

TEST REPORT



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 : DRTFCC2110-0123

2. Customer

• Name (FCC) : MERCURY Corporation

• Address (FCC) : 90, Gajaeul-ro, Seo-gu Incheon South Korea

3. Use of Report : FCC Original Grant

4. Product Name / Model Name : WiFi BT Combo Module / MCR-WMDBE-CWP

FCC ID : 2AVW5MCRWMD BECWP

5. FCC Regulation(s): Part 15.407

Test Method used: KDB789033 D02v02r01, ANSI C63.10-2013

6. Date of Test : 2021.08.09 ~ 2021.10.05

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	Reviewed by
	Name : JaeHyeok Bang 	Name : JaeJin Lee 

2021 . 10 . 08 .

DT&C Co., Ltd.

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

Test Report Version

Test Report No.	Date	Description	Revised by	Reviewed by
DRTFCC2110-0123	Oct. 08, 2021	Initial issue	JaeHyeok Bang	JaeJin Lee

CONTENTS

1. General Information	4
1.1. Description of EUT	4
1.2. Declaration by the applicant / manufacturer	4
1.3. Testing Laboratory	5
1.4. Testing Environment	5
1.5. Measurement Uncertainty	5
1.6. Test Equipment List	6
2. Test Methodology	7
2.1. EUT Configuration	7
2.2. EUT Exercise	7
2.3. General Test Procedures	7
2.4. Instrument Calibration	7
2.5. Description of Test Modes	8
3. Antenna Requirements	9
4. Summary of Test Result	10
5. TEST RESULT	11
5.1 Emission Bandwidth (26 dB Bandwidth)	11
5.2 Minimum Emission Bandwidth (6 dB Bandwidth)	23
5.3 Maximum Conducted Output Power	28
5.4 Maximum Power Spectral Density	31
5.5 Unwanted Emissions	50
5.6 AC Power-Line Conducted Emissions	55
APPENDIX I	64
APPENDIX II	65
APPENDIX III	67

1. General Information

1.1. Description of EUT

Equipment Class	Unlicensed National Information Infrastructure TX(NII)
Product Name	WiFi BT Combo Module
Model Name	2AVW5MCRWMDBECWP
Add Model Name	-
Firmware Version Identification Number	002
EUT Serial Number	Conducted/Radiated :000C96
Power Supply	DC 5 V
Modulation Technique	OFDM

Antenna Specification

Model No	Manufacturer	Antenna Type	Gain(PK)			
			NII 1	NII 2A	NII 2C	NII 3
INNO-APC-0321	INNO-LINK	PCB Antenna	4.58 dBi	3.94 dBi	3.79 dBi	4.04 dBi
CWA-01	Coway	PCB Antenna	3.42 dBi	4.13 dBi	3.91 dBi	4.41 dBi
W5I-BO-07	WINIZEN	PCB Antenna	2.90 dBi	2.65 dBi	3.75 dBi	4.00 dBi
MW25DEC130PT-V	K-Maru	PCB Antenna	3.28 dBi	3.15 dBi	3.21 dBi	2.88 dBi

Band	Mode	Tx. frequency(MHz)	Max. conducted power(dBm)
U-NII 1	802.11a	5 180 ~ 5 240	15.81
	802.11n(HT20)	5 180 ~ 5 240	15.91
U-NII 2A	802.11a	5 260 ~ 5 320	15.87
	802.11n(HT20)	5 260 ~ 5 320	15.95
U-NII 2C	802.11a	5 500 ~ 5 720	15.94
	802.11n(HT20)	5 500 ~ 5 720	15.83
U-NII 3	802.11a	5 745 ~ 5 825	15.89
	802.11n(HT20)	5 745 ~ 5 825	16.14

1.2. Declaration by the applicant / manufacturer

N/A

1.3. 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

1.4. Testing Environment

Ambient Condition	
▪ Temperature	+20 °C ~ +24 °C
▪ Relative Humidity	+40 % ~ +43 %

1.5. 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)	4.9 dB (The confidence level is about 95 %, $k = 2$)
Radiated emission (1 GHz ~ 18 GHz)	5.0 dB (The confidence level is about 95 %, $k = 2$)
Radiated emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, $k = 2$)

1.6. Test Equipment List

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	21/06/24	22/06/24	US47360812
Spectrum Analyzer	Agilent Technologies	N9020A	20/12/16	21/12/16	MY50410399
Spectrum Analyzer	Agilent Technologies	N9020A	20/12/16	21/12/16	MY48011700
Spectrum Analyzer	KEYSIGHT	N9030B	20/12/16	21/12/16	MY55480168
Multimeter	FLUKE	17B+	20/12/16	21/12/16	36390701WS
Signal Generator	Rohde Schwarz	SMBV100A	20/12/16	21/12/16	255571
Signal Generator	ANRITSU	MG3695C	20/12/16	21/12/16	173501
Thermohygrometer	XIAOMI	MHO-C201	20/12/16	21/12/16	00089675
Thermohygrometer	BODYCOM	BJ5478	20/12/16	21/12/16	120612-2
Thermohygrometer	BODYCOM	BJ5478	21/06/24	22/06/24	N/A
HYGROMETER	TESTO	608-H1	21/01/19	22/01/19	34862883
Loop Antenna	ETS-Lindgren	6502	21/01/28	23/01/28	00226186
BILOG ANTENNA	Schwarzbeck	VULB 9160	20/12/16	21/12/16	3362
Horn Antenna	ETS-Lindgren	3117	21/06/24	22/06/24	00143278
Horn Antenna	A.H.Systems Inc.	SAS-574	21/06/24	22/06/24	155
PreAmplifier	tsj	MLA-0118-B01-40	20/12/16	21/12/16	1852267
PreAmplifier	H.P	8447D	20/12/16	21/12/16	2944A07774
PreAmplifier	tsj	MLA-1840-J02-45	21/06/24	22/06/24	16966-10728
High Pass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	21/06/24	22/06/24	8
High Pass Filter	Wainwright Instruments	WHKX10-2838-3300-18000-60SS	21/06/24	22/06/24	1
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5-6SS	21/06/24	22/06/24	3
Attenuator	Hefei Shunze	SS5T2.92-10-40	21/06/24	22/06/24	16012202
Attenuator	SRTechnology	F01-B0606-01	21/06/24	22/06/24	13092403
Attenuator	Aeroflex/Weinschel	56-3	21/06/24	22/06/24	Y2370
Attenuator	SMAJK	SMAJK-2-3	21/06/24	22/06/24	2
Power Meter	Anritsu	ML2495A	21/06/24	22/06/24	1306007
Wide Bandwidth Sensor	Anritsu	MA2490A	21/06/24	22/06/24	1249001
EMI Receiver	ROHDE&SCHWARZ	ESU	21/01/19	22/01/19	100538
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	21/08/23	22/08/23	101333
LISN	SCHWARZBECK	NSLK 8128 RC	20/10/23	21/10/23	8128 RC-387
Cable	HUBER+SUHNER	SUCOFLEX100	21/01/08	22/01/08	M-1
Cable	HUBER+SUHNER	SUCOFLEX100	21/01/08	22/01/08	M-2
Cable	JUNFLON	MWX241/B	21/01/08	22/01/08	M-3
Cable	JUNFLON	J12J101757-00	21/01/08	22/01/08	M-7
Cable	HUBER+SUHNER	SUCOFLEX106	21/01/08	22/01/08	M-9
Cable	DTNC	Cable	21/01/08	22/01/08	G-1
Cable	DTNC	Cable	21/01/08	22/01/08	G-2
Cable	HUBER+SUHNER	SUCOFLEX 100	21/01/08	22/01/08	G-3
Cable	DTNC	Cable	21/01/08	22/01/08	G-4
Cable	RADIALL	TESTPRO3	21/01/05	22/01/05	RFC-03
Cable	DTNC	Cable	21/01/05	22/01/05	RFC-69
Test Software	tsj	Radiated Emission Measurement	NA	NA	Version 2.00.0177
Test Software	tsj	Noise Terminal Measurement	NA	NA	Version 2.00.0170

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 KDB 7899033 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 KDB558074 D01v05r02.

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.

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	Data rate
802.11a	6 Mbps ~ 54 Mbps
802.11n(HT20)	MCS 0 ~ 7

EUT Operation test setup

- **Test Software:** QRCT / V3.0-00277
- **Power setting:** Refer to the table below.

Tested frequency and power setting

Band	Channel	Frequency (MHz)	Power Setting	
			802.11a	802.11n(HT20)
U-NII 1	36	5 180	1E	21
	40	5 200	1E	21
	48	5 240	1E	21
U-NII 2A	52	5 260	1D	20
	60	5 300	1D	20
	64	5 320	1D	20
U-NII 2C	100	5 500	1F	21
	120	5 600	21	20
	144	5 720	21	20
U-NII 3	149	5 745	22	22
	157	5 785	22	22
	165	5 825	22	22

Tested Mode

Test mode	Mode	Worst case data rate
TM 1	802.11a	6 Mbps
TM 2	802.11n(HT20)	MCS 0

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

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 External antenna employs a unique antenna connector.
Therefore this E.U.T complies with the requirement of Part 15.203**

4. Summary of Test Result

FCC Part Section(s)	Test Description	Limit	Test Condition	Status Note 1
15.407(a)	Emission Bandwidth (26 dB Bandwidth)	N/A	Conducted	C
15.407(e)	Minimum Emission Bandwidth (6 dB Bandwidth)	> 500 kHz in 5 725 ~ 5 850 MHz		C
15.407(a)	Maximum Conducted Output Power	Part 15.407(a) (Refer to section 5.3)		C
15.407(a)	Maximum Power Spectral Density	Part 15.407(a) (Refer to section 5.4)		C
15.407(h)	Dynamic Frequency Selection	Part 15.407(h)		C Note 3
15.205 15.209 15.407(b)	Unwanted Emissions	Part 15.209, 15.407(b) (Refer to section 5.5)	Radiated	C Note 4, 5
15.207	AC Conducted Emissions	FCC 15.207 (Refer to section 5.6)	AC Line Conducted	C
15.203	Antenna Requirements	FCC 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: Refer to the DFS test report. Note 4: This test item was performed in three orthogonal EUT positions and the worst case data was reported. Note 5: This test item was performed with the highest gain antenna.				

5. TEST RESULT

5.1 Emission Bandwidth (26 dB Bandwidth)

■ 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.

■ 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 %.

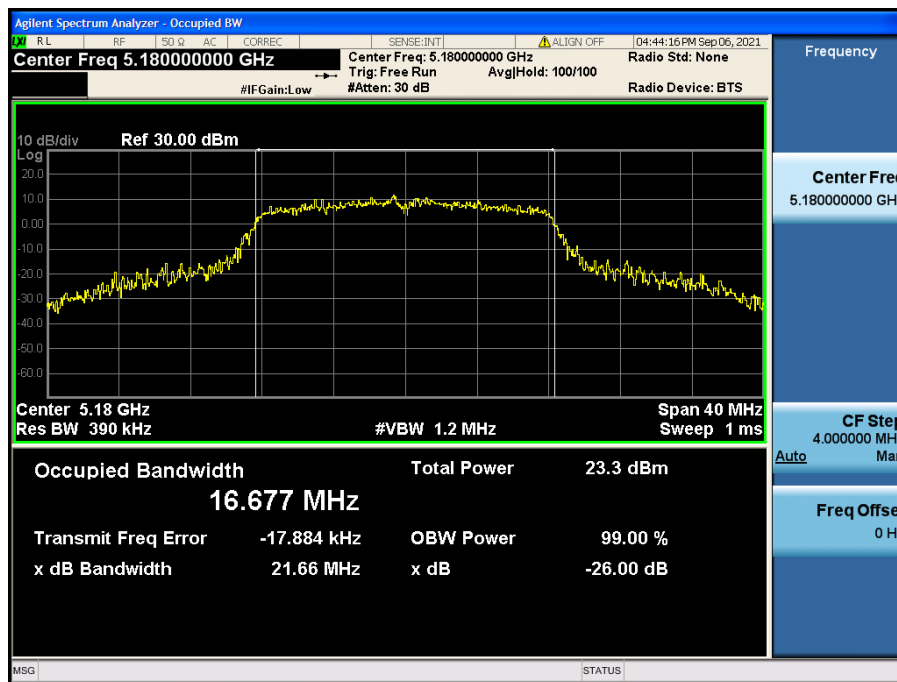
■ Test Results: **Comply**

Test Mode	Band	Channel	Frequency(MHz)	26 dB BW(MHz)
TM 1	U-NII 1	36	5 180	21.66
		40	5 200	22.75
		48	5 240	20.44
	U-NII 2A	52	5 260	21.27
		60	5 300	23.79
		64	5 320	19.73
	U-NII 2C	100	5 500	19.62
		120	5 600	23.19
		144	5 720	20.07
TM 2	U-NII 1	36	5 180	27.89
		40	5 200	26.54
		48	5 240	30.25
	U-NII 2A	52	5 260	26.51
		60	5 300	27.39
		64	5 320	26.22
	U-NII 2C	100	5 500	27.49
		120	5 600	25.84
		144	5 720	30.10

Result Plots

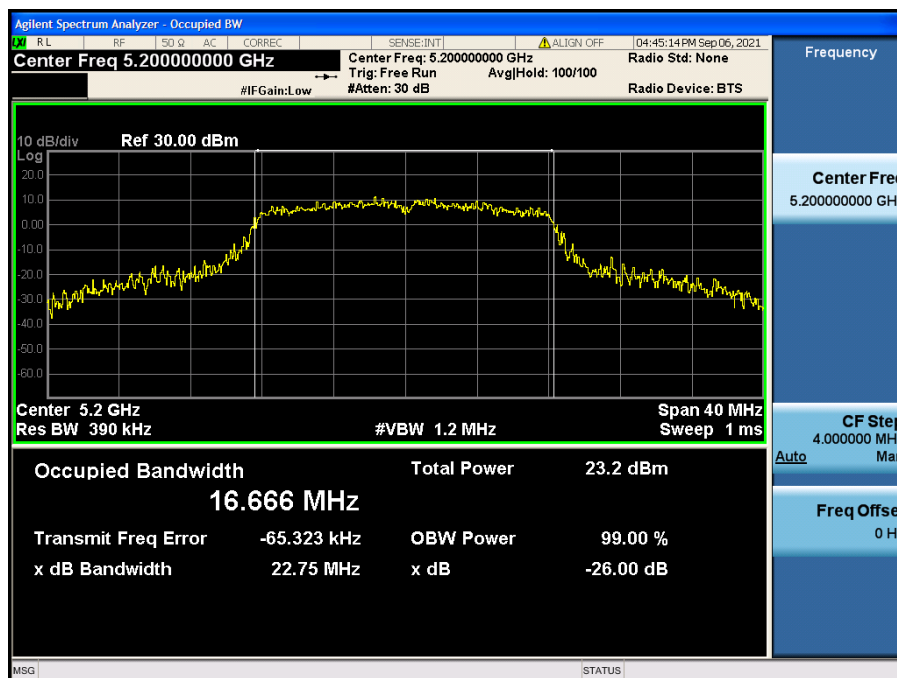
26 dB Bandwidth

Test Mode: TM 1 & Ch.36



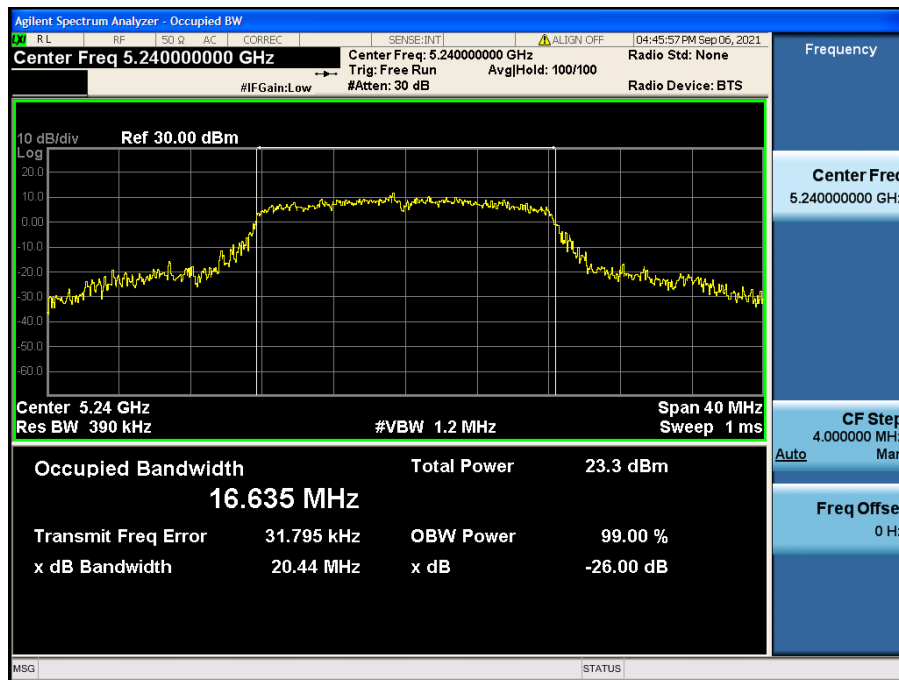
26 dB Bandwidth

Test Mode: TM 1 & Ch.40



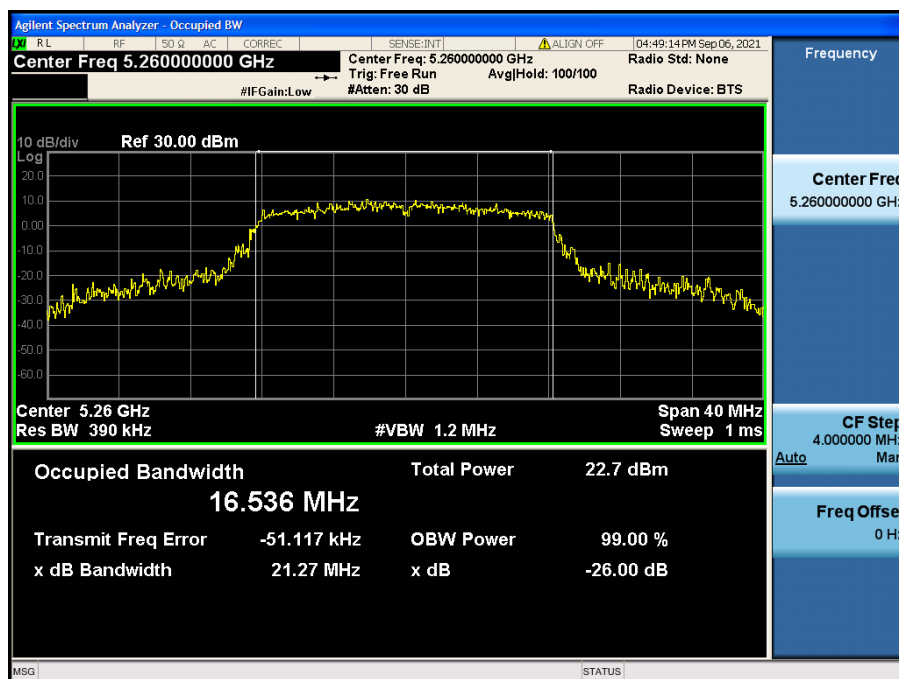
26 dB Bandwidth

Test Mode: TM 1 & Ch.48



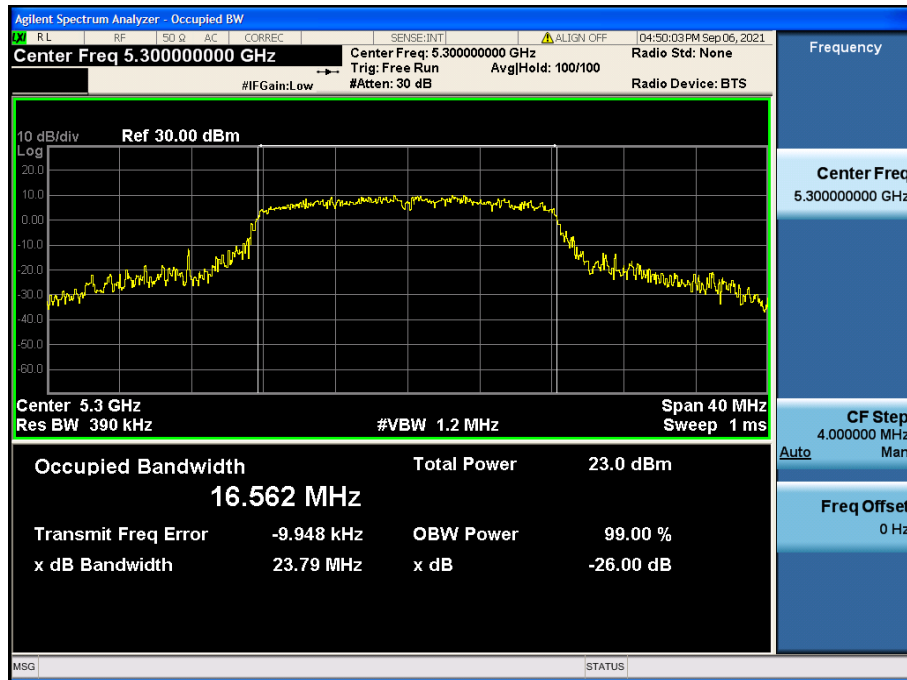
26 dB Bandwidth

Test Mode: TM 1 & Ch.52



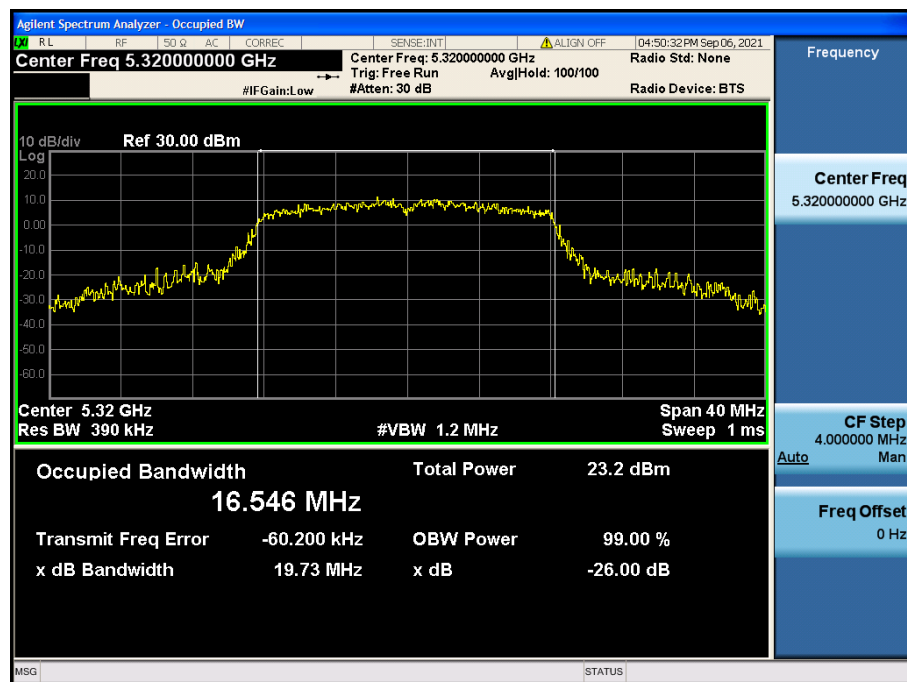
26 dB Bandwidth

Test Mode: TM 1 & Ch.60



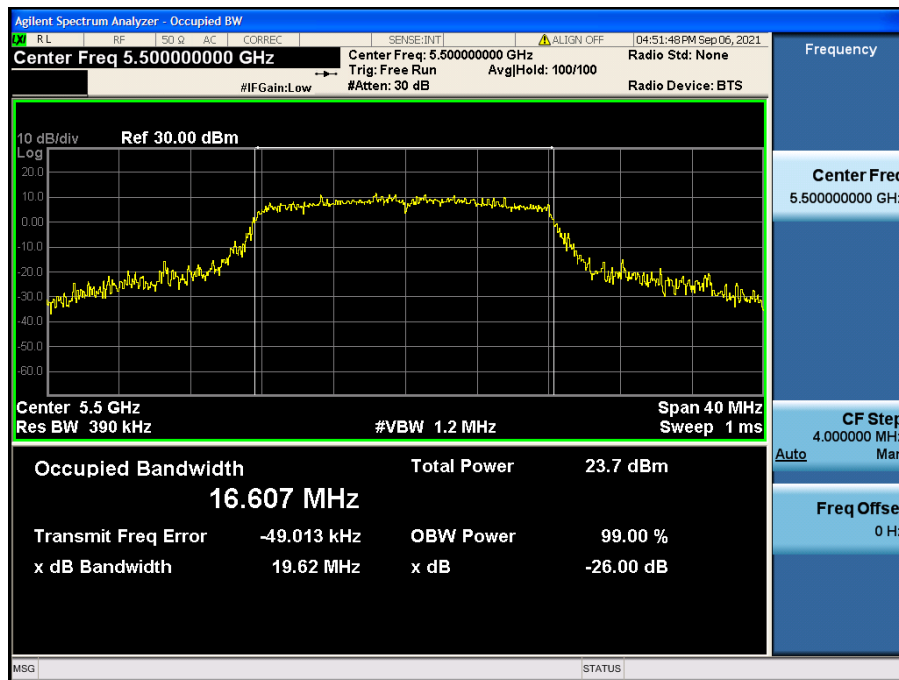
26 dB Bandwidth

Test Mode: TM 1 & Ch.64



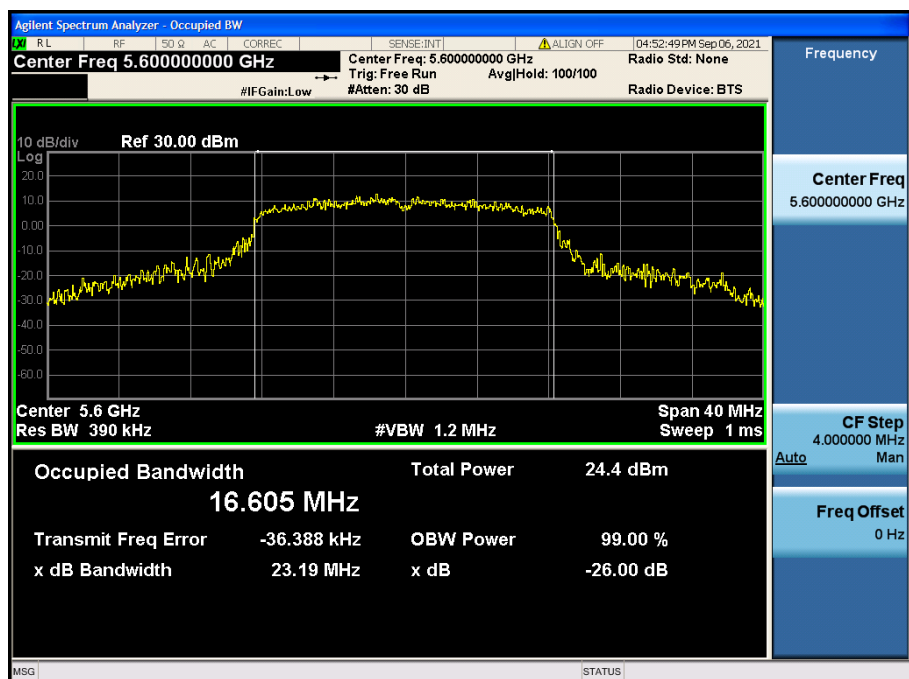
26 dB Bandwidth

Test Mode: TM 1 & Ch.100



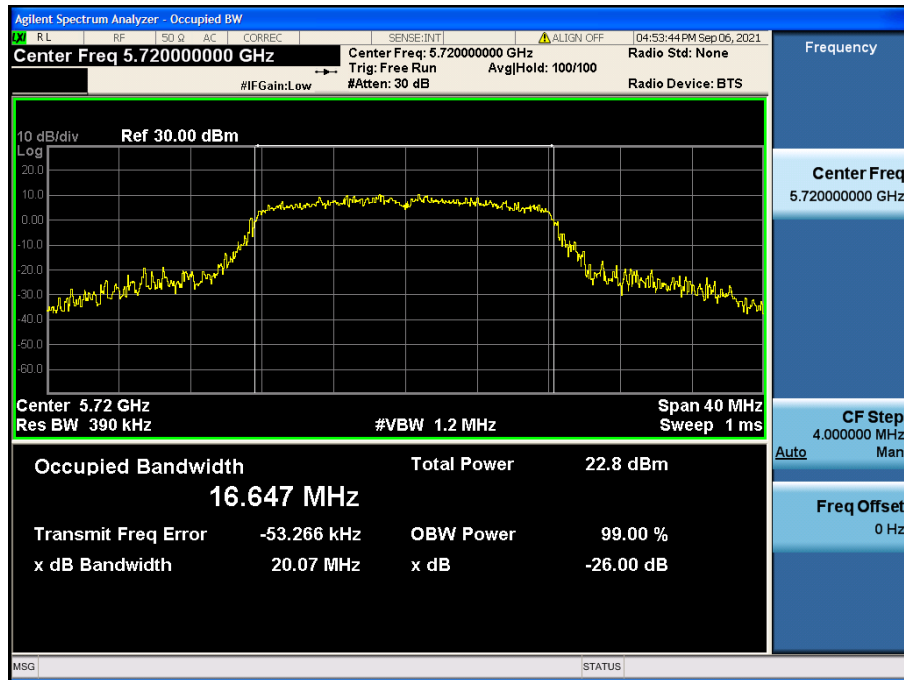
26 dB Bandwidth

Test Mode: TM 1 & Ch.120



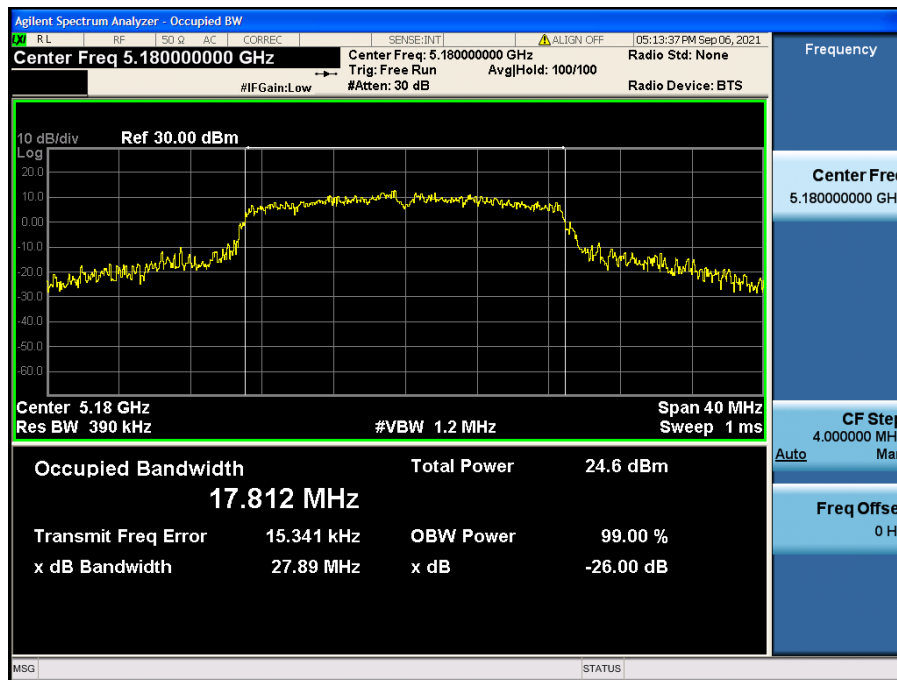
26 dB Bandwidth

Test Mode: TM 1 & Ch.144



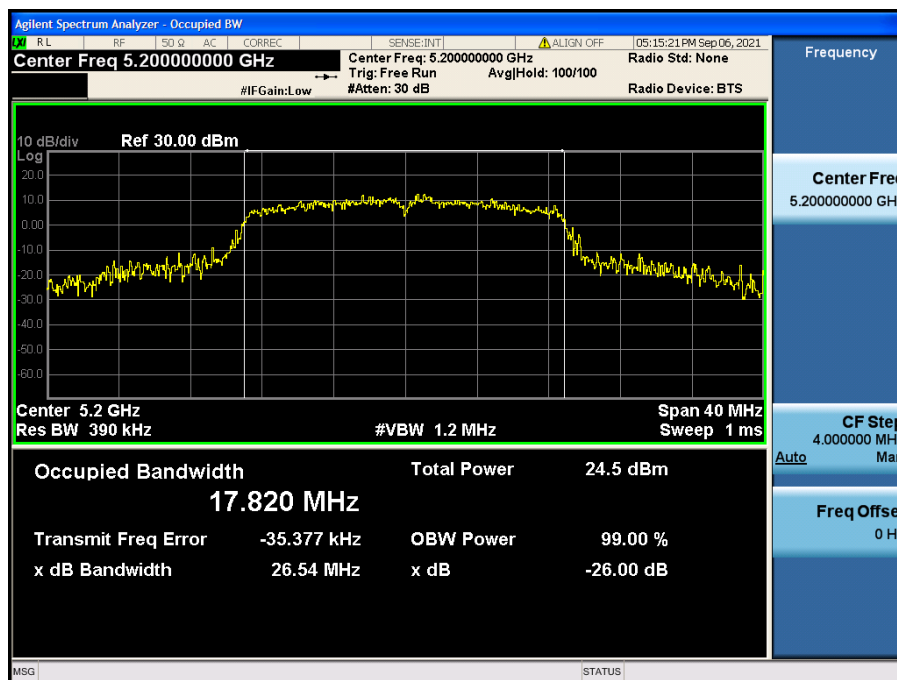
26 dB Bandwidth

Test Mode: TM 2 & Ch.36



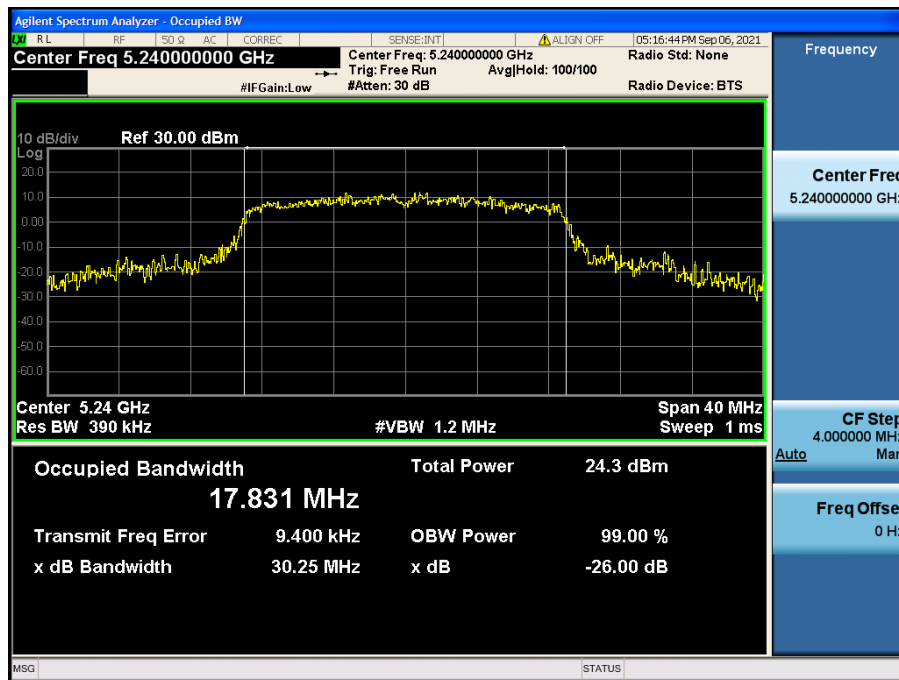
26 dB Bandwidth

Test Mode: TM 2 & Ch.40



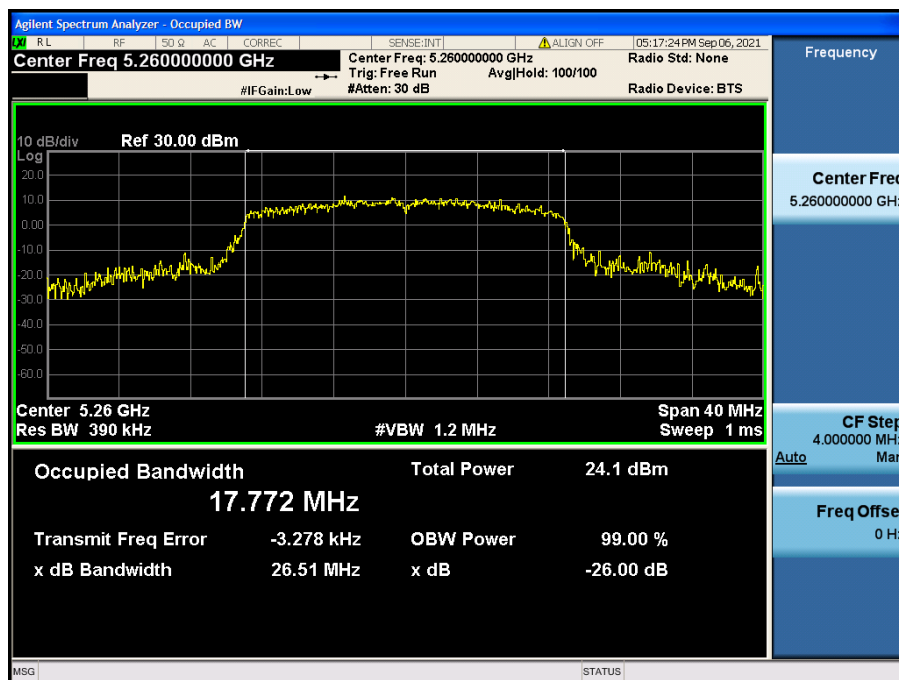
26 dB Bandwidth

Test Mode: TM 2 & Ch.48



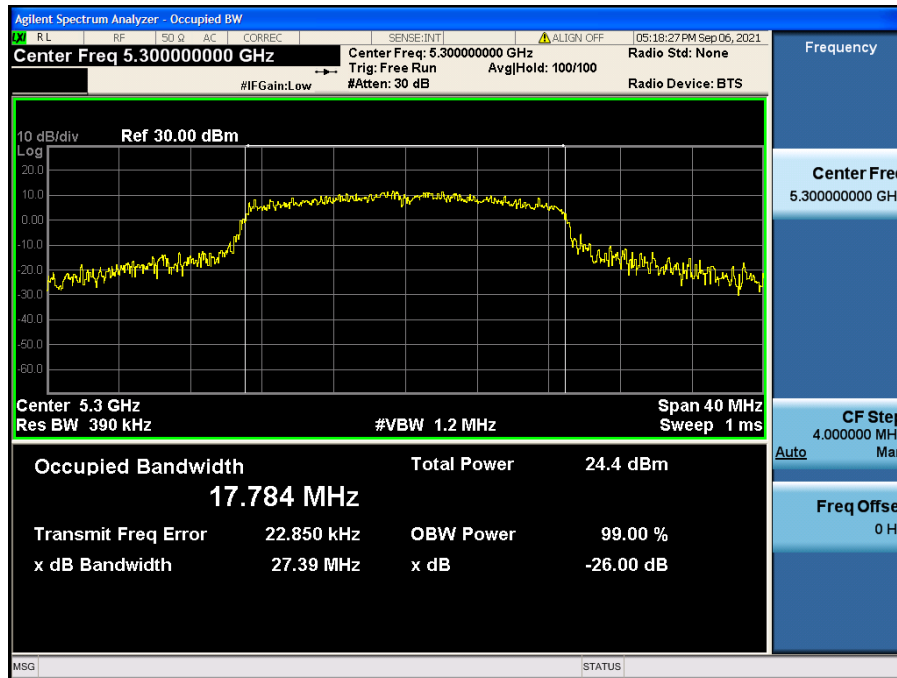
26 dB Bandwidth

Test Mode: TM 2 & Ch.52



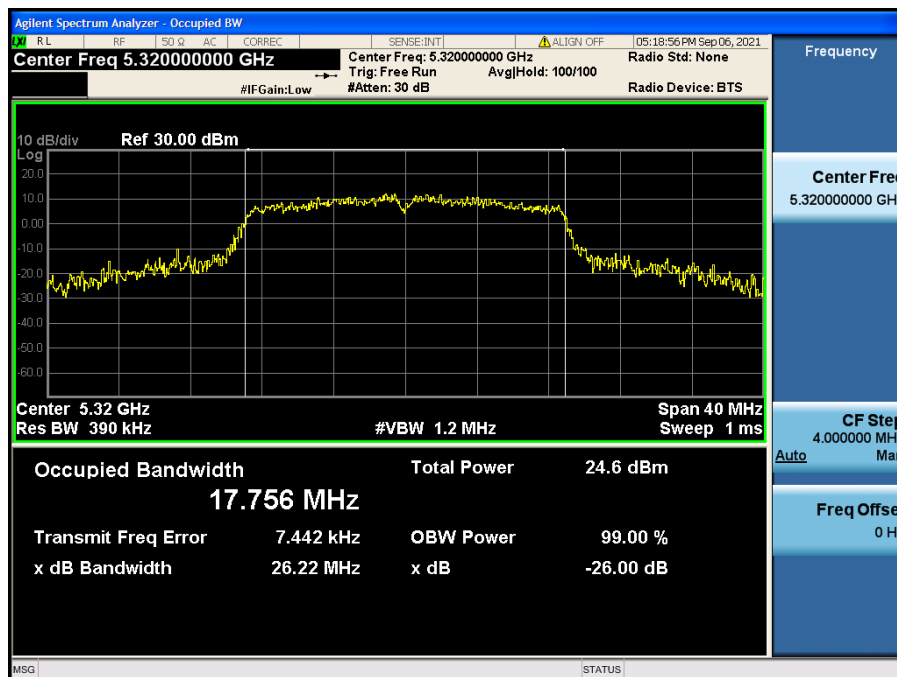
26 dB Bandwidth

Test Mode: TM 2 & Ch.60



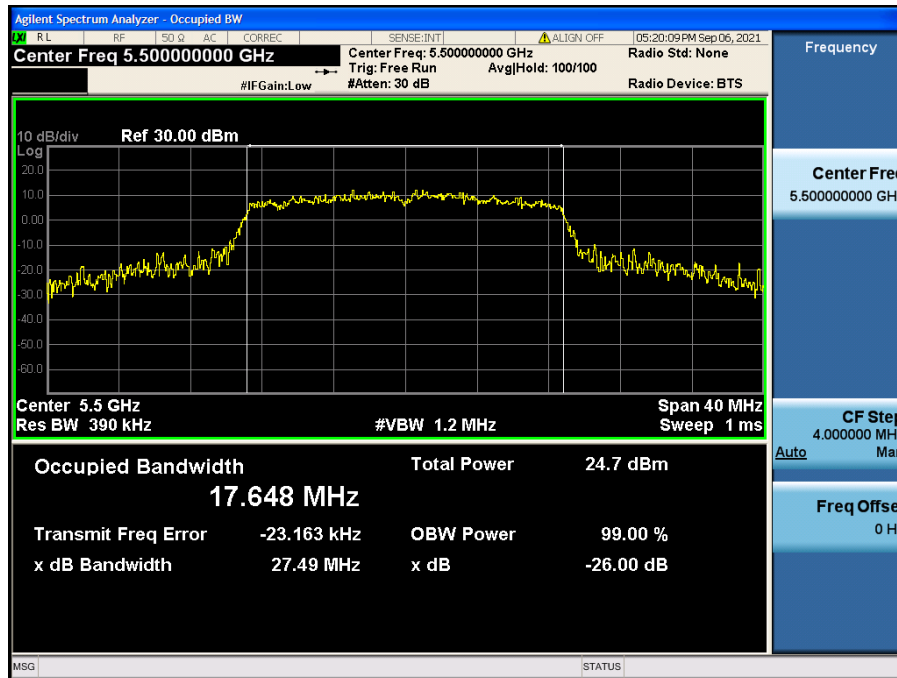
26 dB Bandwidth

Test Mode: TM 2 & Ch.64



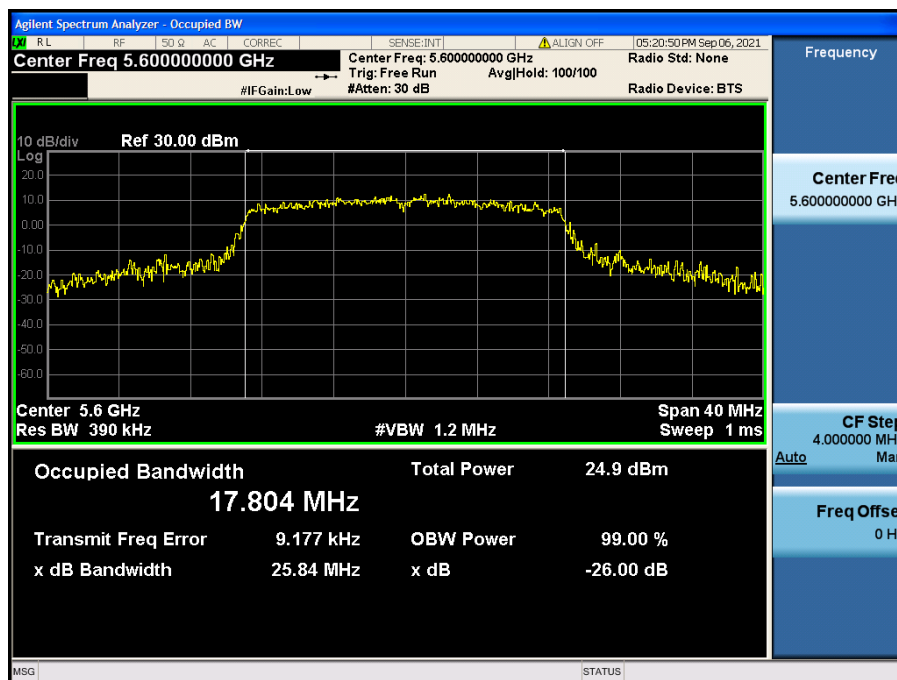
26 dB Bandwidth

Test Mode: TM 2 & Ch.100



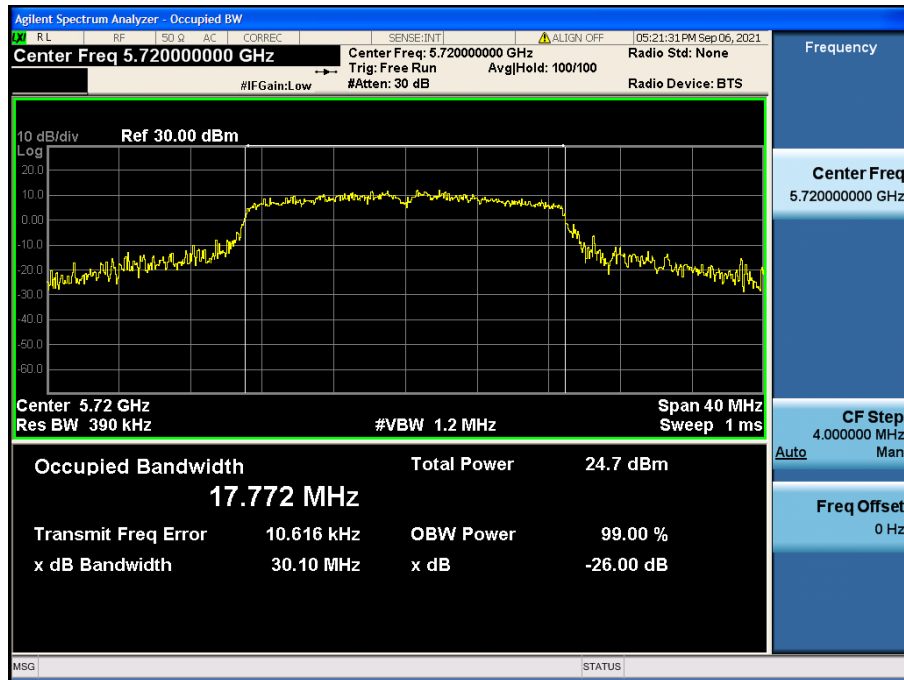
26 dB Bandwidth

Test Mode: TM 2 & Ch.120



26 dB Bandwidth

Test Mode: TM 2 & Ch.144



5.2 Minimum Emission Bandwidth (6 dB Bandwidth)

■ 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.

■ 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 $\geq 3 \times \text{RBW}$.
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.

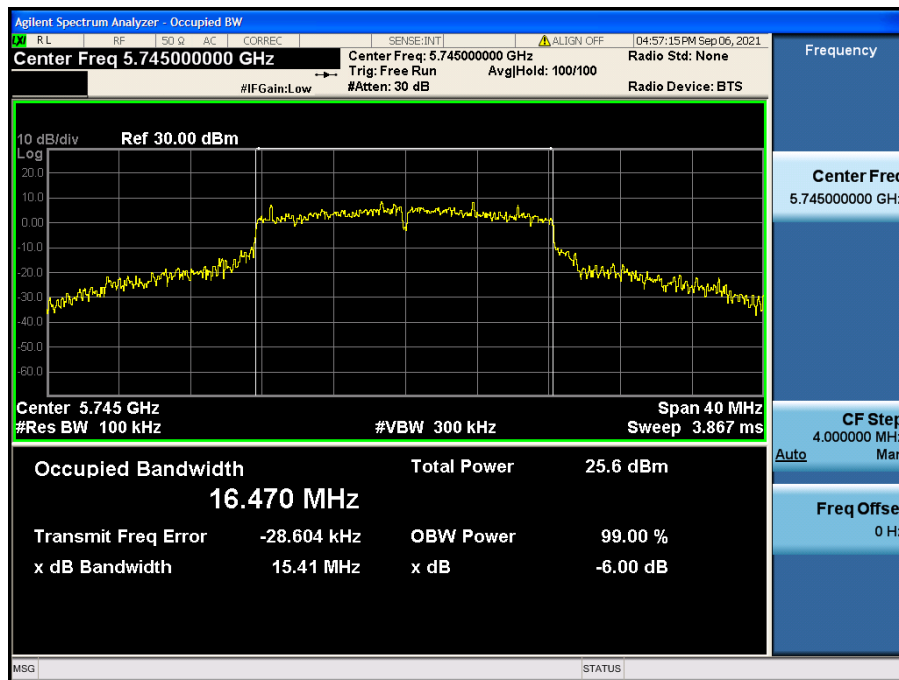
■ Test Results: **Comply**

Test Mode	Band	Channel	Frequency(MHz)	6 dB BW(MHz)
TM 1	U-NII 3	149	5 745	15.41
		157	5 785	14.40
		165	5 825	12.61
TM 2	U-NII 3	149	5 745	12.66
		157	5 785	12.65
		165	5 825	15.63

Result Plots

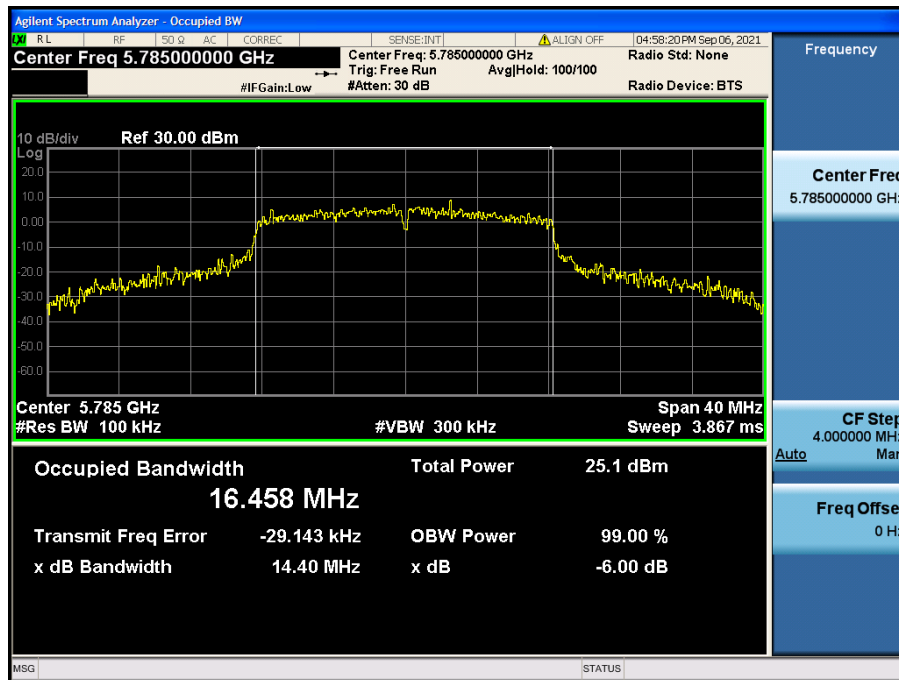
6 dB Bandwidth

Test Mode: TM 1 & Ch.149



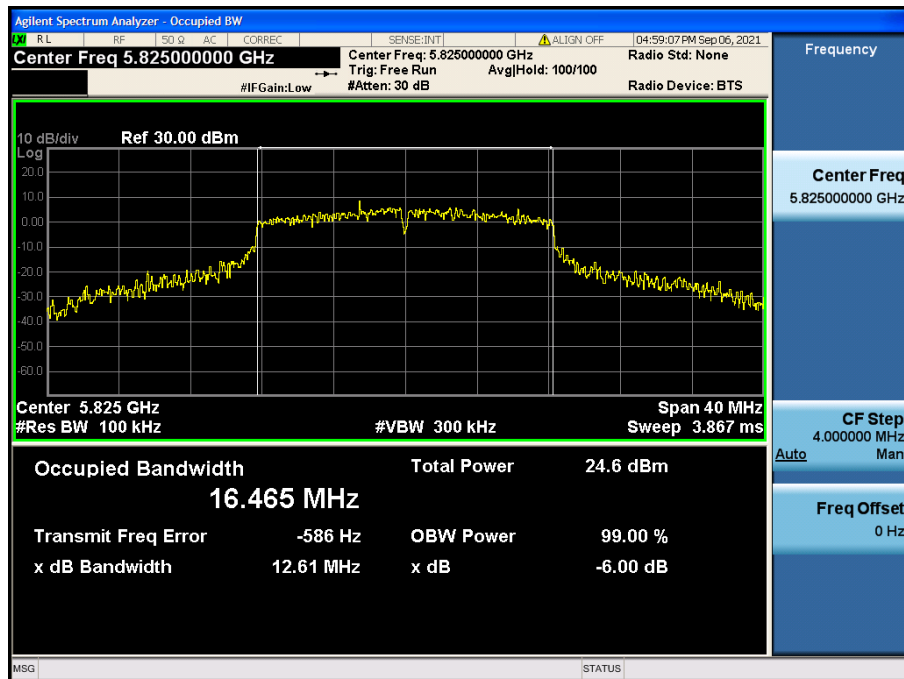
6 dB Bandwidth

Test Mode: TM 1 & Ch.157



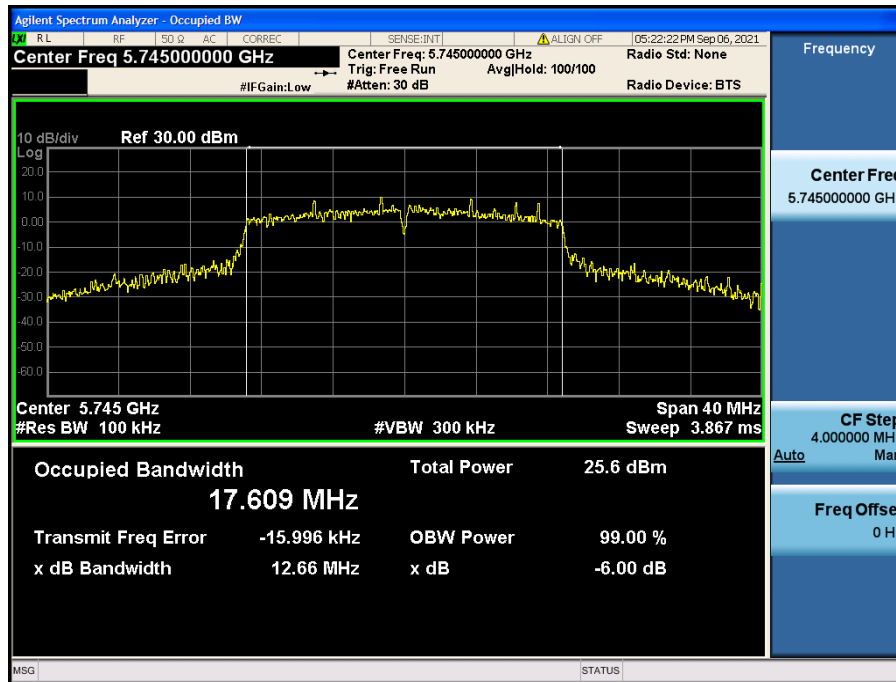
6 dB Bandwidth

Test Mode: TM 1 & Ch.165



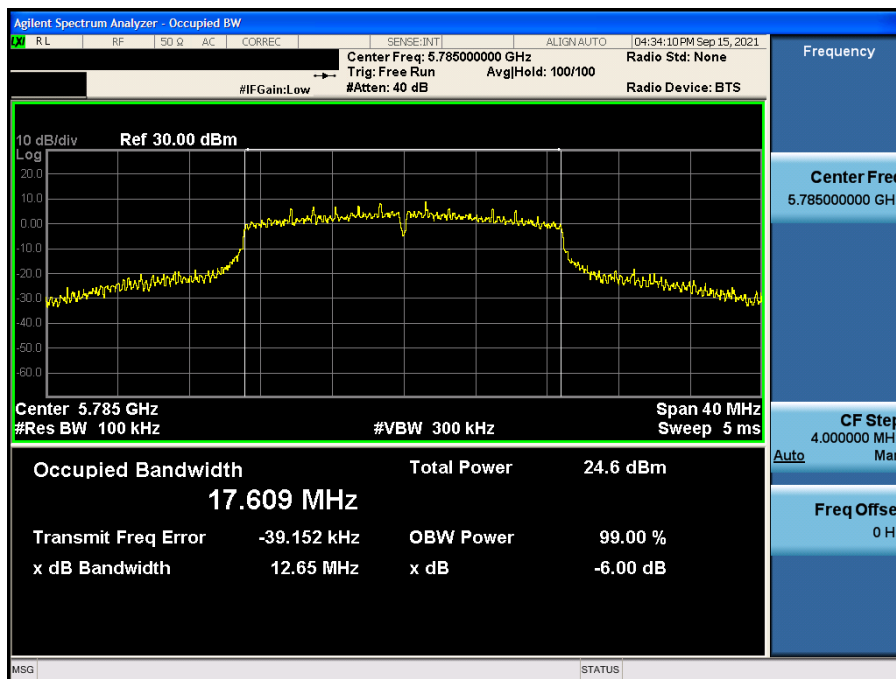
6 dB Bandwidth

Test Mode: TM 2 & Ch.149



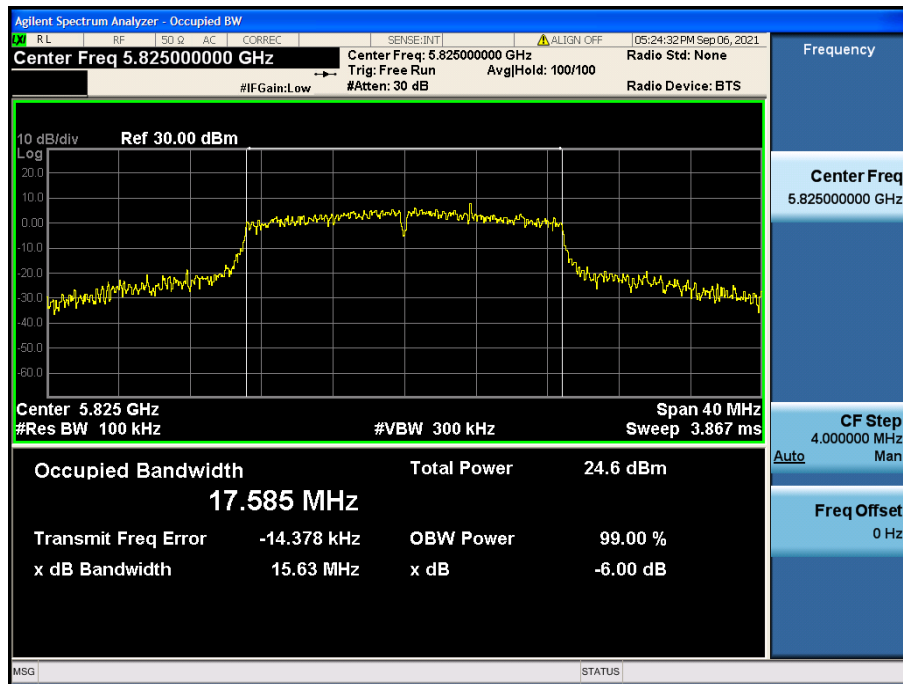
6 dB Bandwidth

Test Mode: TM 2 & Ch.157



6 dB Bandwidth

Test Mode: TM 2 & Ch.165



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 $11 \text{ dBm} + 10 \log B$, 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.

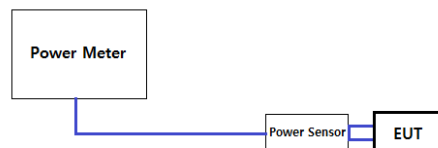
Output power Limit Calculation

Band	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case) [dBi]	Determined Limit [dBm]
U-NII 1	1 000	30.00	4.58	30.00

Band	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case) [dBi]	Determined Limit [dBm]
	Least 26 dBc BW [MHz]			
U-NII 2A	250	23.97	4.13	23.95
	19.73	23.95		
U-NII 2C	250	23.97	3.91	23.92
	19.62	23.92		

Band	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain [dBi]	Determined Limit [dBm]
U-NII 3	1 000	30.00	4.41	30.00

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.

■ Test Results: **Comply**

Mode	Band	Channel	Frequency (MHz)	Conducted Output Power(dBm)
802.11a	U-NII 1	36	5 180	15.21
		40	5 200	15.62
		48	5 240	15.81
	U-NII 2A	52	5 260	15.87
		60	5 300	15.68
		64	5 320	15.65
	U-NII 2C	100	5 500	15.57
		120	5 600	15.94
		144	5 720	15.87
	U-NII 3	149	5 745	15.89
		157	5 785	15.74
		165	5 825	15.80
802.11n (HT20)	U-NII 1	36	5 180	15.85
		40	5 200	15.82
		48	5 240	15.91
	U-NII 2A	52	5 260	15.74
		60	5 300	15.94
		64	5 320	15.95
	U-NII 2C	100	5 500	15.83
		120	5 600	15.27
		144	5 720	15.75
	U-NII 3	149	5 745	16.14
		157	5 785	15.87
		165	5 825	15.92

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.

Maximum Power Spectral Density

Band	Limit [dBm]	Antenna Gain (Worst case) [dBi]	Determined Limit [dBm]
U-NII 1	11	4.58	11
U-NII 2A	11	4.13	11
U-NII 2C	11	3.91	11
U-NII 3	30	4.41	30

■ 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)(5). 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 MHz.
 - b) Set VBW $\geq 1 / T$, where T is defined in item a1) in 12.2.
 - c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log(500 \text{ kHz} / \text{RBW})$ 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 $10 \log(1 \text{ MHz} / \text{RBW})$ to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
 - g) Detector = peak.
 - h) Video filtering shall be applied to a voltage-squared or power signal (i.e., rms mode), if possible. Otherwise, it shall be set to operate on a linear voltage signal (which can require use of linear display mode). Log mode shall not be used:
 - 1) The preferred voltage-squared (i.e., power or rms) mode is selected on some instruments by setting the "average-VBW type" to power or rms.**
 - 2) If RMS mode is not available, then linear voltage mode is selected on some analyzers by setting the display mode to linear. Other instruments have a setting for "average-VBW type" that can be set to "voltage" regardless of the display mode.
 - i) Trace mode = max hold.

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)	CF ^{Note 2} (dB)	Power Spectral Density(dBm)	Limit (dBm)
TM 1	U-NII 1	36	5 180	8.65	1.00	9.65	11.00
		40	5 200	8.52		9.52	11.00
		48	5 240	8.57		9.57	11.00
	U-NII 2A	52	5 260	8.39		9.39	11.00
		60	5 300	8.46		9.46	11.00
		64	5 320	8.63		9.63	11.00
	U-NII 2C	100	5 500	9.27		10.27	11.00
		120	5 600	9.58		10.58	11.00
		144	5 720	9.68		10.68	11.00
	U-NII 3	149	5 745	7.36		8.36	30.00
		157	5 785	6.99		7.99	30.00
		165	5 825	7.04		8.04	30.00
TM 2	U-NII 1	36	5 180	9.39	1.00	10.39	11.00
		40	5 200	9.27		10.27	11.00
		48	5 240	9.36		10.36	11.00
	U-NII 2A	52	5 260	9.22		10.22	11.00
		60	5 300	9.35		10.35	11.00
		64	5 320	9.51		10.51	11.00
	U-NII 2C	100	5 500	9.64		10.64	11.00
		120	5 600	9.18		10.18	11.00
		144	5 720	8.65		9.65	11.00
	U-NII 3	149	5 745	6.86		7.86	30.00
		157	5 785	6.34		7.34	30.00
		165	5 825	6.49		7.49	30.00

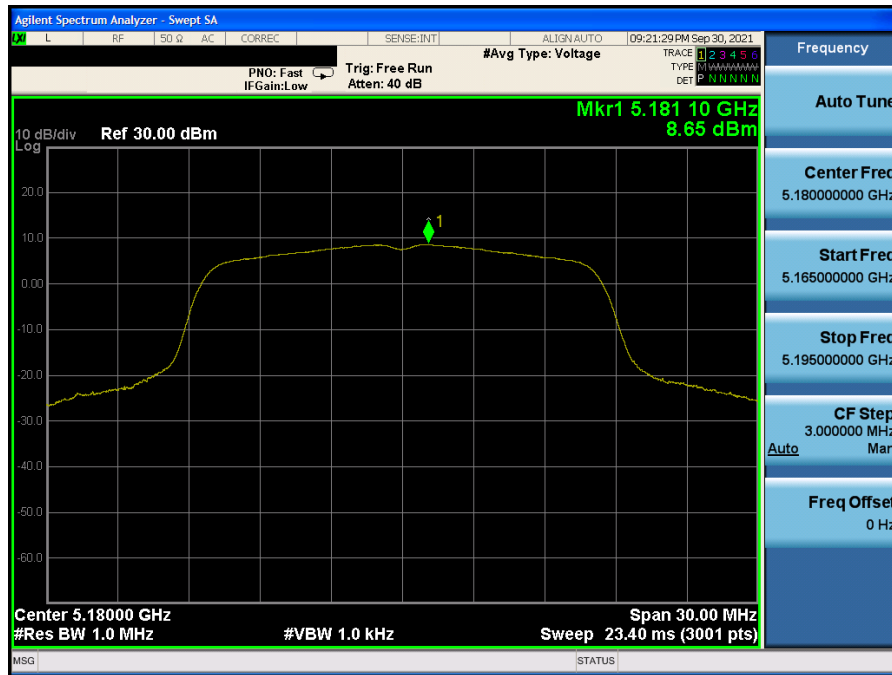
Note 1: Test Result = Measurement Data(Reading) + CF

Note 2: CF is a correction factor between linear averaging and power averaging.

RESULT PLOTS

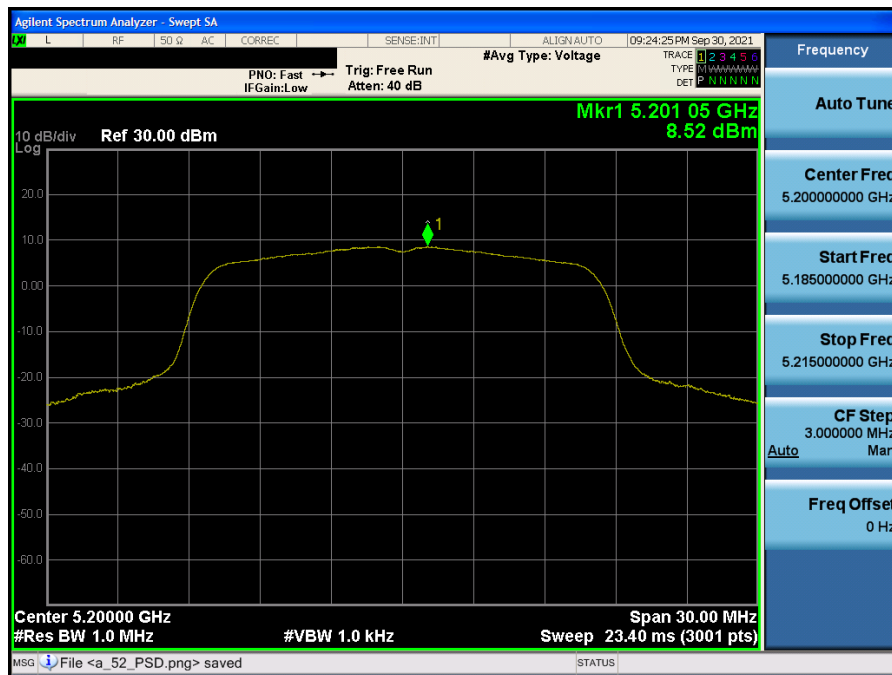
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.36



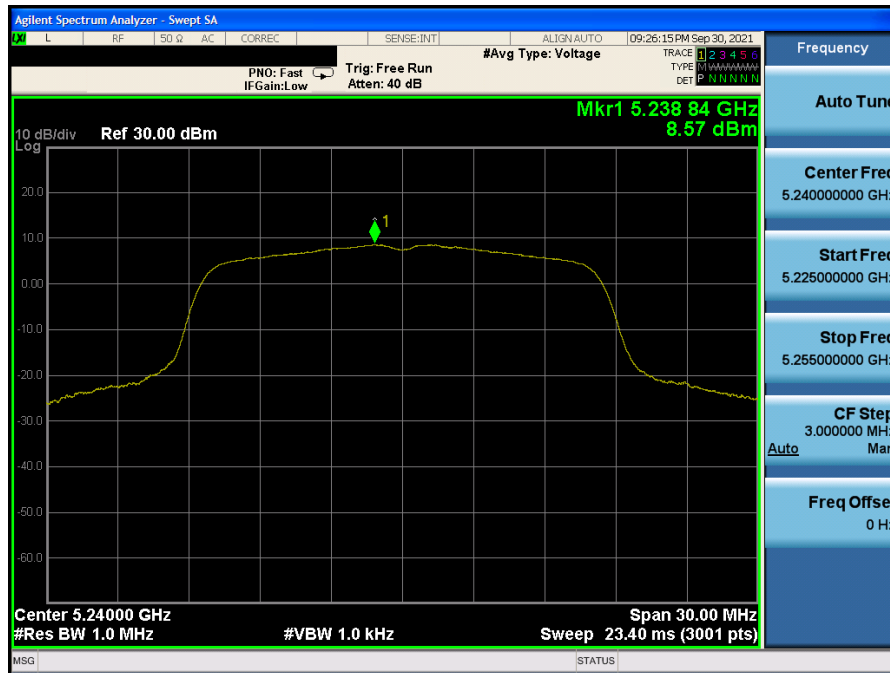
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.40



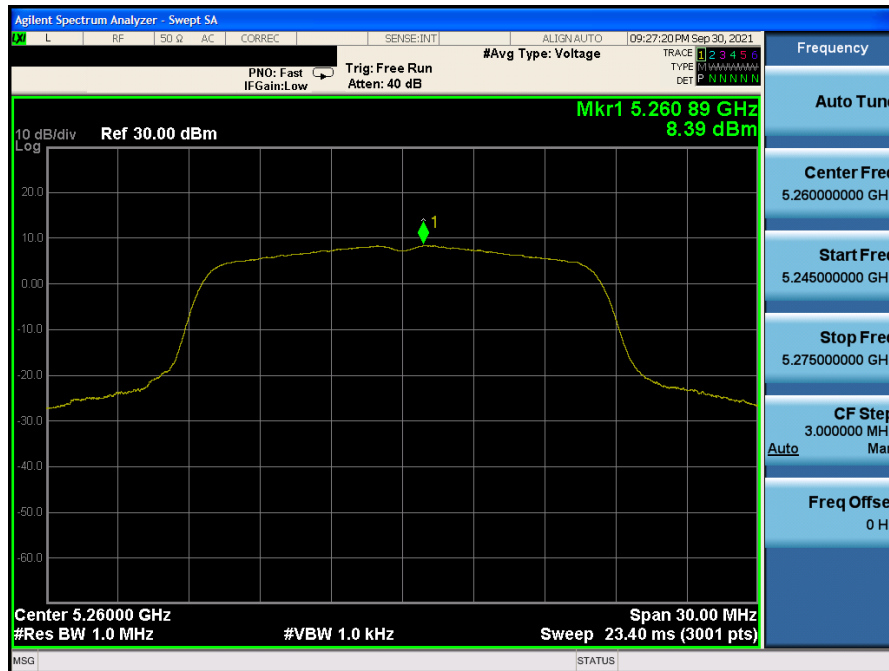
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.48



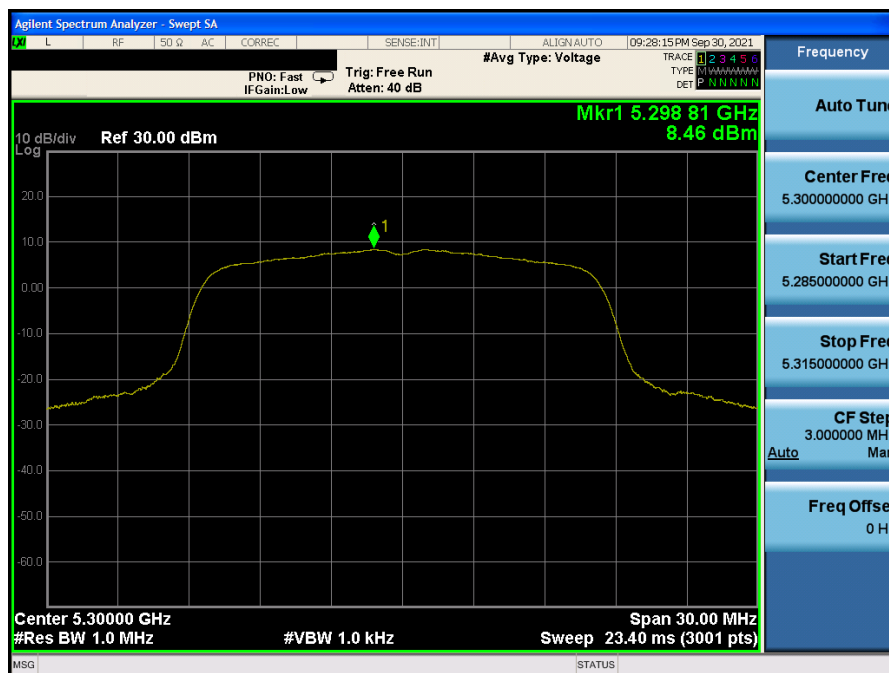
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.52



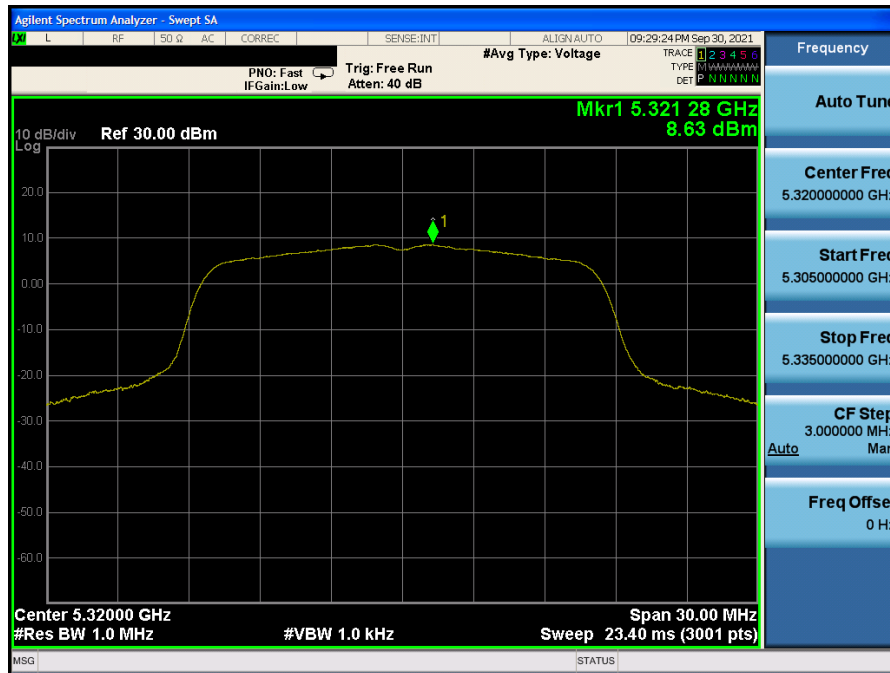
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.60



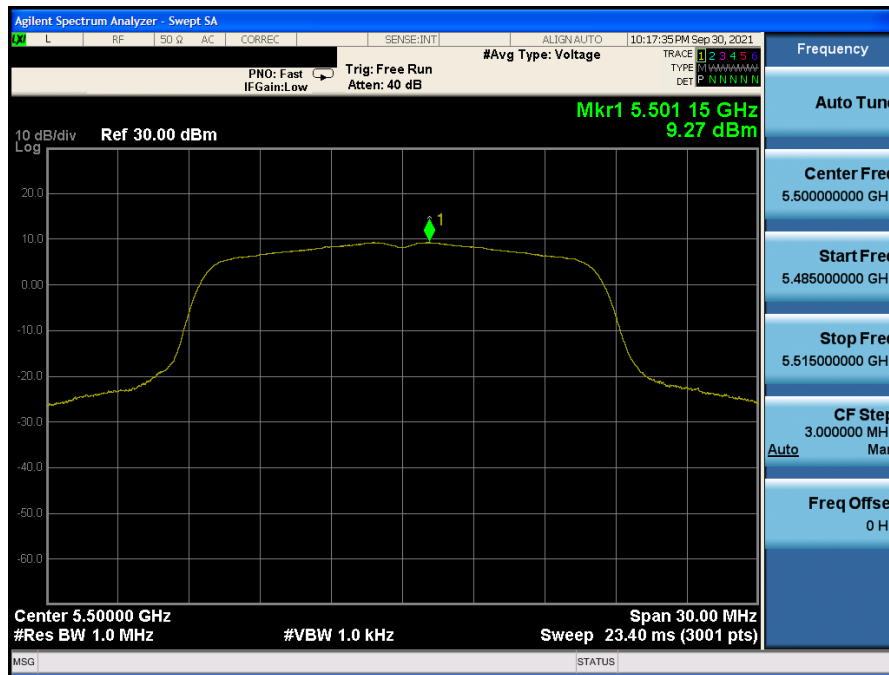
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.64



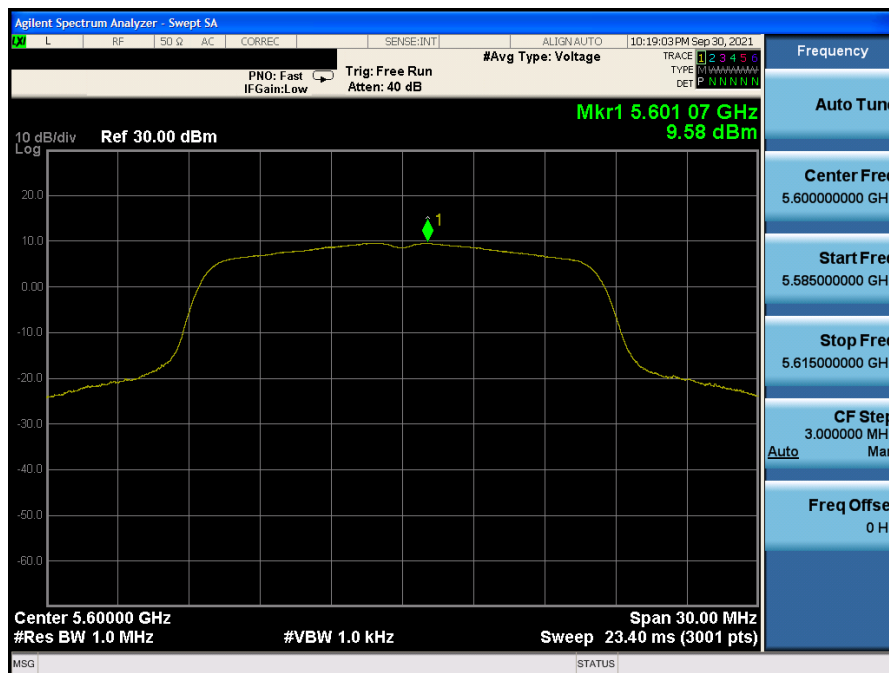
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.100



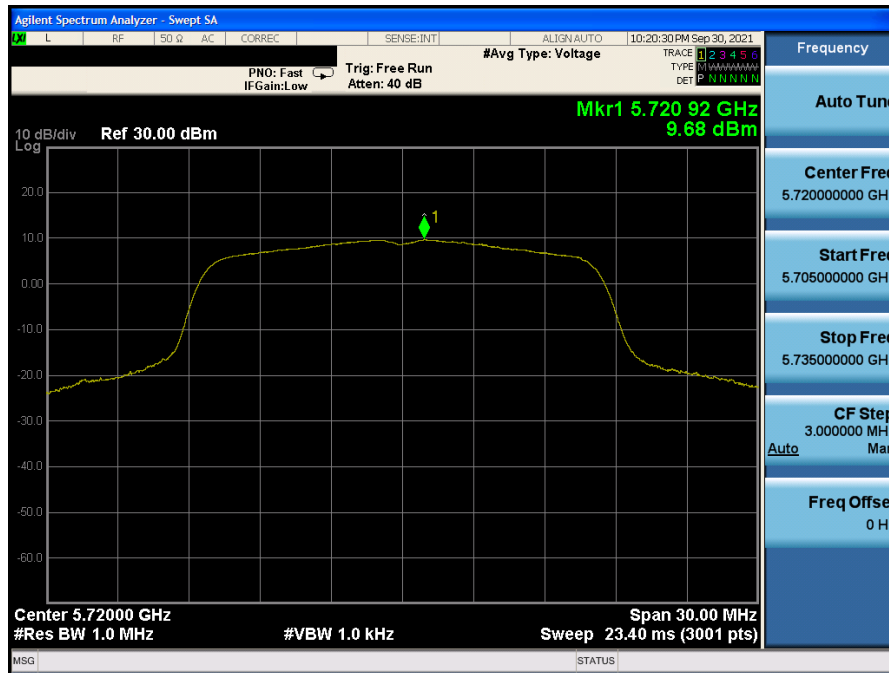
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.120



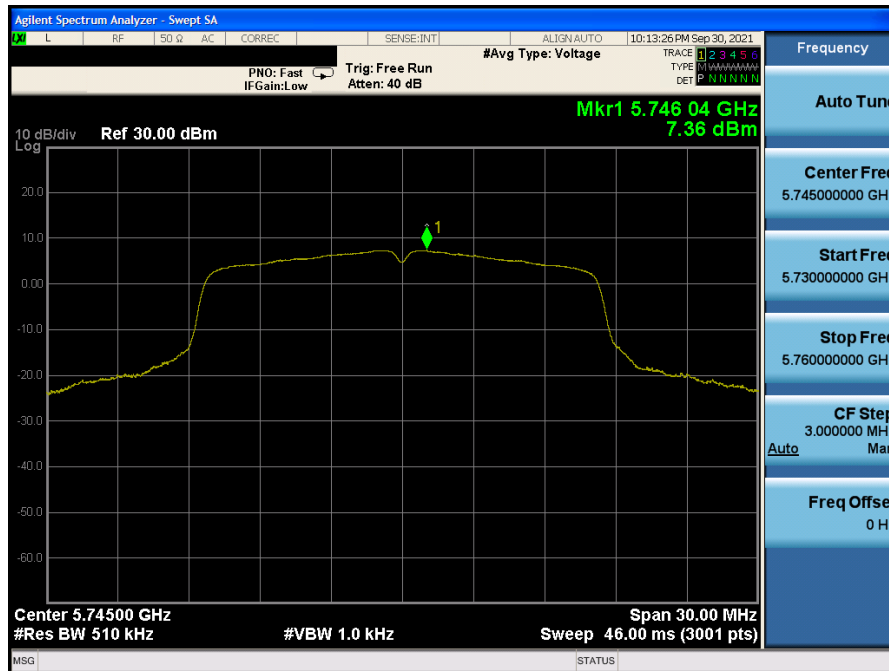
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.144



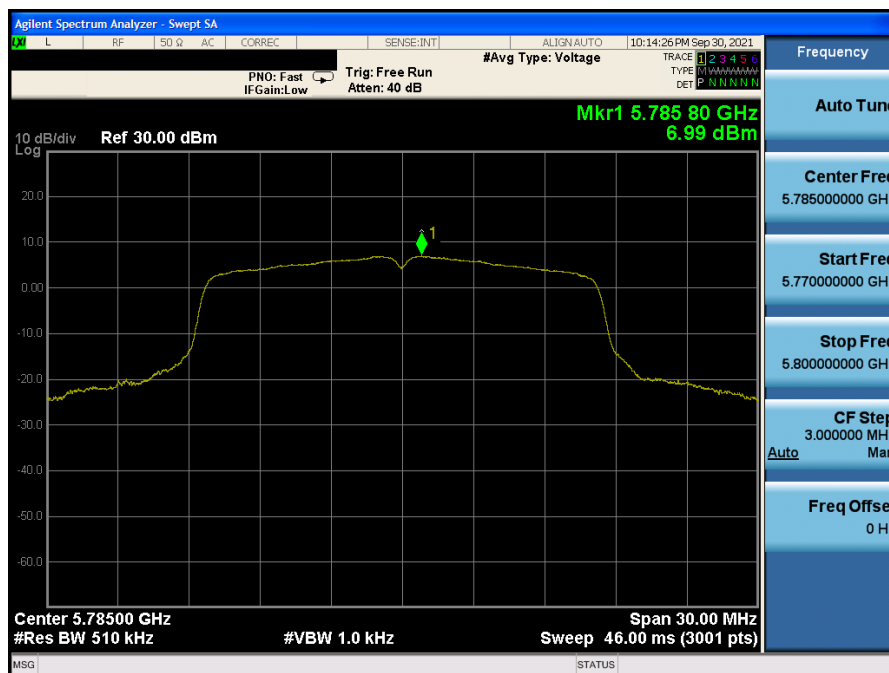
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.149



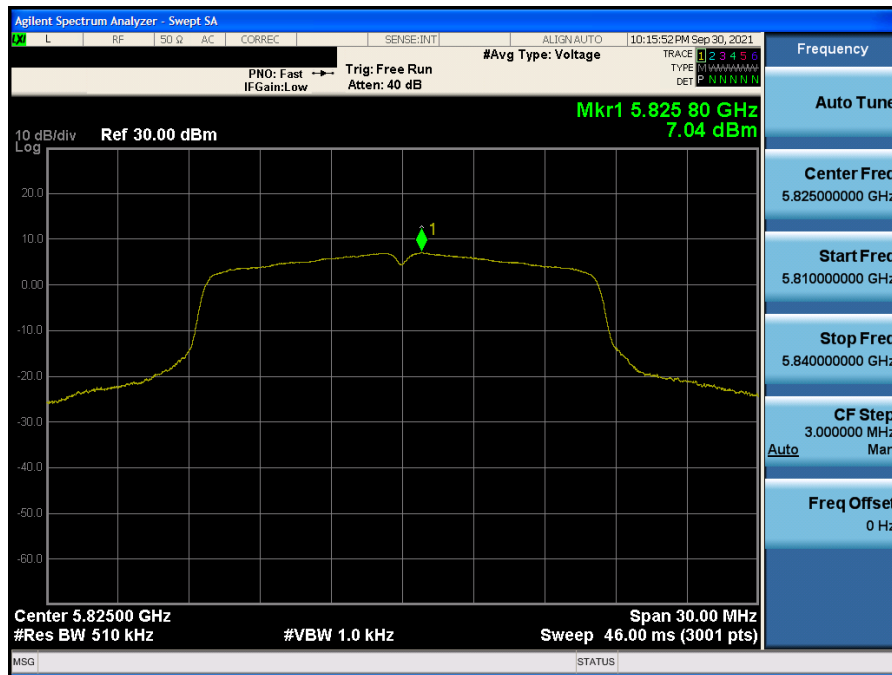
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.157



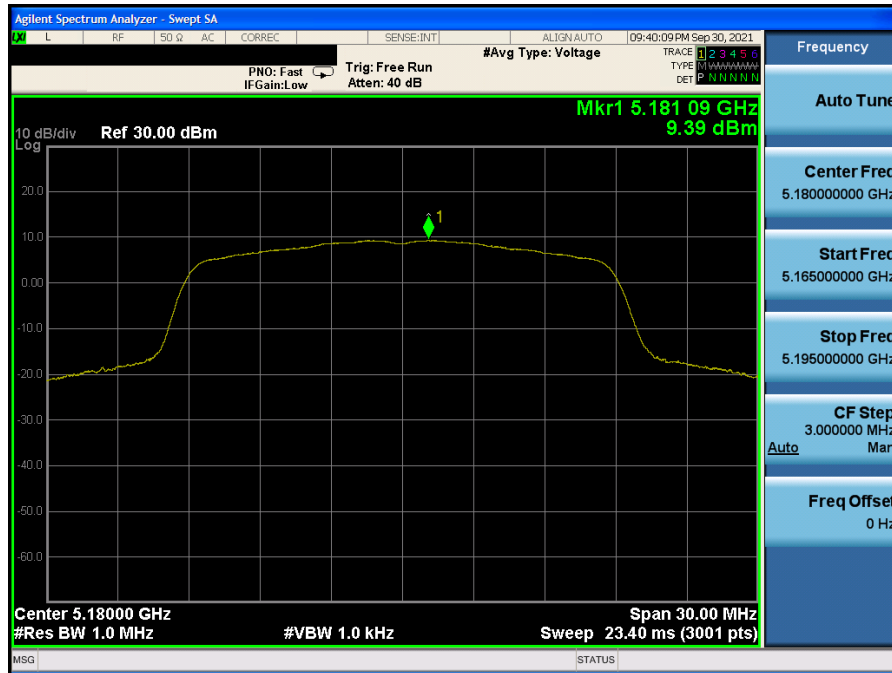
Maximum Power Spectral Density

Test Mode: TM 1 & Ch.165



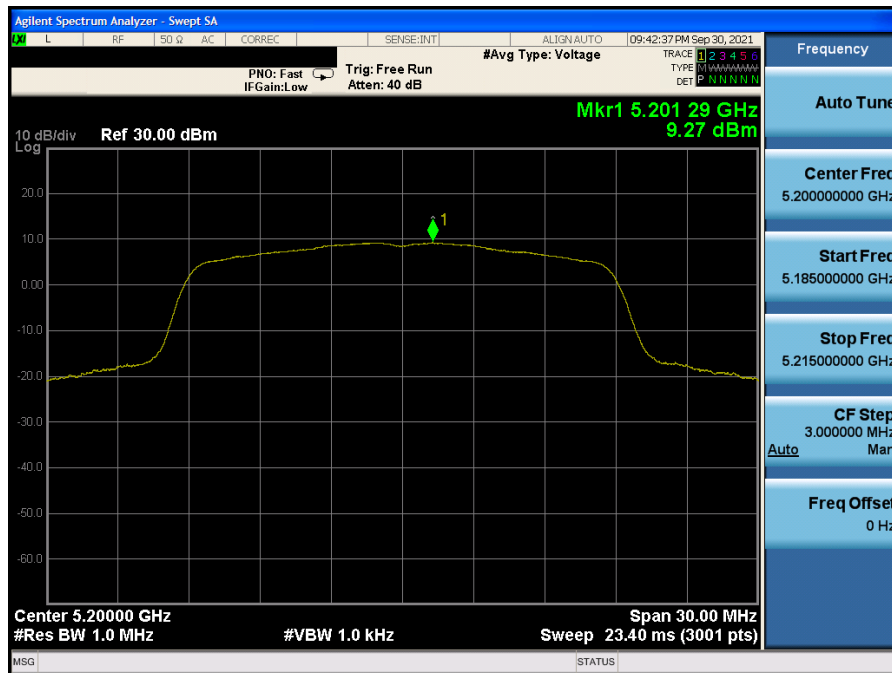
Maximum Power Spectral Density

Test Mode: TM 2 & Ch.36

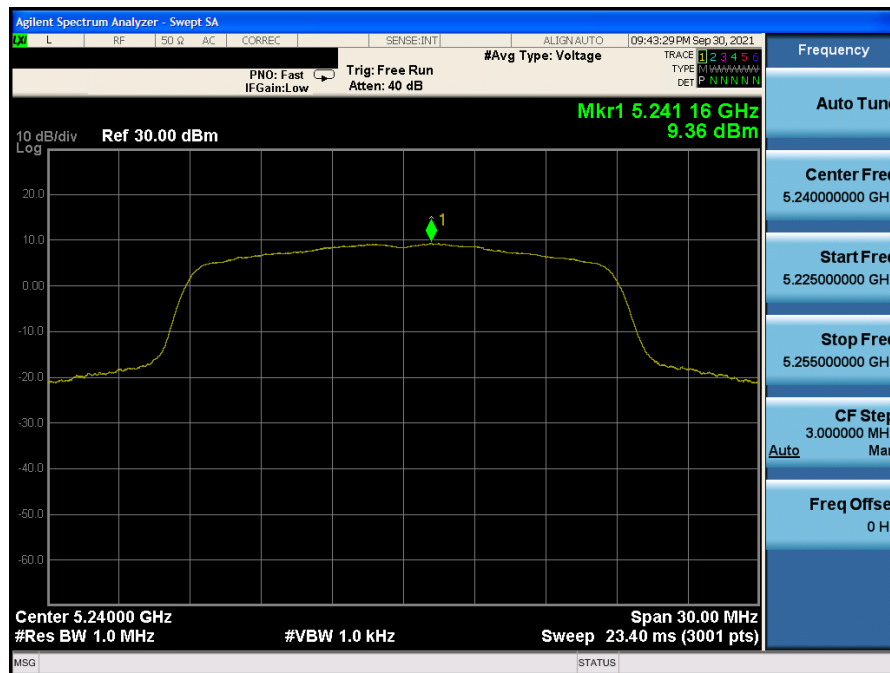


Maximum Power Spectral Density

Test Mode: TM 2 & Ch.40

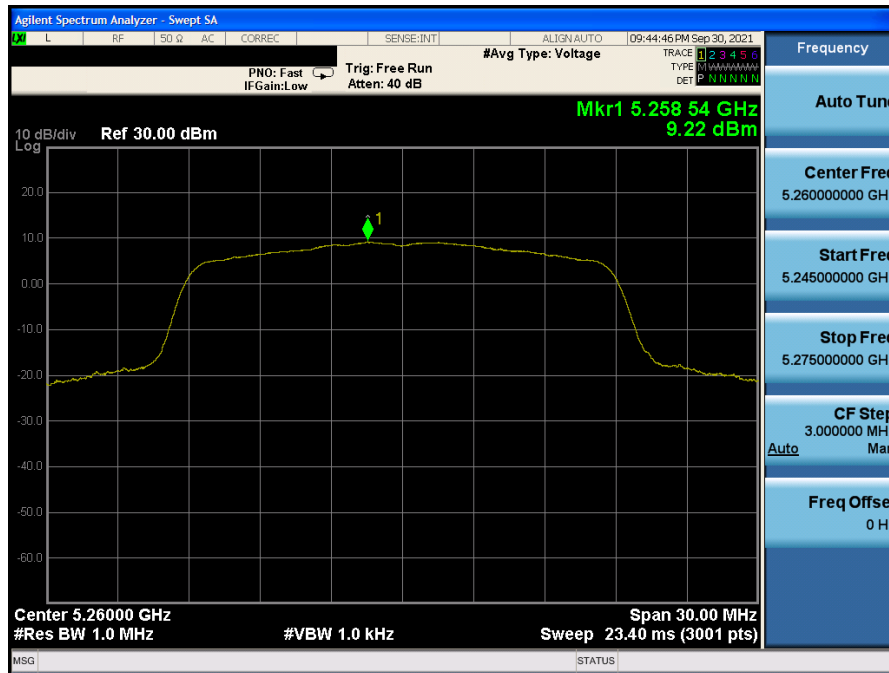


Test Mode: TM 2 & Ch.48



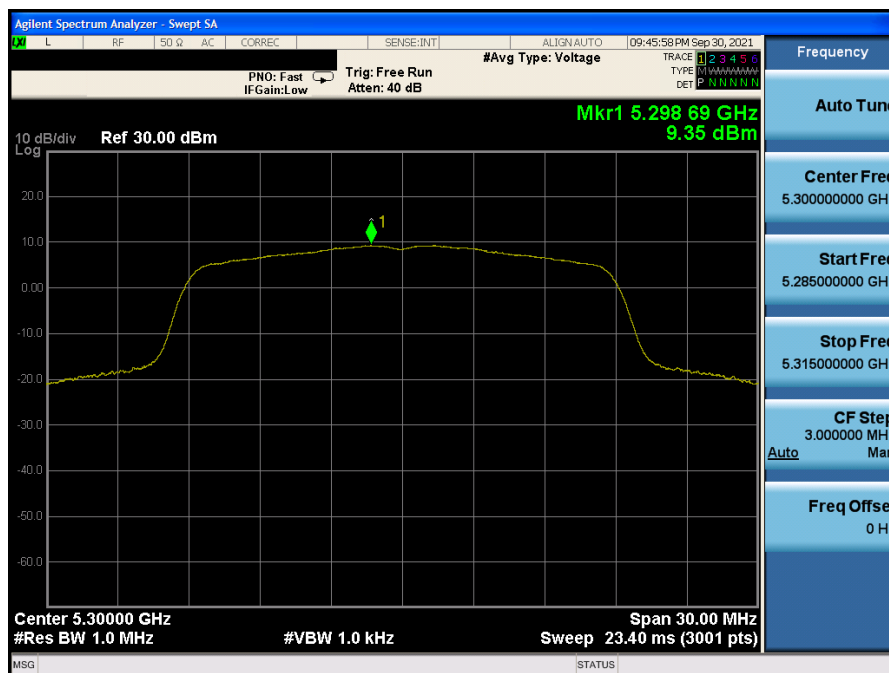
Maximum Power Spectral Density

Test Mode: TM 2 & Ch.52



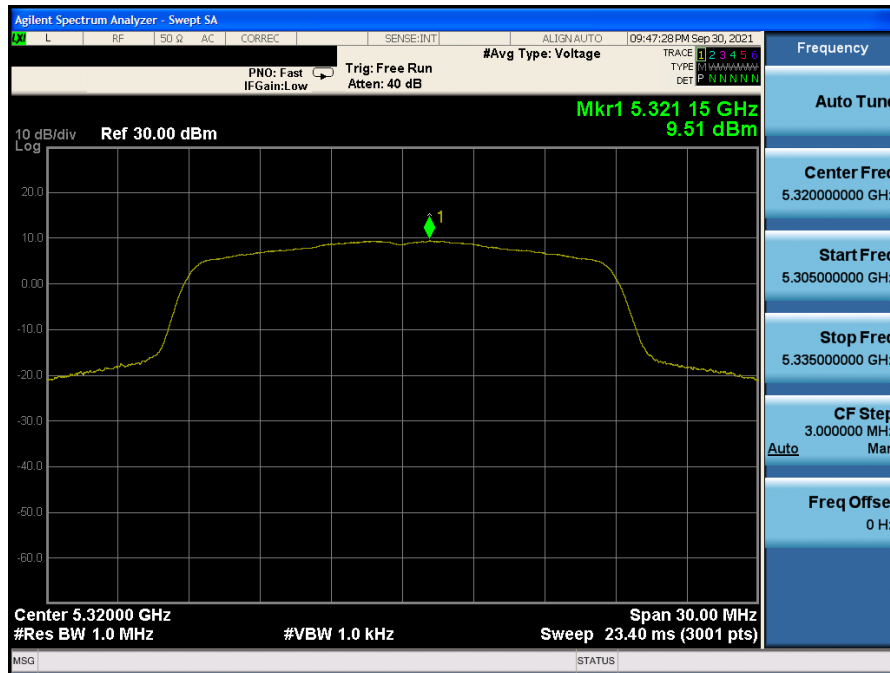
Maximum Power Spectral Density

Test Mode: TM 2 & Ch.60



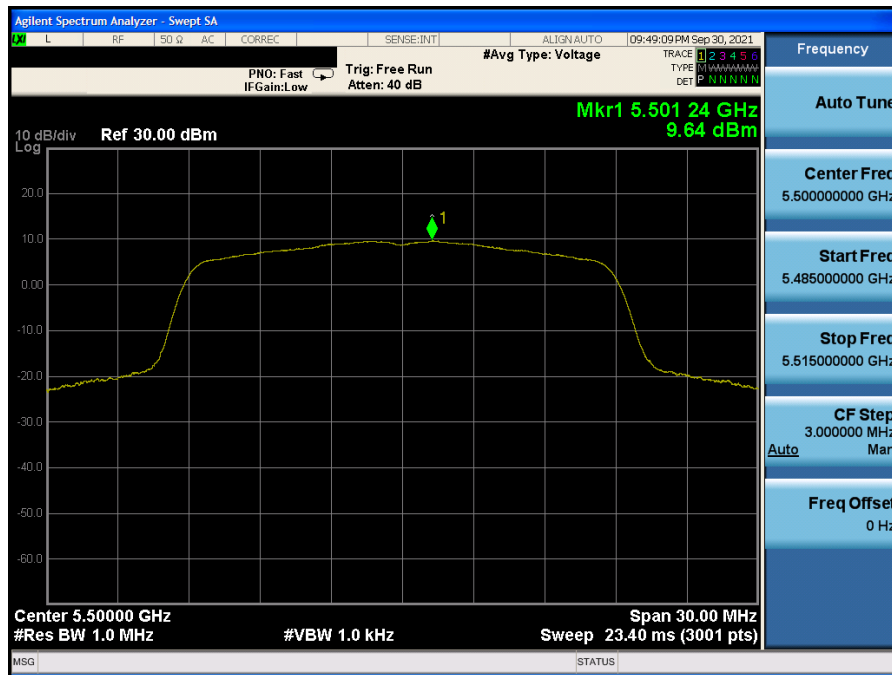
Maximum Power Spectral Density

Test Mode: TM 2 & Ch.64



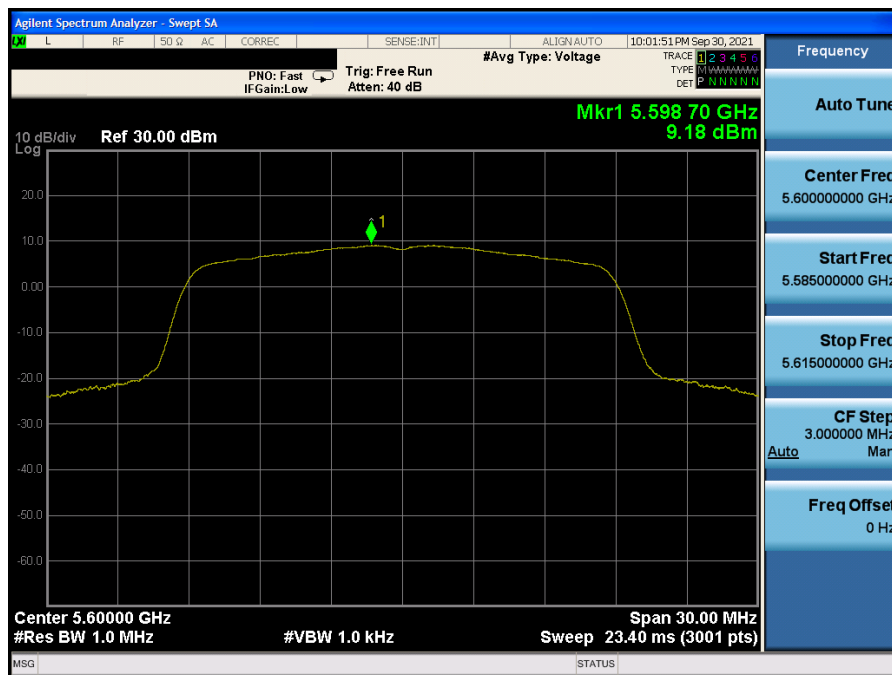
Maximum Power Spectral Density

Test Mode: TM 2 & Ch.100



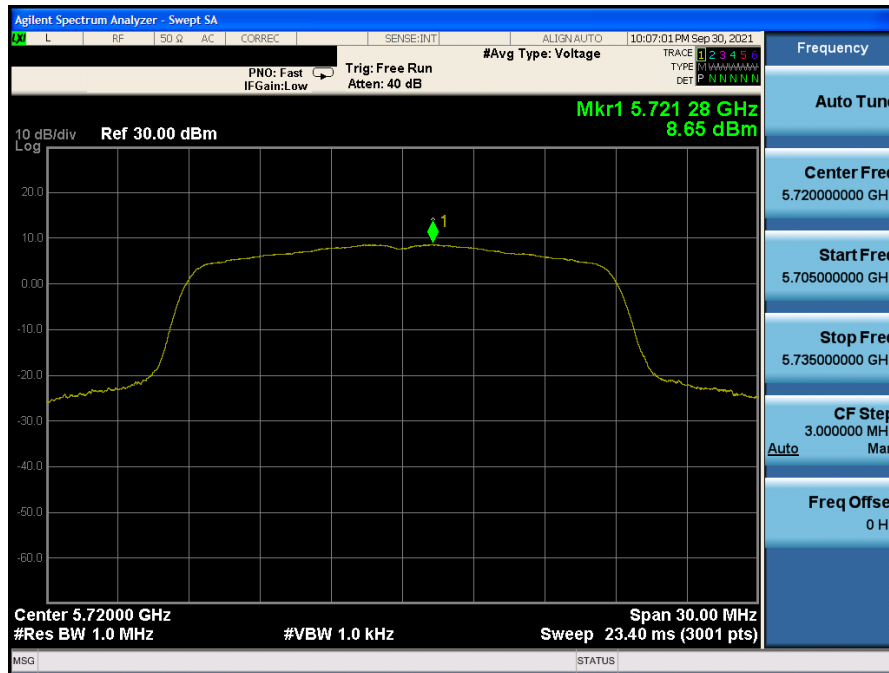
Maximum Power Spectral Density

Test Mode: TM 2 & Ch.120



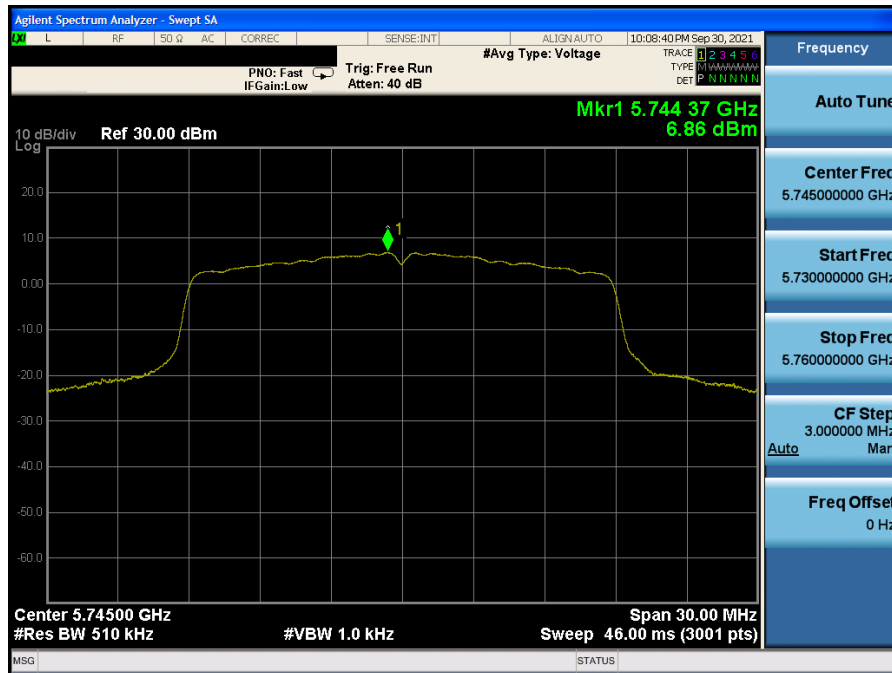
Maximum Power Spectral Density

Test Mode: TM 2 & Ch.144



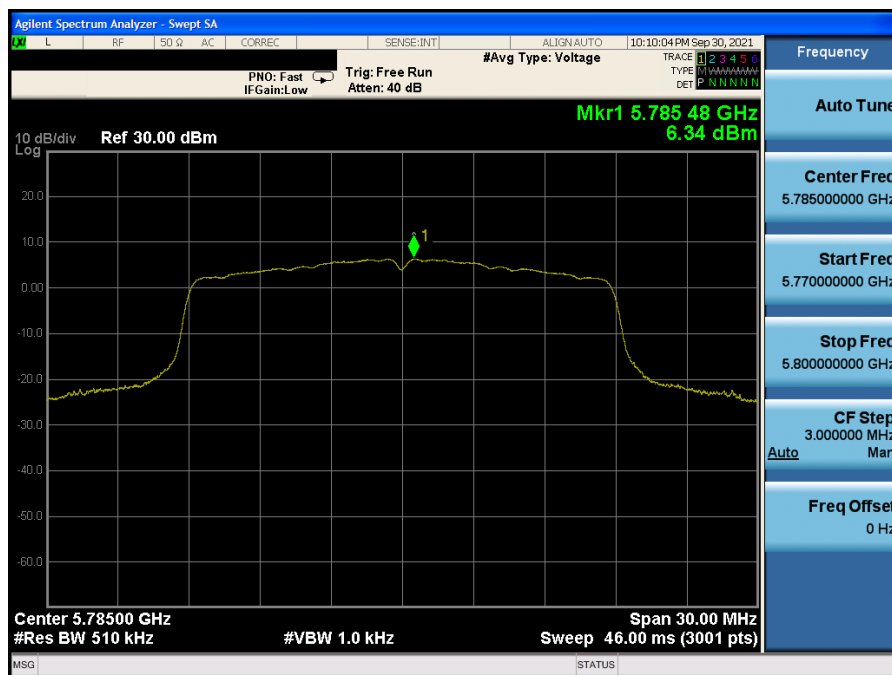
Maximum Power Spectral Density

Test Mode: TM 2 & Ch.149



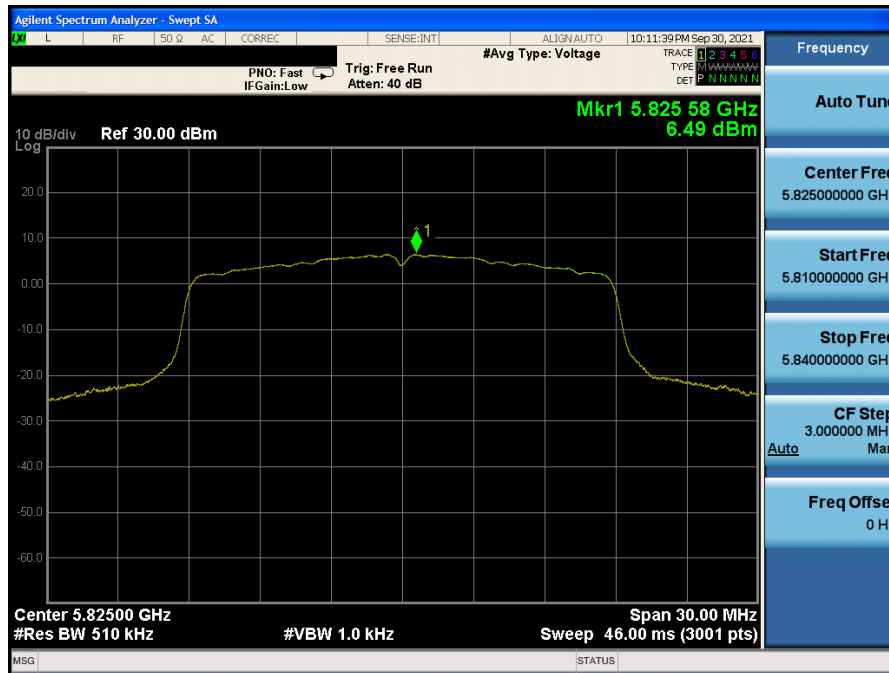
Maximum Power Spectral Density

Test Mode: TM 2 & Ch.157



Maximum Power Spectral Density

Test Mode: TM 2 & Ch.165



5.5 Unwanted Emissions

■ Test Requirements

- Part 15.407(b)

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: Radiated emission limits; general requirement.

Frequency (MHz)	FCC Limit (uV/m)	Measurement Distance (m)
0.009 – 0.490	2 400 / F (kHz)	300
0.490 – 1.705	2 4000 / F (kHz)	30
1.705 – 30.0	30	30

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

- 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 ~ 1240	3 345.8 ~ 3 358		
			3 600 ~ 4 400		

■ Test Configuration

Refer to the APPENDIX I.

■ 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 VB)

- a) RBW = 1 MHz.
- b) Video bandwidth:
 - 1) If the EUT is configured to transmit with $D \geq 98\%$, then set $VBW \leq RBW / 100$ (i.e., 10 kHz), but not less than 10 Hz.
 - 2) If the EUT D is $< 98\%$, then set $VBW \geq 1 / T$, where T is defined in item a1) of 12.2.
- c) Video bandwidth mode or display mode:
 - 1) The instrument shall be set with video filtering applied in the power domain. Typically, this requires setting the detector mode to RMS (power averaging) and setting the average-VBW type to power (rms).
 - 2) As an alternative, the instrument may be set to linear detector mode. Video filtering shall be applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode to accomplish this. Others have a setting for average-VBW type, which can be set to “voltage” regardless of the display mode.
- d) Detector = peak.
- e) Sweep time = auto.
- f) Trace mode = max hold.
- g) Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98% duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of 1/x, where D is the duty cycle. For example, use at least 200 traces if the duty cycle is 25%. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 50 traces should be averaged.)

Test Results

Test Notes

- The radiated emissions were investigated 9 kHz to 40 GHz. And no other spurious and harmonic emissions were found below listed frequencies.
- 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 = $40 \log(\text{tested distance} / \text{specified distance})$
At frequencies at or above 30 MHz = $20 \log(\text{tested distance} / \text{specified distance})$
When distance factor is "N/A", the measurements were performed at the specified distance and distance factor is not applied.
- Sample Calculation.
 $\text{Margin} = \text{Limit} - \text{Result} / \text{Result} = \text{Reading} + \text{TF} + \text{DCCF} + \text{DCF} / \text{TF} = \text{AF} + \text{CL} + \text{HL} + \text{AL} - \text{AG}$
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
- The limit is converted to field strength.
 $E(\text{dBuV/m}) = \text{EIRP}(\text{dBm}) + 95.2 \text{ dB} = -27 \text{ dBm} + 95.2 = 68.2 \text{ dBuV/m}$

Unwanted Emissions data(9 kHz ~ 40 GHz) : TM1

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	5 180	5 149.76	H	Z	PK	52.53	2.63	N/A	N/A	55.16	74.00	18.84
		5 149.85	H	Z	AV	42.43	2.63	N/A	N/A	45.06	54.00	8.94
		10 363.51	H	X	PK	42.75	8.66	N/A	N/A	51.41	68.20	16.79
	5 200	10 394.35	H	X	PK	43.70	8.67	N/A	N/A	52.37	68.20	15.83
	5 240	10 467.41	H	X	PK	43.81	8.70	N/A	N/A	52.51	68.20	15.69
U-NII 2A	5 260	10 507.57	H	X	PK	43.03	8.71	N/A	N/A	51.74	68.20	16.46
	5 300	10 610.27	H	X	PK	42.63	8.58	N/A	N/A	51.21	74.00	22.79
		10 610.59	H	X	AV	32.85	8.58	N/A	N/A	41.43	54.00	12.57
	5 320	5 350.24	H	Z	PK	55.09	3.77	N/A	N/A	58.86	74.00	15.14
		5 350.01	H	Z	AV	43.08	3.77	N/A	N/A	46.85	54.00	7.15
		10 639.73	H	X	PK	42.83	8.46	N/A	N/A	51.29	74.00	22.71
		10 640.23	H	X	AV	31.93	8.46	N/A	N/A	40.39	54.00	13.61
U-NII 2C	5 500	5 459.55	H	Z	PK	53.25	3.55	N/A	N/A	56.80	74.00	17.20
		5 459.85	H	Z	AV	42.34	3.55	N/A	N/A	45.89	54.00	8.11
		5 469.05	H	Z	PK	57.48	3.52	N/A	N/A	61.00	68.20	7.20
		11 016.06	H	X	PK	44.73	8.10	N/A	N/A	52.83	74.00	21.17
		11 016.06	H	X	AV	33.29	8.10	N/A	N/A	41.39	54.00	12.61
	5 600	11 198.61	H	X	PK	43.57	8.50	N/A	N/A	52.07	74.00	21.93
		11 198.02	H	X	AV	33.21	8.50	N/A	N/A	41.71	54.00	12.29
	5 720	11 441.12	H	X	PK	44.13	9.01	N/A	N/A	53.14	74.00	20.86
		11 440.18	H	X	AV	32.88	9.01	N/A	N/A	41.89	54.00	12.11
U-NII 3	5 745	5 714.09	H	Z	PK	57.21	3.21	N/A	N/A	60.42	68.20	7.78
		5 724.62	H	Z	PK	66.99	3.72	N/A	N/A	70.71	78.20	7.49
		11 490.82	H	X	PK	43.68	9.08	N/A	N/A	52.76	74.00	21.24
		11 490.86	H	X	AV	33.19	9.08	N/A	N/A	42.27	54.00	11.73
	5 785	11 571.29	H	X	PK	43.36	9.11	N/A	N/A	52.47	74.00	21.53
		11 570.90	H	X	AV	32.87	9.11	N/A	N/A	41.98	54.00	12.02
	5 825	5 850.53	H	Z	PK	66.35	4.05	N/A	N/A	70.40	78.20	7.80
		5 862.35	H	Z	PK	56.60	4.24	N/A	N/A	60.84	68.20	7.36
		11 650.39	H	X	PK	44.60	9.02	N/A	N/A	53.62	74.00	20.38
		11 649.58	H	X	AV	33.44	9.03	N/A	N/A	42.47	54.00	11.53

Unwanted Emissions data(9 kHz ~ 40 GHz) : TM2

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	5 180	5 149.66	H	Z	PK	55.10	2.63	N/A	N/A	57.73	74.00	16.27
		5 149.86	H	Z	AV	44.26	2.63	N/A	N/A	46.89	54.00	7.11
		10 359.05	H	Z	PK	44.00	8.66	N/A	N/A	52.66	68.20	15.54
	5 200	10 413.29	H	Z	PK	44.18	8.68	N/A	N/A	52.86	68.20	15.34
	5 240	10 475.22	H	Z	PK	43.54	8.70	N/A	N/A	52.24	68.20	15.96
U-NII 2A	5 260	10 535.49	H	Z	PK	43.48	8.71	N/A	N/A	52.19	68.20	16.01
	5 300	10 602.16	H	Z	PK	42.89	8.61	N/A	N/A	51.50	74.00	22.50
		10 602.98	H	Z	AV	32.59	8.61	N/A	N/A	41.20	54.00	12.80
	5 320	5 350.89	H	Z	PK	59.73	3.77	N/A	N/A	63.50	74.00	10.50
		5 350.15	H	Z	AV	46.92	3.77	N/A	N/A	50.69	54.00	3.31
		10 639.82	H	Z	PK	43.00	8.46	N/A	N/A	51.46	74.00	22.54
		10 640.30	H	Z	AV	32.06	8.46	N/A	N/A	40.52	54.00	13.48
U-NII 2C	5 500	5 459.50	H	Z	PK	55.76	3.55	N/A	N/A	59.31	74.00	14.69
		5 459.80	H	Z	AV	43.14	3.55	N/A	N/A	46.69	54.00	7.31
		5 469.61	H	Z	PK	56.63	3.52	N/A	N/A	60.15	68.20	8.05
		10 998.50	H	Z	PK	43.03	8.05	N/A	N/A	51.08	74.00	22.92
		10 999.57	H	Z	AV	32.76	8.05	N/A	N/A	40.81	54.00	13.19
	5 600	11 198.87	H	Z	PK	43.59	8.50	N/A	N/A	52.09	74.00	21.91
		11 199.02	H	Z	AV	33.23	8.50	N/A	N/A	41.73	54.00	12.27
	5 720	11 439.86	H	Z	PK	45.29	9.01	N/A	N/A	54.30	74.00	19.70
		11 440.04	H	Z	AV	33.93	9.01	N/A	N/A	42.94	54.00	11.06
U-NII 3	5 745	5 714.39	H	Z	PK	57.20	3.21	N/A	N/A	60.41	68.20	7.79
		5 724.81	H	Z	PK	69.70	3.73	N/A	N/A	73.43	78.20	4.77
		11 492.92	H	Z	PK	43.26	9.08	N/A	N/A	52.34	74.00	21.66
		11 493.90	H	Z	AV	33.73	9.08	N/A	N/A	42.81	54.00	11.19
	5 785	11 564.41	H	Z	PK	43.99	9.12	N/A	N/A	53.11	74.00	20.89
		11 564.86	H	Z	AV	33.36	9.12	N/A	N/A	42.48	54.00	11.52
	5 825	5 850.23	H	Z	PK	66.87	4.04	N/A	N/A	70.91	78.20	7.29
		5 861.81	H	Z	PK	59.35	4.21	N/A	N/A	63.56	68.20	4.64
		11 648.86	H	Z	PK	44.05	9.03	N/A	N/A	53.08	74.00	20.92
		11 649.59	H	Z	AV	34.12	9.03	N/A	N/A	43.15	54.00	10.85

5.6 AC Power-Line Conducted Emissions

■ Test Requirements

Part 15.207

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 μ H/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

■ 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 $\times$ 3.5 m $\times$ 3.5 m (L $\times$ W $\times$ H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) $\times$ 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 measured spectrum plots and data for worst case result.

AC Power-Line Conducted Emissions (Graph)

Test Mode: U-NII 1 & TM 1 & 5 180 MHz

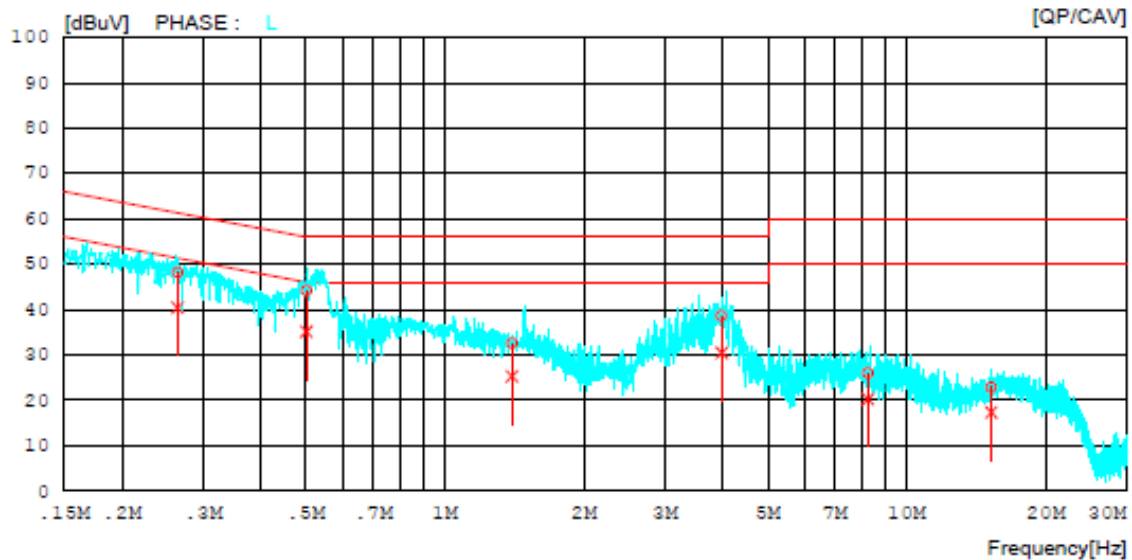
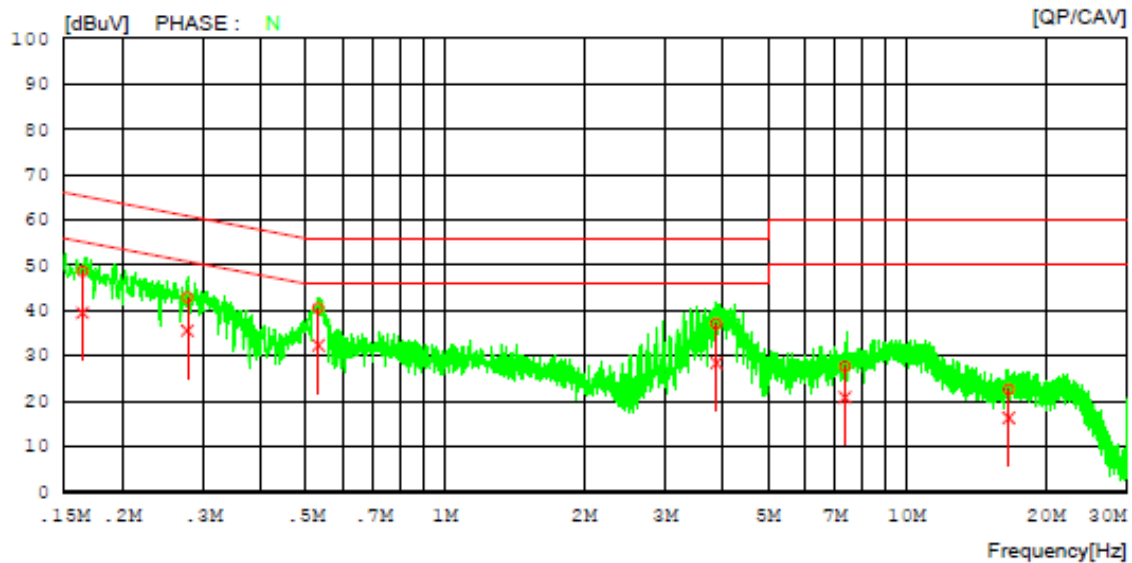
Results of Conducted Emission

DTNC

Date 2021-09-17

Order No.
Model No.
Serial No.
Test ConditionMCR-WMDBE-CWP
5.1 GHzReference No.
Power Supply
Temp/Humi.
Operator23 'C / 43 %
JaeHyeok Bang

Memo

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

AC Power-Line Conducted Emissions (Data List)

Test Mode: U-NII 1 & TM 1 & 5 180 MHz

Results of Conducted Emission

DTNC

Date 2021-09-17

Order No.

Model No.

Serial No.

Test Condition

MCR-WMDBE-CWP

5.1 GHz

Reference No.

Power Supply

Temp/Humi.

Operator

23 °C / 43 %

JaeHyeok Bang

Memo

LIMIT : FCC P15.207 QP

FCC P15.207 AV

NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	CAV [dBuV]		QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	
1	0.16429	38.67	29.64	9.90	48.57	39.54	65.24	55.24	16.67	15.70	N
2	0.27701	33.00	25.70	9.90	42.90	35.60	60.90	50.90	18.00	15.30	N
3	0.53188	30.58	22.44	9.91	40.49	32.35	56.00	46.00	15.51	13.65	N
4	3.87027	26.99	18.40	10.09	37.08	28.49	56.00	46.00	18.92	17.51	N
5	7.34756	17.42	10.70	10.20	27.62	20.90	60.00	50.00	32.38	29.10	N
6	16.64064	12.22	5.94	10.40	22.62	16.34	60.00	50.00	37.38	33.66	N
7	0.26371	38.26	30.54	9.90	48.16	40.44	61.31	51.31	13.15	10.87	L
8	0.50178	34.24	25.22	9.91	44.15	35.13	56.00	46.00	11.85	10.87	L
9	1.39965	22.45	15.19	10.05	32.50	25.24	56.00	46.00	23.50	20.76	L
10	3.97230	28.52	20.30	10.10	38.62	30.40	56.00	46.00	17.38	15.60	L
11	8.23732	15.70	9.99	10.26	25.96	20.25	60.00	50.00	34.04	29.75	L
12	15.24135	12.45	6.91	10.37	22.82	17.28	60.00	50.00	37.18	32.72	L

AC Power-Line Conducted Emissions (Graph)

Test Mode: U-NII 2A & TM 1 & 5 260 MHz

Results of Conducted Emission

DTNC

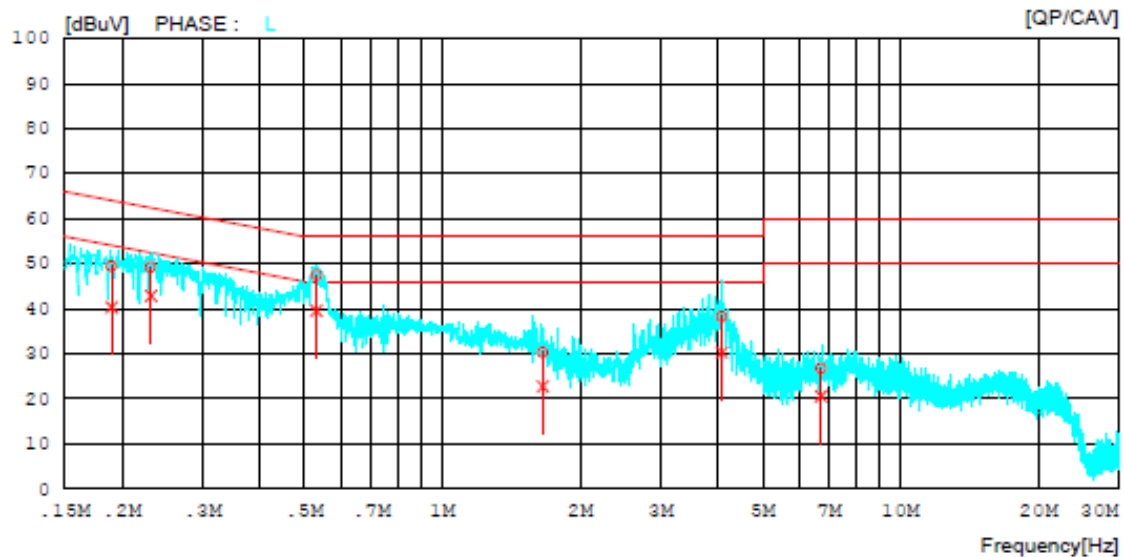
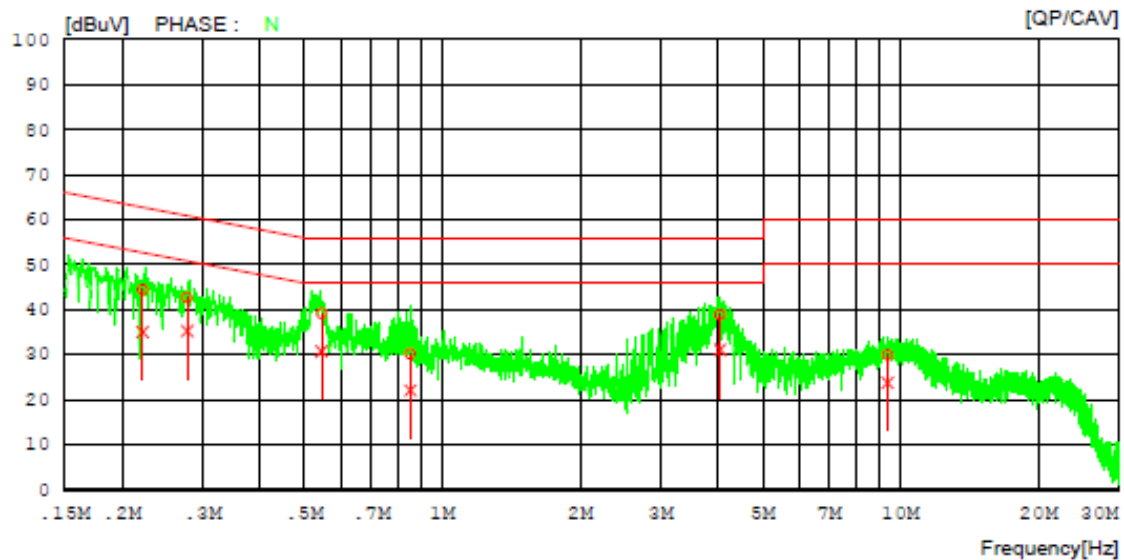
Date 2021-09-17

Order No.
Model No. MCR-WMDBE-CWP
Serial No.
Test Condition 5.3 GHz

Reference No.
Power Supply
Temp/Humi. 23 °C / 43 %
Operator JaeHyeok Bang

Memo

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



AC Power-Line Conducted Emissions (Data List)

Test Mode: U-NII 2A & TM 1 & 5 260 MHz

Results of Conducted Emission

DTNC

Date 2021-09-17

Order No.
Model No. MCR-WMDBE-CWP
Serial No.
Test Condition 5.3 GHz

Reference No.
Power Supply
Temp/Humi. 23 °C / 43 %
Operator JaeHyeok Bang

Memo

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

NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	CAV [dBuV]		QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	
1	0.22172	34.56	25.11	9.90	44.46	35.01	62.75	52.75	18.29	17.74	N
2	0.27750	32.84	25.38	9.90	42.74	35.28	60.89	50.89	18.15	15.61	N
3	0.54488	29.23	20.86	9.91	39.14	30.77	56.00	46.00	16.86	15.23	N
4	0.85161	20.25	12.17	9.93	30.18	22.10	56.00	46.00	25.82	23.90	N
5	4.03848	28.73	21.02	10.10	38.83	31.12	56.00	46.00	17.17	14.88	N
6	9.37523	19.63	13.49	10.34	29.97	23.83	60.00	50.00	30.03	26.17	N
7	0.18976	39.53	30.44	9.90	49.43	40.34	64.05	54.05	14.62	13.71	L
8	0.23101	39.29	32.98	9.90	49.19	42.88	62.41	52.41	13.22	9.53	L
9	0.53086	37.49	29.59	9.91	47.40	39.50	56.00	46.00	8.60	6.50	L
10	1.65665	20.19	12.66	10.06	30.25	22.72	56.00	46.00	25.75	23.28	L
11	4.07523	28.12	20.18	10.10	38.22	30.28	56.00	46.00	17.78	15.72	L
12	6.71415	16.56	10.41	10.17	26.73	20.58	60.00	50.00	33.27	29.42	L

AC Power-Line Conducted Emissions (Graph)

Test Mode: U-NII 2C & TM 1 & 5 500 MHz

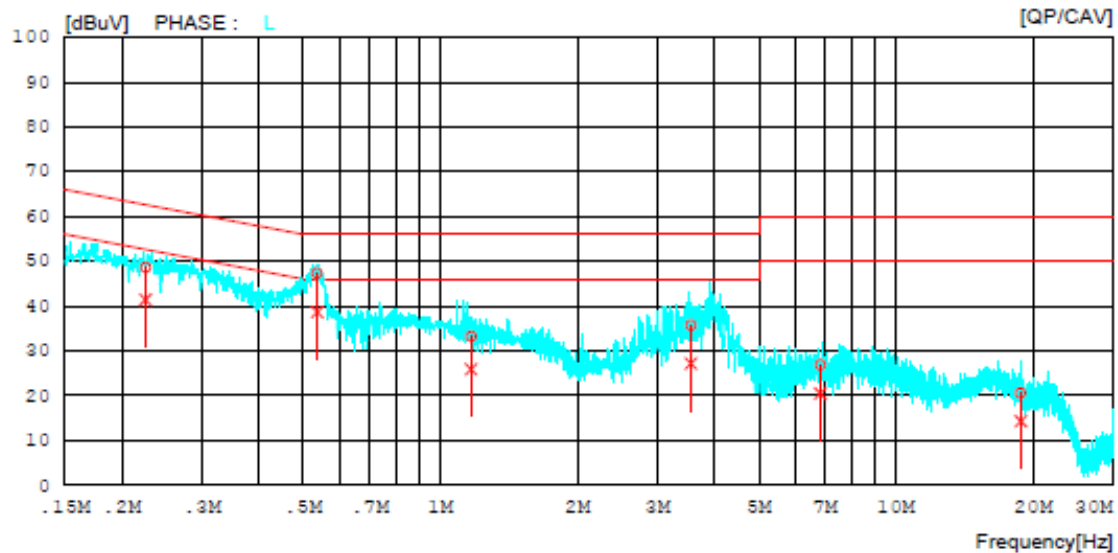
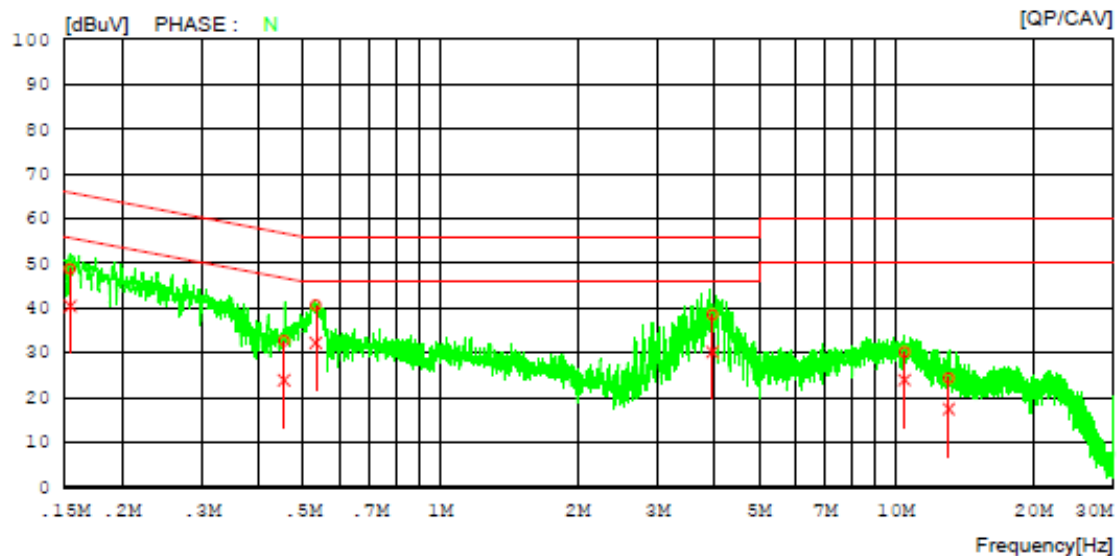
Results of Conducted Emission

DTNC

Date: 2021-09-17

Order No.
Model No.
Serial No.
Test ConditionMCR-WMDBE-CWP
5.5 GHzReference No.
Power Supply
Temp/Humi.
Operator23 'C / 43 %
JaeHyeok Bang

Memo

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

AC Power-Line Conducted Emissions (Data List)

Test Mode: U-NII 2C & TM 1 & 5 500 MHz

Results of Conducted Emission

DTNC

Date 2021-09-17

Order No.
Model No. MCR-WMDBE-CWP
Serial No.
Test Condition 5.5 GHz

Reference No.
Power Supply
Temp/Humi. 23 °C / 43 %
Operator JaeHyeok Bang

Memo

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

NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	CAV [dBuV]		QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	
1	0.15399	38.85	30.64	9.90	48.75	40.54	65.78	55.78	17.03	15.24	N
2	0.45357	22.86	14.01	9.91	32.77	23.92	56.81	46.81	24.04	22.89	N
3	0.53276	30.71	22.40	9.91	40.62	32.31	56.00	46.00	15.38	13.69	N
4	3.95719	28.38	20.13	10.10	38.48	30.23	56.00	46.00	17.52	15.77	N
5	10.44629	19.86	13.62	10.37	30.23	23.99	60.00	50.00	29.77	26.01	N
6	13.06820	14.05	7.13	10.38	24.43	17.51	60.00	50.00	35.57	32.49	N
7	0.22550	38.72	31.54	9.90	48.62	41.44	62.61	52.61	13.99	11.17	L
8	0.53650	37.38	28.71	9.91	47.29	38.62	56.00	46.00	8.71	7.38	L
9	1.16801	23.16	15.81	10.05	33.21	25.86	56.00	46.00	22.79	20.14	L
10	3.54968	25.54	17.07	10.09	35.63	27.16	56.00	46.00	20.37	18.84	L
11	6.82824	16.61	10.26	10.18	26.79	20.44	60.00	50.00	33.21	29.56	L
12	18.79908	10.08	3.88	10.44	20.52	14.32	60.00	50.00	39.48	35.68	L

AC Power-Line Conducted Emissions (Graph)

Test Mode: U-NII 3 & TM 1 & 5 745 MHz

Results of Conducted Emission

DTNC

Date 2021-09-17

Order No.

Model No.

Serial No.

Test Condition

MCR-WMDBE-CWP

5.7 GHz

Reference No.

Power Supply

Temp/Humi.

Operator

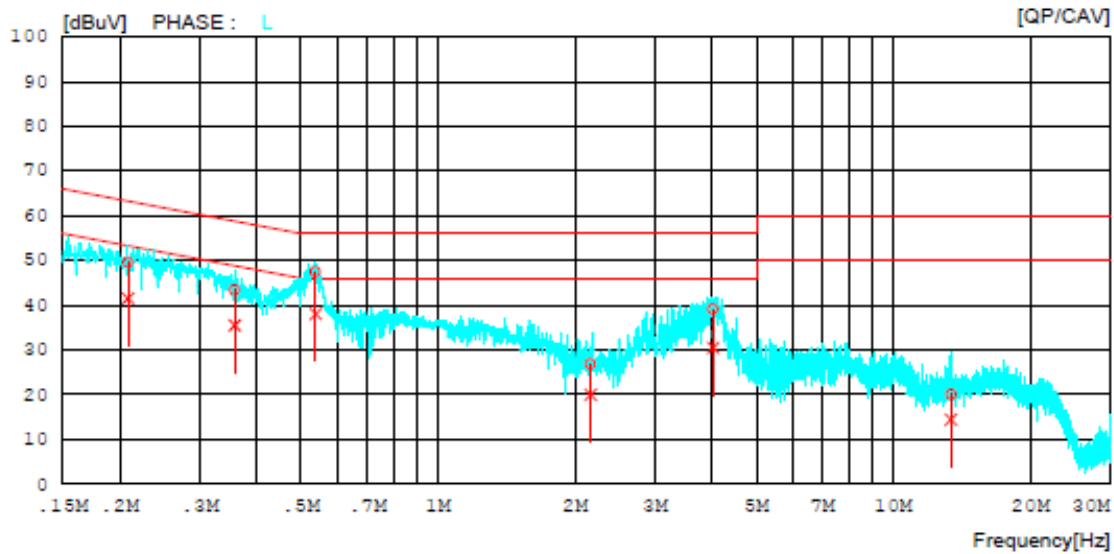
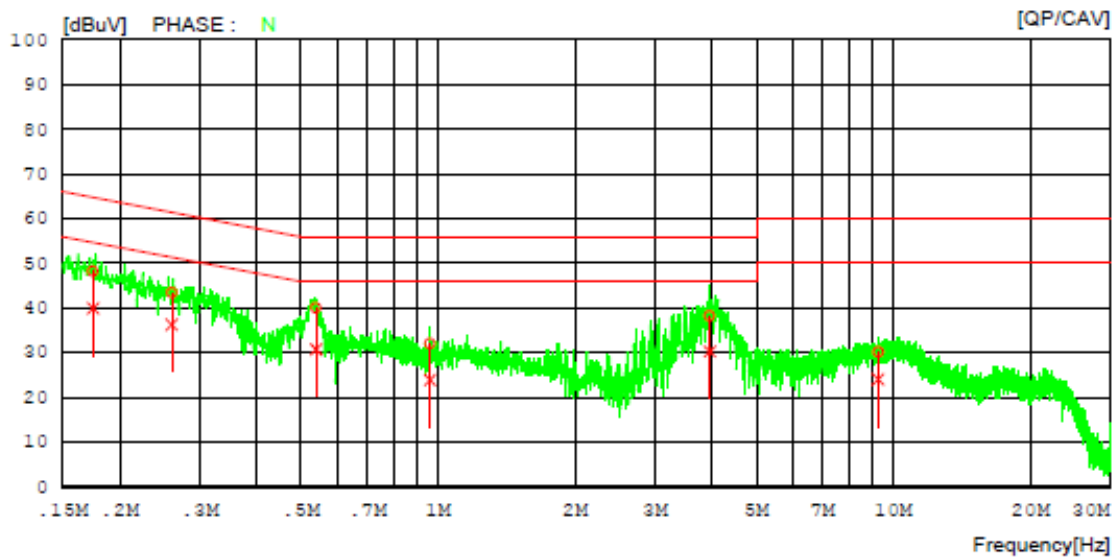
23 'C / 43 %

JaeHyeok Bang

Memo

LIMIT : FCC P15.207 QP

FCC P15.207 AV



AC Power-Line Conducted Emissions (Data List)

Test Mode: U-NII 3 & TM 1 & 5 745 MHz

Results of Conducted Emission

DTNC

Date 2021-09-17

Order No.
Model No. MCR-WMDBE-CWP
Serial No.
Test Condition 5.7 GHz

Reference No.
Power Supply
Temp/Humi. 23 'C / 43 %
Operator JaeHyeok Bang

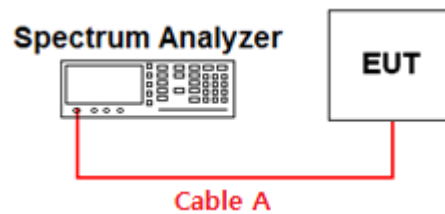
Memo

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

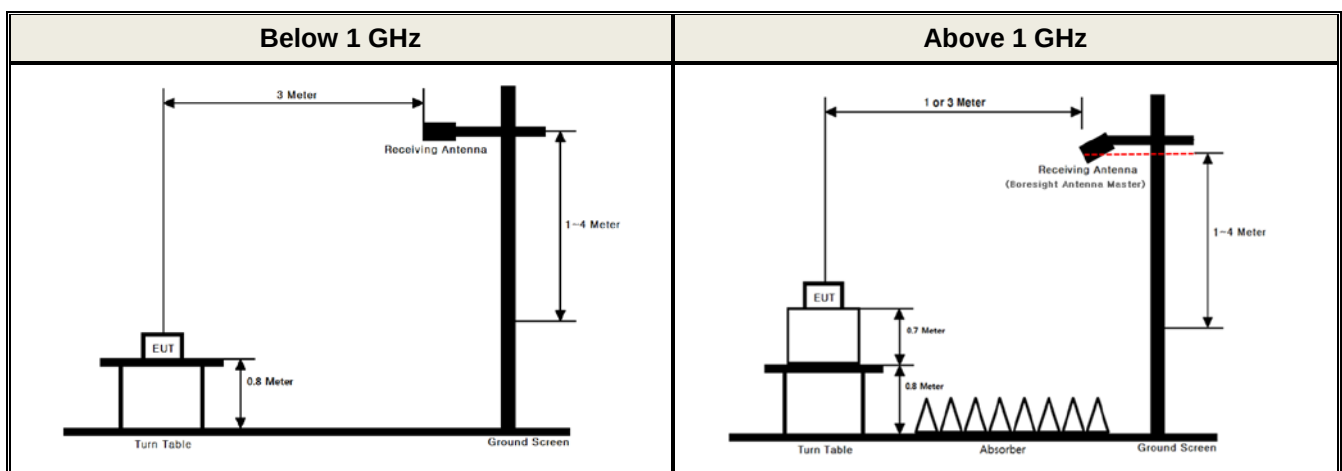
NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	CAV [dBuV]		QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	
1	0.17467	38.28	30.01	9.90	48.18	39.91	64.74	54.74	16.56	14.83	N
2	0.26012	33.56	26.42	9.90	43.46	36.32	61.43	51.43	17.97	15.11	N
3	0.53960	30.08	20.88	9.91	39.99	30.79	56.00	46.00	16.01	15.21	N
4	0.96029	22.06	13.93	10.00	32.06	23.93	56.00	46.00	23.94	22.07	N
5	3.95067	28.23	20.22	10.10	38.33	30.32	56.00	46.00	17.67	15.68	N
6	9.26913	19.89	13.73	10.33	30.22	24.06	60.00	50.00	29.78	25.94	N
7	0.20854	39.62	31.60	9.90	49.52	41.50	63.26	53.26	13.74	11.76	L
8	0.35785	33.43	25.59	9.91	43.34	35.50	58.78	48.78	15.44	13.28	L
9	0.53804	37.52	28.08	9.91	47.43	37.99	56.00	46.00	8.57	8.01	L
10	2.16323	16.75	9.89	10.07	26.82	19.96	56.00	46.00	29.18	26.04	L
11	4.02222	29.06	20.37	10.10	39.16	30.47	56.00	46.00	16.84	15.53	L
12	13.39429	9.67	3.98	10.38	20.05	14.36	60.00	50.00	39.95	35.64	L

APPENDIX I

▪ Conducted Measurement



▪ Radiated 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 $\geq$ EBW if possible; otherwise, set RBW to the largest available value.
3. Set VBW $\geq$ 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 $T \leq 16.7$ 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)

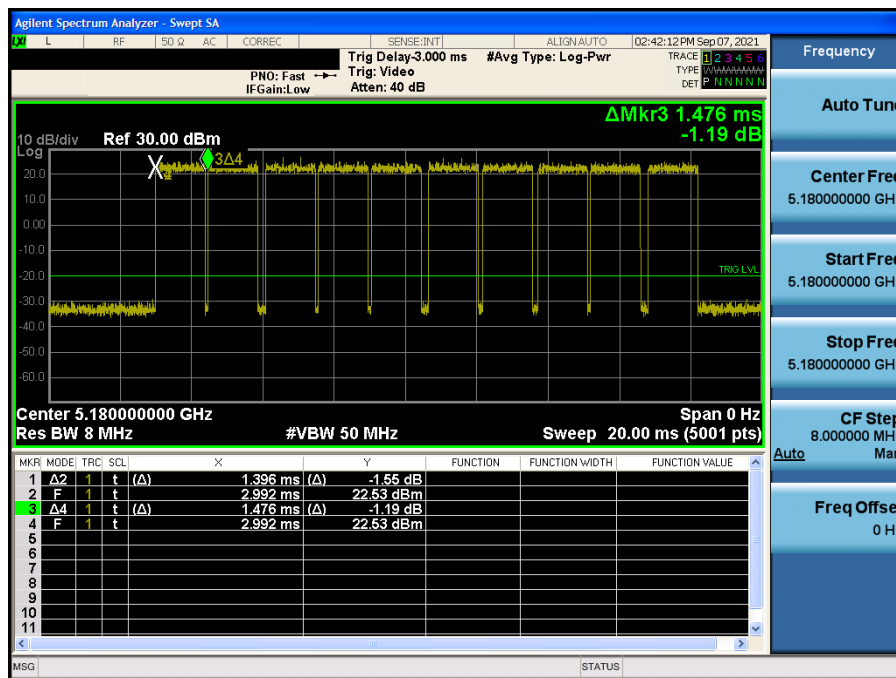
■ Test Results:

Mode	Data Rate	Tested Frequency [MHz]	Maximum Achievable Duty Cycle (x) = On / (On+Off)			50/T [kHz]	1/T [kHz]
			On Time [ms]	(On+Off) Time [ms]	x		
TM 1	6Mbps	5 180	1.396	1.476	0.945 8	35.82	0.72
TM 2	MCS 0	5 180	1.308	1.504	0.869 7	38.23	0.76

Test Plot:

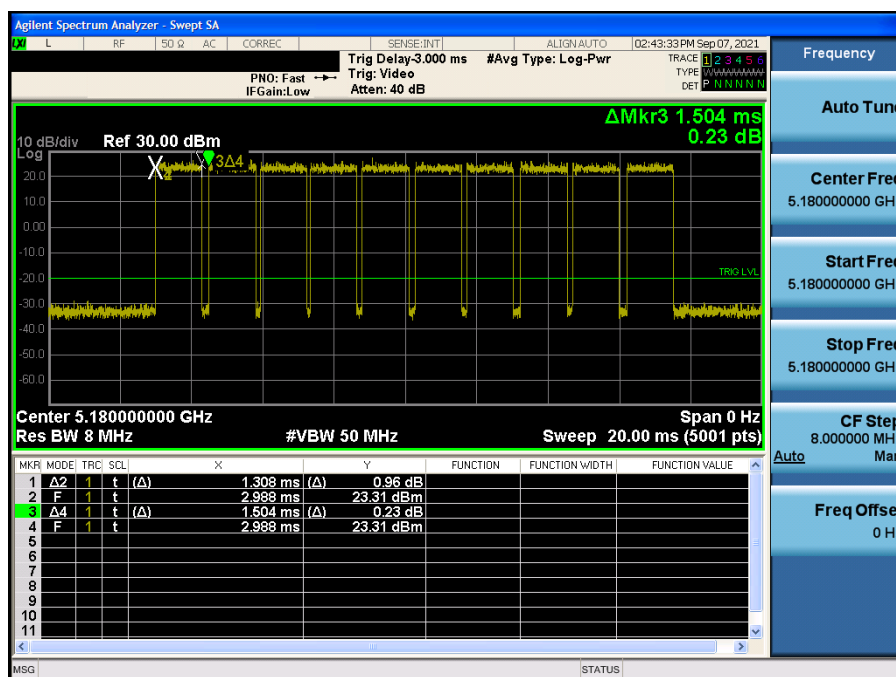
Duty Cycle

Test Mode: TM1 & Ch.36



Duty Cycle

Test Mode: TM 2 & Ch.36

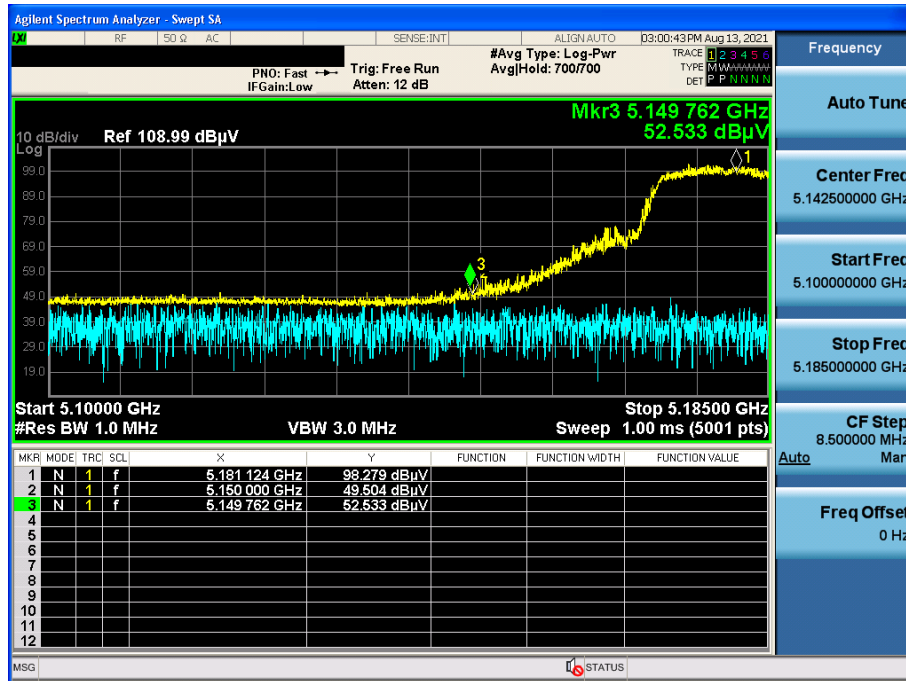


APPENDIX III

Unwanted Emissions (Radiated) Test Plot:

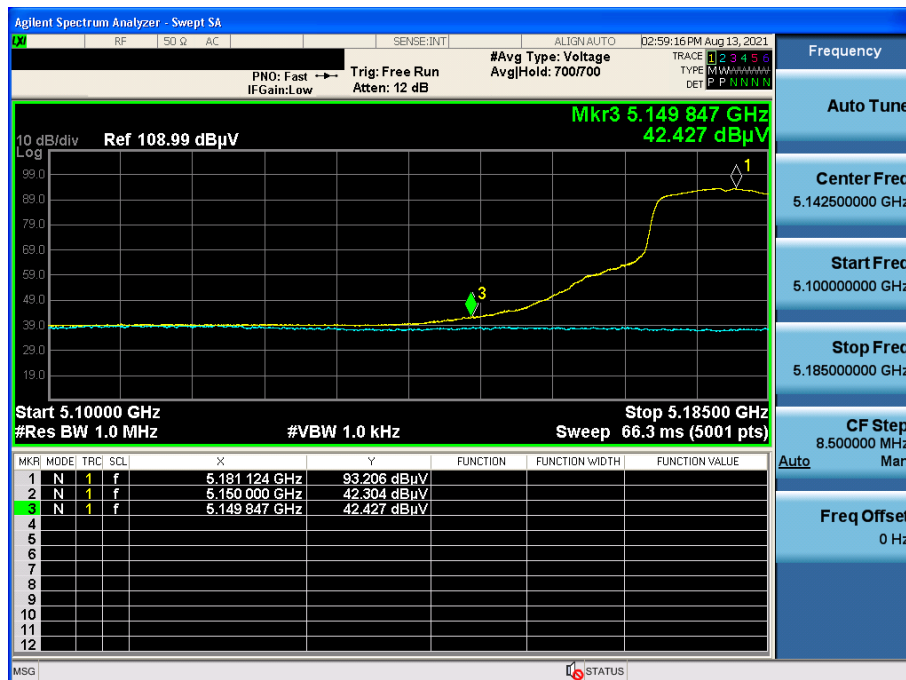
TM 1 & U-NII 1 & 5 180 & Z axis & Hor

Detector Mode : PK

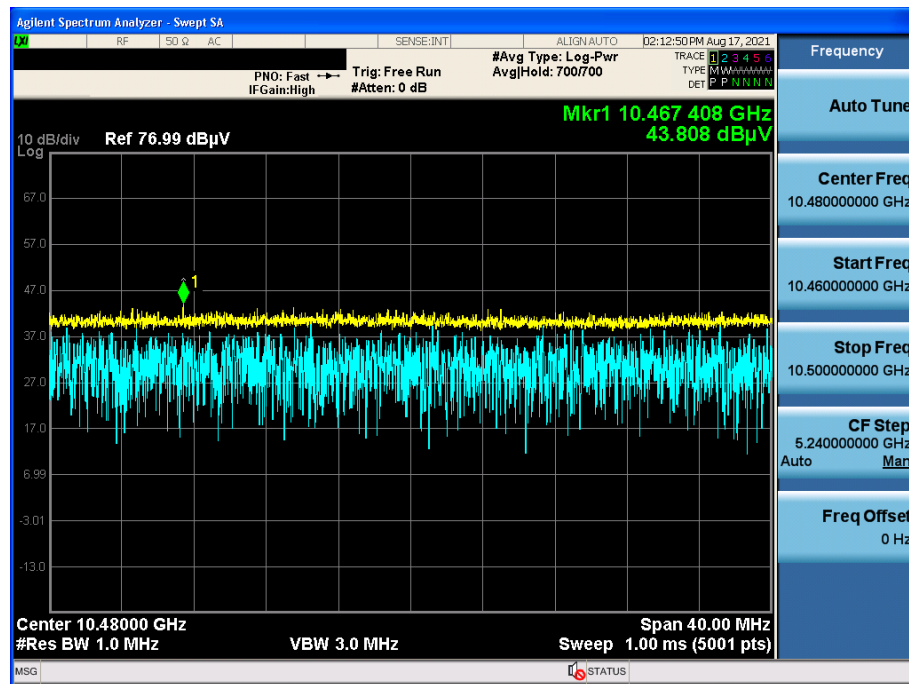


TM 1 & U-NII 1 & 5 180 & Z axis & Hor

Detector Mode : AV

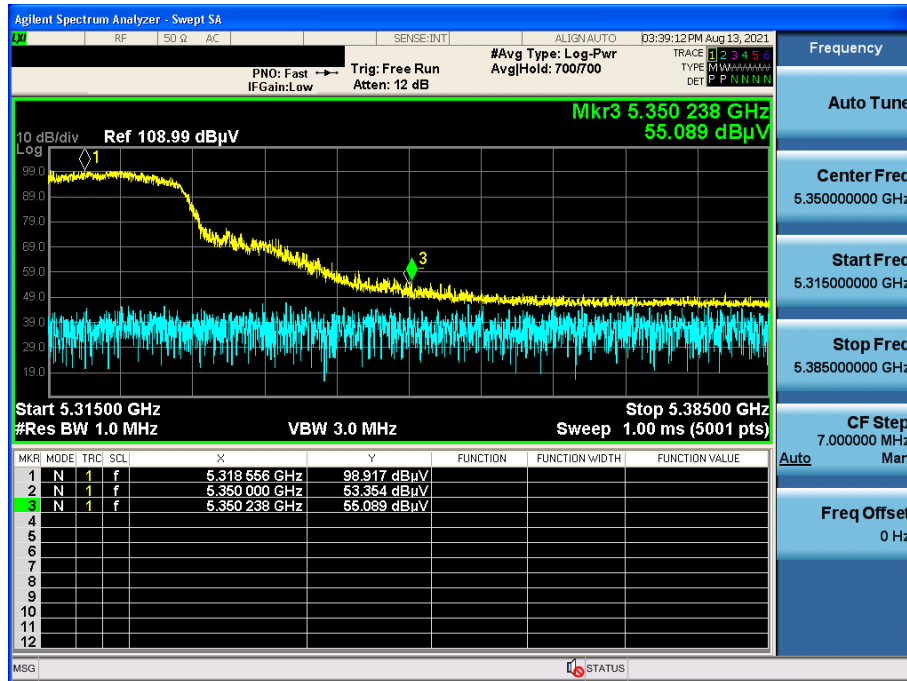


Detector Mode : PK



TM 1 & U-NII 2A & 5 320 & Z axis & Hor

Detector Mode : PK



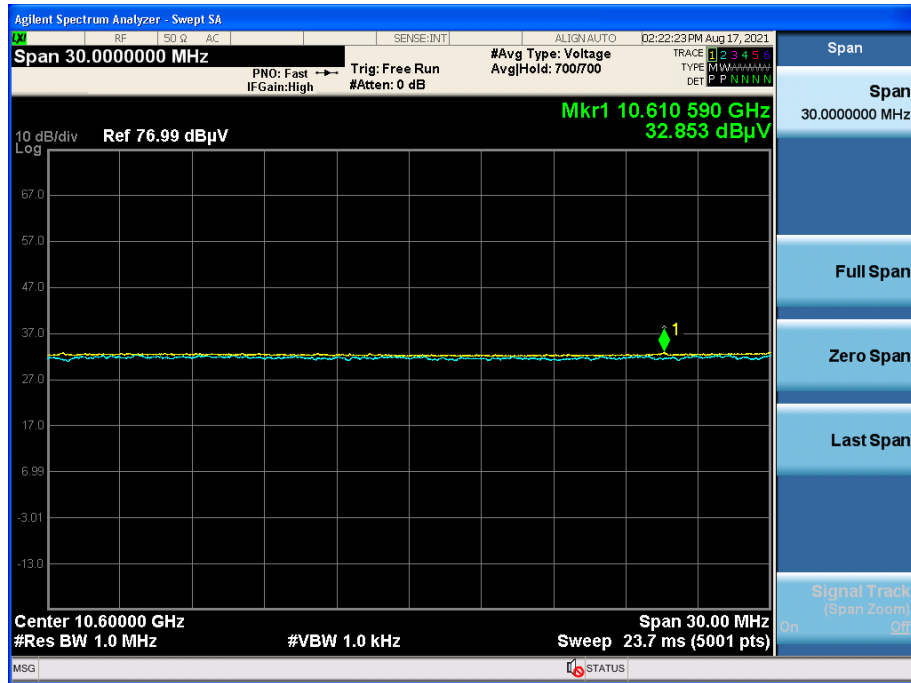
TM 1 & U-NII 2A & 5 320 & Z axis & Hor

Detector Mode : AV



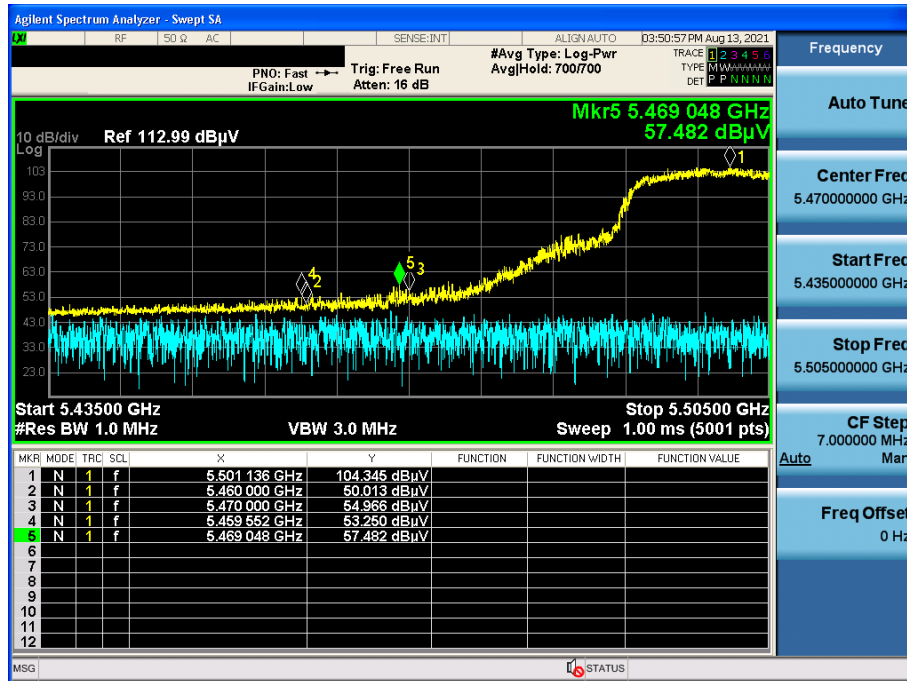
TM 1 & U-NII 2A & 5 300 & X axis & Hor

Detector Mode : AV



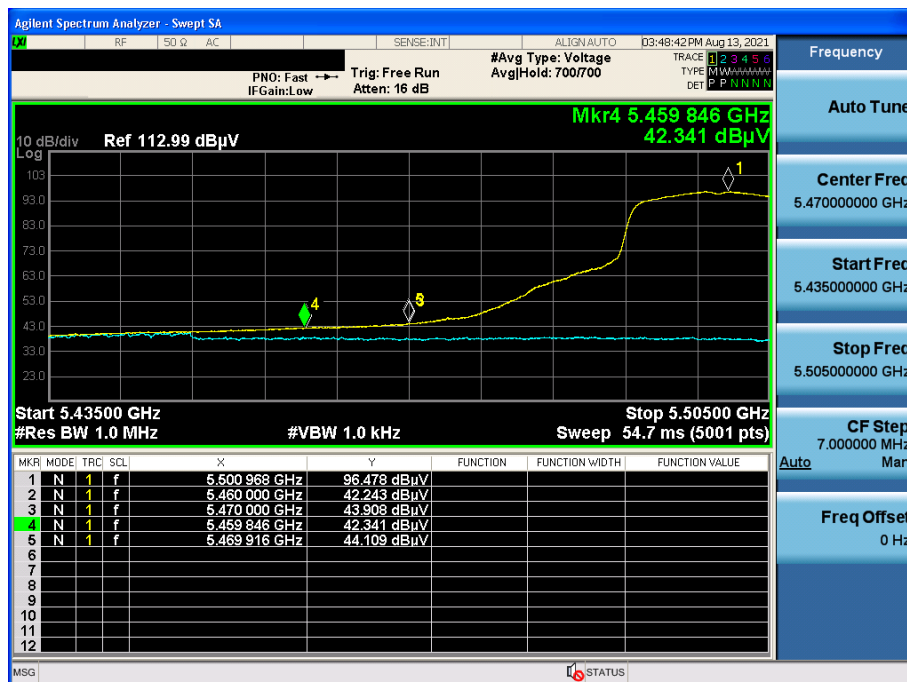
TM 1 & U-NII 2C & 5 500 & Z axis & Hor

Detector Mode : PK



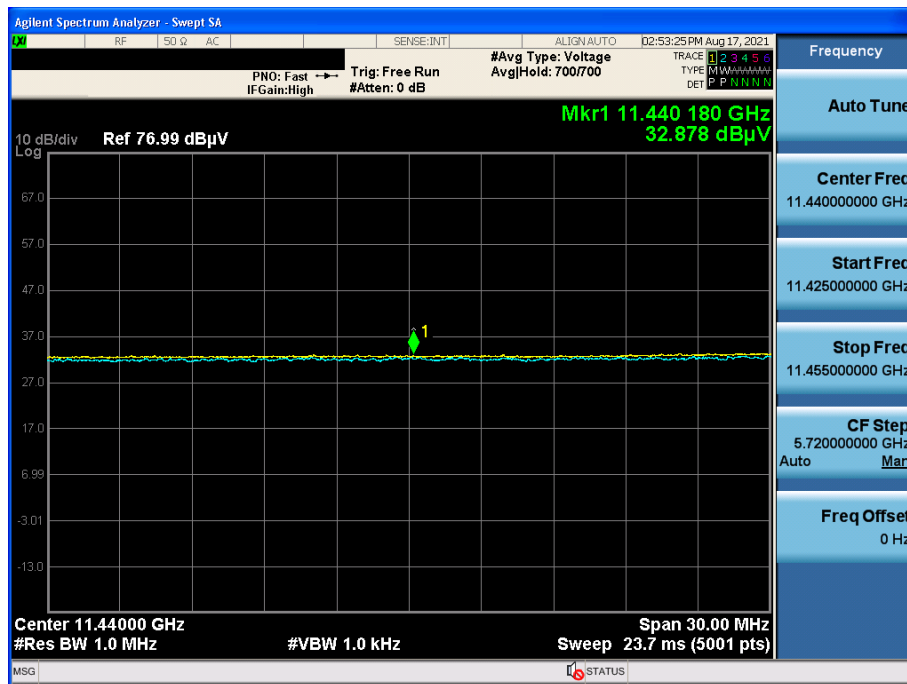
TM 1 & U-NII 2C & 5 500 & Z axis & Hor

Detector Mode : AV



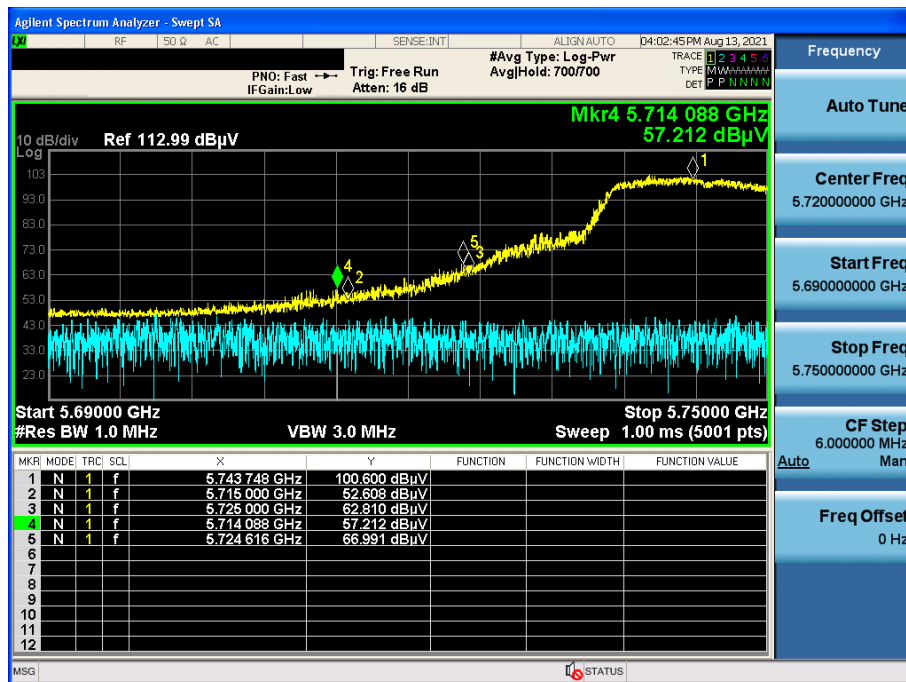
TM 1 & U-NII 2C & 5 720 & X axis & Hor

Detector Mode : AV



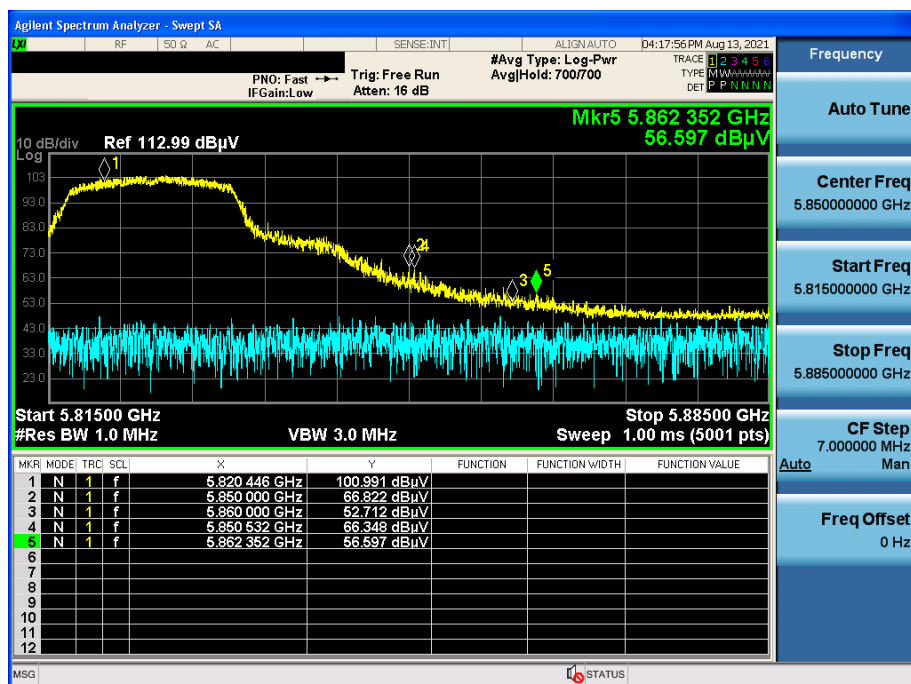
TM 1 & U-NII 3 & 5745 & Z axis & Hor

Detector Mode : PK



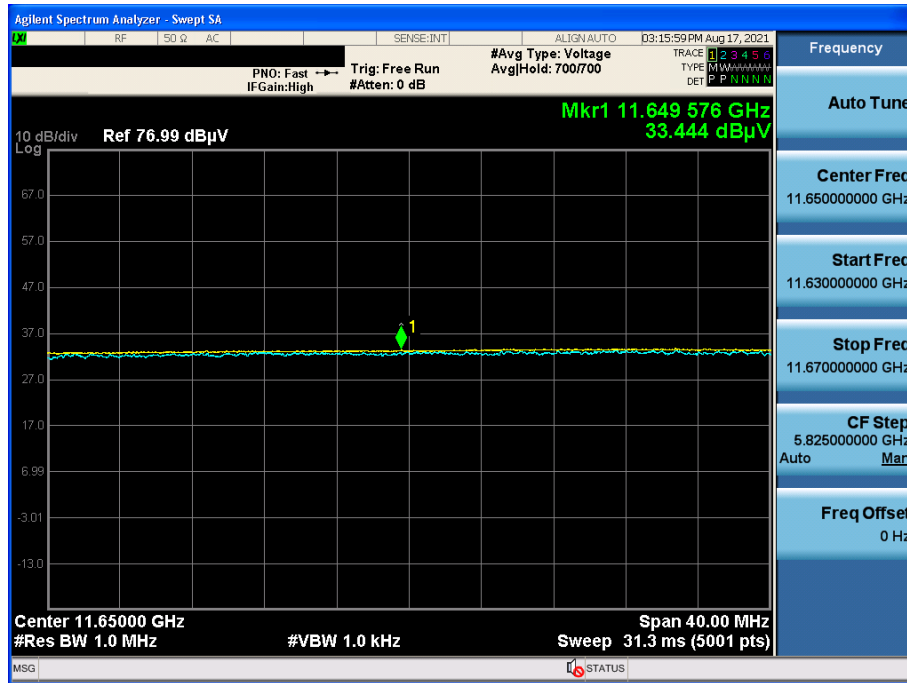
TM 1 & U-NII 3 & 5825 & Z axis & Hor

Detector Mode : PK



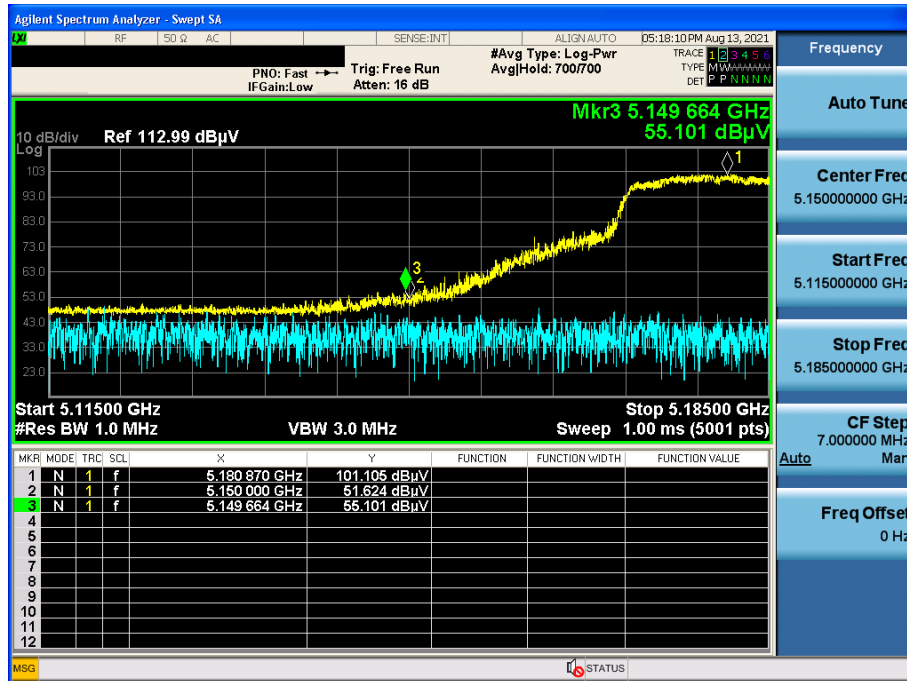
TM 1 & U-NII 3 & 5 825 & X axis & Hor

Detector Mode : AV



TM 2 & U-NII 1 & 5180 & Z axis & Hor

Detector Mode : PK



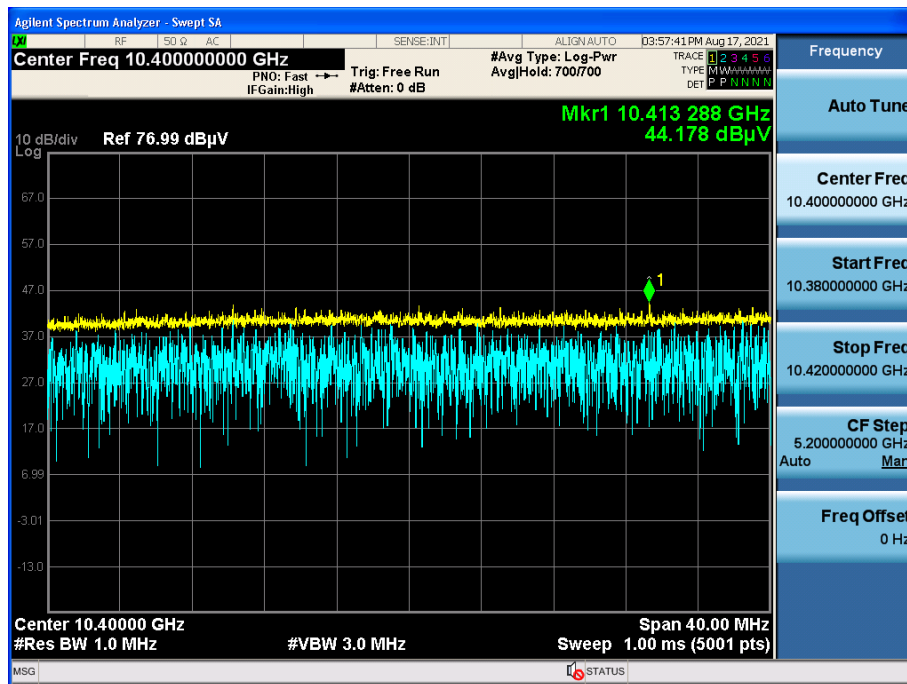
TM 2 & U-NII 1 & 5180 & Z axis & Hor

Detector Mode : AV



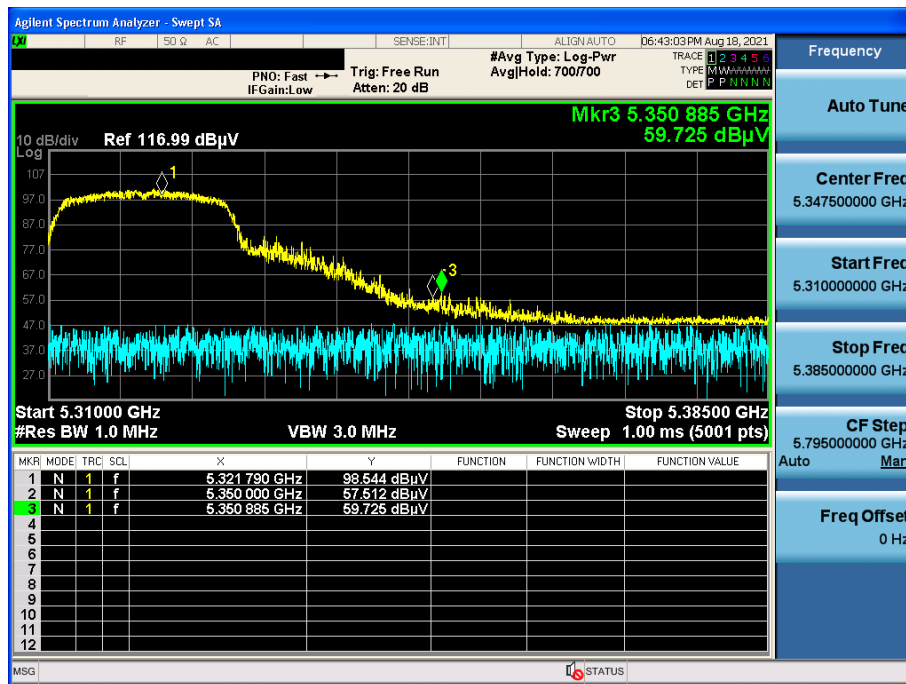
TM 2 & U-NII 1 & 5 200 & Z axis & Hor

Detector Mode : PK



TM 2 & U-NII 2A & 5 320 & Z axis & Hor

Detector Mode : PK



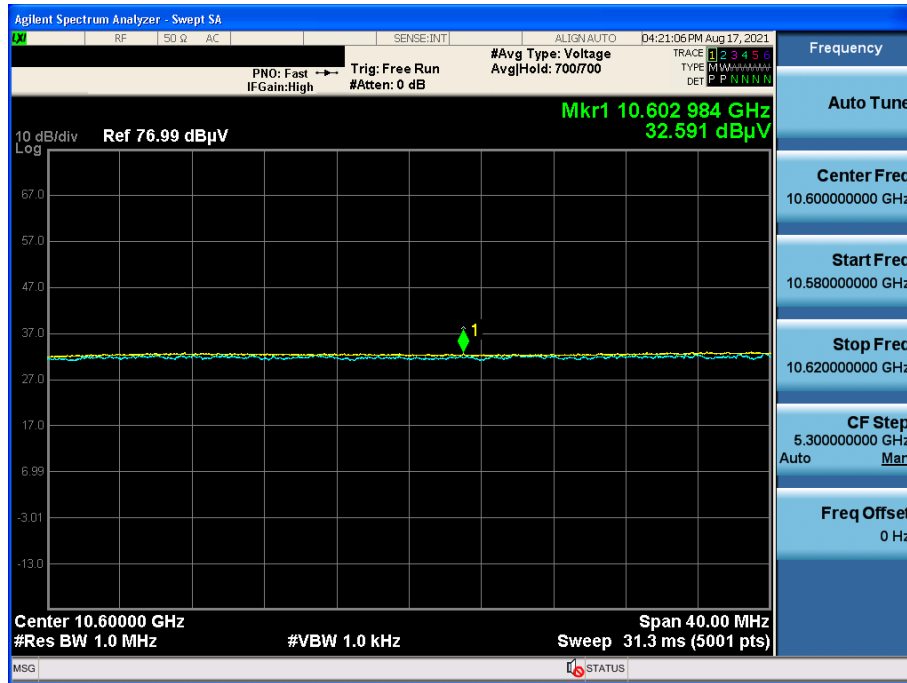
TM 2 & U-NII 2A & 5 320 & Z axis & Hor

Detector Mode : AV

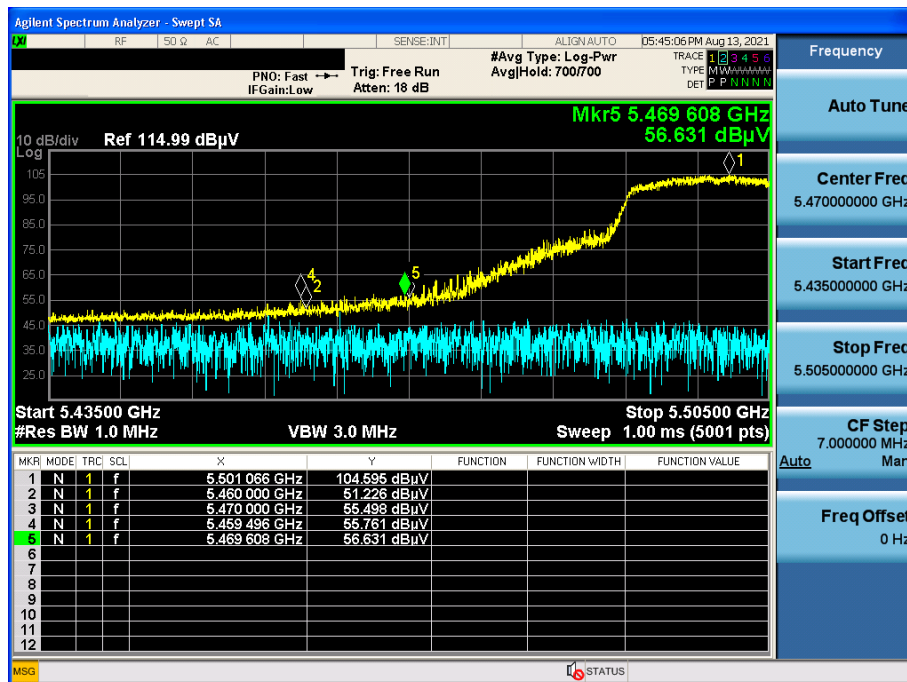


TM 2 & U-NII 2A & 5 300 & Z axis & Hor

Detector Mode : AV



Detector Mode : PK



Detector Mode : AV



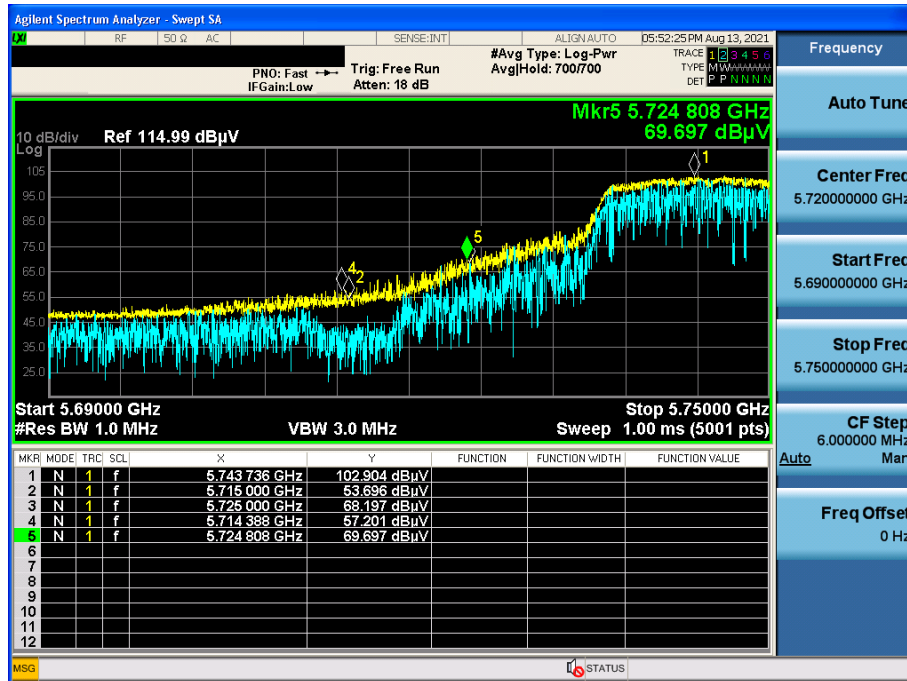
TM 2 & U-NII 2C & 5 720 & Z axis & Hor

Detector Mode : AV



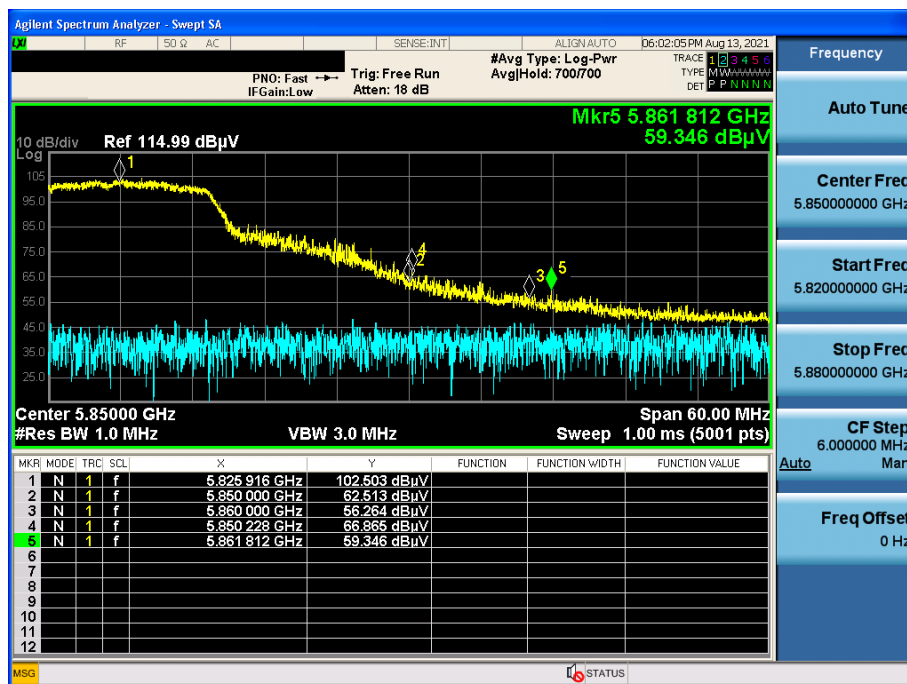
TM 2 & U-NII 3 & 5 745 & Z axis & Hor

Detector Mode : PK



TM 2 & U-NII 3 & 5 825 & Z axis & Hor

Detector Mode : PK



TM 2 & U-NII 3 & 5 825 & Z axis & Hor

Detector Mode : AV

