Excellence in Compliance Testing

Certification Test Report

FCC ID: R7PEG1R1S2

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Report Number: 10-0207.W06.12.A

Manufacturer: Cellnet Technology Inc.
Model: Gridstream RF Enhanced Integrated Focus AX

Test Begin Date: June 22, 2010
Test End Date: March 2, 2011

Report Issue Date: April 25, 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 32 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210.

1.2 Product description

Gridstream RF Enhanced Integrated Focus AX meter is an Active Energy kWh/kW/TOU Meter with field-proven Digital Multiplication Measurement Technique to ensure a highly accurate load performance and dependability during the entire life of the product. It is an integrated solution with FOCUS AX advanced metering electronics the Gridstream RF communication electronics combined together on a single PCB. It also offers a Service Disconnect option and ZigBee connectivity for HAN applications.

Technical Details:

The Gridstream RF Enhanced Integrated Focus AX provides 4 distinct modes of operation as outlined below.

Mode of Operation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Data Rates Supported (kbps)
Wide Mode	902.3 - 927.8	86	300	9.6, 19.2, 38.4, 115.2
Narrow Mode	904.0 - 927.9	240	100	9.6, 19.2, 38.4
Full Narrow Mode	902.3 - 927.8	256	100	9.6, 19.2, 38.4
SUN Mode	902.2 – 927.8	129	200	50.0

Modulation format: FSK
Antenna Type/Gain: Printed Inverted F, 3dBi
Operating Voltage: 120/240VAC

Manufacturer Information:
Cellnet Technology, Inc.
30000 Mill Creek Ave., Suite 100
Alpharetta, GA 30022

Test Sample Serial Number(s): 102324554

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

1.3 Test Methodology and Considerations

All modes of operation, including all available data rates, were evaluated. The data presented in this report represents the worst case where applicable. In most instances data was collected at frequencies representing the lowest and highest available for all modes of operation.

The Gridstream RF Enhanced Integrated Focus AX contains both 900 MHz and 2.4GHz radios. The 900 MHz LAN radio and the 2.4 GHz Zigbee radio operate under CFR 47 Part 15.247 and IC RSS-210. This report addresses the 900 MHz LAN radio only. A separate report, 10-0207.W06.22.A, will be issued to address the 2.4 GHz Zigbee radio.

Both the 900 MHz LAN radio and the 2.4 GHz Zigbee radio can transmit simultaneously therefore radiated inter-modulation products were evaluated and found to be in compliance.

2 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: 894540
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

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:

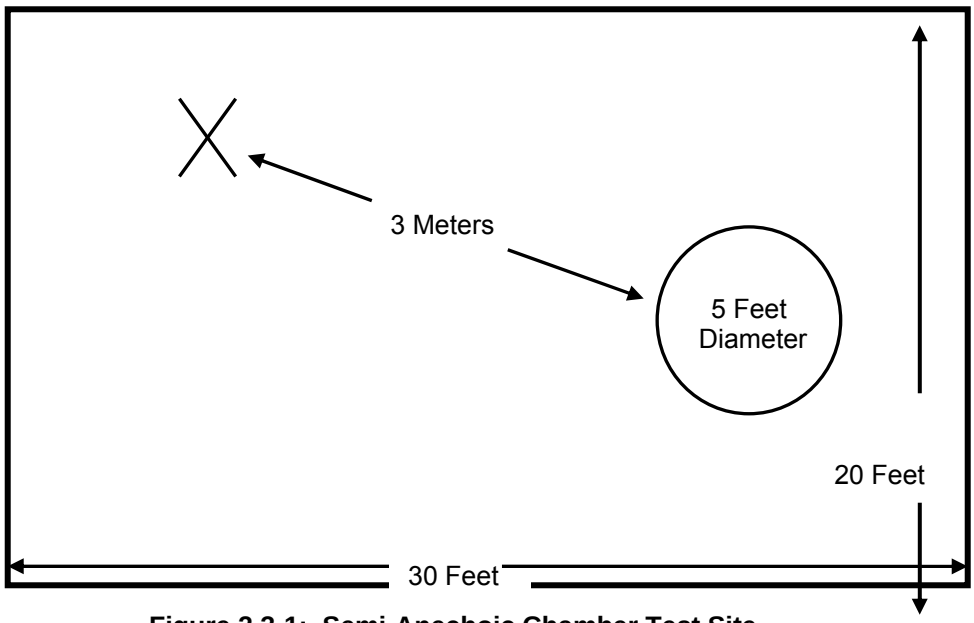


Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

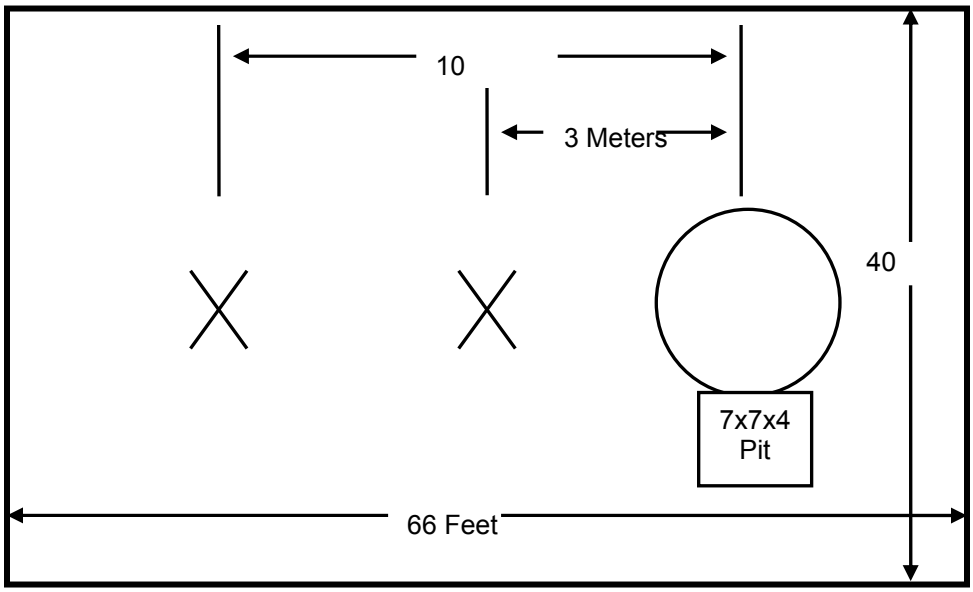


Figure 2.3-2: Open Area Test Site

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:

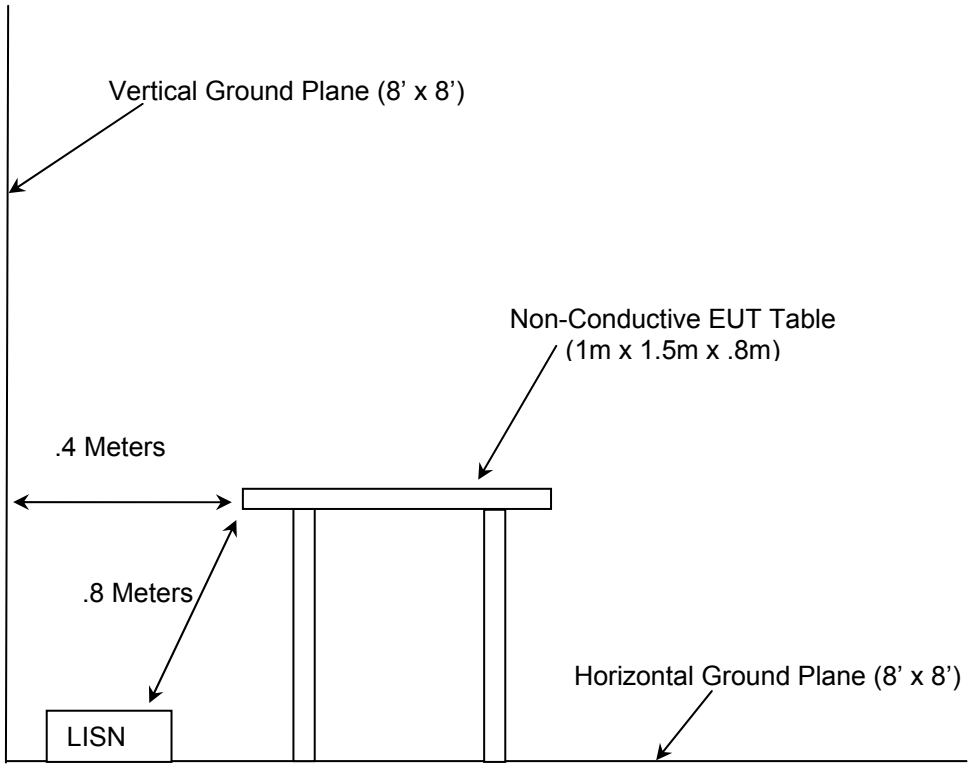


Figure 2.4-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2010
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2010
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8 December 2010
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3, December 2010.

4 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

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
1	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	833771/007	09-21-2010
2	Rohde & Schwarz	Spectrum Analyzers	ESMI - Receiver	839587/003	09-21-2010
3	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	839379/011	02-02-2011
4	Rohde & Schwarz	Spectrum Analyzers	ESMI - Receiver	833827/003	02-02-2011
22	Agilent	Amplifiers	8449B	3008A00526	09-21-2010
25	Chase	Antennas	CBL6111	1043	09-02-2010 (See Note1)
30	Spectrum Technologies	Antennas	DRH-0118	970102	05-08-2011 (See Note1)
73	Agilent	Amplifier	8447D	2727A05624	05-26-2011
153	EMCO	LISN	Feb-25	9411-2268	01-11-2011
167	ACS	Cable Set	Chamber EMI Cable Set	167	01-25-2011
168	Hewlett Packard	Attenuators	11947A	44829	02-04-2011
193	ACS	Cable Set	OATS cable Set	193	01-05-2011
267*	Agilent	Meters	N1911A	MY45100129	11-02-2011
268*	Agilent	Sensors	N1921A	MY45240184	12-02-2011
283*	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	08-31-2011
324	ACS	Cables	Belden	8214	07-09-2011
329	A.H. Systems	Antenna	SAS-571	721	08-04-2011 (See Note1)
291	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	None	12-07-2010
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	12-07-2010
337	Microwave Circuits	Filter	H1G513G1	282706	07-16-2011
338	Hewlett Packard	Amplifiers	8449B	3008A01111	10-16-2010
340*	Aeroflex/Weinschel	Attenuators	AS-20	7136	10-05-2011
343	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	N/A	04-27-2011
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	12-29-2010
430	RF Cables	Cables	SMS-290AW-480-SMS	N/A	04-27-2011

***** Radiated and AC power line conducted emissions tests were performed 6-22-2010 to 6-23-2010. RF conducted measurements were performed 6-23-2010 and 3-2-2011. The calibration dates provided above are appropriate for the testing performed. Assets shown with * where used for RF conducted measurements only.

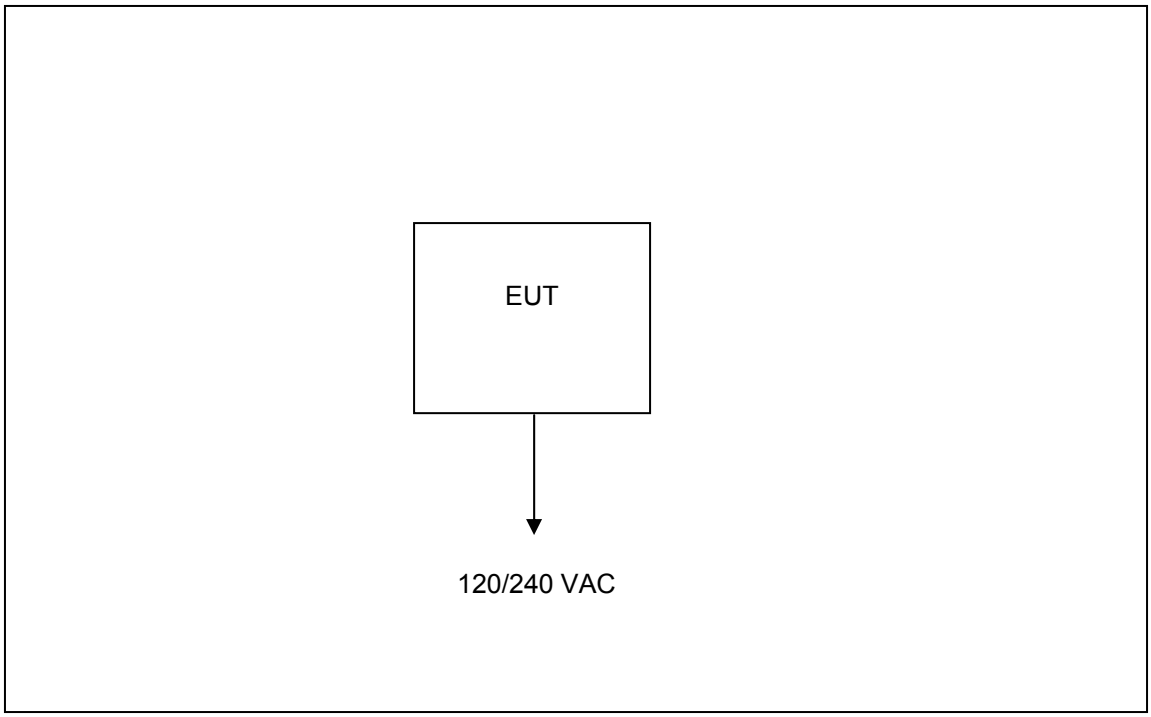
Note1: Items calibrated on a 2 year cycle.

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
The EUT was tested standalone with no support equipment utilized.				

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



7 SUMMARY OF TESTS

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

7.1 Antenna Requirement – FCC: Section 15.203

The EUT uses an inverted F PCB antenna with a maximum gain of +3 dBi. The antenna is integral to the PCB and cannot be removed or modified.

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.4

7.2.1 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

7.2.2 Measurement Results

Results of the test are shown below in and Tables 7.2.2-1 to 7.2.2-4.

Table 7.2.2-1: Line 1 Conducted EMI Results – 120 VAC

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.228	54.00	9.9	63	8.5	L1	GND	QP
0.276	51.80	10.0	61	9.1	L1	GND	QP
0.564	42.60	10.0	56	13.4	L1	GND	QP
0.738	43.00	10.1	56	13.0	L1	GND	QP
0.912	33.10	10.0	56	22.9	L1	GND	QP
3.708	32.20	9.9	56	23.8	L1	GND	QP
4.062	38.10	9.9	56	17.9	L1	GND	QP
4.296	38.80	9.9	56	17.2	L1	GND	QP
4.698	36.00	10.0	56	20.0	L1	GND	QP
4.812	35.60	10.0	56	20.4	L1	GND	QP
0.228	38.30	9.9	53	14.2	L1	GND	AVG
0.348	31.50	10.0	49	17.5	L1	GND	AVG
0.570	32.80	10.0	46	13.2	L1	GND	AVG
0.720	22.00	10.1	46	24.0	L1	GND	AVG
0.978	21.80	10.0	46	24.2	L1	GND	AVG
3.654	28.10	9.9	46	17.9	L1	GND	AVG
4.092	33.70	9.9	46	12.3	L1	GND	AVG
4.302	33.00	9.9	46	13.0	L1	GND	AVG
4.698	30.30	10.0	46	15.7	L1	GND	AVG
4.842	30.70	10.0	46	15.3	L1	GND	AVG

Table 7.2.2-2: Line 2 Conducted EMI Results – 120 VAC

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.228	54.50	9.9	63	8.0	L2	GND	QP
0.258	54.70	10.0	62	6.8	L2	GND	QP
0.528	43.80	10.0	56	12.2	L2	GND	QP
0.894	35.60	10.0	56	20.4	L2	GND	QP
4.128	41.60	9.9	56	14.4	L2	GND	QP
4.422	41.30	10.0	56	14.7	L2	GND	QP
4.488	40.80	10.0	56	15.2	L2	GND	QP
4.674	38.50	10.0	56	17.5	L2	GND	QP
4.746	38.20	10.0	56	17.8	L2	GND	QP
4.914	36.80	10.0	56	19.2	L2	GND	QP
0.264	37.20	10.0	51	14.1	L2	GND	AVG
0.330	33.90	10.0	50	15.6	L2	GND	AVG
0.516	30.90	10.0	46	15.1	L2	GND	AVG
0.954	24.80	10.0	46	21.3	L2	GND	AVG
4.122	35.30	9.9	46	10.7	L2	GND	AVG
4.422	37.30	10.0	46	8.7	L2	GND	AVG
4.5.00	34.20	10.0	46	11.8	L2	GND	AVG
4.674	32.20	10.0	46	13.8	L2	GND	AVG
4.698	32.70	10.0	46	13.3	L2	GND	AVG
4.968	28.80	10.0	46	17.2	L2	GND	AVG

Table 7.2.2-3: Line 1 Conducted EMI Results – 240 VAC

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.228	51.60	9.9	63	11.0	L1	GND	QP
0.294	51.00	10.0	60	9.4	L1	GND	QP
0.354	49.50	10.0	59	9.4	L1	GND	QP
0.438	46.80	10.0	57	10.3	L1	GND	QP
0.702	38.20	10.1	56	17.8	L1	GND	QP
3.468	33.30	9.9	56	22.7	L1	GND	QP
3.534	35.60	9.9	56	20.4	L1	GND	QP
3.816	40.40	9.9	56	15.6	L1	GND	QP
3.924	36.90	9.9	56	19.1	L1	GND	QP
4.386	45.20	10.0	56	10.8	L1	GND	QP
0.228	34.20	9.9	53	18.4	L1	GND	AVG
0.294	34.20	10.0	50	16.2	L1	GND	AVG
0.354	33.80	10.0	49	15.1	L1	GND	AVG
0.510	31.30	10.0	46	14.7	L1	GND	AVG
0.786	17.40	10.1	46	28.6	L1	GND	AVG
3.480	29.10	9.9	46	16.9	L1	GND	AVG
3.534	30.80	9.9	46	15.2	L1	GND	AVG
3.828	33.90	9.9	46	12.1	L1	GND	AVG
3.930	31.30	9.9	46	14.7	L1	GND	AVG
4.368	40.10	10.0	46	5.9	L1	GND	AVG

Table 7.2.2-4: Line 2 Conducted EMI Results – 240 VAC

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.294	51.40	10.0	60	9.0	L2	GND	QP
0.330	50.90	10.0	60	8.6	L2	GND	QP
0.402	49.20	10.1	58	8.6	L2	GND	QP
0.408	49.00	10.1	58	8.6	L2	GND	QP
0.504	46.40	10.0	56	9.6	L2	GND	QP
0.738	37.50	10.1	56	18.5	L2	GND	QP
3.630	41.10	9.9	56	14.9	L2	GND	QP
3.804	42.20	9.9	56	13.8	L2	GND	QP
4.404	48.10	10.0	56	7.9	L2	GND	QP
4.998	37.70	10.0	56	18.3	L2	GND	QP
0.294	35.90	10.0	50	14.5	L2	GND	AVG
0.330	35.30	10.0	50	14.1	L2	GND	AVG
0.450	34.00	10.0	47	12.9	L2	GND	AVG
0.492	32.10	10.0	46	14.1	L2	GND	AVG
0.558	34.90	10.0	46	11.1	L2	GND	AVG
0.750	22.10	10.1	46	23.9	L2	GND	AVG
3.600	35.70	9.9	46	10.4	L2	GND	AVG
3.834	36.70	9.9	46	9.3	L2	GND	AVG
4.392	43.20	10.0	46	2.8	L2	GND	AVG
4.998	32.70	10.0	46	13.3	L2	GND	AVG

7.3 Radiated Emissions – FCC: Section 15.109 (Unintentional Radiation) IC: RSS-Gen 6.1

7.3.1 Measurement Procedure

Radiated emissions tests were performed over the frequency range of 30MHz to 12.5GHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements above 30MHz and below 1GHz were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz using a Quasi-peak detector. Above 1GHz, peak and average measurements are taken with the RBW and VBW were set to 1MHz and 3MHz respectively.

7.3.2 Measurement Results

Results of the test are given in Table 7.3.2-1 below:

Table 7.3.2-1: 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
30	---------	17.22	V	-6.70	---------	10.52	--------	40.0	---------	29.5
171.2	---------	38.15	V	-14.95	---------	23.20	--------	43.5	---------	20.3
173.3	---------	37.44	V	-15.03	---------	22.41	--------	43.5	---------	21.1
319.2	---------	37.33	H	-10.72	---------	26.61	--------	46.0	---------	19.4
329.046	---------	39.01	H	-10.34	---------	28.67	--------	46.0	---------	17.3
702.5	---------	19.36	H	-1.25	---------	18.11	--------	46.0	---------	27.9
957.9	---------	19.25	H	3.57	---------	22.82	--------	46.0	---------	23.2

* Note: All emissions above 957.9 MHz were attenuated below the permissible limit.

7.4 Peak Output Power - FCC Section 15.247(b)(2) IC: RSS-210 A8.4(1)

7.4.1 Measurement Procedure (Conducted Method)

The RF output port of the EUT was directly connected to the input of a power meter. The device employs >50 channels therefore the power is limited to 1 Watt. All data rates were evaluated with worst case data provided below.

7.4.2 Measurement Results

Results are shown below in Table 7.4.2-1 below:

Table 7.4.2-1: RF Output Power

Frequency [MHz]	Level [dBm]
902.2	27.30
902.3	27.30
904.0	27.28
915.0	27.48
927.8	26.80
927.9	26.77

7.5 Channel Usage Requirements

7.5.1 Carrier Frequency Separation – FCC: Section 15.247(a)(1) IC: RSS-210 A8.1(b)

7.5.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set wide enough to capture two adjacent peaks and the RBW and VBW were set to ≥ 1% of the span.

Carrier frequency separation was measured for all modes of operation (i.e. wide mode, narrow/full narrow mode, and SUN mode) and data presented in section 7.5.1.2 below.

7.5.1.2 Measurement Results

The adjacent channel separation was measured to be 100 kHz for narrow (240 channels) and full narrow (256 channels) modes, 300kHz for wide mode (86 channels), and 200kHz for Sun Mode (129 channels). Results are shown below in Figures 7.5.1.2-1 to 7.5.1.2-3.

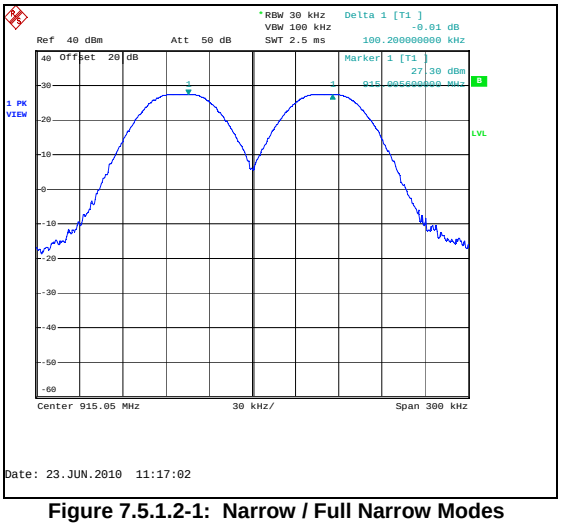


Figure 7.5.1.2-1: Narrow / Full Narrow Modes

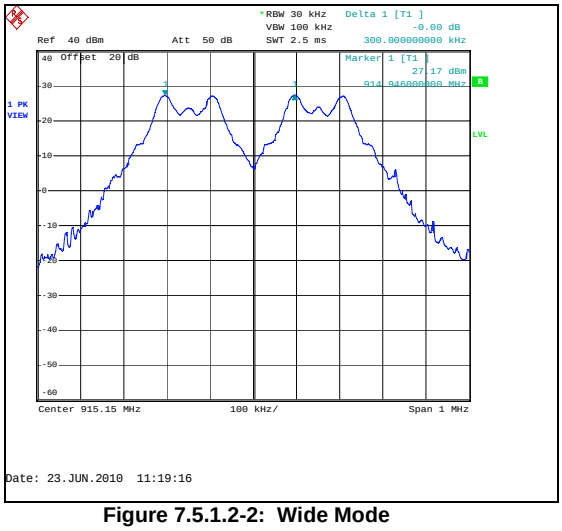


Figure 7.5.1.2-2: Wide Mode

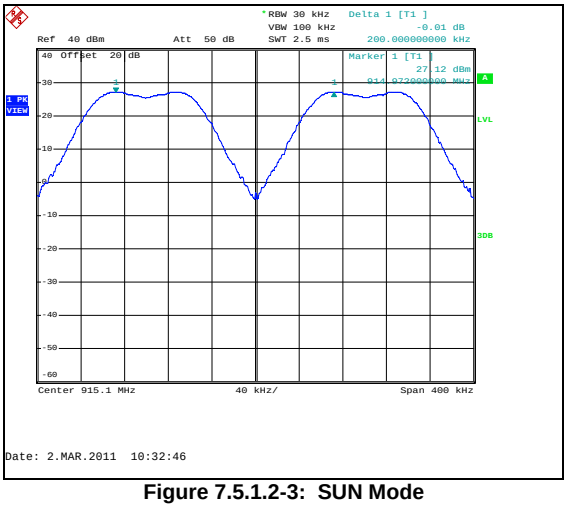


Figure 7.5.1.2-3: SUN Mode

7.5.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

The 20dB bandwidth of the device is less than 250 kHz. The device employs > 50 hopping channels as required. Results are shown below in Figures 7.5.2-1 to 7.5.2-15.

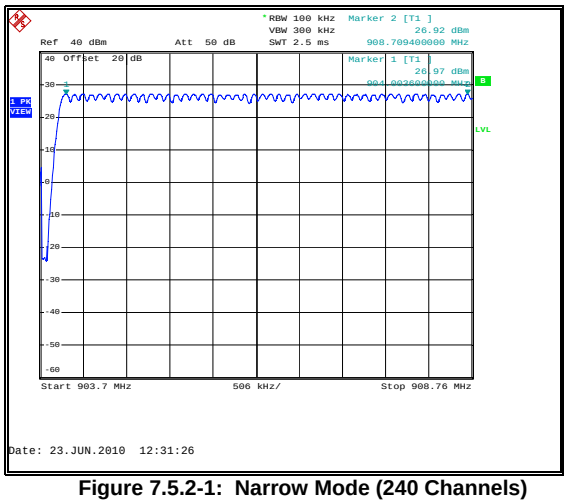


Figure 7.5.2-1: Narrow Mode (240 Channels)

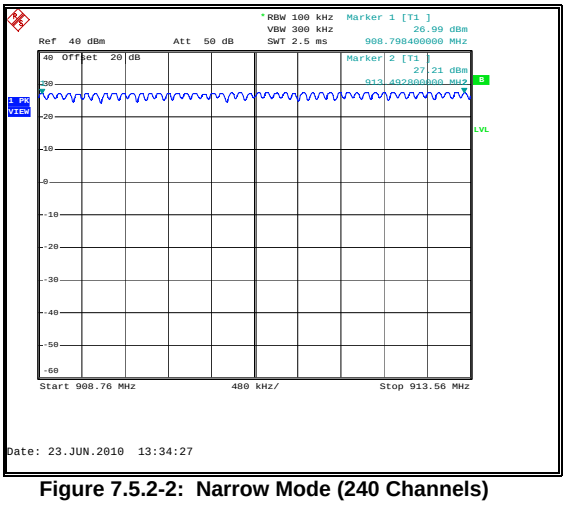


Figure 7.5.2-2: Narrow Mode (240 Channels)

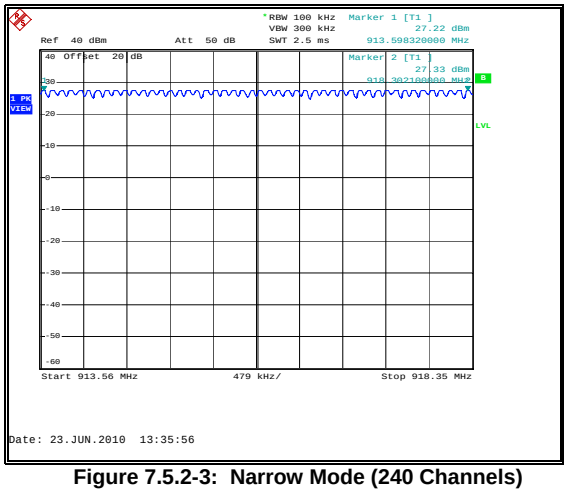


Figure 7.5.2-3: Narrow Mode (240 Channels)

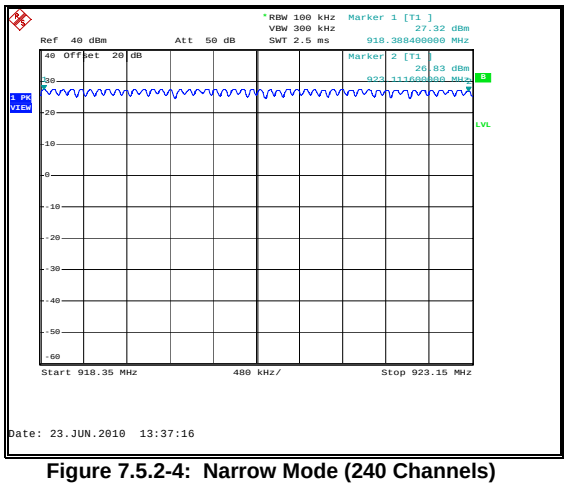


Figure 7.5.2-4: Narrow Mode (240 Channels)

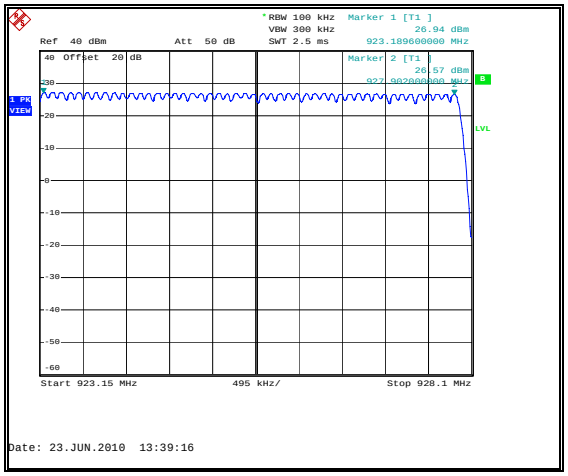


Figure 7.5.2-5: Narrow Mode (240 Channels)

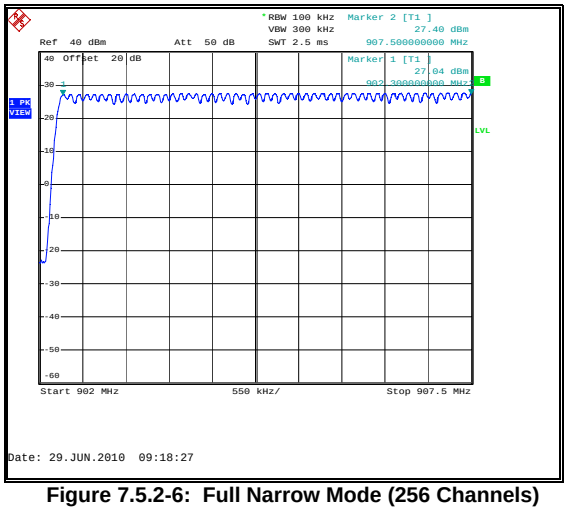


Figure 7.5.2-6: Full Narrow Mode (256 Channels)

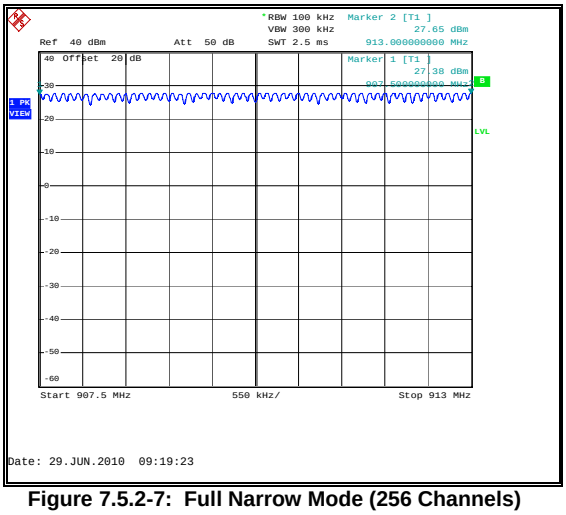


Figure 7.5.2-7: Full Narrow Mode (256 Channels)

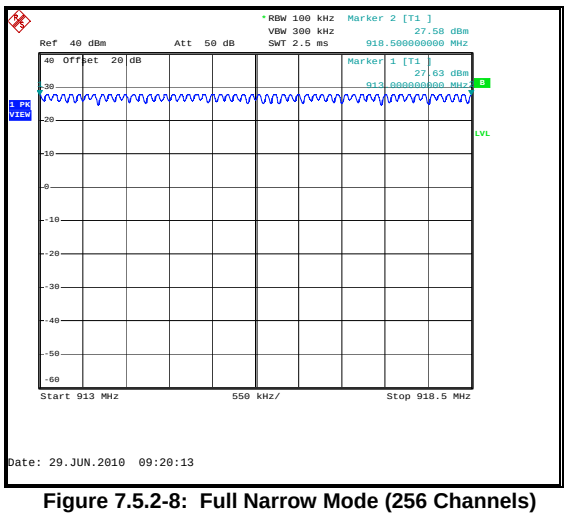


Figure 7.5.2-8: Full Narrow Mode (256 Channels)

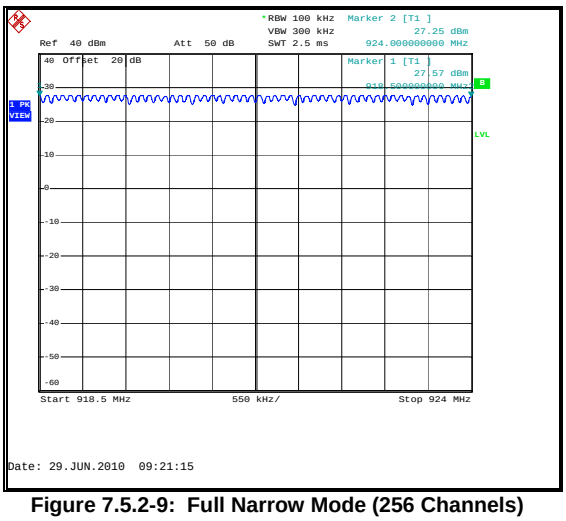


Figure 7.5.2-9: Full Narrow Mode (256 Channels)

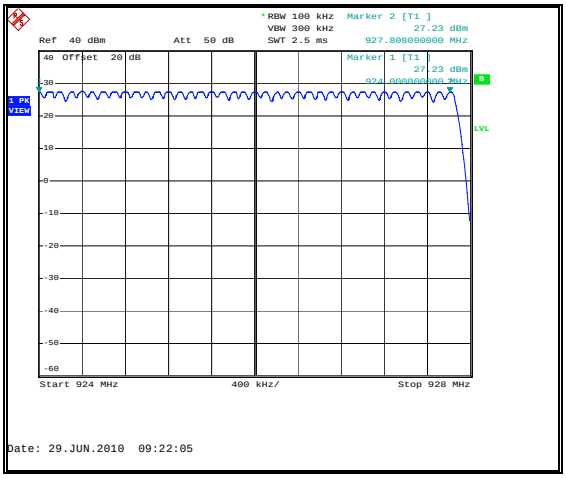


Figure 7.5.2-10: Full Narrow Mode (256 Channels)

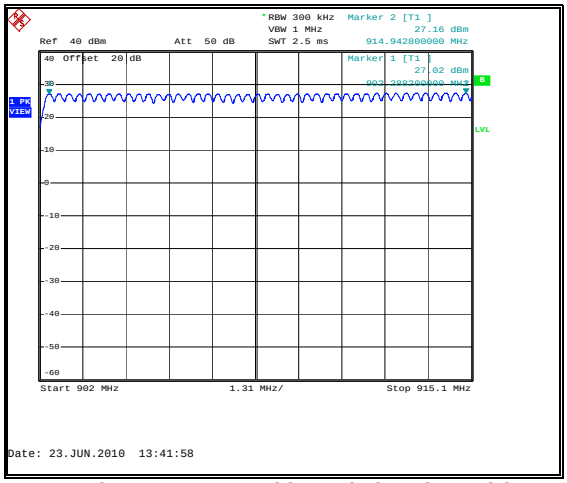


Figure 7.5.2-11: Wide Mode (86 Channels)

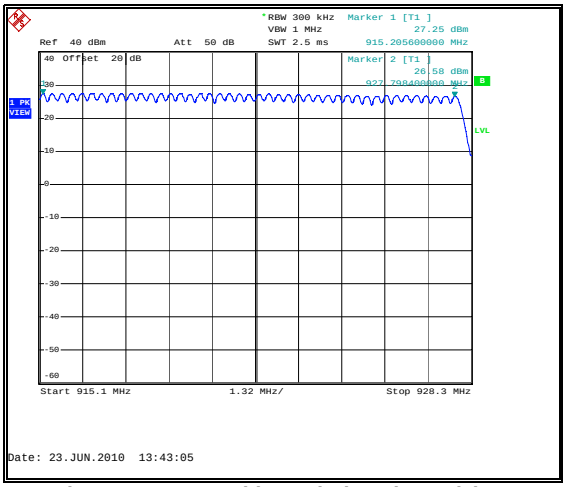


Figure 7.5.2-12: Wide Mode (86 Channels)

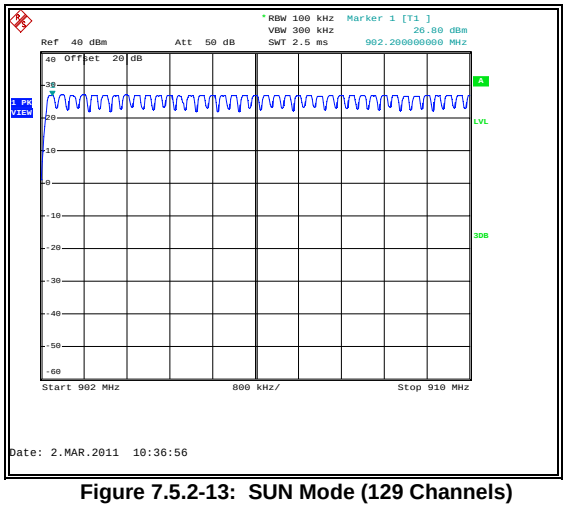


Figure 7.5.2-13: SUN Mode (129 Channels)

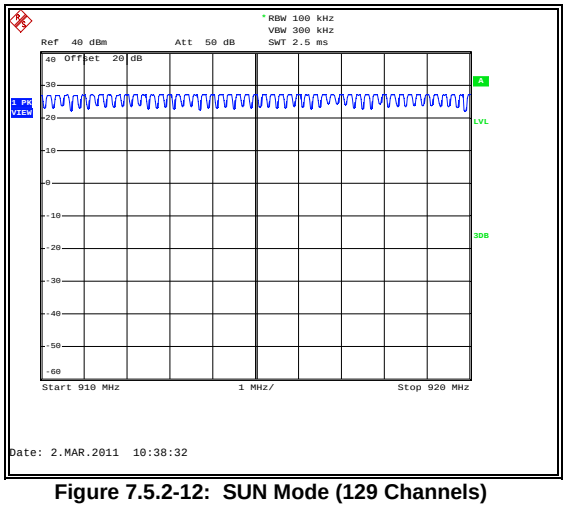


Figure 7.5.2-12: SUN Mode (129 Channels)

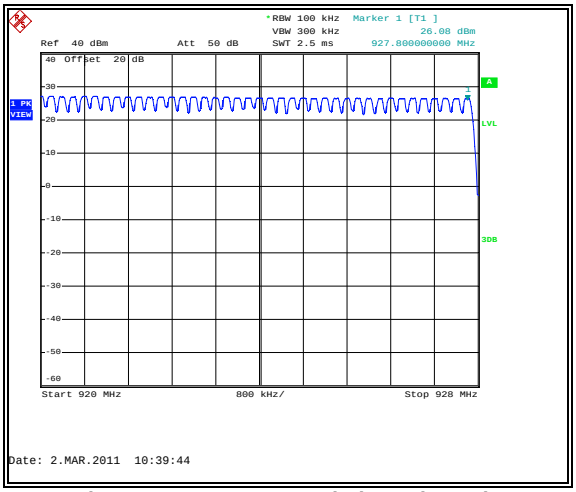


Figure 7.5.2-15: SUN Mode (129 Channels

7.5.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

7.5.3.1 Measurement Procedure

The EUT test mode does not generate a worst case channel dwell time therefore a detailed engineering analysis is provided in the theory of operation.

As described in the theory of operation, the maximum channel transmitter dwell time is < 400ms per channel hop with the minimum period of 700ms between hops. Therefore the maximum time of occupancy on any one channel with a 20s period is <400ms for all modes of operation.

7.5.4 20dB / 99% Bandwidth - FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

7.5.4.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The spectrum analyzer span was set to 2 to 3 times the estimated bandwidth of the emission. The RBW was to ≥ 1% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission and approximately 20dB below the peak level. The RBW was to 1% to 3% of the approximate emission width. The trace was set to max hold with a peak detector active. The occupied bandwidth measurement function of the analyzer was used for the 99% bandwidth.

7.5.4.2 Measurement Results

Results are shown below in Table 7.5.4.2-1 and Figures 7.5.4.2-1 through 7.5.4.2-30.

Table 7.5.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]	Data Rate (kbps)
902.3	22.2	22.74	9.6
902.3	46.8	45.89	19.2
902.3	86.8	85.2	38.4
902.2	104.0	96.75	50.0
902.3	238.0	249.2	115.2
915.0	22.1	22.62	9.6
915.0	47.0	45.63	19.2
915.0	86.4	85.4	38.4
915.0	104.0	97.25	50.0
915.0	238.0	246.4	115.2
927.9	22.96	22.89	9.6
927.9	46.2	46.15	19.2
927.9	86.4	85.40	38.4
927.8	104.5	98.5	50.0
927.8	238.0	250.6	115.2

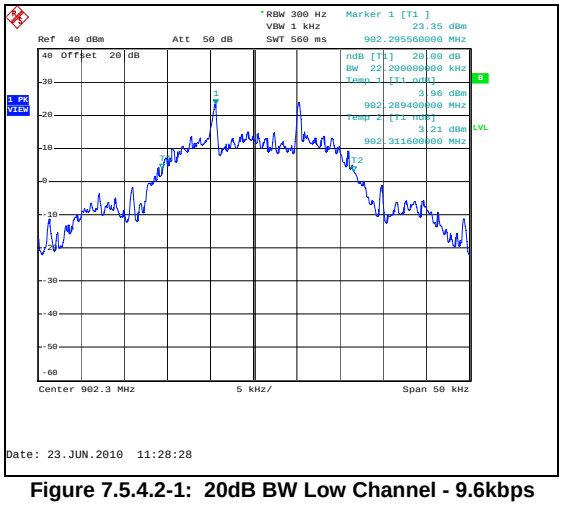


Figure 7.5.4.2-1: 20dB BW Low Channel - 9.6kbps

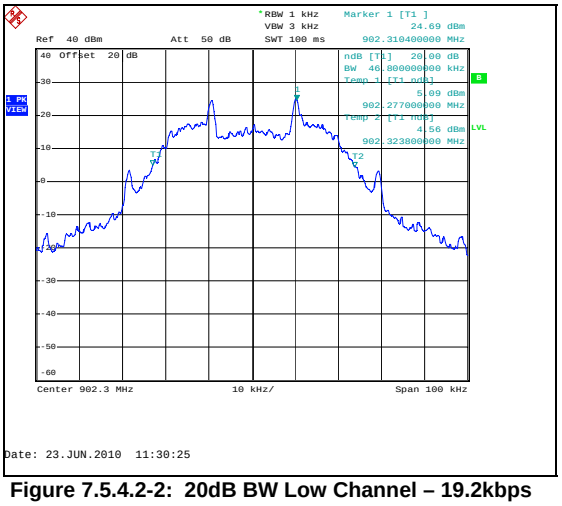


Figure 7.5.4.2-2: 20dB BW Low Channel – 19.2kbps

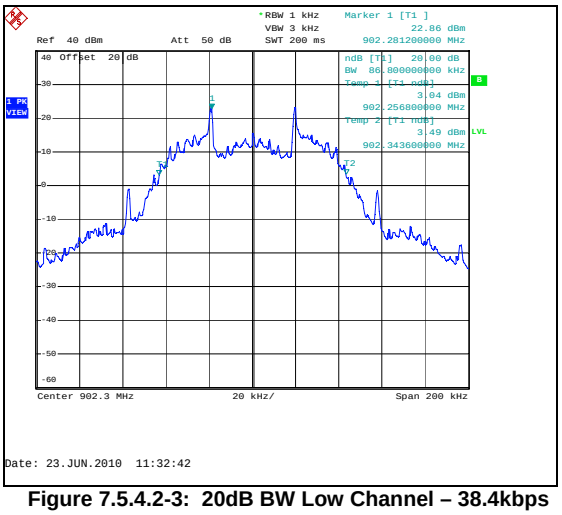


Figure 7.5.4.2-3: 20dB BW Low Channel – 38.4kbps

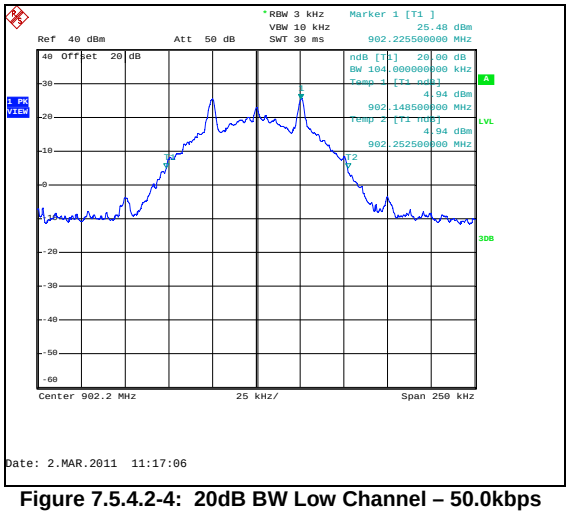


Figure 7.5.4.2-4: 20dB BW Low Channel – 50.0kbps

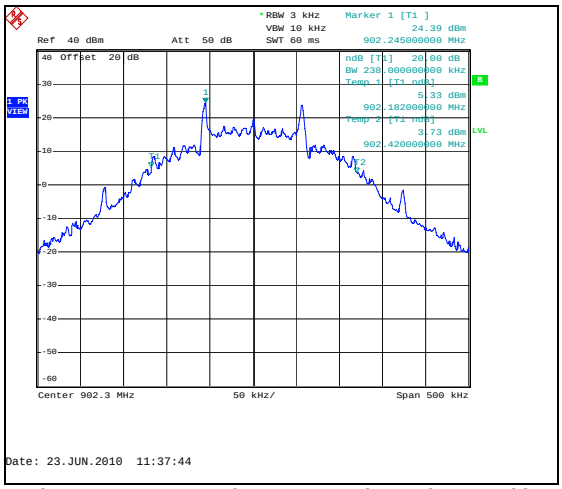


Figure 7.5.4.2-5: 20dB BW Low Channel – 115.2kbps

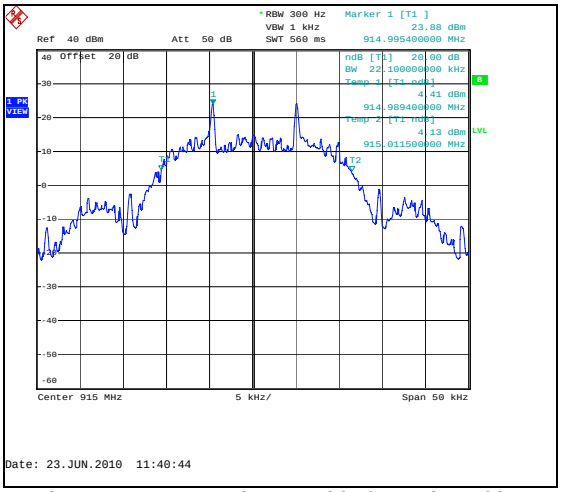


Figure 7.5.4.2-6: 20dB BW Mid Channel - 9.6kbps

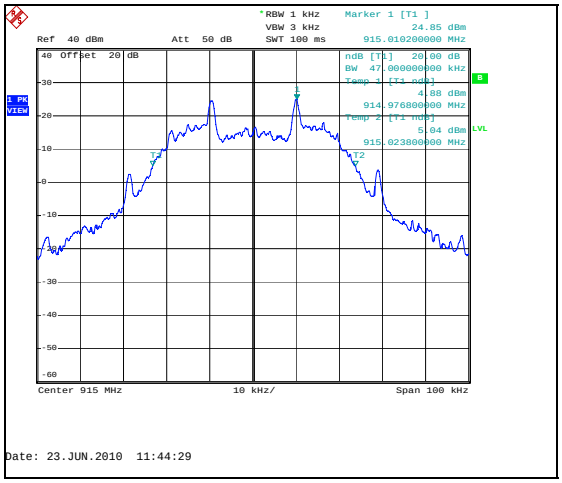


Figure 7.5.4.2-7: 20dB BW Mid Channel – 19.2kbps

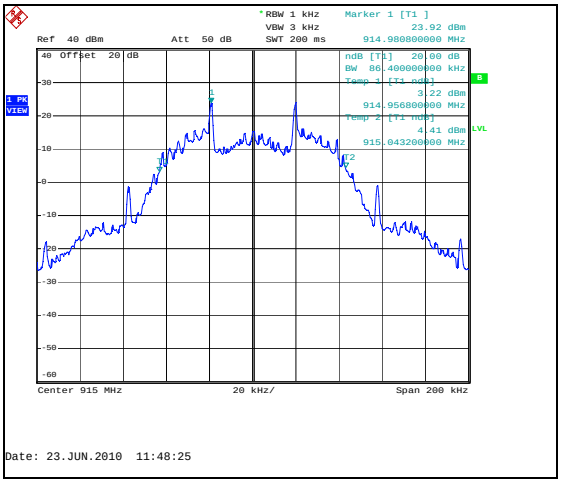


Figure 7.5.4.2-8: 20dB BW Mid Channel – 38.4kbps

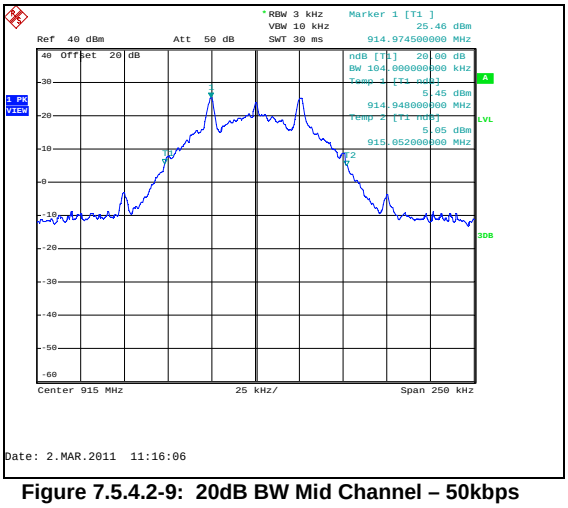


Figure 7.5.4.2-9: 20dB BW Mid Channel – 50kbps

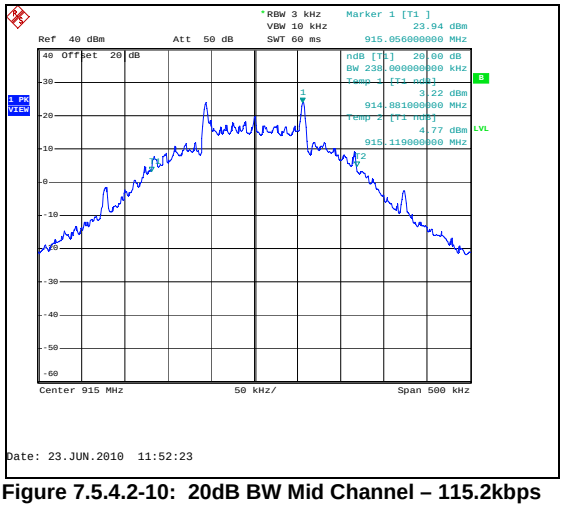


Figure 7.5.4.2-10: 20dB BW Mid Channel – 115.2kbps

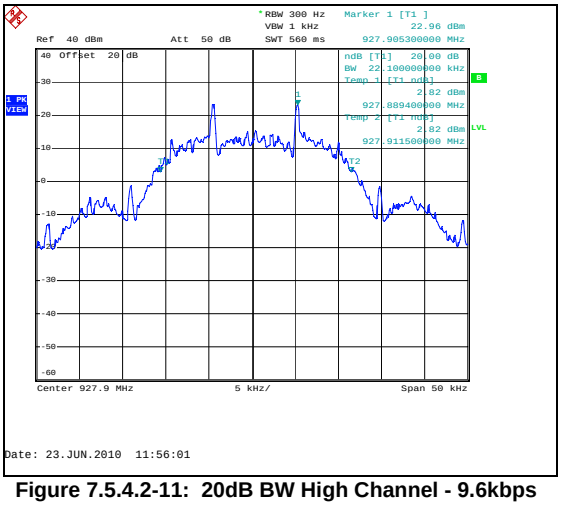


Figure 7.5.4.2-11: 20dB BW High Channel - 9.6kbps

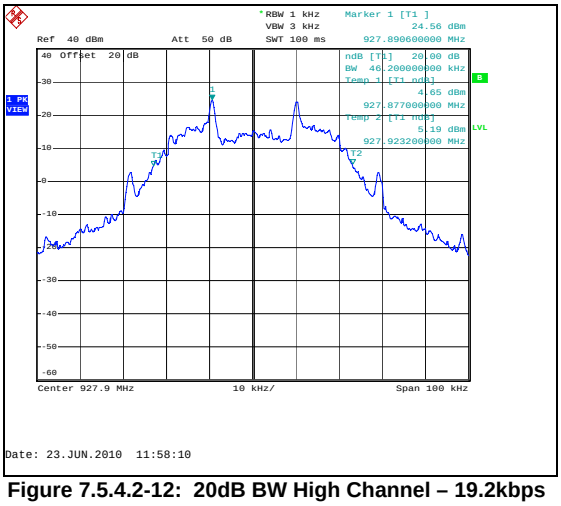


Figure 7.5.4.2-12: 20dB BW High Channel – 19.2kbps

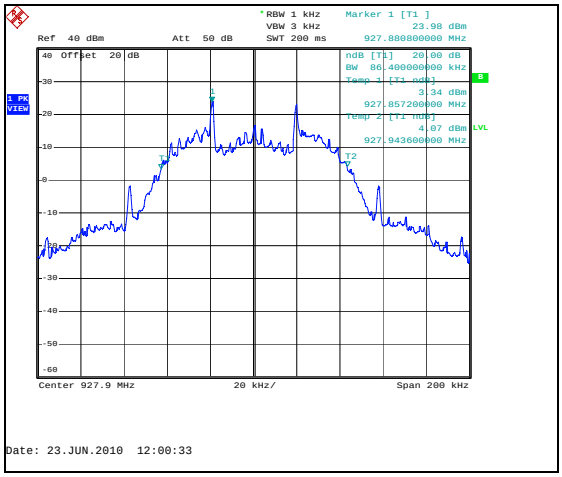


Figure 7.5.4.2-13: 20dB BW High Channel – 38.4kbps

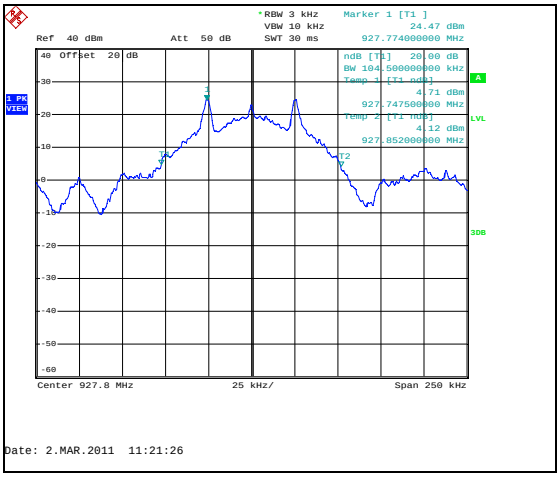


Figure 7.5.4.2-14: 20dB BW High Channel – 50kbps

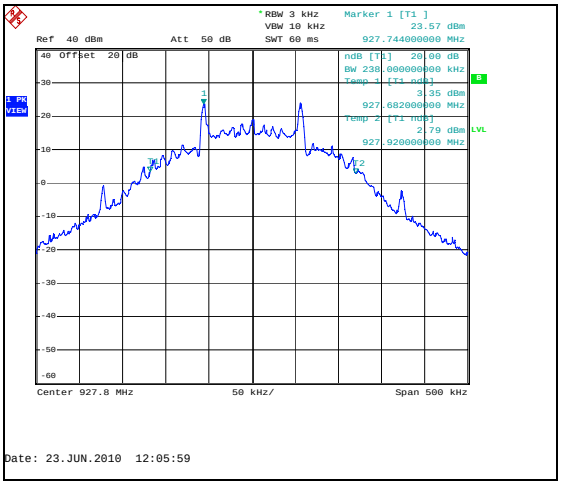


Figure 7.5.4.2-15: 20dB BW High Channel – 115.2kbps

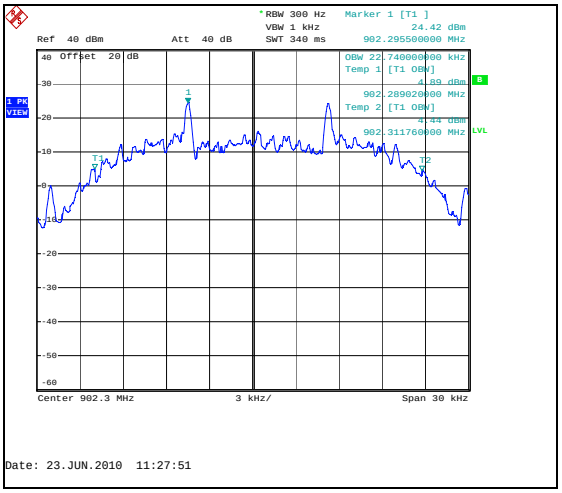


Figure 7.5.4.2-16: 99% BW Low Channel - 9.6kbps

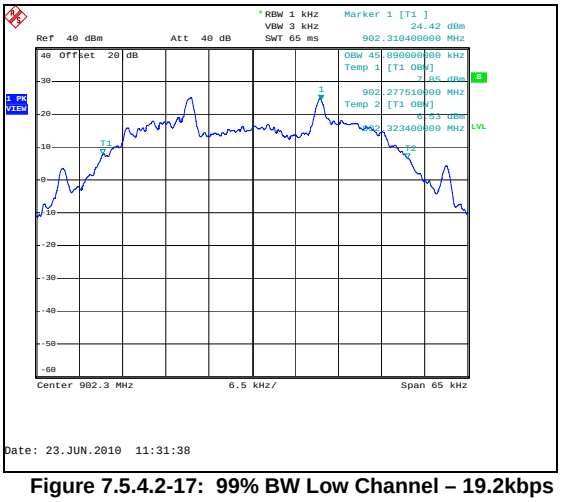


Figure 7.5.4.2-17: 99% BW Low Channel – 19.2kbps

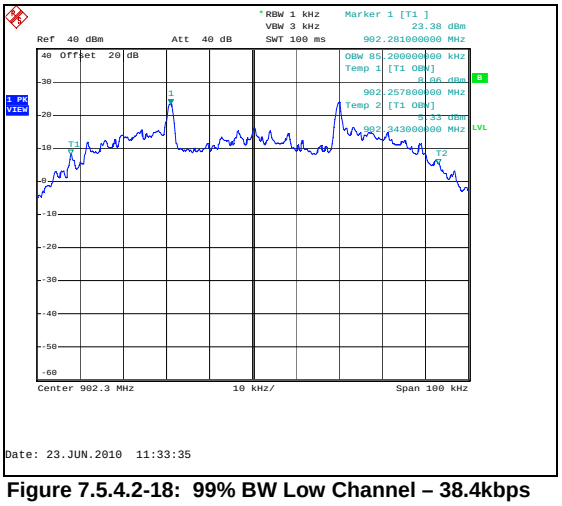


Figure 7.5.4.2-18: 99% BW Low Channel – 38.4kbps

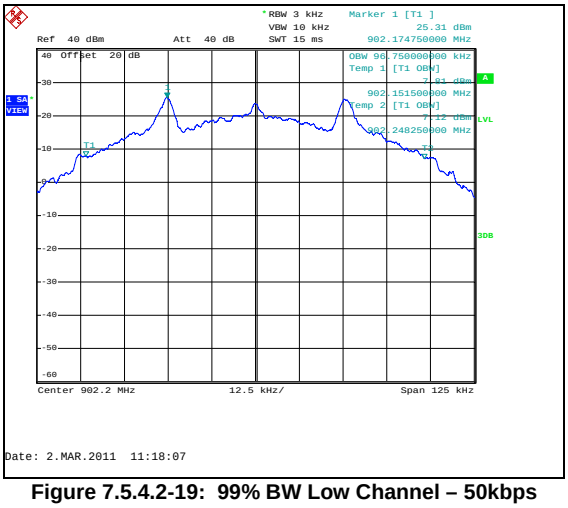


Figure 7.5.4.2-19: 99% BW Low Channel – 50kbps

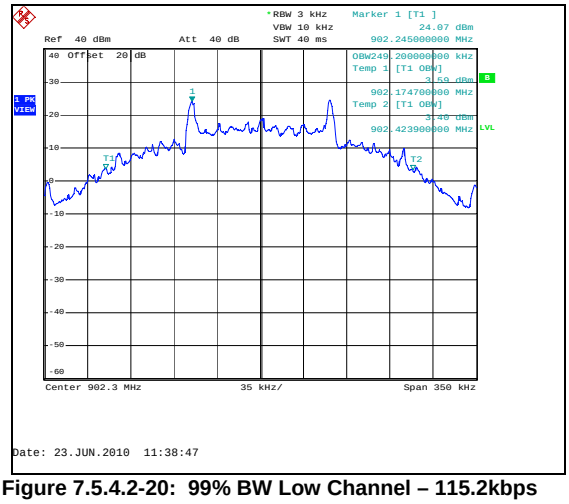


Figure 7.5.4.2-20: 99% BW Low Channel – 115.2kbps

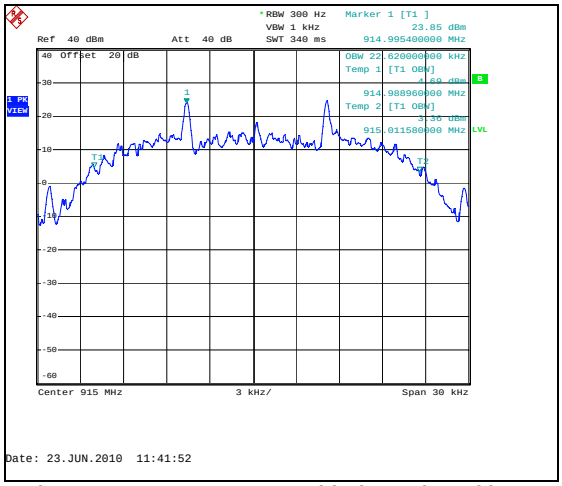


Figure 7.5.4.2-21: 99% BW Mid Channel - 9.6kbps

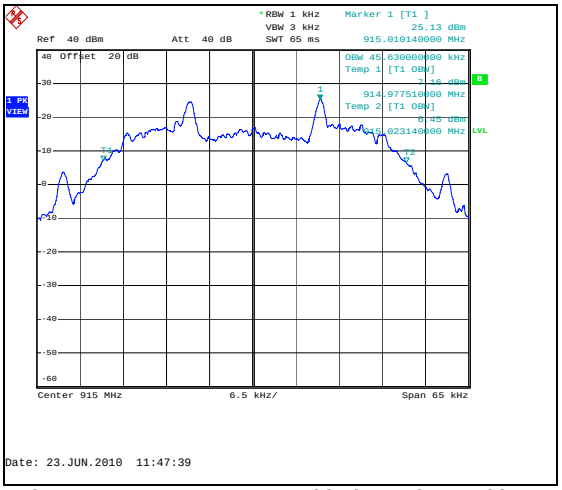


Figure 7.5.4.2-22: 99% BW Mid Channel – 19.2kbps

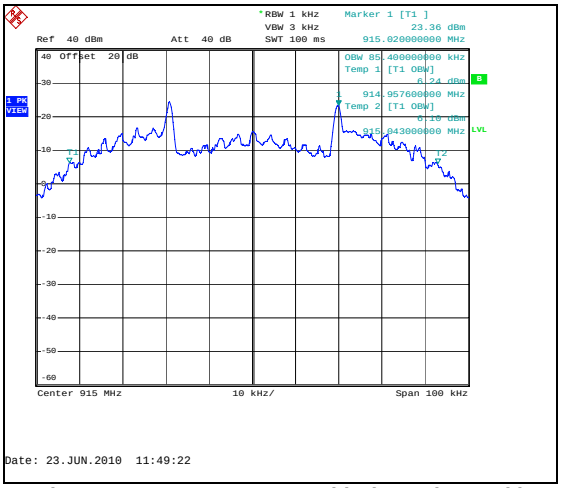


Figure 7.5.4.2-23: 99% BW Mid Channel – 38.4kbps

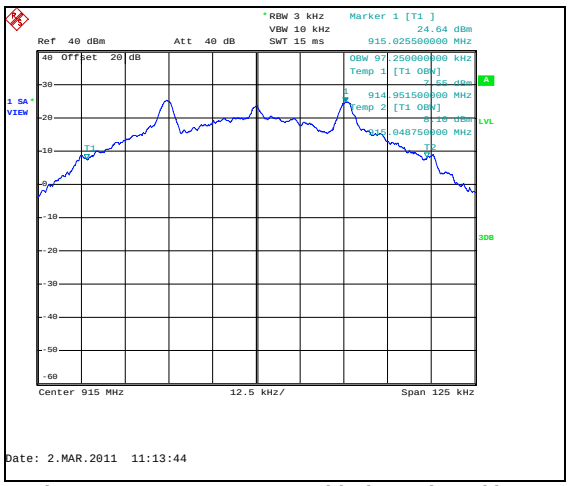


Figure 7.5.4.2-24: 99% BW Mid Channel – 50kbps

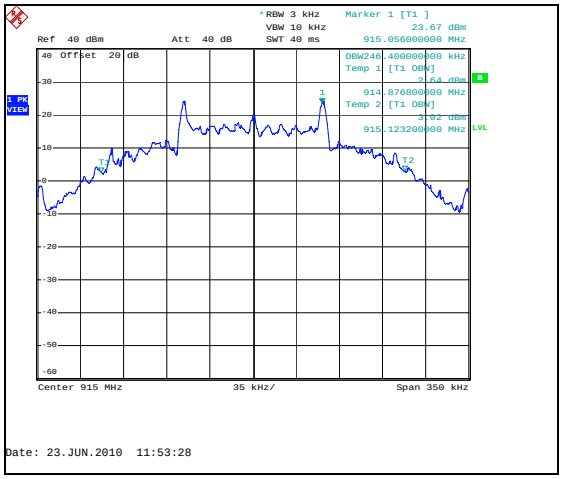


Figure 7.5.4.2-25: 99% BW Mid Channel – 115.2kbps

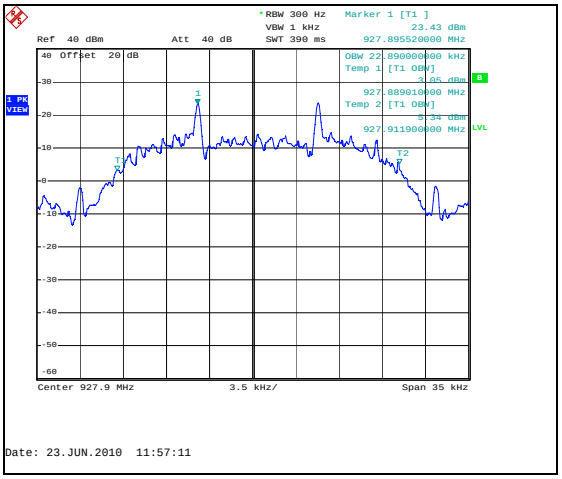


Figure 7.5.4.2-26: 99% BW High Channel - 9.6kbps

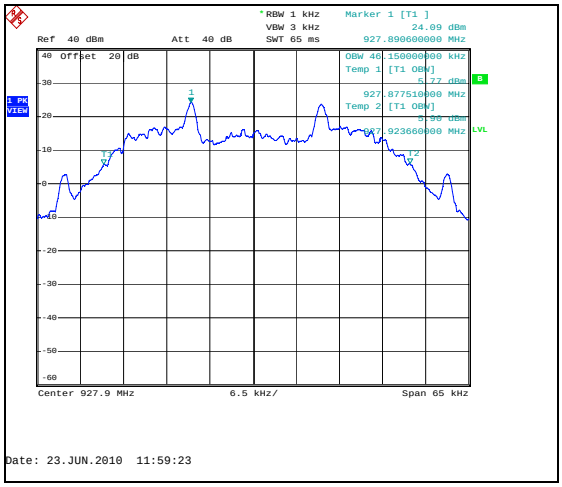


Figure 7.5.4.2-27: 99% BW High Channel – 19.2kbps

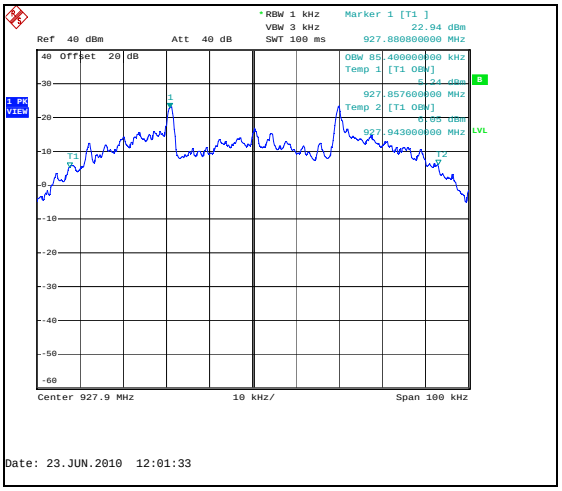


Figure 7.5.4.2-28: 99% BW High Channel – 38.4kbps

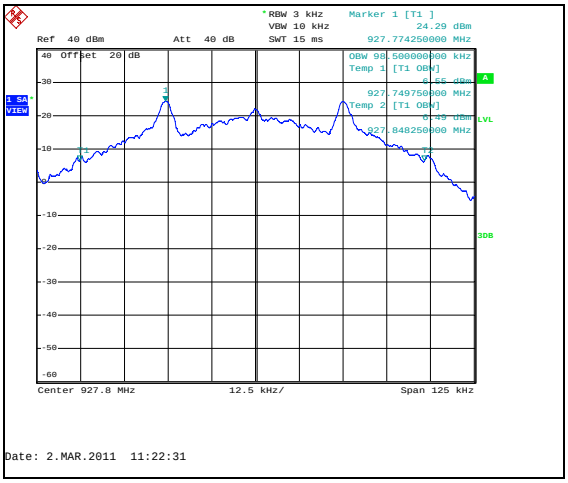


Figure 7.5.4.2-29: 99% BW High Channel – 50kbps

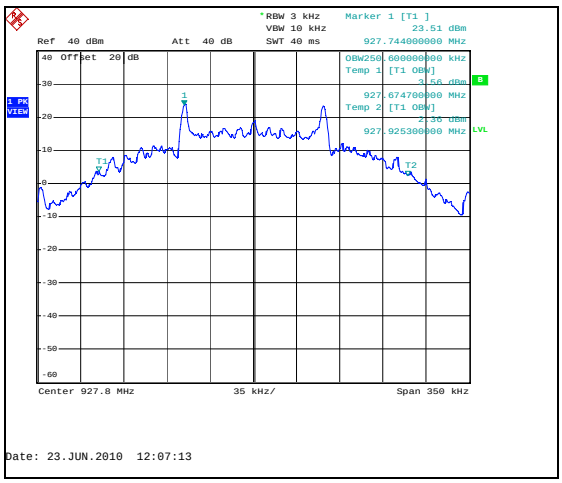


Figure 7.5.4.2-30: 99% BW High Channel – 115.2kbps

7.6 Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC: RSS-210 2.6, A8.5

7.6.1 Band-Edge Compliance of RF Conducted Emissions

7.6.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 30 kHz, which is ≥ 1% of the span, and the VBW was set to 100kHz.

Band-edge was evaluated for all combinations of operating modes and data rates with worst case data provided. Worst case reported utilized 38.4kbps in Narrow Mode, 50.0kbps in Sun Mode, and 115.2kbps in Wide Mode.

7.6.1.2 Measurement Results

Results are shown in the figures 7.6.1.2-1 to 7.6.1.2-8 below.

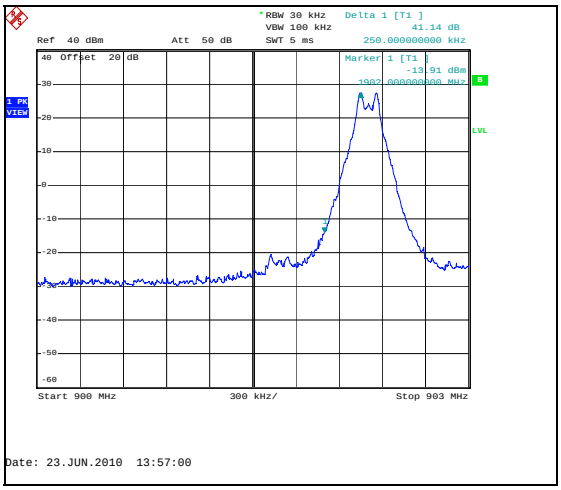


Figure 7.6.1.2-1: Lower Band-edge – Wide Mode

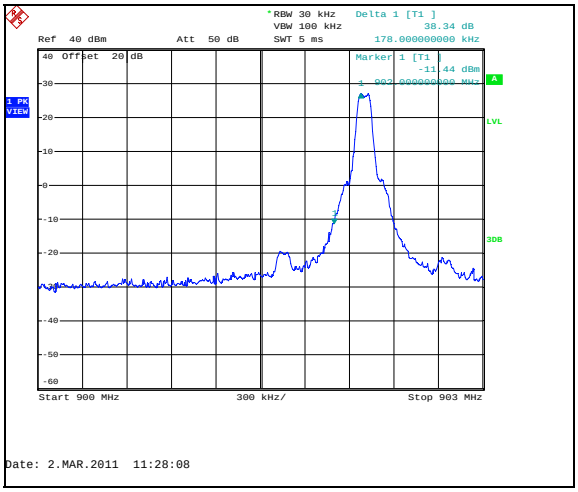


Figure 7.6.1.2-2: Lower Band-edge – Sun Mode

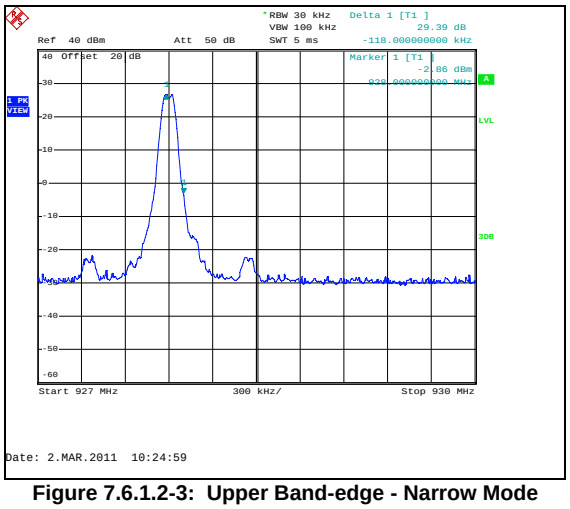


Figure 7.6.1.2-3: Upper Band-edge - Narrow Mode

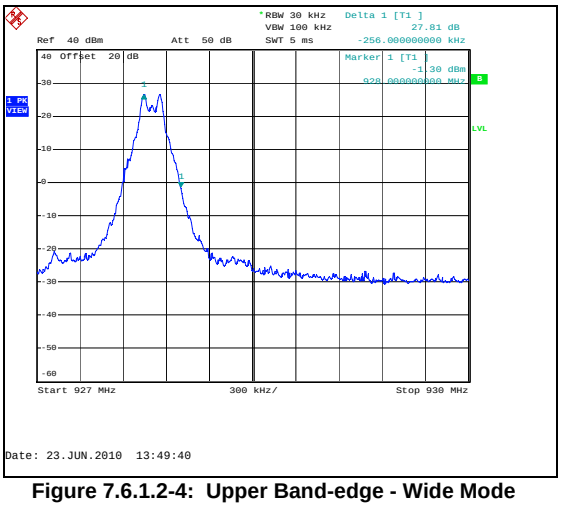


Figure 7.6.1.2-4: Upper Band-edge - Wide Mode

HOPPING MODE:

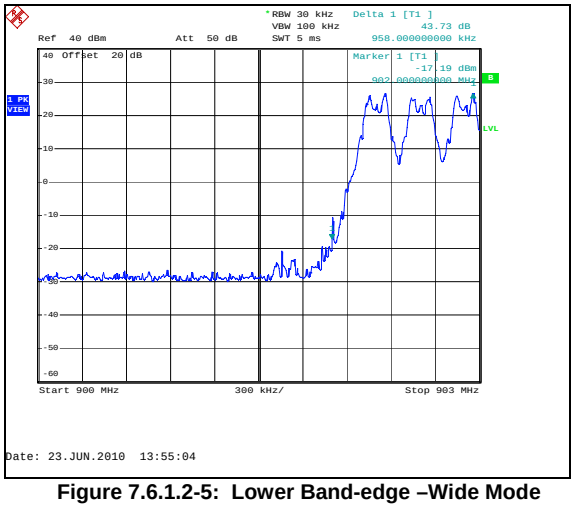


Figure 7.6.1.2-5: Lower Band-edge –Wide Mode

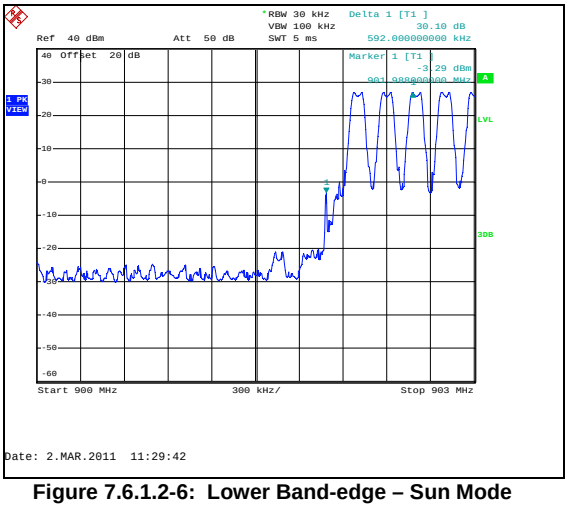


Figure 7.6.1.2-6: Lower Band-edge – Sun Mode

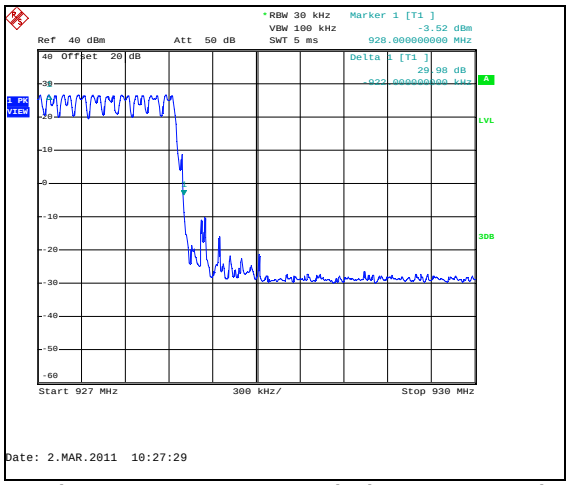


Figure 7.6.1.2-7: Upper Band-edge – Narrow Mode

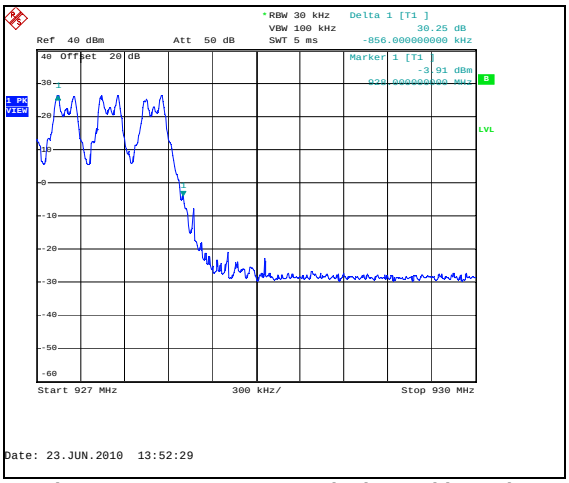


Figure 7.6.1.2-8: Upper Band-edge –Wide Mode

7.6.2 RF Conducted Spurious Emissions

7.6.2.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 10GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100kHz. A peak detector function was used with the trace set to max hold.

RF conducted spurious emissions were evaluated for all combinations of operating modes and data rates with worst case data provided. Worst case report utilized 9.6kbps in Full Narrow Mode.

7.6.2.2 Measurement Results

Results are shown below in Figures 7.6.2.2-1 to 7.6.2.2-6:

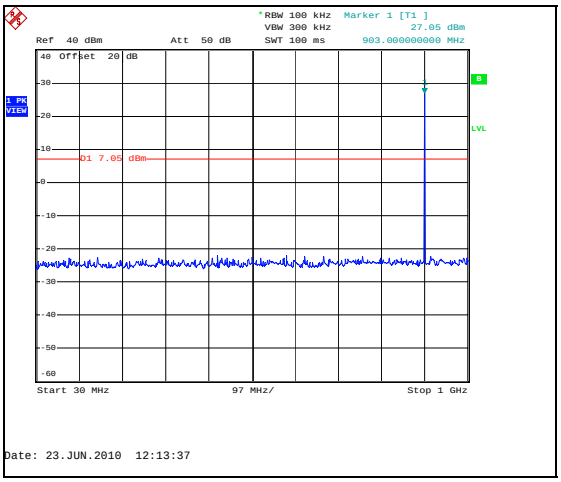


Figure 7.6.2.2-1: 30 MHz – 1 GHz – Low Channel

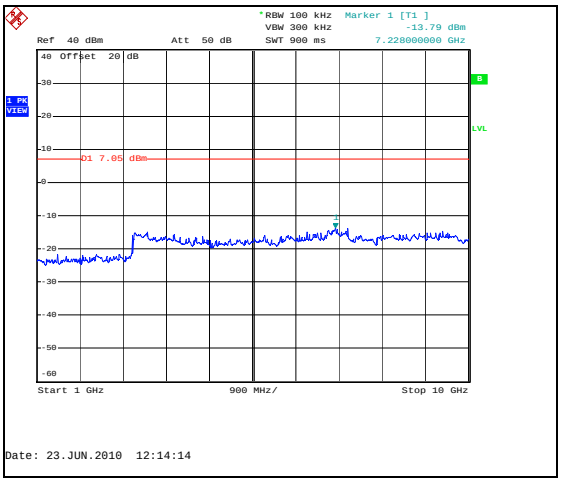


Figure 7.6.2.2-2: 1 GHz – 10 GHz – Low Channel

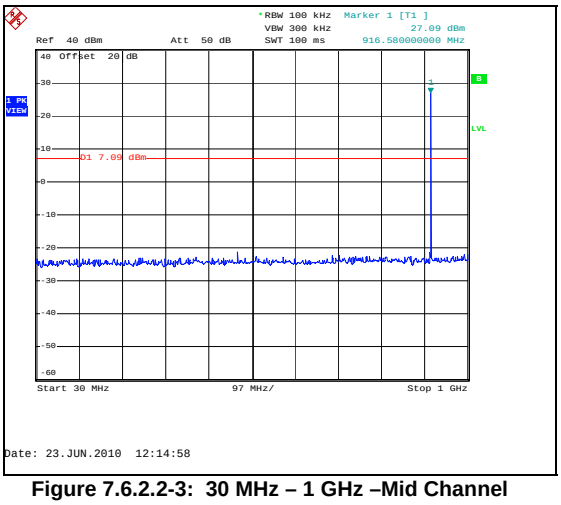


Figure 7.6.2.2-3: 30 MHz – 1 GHz –Mid Channel

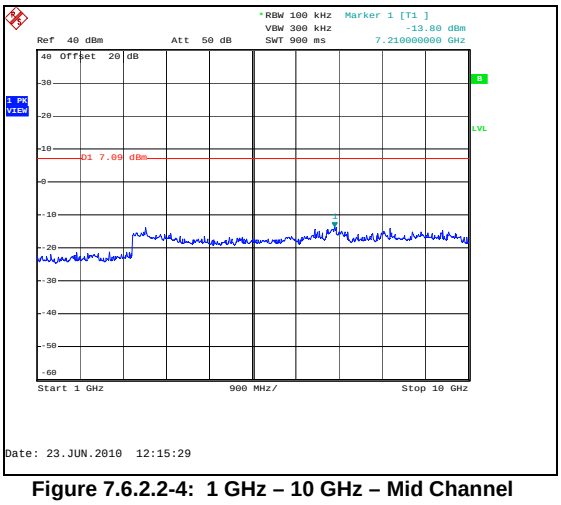


Figure 7.6.2.2-4: 1 GHz – 10 GHz – Mid Channel

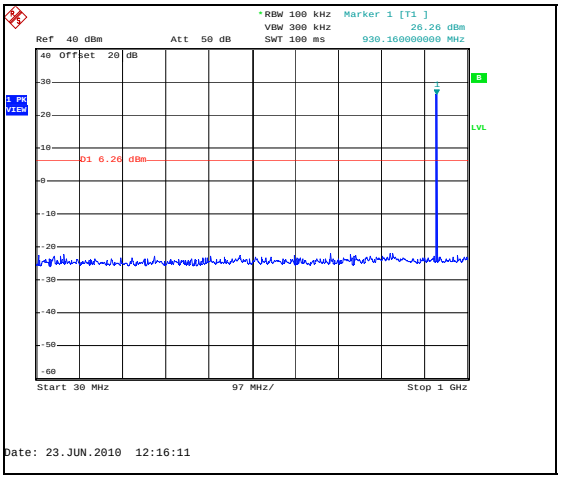


Figure 7.6.2.2-5: 30 MHz – 1 GHz – High Channel

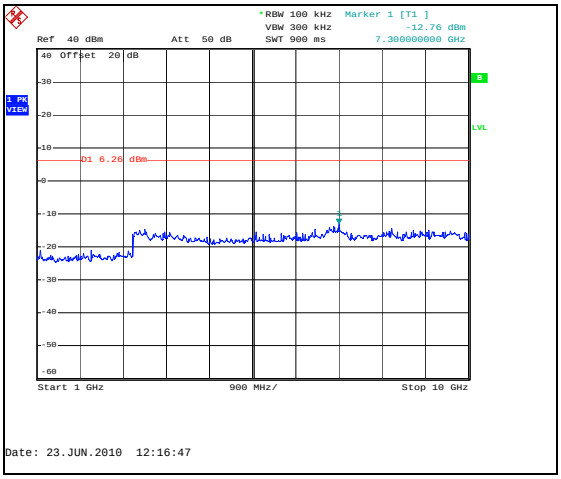


Figure 7.6.2.2-6: 1 GHz – 10 GHz –High Channel

7.6.3 Radiated Spurious Emissions - FCC Section 15.205 IC: RSS-210 2.6

7.6.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 10GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements made with RBW and VBW of 1 MHz and 3MHz respectively.

The EUT was caused to generate a continuous carrier signal on the hopping channel.

Radiated spurious emissions were evaluated for all combinations of operating modes and data rates with worst case data provided. Worst case report utilized 9.6kbps in Full Narrow Mode.

The EUT was evaluated in multiple orientations with the worst case data presented.

7.6.3.2 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in the Table 7.6.3.2-1 below.

Table 7.6.3.2-1: Radiated Spurious 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
Low Channel										
2706.9	55.06	53.15	H	-3.77	51.29	49.38	74.0	54.0	22.7	4.6
2706.9	56.32	49.80	V	-3.77	52.55	46.03	74.0	54.0	21.4	8.0
4511.5	50.78	44.92	H	0.88	51.66	45.80	74.0	54.0	22.3	8.2
4511.5	49.91	43.50	V	0.88	50.79	44.38	74.0	54.0	23.2	9.6
5413.8	49.24	41.74	H	2.78	52.02	44.52	74.0	54.0	22.0	9.5
5413.8	48.81	41.05	V	2.78	51.59	43.83	74.0	54.0	22.4	10.2
9023	50.44	44.12	H	7.92	58.36	52.04	74.0	54.0	15.6	2.0
9023	49.60	41.61	V	7.92	57.52	49.53	74.0	54.0	16.5	4.5
Middle Channel										
2745	54.43	52.32	H	-3.76	50.67	48.56	74.0	54.0	23.3	5.4
2745	50.59	47.34	V	-3.76	46.83	43.58	74.0	54.0	27.2	10.4
3660	52.11	43.43	V	-1.38	50.73	42.05	74.0	54.0	23.3	12.0
4575	50.93	45.14	H	1.01	51.94	46.15	74.0	54.0	22.1	7.9
4575	49.92	43.75	V	1.01	50.93	44.76	74.0	54.0	23.1	9.2
7320	50.13	40.96	V	6.48	56.61	47.44	74.0	54.0	17.4	6.6
8235	48.40	38.34	H	7.40	55.80	45.74	74.0	54.0	18.2	8.3
9150	51.19	44.83	H	8.08	59.27	52.91	74.0	54.0	14.7	1.1
9150	51.67	44.91	V	8.08	59.75	52.99	74.0	54.0	14.3	1.0
High Channel										
2783.7	52.74	47.26	H	-3.75	48.99	43.51	74.0	54.0	25.0	10.5
2783.7	52.79	48.50	V	-3.75	49.04	44.75	74.0	54.0	25.0	9.3
3711.6	53.33	42.67	H	-1.10	52.23	41.57	74.0	54.0	21.8	12.4
3711.6	52.57	45.38	V	-1.10	51.47	44.28	74.0	54.0	22.5	9.7
4639.5	50.80	45.02	H	1.13	51.93	46.15	74.0	54.0	22.1	7.8
4639.5	50.68	44.38	V	1.13	51.81	45.51	74.0	54.0	22.2	8.5
8351.1	48.45	39.27	H	7.50	55.95	46.77	74.0	54.0	18.0	7.2

7.6.3.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak
Corrected Level: 55.06 - 3.77 = 51.29dBuV/m
Margin: 74dBuV/m – 51.29dBuV/m = 22.7dB

Example Calculation: Average
Corrected Level: 53.15 - 3.77 - 0= 49.38dBuV
Margin: 54dBuV – 49.38dBuV = 4.6dB

8 CONCLUSION

In the opinion of ACS, Inc. the Gridstream RF Enhanced Integrated Focus AX, manufactured by Cellnet Technology, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210. .

END REPORT