Compliance Testing, LLC
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Test Report

Prepared for: Proxim Wireless

Model: NGP1058BX

Description: Outdoor Radio Communication System

Serial Number: N/A

FCC ID: HZB-NGP1058B
IC: 1856A-NGP1058B

To

FCC Part 15.407
RSS 247 Issue 2

Date of Issue: April 27, 2018

On the behalf of the applicant:	**Proxim Wireless** **47633 Westinghouse Dr** **Fremont, CA 94539**
Attention of:	**Cor Van de Water, Sr. Regulatory and Compliance Manager** **Ph: (408)383-7626** **E-mail: cwater@proxim.com**

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Project No: p17c0012

Poona Saber
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	January 15, 2018	Poona Saber	Original Document
2.0	March 30, 2018	Poona Saber	- Added a note on page 11 for elevation plot - Added 3 meters measurement distance on page 15 - Fixed tuned frequency on page 18 - Updated Annex B - Updated test equipment table and a note added on page 15 - Added RSS 247 reference
3.0	April 3, 2018	Poona Saber	Revised power and power spectral density tables and test procedures based on the fact that antenna is cross polarized and using KDB 662911 D02 added RSS 247 section to test result summary
4.0	April 26, 2018	Poona Saber	Revised MPE and minimum safe distance calculation

Table of Contents

ILAC / A2LA

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The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

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Non-accredited tests contained in this report:

N/A

The applicant has been cautioned as to the following

15.21 - Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) - Special Accessories

Equipment marked to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.10-2013 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (ºC)	**Humidity (%)**	**Pressure (mbar)**
25.4 – 26.6	21.4 – 22.5	976.7 – 980.9

EUT Operation during Tests

EUT is an 802.11 PCIe Module that is located 20 cm out of the host and controlled by a web access interface to transmit continuously on Low, Mid and High channels and control the power settings on each channel.
It gets power through a POE and is tested for 20, 40 and 80 MHz bands on 802.11 ac mode.

EUT Description
Model: Beam X
Description: 5 GHz MIMO
Firmware: N/A
Software: N/A
Serial Number: N/A
Additional Information: The Module is connected to an active PRX14-200620 beam steering antenna V3.2 and is tested Radiated throughout the report. The maximum antenna gain for 5150-5250 MHz range is 19.5 dBi.

EUT Specifications

Equipment Code	NII
Model(s)Tested	802.11 ac-VHT 20,40,80
Model(s) Covered	802.11a/n-20MHz/ac-20MHz 802.11n-40MHz/ac-40MHz 802.11ac-80MHz
Frequency Range	5150-5250 MHz
Bandwidths	20,40,80 MHz
Data Rates	MCS0
Modulations	802.11a/n/ac: OFDM, BPSK, QPSK, 16QAM, 64QAM, 256QAM

15.203: Antenna Requirement:

	The antenna is permanently attached to the EUT
	The antenna uses a unique coupling
X	The EUT must be professionally installed
	The antenna requirement does not apply

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	POE power supply	SL Power and AULT	PENB1032E4800F02	N/A

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
2	Ethernet cables	<3	N	N	N

Modifications: None

Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
§15.203	Antenna Requirements	Pass	
§15.207 §15.407(b)(6) RSS GEN	Line Conducted Emissions	Pass	
§15.407(a)(3) RSS 6.2.4.1	Radiated Output Power	Pass	
§15.407(a)(3),(5) RSS 6.2.4.1	Power Spectral Density	Pass	
§15.403(i) §15.407(e) RSS 6.2.4.1	26dB Occupied Bandwidth	Pass	
	99% Occupied Bandwidth		
§15.407(b)(4) 6.2.4.2	Undesirable Emissions	Pass	
§15.205 §15.407(b)(4),(5),(6) 6.2.4.1	General Field Strength Limits (Restricted Bands and Radiated Emission limits)	Pass	
§15.407(g)	Frequency Stability	Pass	
§15.407(f)	RF Exposure	Pass	

References	Description
CFR47, Part 15, Subpart B	Unintentional Radiators
CFR47, Part 15, Subpart C	Intentional Radiators
CFR47, Part 15, Subpart E	Unlicensed Nation Information Infrastructure Devices (U-NII)
ANSI C63.10-2009	American National standard for testing Unlicensed Wireless Devices
ANSI C63.4-2009	Method and Measurements of Radio-Noise Emissions from low-Voltage Electrical and Electronic Equipment in the range 9kHz to 40GHz.
ISO/IEC 17025:2005	General requirements for the Competence of Testing and Calibrations Laboratories
KDB 644545 D03	Guidance for IEEE 802 11ac New Rules
KDB 789033 D02	General U-NII Test Procedures New Rules V01
KDB 926956 D01	U-NII Transition Plan
KDB 662911 D02	MIMO with Cross-Polarized Antennas v01
RSS 247- issue 2	Digital Transmission systems, frequency hopping systems and license-Exempt local area network devices

Average Output Power

Engineer: Poona Saber

Test Date: 1/2/2018

Test Requirements

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

In addition to the emission limits specified in § 15.407(a)(1)(i), if the access point is an outdoor Point-to-Multipoint device operating in the band 5.15-5.25 GHz, the rules require that the maximum EIRP at any elevation angle above 30° not exceed 125 mW (21 dBm) as measured from the horizon. This restriction leads to a general requirement for the antenna pattern: if the EIRP within 3-dB elevation beam width of any radiation lobe is higher than 125 mW, this lobe must be controlled, either mechanically or electrically, so that the 3-dB elevation beam width of this lobe is below 30° elevation angle relative to horizon.
For the purposes of compliance, information for all the antenna types must be included in the filing. In order for antennas to be considered of similar type, the antenna patterns must also be similar as well as other characteristics of the antenna.

Based on KDB 662911 D02 for Cross polarized antenna power was first measured radiated and the total emission was derived from below steps
(1) Measured radiated emissions with vertical and horizontal polarizations of the measurement antenna
(2) Converted each radiated measurement to transmit power or PSD based on the antenna gain
(3) Summed the powers or PSDs across the two polarizations

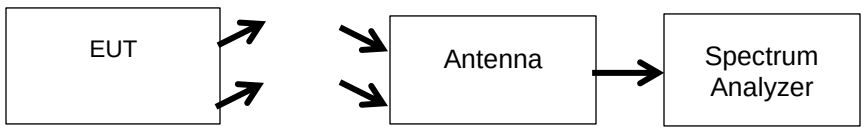
Test Procedure

Testing was done Radiated at 1 meters distance from EUT in anechoic chamber and the position of the EUT and antenna was maximized to get the highest power reading out of the unit. The RF power was calculated using the spectrum analyzers' band power function per Method SA-1 from KDB 789033 D02 General U-NII Test Procedures New Rules v01. Measurements were made at the low, mid, and high channels of the band.

The Spectrum Analyzer was set to the following:

a. RBW = 1 MHz
b. VBW ≥ 3 MHz
c. Sweep time = auto
d. Detector = RMS
e. 100 traces in power averaging mode

Test Setup



Test Results

PTP

Band Width	Frequency	Combined Power (EIRP)	Combined power Conducted	Limit Conducted	Margin
MHz	MHz	dBm	dBm	dBm	dB
20	5180	33.2	16.7	53	-19.8
20	5200	36.3	19.8	53	-16.7
20	5240	39.3	22.8	53	-13.7
40	5190	27.1	10.6	53	-25.9
40	5230	39.0	22.5	53	-14.0
80	5210	26.1	9.6	53	-26.9

PTMP

Band Width	Frequency	Combined Power (EIRP)	Combined power Conducted	Limit	Margin
MHz	MHz	dBm	dBm	dBm	dB
20	5180	19.52	3.02	16.5	-13.5
20	5200	19.7	3.2	16.5	-13.3
20	5240	20.7	4.2	16.5	-12.3
40	5190	20.25	3.75	16.5	-12.8
40	5230	20.12	3.62	16.5	-12.9
80	5210	20.43	3.93	16.5	-12.6

See Annex A for Elevation Pattern results
***Please note that the results has been displayed by 30 degrees shift to zero.**

Transmitter Power Spectral Density

Engineer: Poona Saber
Test Date: 1/2/2018

Test Requirements

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in the maximum conducted power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Based on KDB 662911 D02 for Cross polarized antenna power was first measured radiated and the total emission was derived from below steps
(1) Measured radiated emissions with vertical and horizontal polarizations of the measurement antenna
(2) Converted each radiated measurement to transmit power or PSD based on the antenna gain
(3) Summed the powers or PSDs across the two polarizations

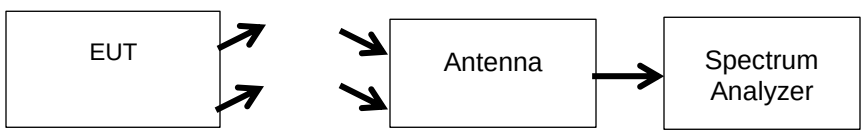
Test Procedure

Testing was done Radiated at 1 meters distance from EUT in anechoic chamber and the position of the EUT and antenna was maximized to get the highest power reading out of the unit. The Power Spectral Density was measured using the method per SA-1 from KDB 789033 D02 General U-NII Test Procedures New Rules v01. Measurements were made at the low, mid, and high channels of the band. The maximum PSD was determine by finding the peak value across the carrier bandwidth.

The Spectrum Analyzer was set to the following:

a. RBW = 1 MHz
b. VBW ≥ 3 MHz
c. Span 1.5 * BW
d. Sweep time = auto
e. Detector = RMS
f. 100 traces in power averaging mode

Test Setup



Test Results

PTP

Band Width	Frequency	Combined spectral density (EIRP)	Combined Spectral Density Conducted	Limit Conducted	Margin
MHz	MHz	dBm	dBm	dBm	dB
20	5180	21.8	5.3	17	-11.7
20	5200	25.0	8.5	17	-8.5
20	5240	27.2	10.7	17	-6.3
40	5190	12.4	-4.1	17	-21.1
40	5230	24.0	7.5	17	-9.5
80	5210	8.1	-8.4	17	-25.4

PTMP

Band Width	Frequency	Combined spectral density (EIRP)	Combined Spectral Density Conducted	Limit	Margin
MHz	MHz	dBm	dBm	dBm	dB
20	5180	7.98	-8.52	**3.5**	**-12.02**
20	5200	7.9	-8.6	**3.5**	**-12.1**
20	5240	8.7	-7.8	**3.5**	**-11.3**
40	5190	4.65	-11.85	**3.5**	**-15.35**
40	5230	4.95	-11.55	**3.5**	**-15.05**
80	5210	2.56	-13.94	**3.5**	**-17.44**

Undesirable Emissions Radiated

Engineer: Poona Saber
Test Date: 1/8/2018

Test Requirements

Unwanted Emissions that fall Outside Restricted Bands

For transmitters operating in the 5.15-5.25 GHz band:

All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz. As specified in § 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a maximum emission limit of -27 dBm/MHz. However, an out-of-band emission that complies with both the peak and average limits of § 15.209 is not required to satisfy the -27 dBm/MHz maximum emission limit.

The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz

The provisions of §15.205 apply to intentional radiators operating under this section

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

In addition to above the provision of §15.209 were applied to meet the requirements of §15.205.

FCC Part 15 Subpart C Paragraph 15.209(a) Limits

Frequency (MHz)	Frequency (microvolts/meter)	Frequency (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remarks: E field strength (dBμV/m) = 20 log E field strength (uV/m)

Test Procedure

The EUT was setup in accordance with ANSI C63.10. 2013 and tested per KDB 789033. The EUT is placed on non-conductive platform at a height of 0.8 and 1.5 meters above the ground plane of the semi-anechoic chambers and 3 meters away from receiving antenna for below and above 1 GHz. The EUT was rotated 360 degrees and the receive antenna raised and lowered to find the maximum emissions from 30MHz to the 10th harmonic of the fundamental. The EUT was set to the maximum power level allowed and the low, mid, and high channels were investigated for emissions.

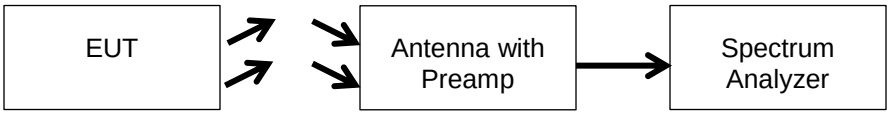
The Spectrum Analyzer was set to the following for emissions > 1000MHz:

a. (RBW = 1 MHz
b. VBW ≥ 3 MHz
c. Detector = Peak
d. Sweep time = auto
e. Trace mode = max hold
    1. Note: For emissions where the peak exceeded that of the average 15.209 emission limit the following was performed.
f. RBW = 1 MHz
g. VBW ≤ RBW/100 (i.e., 10 kHz) but not less than 10Hz

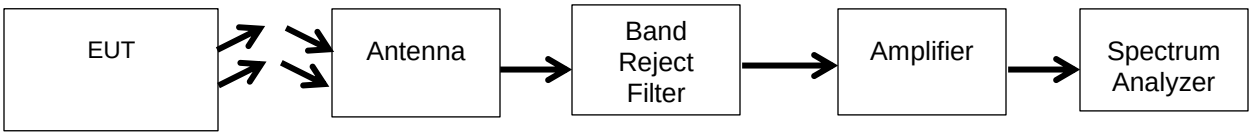
For emissions below 1000MHz the Spectrum Analyzer settings were as follows:

a. RBW = 100 kHz
b. VBW ≥ 300 kHz
c. Detector = Peak
d. Sweep time = auto
e. Trace mode = max hold
    1. Note: A quasi peak detector was used for emissions where the peak exceeded that of the average 15.209 emission limits

Test Setup below 1000MHz



Test Setup above 1000MHz



Test Results: **See Annex B: Undesirable Emission**

Note: All the emissions up to 5th harmonic of the fundamental were investigated and there was nothing observed above noise floor after 18GHz

Occupied Bandwidth

Engineer: Poona Saber
Test Date: 1/2/18

Test Requirement

The emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement

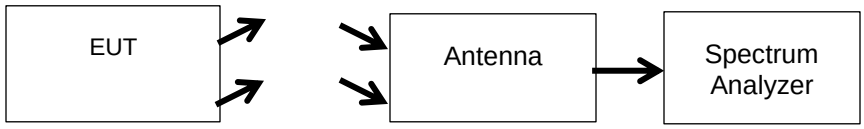
For industry Canada the Occupied bandwidth will be the 99% emission bandwidth in megahertz.

Test Procedure

The Spectrum Analyzer was set to the following parameters:

a. RBW = approximately 1% of the emission bandwidth.
b. VBW > RBW.
c. Detector = Peak.
d. Trace mode = max hold.

Test Setup



Test Results: **See Annex C: Occupied Bandwidth**

Frequency Stability

Engineer: Poona Saber

Test Date: 1/8/2018

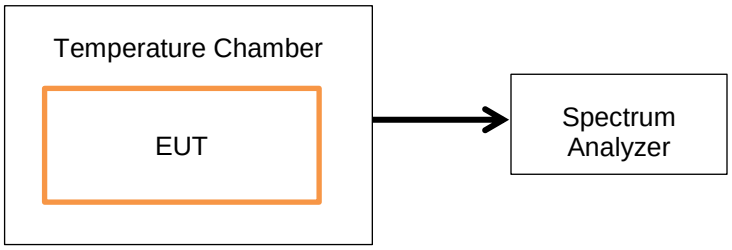
Test Requirement

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

Test Procedure

a. The EUT was placed into a temperature chamber and the temperature ranges were set to the manufacturers' specifications.
b. The RF output of the EUT was connected to a spectrum analyzer
c. The lowest and highest channels of the band were set to transmit
d. The carrier plots were measured to insure that the 26dB band width remained within the band over the prescribed temperature extremes.

Test Setup



Test Results: **See Annex D: Frequency Stability**

RF Exposure

Engineer: Poona Saber
Test Date: 1/15/18

Requirements

U-NII devices are subject to the radio frequency radiation exposure requirements specified in §1.1307(b), §2.1091 and §2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. In addition, systems operating under the provisions of this section shall be operated in a manner that insures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

Exposure Limits

At operating frequencies less than or equal to 6 GHz, the limits for maximum permissible exposure (MPE) shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Section 1.1307(b), except for portable devices as defined in §2.1093 as these evaluations shall be performed according to the SAR provisions in §2.1093 of this chapter.

MPE Limit Calculations

Exposure Limit 1mW/cm^2

Source Based Time Averaged Power Calculation

Average Power Calculations

Average Power = Peak Power * duty-cycle%

Tuned Frequency (MHz)	Radiated Average Output Power EIRP (dBm)	Antenna Gain	Average Power Conducted (mW)
5240	42.3	19.5	190.54

MPE Evaluation

This is a mobile device used in uncontrolled /general population exposure environment.

Limits Uncontrolled Exposure	0.3-1.234 MHz	Limit [mW/cm²] = 100
47 CFR 1.1310	1.34-30 MHz	Limit [mW/cm²] = (180/f²)
Table 1, (B)	30-300 MHz	Limit [mW/cm²] = 0.2
	300-1500 MHz	Limit [mW/cm²] = f/1500
	1500-100,000 MHz	Limit [mW/cm²] = 1.0

Test Data

Test Frequency, MHz	5240
Power, Conducted, mW (P)	190.54
Antenna Gain Isotropic	19.5 dBi
Antenna Gain Numeric (G)	89.12
Antenna Type	Beam steering
Distance (R)	20

$$S = \frac{P * G}{4\pi r^2}$$

Power Density (S) mw/cm²	Power mW (P)	Numeric Gain (G)	Distance (r²) cm
3.37	190.54	89.12	20

Power Density (S) = 3.37
Limit =(from above table) = 1

Since the power density is more than 1 mw/cm2 limit then the minimum safe distance is calculated as below.

formula R=√(PG/4πL)

Distance (R) (cm)	Power (mW)	Numeric Gain (G)	Limit (mW/cm)
36.76	190.54	89.12	1

The minimum safe distance for the device to meet the power density limitation is to be installed at least 36.76 cm from the user all the time

A/C Powerline Conducted Emission

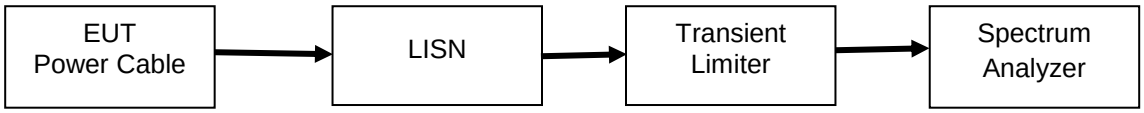
Engineer: Poona Saber

Test Date: 1/16/2018

Test Procedure

The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

Test Setup



Test Results: **See Annex E: A/C Powerline Conducted Emission**

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Temperature Chamber	Tenney	Tenney II Benchmaster	i00287	NCR	NCR
Preamplifier	HP	8447D	i00055	NCR	NCR
Harmonic Mixer 26.5-40GHz	HP	11970A	i00193	6/4/15	6/4/18
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	6/16/16	6/16/18
Spectrum Analyzer	Agilent	E4407B	i00331	11/21/2017	11/21/2018
Bi-Log Antenna	Teseq	CBL 6111D	i00349	8/3/16	8/3/18
EMI Analyzer	Agilent	E7405A	i00379	2/22/2017	2/22/2018
EMI Receiver	HP	8546A	i00033	3/28/2017	3/28/2018
Transient Limiter	Com-Power	LIT-153	i00123	Verified on: 1/16/2018	
AC Power Source	Behlman	BL 6000	i00362	Verified on: 1/16/2018	
LISN	COM-Power	LI-125A	i00446	4/29/16	4/29/18
LISN	COM-Power	LI-125A	i00448	4/29/16	4/29/18
Horn Antenna	Emco	3116	i00085	2/6/17	2/6/19
harmonic mixer 33-50GHz	HP	11970Q	i00465	6/4/2015	6/4/2018
waveguide horn (33GHz-50GHz)	NA	HO22R	i00484	Verified on: 1/16/2018	

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT