TEST REPORT

Dt&C

Dt&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC2309-0125

2. Customer

• Name (FCC) : DOF Inc / Name (IC) : DOF Inc

• Address (FCC) : B204, 601, 602, 77, Seongsuil-ro, Seongdong-gu, Seoul South Korea
Address (IC) : B204, 601, 602, 77, Seongsuil-ro, Seongdong-gu Seoul 04790 Korea (Republic Of)

3. Use of Report : FCC & IC Certification

4. Product Name / Model Name : FREEDOM i / DSI-100
FCC ID : 2BBVT-DSI-100
IC : 30869-DSI100

5. FCC Regulation(s): Part 15.407
IC Standard(s): RSS-247 Issue 2, RSS-Gen Issue 5
Test Method used: KDB789033 D02v02r01, KDB662911 D01v02r01, ANSI C63.10-2013

6. Date of Test : 2023.07.27 ~ 2023.08.16

7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

8. Testing Environment : See appended test report.

9. Test Result : Refer to the attached test result.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test report is not related to KOLAS accreditation.

Affirmation	Tested by Name : JaeHyeok Bang (signature)	Technical Manager Name : JaeJin Lee (signature)

2023 . 09 . 19 .

Dt&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

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Test Report Version

Test Report No.	Date	Description	Revised by	Reviewed by
DRTFCC2309-0125	Sep. 19, 2023	Initial issue	JaeHyeok Bang	JaeJin Lee

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1. General Information

1.1. Description of EUT

Equipment Class	Unlicensed National Information Infrastructure Tx (NII)
Product Name	FREEDOM i
Model Name	DSI-100
Add Model Name	-
Firmware Version Identification Number	Ver 1.0
EUT Serial Number	No Specified
Power Supply	DC 3.6 V (Battery) DC 12 V (Adapter)
Modulation Technique	OFDM
Antenna Specification	Antenna Type: PCB Antenna Antenna Gain: Refer to the clause 3 in test report.

Band	Mode	Tx. frequency(MHz)	Max. conducted power(dBm)	Directional Antenna gain(dBi)	Max. e.i.r.p (dBm)
U-NII 1	802.11ac(VHT40)	5 190 ~ 5 230	14.31	3.92	18.23
	802.11ac(VHT80)	5 210	10.22	3.92	14.14
U-NII 3	802.11ac(VHT40)	5 755 ~ 5 795	16.36	4.79	21.15
	802.11ac(VHT80)	5 775	13.34	4.79	18.13

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1.2. Testing Laboratory

Dt&C Co., Ltd.		
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The test site complies with the requirements of Part 2.948 according to ANSI C63.4-2014. **- FCC & IC MRA Designation No. : KR0034** **- ISED#: 5740A**		
www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

1.3. Testing Environment

Ambient Condition	
▪ Temperature	+21 ℃ ~ +24 ℃
▪ Relative Humidity	+40 % ~ +43 %

1.4. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014 and ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

Parameter	Measurement uncertainty
Antenna-port conducted emission	1.0 dB (The confidence level is about 95 %, k = 2)
AC power-line conducted emission	3.4 dB (The confidence level is about 95 %, k = 2)
Radiated emission (1 GHz Below)	4.8 dB (The confidence level is about 95 %, k = 2)
Radiated emission (1 GHz ~ 18 GHz)	4.8 dB (The confidence level is about 95 %, k = 2)
Radiated emission (18 GHz Above)	4.94 dB (The confidence level is about 95 %, k = 2)

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1.5. Test Equipment List

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	23/06/23	24/06/23	MY46471622
Spectrum Analyzer	Agilent Technologies	N9020A	22/12/16	23/12/16	MY48011700
Spectrum Analyzer	Agilent Technologies	N9020A	23/06/23	24/06/23	US47360812
Spectrum Analyzer	KEYSIGHT	N9030B	22/12/16	23/12/16	MY55480168
Receiver	Rohde Schwarz	ESCI3	23/06/23	24/06/23	100798
DC Power Supply	Agilent Technologies	66332A	23/06/23	24/06/23	US37474125
Multimeter	FLUKE	17B+	22/12/16	23/12/16	36390701WS
Signal Generator	Rohde Schwarz	SMBV100A	22/12/16	23/12/16	255571
Signal Generator	ANRITSU	MG3695C	22/12/16	23/12/16	173501
Thermohygrometer	BODYCOM	BJ5478	22/12/16	23/12/16	120612-1
Thermohygrometer	BODYCOM	BJ5478	22/12/16	23/12/16	120612-2
Thermohygrometer	BODYCOM	BJ5478	23/06/23	24/06/23	N/A
Loop Antenna	ETS-Lindgren	6502	22/04/22	24/04/22	00203480
Hybrid Antenna	Schwarzbeck	VULB 9160	22/12/16	23/12/16	3362
Horn Antenna	ETS-Lindgren	3117	23/06/23	24/06/23	00143278
Horn Antenna	A.H.Systems Inc.	SAS-574	23/06/23	24/06/23	155
PreAmplifier	tsj	MLA-0118-B01-40	22/12/16	23/12/16	1852267
PreAmplifier	tsj	MLA-1840-J02-45	23/06/23	24/06/23	16966-10728
PreAmplifier	H.P	8447D	22/12/16	23/12/16	2944A07774
High Pass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	23/06/23	24/06/23	8
High Pass Filter	Wainwright Instruments	WHKX10-2838-3300-18000-60SS	23/06/23	24/06/23	1
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5-6SS	23/06/23	24/06/23	3
Attenuator	Hefei Shunze	SS5T2.92-10-40	23/06/23	24/06/23	16012202
Attenuator	Aeroflex/Weinschel	56-3	23/06/23	24/06/23	Y2370
Attenuator	SMAJK	SMAJK-2-3	23/06/23	24/06/23	3
Attenuator	SMAJK	SMAJK-2-3	23/06/23	24/06/23	2
Attenuator	Aeroflex/Weinschel	86-10-11	23/06/23	24/06/23	408
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2496A MA2411B	22/12/16	23/12/16	1338004 1911481
EMI Test Receiver	ROHDE&SCHWARZ	ESCI7	23/01/31	24/01/31	100910
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	22/08/22	23/08/22	101333
LISN	SCHWARZBECK	NSLK 8128 RC	22/10/26	23/10/26	8128 RC-387
Thermo Hygro Meter	TESTO	608-H1	23/01/13	24/01/13	45084791
Cable	Dt&C	Cable	23/01/04	24/01/04	G-2
Cable	HUBER+SUHNER	SUCOFLEX 100	23/01/04	24/01/04	G-3
Cable	Dt&C	Cable	23/01/04	24/01/04	G-4
Cable	OMT	YSS21S	23/01/04	24/01/04	G-5
Cable	Junkosha	MWX241	23/01/03	24/01/03	mmW-1
Cable	Junkosha	MWX241	23/01/03	24/01/03	mmW-4
Cable	HUBER+SUHNER	SUCOFLEX100	23/01/04	24/01/04	M-01
Cable	HUBER+SUHNER	SUCOFLEX100	23/01/04	24/01/04	M-02
Cable	JUNKOSHA	MWX241/B	23/01/04	24/01/04	M-03
Cable	JUNKOSHA	J12J101757-00	23/01/04	24/01/04	M-07
Cable	HUBER+SUHNER	SUCOFLEX106	23/01/04	24/01/04	M-09
Cable	Dt&C	Cable	23/01/04	24/01/04	RFC-69
Cable	Radiall	TESTPRO3	23/01/04	24/01/04	RFC-70
Test Software (AC Line Conducted)	tsj	EMI Measurement	NA	NA	Version 2.00.0185
Test Software (Radiated)	tsj	EMI Measurement	NA	NA	Version 2.00.0185

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.
Note2: The cable is not a regular calibration item, so it has been calibrated by Dt&C itself.

2. Test Methodology

The measurement procedures described in the ANSI C63.10-2013 and the guidance provided in KDB789033 D02v02r01 were used in measurement of the EUT.

The EUT was tested per the guidance of KDB789033 D02v02r01. And ANSI C63.10-2013 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the test mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E.

2.3. General Test Procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB789033 D02v02r01.

So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10-2013.

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

Basically the radiated tests were performed with KDB789033 D02v02r01. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10-2013 as stated on KDB789033 D02v02r01.

The EUT is placed on a non-conductive table, which is 0.8 m above ground plane. For emission measurements above 1 GHz, the table height is 1.5 m. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 1 m or 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the highest emission, the relative positions of the EUT were rotated through three orthogonal axis.

2.4. Instrument Calibration

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

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2.5. Description of Test Modes

The EUT has been tested with the operating condition for maximizing the emission characteristics. A test program is used to control the EUT for staying in continuous transmitting.

Transmitting Configuration of EUT

Mode	SISO		MIMO (CDD)	MIMO (SDM)
	Ant 1	Ant 2	Ant 1 & 2	Ant 1 & 2
	Data rate			
802.11ac(VHT40)	MCS 0 ~ 9(1SS)	MCS 0 ~ 9(1SS)	MCS 0 ~ 9(1SS)	MCS 0 ~ 9(2SS)
802.11ac(VHT80)	MCS 0 ~ 9(1SS)	MCS 0 ~ 9(1SS)	MCS 0 ~ 9(1SS)	MCS 0 ~ 9(2SS)

Note1: SDM = Spatial Diversity Multiplexing, CDD = Cycle Delay Diversity, SS = Spatial Streams

EUT Operation test setup

- Test Software: Teraterm-4.104
- Power setting: Refer to the table below.

Tested frequency and power setting

Band	802.11ac(VHT40)		
	Channel	Frequency (MHz)	Power Setting
U-NII 1	38	5 190	10
	46	5 230	13
U-NII 3	151	5 755	15
	159	5 795	15

Band	802.11ac(VHT80)		
	Channel	Frequency (MHz)	Power Setting
U-NII 1	42	5 210	8
U-NII 3	155	5 775	12

Tested Mode

Test Mode		Test Band	ANT configuration	Worst data rate
TM 1	802.11ac(VHT40)	U-NII 1, U-NII 3	CDD Multiple transmitting	MCS0
TM 2	802.11ac(VHT80)	U-NII 1, U-NII 3	CDD Multiple transmitting	MCS0

Note1: The worst case data rate was determined according to the power measurements.

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3. Antenna Requirements

▣ **According to Part 15.203**

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 internal antennas employ unique antenna connectors.
Therefore this E.U.T complies with the requirement of Part 15.203

Directional antenna gain:

Bands	SISO		MIMO (CDD) Note 1.	MIMO (SDM) Note 2
	ANT 1 [dBi]	ANT 2 [dBi]	Directional Gain[dBi]	Directional Gain[dBi]
U-NII 1	0.72	1.09	**3.92**	0.91
U-NII 3	1.94	1.62	**4.79**	1.78

Note 1. Directional gain(correlated signal with unequal antenna gain and equal transmit power)

$10 \log [(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N^{ANT}]$ dBi

Note 2. Directional gain(completely uncorrelated signal with unequal antenna gain and equal transmit power)

$10 \log [(10^{G1/10} + 10^{G2/10} + \ldots + 10^{GN/10}) / N^{ANT}]$ dBi

4. Summary of Test Result

FCC Part Section(s)	RSS Section(s)	Test Description	Limit	Test Condition	Status Note 1
15.407(a)	RSS-247[6.2]	Emission Bandwidth (26 dB Bandwidth)	N/A	Conducted	C
15.407(a)	RSS-247[6.2]	Minimum Emission Bandwidth (6 dB Bandwidth)	> 500 kHz in 5 725 ~ 5 850 MHz		C
15.407(a)	RSS-247[6.2]	Maximum Conducted Output Power	Part 15.407(a) (Refer to section 5.3)		C
15.407(a)	RSS-247[6.2]	Peak Power Spectral Density	Part 15.407(a) (Refer to section 5.4)		C
-	RSS-Gen[6.7]	Occupied Bandwidth (99 %)	N/A		C
15.407(h)	RSS-247[6.3]	Dynamic Frequency Selection	Part 15.407(h)		NA Note 4
15.205 15.209 15.407(b)	RSS-Gen[8.9] RSS-Gen[8.10] RSS-247[6.2]	Unwanted Emissions	Part 15.209, 15.407(b) (Refer to section 5.5)	Radiated	C Note 3
15.207	RSS-Gen[8.8]	AC Conducted Emissions	Part 15.207 (Refer to section 5.6)	AC Line Conducted	C
15.203	-	Antenna Requirements	Part 15.203 (Refer to section 3)	-	C

Note 1: **C** = Comply **NC** = Not Comply **NT** = Not Tested **NA** = Not Applicable
Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS.
Note 3: This test item was performed in three orthogonal EUT positions and the worst case data was reported.
Note 4: This EUT does not supports DFS Band.

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5. TEST RESULT

5.1 Emission Bandwidth (26 dB BW) & Occupied BW (99 %)

▣ Test Requirements

- Emission Bandwidth (26 dB Bandwidth)

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.
The 26 dB bandwidth is used to determine the conducted output power limit.

- Occupied BW (99 %)

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 % emission bandwidth, as calculated or measured

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

- Emission Bandwidth (26 dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02v02r01**.

1. Set resolution bandwidth (RBW) = approximately **1 %** of the EBW.
2. Set the video bandwidth **(VBW) > RBW**.
3. Detector = **Peak**.
4. Trace mode = **max hold**.

Measure the maximum width of the emission that is 26 dB down from the peak 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 %.

- Occupied BW (99 %): RSS-Gen[6.7]

1. The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
2. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
3. The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

▣ Test Results: Comply

Test Mode	Band	Channel	Frequency(MHz)	26 dB BW(MHz)		99 % BW(MHz)	
				ANT 1	ANT 2	ANT 1	ANT 2
TM 1	U-NII 1	38	5 190	39.41	39.09	36.08	36.08
		46	5 230	39.75	38.79	36.12	36.11
TM 2	U-NII 1	42	5 210	80.68	80.73	75.49	75.40

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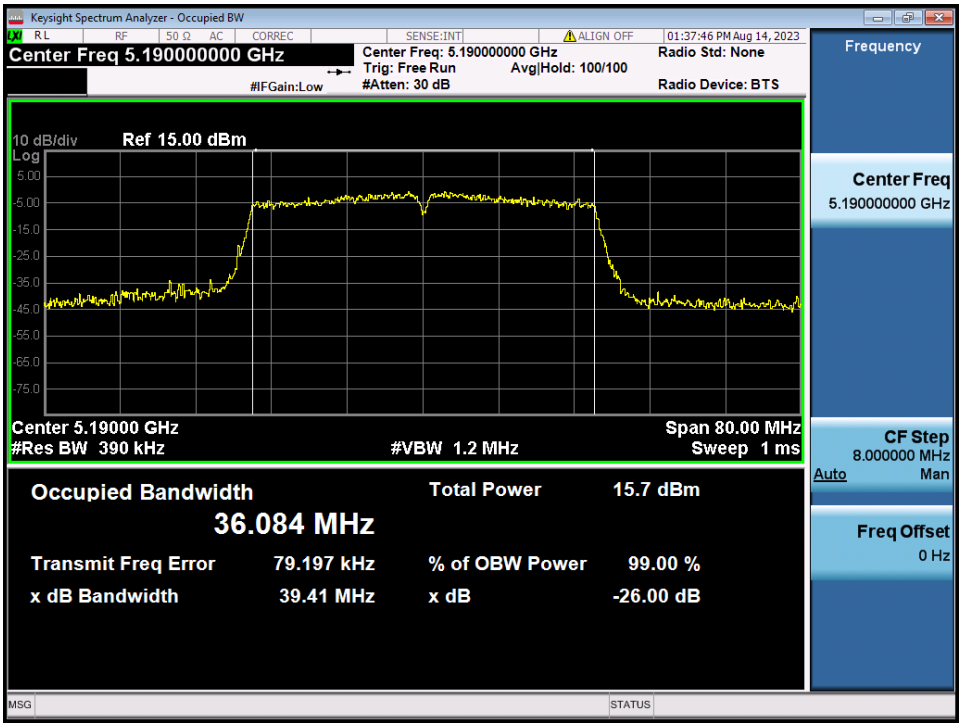
26 dB Bandwidth & Occupied BW

Test Mode: TM 1 & ANT 1 & Ch.38

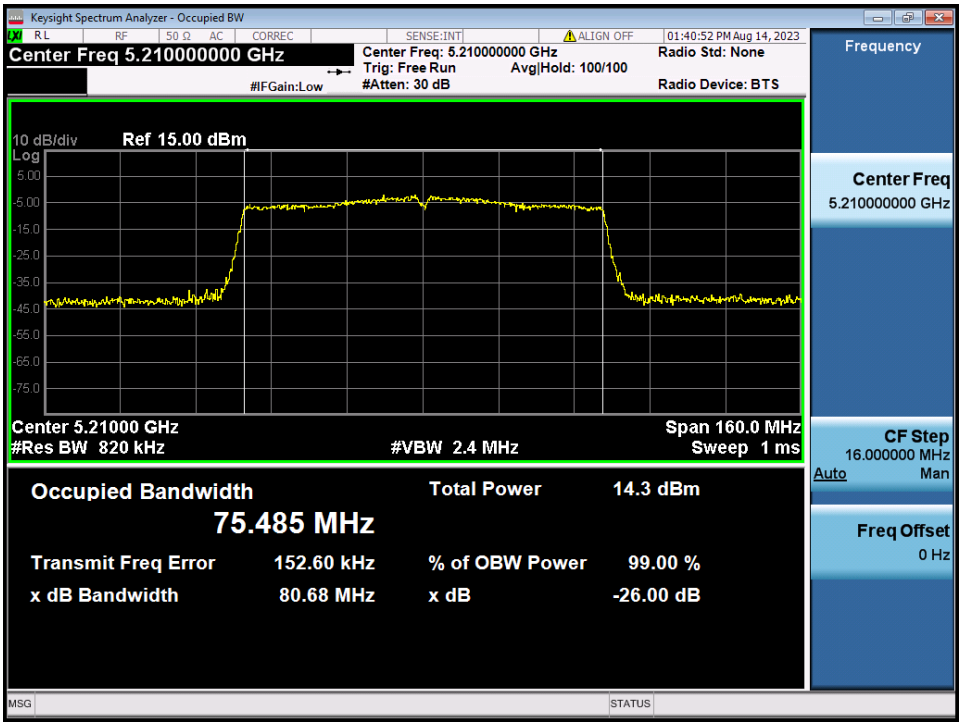


26 dB Bandwidth & Occupied BW

Test Mode: TM 1 & ANT 1 & Ch.46

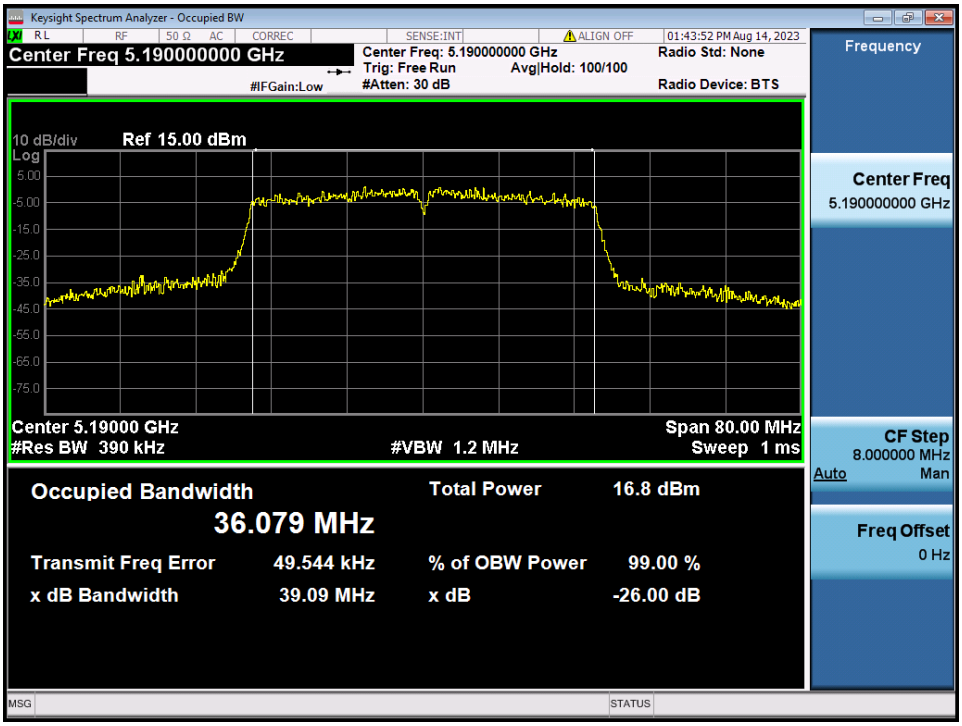
26 dB Bandwidth & Occupied BW

Test Mode: TM 2 & ANT 1 & Ch.42



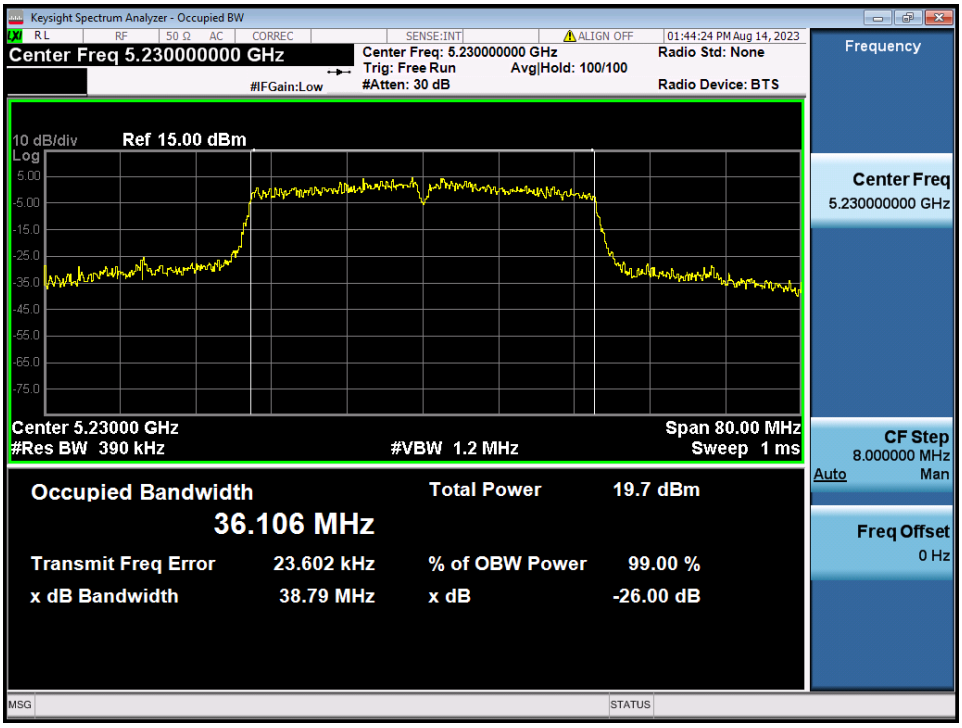
26 dB Bandwidth & Occupied BW

Test Mode: TM 1 & ANT 2 & Ch.38



26 dB Bandwidth & Occupied BW

Test Mode: TM 1 & ANT 2 & Ch.46



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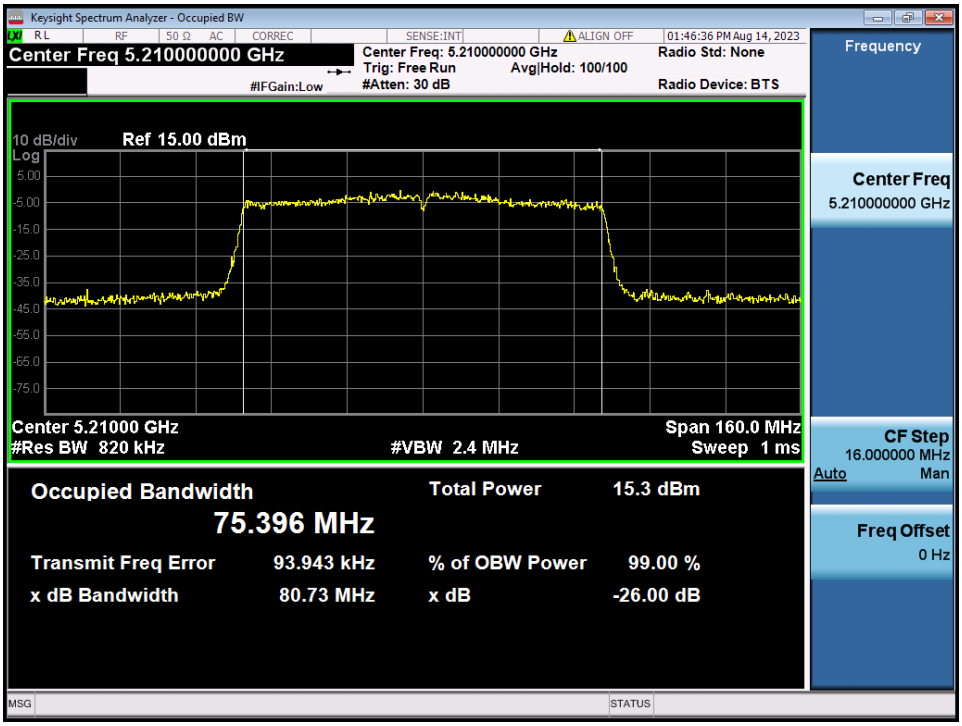
26 dB Bandwidth & Occupied BW

Test Mode: TM 4 & ANT 2 & Ch.42



5.2 Minimum Emission Bandwidth (6 dB BW) & Occupied BW (99 %)

▣ Test Requirements

- Emission Bandwidth (6 dB Bandwidth)

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

- Occupied BW (99 %)

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 % emission bandwidth, as calculated or measured.

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

- Emission Bandwidth (6 dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02v02r01**.

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth **≥ 3 x RBW**.
3. Detector = **Peak**.
4. Trace mode = **max hold**.

   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.

- Occupied BW (99 %) : RSS-Gen[6.7]

1. The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
2. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
3. The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3 x RBW.

▣ Test Results: Comply

Test Mode	Band	Channel	Frequency(MHz)	6 dB BW(MHz)		99 % BW(MHz)	
				ANT 1	ANT 2	ANT 1	ANT 2
TM 1	U-NII 3	151	5 755	35.24	35.21	36.35	36.13
		159	5 795	35.25	35.14	36.30	36.23
TM 2	U-NII 3	155	5 775	75.40	75.35	75.63	75.60

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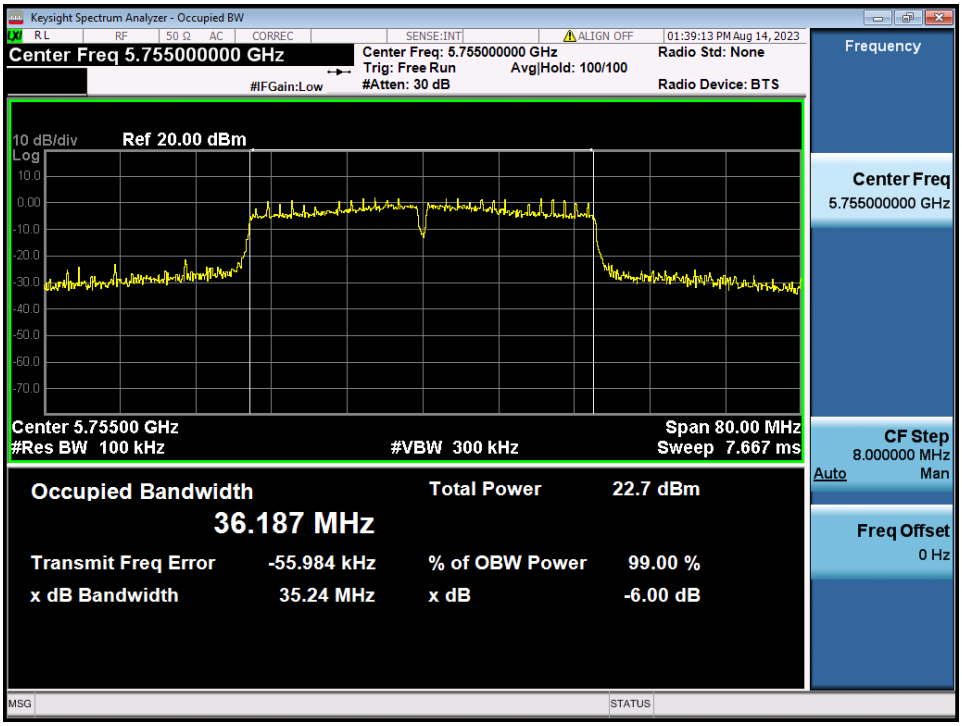
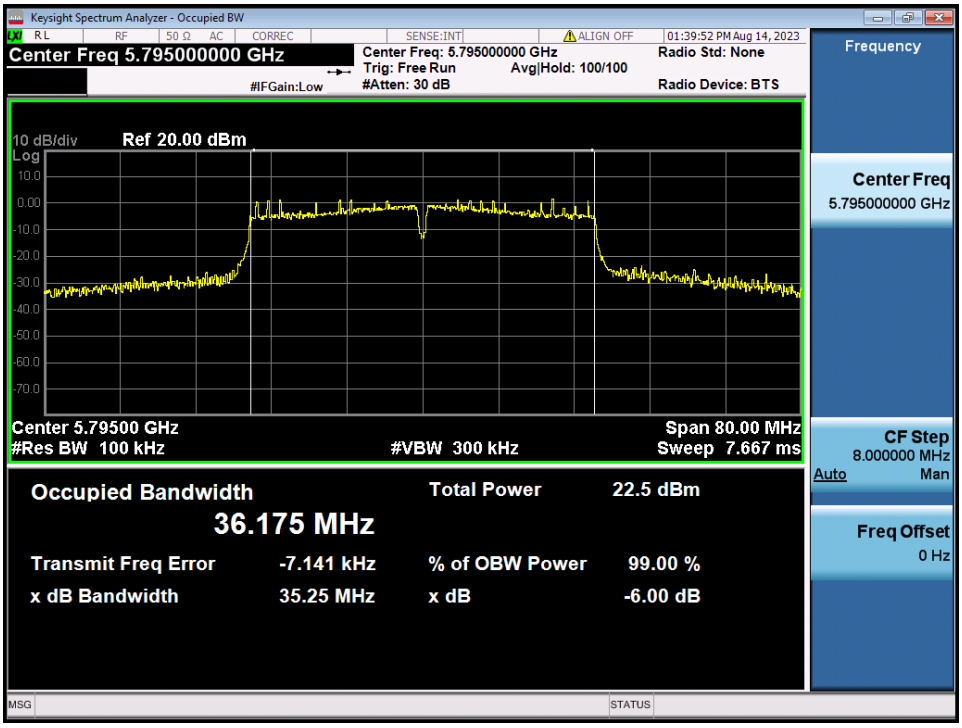
6 dB Bandwidth

Test Mode: TM 1 & ANT 1 & Ch.151



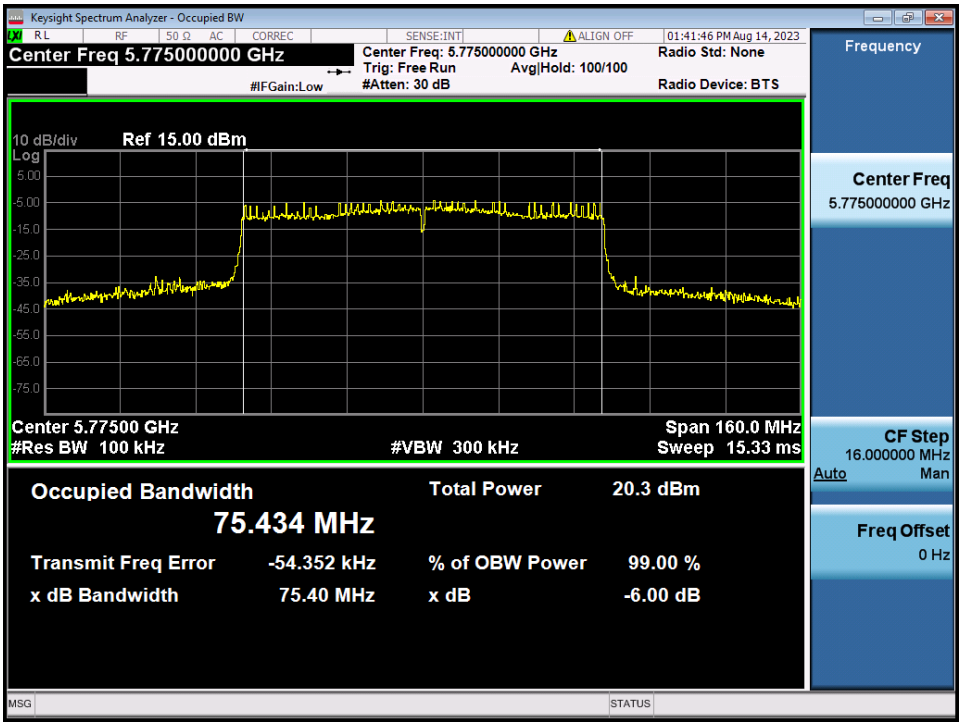
6 dB Bandwidth

Test Mode: TM 1 & ANT 1 & Ch.159



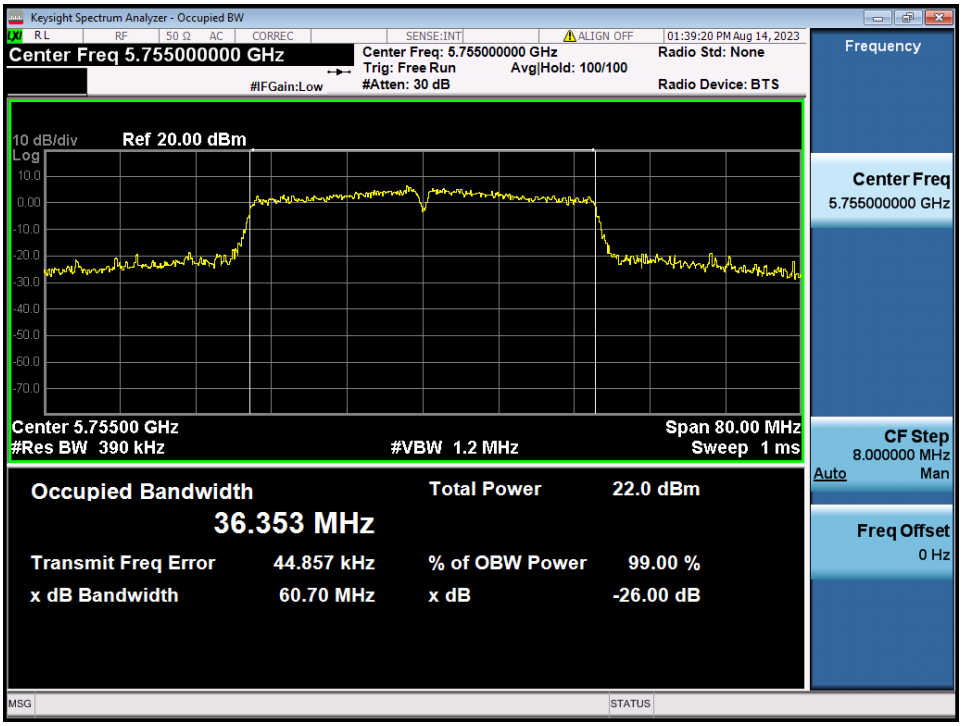
6 dB Bandwidth

Test Mode: TM 2 & ANT 1 & Ch.155



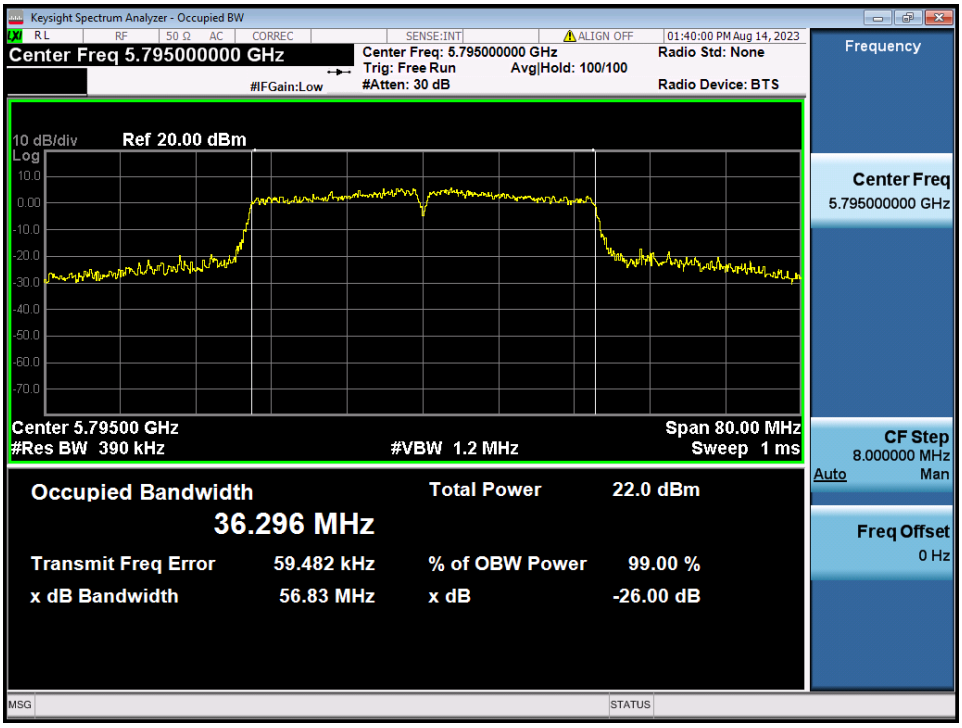
Occupied Bandwidth

Test Mode: TM 1 & ANT 1 & Ch.151

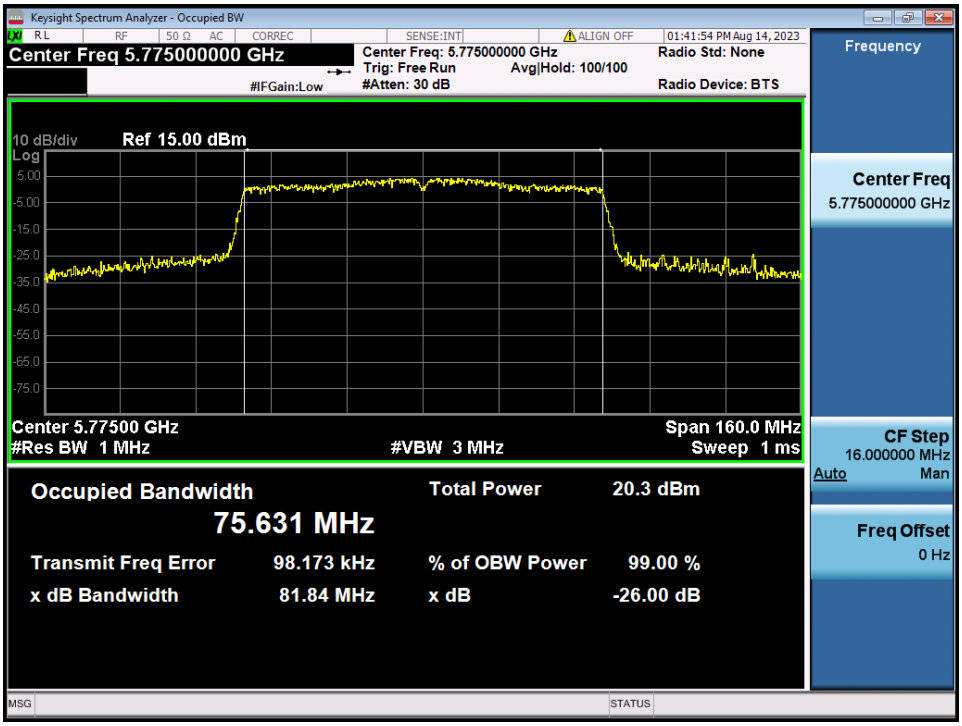


Occupied Bandwidth

Test Mode: TM 1 & ANT 1 & Ch.159

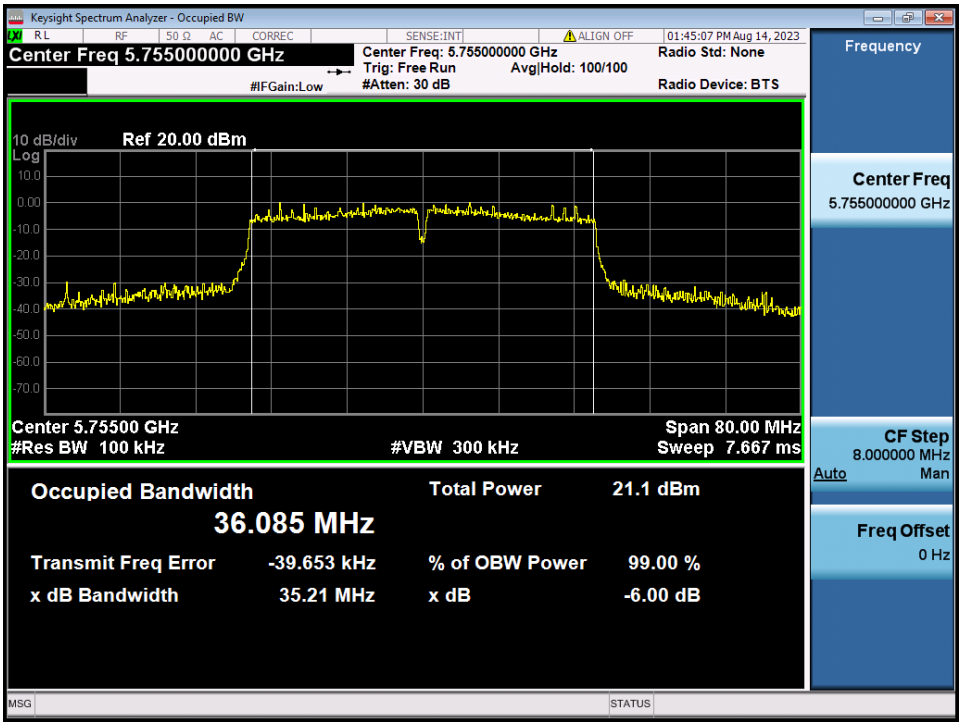


Occupied Bandwidth Test Mode: TM 2 & ANT 1 & Ch.155



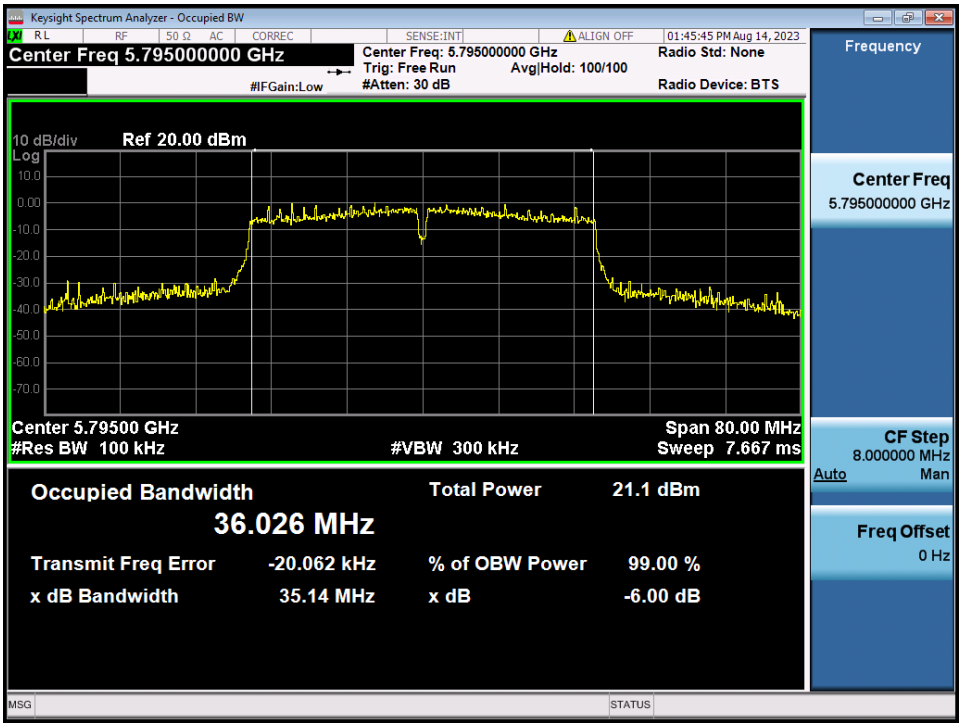
6 dB Bandwidth

Test Mode: TM 1 & ANT 2 & Ch.151



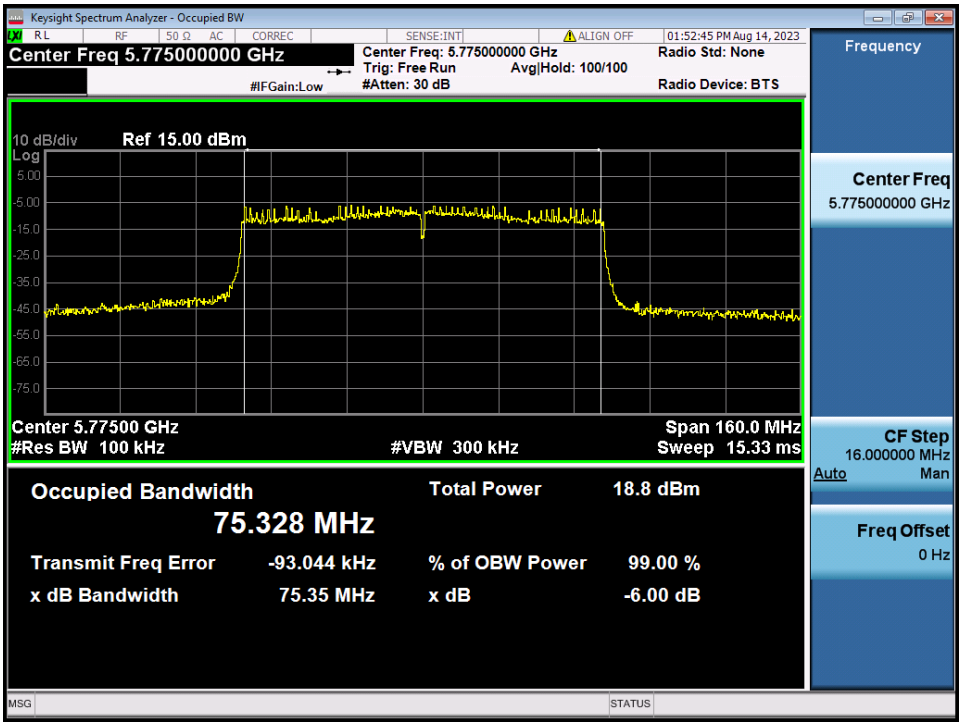
6 dB Bandwidth

Test Mode: TM 1 & ANT 2 & Ch.159



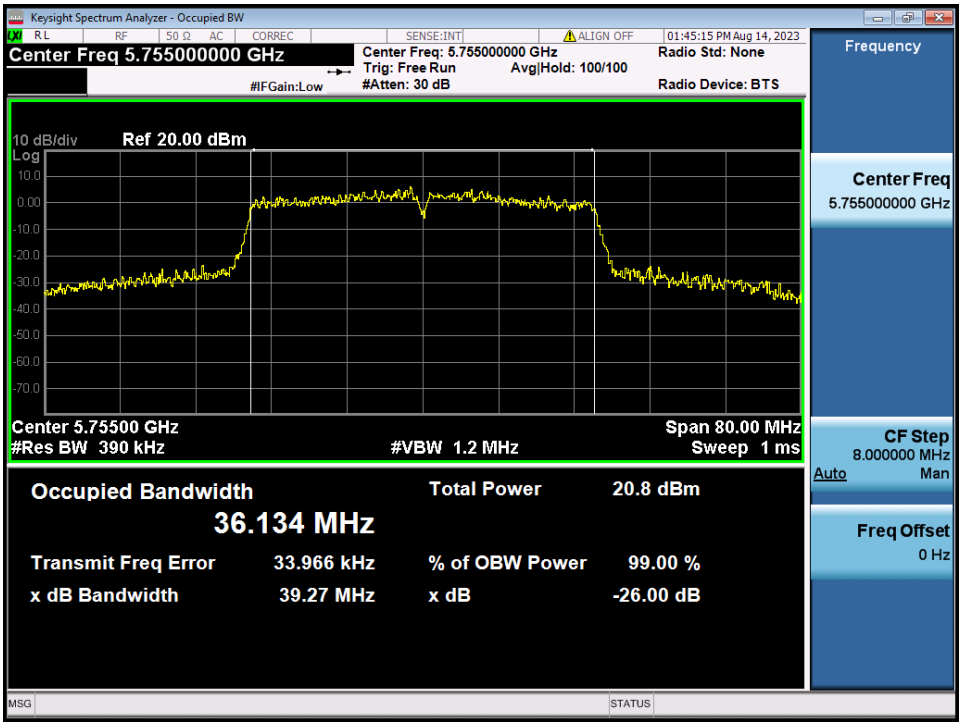
6 dB Bandwidth

Test Mode: TM 2 & ANT 2 & Ch.155



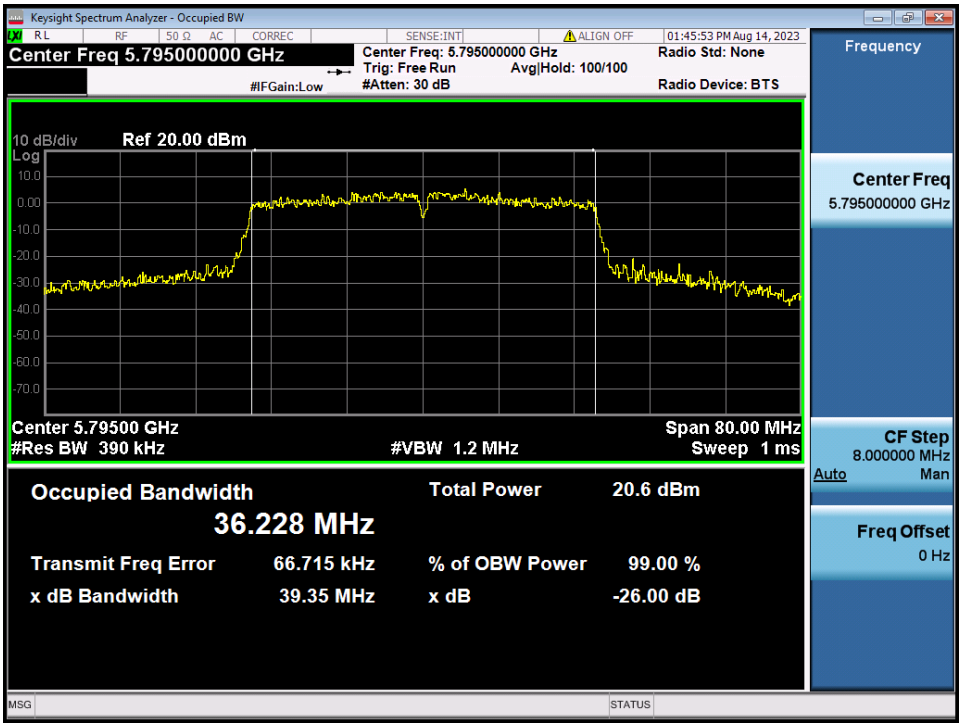
Occupied Bandwidth

Test Mode: TM 1 & ANT 2 & Ch.151

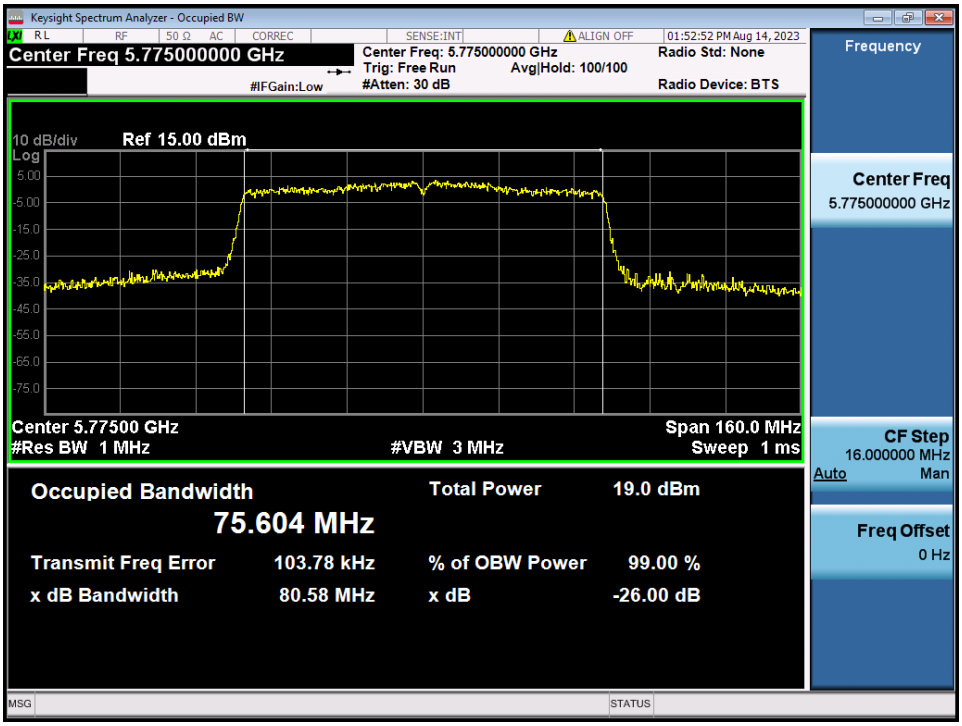


Occupied Bandwidth

Test Mode: TM 1 & ANT 2 & Ch.159



Occupied Bandwidth Test Mode: TM 2 & ANT 2 & Ch.155



5.3 Maximum Conducted Output Power

▣ Test Requirements

Part. 15.407(a)

(1) For the band 5.15 GHz - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 GHz - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).
(ii) For an indoor access point operating in the band 5.15 GHz - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(iii) For fixed point-to-point access points operating in the band 5.15 GHz - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.
(iv) For mobile and portable client devices in the 5.15 GHz - 5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25 GHz - 5.35 GHz and 5.47 GHz - 5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725 GHz - 5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

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RSS-247[6.2]

(1) For band 5 150 MHz – 5 250 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.
For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99 % emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

(2) For band 5 250 MHz – 5 350 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.
Devices, other than devices installed in vehicles, shall comply with the following:
a) The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;
b) The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99 % emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

(3) For band 5 470 MHz – 5 600 MHz and 5 650 MHz – 5 725 MHz

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99 % emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than
500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

(4) For band 5 725 MHz – 5 850 MHz

The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

▣ Test Configuration

Method PM-G

▣ Test Procedure

Method PM-G of KDB789033 D02v02r01

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

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▣ **Test Results: Comply**

- Summed Output Power: CDD

Mode	Band	Channel	Frequency (MHz)	Conducted Output Power(dBm)			Directional Gain(dBi)	e.i.r.p[Note1] (dBm)
				ANT 1	ANT 2	ANT1+ANT2 (CDD)		
802.11ac (VHT40)	U-NII 1	38	5 190	8.59	9.07	11.85	3.92	15.77
		46	5 230	11.27	11.32	14.31	3.92	18.23
	U-NII 3	151	5 755	13.38	13.26	16.33	4.79	21.12
		159	5 795	13.42	13.28	16.36	4.79	21.15
802.11ac (VHT80)	U-NII 1	42	5 210	6.83	7.56	10.22	3.92	14.14
	U-NII 3	155	5 775	10.24	10.41	13.34	4.79	18.13

Note 1: e.i.r.p= Conducted Output Power + Antenna Gain

- Summed Output Power: SDM

Mode	Band	Channel	Frequency (MHz)	Conducted Output Power(dBm)			Directional Gain(dBi)	e.i.r.p[Note1] (dBm)
				ANT 1	ANT 2	ANT1+ANT2 (CDD)		
802.11ac (VHT40)	U-NII 1	38	5 190	8.54	9.02	11.80	0.91	12.71
		46	5 230	11.21	11.28	14.26	0.91	15.17
	U-NII 3	151	5 755	13.33	13.21	16.28	1.78	18.06
		159	5 795	13.37	13.25	16.32	1.78	18.10
802.11ac (VHT80)	U-NII 1	42	5 210	6.77	7.55	10.19	0.91	11.10
	U-NII 3	155	5 775	10.20	10.36	13.29	1.78	15.07

Note 1: e.i.r.p= Conducted Output Power + Antenna Gain

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5.4 Maximum Power Spectral Density

▣ Test requirements

Part. 15.407(a)

(1) For the band 5.15 GHz - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 GHz - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. **note1**

(ii) For an indoor access point operating in the band 5.15 GHz - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. note1

(iii) For fixed point-to-point access points operating in the band 5.15 GHz - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) For mobile and portable client devices in the 5.15 GHz - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. note1

(2) For the 5.25 GHz - 5.35 GHz and 5.47 GHz - 5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. note1

(3) For the band 5.725 GHz - 5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band.note1,note2

Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: Fixed point - to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

RSS-247[6.2]

(1) For band 5 150 MHz – 5 250 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.
For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99 % emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

(2) For band 5 250 MHz – 5 350 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.
Devices, other than devices installed in vehicles, shall comply with the following:
a) The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;
b) The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99 % emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

(3) For band 5 470 MHz – 5 600 MHz and 5 650 MHz – 5 725 MHz

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99 % emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than
500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

(4) For band 5 725 MHz – 5 850 MHz

The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

Maximum Power Spectral Density is measured using Measurement Procedure **of KDB789033 D02v02r01**

1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA - 1, SA - 2, SA - 3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power…". (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)

2) Use the peak search function on the instrument to find the peak of the spectrum and record its value.

3) Make the following adjustments to the peak value of the spectrum, if applicable:
   a) If Method SA - 2 or SA - 2 Alternative was used, add 10 log(1 / x), where x is the duty cycle, to the peak of the spectrum.
   b) If Method SA - 3 Alternative was used and the linear mode was used in step II.E.2.g (viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.

4) The result is the Maximum PSD over 1 MHz reference bandwidth.

5) For devices operating in the bands 5.15 GHz - 5.25 GHz, 5.25 GHz - 5.35 GHz, and 5.47 GHz - 5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in §15.407(a). For devices operating in the band 5.725 GHz - 5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
   a) Set RBW ≥ 1 / T, where T is defined in section II.B.1.a). (Refer to Appendix II)
   b) Set VBW ≥ 3 RBW.
   c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log(500 kHz / RBW) to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
   d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log(1 MHz / RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
   e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the sections 5.c) and 5.d) above, since RBW = 100 kHz is available on nearly all spectrum analyzers.

▣ Test Results: Comply

Test Mode	Band	Channel	Frequency (MHz)	Reading (dBm)		TF Note 1 (dB)	Power Spectral Density(dBm)	Antenna Gain(dBi)	e.i.r.p Spectral Density (dBm)
				ANT 1	ANT 2		ANT1+ANT2 (CDD)		
TM 1	U-NII 1	38	5 190	-3.34	-2.85	0.07	-0.01	3.92	3.91
		46	5 230	-0.70	-0.11	0.07	2.69	3.92	6.61
TM 2	U-NII 1	42	5 210	-9.05	-8.21	0.15	-5.45	3.92	-1.53

Test Mode	Band	Channel	Frequency (MHz)	Reading (dBm/100kHz)		TF Note 1 (dB)	Power Spectral Density (dBm/500kHz)	Antenna Gain(dBi)	e.i.r.p Spectral Density (dBm/500kHz)
				ANT 1	ANT 2		ANT1+ANT2 (CDD)		
TM 1	U-NII 3	151	5 755	-6.31	-7.96	7.06	3.01	4.79	7.80
		159	5 795	-6.38	-8.06	7.06	2.93	4.79	7.72
TM 2	U-NII 3	155	5 775	-12.28	-14.41	7.14	-3.07	4.79	1.72

Note 1: Power Spectral Density = Reading(Measurement Data) + TF
Note 2: e.i.r.p Spectral Density= Power spectral density + EUT Antenna Gain
Note 3: "U-NII 1 [TF] = DCCF"
"U-NII 3 [TF] = 10*LOG(500 kHz/100 kHz) + DCCF"
Where, TF = Total Factor, DCCF = Duty Cycle Correction Factor
For DCCF(Duty Cycle Correction Factor) please refer to appendix II.

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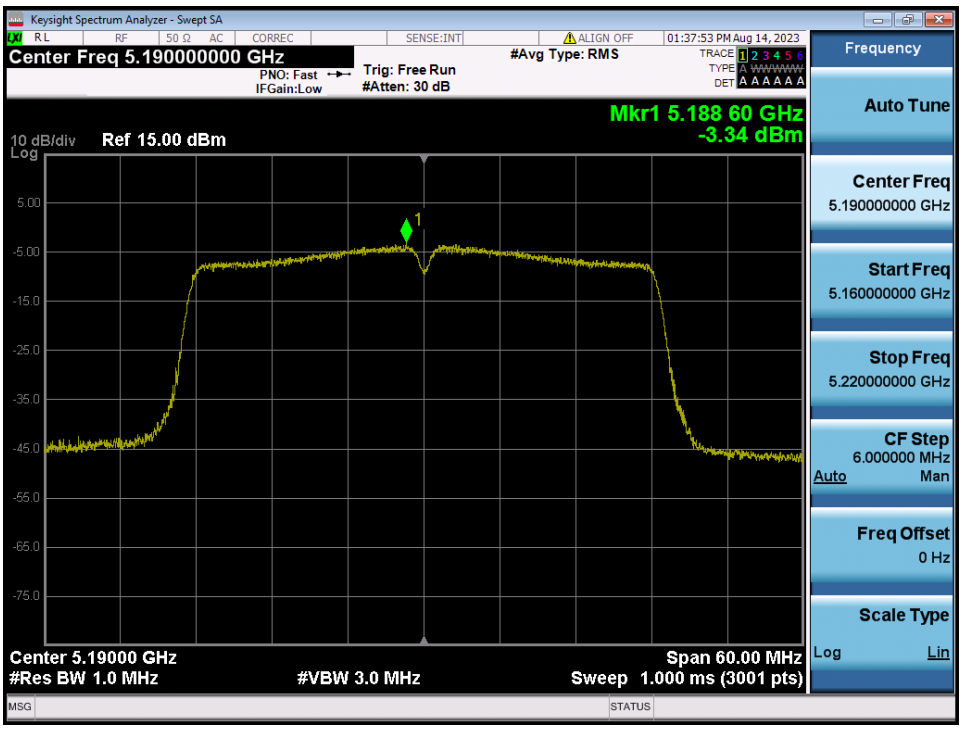
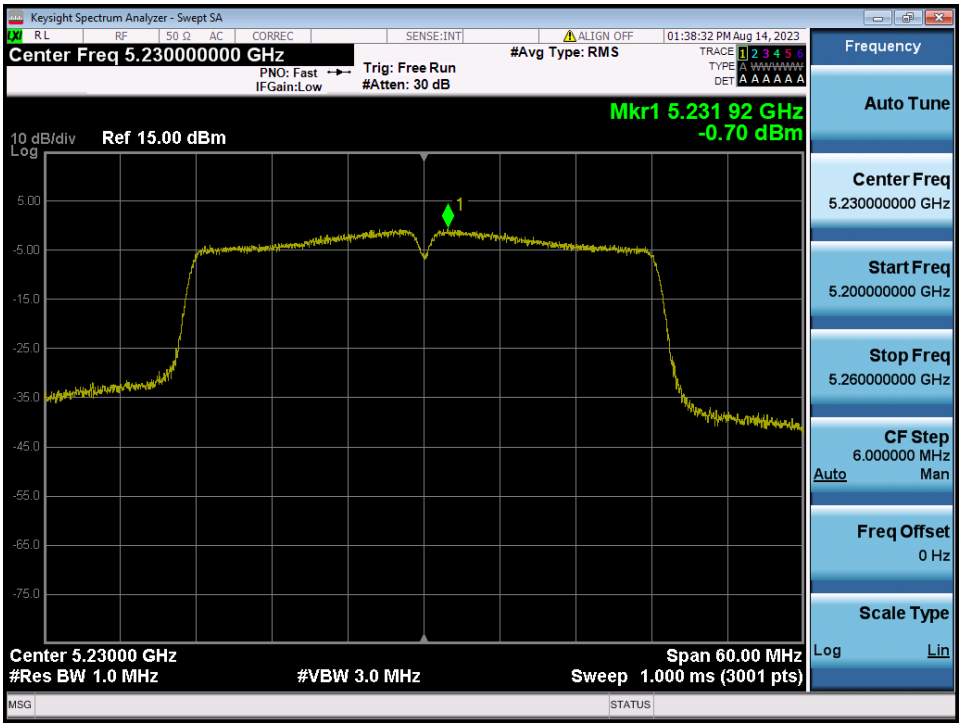
Maximum Power Spectral Density Test Mode: TM 1 & ANT 1 & Ch.38

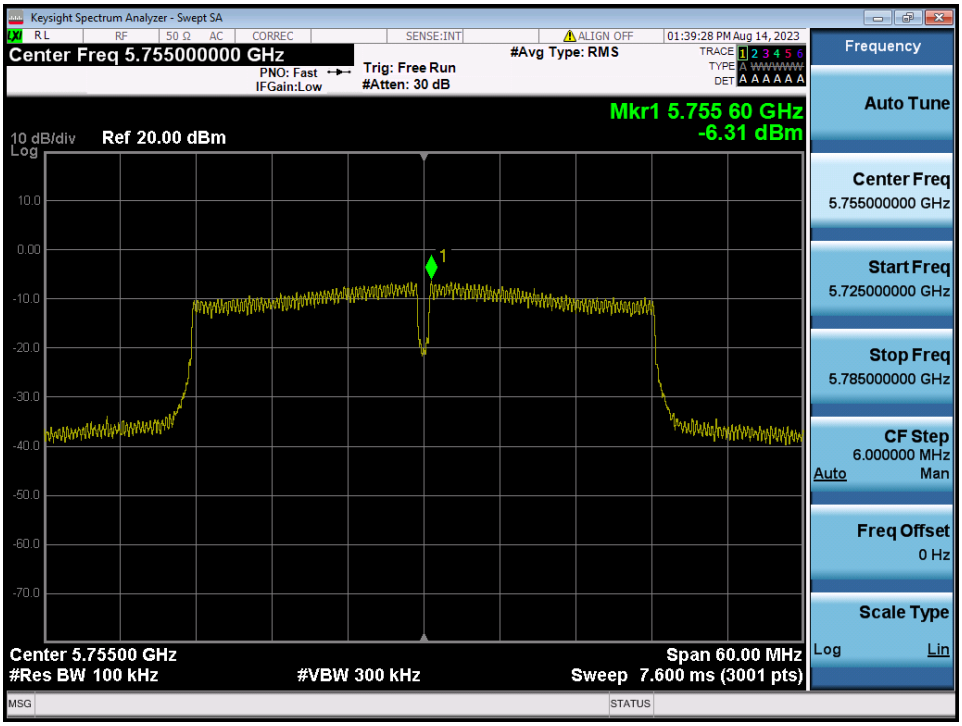


Maximum Power Spectral Density Test Mode: TM 1 & ANT 1 & Ch.46



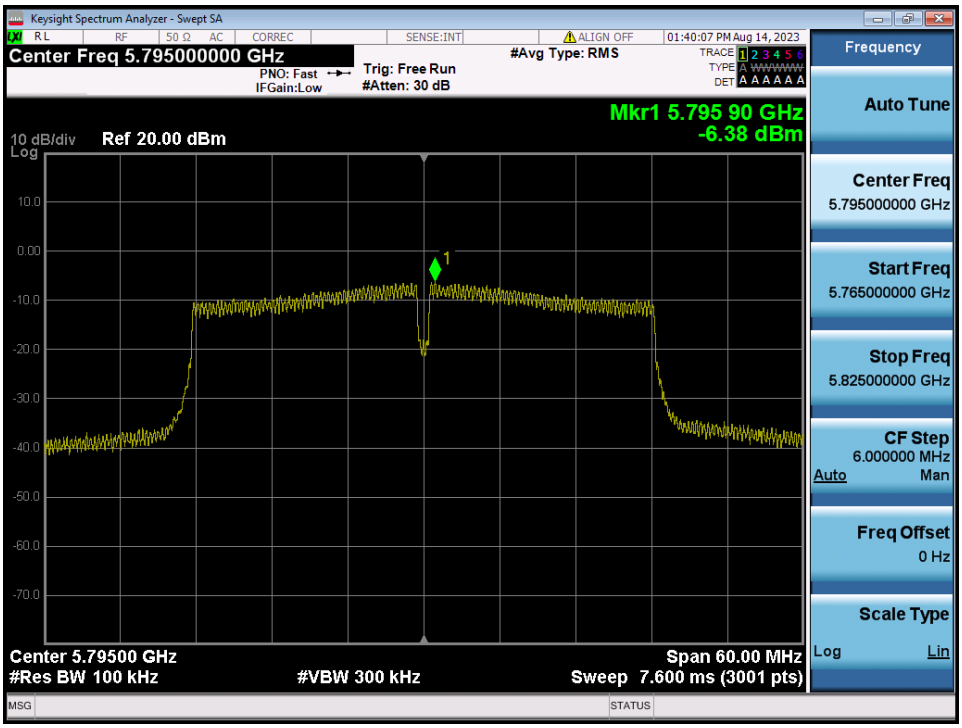
Maximum Power Spectral Density

Test Mode: TM 1 & ANT 1 & Ch.151

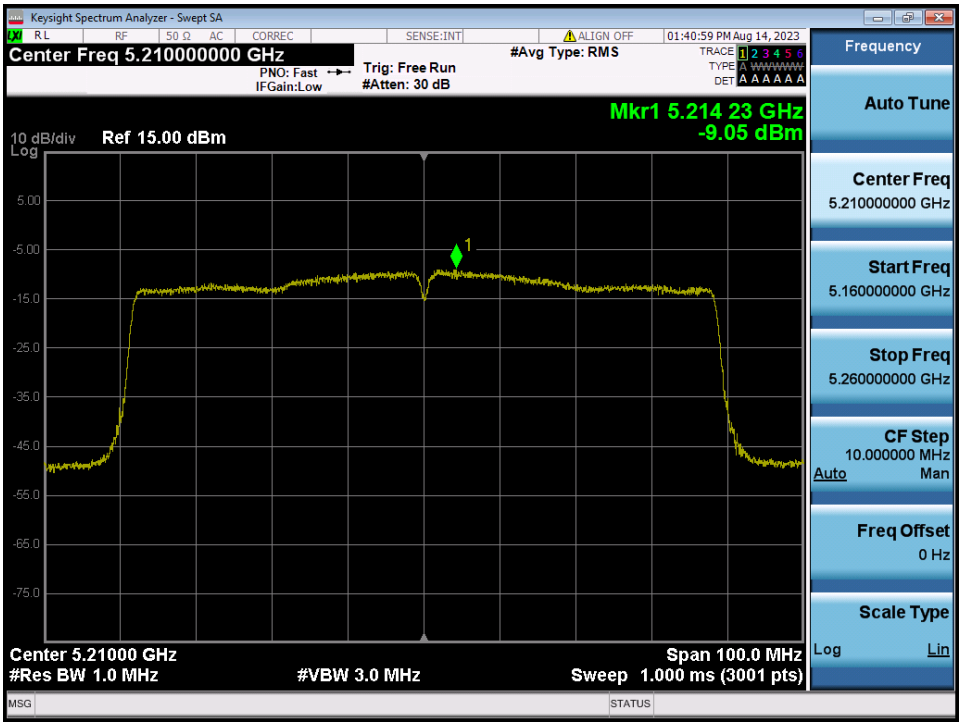


Maximum Power Spectral Density

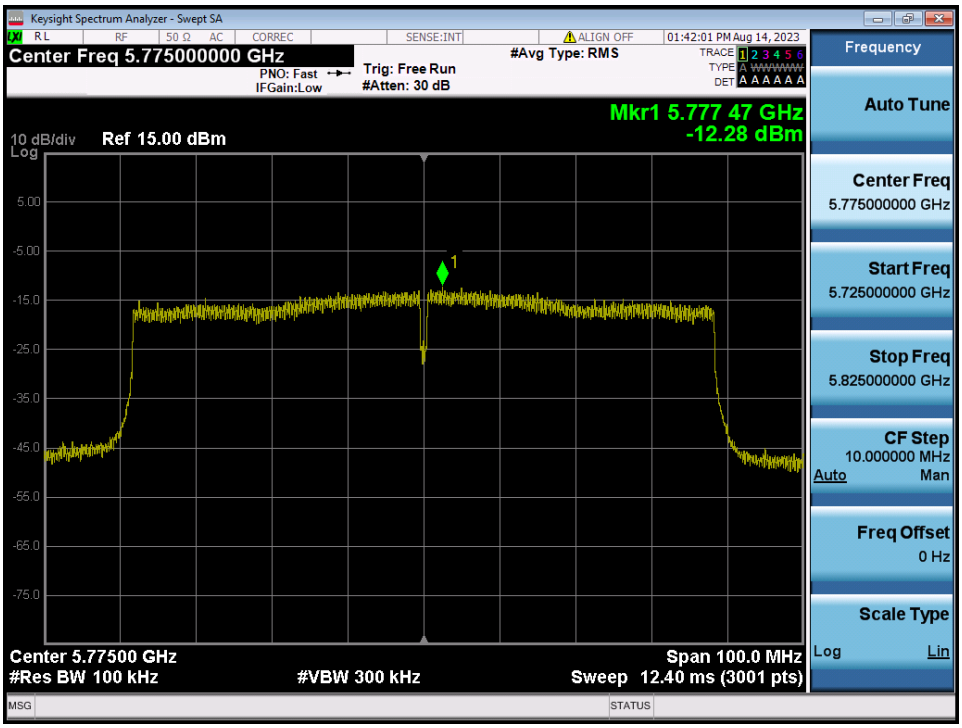
Test Mode: TM 1 & ANT 1 & Ch.159



Maximum Power Spectral Density Test Mode: TM 2 & ANT 1 & Ch.42

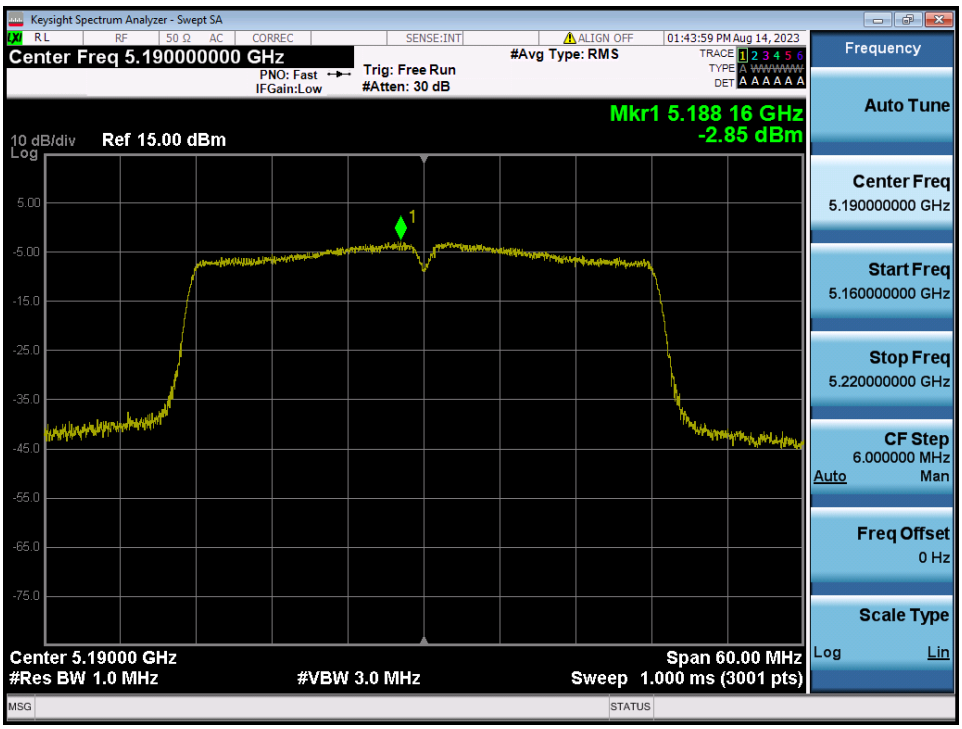


Maximum Power Spectral Density Test Mode: TM 2 & ANT 1 & Ch.155



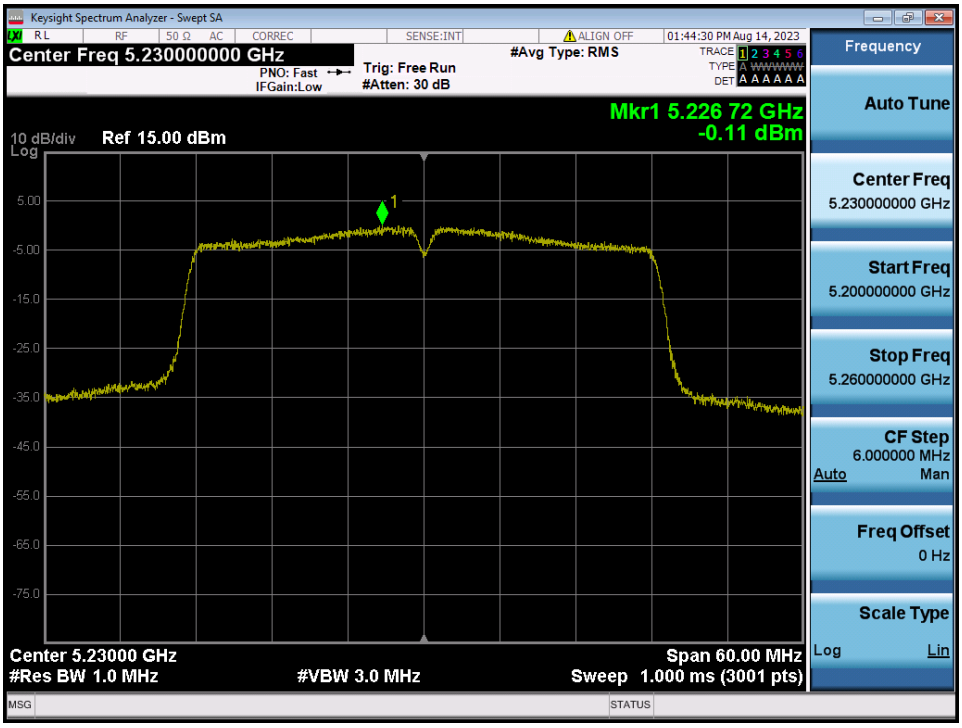
Maximum Power Spectral Density

Test Mode: TM 1 & ANT 2 & Ch.38



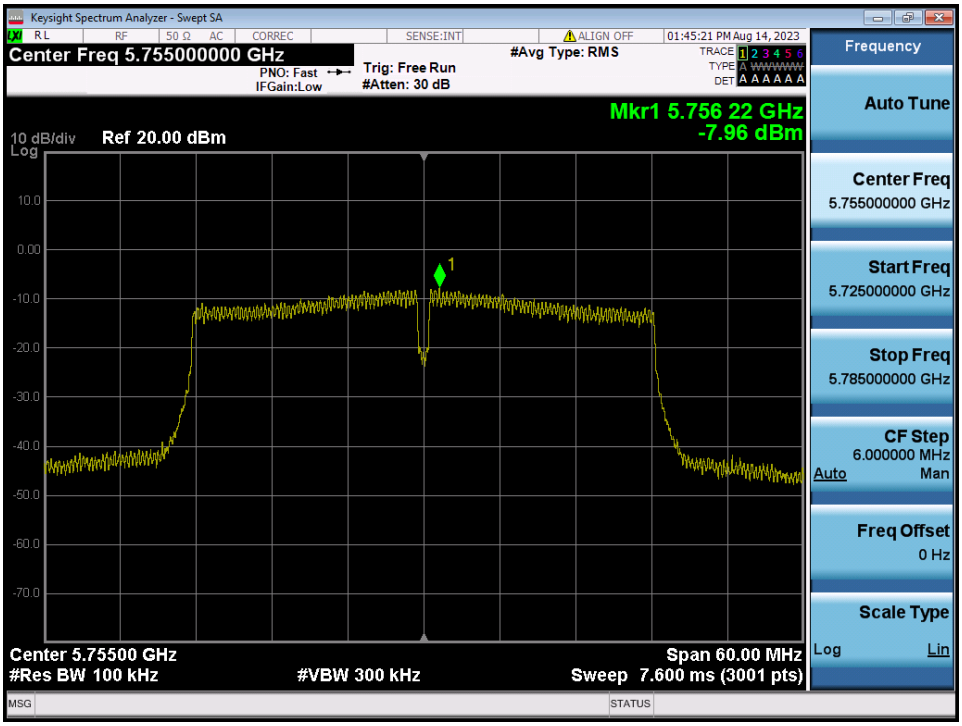
Maximum Power Spectral Density

Test Mode: TM 1 & ANT 2 & Ch.46



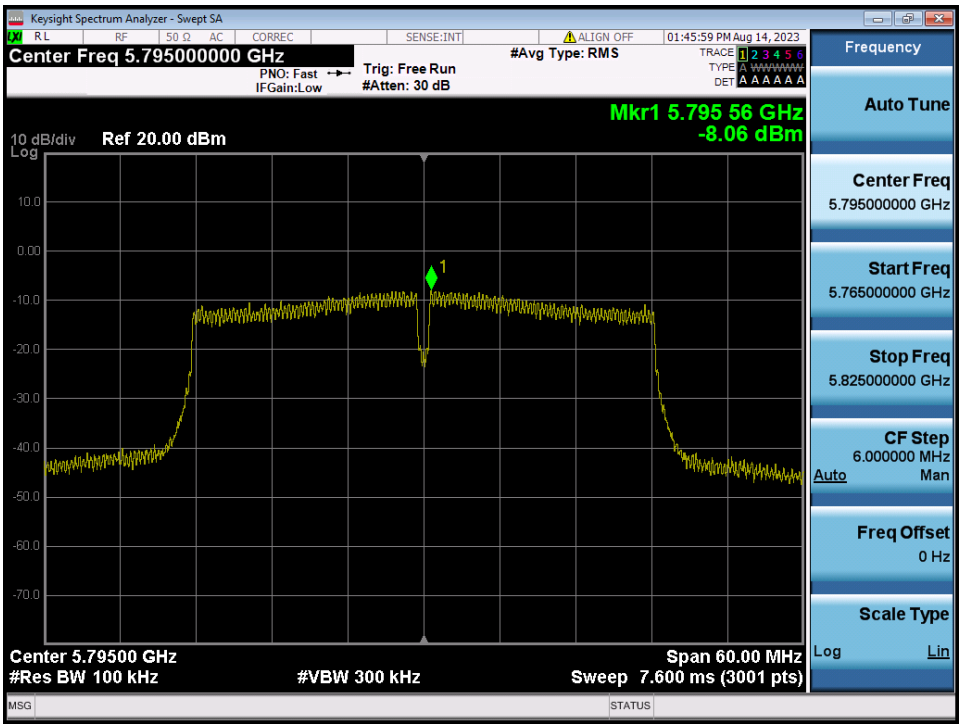
Maximum Power Spectral Density

Test Mode: TM 1 & ANT 2 & Ch.151

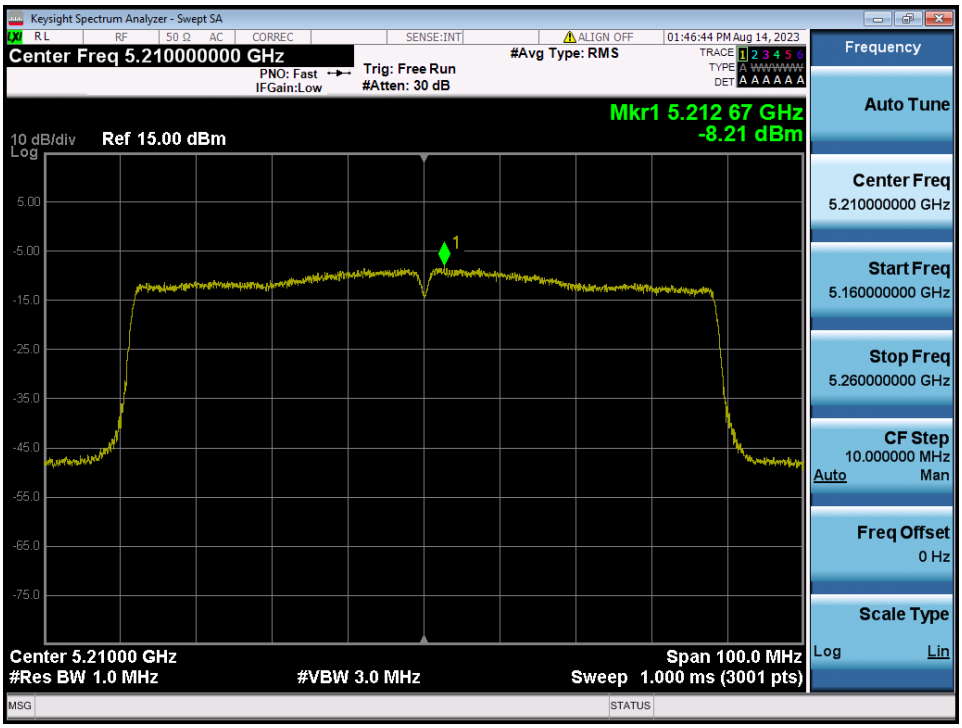


Maximum Power Spectral Density

Test Mode: TM 1 & ANT 2 & Ch.159



Maximum Power Spectral Density Test Mode: TM 2 & ANT 2 & Ch.42



Maximum Power Spectral Density Test Mode: TM 2 & ANT 2 & Ch.155

5.5 Unwanted Emissions

▣ Test Requirements

- Part 15.407(b) & RSS-Gen[6.2]

Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the **5.15 GHz - 5.25 GHz band**: all emissions outside of the **5.15 GHz - 5.35 GHz band** shall not exceed an **EIRP of -27 dBm/MHz**.

(2) For transmitters operating in the **5.25 GHz - 5.35 GHz band**: all emissions outside of the **5.15 GHz - 5.35 GHz band** shall not exceed an **EIRP of -27 dBm/MHz**.

(3) For transmitters operating in the **5.47 GHz - 5.725 GHz band**: all emissions outside of the **5.47 GHz - 5.725 GHz band** shall not exceed an **EIRP of -27 dBm/MHz.**

(4) For transmitters operating in the **5.725 GHz - 5.85 GHz band**: (i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(5) Unwanted emissions **below 1 GHz** must comply with the general field strength limits set forth in **Section 15.209**.
Further, any U-NII devices using an **AC power line** are required to comply also with the conducted limits set forth in **Section 15.207**.

- Part 15.209 & RSS-247[8.9]: General requirements

Frequency (MHz)	FCC Limit (uV/m)	IC Limit (μA/m)	Measurement Distance (m)
0.009 – 0.490	2 400 / F (kHz)	6.37/F (F in kHz)	300
0.490 – 1.705	24 000 / F (kHz)	63.7/F (F in kHz)	30
1.705 – 30.0	30	0.08	30

Frequency (MHz)	FCC Limit (uV/m)	IC Limit (uV/m)	Measurement Distance (m)
30 ~ 88	100 **	100	3
88 ~ 216	150 **	150	3
216 ~ 960	200 **	200	3
Above 960	500	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

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- Part 15.205(a): Restricted band of operation

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.414 25 ~ 8.414 75	108 ~ 121.94	1 300 ~ 1 427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1 435 ~ 1 626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.173 5 ~ 2.190 5	12.519 75 ~ 12.520 25	149.9 ~ 150.05	1 645.5 ~ 1 646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.576 75 ~ 12.577 25	156.524 75 ~ 156.525 25	1 660 ~ 1 710	8.025 ~ 8.5	22.01 ~ 23.12
4.177 25 ~ 4.177 75	13.36 ~ 13.41	156.7 ~ 156.9	1 718.8 ~ 1 722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.207 25 ~ 4.207 75	16.42 ~ 16.423	162.012 5 ~ 167.17	2 200 ~ 2 300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.694 75 ~ 16.695 25	167.72 ~ 173.2	2 310 ~ 2 390	10.6 ~ 12.7	36.43 ~ 36.5
6.267 75 ~ 6.268 25	16.804 25 ~ 16.804 75	240 ~ 285	2 483.5 ~ 2 500	13.25 ~ 13.4	Above 38.6
6.311 75 ~ 6.312 25	25.5 ~ 25.67	322 ~ 335.4	2 655 ~ 2 900		
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3 260 ~ 3 267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3 332 ~ 3 339		
8.376 25 ~ 8.386 75	74.8 ~ 75.2	960 ~ 1 240	3 345.8 ~ 3 358		
			3 600 ~ 4 400		

- RSS-Gen[8.10]: Restricted frequency bands

MHz	MHz	MHz	MHz	MHz	GHz
0.090 ~ 0.110	8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3 345.8 ~ 3 358	9.0 ~ 9.2
0.495 ~ 0.505	8.376 25 ~ 8.386 75	74.8 ~ 75.2	960 ~ 1 427	3 500 ~ 4 400	9.3 ~ 9.5
2.173 5 ~ 2.190 5	8.414 25 ~ 8.414 75	108 ~ 138	1 435 ~ 1 626.5	4 500 ~ 5 150	10.6 ~ 12.7
3.020 ~ 3.026	12.29 ~ 12.293	149.9 ~ 150.05	1 645.5 ~ 1 646.5	5 350 ~ 5 460	13.25 ~ 13.4
4.125 ~ 4.128	12.519 75 ~ 12.520 25	156.524 75 ~	1 660 ~ 1 710	7 250 ~ 7 750	14.47 ~ 14.5
4.177 25 ~ 4.177 75	12.576 75 ~ 12.577 25	156.525 25	1 718.8 ~ 1 722.2	8 025 ~ 8 500	15.35 ~ 16.2
4.207 25 ~ 4.207 75	13.36 ~ 13.41	156.7 ~ 156.9	2 200 ~ 2 300		17.7 ~ 21.4
5.677 ~ 5.683	16.42 ~ 16.423	162.01 25 ~ 167.17	2 310 ~ 2 390		22.01 ~ 23.12
6.215 ~ 6.218	16.694 75 ~ 16.695 25	167.72 ~ 173.2	2 483.5 ~ 2 500		23.6 ~ 24.0
6.267 75 ~ 6.268 25	16.804 25 ~ 16.804 75	240 ~ 285	2 655 ~ 2 900		31.2 ~ 31.8
6.311 75 ~ 6.312 25	25.5 ~ 25.67	322 ~ 335.4	3 260 ~ 3 267		36.43 ~ 36.5
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3 332 ~ 3 339		Above 38.6

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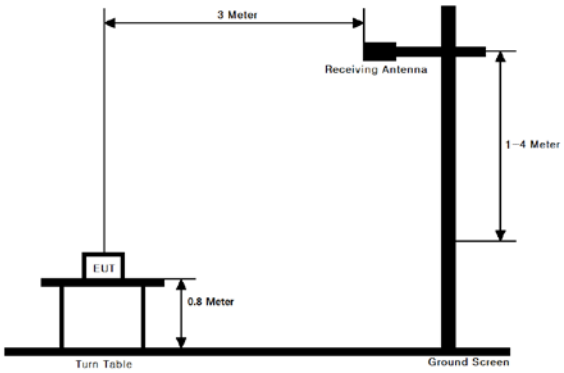
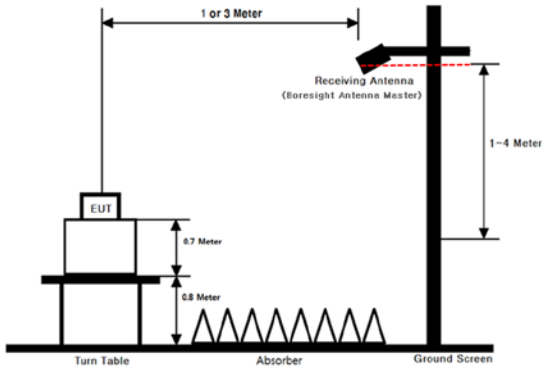
▣ Test Configuration

Below 1 GHz	Above 1 GHz
	

▣ Test Procedure

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
2. The turn table shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 1 m or 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

Radiated spurious emission measured using following Measurement Procedure **of KDB789033 D02v02r01**

► General Requirements for Unwanted Emissions Measurements

The following requirements apply to all unwanted emissions measurements, both in and outside of the restricted bands:

- EUT Duty Cycle

(1) The EUT shall be configured or modified to **transmit continuously** except as stated in (ii), below. The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (**to no lower than 98 percent**) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

(2) If **continuous transmission (or at least 98 percent duty cycle) cannot be achieved** due to hardware limitations of the EUT (e.g., overheating), the following additions to the measurement and reporting procedures are required:

- The EUT shall be configured to operate at the maximum achievable duty cycle.
- Measure the duty cycle, x, of the transmitter output signal.
- Adjustments to measurement procedures (e.g., increasing test time and number of traces averaged) shall be performed as described in the procedures below.
- The test report shall include the following additional information:
  - The reason for the duty cycle limitation.
  - The duty cycle achieved for testing and the associated transmit duration and interval between transmissions.
  - The sweep time and the amount of time used for trace stabilization during max-hold measurements for peak emission measurements.

(3) Reduction of the measured emission amplitude levels to account for operational duty factor is not permitted. Compliance is based on emission levels occurring during transmission - not on an average across on and off times of the transmitter.

► **Measurements below 1 000 MHz**

a) Follow the requirements in section II.G.3, "General Requirements for Unwanted Emissions Measurements".

b) Compliance shall be demonstrated using **CISPR quasi-peak detection**; however, **peak detection** is permitted as an alternative to quasi-peak detection.

► **Measurements Above 1 000 MHz (Peak)**

a) Follow the requirements in section II.G.3, "General Requirements for Unwanted Emissions Measurements".

b) Peak emission levels are measured by setting the analyzer as follows:

(i) **RBW = 1 MHz.**
(ii) **VBW ≥ 3 MHz.**
(iii) **Detector = Peak.**
(iv) Sweep time = Auto.
(v) Trace mode = Max hold.
(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

► **Measurements Above 1000 MHz (Method AD)**

(i) **RBW = 1 MHz.**
(ii) **VBW ≥ 3 MHz.**
(iii) **Detector = RMS**, if span / (# of points in sweep) ≤ RBW / 2. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.
(iv) Averaging type = power (i.e., RMS)
- As an alternative, the detector and averaging type may be set for linear voltage averaging. Some analyzers require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

(v) Sweep time = Auto.
(vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 percent duty cycle, at least 200 traces shall be averaged.
(vii) If tests are performed with the EUT transmitting at a duty cycle less than 98 percent, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
- **If power averaging (RMS) mode was used in step (iv) above, the correction factor is 10 log(1/x), where x is the duty cycle.** For example, if the transmit duty cycle was 50 percent, then 3 dB must be added to the measured emission levels.
- If linear voltage averaging mode was used in step (iv) above, the correction factor is 20 log (1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 dB must be added to the measured emission levels.
- If a specific emission is demonstrated to be continuous (100 percent duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

Duty Cycle Correction factor

Test Mode	Date rate	T_{on}(ms)	T_{on+off} (ms)	x = T_{on} / (T_{on+off})	DCCF = 10 log(1/x) (dB)
TM 1	MCS 0	1.276	1.297	0.983 8	0.07
TM 2	MCS 0	0.612	0.633	0.966 8	0.15

Note1: Where, T = Transmission duration / x = Duty cycle
Note2: Please refer to the appendix II for duty cycle plots.

▣ Test Results

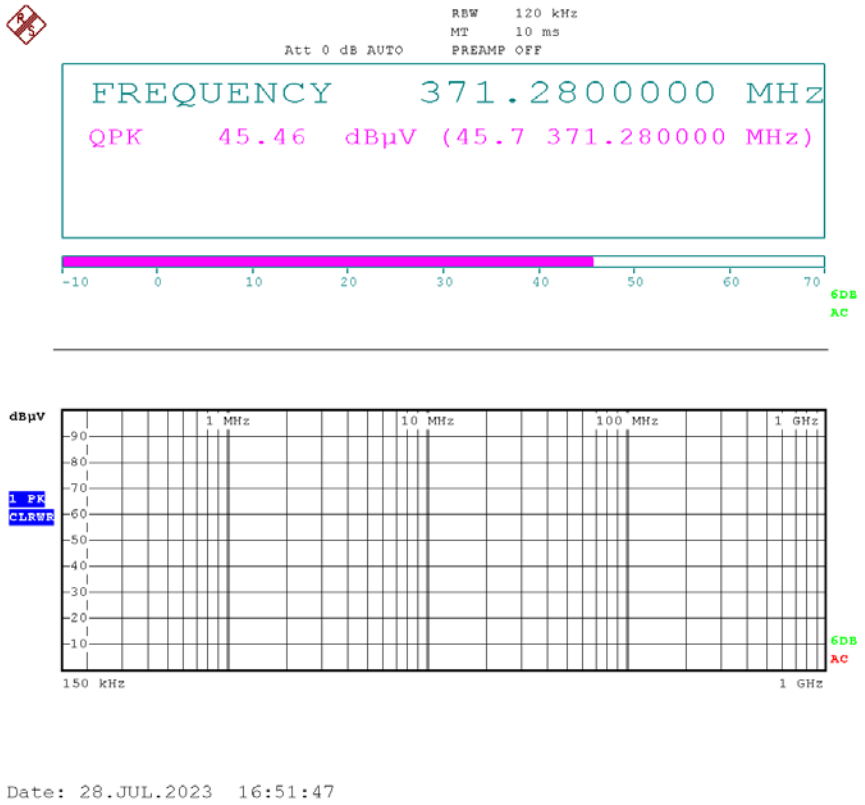
Test Notes

1. The radiated emissions below 1 GHz were investigated 9 kHz to 1 GHz and the worst case data was reported.
2. Information of Distance Correction Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance correction factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is "N/A", the measurements were performed at the specified distance and distance factor is not applied.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + TF+ DCCF + DCF / TF = AF + CL + HL + AL – AG
   Where, TF = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain, HL = High pass filter Loss, AL = Attenuator Loss, DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
4. All mode of operation were investigated and the worst case configuration results are reported.
   (Mode: EUT only, EUT + adapter / Worst case: EUT + adapter)

Radiated Emissions data(9 kHz ~ 1 GHz) : TM 1

Tested Frequency (MHz)	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin(dB)
5 190	371.260	V	Z	QPK	41.80	-2.86	N/A	N/A	38.94	46.02	7.08
	371.280	H	Z	QPK	45.70	-2.86	N/A	N/A	42.84	46.02	3.18
	755.183	H	Z	QPK	33.30	4.88	N/A	N/A	38.18	46.02	7.84

TM 1 & U-NII & 5190 & Z axis & Hor Detector Mode : QPK



Test Notes

1. The radiated emissions above 1GHz were investigated up to 40 GHz. And no other spurious and harmonic emissions were found below listed frequencies.
2. Information of Distance Correction Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance correction factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is "N/A", the measurements were performed at the specified distance and distance factor is not applied.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + TF+ DCCF + DCF / TF = AF + CL + HL + AL – AG
   Where, TF = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain, HL = High pass filter Loss, AL = Attenuator Loss, DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
4. The limit is converted to field strength.
   E(dBuV/m) = EIRP(dBm) + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m
5. All mode of operation were investigated and the worst case configuration results are reported.
   (Mode: EUT only, EUT + adapter / Worst case: EUT + adapter)

Unwanted Emissions data(1 GHz ~ 40 GHz) : *802.11ac(VHT40) & CDD*

Band	Tested Frequency (MHz)	Freq. (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
U-NII 1	5 190	5 149.13	V	Y	PK	65.10	2.67	N/A	N/A	67.77	74.00	6.23
		5 149.52	V	Y	AV	48.43	2.67	N/A	N/A	51.10	54.00	2.90
		10 379.86	H	Z	PK	46.12	8.46	N/A	N/A	54.58	68.20	13.62
	5 230	10 460.03	H	Z	PK	49.38	8.51	N/A	N/A	57.89	68.20	10.31
U-NII 3	5 755	5 647.68	V	Y	PK	58.32	3.23	N/A	N/A	61.55	68.20	6.65
		5 720.28	V	Y	PK	79.36	3.23	N/A	N/A	82.59	111.43	28.84
		11 509.74	H	Z	PK	50.27	8.58	N/A	N/A	58.85	74.00	15.15
		11 509.86	H	Z	AV	41.65	8.58	N/A	N/A	50.23	54.00	3.77
	5 795	5 876.48	V	Y	PK	58.63	3.32	N/A	N/A	61.95	104.10	42.15
		5 942.20	V	Y	PK	52.68	3.88	N/A	N/A	56.56	68.20	11.64
		11 589.76	H	Z	PK	47.92	8.64	N/A	N/A	56.56	74.00	17.44
		11 589.92	H	Z	AV	40.45	8.64	N/A	N/A	49.09	54.00	4.91

Unwanted Emissions data(1 GHz ~ 40 GHz) : *802.11ac(VHT80) & CDD*

Band	Tested Frequency (MHz)	Freq. (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
U-NII 1	5 210	5 149.94	V	Y	PK	58.16	2.67	N/A	N/A	60.83	74.00	13.17
		5 149.96	V	Y	AV	45.49	2.67	0.15	N/A	48.31	54.00	5.69
		10 419.77	H	Z	PK	45.77	8.45	N/A	N/A	54.22	68.20	13.98
U-NII 3	5 775	5 648.73	V	Y	PK	60.89	3.23	N/A	N/A	64.12	68.20	4.08
		5 697.83	V	Y	PK	65.79	3.24	N/A	N/A	69.03	103.59	34.56
		5 878.64	V	Y	PK	60.72	3.34	N/A	N/A	64.06	102.51	38.45
		5 929.12	V	Y	PK	55.11	3.77	N/A	N/A	58.88	68.20	9.32
		11 549.83	H	Z	PK	47.16	8.57	N/A	N/A	55.73	74.00	18.27
		11 549.93	H	Z	AV	40.44	8.57	0.15	N/A	49.16	54.00	4.84

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5.6 AC Power-Line Conducted Emissions

▣ Test Requirements, §15.207 & RSS-Gen[8.8]

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 or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5.0	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

▣ Test Configuration

See test photographs for the actual connections between EUT and support equipment.

▣ Test Procedure

Conducted emissions from the EUT were measured according to the ANSI C63.10-2013.

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

▣ Test Results: Comply

See next pages for actual measurement plots and data for worst case result.

AC Power-Line Conducted Emissions (Graph)

Test Mode: U-NII 1 & TM 1 & 5 190 MHz

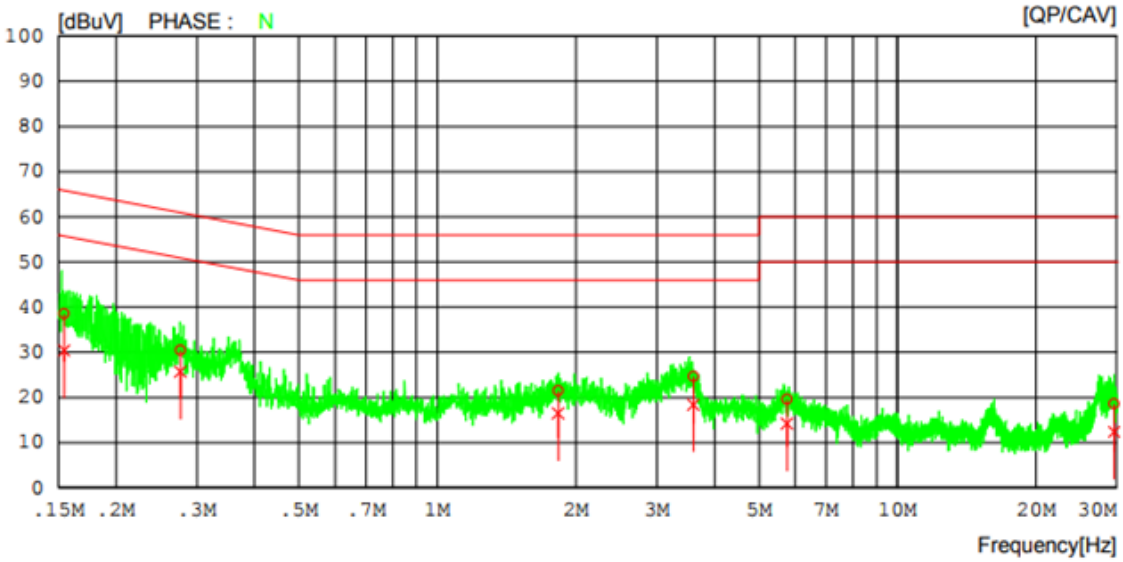
Results of Conducted Emission

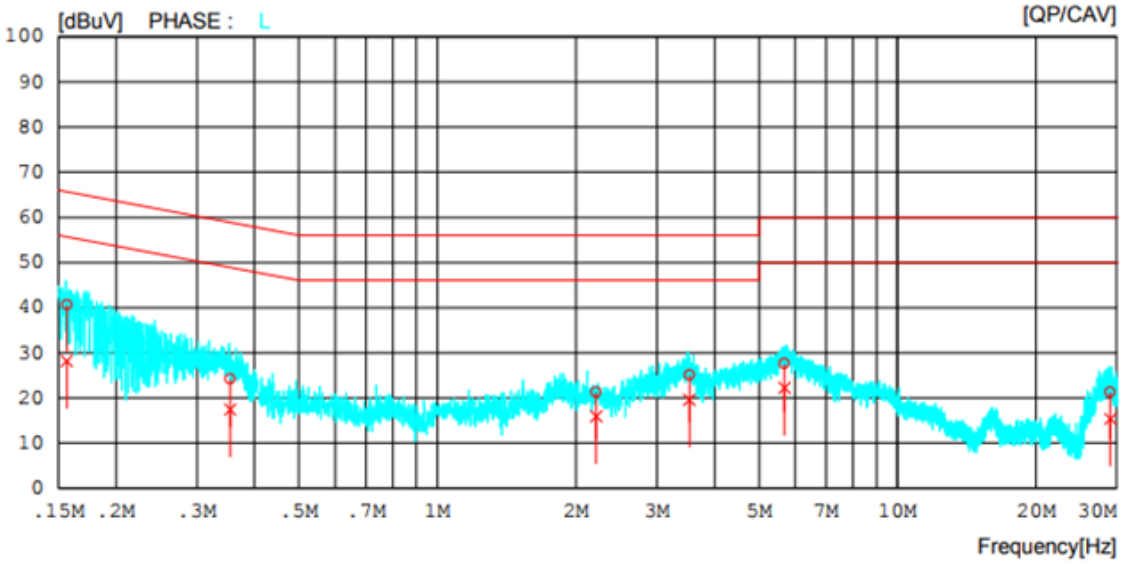
DTNC

Date 2023-07-28

Order No.		Referrence No.	
Model No.	DSI-100	Power Supply	
Serial No.		Temp/Humi.	21 'C / 41 %
Test Condition	WLAN 5.1G	Operator	J.H.Bang
Memo	ac40_5190		

LIMIT : FCC P15.207 AV
FCC P15.207 QP





AC Power-Line Conducted Emissions (Data List)

Test Mode: U-NII 1 & TM 1 & 5 190 MHz

Results of Conducted Emission

DTNC

Date 2023-07-28

Order No.		Referrence No.	
Model No.	DSI-100	Power Supply	
Serial No.		Temp/Humi.	21 'C / 41 %
Test Condition	WLAN 5.1G	Operator	J.H.Bang
Memo	ac40_5190		

LIMIT : FCC P15.207 AV
FCC P15.207 QP

NO	FREQ [MHz]	READING QP [dBuV]	READING CAV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT CAV [dBuV]	LIMIT QP [dBuV]	LIMIT CAV [dBuV]	MARGIN QP [dBuV]	MARGIN CAV [dBuV]	PHASE
1	0.15439	28.56	20.45	9.91	38.47	30.36	65.76	55.76	27.29	25.40	N
2	0.27628	20.59	15.80	9.89	30.48	25.69	60.93	50.93	30.45	25.24	N
3	1.83020	11.55	6.55	9.94	21.49	16.49	56.00	46.00	34.51	29.51	N
4	3.59920	14.69	8.44	9.97	24.66	18.41	56.00	46.00	31.34	27.59	N
5	5.75320	9.59	4.18	10.01	19.60	14.19	60.00	50.00	40.40	35.81	N
6	29.56860	8.15	2.00	10.38	18.53	12.38	60.00	50.00	41.47	37.62	N
7	0.15635	30.73	18.29	9.91	40.64	28.20	65.66	55.66	25.02	27.46	L
8	0.35445	14.25	7.52	9.89	24.14	17.41	58.86	48.86	34.72	31.45	L
9	2.21280	11.29	5.99	9.94	21.23	15.93	56.00	46.00	34.77	30.07	L
10	3.53120	15.10	9.65	9.97	25.07	19.62	56.00	46.00	30.93	26.38	L
11	5.67740	17.58	12.19	10.01	27.59	22.20	60.00	50.00	32.41	27.80	L
12	29.00960	10.97	4.97	10.37	21.34	15.34	60.00	50.00	38.66	34.66	L

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AC Power-Line Conducted Emissions (Graph)

Test Mode: U-NII 3 & TM 1 & 5 755 MHz

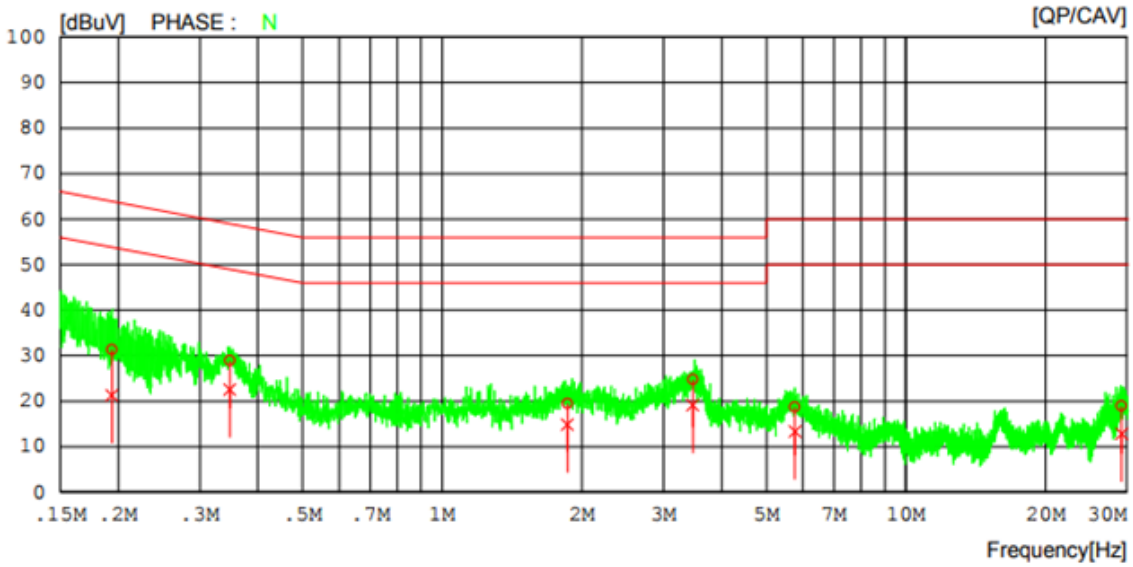
Results of Conducted Emission

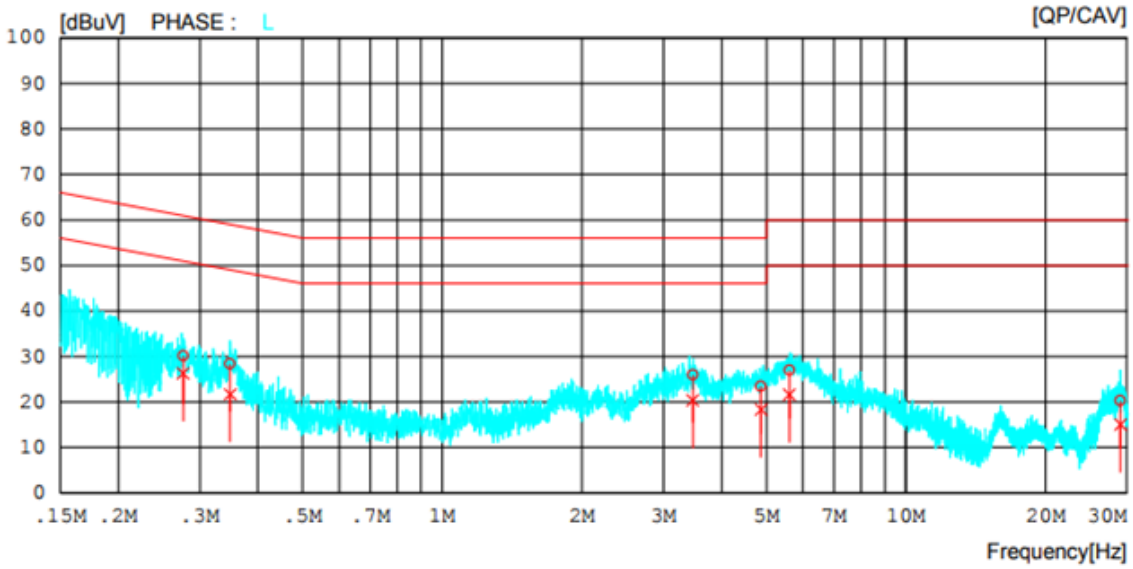
DTNC

Date 2023-07-28

Order No.		Referrence No.	
Model No.	DSI-100	Power Supply	
Serial No.		Temp/Humi.	21 'C / 41 %
Test Condition	WLAN 5.7G	Operator	J.H.Bang
Memo	ac40_5755		

LIMIT : FCC P15.207 AV
FCC P15.207 QP





AC Power-Line Conducted Emissions (Data List)

Test Mode: U-NII 3 & TM 1 & 5 755 MHz

Results of Conducted Emission

DTNC

Date 2023-07-28

Order No.		Referrence No.	
Model No.	DSI-100	Power Supply	
Serial No.		Temp/Humi.	21 'C / 41 %
Test Condition	WLAN 5.7G	Operator	J.H.Bang
Memo	ac40_5755		

LIMIT : FCC P15.207 AV
FCC P15.207 QP

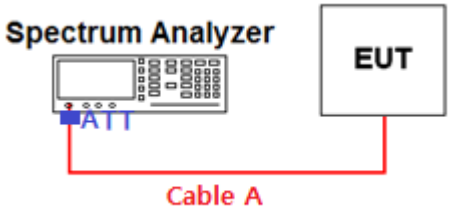
NO	FREQ	READING		C.FACTOR	RESULT		LIMIT		MARGIN		PHASE
		QP	CAV		QP	CAV	QP	CAV	QP	CAV	
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.19388	21.47	11.36	9.88	31.35	21.24	63.87	53.87	32.52	32.63	N
2	0.34817	19.06	12.61	9.89	28.95	22.50	59.01	49.01	30.06	26.51	N
3	1.86260	9.44	4.94	9.94	19.38	14.88	56.00	46.00	36.62	31.12	N
4	3.46960	14.77	9.16	9.96	24.73	19.12	56.00	46.00	31.27	26.88	N
5	5.75780	8.64	3.33	10.01	18.65	13.34	60.00	50.00	41.35	36.66	N
6	29.16900	8.58	2.47	10.37	18.95	12.84	60.00	50.00	41.05	37.16	N
7	0.27597	20.18	16.39	9.89	30.07	26.28	60.94	50.94	30.87	24.66	L
8	0.34859	18.53	11.76	9.89	28.42	21.65	59.00	49.00	30.58	27.35	L
9	3.46840	16.05	10.33	9.96	26.01	20.29	56.00	46.00	29.99	25.71	L
10	4.86460	13.43	8.31	10.00	23.43	18.31	56.00	46.00	32.57	27.69	L
11	5.60100	16.92	11.63	10.01	26.93	21.64	60.00	50.00	33.07	28.36	L
12	28.99880	9.92	4.65	10.37	20.29	15.02	60.00	50.00	39.71	34.98	L

This test report is prohibited to copy or reissue in whole or in part without the approval of Dt&C Co., Ltd.

APPENDIX I

Conducted Test set up Diagram

▪ Conducted Measurement



APPENDIX II

Duty Cycle Information

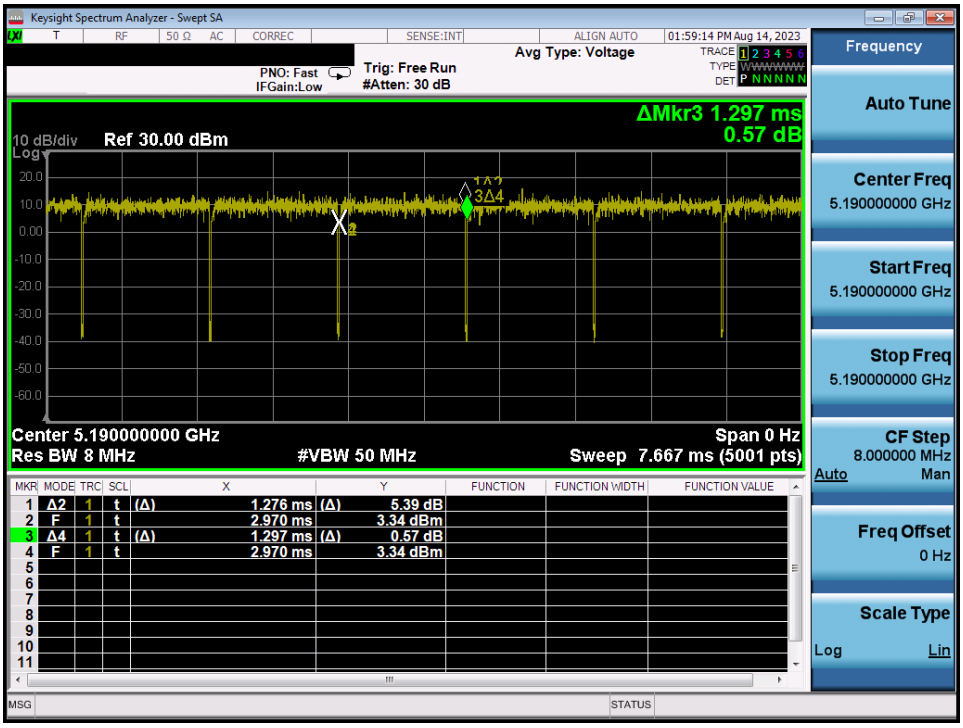
▣ Test Procedure

Duty Cycle [X = On Time / (On + Off time)] is measured using Measurement Procedure **of KDB789033 D02v02r01**

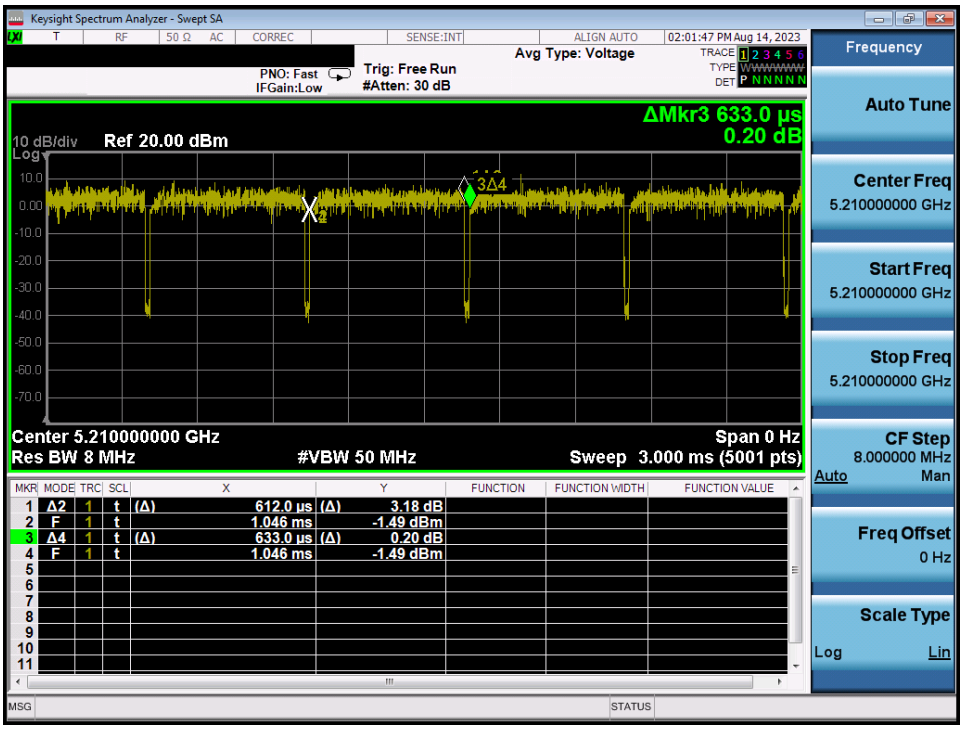
1. Set the center frequency of the spectrum analyzer to the center frequency of the transmission.
2. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value.
3. Set VBW ≥ RBW. Set detector = peak.
4. Note : The zero-span measurement method shall not be used unless both **RBW and VBW are > 50 / *T***, where *T* is defined in section II.B.1.a), 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.)

   T : The minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
   (***T* = On time** of the above table since the EUT operates with above fixed Duty Cycle and it is the minimum On time)

Duty Cycle Test Mode: TM 1 & Ch.38



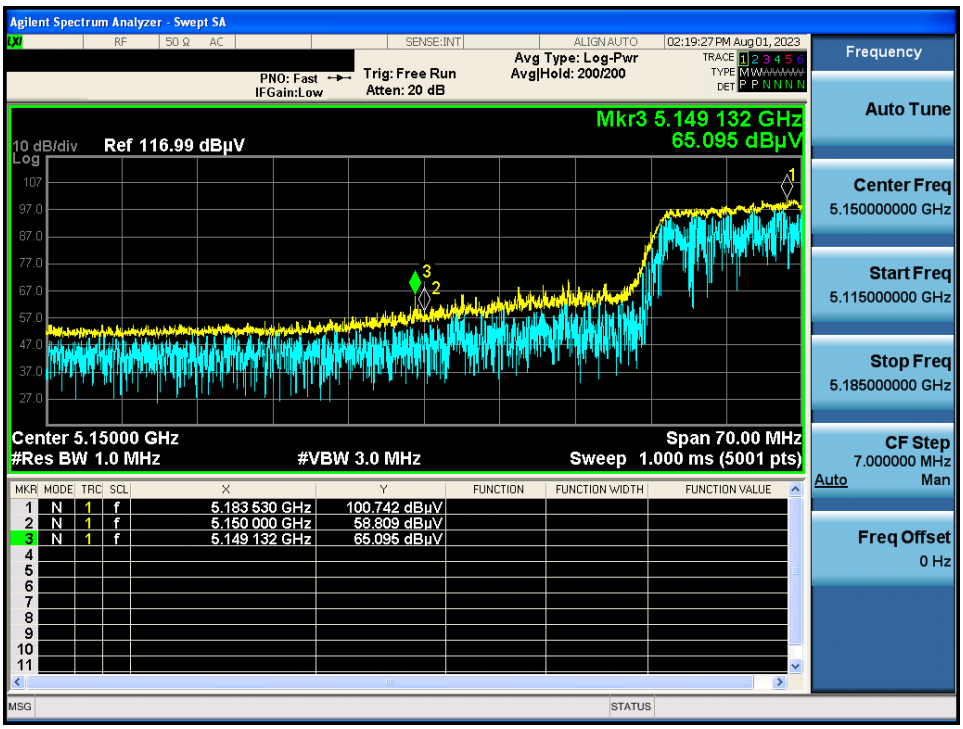
Duty Cycle Test Mode: TM 2 & Ch.42



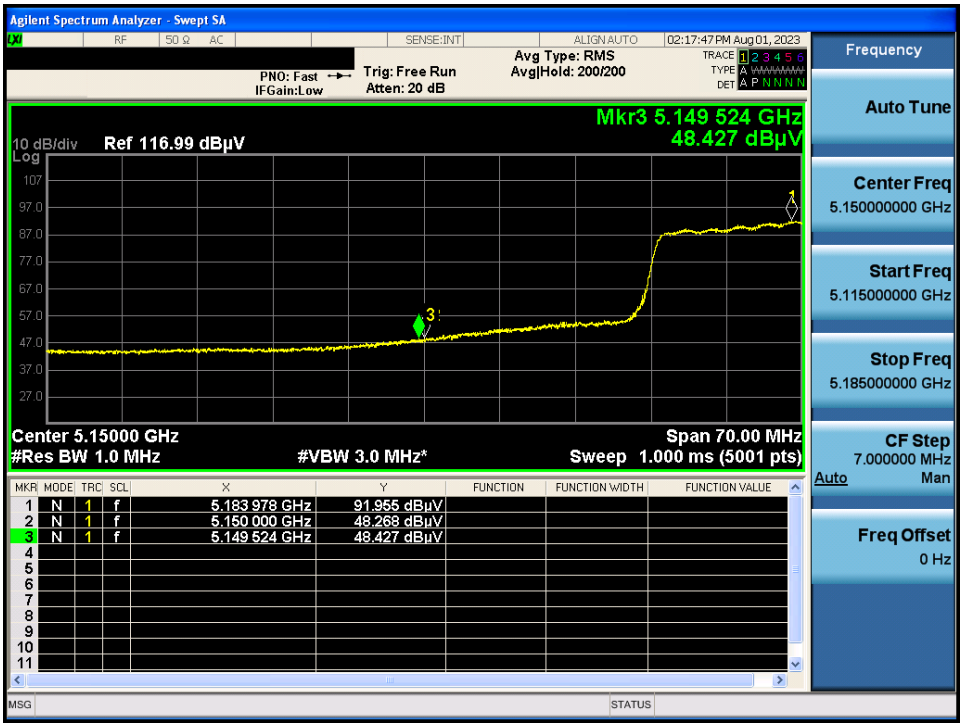
APPENDIX III

Unwanted Emissions (Radiated) Test Plot:

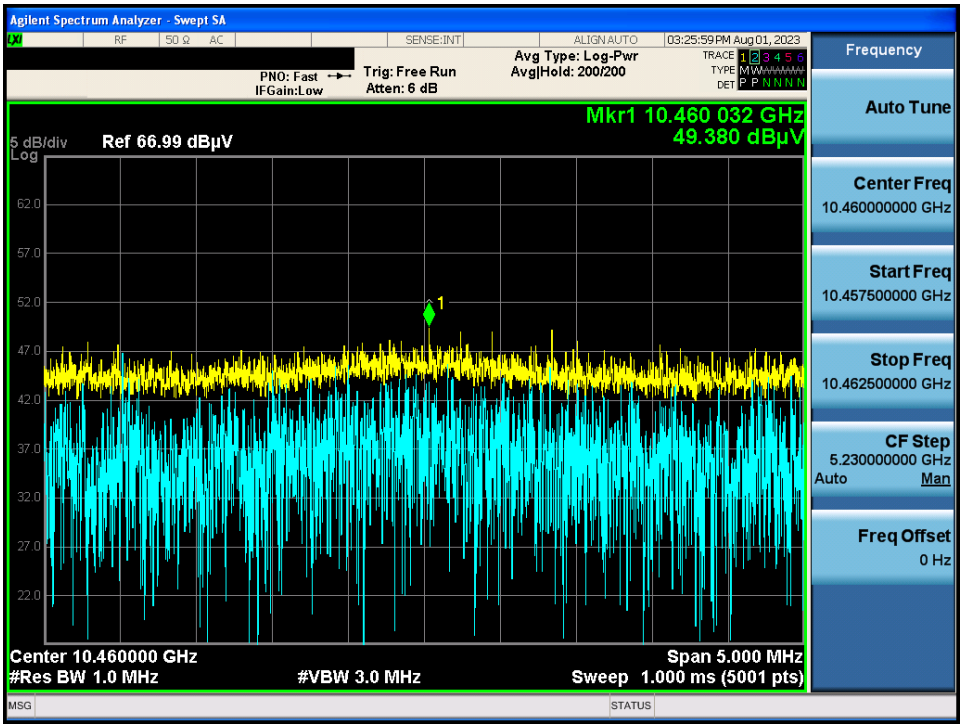
TM 1 & U-NII 1 & 5 190 & Y axis & Ver **Detector Mode : PK**



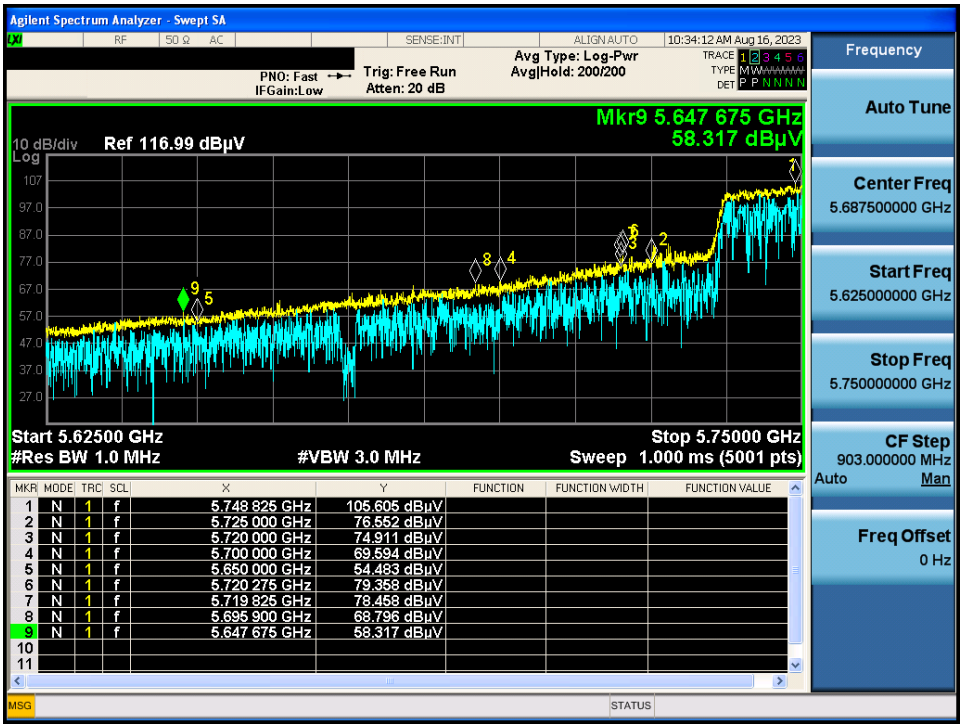
TM 1 & U-NII 1 & 5 190 & Y axis & Ver **Detector Mode : AV**



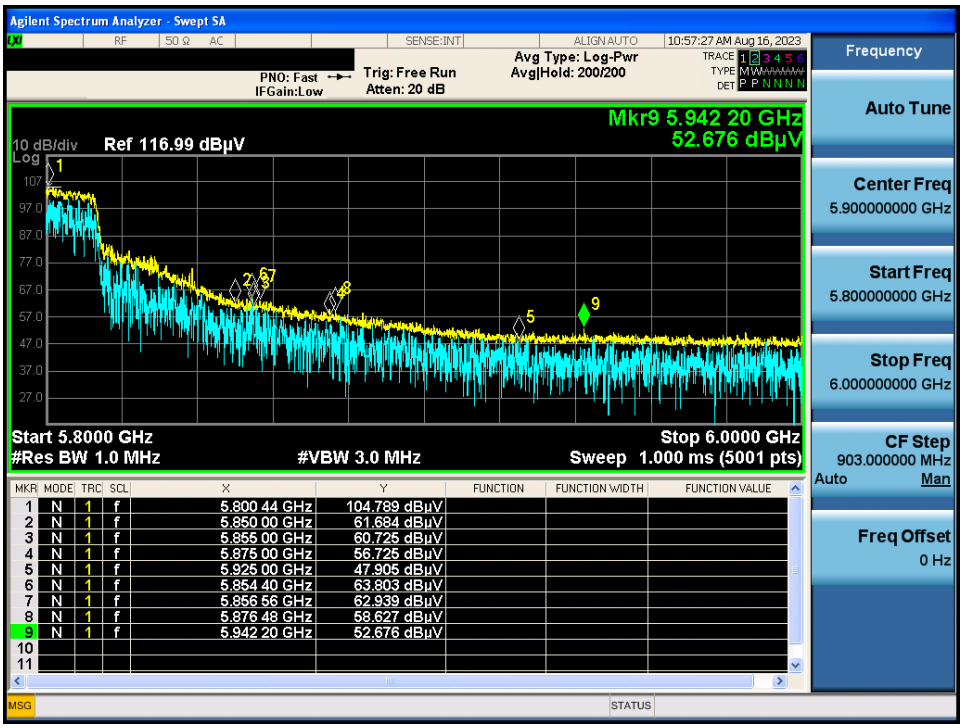
TM 1 & U-NII 1 & 5 230 & Z axis & Hor **Detector Mode : PK**



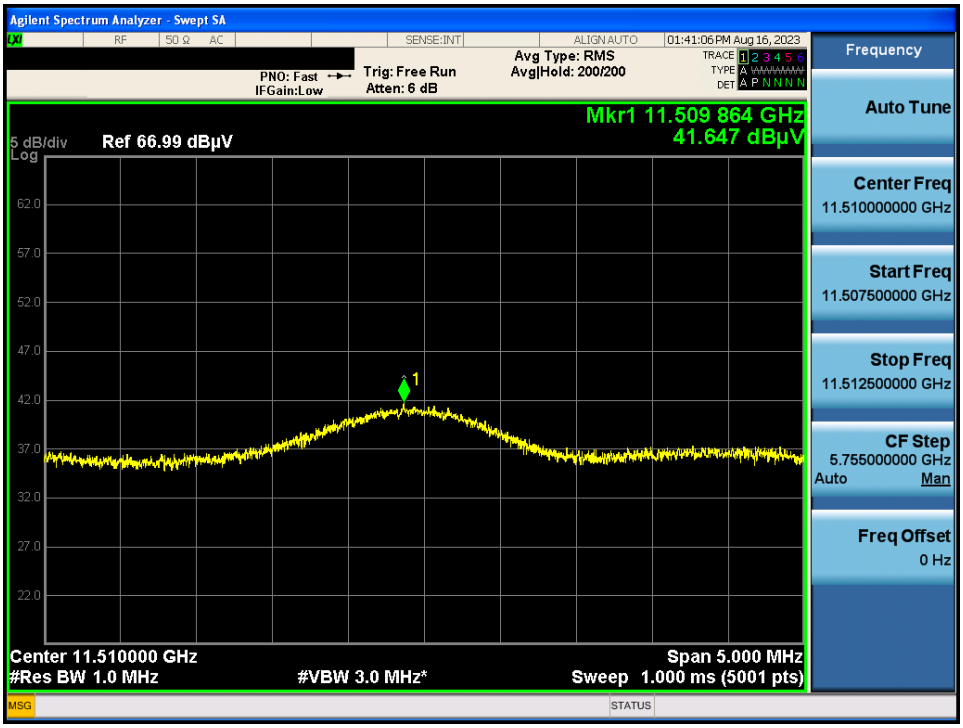
TM 1 & U-NII 3 & 5 755 & Y axis & Ver **Detector Mode : PK**



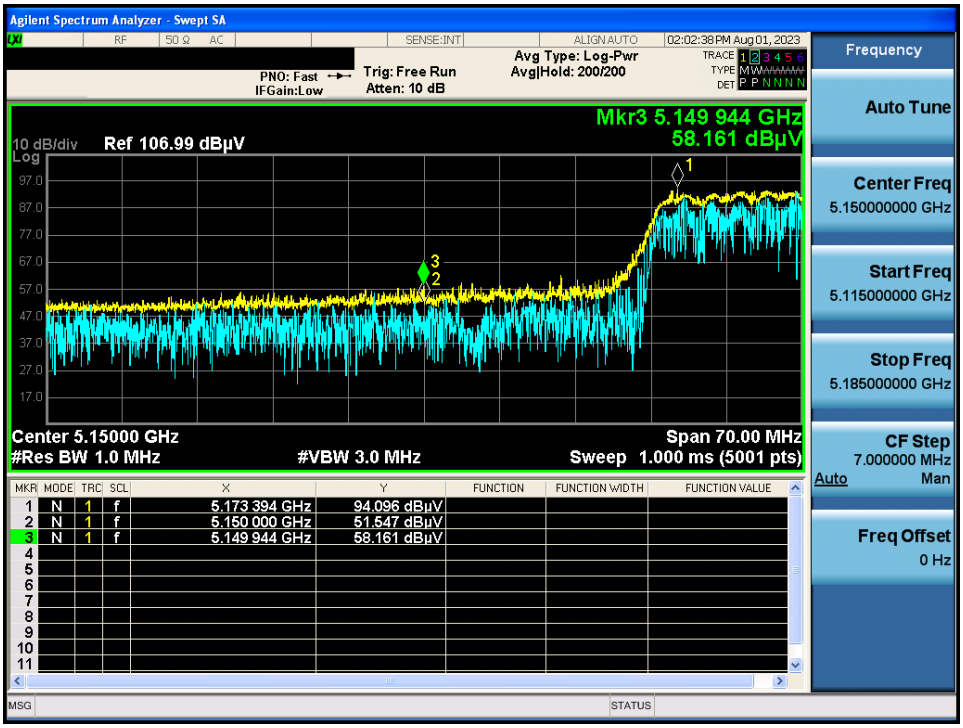
TM 1 & U-NII 3 & 5 795 & Y axis & Ver **Detector Mode : PK**



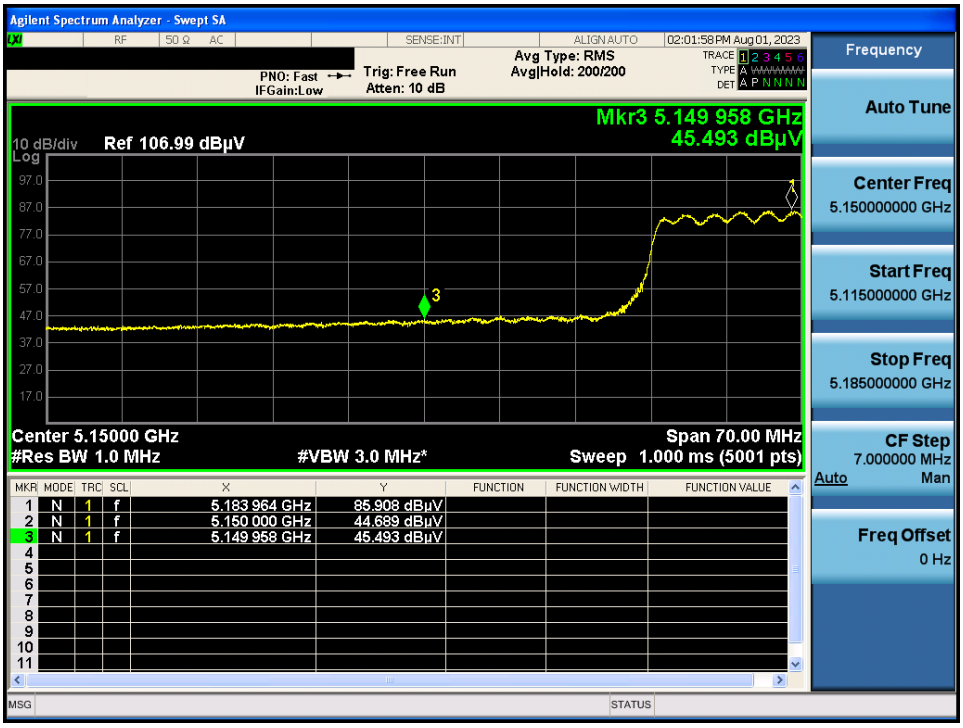
TM 1 & U-NII 3 & 5 755 & Z axis & Hor **Detector Mode : AV**



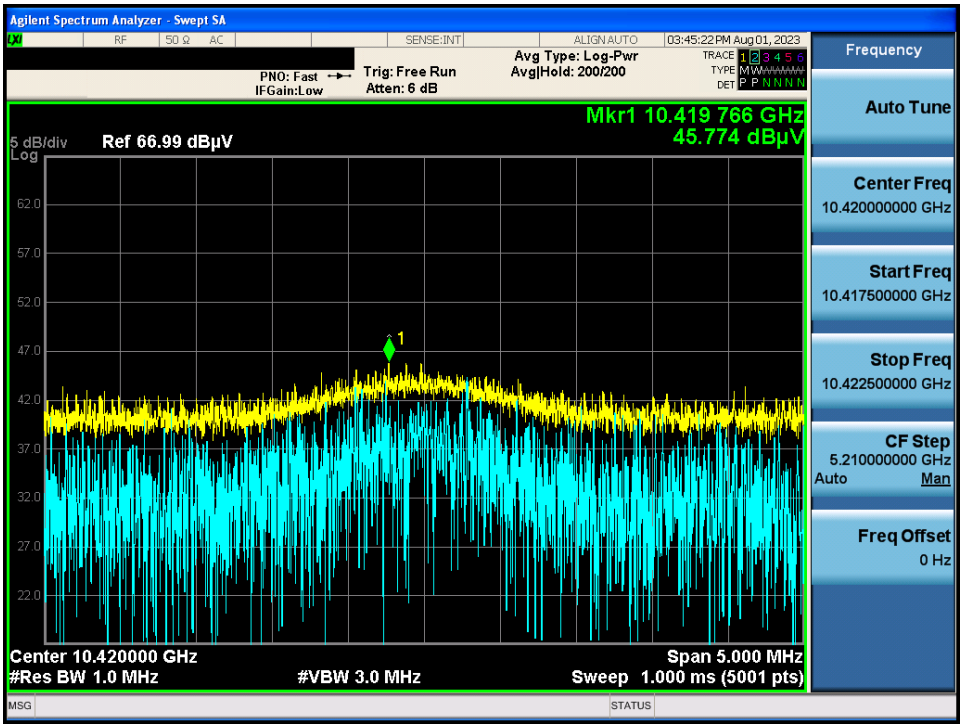
TM 2 & U-NII 1 & 5 210 & Y axis & Ver **Detector Mode : PK**



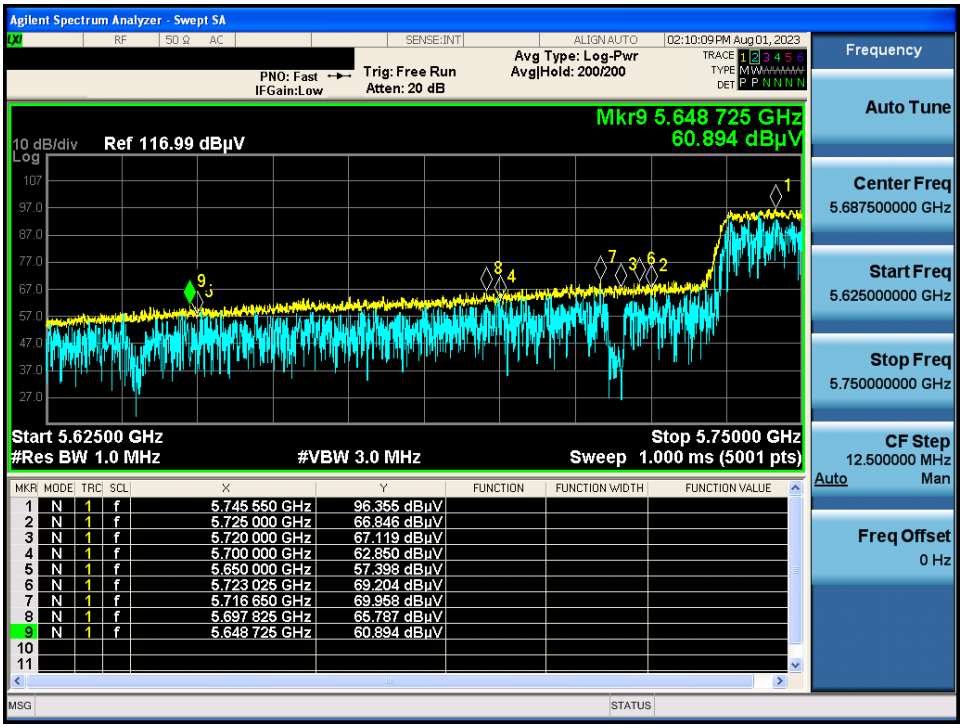
TM 2 & U-NII 1 & 5 210 & Y axis & Ver **Detector Mode : AV**



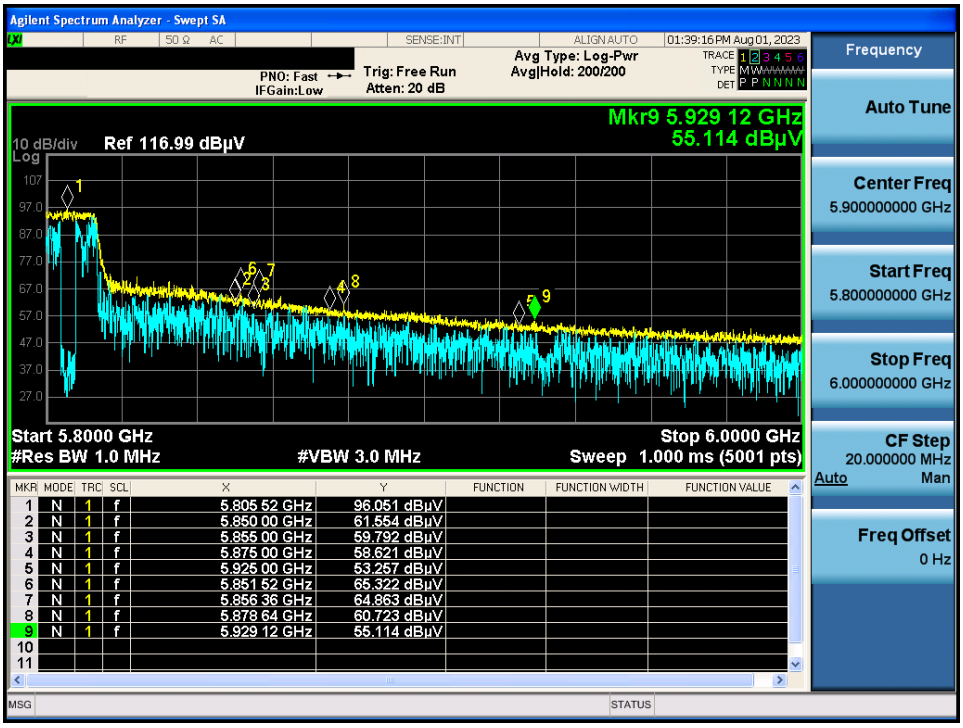
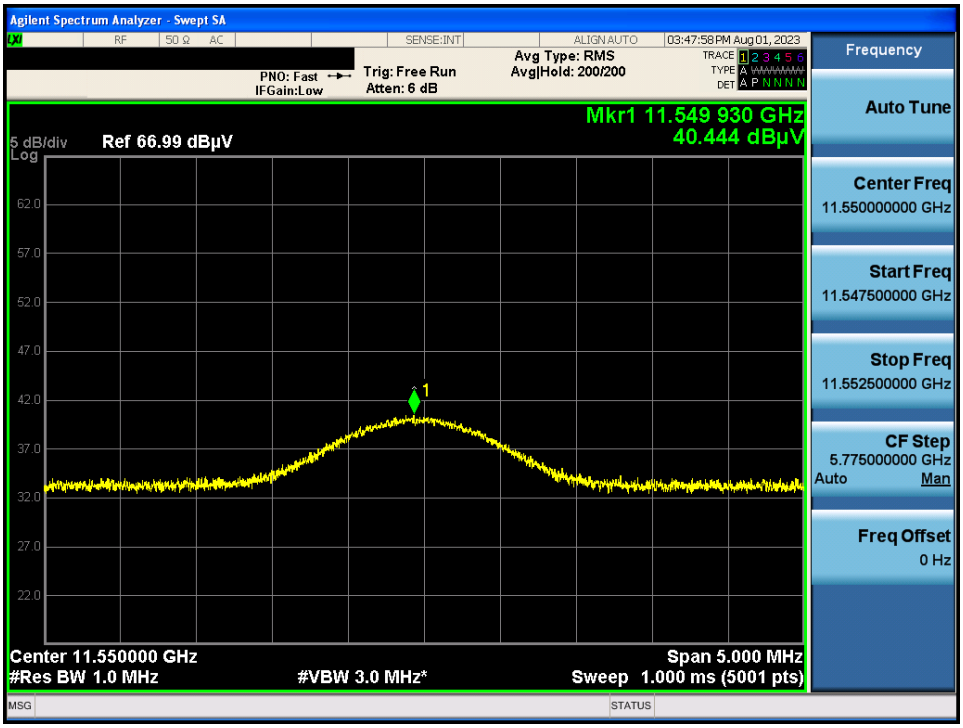
TM 2 & U-NII 1 & 5 210 & Z axis & Hor **Detector Mode : PK**



TM 2 & U-NII 3 & 5 775 & Y axis & Ver **Detector Mode : PK**



TM 2 & U-NII 3 & 5 775 & Y axis & Ver **Detector Mode : PK**



TM 2 & U-NII 3 & 5 775 & Z axis & Hor **Detector Mode : AV**