Excellence in Compliance Testing

Certification Test Report

FCC ID: R7PFTAR1S1
IC: 5294A-FTAR1S1

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

ACS Report Number: 14-0447.W06.1B

Manufacturer: Landis+Gyr Technology, Inc.
Model: Field Tool Adapter

Test Begin Date: October 31, 2014
Test End Date: November 7, 2014

Report Issue Date: January 22, 2015

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.

Reviewed by:

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This report contains 37 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 Certification.

1.2 Product description

The Field Tool Adapter module is a battery powered "bridge" between a PC based application and the 900 MHz End Point Meter. The module contains a 900 MHz two way transceiver, a logarithmic Detector for 1 way Rx, Bluetooth transceiver and a lithium ion battery. It is contained in a belt mounted damage resistant plastic housing. The intent of the field tool is to be a close range device for trouble shooting Electric, Gas and water modules.

Technical Information:
The model Field Tool Adapter provides 5 distinct frequency hopping modes of operation as outlined below.

Mode of Operation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Data Rates Supported (kbps)
1	902.3 - 927.8	86	300	9.6, 19.2, 38.4, 115.2
2	904.0 - 927.9	240	100	9.6, 19.2, 38.4
3	902.5 - 927.3	51	500	300.0
4	902.2 - 927.8	129	200	50.0
5	902.4 - 927.6	64	400	150, 200

Modulation Format: FSK/GFSK
Antenna Type / Gain: Ceramic chip antenna / -1.0 dBi gain
Operating Voltage: 4.2 VDC (Internal Battery) / 120VAC/60Hz (External Power Supply)

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

EUT Serial Numbers: GS 000004

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.

For radiated emissions three orientations of the EUT were evaluated to determine worst case. The worst case orientation was determined to be the Y orientation.

The EUT has provisions for battery charging using an external power supply. Radiated emissions were tested with the EUT standalone which is the typical use configuration. AC power line conducted emissions were evaluated with the external power supply connected and batteries charging.

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

Software power setting during test (900 MHz Radio): 0x62

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
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:

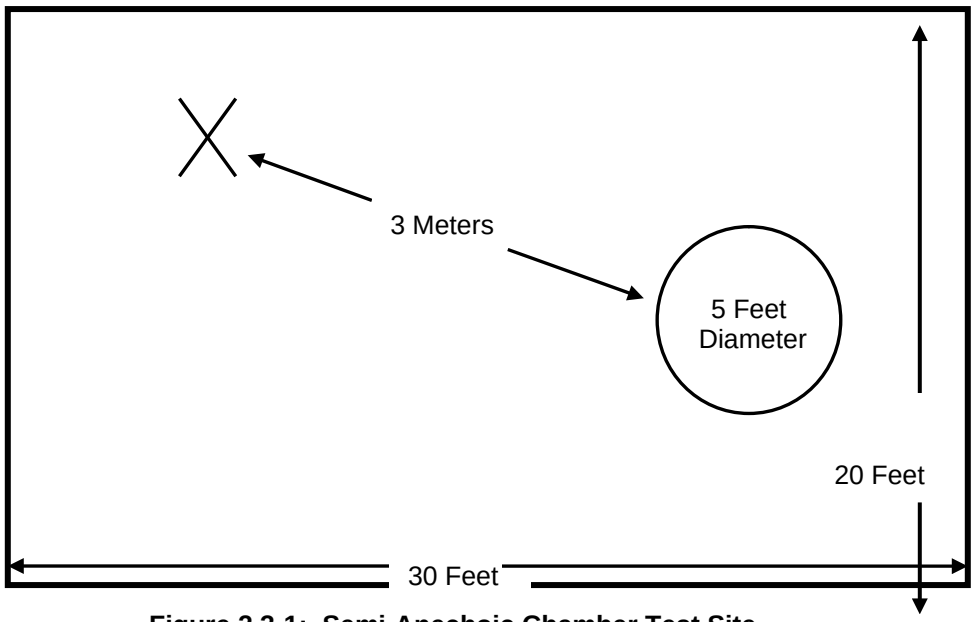

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

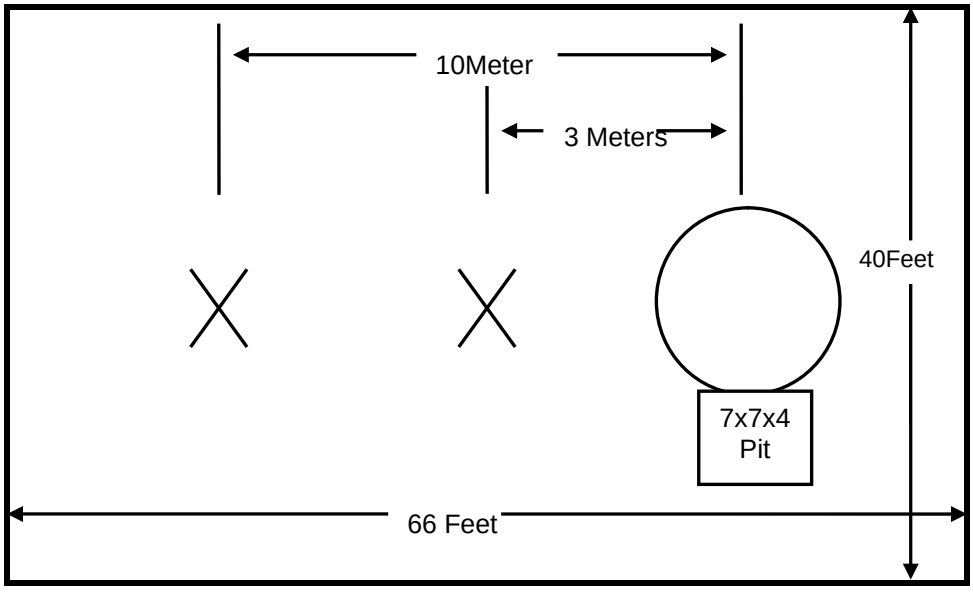

Figure 2.3-2: Open Area Test Site

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 ground 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 2.4-1:

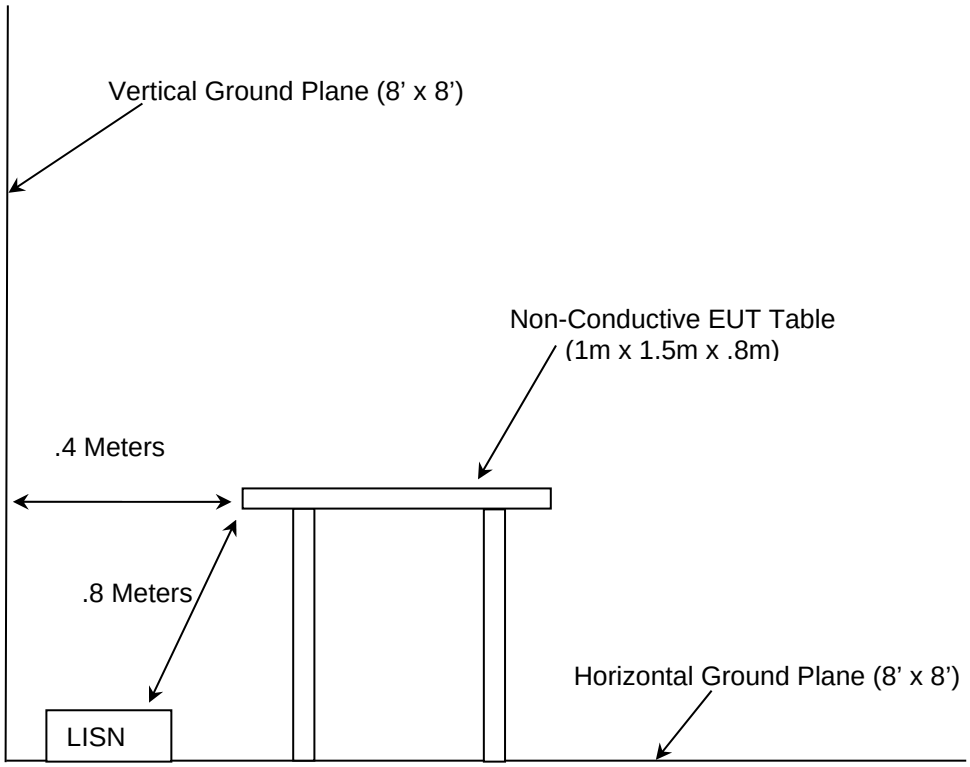

Figure 2.4-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2009: American National Standard for Methods of Measurement of Radio-Noise Emissions from low-voltage electrical and electronic equipment in the range of 9kHz to 40 GHz
- ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2014
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2014
- 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 4, Nov 2014.

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
1	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	833771/007	7/11/2014	7/11/2015
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	7/11/2014	7/11/2015
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/23/2013	4/23/2015
40	EMCO	3104	Antennas	3211	2/14/2013	2/14/2015
73	Agilent	8447D	Amplifiers	2727A05624	7/15/2014	7/15/2015
167	ACS	Chamber EMI Cable Set	Cable Set	167	11/7/2013	11/7/2014
168	Hewlett Packard	11947A	Attenuators	44829	1/27/2014	1/27/2015
267	Agilent	N1911A	Meters	MY45100129	7/30/2013	7/30/2015
268	Agilent	N1921A	Sensors	MY45240184	7/30/2013	7/30/2015
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	3/17/2014	3/17/2015
316	Rohde & Schwarz	ESH3-Z5	LISN	861189-010	10/30/2014	10/30/2015
324	ACS	Belden	Cables	8214	6/4/2014	6/4/2015
331	Microwave Circuits	H1G513G1	Filters	31417	6/2/2014	6/2/2015
338	Hewlett Packard	8449B	Amplifiers	3008A01111	7/30/2013	7/30/2015
340	Aeroflex/Weinschel	AS-20	Attenuators	7136	7/14/2014	7/14/2015
412	Electro Metrics	LPA-25	Antennas	1241	7/24/2014	7/24/2016
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	11/7/2013	11/7/2014
616	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	N/A	9/10/2014	9/10/2015
622	Rohde & Schwarz	FSV40	Analyzers	101338	7/12/2014	7/12/2015
RE361	Agilent	AT/E7405A	Analyzers	MY42000089	5/30/2014	5/30/2016

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Wall Wart Power Supply	Landis + Gyr	69-1757	N/A

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

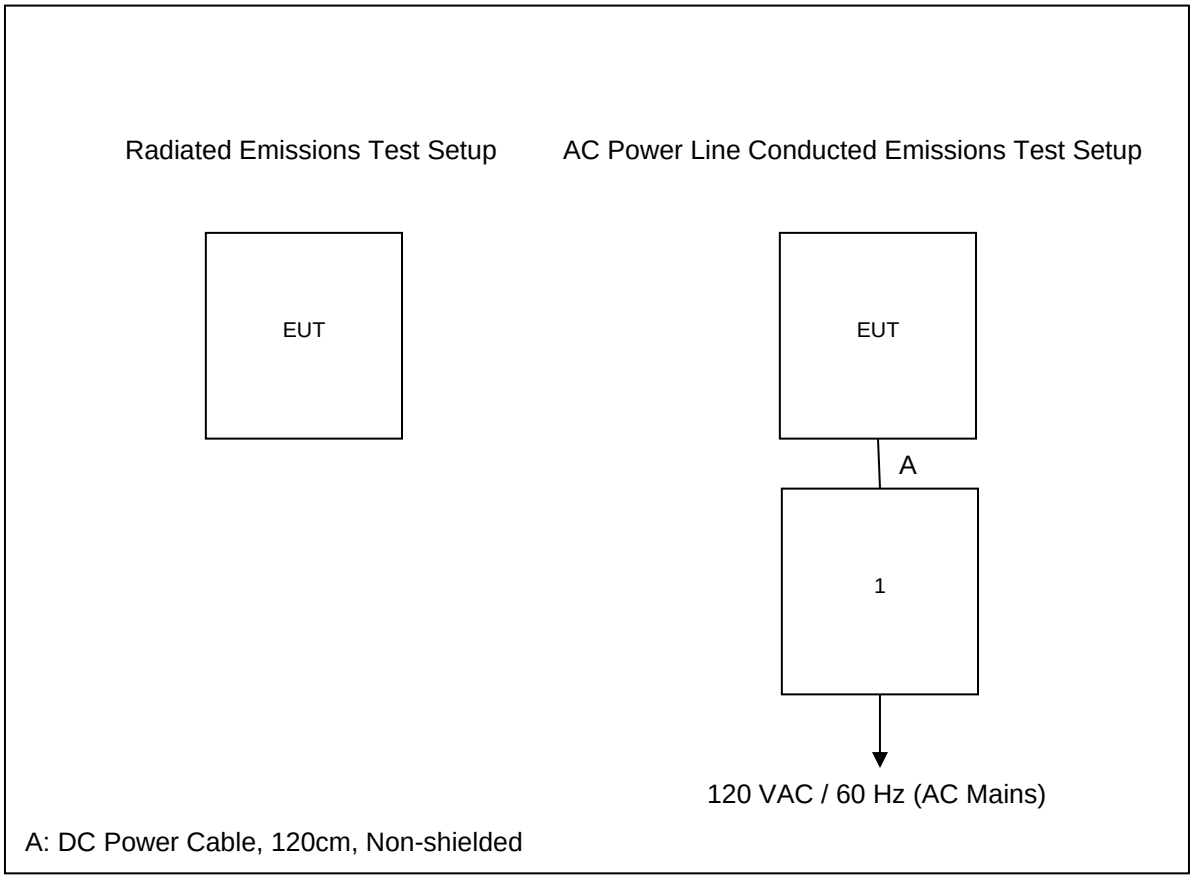

Figure 6-1: Test Setup Block Diagram

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 integral antenna is a ceramic chip with -1.0dBi gain and cannot be removed without permanently damaging the device, therefore satisfying the requirements of Section 15.203.

7.2 Power Line Conducted Emissions – FCC 15.207, IC: RSS-Gen 8.8

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 Tables 7.2.2-1 and 7.2.2-2.

Table 7.2.2-1: Conducted EMI Results – Line 1

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
11.9693	17.364	9.88	10.67	28.033	20.55	60	50	31.967	29.45
3.65406	19.489	11.99	10.327	29.816	22.317	56	46	26.184	23.683
2.74302	18.698	11.79	10.365	29.063	22.155	56	46	26.937	23.845
2.15013	20.373	12.461	10.37	30.743	22.831	56	46	25.257	23.169
2.07366	20.209	12.011	10.37	30.579	22.381	56	46	25.421	23.619
0.25865	25.395	18.475	10.162	35.556	28.636	62.896	52.896	27.339	24.259

Table 7.2.2-2: Conducted EMI Results – Line 2

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
3.36224	16.777	8.98	10.216	26.993	19.196	56	46	29.007	26.804
2.09077	18.109	10.414	10.22	28.329	20.634	56	46	27.671	25.366
0.498849	17.965	12.273	10.2	28.165	22.473	56.033	46.033	27.868	23.56
0.400855	19.873	13.925	10.19	30.063	24.115	58.833	48.833	28.77	24.718
0.318987	22.251	15.38	10.19	32.441	25.57	61.172	51.172	28.731	25.602
0.165393	26.491	18.46	10.205	36.695	28.665	65.56	55.56	28.865	26.896

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

7.3.1 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 and worst case reported. Worst case data rate was 50kbps for 902.2 MHz and 9.6kbps for all other frequencies evaluated.

7.3.2 Measurement Results

Results are shown below in Table 7.3.2-1 below:

Table 7.3.2-1: RF Output Power

Frequency [MHz]	Level [dBm]
902.2	10.71
915.0	10.55
927.9	10.09

7.4 Channel Usage Requirements

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

7.4.1.1 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 and data presented in section 7.4.1.2 below.

7.4.1.2 Measurement Results

Results are shown below in Figures 7.4.1.2-1 to 7.4.1.2-5.

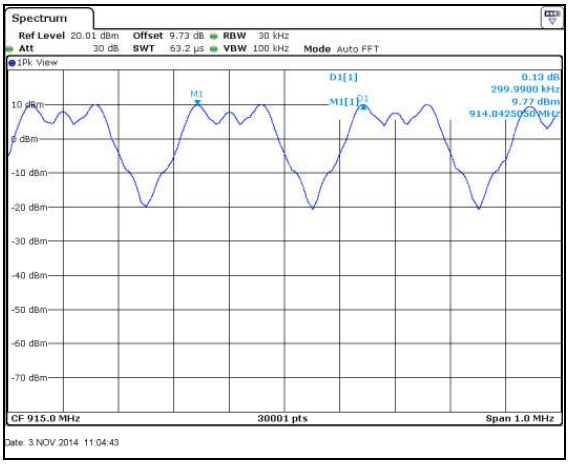

Figure 7.4.1.2-1: Mode 1

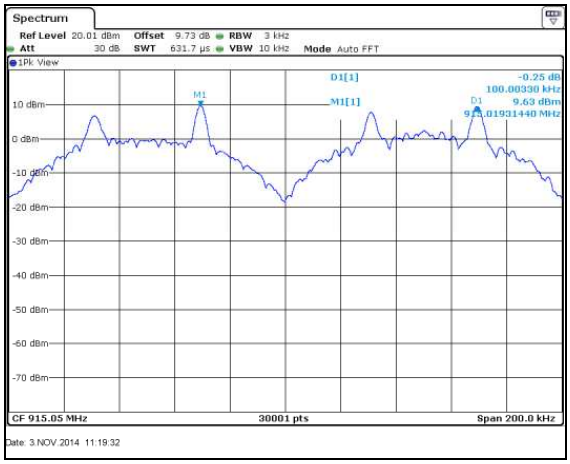

Figure 7.4.1.2-2: Mode 2

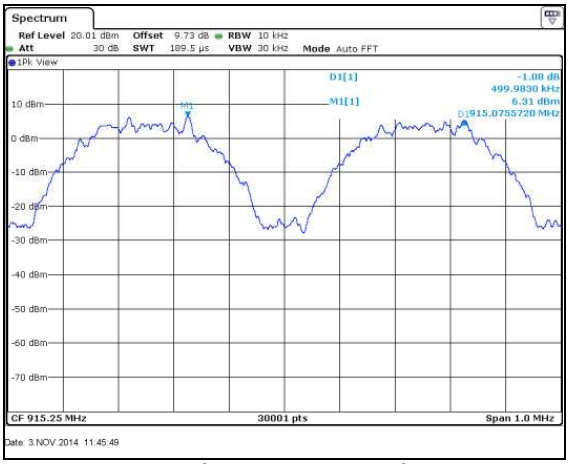

Figure 7.4.1.2-3: Mode 3

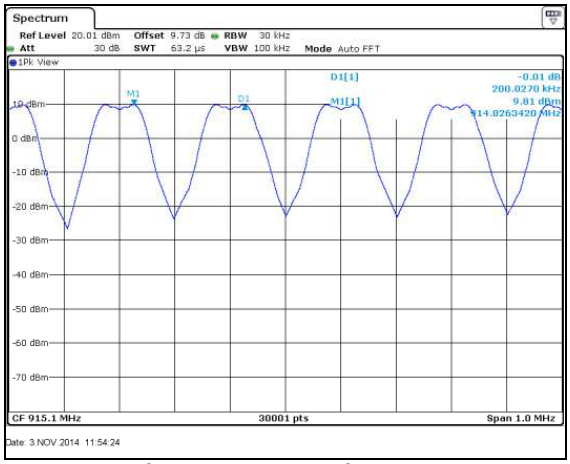

Figure 7.4.1.2-4: Mode 4

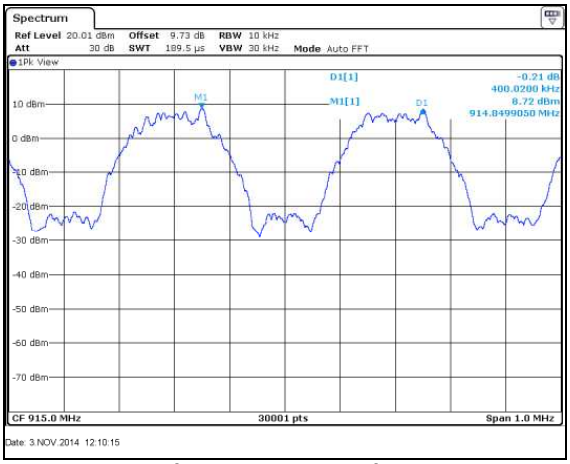

Figure 7.4.1.2-5: Mode 5

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

7.4.2.1 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 the frequency band of operation. The RBW was set to ≥ 1% of the span and VBW set to ≥ RBW.

The number of hopping channels was measured for the modes of operation and data presented in section 7.4.2.2 below.

7.4.2.2 Measurement Results

Results are shown below in Figures 7.4.2.2-1 to 7.4.2.2-14.

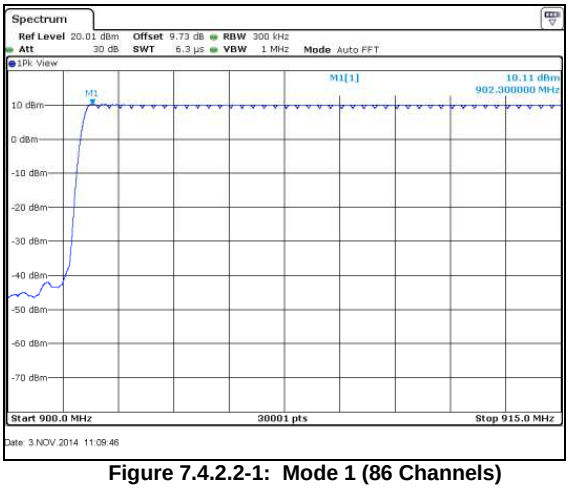

Figure 7.4.2.2-1: Mode 1 (86 Channels)

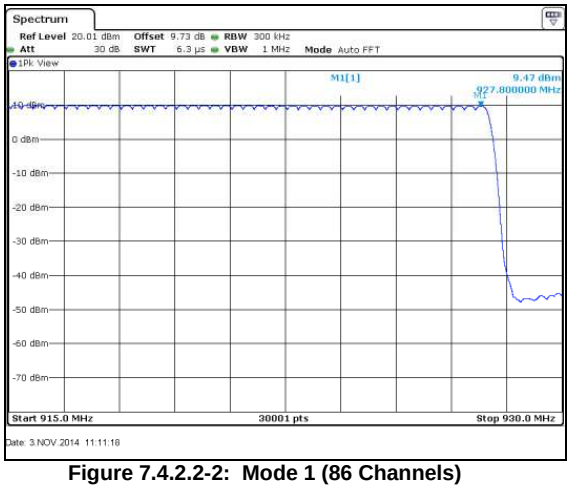

Figure 7.4.2.2-2: Mode 1 (86 Channels)

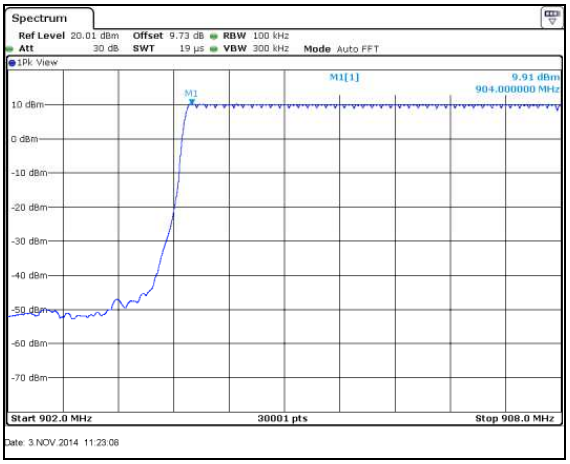

Figure 7.4.2.2-3: Mode 2 (240 Channels)

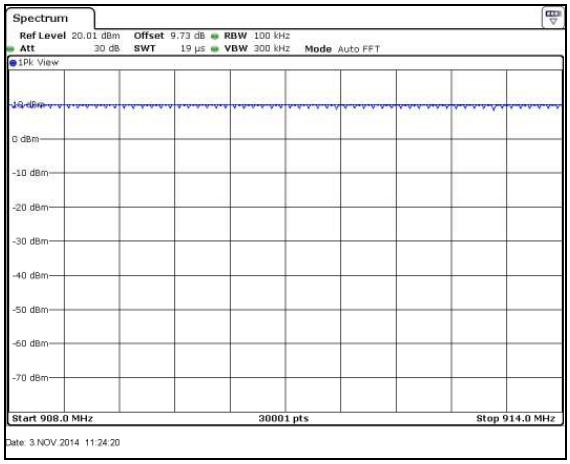

Figure 7.4.2.2-4: Mode 2 (240 Channels)

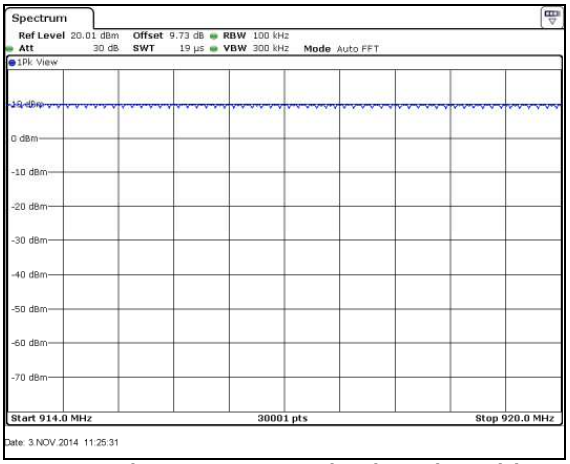

Figure 7.4.2.2-5: Mode 2 (240 Channels)

Figure 7.4.2.2-6: Mode 2 (240 Channels)

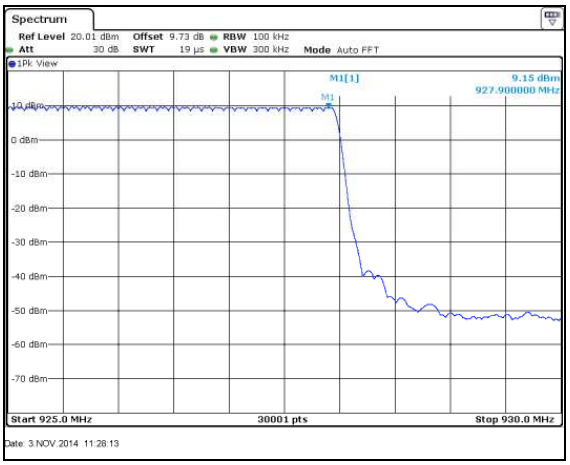

Figure 7.4.2.2-7: Mode 2 (240 Channels)

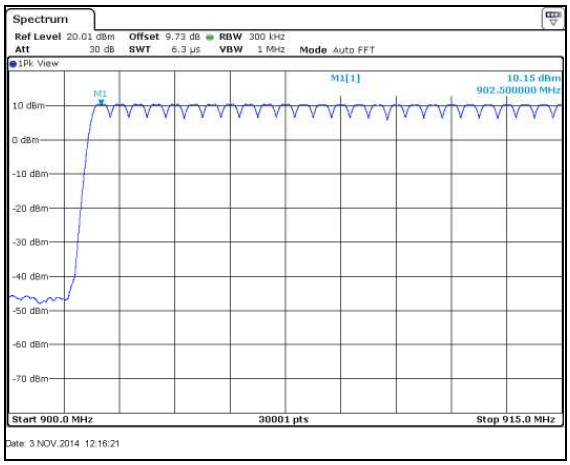

Figure 7.4.2.2-8: Mode 3 (51 Channels)

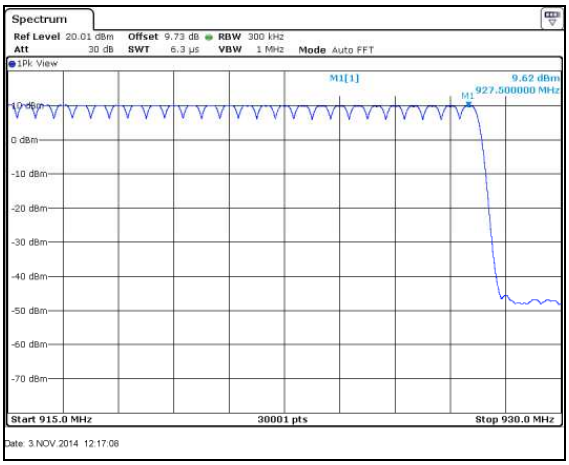

Figure 7.4.2.2-9: Mode 3 (51 Channels)

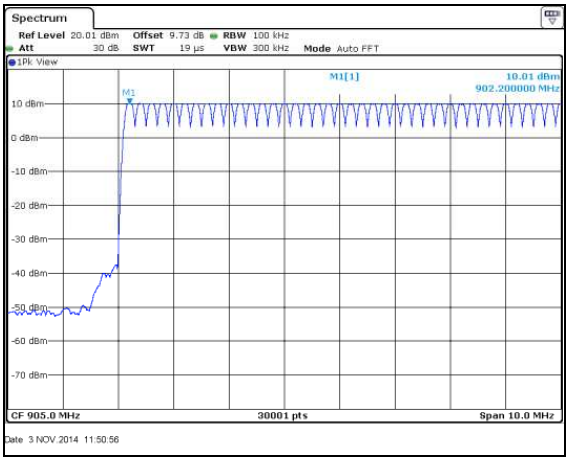

Figure 7.4.2.2-10: Mode 4 (129 Channels)

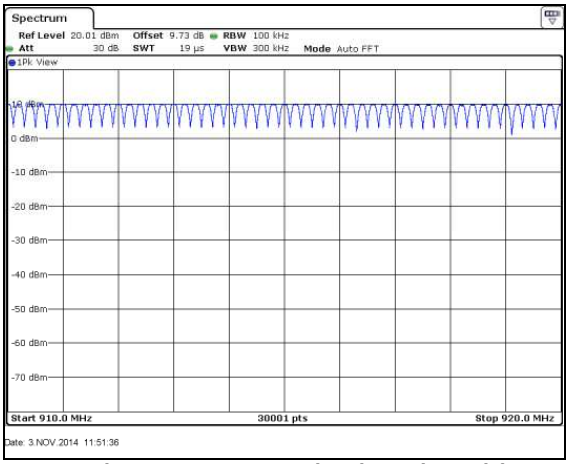

Figure 7.4.2.2-11: Mode 4 (129 Channels)

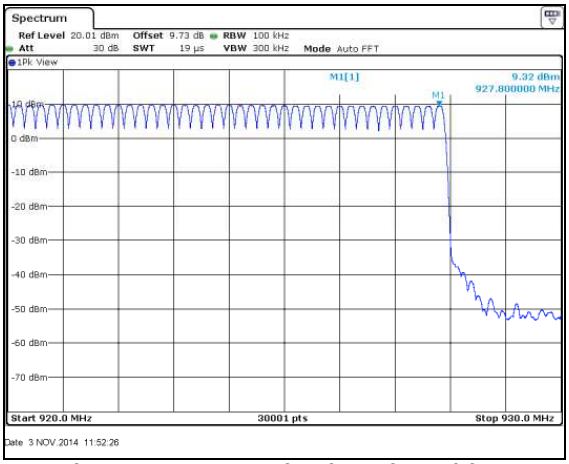

Figure 7.4.2.2-12: Mode 4 (129 Channels)

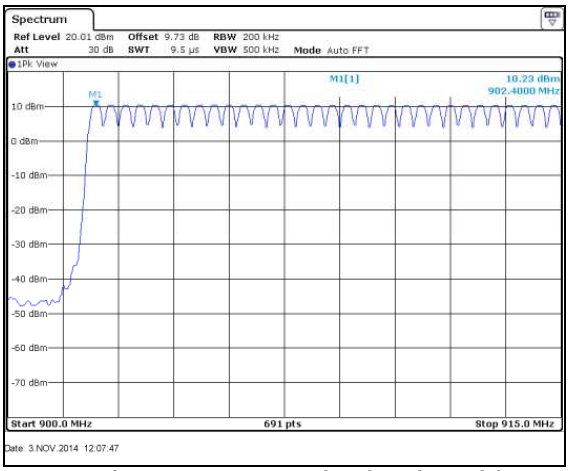

Figure 7.4.2.2-13: Mode 5 (64 Channels)

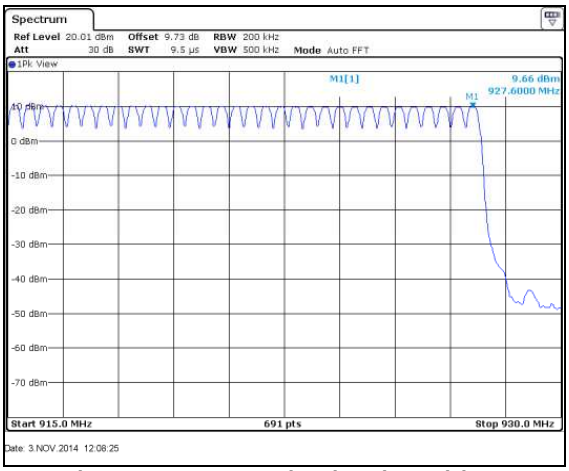

Figure 7.4.2.2-14: Mode 5 (64 Channels)

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

7.4.3.1 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 within a 10s or 20s period is ≤ 400ms for all modes of operation.

7.4.4 20dB / 99% Bandwidth - FCC 15.247(a)(1)(i) IC: RSS-210 A8.2(a)

7.4.4.1 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 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 trace was set to max hold with a peak detector active. The Delta and ndB down functions of the analyzer were utilized to determine the 20 dB bandwidth of the emission.

The occupied bandwidth measurement function of the spectrum analyzer was used to measure the 99% bandwidth. The span of the analyzer was set to capture all products of the modulation process, including the emission sidebands. The resolution bandwidth was set to 1% to 5% of the occupied bandwidth. The video bandwidth was set to 3 times the resolution bandwidth. A sampling detector was used.

7.4.4.2 Measurement Results

Results are shown below in Table 7.4.4.2-1 and Figures 7.4.4.2-1 through 7.4.4.2-48.

Table 7.4.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]	Data Rate (kbps)	Mode(s)
902.3	21.48	20.69	9.6	1 / 2
902.3	43.74	42.68	19.2	1 / 2
902.3	86.64	84.93	38.4	1 / 2
902.2	100.46	88.67	50.0	4
902.3	235.09	204.57	115.2	1
902.4	182.79	157.33	150.0	5
902.4	242.87	209.95	200.0	5
902.5	358.56	314.62	300.0	3
915.0	21.46	20.66	9.6	1 / 2
915.0	42.96	42.54	19.2	1 / 2
915.0	86.66	85.24	38.4	1 / 2
915.0	93.13	88.18	50.0	4
915.0	234.09	204.11	115.2	1
915.0	183.76	157.18	150.0	5
915.0	245.35	209.89	200.0	5
915.0	367.95	316.32	300.0	3
927.9	21.50	20.64	9.6	1 / 2
927.9	43.31	42.80	19.2	1 / 2
927.9	87.07	85.10	38.4	1 / 2
927.8	92.70	88.01	50.0	4
927.8	234.45	204.51	115.2	1
927.6	183.58	156.91	150.0	5
927.6	243.93	210.37	200.0	5
927.5	364.12	315.36	300.0	3

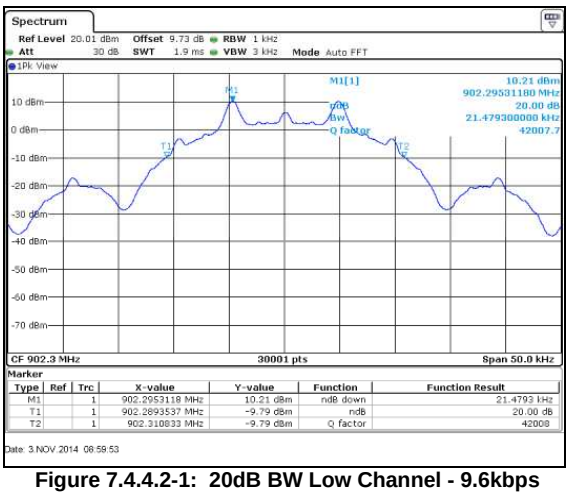

Figure 7.4.4.2-1: 20dB BW Low Channel - 9.6kbps

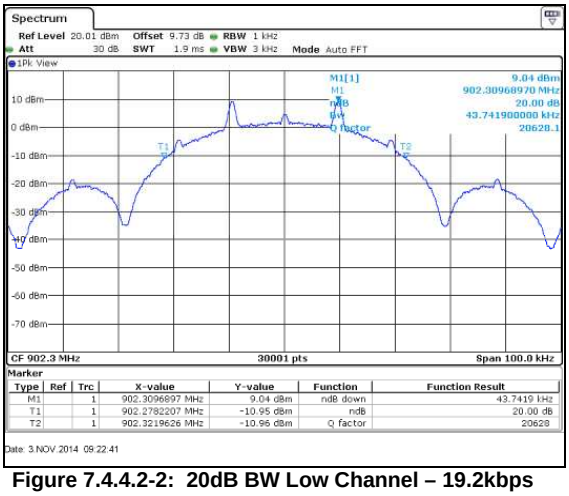

Figure 7.4.4.2-2: 20dB BW Low Channel – 19.2kbps

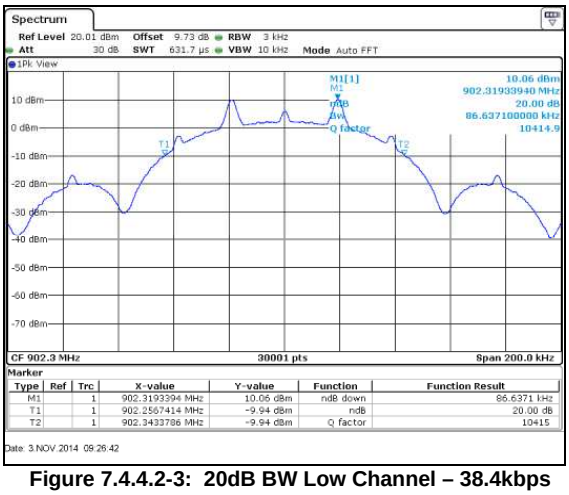

Figure 7.4.4.2-3: 20dB BW Low Channel – 38.4kbps

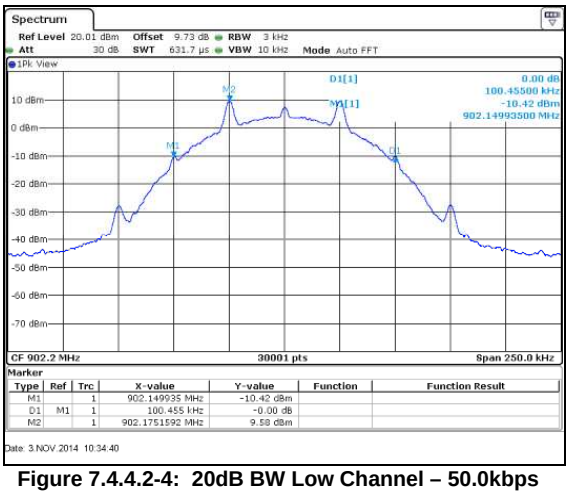

Figure 7.4.4.2-4: 20dB BW Low Channel – 50.0kbps

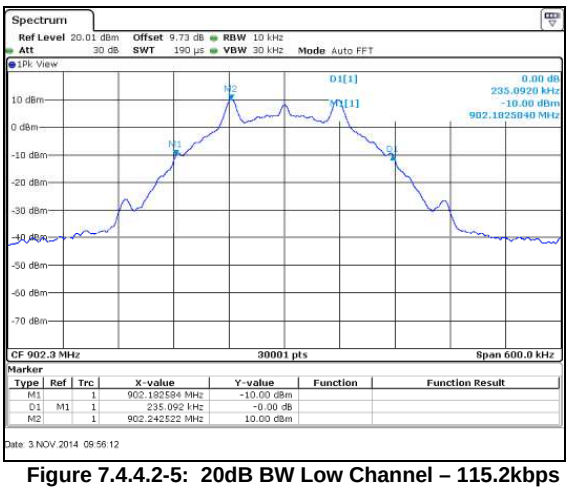

Figure 7.4.4.2-5: 20dB BW Low Channel – 115.2kbps

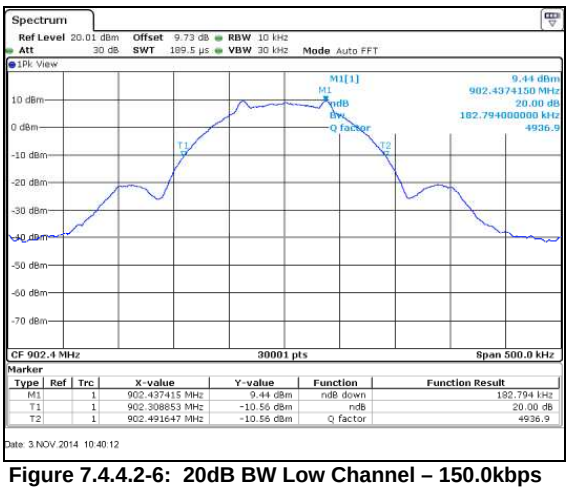

Figure 7.4.4.2-6: 20dB BW Low Channel – 150.0kbps

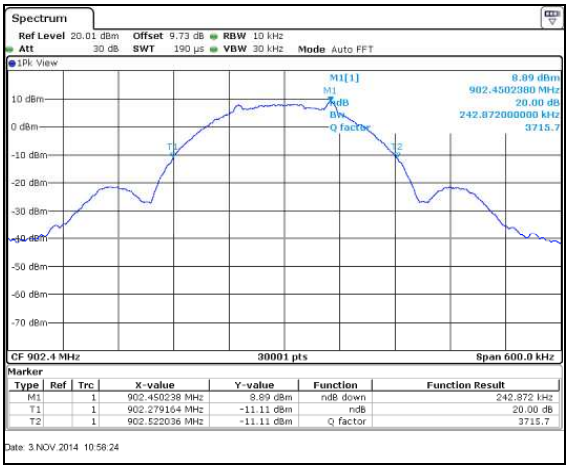

Figure 7.4.4.2-7: 20dB BW Low Channel – 200.0kbps

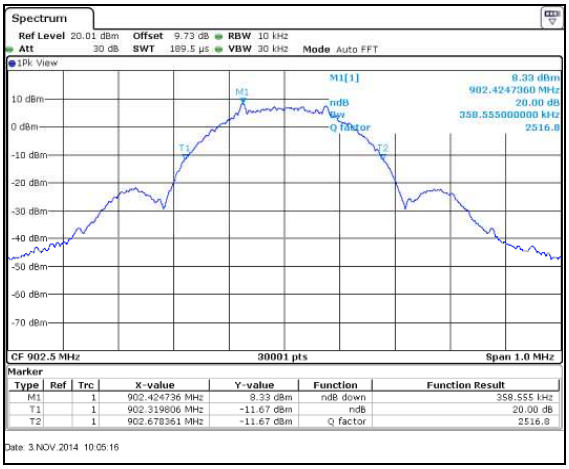

Figure 7.4.4.2-8: 20dB BW Low Channel – 300.0kbps

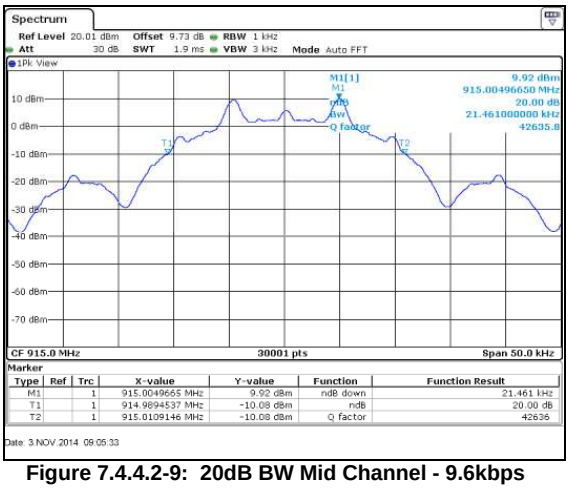

Figure 7.4.4.2-9: 20dB BW Mid Channel - 9.6kbps

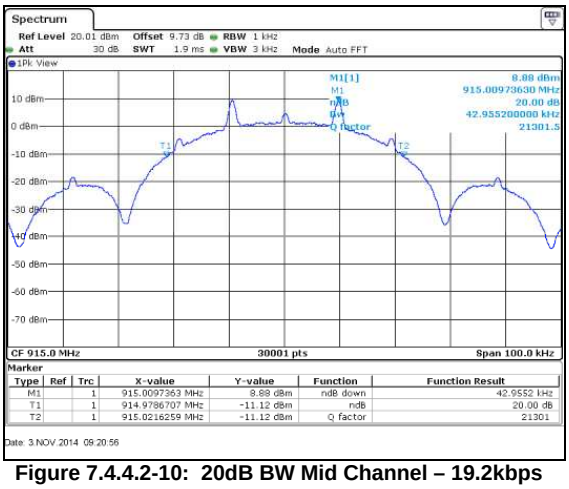

Figure 7.4.4.2-10: 20dB BW Mid Channel – 19.2kbps

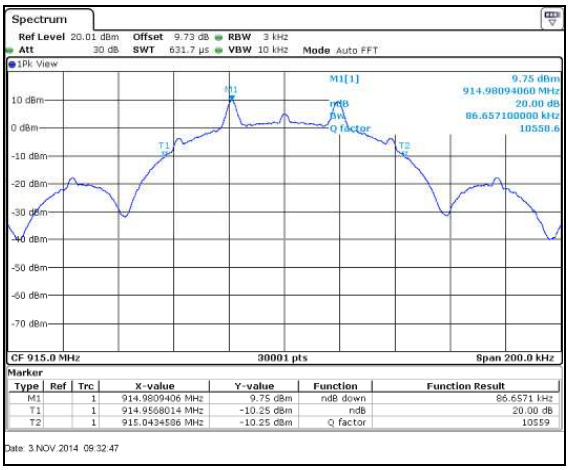

Figure 7.4.4.2-11: 20dB BW Mid Channel – 38.4kbps

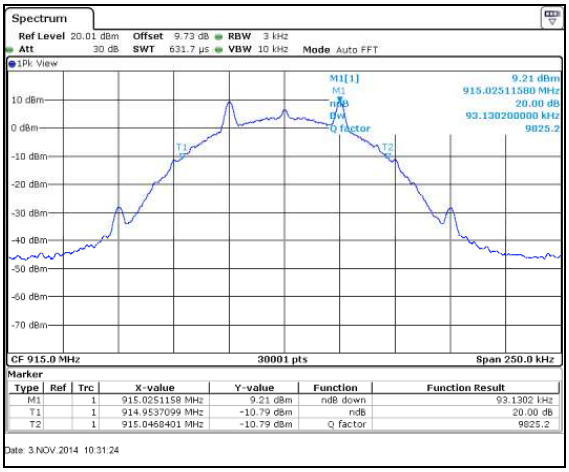

Figure 7.4.4.2-12: 20dB BW Mid Channel – 50.0kbps

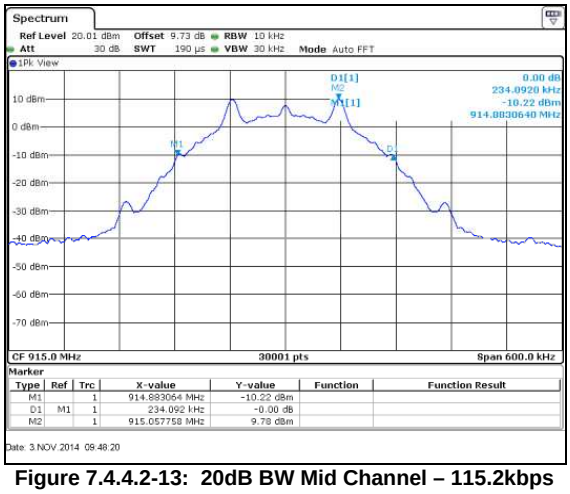

Figure 7.4.4.2-13: 20dB BW Mid Channel – 115.2kbps

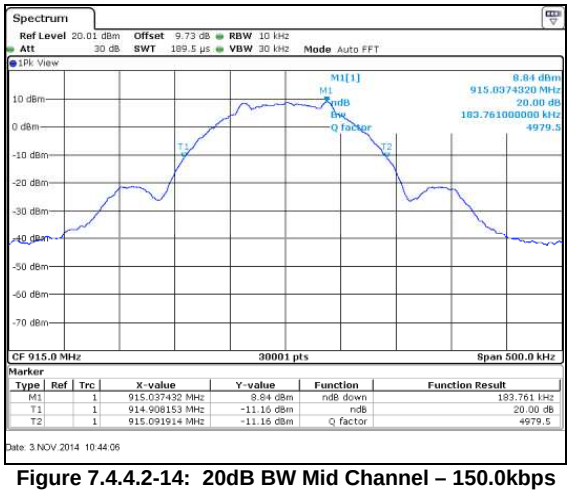

Figure 7.4.4.2-14: 20dB BW Mid Channel – 150.0kbps

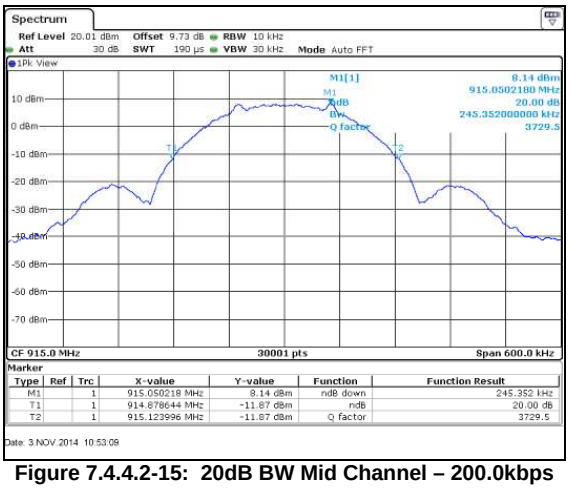

Figure 7.4.4.2-15: 20dB BW Mid Channel – 200.0kbps

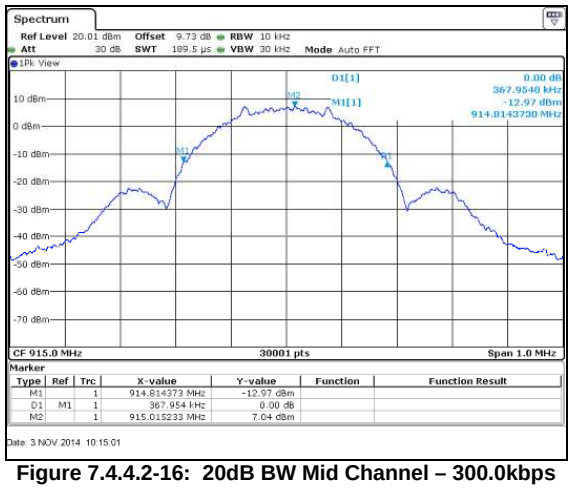

Figure 7.4.4.2-16: 20dB BW Mid Channel – 300.0kbps

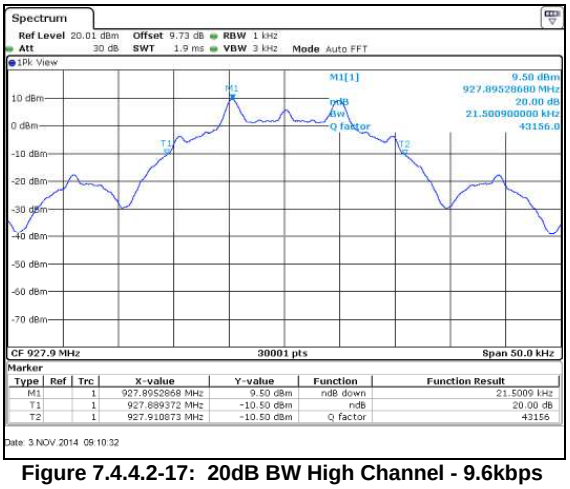

Figure 7.4.4.2-17: 20dB BW High Channel - 9.6kbps

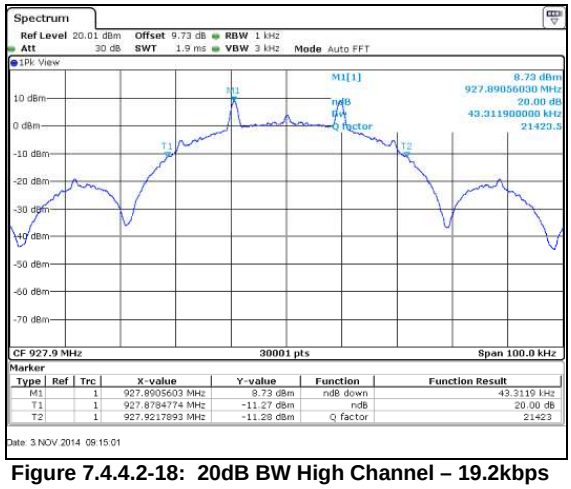

Figure 7.4.4.2-18: 20dB BW High Channel – 19.2kbps

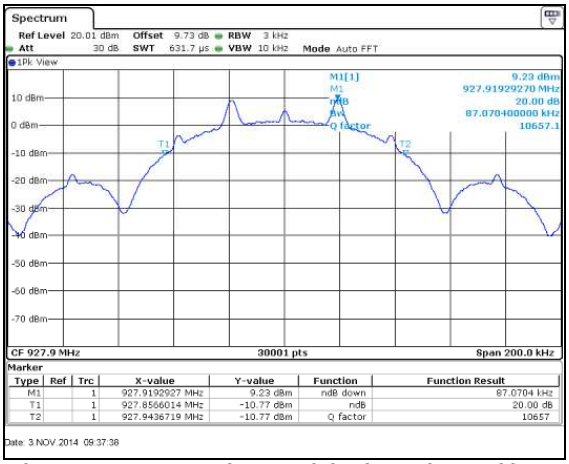

Figure 7.4.4.2-19: 20dB BW High Channel – 38.4kbps

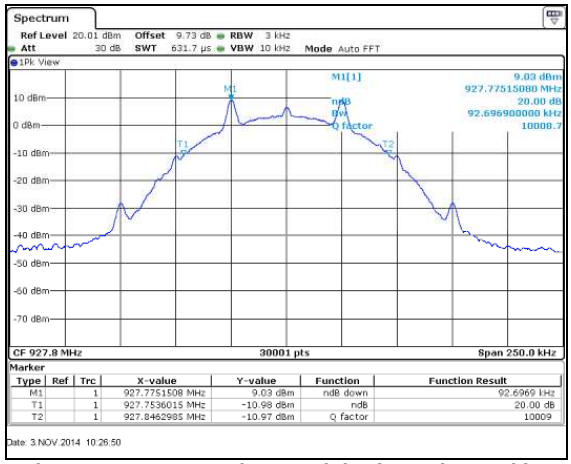

Figure 7.4.4.2-20: 20dB BW High Channel – 50.0kbps

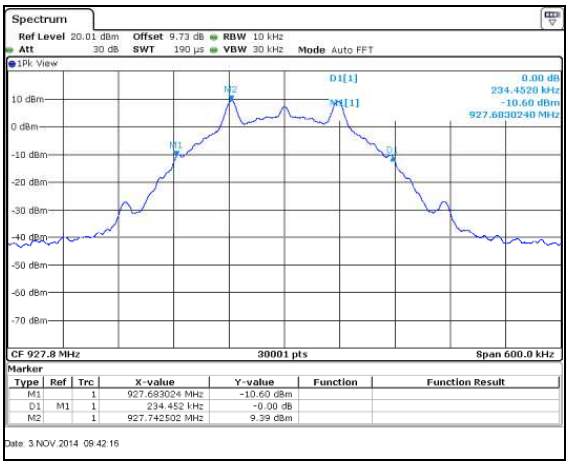

Figure 7.4.4.2-21: 20dB BW High Channel – 115.2kbps

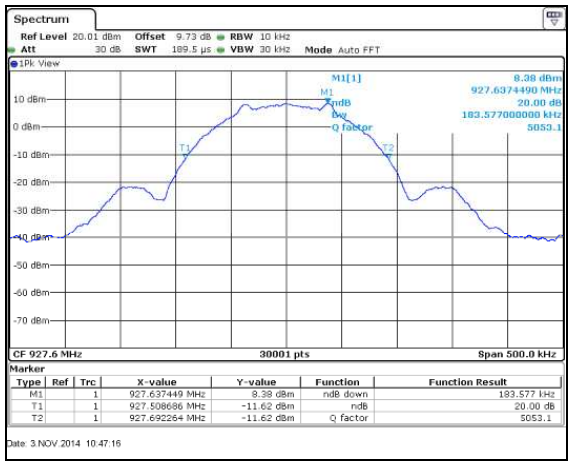

Figure 7.4.4.2-22: 20dB BW High Channel – 150.0kbps

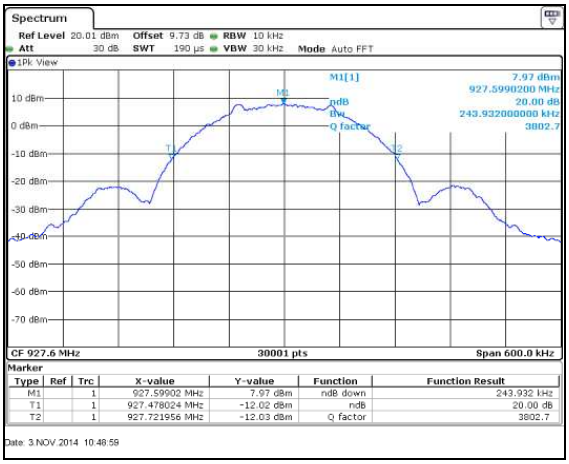

Figure 7.4.4.2-23: 20dB BW High Channel – 200.0kbps

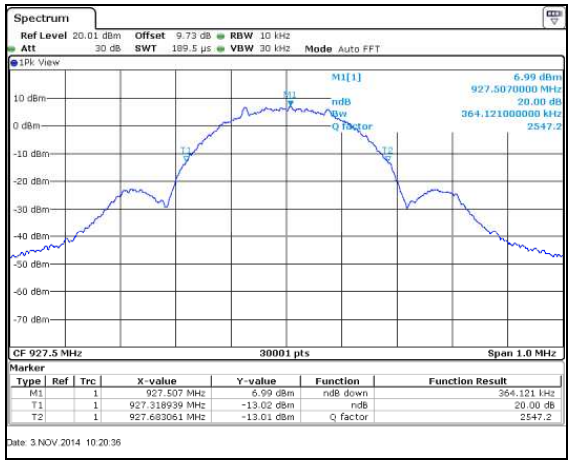

Figure 7.4.4.2-24: 20dB BW High Channel – 300.0kbps

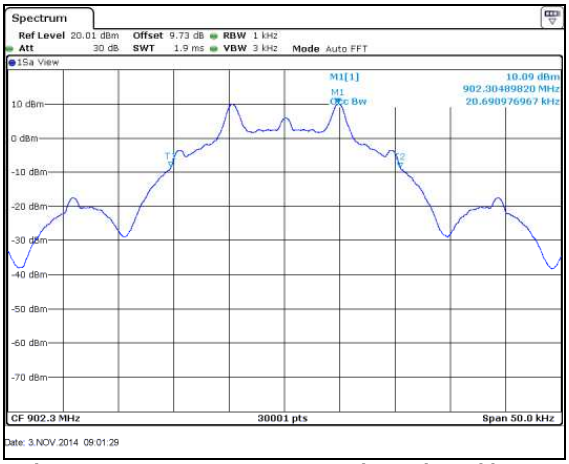

Figure 7.4.4.2-25: 99% BW Low Channel - 9.6kbps

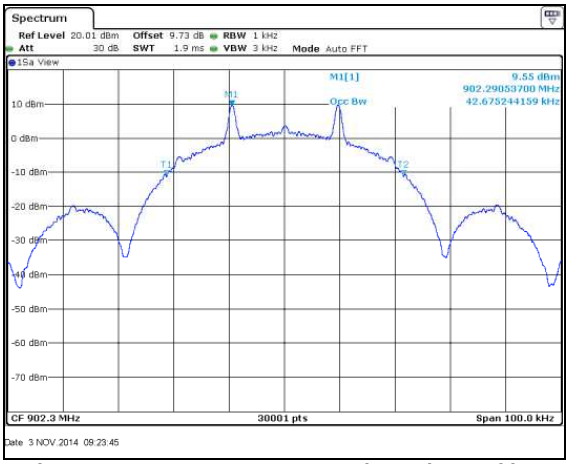

Figure 7.4.4.2-26: 99% BW Low Channel – 19.2kbps

Figure 7.4.4.2-27: 99% BW Low Channel – 38.4kbps

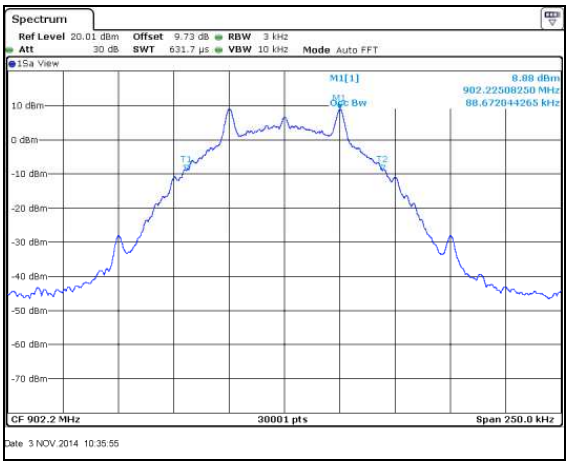

Figure 7.4.4.2-28: 99% BW Low Channel – 50.0kbps

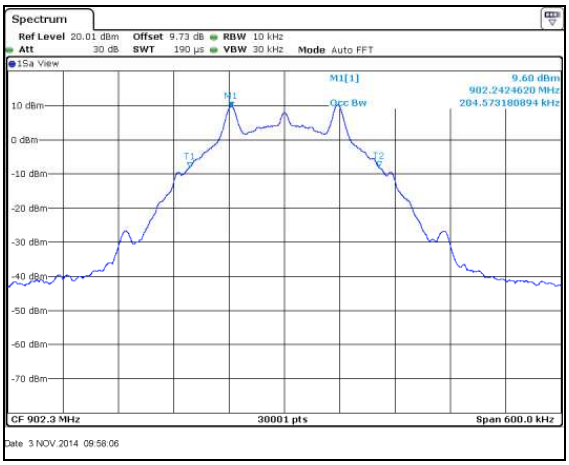

Figure 7.4.4.2-29: 99% BW Low Channel – 115.2kbps

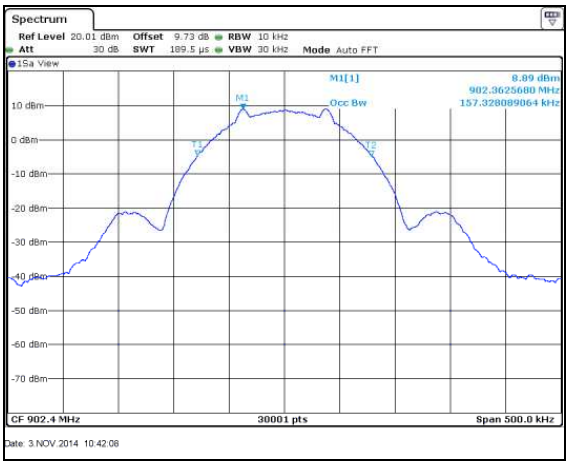

Figure 7.4.4.2-30: 99% BW Low Channel – 150.0kbps

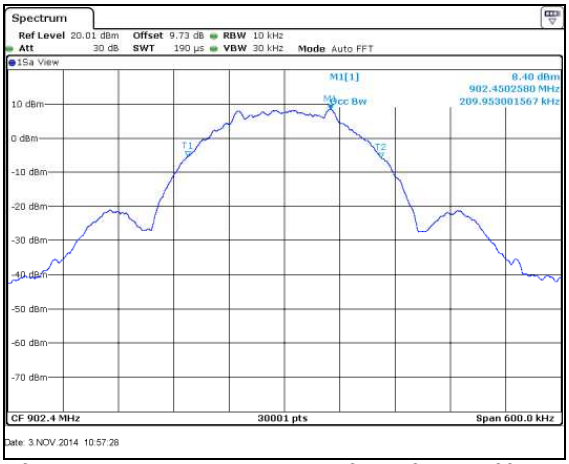

Figure 7.4.4.2-31: 99% BW Low Channel – 200.0kbps

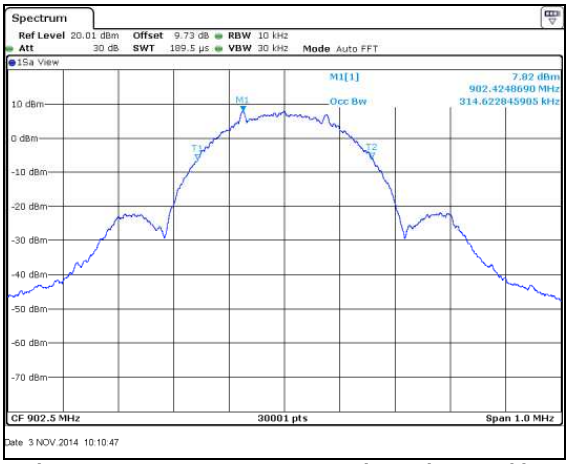

Figure 7.4.4.2-32: 99% BW Low Channel – 300.0kbps

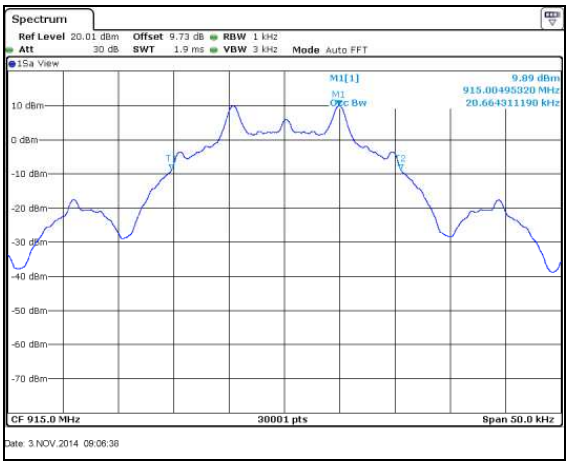

Figure 7.4.4.2-33: 99% BW Mid Channel - 9.6kbps

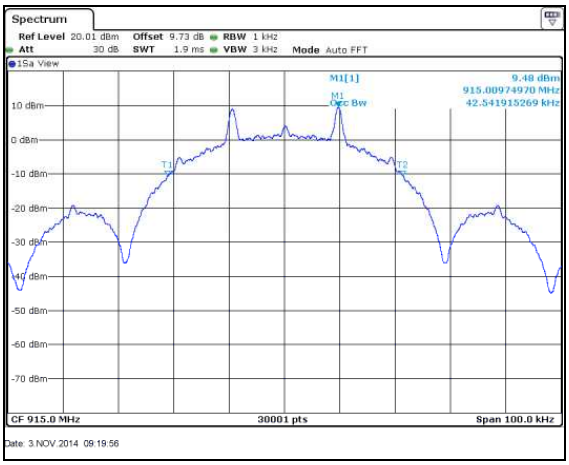

Figure 7.4.4.2-34: 99% BW Mid Channel – 19.2kbps

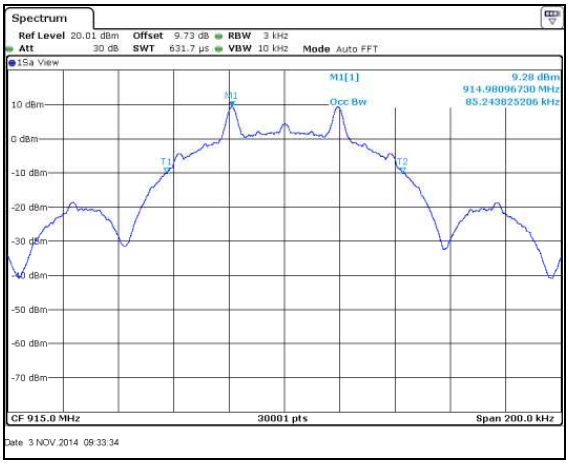

Figure 7.4.4.2-35: 99% BW Mid Channel – 38.4kbps

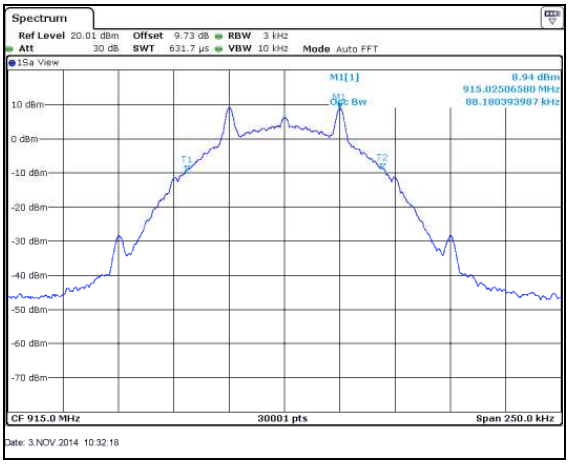

Figure 7.4.4.2-36: 99% BW Mid Channel – 50.0kbps

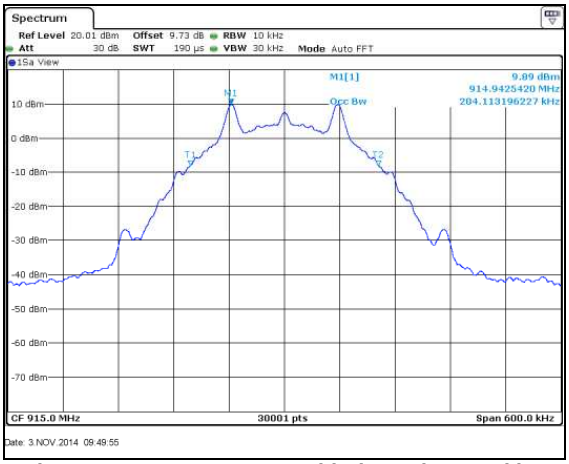

Figure 7.4.4.2-37: 99% BW Mid Channel – 115.2kbps

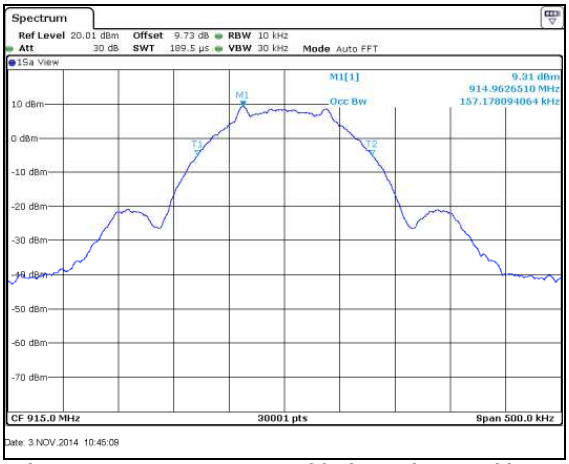

Figure 7.4.4.2-38: 99% BW Mid Channel – 150.0kbps

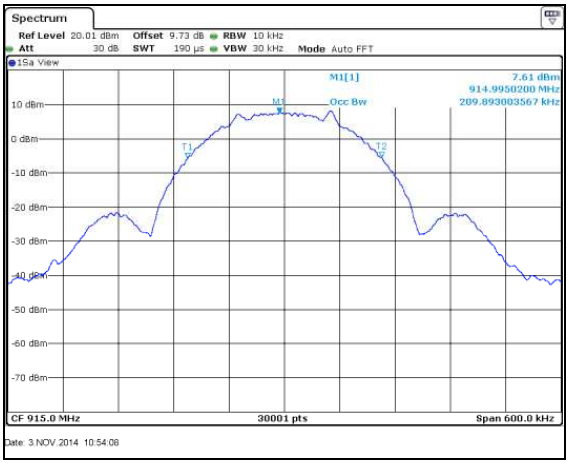

Figure 7.4.4.2-39: 99% BW Mid Channel – 200.0kbps

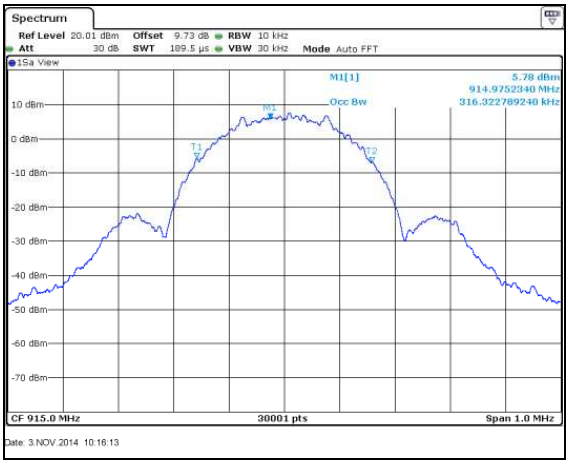

Figure 7.4.4.2-40: 99% BW Mid Channel – 300.0kbps

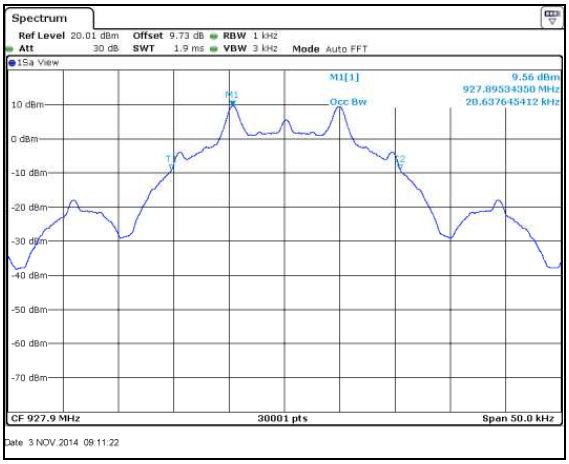

Figure 7.4.4.2-41: 99% BW High Channel - 9.6kbps

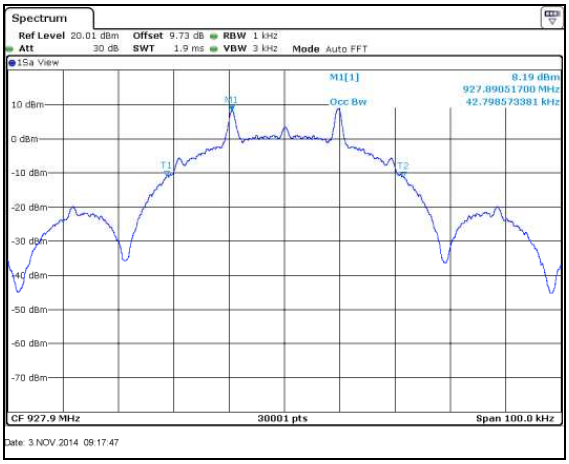

Figure 7.4.4.2-42: 99% BW High Channel – 19.2kbps

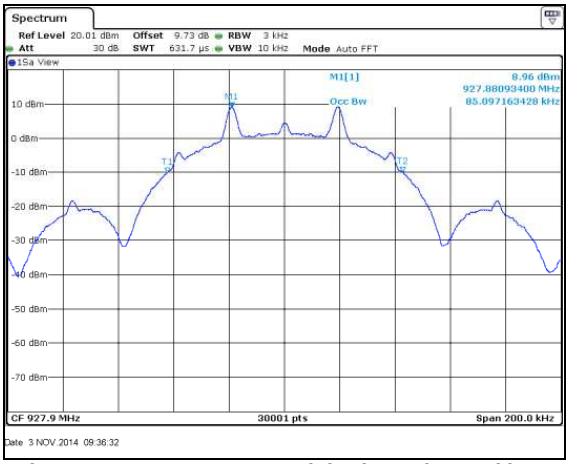

Figure 7.4.4.2-43: 99% BW High Channel – 38.4kbps

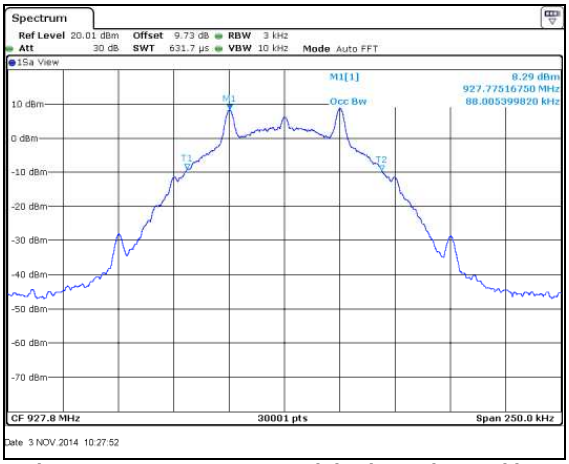

Figure 7.4.4.2-44: 99% BW High Channel – 50.0kbps

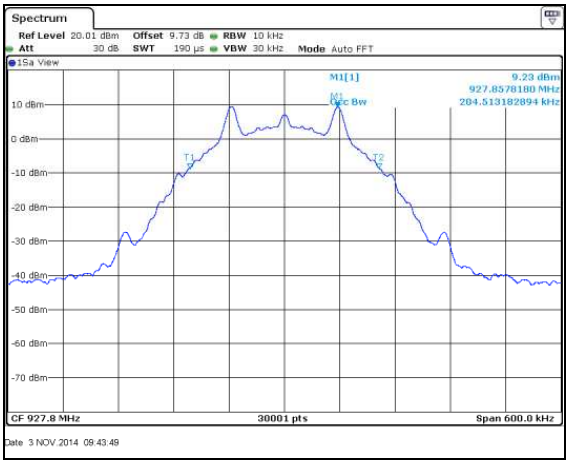

Figure 7.4.4.2-45: 99% BW High Channel – 115.2kbps

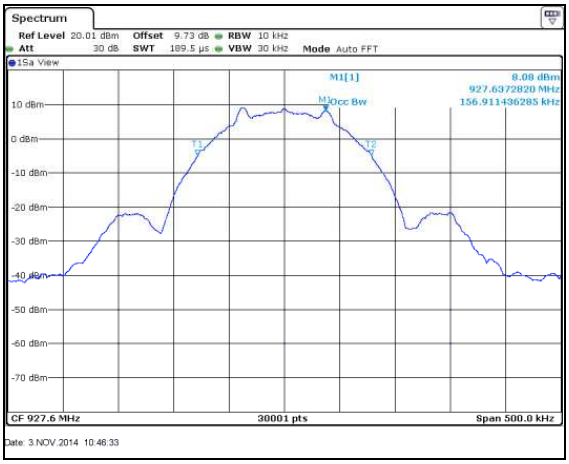

Figure 7.4.4.2-46: 99% BW High Channel – 150.0kbps

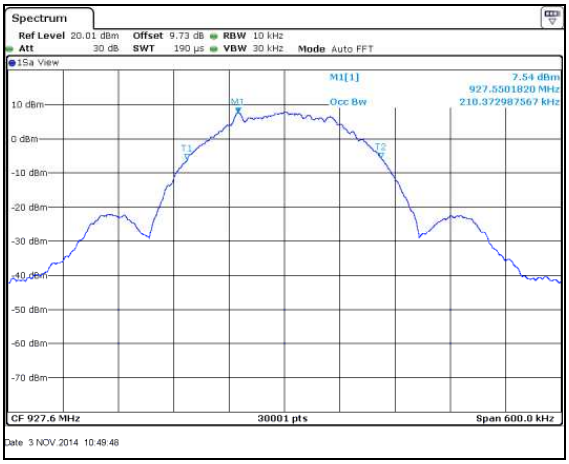

Figure 7.4.4.2-47: 99% BW High Channel – 200.0kbps

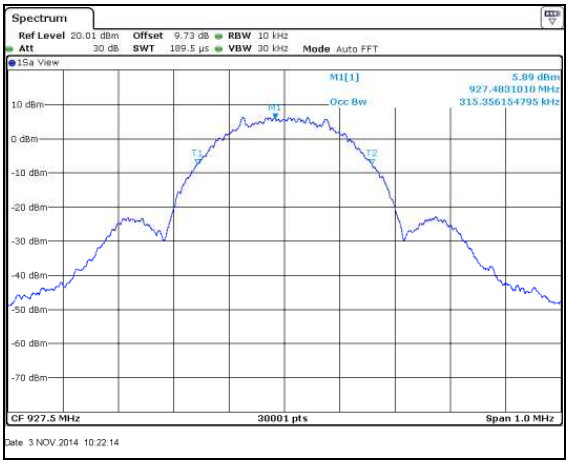

Figure 7.4.4.2-48: 99% BW High Channel – 300.0kbps

7.5 Band-Edge Compliance and Spurious Emissions

7.5.1 Band-Edge Compliance of RF Conducted Emissions - FCC 15.247(d); IC RSS-210 A8.5

7.5.1.1 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 ≥ 1% of the span, and the VBW was set to >> RBW.

Band-edge was evaluated for all combinations of operating modes and data rates. Worst case reported utilized 115.2kbps in Mode 1, 38.4kbps in Mode 2, 300.0kbps in Mode 3, 50.0kbps in Mode 4 and 200.0kbps in Mode 5.

7.5.1.2 Measurement Results

Results are shown in the figures 7.5.1.2-1 to 7.5.1.2-20 below.

NON-HOPPING MODE:

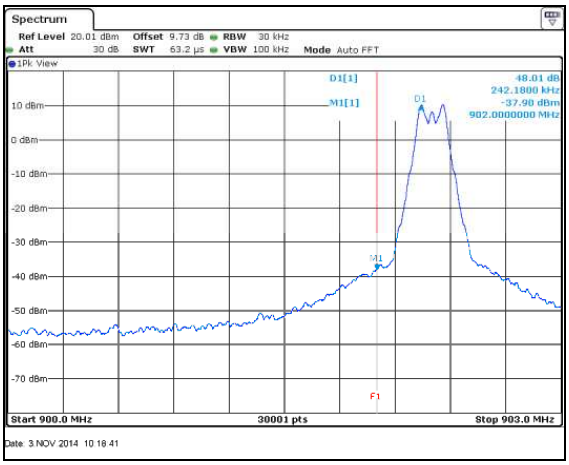

Figure 7.5.1.2-1: Lower Band-edge – Mode 1

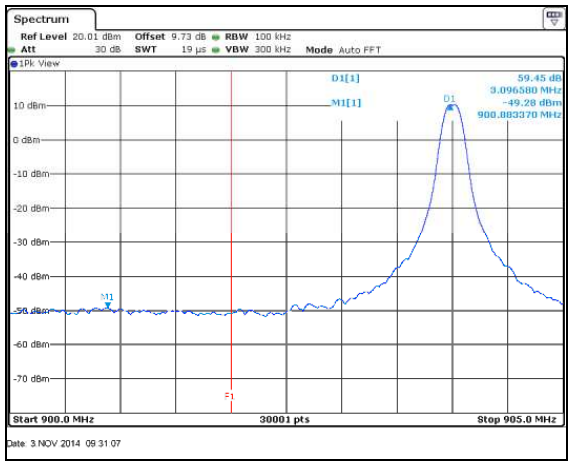

Figure 7.5.1.2-2: Lower Band-edge – Mode 2

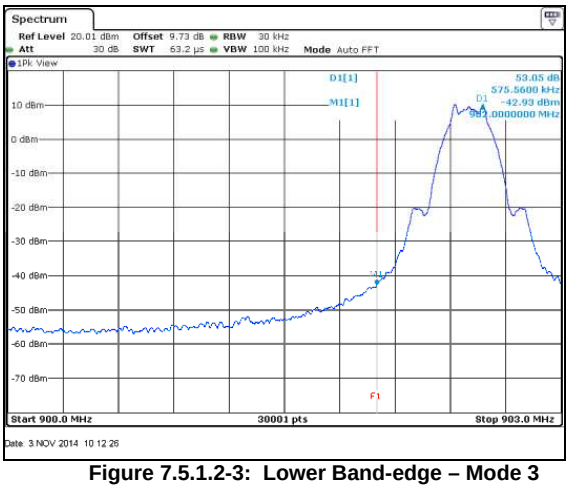

Figure 7.5.1.2-3: Lower Band-edge – Mode 3

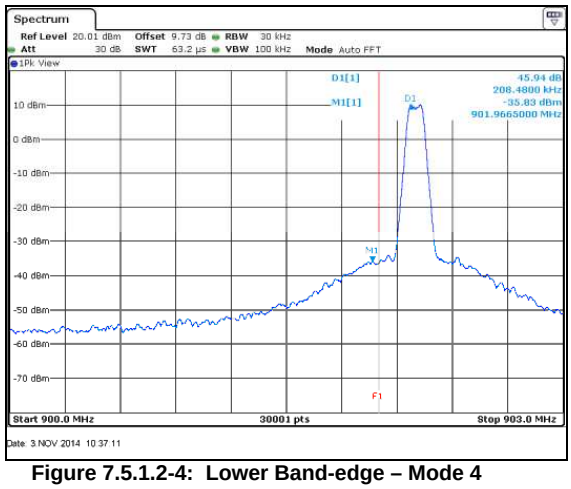

Figure 7.5.1.2-4: Lower Band-edge – Mode 4

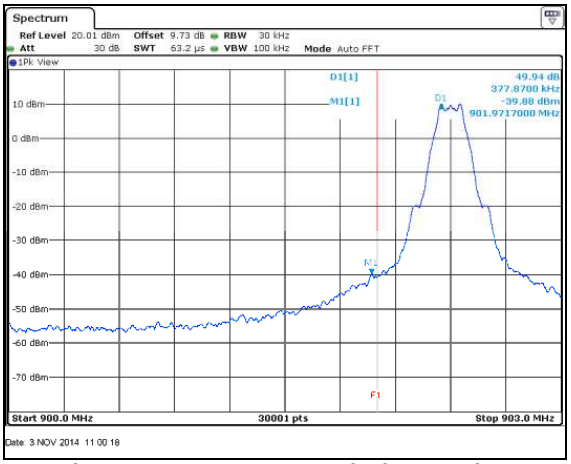

Figure 7.5.1.2-5: Lower Band-edge – Mode 5

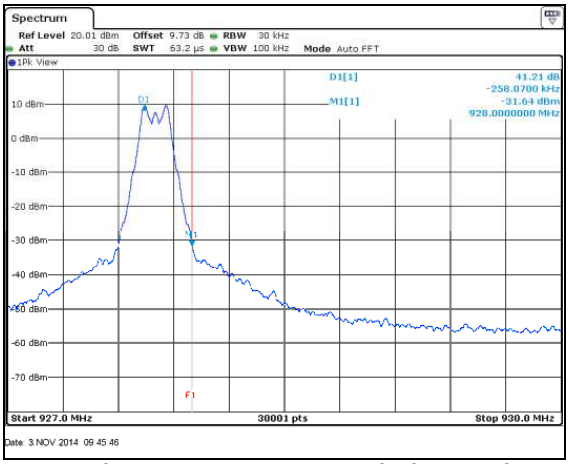

Figure 7.5.1.2-6: Upper Band-edge – Mode 1

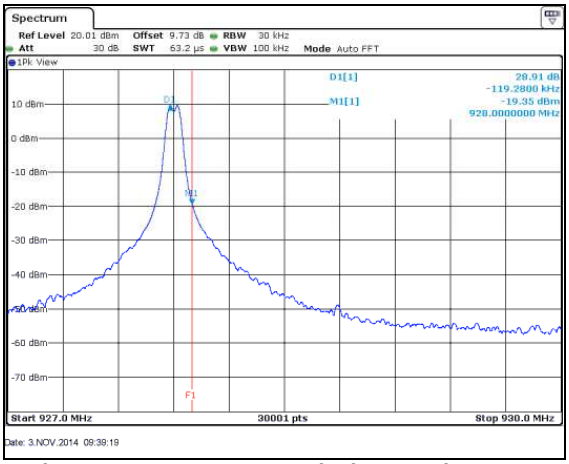

Figure 7.5.1.2-7: Upper Band-edge – Mode 2

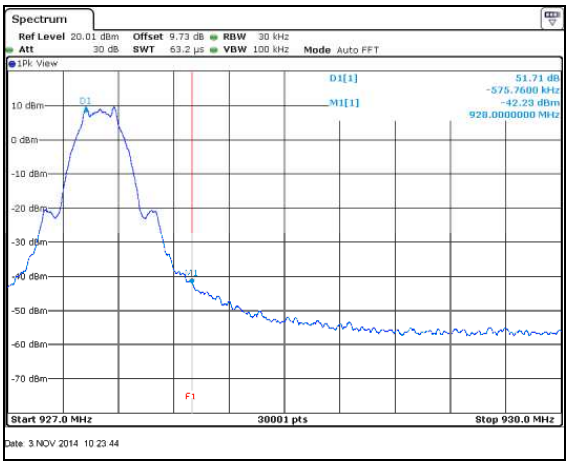

Figure 7.5.1.2-8: Upper Band-edge – Mode 3

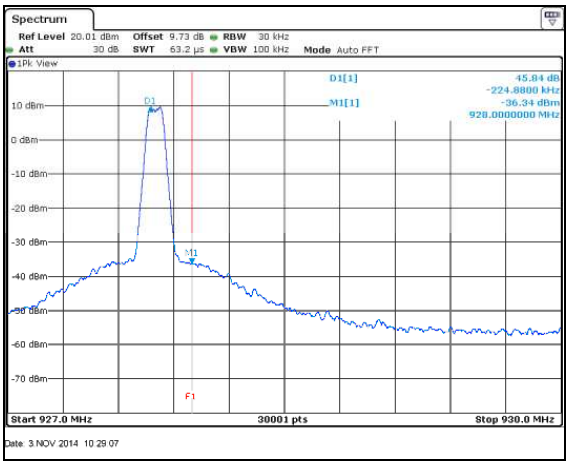

Figure 7.5.1.2-9: Upper Band-edge – Mode 4

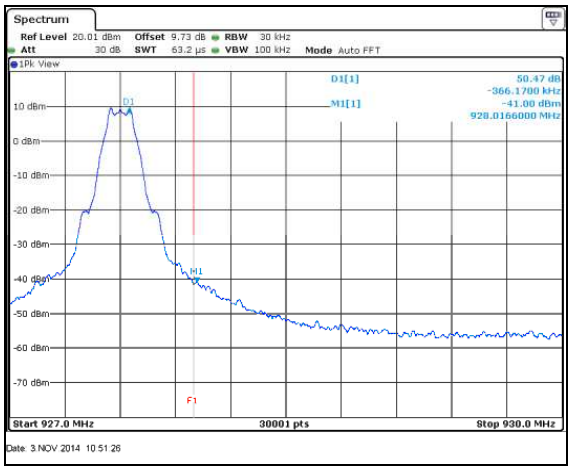

Figure 7.5.1.2-10: Upper Band-edge – Mode 5

HOPPING MODE:

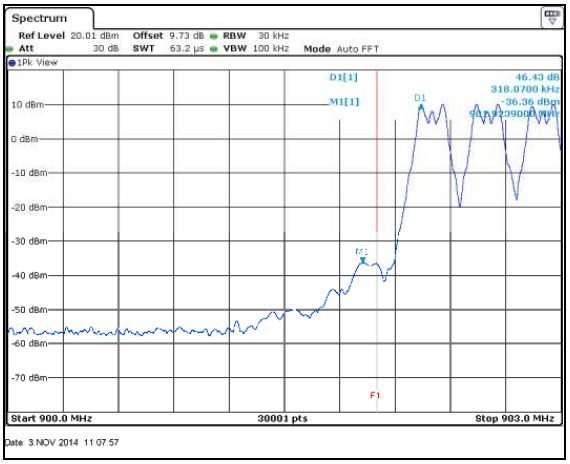

Figure 7.5.1.2-11: Lower Band-edge – Mode 1

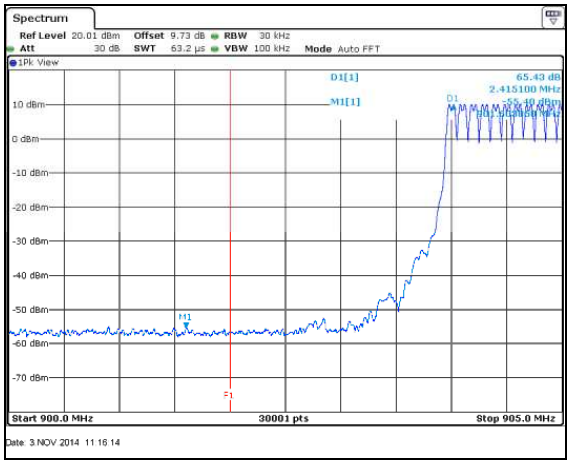

Figure 7.5.1.2-12: Lower Band-edge – Mode 2

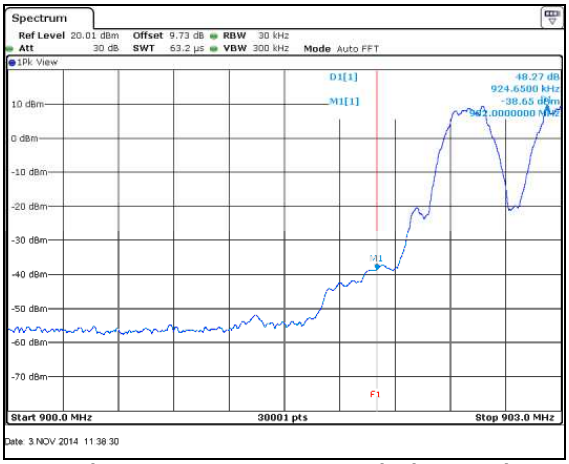

Figure 7.5.1.2-13: Lower Band-edge – Mode 3

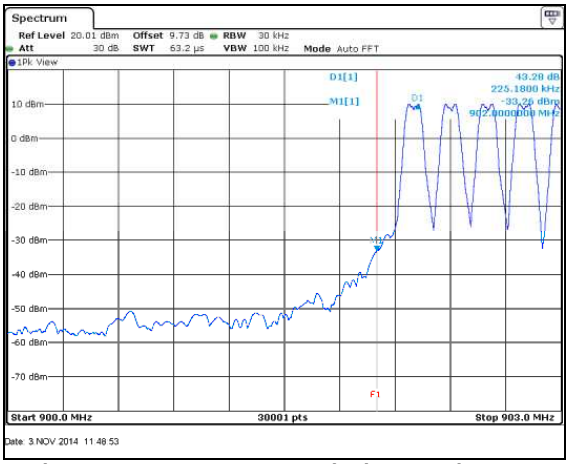

Figure 7.5.1.2-14: Lower Band-edge – Mode 4

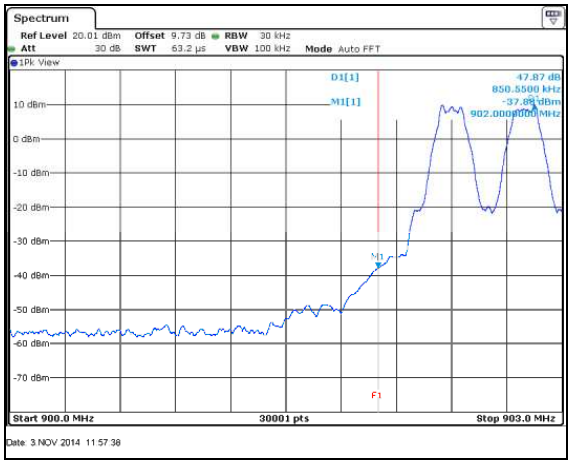

Figure 7.5.1.2-15: Lower Band-edge – Mode 5

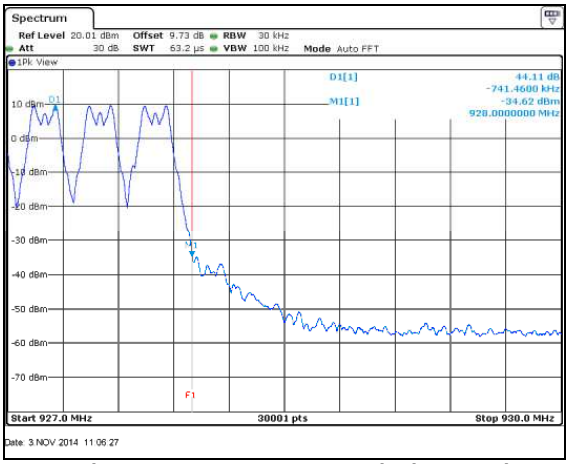

Figure 7.5.1.2-16: Upper Band-edge – Mode 1

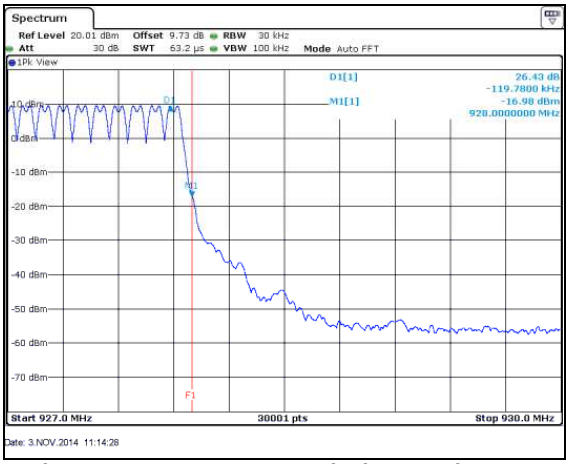

Figure 7.5.1.2-17: Upper Band-edge – Mode 2

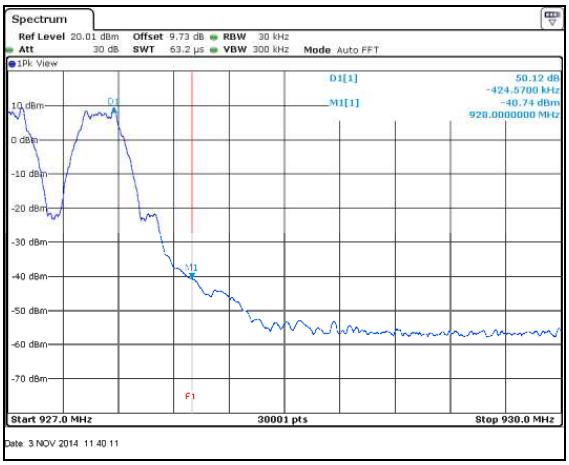

Figure 7.5.1.2-18: Upper Band-edge – Mode 3

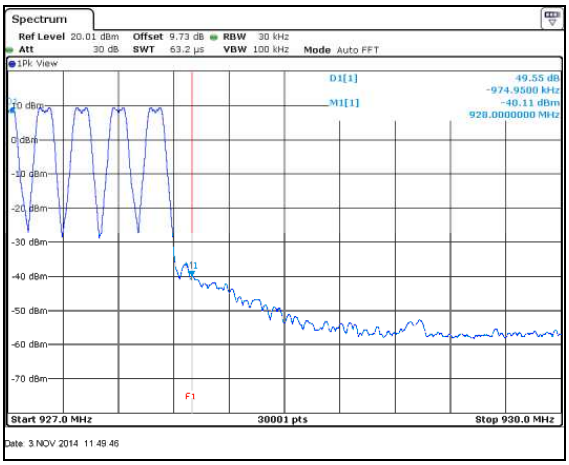

Figure 7.5.1.2-19: Upper Band-edge – Mode 4

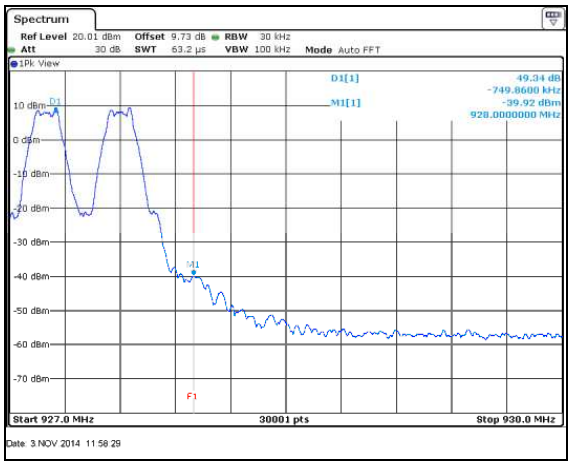

Figure 7.5.1.2-20: Upper Band-edge – Mode 5

7.5.2 RF Conducted Spurious Emissions - FCC 15.247(d); IC RSS-210 A8.5

7.5.2.1 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.

7.5.2.2 Measurement Results

Results are shown below in Figures 7.5.2.2-1 to 7.5.2.2-6:

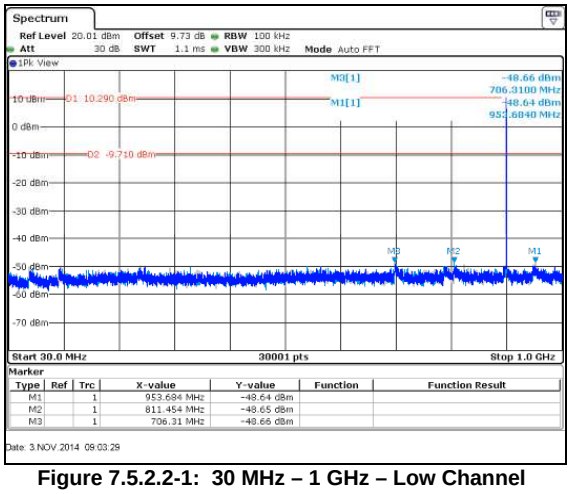

Figure 7.5.2.2-1: 30 MHz – 1 GHz – Low Channel

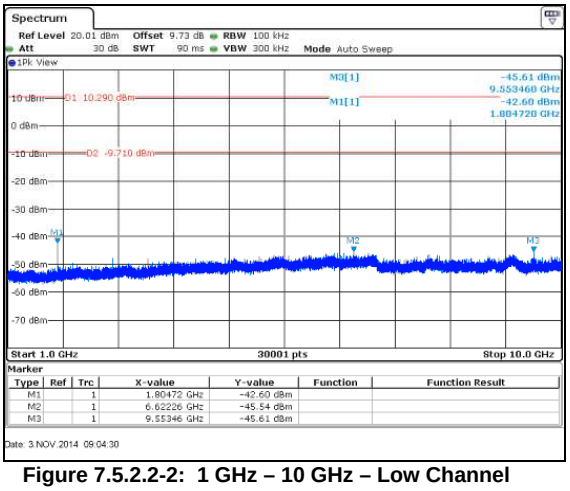

Figure 7.5.2.2-2: 1 GHz – 10 GHz – Low Channel

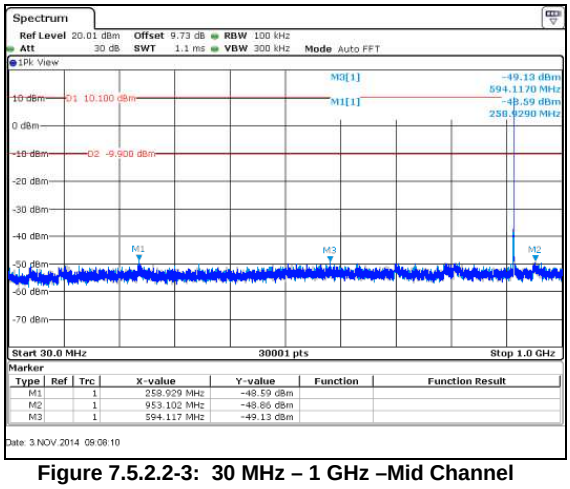

Figure 7.5.2.2-3: 30 MHz – 1 GHz –Mid Channel

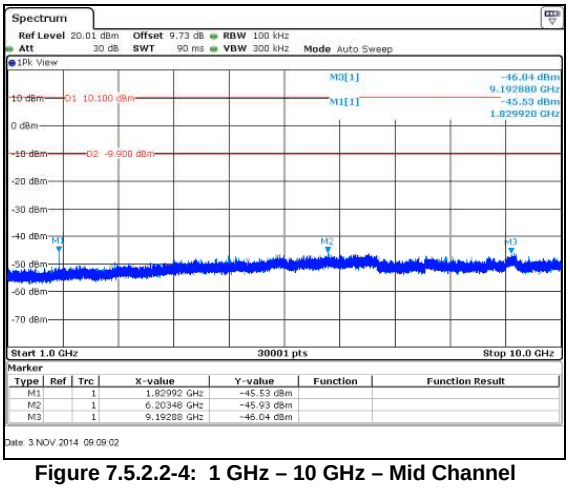

Figure 7.5.2.2-4: 1 GHz – 10 GHz – Mid Channel

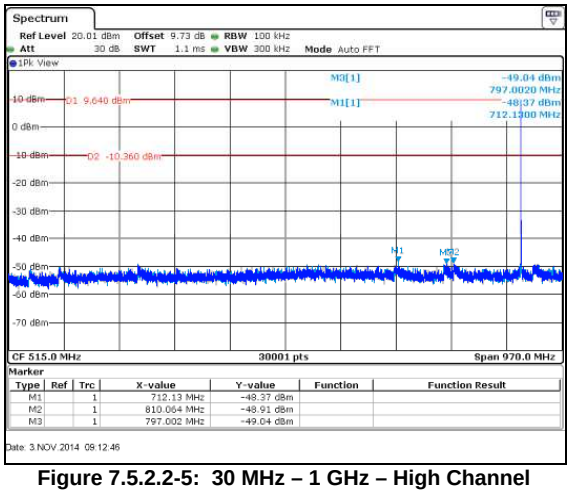

Figure 7.5.2.2-5: 30 MHz – 1 GHz – High Channel

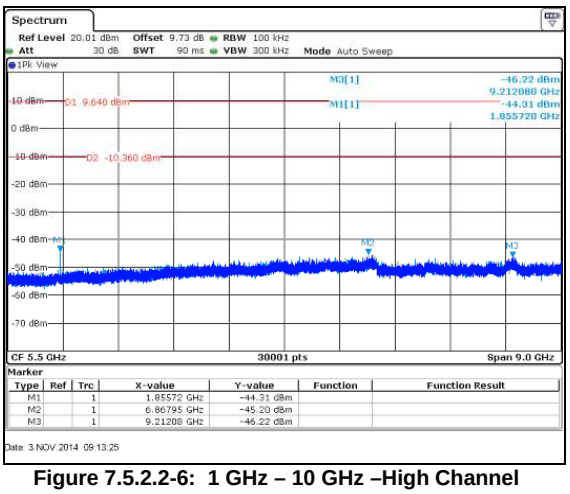

Figure 7.5.2.2-6: 1 GHz – 10 GHz –High Channel

7.5.3 Radiated Spurious Emissions - FCC 15.205, 15.209; IC RSS-210 2.2, RSS-Gen 8.9/8.10

7.5.3.1 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 were made with RBW and VBW of 1 MHz and 3MHz respectively.

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

Each emission found to be in a restricted band was compared to the applicable radiated emission limits.

Radiated spurious emissions were evaluated for all combinations of operating modes and data rates with worst case data provided.

7.5.3.2 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in the Table 7.5.3.2-1 below.

Table 7.5.3.2-1: 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										
2706.6	48.88	39.20	H	-4.65	44.23	34.55	74.0	54.0	29.8	19.5
2706.6	48.09	38.21	V	-4.65	43.44	33.56	74.0	54.0	30.6	20.4
Middle Channel										
2745	48.49	39.73	H	-4.50	43.99	35.23	74.0	54.0	30.0	18.8
2745	47.36	37.52	V	-4.50	42.86	33.02	74.0	54.0	31.1	21.0
High Channel										
2783.7	48.12	39.73	H	-4.34	43.78	35.39	74.0	54.0	30.2	18.6

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: 48.88 - 4.65 = 44.23dBuV/m
Margin: 74dBuV/m – 44.23dBuV/m = 29.8dB

Example Calculation: Average

Corrected Level: 39.20 - 4.65 - 0 = 34.55dBuV
Margin: 54dBuV – 34.55dBuV = 19.5dB

8 CONCLUSION

In the opinion of ACS, Inc. the Field Tool Adapter, manufactured by Landis+Gyr Technology, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT