Excellence in Compliance Testing

Certification Test Report

FCC ID: SDBUSBXCVR
IC: 2220A-USBXCVR

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

ACS Report Number: 08-0039-LD

Manufacturer: Sensus Metering Systems
Model: USBXCVR

Test Begin Date: February 05, 2008
Test End Date: February 08, 2008

Report Issue Date: June 30, 2008

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report is not be used to claim certification, approval, or endorsement by NVLAP, NIST or any government agency.

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This report contains 40 pages

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1.0 GENERAL

1.1 Purpose
The purpose of this report is to demonstrate compliance with Part 2 Subpart J, 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 RSS-134.

1.2 Product Description
The USBXCVR is a compatible USB device for use within a 2-way fixed AMR network where RF modules communicate directly to base stations or other endpoint modules. The USBXCVR is used to remotely communicate to endpoint devices and send setup or status commands.

Only the USB Micro- Transceiver model USBXCVR is included in this report. A separate filing will be made for any other models that may be described in the documentation accompanying this report.

Manufacturer Information:
Sensus Metering Systems
8601 six forks Road
Raleigh, NC 27615

Factory Contact:
Bob Davis
Sensus Metering Systems
114 Northpark Blvd
Suite 10
Covington, LA 70433
985-773-1236

Test Sample Serial Numbers: 1021 (RF conducted), 1028 (radiated & AC power line conducted)

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

Detailed photographs of the EUT are filed separately with this filing.

1.3 Test Methodology and Configurations

1.3.1 Test Configurations and Justification
For RF conducted measurements, the USBXCVR was modified with an external RF connector to the PCB. The USBXCVR utilizes non-detachable antennas 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.

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 USBXCVR 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 / IC Radio Standards Specification	Frequency Band of Operation (MHz)
24D / RSS-134	901.0 - 902.0
24D / RSS-134	930.0 - 931.0
24D / RSS-134	940.0 - 941.0
90 / RSS-119	896.0 - 901.0
90 / RSS-119	935.0 - 940.0
101 / RSS-119	928.85 - 929.0
101 / RSS-119	932.0 - 932.5
101 / RSS-119	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 bands of operation is outlined in the following table.

CFR Title 47 Rule Part / IC Radio Standards Specification	Frequency Band of Operation (MHz)	Location in the Range of Operation
90 / RSS-119	896.0 - 901.0	1 near top and 1 near bottom
24D / RSS-134	901.0 - 902.0	
101 / RSS-119	928.85 - 929.0	Middle
24D / RSS-134	930.0 - 931.0	Middle
101 / RSS-119	932.0 - 932.5	Middle
90 / RSS-119	935.0 - 940.0	1 near top and 1 near bottom
24D / RSS-134	940.0 - 941.0	
101 / RSS-119	941.0 - 941.5	
101	959.85 - 960.0	Middle

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

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

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. In addition, ACS is compliant to ISO 17025 as certified by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 894540
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831
- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

NVLAP Lab Code: 200612-0

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

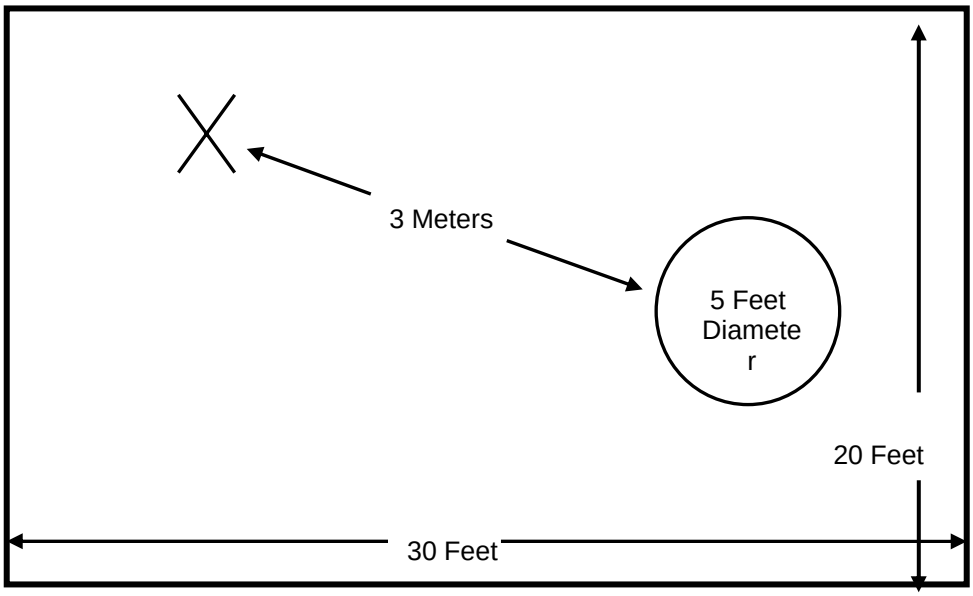

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

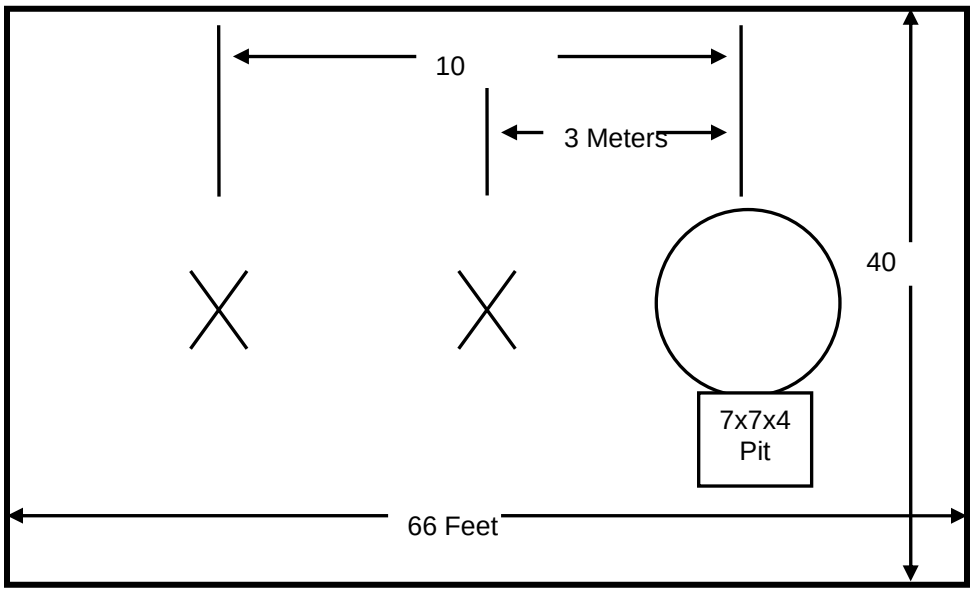

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal group reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

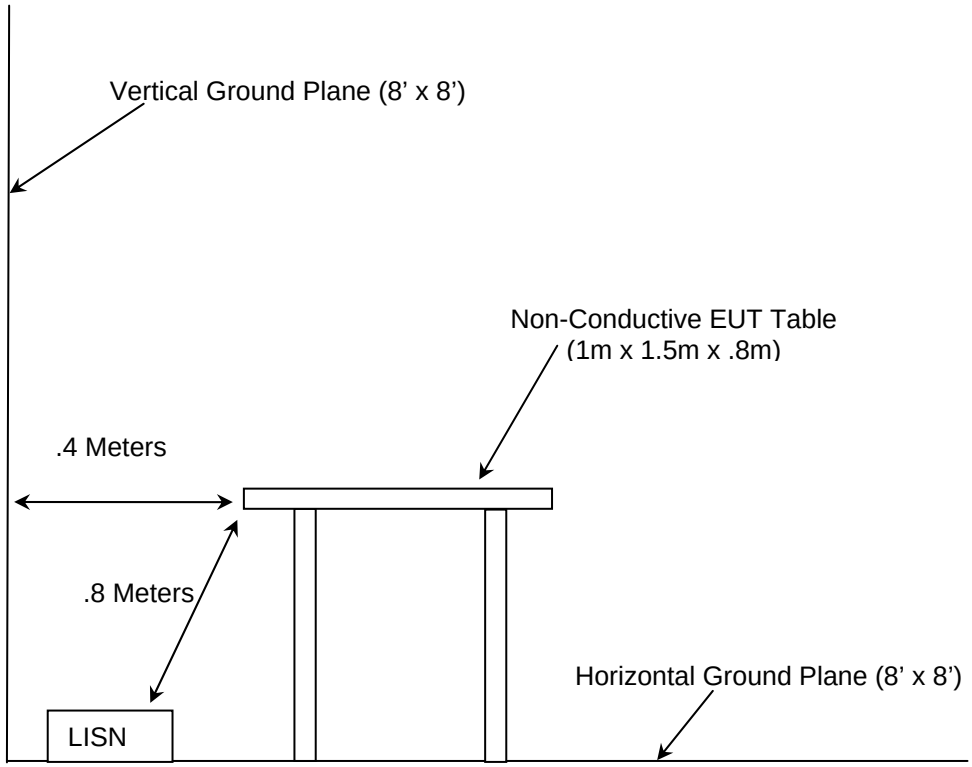

Figure 2.4-1: AC Mains Conducted EMI Site

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 - 2007
3 - US Code of Federal Regulations (CFR): Title 47, Part 24, Subpart D: Personal Communication Service - 2007
4 - US Code of Federal Regulations (CFR): Title 47, Part 90, Subpart I: Private Land Mobile Radio Services - 2007
5 - US Code of Federal Regulations (CFR): Title 47, Part 101, Subpart C: Fixed Microwave Services – 2007
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 9, June 2007
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

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
1	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	833771/007	10-26-2008
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	10-26-2008
16	ACS	Cables	Cable	16	05-21-2008
22	Agilent	Amplifiers	8449B	3008A00526	04-10-2008
25	Chase	Antennas	CBL6111	1043	06-06-2008
30	Spectrum Technologies	Antennas	DRH-0118	970102	05-10-2008
40	EMCO	Antennas	3104	3211	01-10-2009
41	Electro-Metrics	Antennas	BIA-25	2925	05-29-2008
70	Rohde & Schwarz	Spectrum Analyzers	ESH-3	879676/050	10-24-2008
78	EMCO	Antennas	6502	9104-2608	01-15-2009
90	Electro-Metrics	Antennas	LPA25	1476	05-23-2008
140	Thermotron	Environmental Chamber	SM-16C	19639	08-30-2008
144	Omega	Climate Monitoring Equipment	RH4111	H0103373	11-29-2008
152	EMCO	LISN	Feb-25	9111-1905	02-20-2008
153	EMCO	LISN	Feb-25	9411-2268	11-27-2008
167	ACS	Cables	Chamber EMI Cable Set	167	01-04-2009
168	Hewlett Packard	Attenuators	11947A	44829	03-13-2008
222	Andrew	Cables	F1-SMSM	473703-A0138A	08-27-2008
277	Emco	Antennas	93146	9904-5199	06-18-2008
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	11-09-2008
291	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	None	11-21-2008
292	Florida RF Cables	Cables	SMR-290AW-480.0-SMR	None	11-21-2008
321	Hewlett Packard	Amplifiers	HPC 8447D	1937A02809	07-17-2008
329	A.H.Systems	Antennas	SAS-571	721	08-13-2008
331	Microwave Circuits	Filters	H1G513G1	31417	03-24-2008
338	Hewlett Packard	Amplifiers	8449B	3008A01111	10-24-2008
339	Aeroflex/Weinschel	Attenuators	AS-18	7142	08-20-2008

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	EUT	Sensus	USBXCVR	1028
2	Notebook PC	Dell	Latitude D610	CN-0D4571-48643-61Q-8314
3	Power adaptor	Dell	DA65NS0-00	CN-OCF745-48661-63C-4Z2Y
4	USB flash drive	Memorex	MX0023	N/A

6.0 EQUIPMENT UNDER TEST SETUP AND BLOCK DIAGRAM

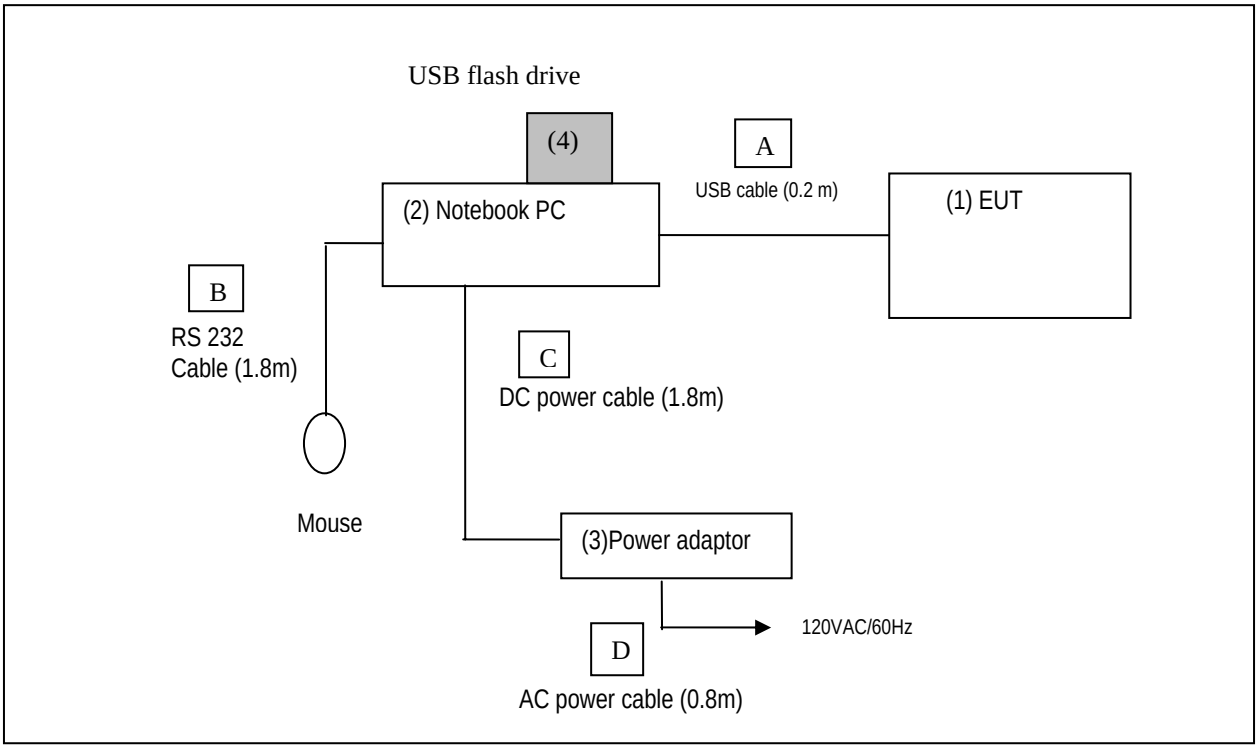

Figure 6-1: EUT Test Setup (Radiated & AC power line conducted)

Table 6-1: Cable Descriptions

Item number	Name/Type	Length (Meter)	Shielded Yes/No
A	Integral USB cable	0.2	No
B	RS-232 cable	1.8	No
C	DC power cable	1.8	No
D	AC power cable	0.8	No

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

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 10 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)	Rule Section (FCC / IC)	Output Power (dBm)
901.9875	Part 24.132 / RSS-134 5.4(a)	17.11
930.5000	Part 24.132 / RSS-134 5.4(a)	17.42
896.0125	Part 90.635(d) / RSS-119 5.41	16.98
935.0125	Part 90.635(d) / RSS-119 5.41	17.38
928.9250	Part 101.113(a) / RSS-119 5.41	17.44
932.2500	Part 101.113(a) / RSS-119 5.41	17.40
941.4875	Part 101.113(a) / RSS-119 5.41	17.27
959.9250	Part 101.113(a) / RSS-119 5.41	16.79

Part 24.132 / RSS-134 5.4(a)

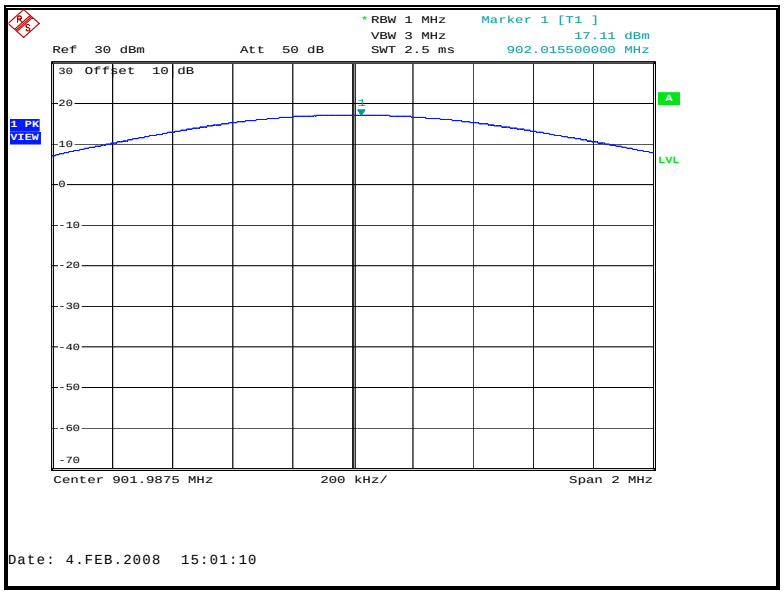

Figure 7.1.2-1: Peak Output Power 901.9875 MHz

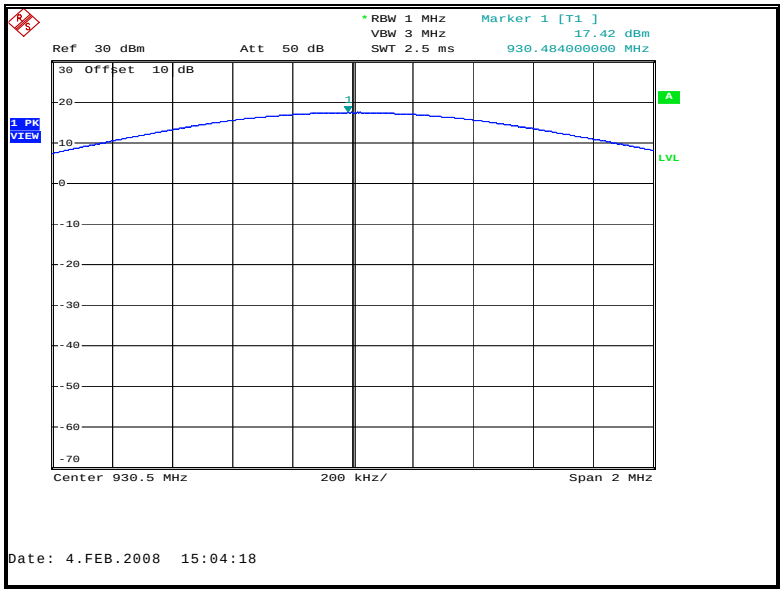

Figure 7.1.2-2: Peak Output Power 930.5 MHz

Part 90.635(d) / RSS-119 5.41

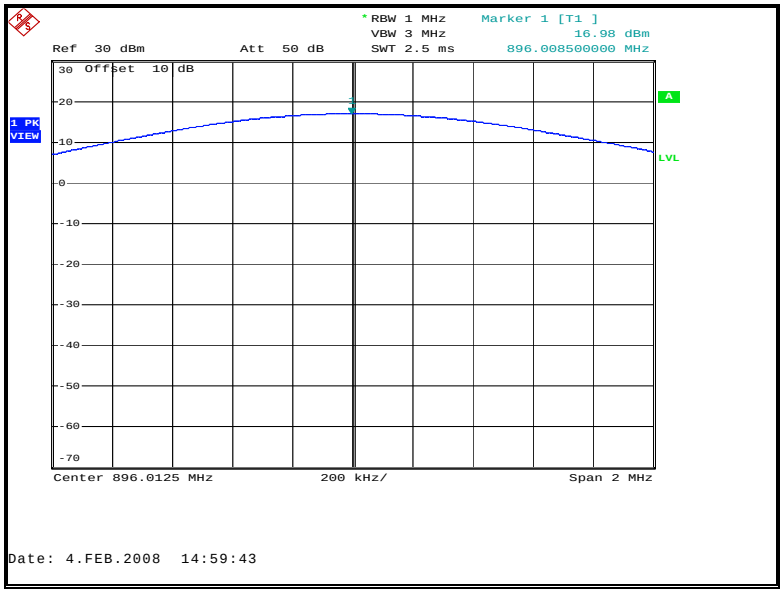

Figure 7.1.2-3: Peak Output Power 896.0125 MHz

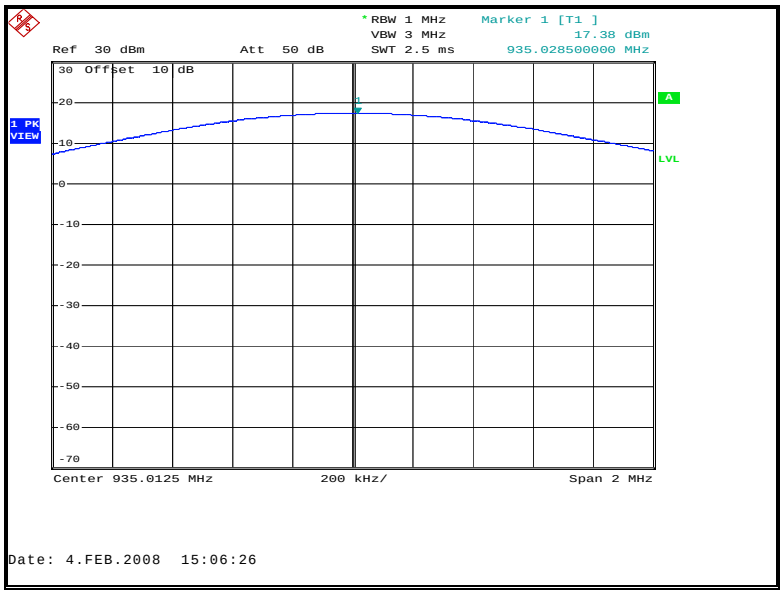

Figure 7.1.2-4: Peak Output Power 935.0125 MHz

Part 101.113(a) / RSS-119 5.41

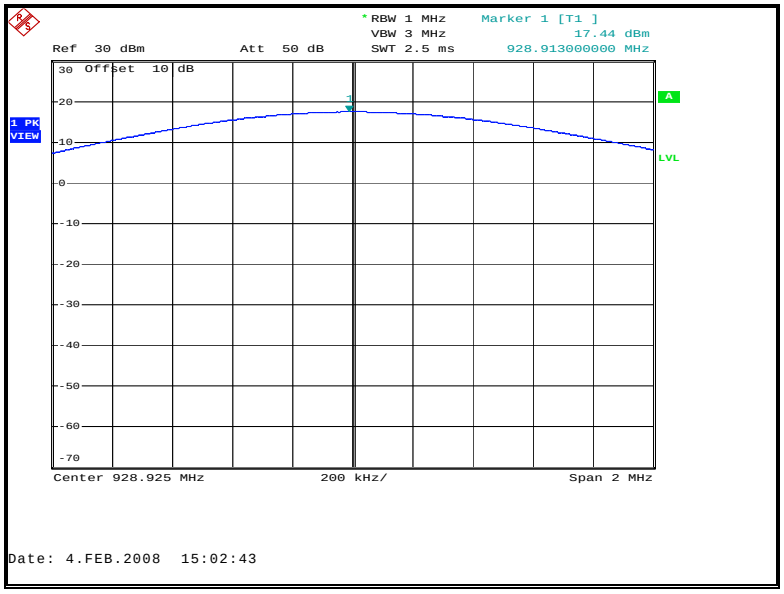

Figure 7.1.2-5: Peak Output Power 928.925 MHz

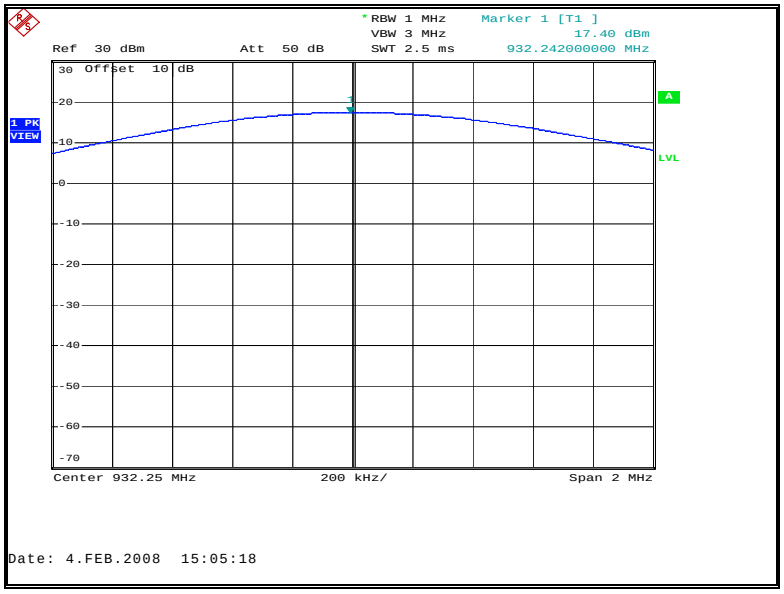

Figure 7.1.2-6: Peak Output Power 932.25 MHz

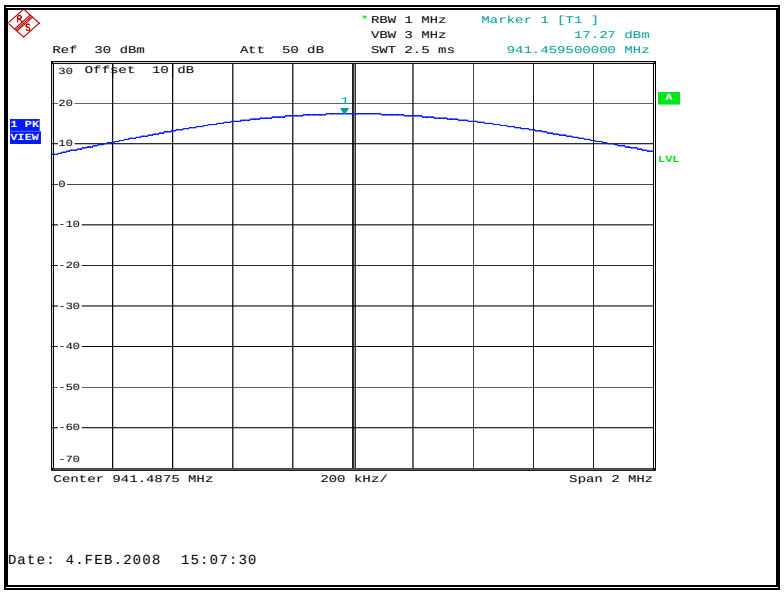

Figure 7.1.2-7: Peak Output Power 941.4875 MHz

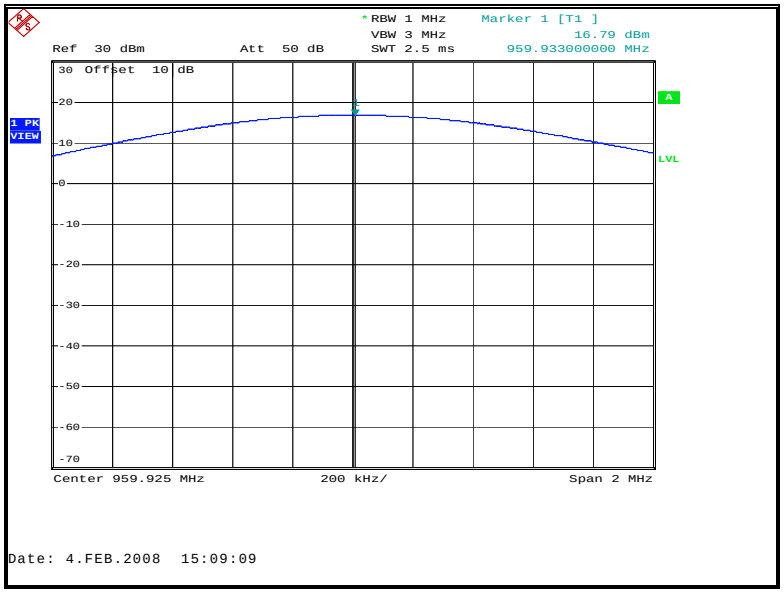

Figure 7.1.2-8: Peak Output Power 959.925 MHz

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 10 dB passive attenuator. The spectrum analyzer resolution and video bandwidths were set to 300 Hz and 3 kHz respectively. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. Results are shown below in Figures 7.2.2-1 through 7.2.2-10.

7.2.2 Measurement Results

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

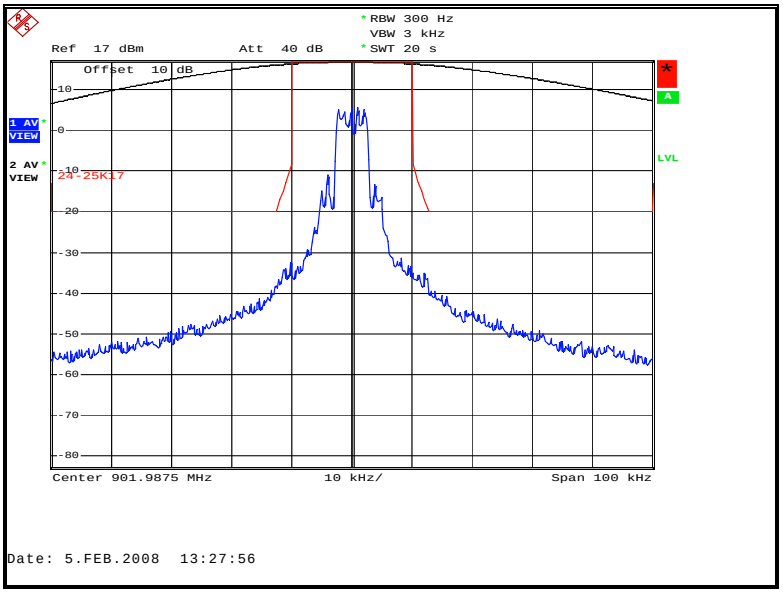

Figure 7.2.2-1: Emission Limits - 901.9875 MHz – 25 kHz Channel

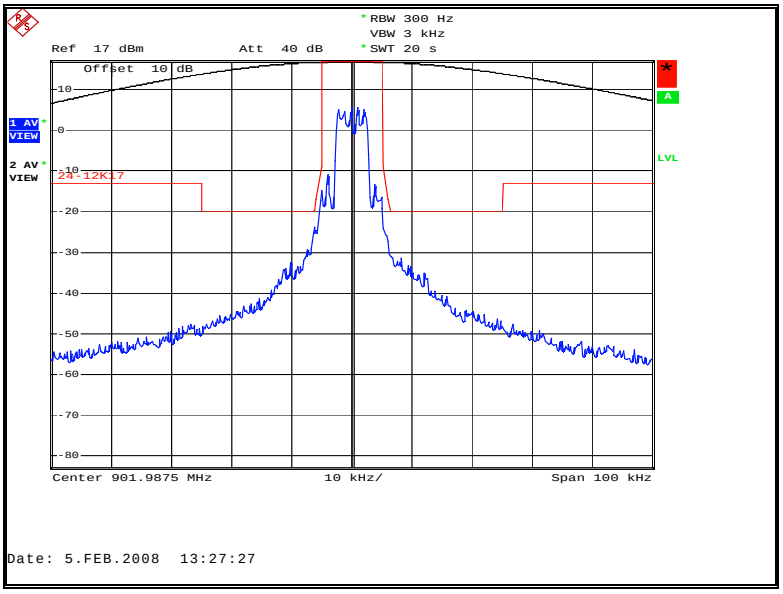

Figure 7.2.2-2: Emission Limits – 901.9875 MHz – 12.5 kHz Channel

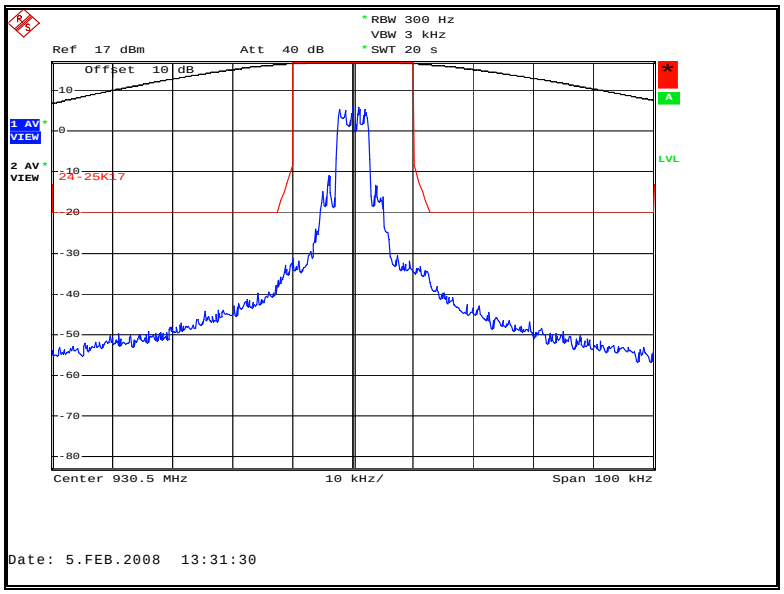

Figure 7.2.2-3: Emission Limits – 930.5 MHz – 25 kHz Channel

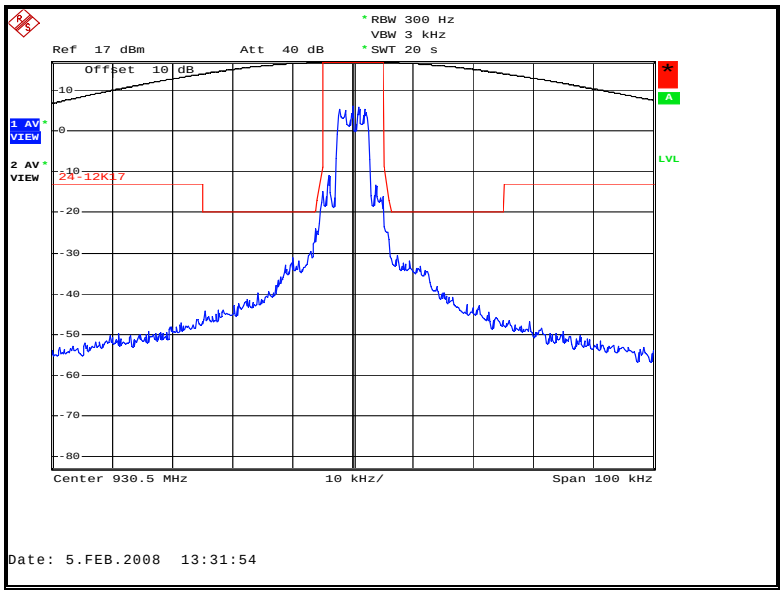

Figure 7.2.2-4: Emission Limits – 930.5 MHz – 12.5 kHz Channel

Part 90.210 (j), RSS-119 5.8.8

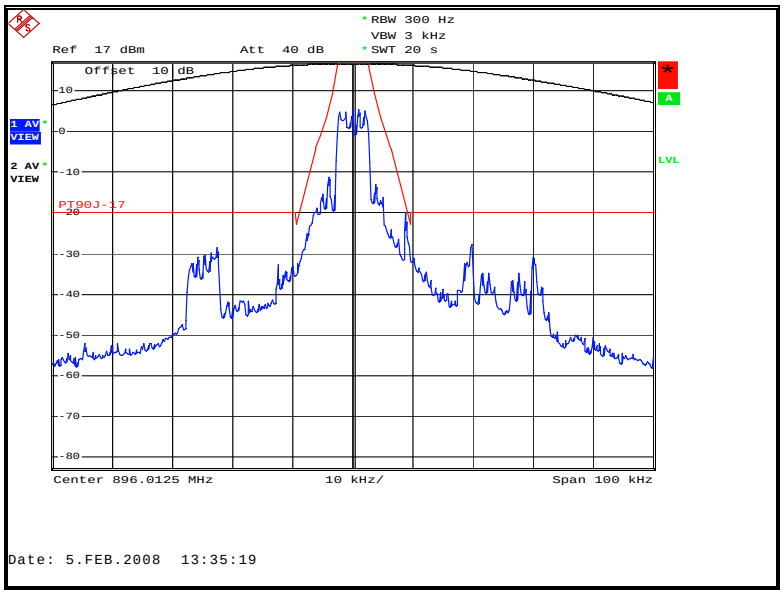

Figure 7.2.2-5: Emission Limits – 896.0125 MHz

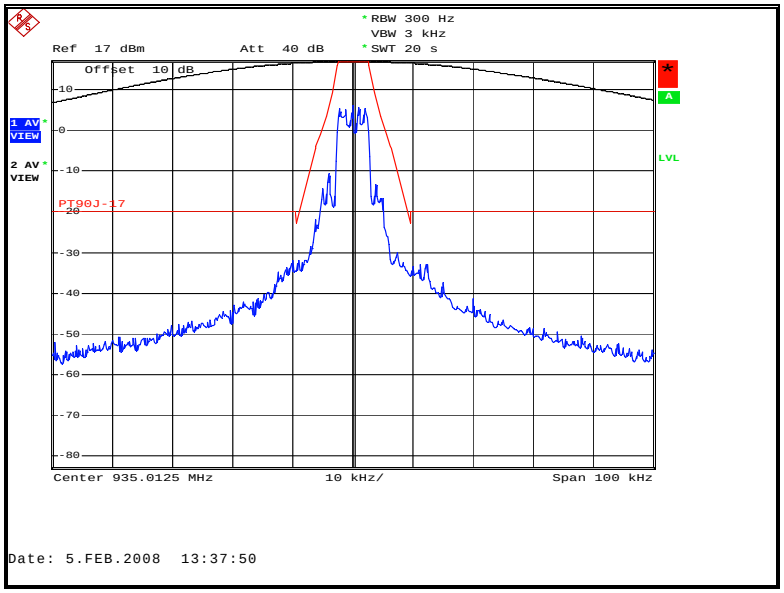

Figure 7.2.2-6: Emission Limits – 935.0125 MHz

Part 101.111 a(6), RSS-119 5.8.6*

*** FCC Part 101.111a(6) provides worst case**

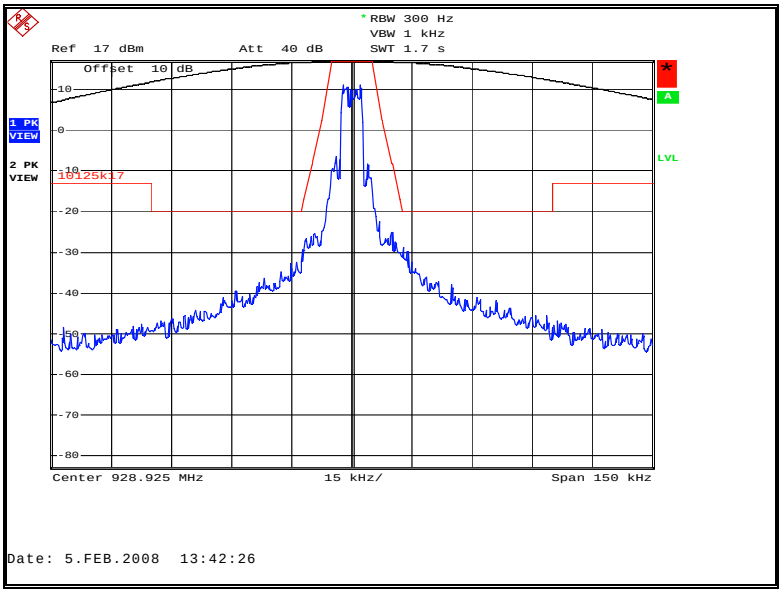

Figure 7.2.2-7: Emission Limits – 928.925 MHz

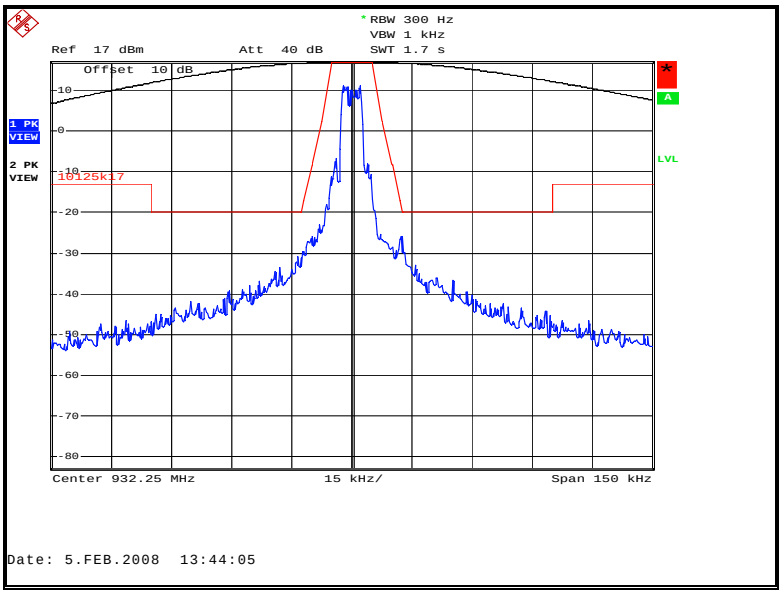

Figure 7.2.2-8: Emission Limits – 932.25 MHz

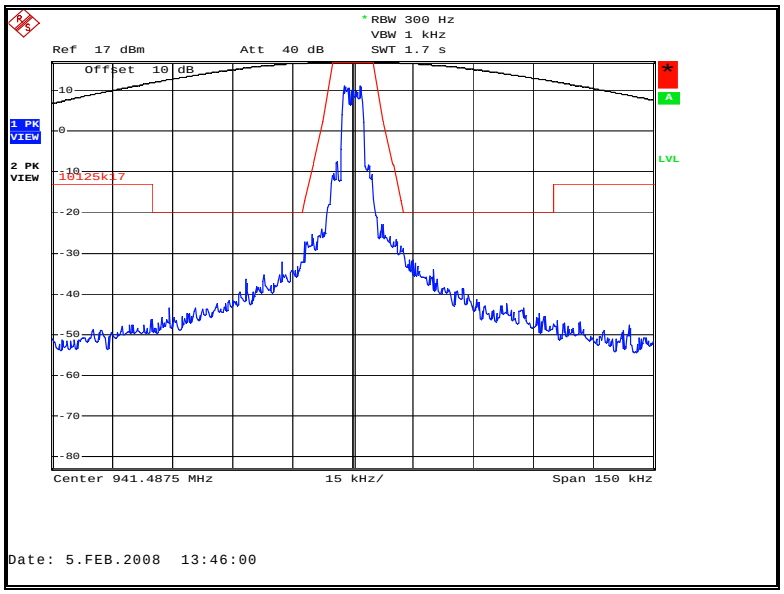

Figure 7.2.2-9: Emission Limits – 941.4875 MHz

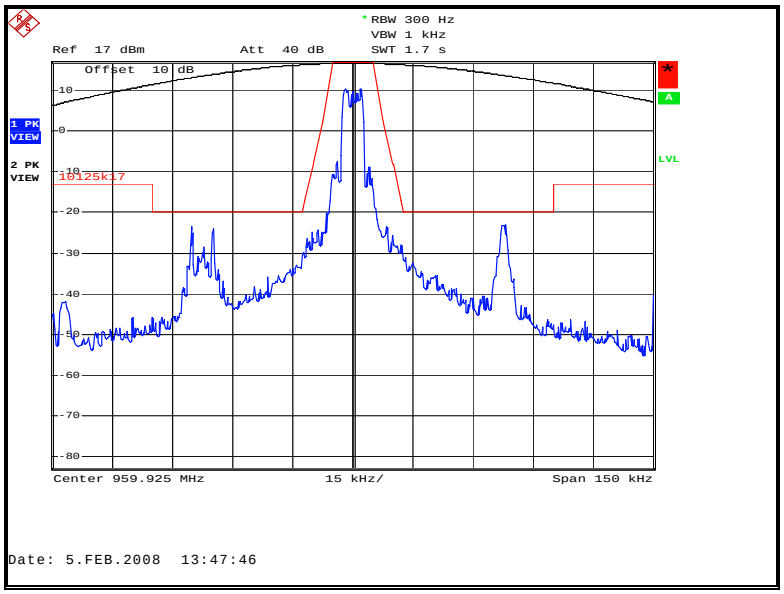

Figure 7.2.2-10: Emission Limits – 959.925 MHz

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 10 dB passive attenuator. 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. Measurement results are shown below in Figures 7.3.2-1 through 7.3.2.16.

7.3.2 Measurement Results

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

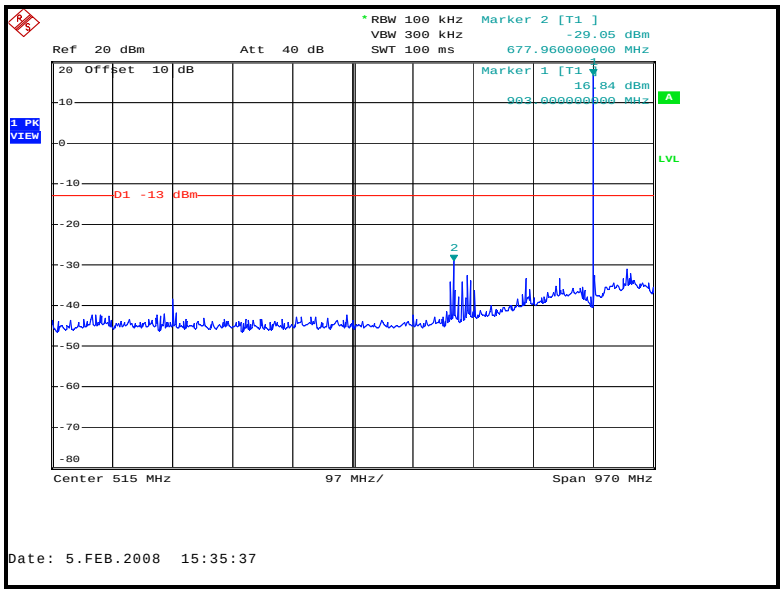

Figure 7.3.2-1: Conducted Spurious Emissions – 901.9875 MHz – 30MHz to 1GHz

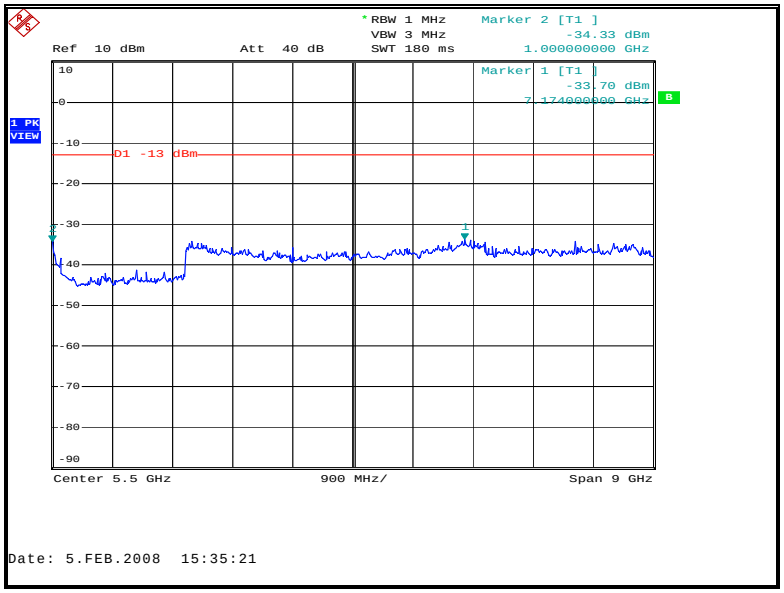

Figure 7.3.2-2: Conducted Spurious – 901.9875 MHz – 1GHz to 10GHz

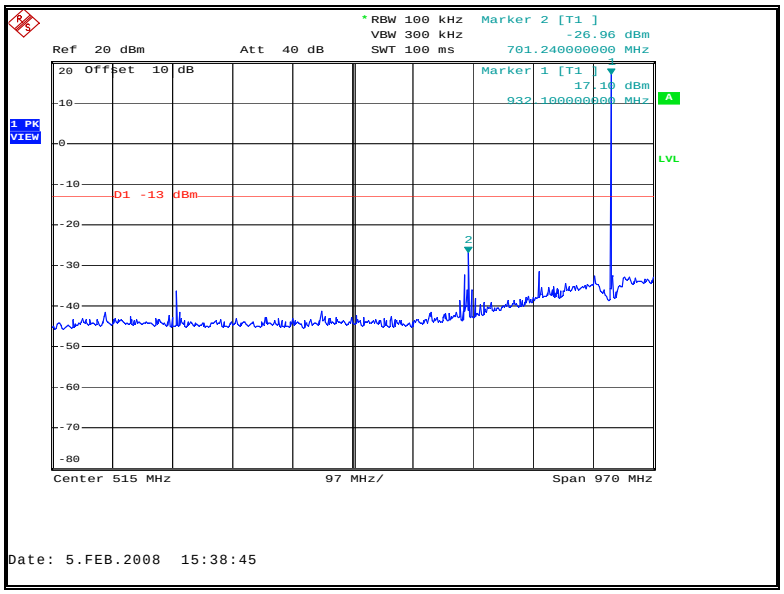

Figure 7.3.2-3: Conducted Spurious Emissions – 930.5 MHz – 30MHz to 1GHz

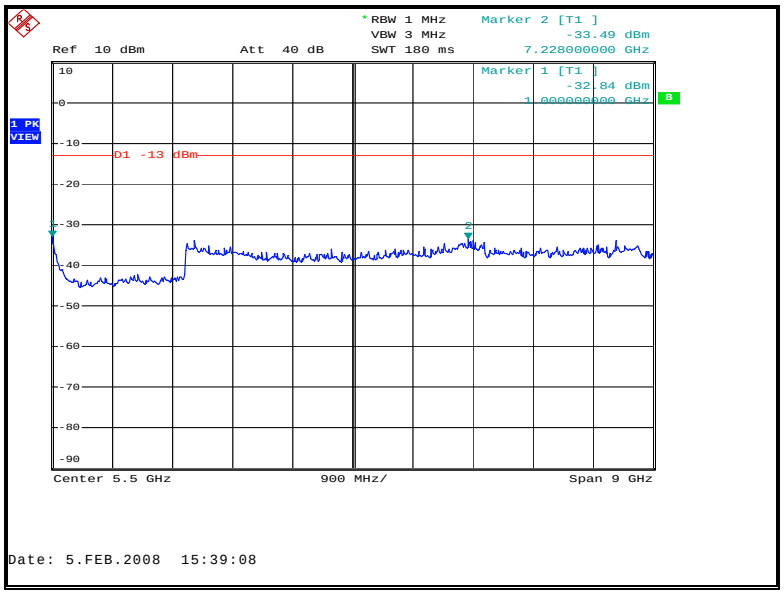

Figure 7.3.2-4: Conducted Spurious Emissions – 930.5 MHz – 1GHz to 10GHz

Part 90.210 (j), RSS-119 5.8.8

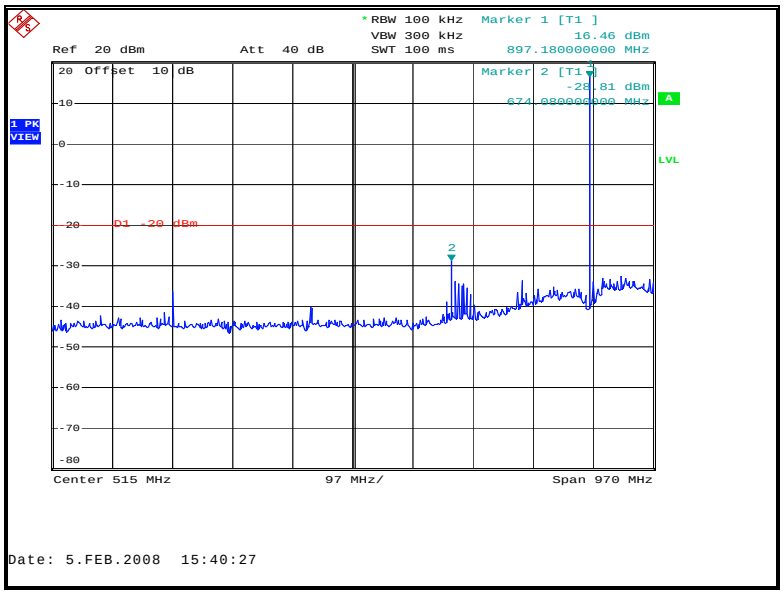

Figure 7.3.2-5: Conducted Spurious Emissions – 896.0125 MHz – 30MHz to 1GHz

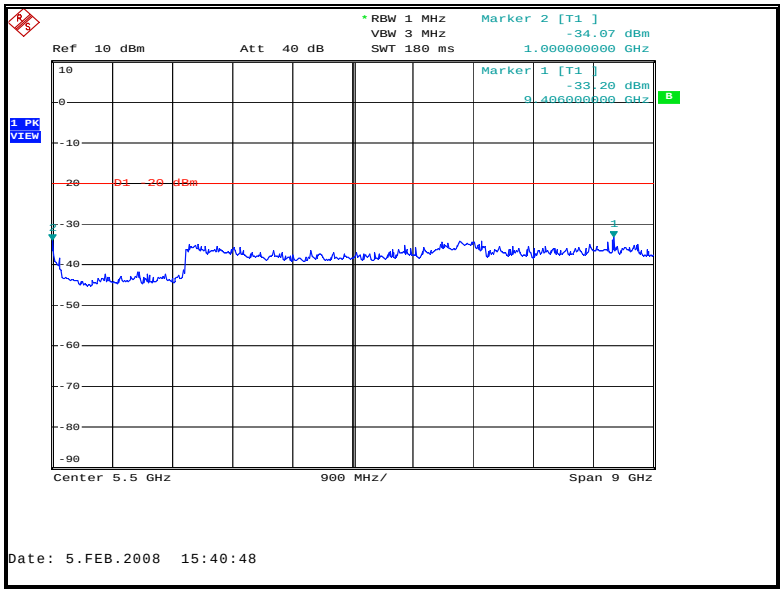

Figure 7.3.2-6: Conducted Spurious Emissions – 896.0125 MHz – 1GHz to 10GHz

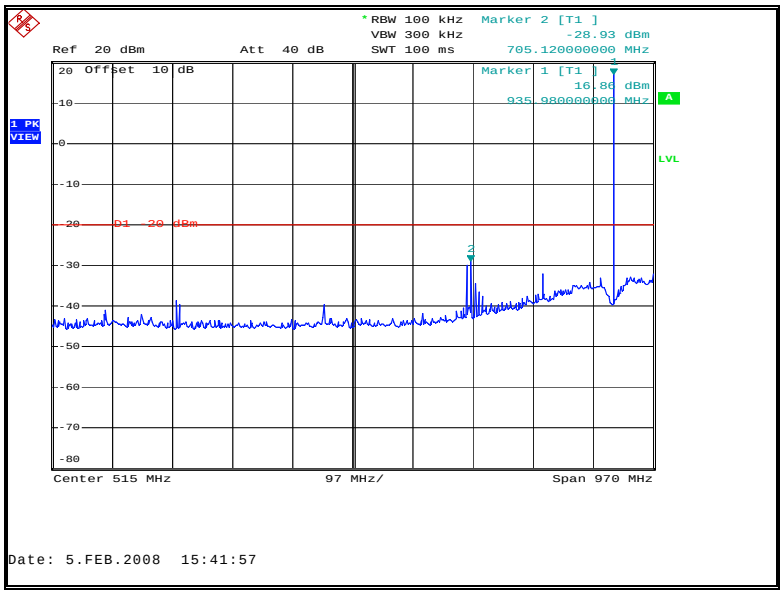

Figure 7.3.2-7: Conducted Spurious Emissions – 935.0125 MHz – 30MHz to 1GHz

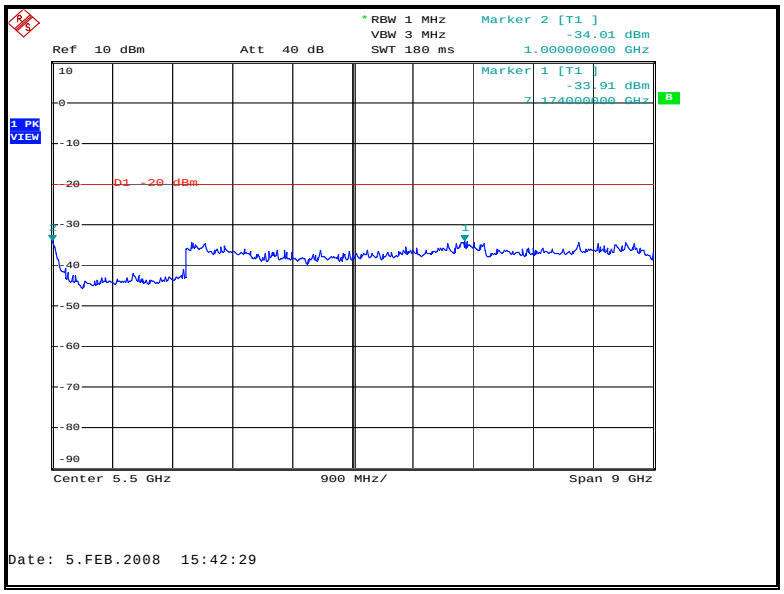

Figure 7.3.2-8: Conducted Spurious Emissions – 935.0125 MHz – 1GHz to 10GHz

Part 101.111 a(6), RSS-119 5.8.6

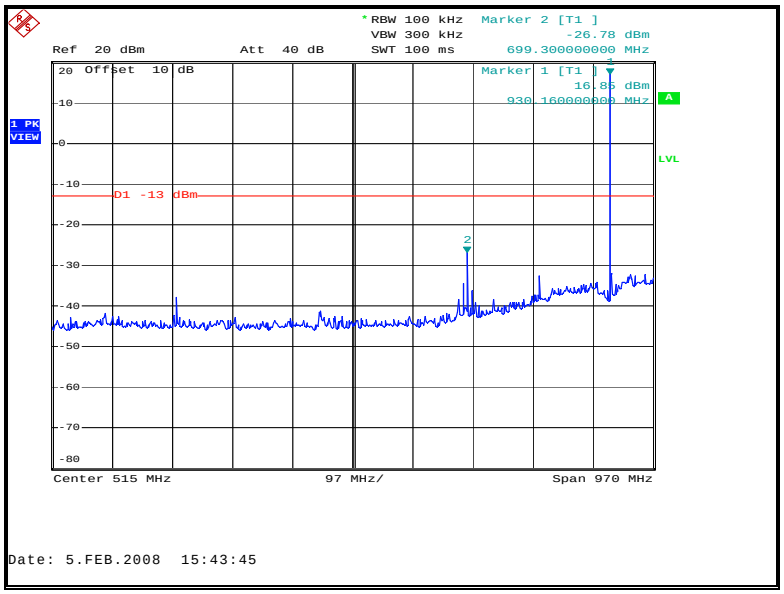

Figure 7.3.2-9: Conducted Spurious Emissions – 928.925 MHz – 30MHz to 1GHz

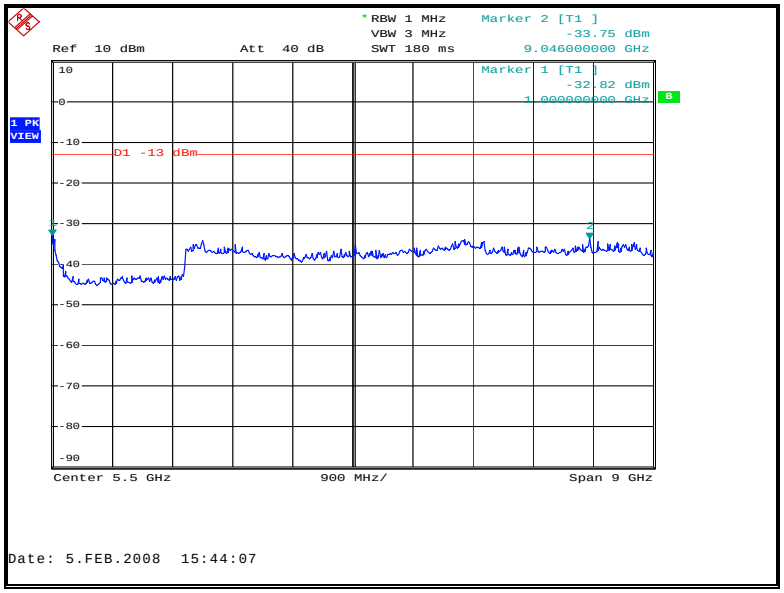

Figure 7.3.2-10: Conducted Spurious Emissions – 928.925 MHz – 1GHz to 10GHz

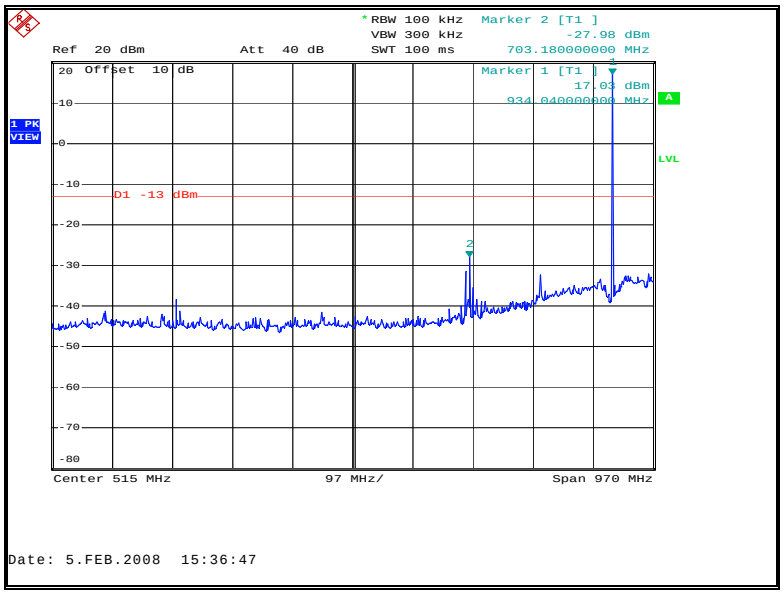

Figure 7.3.2-11: Conducted Spurious Emissions – 932.25 MHz – 30MHz to 1GHz

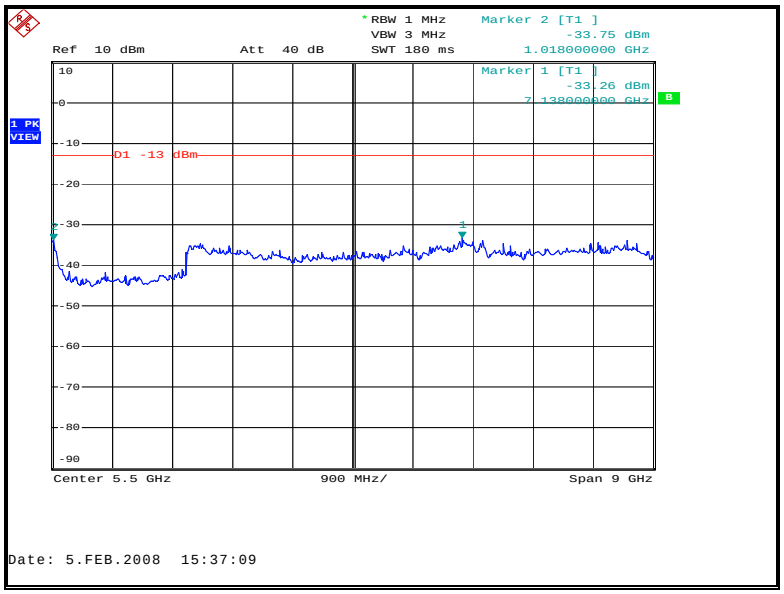

Figure 7.3.2-12: Conducted Spurious Emissions – 932.25 MHz – 1GHz to 10GHz

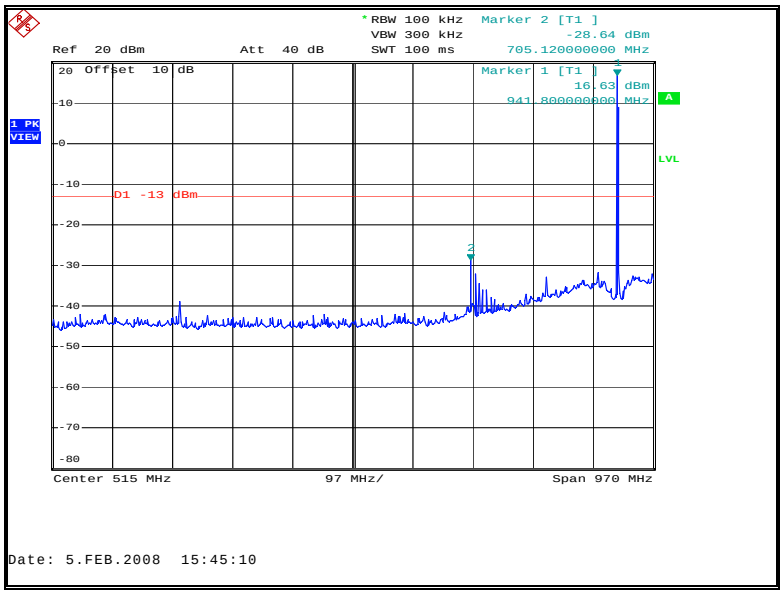

Figure 7.3.2-13: Conducted Spurious Emissions – 941.4875 MHz – 30MHz to 1GHz

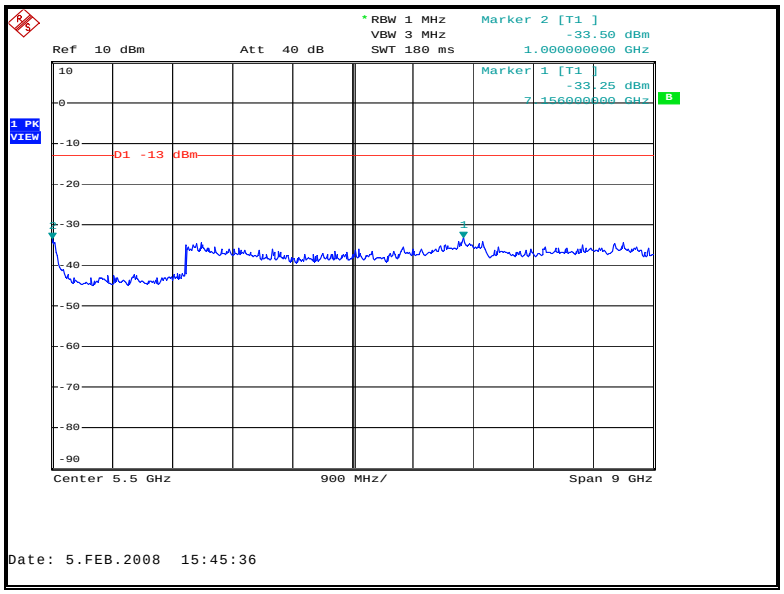

Figure 7.3.2-14: Conducted Spurious Emissions – 941.4875 MHz – 1GHz to 10GHz

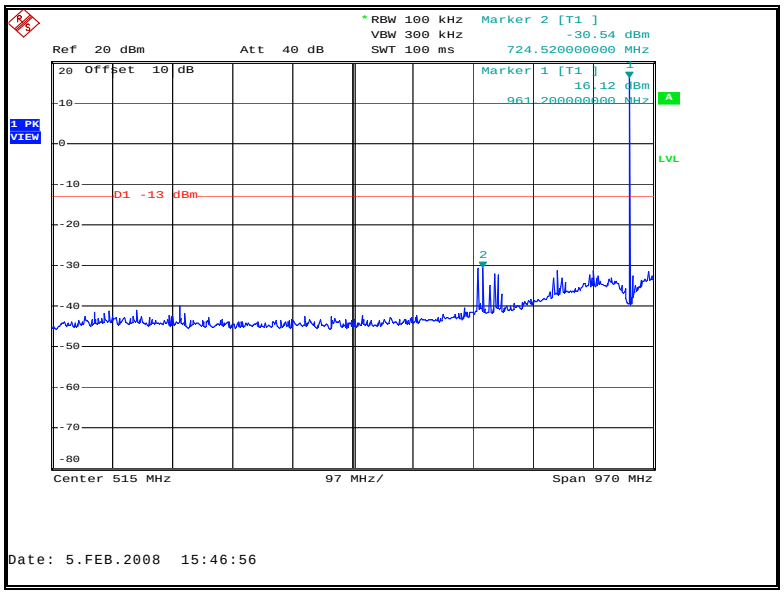

Figure 7.3.2-15: Conducted Spurious Emissions – 959.925 MHz – 30MHz to 1GHz

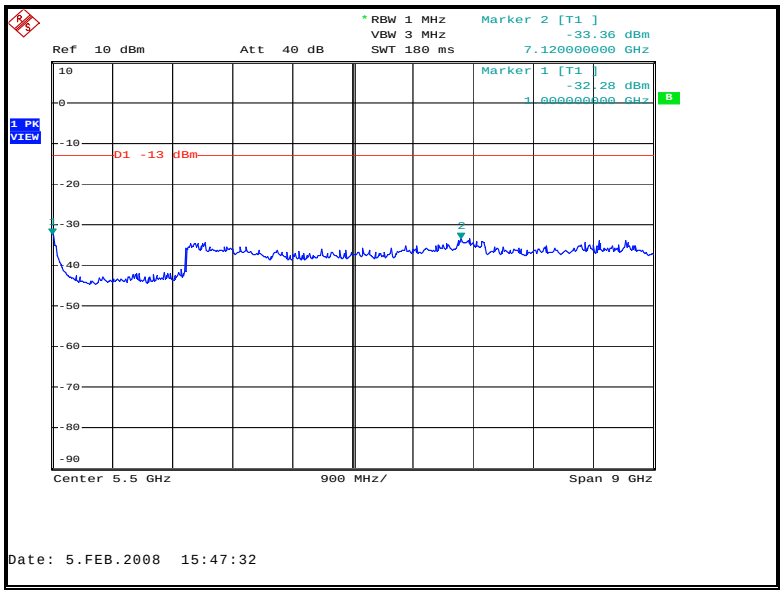

Figure 7.3.2-16: Conducted Spurious Emissions – 959.925 MHz – 1GHz to 10GHz

7.4 Field Strength of Spurious Emissions

7.4.1 Measurement Procedure

The equipment under test is placed in the Semi-Anechoic Chamber (described in section 2.3.1) on a wooden table at the turntable center. For each spurious emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360º and the maximum reading on the spectrum analyzer is recorded. This was repeated for both horizontal and vertical polarizations of the receive antenna.

The equipment under test is then replaced with a substitution antenna fed by a signal generator. The signal generator's frequency is set to that of the spurious emission recorded from the equipment under test. The antenna mast is raised and lowered from one (1) to four (4) meters to obtain a maximum reading on the spectrum analyzer. The output of the signal generator is then adjusted until the reading on the spectrum analyzer matches that obtained from the equipment under test. The signal generator level is recorded. The power in dBm of each spurious emission is calculated by correcting the signal generator level for the cable loss and gain of the substitution antenna referenced to a dipole. The spectrum was investigated up to 10 times the fundamental emission.

Data was collected at frequencies according to Section 1.3.2. Results of the test are shown below. The magnitude of all spurious emissions not reported were attenuated below the noise floor of the measurement system and therefore not specified in this report. No spurs were detected above the noise floor of the measurement system for channels 932.25 MHz, 935.0125 MHz, 941.4875 MHz, and 959.925 MHz.

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

Measurement results are shown below in Tables 7.4.2-1 through 7.4.2.4.

7.4.2 Measurement Results

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

Table 7.4.2-1: Field Strength of Spurious Emissions – 901.9875 MHz

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Generator Level (dBm)	Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBm)	Limit (dBm)	Margin (dB)
1803.975	-57.23	-66.00	H	5.10	-60.90	-20.00	40.90
1803.975	-58.32	-67	V	5.20	-61.80	-20.00	41.80

Note: Frequencies not reported were below the noise floor of the measurement system.

Table 7.4.2-2: Field Strength of Spurious Emissions – 930.5 MHz

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Generator Level (dBm)	Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBm)	Limit (dBm)	Margin (dB)
1861	-59.06	-67.00	H	4.99	-62.01	-20.00	42.01
1861	-58.68	-65	V	5.09	-59.91	-20.00	39.91

Note: Frequencies not reported were below the noise floor of the measurement system.

Part 90.210 (j), RSS-119 5.8.8

Table 7.4.2-3: Field Strength of Spurious Emissions – 896.0125MHz

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Generator Level (dBm)	Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBm)	Limit (dBm)	Margin (dB)
1792.025	-56.65	-60.00	H	5.12	-54.88	-20.00	34.88
1792.025	-57.74	-65	V	5.22	-59.78	-20.00	39.78

Note: Frequencies not reported were below the noise floor of the measurement system.

Part 101.111 a(6), RSS-119 5.8.6

Table 7.4.2-4: Field Strength of Spurious Emissions – 928.925MHz

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Generator Level (dBm)	Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBm)	Limit (dBm)	Margin (dB)
1857.85	-59.82	-67.00	H	4.99	-62.01	-20.00	42.01
1857.85	-59.72	-68	V	5.09	-62.91	-20.00	42.91

Note: Frequencies not reported were below the noise floor of the measurement system.

7.5 Frequency Stability

7.5.1 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.

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 to was varied from 85% to 115% from the normal. The maximum variation of frequency was recorded.

The EUT is a USB device which receives its supply voltage from a host device. For the purpose of this test the EUT was connected to the USB port of a laptop computer. The supply voltage to the laptop was varied from 85% to 115% from the nominal.

The most stringent limit from all rule parts of 1ppm was applied to all channels evaluated.

Data was collected at frequencies according to Section 1.3.2. Results of the test are shown below in Figures 7.5.2-1 through 7.5.2-8.

7.5.2 Measurement Results

Part 24.135, IC RSS-134 (7)

Frequency Stability

Frequency (MHz): 901.9875
Deviation Limit (PPM): 1.0ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VAC)
-30 C	**901.987621**	**0.134**	100%	120.00
-20 C	**901.987617**	**0.130**	100%	120.00
-10 C	**901.987525**	**0.028**	100%	120.00
0 C	**901.987405**	**-0.105**	100%	120.00
10 C	**901.987466**	**-0.038**	100%	120.00
20 C	**901.987458**	**-0.047**	100%	120.00
30 C	**901.987413**	**-0.096**	100%	120.00
40 C	**901.987377**	**-0.136**	100%	120.00
50 C	**901.987411**	**-0.099**	100%	120.00
20 C	**901.987570**	**0.078**	85%	102.000
20 C	**901.987565**	**0.072**	115%	138.000

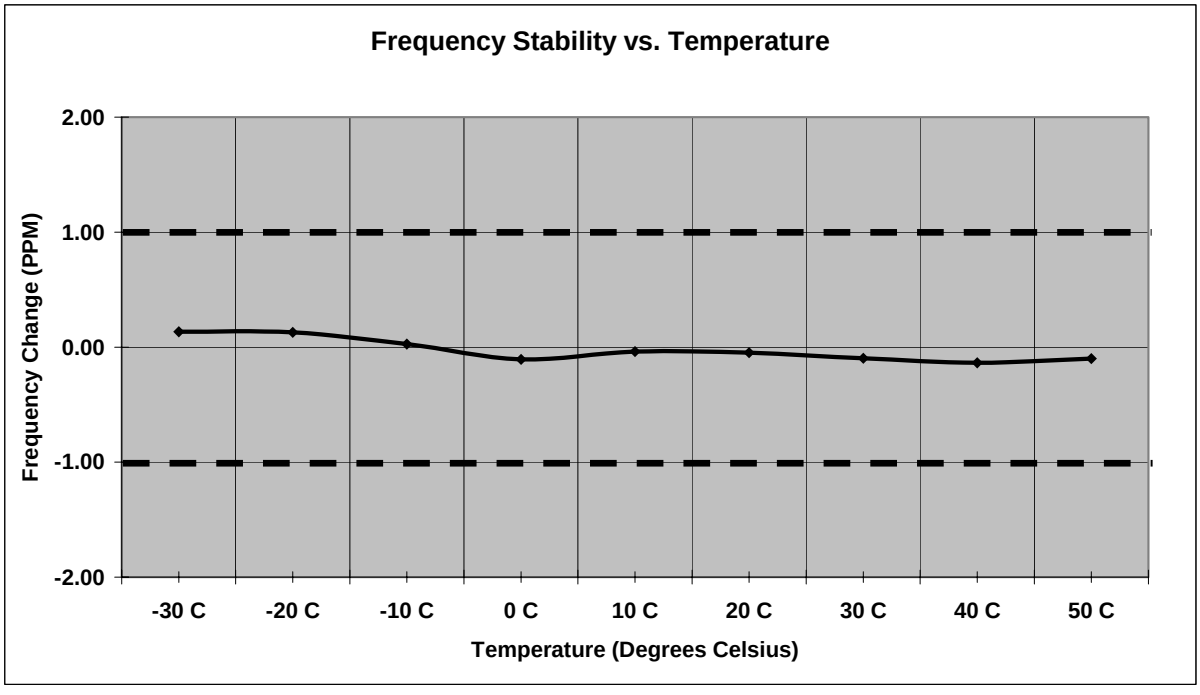

Figure 7.5.2-1: Frequency Stability – 901.9875MHz

Frequency Stability

Frequency (MHz): 930.5
Deviation Limit (PPM): 1.0ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VAC)
-30 C	**930.500150**	**0.161**	100%	120.00
-20 C	**930.500136**	**0.146**	100%	120.00
-10 C	**930.500003**	**0.004**	100%	120.00
0 C	**930.500033**	**0.035**	100%	120.00
10 C	**930.499910**	**-0.097**	100%	120.00
20 C	**930.499965**	**-0.038**	100%	120.00
30 C	**930.499916**	**-0.090**	100%	120.00
40 C	**930.499883**	**-0.126**	100%	120.00
50 C	**930.499916**	**-0.090**	100%	120.00
20 C	**930.500057**	**0.061**	85%	102.000
20 C	**930.500058**	**0.062**	115%	138.000

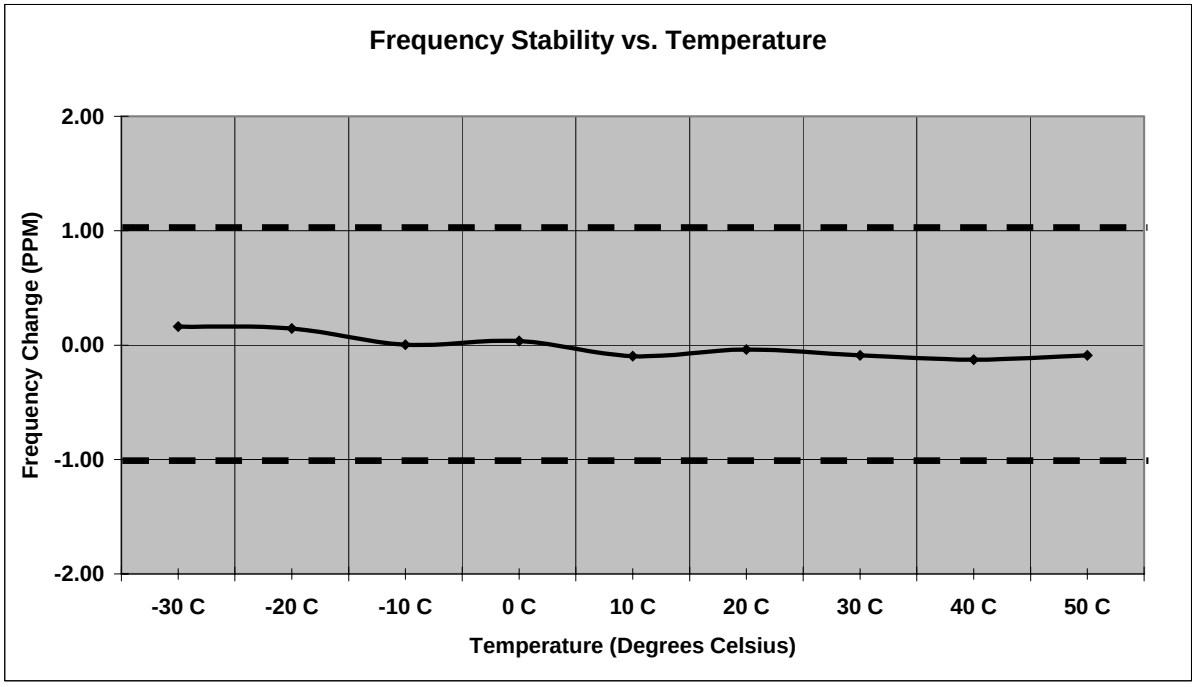

Figure 7.5.2-2: Frequency Stability – 930.5MHz

Part 90.213 (a), RSS-119 5.3

Frequency Stability

Frequency (MHz): 896.0125
Deviation Limit (PPM): 1.0ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VAC)
-30 C	**896.012619**	**0.133**	100%	120.00
-20 C	**896.012617**	**0.131**	100%	120.00
-10 C	**896.012543**	**0.048**	100%	120.00
0 C	**896.012410**	**-0.100**	100%	120.00
10 C	**896.012467**	**-0.037**	100%	120.00
20 C	**896.012460**	**-0.045**	100%	120.00
30 C	**896.012415**	**-0.095**	100%	120.00
40 C	**896.012375**	**-0.140**	100%	120.00
50 C	**896.012407**	**-0.104**	100%	120.00
20 C	**896.012558**	**0.065**	85%	102.000
20 C	**896.012556**	**0.062**	115%	138.000

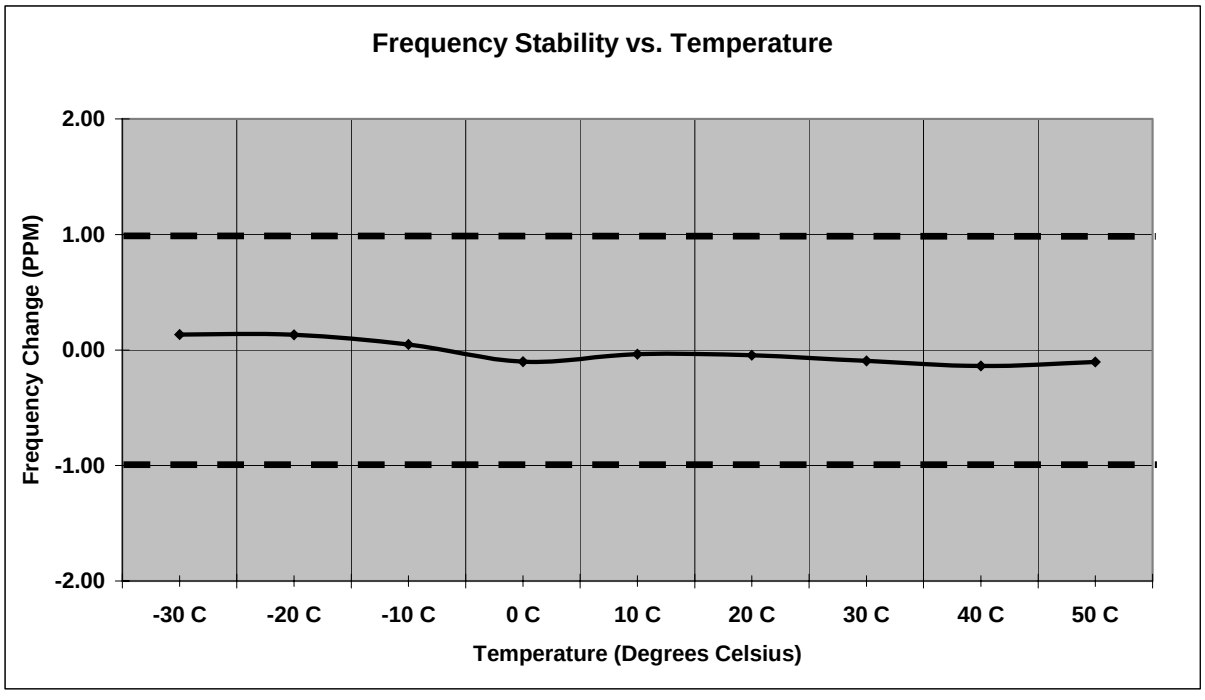

Figure 7.5.2-3: Frequency Stability – 896.0125MHz

Frequency Stability

Frequency (MHz): 935.0125
Deviation Limit (PPM): 1.0ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VAC)
-30 C	**935.012660**	**0.171**	100%	120.00
-20 C	**935.012639**	**0.149**	100%	120.00
-10 C	**935.012532**	**0.034**	100%	120.00
0 C	**935.012412**	**-0.094**	100%	120.00
10 C	**935.012475**	**-0.027**	100%	120.00
20 C	**935.012464**	**-0.039**	100%	120.00
30 C	**935.012416**	**-0.090**	100%	120.00
40 C	**935.012387**	**-0.121**	100%	120.00
50 C	**935.012419**	**-0.087**	100%	120.00
20 C	**935.012561**	**0.065**	85%	102.000
20 C	**935.012560**	**0.064**	115%	138.000

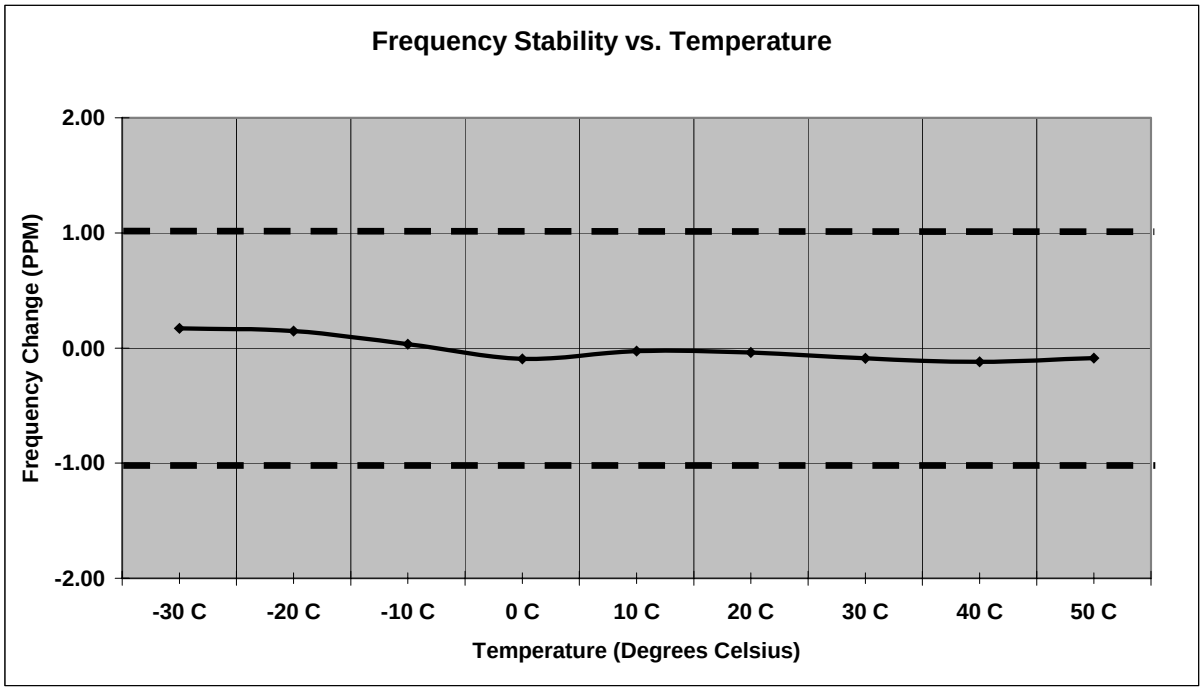

Figure 7.5.2-4: Frequency Stability – 935.0125MHz

Part 101.107 (a), RSS-119 5.3

Frequency Stability

Frequency (MHz): 928.925
Deviation Limit (PPM): 1.0ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VAC)
-30 C	**928.925144**	**0.155**	100%	120.00
-20 C	**928.925135**	**0.145**	100%	120.00
-10 C	**928.925035**	**0.038**	100%	120.00
0 C	**928.924912**	**-0.095**	100%	120.00
10 C	**928.924974**	**-0.028**	100%	120.00
20 C	**928.924966**	**-0.037**	100%	120.00
30 C	**928.924918**	**-0.088**	100%	120.00
40 C	**928.924882**	**-0.127**	100%	120.00
50 C	**928.924915**	**-0.092**	100%	120.00
20 C	**928.925064**	**0.069**	85%	102.000
20 C	**928.925063**	**0.068**	115%	138.000

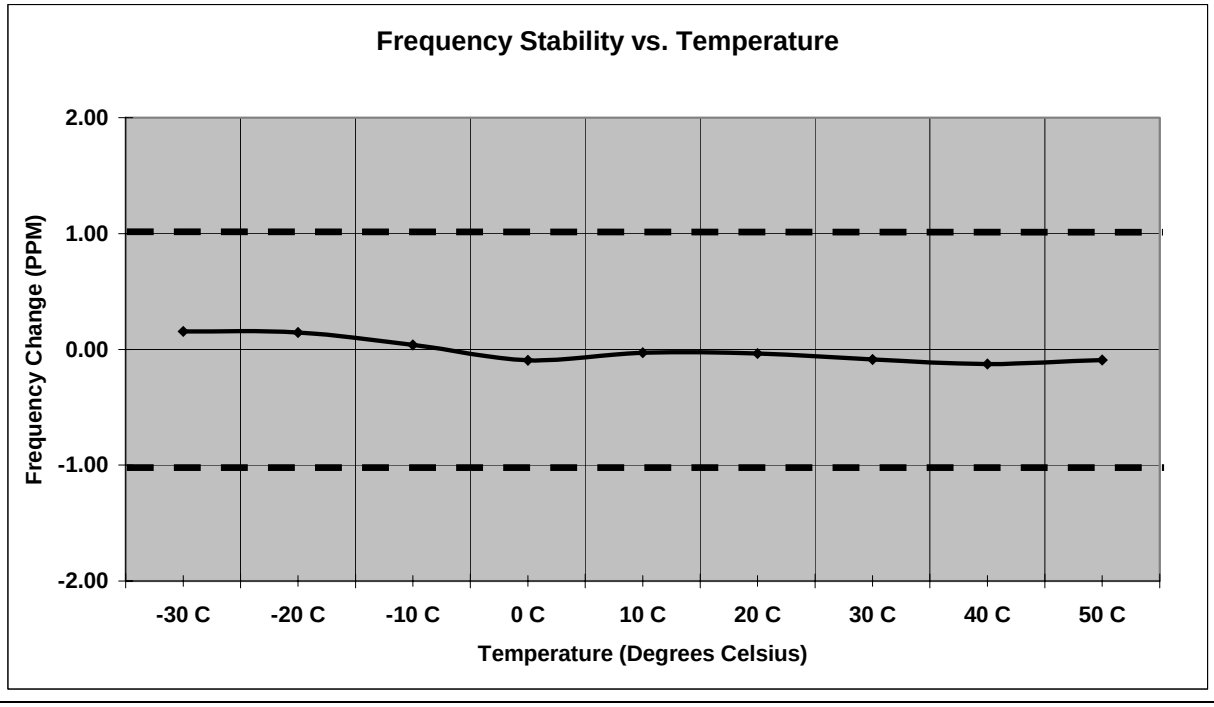

Figure 7.5.2-5: Frequency Stability – 928.925MHz

Frequency Stability

Frequency (MHz): 932.25
Deviation Limit (PPM): 1.0ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VAC)
-30 C	**932.250153**	**0.164**	100%	120.00
-20 C	**932.250137**	**0.147**	100%	120.00
-10 C	**932.250032**	**0.034**	100%	120.00
0 C	**932.249910**	**-0.097**	100%	120.00
10 C	**932.249974**	**-0.028**	100%	120.00
20 C	**932.249963**	**-0.040**	100%	120.00
30 C	**932.249915**	**-0.091**	100%	120.00
40 C	**932.249885**	**-0.123**	100%	120.00
50 C	**932.249917**	**-0.089**	100%	120.00
20 C	**932.250058**	**0.062**	85%	102.000
20 C	**932.250059**	**0.063**	115%	138.000

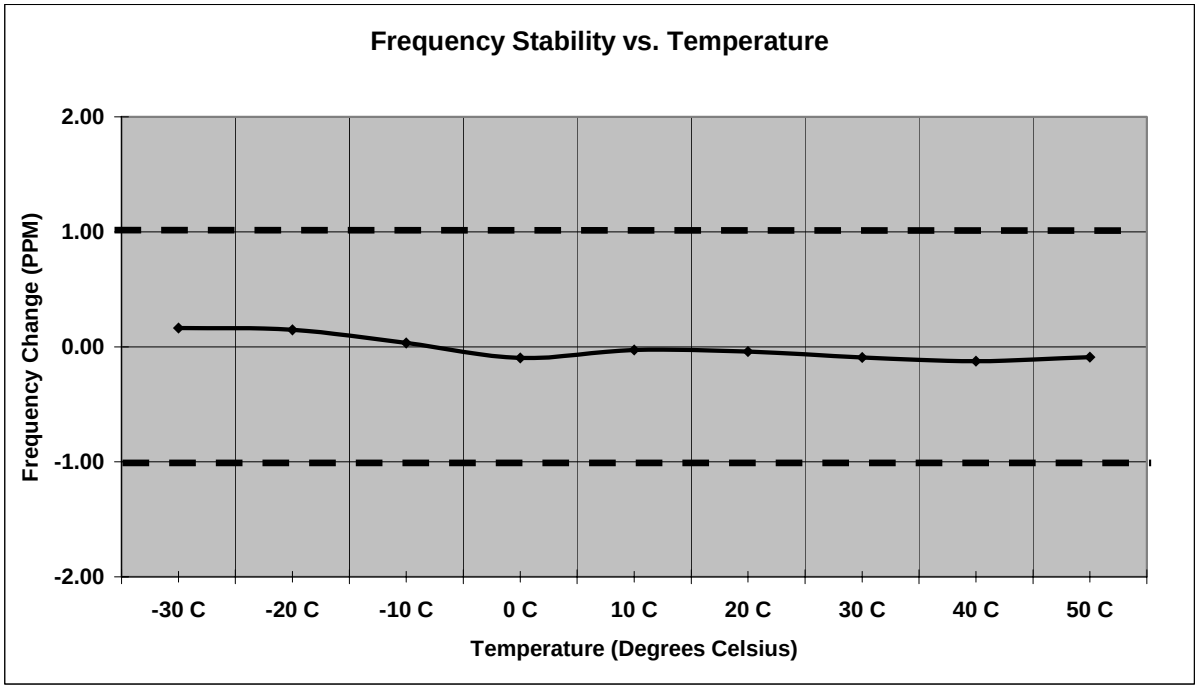

Figure 7.5.2-6: Frequency Stability – 932.5MHz

Frequency Stability

Frequency (MHz): 941.4875
Deviation Limit (PPM): 1.0ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VAC)
-30 C	**941.487670**	**0.181**	100%	120.00
-20 C	**941.487642**	**0.151**	100%	120.00
-10 C	**941.487534**	**0.036**	100%	120.00
0 C	**941.487414**	**-0.091**	100%	120.00
10 C	**941.487479**	**-0.022**	100%	120.00
20 C	**941.487467**	**-0.035**	100%	120.00
30 C	**941.487417**	**-0.088**	100%	120.00
40 C	**941.487389**	**-0.118**	100%	120.00
50 C	**941.487422**	**-0.083**	100%	120.00
20 C	**941.487562**	**0.066**	85%	102.000
20 C	**941.487561**	**0.065**	115%	138.000

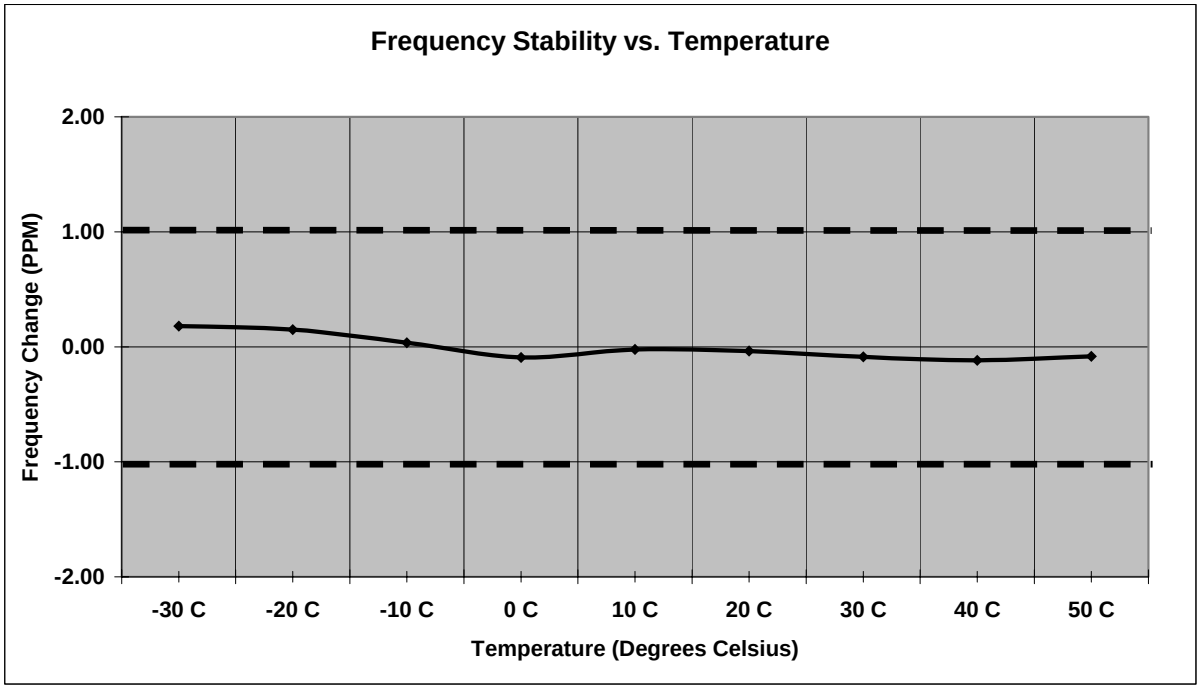

Figure 7.5.2-7: Frequency Stability – 941.4875MHz

Frequency Stability

Frequency (MHz): 959.925
Deviation Limit (PPM): 1.0ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VAC)
-30 C	**959.925178**	**0.185**	100%	120.00
-20 C	**959.925149**	**0.155**	100%	120.00
-10 C	**959.925037**	**0.039**	100%	120.00
0 C	**959.924918**	**-0.085**	100%	120.00
10 C	**959.924983**	**-0.018**	100%	120.00
20 C	**959.924973**	**-0.028**	100%	120.00
30 C	**959.924924**	**-0.079**	100%	120.00
40 C	**959.924893**	**-0.111**	100%	120.00
50 C	**959.924926**	**-0.077**	100%	120.00
20 C	**959.925071**	**0.074**	85%	102.000
20 C	**959.925069**	**0.072**	115%	138.000

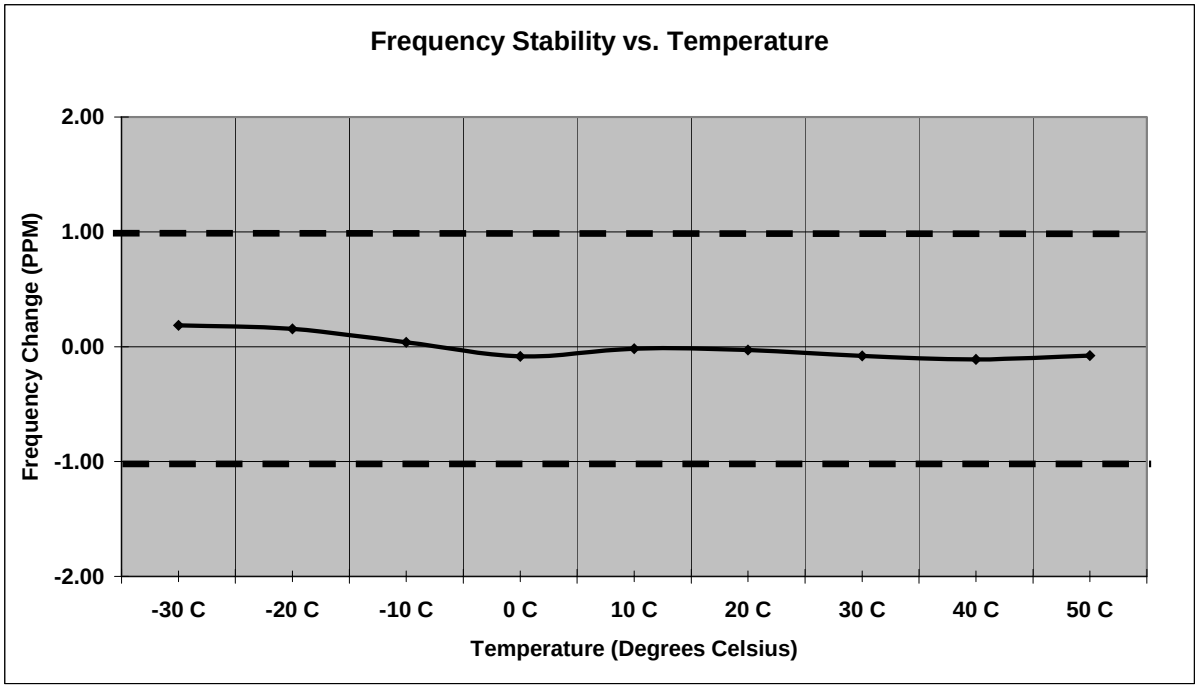

Figure 7.5.2-8: Frequency Stability – 959.925MHz

7.6 Radiated Emissions (Unintentional Radiators)

7.6.1 Measurement Procedure

The equipment under test is placed in the Semi-Anechoic Chamber (described in section 2.3.1) on a wooden table at the turntable center. For each radiated emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360º to obtain a maximum peak reading on the spectrum analyzer. The radiated emissions are then measured using an EMI receiver employing a CISPR quasi-peak detector for frequencies below 1000 MHz and an Average detector function for frequencies above 1000 MHz. This repeated for both horizontal and vertical polarizations of the receive antenna.

The field strength of each radiated emission is calculated by correcting the EMI receiver level for cable loss, amplifier gain, and antenna correction factors.

Field Strength (dBuV/m) = EMI Receiver Level (dBuV) + Cable Loss (dB) – Amplifier Gain (dB) + Antenna Correction Factor (1/m)

Results of the test are shown below in Table 7.6.2-1.

7.6.2 Measurement Results - Part 15.109, RSS-119 5.11, RSS-134 8(i)

Table 7.6.2-1: Radiated Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
32.15	---------	26.74	V	-10.32	---------	16.42	--------	40.0	---------	23.58
42.3	---------	33.29	V	-15.10	---------	18.19	--------	40.0	---------	21.81
129.15	---------	30.02	V	-13.73	---------	16.29	--------	43.5	---------	27.21
366.26	---------	49.37	H	-9.60	---------	39.77	--------	46.0	---------	6.23
432.01	---------	46.27	H	-8.28	---------	37.99	--------	46.0	---------	8.01
453.56	---------	23.67	H	-7.83	---------	15.84	--------	46.0	---------	30.16
529.01	---------	39.67	V	-6.29	---------	33.38	--------	46.0	---------	12.62
662.65	---------	40.68	V	-3.25	---------	37.43	--------	46.0	---------	8.57
762.88	---------	29.81	H	-1.90	---------	27.91	--------	46.0	---------	18.09
839.41	---------	21.48	H	0.09	---------	21.57	--------	46.0	---------	24.43
1327	53.63	38.33	V	-8.25	45.38	30.08	74.0	54.0	28.62	23.92
1627	52.02	46.91	V	-5.87	46.15	41.04	74.0	54.0	27.85	12.96
1133	54.71	40.31	V	-9.85	44.86	30.46	74.0	54.0	29.14	23.54
1993	50.62	36.20	V	-3.10	47.52	33.10	74.0	54.0	26.48	20.90

Measurements taken above 1993 MHz were below the noise floor of the measurement equipment.

7.7 Power Line Conducted Emissions

7.7.1 Measurement Procedure

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

The USBXCVR module was integrated into a representative host device for the purpose of showing compliance. See section 6.0 for test setup details.

Measurement results are shown below in Table 7.7.2-1.

7.7.2 Measurement Results – Part 15.107

Table 7.7.2-1: Conducted EMI Results

Frequency (MHz)	Uncorrected Reading (dBuV)		Total Correction Factor (dB)	Corrected Level (dBuV)		Limit (dBuV)		Margin (dB)		Line
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
Line 1										
0.1543	39.9	27.3	9.80	49.70	37.10	65.77	55.77	16.1	18.7	GND
0.25	32.1	25.9	9.80	41.90	35.70	61.76	51.76	19.9	16.1	GND
0.36	23.5	25.7	9.80	33.30	35.50	58.73	48.73	25.4	13.2	GND
0.46	21.5	20.5	9.80	31.30	30.30	56.69	46.69	25.4	16.4	GND
0.71	21.1	18.7	9.80	30.90	28.50	56.00	46.00	25.1	17.5	GND
10.4	18.9	12.8	10.00	28.90	22.80	60.00	50.00	31.1	27.2	GND
Line 2										
0.16	40.7	27.5	9.80	50.50	37.30	65.46	55.46	15.0	18.2	GND
0.25	32.1	22.1	9.80	41.90	31.90	61.76	51.76	19.9	19.9	GND
0.357	23.9	21	9.80	33.70	30.80	58.80	48.80	25.1	18.0	GND
1.85	19.6	12.8	9.80	29.40	22.60	56.00	46.00	26.6	23.4	GND
2.29	19.5	12.8	9.80	29.30	22.60	56.00	46.00	26.7	23.4	GND
10.49	17.4	12	10.00	27.40	22.00	60.00	50.00	32.6	28.0	GND

8.0 CONCLUSION

In the opinion of ACS, Inc. the model USBXCVR, manufactured by Sensus Metering Systems, meets all the requirements of FCC Part 24, 90, and 101 as well as IC RSS-119 and RSS-134 as applicable.

End Report