Nemko Test Report:	2015 277276 FCC15255
Applicant:	LightPointe Communications Inc 11696 Sorrento Valley Road Suite 101 San Diego CA 92121 United States
Equipment Under Test: (E.U.T.)	60 SX
In Accordance With:	**FCC Part 15, Subpart C, 15.255** **RSS 210, Issue 8** Operation within the band 57-64 GHz
Tested By:	Nemko USA, Inc. 2210 Faraday Ave. Ste 150 Carlsbad, CA 92008 USA

TESTED BY: _____ **DATE:** 09 June 2015

David Light, Wireless Engineer

APPROVED BY: _____ **DATE:** 11/13/2015

Jim Morris, EMC Manager

Number of Pages: 45

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Section 1. Summary of Test Results

Manufacturer: LightPointe Communication, Inc.

Model No.: 60 SX

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.255 for operation in the band 57-64 GHz. Radiated tests were conducted is accordance with ANSI C63.10-2013. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

☒ New Submission ☒ Production Unit

☐ Class II Permissive Change ☐ Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.
See " Summary of Test Data".

NVLAP Lab Code 200116-0

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government. Nemko USA, Inc. is a NVLAP accredited laboratory.

Summary of Test Data

NAME OF TEST	RSS 210 PARA. NO.	FCC Part 15 PARA. NO.	RESULT
Powerline Conducted Emissions	RSS-GEN	15.207(a)	Complies
Operating Restrictions	A.13.2.1	15.255(a)	Complies
EIRP within the band 57 – 64 GHz	A.13.2.2(1)	15.255(b)(1)	Complies
Spurious Emissions	A.13.2.2(2)	15.255(c)	Complies
Emissions in the band 57 – 57.05 GHz	A.13.2.2(2)	15.255(d)	Complies
Peak Conducted Output Power	A.13.2.3	15.255(e)	Complies
Frequency Stability	A.13.2.5	15.255(f)	Complies
Emission Bandwidth	RSS-GEN	15.255	-

Footnotes:

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Band (MHz): 57 to 64 GHz

Operating Frequency of Test Sample: 59.5 GHz and 62.5 GHz fixed

User Frequency Adjustment: Not adjustable by the user

Description of EUT

The AirLink™ 60 radio is a point-to-point outdoor data radio transmitter. The average output power is +8 dBm. There are three antenna configurations that may be used:

60 SX	12 cm integrated antenna	36 dBi
60 MX	30 cm antenna	42 dBi
60 LX	60 cm antenna	47 dBi

Test Conditions

The transmitter was operated at full rf output power with a continuous transmit power for rf power output and spurious emissions testing.

Section 3. EIRP

NAME OF TEST: EIRP	PARA. NO.: 15.255(b)(1)(ii) RSS 210, A.13.2.1
TESTED BY: David Light	DATE: 23 March 2015

Test Results: Complies.

Measurement Data: See attached plots

Test Conditions: 42 %RH
22 °C

Measurement Uncertainty: +/-1x10^{-7} ppm

Test Equipment Used: 1464

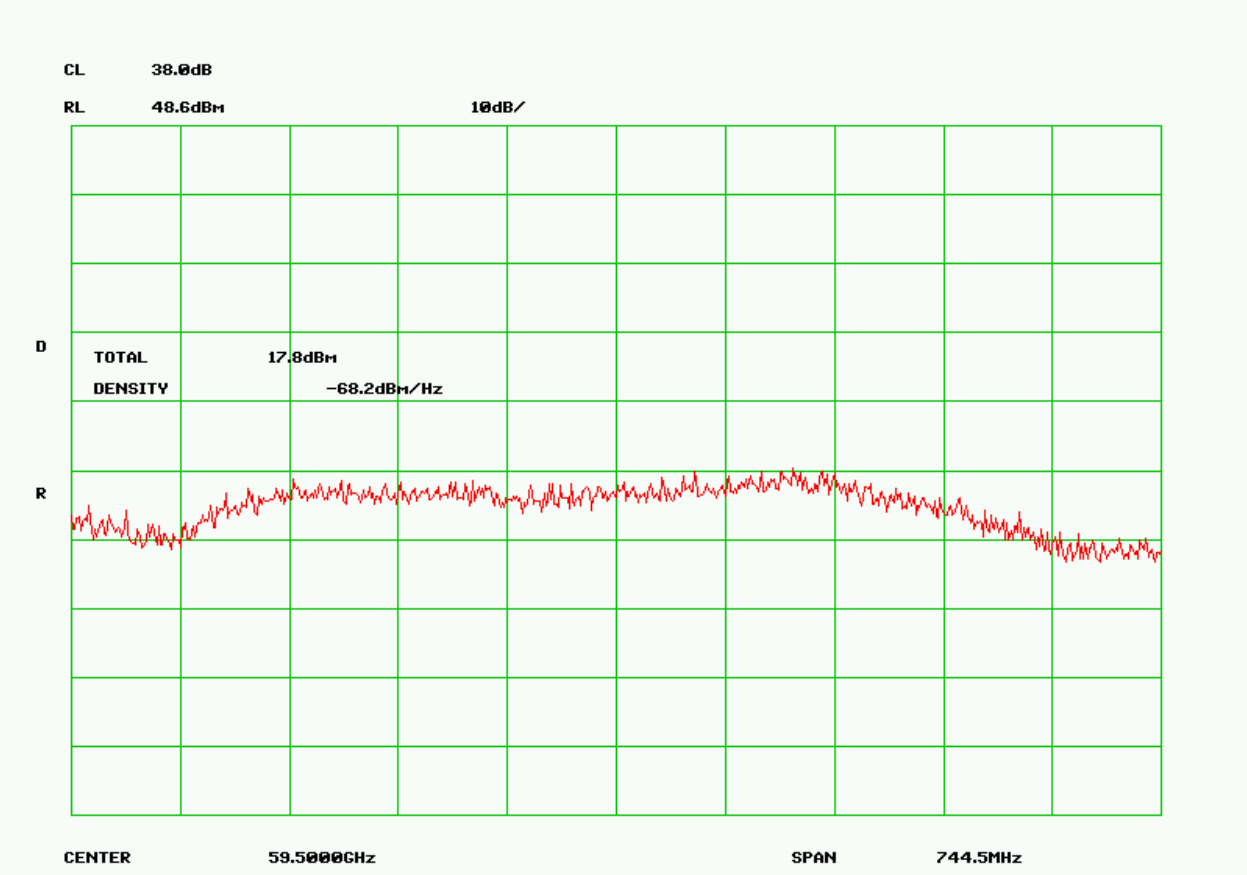
Result
EIRP limit

Antenna configuration	Antenna size (cm)	Gain (dBi)	Amount gain is less than 51 dBi	Avg limit from 15.255(b)(1)(ii) (dBm)	Pk limit from 15.255(b)(1)(ii) (dBm)
60 SX	12	36	15	52	55
60 MX	30	42	9	64	67
60 LX	60	47	4	74	77

Avg/Pk	Antenna configuration	Antenna size (cm)	Gain (dBi)	Measured EIRP (dBm)	EIRP limit from 15.255(b)(1)(ii) (dBm)	Margin of compliance (dB)
Avg	60 SX	12	36	44.1	52	7.9
Pk	60 SX	12	36	53.8	55	1.2
Avg	60 MX	30	42	50.1	64	13.9
Pk	60 MX	30	42	59.8	67	7.2
Avg	60 LX	60	47	55.1	74	18.9
Pk	60 LX	60	47	64.8	77	12.2

Test Data – Output Power

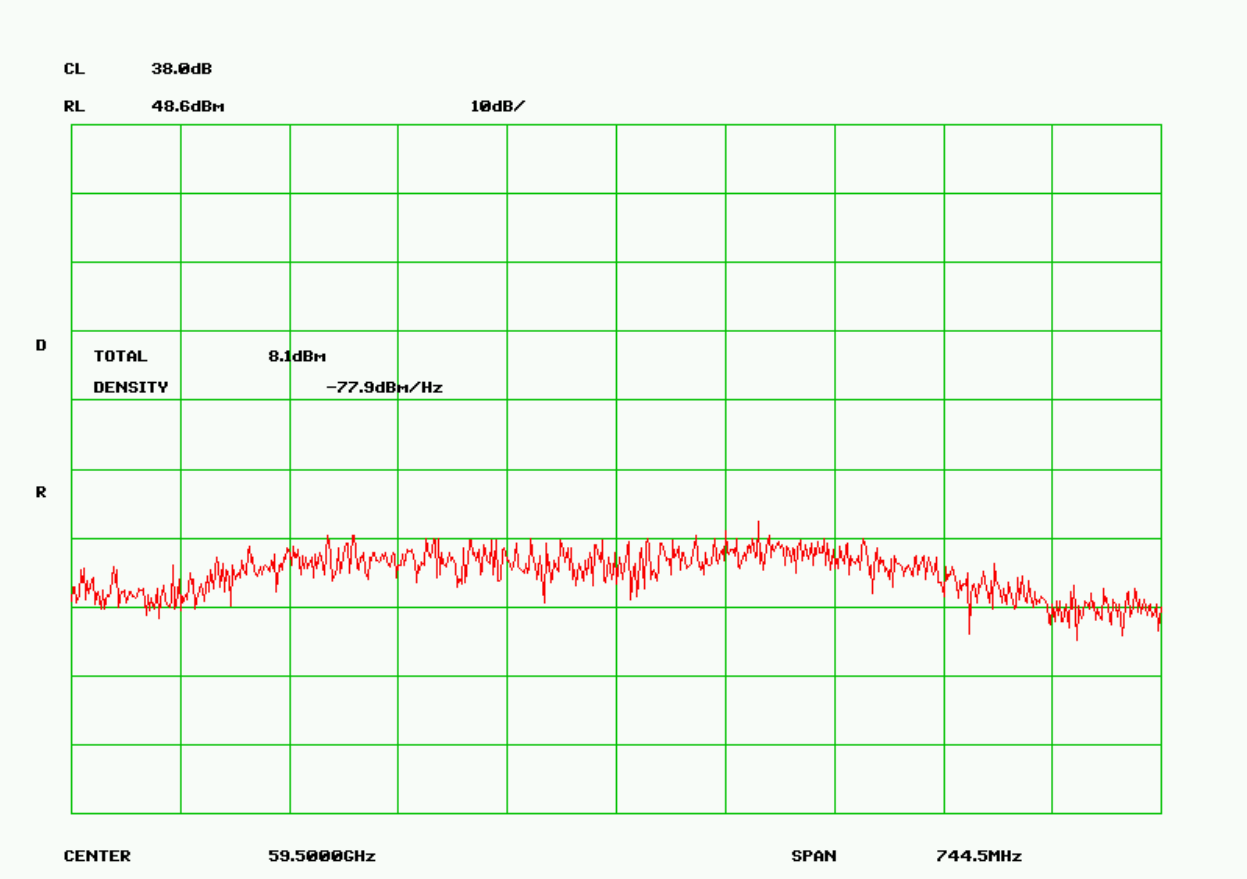
Low Channel – Peak



Detector BW: 20 GHz
Video BW: 80 MHz

Test Data – Output Power

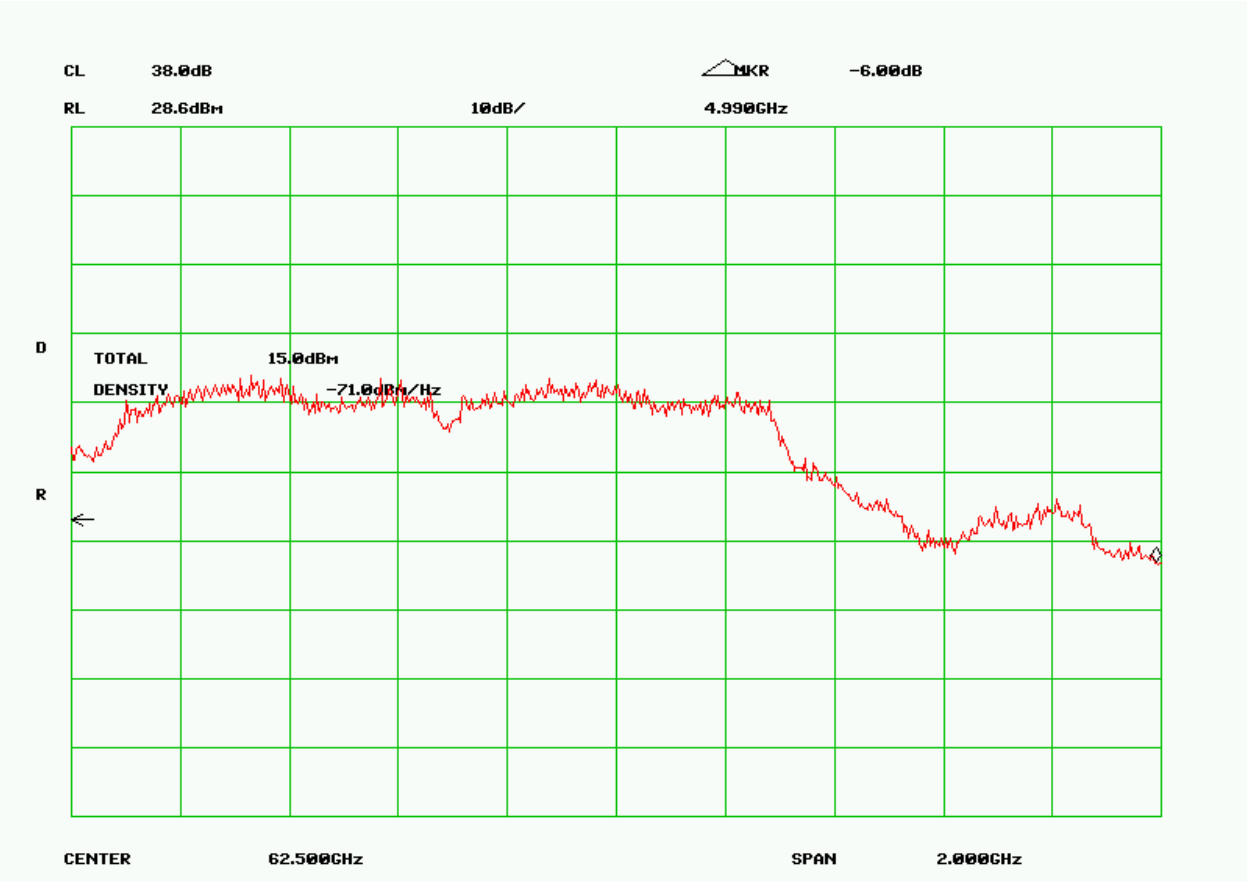
Low Channel – Average



Detector BW: 20 GHz
Video BW: 80 MHz

Test Data – Output Power

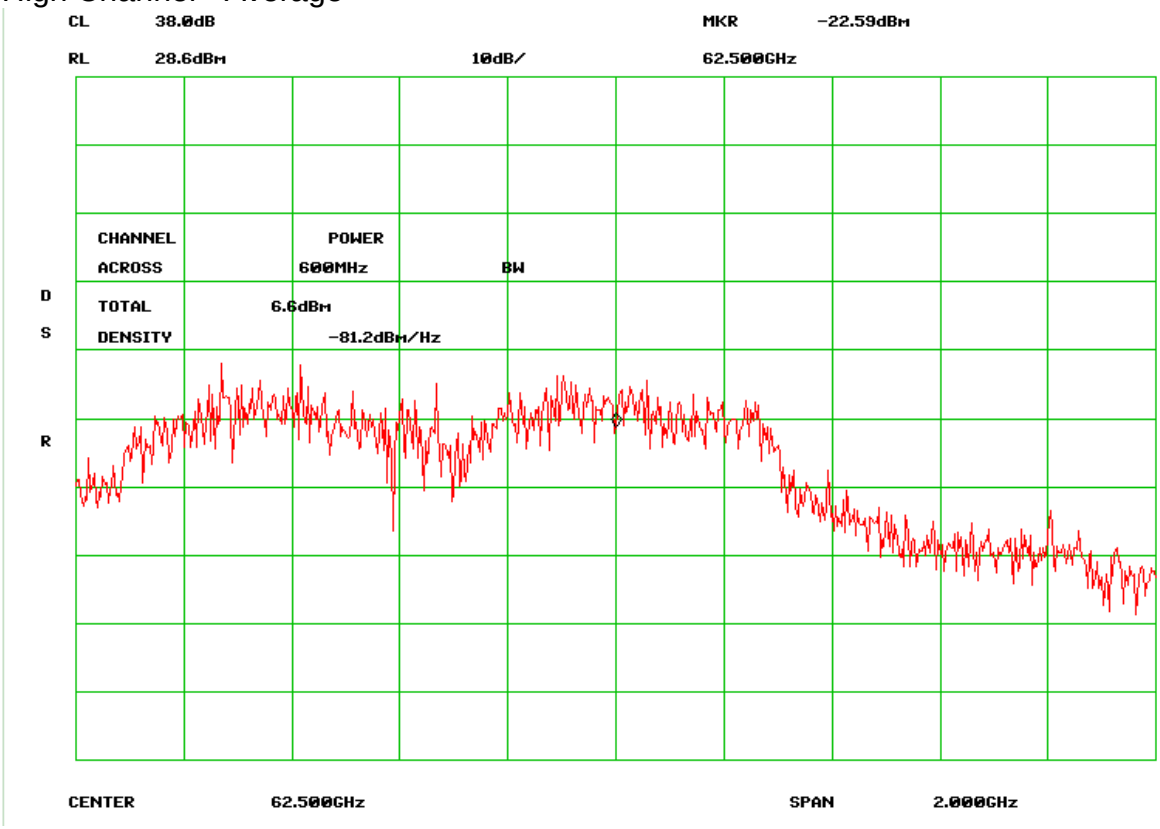
High Channel – Peak



Detector BW: 20 GHz
Video BW: 80 MHz

Test Data – Output Power

High Channel - Average



Detector BW: 20 GHz
Video BW: 80 MHz

Section 4. Emission Bandwidth

NAME OF TEST: Emission Bandwidth	PARA. NO.: 15.255 RSS-GEN
TESTED BY: David Light	DATE: 23 March 2015

Test Results: Complies.

Measurement Data: See attached plots

Test Conditions: 38 %RH
22 °C

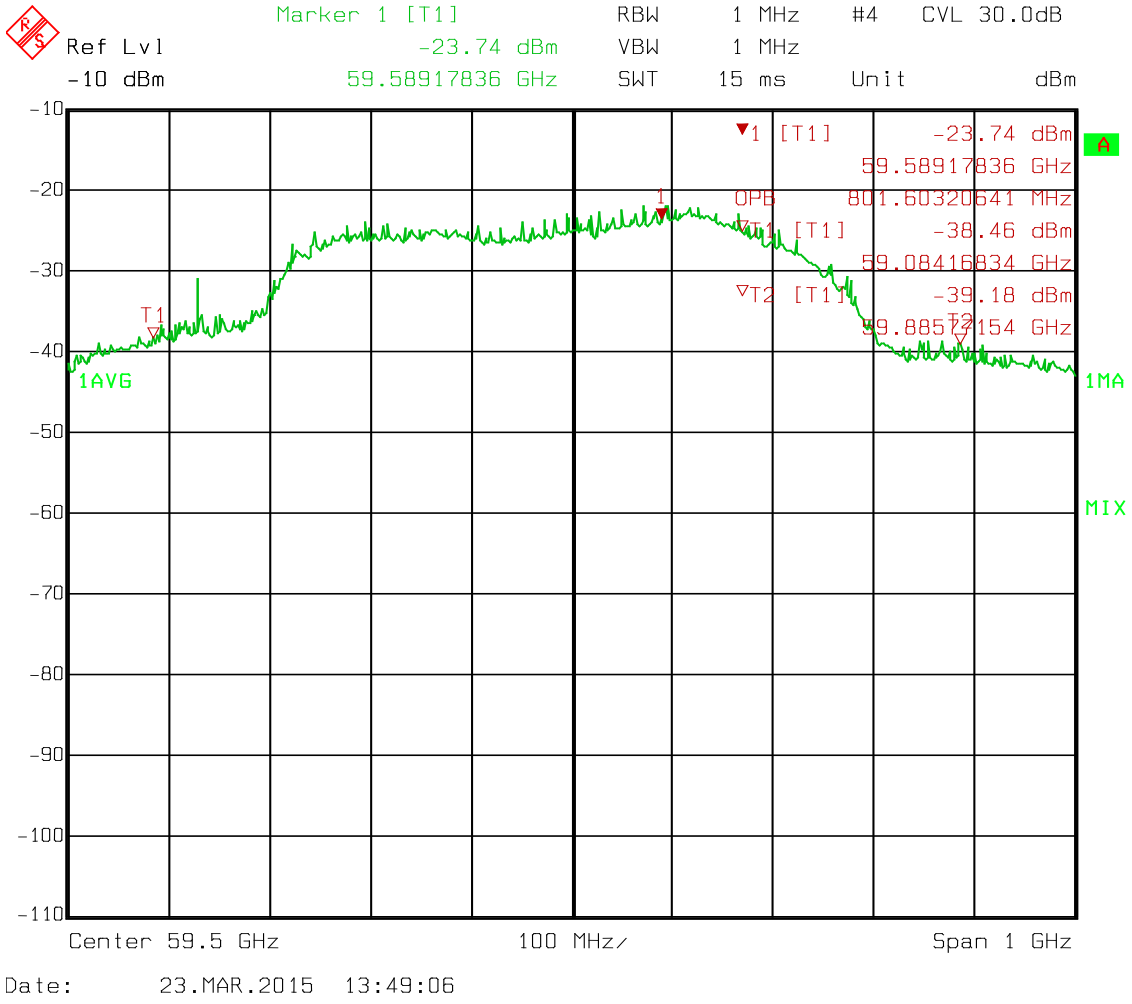
Measurement Uncertainty: +/-1.7 dB

Test Equipment Used: 1036

Result

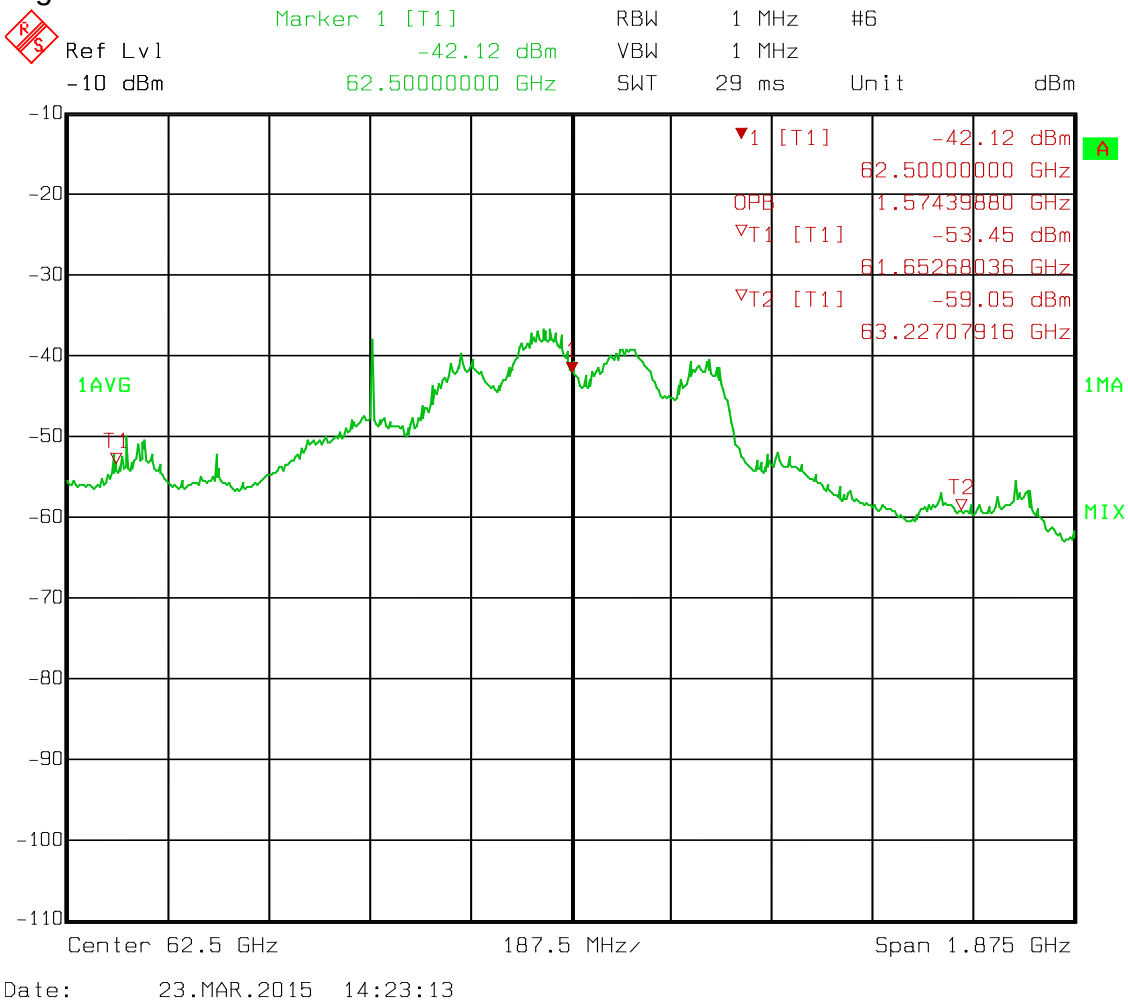
Test Data – Emission Bandwidth

Low Channel



Test Data – Emission Bandwidth

High Channel



Section 5. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.255(c) RSS 210, A.13.2.2(c)
TESTED BY: David Light and Mark Phillips	DATE:

Test Results: Complies.

Measurement Data: See attached table.

Test Conditions: 48%RH
22°C

Measurement Uncertainty: +/-3.7 dB

Test Equipment Used:

E1064, Spectrum Analyzer; D1480, Antenna, Bilog; 902, pre amp; 529, Antenna, DRWG; E1029, Preamplifier (20MHz to 18GHz).

Notes:

☐ For handheld devices, the EUT was tested on three orthogonal axis'

☒ The device was tested from 30 MHz to 220 GHz per 15.33

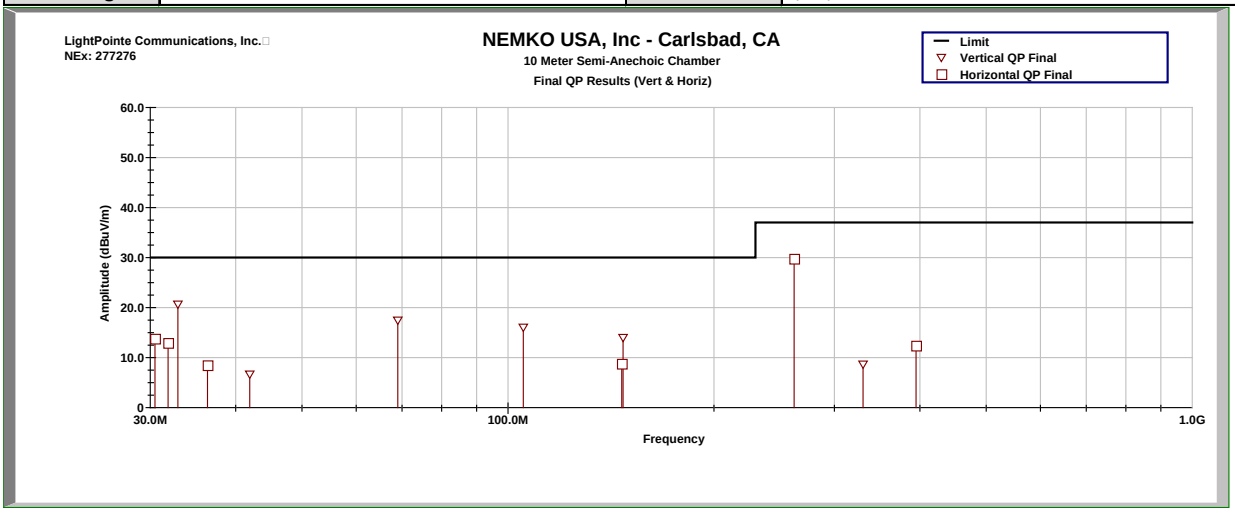
☐ The device was tested on three channels per 15.31(l).

☐ No emissions were detected within 20 dB of the specification limit therefore none are reported per 15.31(o). Band edge data is presented below.

RBW=VBW=100 kHz below 1000 MHz
RBW=VBW=1 MHz above 1000 MHz (Peak)
RBW= 1 MHz VBW=10Hz (Average)

Radiated Emissions

Client	LightPointe Communications, Inc.			
NEx #	277276	Temperature	22	˚C
EUT Name	AireLink 60GHz Transceiver Series	Humidity	48	%
EUT Model	60 SX	Pressure	100.4	kPa
Governing Doc	EN 301 489-1, EN 301 489-4	Test Location	10 Meter Chamber	
Basic Standard	CISPR 22	Test Engineer	Mark Phillips	
Test Voltage	230VAC 50Hz	Date	3/18/2015	



Vertical

Frequency (MHz)	Quasi-Peak Measured	Quasi-Peak Adjustments	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading	Limit (dBµV/m)	Margin (dB)	Result
32.929	34.79	-14.11	1	147	20.68	30	-9.32	**Pass**
41.93	25.49	-18.81	1	246	6.69	30	-23.31	**Pass**
69.016	42.4	-24.91	135	153	17.49	30	-12.51	**Pass**
105.287	35.57	-19.5	45	153	16.08	30	-13.92	**Pass**
147.29	32.98	-18.96	135	153	14.02	30	-15.98	**Pass**
330.359	24.04	-15.36	45	153	8.68	37	-28.32	**Pass**

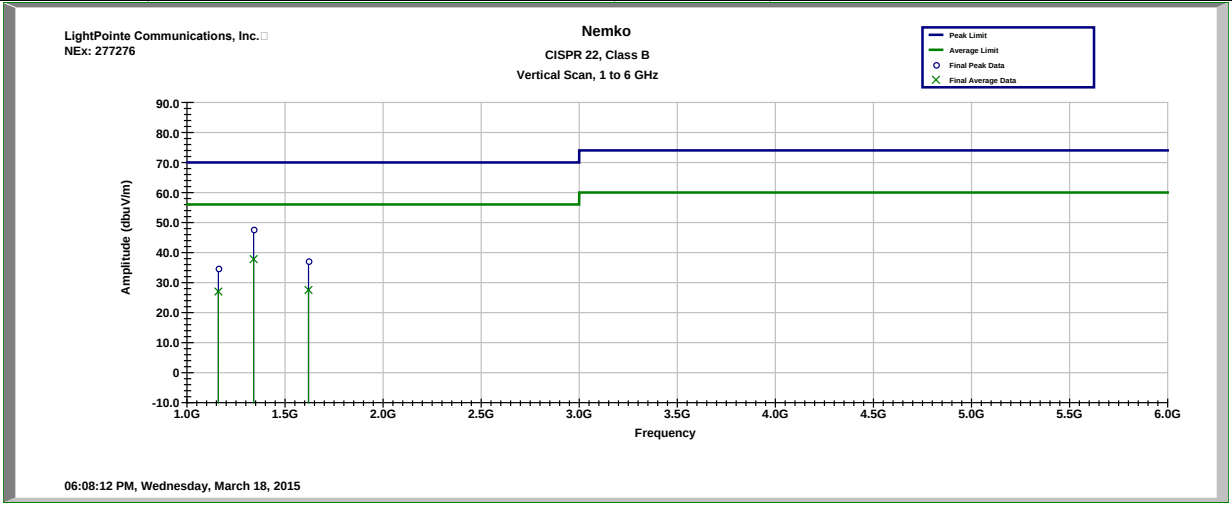
Horizontal

Frequency (MHz)	Quasi-Peak Measured	Quasi-Peak Adjustments	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading	Limit (dBµV/m)	Margin (dB)	Result
30.4882	26.53	-12.73	1	247	13.79	30	-16.21	**Pass**
31.8623	26.43	-13.49	44	153	12.94	30	-17.06	**Pass**
36.3795	24.4	-15.91	135	247	8.48	30	-21.52	**Pass**
146.643	27.71	-18.93	93	247	8.78	30	-21.22	**Pass**
261.972	45.14	-15.36	30	247	29.78	37	-7.22	**Pass**
394.794	25.21	-12.82	315	194	12.4	37	-24.6	**Pass**

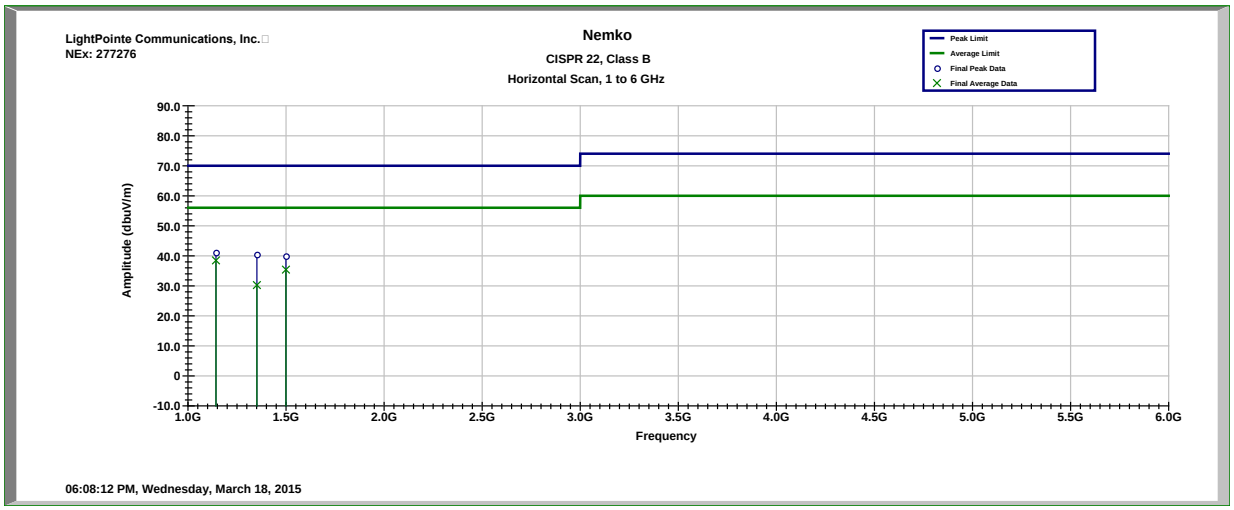
Compliancy			
Compliant?	Yes	Additional Comments	N/A

1 GHz – 18 GHz

Client	LightPointe Communications, Inc.			
NEx #	277276	Temperature	22	˚C
EUT Name	AireLink 60GHz Transceiver Series	Humidity	48	%
EUT Model	60 SX	Pressure	100.4	kPa
Governing Doc	EN 301 489-1, EN 301 489-4	Test Location	10 Meter Chamber	
Basic Standard	CISPR 22	Test Engineer	Mark Phillips	
Test Voltage	230VAC 50Hz	Date	3/18/2015	



Frequency (MHz)	Measured (dBµV)		Limit (dBµV/m)		Margin (dB)		Result
	Average	Peak	Average	Peak	Average	Peak	
1160.36	27	34.7	56	70	-29	-35.3	**Pass**
1340.1	37.8	47.7	56	70	-18.2	-22.3	**Pass**
1619.87	27.5	37.2	56	70	-28.5	-32.8	**Pass**

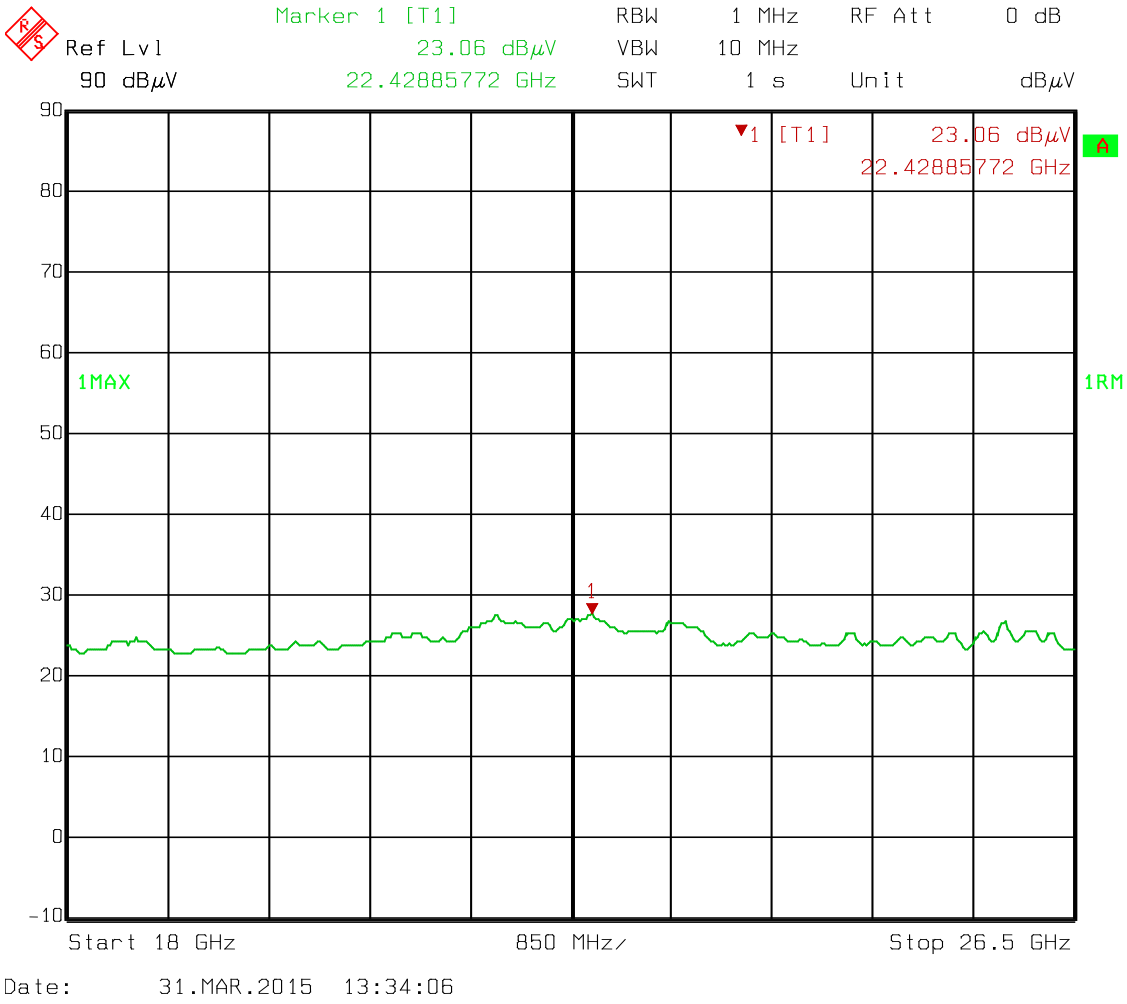


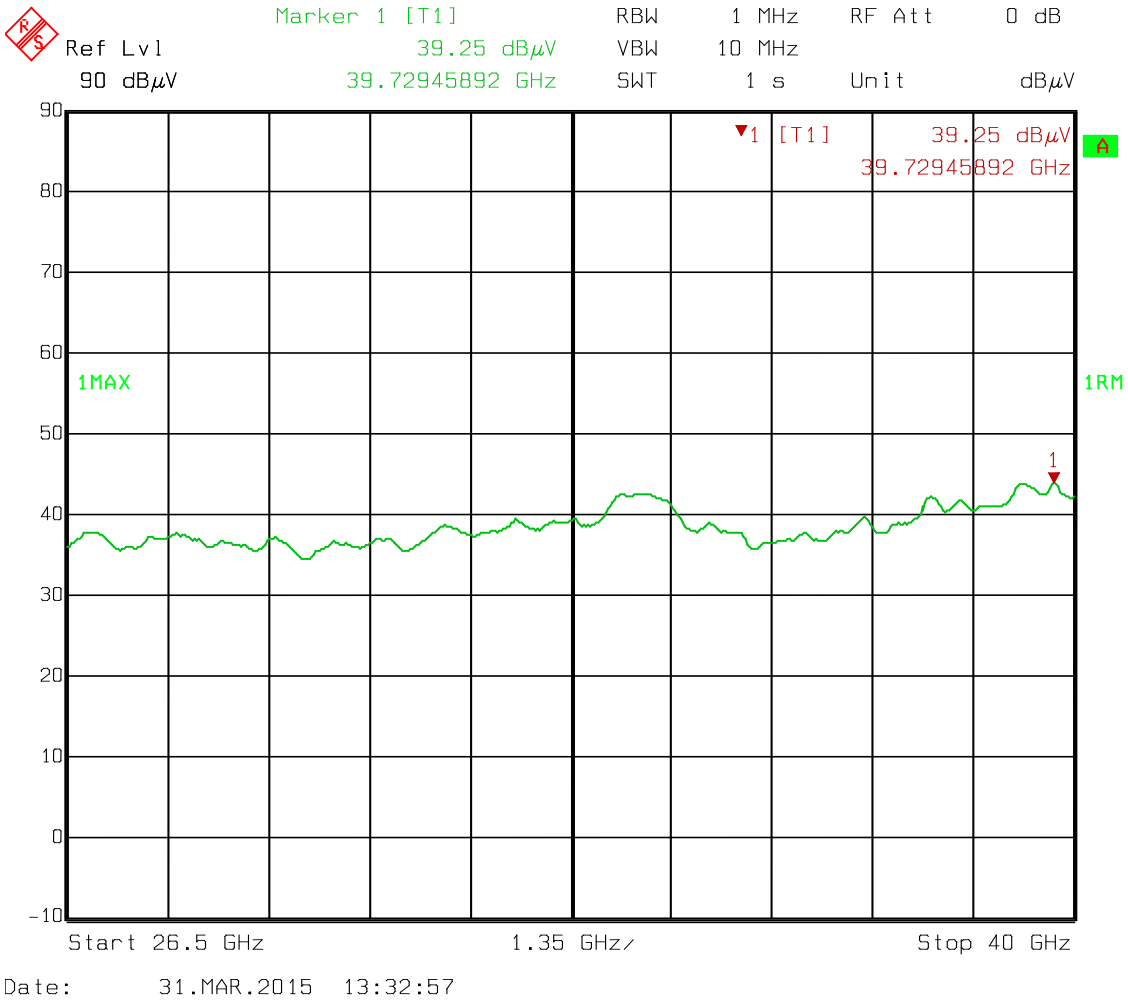
Frequency (MHz)	Measured (dBµV)		Limit (dBµV/m)		Margin (dB)		Result
	Average	Peak	Average	Peak	Average	Peak	
1142.95	38.5	41.1	56	70	-17.5	-28.9	**Pass**
1351.51	30.2	40.4	56	70	-25.8	-29.6	**Pass**
1499.52	35.4	39.9	56	70	-20.6	-30.1	**Pass**

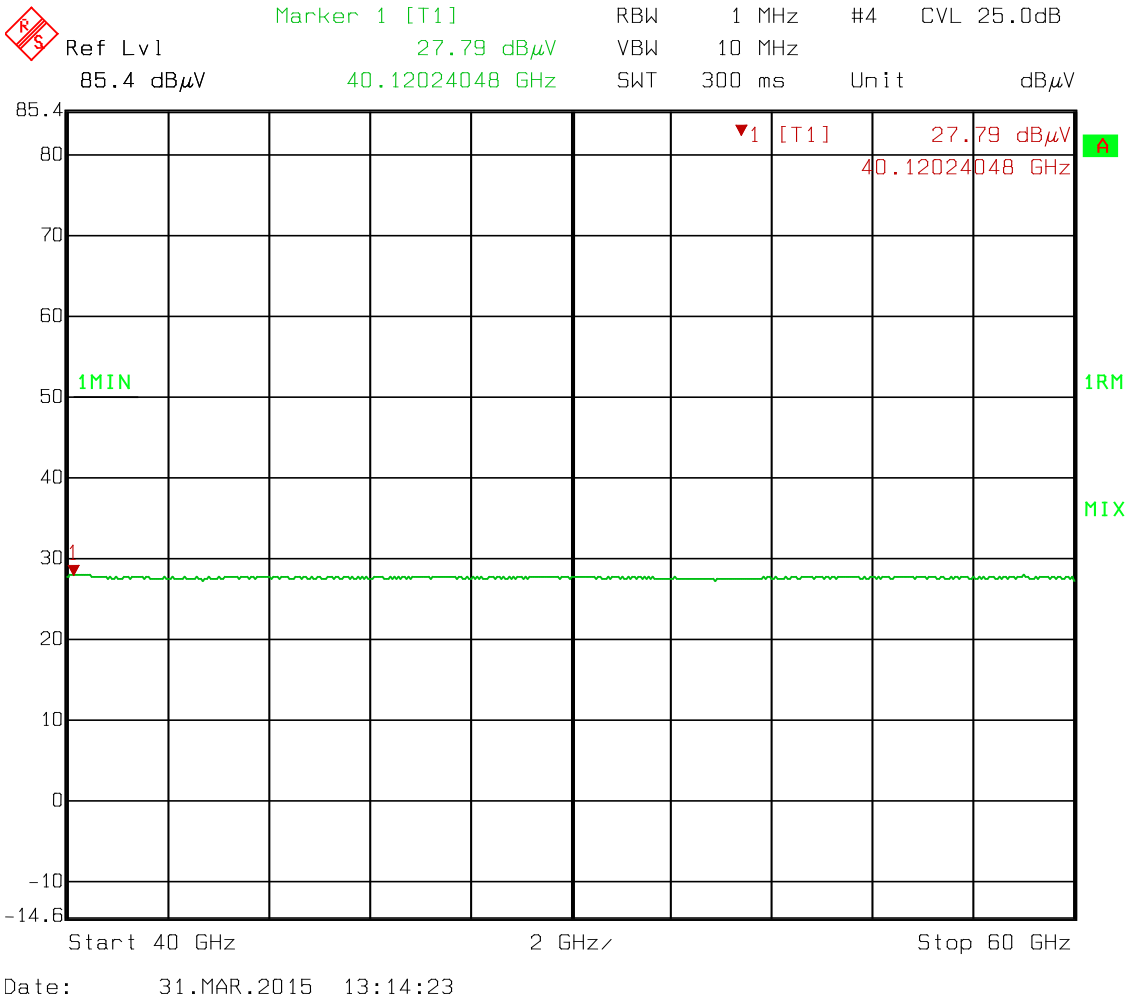
Compliancy			
Compliant?	Yes	Additional Comments	N/A

E1064, Spectrum Analyzer; D1480, Antenna, Bilog; 902, pre amp; 529, Antenna, DRWG; E1029, Preamplifier (20MHz to 18GHz).

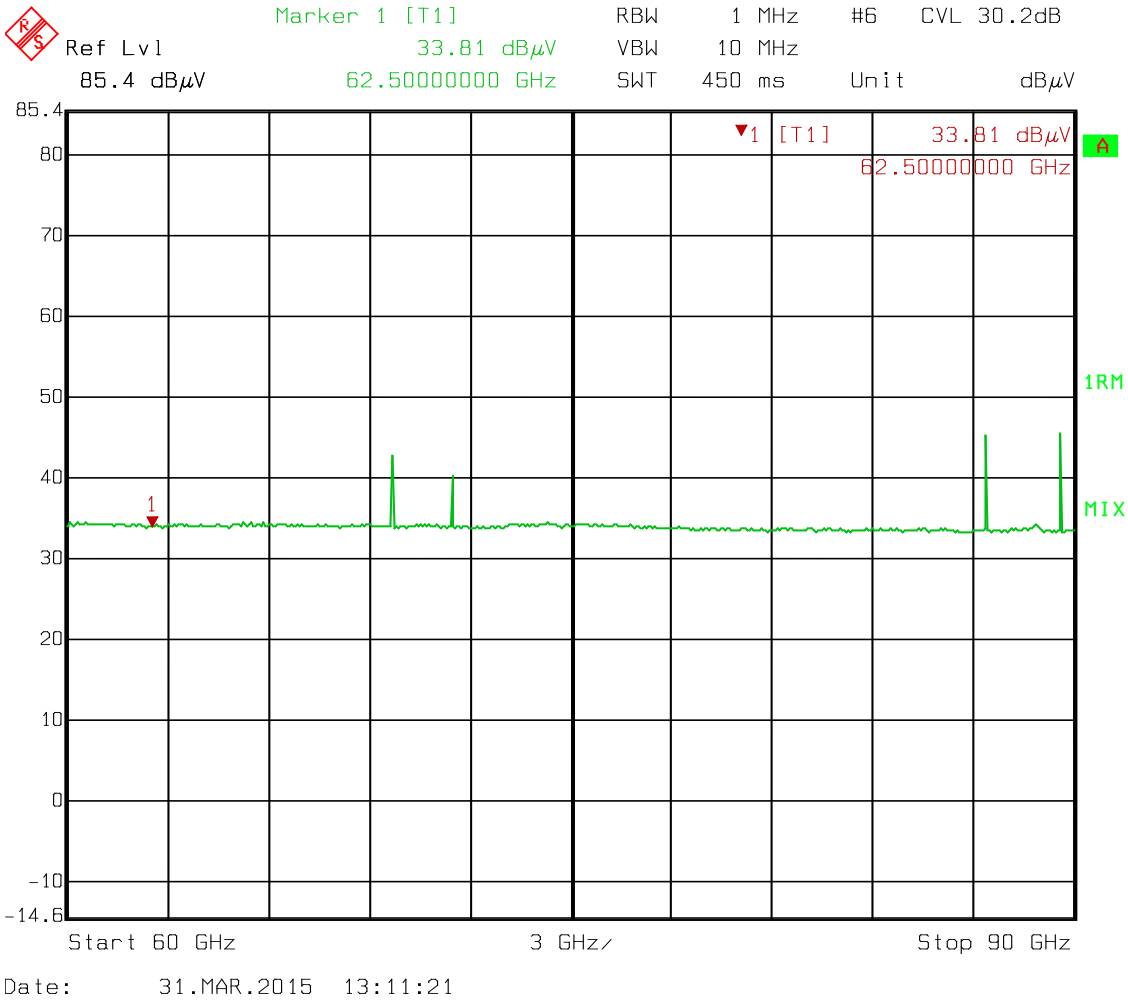
Radiated Emissions



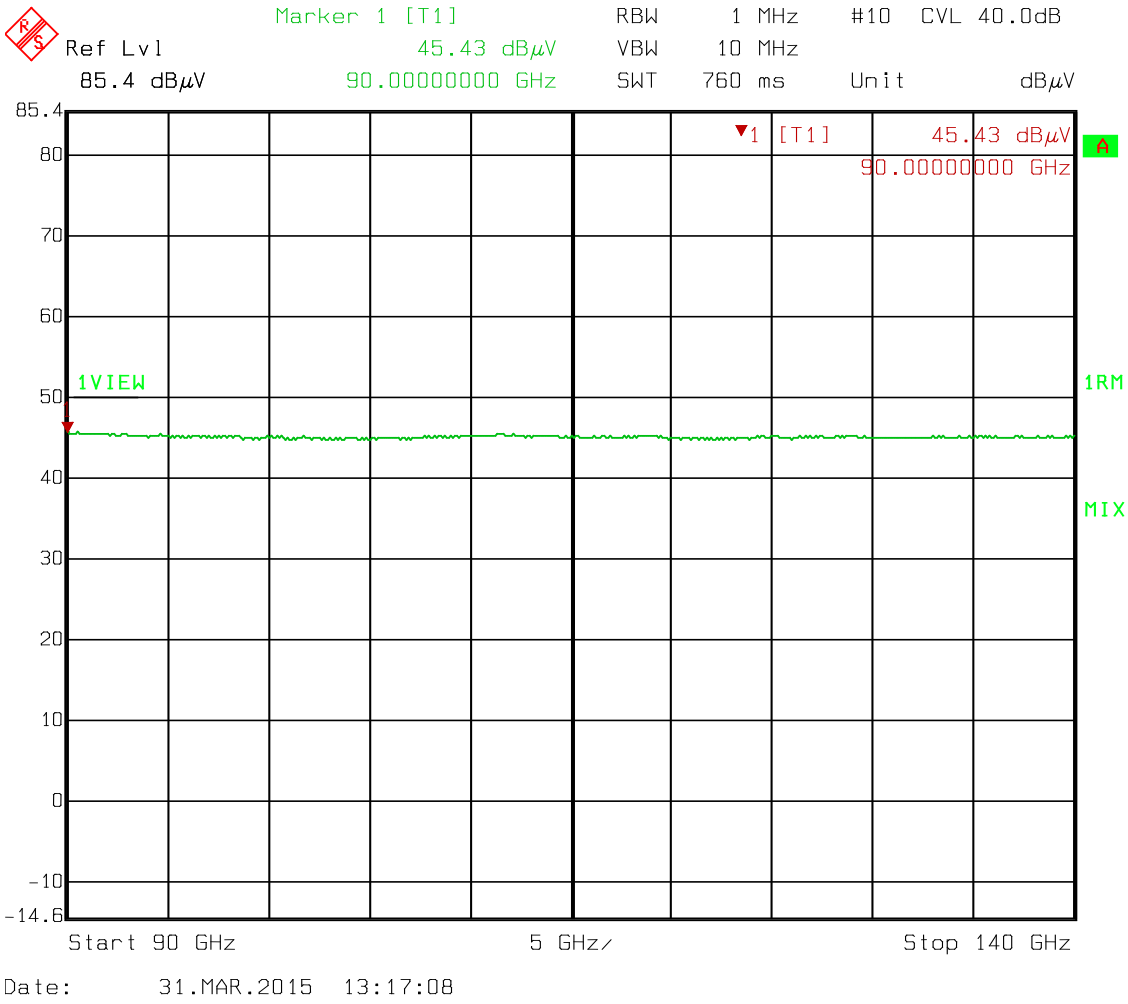

Marker 1 [T1]
Ref Lvl
90 dBµV
39.25 dBµV
39.72945892 GHz
RBW 1 MHz
VBW 10 MHz
SWT 1 s
RF Att 0 dB
Unit dBµV
1 [T1]
39.25 dBµV
39.72945892 GHz
A
1MAX
1RM
90
80
70
60
50
40
30
20
10
0
-10
Start 26.5 GHz
1.35 GHz/
Stop 40 GHz
Date: 31.MAR.2015 13:32:57

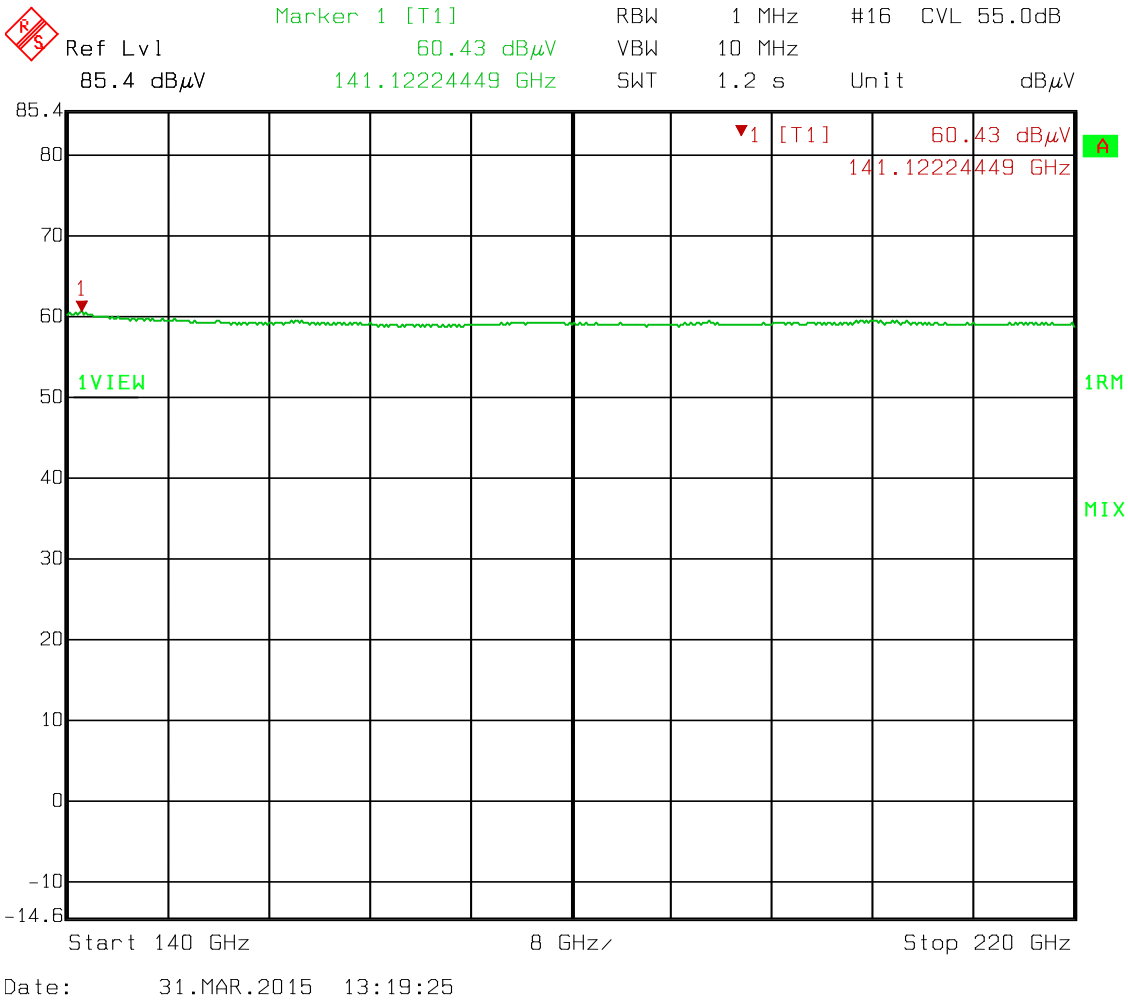

Marker 1 [T1]
RBW 1 MHz
#4 CVL 25.0dB
Ref Lvl
27.79 dBµV
VBW 10 MHz
85.4 dBµV
40.12024048 GHz
SWT 300 ms
Unit dBµV
1 [T1]
27.79 dBµV
40.12024048 GHz
A
1MIN
1RM
MIX
85.4
80
70
60
50
40
30
20
10
0
-10
-14.6
Start 40 GHz
2 GHz/
Stop 60 GHz
Date: 31.MAR.2015 13:14:23

Radiated Emissions



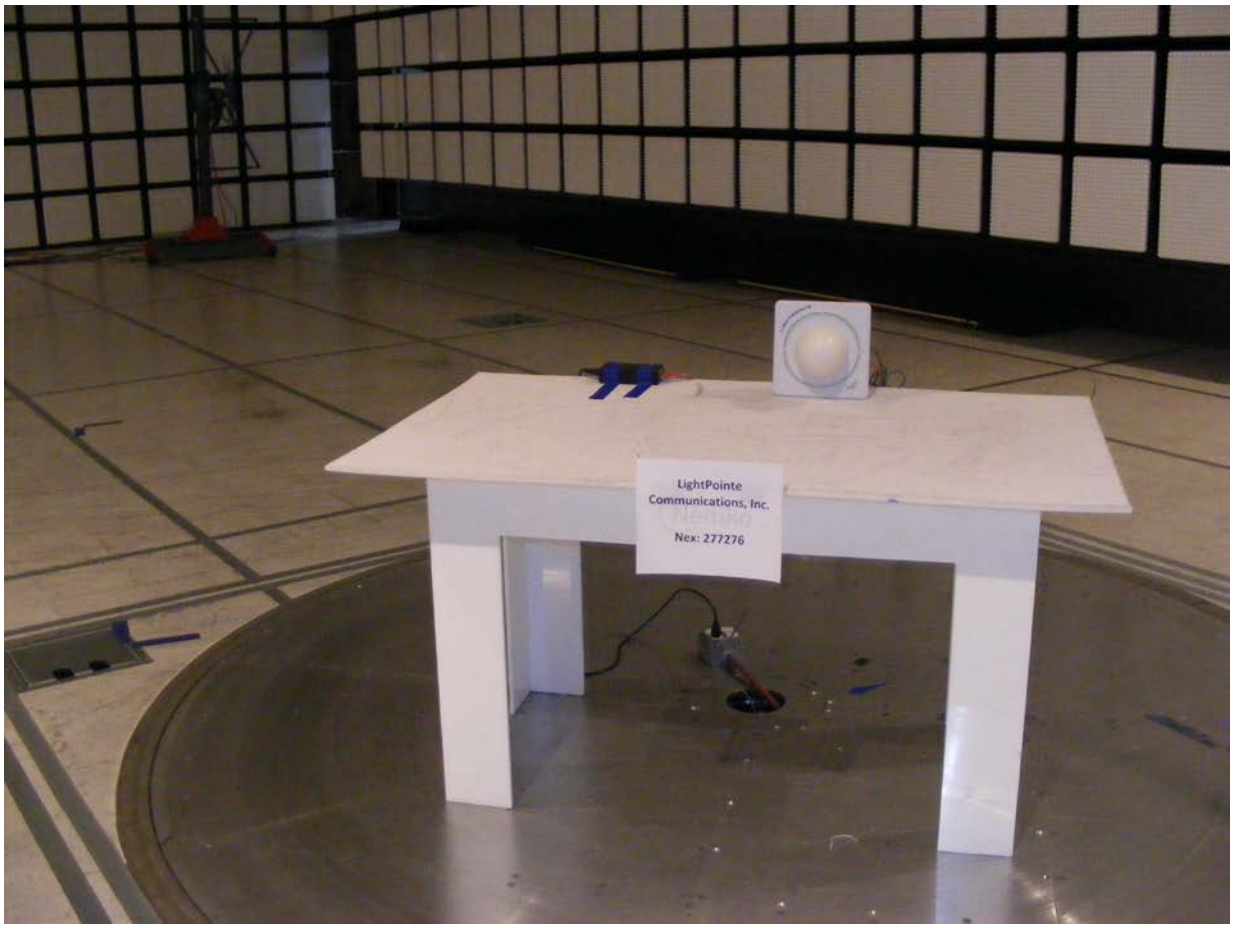
These signals were confirmed to be “ghost” signals caused from the harmonic mixer


Marker 1 [T1]
Ref Lvl
85.4 dBµV
45.43 dBµV
90.00000000 GHz
RBW 1 MHz
VBW 10 MHz
SWT 760 ms
#10 CVL 40.0dB
Unit dBµV
1 [T1]
45.43 dBµV
90.00000000 GHz
A
1VIEW
1RM
MIX
85.4
80
70
60
50
40
30
20
10
0
-10
-14.6
Start 90 GHz
5 GHz/
Stop 140 GHz
Date: 31.MAR.2015 13:17:08

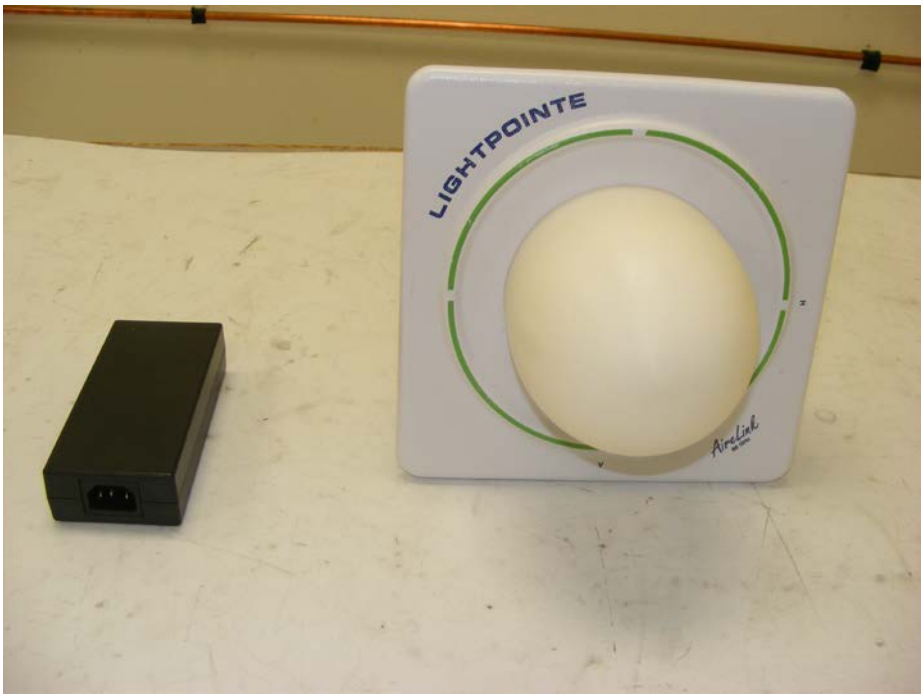

Marker 1 [T1]
Ref Lvl
85.4 dBµV
60.43 dBµV
141.12224449 GHz
RBW 1 MHz
VBW 10 MHz
SWT 1.2 s
#16 CVL 55.0dB
Unit dBµV
1 [T1] 60.43 dBµV
141.12224449 GHz
A
1VIEW
1RM
MIX
85.4
80
70
60
50
40
30
20
10
0
-10
-14.6
Start 140 GHz
8 GHz/
Stop 220 GHz
Date: 31.MAR.2015 13:19:25

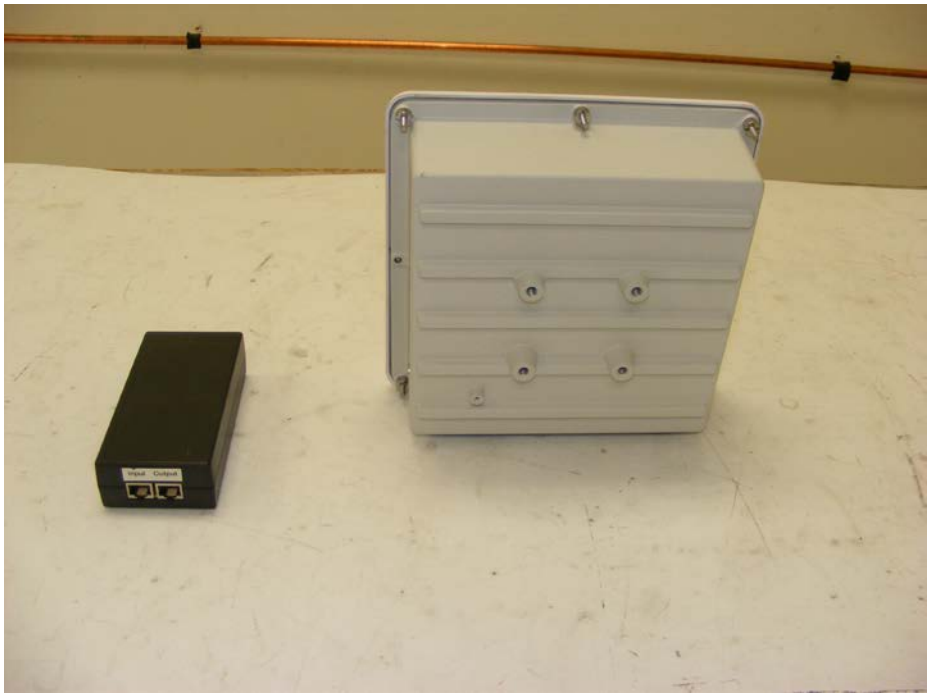
Radiated Photographs

30 MHz – 1 GHz



>18 GHz





Section 6. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 15.255(d) RSS 219, A13.2.5
TESTED BY: David Light	DATE: 31 March 2015

Test Results: Complies.

Measurement Data: See attached data.

Test Conditions: Rel. humidity
uncontrolled
-20 to +50 °C

Measurement Uncertainty: +/-1.7 dB

Temperature (deg C)	Measured CW Carrier (GHz)	Carrier setting (GHz)	Drift (kHz)	Drift (ppm)	
-20	62.446520500	62.446000000	520.500000000	8.3	
20	62.446432000	62.446000000	432.000000004	6.9	
50	62.446318200	62.446000000	318.200000002	5.1	

Section 8. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a) RSS-GEN
TESTED BY: Mark Phillips	DATE: 3/17/2015

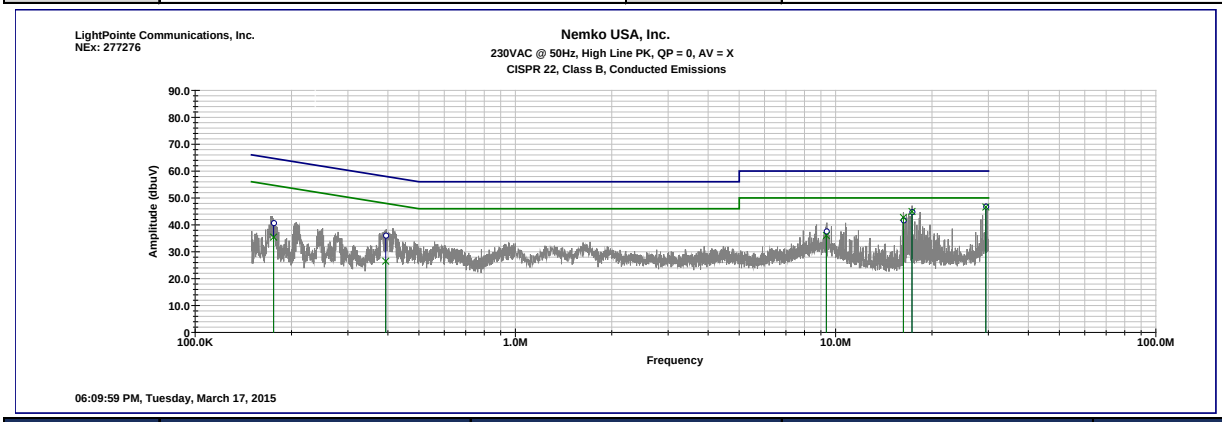
Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 1.7 dB

Test Data – Powerline Conducted Emissions

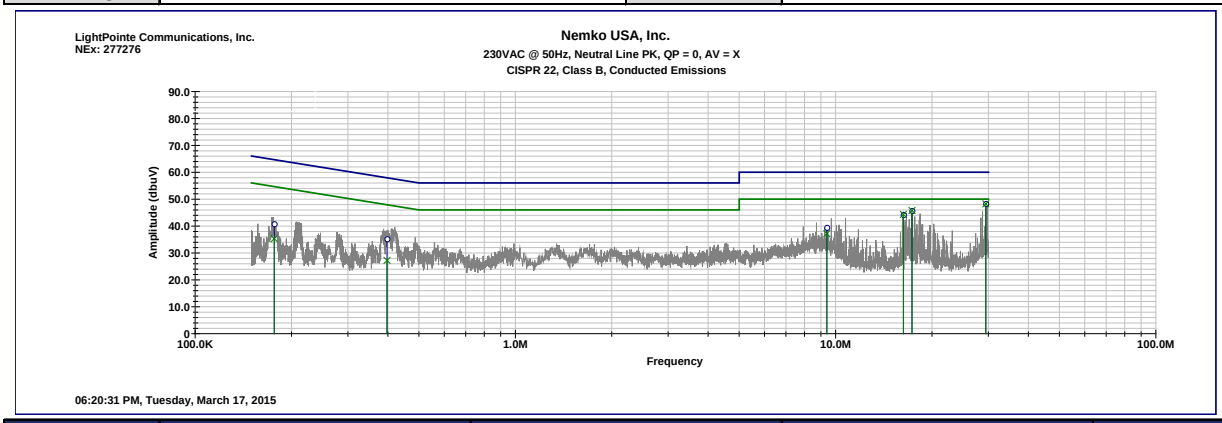
Client	LightPointe Communications, Inc.			
NEx #	277276	Temperature	24	˚C
EUT Name	AireLink 60GHz Transceiver Series	Humidity	52	%
EUT Model	60 SX	Pressure	100.3	kPa
Governing Doc	EN 301 489-1, EN 301 489-4	Test Location	Ground Plane 3	
Basic Standard	CISPR 22	Test Engineer	Mark Phillips	
Test Voltage	230VAC 50Hz	Date	3/17/2015	



Frequency (kHz)	Measured (dBµV)		Limit (dBµV)		Margin (dB)		Result
	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
175.819	40.8	35.4	65.3	55.3	-24.5	-19.8	**Pass**
393.785	36.1	26.5	59	49	-22.9	-22.5	**Pass**
9353.57	37.7	36	60	50	-22.3	-14	**Pass**
16282	41.8	42.8	60	50	-18.2	-7.2	**Pass**
17317.6	44.9	45	60	50	-15.1	-5	**Pass**
29439	46.9	46.6	60	50	-13.1	-3.4	**Pass**

Compliancy			
Compliant?	Yes	Additional Comments	N/A

Client	LightPointe Communications, Inc.			
NEx #	277276	Temperature	24	˚C
EUT Name	AireLink 60GHz Transceiver Series	Humidity	52	%
EUT Model	60 SX	Pressure	100.3	kPa
Governing Doc	EN 301 489-1, EN 301 489-4	Test Location	Ground Plane 3	
Basic Standard	CISPR 22	Test Engineer	Mark Phillips	
Test Voltage	230VAC 50Hz	Date	3/17/2015	

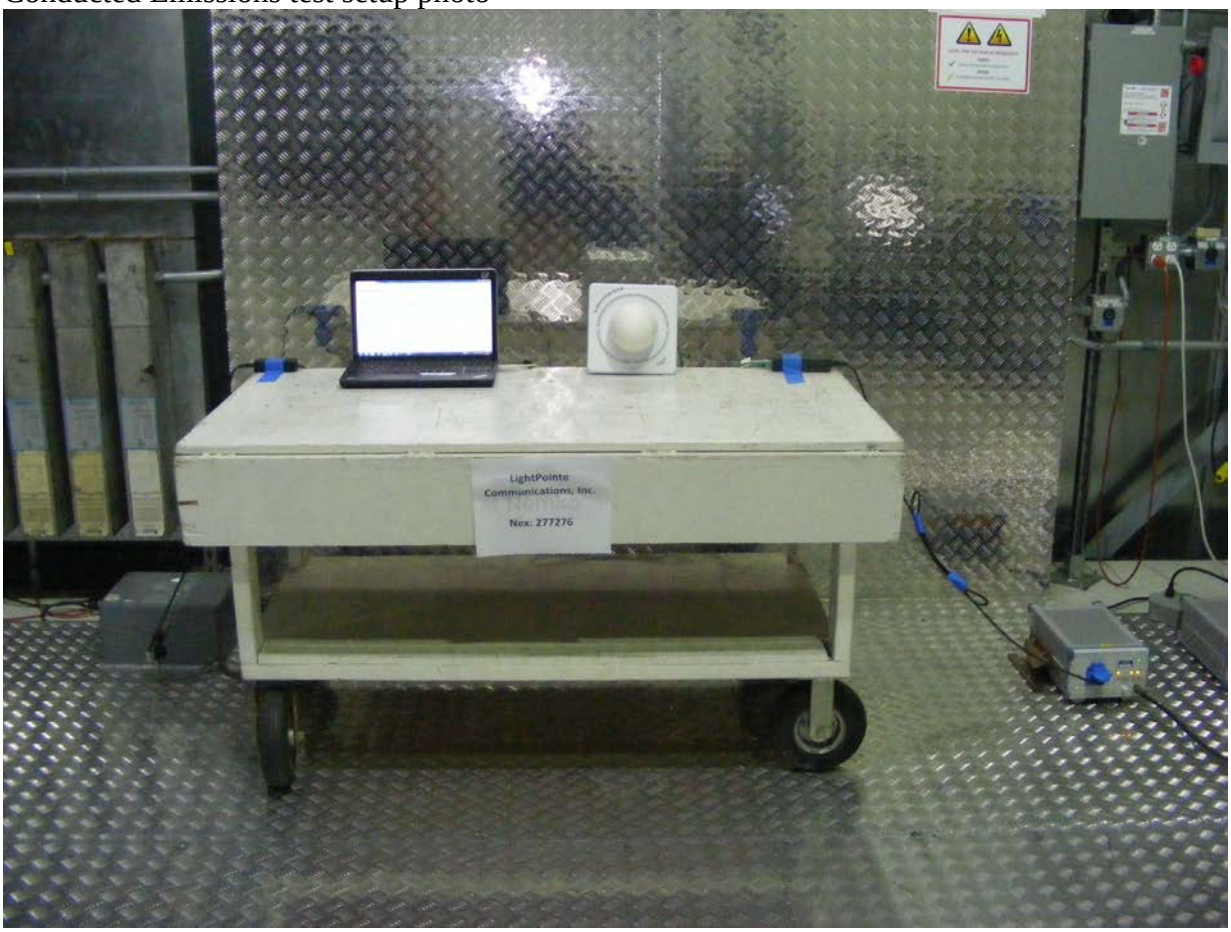


Frequency (kHz)	Measured (dBµV)		Limit (dBµV)		Margin (dB)		Result
	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
176.677	40.8	35.3	65.2	55.2	-24.4	-19.9	**Pass**
397.471	35.2	27.2	58.9	48.9	-23.7	-21.7	**Pass**
9389.62	39.5	37.2	60	50	-20.5	-12.8	**Pass**
16278.1	44.2	44.3	60	50	-15.8	-5.7	**Pass**
17317.6	45.7	45.8	60	50	-14.3	-4.2	**Pass**
29440.2	48.3	48.3	60	50	-11.7	-1.7	**Pass**

Compliancy			
Compliant?	Yes	Additional Comments	N/A

Test Equipment:
E1026, EMI Test Receiver 9 kHz to 7GHz; E1019, Two Line V-Network; 805, LISN.

Conducted Emissions test setup photo



Section 9. Test Equipment List

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
529	Antenna, DRWG	EMCO	3115	2505	08-Dec-2014	08-Dec-2016
805	LISN	Solar	9348-50-R-24-BNC	992823	23-Sep-2015	23-Sep-2016
902	pre amp	Sonoma	310 N	185803	21-Aug-2015	21-Aug-2016
E1019	Two Line V-Network	Rohde & Schwarz	ENV216	101045	15-May-2015	15-May-2016
E1026	EMI Test Receiver 9kHz to 7GHz	Rohde & Schwarz	ESCI 7	100800	14-Aug-2014	14-Aug-2015
E1029	Preamplifier (20MHz to 18GHz)	A.H. Systems, Inc.	PAM-0118	343	09-Sep-2015	09-Sep-2016
1026	Frequency counter	Hewlett Packard	5350B	8232A01493	11-Jun-2014	11-Jun-2015
1464	Spectrum Analyzer	Hewlett Packard	8563E	3551A04428	22-Jul-2015	22-Jul-2017
1480	Antenna, Bilog	Schaffner-Chase	CBL6111C	2572	18-May-2015	18-May-2016
E1064	Spectrum Analyzer	Agilent	E4440A	US42221762	22-Dec-2014	22-Dec-2015
1523	Harmonic mixer + horn antenna 40-60 GHz	OML	WR-19	U91220-1	Validated*	Validated*
1524	Harmonic mixer + horn antenna 60-90 GHz	OML	WR-12	E91220-1	Validated*	Validated*
1525	Harmonic mixer + horn antenna 90-140 GHz	OML	WR-08	F91220-1	Validated*	Validated*
1526	Harmonic mixer + horn antenna 140-220 GHz	OML	WR-05	G91220-1	Validated*	Validated*

*This equipment is validated according to procedures in Nemko San Diego ISO 17025 quality management system as there is no reference calibration standard available for frequencies above 40 GHz.

ANNEX A - TEST DETAILS

NAME OF TEST: Powerline Conducted Emissions PARA. NO.: 15.207(a)

Minimum Standard: §15.207 Conducted limits.

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 mH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Conducted Emission (MHz)	Limit (dBmV) Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 mV within the frequency band 535-1705 kHz, as measured using a 50 mH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as provided in §15.205 and §§15.209, 15.221, 15.223, 15.225 or 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another

device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

NAME OF TEST: Maximum Peak Output Power	PARA. NO.: 15.247(b)(3)

Minimum Standard: The maximum peak output power shall not exceed 1 watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Measurement Method

5.2.1 Maximum Peak Conducted Output Power Level

§15.247(b)(3) specifies that the maximum peak conducted output power for DTS transmitters in any of the three authorized frequency bands is 1 watt (30 dBm). The following procedures can be used to determine the maximum peak conducted output power from a DTS EUT using a spectrum analyzer.

5.2.1.1 Measurement Procedure PK1:
1. This procedure requires availability of a spectrum analyzer resolution bandwidth that is ≥ EBW.
2. Set the RBW ≥ EBW.
3. Set VBW ≥ 3 x RBW.
4. Set span = zero.
5. Sweep time = auto couple.
6. Detector = peak.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use peak marker function to determine the peak amplitude level within the fundamental emission.

5.2.1.2 Measurement Procedure PK2:

1. This procedure provides an integrated measurement alternative when the maximum available RBW < EBW.
2. Set the RBW = 1 MHz.
3. Set the VBW = 3 MHz.
4. Set the span to a value that is 5-30 % greater than the EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges (for some analyzers, this may require a manual override to ensure use of peak detector). If the spectrum analyzer does not have a band power function, sum the spectrum levels (in linear power units) at 1 MHz intervals extending across the EBW of the spectrum.

5.2.2 Maximum Conducted (Average) Output Power Level

§15.247(b)(3) permits the maximum conducted output power to be measured as an alternative to a peak power measurement to demonstrate compliance to the one watt (30 dBm) output power limit. The maximum conducted output power is the highest total transmit power occurring in any mode when averaged over the EUT EBW. This measurement requires that the EUT be configured to transmit continuously (at a minimum duty cycle of 98%) at full power over the measurement duration. Time intervals during which the transmitter is off or transmitting at reduced power levels shall not be included.

The spectrum analyzer must be capable of utilizing a number of measurement points in each sweep that is greater than or equal to twice the span/RBW in order to ensure bin-to-bin spacing of ≤ RBW/2 so that narrowband signals are not lost between frequency bins (the use of a greater number of measurement points than the minimum requirement is recommended).
The following procedures are acceptable for determining the maximum conducted output power with a spectrum analyzer.

5.2.2.1 Measurement Procedure AVG1 (power averaging over the EBW with slow sweep speed):
1. Set the analyzer span to 5-30% greater than the EBW.
2. Set the RBW = 1 MHz.
3. Set the VBW ≥ 3 MHz.
4. Detector = power average (RMS).
5. Ensure that the number of measurement points in the sweep ≥ 2 x (span/RBW).
6. Manually set the sweep time to: ≥10 x (number of measurement points in sweep) x (transmission symbol period).
7. Perform the measurement over a single sweep.
8. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges to determine the maximum conducted output power of the EUT over the EBW.

Note: If the analyzer does not have a band power function, sum the spectral levels (in linear power units) at 1 MHz intervals extending across the entire EBW.

5.2.2.2 Measurement Procedure AVG2 (trace averaging over the EBW):

1. Set the analyzer span to 5-30% greater than the EBW.
2. Set the RBW = 1 MHz.
3. Set the VBW ≥ 3 MHz.
4. Ensure that the number of measurement points in the sweep ≥ 2 x (span/RBW).
5. Sweep time = auto couple.
6. Detector = power averaging (RMS) or sample.
7. Employ trace averaging in power averaging (RMS) mode over a minimum of 100 traces.
8. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges to determine the maximum conducted output power of the EUT over the EBW. If the analyzer does not have a band power function, sum the spectral levels (in linear power units) at 1 MHz intervals extending across the entire EBW.

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)

Minimum Standard: Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Method Of Measurement:

5.1.1 EBW Measurement Procedure:
1. Set resolution bandwidth (RBW) = 1-5 % of the emission bandwidth (EBW).
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5 %.

5.1.2 Alternate EBW Measurement Procedure:
The automatic bandwidth measurement capability of a spectrum analyzer may be employed if it implements the functionality described above (*e.g.*, RBW = 1-5% of EBW, VBW ≥ 3 x RBW, peak detector with maximum hold). When using this capability, care should be taken to ensure that the bandwidth measurement is not influenced by any nulls in the fundamental emission.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

NAME OF TEST: Spurious Emissions(conducted)	PARA. NO.: 15.247(d)

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

5.4.1.1 Measurement Procedure – Reference Level

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Set the span to 5-30 % greater than the EBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW. Next, determine the power in 100 kHz band segments outside of the authorized frequency band using the following measurement:

5.4.1.2 Measurement Procedure - Unwanted Emissions

1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Set span to encompass the spectrum to be examined.
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize (this may take some time, depending on the extent of the span).

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified above.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

NAME OF TEST: Radiated Spurious Emissions PARA. NO.: 15.247(c)

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits:

Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (μV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

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15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41	1718		

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

NAME OF TEST: Transmitter Power Density	PARA. NO.: 15.247(d)

Minimum Standard: The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

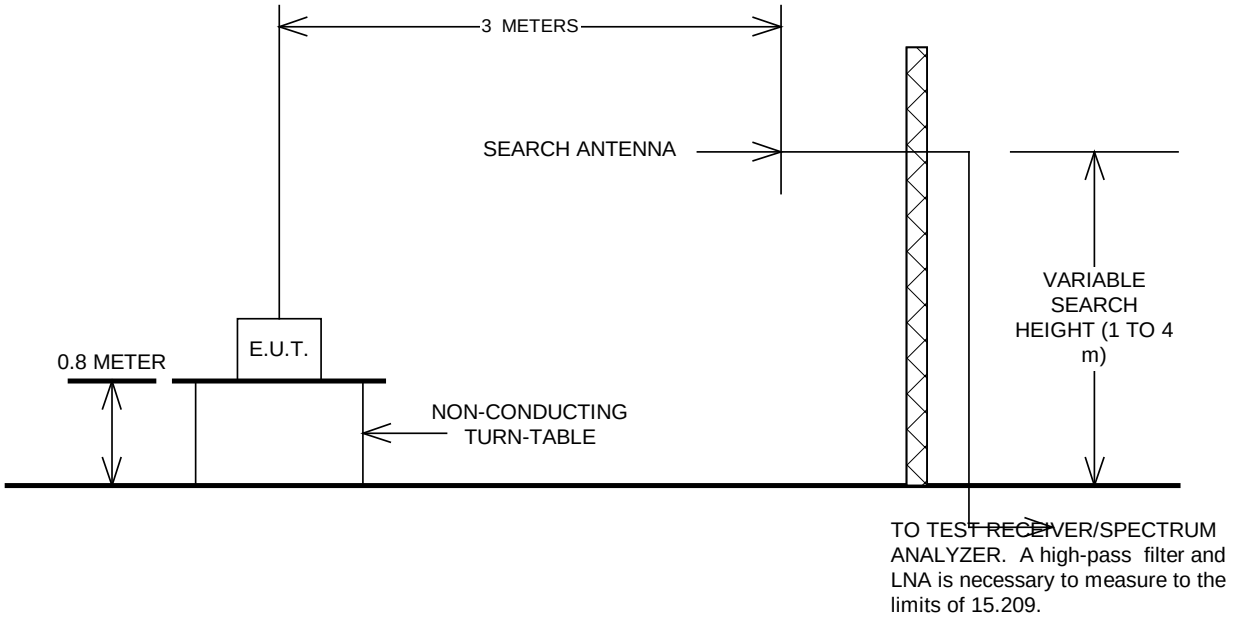
Method Of Measurement:

5.3.1 Measurement Procedure PKPSD:
1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 100 kHz.
3. Set the VBW ≥ 300 kHz.
4. Set the span to 5-30 % greater than the EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
10. Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where
BWCF = 10log (3 kHz/100 kHz = -15.2 dB).
11. The resulting peak PSD level must be ≤ 8 dBm.

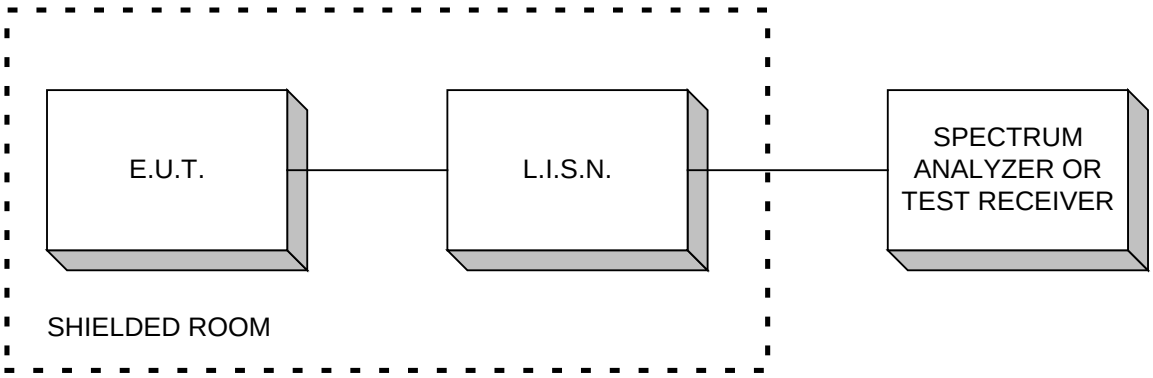
5.3.2 Measurement Procedure AVGPSD:
1. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
2. Set the analyzer span to 5-30% greater than the EBW.
3. Set the RBW = 100 kHz.
4. Set the VBW ≥ 300 kHz.
5. Detector = power average (RMS).
6. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW (use of a greater
number of measurement points than this minimum requirement is recommended).
7. Manually set the sweep time to: ≥ 10 x (number of measurement points in sweep) x (transmission symbol period).
8. Perform the measurement over a single sweep.
9. Use the peak marker function to determine the maximum level in any 100 kHz band segment within the fundamental EBW.
10. Scale the observed power level to an equivalent level in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where
BWCF = 10log (3 kHz/100 kHz = -15.2 dB).
11. The resulting PSD level must be ≤ 8 dBm

ANNEX B - TEST DIAGRAMS

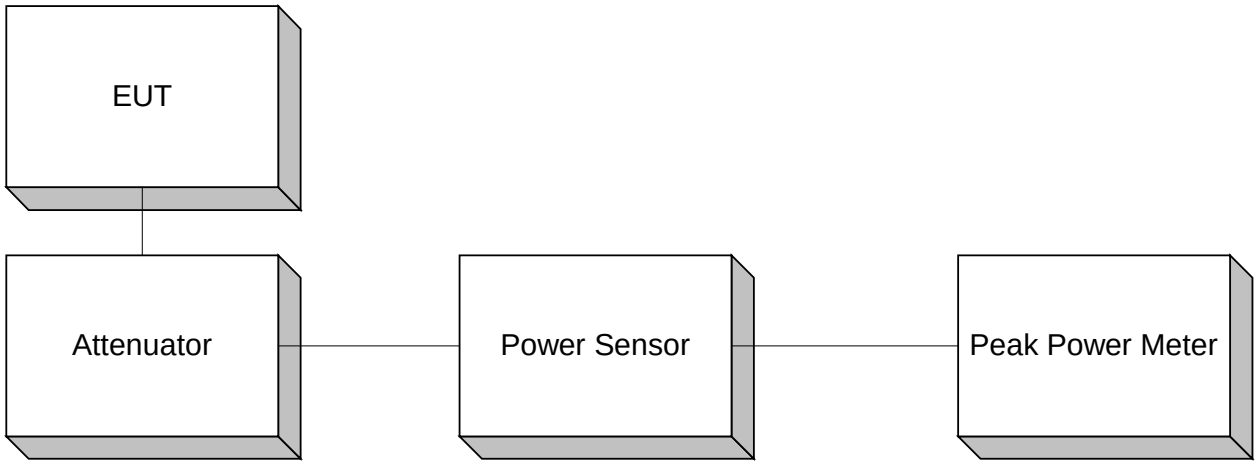
Test Site For Radiated Emissions



Conducted Emissions



Peak Power At Antenna Terminals



Note: A spectrum analyzer may be substituted for Peak Power Meter given that the measurement bandwidth is sufficient to capture the 60 dB bandwidth of the transmitter.

Minimum 6 dB Bandwidth
Peak Power Spectral Density
Spurious Emissions (conducted)