

Certification Test Report

FCC ID: TEB-HUNTGS10122
IC: 5931A-HUNTGS10122

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

ACS Report Number: 11-0031.W06.34.A

Manufacturer: Hunt Technologies, Inc.
Model: 10122

Test Begin Date: October 17, 2011
Test End Date: October 17, 2011

Report Issue Date: October 17, 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: _____

A handwritten signature in black ink, appearing to read "Kirby Munroe", is written over a horizontal line.

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

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This report contains 23 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 for single modular approval.

1.2 Product description

This device is a daughter board module, manufactured by Hunt Technologies, Inc. that plugs into a GE KV2C metrology circuit board. The daughter board contains two separate radios: a 900 MHz ISM band frequency-hopping spread spectrum (FHSS) transceiver and a 2.4 MHz ISM band transceiver employing 802.15.4/ZigBee.

The 10122 module collects metering data from the meter module and transmits it to electric utility companies. It can also receive and repeat data from other similar modules or a central collector module. The 10122 module will be assembled into a GE KV2C meter before delivery to the customer.

The 10122 module is a composite device by definition. 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 RF conducted measurements on the 900 MHz LAN radio only. Separate reports will be issued to address the radiated emissions as well as the 2.4 GHz Zigbee radio.

Technical Details:

The EUT 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: GFSK
Antenna Type / Gain: Patch / 2.15dBi
Operating Voltage: 28VDC

Manufacturer Information:
Hunt technologies, Inc.
6436 County Rd 11
Pequot Lakes, MN 56472

Test Sample Serial Number(s): ACS#3

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

1.3 Test Methodology and Considerations

For the purpose of RF conducted measurements, the EUT was modified with a temporary 50 ohm antenna port.

Multiple data rates were evaluated with worst case provided where applicable.

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: 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 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, 2011
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2011
- ❖ 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

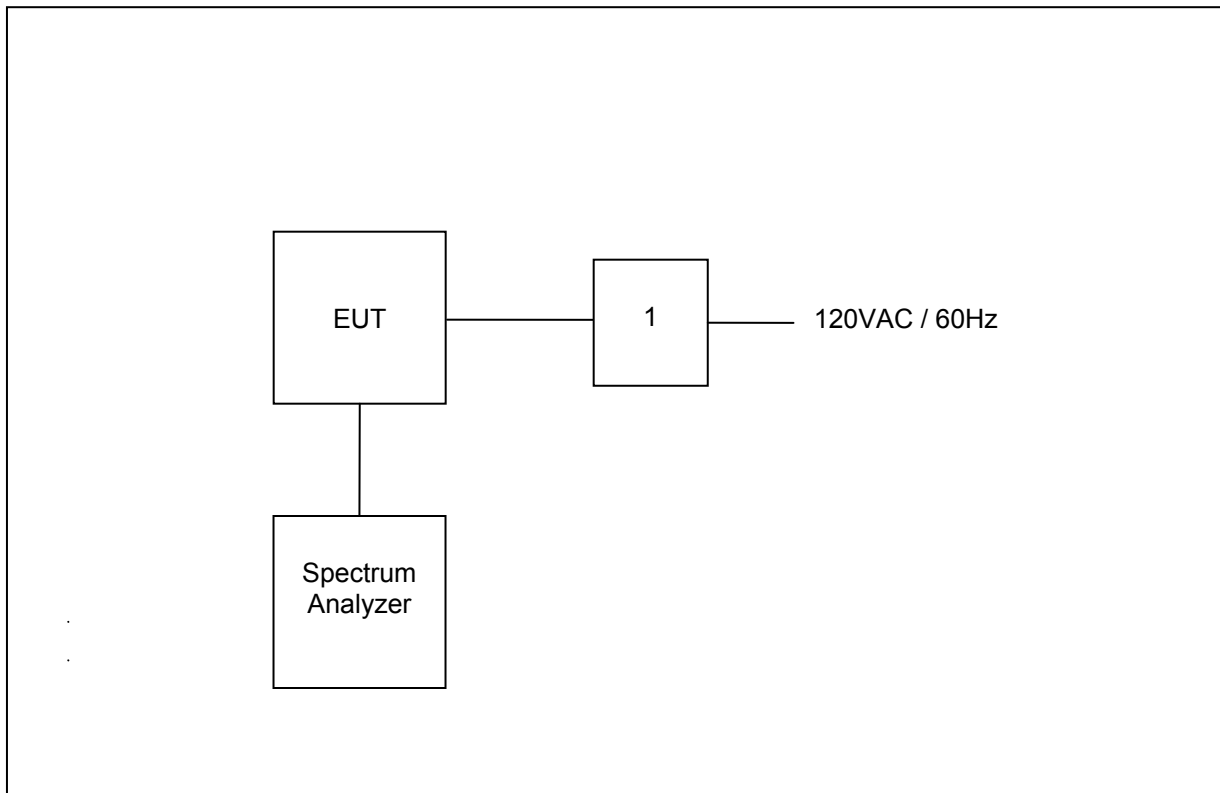
AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	8/26/2011	8/26/2012
340	Aeroflex/Weinschel	AS-20	Attenuators	7136	8/29/2011	8/29/2012

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	DC Supply	Trygon Electronics	DL40-1	489512

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 transmitter antenna is a patch antenna external to the circuit board and utilizes a unique IPEX male connector on the antennas feed cable. The female IPEX connector is soldered to the circuit board at the manufacturing plant, and therefore complies with the requirement that no other antenna shall be used with the device.

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

7.2.1 Measurement Procedure (Conducted Method)

The RF output of the equipment under test was directly connected to the input of the spectrum analyzer. The spectrum analyzer RBW was set such that $RBW \gg EBW$. Data was collected with the EUT operating at maximum power per channelization.

7.2.2 Measurement Results

Results are shown below in Table 7.2.2-1 and Figures 7.2.2-1 to 7.2.2-6 below:

Table 7.2.2-1: RF Output Power

Frequency [MHz]	Level [dBm]
902.2	26.9
902.3	26.92
904.0	26.97
915.0	26.74
927.8	26.14
927.9	26.16

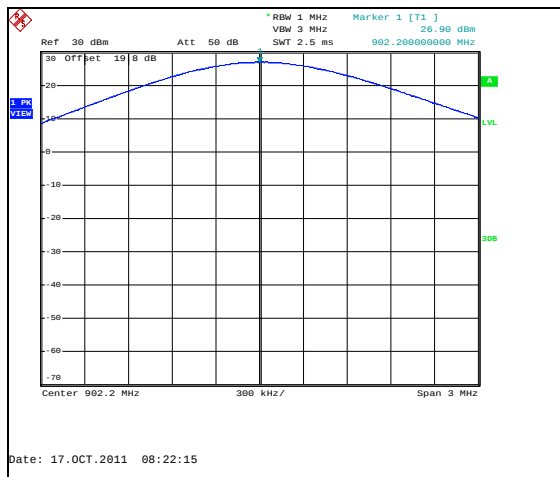


Figure 7.2.2-1: Output Power – 902.2MHz

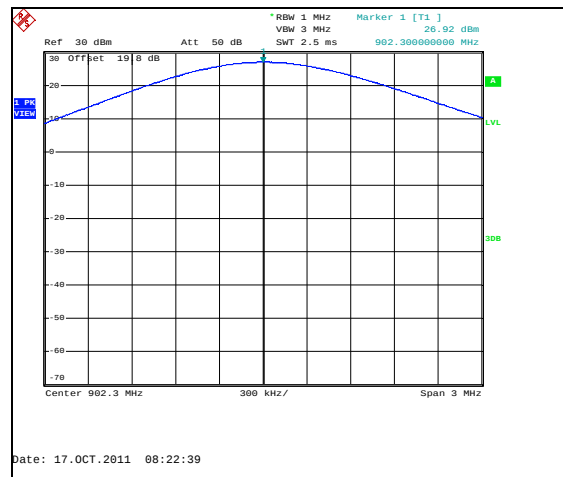


Figure 7.2.2-2: Output Power – 902.3MHz

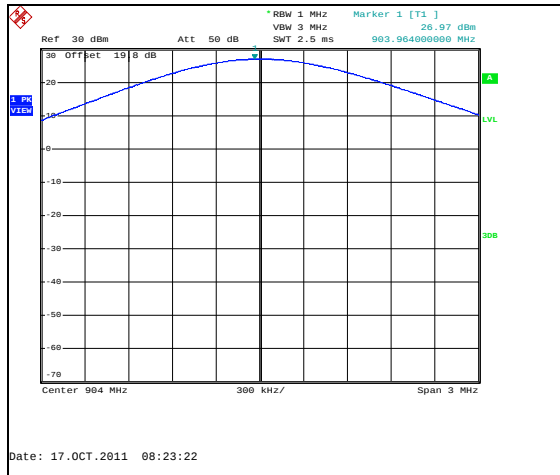


Figure 7.2.2-3: Output Power – 904MHz

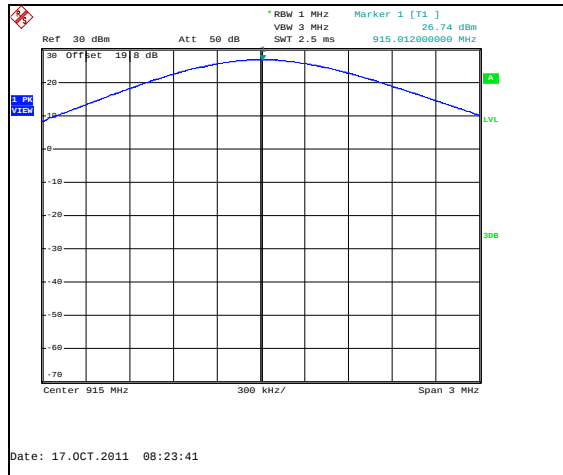


Figure 7.2.2-4: Output Power – 915MHz

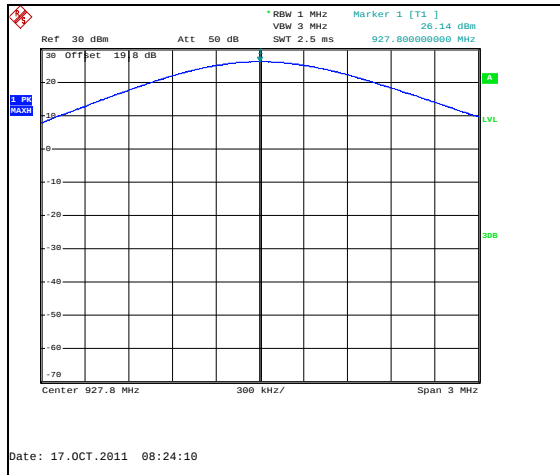


Figure 7.2.2-5: Output Power – 927.8MHz

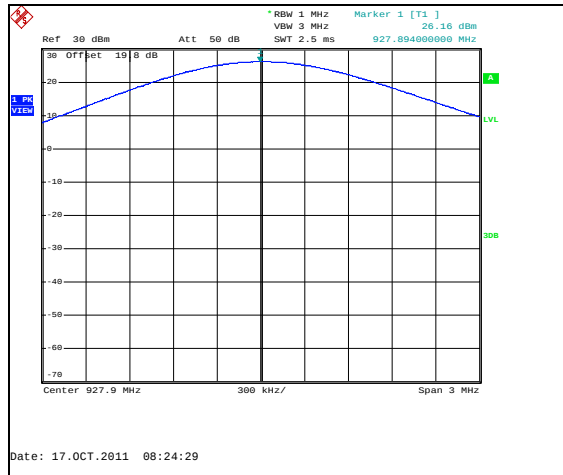


Figure 7.2.2-6: Output Power – 927.9MHz

7.3 Channel Usage Requirements

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

7.3.1.1 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 $\geq 1\%$ 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 7.3.1.2 below.

7.3.1.2 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 7.3.1.2-1 to 7.3.1.2-3.

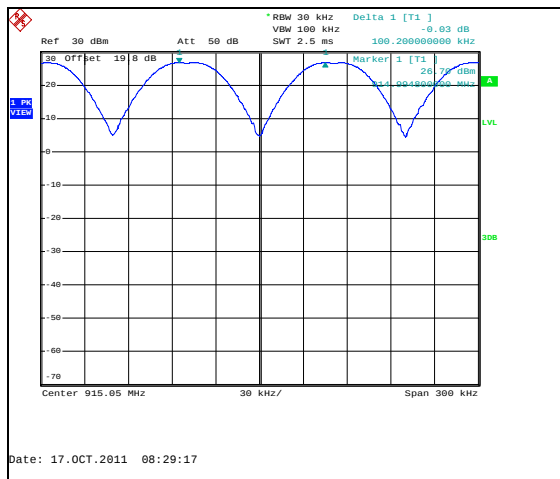


Figure 7.3.1.2-1: Narrow / Full Narrow Modes

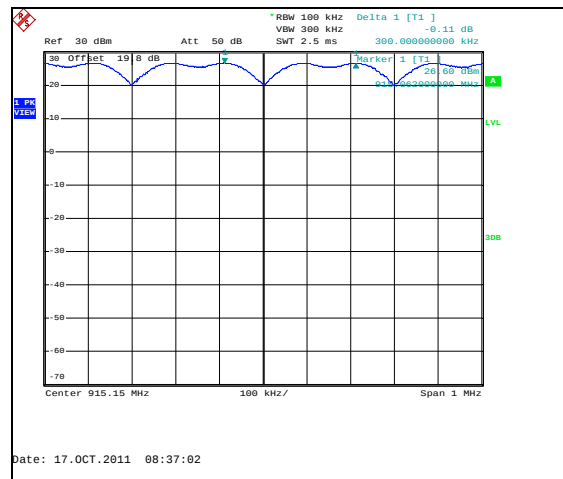


Figure 7.3.1.2-2: Wide Mode

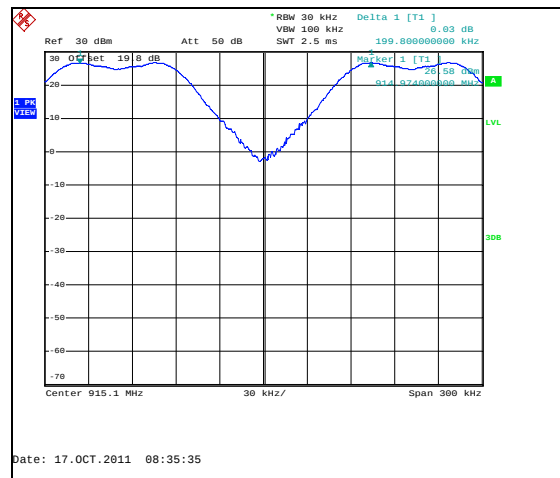


Figure 7.3.1.2-3: SUN Mode

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

The minimum 20dB bandwidth of the device is less than 250 kHz. The device employs > 50 hopping channels as required. Results are shown below in Figures 7.3.2-1 to 7.3.2-15.

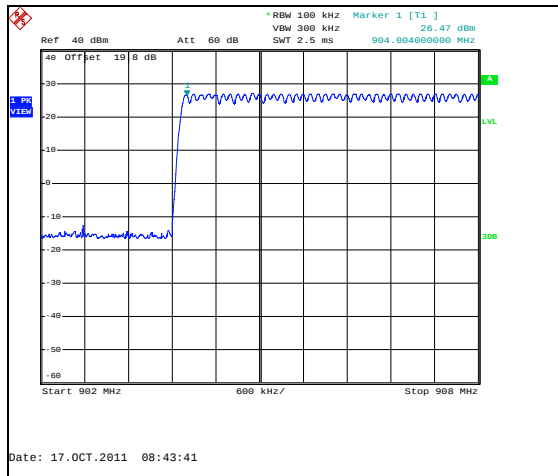


Figure 7.3.2-1: Narrow Mode (240 Channels)

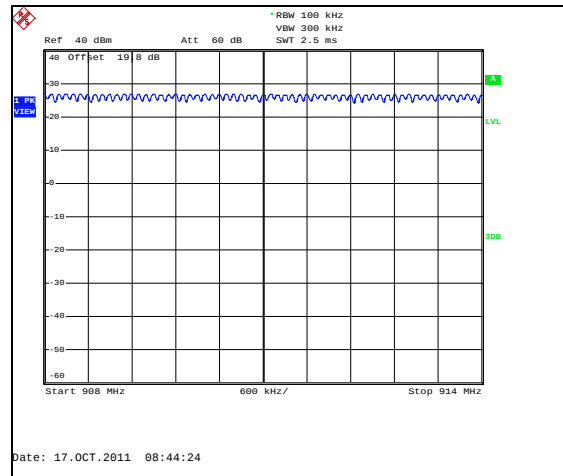


Figure 7.3.2-2: Narrow Mode (240 Channels)

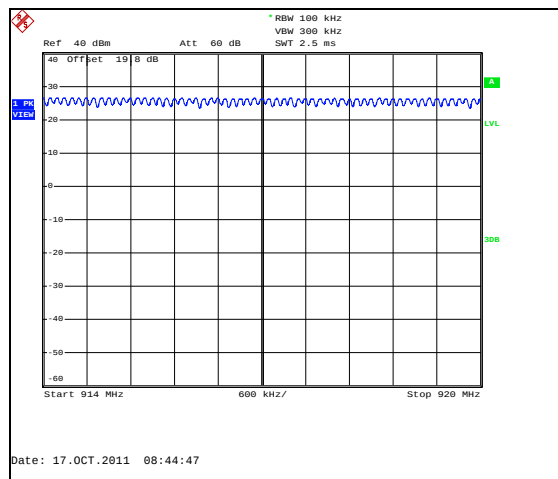


Figure 7.3.2-3: Narrow Mode (240 Channels)

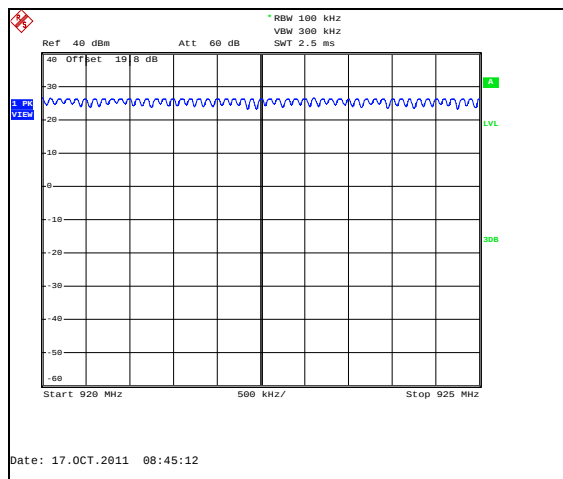


Figure 7.3.2-4: Narrow Mode (240 Channels)

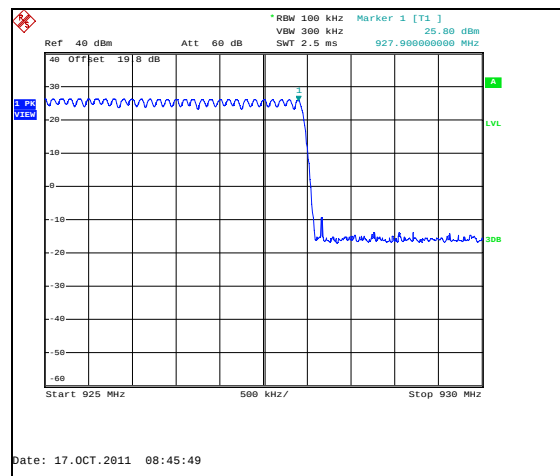


Figure 7.3.2-5: Narrow Mode (240 Channels)

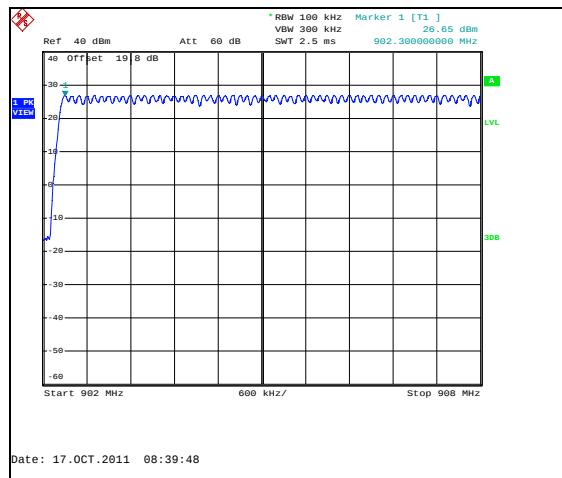


Figure 7.3.2-6: Full Narrow Mode (256 Channels)

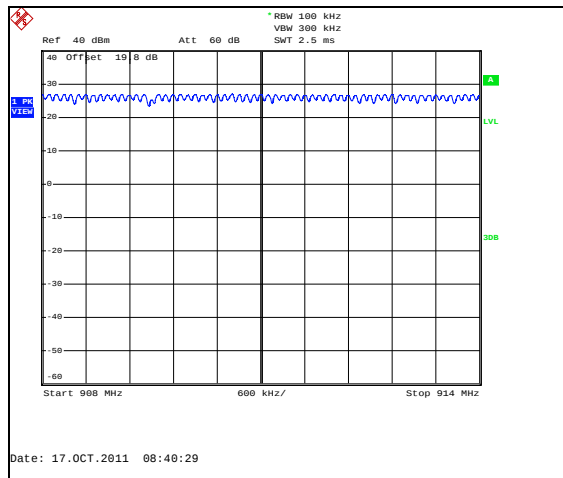


Figure 7.3.2-7: Full Narrow Mode (256 Channels)

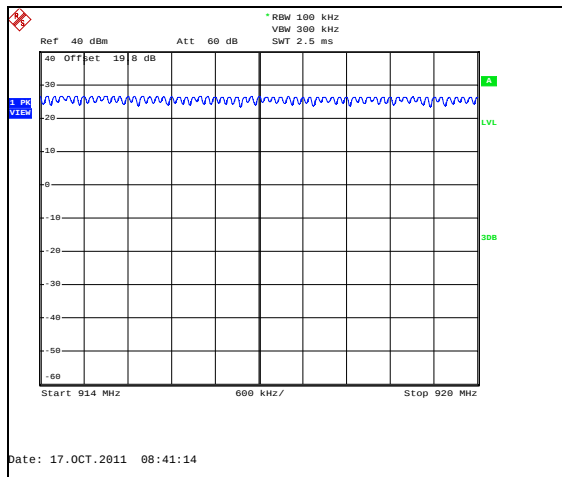


Figure 7.3.2-8: Full Narrow Mode (256 Channels)

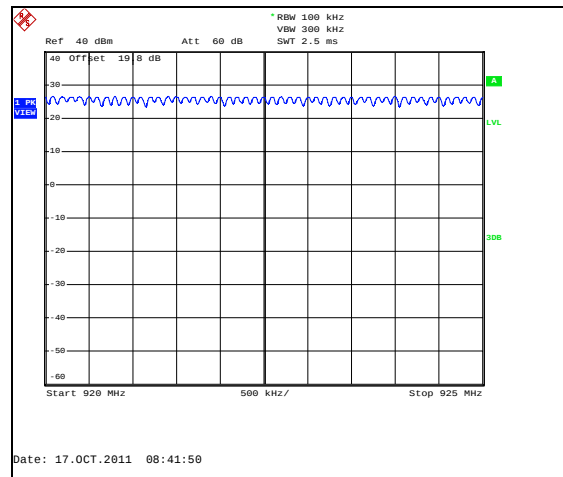


Figure 7.3.2-9: Full Narrow Mode (256 Channels)

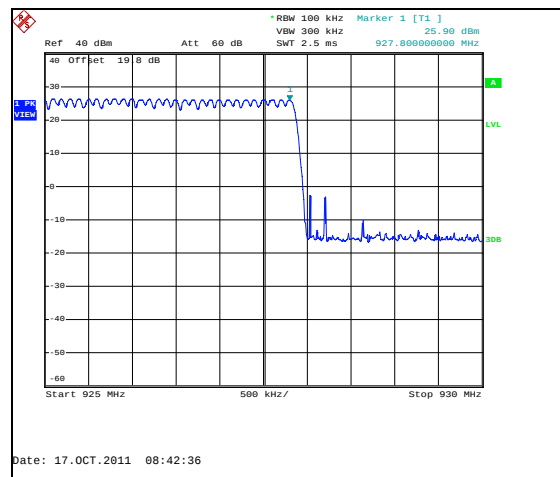


Figure 7.3.2-10: Full Narrow Mode (256 Channels)

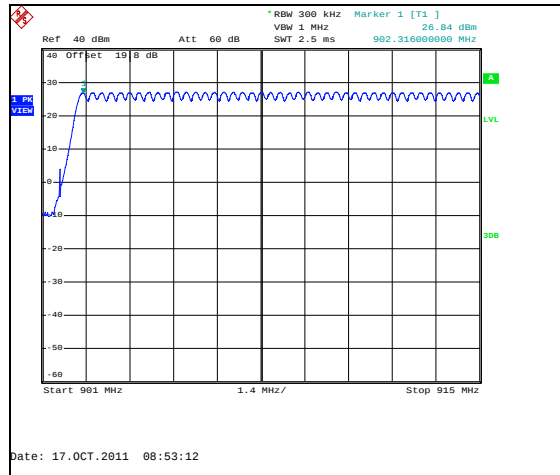


Figure 7.3.2-11: Wide Mode (86 Channels)

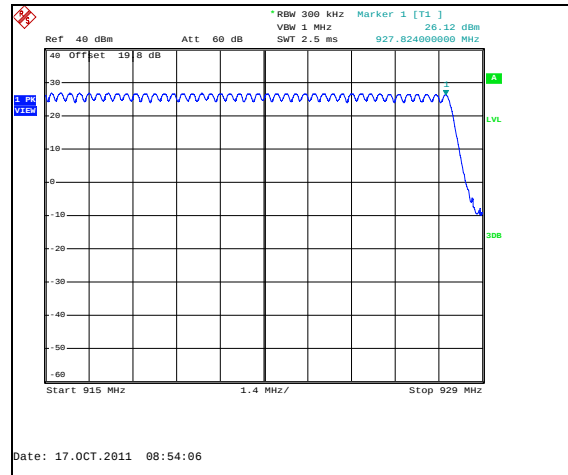


Figure 7.3.2-12: Wide Mode (86 Channels)

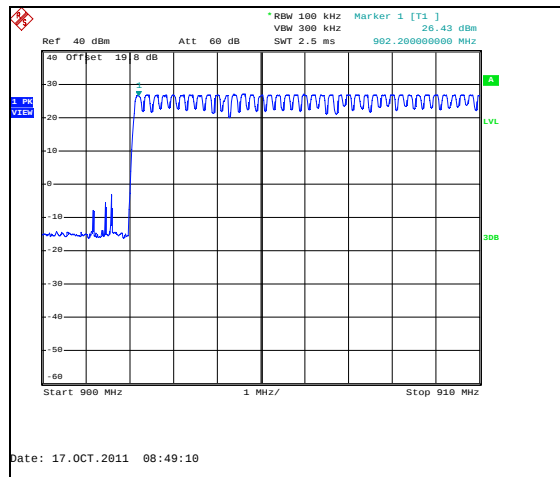


Figure 7.3.2-13: SUN Mode (129 Channels)

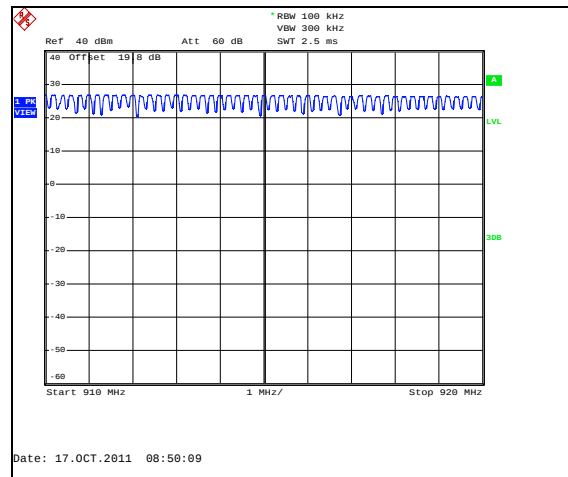


Figure 7.3.2-14: SUN Mode (129 Channels)

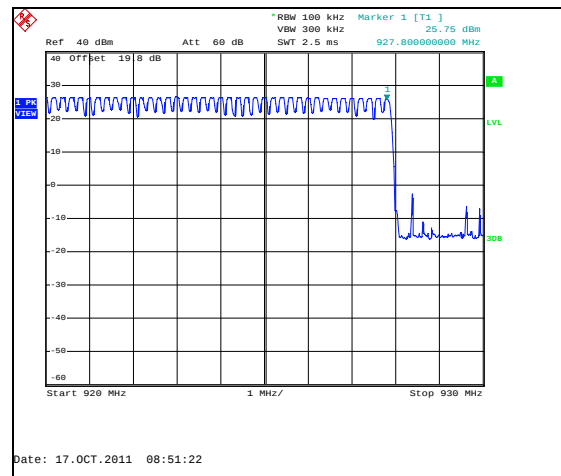


Figure 7.3.2-15: SUN Mode (129 Channels)

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

7.3.3.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The hopping channel is centered on the analyzer and the span set to 0 Hz. The RBW was set to 1 MHz and the VBW to 3 MHz. Sweep time was adjusted to capture the burst duration of the emission. The marker –delta function of the analyzer was employed to measure the burst duration.

7.3.3.2 Measurement Results

The duration of the RF transmission was measured as 277.6 ms. Regardless of the hopping mode, the dwell time on each channel is 700 milliseconds. The time between two dwells on the same channel is set by the number of channels in the hopping sequence. Each channel in the hopping sequence is used exactly once, then the sequence is repeated. For worst case, wide channel mode, the radio uses 86 channels. After using a channel, the radio will return to that channel in $85 \text{ channels} \times 0.7 \text{ seconds} = 59.5 \text{ seconds}$. Therefore the maximum time of occupancy on any one channel with a 10s or 20s period is 277.6 ms.

A single transmission for each modulation is shown in figure 7.3.3.2-1 below.

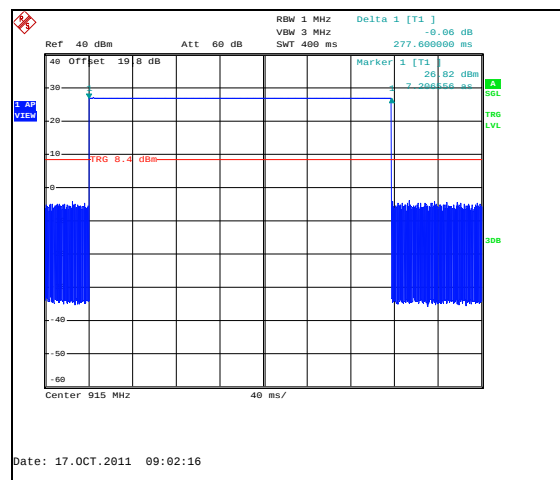


Figure 7.3.3.2-1: Dwell Time

7.3.4 20dB / 99% Bandwidth - FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)**7.3.4.1 Measurement Procedure**

The span of the spectrum analyzer display was set between two times and five times the occupied bandwidth (OBW) of the emission. The RBW of the spectrum analyzer was set to approximately 1 % to 5 % of the OBW.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission and side bands. The RBW was to ~ 1% of the span. The trace was set to max hold with a sample detector. The occupied bandwidth measurement function of the analyzer was used for the 99% bandwidth.

7.3.4.2 Measurement Results

Results are shown below in Table 7.3.4.2-1 and Figures 7.3.4.2-1 through 7.3.4.2-30.

Table 7.3.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]	Data Rate (kbps)
902.3	24.1	23.3	9.6
902.3	58.2	48.6	19.2
902.3	92	87.6	38.4
902.2	104.5	101	50.0
902.3	274.3	263.9	115.2
915.0	24	23.3	9.6
915.0	57.6	47.4	19.2
915.0	92.8	88.8	38.4
915.0	105	100	50.0
915.0	275.6	265.2	115.2
927.9	23.5	23.5	9.6
927.9	57.6	48.4	19.2
927.9	94.8	90.8	38.4
927.8	104.5	102	50.0
927.8	283.4	287.3	115.2

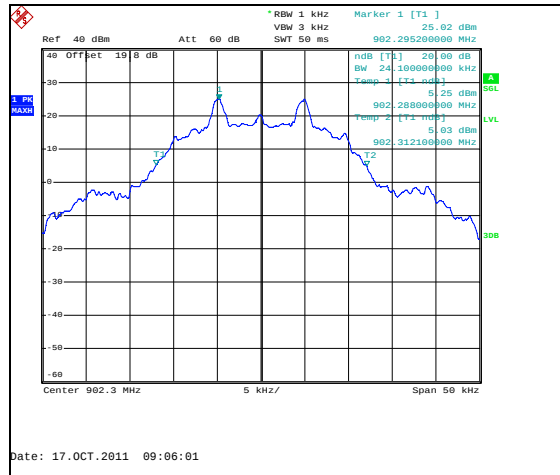


Figure 7.3.4.2-1: 20dB BW Low Channel - 9.6kbps

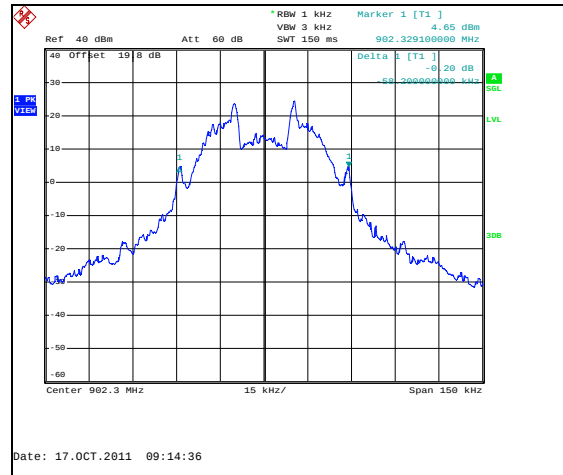


Figure 7.3.4.2-2: 20dB BW Low Channel - 19.2kbps

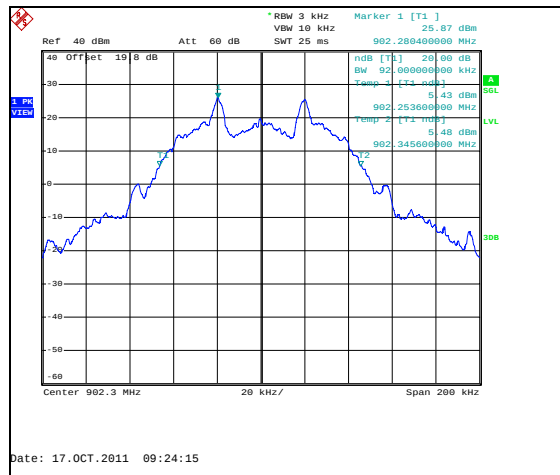


Figure 7.3.4.2-3: 20dB BW Low Channel - 38.4kbps

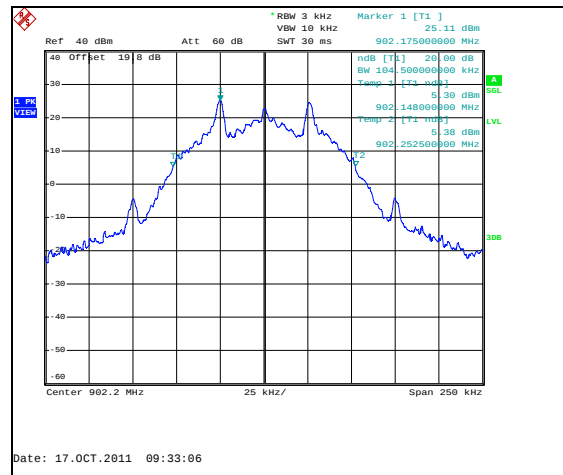


Figure 7.3.4.2-4: 20dB BW Low Channel - 50.0kbps

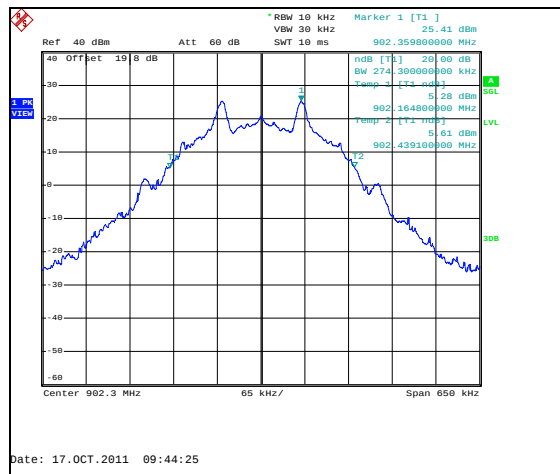


Figure 7.3.4.2-5: 20dB BW Low Channel - 115.2kbps

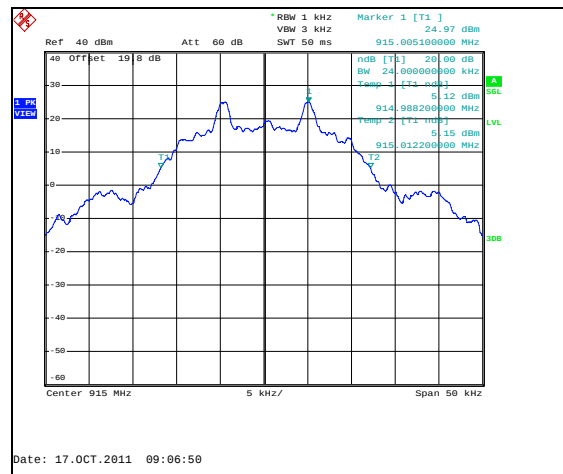


Figure 7.3.4.2-6: 20dB BW Mid Channel - 9.6kbps

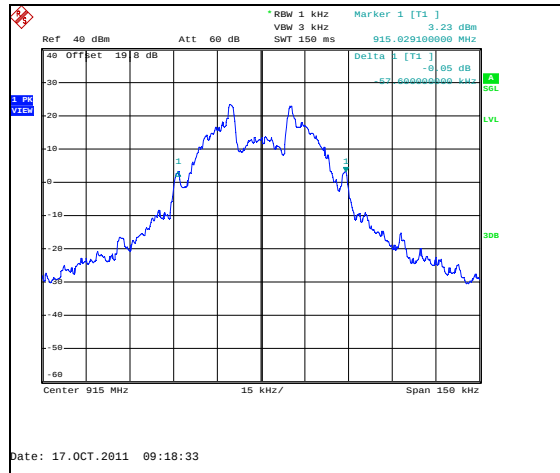


Figure 7.3.4.2-7: 20dB BW Mid Channel – 19.2kbps

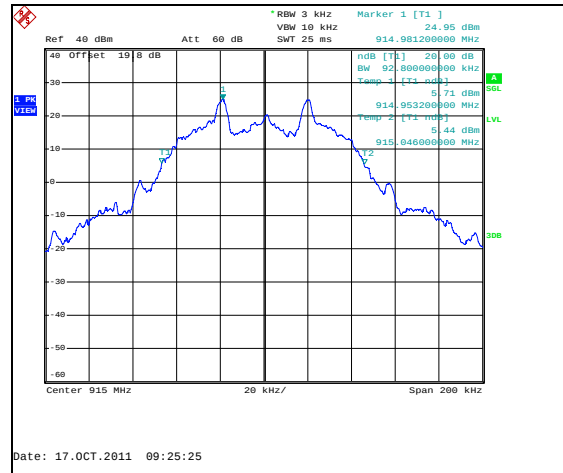


Figure 7.3.4.2-8: 20dB BW Mid Channel – 38.4kbps

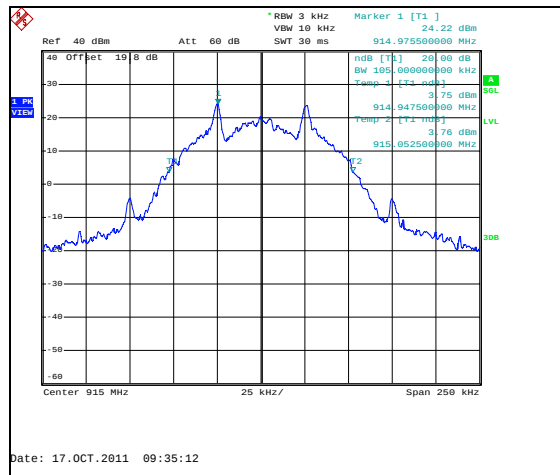


Figure 7.3.4.2-9: 20dB BW Mid Channel – 50kbps

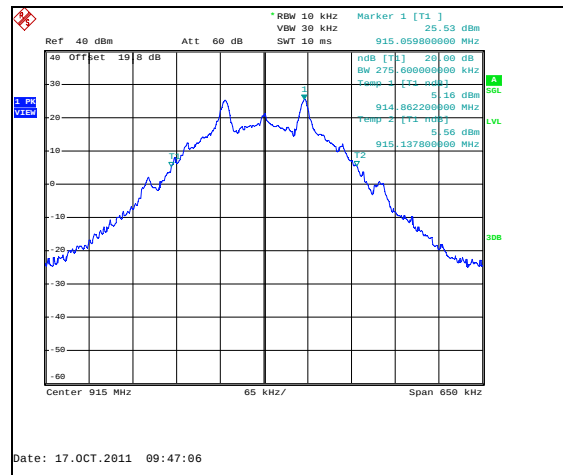


Figure 7.3.4.2-10: 20dB BW Mid Channel – 115.2kbps

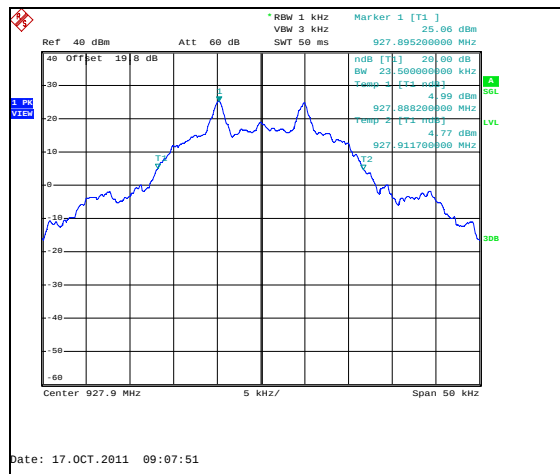


Figure 7.3.4.2-11: 20dB BW High Channel - 9.6kbps

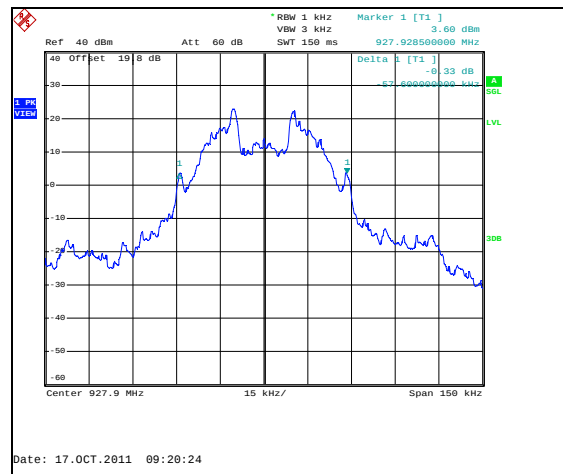


Figure 7.3.4.2-12: 20dB BW High Channel – 19.2kbps

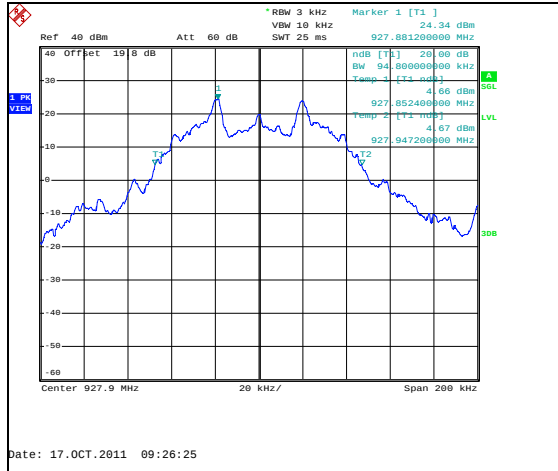


Figure 7.3.4.2-13: 20dB BW High Channel – 38.4kbps

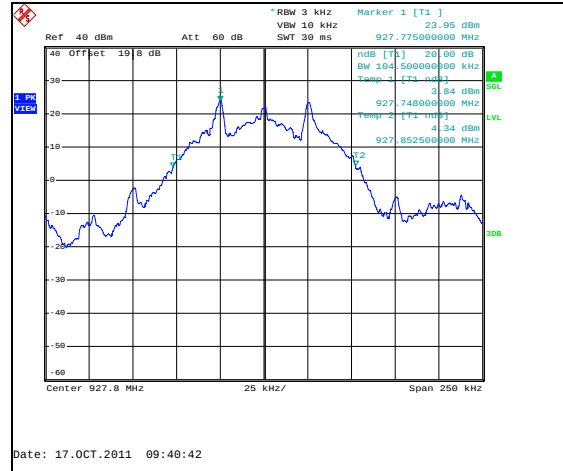


Figure 7.3.4.2-14: 20dB BW High Channel – 50kbps

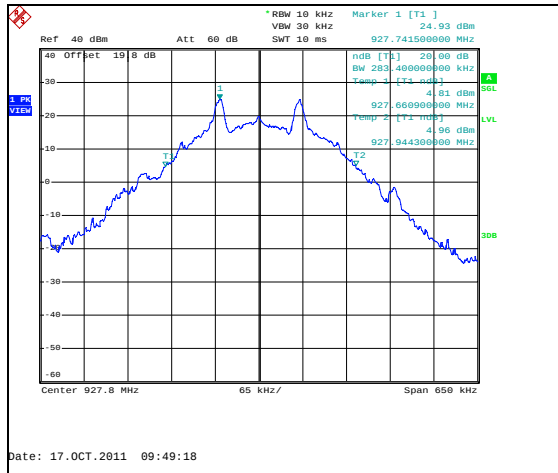


Figure 7.3.4.2-15: 20dB BW High Channel – 115.2kbps

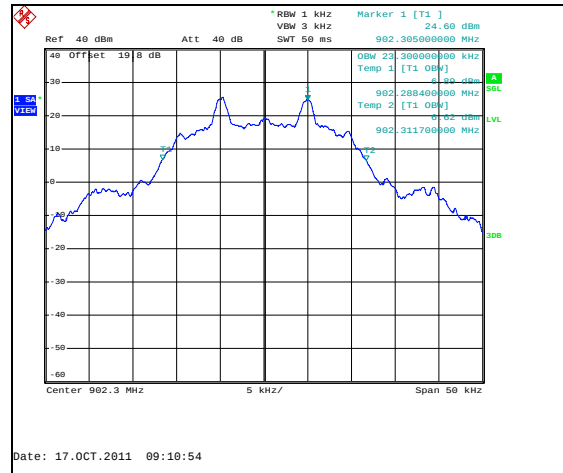


Figure 7.3.4.2-16: 99% BW Low Channel - 9.6kbps

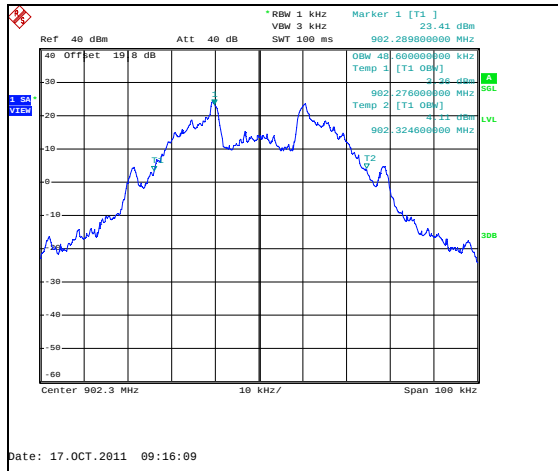


Figure 7.3.4.2-17: 99% BW Low Channel – 19.2kbps

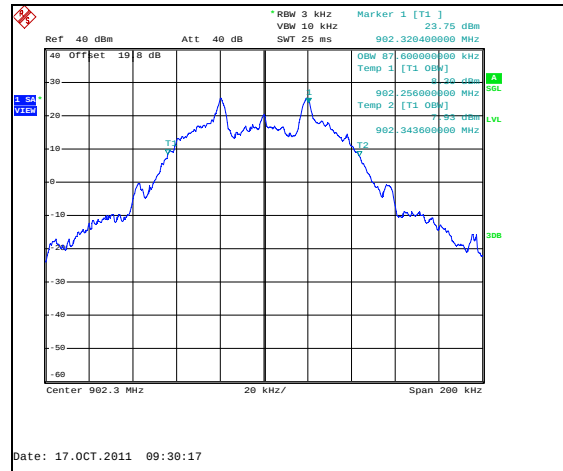


Figure 7.3.4.2-18: 99% BW Low Channel – 38.4kbps

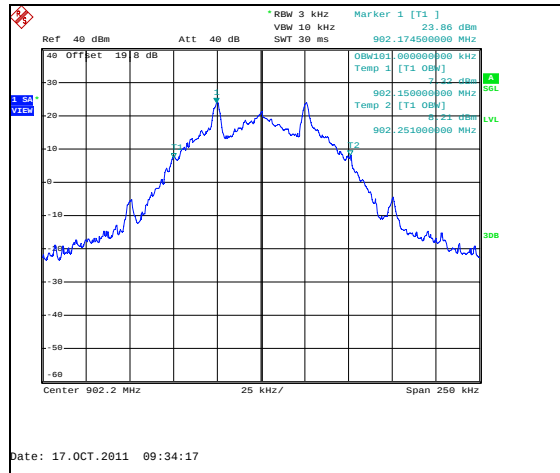


Figure 7.3.4.2-19: 99% BW Low Channel – 50kbps

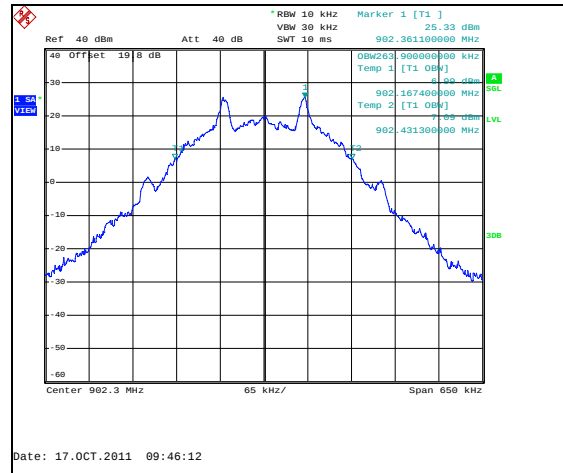


Figure 7.3.4.2-20: 99% BW Low Channel – 115.2kbps

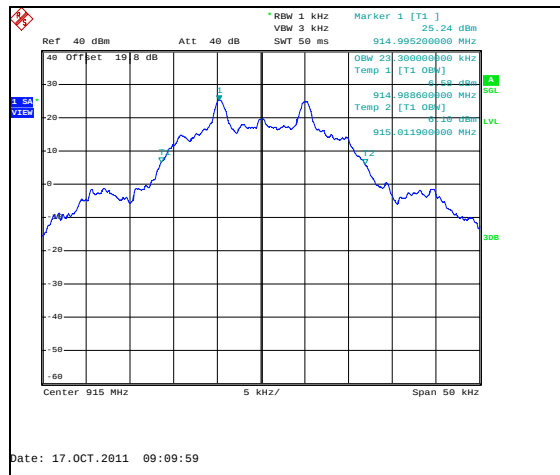


Figure 7.3.4.2-21: 99% BW Mid Channel - 9.6kbps

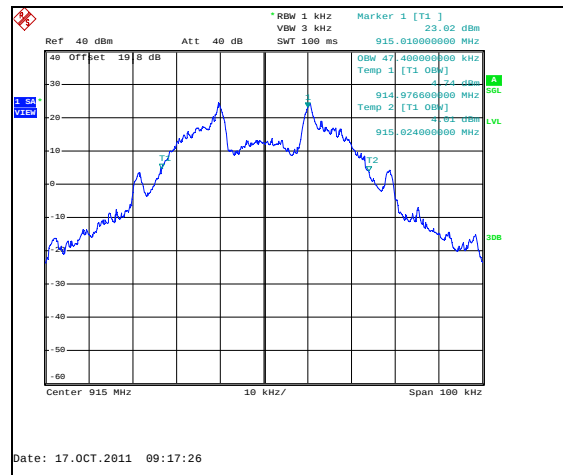


Figure 7.3.4.2-22: 99% BW Mid Channel – 19.2kbps

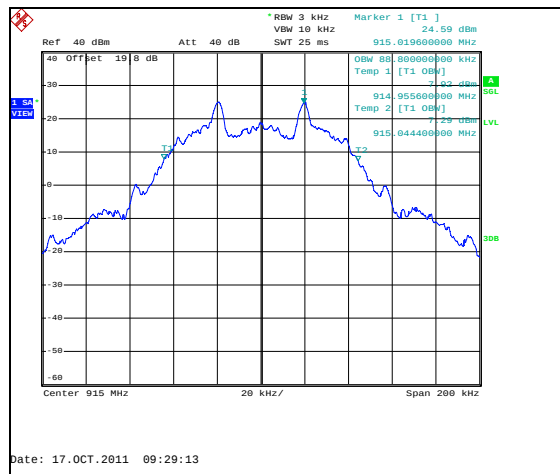


Figure 7.3.4.2-23: 99% BW Mid Channel – 38.4kbps

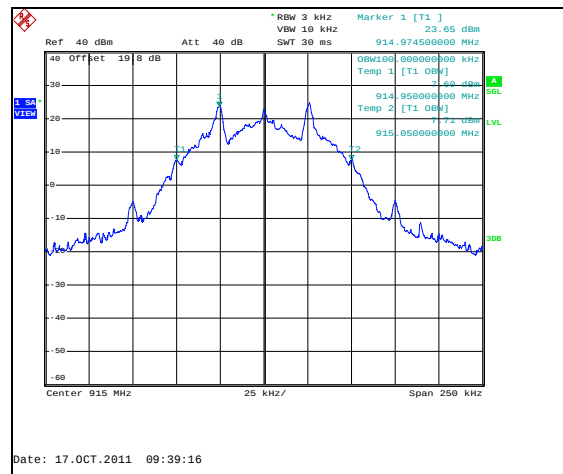


Figure 7.3.4.2-24: 99% BW Mid Channel – 50kbps

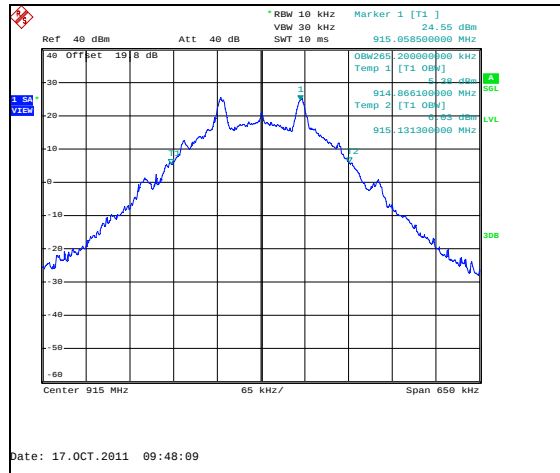


Figure 7.3.4.2-25: 99% BW Mid Channel – 115.2kbps



Figure 7.3.4.2-26: 99% BW High Channel - 9.6kbps

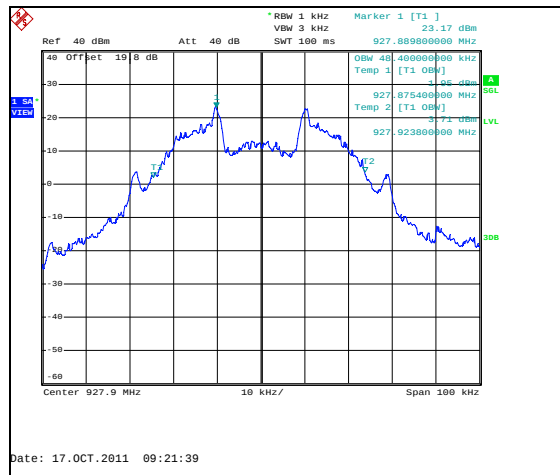


Figure 7.3.4.2-27: 99% BW High Channel – 19.2kbps

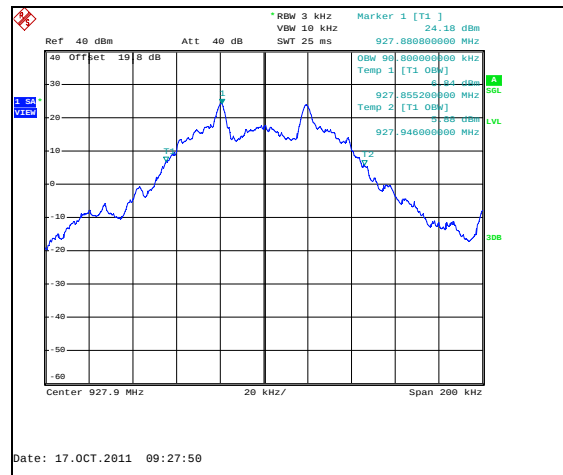


Figure 7.3.4.2-28: 99% BW High Channel – 38.4kbps

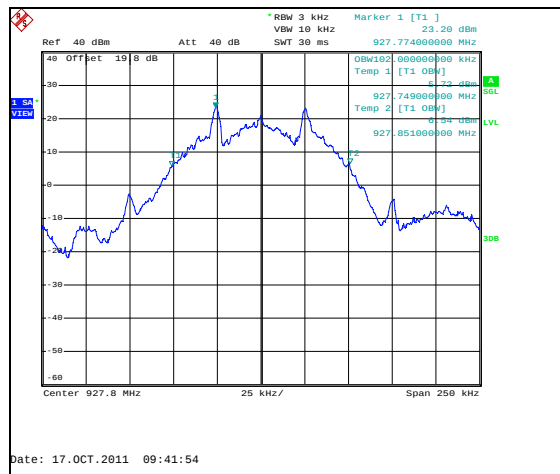


Figure 7.3.4.2-29: 99% BW High Channel – 50kbps

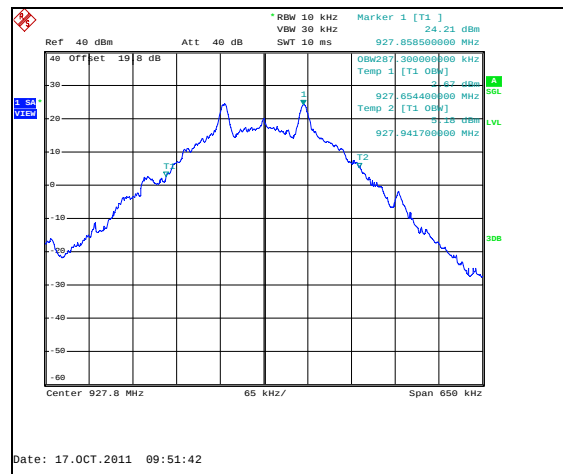


Figure 7.3.4.2-30: 99% BW High Channel – 115.2kbps

7.4 Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC: RSS-210 2.2, A8.5

7.4.1 Band-Edge Compliance of RF Conducted Emissions

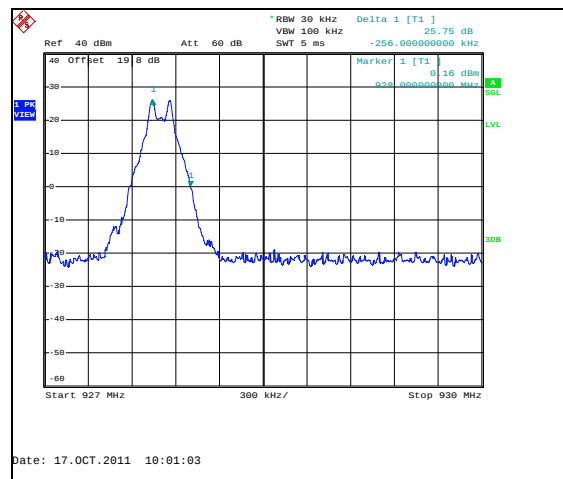
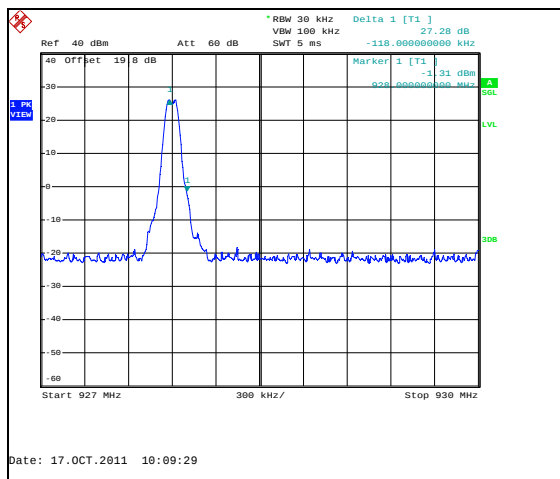
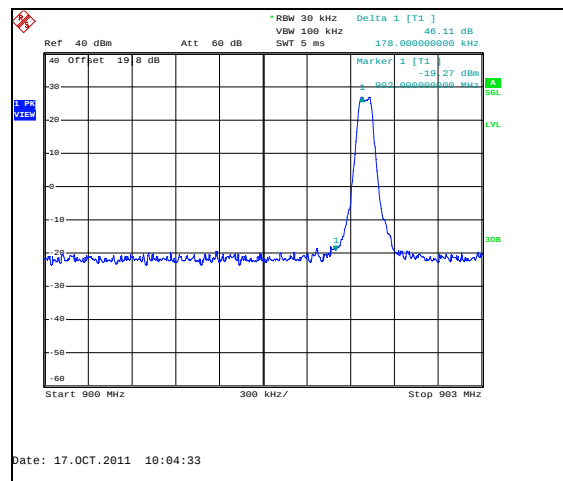
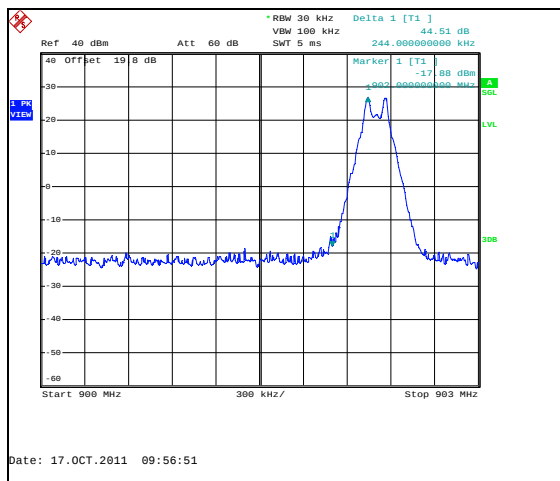
7.4.1.1 Measurement Procedure

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 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.

7.4.1.2 Measurement Results

Results are shown in the figures 7.4.1.2-1 to 7.4.1.2-8 below.



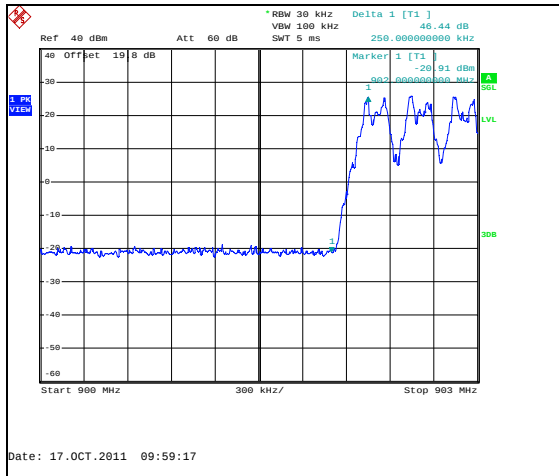
HOPPING MODE:

Figure 7.4.1.2-5: Lower Band-edge -Wide Mode

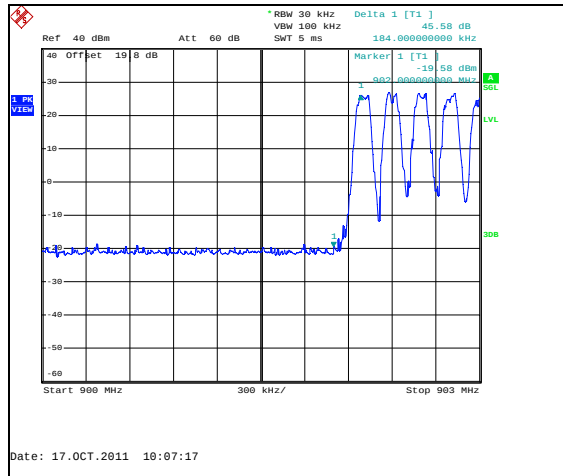


Figure 7.4.1.2-6: Lower Band-edge - Sun Mode

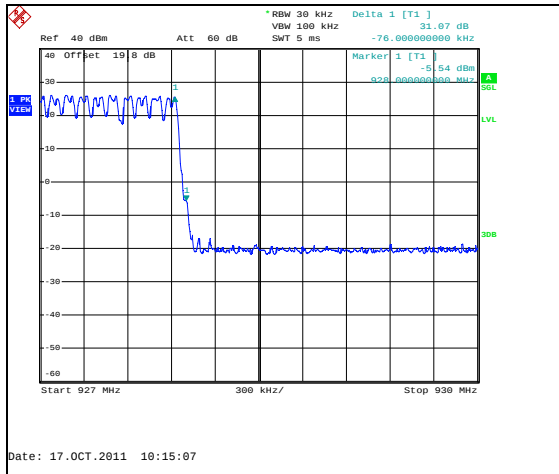


Figure 7.4.1.2-7: Upper Band-edge - Narrow Mode

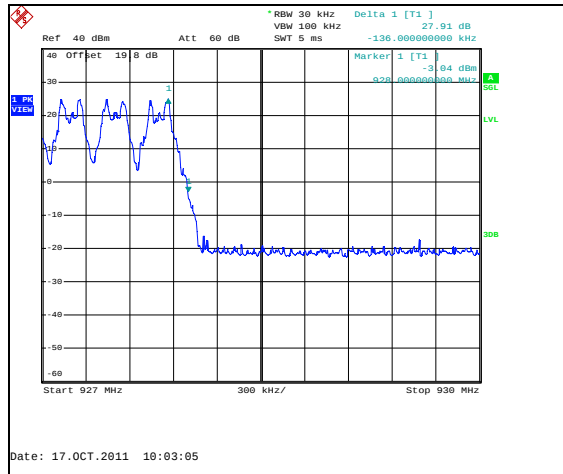


Figure 7.4.1.2-8: Upper Band-edge -Wide Mode

7.4.2 RF Conducted Spurious Emissions

7.4.2.1 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.

7.4.2.2 Measurement Results

Results are shown below in Figures 7.4.2.2-1 to 7.4.2.2-6:

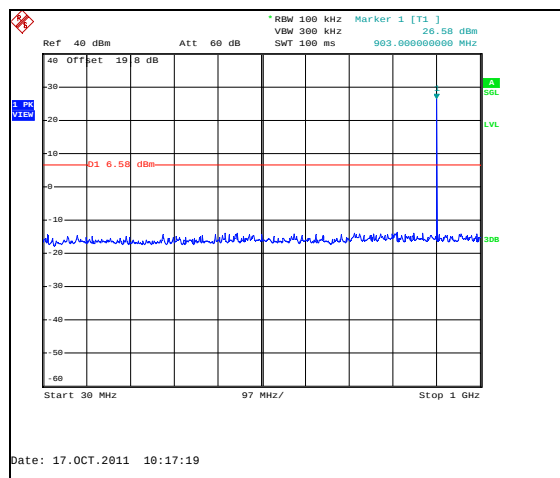


Figure 7.4.2.2-1: 30 MHz – 1 GHz – Low Channel

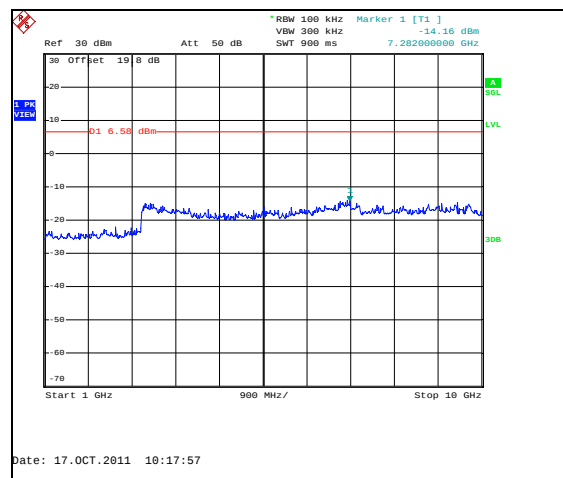


Figure 7.4.2.2-2: 1 GHz – 10 GHz – Low Channel

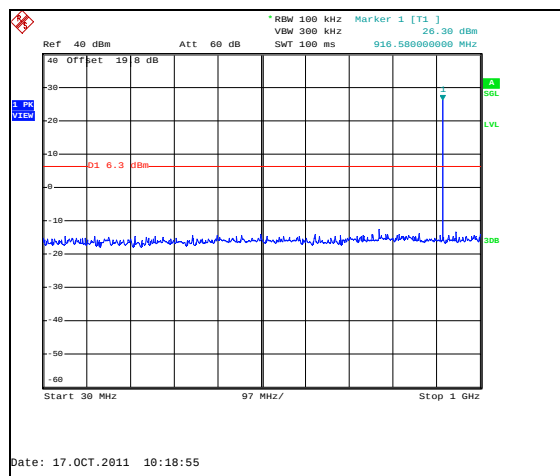


Figure 7.4.2.2-3: 30 MHz – 1 GHz – Mid Channel

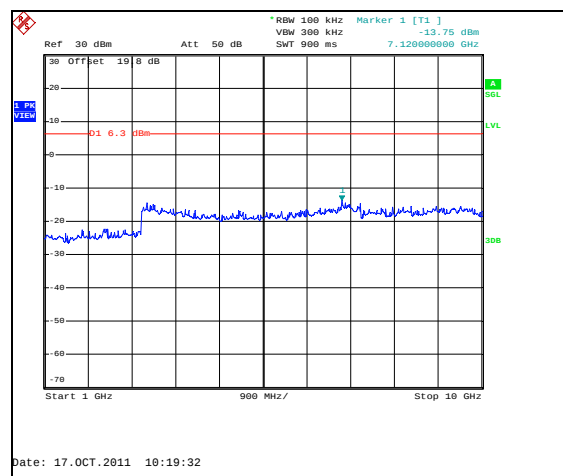


Figure 7.4.2.2-4: 1 GHz – 10 GHz – Mid Channel

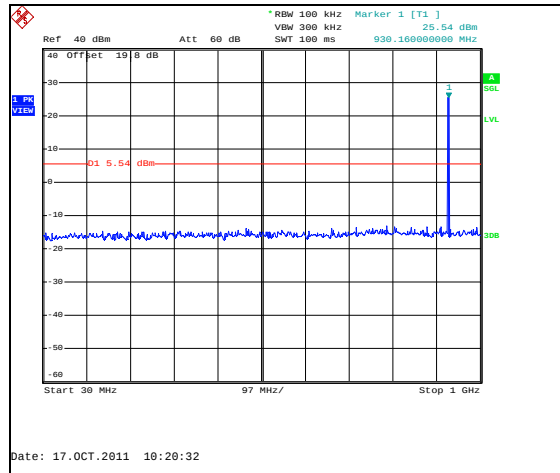


Figure 7.4.2.2-5: 30 MHz – 1 GHz – High Channel

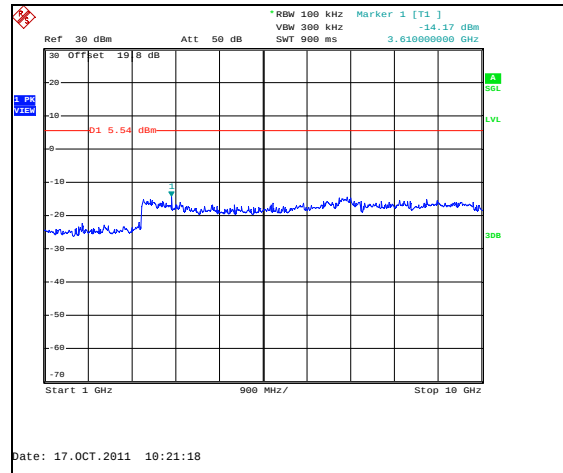


Figure 7.4.2.2-6: 1 GHz – 10 GHz –High Channel

8 CONCLUSION

In the opinion of ACS, Inc. the 10122, manufactured by Hunt Technologies, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT