Hopping Channels from 909.5 – 919.5 MHz



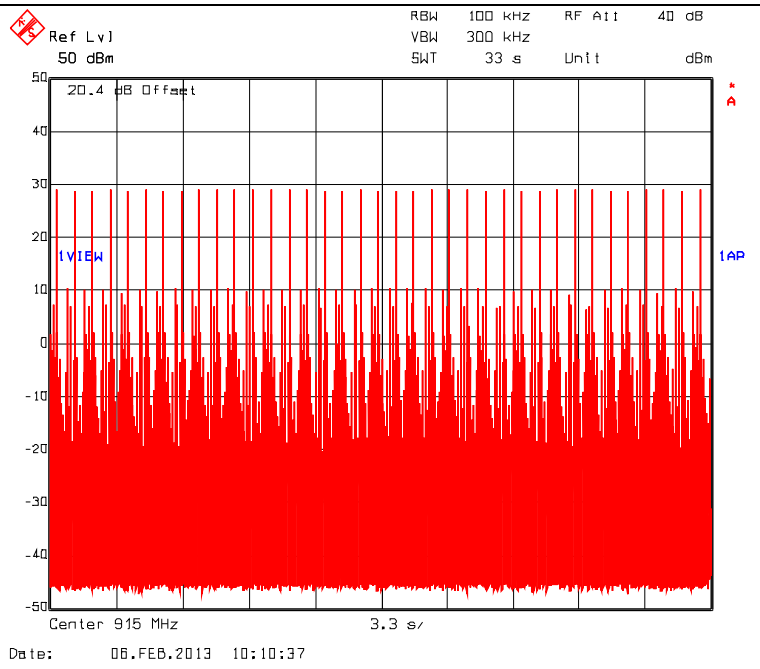
Plot 5.3.4.24. Number of Hopping Frequencies, MODEM 250, 17 Hopping Channels from 919.5 – 928 MHz



Plot 5.3.4.25. Time of Occupancy, 915 MHz, MODEM 125, Option 1

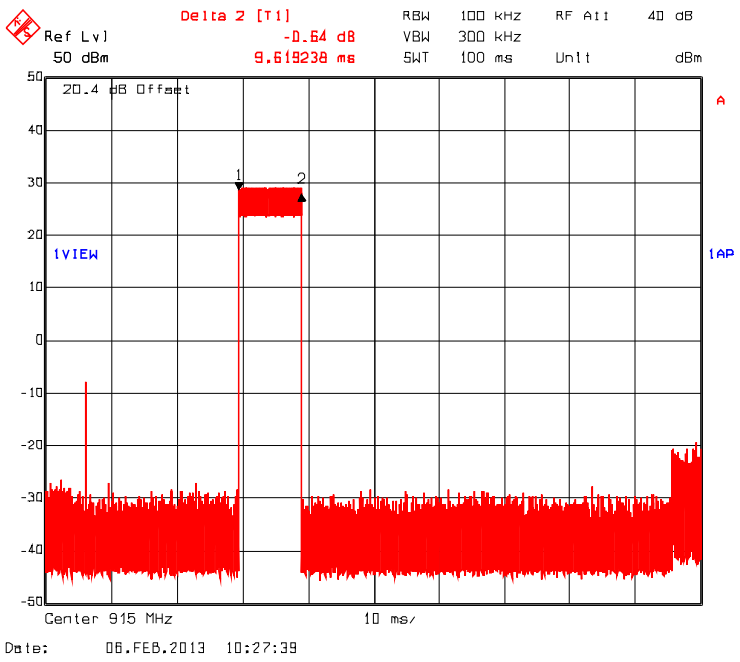


Plot 5.3.4.26. Time of Occupancy, 915 MHz, MODEM 125, Dwell Time @ 915 MHz = 355.91 ms

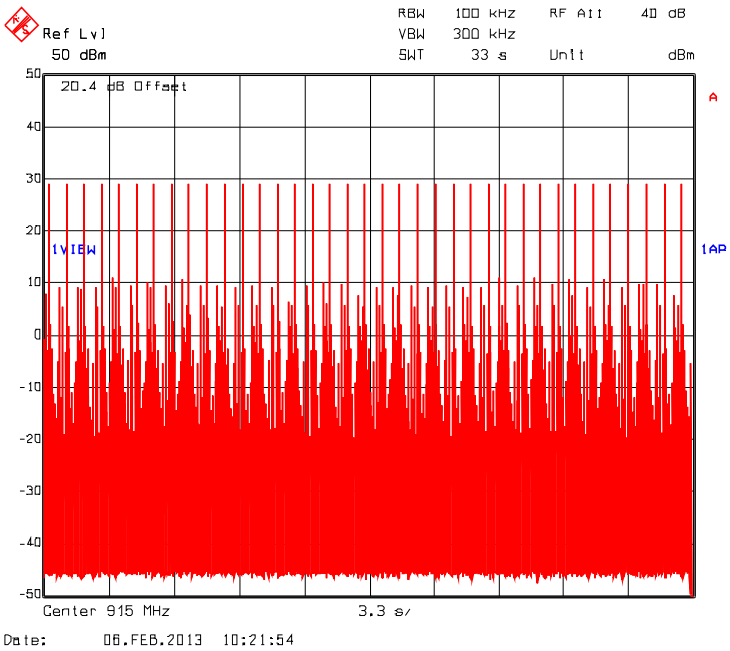


Time of Occupancy of 915 MHz = 9.6192 ms x 37(in 33s) = 355.91 ms < 400 ms (0.4 sec)
Period= 0.4 seconds * 81 (number of hopping channels employed) = 32.4 seconds

Plot 5.3.4.27. Time of Occupancy, 915 MHz, MODEM 250 , Option 1

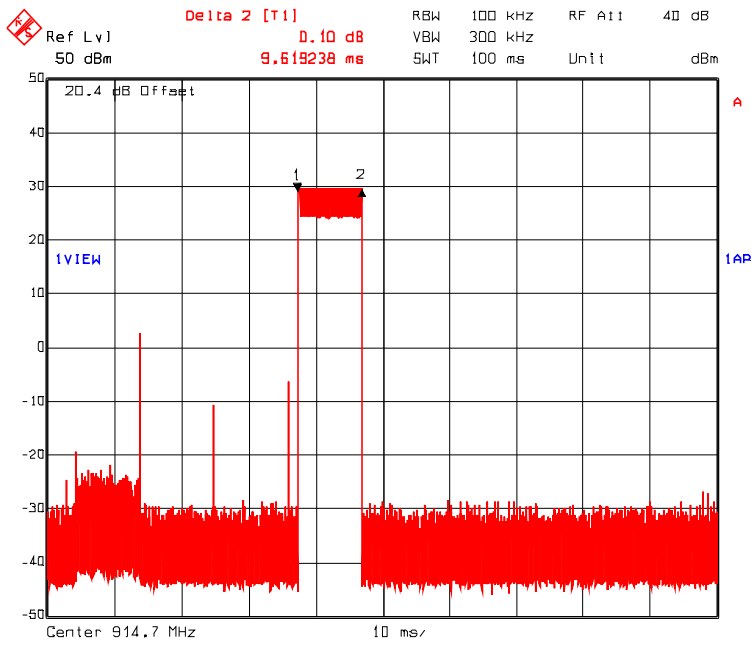


Plot 5.3.4.28. Time of Occupancy, 915 MHz, MODEM 250 , Dwell Time @ 915 MHz = 355.91 ms

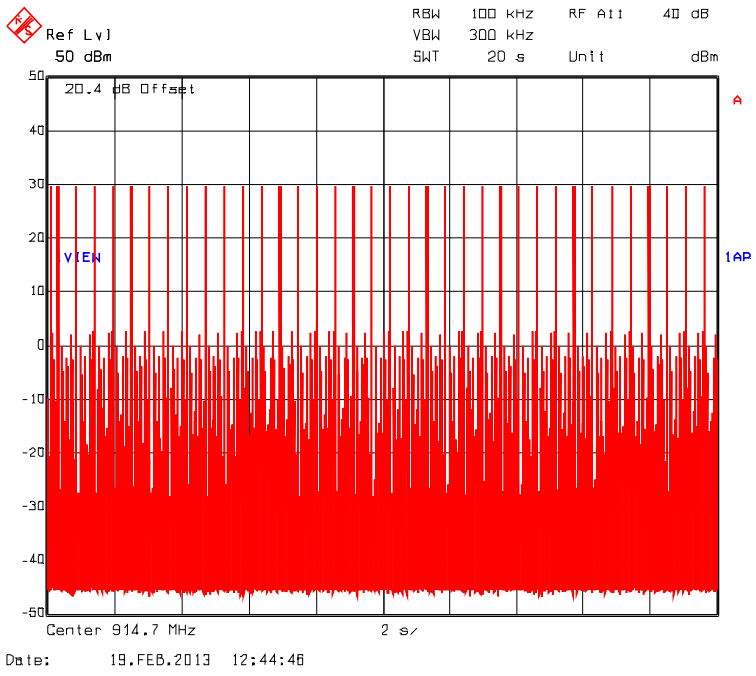


Time of Occupancy of 915 MHz = 9.6192 ms x 37(in 33s) = 355.91 ms < 400 ms (0.4 sec)
Period= 0.4 seconds * 81 (number of hopping channels employed) = 32.4 seconds

Plot 5.3.4.29. Time of Occupancy, 915 MHz, MODEM 125, Option 2

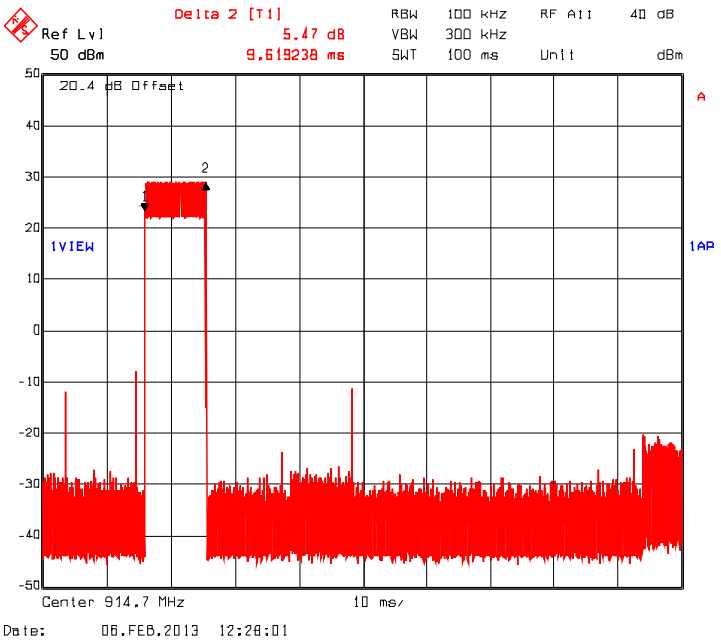


Plot 5.3.4.30. Time of Occupancy, 915 MHz, MODEM 125, Dwell Time @ 915 MHz = 346.32 ms

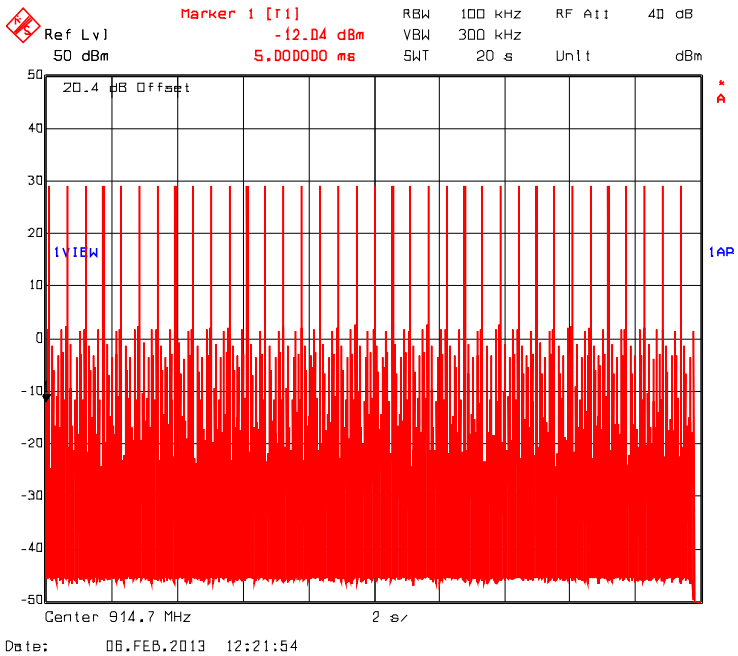


Time of Occupancy of 915 MHz = 9.62 ms x 36(20s) = 346.32 ms < 400 ms (0.4 sec)
Period= 0.4 seconds * 50 (number of hopping channels employed) = 20 seconds

Plot 5.3.4.31. Time of Occupancy, 915 MHz, MODEM 250 , Option 2



Plot 5.3.4.32. Time of Occupancy, 915 MHz, MODEM 250, Dwell Time @ 915 MHz = 346.32 ms



Time of Occupancy of 915 MHz = 9.62 ms x 36(20s) = 346.32 ms < 400 ms (0.4 sec)
Period= 0.4 seconds * 50 (number of hopping channels employed) = 20 seconds

5.4. PEAK CONDUCTED OUTPUT POWER & EIRP [§ 15.247(b)(2)]

5.4.1. Limit

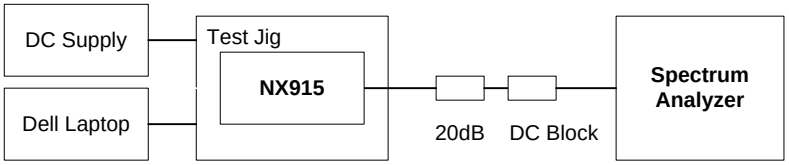
§15.247(b)(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

§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..

5.4.2. Method of Measurements

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

5.4.3. Test Arrangement



5.4.4. Test Data

Notes:

1) Antennas shall be connected to the NX915 with a PCTEL make PFP400 (610 cm) N Type male to N Type male cable with cable loss of **0.86 dB.**
2) 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 = $P_{dBm} + G_{dBi} - CL_{dB}$
3) The following power settings, measured powers and antenna assembly gains are conditions required for compliance with band-edge radiated emissions.

(A) Conducted Output Power

Frequency (MHz)	Modem Type	Peak Output Power at Antenna Terminal (dBm)	Calculated EIRP (dBm)	Peak Output Power Limit (dBm)	EIRP Limit (dBm)
High Power Setting					
902.7	125	29.99	See notes above	30	36
915.0	125	29.99	See notes above	30	36
927.3	125	29.99	See notes above	30	36
902.7	250	29.99	See notes above	30	36
915.0	250	29.99	See notes above	30	36
927.3	250	29.99	See notes above	30	36
Low Power Setting					
902.7	125	19.77	See notes above	30	36
915.0	125	19.51	See notes above	30	36
927.3	125	19.90	See notes above	30	36
902.7	250	19.90	See notes above	30	36
915.0	250	19.51	See notes above	30	36
927.3	250	19.77	See notes above	30	36

(B) EIRP

Frequency (MHz)	Modem Type	Peak Output Power at Antenna Terminal (dBm)	Peak Output Power Adding Assembly Loss (Attenuator + 0.86dB) (dBm)	Maximum Calculated EIRP* (dBm)	EIRP Limit
12.15 dBi Gain Yagi Directional Antenna with 6 dB Attenuator					
902.7	125	29.99	23.13	35.28	36
915.0	125	29.99	23.13	35.28	36
927.3	125	29.99	23.13	35.28	36
12.15 dBi Gain Yagi Directional Antenna with 6 dB Attenuator					
902.7	250	29.99	23.13	35.28	36
915.0	250	29.99	23.13	35.28	36
927.3	250	29.99	23.13	35.28	36
9.15 dBi Gain Omni Directional Antenna with 3 dB Attenuator					
902.7	125	29.99	26.13	35.28	36
915.0	125	29.99	26.13	35.28	36
927.3	125	29.99	26.13	35.28	36
9.15 dBi Gain Omni Directional Antenna with 3 dB Attenuator					
902.7	250	29.99	26.13	35.28	36
915.0	250	29.99	26.13	35.28	36
927.3	250	29.99	26.13	35.28	36

* This limit shall not be exceeded in the final installation for above antenna configurations.

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

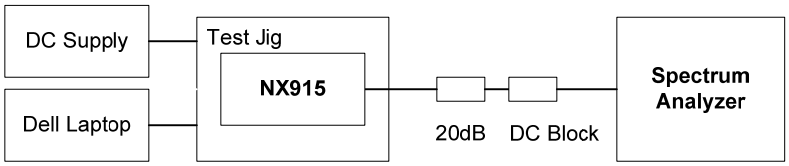
5.5.1. Limit

§ 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)).

5.5.2. Method of Measurements

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

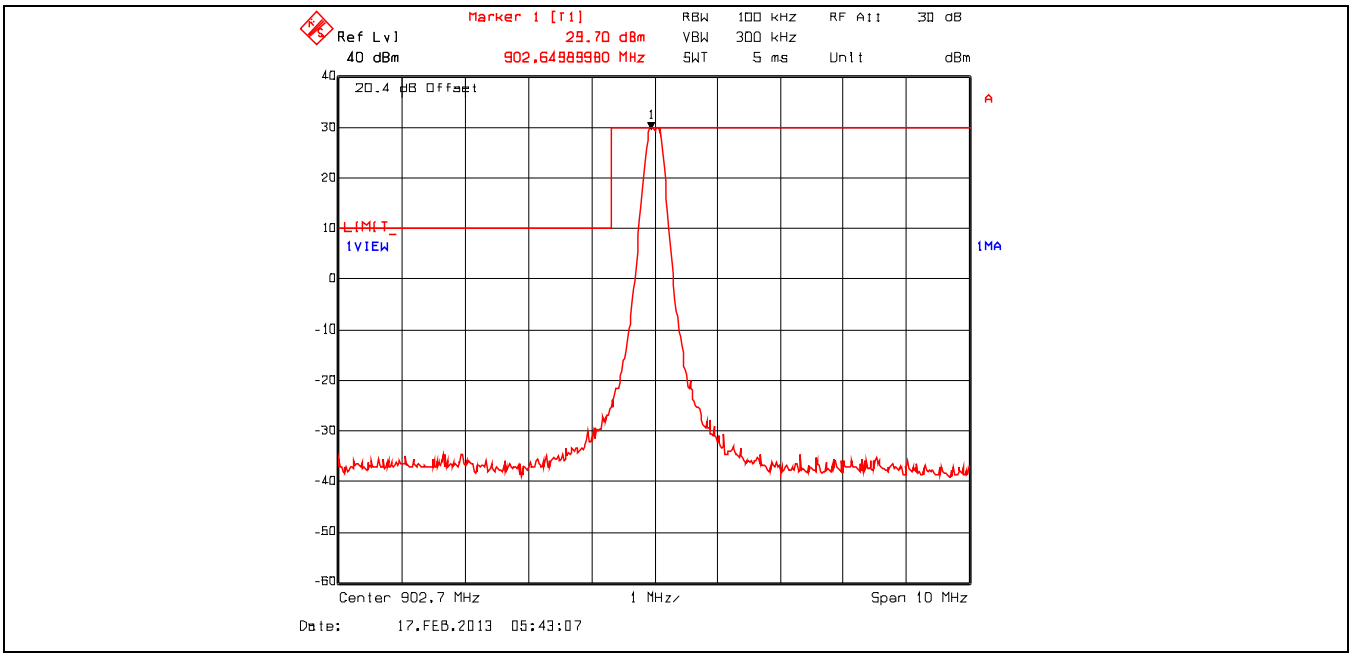
5.5.3. Test Arrangement



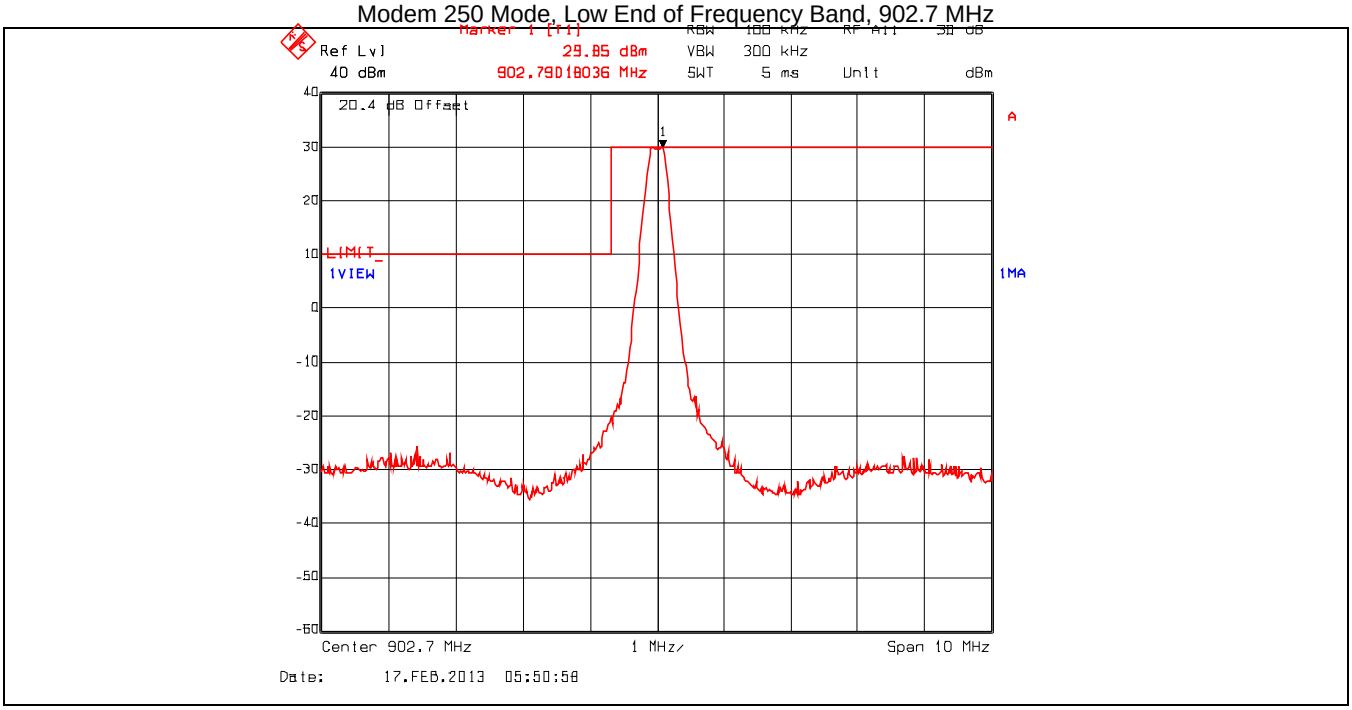
5.5.4. Test Data

5.5.4.1. Band-Edge RF Conducted Emissions

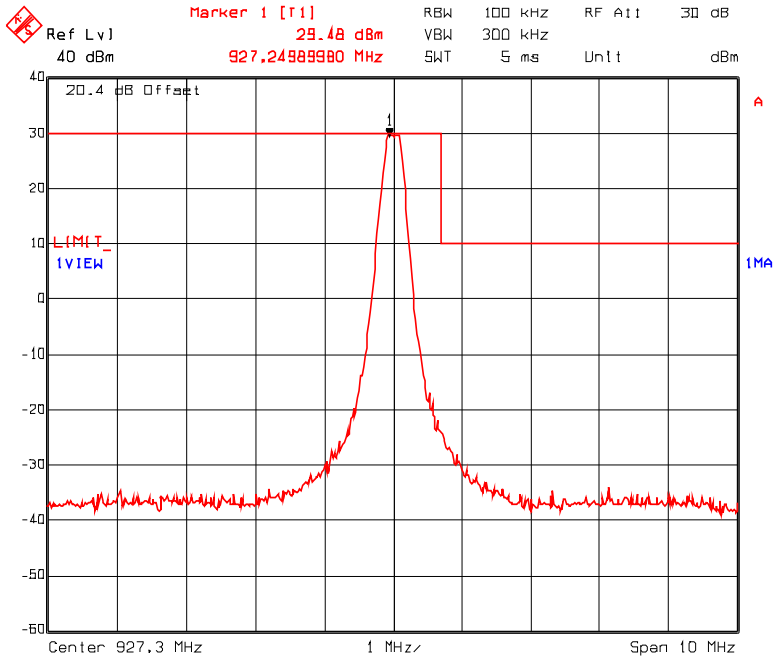
Plot 5.5.4.1.1. Band-Edge RF Conducted Emissions
Modem 125 Mode, Low End of Frequency Band, 902.7 MHz



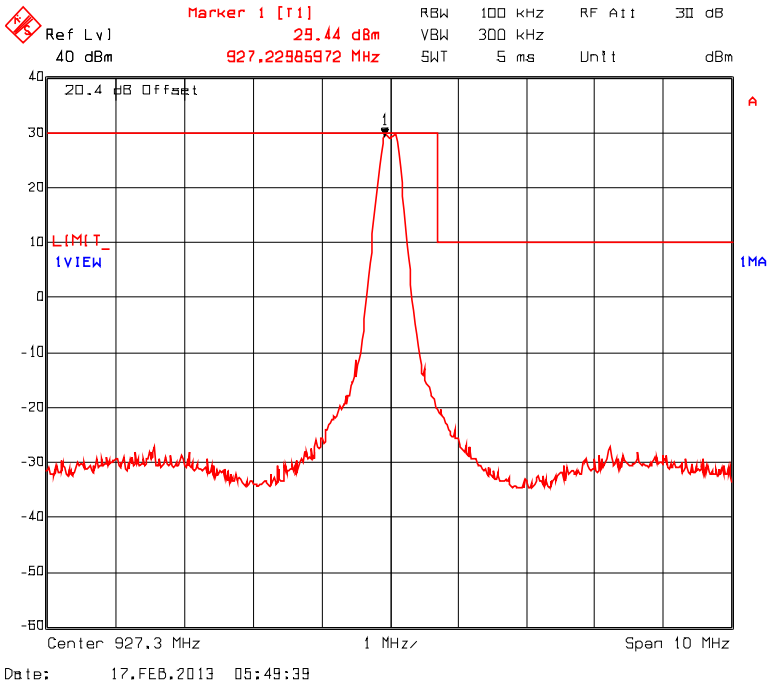
Plot 5.5.4.1.2. Band-Edge RF Conducted Emissions
Modem 250 Mode, Low End of Frequency Band, 902.7 MHz



Plot 5.5.4.1.3. Band-Edge RF Conducted Emissions
Modem 125 Mode, High End of Frequency Band, 927.3 MHz

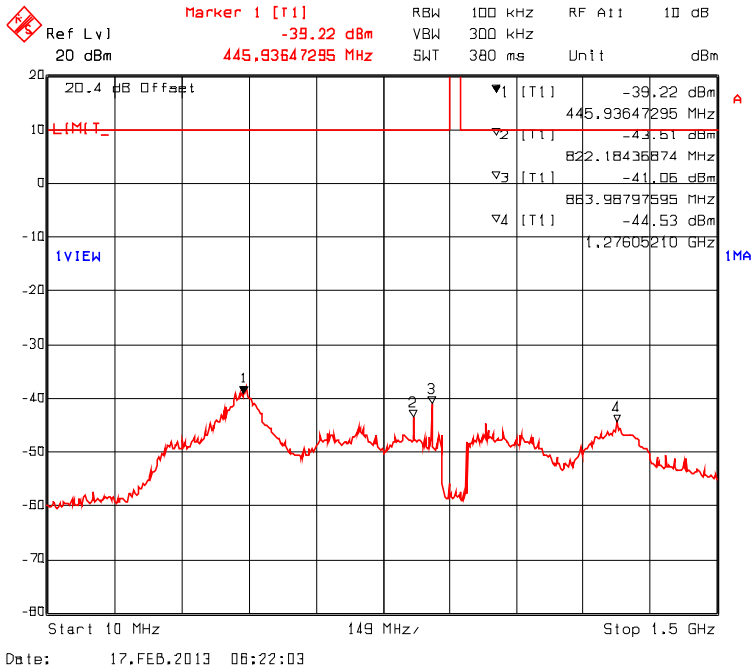


Plot 5.5.4.1.4. Band-Edge RF Conducted Emissions
Modem 250 Mode, High End of Frequency Band, 927.3 MHz

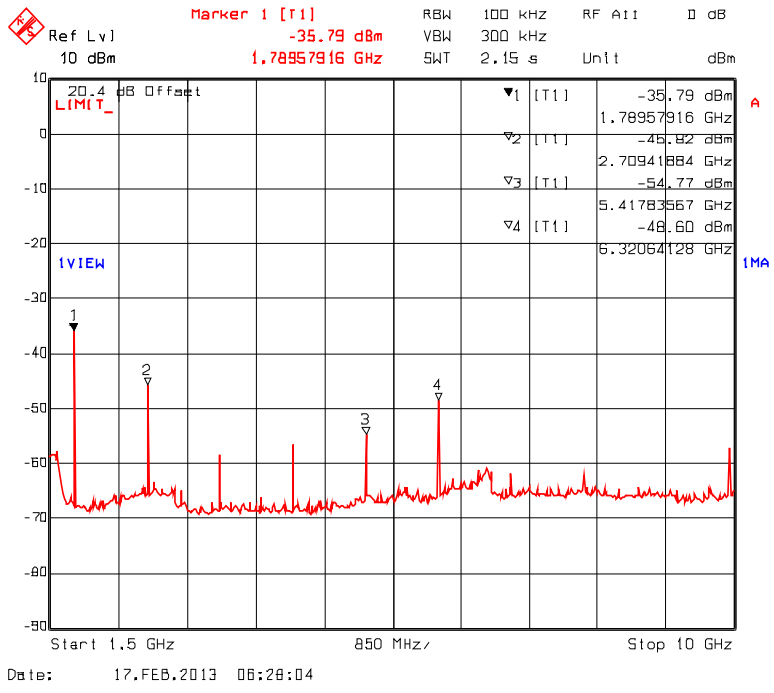


5.5.4.2. Spurious RF Conducted Emissions

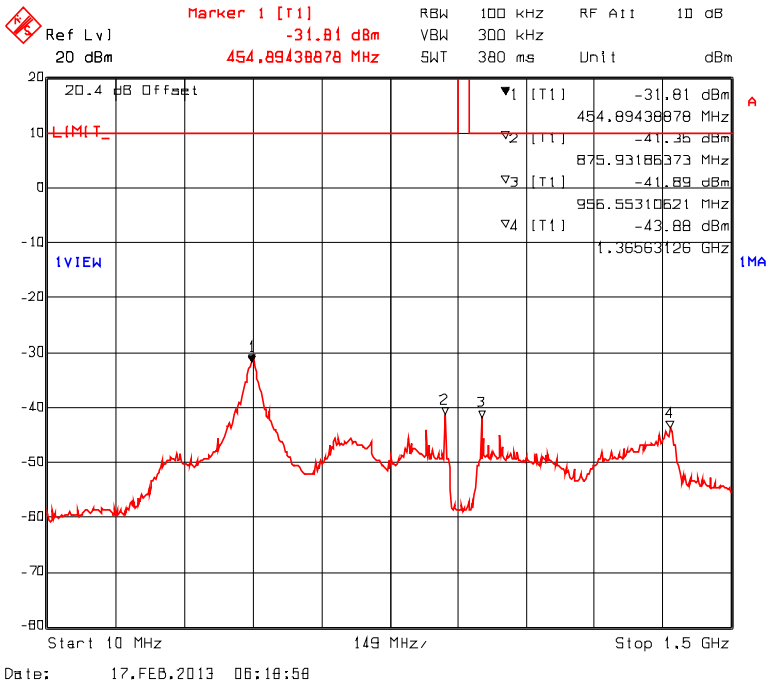
Plot 5.5.4.2.1. Spurious RF Conducted Emissions
High Power, 902.7 MHz, Modem 125 Mode, 10 MHz – 1.5 GHz



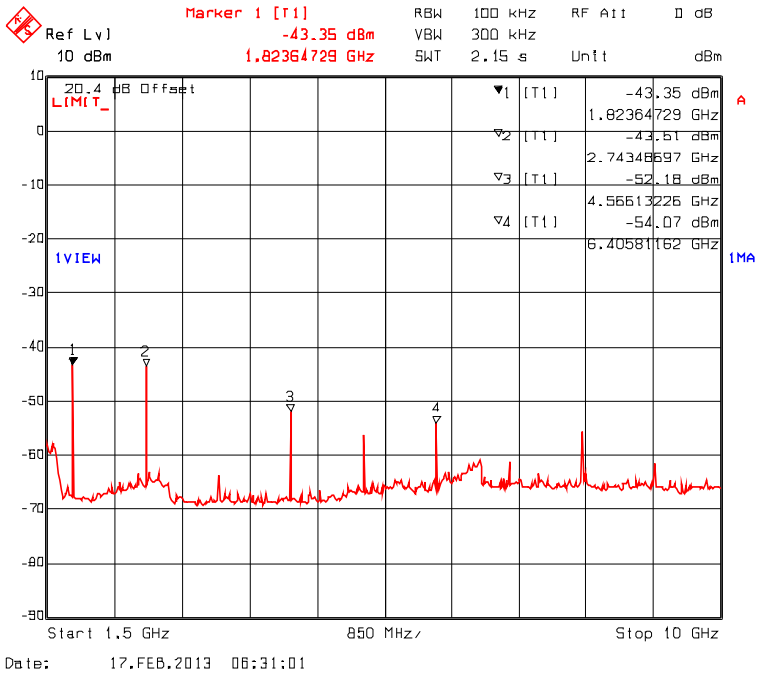
Plot 5.5.4.2.2. Conducted Spurious Emissions - Non Restricted Frequency Bands
High Power, 902.7 MHz, Modem 125 Mode, 1.5 GHz - 10 GHz



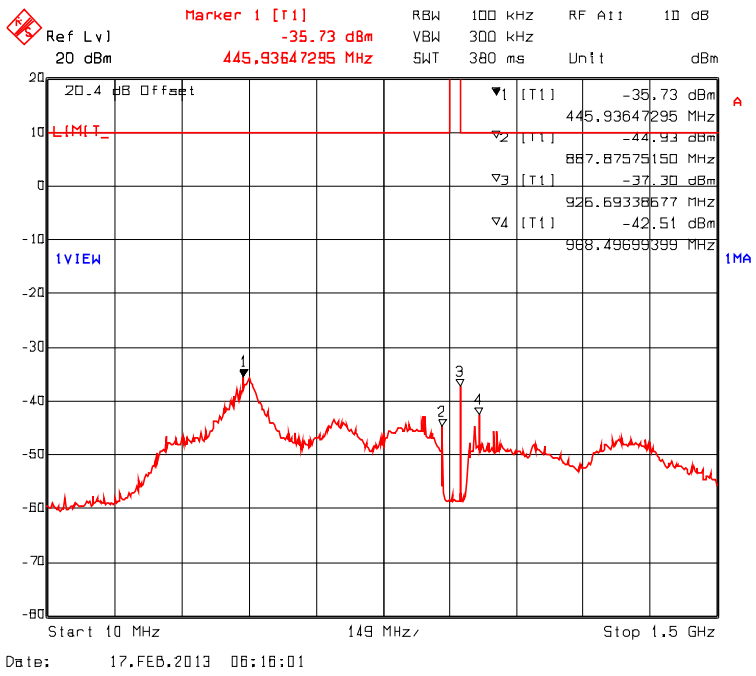
Plot 5.5.4.2.3. Spurious RF Conducted Emissions
High Power, 915.0 MHz, Modem 125 Mode, 10 MHz – 1.5 GHz



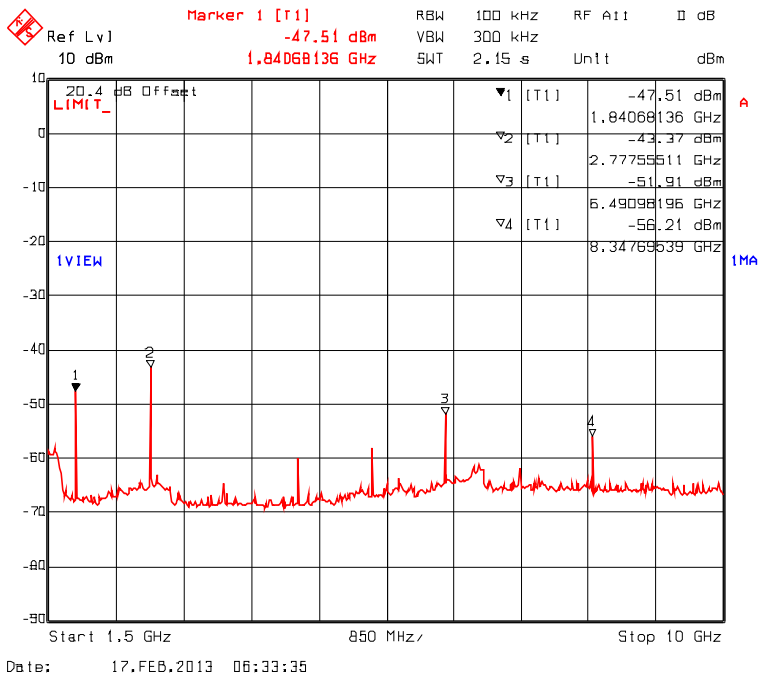
Plot 5.5.4.2.4. Conducted Spurious Emissions - Non Restricted Frequency Bands
High Power, 915.0 MHz, Modem 125 Mode, 1.5 GHz - 10 GHz



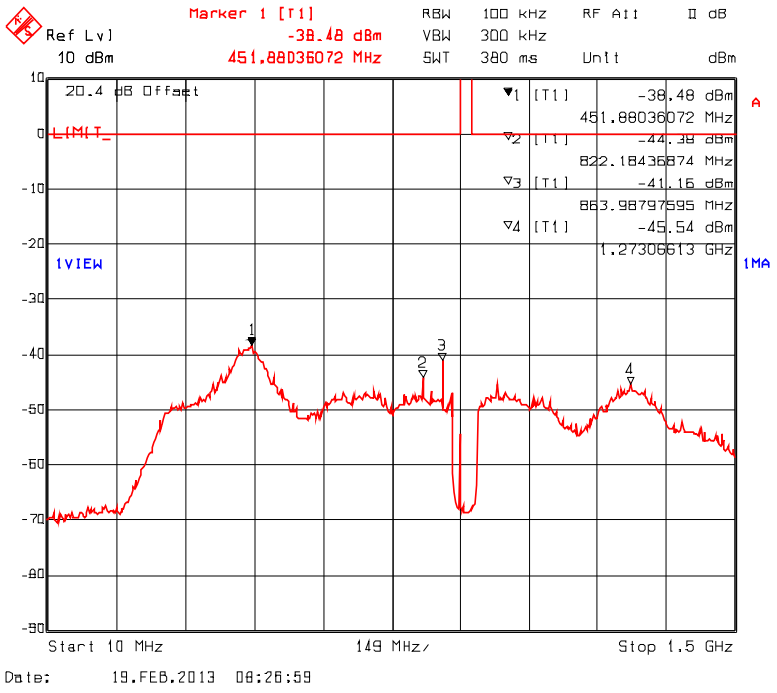
Plot 5.5.4.2.5. Spurious RF Conducted Emissions
High Power, 927.3 MHz, Modem 125 Mode, 10 MHz – 1.5 GHz



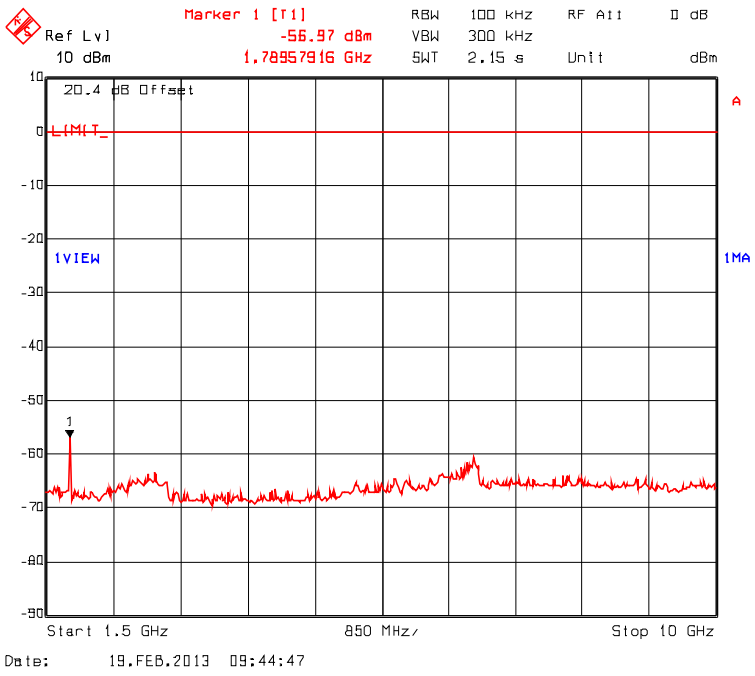
Plot 5.5.4.2.6. Conducted Spurious Emissions - Non Restricted Frequency Bands
High Power, 927.3 MHz, Modem 125 Mode, 1.5 GHz - 10 GHz



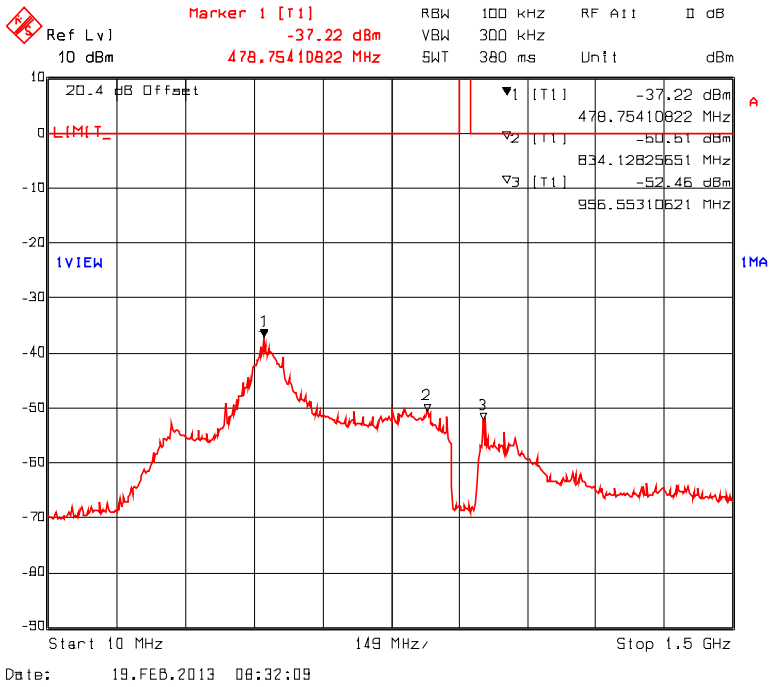
Plot 5.5.4.2.7. Spurious RF Conducted Emissions
Low Power, 902.7 MHz, Modem 125 Mode, 10 MHz – 1.5 GHz



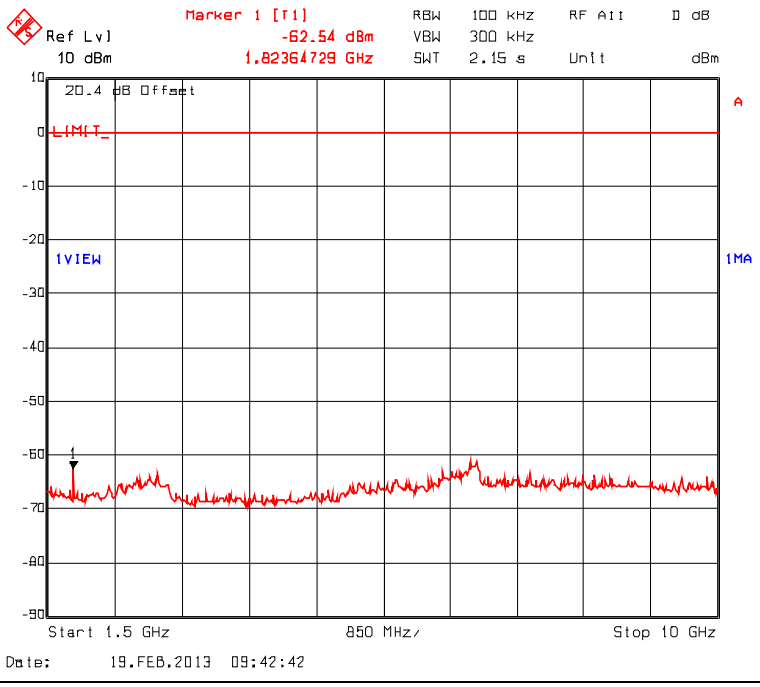
Plot 5.5.4.2.8. Conducted Spurious Emissions - Non Restricted Frequency Bands
Low Power, 902.7 MHz, Modem 125 Mode, 1.5 GHz - 10 GHz



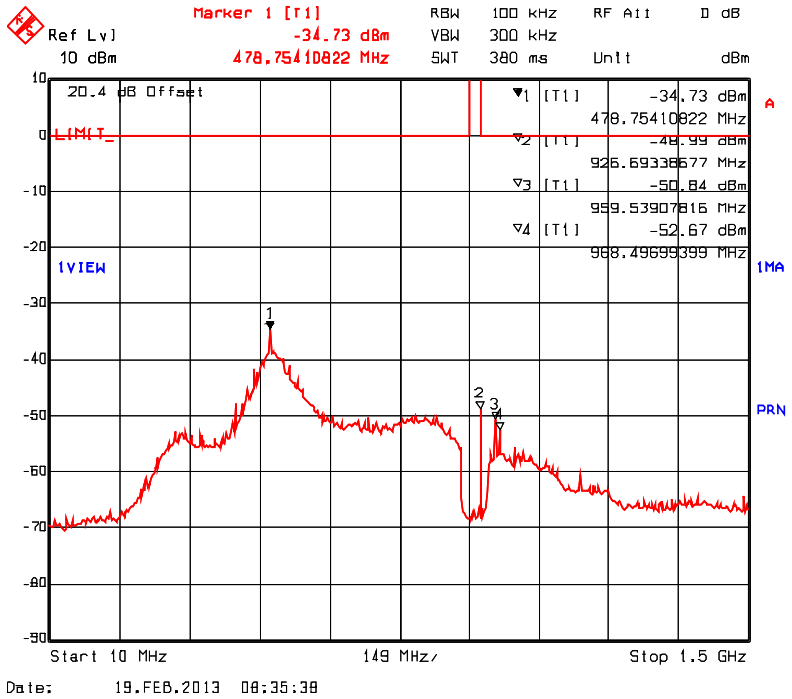
Plot 5.5.4.2.9. Spurious RF Conducted Emissions
Low Power, 915.0 MHz, Modem 125 Mode, 10 MHz – 1.5 GHz



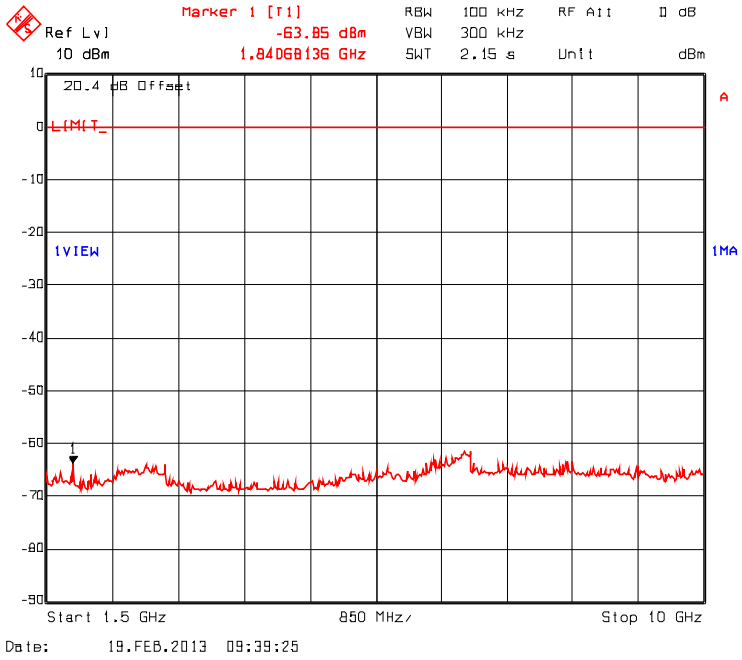
Plot 5.5.4.2.10. Conducted Spurious Emissions - Non Restricted Frequency Bands
Low Power, 915.0 MHz, Modem 125 Mode, 1.5 GHz - 10 GHz



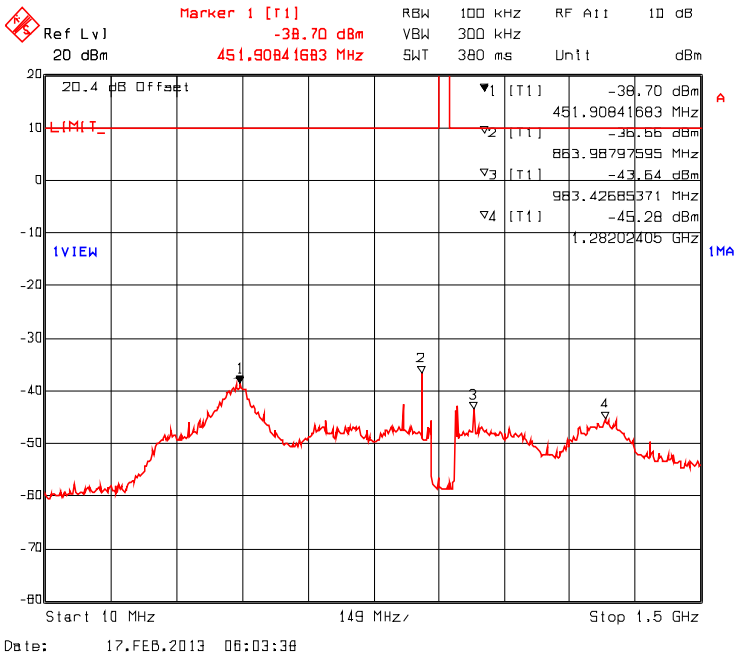
Plot 5.5.4.2.11. Spurious RF Conducted Emissions
Low Power, 927.3 MHz, Modem 125 Mode, 10 MHz – 1.5 GHz



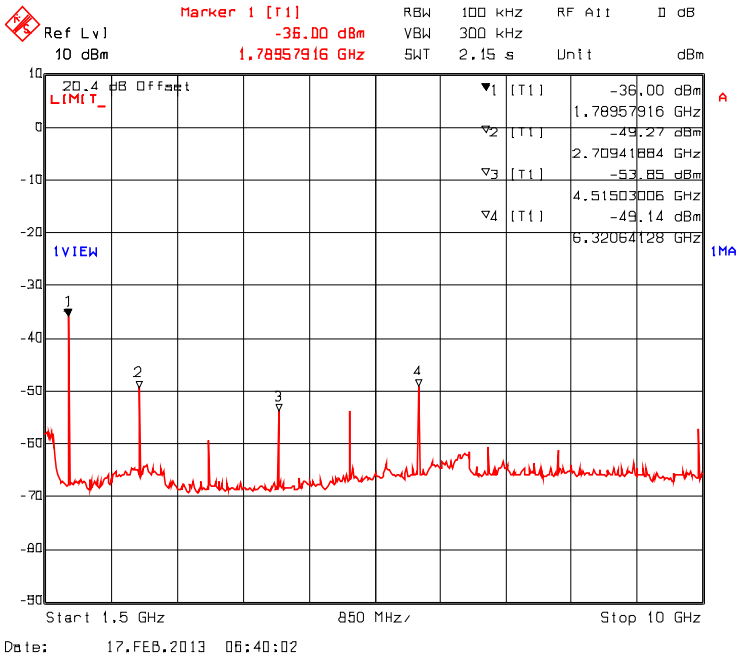
Plot 5.5.4.2.12. Conducted Spurious Emissions - Non Restricted Frequency Bands
Low Power, 927.3 MHz, Modem 125 Mode, 1.5 GHz - 10 GHz



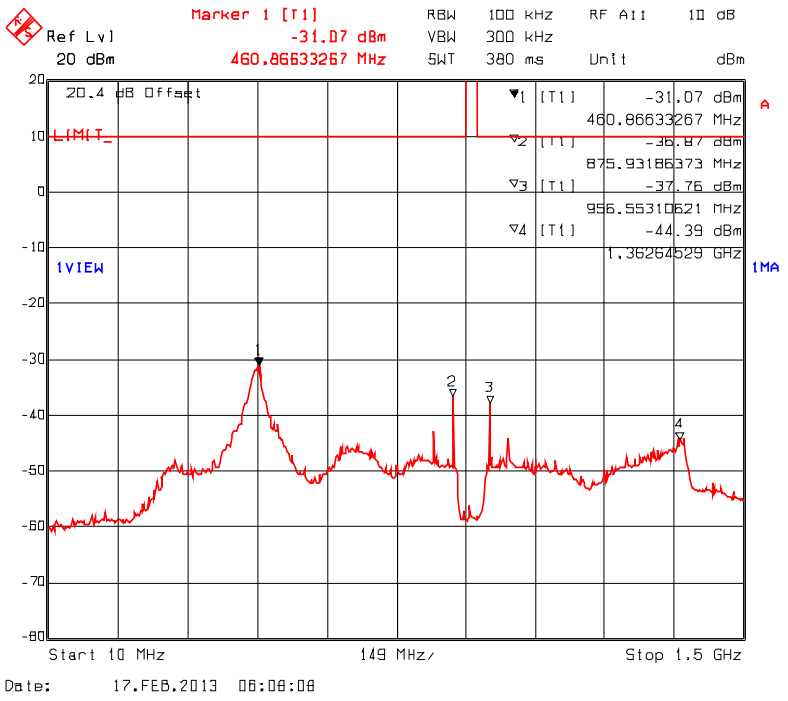
Plot 5.5.4.2.13. Spurious RF Conducted Emissions
High Power, 902.7 MHz, Modem 250 ode, 10 MHz – 1.5 GHz



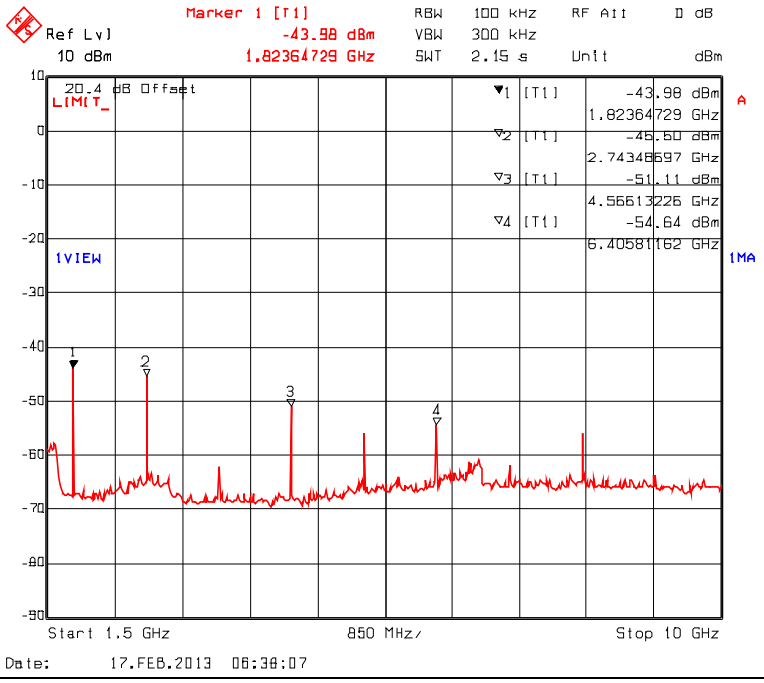
Plot 5.5.4.2.14. Conducted Spurious Emissions - Non Restricted Frequency Bands
High Power, 902.7 MHz, Modem 250 Mode, 1.5 GHz - 10 GHz



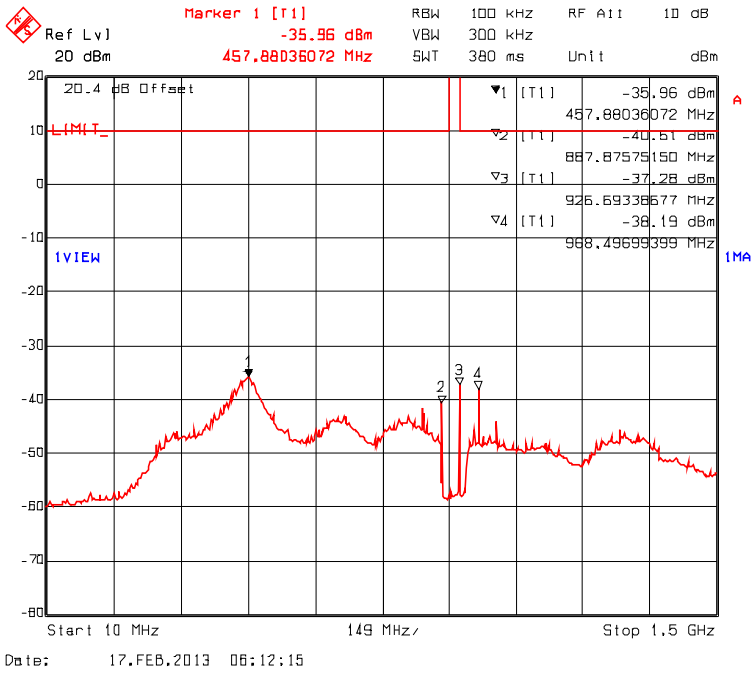
Plot 5.5.4.2.15. Spurious RF Conducted Emissions
High Power, 915.0 MHz, Modem 250 Mode, 10 MHz – 1.5 GHz



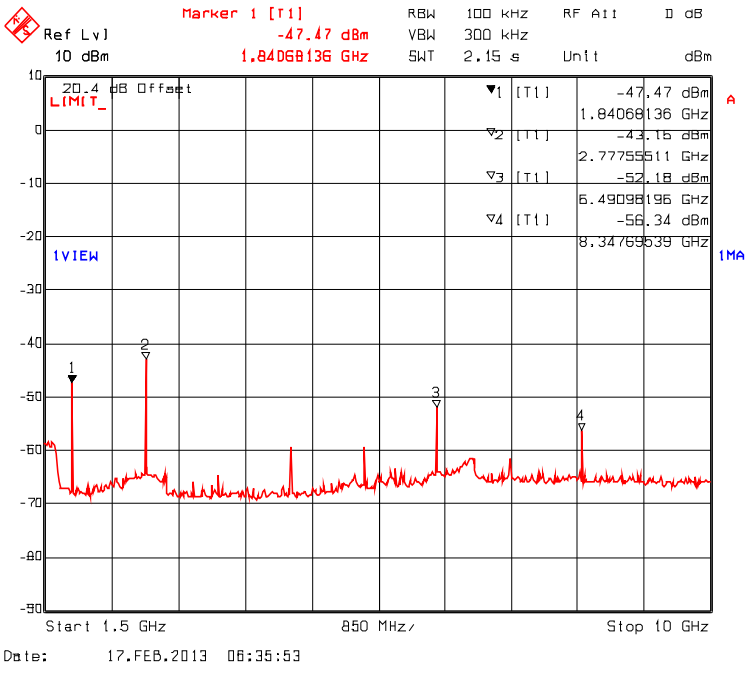
Plot 5.5.4.2.16. Conducted Spurious Emissions - Non Restricted Frequency Bands
High Power, 915.0 MHz, Modem 250 Mode, 1.5 GHz - 10 GHz



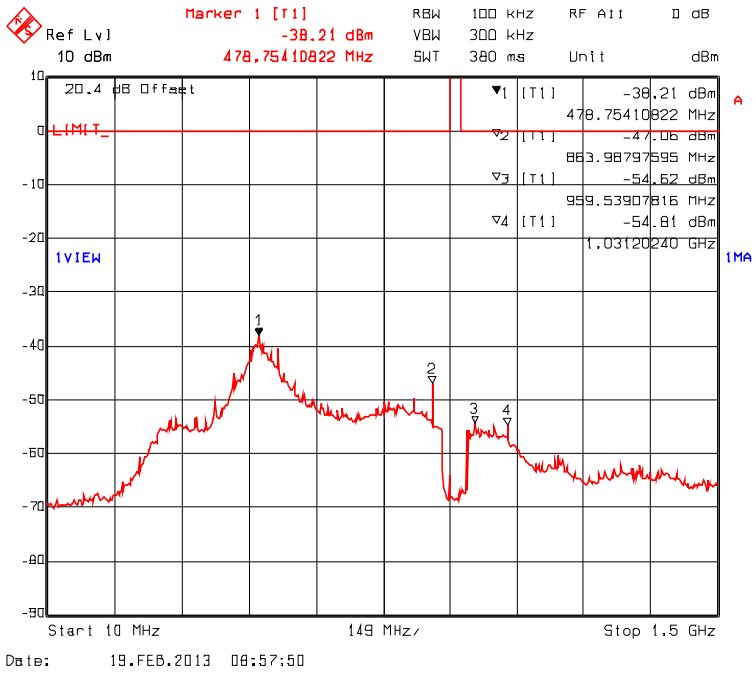
Plot 5.5.4.2.17. Spurious RF Conducted Emissions
High Power, 927.3 MHz, Modem 250 Mode, 10 MHz – 1.5 GHz



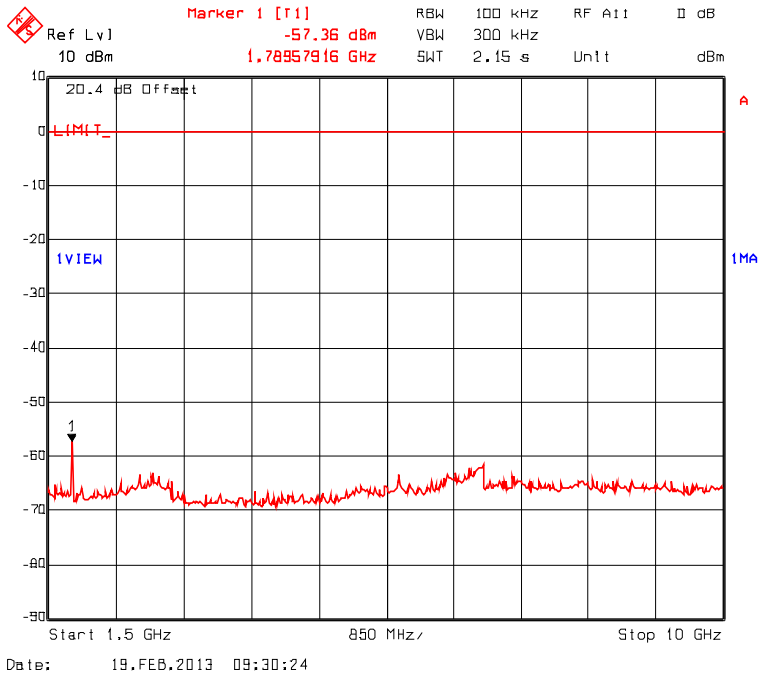
Plot 5.5.4.2.18. Conducted Spurious Emissions - Non Restricted Frequency Bands
High Power, 927.3 MHz, Modem 250 Mode, 1.5 GHz - 10 GHz



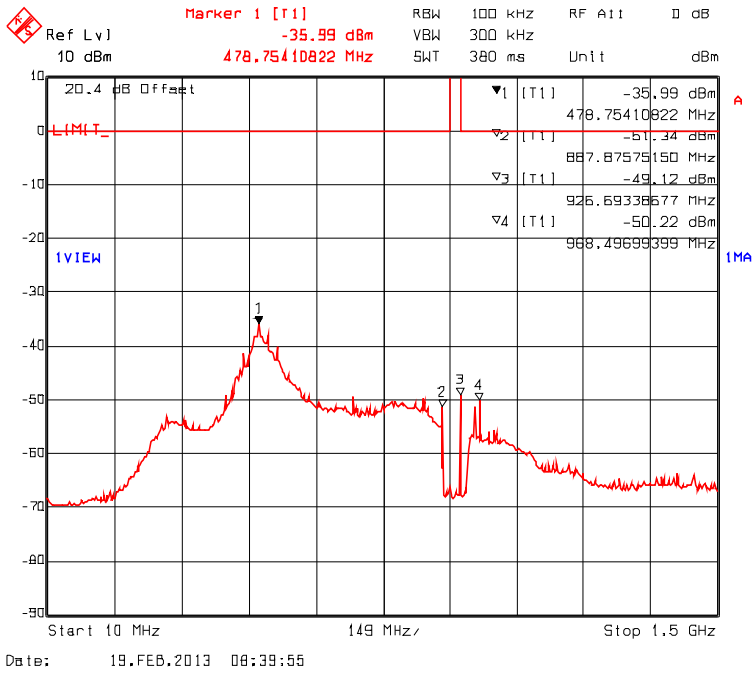
Plot 5.5.4.2.19. Spurious RF Conducted Emissions
Low Power, 902.7 MHz, Modem 250 Mode, 10 MHz – 1.5 GHz



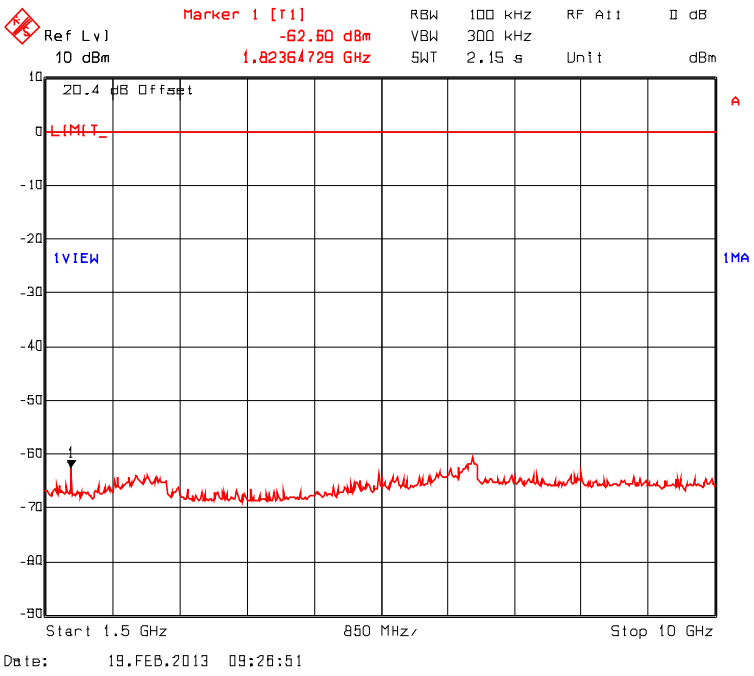
Plot 5.5.4.2.20. Conducted Spurious Emissions - Non Restricted Frequency Bands
Low Power, 902.7 MHz, Modem 250 Mode, 1.5 GHz - 10 GHz



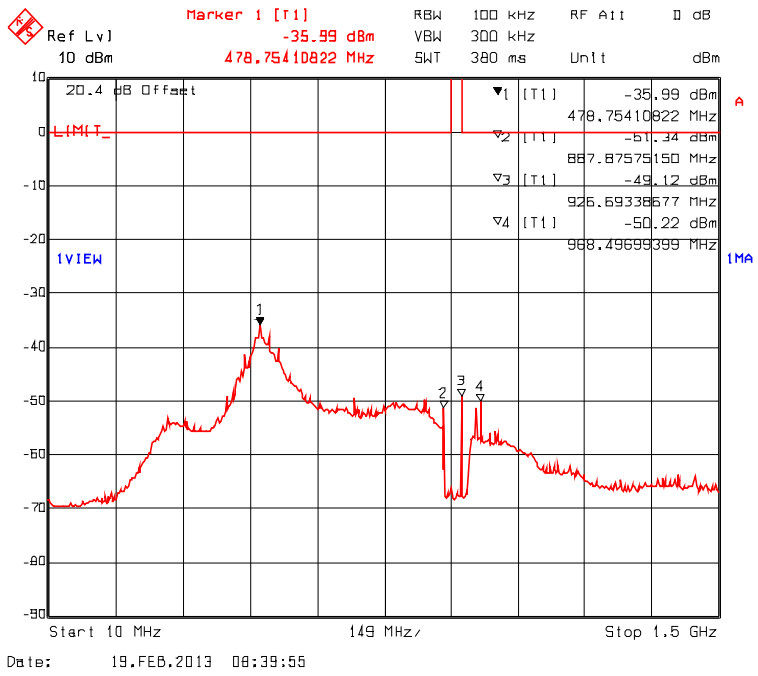
Plot 5.5.4.2.21. Spurious RF Conducted Emissions
Low Power, 915.0 MHz, Modem 250 Mode, 10 MHz – 1.5 GHz



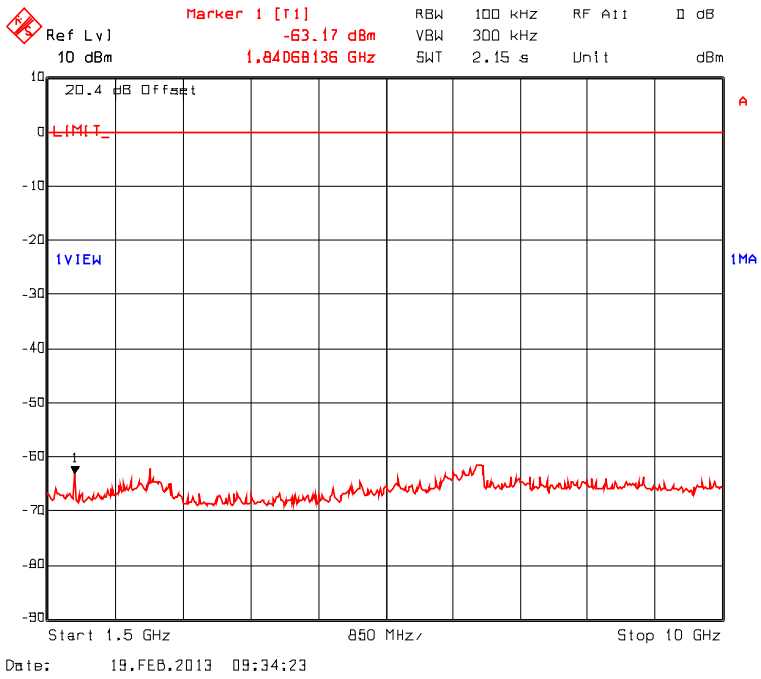
Plot 5.5.4.2.22. Conducted Spurious Emissions - Non Restricted Frequency Bands
Low Power, 915.0 MHz, Modem 250 Mode, 1.5 GHz - 10 GHz



Plot 5.5.4.2.23. Spurious RF Conducted Emissions
Low Power, 927.3 MHz, Modem 250 Mode, 10 MHz – 1.5 GHz



Plot 5.5.4.2.24. Conducted Spurious Emissions - Non Restricted Frequency Bands
Low Power, 927.3 MHz, Modem 250 Mode, 1.5 GHz - 10 GHz



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

5.6.1. 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

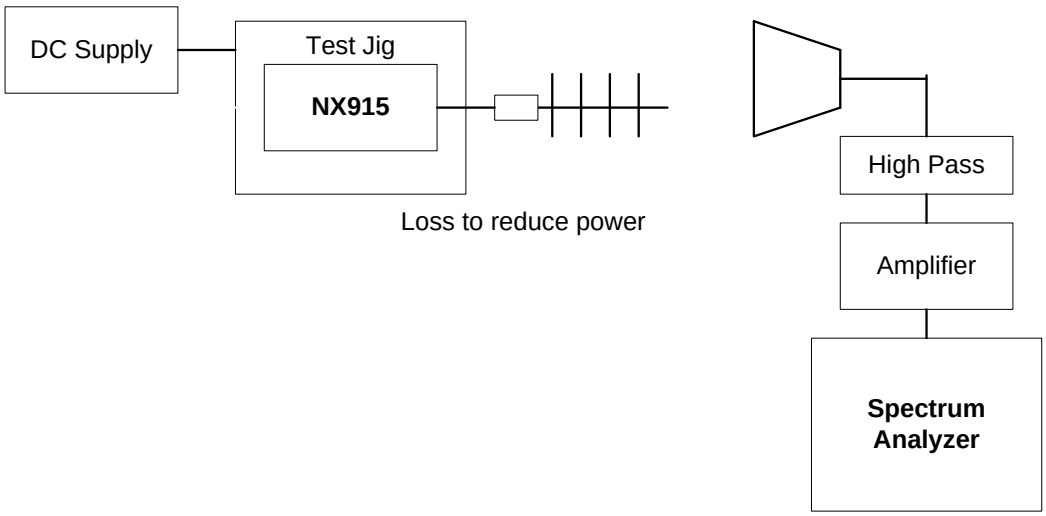
Section 15.209(a) - Field Strength Limits within Restricted Frequency Bands

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

5.6.2. Method of Measurements

FCC Public Notice DA 00-705, ANSI C63.10 and ANSI 63.4 procedures.

5.6.3. Test Arrangement



5.6.4. 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.
- Both Modem 125 & Modem 250 modes were pre-scanned and found that Modem 125 results are the worst-case measurements as tabulated below.

5.6.4.1. EUT connected with 12.15 dBi Yagi Antenna & 6 dB Attenuator

5.6.4.1.1. Spurious Radiated Emissions

Fundamental Frequency:	902.7 MHz
Measured Conducted Power:	29.99 dBm
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
902.7	130.91	--	V	--	--	--	--
902.7	130.62	--	H	--	--	--	--
995.0	53.25	49.27	V	54.0	110.9	-4.7	Pass*
995.0	55.61	51.59	H	54.0	110.9	-2.4	Pass*
2708.1	53.81	51.37	V	54.0	110.9	-2.6	Pass*
2708.1	52.42	49.48	H	54.0	110.9	-4.5	Pass*
3610.8	46.76	36.61	V	54.0	110.9	-17.4	Pass*
3610.8	46.17	35.17	H	54.0	110.9	-18.8	Pass*
4513.5	50.11	41.99	V	54.0	110.9	-12.0	Pass*
4513.5	51.25	44.39	H	54.0	110.9	-9.6	Pass*
5416.2	52.68	44.18	V	54.0	110.9	-9.8	Pass*
5416.2	52.81	46.24	H	54.0	110.9	-7.8	Pass*
8124.3	55.17	44.65	V	54.0	110.9	-9.3	Pass*
8124.3	55.19	43.71	H	54.0	110.9	-10.3	Pass*
9027.0	55.81	42.74	V	54.0	110.9	-11.3	Pass*
9027.0	51.92	41.80	H	54.0	110.9	-12.2	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:	915.0 MHz						
Measured Conducted Power:	29.99 dBm						
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**
915.0	130.10	--	V	--	--	--	--
915.0	130.07	--	H	--	--	--	--
2745.0	55.37	53.26	V	54.0	110.1	-0.7	Pass*
2745.0	53.76	51.48	H	54.0	110.1	-24.5	Pass*
3660.0	45.69	34.64	V	54.0	110.1	-19.4	Pass*
3660.0	47.29	36.36	H	54.0	110.1	-17.6	Pass*
4575.0	52.84	47.12	V	54.0	110.1	-6.9	Pass*
4575.0	52.90	47.48	H	54.0	110.1	-6.5	Pass*
7320.0	53.84	41.65	V	54.0	110.1	-12.3	Pass*
7320.0	54.23	45.18	H	54.0	110.1	-8.8	Pass*
8235.0	54.15	41.95	V	54.0	110.1	-12.0	Pass*
8235.0	55.36	43.82	H	54.0	110.1	-10.2	Pass*
9150.0	56.08	44.42	V	54.0	110.1	-9.6	Pass*
9150.0	52.37	42.83	H	54.0	110.1	-11.2	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

Fundamental Frequency:	927.3 MHz						
Measured Conducted Power:	29.99 dBm						
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**
927.3	130.03	--	V	--	--	--	--
927.3	130.09	--	H	--	--	--	--
2781.9	55.11	53.35	V	54.0	110.1	-0.6	Pass*
2781.9	51.55	48.31	H	54.0	110.1	-5.7	Pass*
4636.5	51.41	44.40	V	54.0	110.1	-9.6	Pass*
4636.5	52.22	46.19	H	54.0	110.1	-7.8	Pass*
7418.4	53.87	45.31	V	54.0	110.1	-8.7	Pass*
7418.4	53.68	41.31	H	54.0	110.1	-12.7	Pass*
8345.7	53.27	40.95	V	54.0	110.1	-13.0	Pass*
8345.7	53.38	40.89	H	54.0	110.1	-13.1	Pass*
9273.0	53.19	41.93	V	54.0	110.1	-12.1	Pass*
9273.0	53.07	41.03	H	54.0	110.1	-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
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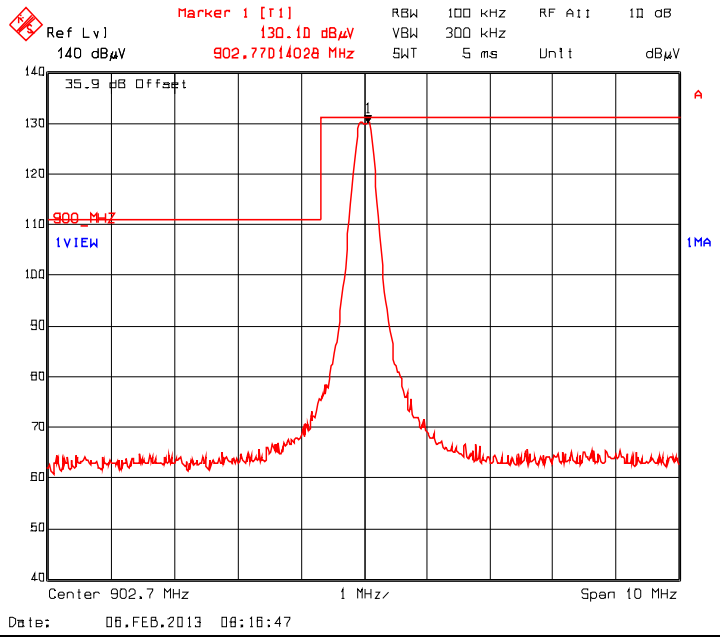
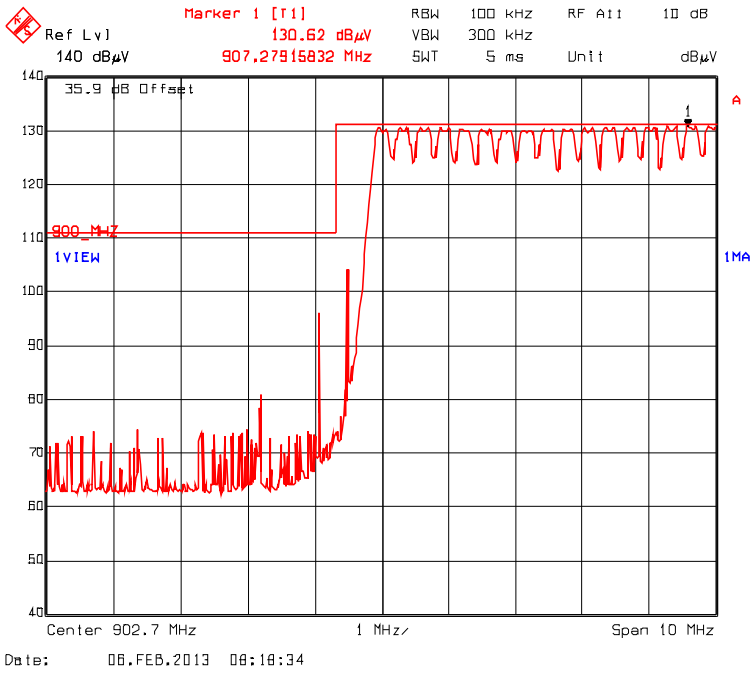
5.6.4.1.2. Band-Edge RF Radiated Emissions

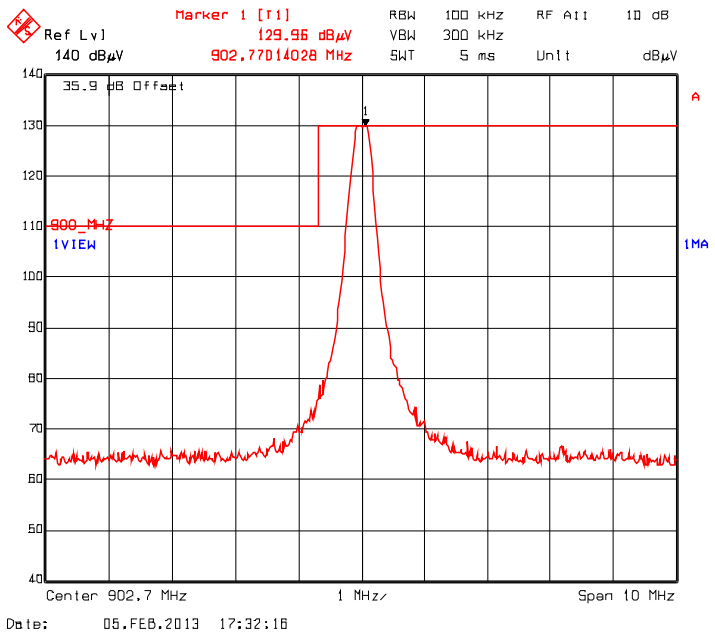
Plot 5.6.4.1.2.1. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 125, Single Frequency Mode



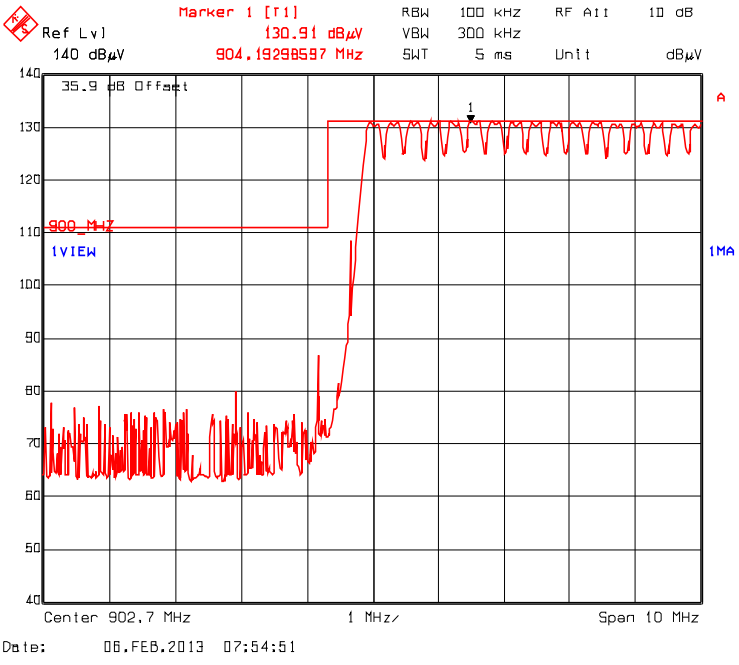
Plot 5.6.4.1.2.2. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 125, Hopping Mode



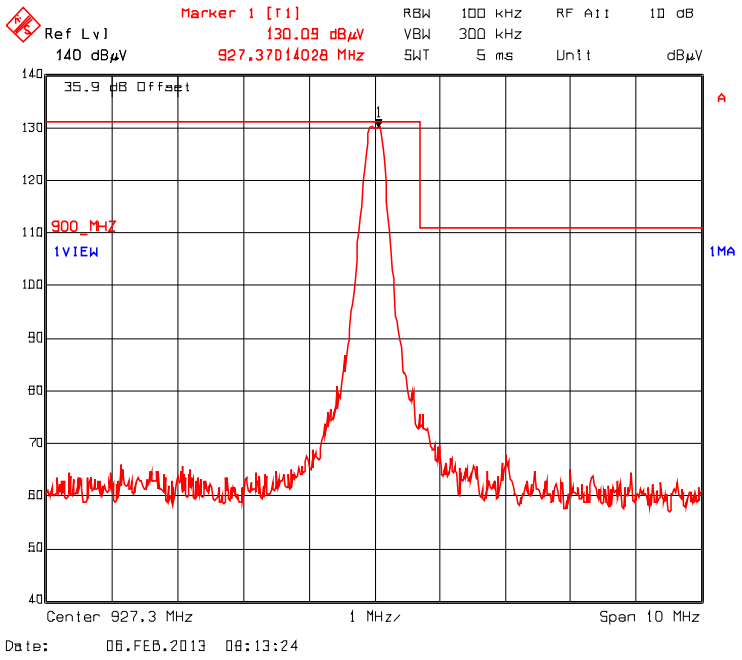
Plot 5.6.4.1.2.3. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 125, Single Frequency Mode



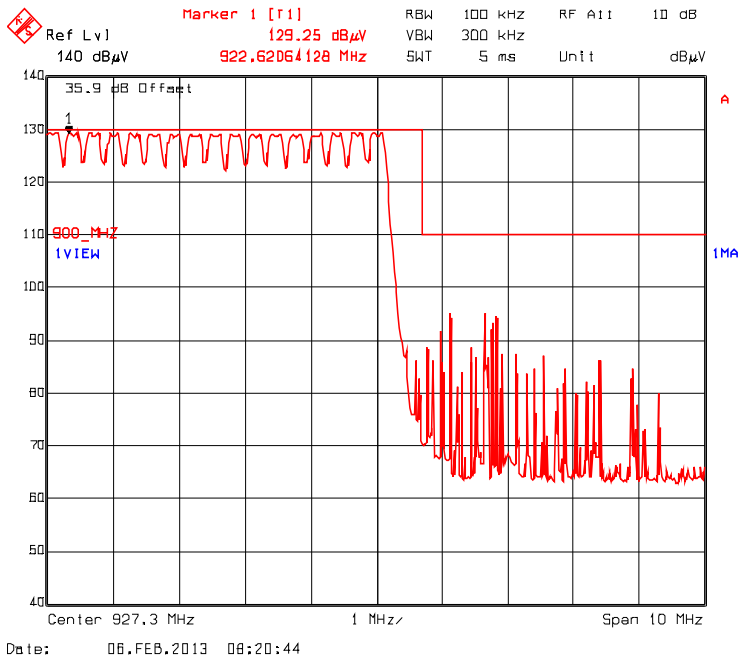
Plot 5.6.4.1.2.4. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 125, Hopping Mode



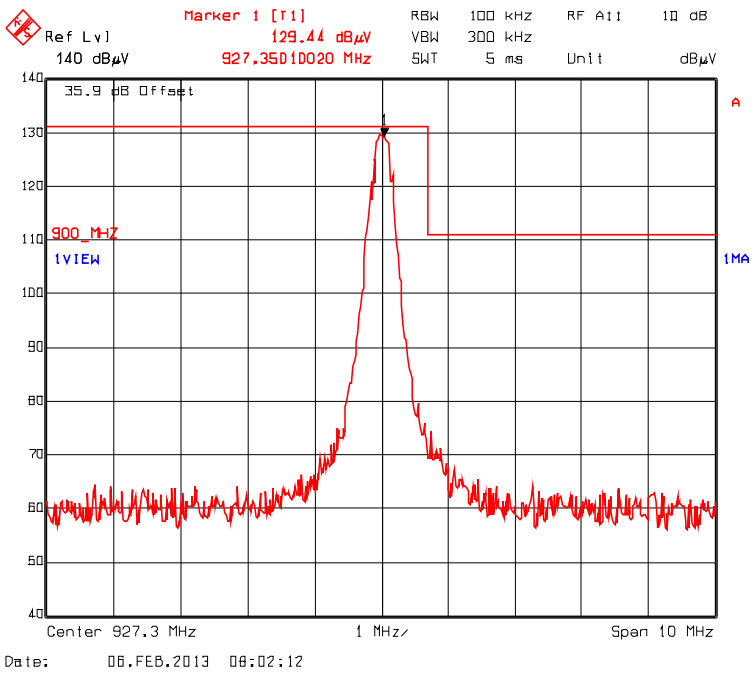
Plot 5.6.4.1.2.5. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 125, Single Frequency Mode



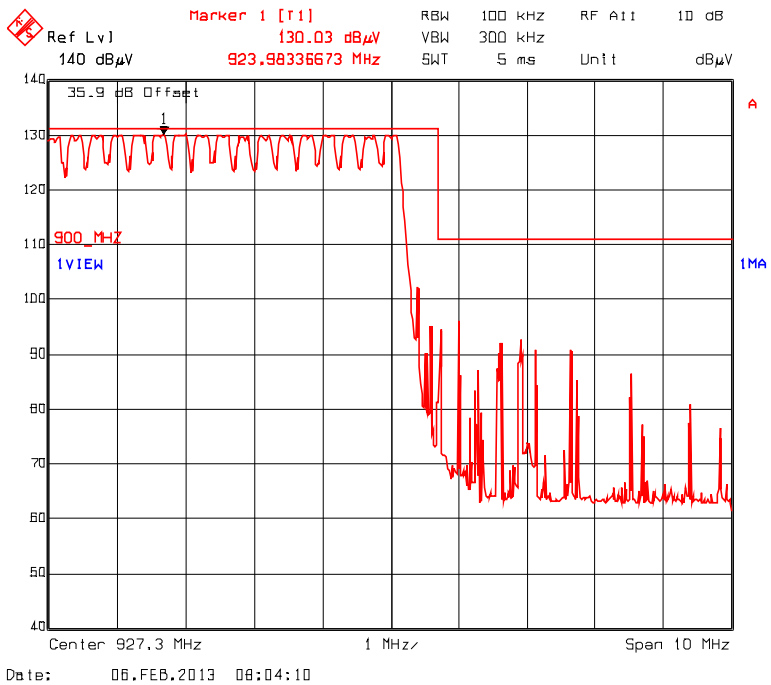
Plot 5.6.4.1.2.6. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 125, Hopping Mode



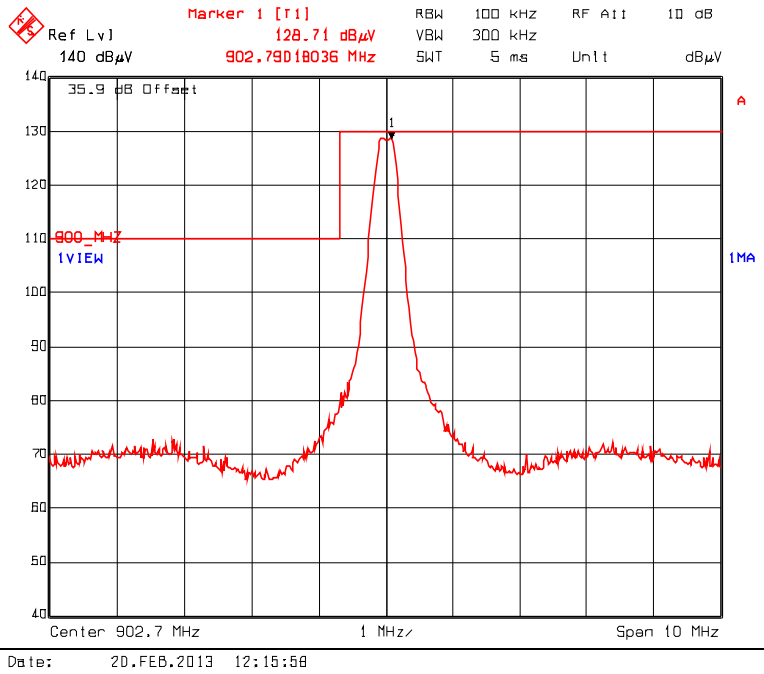
Plot 5.6.4.1.2.7. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 125, Single Frequency Mode



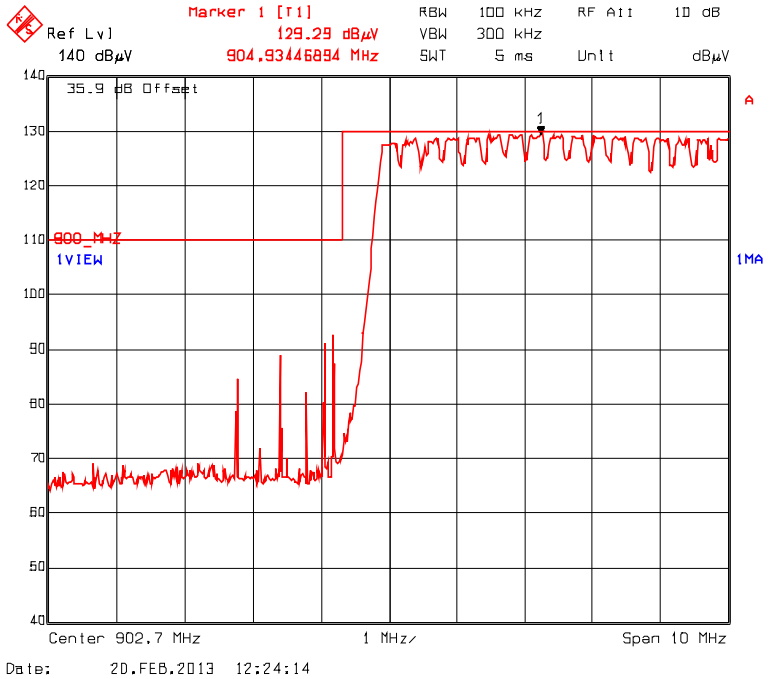
Plot 5.6.4.1.2.8. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 125, Hopping Mode



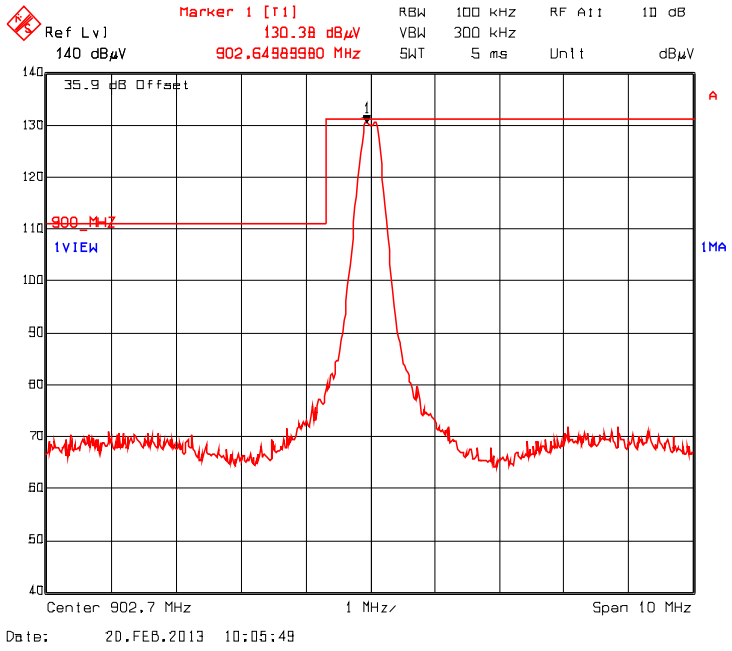
Plot 5.6.4.1.2.9. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 250, Single Frequency Mode



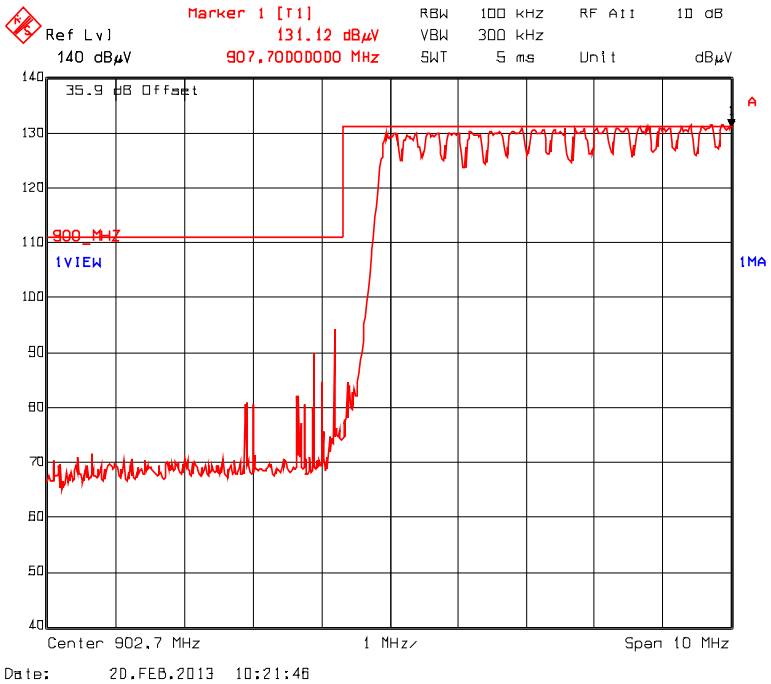
Plot 5.6.4.1.2.10. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 250, Hopping Mode



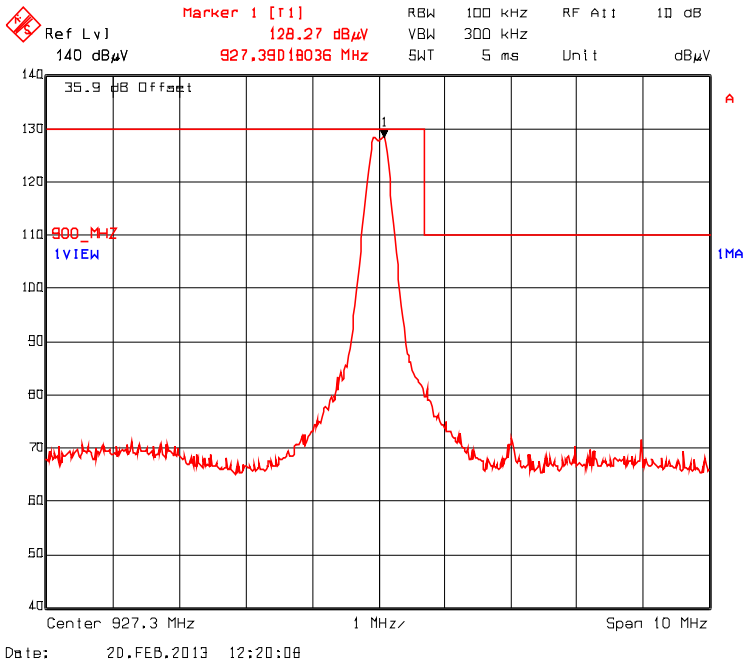
Plot 5.6.4.1.2.11. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 250, Single Frequency Mode



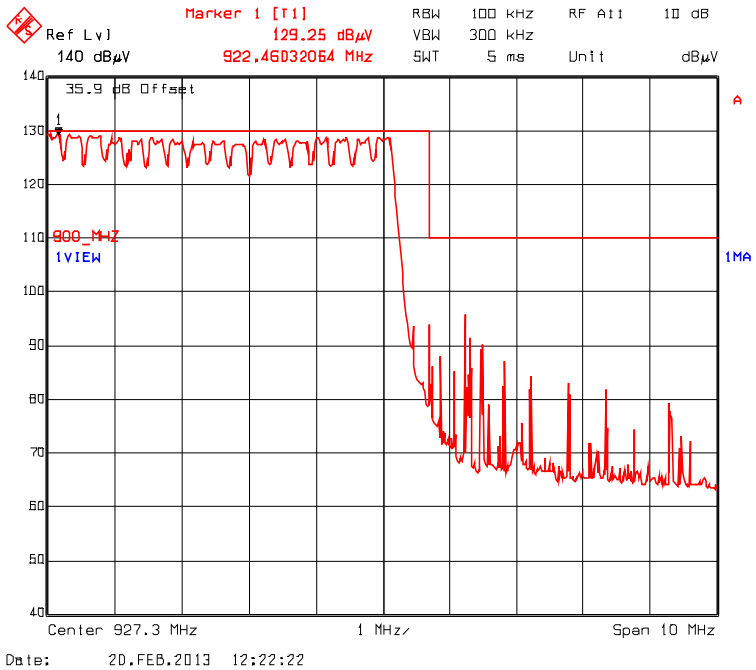
Plot 5.6.4.1.2.12. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 250, Hopping Mode



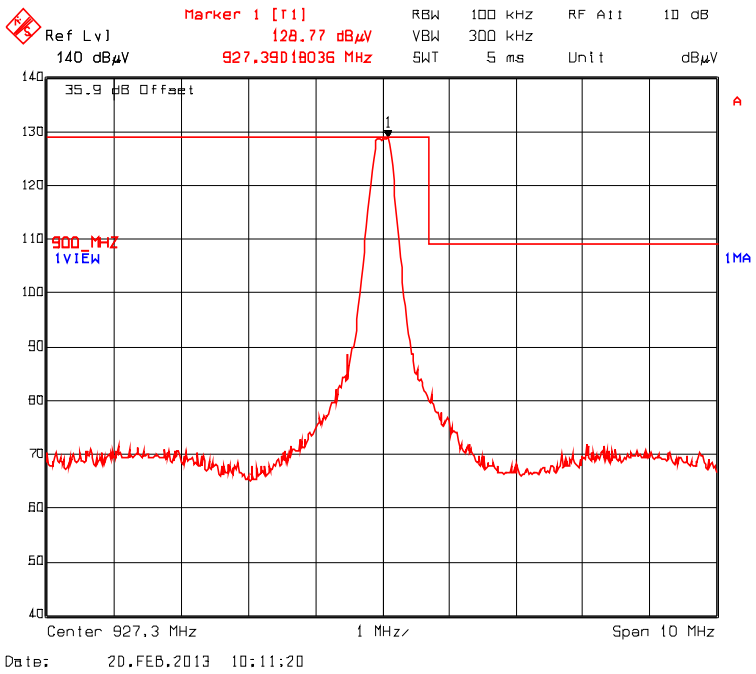
Plot 5.6.4.1.2.13. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 250, Single Frequency Mode



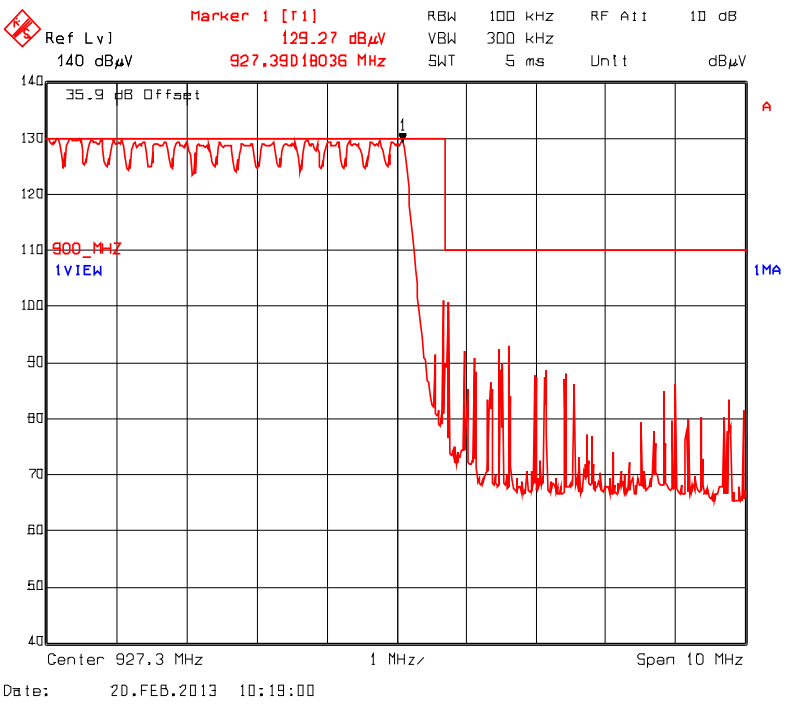
Plot 5.6.4.1.2.14. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 250, Hopping Mode



Plot 5.6.4.1.2.15. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 250, Single Frequency Mode



Plot 5.6.4.1.2.16. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 250, Hopping Mode



5.6.4.2. EUT connected with 9.15 dBi Omni Antenna & 3 dB Attenuator

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.
- Both Modem 125 & Modem 250 modes were pre-scanned and found that Modem 125 results are the worst-case measurements as tabulated below.

5.6.4.2.1. Spurious Radiated Emissions

Fundamental Frequency:	902.7 MHz
Measured Conducted Power:	29.99 dBm
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
902.7	130.41	--	V	--	--	--	--
902.7	129.16	--	H	--	--	--	--
2708.1	51.76	49.13	V	54.0	110.4	-4.9	Pass*
2708.1	51.70	48.27	H	54.0	110.4	-5.7	Pass*
3610.8	46.68	35.84	V	54.0	110.4	-18.2	Pass*
4513.5	50.78	43.50	V	54.0	110.4	-10.5	Pass*
4513.5	48.42	37.54	H	54.0	110.4	-16.5	Pass*
5416.2	50.21	39.41	V	54.0	110.4	-14.5	Pass*
5416.2	50.11	42.20	H	54.0	110.4	-11.8	Pass*
8124.3	54.61	43.25	V	54.0	110.4	-10.7	Pass*
8124.3	56.01	44.15	H	54.0	110.4	-9.8	Pass*
9027.0	55.63	42.03	V	54.0	110.4	-12.0	Pass*
9027.0	55.72	42.57	H	54.0	110.4	-11.4	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.

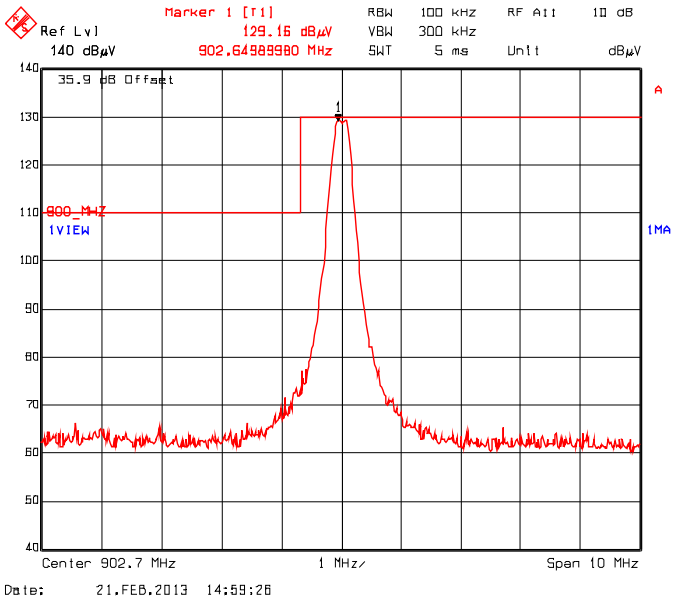
Fundamental Frequency:	915.0 MHz						
Measured Conducted Power:	29.99 dBm						
Frequency Test Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
915.0	128.42	--	V	--	--	--	--
915.0	126.61	--	H	--	--	--	--
2745.0	51.44	48.18	V	54.0	108.4	-5.8	Pass*
2745.0	50.69	47.53	H	54.0	108.4	-6.5	Pass*
4575.0	51.49	44.23	V	54.0	108.4	-9.8	Pass*
4575.0	50.38	43.67	H	54.0	108.4	-10.3	Pass*
7320.0	52.38	39.68	V	54.0	108.4	-14.3	Pass*
7320.0	54.78	44.38	H	54.0	108.4	-9.6	Pass*
8235.0	54.70	42.17	V	54.0	108.4	-11.8	Pass*
8235.0	55.15	44.38	H	54.0	108.4	-9.6	Pass*
9150.0	55.14	41.86	V	54.0	108.4	-12.1	Pass*
9150.0	55.19	42.41	H	54.0	108.4	-11.6	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

Fundamental Frequency:	927.3 MHz						
Measured Conducted Power:	29.99 dBm						
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**
927.3	127.00	--	V	--	--	--	--
927.3	125.10	--	H	--	--	--	--
2781.9	51.27	47.64	V	54.0	107.0	-6.4	Pass*
2781.9	50.62	46.72	H	54.0	107.0	-7.3	Pass*
4636.5	47.31	39.20	V	54.0	107.0	-14.8	Pass*
4636.5	48.62	39.19	H	54.0	107.0	-14.8	Pass*
7418.4	50.67	39.29	V	54.0	107.0	-14.7	Pass*
7418.4	51.13	40.93	H	54.0	107.0	-13.1	Pass*
8345.7	53.80	41.46	V	54.0	107.0	-12.5	Pass*
8345.7	54.96	43.66	H	54.0	107.0	-10.3	Pass*
9273.0	54.38	40.84	V	54.0	107.0	-13.2	Pass*
9273.0	54.92	41.14	H	54.0	107.0	-12.9	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

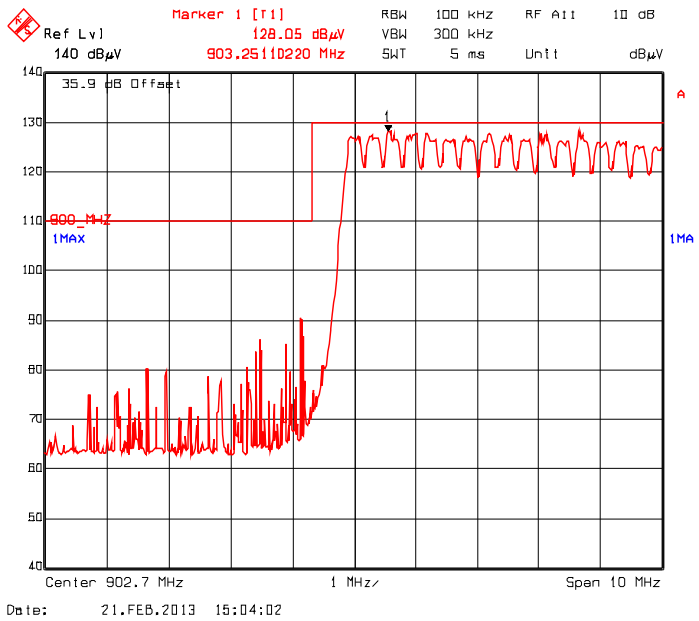
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.6.4.2.2. Band-Edge RF Radiated Emissions

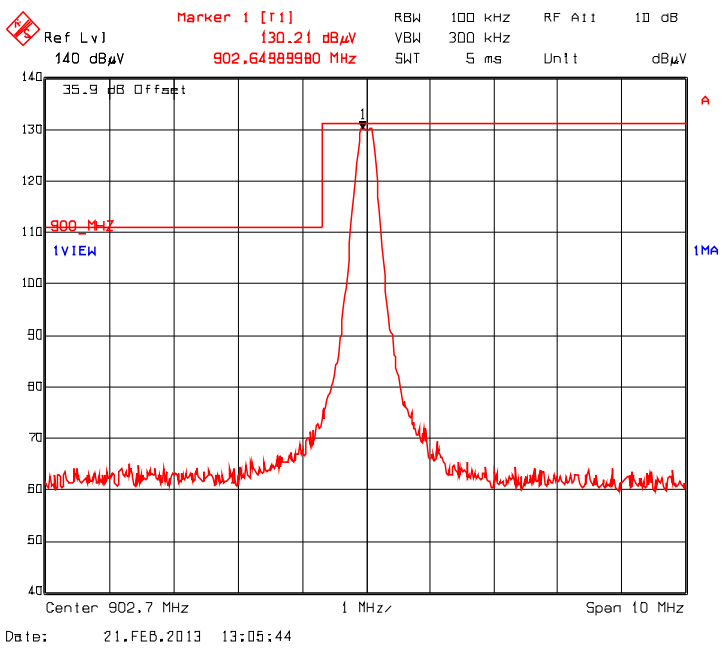
Plot 5.6.4.2.2.1. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 125, Single Frequency Mode



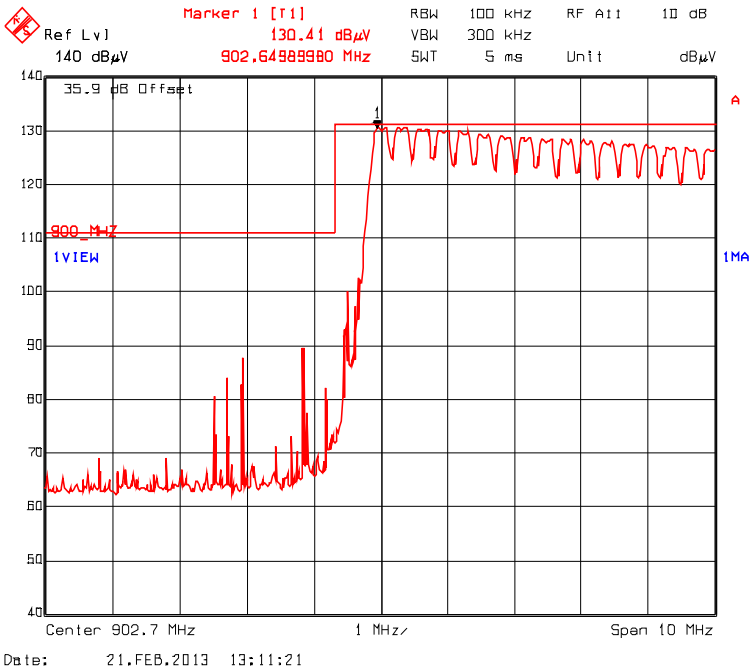
Plot 5.6.4.2.2.2. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 125, Hopping Mode



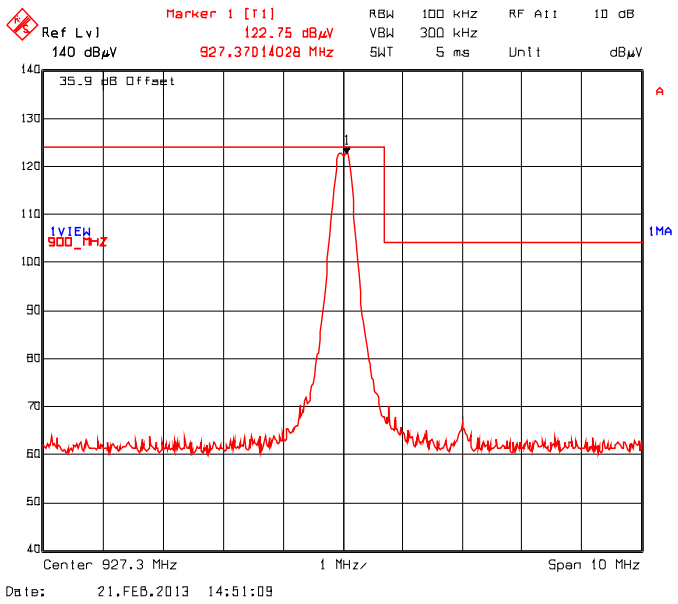
Plot 5.6.4.2.2.3. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 125, Single Frequency Mode



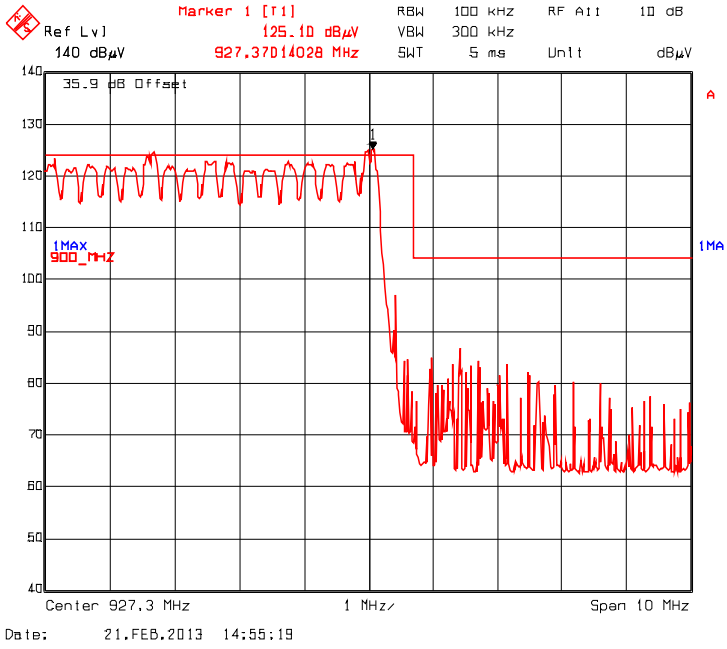
Plot 5.6.4.2.2.4. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 125, Hopping Mode



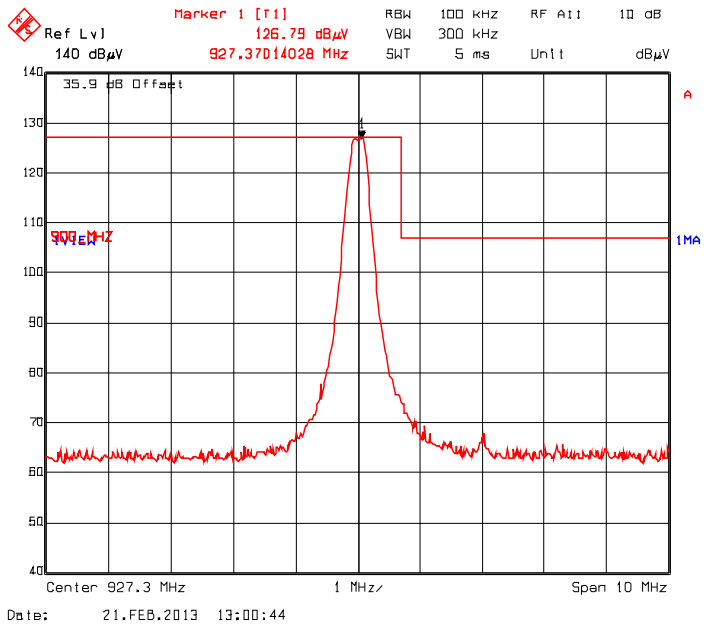
Plot 5.6.4.2.2.5. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 125, Single Frequency Mode



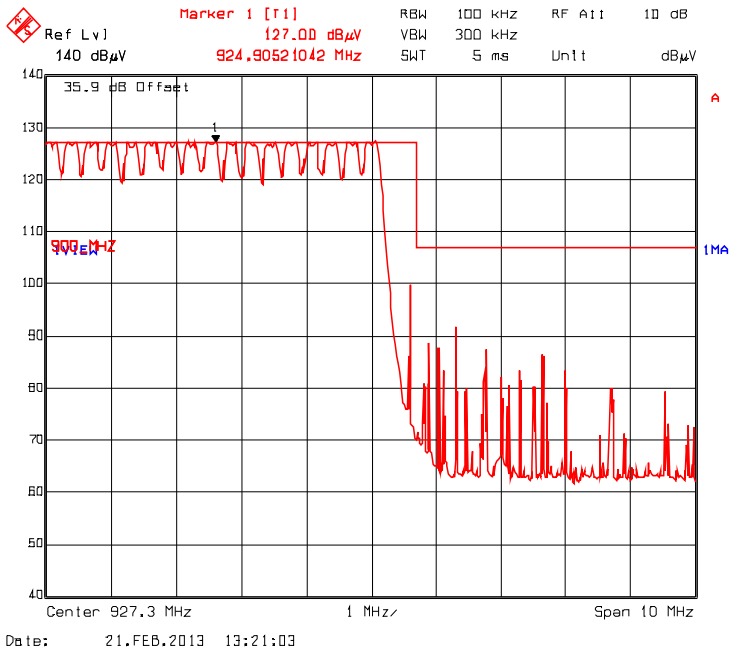
Plot 5.6.4.2.2.6. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 125, Hopping Mode



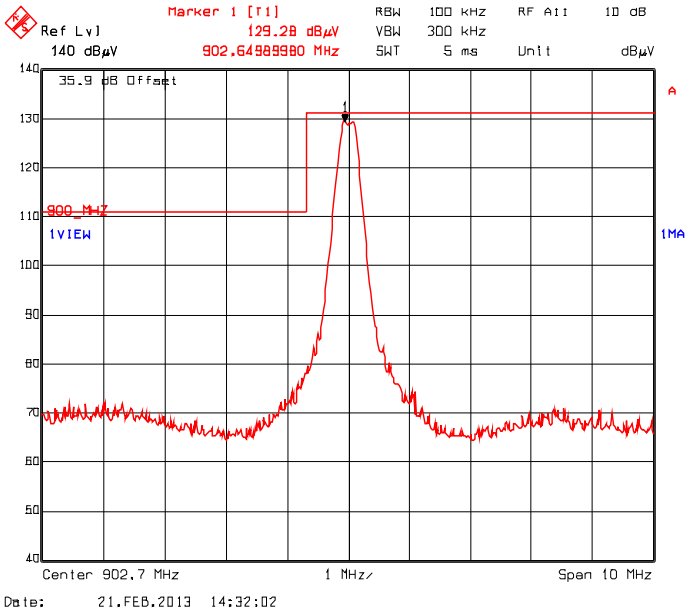
Plot 5.6.4.2.2.7. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 125, Single Frequency Mode



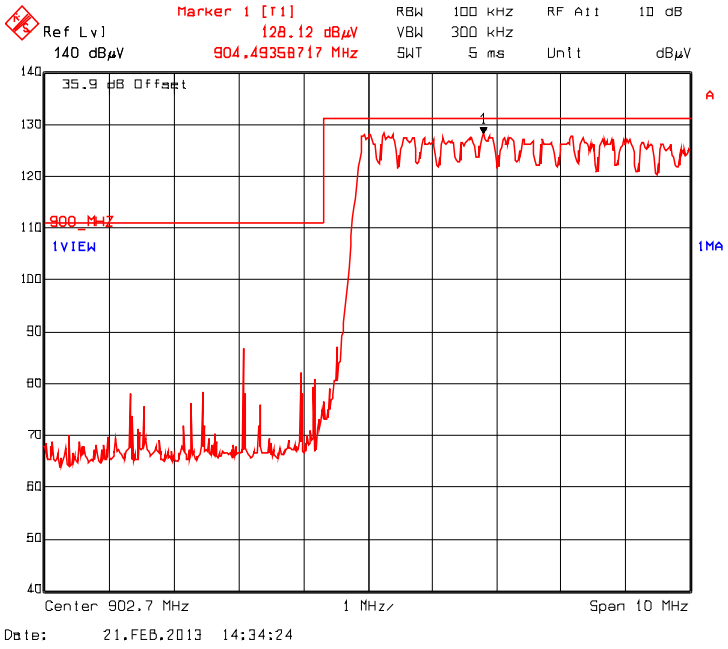
Plot 5.6.4.2.2.8. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 125, Hopping Mode



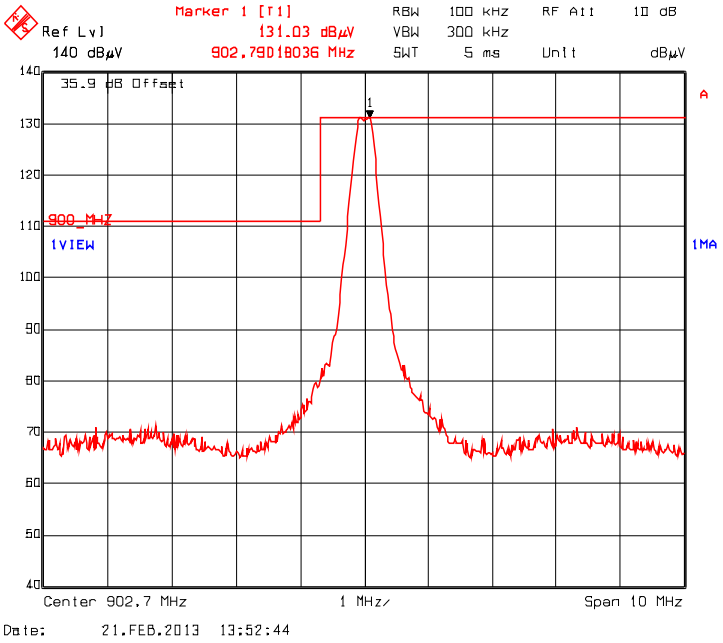
Plot 5.6.4.2.2.9. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 250, Single Frequency Mode



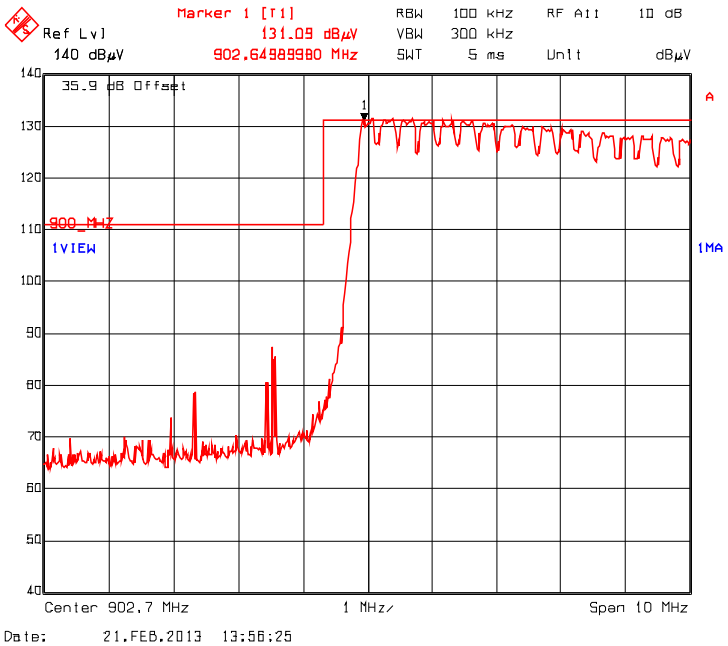
Plot 5.6.4.2.2.10. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 250, Hopping Mode



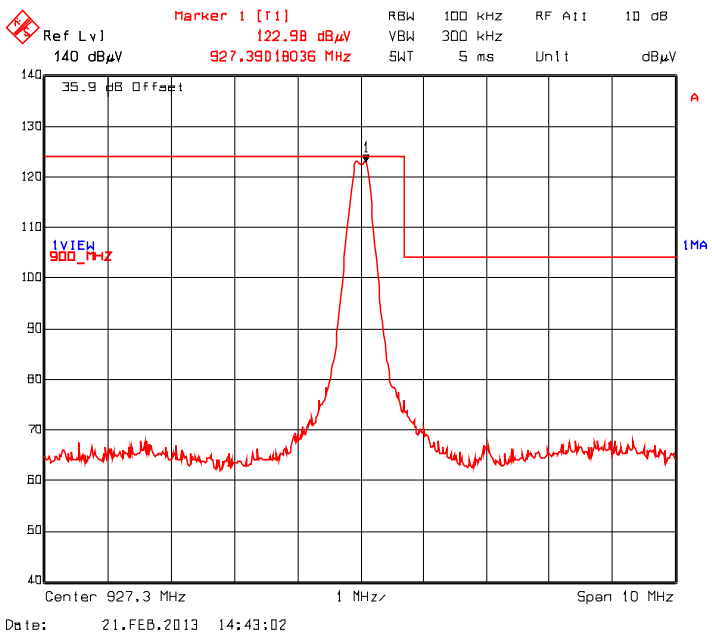
Plot 5.6.4.2.2.11. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 250, Single Frequency Mode



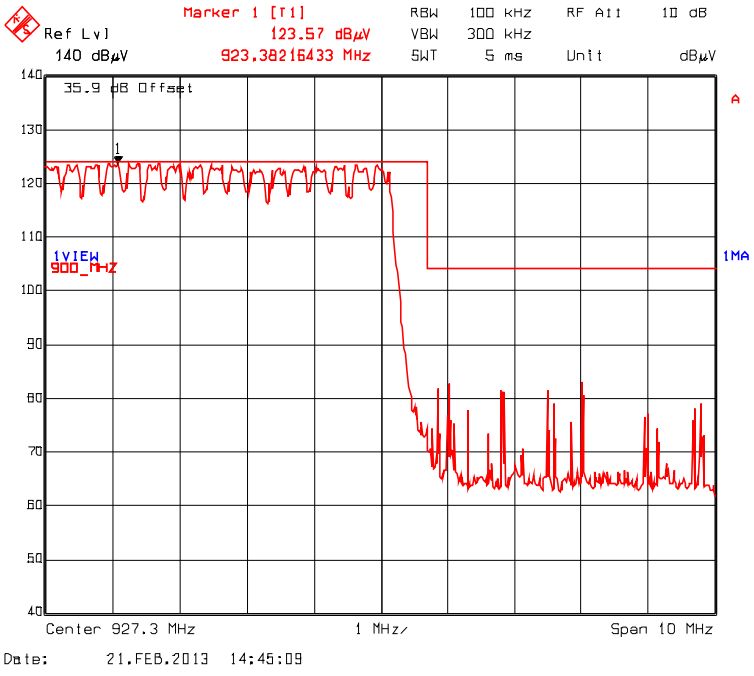
Plot 5.6.4.2.2.12. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 902.7 MHz, FHSS Modem 250, Hopping Mode



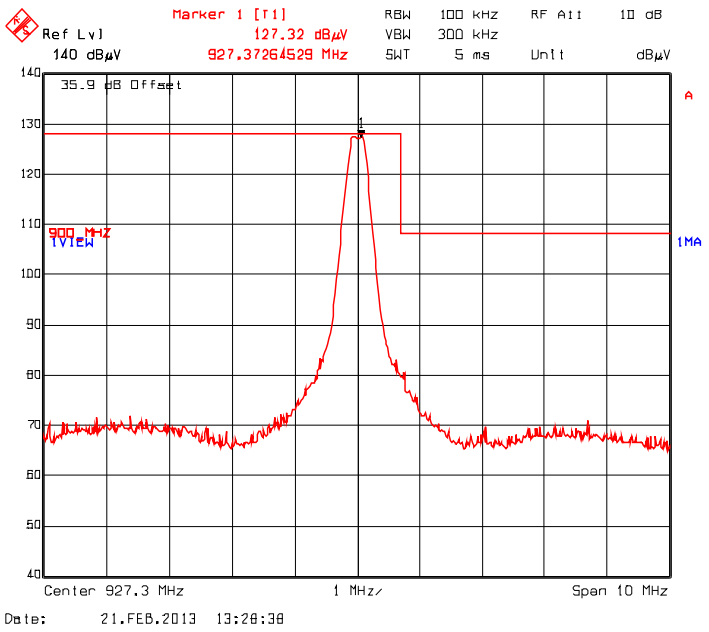
Plot 5.6.4.2.2.13. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 250, Single Frequency Mode



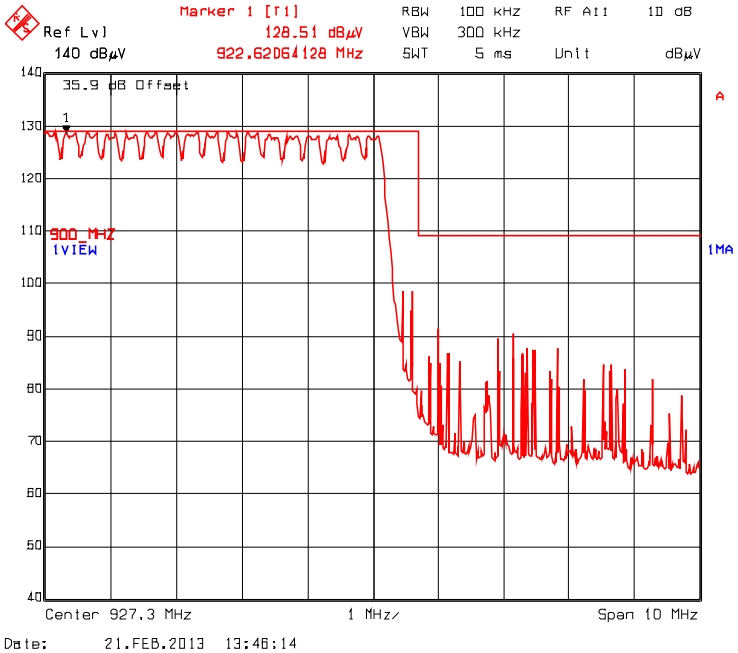
Plot 5.6.4.2.2.14. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 250, Hopping Mode



Plot 5.6.4.2.2.15. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 250, Single Frequency Mode



Plot 5.6.4.2.2.16. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High End of Frequency Band, 927.3 MHz, FHSS Modem 250, Hopping Mode



5.7. 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.

5.7.1. 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

5.7.2. RF Evaluation

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum separation distance between antenna and persons required: **22.98 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 = 0.6 mW/cm^2
EIRP = 36.0 dBm = $10^{36/10}$ mW = 3981 mW (Worst Case)

(Minimum Safe Distance, r) = $\sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}} = \sqrt{\frac{3981}{4 \cdot \pi \cdot (0.6)}} \approx 22.98cm$

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Hewlett Packard	E7401A	US40240432	9 kHz–1.5 GHz	1 May 2013
L.I.S.N	EMCO	3825/2	8907-1531	10 kHz -100 MHz	05 Apr 2013
Attenuator	Pasternack	PE7010-20	-	DC – 2 GHz	11 Jan 2014
Signal Generator	Hewlett Packard	8648C	3443U00391	100 kHz-3200 MHz	03 Jan 2014
DC Power Supply	Kenwood	PD56-10	3010008	1 – 56 Vdc	Cal on use
Band Pass Filter	Telemeter Electronics	MTA-HPF-150	2110465-007	-	17 Aug 2013
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20Hz–40 GHz	02 Nov 2013
Attenuator	Narda	4768-20	-	DC–40 GHz	Cal on use
DC Block	Hewlett Packard	11742A	12460	0.045–26.5 GHz	Cal on use
High Pass Filter	K & L	11SH10-4000/T12000	4	Cut off 2400 MHz	Cal on use
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	19 Mar 2013
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	06 Aug 2013
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	16 Mar 2013
Attenuator	Pasternack	PE7024-10	-	DC–26.5 GHz	Cal on use
Horn Antenna	EMCO	3115	6570	1 -18 GHz	02 Apr 2013
Biconi-Log Antenna	EMCO	3142B	1575	26 – 3000 MHz	04 May 2013
Log Periodic	EMCO	93148	1101	200 – 2000 MHz	02 Apr 2013
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

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