ENGINEERING TEST REPORT

XTend
Model: XT09B
FCC ID: MCQ-9XTENDB

Applicant:

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

In Accordance With

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

UltraTech's File No.: DIGI-068F15C247

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

Date: September 10, 2012

Report Prepared by: Dan Huynh	Tested by: Mr. Hung Trinh
Issued Date: September 10, 2012	Test Dates: July 22 - August 28, 2012

- *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 91038 | VCCI 1309 | Industry Canada / Industrie Canada Approved Test Facility 46390-2049 | NVLAP NvLap Lab Code 200093-0 | BSMI SL2-IN-E-1119R | Korea KCC-RRL 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 – Radio Frequency Devices
Purpose of Test:	Equipment Certification for Frequency Hopping Spread Spectrum Transceiver Operating within the Frequency Band 902-928 MHz.
Test Procedures:	ANSI C63.4 ANSI C63.10 FCC Public Notice DA 00-705
Environmental Classification:	[x] Commercial, industrial or business environment [x] Residential environment

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

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2011	Code of Federal Regulations (CFR), Title 47 – Telecommunication
ANSI C63.4	2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
CISPR 22 & EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances
FCC Public Notice DA 00-705	2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
FCC ET Docket No. 99-231	2002	Amendment to FCC Part 15 of the Commission's Rules Regarding to Spread Spectrum Devices

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

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

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

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

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

Brand Name:	Digi International Inc
Product Name:	XTend
Model Name or Number:	XT09B
Serial Number:	Test Sample
Type of Equipment:	Spread Spectrum Transmitter
Input Power Supply Type:	External Regulated DC Sources
Primary User Functions of EUT:	Long range drop-in wireless solution for embedded systems in 902-928MHz band

2.3. EUT'S TECHNICAL SPECIFICATIONS

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

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

Antenna Type	Maximum Gain (dBi)
Monopole antenna	2.1
Multi-path antenna	3.0
Omni-directional antenna	8.1
Yagi antenna	15.1
The highest gain antenna from each of the above antenna types were selected for testing to represents the worst-case. Refer to user manual for antennas list information.	

2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	RF IN/OUT Port	1	RPSMA/MMCX	Shielded
2	DC Supply & I/O Port	1	Pin Header	No cable, direct connection

2.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Test Jig Cable
Brand name:	Digi International Inc.
Model Name or Number:	N/A
Serial Number:	N/A
Connected to EUT's Port:	Module pin signals

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power Input Source:	5.5 VDC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	▪ Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements. ▪ The EUT operates in normal Frequency Hopping mode for occupancy duration, and frequency separation.
Special Test Software:	Special software provided by the Applicant to operate the EUT at each channel frequency continuously and in the range of typical modes of operation.
Special Hardware Used:	Test Jig
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as non-integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	902.9-927.1 MHz
Frequency(ies) Tested: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	902.9, 915.2 and 927.1 MHz
RF Power Output: (measured maximum output power at antenna terminals)	1 W (conducted)
Normal Test Modulation:	FSK, GFSK
Modulating Signal Source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2014-04-04.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	Yes
15.207(a)	Power Line Conducted Emissions Measurements	Yes
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	Transmitter Spurious Radiated Emissions	Yes
15.247(i), 1.1307, 1.1310, 2.1091	RF Exposure	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

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

5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

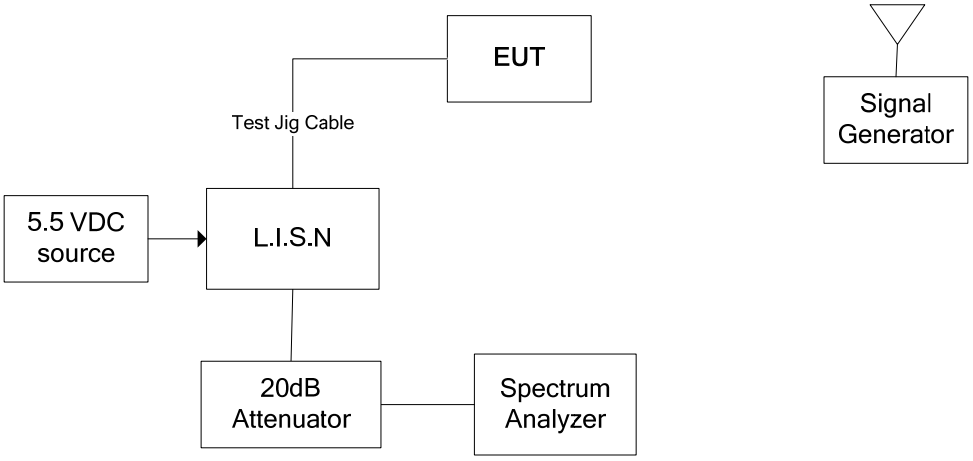
Frequency of emission (MHz)	Conducted Limits (dBμV)	
	Quasi-peak	Average
0.15–0.5 .....……..	66 to 56*	56 to 46*
0.5–5 .....……..	56	46
5-30 …….....	60 …….....	50

*Decreases linearly with the logarithm of the frequency

5.1.2. Method of Measurements

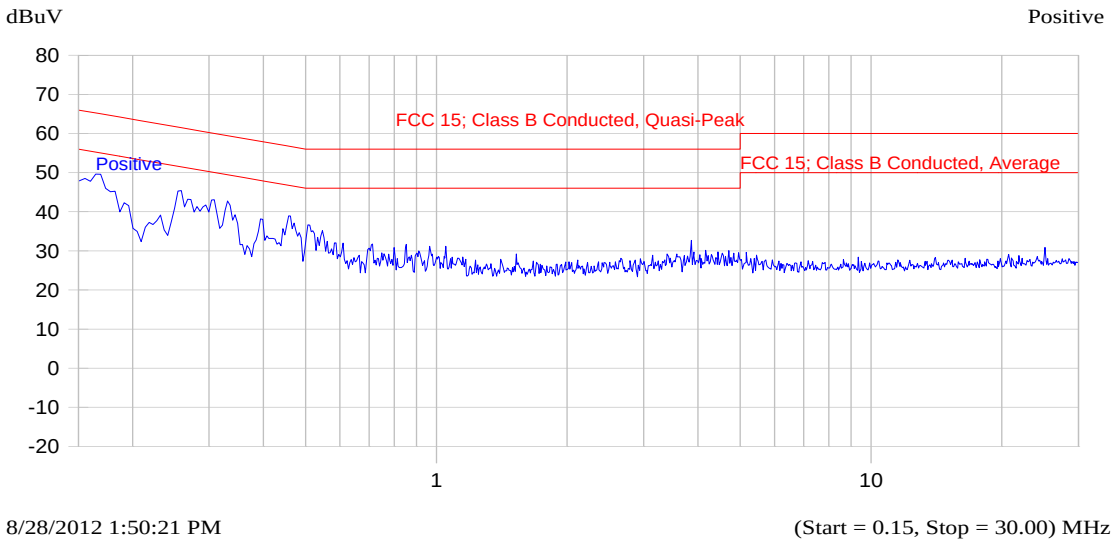
ANSI C63.4-2009

5.1.3. Test Arrangement



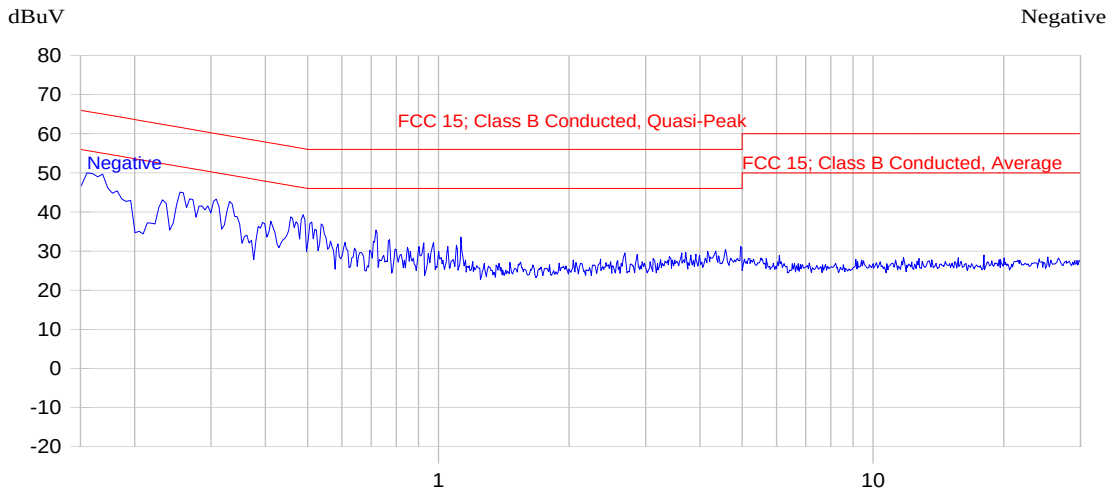
5.1.4. Test Data

Plot 5.1.4.1. Power Line Conducted Emissions, Tx Mode, Line Voltage: 5.5 VDC, Line Tested: Positive



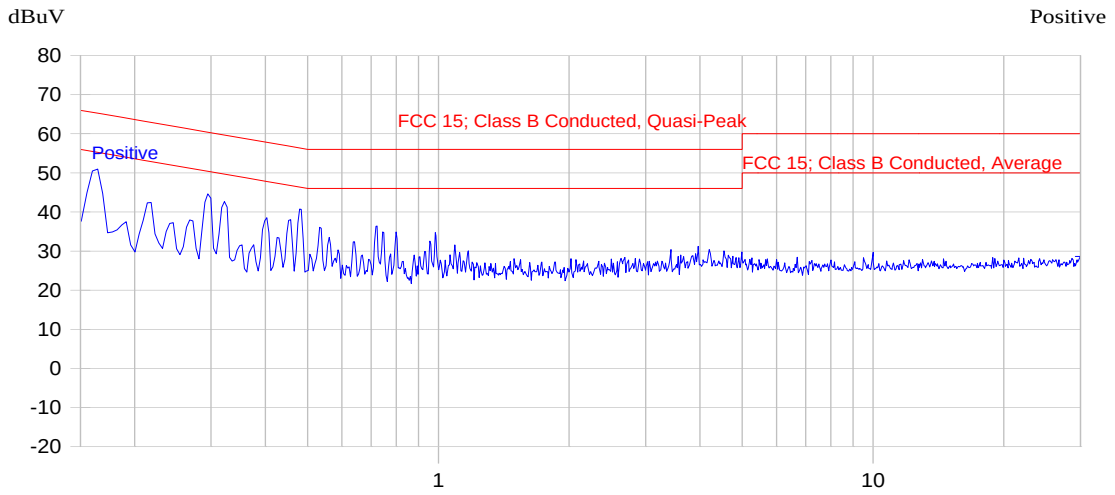
Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.164	43.2	32.7	-32.9	28.0	-27.6	Positive
0.255	41.4	41.4	-21.5	40.6	-12.3	Positive
0.329	39.3	38.0	-22.8	39.4	-11.4	Positive
0.455	34.5	34.5	-22.8	27.9	-19.4	Positive

Plot 5.1.4.2. Power Line Conducted Emissions, Tx Mode, Line Voltage: 5.5 VDC, Line Tested: Negative



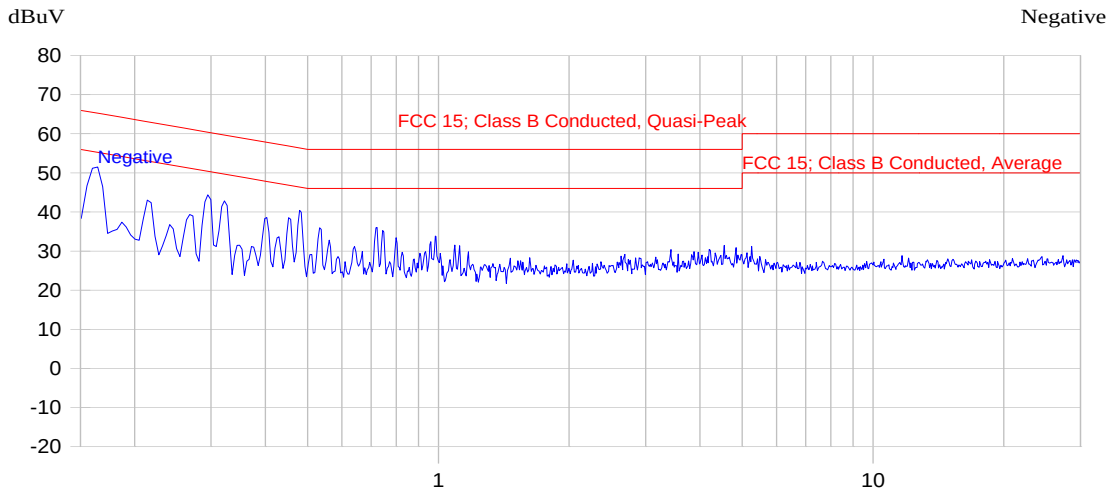
Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.164	48.6	48.6	-17.0	28.2	-27.3	Negative
0.257	38.7	37.0	-25.8	38.5	-14.4	Negative
0.329	41.6	41.6	-19.2	37.7	-13.1	Negative
0.485	33.6	33.6	-22.8	25.2	-21.2	Negative

Plot 5.1.4.3. Power Line Conducted Emissions, Rx Mode, Line Voltage: 5.5 VDC, Line Tested: Positive



Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.159	51.8	50.6	-15.1	50.1	-5.7	Positive
0.292	44.7	43.9	-18.0	43.5	-8.3	Positive
0.477	40.6	39.6	-17.0	39.2	-7.4	Positive

Plot 5.1.4.4. Power Line Conducted Emissions, Rx Mode, Line Voltage: 5.5 VDC, Line Tested: Negative



Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.159	52.2	50.7	-15.0	50.2	-5.6	Negative
0.291	44.9	43.7	-18.2	43.4	-8.5	Negative
0.478	40.6	39.6	-17.0	39.2	-7.4	Negative

5.2. COMPLIANCE WITH FCC PART 15 – GENERAL TECHNICAL REQUIREMENTS

FCC Section	FCC Rules	Manufacturer's Clarification
15.31(m)	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.	Hoping function was disabled for the required tests at low, middle and high channels.
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	Employs unique antenna connectors: Reverse Polarity SMA or MMCX
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.
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
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

FCC Section	FCC Rules	Manufacturer's Clarification
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)]

5.3.1. Limits

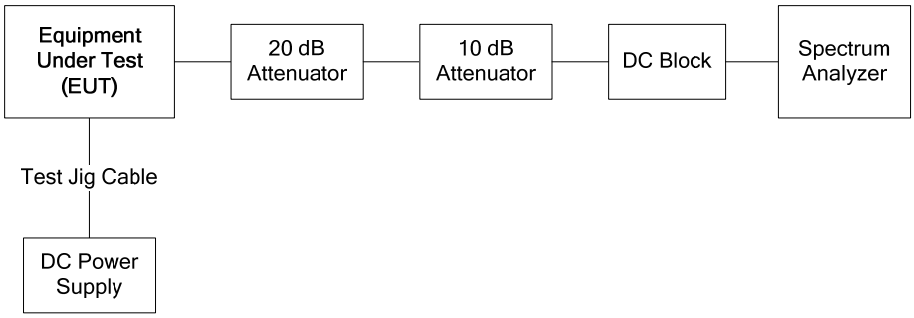
§ 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier 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.

5.3.2. Method of Measurements

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

5.3.3. Test Arrangement



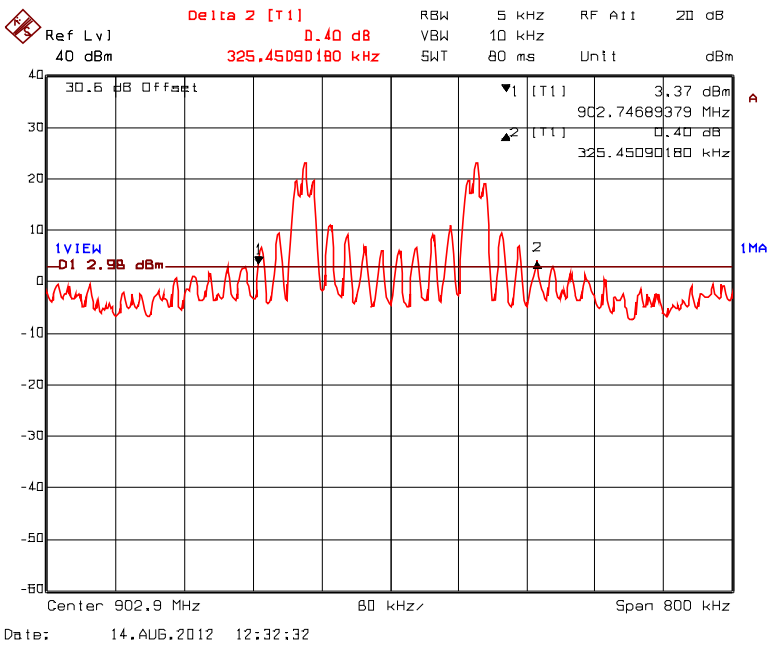
5.3.4. Test Data

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	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. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.	341.48 kHz	See Note 2
Channel Hopping Frequency Separation	Minimum of 25 kHz or 20dB BW, whichever is greater.	354.31 kHz	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.	70 hopping frequencies	See Note 1 and 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	286 ms	See Note 2

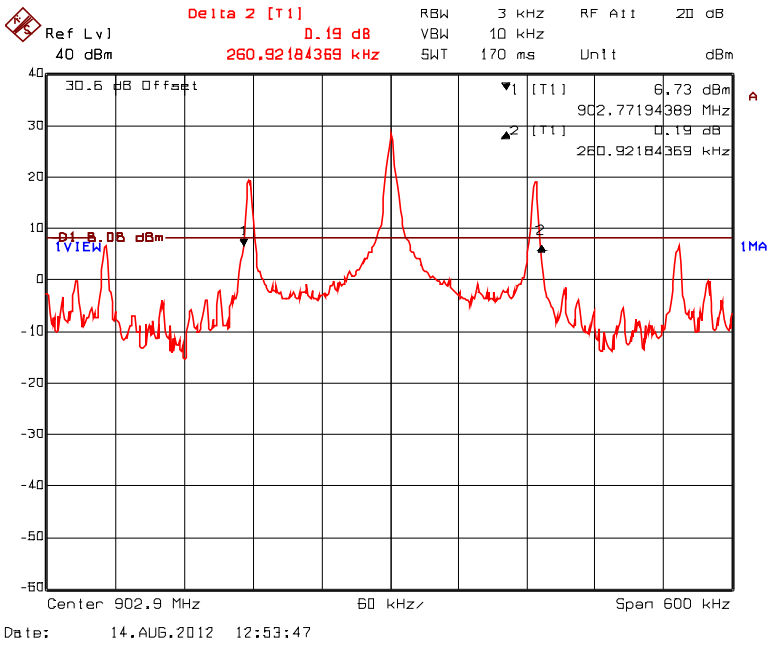
Note 1: See operational description exhibit for details.

Note 2: See the following plots for details.

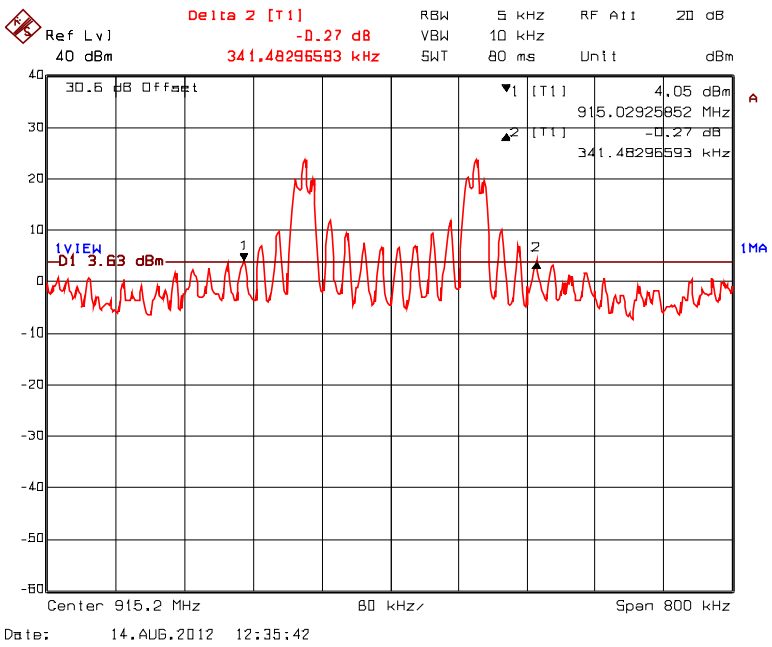
Plot 5.3.4.1. 20 dB Bandwidth, 902.9 MHz, FSK, 10 kbps



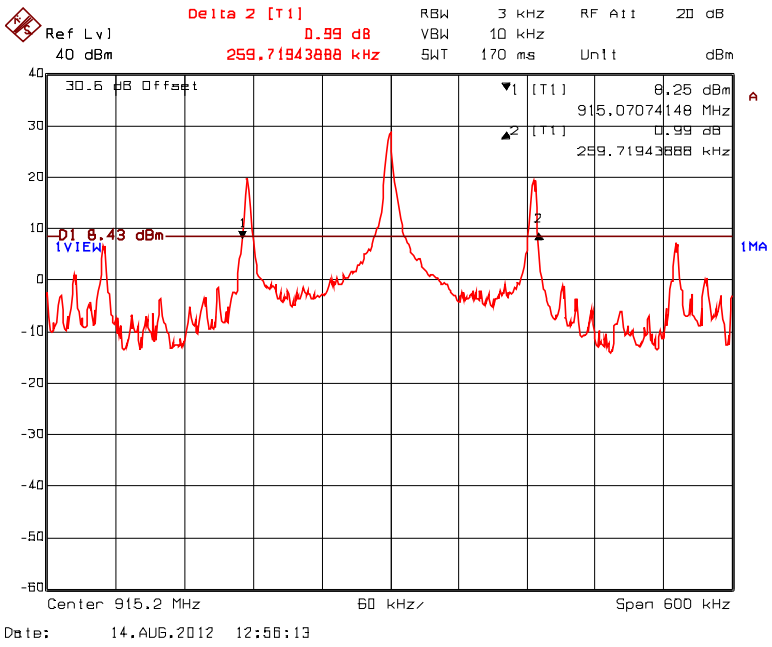
Plot 5.3.4.2. 20 dB Bandwidth, 902.9 MHz, GFSK, 125 kbps



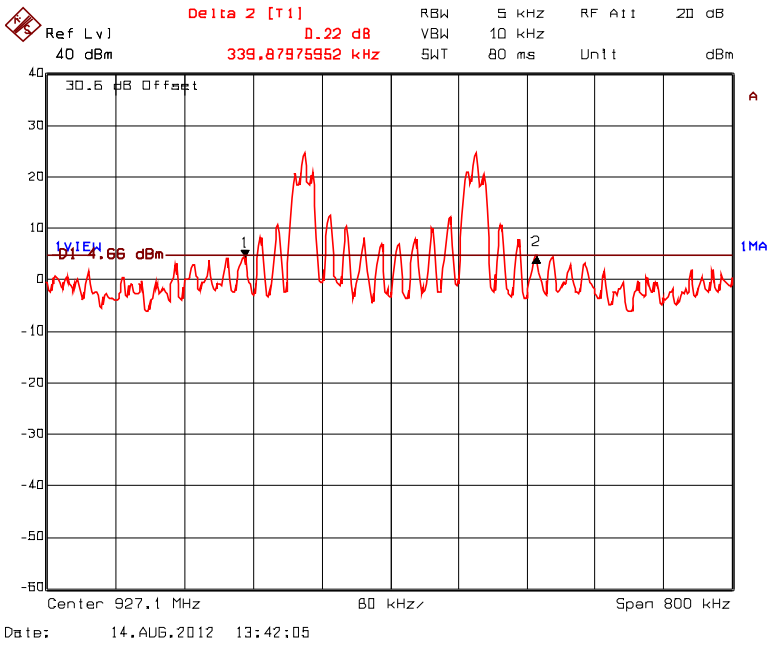
Plot 5.3.4.3. 20 dB Bandwidth, 915.2 MHz, FSK, 10 kbps



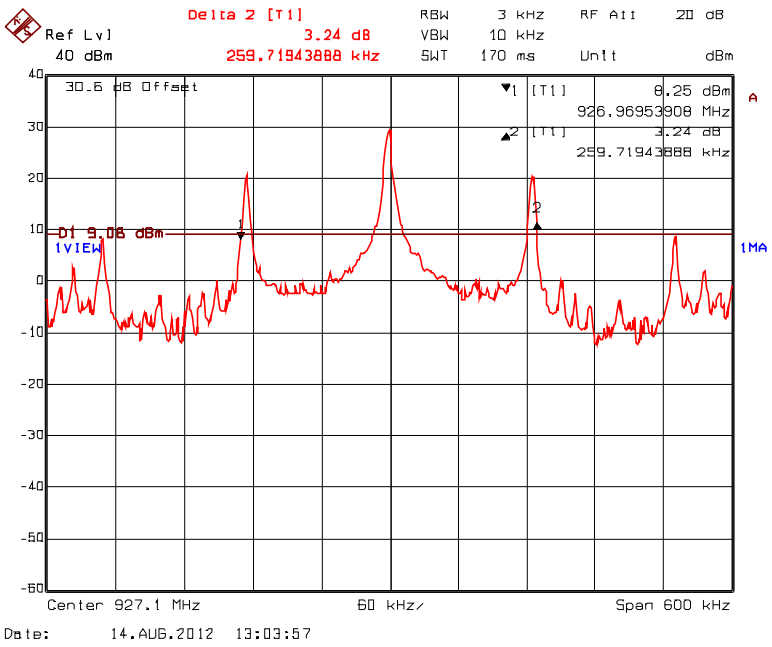
Plot 5.3.4.4. 20 dB Bandwidth, 915.2 MHz, GFSK, 125 kbps



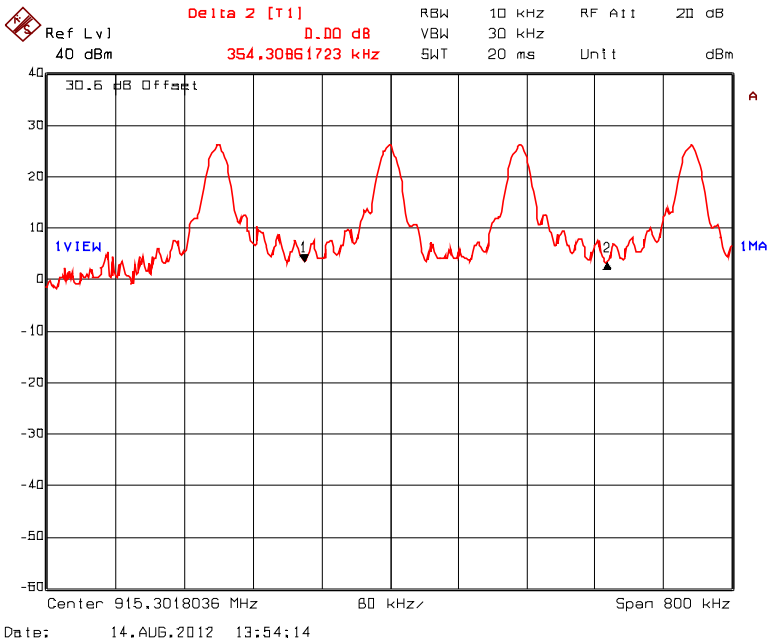
Plot 5.3.4.5. 20 dB Bandwidth, 927.1 MHz, FSK, 10 kbps



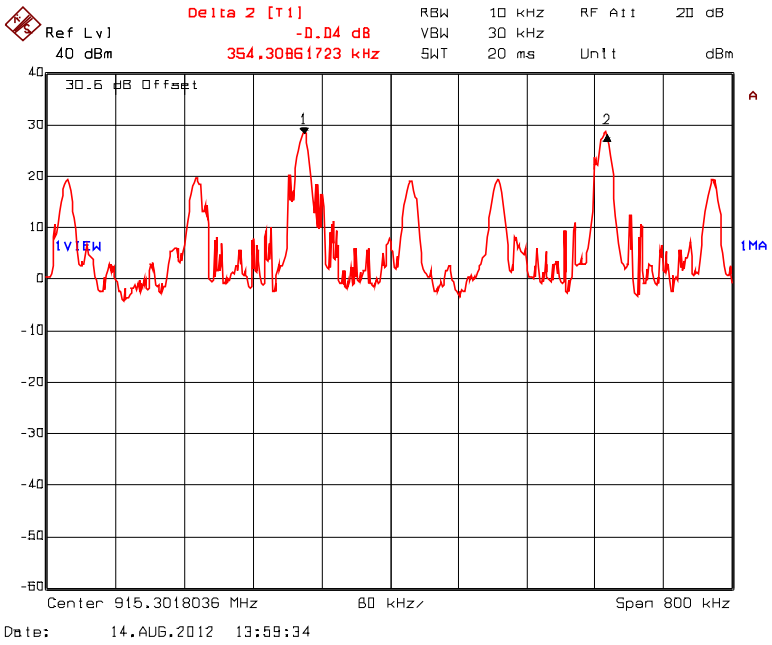
Plot 5.3.4.6. 20 dB Bandwidth, 927.1 MHz, GFSK, 125 kbps



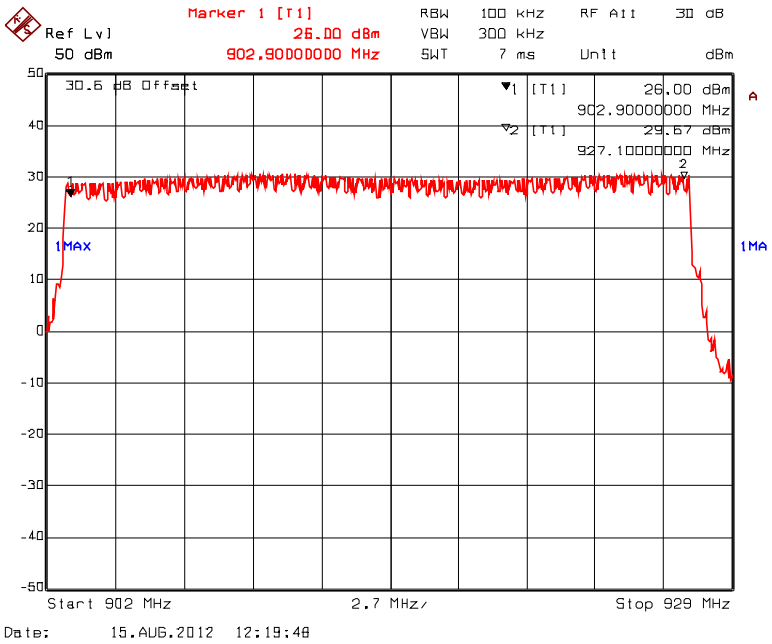
Plot 5.3.4.7. Carrier Frequency Separation, FSK, 10 kbps



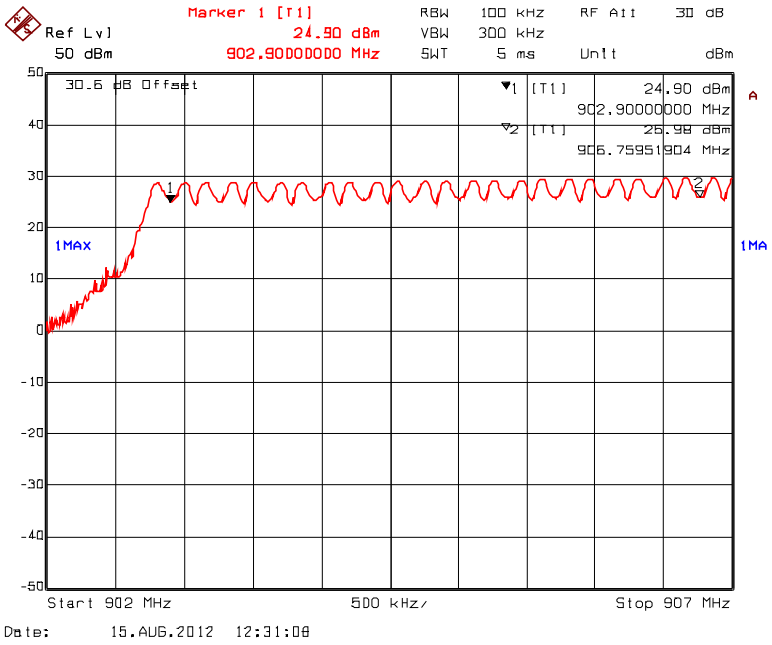
Plot 5.3.4.8. Carrier Frequency Separation, GFSK, 125 kbps



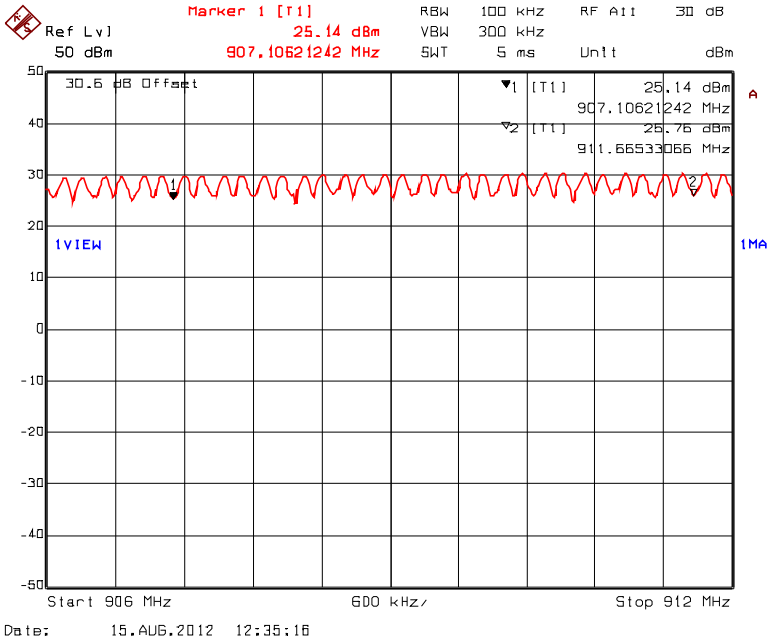
Plot 5.3.4.9. Number of Hopping Frequencies, FSK, 10 kbps, 70 Hopping Channels from 902-928 MHz



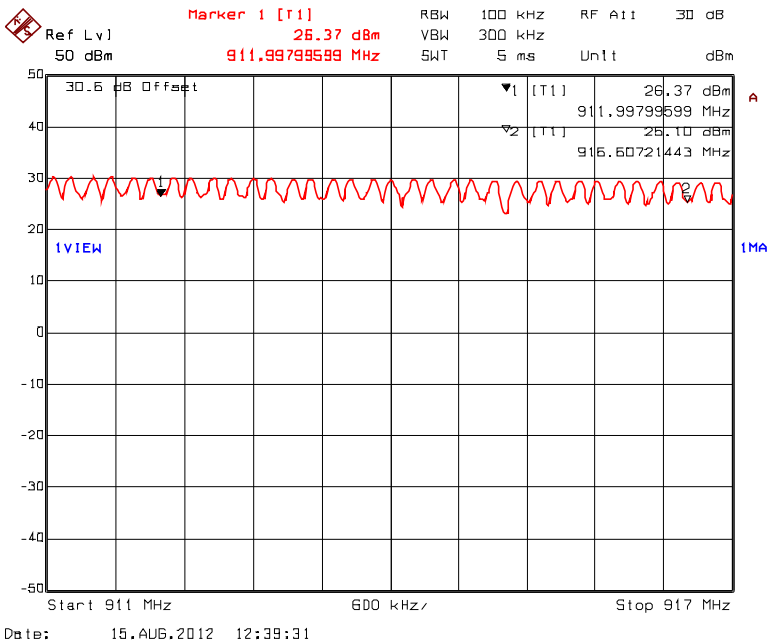
Plot 5.3.4.10. Number of Hopping Frequencies, FSK, 10 kbps, 12 Hopping Channels from 902.9 – 906.8 MHz



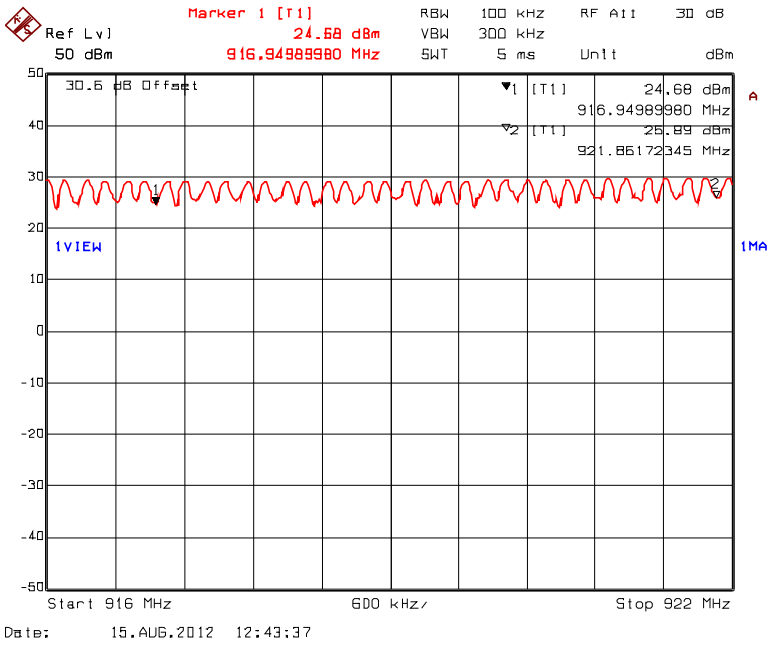
Plot 5.3.4.11. Number of Hopping Frequencies, FSK, 10 kbps, 14 Hopping Channels from 907.1 – 911.7 MHz



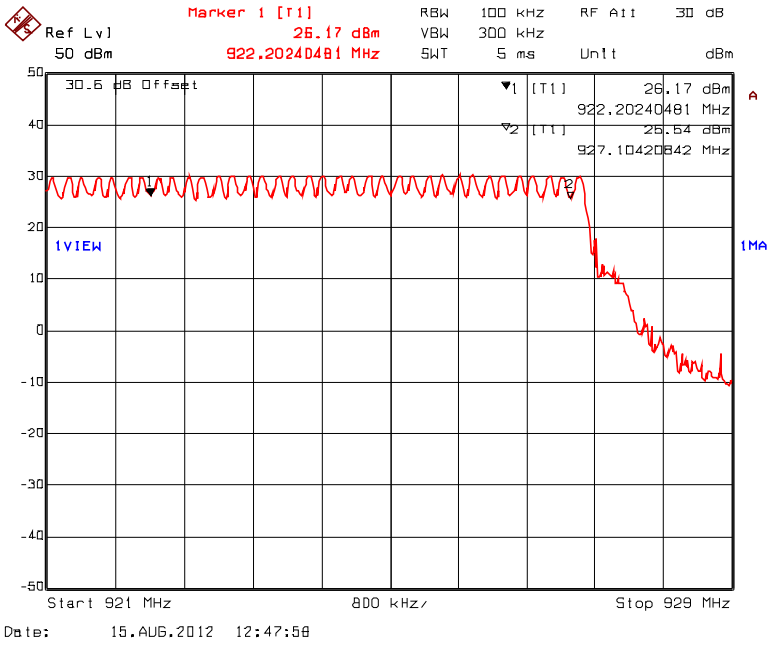
Plot 5.3.4.12. Number of Hopping Frequencies, FSK, 10 kbps, 14 Hopping Channels from 912.0 – 916.6 MHz



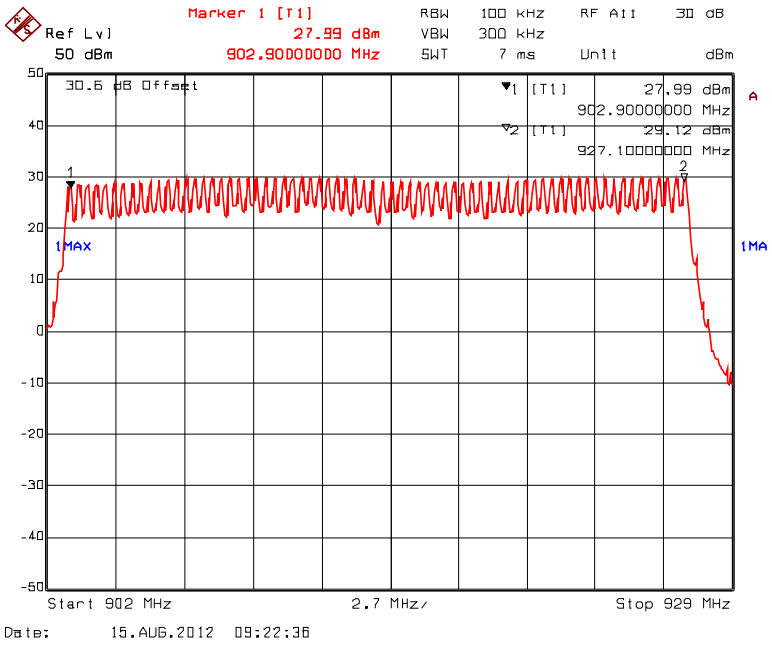
Plot 5.3.4.13. Number of Hopping Frequencies, FSK, 10 kbps, 15 Hopping Channels from 916.9 – 921.9 MHz



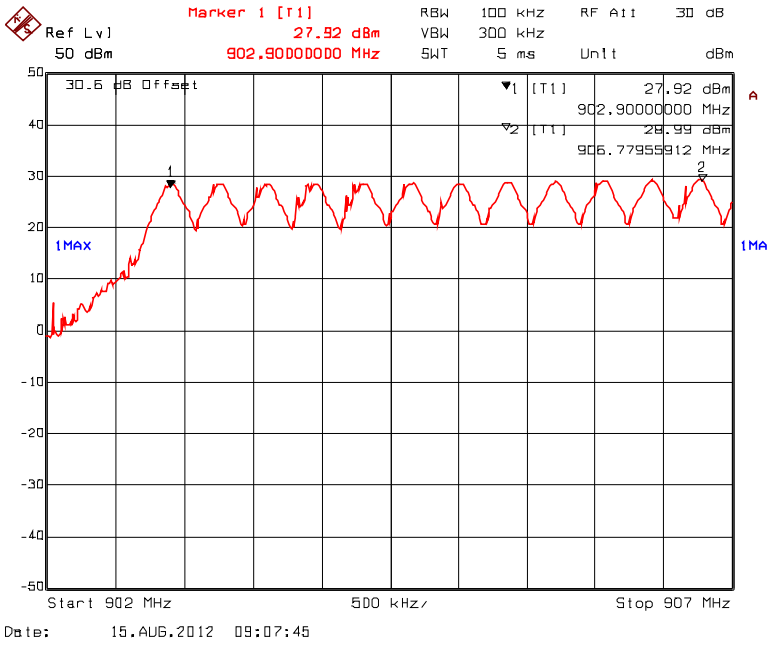
Plot 5.3.4.14. Number of Hopping Frequencies, FSK, 10 kbps, 15 Hopping Channels from 922.2 – 927.1 MHz



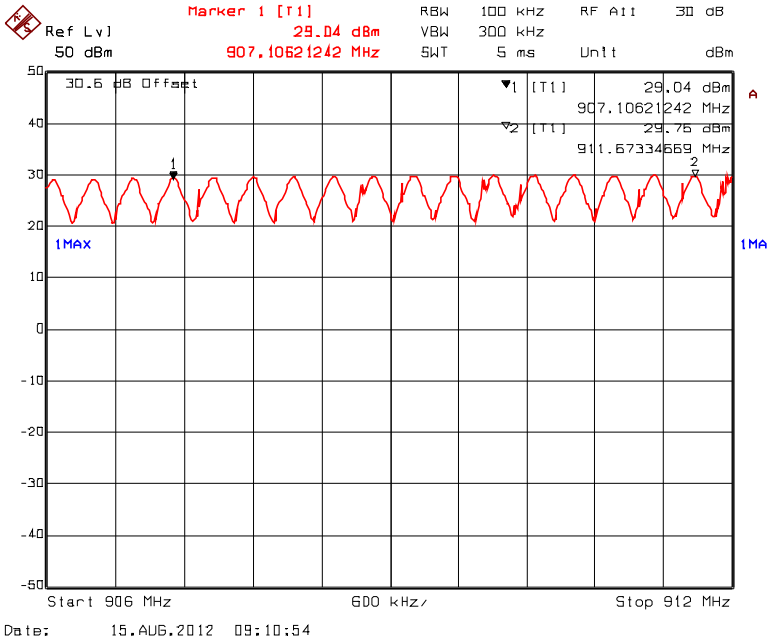
Plot 5.3.4.15. Number of Hopping Frequencies, GFSK, 125 kbps, 70 Hopping Channels from 902-928 MHz



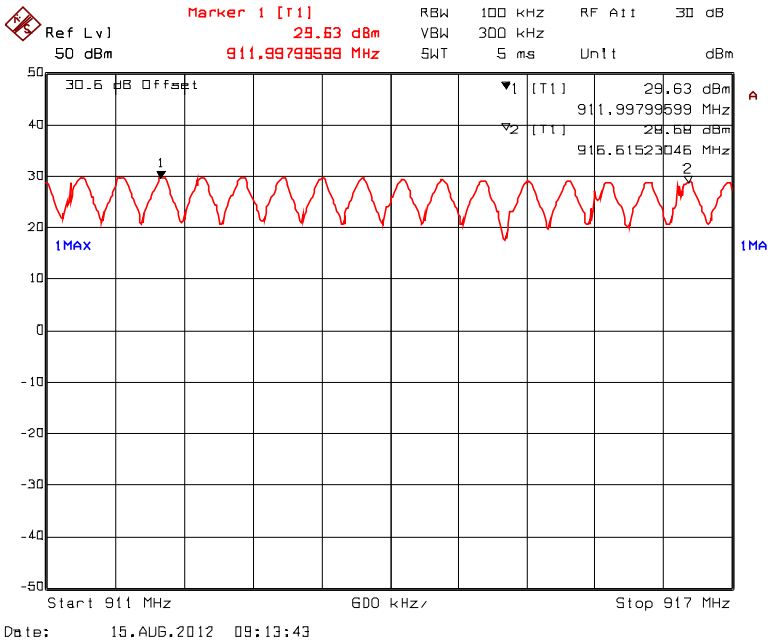
Plot 5.3.4.16. Number of Hopping Frequencies, GFSK, 125 kbps, 12 Hopping Channels from 902.9 – 906.8 MHz



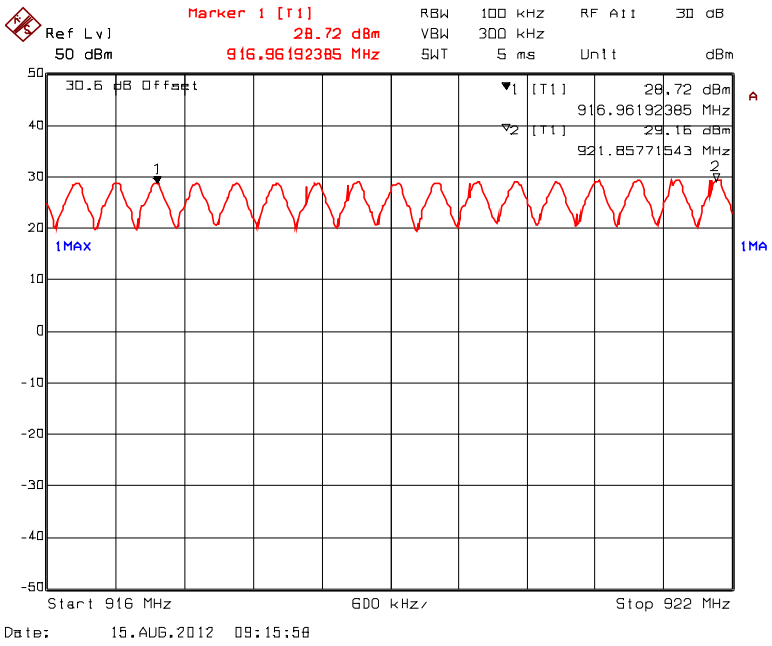
Plot 5.3.4.17. Number of Hopping Frequencies, GFSK, 125 kbps, 14 Hopping Channels from 907.1 – 911.7 MHz



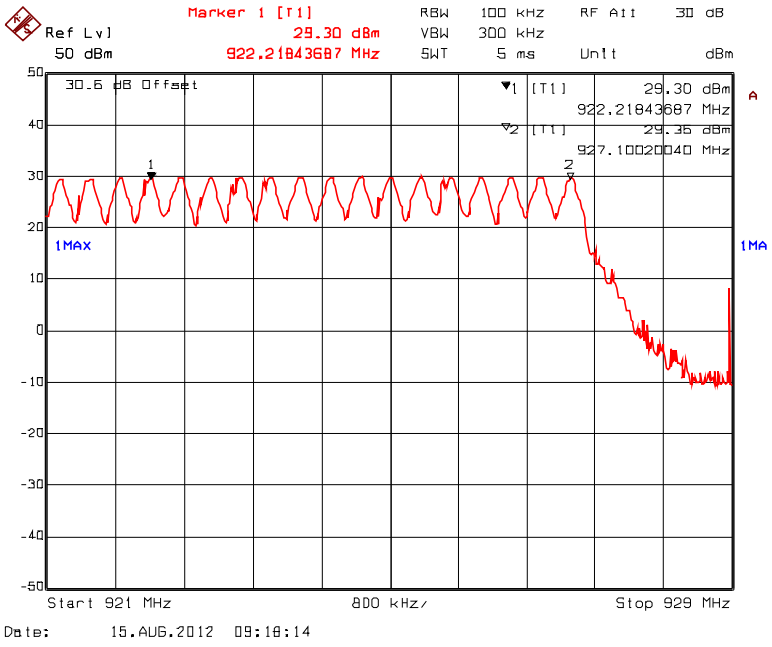
Plot 5.3.4.18. Number of Hopping Frequencies, GFSK, 125 kbps, 14 Hopping Channels from 912.0 – 916.6 MHz



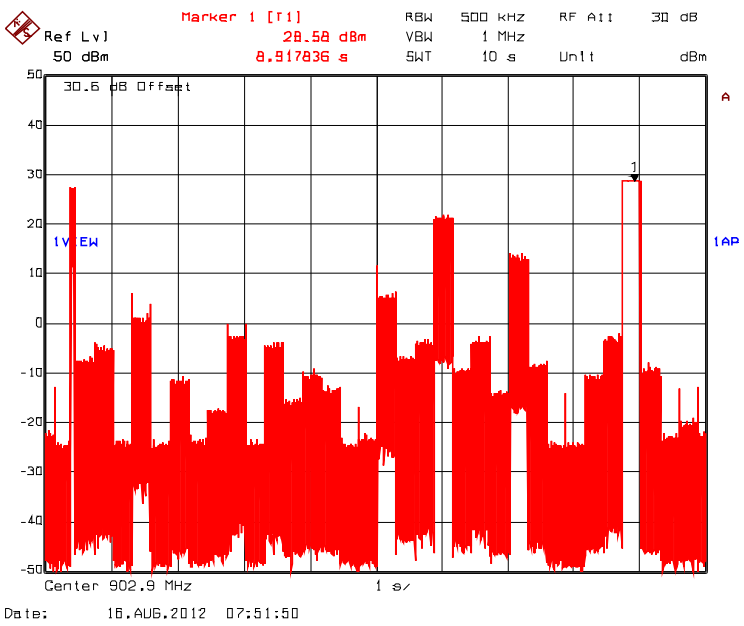
Plot 5.3.4.19. Number of Hopping Frequencies, GFSK, 125 kbps, 15 Hopping Channels from 917.0 – 921.9 MHz



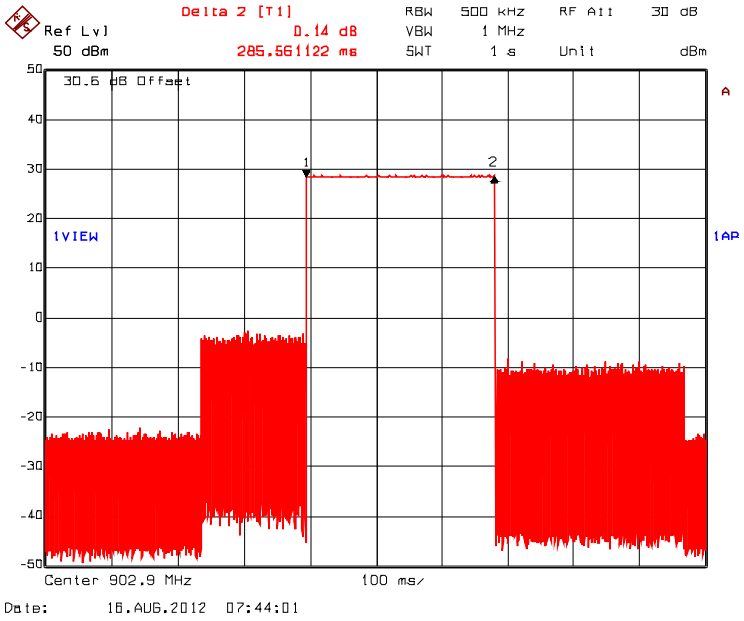
Plot 5.3.4.20. Number of Hopping Frequencies, GFSK, 125 kbps, 15 Hopping Channels from 922.2 – 927.1 MHz



Plot 5.3.4.21. Time of Occupancy, 902.9 MHz, FSK 10 kbps

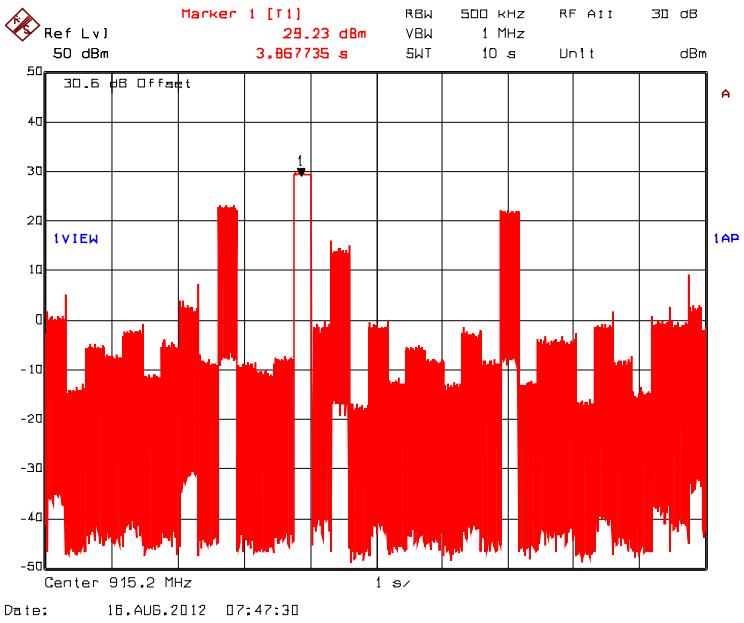


Plot 5.3.4.22. Time of Occupancy, 902.9 MHz, FSK 10 kbps, Dwell Time @ 902.9 MHz = 285.561122 ms

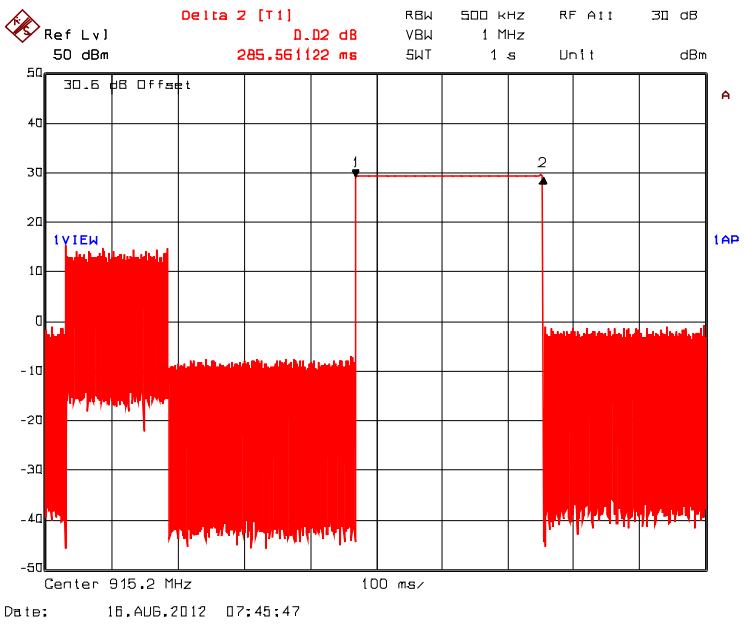


Average time of occupancy within a 10 s	= (Dwell Time @ 902.9 MHz) x (number of hops within a period) = 285.561122 x 1 = 286 ms

Plot 5.3.4.23. Time of Occupancy, 915.2 MHz, FSK 10 kbps

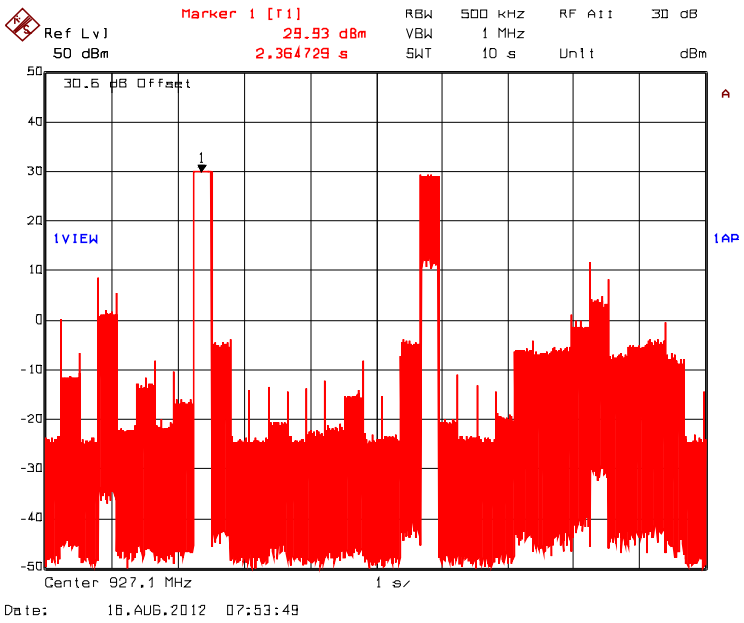


Plot 5.3.4.24. Time of Occupancy, 915.2 MHz, FSK 10 kbps, Dwell Time @ 915.2 MHz = 285.561122 ms

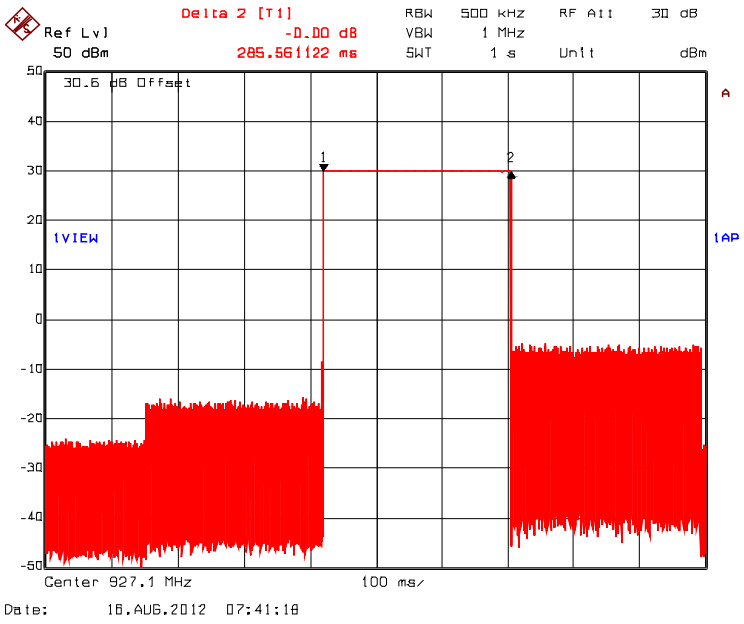


Average time of occupancy within a 10 s	= (Dwell Time @ 915.2 MHz) x (number of hops within a period) = 285.561122 ms x 1 = 286 ms

Plot 5.3.4.25. Time of Occupancy, 927.1 MHz, FSK 10 kbps

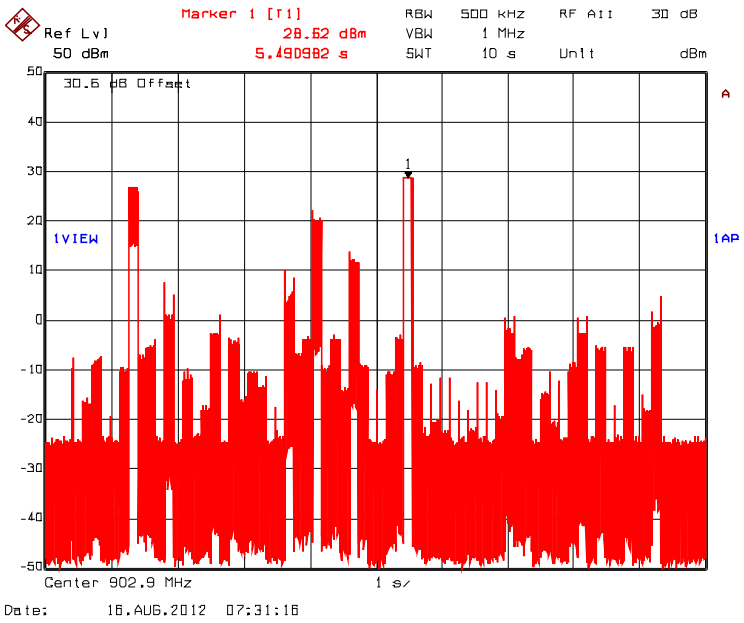


Plot 5.3.4.26. Time of Occupancy, 927.1 MHz, FSK 10 kbps, Dwell Time @ 927.1 MHz = 285.561122 ms

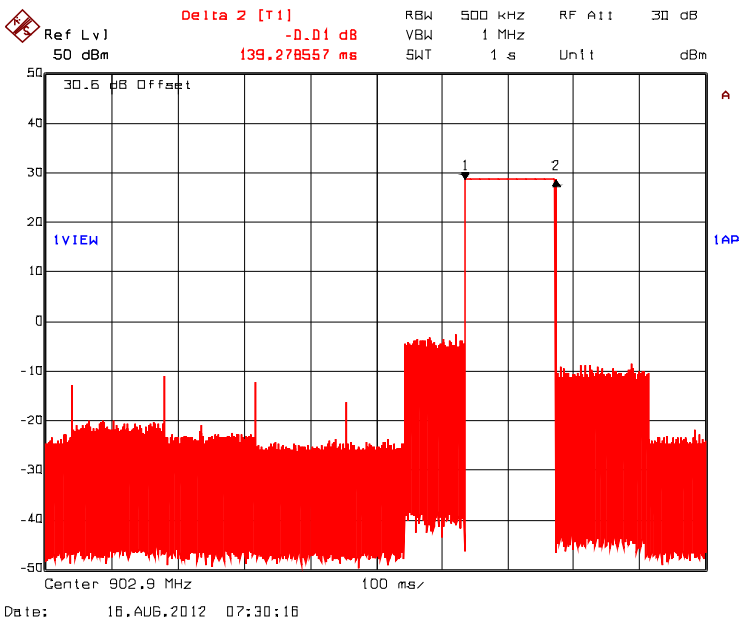


Average time of occupancy within a 10 s	= (Dwell Time @ 927.1 MHz) x (number of hops within a period) = 285.561122 ms x 1 = 286 ms

Plot 5.3.4.27. Time of Occupancy, 902.9 MHz, GFSK 125 kbps

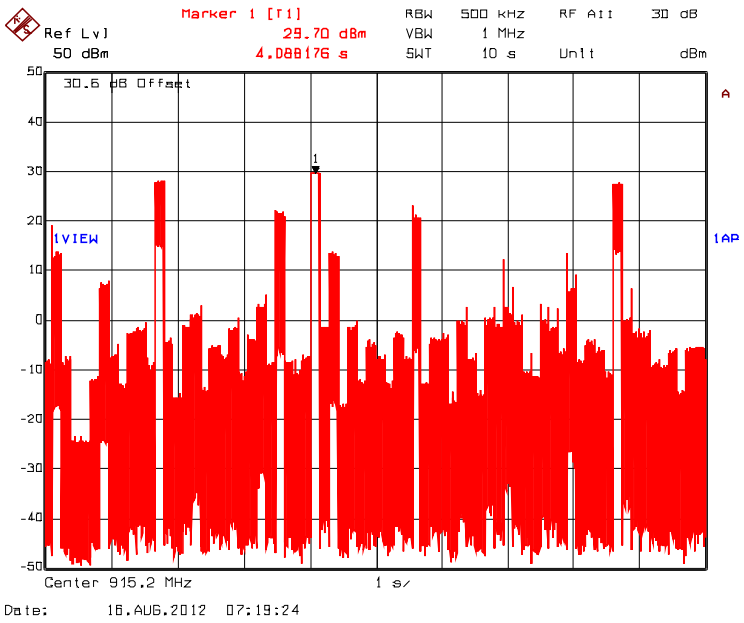


Plot 5.3.4.28. Time of Occupancy, 902.9 MHz, GFSK 125 kbps, Dwell Time @ 902.9 MHz = 139.278557 ms

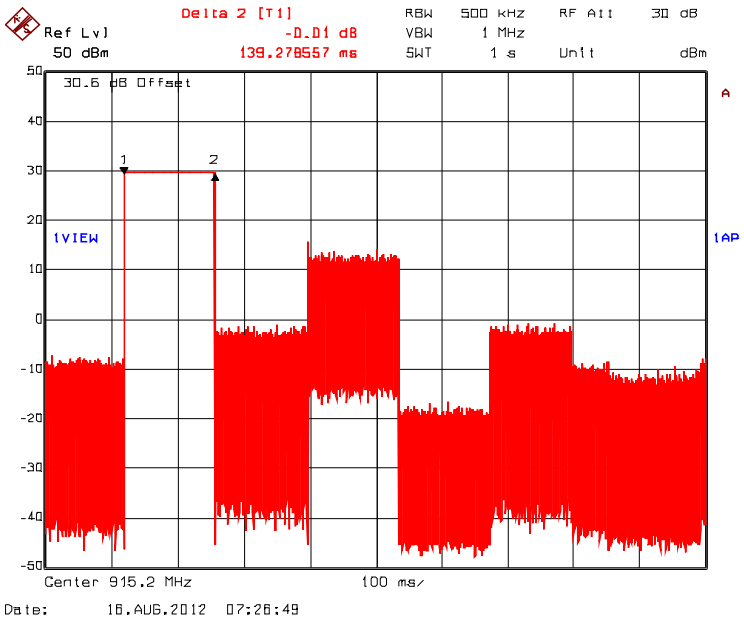


Average time of occupancy within a 10 s	= (Dwell Time @ 902.9 MHz) x (number of hops within a period) = 139.278557 ms x 1 = 139 ms

Plot 5.3.4.29. Time of Occupancy, 915.2 MHz, GFSK 125 kbps

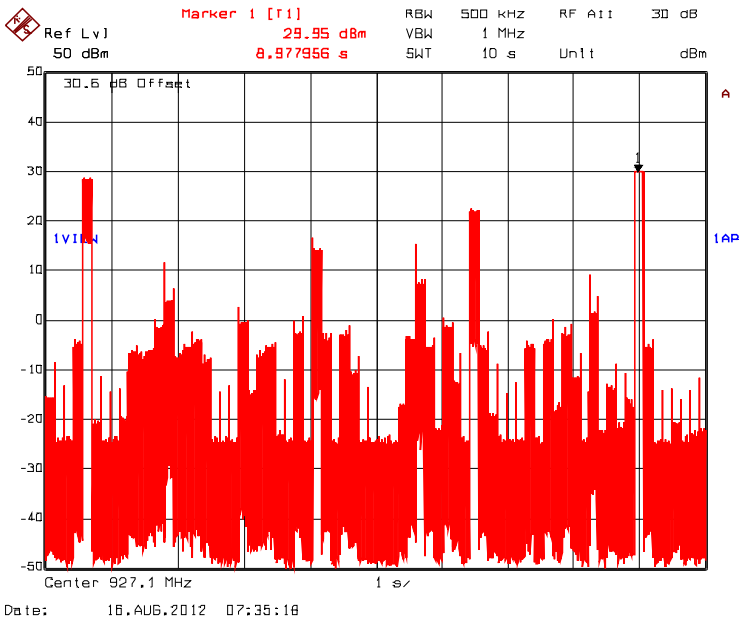


Plot 5.3.4.30. Time of Occupancy, 915.2 MHz, GFSK 125 kbps, Dwell Time @ 915.2 MHz = 139.278557 ms

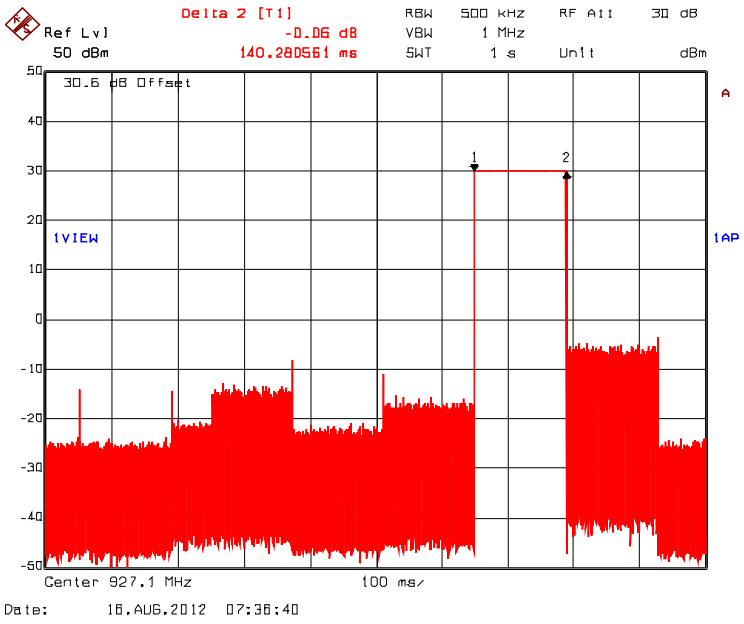


Average time of occupancy within a 10 s	= (Dwell Time @ 915.2 MHz) x (number of hops within a period) = 139.278557 ms x 1 = 139 ms

Plot 5.3.4.31. Time of Occupancy, 927.1 MHz, GFSK 125 kbps



Plot 5.3.4.32. Time of Occupancy, 927.1 MHz, GFSK 125 kbps, Dwell Time @ 927.1 MHz = 140.280561 ms



Average time of occupancy within a 10 s	= (Dwell Time @ 927.1 MHz) x (number of hops within a period) = 140.280561 ms x 1 = 140 ms

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

5.4.1. Limit

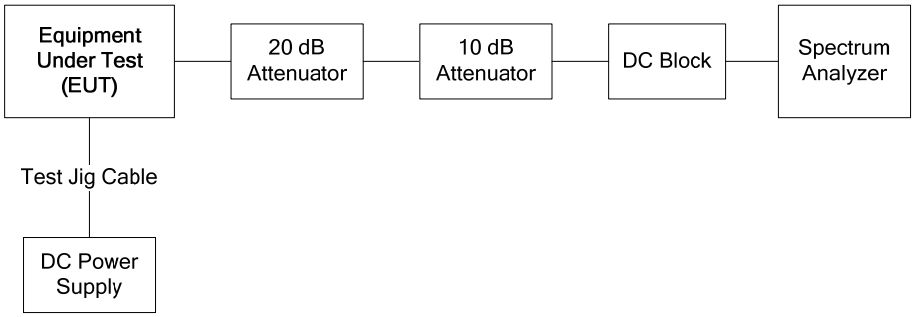
§15.247(b)(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

§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 C63.10-2009

5.4.3. Test Arrangement



5.4.4. Test Data

Operation Mode	Frequency (MHz)	Peak Output Power at Antenna Terminal (dBm)	Calculated EIRP (dBm)	Peak Output Power Limit (dBm)	EIRP Limit (dBm)
FSK 10 kbps Low power setting (0 dBm, 1 mW)	902.9	0.32	See Notes below	30	36
	915.2	1.01	See Notes below	30	36
	927.1	0.73	See Notes below	30	36
FSK 10 kbps High power setting (30 dBm, 1 W)	902.9	29.00	See Notes below	30	36
	915.2	29.60	See Notes below	30	36
	927.1	29.90	See Notes below	30	36
GFSK 125 kbps Low power setting (0 dBm, 1 mW)	902.9	0.18	See Notes below	30	36
	915.2	1.01	See Notes below	30	36
	927.1	0.73	See Notes below	30	36
GFSK 125 kbps High power setting (30 dBm, 1 W)	902.9	28.75	See Notes below	30	36
	915.2	29.48	See Notes below	30	36
	927.1	29.90	See Notes below	30	36

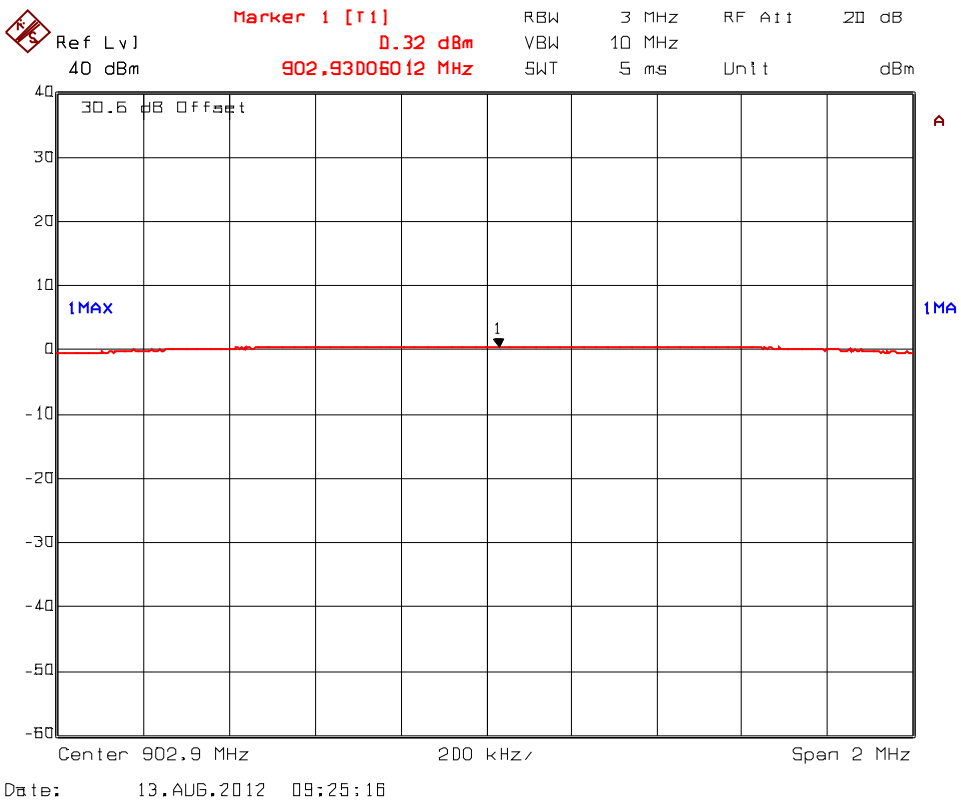
Notes:

1. The EIRP shall be calculated based on the transmitter antenna gain (G_{dBi}), cable loss (CL_{dB}) and peak output power at antenna terminal (P_{dBm}). Calculated EIRP = $P_{dBm} + G_{dBi} - CL_{dB}$

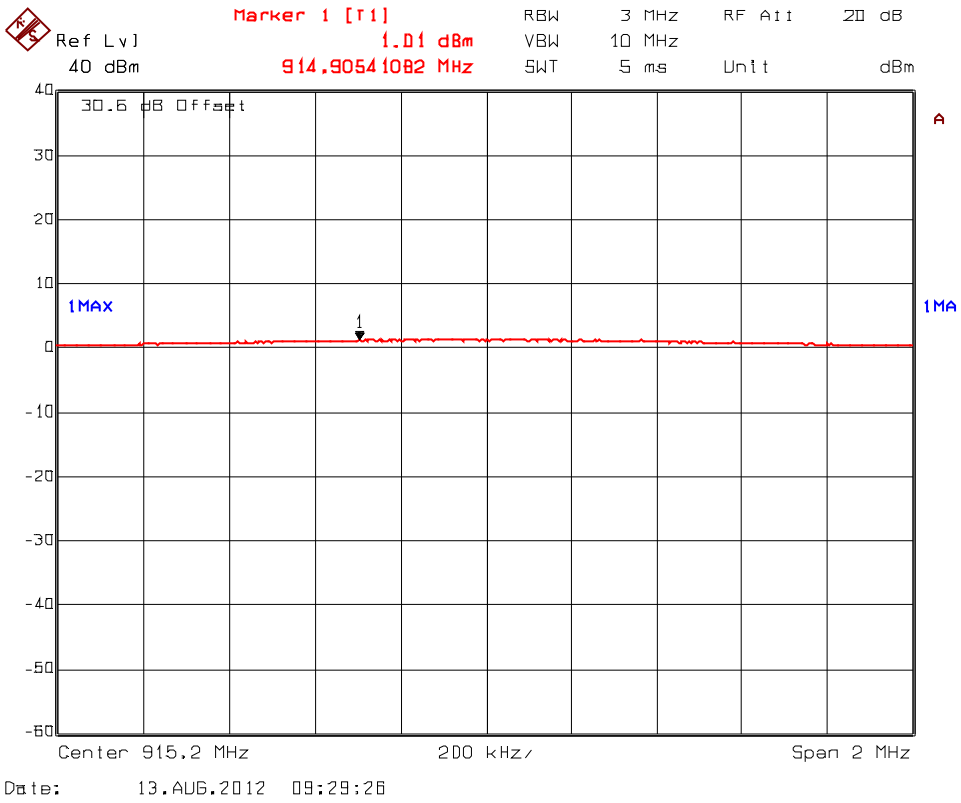
2. EIRP shall not exceed 36 dBm limit (Power Setting = 36 dBm - $G_{dBi} + CL_{dB}$).

See the following plots for details.

Plot 5.4.4.1. Peak Output Power, 902.9 MHz, FSK 10 kbps, Low Power Setting

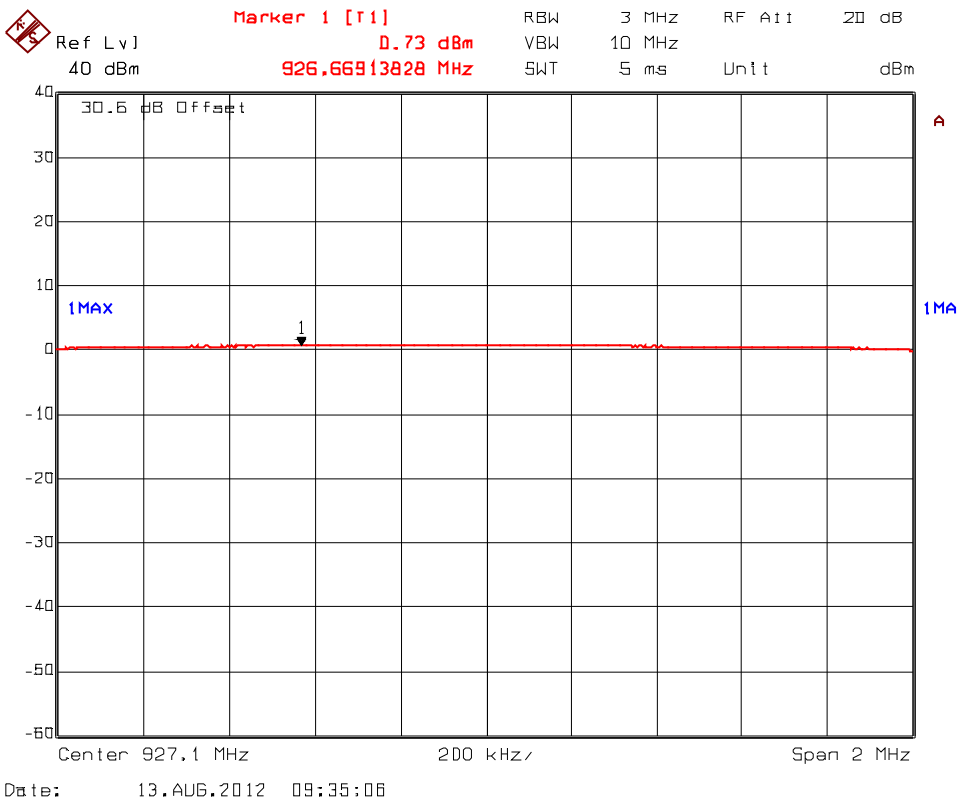


Plot 5.4.4.2. Peak Output Power, 915.2 MHz, FSK 10 kbps, Low Power Setting



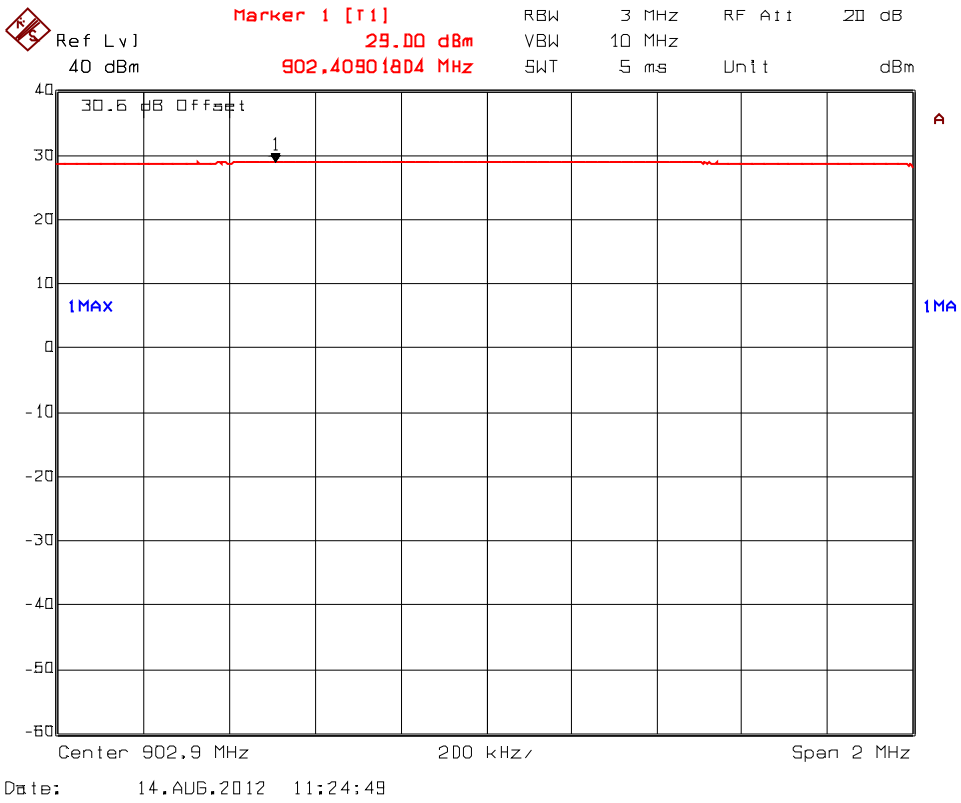
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot 5.4.4.3. Peak Output Power, 927.1 MHz, FSK 10 kbps, Low Power Setting

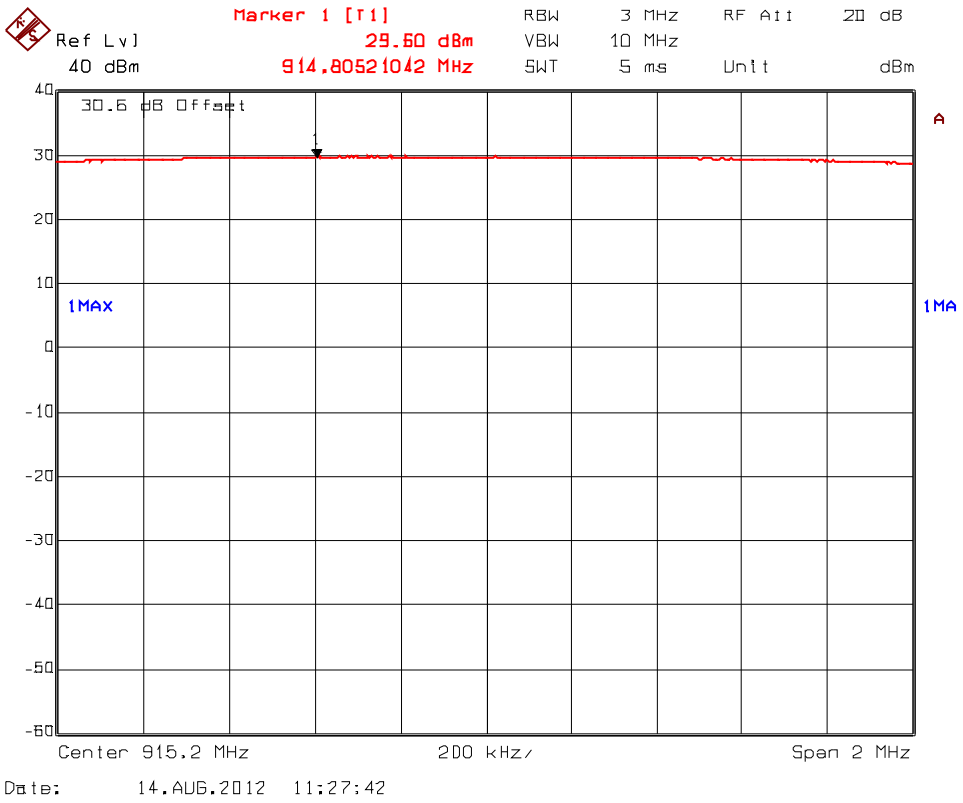


All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

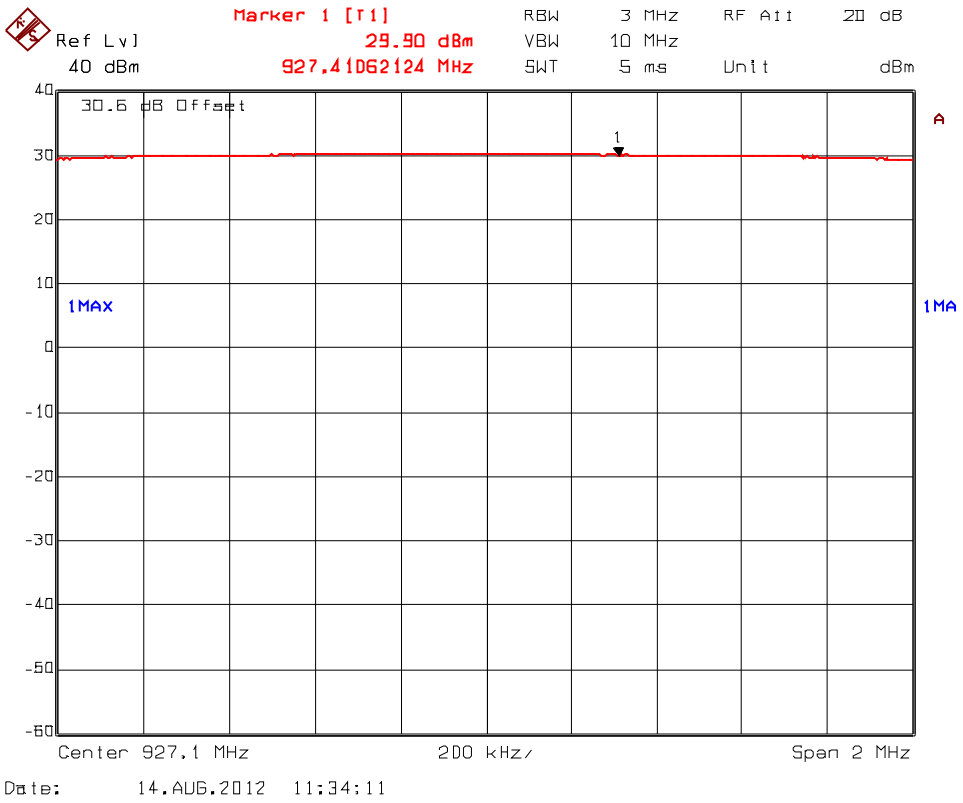
Plot 5.4.4.4. Peak Output Power, 902.9 MHz, FSK 10 kbps, High Power Setting



Plot 5.4.4.5. Peak Output Power, 915.2 MHz, FSK 10 kbps, High Power Setting

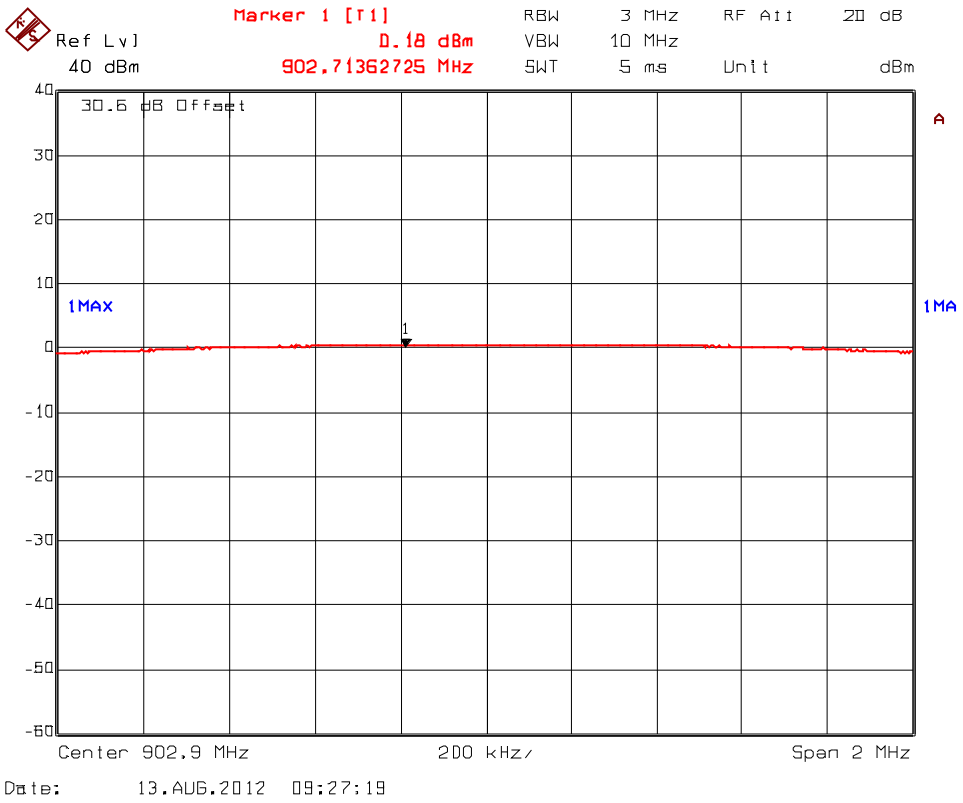


Plot 5.4.4.6. Peak Output Power, 927.1 MHz, FSK 10 kbps, High Power Setting



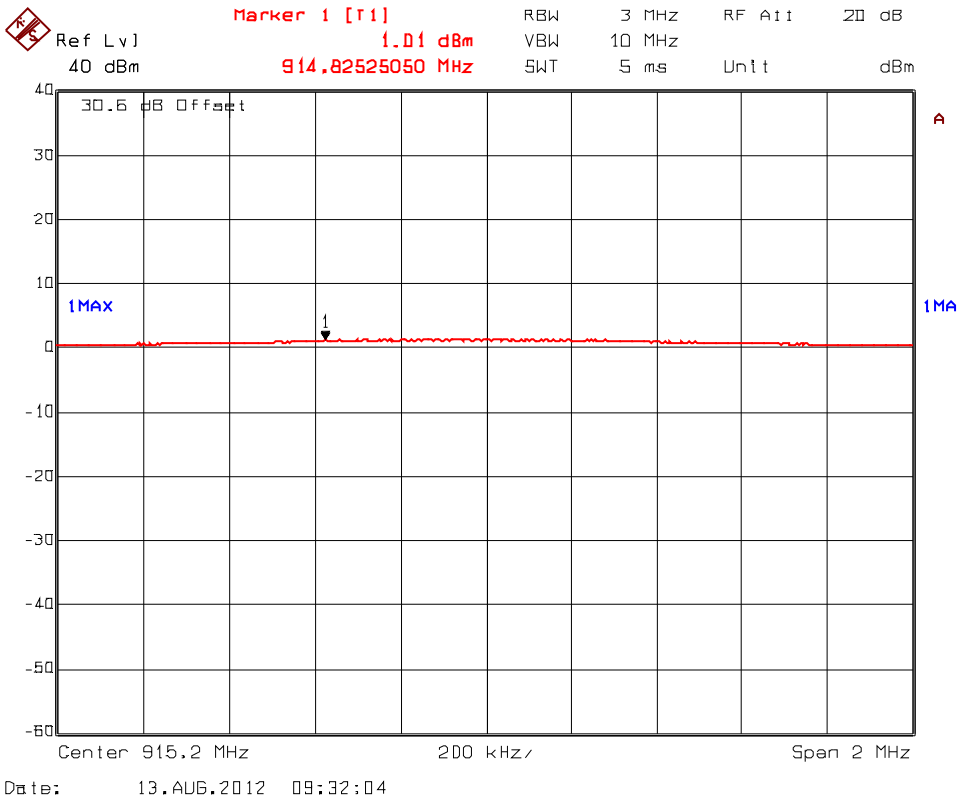
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot 5.4.4.7. Peak Output Power, 902.9 MHz, GFSK 125 kbps, Low Power Setting

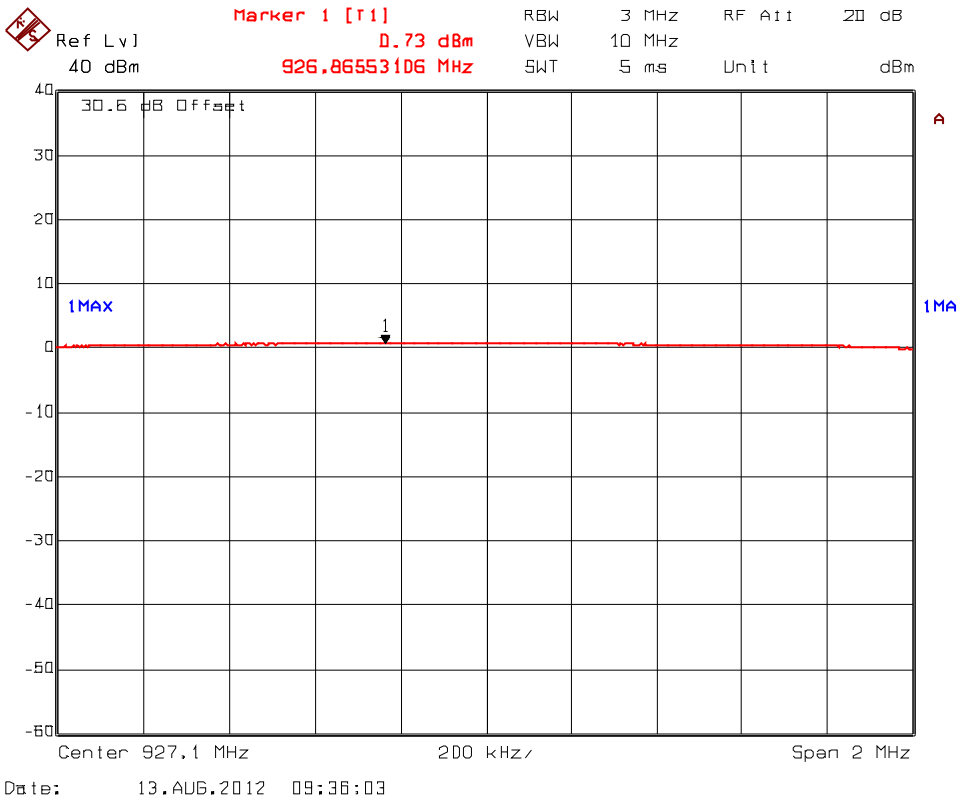


All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

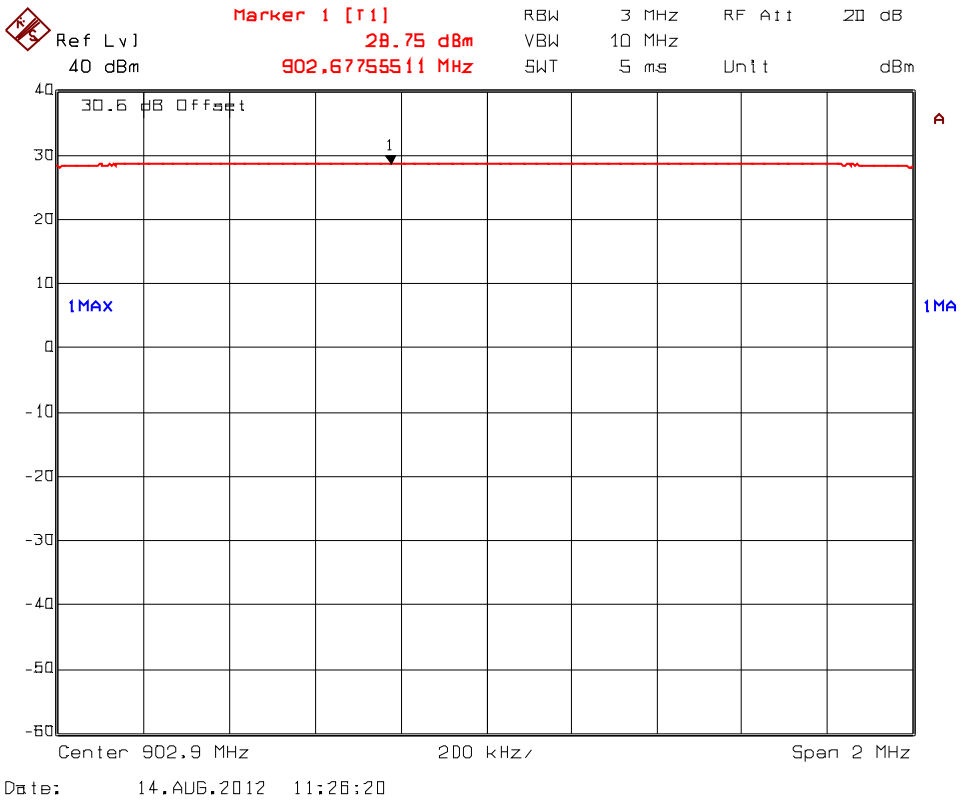
Plot 5.4.4.8. Peak Output Power, 915.2 MHz, GFSK 125 kbps, Low Power Setting



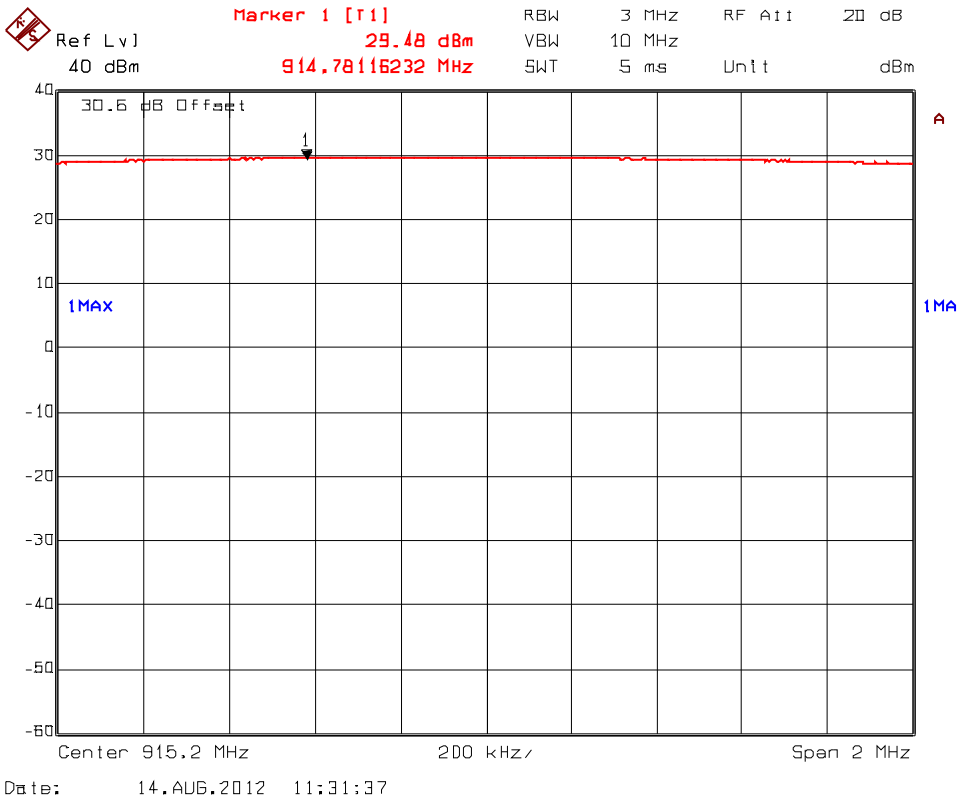
Plot 5.4.4.9. Peak Output Power, 927.1 MHz, GFSK 125 kbps, Low Power Setting



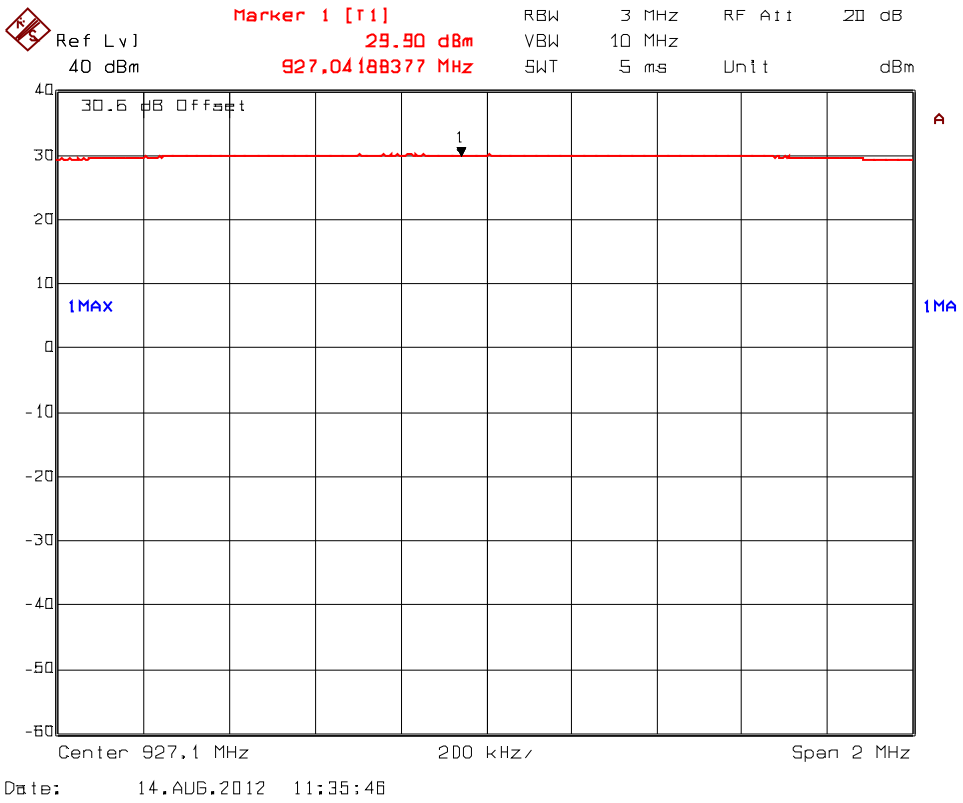
Plot 5.4.4.10. Peak Output Power, 902.9 MHz, GFSK 125 kbps, High Power Setting



Plot 5.4.4.11. Peak Output Power, 915.2 MHz, GFSK 125 kbps, High Power Setting



Plot 5.4.4.12. Peak Output Power, 927.1 MHz, GFSK 125 kbps, High Power Setting



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

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

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

FCC 47 CFR § 1.1310:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

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

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

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

5.5.1. 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

5.5.2. RF Evaluation

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

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

RF Exposure Distance Limits

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

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

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

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

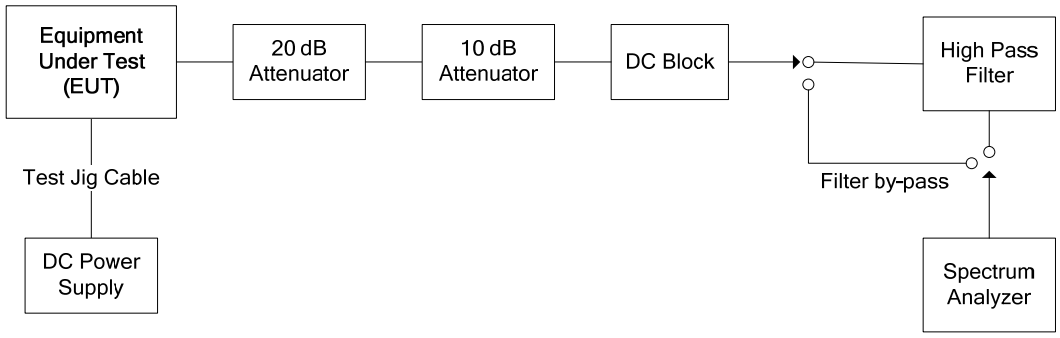
5.6.1. Limits

§ 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)).

5.6.2. Method of Measurements

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

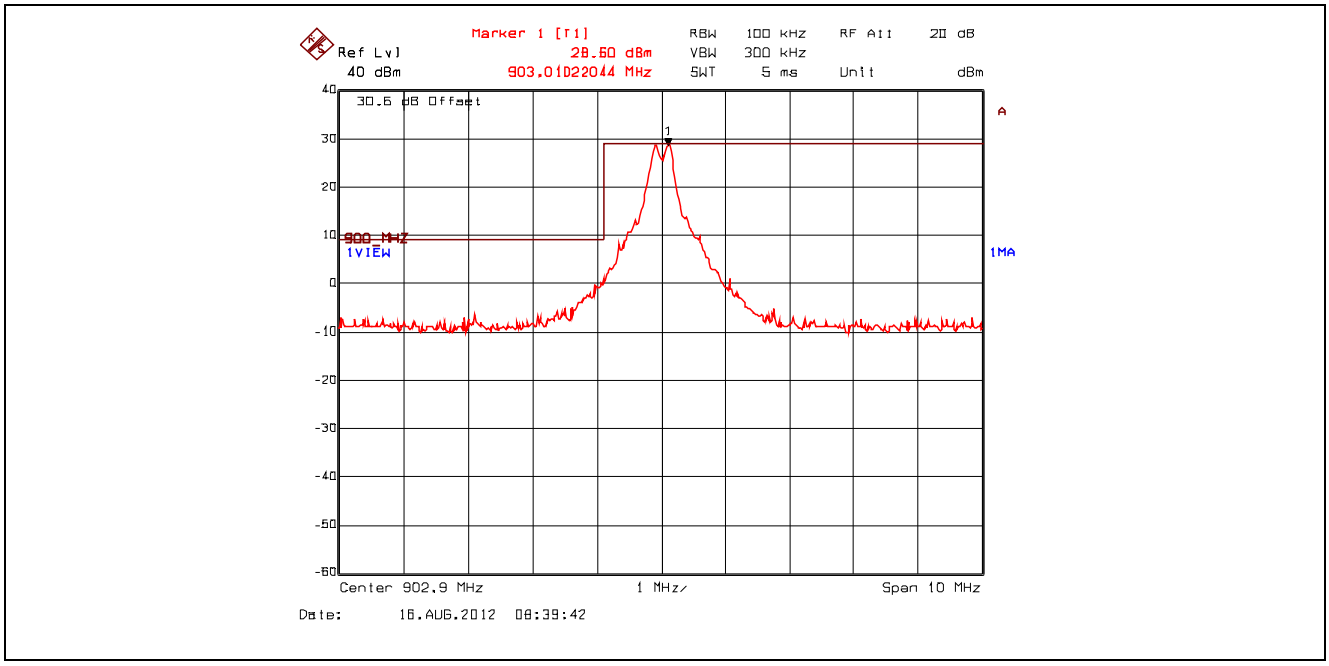
5.6.3. Test Arrangement



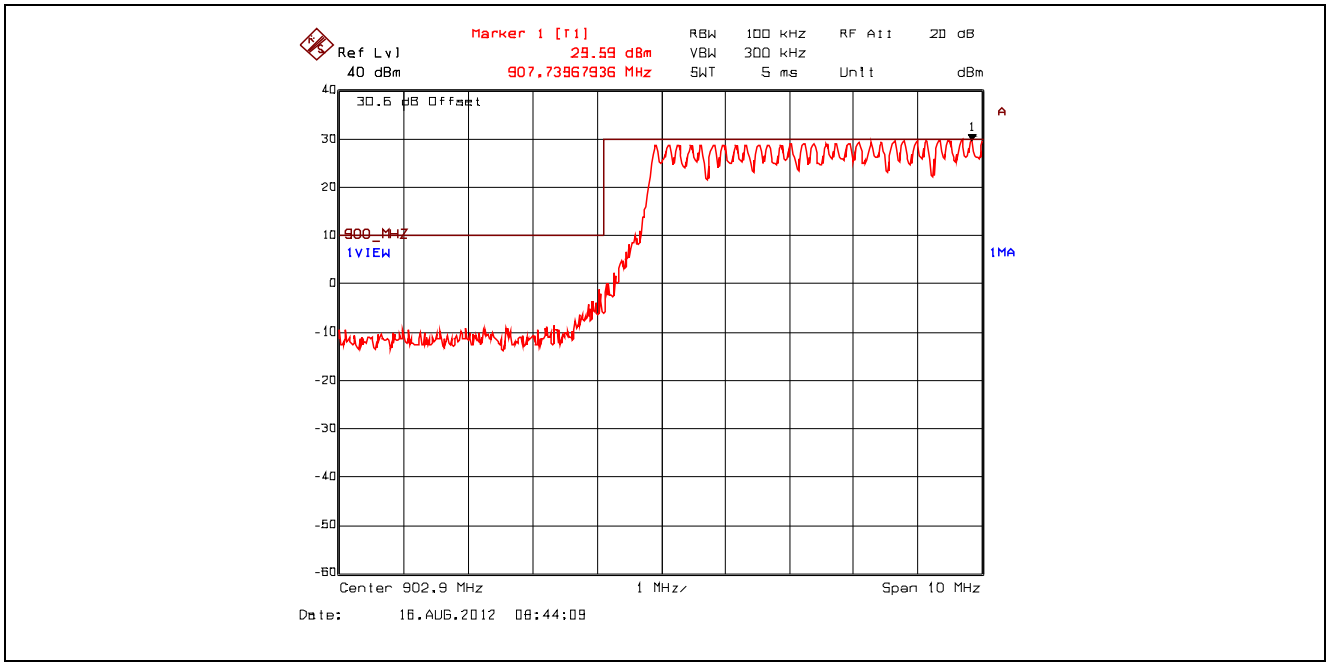
5.6.4. Test Data

5.6.4.1. Band-Edge RF Conducted Emissions Test Results

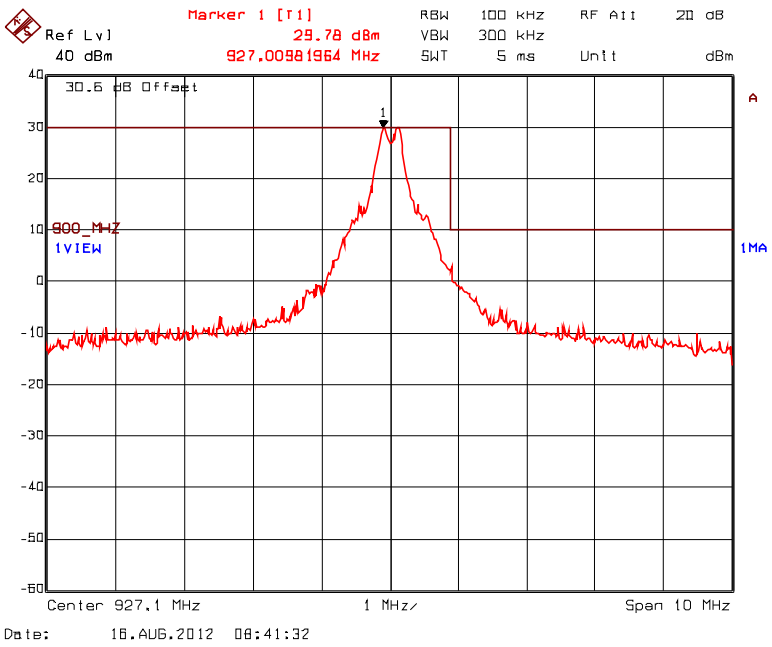
Plot 5.6.4.1.1. Band-Edge RF Conducted Emissions, Lowest End of Frequency Band, Single Frequency Mode, FSK 10 kbps



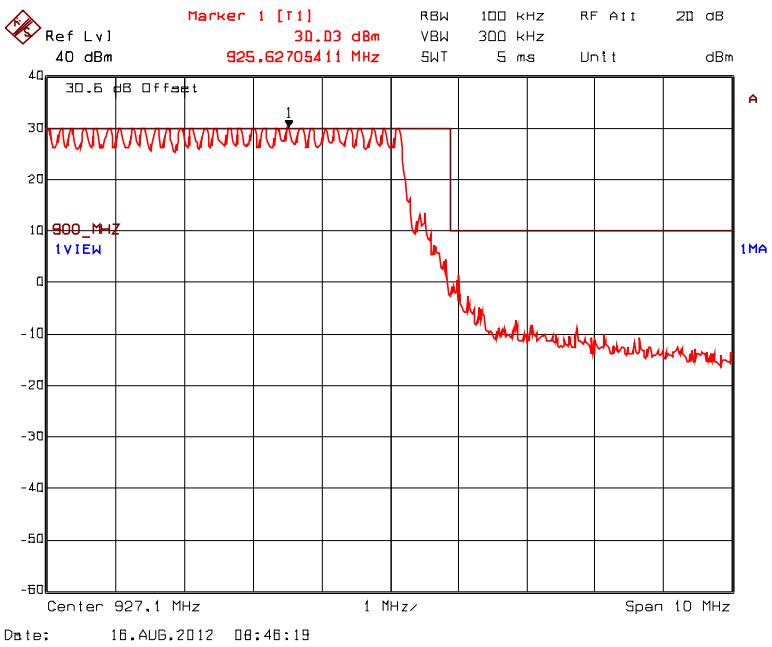
Plot 5.6.4.1.2. Band-Edge RF Conducted Emissions, Low End of Frequency Band, Hopping Mode, FSK 10 kbps



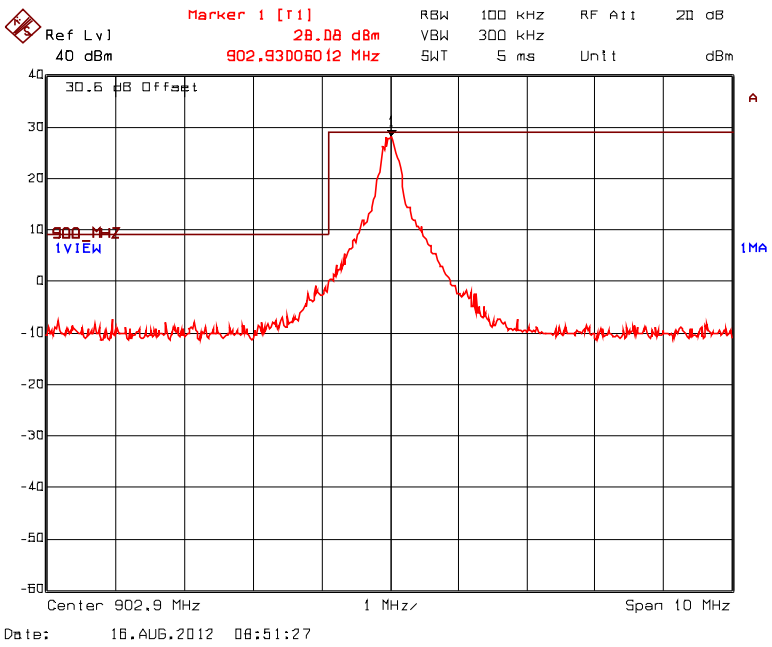
Plot 5.6.4.1.3. Band-Edge RF Conducted Emissions, High End of Frequency Band, Single Frequency Mode, FSK 10 kbps



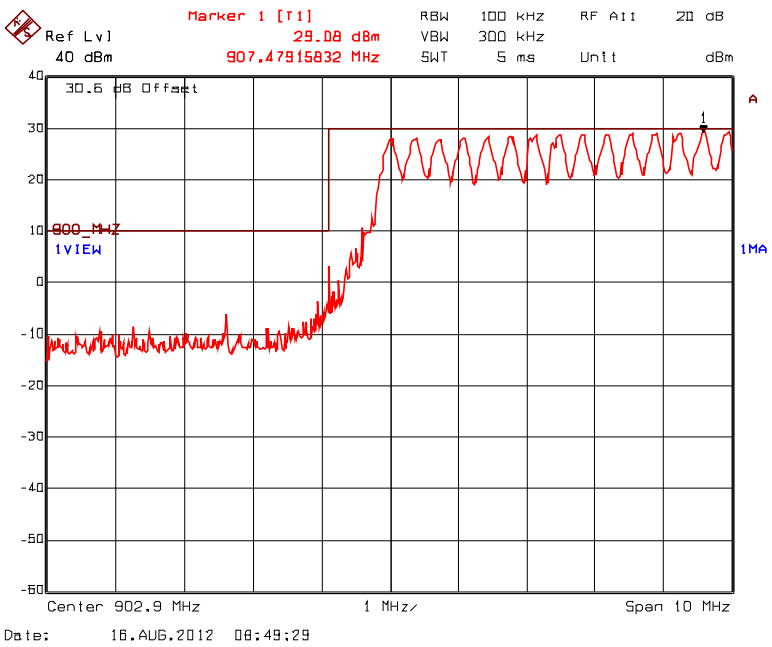
Plot 5.6.4.1.4. Band-Edge RF Conducted Emissions, High End of Frequency Band, Hopping Mode, FSK 10 kbps



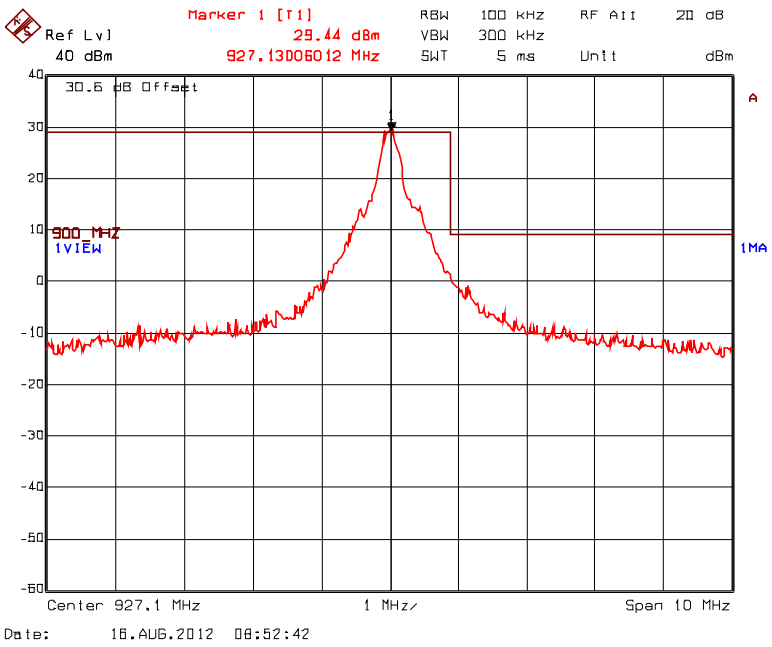
Plot 5.6.4.1.5. Band-Edge RF Conducted Emissions, Low End of Frequency Band, Single Frequency Mode, GFSK 125 kbps



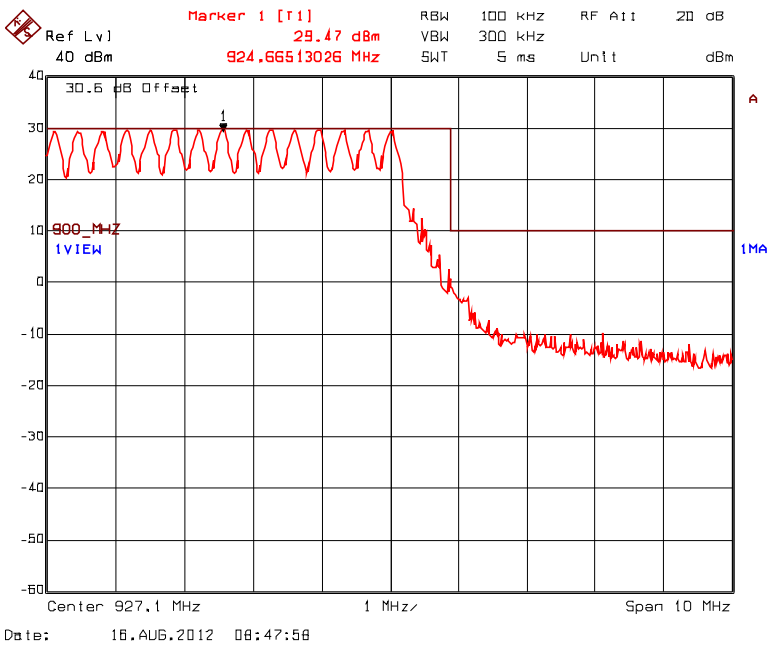
Plot 5.6.4.1.6. Band-Edge RF Conducted Emissions, Low End of Frequency Band, Hopping Mode, GFSK 125 kbps



Plot 5.6.4.1.7. Band-Edge RF Conducted Emissions, High End of Frequency Band, Single Frequency Mode, GFSK 125 kbps

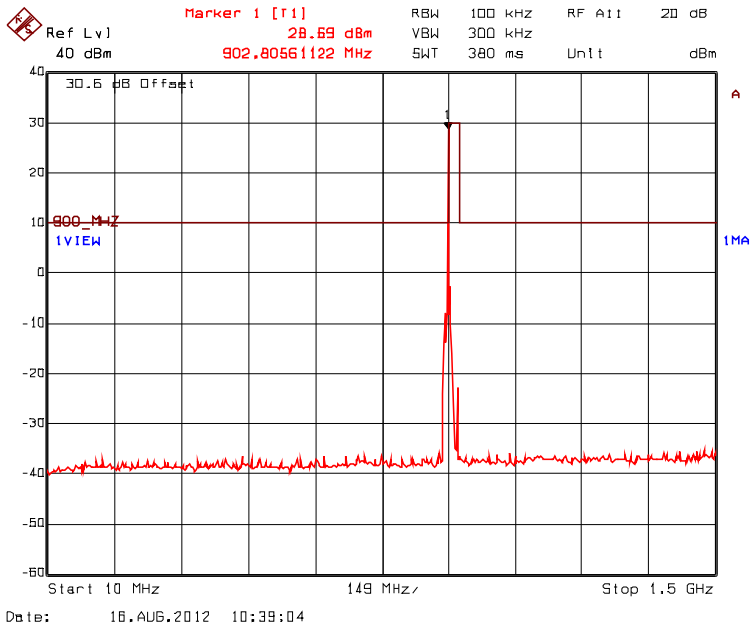


Plot 5.6.4.1.8. Band-Edge RF Conducted Emissions, High End of Frequency Band, Hopping Mode, GFSK 125 kbps

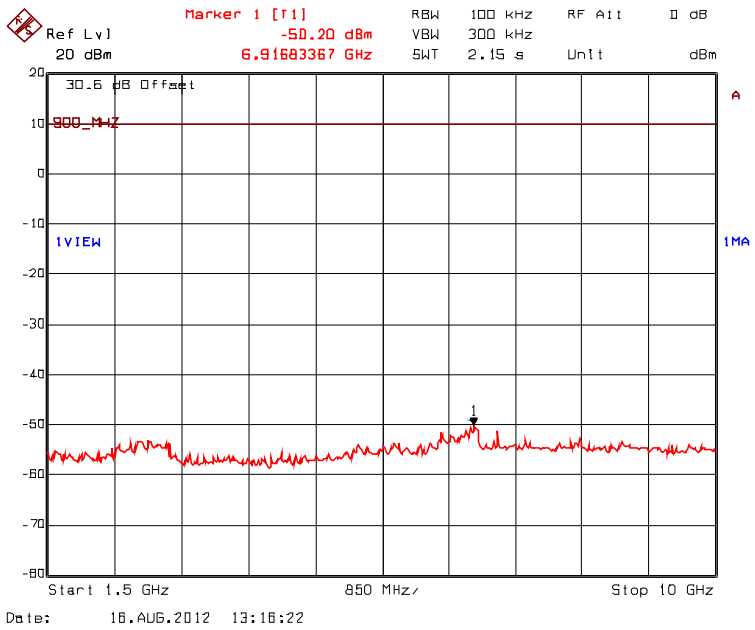


5.6.4.2. Spurious RF Conducted Emissions Test Results

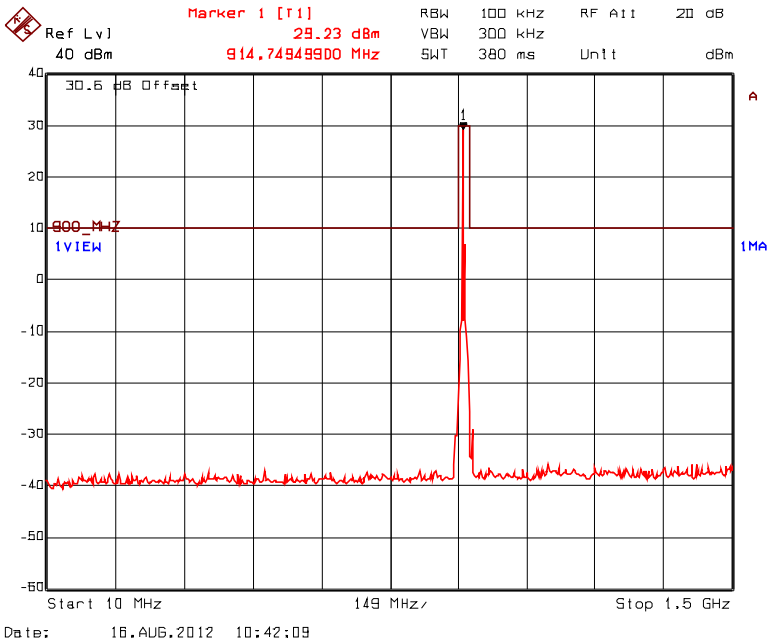
Plot 5.6.4.2.1. Spurious RF Conducted Emissions, 902.9 MHz, High Power, FSK 10 kbps, 10 MHz – 1.5 GHz



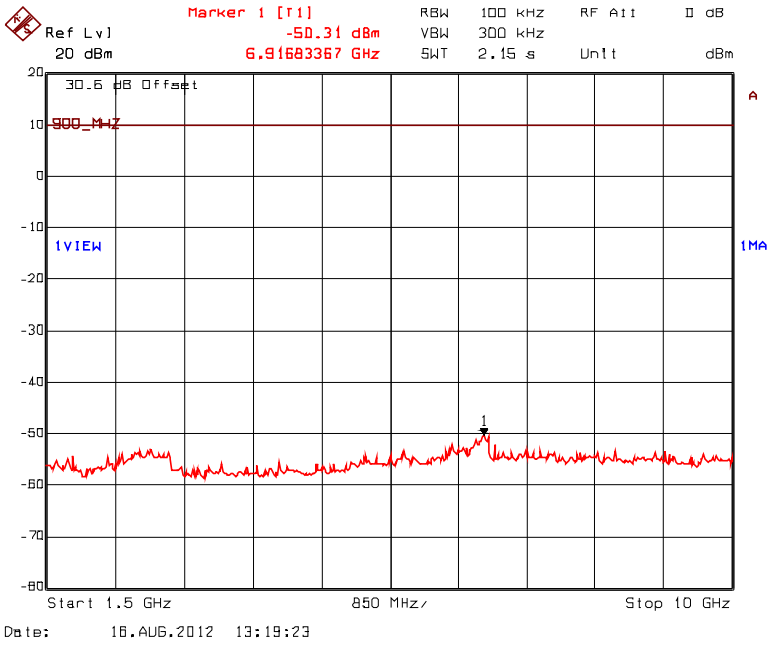
Plot 5.6.4.2.2. Spurious RF Conducted Emissions, 902.9 MHz, High Power, FSK 10 kbps, 1.5 GHz – 10 GHz



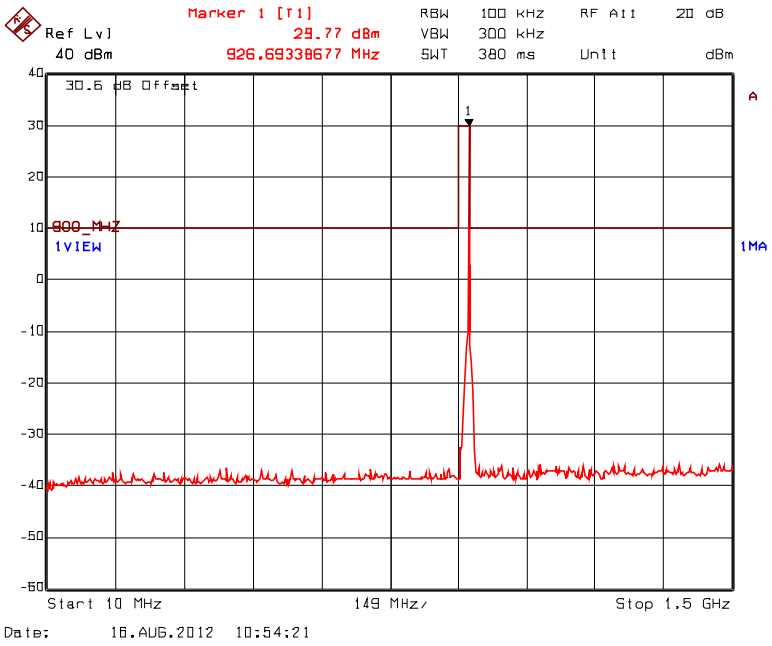
Plot 5.6.4.2.3. Spurious RF Conducted Emissions, 915.2 MHz, High Power, FSK 10 kbps, 10 MHz – 1.5 GHz



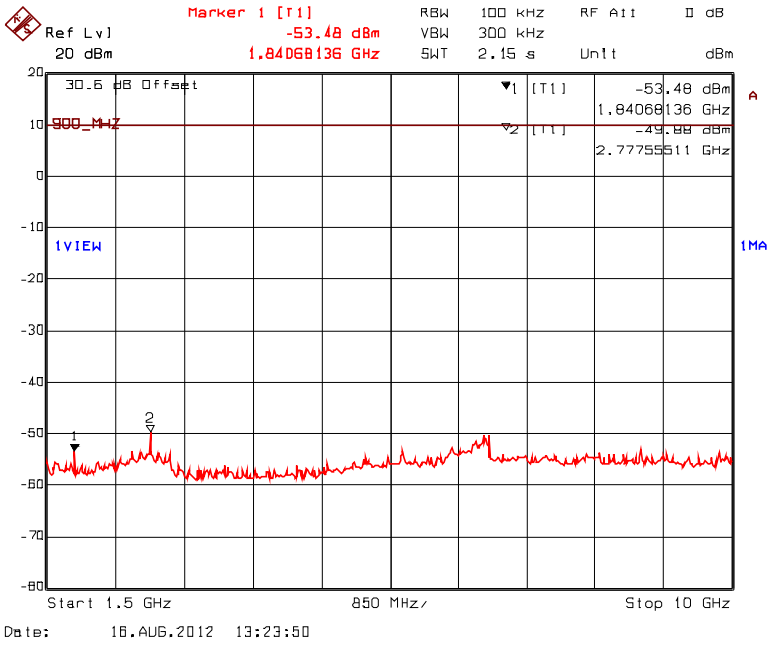
Plot 5.6.4.2.4. Spurious RF Conducted Emissions, 915.2 MHz, High Power, FSK 10 kbps, 1.5 GHz – 10 GHz



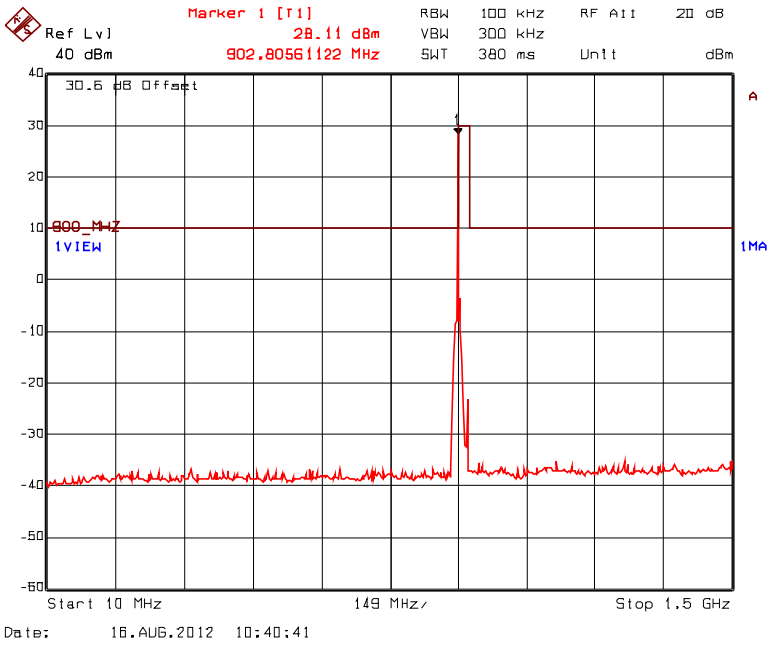
Plot 5.6.4.2.5. Spurious RF Conducted Emissions, 927.1 MHz, High Power, FSK 10 kbps, 10 MHz – 1.5 GHz



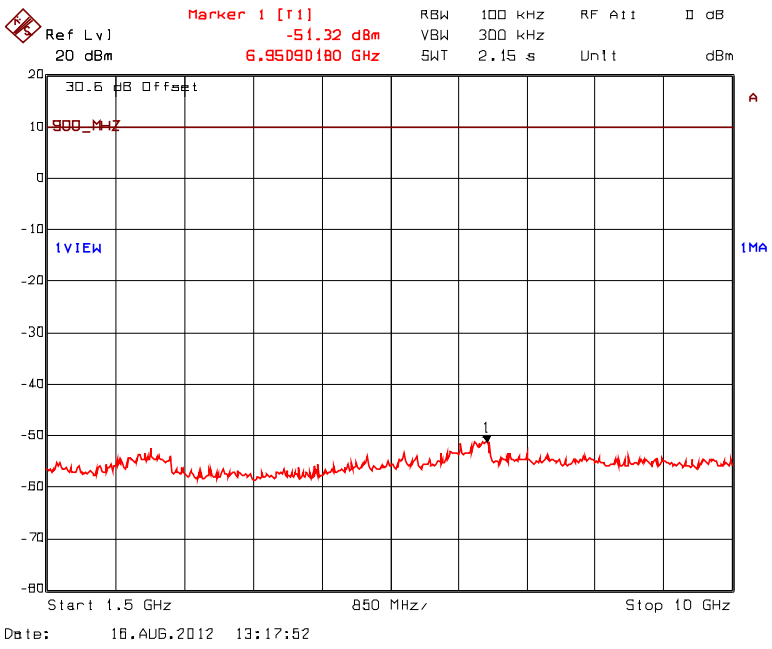
Plot 5.6.4.2.6. Spurious RF Conducted Emissions, 927.1 MHz, High Power, FSK 10 kbps, 1.5 GHz – 10 GHz



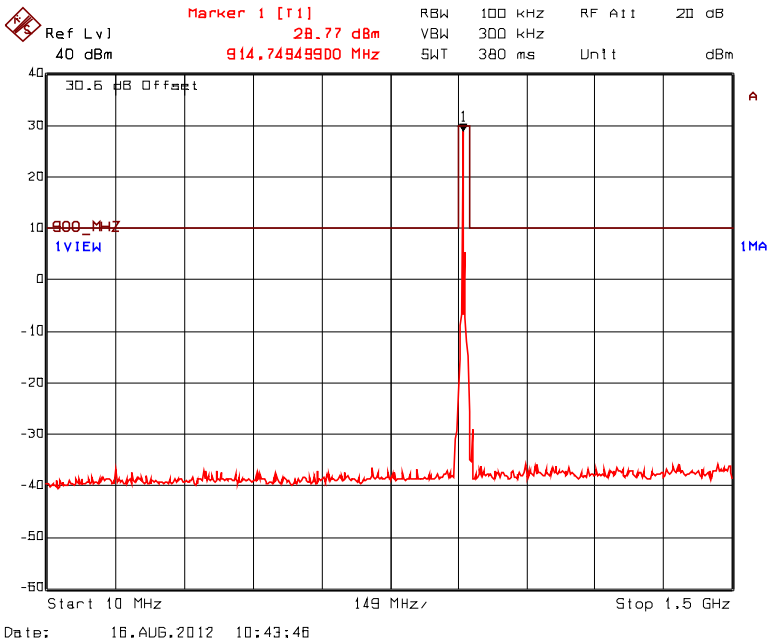
Plot 5.6.4.2.7. Spurious RF Conducted Emissions, 902.9 MHz, High Power, GFSK 125 kbps, 10 MHz – 1.5 GHz



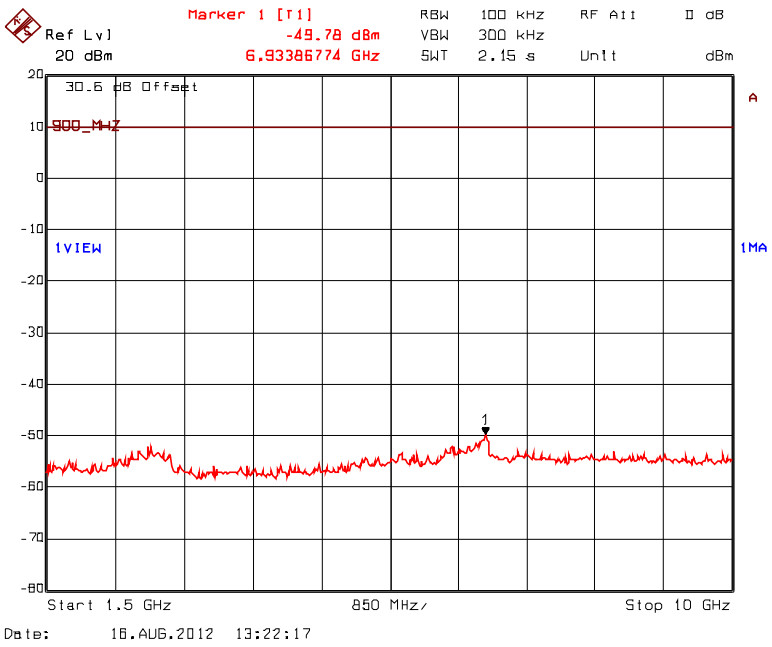
Plot 5.6.4.2.8. Spurious RF Conducted Emissions, 902.9 MHz, High Power, GFSK 125 kbps, 1.5 GHz – 10 GHz



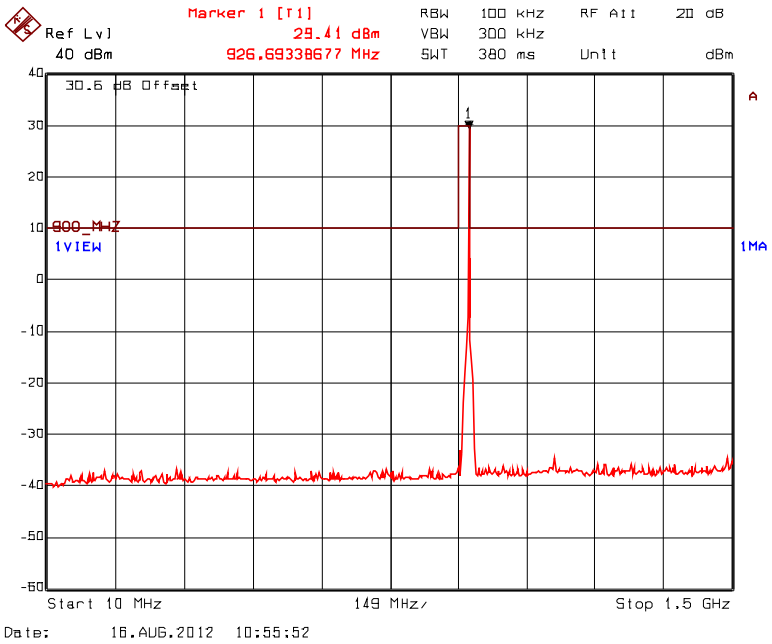
Plot 5.6.4.2.9. Spurious RF Conducted Emissions, 915.2 MHz, High Power, GFSK 125 kbps, 10 MHz – 1.5 GHz



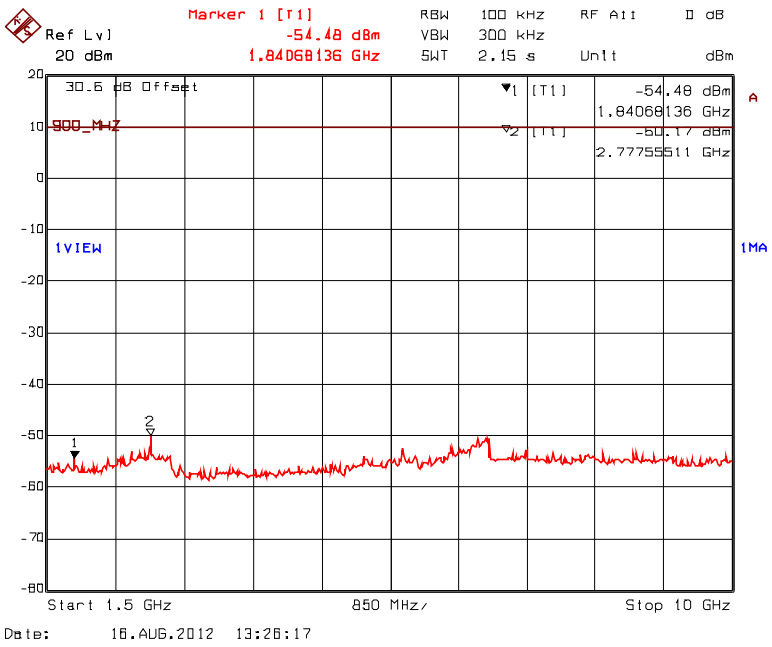
Plot 5.6.4.2.10. Spurious RF Conducted Emissions, 915.2 MHz, High Power, GFSK 125 kbps, 1.5 GHz – 10 GHz



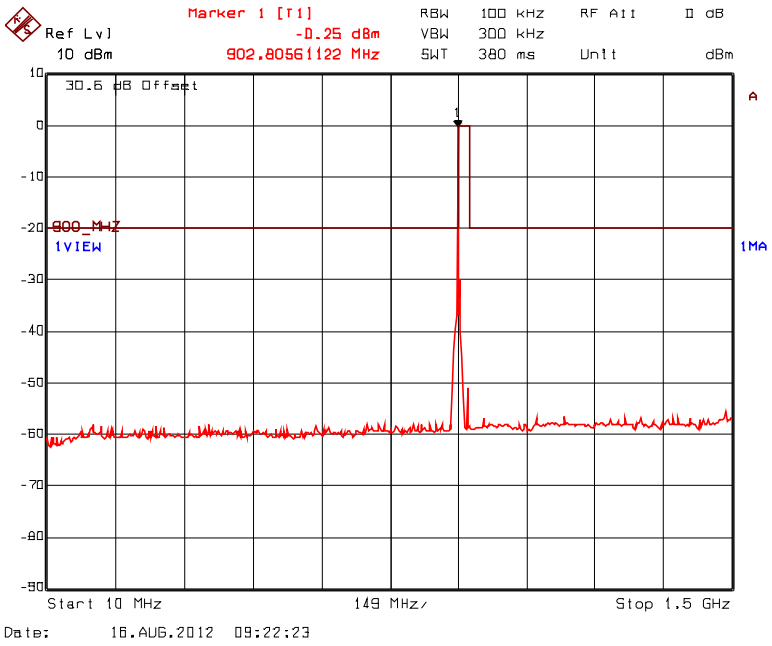
Plot 5.6.4.2.11. Spurious RF Conducted Emissions, 927.1 MHz, High Power, GFSK 125 kbps, 10 MHz – 1.5 GHz



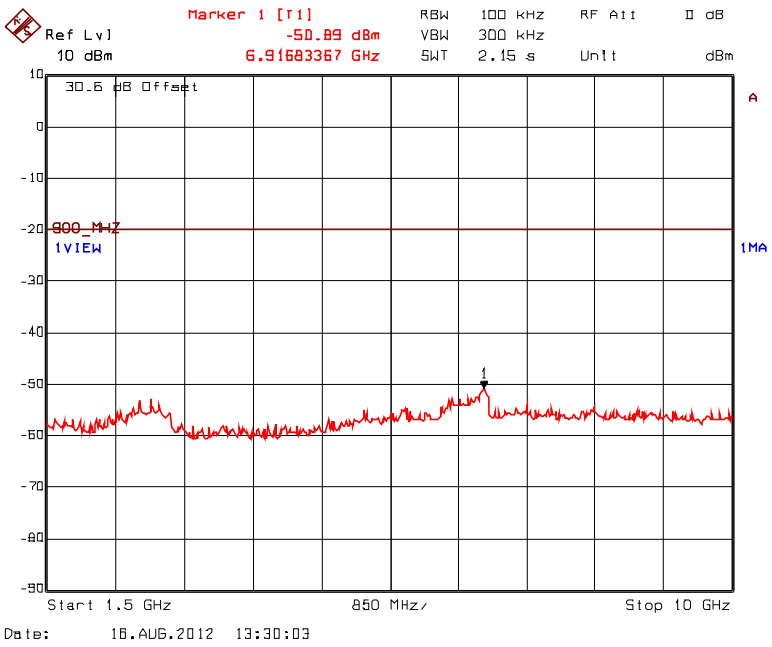
Plot 5.6.4.2.12. Spurious RF Conducted Emissions, 927.1 MHz, High Power, GFSK 125 kbps, 1.5 GHz – 10 GHz



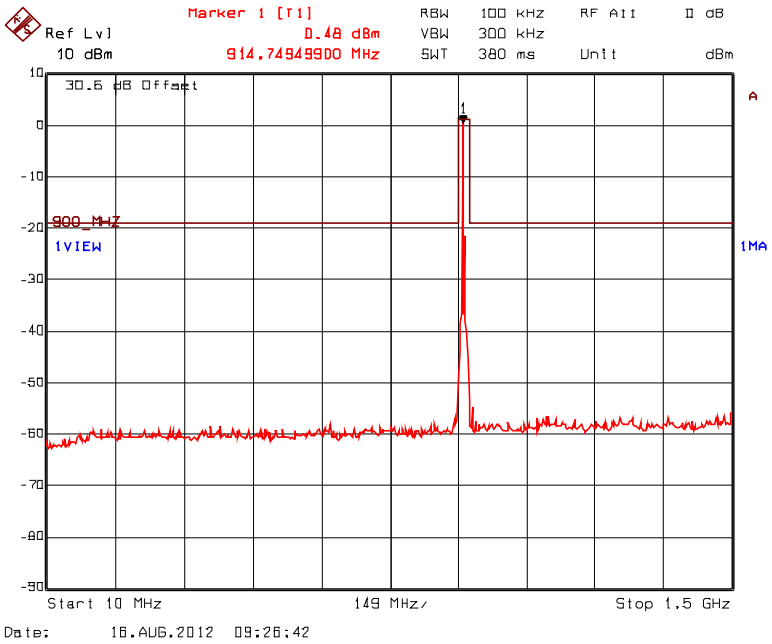
Plot 5.6.4.2.13. Spurious RF Conducted Emissions, 902.9 MHz, Low Power, FSK 10 kbps, 10 MHz – 1.5 GHz



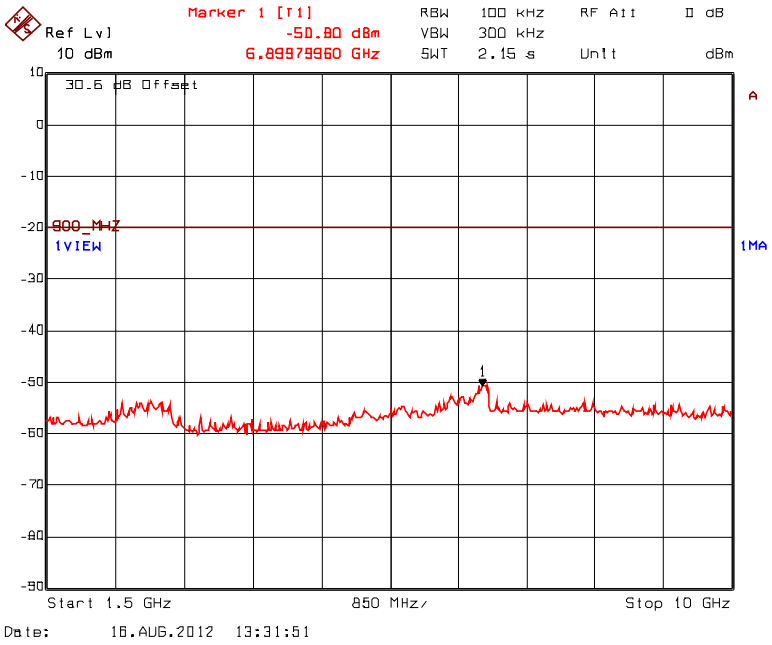
Plot 5.6.4.2.14. Spurious RF Conducted Emissions, 902.9 MHz, Low Power, FSK 10 kbps, 1.5 GHz – 10 GHz



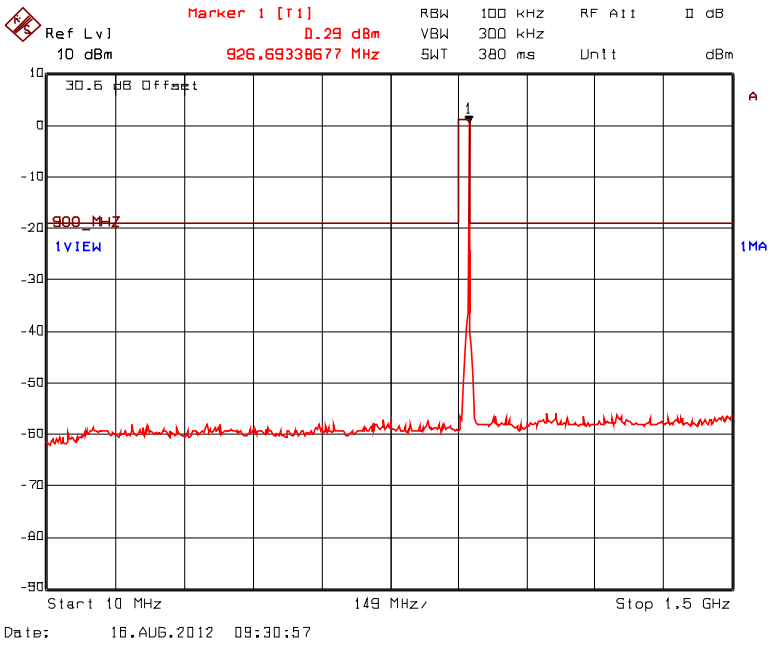
Plot 5.6.4.2.15. Spurious RF Conducted Emissions, 915.2 MHz, Low Power, FSK 10 kbps, 10 MHz – 1.5 GHz



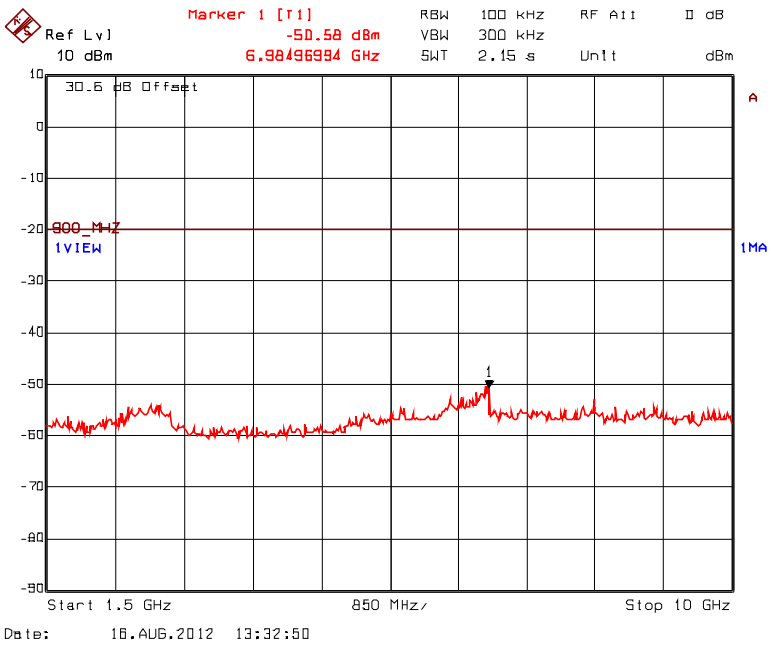
Plot 5.6.4.2.16. Spurious RF Conducted Emissions, 915.2 MHz, Low Power, FSK 10 kbps, 1.5 GHz – 10 GHz



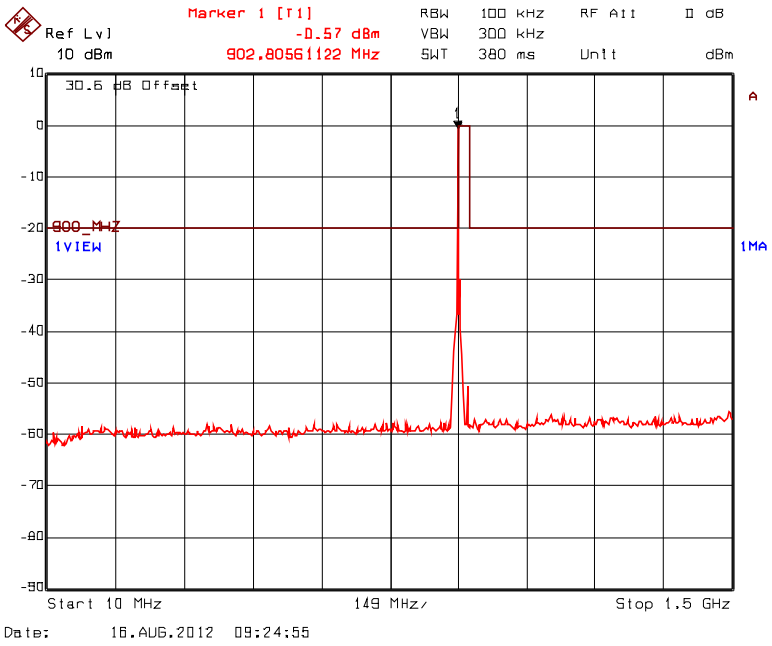
Plot 5.6.4.2.17. Spurious RF Conducted Emissions, 927.1 MHz, Low Power, FSK 10 kbps, 10 MHz – 1.5 GHz



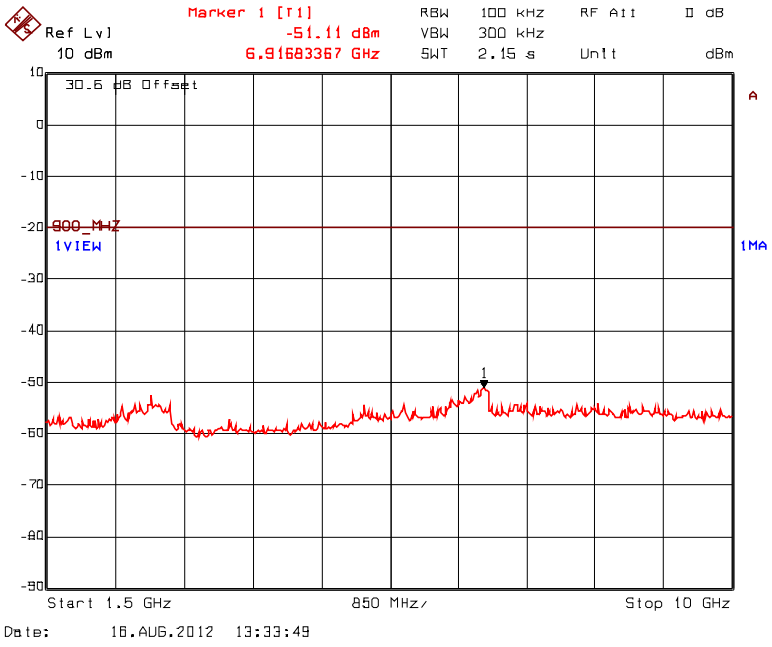
Plot 5.6.4.2.18. Spurious RF Conducted Emissions, 927.1 MHz, Low Power, FSK 10 kbps, 1.5 GHz – 10 GHz



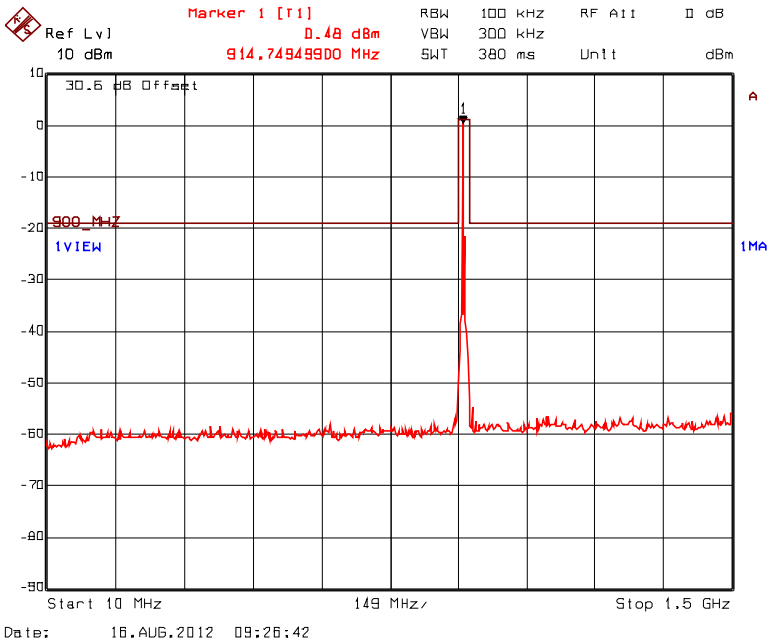
Plot 5.6.4.2.19. Spurious RF Conducted Emissions, 902.9 MHz, Low Power, GFSK 125 kbps, 10 MHz – 1.5 GHz



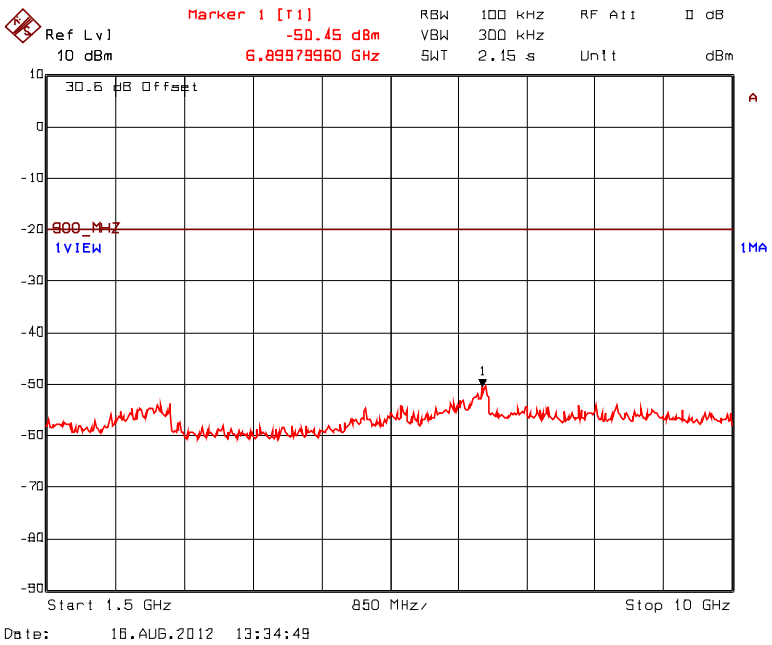
Plot 5.6.4.2.20. Spurious RF Conducted Emissions, 902.9 MHz, Low Power, GFSK 125 kbps, 1.5 GHz – 10 GHz



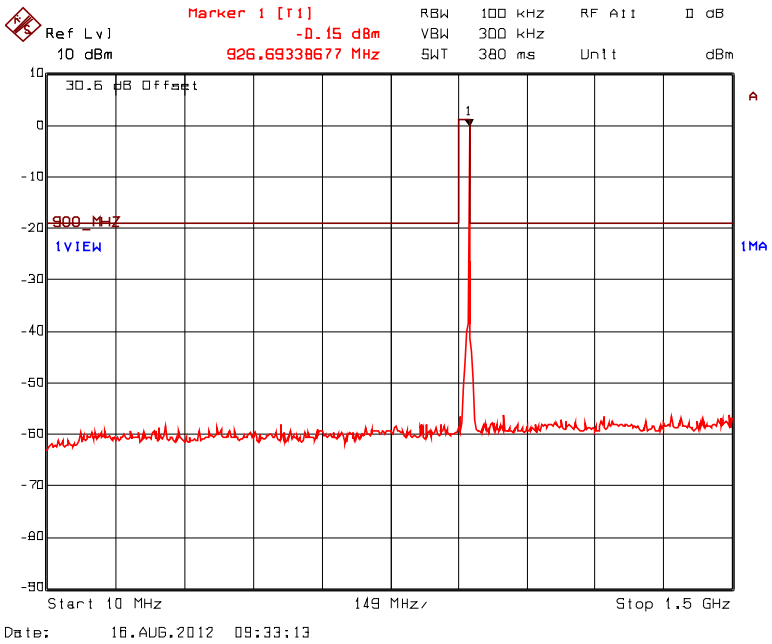
Plot 5.6.4.2.21. Spurious RF Conducted Emissions, 915.2 MHz, Low Power, GFSK 125 kbps, 10 MHz – 1.5 GHz



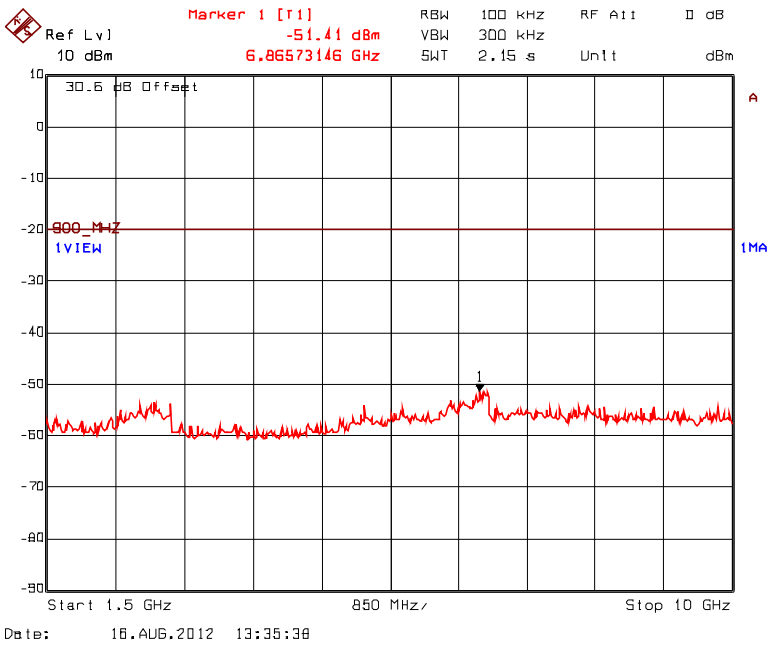
Plot 5.6.4.2.22. Spurious RF Conducted Emissions, 915.2 MHz, Low Power, GFSK 125 kbps, 1.5 GHz – 10 GHz



Plot 5.6.4.2.23. Spurious RF Conducted Emissions, 927.1 MHz, Low Power, GFSK 125 kbps, 10 MHz – 1.5 GHz



Plot 5.6.4.2.24. Spurious RF Conducted Emissions, 927.1 MHz, Low Power, GFSK 125 kbps, 1.5 GHz – 10 GHz



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

5.7.1. 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

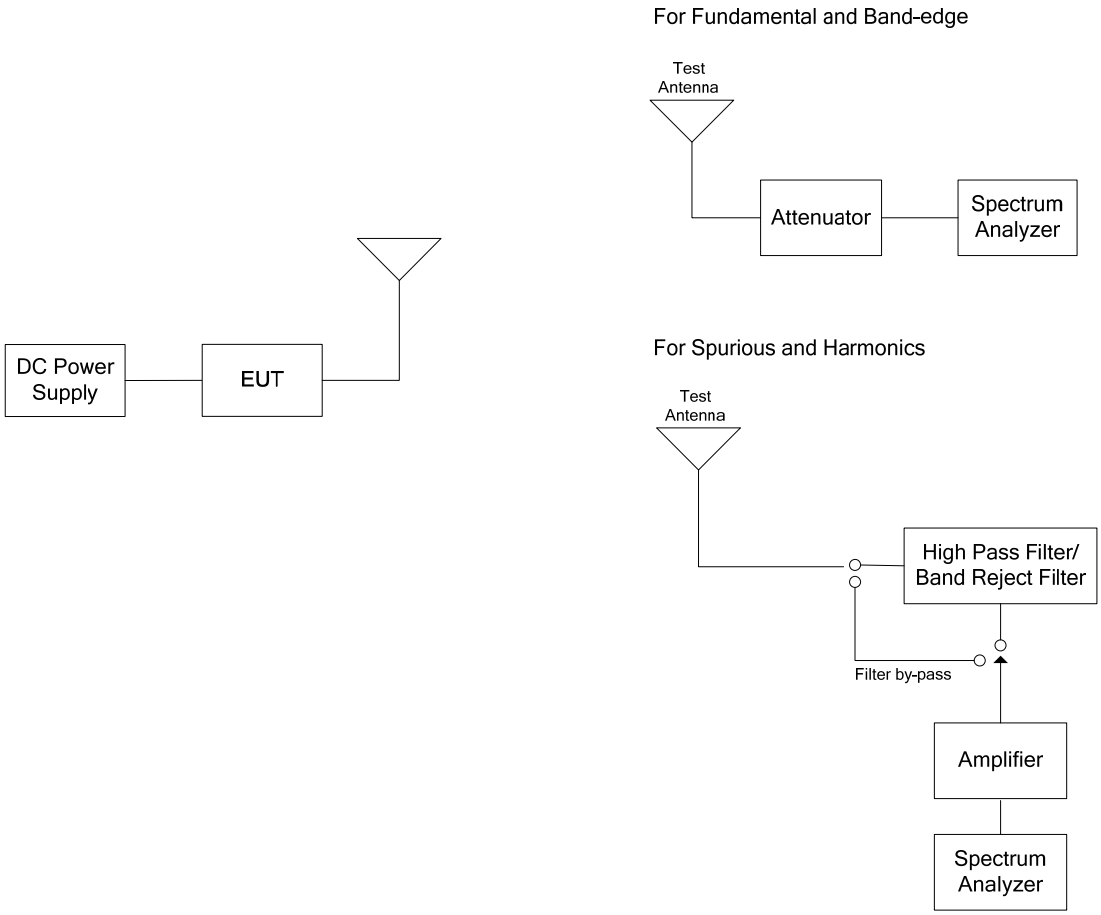
§ 15.209(a) Radiated Emission Limits; General Requirements

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

5.7.2. Method of Measurements

ANSI C63.10-2009

5.7.3. Test Arrangement



5.7.4. Test Data

Remark(s):
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT shall be tested in three orthogonal positions.
- Exploratory tests were performed to determined final test configuration, the following test results at the highest data rate (125kbps, GFSK modulation) represent the worst-case.

5.7.4.1. EUT with 2.1 dBi Monopole Antenna at 100 mW Output Power

5.7.4.1.1. Spurious RF Radiated Emissions Test Results

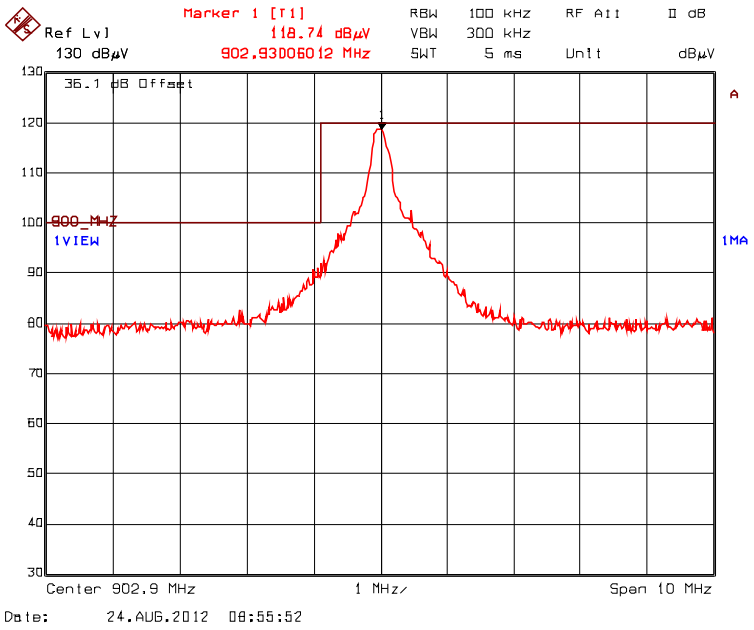
Fundamental Frequency:	902.9 MHz						
Frequency Test Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
902.9	**117.95**	**--**	**V**	**--**	**--**	**--**	**--**
902.9	**120.04**	**--**	**H**	**--**	**--**	**--**	**--**
30-10000	*	*	V/H	*	100.0	*	Pass
*All spurious emissions/harmonics are more than 20 dB below the applicable limit.							

Fundamental Frequency:	915.2 MHz						
Frequency Test Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
915.2	**117.82**	**--**	**V**	**--**	**--**	**--**	**--**
915.2	**120.36**	**--**	**H**	**--**	**--**	**--**	**--**
30-10000	*	*	V/H	*	100.4	*	Pass
*All spurious emissions/harmonics are more than 20 dB below the applicable limit.							

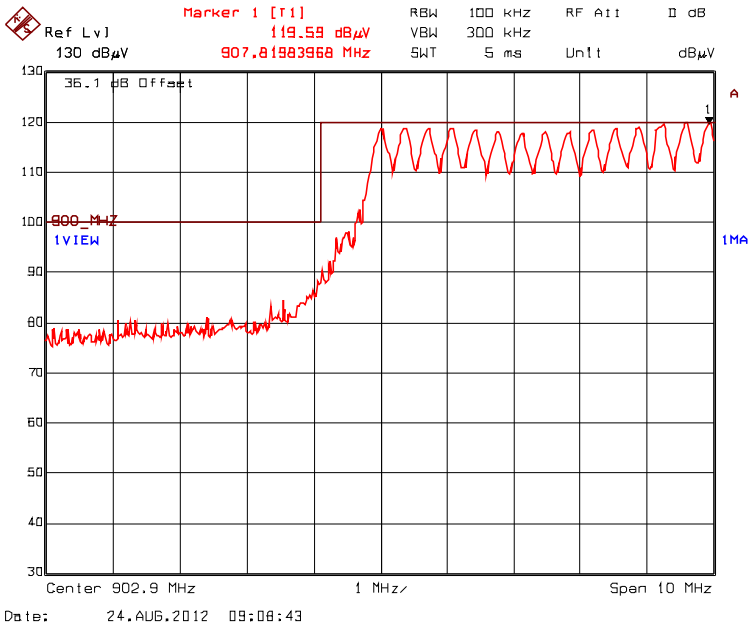
Fundamental Frequency:	927.1 MHz						
Frequency Test Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
927.1	**118.36**	**--**	**V**	**--**	**--**	**--**	**--**
927.1	**120.98**	**--**	**H**	**--**	**--**	**--**	**--**
30-10000	*	*	V/H	*	101.0	*	Pass
*All spurious emissions/harmonics are more than 20 dB below the applicable limit.							

5.7.4.1.2. Band-Edge RF Radiated Emissions Test Results

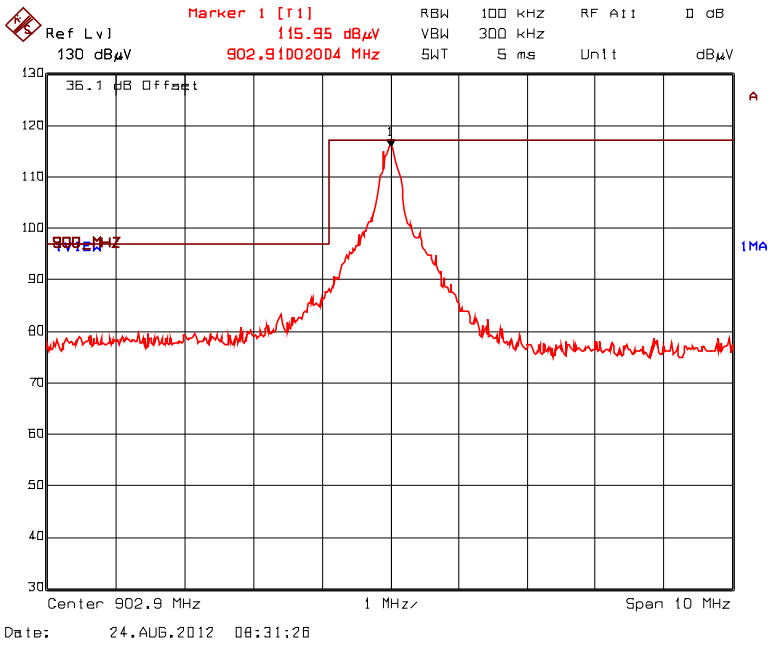
Plot 5.7.4.1.2.1. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, 100 mW, Horizontal



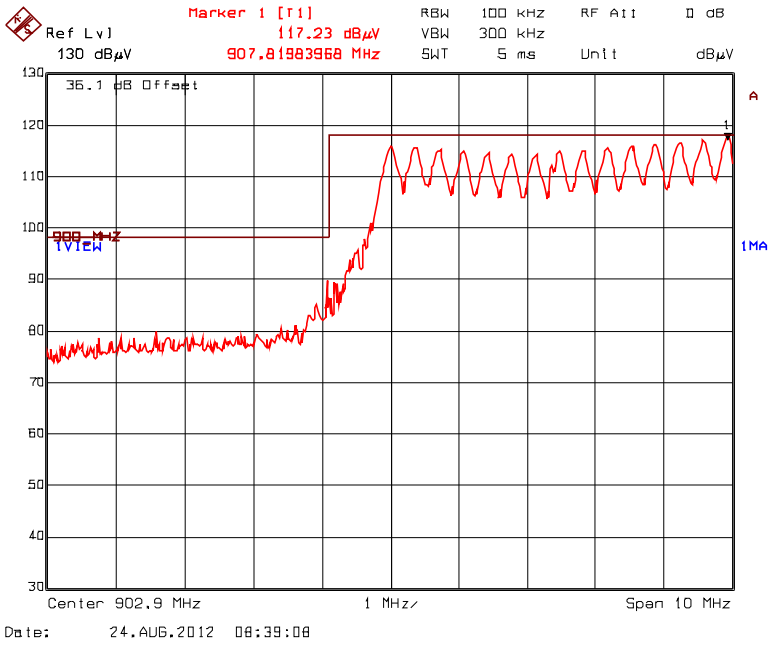
Plot 5.7.4.1.2.2. Radiated Band-Edge, Low End of Frequency Band, Pseudorandom Hopping Mode, 100 mW, Horizontal



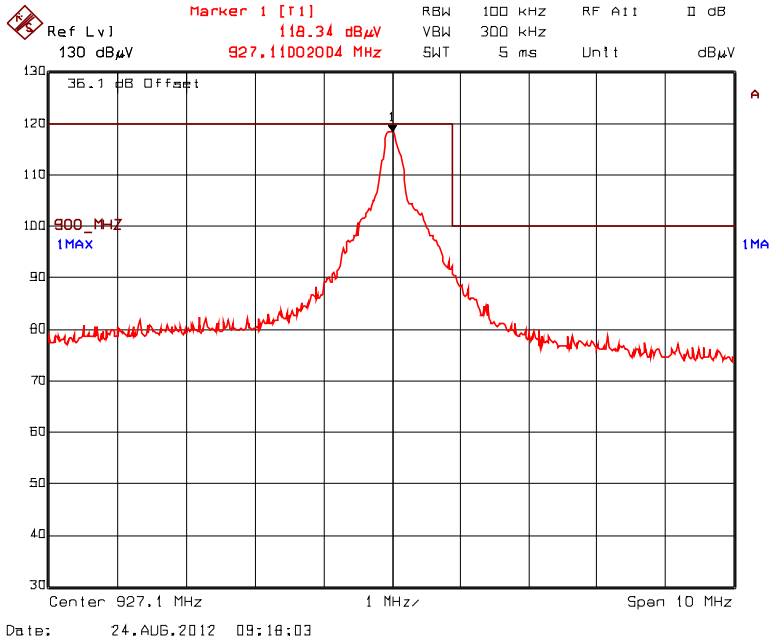
Plot 5.7.4.1.2.3. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, 100 mW, Vertical



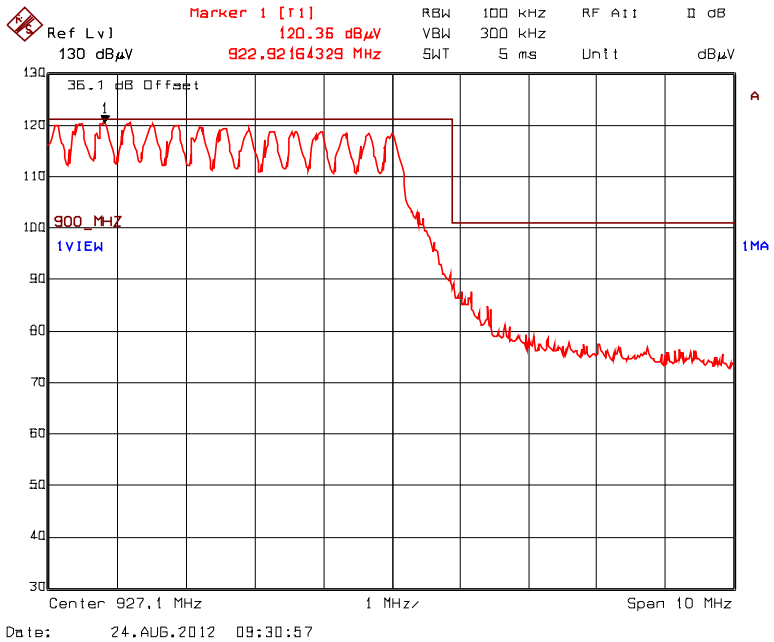
Plot 5.7.4.1.2.4. Radiated Band-Edge, Low End of Frequency Band, Pseudorandom Hopping Mode, 100 mW, Vertical



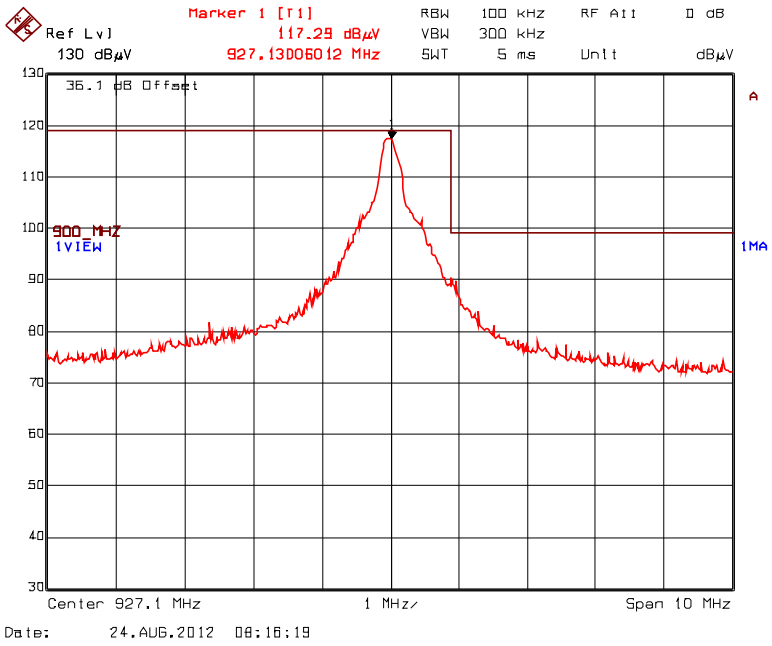
Plot 5.7.4.1.2.5. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, 100 mW, Horizontal



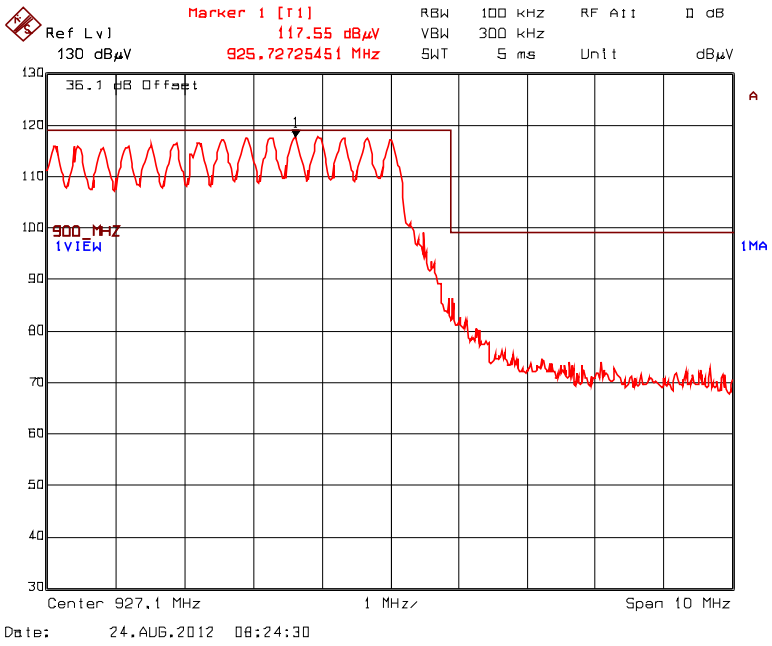
Plot 5.7.4.1.2.6. Radiated Band-Edge, High End of Frequency Band, Pseudorandom Hopping Mode, 100 mW, Horizontal



Plot 5.7.4.1.2.7. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, 100 mW, Vertical



Plot 5.7.4.1.2.8. Radiated Band-Edge, High End of Frequency Band, Pseudorandom Hopping Mode, 100 mW, Vertical



5.7.4.2. EUT with 3.0 dBi Multi-path Antenna, 0.5 dB Assembly Cable Loss at 1 W Output Power

5.7.4.2.1. Spurious RF Radiated Emissions Test Results

Fundamental Frequency: 902.9 MHz
Frequency Test Range: 30 MHz – 10 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
902.9	**124.37**	**--**	**V**	**--**	**--**	**--**	**--**
902.9	**124.28**	**--**	**H**	**--**	**--**	**--**	**--**
2708.7	50.90	45.97	V	54.0	104.4	-8.0	Pass*
2708.7	48.00	41.82	H	54.0	104.4	-12.2	Pass*
3611.6	49.55	42.94	V	54.0	104.4	-11.1	Pass*
3611.6	48.95	40.09	H	54.0	104.4	-13.9	Pass*

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

* Emission within the restricted frequency bands.

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

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
915.2	**124.65**	**--**	**V**	**--**	**--**	**--**	--
915.2	**123.47**	**--**	**H**	**--**	**--**	**--**	**--**
2745.6	49.37	44.51	V	54.00	104.7	-9.5	Pass*
2745.6	51.17	46.13	H	54.00	104.7	-7.9	Pass*
3660.8	48.83	40.11	V	54.00	104.7	-13.9	Pass*
3660.8	47.45	38.10	H	54.00	104.7	-15.9	Pass*

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

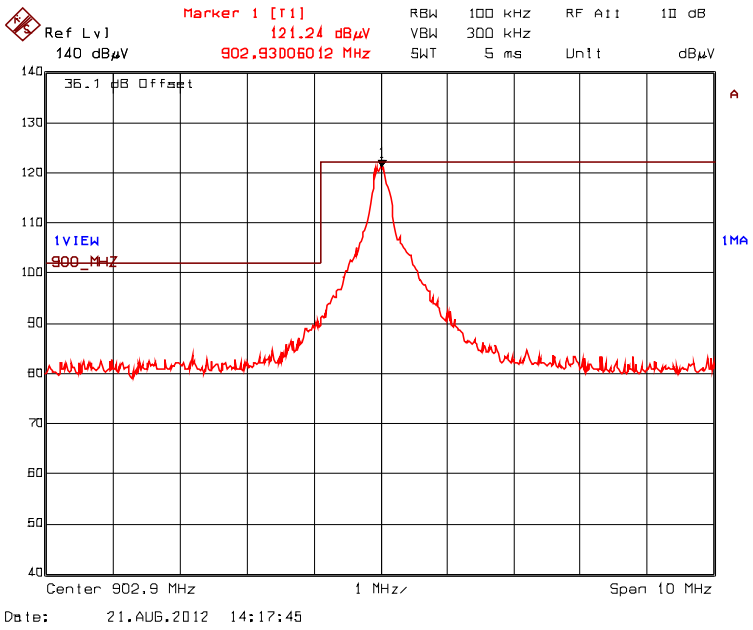
* Emission within the restricted frequency bands.

Fundamental Frequency:	927.1 MHz						
Frequency Test Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
927.1	**125.63**	**--**	**V**	**--**	**--**	**--**	**--**
927.1	**122.65**	**--**	**H**	**--**	**--**	**--**	**--**
2781.3	48.53	43.59	V	54.0	105.6	-10.4	Pass*
2781.3	49.90	45.37	H	54.0	105.6	-8.6	Pass*
3708.4	48.94	41.28	V	54.0	105.6	-12.7	Pass*
3708.4	48.68	41.63	H	54.0	105.6	-12.4	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

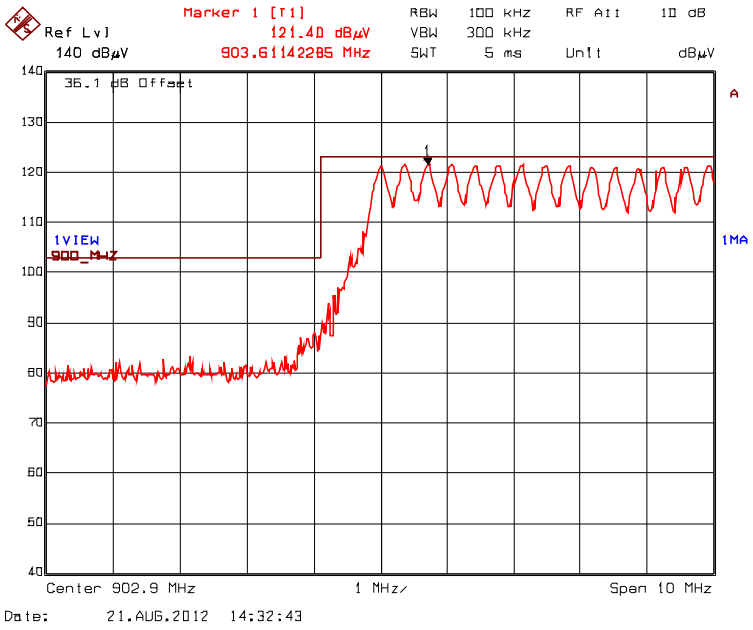
* Emission within the restricted frequency bands.

5.7.4.2.2. Band-Edge RF Radiated Emissions Test Results

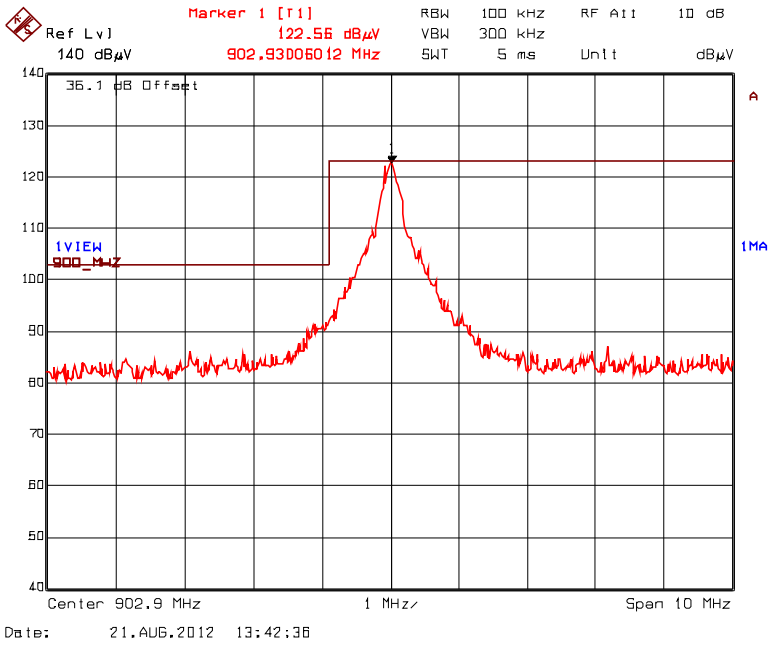
Plot 5.7.4.2.2.1. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, High Power, Horizontal



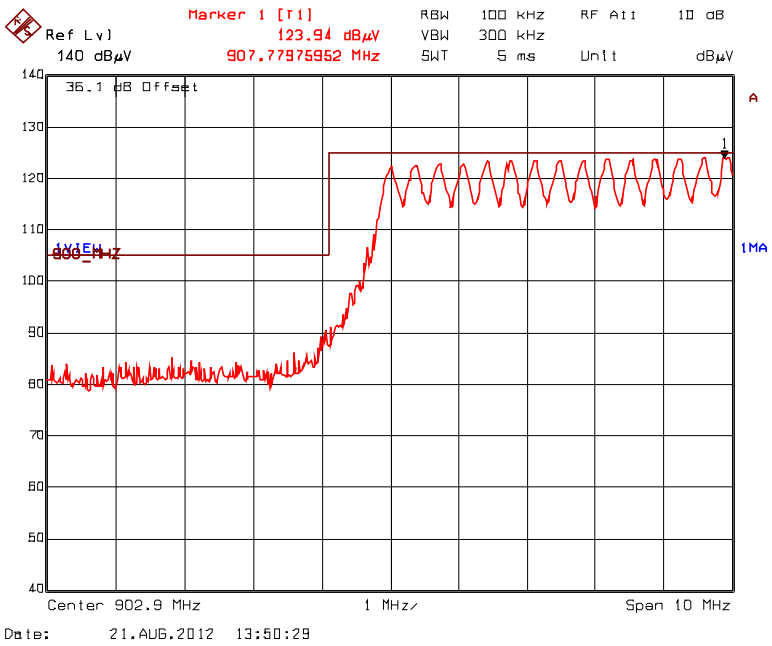
Plot 5.7.4.2.2.2. Radiated Band-Edge, Low End of Frequency Band, Pseudorandom Hopping Mode, High Power, Horizontal



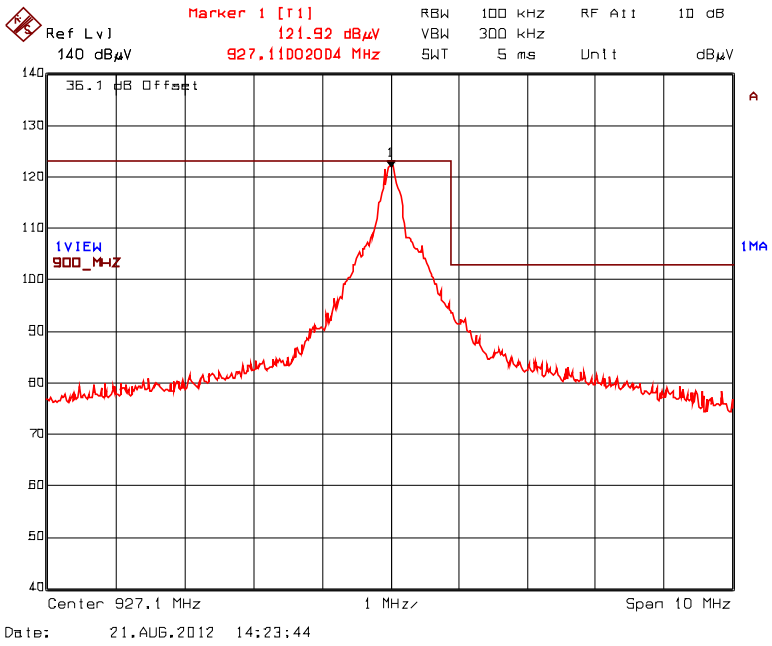
Plot 5.7.4.2.2.3. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, High Power, Vertical



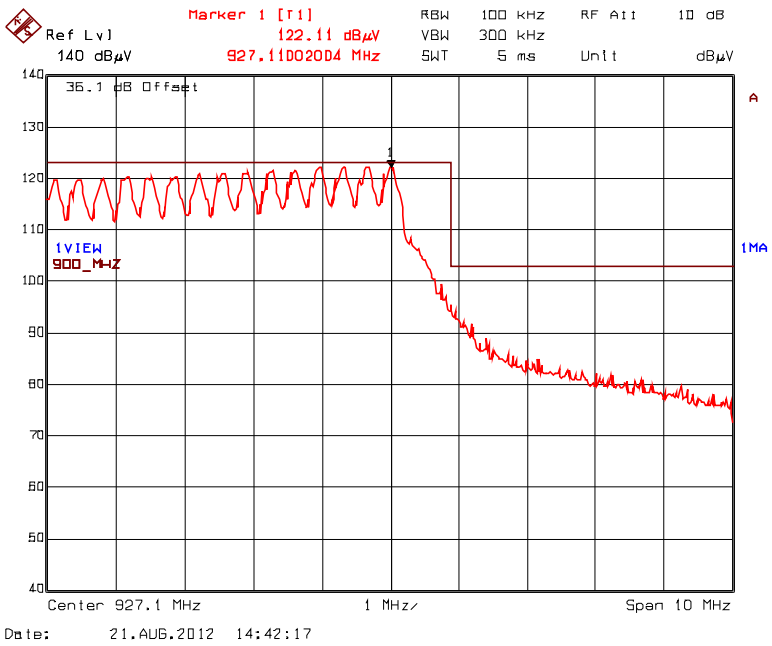
Plot 5.7.4.2.2.4. Radiated Band-Edge , Low End of Frequency Band, Pseudorandom Hopping Mode, High Power, Vertical



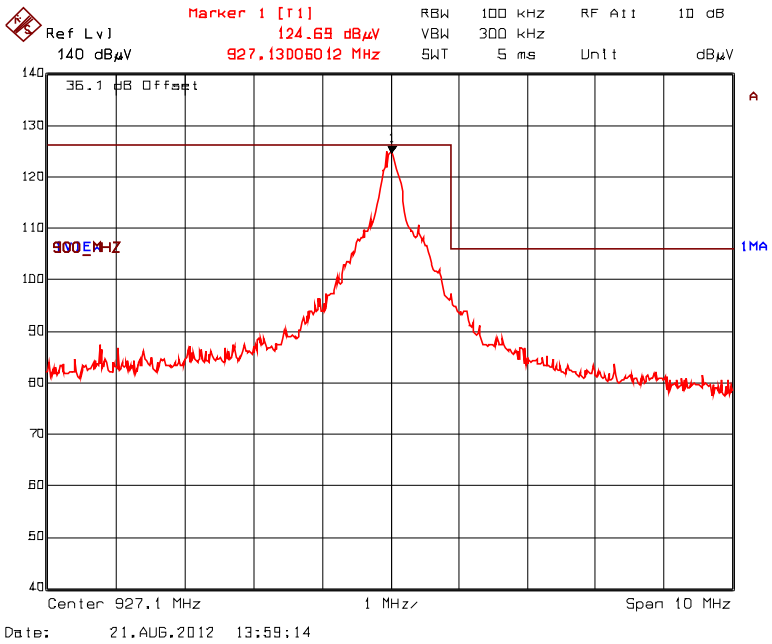
Plot 5.7.4.2.2.5. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, High Power, Horizontal



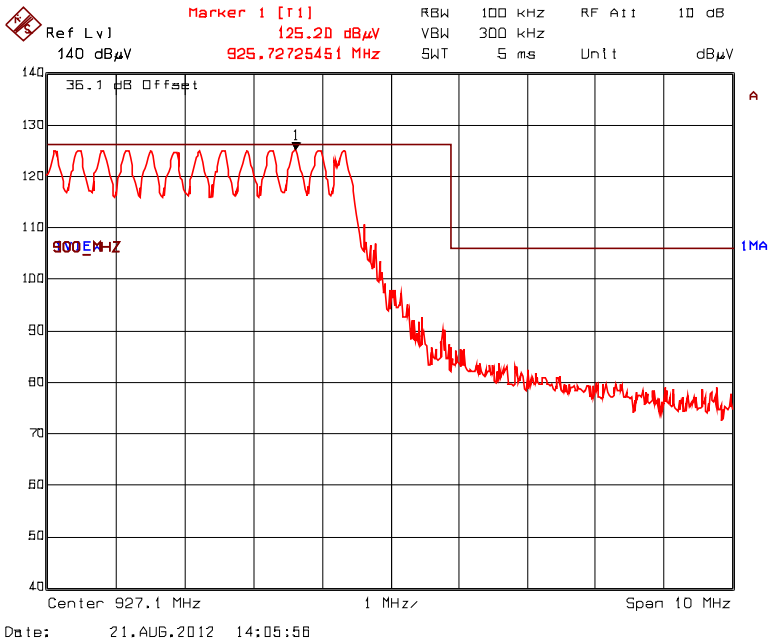
Plot 5.7.4.2.2.6. Radiated Band-Edge, High End of Frequency Band, Pseudorandom Hopping Mode, High Power, Horizontal



Plot 5.7.4.2.2.7. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, High Power, Vertical



Plot 5.7.4.2.2.8. Radiated Band-Edge, High End of Frequency Band, Pseudorandom Hopping Mode, High Power, Vertical



5.7.4.3. EUT with 8.1 dBi Omni-directional Antenna, 2.07 dB Assembly Cable Loss at 1 W Output Power

5.7.4.3.1. Spurious RF Radiated Emissions Test Results

Fundamental Frequency: 902.9 MHz
Frequency Test Range: 30 MHz – 10 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
902.9	**130.41**	**--**	**V**	**--**	**--**	**--**	**--**
902.9	**129.11**	**--**	**H**	**--**	**--**	**--**	**--**
2708.7	43.93	34.20	V	54.0	110.4	-19.8	Pass*
2708.7	49.82	45.51	H	54.0	110.4	-8.5	Pass*
3611.6	46.26	35.05	V	54.0	110.4	-19.0	Pass*
3611.6	47.63	36.82	H	54.0	110.4	-17.2	Pass*
4514.5	47.91	37.81	V	54.0	110.4	-16.2	Pass*
4514.5	48.17	36.30	H	54.0	110.4	-17.7	Pass*

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

* Emission within the restricted frequency bands.

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

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
915.2	**130.11**	**--**	**V**	**--**	**--**	**--**	--
915.2	**129.35**	**--**	**H**	**--**	**--**	**--**	**--**
2745.6	48.73	42.34	V	54.00	110.1	-11.66	Pass*
2745.6	50.84	45.81	H	54.00	110.1	-8.19	Pass*
3660.8	47.46	35.63	H	54.00	110.1	-18.37	Pass*
4576.0	49.39	40.05	V	54.00	110.1	-13.95	Pass*
4576.0	50.10	40.27	H	54.00	110.1	-13.73	Pass*

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

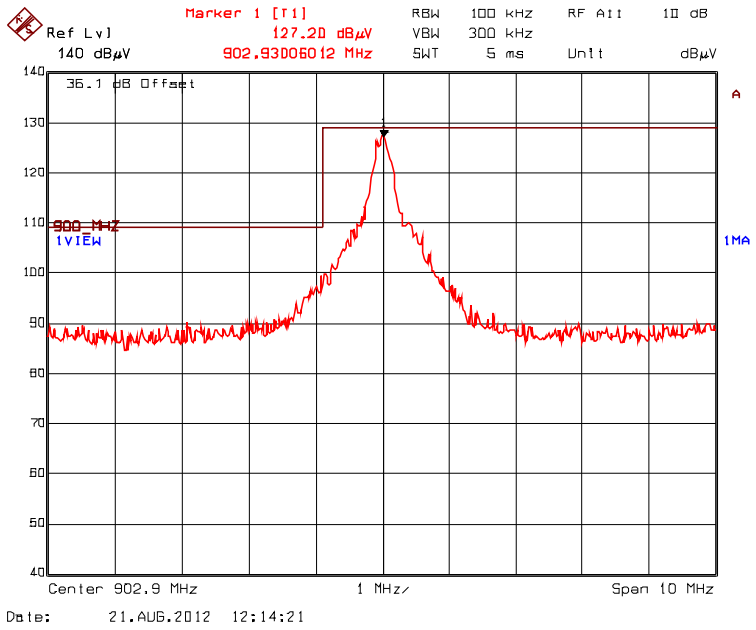
* Emission within the restricted frequency bands.

Fundamental Frequency:	927.1 MHz						
Frequency Test Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
927.1	**130.14**	**--**	**V**	**--**	**--**	**--**	**--**
927.1	**128.32**	**--**	**H**	**--**	**--**	**--**	**--**
2781.3	50.01	44.35	V	54.0	110.1	-9.7	Pass*
2781.3	50.76	47.19	H	54.0	110.1	-6.8	Pass*
3708.4	47.61	36.37	V	54.0	110.1	-17.6	Pass*
3708.4	48.27	38.79	H	54.0	110.1	-15.2	Pass*
4635.5	51.00	44.17	V	54.0	110.1	-9.8	Pass*
4635.5	52.75	45.68	H	54.0	110.1	-8.3	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

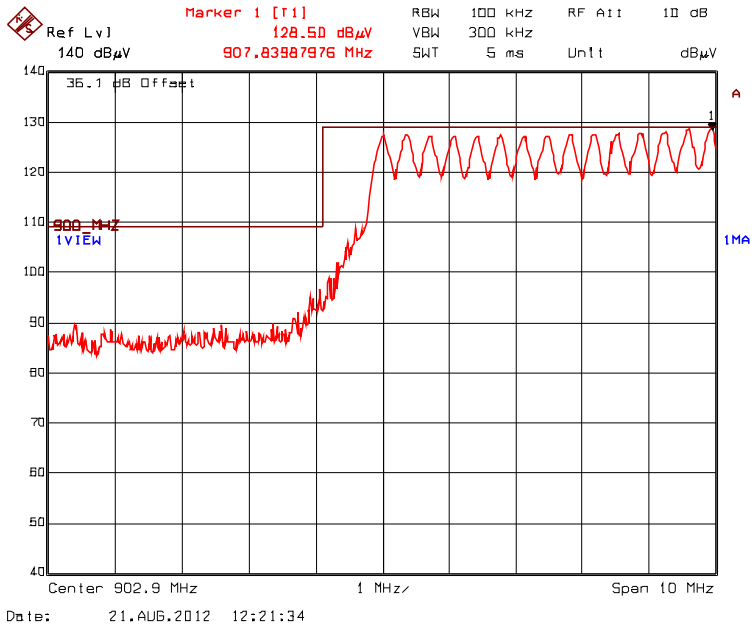
* Emission within the restricted frequency bands.

5.7.4.3.2. Band-Edge RF Radiated Emissions Test Results

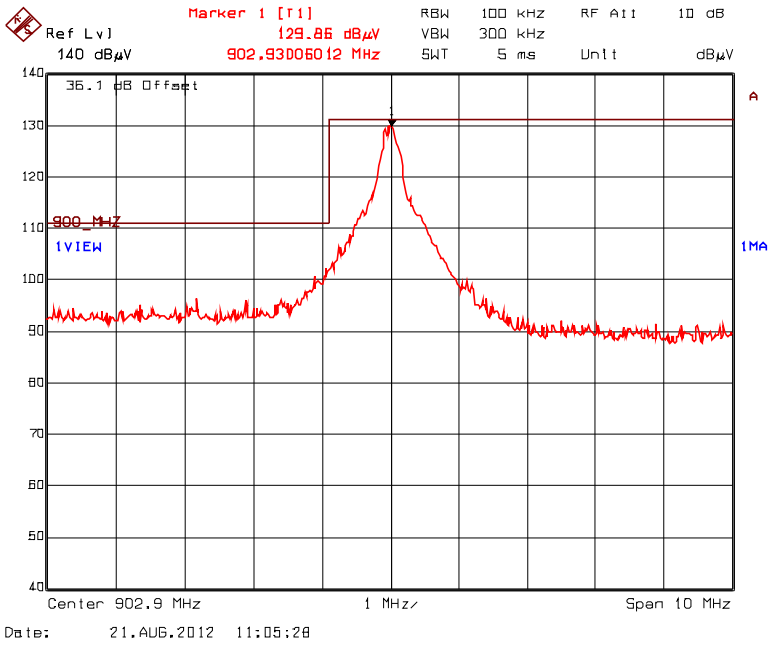
Plot 5.7.4.3.2.1. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, High Power, Horizontal



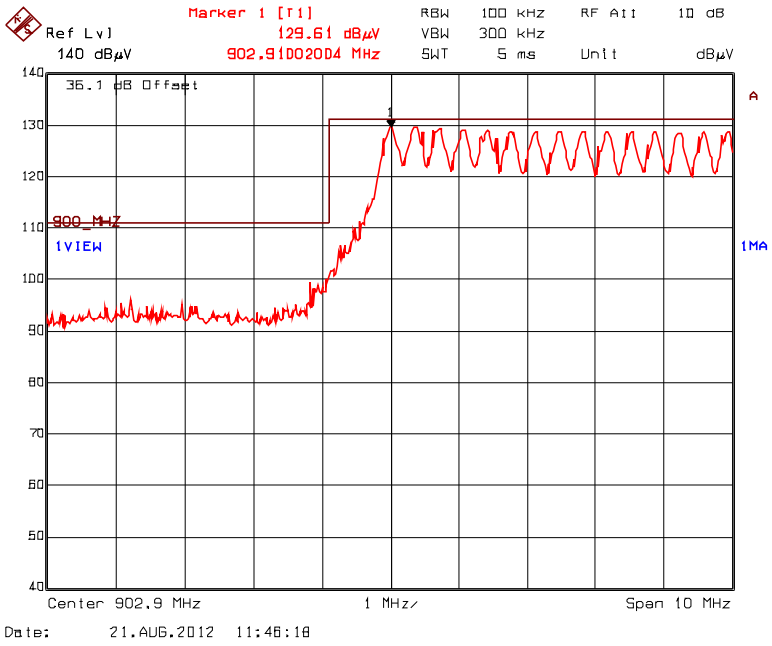
Plot 5.7.4.3.2.2. Radiated Band-Edge, Low End of Frequency Band, Pseudorandom Hopping Mode, High Power, Horizontal



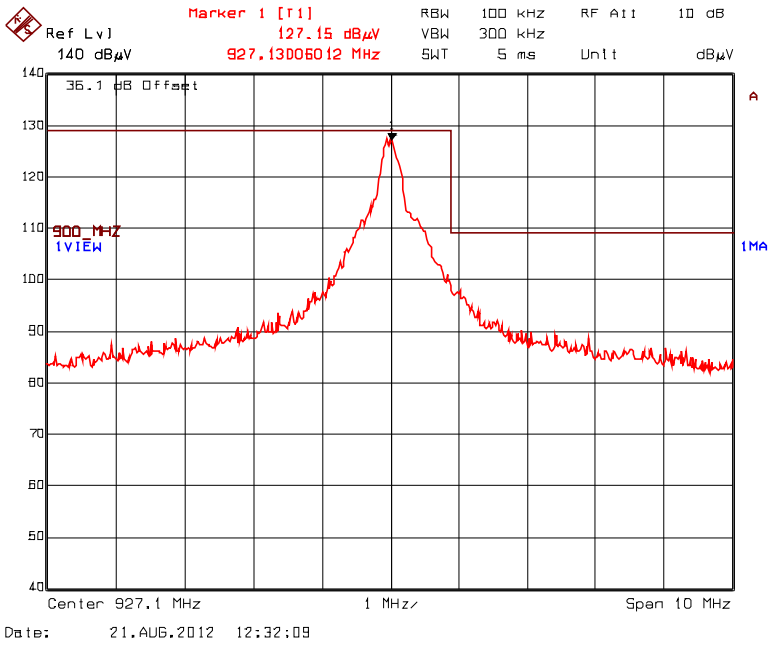
Plot 5.7.4.3.2.3. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, High Power, Vertical



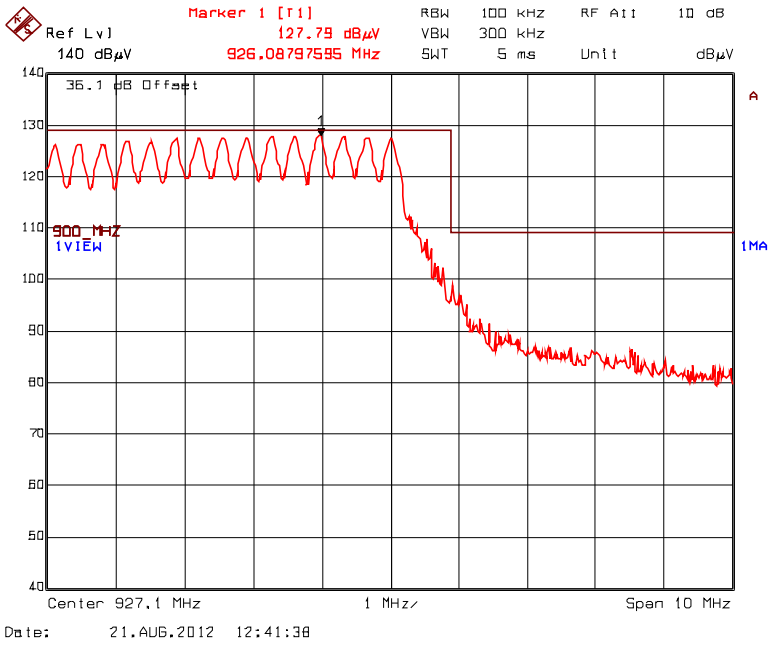
Plot 5.7.4.3.2.4. Radiated Band-Edge, Low End of Frequency Band, Pseudorandom Hopping Mode, High Power, Vertical



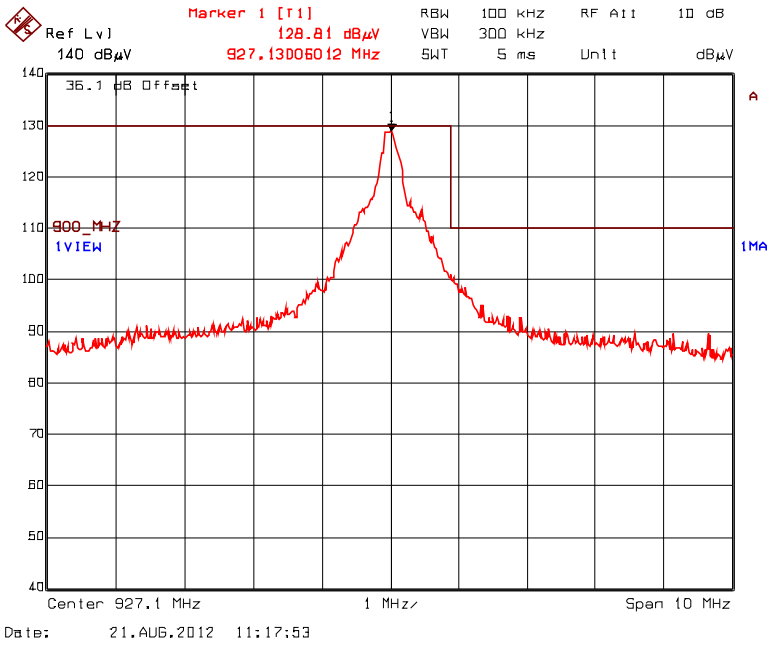
Plot 5.7.4.3.2.5. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, High Power, Horizontal



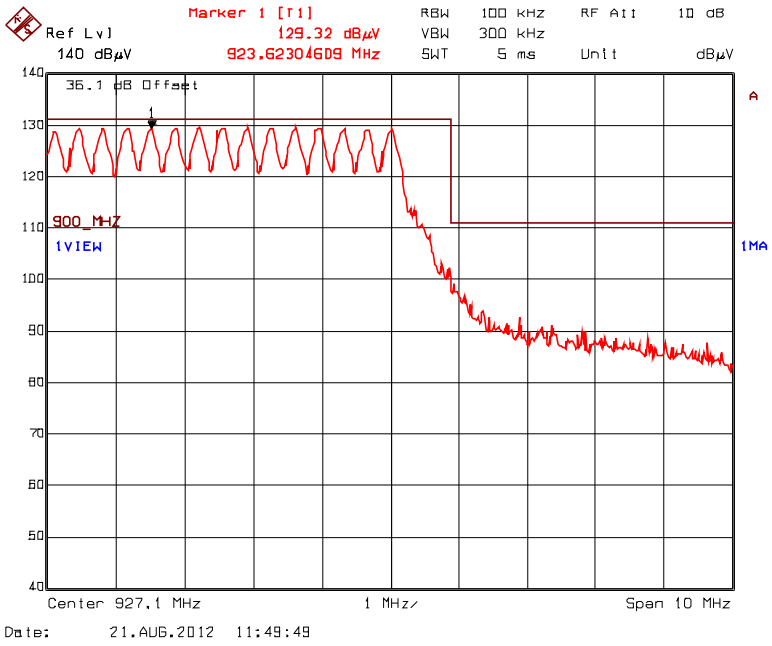
Plot 5.7.4.3.2.6. Radiated Band-Edge , High End of Frequency Band, Pseudorandom Hopping Mode, High Power, Horizontal



Plot 5.7.4.3.2.7. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, High Power, Vertical



Plot 5.7.4.3.2.8. Radiated Band-Edge, High End of Frequency Band, Pseudorandom Hopping Mode, High Power, Vertical



5.7.4.4. EUT with 15.1 dBi Yagi Antenna, 10.62 dB Assembly Cable Loss at 1 W Output Power

5.7.4.4.1. Spurious RF Radiated Emissions Test Results

Fundamental Frequency: 902.9 MHz
Frequency Test Range: 30 MHz – 10 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
902.9	**131.80**	**--**	**V**	**--**	**--**	**--**	**--**
902.9	**131.19**	**--**	**H**	**--**	**--**	**--**	**--**
2708.7	51.52	47.53	V	54.0	111.8	-6.5	Pass*
2708.7	48.75	44.20	H	54.0	111.8	-9.8	Pass*
3611.6	46.79	37.08	V	54.0	111.8	-16.9	Pass*
3611.6	48.62	39.30	H	54.0	111.8	-14.7	Pass*
4514.5	47.68	34.69	V	54.0	111.8	-19.3	Pass*
4514.5	47.77	34.53	H	54.0	111.8	-19.5	Pass*

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

* Emission within the restricted frequency bands.

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

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
915.2	**131.77**	**--**	**V**	**--**	**--**	**--**	--
915.2	**130.94**	**--**	**H**	**--**	**--**	**--**	**--**
2745.6	51.70	47.26	V	54.00	111.8	-6.74	Pass*
2745.6	51.82	48.20	H	54.00	111.8	-5.80	Pass*
3660.8	48.61	38.95	V	54.00	111.8	-15.05	Pass*
3660.8	50.15	41.12	H	54.00	111.8	-12.88	Pass*
4576.0	48.64	35.33	V	54.00	111.8	-18.67	Pass*
4576.0	48.48	35.01	H	54.00	111.8	-18.99	Pass*

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

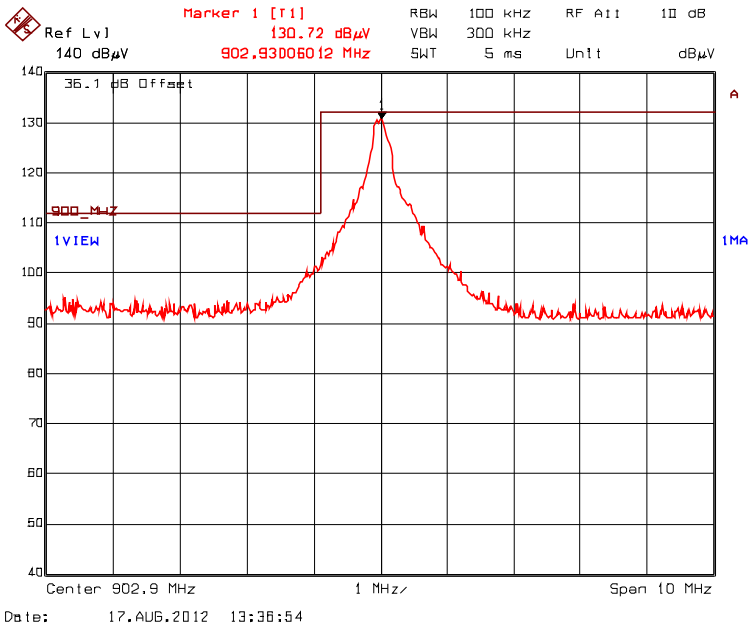
* Emission within the restricted frequency bands.

Fundamental Frequency:	927.1 MHz						
Frequency Test Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
927.1	**132.48**	**--**	**V**	**--**	**--**	**--**	**--**
927.1	**132.13**	**--**	**H**	**--**	**--**	**--**	**--**
2781.3	49.04	41.42	V	54.0	112.5	-12.6	Pass*
2781.3	51.46	47.10	H	54.0	112.5	-6.9	Pass*
3708.4	53.26	48.18	V	54.0	112.5	-5.8	Pass*
3708.4	51.32	46.55	H	54.0	112.5	-7.5	Pass*
4635.5	49.24	37.94	V	54.0	112.5	-16.1	Pass*
4635.5	48.81	37.33	H	54.0	112.5	-16.7	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

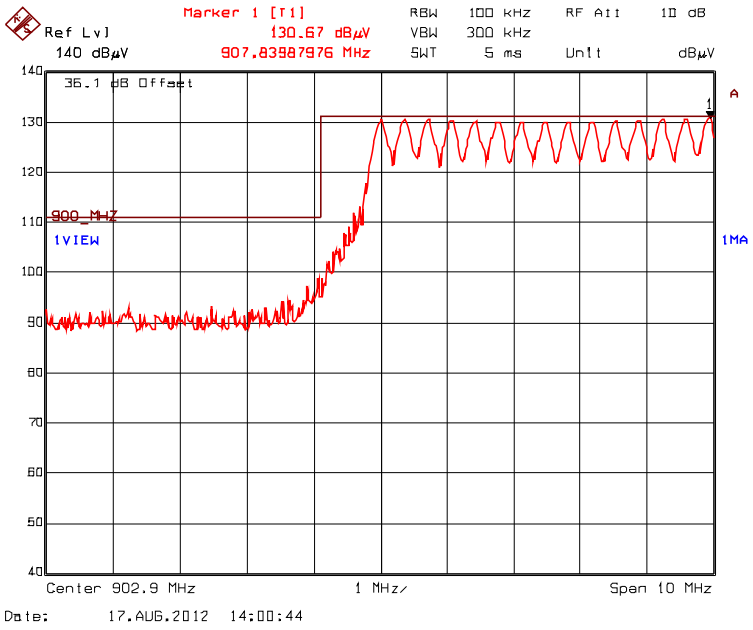
* Emission within the restricted frequency bands.

5.7.4.4.2. Band-Edge RF Radiated Emissions Test Results

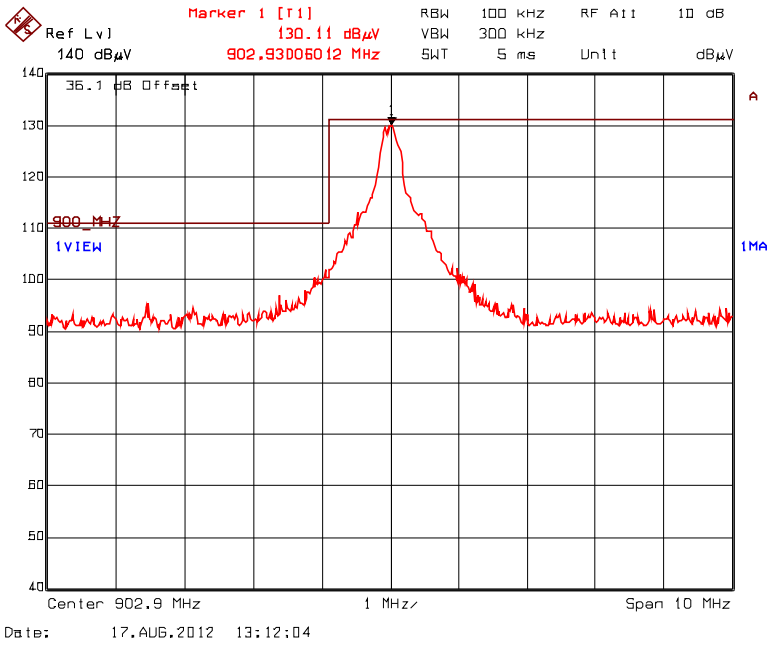
Plot 5.7.4.4.2.1. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, High Power, Horizontal



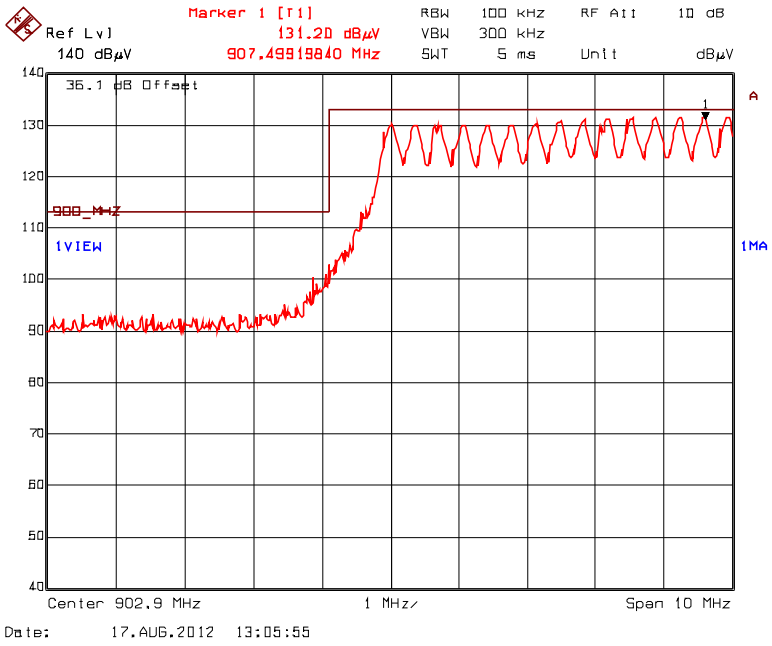
Plot 5.7.4.4.2.2. Radiated Band-Edge, Low End of Frequency Band, Pseudorandom Hopping Mode, High Power, Horizontal



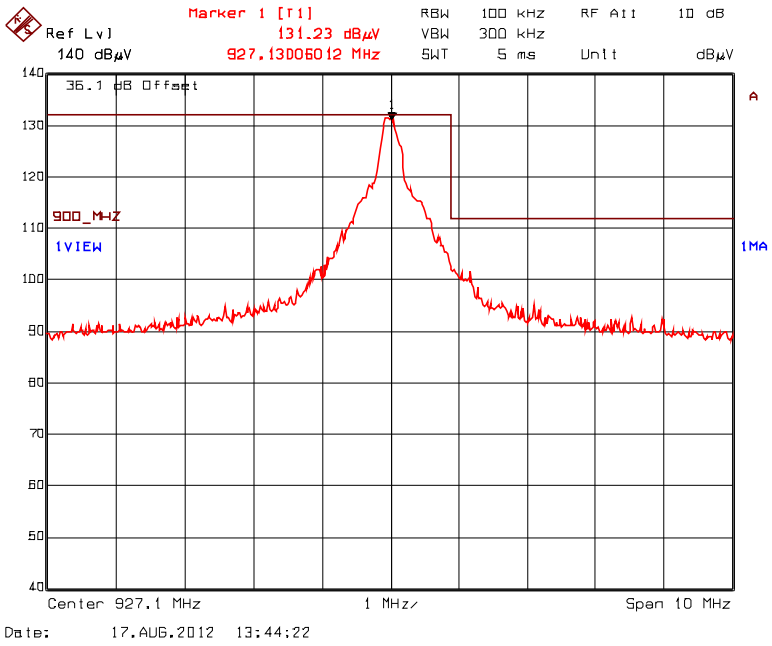
Plot 5.7.4.4.2.3. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, High Power, Vertical



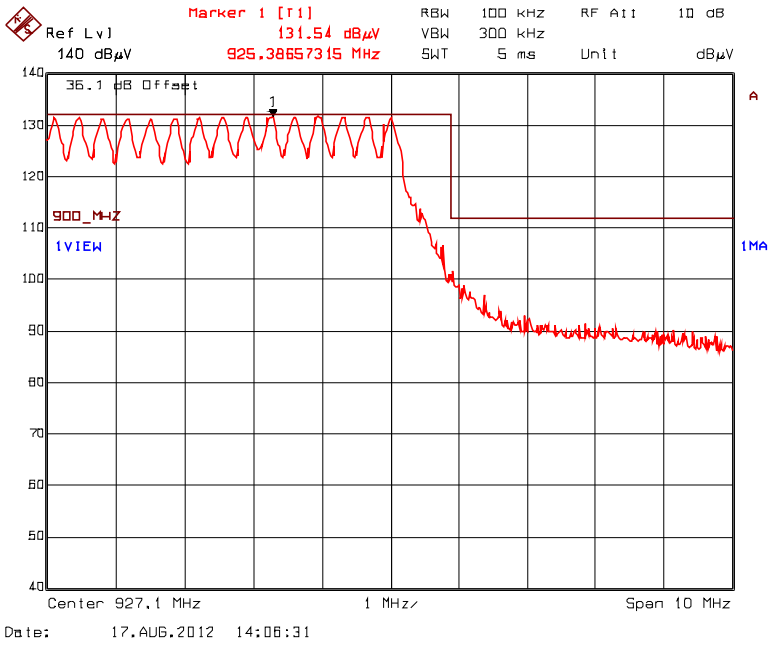
Plot 5.7.4.4.2.4. Radiated Band-Edge, Low End of Frequency Band, Pseudorandom Hopping Mode, High Power, Vertical



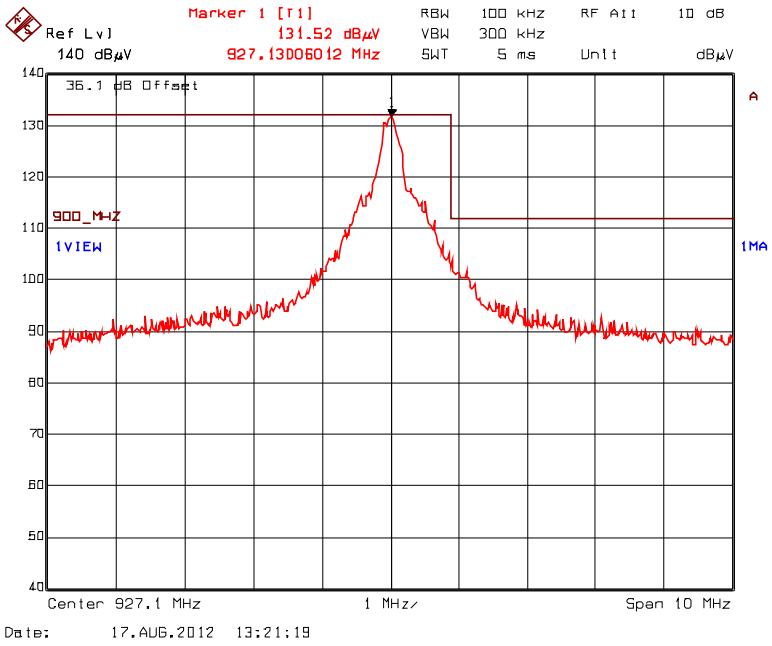
Plot 5.7.4.4.2.5. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, High Power, Horizontal



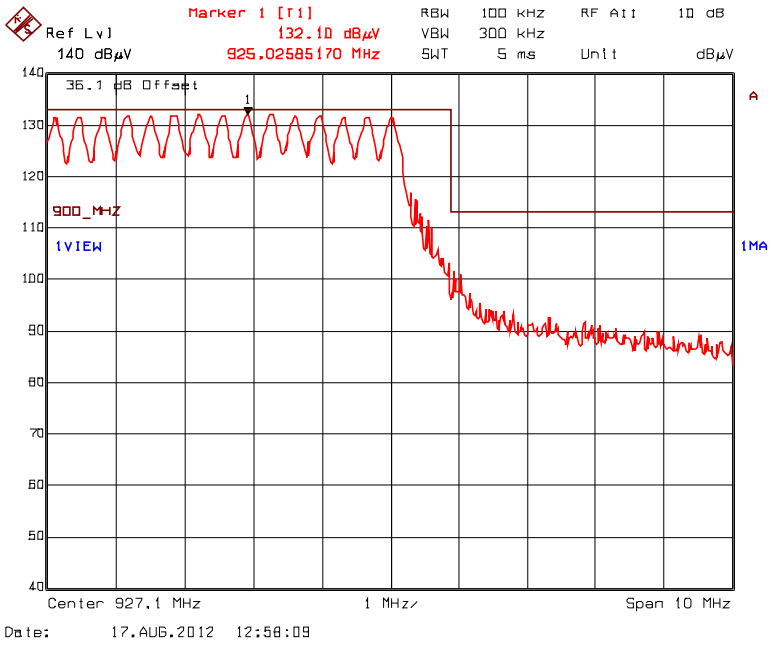
Plot 5.7.4.4.2.6. Radiated Band-Edge, High End of Frequency Band, Pseudorandom Hopping Mode, High Power, Horizontal



Plot 5.7.4.4.2.7. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, High Power, Vertical



Plot 5.7.4.4.2.8. Radiated Band-Edge, High End of Frequency Band, Pseudorandom Hopping Mode, High Power, Vertical



5.7.4.5. EUT with 15.1 dBi Yagi Antenna, 3.95 dB Assembly Cable Loss at 100 mW Output Power

5.7.4.5.1. Spurious RF Radiated Emissions Test Results

Fundamental Frequency: 902.9 MHz
Frequency Test Range: 30 MHz – 10 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
902.9	**130.59**	**--**	**V**	**--**	**--**	**--**	**--**
902.9	**130.22**	**--**	**H**	**--**	**--**	**--**	**--**
30-10000	*	*	V/H	*	110.6	*	Pass

*All spurious emissions/harmonics are more than 20 dB below the applicable limit.

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

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
915.2	**131.97**	**--**	**V**	**--**	**--**	**--**	**--**
915.2	**130.81**	**--**	**H**	**--**	**--**	**--**	**--**
30-10000	*	*	V/H	*	112.0	*	Pass

*All spurious emissions/harmonics are more than 20 dB below the applicable limit.

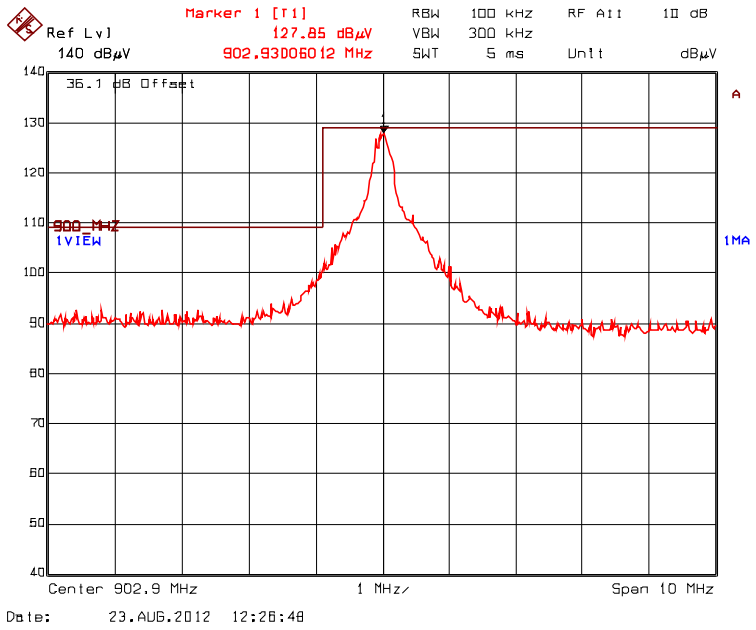
Fundamental Frequency: 927.1 MHz
Frequency Test Range: 30 MHz – 10 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
927.1	**131.68**	**--**	**V**	**--**	**--**	**--**	**--**
927.1	**131.87**	**--**	**H**	**--**	**--**	**--**	**--**
30-10000	*	*	V/H	*	111.9	*	Pass

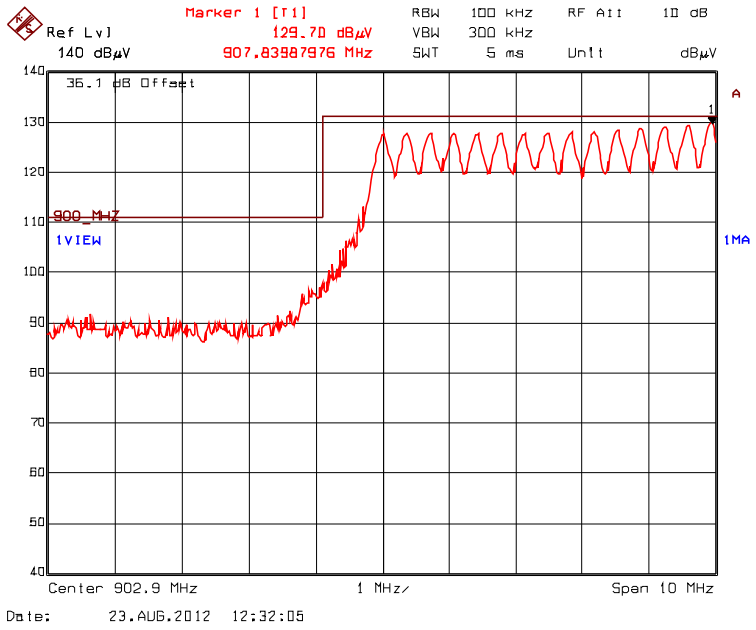
*All spurious emissions/harmonics are more than 20 dB below the applicable limit.

5.7.4.5.2. Band-Edge RF Radiated Emissions Test Results

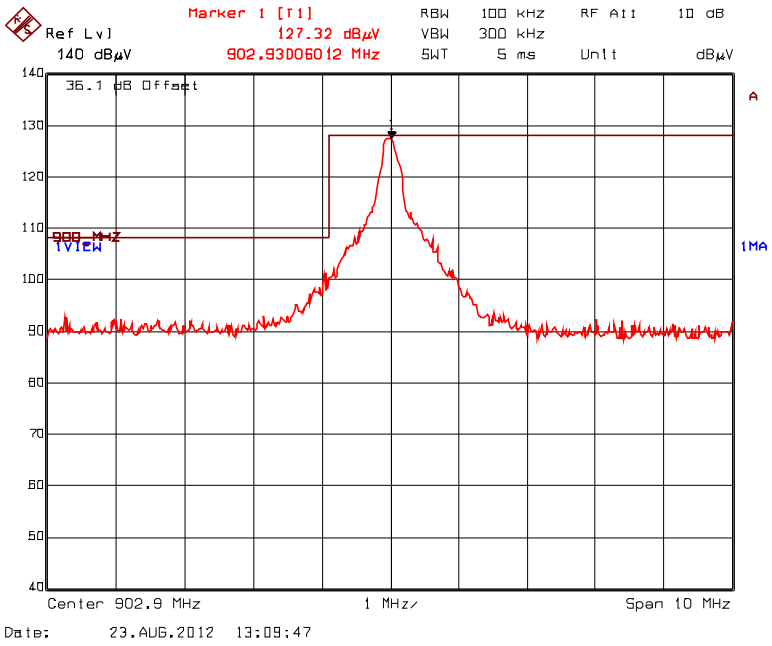
Plot 5.7.4.5.2.1. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, High Power, Horizontal



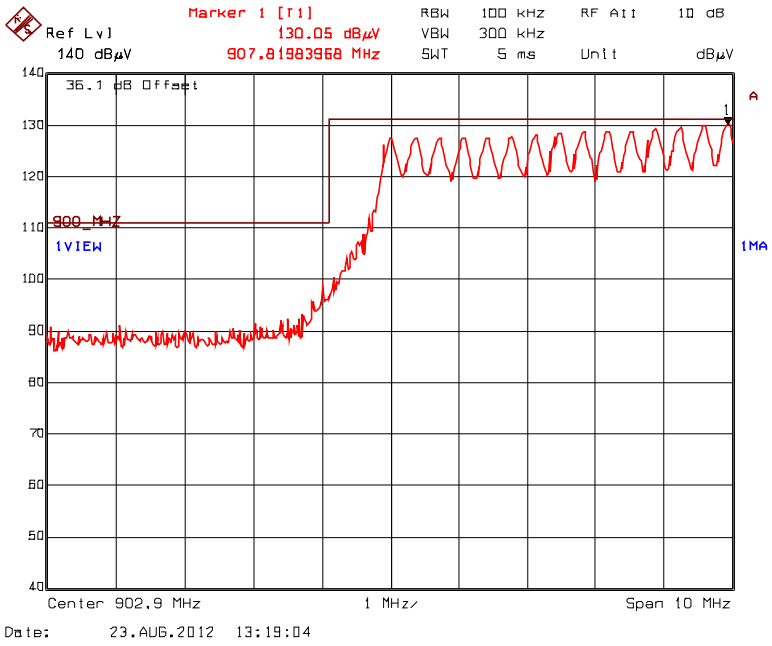
Plot 5.7.4.5.2.2. Radiated Band-Edge, Low End of Frequency Band, Pseudorandom Hopping Mode, High Power, Horizontal



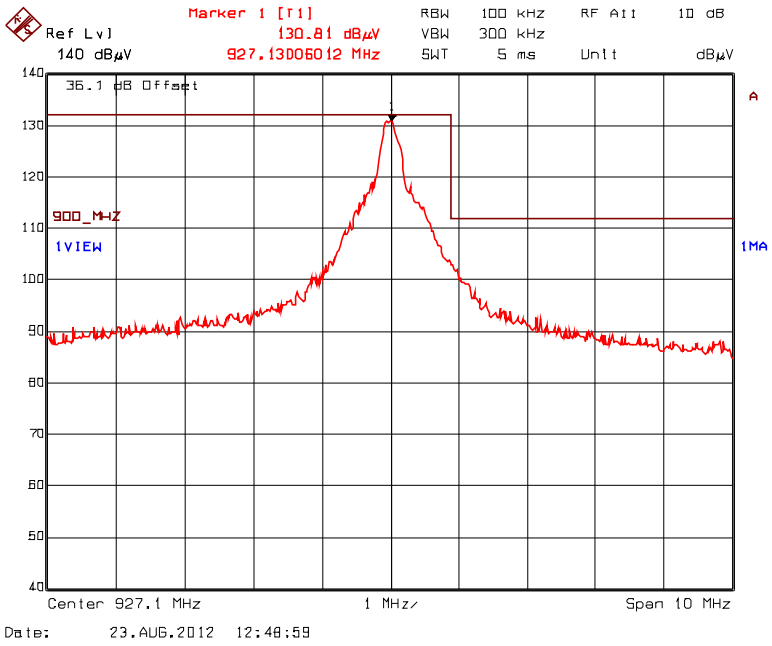
Plot 5.7.4.5.2.3. Radiated Band-Edge, Low End of Frequency Band, Single Frequency Mode, High Power, Vertical



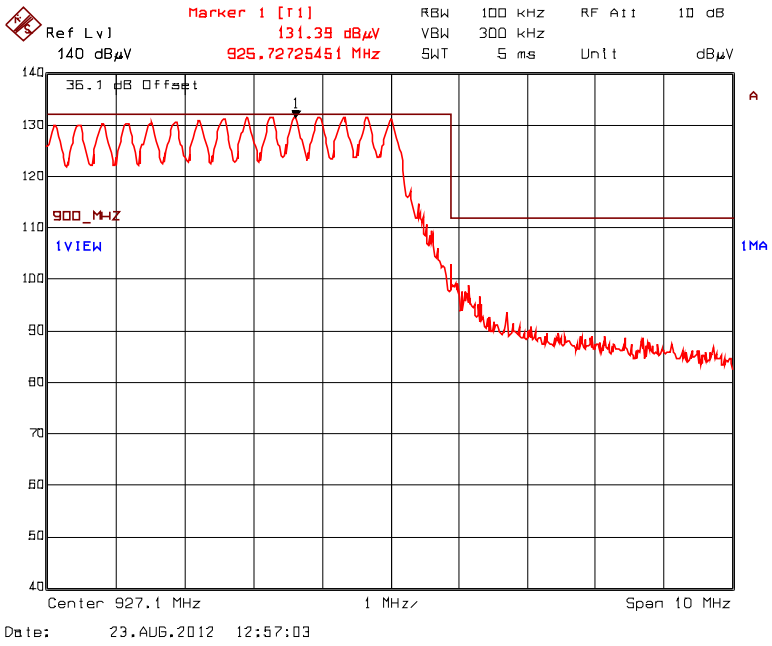
Plot 5.7.4.5.2.4. Radiated Band-Edge, Low End of Frequency Band, Pseudorandom Hopping Mode, High Power, Vertical



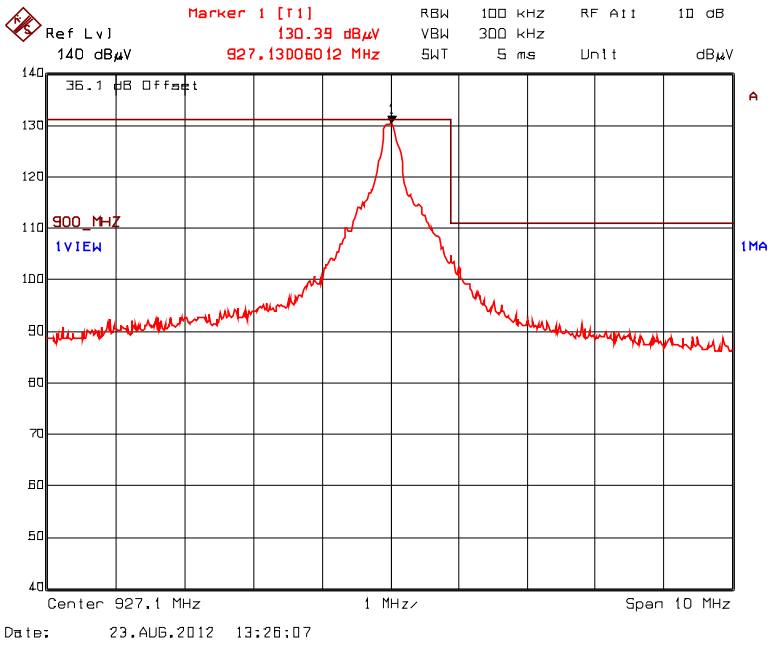
Plot 5.7.4.5.2.5. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, High Power, Horizontal



Plot 5.7.4.5.2.6. Radiated Band-Edge, High End of Frequency Band, Pseudorandom Hopping Mode, High Power, Horizontal



Plot 5.7.4.5.2.7. Radiated Band-Edge, High End of Frequency Band, Single Frequency Mode, High Power, Vertical



Plot 5.7.4.5.2.8. Radiated Band-Edge, High End of Frequency Band, Pseudorandom Hopping Mode, High Power, Vertical

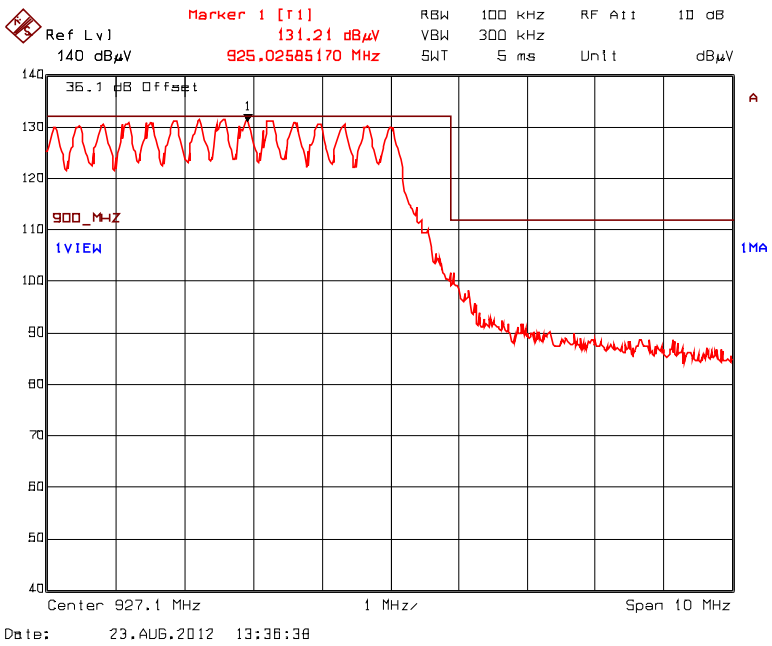


EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20Hz–40 GHz	27 Sep 2012
Attenuator	Pasternack	7024-20	-	DC–26.5 GHz	Cal on use
Attenuator	Pasternack	7024-10	-	DC–26.5 GHz	Cal on use
DC Block	Hewlett Packard	11742A	12460	0.045–26.5 GHz	Cal on use
DC Power Supply	Tenma	72-7295	490300270	1 – 40 Vdc	Cal on use
High Pass Filter	K & L	11SH10-1500/T8000	2	Cut off 900 MHz	Cal. on use
Spectrum Analyzer	Agilent	E7401A	US40240432	9 kHz–1.5 GHz	15 Feb 2013
Attenuator	Pasternack	PE7010-20	-	DC–2 GHz	09 Jan 2013
L.I.S.N	EMCO	3825/2	8907-1531	10 kHz -100 MHz	05 Apr 2013
Signal Generator	Hewlett Packard	8648C	3443U00391	100 kHz – 3200 MHz	14 Dec 2012
Log Periodic Antenna	ETS Lundgren	93148	1101	200–2000 MHz	20 Mar 2013
Attenuator	Pasternack	PE7024-10	-	DC–26.5 GHz	Cal on use
DC Power Supply	Tenma	72-7295	490300270	1 – 40 Vdc	Cal on use
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	19 Mar 2013
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	6 Aug 2013
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	16 Mar 2013
High Pass Filter	K & L	11SH10-1500/T8000	2	Cut off 900 MHz	Cal on use
Horn Antenna	Emco	3155	6570	1 – 18 GHz	2 Apr 2013
Biconi-Log Antenna	ETS Lundgren	3142B	1575	26 – 3000 MHz	4 May 2013
Dipole Antenna	EMCO	3121-DB4	434	400-1000 MHz	6 Jan 2014
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