

FCC PART 101 TYPE APPROVALS EMI TEST AND MEASUREMENT REPORT

For

LightPointe Communications Inc.

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San Diego, CA 92121, USA

FCC ID: PHVABG80

Report Type: Original Report	Product Type: P-to-P Millimeter Wave Radio
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* This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk "*" ...

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1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The LightPointe Communications Inc. *FCC ID: PHVABG80*, model: *AireBeam G80*, or the “EUT” as referred to in this report is a Point-to-Point Millimeter Wave Transmitter system. This system supports the use of two parabolic antennae: mWave, P/N HRP2-800-MWC/52461 employs a maximal gain of 2 ft 51 dBi gain antenna and the mWave, P/N HRP1-800-LPP/1625 employs a 1 ft 45 dBi gain antenna. The operating frequency band is 71-86 GHz.

1.2 Mechanical Description of EUT

The “EUT” with 1 ft (45 dBi Antenna) measures 57 cm (L) x 33 cm (w) x 36 cm (H) and weighs approximately 8.2 kg.

The “EUT” with 2 ft (51 dBi Antenna) measures 70 cm (L) X 51 cm (W) X 66 cm (H) and weighs approximately 11.1 kg.

The data gathered are from production sample. Serial number AB assigned by LightPointe Communications Inc.

1.3 Objective

This type approval report is prepared on behalf of LightPointe Communications Inc. in accordance with Part 2, Subpart J, and Part 101 Subpart Q of the Federal Communication Commissions rules.

The objective of to determine the equipment under test compliance with FCC part 101 rules for RF output power, field strength of spurious radiation and RF Exposure.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

Part 101 Subpart Q Service and Technical Rules for the 70/80/90 GHz Bands

Applicable Standards: TIA603-C.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 or 1 meters.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are: spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values ranging from +2.0 dB for Conducted Emissions tests and +4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

Detailed instrumentation measurement uncertainties can be found in BACL Corp. report QAP-018.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the test methods and procedures set forth in ANSI C63.4-2003 & TIA/EIA-603.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: R-2463 and C-2698. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is a National Institute of Standards and Technology (NIST) accredited laboratory under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>.

2 SYSTEM TEST CONFIGURATION

2.1 Justification

The EUT was configured for testing according to TIA/EIA-603 C.

The final qualification test was performed with the EUT operating at normal mode.

2.2 Equipment Modifications

No modifications were made to the EUT.

2.3 Local Support Equipment List and Details

Manufacturers	Description	Model No.	Serial No.
Motion Computing	Tablet PC	T008	-
Acterna	Ethernet Test Pad	FST-2802	-

2.4 Power Supply Information

Manufacturers	Description	Model No.	Serial No.
Cincon electronics co.LTD	Power over Ethernet	TR60A-POE-L	046559

2.5 Interface Ports and Cabling

Cable Description	Length (M)	From	To
Ethernet Cable	< 1	AC/DC Power Supply	EUT
Ethernet Cable	< 1	Ethernet Test Pad	EUT

2.6 Internal Parts List and Details

Manufacturer	Description	Model No.	Serial No.
LightPoint	Mainboard	LP-OCIV-20A002	311170240

3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC Rules	Description of Tests	Results
§2.1047, §101.141	Modulation Characteristics	NA
§2.1053, §101.111	Field Strength of Spurious Radiation	Compliant
§2.1091, §101.1525	RF Exposure	Compliant
§2.1046, §101.113	RF Output Power	Compliant
§2.1049, §101.109	Occupied Bandwidth	Compliant
§2.1055 (a), §2.1055 (d), §101.107	Frequency stability vs. temperature Frequency stability vs. voltage	N/A

4 FCC §2.1047 & §101.141 – MODULATION CHARACTERISTIC

4.1 Applicable Standard

FCC §2.1047(d). As FCC §101.141, there is no requirement for transmitters operating at 70 and 80 GHz.

5 FCC §2.1053 & §101.111 - HARMONIC & SPURIOUS EMISSIONS

5.1 Applicable Standards

Requirements: FCC §2.1053, §101.111 (2) (ii)

For operating frequencies above 15 GHz, In any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log_{10}$ (the mean output power in watts) decibels, or 80 decibels, whichever is the lesser attenuation. The authorized bandwidth includes the nominal radio frequency bandwidth of an individual transmitter/modulator in block-assigned bands. Equipment licensed prior to April 1, 2005 shall only be required to meet this standard in any 4 kHz band.

For EIRP=68 dBm, which is equivalent = 172.77 dBμV/m @ 1 meter or 163.23 dBμV/m @ 3 meter.

$A = 43 + 38 \text{ dBW} = 81 \text{ dBc}$.

Emission Limit = 91.77 dBμV/m @ 1 meter or 82.23 dBμV/m @ 3 meter

5.2 Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into antenna which was also placed on the turntable.

The measurement antenna was placed at a distance of 1 or 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up 200 GHz.

5.3 Test Equipment List and Details

Manufacturers	Description	Models	Serial Numbers	Calibration Dates
OML	Diplexer	N/A	DPL26	N/A
OML	WR-12 harmonic Mixer with Horn antenna	M12RH	E60120-1	2009-05-16 ¹
OML	WR-12 harmonic Mixer with Horn antenna	M08RH	F06313-1-1	2009-10-16 ¹
WiseWave	Horn Antenna	ARH-2823-02	10555-02	2009-10-19 ¹
WiseWave	Horn Antenna	ARH-1923-02	11648-01	2009-09-18 ¹
WiseWave	Horn Antenna	ARH-4223-02	10555-02	2010-06-14 ¹
WiseWave	Pre-Amplifier	ALN-33144030-01	11424-01	2011-03-30
WiseWave	Pre-Amplifier	ALN-22093530-01	12263-01	2011-06-09
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2011-06-29
A.R.A Inc.	Horn antenna	DRG-1181A	1132	2010-11-29
Hewlett Packard	Pre amplifier	8447D	2944A06639	2011-06-09
Agilent	Spectrum Analyzer	E4446A	US44300386	2011-08-11

¹**Note:** 3 year calibration cycle

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

5.4 Test Environmental Conditions

Temperature:	22-25°C
Relative Humidity:	42-50 %
ATM Pressure:	101-102 kPa

The testing was performed by Quinn Jiang on 2011-10-14 to 2011-10-19 in 5 meter chamber #3.

5.5 Test Results

According to the data hereinafter, the EUT complied with the FCC requirements, and had the worst margin readings of:

1 ft 45 dBi Antenna 30 MHz – 200 GHz

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-18.52	9225	Vertical	30MHz – 200GHz

2 ft 51 dBi Antenna 30 MHz – 200 GHz

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-18.87	6310	Vertical	30MHz – 200GHz

Please refer to the following data for detailed results.

1 ft, 45 dBi Antenna Radiated Test Data

Frequency MHz	S.A. Reading dBuV	Table Direction Degree	Test Antenna		Mixer Conversion Factor	Pre-Amplifier (dB)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin dB
			Height (cm)	Polar (H/V)					
-	-	-	-	-	-	-	-	-	-1
4423	-	-	-	H	-	-	-	91.77	-1
4423	31.19	0	110	V	36.8	0.0	67.99	91.77	-23.78
6310	22.71	0	110	H	45	0.0	67.71	91.77	-24.06
6310	28.2	0	110	V	45	0.0	73.2	91.77	-18.57
9225	-	-	-	H	-	-	-	91.77	-1
9225	29.25	0	110	V	44	0.0	73.25	91.77	-18.52
11142	-	-	-	H	-	-	-	91.77	-1
11142	24.13	0	110	V	48.8	0.0	72.93	91.77	-18.84

¹**Note:** All other emissions are at the noise floor and/or more than 20 dB below the limit.

2 ft, 51 dBi Antenna Radiated Test Data

Frequency MHz	S.A. Reading dBuV	Table Direction Degree	Test Antenna		Mixer Conversion Factor	Pre- Amplifier (dB)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin dB
			Height (cm)	Polar (H/V)					
-	-	-	-	-	-	-	-	-	⁻¹
4423	-	-	-	H	-	-	-	91.77	⁻¹
4423	29.58	0	110	V	36.8	0	66.38	91.77	-25.39
6310	21.8	0	110	H	45	0	66.8	91.77	-24.97
6310	27.9	0	110	V	45	0	72.9	91.77	-18.87
9225	-	-	-	H	-	-	-	91.77	⁻¹
9225	28.81	0	110	V	44	0	72.81	91.77	-18.96
11142	-	-	-	H	-	-	-	91.77	⁻¹
11142	23.72	0	110	V	48.8	0	72.52	91.77	-19.25

¹Note: All other emissions are at the noise floor and/or more than 20 dB below the limit.

6 FCC §1.1307(b) (1), §2.1091 & 101.1525 - RF EXPOSURE

6.1 Applicable Standard

According to FCC §1.1307(b)(1) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

6.2 MPE Prediction

Prediction of MPE limit at a given distance

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

74GHz Band

Maximum peak output power at antenna input terminal (dBm): 16.62

Maximum peak output power at antenna input terminal (mW): 45.9198

Prediction distance (cm): 700

Prediction frequency (MHz): 74.875

Maximum Antenna Gain, typical (dBi): 51

Maximum Antenna Gain (numeric): 125892.5

Power density of prediction frequency at 700 cm (mW/cm²): 0.938845

MPE limit for uncontrolled exposure at prediction frequency (mW/cm²): 1.0

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>16.62</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>45.9198</u>
<u>Prediction distance (cm):</u>	<u>350</u>
<u>Prediction frequency (MHz):</u>	<u>74.875</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>45</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>31622.78</u>
<u>Power density of prediction frequency at 350 cm (mW/cm²):</u>	<u>0.943309</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>

84GHz Band

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>16.67</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>46.45153</u>
<u>Prediction distance (cm):</u>	<u>700</u>
<u>Prediction frequency (MHz):</u>	<u>84.875</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>51</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>125892.5</u>
<u>Power density of prediction frequency at 700 cm (mW/cm²):</u>	<u>0.949717</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>16.67</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>46.45153</u>
<u>Prediction distance (cm):</u>	<u>350</u>
<u>Prediction frequency (MHz):</u>	<u>84.875</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>45</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>31622.78</u>
<u>Power density of prediction frequency at 350 cm (mW/cm²):</u>	<u>0.954232</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>

6.3 Test Result

For 45 dBi 1ft antenna: the worst power density level at 350 cm is 0.954232 mW/cm² antenna, which is below the uncontrolled exposure limit of 1.0 mW/cm².

For 51 dBi 2ft antenna: the worst power density level at 700 cm is 0.949717 mW/cm² antenna, which is below the uncontrolled exposure limit of 1.0 mW/cm².

7 FCC §2.1046 & §101.113 – TRANSMITTER POWER LIMITATION

7.1 Applicable Standard

FCC §2.1046, §101.113

7.2 Test Procedure

Conducted:

The RF output of the transmitter was connected to the spectrum analyzer through sufficient attenuation.

7.3 Test Equipment List and Details

Manufacturers	Description	Models	Serial Numbers	Calibration Dates
OML	Diplexer for Agilent Spectrum Analyzer	N/A	DPL26	N/A
OML	WR-12 harmonic Mixer with Horn antenna	M12RH	E60120-1	2009-10-16 ¹
Agilent	PSA Series Spectrum Analyzer	E4446A	US44300386	2011-08-11

¹Note: 3 year calibration cycle

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

7.4 Test Environmental Conditions

Temperature:	22-25°C
Relative Humidity:	44 %
ATM Pressure:	101.3 kPa

The testing was performed by Quinn Jiang on 2011-10-14 in RF Site.

7.5 Test Results

1 ft, 45 dBi Antenna:

Frequency (GHz)	Reading (dBm)	Mixer Conversion Factor (dB)	Corrected Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (dBW)	§101.113 limit (dBW)	Margin (dB)	Comments
74.875	-32.04	47.56	16.62	45	61.62	31.62	55	-24.38	Fund/Peak
84.875	-27.33	43	16.67	45	61.67	31.67	55	-24.33	Fund/Peak

2 ft, 51 dBi Antenna:

Frequency (GHz)	Reading (dBm)	Mixer Conversion Factor (dB)	Corrected Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (dBW)	§101.113 limit (dBW)	Margin (dB)	Comments
74.875	-32.04	47.56	16.62	51	67.62	37.62	55	-17.38	Fund/Peak
84.875	-27.33	43	16.67	51	67.67	37.67	55	-17.33	Fund/Peak

8 FCC §2.1049 & §101.109 - OCCUPIED BANDWIDTH

8.1 Applicable Standard

Frequency band (MHz)	Maximum authorized bandwidth
928 to 929.....	25 kHz 1 5 6
932 to 932.5, 941 to 941.5.....	12.5 kHz 1 5 6
932.5 to 935, 941.5 to 944.....	200 kHz \1\
952 to 960.....	200 KHz 1 5 6
1,850 to 1,990.....	10 MHz \1\
2,110 to 2,130.....	3.5 MHz
2,130 to 2,150.....	800 or 1600 KHz \1\
2,150 to 2,160.....	10 MHz
2,160 to 2,180.....	3.5 MHz
2,180 to 2,200.....	800 or 1600 KHz \1\
2,450 to 2,483.5.....	625 KHz \2\
2,483.5 to 2,500.....	800 KHz
3,700 to 4,200.....	20 MHz
5,925 to 6,425.....	30 MHz \1\
6,425 to 6,525.....	25 MHz
6,525 to 6,875.....	10 MHz \1\
10,550 to 10,680.....	5 MHz \1\
10,700 to 11,700.....	40 MHz \1\
12,200 to 12,700\8\.....	500 megahertz
13,200 to 13,250.....	25 MHz
17,700 to 18,140.....	220 MHz \1\
18,140 to 18,142.....	2 MHz
18,142 to 18,580.....	6 MHz
18,580 to 18,820.....	20 MHz \1\
18,820 to 18,920.....	10 MHz
18,920 to 19,160.....	20 MHz \1\
19,160 to 19,260.....	10 MHz
19,260 to 19,700.....	220 MHz \1\
21,200 to 23,600.....	50 MHz \1\ \4\
24,250 to 25,250.....	40 MHz \7\
27,500 to 28,350.....	850 MHz
29,100 to 29,250.....	150 MHz
31,000 to 31,075.....	75 MHz
31,075 to 31,225.....	150 MHz
31,225 to 31,300.....	75 MHz
38,600 to 40,000.....	50 MHz \7\
71,000 to 76,000.....	5000 MHz
81,000 to 86,000.....	5000 MHz
92,000 to 95,000.....	(\3\)

8.2 Test Procedure

The RF output of the transmitter was connected to the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 1 MHz and the 26 dB Bandwidth was recorded.

8.3 Test Equipment List and Details

Manufacturer	Description	Serial Number	Model
Agilent	Spectrum Analyzer	8564E	09666
Agilent	Pre-selected mixer	11974V	3001A00403
Agilent	Un-preselected mixer	11970W	2521A01628
FLANN	Attenuator (20dB)	25580-20	127144

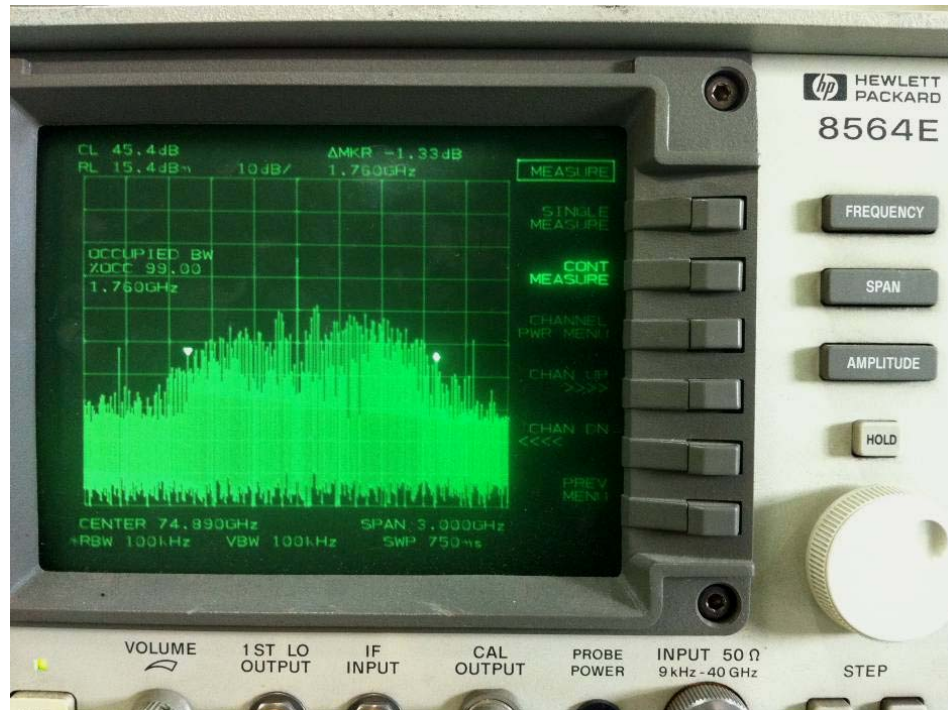
The testing was performed by the manufacture: Comotech

8.4 Test Results

Frequency (GHz)	Occupied Bandwidth (MHz)	Limit (MHz)	Result
74.875	17600	5000	Compliant
84.875	17300	5000	Compliant

The Occupied Bandwidth of both Signals for 74.875 GHz and 84.875 GHz are within 5000 MHz. Please refer to the following plots for more details.

Fundamental: 74.875 GHz



Fundamental: 84.875 GHz

