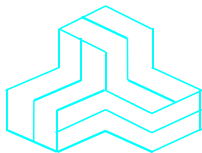




ULTRATECH DOCUMENT REVISION PAGE

Revision Number	Reason	Revision Issued Date	Revision File Number	Issued by
Original	Original report	April 12, 2013	MIC-165Q_F15C247DTS	Dharmajit Solanki
R1	Corrected plot # 5.5.4.2.2.4 on Page no.60 of the report.	April 29, 2013	MIC-165Q_F15C247DTS-R1	Dharmajit Solanki

ENGINEERING TEST REPORT



900 MHz OEM DTS / FHSS Module

Model: NX915

FCC ID: E5MDS-NX915

Applicant:

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

In Accordance With

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

UltraTech's File No.: MIC-165Q_F15C247DTS-R1

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

Date: April 29, 2013

Report Prepared by: Dharmajit Solanki

Tested by: Mr. Hung Trinh

Issued Date: April 29, 2013

Test Dates: February 5 - March 5 & April 12, 29, 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.*

UltraTech

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FCC

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NvLap Lab Code 200093-0



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
Purpose of Test:	Equipment Certification for Digital Modulation Systems (DTS) 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 KDB Publication No. 558074 D01 DTS Meas Guidance v01	2012	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

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File #: MIC-165Q_F15C247DTS-R1
 April 29, 2013

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

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:	Digital Transmission System (DTS)
Input Power Supply Type:	External Regulated DC Sources
Primary User Functions of EUT:	OEM Transceiver Industrial Wireless Data applications

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File #: MIC-165Q_F15C247DTS-R1
April 29, 2013

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

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	▪ Base Station (fixed use)
Intended Operating Environment:	▪ Commercial, industrial or business environment
Power Supply Requirement:	4.5Vdc, <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 (DTS)

Modem 500 Mode:

Modulation Format: 2-GFSK
Symbol Rate (bps): 499999
RX Channel BW (Hz): 833333

Modem 1000 Mode:

Modulation Format: 4-GFSK
Symbol Rate (bps): 499999
RX Channel BW (Hz): 833333

Modem 1000W Mode:

Modulation Format: 4-GFSK
Symbol Rate (bps): 499999
RX Channel BW (Hz): 1666666

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 °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.
Special Test Software:	Special software and hardware provided by the Applicant to operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of the lowest, middle and highest frequencies individually continuously during testing.
Special Hardware Used:	Test Jig
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as non-integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	902 - 928 MHz
Frequency(ies) Tested:	902.7, 915.0 and 927.3 MHz (Modem 500) 903.0075, 915.0 and 926.9925 MHz (Modem 1000) 903.0075, 915.0 and 926.9925 MHz (Modem 1000W)
RF Power Output: (Maximum output power at antenna terminals)	1 Watt (conducted)
*Normal Test Modulation:	2 & 4 GFSK (Modem 500, 1000 & 1000W)
Modulating Signal Source:	Internal

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

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)(2)	6 dB Bandwidth	Yes
15.247(b)(3)	Peak Conducted Output Power - DTS	Yes
15.247(d)	Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	Yes
15.247(e)	Power Spectral Density	Yes
15.247(i), 1.1307, 1.1310, 2.1091	RF Exposure	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

EXHIBIT 5. TEST DATA

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

5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

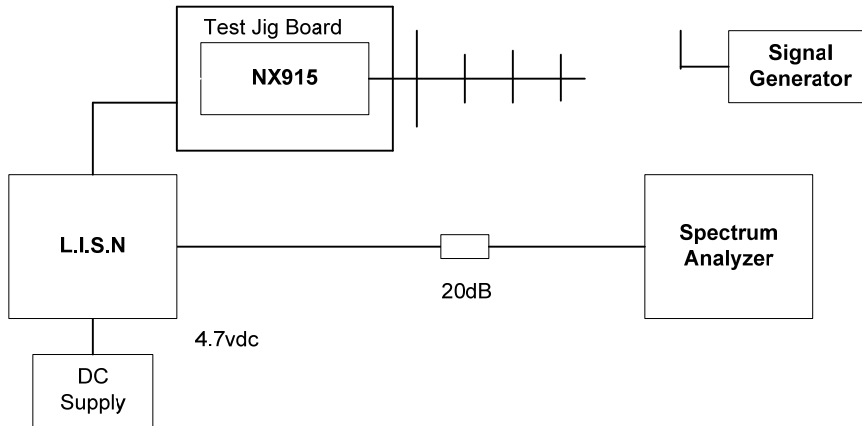
Frequency of emission (MHz)	Conducted Limits (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases linearly with the logarithm of the frequency.

5.1.2. Method of Measurements

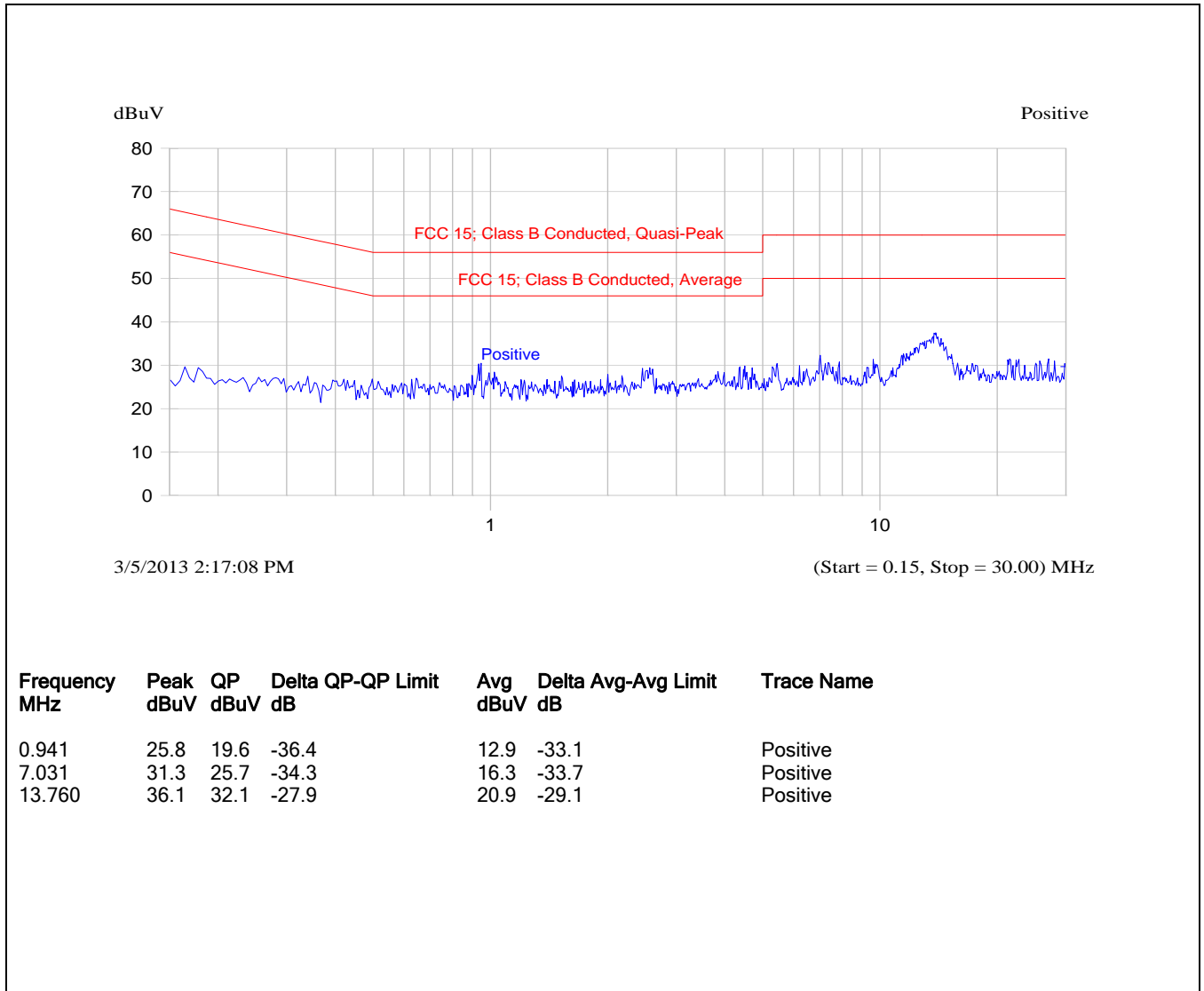
ANSI C63.4-2009

5.1.3. Test Arrangement

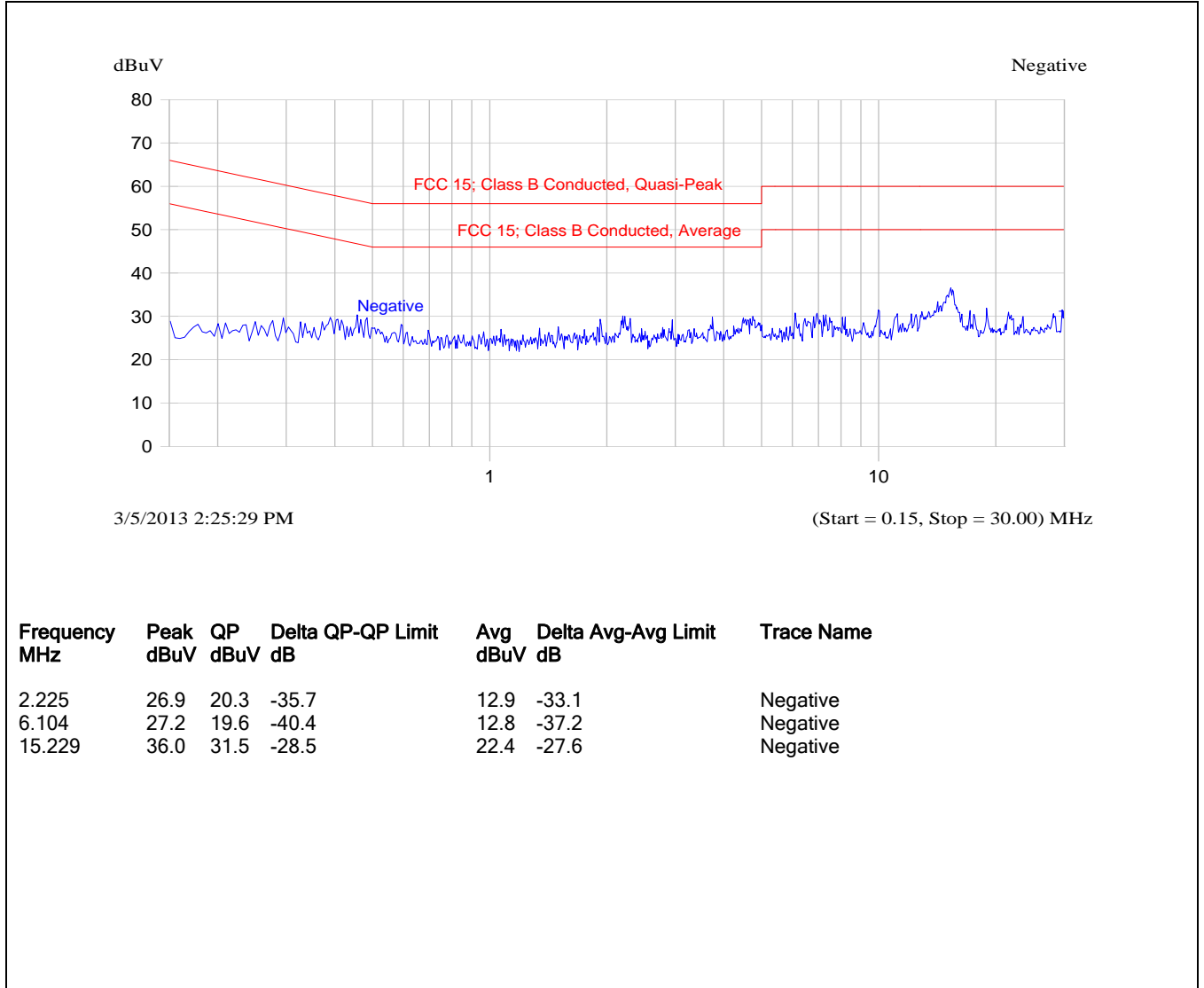


5.1.4. Test Data

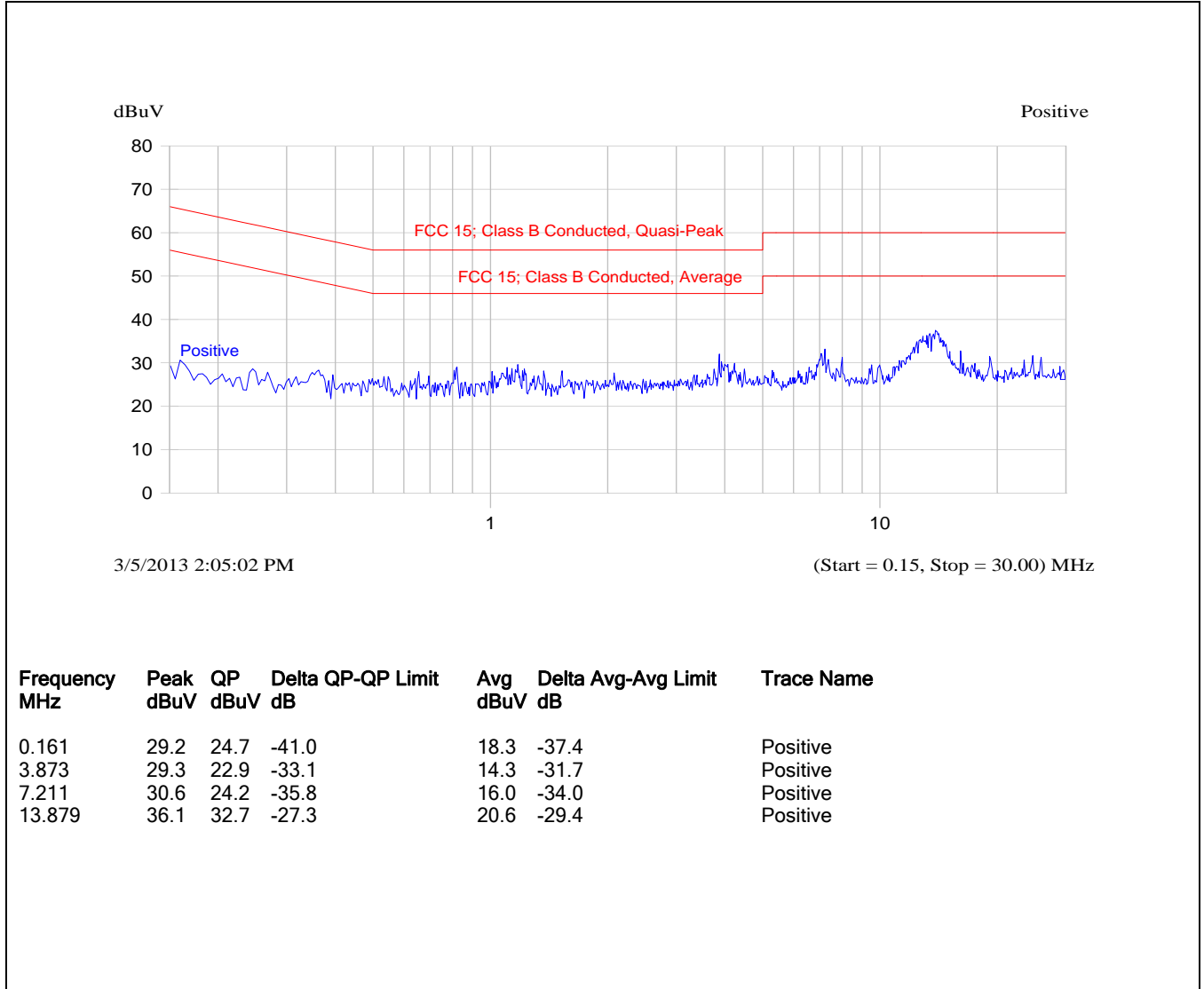
Plot 5.1.4.1. Power Line Conducted Emissions, Tx Mode, Line Voltage: 4.7 VDC, Line Tested: Positive



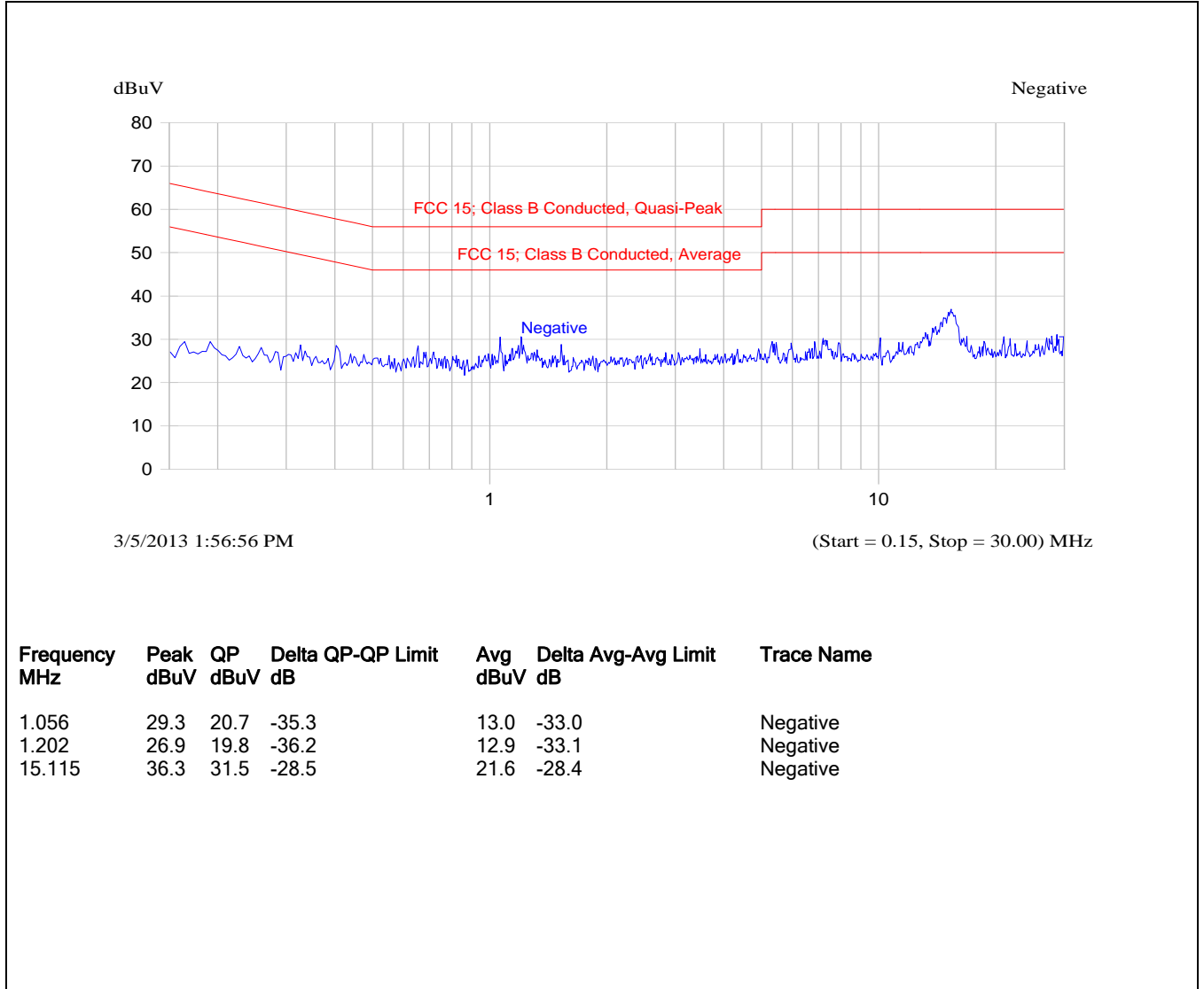
Plot 5.1.4.2. Power Line Conducted Emissions, Tx Mode, Line Voltage: 4.7 VDC, Line Tested: Negative



Plot 5.1.4.3. Power Line Conducted Emissions, Rx Mode, Line Voltage: 4.7 VDC, Line Tested: 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. OCCUPIED BANDWIDTH [§ 15.247(a)(2)]

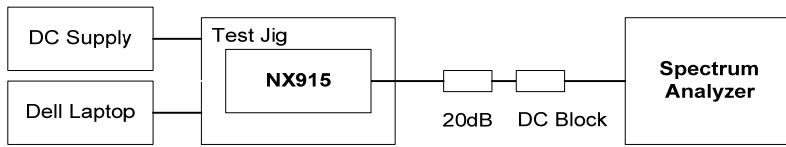
5.2.1. Limit(s)

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

5.2.2. Method of Measurements

KDB Publication No. 558074 D01 Section 5.1.1 EBW Measurement Procedure.

5.2.3. Test Arrangement

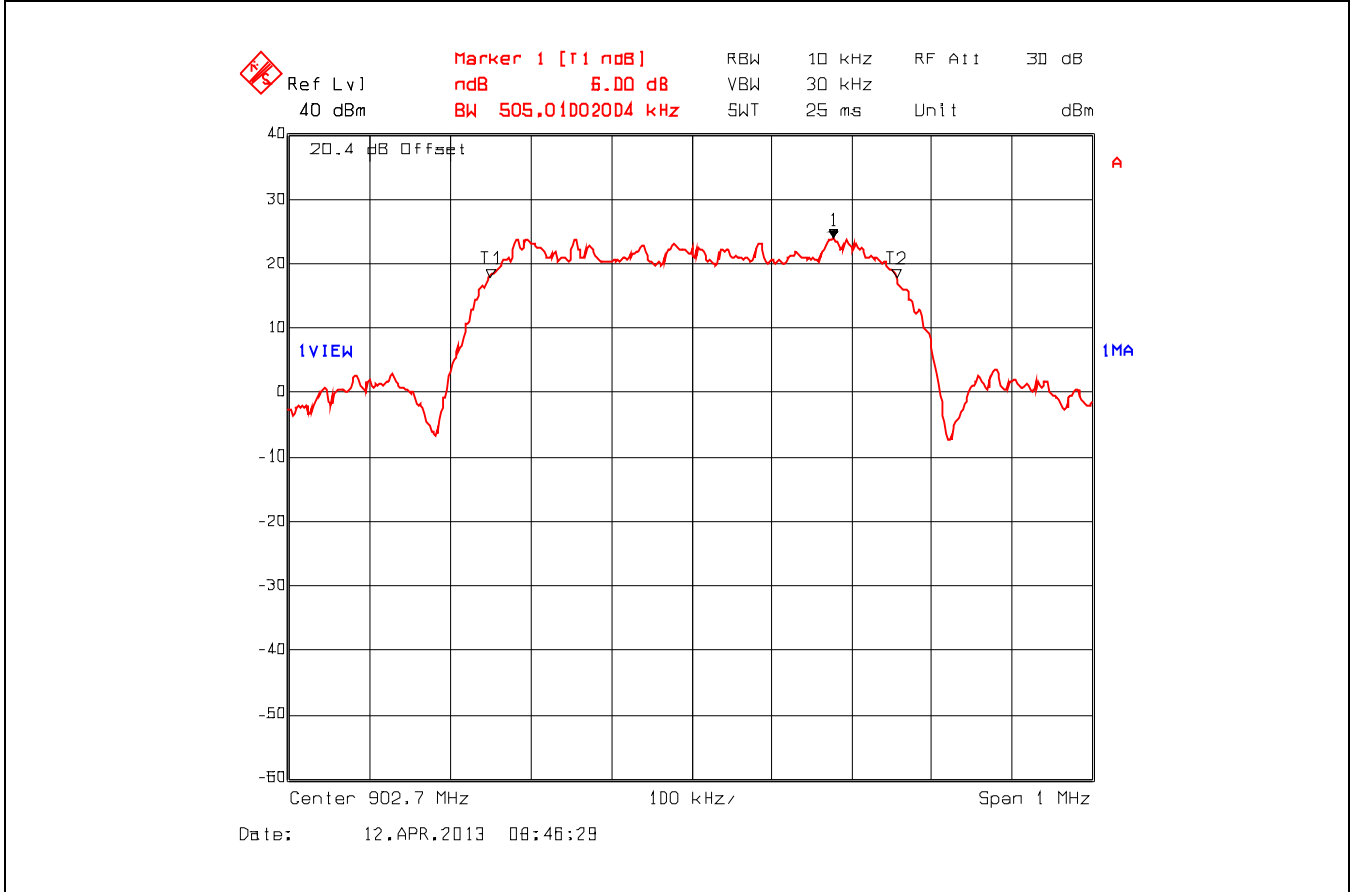


5.2.4. Test Data

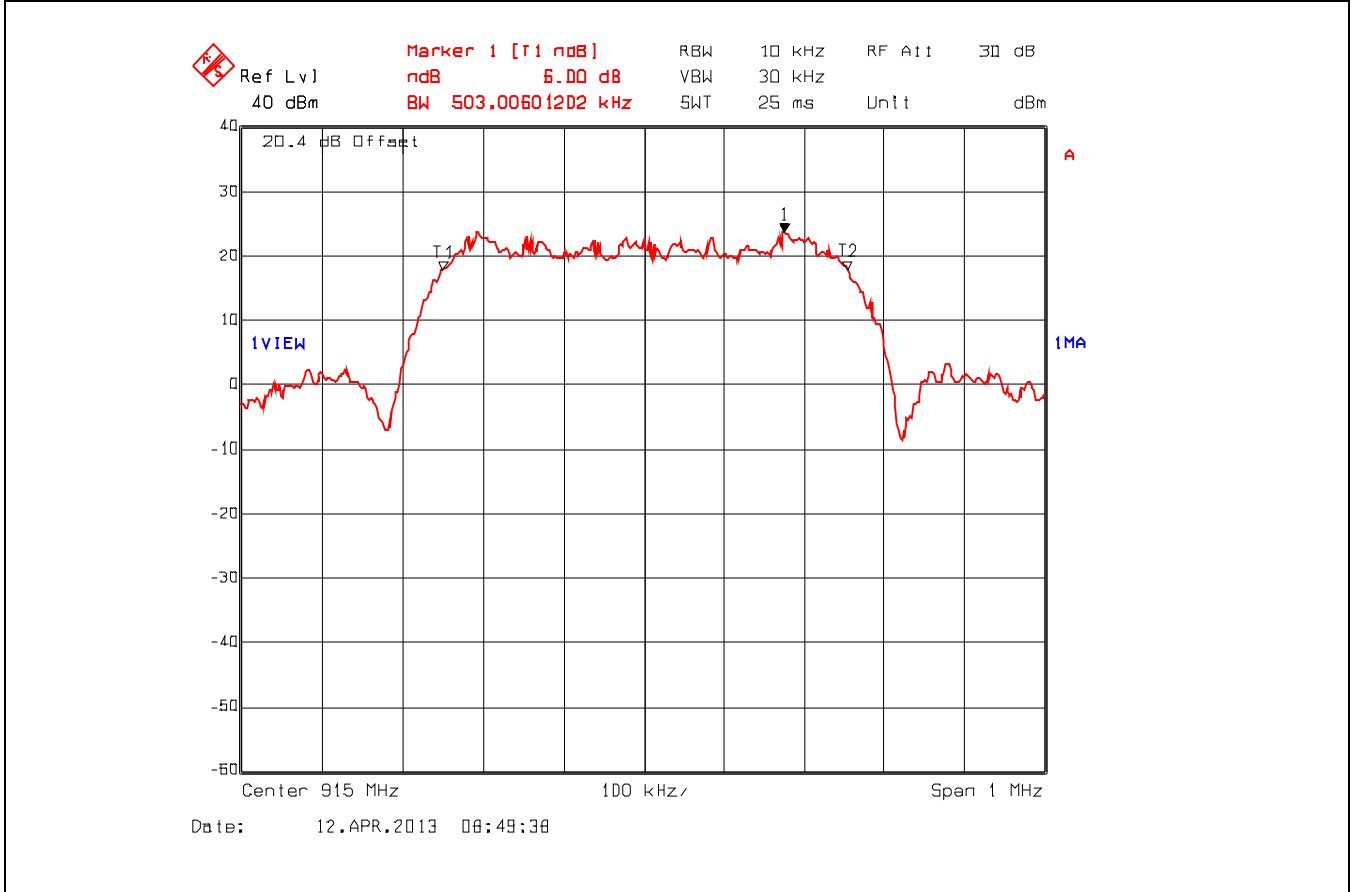
Frequency (MHz)	Modulation Mode	6 dB Bandwidth (kHz)	6 dB BW Limit (kHz)	99% OBW (kHz)
902.70	Modem 500	505.01	> 500 kHz	565.13
915.00	Modem 500	505.00	> 500 kHz	565.13
927.30	Modem 500	507.01	> 500 kHz	565.13
903.0075	Modem 1000	682.36	> 500 kHz	889.78
915.0000	Modem 1000	682.36	> 500 kHz	881.76
926.9925	Modem 1000	685.37	> 500 kHz	889.78
903.0075	Modem 1000W	917.84	> 500 kHz	1087.17
915.0000	Modem 1000W	933.87	> 500 kHz	1087.17
926.9925	Modem 1000W	937.88	> 500 kHz	1087.17

See the following plots for detailed measurements.

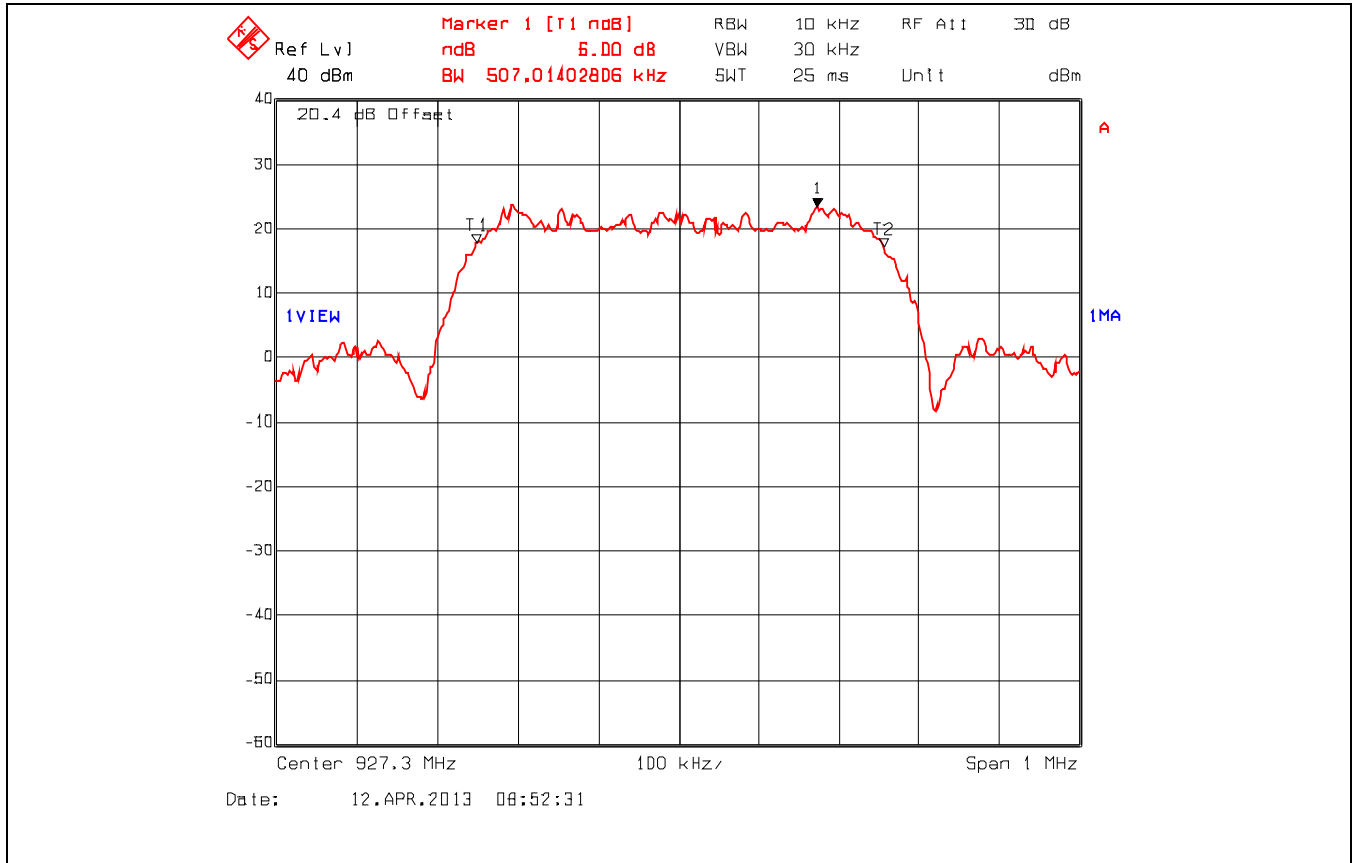
Plot 5.2.4.1. 6 dB Bandwidth, 902.70 MHz, Modem 500



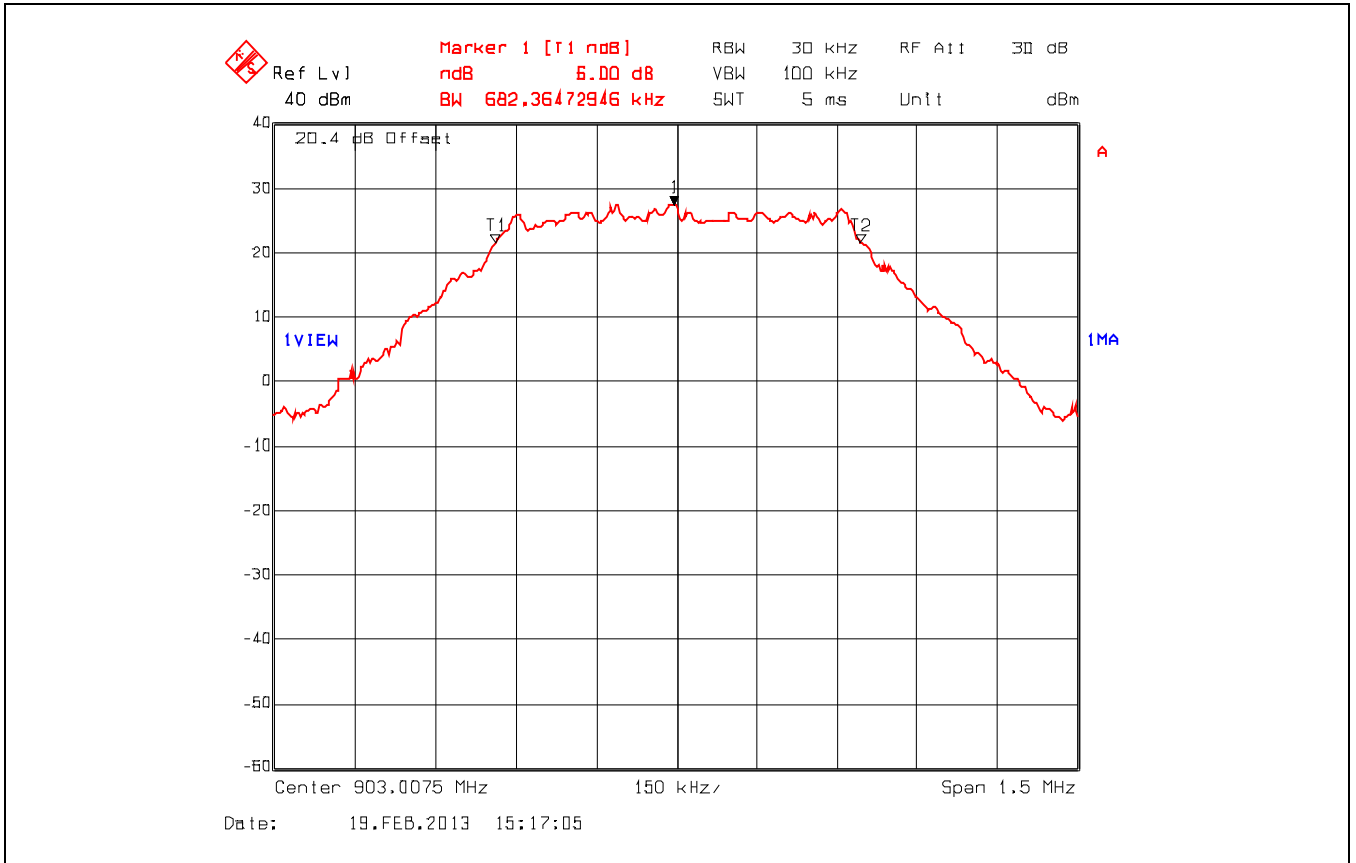
Plot 5.2.4.2. 6 dB Bandwidth, 915.00 MHz, Modem 500



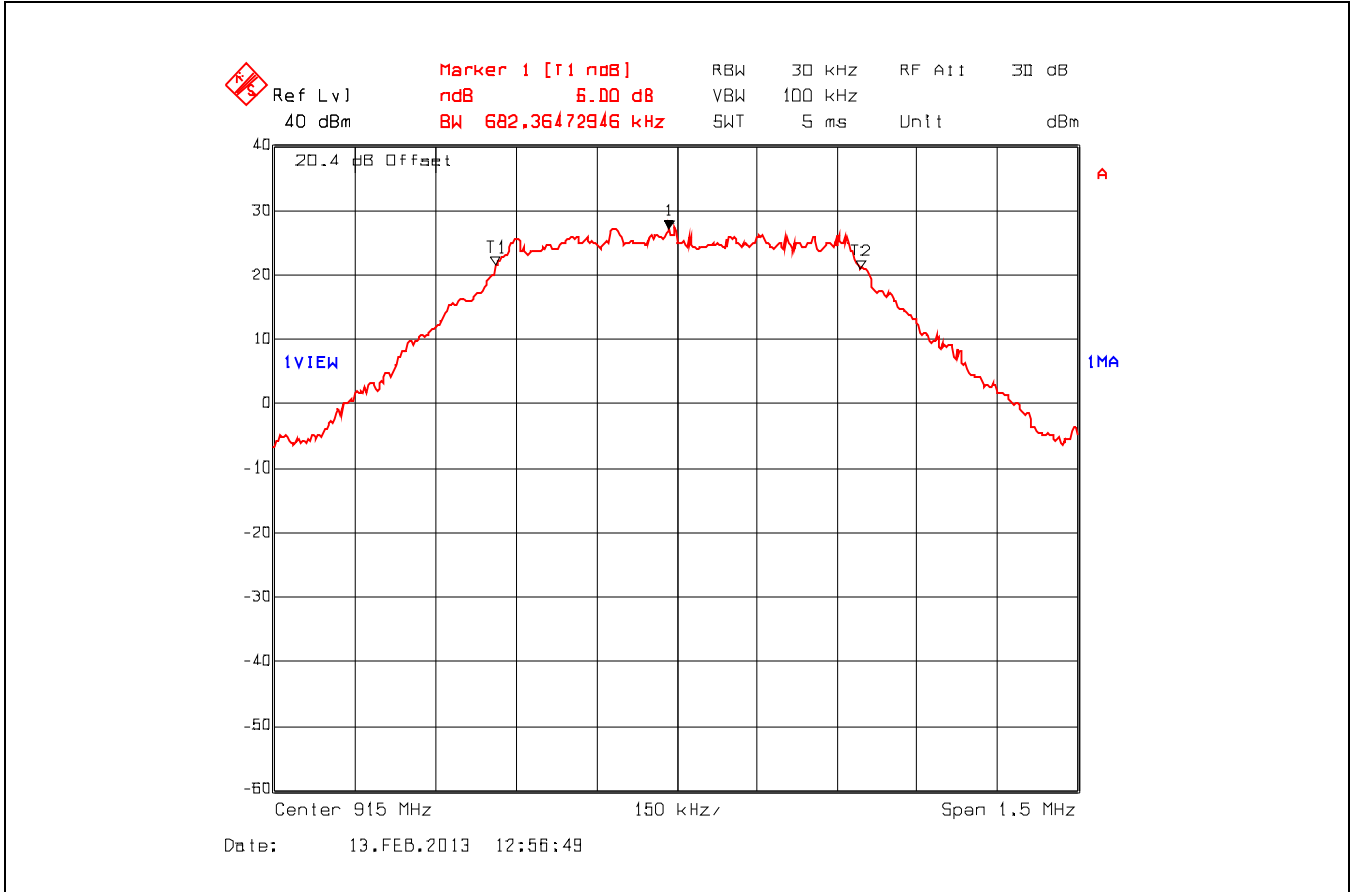
Plot 5.2.4.3. 6 dB Bandwidth, 927.30 MHz, Modem 500



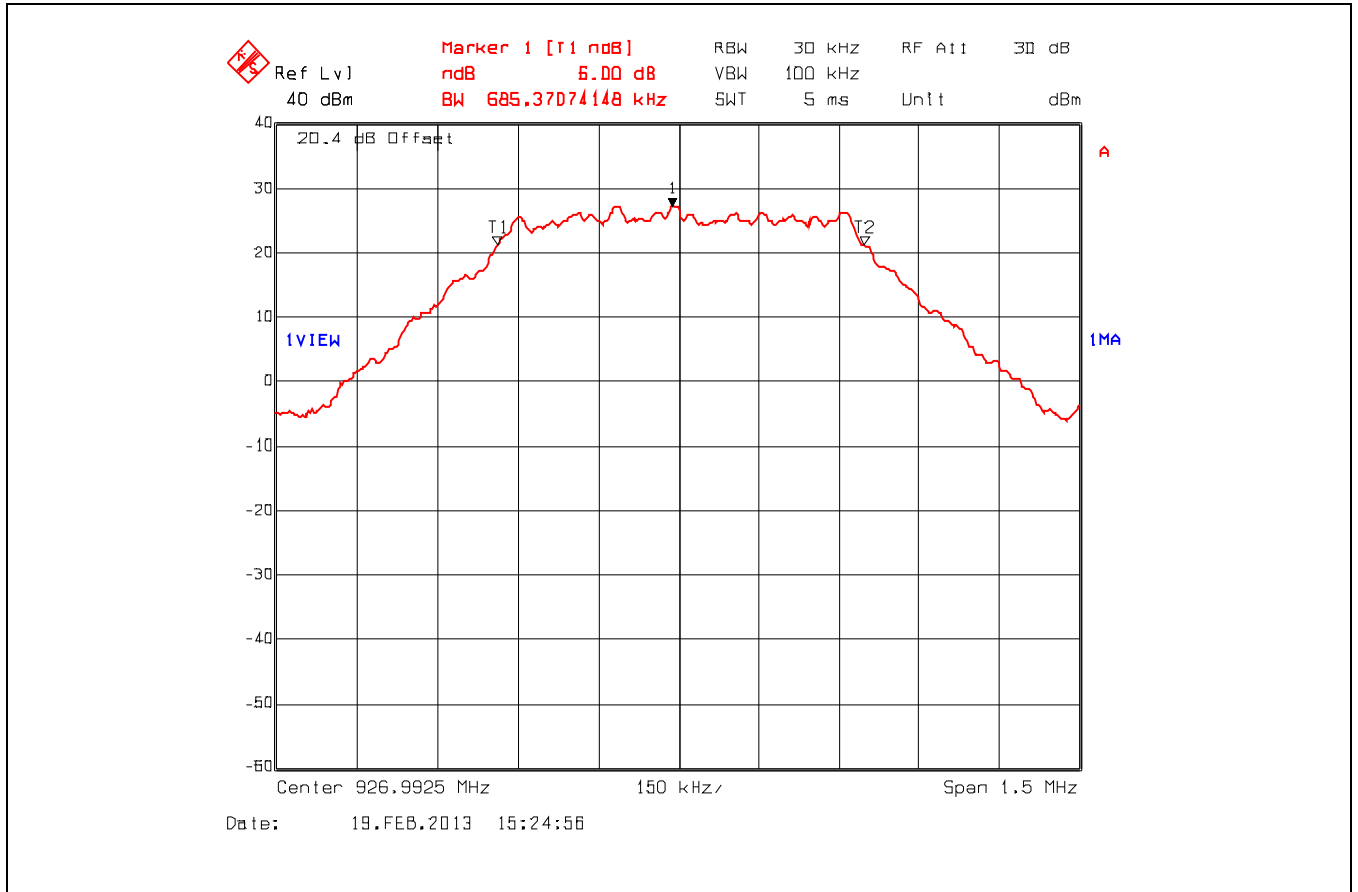
Plot 5.2.4.4. 6 dB Bandwidth, 903.0075 MHz, Modem 1000



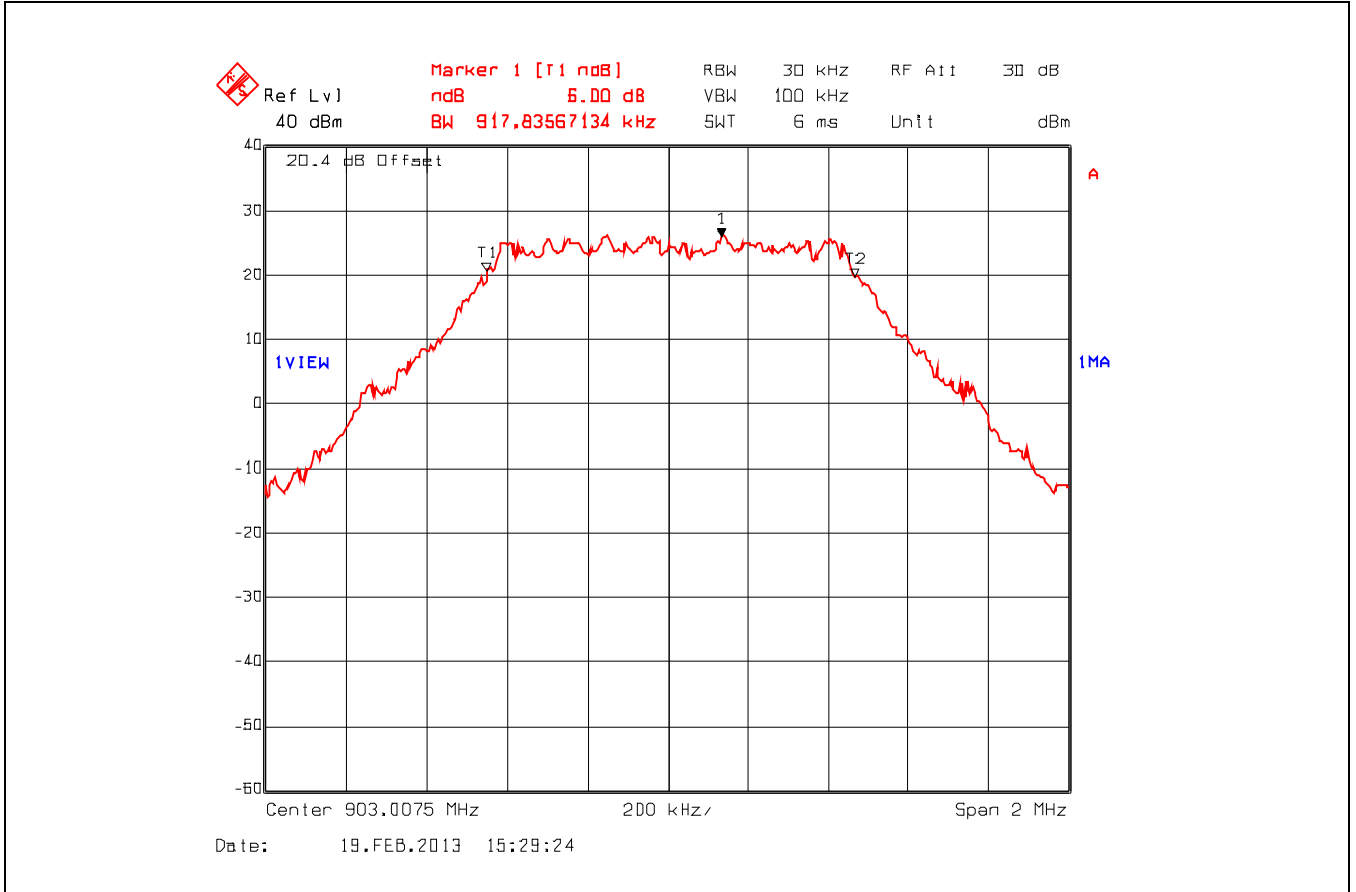
Plot 5.2.4.5. 6 dB Bandwidth, 915.0000 MHz, Modem 1000



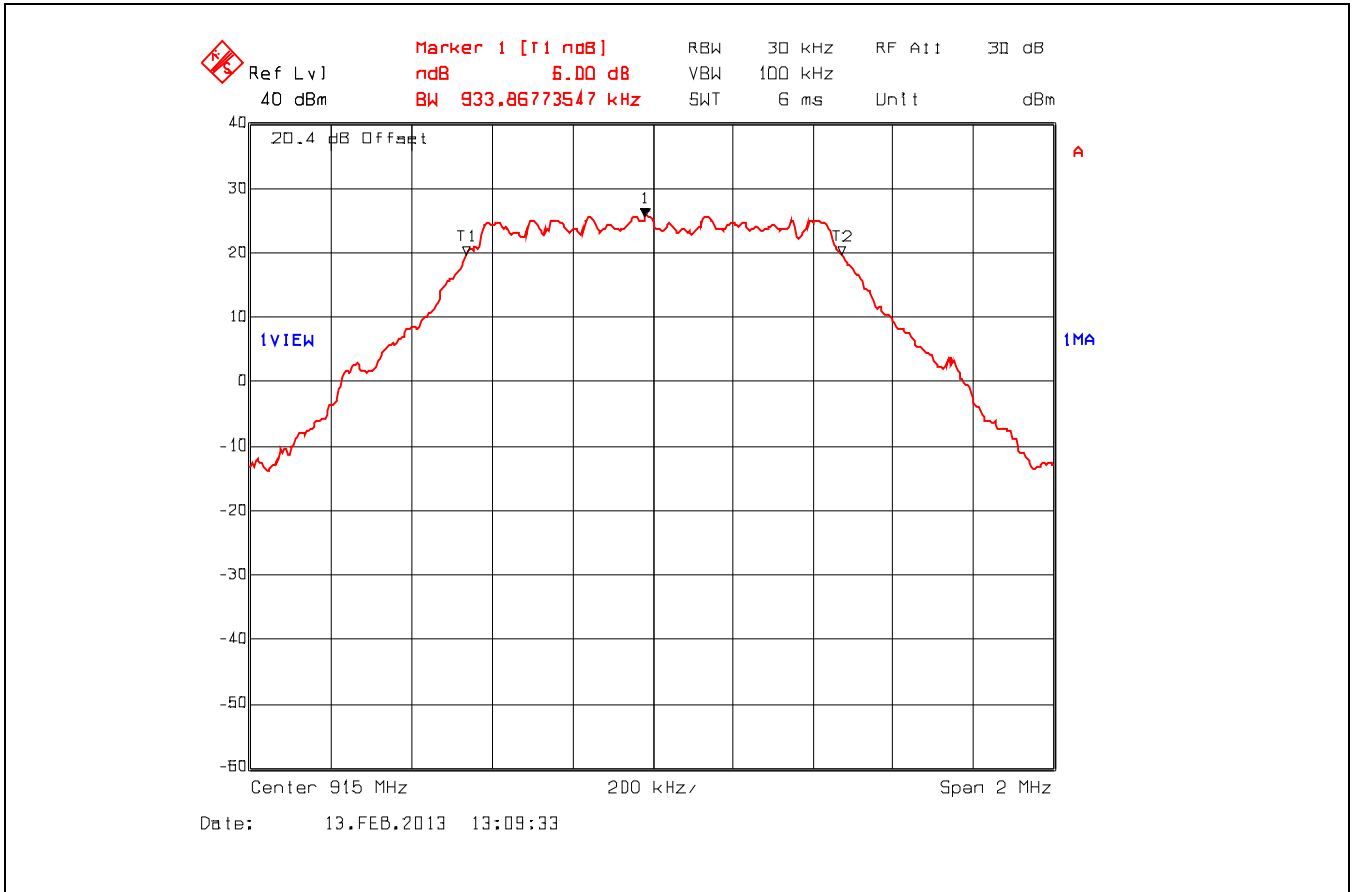
Plot 5.2.4.6. 6 dB Bandwidth, 926.9925 MHz, Modem 1000



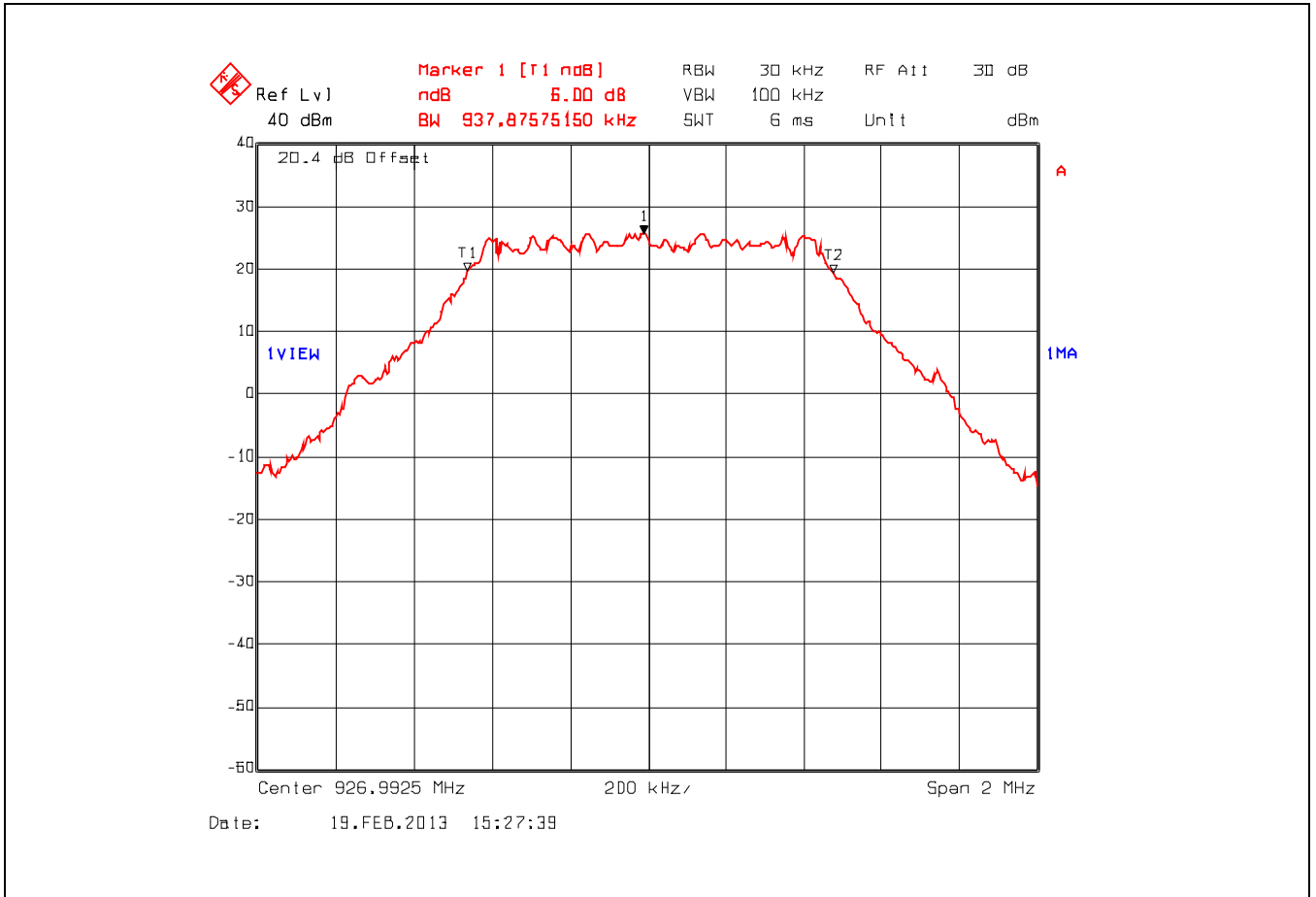
Plot 5.2.4.7. 6 dB Bandwidth, 903.0075 MHz, Modem 1000W



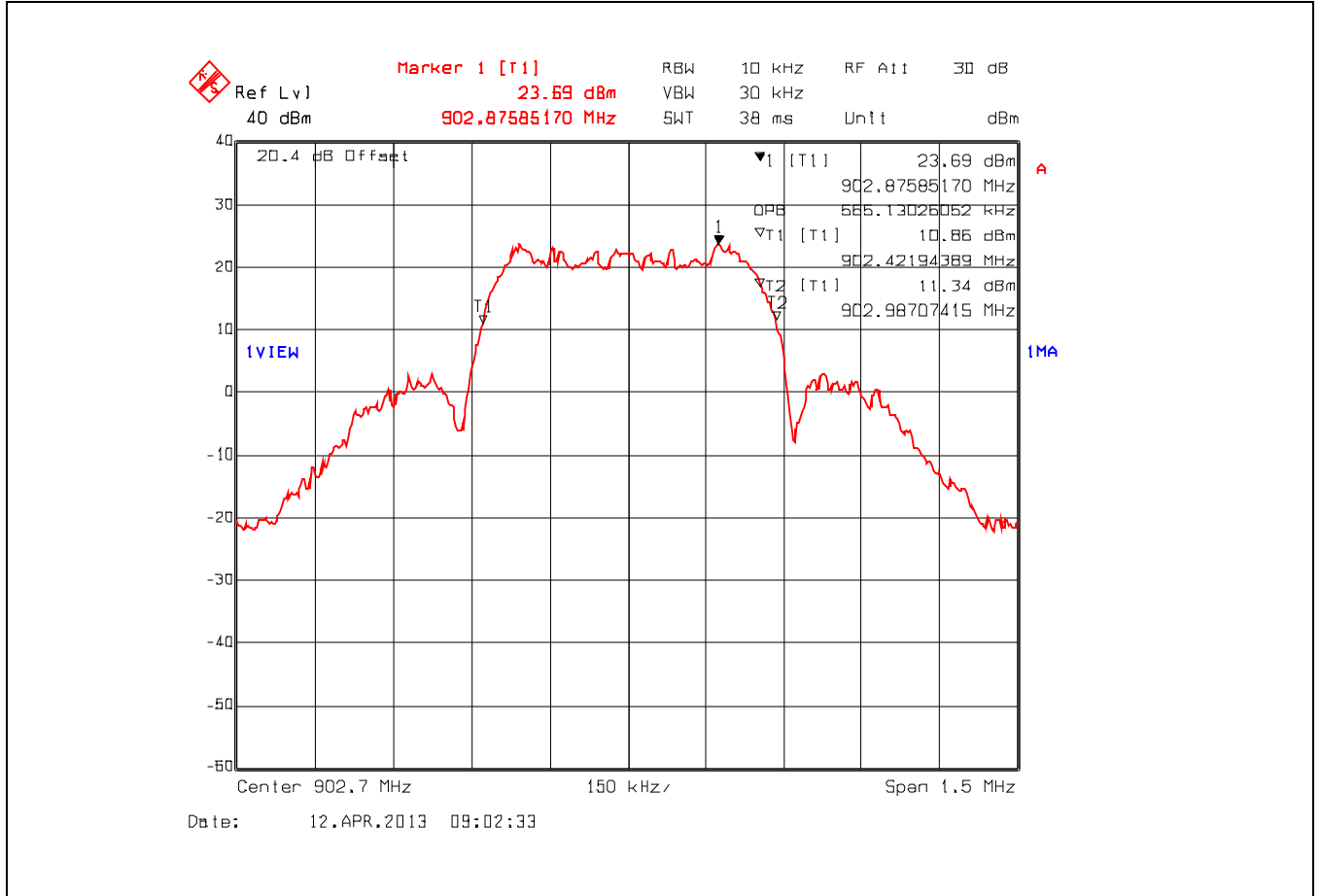
Plot 5.2.4.8. 6 dB Bandwidth, 915.0000 MHz, Modem 1000W



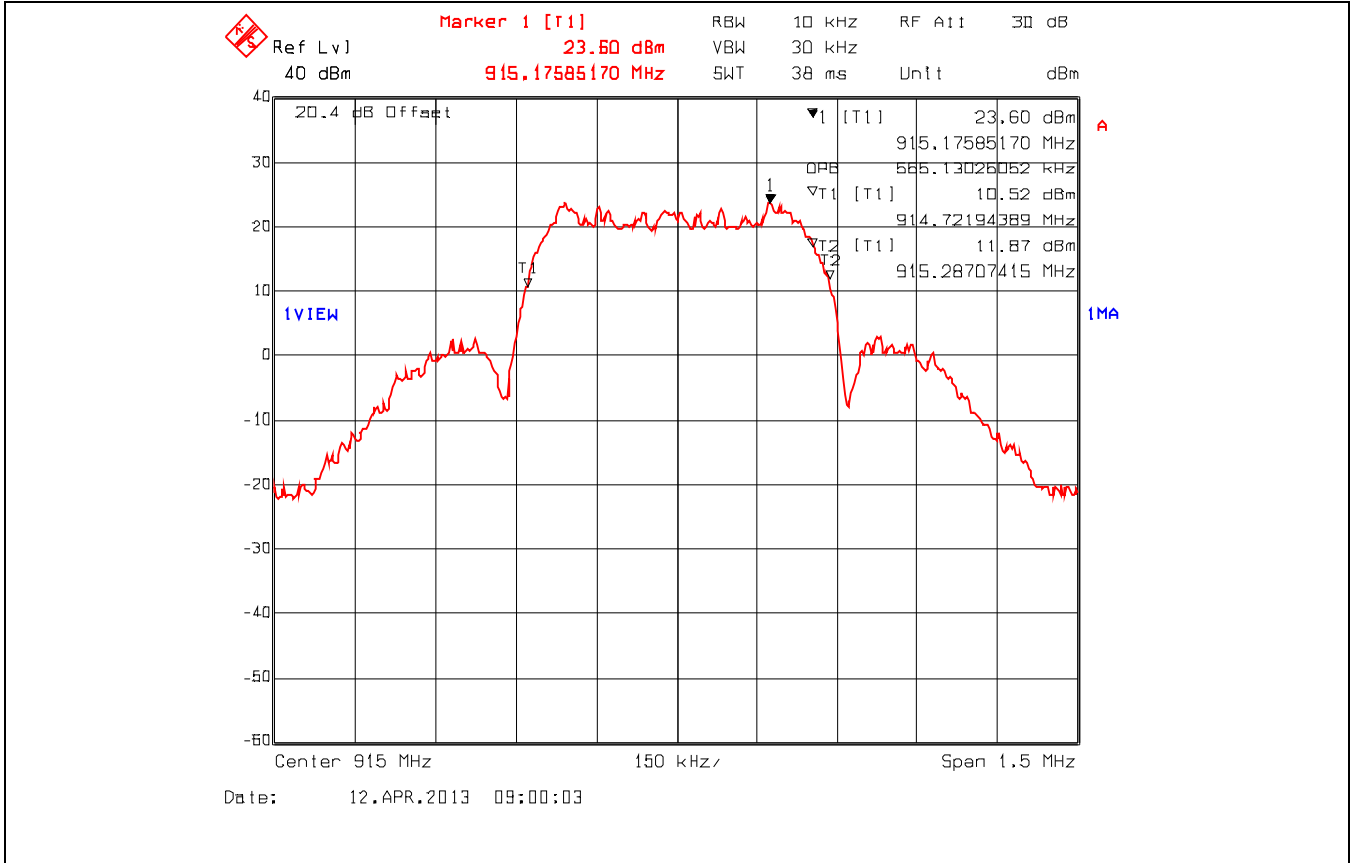
Plot 5.2.4.9. 6 dB Bandwidth, 926.9925 MHz, Modem 1000W



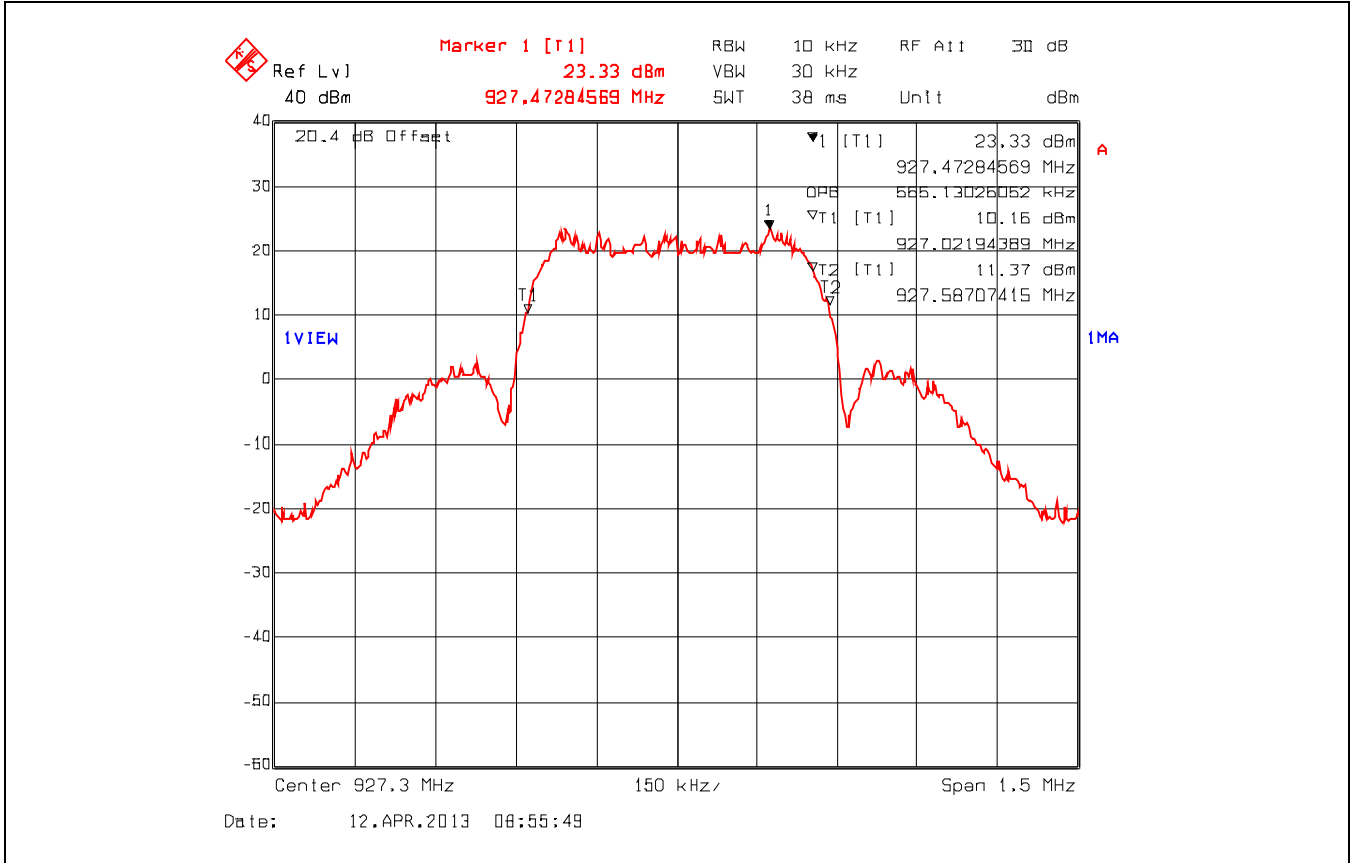
Plot 5.2.4.10. 99% Occupied Bandwidth, 902.70 MHz, Modem 500



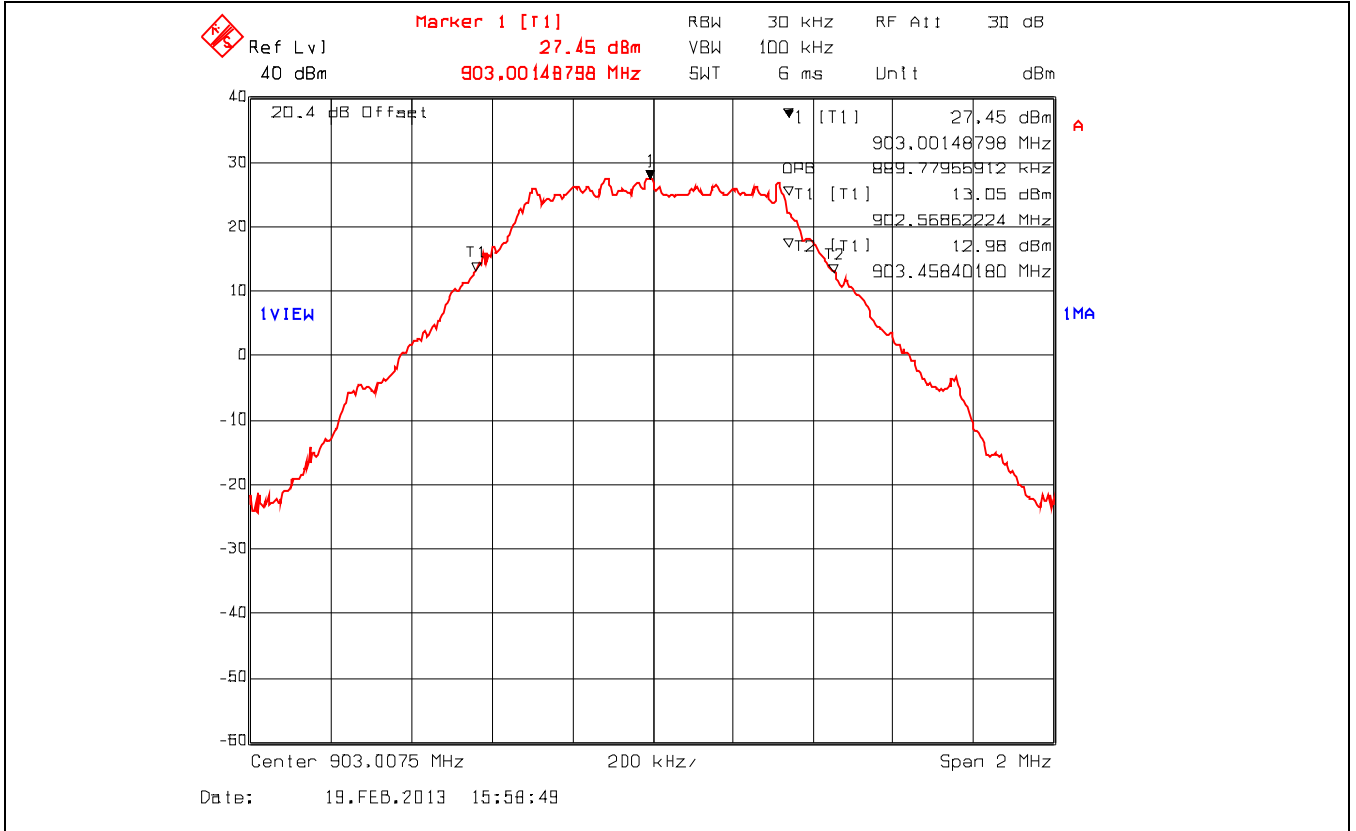
Plot 5.2.4.11. 99% Occupied Bandwidth, 915.00 MHz, Modem 500



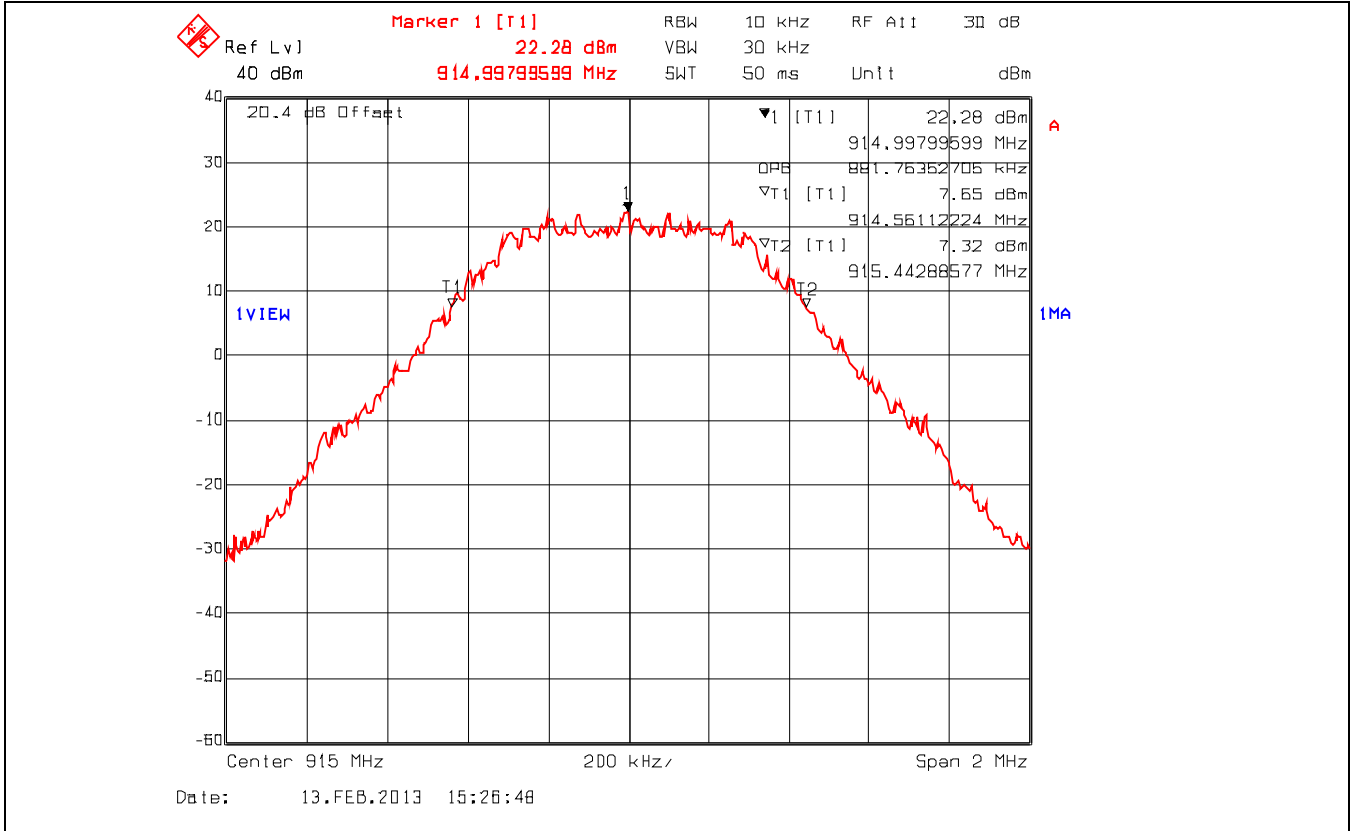
Plot 5.2.4.12. 99% Occupied Bandwidth, 927.30 MHz, Modem 500



Plot 5.2.4.13. 99% Occupied Bandwidth, 903.0075 MHz, Modem 1000



Plot 5.2.4.14. 99% Occupied Bandwidth, 915.0000 MHz, Modem 1000



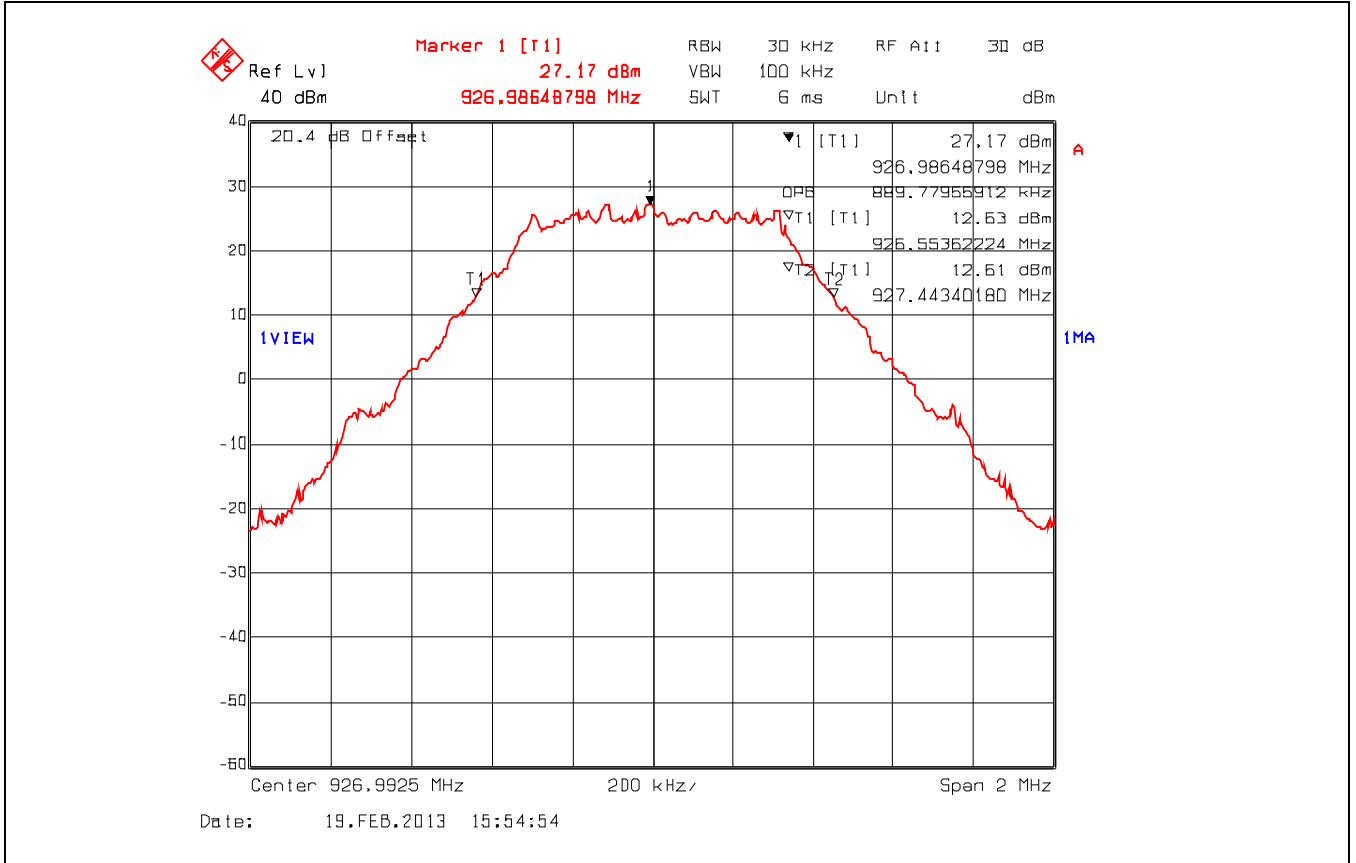
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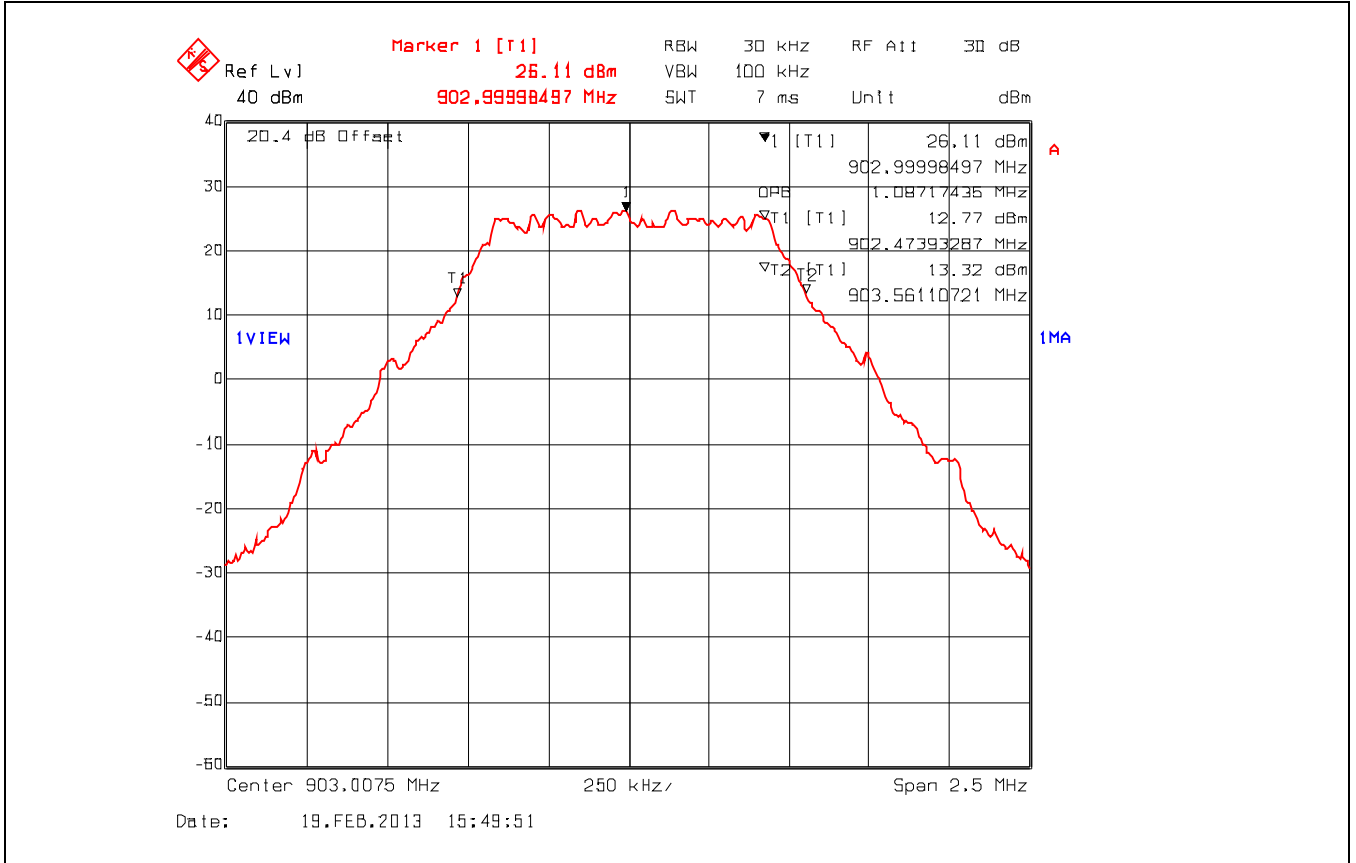
File #: MIC-165Q_F15C247DTS-R1
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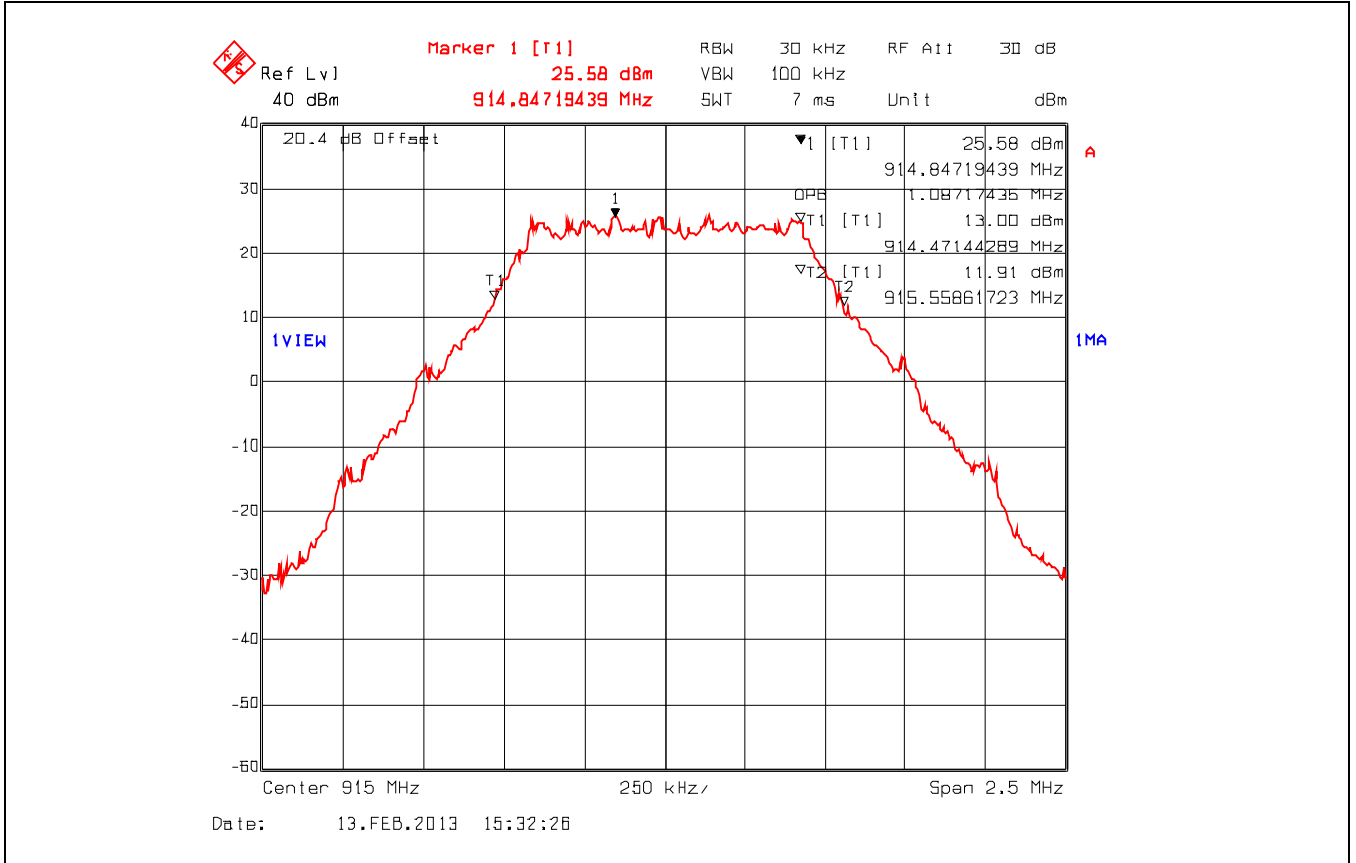
Plot 5.2.4.15. 99% Occupied Bandwidth, 926.9925 MHz, Modem 1000



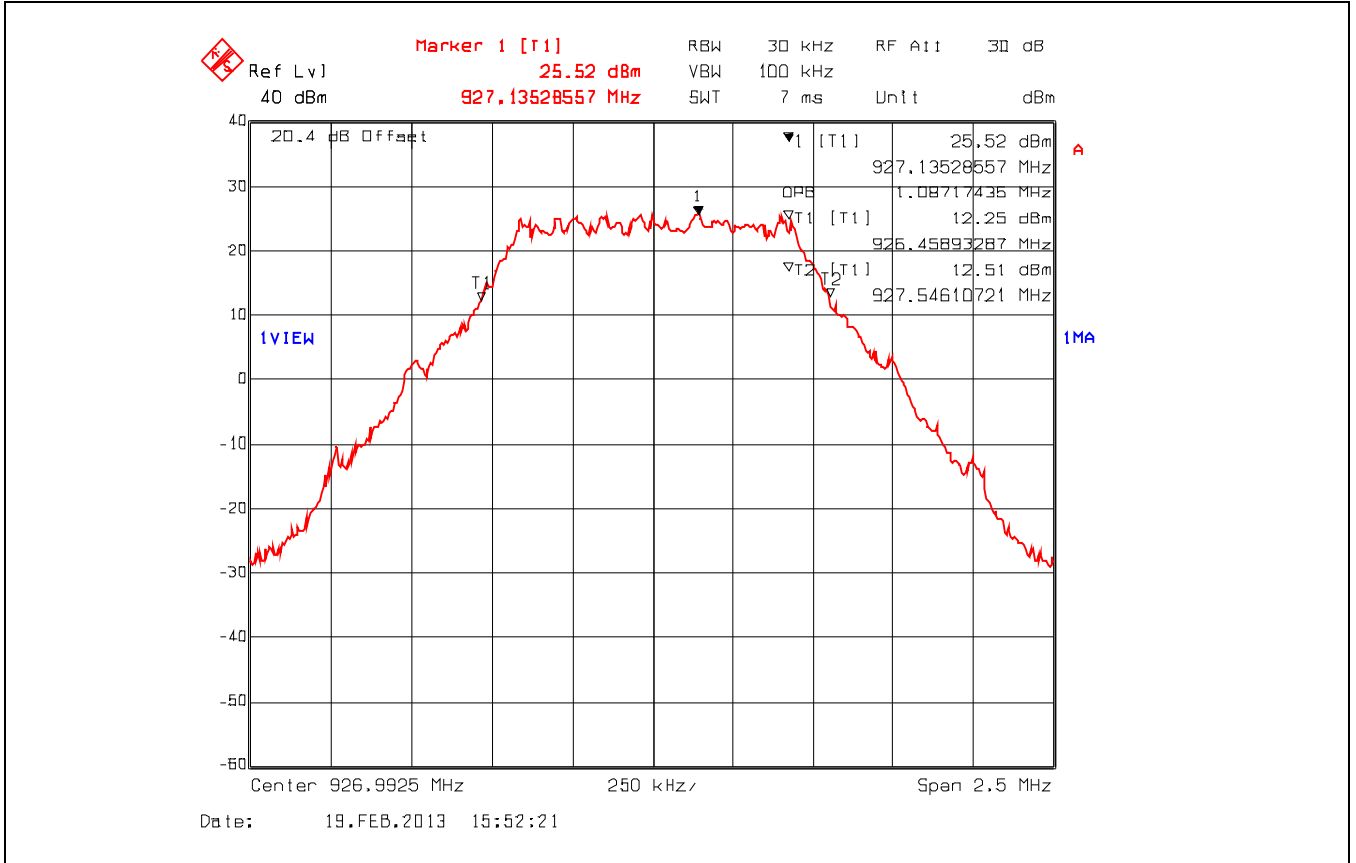
Plot 5.2.4.16. 99% Occupied Bandwidth, 903.0075MHz, Modem 1000W



Plot 5.2.4.17. 99% Occupied Bandwidth, 915.0000 MHz, Modem 1000W



Plot 5.2.4.18. 99% Occupied Bandwidth, 926.9925 MHz, Modem 1000W



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

5.3.1. Limit(s)

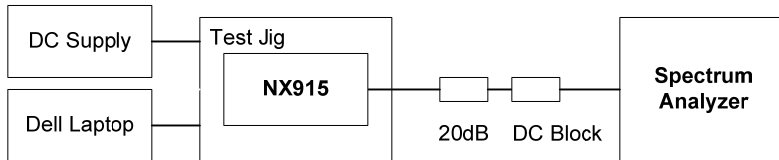
§ 15.247(b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power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

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

5.3.2. Method of Measurements & Test Arrangement

KDB Publication No. 558074 D01 Section 5.2.2.2 Measurement Procedure AVG2.

5.3.3. Test Arrangement



5.3.4. 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	500	27.55	See notes above	30	36
915.0	500	27.93	See notes above	30	36
927.3	500	27.05	See notes above	30	36
903.0075	1000	28.80	See notes above	30	36
915.0000	1000	28.41	See notes above	30	36
926.9925	1000	28.46	See notes above	30	36
903.0075	1000W	29.37	See notes above	30	36
915.0000	1000W	29.62	See notes above	30	36
926.9925	1000W	29.14	See notes above	30	36
Low Power Setting					
902.7	500	19.42	See notes above	30	36
915.0	500	19.41	See notes above	30	36
927.3	500	19.87	See notes above	30	36
903.0075	1000	19.33	See notes above	30	36
915.0000	1000	19.38	See notes above	30	36
926.9925	1000	19.81	See notes above	30	36
903.0075	1000W	19.57	See notes above	30	36
915.0000	1000W	19.50	See notes above	30	36
926.9925	1000W	20.00	See notes above	30	36

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

(B) EIRP

Frequency (MHz)	Modem Type	Peak Output Power at Antenna Terminal (dBm)	Peak Output Power Adding Assembly Loss (Attenuator + 0.86 dB) (dBm)	Maximum Calculated EIRP* (dBm)	EIRP Limit
12.15 dBi Gain Yagi Directional Antenna with 4 dB Attenuator					
902.7	500	27.55	22.69	34.84	36
915.0	500	27.93	23.07	35.22	36
927.3	500	27.05	22.19	34.34	36
12.15 dBi Gain Yagi Directional Antenna with 5 dB Attenuator					
903.0075	1000	28.80	22.94	35.09	36
915.0000	1000	28.41	22.55	34.70	36
926.9925	1000	28.46	22.60	34.75	36
12.15 dBi Gain Yagi Directional Antenna with 5 dB Attenuator					
903.0075	1000W	29.37	23.51	35.66	36
915.0000	1000W	29.62	23.76	35.91	36
926.9925	1000W	29.14	23.28	35.43	36
9.15 dBi Gain Omni Directional Antenna with 1 dB Attenuator					
902.7	500	27.55	25.69	34.84	36
915.0	500	27.93	26.07	35.22	36
927.3	500	27.05	25.19	34.34	36
9.15 dBi Gain Omni Directional Antenna with 2 dB Attenuator					
903.0075	1000	28.80	25.94	35.09	36
915.0000	1000	28.41	25.55	34.70	36
926.9925	1000	28.46	25.60	34.75	36
9.15 dBi Gain Omni Directional Antenna with 2 dB Attenuator					
903.0075	1000W	29.37	26.51	35.66	36
915.0000	1000W	29.62	26.76	35.91	36
926.9925	1000W	29.14	26.28	35.43	36

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

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

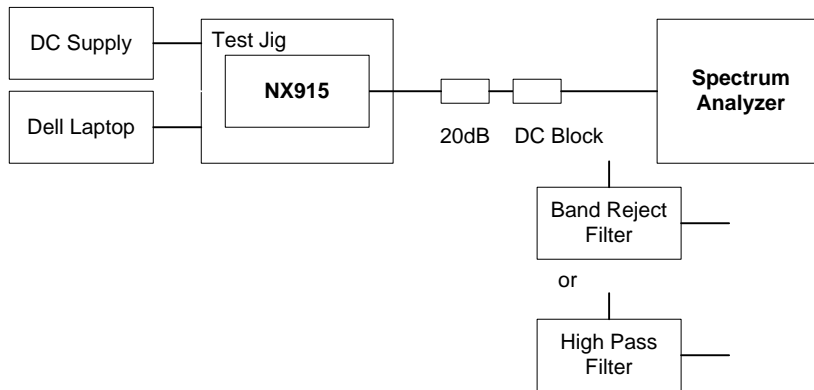
5.4.1. Limit(s)

§ 15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

5.4.2. Method of Measurements

KDB Publication No. 558074 D01, Sections 5.4.2.2.4 Band-Edge Measurements, 5.4.1 Unwanted Emissions into Non-Restricted Bands, 5.4.2 Unwanted Emissions into Restricted Frequency Bands, 5.4.2.2.1.1 Peak Power Procedure, 5.4.2.2.2.2 Measurement Procedure RBAVG2 (Trace Averaging) and 5.4.2.2.3 Applicability of §15.35(b) and §15.35(c).

5.4.3. Test Arrangement

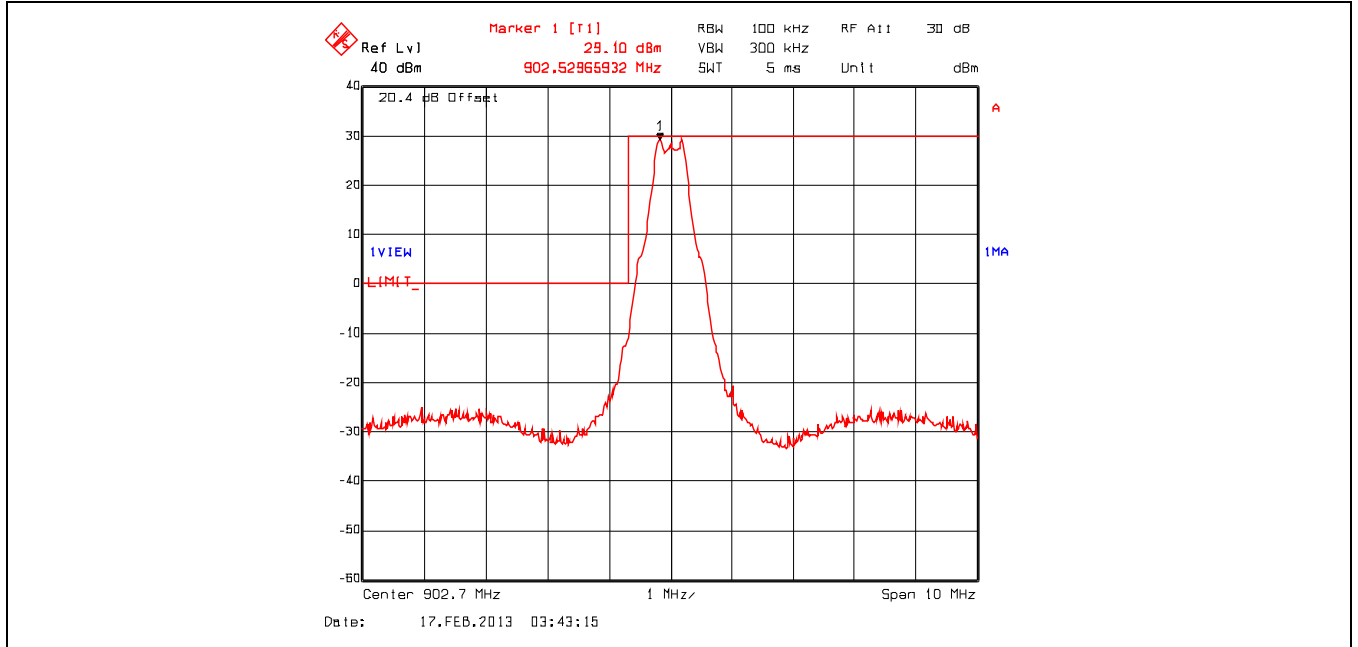


5.4.4. Test Data

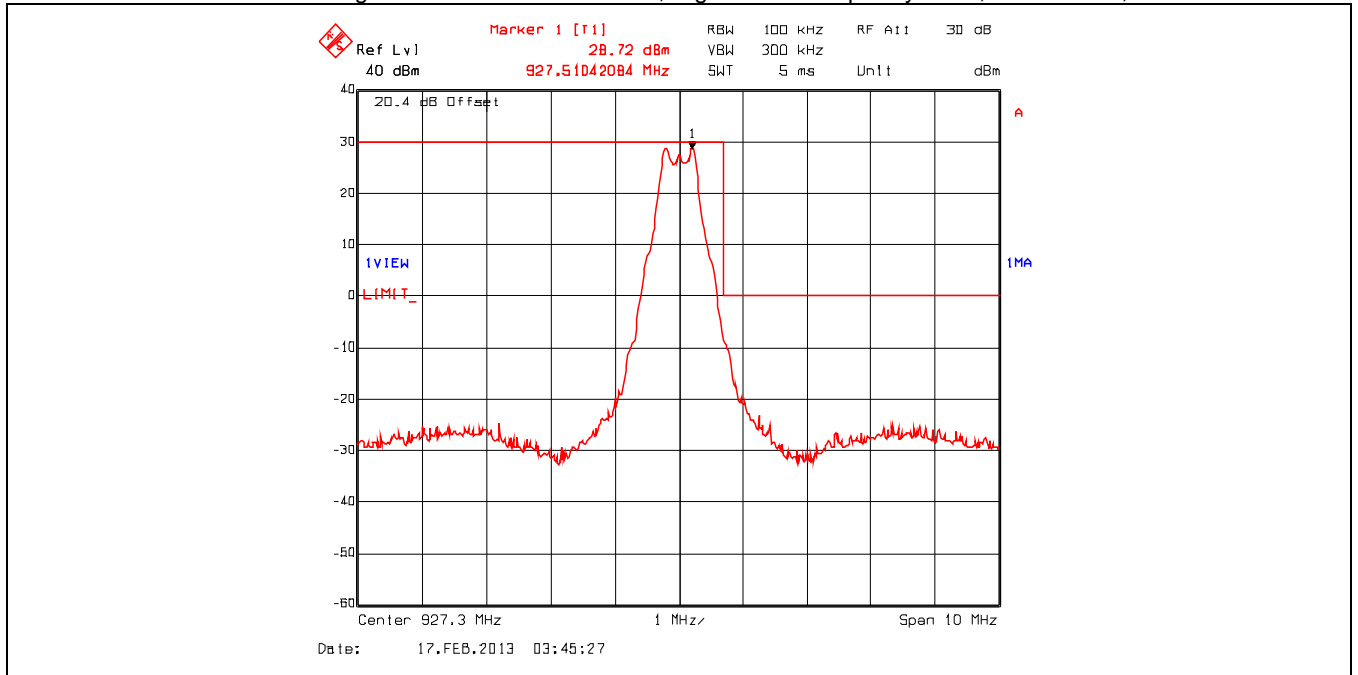
5.4.4.1. Band-Edge RF Conducted Emissions

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

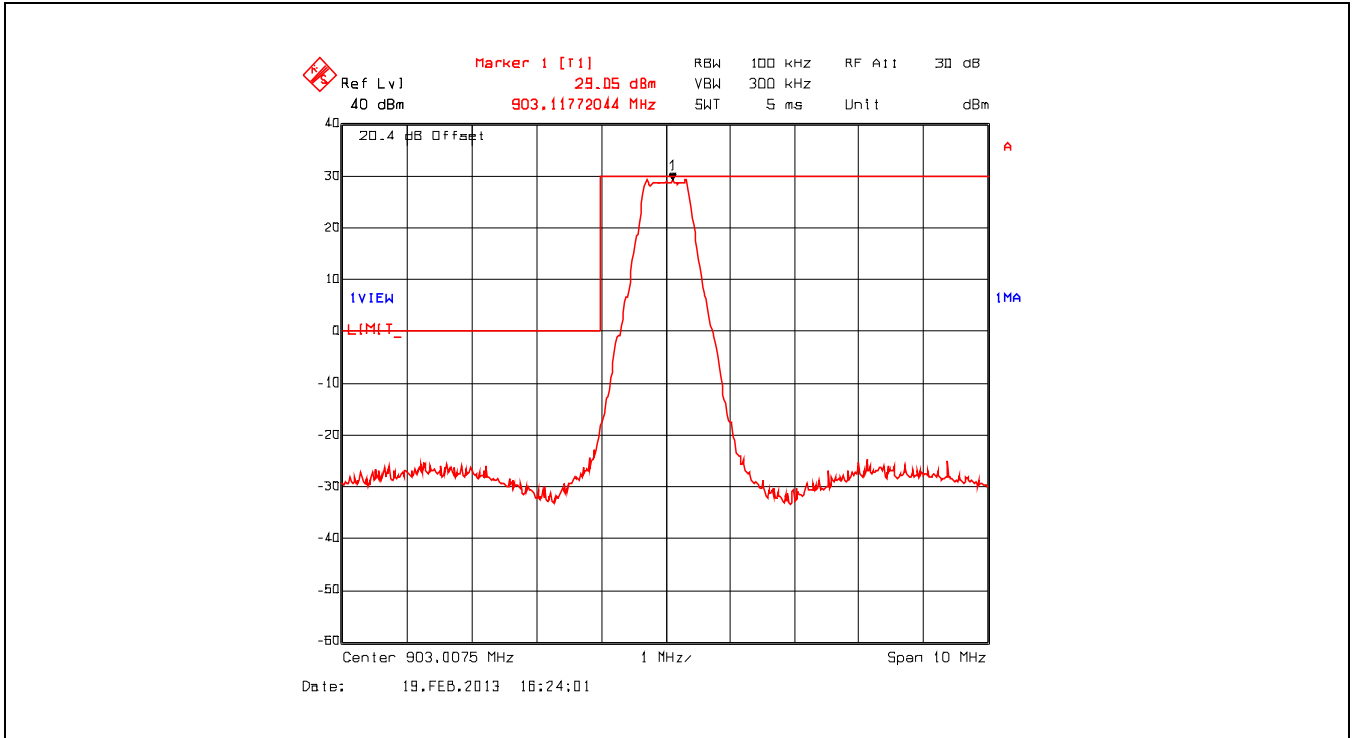
Plot 5.4.4.1.1. Band-Edge RF Conducted Emissions, Low End of Frequency Band, 902.70 MHz, Modem 500



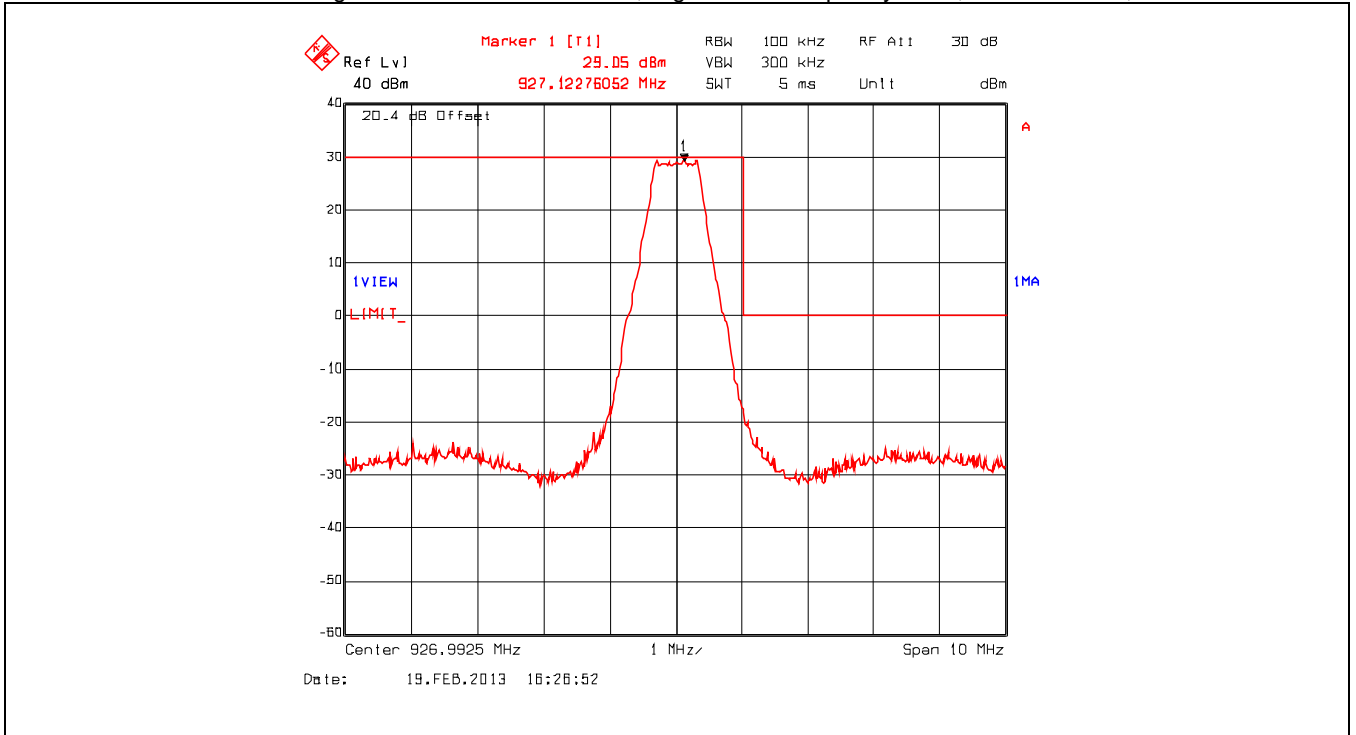
Plot 5.4.4.1.2. Band-Edge RF Conducted Emissions, High End of Frequency Band, 927.30 MHz, Modem 500



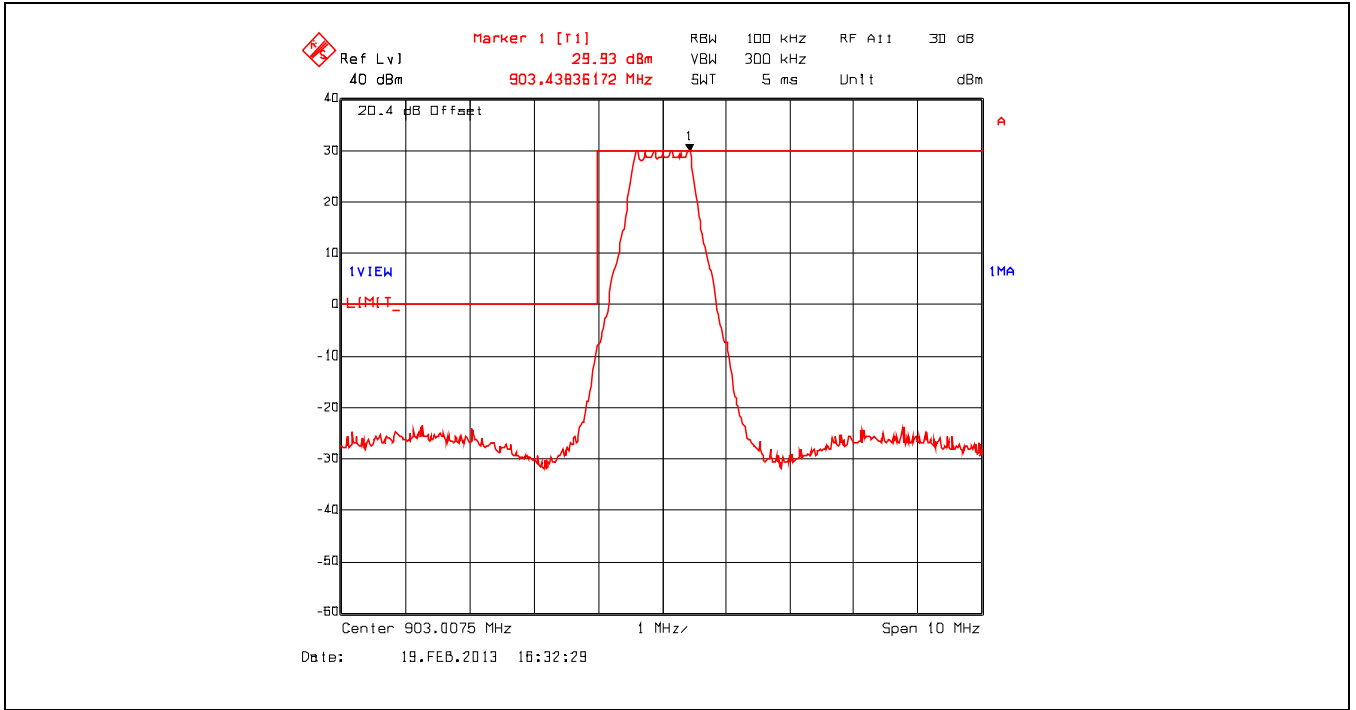
Plot 5.4.4.1.3. Band-Edge RF Conducted Emissions, Low End of Frequency Band, 903.0075 MHz, Modem 1000



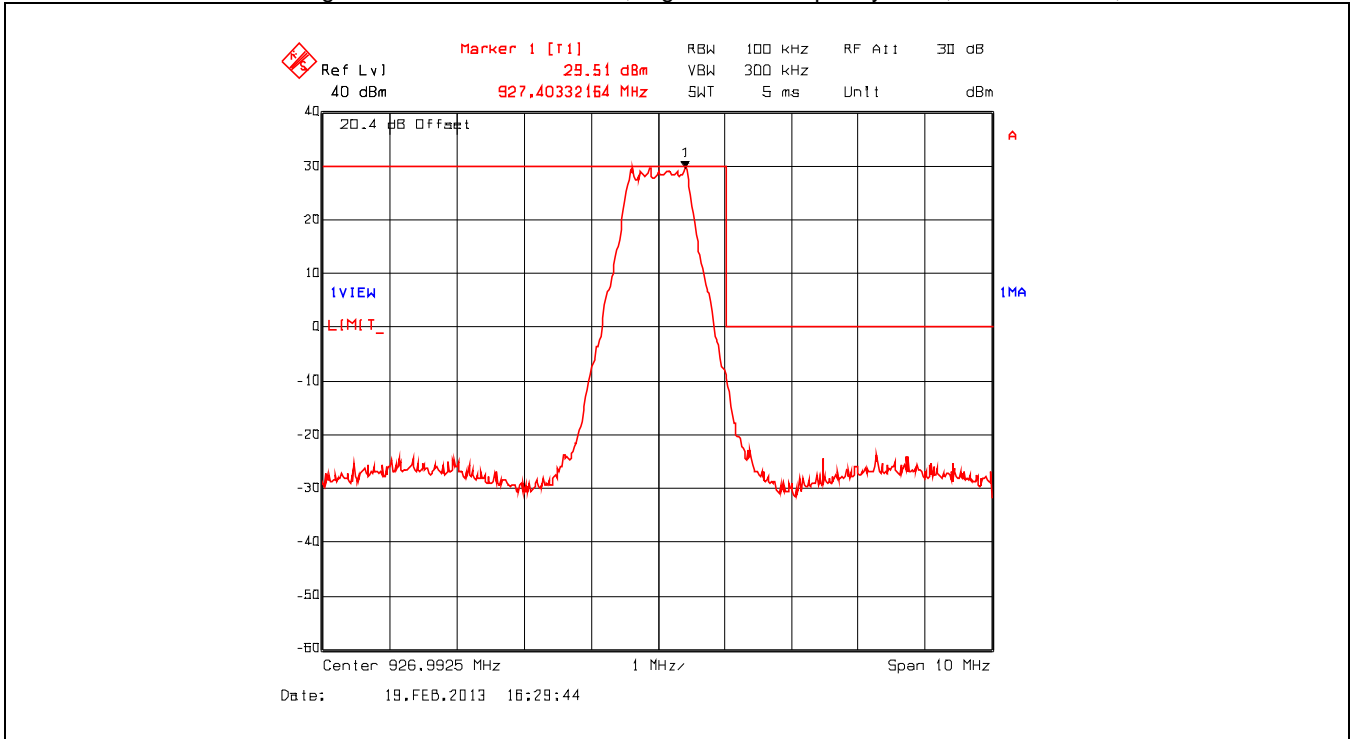
Plot 5.4.4.1.4. Band-Edge RF Conducted Emissions, High End of Frequency Band, 926.9925 MHz, Modem 1000



Plot 5.4.4.1.5. Band-Edge RF Conducted Emissions, Low End of Frequency Band, 903.0075 MHz, Modem 100W



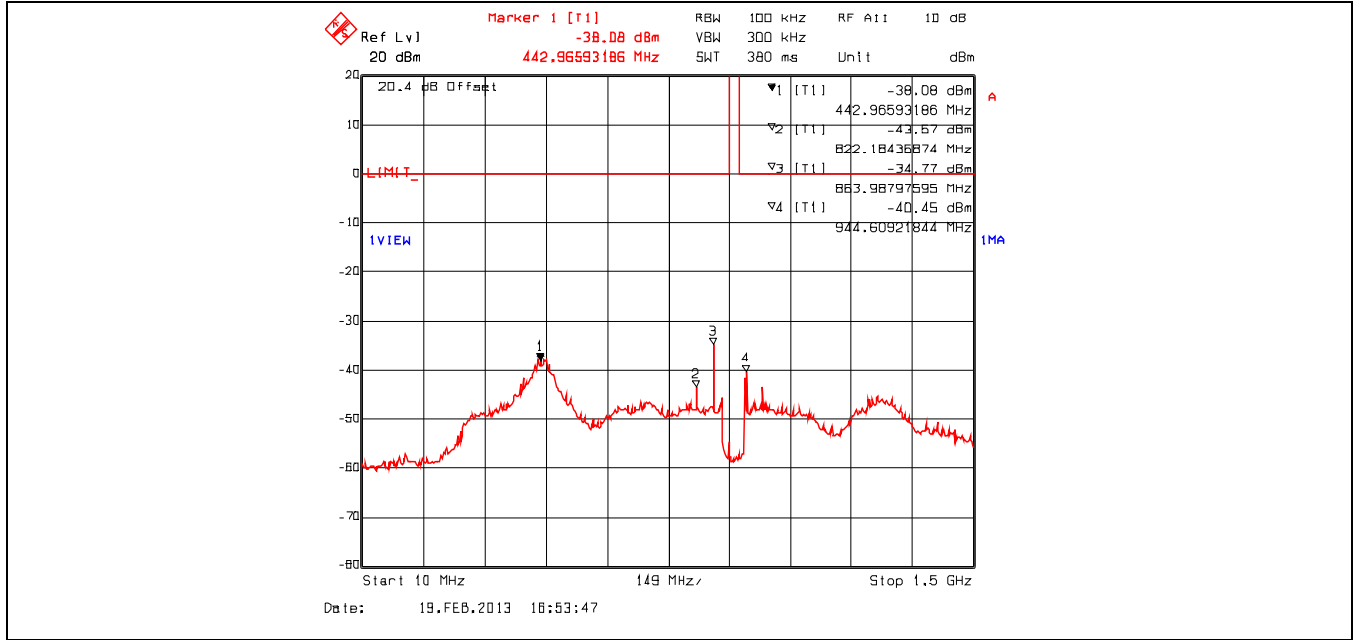
Plot 5.4.4.1.6. Band-Edge RF Conducted Emissions, High End of Frequency Band, 926.9925 MHz, Modem 100W



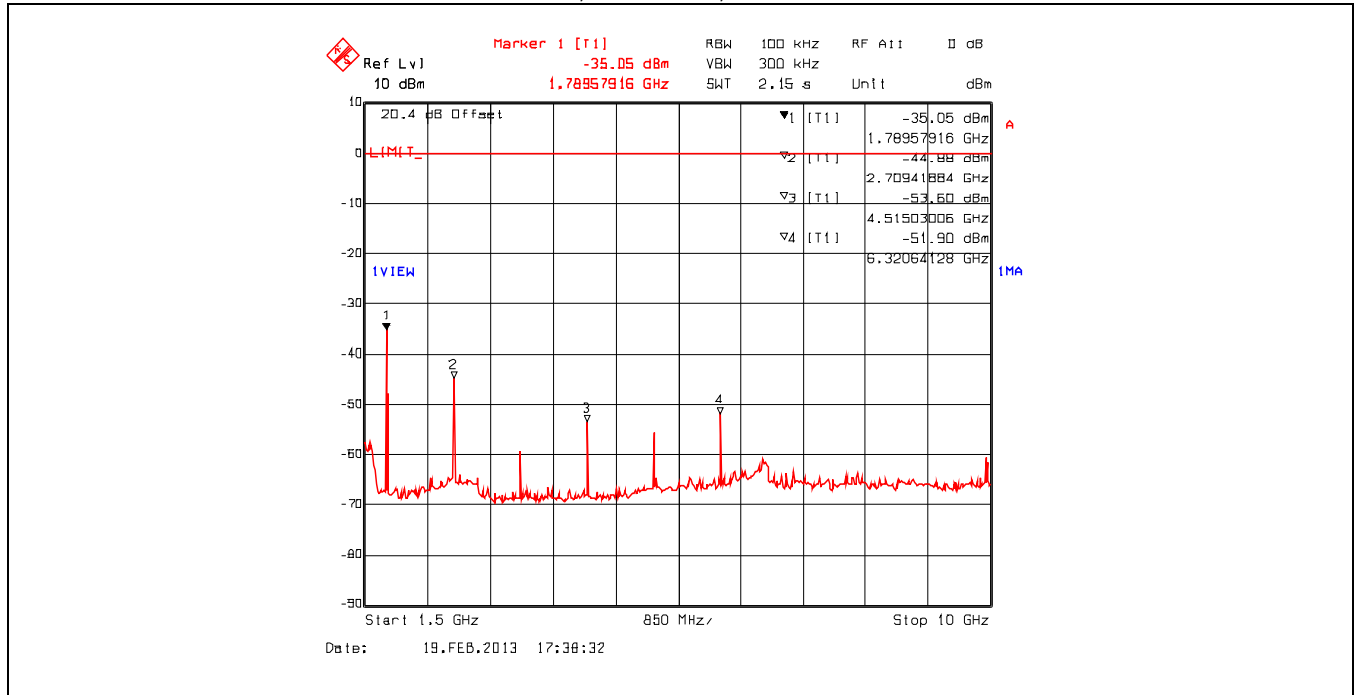
5.4.4.2. Conducted Spurious Emissions – Non Restricted Frequency Bands

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

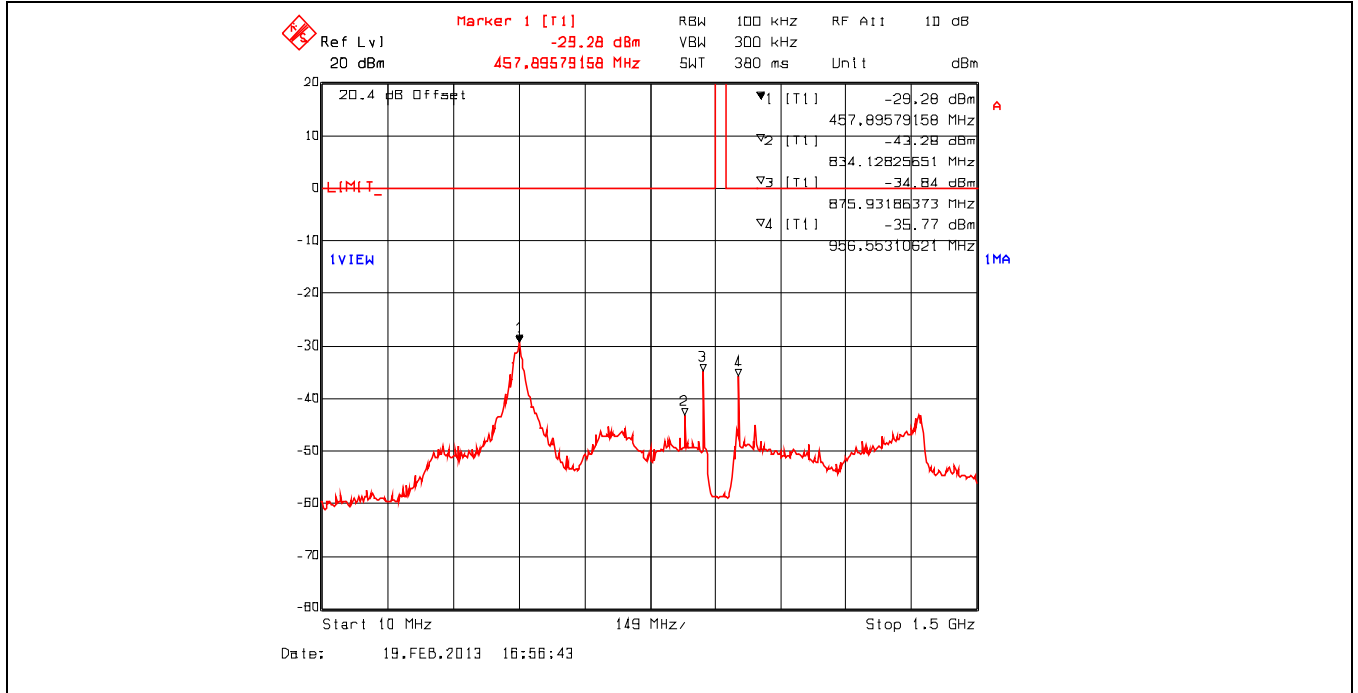
**Plot 5.4.4.2.1. Conducted Spurious Emissions - Non Restricted Frequency Bands
 902.70 MHz, Modem 500, 10 MHz – 1.5 GHz**



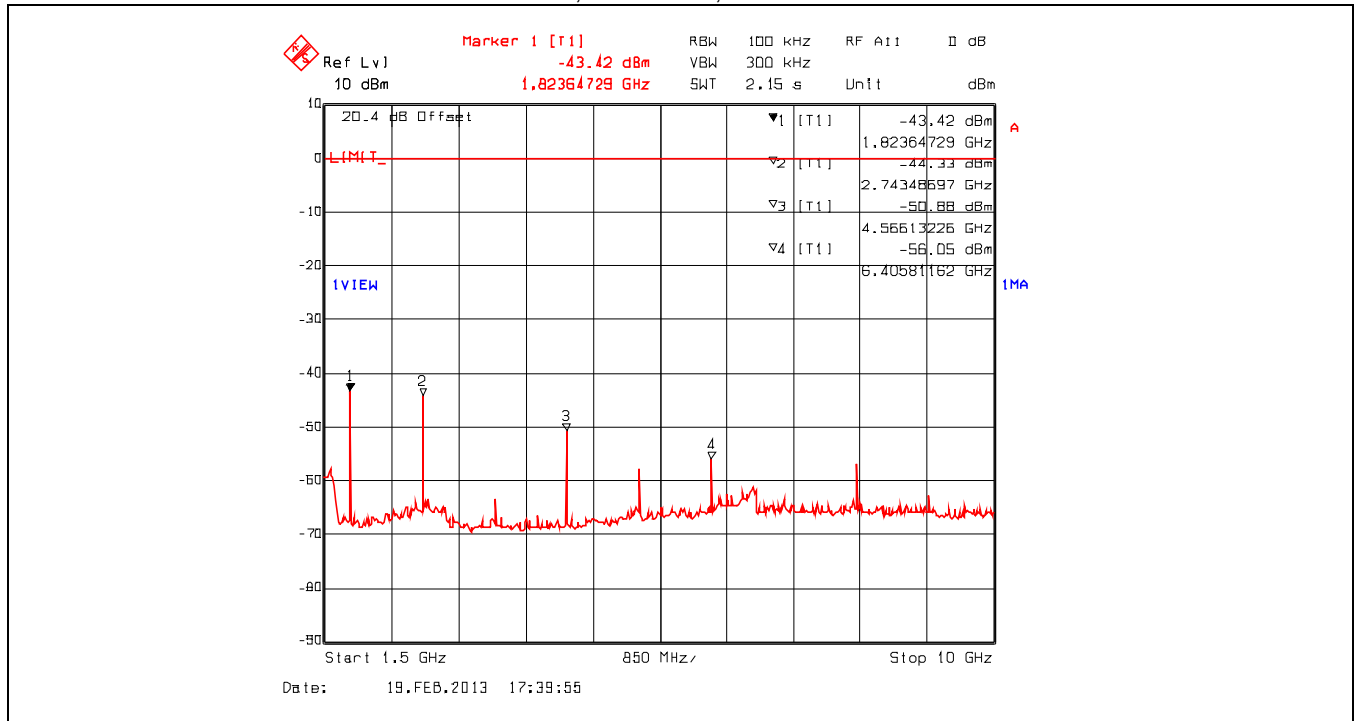
**Plot 5.4.4.2.2. Conducted Spurious Emissions - Non Restricted Frequency Bands
 902.70 MHz, Modem 500, 1.5 GHz - 10 GHz**



**Plot 5.4.4.2.3. Conducted Spurious Emissions - Non Restricted Frequency Bands
 915.00 MHz, Modem 500, 10 MHz – 1.5 GHz**



**Plot 5.4.4.2.4. Conducted Spurious Emissions - Non Restricted Frequency Bands
 915.00 MHz, Modem 500, 1.5 GHz - 10 GHz**



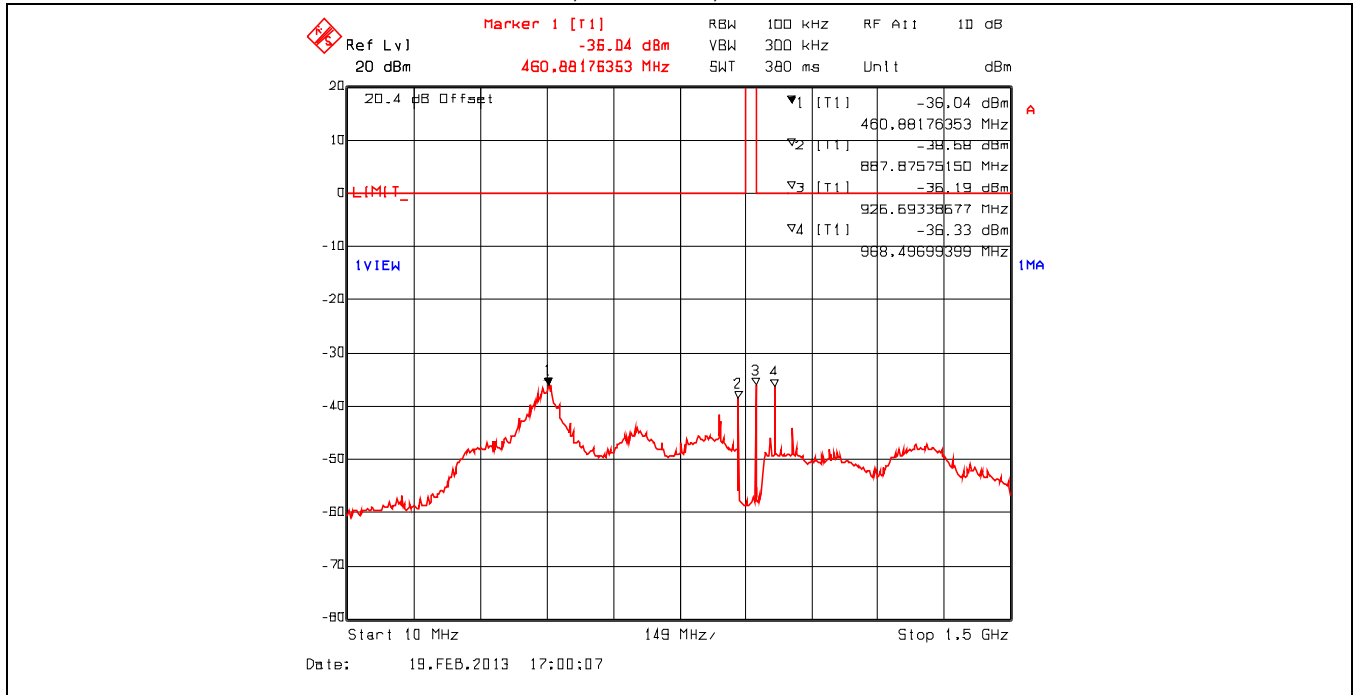
ULTRATECH GROUP OF LABS

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

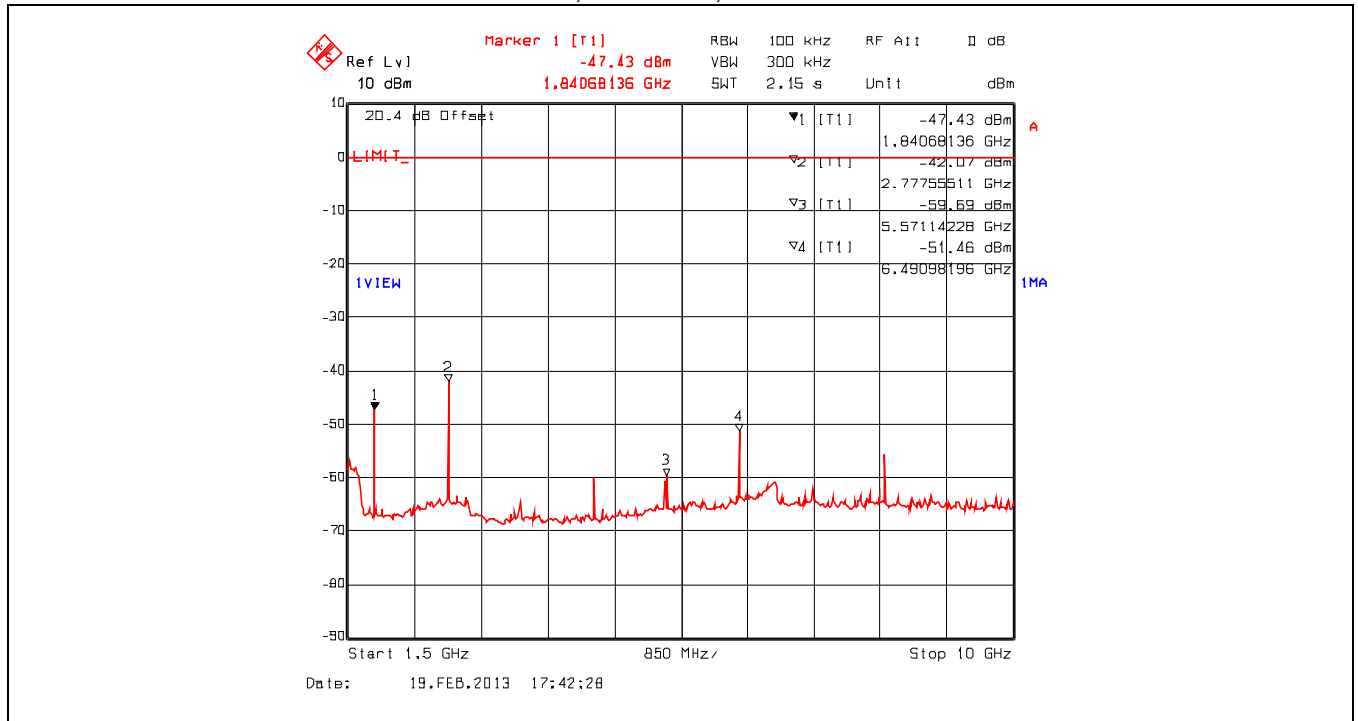
File #: MIC-165Q_F15C247DTS-R1
 April 29, 2013

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

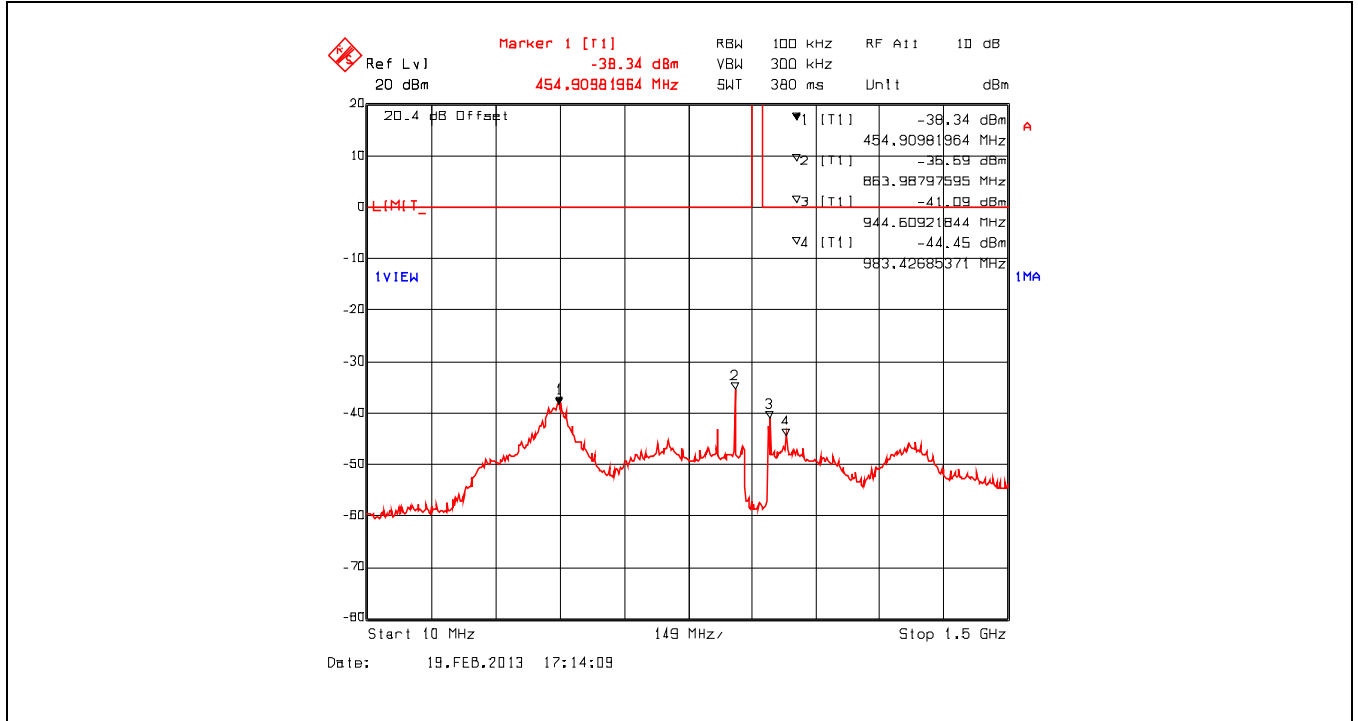
**Plot 5.4.4.2.5. Conducted Spurious Emissions - Non Restricted Frequency Bands
 927.30 MHz, Modem 500, 10 MHz – 1.5 GHz**



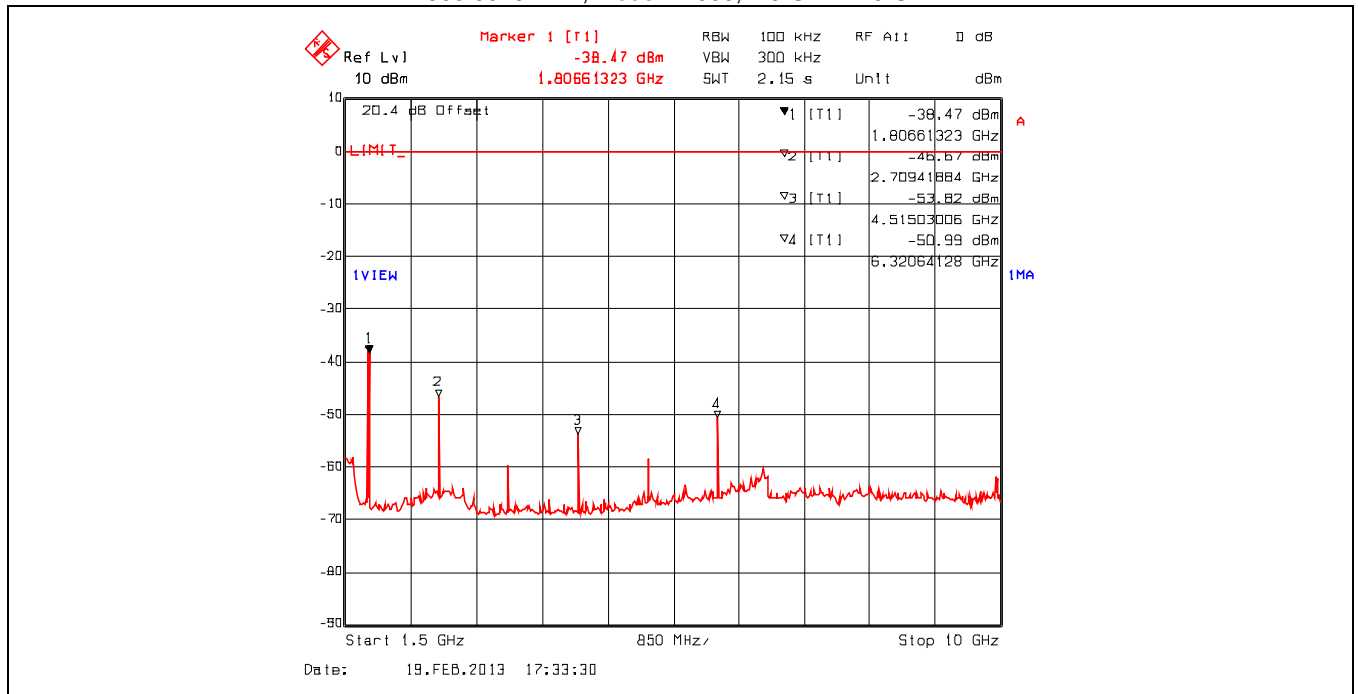
**Plot 5.4.4.2.6. Conducted Spurious Emissions - Non Restricted Frequency Bands
 927.30 MHz, Modem 500, 1.5 GHz - 10 GHz**



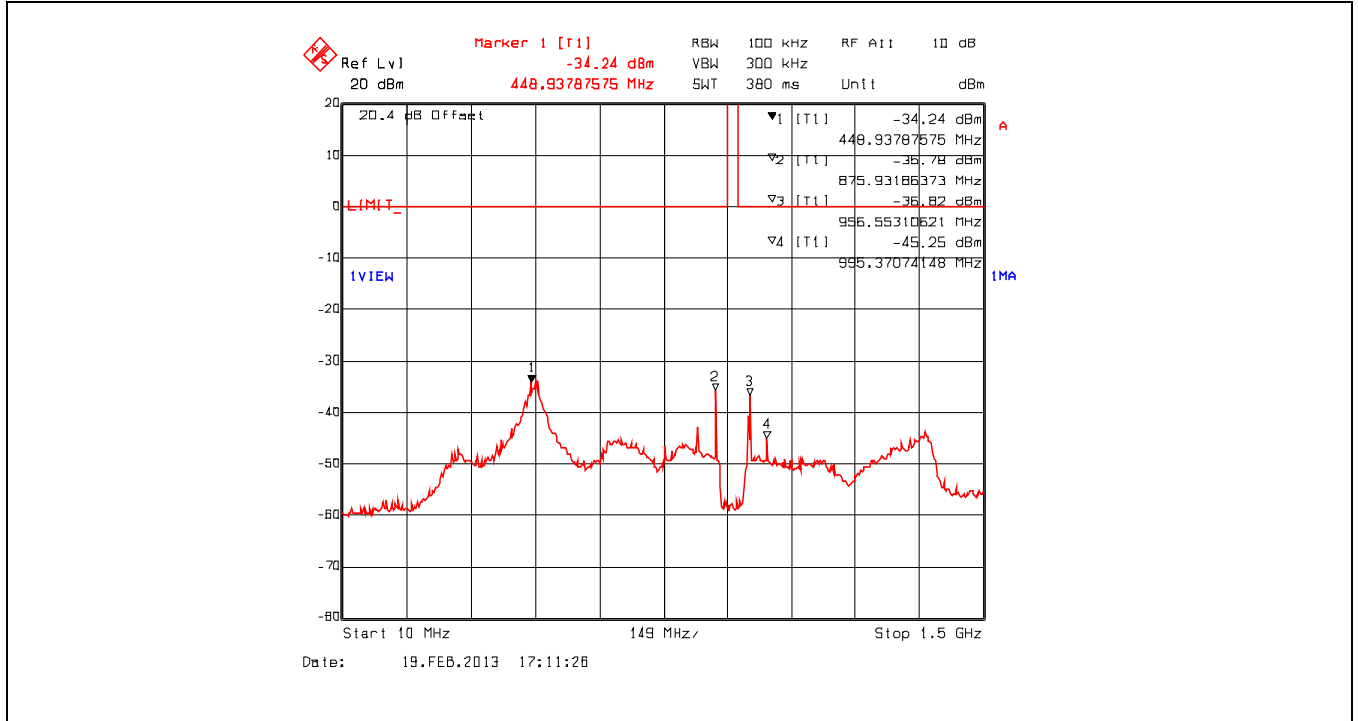
**Plot 5.4.4.2.7. Conducted Spurious Emissions - Non Restricted Frequency Bands
 903.0075 MHz, Modem 1000, 10 MHz – 1.5 GHz**



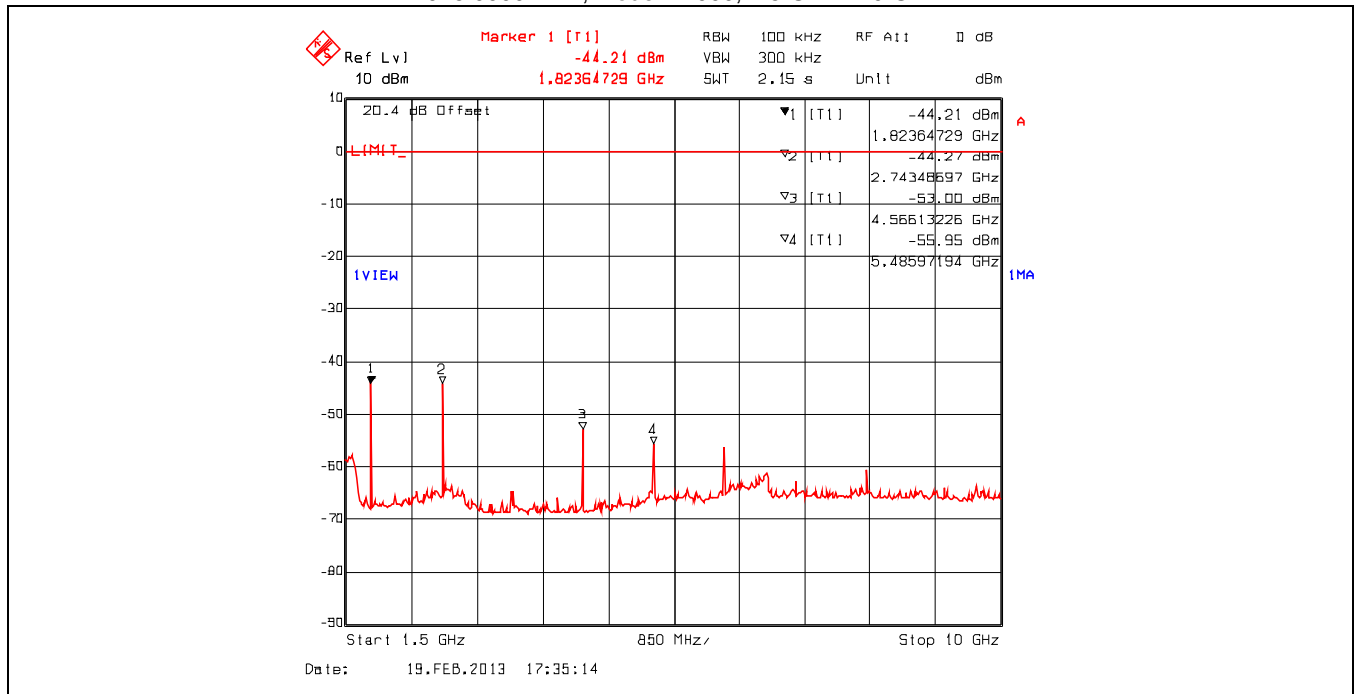
**Plot 5.4.4.2.8. Conducted Spurious Emissions - Non Restricted Frequency Bands
 903.0075 MHz, Modem 1000, 1.5 GHz - 10 GHz**



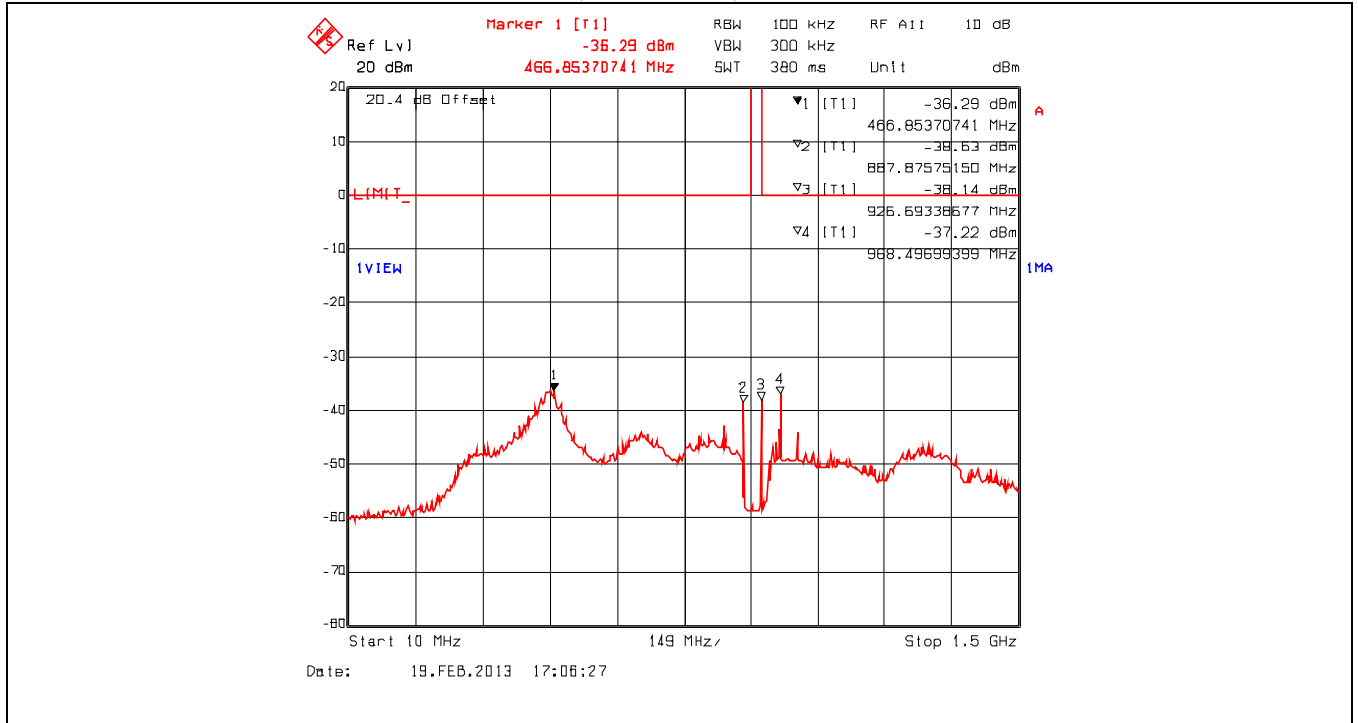
**Plot 5.4.4.2.9. Conducted Spurious Emissions - Non Restricted Frequency Bands
 915.0000 MHz, Modem 1000, 10 MHz – 1.5 GHz**



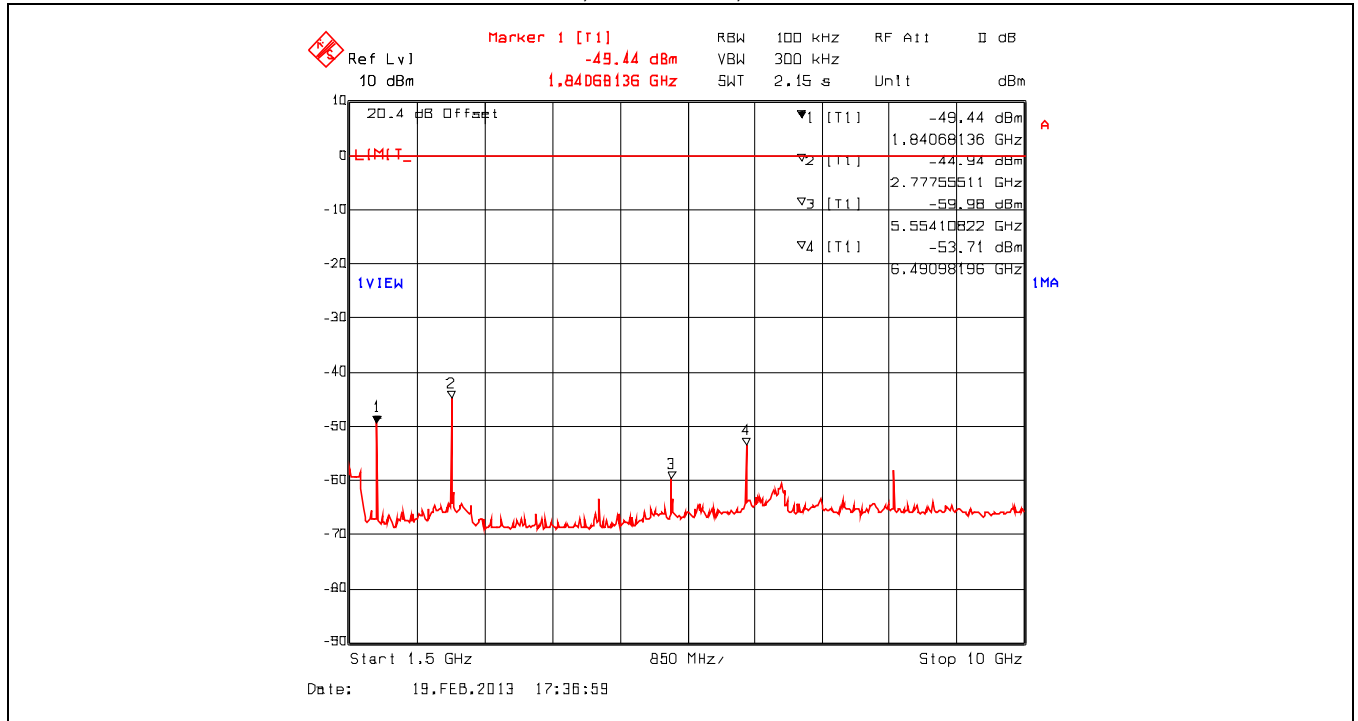
**Plot 5.4.4.2.10. Conducted Spurious Emissions - Non Restricted Frequency Bands
 915.0000 MHz, Modem 1000, 1.5 GHz - 10 GHz**



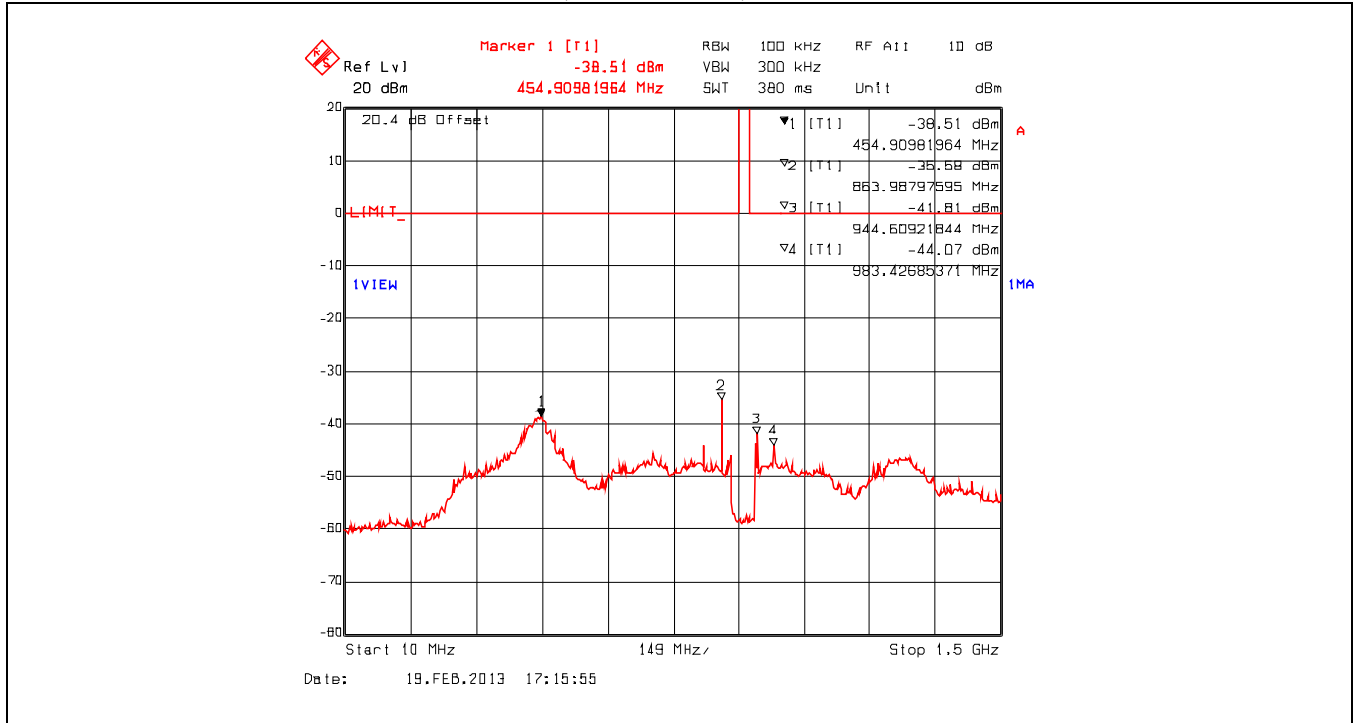
**Plot 5.4.4.2.11. Conducted Spurious Emissions - Non Restricted Frequency Bands
 926.9925 MHz, Modem 1000, 10 MHz – 1.5 GHz**



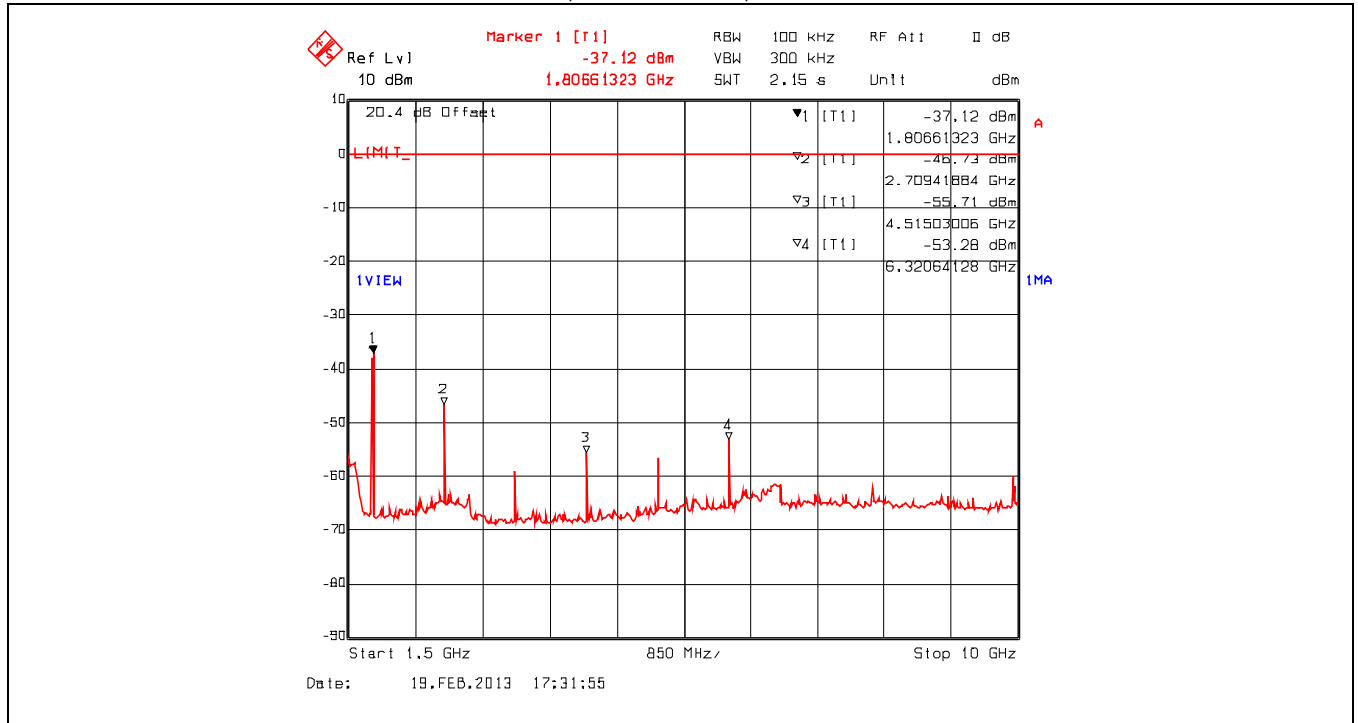
**Plot 5.4.4.2.12. Conducted Spurious Emissions - Non Restricted Frequency Bands
 926.9925 MHz, Modem 1000, 1.5 GHz - 10 GHz**



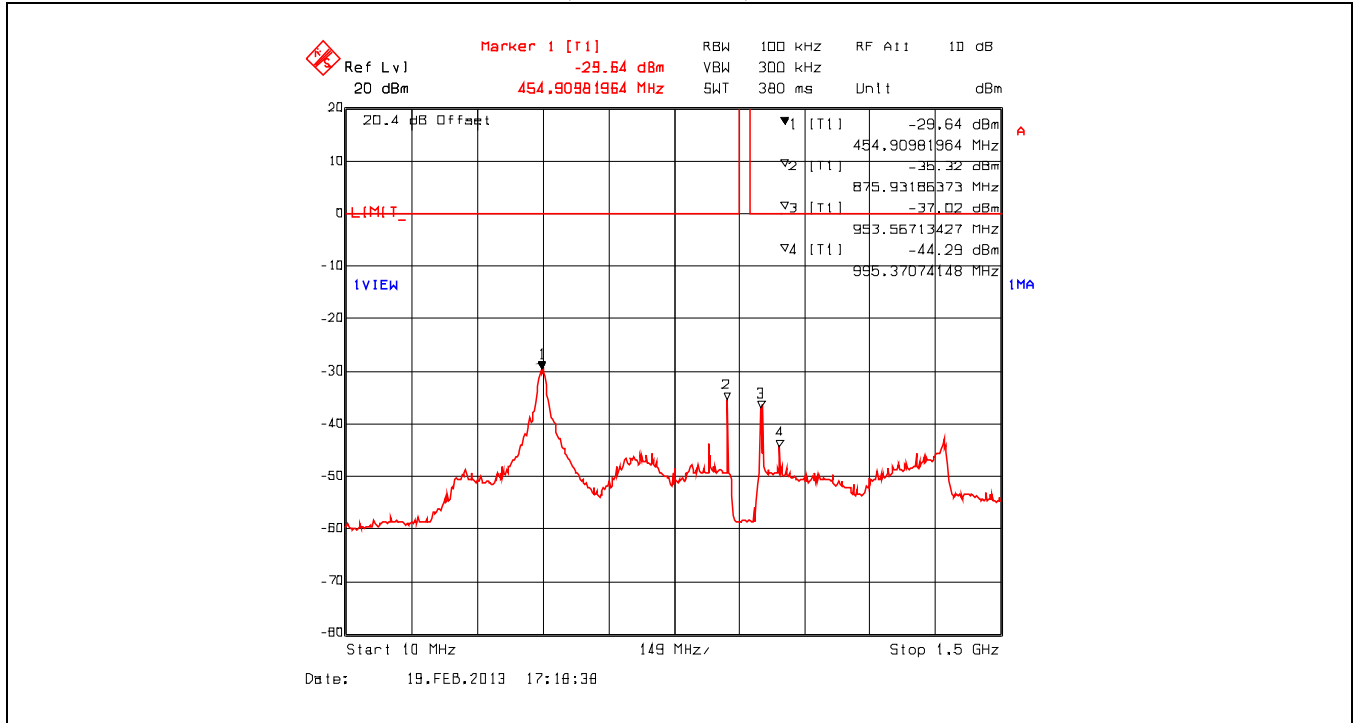
**Plot 5.4.4.2.13. Conducted Spurious Emissions - Non Restricted Frequency Bands
 903.0075MHz, Modem 1000W, 10 MHz – 1.5 GHz**



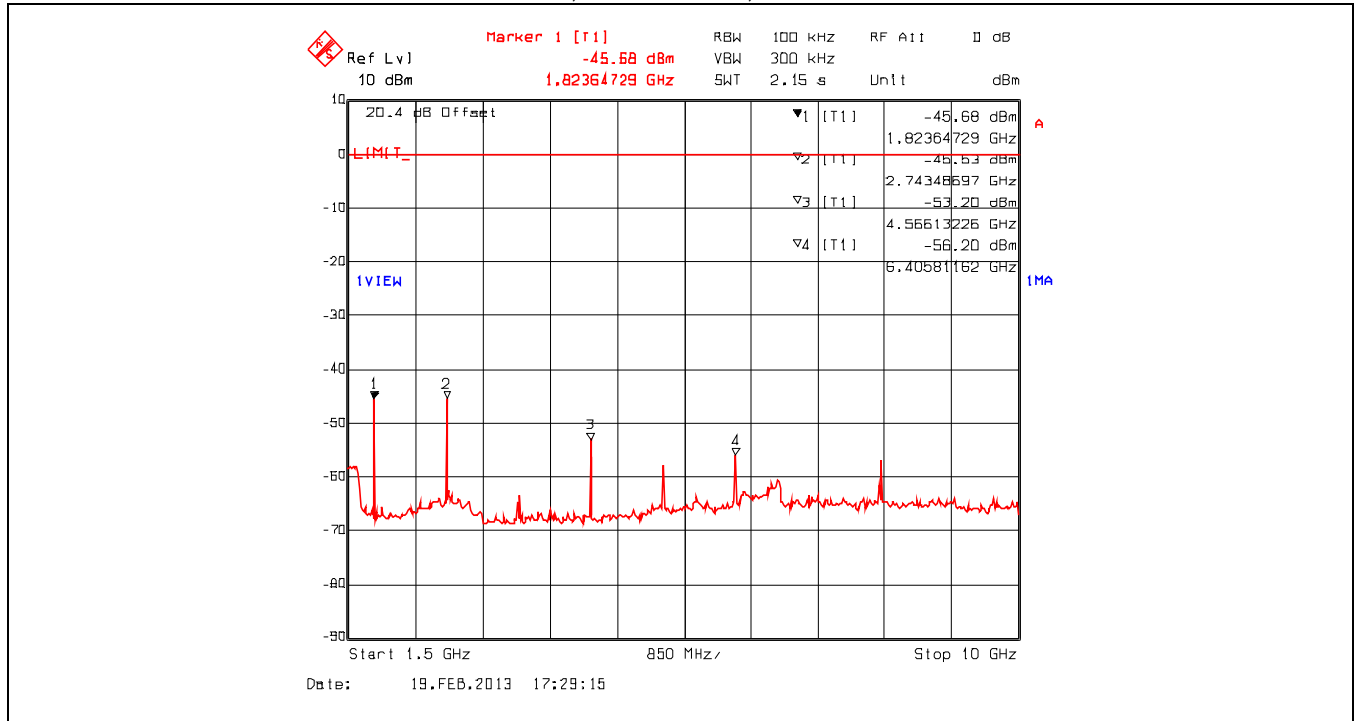
**Plot 5.4.4.2.14. Conducted Spurious Emissions - Non Restricted Frequency Bands
 903.0075MHz, Modem 1000W, 1.5 GHz - 10 GHz**



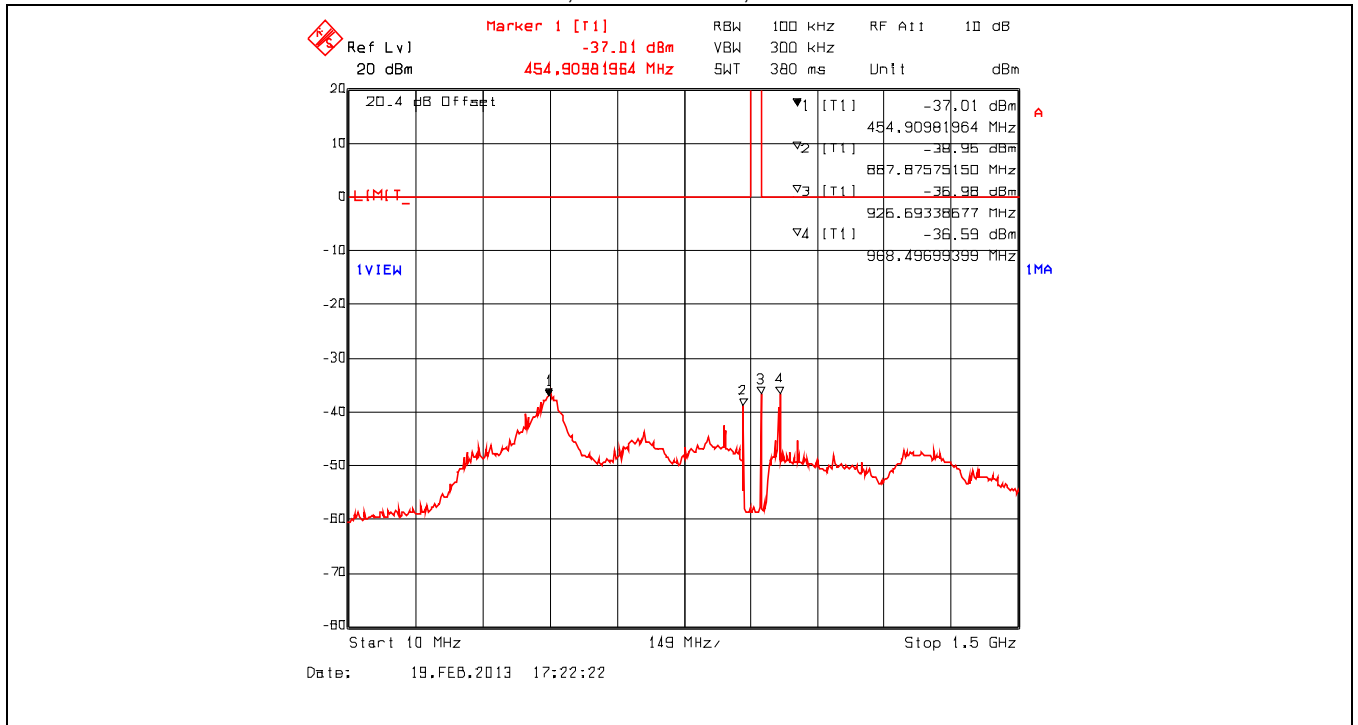
**Plot 5.4.4.2.15. Conducted Spurious Emissions - Non Restricted Frequency Bands
 915.0000 MHz, Modem 1000W, 10 MHz – 1.5 GHz**



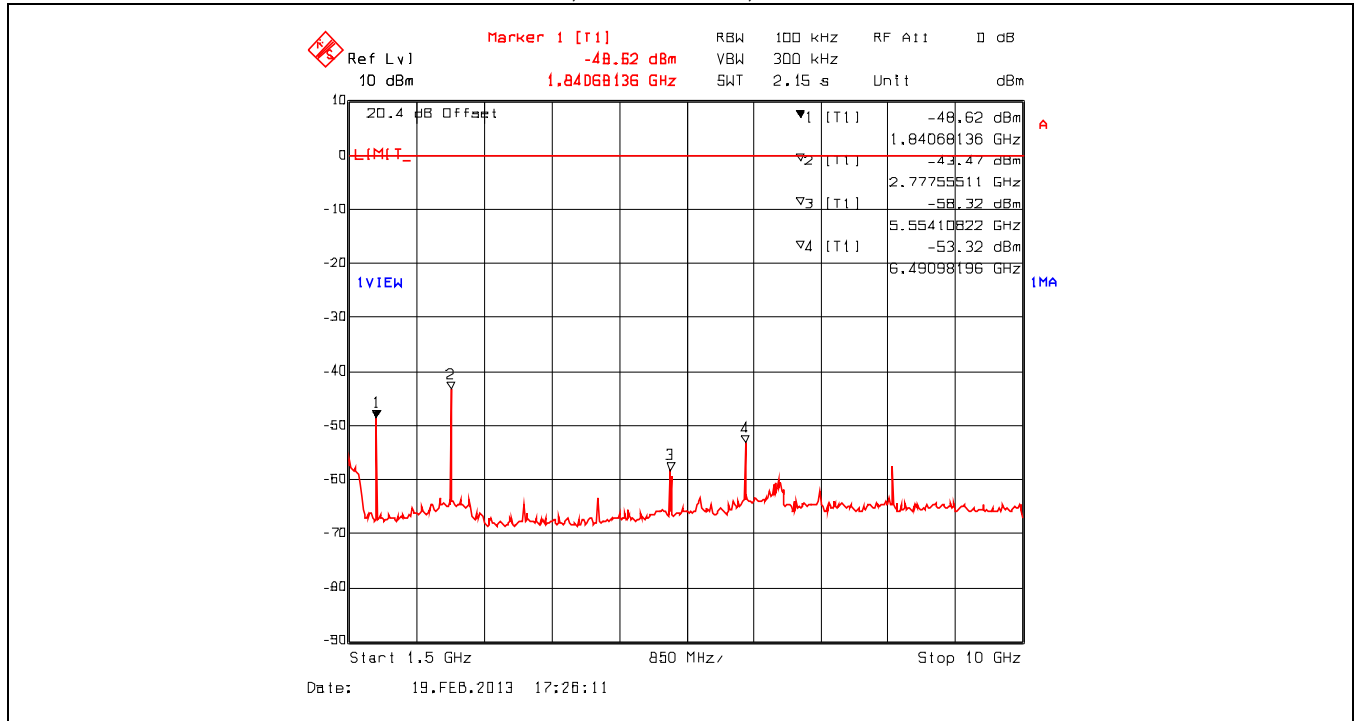
**Plot 5.4.4.2.16. Conducted Spurious Emissions - Non Restricted Frequency Bands
 915.0000 MHz, Modem 1000W, 1.5 GHz - 10 GHz**



Plot 5.4.4.2.17. Conducted Spurious Emissions - Non Restricted Frequency Bands
 926.9925 MHz, Modem 100W, 10 MHz – 1.5 GHz



Plot 5.4.4.2.18. Conducted Spurious Emissions - Non Restricted Frequency Bands
 926.9925 MHz, Modem 100W, 1.5 GHz - 10 GHz



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

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 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

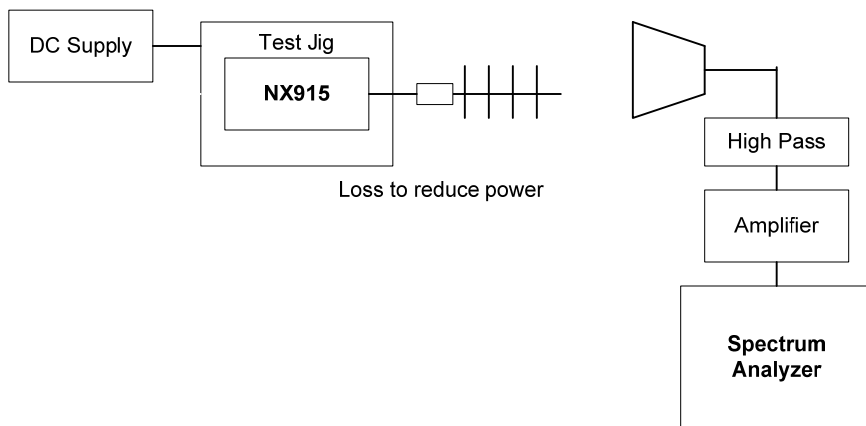
Section 15.209(a) - Field Strength Limits within Restricted Frequency Bands

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

5.5.2. Method of Measurements

KDB Publication No. 558074 D01: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

5.5.3. Test Arrangement



5.5.4. 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.
- Modem 500, 1000 & 1000W modes were pre-scanned and found that High Power, Modem 500 results are the worst-case measurements as tabulated below.

5.5.4.1. EUT connected with 12.15 dBi Yagi Antenna with 5 dB Attenuator

5.5.4.1.1. Spurious Radiated Emissions

Fundamental Frequency:		902.7 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
902.7	131.00	--	V	--	--	--	--
902.7	130.91	--	H	--	--	--	--
995.0	53.25	48.72	V	54.0	111.0	-5.28	Pass*
995.0	55.61	50.11	H	54.0	111.0	-3.89	Pass*
2708.1	54.17	48.76	V	54.0	111.0	-5.24	Pass*
2708.1	52.62	46.67	H	54.0	111.0	-7.33	Pass*
4513.5	50.24	38.07	V	54.0	111.0	-15.93	Pass*
4513.5	49.56	37.07	H	54.0	111.0	-16.93	Pass*
5416.2	50.43	37.08	V	54.0	111.0	-16.92	Pass*
5416.2	49.66	37.46	H	54.0	111.0	-16.54	Pass*
8124.3	52.85	40.09	V	54.0	111.0	-13.91	Pass*
8124.3	53.34	39.57	H	54.0	111.0	-14.43	Pass*
9027.0	54.13	40.95	V	54.0	111.0	-13.05	Pass*
9027.0	54.17	41.22	H	54.0	111.0	-12.78	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.

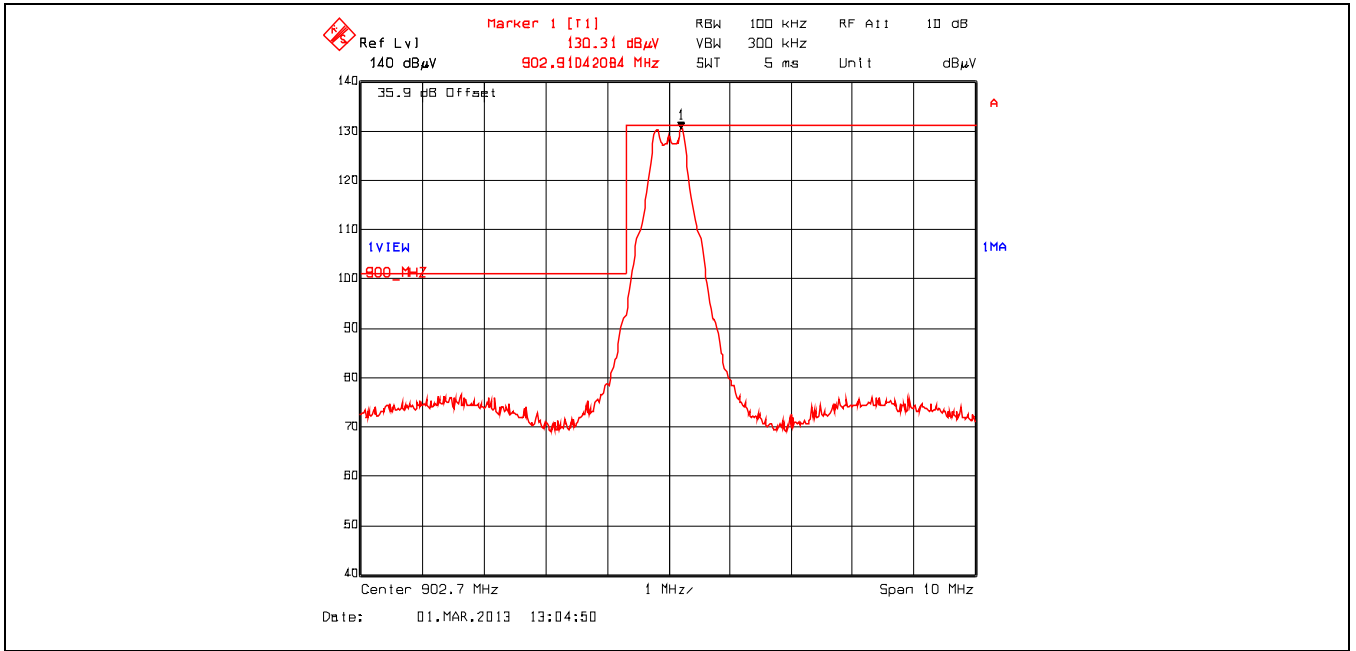
Fundamental Frequency:		915.0 MHz					
Frequency Test Range:		30 MHz – 10 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
915.0	129.58	--	V	--	--	--	--
915.0	129.76	--	H	--	--	--	--
2745.0	52.46	46.56	V	54.0	109.8	-7.44	Pass*
2745.0	49.54	42.48	H	54.0	109.8	-11.52	Pass*
7320.0	52.03	38.73	V	54.0	109.8	-15.27	Pass*
7320.0	52.05	38.77	H	54.0	109.8	-15.23	Pass*
8235.0	52.37	40.31	V	54.0	109.8	-13.69	Pass*
8235.0	52.62	39.61	H	54.0	109.8	-14.39	Pass*
9150.0	53.52	40.12	V	54.0	109.8	-13.88	Pass*
9150.0	53.10	39.60	H	54.0	109.8	-14.40	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

Fundamental Frequency:		927.3 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
927.3	130.11	--	V	--	--	--	--
927.3	127.59	--	H	--	--	--	--
2781.9	53.15	47.66	V	54.0	110.1	-6.34	Pass*
2781.9	50.98	44.35	H	54.0	110.1	-9.65	Pass*
4636.5	49.27	36.45	V	54.0	110.1	-17.55	Pass*
4636.5	49.96	36.47	H	54.0	110.1	-17.53	Pass*
7418.4	52.36	38.42	V	54.0	110.1	-15.58	Pass*
7418.4	52.06	38.13	H	54.0	110.1	-15.87	Pass*
8345.7	53.14	40.27	V	54.0	110.1	-13.73	Pass*
8345.7	52.31	39.64	H	54.0	110.1	-14.36	Pass*
9273.0	53.39	40.32	V	54.0	110.1	-13.68	Pass*
9273.0	53.28	39.51	H	54.0	110.1	-14.49	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

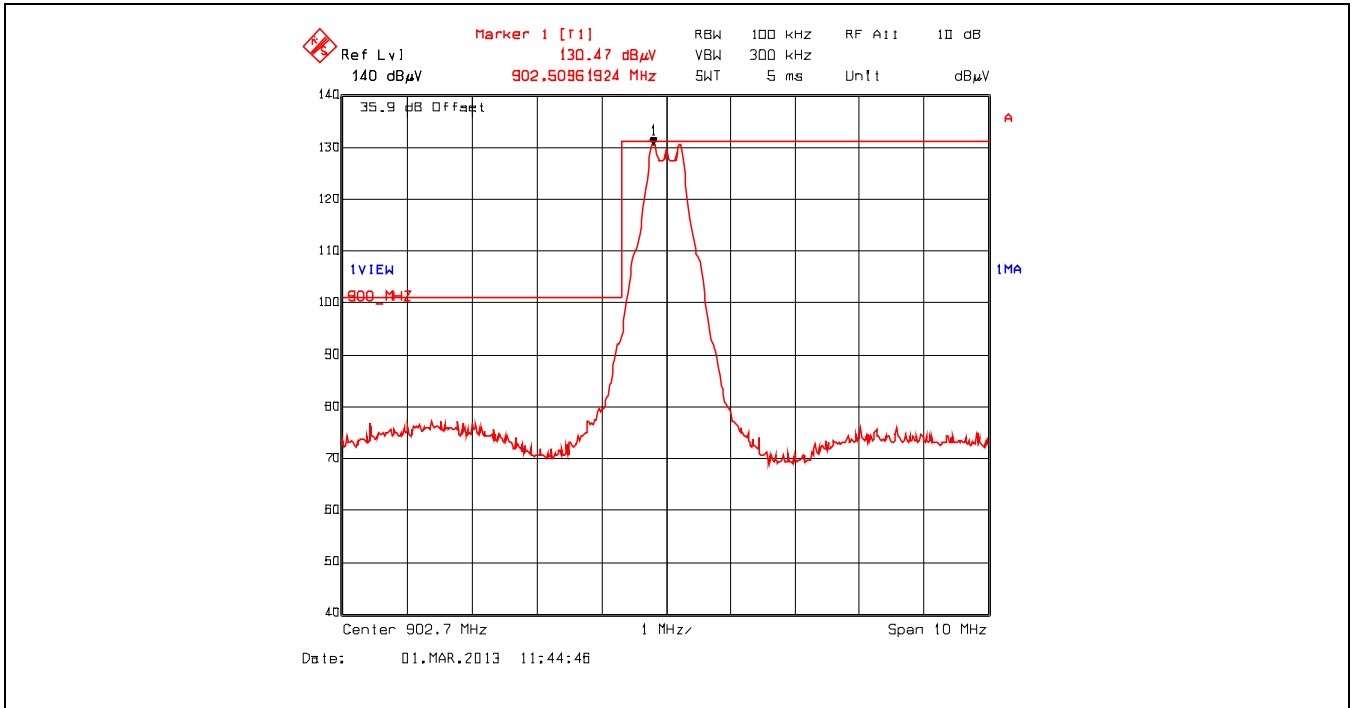
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.5.4.1.2. Band-Edge RF Radiated Emissions

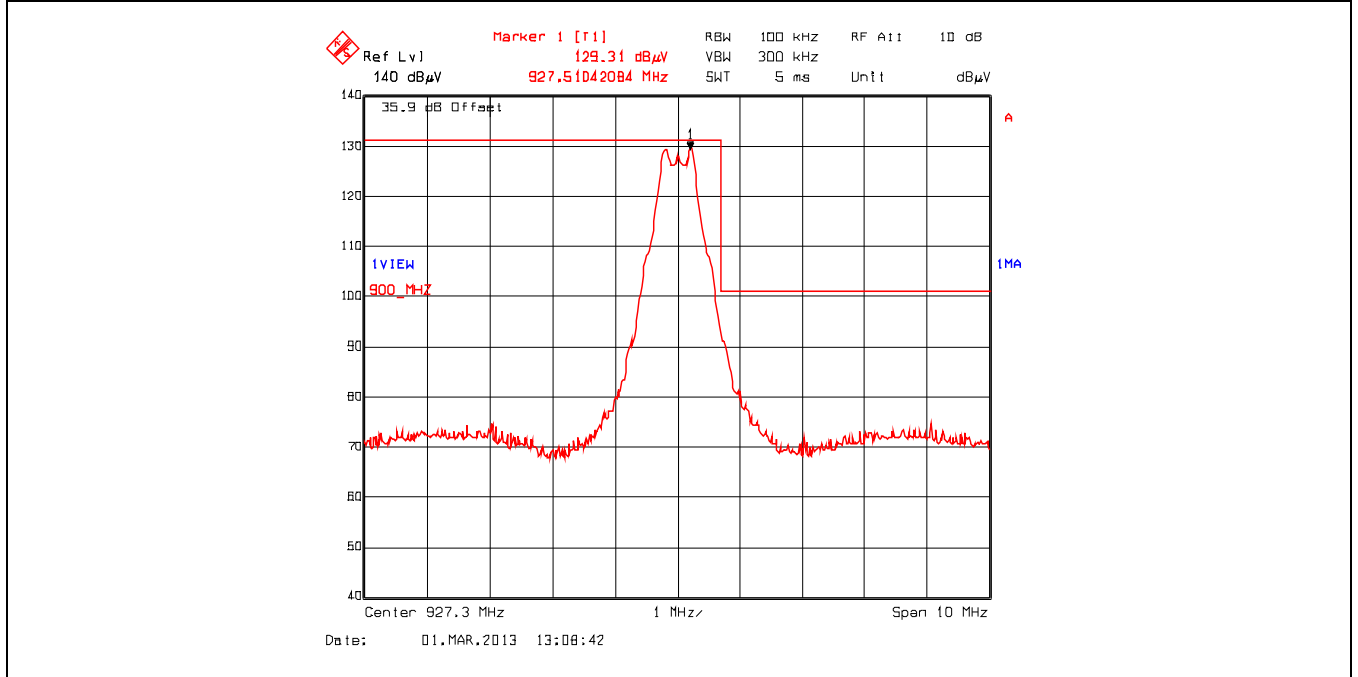
Plot 5.5.4.1.2.1. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 902.7 MHz, Modem 500



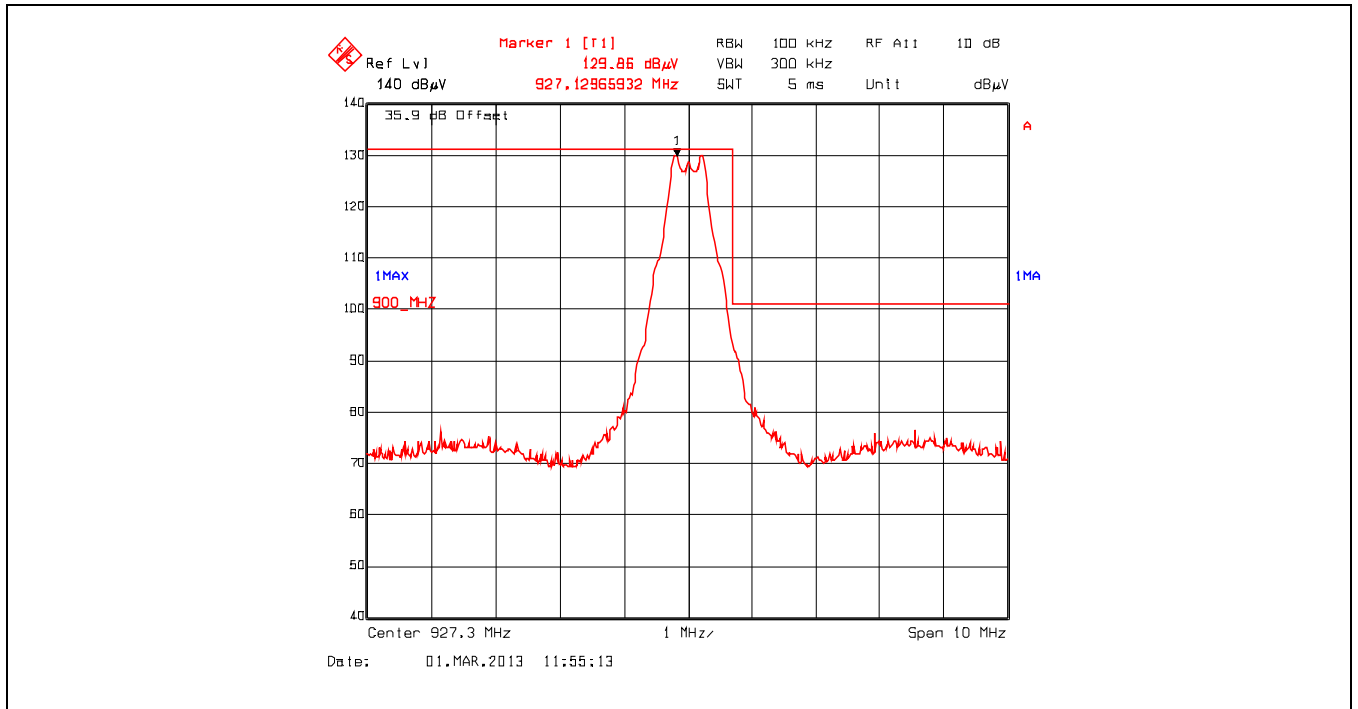
Plot 5.5.4.1.2.2. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 902.7 MHz, Modem 500



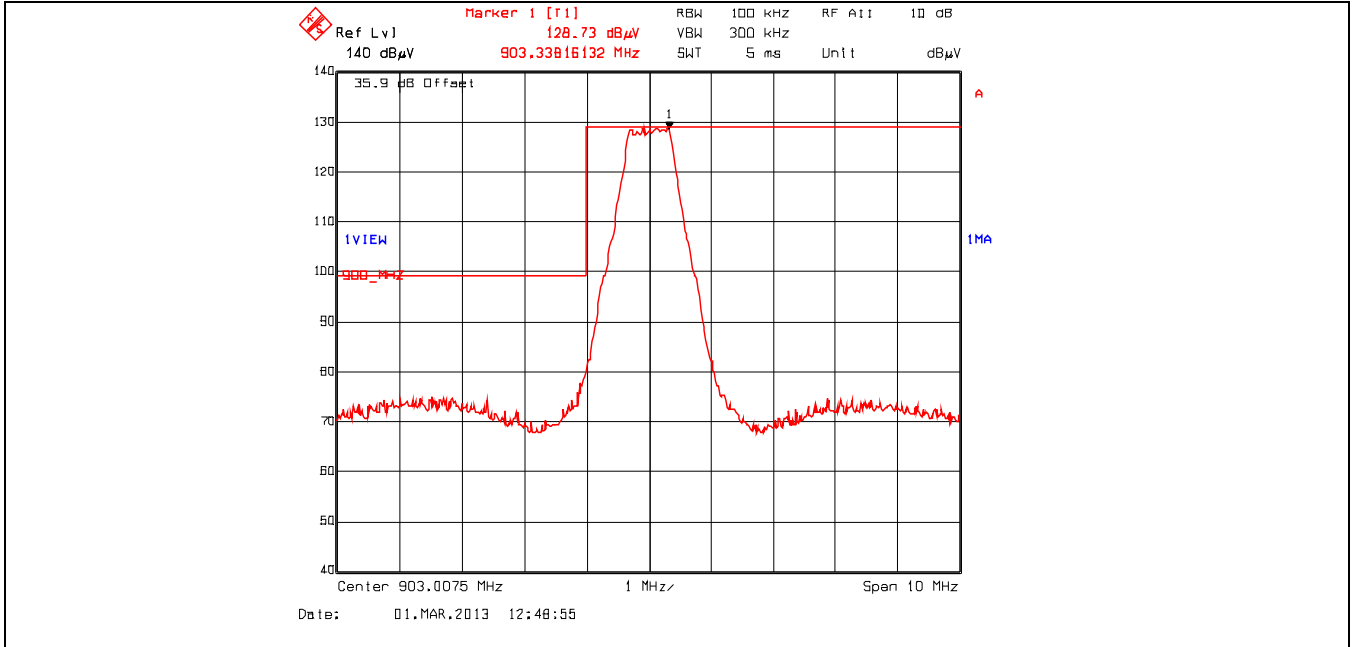
**Plot 5.5.4.1.2.3. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
 High End of Frequency Band, 927.3 MHz, Modem 500**



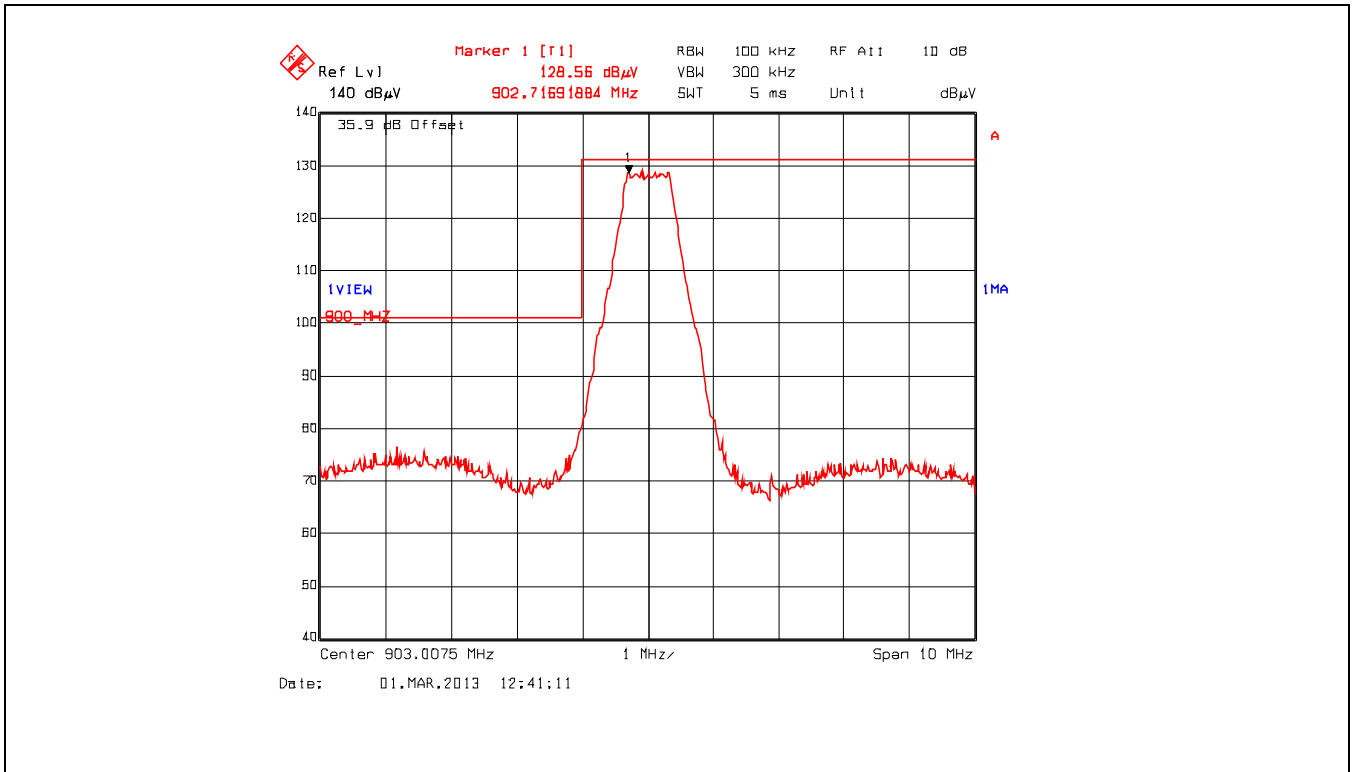
**Plot 5.5.4.1.2.4. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
 High End of Frequency Band, 927.3 MHz, Modem 500**



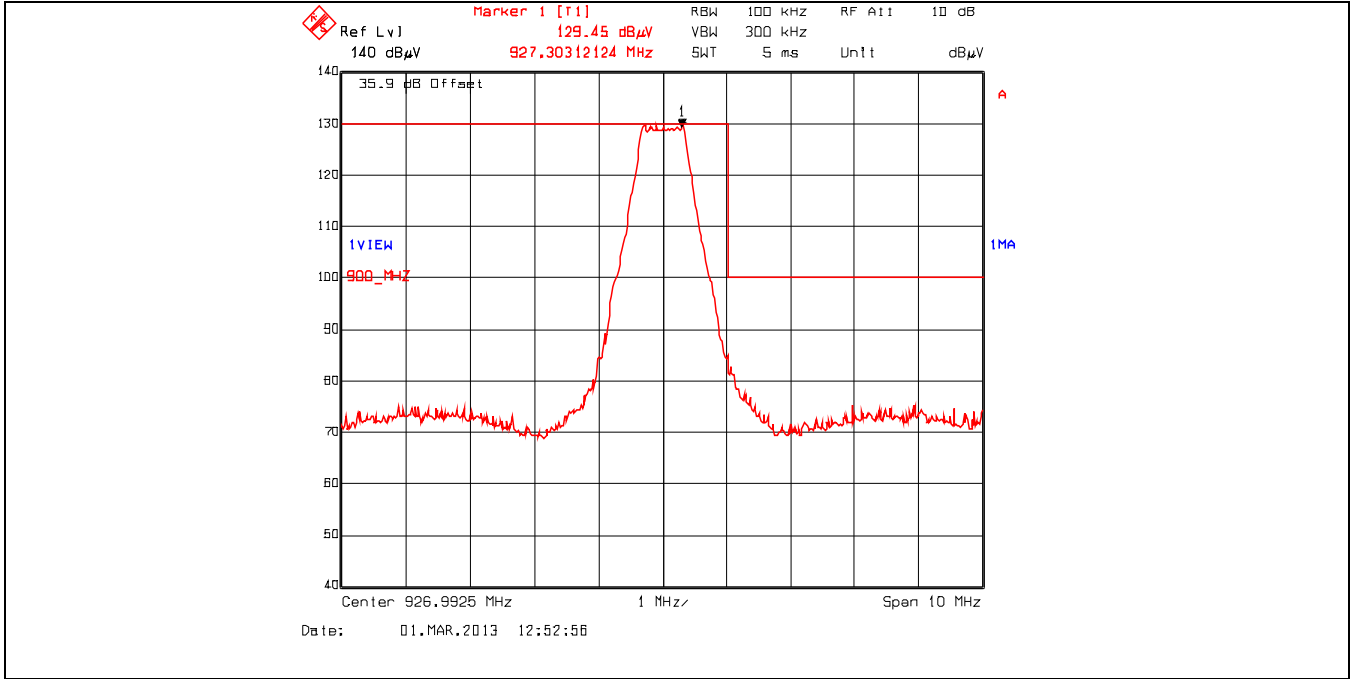
Plot 5.5.4.1.2.5. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
 Low End of Frequency Band, 903.0075 MHz, Modem 1000



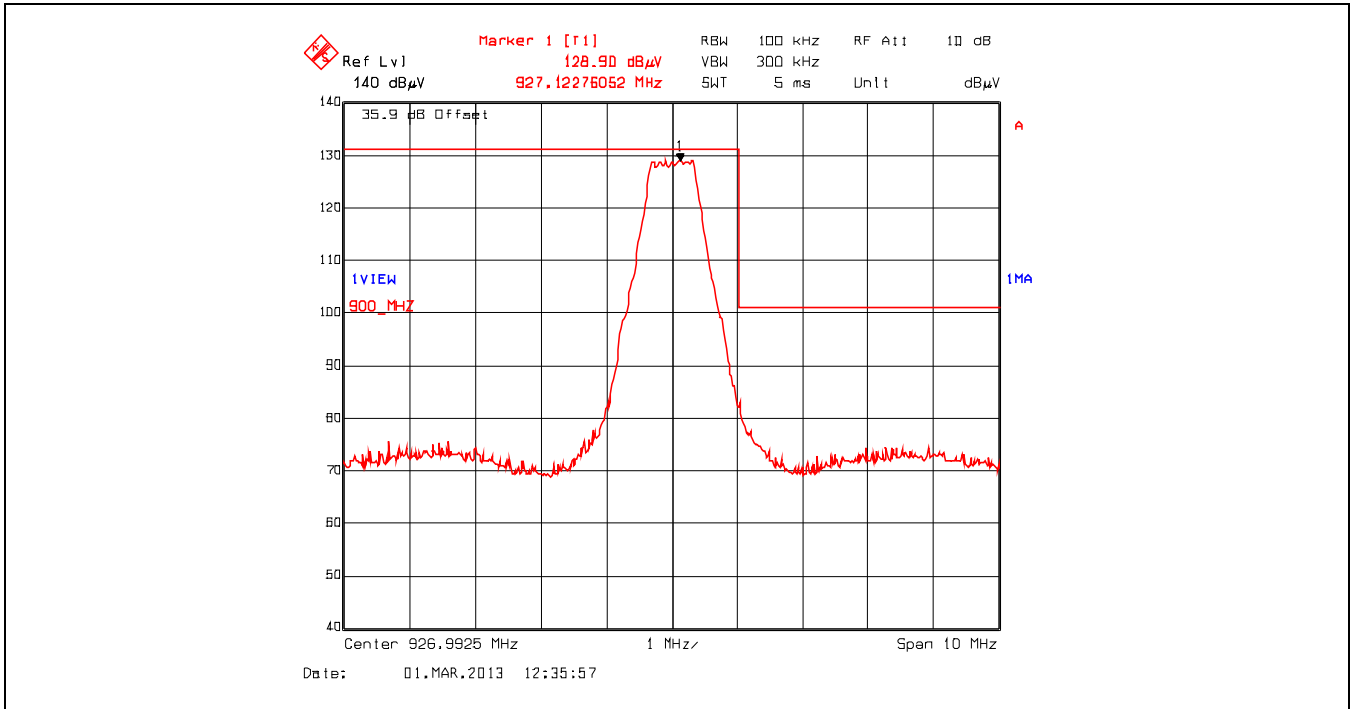
Plot 5.5.4.1.2.6. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
 Low End of Frequency Band, 903.0075 MHz, Modem 1000



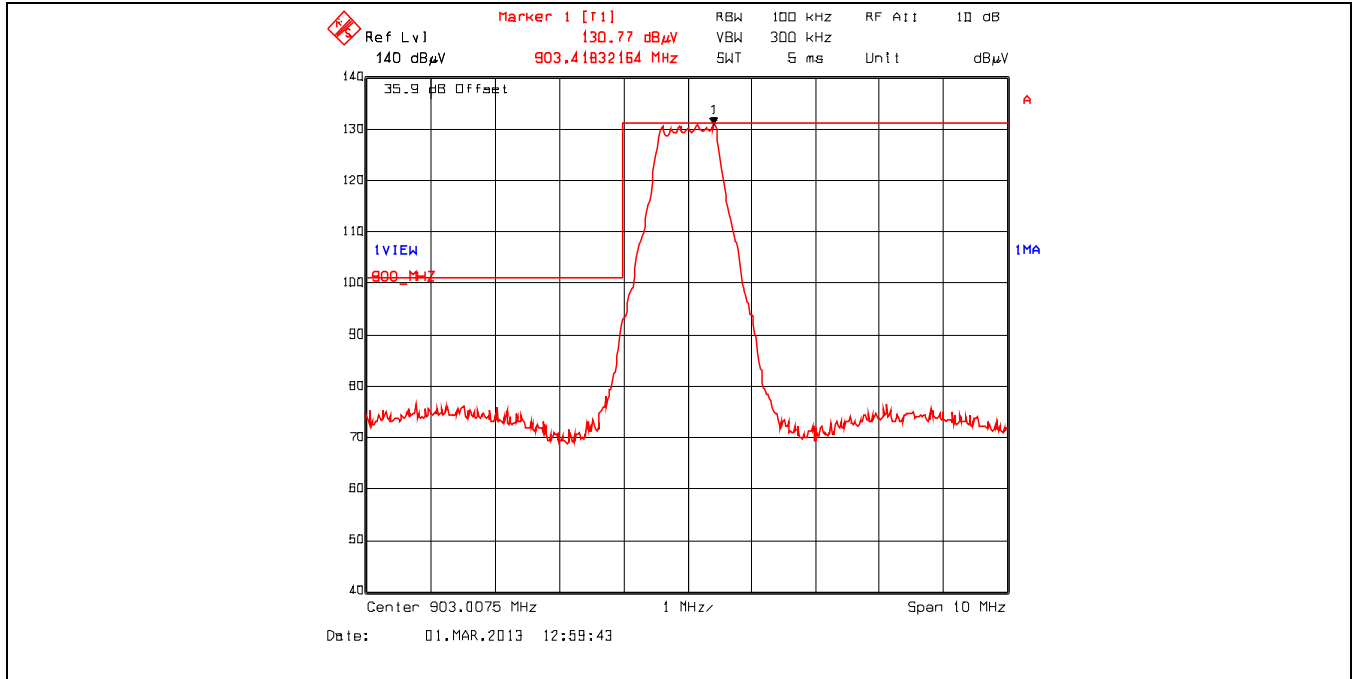
**Plot 5.5.4.1.2.7. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
 High End of Frequency Band, 926.9925 MHz, Modem 1000**



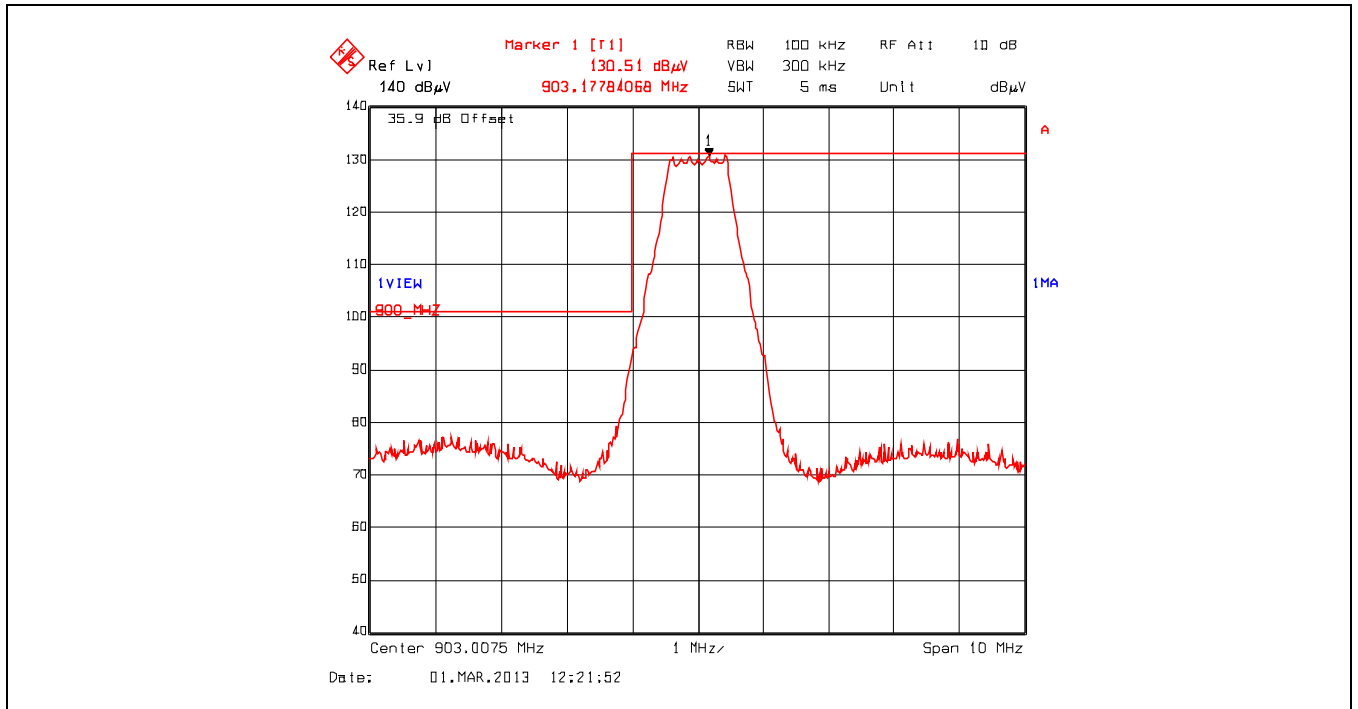
**Plot 5.5.4.1.2.8. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
 High End of Frequency Band, 926.9925 MHz, Modem 1000**



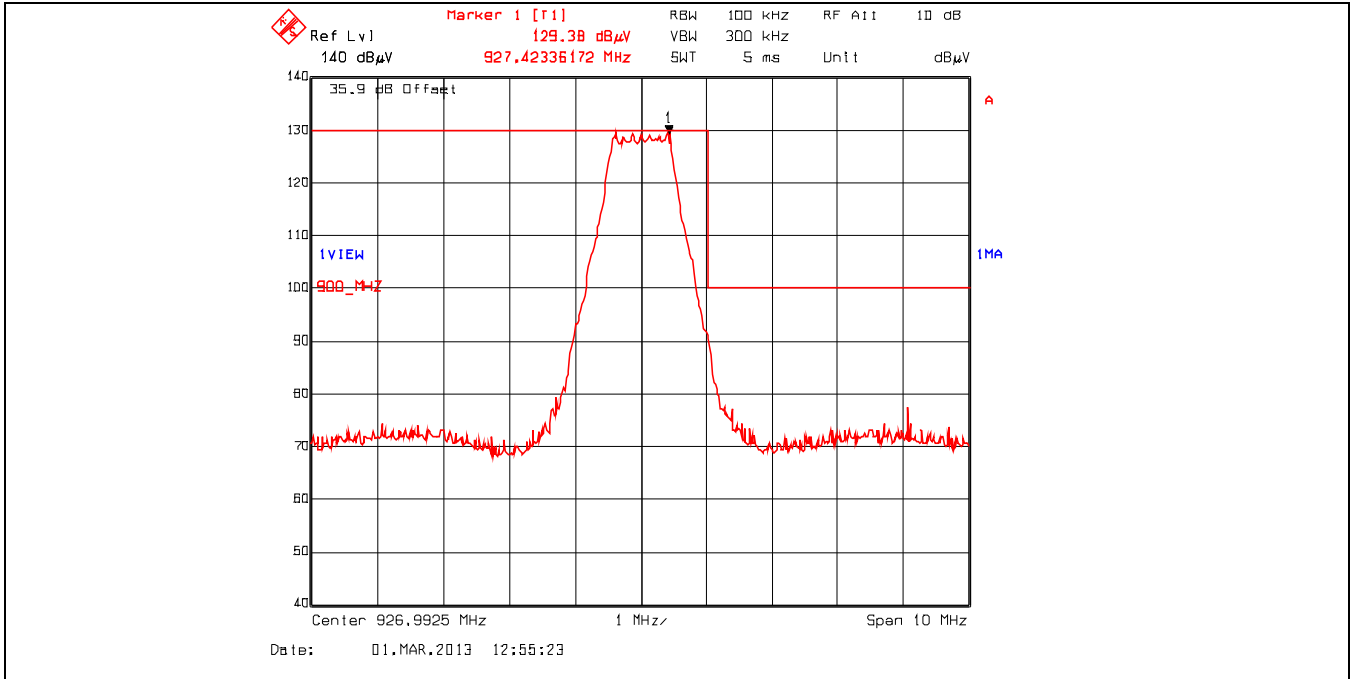
Plot 5.5.4.1.2.9. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
 Low End of Frequency Band, 903.0075 MHz, Modem 100W



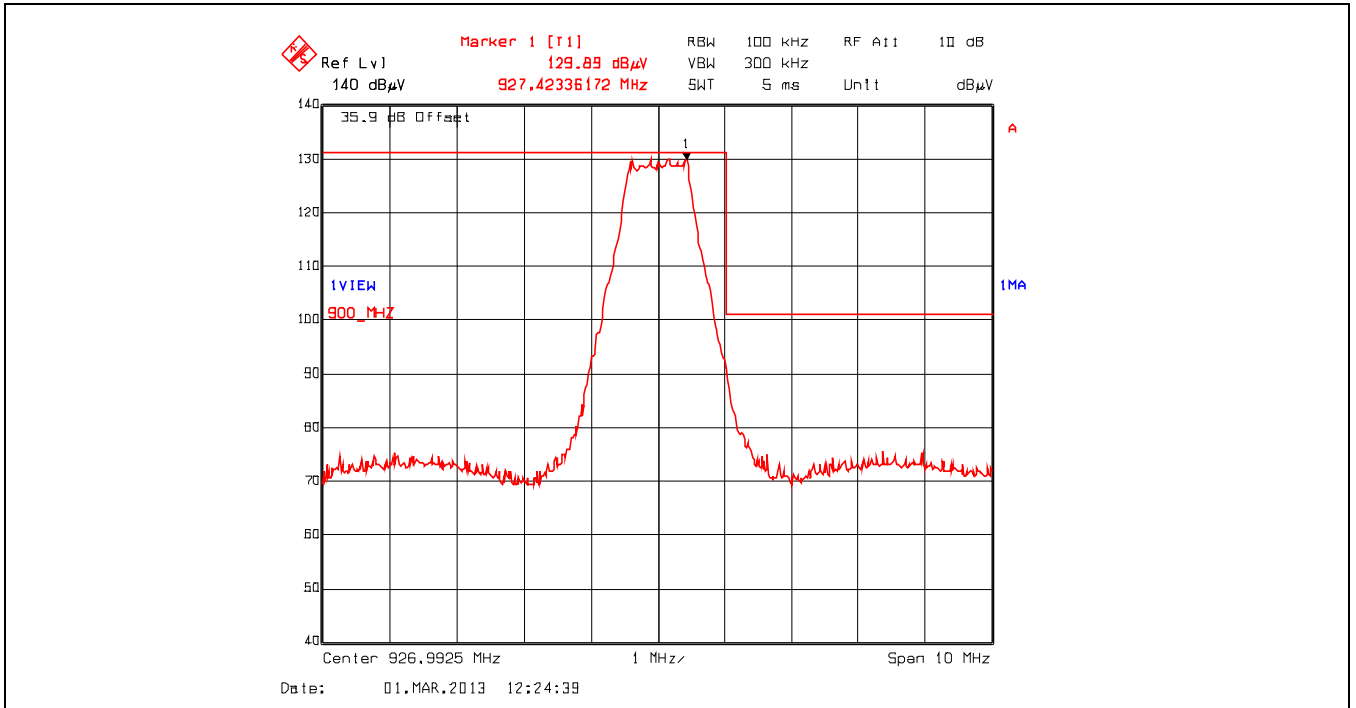
Plot 5.5.4.1.2.10. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
 Low End of Frequency Band, 903.0075 MHz, Modem 100W



Plot 5.5.4.1.2.11. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
 High End of Frequency Band, 926.9925 MHz, Modem 1000W



Plot 5.5.4.1.2.12. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
 High End of Frequency Band, 926.9925 MHz, Modem 1000W



5.5.4.2. EUT connected with 9.15 dBi Omni Antenna with 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.
- Modem 500, 1000 & 1000W modes were pre-scanned and found that High Power, Modem 500 results are the worst-case measurements as tabulated below.

5.5.4.2.1. Spurious Radiated Emissions

Fundamental Frequency:		902.7 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
902.7	130.43	--	V	--	--	--	--
902.7	130.34	--	H	--	--	--	--
2708.1	52.71	46.60	V	54.0	110.4	-7.40	Pass*
2708.1	50.67	43.81	H	54.0	110.4	-10.19	Pass*
3610.8	46.89	34.18	V	54.0	110.4	-19.82	Pass*
4513.5	50.64	38.84	V	54.0	110.4	-15.16	Pass*
4513.5	49.94	37.56	H	54.0	110.4	-16.44	Pass*
5416.2	50.92	38.03	V	54.0	110.4	-15.97	Pass*
5416.2	50.30	37.78	H	54.0	110.4	-16.22	Pass*
8124.3	52.81	40.13	V	54.0	110.4	-13.87	Pass*
8124.3	51.27	39.71	H	54.0	110.4	-14.29	Pass*
9027.0	53.99	40.87	V	54.0	110.4	-13.13	Pass*
9027.0	53.26	41.16	H	54.0	110.4	-12.84	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					
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	128.79	--	V	--	--	--	--
915.0	128.14	--	H	--	--	--	--
2745.0	52.51	46.51	V	54.0	108.8	-7.49	Pass*
2745.0	49.63	42.49	H	54.0	108.8	-11.51	Pass*
3660.0	46.27	34.06	V	54.0	108.8	-19.94	Pass*
3660.0	46.62	34.67	H	54.0	108.8	-19.33	Pass*
4575.0	51.33	37.77	V	54.0	108.8	-16.23	Pass*
4575.0	50.05	38.17	H	54.0	108.8	-15.83	Pass*
7320.0	53.39	40.26	V	54.0	108.8	-13.74	Pass*
7320.0	53.14	39.28	H	54.0	108.8	-14.72	Pass*
8235.0	52.38	41.85	V	54.0	108.8	-12.15	Pass*
8235.0	51.37	40.03	H	54.0	108.8	-13.97	Pass*
9150.0	52.14	40.10	V	54.0	108.8	-13.90	Pass*
9150.0	52.92	40.31	H	54.0	108.8	-13.69	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

Fundamental Frequency:		927.3 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
927.3	126.55	--	V	--	--	--	--
927.3	125.75	--	H	--	--	--	--
2781.9	51.92	45.37	V	54.0	106.6	-8.63	Pass*
2781.9	50.51	43.81	H	54.0	106.6	-10.19	Pass*
4636.5	48.82	36.39	V	54.0	106.6	-17.61	Pass*
4636.5	48.11	34.72	H	54.0	106.6	-19.28	Pass*
7418.4	52.20	38.61	V	54.0	106.6	-15.39	Pass*
7418.4	52.13	38.75	H	54.0	106.6	-15.25	Pass*
8345.7	52.93	40.26	V	54.0	106.6	-13.74	Pass*
8345.7	51.43	40.21	H	54.0	106.6	-13.79	Pass*
9273.0	53.24	39.80	V	54.0	106.6	-14.20	Pass*
9273.0	52.46	40.25	H	54.0	106.6	-13.75	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.

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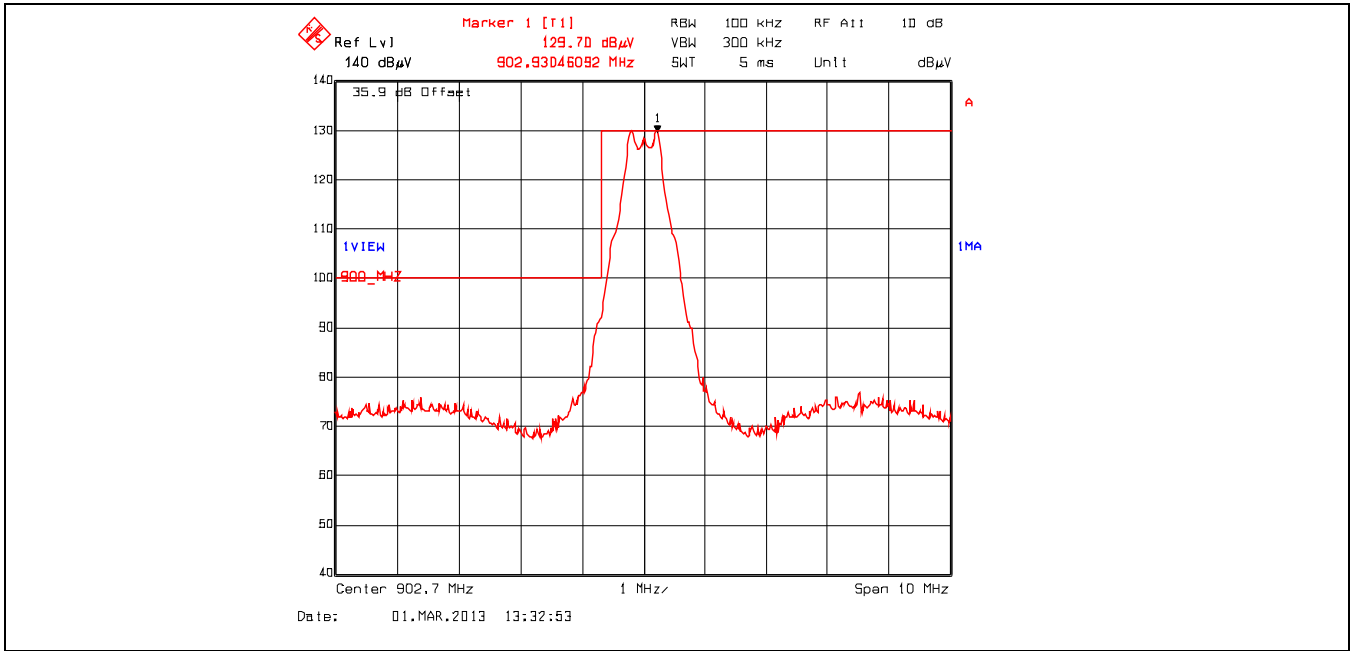
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: MIC-165Q_F15C247DTS-R1
 April 29, 2013

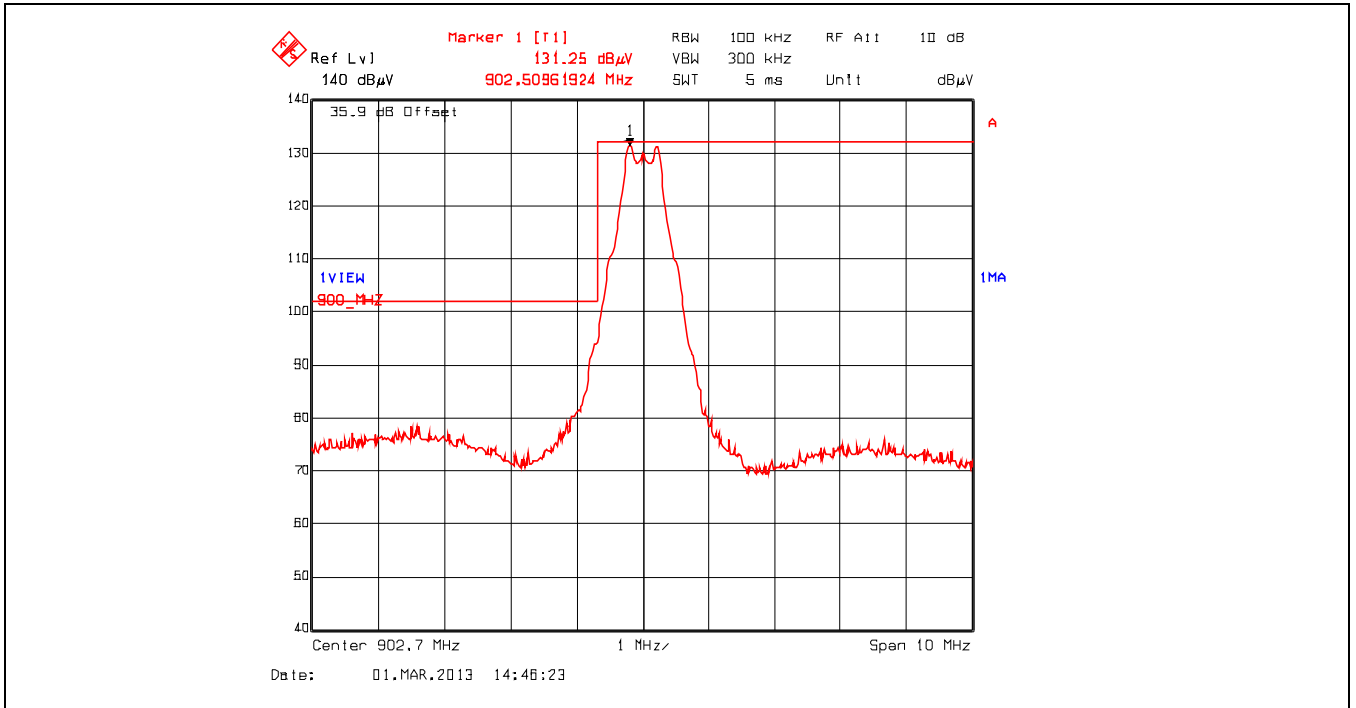
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.5.4.2.2. Band-Edge RF Radiated Emissions

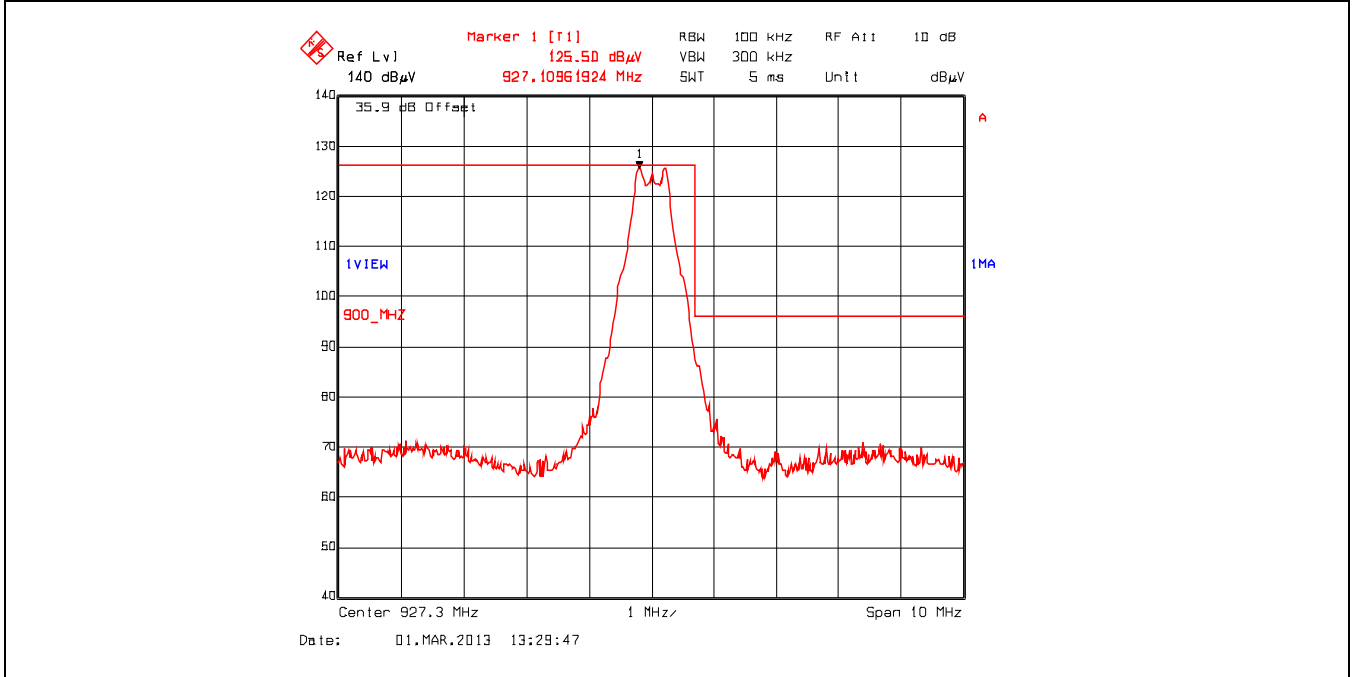
Plot 5.5.4.2.2.1. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 902.7 MHz, Modem 500



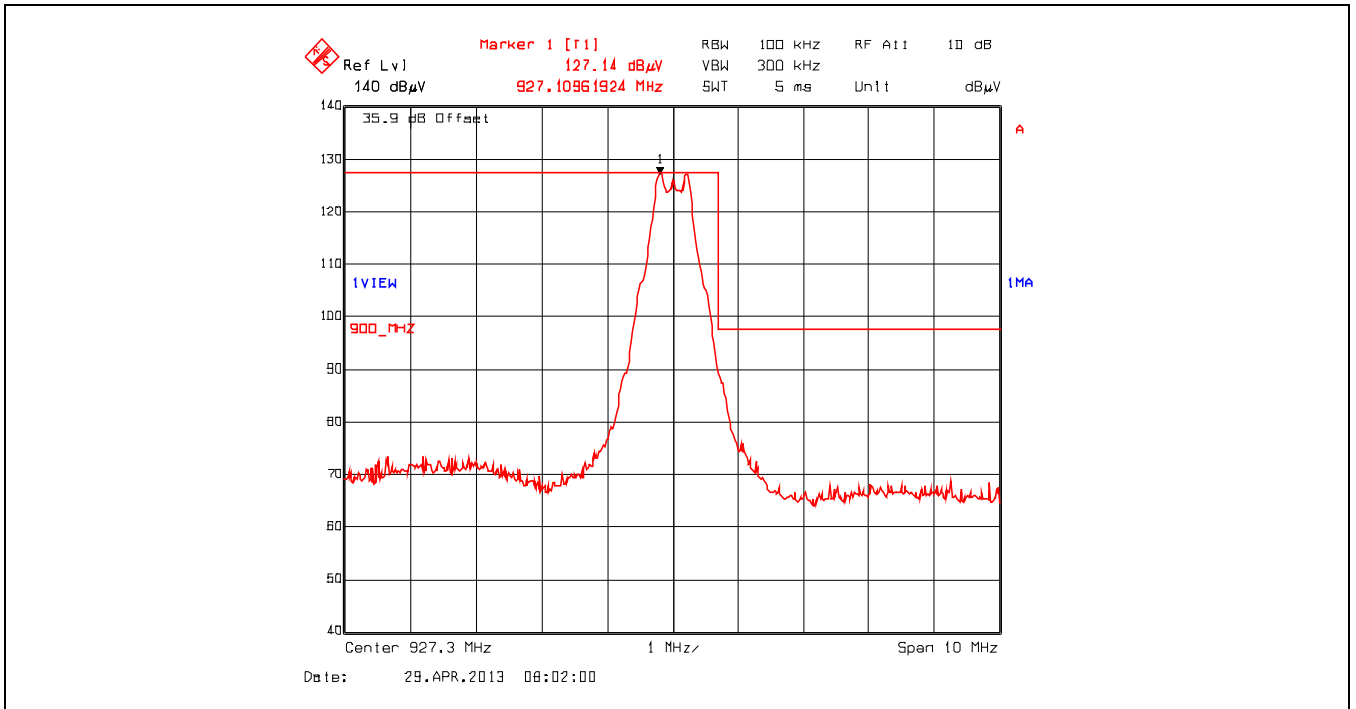
Plot 5.5.4.2.2.2. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 902.7 MHz, Modem 500



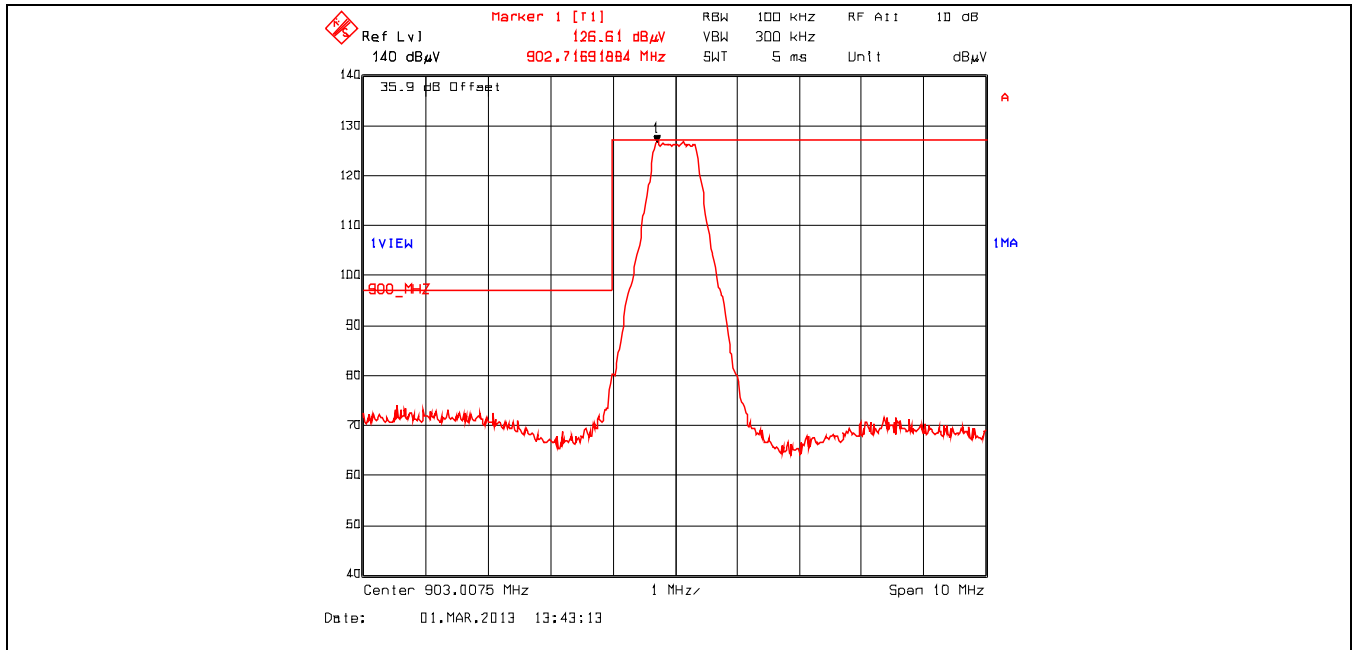
Plot 5.5.4.2.2.3. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
 High End of Frequency Band, 927.3 MHz, Modem 500



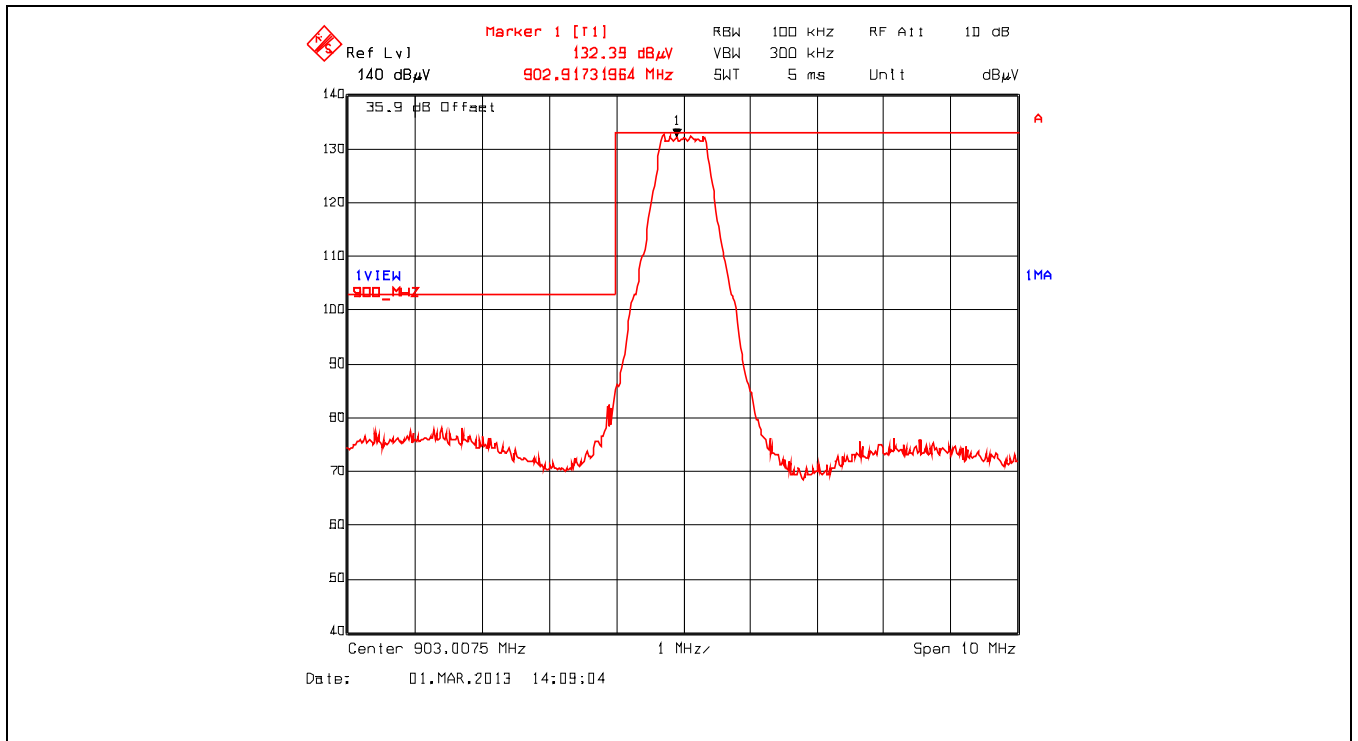
Plot 5.5.4.2.2.4. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
 High End of Frequency Band, 927.3 MHz, Modem 500



Plot 5.5.4.2.2.5. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
 Low End of Frequency Band, 903.0075 MHz, Modem 1000



Plot 5.5.4.2.2.6. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
 Low End of Frequency Band, 903.0075 MHz, Modem 1000



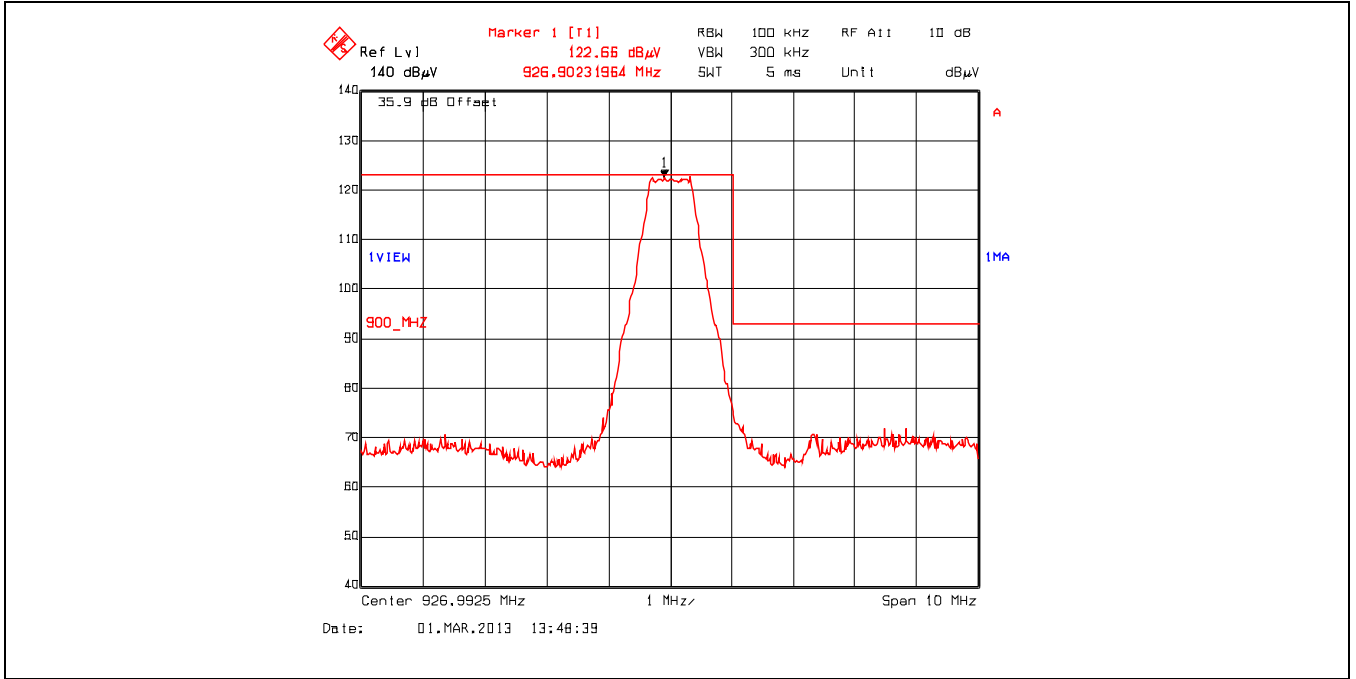
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

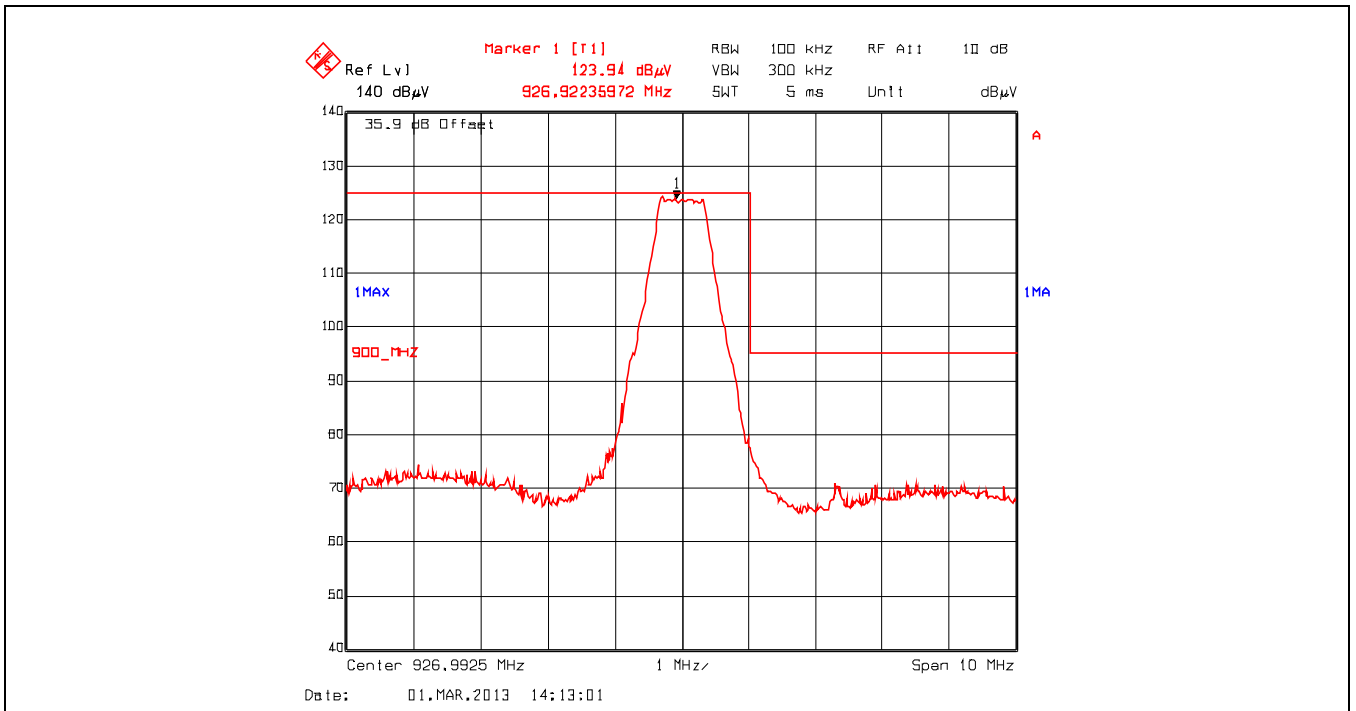
File #: MIC-165Q_F15C247DTS-R1
 April 29, 2013

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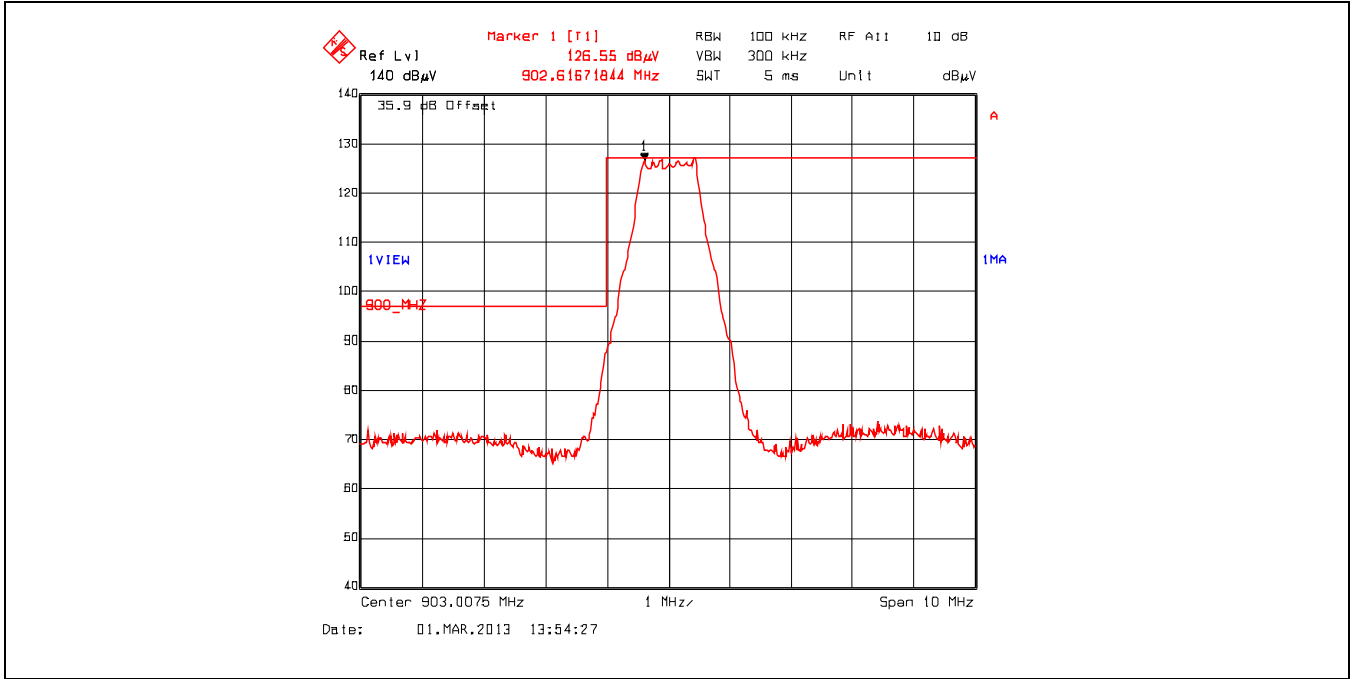
Plot 5.5.4.2.2.7. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
 High End of Frequency Band, 926.9925 MHz, Modem 1000



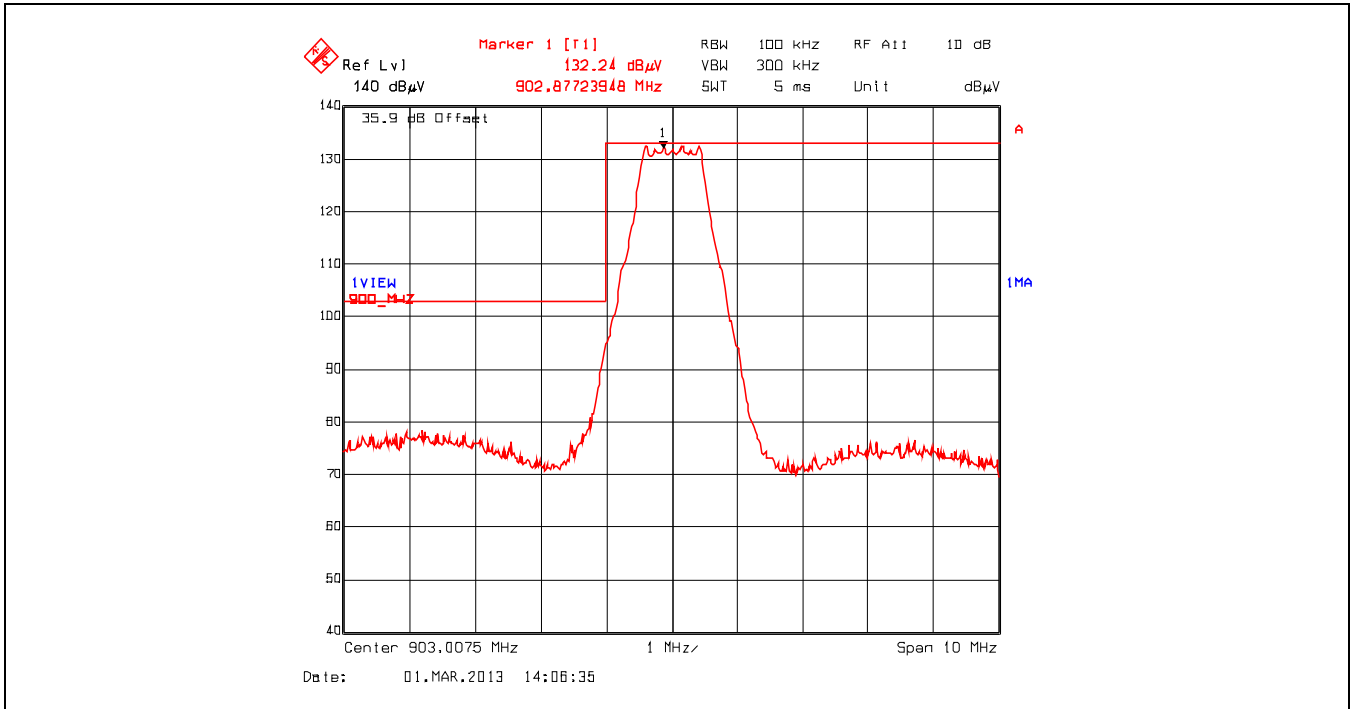
Plot 5.5.4.2.2.8. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
 High End of Frequency Band, 926.9925 MHz, Modem 1000



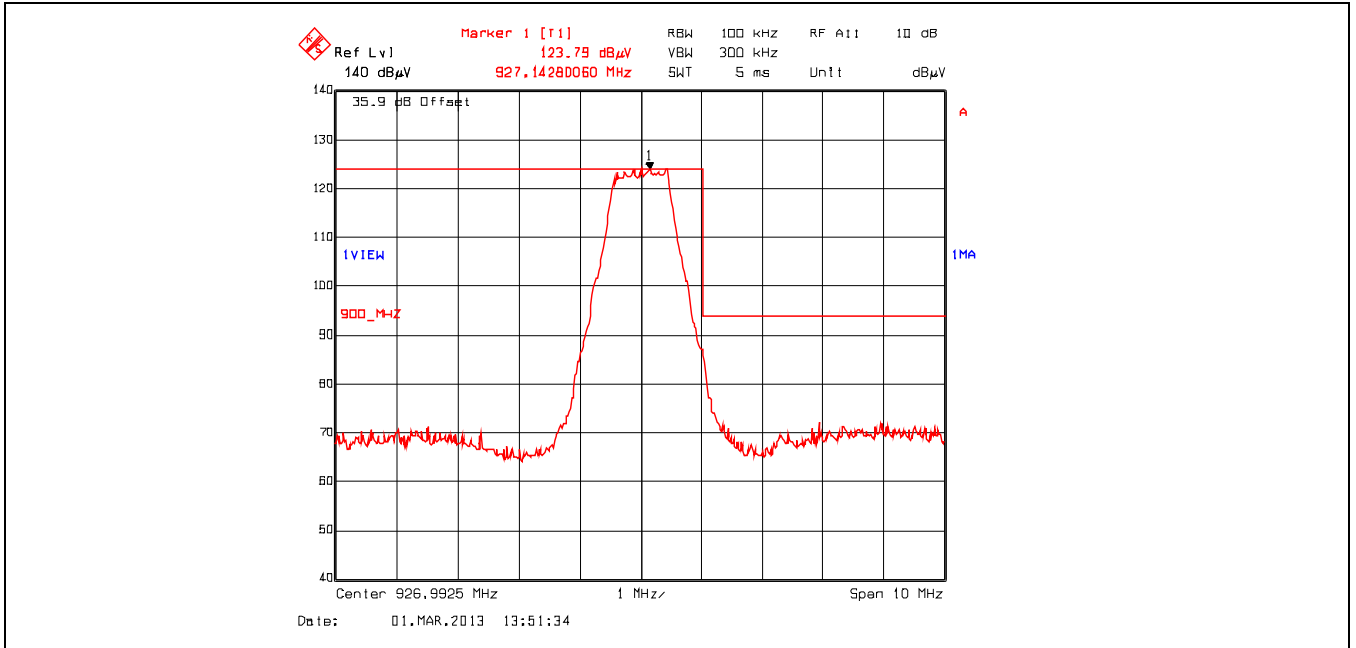
Plot 5.5.4.2.2.9. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 903.0075 MHz, Modem 1000W



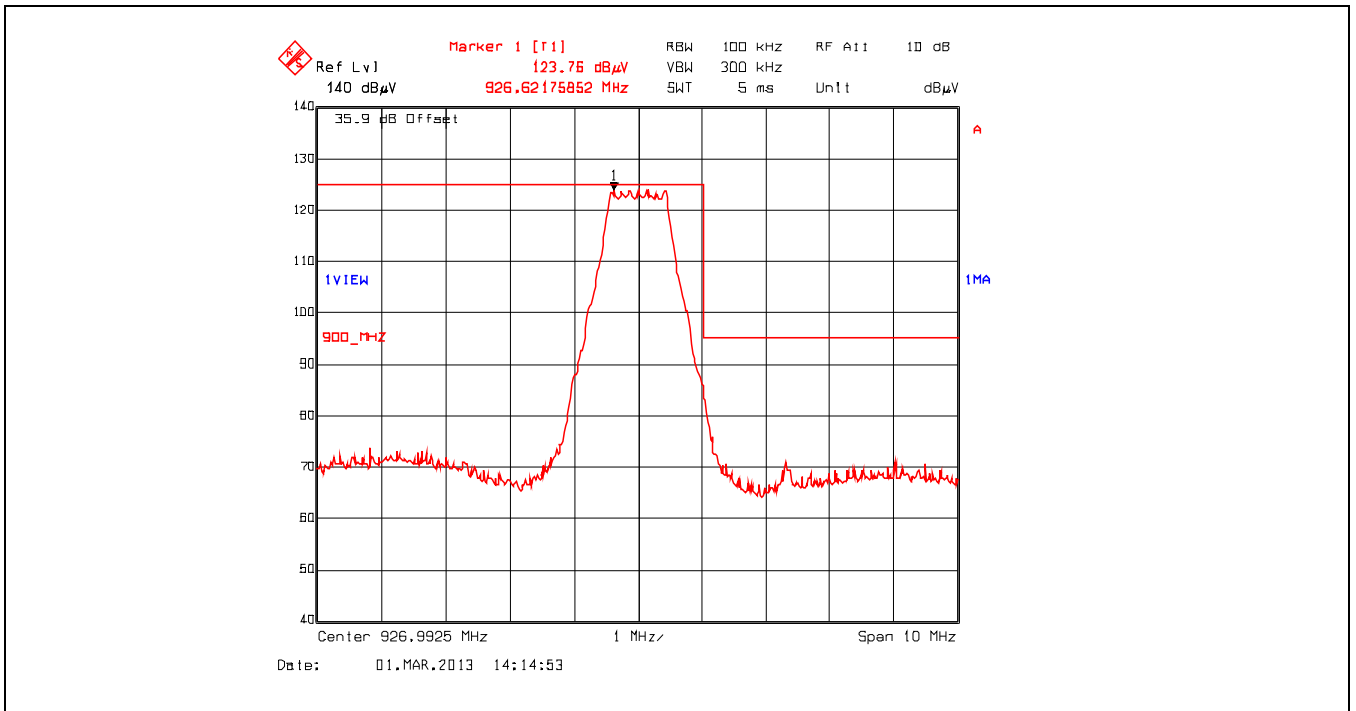
Plot 5.5.4.2.2.10. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 903.0075 MHz, Modem 1000W



Plot 5.5.4.2.2.11. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
 High End of Frequency Band, 926.9925 MHz, Modem 1000W



Plot 5.5.4.2.2.12. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
 High End of Frequency Band, 926.9925 MHz, Modem 1000W



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

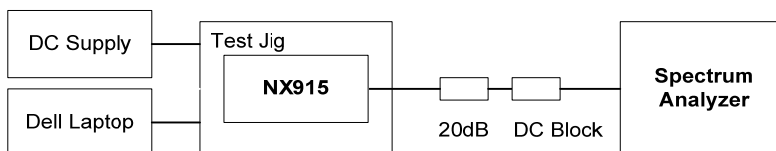
5.6.1. Limit(s)

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

5.6.2. Method of Measurements

KDB 558074 D01 Section 5.3.2 Measurement Procedure AVGPSD.

5.6.3. Test Arrangement

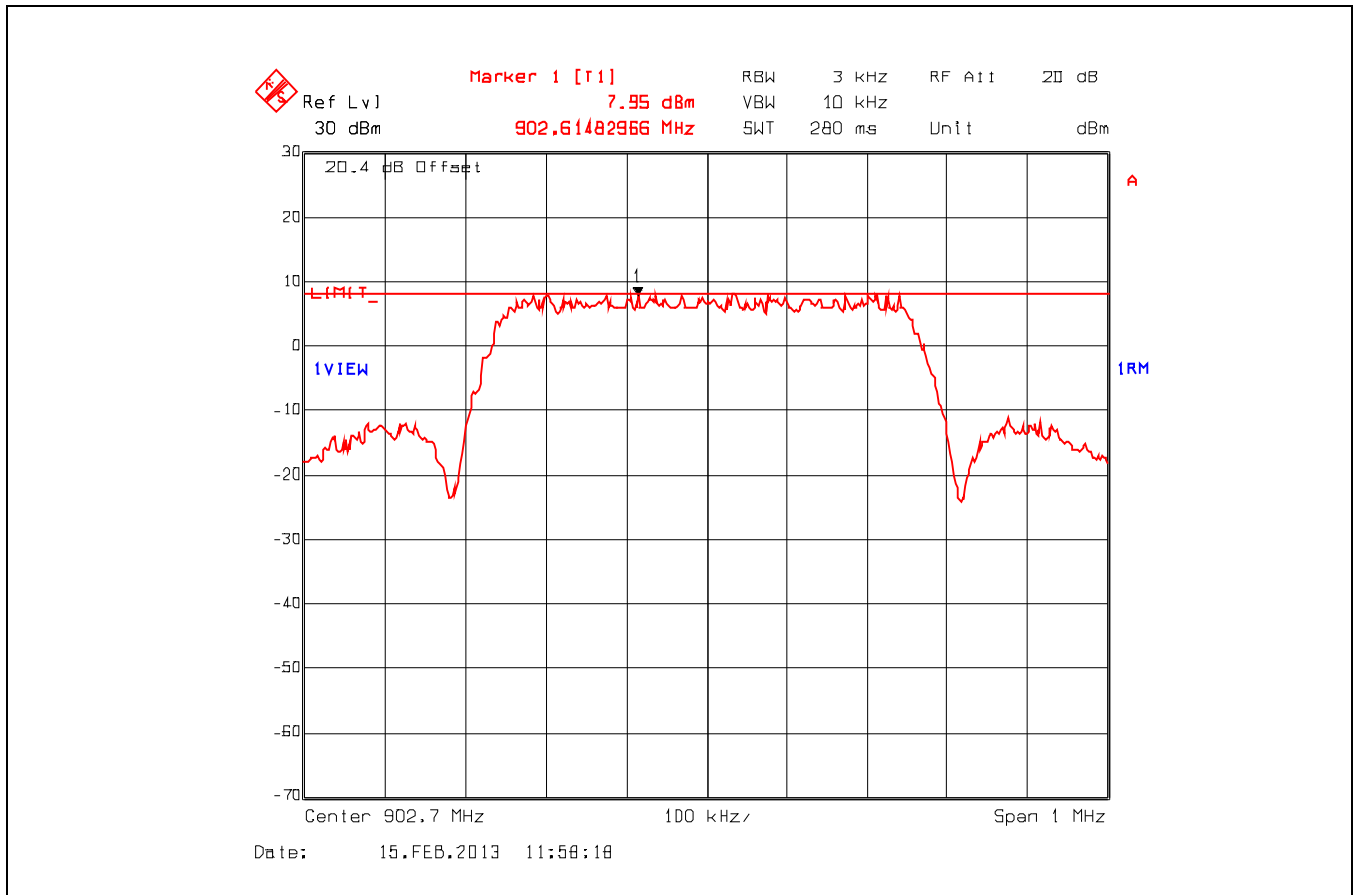


5.6.4. Test Data

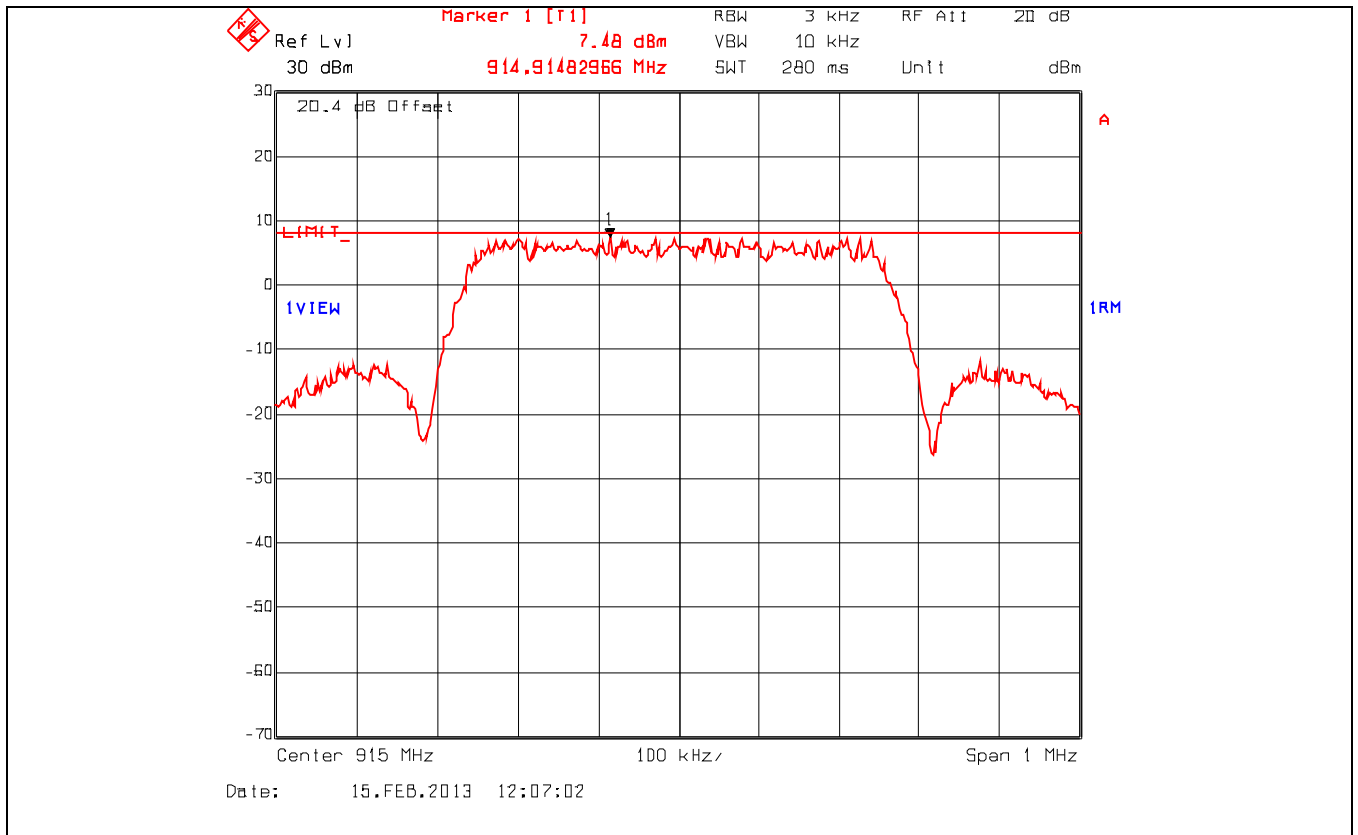
Frequency (MHz)	Modulation / Data Rate	Power Setting	*PSD in 3 kHz BW (dBm)	Limit (dBm)	Margin (dB)
902.70	Modem 500	6	7.95	8	-2.2
915.00	Modem 500	6	7.48	8	-2.3
927.30	Modem 500	7	7.41	8	-2.9
903.0075	Modem 1000	6	7.95	8	-2.9
915.0000	Modem 1000	8	7.81	8	-3.2
926.9925	Modem 1000	8	7.93	8	-3.9
903.0075	Modem 1000W	10	7.09	8	-4.4
915.0000	Modem 1000W	10	7.51	8	-4.3
926.9925	Modem 1000W	10	7.52	8	-4.8

See the following plots for measurement details.

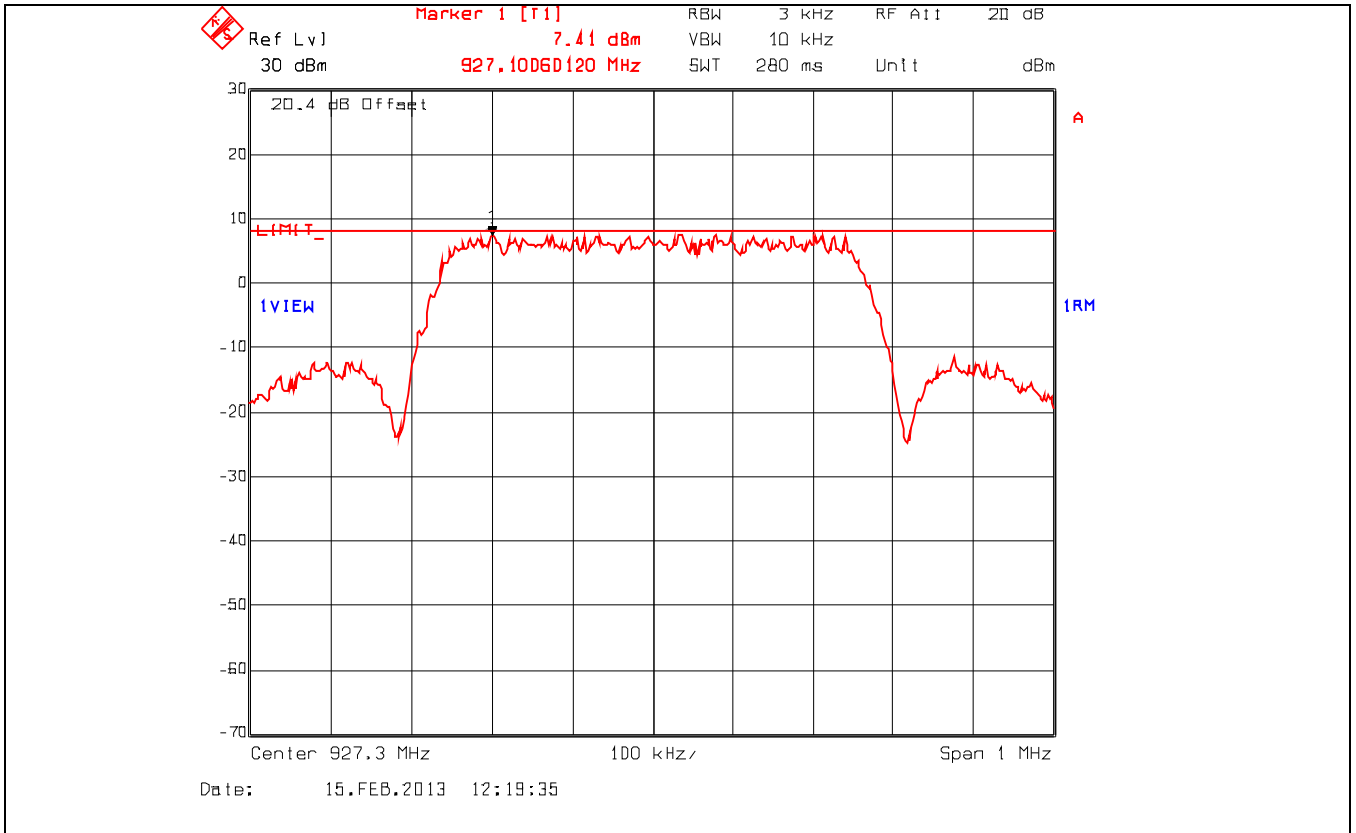
Plot 5.6.4.1. Power Spectral Density
Modem 500, 902.7 MHz , High Power Setting
Detector RMS, Video Trace Averaging with 100 traces



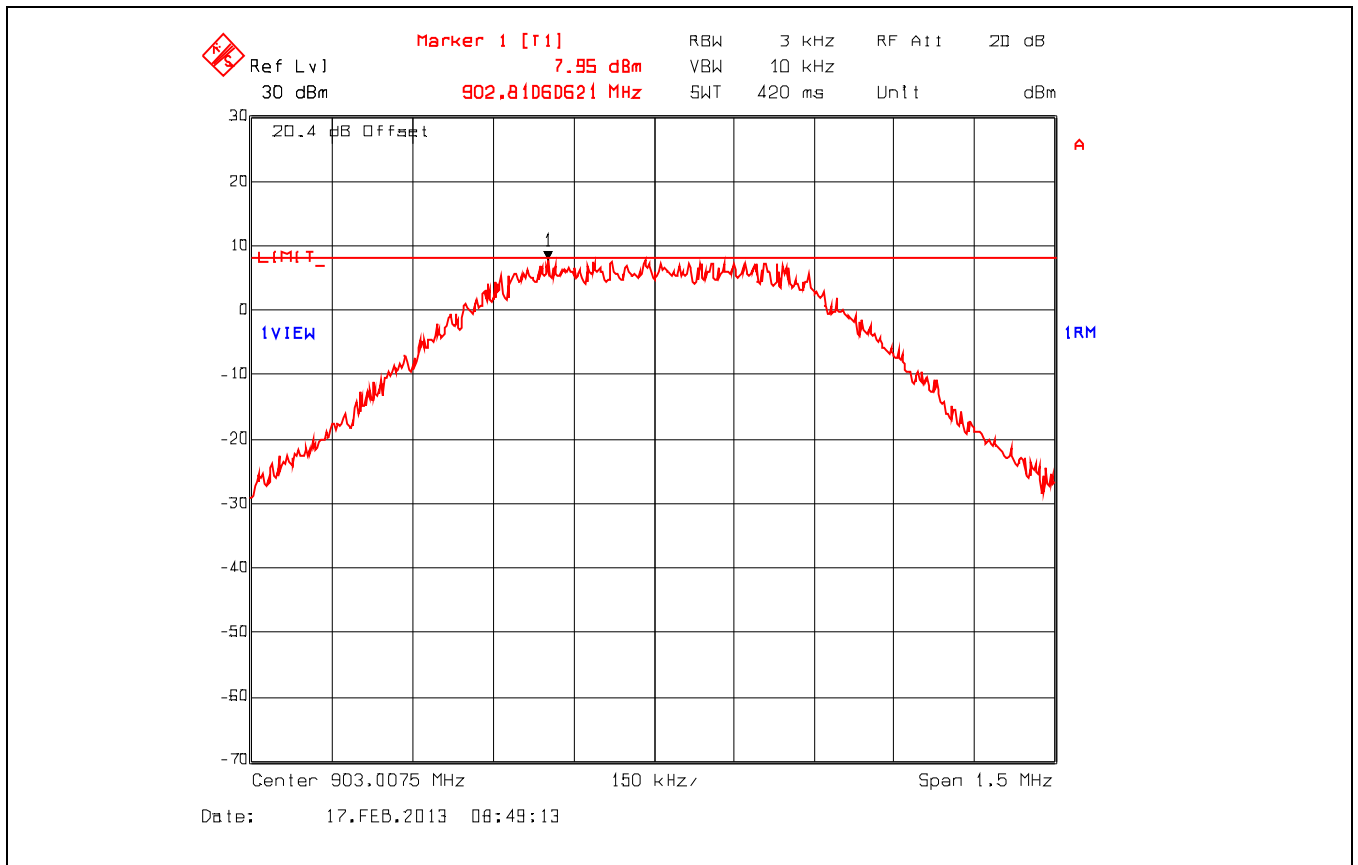
Plot 5.6.4.2. Power Spectral Density
Modem 500, 915.00 MHz, High Power Setting
Detector RMS, Video Trace Averaging with 100 traces



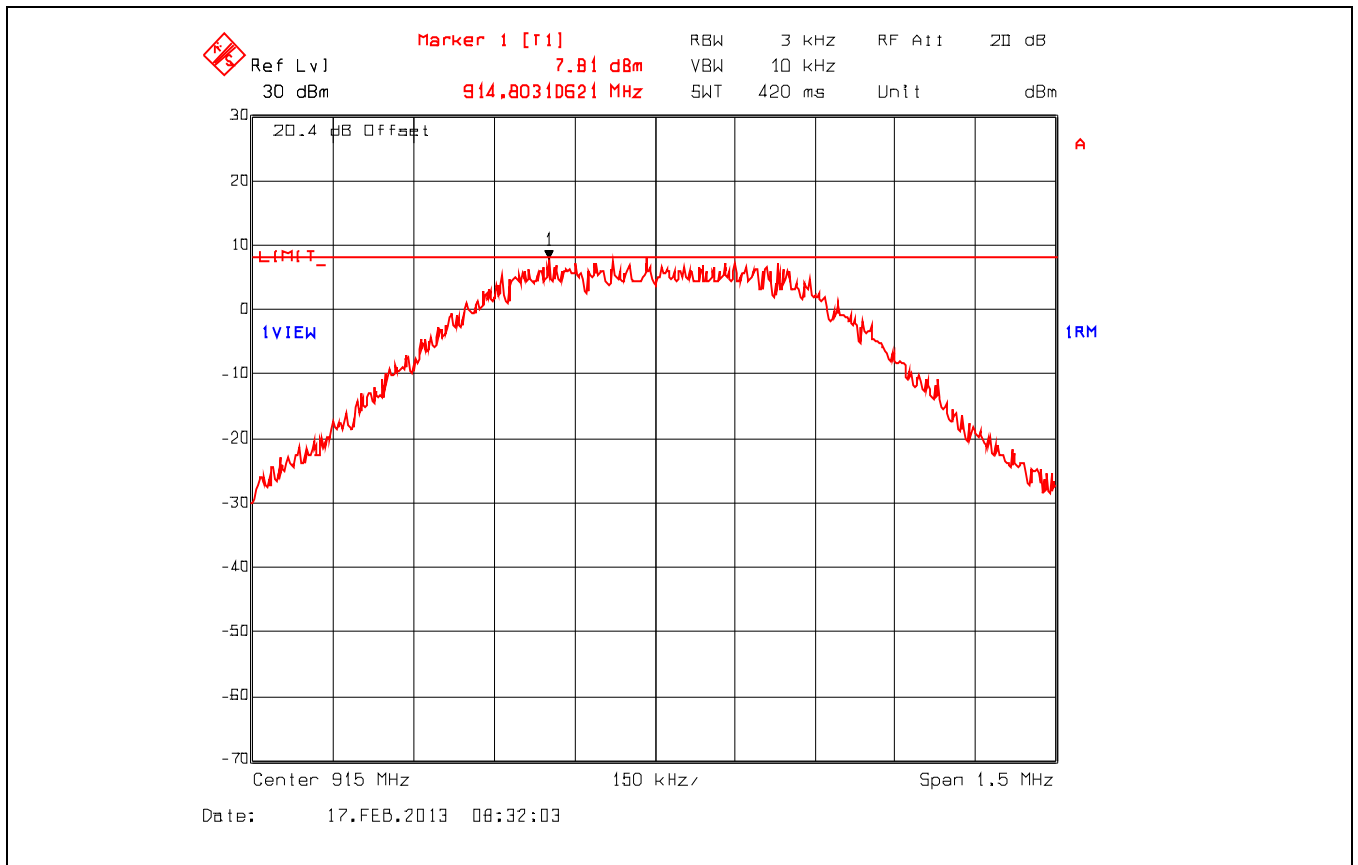
Plot 5.6.4.3. Power Spectral Density
Modem 500, 927.30 MHz, High Power Setting
Detector RMS, Video Trace Averaging with 100 traces



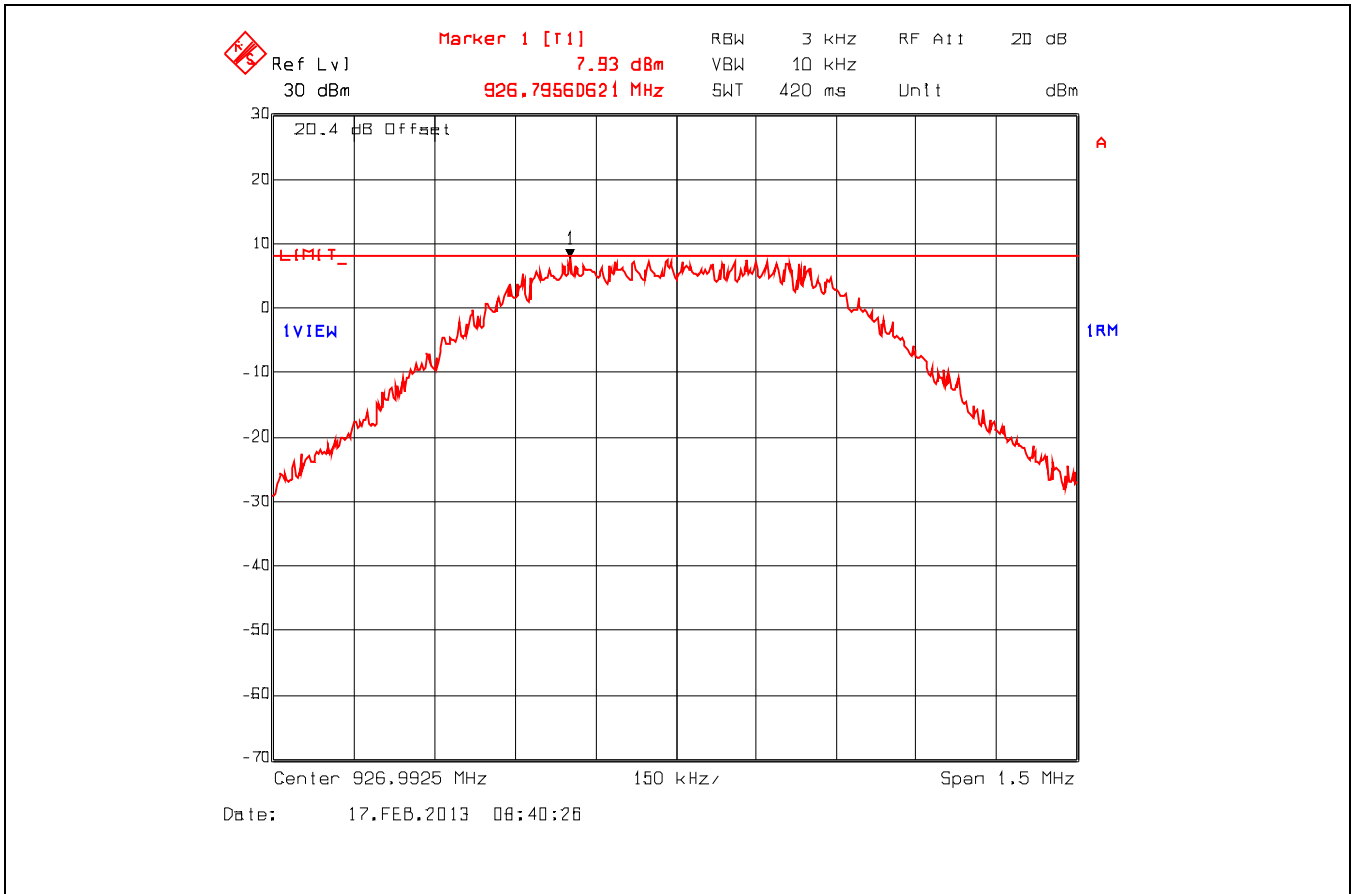
Plot 5.6.4.4. Power Spectral Density
Modem 1000, 903.0075 MHz, High Power Setting
Detector RMS, Video Trace Averaging with 100 traces



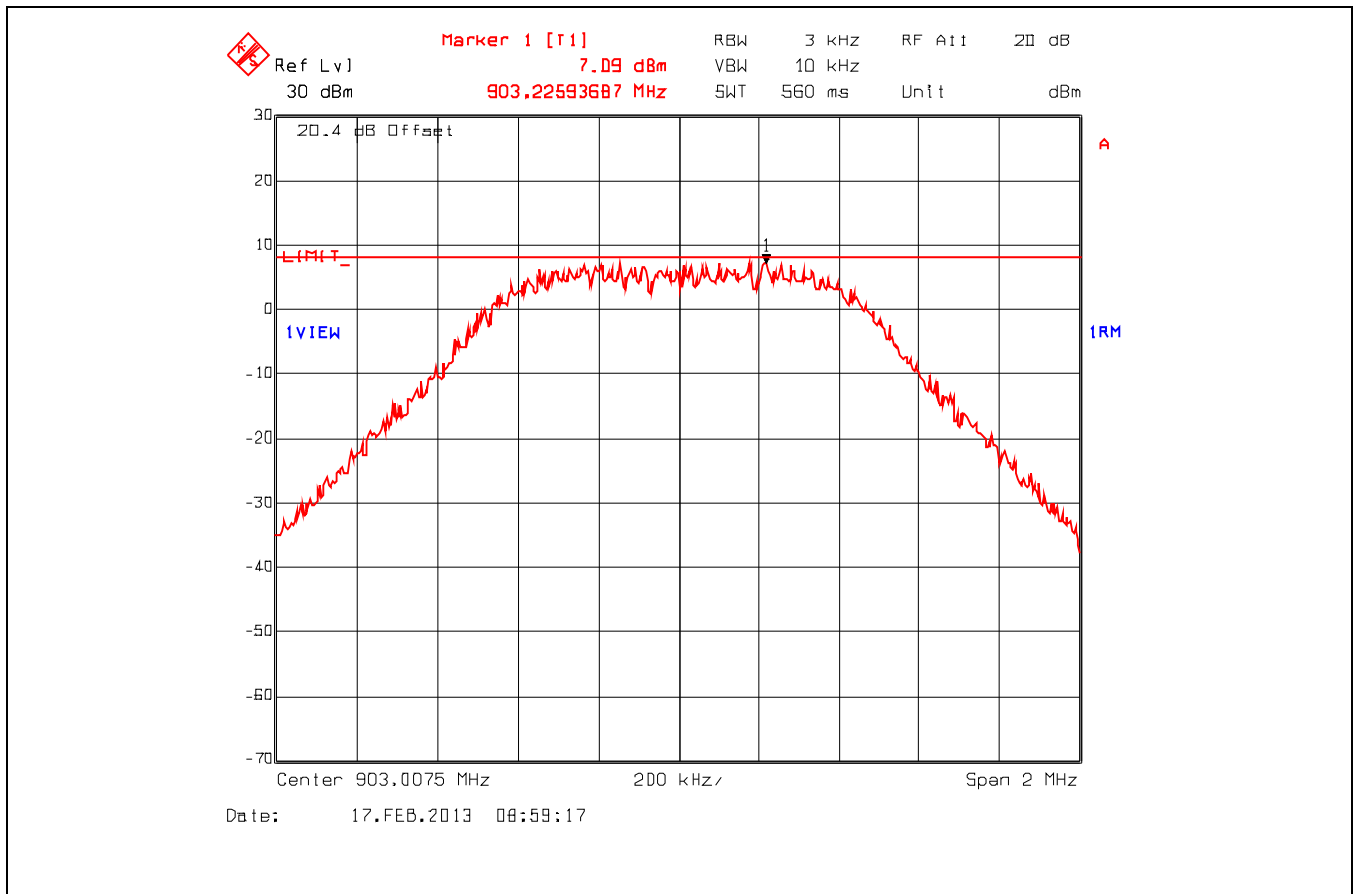
Plot 5.6.4.5. Power Spectral Density
Modem 1000, 915.0000 MHz, High Power Setting
Detector RMS, Video Trace Averaging with 100 traces



Plot 5.6.4.6. Power Spectral Density
Modem 1000, 926.9925 MHz, High Power Setting
Detector RMS, Video Trace Averaging with 100 traces



Plot 5.6.4.7. Power Spectral Density
 Modem 1000W, 903.0075MHz, High Power Setting
 Detector RMS, Video Trace Averaging with 100 traces



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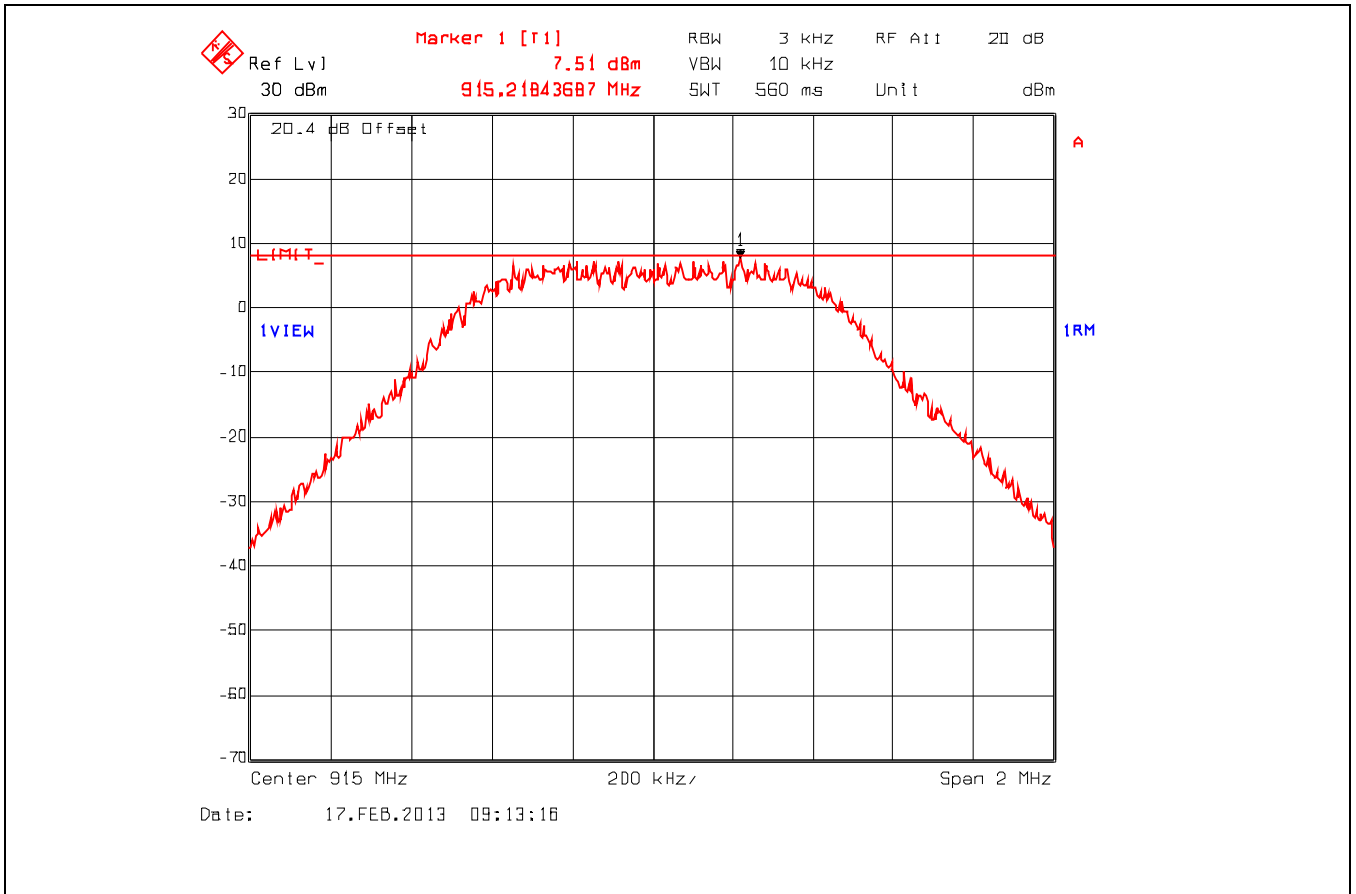
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: MIC-165Q_F15C247DTS-R1

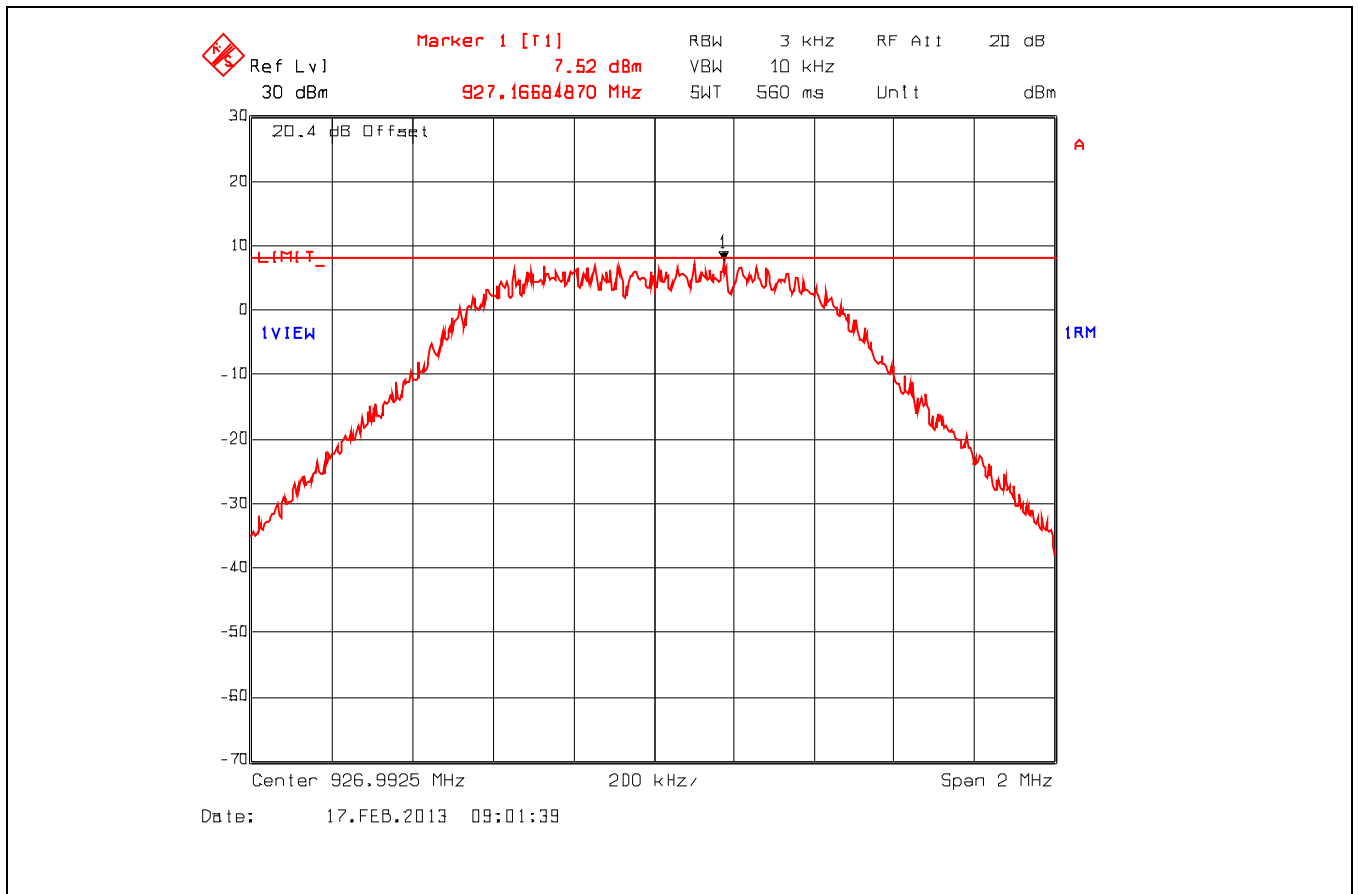
April 29, 2013

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Plot 5.6.4.8. Power Spectral Density
Modem 1000W, 915.0000 MHz, High Power Setting
Detector RMS, Video Trace Averaging with 100 traces



Plot 5.6.4.9. Power Spectral Density
Modem 1000W, 926.9925 MHz, High Power Setting
Detector RMS, Video Trace Averaging with 100 traces



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/cm²
 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/cm²
 EIRP = 36.0 dBm = 10^{36/10} mW = 3981 mW (Worst Case)

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

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

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

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