FCC PART 101

TEST AND MEASUREMENT REPORT

For

LightPointe, Inc.

11696 Sorento Valley Road, Ste. 101,

San Diego, CA 92121, USA

FCC ID: PHVABG80PLUS

Report Type:	**Product Type:**
Original Report	Point-to-Point Millimeter Wave Communication Radio

Prepared By: Glenn Escano

Report Number: R1311208-101

Report Date: 2014-02-10

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1311208-101	Original Report	2014-02-10

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of LightPointe, *Inc.*, and their product FCC ID: PHVABG80PLUS, models: SAX1-1250-93X-M8S and SAB2-1250-93E-M8S which will henceforth be referred to as the EUT (Equipment Under Test). The EUT is a point-to-point 70/80GHz radio system for full duplex transfer of data at up to Gigabit Ethernet rates. The models can be DC with AC adapter or Power over Ethernet.

1.2 Mechanical Description of EUT

The "EUT" with 1 ft (45 dBi Antenna) measures approximately *57cm (L) x 33cm (W) x 36cm (H),* and weighs approximately *8.2 k*g.

The "EUT" with 2 ft (51 dBi Antenna) measures approximately *70cm (L) x 51cm (W) x 66cm (H),* and weighs approximately *11.1 k*g.

The test data gathered are from typical production sample provided by LightPointe, Inc. Serial number R1311208-1 assigned by BACL Sunnyvale.

1.3 Objective

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

The objective is to determine 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 70/80/90GHz Bands

Applicable Standards: TIA603-D.

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 CISPR16-4-2:2011, 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.

1.7 Test Facility

Bay Area Compliance Laboratories Corp. (BACL) is:

1- An independent Commercial Test Laboratory accredited to **ISO 17025:2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminares and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65:1996** by **A2LA** to certify:
1- Unlicensed, Licensed radio frequency devices and Telephone Terminal Equipment for the FCC. Scope A1, A2, A3, A4, B1, B2, B3, B4 & C.
2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.
3. Radio Communication Equipment for Singapore.
4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.
5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).
6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s),Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

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 test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2009, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

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.: A-0027. 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 an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 System Test Configuration

2.1 Justification

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

2.2 EUT Exercise Software

N/A, EUT is operating at normal mode.

2.3 Special Equipment

N/A

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

N/A

2.6 EUT Internal Configuration Details

72 GHz Band

Manufacturers	Descriptions	Models	Serial Numbers
LightPointe, Inc.	Main PCB (B-Board)	LP-CIU-21A002	1013850145
LightPoint, Inc.	Main PCB (D-Board)	LP-CCIU-10A001	0413A50144
LightPoint, Inc.	RF Module	-	S0831309001

82 GHz Band

Manufacturers	Descriptions	Models	Serial Numbers
LightPointe, Inc.	Main PCB (B-Board)	LP-CIU-21A002	1013850143
LightPoint, Inc.	Main PCB (D-Board)	LP-CCIU-10A001	0413A50144
LightPoint, Inc.	RF Module	-	S0841309001

74 GHz Band

Manufacturers	Descriptions	Models	Serial Numbers
LightPointe, Inc.	Main PCB (B-Board)	LP-CIU-21A002	1013B50140
LightPoint, Inc.	Main PCB (D-Board)	LP-CCIU-10A001	0413A50131
LightPoint, Inc.	RF Module	-	S0731309001

84 GHz Band

Manufacturers	Descriptions	Models	Serial Numbers
LightPointe, Inc.	Main PCB (B-Board)	LP-CIU-21A002	1013B50130
LightPoint, Inc.	Main PCB (D-Board)	LP-CCIU-10A001	0413A50131
LightPoint, Inc.	RF Module	-	S0741309001

2.7 External I/O Cabling List and AC Cord

Cable Description	Length (m)	From	To
RJ45	>1	EUT (MGMT Port)	POE
RJ45	>1	POE	Internet
RJ45	>1	EUT (Data Port)	Internet

2.8 Power Supply List and Details

Manufacturer	Description	Model	Serial Number
Mean Well	AC/DC Adapter	CLG-100-48	RA90322217
Cincon Electronics Co., Ltd.	POE	TR60A-POE-L	042188

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
§101.1525, §2.1091	RF Exposure	Compliant
§101.113, §2.1046	RF Output Power	Compliant
§101.141, §2.1047	Modulation Characteristics	N/A[1]
§101.109, §2.1049	Occupied Bandwidth	Compliant [2]
§101.111, §2.1053	Field Strength of Spurious Radiation	Compliant
§101.107, §2.1055	Frequency stability vs. temperature Frequency stability vs. voltage	N/A[3]

Note 1: As per FCC §2.1047 (d) and FCC §101.141, there is no requirement for transmitters operating at 70 and 80 GHz
Note 2: The testing was performed by the manufacturer.
Note 3: Frequency Stability is not required for the frequencies of this EUT

4 FCC §101.1525 & §2.1091 – RF Exposure

4.1 Applicable Standard

According to FCC §1.1307 (b) (1) and §101.1525, 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)
Limits for General Population/Uncontrolled Exposure				
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

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF fields.

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

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

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

4.3 MPE Results

72 GHz band:

Maximum peak output power at antenna input terminal (dBm):	21.2
Maximum peak output power at antenna input terminal (mW):	131.82
Prediction distance (cm):	583
Prediction frequency (MHz):	72,375
Maximum Antenna Gain, typical (dBi):	45
Maximum Antenna Gain (numeric):	125892.54
Power density of prediction frequency at 20 cm (mW/cm^2):	0.9760
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

Maximum peak output power at antenna input terminal (dBm):	21.2
Maximum peak output power at antenna input terminal (mW):	131.82
Prediction distance (cm):	1163
Prediction frequency (MHz):	72,375
Maximum Antenna Gain, typical (dBi):	51
Maximum Antenna Gain (numeric):	125892.54
Power density of prediction frequency at 20 cm (mW/cm^2):	0.9764
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

82 GHz band:

Maximum peak output power at antenna input terminal (dBm):	21.3
Maximum peak output power at antenna input terminal (mW):	134.89
Prediction distance (cm):	583
Prediction frequency (MHz):	82,375
Maximum Antenna Gain, typical (dBi):	45
Maximum Antenna Gain (numeric):	31622.77
Power density of prediction frequency at 20 cm (mW/cm^2):	0.9987
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

Maximum peak output power at antenna input terminal (dBm):	21.3
Maximum peak output power at antenna input terminal (mW):	134.89
Prediction distance (cm):	1163
Prediction frequency (MHz):	82,375
Maximum Antenna Gain, typical (dBi):	51
Maximum Antenna Gain (numeric):	125892.54
Power density of prediction frequency at 20 cm (mW/cm^2):	0.9991
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

74 GHz band:

Maximum peak output power at antenna input terminal (dBm):	21.9
Maximum peak output power at antenna input terminal (mW):	154.88
Prediction distance (cm):	625
Prediction frequency (MHz):	74,875
Maximum Antenna Gain, typical (dBi):	45
Maximum Antenna Gain (numeric):	31622.77
Power density of prediction frequency at 20 cm (mW/cm^2):	0.9977
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

Maximum peak output power at antenna input terminal (dBm):	21.9
Maximum peak output power at antenna input terminal (mW):	154.88
Prediction distance (cm):	1246
Prediction frequency (MHz):	74,875
Maximum Antenna Gain, typical (dBi):	51
Maximum Antenna Gain (numeric):	125892.54
Power density of prediction frequency at 20 cm (mW/cm^2):	0.9994
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

84 GHz band:

Maximum peak output power at antenna input terminal (dBm):	21.7
Maximum peak output power at antenna input terminal (mW):	147.91
Prediction distance (cm):	625
Prediction frequency (MHz):	84,875
Maximum Antenna Gain, typical (dBi):	45
Maximum Antenna Gain (numeric):	31622.77
Power density of prediction frequency at 20 cm (mW/cm^2):	0.9528
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

Maximum peak output power at antenna input terminal (dBm):	21.7
Maximum peak output power at antenna input terminal (mW):	147.91
Prediction distance (cm):	1246
Prediction frequency (MHz):	84,875
Maximum Antenna Gain, typical (dBi):	51
Maximum Antenna Gain (numeric):	125892.54
Power density of prediction frequency at 20 cm (mW/cm^2):	0.9544
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

4.4 Test Results

72/82 GHz Band:

For 45 dBi 1ft Antenna: the worst power density level at 583 cm is 0.9987 mW/cm^2 antenna, which is below the uncontrolled exposure limit of 1.0 mW/cm^2.

For 51 dBi 2ft Antenna: the worst power density level at 1163 cm is 0.9991 mW/cm^2 antenna, which is below the uncontrolled exposure limit of 1.0 mW/cm^2.

74/84 GHz Band:

For 45 dBi 1ft Antenna: the worst power density level at 625 cm is 0.9977 mW/cm^2 antenna, which is below the uncontrolled exposure limit of 1.0 mW/cm^2.

For 51 dBi 2ft Antenna: the worst power density level at 1163 cm is 0.9994 mW/cm^2 antenna, which is below the uncontrolled exposure limit of 1.0 mW/cm^2.

5 FCC §2.1046 & §101.113 – RF Output Power

5.1 Applicable Standards

FCC §2.1046 and §101.113.

5.2 Test Procedure

Conducted:

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

5.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
OML	Diplexer for Agilent Spectrum Analyzer	DPL.26	N/A	N/A[1]	N/A[1]
OML	WR-12 Harmonic Mixer with Horn Antenna	M12HWD	130529-1	N/A[1]	N/A[1]
OML	WR-12 Broadband 20 dB Attenuator	V12AT20	120325-1	N/A[1]	N/A[1]
Ducommun Technologies	30 dB Attenuator	CAF-1230-01	1006900-01	N/A[1]	N/A[1]
Agilent	PSA Series Spectrum Analyzer	E4446A	US44300386	2013-10-22	1 year

Note 1. Verification was performed at system level and not at the individual component level

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

5.4 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	35 %
ATM Pressure:	101.87 kPa

The testing was performed by Glenn Escano on 2014-01-10 at RF test site.

5.5 Test Results

72/82 GHz Band:

SAB2-1250-93E-M8S

1 ft., 45 dBi Antenna:

Frequency (MHz)	Power Output (dBm)	Reading (dBm)	Mixer Conversion Factor (dB)	Cable Loss (dB)	Cord. Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (dBW)	Limit (dBW)	Margin (dB)
72375	21.2	-71.8	43	50	21.2	45	66.2	36.2	55	-18.8
82375	21.3	-71.7	43	50	21.3	45	66.3	36.3	55	-18.7

2 ft., 51 dBi Antenna:

Frequency (MHz)	Power Output (dBm)	Reading (dBm)	Mixer Conversion Factor (dB)	Cable Loss (dB)	Cord. Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (dBW)	Limit (dBW)	Margin (dB)
72375	21.2	-71.8	43	50	21.2	51	72.2	42.2	55	-12.8
82375	21.3	-71.7	43	50	21.3	51	72.3	42.3	55	-12.7

SAX1-1250-93X-M8S

1 ft., 45 dBi Antenna:

Frequency (MHz)	Power Output (dBm)	Reading (dBm)	Mixer Conversion Factor (dB)	Cable Loss (dB)	Cord. Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (dBW)	Limit (dBW)	Margin (dB)
72375	21.2	-71.8	43	50	21.2	45	66.2	36.2	55	-18.8
82375	21.3	-71.7	43	50	21.3	45	66.3	36.3	55	-18.7

2 ft, 51 dBi Antenna:

Frequency (MHz)	Power Output (dBm)	Reading (dBm)	Mixer Conversion Factor (dB)	Cable Loss (dB)	Cord. Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (dBW)	Limit (dBW)	Margin (dB)
72375	21.2	-71.8	43	50	21.2	51	72.2	42.2	55	-12.8
82375	21.3	-71.7	43	50	21.3	51	72.3	42.3	55	-12.7

74/84 GHz Band:

SAB2-1250-93E-M8S

1 ft., 45 dBi Antenna:

Frequency (MHz)	Power Output (dBm)	Reading (dBm)	Mixer Conversion Factor (dB)	Cable Loss (dB)	Cord. Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (dBW)	Limit (dBW)	Margin (dB)
74875	21.9	-71.1	43	50	21.9	45	66.9	36.9	55	-18.1
84875	21.7	-71.3	43	50	21.7	45	66.7	36.7	55	-18.3

2 ft., 51 dBi Antenna:

Frequency (MHz)	Power Output (dBm)	Reading (dBm)	Mixer Conversion Factor (dB)	Cable Loss (dB)	Cord. Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (dBW)	Limit (dBW)	Margin (dB)
74875	21.9	-71.1	43	50	21.9	51	72.9	42.9	55	-12.1
84875	21.7	-71.3	43	50	21.7	51	72.7	42.7	55	-12.3

SAX1-1250-93X-M8S

1 ft., 45 dBi Antenna:

Frequency (MHz)	Power Output (dBm)	Reading (dBm)	Mixer Conversion Factor (dB)	Cable Loss (dB)	Cord. Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (dBW)	Limit (dBW)	Margin (dB)
74875	21.9	-71.1	43	50	21.9	45	66.9	36.9	55	-18.1
84875	21.7	-71.3	43	50	21.7	45	66.7	36.7	55	-18.3

2 ft., 51 dBi Antenna:

Frequency (MHz)	Power Output (dBm)	Reading (dBm)	Mixer Conversion Factor (dB)	Cable Loss (dB)	Cord. Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (dBW)	Limit (dBW)	Margin (dB)
74875	21.9	-71.1	43	50	21.9	51	72.9	42.9	55	-12.1
84875	21.7	-71.3	43	50	21.7	51	72.7	42.7	55	-12.3

6 FCC §2.1049 & §101.109 – Occupied Bandwidth

6.1 Applicable Standards

According to FCC §101.109, the maximum bandwidth which will be authorized per frequency assigned is set out in the table that follows

Frequency band (MHz)	Maximum Authorized Bandwidth
/	/
/	/
71,000 to 76,000	5000 MHz
81,000 to 86,000	5000 MHz
/	/

6.2 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.

6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.
Agilent	Spectrum Analyzer	8564E	09666
Agilent	Pre-selected mixer	11974V	3001A00403
Agilent	Un-preselected mixer	11970W	2521A01628
FLANN	Attenuator (20 dB)	25580-20	127144

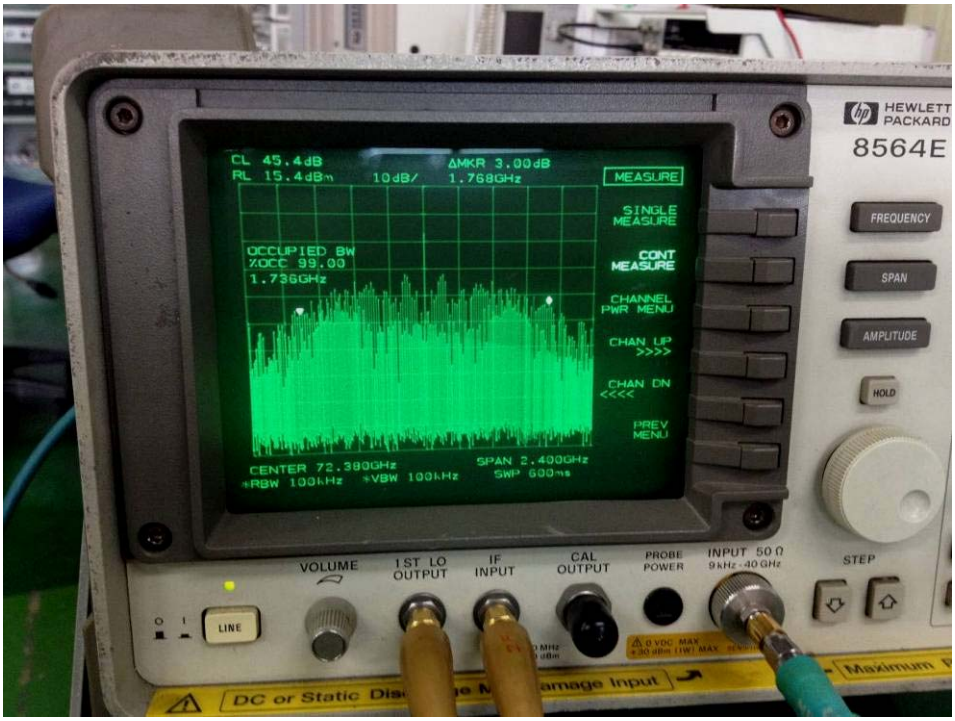
Note: The testing was performed by the manufacturer.

6.4 Test Results

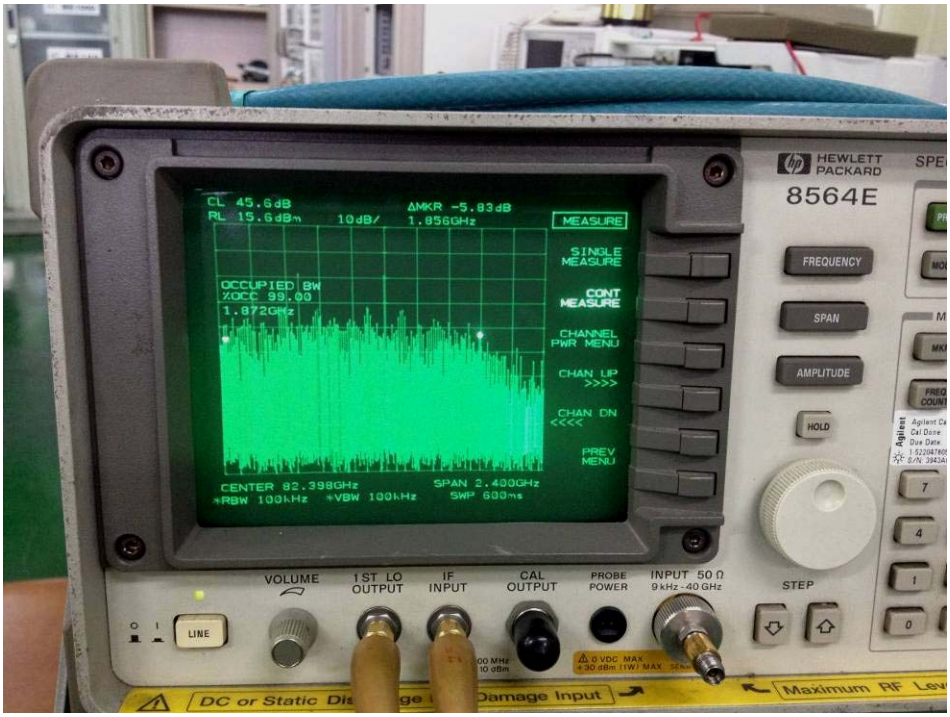
Frequency (MHz)	Occupied Bandwidth (MHz)	Limit (MHz)	Result
72/82 GHz Band			
72375	1736	5000	Compliant
82375	1872	5000	Compliant
74/84 GHz Band			
74.875	1536	5000	Compliant
84.875	1784	5000	Compliant

Please refer to the following plots for more details.

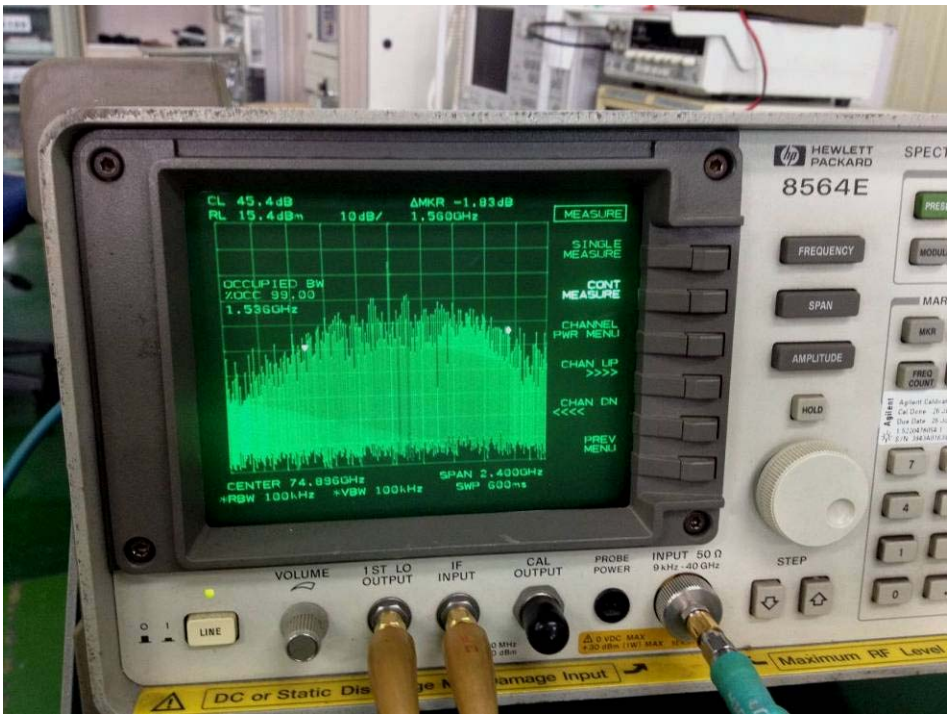
Fundamental: 72.375 GHz



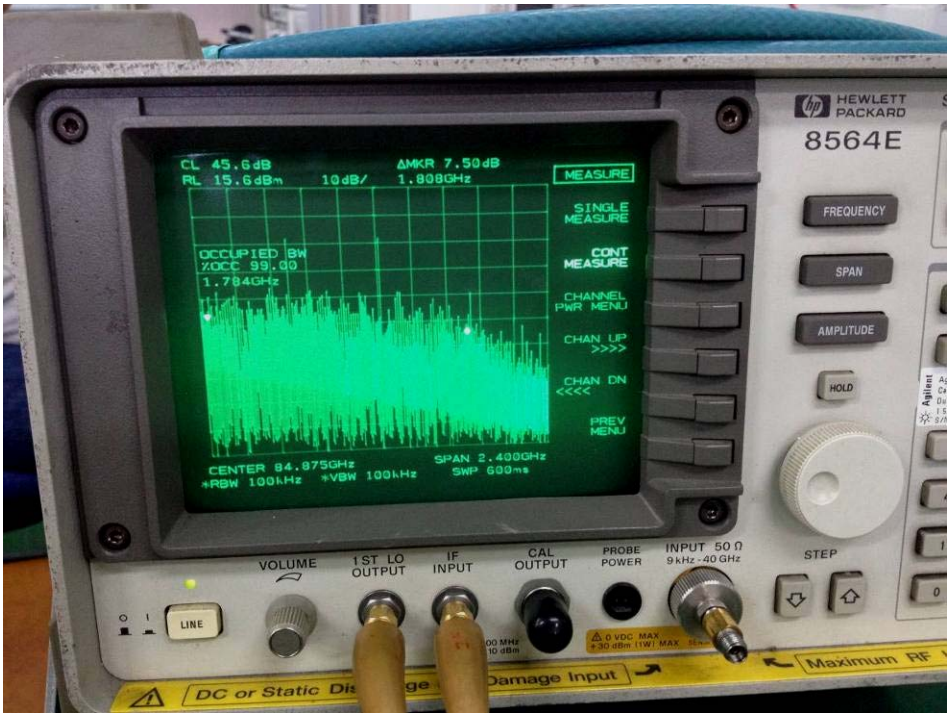
Fundamental: 82.375 GHz



Fundamental: 74.875 GHz



Fundamental: 84.875 GHz



7 FCC §2.1053 & §101.111 – Field Strength of Spurious Radiation

7.1 Applicable Standards

Requirements: FCC §2.1053 and §101.111 (2) (iii)

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.

72/82 GHz Bands:

For EIRP= 72dBm, which is equivalent = 176.77dBµV/m @ 1 meter or 167.23dBµV/m @ 3 meter.

A= 43 + 42 dBW = 85 dBc.

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

74/84 GHz Bands:

For EIRP= 73dBm, which is equivalent = 177.77dBµV/m @ 1 meter or 168.23dBµV/m @ 3 meter.

A= 43 + 43 dBW = 86dBc.

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

7.2 Test Procedure

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

The measurements 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 to 200 GHz.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
OML	Diplexer for Agilent Spectrum Analyzer	DPL.26	N/A	N/A[1]
OML	WR-12 Harmonic Mixer with Horn Antenna	M12HWD	130529-1	N/A[1]
OML	WR19 Harmonic Mixer with Horn Antenna	M19HWD	U60313-1	N/A[1]
OML	WR08 Harmonic Mixer with Horn Antenna	M08HWD	F60313-1	N/A[1]
OML	G Band Harmonic Mixer with Horn Antenna	M05HWD	G60106-1	N/A[1]
Wisewave	Horn Antenna	ARH-4223-02	10555-02	2013-09-20
Wisewave	Horn Antenna	ARH-2823-02	10555-01	2012-08-09
Sunol Sciences Corp	Horn Antenna	DRH-118	A052704	2013-03-07
Wisewave	Amplifier, Low Noise	ALN-33144030-01	11424-01	2013-03-30
Mini Circuit	Amplifier	ZVA-183-S	570400946	2013-05-09
Hewlett & Packard	Amplifier, Pre	8447D	2944A10187	2013-03-08
Sunol Sciences Corp	Antenna, Biconical Log	JB3	A020106-3	2013-07-11
Sunol Sciences Corp	System Controller	SC99V	011003-1	N/R
Agilent	PSA Series Spectrum Analyzer	E4446A	US44300386	2013-10-22

Note 1. Verification was performed at system level and not at the individual component level

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

7.4 Test Environmental Conditions

Temperature:	26 °C
Relative Humidity:	36 %
ATM Pressure:	101.67 kPa

The testing was performed by Glenn Escano on 2014-01-07 at 5m chamber 2.

7.5 Test Results

72/82 GHz Band

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 to 200 GHz:

SAB2-1250-93E-M8S

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-5.25	7399.94	Vertical	30 MHz to 200 GHz

SAX1-1250-93X-M8S

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-2.74	7399.94	Horizontal	30 MHz to 200 GHz

2 ft. 51 dBi Antenna 30 MHz to 200 GHz:

SAB2-1250-93E-M8S

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-1.54	7399.94	Horizontal	30 MHz to 200 GHz

SAX1-1250-93X-M8S

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-2.16	7399.94	Horizontal	30 MHz to 200 GHz

Please refer to the following tables for detailed test results.

1 ft. 45 dBi Antenna 30 MHz to 200 GHz

SAB2-1250-93E-M8S

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)					
3264.41	49.4	119	107	V	31.4	0	80.8	91.77	-10.97
3264.41	46.3	137	100	H	31.4	0	77.7	91.77	-14.07
4262.45	44.5	106	100	V	32.29	0	76.79	91.77	-14.98
4262.45	44.9	137	100	H	32.29	0	77.19	91.77	-14.58
7399.94	49.95	147	100	V	36.57	0	86.52	91.77	-5.25
7399.94	49.56	182	100	H	36.57	0	86.13	91.77	-5.64

SAX1-1250-93X-M8S

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)					
2693.9	48.08	175	100	V	29.1	0	77.18	91.77	-14.59
2693.9	47.36	120	100	H	29.1	0	76.46	91.77	-15.31
5386.8	42.66	120	100	V	33.7	0	76.36	91.77	-15.41
5386.8	42.42	117	100	H	33.7	0	76.12	91.77	-15.65
7399.94	52.2	134	100	V	36.57	0	88.77	91.77	-3.0
7399.94	52.46	125	100	H	36.57	0	89.03	91.77	-2.74

2 ft. 51 dBi Antenna 30 MHz to 200 GHz

SAB2-1250-93E-M8S

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)					
3264.41	52.38	119	107	V	31.4	0	83.78	91.77	-7.99
3264.41	49.42	137	100	H	31.4	0	80.82	91.77	-10.95
4262.45	46.39	106	100	V	32.29	0	78.68	91.77	-13.09
4262.45	46.88	137	100	H	32.29	0	79.17	91.77	-12.6
7399.94	53.53	147	100	V	36.57	0	90.1	91.77	-1.67
7399.94	53.66	182	100	H	36.57	0	90.23	91.77	-1.54

SAX1-1250-93X-M8S

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)					
2693.9	46.76	180	100	V	29.1	0	75.86	91.77	-15.91
2693.9	43.33	146	100	H	29.1	0	72.43	91.77	-19.34
5386.8	40.2	120	100	V	33.7	0	73.9	91.77	-17.87
5386.8	40.66	80	100	H	33.7	0	74.36	91.77	-17.41
7399.94	52.48	111	100	V	36.57	0	89.05	91.77	-2.72
7399.94	53.04	135	100	H	36.57	0	89.61	91.77	-2.16

74/84 GHz Band

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 to 200 GHz:

SAB2-1250-93E-M8S

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-2.66	1338.35	Horizontal	30 MHz to 200 GHz

SAX1-1250-93X-M8S

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-0.25	1338.35	Vertical	30 MHz to 200 GHz

2 ft. 51dBi Antenna 30 MHz to 200 GHz:

SAB2-1250-93E-M8S

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-1.07	6299.9	Horizontal	30 MHz to 200 GHz

SAX1-1250-93X-M8S

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-0.8	6299.9	Vertical	30 MHz to 200 GHz

Please refer to the following tables for detailed test results.

1 ft. 45 dBi Antenna 30 MHz to 200 GHz

SAB2-1250-93E-M8S

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)					
1338.35	48.8	123	100	V	35	0	83.8	91.77	-7.97
1338.35	54.11	122	100	H	35	0	89.11	91.77	-2.66
5737.33	44.31	99	100	V	34.1	0	78.41	91.77	-13.36
5737.33	46.63	115	100	H	34.1	0	80.73	91.77	-11.04
6299.9	52.2	220	100	V	34.71	0	86.91	91.77	-4.86
6299.9	52.89	206	100	H	34.71	0	87.6	91.77	-4.17

SAX1-1250-93X-M8S

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)					
1338.35	56.52	158	100	V	35	0	91.52	91.77	-0.25
1338.35	55.29	135	100	H	35	0	90.29	91.77	-1.48
6299.9	54.47	115	100	V	34.71	0	89.18	91.77	-2.59
6299.9	54.92	73	100	H	34.71	0	89.63	91.77	-2.14

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

2 ft. 51 dBi Antenna 30 MHz to 200 GHz

SAB2-1250-93E-M8S

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)					
1338.35	51.61	123	100	V	35	0	86.61	91.77	-5.16
1338.35	52.43	122	100	H	35	0	87.43	91.77	-4.34
5737.33	48.04	99	100	V	34.1	0	82.14	91.77	-9.63
5737.33	44.94	115	100	H	34.1	0	79.04	91.77	-12.73
6299.9	54.39	220	100	V	34.71	0	89.1	91.77	-2.67
6299.9	55.99	206	100	H	34.71	0	90.7	91.77	-1.07

SAX1-1250-93X-M8S

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)					
1338.35	51.54	204	100	V	35	0	86.54	91.77	-5.23
1338.35	53.74	185	100	H	35	0	88.74	91.77	-3.03
6299.9	56.26	117	100	V	34.71	0	90.97	91.77	-0.8
6299.9	53.74	81	100	H	34.71	0	88.45	91.77	-3.32

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