Avnet, Inc.

REVISED EMC TEST REPORT TO 105053-25

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

Tested to The Following Standards:

FCC Part 15 Subpart E Section(s)

15.207 & 15.407
(NII 5.725 – 5.850GHz)

Report No.: 105053-25A

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:

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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
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5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 105053

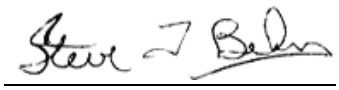
DATE OF EQUIPMENT RECEIPT: July 13, 2021
DATE(S) OF TESTING: July 13 – 19, 21, and 26 - 27, 2021, October 8, 2021, and January 30, 2023

Revision History

Original: Testing of the Secure Wi-Fi module, Model: AES-MS-MT3620-UFL-M-G Rev2 to FCC Part 15 Subpart E Section(s) 15.207 & 15.407 (NII 5.725 – 5.850GHz).
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 E - 15.407 (NII)

Test Procedure	Description	Modifications	Results
15.407(e)	6dB Bandwidth	NA	Pass
15.407(a)	Output Power	NA	Pass
15.407(a)	Power Spectral Density	NA	Pass
15.407(g)	Frequency Stability	NA	Pass
15.407(b)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	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
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
Secure Wi-Fi module	Avnet, Inc.	AES-MS-MT3620-UFL-M-G Rev2	NA

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 Rev2	NA

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

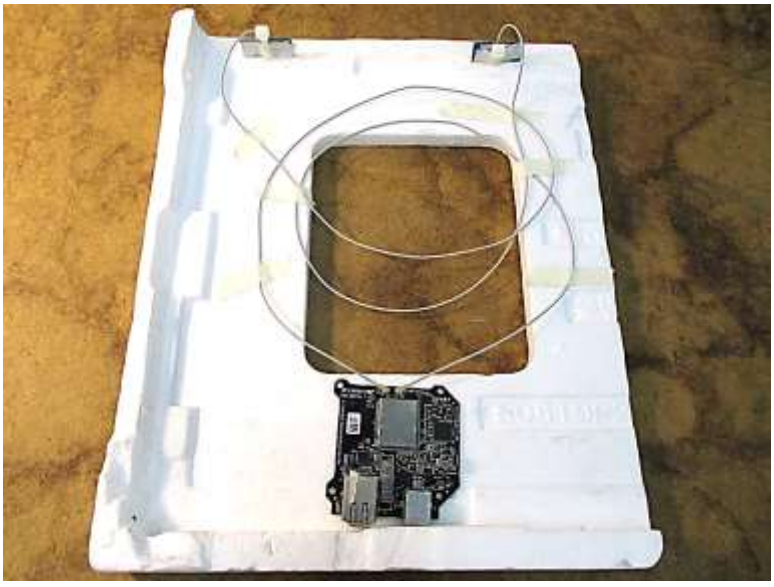
General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Radio Module
Type of Wideband System:	802.11 n20
Operating Frequency Range:	5745-5825MHz
Modulation Type(s):	MCS7, OFDM54M
Maximum Duty Cycle:	98%
Number of TX Chains:	1
Antenna Type(s) and Gain:	External, Patch, 2.7dBi
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)

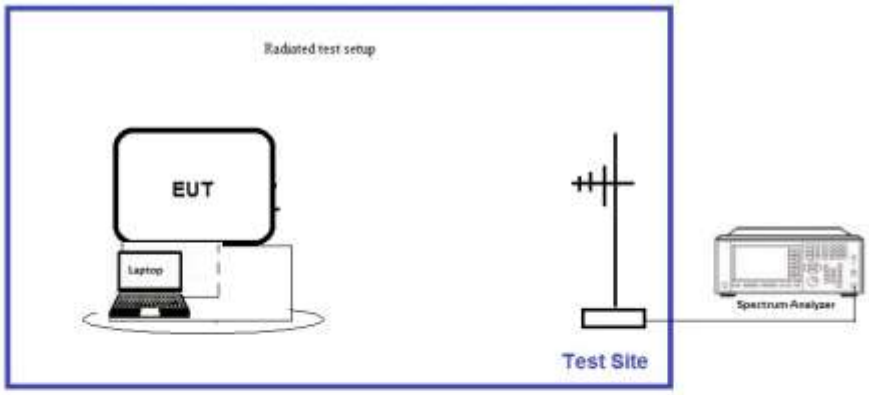
Support Equipment Photo(s)

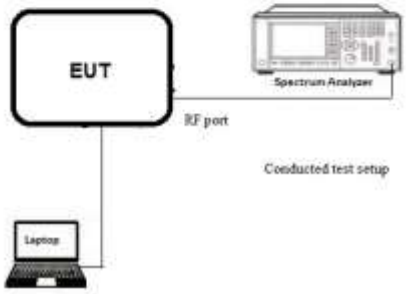
Laptop



Host

Block Diagram of Test Setup





FCC Part 15 Subpart E

15.407(e) 6dB Bandwidth

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 789033 V02R01 December 14, 2017	Test Date(s):	7/13/2021
Configuration:	1		
Test Setup:	The EUT 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. RF parameter evaluated at the antenna port J1. Power at antenna port J2 is verified. device does not transmit simultaneously from J1 and J2. Firmware power setting = 14		

Environmental Conditions			
Temperature (ºC)	25.9	Relative Humidity (%):	54

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

6dB Occupied Bandwidth

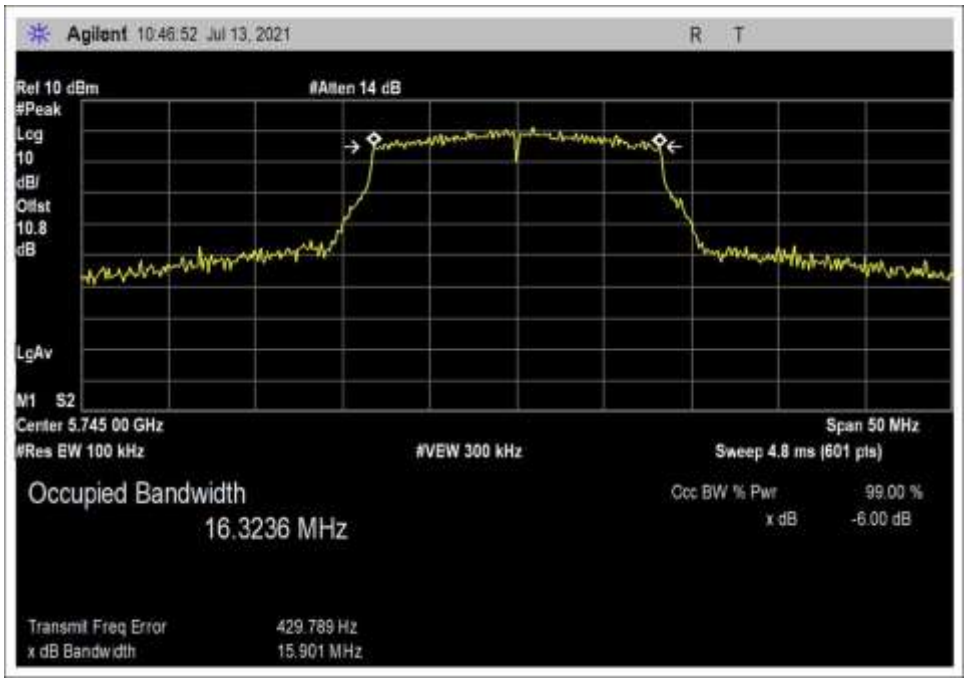
Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
5745	1	MCS7	15901	≥500	Pass
5785	1	MCS7	16175	≥500	Pass
5825	1	MCS7	15486	≥500	Pass
5745	1	OFDM54M	16258	≥500	Pass
5785	1	OFDM54M	15955	≥500	Pass
5825	1	OFDM54M	16092	≥500	Pass

99% Occupied Bandwidth

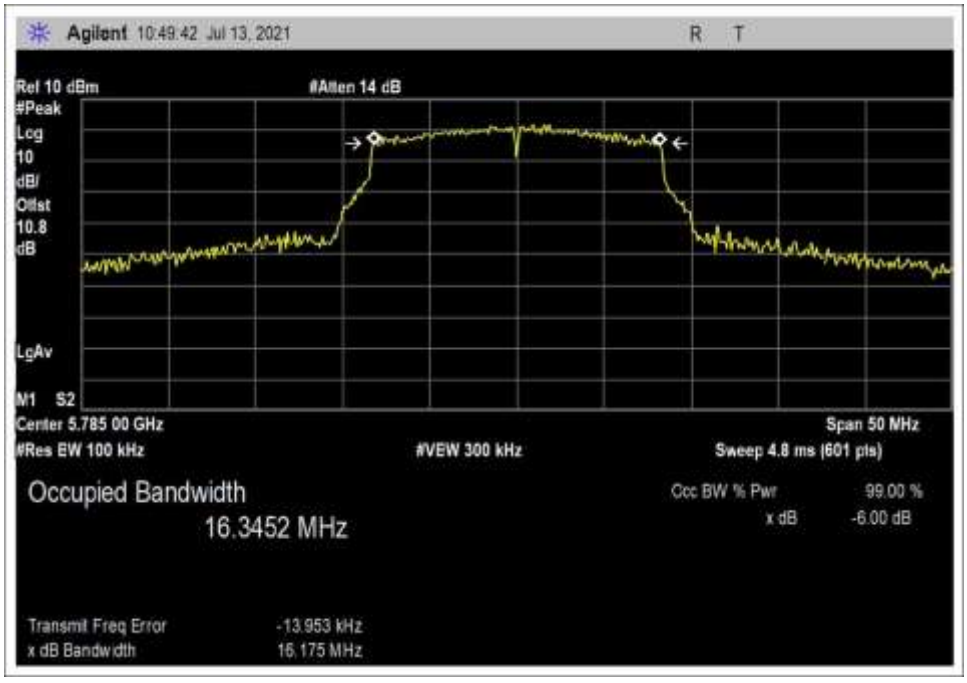
Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
5745	1	MCS7	16443	None	NA
5785	1	MCS7	16375		
5825	1	MCS7	16447		
5745	1	OFDM54M	16418	None	NA
5785	1	OFDM54M	16406		
5825	1	OFDM54M	16486		

6dB BW Plot(s)

MCS7



Low Channel



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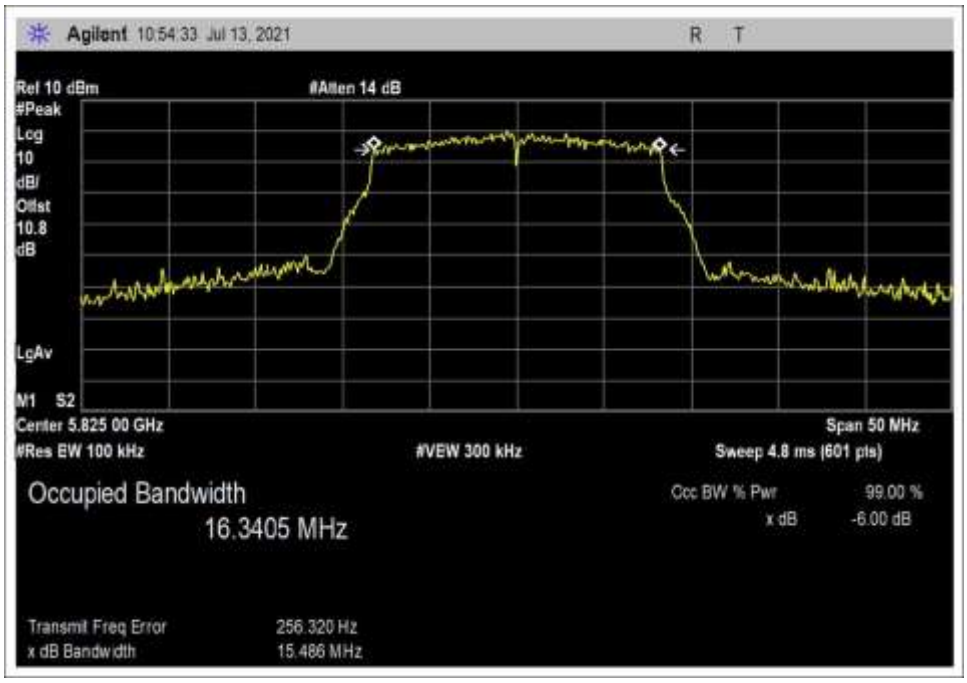
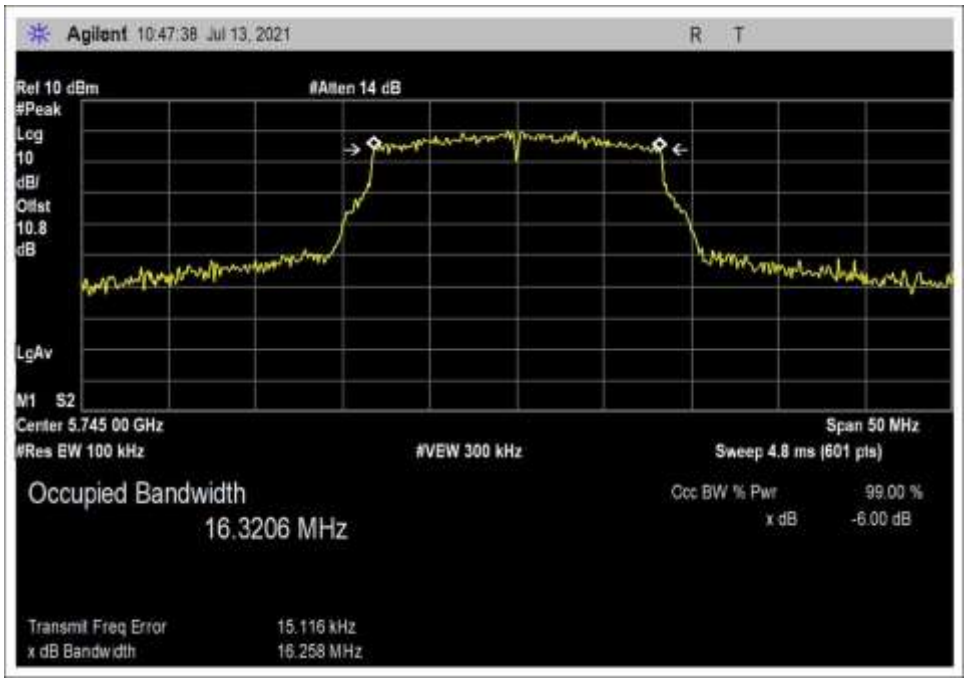


High Channel

ODFM54M



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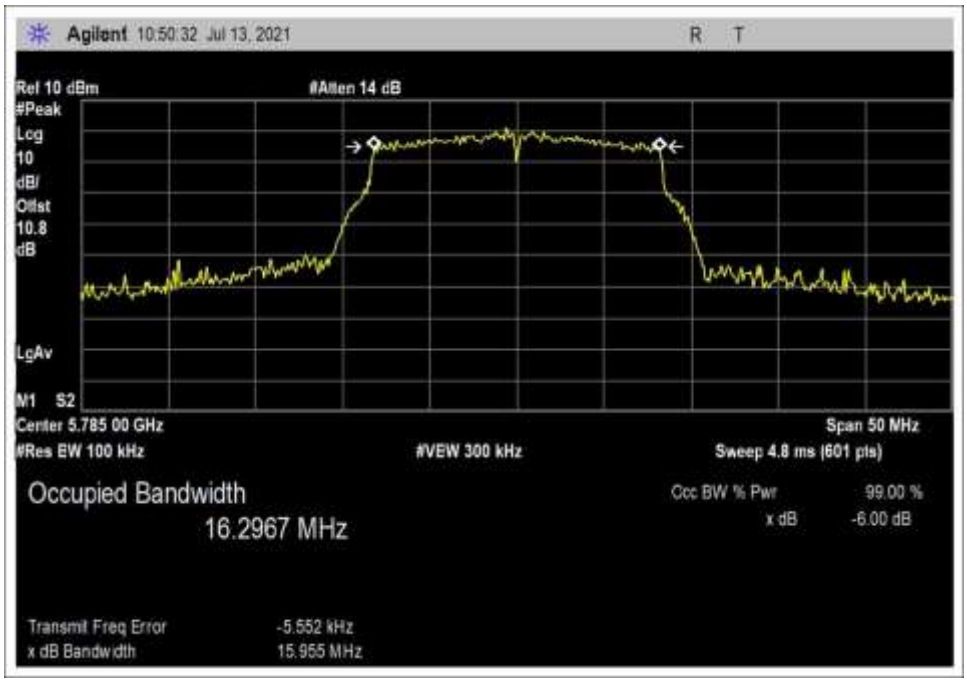

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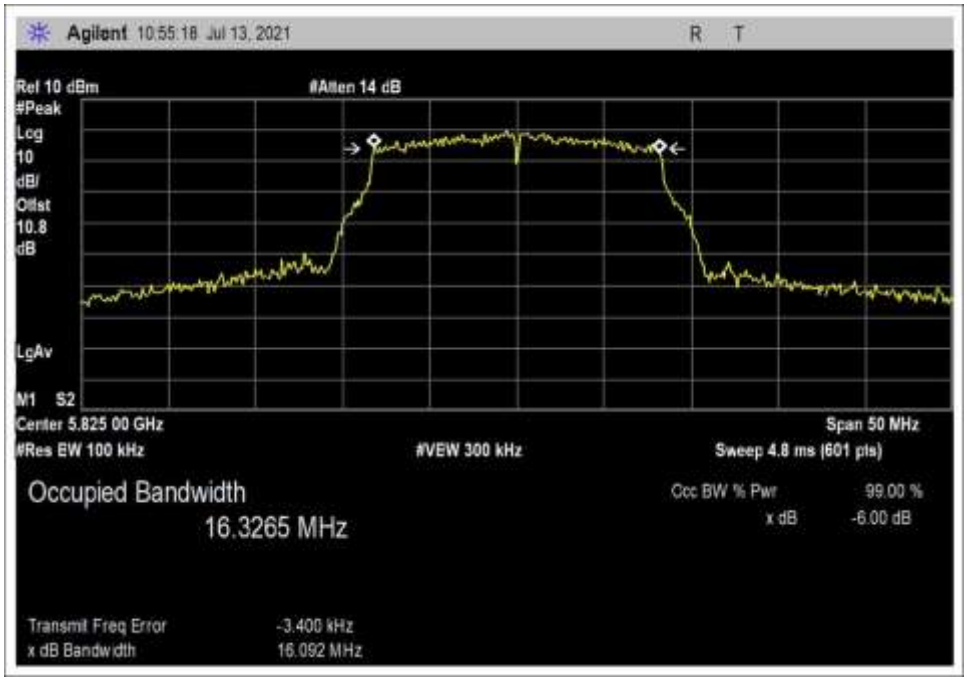
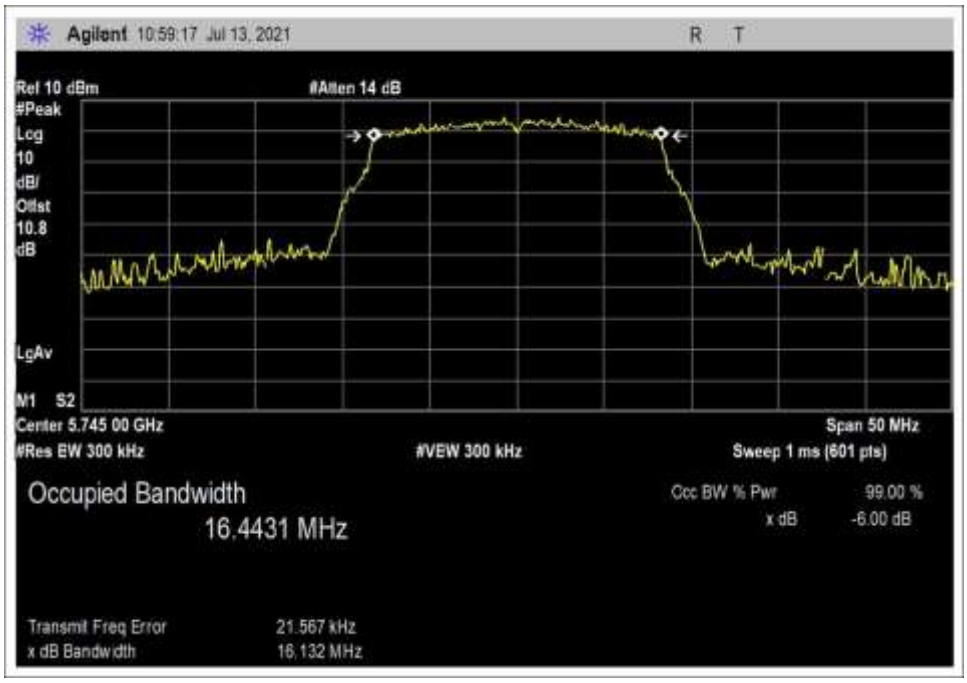


High Channel

99%BW Plot(s)

MCS7



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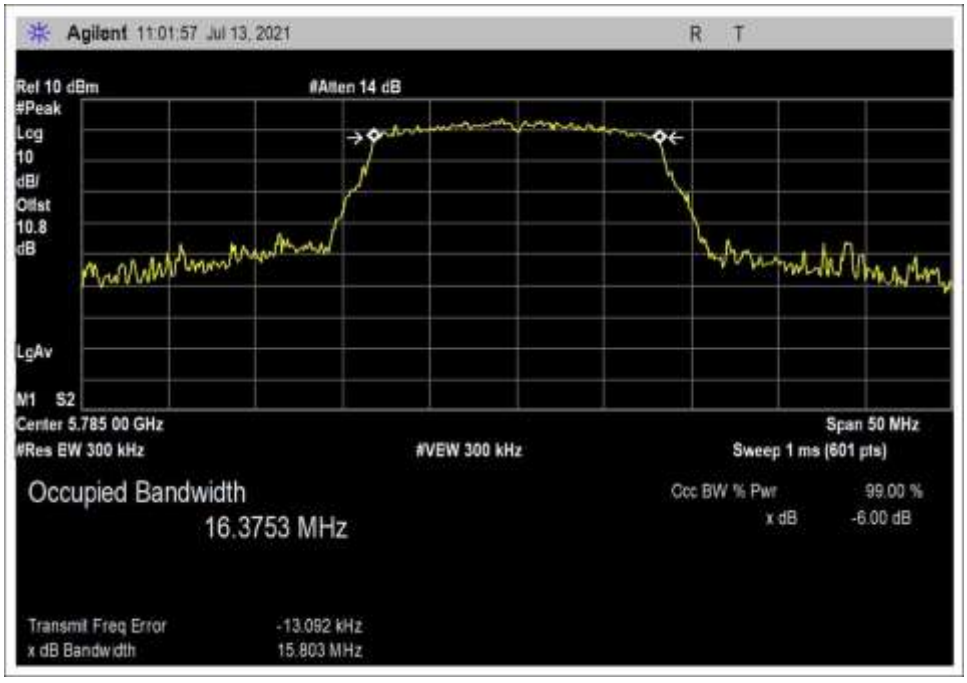
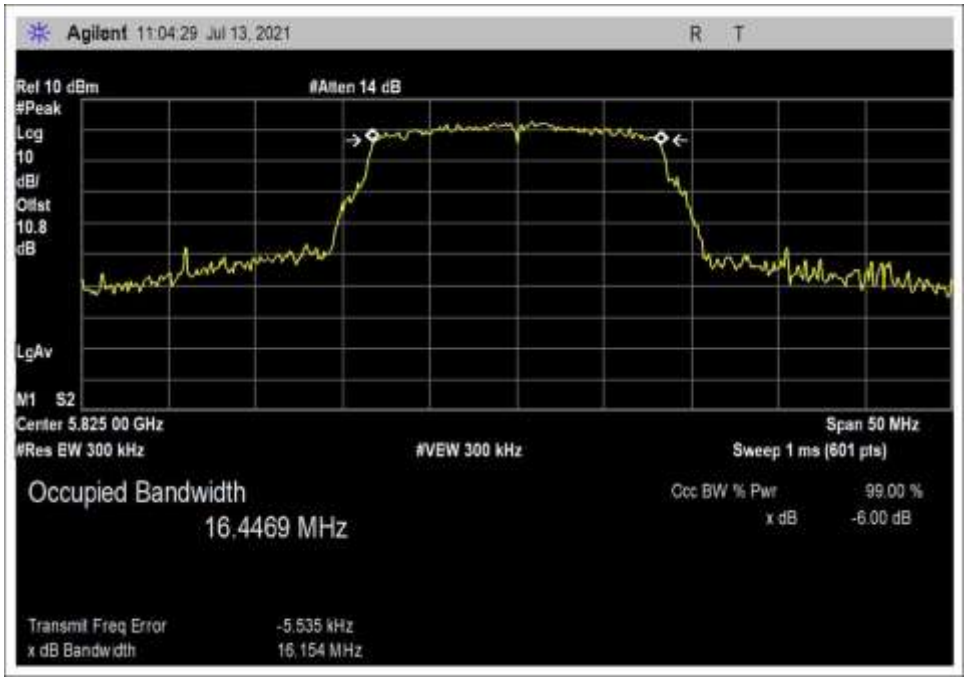
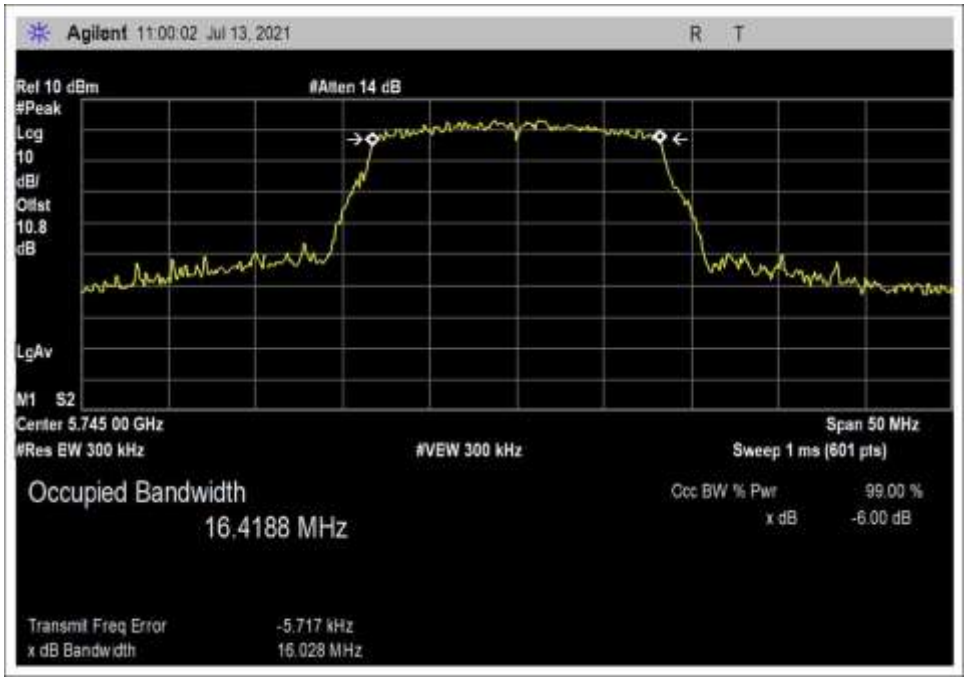


Middle Channel



High Channel

OFDM54M



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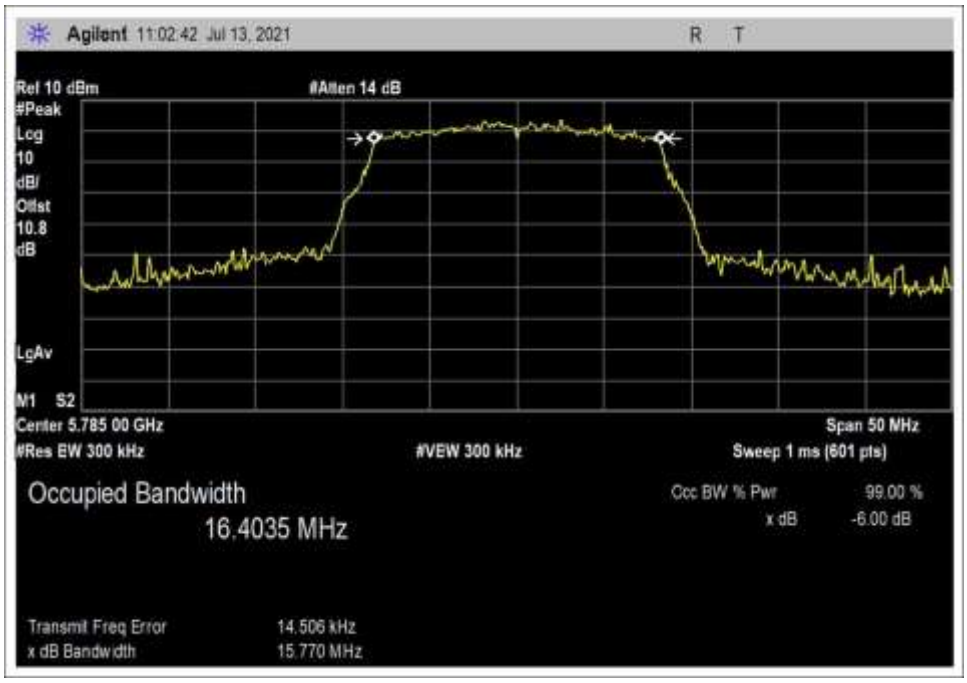

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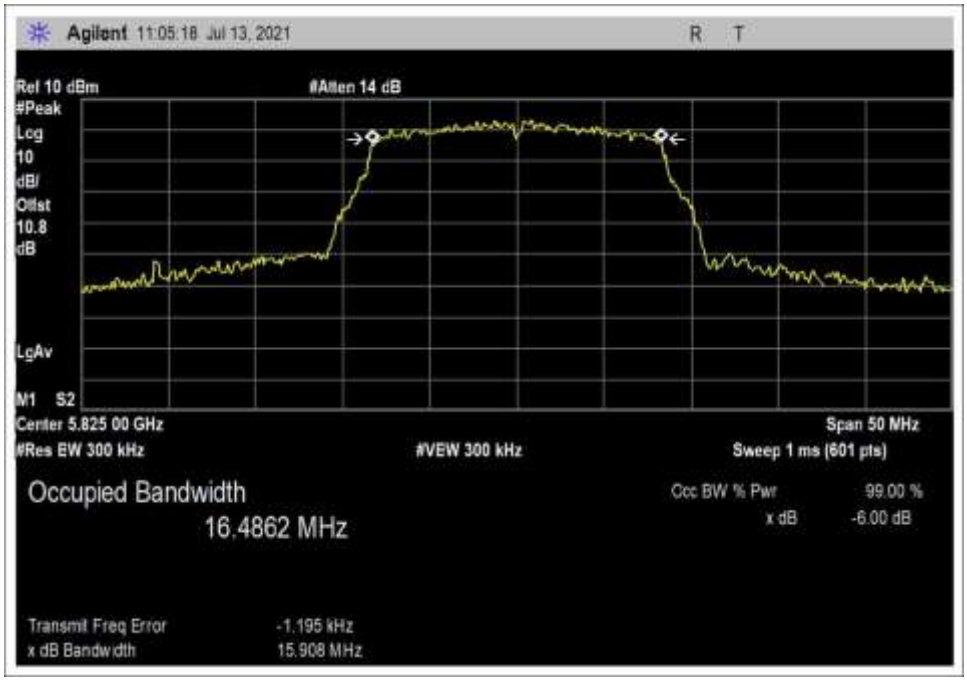
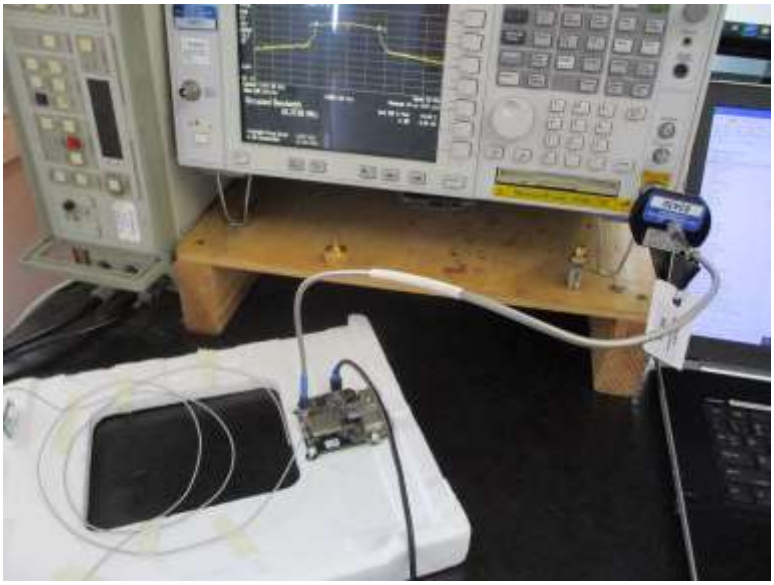


High Channel

Test Setup Photo(s)



15.407(a) Output Power

Test Setup/Conditions			
Test Location:	Brea Lab A & Bothell Bench	Test Engineer:	E. Wong & S. Pittsford
Test Method:	ANSI C63.10 (2013), KDB 789033 V02R01 December 14, 2017	Test Date(s):	7/13/2021 & 1/30/2023
Configuration:	1		
Test Setup:	The EUT 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. RF parameter evaluated at the antenna port J1. Power at antenna port J2 is verified. device does not transmit simultaneously from J1 and J2. Firmware power setting = 14 Conducted power was remeasured on 1/30/2023. All measurements are within measurement uncertainty and device tolerances.		

Environmental Conditions			
Temperature (ºC)	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**	**$V_{Minimum}$ (dBm)**	**$V_{Nominal}$ (dBm)**	**$V_{Maximum}$ (dBm)**	**Max Deviation from $V_{Nominal}$ (dB)**
5745	MCS7	11.0	**11.4**	11.7	-0.4
5785	MCS7	10.4	11.0	11.3	-0.6
5825	MCS7	10.6	11.1	11.3	-0.6
5745	OFDM54M	10.3	10.9	11.0	-0.6
5785	OFDM54M	10.4	10.8	11.0	-0.6
5825	OFDM54M	10.2	10.8	12.0	-0.6

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
$V_{Nominal}$:	3.3
$V_{Minimum}$:	3.0
$V_{Maximum}$:	3.6

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

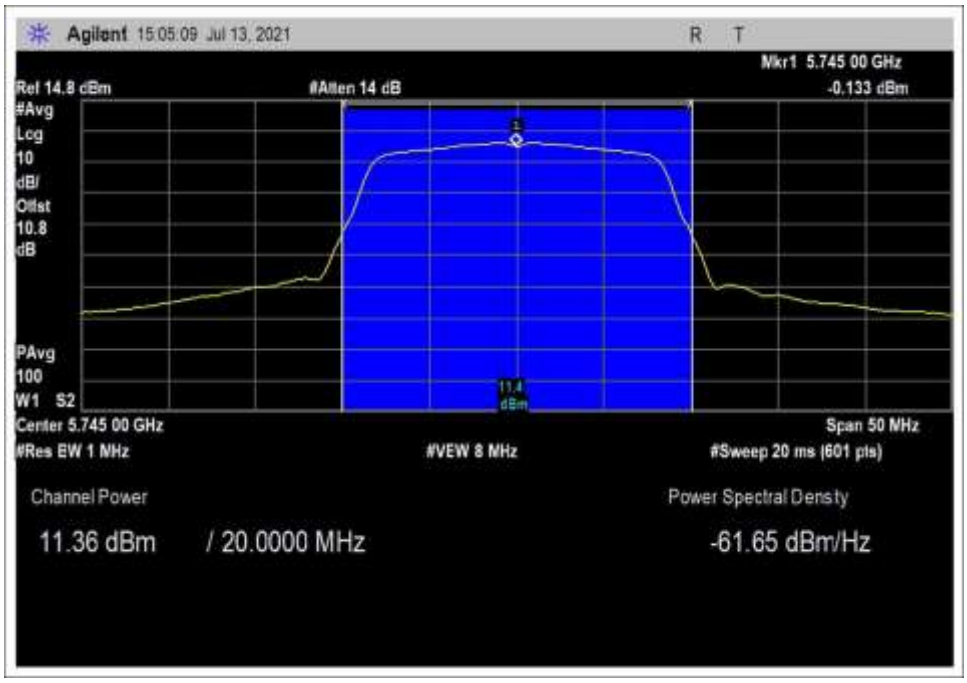
Test Data Summary - RF Conducted Measurement					
Measurement Option: AVGSA-1					
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Measured (dBm)**	**Limit (dBm)**	**Results**
5745	MCS7	Ext patch/ 2.7dBi	11.4	≤ 30	Pass
5785	MCS7	Ext patch/ 2.7dBi	11.0	≤ 30	Pass
5825	MCS7	Ext patch/ 2.7dBi	11.1	≤ 30	Pass
5745	OFDM54M	Ext patch/ 2.7dBi	10.9	≤ 30	Pass
5785	OFDM54M	Ext patch/ 2.7dBi	10.8	≤ 30	Pass
5825	OFDM54M	Ext patch/ 2.7dBi	10.8	≤ 30	Pass

For equipment using antennas other than in fixed point-to-point applications, the limit is calculated in accordance with 15.407(a)(3):

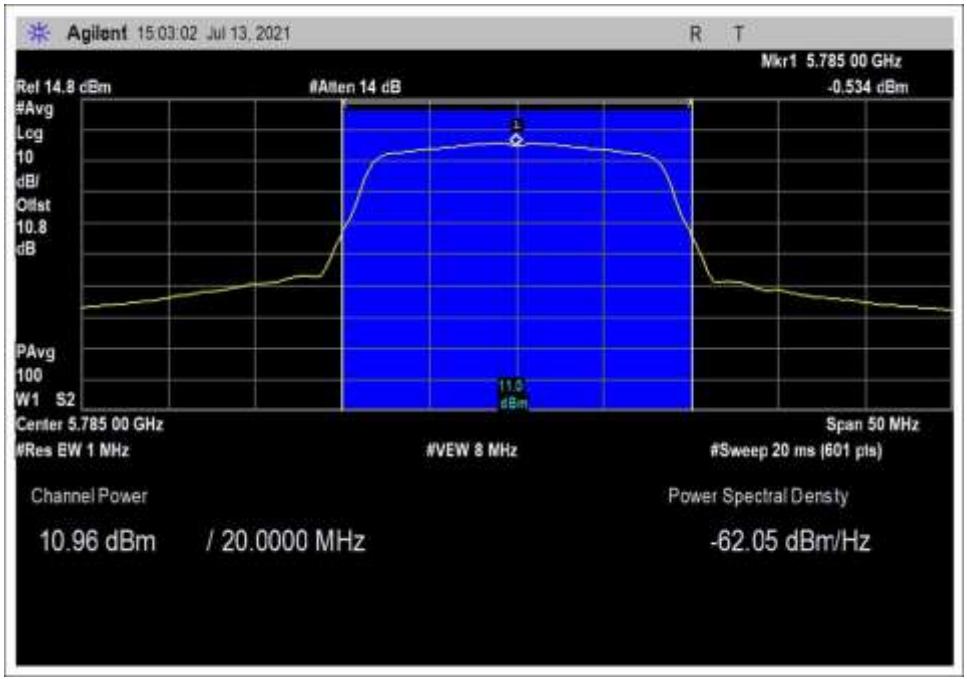
$$Limit = 30 - Roundup(G - 6)$$

Plot(s)

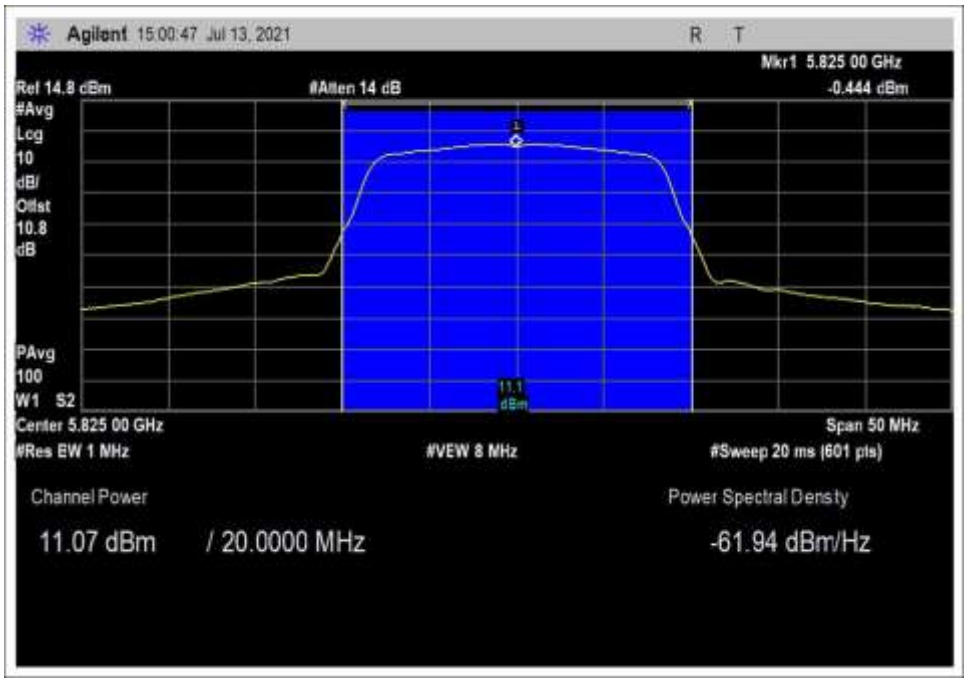
MCS7



Low Channel

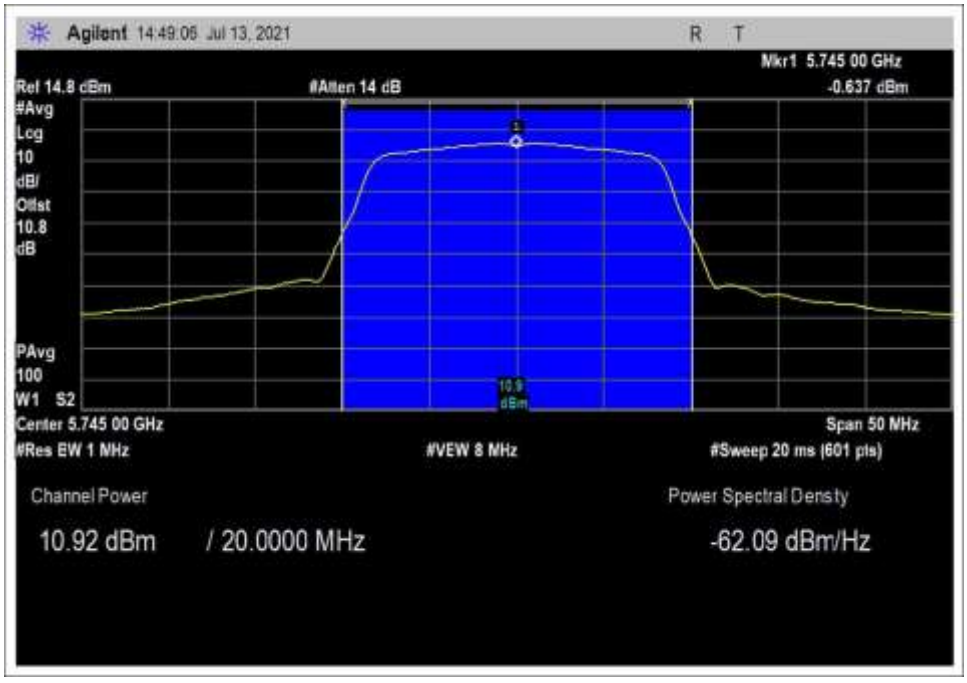


Middle Channel



High Channel

ODFM54M



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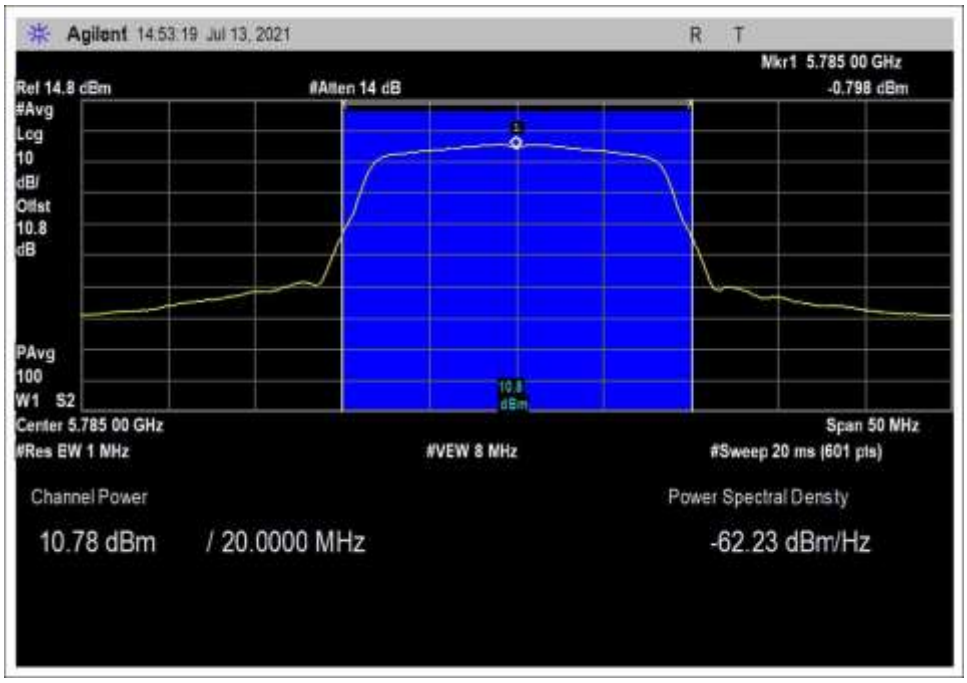

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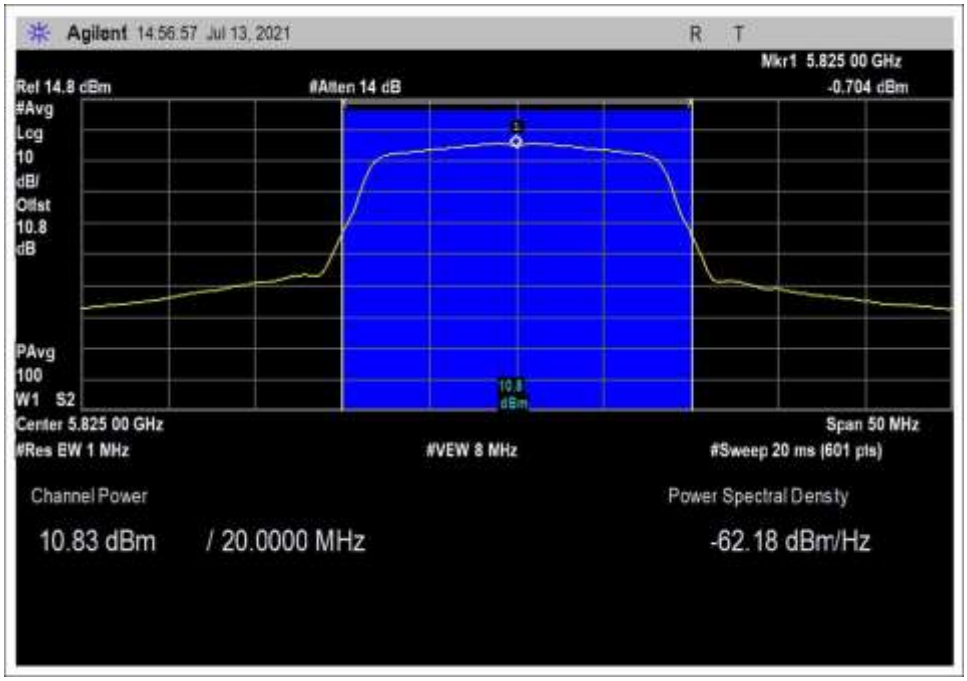
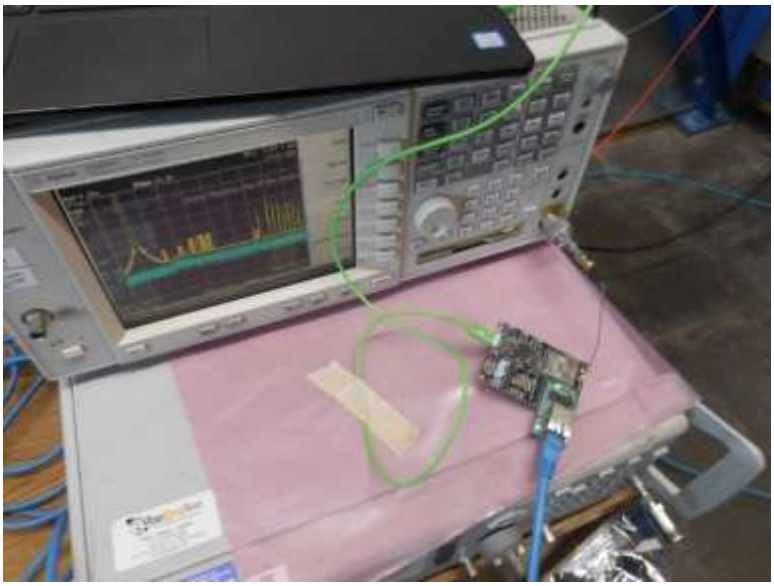
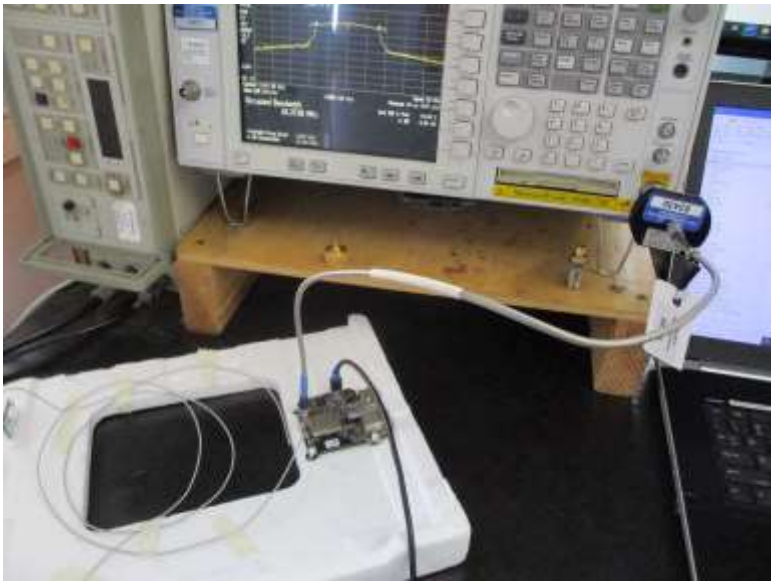


High Channel

Test Setup Photo(s)



Power Setup



Antenna Port

15.407(a) Power Spectral Density

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 789033 V02R01 DECEMBER 14, 2017	Test Date(s):	7/14/2021
Configuration:	1		
Test Setup:	The EUT 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. RF parameter evaluated at the antenna port J1. Power at antenna port J2 is verified. device does not transmit simultaneously from J1 and J2. Firmware power setting = 14		

Environmental Conditions			
Temperature (ºC)	26	Relative Humidity (%):	57

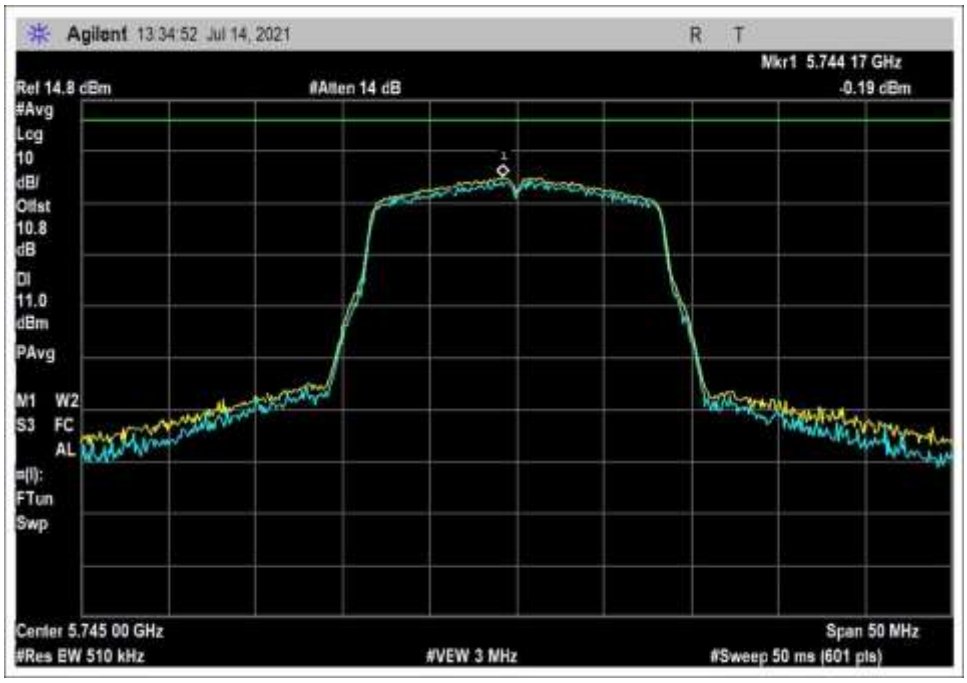
Test Data Summary - RF Conducted Measurement					
Measurement Option: AVGSA-1					
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Measured (dBm/500kHz)**	**Limit (dBm/500kHz)**	**Results**
5745	MCS7	Ext patch/ 2.7dBi	-0.2	≤ 30	Pass
5785	MCS7	Ext patch/ 2.7dBi	-0.9	≤ 30	Pass
5825	MCS7	Ext patch/ 2.7dBi	-1.2	≤ 30	Pass
5745	OFDM54M	Ext patch/ 2.7dBi	-0.6	≤ 30	Pass
5785	OFDM54M	Ext patch/ 2.7dBi	-1.1	≤ 30	Pass
5825	OFDM54M	Ext patch/ 2.7dBi	-1.7	≤ 30	Pass

The limit is calculated in accordance with 15.407(a)(3):

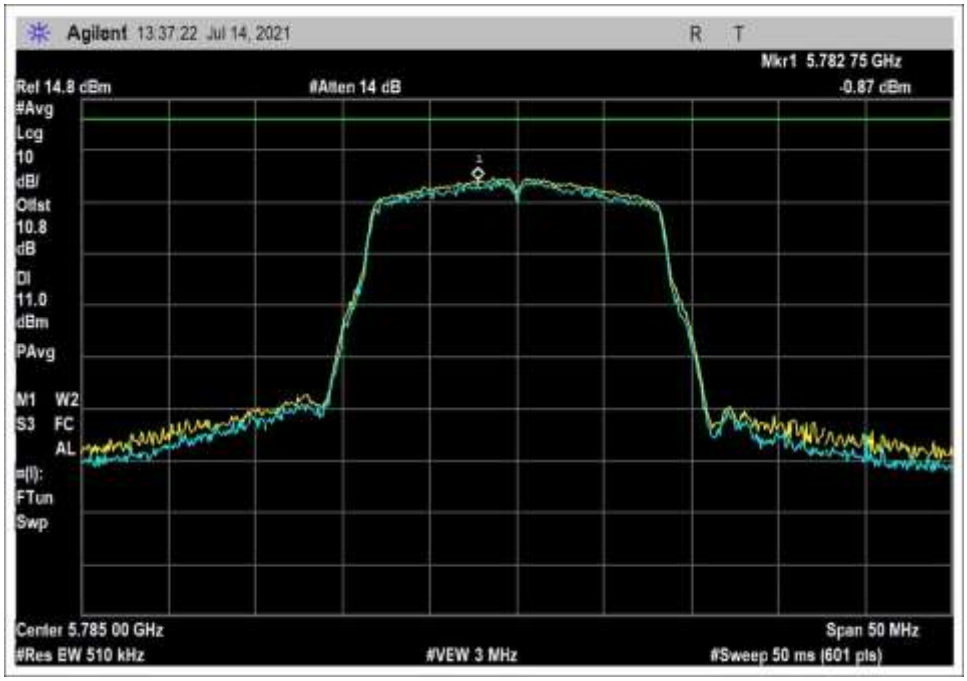
$Limit = 30 - Roundup(G - 6)$

Plot(s)

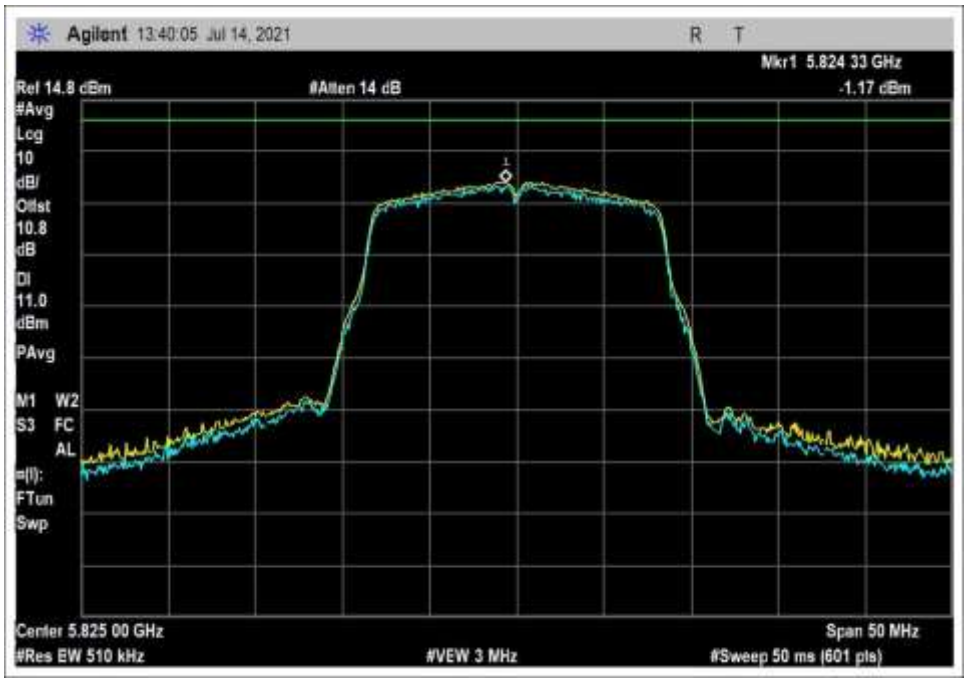
MCS7



Low Channel

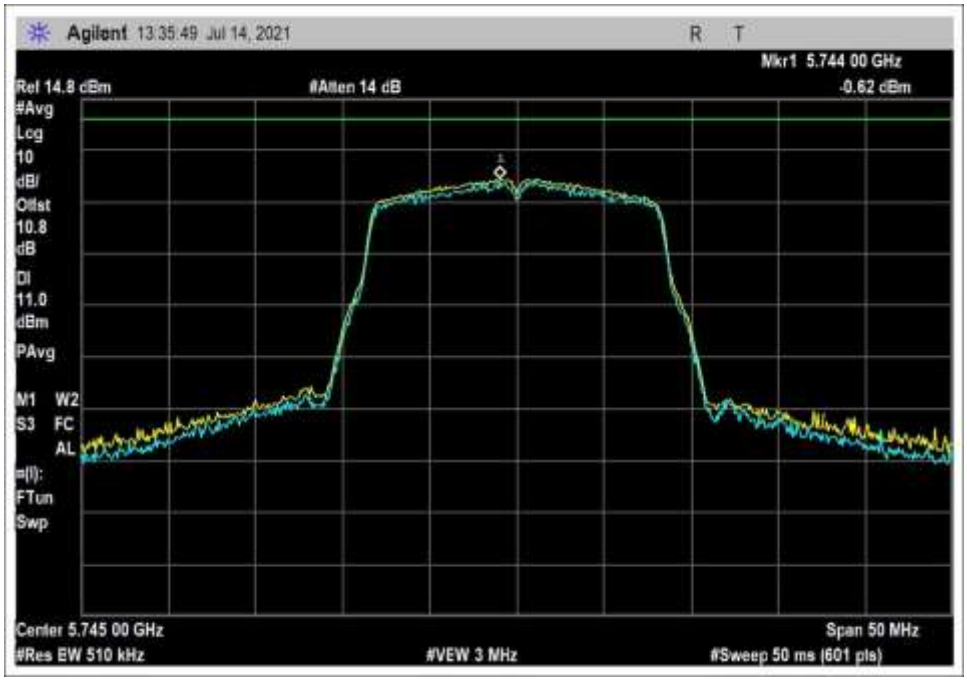


Middle Channel



High Channel

ODFM54M



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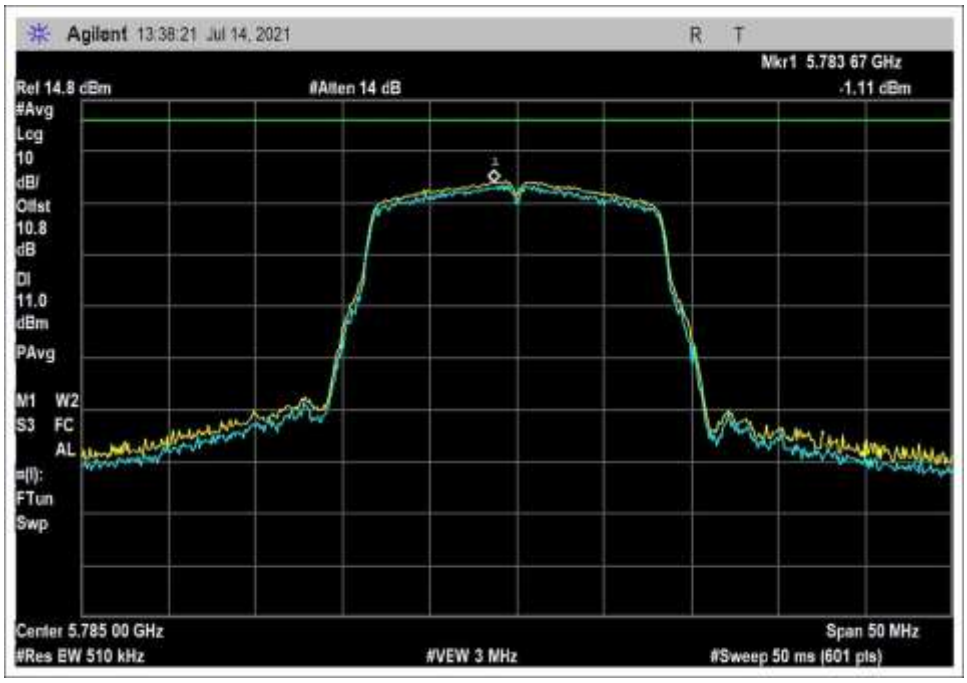

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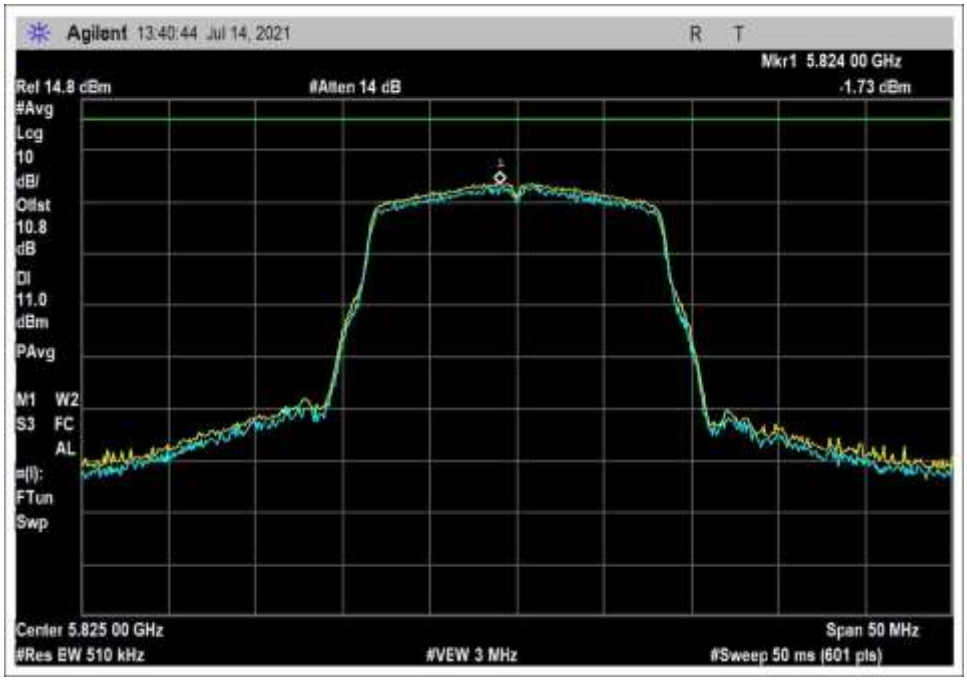
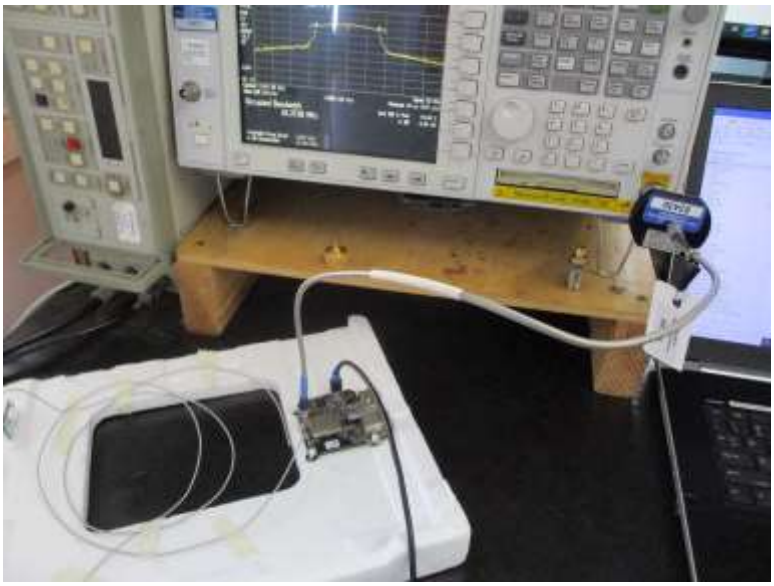


High Channel

Test Setup Photo(s



15.407(g) Frequency Stability

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 789033 V02R01 December 14, 2017	Test Date(s):	7/27/2021
Configuration:	2		
Test Setup:	EUT is set in temperature chamber. Evaluation performed at antenna port. Reference to Fl and FH of radiated Bandedge plot. Voltage variation was performed along with 15.31 (e) no drift were detected.		

Environmental Conditions			
Temperature (ºC)	25.4	Relative Humidity (%):	60

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
05947	Thermometer	Fluke	51	4/28/2020	4/28/2022
01878	Temperature chamber	Thermotron Corp.	S 1.2 Mini-Max	3/30/2021	3/30/2023

Test Data Summary					
Temperature (ºC)	**Voltage**	**Low Frequency (MHz)**	**High Frequency (MHz)**	**Limit (MHz)**	**Results**
-40	$V_{Nominal}$	5729.84	5842.08	All emissions remain within 5725-5850	Pass
-20	$V_{Nominal}$	5729.84	5842.08		
-10	$V_{Nominal}$	5729.84	5842.08		
0	$V_{Nominal}$	5729.84	5841.92		
10	$V_{Nominal}$	5729.84	5842.00		
20	$V_{Minimum}$	5730.00	5842.00		
20	$V_{Nominal}$	5730.00	5842.00		
20	$V_{Maximum}$	5730.00	5842.00		
30	$V_{Nominal}$	5730.00	5842.08		
40	$V_{Nominal}$	5730.00	5842.08		
50	$V_{Nominal}$	5729.84	5842.08		
80	$V_{Nominal}$	5729.92	5842.00		
Nominal Frequency:		5730.00	5842.00		

Note Listed Nominal frequency is where the limit intersects the signal.

Parameter Definitions:

Measurements performed at input voltage according to manufacturer specification.

Parameter	Value
$V_{Nominal}$:	3.3Vdc
$V_{Minimum}$:	3.0Vdc
$V_{Maximum}$:	3.6Vdc

Test Setup Photo(s)

15.407(b) Radiated Emissions & Band Edge

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA • 714 993 6112		
Customer:	**Avnet Inc.**		
Specification:	**15.407(b) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105053**	Date:	7/21/2021
Test Type:	**Radiated Scan**	Time:	10:52:24
Tested By:	E. Wong	Sequence#:	7
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 a 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.

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

Frequency range: 5725-5850MHz

UNII3 TX frequency: 5745MHz ch149, 5785MHz ch157, 5825MHz ch165

Protocol: OFDM54M, MCS7
Firmware power setting: 14dBm.
Worse case Protocol: MCS7

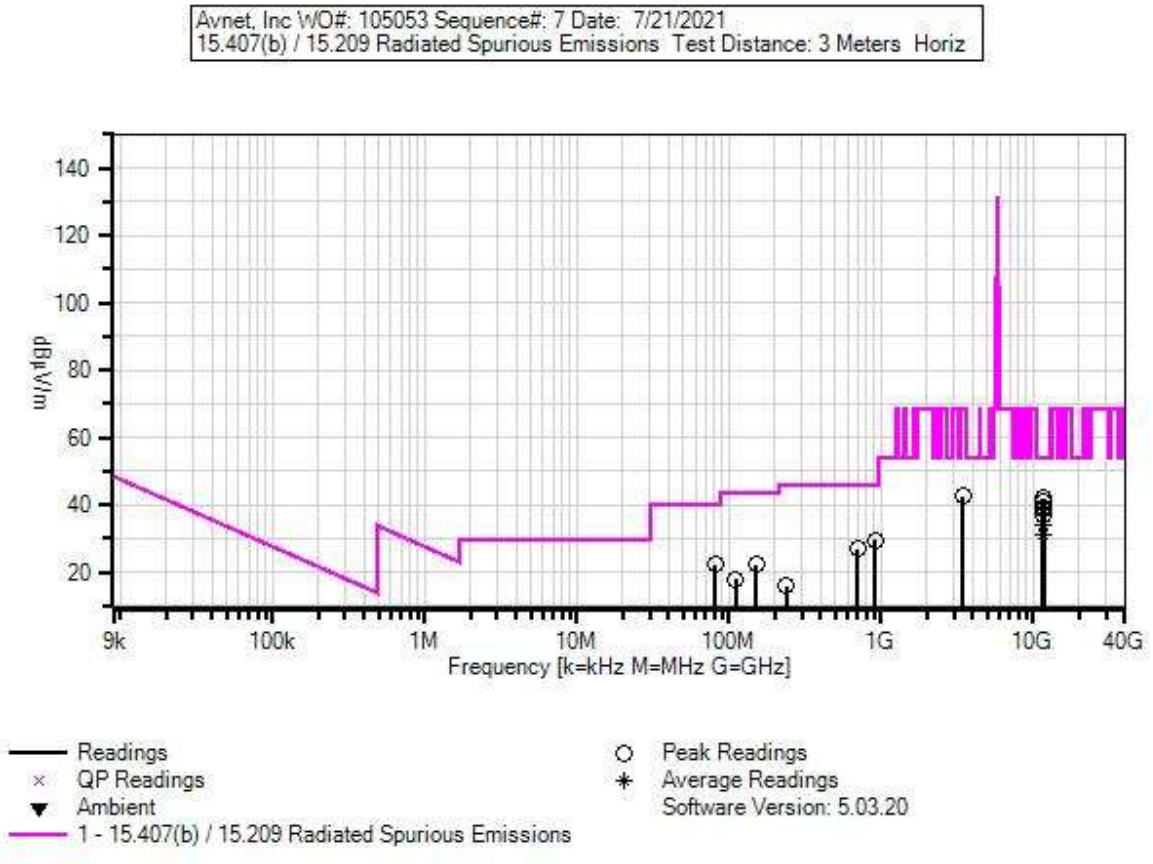
Frequency range of measurement = 9 kHz- 40 GHz.
9 kHz -150 kHz;RBW=200 Hz,VBW=600 Hz;150 kHz-30 MHz;RBW=9 kHz,VBW=27 kHz;30 MHz-1000 MHz;RBW=120 kHz,VBW=360 kHz,1000 MHz-40 000 MHz;RBW=1MHz,VBW=3 MHz.

Test environment conditions:
Temperature: 25.3°C
Relative Humidity: 58%
Pressure: 98.9kPa

Site A
ANSI C63.10-2013
789033 D02 General U-NII Test Procedures New Rules v02r01 December 14,2017

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

Note -27dBm/MHz eirp = 68.2dVuV/m@3m



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T1	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T2	ANP07246	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
T3	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T4	AN02755	High Pass Filter	11SH10-6000/T18000-O/O	4/9/2020	4/9/2022
T5	ANP06360	Cable	L1-PNMNM-48	8/8/2019	8/8/2021
	AN03367	Horn Antenna	62-GH-62-25.	8/1/2019	8/1/2021
	AN01413	Horn Antenna	84125-80008	10/19/2020	10/19/2022
	ANP07658	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022
T6	AN00851	Biconilog Antenna	CBL6111C	4/14/2020	4/14/2022
T7	ANP05505	Attenuator	NAT-6	5/26/2021	5/26/2023
T8	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/21/2020	12/21/2022
T9	AN00309	Preamp	8447D	12/24/2019	12/24/2021
T10	ANP05050	Cable	RG223/U	12/24/2020	12/24/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
	AN03158A	Horn Antenna	GH-28-25	8/15/2019	8/15/2021

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

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	11650.000M	37.5	+39.2 +8.1 +0.0	+1.1 +0.0 +0.0	-36.6 +0.0	+0.6 +0.0	+0.0	49.9	54.0 Band3_H_Z	-4.1	Vert
2	11492.200M	36.6	+39.2 +8.0 +0.0	+1.0 +0.0 +0.0	-36.6 +0.0	+0.5 +0.0	+0.0	48.7	54.0 Band3_L_Y	-5.3	Horiz
3	11569.500M	35.2	+39.2 +8.0 +0.0	+1.0 +0.0 +0.0	-36.6 +0.0	+0.5 +0.0	+0.0	47.3	54.0 Band3_M_Y	-6.7	Vert
4	11650.000M	34.8	+39.2 +8.1 +0.0	+1.1 +0.0 +0.0	-36.6 +0.0	+0.6 +0.0	+0.0	47.2	54.0 Band3_H_X	-6.8	Vert
5	11490.000M	34.6	+39.2 +8.0 +0.0	+1.0 +0.0 +0.0	-36.6 +0.0	+0.5 +0.0	+0.0	46.7	54.0 Band3_L_Y	-7.3	Vert
6	3453.333M	48.9	+31.2 +3.9 +0.0	+0.6 +0.0 +0.0	-38.2 +0.0	+0.0 +0.0	+0.0	46.4	54.0 non intentional	-7.6	Horiz
7	11650.000M	32.7	+39.2 +8.1 +0.0	+1.1 +0.0 +0.0	-36.6 +0.0	+0.6 +0.0	+0.0	45.1	54.0 Band3_H_Y	-8.9	Vert
8	11650.000M Ave	29.5	+39.2 +8.1 +0.0	+1.1 +0.0 +0.0	-36.6 +0.0	+0.6 +0.0	+0.0	41.9	54.0 Band3_H_Y	-12.1	Horiz
^	11650.000M	41.9	+39.2 +8.1 +0.0	+1.1 +0.0 +0.0	-36.6 +0.0	+0.6 +0.0	+0.0	54.3	54.0 Band3_H_Y_worst case peak	+0.3	Horiz
^	11650.000M	38.1	+39.2 +8.1 +0.0	+1.1 +0.0 +0.0	-36.6 +0.0	+0.6 +0.0	+0.0	50.5	54.0 Band3_H_Y_OFD M54M	-3.5	Horiz
^	11650.000M	36.6	+39.2 +8.1 +0.0	+1.1 +0.0 +0.0	-36.6 +0.0	+0.6 +0.0	+0.0	49.0	54.0 Band3_H_X	-5.0	Horiz
^	11650.000M	34.8	+39.2 +8.1 +0.0	+1.1 +0.0 +0.0	-36.6 +0.0	+0.6 +0.0	+0.0	47.2	54.0 Band3_H_Z	-6.8	Horiz
13	11570.000M Ave	26.7	+39.2 +8.0 +0.0	+1.0 +0.0 +0.0	-36.6 +0.0	+0.5 +0.0	+0.0	38.8	54.0 Band3_M_Y	-15.2	Horiz
^	11570.000M	38.5	+39.2 +8.0 +0.0	+1.0 +0.0 +0.0	-36.6 +0.0	+0.5 +0.0	+0.0	50.6	54.0 Band3_M_Y	-3.4	Horiz
15	913.500M	20.6	+0.0 +0.0 -27.1	+0.0 +23.3 +0.5	+0.0 +6.3	+0.0 +5.8	+0.0	29.4	46.0	-16.6	Horiz

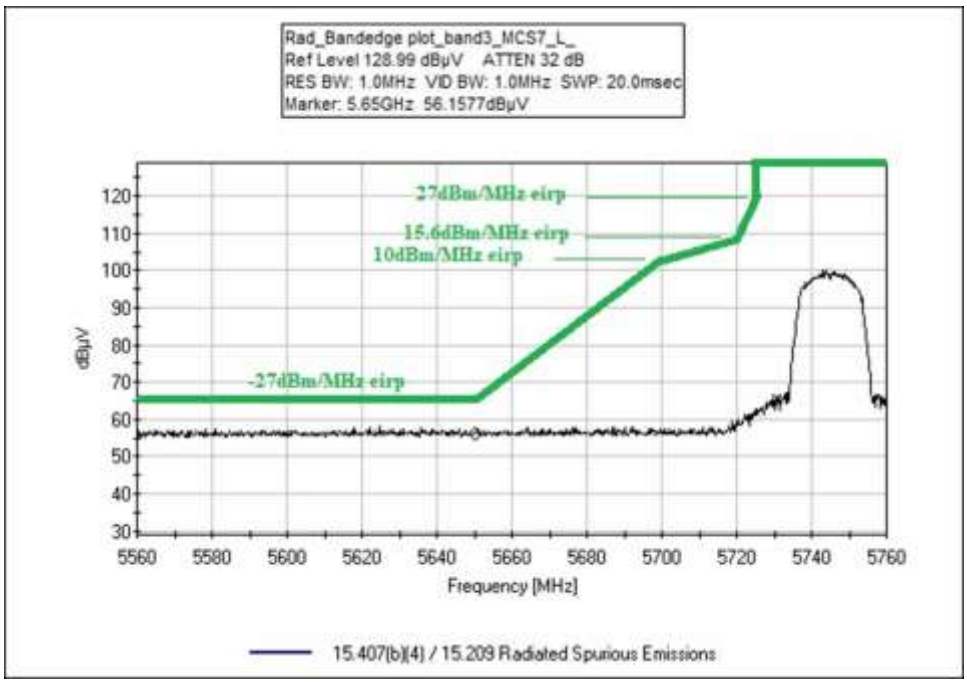
16	81.300M	34.9	+0.0 +0.0 -28.1	+0.0 +7.7 +0.1	+0.0 +6.1	+0.0 +1.5	+0.0	22.2	40.0	-17.8	Vert
17	696.750M	21.7	+0.0 +0.0 -27.2	+0.0 +20.8 +0.3	+0.0 +6.2	+0.0 +4.9	+0.0	26.7	46.0	-19.3	Horiz
18	150.000M	30.5	+0.0 +0.0 -28.0	+0.0 +11.2 +0.2	+0.0 +6.1	+0.0 +2.1	+0.0	22.1	43.5	-21.4	Horiz
19	110.600M	27.2	+0.0 +0.0 -28.0	+0.0 +10.7 +0.1	+0.0 +6.1	+0.0 +1.8	+0.0	17.9	43.5	-25.6	Vert
20	238.300M	23.0	+0.0 +0.0 -27.9	+0.0 +11.8 +0.2	+0.0 +6.1	+0.0 +2.7	+0.0	15.9	46.0	-30.1	Vert

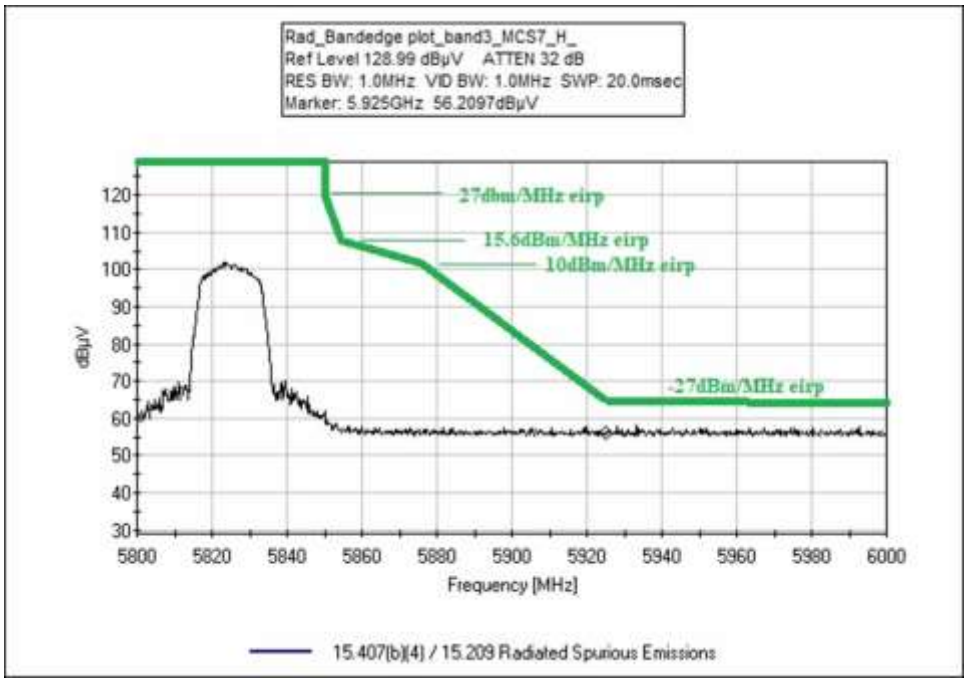
Band Edge

Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
5650	MCS7	Ext patch/ 2.7dBi	59.0 Pk	< 68.2 Pk	Pass
5725	MCS7	Ext patch/ 2.7dBi	65.8 Pk	< 122.2 Pk	Pass
5850	MCS7	Ext patch/ 2.7dBi	63.6 Pk	< 122.2 Pk	Pass
5925	MCS7	Ext patch/ 2.7dBi	59.8 Pk	< 68.2 Pk	Pass

Note -27dBm/MHz eirp = 68.2dVuV/m@3m

Band Edge Plots

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RES BW: 1.0MHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 5.925GHz 56.2097dBµV
27dbm/MHz eirp
15.6dBm/MHz eirp
10dBm/MHz eirp
-27dBm/MHz eirp
dBµV
120
110
100
90
80
70
60
50
40
30
5800
5820
5840
5860
5880
5900
5920
5940
5960
5980
6000
Frequency [MHz]
15.407(b)(4) / 15.209 Radiated Spurious Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA • 714 993 6112		
Customer:	**Avnet Inc.**		
Specification:	**15.407(b)(4) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105053**	Date:	10/8/2021
Test Type:	**Radiated Scan**	Time:	20:12:11
Tested By:	E. Wong	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:

Placed on a 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.

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

Frequency range: 5725-5850MHz

UNII3 TX frequency: 5745MHz ch149, 5785MHz ch157, 5825MHz ch165

Protocol: OFDM54M, MCS7
Firmware power setting: 14dBm.
Worse case Protocol tested MCS7

Test environment conditions:
Temperature:25.3°C
Relative Humidity: 58%
Pressure: 98.9kPa

Site A
ANSI C63.10-2013
789033 D02 General U-NII Test Procedures New Rules v02r01 December 14,2017

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

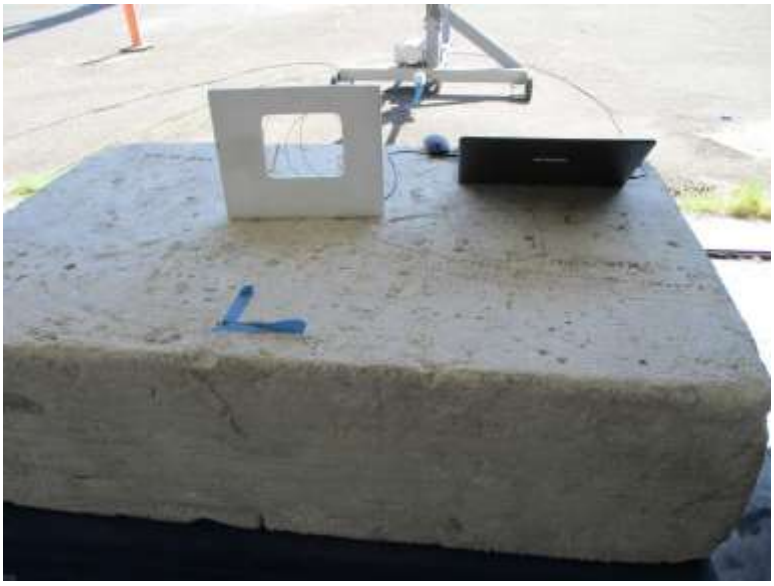
Test Equipment:

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	9/30/2021	9/30/2023

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	5925.000M	56.2	+0.0 +5.8	+34.3	+0.8	-37.3	+0.0	59.8	68.2 Band3_bandedge_H_Y	-8.4	Horiz
2	5650.000M	56.2	+0.0 +5.4	+34.0	+0.7	-37.3	+0.0	59.0	68.2 Band3_bandedge_L_Y	-9.2	Horiz
3	5725.000M	63.1	+0.0 +5.4	+34.0	+0.7	-37.4	+0.0	65.8	122.2 Band3_bandedge_L_Y	-56.4	Horiz
4	5850.000M	60.5	+0.0 +5.6	+34.2	+0.7	-37.4	+0.0	63.6	122.2 Band3_bandedge_H_Y	-58.6	Horiz

Test Setup Photo(s)



Below 1GHz

Below 1GHz

Above 1GHz

Above 1GHz

X Axis

Y Axis

5GHz Y Axis

5GHz Y Axis

Z Axis

15.207 AC Conducted Emissions

Test 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:	18:11:50
Tested By:	E. Wong	Sequence#:	15
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: 5725-5850MHz

UNII 3 5785MHz ch157

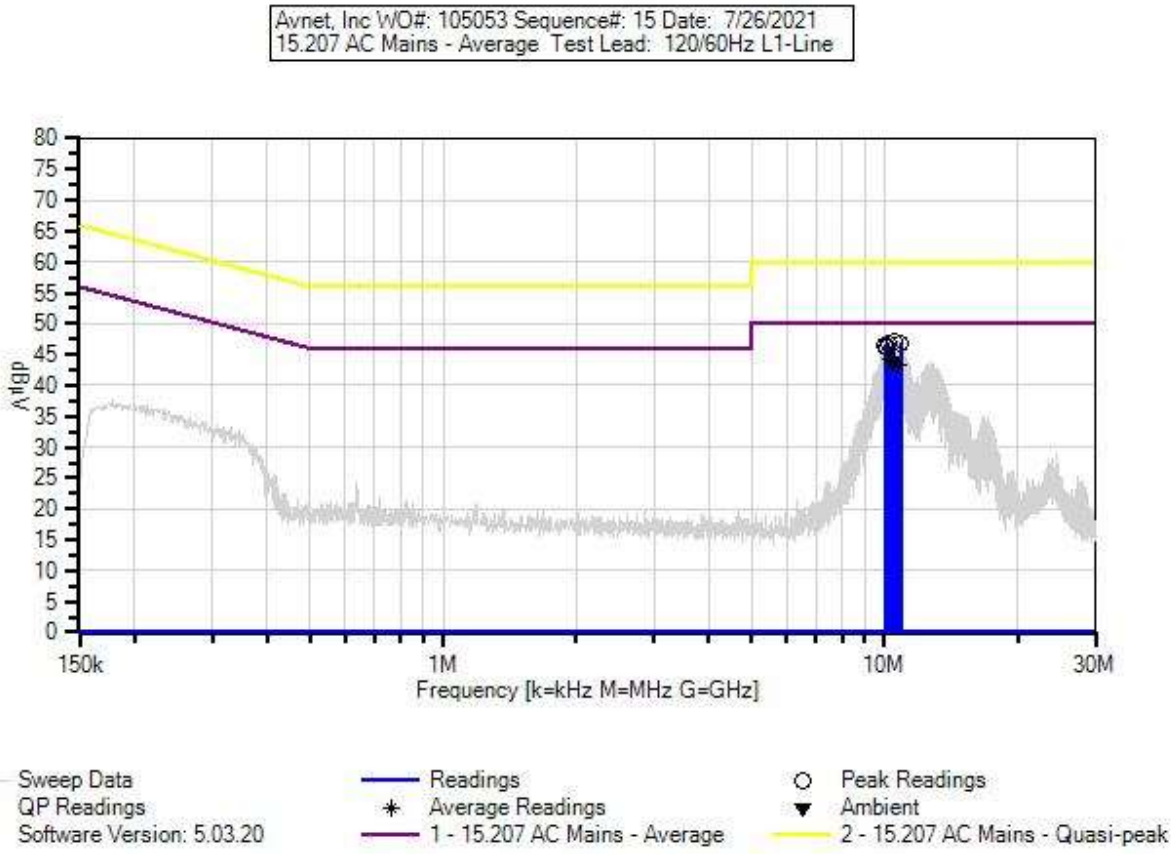
Protocol: OFDM54M, MCS7
Firmware power setting: 14dBm.
Worse case Protocol tested MCS7

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



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

Measurement Data: Reading listed by margin. Test Lead: L1-Line

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	10.481M	40.5	+0.2	+0.3	+5.7	+0.3	+0.0	47.0	50.0	-3.0	L1-Li
2	10.860M	40.5	+0.2	+0.3	+5.7	+0.2	+0.0	46.9	50.0	-3.1	L1-Li
3	10.193M	40.3	+0.2	+0.3	+5.7	+0.3	+0.0	46.8	50.0	-3.2	L1-Li
4	10.004M	40.0	+0.2	+0.3	+5.7	+0.3	+0.0	46.5	50.0	-3.5	L1-Li
5	10.139M	39.8	+0.2	+0.3	+5.7	+0.3	+0.0	46.3	50.0	-3.7	L1-Li
6	10.287M Ave	37.7	+0.2	+0.3	+5.7	+0.3	+0.0	44.2	50.0	-5.8	L1-Li
^	10.283M	40.7	+0.2	+0.3	+5.7	+0.3	+0.0	47.2	50.0	-2.8	L1-Li
8	10.382M Ave	37.6	+0.2	+0.3	+5.7	+0.3	+0.0	44.1	50.0	-5.9	L1-Li
^	10.382M	40.5	+0.2	+0.3	+5.7	+0.3	+0.0	47.0	50.0	-3.0	L1-Li
10	10.571M Ave	37.5	+0.2	+0.3	+5.7	+0.2	+0.0	43.9	50.0	-6.1	L1-Li
^	10.571M	40.7	+0.2	+0.3	+5.7	+0.2	+0.0	47.1	50.0	-2.9	L1-Li
12	10.762M Ave	36.8	+0.2	+0.3	+5.7	+0.2	+0.0	43.2	50.0	-6.8	L1-Li
^	10.761M	40.8	+0.2	+0.3	+5.7	+0.2	+0.0	47.2	50.0	-2.8	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:	18:07:05
Tested By:	E. Wong	Sequence#:	14
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: 5725-5850MHz

UNII 3 5785MHz ch157

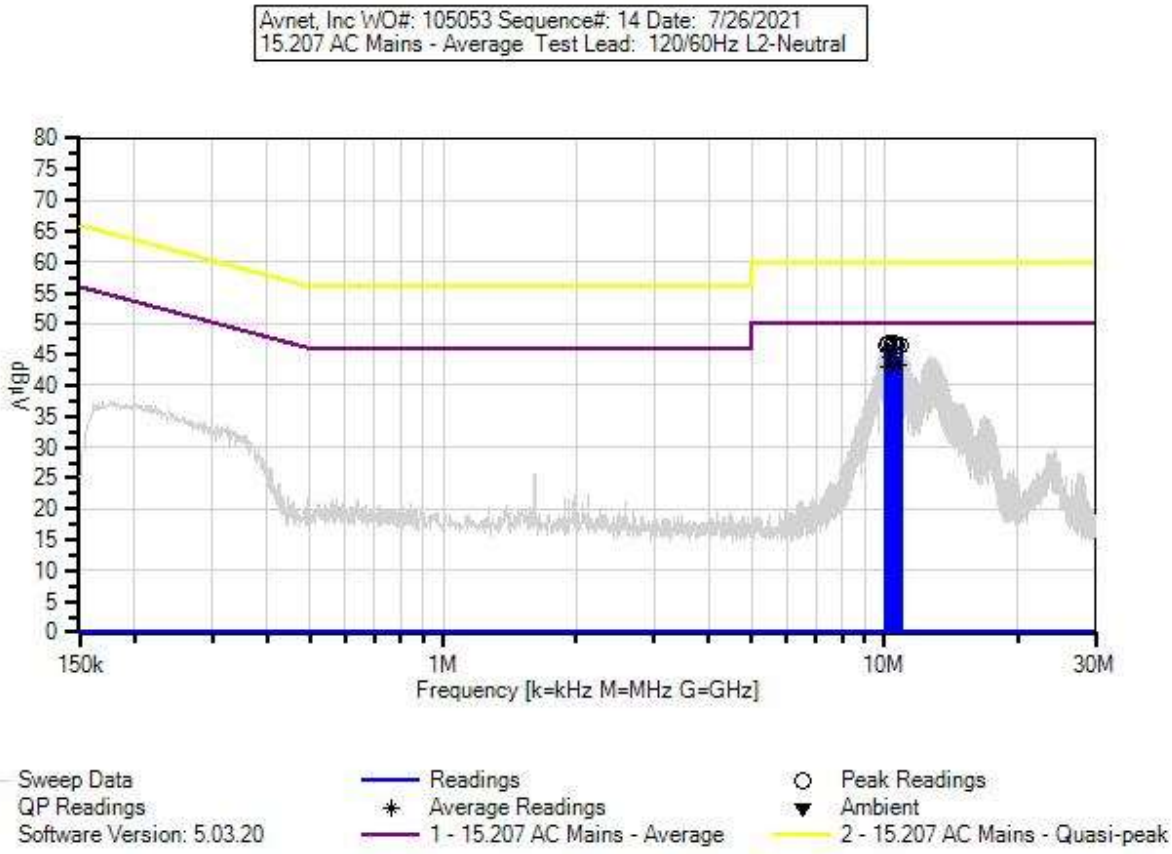
Protocol: OFDM54M, MCS7
Firmware power setting: 14dBm.
Worse case Protocol tested MCS7

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



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

Measurement Data: Reading listed by margin. Test Lead: L2-Neutral

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	10.526M	40.4	+0.2	+0.3	+5.7	+0.2	+0.0	46.8	50.0	-3.2	L2-Ne
2	10.238M	40.2	+0.2	+0.3	+5.7	+0.3	+0.0	46.7	50.0	-3.3	L2-Ne
3	10.427M	40.2	+0.2	+0.3	+5.7	+0.3	+0.0	46.7	50.0	-3.3	L2-Ne
4	10.616M	40.1	+0.2	+0.3	+5.7	+0.2	+0.0	46.5	50.0	-3.5	L2-Ne
5	10.860M	40.1	+0.2	+0.3	+5.7	+0.2	+0.0	46.5	50.0	-3.5	L2-Ne
6	10.094M	39.9	+0.2	+0.3	+5.7	+0.3	+0.0	46.4	50.0	-3.6	L2-Ne
7 Ave	10.334M	38.1	+0.2	+0.3	+5.7	+0.3	+0.0	44.6	50.0	-5.4	L2-Ne
^	10.337M	40.3	+0.2	+0.3	+5.7	+0.3	+0.0	46.8	50.0	-3.2	L2-Ne
9 Ave	10.762M	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
11 Ave	10.193M	36.7	+0.2	+0.3	+5.7	+0.3	+0.0	43.2	50.0	-6.8	L2-Ne
^	10.193M	40.3	+0.2	+0.3	+5.7	+0.3	+0.0	46.8	50.0	-3.2	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 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.