Tonal

TEST REPORT FOR

Trainer
Model: T1522

Tested to The Following Standards:

FCC Part 15 Subpart E Section(s)

15.207 & 15.407
(NII 5.725 – 5.850GHz)
Wi-Fi 5.8GHz for Hydra Board for Main System

Report No.: 105488-30

Date of issue: February 15, 2022

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

TABLE OF CONTENTS

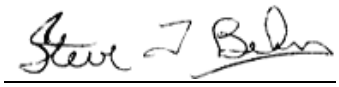
ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:	REPORT PREPARED BY:
Tonal 617 Bryant Street San Francisco, CA 94107	Darcy Thompson CKC Laboratories, Inc. 5046 Sierra Pines Drive Mariposa, CA 95338
Representative: Lars Gilstrom Customer Reference Number: PO1203	Project Number: 105488
DATE OF EQUIPMENT RECEIPT:	December 8, 2021
DATE(S) OF TESTING:	December 8 - 23, 2021

Report Authorization

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



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

Test Facility Information

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

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

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.20

Site Registration & Accreditation Information

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

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

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart 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	Mods. #1, #2, #3 #4, #5, #6	Pass
15.207	AC Conducted Emissions	NA	Pass

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
Radiated Emissions only; Configurations: 1 & 3 Mod. #1 = Copper tape between microphone PCBA gold-plated pads and chassis. Mod. #2 = Screws on hydra backplane mounting bracket. Mod. #3 = Copper tape on hydra backplane to display backplane. Mod. #4 = Ferrite (1 each) 742-712-21 on upper lead to shunt. Mod. #5 = Door bonding replaced with three (3) lug-to-lug wire strap. Mod. #6 = Set display mode into spread spectrum.

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
The Test Setup Photos are incorporated by reference 105488-30_Test Setup_Photos

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 Under Test* (* = EUT):**

Device Name	Manufacturer	Model #	S/N
Trainer	Tonal System	T1522	02016558
Hydra Board	Tonal System	500-0801 Rev 008	080100702000476
Internal Power Supply	Artesyn Embedded Tech.	LCM1500W-T	K510UN001BBVC-8-416 Revision: BV Firmware 6/2/2021
Direct Bond 2312 Touch screen display	BOE	380-0015 Rev. 1-1 CJ238FSB-TG21	00000015

Support Equipment:

Device Name	Manufacturer	Model #	S/N
None			

Configuration 3

***Equipment Under Test* (* = EUT):**

Device Name	Manufacturer	Model #	S/N
Trainer	Tonal System	T1522	02016558
Hydra Board	Tonal System	500-0801 Rev 008	080100702000476
Internal Power Supply	Artesyn Embedded Tech.	LCM1500W-T	K510UN001BBVC-8-416 Revision: BV Firmware 6/2/2021
Direct Bond 2312 Touch screen display	BOE	380-0015 Rev. 1-1 CJ238FSB-TG21	00000015

Support Equipment:

Device Name	Manufacturer	Model #	S/N
Laptop	Lenovo	X1 Carbon Gen 9	PF-37KBYM
Laptop Power Supply	Lenovo	SA10R16922	8SSA10R16922C2TJ-19M0G0G

Configuration 9

***Equipment Under Test* (* = EUT):**

Device Name	Manufacturer	Model #	S/N
Hydra Board	Tonal System	500-0801 Rev 008	080100702000476

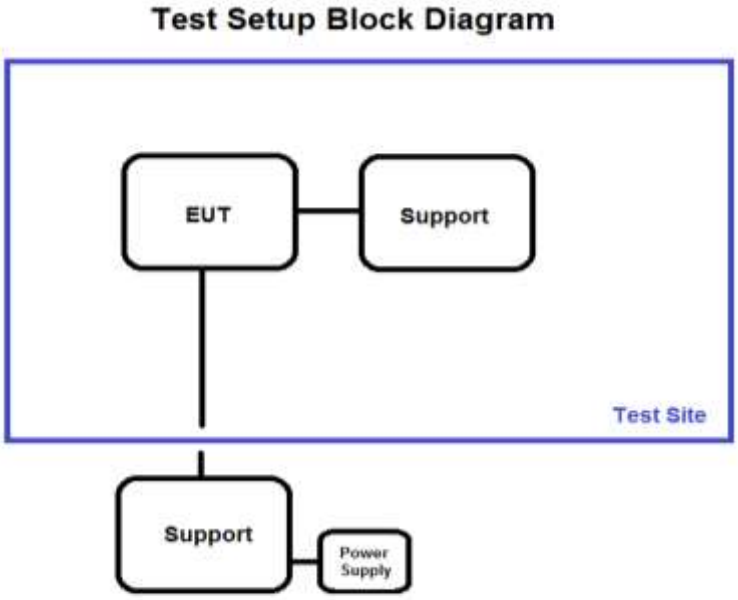
Support Equipment:

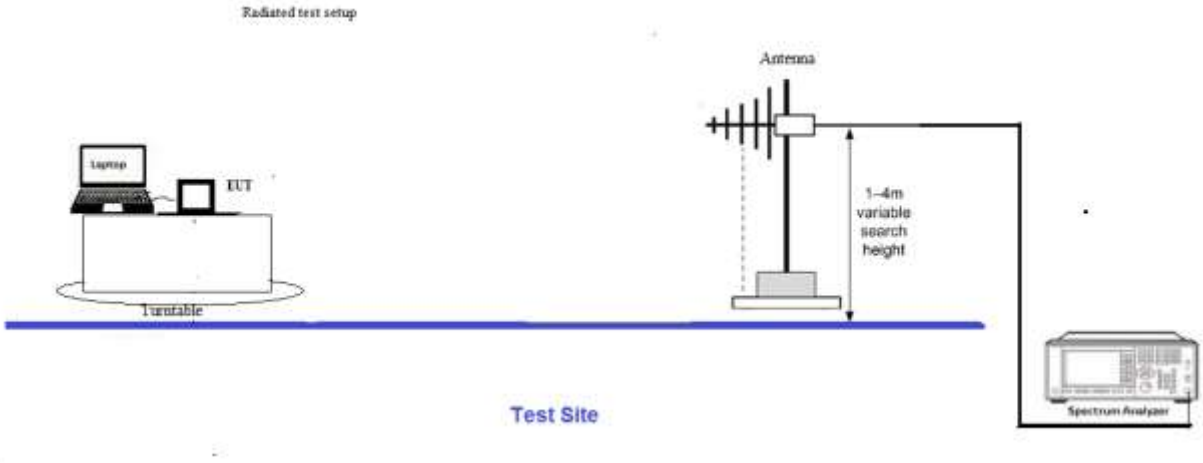
Device Name	Manufacturer	Model #	S/N
Laptop	Lenovo	X1 Carbon Gen 9	PF-37KBYM
Laptop Power Supply	Lenovo	SA10R16922	8SSA10R16922C2TJ-19M0G0G

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	Wi-Fi 5.8GHz for Hydra Board for Main System
Operating Frequency Range:	5725-5850MHz
Modulation Type(s):	OFDM, HT20, HT40, HT80
Maximum Duty Cycle:	100%
Number of TX Chains:	2
Antenna Type(s) and Gain:	External 4.00dBi
Beamforming Type:	NA
Antenna Connection Type:	External Connector
Nominal Input Voltage:	15VDC
Firmware / Software used for Test:	QRCT (Qualcomm Radio Control Toolkit) Version 4
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

Block Diagram of Test Setup(s)





Rev. C

FCC Part 15 Subpart E

15.407(e) 6dB Bandwidth

Test Setup/Conditions			
Test Location:	Fremont Lab C3	Test Engineer:	Hoang Cao
Test Method:	ANSI C63.10 (2013), KDB 789033	Test Date(s):	12/8/2021
Configuration:	9		
Test Setup:	The EUT is placed non-conducted table. It is operated as intended. It is connected straight to a Spectrum Analyzer.		

Environmental Conditions			
Temperature (ºC)	22.5	Relative Humidity (%):	45

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
03360	Cable	Astrolab	32022-2-29094-36TC	4/9/2020	4/9/2022
P06239	Attenuator	Weinschel	54A-10	6/17/2020	6/17/2022
03471	Spectrum Analyzer	Agilent	E4440A	2/11/2020	2/11/2022

6dB Occupied Bandwidth

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
5745	1	OFDM	16925	≥500	Pass
5785	1	OFDM	17244	≥500	Pass
5825	1	OFDM	17552	≥500	Pass
5745	1	HT20	17518	≥500	Pass
5785	1	HT20	17542	≥500	Pass
5825	1	HT20	17586	≥500	Pass
5755	1	HT40	36019	≥500	Pass
5795	1	HT40	35661	≥500	Pass
5775	1	HT80	75138	≥500	Pass

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
5745	2	OFDM	17148	≥500	Pass
5785	2	OFDM	17500	≥500	Pass
5825	2	OFDM	17340	≥500	Pass
5745	2	HT20	17589	≥500	Pass
5785	2	HT20	17592	≥500	Pass
5825	2	HT20	17589	≥500	Pass
5755	2	HT40	36080	≥500	Pass
5795	2	HT40	36071	≥500	Pass
5775	2	HT80	75126	≥500	Pass

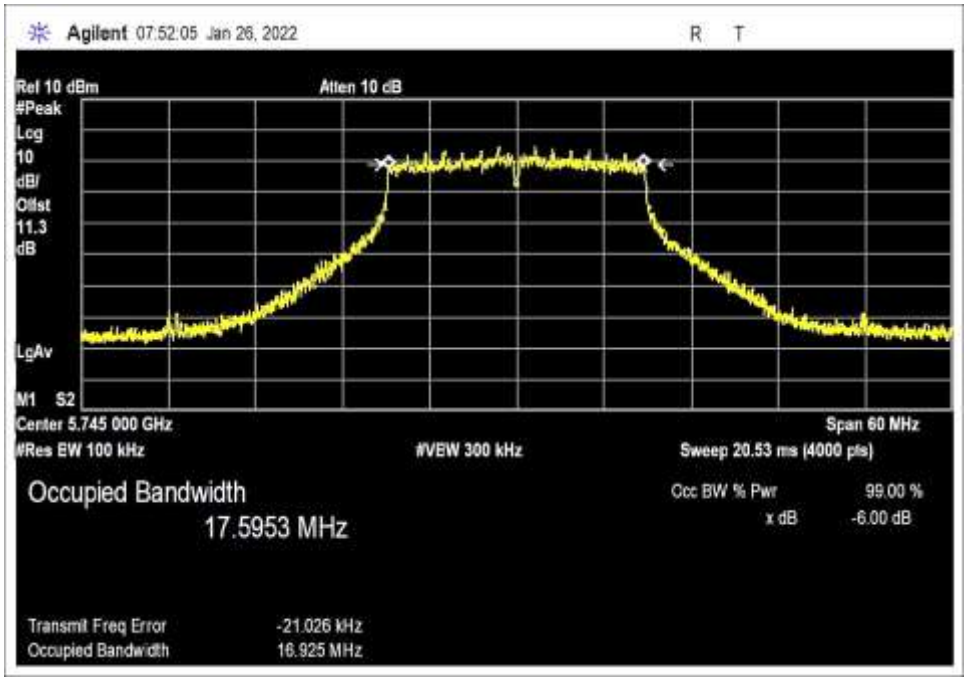
99% Occupied Bandwidth

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
5745	1	OFDM	17913	None	N/A
5785	1	OFDM	18093		
5825	1	OFDM	18077		
5745	1	HT20	18118	None	N/A
5785	1	HT20	18105		
5825	1	HT20	18095		
5755	1	HT40	36385	None	N/A
5795	1	HT40	36400		
5775	1	HT80	75520	None	N/A

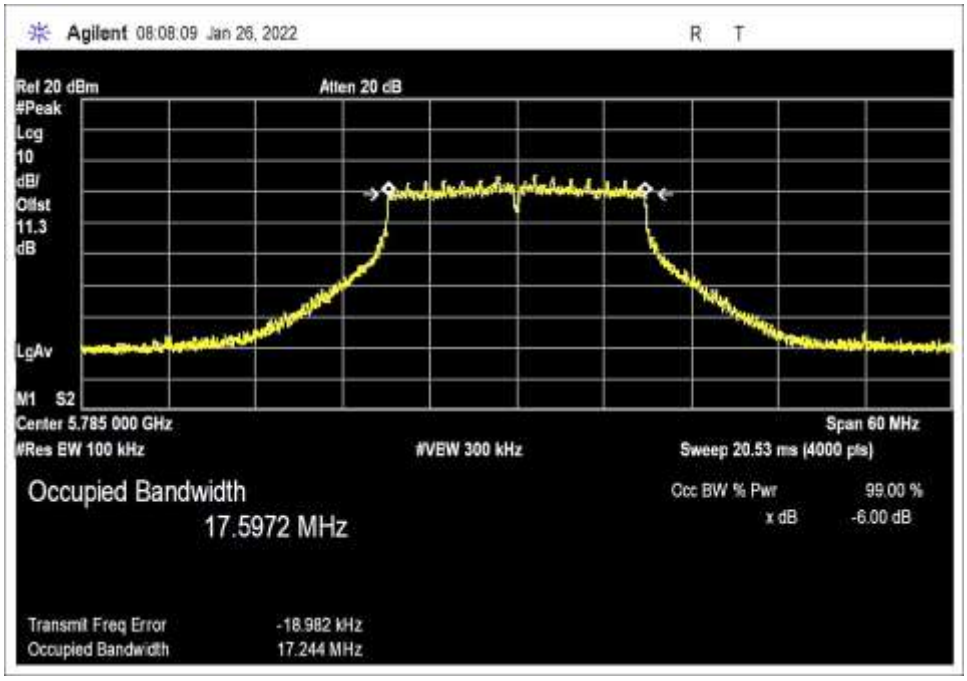
Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
5745	2	OFDM	18062	None	N/A
5785	2	OFDM	17997		
5825	2	OFDM	17955		
5745	2	HT20	18421	None	N/A
5785	2	HT20	18391		
5825	2	HT20	18160		
5755	2	HT40	36366	None	N/A
5795	2	HT40	36393		
5775	2	HT80	75571	None	N/A

Plot(s)

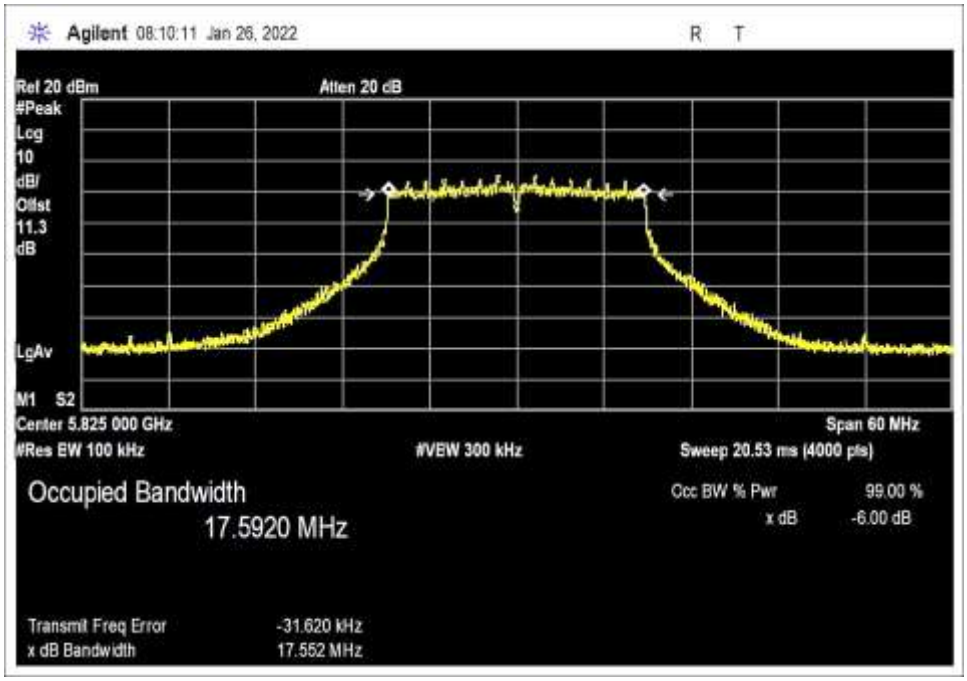
6dB Occupied Bandwidth – Chain 0 - OFDM



Low Channel

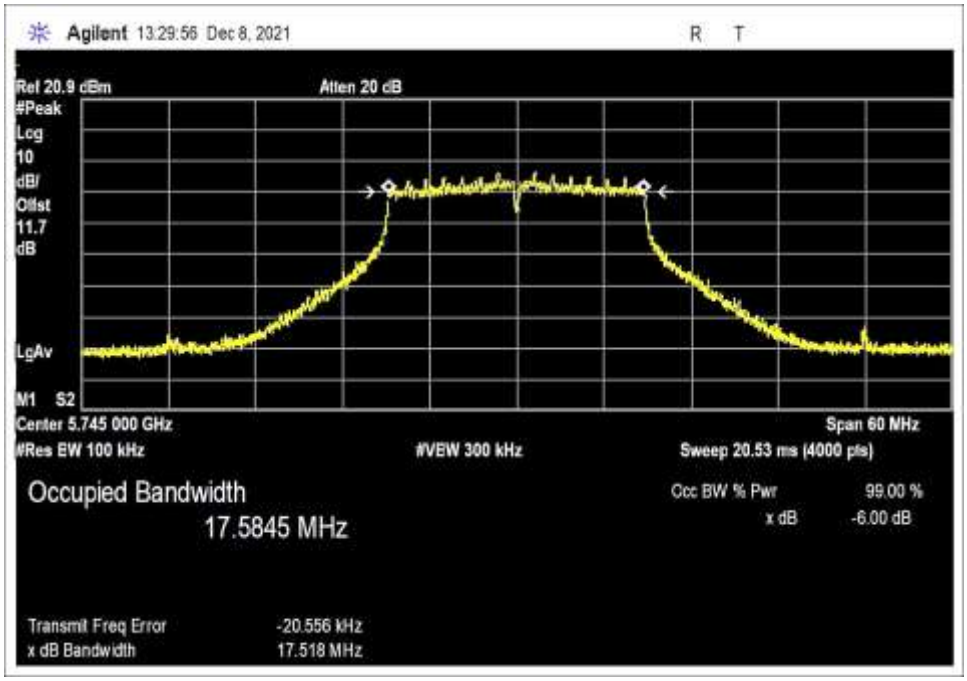


Middle Channel

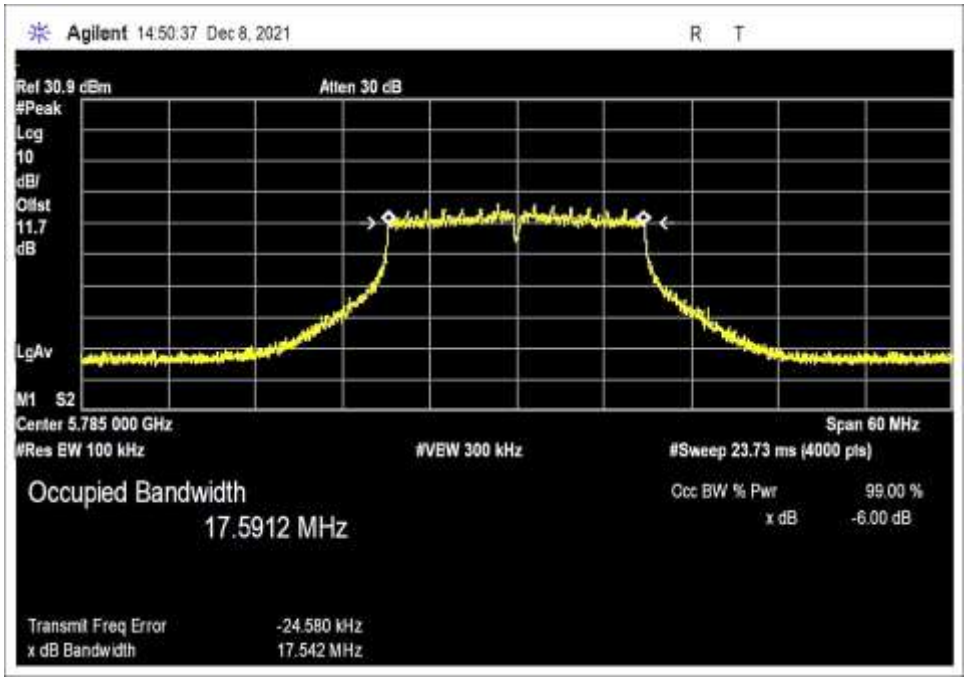


High Channel

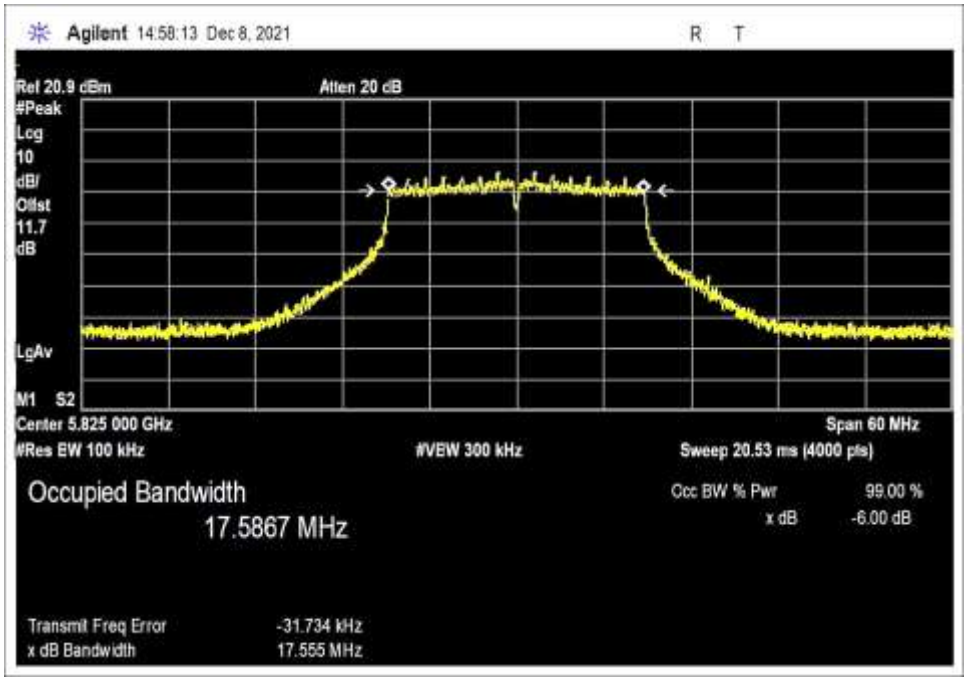
6dB Occupied Bandwidth – Chain 0 – HT20



Low Channel

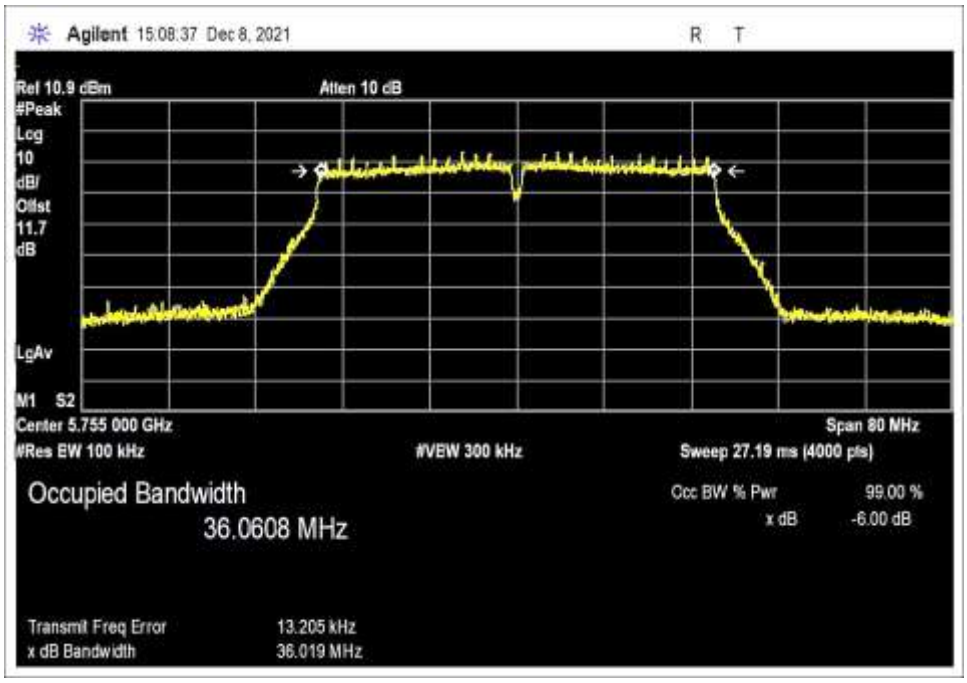


Middle Channel

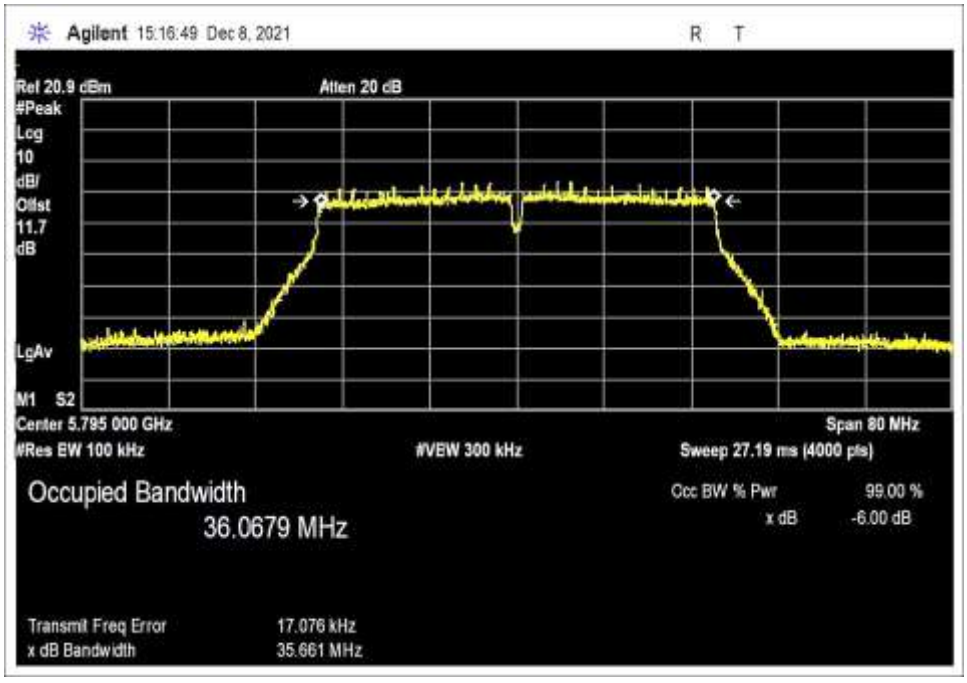


High Channel

6dB Occupied Bandwidth – Chain 0 – HT40

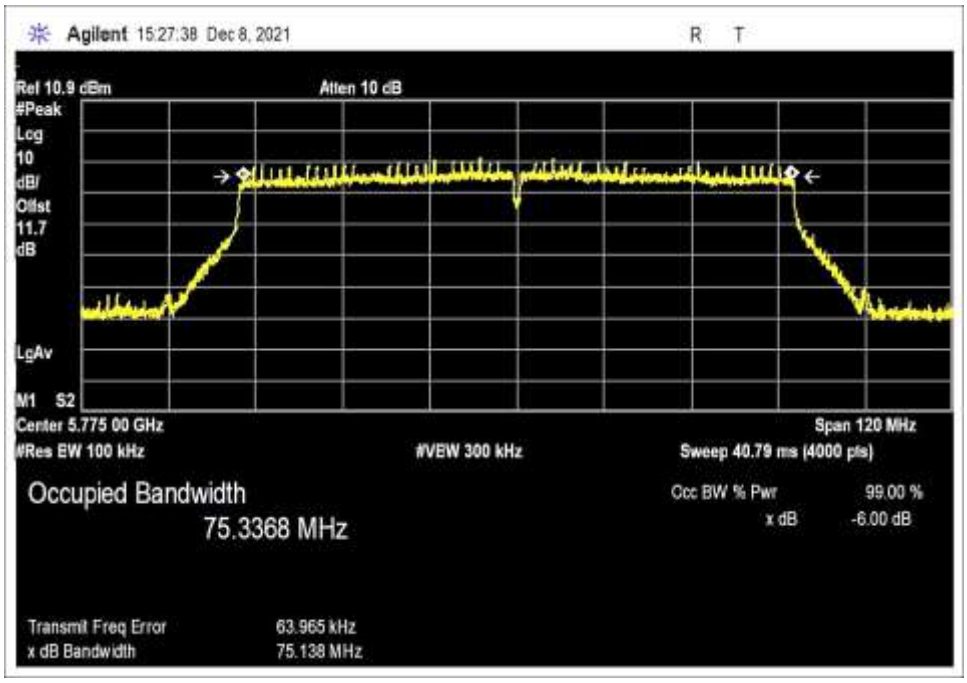


Low Channel

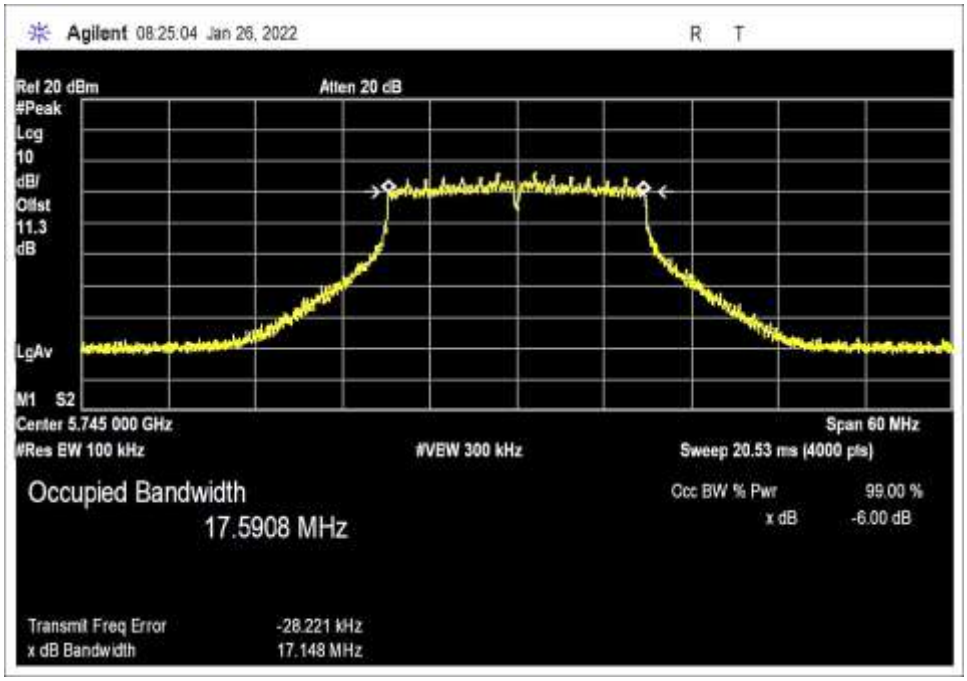


High Channel

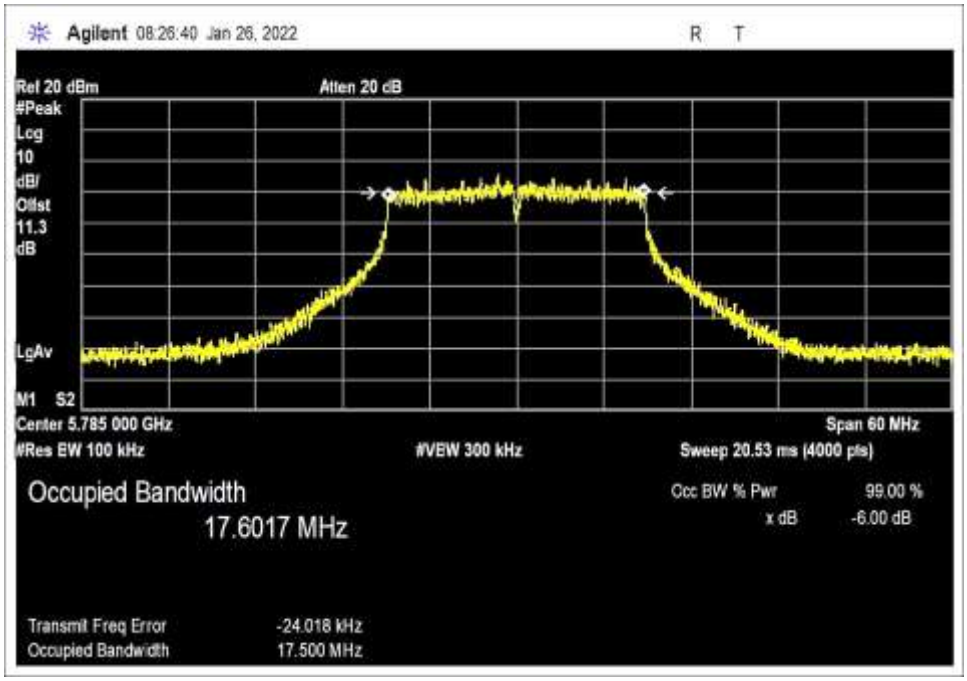
6dB Occupied Bandwidth – Chain 0 – HT80



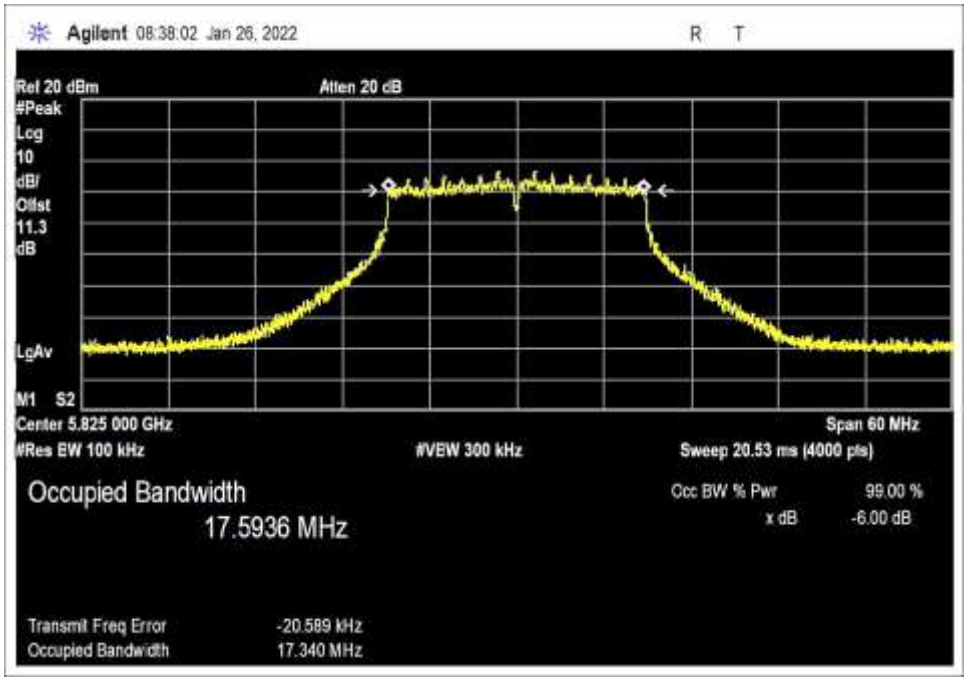
6dB Occupied Bandwidth – Chain 1 - OFDM



Low Channel

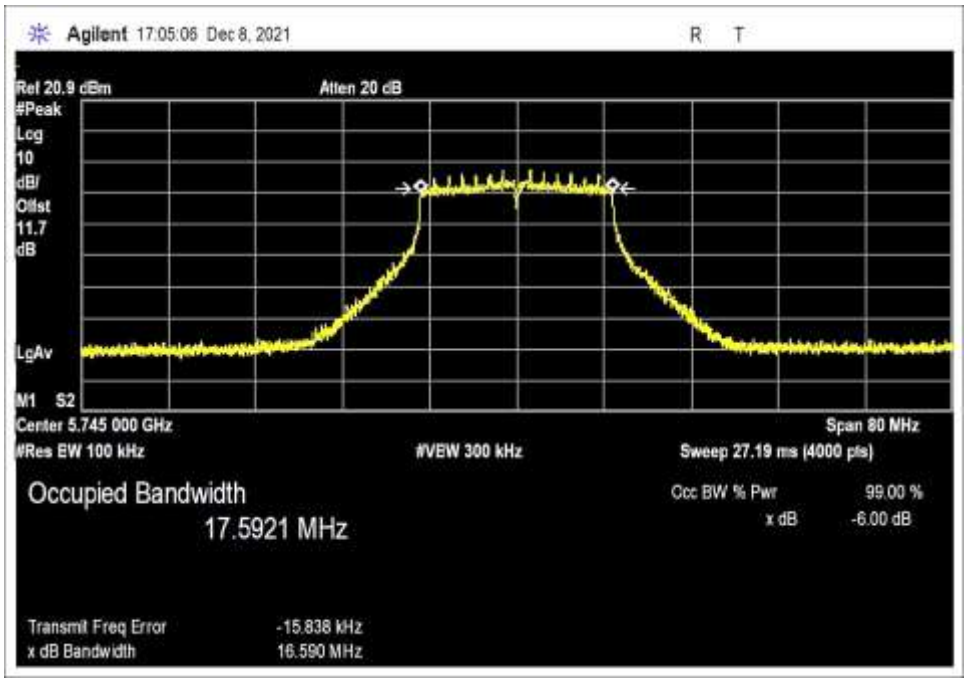


Middle Channel

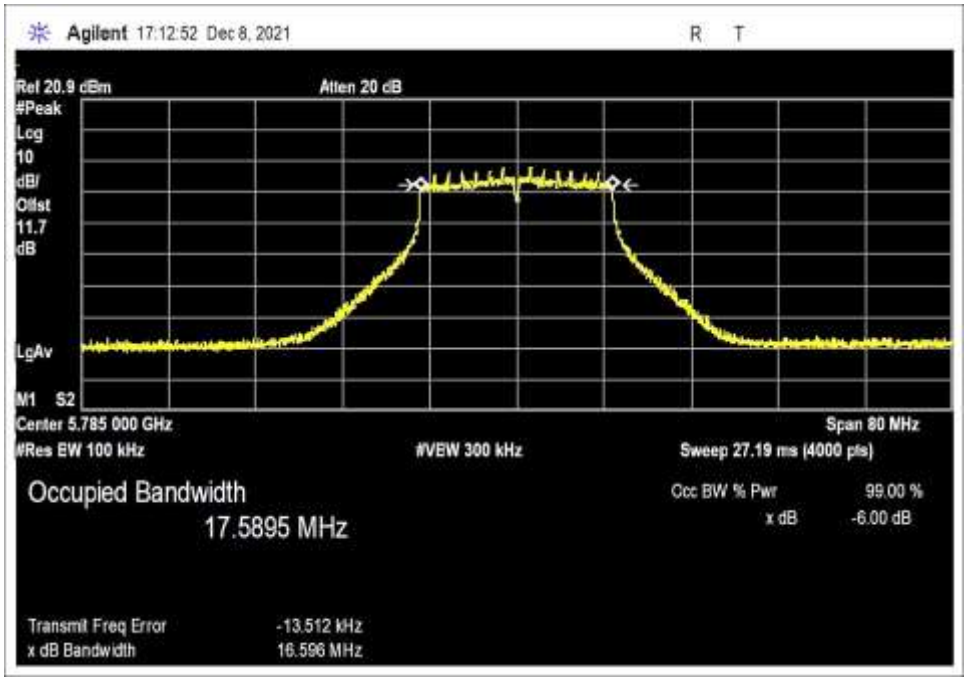


High Channel

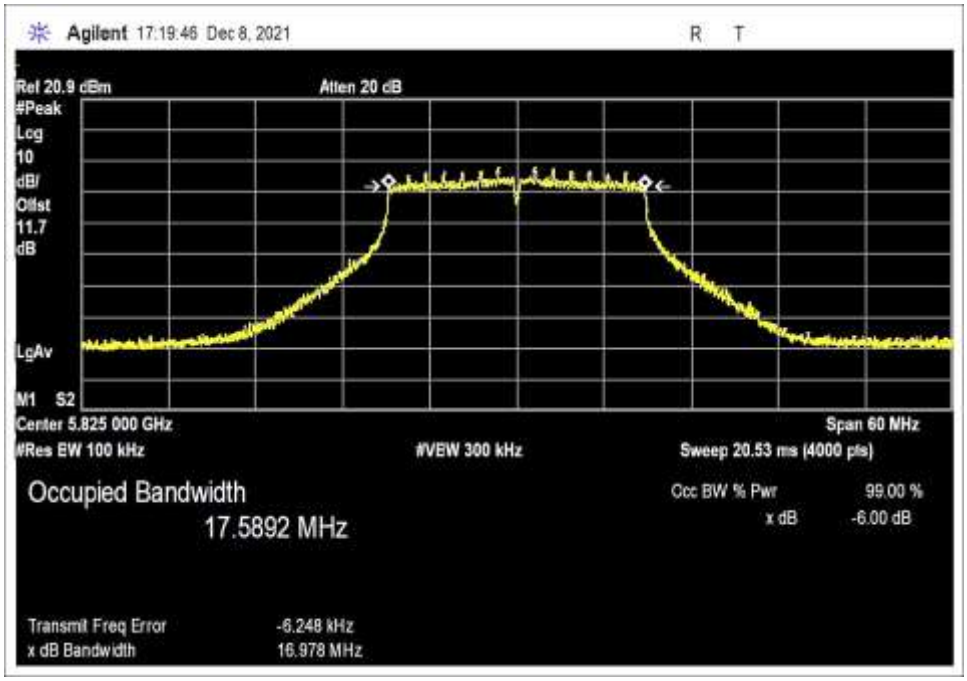
6dB Occupied Bandwidth – Chain 1 – HT20



Low Channel

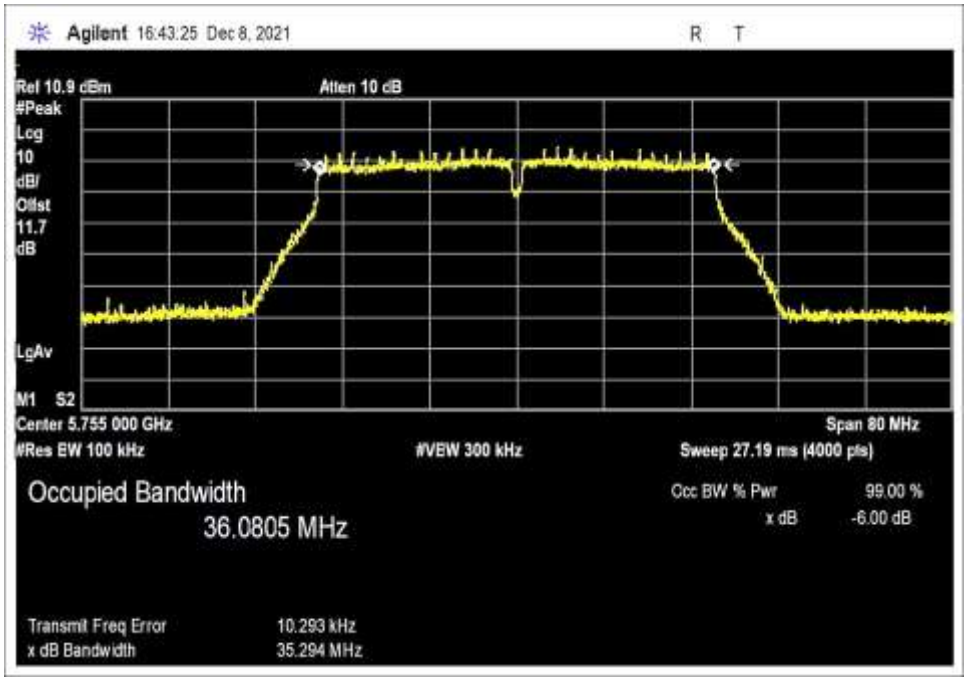


Middle Channel

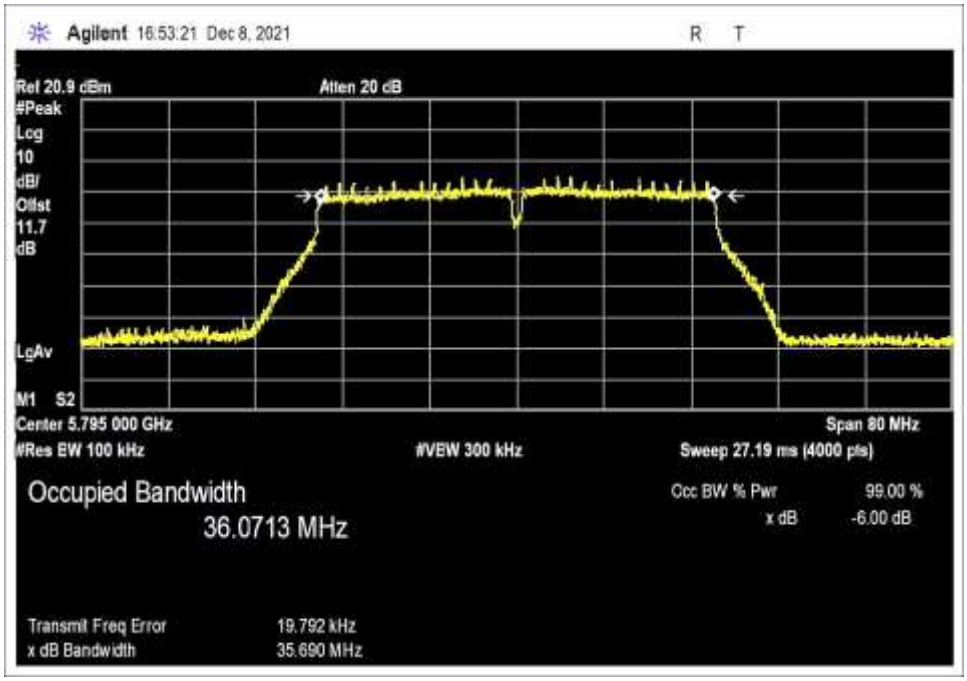


High Channel

6dB Occupied Bandwidth – Chain 1 – HT40

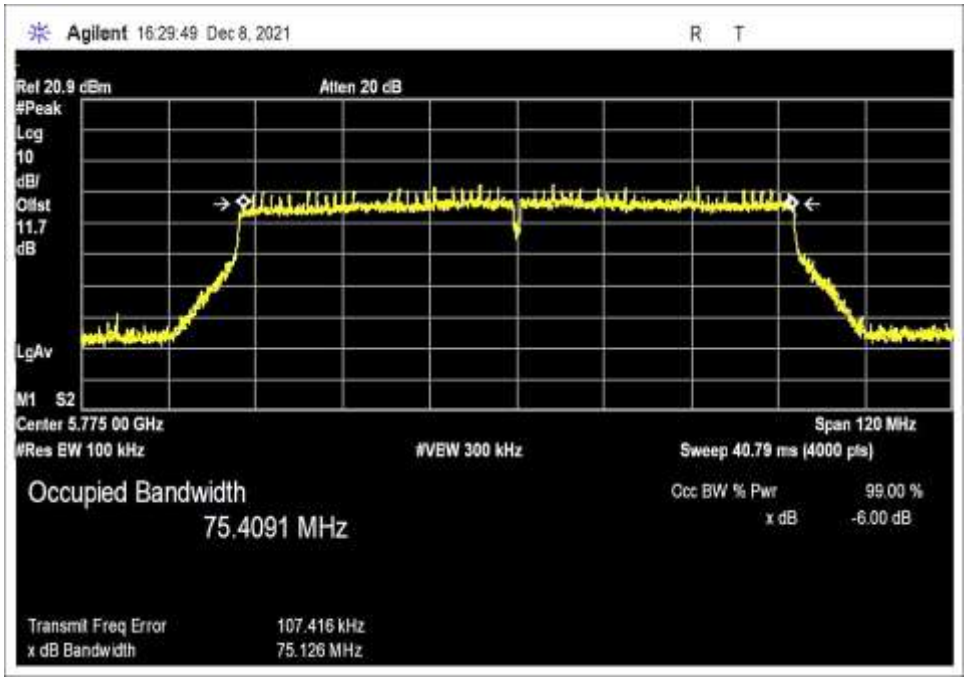


Low Channel

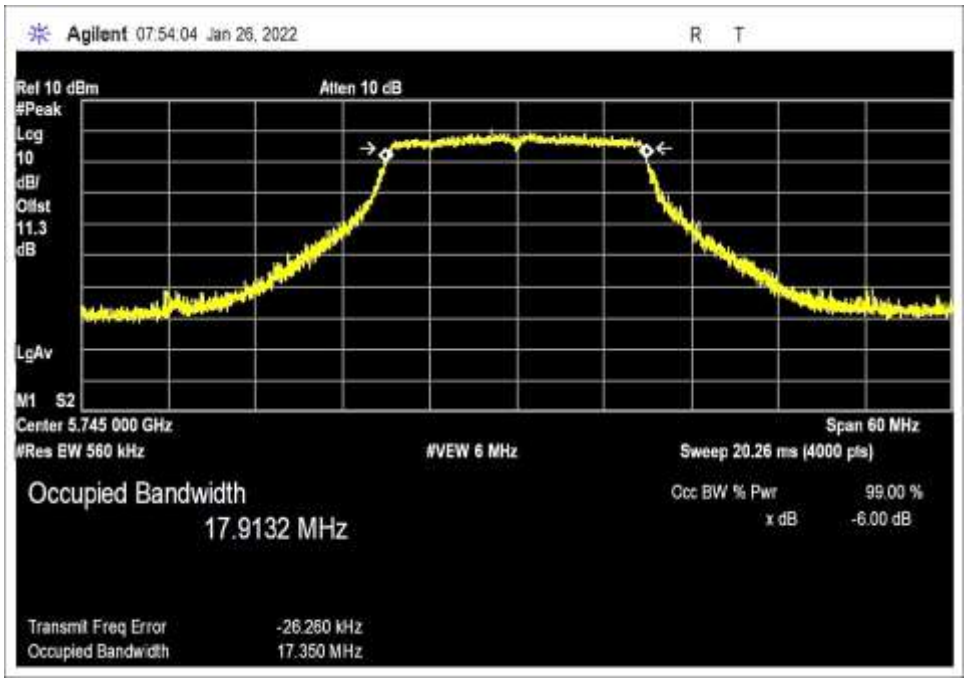


High Channel

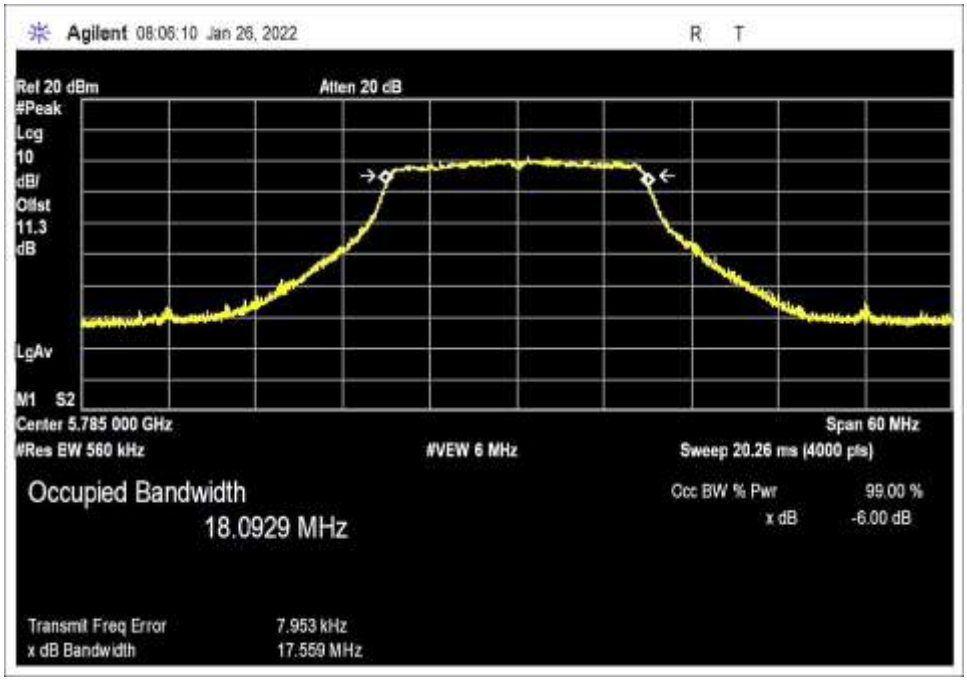
6dB Occupied Bandwidth – Chain 1 – HT80



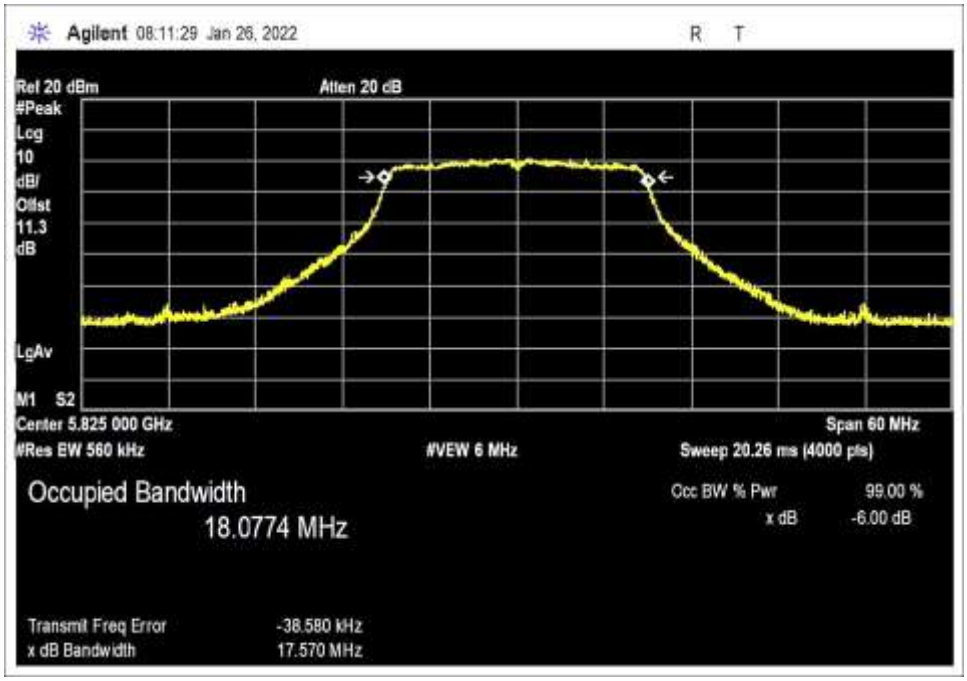
99% Occupied Bandwidth – Chain 0 - OFDM



Low Channel

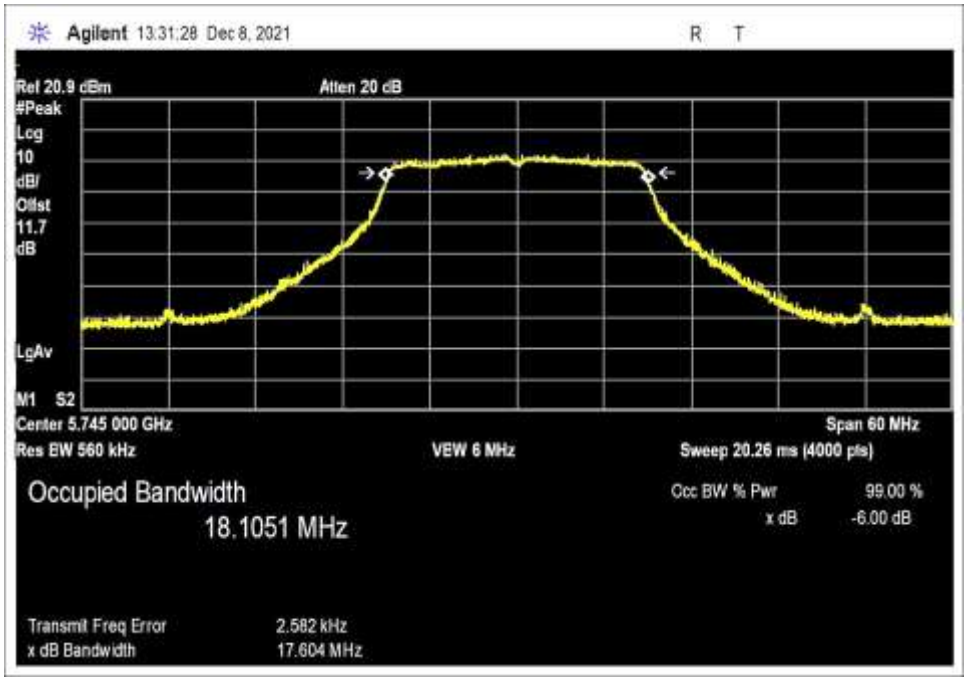


Middle Channel

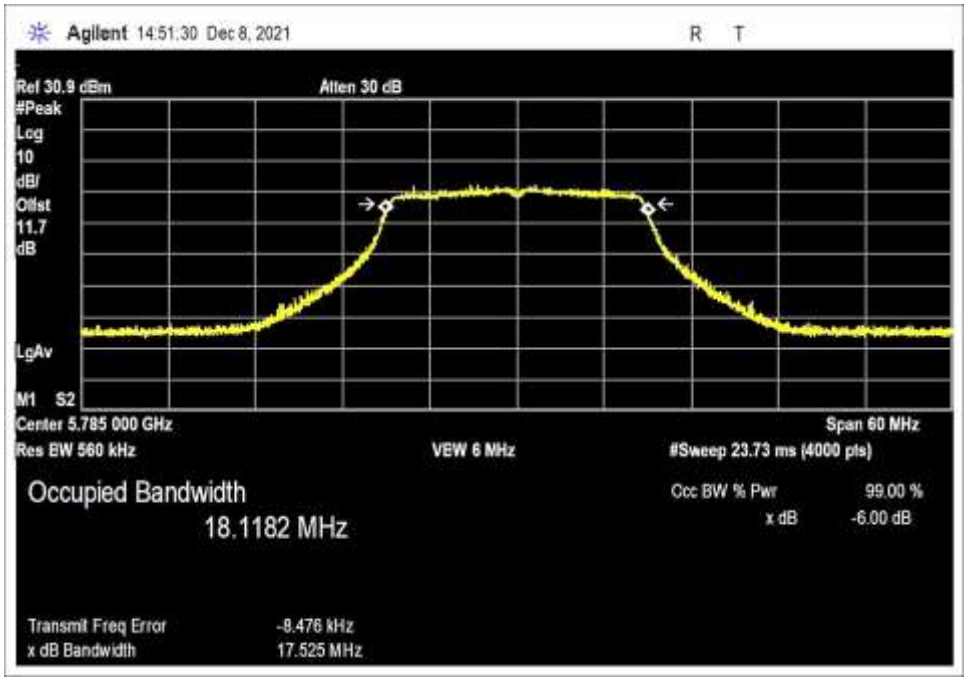


High Channel

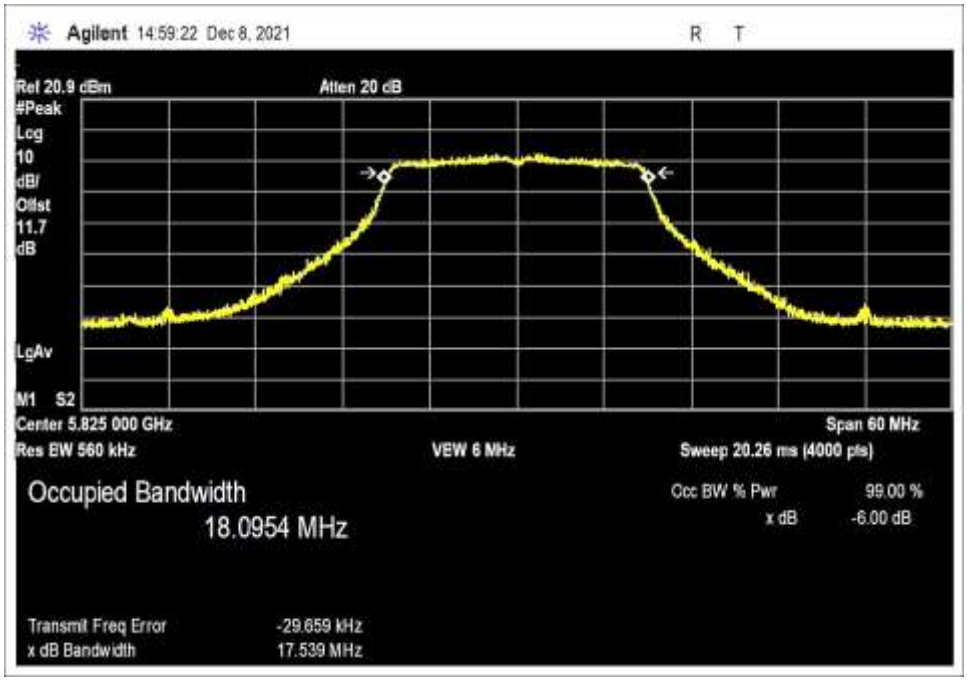
99% Occupied Bandwidth – Chain 0 – HT20



Low Channel

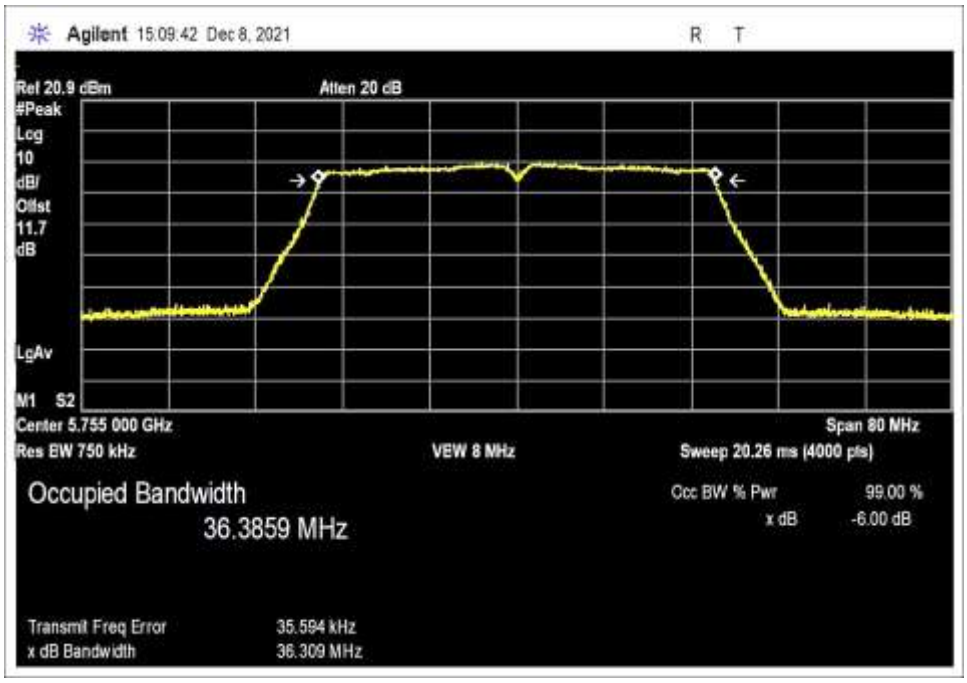


Middle Channel

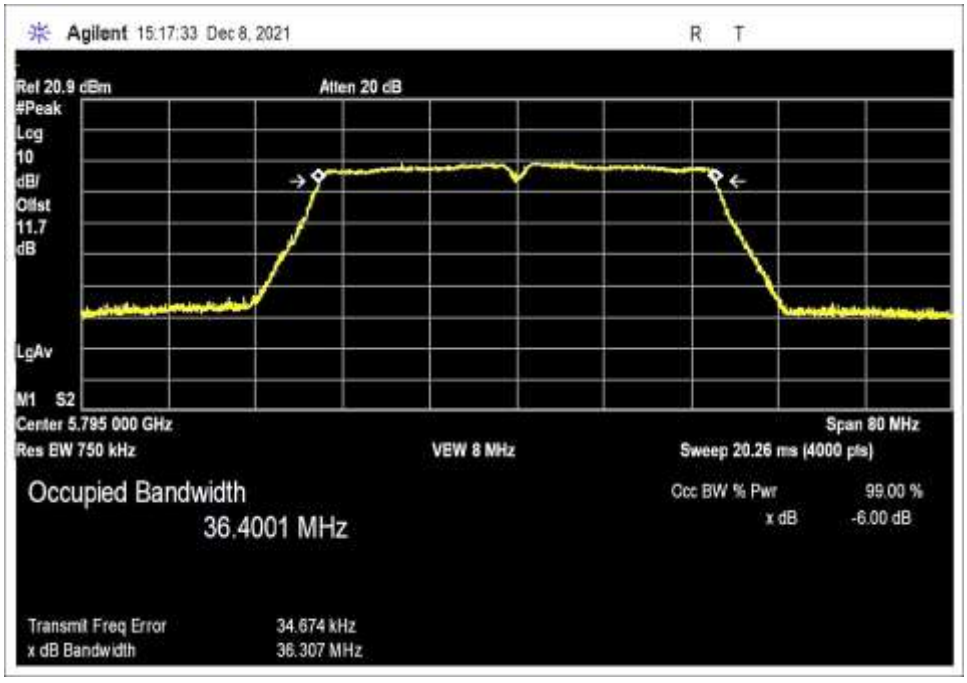


High Channel

99% Occupied Bandwidth – Chain 0 – HT40

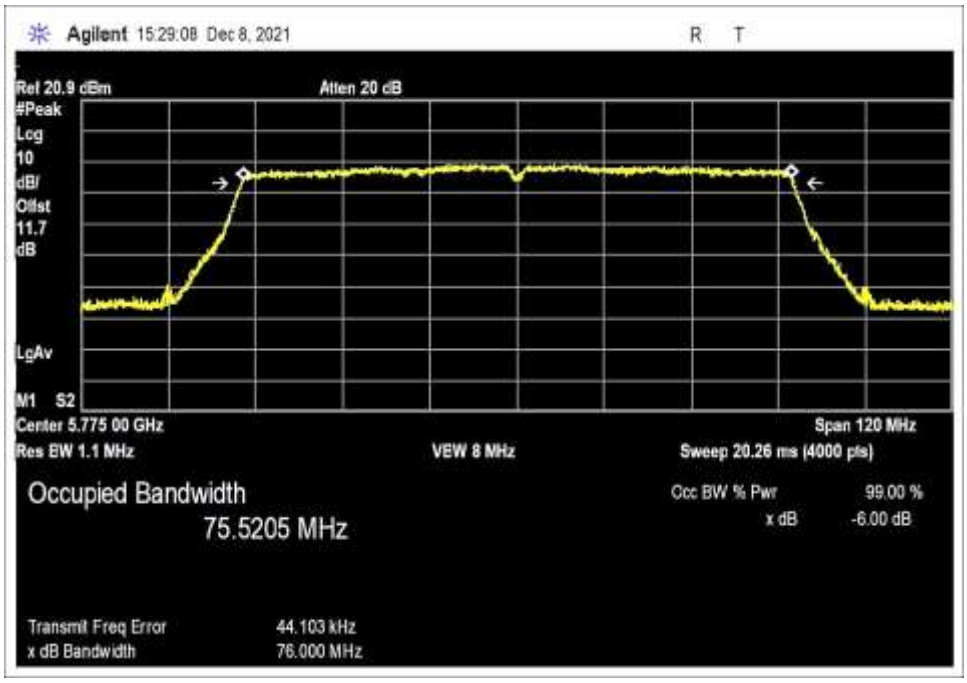


Low Channel

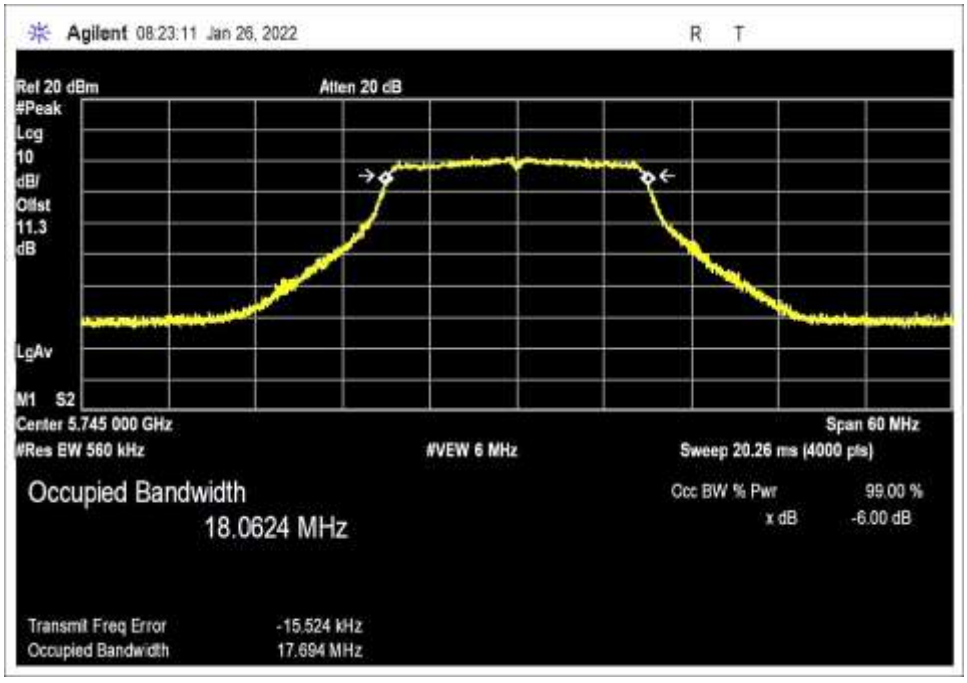


High Channel

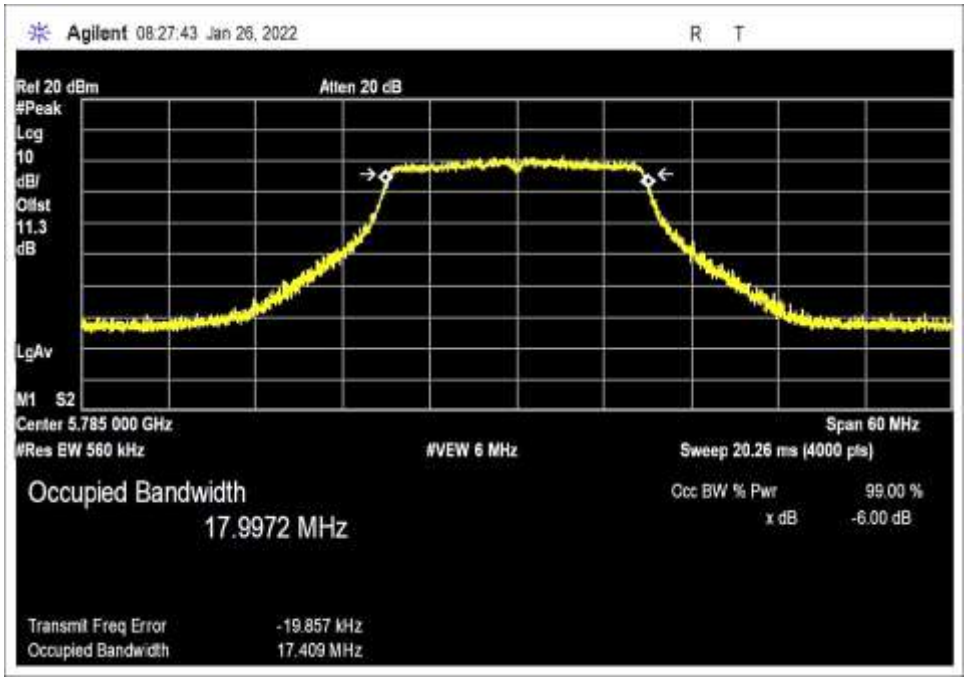
99% Occupied Bandwidth – Chain 0 – HT80



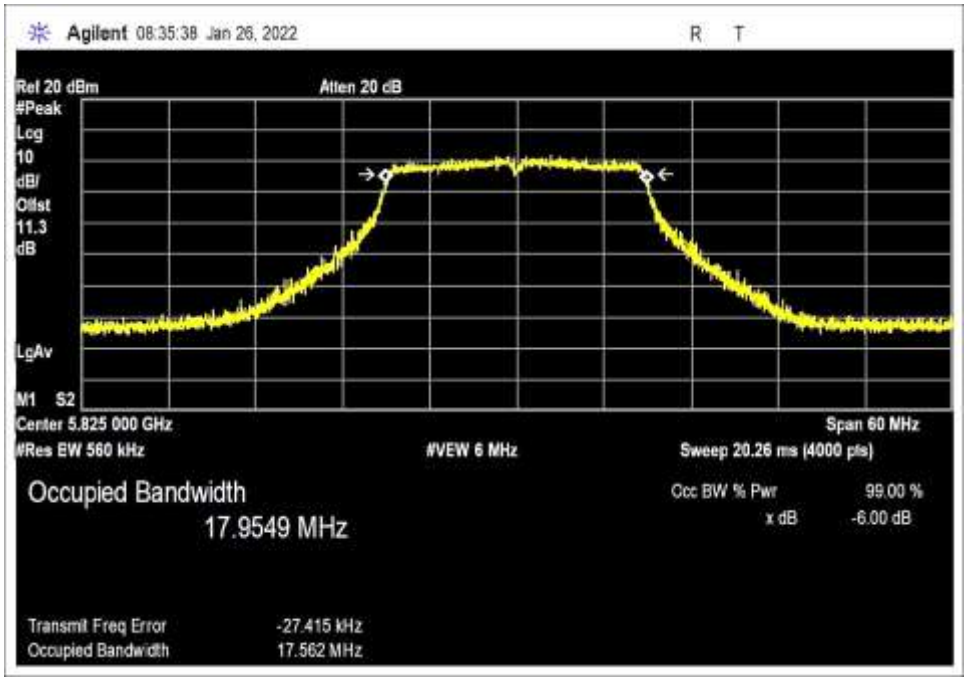
99% Occupied Bandwidth – Chain 1 - OFDM



Low Channel

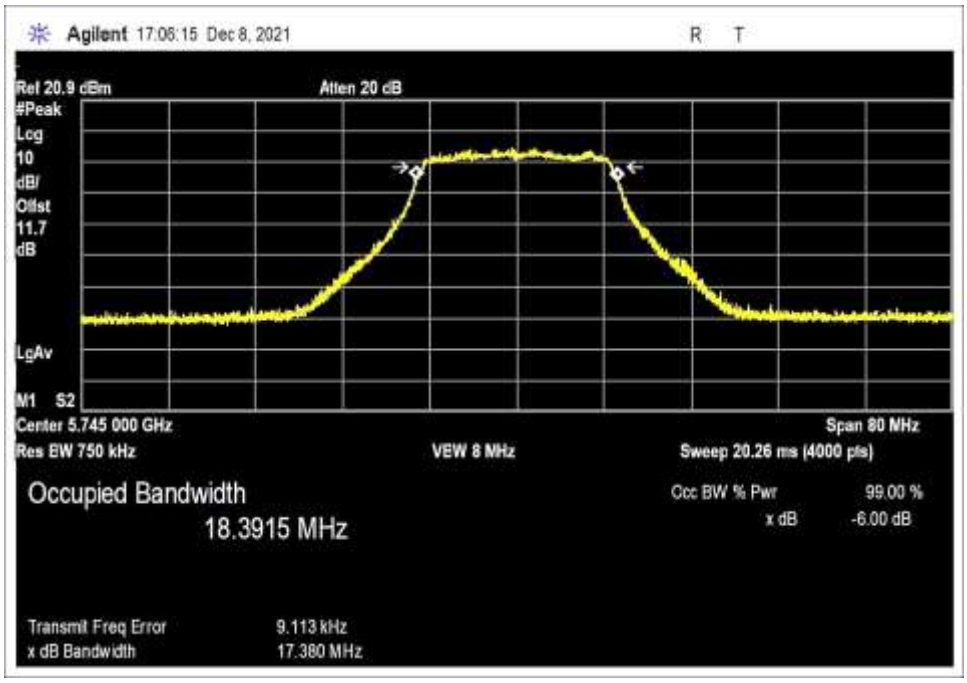


Middle Channel

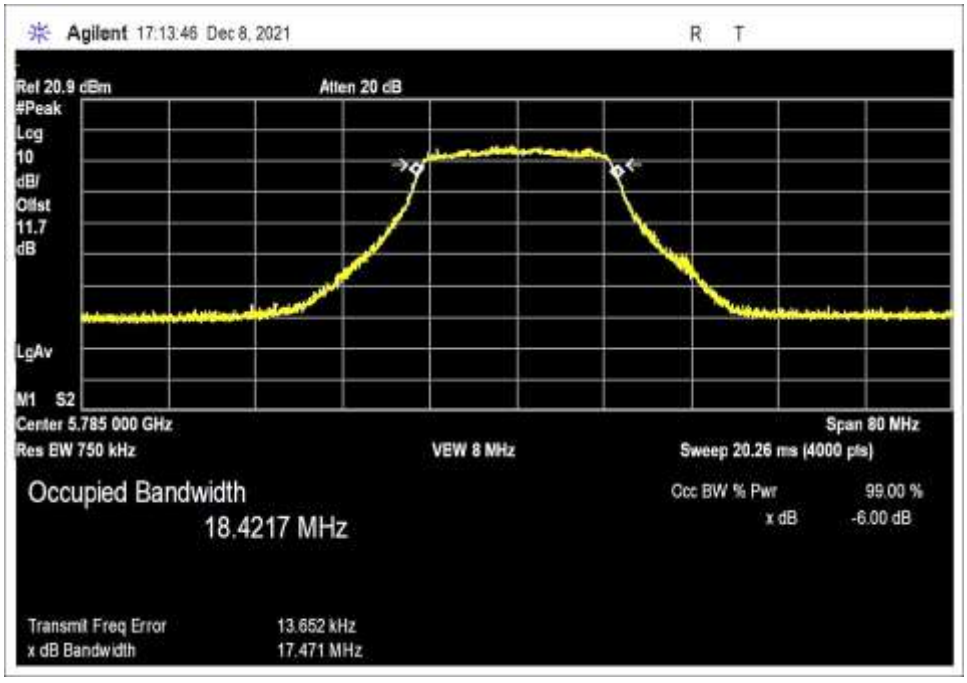


High Channel

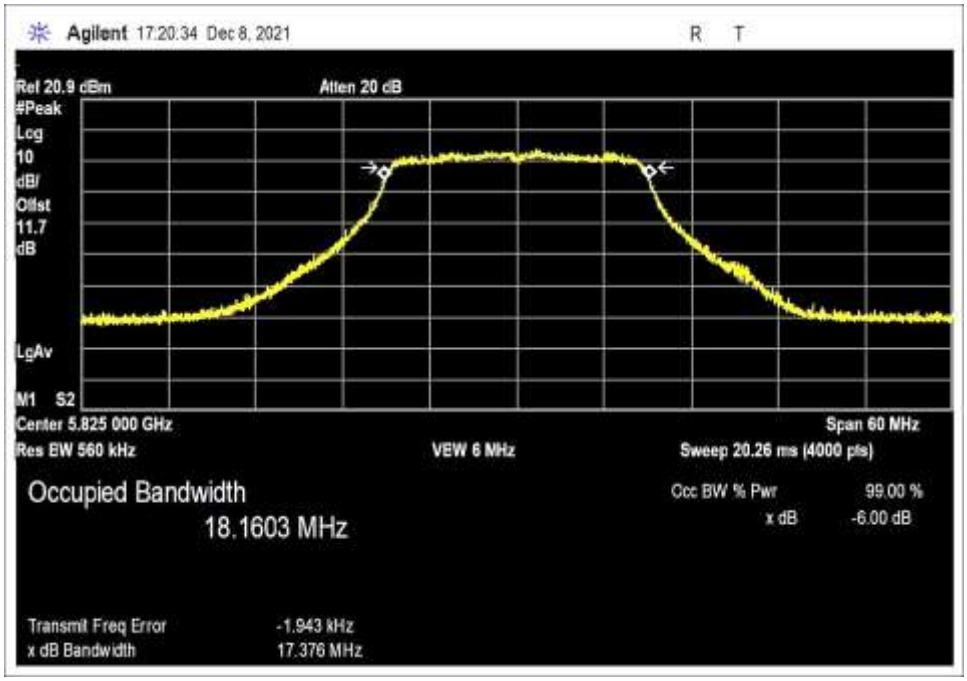
99% Occupied Bandwidth – Chain 1 – HT20



Low Channel

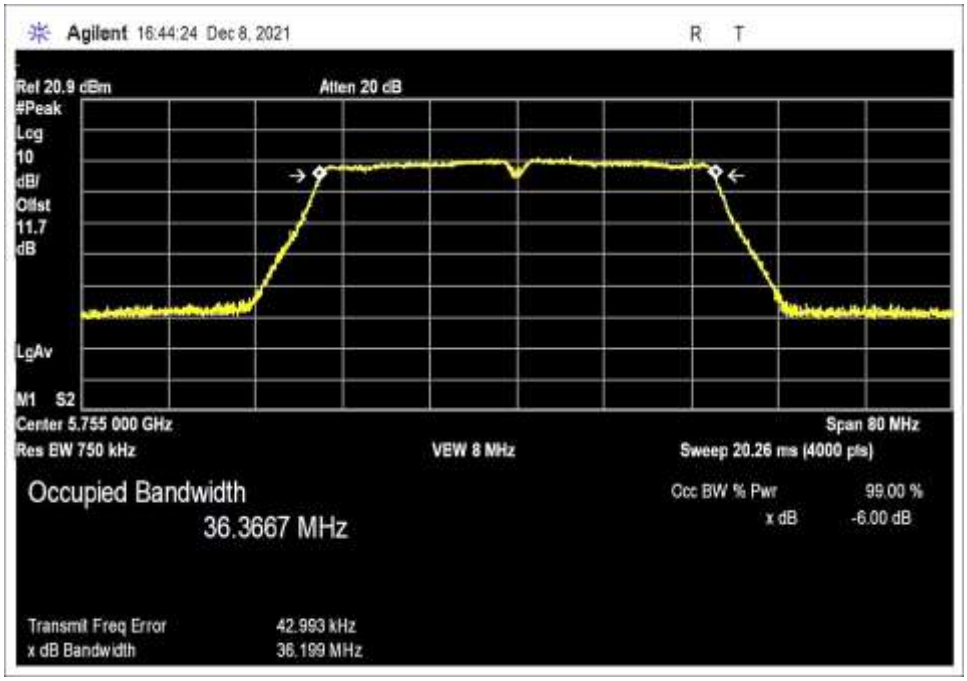


Middle Channel

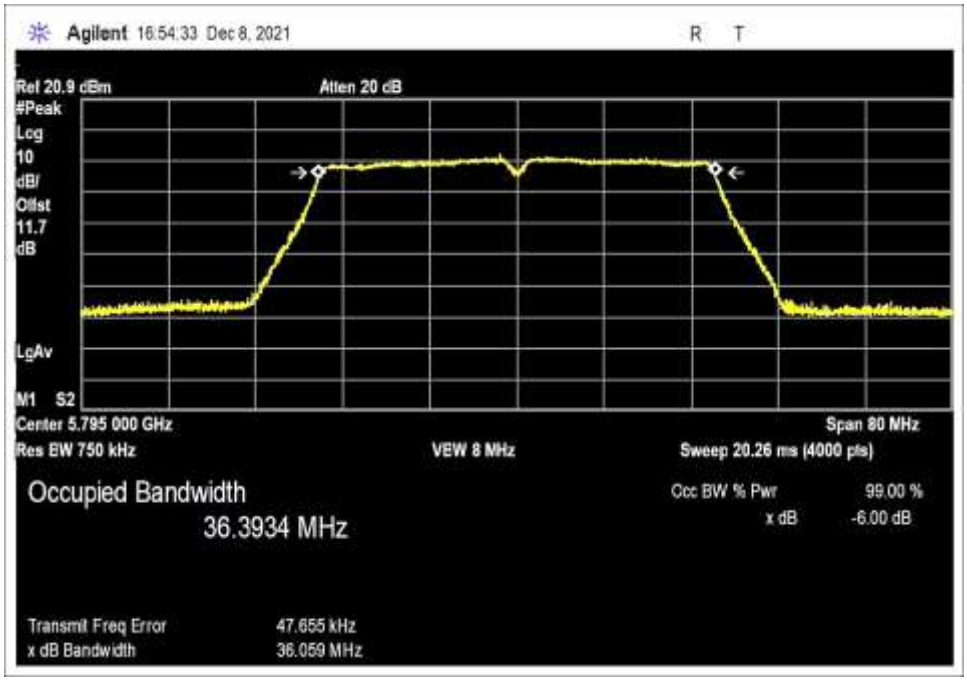


High Channel

99% Occupied Bandwidth – Chain 1 – HT40

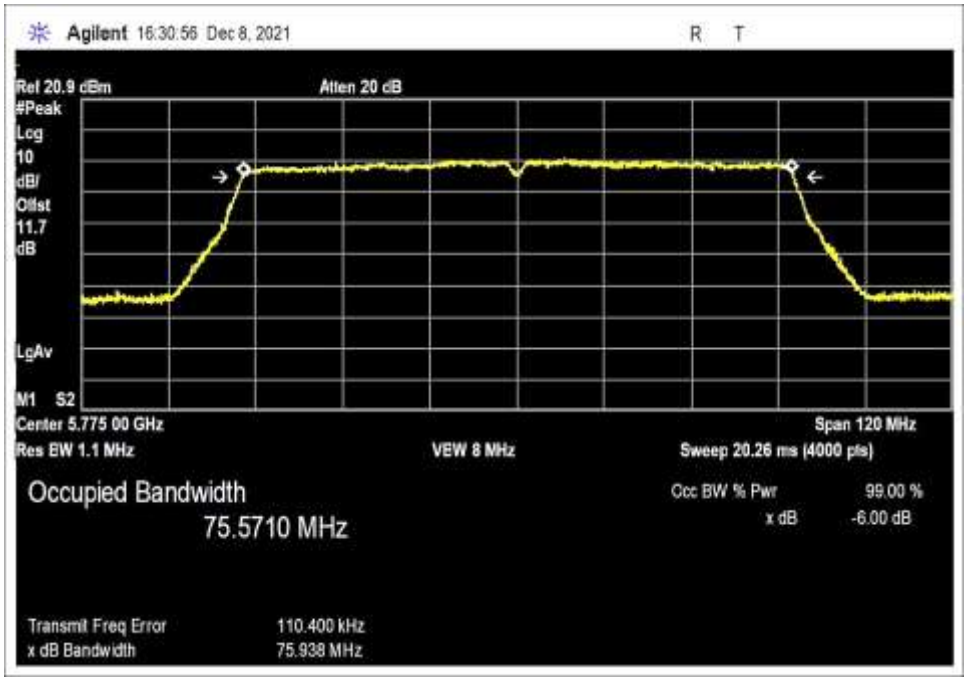


Low Channel



High Channel

99% Occupied Bandwidth – Chain 1 – HT80



15.407(a) Output Power

Test Setup/Conditions – RF Conducted Measurement			
Test Location:	Fremont Lab C3	Test Engineer:	Hoang Cao
Test Method:	ANSI C63.10 (2013), KDB 789033	Test Date(s):	12/8/2021
Configuration:	9		
Test Setup:	The EUT is placed non-conducted table. It is operated as intended. It is connected straight to a Spectrum Analyzer.		

Environmental Conditions			
Temperature (ºC)	22.5	Relative Humidity (%):	45

Test Equipment – RF Conducted Measurement					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
03360	Cable	Astrolab	32022-2-29094-36TC	4/9/2020	4/9/2022
P06239	Attenuator	Weinschel	54A-10	6/17/2020	6/17/2022
03471	Spectrum Analyzer	Agilent	E4440A	2/11/2020	2/11/2022

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	HT20/1	8.85	8.89	8.87	0.04
5785	HT20/1	9.07	9.12	9.10	0.05
5825	HT20/1	8.99	8.99	9.02	0.03

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

Parameter Definitions:

Measurements performed at input voltage Vnominal ± 15%.

Parameter	Value
$V_{Nominal}$:	15VDC
$V_{Minimum}$:	12.75VDC
$V_{Maximum}$:	17.25VDC

Test Data Summary - RF Conducted Measurement – Chain 0					
Measurement Option: AVGSA-1					
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Measured (dBm)**	**Limit (dBm)**	**Results**
5745	OFDM	External 4.00dBi	5.03	≤30	Pass
5785	OFDM	External 4.00dBi	5.52	≤30	Pass
5825	OFDM	External 4.00dBi	5.67	≤30	Pass
5745	HT20	External 4.00dBi	7.35	≤30	Pass
5785	HT20	External 4.00dBi	7.36	≤30	Pass
5825	HT20	External 4.00dBi	7.39	≤30	Pass
5755	HT40	External 4.00dBi	7.39	≤30	Pass
5795	HT40	External 4.00dBi	7.43	≤30	Pass
5775	HT80	External 4.00dBi	7.35	≤30	Pass

Test Data Summary - RF Conducted Measurement – Chain 1					
Measurement Option: AVGSA-1					
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Measured (dBm)**	**Limit (dBm)**	**Results**
5745	OFDM	External 4.00dBi	6.37	≤30	Pass
5785	OFDM	External 4.00dBi	6.42	≤30	Pass
5825	OFDM	External 4.00dBi	6.86	≤30	Pass
5745	HT20	External 4.00dBi	8.62	≤30	Pass
5785	HT20	External 4.00dBi	9.17	≤30	Pass
5825	HT20	External 4.00dBi	9.11	≤30	Pass
5755	HT40	External 4.00dBi	8.55	≤30	Pass
5795	HT40	External 4.00dBi	9.12	≤30	Pass
5775	HT80	External 4.00dBi	8.69	≤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)(i):

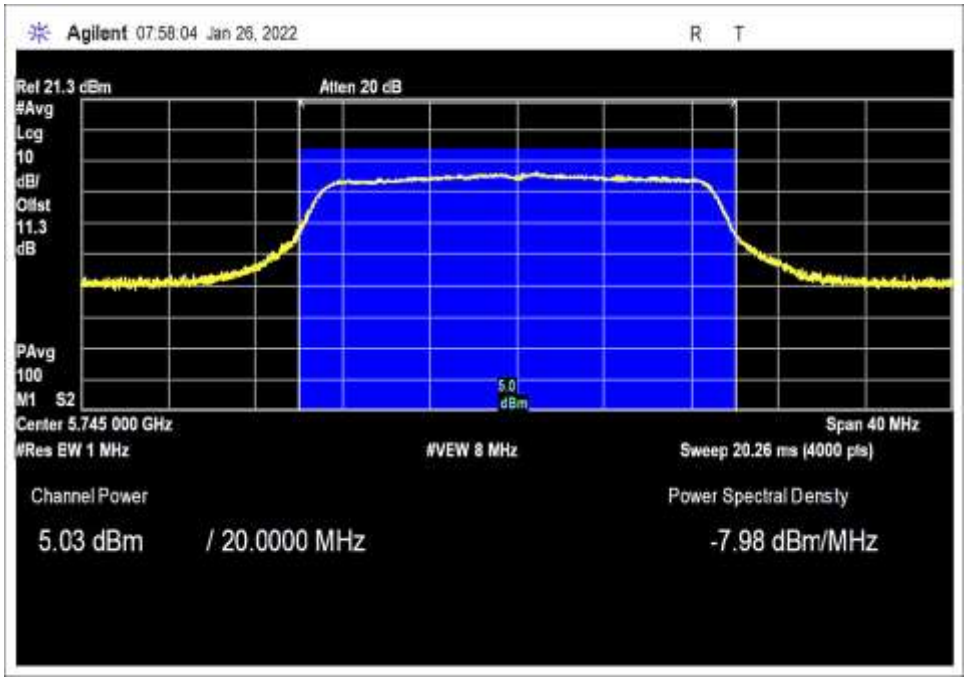
$$Limit = 30 - Roundup(G - 6)$$

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

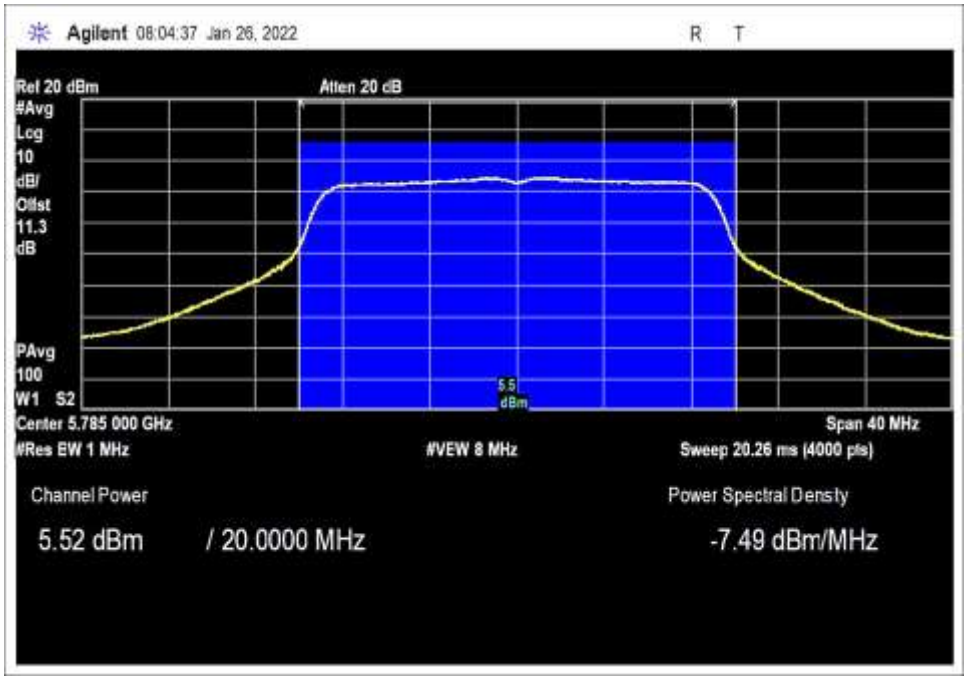
$$Limit = 30$$

Plot Data – RF Conducted Measurement

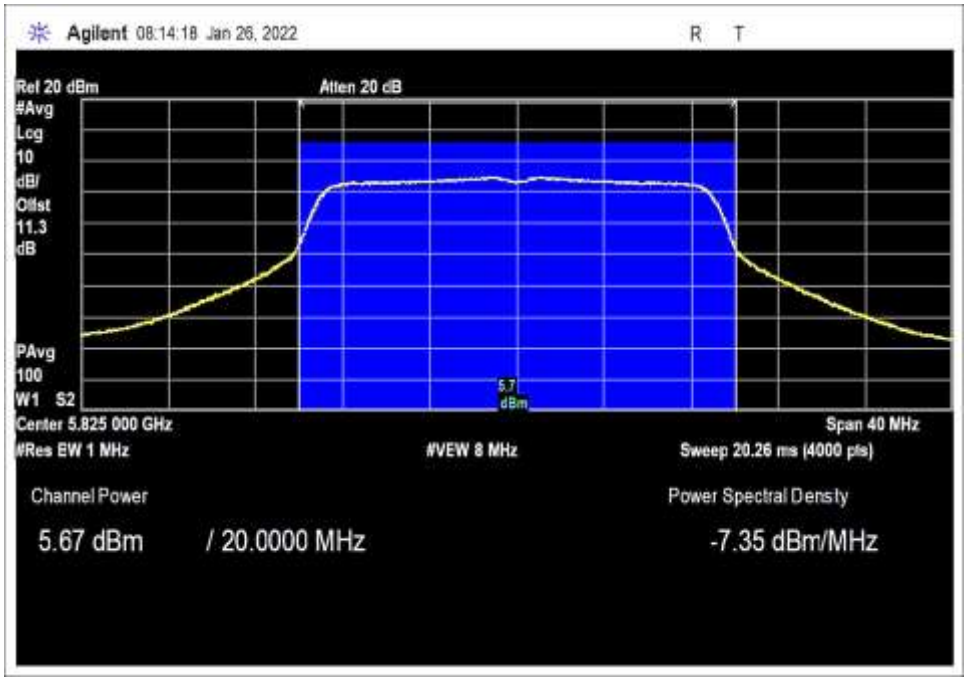
Chain 0 - OFDM



Low Channel

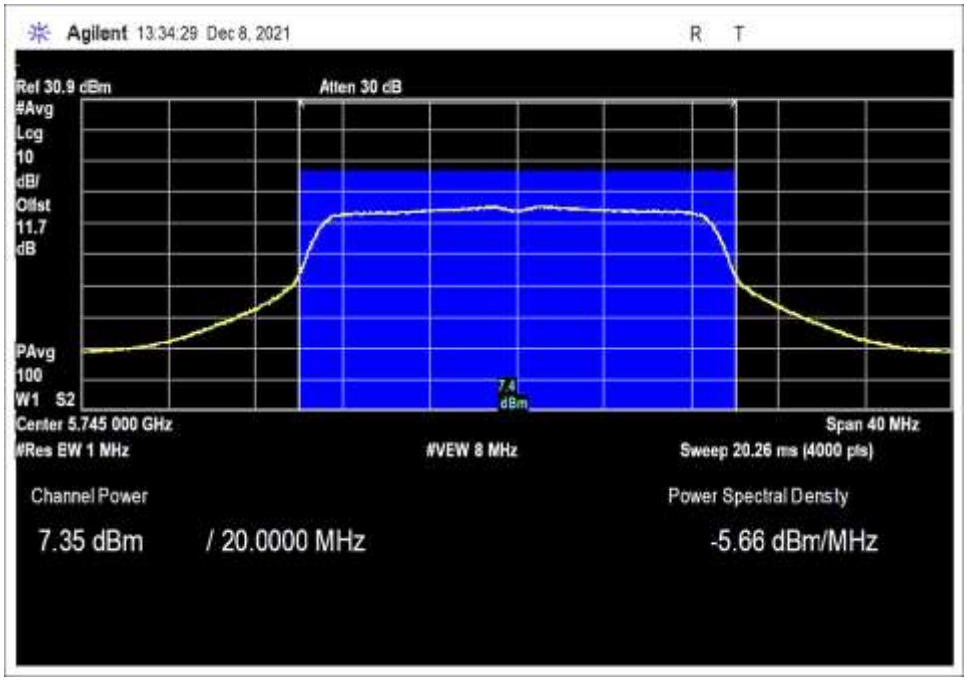


Middle Channel

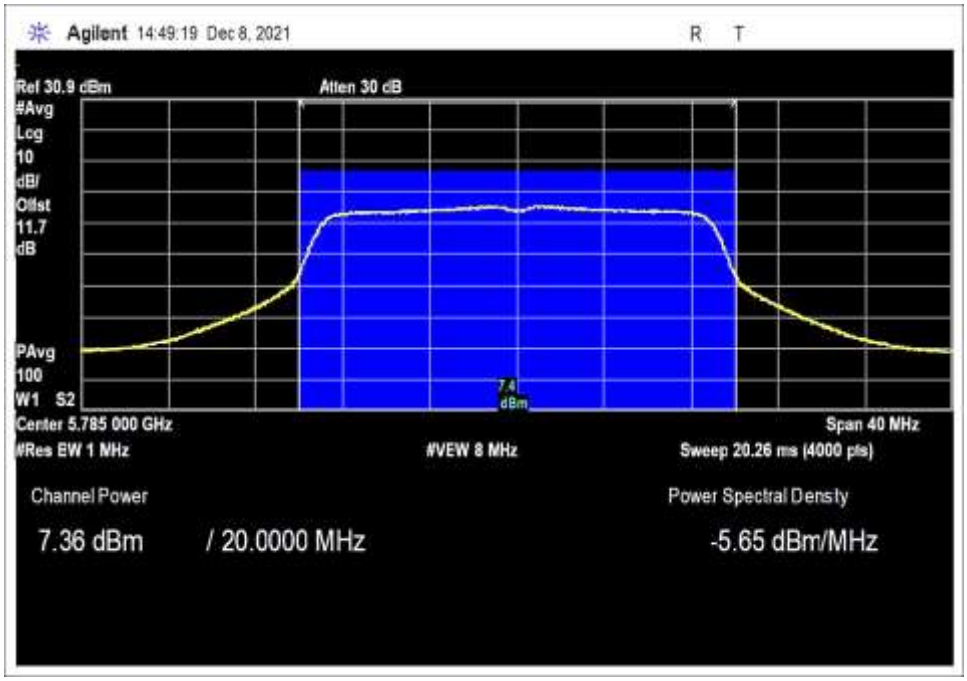


High Channel

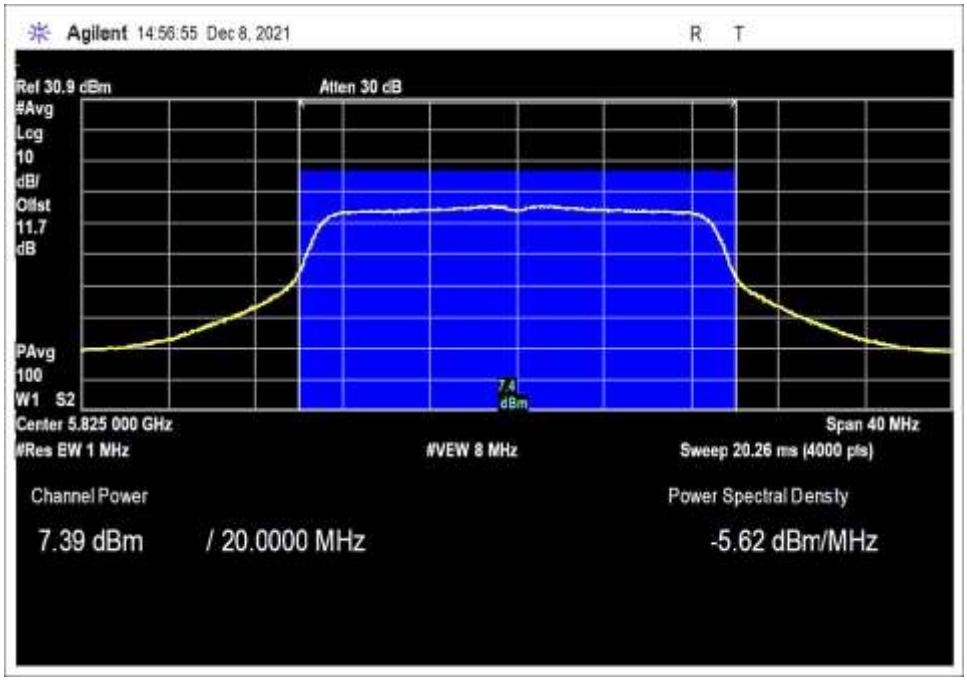
Chain 0 – HT20



Low Channel

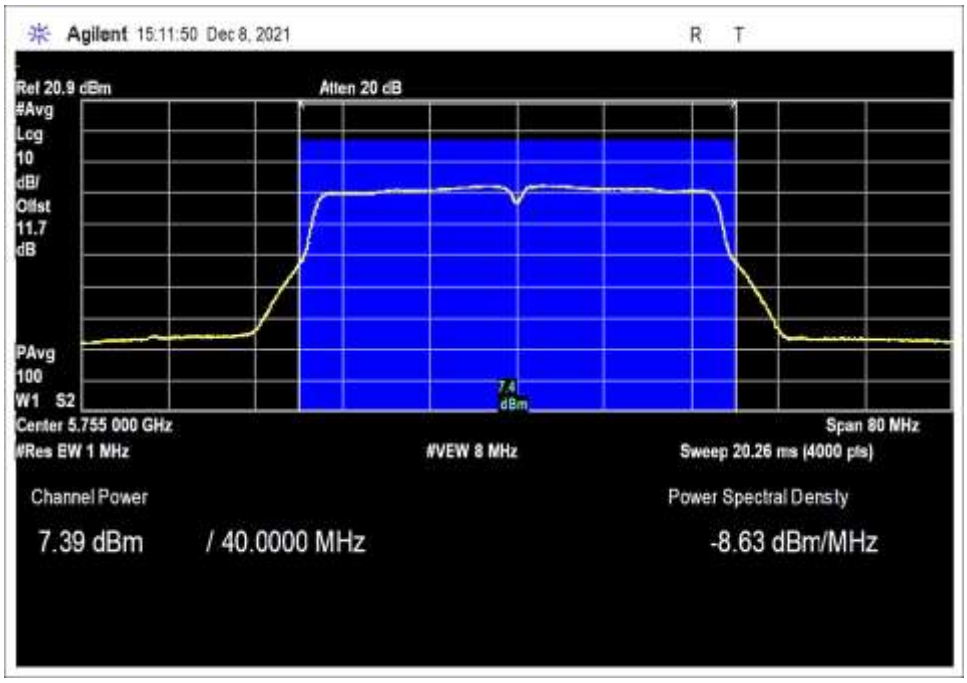


Middle Channel

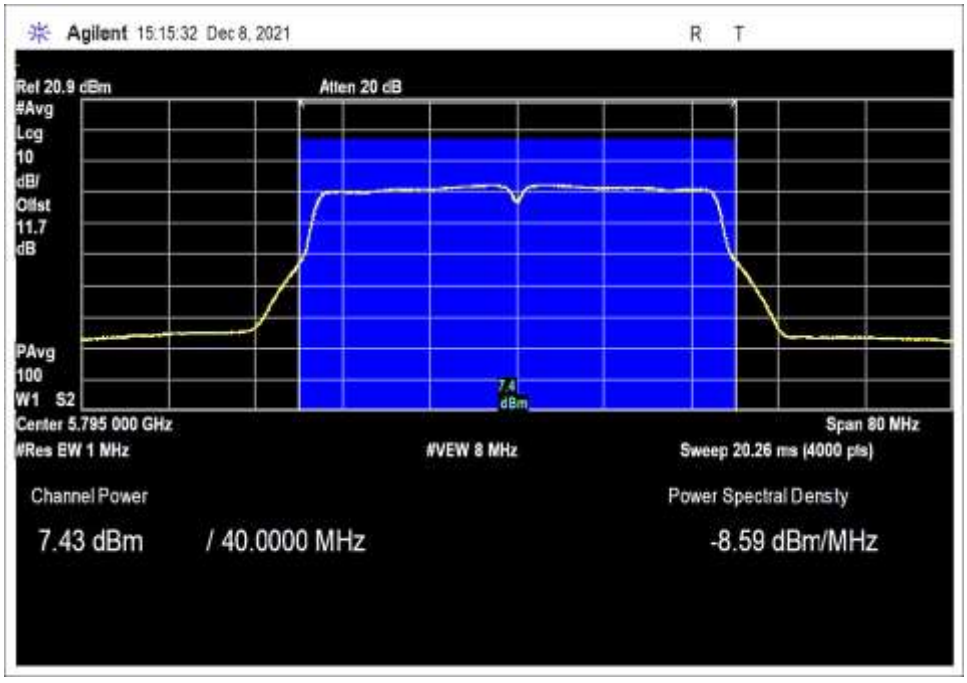


High Channel

Chain 0 – HT40

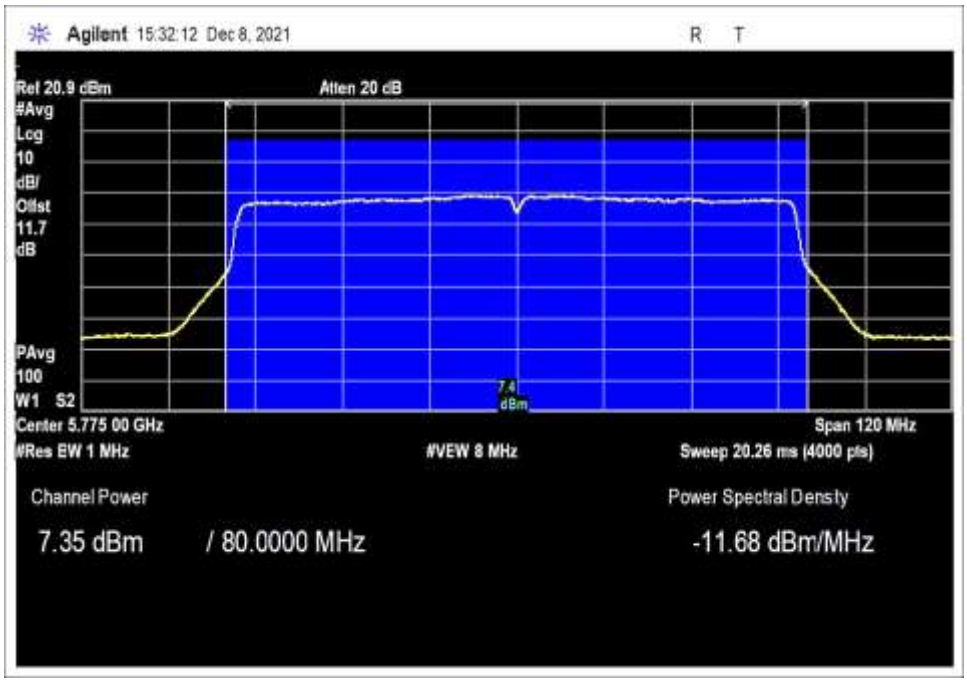


Low Channel

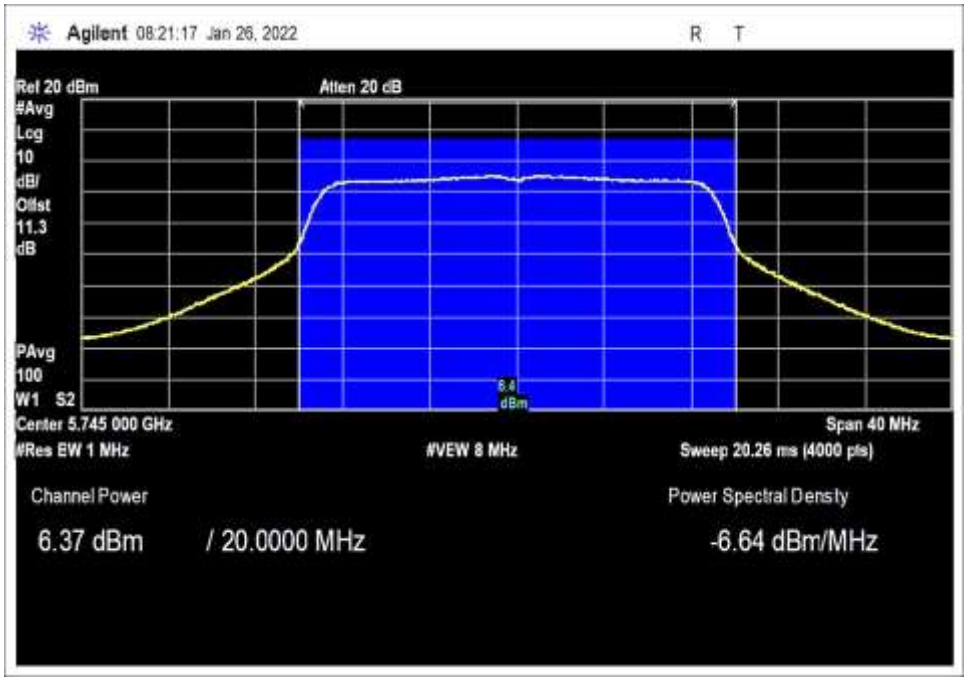


High Channel

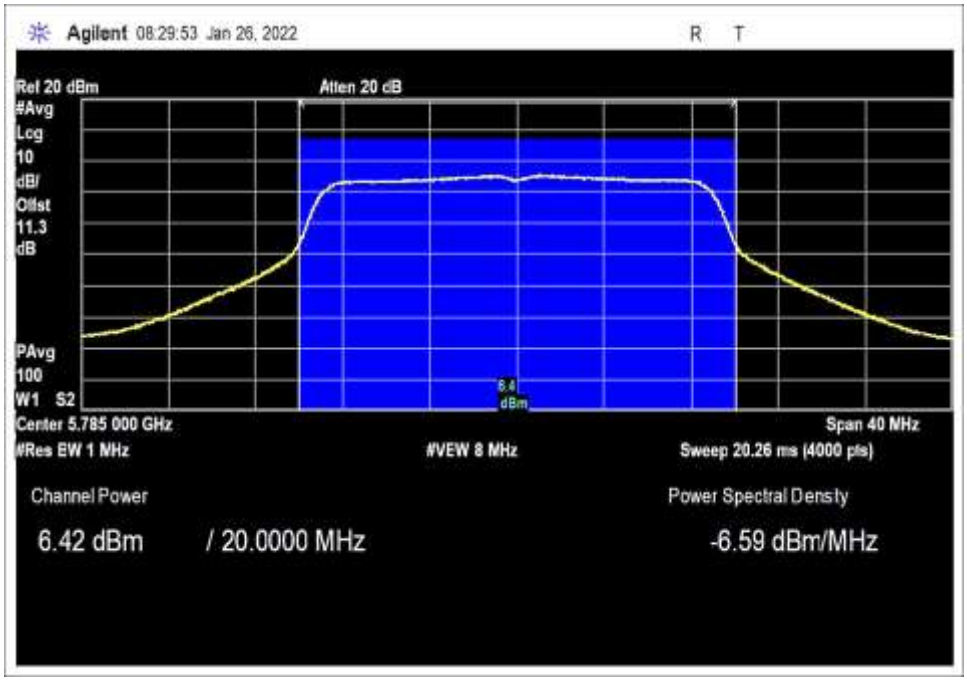
Chain 0 – HT80



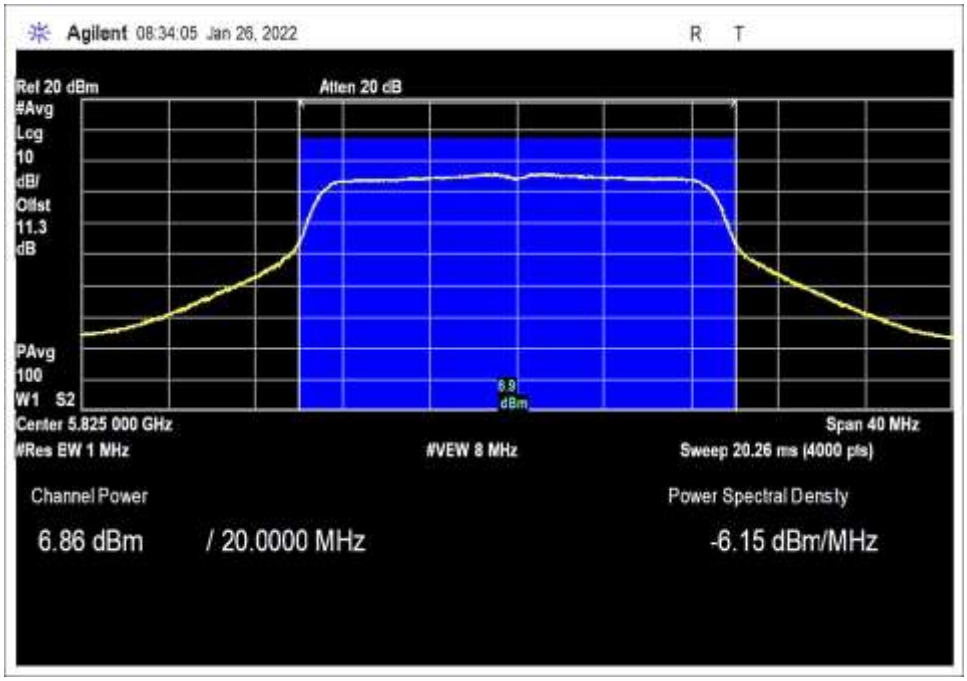
Chain 1 - OFDM



Low Channel

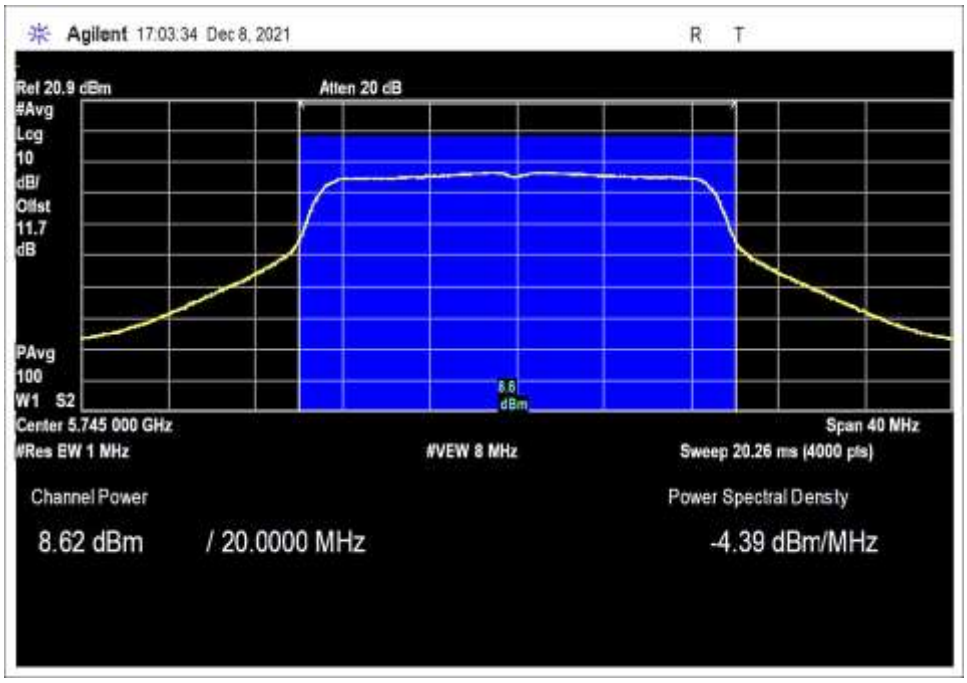


Middle Channel

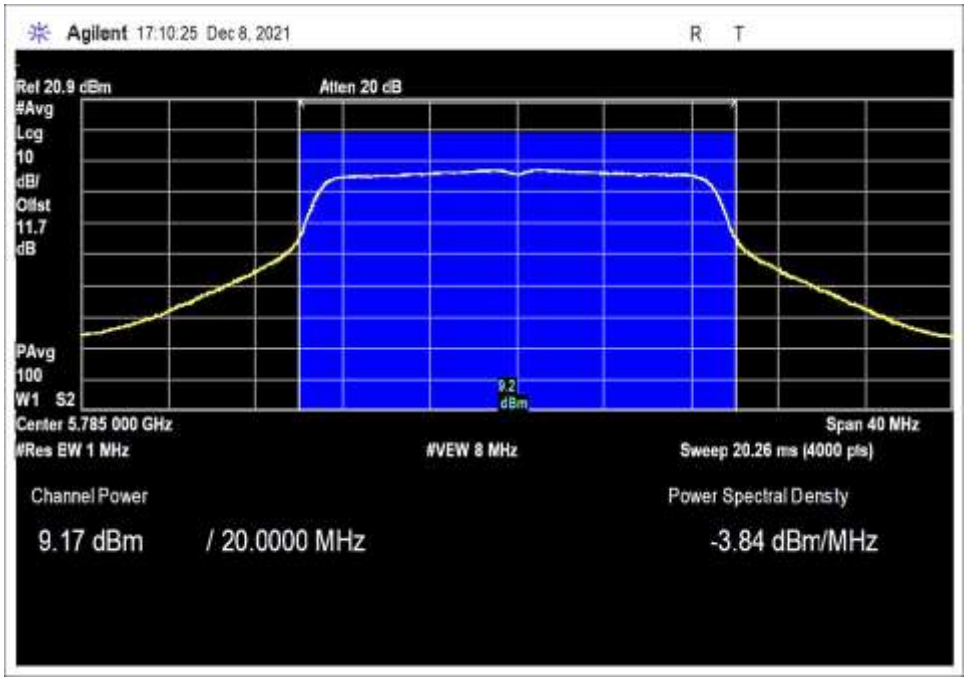


High Channel

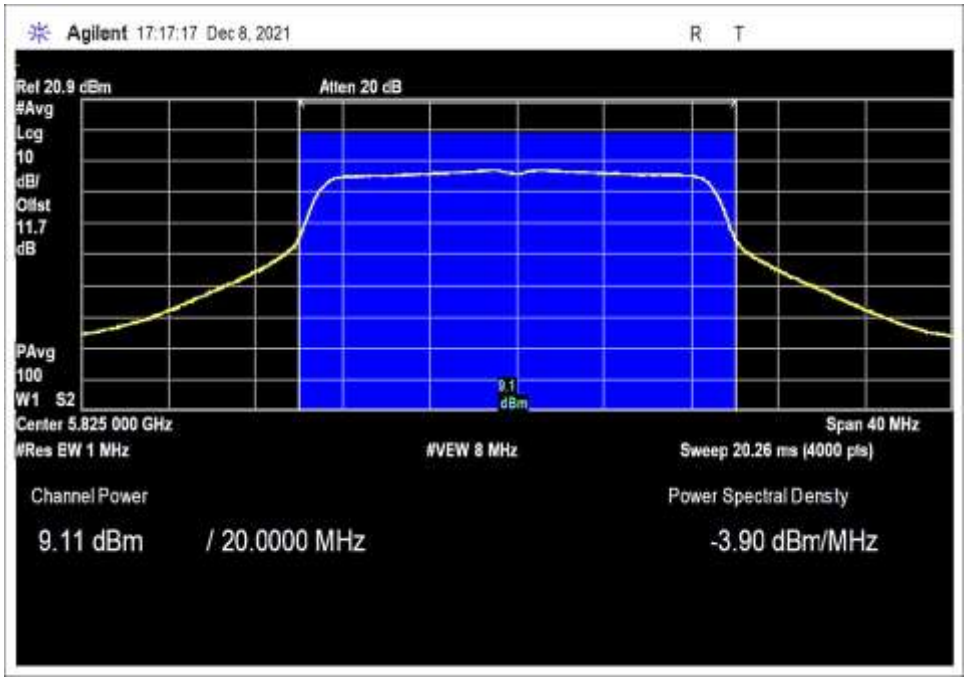
Chain 1 – HT20



Low Channel

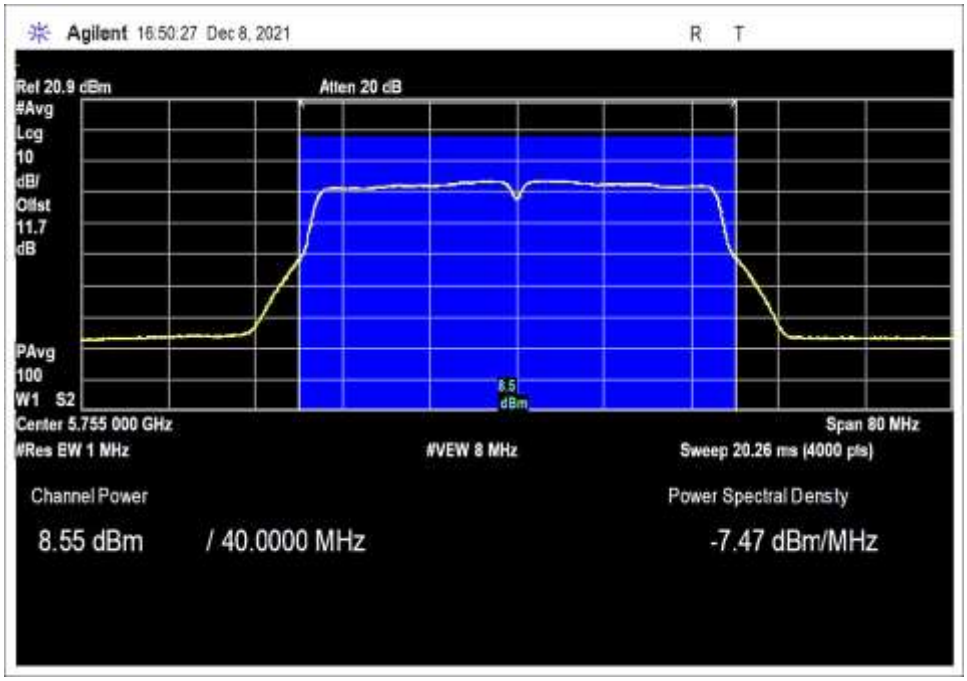


Middle Channel

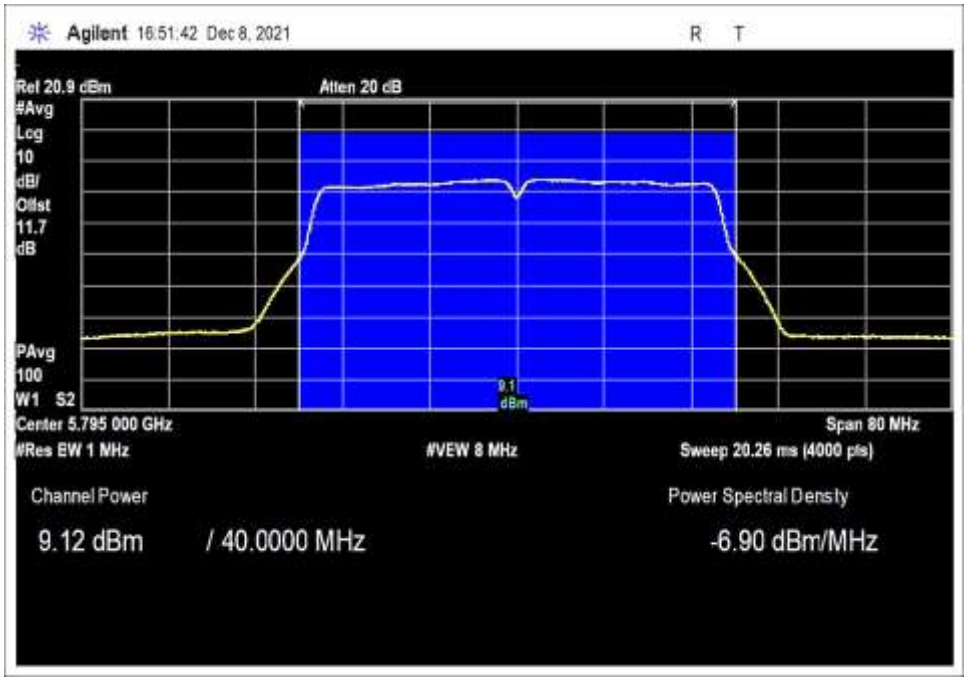


High Channel

Chain 1 – HT40

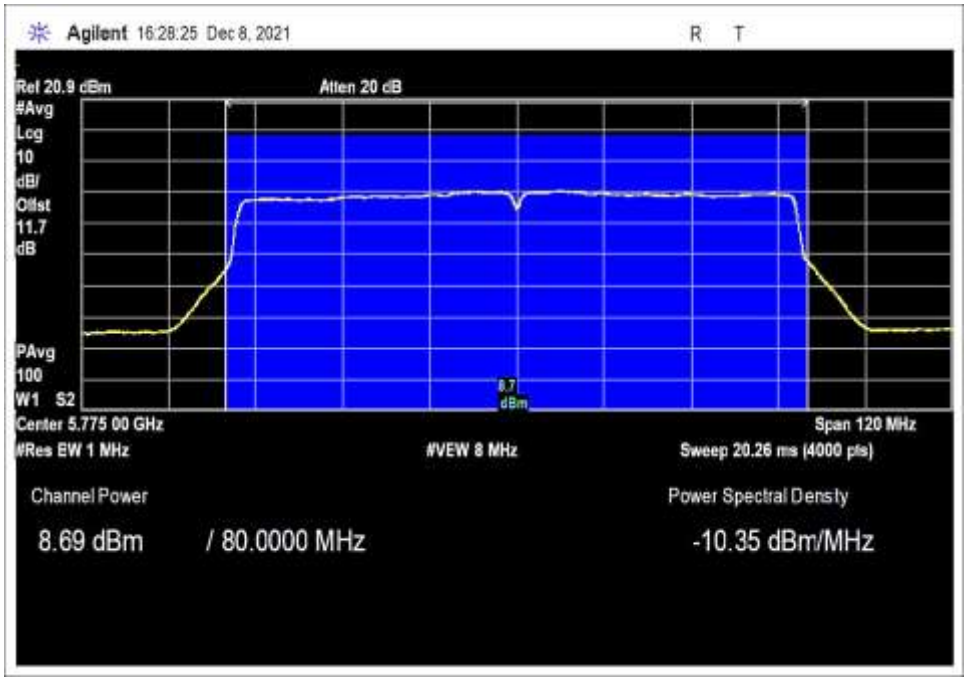


Low Channel



High Channel

Chain 1 – HT80



15.407(a) Power Spectral Density

Test Setup/Conditions - RF Conducted Measurement			
Test Location:	Bothell Lab C3	Test Engineer:	Hoang Cao
Test Method:	ANSI C63.10 (2013), KDB 789033	Test Date(s):	12/8/2021
Configuration:	9		
Test Setup:	The EUT is placed non-conducted table. It is operated as intended. It is connected straight to a Spectrum Analyzer.		

Environmental Conditions			
Temperature (ºC)	22.5	Relative Humidity (%):	45

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
03360	Cable	Astrolab	32022-2-29094-36TC	4/9/2020	4/9/2022
P06239	Attenuator	Weinschel	54A-10	6/17/2020	6/17/2022
03471	Spectrum Analyzer	Agilent	E4440A	2/11/2020	2/11/2022

Test Data Summary - RF Conducted Measurement – Chain 0					
Measurement Option: AVGSA-1					
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Measured (dBm/500kHz)**	**Limit (dBm/500kHz)**	**Results**
5745	OFDM	External 4.00dBi	-3.933	≤30	Pass
5785	OFDM	External 4.00dBi	-3.661	≤30	Pass
5825	OFDM	External 4.00dBi	-3.416	≤30	Pass
5745	HT20	External 4.00dBi	-6.575	≤30	Pass
5785	HT20	External 4.00dBi	-6.915	≤30	Pass
5825	HT20	External 4.00dBi	-6.683	≤30	Pass
5755	HT40	External 4.00dBi	-9.602	≤30	Pass
5795	HT40	External 4.00dBi	-9.595	≤30	Pass
5775	HT80	External 4.00dBi	-12.873	≤30	Pass

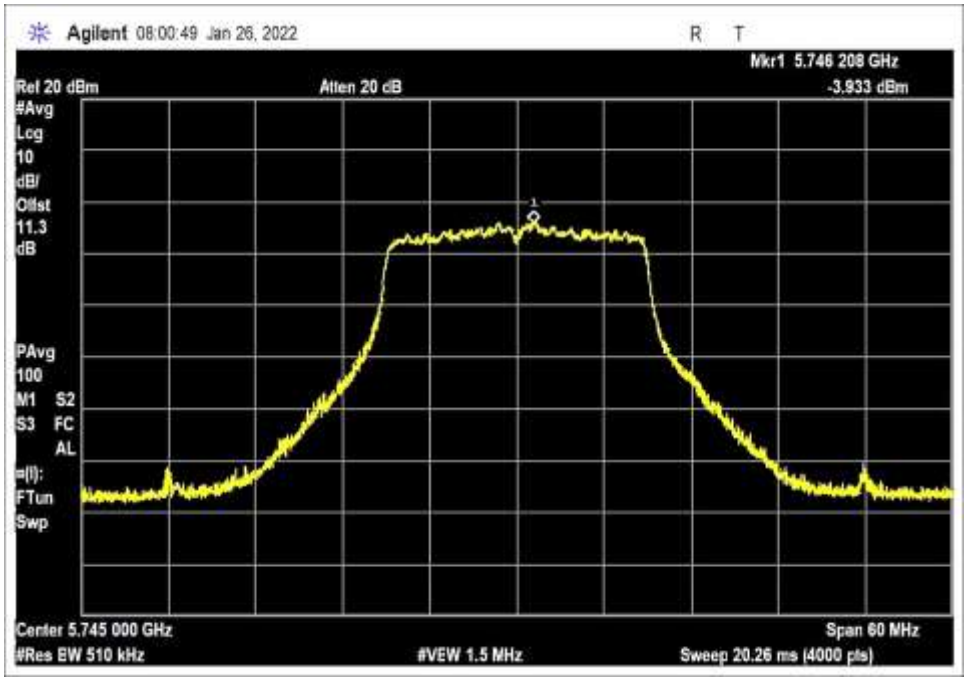
Test Data Summary - RF Conducted Measurement – Chain 1					
Measurement Option: AVGSA-1					
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Measured (dBm/500kHz)**	**Limit (dBm/500kHz)**	**Results**
5745	OFDM	External 4.00dBi	-2.567	≤30	Pass
5785	OFDM	External 4.00dBi	-2.591	≤30	Pass
5825	OFDM	External 4.00dBi	-2.133	≤30	Pass
5745	HT20	External 4.00dBi	-5.399	≤30	Pass
5785	HT20	External 4.00dBi	-4.879	≤30	Pass
5825	HT20	External 4.00dBi	-4.823	≤30	Pass
5755	HT40	External 4.00dBi	-8.381	≤30	Pass
5795	HT40	External 4.00dBi	-7.962	≤30	Pass
5775	HT80	External 4.00dBi	-11.613	≤30	Pass

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

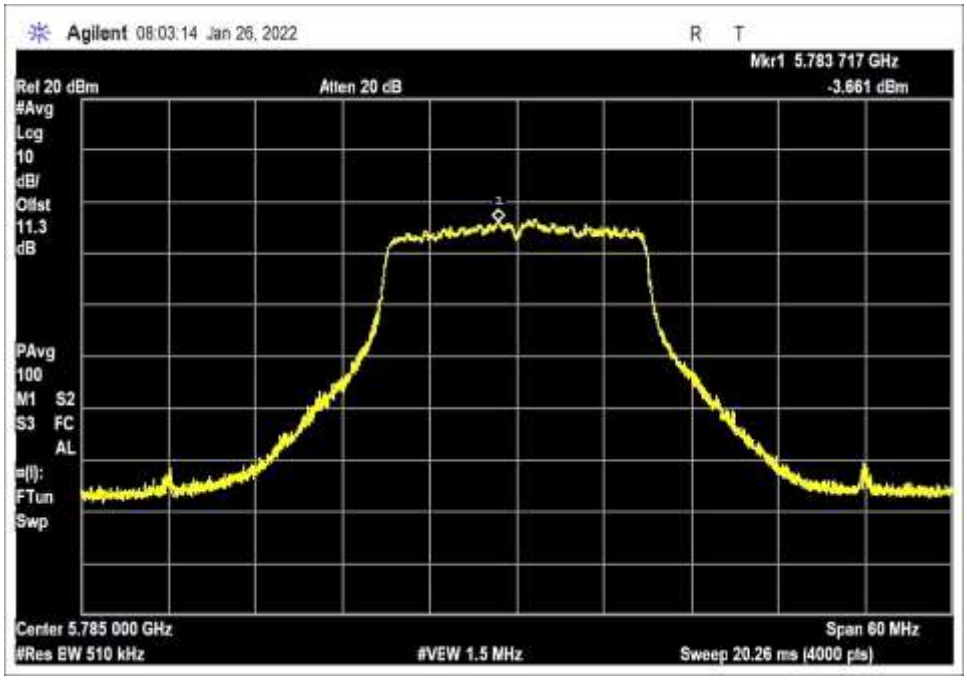
$$Limit = 30 - Roundup(G - 6)$$

Plot Data – RF Conducted Measurement

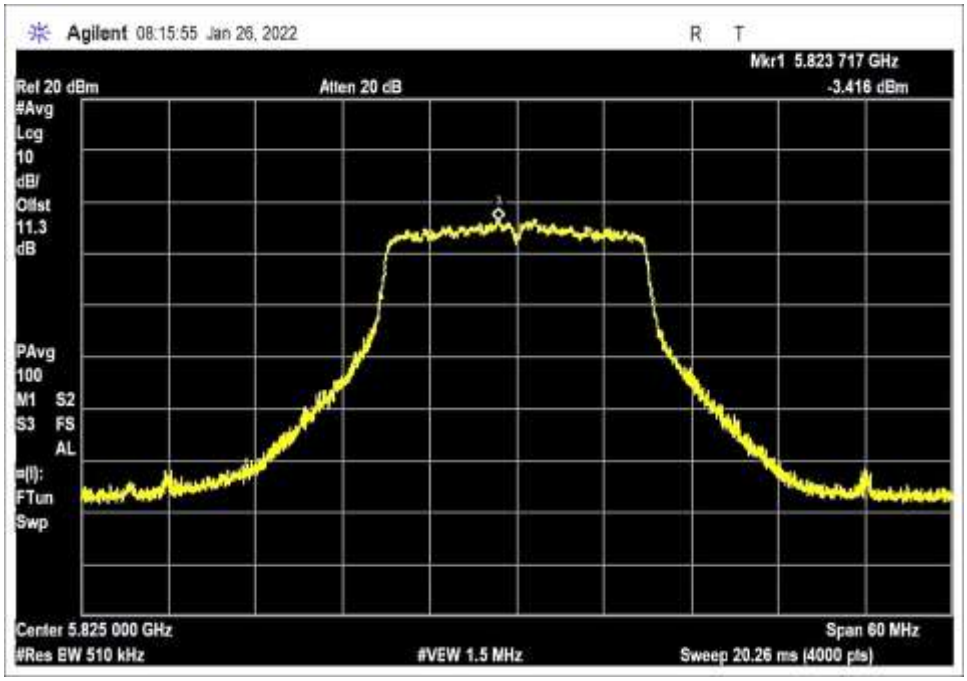
Chain 0 - OFDM



Low Channel

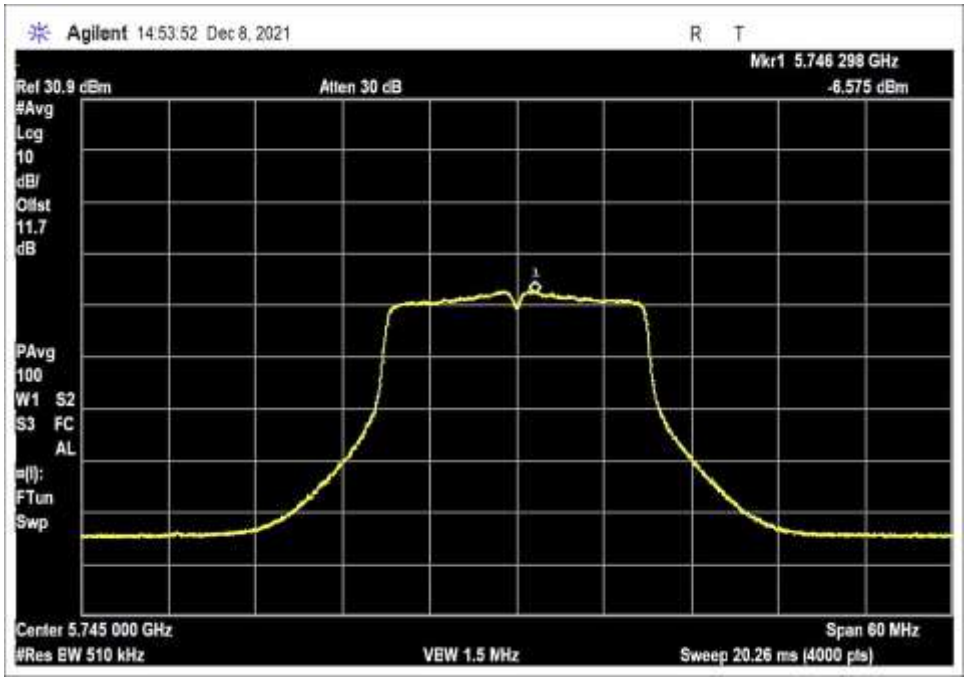


Middle Channel

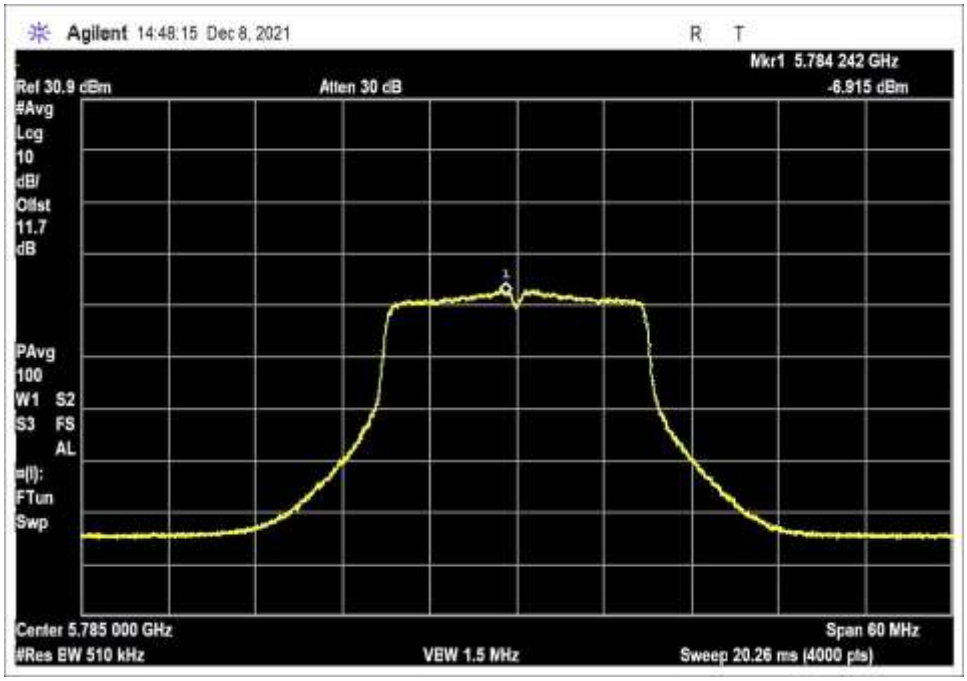


High Channel

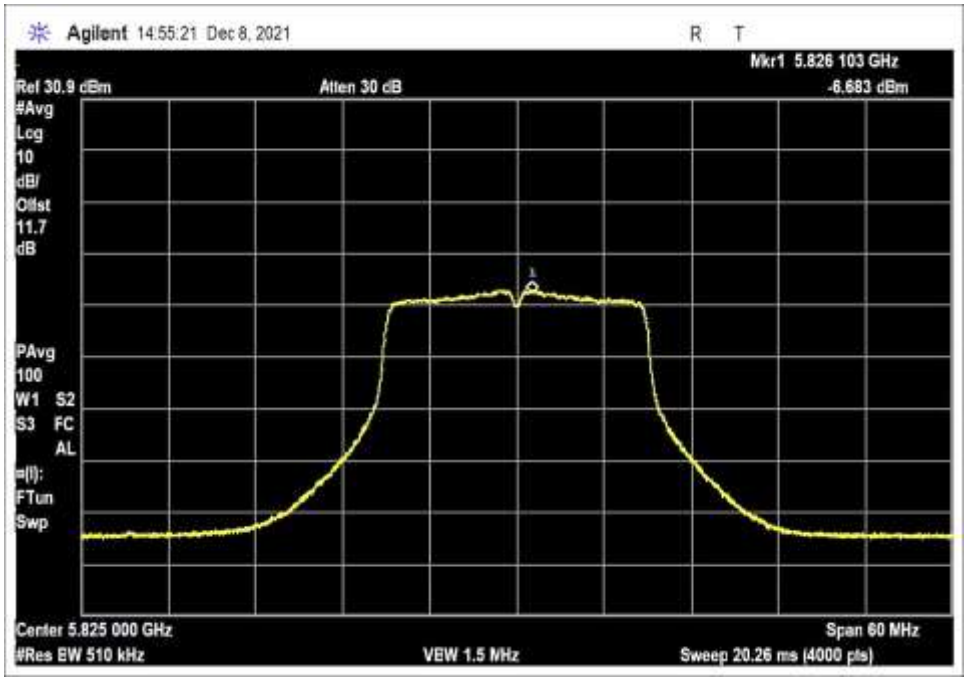
Chain 0 – HT20



Low Channel

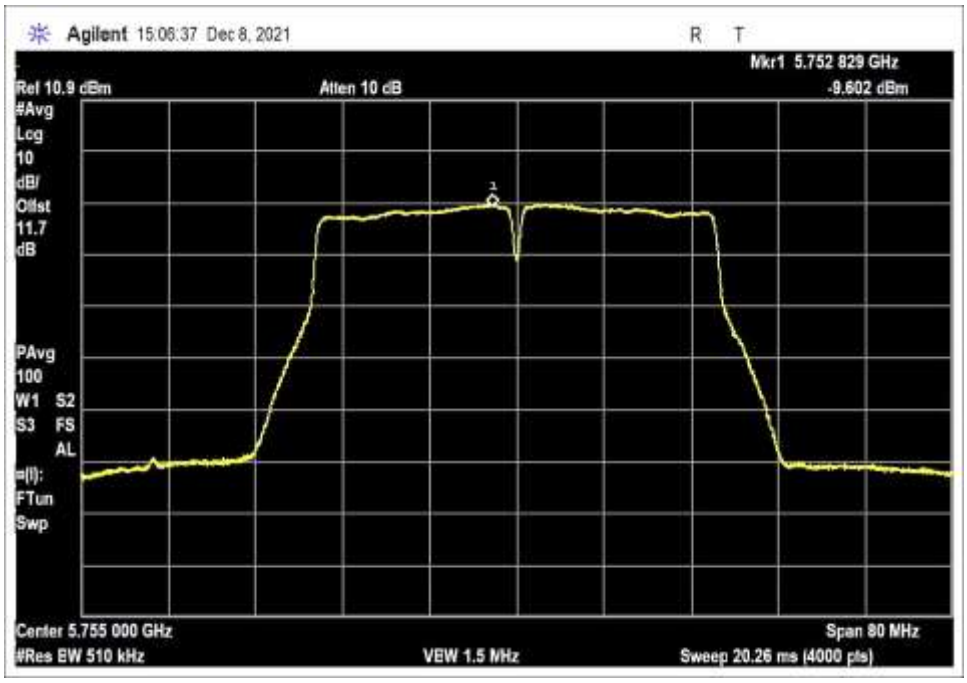


Middle Channel

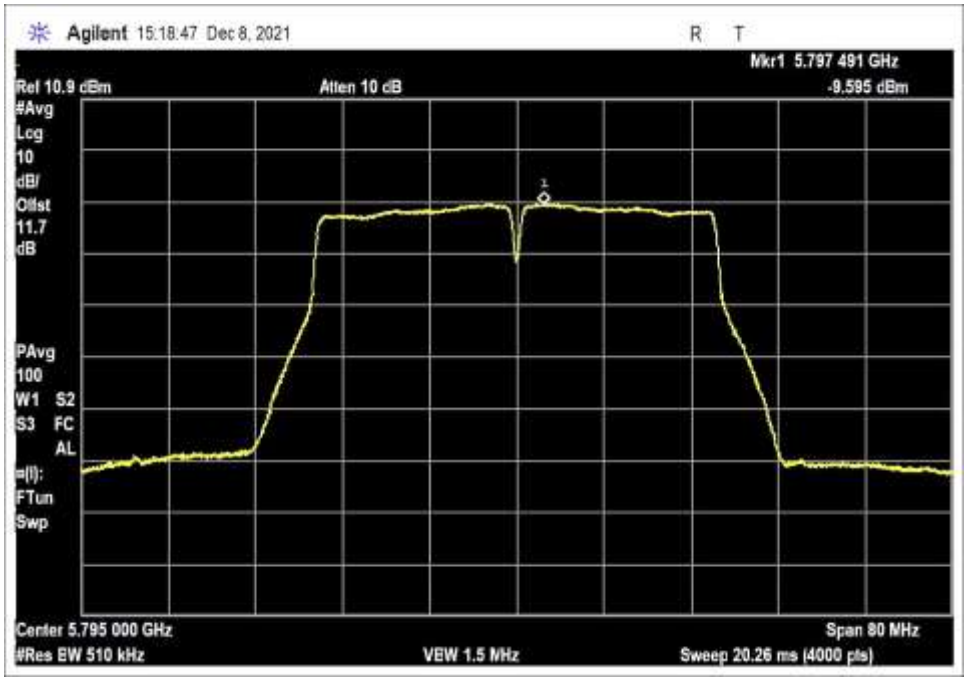


High Channel

Chain 0 – HT40

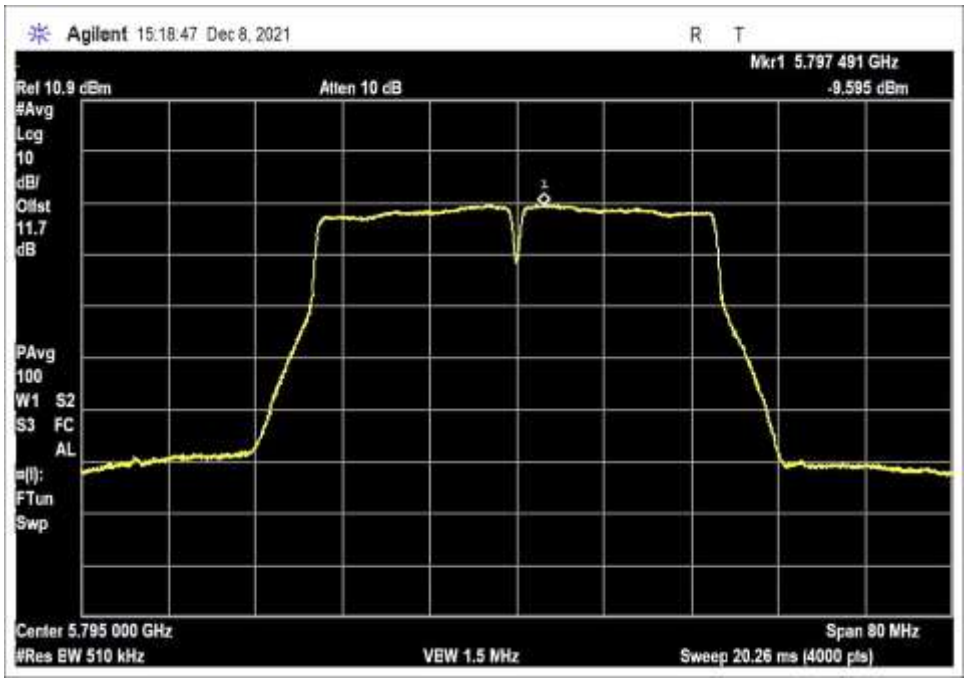


Low Channel

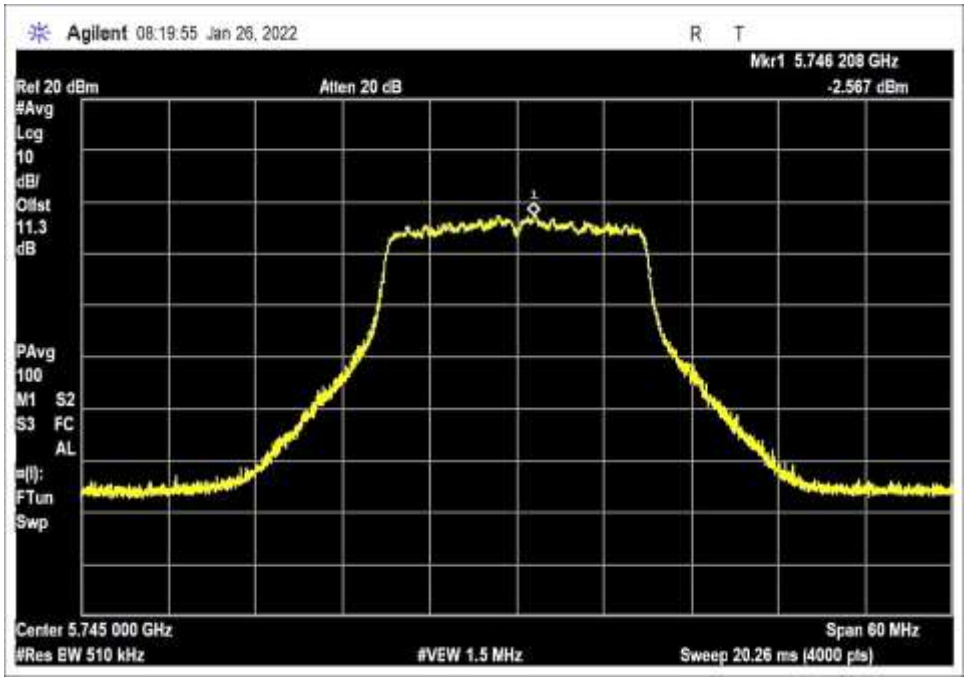


High Channel

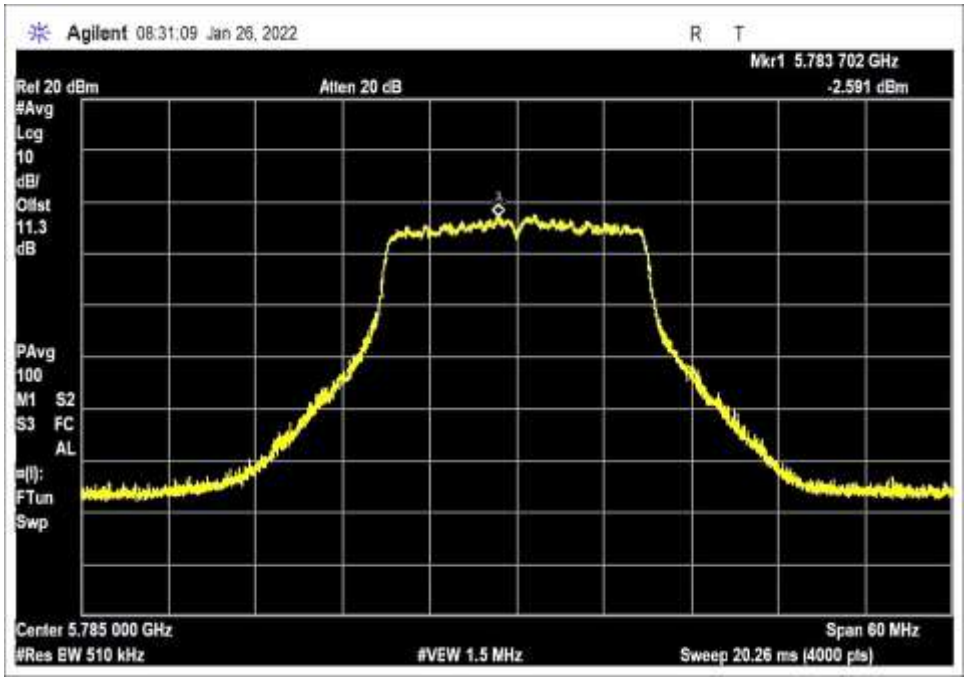
Chain 0 – HT80



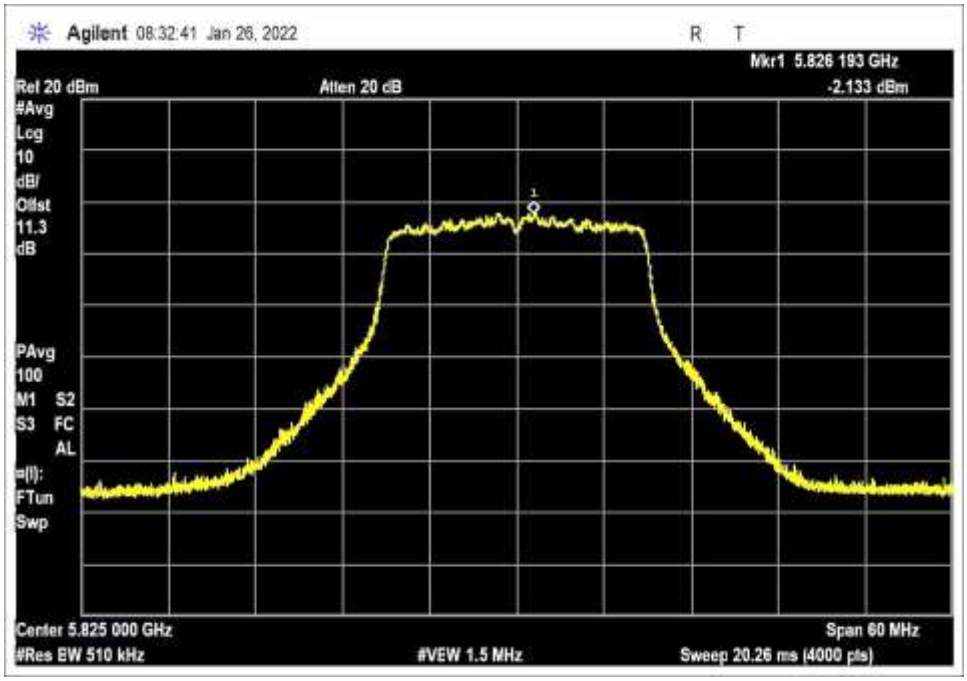
Chain 1 - OFDM



Low Channel

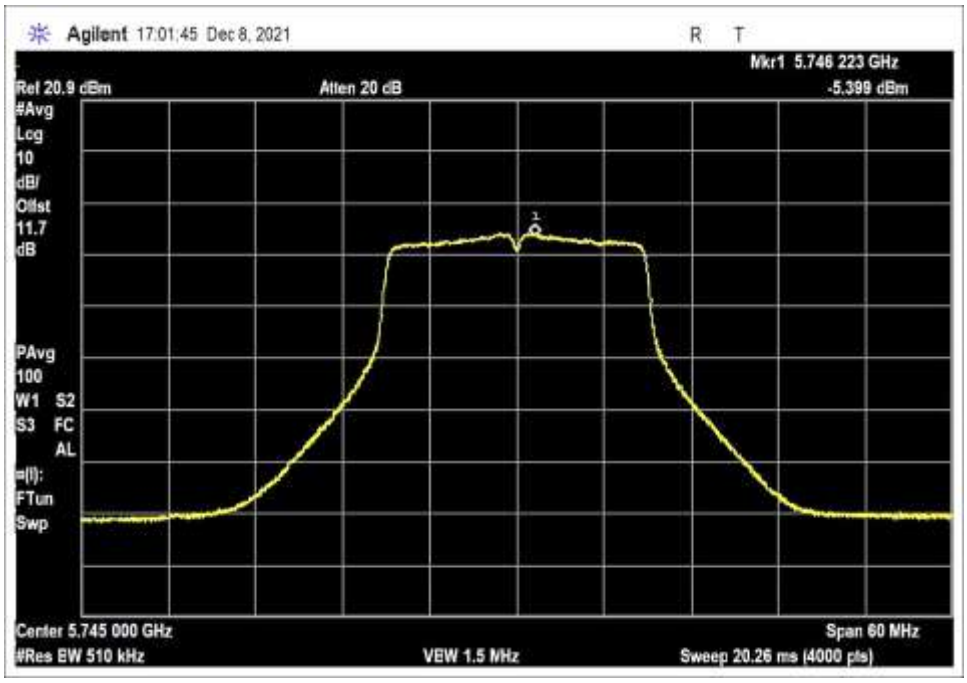


Middle Channel

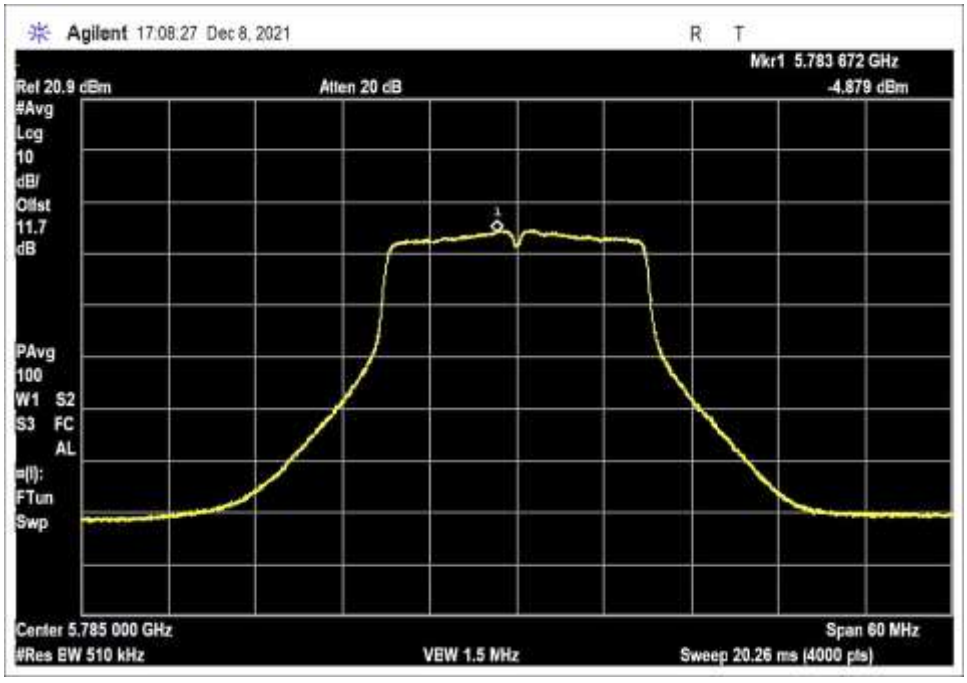


High Channel

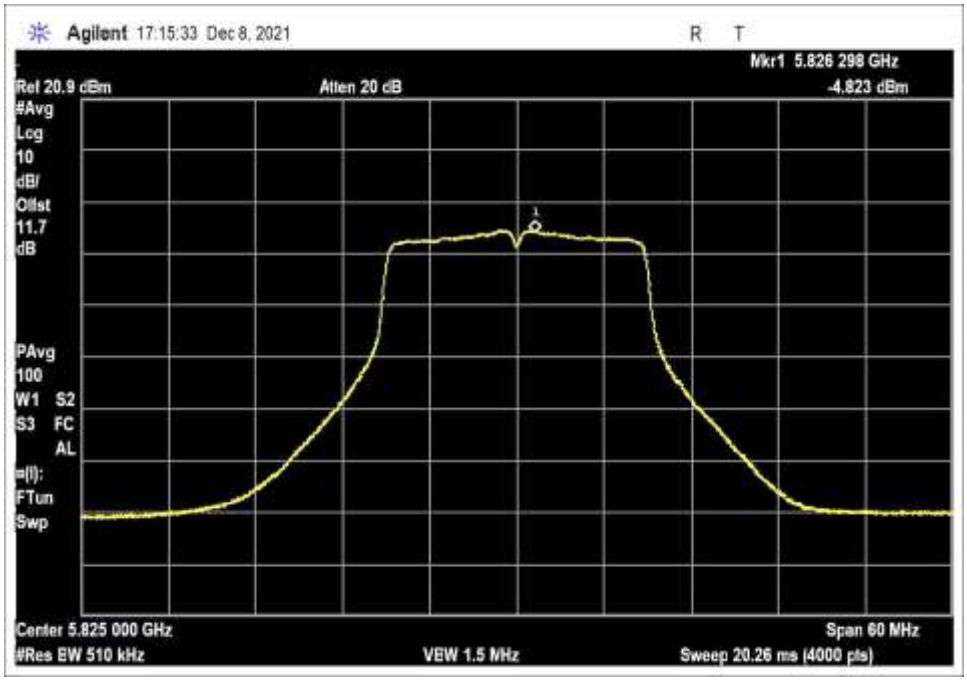
Chain 1 – HT20



Low Channel

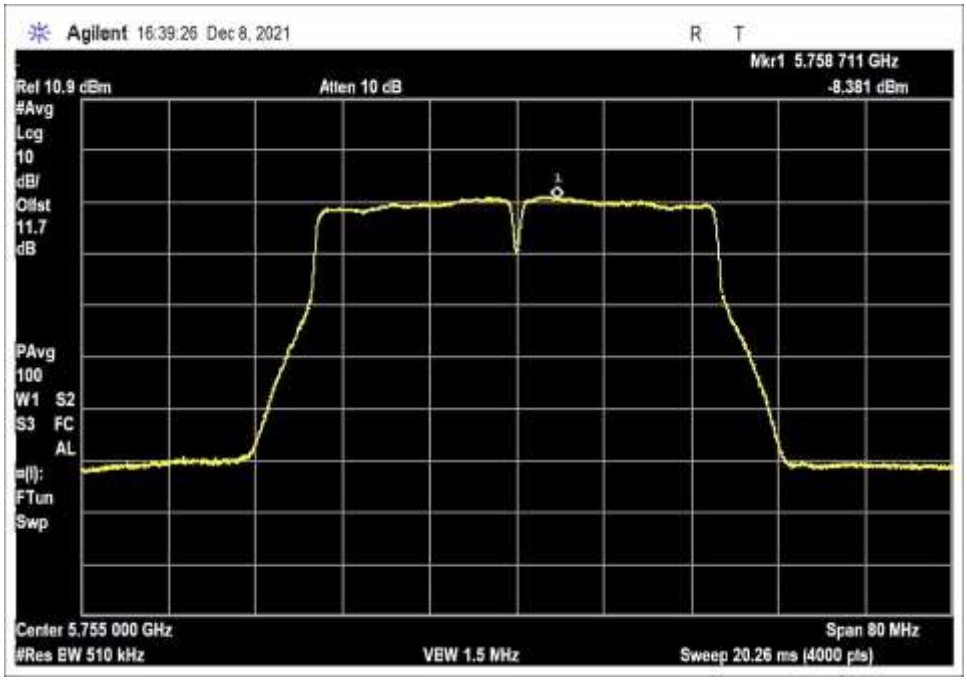


Middle Channel

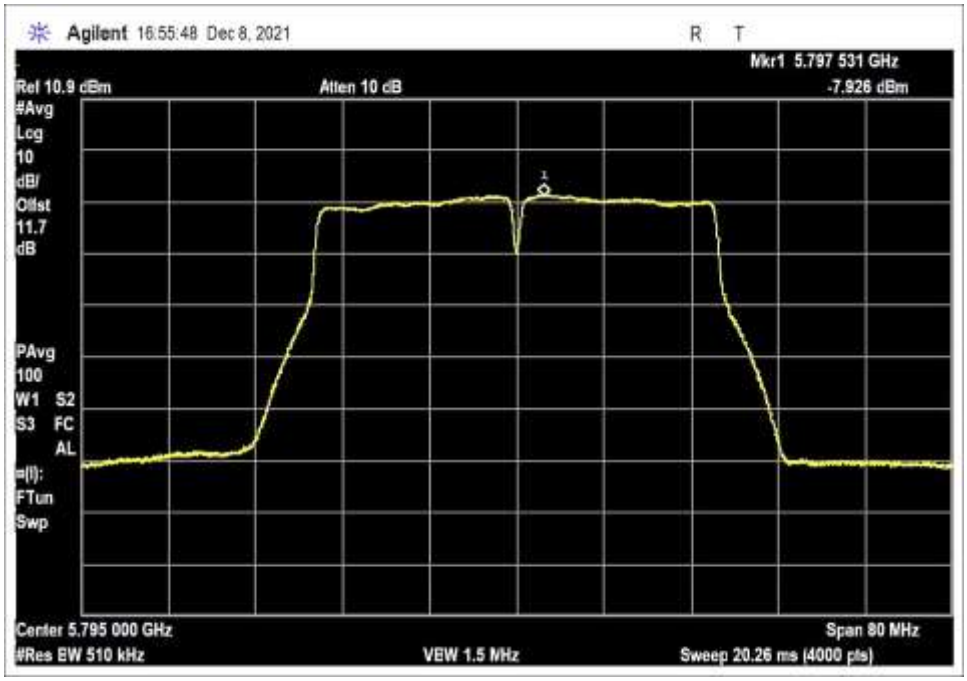


High Channel

Chain 1 – HT40

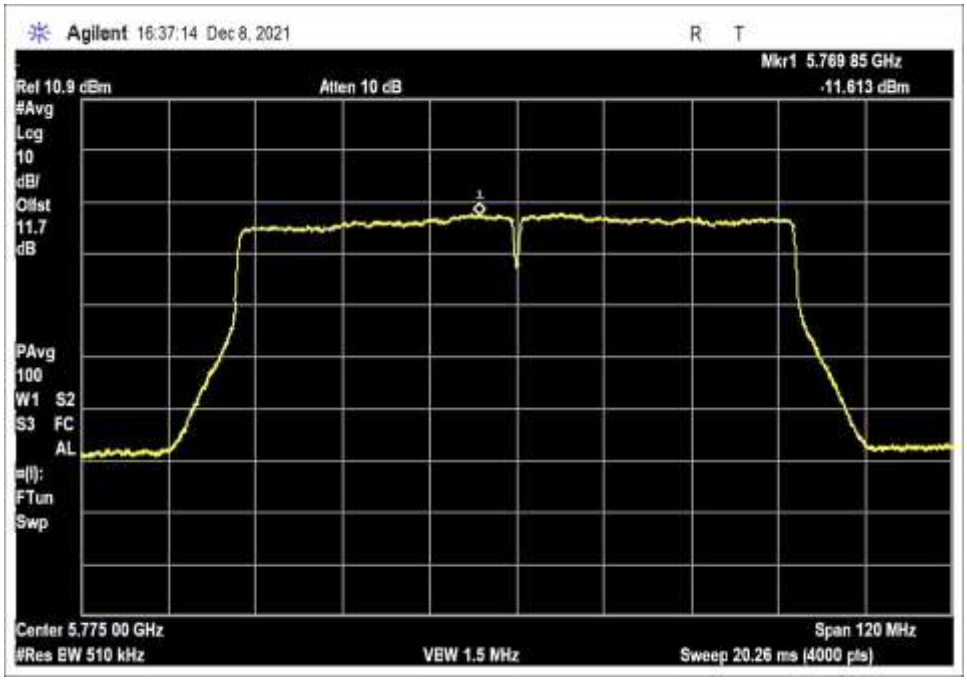


Low Channel



High Channel

Chain 1 – HT80



15.407(b) Radiated Emissions & Band Edge

Test Data

Note: Chain 0 is the worst case based on the investigation on RF output power before measuring Radiated Spurious Emission.

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.209 Radiated Emissions**		
Work Order #:	**105488**	Date:	12/19/2021
Test Type:	**Radiated Scan**	Time:	9:43:54 AM
Tested By:	Randy Clark	Sequence#:	70
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Radiated Emission
Frequency Range: 9kHz to 1GHz

Environmental Conditions:
Temperature: 18.7°C
Humidity: 36%
Atmospheric Pressure: 101.9kPa

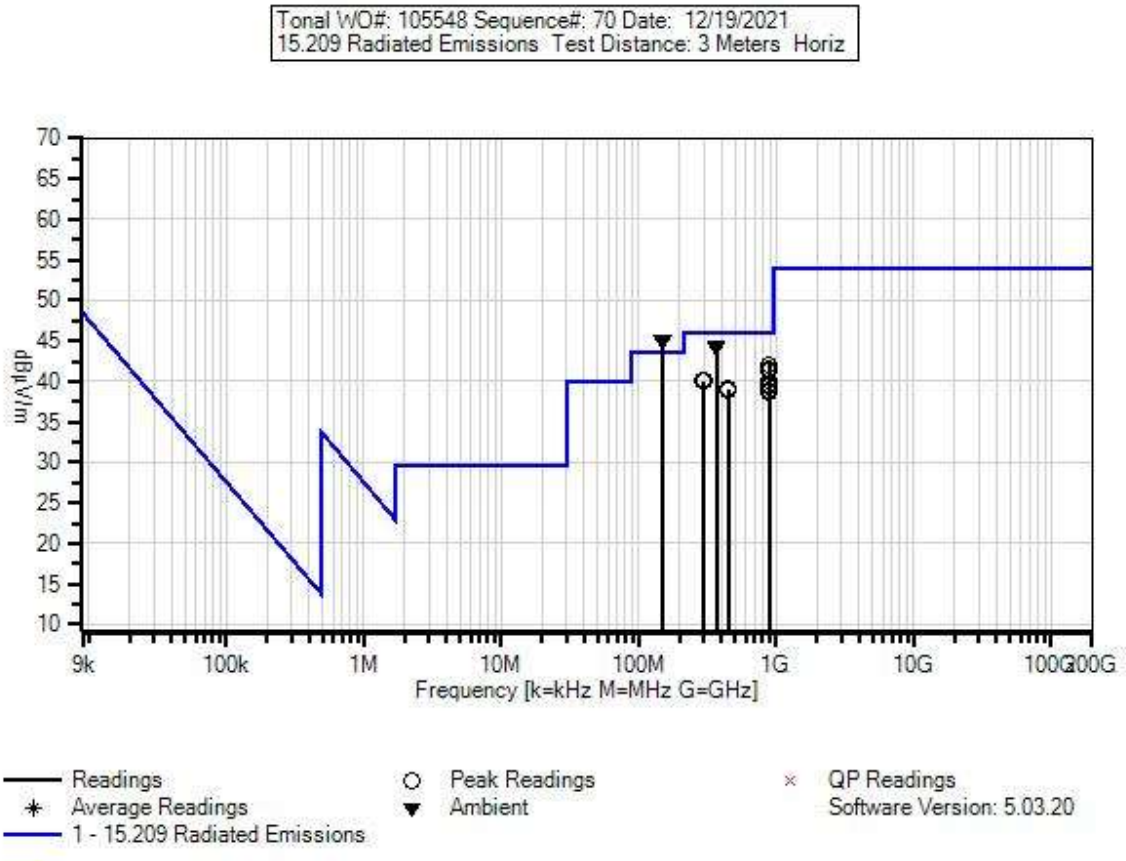
Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi is set to 5785 MHz with nonHT modulation type, 11MBPS at power level 10, chain 0 with repeating pattern of 0s and 1s with duty cycle at 98%.
Operational mode is representative of worst case.

Measurements marked as Unintentional have been evaluated with radios turned off and determined not to be radio emissions. Indicated emissions are ignored for the purposes of this report.

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.
No emissions from EUT has been found in 20dB tolerance in the frequency range 9kHz to 30MHz.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07508	Preamp	310N	7/9/2020	7/9/2022
T2	AN00852	Biconilog Antenna	CBL 6111C	4/14/2020	4/14/2022
T3	ANP06049	Attenuator	PE7002-6	5/11/2020	5/11/2022
T4	ANP01187	Cable	CNT-195	7/6/2020	7/6/2022
T5	ANP06691	Cable	PE3062-180	3/25/2020	3/25/2022
T6	ANP06694	Cable	PE3062-480	3/25/2020	3/25/2022
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
	AN00432	Loop Antenna	6502	7/19/2021	7/19/2023

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

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	147.480M	58.1	-32.0	+11.5	+5.9	+0.2	+0.0	45.2	43.5	+1.7	Horiz
	Ambient		+0.4	+1.1					Unintentional Emissions		
2	149.402M	58.1	-32.0	+11.5	+5.9	+0.2	+0.0	45.2	43.5	+1.7	Horiz
	Ambient		+0.4	+1.1					Unintentional Emissions		
3	372.104M	52.3	-31.9	+15.1	+6.0	+0.4	+0.0	44.5	46.0	-1.5	Horiz
	Ambient		+0.7	+1.9					Unintentional Emissions		
4	370.302M	52.0	-31.9	+15.0	+6.0	+0.4	+0.0	44.1	46.0	-1.9	Horiz
	Ambient		+0.7	+1.9					Unintentional Emissions		
5	885.377M	39.4	-31.4	+23.1	+5.9	+0.7	+0.0	42.1	46.0	-3.9	Horiz
			+1.2	+3.2							
6	884.536M	38.9	-31.4	+23.1	+5.9	+0.7	+0.0	41.6	46.0	-4.4	Horiz
			+1.2	+3.2							
7	888.740M	38.7	-31.4	+23.1	+5.9	+0.7	+0.0	41.4	46.0	-4.6	Horiz
			+1.2	+3.2							
8	893.305M	38.5	-31.4	+23.2	+5.9	+0.7	+0.0	41.3	46.0	-4.7	Horiz
			+1.2	+3.2							
9	897.269M	37.2	-31.4	+23.2	+5.9	+0.7	+0.0	40.0	46.0	-6.0	Horiz
			+1.2	+3.2							
10	295.107M	50.2	-31.9	+13.1	+6.0	+0.4	+0.0	40.0	46.0	-6.0	Horiz
			+0.6	+1.6							
11	299.071M	50.1	-31.9	+13.2	+6.0	+0.4	+0.0	40.0	46.0	-6.0	Horiz
			+0.6	+1.6							
12	887.419M	37.3	-31.4	+23.1	+5.9	+0.7	+0.0	40.0	46.0	-6.0	Horiz
			+1.2	+3.2							
13	896.668M	36.9	-31.4	+23.2	+5.9	+0.7	+0.0	39.7	46.0	-6.3	Horiz
			+1.2	+3.2							
14	890.062M	36.7	-31.4	+23.1	+5.9	+0.7	+0.0	39.4	46.0	-6.6	Horiz
			+1.2	+3.2							
15	448.501M	44.7	-31.9	+17.0	+5.9	+0.5	+0.0	39.1	46.0	-6.9	Horiz
			+0.8	+2.1							
16	446.699M	44.7	-31.9	+16.9	+5.9	+0.5	+0.0	39.0	46.0	-7.0	Horiz
			+0.8	+2.1							
17	895.107M	36.2	-31.4	+23.2	+5.9	+0.7	+0.0	39.0	46.0	-7.0	Horiz
			+1.2	+3.2							
18	895.948M	35.9	-31.4	+23.2	+5.9	+0.7	+0.0	38.7	46.0	-7.3	Horiz
			+1.2	+3.2							

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.209 Radiated Emissions**		
Work Order #:	**105488**	Date:	12/19/2021
Test Type:	**Radiated Scan**	Time:	10:02:31 AM
Tested By:	Randy Clark	Sequence#:	71
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Radiated Emission
Frequency Range: 9kHz to 1GHz

Environmental Conditions:
Temperature: 18.7°C
Humidity: 36%
Atmospheric Pressure: 101.9kPa

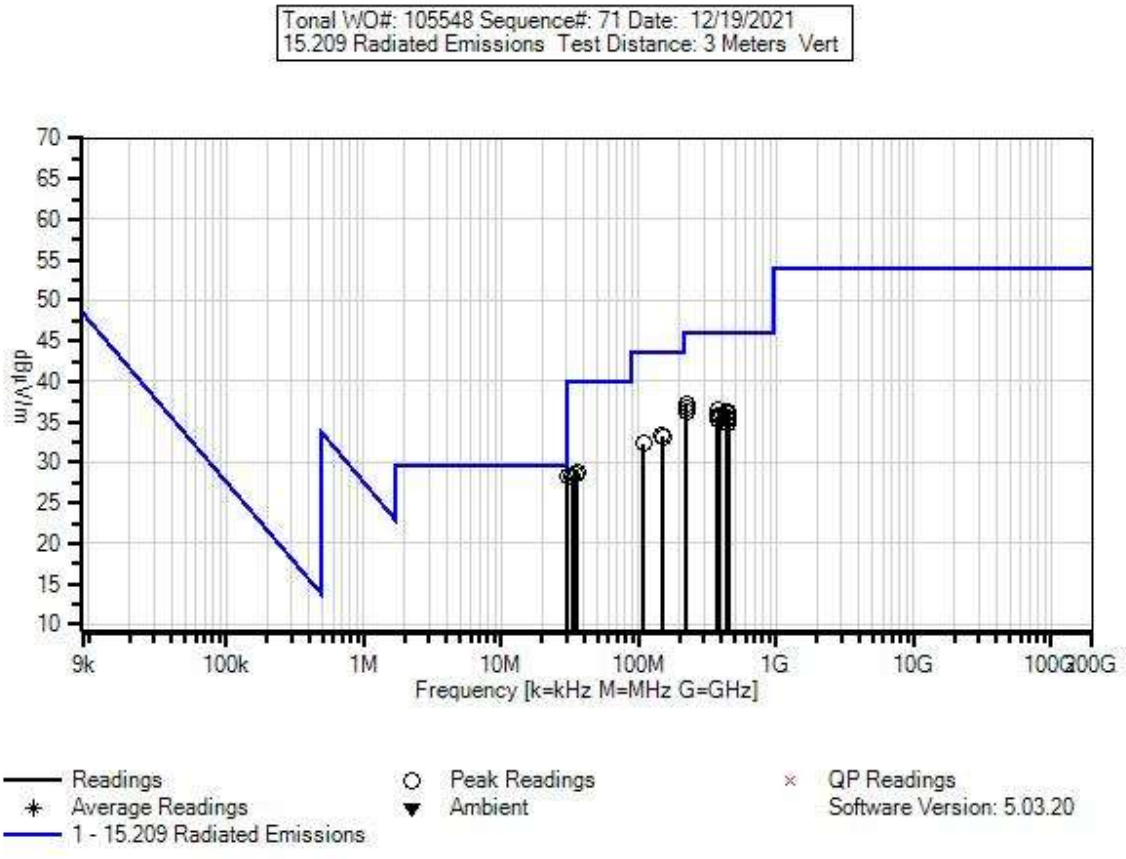
Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi is set to 5785 MHz with nonHT modulation type, 11MBPS at power level 10, chain 0 with repeating pattern of 0s and 1s with duty cycle at 98%.
Operational mode is representative of worst case.

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.

No emissions from EUT has been found in 20dB tolerance in the frequency range 9kHz to 30MHz.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07508	Preamp	310N	7/9/2020	7/9/2022
T2	AN00852	Biconilog Antenna	CBL 6111C	4/14/2020	4/14/2022
T3	ANP06049	Attenuator	PE7002-6	5/11/2020	5/11/2022
T4	ANP01187	Cable	CNT-195	7/6/2020	7/6/2022
T5	ANP06691	Cable	PE3062-180	3/25/2020	3/25/2022
T6	ANP06694	Cable	PE3062-480	3/25/2020	3/25/2022
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
	AN00432	Loop Antenna	6502	7/19/2021	7/19/2023

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

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	223.876M	50.1	-31.9 +0.5	+10.9 +1.4	+5.9	+0.3	+0.0	37.2	46.0	-8.8	Vert
2	222.194M	49.7	-31.9 +0.5	+10.8 +1.4	+5.9	+0.3	+0.0	36.7	46.0	-9.3	Vert
3	379.552M	44.2	-31.9 +0.7	+15.2 +1.9	+6.0	+0.4	+0.0	36.5	46.0	-9.5	Vert
4	446.579M	42.0	-31.9 +0.8	+16.9 +2.1	+5.9	+0.5	+0.0	36.3	46.0	-9.7	Vert
5	224.236M	49.1	-31.9 +0.5	+10.9 +1.4	+5.9	+0.3	+0.0	36.2	46.0	-9.8	Vert
6	448.621M	41.7	-31.9 +0.8	+17.0 +2.1	+5.9	+0.5	+0.0	36.1	46.0	-9.9	Vert
7	147.480M	46.2	-32.0 +0.4	+11.5 +1.1	+5.9	+0.2	+0.0	33.3	43.5	-10.2	Vert
8	380.152M	43.4	-31.9 +0.7	+15.3 +1.9	+6.0	+0.4	+0.0	35.8	46.0	-10.2	Vert
9	384.597M	43.2	-31.9 +0.7	+15.4 +1.9	+6.0	+0.4	+0.0	35.7	46.0	-10.3	Vert
10	149.402M	46.0	-32.0 +0.4	+11.5 +1.1	+5.9	+0.2	+0.0	33.1	43.5	-10.4	Vert
11	444.537M	41.2	-31.9 +0.8	+16.9 +2.1	+5.9	+0.5	+0.0	35.5	46.0	-10.5	Vert
12	375.828M	43.0	-31.9 +0.7	+15.2 +1.9	+6.0	+0.4	+0.0	35.3	46.0	-10.7	Vert
13	447.780M	40.8	-31.9 +0.8	+17.0 +2.1	+5.9	+0.5	+0.0	35.2	46.0	-10.8	Vert
14	448.140M	40.5	-31.9 +0.8	+17.0 +2.1	+5.9	+0.5	+0.0	34.9	46.0	-11.1	Vert
15	35.989M	38.3	-32.0 +0.2	+16.0 +0.4	+5.9	+0.0	+0.0	28.8	40.0	-11.2	Vert
16	107.960M	46.1	-32.0 +0.3	+11.0 +0.9	+5.9	+0.1	+0.0	32.3	43.5	-11.2	Vert
17	34.725M	37.4	-32.0 +0.2	+16.7 +0.4	+5.9	+0.0	+0.0	28.6	40.0	-11.4	Vert
18	30.466M	35.5	-32.1 +0.2	+18.5 +0.4	+5.9	+0.0	+0.0	28.4	40.0	-11.6	Vert
19	30.200M	35.3	-32.1 +0.2	+18.6 +0.4	+5.9	+0.0	+0.0	28.3	40.0	-11.7	Vert
20	32.862M	36.4	-32.1 +0.2	+17.5 +0.4	+5.9	+0.0	+0.0	28.3	40.0	-11.7	Vert

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.407(b)(4) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105488**	Date:	12/21/2021
Test Type:	**Radiated Scan**	Time:	19:48:27
Tested By:	Hoang Cao	Sequence#:	155
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Radiated Emission
Frequency Range: 1 to 40GHz

Environmental Conditions:
Temperature: 22.6°C
Humidity: 33%
Atmospheric Pressure: 101.8kPa

Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi transmitting continuously with modulation type as listed with pattern of 0s and 1s at power level 10.
MIMO not enabled, manufacturer declares chain 0 and chain 1 transmit uncorrelated data.
Chain 0

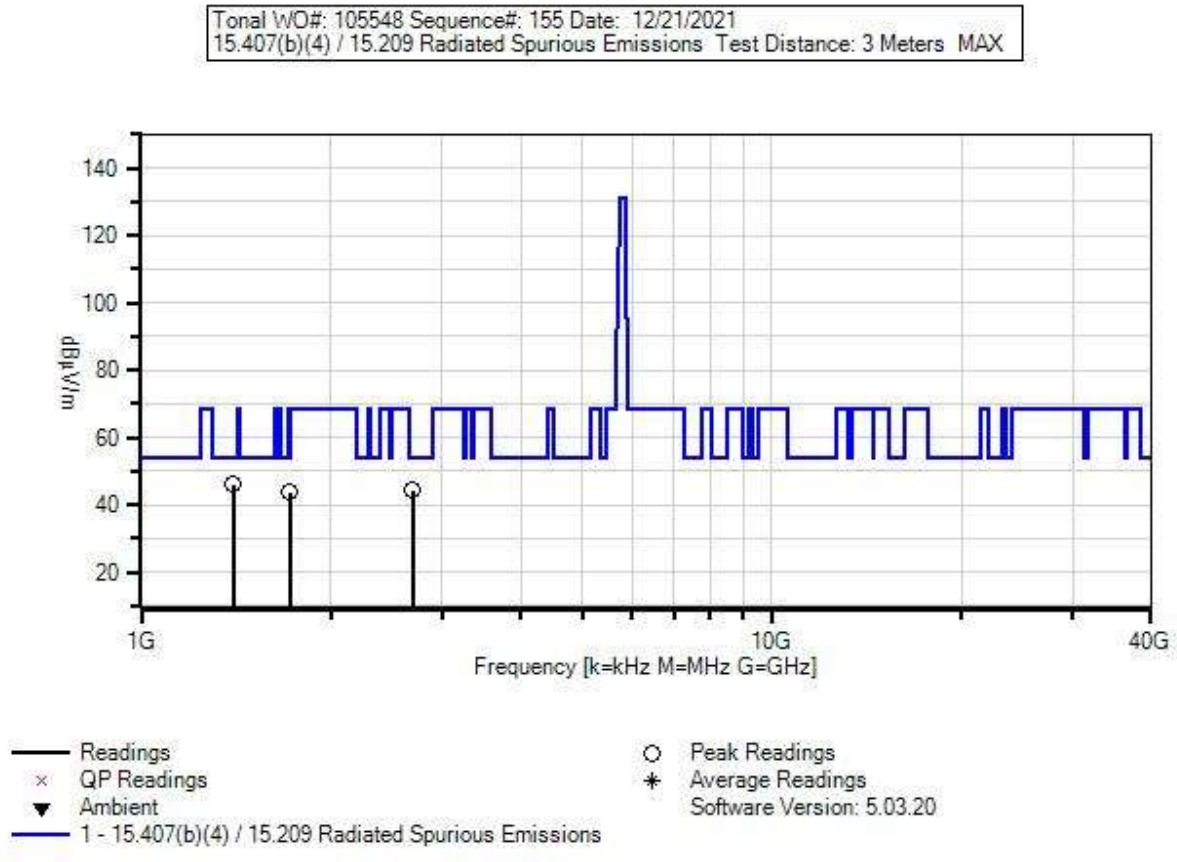
Operational mode is representative of worst case.

UNII3 - OFDM
Low Channel

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.

Support laptop included in this setup to control Wi-Fi operating mode; port is internal to the equipment for configuration only.
Unintentional emissions related to display and display controller increased due to external cable to laptop.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T1	AN02812	Preamp	83017-69004	9/22/2020	9/22/2022
T2	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T3	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T4	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T5	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
	AN02695	Active Horn Antenna	AMFW-5F-260400-33-8P	10/26/2021	10/26/2023
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP00930	Cable	various	1/9/2020	1/9/2022

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	1400.463M	49.2	-32.0 +0.6	+25.3	+0.9	+1.9	+0.0	45.9	54.0	-8.1	Vert
2	2696.316M	41.1	-30.5 +0.9	+28.8	+1.3	+2.7	+0.0	44.3	54.0	-9.7	Horiz
3	1721.694M	44.8	-31.4 +0.7	+26.4	+1.0	+2.1	+0.0	43.6	54.0	-10.4	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.407(b)(4) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105488**	Date:	12/21/2021
Test Type:	**Radiated Scan**	Time:	20:12:12
Tested By:	Hoang Cao	Sequence#:	158
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Radiated Emission
Frequency Range: 1 to 40GHz

Environmental Conditions:
Temperature: 22.6°C
Humidity: 33%
Atmospheric Pressure: 101.8kPa

Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi transmitting continuously with modulation type as listed with pattern of 0s and 1s at power level 10.
MIMO not enabled, manufacturer declares chain 0 and chain 1 transmit uncorrelated data.
Chain 0

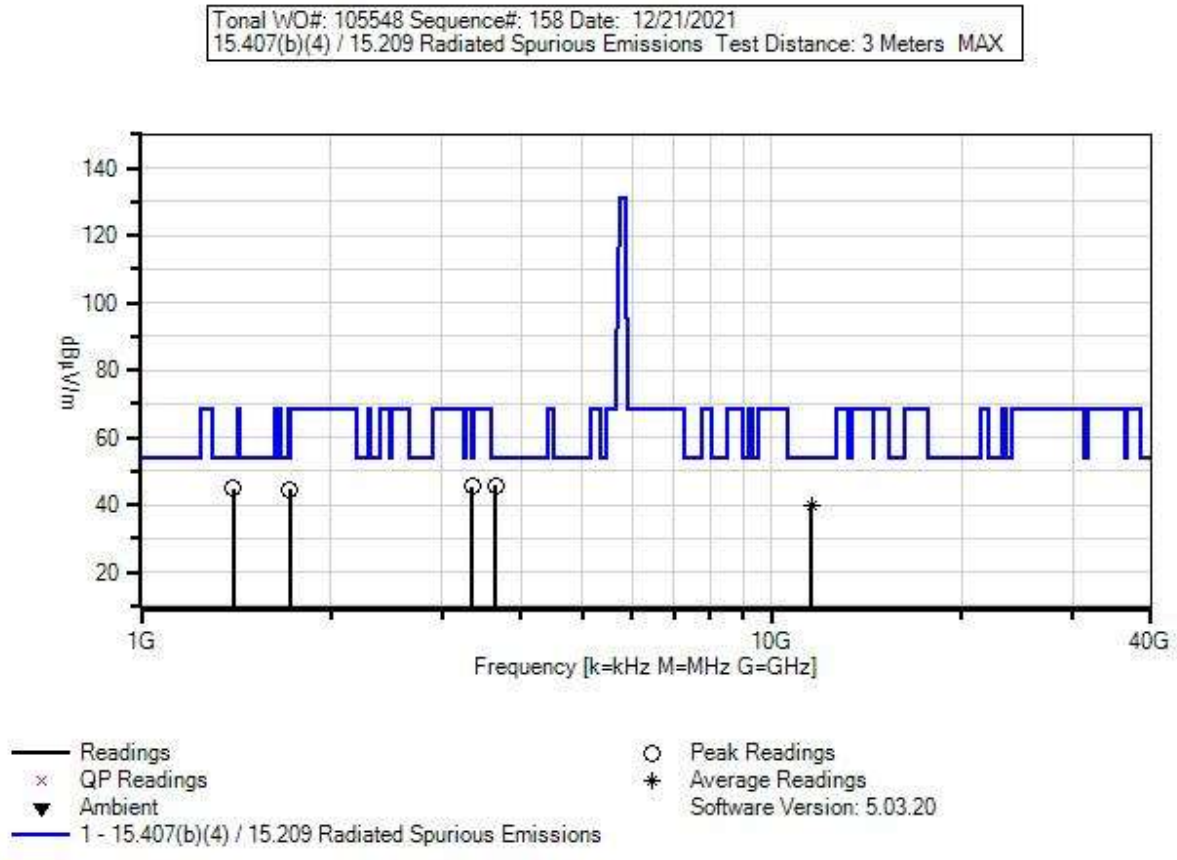
Operational mode is representative of worst case.

UNII3 - OFDM
Middle Channel

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.

Support laptop included in this setup to control Wi-Fi operating mode; port is internal to the equipment for configuration only.
Unintentional emissions related to display and display controller increased due to external cable to laptop.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T1	AN02812	Preamp	83017-69004	9/22/2020	9/22/2022
T2	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T3	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T4	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T5	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
	AN02695	Active Horn Antenna	AMFW-5F-260400-33-8P	10/26/2021	10/26/2023
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP00930	Cable	various	1/9/2020	1/9/2022

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	3649.067M	38.4	-30.0 +1.0	+31.4	+1.6	+3.2	+0.0	45.6	54.0	-8.4	Horiz
2	3351.899M	38.4	-29.3 +1.0	+30.8	+1.5	+3.1	+0.0	45.5	54.0	-8.5	Vert
3	1399.601M	48.1	-32.0 +0.6	+25.3	+0.9	+1.9	+0.0	44.8	54.0	-9.2	Vert
4	1721.694M	45.6	-31.4 +0.7	+26.4	+1.0	+2.1	+0.0	44.4	54.0	-9.6	Horiz
5	11580.700 M Ave	22.5	-31.3 +1.8	+38.0	+2.9	+6.0	+0.0	39.9	54.0	-14.1	Horiz
^	11580.700 M	35.8	-31.3 +1.8	+38.0	+2.9	+6.0	+0.0	53.2	54.0	-0.8	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.407(b)(4) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105488**	Date:	12/21/2021
Test Type:	**Radiated Scan**	Time:	20:31:12
Tested By:	Hoang Cao	Sequence#:	161
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Radiated Emission
Frequency Range: 1 to 40GHz

Environmental Conditions:
Temperature: 22.6°C
Humidity: 33%
Atmospheric Pressure: 101.8kPa

Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi transmitting continuously with modulation type as listed with pattern of 0s and 1s at power level 10.
MIMO not enabled, manufacturer declares chain 0 and chain 1 transmit uncorrelated data.
Chain 0

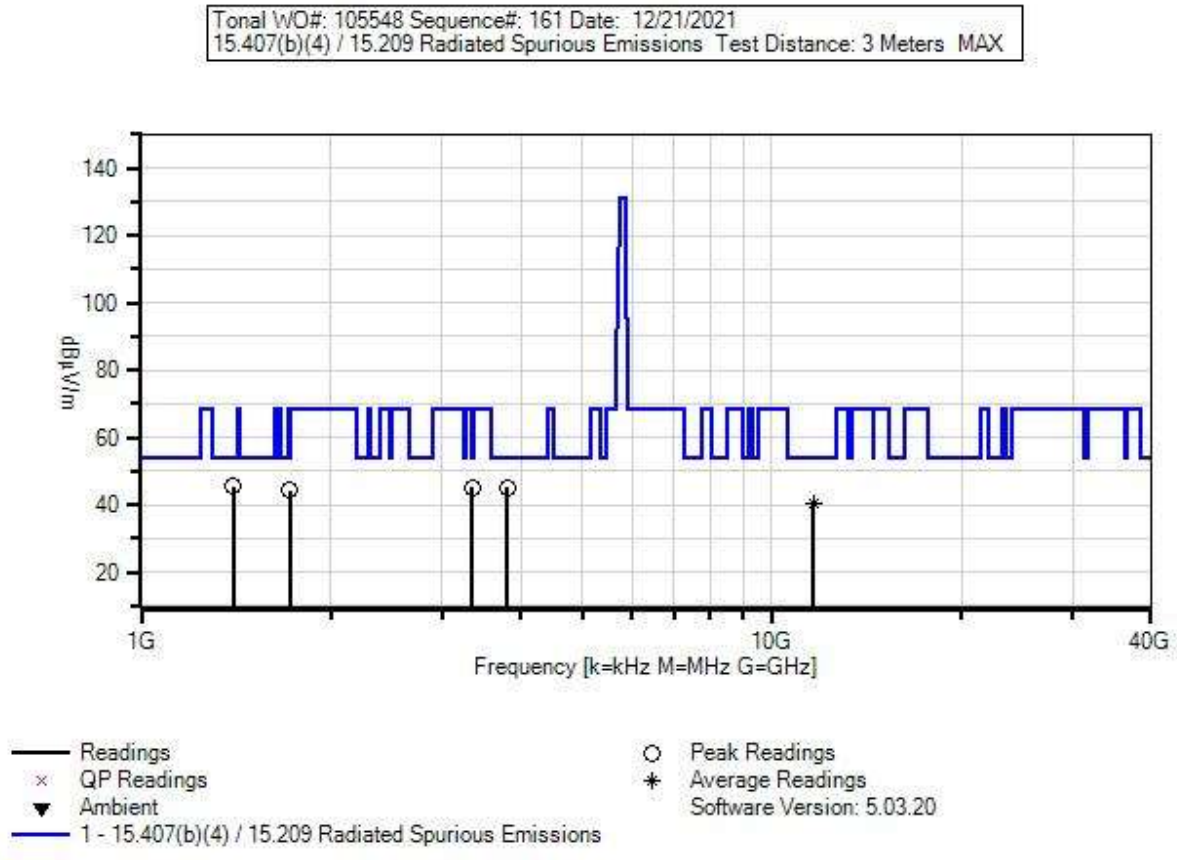
Operational mode is representative of worst case.

UNII3 - OFDM
High Channel

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.

Support laptop included in this setup to control Wi-Fi operating mode; port is internal to the equipment for configuration only.
Unintentional emissions related to display and display controller increased due to external cable to laptop.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T1	AN02812	Preamp	83017-69004	9/22/2020	9/22/2022
T2	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T3	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T4	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T5	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
	AN02695	Active Horn Antenna	AMFW-5F-260400-33-8P	10/26/2021	10/26/2023
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP00930	Cable	various	1/9/2020	1/9/2022

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	1398.740M	48.6	-32.0 +0.6	+25.3	+0.9	+1.9	+0.0	45.3	54.0	-8.7	Vert
2	3348.693M	38.1	-29.3 +1.0	+30.8	+1.5	+3.1	+0.0	45.2	54.0	-8.8	Horiz
3	3813.150M	38.1	-30.3 +1.0	+31.5	+1.6	+3.3	+0.0	45.2	54.0	-8.8	Horiz
4	1721.694M	45.4	-31.4 +0.7	+26.4	+1.0	+2.1	+0.0	44.2	54.0	-9.8	Horiz
5	11650.423 M Ave	22.9	-31.4 +1.8	+38.0	+2.9	+6.0	+0.0	40.2	54.0	-13.8	Horiz
^	11650.423 M	35.9	-31.4 +1.8	+38.0	+2.9	+6.0	+0.0	53.2	54.0	-0.8	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.407(b)(4) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105488**	Date:	12/23/2021
Test Type:	**Radiated Scan**	Time:	08:33:04
Tested By:	Hoang Cao	Sequence#:	164
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Radiated Emission
Frequency Range: 1 to 40GHz

Environmental Conditions:
Temperature: 23.4°C
Humidity: 50%
Atmospheric Pressure: 100.6kPa

Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi transmitting continuously with modulation type as listed with pattern of 0s and 1s at power level 10.
MIMO not enabled, manufacturer declares chain 0 and chain 1 transmit uncorrelated data.
Chain 0

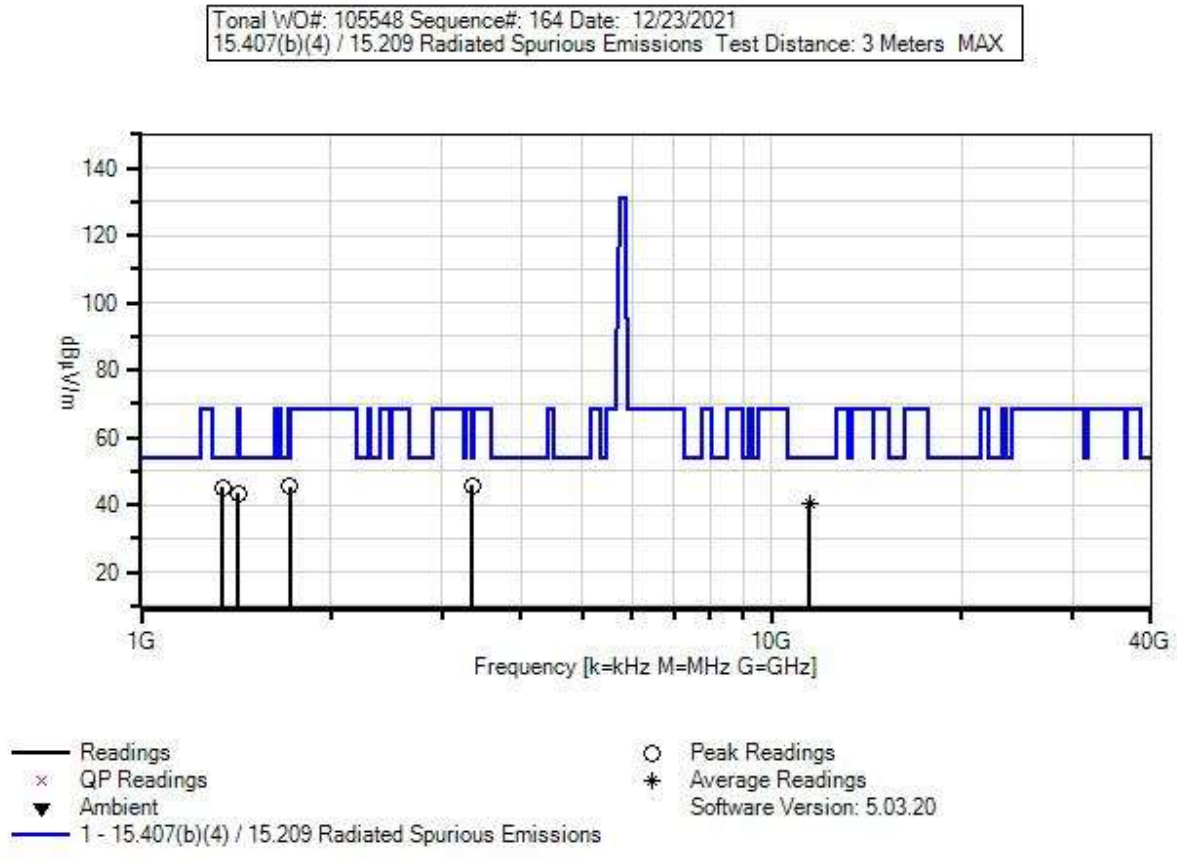
Operational mode is representative of worst case.

UNII3 - HT20
Low Channel

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.

Support laptop included in this setup to control Wi-Fi operating mode; port is internal to the equipment for configuration only.
Unintentional emissions related to display and display controller increased due to external cable to laptop.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T1	AN02812	Preamp	83017-69004	9/22/2020	9/22/2022
T2	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T3	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T4	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T5	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
	AN02695	Active Horn Antenna	AMFW-5F-260400-33-8P	10/26/2021	10/26/2023
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP00930	Cable	various	1/9/2020	1/9/2022

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	3348.693M	38.5	-29.3 +1.0	+30.8	+1.5	+3.1	+0.0	45.6	54.0	-8.4	Horiz
2	1721.694M	46.6	-31.4 +0.7	+26.4	+1.0	+2.1	+0.0	45.4	54.0	-8.6	Horiz
3	1347.929M	48.7	-32.2 +0.6	+25.2	+0.9	+1.9	+0.0	45.1	54.0	-8.9	Vert
4	1422.854M	46.6	-32.0 +0.6	+25.4	+0.9	+1.9	+0.0	43.4	54.0	-10.6	Horiz
5	11486.640 M Ave	23.1	-31.3 +1.8	+38.0	+2.9	+5.9	+0.0	40.4	54.0	-13.6	Horiz
^	11486.640 M	35.8	-31.3 +1.8	+38.0	+2.9	+5.9	+0.0	53.1	54.0	-0.9	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.407(b)(4) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105488**	Date:	12/23/2021
Test Type:	**Radiated Scan**	Time:	08:59:52
Tested By:	Hoang Cao	Sequence#:	167
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Radiated Emission
Frequency Range: 1 to 40GHz

Environmental Conditions:
Temperature: 23.4°C
Humidity: 50%
Atmospheric Pressure: 100.6kPa

Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi transmitting continuously with modulation type as listed with pattern of 0s and 1s at power level 10.
MIMO not enabled, manufacturer declares chain 0 and chain 1 transmit uncorrelated data.
Chain 0

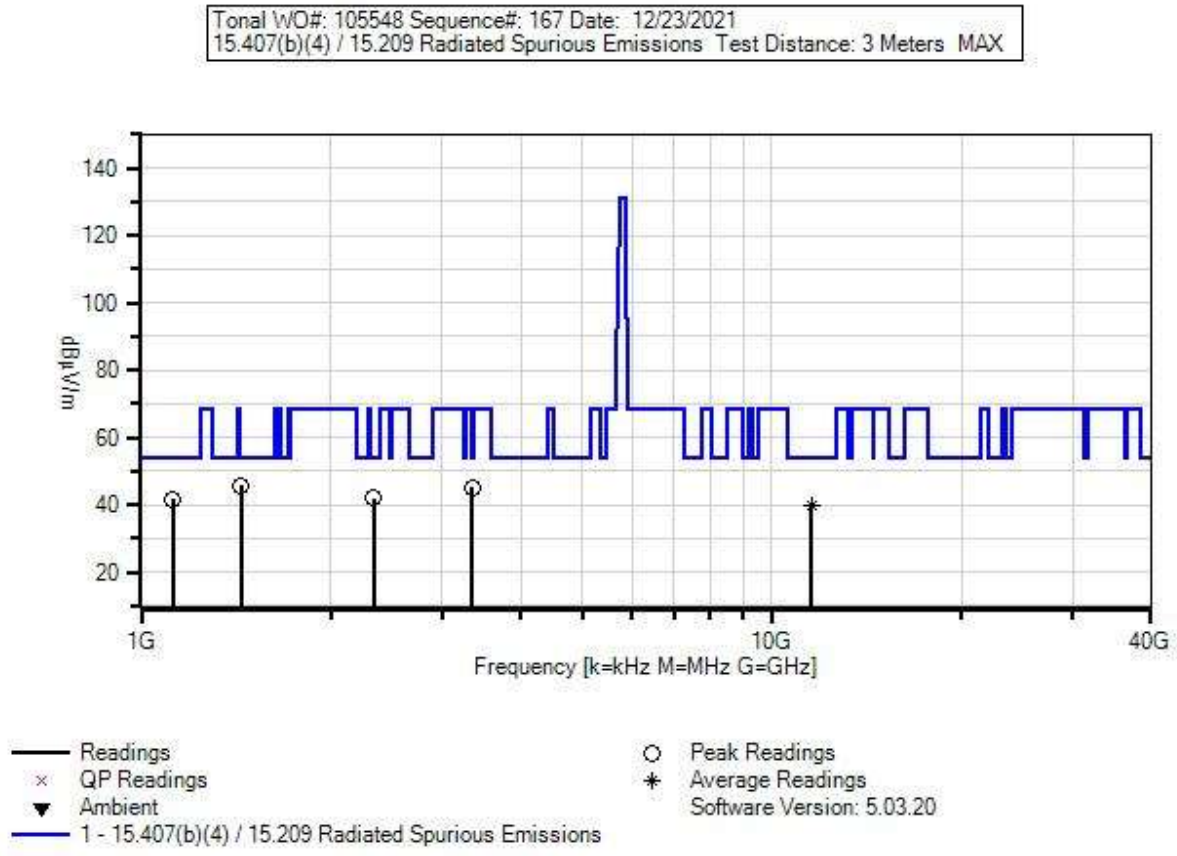
Operational mode is representative of worst case.

UNII3 - HT20
Middle Channel

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.

Support laptop included in this setup to control Wi-Fi operating mode; port is internal to the equipment for configuration only.
Unintentional emissions related to display and display controller increased due to external cable to laptop.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T1	AN02812	Preamp	83017-69004	9/22/2020	9/22/2022
T2	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T3	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T4	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T5	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
	AN02695	Active Horn Antenna	AMFW-5F-260400-33-8P	10/26/2021	10/26/2023
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP00930	Cable	various	1/9/2020	1/9/2022

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	1439.217M	48.8	-31.9 +0.6	+25.4	+0.9	+2.0	+0.0	45.8	54.0	-8.2	Horiz
2	3355.105M	37.8	-29.2 +1.0	+30.8	+1.5	+3.1	+0.0	45.0	54.0	-9.0	Vert
3	2338.872M	40.0	-30.6 +0.8	+28.0	+1.2	+2.5	+0.0	41.9	54.0	-12.1	Horiz
4	1121.431M	46.8	-33.1 +0.5	+24.7	+1.0	+1.7	+0.0	41.6	54.0	-12.4	Vert
5	11569.861 M Ave	22.6	-31.3 +1.8	+38.0	+2.9	+6.0	+0.0	40.0	54.0	-14.0	Horiz
^	11569.861 M	35.3	-31.3 +1.8	+38.0	+2.9	+6.0	+0.0	52.7	54.0	-1.3	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.407(b)(4) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105488**	Date:	12/23/2021
Test Type:	**Radiated Scan**	Time:	09:13:52
Tested By:	Hoang Cao	Sequence#:	170
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Radiated Emission
Frequency Range: 1 to 40GHz

Environmental Conditions:
Temperature: 23.4°C
Humidity: 50%
Atmospheric Pressure: 100.6kPa

Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi transmitting continuously with modulation type as listed with pattern of 0s and 1s at power level 10.
MIMO not enabled, manufacturer declares chain 0 and chain 1 transmit uncorrelated data.
Chain 0

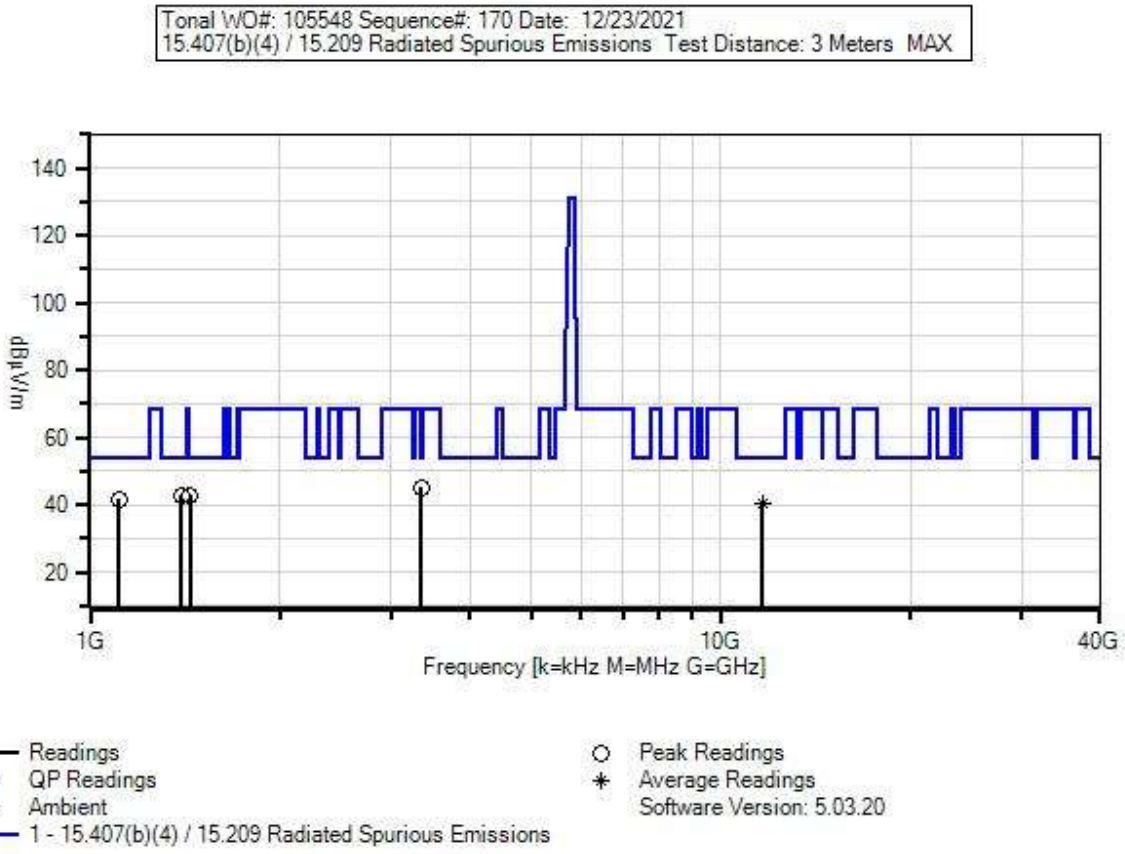
Operational mode is representative of worst case.

UNII3 - HT20
High Channel

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.

Support laptop included in this setup to control Wi-Fi operating mode; port is internal to the equipment for configuration only.
Unintentional emissions related to display and display controller increased due to external cable to laptop.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T1	AN02812	Preamp	83017-69004	9/22/2020	9/22/2022
T2	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T3	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T4	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T5	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
	AN02695	Active Horn Antenna	AMFW-5F-260400-33-8P	10/26/2021	10/26/2023
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP00930	Cable	various	1/9/2020	1/9/2022

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	3355.105M	37.9	-29.2 +1.0	+30.8	+1.5	+3.1	+0.0	45.1	54.0	-8.9	Horiz
2	1392.712M	46.3	-32.1 +0.6	+25.3	+0.9	+1.9	+0.0	42.9	54.0	-11.1	Horiz
3	1440.078M	45.8	-31.9 +0.6	+25.4	+0.9	+2.0	+0.0	42.8	54.0	-11.2	Horiz
4	1111.957M	46.8	-33.1 +0.5	+24.7	+1.0	+1.7	+0.0	41.6	54.0	-12.4	Vert
5	11650.457 M Ave	22.9	-31.4 +1.8	+38.0	+2.9	+6.0	+0.0	40.2	54.0	-13.8	Horiz
^	11650.457 M	35.8	-31.4 +1.8	+38.0	+2.9	+6.0	+0.0	53.1	54.0	-0.9	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.407(b)(4) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105488**	Date:	12/23/2021
Test Type:	**Radiated Scan**	Time:	09:27:35
Tested By:	Hoang Cao	Sequence#:	173
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Radiated Emission
Frequency Range: 1 to 40GHz

Environmental Conditions:
Temperature: 23.4°C
Humidity: 50%
Atmospheric Pressure: 100.6kPa

Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi transmitting continuously with modulation type as listed with pattern of 0s and 1s at power level 10.
MIMO not enabled, manufacturer declares chain 0 and chain 1 transmit uncorrelated data.
Chain 0

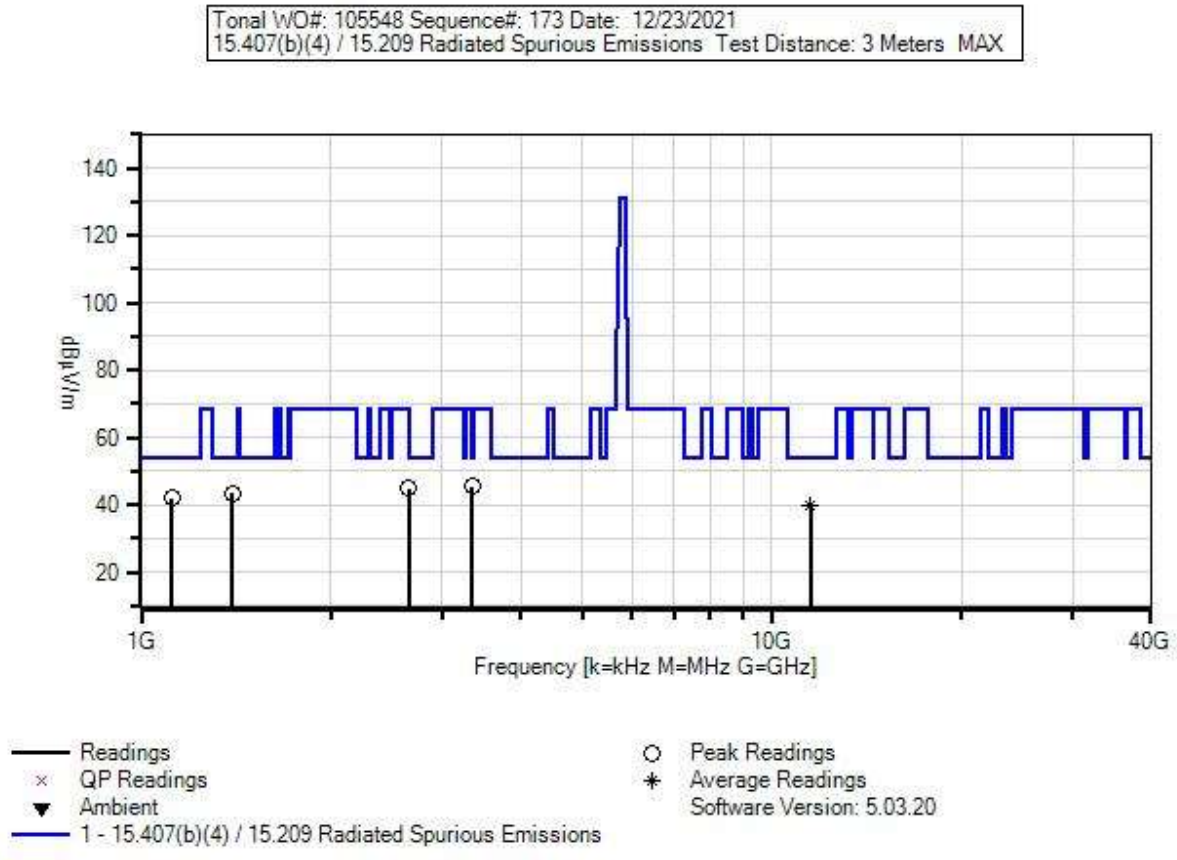
Operational mode is representative of worst case.

UNII3 - HT40
Low Channel

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.

Support laptop included in this setup to control Wi-Fi operating mode; port is internal to the equipment for configuration only.
Unintentional emissions related to display and display controller increased due to external cable to laptop.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T1	AN02812	Preamp	83017-69004	9/22/2020	9/22/2022
T2	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T3	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T4	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T5	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
	AN02695	Active Horn Antenna	AMFW-5F-260400-33-8P	10/26/2021	10/26/2023
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP00930	Cable	various	1/9/2020	1/9/2022

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	3351.899M	38.3	-29.3 +1.0	+30.8	+1.5	+3.1	+0.0	45.4	54.0	-8.6	Horiz
2	2659.450M	41.8	-30.5 +0.9	+28.7	+1.3	+2.7	+0.0	44.9	54.0	-9.1	Vert
3	1395.295M	46.8	-32.0 +0.6	+25.3	+0.9	+1.9	+0.0	43.5	54.0	-10.5	Horiz
4	1119.708M	47.1	-33.1 +0.5	+24.7	+1.0	+1.7	+0.0	41.9	54.0	-12.1	Vert
5	11516.140 M Ave	22.7	-31.3 +1.8	+38.0	+2.9	+5.9	+0.0	40.0	54.0	-14.0	Horiz
^	11516.140 M	35.3	-31.3 +1.8	+38.0	+2.9	+5.9	+0.0	52.6	54.0	-1.4	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.407(b)(4) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105488**	Date:	12/23/2021
Test Type:	**Radiated Scan**	Time:	09:41:32
Tested By:	Hoang Cao	Sequence#:	176
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Radiated Emission
Frequency Range: 1 to 40GHz

Environmental Conditions:
Temperature: 23.4°C
Humidity: 50%
Atmospheric Pressure: 100.6kPa

Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi transmitting continuously with modulation type as listed with pattern of 0s and 1s at power level 10.
MIMO not enabled, manufacturer declares chain 0 and chain 1 transmit uncorrelated data.
Chain 0

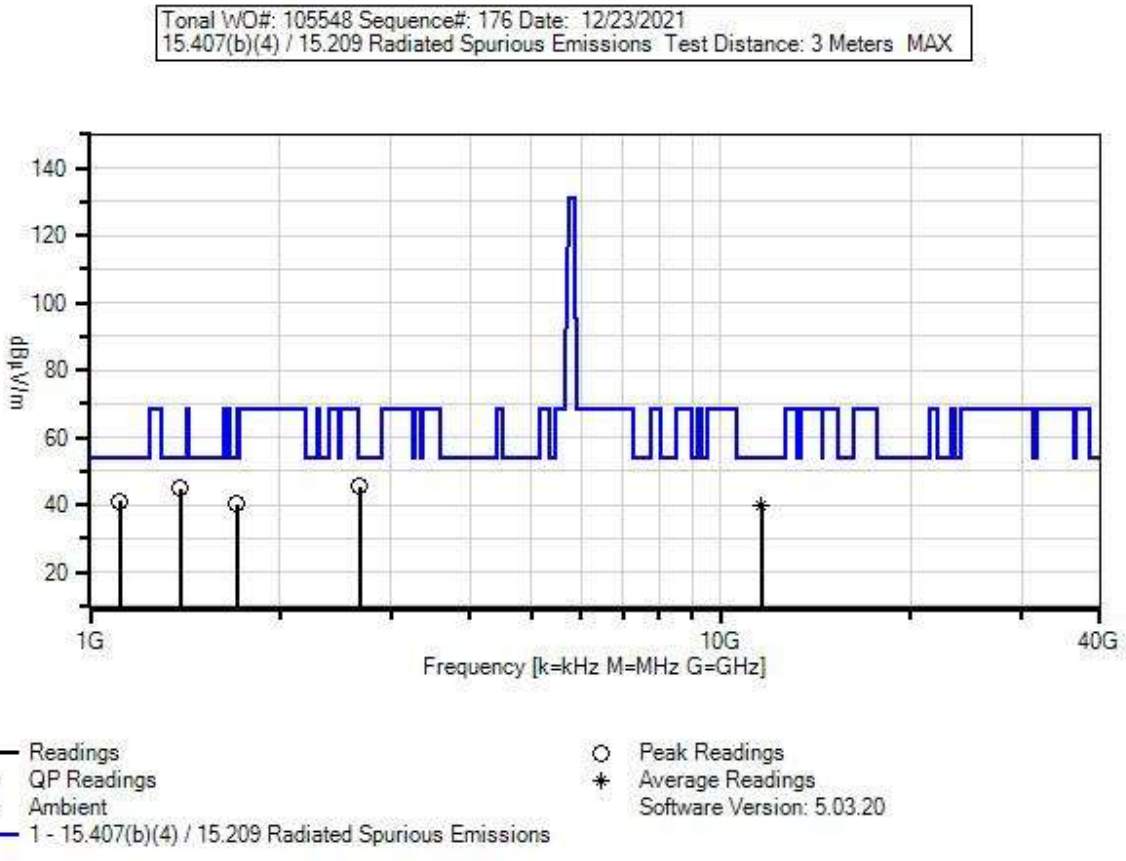
Operational mode is representative of worst case.

UNII3 - HT40
High Channel

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.

Support laptop included in this setup to control Wi-Fi operating mode; port is internal to the equipment for configuration only.
Unintentional emissions related to display and display controller increased due to external cable to laptop.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T1	AN02812	Preamp	83017-69004	9/22/2020	9/22/2022
T2	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T3	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T4	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T5	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
	AN02695	Active Horn Antenna	AMFW-5F-260400-33-8P	10/26/2021	10/26/2023
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP00930	Cable	various	1/9/2020	1/9/2022

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	2680.287M	42.3	-30.5 +0.9	+28.8	+1.3	+2.7	+0.0	45.5	54.0	-8.5	Horiz
2	1388.406M	48.2	-32.1 +0.6	+25.3	+0.9	+1.9	+0.0	44.8	54.0	-9.2	Horiz
3	1116.263M	46.3	-33.1 +0.5	+24.7	+1.0	+1.7	+0.0	41.1	54.0	-12.9	Vert
4	1706.192M	41.5	-31.4 +0.7	+26.4	+1.0	+2.1	+0.0	40.3	54.0	-13.7	Vert
5	11589.761 M Ave	22.5	-31.3 +1.8	+38.0	+2.9	+6.0	+0.0	39.9	54.0	-14.1	Horiz
^	11589.761 M	36.2	-31.3 +1.8	+38.0	+2.9	+6.0	+0.0	53.6	54.0	-0.4	Horiz

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.407(b)(4) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105488**	Date:	12/23/2021
Test Type:	**Radiated Scan**	Time:	10:00:11
Tested By:	Hoang Cao	Sequence#:	179
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Radiated Emission
Frequency Range: 1 to 40GHz

Environmental Conditions:
Temperature: 23.4°C
Humidity: 50%
Atmospheric Pressure: 100.6kPa

Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi transmitting continuously with modulation type as listed with pattern of 0s and 1s at power level 10.
MIMO not enabled, manufacturer declares chain 0 and chain 1 transmit uncorrelated data.
Chain 0

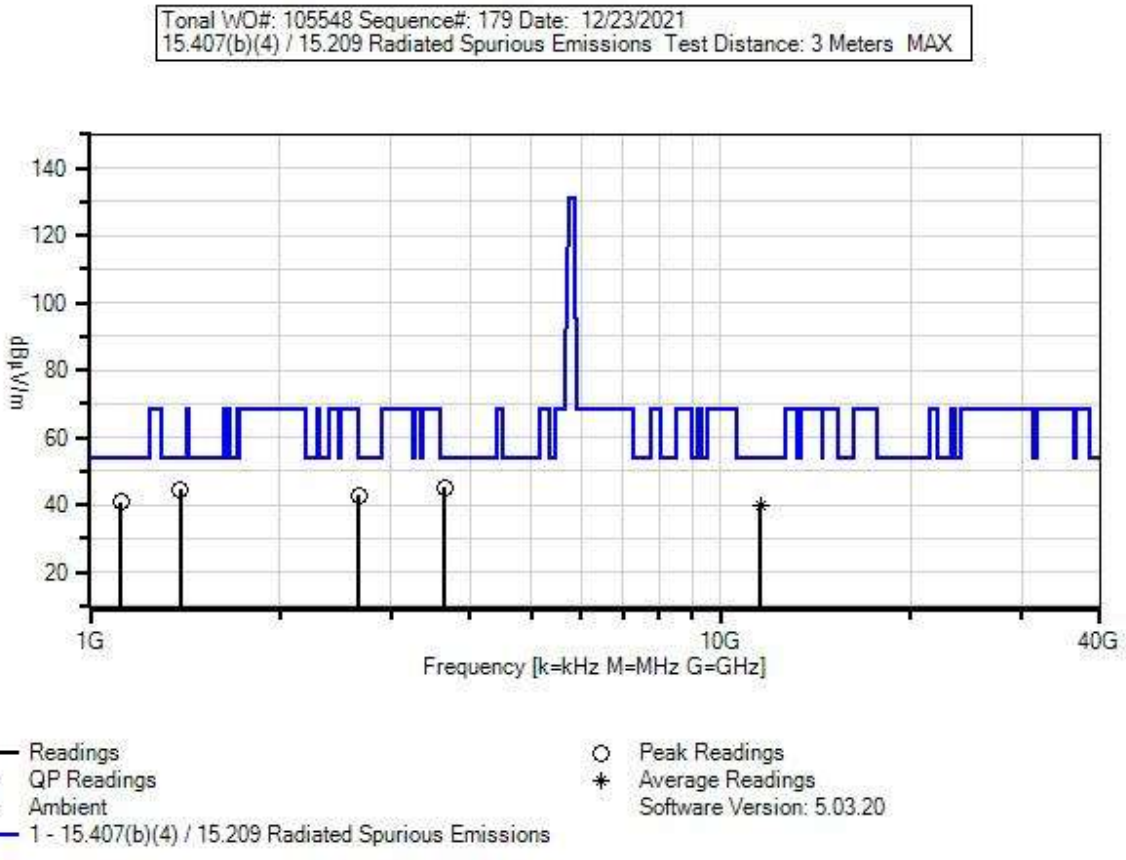
Operational mode is representative of worst case.

UNII3 - HT80

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.

Support laptop included in this setup to control Wi-Fi operating mode; port is internal to the equipment for configuration only.
Unintentional emissions related to display and display controller increased due to external cable to laptop.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T1	AN02812	Preamp	83017-69004	9/22/2020	9/22/2022
T2	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T3	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
T4	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T5	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02693	Active Horn Antenna	AMFW-5F-12001800-20-10P	10/26/2021	10/26/2023
	AN02694	Horn Antenna	AMFW-5F-18002650-20-10P	10/26/2021	10/26/2023
	AN02695	Active Horn Antenna	AMFW-5F-260400-33-8P	10/26/2021	10/26/2023
	ANP00928	Cable	various	1/9/2020	1/9/2022
	ANP00929	Cable	various	1/9/2020	1/9/2022
	ANP00930	Cable	various	1/9/2020	1/9/2022

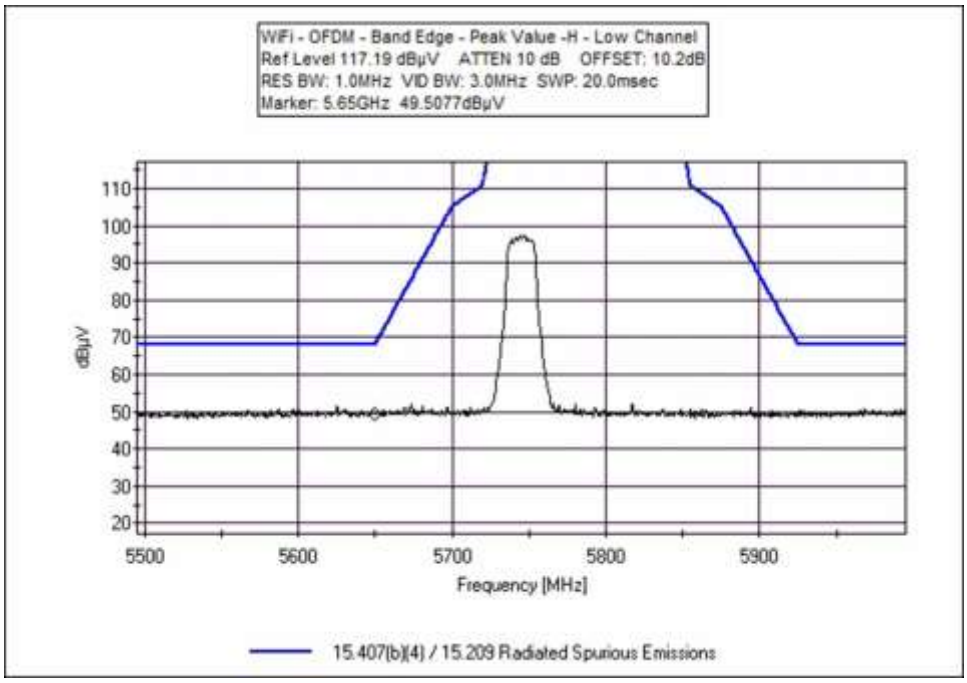
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

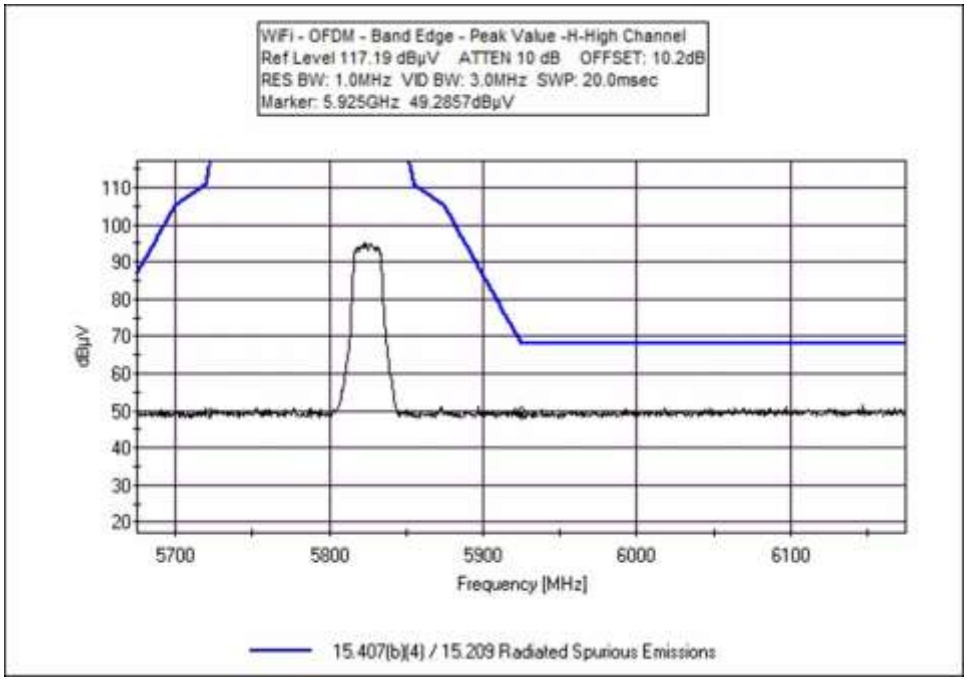
#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	3649.067M	38.0	-30.0 +1.0	+31.4	+1.6	+3.2	+0.0	45.2	54.0	-8.8	Horiz
2	1388.406M	47.8	-32.1 +0.6	+25.3	+0.9	+1.9	+0.0	44.4	54.0	-9.6	Vert
3	2667.464M	39.7	-30.5 +0.9	+28.7	+1.3	+2.7	+0.0	42.8	54.0	-11.2	Horiz
4	1120.569M	46.1	-33.1 +0.5	+24.7	+1.0	+1.7	+0.0	40.9	54.0	-13.1	Vert
5	11550.000 M Ave	22.5	-31.3 +1.8	+38.0	+2.9	+6.0	+0.0	39.9	54.0	-14.1	Horiz
^	11550.000 M	35.5	-31.3 +1.8	+38.0	+2.9	+6.0	+0.0	52.9	54.0	-1.1	Horiz

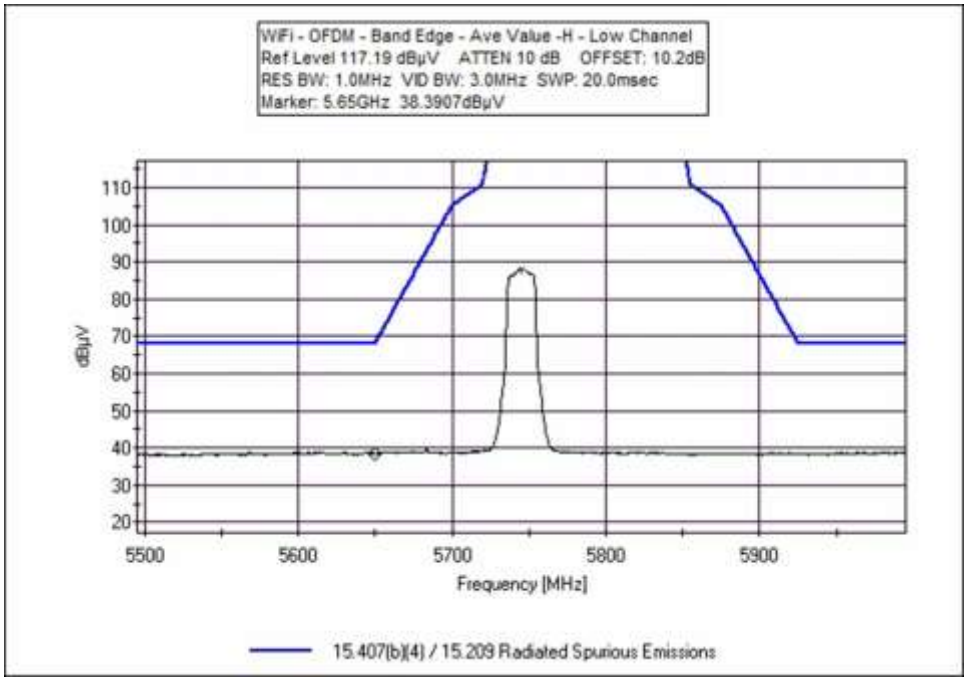
Note: Chain 0 is the worst case based on the investigation on RF output power before measuring Radiated Spurious Emission.

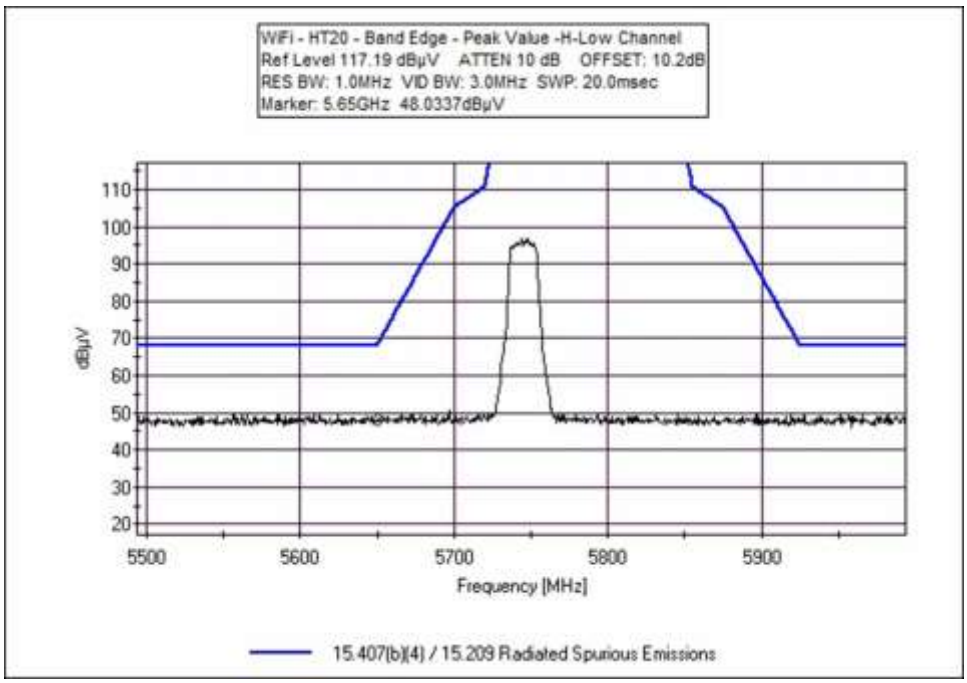
Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
5725	OFDM	External	49.5077	< 122.2 Pk	Pass
5850	OFDM	External	49.2857	< 122.2 Pk	Pass
5725	HT20	External	48.0337	< 122.2 Pk	Pass
5850	HT20	External	49.0897	< 122.2 Pk	Pass
5725	HT40	External	55.0677	< 122.2 Pk	Pass
5850	HT40	External	52.8917	< 122.2 Pk	Pass
5725	HT80	External	55.5887	< 122.2 Pk	Pass
5850	HT80	External	48.9797	< 122.2 Pk	Pass

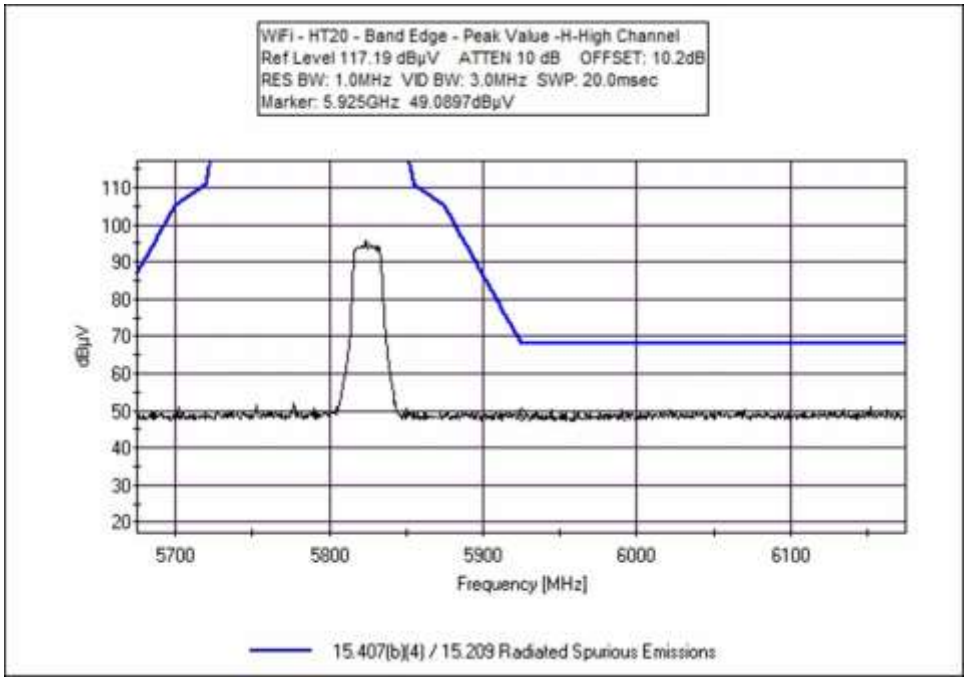
Band Edge Plots

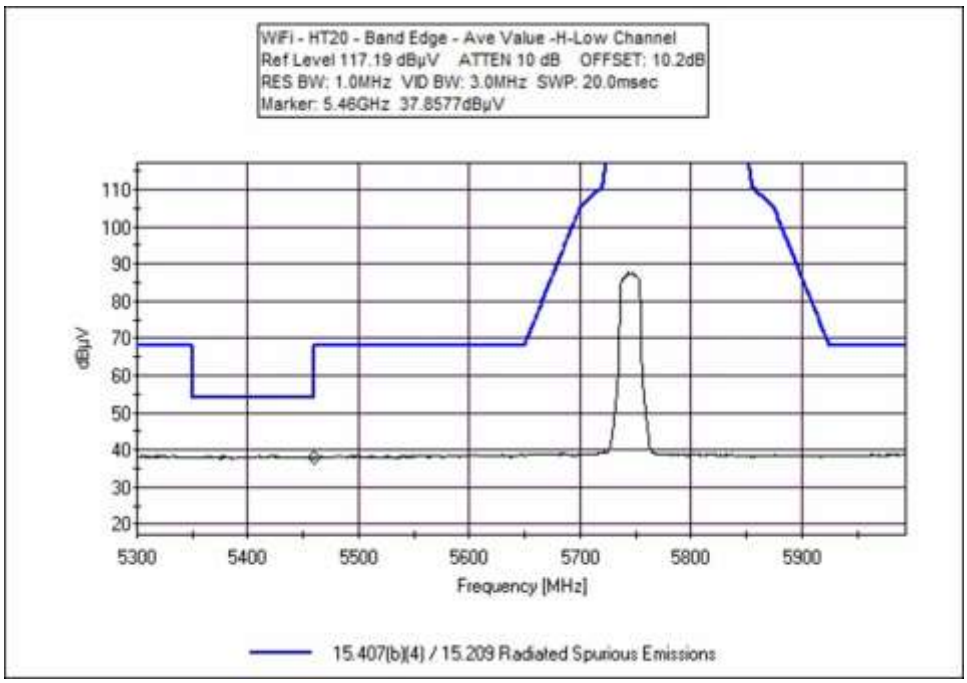


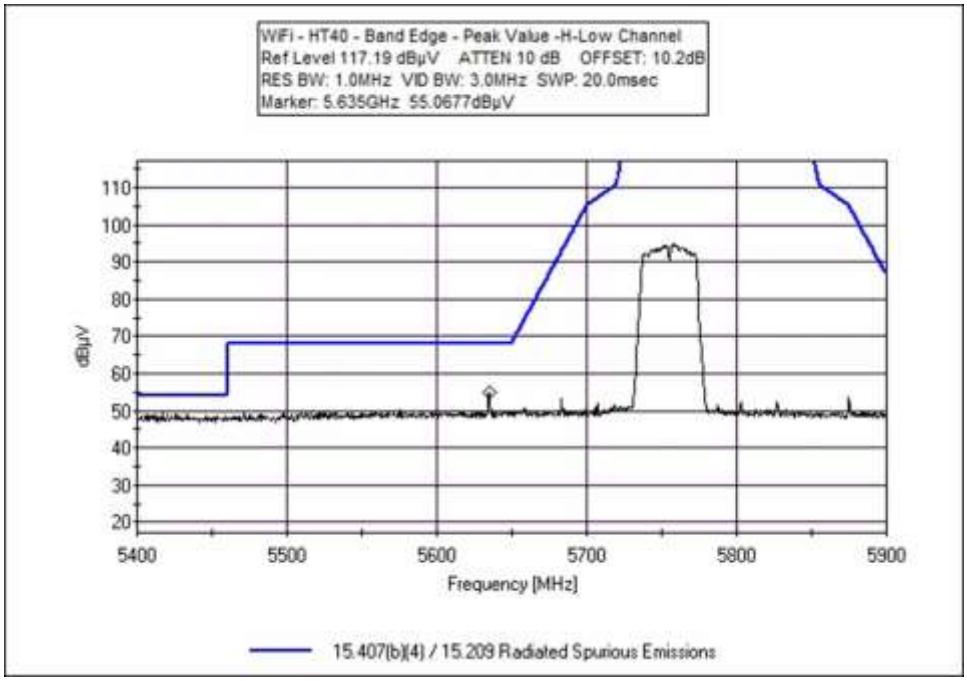


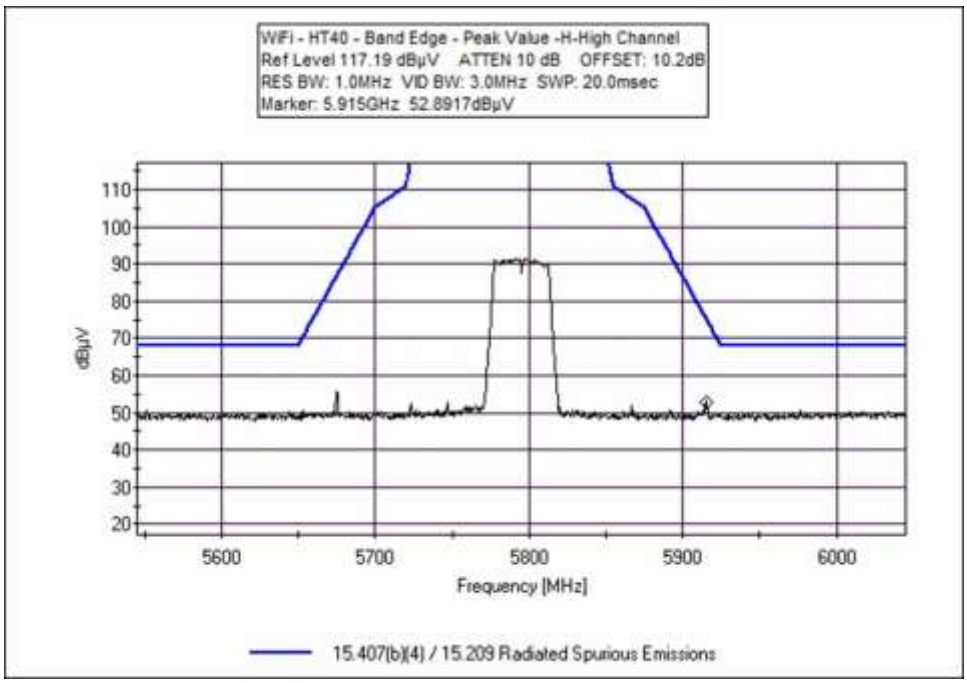

WiFi - OFDM - Band Edge - Ave Value -H - Low Channel
Ref Level 117.19 dBµV ATTEN 10 dB OFFSET: 10.2dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 5.65GHz 38.3907dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
5500
5600
5700
5800
5900
Frequency [MHz]
15.407(b)(4) / 15.209 Radiated Spurious Emissions

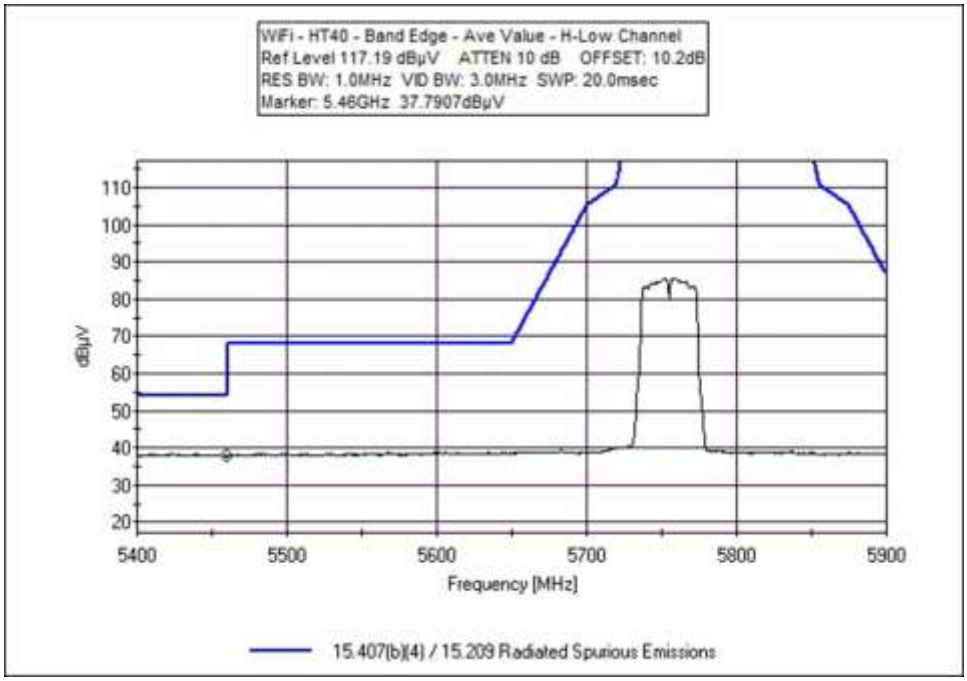

WiFi - HT20 - Band Edge - Peak Value -H-Low Channel
Ref Level 117.19 dBµV ATTEN 10 dB OFFSET: 10.2dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 5.65GHz 48.0337dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
5500
5600
5700
5800
5900
Frequency [MHz]
15.407(b)(4) / 15.209 Radiated Spurious Emissions

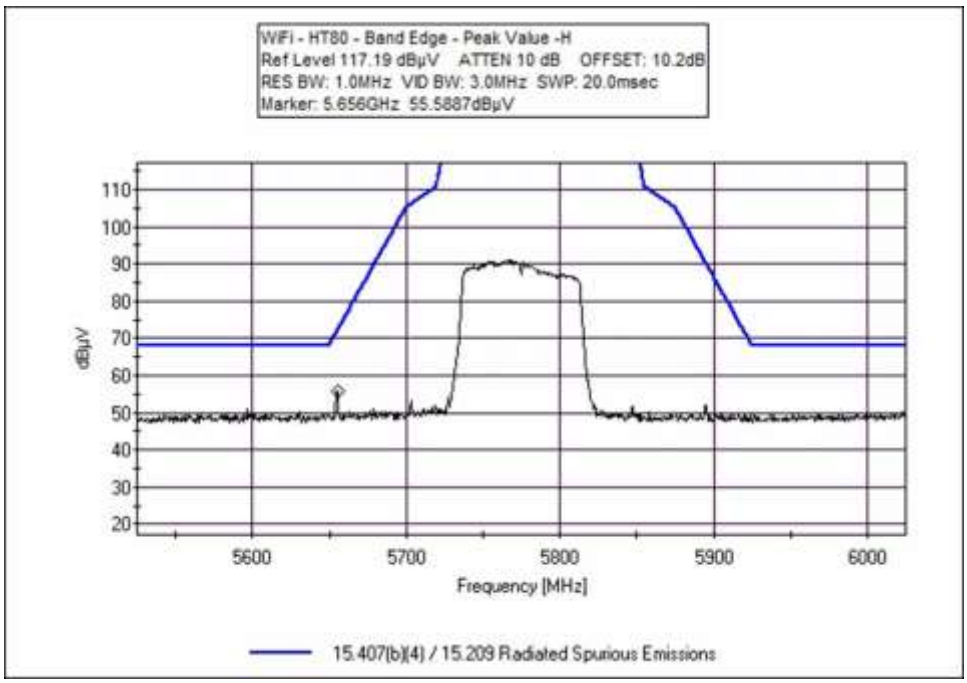

WiFi - HT20 - Band Edge - Peak Value -H-High Channel
Ref Level 117.19 dBµV ATTEN 10 dB OFFSET: 10.2dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 5.925GHz 49.0897dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
5700
5800
5900
6000
6100
Frequency [MHz]
15.407(b)(4) / 15.209 Radiated Spurious Emissions

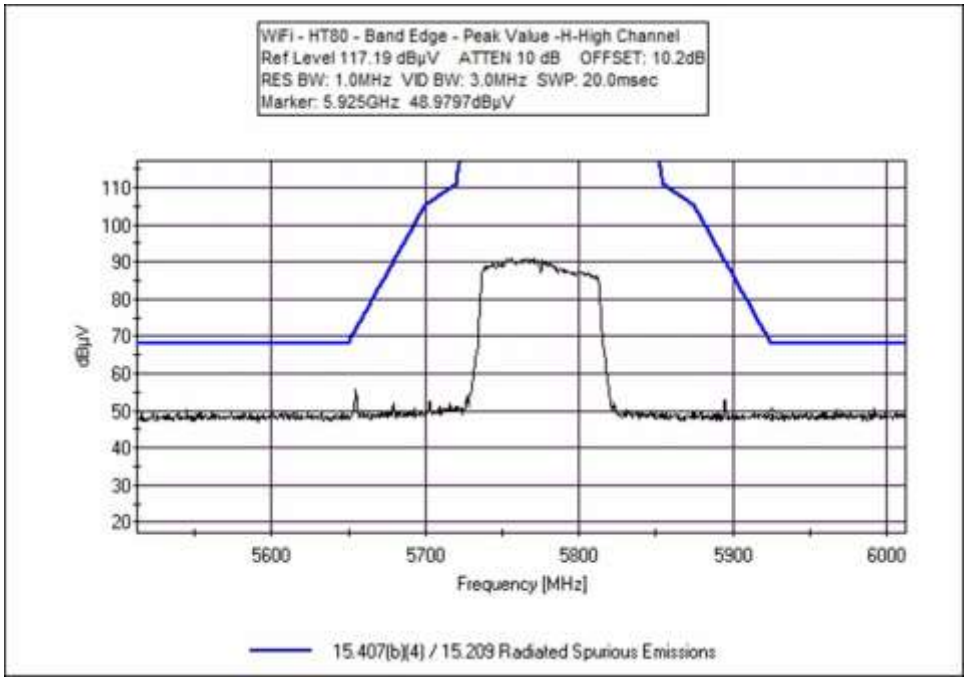

WiFi - HT20 - Band Edge - Ave Value -H-Low Channel
Ref Level 117.19 dBµV ATTEN 10 dB OFFSET: 10.2dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 5.46GHz 37.8577dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
5300
5400
5500
5600
5700
5800
5900
Frequency [MHz]
15.407(b)(4) / 15.209 Radiated Spurious Emissions

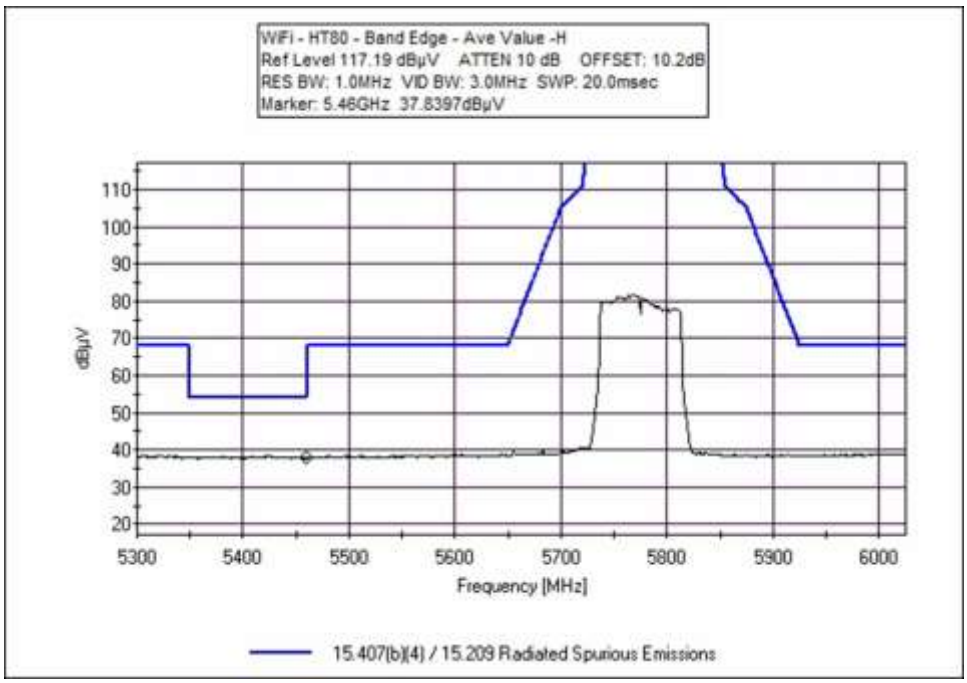

WiFi - HT40 - Band Edge - Peak Value -H-Low Channel
Ref Level 117.19 dBµV ATTEN 10 dB OFFSET: 10.2dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 5.635GHz 55.0677dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
5400
5500
5600
5700
5800
5900
Frequency [MHz]
15.407(b)(4) / 15.209 Radiated Spurious Emissions


WiFi - HT40 - Band Edge - Peak Value -H-High Channel
Ref Level 117.19 dBµV ATTEN 10 dB OFFSET: 10.2dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 5.915GHz 52.8917dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
5600
5700
5800
5900
6000
Frequency [MHz]
15.407(b)(4) / 15.209 Radiated Spurious Emissions


WiFi - HT40 - Band Edge - Ave Value - H-Low Channel
Ref Level 117.19 dBµV ATTEN 10 dB OFFSET: 10.2dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 5.46GHz 37.7907dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
5400
5500
5600
5700
5800
5900
Frequency [MHz]
15.407(b)(4) / 15.209 Radiated Spurious Emissions


WiFi - HT80 - Band Edge - Peak Value -H
Ref Level 117.19 dBµV ATTEN 10 dB OFFSET: 10.2dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 5.656GHz 55.5887dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
5600
5700
5800
5900
6000
Frequency [MHz]
15.407(b)(4) / 15.209 Radiated Spurious Emissions


WiFi - HT80 - Band Edge - Peak Value -H-High Channel
Ref Level 117.19 dBµV ATTEN 10 dB OFFSET: 10.2dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 5.925GHz 48.9797dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
5600
5700
5800
5900
6000
Frequency [MHz]
15.407(b)(4) / 15.209 Radiated Spurious Emissions


WiFi - HT80 - Band Edge - Ave Value -H
Ref Level 117.19 dBµV ATTEN 10 dB OFFSET: 10.2dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 5.46GHz 37.8397dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
5300
5400
5500
5600
5700
5800
5900
6000
Frequency [MHz]
15.407(b)(4) / 15.209 Radiated Spurious Emissions

Test Data

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**Band Edge**		
Work Order #:	**105488**	Date:	12/20/2021
Test Type:	**Radiated Scan**	Time:	15:09:00
Tested By:	Hoang Cao	Sequence#:	80
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Band Edge

Environmental Conditions:
Temperature: 22.6°C
Humidity: 33%
Atmospheric Pressure: 101.8kPa

Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
One weight line is extended to the floor.
Wi-Fi transmitting continuously with modulation type as listed with pattern of 0s and 1s at power level 10.
MIMO not enabled, manufacturer declares chain 0 and chain 1 transmit uncorrelated data.
Chain 0
Operational mode is representative of worst case.

Notes:
Air gap touchscreen display
Display is showing home screen

Modifications #1, #2, #3 #4, #5 and #6 were in place during testing.

Support laptop included in this setup to control Wi-Fi operating mode; port is internal to the equipment for configuration only.
Unintentional emissions related to display and display controller increased due to external cable to laptop.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
	AN03302	Cable	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
	AN02812	Preamp	83017-69004	9/22/2020	9/22/2022
	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022

15.207 AC Conducted Emissions

Test Data

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.207 AC Mains - Average**		
Work Order #:	**105488**	Date:	12/17/2021
Test Type:	**Conducted Emissions**	Time:	10:10:04
Tested By:	Hoang Cao	Sequence#:	46
Software:	EMITest 5.03.20		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

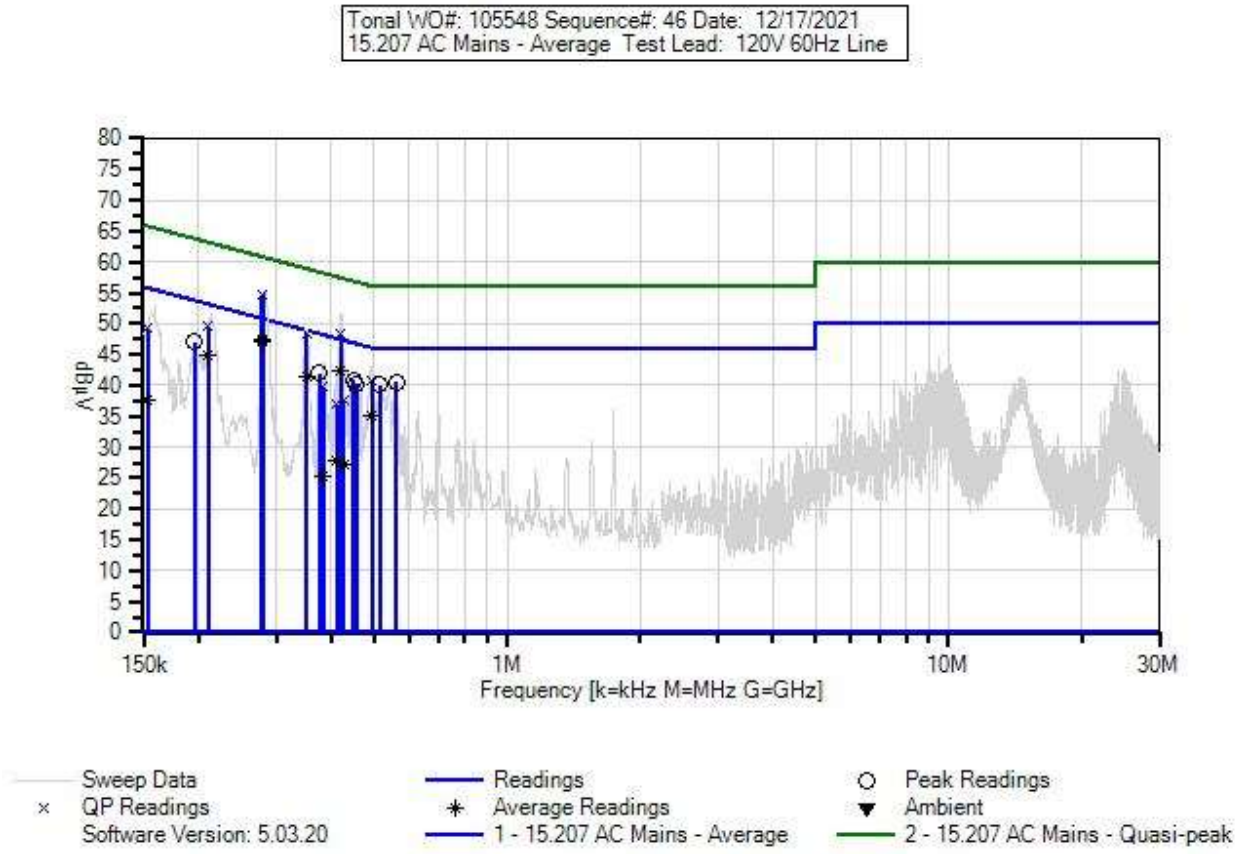
Conducted Emission
Frequency Range: 150kHz to 30MHz

Environmental Conditions:
Temperature: 21.8°C
Humidity: 47%
Atmospheric Pressure: 101.5kPa

Highest Generation Frequency: 5.8GHz
Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
It is set in a testing mode, lifting a weight on a loop.
All WIFI and Bluetooth modules are on.

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP01211	Attenuator	23-10-34	2/25/2021	2/25/2023
T2	ANP06691	Cable	PE3062-180	3/25/2020	3/25/2022
T3	ANP06694	Cable	PE3062-480	3/25/2020	3/25/2022
T4	AN00494	50uH LISN-Line Loss (dB)	3816/NM	3/11/2021	3/11/2023
	AN00494	50uH LISN-Return Loss (dB)	3816/NM	3/11/2021	3/11/2023
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T5	ANP05258	High Pass Filter	HE9615-150K-50-720B	7/6/2020	7/6/2022

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

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	280.316k	37.3	+9.9	+0.0	+0.0	+0.1	+0.0	47.4	50.8	-3.4	Line
	Ave		+0.1								
2	278.856k	37.1	+9.9	+0.0	+0.0	+0.1	+0.0	47.2	50.8	-3.6	Line
	Ave		+0.1								
3	420.747k	32.4	+9.9	+0.0	+0.0	+0.0	+0.0	42.4	47.4	-5.0	Line
	Ave		+0.1								
4	562.324k	30.3	+9.9	+0.0	+0.1	+0.1	+0.0	40.6	46.0	-5.4	Line
			+0.2								
5	515.783k	29.7	+9.9	+0.0	+0.1	+0.1	+0.0	40.0	46.0	-6.0	Line
			+0.2								
6	280.316k	44.6	+9.9	+0.0	+0.0	+0.1	+0.0	54.7	60.8	-6.1	Line
	QP		+0.1								
7	448.880k	30.7	+9.9	+0.0	+0.1	+0.0	+0.0	40.8	46.9	-6.1	Line
			+0.1								
8	278.856k	44.5	+9.9	+0.0	+0.0	+0.1	+0.0	54.6	60.8	-6.2	Line
	QP		+0.1								
^	280.316k	46.6	+9.9	+0.0	+0.0	+0.1	+0.0	56.7	50.8	+5.9	Line
			+0.1								
^	278.856k	46.5	+9.9	+0.0	+0.0	+0.1	+0.0	56.6	50.8	+5.8	Line
			+0.1								
11	375.432k	31.8	+9.9	+0.0	+0.0	+0.1	+0.0	41.9	48.4	-6.5	Line
			+0.1								
12	454.698k	30.1	+9.9	+0.0	+0.1	+0.0	+0.0	40.2	46.8	-6.6	Line
			+0.1								
13	195.812k	36.8	+9.9	+0.0	+0.0	+0.1	+0.0	47.0	53.8	-6.8	Line
			+0.2								
14	351.428k	31.4	+9.9	+0.0	+0.0	+0.0	+0.0	41.4	48.9	-7.5	Line
	Ave		+0.1								
15	209.905k	34.9	+9.9	+0.0	+0.0	+0.1	+0.0	45.0	53.2	-8.2	Line
	Ave		+0.1								
16	420.747k	38.3	+9.9	+0.0	+0.0	+0.0	+0.0	48.3	57.4	-9.1	Line
	QP		+0.1								
^	420.747k	43.2	+9.9	+0.0	+0.0	+0.0	+0.0	53.2	47.4	+5.8	Line
			+0.1								
18	351.428k	38.5	+9.9	+0.0	+0.0	+0.0	+0.0	48.5	58.9	-10.4	Line
	QP		+0.1								
^	351.428k	42.2	+9.9	+0.0	+0.0	+0.0	+0.0	52.2	48.9	+3.3	Line
			+0.1								
20	493.040k	24.9	+9.9	+0.0	+0.1	+0.1	+0.0	35.1	46.1	-11.0	Line
	Ave		+0.1								
21	209.905k	39.5	+9.9	+0.0	+0.0	+0.1	+0.0	49.6	63.2	-13.6	Line
	QP		+0.1								
^	209.905k	43.1	+9.9	+0.0	+0.0	+0.1	+0.0	53.2	53.2	+0.0	Line
			+0.1								
23	493.040k	30.7	+9.9	+0.0	+0.1	+0.1	+0.0	40.9	56.1	-15.2	Line
	QP		+0.1								

^	493.040k	35.1	+9.9 +0.1	+0.0	+0.1	+0.1	+0.0	45.3	46.1	-0.8	Line
25	153.270k QP	37.7	+9.9 +1.6	+0.0	+0.0	+0.1	+0.0	49.3	65.8	-16.5	Line
26	153.270k Ave	25.9	+9.9 +1.6	+0.0	+0.0	+0.1	+0.0	37.5	55.8	-18.3	Line
^	153.270k	44.2	+9.9 +1.6	+0.0	+0.0	+0.1	+0.0	55.8	55.8	+0.0	Line
28	383.373k QP	29.6	+9.9 +0.1	+0.0	+0.0	+0.1	+0.0	39.7	58.2	-18.5	Line
29	427.092k QP	27.5	+9.9 +0.1	+0.0	+0.0	+0.0	+0.0	37.5	57.3	-19.8	Line
30	411.207k Ave	17.7	+9.9 +0.1	+0.0	+0.0	+0.0	+0.0	27.7	47.6	-19.9	Line
31	427.092k Ave	17.3	+9.9 +0.1	+0.0	+0.0	+0.0	+0.0	27.3	47.3	-20.0	Line
^	427.092k	37.0	+9.9 +0.1	+0.0	+0.0	+0.0	+0.0	47.0	47.3	-0.3	Line
33	411.207k QP	26.9	+9.9 +0.1	+0.0	+0.0	+0.0	+0.0	36.9	57.6	-20.7	Line
^	411.207k	35.2	+9.9 +0.1	+0.0	+0.0	+0.0	+0.0	45.2	47.6	-2.4	Line
^	409.611k	32.4	+9.9 +0.1	+0.0	+0.0	+0.0	+0.0	42.4	47.7	-5.3	Line
36	383.373k Ave	15.2	+9.9 +0.1	+0.0	+0.0	+0.1	+0.0	25.3	48.2	-22.9	Line
^	383.373k	35.4	+9.9 +0.1	+0.0	+0.0	+0.1	+0.0	45.5	48.2	-2.7	Line
^	385.613k	32.5	+9.9 +0.1	+0.0	+0.0	+0.1	+0.0	42.6	48.2	-5.6	Line

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • 510-249-1170		
Customer:	**Tonal**		
Specification:	**15.207 AC Mains - Average**		
Work Order #:	**105488**	Date:	12/17/2021
Test Type:	**Conducted Emissions**	Time:	10:28:13
Tested By:	Hoang Cao	Sequence#:	47
Software:	EMITest 5.03.20		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

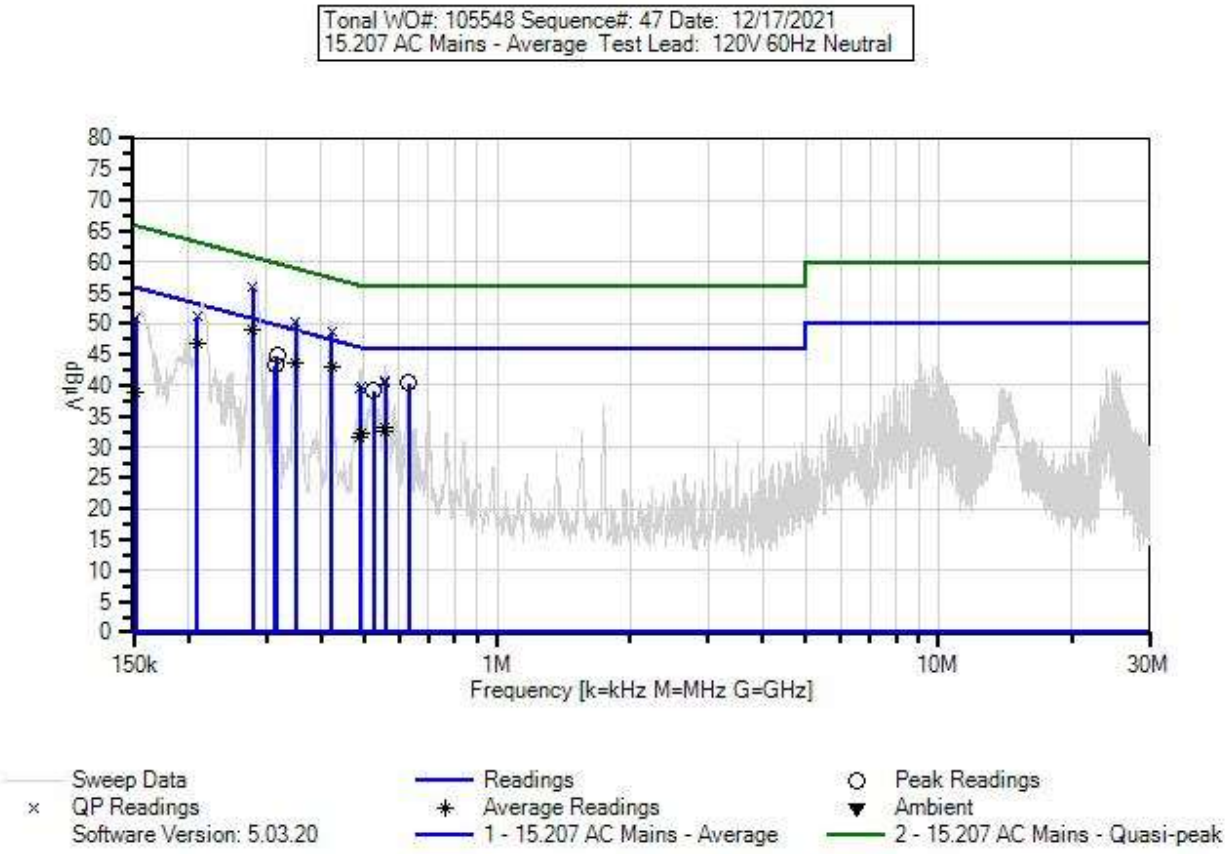
Conducted Emission
Frequency Range: 150kHz to 30MHz

Environmental Conditions:
Temperature: 21.8°C
Humidity: 47%
Atmospheric Pressure: 101.5kPa

Highest Generation Frequency: 5.8GHz
Method: ANSI C63.10 2013

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup.
It is set in a testing mode, lifting a weight on a loop.
All WIFI and Bluetooth modules are on.

Notes:
Touch screen display: Direct bond 2312
Power Supply: Artesyn



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP01211	Attenuator	23-10-34	2/25/2021	2/25/2023
T2	ANP06691	Cable	PE3062-180	3/25/2020	3/25/2022
T3	ANP06694	Cable	PE3062-480	3/25/2020	3/25/2022
	AN00494	50uH LISN-Line Loss (dB)	3816/NM	3/11/2021	3/11/2023
T4	AN00494	50uH LISN-Return Loss (dB)	3816/NM	3/11/2021	3/11/2023
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T5	ANP05258	High Pass Filter	HE9615-150K-50-720B	7/6/2020	7/6/2022

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

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	280.264k	38.9	+9.9	+0.0	+0.0	+0.0	+0.0	48.9	50.8	-1.9	Neutr
	Ave		+0.1								
2	421.660k	33.0	+9.9	+0.0	+0.0	+0.0	+0.0	43.0	47.4	-4.4	Neutr
	Ave		+0.1								
3	280.264k	45.9	+9.9	+0.0	+0.0	+0.0	+0.0	55.9	60.8	-4.9	Neutr
	QP		+0.1								
^	280.264k	47.7	+9.9	+0.0	+0.0	+0.0	+0.0	57.7	50.8	+6.9	Neutr
			+0.1								
5	317.256k	34.8	+9.9	+0.0	+0.0	+0.0	+0.0	44.8	49.8	-5.0	Neutr
			+0.1								
6	350.035k	33.5	+9.9	+0.0	+0.0	+0.0	+0.0	43.5	49.0	-5.5	Neutr
	Ave		+0.1								
7	630.682k	30.2	+9.9	+0.0	+0.1	+0.0	+0.0	40.4	46.0	-5.6	Neutr
			+0.2								
8	209.412k	36.7	+9.9	+0.0	+0.0	+0.0	+0.0	46.7	53.2	-6.5	Neutr
	Ave		+0.1								
9	315.074k	33.3	+9.9	+0.0	+0.0	+0.0	+0.0	43.3	49.8	-6.5	Neutr
			+0.1								
10	525.237k	29.0	+9.9	+0.0	+0.1	+0.0	+0.0	39.2	46.0	-6.8	Neutr
			+0.2								
11	350.035k	40.4	+9.9	+0.0	+0.0	+0.0	+0.0	50.4	59.0	-8.6	Neutr
	QP		+0.1								
^	350.035k	43.5	+9.9	+0.0	+0.0	+0.0	+0.0	53.5	49.0	+4.5	Neutr
			+0.1								
13	421.660k	38.6	+9.9	+0.0	+0.0	+0.0	+0.0	48.6	57.4	-8.8	Neutr
	QP		+0.1								
^	421.660k	43.9	+9.9	+0.0	+0.0	+0.0	+0.0	53.9	47.4	+6.5	Neutr
			+0.1								
15	209.412k	41.1	+9.9	+0.0	+0.0	+0.0	+0.0	51.1	63.2	-12.1	Neutr
	QP		+0.1								
^	209.412k	44.4	+9.9	+0.0	+0.0	+0.0	+0.0	54.4	53.2	+1.2	Neutr
			+0.1								
17	558.862k	23.0	+9.9	+0.0	+0.1	+0.0	+0.0	33.2	46.0	-12.8	Neutr
	Ave		+0.2								
18	558.003k	22.4	+9.9	+0.0	+0.1	+0.0	+0.0	32.6	46.0	-13.4	Neutr
	Ave		+0.2								
19	492.486k	22.0	+9.9	+0.0	+0.1	+0.0	+0.0	32.1	46.1	-14.0	Neutr
	Ave		+0.1								
20	488.923k	21.6	+9.9	+0.0	+0.1	+0.0	+0.0	31.7	46.2	-14.5	Neutr
	Ave		+0.1								
21	152.236k	38.8	+9.9	+0.0	+0.0	+0.1	+0.0	50.9	65.9	-15.0	Neutr
	QP		+2.1								
22	558.862k	30.4	+9.9	+0.0	+0.1	+0.0	+0.0	40.6	56.0	-15.4	Neutr
	QP		+0.2								
23	558.003k	30.3	+9.9	+0.0	+0.1	+0.0	+0.0	40.5	56.0	-15.5	Neutr
	QP		+0.2								

^	558.003k	33.6	+9.9 +0.2	+0.0	+0.1	+0.0	+0.0	43.8	46.0	-2.2	Neutr
^	558.862k	33.4	+9.9 +0.2	+0.0	+0.1	+0.0	+0.0	43.6	46.0	-2.4	Neutr
26	492.486k QP	29.9	+9.9 +0.1	+0.0	+0.1	+0.0	+0.0	40.0	56.1	-16.1	Neutr
27	488.923k QP	29.5	+9.9 +0.1	+0.0	+0.1	+0.0	+0.0	39.6	56.2	-16.6	Neutr
^	488.923k	33.9	+9.9 +0.1	+0.0	+0.1	+0.0	+0.0	44.0	46.2	-2.2	Neutr
^	492.486k	33.6	+9.9 +0.1	+0.0	+0.1	+0.0	+0.0	43.7	46.1	-2.4	Neutr
^	485.968k	30.0	+9.9 +0.1	+0.0	+0.1	+0.0	+0.0	40.1	46.2	-6.1	Neutr
31	152.236k Ave	26.9	+9.9 +2.1	+0.0	+0.0	+0.1	+0.0	39.0	55.9	-16.9	Neutr
^	152.236k	44.8	+9.9 +2.1	+0.0	+0.0	+0.1	+0.0	56.9	55.9	+1.0	Neutr

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.