

# Enlighted, Inc.

ADDENDUM EMC TEST REPORT TO 97329-6

**Gateway**  
**Model: GW-2-01**  
**2.4GHz Swivel Antenna-151 Model**  
**Model: S151AH-07826**

**Tested To The Following Standard:**

**FCC Part 15 Subpart C Section**  
**15.247**  
**(DTS 2400-2483.5 MHz)**

**Report No.: 97329-6A**

**Date of issue: August 10, 2015**



This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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## ADMINISTRATIVE INFORMATION

### Test Report Information

**REPORT PREPARED FOR:**

Enlighted, Inc.  
930 Benecia Ave.  
Sunnyvale, CA 94085

**REPORT PREPARED BY:**

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REPRESENTATIVE: Deepak Kumar  
Customer Reference Number: 0002568

Project Number: 97329

**DATE OF EQUIPMENT RECEIPT:**

July 6, 2015

**DATE(S) OF TESTING:**

July 6-8, 2015

### Revision History

**Original:** Testing of the Gateway Model: GW-2-01, 2.4GHz Swivel Antenna-151 Model, Model: S151AH-07826 to FCC Part 15 Subpart C Section 15.247 (DTS 2400-2483.5 MHz).

**Addendum A:** The addendum is to clarify the resolution bandwidth used during testing for 1-25GHz.

### Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



**Steve Behm**  
*Director of Quality Assurance & Engineering Services*  
*CKC Laboratories, Inc.*

## Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):  
CKC Laboratories, Inc.  
1120 Fulton Place  
Fremont, CA 94539

## Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.02.00
EMITest Immunity	5.02.00

## Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Fremont	US0082	SL2-IN-E-1148R	3082B-1	958979	A-0149

## SUMMARY OF RESULTS

### Standard / Specification: FCC Part 15 Subpart C

Test Procedure	Description	Modifications	Results
15.247(a)(2)	6dB Bandwidth	NA	NP
15.247(b)(3)	Output Power	NA	Pass
15.247(e)	Power Spectral Density	NA	NP
15.247(d)	RF Conducted Emissions & Band Edge	NA	NP
15.247(d)	Radiated Emissions & Band Edge	NA	Pass

NA = Not applicable.

NP = Not performed because the data included in this report comprises a supplemental demonstration of continued compliance for the equipment identified herein. Only those tests which were determined to be necessary are included.

### Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
No modifications were made during testing.

**Modifications listed above must be incorporated into all production units.**

### Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
Partial testing is being performed on a previously tested EUT because the antenna has changed.

## EQUIPMENT UNDER TEST (EUT)

During testing numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

### Configuration 1

#### *Equipment Tested:*

Device	Manufacturer	Model #	S/N
Gateway	Enlighted, Inc.	GW-2-01	6854F5FFF245
2.4GHz Swivel Antenna-151 Model	NEARSON	S151AH-07826	NA

#### *Support Equipment:*

Device	Manufacturer	Model #	S/N
AC/ DC Adaptor for Laptop	Lenovo	42T4434	NA
Laptop	Lenovo	T420	NA
AC/DC Power Adapter for Prosafe	NETGEAR	NU60-F480125-I1NN	24143018110290054N
Prosafe 8 port 10/100Mbps Switch with PoE	NETGEAR	FS108p	3BN14871809C2

# FCC PART 15 SUBPART C

## 15.247(b)(3) Output Power

### Test Conditions / Setup / Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170  
 Customer: **Enlighted, Inc.**  
 Specification: **15.247(b) Power Output (2400-2483.5 MHz DTS)**  
 Work Order #: **97329** Date: 7/6/2015  
 Test Type: **Conducted Power Measurement** Time: 17:32:04  
 Tested By: Hieu Song Nguyenpham Sequence#: 2  
 Software: EMITest 5.02.00

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

Fundamental of the EUT

Application: PuTTY version 0.64 for Zigbee

Temperature: 22.7°C  
 Humidity: 46 %  
 Atmospheric Pressure: 100.3 kPa

High Clock: 16MHz  
 Transmitting operating frequency= 2.4GHz Band  
 Gain of the antenna for Zigbee= 5dBi  
 Number of Channel=16  
 Method: 558074 D01 DTS Meas Guidance v03r02 section 9.1.1

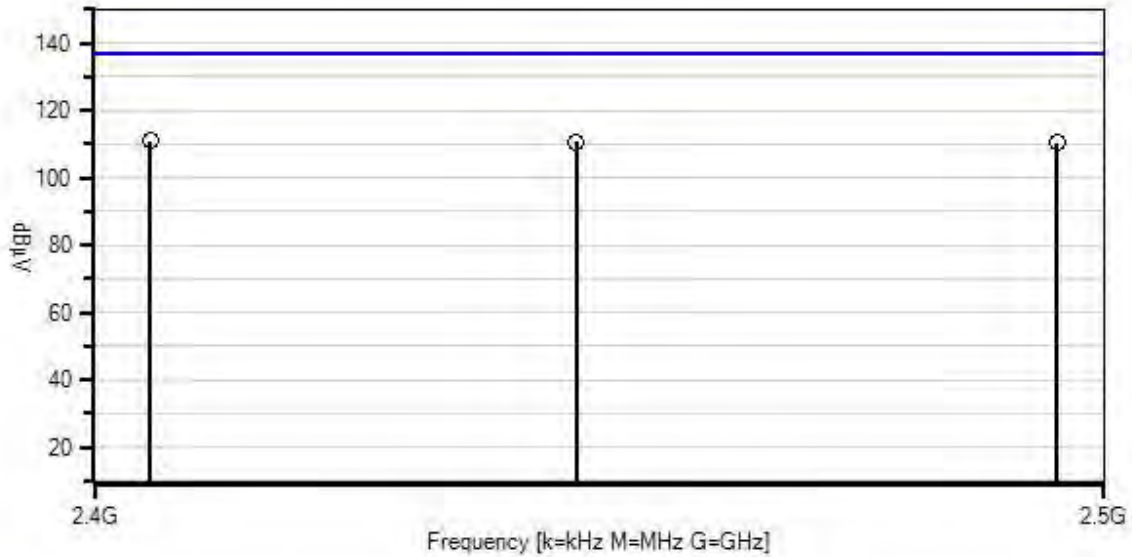
The EUT is placed and connected straight to the spectrum analyzer. It is powered through an Ethernet cable. The transmitter is in continuous Tx Mode fully modulated. The Ethernet port is connected to passive power over Ethernet device. The debug port is connected to the laptop via serial to an USB adapter to control the EUT for testing purpose.

RBW=3MHz  
 VBW =8MHz

**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	ANP01211	Attenuator	23-10-34	3/31/2015	3/31/2017
	AN03471	RF Characteristics Analyzer	E4440A	12/19/2013	12/19/2015

Enlighted, Inc WO#: 97329 Sequence#: 2 Date: 7/6/2015  
 15.247(b) Power Output (2400-2483.5 MHz DTS) Test Distance: None None

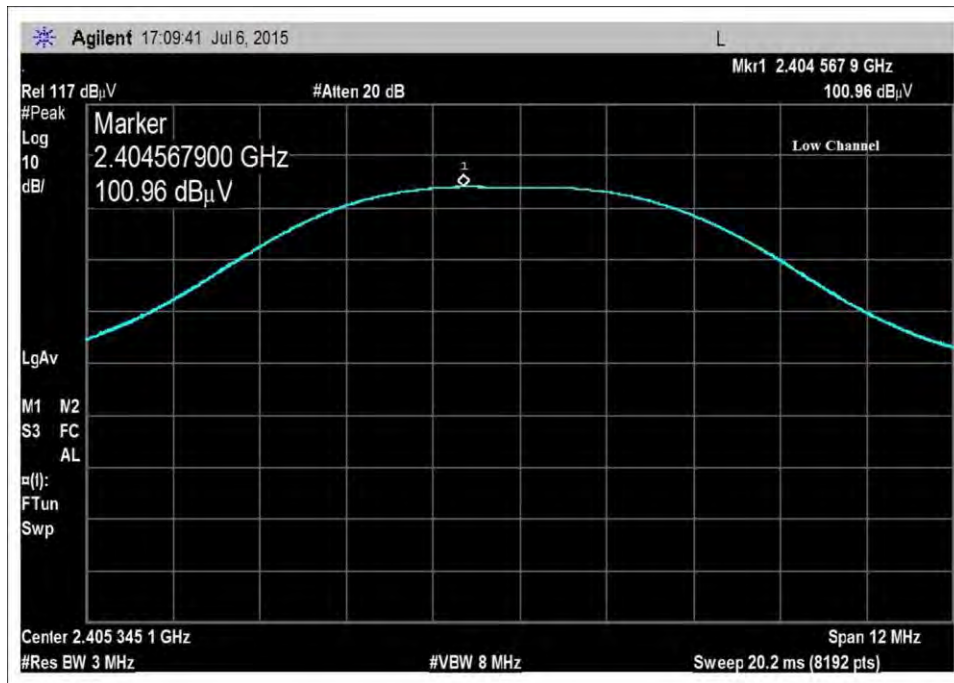


- Readings
- × QP Readings
- ▼ Ambient
- 1 - 15.247(b) Power Output (2400-2483.5 MHz DTS)
- Peak Readings
- \* Average Readings
- Software Version: 5.02.00

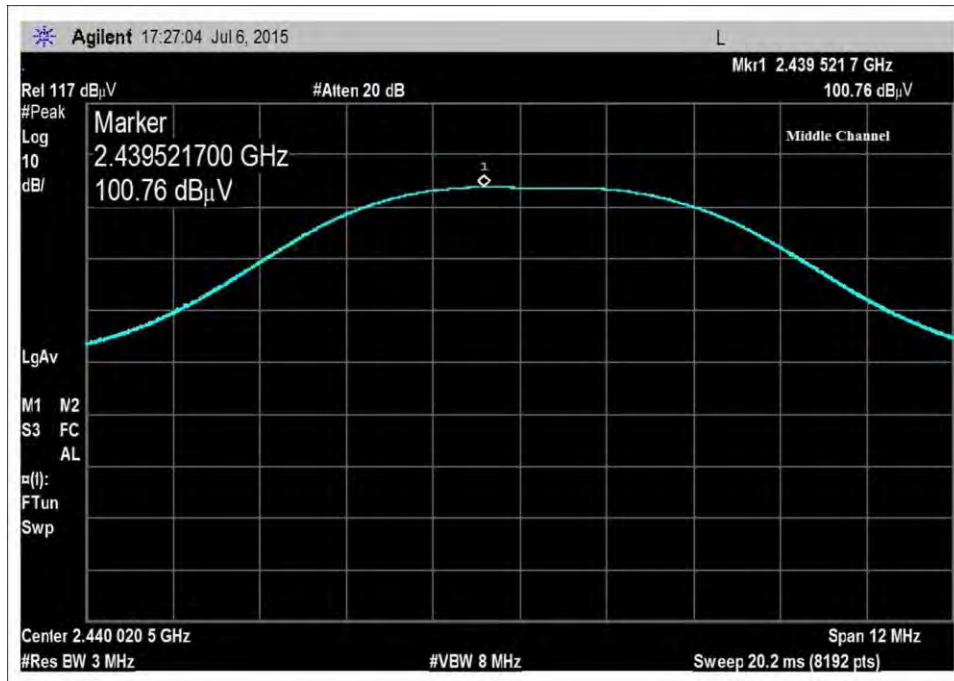


**Convert equivalent electric field strength to the resultant power level**

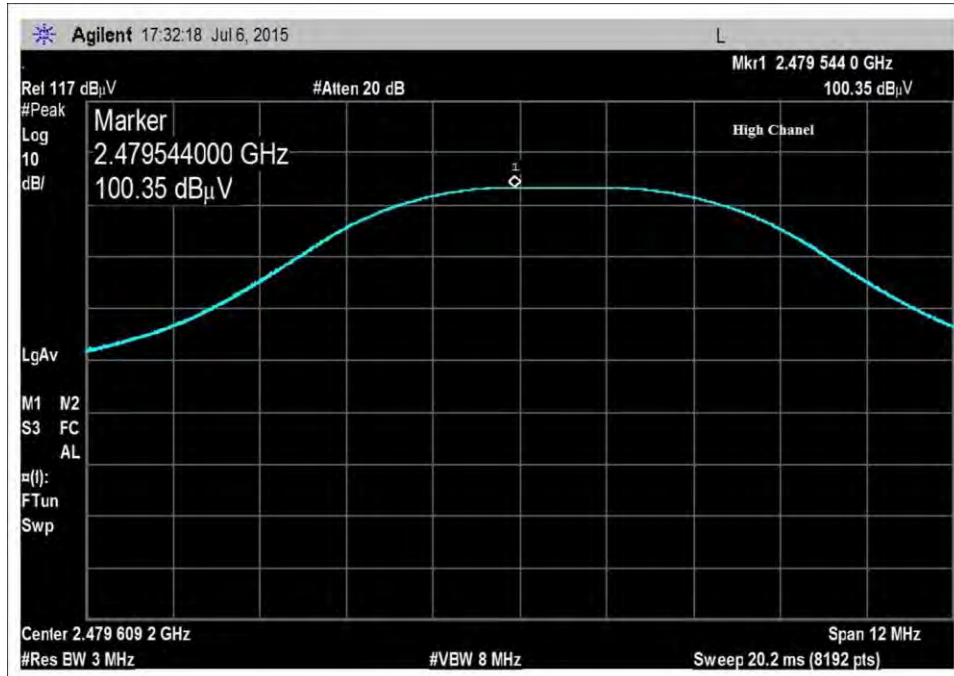
Frequency (MHz)	Measured Power in Watt	Power Limit in Watt	Pass/Fail
Low Channel	0.002511886	1.00	Pass
Middle Channel	0.002398833	1.00	Pass
High Channel	0.002187762	1.00	Pass



Low Channel



Middle Channel



High Channel

**Test Setup Photos**



**15.247(d) Radiated Emissions & Band Edge**

**Test Conditions / Setup / Data**

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170  
 Customer: **Enlighted, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **97329** Date: 7/8/2015  
 Test Type: **Radiated Measurement** Time: 10:39:57  
 Tested By: Hieu Song Nguyenpham Sequence#: 42  
 Software: EMITest 5.02.00

**Equipment Tested:**

Device	Manufacturer	Model #	S/N
Configuration 1			

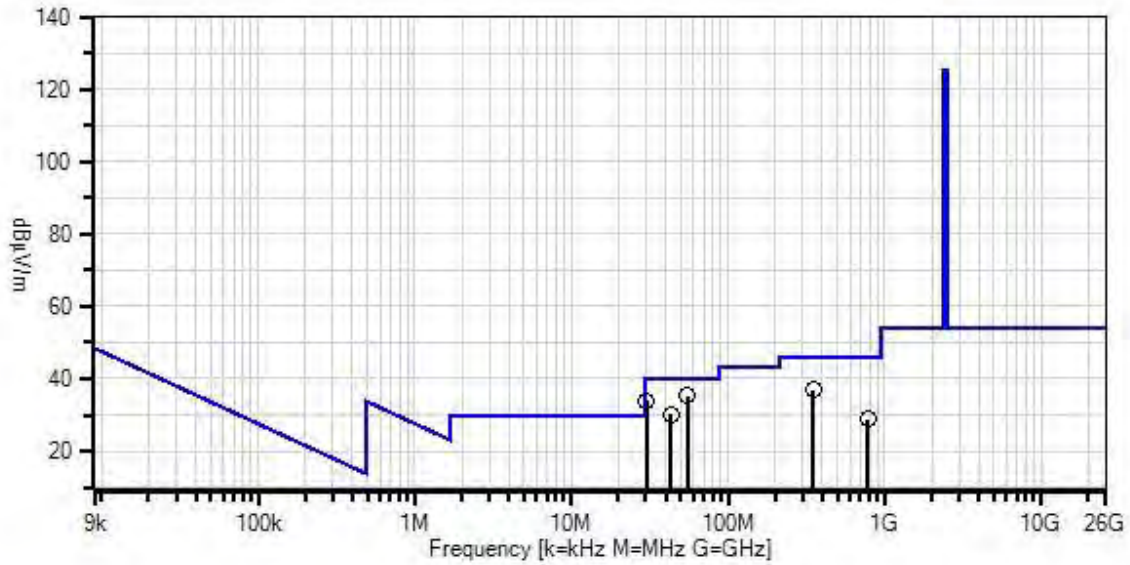
**Support Equipment:**

Device	Manufacturer	Model #	S/N
Configuration 1			

**Test Conditions / Notes:**

Radiated Emission  
 Frequency Range: 9kHz to 1000MHz  
 Application: PuTTY version 0.64 for Zigbee  
 Temperature: 22.7°C  
 Humidity: 46 %  
 Atmospheric Pressure: 100.3 kPa  
 High Clock: 16MHz  
 Transmitting operating frequency= 2.4GHz Band  
 Gain of the antenna for Zigbee= 5dBi  
 Number of Channel=16  
 Method: KDB 558074 v03r02 section 12.1 and ANSI C63.4 2009  
 Frequency range of measurement = 9kHz - 1GHz.  
 9kHz - 150kHz RBW=200Hz VBW=200Hz  
 150kHz - 30MHz RBW=9kHz VBW=9kHz  
 30MHz - 1000MHz RBW=120kHz VBW=120kHz  
 The EUT is placed on an 80cm Styrofoam table. It is powered through an Ethernet cable. The transmitter is in continuous Tx Mode fully modulated. The Ethernet port is connected to passive power over Ethernet device which is outside the chamber. The debug port is connected to the laptop which also is outside the chamber via serial to an USB adapter to control the EUT for testing purpose.  
**Low Channel**

Enlighted, Inc WO#: 97329 Sequence#: 42 Date: 7/8/2015  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



- Readings
  - × QP Readings
  - ▼ Ambient
  - 1 - 15.247(d) / 15.209 Radiated Spurious Emissions
  - Peak Readings
  - \* Average Readings
- Software Version: 5.02.00

**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	AN00686	Preamp	8447D Opt 010	5/27/2014	5/27/2016
	AN00432	Loop Antenna	6502	5/8/2015	5/8/2017
T2	AN00852	Biconilog Antenna	CBL 6111C	11/24/2014	11/24/2016
T3	ANP00880	Cable	RG214U	6/13/2014	6/13/2016
T4	ANP01183	Cable	CNT-195	9/3/2013	9/3/2015
T5	ANP06691	Cable	PE3062-180	8/8/2014	8/8/2016
	AN03471	RF Characteristics Analyzer	E4440A	12/19/2013	12/19/2015

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB $\mu$ V	T5				Table	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
			dB	dB	dB	dB					
1	55.488M	56.2	-29.3 +0.2	+7.4	+0.6	+0.2	+0.0	35.3	40.0	-4.7	Vert
2	30.333M	43.9	-29.4 +0.2	+18.7	+0.4	+0.2	+0.0	34.0	40.0	-6.0	Vert
3	350.002M	47.2	-28.6 +0.7	+15.0	+1.8	+0.7	+0.0	36.8	46.0	-9.2	Vert
4	43.509M	46.3	-29.3 +0.2	+12.1	+0.6	+0.3	+0.0	30.2	40.0	-9.8	Vert
5	785.557M	31.1	-29.5 +1.3	+21.7	+2.9	+1.2	+0.0	28.7	46.0	-17.3	Horiz

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170  
 Customer: **Enlighted, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **97329** Date: 7/7/2015  
 Test Type: **Radiated Measurement** Time: 09:59:52  
 Tested By: Hieu Song Nguyenpham Sequence#: 10  
 Software: EMITest 5.02.00

**Equipment Tested:**

Device	Manufacturer	Model #	S/N
Configuration 1			

**Support Equipment:**

Device	Manufacturer	Model #	S/N
Configuration 1			

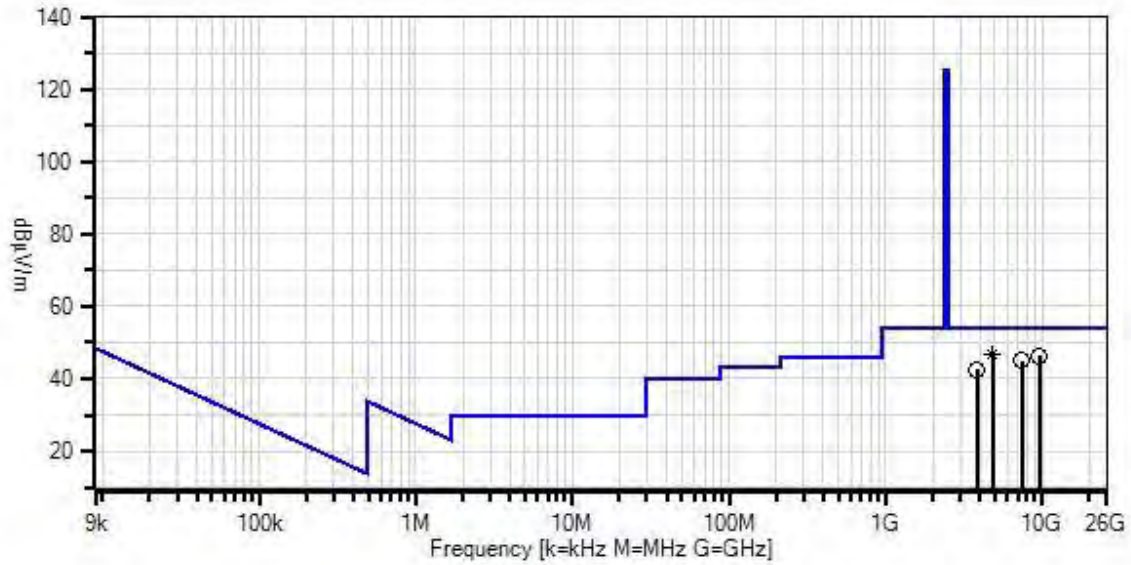
**Test Conditions / Notes:**

Radiated Emission  
 Frequency Range: 1000MHz to 25000MHz  
 Application: PuTTY version 0.64 for Zigbee  
 Temperature: 22.7°C  
 Humidity: 46 %  
 Atmospheric Pressure: 100.3 kPa  
 High Clock: 16MHz  
 Transmitting operating frequency= 2.4GHz Band  
 Gain of the antenna for Zigbee= 5dBi  
 Number of Channel=16  
 Method: KDB 558074 v03r02 section 12.1 and ANSI C63.10 (2009)  
 RBW=VBW=1MHz

The EUT is placed on an 80cm Styrofoam table. It is powered through an Ethernet cable. The transmitter is in continuous Tx Mode fully modulated. The Ethernet port is connected to passive power over Ethernet device which is outside the chamber. The debug port is connected to the laptop which also is outside the chamber via serial to an USB adapter to control the EUT for testing purpose.

**Low Channel**

Enlighted, Inc WO#: 97329 Sequence#: 10 Date: 7/7/2015  
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



- Readings
  - × QP Readings
  - ▼ Ambient
  - Peak Readings
  - \* Average Readings
- 1 - 15.247(d) / 15.209 Radiated Spurious Emissions
- Software Version: 5.02.00



**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna-ANSI C63.5 Calibration	3115	12/2/2014	12/2/2016
T2	AN03302	Cable	32026-29094K-29094K-72TC	3/24/2014	3/24/2016
T3	AN03114	Preamp	AMF-7D-00101800-30-10P	4/22/2015	4/22/2017
T4	AN03143	Cable	32022-29094K-144TC	3/18/2015	3/18/2017
	ANP00928	Cable	various	1/23/2014	1/23/2016
	ANP00929	Cable	various	1/23/2014	1/23/2016
T5	ANP06126	Cable	32022-29094K-29094K-168TC	3/18/2015	3/18/2017
T6	ANP06712	Cable	32022-29094K-29094K-48TC	9/18/2014	9/18/2016
T7	AN03309	High Pass Filter	11SH10-3000/T10000-O/O	4/2/2014	4/2/2016
	AN03471	RF Characteristics Analyzer	E4440A	12/19/2013	12/19/2015
	AN02693	Active Horn Antenna-ANSI C63.5 3m	AMFW-5F-12001800-20-10P	5/6/2015	5/6/2017
	AN02694	Horn Antenna-ANSI C63.5 3m	AMFW-5F-18002650-20-10P	5/7/2015	5/7/2017

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB $\mu$ V	T5	T6	T7		Table	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
1	4811.305M	61.6	+33.2	+1.7	-57.8	+2.9	+0.0	46.5	54.0	-7.5	Vert
	Ave		+3.6	+1.1	+0.2						
^	4811.305M	68.7	+33.2	+1.7	-57.8	+2.9	+0.0	53.6	54.0	-0.4	Vert
			+3.6	+1.1	+0.2						
3	9652.168M	51.1	+38.7	+2.4	-57.3	+4.3	+0.0	46.3	54.0	-7.7	Vert
			+5.3	+1.6	+0.2						
4	7394.243M	54.6	+36.6	+2.1	-58.3	+3.7	+0.0	44.9	54.0	-9.1	Horiz
			+4.6	+1.4	+0.2						
5	3840.025M	60.7	+32.5	+1.5	-58.9	+2.5	+0.0	42.6	54.0	-11.4	Vert
			+3.1	+0.9	+0.3						

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170  
 Customer: **Enlighted, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **97329** Date: 7/8/2015  
 Test Type: **Radiated Measurement** Time: 11:01:39  
 Tested By: Hieu Song Nguyenpham Sequence#: 45  
 Software: EMITest 5.02.00

**Equipment Tested:**

Device	Manufacturer	Model #	S/N
Configuration 1			

**Support Equipment:**

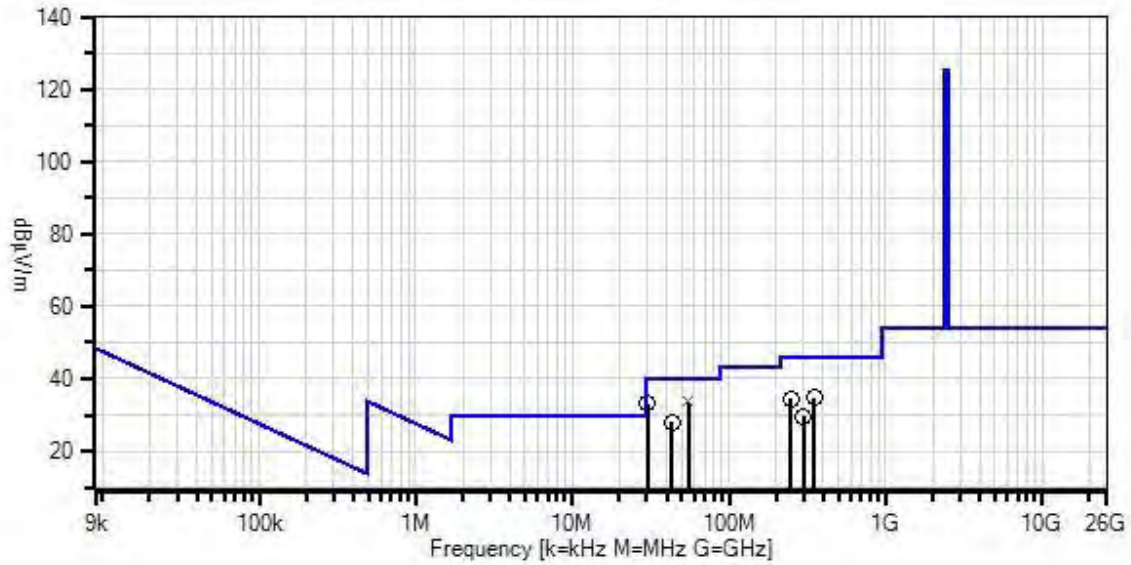
Device	Manufacturer	Model #	S/N
Configuration 1			

**Test Conditions / Notes:**

Radiated Emission  
 Frequency Range: 9kHz to 1000MHz  
 Application: PuTTY version 0.64 for Zigbee  
 Temperature: 22.7C  
 Humidity: 46 %  
 Atmospheric Pressure: 100.3 kPa  
 High Clock: 16MHz  
 Transmitting operating frequency= 2.4GHz Band  
 Gain of the antenna for Zigbee= 5dBi  
 Number of Channel=16  
 Method: KDB 558074 v03r02 section 12.1 and ANSI C63.4 2009  
 Frequency range of measurement = 9 kHz- 1GHz.  
 9kHz - 150kHz RBW=200Hz VBW=200Hz  
 150kHz - 30MHz RBW=9kHz VBW=9kHz  
 30MHz - 1000MHz RBW=120kHz VBW=120kHz  
 The EUT is placed on an 80cm Styrofoam table. It is powered through an Ethernet cable. The transmitter is in continuous Tx Mode fully modulated. The Ethernet port is connected to passive power over Ethernet device which is outside the chamber. The debug port is connected to the laptop which also is outside the chamber via serial to an USB adapter to control the EUT for testing purpose.

**Middle Channel**

Enlighted, Inc WO#: 97329 Sequence#: 45 Date: 7/8/2015  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



- Readings
  - × QP Readings
  - ▼ Ambient
  - Peak Readings
  - \* Average Readings
- 1 - 15.247(d) / 15.209 Radiated Spurious Emissions
- Software Version: 5.02.00

**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	AN00686	Preamp	8447D Opt 010	5/27/2014	5/27/2016
	AN00432	Loop Antenna	6502	5/8/2015	5/8/2017
T2	AN00852	Biconilog Antenna	CBL 6111C	11/24/2014	11/24/2016
T3	ANP00880	Cable	RG214U	6/13/2014	6/13/2016
T4	ANP01183	Cable	CNT-195	9/3/2013	9/3/2015
T5	ANP06691	Cable	PE3062-180	8/8/2014	8/8/2016
	AN03471	RF Characteristics Analyzer	E4440A	12/19/2013	12/19/2015

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB $\mu$ V	T5 dB	dB	dB	dB	Table	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
1	55.459M	54.5	-29.3 +0.2	+7.5	+0.6	+0.2	+0.0	33.7	40.0	-6.3	Vert
^	55.459M	59.1	-29.3 +0.2	+7.5	+0.6	+0.2	+0.0	38.3	40.0	-1.7	Vert
3	30.042M	42.7	-29.4 +0.2	+18.9	+0.4	+0.3	+0.0	33.1	40.0	-6.9	Vert
4	350.090M	45.2	-28.6 +0.7	+15.0	+1.8	+0.7	+0.0	34.8	46.0	-11.2	Vert
5	249.985M	47.5	-28.5 +0.6	+12.8	+1.5	+0.7	+0.0	34.6	46.0	-11.4	Horiz
6	43.509M	44.2	-29.3 +0.2	+12.1	+0.6	+0.3	+0.0	28.1	40.0	-11.9	Vert
7	300.038M	41.8	-28.4 +0.7	+13.3	+1.7	+0.6	+0.0	29.7	46.0	-16.3	Horiz

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170  
 Customer: **Enlighted, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **97329** Date: 7/7/2015  
 Test Type: **Radiated Measurement** Time: 10:36:52  
 Tested By: Hieu Song Nguyenpham Sequence#: 13  
 Software: EMITest 5.02.00

**Equipment Tested:**

Device	Manufacturer	Model #	S/N
Configuration 1			

**Support Equipment:**

Device	Manufacturer	Model #	S/N
Configuration 1			

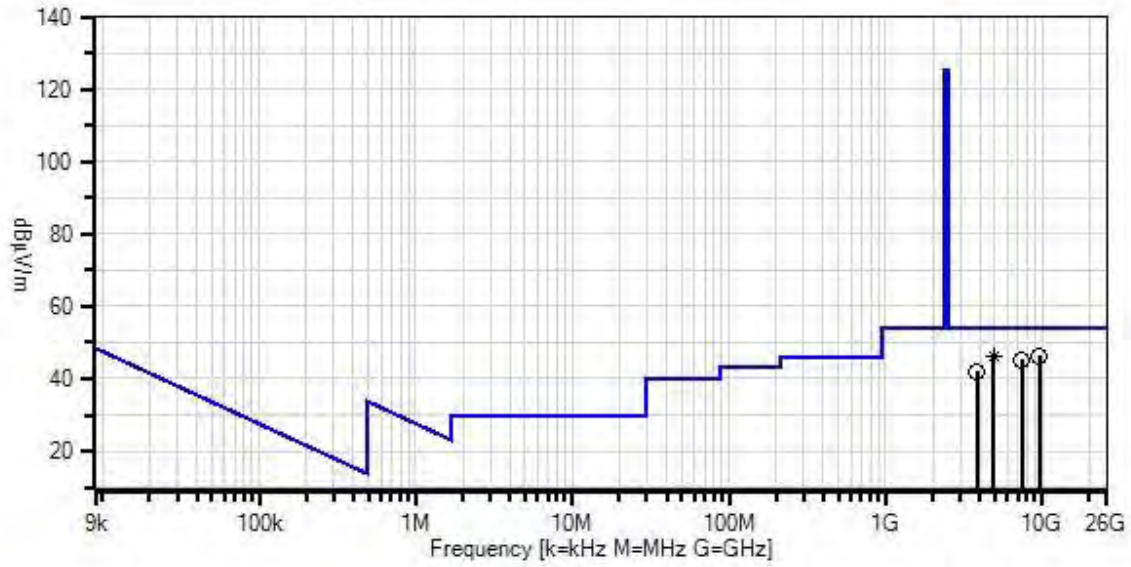
**Test Conditions / Notes:**

Radiated Emission  
 Frequency Range: 1000MHz to 25000MHz  
 Application: PuTTY version 0.64 for Zigbee  
 Temperature: 22.7°C  
 Humidity: 46 %  
 Atmospheric Pressure: 100.3 kPa  
 High Clock: 16MHz  
 Transmitting operating frequency= 2.4GHz Band  
 Gain of the antenna for Zigbee= 5dBi  
 Number of Channel=16  
 Method: KDB 558074 v03r02 section 12.1 and ANSI C63.10 (2009)  
 RBW=VBW=1MHz

The EUT is placed on an 80cm Styrofoam table. It is powered through an Ethernet cable. The transmitter is in continuous Tx Mode fully modulated. The Ethernet port is connected to passive power over Ethernet device which is outside the chamber. The debug port is connected to the laptop which also is outside the chamber via serial to an USB adapter to control the EUT for testing purpose.

**Middle Channel**

Enlighted, Inc WO#: 97329 Sequence#: 13 Date: 7/7/2015  
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



— Readings  
 × QP Readings  
 ▼ Ambient  
 — 1 - 15.247(d) / 15.209 Radiated Spurious Emissions

○ Peak Readings  
 \* Average Readings  
 Software Version: 5.02.00

**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna-ANSI C63.5 Calibration	3115	12/2/2014	12/2/2016
T2	AN03302	Cable	32026-29094K-29094K-72TC	3/24/2014	3/24/2016
T3	AN03114	Preamp	AMF-7D-00101800-30-10P	4/22/2015	4/22/2017
T4	AN03143	Cable	32022-29094K-144TC	3/18/2015	3/18/2017
	ANP00928	Cable	various	1/23/2014	1/23/2016
	ANP00929	Cable	various	1/23/2014	1/23/2016
T5	ANP06126	Cable	32022-29094K-29094K-168TC	3/18/2015	3/18/2017
T6	ANP06712	Cable	32022-29094K-29094K-48TC	9/18/2014	9/18/2016
T7	AN03309	High Pass Filter	11SH10-3000/T10000-O/O	4/2/2014	4/2/2016
	AN03471	RF Characteristics Analyzer	E4440A	12/19/2013	12/19/2015
	AN02693	Active Horn Antenna-ANSI C63.5 3m	AMFW-5F-12001800-20-10P	5/6/2015	5/6/2017
	AN02694	Horn Antenna-ANSI C63.5 3m	AMFW-5F-18002650-20-10P	5/7/2015	5/7/2017

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB $\mu$ V	T5	T6	T7		Table	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
1	9652.168M	51.0	+38.7	+2.4	-57.3	+4.3	+0.0	46.2	54.0	-7.8	Vert
			+5.3	+1.6	+0.2						
2	4881.422M	60.9	+33.4	+1.7	-57.6	+2.9	+0.0	46.2	54.0	-7.8	Vert
	Ave		+3.6	+1.1	+0.2						
^	4881.422M	68.2	+33.4	+1.7	-57.6	+2.9	+0.0	53.5	54.0	-0.5	Vert
			+3.6	+1.1	+0.2						
4	7416.610M	54.8	+36.6	+2.1	-58.2	+3.7	+0.0	45.2	54.0	-8.8	Vert
			+4.6	+1.4	+0.2						
5	3840.025M	60.2	+32.5	+1.5	-58.9	+2.5	+0.0	42.1	54.0	-11.9	Vert
			+3.1	+0.9	+0.3						

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170  
 Customer: **Enlighted, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **97329** Date: 7/8/2015  
 Test Type: **Radiated Measurement** Time: 11:21:27  
 Tested By: Hieu Song Nguyenpham Sequence#: 48  
 Software: EMITest 5.02.00

**Equipment Tested:**

Device	Manufacturer	Model #	S/N
Configuration 1			

**Support Equipment:**

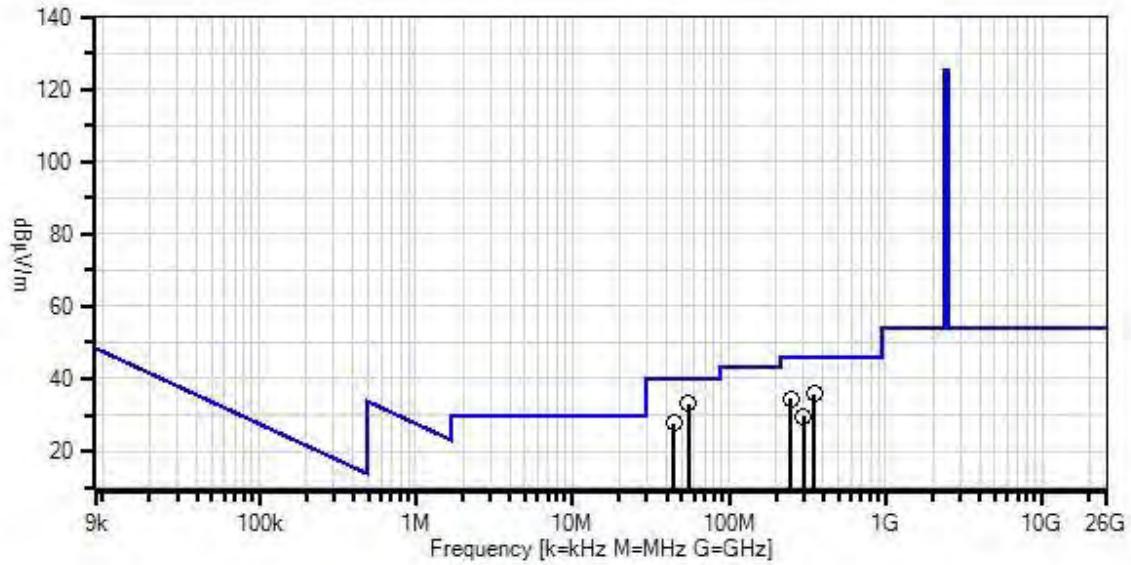
Device	Manufacturer	Model #	S/N
Configuration 1			

**Test Conditions / Notes:**

Radiated Emission  
 Frequency Range: 9kHz to 1000MHz  
  
 Application: PuTTY version 0.64 for Zigbee  
  
 Temperature: 22.7°C  
 Humidity: 46 %  
 Atmospheric Pressure: 100.3 kPa  
  
 High Clock: 16MHz  
 Transmitting operating frequency= 2.4GHz Band  
 Gain of the antenna for Zigbee= 5dBi  
 Number of Channel=16  
 Method: KDB 558074 v03r02 section 12.1 and ANSI C63.4 2009  
  
 Frequency range of measurement = 9 kHz - 1GHz.  
 9kHz - 150kHz      RBW=200Hz    VBW=200Hz  
 150kHz - 30MHz    RBW=9kHz      VBW=9kHz  
 30MHz - 1000MHz    RBW=120kHz    VBW=120kHz  
  
 The EUT is placed on an 80cm Styrofoam table. It is powered through an Ethernet cable. The transmitter is in continuous Tx Mode fully modulated. The Ethernet port is connected to passive power over Ethernet device which is outside the chamber. The debug port is connected to the laptop which also is outside the chamber via serial to an USB adapter to control the EUT for testing purpose.  
  
**High Channel**



Enlighted, Inc WO#: 97329 Sequence#: 48 Date: 7/8/2015  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



- Readings
  - × QP Readings
  - ▼ Ambient
  - Peak Readings
  - \* Average Readings
- 1 - 15.247(d) / 15.209 Radiated Spurious Emissions
- Software Version: 5.02.00

**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	AN00686	Preamp	8447D Opt 010	5/27/2014	5/27/2016
	AN00432	Loop Antenna	6502	5/8/2015	5/8/2017
T2	AN00852	Biconilog Antenna	CBL 6111C	11/24/2014	11/24/2016
T3	ANP00880	Cable	RG214U	6/13/2014	6/13/2016
T4	ANP01183	Cable	CNT-195	9/3/2013	9/3/2015
T5	ANP06691	Cable	PE3062-180	8/8/2014	8/8/2016
	AN03471	RF Characteristics Analyzer	E4440A	12/19/2013	12/19/2015

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB $\mu$ V	T5 dB	dB	dB	dB	Table	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
1	55.461M	54.0	-29.3 +0.2	+7.5	+0.6	+0.2	+0.0	33.2	40.0	-6.8	Vert
2	350.090M	46.1	-28.6 +0.7	+15.0	+1.8	+0.7	+0.0	35.7	46.0	-10.3	Vert
3	249.985M	47.5	-28.5 +0.6	+12.8	+1.5	+0.7	+0.0	34.6	46.0	-11.4	Horiz
4	44.393M	44.2	-29.3 +0.2	+11.7	+0.6	+0.3	+0.0	27.7	40.0	-12.3	Vert
5	300.038M	41.8	-28.4 +0.7	+13.3	+1.7	+0.6	+0.0	29.7	46.0	-16.3	Horiz

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170  
 Customer: **Enlighted, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **97329** Date: 7/7/2015  
 Test Type: **Radiated Measurement** Time: 10:53:47  
 Tested By: Hieu Song Nguyenpham Sequence#: 16  
 Software: EMITest 5.02.00

**Equipment Tested:**

Device	Manufacturer	Model #	S/N
Configuration 1			

**Support Equipment:**

Device	Manufacturer	Model #	S/N
Configuration 1			

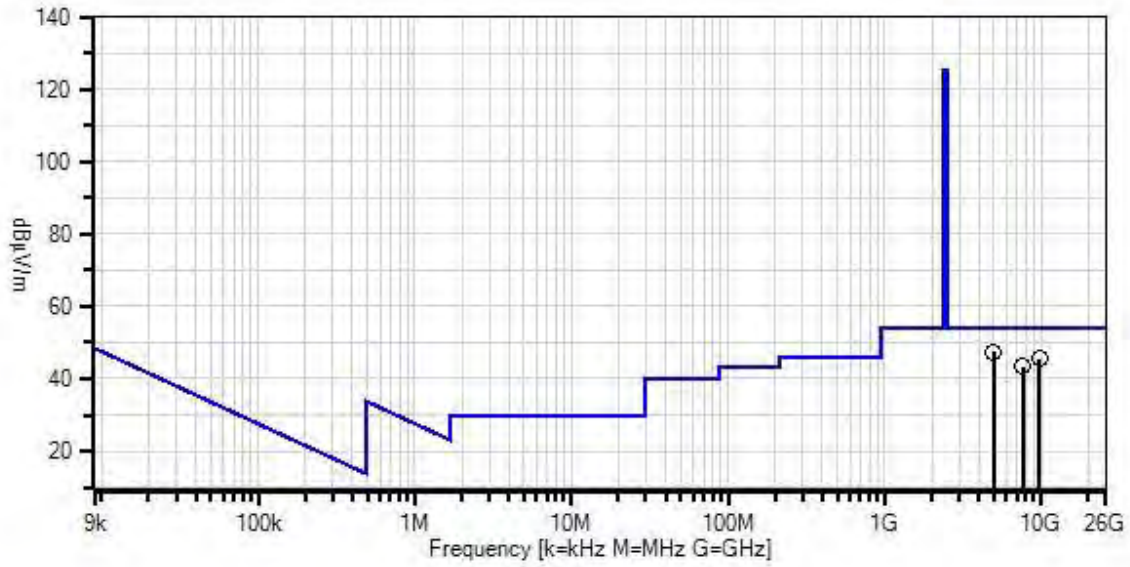
**Test Conditions / Notes:**

Radiated Emission  
 Frequency Range: 1000MHz to 25000MHz  
 Application: PuTTY version 0.64 for Zigbee  
 Temperature: 22.7°C  
 Humidity: 46 %  
 Atmospheric Pressure: 100.3 kPa  
 High Clock: 16MHz  
 Transmitting operating frequency= 2.4GHz Band  
 Gain of the antenna for Zigbee= 5dBi  
 Number of Channel=16  
 Method: KDB 558074 v03r02 section 12.1 and ANSI C63.10 (2009)  
 RBW=VBW=1MHz

The EUT is placed on an 80cm Styrofoam table. It is powered through an Ethernet cable. The transmitter is in continuous Tx Mode fully modulated. The Ethernet port is connected to passive power over Ethernet device which is outside the chamber. The debug port is connected to the laptop which also is outside the chamber via serial to an USB adapter to control the EUT for testing purpose.

**High Channel**

Enlighted, Inc WO#: 97329 Sequence#: 16 Date: 7/7/2015  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



- Readings
  - × QP Readings
  - ▼ Ambient
  - Peak Readings
  - \* Average Readings
- 1 - 15.247(d) / 15.209 Radiated Spurious Emissions  
 Software Version: 5.02.00

**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna-ANSI C63.5 Calibration	3115	12/2/2014	12/2/2016
T2	AN03302	Cable	32026-29094K-29094K-72TC	3/24/2014	3/24/2016
T3	AN03114	Preamp	AMF-7D-00101800-30-10P	4/22/2015	4/22/2017
T4	AN03143	Cable	32022-29094K-144TC	3/18/2015	3/18/2017
	ANP00928	Cable	various	1/23/2014	1/23/2016
	ANP00929	Cable	various	1/23/2014	1/23/2016
T5	ANP06126	Cable	32022-29094K-29094K-168TC	3/18/2015	3/18/2017
T6	ANP06712	Cable	32022-29094K-29094K-48TC	9/18/2014	9/18/2016
T7	AN03309	High Pass Filter	11SH10-3000/T10000-O/O	4/2/2014	4/2/2016
	AN03471	RF Characteristics Analyzer	E4440A	12/19/2013	12/19/2015
	AN02693	Active Horn Antenna-ANSI C63.5 3m	AMFW-5F-12001800-20-10P	5/6/2015	5/6/2017
	AN02694	Horn Antenna-ANSI C63.5 3m	AMFW-5F-18002650-20-10P	5/7/2015	5/7/2017

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dB $\mu$ V	Reading listed by margin.				T4 dB	Dist Table	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar Ant
			T1 dB	T2 dB	T3 dB	T5 dB						
1	4959.643M	61.8	+33.5 +3.6	+1.7 +1.1	-57.3 +0.2	+2.9	+0.0	47.5	54.0	-6.5	Vert	
2	9736.521M	50.2	+38.9 +5.4	+2.4 +1.6	-57.6 +0.2	+4.3	+0.0	45.4	54.0	-8.6	Vert	
3	7632.830M	52.9	+36.5 +4.6	+2.1 +1.4	-58.1 +0.2	+3.7	+0.0	43.3	54.0	-10.7	Vert	

**Band Edge**

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170  
 Customer: **Enlighted, Inc.**  
 Specification: **Band Edge**  
 Work Order #: **97329** Date: 7/6/2015  
 Test Type: **Radiated Measurement** Time: 19:50:05  
 Tested By: Hieu Song Nguyenpham Sequence#: 7  
 Software: EMITest 5.02.00

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna-ANSI C63.5	3115	1/23/2013	1/23/2015
T2	AN03302	Cable	32026-29094K-29094K-72TC	3/24/2014	3/24/2016
T3	ANP01210	Cable	FSJ1P-50A-4A	1/15/2015	1/15/2017
	AN03471	RF Characteristics Analyzer	E4440A	12/19/2013	12/19/2015

**Equipment Tested:**

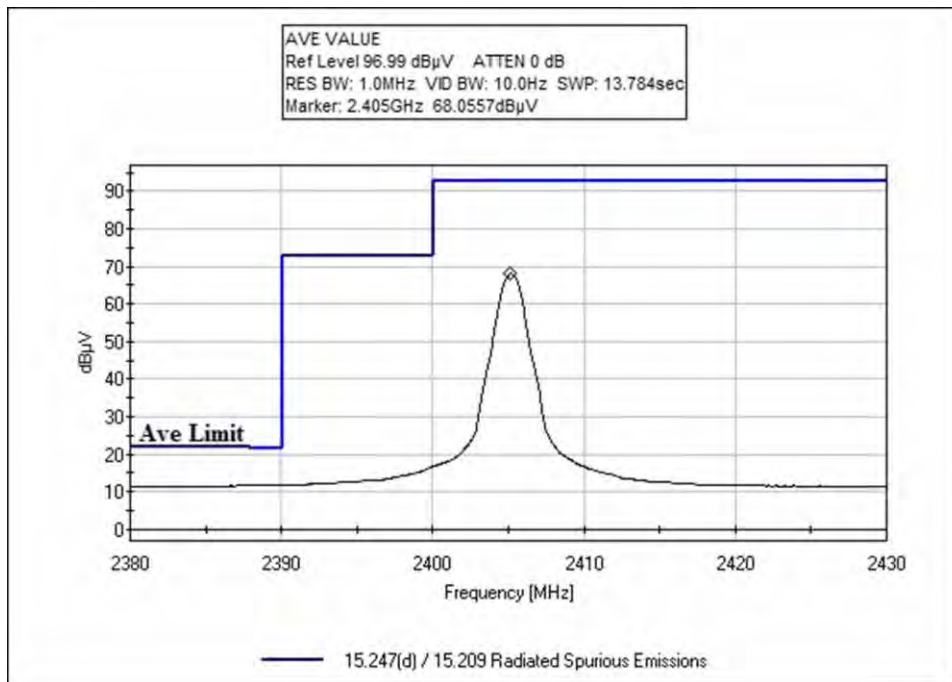
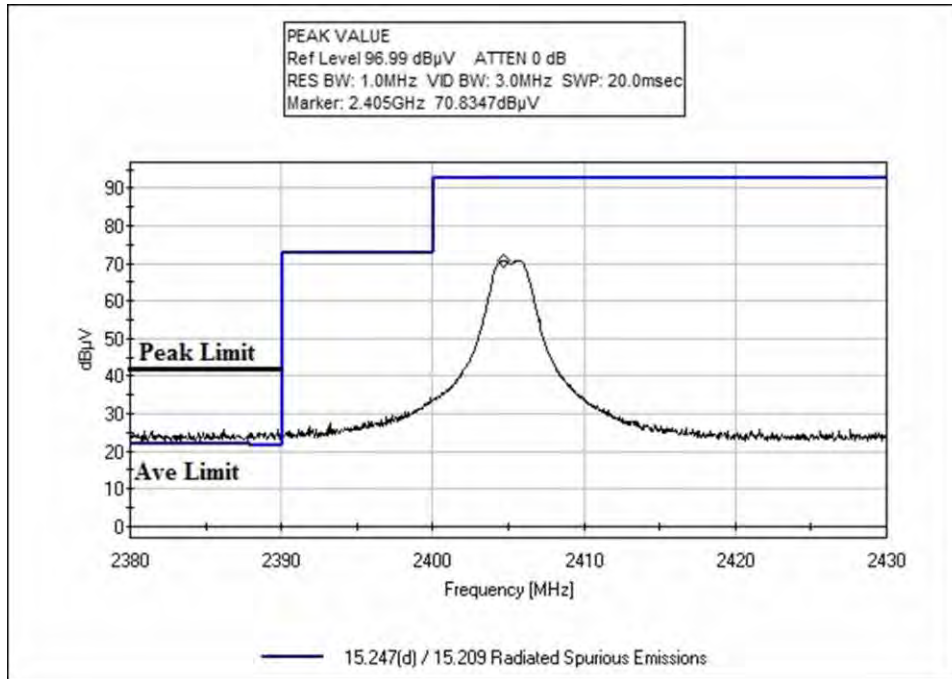
Device	Manufacturer	Model #	S/N
Configuration 1			

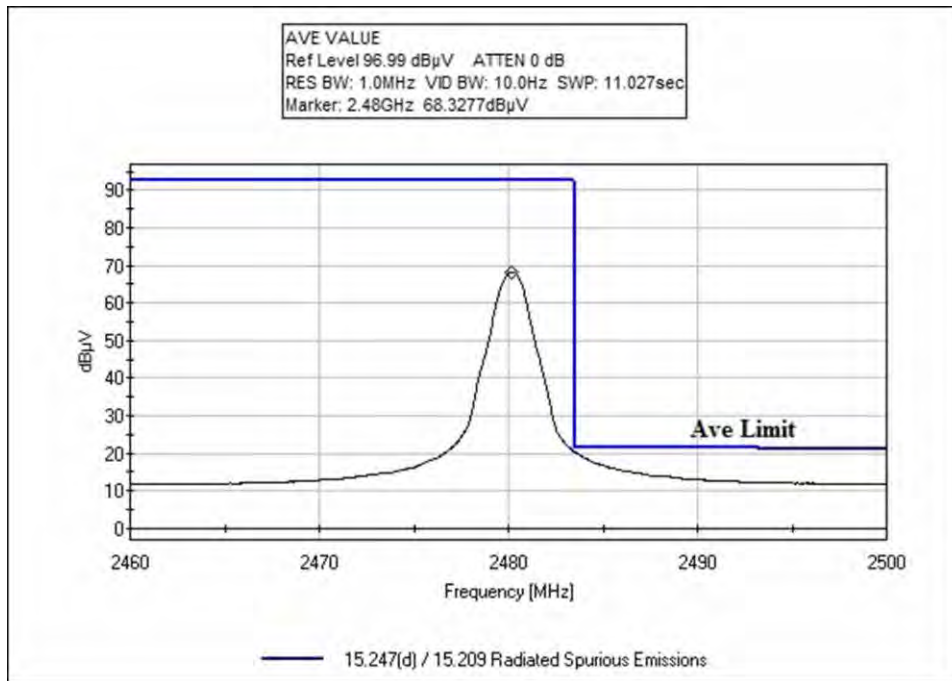
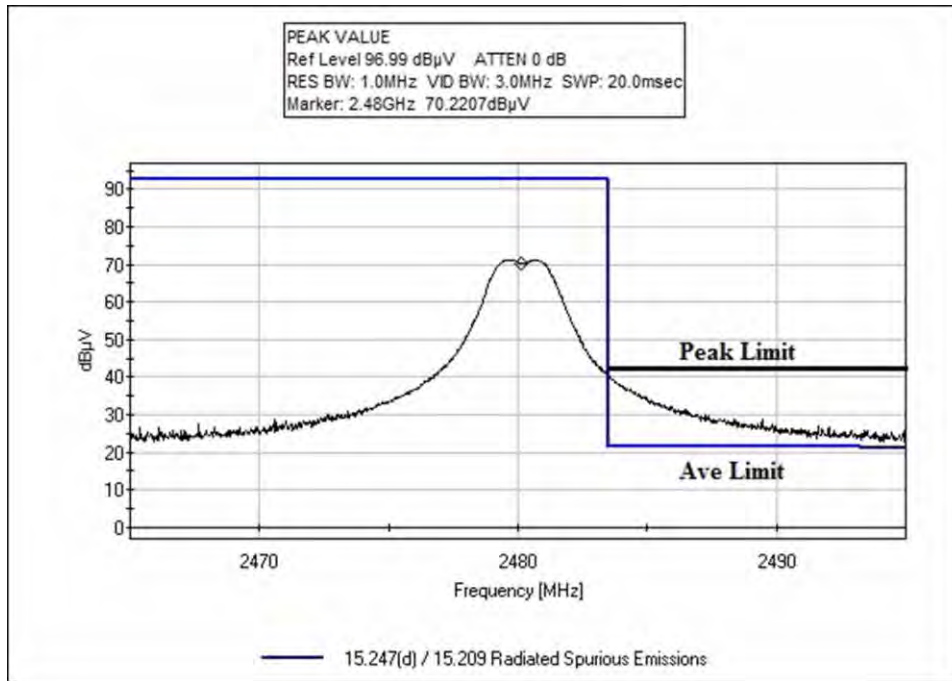
**Support Equipment:**

Device	Manufacturer	Model #	S/N
Configuration 1			

**Test Conditions / Notes:**

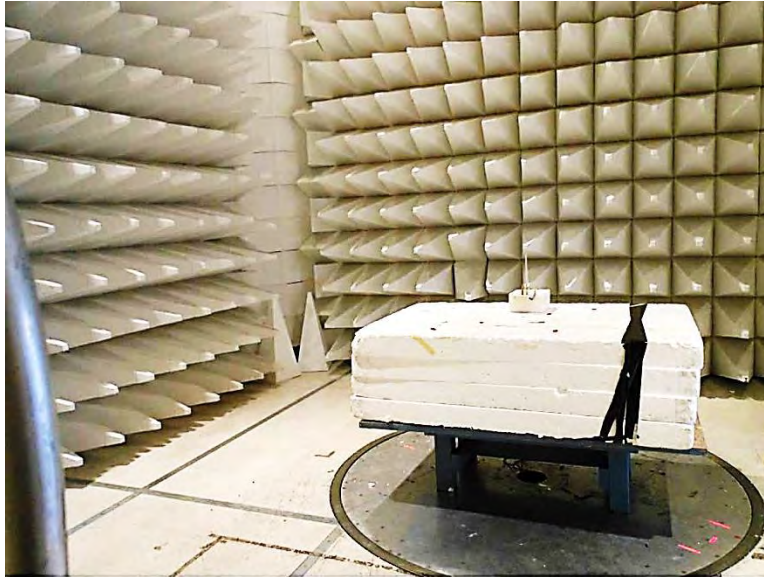
Band edge set up  
  
 Application: PuTTY version 0.64 for Zigbee  
  
 Temperature: 22.7°C  
 Humidity: 46 %  
 Atmospheric Pressure: 100.3 kPa  
  
 High Clock: 16MHz  
 Transmitting operating frequency= 2.4GHz Band  
 Gain of the antenna for Zigbee= 5dBi  
 Number of Channel=16  
 Method: KDB 558074 v03r02 section 13.2  
  
 The EUT is placed on an 80cm Styrofoam table. It is powered through an Ethernet cable. The transmitter is in continuous Tx Mode fully modulated. The Ethernet port is connected to passive power over Ethernet device which is outside the chamber. The debug port is connected to the laptop which also is outside the chamber via serial to an USB adapter to control the EUT for testing purpose.



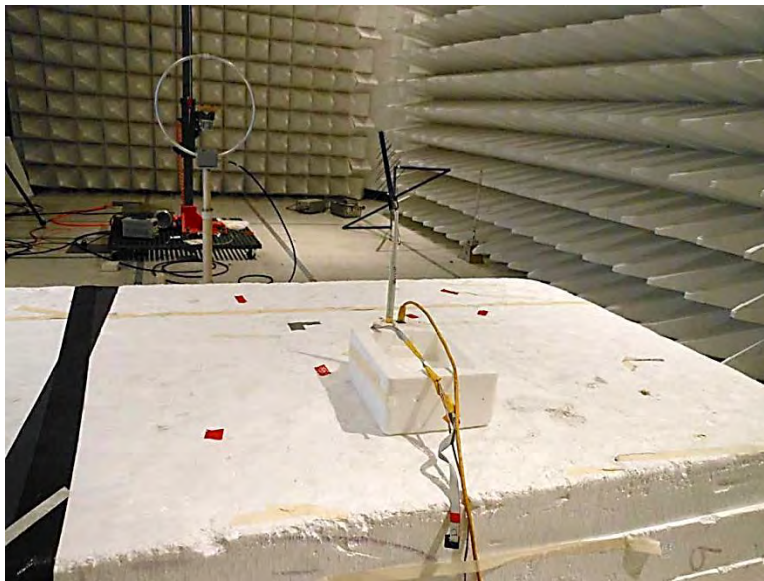




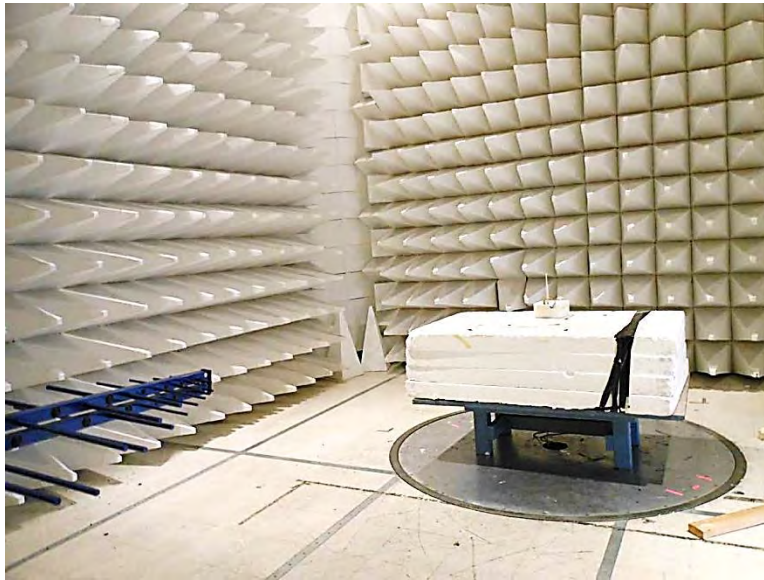
**Test Setup Photos**



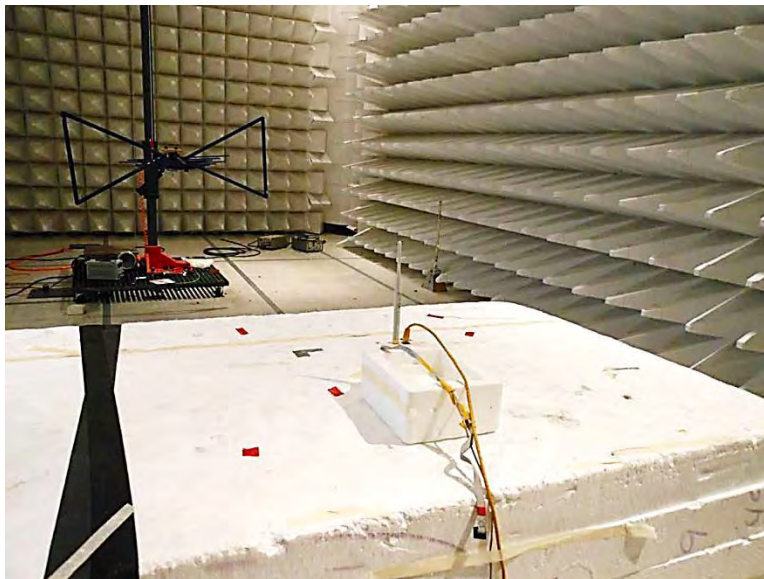
9kHz – 30MHz



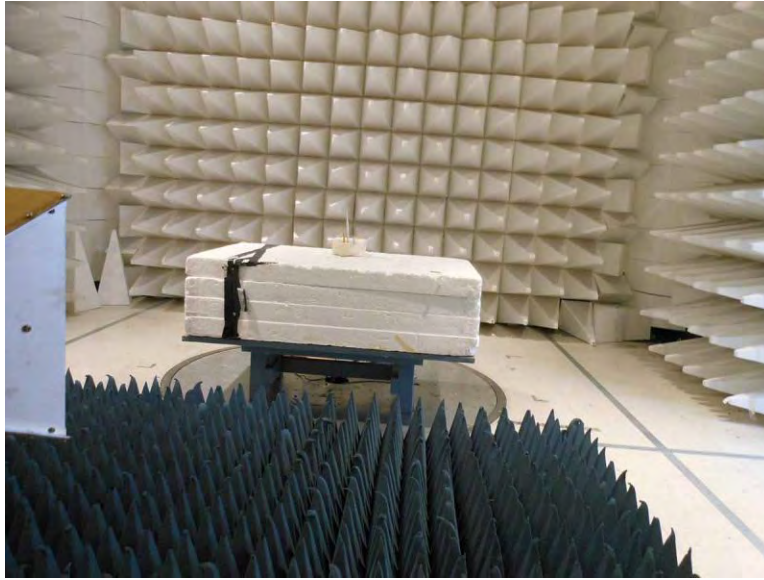
9kHz – 30MHz



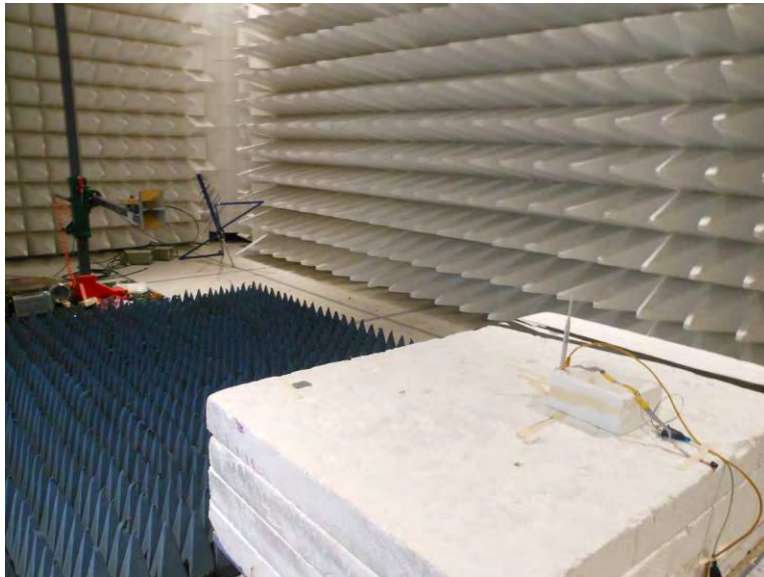
30MHz – 1GHz



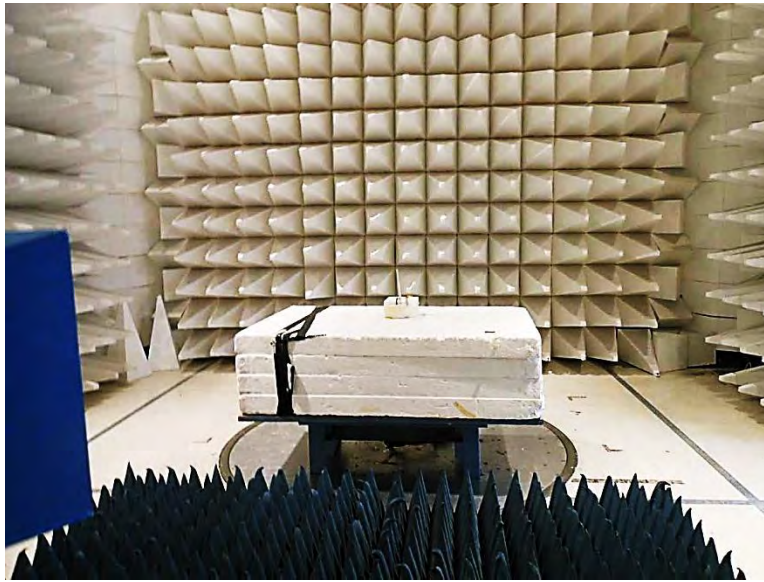
30MHz – 1GHz



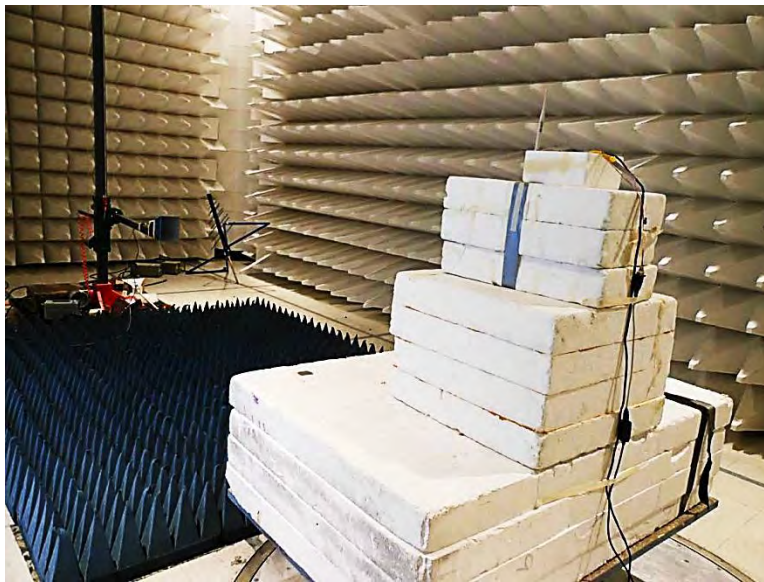
1 – 12GHz



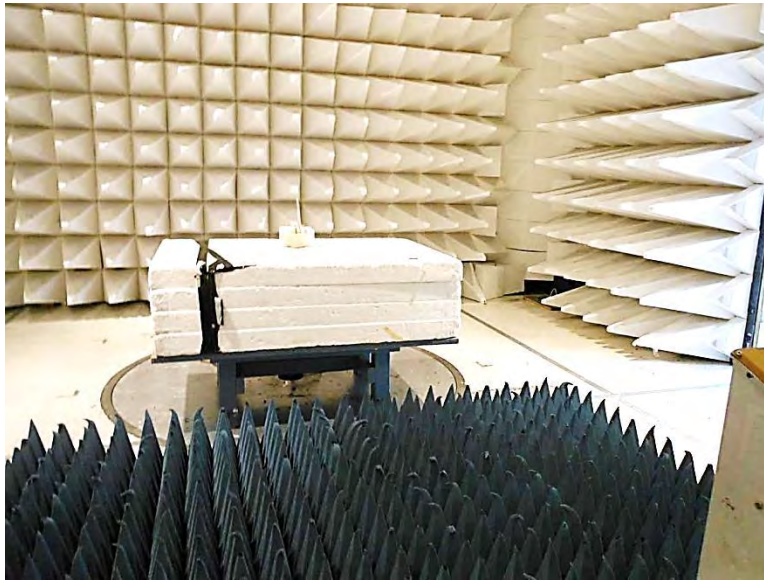
1 – 12GHz



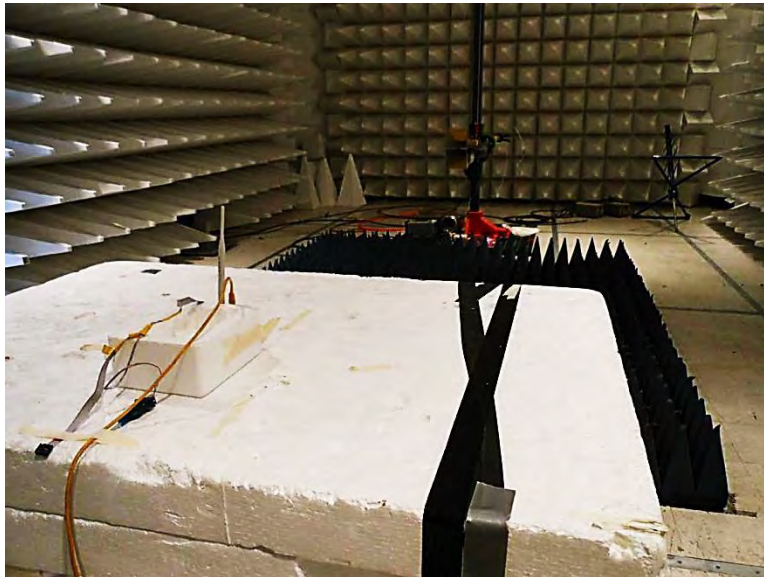
12 – 25GHz



12 – 25GHz



Band Edge



Band Edge

## SUPPLEMENTAL INFORMATION

### Emissions Test Details

#### TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

#### CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dB $\mu$ V/m, the spectrum analyzer reading in dB $\mu$ V was corrected by using the following formula. This reading was then compared to the applicable specification limit.

SAMPLE CALCULATIONS		
	Meter reading	(dB $\mu$ V)
+	Antenna Factor	(dB)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dB $\mu$ V/m)

### TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

### SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or carrot ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

#### **Peak**

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

#### **Quasi-Peak**

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

#### **Average**

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.