Excellence in Compliance Testing

Certification Test Report

FCC ID: SDBRGS10
IC: 2220A-RGS10

FCC Rule Part: CFR 47 Part 24 Subpart D, Part 90 Subpart I, Part 101 Subpart C
IC Radio Standards Specification: RSS 119, RSS 134

ACS Report Number: 10-0300.W06.11.A

Manufacturer: Sensus Metering Systems, Inc.
Model: RGS10

Test Begin Date: March 8, 2011
Test End Date: March 9, 2011

Report Issue Date: July 29, 2011

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Reviewed by: _____

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This report contains 43 pages

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with CFR 47 Part 24 Subpart D, Part 90 Subpart I, and Part 101 Subpart C of the FCC's Code of Federal Regulations; and RSS 119 and 134 of Industry Canada's Radio Standard Specifications.

1.2 Product Description

The RGS10 meter module is a battery-powered module that provides wireless communication capability to a variety of gas meters.

Manufacturer Information:
Sensus Metering Systems, Inc.
400 Perimeter Park Drive, Ste. K
Raleigh, NC 27560

Test Sample Serial Numbers: 23009971

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.3 Test Methodology

1.3.1 Test Configurations and Justification

For RF conducted measurements, the RGS10 was modified with an external RF connector to the PCB. The RGS10 utilizes a non-detachable antenna for normal operation but for RF conducted testing the antennas were disconnected and a 50-Ohm test cable soldered (with the appropriate ground connection) to the PCB.

The RGS10 operates using various modulation formats/modes all of which were evaluated and worst case data presented where applicable.

1.3.2 In-Band Testing Methodology

For testing in accordance with 47 CFR 2.1046-2.1057, OET/Lab recommends that the following be used to select test frequencies for licensed devices:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
10 to 100 MHz	3	1 near top, 1 near middle and 1 near bottom

The RGS10 module is designed to operate in multiple bands under the requirements of CFR 47 Parts 24, 90, and 101. The following is a list of the frequency bands of operation sorted based on the FCC rule parts in which the band is associated.

CFR Title 47 Rule Part	Frequency Band of Operation (MHz)
24D	901.0 - 902.0
24D	930.0 - 931.0
24D	940.0 - 941.0
90	896.0 - 901.0
90	935.0 - 940.0
101	928.85 - 929.0
101	932.0 - 932.5
101	941.0 - 941.5
101	959.85 - 960.0

Based on the requirements set forth in accordance 47 CFR 2.1046-2.1057 as stated above, the methodology in selecting the places to test in the available bands of operation is outlined in the following table.

CFR Title 47 Rule Part	Frequency Band of Operation (MHz)	Location in the Range of Operation
90	896.0 - 901.0	1 near top and 1 near bottom
24D	901.0 - 902.0	
101	928.85 - 929.0	Middle
24D	930.0 - 931.0	Middle
101	932.0 - 932.5	Middle
90	935.0 - 940.0	1 near top and 1 near bottom
24D	940.0 - 941.0	
101	941.0 - 941.5	
101	959.85 - 960.0	Middle

The data provided in this report is sorted based on the rule part.

1.4 Emission Designators

The RGS10 transceiver produces (7) distinct modulation formats. The emissions designators for the nine modulation types used by the RGS10 transceiver are as follows:

EMISSIONS DESIGNATORS:

Normal Mode:	9K60F2D (7-FSK)
Double Density Mode:	9K60F2D (13-FSK)
C&I Mode:	4K80F2D (7-FSK)
Priority Mode:	4K80F2D (13-FSK)
Boost Mode:	1K10F2D (7-FSK)
MPass Mode (5K):	5K90F1D (2-GFSK)
MPass Mode (10K):	11K8F1D (2-GFSK)

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200612-0. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number: 511277
Industry Canada Lab Code: IC 4175A-1
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

1 - ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz - 2003
2 -US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures - 2010
3 - US Code of Federal Regulations (CFR): Title 47, Part 24, Subpart D: Personal Communication Service - 2010
4 - US Code of Federal Regulations (CFR): Title 47, Part 90, Subpart I: Private Land Mobile Radio Services - 2010
5 - US Code of Federal Regulations (CFR): Title 47, Part 101, Subpart C: Fixed Microwave Services – 2010
6 – TIA-603-C: Land Mobile FM or PM - Communications Equipment - Measurement and Performance Standards – 2004
7 - Industry Canada Radio Standards Specification: RSS-119 - Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41-960 MHz - Issue 11, June 2011
8 - Industry Canada Radio Standards Specification: RSS-134 - 900 MHz Narrowband Personal Communications Services - Issue 1, Revision 1, March 25, 2000

4.0 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
140	Thermotron	SM-16C	Environmental Chamber	19639	8/31/2010	8/30/2011
267	Agilent	N1911A	Meters	MY45100129	11/2/2010	11/2/2011
268	Agilent	N1921A	Sensors	MY45240184	12/2/2010	12/2/2011
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	8/31/2010	8/31/2011
340	Aeroflex/Weinschel	AS-20	Attenuators	7136	10/5/2010	10/5/2011

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Diagram #	Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
1	Sorensen	DC Power Supply	QRD 20-14	2782	NA

6.0 EQUIPMENT UNDER TEST SETUP AND BLOCK DIAGRAM

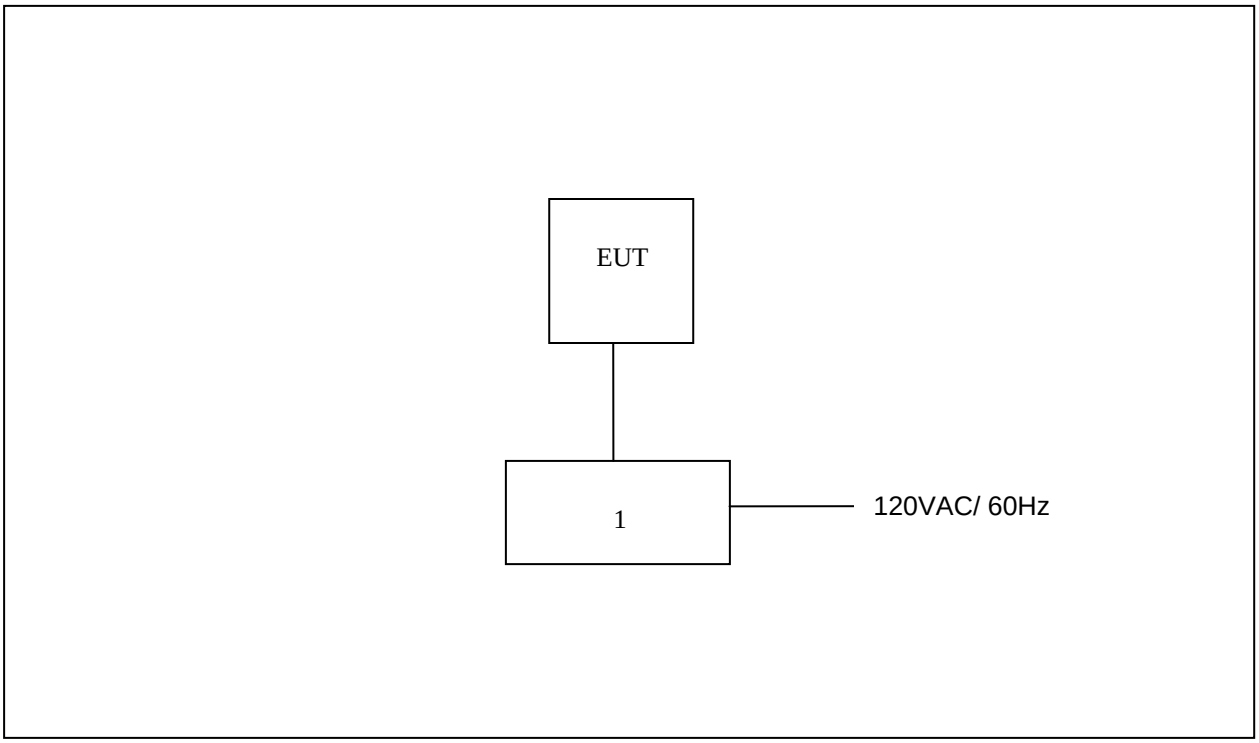

Figure 6-1: EUT Test Setup

* For RF conducted measurements, the transceiver was modified with an external 50-Ohm test cable soldered (with the appropriate ground connection) to the PCB.

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 RF Power Output

7.1.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 20 dB passive attenuator. The resolution and video bandwidths of the spectrum analyzer were set at sufficient levels, >> signal bandwidth, to produce accurate results. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. Results are shown below in Table 7.1.2-1 and Figure 7.1.2-1 through 7.1.2-8.

7.1.2 Measurement Results

Table 7.1.2-1: Peak Output Power

Frequency (MHz)	FCC Rule Part	Output Power (dBm)
901.9875	Part 24	26.32
930.5000	Part 24	26.98
896.0125	Part 90	26.16
935.0125	Part 90	26.98
928.9250	Part 101	26.94
932.2500	Part 101	26.99
941.4875	Part 101	27.02
959.9250	Part 101	27.00

Part 24.132/RSS-134 5.4(a)

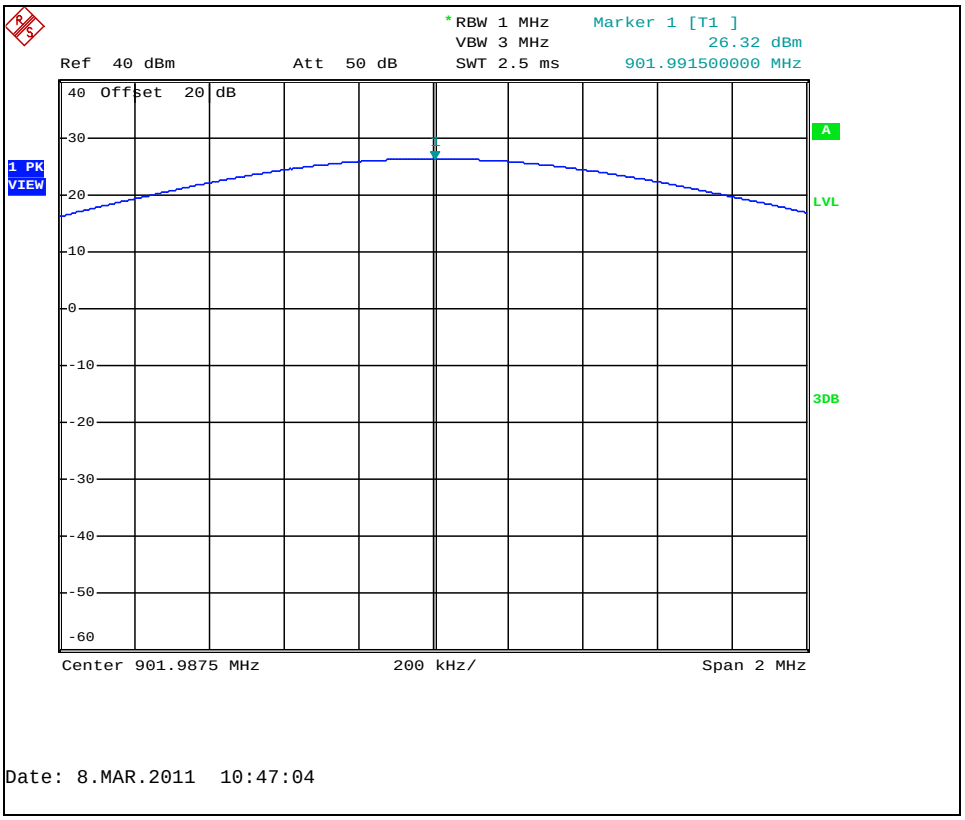

Figure 7.1.2-1: Peak Output Power 901.9875 MHz

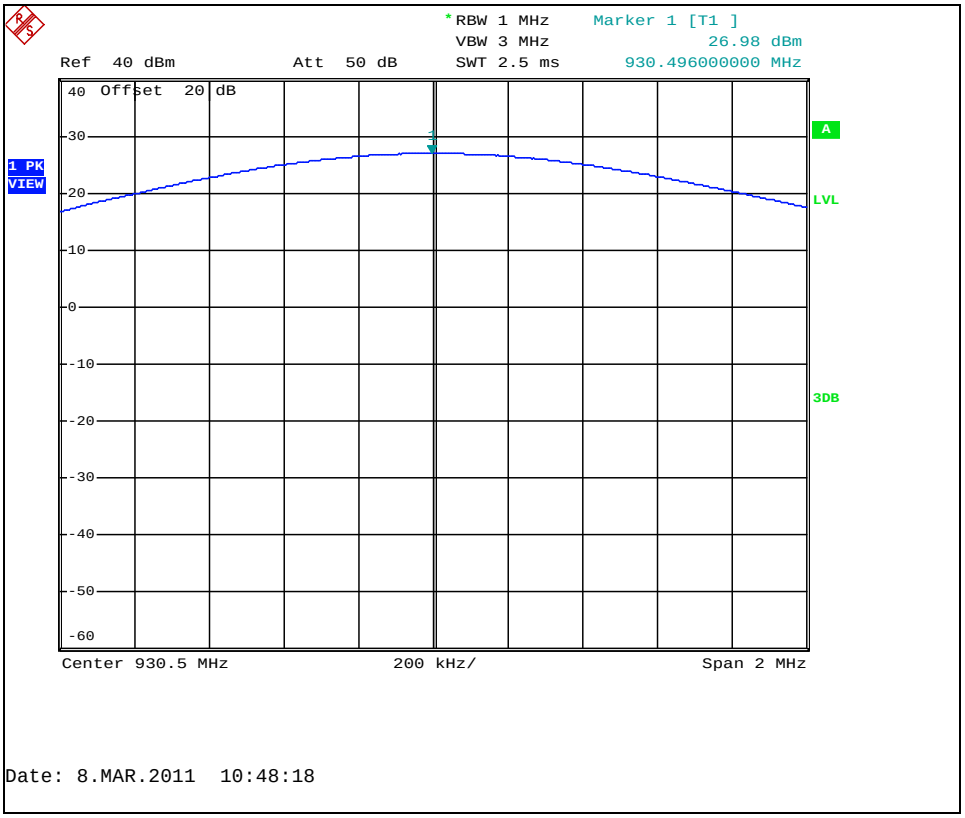

Figure 7.1.2-2: Peak Output Power 930.5 MHz

Part 90.635(d) / RSS-119 5.41

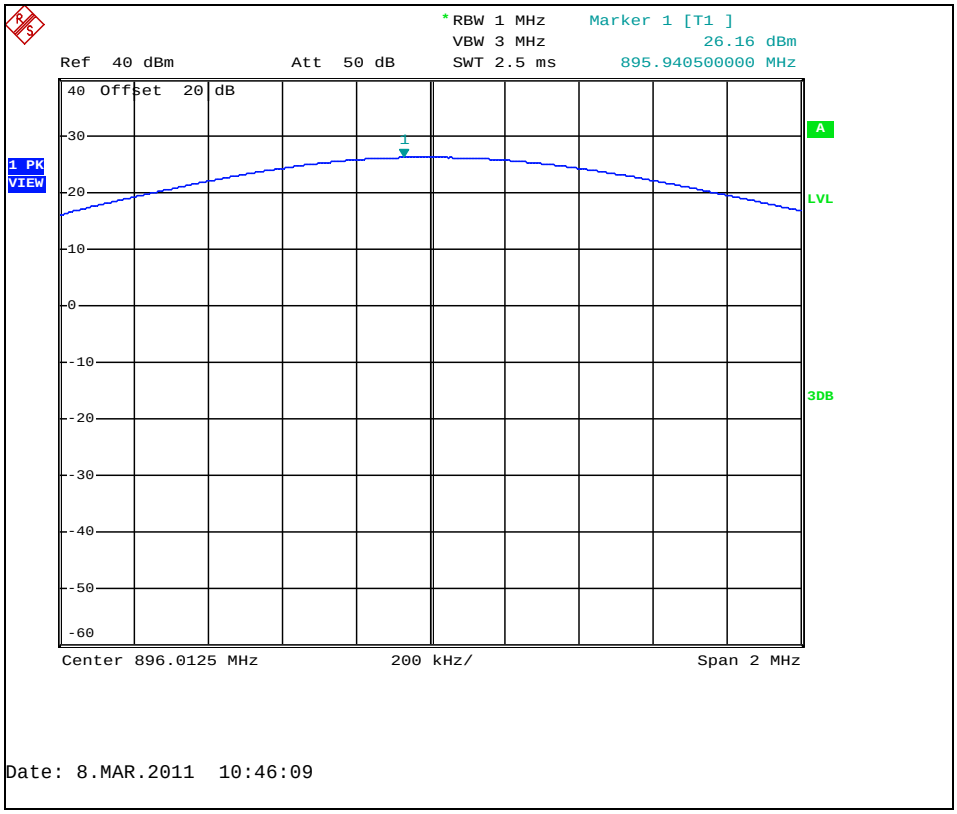

Figure 7.1.2-3: Peak Output Power 896.0125 MHz

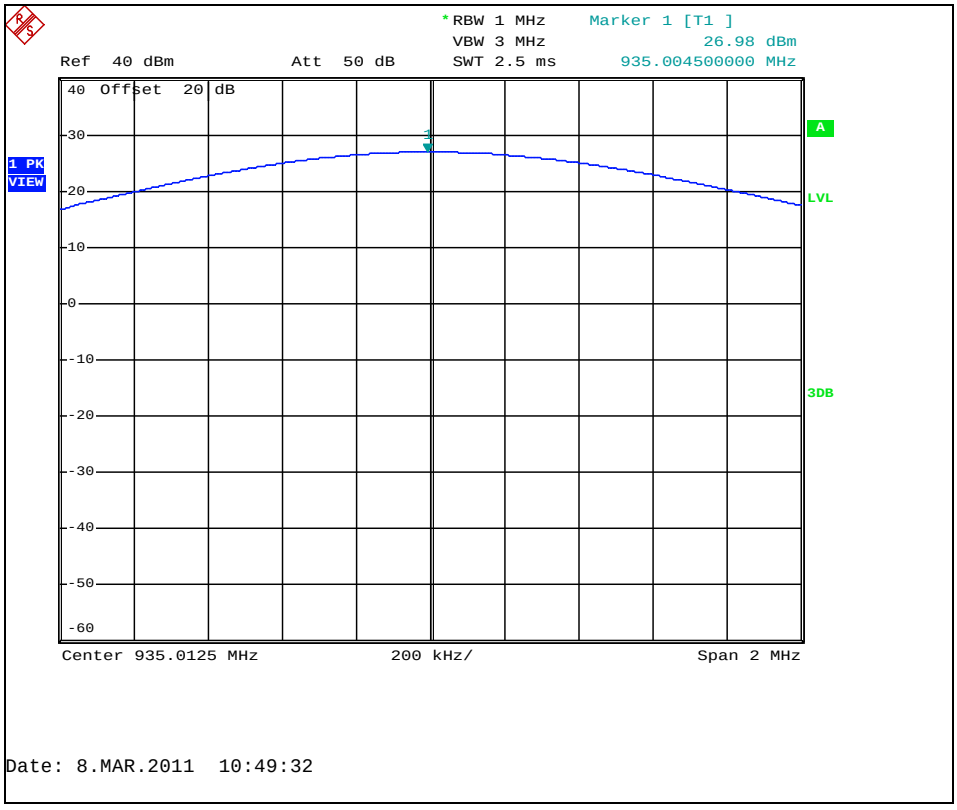

Figure 7.1.2-4: Peak Output Power 935.0125 MHz

Part 101.113(a) / RSS-119 5.41

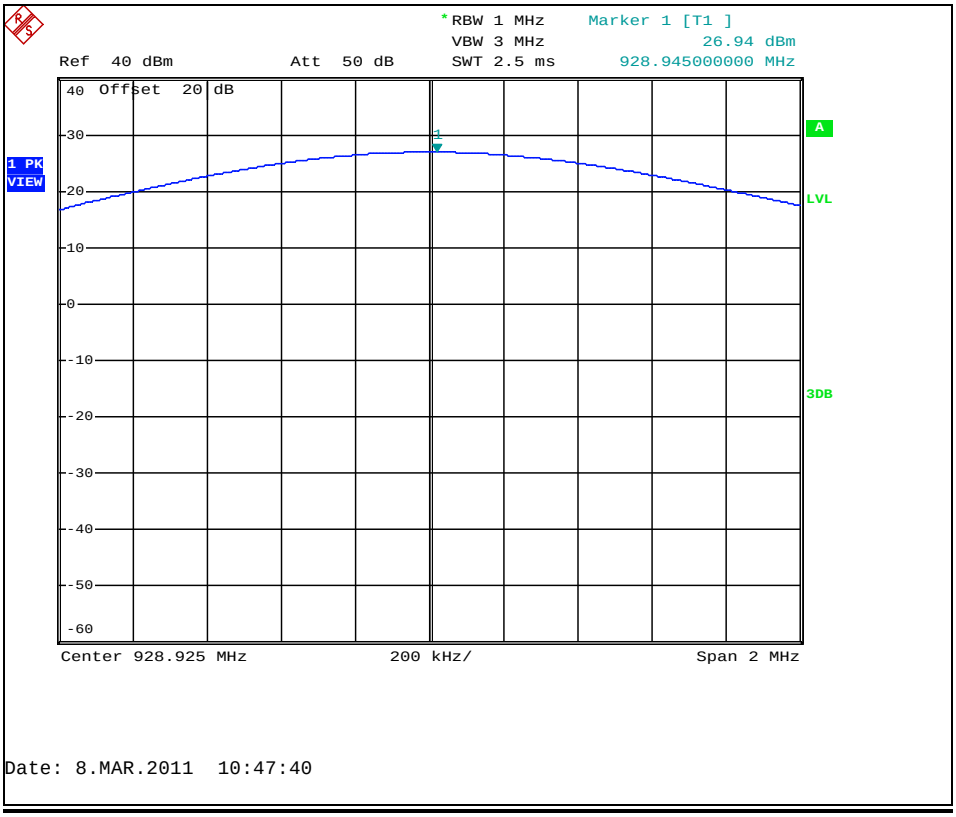

Figure 7.1.2-5: Peak Output Power 928.925 MHz

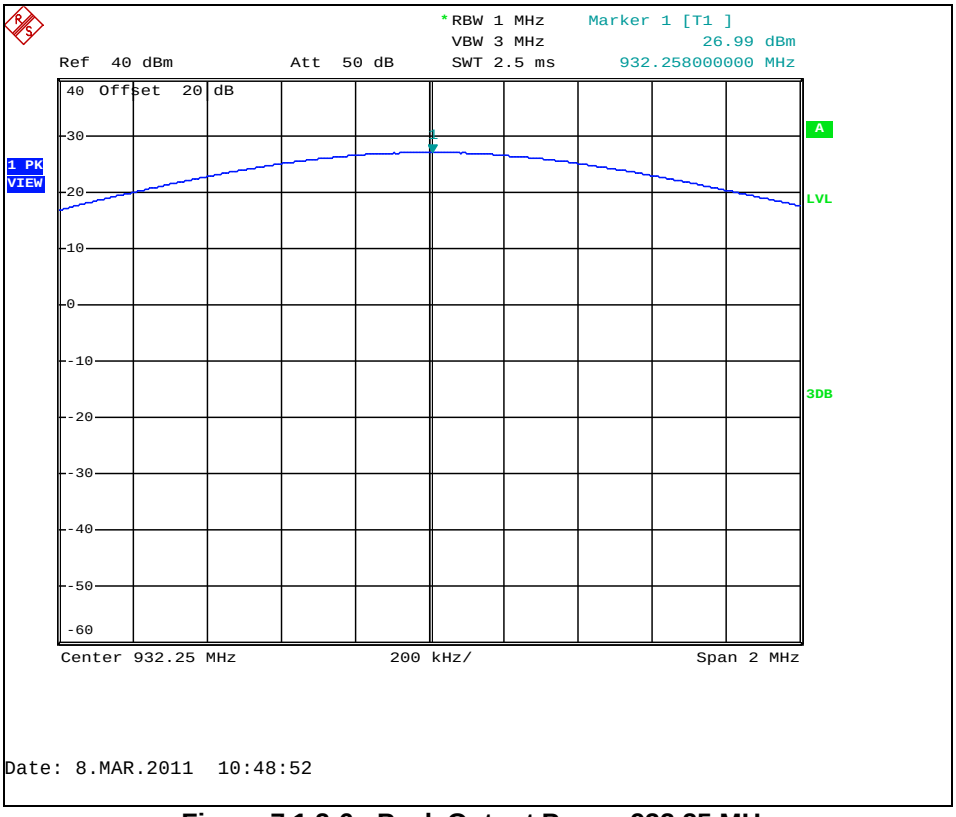

Figure 7.1.2-6: Peak Output Power 932.25 MHz

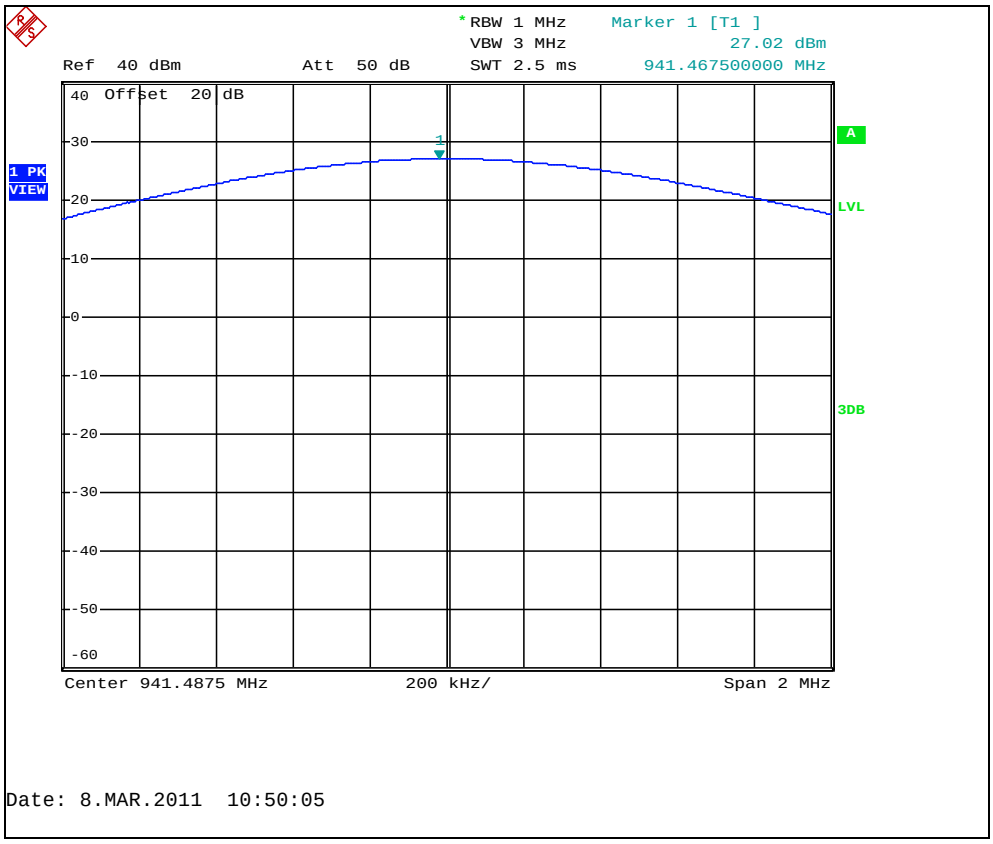

Figure 7.1.2-7: Peak Output Power 941.4875 MHz

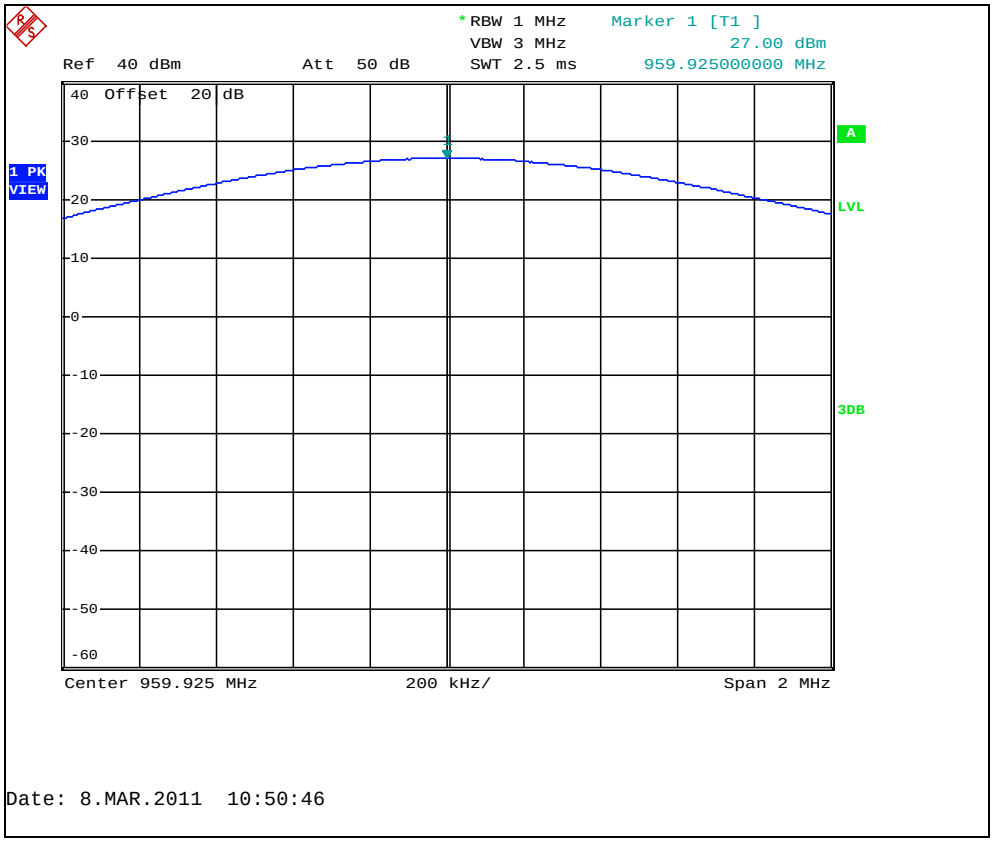

Figure 7.1.2-8: Peak Output Power 959.925 MHz

7.2 Occupied Bandwidth (Emission Limits)

7.2.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 20 dB passive attenuator. The spectrum analyzer resolution and video bandwidths were set to 300 Hz and >>RBW respectively. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. Results of the test are shown below for all modes of operation.

7.2.2 Measurement Results

Part 24.133 a(1), a(2), IC RSS-134 6.3(i), (ii)

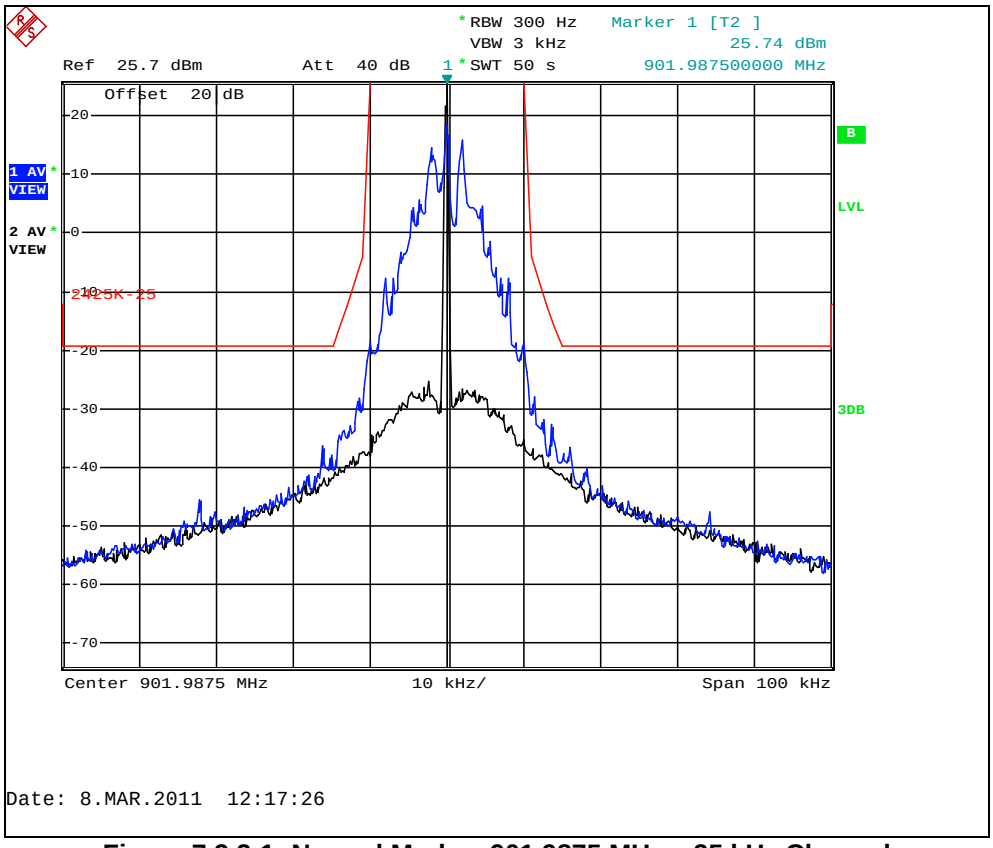

Figure 7.2.2-1: Normal Mode – 901.9875 MHz – 25 kHz Channel

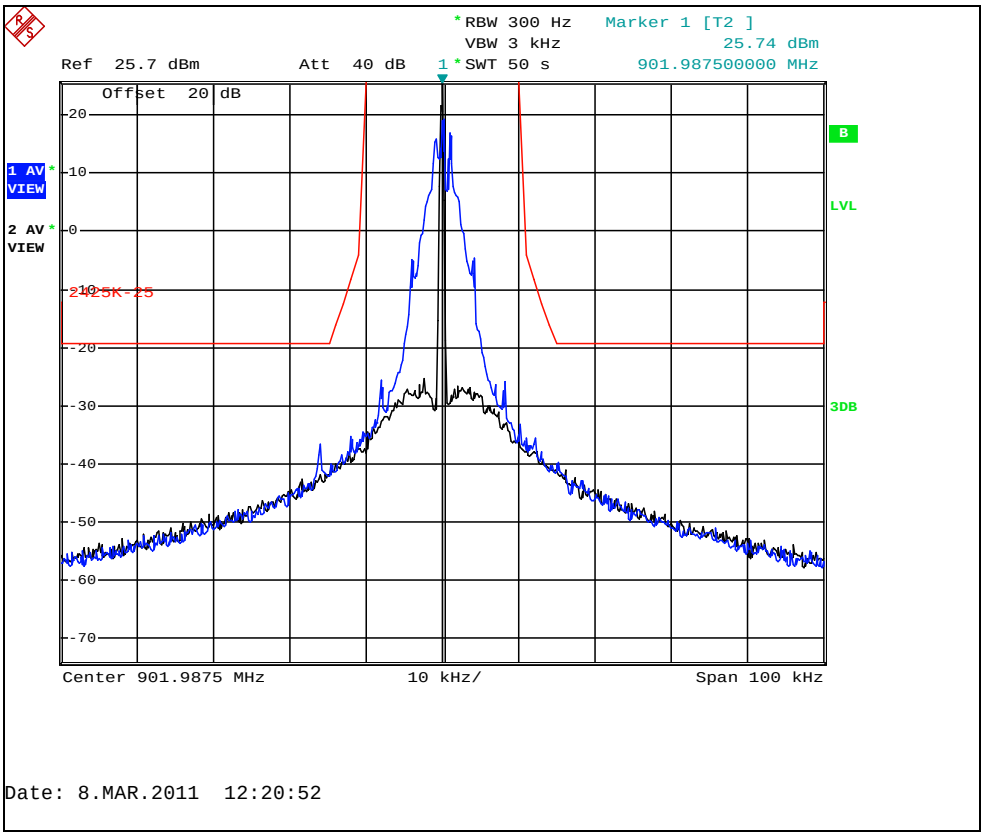

Figure 7.2.2-2: C&I Mode – 901.9875 MHz – 25 kHz Channel

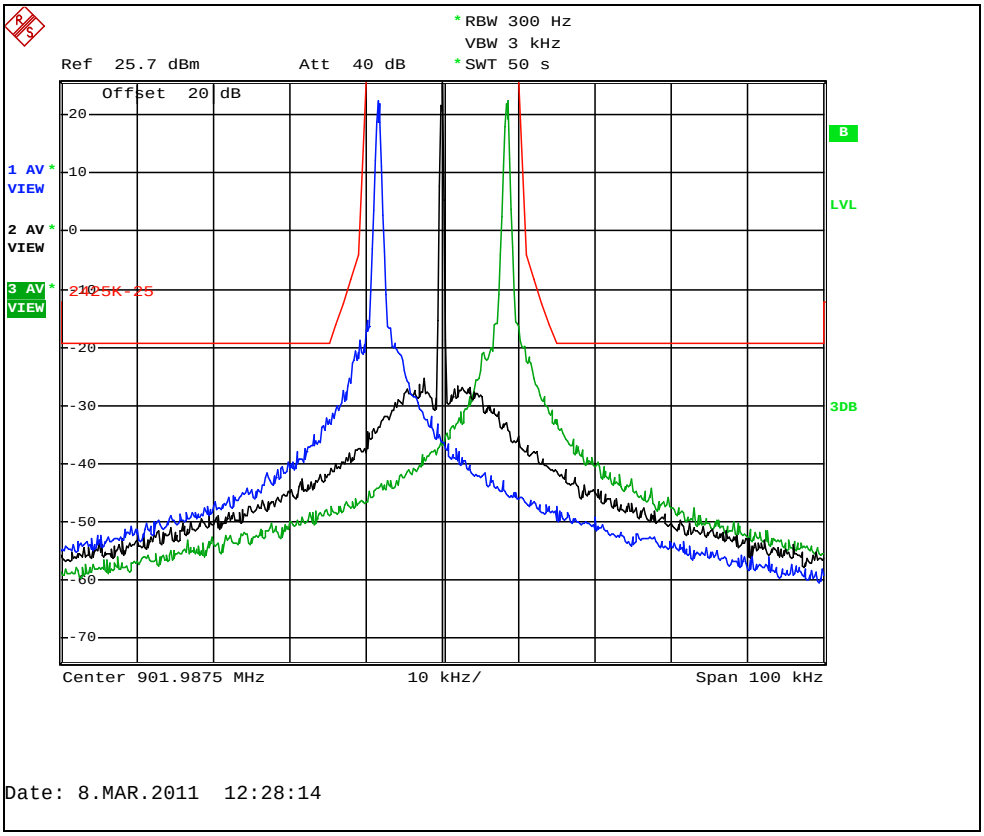

Figure 7.2.2-3: Boost Mode – 901.9875 MHz – 25 kHz Channel Offset Channel of +/- 14 (+/- 8400 Hz)

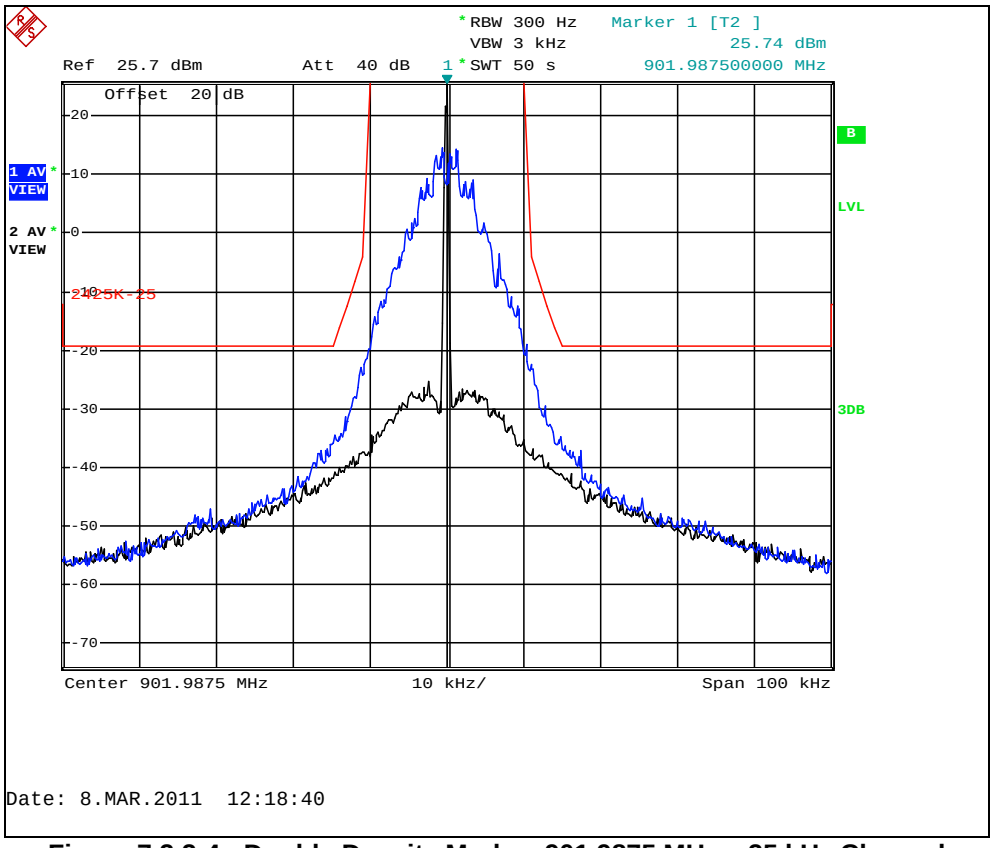

Figure 7.2.2-4: Double Density Mode – 901.9875 MHz – 25 kHz Channel

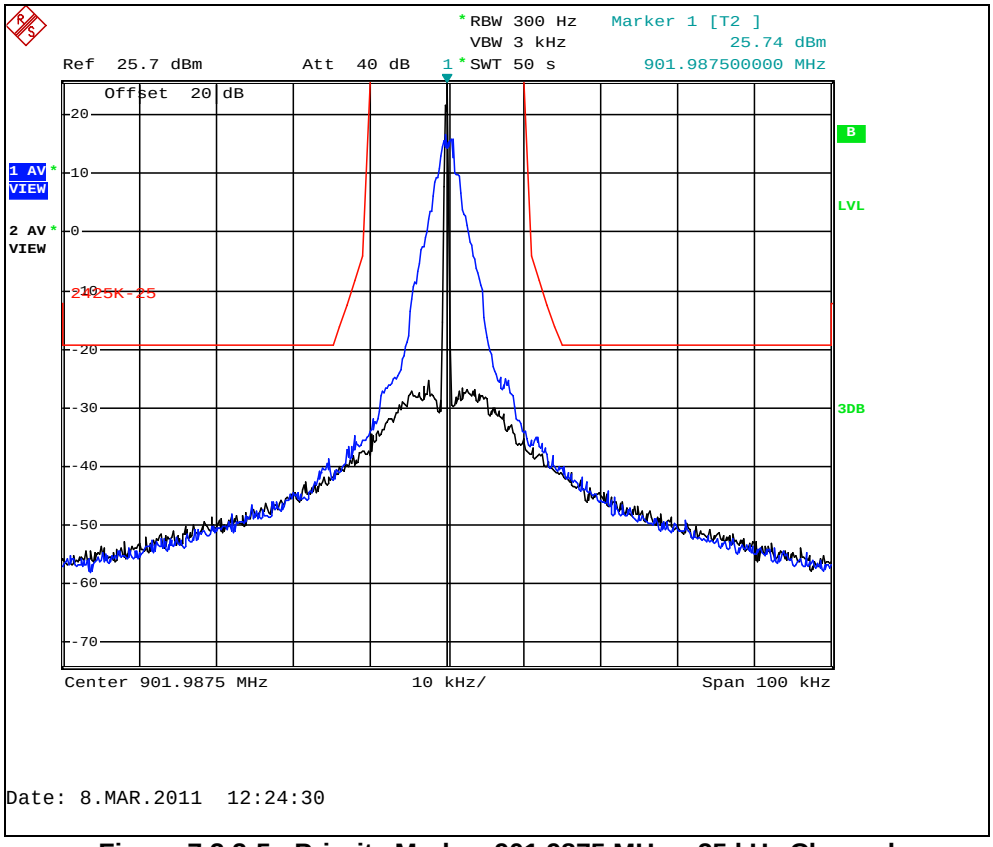

Figure 7.2.2-5: Priority Mode – 901.9875 MHz – 25 kHz Channel

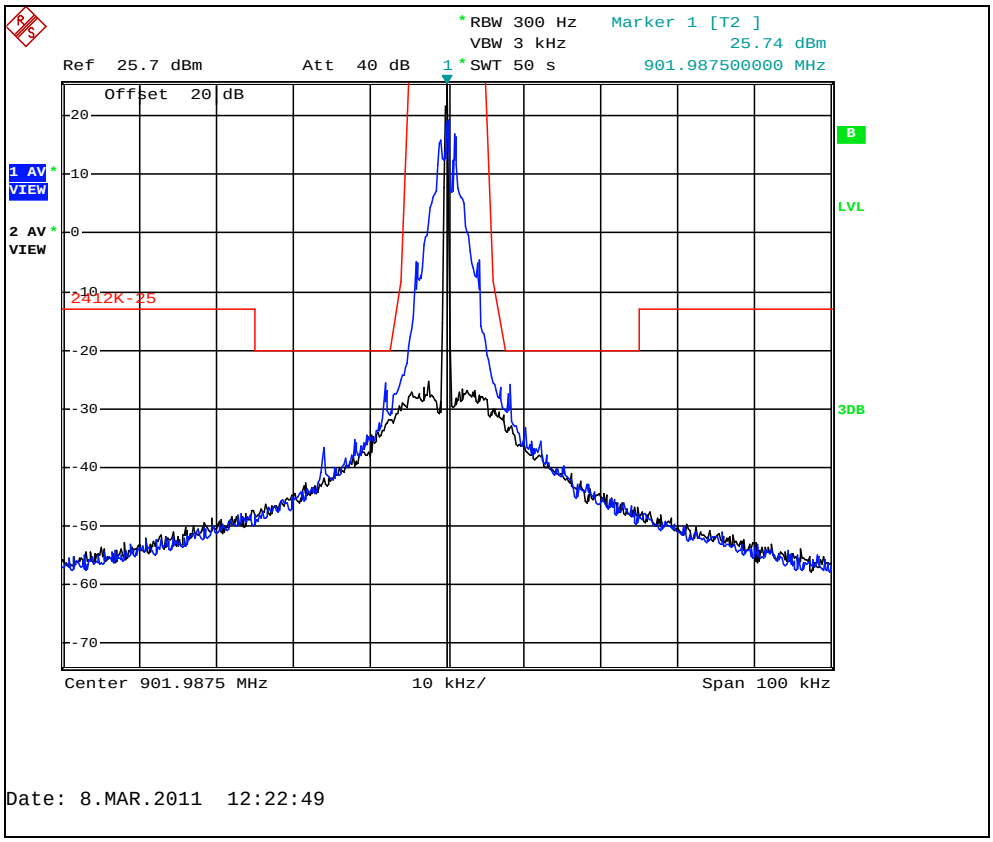

Figure 7.2.2-6: C&I Mode – 901.9875 MHz – 12.5 kHz Channel

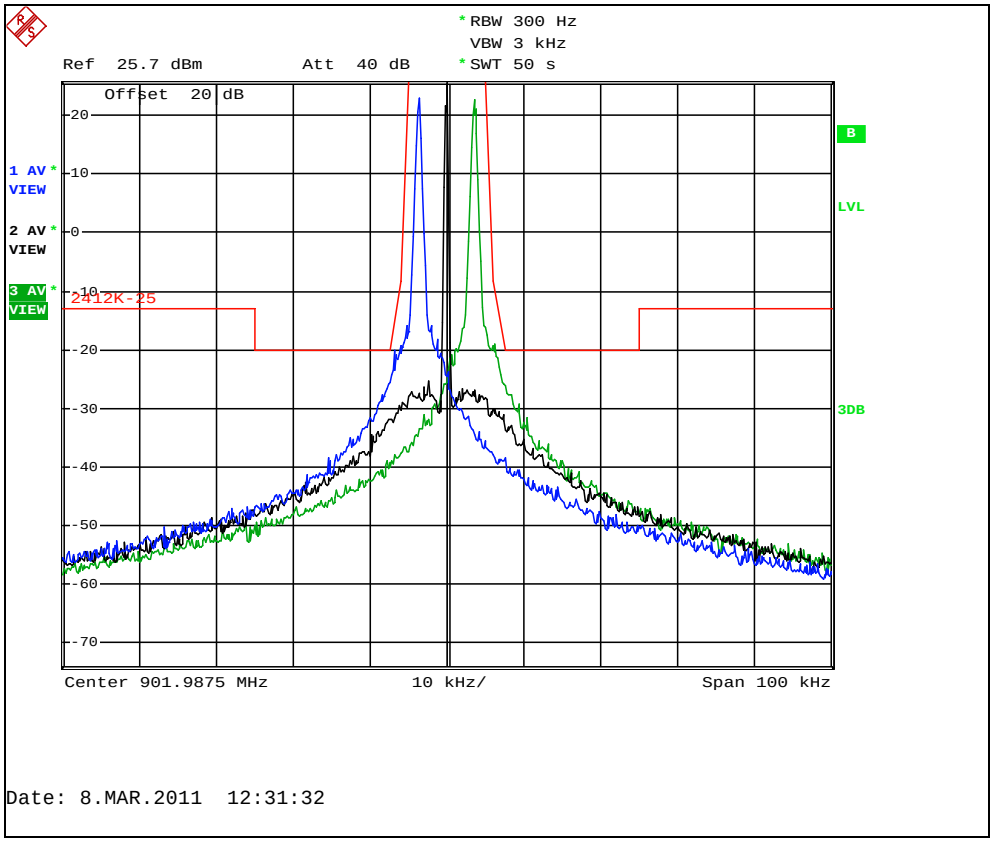

Figure 7.2.2-7: Boost Mode – 901.9875 MHz – 12.5 kHz Channel Offset Channel of +/- 6 (+/- 3600 Hz)

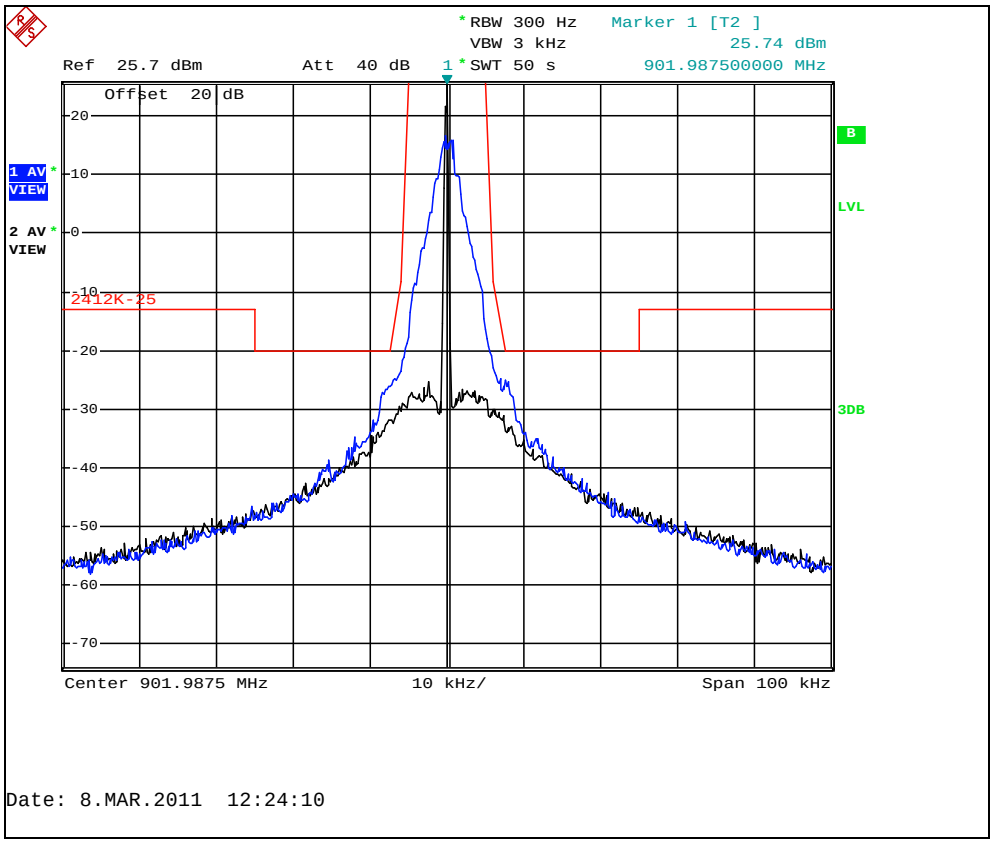

Figure 7.2.2-8: Priority Mode – 901.9875 MHz – 12.5 kHz Channel

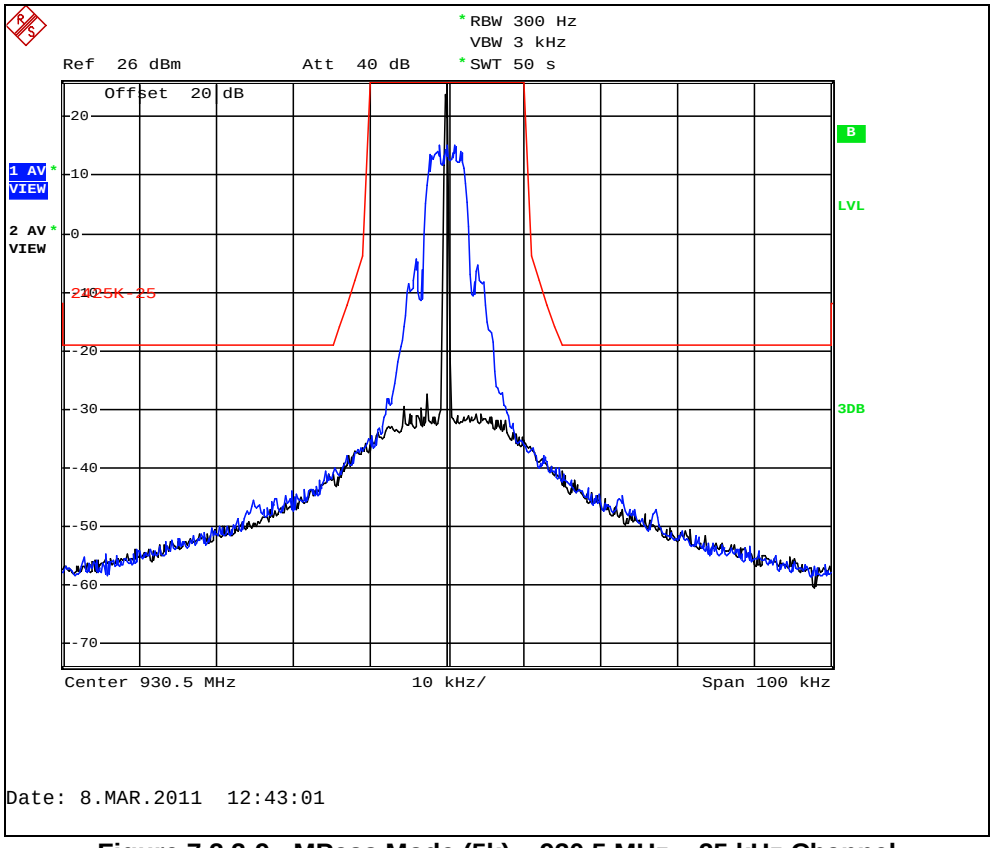

Figure 7.2.2-9: MPass Mode (5k) – 930.5 MHz – 25 kHz Channel

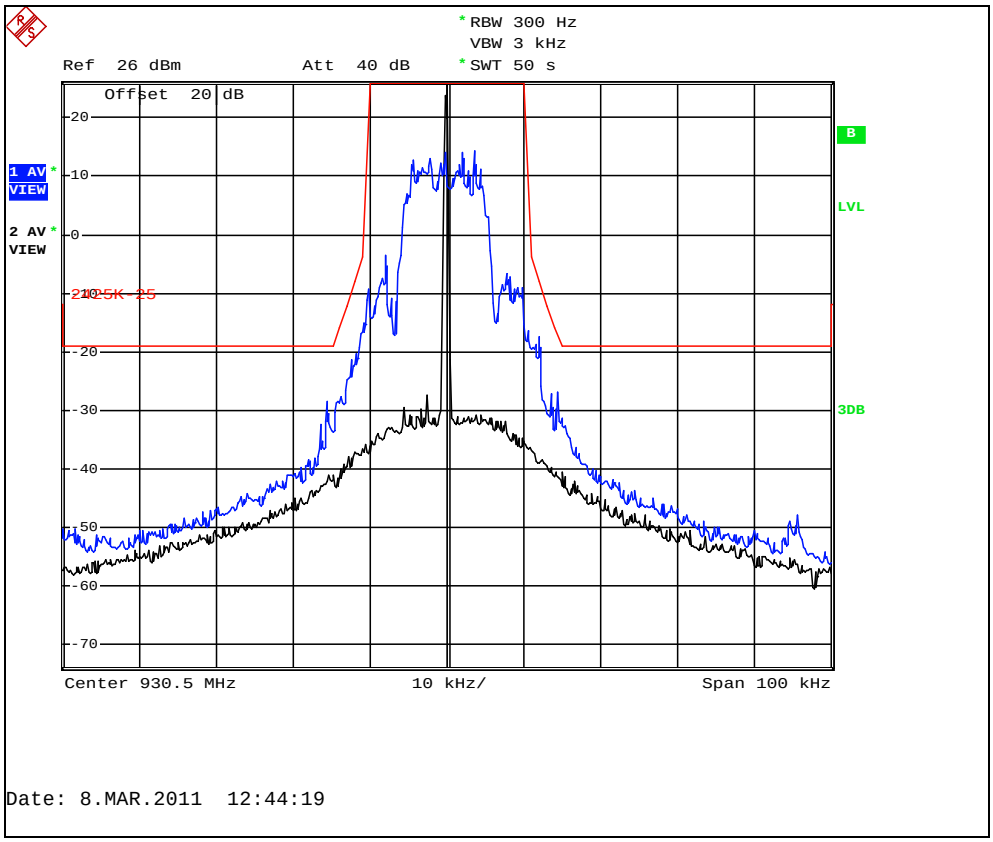

Figure 7.2.2-10: MPass Mode (10k) – 930.5 MHz – 25 kHz Channel

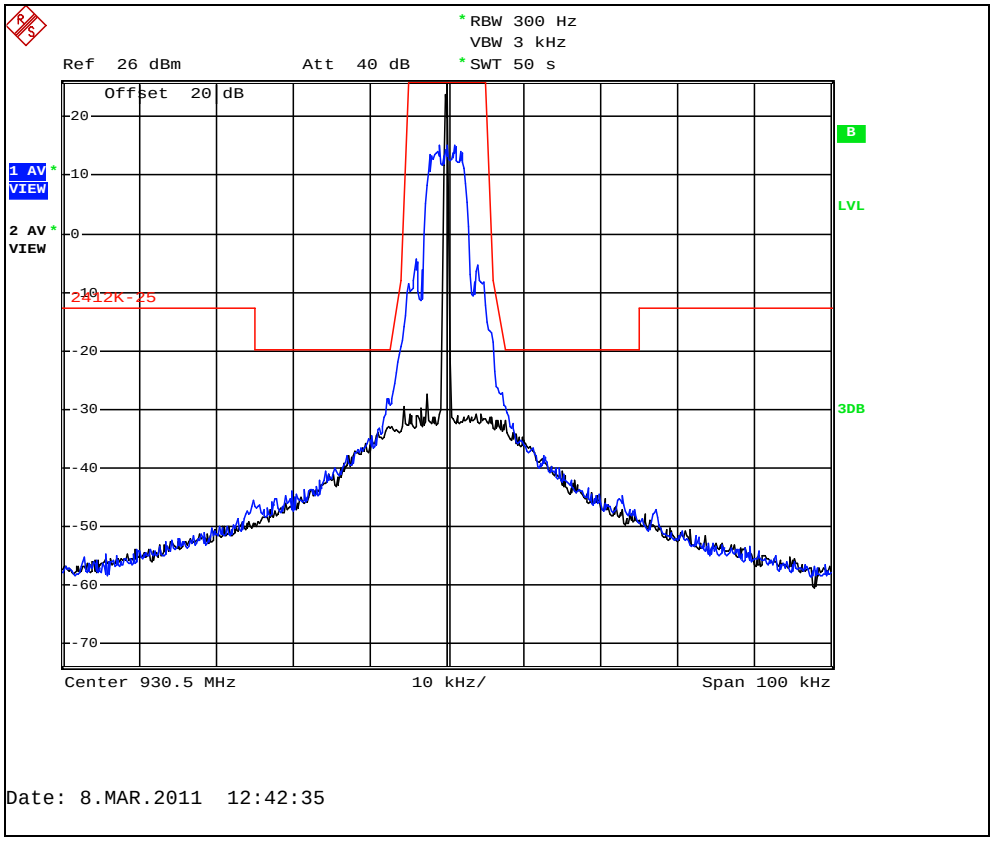

Figure 7.2.2-11: MPass Mode (5K)– 930.5 MHz – 12.5 kHz Channel

Part 90.210 (j), RSS-119 5.8.8

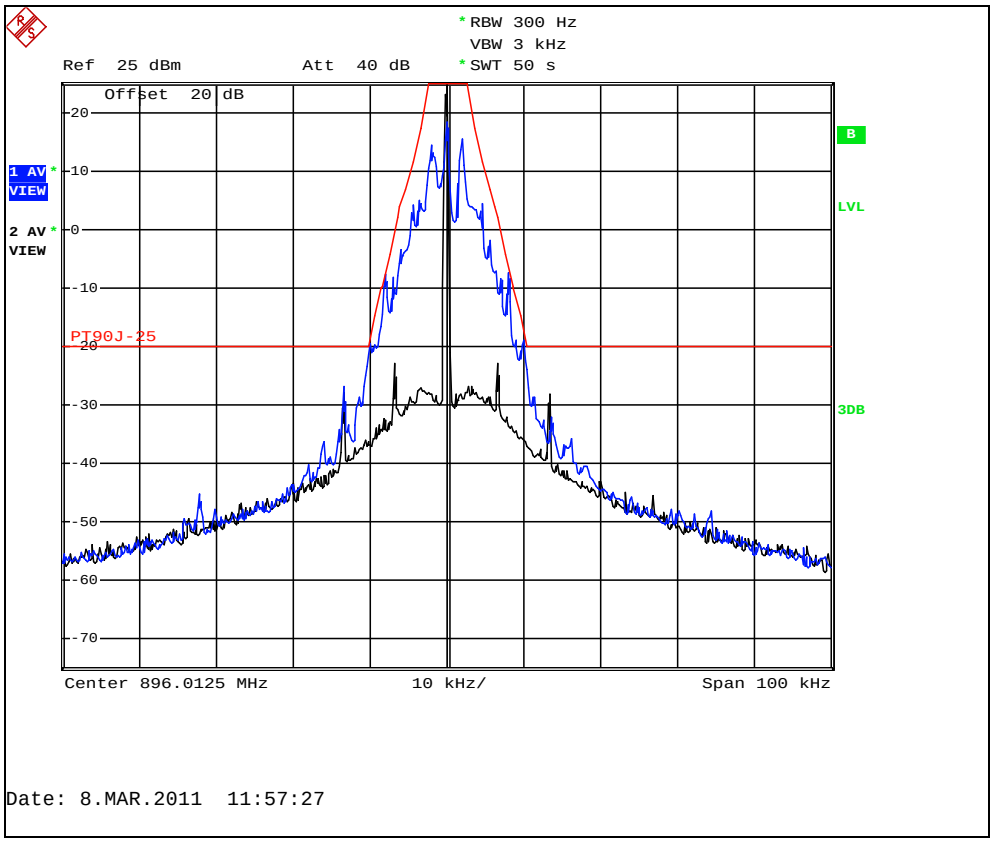

Figure 7.2.2-12: Normal Mode – 896.0125 MHz

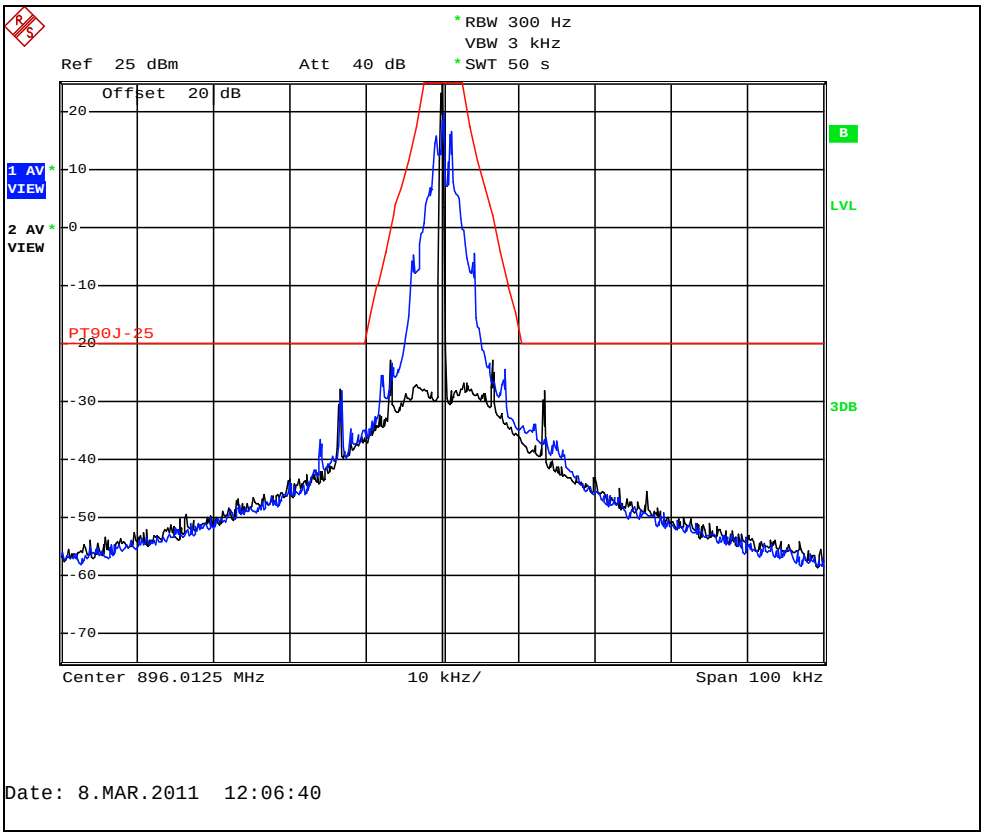

Figure 7.2.2-13: C&I Mode – 896.0125 MHz

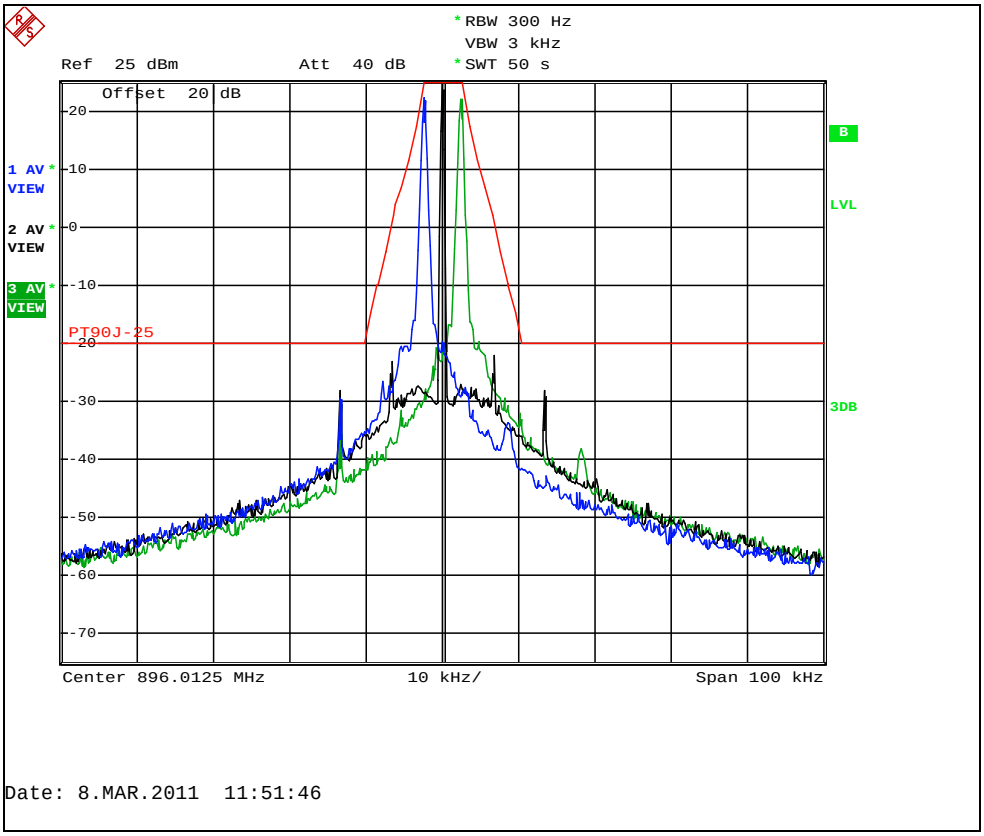

Figure 7.2.2-14: Boost Mode – 896.0125 MHz
Offset Channel of +/- 4 (+/- 2400 Hz)

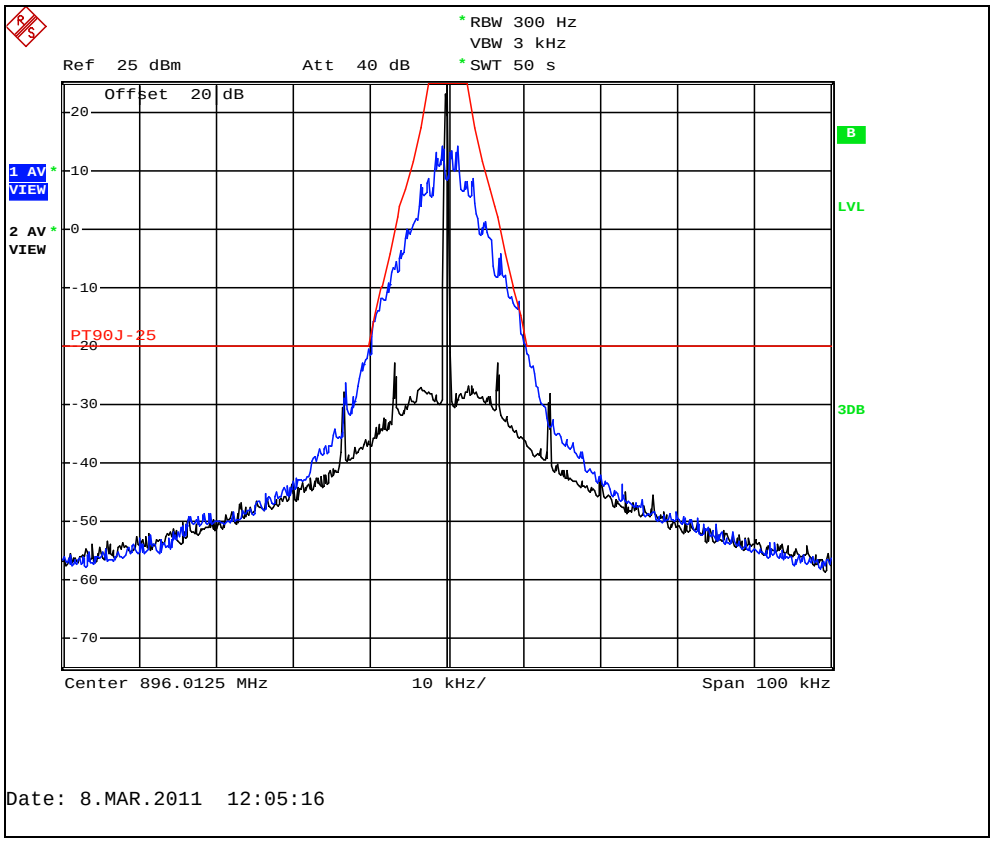

Figure 7.2.2-15: Double Density Mode – 896.0125 MHz

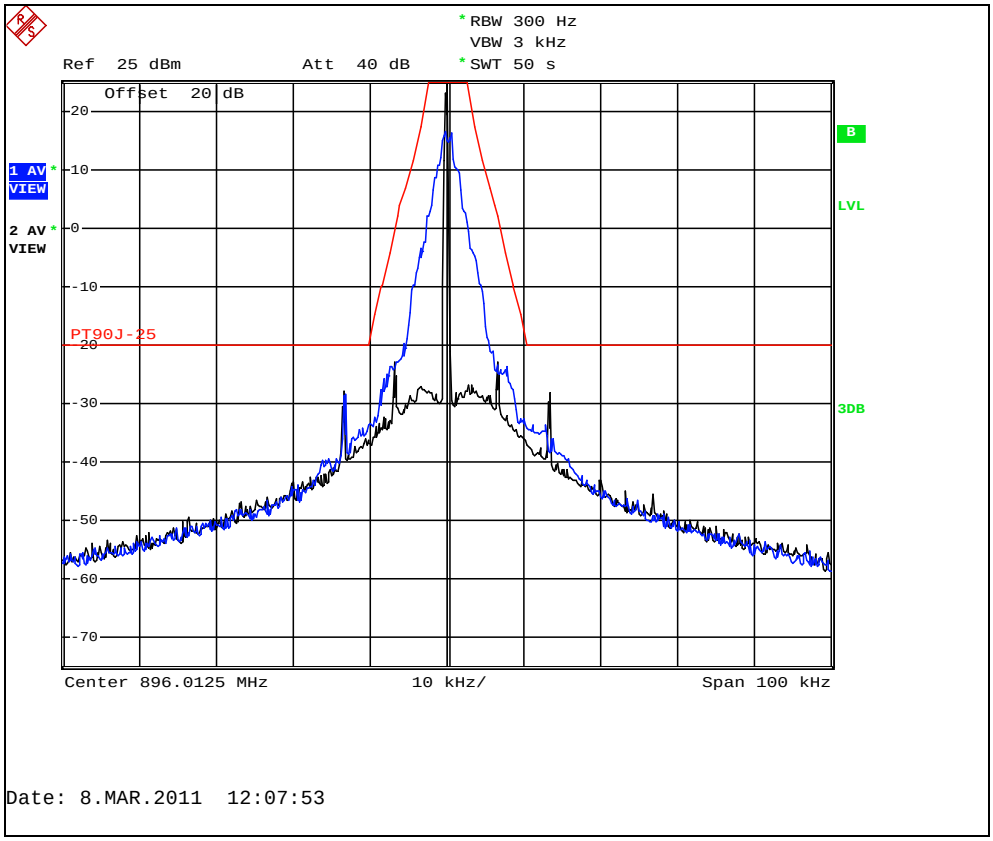

Figure 7.2.2-16: Priority Mode – 896.0125 MHz

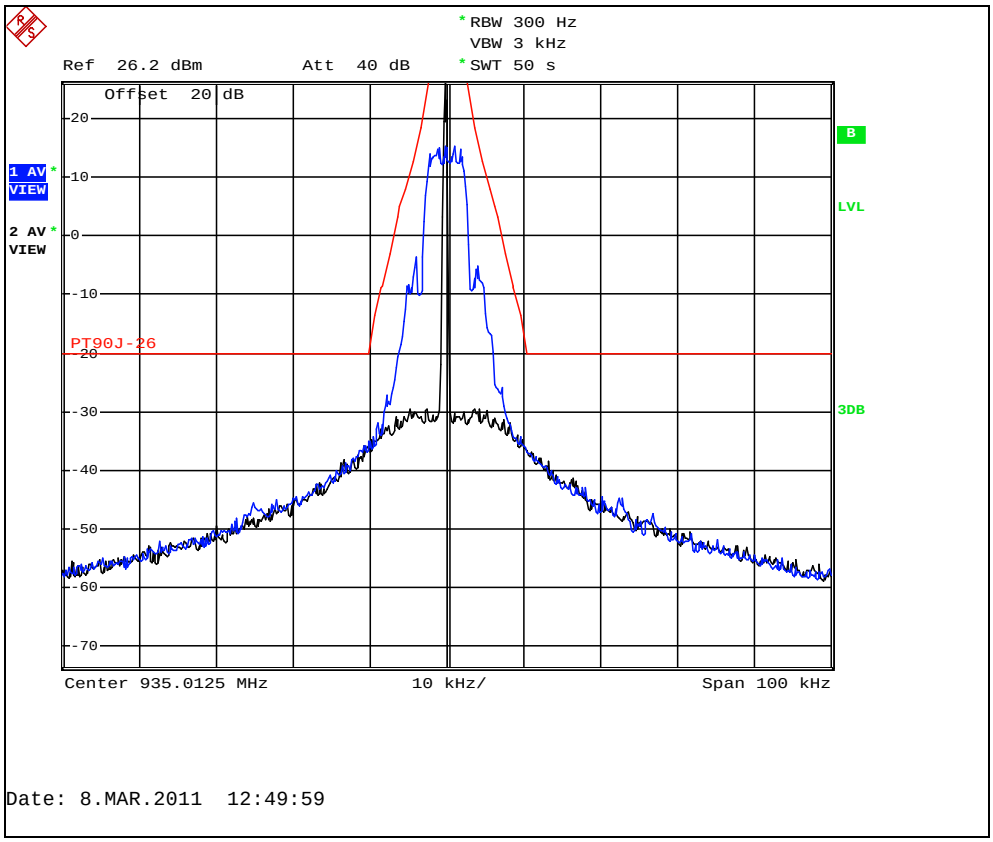

Figure 7.2.2-17: MPass Mode (5k) – 935.0125 MHz

Part 101.111 a(6), RSS-119 5.8.6 (FCC Part 101.111a(6) provides worst case)

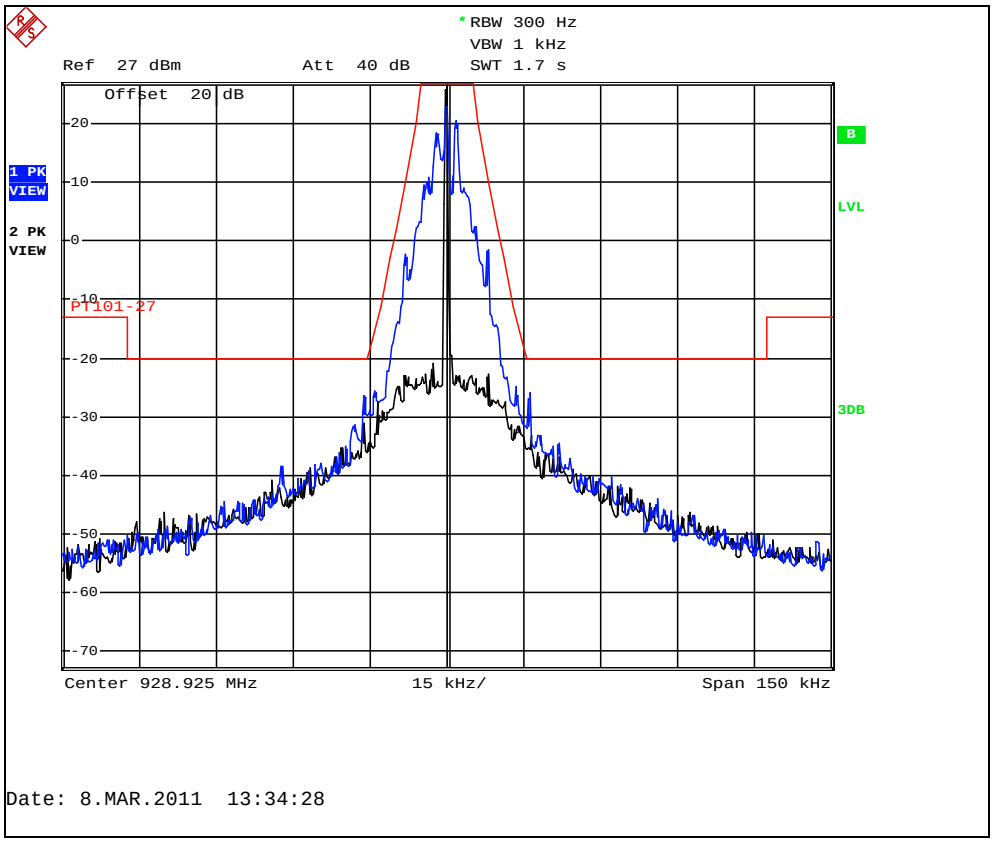

Figure 7.2.2-18: Normal Mode – 928.925 MHz

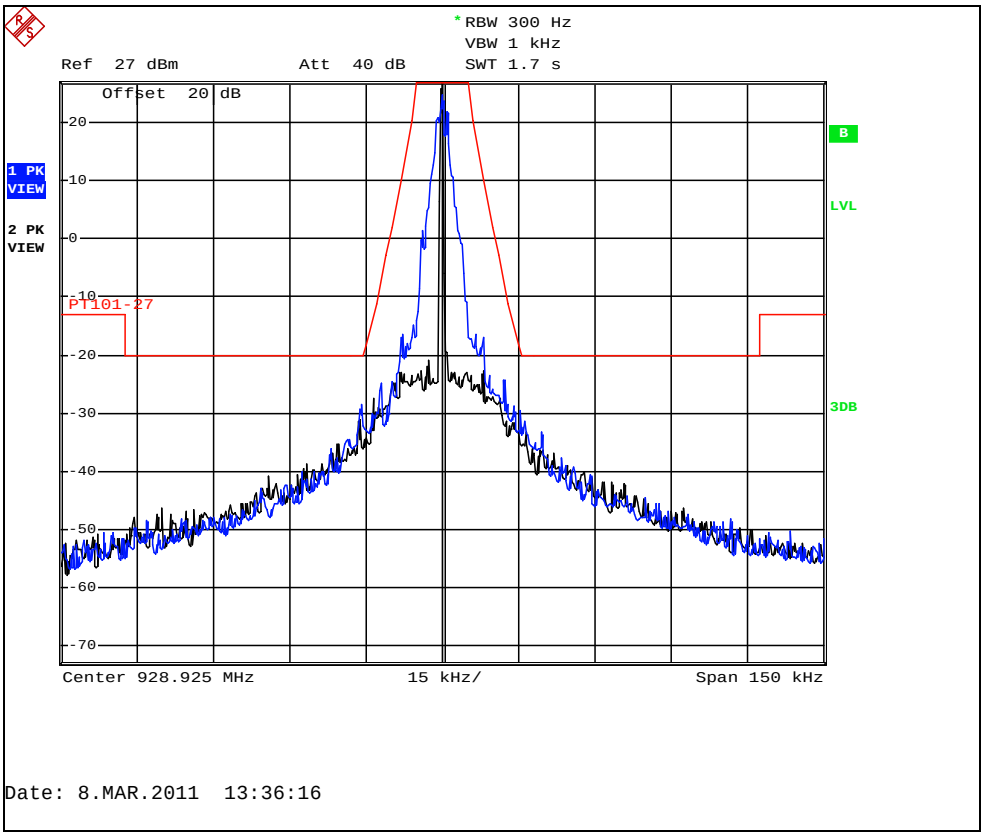

Figure 7.2.2-19: C&I Mode – 928.925 MHz

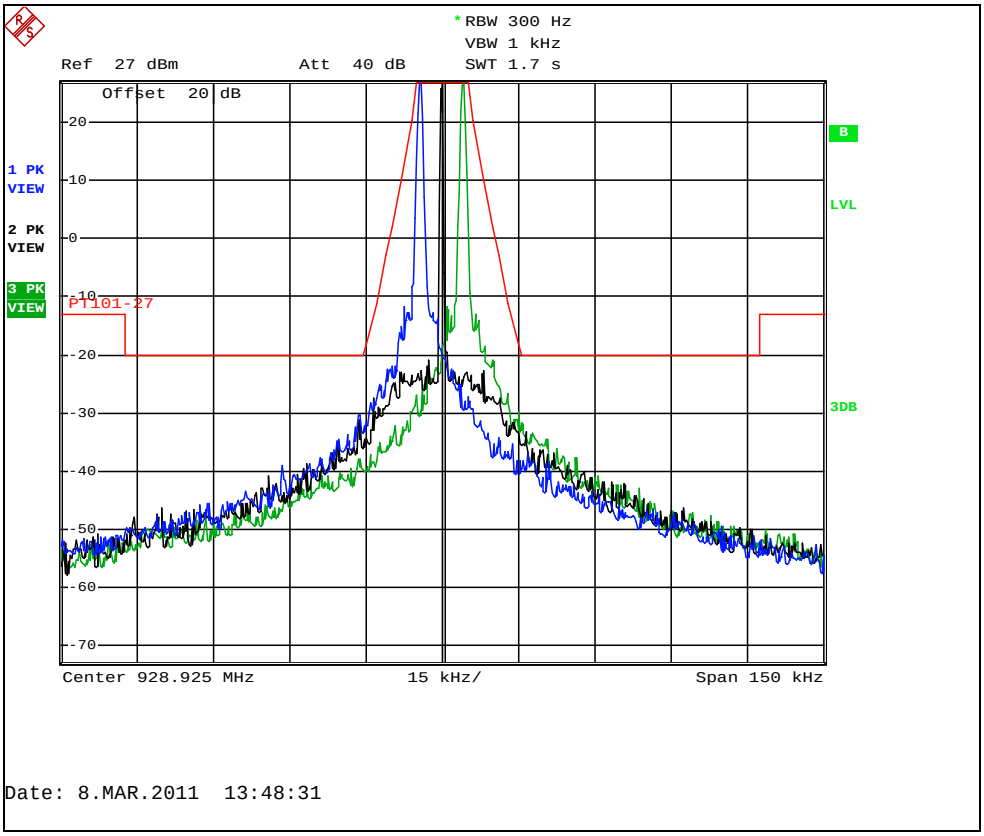

Figure 7.2.2-20: Boost Mode – 928.925 MHz
Offset Channel of +/- 7 (+/- 4200 Hz)

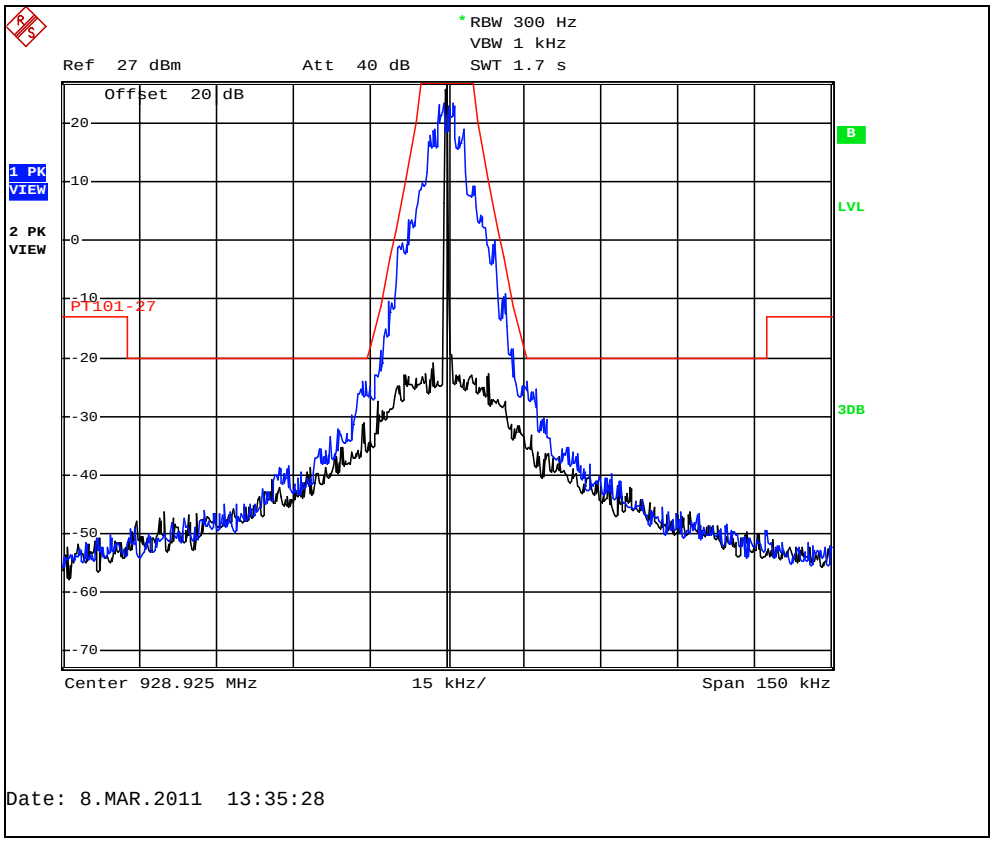

Figure 7.2.2-21: Double Density Mode – 928.925 MHz

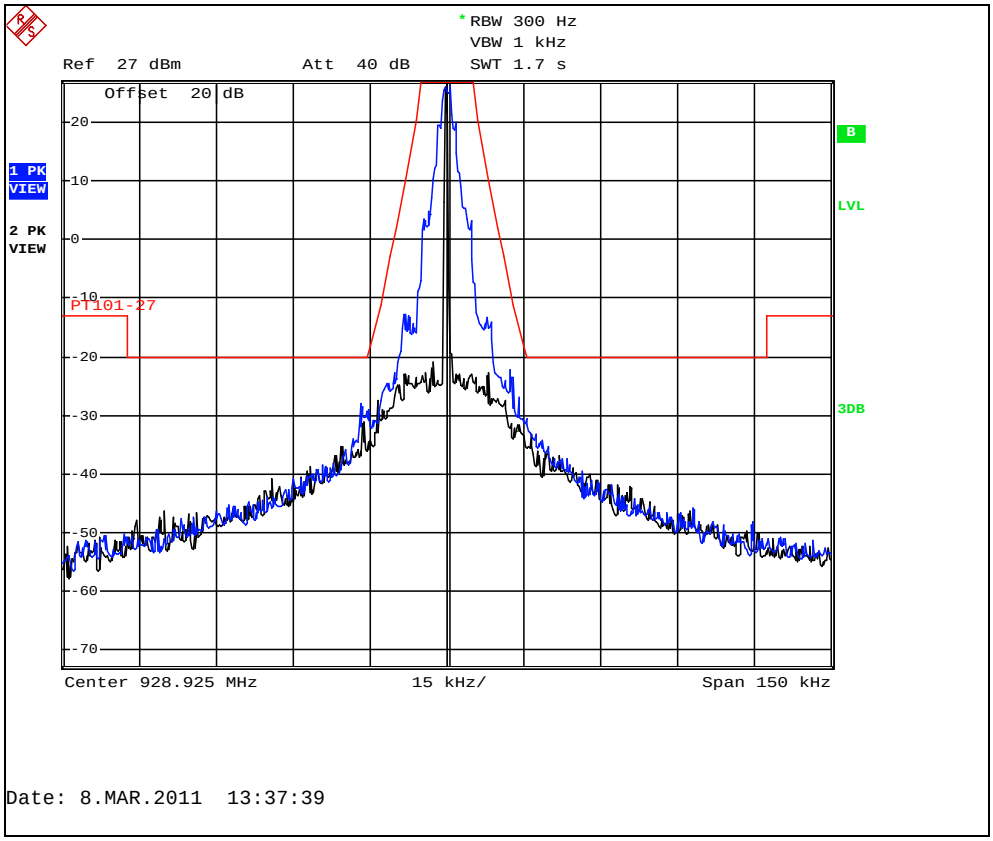

Figure 7.2.2-22: Priority Mode – 928.925 MHz

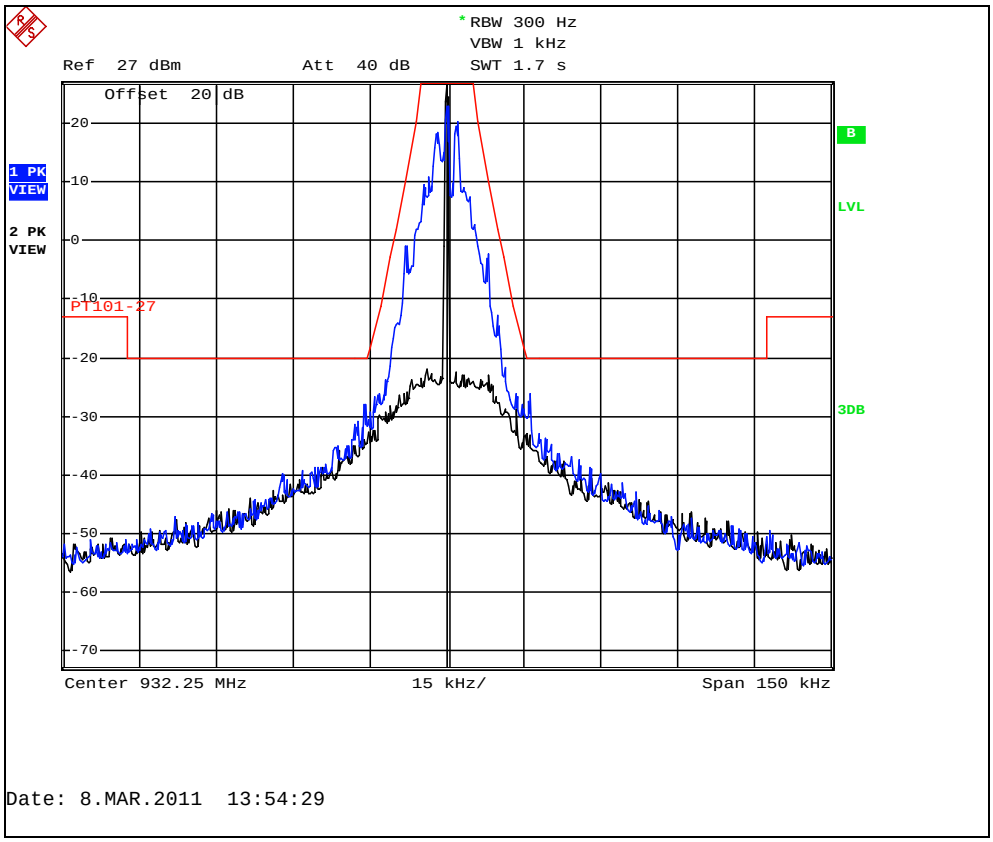

Figure 7.2.2-23: Normal Mode – 932.25 MHz

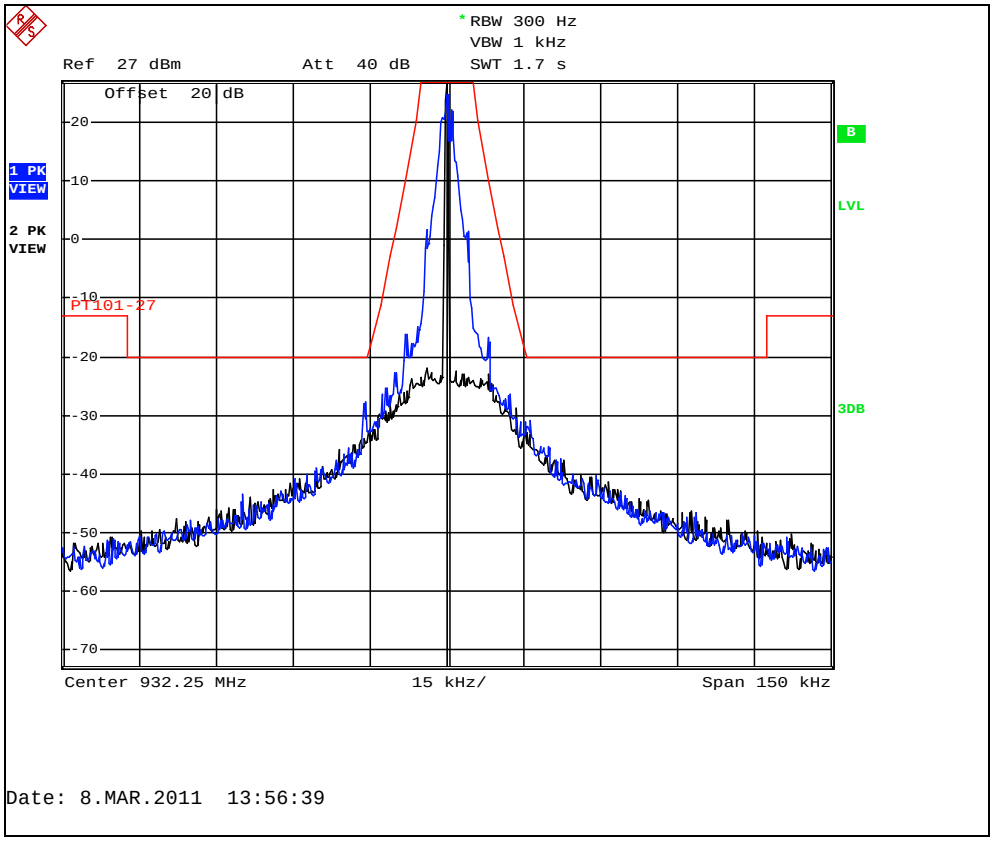

Figure 7.2.2-24: C&I Mode – 932.25 MHz

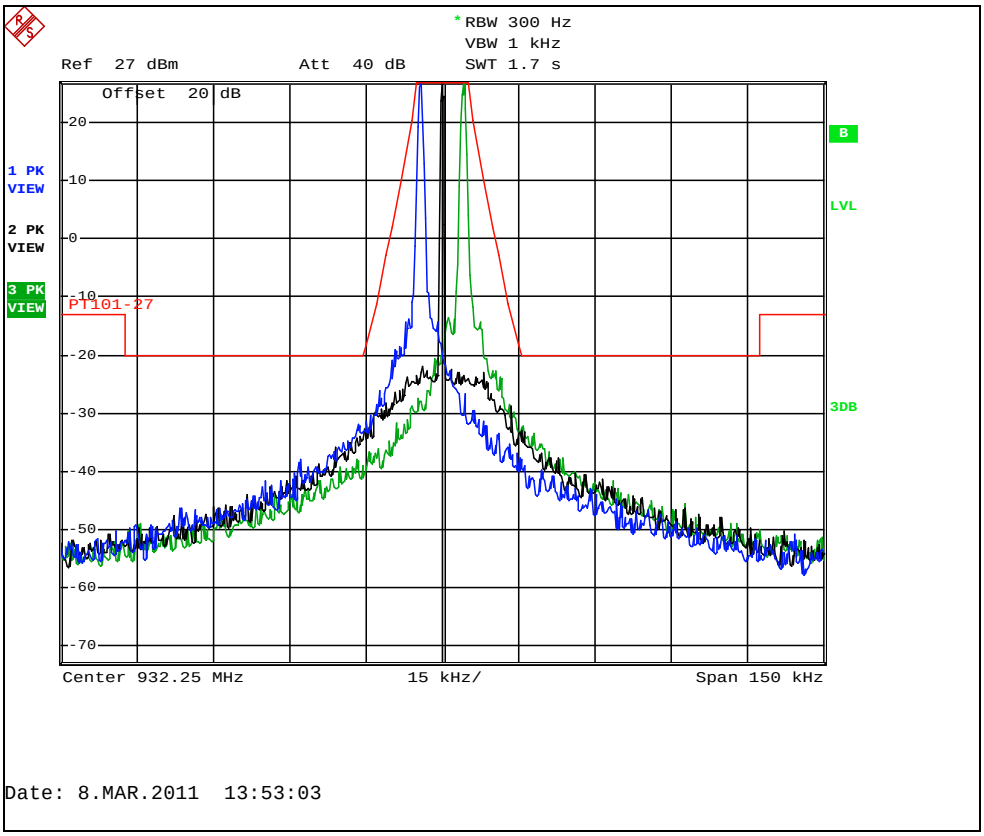

Figure 7.2.2-25: Boost Mode – 932.25 MHz
Offset Channel of +/- 7 (+/- 4200 Hz)

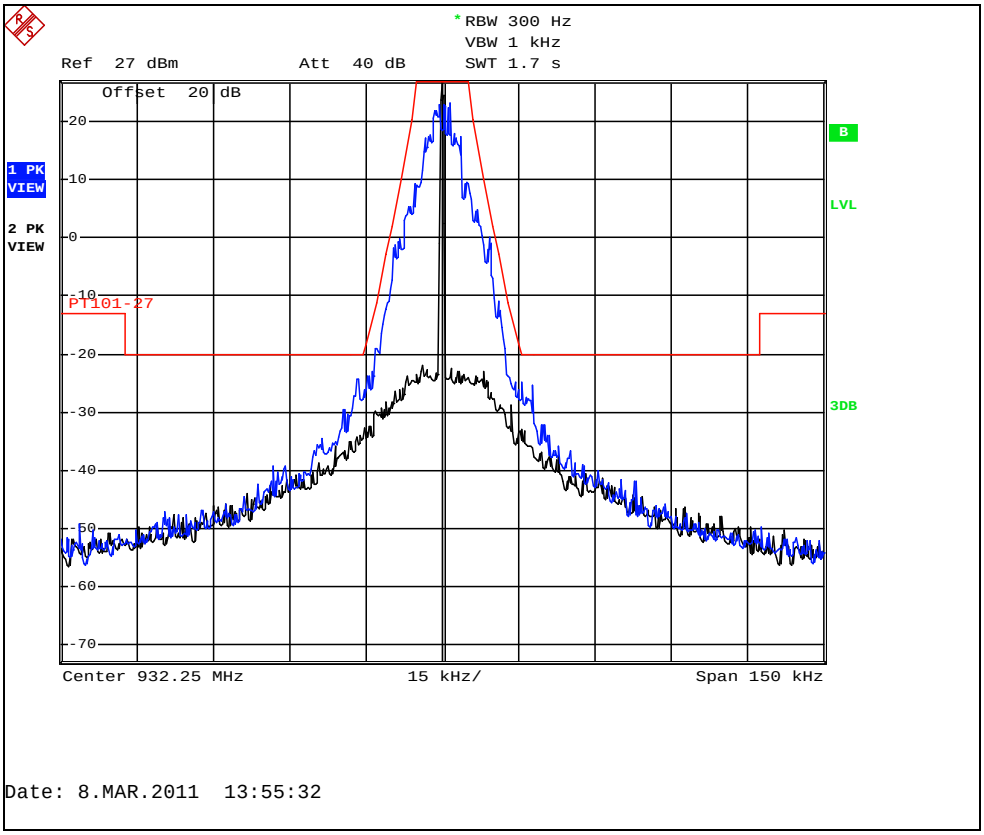

Figure 7.2.2-26: Double Density Mode – 932.25 MHz

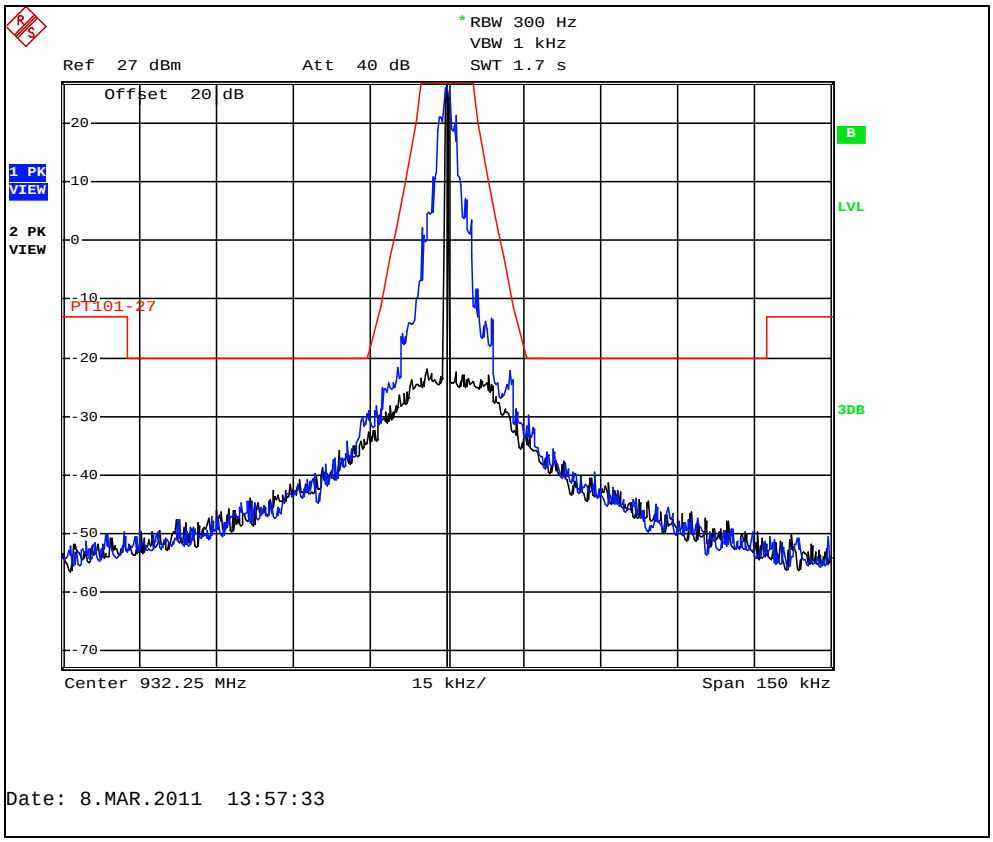

Figure 7.2.2-27: Priority Mode – 932.25 MHz

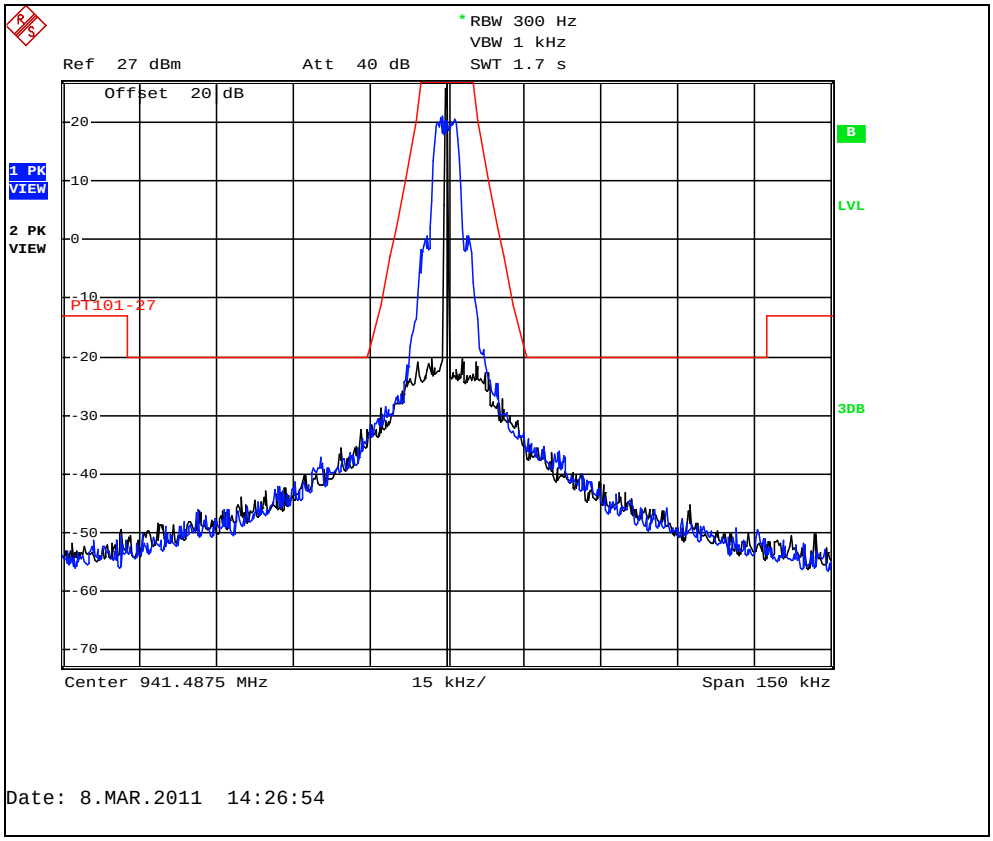

Figure 7.2.2-28: MPass Mode (5k) – 941.4875 MHz

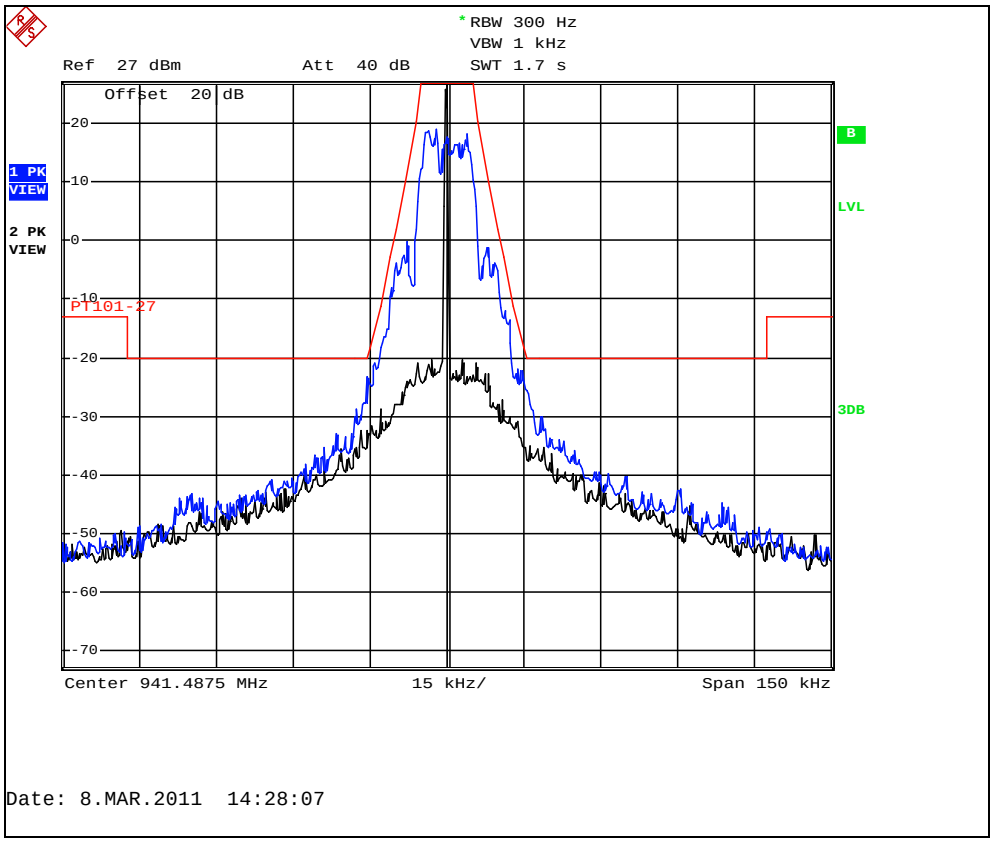

Figure 7.2.2-29: MPass Mode (10k) – 941.4875 MHz

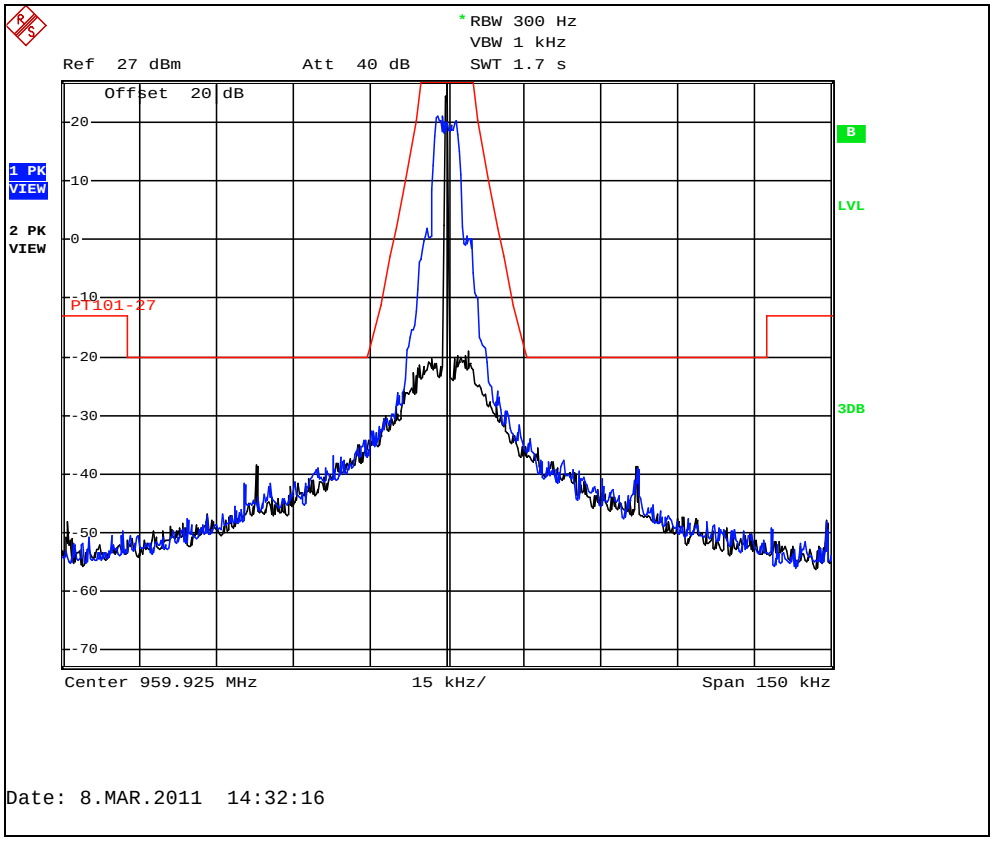

Figure 7.2.2-30: MPass Mode (5k) – 959.925 MHz

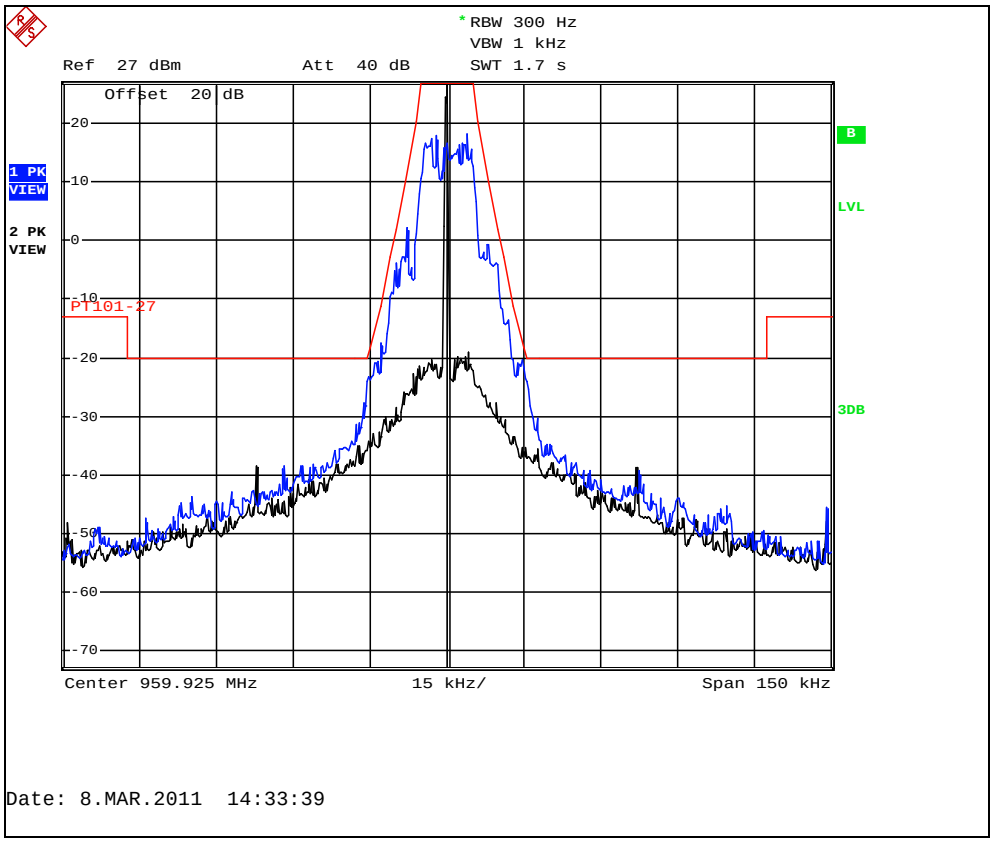

Figure 7.2.2-31: MPass Mode (10k) – 959.925 MHz

7.3 Spurious Emissions at Antenna Terminals

7.3.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 20 dB passive attenuator for measurements below 1000 MHz. The spectrum analyzer resolution bandwidth was set to 100 kHz below 1000 MHz and 1 MHz above 1000 MHz. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. The spectrum was investigated in accordance to CFR 47 Part 2.1057.

The equipment under test was evaluated to multiple FCC rule parts with the most stringent limit applied to all measurements.

The EUT was evaluated for all modulation modes with the worst case presented in section 7.3.2 below.

7.3.2 Measurement Results

Part 24.133 a(1), a(2), IC RSS-134 6.3(i), (ii)

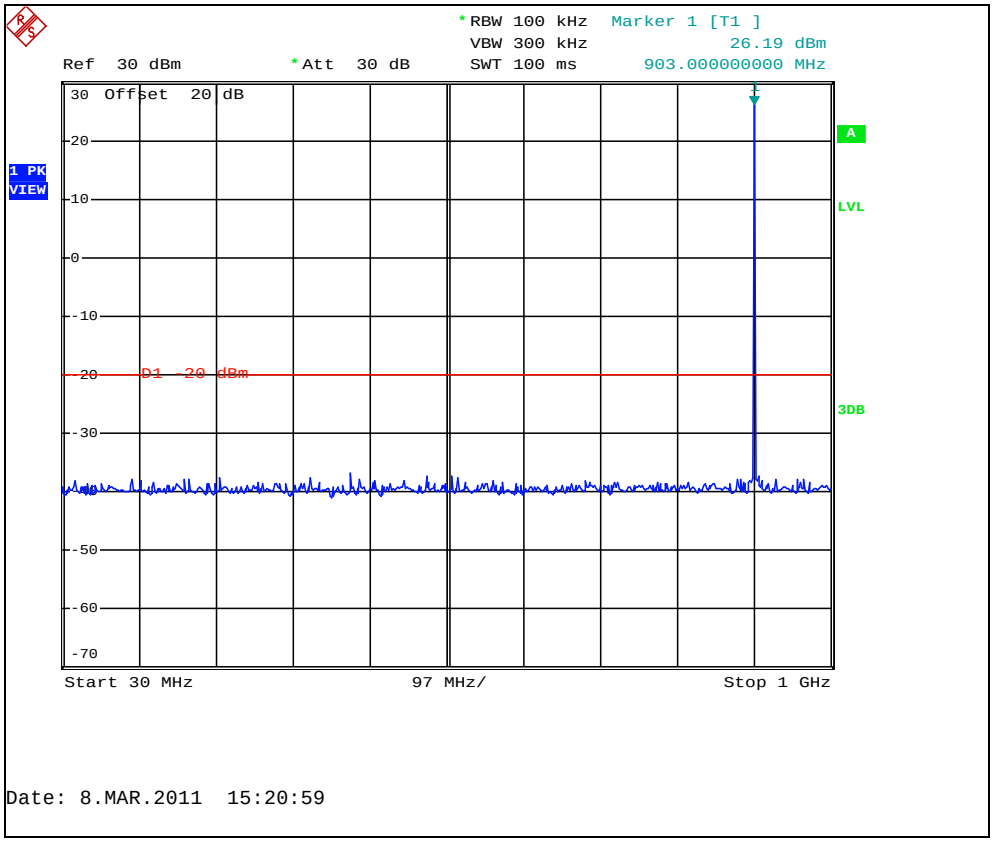

Figure 7.3.2-1: 901.9875 MHz – 30MHz to 1GHz

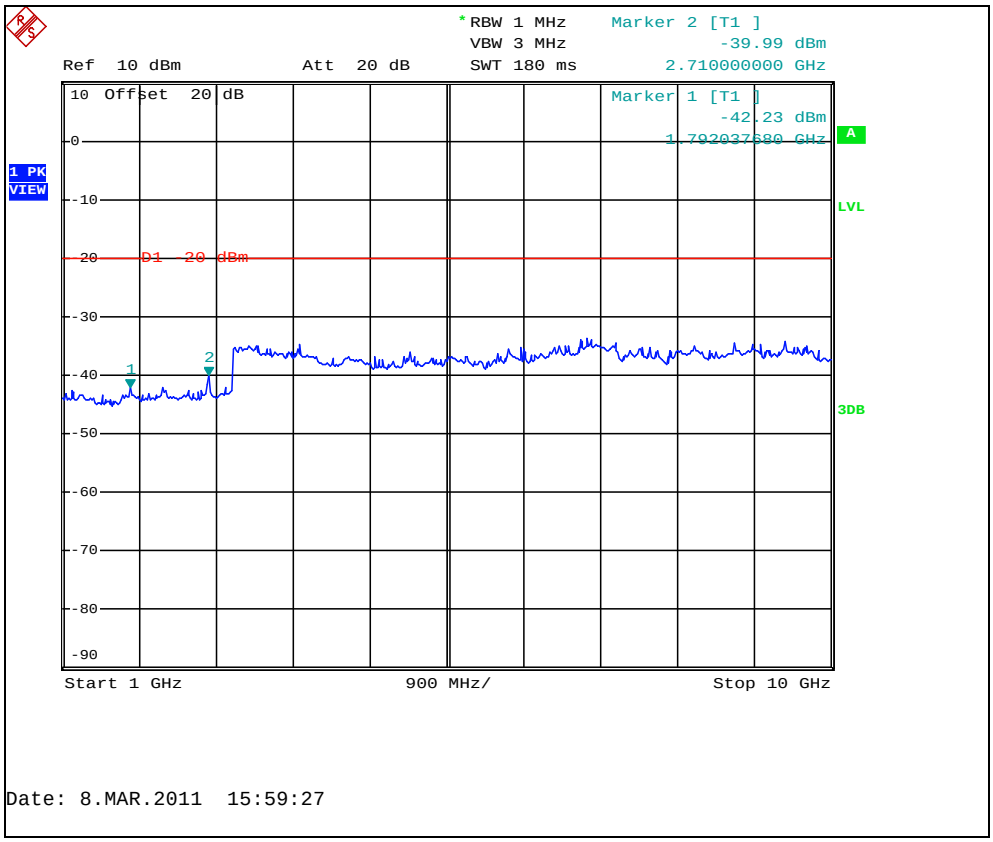

Figure 7.3.2-2: 901.9875 MHz – 1GHz to 10GHz

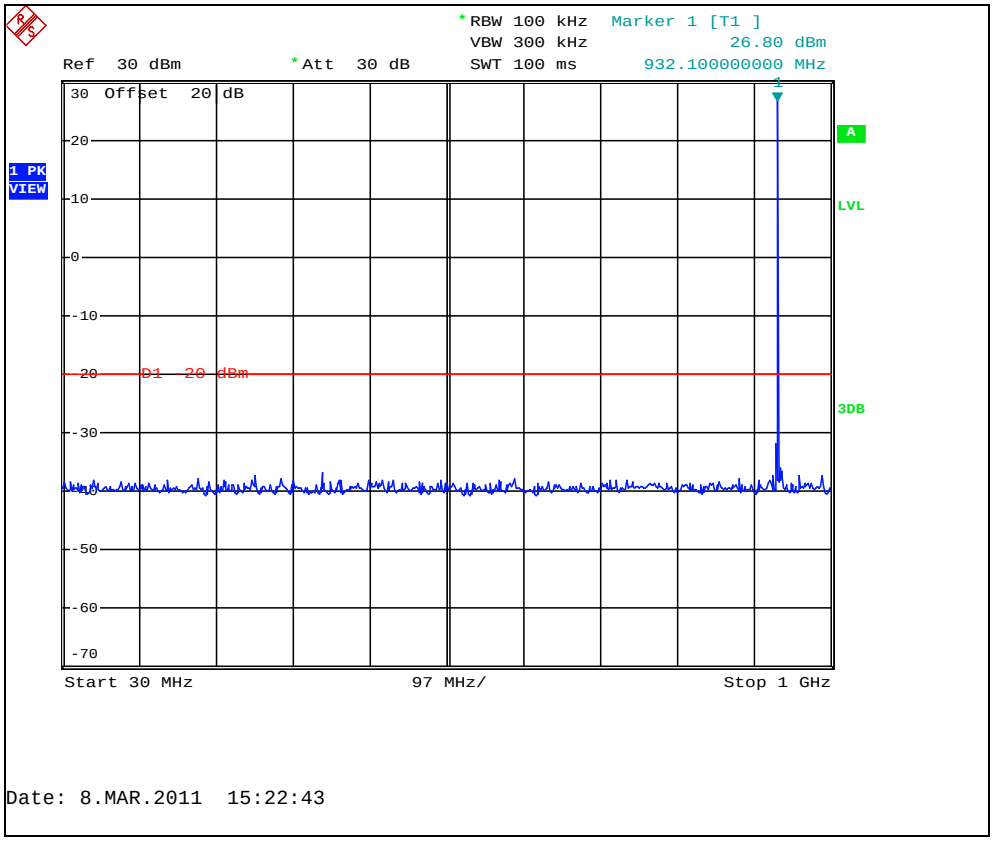

Figure 7.3.2-3: 930.5 MHz – 30MHz to 1GHz

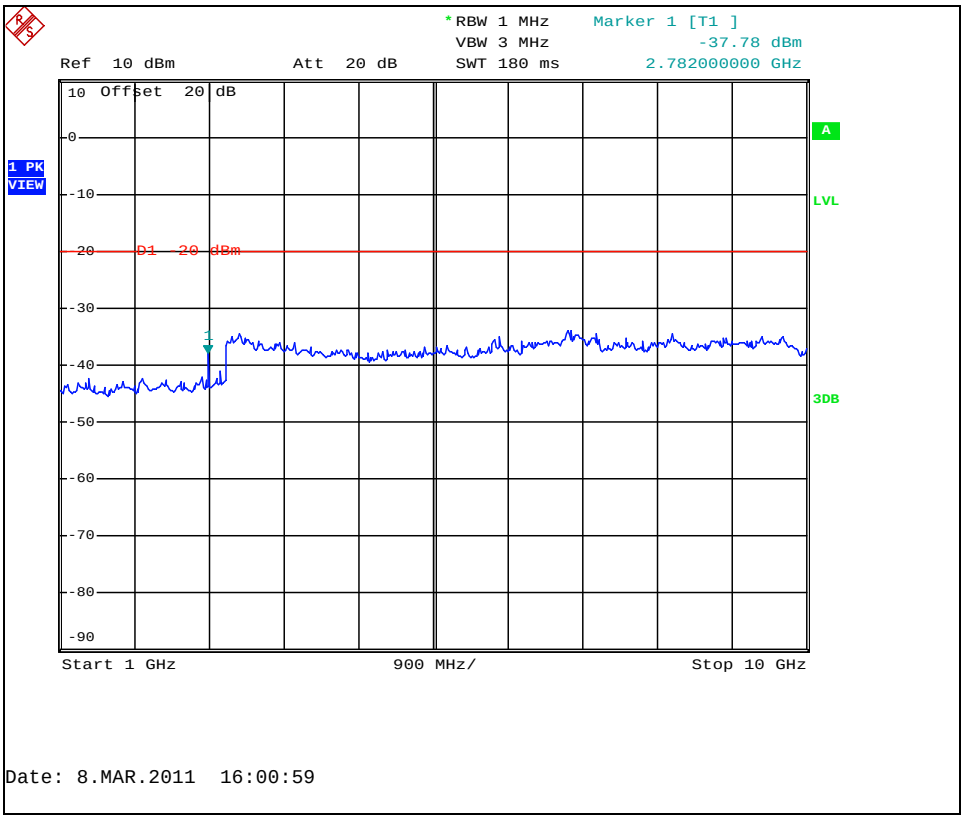

Figure 7.3.2-4: 930.5 MHz – 1GHz to 10GHz

Part 90.210 (j), RSS-119 5.8.8

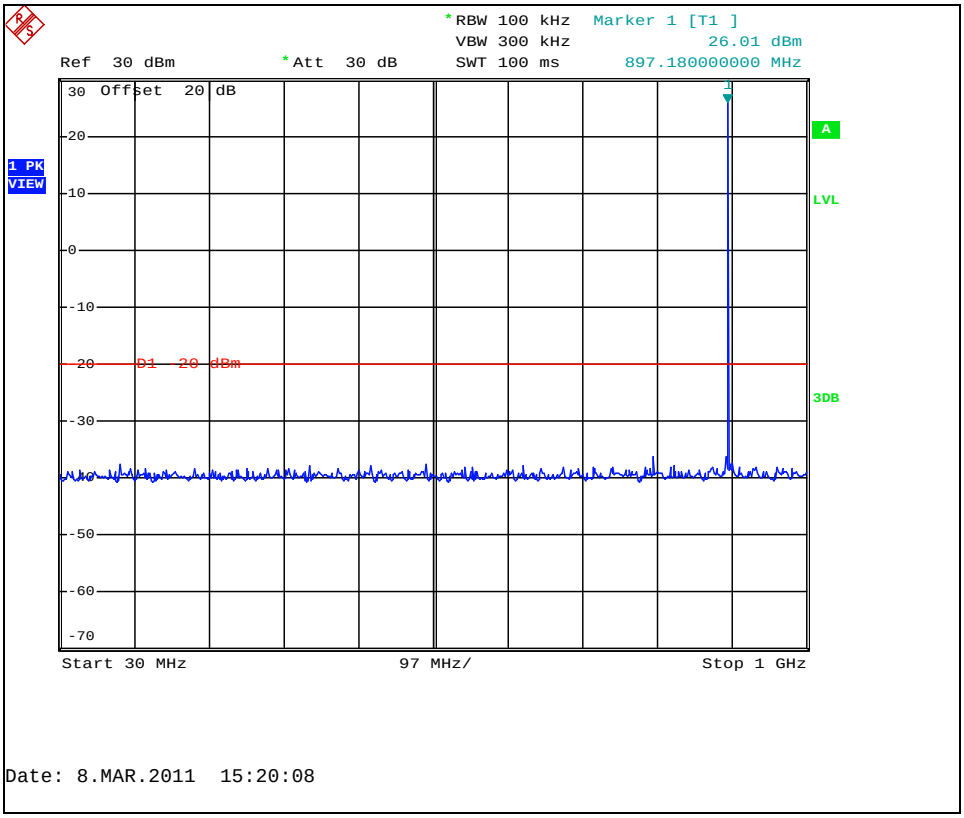

Figure 7.3.2-5: 896.0125 MHz – 30MHz to 1GHz

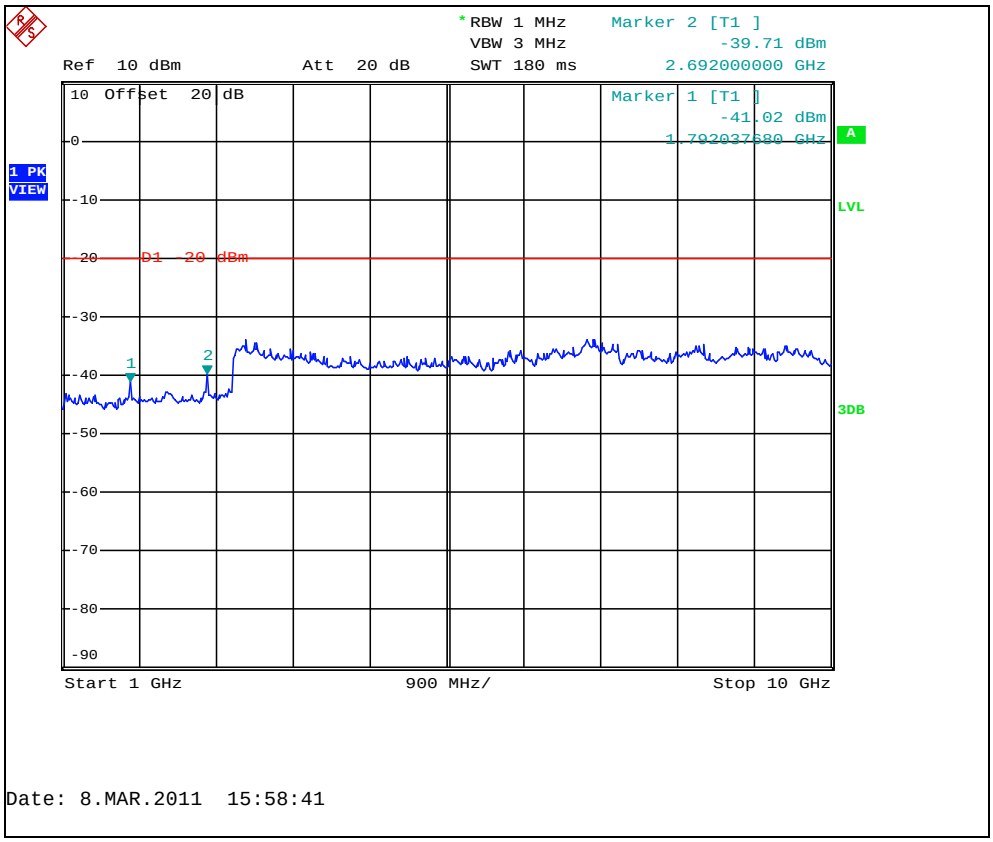

Figure 7.3.2-6: 896.0125 MHz – 1GHz to 10GHz

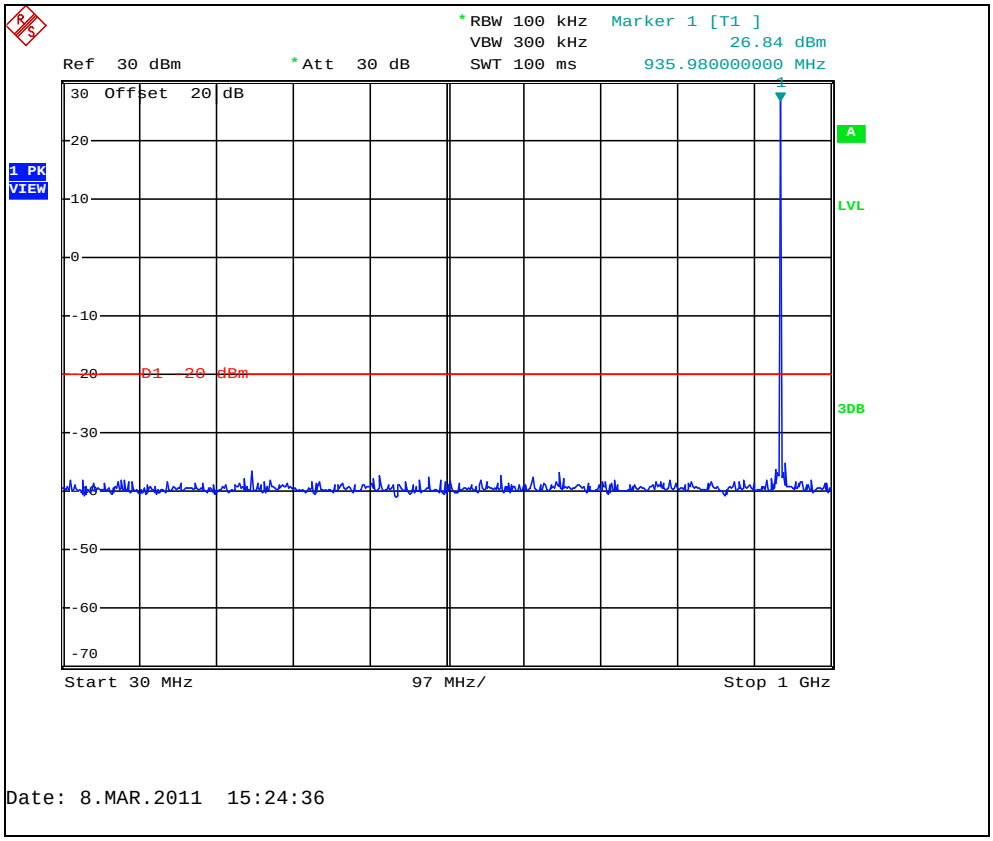

Figure 7.3.2-7: 935.0125 MHz – 30MHz to 1GHz

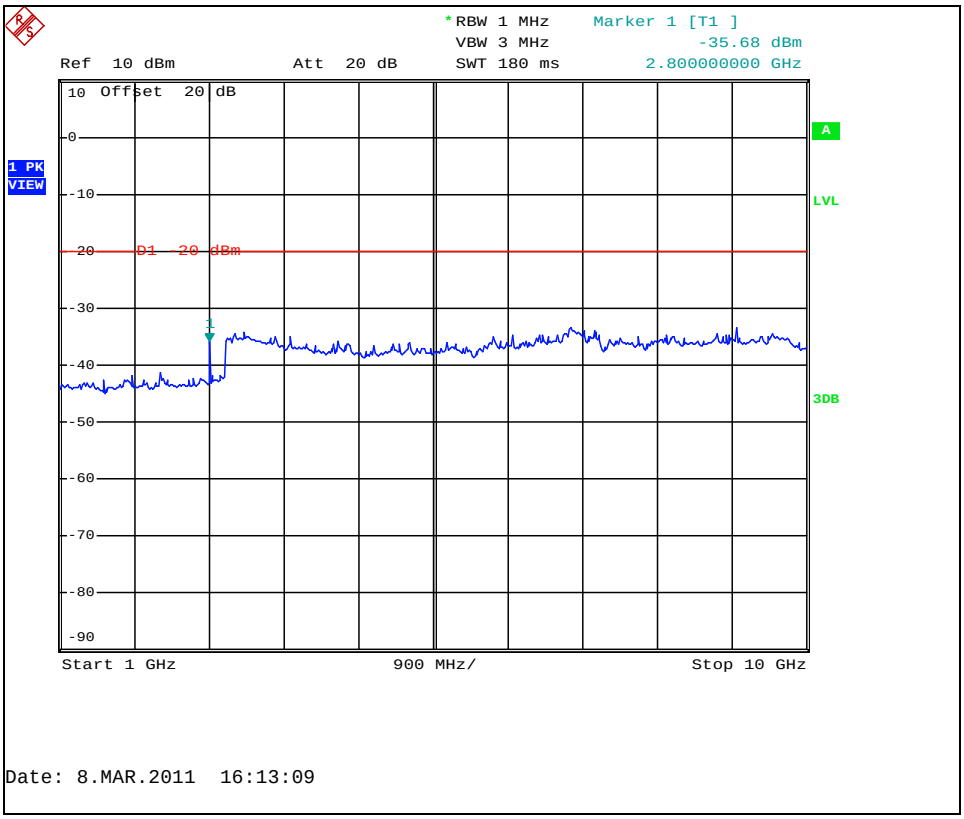

Figure 7.3.2-8: 935.0125 MHz – 1GHz to 10GHz

Part 101.111 a(6), RSS-119 5.8.6

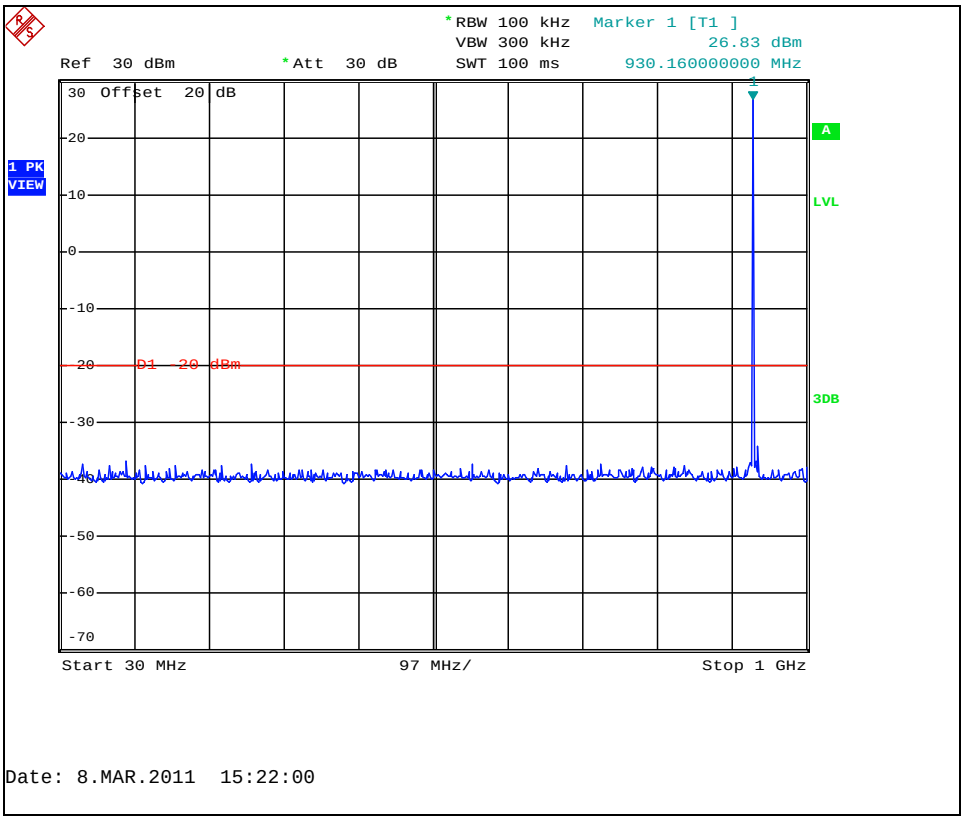

Figure 7.3.2-9: 928.925 MHz – 30MHz to 1GHz

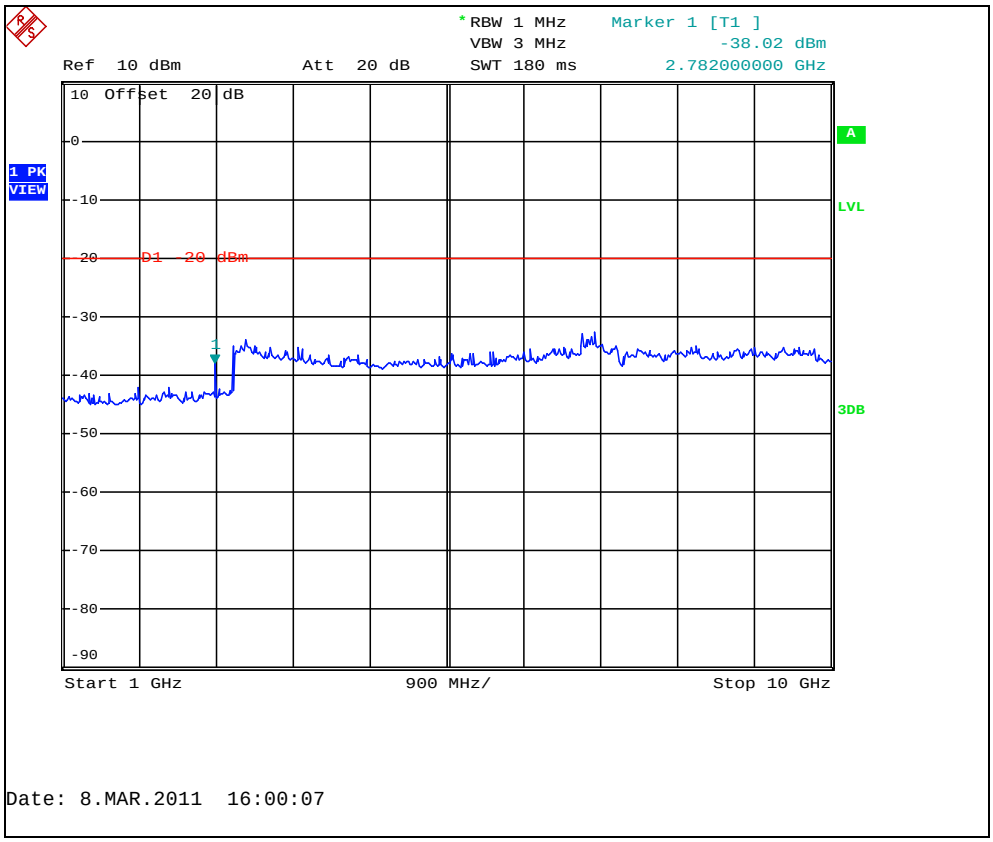

Figure 7.3.2-10: 928.925 MHz – 1GHz to 10GHz

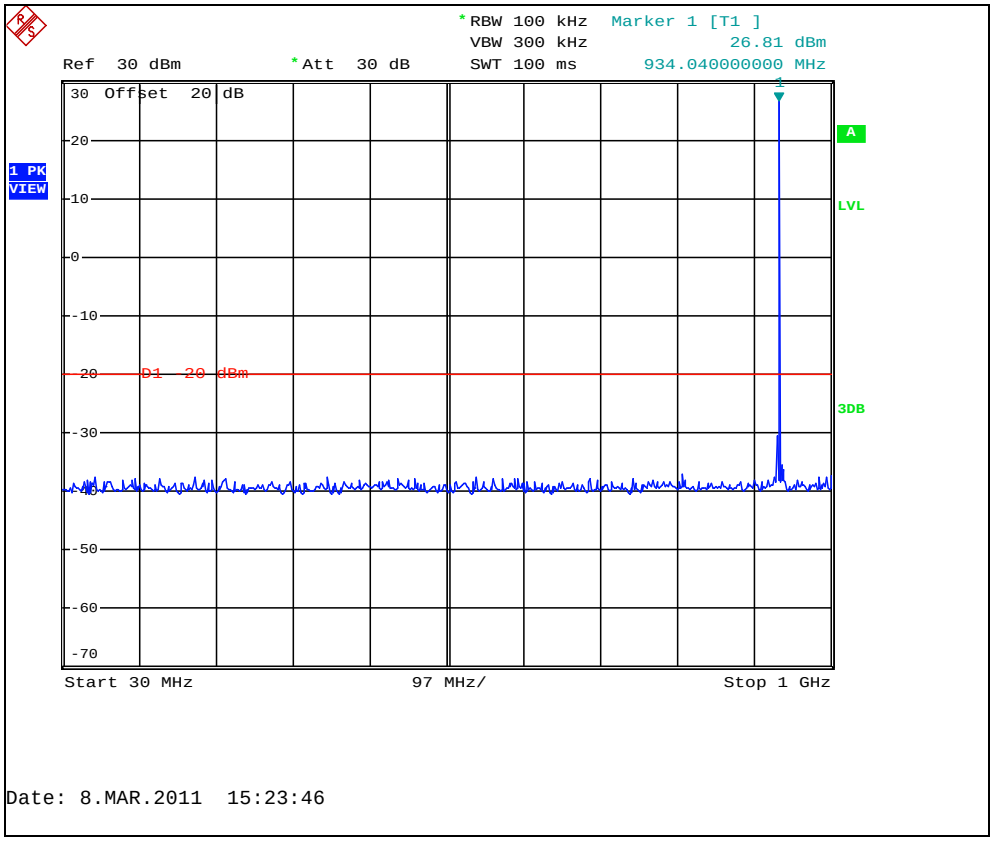

Figure 7.3.2-11: 932.25 MHz – 30MHz to 1GHz

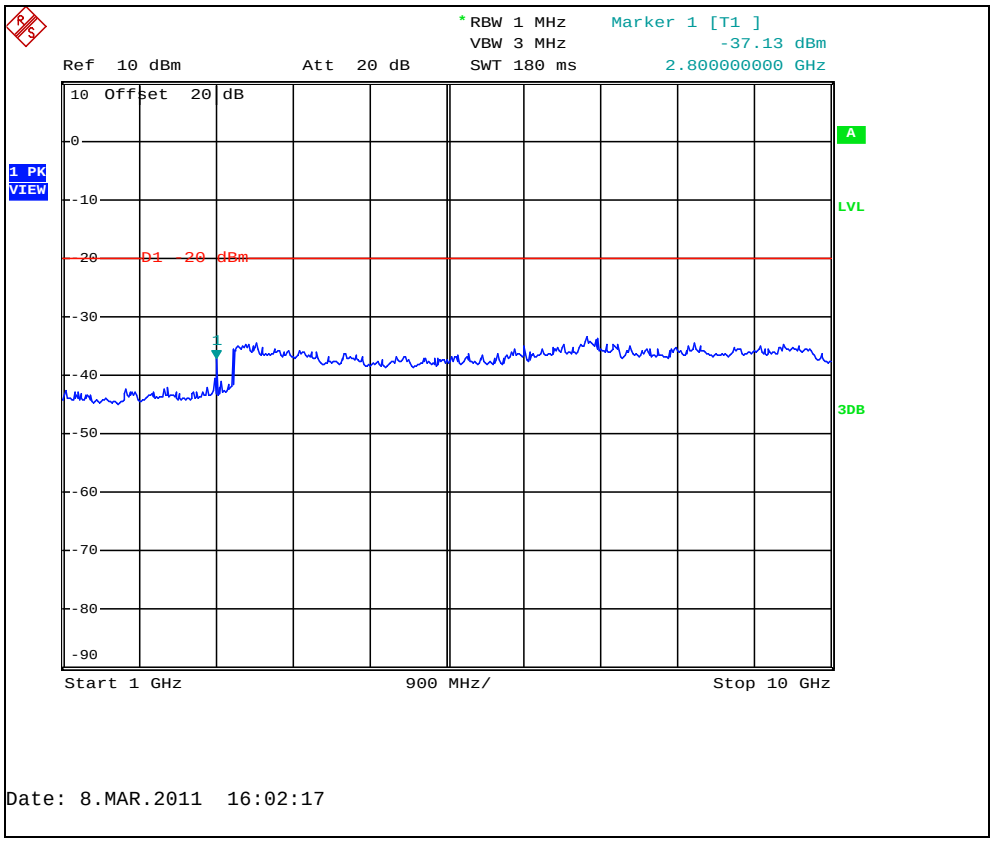

Figure 7.3.2-12: 932.25 MHz – 1GHz to 10GHz

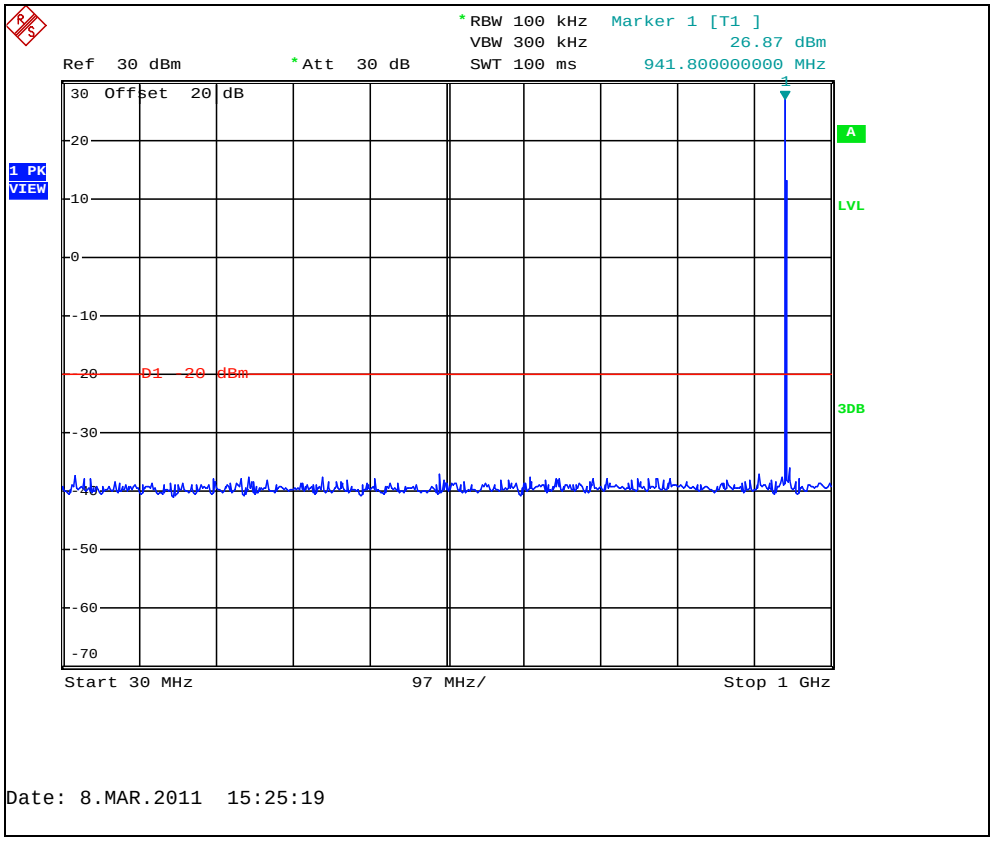

Figure 7.3.2-13: 941.4875 MHz – 30MHz to 1GHz

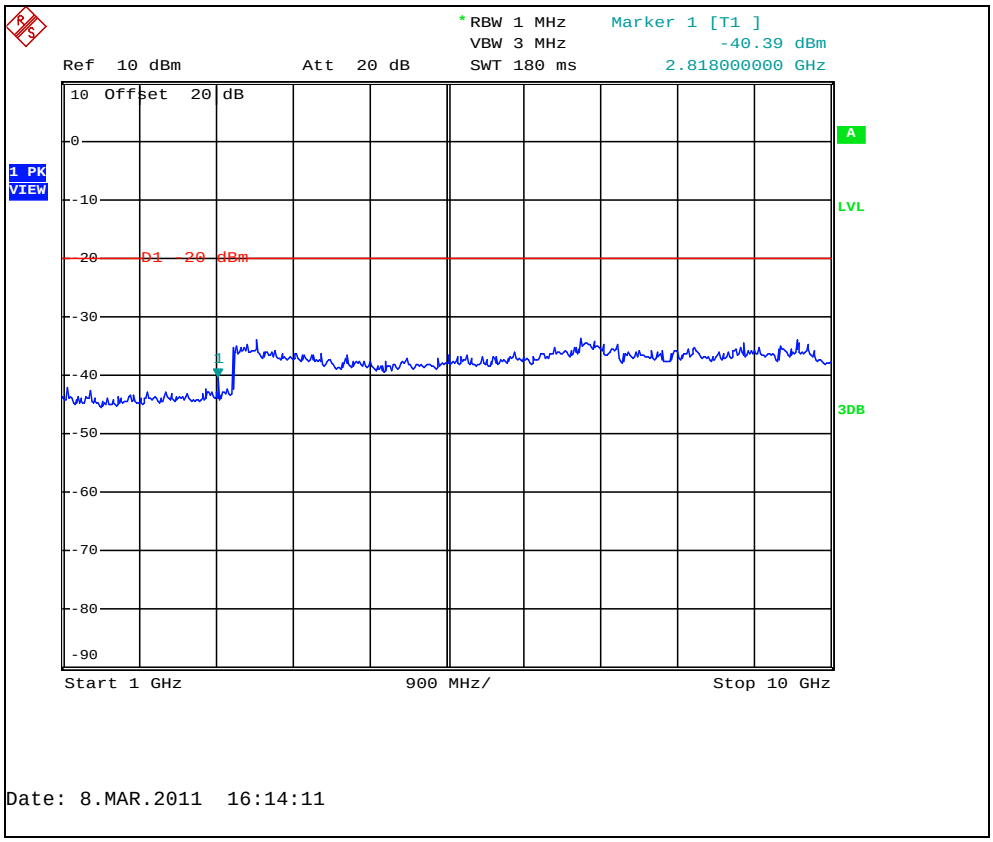

Figure 7.3.2-14: 941.4875 MHz – 1GHz to 10GHz

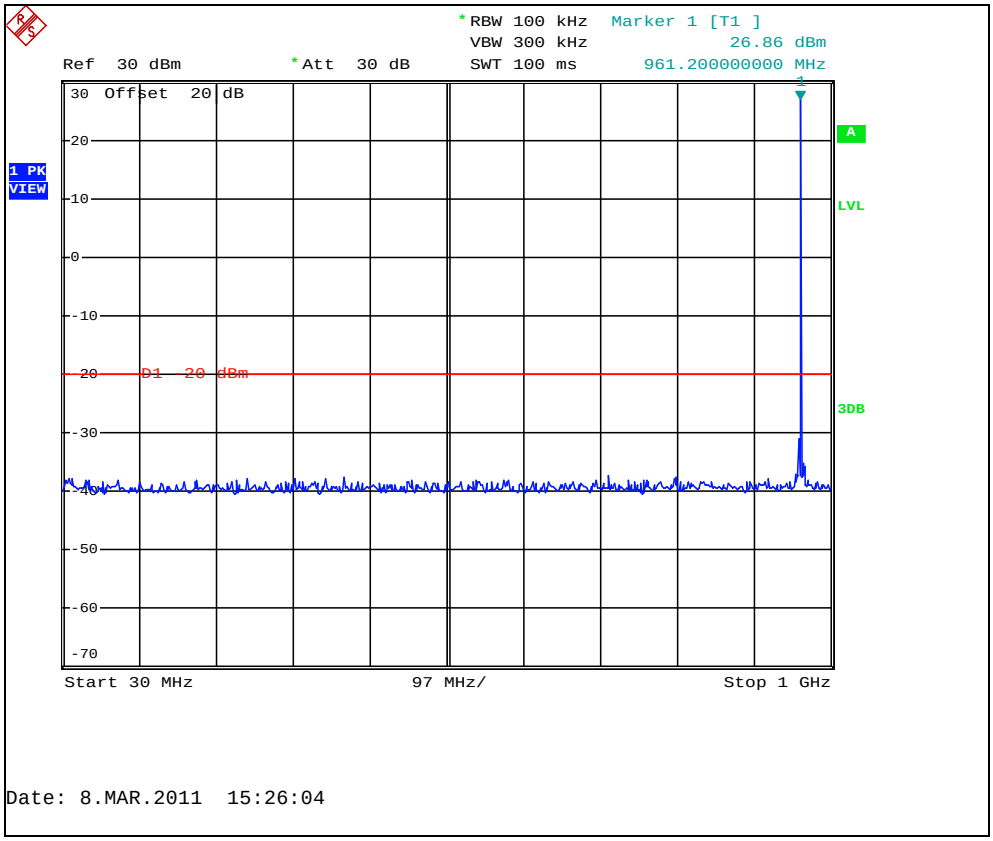

Figure 7.3.2-15: 959.925 MHz – 30MHz to 1GHz

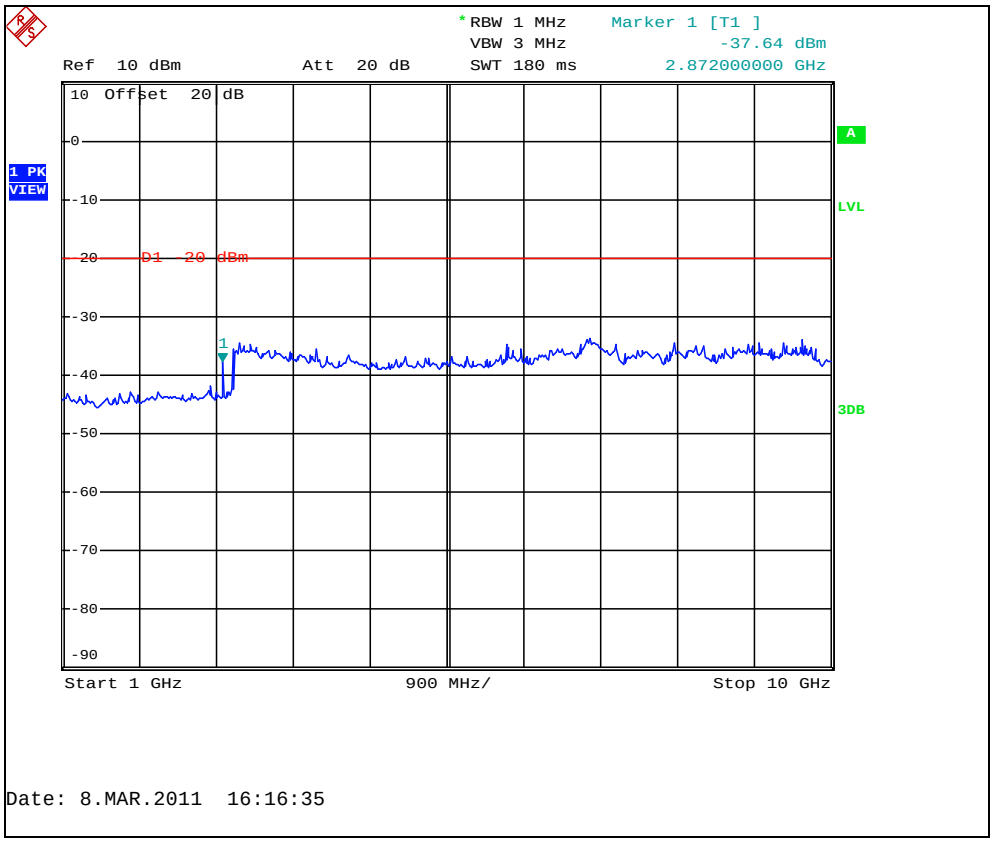

Figure 7.3.2-16: 959.925 MHz – 1GHz to 10GHz

7.4 Frequency Stability

7.4.1 Measurement Procedure

The equipment under test is placed inside an environmental chamber. The RF output is directly coupled to the input of the measurement equipment and a power supply is attached to the primary supply voltage.

Frequency measurements were made at the extremes of the of temperature range -30º C to +50º C and at intervals of 10º C at normal supply voltage. A period of time sufficient to stabilize all components of the equipment was allowed at each frequency measurement. At a temperature 20º C the supply voltage was varied to the battery endpoint voltage. The maximum variation of frequency was recorded.

Data was collected at a frequency within each Rule Part with the most stringent limit from all rule parts applied. Results of the test are shown below in Figures 7.4.2-1 through 7.4.2-3.

7.4.2 Measurement Results

PART 24.135, IC RSS-134 (7)

Frequency Stability

Frequency (MHz): 930.5
Deviation Limit (PPM): 1ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**930.500348**	**0.374**	100%	3.60
-20 C	**930.500139**	**0.149**	100%	3.60
-10 C	**930.500066**	**0.071**	100%	3.60
0 C	**930.499983**	**-0.018**	100%	3.60
10 C	**930.499965**	**-0.038**	100%	3.60
20 C	**930.499998**	**-0.002**	100%	3.60
30 C	**930.500115**	**0.124**	100%	3.60
40 C	**930.500314**	**0.337**	100%	3.60
50 C	**930.500402**	**0.432**	100%	3.60
20 C	**930.500066**	**0.071**	End Point	3.060

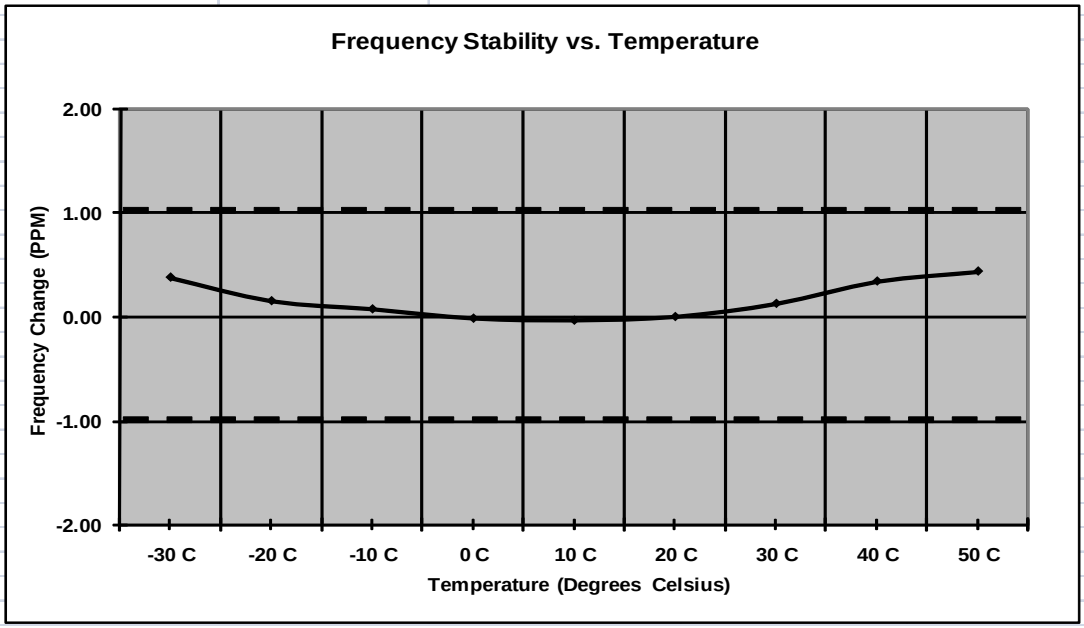

Figure 7.4.2-1: Frequency Stability – 930.5MHz

PART 90.213, RSS-119 5.3

Frequency Stability

Frequency (MHz): 896.0125
Deviation Limit (PPM): 1ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**896.012849**	**0.390**	100%	3.60
-20 C	**896.012691**	**0.213**	100%	3.60
-10 C	**896.012588**	**0.098**	100%	3.60
0 C	**896.012522**	**0.025**	100%	3.60
10 C	**896.012504**	**0.004**	100%	3.60
20 C	**896.012498**	**-0.002**	100%	3.60
30 C	**896.012634**	**0.150**	100%	3.60
40 C	**896.012853**	**0.394**	100%	3.60
50 C	**896.012927**	**0.477**	100%	3.60
20 C	**896.012606**	**0.118**	End Point	3.060

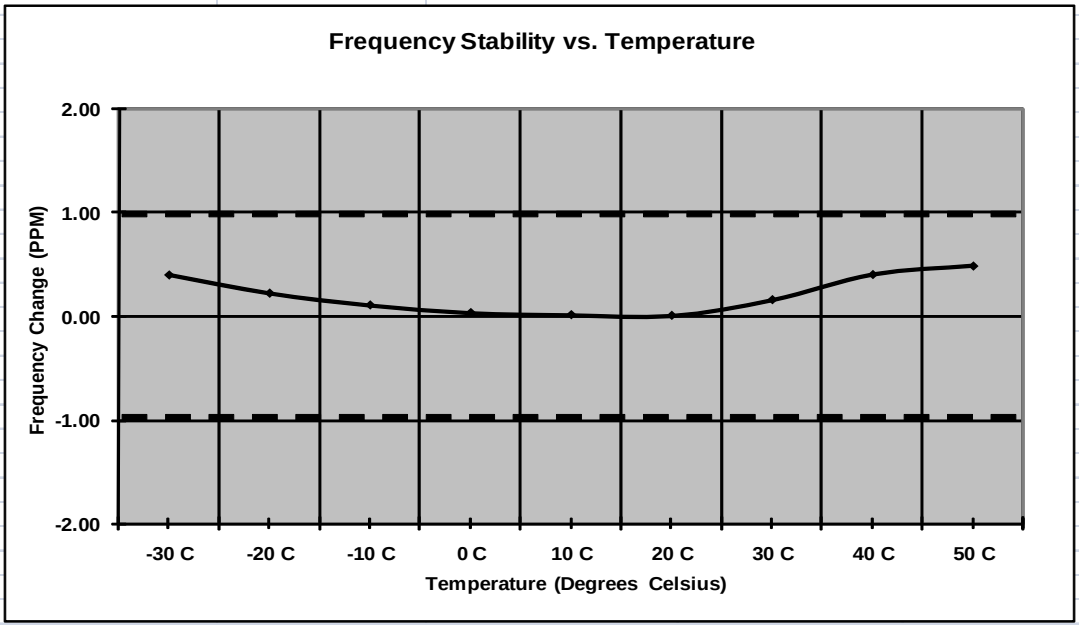

Figure 7.4.2-2: Frequency Stability – 896.0125 MHz

PART 101.107, RSS-119 5.3

Frequency Stability

Frequency (MHz): 959.925
Deviation Limit (PPM): 1ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**959.925312**	**0.325**	100%	3.60
-20 C	**959.925096**	**0.100**	100%	3.60
-10 C	**959.925030**	**0.031**	100%	3.60
0 C	**959.924955**	**-0.047**	100%	3.60
10 C	**959.924931**	**-0.072**	100%	3.60
20 C	**959.924962**	**-0.040**	100%	3.60
30 C	**959.925095**	**0.099**	100%	3.60
40 C	**959.925270**	**0.281**	100%	3.60
50 C	**959.925376**	**0.392**	100%	3.60
20 C	**959.924998**	**-0.002**	85%	3.060

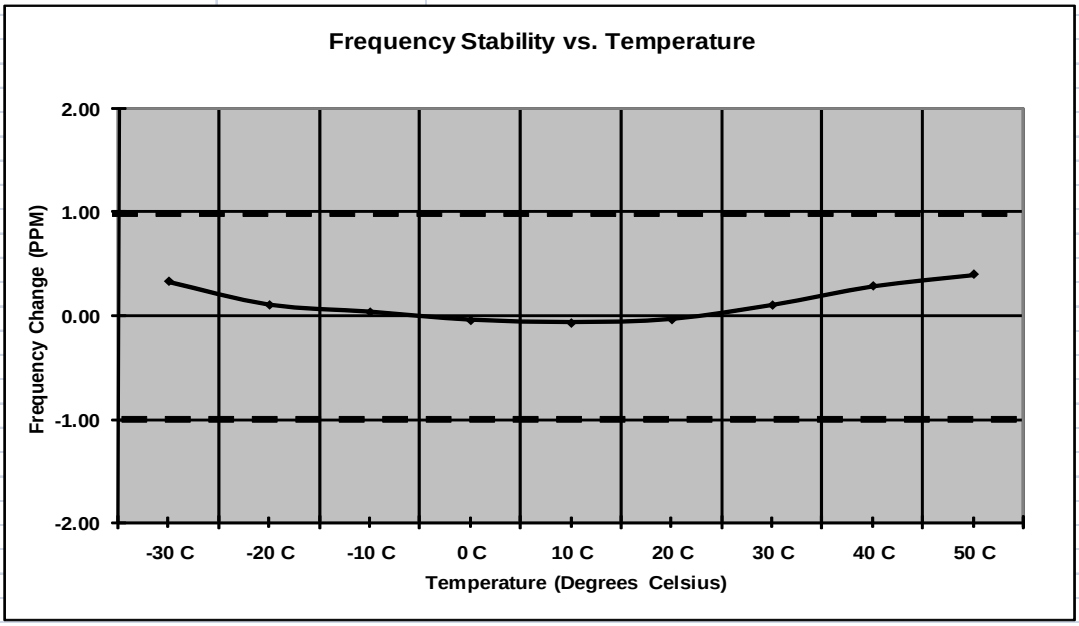

Figure 7.4.2-3: Frequency Stability – 959.925 MHz

8.0 CONCLUSION

In the opinion of ACS, Inc. model RGS10 meets all the requirements of FCC Part 24, 90, and 101 as well as IC RSS-119 and RSS-134 as applicable.

End Report