RF Test Report

For

Applicant Name:	**EVELAB INSIGHT (SINGAPORE) PTE. LTD.**
Address:	80 Robinson Road #02-00 Singapore 068898
EUT Name:	EveLab Insight Eve Key
Brand Name:	EveLab Insight
Model Number:	MS2201
Series Model Number:	--

Issued By

Company Name:	**BTF Testing Lab (Shenzhen) Co., Ltd.**
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Report Number:	BTF-SZ220530R-005
Test Standards:	47 CFR Part 15 Subpart E Section 15.407
FCC ID:	2BAG3MS2201
Test Conclusion:	Pass
Test Date:	2023-07-22 to 2023-09-11
Date of Issue:	2023-09-11

Prepared By: Elma.Yang

elma.yang / Project Engineer

Date: 2023-09-11

Approved By: Ryan.CJ

Ryan.CJ / EMC Manager

Date: 2023-09-11

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Revision History		
Version	Issue Date	Revisions Content
R_V0	2023-09-11	Original
Note:	Once the revision has been made, then previous versions reports are invalid.	

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1. Introduction

1.1 Identification of Testing Laboratory

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Phone Number:	+86-0755-23146130
Fax Number:	+86-0755-23146130

1.2 Identification of the Responsible Testing Location

Test Location:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Description:	All measurement facilities used to collect the measurement data are located at F101,201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
FCC Registration Number:	518915
Designation Number:	CN1330

1.3 Laboratory Condition

Ambient Temperature:	20℃ to 25℃
Ambient Relative Humidity:	45% to 55%
Ambient Pressure:	100 kPa to 102 kPa

1.4 Announcement

(1) The test report reference to the report template version v0.

(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.

(3) The test report is invalid if there is any evidence and/or falsification.

(4) This document may not be altered or revised in any way unless done so by BTF and all revisions are duly noted in the revisions section.

(5) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

(6) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

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2. Product Information

2.1 Application Information

Company Name:	EVELAB INSIGHT (SINGAPORE) PTE. LTD.
Address:	80 Robinson Road #02-00 Singapore 068898

2.2 Manufacturer Information

Company Name:	EVELAB INSIGHT (SINGAPORE) PTE. LTD.
Address:	80 Robinson Road #02-00 Singapore 068898

2.3 Factory Information

Company Name:	Kingtronics Corporation Of Elec.& Mech. Technology (Zhangzhou) Co.,Ltd.
Address:	No.20 Longchi Road, Longchi Industrial Park, Zhangzhou Taiwanese Investment Zone, Fujian, China

2.4 General Description of Equipment under Test (EUT)

EUT Name	EveLab Insight Eve Key
Under Test Model Name	MS2201
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	V1.0
Software and Firmware Version	V1.0

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2.5 Technical Information

Modulation technology	OFDM
Modulation Type	BPSK, QPSK, 16QAM, 64QAM, 256QAM
Function	☐ Outdoor AP ☐ Indoor AP ☐ Fixed P2P ☐ Client
Operation Frequency Range	U-NII Band 1: 5.18~5.24 GHz U-NII Band 3: 5.745~5.825 GHz
Frequency Block	U-NII Band 1: 5.15~5.25 GHz U-NII Band 3: 5.725~5.85 GHz
Channel Bandwidth	802.11a: 20 MHz 802.11n: 20 MHz, 40 MHz 802.11ac: 20 MHz, 40 MHz, 80 MHz
Antenna Type	FPCB Antenna
Antenna Gain#	ANT1:3dBi, ANT2:3dBi
Antenna Impedance	50Ω
Antenna System (MIMO Smart Antenna)	N/A

Note:

#: The antenna gain provided by the applicant, and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.

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Modulation technology	Modulation Type	Transfer Rate (Mbps)
OFDM (802.11a)	BPSK	6, 9
	QPSK	12, 18
	16QAM	24, 36
	64QAM	48, 54
OFDM (802.11n(HT20))	BPSK	6.5, 7.2
	QPSK	13, 14.4, 19.5, 21.7
	16QAM	26, 28.9, 39, 43.3
	64QAM	52, 57.8, 58.5, 65, 72.2
OFDM (802.11n(HT40))	BPSK	13.5, 15.0
	QPSK	27, 30, 40.5, 45.0
	16QAM	54, 60, 81, 90
	64QAM	108, 120, 121.5, 135, 150

OFDM (802.11ac(VHT20)/ (VHT40)/ (VHT80)):

MCS index	Modulation type	20 MHz channels		40 MHz channels		80 MHz channels	
		800ns GI	400ns GI	800ns GI	400ns GI	800ns GI	400ns GI
0	BPSK	6.5	7.2	13.5	15	29.3	32.5
1	QPSK	13	14.4	27	30	58.5	65
2	QPSK	19.5	21.7	40.5	45	87.8	97.5
3	16-QAM	26	28.9	54	60	117	130
4	16-QAM	39	43.3	81	90	175.5	195
5	64-QAM	52	57.8	108	120	234	260
6	64-QAM	58.5	65	121.5	135	263.3	292.5
7	64-QAM	65	72.2	135	150	292.5	325
8	256-QAM	78	86.7	162	180	351	390
9	256-QAM	N/A	N/A	180	200	390	433.3

Note: Preliminary tests were performed in different data rate in above table to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

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Test Items	Mode	Data Rate	Modulation Type	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
				Channel	Channel	Channel	Channel
RF Output Power	11a	6	BPSK QPSK 16QAM 64QAM 256QAM	36/44/48	N/A	N/A	149/157/165
	11n(20 MHz)	6.5		36/44/48	N/A	N/A	149/157/165
	11n(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(20 MHz)	6.5		36/44/48	N/A	N/A	149/157/165
	11ac(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(80 MHz)	29.3		42	N/A	N/A	155
26dB Emission Bandwidth & 99% Occupied Bandwidth	11a	6	BPSK QPSK 16QAM 64QAM 256QAM	36/44/48	N/A	N/A	149/157/165
	11n(20 MHz)	6.5		36/44/48	N/A	N/A	149/157/165
	11n(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(20 MHz)	6.5		36/44/48	N/A	N/A	149/157/165
	11ac(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(80 MHz)	29.3		42	N/A	N/A	155
6 dB bandwidth	11a	6	BPSK QPSK 16QAM 64QAM 256QAM	N/A	N/A	N/A	149/157/165
	11n(20 MHz)	6.5		N/A	N/A	N/A	149/157/165
	11n(40 MHz)	13.5		N/A	N/A	N/A	151/159
	11ac(20 MHz)	6.5		N/A	N/A	N/A	149/157/165
	11ac(40 MHz)	13.5		N/A	N/A	N/A	151/159
	11ac(80 MHz)	29.3		N/A	N/A	N/A	155
Power Spectral Density	11a	6	BPSK QPSK 16QAM 64QAM 256QAM	36/44/48	N/A	N/A	149/157/165
	11n(20 MHz)	6.5		36/44/48	N/A	N/A	149/157/165
	11n(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(20 MHz)	6.5		36/44/48	N/A	N/A	149/157/165
	11ac(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(80 MHz)	29.3		42	N/A	N/A	155
Radiated Spurious Emissions	11a	6	BPSK QPSK 16QAM 64QAM 256QAM	36/44/48	N/A	N/A	149/157/165
	11n(20 MHz)	6.5		36/44/48	N/A	N/A	149/157/165
	11n(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(20 MHz)	6.5		36/44/48	N/A	N/A	149/157/165
	11ac(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(80 MHz)	29.3		42	N/A	N/A	155
Band Edge (Restricted -band)	11a	6	BPSK QPSK 16QAM 64QAM 256QAM	36/48	N/A	N/A	149/165
	11n(20 MHz)	6.5		36/48	N/A	N/A	149/165
	11n(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(20 MHz)	6.5		36/48	N/A	N/A	149/165
	11ac(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(80 MHz)	29.3		42	N/A	N/A	155

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Frequency Stability	11a	6	BPSK QPSK 16QAM 64QAM 256QAM	36/44/48	N/A	N/A	149/157/165
	11n(20 MHz)	6.5		36/44/48	N/A	N/A	149/157/165
	11n(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(20 MHz)	6.5		36/44/48	N/A	N/A	149/157/165
	11ac(40 MHz)	13.5		38/46	N/A	N/A	151/159
	11ac(80 MHz)	29.3		42	N/A	N/A	155

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channels which were tested. The Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the below .

Band	Test Channel	20MHz		40MHz		80MHz	
		Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
U-NII-1	CH_L	36	5180	38	5190	-	-
	CH_M	44	5220	-	-	42	5210
	CH_H	48	5240	46	5230	-	-
U-NII-2A	CH_L	-	-	-	-	-	-
	CH_M	-	-	-	-	-	-
	CH_H	-	-	-	-	-	-
U-NII-2C	CH_L	-	-	-	-	-	-
	CH_M	-	-	-	-	-	-
	CH_H	-	-	-	-	-	-
	CH_{H1}	-	-	-	-	-	-
U-NII-3	CH_L	149	5745	151	5755	-	-
	CH_M	157	5785	-	-	155	5775
	CH_H	165	5825	159	5795	-	-

3. Summary of Test Results

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15 Subpart E Section 15.407	Unlicensed National Information Infrastructure Devices
2	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
3	KDB 789033 D02 v02r01	GUIDELINES FOR COMPLIANCE TESTING OF UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII) DEVICES PART 15, SUBPART E

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3.2 Summary of Test Result

No.	Description	FCC Part No.	Channel	Test Result	Test By	Verdict	Remark
1	Antenna Requirement	15.203	N/A	--	--	Pass	--
2	AC Conducted Emission	15.207	N/A	ANNEX A.1		Pass	--
3	Peak Output Power	15.407(a)	Low/Middle/High	ANNEX A.2		Pass	--
4	Power Spectral Density	15.407(a)	Low/Middle/High	ANNEX A.3		Pass	--
5	26dB Emission Bandwidth & 99% Occupied Bandwidth	15.407(a)	Low/Middle/High	ANNEX A.4		Pass	--
6	6 dB bandwidth	15.407(e)	Low/Middle/High	ANNEX A.5		Pass	--
7	Radiated Spurious Emissions	15.407(b)	Low/Middle/High	ANNEX A.6		Pass	--
8	Band Edge (Restricted-band)	15.407(b)	Low/High	ANNEX A.7		Pass	--
9	Frequency Stability	15.407(g)	Low/Middle/High	ANNEX A.8		Pass	--
10	Duty Cycle	ANSI 63.10 Section 11.6	Low	ANNEX A.9		Pass	--

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3.3 Uncertainty of Test

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2 and TR100 028-1/-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Occupied Channel Bandwidth	69 KHz
RF output power, conducted	0.87 dB
Power Spectral Density, conducted	0.69 dB
Unwanted Emissions, conducted	0.94 dB
All emissions, radiated(<1GHz)	4.12 dB
All emissions, radiated(>1GHz)	4.16 dB
Temperature	0.82 °C
Humidity	4.1 %

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4. Test Configuration

4.1 Environment Condition

Environment Parameter	Selected Values During Tests			
	Temperature	Voltage	Relative Humidity	Ambient Pressure
Normal Temperature, Normal Voltage (NTNV)	20°C to 25°C	DC 3.7V from battery	30% to 60%	100 kPa to 102 kPa

4.2 Test Equipment List

Conducted Method Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2022.11.24	2023.11.23	☒
WIDEBAND RADIO COMMNUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2022.11.24	2023.11.23	☒
ESG VECTOR SIGNAL GENERATOR	Agilent	E4438C	MY45094854	2022.11.24	2023.11.23	☒
MXG Vector Signal Generator	Agilent	N5182A	MY46240163	2022.11.24	2023.11.23	☒
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co., LTD	etm-6050c	20211026123	2022.11.25	2023.11.24	☒
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2022.11.24	2023.11.23	☒
RF Control Unit	TST	TST-Full	S01	/	/	☒
RF Test software	TST	V2.0	/	/	/	☒

Radiated Method Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
SIGNAL ANALYZER	ROHDE&SCHWARZ	FSQ40	100010	2022.11.24	2023.11.23	☒
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI7	101032	2022.11.24	2023.11.23	☒
Log periodic antenna	SCHWARZBECK	VULB 9168	01328	2021.11.28	2023.11.27	☒
Horn Antenna	SCHWARZBECK	BBHA9170	01157	2021.11.28	2023.11.27	☒
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/	☒
RE Cable	REBES Talent	UF2-NMNM-10m	21101570	2022.11.24	2023.11.23	☒
RE Cable	REBES Talent	UF2-NMNM-2.5m	21101573	2022.11.24	2023.11.23	☒

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RE Cable	REBES Talent	UF2-NMNM-1m	21101576	2022.11.24	2023.11.23	☒
Coaxial cable Multiflex 141	Schwarzbeck	N/SMA 0.5m	517386	2023.3.24	2024.3.23	☒
RE Cable	Talent Microwave	A40-2.92M2.92 M-14M	22080539	2022.11.24	2023.11.23	☒
RE Cable	Talent Microwave	A81-SMAMNM-14M	22080538	2022.11.24	2023.11.23	☒
Preamplifier	SCHWARZBECK	BBV9744	00246	2022.11.24	2023.11.23	☒
Horn Antenna	Schwarzbeck	BBHA9120D	2597	2022.5.22	2024.5.21	☒
Broadband Preamplilifier	Schwarzbeck	BBV9718D	00008	2023.3.24	2024.3.23	☒

Conducted disturbance Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWARZ	ESCI3	101422	2022.11.24	2023.11.23	☒
V-LISN	SCHWARZBECK	NSLK 8127	01073	2022.11.24	2023.11.23	☒
LISN	AFJ	LS16/110VAC	16010020076	2022.11.24	2023.11.23	☒
Coaxial Switcher	SCHWARZBECK	CX210	CX210	2022.11.24	2023.11.23	☒
Pulse Limiter	SCHWARZBECK	VTSD 9561-F	00953	2022.11.24	2023.11.23	☒
EZ_EMC	Frad	EMC-CON 3A1.1+	/	/	/	☒

4.3 Test Auxiliary Equipment

Title	Manufacturer	Model No.	Serial No.
Adapter	Huawei	HW-100225C00	/

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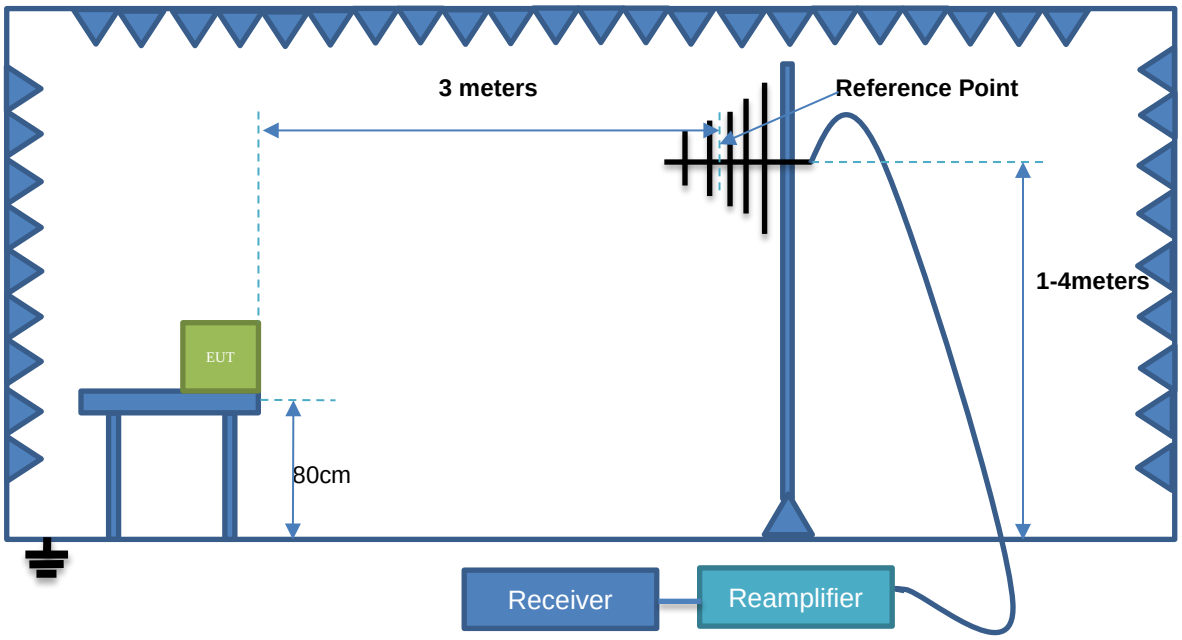
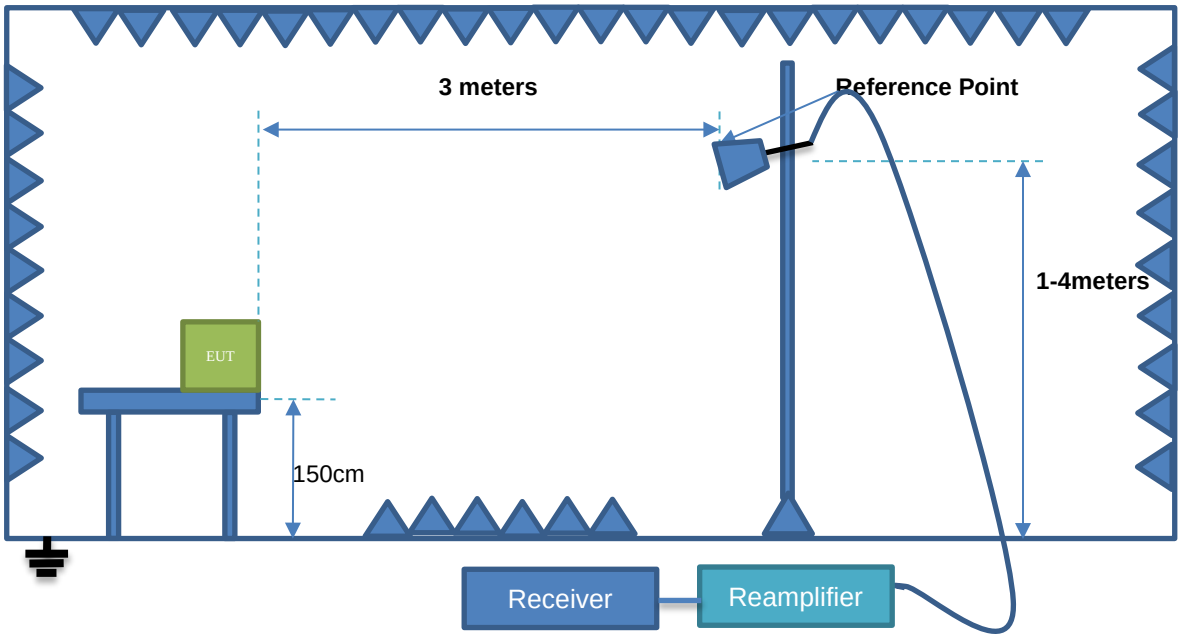
4.4 Test Setup

Test Setup 1



Radiation Test (30MHz – 1GHz)



Radiation Test (Above 1GHz)

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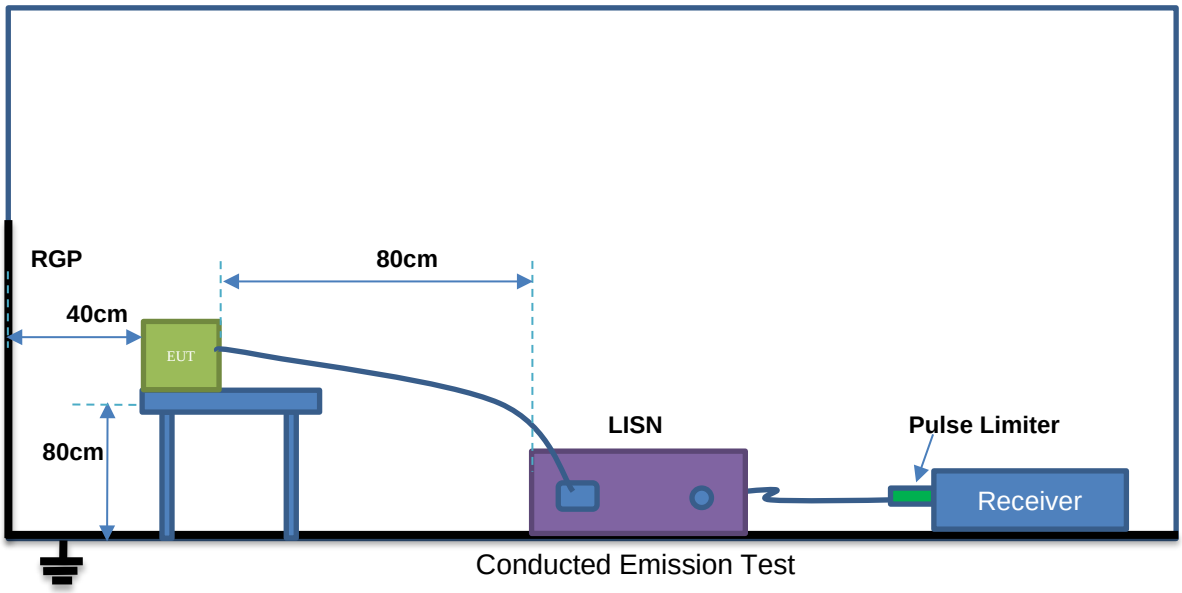
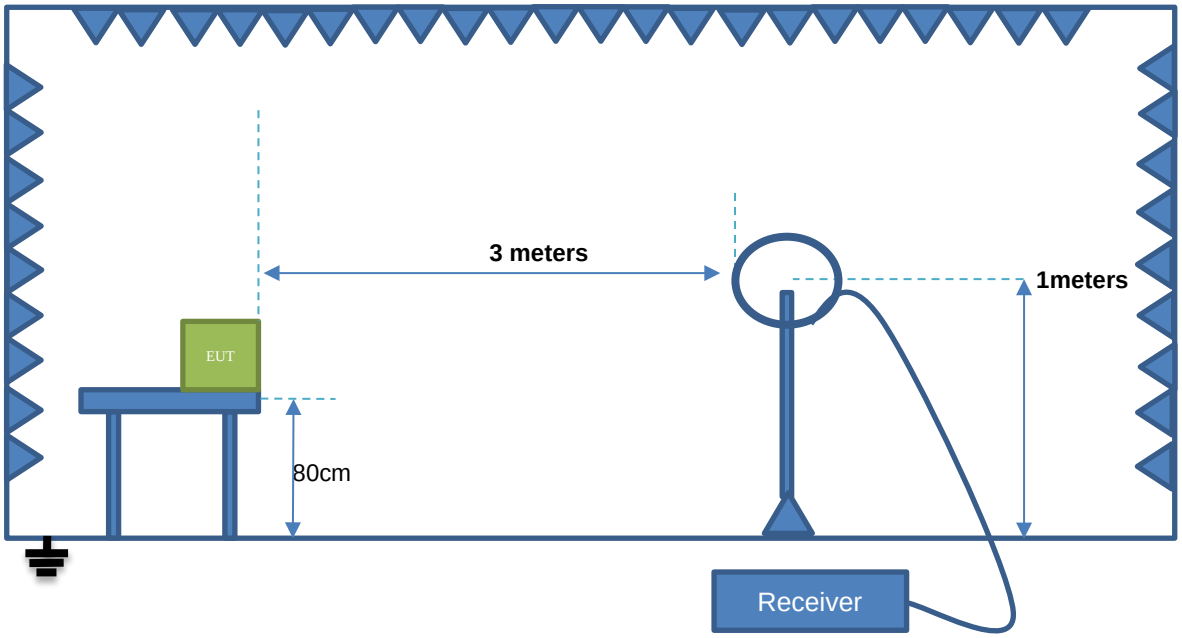
Test Setup 2



Conducted Emission Test

Test Setup 3



Radiation Test (9k - 30MHz)

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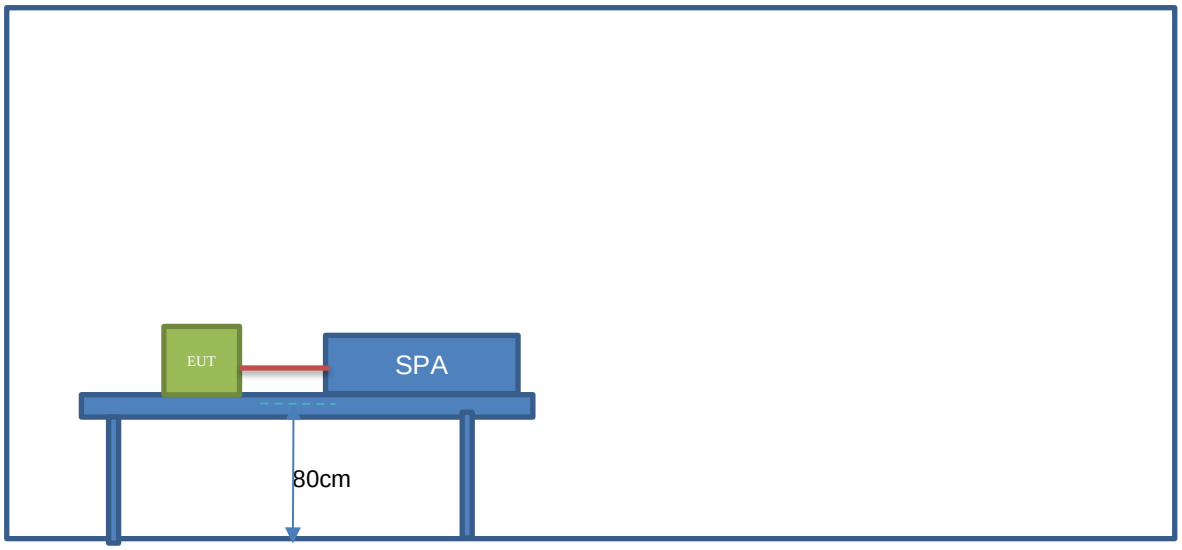
Test Setup 4



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5. Test Items

5.1 Antenna Requirements

5.1.1 Relevant Standards

FCC §15.203; RSS-247, 5.4(f)
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

5.1.2 Antenna Anti-Replacement Construction

Protected Method	Description
The antenna is embedded in the product.	An embedded in antenna design is used.

5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

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5.2 AC Conducted Emission

5.2.1 Limit

FCC §15.2074

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

5.2.2 Test Setup

See section 4.4 for test setup description for setup 2. The photo of test setup please refer to ANNEX B

5.2.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

5.2.4 Test Result

Please refer to ANNEX A.1

NOTE:

1. Results (dBuV) = Reading (dBuV) + Factor (dB)
   The reading level is calculated by software which is not shown in the sheet
2. Factor = Insertion loss + Cable loss
3. Over limit = Results – Limit.

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5.3 Peak Output Power

5.3.1 Limit

FCC §15.407(a)

Frequency Band (MHz)	Limit
5.15~5.25GHz band	Outdoor AP The maximum conducted output power (P_{out}) shall not exceed 1W (30dBm). if G_{TX}>6dBi, then P_{out} =30-(G_{TX}-6). e.i.r.p. at any elevation angle above 30 degrees ≤125mW (21dBm). Indoor AP The maximum conducted output power (P_{out}) shall not exceed 1W (30dBm). if G_{TX}>6dBi, then P_{out} =30-(G_{TX}-6). Point-to-point AP The maximum conducted output power (P_{out}) shall not exceed of 1W (30dBm). if G_{TX}>23dBi, then P_{out} =30-(G_{TX}-23). Client devices The maximum conducted output power (P_{out}) shall not exceed 250mW (24dBm). if G_{TX}>6dBi, then P_{out} =24-(G_{TX}-6).
5.25~5.35GHz band	The maximum conducted output power (P_{out}) shall not exceed 250mW (24dBm) or 11dBm+10 log B, where B is the 26dB emission bandwith in MHz. if G_{TX}>6dBi, then P_{out} =24-(G_{TX}-6).
5.47~5.725GHz band	The maximum conducted output power (P_{out}) shall not exceed 250mW (24dBm) or 11dBm+10 log B, where B is the 26dB emission bandwith in MHz. if G_{TX}>6dBi, then P_{out} =24-(G_{TX}-6).
5.725~5.85GHz band	Point-to-multipoint systems (P2M) The maximum conducted output power (P_{out}) shall not exceed 1W (30dBm). if G_{TX}>6dBi, then P_{out} =30-(G_{TX}-6). Point-to-point systems (P2P) The maximum conducted output power (P_{out}) shall not exceed 1W (30dBm).

5.3.2 Test Setup

See section 4.4 for test setup description for the antenna port.

5.3.4 Test Result

Please refer to ANNEX A.2

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5.4 Power Spectral Density

5.4.1 Limit

FCC §15.407(a)

Frequency Band (MHz)	Limit
5.15~5.25GHz band	Outdoor AP The peak power spectral density (PSD) shall not exceed 17dBm/MHz. if G_{TX}>6dBi, then PSD =17-(G_{TX}-6). Indoor AP The peak power spectral density (PSD) shall not exceed 17dBm/MHz. if G_{TX}>6dBi, then PSD =17-(G_{TX}-6). Point-to-point AP The peak power spectral density (PSD) shall not exceed 17dBm/MHz. if G_{TX}>23dBi, then PSD =17-(G_{TX}-23). Client devices The peak power spectral density (PSD) shall not exceed 11dBm/MHz. if G_{TX}>6dBi, then PSD =11-(G_{TX}-6).
5.25~5.35GHz band	The peak power spectral density (PSD) shall not exceed 11dBm/MHz. if G_{TX}>6dBi, then PSD =11-(G_{TX}-6).
5.47~5.725GHz band	The peak power spectral density (PSD) shall not exceed 11dBm/MHz. if G_{TX}>6dBi, then PSD =11-(G_{TX}-6).
5.725~5.85GHz band	Point-to-multipoint systems (P2M) The peak power spectral density (PSD) shall not exceed 30dBm/500KHz. if G_{TX}>6dBi, then PSD =30-(G_{TX}-6). Point-to-point systems (P2P) The peak power spectral density (PSD) shall not exceed 30dBm/500KHz.

5.4.2 Test Setup

See section 4.4 for test setup description for the antenna port.

5.4.3 Test Procedure

According KDB 789033 D02 – Section F
Analyzer was setting as follow:
Center frequency: test channel
Span was set to encompass the entire emission bandwidth of the signal
RBW=1MHz for devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz

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RBW=500kHz for devices operating in the band 5.725-5.85 GHz, VBW ≥ 3 RBW
Number of sweep points > 2 x (span/RBW)
Sweep time = auto
Detector = Peak
Trigger was set to free run for all modes, trace was averaged over 100 sweeps
The peak search function of the spectrum analyzer was used to find the peak of the spectrum.

5.4.4 Test Result

Please refer to ANNEX A.3

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5.5 26dB Emission Bandwidth & 99% Occupied Bandwidth

5.5.1 Limit

FCC §15.407(a)
The bandwidth at 26dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in KDB 789033 D02 , and at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26dB bandwidth.

5.5.2 Test Setup

See section 4.4 for test setup description for the antenna port.

5.5.3 Test Procedure

1. According KDB 789033 D02 – Section C, 26dB bandwidth test as follow

a) Set RBW = approximately 1% of the emission bandwidth.

b) Set the VBW > RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

2. According KDB 789033 D02 – Section D, 99% bandwidth test as follow

a). Set center frequency to the nominal EUT channel center frequency.

b). Set span = 1.5 times to 5.0 times the OBW.

c). Set RBW = 1% to 5% of the OBW

d). Set VBW ⩾ 3RBW

e). Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

f). Use the 99% power bandwidth function of the instrument

5.5.4 Test Result

Please refer to ANNEX A.4

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5.6 6 dB bandwidth

5.6.1 Limit

FCC §15.407(e)
Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz

5.6.2 Test Setup

See section 4.4 for test setup description for the antenna port.

5.6.3 Test Procedure

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).
   Center Frequency =test channel center frequency
   Span=2 x emission bandwidth
   RBW = 100 kHz, VBW ⩾ 3 × RBW
   Sweep time= auto couple
   Detector = Peak
   Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter wave form on the spectrum analyzer.
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission, and record the pertinent measurements.

5.6.4 Test Result

Please refer to ANNEX A.5

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5.7 Radiated Spurious Emissions

5.7.1 Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.209 and Part 15 Subpart E Section 15.407(b)

Frequency	Limit (dBuV/m)	Value
0.009 MHz ~0.49 MHz	2400/F(kHz) @300m	Quasi-peak
0.49 MHz ~ 1.705 MHz	24000/F(kHz) @30m	Quasi-peak
1.705 MHz ~30 MHz	30 @30m	Quasi-peak

Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3)= Limit dBuV/m @300m +80,

Limit dBuV/m @3m = Limit dBuV/m @30m +40*log(30/3)= Limit dBuV/m @30m + 40.

Unwanted emissions below 1GHz and Restricted band emissions above 1GHz		
Frequency	Limit (dBuV/m @3m)	Value
30MHz-88MHz	40.00	Quasi-peak
88MHz-216MHz	43.50	Quasi-peak
216MHz-960MHz	46.00	Quasi-peak
960MHz-1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

5.7.2 Test Setup

See section 4.4 for test setup description for setup 1 and 3.

5.7.3 Test Procedure

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10-2013. The test distance is 3m.The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.
This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205.
It must be performed with the highest gain of each type of antenna proposed for use with the EUT.
Use the following spectrum analyzer settings:

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

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Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 0.8 m for below 1GHz and 1.5m for above 1GHz the ground at a 3 meter. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 0.8 m for below 1GHz and 1.5m for above 1GHz; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

Note: for the frequency ranges below 30 MHz, a narrower RBW is used for these ranges but the measured value should add a RBW correction factor (RBWCF) where RBWCF [dB] =10*lg(100 [kHz]/narrower RBW [kHz]). , the narrower RBW is 1 kHz and RBWCF is 20 dB for the frequency 9 kHz to 150 kHz, and the narrower RBW is 10 kHz and RBWCF is 10 dB for the frequency 150 kHz to 30 MHz.

5.7.4 Test Result

Please refer to ANNEX A.6

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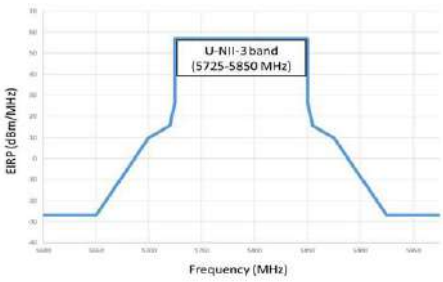
5.8 Band Edge (Restricted-band)

5.8.1 Limit

FCC §15.407(b)

Un-restricted band emissions above 1GHz			
Operating Band	Frequency	EIRP Limit	Value
5150-5250MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
5250-5350MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
5470-5725MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
5725-5850 MHz 	1GHz-5.65GHz	-27 dBm/MHz(68.2dBuV/m)@3m	Peak
	5.65GHz-5.7GHz	-27dBm/MHz to 10dBm/MHz* (68.2dBuV/m to 105.6dBuV/m) *	Peak
	5.7GHz-5.72GHz	10dBm/MHz to 15.6dBm/MHz* (105.6dBuV/m to 110.8dBuV/m) *	Peak
	5.72GHz-5.725GHz	15.6dBm/MHz to 27dBm/MHz* (110.8dBuV/m to 122.2dBuV/m) *	Peak
	5.85GHz-5.855GHz	27dBm/MHz to 15.6dBm/MHz* (122.2dBuV/m to110.8dBuV/m)*	Peak
	5.855GHz-5.875GHz	15.6dBm/MHz to 10dBm/MHz* (110.8dBuV/m to 105.6dBuV/m*	Peak
	5.875GHz-5.925GHz	10dBm/MHz to -27dBm/MHz* (105.6dBuV/m to 68.2dBuV/m) *	Peak
	Above 5.925GHz	-27 dBm/MHz(68.2dBuV/m)@3m	Peak

* Increase/Decreases with the linearly of the frequency.

For emission above 1GHz and in restricted band, according to FCC KDB 789033 D02 General UNII Test Procedure, all emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit. E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

5.8.2 Test Setup

See section 4.4 for test setup description for setup 4.

5.8.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal froman external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antennaterminal to measurement instrument via a low loss cable. Then set it to any one measured frequency withinits operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graphwith marking the highest point and edge frequency.

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5. Repeat above procedures until all measured frequencies were complete.

5.8.4 Test Result

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5.9 Frequency Stability

5.9.1 Limit

FCC §15.407(g)
Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

5.9.2 Test Setup

See section 4.4 for test setup description for antenna port. The photo of test setup please refer to ANNEX B

5.9.3 Test Procedure

Frequency stability with respect to ambient temperature

1. The equipment under test was connected to an external power supply.
2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators.
3. The EUT was placed inside the temperature chamber.
4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution.
5. Turn EUT off and set the chamber temperature to -30℃. After the temperature stabilized for approximately 30 minutes recorded the frequency.
6. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached..

Frequency stability when varying supply voltage

1. The equipment under test was connected to an external power supply.
2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators.
3. The EUT was placed in normal room temperature of 25℃.
4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution.
5. Measure the frequency when EUT supply by normal rate voltage.
6. Repeat step measure when supply voltage adjusted to 85% and 115%.

5.9.4 Test Result

Please refer to ANNEX A.8

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5.10 Duty Cycle

5.10.1 Limit

No limit requirement.

5.10.2 Test Setup

See section 4.4 for test setup description for antenna port. The photo of test setup please refer to ANNEX B

5.10.3 Test Procedure

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ⩾ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ⩾ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ⩽ 16.7 microseconds.)

The transmitter output is connected to the Spectrum Analyzer. We tested according to the zero-span measurement method, 6.0(b) in KDB 558074 D01 DTS Meas Guidance v05r02.

The largest availble value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if T ⩽ 6.25 microseconds. (50/6.25 = 8)

The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are > 50/T.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = Zero Span

RBW = 8MHz (the largest available value)

VBW = 50MHz (≥ RBW)

Number of points in Sweep >100

Detector function = peak

Trace = Clear write

Measure Total and Ton

Calculate Duty Cycle = Ton / Total

5.10.4 Test Result

Please refer to ANNEX A.9

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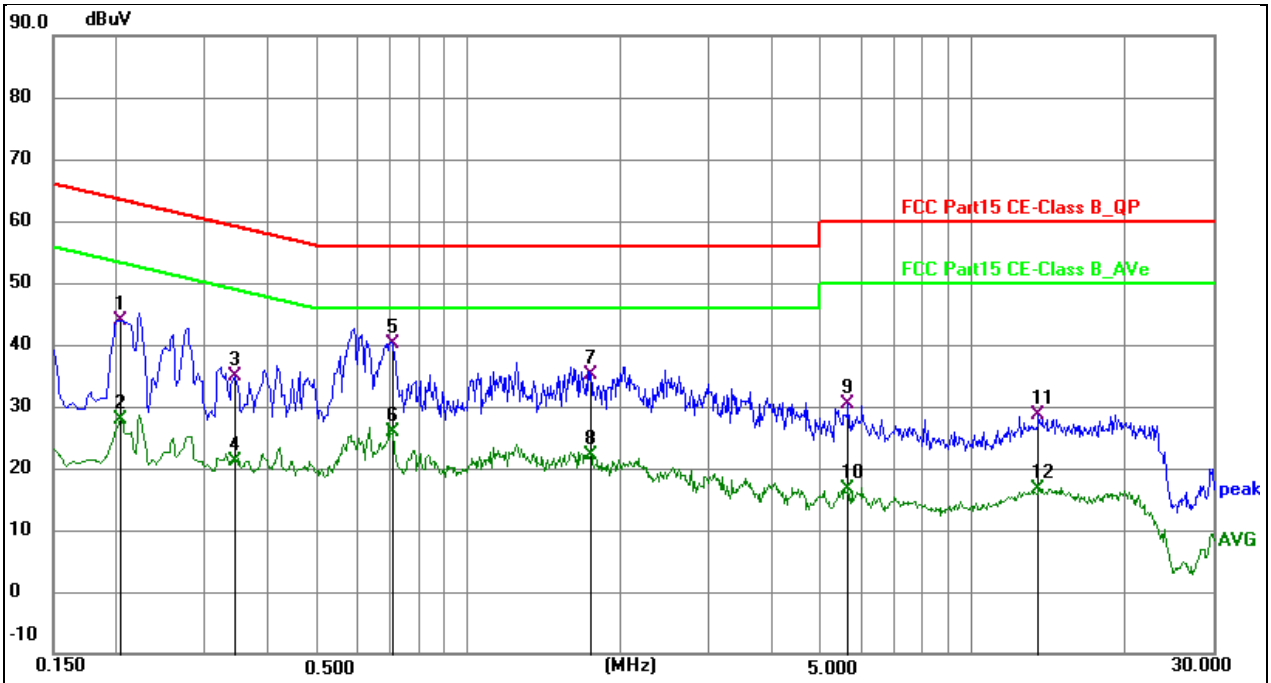
ANNEX A Test Results

A.1 AC Conducted Emission

(150kHz ~ 30MHz) Phase: N



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.2040	34.33	9.60	43.93	63.45	-19.52	QP	P	
2	0.2040	18.24	9.60	27.84	53.45	-25.61	AVG	P	
3	0.3435	25.61	9.39	35.00	59.12	-24.12	QP	P	
4	0.3435	11.75	9.39	21.14	49.12	-27.98	AVG	P	
5 *	0.7047	30.44	9.62	40.06	56.00	-15.94	QP	P	
6	0.7047	16.21	9.62	25.83	46.00	-20.17	AVG	P	
7	1.7475	25.18	10.04	35.22	56.00	-20.78	QP	P	
8	1.7475	12.04	10.04	22.08	46.00	-23.92	AVG	P	
9	5.6760	20.23	10.23	30.46	60.00	-29.54	QP	P	
10	5.6760	6.35	10.23	16.58	50.00	-33.42	AVG	P	
11	13.5240	18.49	10.09	28.58	60.00	-31.42	QP	P	
12	13.5240	6.47	10.09	16.56	50.00	-33.44	AVG	P	

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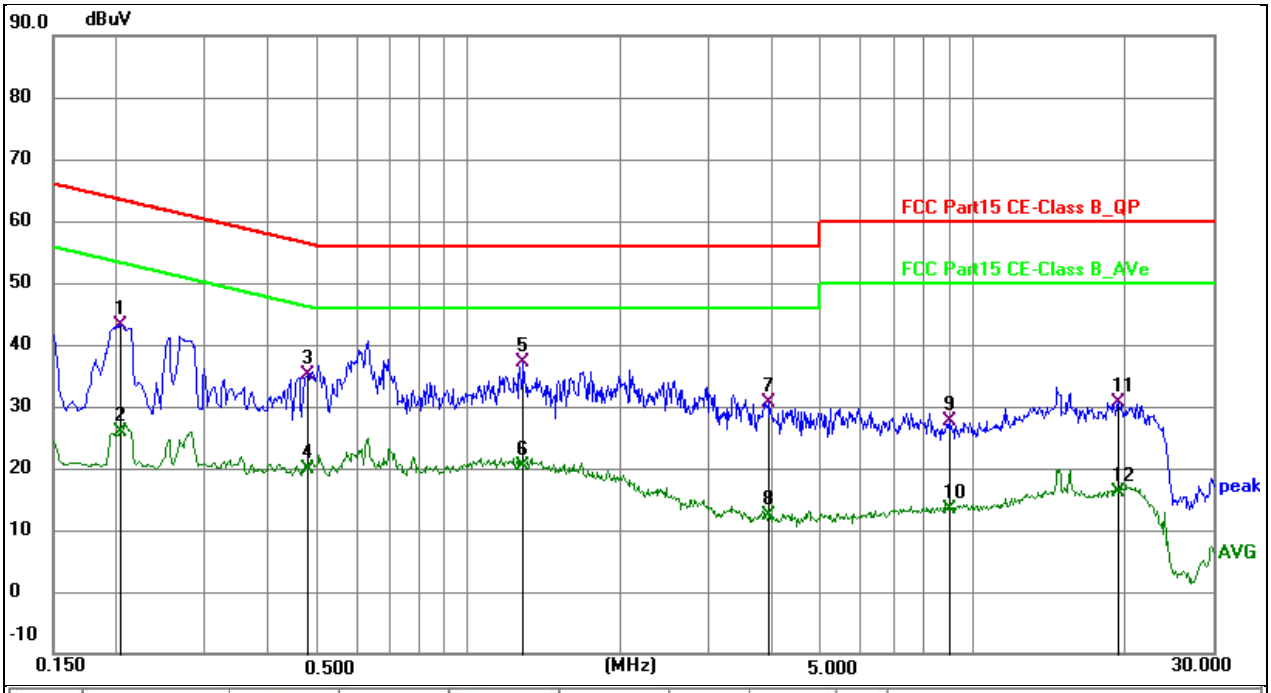
(150kHz ~ 30MHz) Phase: L



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.2040	34.02	9.00	43.02	63.45	-20.43	QP	P	
2	0.2040	16.76	9.00	25.76	53.45	-27.69	AVG	P	
3	0.4785	25.23	9.93	35.16	56.37	-21.21	QP	P	
4	0.4785	10.04	9.93	19.97	46.37	-26.40	AVG	P	
5 *	1.2839	27.19	10.03	37.22	56.00	-18.78	QP	P	
6	1.2839	10.43	10.03	20.46	46.00	-25.54	AVG	P	
7	3.9300	20.57	10.13	30.70	56.00	-25.30	QP	P	
8	3.9300	2.20	10.13	12.33	46.00	-33.67	AVG	P	
9	8.9790	17.40	10.12	27.52	60.00	-32.48	QP	P	
10	8.9790	3.36	10.12	13.48	50.00	-36.52	AVG	P	
11	19.4325	20.09	10.50	30.59	60.00	-29.41	QP	P	
12	19.4325	5.71	10.50	16.21	50.00	-33.79	AVG	P	

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A.2 Peak Output Power

Sub-band(5.2GHz): 5150-5250MHz

Mode	Frequency	ANT1 Power (dBm)	ANT2 Power (dBm)	Total Power (dBm)	Limit (dBm/MHz)
802.11 a	5180 MHz	1.71	2.26	5	23.98
	5200 MHz	1.13	1.89	4.54	23.98
	5240 MHz	0.9	1.81	4.39	23.98
802.11 ac20	5180 MHz	0.91	1.55	4.25	23.98
	5200 MHz	0.37	0.67	3.53	23.98
	5240 MHz	-0.09	0.8	3.39	23.98
802.11 n20	5180 MHz	0.89	1.47	4.2	23.98
	5200 MHz	0.33	0.69	3.52	23.98
	5240 MHz	-0.09	0.78	3.38	23.98
802.11 n40	5190 MHz	-0.34	-0.07	2.81	23.98
	5230 MHz	-0.89	-0.39	2.38	23.98
802.11 ac40	5190 MHz	-0.28	0.05	2.9	23.98
	5230 MHz	-0.84	-0.26	2.47	23.98
802.11 ac80	5210 MHz	-0.55	-0.05	2.72	23.98

Sub-band(5.8GHz): 5725-5850MHz

Mode	Frequency	ANT1 Power (dBm)	ANT2 Power (dBm)	Total Power (dBm)	Limit (dBm/MHz)
802.11 a	5745 MHz	-1.03	0.8	2.99	30
	5785 MHz	0.65	1.37	4.04	30
	5825 MHz	0.15	2.08	4.23	30
802.11 ac20	5745 MHz	-1.99	0.14	2.21	30
	5785 MHz	-0.52	1.06	3.35	30
	5825 MHz	-0.67	0.76	3.11	30
802.11 n20	5745 MHz	-1.95	0.11	2.21	30
	5785 MHz	-0.55	1.01	3.31	30
	5825 MHz	-0.71	0.73	3.08	30
802.11 n40	5755 MHz	-2.53	-0.8	1.43	30
	5795 MHz	-1.44	-0.48	2.08	30
802.11 ac40	5755 MHz	-2.46	-0.64	1.55	30
	5795 MHz	-1.37	-0.32	2.2	30
802.11 ac80	5775 MHz	-1.77	0.28	2.39	30

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A.3 Power Spectral Density

Sub-band(5.2GHz): 5150-5250MHz

Mode	Frequency	ANT1 PSD (dBm/MHz)	ANT2 PSD (dBm/MHz)	Total PSD (dBm/MHz)	Limit (dBm/MHz)
802.11 a	5180 MHz	-21.07	-22.48	-18.71	11
	5200 MHz	-21.6	-21.64	-18.61	11
	5240 MHz	-19.04	-23.8	-17.79	11
802.11 ac20	5180 MHz	-26.61	-24.38	-22.34	11
	5200 MHz	-22.73	-27.26	-21.42	11
	5240 MHz	-26.06	-24.39	-22.13	11
802.11 n20	5180 MHz	-22.22	-22.94	-19.55	11
	5200 MHz	-23.69	-24.09	-20.88	11
	5240 MHz	-24.32	-22.25	-20.15	11
802.11 n40	5190 MHz	-32.1	-30.78	-28.38	11
	5230 MHz	-34.35	-34.25	-31.29	11
802.11 ac40	5190 MHz	-33.42	-32.24	-29.78	11
	5230 MHz	-29.93	-32.04	-27.85	11
802.11 ac80	5210 MHz	-41.44	-40.18	-37.75	11

Sub-band(5.8GHz): 5725-5850MHz

Mode	Frequency	ANT1 PSD (dBm/500kHz)	ANT2 PSD (dBm/500kHz)	Total PSD (dBm/500kHz)	Limit (dBm/500kHz)
802.11 a	5745 MHz	-25.65	-27.91	-23.62	30
	5785 MHz	-21.41	-27.63	-20.48	30
	5825 MHz	-24.59	-26.51	-22.43	30
802.11 ac20	5745 MHz	-30.17	-32.13	-28.03	30
	5785 MHz	-28.08	-28.87	-25.45	30
	5825 MHz	-27.65	-27.22	-24.42	30
802.11 n20	5745 MHz	-28.21	-30.02	-26.01	30
	5785 MHz	-27.32	-26.54	-23.9	30
	5825 MHz	-25.47	-29.98	-24.15	30
802.11 n40	5755 MHz	-36.55	-36.97	-33.74	30
	5795 MHz	-35.17	-36.42	-32.74	30
802.11 ac40	5755 MHz	-35.74	-37.53	-33.53	30
	5795 MHz	-39.45	-38.68	-36.04	30
802.11 ac80	5775 MHz	-41.25	-45.3	-39.81	30

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5.2GHz Power Spectrum Density

802.11a on channel 36 ANT1

802.11a on channel 36 ANT2

802.11a on channel 40 ANT1

802.11a on channel 40 ANT2

802.11a on channel 48 ANT1

802.11a on channel 48 ANT2

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802.11ac20 on channel 36 ANT1

802.11ac20 on channel 36 ANT2

802.11ac20 on channel 40 ANT1

802.11ac20 on channel 40 ANT2

802.11ac20 on channel 48 ANT1

802.11ac20 on channel 48 ANT2

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802.11n20 on channel 36 ANT1

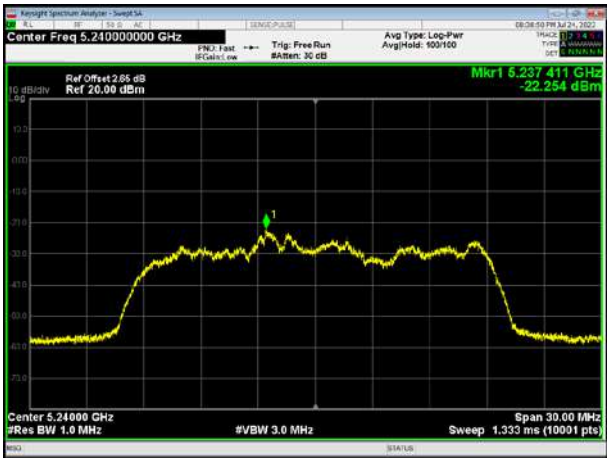
802.11n20 on channel 36 ANT2

802.11n20 on channel 40 ANT1

802.11n20 on channel 40 ANT2

802.11n20 on channel 48 ANT1

802.11n20 on channel 48 ANT2



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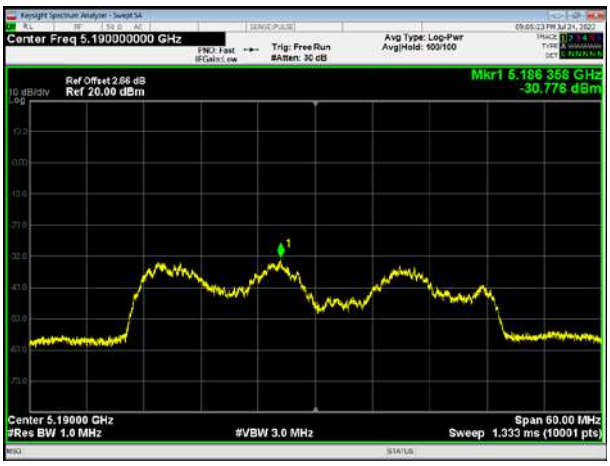
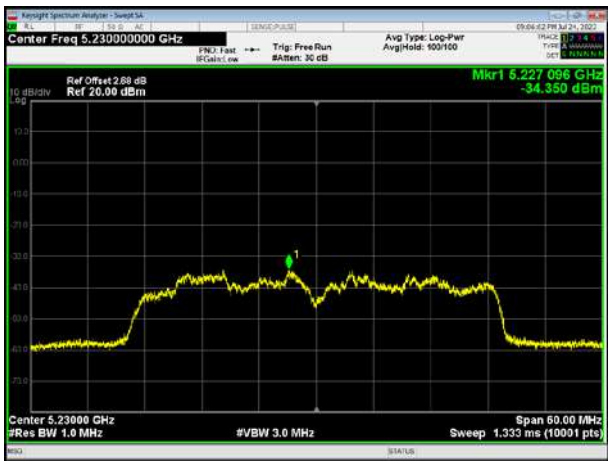
802.11n40 on channel 38 ANT1

802.11n40 on channel 38 ANT2



802.11n40 on channel 46 ANT1



802.11n40 on channel 46 ANT2

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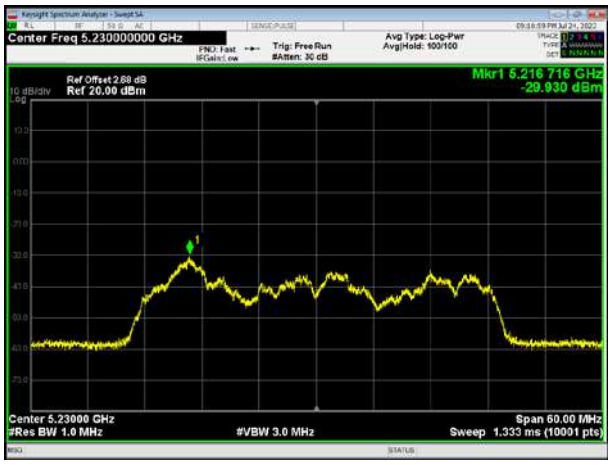
802.11ac40 on channel 38 ANT1

802.11ac40 on channel 38 ANT2

802.11ac40 on channel 46 ANT1



802.11ac40 on channel 46 ANT2

802.11ac80 on channel 42 ANT1

802.11ac80 on channel 42 ANT2

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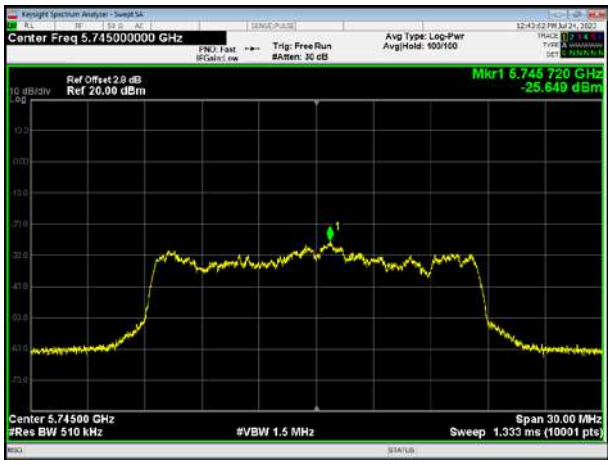
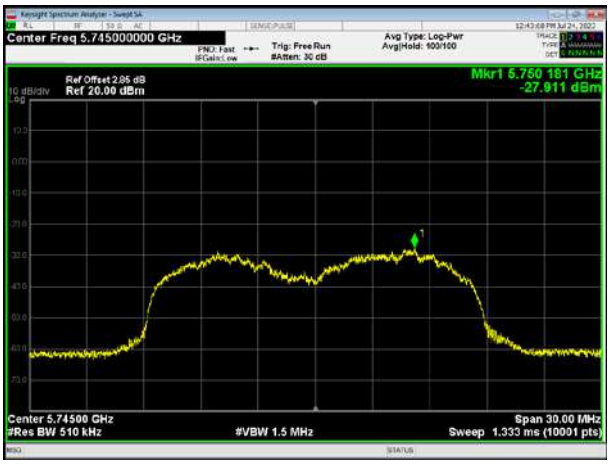
5.8GHz Power Spectrum Density

802.11a on channel 149 ANT1



802.11a on channel 149 ANT2

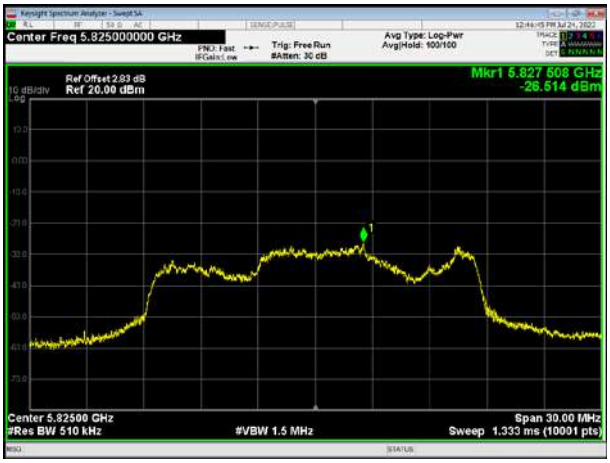


802.11a on channel 157 ANT1

802.11a on channel 157 ANT2

802.11a on channel 165 ANT1

802.11a on channel 165 ANT2



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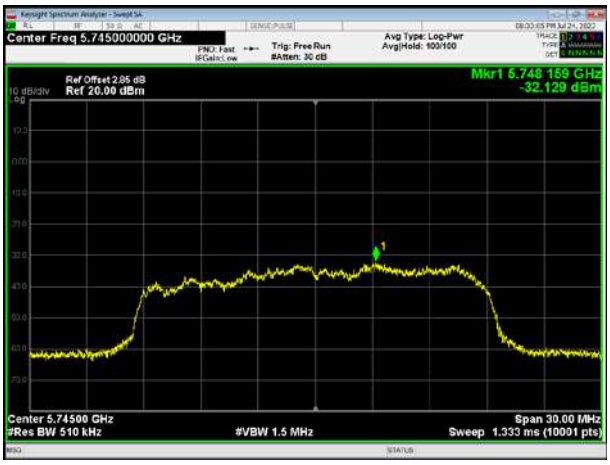
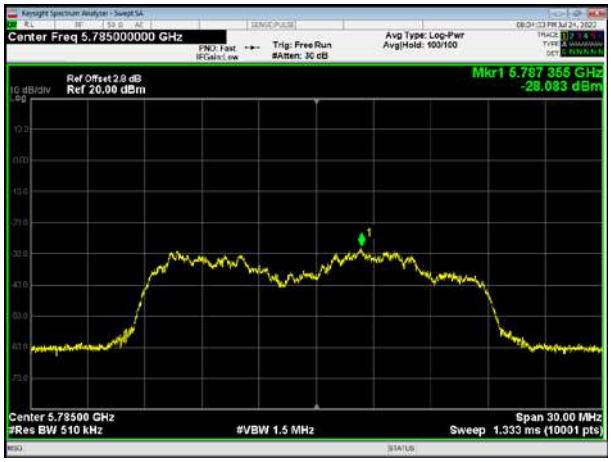
802.11ac20 on channel 149 ANT1

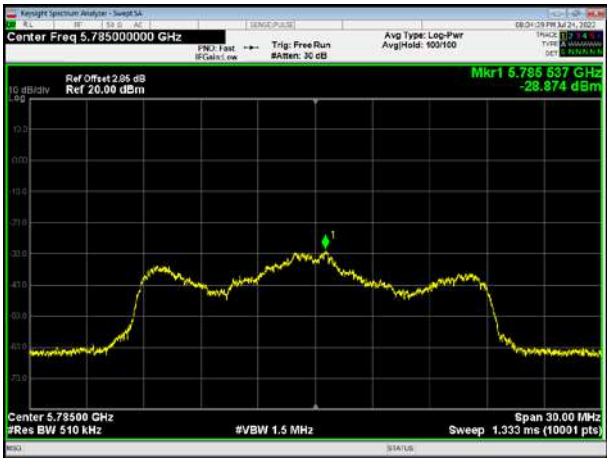
802.11ac20 on channel 149 ANT2



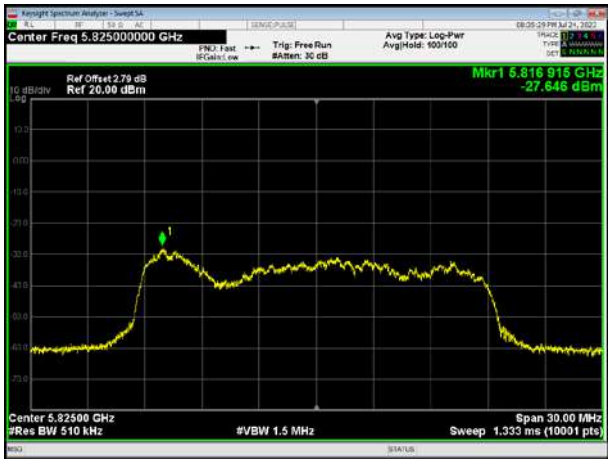
802.11ac20 on channel 157 ANT1



802.11ac20 on channel 157 ANT2



802.11ac20 on channel 165 ANT1



802.11ac20 on channel 165 ANT2

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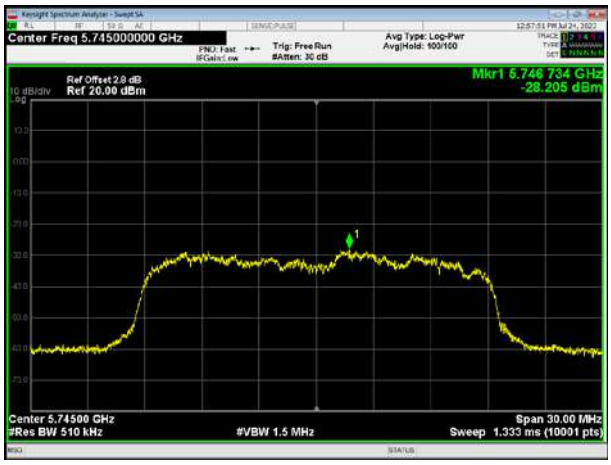
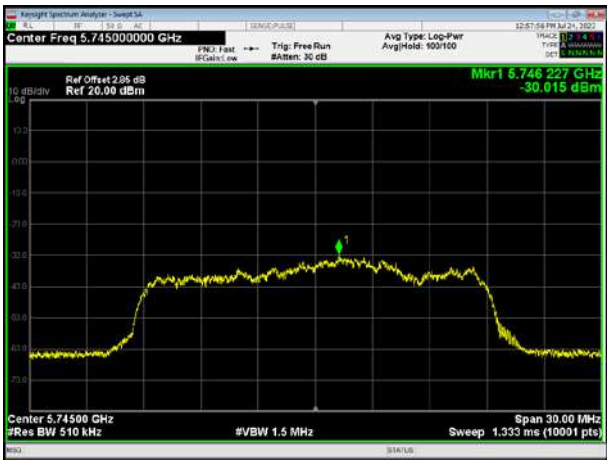
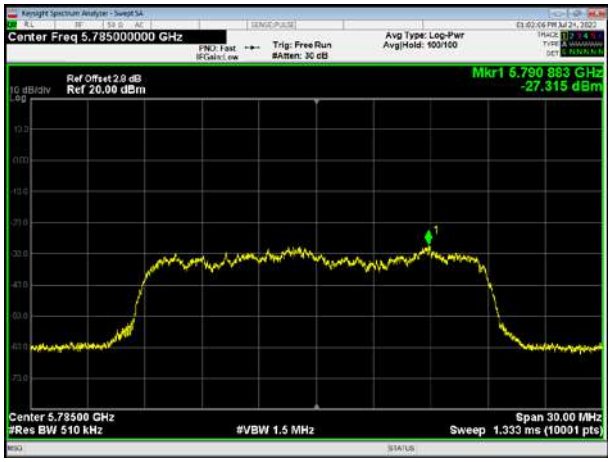
802.11n20 on channel 149 ANT1



802.11n20 on channel 149 ANT2

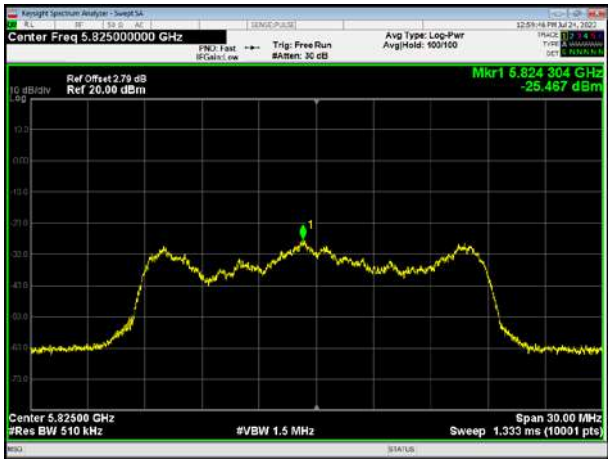


802.11n20 on channel 157 ANT1



802.11n20 on channel 157 ANT2

802.11n20 on channel 165 ANT1



802.11n20 on channel 165 ANT2

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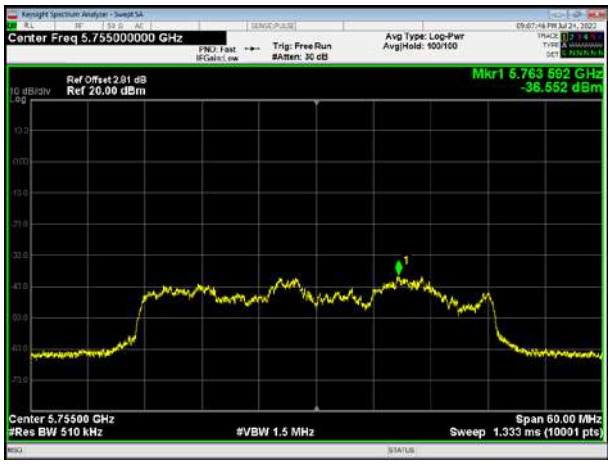
802.11n40 on channel 151 ANT1



802.11n40 on channel 151 ANT2

802.11n40 on channel 159 ANT1

802.11n40 on channel 159 ANT2

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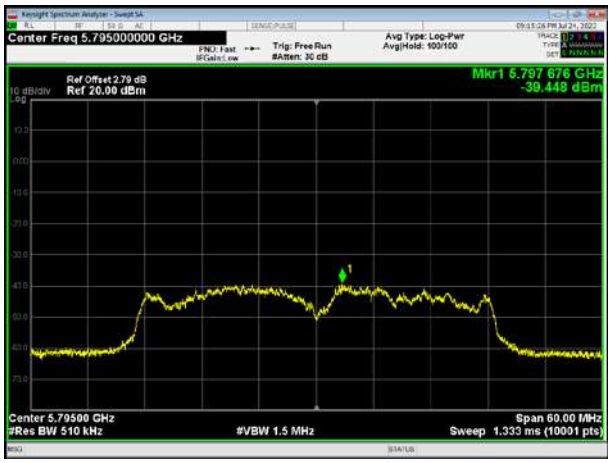
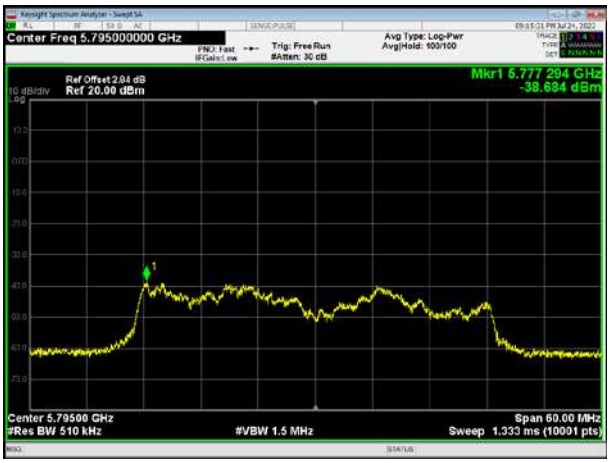
802.11ac40 on channel 151 ANT1

802.11ac40 on channel 151 ANT2

802.11ac40 on channel 159 ANT1



802.11ac40 on channel 159 ANT2



802.11ac80 on channel 155 ANT1

802.11ac80 on channel 155 ANT2

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A.4 26dB Emission Bandwidth & 99% Occupied Bandwidth

Sub-band(5.2GHz): 5150-5250MHz

Mode	Frequency	-26dB Bandwidth		99% Bandwidth		Limit (kHz)
		ANT1 (MHz)	ANT2 (MHz)	ANT1 (MHz)	ANT2 (MHz)	
802.11 a	5180 MHz	18.256	17.972	16.308	16.298	--
	5200 MHz	18.254	18.23	16.309	16.312	--
	5240 MHz	17.811	18.222	16.299	16.306	--
802.11 ac20	5180 MHz	19.083	19.305	17.514	17.551	--
	5200 MHz	19.079	18.966	17.553	17.48	--
	5240 MHz	19.209	19.199	17.517	17.542	--
802.11 n20	5180 MHz	19.161	19.212	17.508	17.504	--
	5200 MHz	18.996	19.184	17.483	17.505	--
	5240 MHz	19.319	19.385	17.5	17.547	--
802.11 n40	5190 MHz	38.342	38.106	35.907	35.903	--
	5230 MHz	38.194	38.282	35.907	36.004	--
802.11 ac40	5190 MHz	38.085	38.579	35.998	35.822	--
	5230 MHz	38.365	38.359	35.993	35.86	--
802.11 ac80	5210 MHz	79.871	79.966	75.593	75.474	--

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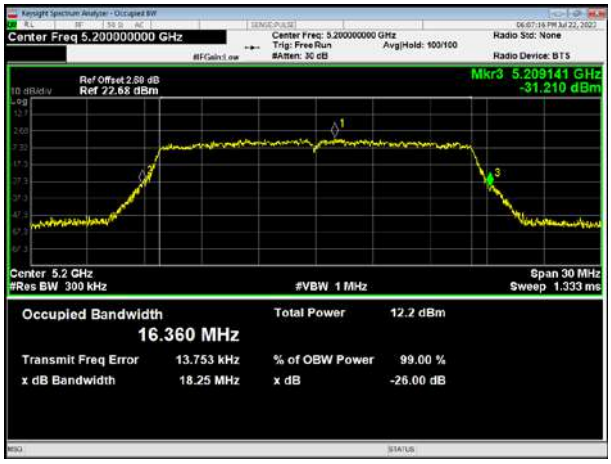
5.2GHz -26dB Bandwidth

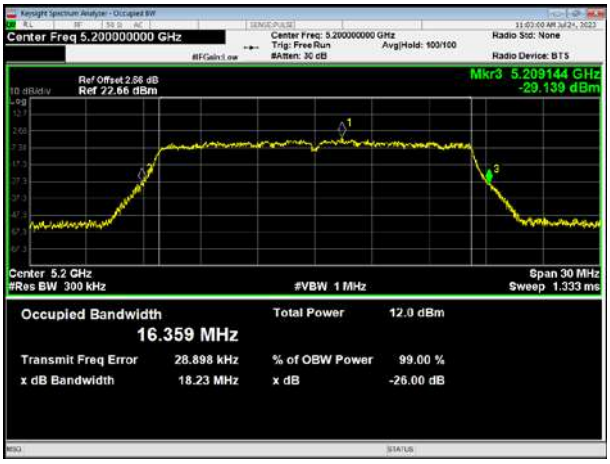
802.11a on channel 36 ANT1

802.11a on channel 36 ANT2

802.11a on channel 40 ANT1

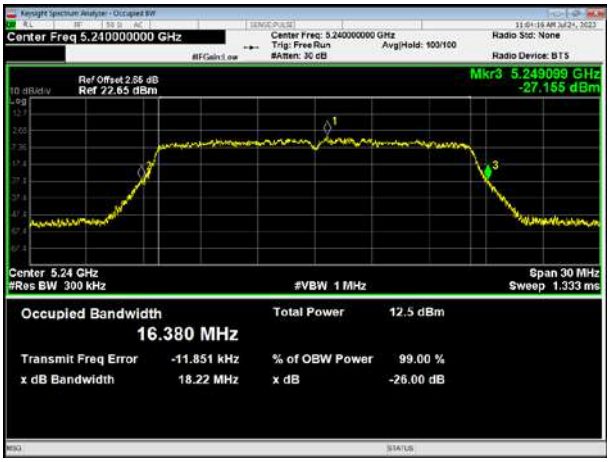


802.11a on channel 40 ANT2



802.11a on channel 48 ANT1

802.11a on channel 48 ANT2



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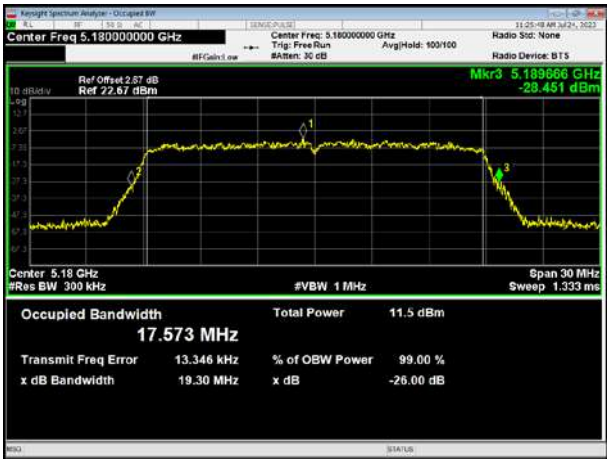
802.11ac20 on channel 36 ANT1

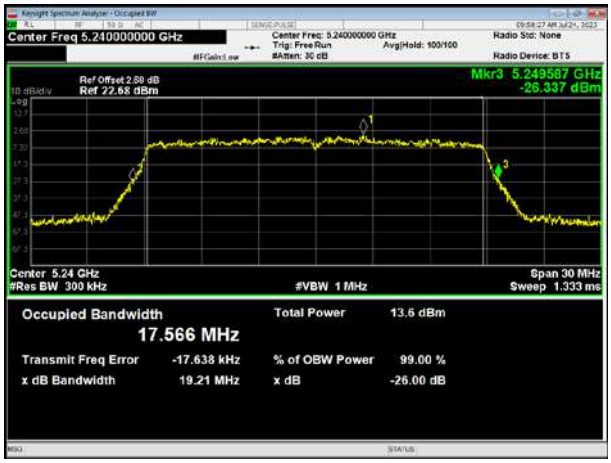
802.11ac20 on channel 36 ANT2



802.11ac20 on channel 40 ANT1

802.11ac20 on channel 40 ANT2

802.11ac20 on channel 48 ANT1



802.11ac20 on channel 48 ANT2

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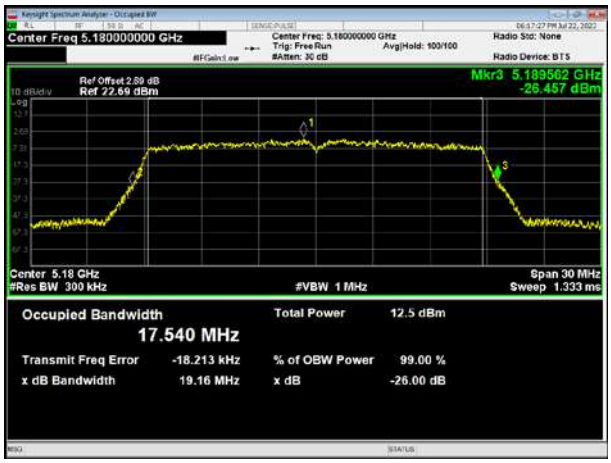
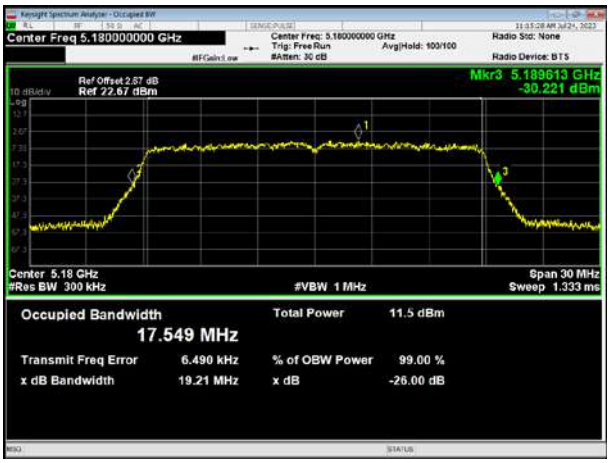
802.11n20 on channel 36 ANT1

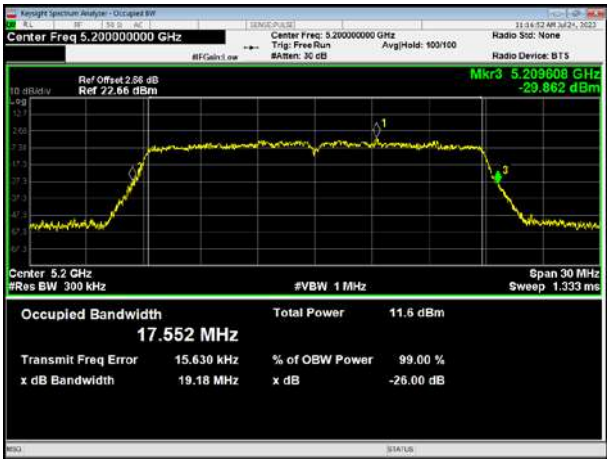


802.11n20 on channel 36 ANT2



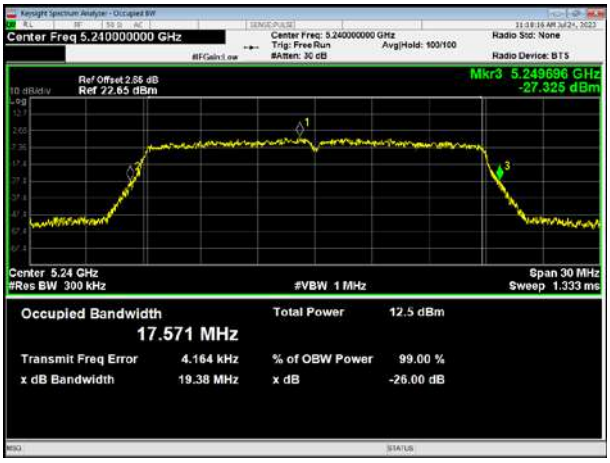
802.11n20 on channel 40 ANT1

802.11n20 on channel 40 ANT2



802.11n20 on channel 48 ANT1

802.11n20 on channel 48 ANT2



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802.11n40 on channel 38 ANT1

802.11n40 on channel 38 ANT2

802.11n40 on channel 46 ANT1

802.11n40 on channel 46 ANT2

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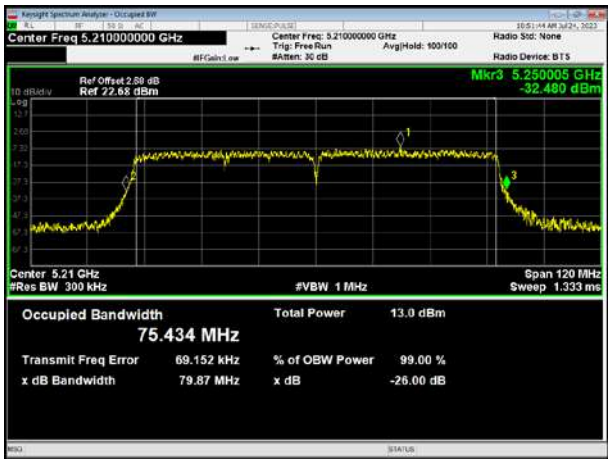
802.11ac40 on channel 38 ANT1

802.11ac40 on channel 38 ANT2

802.11ac40 on channel 46 ANT1

802.11ac40 on channel 46 ANT2

802.11ac80 on channel 42 ANT1



802.11ac80 on channel 42 ANT2

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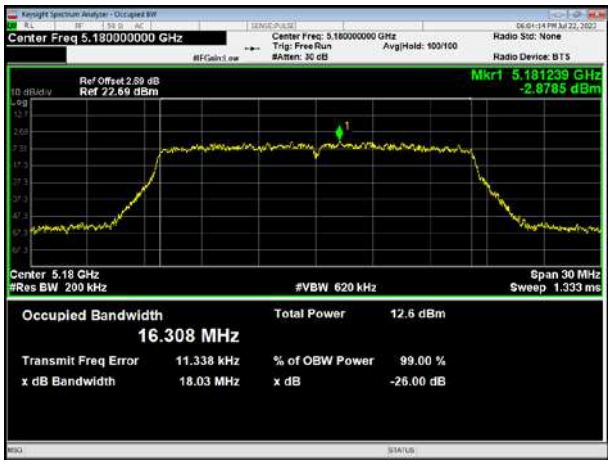
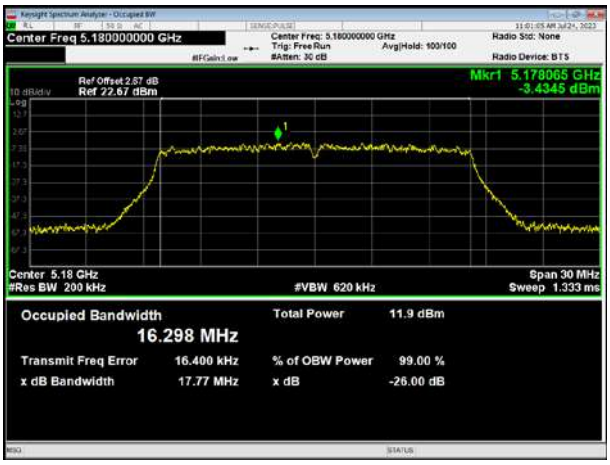
5.2GHz 99% Bandwidth

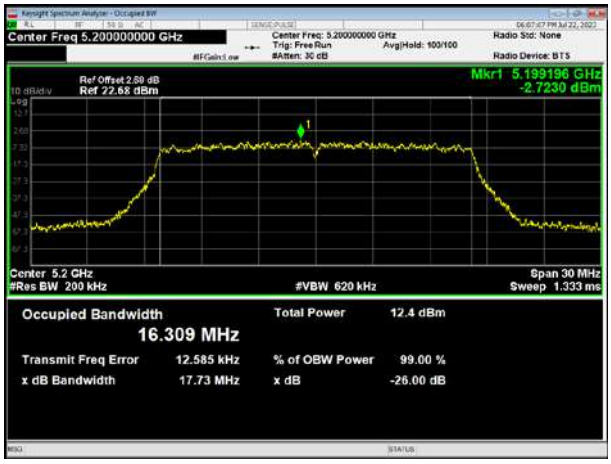
802.11a on channel 36 ANT1



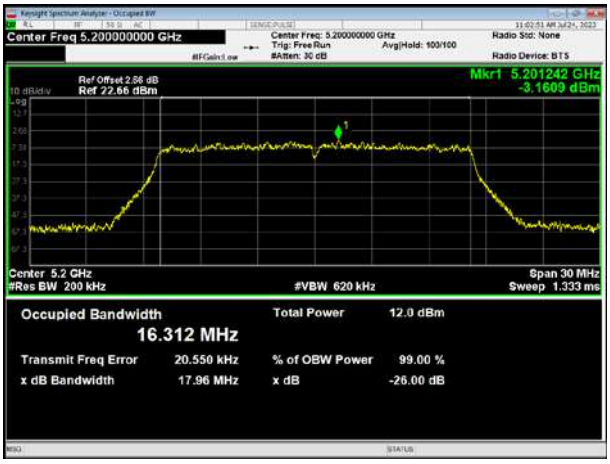
802.11a on channel 36 ANT2



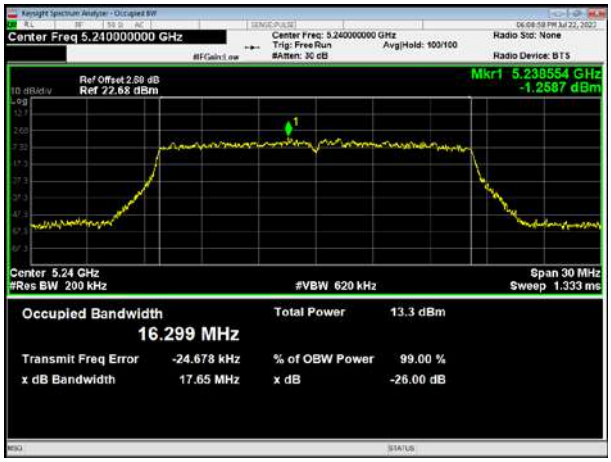
802.11a on channel 40 ANT1



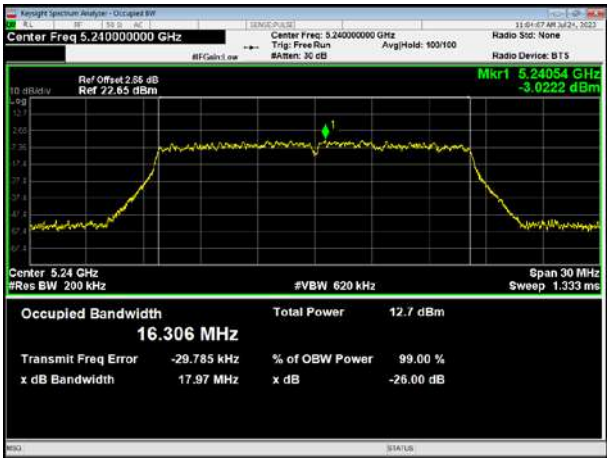
802.11a on channel 40 ANT2



802.11a on channel 48 ANT1



802.11a on channel 48 ANT2



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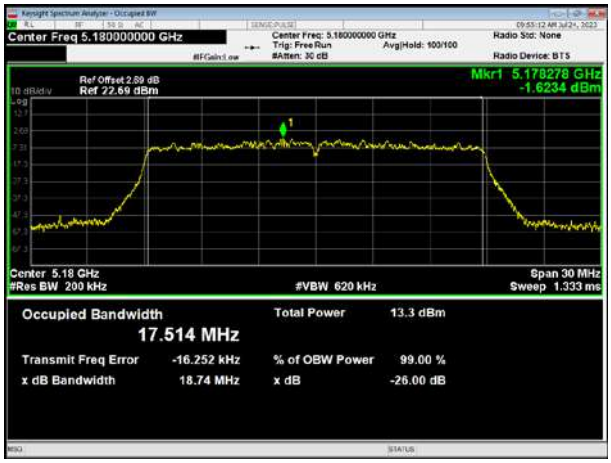
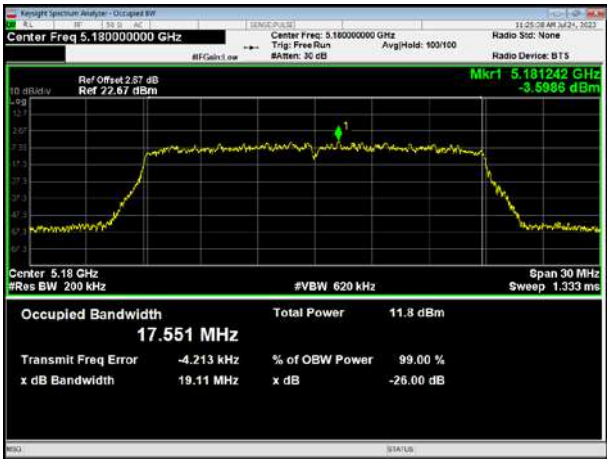
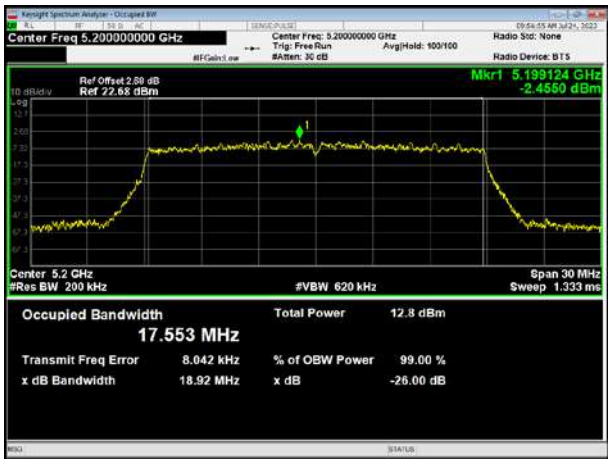
802.11ac20 on channel 36 ANT1



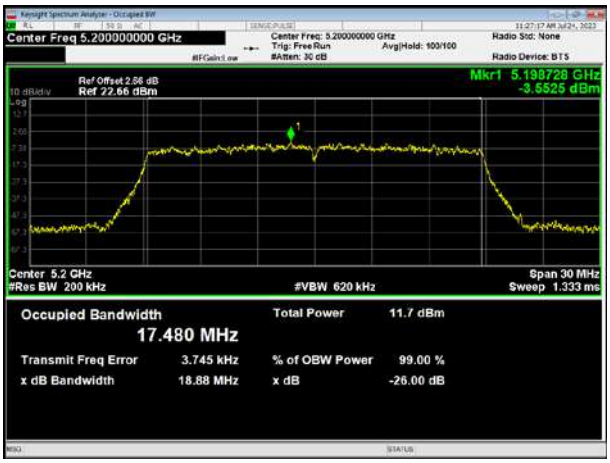
802.11ac20 on channel 36 ANT2



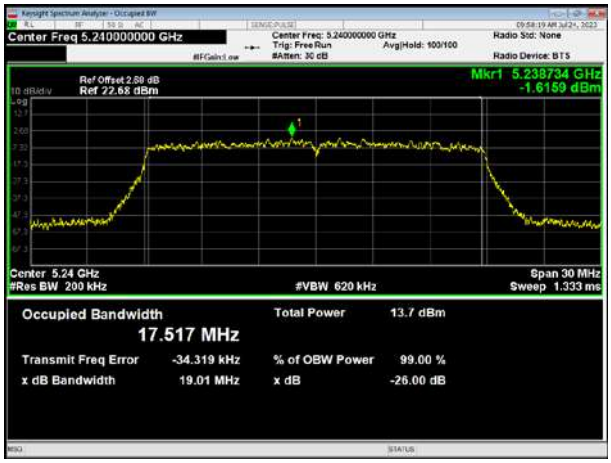
802.11ac20 on channel 40 ANT1



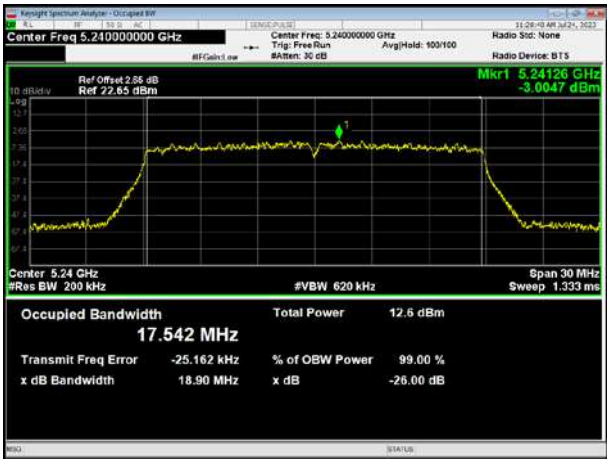
802.11ac20 on channel 40 ANT2



802.11ac20 on channel 48 ANT1



802.11ac20 on channel 48 ANT2



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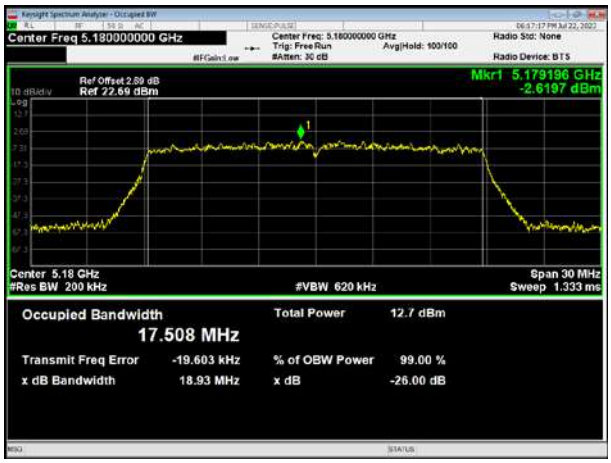
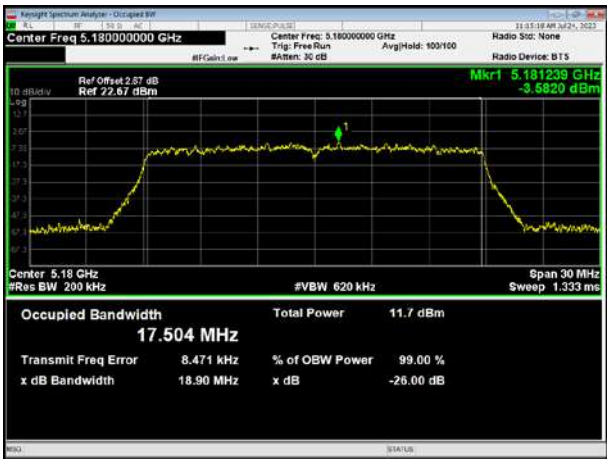
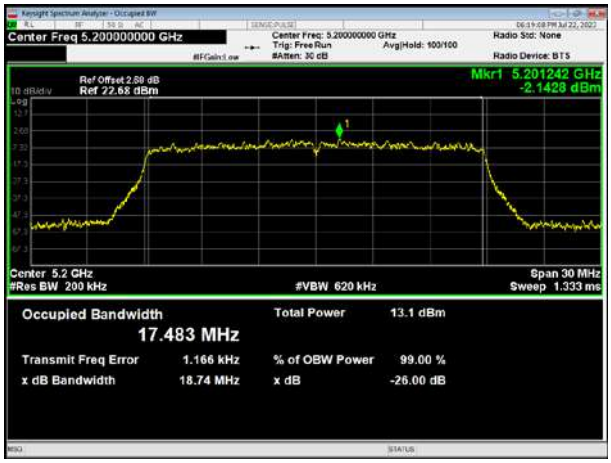
802.11n20 on channel 36 ANT1



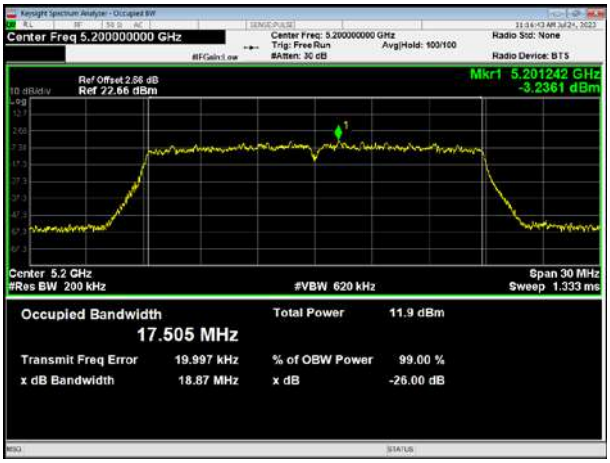
802.11n20 on channel 36 ANT2



802.11n20 on channel 40 ANT1



802.11n20 on channel 40 ANT2



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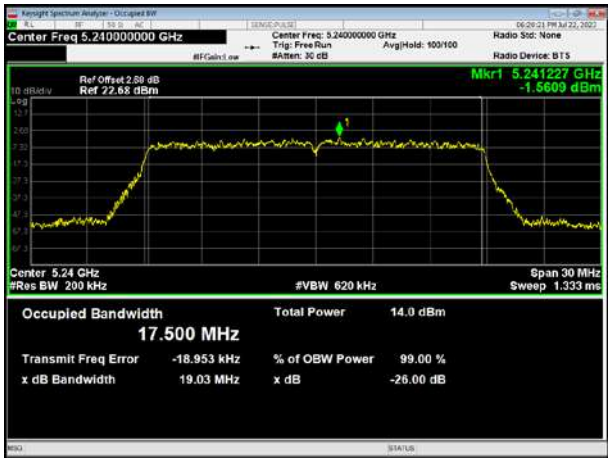
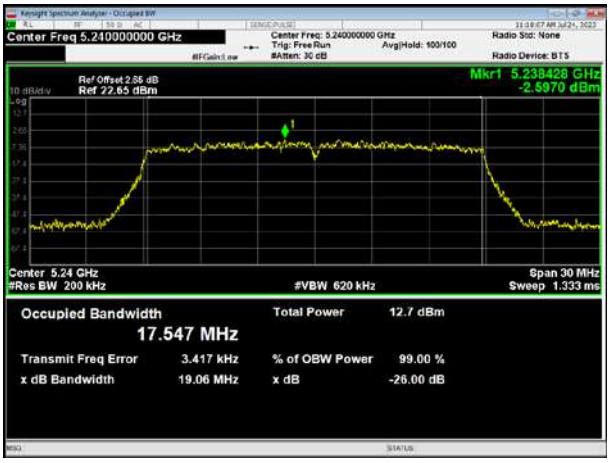


802.11n20 on channel 48 ANT2



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802.11n40 on channel 38 ANT1

802.11n40 on channel 38 ANT2

802.11n40 on channel 46 ANT1

802.11n40 on channel 46 ANT2

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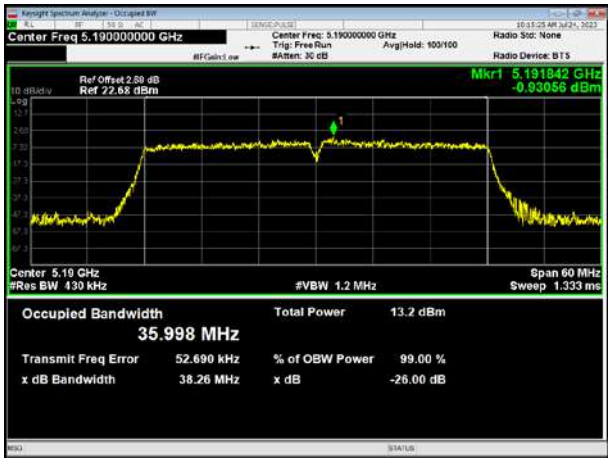
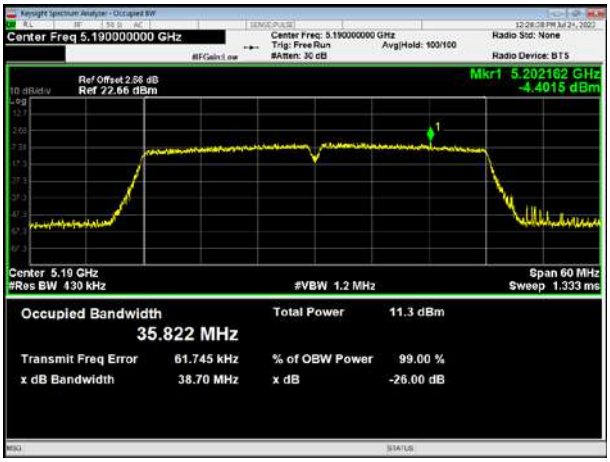
802.11ac40 on channel 38 ANT1



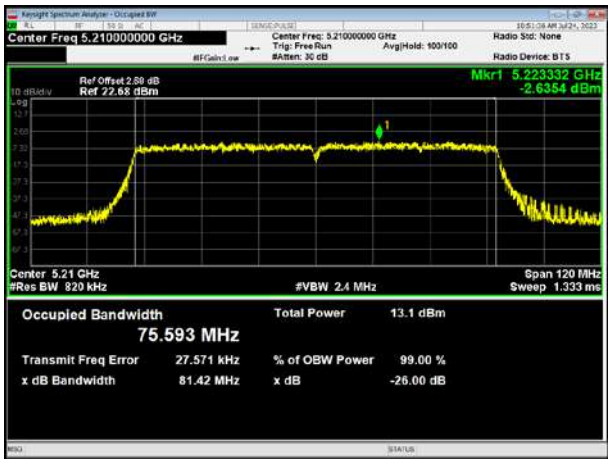
802.11ac40 on channel 38 ANT2



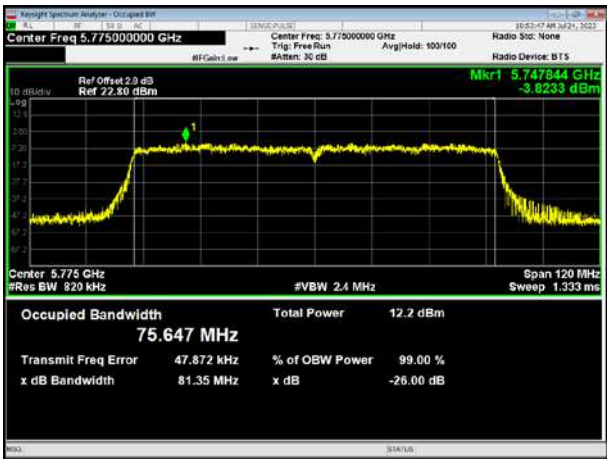
802.11ac40 on channel 46 ANT1

802.11ac40 on channel 46 ANT2

802.11ac80 on channel 42 ANT1



802.11ac80 on channel 42 ANT2



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A.5 6 dB bandwidth

Sub-band(5.8GH): 5725-5850MHz

Mode	Frequency	-6dB Bandwidth		99% Bandwidth		-6dB Bandwidth Limit (kHz)
		ANT1 (MHz)	ANT2 (MHz)	ANT1 (MHz)	ANT2 (MHz)	
802.11 a	5745 MHz	16.344	15.653	16.352	16.323	500
	5785 MHz	16.306	16.069	16.34	16.311	500
	5825 MHz	15.613	15.975	16.312	16.339	500
802.11 ac20	5745 MHz	15.698	15.736	17.502	17.525	500
	5785 MHz	16.893	15.981	17.53	17.493	500
	5825 MHz	17.49	16.05	17.514	17.476	500
802.11 n20	5745 MHz	16.054	16.822	17.495	17.437	500
	5785 MHz	16.935	16.166	17.49	17.545	500
	5825 MHz	16.031	16.927	17.477	17.497	500
802.11 n40	5755 MHz	35.086	35.121	35.916	35.95	500
	5795 MHz	35.093	33.828	35.869	35.883	500
802.11 ac40	5755 MHz	35.045	35.096	35.994	35.936	500
	5795 MHz	35.112	35.112	35.825	35.902	500
802.11 ac80	5775 MHz	75.131	75.136	75.647	75.546	500

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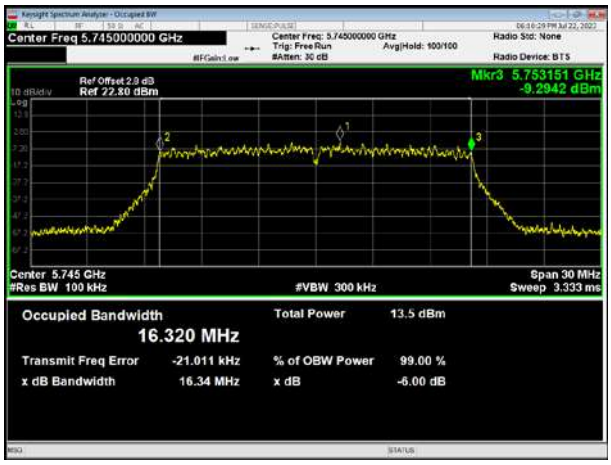
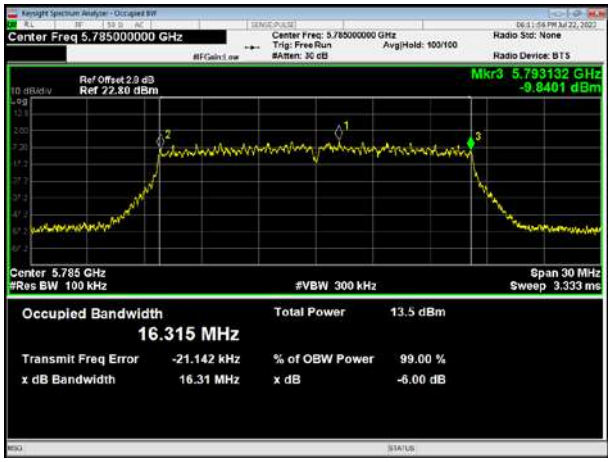
5.8GHz -6dB Bandwidth

802.11a on channel 149 ANT1

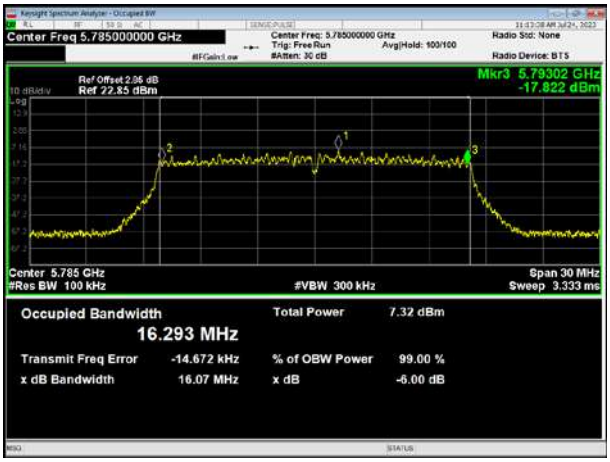


802.11a on channel 149 ANT2

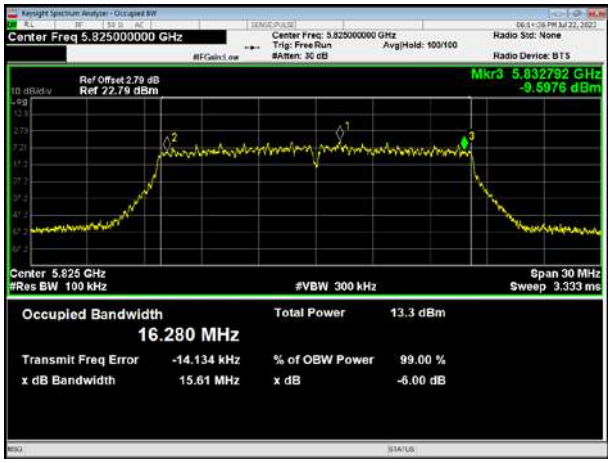
802.11a on channel 157 ANT1



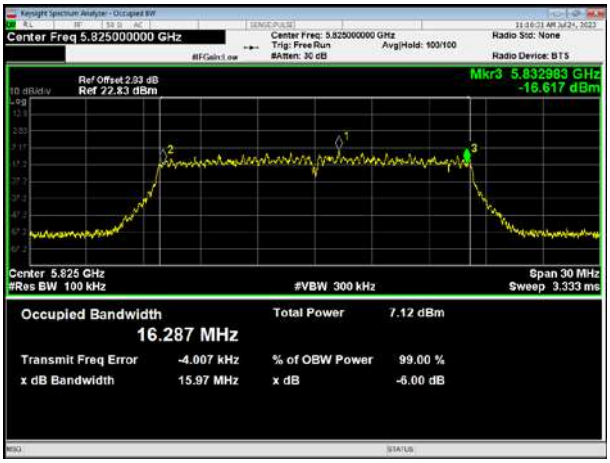
802.11a on channel 157 ANT2



802.11a on channel 165 ANT1



802.11a on channel 165 ANT2



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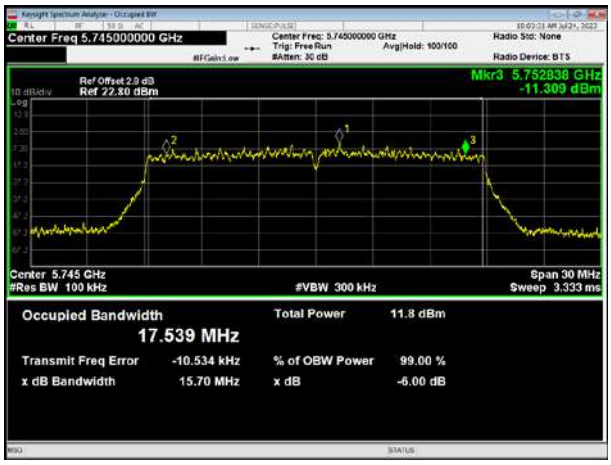
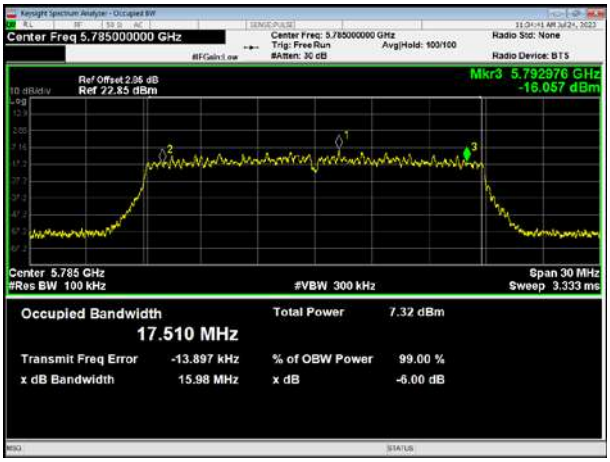
802.11ac20 on channel 149 ANT1



802.11ac20 on channel 149 ANT2

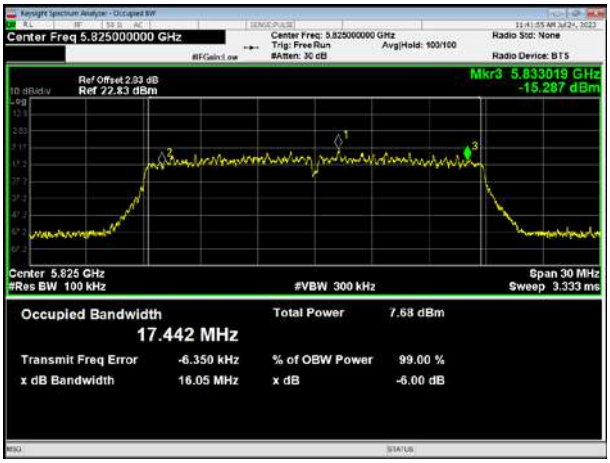
802.11ac20 on channel 157 ANT1

802.11ac20 on channel 157 ANT2



802.11ac20 on channel 165 ANT1

802.11ac20 on channel 165 ANT2



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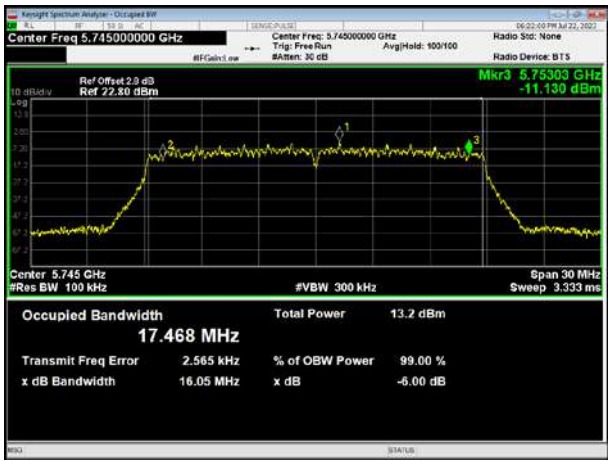
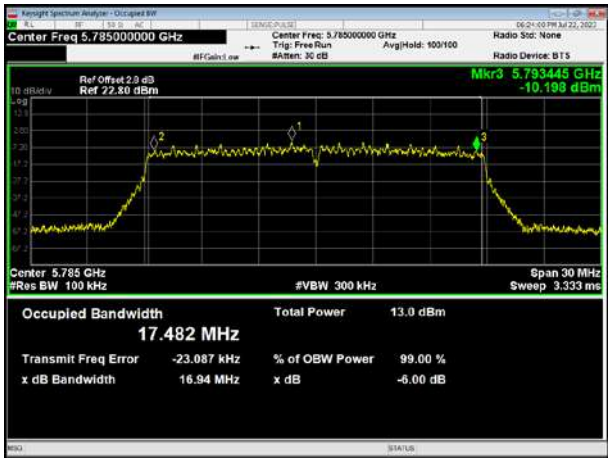
802.11n20 on channel 149 ANT1

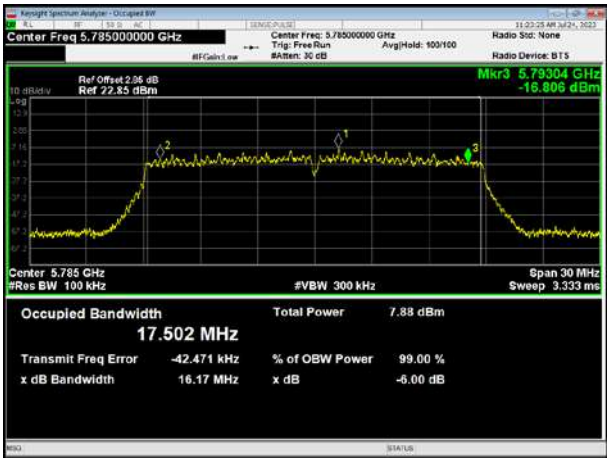


802.11n20 on channel 149 ANT2

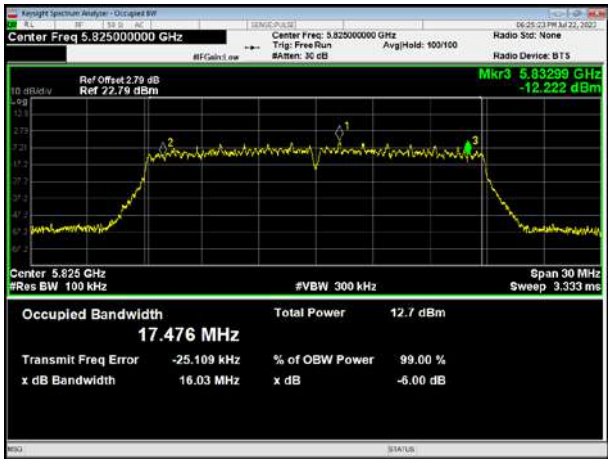
802.11n20 on channel 157 ANT1



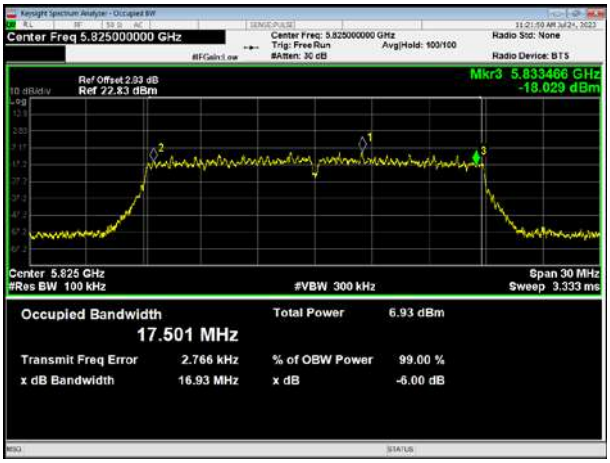
802.11n20 on channel 157 ANT2



802.11n20 on channel 165 ANT1



802.11n20 on channel 165 ANT2



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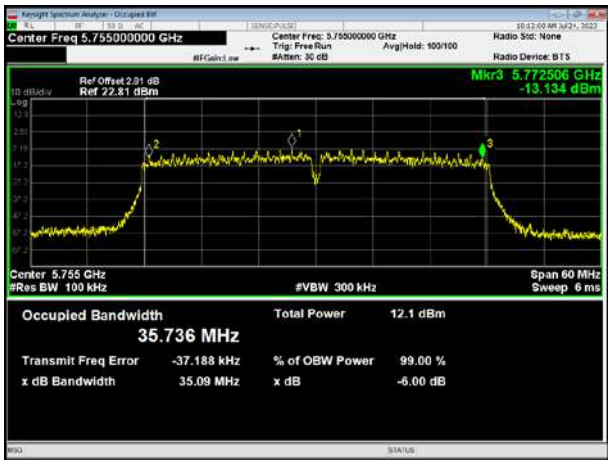
802.11n40 on channel 151 ANT1



802.11n40 on channel 151 ANT2

802.11n40 on channel 159 ANT1

802.11n40 on channel 159 ANT2

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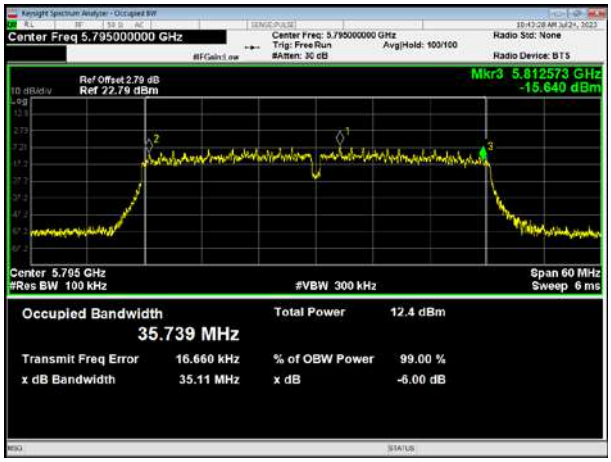
802.11ac40 on channel 151 ANT1

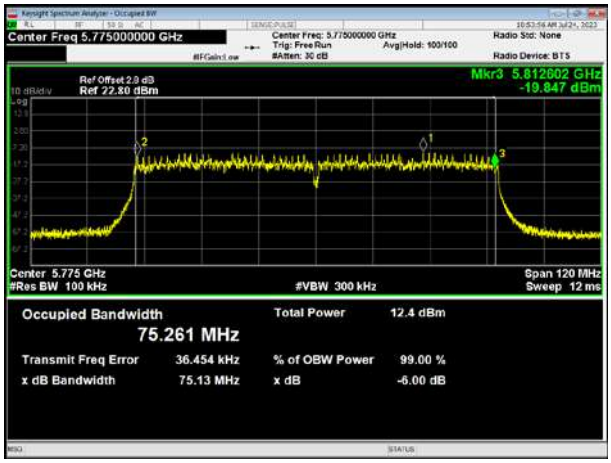
802.11ac40 on channel 151 ANT2

802.11ac40 on channel 159 ANT1

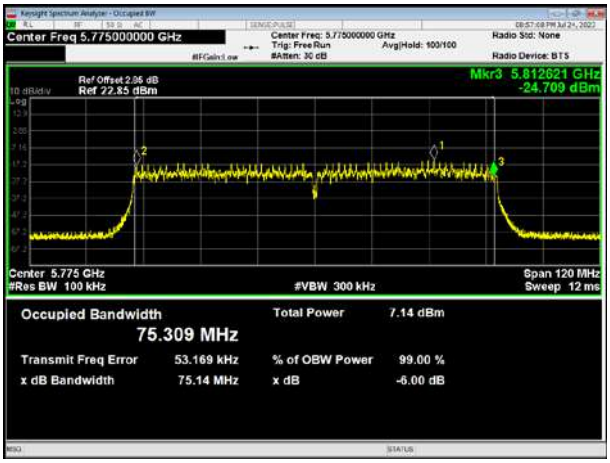


802.11ac40 on channel 159 ANT2

802.11ac80 on channel 155 ANT1



802.11ac80 on channel 155 ANT2



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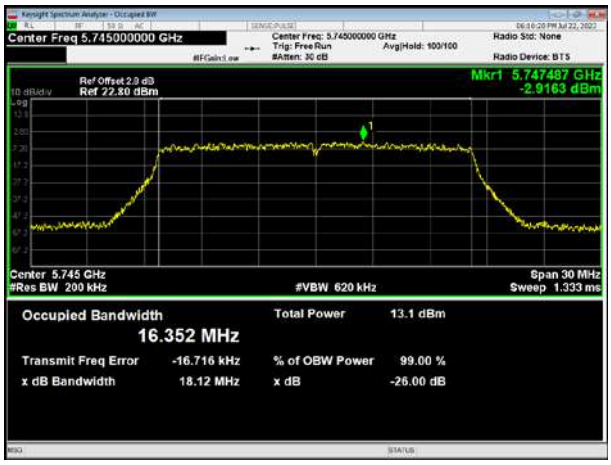
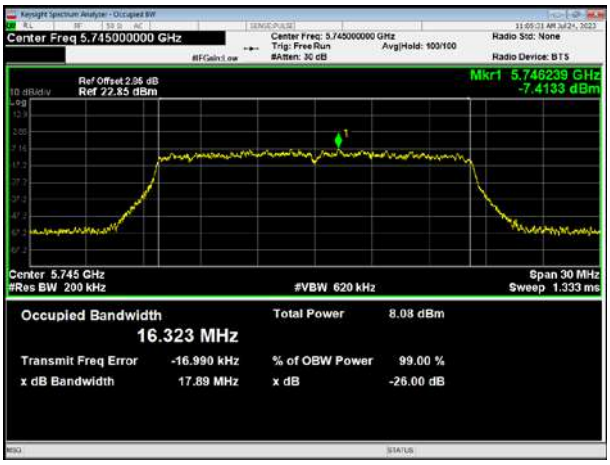
5.8GHz 99%dB Bandwidth

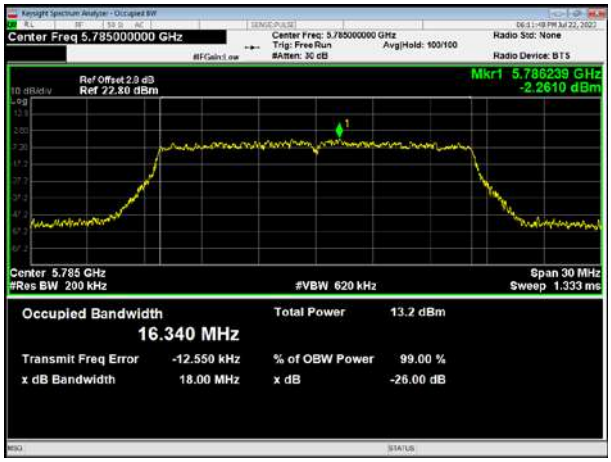
802.11a on channel 149 ANT1



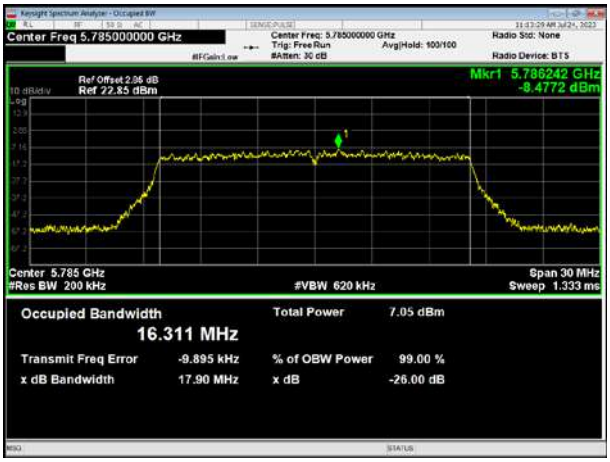
802.11a on channel 149 ANT2



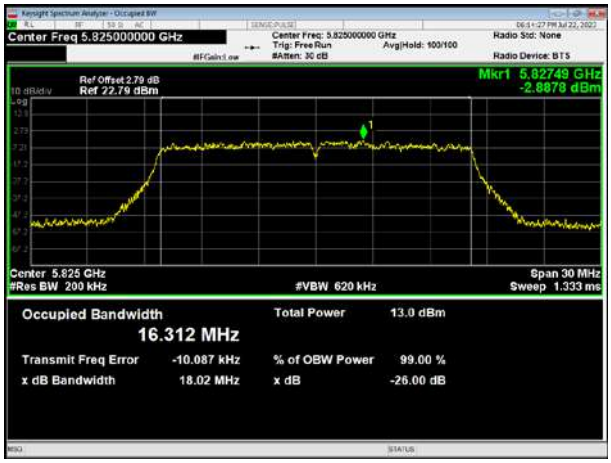
802.11a on channel 157 ANT1



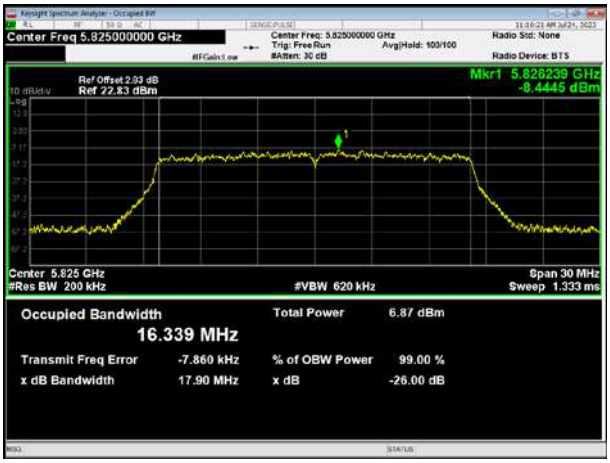
802.11a on channel 157 ANT2



802.11a on channel 165 ANT1



802.11a on channel 165 ANT2



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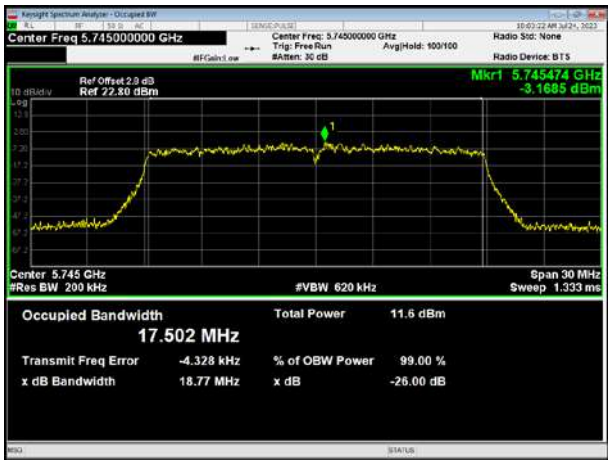
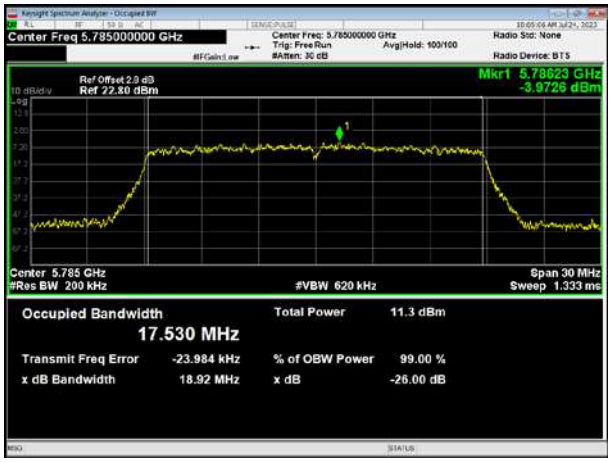
802.11ac20 on channel 149 ANT1

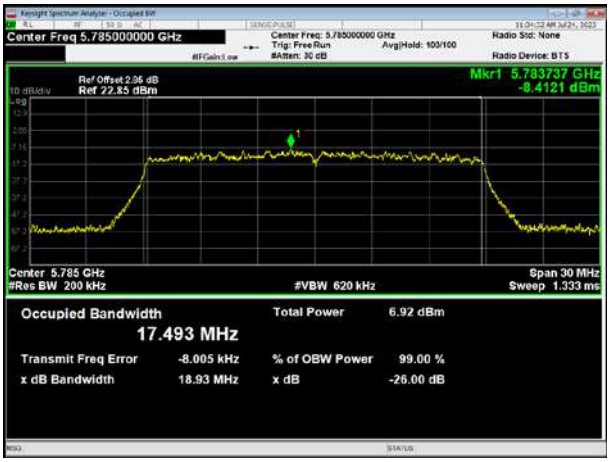


802.11ac20 on channel 149 ANT2

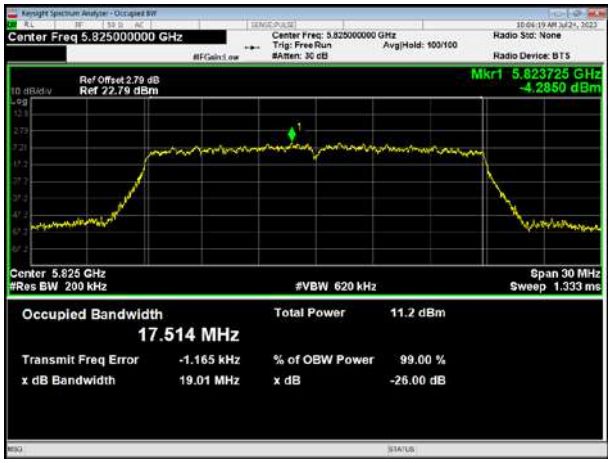
802.11ac20 on channel 157 ANT1



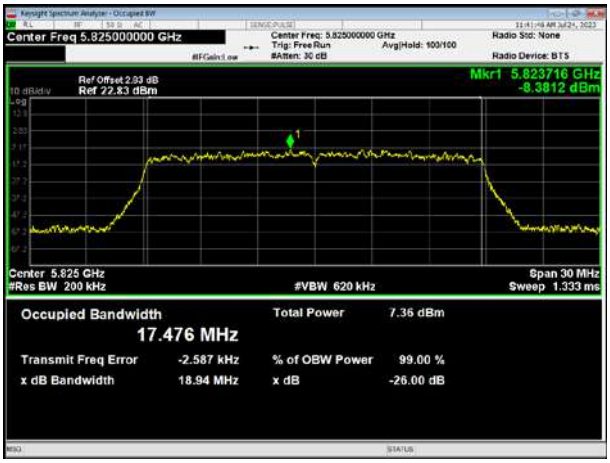
802.11ac20 on channel 157 ANT2



802.11ac20 on channel 165 ANT1



802.11ac20 on channel 165 ANT2



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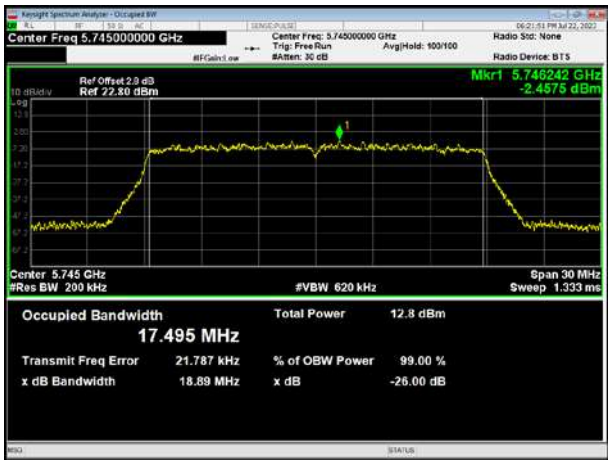
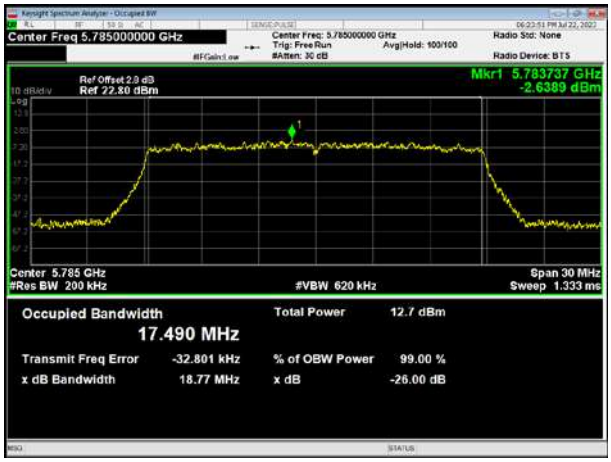
802.11n20 on channel 149 ANT1

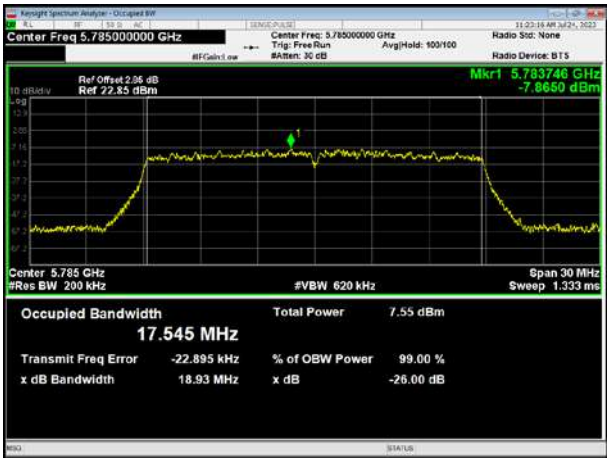


802.11n20 on channel 149 ANT2

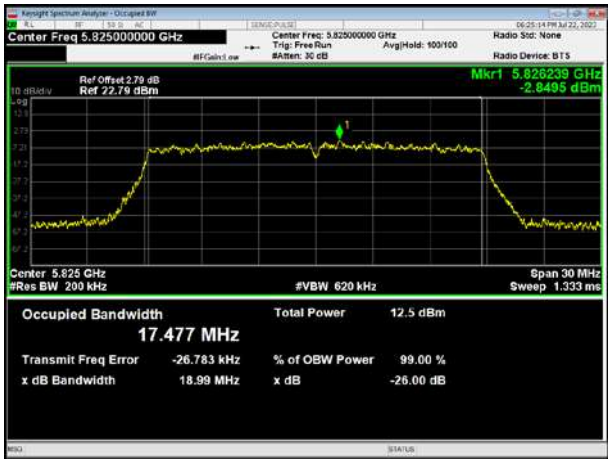
802.11n20 on channel 157 ANT1



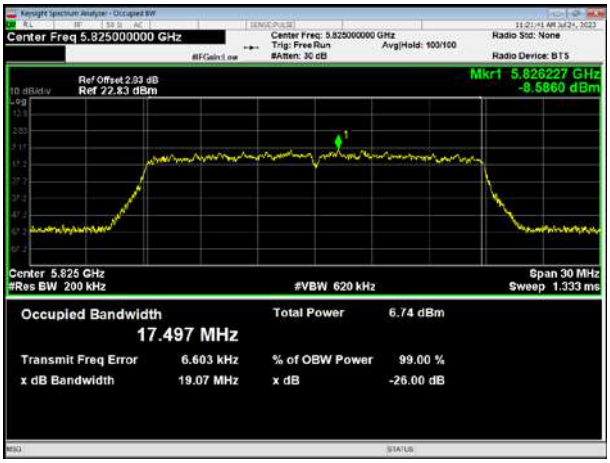
802.11n20 on channel 157 ANT2



802.11n20 on channel 165 ANT1



802.11n20 on channel 165 ANT2



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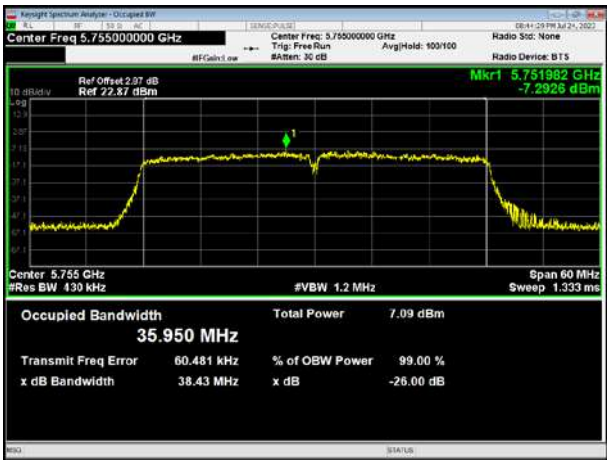
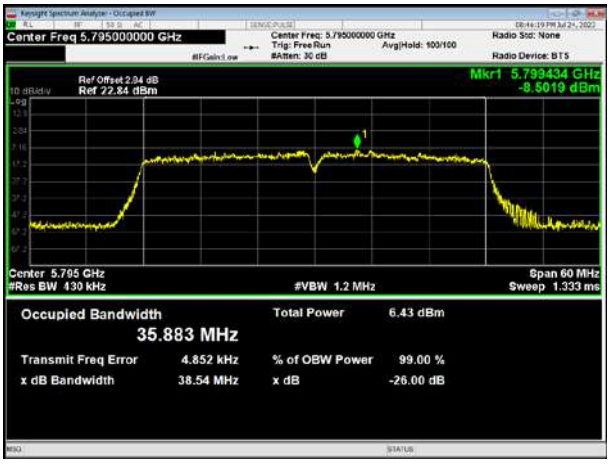
802.11n40 on channel 151 ANT1

802.11n40 on channel 151 ANT2



802.11n40 on channel 159 ANT1

802.11n40 on channel 159 ANT2



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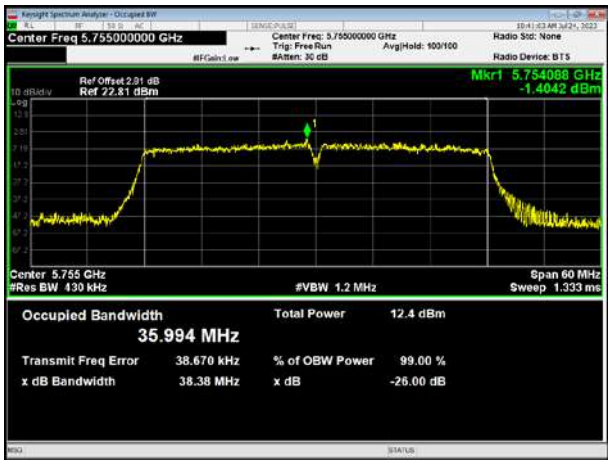
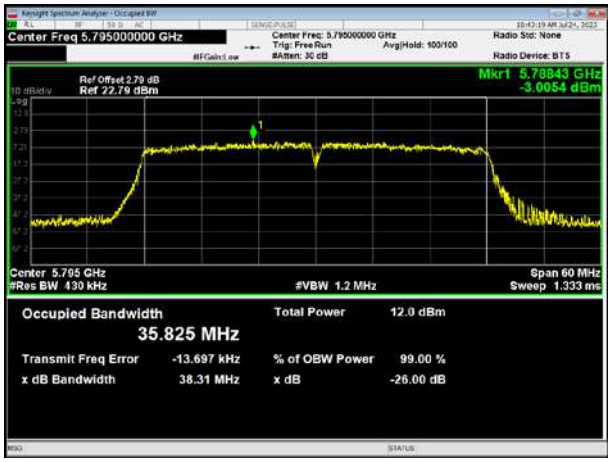
802.11ac40 on channel 151 ANT1

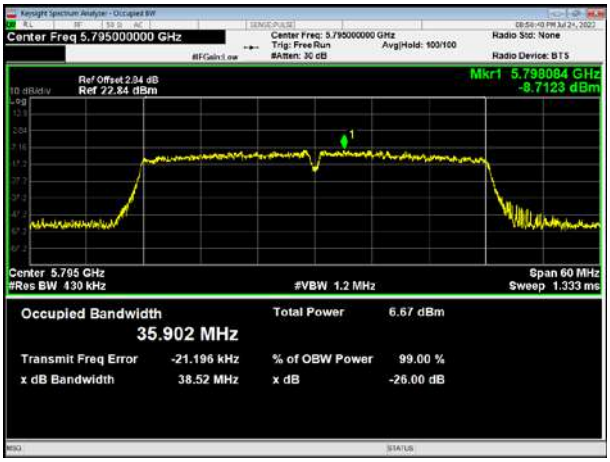


802.11ac40 on channel 151 ANT2

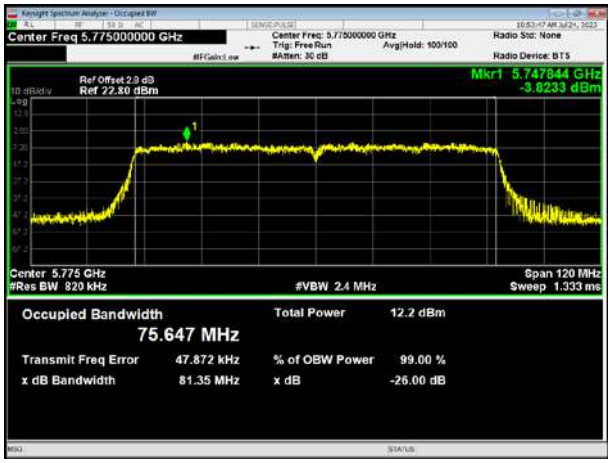
802.11ac40 on channel 159 ANT1



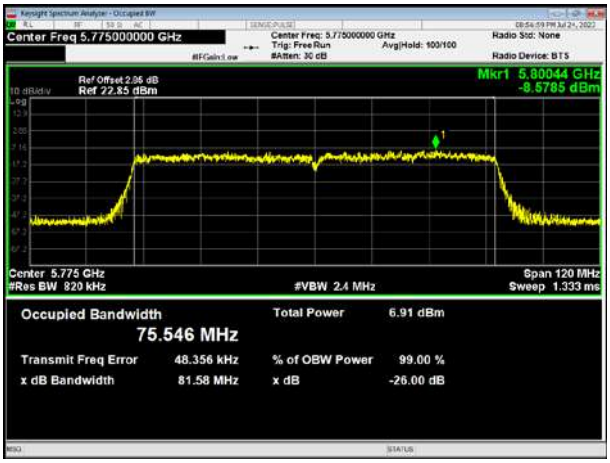
802.11ac40 on channel 159 ANT2



802.11ac80 on channel 155 ANT1



802.11ac80 on channel 155 ANT2



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A.6 Radiated Spurious Emission

Note 1: For the test data above 1 GHz, according the ANSI C63.10-2013, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, only show the worst case mode for each band.
Note 2: The EUT is working in the Normal link mode below 1 GHz. All modes have been tested and 802.11a mode is the worst.
Note 3: Results (dBuV/m) = Original reading level of Spectrum Analyzer (dBuV/m) + Factor (dB)
The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line was not reported.
Note 4: The worst mode is 802.11a, only the worst data is recorded.
Note 5: The test data shows ANT1 and ANT2 Simultaneous emission mode

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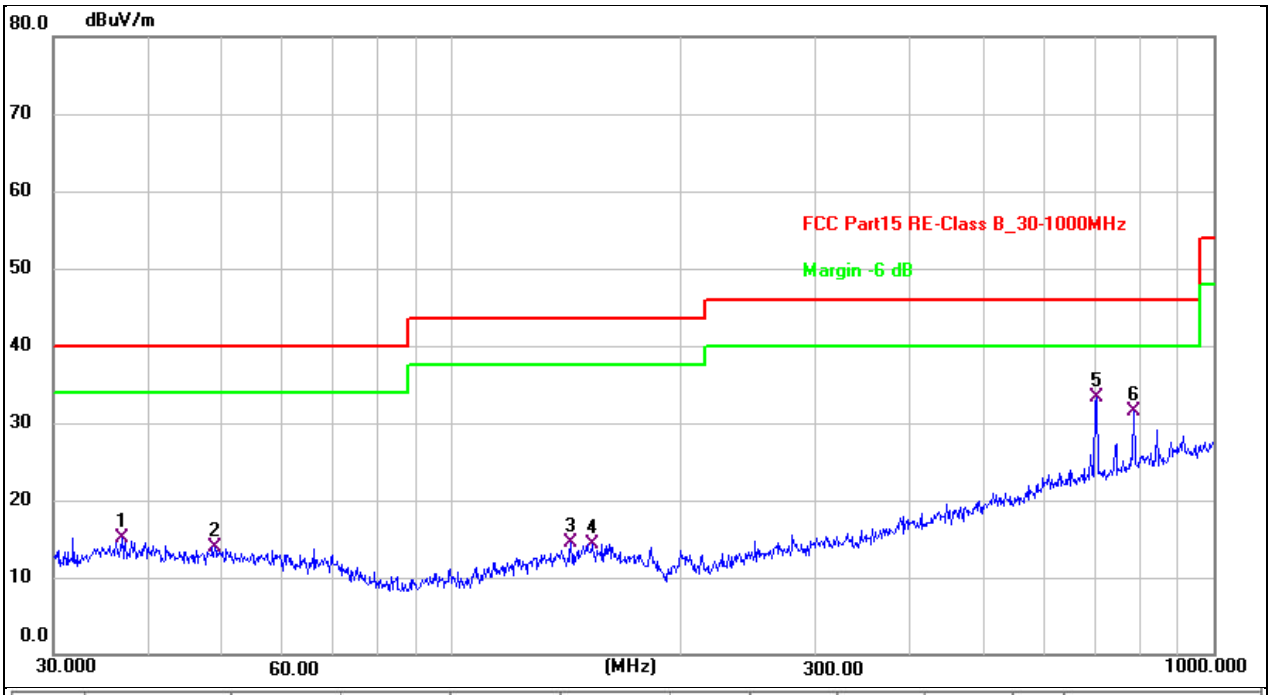
(30 MHz ~ 1GHz) ANT Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	36.8953	23.66	-8.58	15.08	40.00	-24.92	QP	100	299	P	
2	48.8429	22.80	-8.89	13.91	40.00	-26.09	QP	100	339	P	
3	143.3261	23.70	-9.15	14.55	43.50	-28.95	QP	100	349	P	
4	152.6641	23.18	-8.82	14.36	43.50	-29.14	QP	100	238	P	
5 *	701.7610	32.54	0.67	33.21	46.00	-12.79	QP	100	177	P	
6	785.0935	29.55	1.99	31.54	46.00	-14.46	QP	100	16	P	

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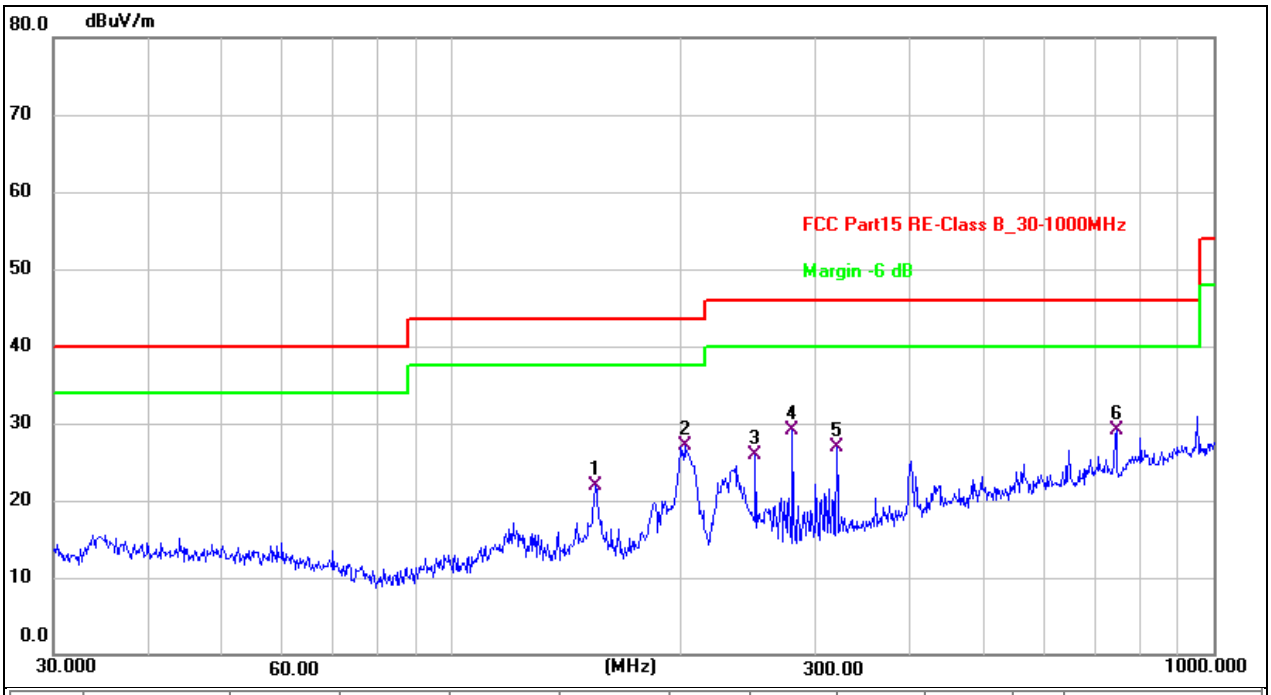
(30 MHz ~ 1GHz) ANT Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	154.2786	30.74	-8.87	21.87	43.50	-21.63	QP	100	193	P	
2 *	202.1005	39.12	-11.97	27.15	43.50	-16.35	QP	100	42	P	
3	250.3012	35.67	-9.79	25.88	46.00	-20.12	QP	100	132	P	
4	280.0237	38.04	-8.84	29.20	46.00	-16.80	QP	100	264	P	
5	319.9370	35.06	-8.16	26.90	46.00	-19.10	QP	100	264	P	
6	744.8661	28.30	0.80	29.10	46.00	-16.90	QP	100	82	P	

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(1 GHz ~ 10th Harmonic)

Sub-band: 5180MHz~5240MHz 802.11a

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel: 5180MHz									
V	10360.00	55.39	30.55	5.77	24.66	55.27	74.00	-18.73	PK
V	10360.00	42.52	30.55	5.77	24.66	42.40	54.00	-11.60	AV
V	15540.00	50.48	30.33	6.32	24.55	51.02	74.00	-22.98	PK
V	15540.00	41.54	30.33	6.32	24.55	42.08	54.00	-11.92	AV
V	20720.00	51.95	30.85	7.45	24.69	53.24	74.00	-20.76	PK
V	20720.00	43.43	30.85	7.45	24.69	44.72	54.00	-9.28	AV
V	25900.00	48.05	31.02	8.99	25.57	51.59	74.00	-22.41	PK
V	25900.00	40.09	31.02	8.99	25.57	43.63	54.00	-10.37	AV
H	10360.00	55.16	30.55	5.77	24.66	55.04	74.00	-18.96	PK
H	10360.00	45.68	30.55	5.77	24.66	45.56	54.00	-8.44	AV
H	15540.00	54.34	30.33	6.32	24.55	54.88	74.00	-19.12	PK
H	15540.00	42.60	30.33	6.32	24.55	43.14	54.00	-10.86	AV
H	20720.00	50.20	30.85	7.45	24.69	51.49	74.00	-22.51	PK
H	20720.00	44.39	30.85	7.45	24.69	45.68	54.00	-8.32	AV
H	25900.00	51.71	31.02	8.99	25.57	55.25	74.00	-18.75	PK
H	25900.00	41.07	31.02	8.99	25.57	44.61	54.00	-9.39	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel: 5200MHz									
V	10400.00	52.74	30.55	5.77	24.66	52.62	74.00	-21.38	PK
V	10400.00	46.05	30.55	5.77	24.66	45.93	54.00	-8.07	AV
V	15600.00	51.20	30.33	6.32	24.55	51.74	74.00	-22.26	PK
V	15600.00	43.42	30.33	6.32	24.55	43.96	54.00	-10.04	AV
V	20800.00	51.87	30.85	7.45	24.69	53.16	74.00	-20.84	PK
V	20800.00	42.36	30.85	7.45	24.69	43.65	54.00	-10.35	AV
V	26000.00	49.84	31.02	8.99	25.57	53.38	74.00	-20.62	PK
V	26000.00	39.61	31.02	8.99	25.57	43.15	54.00	-10.85	AV
H	10400.00	51.19	30.55	5.77	24.66	51.07	74.00	-22.93	PK
H	10400.00	42.68	30.55	5.77	24.66	42.56	54.00	-11.44	AV
H	15600.00	54.29	30.33	6.32	24.55	54.83	74.00	-19.17	PK
H	15600.00	41.30	30.33	6.32	24.55	41.84	54.00	-12.16	AV
H	20800.00	50.19	30.85	7.45	24.69	51.48	74.00	-22.52	PK
H	20800.00	40.10	30.85	7.45	24.69	41.39	54.00	-12.61	AV
H	26000.00	49.73	31.02	8.99	25.57	53.27	74.00	-20.73	PK
H	26000.00	39.53	31.02	8.99	25.57	43.07	54.00	-10.93	AV

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Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel: 5240MHz									
V	10480.00	53.78	30.55	5.77	24.66	53.66	74.00	-20.34	PK
V	10480.00	44.32	30.55	5.77	24.66	44.20	54.00	-9.80	AV
V	15720.00	50.75	30.33	6.32	24.55	51.29	74.00	-22.71	PK
V	15720.00	43.59	30.33	6.32	24.55	44.13	54.00	-9.87	AV
V	20960.00	50.00	30.85	7.45	24.69	51.29	74.00	-22.71	PK
V	20960.00	44.25	30.85	7.45	24.69	45.54	54.00	-8.46	AV
V	26200.00	51.33	31.02	8.99	25.57	54.87	74.00	-19.13	PK
V	26200.00	37.82	31.02	8.99	25.57	41.36	54.00	-12.64	AV
H	10480.00	52.54	30.55	5.77	24.66	52.42	74.00	-21.58	PK
H	10480.00	42.00	30.55	5.77	24.66	41.88	54.00	-12.12	AV
H	15720.00	51.36	30.33	6.32	24.55	51.90	74.00	-22.10	PK
H	15720.00	42.19	30.33	6.32	24.55	42.73	54.00	-11.27	AV
H	20960.00	50.78	30.85	7.45	24.69	52.07	74.00	-21.93	PK
H	20960.00	40.21	30.85	7.45	24.69	41.50	54.00	-12.50	AV
H	26200.00	50.13	31.02	8.99	25.57	53.67	74.00	-20.33	PK
H	26200.00	39.63	31.02	8.99	25.57	43.17	54.00	-10.83	AV

Sub-band: 5745MHz~5825MHz 802.11a

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel: 5745MHz									
V	11490.00	54.09	30.55	5.77	24.66	53.97	74.00	-20.03	PK
V	11490.00	45.02	30.55	5.77	24.66	44.90	54.00	-9.10	AV
V	17235.00	50.67	30.33	6.32	24.55	51.21	74.00	-22.79	PK
V	17235.00	45.18	30.33	6.32	24.55	45.72	54.00	-8.28	AV
V	22980.00	53.11	30.85	7.45	24.69	54.40	74.00	-19.60	PK
V	22980.00	41.52	30.85	7.45	24.69	42.81	54.00	-11.19	AV
V	28725.00	49.52	31.02	8.99	25.57	53.06	74.00	-20.94	PK
V	28725.00	37.65	31.02	8.99	25.57	41.19	54.00	-12.81	AV
H	11490.00	53.52	30.55	5.77	24.66	53.40	74.00	-20.60	PK
H	11490.00	45.70	30.55	5.77	24.66	45.58	54.00	-8.42	AV
H	17235.00	50.78	30.33	6.32	24.55	51.32	74.00	-22.68	PK
H	17235.00	44.73	30.33	6.32	24.55	45.27	54.00	-8.73	AV
H	22980.00	49.94	30.85	7.45	24.69	51.23	74.00	-22.77	PK
H	22980.00	41.37	30.85	7.45	24.69	42.66	54.00	-11.34	AV
H	28725.00	51.75	31.02	8.99	25.57	55.29	74.00	-18.71	PK
H	28725.00	41.50	31.02	8.99	25.57	45.04	54.00	-8.96	AV

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Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel: 5785MHz									
V	11570.00	54.87	30.55	5.77	24.66	54.75	74.00	-19.25	PK
V	11570.00	44.18	30.55	5.77	24.66	44.06	54.00	-9.94	AV
V	17335.00	50.70	30.33	6.32	24.55	51.24	74.00	-22.76	PK
V	17335.00	44.43	30.33	6.32	24.55	44.97	54.00	-9.03	AV
V	23140.00	51.13	30.85	7.45	24.69	52.42	74.00	-21.58	PK
V	23140.00	39.80	30.85	7.45	24.69	41.09	54.00	-12.91	AV
V	28925.00	48.53	31.02	8.99	25.57	52.07	74.00	-21.93	PK
V	28925.00	38.80	31.02	8.99	25.57	42.34	54.00	-11.66	AV
H	11570.00	55.60	30.55	5.77	24.66	55.48	74.00	-18.52	PK
H	11570.00	45.25	30.55	5.77	24.66	45.13	54.00	-8.87	AV
H	17335.00	52.53	30.33	6.32	24.55	53.07	74.00	-20.93	PK
H	17335.00	43.83	30.33	6.32	24.55	44.37	54.00	-9.63	AV
H	23140.00	51.11	30.85	7.45	24.69	52.40	74.00	-21.60	PK
H	23140.00	41.15	30.85	7.45	24.69	42.44	54.00	-11.56	AV
H	28925.00	50.81	31.02	8.99	25.57	54.35	74.00	-19.65	PK
H	28925.00	40.32	31.02	8.99	25.57	43.86	54.00	-10.14	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel: 5825MHz									
V	11650.00	55.20	30.55	5.77	24.66	55.08	74.00	-18.92	PK
V	11650.00	45.28	30.55	5.77	24.66	45.16	54.00	-8.84	AV
V	17475.00	53.66	30.33	6.32	24.55	54.20	74.00	-19.80	PK
V	17475.00	42.75	30.33	6.32	24.55	43.29	54.00	-10.71	AV
V	23300.00	52.57	30.85	7.45	24.69	53.86	74.00	-20.14	PK
V	23300.00	44.58	30.85	7.45	24.69	45.87	54.00	-8.13	AV
V	29125.00	50.50	31.02	8.99	25.57	54.04	74.00	-19.96	PK
V	29125.00	40.81	31.02	8.99	25.57	44.35	54.00	-9.65	AV
H	11650.00	51.13	30.55	5.77	24.66	51.01	74.00	-22.99	PK
H	11650.00	45.80	30.55	5.77	24.66	45.68	54.00	-8.32	AV
H	17475.00	53.30	30.33	6.32	24.55	53.84	74.00	-20.16	PK
H	17475.00	42.31	30.33	6.32	24.55	42.85	54.00	-11.15	AV
H	23300.00	53.76	30.85	7.45	24.69	55.05	74.00	-18.95	PK
H	23300.00	43.04	30.85	7.45	24.69	44.33	54.00	-9.67	AV
H	29125.00	49.26	31.02	8.99	25.57	52.80	74.00	-21.20	PK
H	29125.00	38.77	31.02	8.99	25.57	42.31	54.00	-11.69	AV

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A.7 Band Edge (Restricted-band-edge)

Sub-band(5.2GHz): 5150-5250MHz

Mode	Frequency (MHz)	Antenna	Max Value (dBm/MHz)	Limit (dBm/MHz)	Verdict
11a	5180	ANT1	-46.91	-27	Pass
11a	5240	ANT1	-46.45	-27	Pass
11a	5180	ANT2	-46.82	-27	Pass
11a	5240	ANT2	-46.52	-27	Pass
11ac20	5180	ANT1	-46.57	-27	Pass
11ac20	5240	ANT1	-46.05	-27	Pass
11ac20	5180	ANT2	-45.79	-27	Pass
11ac20	5240	ANT2	-46.98	-27	Pass
11n20	5180	ANT1	-46.74	-27	Pass
11n20	5240	ANT1	-46.3	-27	Pass
11n20	5180	ANT2	-46.55	-27	Pass
11n20	5240	ANT2	-46.67	-27	Pass
11n40	5190	ANT1	-45.56	-27	Pass
11n40	5230	ANT1	-46.02	-27	Pass
11n40	5190	ANT2	-46.92	-27	Pass
11n40	5230	ANT2	-46.32	-27	Pass
11ac40	5190	ANT1	-44.86	-27	Pass
11ac40	5230	ANT1	-46.26	-27	Pass
11ac40	5190	ANT2	-46.52	-27	Pass
11ac40	5230	ANT2	-46.16	-27	Pass

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Sub-band(5.8GHz): 5725-5850MHz

Mode	Frequency (MHz)	Antenna	Max Value (dBm/MHz)	Limit (dBm/MHz)	Verdict
11a	5745	ANT1	-45.28	-27	Pass
11a	5825	ANT1	-45.92	-27	Pass
11a	5745	ANT2	-46.62	-27	Pass
11a	5825	ANT2	-45.51	-27	Pass
11ac20	5745	ANT1	-46.16	-27	Pass
11ac20	5825	ANT1	-45.41	-27	Pass
11ac20	5745	ANT2	-45.81	-27	Pass
11ac20	5825	ANT2	-45.81	-27	Pass
11n20	5745	ANT1	-45.96	-27	Pass
11n20	5825	ANT1	-45.39	-27	Pass
11n20	5745	ANT2	-46.61	-27	Pass
11n20	5825	ANT2	-46.53	-27	Pass
11n40	5755	ANT1	-42.06	-27	Pass
11n40	5795	ANT1	-45.81	-27	Pass
11n40	5755	ANT2	-46.41	-27	Pass
11n40	5795	ANT2	-46.3	-27	Pass
11ac40	5755	ANT1	-42.28	-27	Pass
11ac40	5795	ANT1	-46.66	-27	Pass
11ac40	5755	ANT2	-45.59	-27	Pass
11ac40	5795	ANT2	-46.09	-27	Pass

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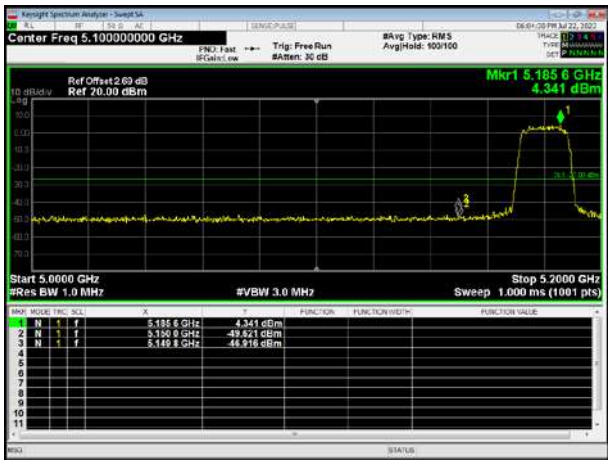
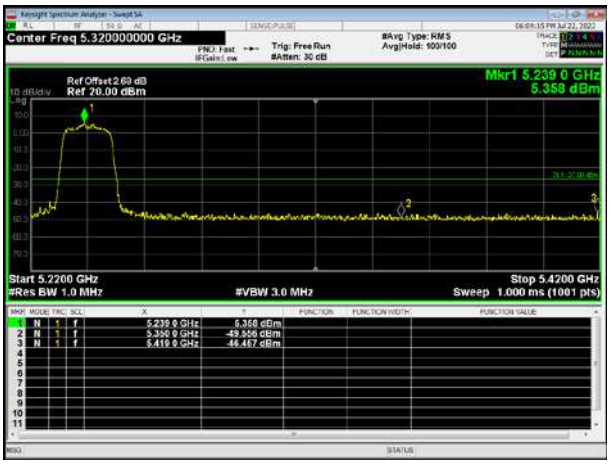
5.2GHz Band Edge

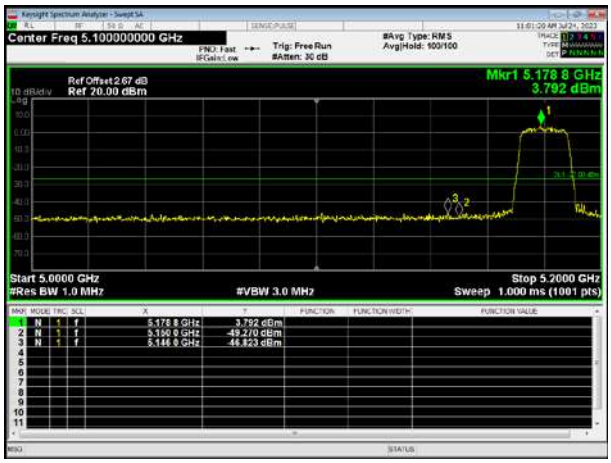
802.11a Left Side, ANT1



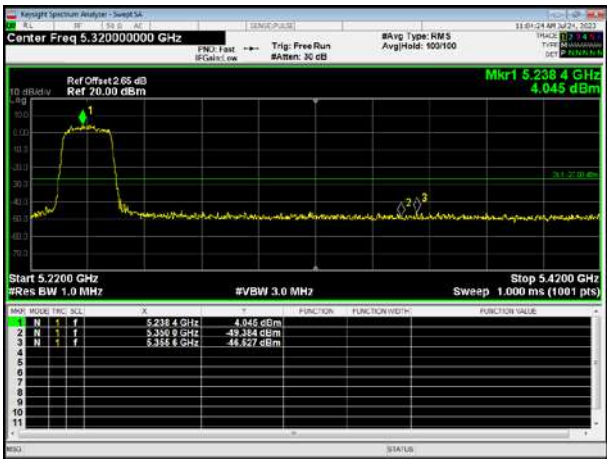
802.11a Right Side, ANT1



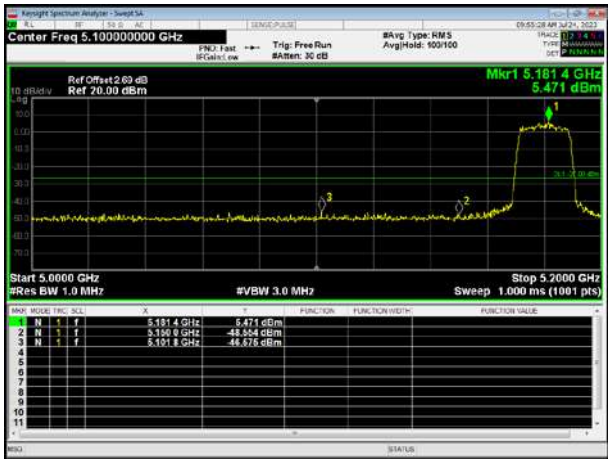
802.11a Left Side, ANT2



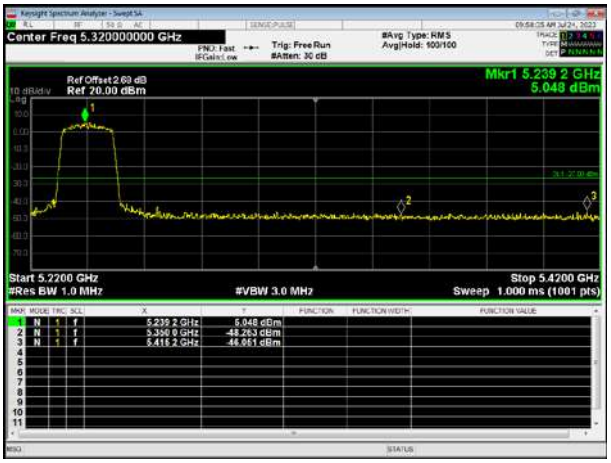
802.11a Right Side, ANT2



802.11ac20 Left Side, ANT1



802.11ac20 Right Side, ANT1



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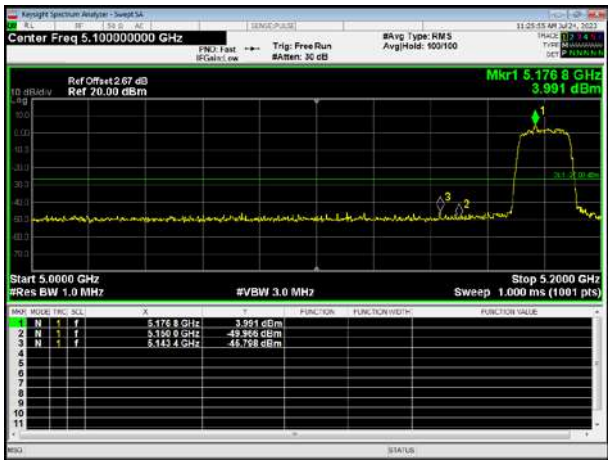
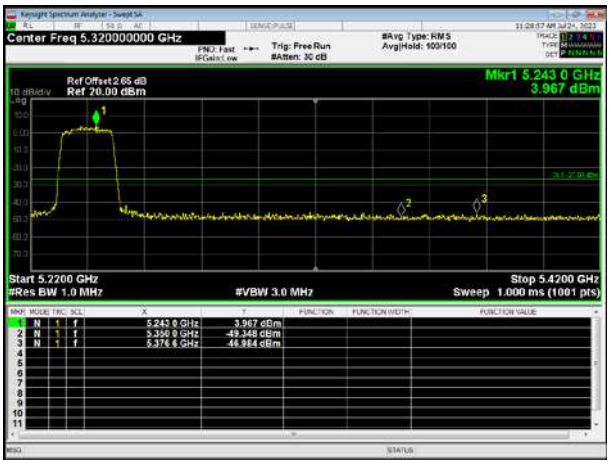
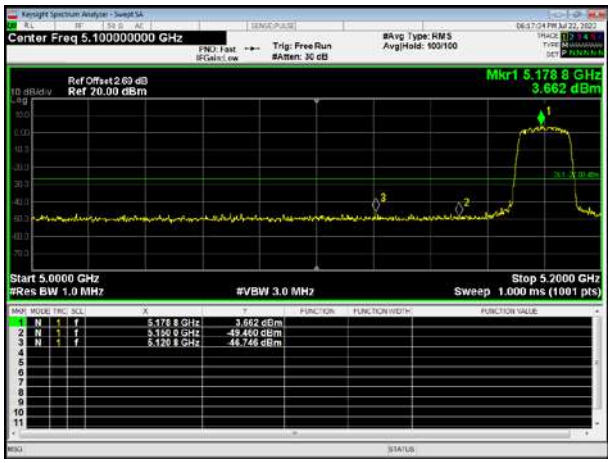
802.11ac20 Left Side, ANT2



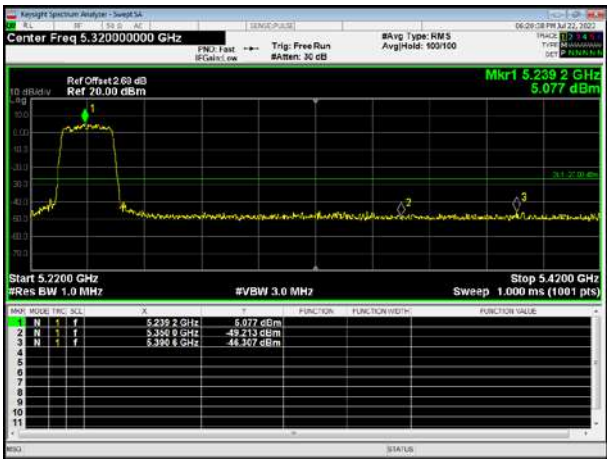
802.11ac20 Right Side, ANT2



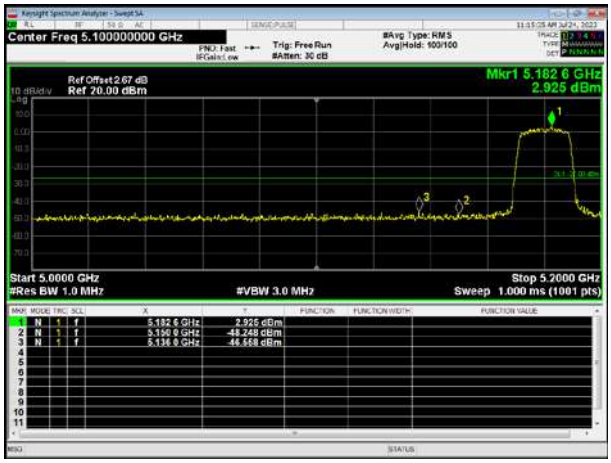
802.11n20 Left Side, ANT1



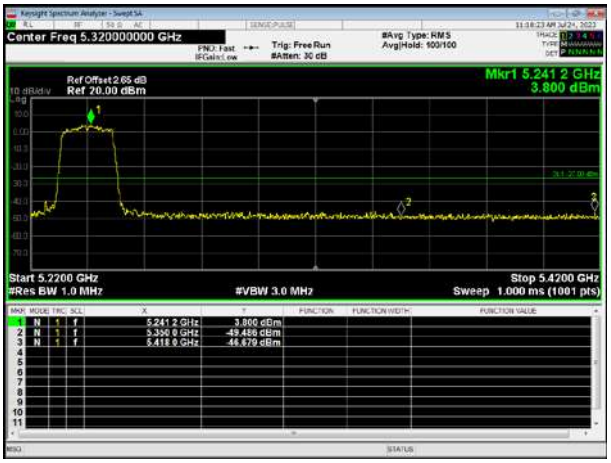
802.11n20 Right Side, ANT1



802.11n20 Left Side, ANT2



802.11n20 Right Side, ANT2



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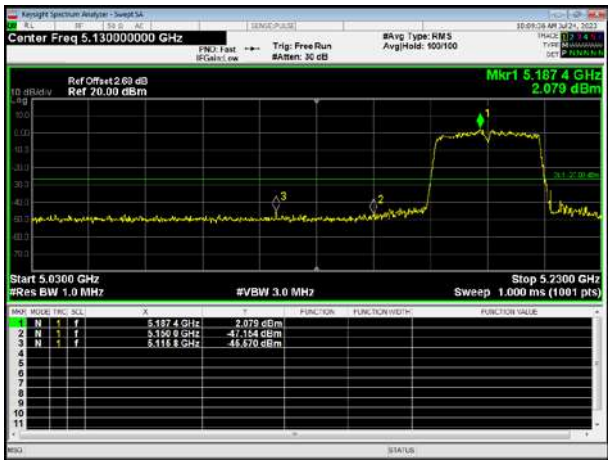
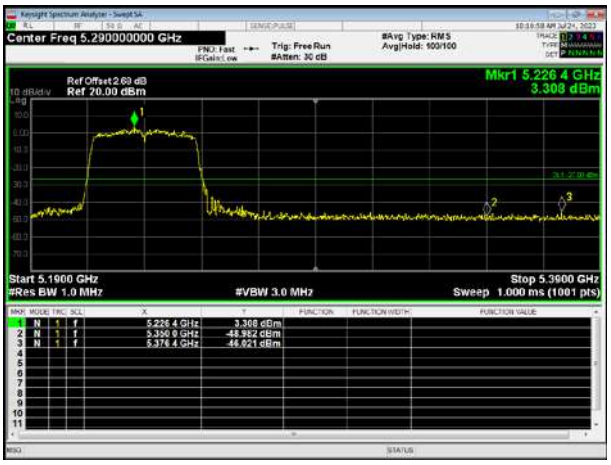
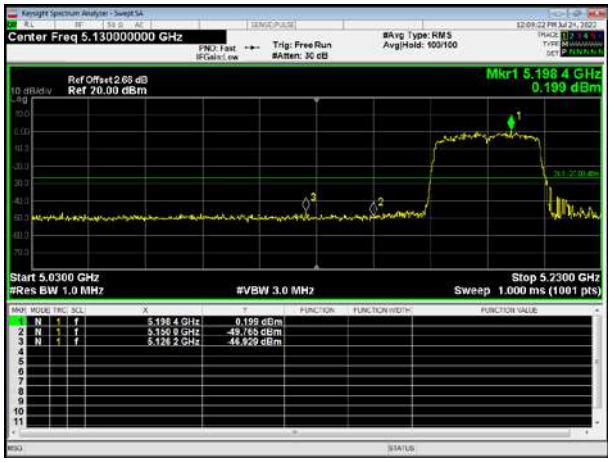
802.11n40 Left Side, ANT1



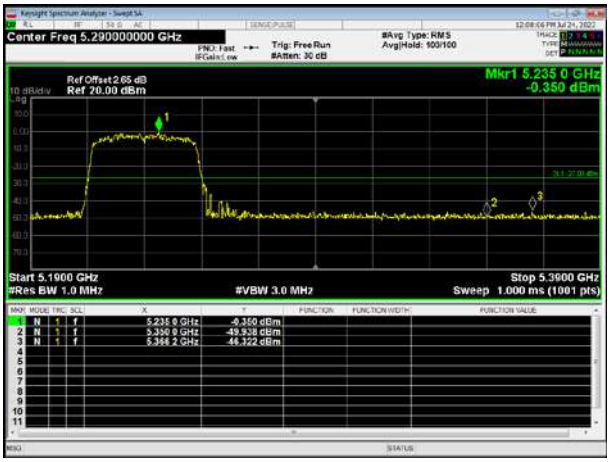
802.11n40 Right Side, ANT1



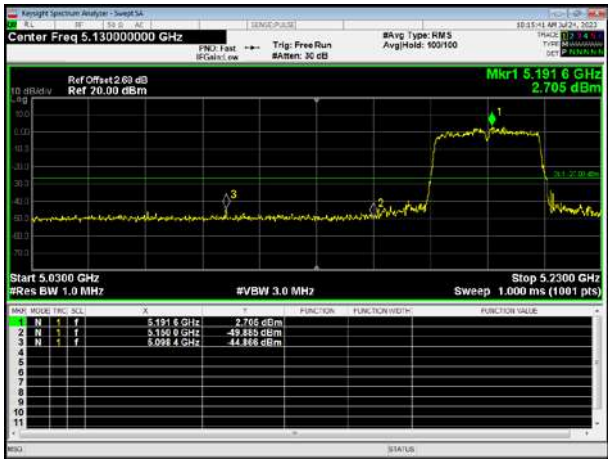
802.11n40 Left Side, ANT2



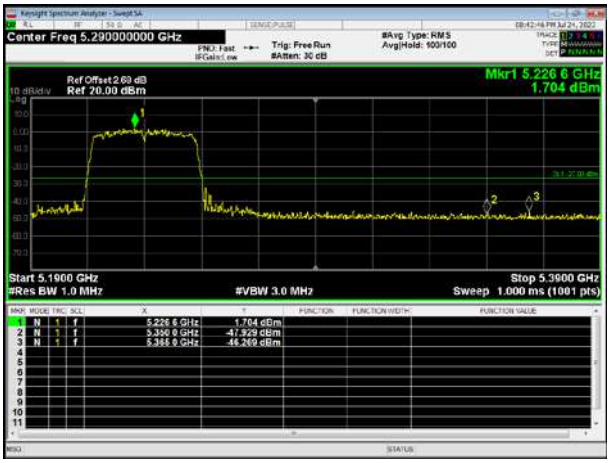
802.11n40 Right Side, ANT2



802.11ac40 Left Side, ANT1



802.11ac40 Right Side, ANT1



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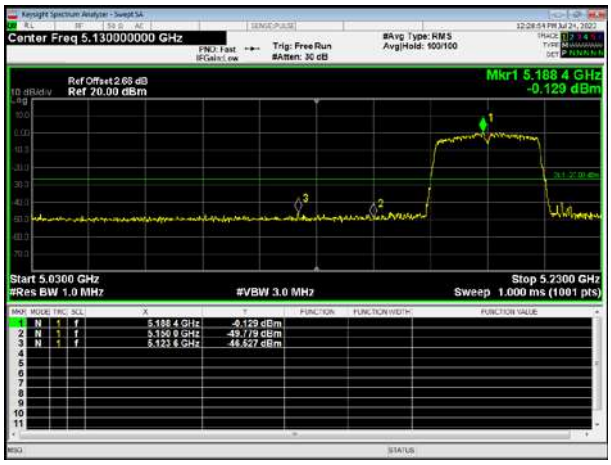
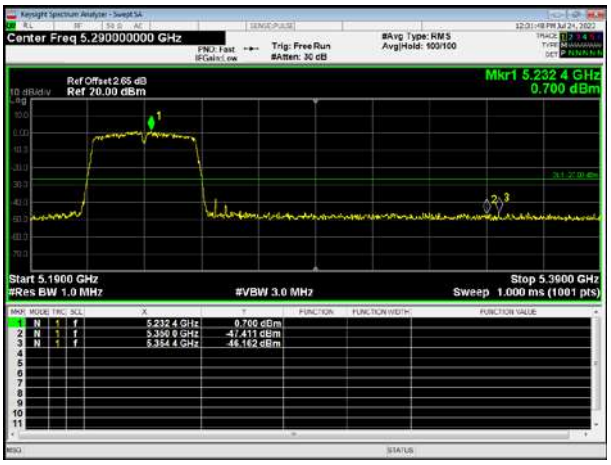
802.11ac40 Left Side, ANT2



802.11ac40 Right Side, ANT2



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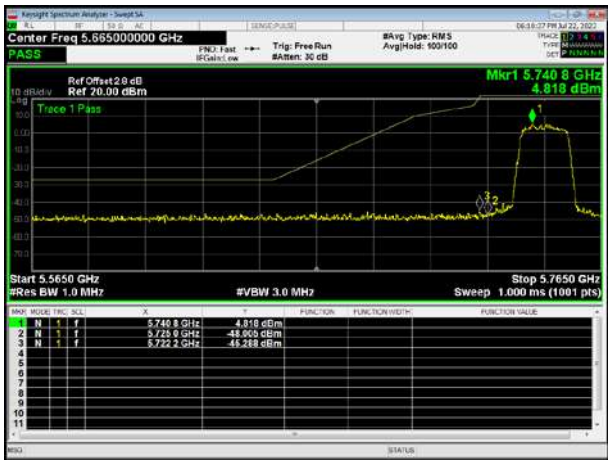
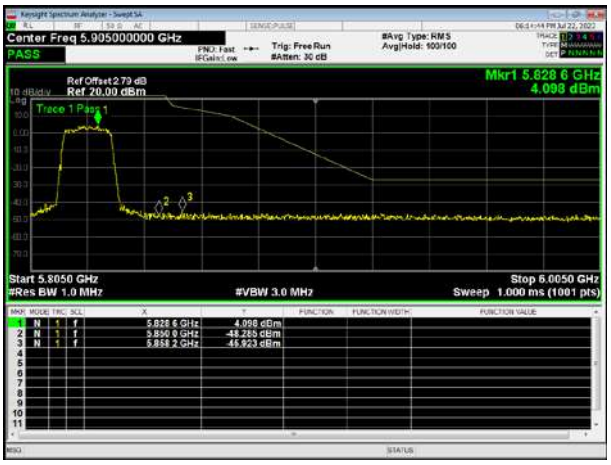
5.8GHz Band Edge

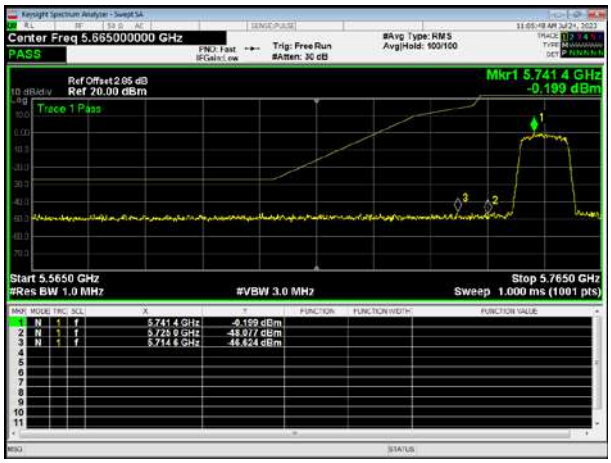
802.11a Left Side, ANT1



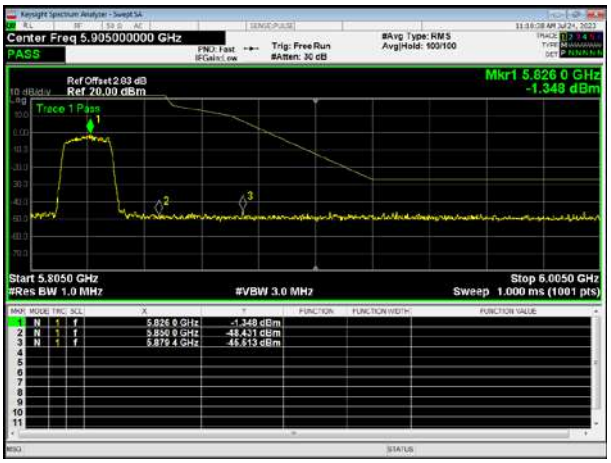
802.11a Right Side, ANT1



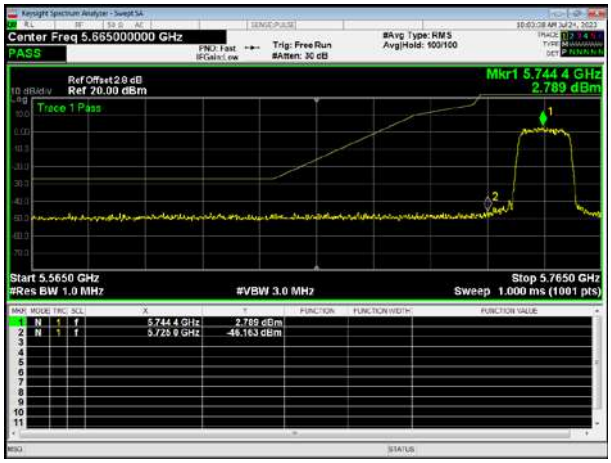
802.11a Left Side, ANT2



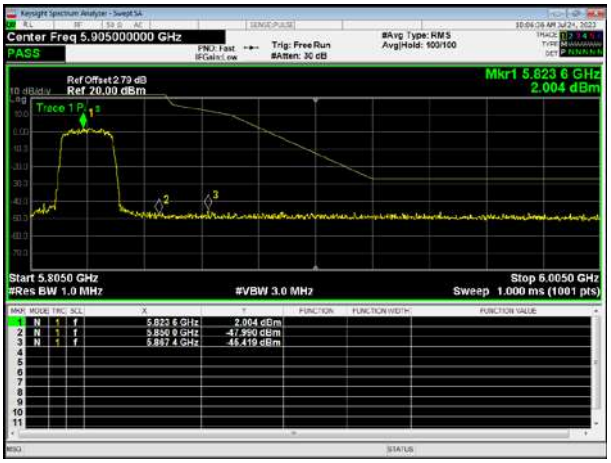
802.11a Right Side, ANT2



802.11ac20 Left Side, ANT1



802.11ac20 Right Side, ANT1



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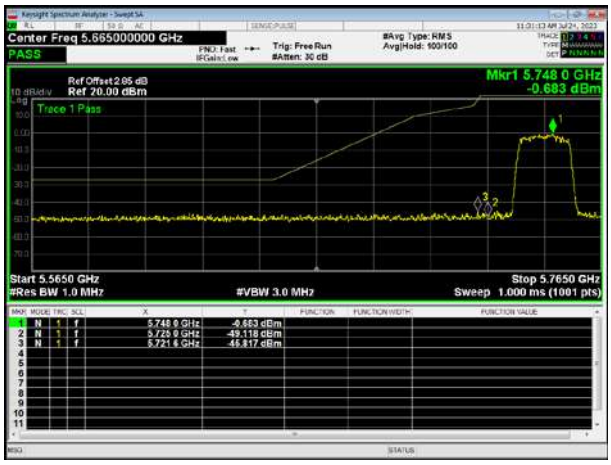
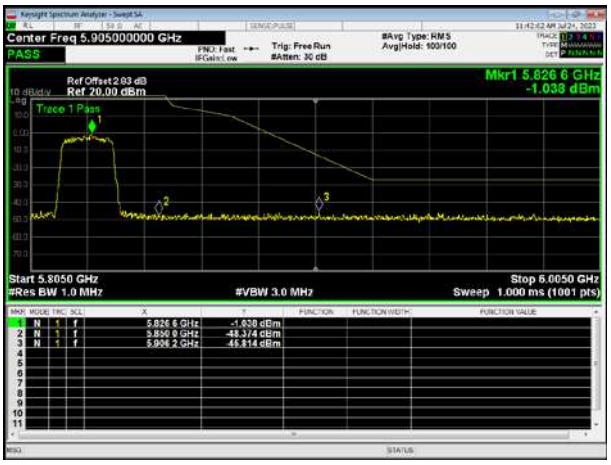
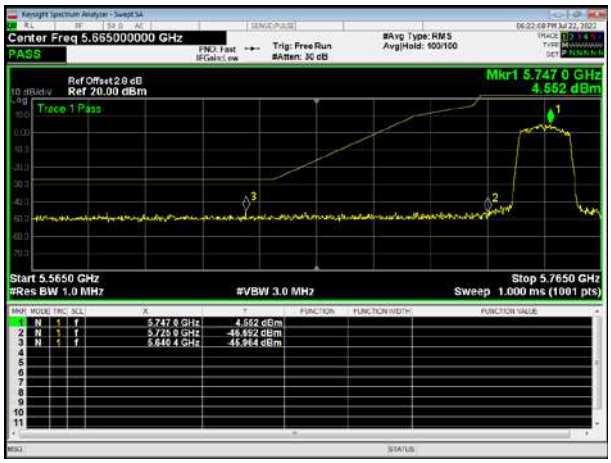
802.11ac20 Left Side, ANT2



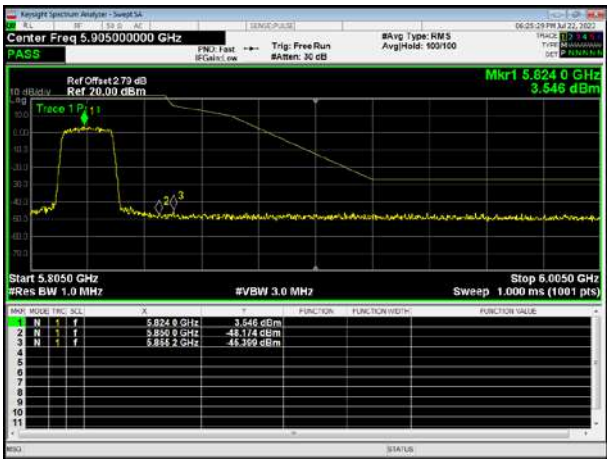
802.11ac20 Right Side, ANT2



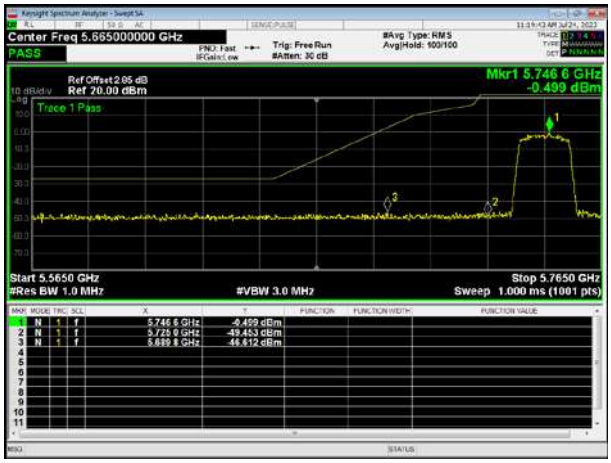
802.11n20 Left Side, ANT1



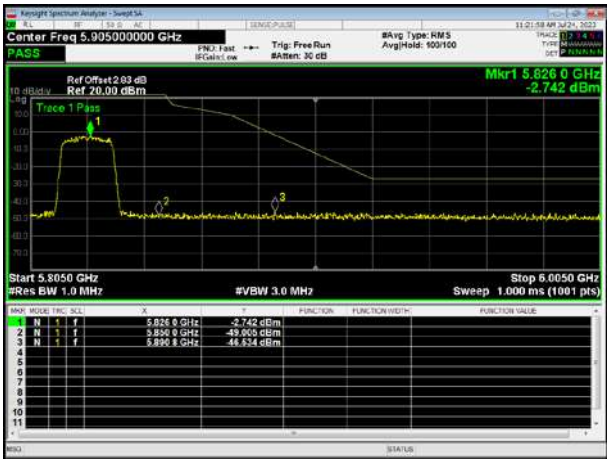
802.11n20 Right Side, ANT1



802.11n20 Left Side, ANT2



802.11n20 Right Side, ANT2



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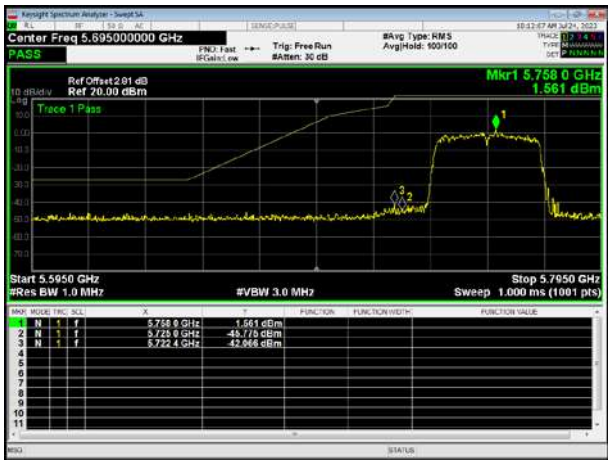
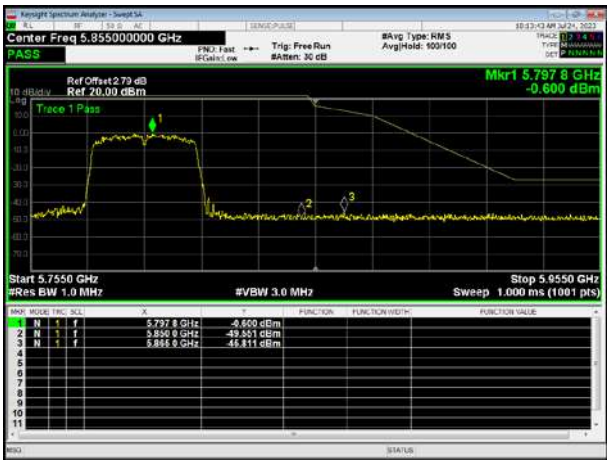
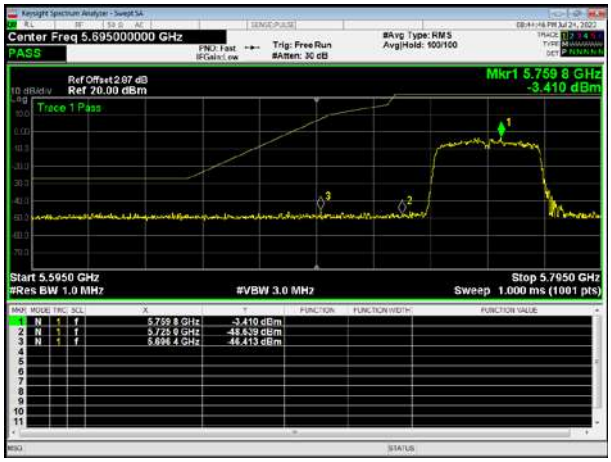
802.11n40 Left Side, ANT1



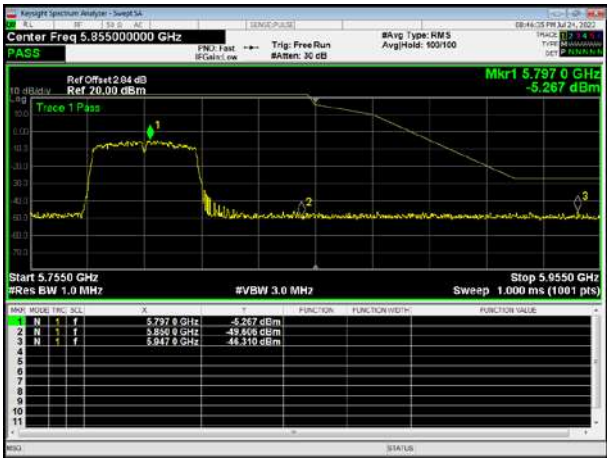
802.11n40 Right Side, ANT1



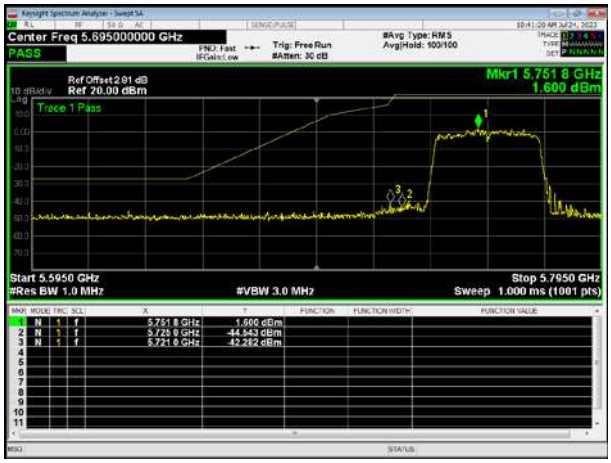
802.11n40 Left Side, ANT2



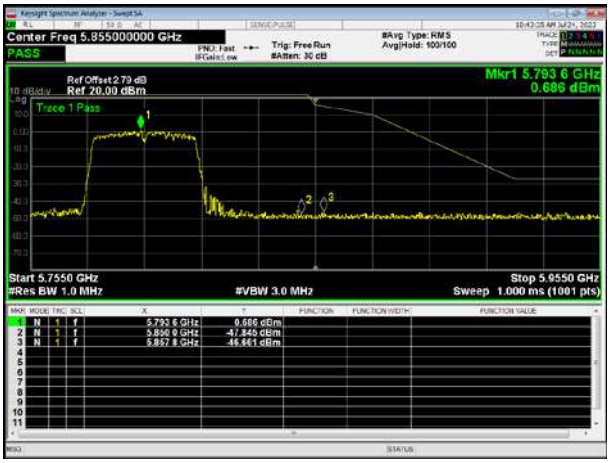
802.11n40 Right Side, ANT2



802.11ac40 Left Side, ANT1



802.11ac40 Right Side, ANT1



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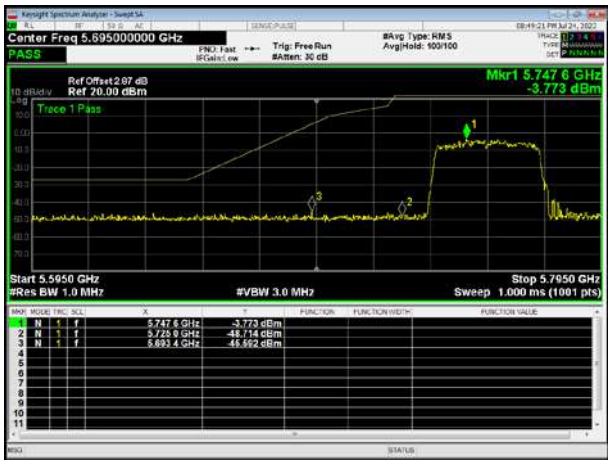
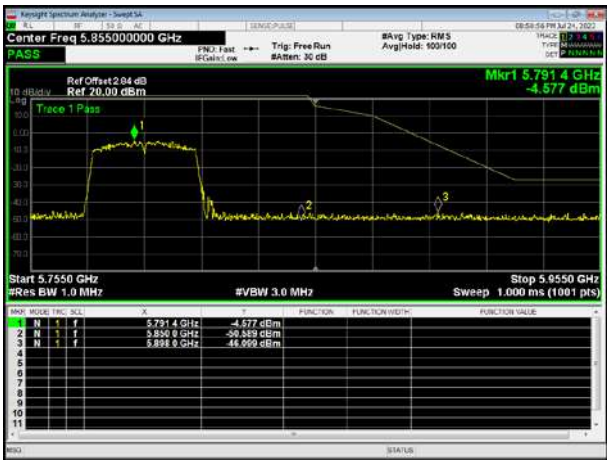
802.11ac40 Left Side, ANT2



802.11ac40 Right Side, ANT2



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A.8 Frequency Stability

5.2G

802.11a

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	65	0.01250
40	7.4	37	0.00712
30	7.4	47	0.00904
20	7.4	47	0.00904
10	7.4	38	0.00731
0	7.4	39	0.00750
-10	7.4	38	0.00731
-20	7.4	28	0.00538
-30	7.4	46	0.00885

802.11ac20

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	47	0.00904
40	7.4	34	0.00654
30	7.4	38	0.00731
20	7.4	24	0.00462
10	7.4	23	0.00442
0	7.4	38	0.00731
-10	7.4	48	0.00923
-20	7.4	48	0.00923
-30	7.4	38	0.00731

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802.11n_HT20

Reference Frequency(Middle Channel): 5200MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	74	0.01423
40	7.4	37	0.00712
30	7.4	45	0.00865
20	7.4	28	0.00538
10	7.4	89	0.01712
0	7.4	35	0.00673
-10	7.4	63	0.01212
-20	7.4	37	0.00712
-30	7.4	37	0.00712

802.11ac40

Reference Frequency(Middle Channel): 5190MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	37	0.00713
40	7.4	46	0.00886
30	7.4	47	0.00906
20	7.4	23	0.00443
10	7.4	23	0.00443
0	7.4	36	0.00694
-10	7.4	37	0.00713
-20	7.4	28	0.00539
-30	7.4	47	0.00906

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802.11n_HT40

Reference Frequency(Middle Channel): 5190MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	37	0.00713
40	7.4	34	0.00655
30	7.4	38	0.00732
20	7.4	47	0.00906
10	7.4	38	0.00732
0	7.4	29	0.00559
-10	7.4	48	0.00925
-20	7.4	37	0.00713
-30	7.4	78	0.01503

802.11ac80

Reference Frequency(Middle Channel): 5210MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	38	0.00729
40	7.4	34	0.00653
30	7.4	46	0.00883
20	7.4	73	0.01401
10	7.4	73	0.01401
0	7.4	26	0.00499
-10	7.4	36	0.00691
-20	7.4	67	0.01286
-30	7.4	83	0.01593

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So, Frequency Stability Versus Input Voltage is:

802.11a

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	37	0.00712
	6.6	27	0.00519
	8.4	36	0.00692

802.11ac20

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	36	0.00692
	6.6	38	0.00731
	8.4	38	0.00731

802.11n_HT20

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	48	0.00923
	6.6	28	0.00538
	8.4	29	0.00558

802.11ac40

Reference Frequency(Middle Channel): 5190 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	77	0.01484
	6.6	62	0.01195
	8.4	58	0.01118

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802.11n_HT40

Reference Frequency(Middle Channel): 5190 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	28	0.00539
	6.6	63	0.01214
	8.4	12	0.00231

802.11ac80

Reference Frequency(Middle Channel): 5210 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	64	0.01228
	6.6	62	0.01190
	8.4	82	0.01577

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5.8G

802.11a

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	73	0.01262
40	7.4	63	0.01089
30	7.4	67	0.01158
20	7.4	34	0.00588
10	7.4	78	0.01348
0	7.4	82	0.01417
-10	7.4	67	0.01158
-20	7.4	63	0.01089
-30	7.4	72	0.01245

802.11ac20

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	63	0.01089
40	7.4	72	0.01245
30	7.4	73	0.01262
20	7.4	26	0.00449
10	7.4	63	0.01089
0	7.4	72	0.01245
-10	7.4	29	0.00501
-20	7.4	72	0.01245
-30	7.4	92	0.01590

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802.11n_HT20

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	82	0.01417
40	7.4	62	0.01072
30	7.4	78	0.01348
20	7.4	73	0.01262
10	7.4	23	0.00398
0	7.4	23	0.00398
-10	7.4	63	0.01089
-20	7.4	37	0.00640
-30	7.4	28	0.00484

802.11ac40

Reference Frequency(Middle Channel): 5755 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	63	0.01095
40	7.4	26	0.00452
30	7.4	36	0.00626
20	7.4	47	0.00817
10	7.4	28	0.00487
0	7.4	67	0.01164
-10	7.4	83	0.01442
-20	7.4	72	0.01251
-30	7.4	23	0.00400

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802.11n_HT40

Reference Frequency(Middle Channel): 5755 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	63	0.01095
40	7.4	72	0.01251
30	7.4	28	0.00487
20	7.4	36	0.00626
10	7.4	19	0.00330
0	7.4	37	0.00643
-10	7.4	37	0.00643
-20	7.4	47	0.00817
-30	7.4	27	0.00469

802.11ac80

Reference Frequency(Middle Channel): 5775 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	7.4	27	0.00468
40	7.4	38	0.00658
30	7.4	23	0.00398
20	7.4	47	0.00814
10	7.4	23	0.00398
0	7.4	49	0.00848
-10	7.4	37	0.00641
-20	7.4	45	0.00779
-30	7.4	23	0.00398

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So, Frequency Stability Versus Input Voltage is:

802.11a

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	34	0.00588
	6.6	23	0.00398
	8.4	38	0.00657

802.11ac20

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	74	0.01279
	6.6	47	0.00812
	8.4	37	0.00640

802.11n_HT20

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	23	0.00398
	6.6	12	0.00207
	8.4	27	0.00467

802.11ac40

Reference Frequency(Middle Channel): 5755 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	83	0.01442
	6.6	34	0.00591
	8.4	63	0.01095

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802.11n_HT40

Reference Frequency(Middle Channel): 5755 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	45	0.00782
	6.6	34	0.00591
	8.4	39	0.00678

802.11ac80

Reference Frequency(Middle Channel): 5775 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	7.4	64	0.01108
	6.6	53	0.00918
	8.4	52	0.00900

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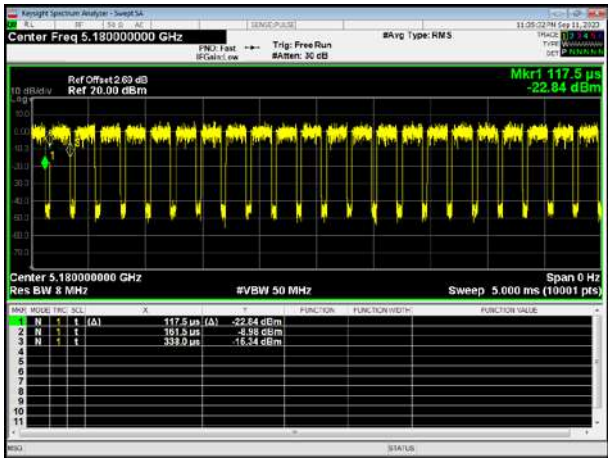
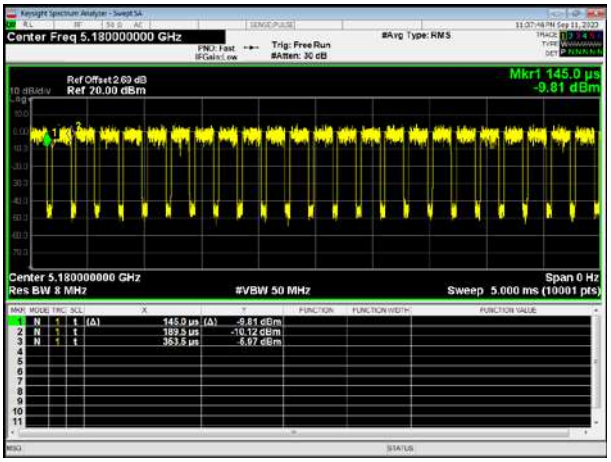
A.9 Duty Cycle

5.2GHz

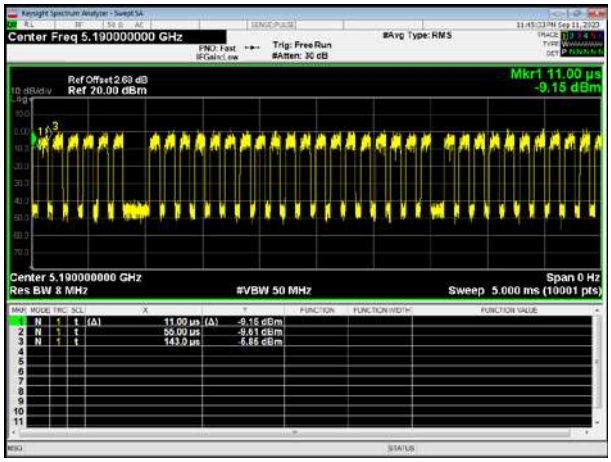
802.11a



802.11n-HT20



802.11n-HT40



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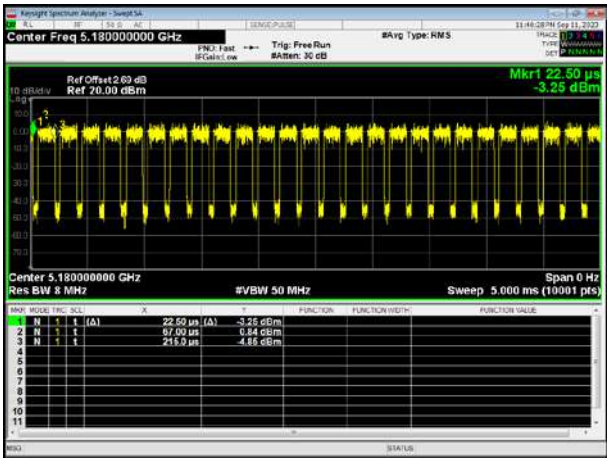

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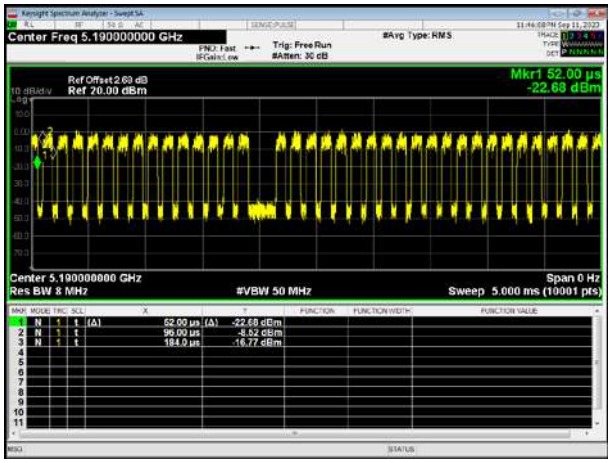

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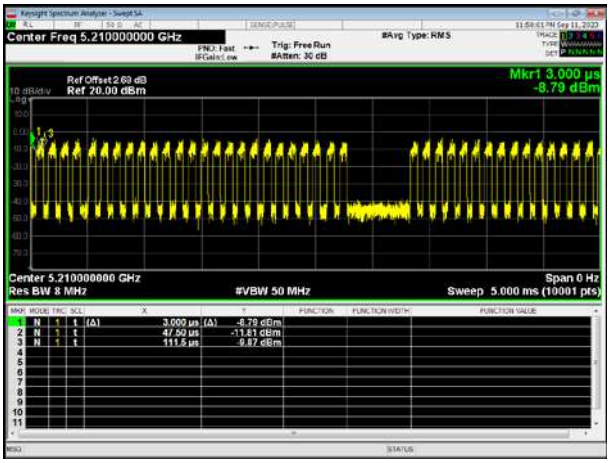

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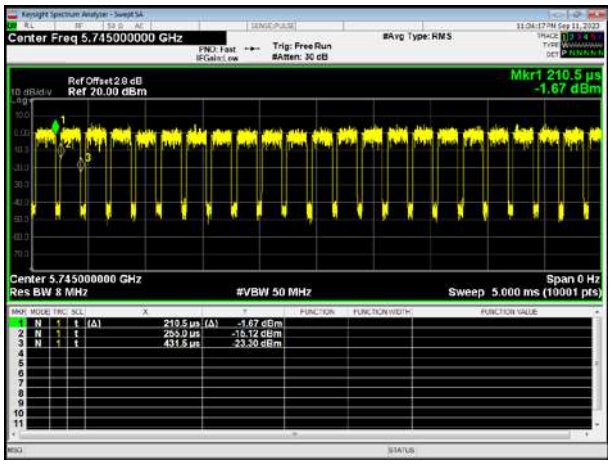
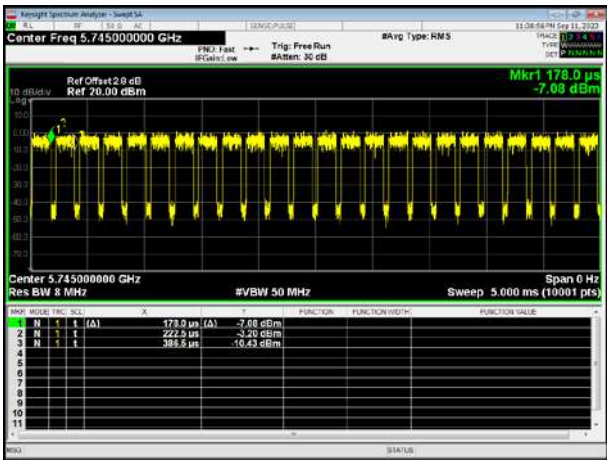
5.8GHz

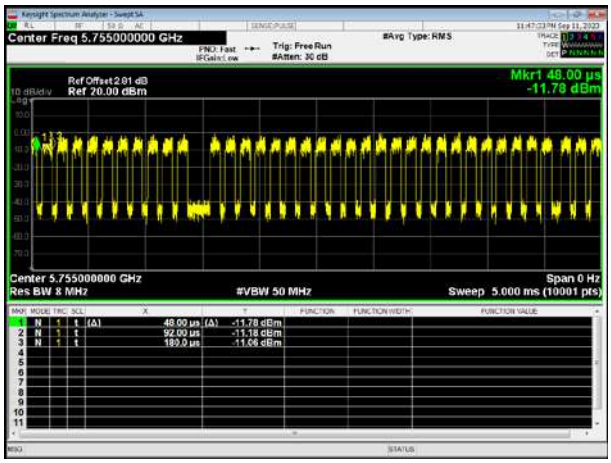
802.11a



802.11n-HT20



802.11n-HT40



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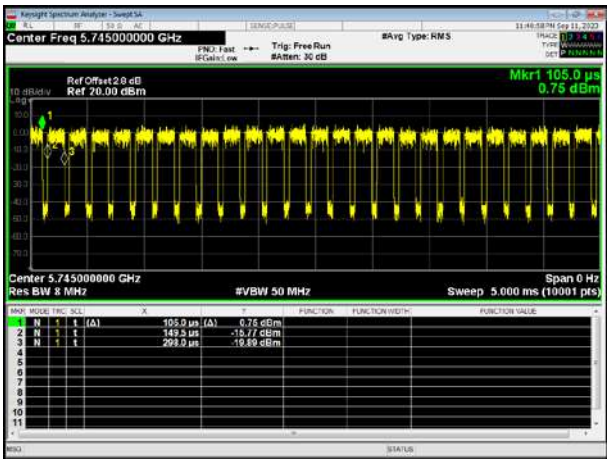

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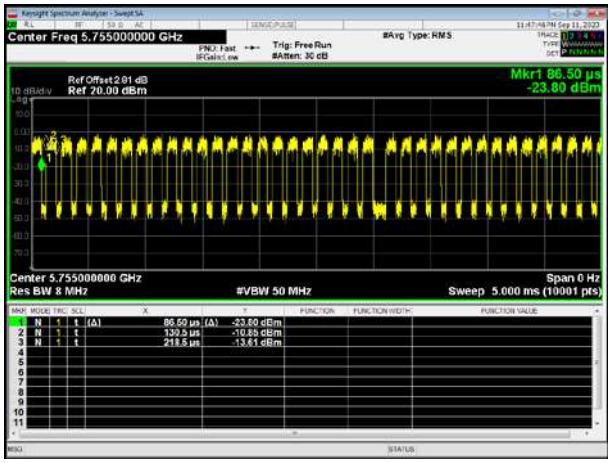

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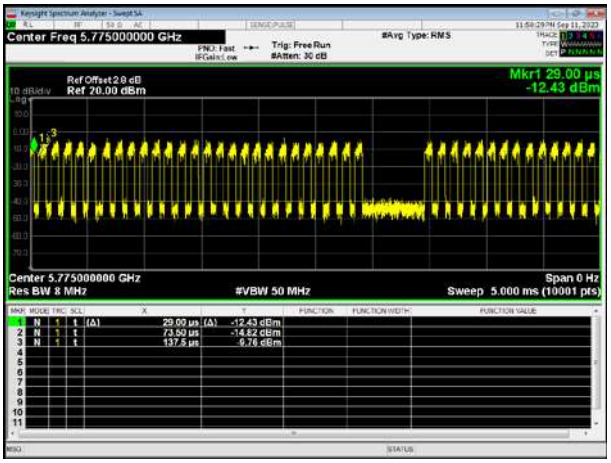

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