

# Avnet, Inc.

## REVISED EMC TEST REPORT TO 105053-13

**Secure Wi-Fi module**  
**Model: AES-MS-MT3620-UFL-M-G Rev2**

**Tested to The Following Standards:**

**FCC Part 15 Subpart C Section(s)**

**15.207 & 15.247**  
**(DTS 2400-2483.5MHz)**

**Report No.: 105053-13A**

**Date of issue: February 8, 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**

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# ADMINISTRATIVE INFORMATION

## Test Report Information

**REPORT PREPARED FOR:**

Avnet, Inc.  
2211 S 47th Street  
Phoenix, AZ 85034

Representatives: Avnet, Inc. - Brian Willess  
F-Squared Laboratories - Karen Whipkey  
Customer Reference Number: 5313

**REPORT PREPARED BY:**

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

Project Number: 105053

**DATE OF EQUIPMENT RECEIPT:**

July 13, 2021

**DATE(S) OF TESTING:**

July 13 - 29, 2021

January 30, 2023

## Revision History

**Original:** Testing of the Secure Wi-Fi module, Model: AES-MS-MT3620-UFL-M-G Rev2 to FCC Part 15 Subpart C Section(s) 15.207 & 15.247 (DTS 2400-2483.5 MHz)

**Revision A:** To add additional information and photo to the Output Power section.

## 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.  
 110 Olinda Place  
 Brea, CA 92823

## Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.19

## 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	Mod. #1	Pass
15.247(b)(3)	Output Power	Mod. #1	Pass
15.247(d)	RF Conducted Emissions & Band Edge	Mod. #1	Pass
15.247(d)	Radiated Emissions & Band Edge	Mod. #1	Pass
15.247(e)	Power Spectral Density	Mod. #1	Pass
15.207	AC Conducted Emissions	Mod. #1	Pass

NA = Not Applicable

#### 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

Modification #1: Power setting reduced to 14 to comply with radiated Band Edge requirement

**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
Secure Wi-Fi module	Avnet, Inc.	AES-MS-MT3620-UFL-M-G	NA
		Rev2	

**Support Equipment:**

Device	Manufacturer	Model #	S/N
Laptop	Dell	Inspiron 15 3000	41436059078
PCB	Avnet Inc.	AES-MS-MT3620_Guard_PCB-RevA	4000242

### Configuration 2

**Equipment Tested:**

Device	Manufacturer	Model #	S/N
Secure Wi-Fi module	Avnet, Inc.	AES-MS-MT3620-UFL-M-G	NA
		Rev2	

**Support Equipment:**

Device	Manufacturer	Model #	S/N
Laptop	Dell	Inspiron 15 3000	41436059078
PCB	Avnet Inc.	AES-MS-MT3620_Guard_PCB-RevA	4000242
Power Supply	Extech Instruments	382225	P99250026

## General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Radio Module
Type of Wideband System:	802.11b/g/n20
Operating Frequency Range:	2412-2462MHz
Modulation Type(s):	CCK11M, MCS7,OFDM54M
Maximum Duty Cycle:	98%
Number of TX Chains:	1
Antenna Type(s) and Gain:	External, Patch, 1.9dBi
Beamforming Type:	NA
Antenna Connection Type:	External Connector
Nominal Input Voltage:	3.3V DC
Firmware / Software used for Test:	Azure Sphere OS v20.07
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

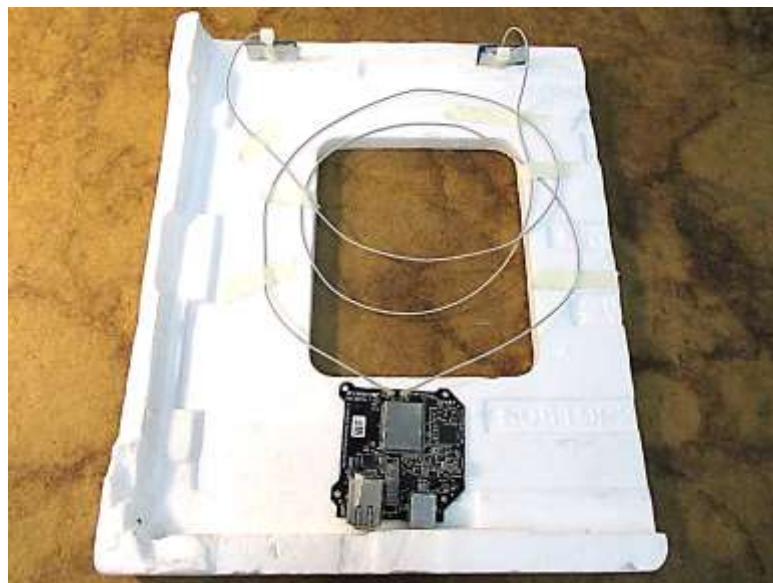
**EUT Photo(s)**



**Support Equipment Photo(s)**

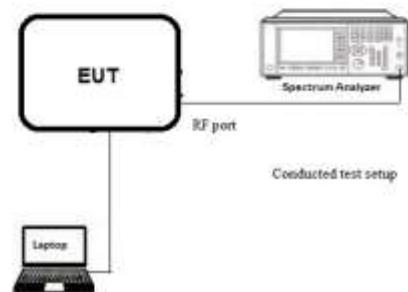
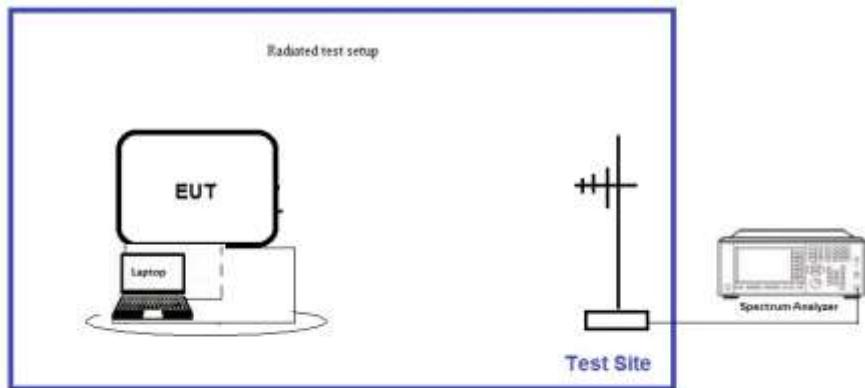


Laptop



Host

## Block Diagram of Test Setup



## FCC Part 15 Subpart C

### 15.247(a)(2) 6dB Bandwidth

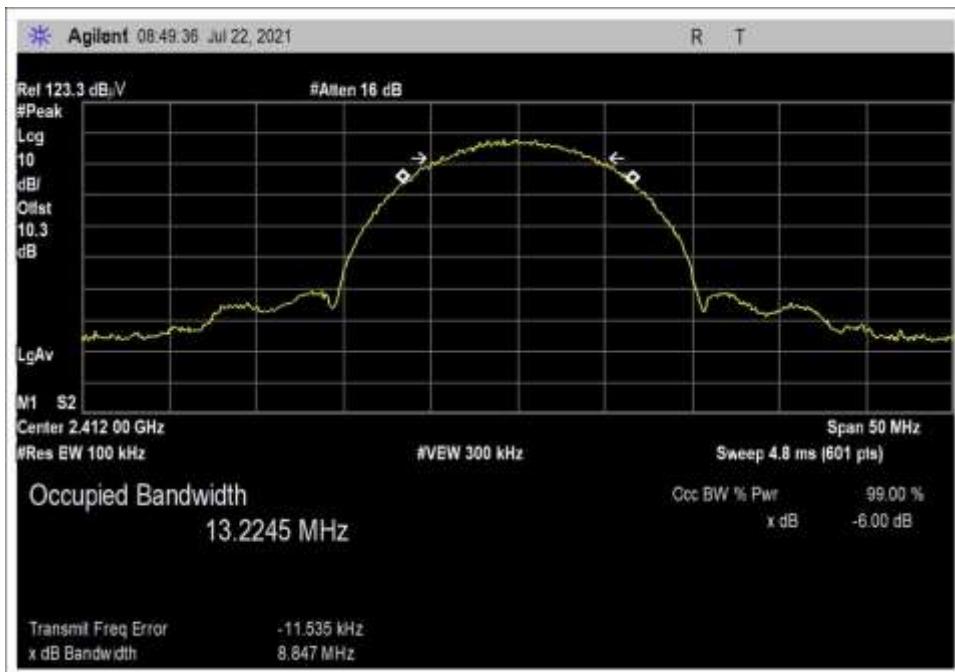
Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 15.247 MEAS GUIDANCE V05R02 APRIL 2, 2019	Test Date(s):	7/15/2021
Configuration:	1		
Test Setup:	<p>The EUT seeking single modular approval is installed on a support PCB which provide power and configuration interface for testing purposes. The Ethernet and USB-B port of the support PCB is not populated as the function of the PCB is to act as source of power and configuration only.</p> <p>RF parameter evaluated at the antenna port J1. Power at antenna port J2 is verified. device does not transmit simultaneously from J1 and J2.</p> <p>A support laptop is connected to the PCB via micro-USB cable for configuration of the EUT.</p> <p>Firmware power setting: 14dBm.</p> <p>Modification #1 was in place during testing.</p>		

Environmental Conditions			
Temperature (°C)	25.4	Relative Humidity (%):	56

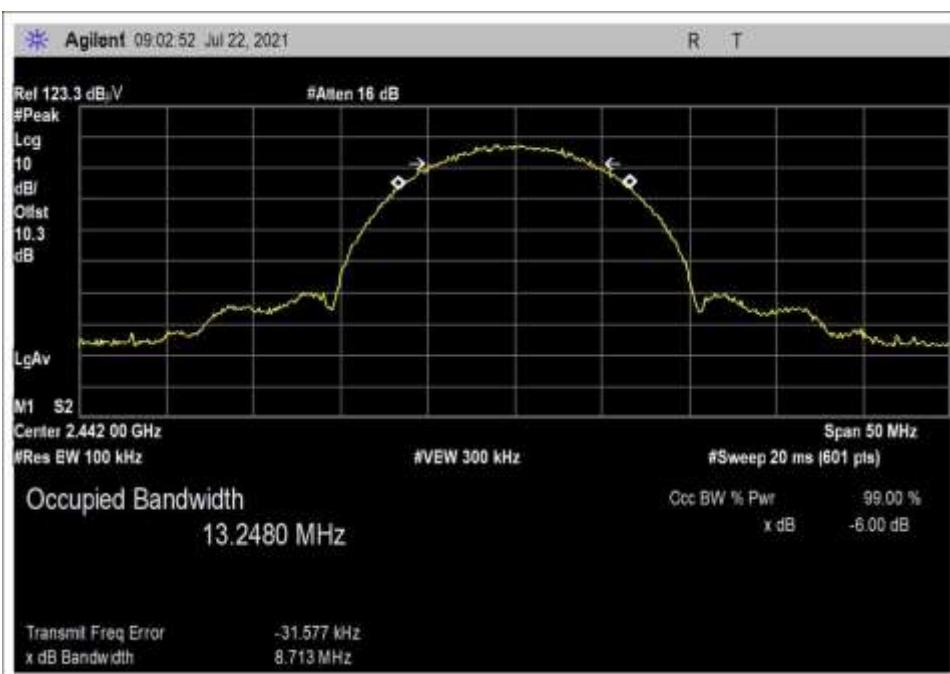
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02762	Spectrum Analyzer	Agilent	E4446A	4/29/2020	4/29/2022
03430	Attenuator	Aeroflex/Weinschel	75A-10-12	12/20/2019	12/20/2021
07655	Cable	Astro lab	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

**Test Data Summary**

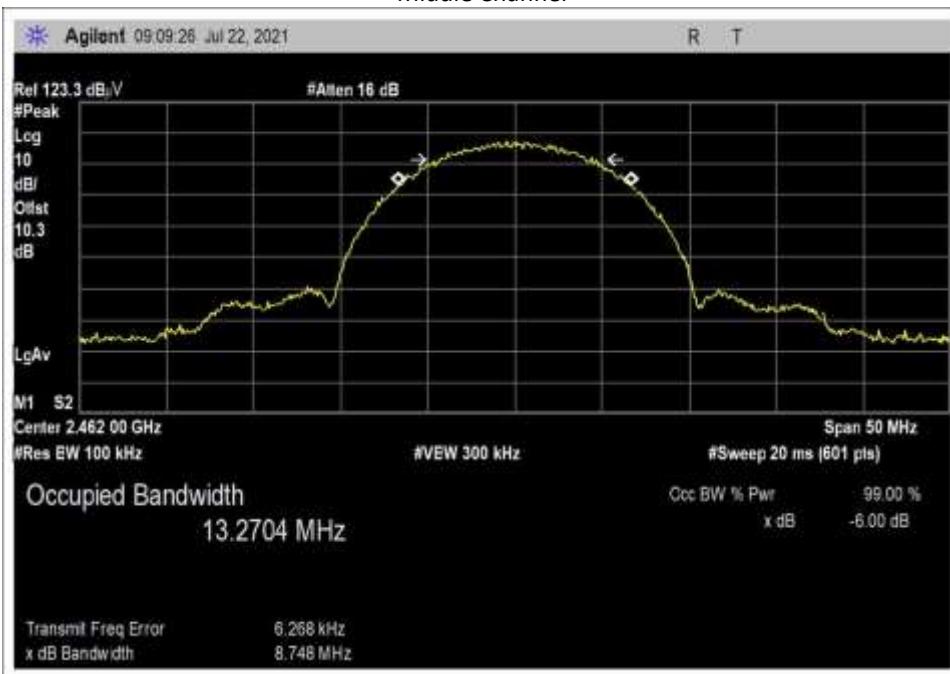
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2412	1	CCK11M	8848	≥500	Pass
2442	1	CCK11M	8713	≥500	Pass
2462	1	CCK11M	8748	≥500	Pass
2412	1	MCS7	16386	≥500	Pass
2442	1	MCS7	16372	≥500	Pass
2462	1	MCS7	16358	≥500	Pass
2412	1	OFDM54M	16391	≥500	Pass
2442	1	OFDM54M	16392	≥500	Pass
2462	1	OFDM54M	16330	≥500	Pass

**Plot(s)**
[CCK11M](#)


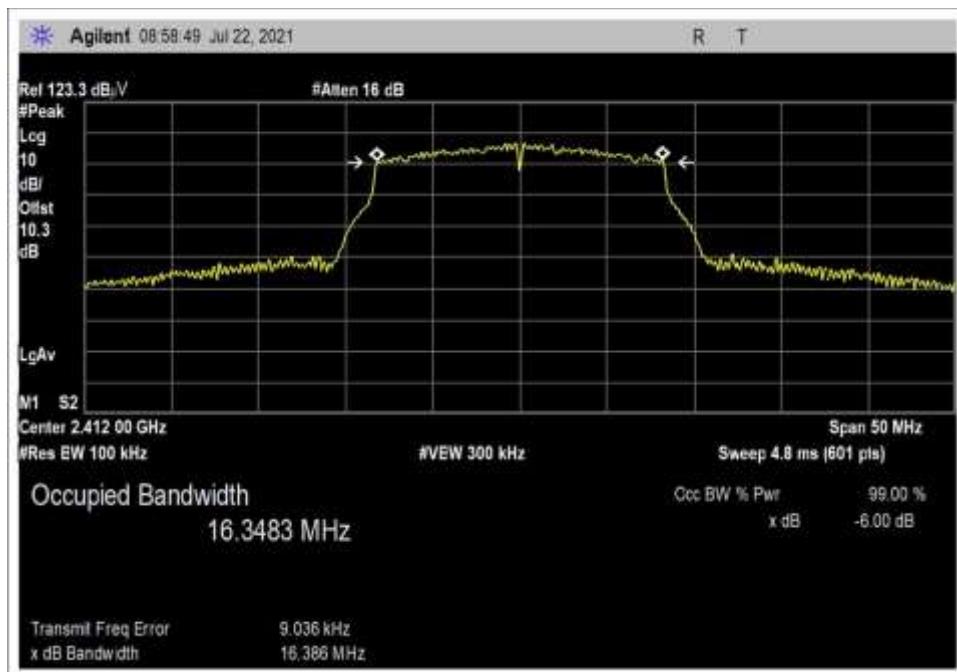
Low Channel



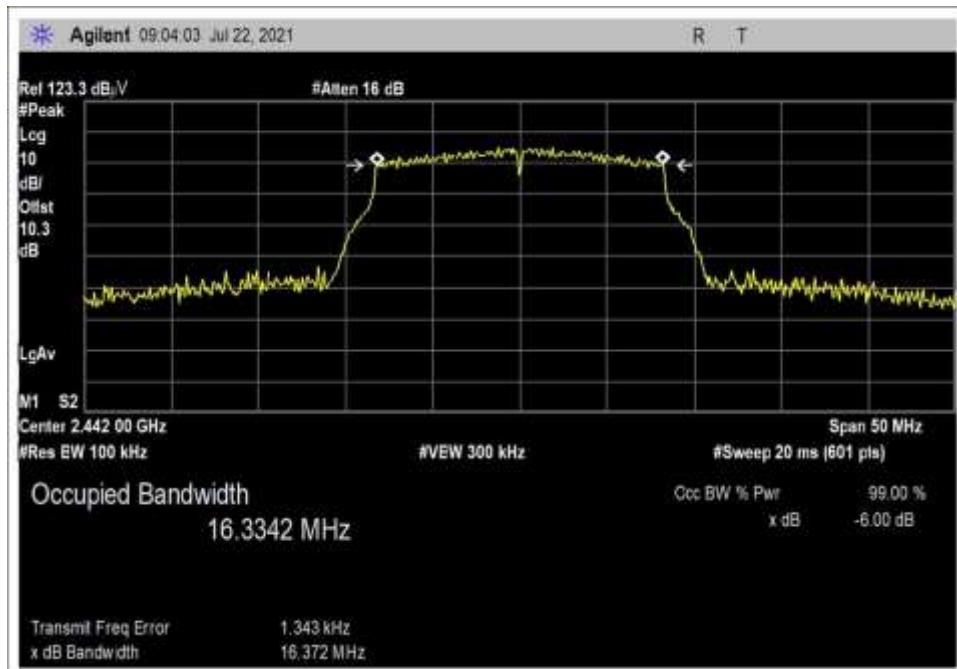
Middle Channel



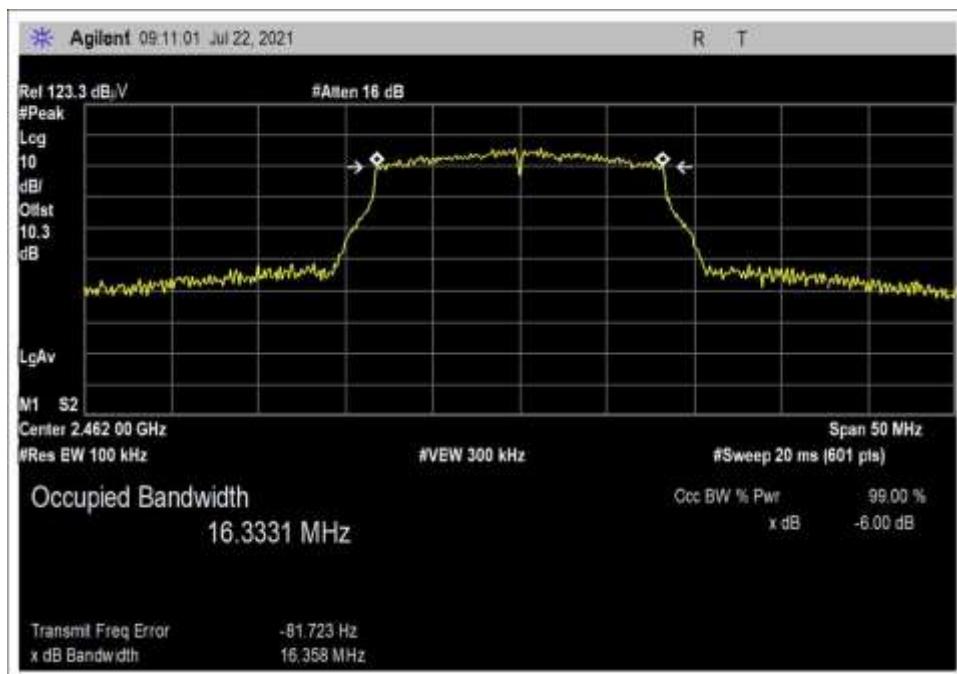
High Channel

MCS7


Low Channel

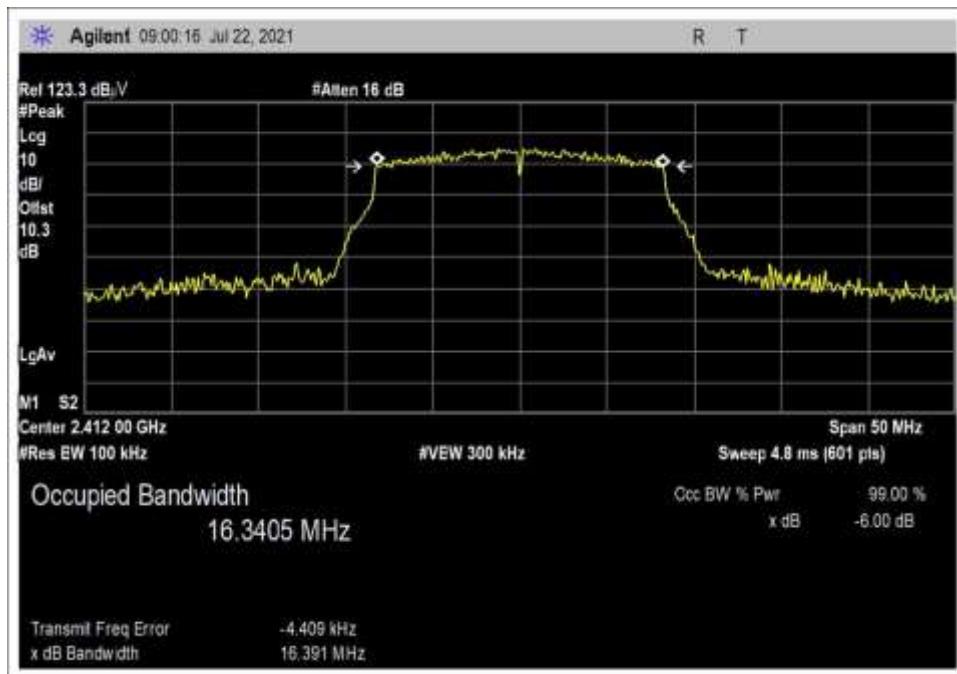


Middle Channel

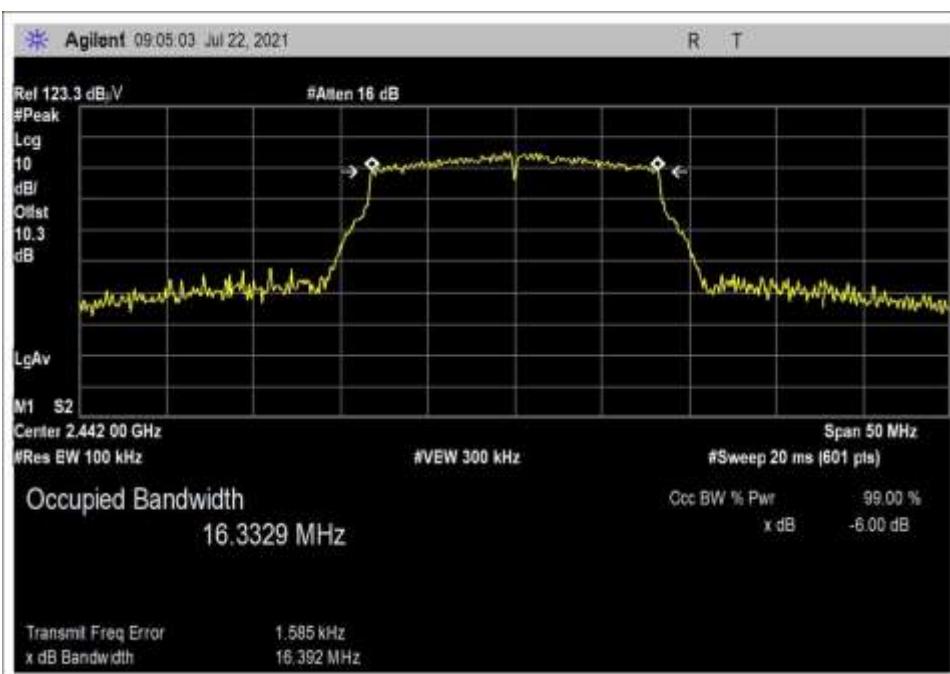


High Channel

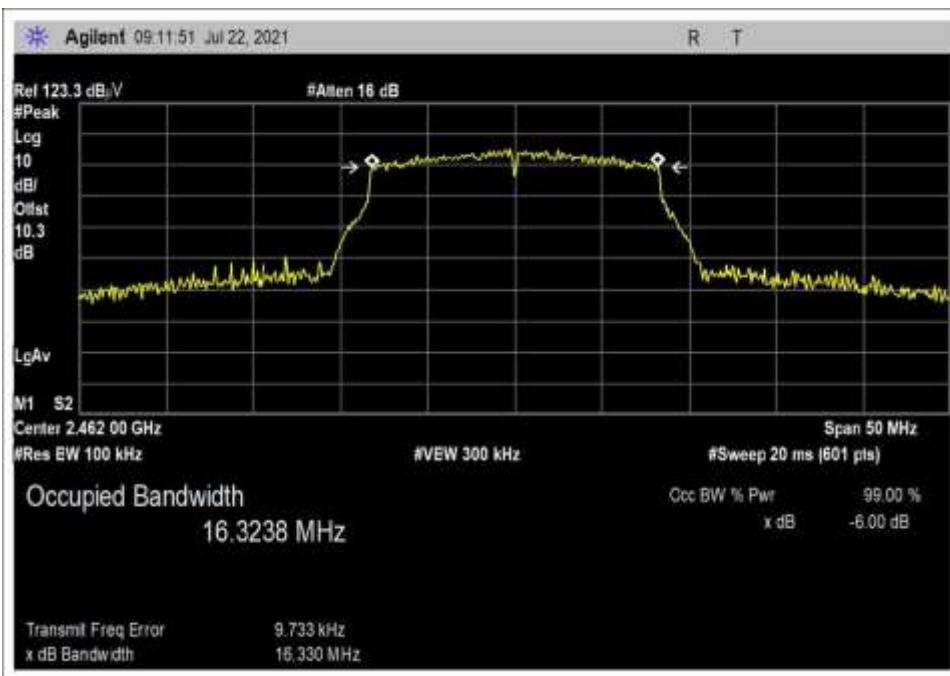
### OFDM54M



Low Channel

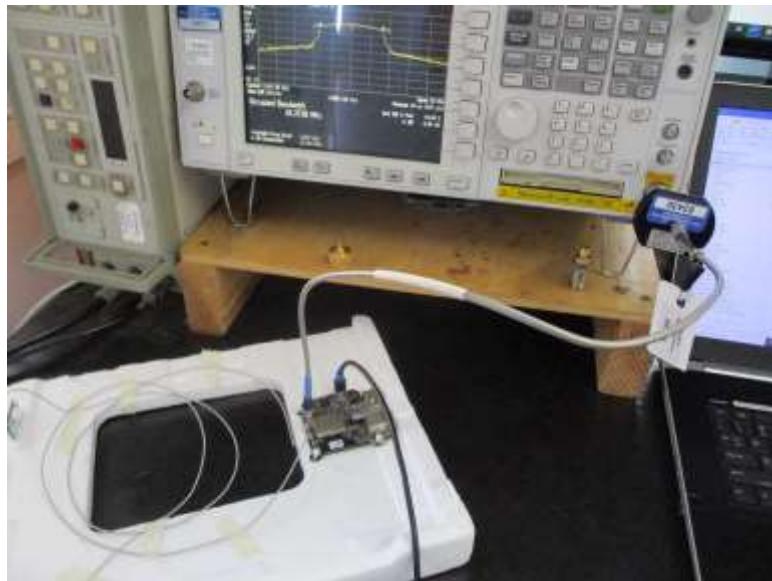


Middle Channel



High Channel

**Test Setup Photo(s)**



## 15.247(b)(3) Output Power

Test Setup/Conditions			
Test Location:	Brea Lab A & Bothell Bench	Test Engineer:	E. Wong & S. Pittsford
Test Method:	ANSI C63.10 (2013, KDB558074 D01 15.247 MEAS GUIDANCE V05R02 APRIL 2, 2019)	Test Date(s):	7/15/2021 & 1/30/2023
Configuration:	Configuration 1		
Test Setup:	<p>The EUT seeking single modular approval is installed on a support PCB which provide power and configuration interface for testing purposes. The Ethernet and USB-B port of the support PCB is not populated as the function of the PCB is to act as source of power and configuration only.</p> <p>RF parameter evaluated at the antenna port J1. Power at antenna port J2 is verified. device does not transmit simultaneously from J1 and J2.</p> <p>A support laptop is connected to the PCB via micro-USB cable for configuration of the EUT.</p> <p>Firmware power setting: 14dBm.</p> <p>Conducted power was remeasured on 1/30/2023. All measurements are within measurement uncertainty and device tolerances.</p> <p>Modification #1 was in place during testing.</p>		

Environmental Conditions			
Temperature (°C)	19-25	Relative Humidity (%):	34-55

Test Equipment 7/15/2021					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02762	Spectrum Analyzer	Agilent	E4446A	4/29/2020	4/29/2022
03430	Attenuator	Aeroflex/Weinschel	75A-10-12	12/20/2019	12/20/2021
07655	Cable	Astro lab	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Test Equipment 1/30/2023					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
03803	Spectrum Analyzer	Agilent	E4440A	2/23/2022	2/23/2024

Test Data Summary - Voltage Variations					
Frequency (MHz)	Modulation / Ant Port	V <sub>Minimum</sub> (dBm)	V <sub>Nominal</sub> (dBm)	V <sub>Maximum</sub> (dBm)	Max Deviation from V <sub>Nominal</sub> (dB)
2412	CCK11M	11.8	12.2	12.4	-0.4
2442	CCK11M	11.6	12.0	12.1	-0.4
2462	CCK11M	12.0	12.2	12.4	-0.2
2412	MCS7	12.7	13.1	13.2	-0.4
2442	MCS7	11.8	12.1	12.3	-0.3
2462	MCS7	11.7	12.2	12.5	-0.5
2412	OFDM54M	13.6	13.0	13.2	-0.4
2442	OFDM54M	11.7	12.2	12.4	-0.5
2462	OFDM54M	12.7	12.7	12.9	-0.5

Test performed using operational mode with the highest output power, representing worst case.

**Parameter Definitions:**

Measurements performed at input voltage according to manufacturer specification.

Parameter	Value
V <sub>Nominal</sub> :	3.3
V <sub>Minimum</sub> :	3.0
V <sub>Maximum</sub> :	3.6

Per manufacturer, equipment voltage specification is 10% of nominal.

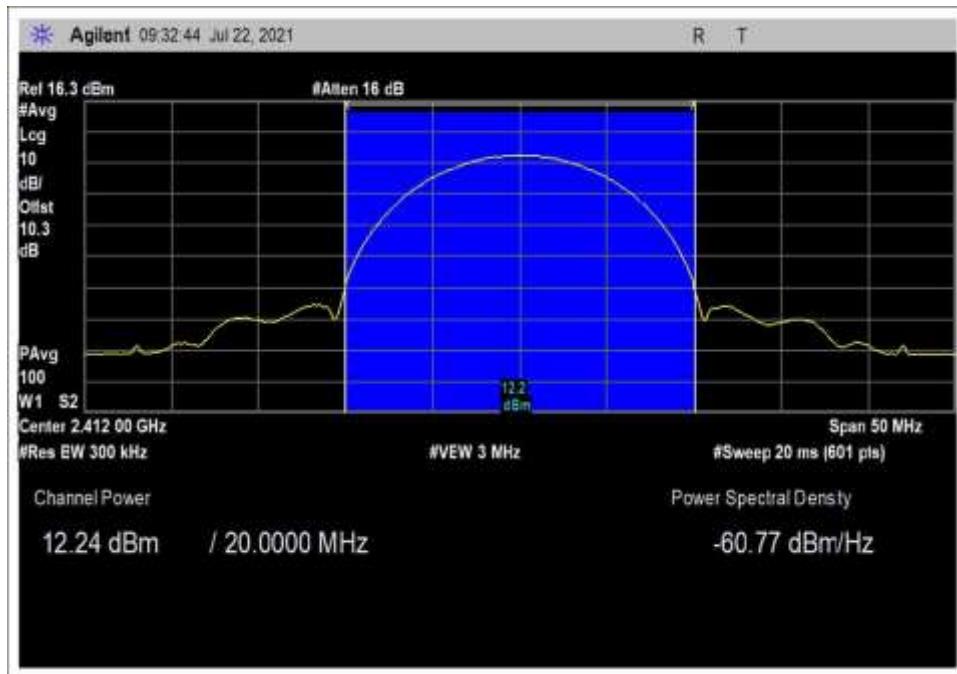
Test Data Summary - RF Conducted Measurement					
Measurement Option: AVGSA-1					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
2412	CCK11M	Ext patch/ 1.9dBi	12.2	≤ 30	Pass
2442	CCK11M	Ext patch/ 1.9dBi	12.0	≤ 30	Pass
2462	CCK11M	Ext patch/ 1.9dBi	12.2	≤ 30	Pass
2412	MCS7	Ext patch/ 1.9dBi	13.1	≤ 30	Pass
2442	MCS7	Ext patch/ 1.9dBi	12.1	≤ 30	Pass
2462	MCS7	Ext patch/ 1.9dBi	12.2	≤ 30	Pass
2412	OFDM54M	Ext patch/ 1.9dBi	13.0	≤ 30	Pass
2442	OFDM54M	Ext patch/ 1.9dBi	12.2	≤ 30	Pass
2462	OFDM54M	Ext patch/ 1.9dBi	12.7	≤ 30	Pass

For fixed point-to-point antennas, the limit is calculated in accordance with 15.247(c)(1):

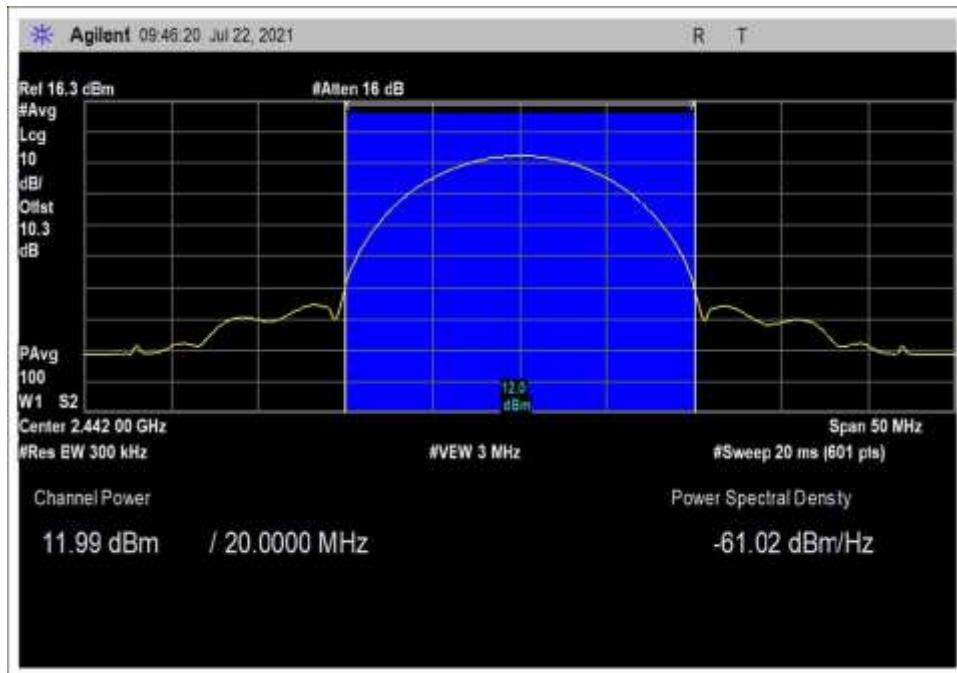
$$\text{Limit} = 30 - \text{Roundup} \left( \frac{G-6}{3} \right)$$

## Plots

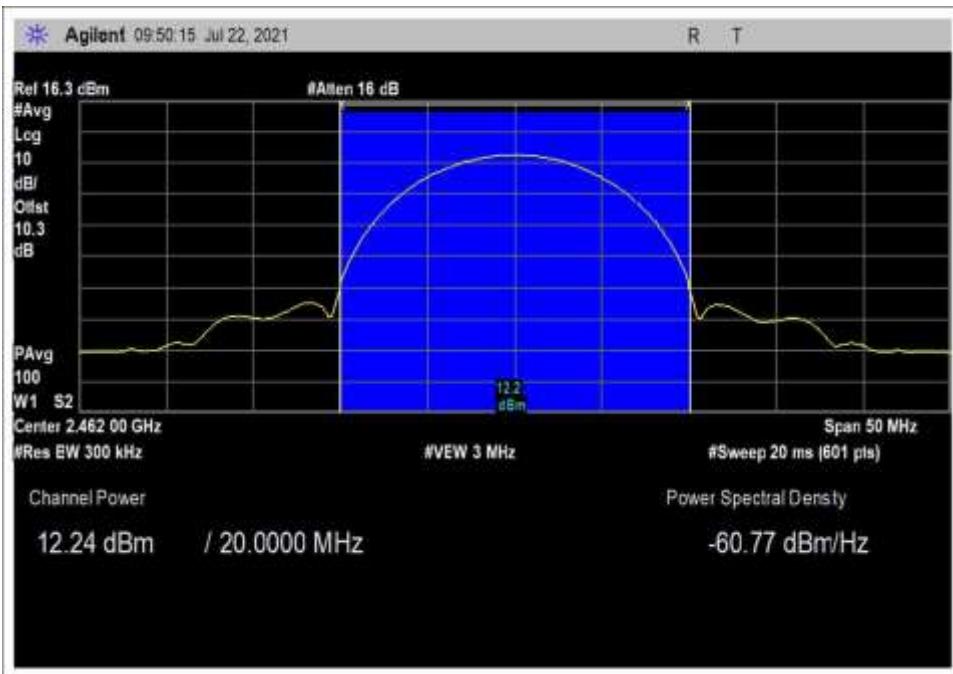
### CCK11M



Low Channel

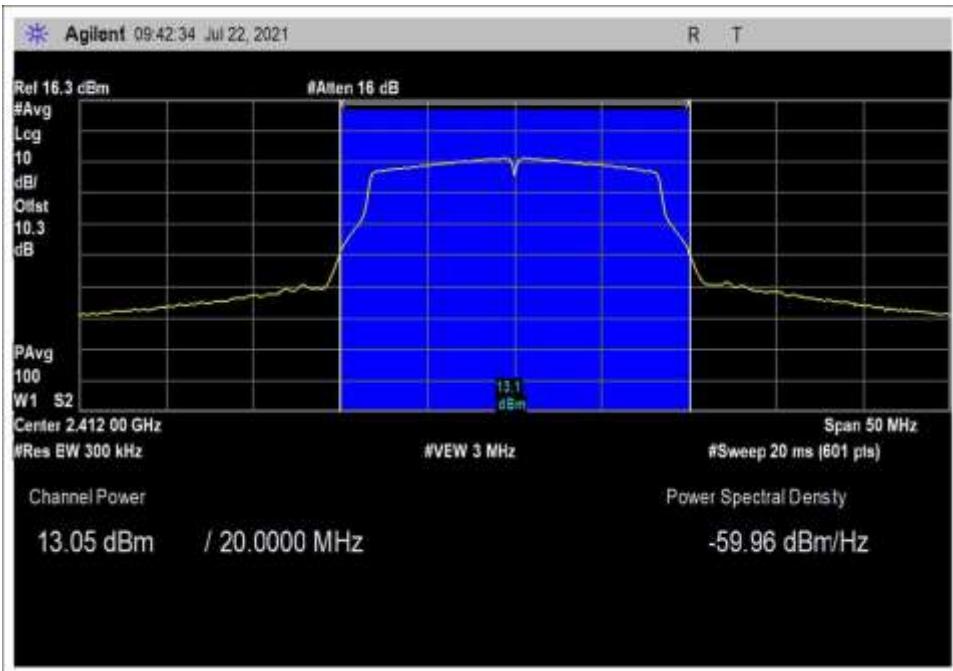


Middle Channel

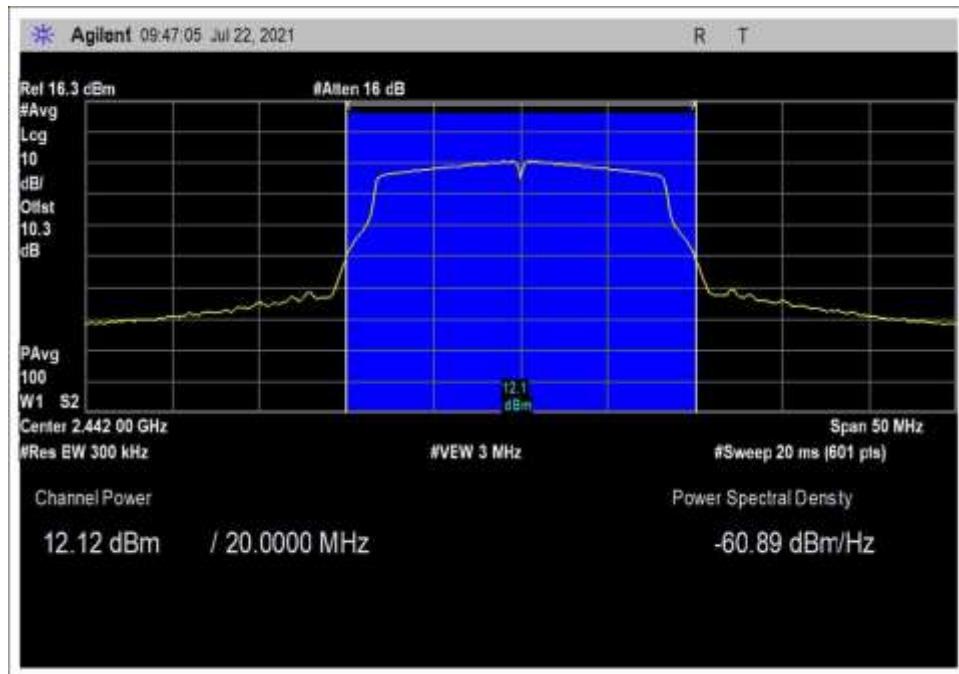


High Channel

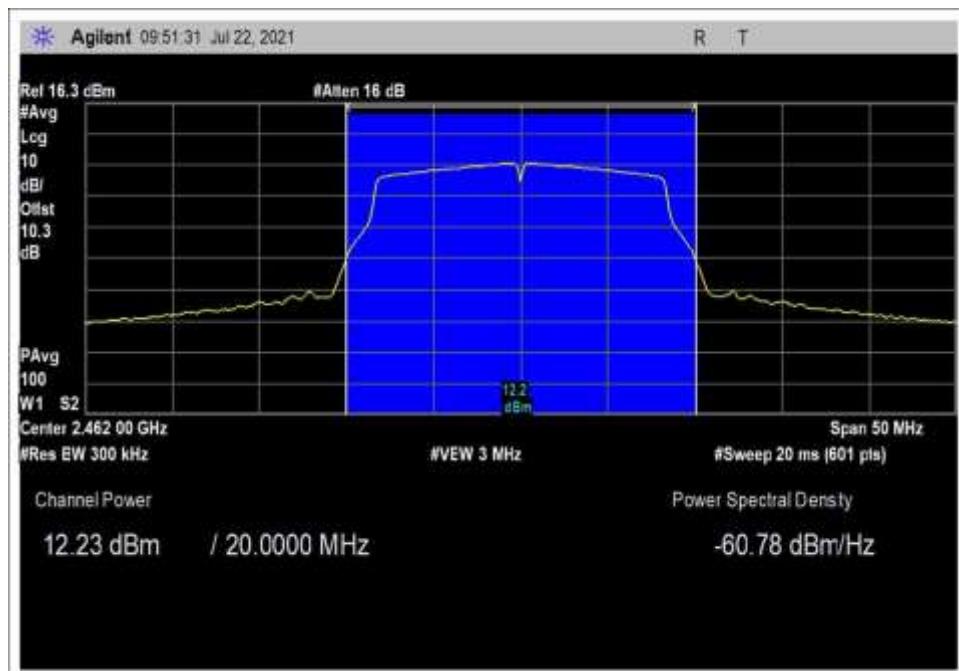
MCS7



Low Channel

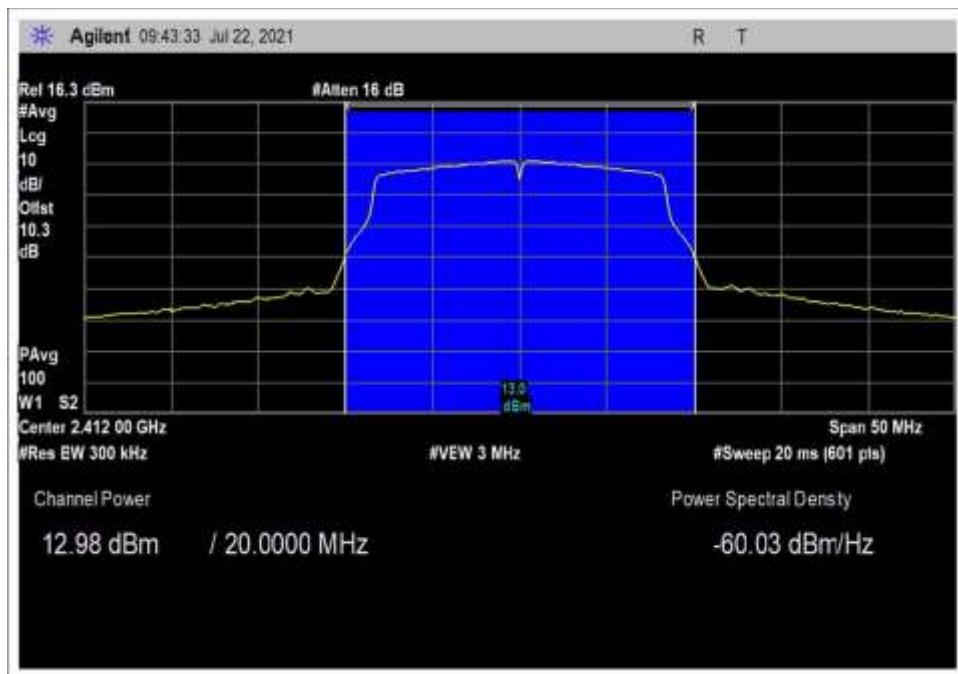


Middle Channel

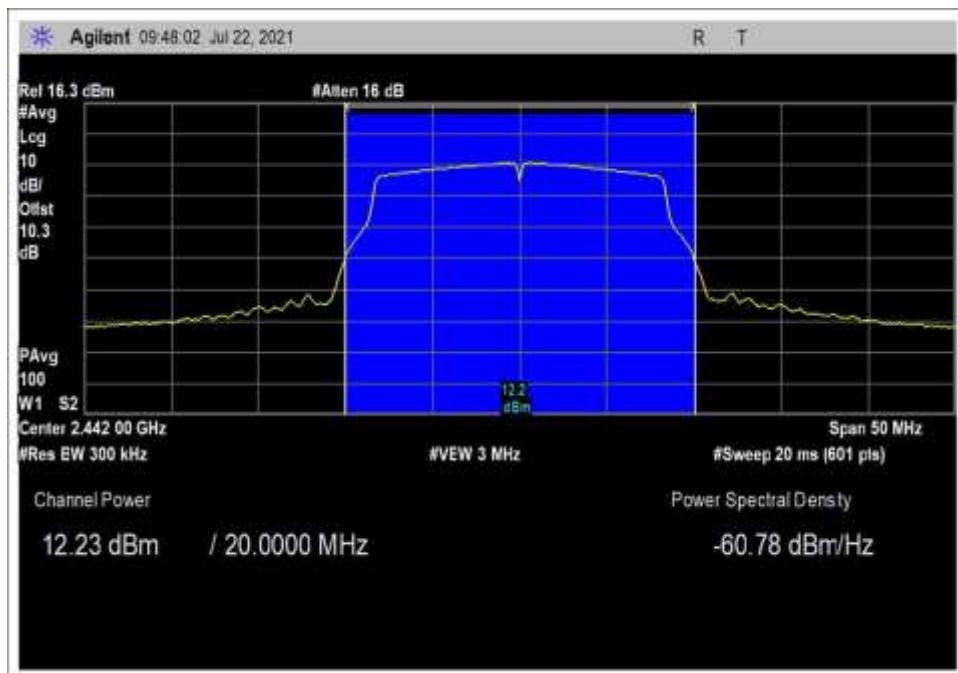


High Channel

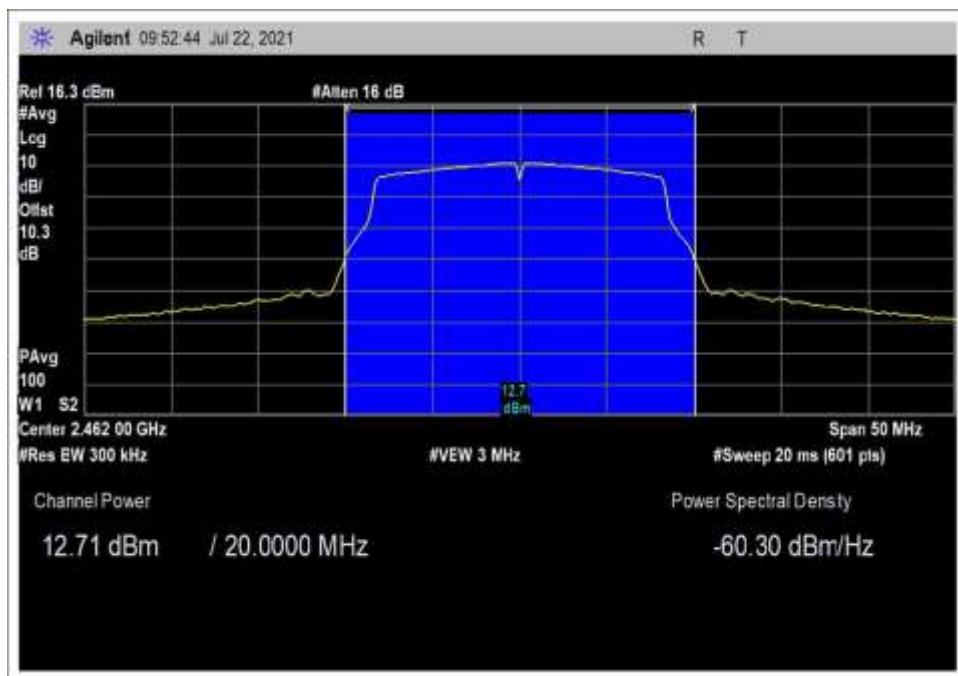
### OFDM54M



Low Channel

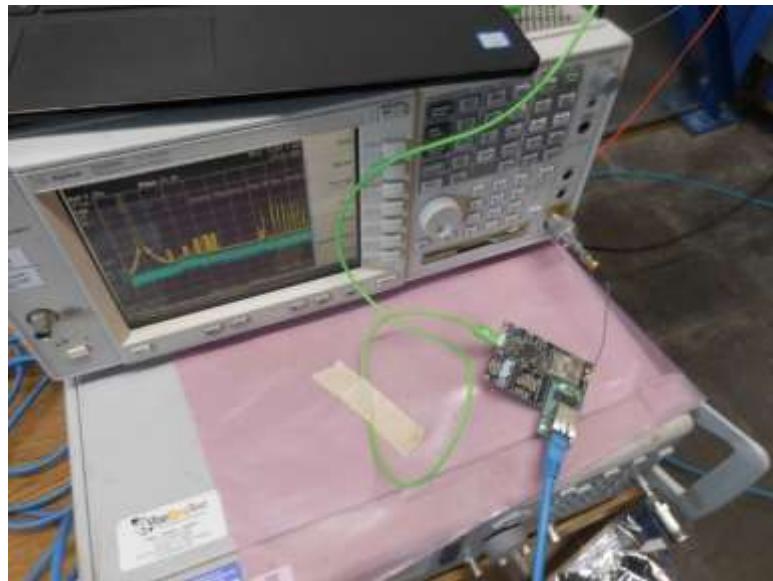


Middle Channel

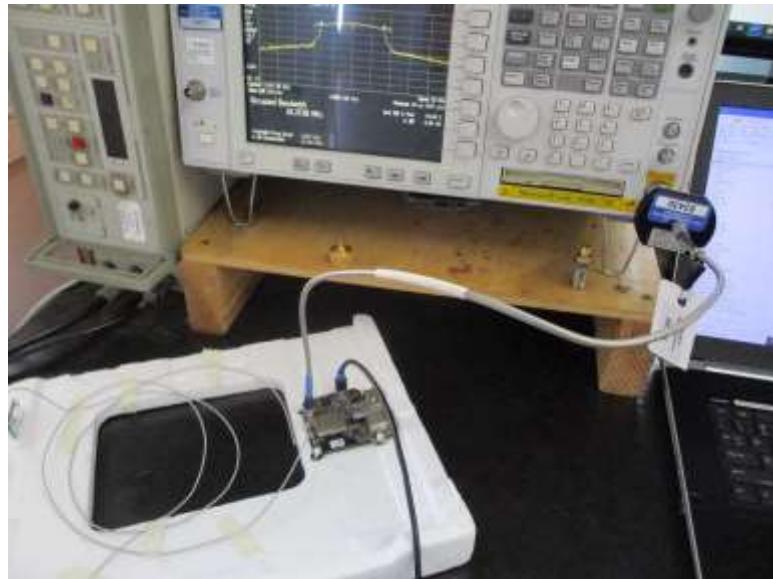


High Channel

**Test Setup Photo(s)**



Power Setup



Antenna Port

## 15.247(d) RF Conducted Emissions & Band Edge

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA • 714 993 6112  
 Customer: **Avnet Inc.**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **105053** Date: 7/22/2021  
 Test Type: **Conducted Emissions** Time: 14:20:18  
 Tested By: E. Wong Sequence#: 5  
 Software: EMITest 5.03.19 120/60Hz

#### *Equipment Tested:*

Device	Manufacturer	Model #	S/N
Configuration 1			

#### *Support Equipment:*

Device	Manufacturer	Model #	S/N
Configuration 1			

#### *Test Conditions / Notes:*

The EUT seeking single modular approval is installed on a support PCB which provide power and configuration interface for testing purposes. The Ethernet and USB-B port of the support PCB is not populated as the function of the PCB is to act as source of power and configuration only.

RF parameter evaluated at the antenna port J1. Power at antenna port J2 is verified. device does not transmit simultaneously from J1 and J2.

A support laptop is connected to the PCB via micro-USB cable for configuration of the EUT.

**Frequency range: 2412MHz, 2442MHz, 2462MHz**

Channel 1,7,11.

Protocol: CCK, OFDM54M, MCS7

Firmware power setting: 14dBm.

Frequency range of measurement = 9 kHz- 25 GHz.

9 kHz -150 kHz;RBW=200 Hz,VBW=600 Hz;150 kHz-30 MHz;RBW=9 kHz,VBW=27 kHz;30 MHz-1000 MHz;RBW=120 kHz,VBW=360 kHz,1000 MHz-25000 MHz;RBW=1MHz,VBW=3 MHz.

Test environment conditions:

Temperature: 27.6°C

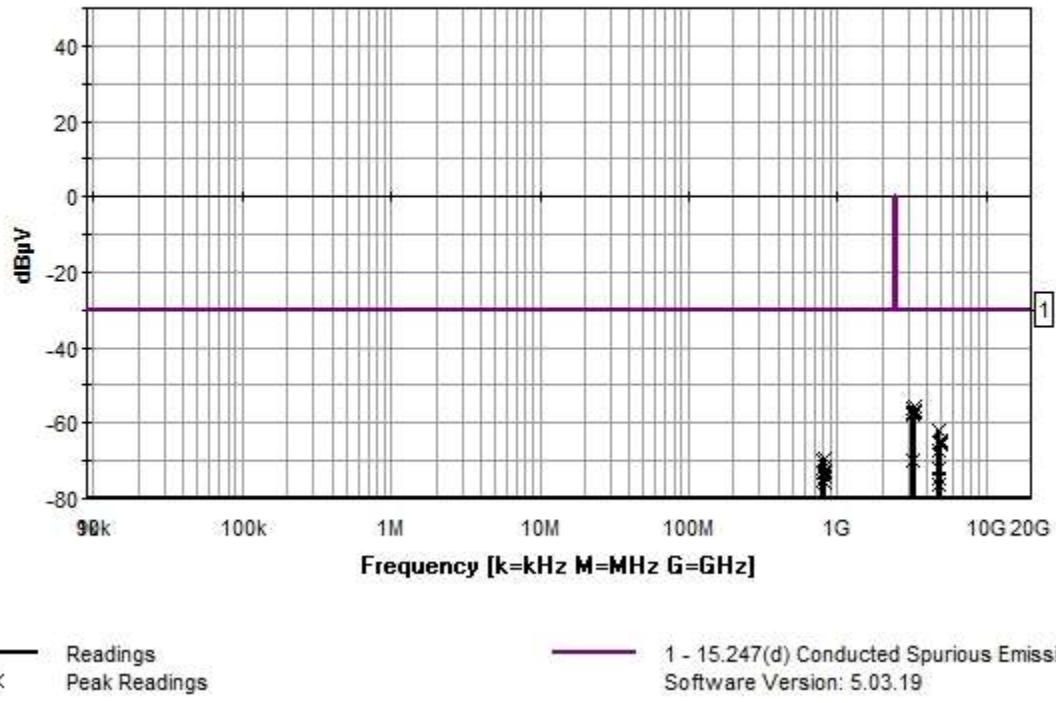
Relative Humidity: 52%

Pressure: 99.9kPa

Site A

ANSI C63.10-2013

Modification #1 was in place during testing.

Avnet Inc. WO#: 105053 Sequence#: 5 Date: 7/22/2021  
 15.247(d) Conducted Spurious Emissions Test Lead: 120/60Hz Antenna port

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T2	AN03430	Attenuator	75A-10-12	12/20/2019	12/20/2021
T3	ANP07655	Cable	32022-29094K- 29094K-24TC	7/30/2020	7/30/2022

<b>Measurement Data:</b>			Reading listed by margin.				Test Lead: Antenna port				
#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant
1	3282.667M	-66.0	+0.0	+10.1	+0.5		+0.0	-55.4	-30.0	-25.4	Anten
									CCK11M_H		
2	3215.990M	-66.7	+0.0	+10.1	+0.5		+0.0	-56.1	-30.0	-26.1	Anten
									CCK11M_L		
3	3256.009M	-66.7	+0.0	+10.1	+0.5		+0.0	-56.1	-30.0	-26.1	Anten
									CCK11M_M		
4	3282.675M	-67.2	+0.0	+10.1	+0.5		+0.0	-56.6	-30.0	-26.6	Anten
									OFDM54M_H		
5	3256.000M	-67.7	+0.0	+10.1	+0.5		+0.0	-57.1	-30.0	-27.1	Anten
									OFDM54M_M		
6	3282.675M	-67.7	+0.0	+10.1	+0.5		+0.0	-57.1	-30.0	-27.1	Anten
									MCS7_H		
7	3216.000M	-68.3	+0.0	+10.1	+0.5		+0.0	-57.7	-30.0	-27.7	Anten
									OFDM54M_L		
8	4824.000M	-73.0	+0.0	+10.2	+0.7		+0.0	-62.1	-30.0	-32.1	Anten
									OFDM54M_L		
9	4924.010M	-75.6	+0.0	+10.1	+0.7		+0.0	-64.8	-30.0	-34.8	Anten
									MCS7_H		
10	4924.000M	-75.9	+0.0	+10.1	+0.7		+0.0	-65.1	-30.0	-35.1	Anten
									OFDM54M_H		
11	4883.983M	-76.0	+0.0	+10.1	+0.7		+0.0	-65.2	-30.0	-35.2	Anten
									OFDM54M_M		
12	4924.000M	-76.4	+0.0	+10.1	+0.7		+0.0	-65.6	-30.0	-35.6	Anten
									CCK11M_H		
13	4884.000M	-77.8	+0.0	+10.1	+0.7		+0.0	-67.0	-30.0	-37.0	Anten
									CCK11M_M		
14	820.000M	-79.6	+0.0	+10.0	+0.3		+0.0	-69.3	-30.0	-39.3	Anten
									OFDM54M_H		
15	803.670M	-80.2	+0.0	+10.0	+0.3		+0.0	-69.9	-30.0	-39.9	Anten
									OFDM54M_L		
16	3215.300M	-80.6	+0.0	+10.1	+0.5		+0.0	-70.0	-30.0	-40.0	Anten
									MCS7_L		
17	3256.700M	-80.6	+0.0	+10.1	+0.5		+0.0	-70.0	-30.0	-40.0	Anten
									MCS7_M		
18	815.830M	-81.9	+0.0	+10.0	+0.3		+0.0	-71.6	-30.0	-41.6	Anten
									OFDM54M_M		
19	4823.700M	-82.7	+0.0	+10.2	+0.7		+0.0	-71.8	-30.0	-41.8	Anten
									MCS7_L		
20	819.700M	-83.0	+0.0	+10.0	+0.3		+0.0	-72.7	-30.0	-42.7	Anten
									MCS7_H		

21	820.000M	-83.2	+0.0	+10.0	+0.3	+0.0	-72.9	-30.0	-42.9	Anten
22	804.670M	-83.6	+0.0	+10.0	+0.3	+0.0	-73.3	-30.0	-43.3	Anten
23	815.800M	-84.7	+0.0	+10.0	+0.3	+0.0	-74.4	-30.0	-44.4	Anten
24	4825.000M	-85.4	+0.0	+10.2	+0.7	+0.0	-74.5	-30.0	-44.5	Anten
25	804.200M	-85.6	+0.0	+10.0	+0.3	+0.0	-75.3	-30.0	-45.3	Anten
26	813.500M	-86.0	+0.0	+10.0	+0.3	+0.0	-75.7	-30.0	-45.7	Anten
27	4883.300M	-86.9	+0.0	+10.1	+0.7	+0.0	-76.1	-30.0	-46.1	Anten
										MCS7_M

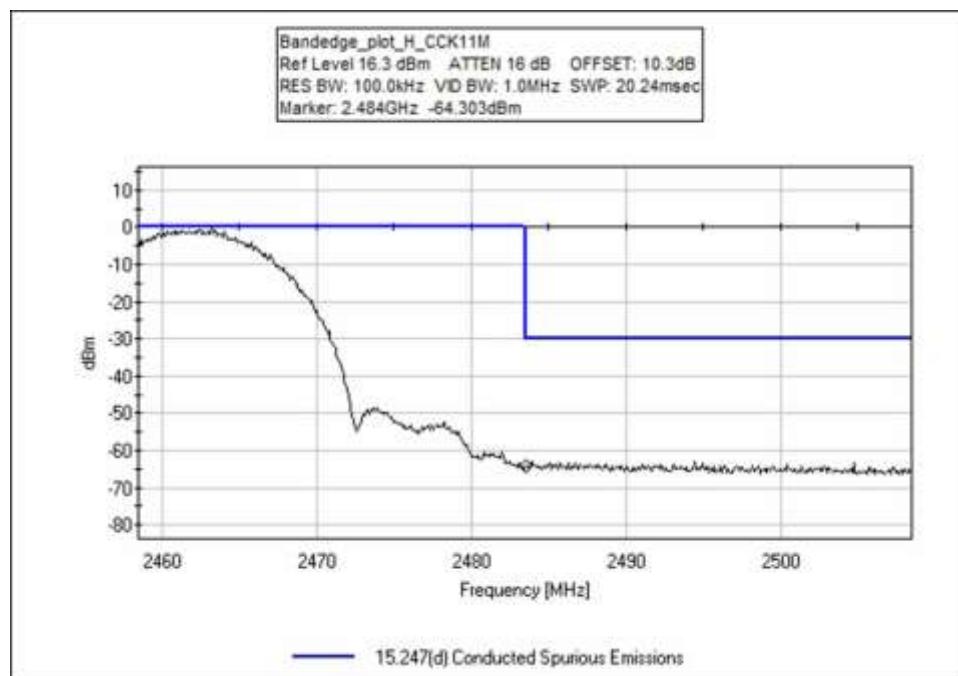
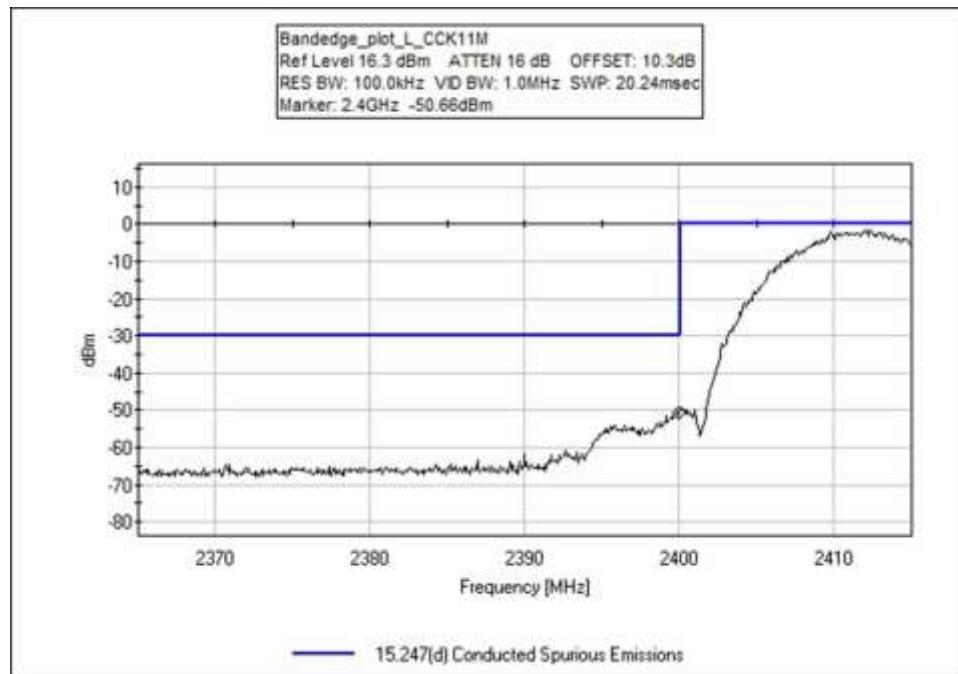
## Band Edge

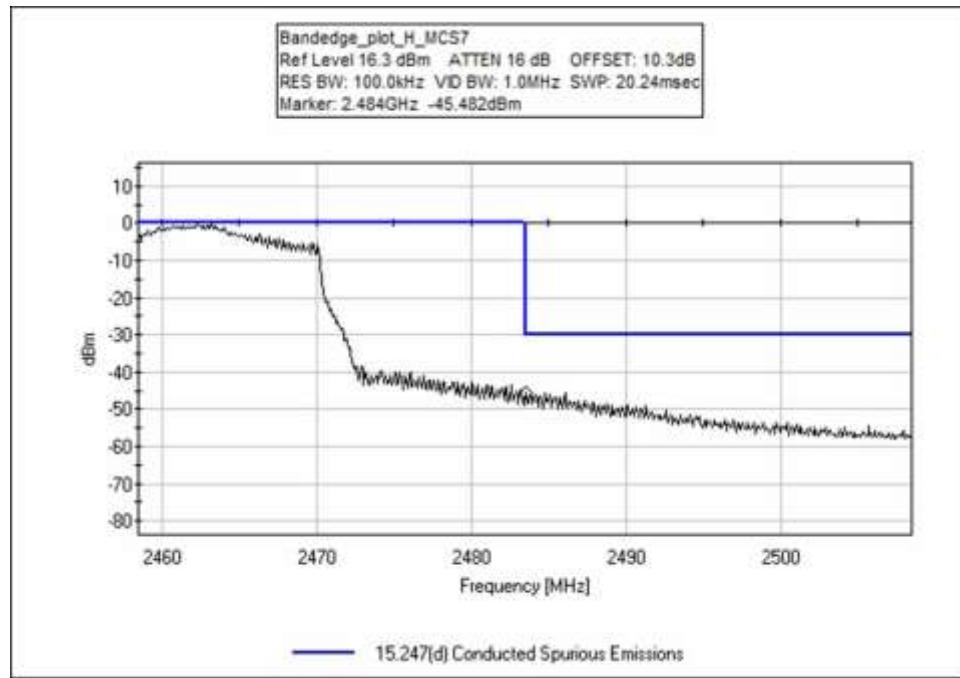
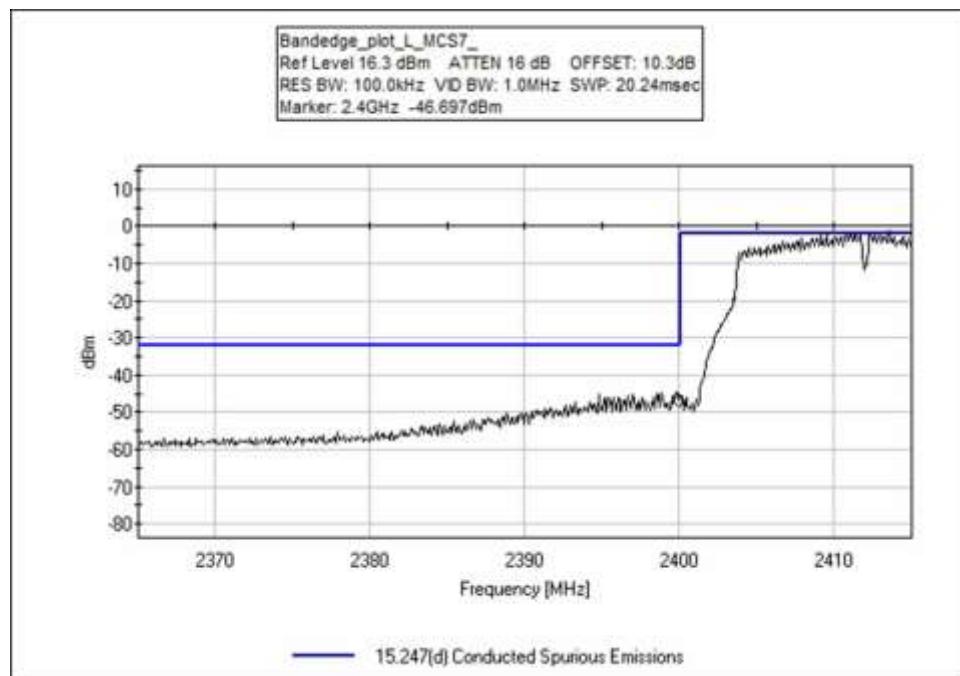
### Band Edge Summary

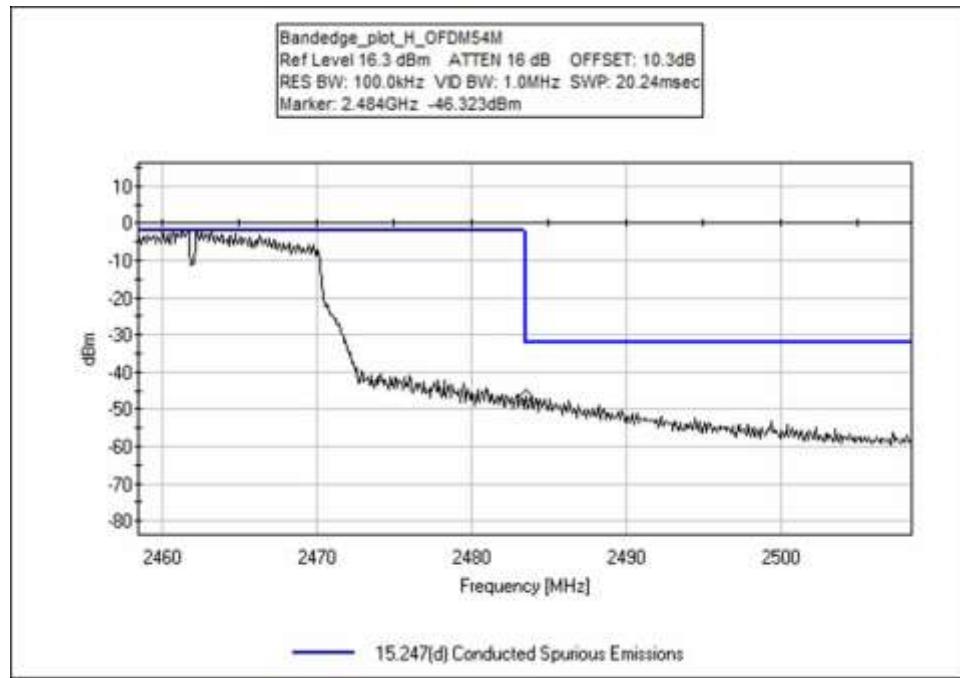
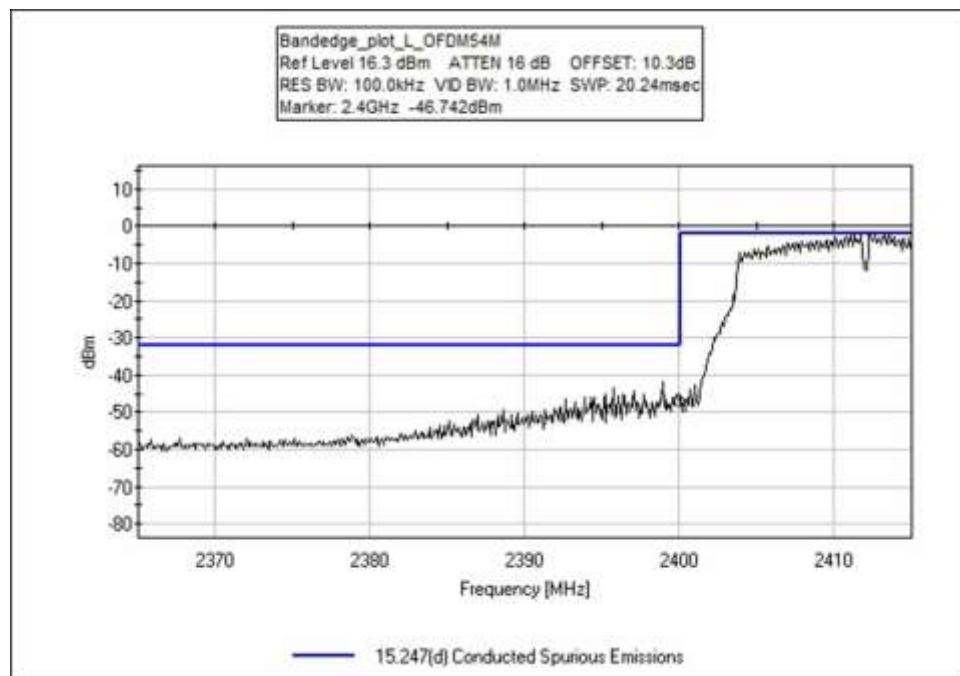
Limit applied: Max Power/100kHz - 30dB (When average power limit is applied).

Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
2400.0	CCK11M	-50.6	< -30	Pass
2483.5	CCK11M	-64.3	<-30	Pass
2400.0	MCS7	-46.7	< -32	Pass
2483.5	MCS7	-45.5	<-30	Pass
2400.0	OFDM54M	-46.7	< -32	Pass
2483.5	OFDM54M	-46.3	<-32	Pass

## Band Edge Plots







## Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA • 714 993 6112  
 Customer: **Avnet Inc.**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **105053** Date: 7/22/2021  
 Test Type: **Conducted Emissions** Time: 13:37:21  
 Tested By: E. Wong Sequence#: 4  
 Software: EMITest 5.03.19 120/60Hz

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

The EUT seeking single modular approval is installed on a support PCB which provide power and configuration interface for testing purposes. The Ethernet and USB-B port of the support PCB is not populated as the function of the PCB is to act as source of power and configuration only.

RF parameter evaluated at the antenna port J1. Power at antenna port J2 is verified. device does not transmit simultaneously from J1 and J2.

A support laptop is connected to the PCB via micro-USB cable for configuration of the EUT.

**Frequency range: 2412MHz, 2442MHz, 2462MHz**

Channel 1,7,11.

Protocol: CCK, OFDM54M, MCS7

Firmware power setting: 14dBm.

Frequency range of measurement = 9 kHz- 25 GHz.

9 kHz -150 kHz;RBW=200 Hz,VBW=600 Hz;150 kHz-30 MHz;RBW=9 kHz,VBW=27 kHz;30 MHz-1000 MHz;RBW=120 kHz,VBW=360 kHz,1000 MHz-25000 MHz;RBW=1MHz,VBW=3 MHz.

Test environment conditions:

Temperature: 27.6°C

Relative Humidity: 52%

Pressure: 99.9kPa

Site A

ANSI C63.10-2013

Attenuator and Cable loss is included as amplitude offset of the measuring instrument.

Modification #1 was in place during testing.

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
	AN03430	Attenuator	75A-10-12	12/20/2019	12/20/2021
	ANP07655	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

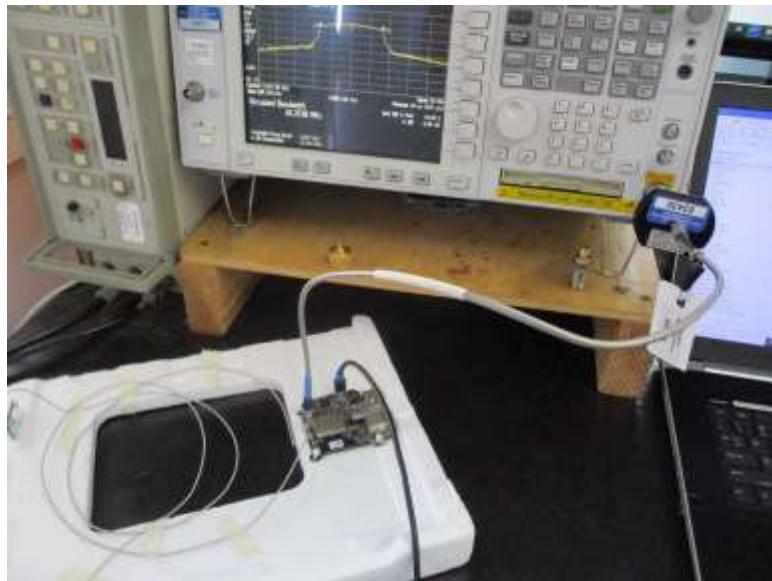
**Measurement Data:**

Reading listed by margin.

Test Lead: Antenna port

#	Freq MHz	Rdng dB $\mu$ V	T1 dB	dB	dB	Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant
1	2483.500M	-46.3	+0.0			+0.0	-46.3	-32.0	-14.3	Anten Bandedge_H_OFD M54M
2	2400.000M	-46.7	+0.0			+0.0	-46.7	-32.0	-14.7	Anten Bandedge_OFDM5 4M
3	2400.000M	-46.7	+0.0			+0.0	-46.7	-32.0	-14.7	Anten Bandedge_L_MCS 7
4	2483.500M	-45.5	+0.0			+0.0	-45.5	-30.0	-15.5	Anten Bandedge_H_MCS 7
5	2400.000M	-50.6	+0.0			+0.0	-50.6	-30.0	-20.6	Anten Bandedge_L_CCK1 1M
6	2483.550M	-64.3	+0.0			+0.0	-64.3	-30.0	-34.3	Anten Bandedge_H_CCK 11M

**Test Setup Photo(s)**



## 15.247(d) Radiated Emissions & Band Edge

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA • 714 993 6112  
 Customer: **Avnet Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **105053** Date: 7/21/2021  
 Test Type: **Radiated Scan** Time: 09:55:31  
 Tested By: E. Wong Sequence#: 6  
 Software: EMITest 5.03.19

#### *Equipment Tested:*

Device	Manufacturer	Model #	S/N
Configuration 1			

#### *Support Equipment:*

Device	Manufacturer	Model #	S/N
Configuration 1			

#### *Test Conditions / Notes:*

Placed on Styrofoam block, the EUT seeking single modular approval is installed on a support PCB which provide power and configuration interface for testing purposes. The Ethernet and USB-B port of the support PCB is not populated as the function of the PCB is to act as source of power and configuration only.  
 RF parameter evaluated at the antenna port J1. Power at antenna port J2 is verified. device does not transmit simultaneously from J1 and J2.  
 A support laptop is connected to the PCB via micro-USB cable for configuration of the EUT.

**Frequency range: 2412MHz, 2442MHz, 2462MHz**

Channel 1,7,11.

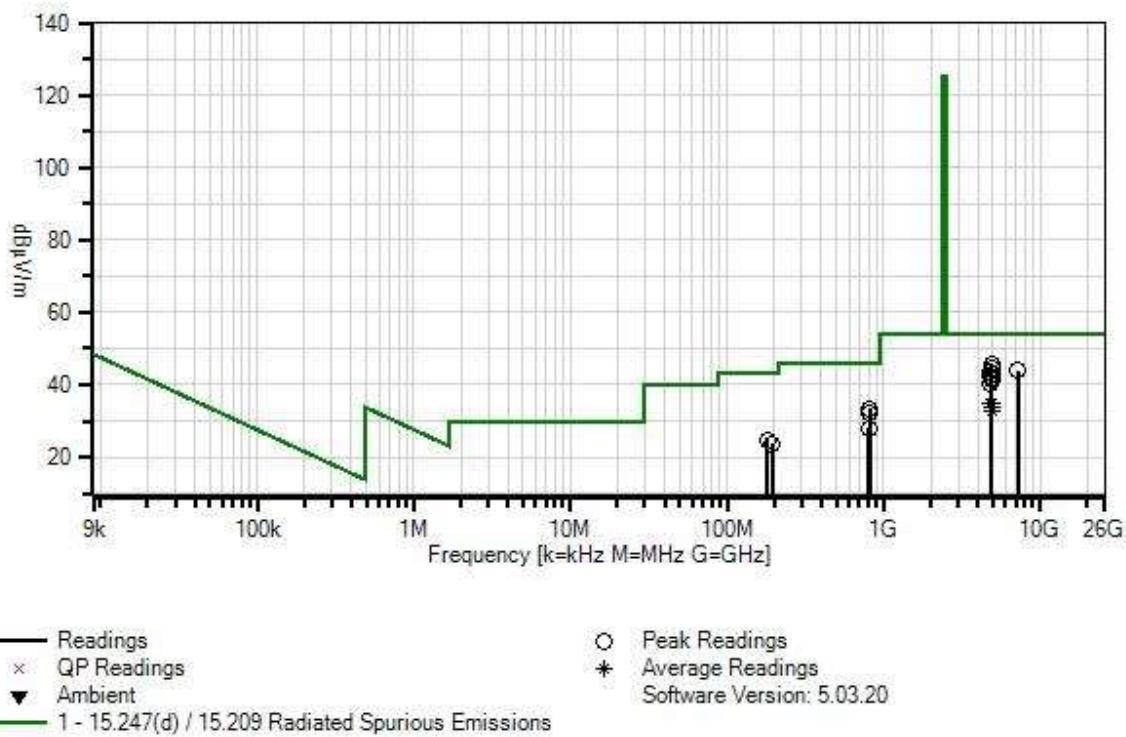
Protocol: CCK, OFDM54M, MCS7  
 Firmware power setting: 14dBm.

Frequency range of measurement = 9 kHz- 25 GHz.  
 9 kHz -150 kHz;RBW=200 Hz,VBW=600 Hz;150 kHz-30 MHz;RBW=9 kHz,VBW=27 kHz;30 MHz-1000 MHz;RBW=120 kHz,VBW=360 kHz,1000 MHz-25000 MHz;RBW=1MHz,VBW=3 MHz.

Test environment conditions:  
 Temperature: 25°C  
 Relative Humidity: 57%  
 Pressure: 99.9kPa

Site A  
 ANSI C63.10-2013

Emission profile of the EUT rotated along the three orthogonal axes was investigated, worse case report.  
 Modification #1 was in place during testing.

Avnet, Inc WO#: 105053 Sequence#: 6 Date: 7/21/2021  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz

**Test Equipment:**

ID	Asset #	Description	Model	Cal Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T2	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T3	ANP07246	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
T4	AN00786	Preamplifier	83017A	5/20/2020	5/20/2022
T5	ANP06360	Cable	L1-PNMNM-48	8/8/2019	8/8/2021
T6	AN03385	High Pass Filter	11SH10-3000/T10000-O/O	5/17/2021	5/17/2023
	AN03367	Horn Antenna	62-GH-62-25.	8/1/2019	8/1/2021
	ANP07658	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022
	AN01413	Horn Antenna	84125-80008	10/19/2020	10/19/2022
T7	AN00851	Biconilog Antenna	CBL6111C	4/14/2020	4/14/2022
T8	ANP05505	Attenuator	NAT-6	5/26/2021	5/26/2023
T9	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/21/2020	12/21/2022
T10	AN00309	Preamplifier	8447D	12/24/2019	12/24/2021
T11	ANP05050	Cable	RG223/U	12/24/2020	12/24/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022

<b>Measurement Data:</b>			Reading listed by margin.				Test Distance: 3 Meters				
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6	T7	T8	Table	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
			MHz	dB $\mu$ V	dB	dB	dB	Table	dB $\mu$ V/m	dB	Ant
1	4884.000M	44.6	+0.0	+33.2	+0.6	-37.6	+0.0	45.6	54.0	-8.4	Horiz
			+4.5	+0.3	+0.0	+0.0					CCK11M_Z_M
			+0.0	+0.0	+0.0						
2	4884.000M	43.8	+0.0	+33.2	+0.6	-37.6	+0.0	44.8	54.0	-9.2	Horiz
			+4.5	+0.3	+0.0	+0.0					MCS7_Z_M
			+0.0	+0.0	+0.0						
3	7230.500M	37.9	+0.0	+36.0	+0.8	-37.1	+0.0	43.9	54.0	-10.1	Vert
			+6.1	+0.2	+0.0	+0.0					CCK11M_Z_L
			+0.0	+0.0	+0.0						
4	4824.500M	42.5	+0.0	+33.1	+0.7	-37.6	+0.0	43.5	54.0	-10.5	Horiz
			+4.5	+0.3	+0.0	+0.0					MCS7_Z_L
			+0.0	+0.0	+0.0						
5	4925.700M	42.1	+0.0	+33.3	+0.6	-37.6	+0.0	43.2	54.0	-10.8	Horiz
			+4.5	+0.3	+0.0	+0.0					CCK11M_Z_H
			+0.0	+0.0	+0.0						
6	4823.500M	41.5	+0.0	+33.1	+0.7	-37.6	+0.0	42.5	54.0	-11.5	Horiz
			+4.5	+0.3	+0.0	+0.0					CCK11M_Z_L
			+0.0	+0.0	+0.0						
7	4924.000M	40.9	+0.0	+33.3	+0.6	-37.6	+0.0	42.0	54.0	-12.0	Horiz
			+4.5	+0.3	+0.0	+0.0					MCS7_Z_H
			+0.0	+0.0	+0.0						
8	4924.000M	40.8	+0.0	+33.3	+0.6	-37.6	+0.0	41.9	54.0	-12.1	Horiz
			+4.5	+0.3	+0.0	+0.0					OFDM54M_Z_L
			+0.0	+0.0	+0.0						
9	4925.700M	40.7	+0.0	+33.3	+0.6	-37.6	+0.0	41.8	54.0	-12.2	Vert
			+4.5	+0.3	+0.0	+0.0					CCK11M_Z_H
			+0.0	+0.0	+0.0						
10	821.000M	26.1	+0.0	+0.0	+0.0	+0.0	+0.0	33.4	46.0	-12.6	Vert
			+0.0	+0.0	+22.2	+6.3					
			+5.5	-27.1	+0.4						
11	4924.000M	40.2	+0.0	+33.3	+0.6	-37.6	+0.0	41.3	54.0	-12.7	Horiz
			+4.5	+0.3	+0.0	+0.0					OFDM54M_Z_H
			+0.0	+0.0	+0.0						
12	814.000M	25.1	+0.0	+0.0	+0.0	+0.0	+0.0	32.3	46.0	-13.7	Horiz
			+0.0	+0.0	+22.1	+6.3					
			+5.5	-27.1	+0.4						
13	4820.300M	39.3	+0.0	+33.1	+0.7	-37.6	+0.0	40.3	54.0	-13.7	Vert
			+4.5	+0.3	+0.0	+0.0					CCK11M_Z_L
			+0.0	+0.0	+0.0						
14	803.998M	20.9	+0.0	+0.0	+0.0	+0.0	+0.0	27.9	46.0	-18.1	Vert
			+0.0	+0.0	+22.0	+6.3					
			+5.4	-27.1	+0.4						
15	181.700M	35.2	+0.0	+0.0	+0.0	+0.0	+0.0	24.7	43.5	-18.8	Vert
			+0.0	+0.0	+8.9	+6.1					
			+2.3	-28.0	+0.2						

16	4824.500M	34.1	+0.0	+33.1	+0.7	-37.6	+0.0	35.1	54.0	-18.9	Vert
	Ave		+4.5	+0.3	+0.0	+0.0			MCS7_Z_L		
			+0.0	+0.0	+0.0						
^	4824.500M	47.4	+0.0	+33.1	+0.7	-37.6	+0.0	48.4	54.0	-5.6	Vert
			+4.5	+0.3	+0.0	+0.0			MCS7_Z_L		
			+0.0	+0.0	+0.0						
18	4882.417M	34.0	+0.0	+33.2	+0.6	-37.6	+0.0	35.0	54.0	-19.0	Vert
	Ave		+4.5	+0.3	+0.0	+0.0			OFDM54M_Z_M		
			+0.0	+0.0	+0.0						
^	4882.417M	46.7	+0.0	+33.2	+0.6	-37.6	+0.0	47.7	54.0	-6.3	Vert
			+4.5	+0.3	+0.0	+0.0			OFDM54M_Z_M		
			+0.0	+0.0	+0.0						
20	4884.000M	34.0	+0.0	+33.2	+0.6	-37.6	+0.0	35.0	54.0	-19.0	Vert
	Ave		+4.5	+0.3	+0.0	+0.0			MCS7_Z_M		
			+0.0	+0.0	+0.0						
^	4884.000M	46.8	+0.0	+33.2	+0.6	-37.6	+0.0	47.8	54.0	-6.2	Vert
			+4.5	+0.3	+0.0	+0.0			MCS7_Z_M		
			+0.0	+0.0	+0.0						
^	4884.000M	44.3	+0.0	+33.2	+0.6	-37.6	+0.0	45.3	54.0	-8.7	Vert
			+4.5	+0.3	+0.0	+0.0			CCK11M_Z_M		
			+0.0	+0.0	+0.0						
^	4884.000M	44.2	+0.0	+33.2	+0.6	-37.6	+0.0	45.2	54.0	-8.8	Vert
			+4.5	+0.3	+0.0	+0.0			CCK11M_X_M		
			+0.0	+0.0	+0.0						
^	4884.000M	40.9	+0.0	+33.2	+0.6	-37.6	+0.0	41.9	54.0	-12.1	Vert
			+4.5	+0.3	+0.0	+0.0			CCK11M_Y_M		
			+0.0	+0.0	+0.0						
25	194.730M	34.3	+0.0	+0.0	+0.0	+0.0	+0.0	23.8	43.5	-19.7	Vert
			+0.0	+0.0	+8.8	+6.1					
			+2.4	-28.0	+0.2						
26	4882.417M	33.0	+0.0	+33.2	+0.6	-37.6	+0.0	34.0	54.0	-20.0	Horiz
	Ave		+4.5	+0.3	+0.0	+0.0			OFDM54M_Z_M		
			+0.0	+0.0	+0.0						
^	4882.417M	45.8	+0.0	+33.2	+0.6	-37.6	+0.0	46.8	54.0	-7.2	Horiz
			+4.5	+0.3	+0.0	+0.0			OFDM54M_Z_M		
			+0.0	+0.0	+0.0						
28	4924.000M	31.7	+0.0	+33.3	+0.6	-37.6	+0.0	32.8	54.0	-21.2	Vert
	Ave		+4.5	+0.3	+0.0	+0.0			OFDM54M_Z_H		
			+0.0	+0.0	+0.0						
^	4924.000M	43.9	+0.0	+33.3	+0.6	-37.6	+0.0	45.0	54.0	-9.0	Vert
			+4.5	+0.3	+0.0	+0.0			MCS7_Z_H		
			+0.0	+0.0	+0.0						
^	4924.000M	43.8	+0.0	+33.3	+0.6	-37.6	+0.0	44.9	54.0	-9.1	Vert
			+4.5	+0.3	+0.0	+0.0			OFDM54M_Z_H		
			+0.0	+0.0	+0.0						
^	4924.000M	42.0	+0.0	+33.3	+0.6	-37.6	+0.0	43.1	54.0	-10.9	Vert
			+4.5	+0.3	+0.0	+0.0			OFDM54M_Z_L		
			+0.0	+0.0	+0.0						

## Band Edge

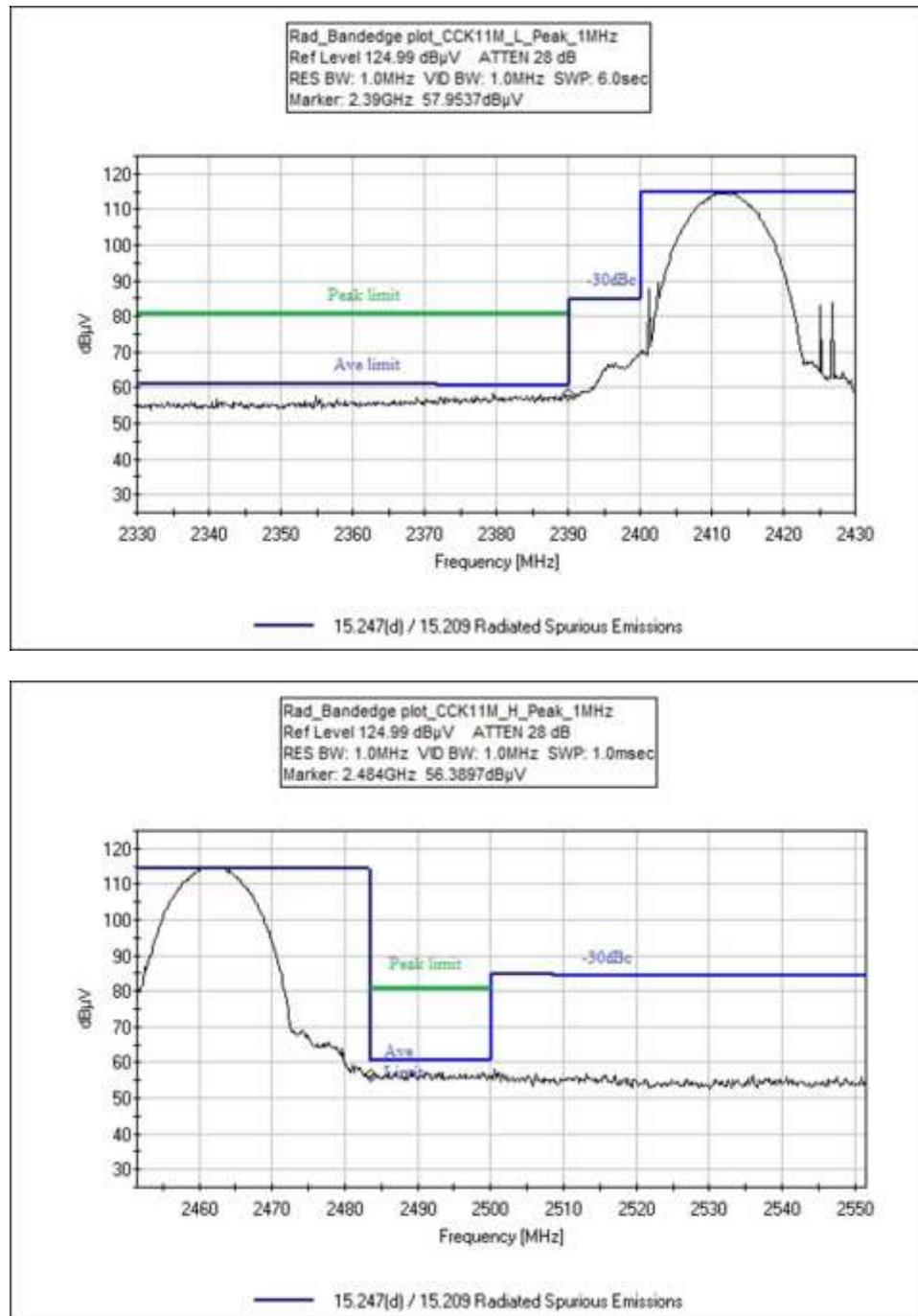
### Band Edge Summary

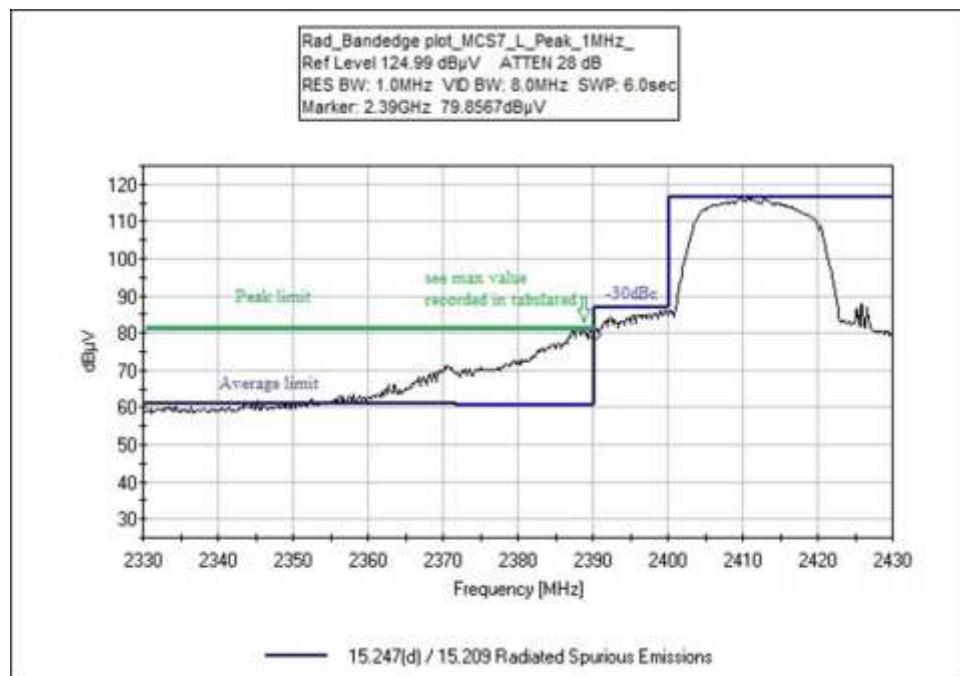
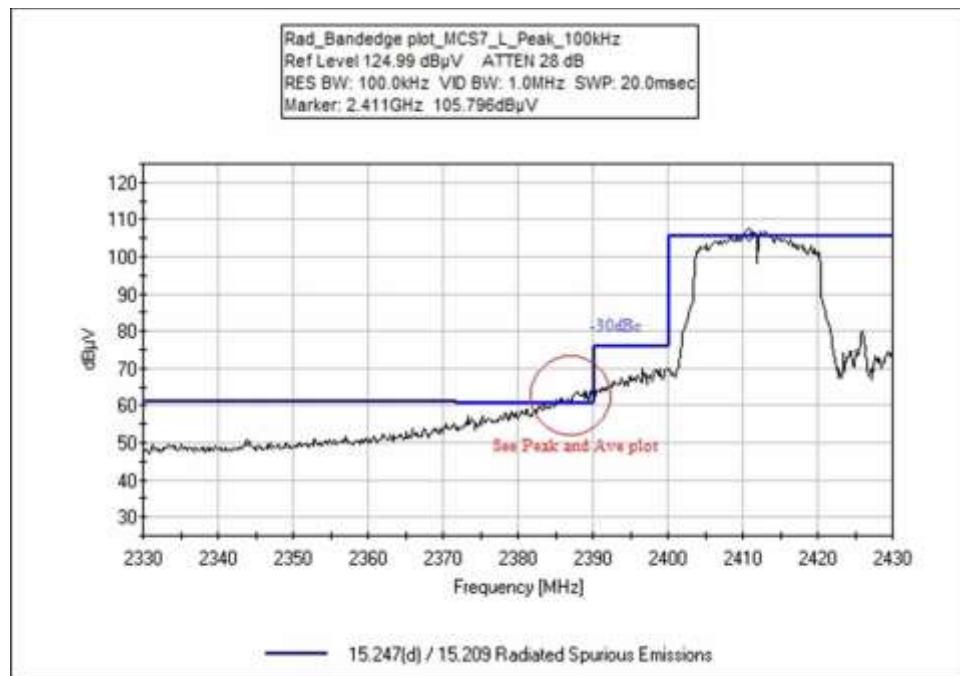
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	CCK11M	Ext patch/ 1.9dBi	51.3 pk 1MHz*	<54	Pass
2400.0	CCK11M	Ext patch/ 1.9dBi	62.8 pk 1MHz	< 78	Pass
2483.5	CCK11M	Ext patch/ 1.9dBi	49.8 pk 1MHz*	<54	Pass
2390.0	MCS7	Ext patch/ 1.9dBi	46.9 av 1MHz	<54	Pass
2390.0	MCS7	Ext patch/ 1.9dBi	73.2 pk 1MHz	<74	Pass
2400.0	MCS7	Ext patch/ 1.9dBi	62.9 pk 100kHz	<69	Pass
2483.5	MCS7	Ext patch/ 1.9dBi	45.8 1MHz	<54	Pass
2483.5	MCS7	Ext patch/ 1.9dBi	68.4 1MHz	<74	Pass
2390.0	OFDM54M	Ext patch/ 1.9dBi	48.7 av 1MHz	<54	Pass
2390.0	OFDM54M	Ext patch/ 1.9dBi	73.3 pk 1MHz	<74	Pass
2400.0	OFDM54M	Ext patch/ 1.9dBi	60.5 pk 100kHz	< 69	Pass
2483.5	OFDM54M	Ext patch/ 1.9dBi	69.2 pk 1MHz	<74	Pass
2483.5	OFDM54M	Ext patch/ 1.9dBi	45.9 av 1MHz	<54	Pass

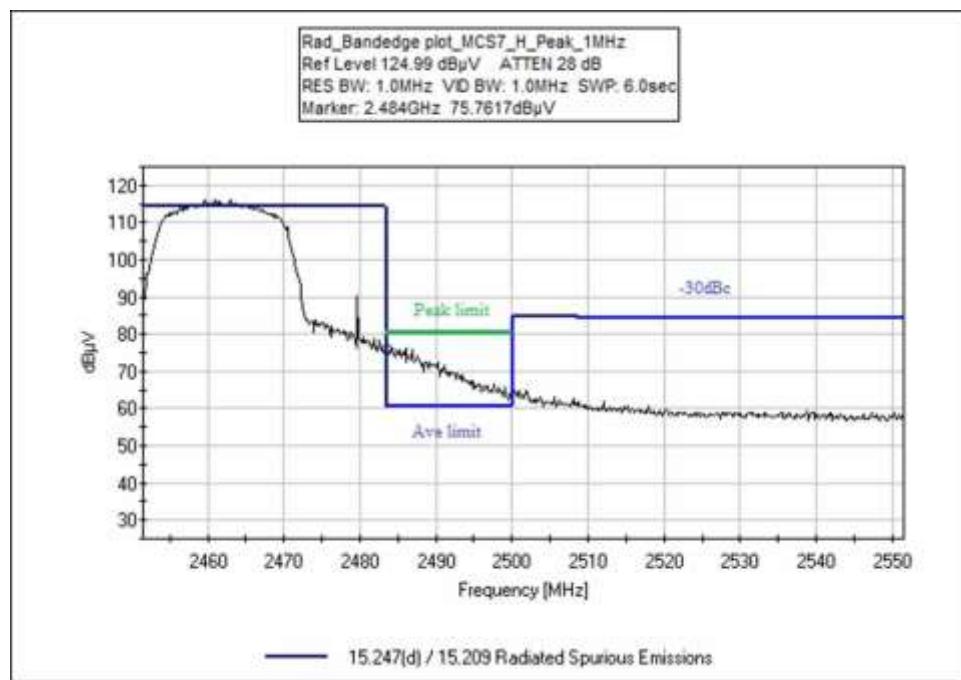
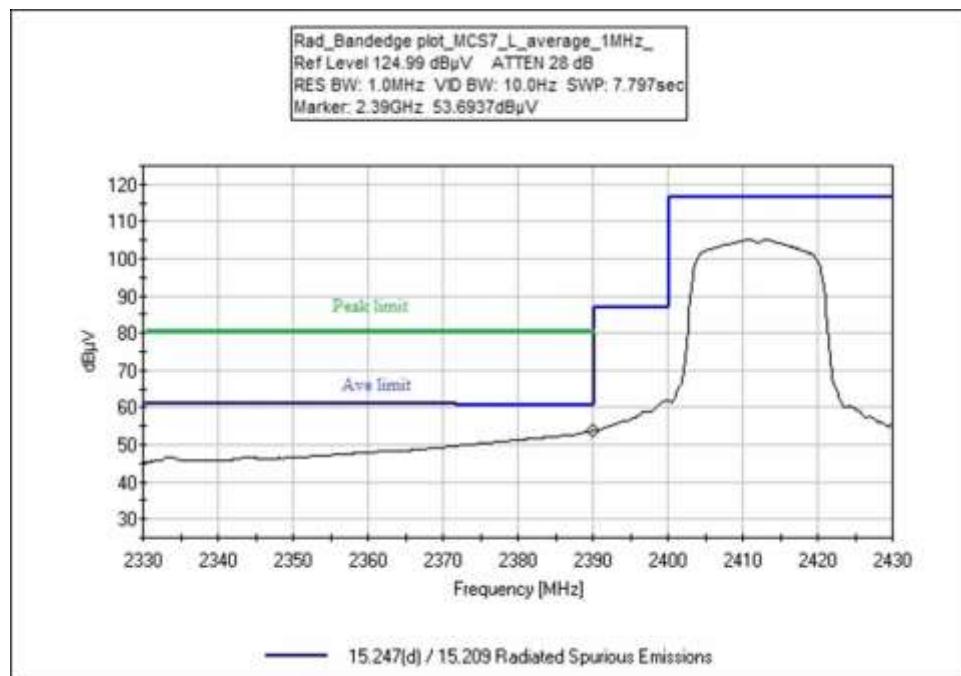
\* Complies with both peak and average limit.

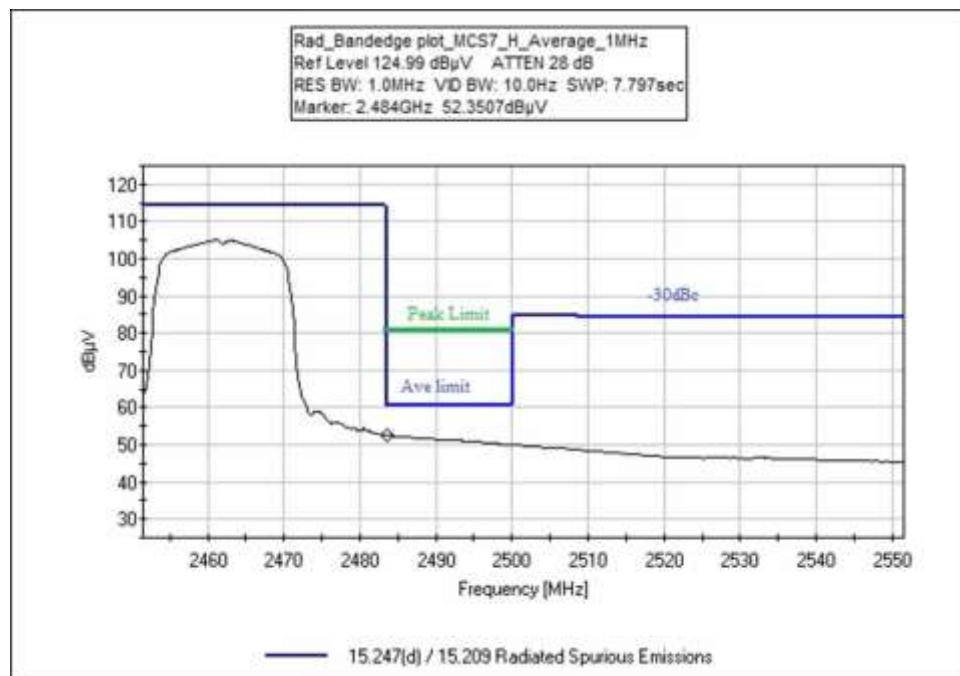
## Band Edge Plots

### CCK11M

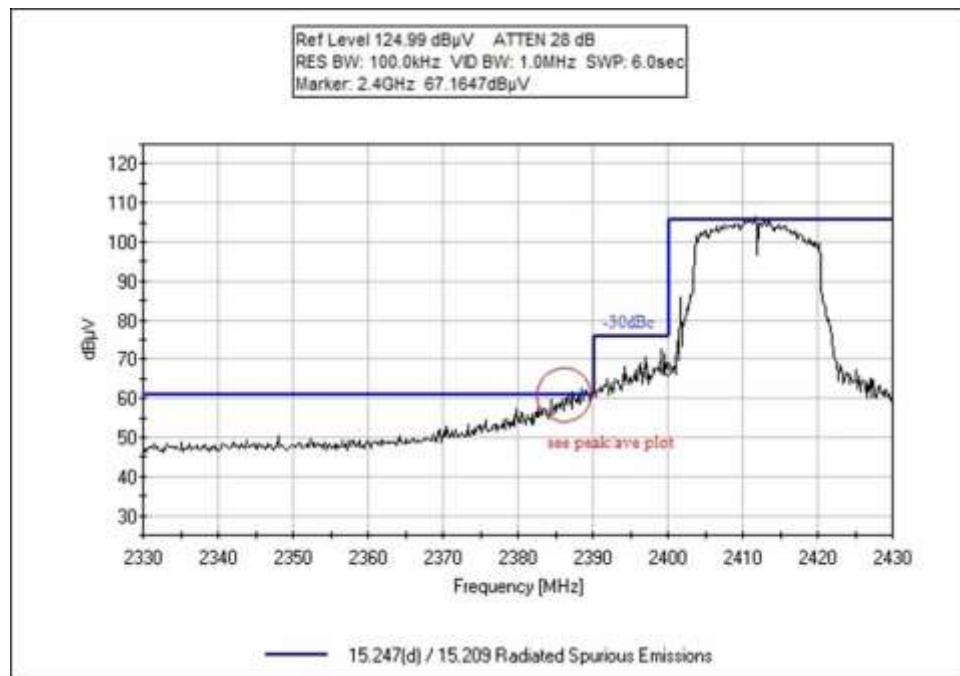


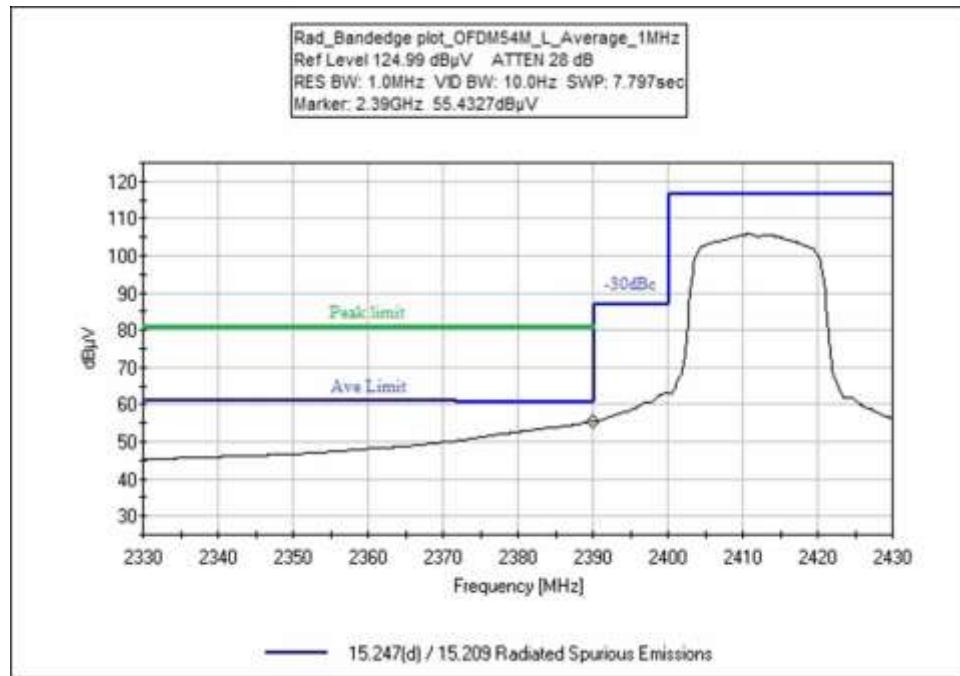
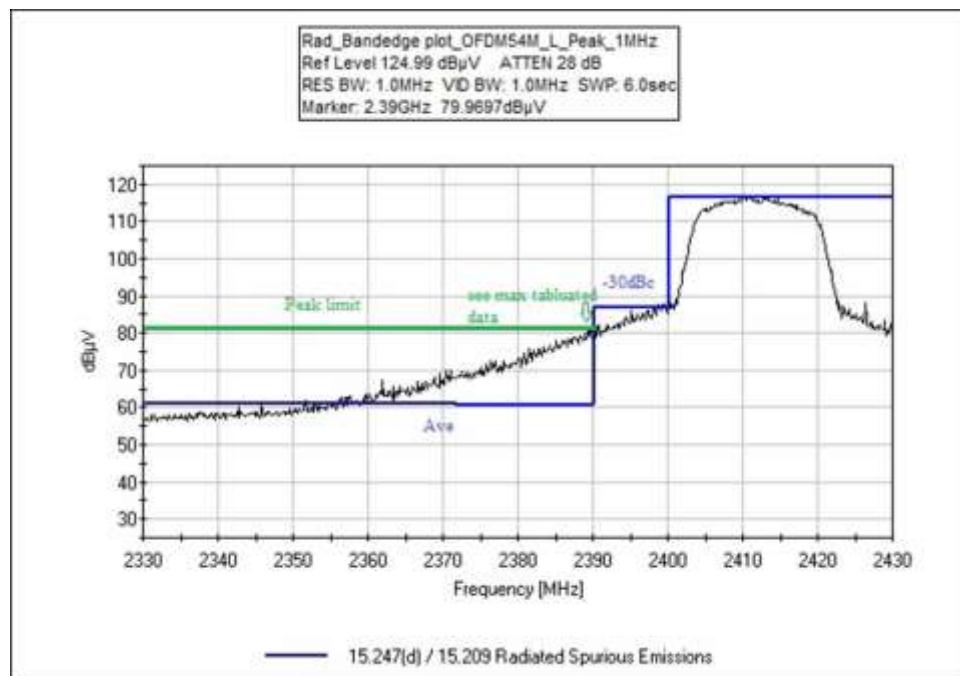
MCS7


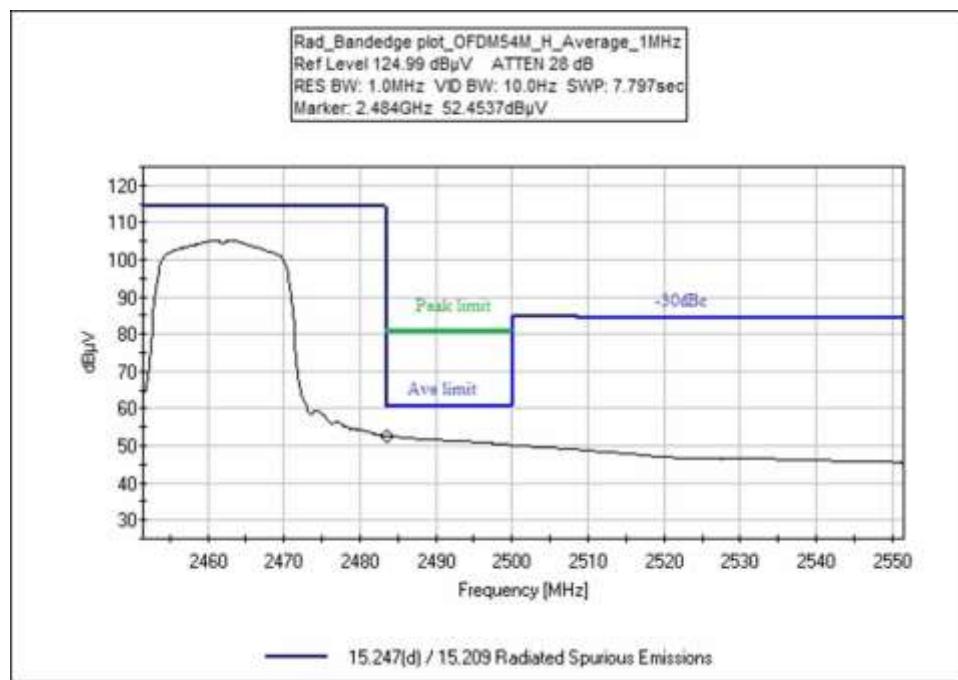
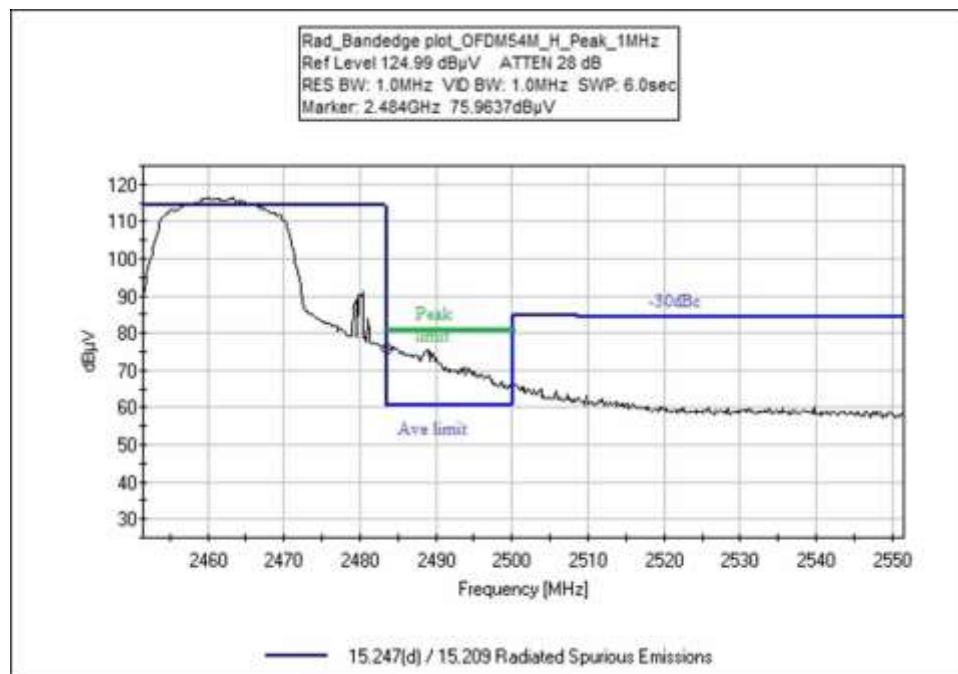




### OFDM54M







## Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA • 714 993 6112  
 Customer: **Avnet Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **105053** Date: 7/16/2021  
 Test Type: **Radiated Scan** Time: 14:44:55  
 Tested By: E. Wong Sequence#: 5  
 Software: EMITest 5.03.19

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

Placed on Styrofoam block, the EUT seeking single modular approval is installed on a support PCB which provide power and configuration interface for testing purposes. The Ethernet and USB-B port of the support PCB is not populated as the function of the PCB is to act as source of power and configuration only.

RF parameter evaluated at the antenna port J1. Power at antenna port J2 is verified. device does not transmit simultaneously from J1 and J2.

A support laptop is connected to the PCB via micro-USB cable for configuration of the EUT.

**Frequency range: 2412MHz, 2442MHz, 2462MHz**

Channel 1,7,11.

Protocol: CCK, OFDM54M, MCS7

Firmware power setting: 14dBm.

Frequency range of measurement = 9 kHz- 25 GHz.

9 kHz -150 kHz;RBW=200 Hz,VBW=600 Hz;150 kHz-30 MHz;RBW=9 kHz,VBW=27 kHz;30 MHz-1000 MHz;RBW=120 kHz,VBW=360 kHz,1000 MHz-25000 MHz;RBW=1MHz,VBW=3 MHz.

Test environment conditions:

Temperature: 25°C

Relative Humidity: 57%

Pressure: 99.9kPa

Site A

ANSI C63.10-2013

Emission profile of the EUT rotated along the three orthogonal axes was investigated, worse case report.

Modification #1 was in place during testing.

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T2	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T3	ANP07246	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
T4	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T5	ANP06360	Cable	L1-PNMNM-48	8/8/2019	8/8/2021
	AN03385	High Pass Filter	11SH10-3000/T10000-O/O	5/17/2021	5/17/2023

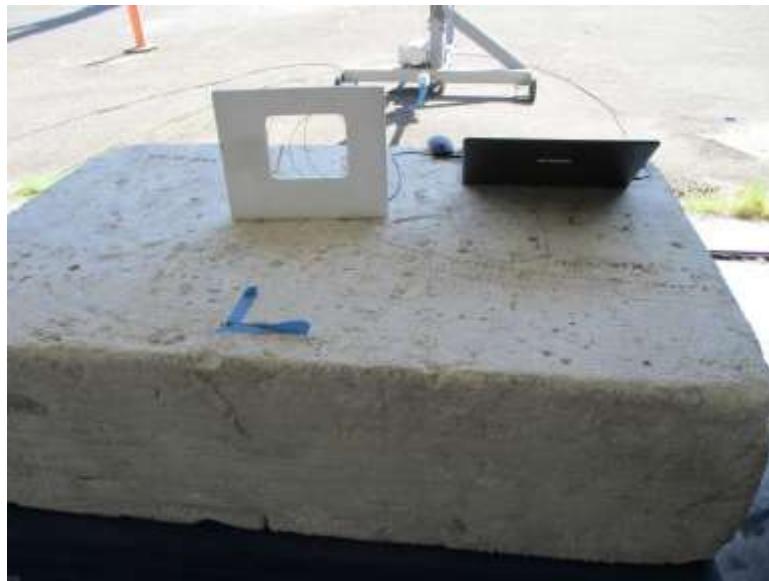
**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 MHz	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
							Table	dB $\mu$ V/m	dB $\mu$ V/m		
1	2390.000M Ave	55.4	+0.0 +3.2	+28.3	+0.4	-38.6	+0.0	48.7	54.0	-5.3	Vert
											OFDM54M_L
2	2400.000M	69.6	+0.0 +3.2	+28.3	+0.4	-38.6	+0.0	62.9	69.0	-6.1	Vert
											MCS7_100K_L
3	2390.000M Ave	53.6	+0.0 +3.2	+28.3	+0.4	-38.6	+0.0	46.9	54.0	-7.1	Vert
											MCS7_L
^	2390.000M	80.0	+0.0 +3.2	+28.3	+0.4	-38.6	+0.0	73.3	54.0	+19.3	Vert
											OFDM54M_1MHz_L
^	2390.000M	79.9	+0.0 +3.2	+28.3	+0.4	-38.6	+0.0	73.2	54.0	+19.2	Vert
^	2390.000M	58.0	+0.0 +3.2	+28.3	+0.4	-38.6	+0.0	51.3	54.0	-2.7	Vert
7	2483.500M Ave	52.5	+0.0 +3.3	+28.3	+0.4	-38.6	+0.0	45.9	54.0	-8.1	Vert
8	2483.500M Ave	52.4	+0.0 +3.3	+28.3	+0.4	-38.6	+0.0	45.8	54.0	-8.2	Vert
^	2483.500M	75.8	+0.0 +3.3	+28.3	+0.4	-38.6	+0.0	69.2	54.0	+15.2	Vert
^	2483.500M	75.0	+0.0 +3.3	+28.3	+0.4	-38.6	+0.0	68.4	54.0	+14.4	Vert
^	2483.500M	56.4	+0.0 +3.3	+28.3	+0.4	-38.6	+0.0	49.8	54.0	-4.2	Vert
12	2400.000M	67.2	+0.0 +3.2	+28.3	+0.4	-38.6	+0.0	60.5	69.0	-8.5	Vert
13	2400.000M	69.5	+0.0 +3.2	+28.3	+0.4	-38.6	+0.0	62.8	78.0	-15.2	Vert
											CCK11M_L

**Test Setup Photo(s)**



Below 1GHz



Below 1GHz



Above 1GHz



Above 1GHz



X Axis



Y Axis



Z Axis



2.4GHz Z Axis



2.4GHz Z Axis

## 15.247(e) Power Spectral Density

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013) KDB558074 D01 15.247 MEAS GUIDANCE V05R02 APRIL 2, 2019	Test Date(s):	7/15/2021
Configuration:	1		
Test Setup:	<p>The EUT seeking single modular approval is installed on a support PCB which provide power and configuration interface for testing purposes. The Ethernet and USB-B port of the support PCB is not populated as the function of the PCB is to act as source of power and configuration only.</p> <p>RF parameter evaluated at the antenna port J1. Power at antenna port J2 is verified. device does not transmit simultaneously from J1 and J2.</p> <p>A support laptop is connected to the PCB via micro-USB cable for configuration of the EUT.</p> <p>Firmware power setting: 14dBm.</p> <p>Modification #1 was in place during testing.</p>		

Environmental Conditions			
Temperature (°C)	27	Relative Humidity (%):	48

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02762	Spectrum Analyzer	Agilent	E4446A	4/29/2020	4/29/2022
03430	Attenuator	Aeroflex/Weinschel	75A-10-12	12/20/2019	12/20/2021
07655	Cable	Astro lab	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

### Test Data Summary - RF Conducted Measurement

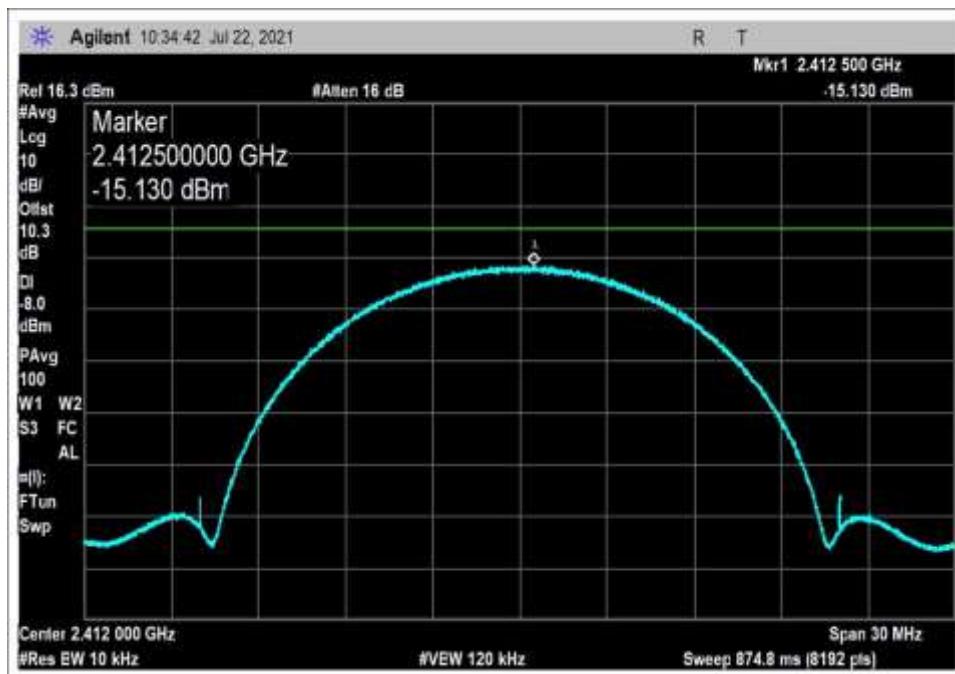
Measurement Method: AVGPSD-1

Frequency (MHz)	Modulation	Measured (dBm/10kHz)	Limit (dBm/3kHz)	Results
2412	CCK11M	-15.1	≤8	Pass
2442	CCK11M	-15.9	≤8	Pass
2462	CCK11M	-14.9	≤8	Pass
2412	MCS7	-16.0	≤8	Pass
2442	MCS7	-16.4	≤8	Pass
2462	MCS7	-14.7	≤8	Pass
2412	OFDM54M	-15.4	≤8	Pass
2442	OFDM54M	-15.7	≤8	Pass
2462	OFDM54M	-15.4	≤8	Pass

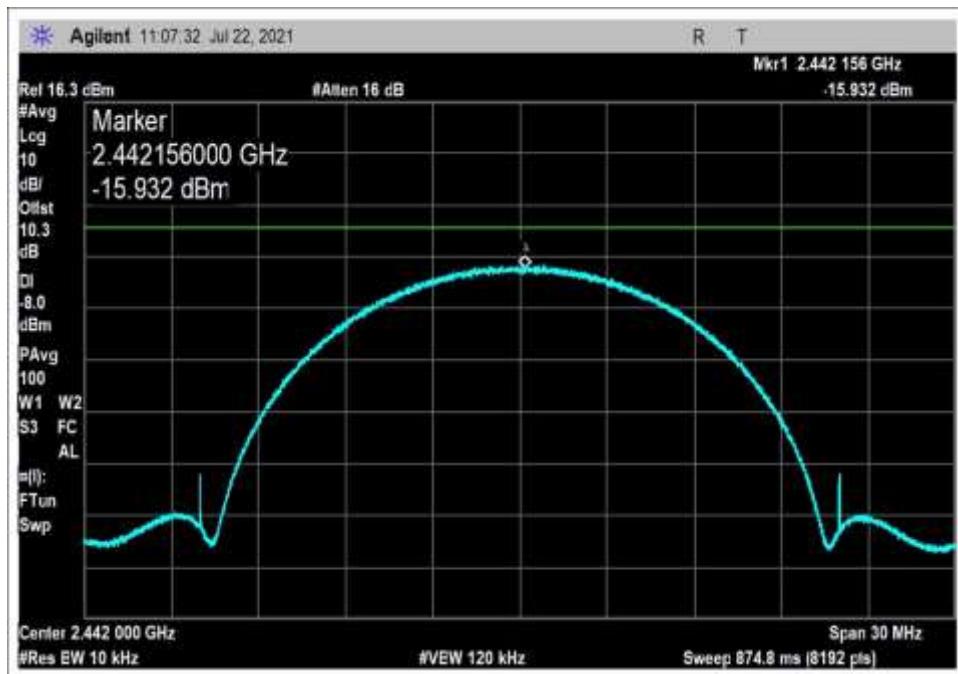
PSD was measured at RBW of 10kHz instead of 3kHz as allowed in clause 11.10.3 of ANSI 63.10

### Plots

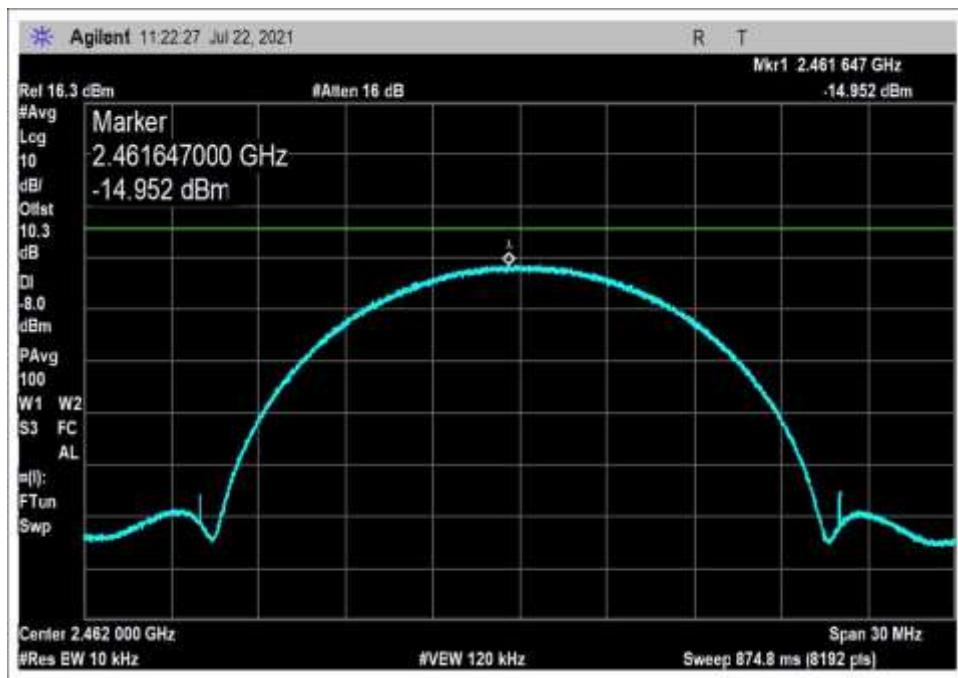
#### CCK11M



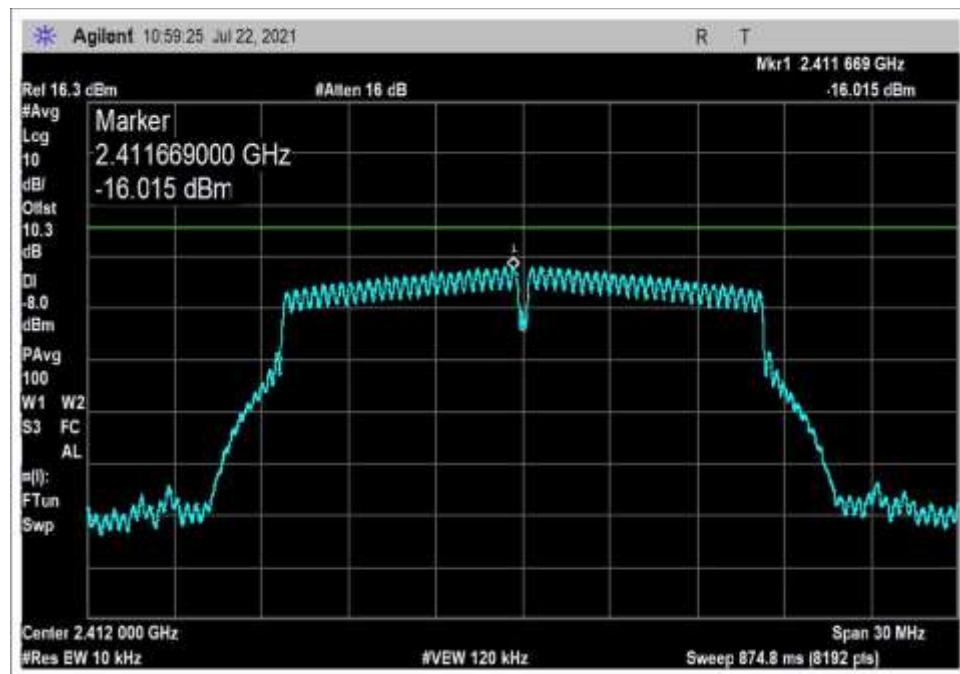
Low Channel



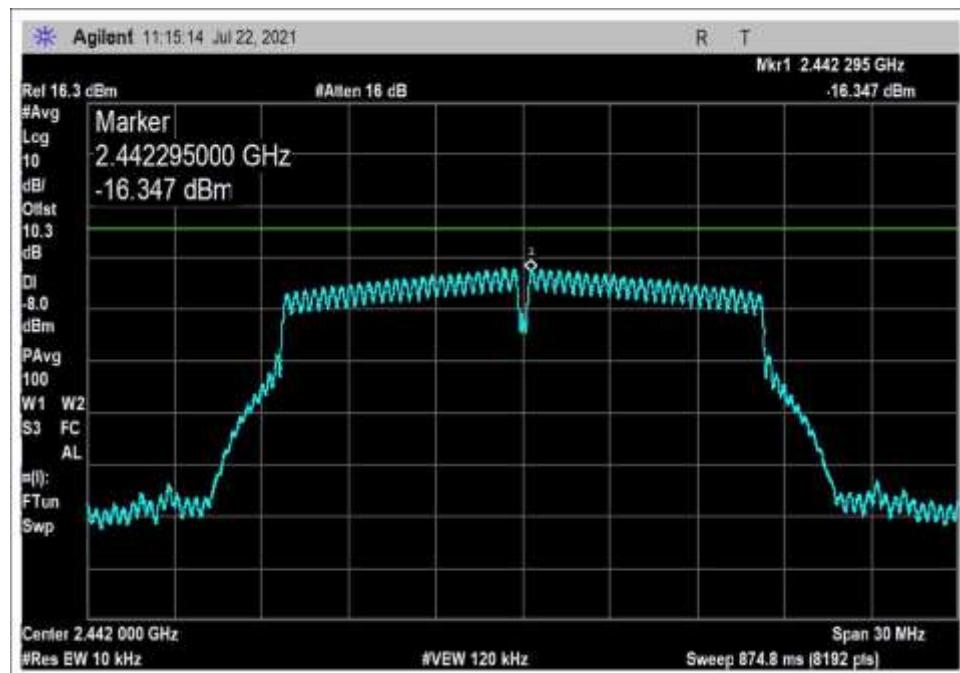
Middle Channel



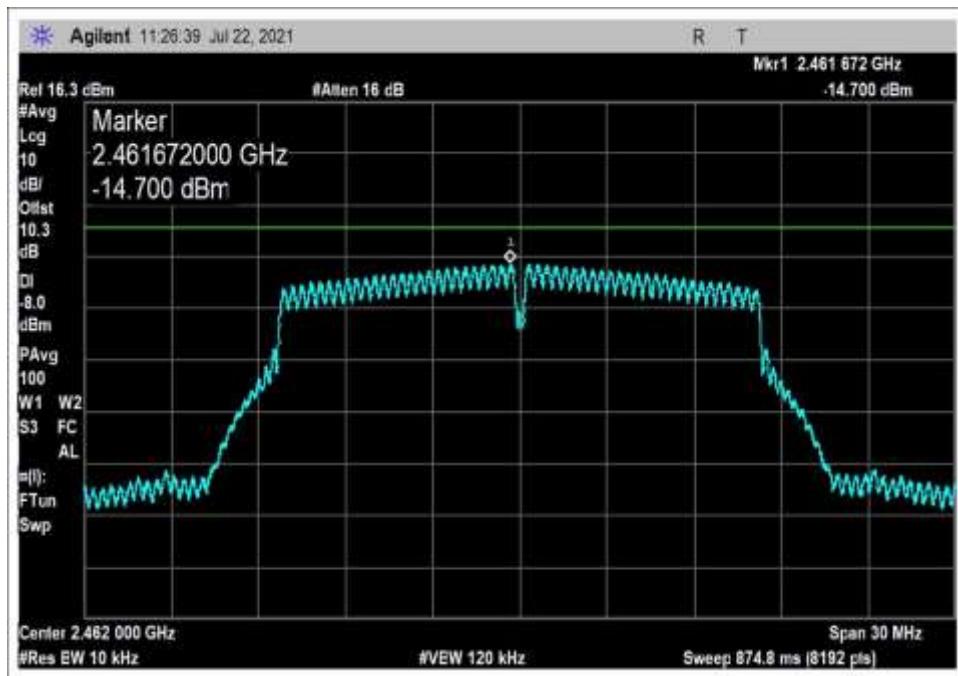
High Channel

MCS7


Low Channel

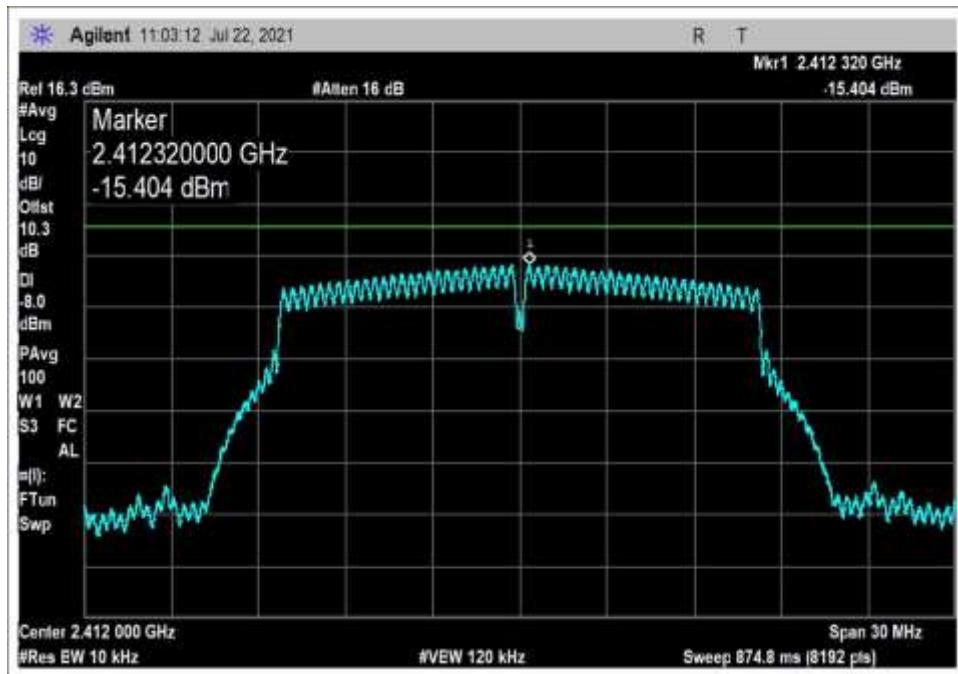


Middle Channel

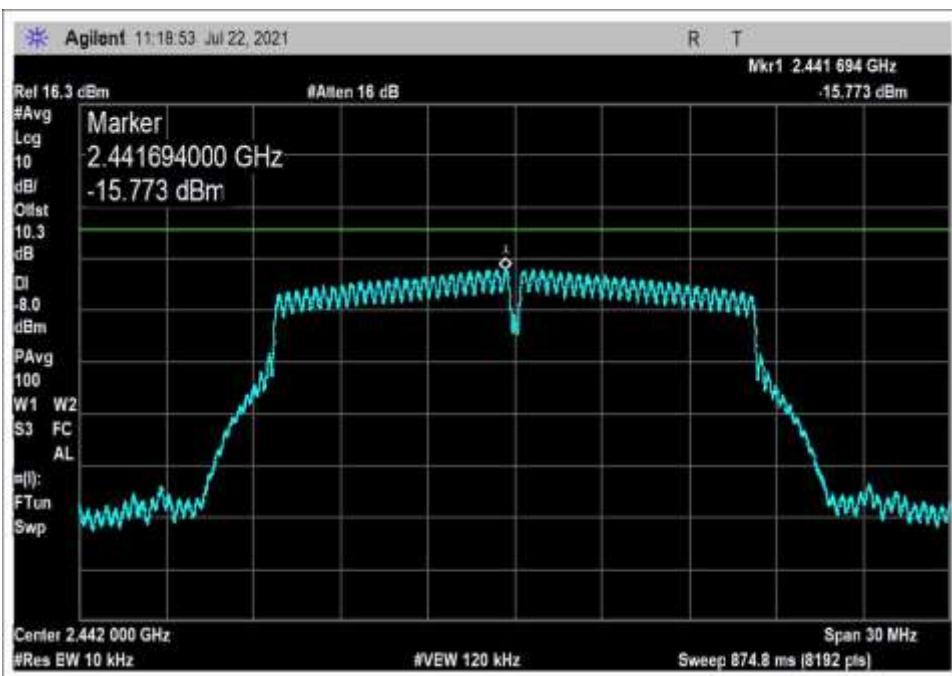


## High Channel

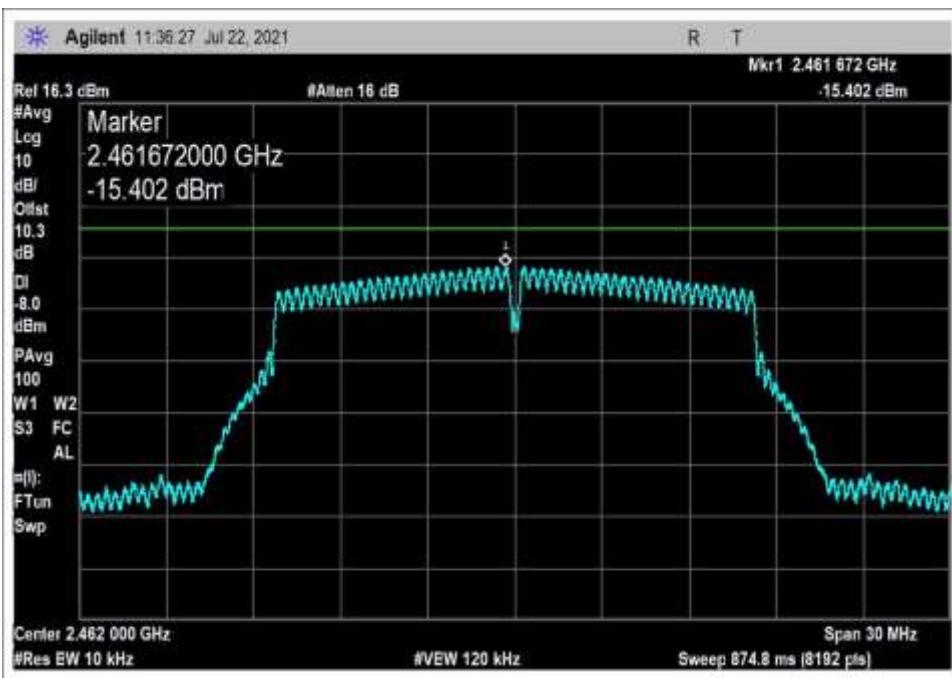
## OFDN54M



### Low Channel

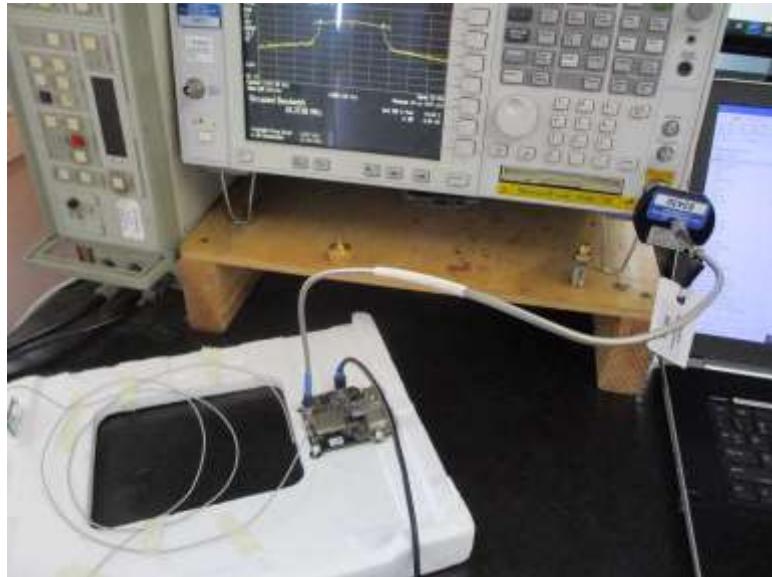


Middle Channel



High Channel

**Test Setup Photo(s)**



## 15.207 AC Conducted Emissions

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA • 714 993 6112  
 Customer: **Avnet Inc.**  
 Specification: **15.207 AC Mains - Average**  
 Work Order #: **105053** Date: 7/26/2021  
 Test Type: **Conducted Emissions** Time: 18:16:02  
 Tested By: E. Wong Sequence#: 16  
 Software: EMITest 5.03.19 120/60Hz

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Test Conditions / Notes:***

Placed on the test bench, the EUT seeking single modular approval is installed on a support PCB which provide power and configuration interface for testing purposes. The Ethernet and USB-B port of the support PCB is not populated as the function of the PCB is to act as source of power and configuration only.

A support laptop is connected to the PCB via micro-USB cable for configuration of the EUT.

**Frequency range: 2412-2460MHz**

Protocol: OFDM54M, MCS7, CCK11M

Firmware power setting: 14dBm.

Worse case Protocol tested MCS7

Frequency range of measurement = 150kHz- 30MHz.

150 kHz-30 MHz;RBW=9 kHz,VBW=30kHz

AC conducted emission perform at AC main of support DC power supply. 3.3 Vdc supplied to the EUT.

Test environment conditions:

Temperature: 25.3°C

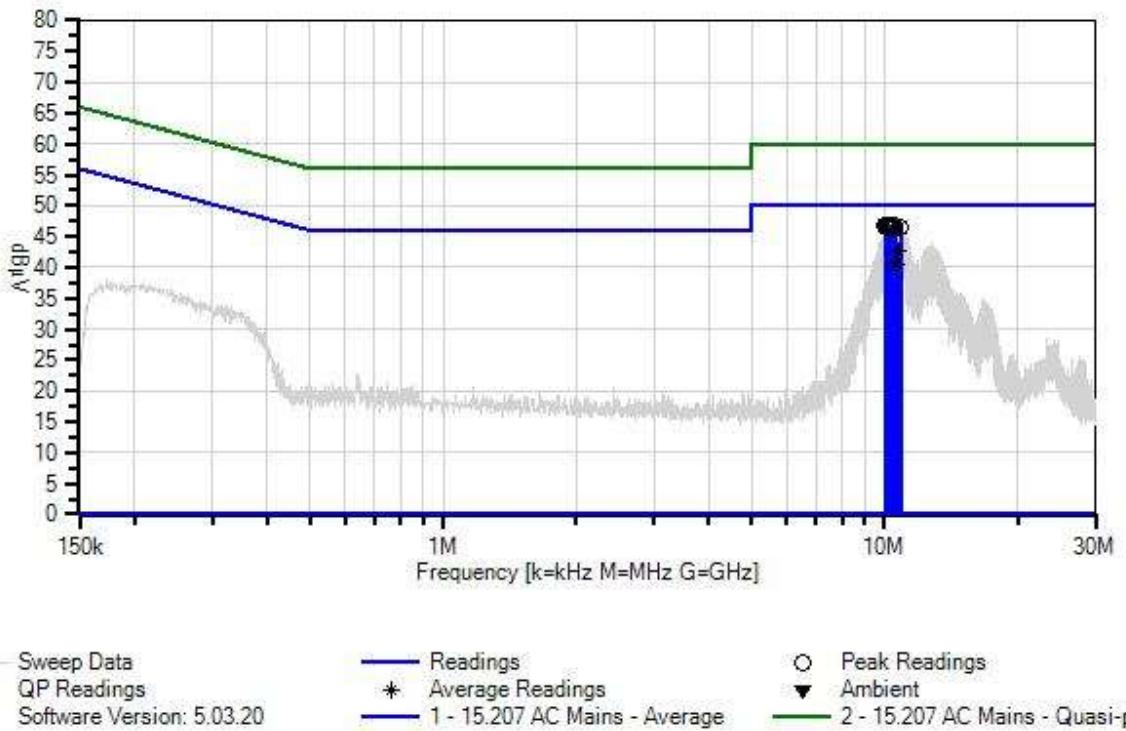
Relative Humidity: 58%

Pressure: 98.9kPa

Site A

ANSI C63.10-2013

Modification #1 was in place during testing.

Avnet, Inc WO#: 105053 Sequence#: 16 Date: 7/26/2021  
 15.207 AC Mains - Average Test Lead: 120/60Hz L1-Line

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T1	AN02610	High Pass Filter	HE9615-150K-50-720B	10/22/2019	10/22/2021
T2	ANP07338	Cable	2249-Y-240	12/24/2019	12/24/2021
T3	ANP07545	Attenuator	SA18N10W-06	1/4/2021	1/4/2023
T4	AN00969A	50uH LISN-Line (dB)	3816/2NM	7/27/2020	7/27/2022
	AN00969A	50uH LISN-Return (dB)	3816/2NM	7/27/2020	7/27/2022

<b>Measurement Data:</b>		Reading listed by margin.						Test Lead: L1-Line			
#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant
1	10.283M	40.4	+0.2	+0.3	+5.7	+0.3	+0.0	46.9	50.0	-3.1	L1-Li
2	10.193M	40.4	+0.2	+0.3	+5.7	+0.3	+0.0	46.9	50.0	-3.1	L1-Li
3	10.382M	40.4	+0.2	+0.3	+5.7	+0.3	+0.0	46.9	50.0	-3.1	L1-Li
4	10.337M	40.4	+0.2	+0.3	+5.7	+0.3	+0.0	46.9	50.0	-3.1	L1-Li
5	10.004M	40.3	+0.2	+0.3	+5.7	+0.3	+0.0	46.8	50.0	-3.2	L1-Li
6	10.481M	40.3	+0.2	+0.3	+5.7	+0.3	+0.0	46.8	50.0	-3.2	L1-Li
7	10.571M	40.3	+0.2	+0.3	+5.7	+0.2	+0.0	46.7	50.0	-3.3	L1-Li
8	10.148M	40.2	+0.2	+0.3	+5.7	+0.3	+0.0	46.7	50.0	-3.3	L1-Li
9	10.427M	40.1	+0.2	+0.3	+5.7	+0.3	+0.0	46.6	50.0	-3.4	L1-Li
10	10.526M	40.2	+0.2	+0.3	+5.7	+0.2	+0.0	46.6	50.0	-3.4	L1-Li
11	10.860M	40.2	+0.2	+0.3	+5.7	+0.2	+0.0	46.6	50.0	-3.4	L1-Li
12	10.094M	39.9	+0.2	+0.3	+5.7	+0.3	+0.0	46.4	50.0	-3.6	L1-Li
13	10.238M	39.9	+0.2	+0.3	+5.7	+0.3	+0.0	46.4	50.0	-3.6	L1-Li
14	10.761M Ave	36.4	+0.2	+0.3	+5.7	+0.2	+0.0	42.8	50.0	-7.2	L1-Li
^	10.761M	40.6	+0.2	+0.3	+5.7	+0.2	+0.0	47.0	50.0	-3.0	L1-Li
16	10.670M Ave	34.2	+0.2	+0.3	+5.7	+0.2	+0.0	40.6	50.0	-9.4	L1-Li
^	10.670M	40.9	+0.2	+0.3	+5.7	+0.2	+0.0	47.3	50.0	-2.7	L1-Li



Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA • 714 993 6112  
Customer: **Avnet Inc.**  
Specification: **15.207 AC Mains - Average**  
Work Order #: **105053** Date: 7/26/2021  
Test Type: **Conducted Emissions** Time: 18:22:11  
Tested By: E. Wong Sequence#: 17  
Software: EMITest 5.03.19 120/60Hz

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Test Conditions / Notes:***

Placed on the test bench, the EUT seeking single modular approval is installed on a support PCB which provide power and configuration interface for testing purposes. The Ethernet and USB-B port of the support PCB is not populated as the function of the PCB is to act as source of power and configuration only.

A support laptop is connected to the PCB via micro-USB cable for configuration of the EUT.

**Frequency range: 2412-2460MHz**

Protocol: OFDM54M, MCS7, CCK11M

Firmware power setting: 14dBm.

Worse case Protocol tested MCS7

Frequency range of measurement = 150kHz- 30MHz.

150 kHz-30 MHz;RBW=9 kHz,VBW=30kHz

AC conducted emission perform at AC main of support DC power supply. 3.3 Vdc supplied to the EUT.

Test environment conditions:

Temperature: 25.3°C

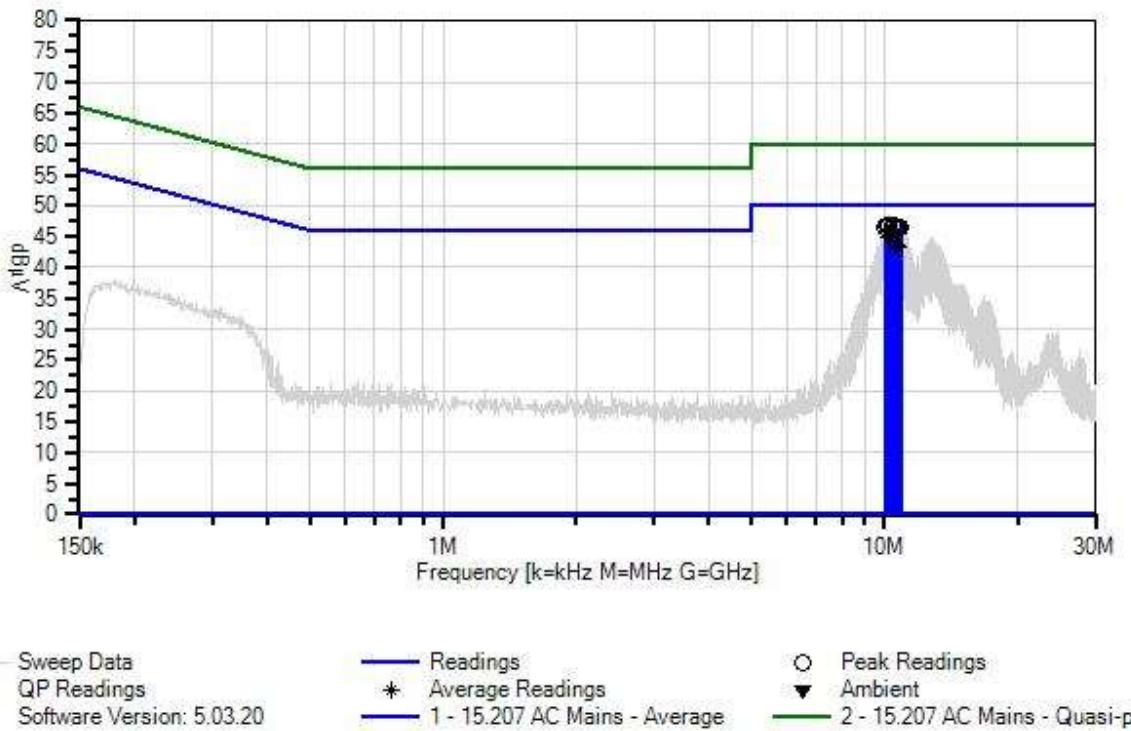
Relative Humidity: 58%

Pressure: 98.9kPa

Site A

ANSI C63.10-2013

Modification #1 was in place during testing.

Avnet, Inc WO#: 105053 Sequence#: 17 Date: 7/26/2021  
 15.207 AC Mains - Average Test Lead: 120/60Hz L2-Neutral

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T1	AN02610	High Pass Filter	HE9615-150K-50-720B	10/22/2019	10/22/2021
T2	ANP07338	Cable	2249-Y-240	12/24/2019	12/24/2021
T3	ANP07545	Attenuator	SA18N10W-06	1/4/2021	1/4/2023
	AN00969A	50uH LISN-Line (dB)	3816/2NM	7/27/2020	7/27/2022
T4	AN00969A	50uH LISN-Return (dB)	3816/2NM	7/27/2020	7/27/2022

<b>Measurement Data:</b>		Reading listed by margin.						Test Lead: L2-Neutral			
#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant
1	10.382M	40.4	+0.2	+0.3	+5.7	+0.3	+0.0	46.9	50.0	-3.1	L2-Ne
2	10.139M	40.4	+0.2	+0.3	+5.7	+0.3	+0.0	46.9	50.0	-3.1	L2-Ne
3	10.472M	40.5	+0.2	+0.3	+5.7	+0.2	+0.0	46.9	50.0	-3.1	L2-Ne
4	10.427M	40.4	+0.2	+0.3	+5.7	+0.3	+0.0	46.9	50.0	-3.1	L2-Ne
5	10.571M	40.4	+0.2	+0.3	+5.7	+0.2	+0.0	46.8	50.0	-3.2	L2-Ne
6	10.238M	40.2	+0.2	+0.3	+5.7	+0.3	+0.0	46.7	50.0	-3.3	L2-Ne
7	10.049M	40.0	+0.2	+0.3	+5.7	+0.3	+0.0	46.5	50.0	-3.5	L2-Ne
8	10.860M	40.1	+0.2	+0.3	+5.7	+0.2	+0.0	46.5	50.0	-3.5	L2-Ne
9	10.616M	40.0	+0.2	+0.3	+5.7	+0.2	+0.0	46.4	50.0	-3.6	L2-Ne
10	10.716M	40.0	+0.2	+0.3	+5.7	+0.2	+0.0	46.4	50.0	-3.6	L2-Ne
11	10.285M Ave	38.4	+0.2	+0.3	+5.7	+0.3	+0.0	44.9	50.0	-5.1	L2-Ne
^	10.283M	41.1	+0.2	+0.3	+5.7	+0.3	+0.0	47.6	50.0	-2.4	L2-Ne
13	10.334M Ave	38.4	+0.2	+0.3	+5.7	+0.3	+0.0	44.9	50.0	-5.1	L2-Ne
^	10.337M	40.6	+0.2	+0.3	+5.7	+0.3	+0.0	47.1	50.0	-2.9	L2-Ne
15	10.191M Ave	38.3	+0.2	+0.3	+5.7	+0.3	+0.0	44.8	50.0	-5.2	L2-Ne
^	10.193M	42.0	+0.2	+0.3	+5.7	+0.3	+0.0	48.5	50.0	-1.5	L2-Ne
17	10.668M Ave	37.3	+0.2	+0.3	+5.7	+0.2	+0.0	43.7	50.0	-6.3	L2-Ne
^	10.670M	40.9	+0.2	+0.3	+5.7	+0.2	+0.0	47.3	50.0	-2.7	L2-Ne
19	10.762M Ave	36.9	+0.2	+0.3	+5.7	+0.2	+0.0	43.3	50.0	-6.7	L2-Ne
^	10.761M	40.8	+0.2	+0.3	+5.7	+0.2	+0.0	47.2	50.0	-2.8	L2-Ne

**Test Setup Photo(s)**



## 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 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. 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	(dB $\mu$ V)
+ Antenna Factor	(dB/m)
+ 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 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.