Enphase Energy

TEST REPORT FOR

WiFi & Bluetooth Module
Model: ESP32-WROVER-IE

Antena 2.4GHZ/5.4GHZ FLAT PATCH
Model: FXP830.07.0100C

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.247
(DTS 2400-2483.5MHz)

Report No.: 107662-7

Date of issue: January 20, 2023

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 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.

Test Certificate # 803.01

Testing the Future
CKC LABORATORIES, INC.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Enphase Energy
1420 N. McDowell Blvd.
Petaluma, CA 94954

Representative: Mark Seay
Customer Reference Number: ENUSA203026

REPORT PREPARED BY:

Viviana Prado
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 107662

DATE OF EQUIPMENT RECEIPT: January 4, 2023
DATE(S) OF TESTING: January 4 and 5, 2023

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, 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	5.03.20

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Canada	Japan
Canyon Park, Bothell, WA	US0103	US1024	3082C	A-0136
Brea, CA	US0103	US1024	3082D	A-0136
Fremont, CA	US0103	US1024	3082B	A-0136
Mariposa, CA	US0103	US1024	3082A	A-0136

*CKC's list of NIST designated countries can be found at: https://standards.gov/cabs/designations.html

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS)

Test Procedure	Description	Modifications	Results
15.247(a)(2)	6dB Bandwidth	NA	NA1
15.247(b)(3)	Output Power	NA	NA1
15.247(d)	RF Conducted Emissions & Band Edge	NA	NA1
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.247(e)	Power Spectral Density	NA	NA1
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable
NA1 = Not applicable because the EUT is a certified modular (FCC ID: 2AC7Z-ESP32WROVERE) with a new antenna.

ISO/IEC 17025 Decision Rule
The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

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
None

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
WiFi & Bluetooth Module	Espressif Systems	ESP32-WROVER-IE	NA
Antena 2.4GHZ/5.4GHZ FLAT PATCH	Taoglas Limited	FXP830.07.0100C	NA

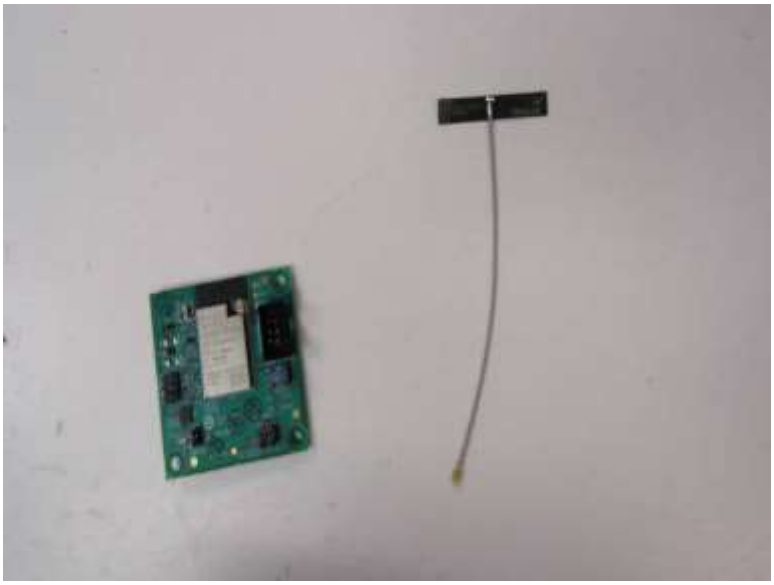
Support Equipment:

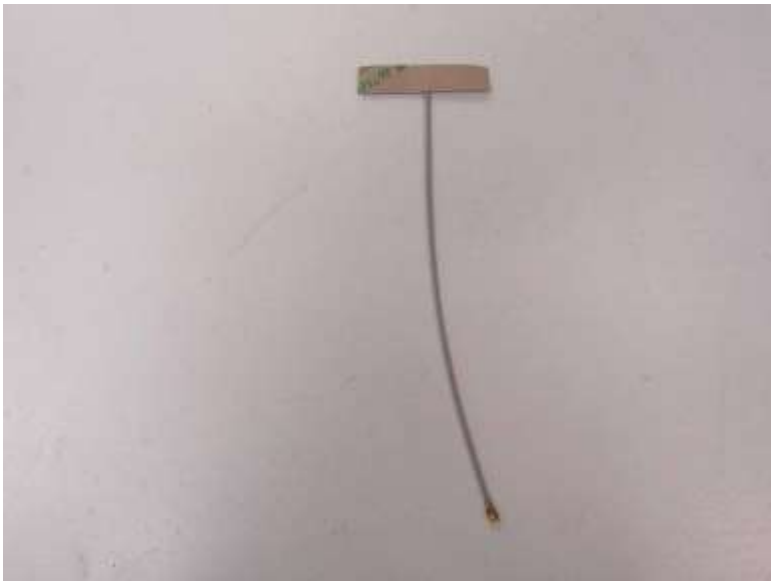
Device	Manufacturer	Model #	S/N
Serial Comm Board	Espressif Systems	ESP-FACTORYTB1	NA
Laptop	Dell	Insperon 5501 P102F	NA
DC Power Supply	Jameco	211684	NA

General Product Information:

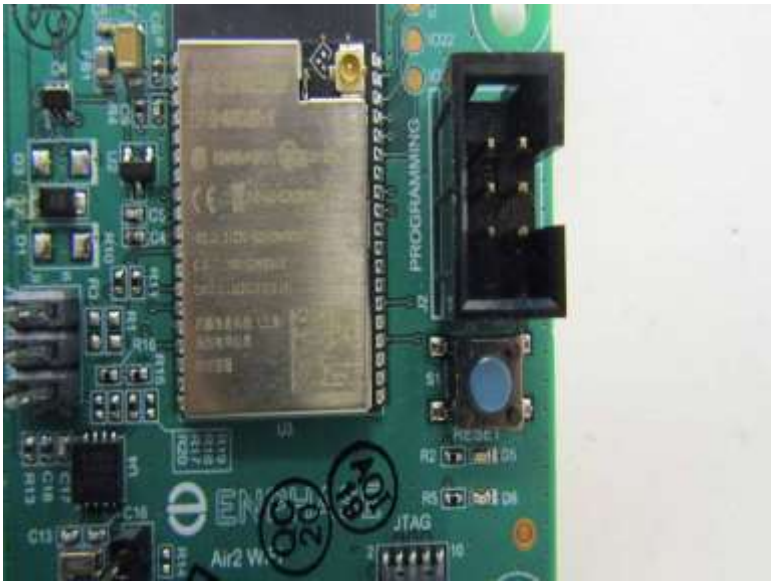
Product Information	Manufacturer-Provided Details
Equipment Type:	Radio Module
Type of Wideband System:	BLE (1Mbps) and 802.11b/g/n-HT20 and n-HT40
Operating Frequency Range:	2402MHz to 2480MHz for Bluetooth 2412MHz to 2462MHz for 802.11b/g/n-HT20 2422MHz to 2452MHz for 802.11n-HT40
Modulation Type(s):	GFSK for BLE (1Mbps) DSSS and OFDM for 802.11
Maximum Duty Cycle:	100%
Number of TX Chains:	1
Antenna Type(s) and Gain:	Dipole Antenna and 2.5dBi
Beamforming Type:	NA
Antenna Connection Type:	External Connector
Nominal Input Voltage:	3-3.6VDC
Firmware / Software used for Test:	EspRFTestTool_v2.8
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

EUT Photo(s)

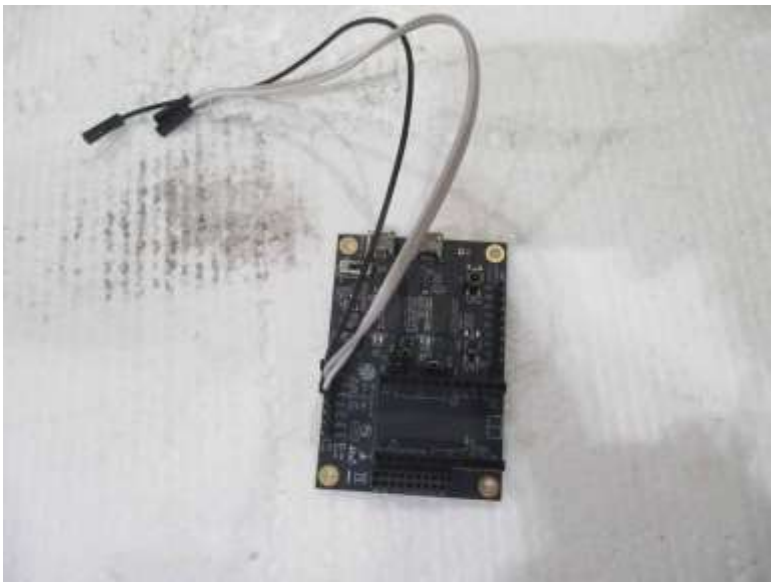





PROGRAMMING


PROGRAMMING
JTAG

Support Equipment Photo(s)



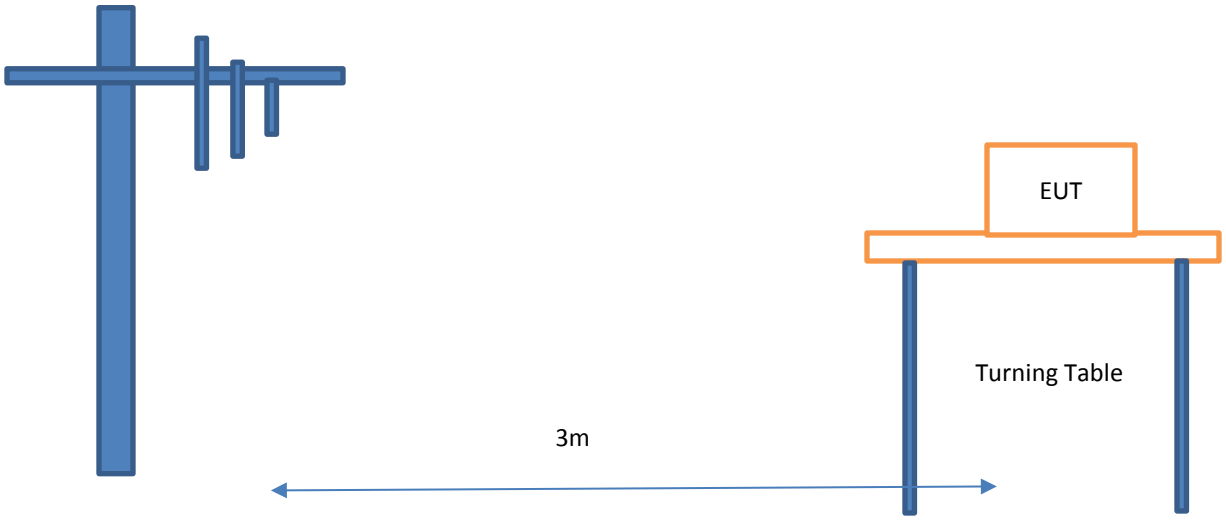
Serial Comm Board

Laptop

DC Power Supply

Block Diagram of Test Setup(s)

Radiated Method Setup



FCC Part 15 Subpart C

15.247(d) Radiated Emissions & Band Edge

Test Setup/Conditions			
Test Location:	Fremont Lab C3	Test Engineer:	Hieu Song Nguyenpham
Test Method:	ANSI C63.10 (2013), KDB 558074	Test Date(s):	01/04-05/2023
Configuration:	1		
Note	The RF output power was adjusted according to the original report for the modular		

Environmental Conditions			
Temperature (ºC)	22-23.3	Relative Humidity (%):	40-47

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
Customer: **Enphase Energy**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **107662** Date: 1/5/2023
Test Type: **Radiated Scan** Time: 15:24:50
Tested By: Hieu Song Nguyenpham Sequence#: 10
Software: EMITest 5.03.20

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 1GHz

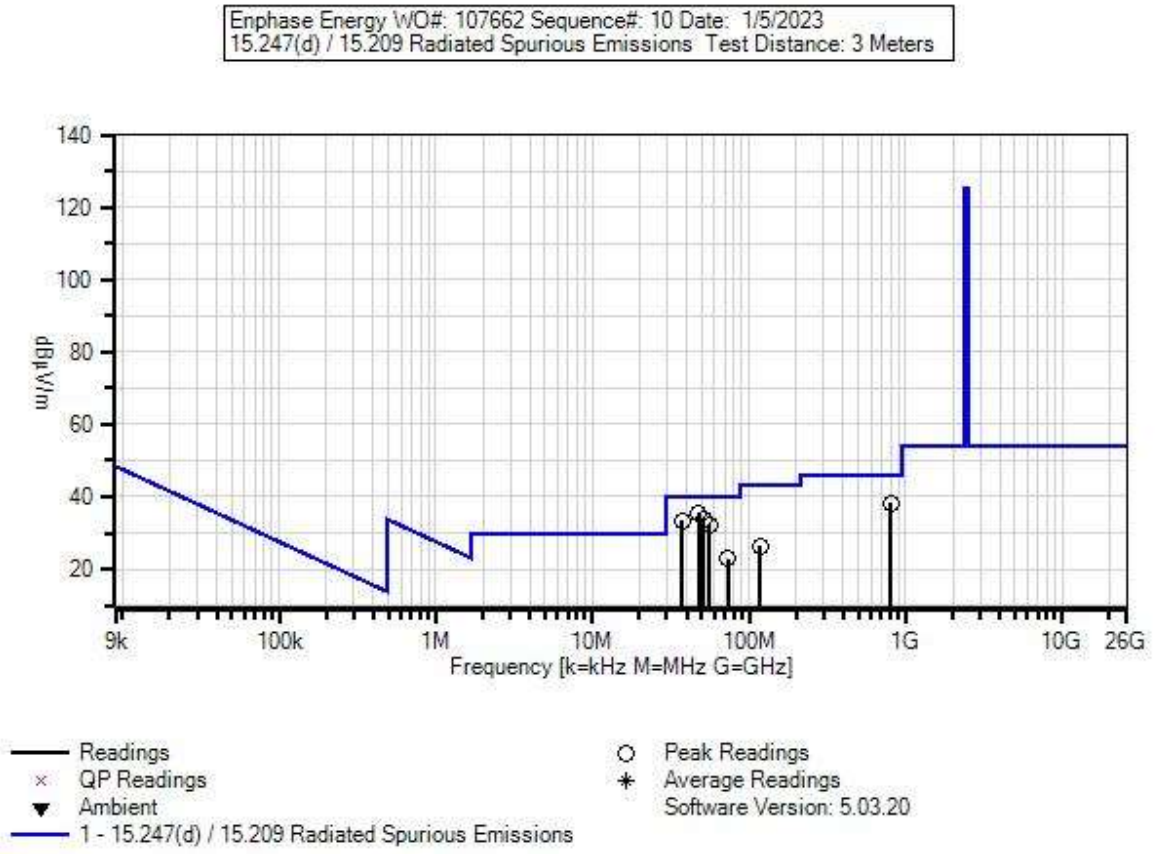
Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Perform 3 orientation of a receiving antenna from 9kHz to 30MHz. No Emission from the EUT has been found in 20dB tolerant from 9kHz to 30MHz.

Note:
BLE-Low Channel



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07508	Preamp	310N	5/9/2022	5/9/2024
	AN00432	Loop Antenna	6502	7/19/2021	7/19/2023
T2	ANP01187	Cable	CNT-195	7/12/2022	7/12/2024
T3	ANP06691	Cable	PE3062-180	3/16/2022	3/16/2024
T4	ANP06694	Cable	PE3062-480	3/16/2022	3/16/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T5	AN01995	Biconilog Antenna	CBL6111C	4/19/2022	4/19/2024

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	47.569M	50.4	-32.0 +15.8	+0.2	+0.2	+0.6	+0.0	35.2	40.0	-4.8	Horiz
2	51.229M	50.9	-32.0 +14.0	+0.2	+0.2	+0.6	+0.0	33.9	40.0	-6.1	Horiz
3	37.587M	43.5	-32.0 +21.0	+0.2	+0.2	+0.5	+0.0	33.4	40.0	-6.6	Vert
4	55.888M	51.0	-32.0 +12.3	+0.2	+0.2	+0.6	+0.0	32.3	40.0	-7.7	Horiz
5	800.692M	36.1	-31.8 +29.0	+0.7	+1.2	+3.0	+0.0	38.2	46.0	-7.8	Horiz
6	73.789M	41.0	-32.0 +12.8	+0.2	+0.3	+0.7	+0.0	23.0	40.0	-17.0	Vert
7	117.930M	39.3	-31.9 +17.7	+0.2	+0.3	+0.9	+0.0	26.5	43.5	-17.0	Vert

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107662**	Date:	1/5/2023
Test Type:	**Radiated Scan**	Time:	15:19:17
Tested By:	Hieu Song Nguyenpham	Sequence#:	7
Software:	EMITest 5.03.20		

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: 1GHz to 25GHz

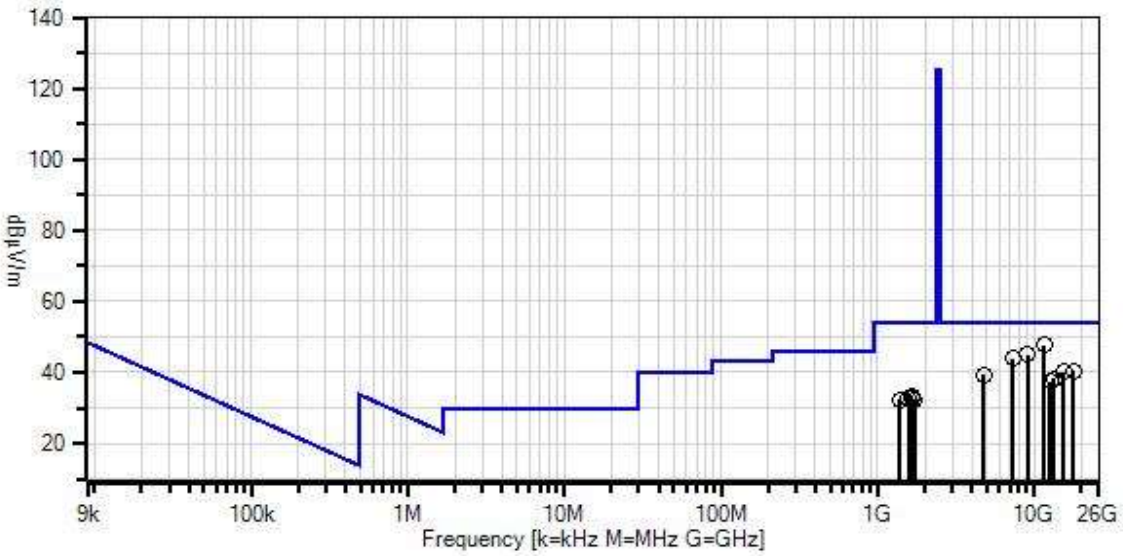
Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Note:
BLE-Low Channel

Enphase Energy WO#: 107662 Sequence#: 7 Date: 1/5/2023
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters



Readings
QP Readings
Ambient
1 - 15.247(d) / 15.209 Radiated Spurious Emissions
Peak Readings
Average Readings
Software Version: 5.03.20

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna-ANSI C63.5	3115	1/7/2021	1/7/2023
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/10/2022	1/10/2024
T3	ANP01210	Cable	FSJ1P-50A-4A	11/1/2022	11/1/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T4	AN03738	Preamp	BZRYE-00101800-221055-202323	2/4/2022	2/4/2024
T5	AN03386	High Pass Filter	11SH10-3000/T10000-O/O	3/22/2022	3/22/2024
T6	AN03013	Cable	32022-2-2909K-36TC	3/7/2022	3/7/2024
T7	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
T8	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
T9	ANP00928	Cable	various	1/12/2022	1/12/2024
T10	ANP00929	Cable	various	1/12/2022	1/12/2024
T11	ANP07698	Cable	32022-29094K-29094K-72TC	9/1/2022	9/1/2024
T12	ANP07705	Cable	32022-29094K-29094K-120TC	11/7/2022	11/7/2024
	AN02748	Low Pass Filter	11SL10-2000/U6000-O/O	1/3/2023	1/3/2025

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	11571.456 M	51.8	+38.8 +0.8 +1.7	+3.2 +1.7 +1.7	+6.1 +1.7 +1.7	-54.6 +1.7 +1.7	+0.0	47.8	54.0	-6.2	Vert
2	9030.063M	52.8	+37.3 +0.4 +1.5	+2.8 +1.5 +1.5	+5.4 +1.5 +1.5	-55.1 +1.5 +1.5	+0.0	45.1	54.0	-8.9	Horiz
3	7297.317M	55.2	+35.6 +0.4 +1.3	+2.5 +1.3 +1.3	+4.6 +1.3 +1.3	-55.8 +1.3 +1.3	+0.0	43.8	54.0	-10.2	Horiz
4	17774.720 M	42.8	-11.2 +5.3 +0.0	+0.0 +0.0 +0.0	+0.3 +0.0 +0.0	+3.3 +0.0 +0.0	+0.0	40.5	54.0	-13.5	Horiz
5	15384.521 M	45.1	-13.6 +5.0 +0.0	+0.0 +0.0 +0.0	+0.5 +0.0 +0.0	+3.1 +0.0 +0.0	+0.0	40.1	54.0	-13.9	Horiz
6	4773.363M	54.1	+32.7 +0.4 +1.1	+2.0 +1.1 +1.1	+3.7 +1.1 +1.1	-54.6 +1.1 +1.1	+0.0	39.4	54.0	-14.6	Horiz
7	13267.697 M	44.7	-14.6 +4.7 +0.0	+0.0 +0.0 +0.0	+0.5 +0.0 +0.0	+2.9 +0.0 +0.0	+0.0	38.2	54.0	-15.8	Vert
8	12665.107 M	43.5	-14.0 +4.6 +0.0	+0.0 +0.0 +0.0	+0.6 +0.0 +0.0	+2.8 +0.0 +0.0	+0.0	37.5	54.0	-16.5	Vert
9	1645.578M	58.8	+25.5 +0.6 +0.2	+1.1 +0.2 +0.2	+2.0 +0.2 +0.2	-54.7 +0.2 +0.2	+0.0	33.5	54.0	-20.5	Horiz
10	1682.299M	57.7	+25.7 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	32.7	54.0	-21.3	Horiz
11	1667.858M	57.8	+25.6 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	32.7	54.0	-21.3	Horiz
12	1577.249M	58.2	+25.2 +0.6 +0.2	+1.1 +0.2 +0.2	+2.0 +0.2 +0.2	-54.6 +0.2 +0.2	+0.0	32.7	54.0	-21.3	Vert
13	1721.496M	57.3	+25.8 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	32.4	54.0	-21.6	Vert
14	1377.814M	58.9	+24.6 +0.5 +0.1	+1.1 +0.1 +0.1	+1.9 +0.1 +0.1	-54.8 +0.1 +0.1	+0.0	32.3	54.0	-21.7	Vert

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107662**	Date:	1/5/2023
Test Type:	**Radiated Scan**	Time:	15:27:16
Tested By:	Hieu Song Nguyenpham	Sequence#:	11
Software:	EMITest 5.03.20		

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 1GHz

Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Perform 3 orientation of a receiving antenna from 9kHz to 30MHz. No Emission from the EUT has been found in 20dB tolerant from 9kHz to 30MHz.

Note:
BLE-Middle Channel

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07508	Preamp	310N	5/9/2022	5/9/2024
	AN00432	Loop Antenna	6502	7/19/2021	7/19/2023
T2	ANP01187	Cable	CNT-195	7/12/2022	7/12/2024
T3	ANP06691	Cable	PE3062-180	3/16/2022	3/16/2024
T4	ANP06694	Cable	PE3062-480	3/16/2022	3/16/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T5	AN01995	Biconilog Antenna	CBL6111C	4/19/2022	4/19/2024

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	37.653M	47.6	-32.0 +21.0	+0.2	+0.2	+0.5	+0.0	37.5	40.0	-2.5	Vert
2	37.853M	46.9	-32.0 +20.9	+0.2	+0.2	+0.5	+0.0	36.7	40.0	-3.3	Vert
3	38.119M	46.6	-32.0 +20.7	+0.2	+0.2	+0.5	+0.0	36.2	40.0	-3.8	Vert
4	117.184M	46.6	-31.9 +17.7	+0.2	+0.3	+0.9	+0.0	33.8	43.5	-9.7	Horiz
5	126.386M	45.8	-32.0 +17.8	+0.3	+0.4	+1.0	+0.0	33.3	43.5	-10.2	Horiz
6	109.600M	41.3	-32.0 +17.2	+0.2	+0.3	+0.9	+0.0	27.9	43.5	-15.6	Horiz
7	75.120M	41.2	-32.0 +12.9	+0.2	+0.3	+0.7	+0.0	23.3	40.0	-16.7	Vert
8	608.256M	29.6	-32.0 +26.0	+0.6	+0.9	+2.5	+0.0	27.6	46.0	-18.4	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107662**	Date:	1/5/2023
Test Type:	**Radiated Scan**	Time:	15:23:21
Tested By:	Hieu Song Nguyenpham	Sequence#:	8
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

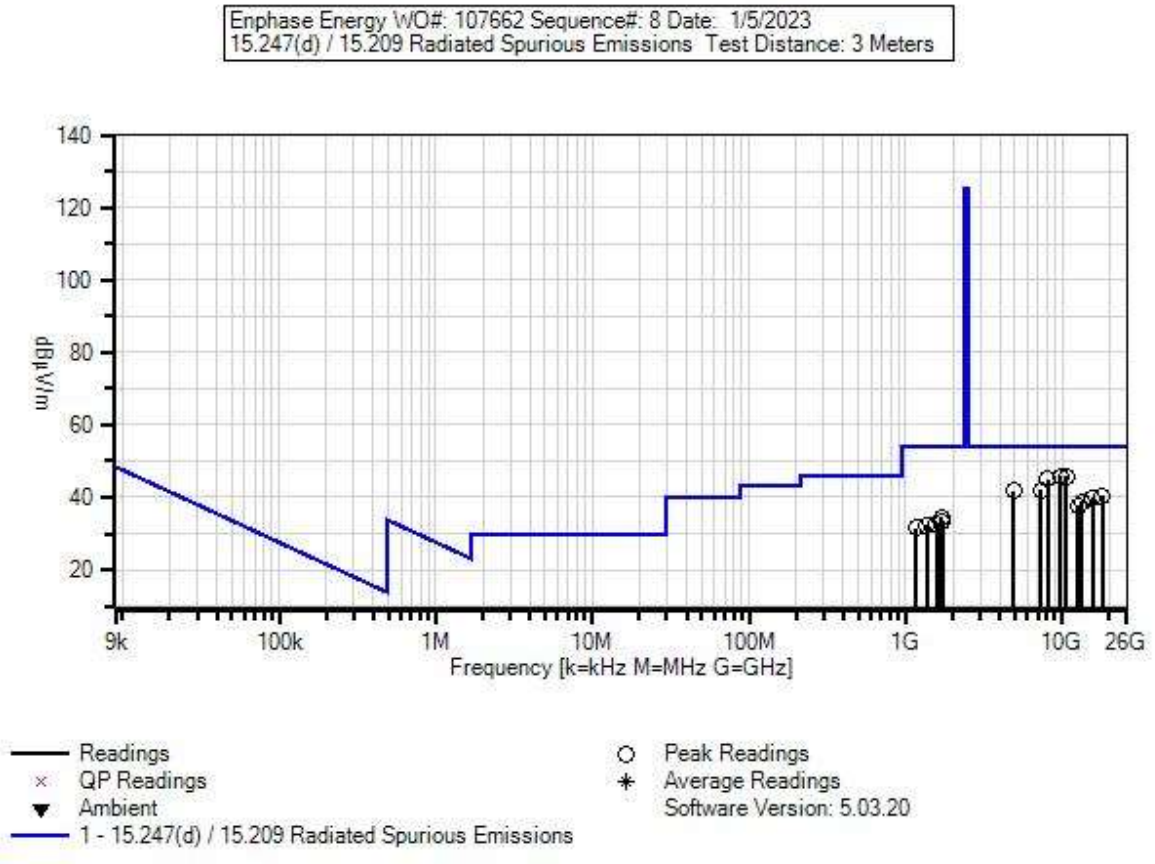
Radiated Emission
Frequency Range: 1GHz to 25GHz

Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Note:
BLE-Middle Channel



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna-ANSI C63.5	3115	1/7/2021	1/7/2023
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/10/2022	1/10/2024
T3	ANP01210	Cable	FSJ1P-50A-4A	11/1/2022	11/1/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T4	AN03738	Preamp	BZRYE-00101800-221055-202323	2/4/2022	2/4/2024
T5	AN03386	High Pass Filter	11SH10-3000/T10000-O/O	3/22/2022	3/22/2024
T6	AN03013	Cable	32022-2-2909K-36TC	3/7/2022	3/7/2024
T7	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
T8	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
T9	ANP00928	Cable	various	1/12/2022	1/12/2024
T10	ANP00929	Cable	various	1/12/2022	1/12/2024
T11	ANP07698	Cable	32022-29094K-29094K-72TC	9/1/2022	9/1/2024
T12	ANP07705	Cable	32022-29094K-29094K-120TC	11/7/2022	11/7/2024
	AN02748	Low Pass Filter	11SL10-2000/U6000-O/O	1/3/2023	1/3/2025

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	10618.716 M	50.2	+38.6 +0.5 +1.6	+3.1 +1.6 +1.6	+5.8 +1.6 +1.6	-54.1 +1.6 +1.6	+0.0	45.7	54.0	-8.3	Vert
2	8065.269M	53.9	+36.9 +0.4 +1.4	+2.7 +1.4 +1.4	+5.0 +1.4 +1.4	-55.4 +1.4 +1.4	+0.0	44.9	54.0	-9.1	Vert
3	7289.861M	53.3	+35.6 +0.4 +1.3	+2.5 +1.3 +1.3	+4.6 +1.3 +1.3	-55.8 +1.3 +1.3	+0.0	41.9	54.0	-12.1	Horiz
4	4866.503M	56.1	+33.0 +0.4 +1.1	+2.0 +1.1 +1.1	+3.7 +1.1 +1.1	-54.6 +1.1 +1.1	+0.0	41.7	54.0	-12.3	Horiz
5	17954.489 M	42.5	-11.0 +5.3 +0.0	+0.0 +0.0 +0.0	+0.3 +0.0 +0.0	+3.3 +0.0 +0.0	+0.0	40.4	54.0	-13.6	Horiz
6	15587.285 M	45.2	-13.8 +5.0 +0.0	+0.0 +0.0 +0.0	+0.4 +0.0 +0.0	+3.1 +0.0 +0.0	+0.0	39.9	54.0	-14.1	Vert
7	13281.589 M	45.2	-14.6 +4.7 +0.0	+0.0 +0.0 +0.0	+0.5 +0.0 +0.0	+2.9 +0.0 +0.0	+0.0	38.7	54.0	-15.3	Vert
8	12574.805 M	43.7	-14.0 +4.6 +0.0	+0.0 +0.0 +0.0	+0.6 +0.0 +0.0	+2.8 +0.0 +0.0	+0.0	37.7	54.0	-16.3	Horiz
9	1684.774M	59.2	+25.7 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	34.2	54.0	-19.8	Horiz
10	1721.496M	58.2	+25.8 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	33.3	54.0	-20.7	Horiz
11	1575.939M	58.2	+25.2 +0.6 +0.2	+1.1 +0.2 +0.2	+2.0 +0.2 +0.2	-54.6 +0.2 +0.2	+0.0	32.7	54.0	-21.3	Horiz
12	1369.478M	58.9	+24.6 +0.5 +0.1	+1.1 +0.1 +0.1	+1.8 +0.1 +0.1	-54.7 +0.1 +0.1	+0.0	32.3	54.0	-21.7	Vert
13	9676.771M	52.6	+37.6 +0.4 +1.5	+2.9 +1.5 +1.5	+5.6 +1.5 +1.5	-54.7 +1.5 +1.5	+0.0	45.9	68.0	-22.1	Horiz
14	1174.798M	59.1	+24.0 +0.5 +0.1	+1.0 +0.1 +0.1	+1.7 +0.1 +0.1	-54.8 +0.1 +0.1	+0.0	31.6	54.0	-22.4	Vert

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107662**	Date:	1/5/2023
Test Type:	**Radiated Scan**	Time:	15:27:45
Tested By:	Hieu Song Nguyenpham	Sequence#:	12
Software:	EMITest 5.03.20		

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 1GHz

Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Perform 3 orientation of a receiving antenna from 9kHz to 30MHz. No Emission from the EUT has been found in 20dB tolerant from 9kHz to 30MHz.

Note:
BLE-High Channel

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07508	Preamp	310N	5/9/2022	5/9/2024
	AN00432	Loop Antenna	6502	7/19/2021	7/19/2023
T2	ANP01187	Cable	CNT-195	7/12/2022	7/12/2024
T3	ANP06691	Cable	PE3062-180	3/16/2022	3/16/2024
T4	ANP06694	Cable	PE3062-480	3/16/2022	3/16/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T5	AN01995	Biconilog Antenna	CBL6111C	4/19/2022	4/19/2024

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	37.629M	49.1	-32.0	+0.2	+0.2	+0.5	+0.0	39.0	40.0	-1.0	Vert
	QP		+21.0								
^	37.629M	51.7	-32.0	+0.2	+0.2	+0.5	+0.0	41.6	40.0	+1.6	Vert
			+21.0								
3	38.124M	48.7	-32.0	+0.2	+0.2	+0.5	+0.0	38.3	40.0	-1.7	Vert
	QP		+20.7								
^	38.124M	51.0	-32.0	+0.2	+0.2	+0.5	+0.0	40.6	40.0	+0.6	Vert
			+20.7								
5	125.779M	45.6	-32.0	+0.3	+0.4	+1.0	+0.0	33.1	43.5	-10.4	Horiz
			+17.8								
6	117.488M	45.3	-31.9	+0.2	+0.3	+0.9	+0.0	32.5	43.5	-11.0	Horiz
			+17.7								
7	116.679M	45.1	-32.0	+0.2	+0.3	+0.9	+0.0	32.2	43.5	-11.3	Horiz
			+17.7								
8	73.197M	41.8	-32.0	+0.2	+0.3	+0.7	+0.0	23.7	40.0	-16.3	Vert
			+12.7								
9	123.353M	38.3	-32.0	+0.3	+0.3	+1.0	+0.0	25.7	43.5	-17.8	Vert
			+17.8								

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107662**	Date:	1/5/2023
Test Type:	**Radiated Scan**	Time:	15:24:05
Tested By:	Hieu Song Nguyenpham	Sequence#:	9
Software:	EMITest 5.03.20		

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: 1GHz to 25GHz

Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Note:
BLE-High Channel

Enphase Energy \WO#: 107662 Sequence#: 9 Date: 1/5/2023
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters

Readings
QP Readings
Ambient
1 - 15.247(d) / 15.209 Radiated Spurious Emissions
Peak Readings
Average Readings
Software Version: 5.03.20

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna-ANSI C63.5	3115	1/7/2021	1/7/2023
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/10/2022	1/10/2024
T3	ANP01210	Cable	FSJ1P-50A-4A	11/1/2022	11/1/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T4	AN03738	Preamp	BZRYE-00101800-221055-202323	2/4/2022	2/4/2024
T5	AN03386	High Pass Filter	11SH10-3000/T10000-O/O	3/22/2022	3/22/2024
T6	AN03013	Cable	32022-2-2909K-36TC	3/7/2022	3/7/2024
T7	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
T8	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
T9	ANP00928	Cable	various	1/12/2022	1/12/2024
T10	ANP00929	Cable	various	1/12/2022	1/12/2024
T11	ANP07698	Cable	32022-29094K-29094K-72TC	9/1/2022	9/1/2024
T12	ANP07705	Cable	32022-29094K-29094K-120TC	11/7/2022	11/7/2024
	AN02748	Low Pass Filter	11SL10-2000/U6000-O/O	1/3/2023	1/3/2025

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	8187.048M	54.1	+36.8 +0.5 +1.4	+2.7 +1.4 +1.4	+5.1 +1.4 +1.4	-54.9 +1.4 +1.4	+0.0	45.7	54.0	-8.3	Vert
2	10826.084 M	50.3	+38.4 +0.6 +1.6	+3.1 +1.6 +1.6	+5.8 +1.6 +1.6	-54.3 +1.6 +1.6	+0.0	45.5	54.0	-8.5	Vert
3	9423.711M	52.5	+37.5 +0.4 +1.5	+2.9 +1.5 +1.5	+5.6 +1.5 +1.5	-54.9 +1.5 +1.5	+0.0	45.5	54.0	-8.5	Horiz
4	7284.890M	53.9	+35.6 +0.4 +1.3	+2.5 +1.3 +1.3	+4.6 +1.3 +1.3	-55.8 +1.3 +1.3	+0.0	42.5	54.0	-11.5	Horiz
5	17787.070 M	42.7	-11.2 +5.3 +0.0	+0.0 +0.0 +0.0	+0.3 +0.0 +0.0	+3.3 +0.0 +0.0	+0.0	40.4	54.0	-13.6	Horiz
6	4855.959M	54.9	+32.9 +0.4 +1.1	+2.0 +1.1 +1.1	+3.7 +1.1 +1.1	-54.6 +1.1 +1.1	+0.0	40.4	54.0	-13.6	Horiz
7	15481.478 M	45.4	-13.7 +5.0 +0.0	+0.0 +0.0 +0.0	+0.4 +0.0 +0.0	+3.1 +0.0 +0.0	+0.0	40.2	54.0	-13.8	Horiz
8	14490.488 M	43.5	-13.4 +4.9 +0.0	+0.0 +0.0 +0.0	+0.6 +0.0 +0.0	+3.0 +0.0 +0.0	+0.0	38.6	54.0	-15.4	Vert
9	13275.274 M	45.1	-14.6 +4.7 +0.0	+0.0 +0.0 +0.0	+0.5 +0.0 +0.0	+2.9 +0.0 +0.0	+0.0	38.6	54.0	-15.4	Vert
10	12242.242 M	43.7	-13.5 +4.5 +0.0	+0.0 +0.0 +0.0	+0.6 +0.0 +0.0	+2.8 +0.0 +0.0	+0.0	38.1	54.0	-15.9	Vert
11	1708.864M	58.3	+25.8 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.7 +0.2 +0.2	+0.0	33.5	54.0	-20.5	Horiz
12	1574.719M	58.6	+25.2 +0.6 +0.2	+1.1 +0.2 +0.2	+2.0 +0.2 +0.2	-54.6 +0.2 +0.2	+0.0	33.1	54.0	-20.9	Horiz

13	1692.614M	57.6	+25.7 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	32.6	54.0	-21.4	Vert
14	1454.444M	58.6	+24.8 +0.6 +0.2	+1.1 +0.2 +0.2	+1.9 +0.2 +0.2	-54.7 +0.2 +0.2	+0.0	32.5	54.0	-21.5	Vert
15	1361.194M	59.1	+24.5 +0.5 +0.1	+1.0 +0.1 +0.1	+1.8 +0.1 +0.1	-54.6 +0.1 +0.1	+0.0	32.4	54.0	-21.6	Horiz
16	1378.469M	58.7	+24.6 +0.5 +0.1	+1.1 +0.1 +0.1	+1.9 +0.1 +0.1	-54.8 +0.1 +0.1	+0.0	32.1	54.0	-21.9	Vert

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107662**	Date:	1/5/2023
Test Type:	**Radiated Scan**	Time:	14:54:33
Tested By:	Hieu Song Nguyenpham	Sequence#:	2
Software:	EMITest 5.03.20		

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 1GHz

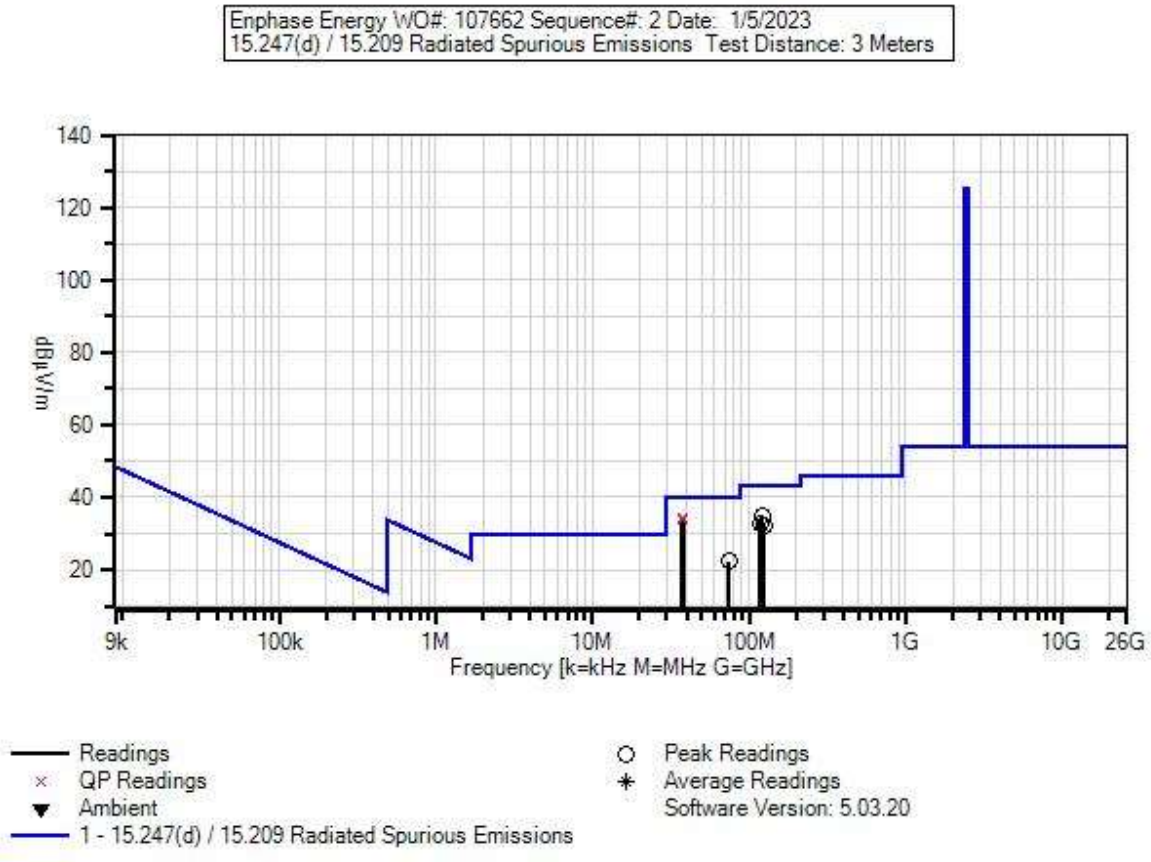
Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Perform 3 orientation of a receiving antenna from 9kHz to 30MHz. No Emission from the EUT has been found in 20dB tolerant from 9kHz to 30MHz.

Note:
Choose 802.11b is the highest RF output power to perform Radiated Spurious Emission.
802.11b-Low Channel



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07508	Preamp	310N	5/9/2022	5/9/2024
	AN00432	Loop Antenna	6502	7/19/2021	7/19/2023
T2	ANP01187	Cable	CNT-195	7/12/2022	7/12/2024
T3	ANP06691	Cable	PE3062-180	3/16/2022	3/16/2024
T4	ANP06694	Cable	PE3062-480	3/16/2022	3/16/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T5	AN01995	Biconilog Antenna	CBL6111C	4/19/2022	4/19/2024

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	37.631M QP	44.7	-32.0 +21.0	+0.2	+0.2	+0.5	+0.0	34.6	40.0	-5.4	Vert
^	37.631M	48.3	-32.0 +21.0	+0.2	+0.2	+0.5	+0.0	38.2	40.0	-1.8	Vert
3	38.121M QP	44.1	-32.0 +20.7	+0.2	+0.2	+0.5	+0.0	33.7	40.0	-6.3	Vert
^	38.121M	47.2	-32.0 +20.7	+0.2	+0.2	+0.5	+0.0	36.8	40.0	-3.2	Vert
5	120.622M	47.4	-31.9 +17.8	+0.2	+0.3	+1.0	+0.0	34.8	43.5	-8.7	Horiz
6	117.791M	45.6	-31.9 +17.7	+0.2	+0.3	+0.9	+0.0	32.8	43.5	-10.7	Horiz
7	125.678M	44.7	-32.0 +17.8	+0.3	+0.4	+1.0	+0.0	32.2	43.5	-11.3	Horiz
8	74.815M	40.3	-32.0 +12.9	+0.2	+0.3	+0.7	+0.0	22.4	40.0	-17.6	Vert

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107662**	Date:	1/5/2023
Test Type:	**Radiated Scan**	Time:	14:42:48
Tested By:	Hieu Song Nguyenpham	Sequence#:	1
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

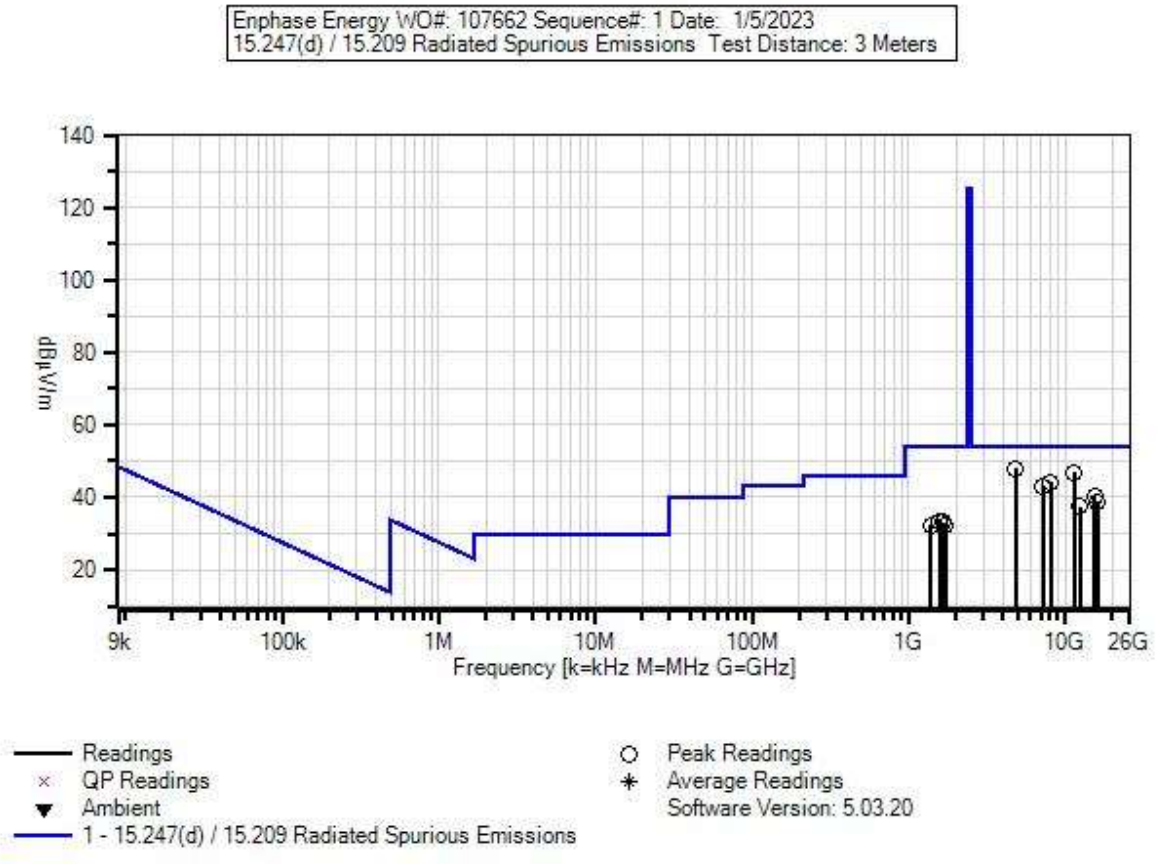
Radiated Emission
Frequency Range: 1GHz to 25GHz

Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Note:
Choose 802.11b is the highest RF output power to perform Radiated Spurious Emission.
802.11b-Low Channel



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna-ANSI C63.5	3115	1/7/2021	1/7/2023
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/10/2022	1/10/2024
T3	ANP01210	Cable	FSJ1P-50A-4A	11/1/2022	11/1/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T4	AN03738	Preamp	BZRYE-00101800-221055-202323	2/4/2022	2/4/2024
T5	AN03386	High Pass Filter	11SH10-3000/T10000-O/O	3/22/2022	3/22/2024
T6	AN03013	Cable	32022-2-2909K-36TC	3/7/2022	3/7/2024
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
	ANP00928	Cable	various	1/12/2022	1/12/2024
	ANP00929	Cable	various	1/12/2022	1/12/2024
	ANP07705	Cable	32022-29094K-29094K-120TC	11/7/2022	11/7/2024
	ANP07698	Cable	32022-29094K-29094K-72TC	9/1/2022	9/1/2024
	AN02748	Low Pass Filter	11SL10-2000/U6000-O/O	1/3/2023	1/3/2025

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4823.822M	62.6	+32.9 +0.4	+2.0 +1.1	+3.7	-54.7	+0.0	48.0	54.0	-6.0	Horiz
2	11377.024 M	51.3	+38.7 +0.8	+3.2 +1.7	+6.0	-54.7	+0.0	47.0	54.0	-7.0	Vert
3	8046.041M	53.1	+37.0 +0.4	+2.7 +1.4	+5.0	-55.4	+0.0	44.2	54.0	-9.8	Horiz
4	7256.252M	54.1	+35.6 +0.4	+2.5 +1.3	+4.6	-55.5	+0.0	43.0	54.0	-11.0	Horiz
5	15398.436 M	45.4	-13.6 +5.0	+0.0 +0.0	+0.5	+3.1	+0.0	40.4	54.0	-13.6	Horiz
6	16161.157 M	44.7	-14.6 +5.1	+0.0 +0.0	+0.4	+3.2	+0.0	38.8	54.0	-15.2	Vert
7	12460.191 M	43.4	-13.9 +4.6	+0.0 +0.0	+0.6	+2.8	+0.0	37.5	54.0	-16.5	Horiz
8	1570.045M	58.8	+25.2 +0.6	+1.1 +0.2	+2.0	-54.6	+0.0	33.3	54.0	-20.7	Horiz
9	1661.256M	58.2	+25.6 +0.6	+1.2 +0.2	+2.1	-54.8	+0.0	33.1	54.0	-20.9	Vert
10	1721.496M	57.3	+25.8 +0.6	+1.2 +0.2	+2.1	-54.8	+0.0	32.4	54.0	-21.6	Vert
11	1377.814M	58.9	+24.6 +0.5	+1.1 +0.1	+1.9	-54.8	+0.0	32.3	54.0	-21.7	Vert

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107662**	Date:	1/5/2023
Test Type:	**Radiated Scan**	Time:	14:58:53
Tested By:	Hieu Song Nguyenpham	Sequence#:	3
Software:	EMITest 5.03.20		

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 1GHz

Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Perform 3 orientation of a receiving antenna from 9kHz to 30MHz. No Emission from the EUT has been found in 20dB tolerant from 9kHz to 30MHz.

Note:
Choose 802.11b is the highest RF output power to perform Radiated Spurious Emission.
802.11b-Middle Channel

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07508	Preamp	310N	5/9/2022	5/9/2024
	AN00432	Loop Antenna	6502	7/19/2021	7/19/2023
T2	ANP01187	Cable	CNT-195	7/12/2022	7/12/2024
T3	ANP06691	Cable	PE3062-180	3/16/2022	3/16/2024
T4	ANP06694	Cable	PE3062-480	3/16/2022	3/16/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T5	AN01995	Biconilog Antenna	CBL6111C	4/19/2022	4/19/2024

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	37.617M	48.4	-32.0	+0.2	+0.2	+0.5	+0.0	38.3	40.0	-1.7	Vert
	QP		+21.0								
^	37.617M	51.1	-32.0	+0.2	+0.2	+0.5	+0.0	41.0	40.0	+1.0	Vert
			+21.0								
3	37.875M	48.1	-32.0	+0.2	+0.2	+0.5	+0.0	37.9	40.0	-2.1	Vert
	QP		+20.9								
^	37.875M	50.9	-32.0	+0.2	+0.2	+0.5	+0.0	40.7	40.0	+0.7	Vert
			+20.9								
5	38.120M	48.2	-32.0	+0.2	+0.2	+0.5	+0.0	37.8	40.0	-2.2	Vert
	QP		+20.7								
^	38.120M	50.8	-32.0	+0.2	+0.2	+0.5	+0.0	40.4	40.0	+0.4	Vert
			+20.7								
7	120.825M	46.5	-31.9	+0.2	+0.3	+1.0	+0.0	33.9	43.5	-9.6	Horiz
			+17.8								
8	116.982M	46.8	-32.0	+0.2	+0.3	+0.9	+0.0	33.9	43.5	-9.6	Horiz
			+17.7								
9	124.566M	45.8	-32.0	+0.3	+0.4	+1.0	+0.0	33.3	43.5	-10.2	Horiz
			+17.8								
10	73.601M	41.2	-32.0	+0.2	+0.3	+0.7	+0.0	23.2	40.0	-16.8	Vert
			+12.8								

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107662**	Date:	1/5/2023
Test Type:	**Radiated Scan**	Time:	15:00:09
Tested By:	Hieu Song Nguyenpham	Sequence#:	5
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

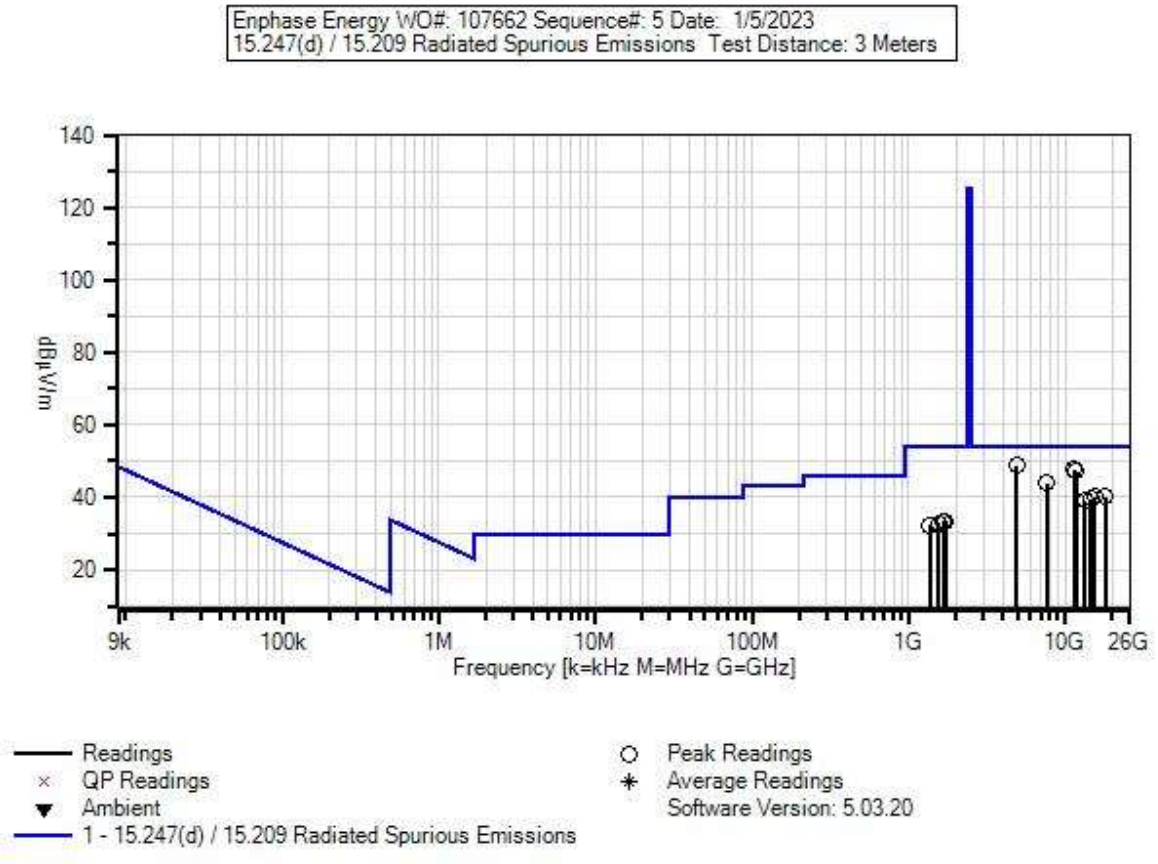
Radiated Emission
Frequency Range: 1GHz to 25GHz

Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Note:
Choose 802.11b is the highest RF output power to perform Radiated Spurious Emission.
802.11b-Middle Channel



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna-ANSI C63.5	3115	1/7/2021	1/7/2023
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/10/2022	1/10/2024
T3	ANP01210	Cable	FSJ1P-50A-4A	11/1/2022	11/1/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T4	AN03738	Preamp	BZRYE-00101800-221055-202323	2/4/2022	2/4/2024
T5	AN03386	High Pass Filter	11SH10-3000/T10000-O/O	3/22/2022	3/22/2024
T6	AN03013	Cable	32022-2-2909K-36TC	3/7/2022	3/7/2024
T7	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
T8	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
T9	ANP00928	Cable	various	1/12/2022	1/12/2024
T10	ANP00929	Cable	various	1/12/2022	1/12/2024
T11	ANP07705	Cable	32022-29094K-29094K-120TC	11/7/2022	11/7/2024
T12	ANP07698	Cable	32022-29094K-29094K-72TC	9/1/2022	9/1/2024
	AN02748	Low Pass Filter	11SL10-2000/U6000-O/O	1/3/2023	1/3/2025

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4883.882M	63.1	+33.0 +0.4 +1.1	+2.0 +1.1 +1.1	+3.7 +1.1 +1.1	-54.5 +1.1 +1.1	+0.0	48.8	54.0	-5.2	Horiz
2	11367.104 M	51.9	+38.7 +0.8 +1.7	+3.2 +1.7 +1.7	+6.0 +1.7 +1.7	-54.7 +1.7 +1.7	+0.0	47.6	54.0	-6.4	Horiz
3	11810.528 M	51.2	+38.7 +0.8 +1.7	+3.2 +1.7 +1.7	+6.3 +1.7 +1.7	-54.7 +1.7 +1.7	+0.0	47.2	54.0	-6.8	Vert
4	7614.610M	54.3	+36.1 +0.3 +1.3	+2.5 +1.3 +1.3	+4.7 +1.3 +1.3	-55.4 +1.3 +1.3	+0.0	43.8	54.0	-10.2	Horiz
5	15354.703 M	45.3	-13.6 +5.0 +0.0	+0.0 +0.0 +0.0	+0.4 +0.0 +0.0	+3.1 +0.0 +0.0	+0.0	40.2	54.0	-13.8	Horiz
6	17995.449 M	42.2	-11.0 +5.3 +0.0	+0.0 +0.0 +0.0	+0.4 +0.0 +0.0	+3.3 +0.0 +0.0	+0.0	40.2	54.0	-13.8	Horiz
7	14476.061 M	44.6	-13.4 +4.9 +0.0	+0.0 +0.0 +0.0	+0.5 +0.0 +0.0	+3.0 +0.0 +0.0	+0.0	39.6	54.0	-14.4	Vert
8	13318.057 M	45.4	-14.6 +4.7 +0.0	+0.0 +0.0 +0.0	+0.6 +0.0 +0.0	+2.9 +0.0 +0.0	+0.0	39.0	54.0	-15.0	Vert
9	1665.516M	58.6	+25.6 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	33.5	54.0	-20.5	Vert
10	1721.496M	58.2	+25.8 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	33.3	54.0	-20.7	Horiz
11	1557.145M	58.7	+25.1 +0.6 +0.2	+1.1 +0.2 +0.2	+2.0 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	32.9	54.0	-21.1	Vert
12	1369.478M	58.9	+24.6 +0.5 +0.1	+1.1 +0.1 +0.1	+1.8 +0.1 +0.1	-54.7 +0.1 +0.1	+0.0	32.3	54.0	-21.7	Vert

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107662**	Date:	1/5/2023
Test Type:	**Radiated Scan**	Time:	14:59:22
Tested By:	Hieu Song Nguyenpham	Sequence#:	4
Software:	EMITest 5.03.20		

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 1GHz

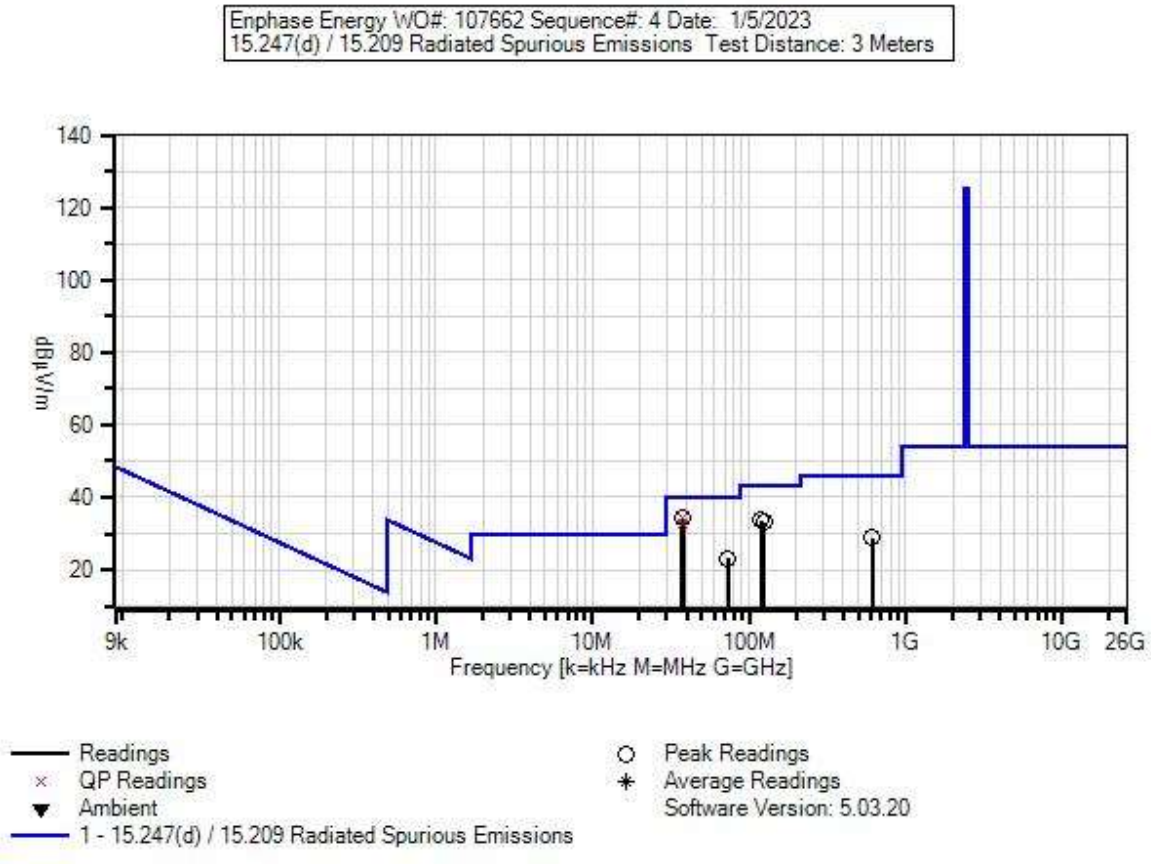
Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Perform 3 orientation of a receiving antenna from 9kHz to 30MHz. No Emission from the EUT has been found in 20dB tolerant from 9kHz to 30MHz.

Note:
Choose 802.11b is the highest RF output power to perform Radiated Spurious Emission.
802.11b-High Channel



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07508	Preamp	310N	5/9/2022	5/9/2024
	AN00432	Loop Antenna	6502	7/19/2021	7/19/2023
T2	ANP01187	Cable	CNT-195	7/12/2022	7/12/2024
T3	ANP06691	Cable	PE3062-180	3/16/2022	3/16/2024
T4	ANP06694	Cable	PE3062-480	3/16/2022	3/16/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T5	AN01995	Biconilog Antenna	CBL6111C	4/19/2022	4/19/2024

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	38.126M	44.6	-32.0 +20.7	+0.2	+0.2	+0.5	+0.0	34.2	40.0	-5.8	Vert
2	37.643M QP	44.2	-32.0 +21.0	+0.2	+0.2	+0.5	+0.0	34.1	40.0	-5.9	Vert
^	37.643M	47.7	-32.0 +21.0	+0.2	+0.2	+0.5	+0.0	37.6	40.0	-2.4	Vert
4	37.870M QP	42.8	-32.0 +20.9	+0.2	+0.2	+0.5	+0.0	32.6	40.0	-7.4	Vert
^	37.870M	46.8	-32.0 +20.9	+0.2	+0.2	+0.5	+0.0	36.6	40.0	-3.4	Vert
6	119.409M	46.4	-31.9 +17.7	+0.2	+0.3	+0.9	+0.0	33.6	43.5	-9.9	Horiz
7	125.375M	45.5	-32.0 +17.8	+0.3	+0.4	+1.0	+0.0	33.0	43.5	-10.5	Horiz
8	73.096M	41.2	-32.0 +12.7	+0.2	+0.3	+0.7	+0.0	23.1	40.0	-16.9	Vert
9	611.759M	30.4	-32.0 +26.2	+0.6	+1.0	+2.6	+0.0	28.8	46.0	-17.2	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107662**	Date:	1/5/2023
Test Type:	**Radiated Scan**	Time:	15:00:47
Tested By:	Hieu Song Nguyenpham	Sequence#:	6
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

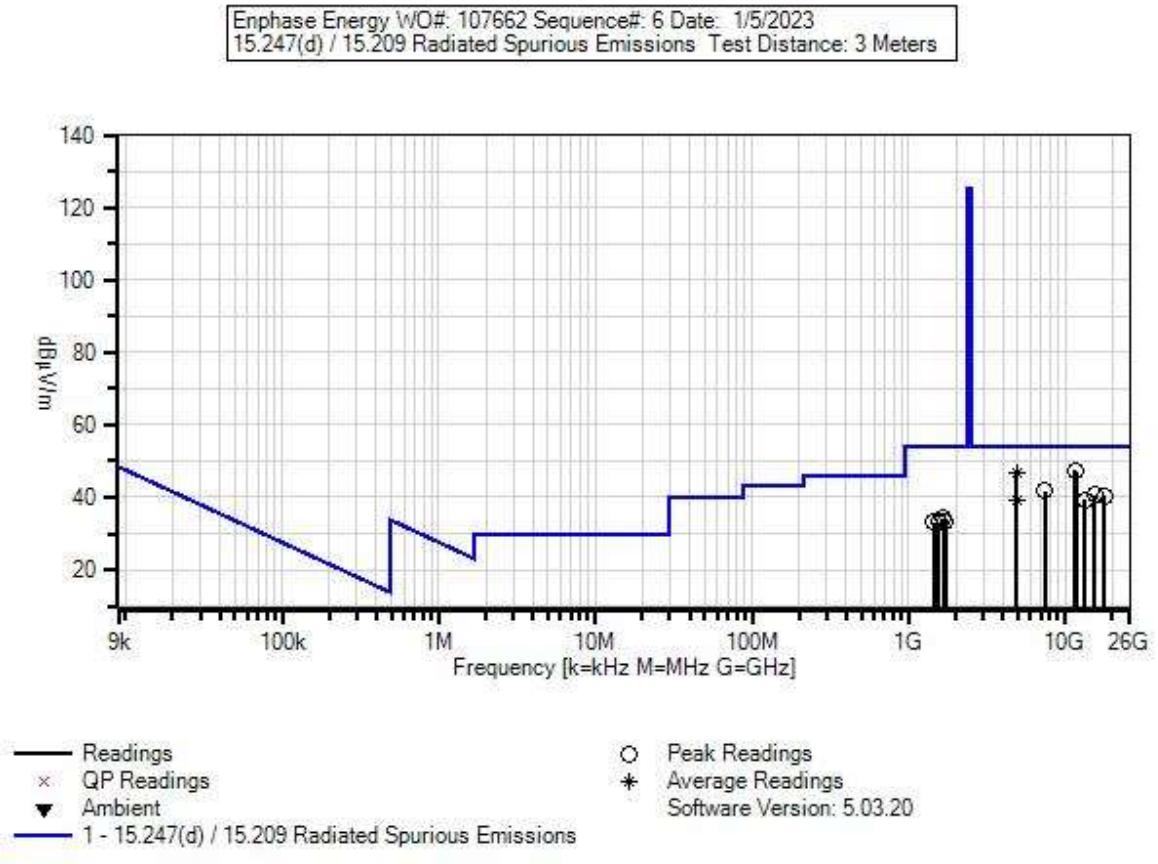
Radiated Emission
Frequency Range: 1GHz to 25GHz

Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Note:
Choose 802.11b is the highest RF output power to perform Radiated Spurious Emission.
802.11b-High Channel



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna-ANSI C63.5	3115	1/7/2021	1/7/2023
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/10/2022	1/10/2024
T3	ANP01210	Cable	FSJ1P-50A-4A	11/1/2022	11/1/2024
	AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023
T4	AN03738	Preamp	BZRYE-00101800-221055-202323	2/4/2022	2/4/2024
T5	AN03386	High Pass Filter	11SH10-3000/T10000-O/O	3/22/2022	3/22/2024
T6	AN03013	Cable	32022-2-2909K-36TC	3/7/2022	3/7/2024
T7	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
T8	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
T9	ANP00928	Cable	various	1/12/2022	1/12/2024
T10	ANP00929	Cable	various	1/12/2022	1/12/2024
T11	ANP07705	Cable	32022-29094K-29094K-120TC	11/7/2022	11/7/2024
T12	ANP07698	Cable	32022-29094K-29094K-72TC	9/1/2022	9/1/2024
	AN02748	Low Pass Filter	11SL10-2000/U6000-O/O	1/3/2023	1/3/2025

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	11570.464 M	51.5	+38.8 +0.8 +1.7	+3.2 +1.7 +1.7	+6.1 +1.7 +1.7	-54.6 +1.7 +1.7	+0.0	47.5	54.0	-6.5	Horiz
2	11698.432 M	51.2	+38.7 +0.8 +1.7	+3.2 +1.7 +1.7	+6.2 +1.7 +1.7	-54.6 +1.7 +1.7	+0.0	47.2	54.0	-6.8	Vert
3	4923.920M Ave	61.2	+33.1 +0.4 +1.1	+2.0 +1.1 +1.1	+3.8 +1.1 +1.1	-54.6 +1.1 +1.1	+0.0	47.0	54.0	-7.0	Horiz
^	4923.920M	66.7	+33.1 +0.4 +1.1	+2.0 +1.1 +1.1	+3.8 +1.1 +1.1	-54.6 +1.1 +1.1	+0.0	52.5	54.0	-1.5	Horiz
5	7386.000M	52.7	+35.7 +0.3 +1.3	+2.5 +1.3 +1.3	+4.6 +1.3 +1.3	-55.4 +1.3 +1.3	+0.0	41.7	54.0	-12.3	Horiz
6	15378.375 M	45.7	-13.6 +5.0 +0.0	+0.0 +0.0 +0.0	+0.5 +0.0 +0.0	+3.1 +0.0 +0.0	+0.0	40.7	54.0	-13.3	Vert
7	17730.355 M	42.8	-11.3 +5.3 +0.0	+0.0 +0.0 +0.0	+0.3 +0.0 +0.0	+3.3 +0.0 +0.0	+0.0	40.4	54.0	-13.6	Horiz
8	4927.080M Ave	53.5	+33.1 +0.4 +1.1	+2.0 +1.1 +1.1	+3.8 +1.1 +1.1	-54.6 +1.1 +1.1	+0.0	39.3	54.0	-14.7	Horiz
^	4927.080M	63.4	+33.1 +0.4 +1.1	+2.0 +1.1 +1.1	+3.8 +1.1 +1.1	-54.6 +1.1 +1.1	+0.0	49.2	54.0	-4.8	Horiz
10	13290.289 M	45.7	-14.6 +4.7 +0.0	+0.0 +0.0 +0.0	+0.5 +0.0 +0.0	+2.9 +0.0 +0.0	+0.0	39.2	54.0	-14.8	Horiz
11	13287.286 M	45.6	-14.6 +4.7 +0.0	+0.0 +0.0 +0.0	+0.5 +0.0 +0.0	+2.9 +0.0 +0.0	+0.0	39.1	54.0	-14.9	Vert
12	1660.018M	59.4	+25.6 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	34.3	54.0	-19.7	Horiz

13	1719.020M	58.3	+25.8 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	33.4	54.0	-20.6	Horiz
14	1707.055M	58.1	+25.8 +0.6 +0.2	+1.2 +0.2 +0.2	+2.1 +0.2 +0.2	-54.7 +0.2 +0.2	+0.0	33.3	54.0	-20.7	Vert
15	1548.431M	59.0	+25.1 +0.6 +0.2	+1.1 +0.2 +0.2	+2.0 +0.2 +0.2	-54.8 +0.2 +0.2	+0.0	33.2	54.0	-20.8	Horiz
16	1442.000M	59.1	+24.8 +0.6 +0.2	+1.1 +0.2 +0.2	+1.9 +0.2 +0.2	-54.7 +0.2 +0.2	+0.0	33.0	54.0	-21.0	Vert

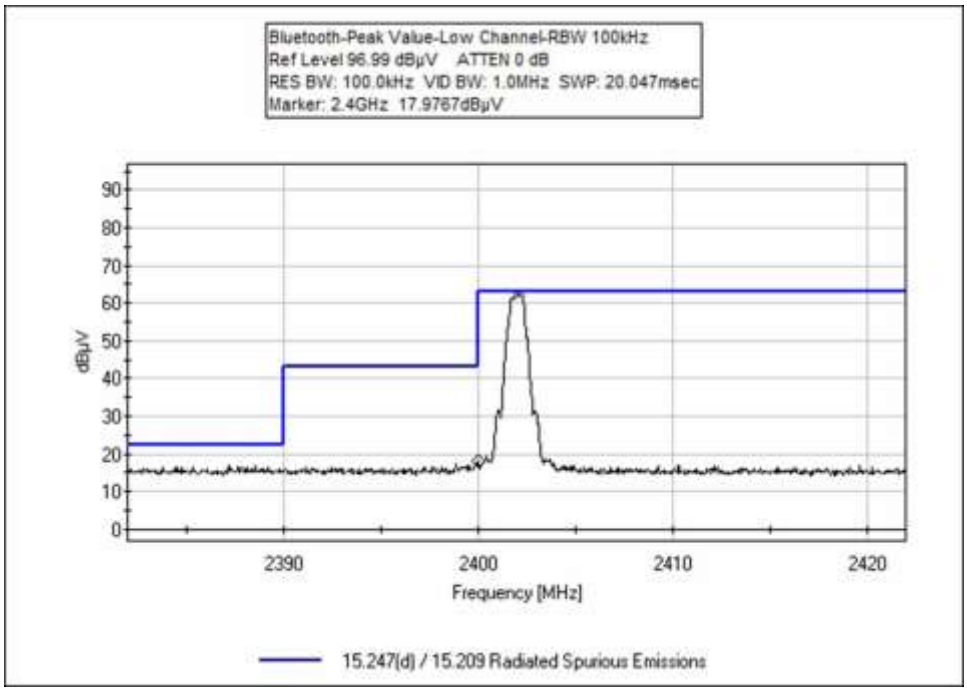
Band Edge

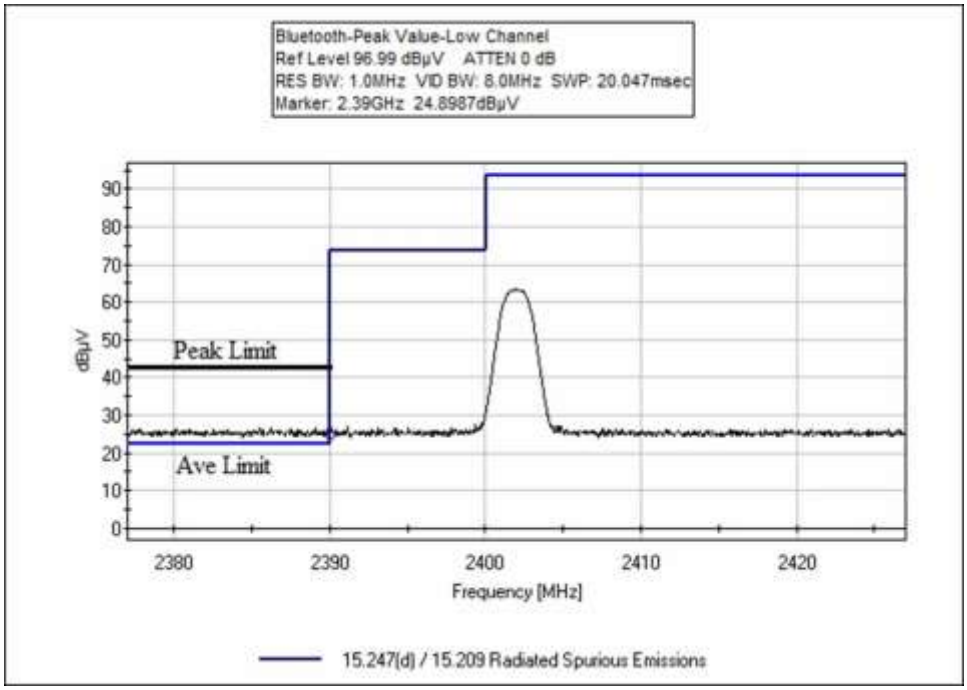
Band Edge Summary for Bluetooth					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	GFSK	External	44.1	<54	Pass
2400.0	GFSK	External	49.6	<74.6	Pass
2483.5	GFSK	External	44.7	<54	Pass

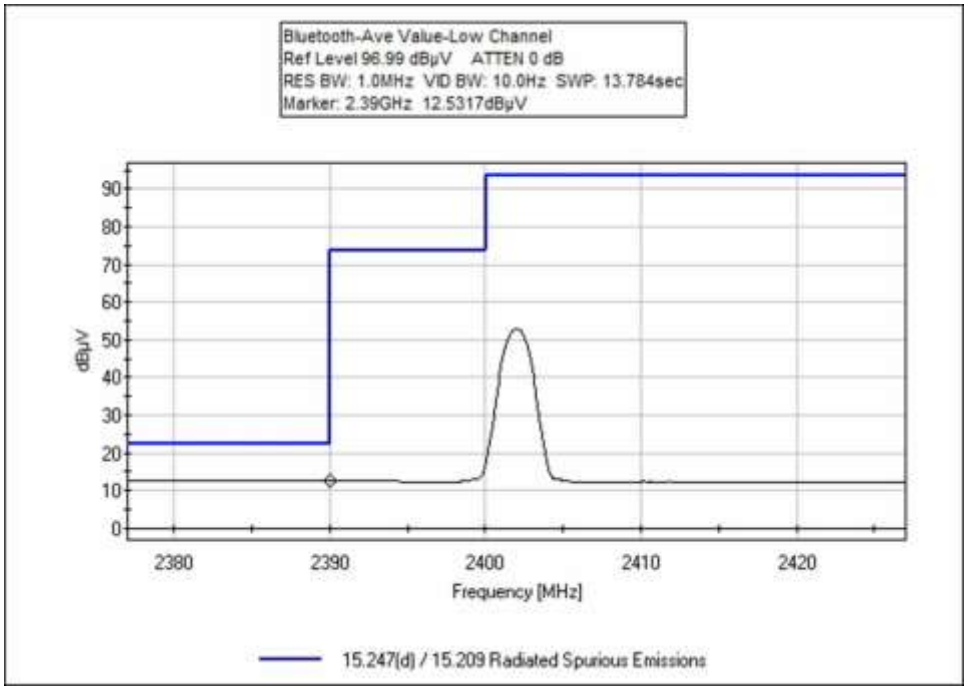
Band Edge Summary for 802.11					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	802.11b	External	44.4	<54	Pass
2400.0	802.11b	External	50.8	<79.3	Pass
2483.5	802.11b	External	49.9	<54	Pass
2390.0	802.11g	External	45	<54	Pass
2400.0	802.11g	External	55.1	<74.8	Pass
2483.5	802.11g	External	53.1	<54	Pass
2390.0	802.11n-HT20	External	44.7	<54	Pass
2400.0	802.11n-HT20	External	53.5	<73.8	Pass
2483.5	802.11n-HT20	External	51.8	<54	Pass
2390.0	802.11n-HT40	External	44.5	<54	Pass
2400.0	802.11n-HT40	External	53	<68	Pass
2483.5	802.11n-HT40	External	49.3	<54	Pass

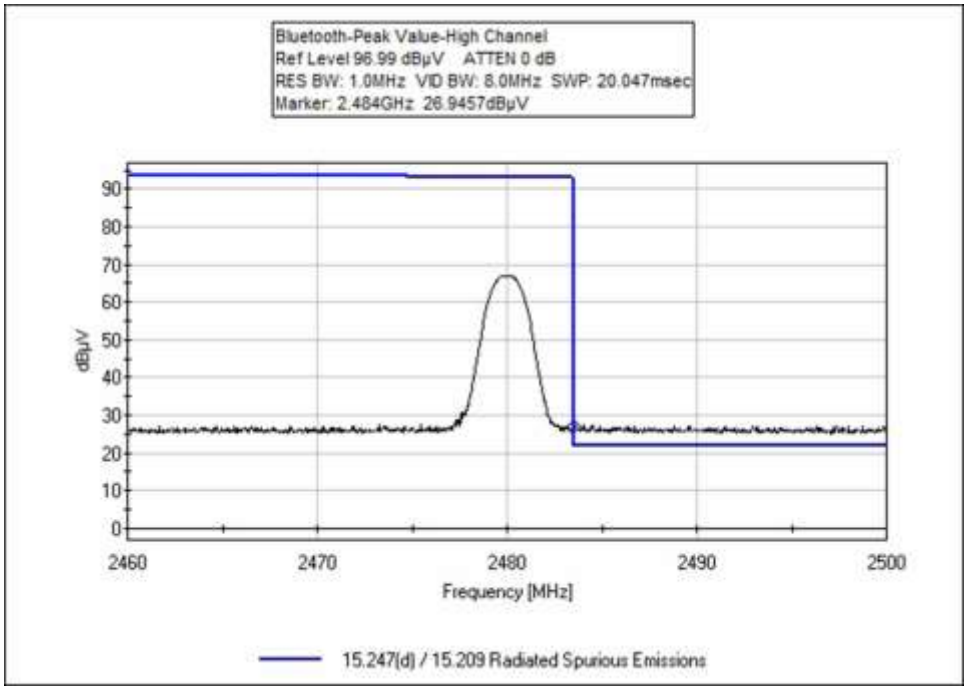
Band Edge Plots

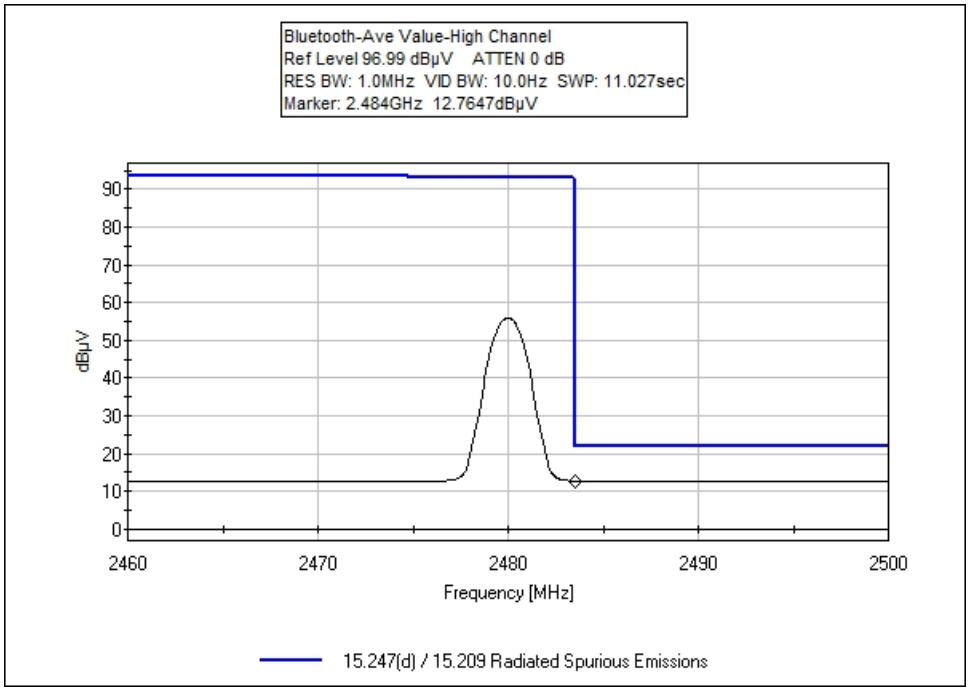
Bluetooth



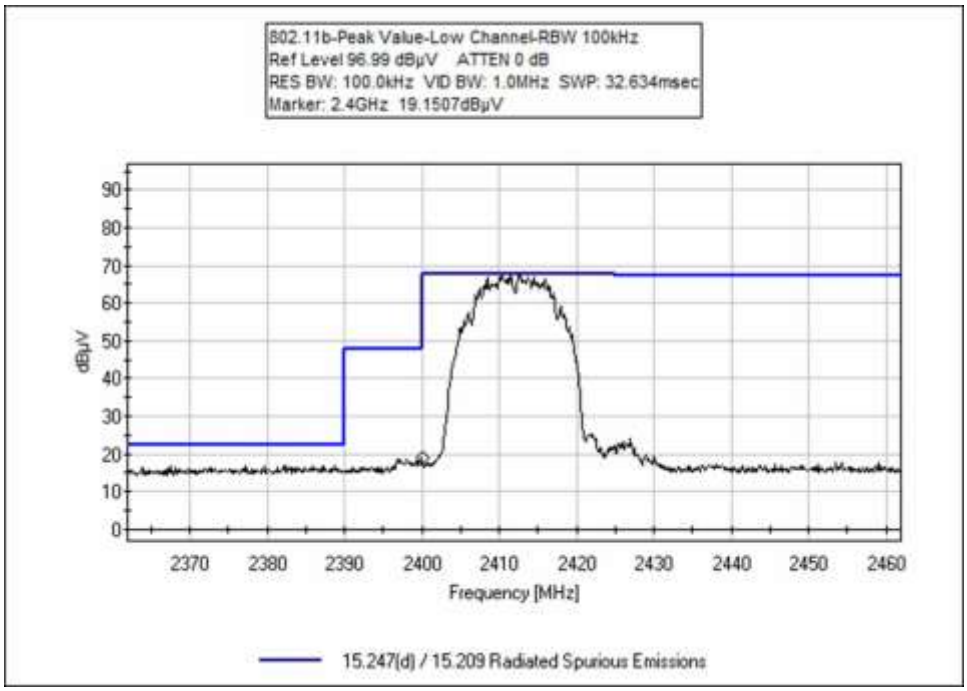

Bluetooth-Peak Value-Low Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 8.0MHz SWP: 20.047msec
Marker: 2.39GHz 24.8987dBµV
dBµV
Peak Limit
Ave Limit
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

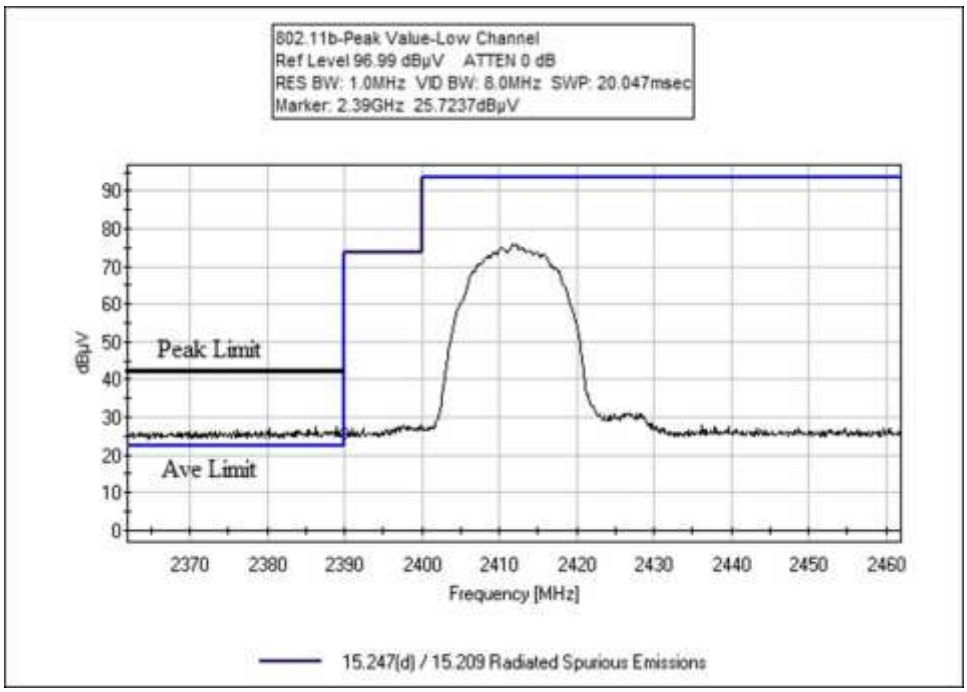

Bluetooth-Ave Value-Low Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 13.784sec
Marker: 2.39GHz 12.5317dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

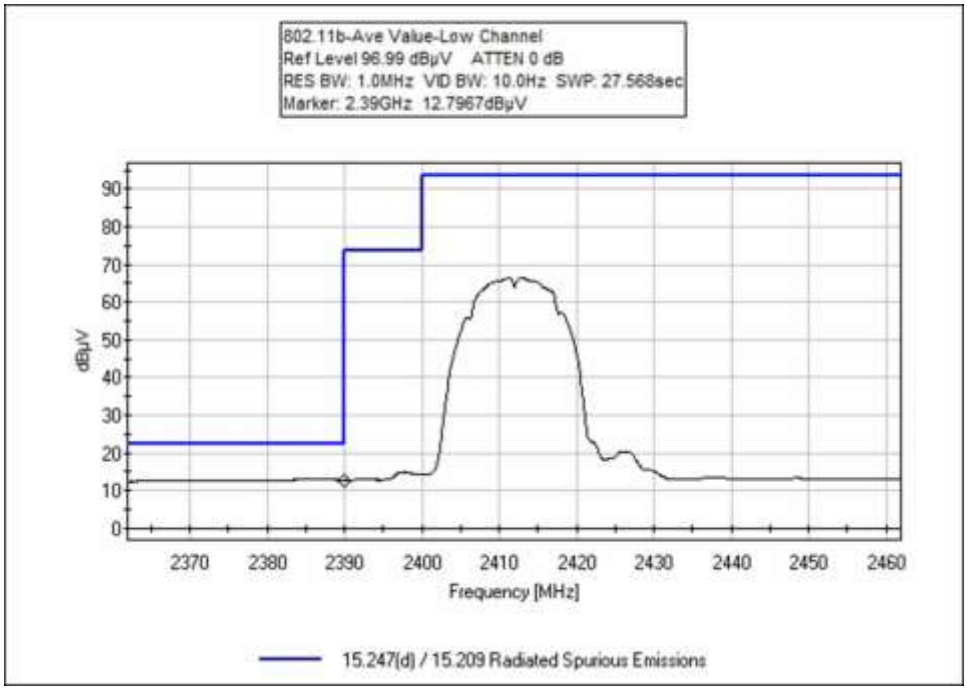

Bluetooth-Peak Value-High Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 8.0MHz SWP: 20.047msec
Marker: 2.484GHz 26.9457dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
2460
2470
2480
2490
2500
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

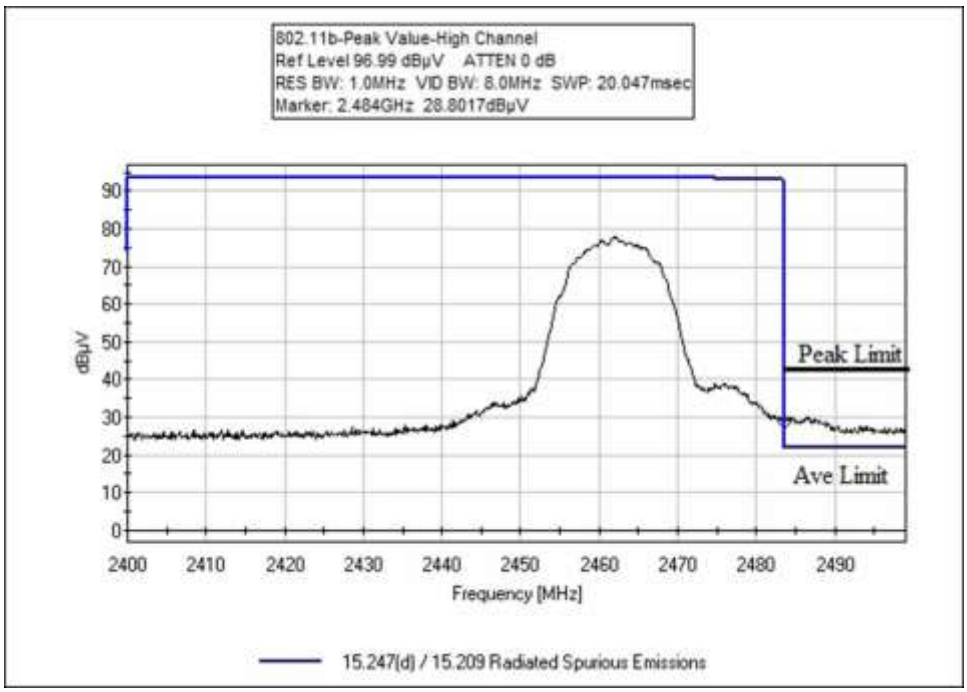

Bluetooth-Ave Value-High Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 11.027sec
Marker: 2.484GHz 12.7647dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
2460
2470
2480
2490
2500
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

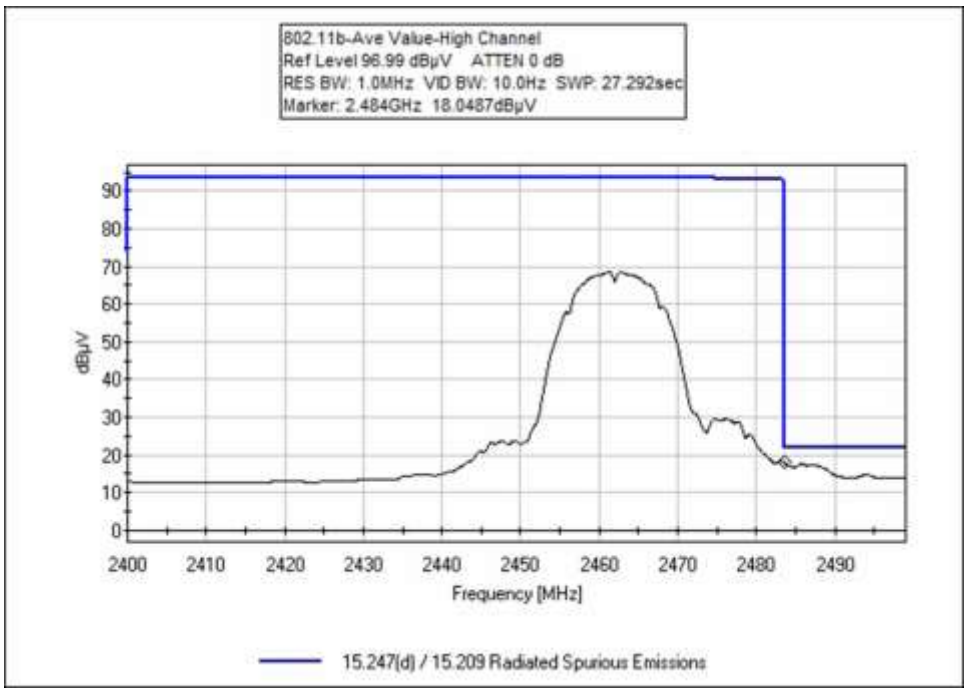
802.11

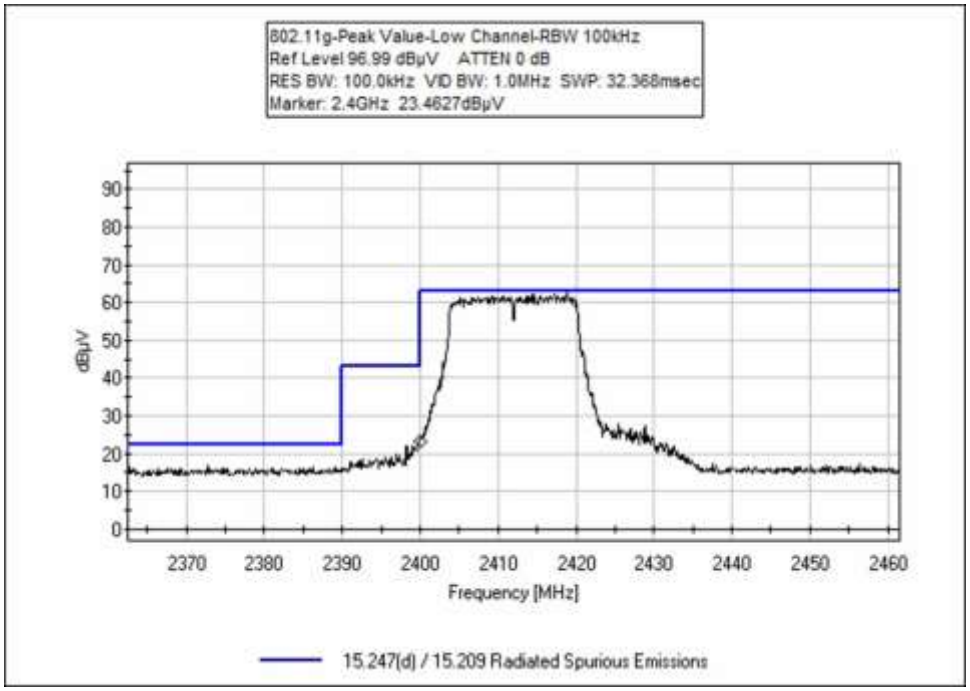

802.11b-Peak Value-Low Channel-RBW 100kHz
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 32.634msec
Marker: 2.4GHz 19.1507dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
2370
2380
2390
2400
2410
2420
2430
2440
2450
2460
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

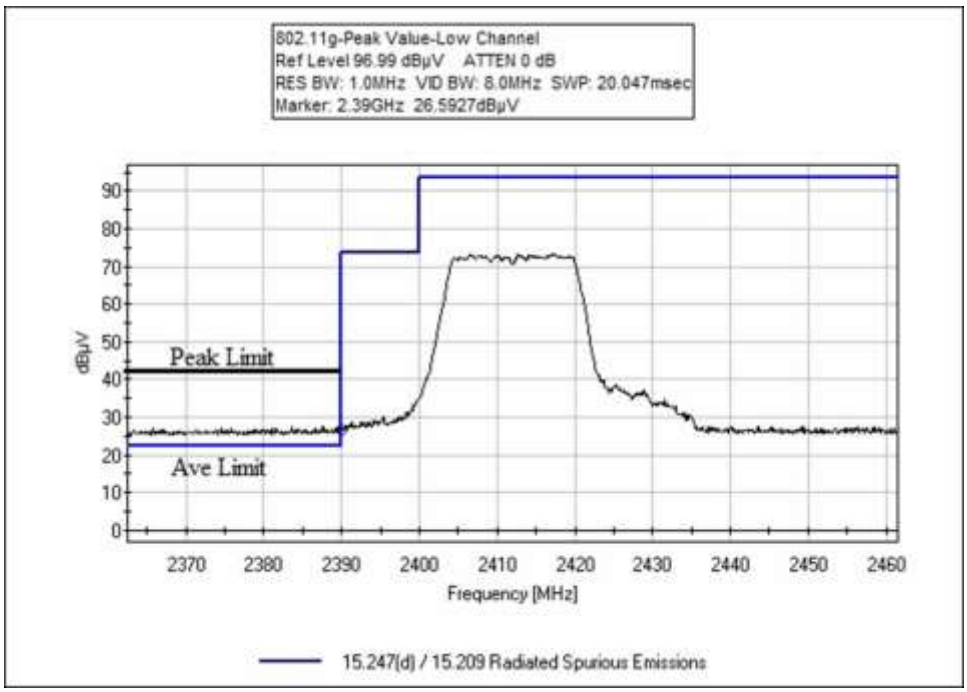

802.11b-Peak Value-Low Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 8.0MHz SWP: 20.047msec
Marker: 2.39GHz 25.7237dBµV
dBµV
Peak Limit
Ave Limit
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

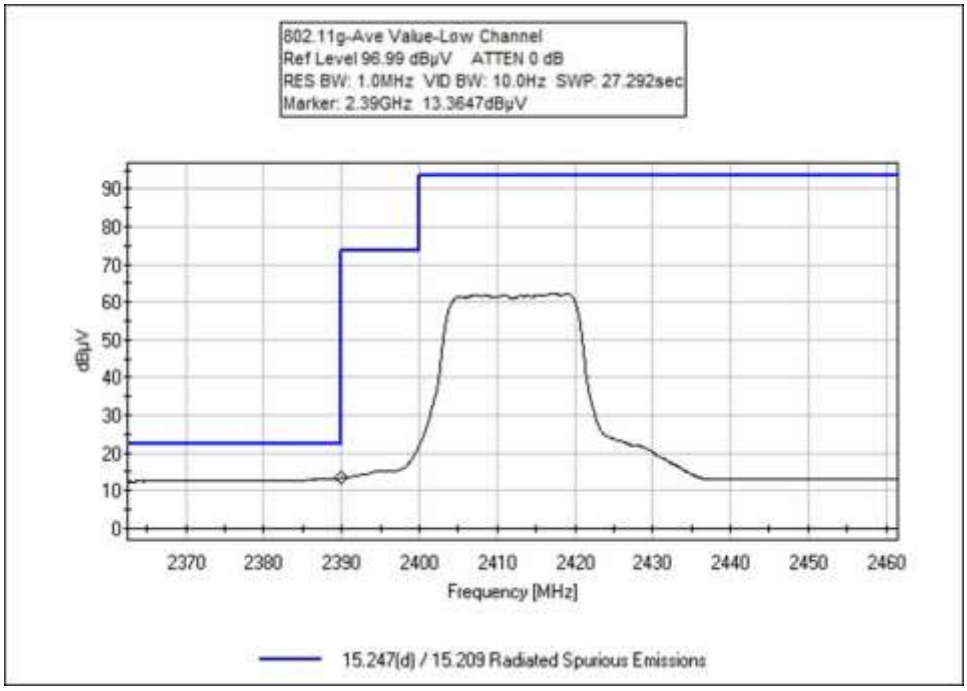

802.11b-Ave Value-Low Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 27.568sec
Marker: 2.39GHz 12.7967dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

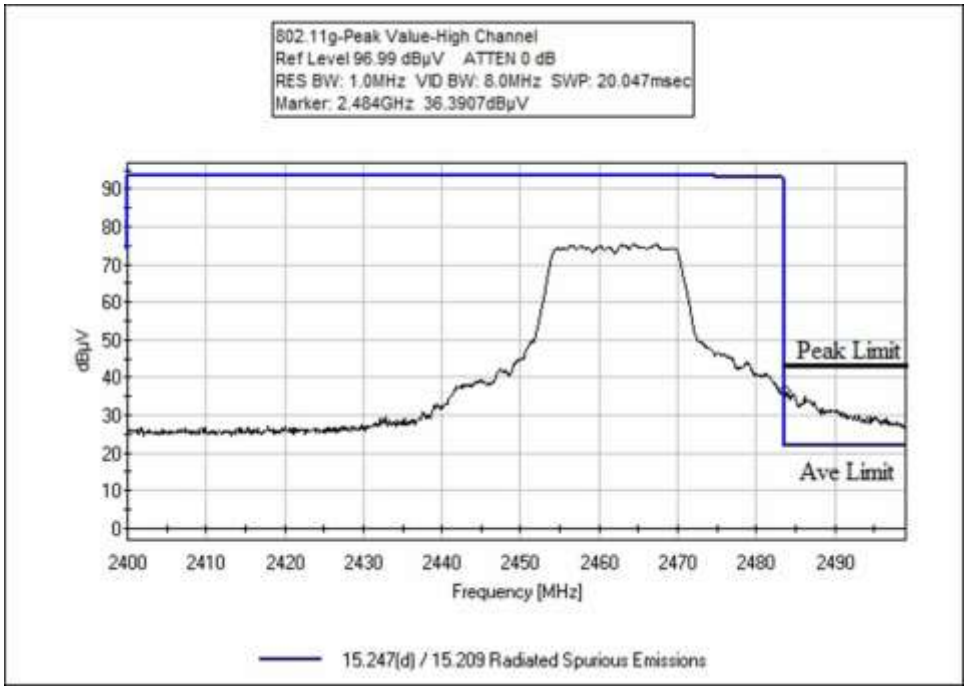

802.11b-Peak Value-High Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 8.0MHz SWP: 20.047msec
Marker: 2.484GHz 28.8017dBµV
dBµV
Peak Limit
Ave Limit
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

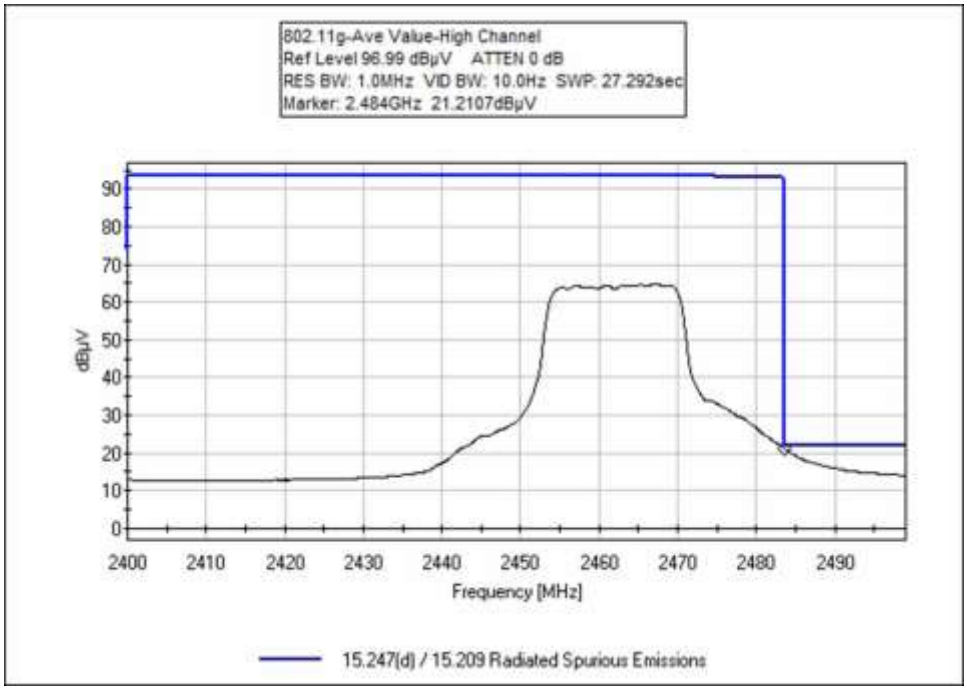

802.11b-Ave Value-High Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 27.292sec
Marker: 2.484GHz 18.0487dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

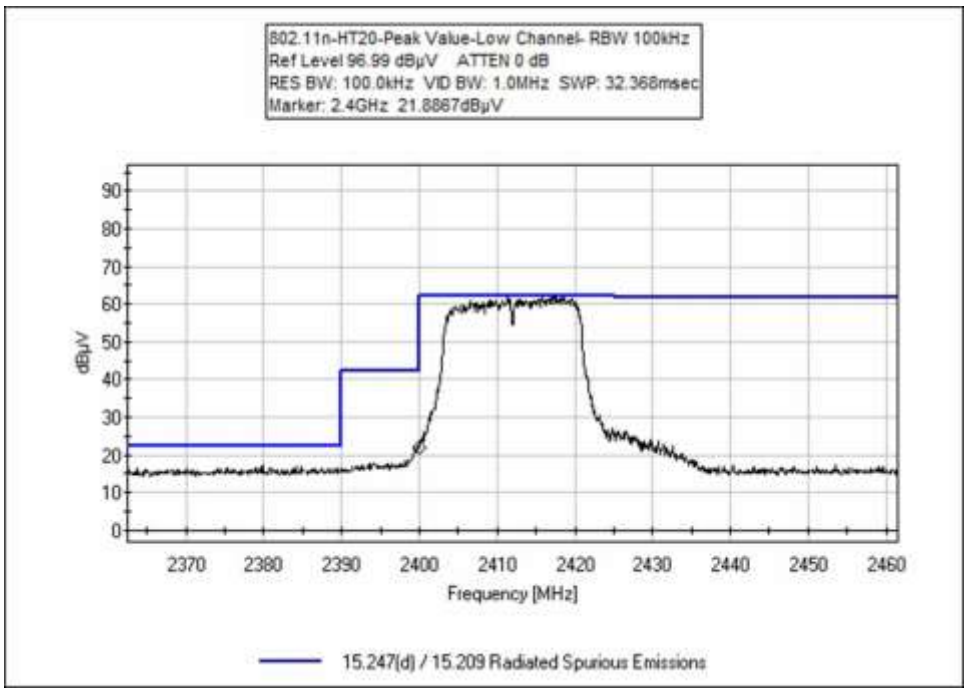

802.11g-Peak Value-Low Channel-RBW 100kHz
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 32.368msec
Marker: 2.4GHz 23.4627dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
2370
2380
2390
2400
2410
2420
2430
2440
2450
2460
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

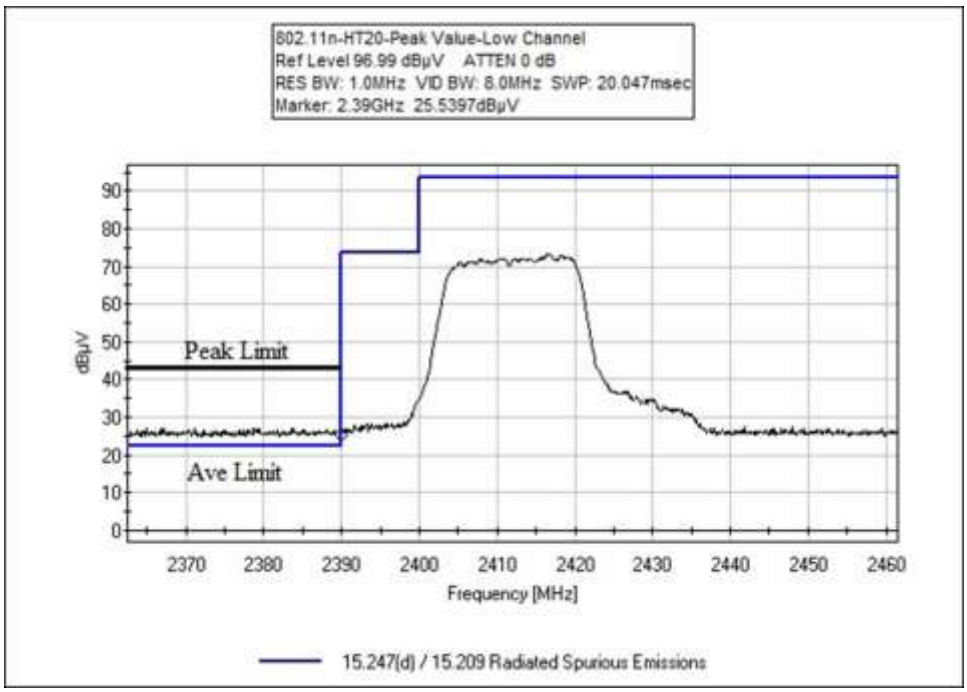

802.11g-Peak Value-Low Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 8.0MHz SWP: 20.047msec
Marker: 2.39GHz 26.5927dBµV
dBµV
Peak Limit
Ave Limit
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

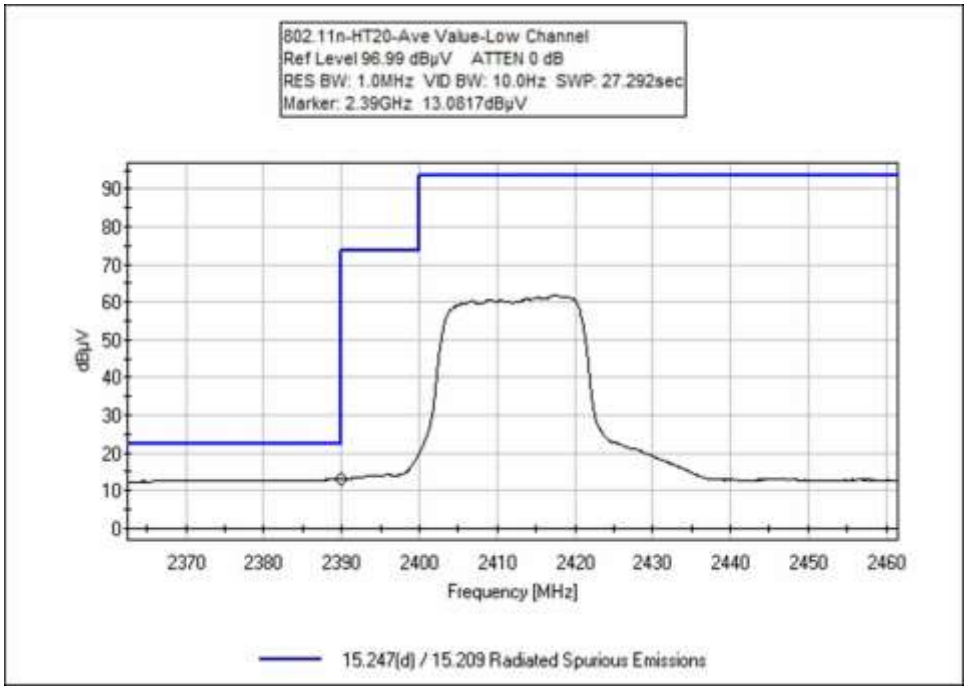

802.11g-Ave Value-Low Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 27.292sec
Marker: 2.39GHz 13.3647dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

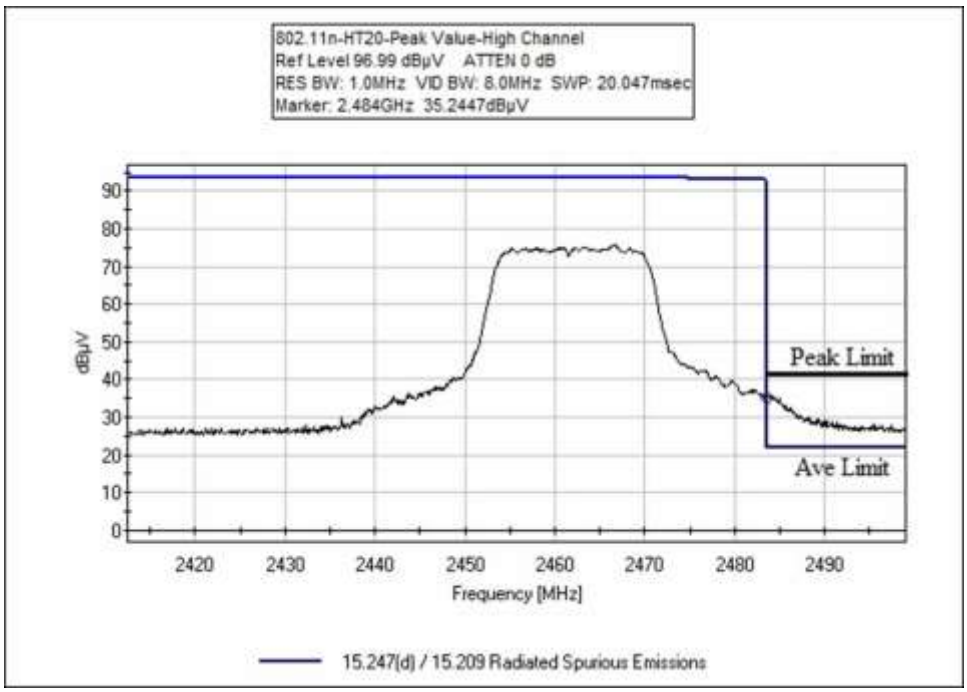

802.11g-Peak Value-High Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 8.0MHz SWP: 20.047msec
Marker: 2.484GHz 36.3907dBµV
dBµV
Peak Limit
Ave Limit
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

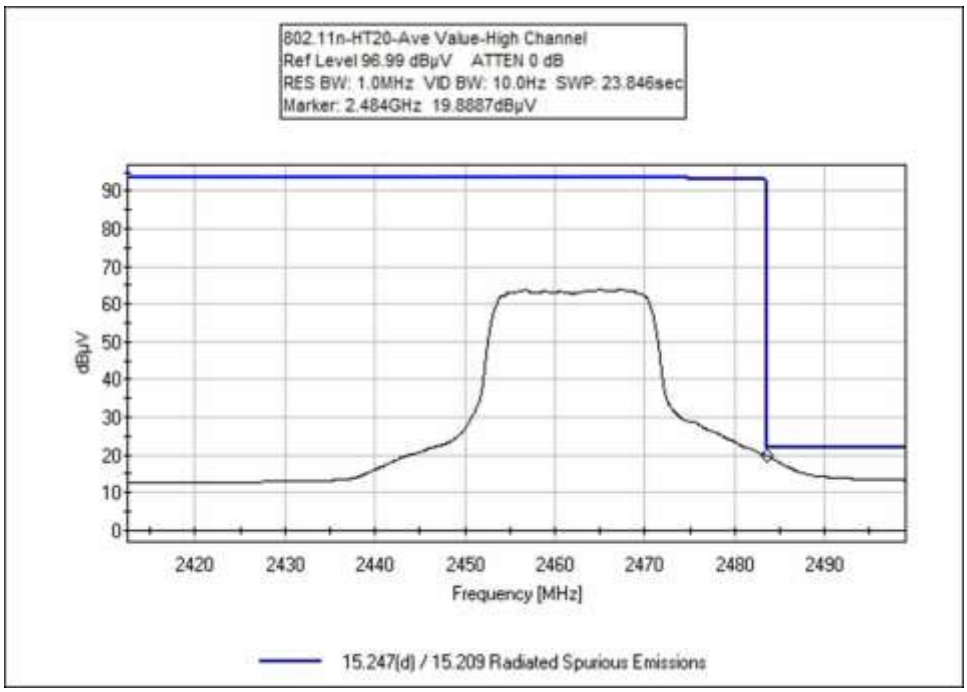

802.11g-Ave Value-High Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 27.292sec
Marker: 2.484GHz 21.2107dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

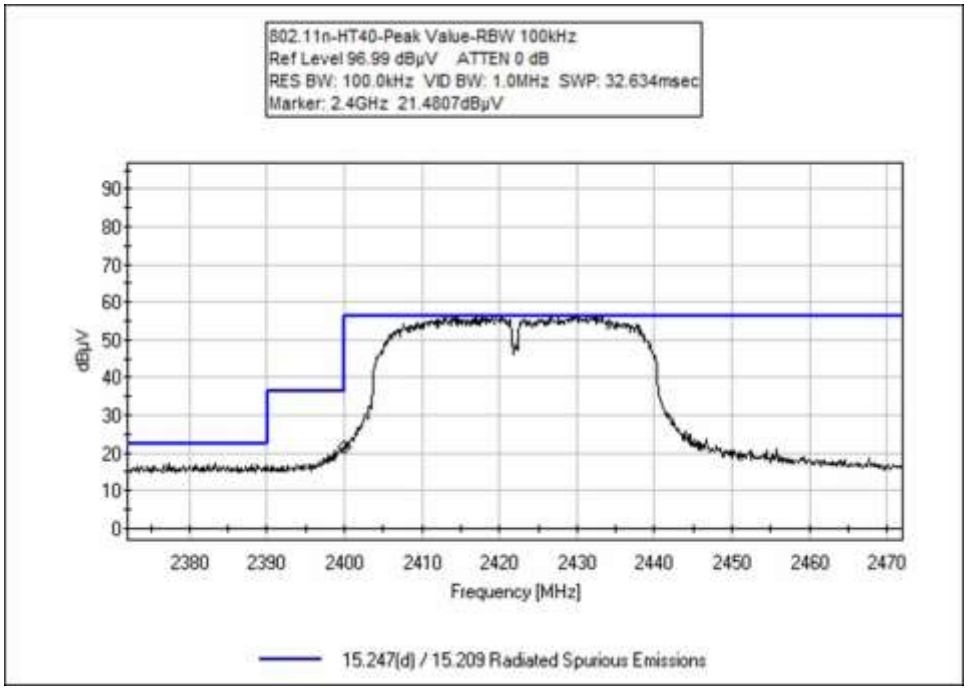

802.11n-HT20-Peak Value-Low Channel- RBW 100kHz
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 32.368msec
Marker: 2.4GHz 21.8867dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
2370
2380
2390
2400
2410
2420
2430
2440
2450
2460
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

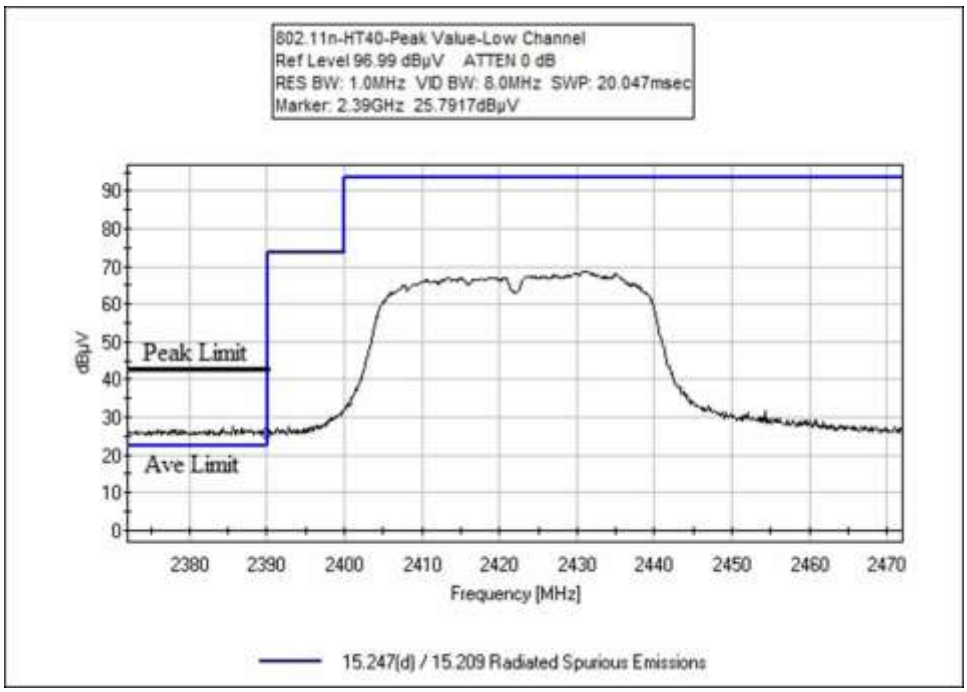

802.11n-HT20-Peak Value-Low Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 8.0MHz SWP: 20.047msec
Marker: 2.39GHz 25.5397dBµV
dBµV
Peak Limit
Ave Limit
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

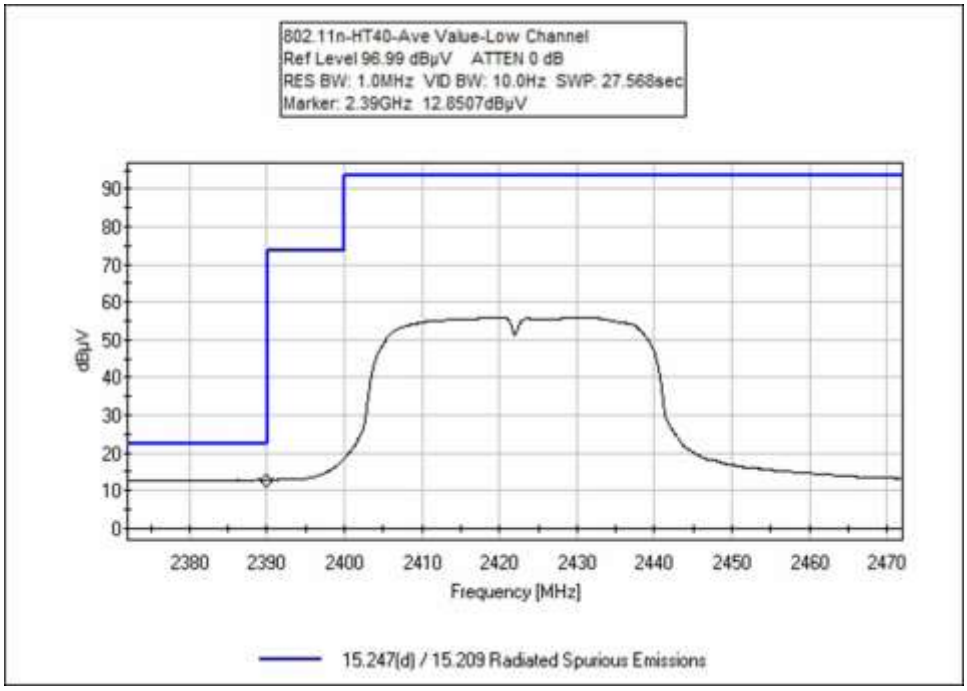

802.11n-HT20-Ave Value-Low Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 27.292sec
Marker: 2.39GHz 13.0817dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

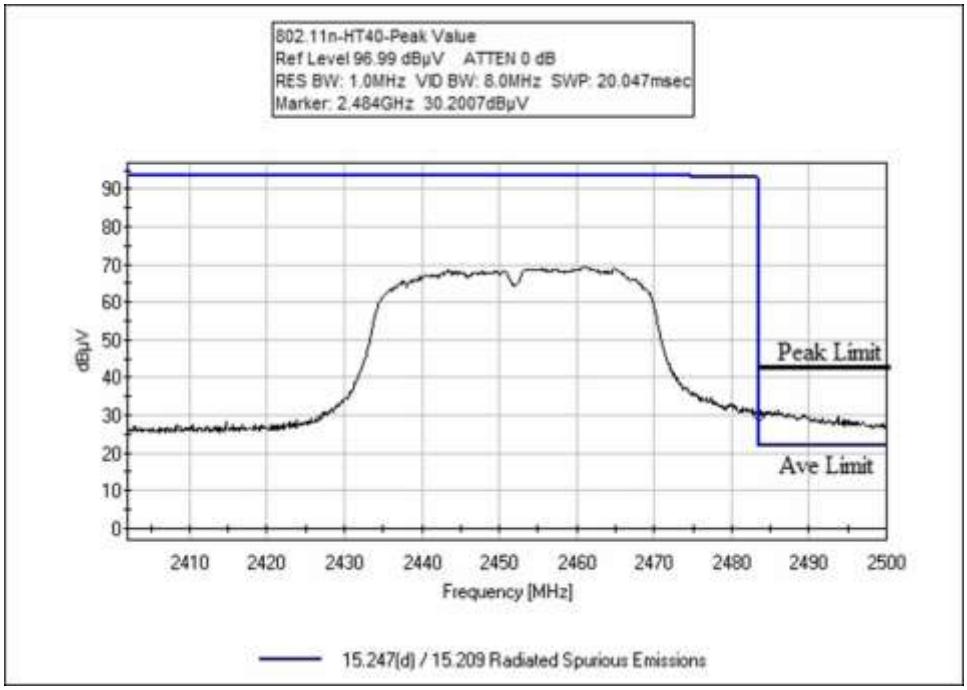

802.11n-HT20-Peak Value-High Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 8.0MHz SWP: 20.047msec
Marker: 2.484GHz 35.2447dBµV
dBµV
Peak Limit
Ave Limit
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

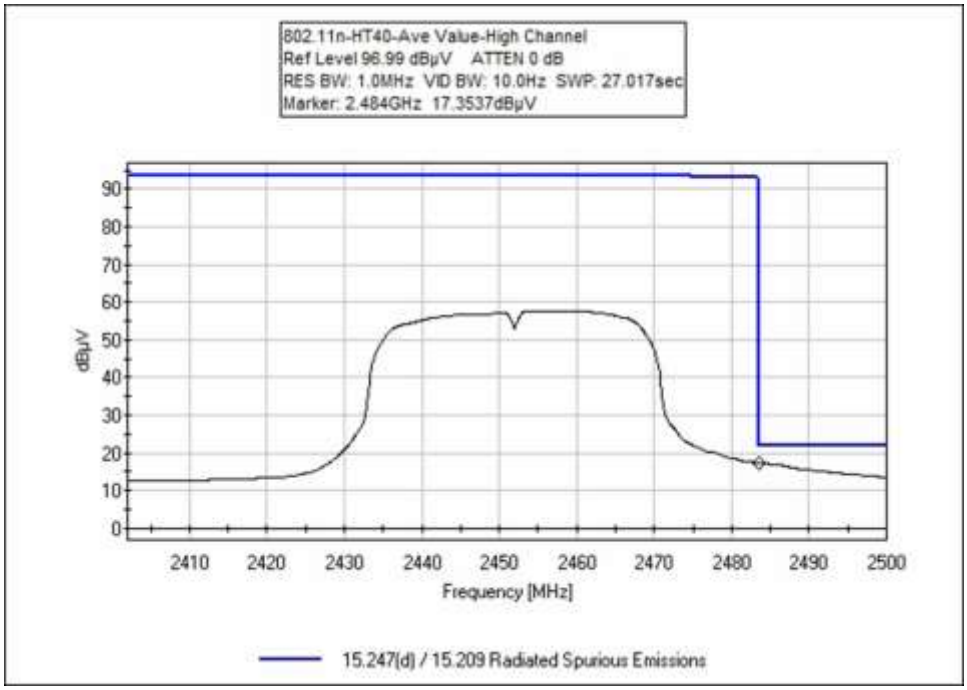

802.11n-HT20-Ave Value-High Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 23.846sec
Marker: 2.484GHz 19.8887dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


802.11n-HT40-Peak Value-RBW 100kHz
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 32.634msec
Marker: 2.4GHz 21.4807dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
2380
2390
2400
2410
2420
2430
2440
2450
2460
2470
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


802.11n-HT40-Peak Value-Low Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 8.0MHz SWP: 20.047msec
Marker: 2.39GHz 25.7917dBµV
dBµV
Peak Limit
Ave Limit
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


802.11n-HT40-Ave Value-Low Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 27.568sec
Marker: 2.39GHz 12.8507dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


802.11n-HT40-Peak Value
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 8.0MHz SWP: 20.047msec
Marker: 2.484GHz 30.2007dBµV
dBµV
Peak Limit
Ave Limit
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


802.11n-HT40-Ave Value-High Channel
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 1.0MHz VID BW: 10.0Hz SWP: 27.017sec
Marker: 2.484GHz 17.3537dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	**Enphase Energy**		
Specification:	**Band Edge (FCC 15.247/FCC 15.209)**		
Work Order #:	**107662**	Date:	1/4/2023
Test Type:	**Radiated Scan**	Time:	
Tested By:	Hieu Song Nguyenpham	Sequence#:	
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Band Edge

Test Environment Conditions:
Temperature: 22.9°C
Humidity: 41%
Pressure: 100.7kPa

Dipole Antenna Gain: 2.5dBi
Highest Generated Frequency: 2480MHz
Test Method: ANSI C63.10 (2013)

The EUT is set up and operated as intended. It is powered up at 3.3VDC by the DC Power supply, which is outside of the chamber. The EUT is set up in the worst orientation.

Test Equipment:

Asset #	Description	Model	Calibration Date	Cal Due Date
AN02157	Horn Antenna-ANSI C63.5	3115	1/7/2021	1/7/2023
AN03302	Cable	32026-29094K-29094K-72TC	1/10/2022	1/10/2024
ANP01210	Cable	FSJ1P-50A-4A	11/1/2022	11/1/2024
AN03470	Spectrum Analyzer	E4440A	7/24/2021	7/24/2023

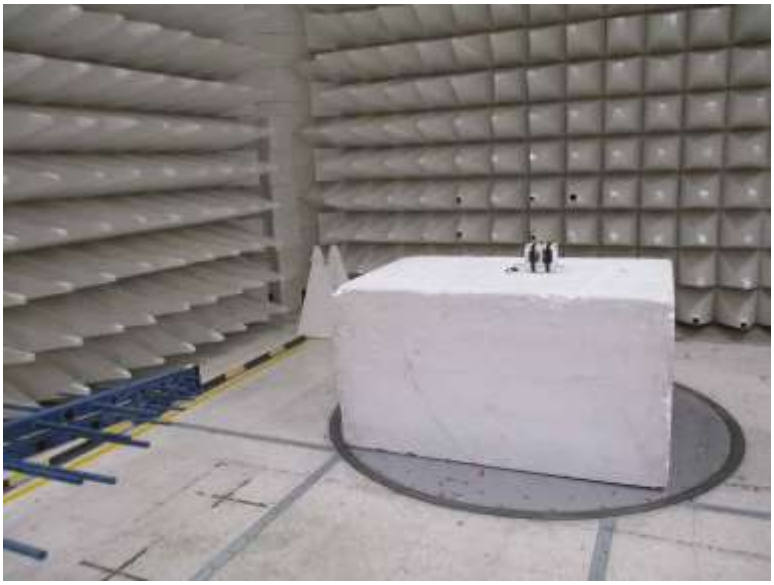
Measurement Data: Reading listed by order taken. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	2483.500M	30.1	+27.9	+1.4	+2.6		+0.0	62.0	54.0 802.11n-HT40	+8.0	Horiz
2	2483.500M Ave	17.4	+27.9	+1.4	+2.6		+0.0	49.3	54.0 802.11n-HT40	-4.7	Horiz
3	2390.000M	25.8	+27.7	+1.4	+2.5		+0.0	57.4	54.0 802.11n-HT40	+3.4	Horiz
4	2390.000M Ave	12.9	+27.7	+1.4	+2.5		+0.0	44.5	54.0 802.11n-HT40	-9.5	Horiz
5	2400.000M	21.4	+27.7	+1.4	+2.5		+0.0	53.0	68.0 802.11n-HT40-RBW 100kHz	-15.0	Horiz
6	2390.000M	25.7	+27.7	+1.4	+2.5		+0.0	57.3	54.0 802.11b	+3.3	Horiz
7	2390.000M Ave	12.8	+27.7	+1.4	+2.5		+0.0	44.4	54.0 802.11b	-9.6	Horiz
8	2400.000M	19.2	+27.7	+1.4	+2.5		+0.0	50.8	79.3 802.11b RBW-100kHz	-28.5	Horiz
9	2483.500M	29.9	+27.9	+1.4	+2.6		+0.0	61.8	54.0 802.11b	+7.8	Horiz
10	2483.500M Ave	18.0	+27.9	+1.4	+2.6		+0.0	49.9	54.0 802.11b	-4.1	Horiz
11	2483.500M	36.4	+27.9	+1.4	+2.6		+0.0	68.3	54.0 802.11g	+14.3	Horiz
12	2483.500M Ave	21.2	+27.9	+1.4	+2.6		+0.0	53.1	54.0 802.11g	-0.9	Horiz
13	2390.000M	26.6	+27.7	+1.4	+2.5		+0.0	58.2	54.0 802.11g	+4.2	Horiz
14	2390.000M Ave	13.4	+27.7	+1.4	+2.5		+0.0	45.0	54.0 802.11g	-9.0	Horiz
15	2400.000M	23.5	+27.7	+1.4	+2.5		+0.0	55.1	74.8 802.11g-RBW 100kHz	-19.7	Horiz
16	2390.000M	25.5	+27.7	+1.4	+2.5		+0.0	57.1	54.0 802.11n-HT20	+3.1	Horiz
17	2390.000M Ave	13.1	+27.7	+1.4	+2.5		+0.0	44.7	54.0 802.11n-HT20	-9.3	Horiz

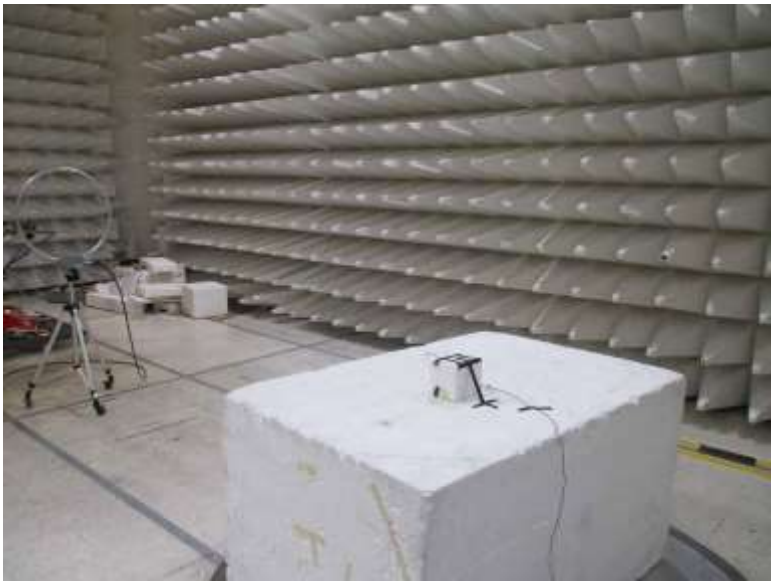
18	2400.000M	21.9	+27.7	+1.4	+2.5	+0.0	53.5	73.8	-20.3	Horiz	802.11n-HT20-RBW 100kHz
19	2483.500M	35.2	+27.9	+1.4	+2.6	+0.0	67.1	54.0	+13.1	Horiz	802.11n-HT20
20	2483.500M Ave	19.9	+27.9	+1.4	+2.6	+0.0	51.8	54.0	-2.2	Horiz	802.11n-HT20
21	2390.000M	25.8	+27.7	+1.4	+2.5	+0.0	57.4	54.0	+3.4	Horiz	BLE
22	2390.000M Ave	12.5	+27.7	+1.4	+2.5	+0.0	44.1	54.0	-9.9	Horiz	BLE
23	2400.000M	18.0	+27.7	+1.4	+2.5	+0.0	49.6	74.6	-25.0	Horiz	BLE-RBW 100kHz
24	2483.500M	26.9	+27.9	+1.4	+2.6	+0.0	58.8	54.0	+4.8	Horiz	BLE
25	2483.500M Ave	12.8	+27.9	+1.4	+2.6	+0.0	44.7	54.0	-9.3	Horiz	BLE

Test Setup Photo(s)

Below 1GHz; Front View 1

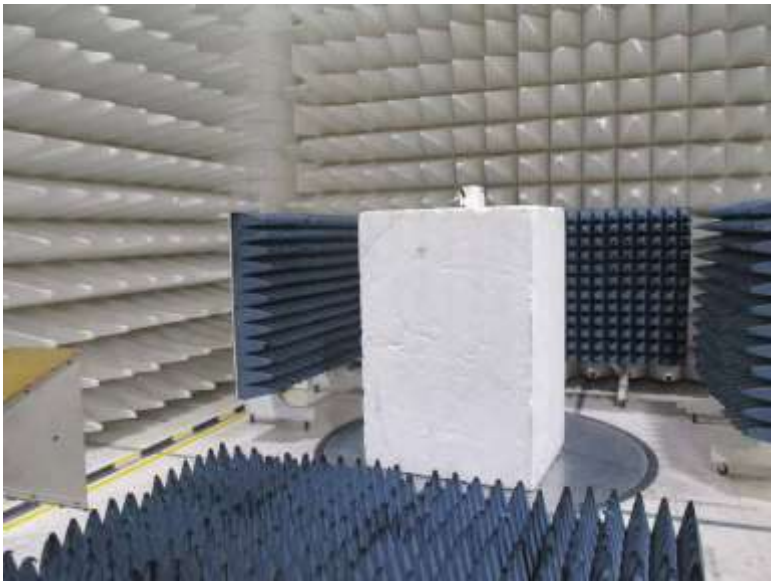


Below 1GHz; Front View 2

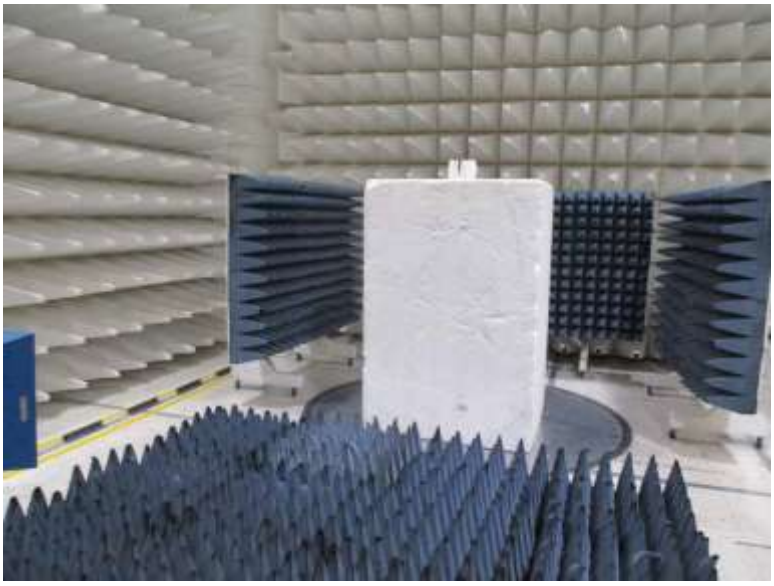


Below 1GHz; Back View 1

Below 1GHz; Back View 2



Above 1GHz; Front View 1



Above 1GHz; Front View 2

Above 1GHz; Back View 1

Above 1GHz; Back View 2

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

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 dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/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 caret ("^") 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.