

# **Certification Test Report**

# FCC ID: R7PCONCS4B5

# FCC Rule Part: 15.247

# ACS Report Number: 12-0408.W03.1A

Manufacturer: Landis+Gyr Technology, Inc. Model: Series-4 Conc., BLT-5

Test Begin Date: September 25, 2012 Test End Date: April 1, 2013

Report Issue Date: June 27, 2013

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

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

Reviewed by:

Kirby Munroe Director, Wireless Certifications ACS, Inc.

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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 for certification.

# 1.2 General

The Series-4 Conc., BLT-5 is two-way radio frequency device that uses Cellnet RF technology and protocol to transmit data over a mesh network in the unlicensed 902-928 MHz frequency range. The Concentrator is a device that receives one-way endpoint data from the network, processes that data, and sends it to a Collector. It also receives and passes, but does not process, 2-way data. The concentrator contains:

- a 917.58 MHz DTS radio (BLT 5)
- a 902-928 MHz frequency hopping DSS radio (IWR)
- a power supply
- a processor board (CPU)
- a battery pack in case of an AC power outage.

The Series-4 Conc., BLT-5 contains (1) 902-928 MHz frequency hopping spread spectrum radio and (1) 917.58 MHz direct sequence spread spectrum radio. This report applies to the 917.58 MHz direct sequence spread spectrum radio only. A separate report is issued for the 902-928 MHz frequency hopping spread spectrum radio.

Technical Details: Band of Operation: 917.58 MHZ Number of Channels: 1 Modulation Format: OOK Antenna Type/Gain: ASPG918 omni-directional collinear elevated feed point, 5.15 dBi RF Outputs: 2 (Port A / Port B) Operating Voltage: 120VAC

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

Test Sample Serial Number: LT-8073D7C9, LT8073D7D0

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

# **1.3 Test Methodology and Considerations**

For radiated emissions the EUT was tested in an orientation representative of final installation. The EUT provides two RF output ports for diversity, both of which were evaluated with worst case data provided in this report where appropriate.

The (1) 902-928 MHz frequency hopping spread spectrum radio and (1) 917.58 MHz direct sequence spread spectrum radio cannot transmit simultaneously therefore radiated intermodulation products were not evaluated.

# 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

# 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:

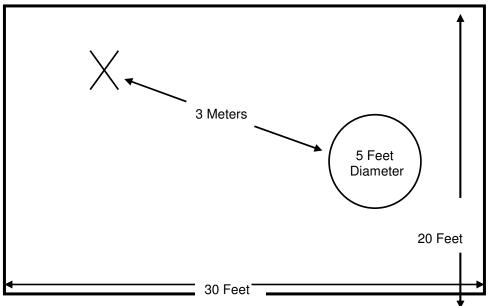


Figure 2.3-1: Semi-Anechoic Chamber Test Site

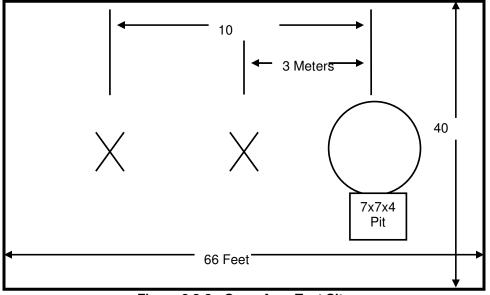
# 2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electroplated 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 4.1.3-1:

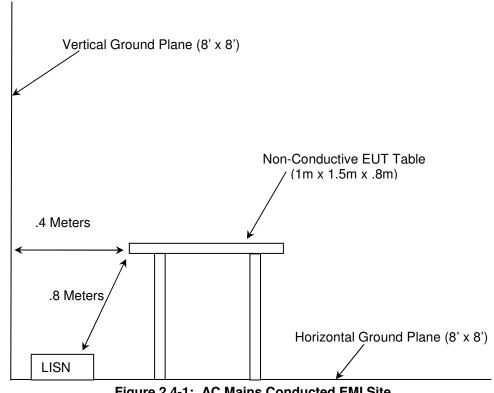


Figure 2.4-1: AC Mains Conducted EMI Site

#### **APPLICABLE STANDARD REFERENCES** 3

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage ٠ Electrical and Electronic Equipment in the 9KHz to 40GHz
- ٠ 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, 2013
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, ••• Intentional Radiators, 2013
- ٠ FCC KDB 558074 D01 DTS Meas Guidance v02 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, October 4, 2012
- Industry Canada Radio Standards Specification: RSS-210 Low-power License-exempt ••• Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8, Dec 2010
- Industry Canada Radio Standards Specification: RSS-GEN - General Requirements and ٠ Information for the Certification of Radiocommunication Equipment, Issue 3, Dec 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.

						Calibration
AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Due Date
1			Spectrum Analyzers	833771/007	8/2/2012	8/2/2014
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	8/2/2012	8/2/2014
3	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	839379/011	5/26/2011	5/26/2013
4	Rohde & Schwarz	ESMI - Receiver	Spectrum Analyzers	833827/003	5/26/2011	5/26/2013
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/27/2011	4/27/2013
40*	EMCO	3104	Antennas	3211	2/11/2011	2/11/2013
40*	EMCO	3104	Antennas	3211	2/14/2013	2/14/2014
73	Agilent	8447D	Amplifiers	2727A05624	9/28/2012	9/28/2013
73	Agilent	8447D	Amplifiers	2727A05624	9/30/2011	9/30/2012
153	EMCO	3825/2	LISN	9411-2268	7/31/2012	7/31/2014
		Chamber EMI				
167	ACS	Cable Set	Cable Set	167	12/21/2011	12/21/2012
167	ACS	amber EMI Cable S	Cable Set	167	12/17/2012	12/17/2013
168	Hewlett Packard	11947A	Attenuators	44829	2/1/2012	2/1/2013
168	Hewlett Packard	11947A	Attenuators	44829	2/1/2013	2/1/2014
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	8/1/2012	8/1/2013
		SMRE-200W-12.0-				
291	Florida RF Cables	SMRE	Cables	None	12/2/2011	12/2/2012
291	Florida RF Cables	IRE-200W-12.0-SM	Cables	None	11/20/2012	11/20/2013
		SMR-290AW-				
292	Florida RF Cables	480.0-SMR	Cables	None	4/2/2012	4/2/2013
324	ACS	Belden	Cables	8214	6/26/2012	6/26/2013
337	Microwave Circuits	H1G513G1	Filters	282706	7/2/2012	7/2/2013
338	Hewlett Packard	8449B	Amplifiers	3008A01111	8/2/2012	8/2/2013
339	Aeroflex/Weinschel	AS-18	Attenuators	7142	6/4/2012	6/4/2013
412	Electro Metrics	LPA-25	Antennas	1241	7/27/2012	7/27/2014
		SMS-200AW-72.0-				
422	Florida RF	SMR	Cables	805	12/2/2011	12/2/2012
422	Florida RF	/IS-200AW-72.0-SN	Cables	805	11/20/2012	11/20/2013
	United Microwave Products,					
562	Inc.	AA-190-00.48.0	Cables	562	7/31/2012	7/31/2013

Table 4-1: Test Equipment

\*Asset used during active calibration dates only

#### 5 SUPPORT EQUIPMENT

	Table 5-1: Support Equipment									
Item	m Equipment Type Manufacturer		Model Number	Serial Number						
	The EUT was tested stand-alone therefore no support equipment was utilized.									

Table 5-1. Support Equipment

#### EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM 6

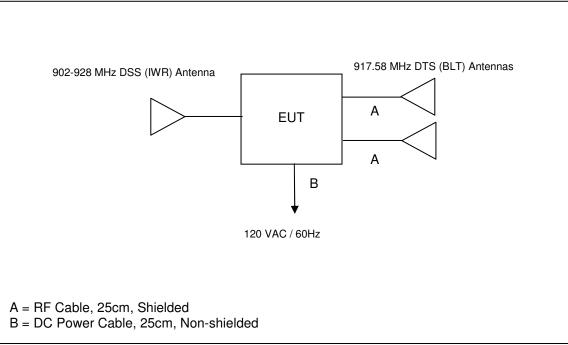


Figure 6-1: Test Setup Block Diagram

# 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 917.58 MHz antennas are an omni-directional collinear elevated feed point antenna with gain of 5.15 dBi. The EUT coupling is N-Type however professional installation is specified.

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

# 7.2.1 Measurement Procedure

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

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

# 7.2.2 Measurement Results

Results of the test are shown below in and Tables 7.2.2-1 to 7.2.2-2.

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.192	45.8	10.4	64	18.2	L1	GND	QP
0.276	53.6	10.5	61	7.3	L1	GND	QP
0.642	29	10.4	56	27	L1	GND	QP
0.888	30	10.5	56	26	L1	GND	QP
2.922	24.3	10.5	56	31.7	L1	GND	QP
3.348	24.1	10.5	56	31.9	L1	GND	QP
3.864	24.7	10.5	56	31.3	L1	GND	QP
4.668	25.9	10.5	56	30.1	L1	GND	QP
4.908	25.5	10.5	56	30.5	L1	GND	QP
0.192	37.9	10.4	54	16.1	L1	GND	AVG
0.276	41.3	10.5	51	9.6	L1	GND	AVG
0.726	15	10.3	46	31	L1	GND	AVG
0.918	19.7	10.5	46	26.3	L1	GND	AVG
2.922	16.6	10.5	46	29.4	L1	GND	AVG
3.3	17.2	10.5	46	28.8	L1	GND	AVG
3.816	18.4	10.5	46	27.6	L1	GND	AVG
4.674	18.9	10.5	46	27.1	L1	GND	AVG
4.89	19.6	10.5	46	26.4	L1	GND	AVG

Table 7.2.2-1: Conducted EMI Results – Line 1

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector		
0.192	46.4	10.4	64	17.5	L2	GND	QP		
0.276	54.7	10.5	61	6.2	L2	GND	QP		
0.636	30	10.4	56	26	L2	GND	QP		
0.906	30.3	10.5	56	25.8	L2	GND	QP		
1.008	26.6	10.5	56	29.4	L2	GND	QP		
1.212	27.6	10.5	56	28.5	L2	GND	QP		
3.954	26	10.5	56	30	L2	GND	QP		
4.86	26.8	10.5	56	29.2	L2	GND	QP		
4.962	26.1	10.5	56	29.9	L2	GND	QP		
0.186	37.5	10.4	54	16.7	L2	GND	AVG		
0.276	42.5	10.5	51	8.4	L2	GND	AVG		
0.684	21.4	10.3	46	24.6	L2	GND	AVG		
0.888	23.9	10.5	46	22.1	L2	GND	AVG		
1.014	19.7	10.5	46	26.3	L2	GND	AVG		
1.242	18.7	10.5	46	27.3	L2	GND	AVG		
4.008	17.9	10.5	46	28.1	L2	GND	AVG		
4.938	20.4	10.5	46	25.6	L2	GND	AVG		
4.998	20.1	10.5	46	25.9	L2	GND	AVG		

 Table 7.2.2-2:
 Conducted EMI Results – Line 2

#### 7.3 6dB / 99% Bandwidth – FCC: Section 15.247(a)(2) IC: RSS-210 A8.2(a)

#### **Measurement Procedure** 7.3.1

The 6dB bandwidth was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v02. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to approximately 1% to 5% of the DTS Bandwidth (6 dB bandwidth), not to exceed 100 kHz. The Video Bandwidth (VBW) was set to  $\geq$  3 times the RBW. The trace was set to max hold with a peak detector active. The marker-delta function of the spectrum analyzer was utilized to determine the 6 dB bandwidth of the emission, Option 1.

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 as close to 1% of the selected span as is possible without being below 1%. The video bandwidth was set to 3 times the resolution bandwidth. A sampling detector was used.

#### 7.3.2 **Measurement Results**

Results are shown below in Table 7.3.2-1 and Figures 7.3.2-1 to 7.3.2-4:

Table 7.3.2-1: 6dB / 99% Bandwidth								
RF Output Port (A/B)	Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth [MHz]					
A	917.58	1.12	4.04					
В	917.58	1.12	4.00					

# te: 27.SEP.2012 08:31:35 27.SEP.2012 08:46:04 Figure 7.3.2-1: 6dB Bandwidth Plot – Port A Figure 7.3.2-2: 99% Bandwidth Plot – Port B ate: 27.SEP.2012 09:06:35 te: 27.SEP.2012 09:07:40 Figure 7.3.2-3: 6dB Bandwidth Plot – Port A Figure 7.3.2-4: 99% Bandwidth Plot – Port B

# Table 7.2.2.1, EdB / 000/ Bandwidth

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# 7.4 Fundamental Emission Output Power – FCC: Section 15.247(b)(3) IC: RSS-210 A8.4(4)

### 7.4.1 Measurement Procedure

The maximum peak conducted output power was measured in accordance with FCC KDB 558074 D01 DTS Meas Guidance v02 Option 3 (Peak Power Meter Method). The RF output of the equipment under test was directly connected to the input of the peak power meter applying suitable attenuation.

### 7.4.2 Measurement Results

Results are shown below in Table 7.4.2-1.

Table 7.4.2-1: Peak Output Power								
RF Output Port (A/B)	Frequency (MHz)	Output Power (dBm)						
A	917.58	24.87						
В	917.58	24.82						

Table 7.4.2-1: Peak Output Power

# 7.5 Maximum Unwanted Emission Levels – FCC: Section 15.247(d), 15.205 IC: RSS-210 2.2, A8.5

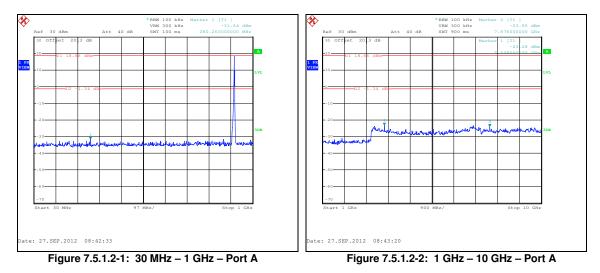
# 7.5.1 Unwanted Emissions into Non-restricted Frequency Bands

### 7.5.1.1 Measurement Procedure

The unwanted emissions into non-restricted bands were measured conducted in accordance with FCC KDB 558074 D01 DTS Meas Guidance v02. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to  $\geq$  300 kHz. Span was set to 1.5 times the DTS bandwidth. The trace was set to max hold with a peak detector active. The resulting spectrum analyzer peak level was used to determine the reference level with respect to the 20 dBc limit. The spectrum span was then adjusted for the measurement of spurious emissions from 30MHz to 10GHz, 10 times the highest fundamental frequency.

Band-edge compliance was determined using the conducted marker-delta method in which the radio frequency power that is produced by the EUT is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power.

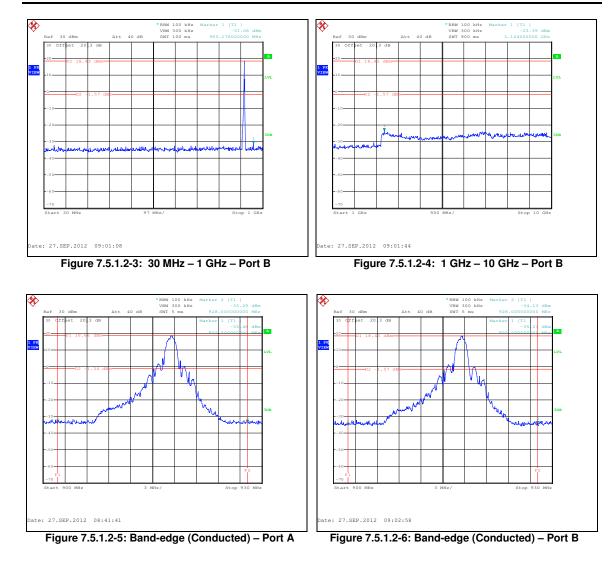
### 7.5.1.2 Measurement Results



RF Conducted Emissions are displayed in Figures 7.5.1.2-1 through 7.5.1.2-6.

# Model: Series-4 Conc., BLT-5

# FCC ID: R7PCONCS4B5



# 7.5.2 Unwanted Emissions into Restricted Frequency Bands

# 7.5.2.1 Measurement Procedure

The unwanted emissions into restricted bands were measured radiated 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 3 MHz respectively.

Each emission found to be in a restricted band as defined by section 15.205 was compared to the radiated emission limits as defined in section 15.209.

# 7.5.2.2 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in the table 7.5.2.2-1 to 7.5.2.2-2 below.

Frequency (dBuV) (MHz)		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
2752.74	61.27	49.81	Н	-3.53	57.74	46.28	74.0	54.0	16.3	7.7
2752.74	64.97	54.54	V	-3.53	61.44	51.01	74.0	54.0	12.6	3.0
3670.32	50.37	39.15	Н	-0.24	50.13	38.91	74.0	54.0	23.9	15.1
3670.32	52.49	42.12	V	-0.24	52.25	41.88	74.0	54.0	21.8	12.1

Table 7.5.2.2-1: Radiated Spurious Emissions Tabulated Data – RF Output Port A

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
(1112)	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2752.74	62.56	51.67	Н	-3.53	59.03	48.14	74.0	54.0	15.0	5.9
2752.74	70.68	56.98	V	-3.53	67.15	53.45	74.0	54.0	6.8	0.5
3670.32	50.23	39.30	Н	-0.24	49.99	39.06	74.0	54.0	24.0	14.9
3670.32	51.19	40.01	V	-0.24	50.95	39.77	74.0	54.0	23.1	14.2

# 7.5.2.3 Sample Calculation:

 $R_{C} = R_{U} + CF_{T}$ 

Where:

- CF<sub>T</sub> = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
- R<sub>U</sub> = Uncorrected Reading
- R<sub>C</sub> = Corrected Level
- AF = Antenna Factor
- CA = Cable Attenuation
- AG = Amplifier Gain
- DC = Duty Cycle Correction Factor

# **Example Calculation: Peak**

Corrected Level: 61.27 - 3.53 = 57.74dBuV/m Margin: 74dBuV/m - 57.74dBuV/m = 16.3dB

# Example Calculation: Average

Corrected Level: 49.81 - 3.53 - 0 = 46.28dBuV Margin: 54dBuV - 46.28dBuV = 7.7dB

# 7.6 Maximum Power Spectral Density in the Fundamental Emission – FCC: Section 15.247(e) IC: RSS-210 A8.2(b)

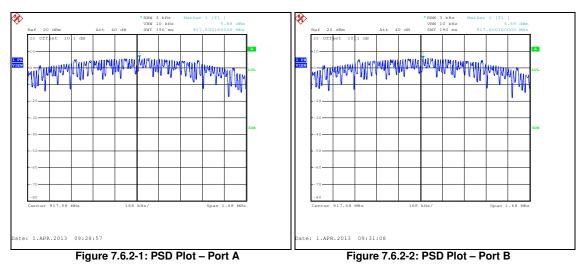
# 7.6.1 Measurement Procedure

The power spectral density was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v02 Option 1. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 3 kHz. The Video Bandwidth (VBW) was set to 10 kHz. Span was set to 1.5 times the DTS bandwidth. The trace was set to max hold with a peak detector active.

# 7.6.2 Measurement Results

Results are shown below in table 7.6.2-1 and figures 7.6.2-1 to 7.6.2-2.

Table 7.6.2-1: Peak Power Spectral Density							
RF Output Port (A/B)	Frequency (MHz)	PSD Level (dBm)					
A	917.58	5.88					
В	917.58	5.69					



# 8 CONCLUSION

In the opinion of ACS, Inc. the Series-4 Conc., BLT-5, 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**