



Test Report

Prepared for: Packet Power, LLC

Model: E4

Description: Wireless Ethernet Gateway

Serial Number: N/A

FCC ID: WCGEG4
IC: 11906A-EG4

To

FCC Part 15.247 FHSS

And

IC RSS-210 Issue 8, December 2010

Date of Issue: April 7, 2016

On the behalf of the applicant:

Packet Power, LLC
2716 Summer St NE
Minneapolis, MN 55413

Attention of:

Alan Katz
Ph: (714)227-8145
E-mail: alan@packetpower.com

Prepared by
Compliance Testing, LLC
1724 S. Nevada Way
Mesa, AZ 85204
(480) 926-3100 phone / (480) 926-3598 fax
www.compliancetesting.com
Project No: p1610002



Alex Macon
Project Test Engineer

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All results contained herein relate only to the sample tested.



Test Report Revision History

| Revision | Date | Revised By | Reason for Revision |
|----------|---------------|------------|---------------------|
| 1.0 | April 4, 2016 | Alex Macon | Original Document |
| | | | |
| | | | |
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The tests results contained within this test report all fall within our scope of accreditation, unless noted in the table below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

Testing Certificate Number: **2152.01**



FCC Site Reg. #349717

IC Site Reg. #2044A-2

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 marketed 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 and Engineering Practices

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2 and the following individual Part: 15.247 Operation within bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

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

In accordance with ANSI C63.4-2009, ANSI C63.10-2009, FCC DA 00-705, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10 to 40C (50 to 104F) 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.

| Environmental Conditions | | |
|--------------------------|--------------|-----------------|
| Temperature (°C) | Humidity (%) | Pressure (mbar) |
| 22.4 – 23.1 | 28.4 – 42.2 | 965.1 – 970.8 |

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

EUT Description

Model: E4

Description: Wireless Ethernet Gateway

Software: N/A

Serial Number: N/A

Additional Information:

The EUT incorporates a 2.4 GHz radio with an integral antenna.

EUT Operation during Tests

EUT was placed in test modes using the NMX PacketPower URL paired with the node configurator.

15.203: Antenna Requirement:

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



Accessories:

| Qty | Description | Manufacturer | Model | S/N |
|-----|-------------------|--------------|---------------------|-----|
| 1 | Node Configurator | Packet Power | 63E1-0200-2014-001D | N/A |

Cables: None

Modifications: None



Test Results Summary

| Specification | Test Name | Pass, Fail, N/A | Comments |
|---------------------------------|-----------------------------------|-----------------|--|
| 15.247(b) | Peak Output Power | Pass | |
| 15.247(d) | Conducted Spurious Emissions | N/A | Device incorporates an integral antenna. |
| 15.247(d), 15.209(a), 15.205 | Radiated Spurious Emissions | Pass | |
| 15.247(d), 15.209(a), 15.205 | Emissions At Band Edges | Pass | |
| 15.247(a) | Occupied Bandwidth | Pass | |
| 15.247(a) | Dwell Time | Pass | |
| 15.247(a) | Number of Hopping Channels | Pass | |
| 15.207 | A/C Powerline Conducted Emissions | Pass | |



Peak Output Power

Engineer: Alex Macon

Test Date: 1/7/16

Test Procedure

The EUT was tested in a semi-anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements. The antenna and cable correction factors were summed and entered into the spectrum analyzer as an offset to ensure accurate readings.

Test Setup



Transmitter Peak Output Power

| Tuned Frequency (MHz) | Recorded Measurement (mW) | Specification Limit (mW) | Result |
|-----------------------|---------------------------|--------------------------|--------|
| 2403 | 0.207 | 125 | Pass |
| 2431 | 0.197 | 125 | Pass |
| 2464 | 0.215 | 125 | Pass |



Radiated Spurious Emissions

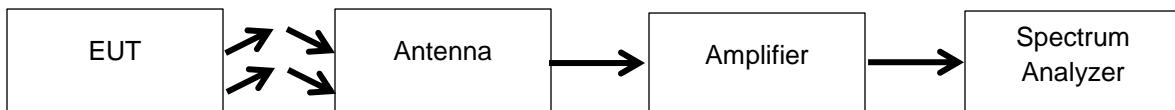
Engineer: Alex Macon

Test Date: 1/7/16

Test Procedure

The EUT was tested in a semi-anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions. The antenna and cable correction factors were summed with the amplifier gain and entered into the spectrum analyzer as an offset to ensure accurate readings. The spectrum for each tuned frequency was examined to the 10th harmonic.

Test Setup



| Detector Settings | RBW | VBW |
|-------------------|-------|-------|
| Peak | 1 MHz | 3 MHz |
| Average | 1 MHz | 30 Hz |

See Annex A for test data

No other emissions were detectable. All emissions were greater than -20 dBc.



Emissions at Band Edges

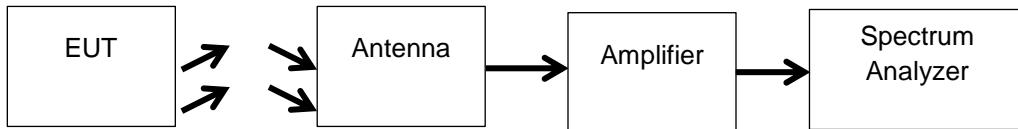
Engineer: Alex Macon

Test Date: 1/7/16

Test Procedure

The EUT was tested in a 3 meter semi-anechoic chamber. A spectrum analyzer was used to verify that the EUT met the requirements for band edge with both peak and average measurements. The cable and transducer correction factors were input into the analyzer as a reference level offset to ensure accurate readings.

Test Setup

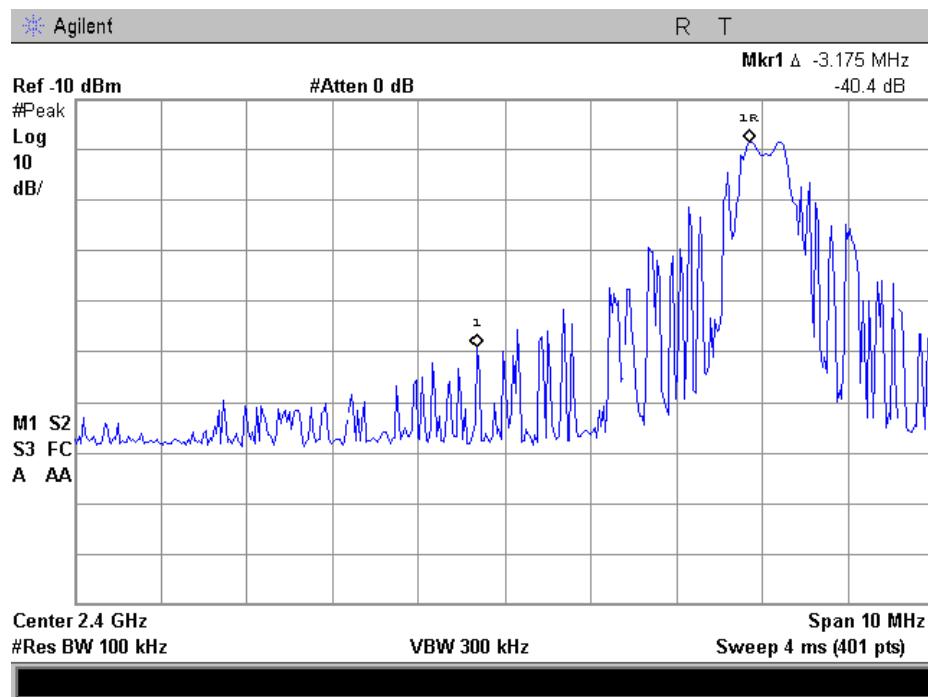


Band Edge Emissions Summary

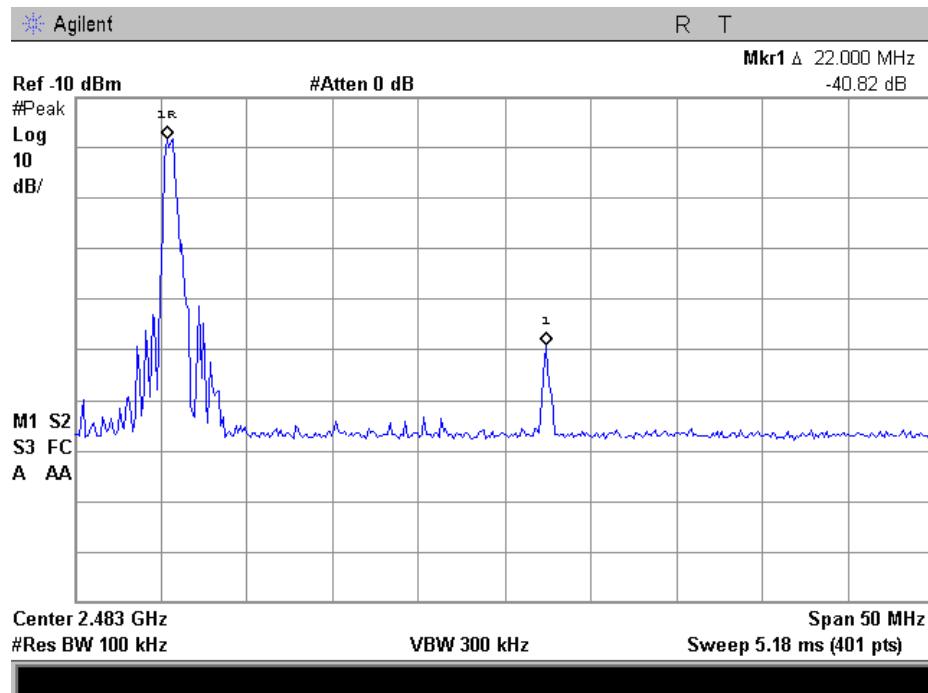
| Tuned Frequency (MHz) | Emission Frequency (MHz) | Monitored Level | Detector | Limit | Result |
|-----------------------|--------------------------|-----------------|----------|---------|--------|
| 2403 | 2398 | -40.4 dBc | Peak | -20 dBc | Pass |
| 2464 | 2486 | -40.8 dBc | Peak | -20 dBc | Pass |



Band Edge 2400 MHz



Band Edge 2483.5 MHz

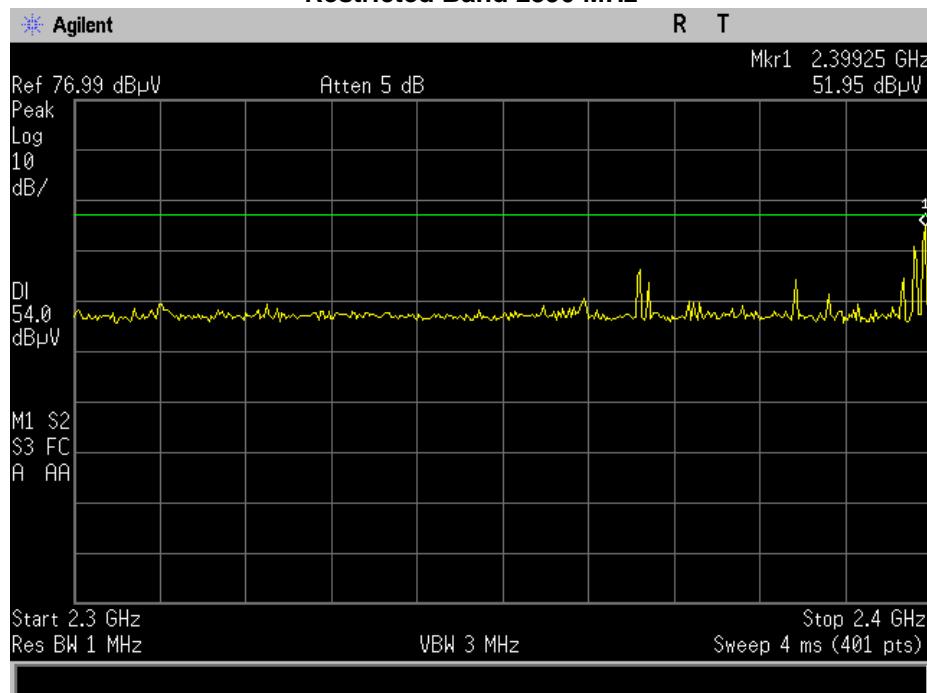




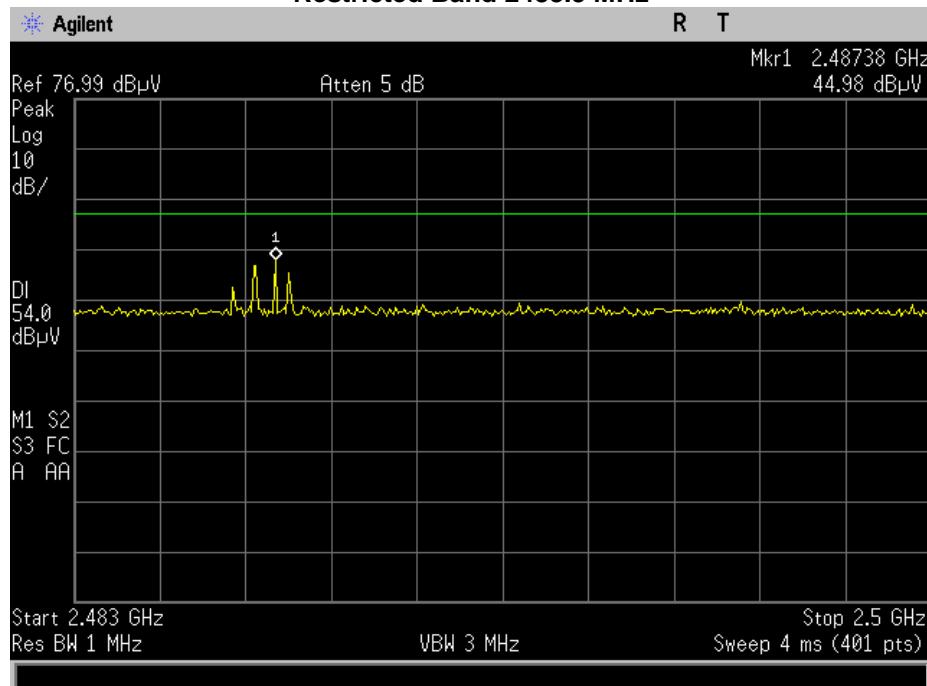
Restricted Band Emissions Summary

| Tuned Frequency (MHz) | Emission Frequency (MHz) | Peak Monitored Level (dB μ V/m) | Peak Limit (dB μ V/m) | Average Monitored Level (dB μ V/m) | Average Limit (dB μ V/m) | Result |
|-----------------------|--------------------------|-------------------------------------|---------------------------|--|------------------------------|--------|
| 2403 | 2399.2 | 51.95 | 74.0 | N/A | 54.0 | Pass |
| 2464 | 2487.3 | 44.98 | 74.0 | N/A | 54.0 | Pass |

Restricted Band 2390 MHz



Restricted Band 2483.5 MHz





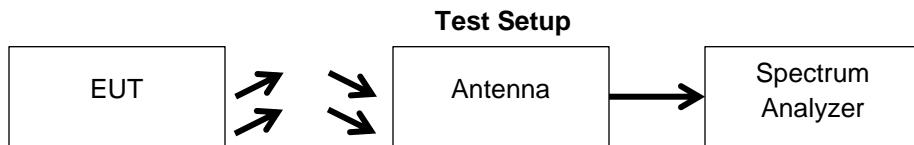
Occupied Bandwidth

Engineer: Alex Macon

Test Date: 12/15/14

Test Procedure

The EUT was tested in a 3 meter semi-anechoic chamber. The Span was set wide enough to capture the entire transmitting spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold and when the entire spectrum was captured, the 20dB and 99% bandwidths were measured to verify that the bandwidth met the specification.



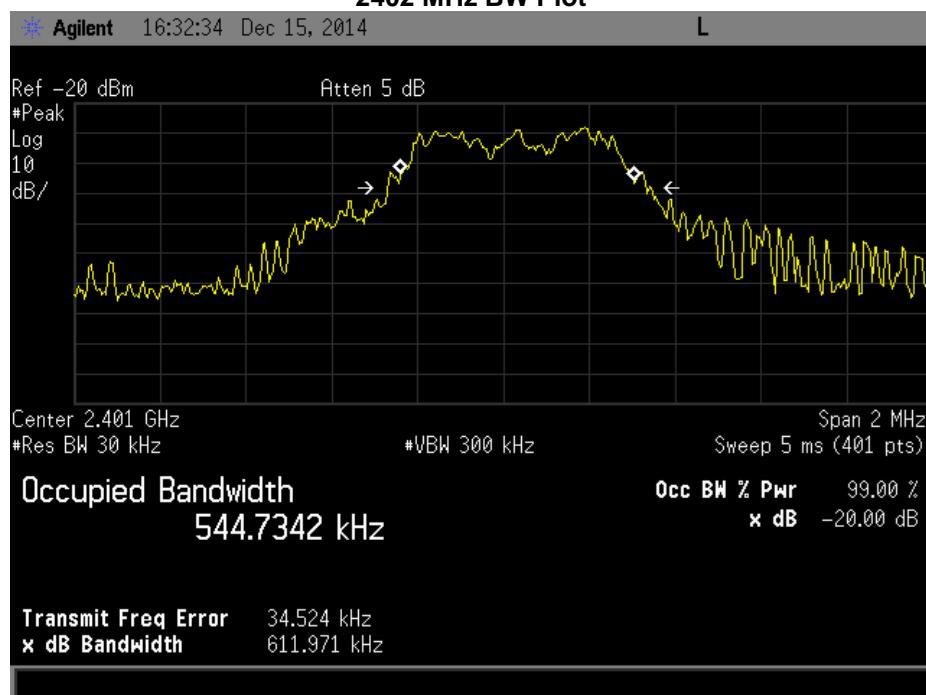
20 dB Bandwidth Summary

| Frequency (MHz) | Recorded Measurement (kHz) |
|-----------------|----------------------------|
| 2401 | 612 |
| 2431 | 640 |
| 2464 | 623 |

99% Bandwidth Summary

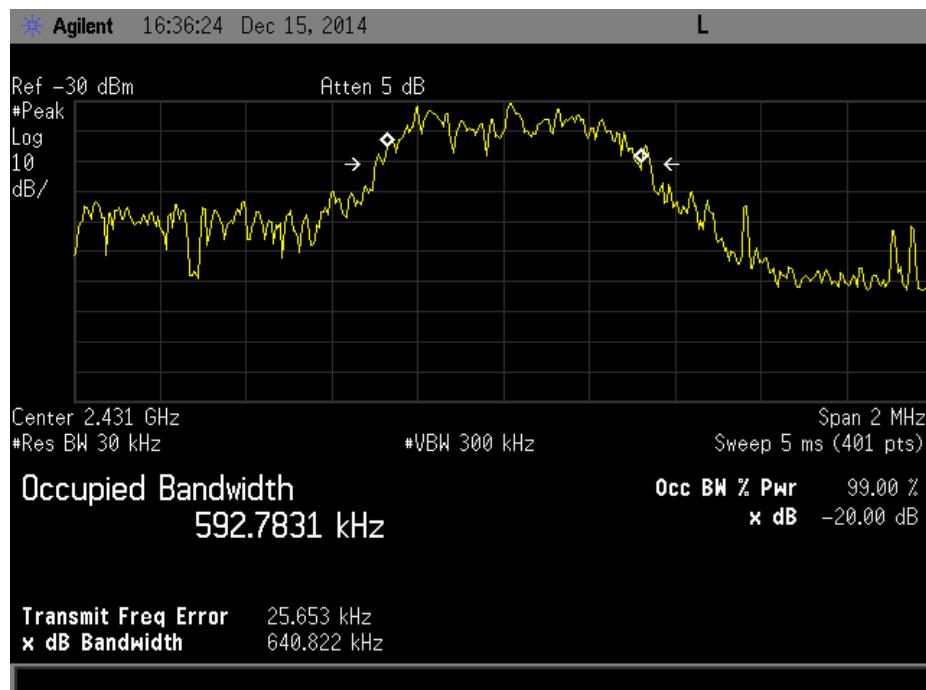
| Frequency (MHz) | Recorded Measurement (kHz) |
|-----------------|----------------------------|
| 2401 | 544 |
| 2431 | 592 |
| 2464 | 545 |

2402 MHz BW Plot

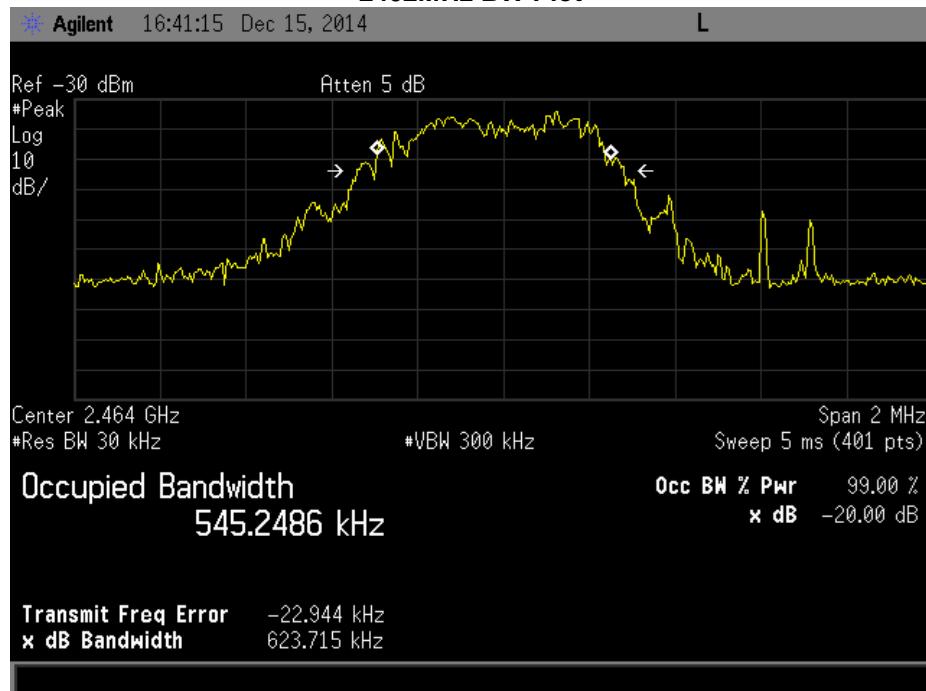




2431MHz BW Plot



2402MHz BW Plot





Dwell Time

Engineer: Alex Macon

Test Date: 12/3/14

Test Procedure

The EUT was tested in a 3 meter semi-anechoic chamber. The EUT was set to hopping mode with the spectrum analyzer set to a 0 Hz span. A single transmission was captured and the dwell time was recorded.

Test Setup



The Average Dwell time in a 25.2 second span (.4 * 63 channels) is 7ms.

Due to the infrequent duty of the transmitter in normal operation, it was deemed impractical to measure the dwell time using a spectrum analyzer. The manufacturer has provided a detailed timing document to determine compliance.



Number of Hopping Channels

Engineer: Alex Macon

Test Date: 12/3/14

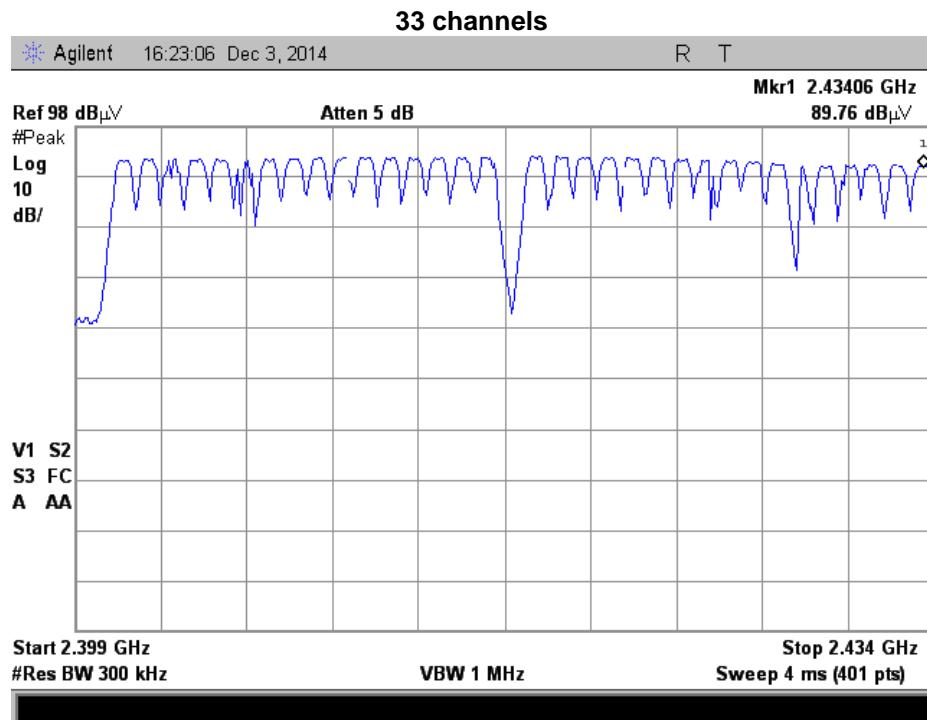
Test Procedure

The EUT was tested in a 3 meter semi-anechoic chamber. The Span was set to the specified band end points. The EUT was then set to operate in hopping mode. The MAX HOLD function of the spectrum analyzer was utilized to verify the number of hopping channels.

Test Setup

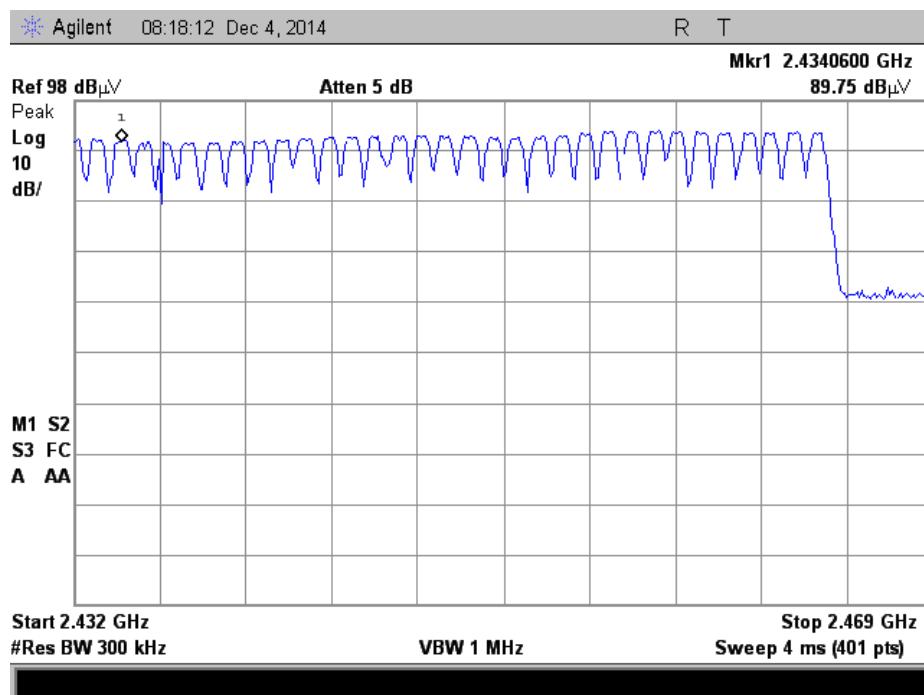


Number of Hopping Channels





30 channels



A total of 63 channels were plotted.

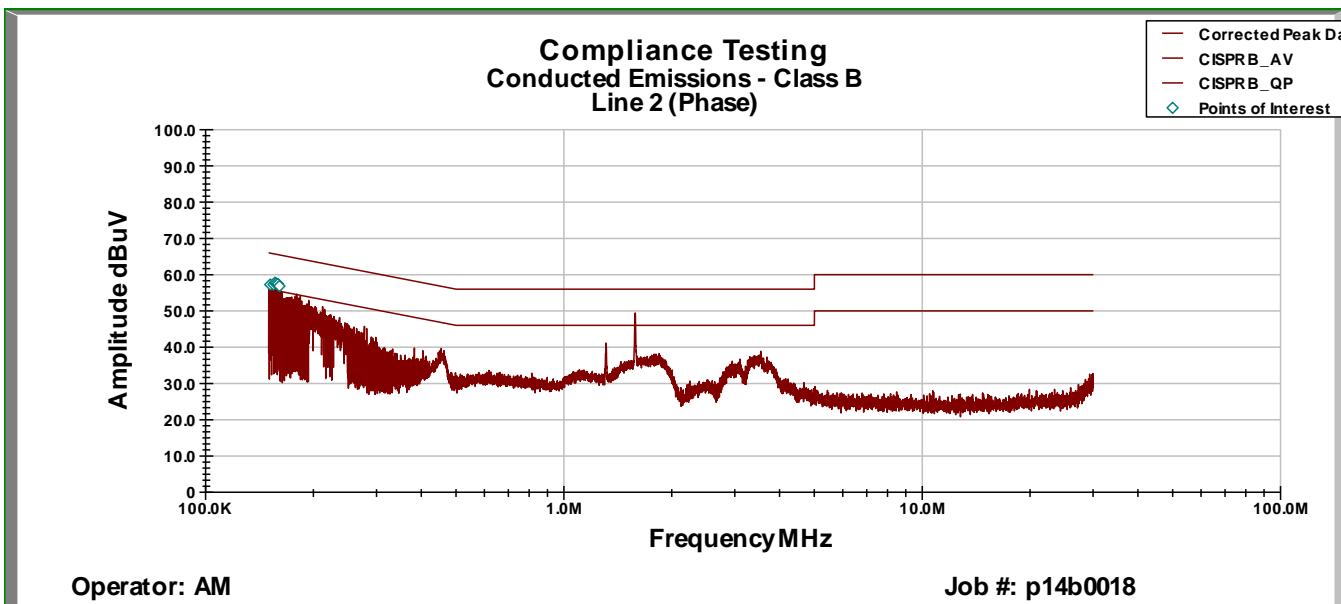
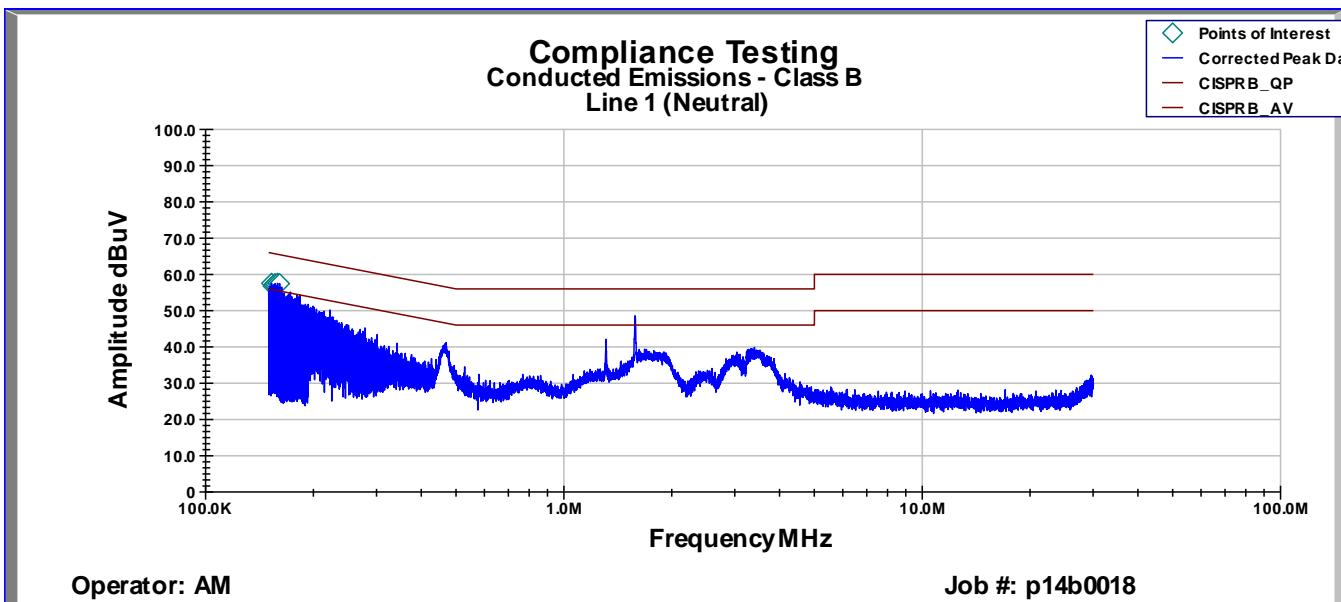
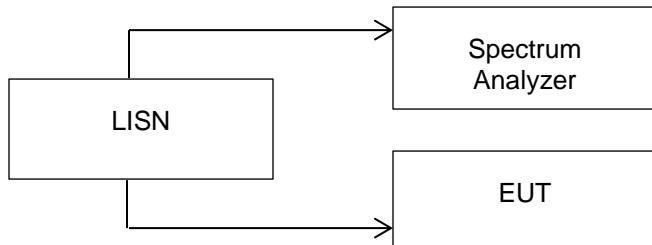


A/C Powerline Conducted Emissions

Engineer: Alex Macon

Test Date: 12/5/14

Test Setup



*The 1.31 MHz and 1.58 MHz emissions are ambient signals and are not created by the EUT



Line 1 Neutral Avg Detector

| Frequency | Measured Value (dBuV) | LISN Correction Factor (dB) | Cable Loss (dB) | Transient Limiter (dB) | Final Data (dBuV) | Limit (dBuV) | Avg Margin (dB) |
|------------|-----------------------|-----------------------------|-----------------|------------------------|-------------------|--------------|-----------------|
| 157.26 KHz | 25.65 | 0.23 | 0.02 | 10.2 | 36.097 | 55.793 | -19.695 |
| 155.65 KHz | 26.63 | 0.24 | 0.02 | 10.2 | 37.09 | 55.839 | -18.748 |
| 155.38 KHz | 25.79 | 0.25 | 0.02 | 10.2 | 36.253 | 55.846 | -19.593 |
| 153.41 KHz | 25.73 | 0.27 | 0.02 | 10.2 | 36.216 | 55.903 | -19.687 |
| 152.74 KHz | 24.89 | 0.27 | 0.02 | 10.2 | 35.379 | 55.922 | -20.542 |
| 151.73 KHz | 24.71 | 0.28 | 0.02 | 10.2 | 35.216 | 55.951 | -20.735 |

Line 2 Phase Avg Detector

| Frequency | Measured Value (dBuV) | LISN Correction Factor (dB) | Cable Loss (dB) | Transient Limiter (dB) | Final Data (dBuV) | Limit (dBuV) | Avg Margin (dB) |
|------------|-----------------------|-----------------------------|-----------------|------------------------|-------------------|--------------|-----------------|
| 157.73 KHz | 25.97 | 0.22 | 0.02 | 10.2 | 36.413 | 55.779 | -19.366 |
| 157.26 KHz | 26.73 | 0.23 | 0.02 | 10.2 | 37.177 | 55.793 | -18.615 |
| 156.6 KHz | 25.91 | 0.23 | 0.02 | 10.2 | 36.361 | 55.811 | -19.451 |
| 155.49 KHz | 26.52 | 0.25 | 0.02 | 10.2 | 36.988 | 55.843 | -18.855 |
| 152.56 KHz | 25.3 | 0.27 | 0.02 | 10.2 | 35.791 | 55.927 | -20.136 |
| 150.41 KHz | 24.19 | 0.3 | 0.02 | 10.2 | 34.709 | 55.988 | -21.279 |

Line 1 Neutral QP Detector

| Frequency | Measured Value (dBuV) | LISN Correction Factor (dB) | Cable Loss (dB) | Transient Limiter (dB) | Final Data (dBuV) | Limit (dBuV) | QP Margin (dB) |
|------------|-----------------------|-----------------------------|-----------------|------------------------|-------------------|--------------|----------------|
| 157.26 KHz | 45.09 | 0.227 | 0.02 | 10.2 | 55.537 | 65.793 | -10.255 |
| 155.65 KHz | 45.24 | 0.244 | 0.02 | 10.2 | 55.704 | 65.839 | -10.135 |
| 155.38 KHz | 45.42 | 0.246 | 0.02 | 10.2 | 55.886 | 65.846 | -9.96 |
| 153.41 KHz | 45.03 | 0.266 | 0.02 | 10.2 | 55.516 | 65.903 | -10.387 |
| 152.74 KHz | 44.11 | 0.273 | 0.02 | 10.2 | 54.603 | 65.922 | -11.319 |
| 151.73 KHz | 44.38 | 0.283 | 0.02 | 10.2 | 54.883 | 65.951 | -11.068 |

Line 2 Phase QP Detector

| Frequency | Measured Value (dBuV) | LISN Correction Factor (dB) | Cable Loss (dB) | Transient Limiter (dB) | Final Data (dBuV) | Limit (dBuV) | QP Margin (dB) |
|------------|-----------------------|-----------------------------|-----------------|------------------------|-------------------|--------------|----------------|
| 157.73 KHz | 45.61 | 0.22 | 0.02 | 10.2 | 56.053 | 65.779 | -9.726 |
| 157.26 KHz | 44.87 | 0.23 | 0.02 | 10.2 | 55.317 | 65.793 | -10.475 |
| 156.6 KHz | 45.2 | 0.23 | 0.02 | 10.2 | 55.654 | 65.811 | -10.157 |
| 155.49 KHz | 44.86 | 0.25 | 0.02 | 10.2 | 55.325 | 65.843 | -10.518 |
| 152.56 KHz | 43.85 | 0.27 | 0.02 | 10.2 | 54.344 | 65.927 | -11.582 |
| 150.41 KHz | 43.34 | 0.3 | 0.02 | 10.2 | 53.856 | 65.988 | -12.132 |



Test Equipment Utilized

| Description | Manufacturer | Model # | CT Asset # | Last Cal Date | Cal Due Date |
|-------------------------------|--------------|-------------------------------|------------|---------------------|--------------|
| EMI Receiver | HP | 8546A | i00033 | 3/29/16 | 3/29/17 |
| Horn Antenna | EMCO | 3115 | i00103 | 1/20/15 | 1/20/17 |
| High Pass Filter | Trilithic | 4HX3400-3-XX | i00177 | Verified on: 1/6/16 | |
| Horn Antenna, Amplified | ARA | DRG-118/A | i00271 | 5/8/14 | 5/8/16 |
| Horn Antenna, Amplified | ARA | MWH-1826/B | i00273 | 4/22/15 | 4/22/18 |
| Humidity / Temp Meter | Newport | IBTHX-W-5 | i00282 | 4/1/15 | 4/1/16 |
| Spectrum Analyzer | Agilent | E4407B | i00331 | 9/18/15 | 9/18/16 |
| Bi-Log Antenna | Schaffner | CBL 6111D | i00349 | 10/19/15 | 10/19/17 |
| EMI Analyzer | Agilent | E7405A | i00379 | 2/11/16 | 2/11/17 |
| 3 Meter Semi-Anechoic Chamber | Panashield | 3 Meter Semi-Anechoic Chamber | i00428 | 7/27/14 | 7/27/16 |
| LISN | COM-Power | LI-125 | i00446 | 7/25/14 | 7/25/15 |
| LISN | COM-Power | LI-125A | i00447 | 7/25/14 | 7/25/15 |

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