America

Certification Test Report

FCC ID: P2SBELTCLIPT3
IC: 4171B-BELTCLIPT3

FCC Rule Part: 15.247
ISED Canada Radio Standards Specification: RSS-247

Report Number: AT72129069-1C1

Manufacturer: Neptune Technology Group
Model: BCT3

Test Begin Date: June 26, 2017
Test End Date: August 10, 2017

Report Issue Date: October 12, 2017

FOR THE SCOPE OF ACCREDITATION UNDER Certificate Number: AT-2021

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

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This report contains 24 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 Innovation, Science, and Economic Development Canada's Radio Standards Specification RSS-247 Certification.

1.2 Product description

The BCT3 is a body-worn, battery powered, 910-920MHz transceiver that is used to read RF-communicating water meters manufactured by Neptune Technology Group. It stores readings on an SD card, and, upon command, transmits the readings to a another computing device via Bluetooth. The BCT3 contains a Bluetooth transceiver with modular certification, the Laird BT900-SA, whose regulatory identifiers are: (FCC) SQGBT900 and (Industry Canada) 3147A-BT900. The BCT3 contains a low-powered (+18.5 dBm conducted max) transmitter called the R900 Transmitter that can command one of Neptune's water meters to perform maintenance functions, such as retrieving the stored readings log. Meter reading packets are received by the 915 MHz Receiver, processed by the Microprocessor with support of the Microcontroller, stored on an SD card, and sent to the Bluetooth transceiver for wireless transfer to another computing device.

Technical Details:

Detail	Description
Frequency Range	911.0815 – 919.0764 MHz
Number of Channels	50
Modulation Format	GFSK
Data Rates	65536 bps
Number of Inputs/Outputs	1T1R
Operating Voltage	4.2 Vdc
Antenna Type(s) / Gain(s)	Neptune Technology Group Planar Dipole Antenna -2 dBi

Manufacturer Information:
Neptune Technology Group Inc.
1600 Alabama Highway 226
Tallassee, AL 36078

Test Sample Serial Number: BC003575

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 data rates, were evaluated and the data presented in this report represents the worst case where applicable.

For radiated emissions, the EUT was evaluated in a stand-alone configuration and connected to a DC-DC Cigarette Lighter Adapter. The worst-case configuration was the stand-alone configuration. The EUT was tested stand-alone in three orthogonal orientations. The worst-case orientation was Z-orientation. See test setup photos for more information.

The EUT is a battery powered device that is marketed with a dedicated wall wart power supply and a cigarette lighter adapter. For AC Power Line Conducted Emissions, the EUT was evaluated with the dedicated wall wart power supply and connected to a laptop.

For RF Conducted Emissions, the EUT was evaluated with a U.FL to SMA connector to facilitate connection to the test equipment. The insertion loss of the U.FL to SMA connector was characterized for RF conducted emissions testing.

The EUT was evaluated for all combinations of simultaneous transmission and found to be in compliance.

Power drive level during test: 8
PA level during test: 2930

2 TEST FACILITIES

2.1 Location

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

TÜV SÜD America, Inc.
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by the ANSI-ASQ National Accreditation Board/ANAB accreditation program, and has been issued certificate number AT-2021 in recognition of this accreditation. 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, Innovation, Science, and Economic Development Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number: 391271
Innovation, Science, and Economic Development 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:

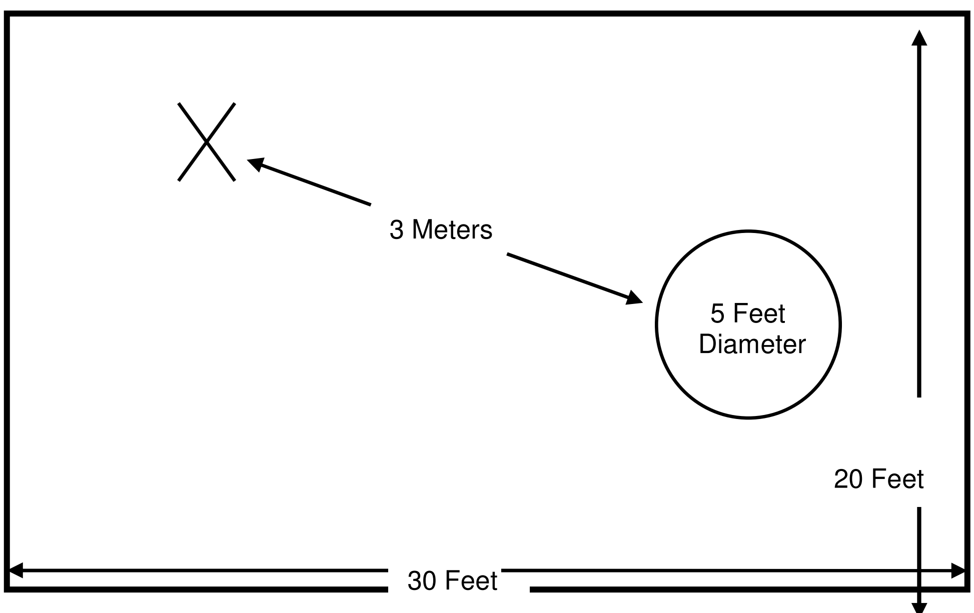

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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 C63.10.

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

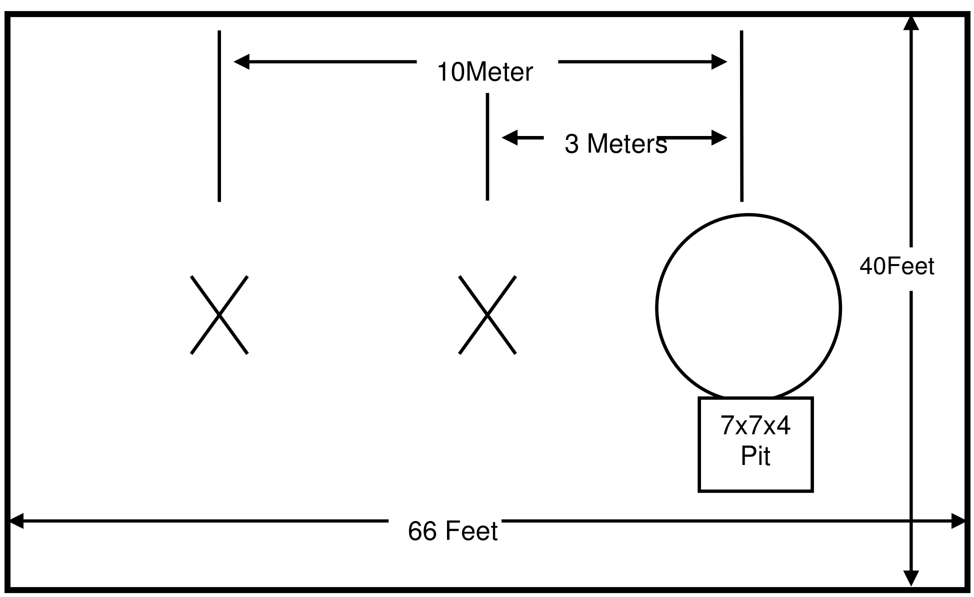

Figure 2.3-2: Open Area Test Site

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 ANSI C63.10.

A diagram of the room is shown below in figure 2.4-1:

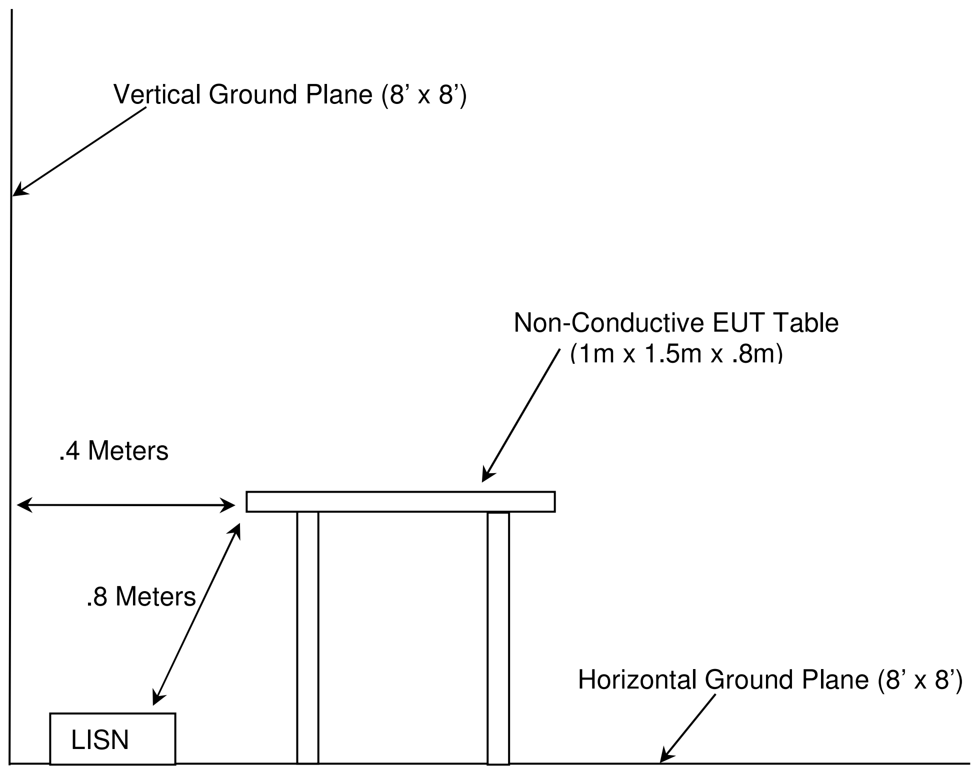

Figure 2.4-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2017
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2017
- ISED Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices, Issue 2, Feb 2017
- ISED 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

Asset ID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
30	Spectrum Technologies	DRH-0118	Antennas	970102	5/9/2017	5/9/2019
40	EMCO	3104	Antennas	3211	6/8/2016	6/8/2018
73	Agilent	8447D	Amplifiers	2727A05624	7/21/2016	7/21/2017
73	Agilent	8447D	Amplifiers	2727A05624	7/24/2017	7/24/2018
167	ACS	Chamber EMI Cable Set	Cable Set	167	9/30/2016	9/30/2017
267	Agilent	N1911A	Meters	MY45100129	8/24/2015	8/24/2017
268	Agilent	N1921A	Sensors	MY45240184	8/13/2015	8/13/2017
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	1/18/2017	1/18/2018
324	ACS	Belden	Cables	8214	3/21/2017	3/21/2018
337	Microwave Circuits	H1G513G1	Filters	282706	5/13/2017	5/13/2018
338	Hewlett Packard	8449B	Amplifiers	3008A01111	8/21/2015	8/21/2017
338	Hewlett Packard	8449B	Amplifiers	3008A01111	7/11/2017	7/11/2019
340	Aeroflex/Weinschel	AS-20	Attenuators	7136	7/12/2016	7/12/2017
340	Aeroflex/Weinschel	AS-20	Attenuators	7136	7/10/2017	7/10/2018
412	Electro Metrics	LPA-25	Antennas	1241	8/8/2016	8/8/2018
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	10/27/2016	10/27/2017
616	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	N/A	9/2/2016	9/2/2017
622	Rohde & Schwarz	FSV40	Analyzers	101338	7/15/2016	7/15/2018
676	Florida RF Labs	SMS-290AW-480.0-SMS	Cables	MFR2Y194	11/4/2016	11/4/2017
813	PMM	9010	Receiver	697WW30606	2/6/2017	2/6/2018
3010	Rohde & Schwarz	ENV216	LISN	3010	7/11/2016	7/11/2017
3010	Rohde & Schwarz	ENV216	LISN	3010	7/11/2017	7/11/2018
RE135	Rohde & Schwarz	FSP30	Spectrum Analyzers	835618/031	10/31/2016	10/31/2017

NCR = No Calibration Required
NOTE: All test equipment was used only during active calibration cycles.

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model/Part Number	Serial Number
1	Wall Wart Power Supply	Artesyn	DA10-050US	L340SB003HBFL
2	Laptop Computer	Dell	Latitude E5550	COTWX52
3	Laptop Power Supply	Dell	DA65NM130	CN-03F1CN-48661-56K-5ZEJ-A03
4	USB Mouse	Dell	M-UVDEL1	LNA40736948
5	Stereo Headphones	RCA	N/A	N/A
6	Cigarette Lighter Adapter	Monoprice	8858	N/A
7	Automotive Battery	Duralast	24MD-DL	N/A

Table 5-2: Cable Description

Cable	Cable Type	Length	Shield	Termination
A	USB Cable	100 cm	No	EUT to Wall Wart Power Supply / Cigarette Lighter Adapter
B	DC Power Cable	200 cm	No	Laptop Computer to Laptop Power Supply
C	AC Power Cable	150 cm	No	Laptop Power Supply to AC Mains
D	USB Cable	150 cm	No	Laptop Computer to USB Mouse
E	Stereo Audio	150 cm	No	Laptop Computer to Stereo Headphones
F	DC Power Cable	150 cm	No	Cigarette Lighter Adapter to Automotive Battery

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

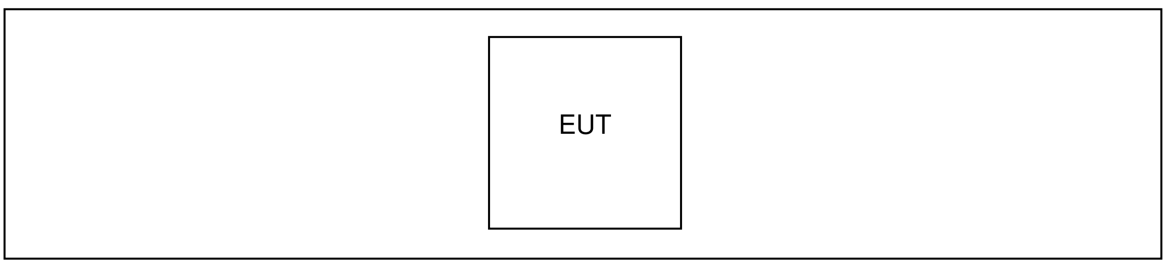

Figure 6-1: Test Setup Block Diagram – Radiated Emissions – Stand-Alone Configuration

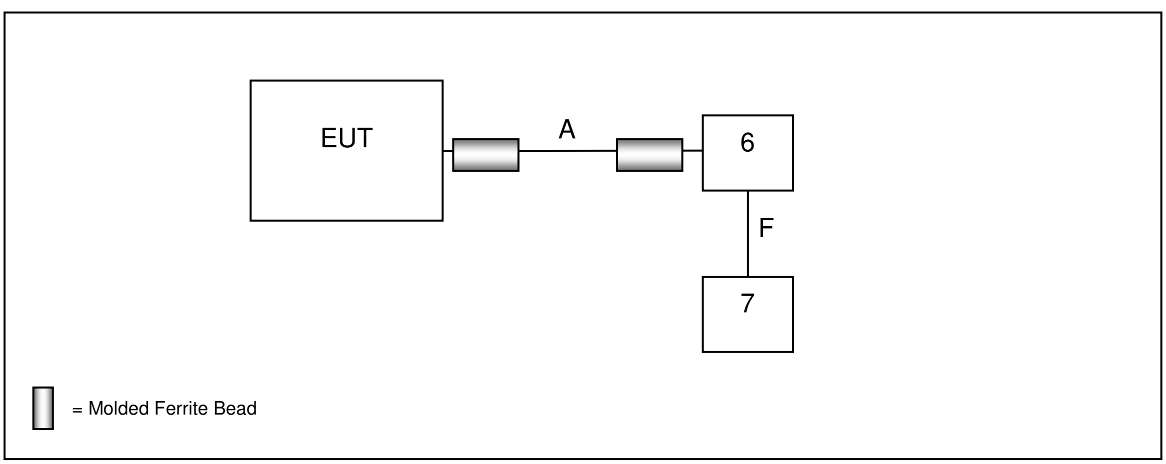

Figure 6-2: Test Setup Block Diagram – Radiated Emissions – Stand-Alone Configuration

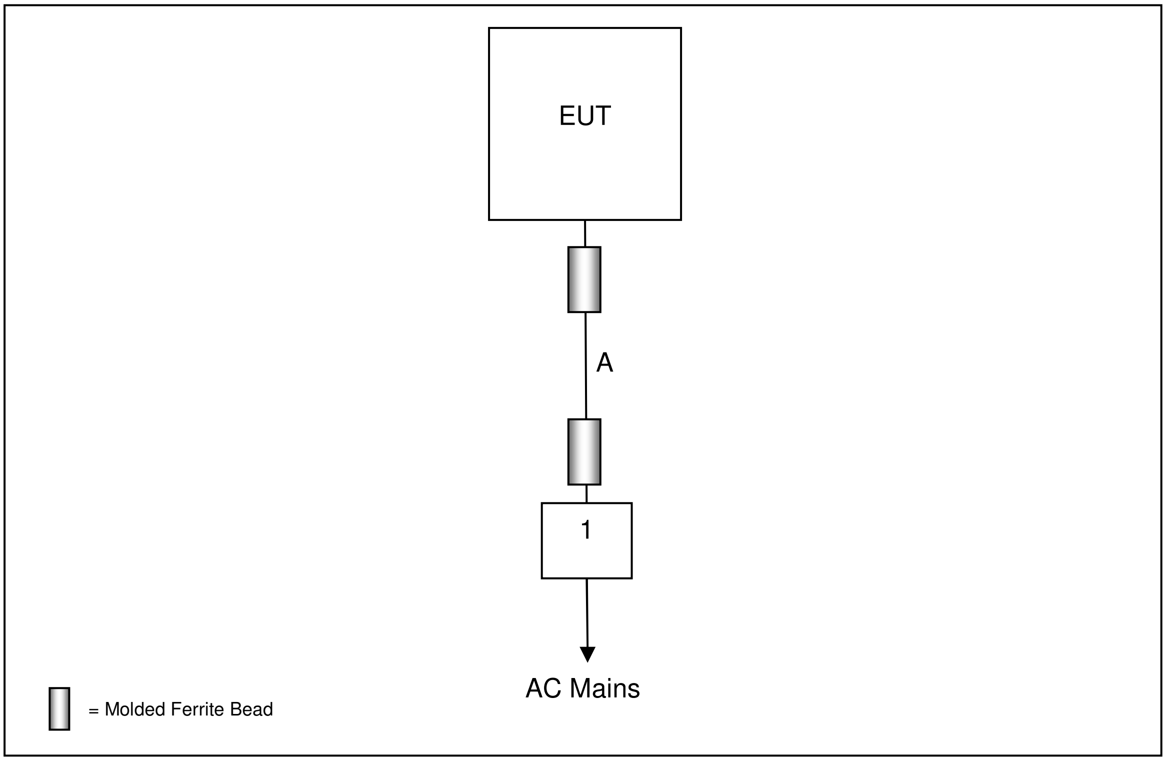

Figure 6-3: Test Setup Block Diagram – AC Power Line Conducted Emissions – Wall Wart

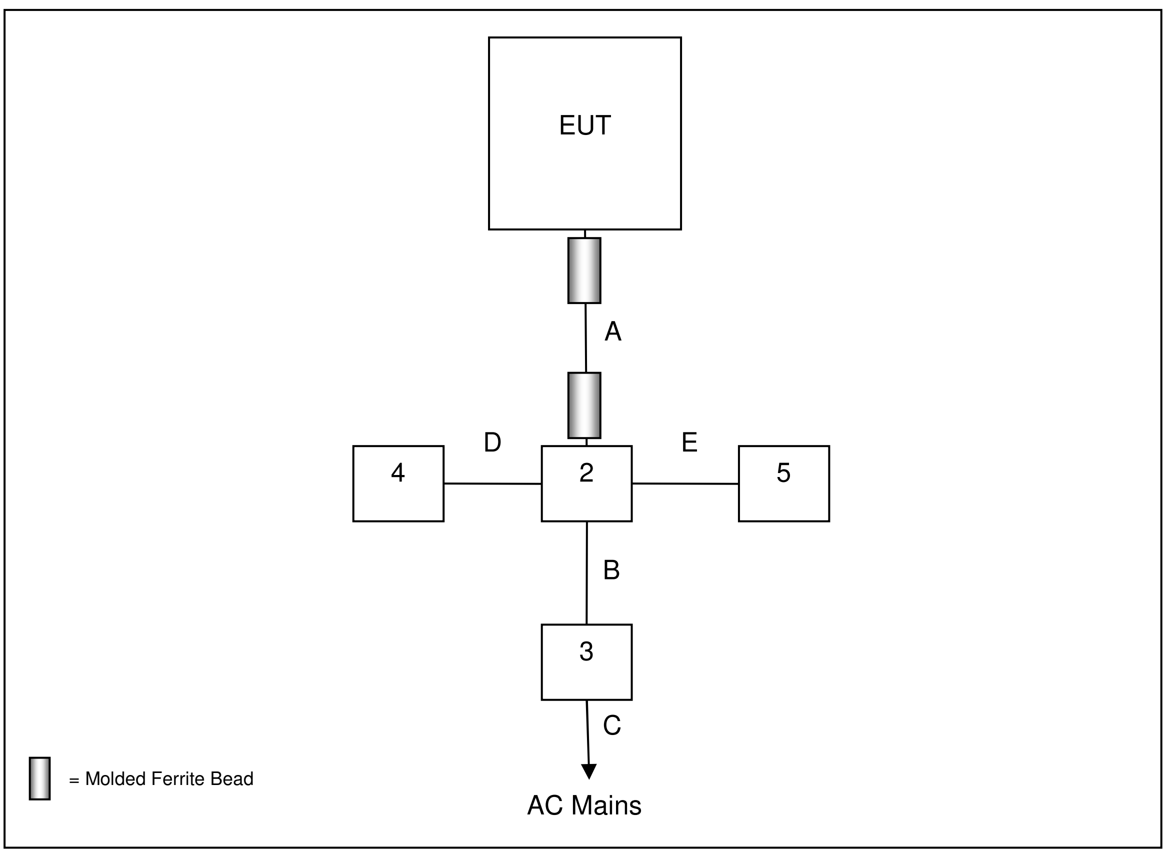

Figure 6-4: Test Setup Block Diagram – AC Power Line Conducted Emissions – Laptop

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 planar dipole antenna is internal to the unit and interfaces with the EUT via a U.FL coax cable, therefore meeting the requirements of FCC Section 15.203. The gain of the antenna is -2 dBi.

7.2 Power Line Conducted Emissions – FCC: Section 15.207; ISED Canada: RSS-Gen 8.8

7.2.1 Measurement Procedure

Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. 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

Performed by: Wayne Orwig, Alton Smith

Table 7.2.2-1: Conducted EMI Results Line 1 – Wall Wart Power Supply Configuration

Frequency (MHz)	Corrected Reading		Limit		Margin		Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	
0.15	47.43	30.81	66	56	-18.57	-25.19	9.59
0.154	47.14	29.38	65.78	55.78	-18.64	-26.4	9.58
0.166	46.83	29.78	65.16	55.16	-18.33	-25.38	9.58
0.178	45.66	27.26	64.58	54.58	-18.92	-27.32	9.58
0.19	44.47	28.14	64.04	54.04	-19.57	-25.9	9.58
0.206	44.1	25.92	63.37	53.37	-19.27	-27.45	9.58
0.214	42.08	26.82	63.05	53.05	-20.97	-26.23	9.58
0.23	41.61	24.38	62.45	52.45	-20.84	-28.07	9.58
0.242	41.43	24.99	62.03	52.03	-20.6	-27.04	9.58
0.474	41.53	27.9	56.44	46.44	-14.91	-18.54	9.59

Table 7.2.2-2: Conducted EMI Results Line 2 – Wall Wart Power Supply Configuration

Frequency (MHz)	Corrected Reading		Limit		Margin		Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	
0.15	43.65	29.22	66	56	-22.35	-26.78	9.59
0.154	44.45	29.39	65.78	55.78	-21.33	-26.39	9.58
0.162	44.4	29.51	65.36	55.36	-20.96	-25.85	9.58
0.182	41.1	27.35	64.39	54.39	-23.29	-27.04	9.58
0.194	41.37	29.48	63.86	53.86	-22.49	-24.38	9.58
0.214	40.8	28.79	63.05	53.05	-22.25	-24.26	9.58
0.226	39.15	27.57	62.6	52.6	-23.45	-25.03	9.58
0.234	37.99	27.65	62.31	52.31	-24.32	-24.66	9.58
0.266	36.19	25.15	61.24	51.24	-25.05	-26.09	9.59
0.478	39.14	30.5	56.37	46.37	-17.23	-15.87	9.59

Table 7.2.2-3: Conducted EMI Results Line 1 – Laptop Configuration

Frequency (MHz)	Corrected Reading		Limit		Margin		Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	
0.15	52.24	36.77	66	56	-13.76	-19.23	9.59
0.154	49.96	34.93	65.78	55.78	-15.82	-20.85	9.58
0.17	50.67	33.96	64.96	54.96	-14.29	-21	9.58
0.19	50.22	26.75	64.04	54.04	-13.82	-27.29	9.58
0.21	43.52	26.18	63.21	53.21	-19.69	-27.03	9.58
0.222	42.84	22.6	62.74	52.74	-19.9	-30.14	9.58
0.242	41.04	22.41	62.03	52.03	-20.99	-29.62	9.58
0.254	40.44	22.34	61.63	51.63	-21.19	-29.29	9.58
0.49	41.84	34.42	56.17	46.17	-14.33	-11.75	9.59
9.238	40.57	25.94	60	50	-19.43	-24.06	9.78

Table 7.2.2-4: Conducted EMI Results Line 2 – Laptop Configuration

Frequency (MHz)	Corrected Reading		Limit		Margin		Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	
0.15	52.99	37	66	56	-13.01	-19	9.59
0.166	49.48	31.85	65.16	55.16	-15.68	-23.31	9.58
0.182	48.14	30.21	64.39	54.39	-16.25	-24.18	9.58
0.19	46.68	27.18	64.04	54.04	-17.36	-26.86	9.58
0.21	44.39	25.88	63.21	53.21	-18.82	-27.33	9.58
0.23	42.04	22.46	62.45	52.45	-20.41	-29.99	9.58
0.41	40.34	22.42	57.65	47.65	-17.31	-25.23	9.59
0.502	42	34.55	56	46	-14	-11.45	9.59
0.618	41.5	22.47	56	46	-14.5	-23.53	9.59
0.682	32.98	22.43	56	46	-23.02	-23.57	9.59

7.3 Peak Output Power – FCC: Section 15.247(b)(2); ISED Canada: RSS-247 5.4(a)

7.3.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of a power meter using suitable attenuation. The device employs ≥ 50 channels in this mode of operation therefore the power is limited to 1 Watt.

7.3.2 Measurement Results

Performed by: Ryan McGann

Table 7.3.2-1: Maximum Conducted Peak Output Power

Frequency [MHz]	Level [dBm]
911.0815	18.31
919.0764	18.18

7.4 Channel Usage Requirements

7.4.1 Carrier Frequency Separation – FCC: Section 15.247(a)(1); ISED Canada: RSS-247 5.1(b)

7.4.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer using suitable attenuation. The span of the spectrum analyzer was set wide enough to capture two adjacent peaks. The RBW was set to approximately 30 % of the channel spacing and adjusted as necessary to best identify the center of each channel. The VBW was set >= RBW.

7.4.1.2 Measurement Results

Performed by: Ryan McGann

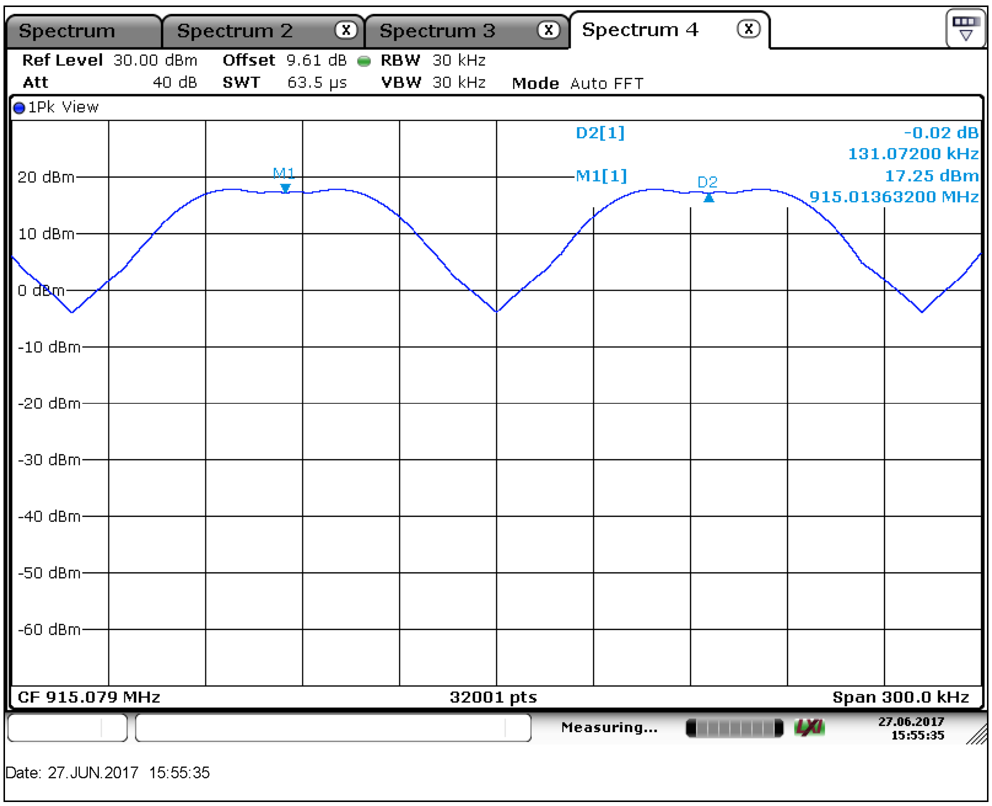

Figure 7.4.1.2-1: Frequency Separation

7.4.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(i); ISED Canada: RSS-247 5.1(c)

7.4.2.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer using suitable attenuation. The span of the spectrum analyzer was set wide enough to capture the frequency band of operation. The RBW was set to < 30 % of the channel spacing and VBW set to ≥ RBW.

7.4.2.2 Measurement Results

Performed by: Ryan McGann

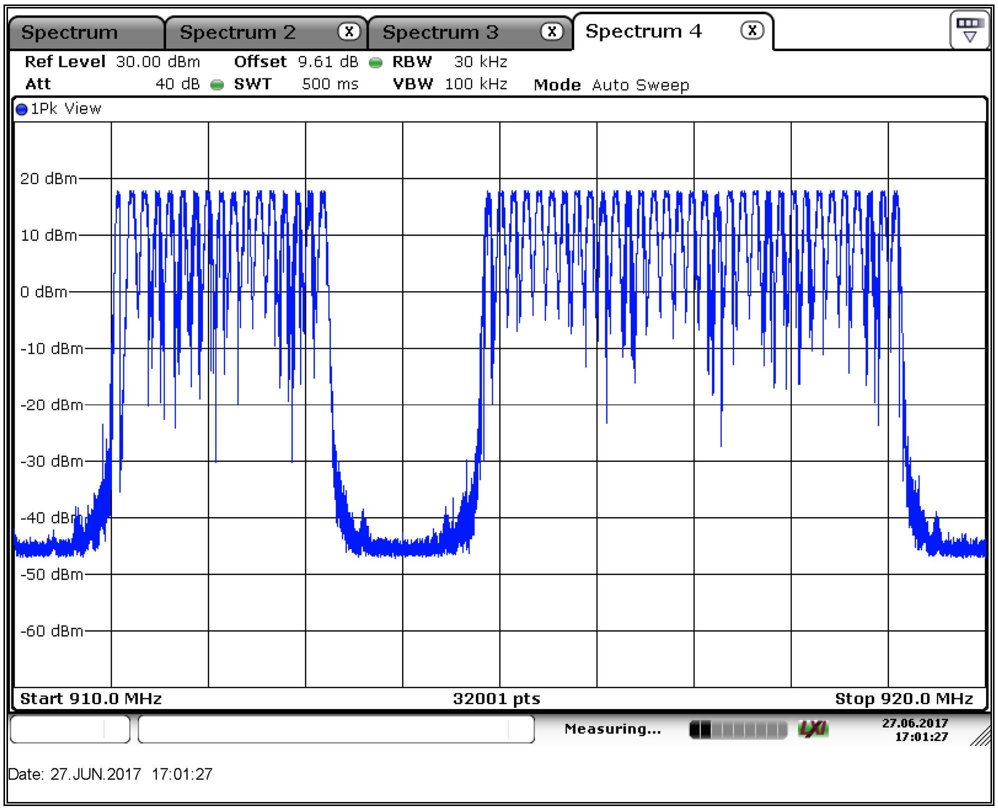

Figure 7.4.2.2-1: Number of Hopping Channels

7.4.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(i); ISED Canada: RSS-247 5.1(c)

7.4.3.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer using suitable attenuation. The spectrum analyzer was set to zero span centered on a hopping channel. The RBW was set to ≤ channel spacing but >> 1/(expected dwell time per channel). The sweep time was adjusted to capture the entire dwell time per hopping channel using a video trigger and a trigger delay. The EUT was not capable of producing a worst case dwell time in a 20 second period. See the Theory of Operations accompanying this test report for how the number of occurrences in 20 seconds was determined.

7.4.3.2 Measurement Results

Performed by: Ryan McGann

Table 7.4.3.2-1: Channel Dwell Time

Channel Number	Single Occurrence (ms)	Number of Occurrences / 20s	Total Dwell Time (ms)
N	0.4775	800	382.00
N+1	179.2969	1	179.2969

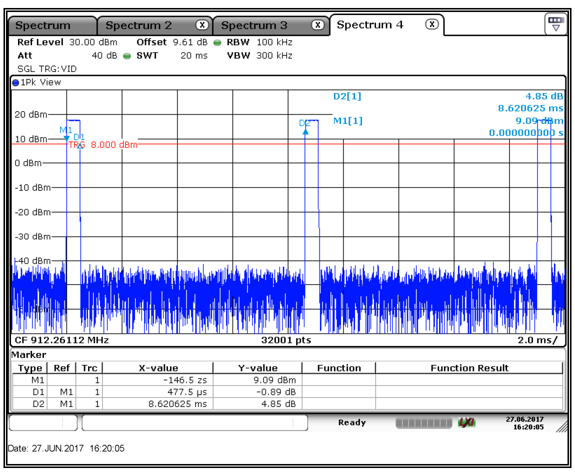

Figure 7.4.3.2-1: Dwell Time – N Channel

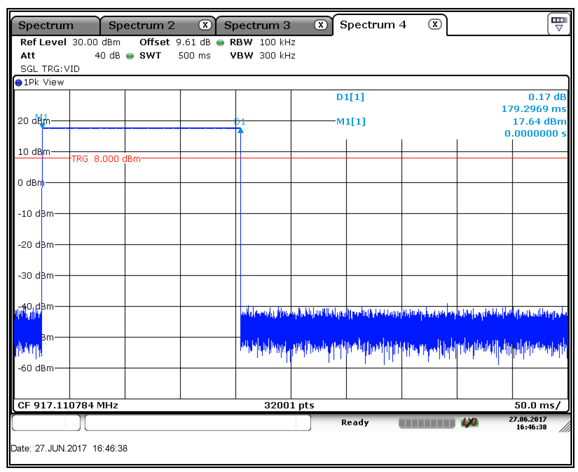

Figure 7.4.3.2-2: Dwell Time – N+1 Channel

7.4.4 20dB / 99% Bandwidth – FCC: Section 15.247(a)(1)(i); ISED Canada: RSS-247 5.1(c)

7.4.4.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer using suitable attenuation. 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 ndB down measurement function of the analyzer was 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 peak detector was used.

7.4.4.2 Measurement Results

Performed by: Ryan McGann

Table 7.4.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
911.0815	75.5883	69.7572
919.0764	76.5257	69.7010

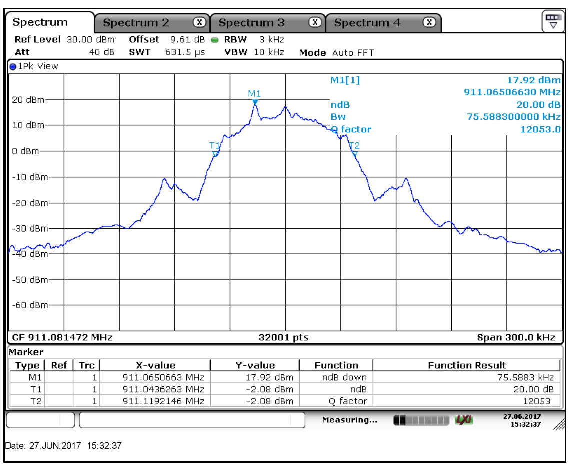

Figure 7.4.4.2-1: 20dB BW Low Channel

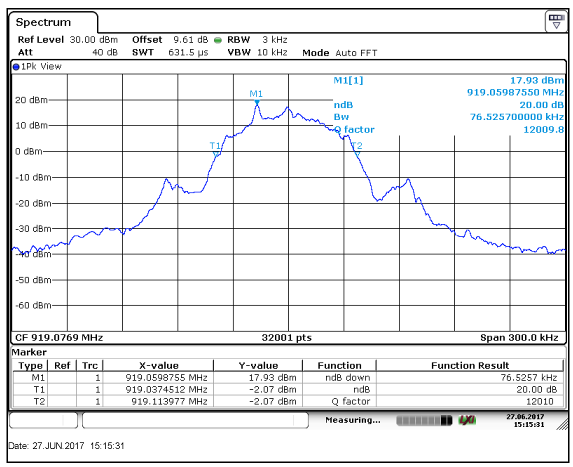

Figure 7.4.4.2-2: 20dB BW High Channel

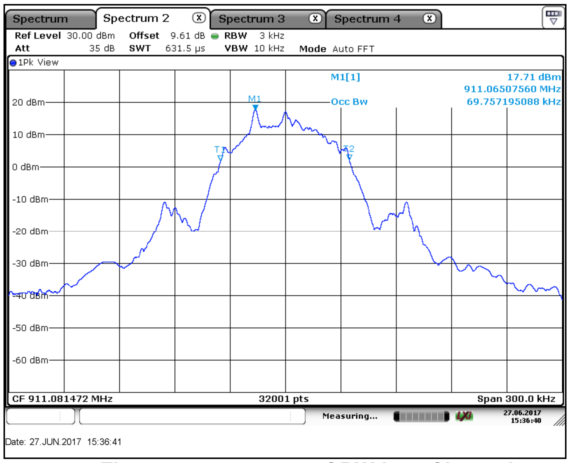

Figure 7.4.4.2-3: 99% OBW Low Channel

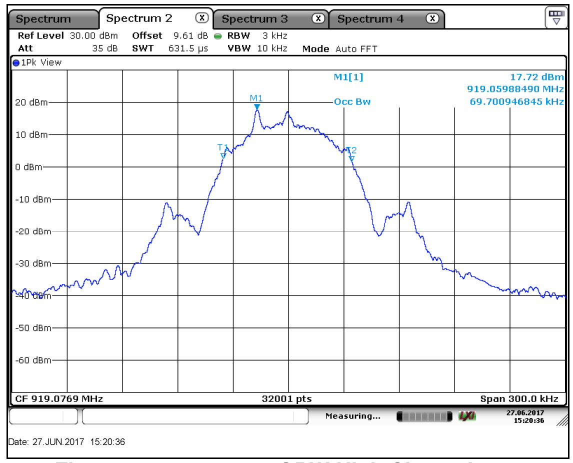

Figure 7.4.4.2-4: 99% OBW High Channel

7.5 Band-Edge Compliance and Spurious Emissions

7.5.1 Band-Edge Compliance of RF Conducted Emissions – FCC: Section 15.247(d); ISED Canada: RSS-247 5.5

7.5.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer using suitable attenuation. 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 100 kHz, and the VBW was set to 300 kHz.

7.5.1.2 Measurement Results

Performed by: Ryan McGann

NON-HOPPING MODE:

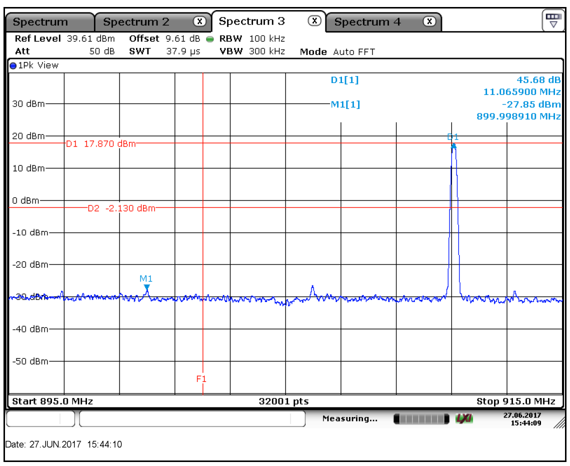

Figure 7.5.1.2-1: Lower Band-Edge

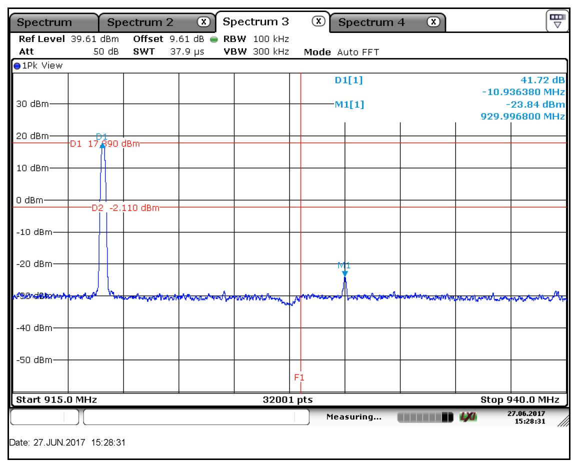

Figure 7.5.1.2-2: Upper Band-Edge

HOPPING MODE:

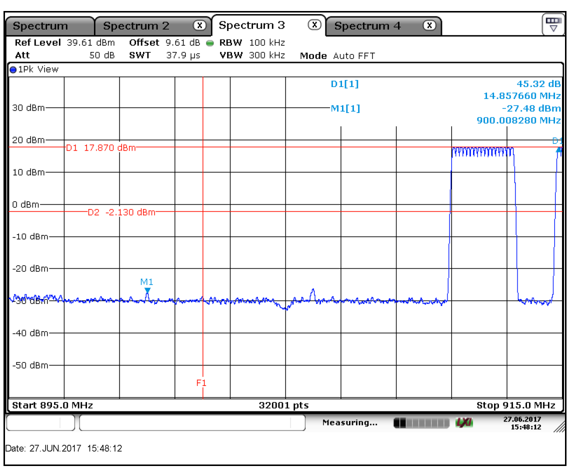

Figure 7.5.1.2-3: Lower Band-Edge Hopping

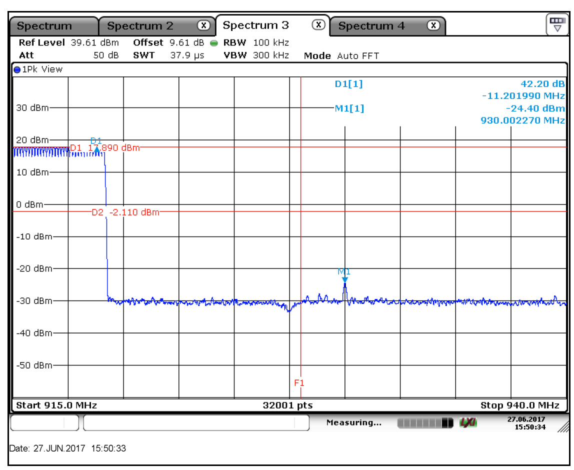

Figure 7.5.1.2-4: Upper Band-Edge Hopping

7.5.2 RF Conducted Spurious Emissions – FCC: Section 15.247(d); ISED Canada: RSS-247 5.5

7.5.2.1 Measurement Procedure

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

7.5.2.2 Measurement Results

Performed by: Ryan McGann

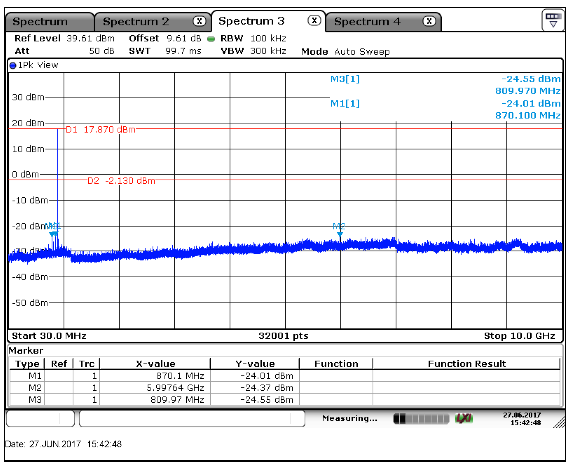

Figure 7.5.2.2-1: Conducted Emissions – LCH

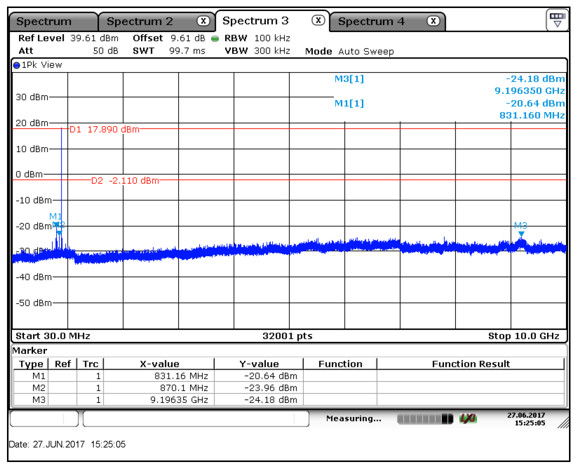

Figure 7.5.2.2-2: Conducted Emissions – HCH

7.5.3 Radiated Spurious Emissions – FCC: Sections 15.205, 15.209; ISED Canada: RSS-Gen 8.9/8.10

7.5.3.1 Measurement Procedure

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

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

The EUT was caused to generate a continuous modulated carrier on the hopping channel for less than one second, then repeated every second.

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

7.5.3.2 Measurement Results

Performed by: Wayne Orwig, Alton Smith

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										
2733.2445	50.64	43.64	V	-3.78	46.86	39.86	74.0	54.0	27.1	14.1
3644.326	50.12	40.86	V	-0.73	49.39	40.13	74.0	54.0	24.6	13.9
High Channel										
150	---------	47.52	H	-10.90	---------	36.62	--------	43.5	---------	6.9
150	---------	43.77	V	-10.90	---------	32.87	--------	43.5	---------	10.6
270	---------	45.84	H	-10.82	---------	35.02	--------	46.0	---------	11.0
270	---------	36.58	V	-10.82	---------	25.76	--------	46.0	---------	20.2
1006.62	63.13	56.89	H	-13.10	50.03	43.79	74.0	54.0	24.0	10.2
1006.62	55.46	50.62	V	-13.10	42.36	37.52	74.0	54.0	31.6	16.5
1055	63.66	61.24	H	-12.72	50.94	48.52	74.0	54.0	23.1	5.5
1055	61.69	60.12	V	-12.72	48.97	47.40	74.0	54.0	25.0	6.6
1189	54.22	50.53	H	-11.66	42.56	38.87	74.0	54.0	31.4	15.1
1189	52.61	44.85	V	-11.66	40.95	33.19	74.0	54.0	33.0	20.8
1335	56.64	43.38	H	-10.51	46.13	32.87	74.0	54.0	27.9	21.1
2757.2307	51.94	48.28	V	-3.72	48.22	44.56	74.0	54.0	25.8	9.4

7.5.3.3 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: 50.64 - 3.78 = 46.86dBuV/m
Margin: 74dBuV/m – 46.86dBuV/m = 27.1dB

Example Calculation: Average

Corrected Level: 43.64 - 3.78 - 0 = 39.86dBuV
Margin: 54dBuV – 39.86dBuV = 14.1dB

8 ESTIMATION OF MEASUREMENT UNCERTAINTY

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) k = 1.96 which provide confidence levels of 95%.

Table 8-1: Estimation of Measurement Uncertainty

Parameter	U_{lab}
Occupied Channel Bandwidth	± 0.009 %
RF Conducted Output Power	± 0.349 dB
Power Spectral Density	± 0.372 dB
Antenna Port Conducted Emissions	± 1.264 dB
Radiated Emissions ≤ 1 GHz	± 5.814 dB
Radiated Emissions > 1 GHz	± 4.318 dB
Temperature	± 0.860 °C
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	± 3.360 dB

9 CONCLUSION

In the opinion of TÜV SÜD America, Inc. the BCT3, manufactured by Neptune Technology Group meets the requirements of FCC Part 15 subpart C and Innovation, Science, and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented in this test report.

END REPORT