

Report No.: SEWM2306000197RG04

Rev.: 01

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TEST REPORT

Application No.: SEWM2306000197RG
Applicant: Quectel Wireless Solutions Co., Ltd.
Address of Applicant: Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer: Quectel Wireless Solutions Co., Ltd.
Address of Manufacturer: Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
EUT Description: Wi-Fi & Bluetooth Module
Model No.: FCS950R
Trade Mark: Quectel
FCC ID: XMR2023FCS950R
Standards: FCC 47 CFR Part 2, Subpart J
FCC 47 CFR Part 15, Subpart E
Date of Receipt: 2023/06/13
Date of Test: 2023/06/13 to 2023/07/12
Date of Issue: 2023/07/13

Test Result :	PASS *
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* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:

Well Wei

Well Wei
Wireless Laboratory Manager

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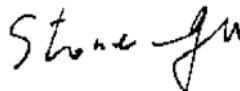
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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023/07/13		Original

Prepared By	
	(Ives Cheng) / Test Engineer
Checked By	
	(Stone Gu) / Reviewer



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2 Test Summary

Test Item	Band ^[1]	FCC rules No.	Test Requirements	Test Result	Result
Antenna Requirement	--	15.203/15.407(a)	--	Clause 4.1	PASS
26dB Emission Bandwidth	Band I	15.407(a)(1)	No limit.	Clause 4.5	For Report Purpose
	Band II-A	15.407(a)(2)			
	Band II-C	15.407(a)(2)			
6dB Emission Bandwidth	Band III	15.407(e)	≥ 500 kHz.	Clause 4.6	PASS
99% Occupied Bandwidth	Band I	KDB 789033 D02§ D	No limit.	Clause 4.7	For Report Purpose
	Band II-A				
	Band II-C				
	Band III				
Duty Cycle	Band I Band II-A Band II-C Band III	--	No limit.	Clause 4.3	For Report Purpose
Maximum Conducted Output Power	Band I	15.407(a)(iv)	< 250mW	Clause 4.4	PASS
	Band II-A	15.407(a)(2)	<MIN{250mW, 11dBm+10*lg(EBW)}		
	Band II-C	15.407(a)(3)	< 1W		
	Band III	15.407(a)(3)	< 1W		
Maximum Power Spectral Density	Band I	15.407(a)(iv)	<11dBm/MHz	Clause 4.8	PASS
	Band II-A	15.407(a)(2)	<11dBm/MHz		
	Band II-C	15.407(a)(2)	<11dBm/MHz		
	Band III	15.407(a)(3)	<30dBm/500KHz		
Radiated Spurious Emissions	Band I	15.407(b) 15.205/15.209	F<1GHz: §15.209 limit (QP). F≥1GHz & out-restricted: <-27dBm/MHz PK e.i.r.p. (exl. 5.15-5.35 GHz). F≥1GHz & in-restricted: §15.209 limit (AV&PK).	Clause 4.9	PASS
	Band II-A	15.407(b) 15.205/15.209	F<1GHz: §15.209 limit (QP). F≥1GHz & out-restricted: <-27dBm/MHz PK e.i.r.p. (exl. 5.25-5.35 GHz). F≥1GHz & in-restricted: §15.209 limit (AV&PK).		PASS
	Band II-C	15.407(b) 15.205/15.209	F<1GHz: §15.209 limit (QP). F≥1GHz & out-restricted: <-27dBm/MHz PK e.i.r.p. (exl. 5.47-5.725 GHz). F≥1GHz & in-restricted: §15.209 limit (AV&PK).		PASS
	Band III	15.407(b) 15.205/15.209	F<1GHz: §15.209 limit (QP) F≥1GHz & out-restricted:(PK)		PASS



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			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. F≥1GHz & in-restricted: §15.209 limit (AV&PK).		
Restricted bands around fundamental frequency	Band I Band II-A Band II-C Band III	15.407(b) 15.205/15.209	---	Clause 4.10	PASS
AC Power Line Conducted Emissions	Band I Band II-A Band II-C Band III	15.207	---	Clause 4.2	PASS
Dynamic Frequency Selection	Band II-A Band II-C	15.407	Channel Move Time:10 Seconds	Clause 4.11	PASS
Frequency Stability	Band I Band II-A Band II-C Band III	15.407(g)	Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual	N/A	N/A
Note 1: Band I: 5150-5250MHz Band II-A: 5250-5350MHz Band II-C: 5470-5725MHz Band III: 5725-5850MHz					



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3 General Information

3.1 Details of Client

Applicant:	Quectel Wireless Solutions Co., Ltd.
Address of Applicant:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer:	Quectel Wireless Solutions Co., Ltd.
Address of Manufacturer:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd.
Address:	South of No. 6 Plant, No. 1, Runsheng Road, Suzhou Industrial Park, Suzhou Area, China (Jiangsu) Pilot Free Trade Zone
Post code:	215000
Test engineer:	Ives Cheng, Tizzy Song

3.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **A2LA (Certificate No. 6336.01)**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6336.01.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0120.

IC#: 27594.

- **FCC –Designation Number: CN1312**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized as an accredited testing laboratory.

Designation Number: CN1312.

Test Firm Registration Number: 717327



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3.4 General Description of EUT

EUT Description:	Wi-Fi & Bluetooth Module	
Model No.:	FCS950R	
Trade Mark:	Quectel	
Hardware Version:	R1.0	
Software Version:	NA	
SN:	E1N23DT07000059	
WLAN Mode Supported:	802.11a:	20 MHz channel bandwidth
	802.11n:	20 MHz / 40 MHz channel bandwidth
	802.11ac:	20 MHz / 40 MHz / 80 MHz channel bandwidth
Operation Frequency:	5150MHz to 5250MHz 5250MHz to 5350MHz 5470MHz to 5725MHz 5725MHz to 5850MHz	
Modulation Type:	802.11a:	OFDM (BPSK, QPSK, 16QAM, 64QAM)
	802.11n:	OFDM (BPSK, QPSK, 16QAM, 64QAM)
	802.11ac:	OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Channel Spacing:	20MHz:	802.11a/n(HT20)/ac(VHT20)
	40MHz:	802.11n(HT40)/ac(VHT40)
	80MHz:	802.11ac(VHT80)
Antenna Type:	Dipole Antenna	
Antenna Gain:	5150MHz to 5250MHz: 1.14dBi(Ant0); 5250MHz to 5350MHz: 1.14dBi(Ant0); 5470MHz to 5725MHz: 1.14dBi(Ant0); 5725MHz to 5850MHz: 1.14dBi(Ant0);	
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.	
Smart System:	☒ SISO	802.11a/n/ac
	☐ MIMO	CDD: 802.11a/n/ac: Tx & Rx
		STBC: 802.11n/ac: Tx & Rx
		TXBF: 802.11n/ac: Tx & Rx
	☐ Diversity	802.11a: Tx & Rx
TPC Function:	☐ Support, ☒ Not Support	
DFS Function:	☐ Master	
	☐ Slave with radar detection	☒ Slave without radar detection
RF Cable:	1.5dB	



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Remark:

In FCC 15.31, for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table, and the selected channel to perform the test as below:

Frequency range over which device operates	Number of Measurement Frequencies Required	Location of Measurement Frequency in Band of Operation
1 MHz or less	1	centre
1 MHz to 10 MHz	2	1 near high end, 1 near low end
Greater than 10 MHz	3	1 near high end, 1 near centre

For UNII Band I:

Mode	Channel	Frequency(MHz)
IEEE 802.11a/n/ac 20MHz	The Lowest channel	5180
	The Middle channel	5200
	The Highest channel	5240
IEEE 802.11n/ac 40MHz	The Lowest channel	5190
	The Highest channel	5230
IEEE 802.11ac 80MHz	The Middle channel	5210

For UNII Band II-A:

Mode	Channel	Frequency(MHz)
IEEE 802.11a/n/ac 20MHz	The Lowest channel	5260
	The Middle channel	5280
	The Highest channel	5320
IEEE 802.11n/ac 40MHz	The Lowest channel	5270
	The Highest channel	5310
IEEE 802.11ac 80MHz	The Middle channel	5290



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For UNII Band II-C:		
Mode	Channel	Frequency(MHz)
IEEE 802.11a/n/ac 20MHz	The Lowest channel	5500
	The Middle channel	5580
	The Highest channel	5700
IEEE 802.11n/ac 40MHz	The Lowest channel	5510
	The Middle channel	5550
	The Highest channel	5670
IEEE 802.11ac 80MHz	The Middle channel	5530

For UNII Band III:		
Mode	Channel	Frequency(MHz)
IEEE 802.11a/n/ac 20MHz	The Lowest channel	5745
	The Middle channel	5785
	The Highest channel	5825
IEEE 802.11n/ac 40MHz	The Lowest channel	5755
	The Highest channel	5795
IEEE 802.11ac 80MHz	The Middle channel	5775

Frequency Band	Channel	Freq.(MHz)	Channel	Freq.(MHz)
Straddle Channel	144 ^[1]	5720	142 ^[2]	5710
	138 ^[3]	5690		

Note:

1. The above Frequency and Channel were 802.11a, 802.11n HT20 and 802.11ac VHT20.
2. The above Frequency and Channel were 802.11n HT40 and 802.11ac VHT40.
3. The above Frequency and Channel were 802.11ac VHT80.



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3.5 Test Environment and Mode

Environment Parameter	101.0 kPa Selected Values During Tests	
Relative Humidity	44-46 % RH Ambient	
Value	Temperature(°C)	Voltage(V)
NTNV	22~23	3.3
Remark: NV: Normal Voltage NT: Normal Temperature		

3.6 Description of Support Units

Description	Manufacturer	Model No.
Router	ASUS	GT-AXE11000 (FCC ID MSQ-RTAXJF00)

3.7 Worst-case configuration and mode

Low data rate was used to test on antenna port conducted tests and radiated spurious emissions since it has the highest maximum power. Following are the worst-case data rates set for test:

Modulation Type	SISO - Data Rate	MIMO - Data Rate
802.11a	6 Mbps	/
802.11n (HT 20)	MCS0 (6.5 Mbps)	/
802.11n (HT 40)	MCS0 (13.5 Mbps)	/
802.11ac (VHT 20)	MCS0 (6.5 Mbps)	/
802.11ac (VHT 40)	MCS0 (13.5 Mbps)	/
802.11ac (VHT 80)	MCS0 (29.3 Mbps)	/



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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15 Section 15.203
The antenna is Dipole Antenna on the main PCB and no consideration of replacement. The best case gain of the antenna is 5150MHz to 5250MHz: 1.14dBi(Ant0);* 5250MHz to 5350MHz: 1.14dBi(Ant0);* 5470MHz to 5725MHz: 1.14dBi(Ant0);* 5725MHz to 5850MHz: 1.14dBi(Ant0);* <i>*Note:</i> <i>The antenna gain are derived from the gain information report provided by the manufacturer.</i> <i>Remark:</i> <i>As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.</i>	



4.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15 Section 15.207		
Test Method:	ANSI C63.10-2020 Section 6.2		
Test Frequency Range:	150kHz to 30MHz		
Receiver Setup:	RBW = 9kHz, VBW = 30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
* Decreases with the logarithm of the frequency.			
Test Procedure:	1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10-2020 on conducted measurement.		



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Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel.
Final Test Mode:	Refer to section 3.7 for details. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass



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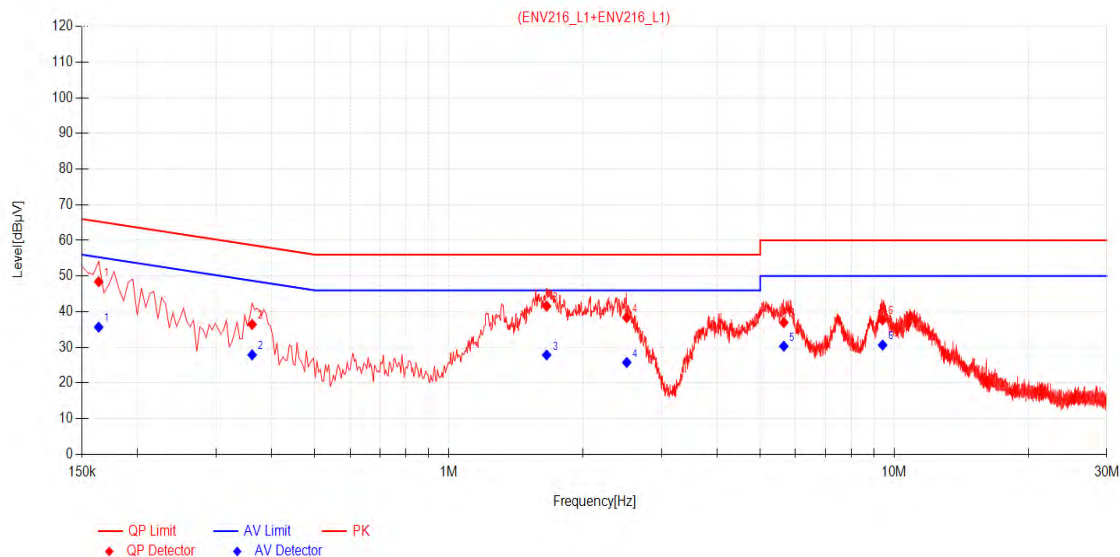
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Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Phase: Line



Data List

NO.	Frequency [MHz]	Factor [dB]	QP Reading [dBμV]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading [dBμV]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.1635	10.69	37.72	48.41	65.28	16.87	24.98	35.67	55.28	19.61	PASS
2	0.3615	10.51	25.92	36.43	58.69	22.26	17.39	27.90	48.69	20.79	PASS
3	1.6575	10.75	30.81	41.56	56.00	14.44	17.11	27.86	46.00	18.14	PASS
4	2.5080	10.66	27.69	38.35	56.00	17.65	15.09	25.75	46.00	20.25	PASS
5	5.6490	10.66	26.30	36.96	60.00	23.04	19.67	30.33	50.00	19.67	PASS
6	9.4155	10.65	27.06	37.71	60.00	22.29	20.00	30.65	50.00	19.35	PASS

Remark:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Value = Reading[dBμV] + Factor(Lin factor[dB] + cable loss[dB]).
3. Margin = Limit[dBμV] – Value[dBμV]



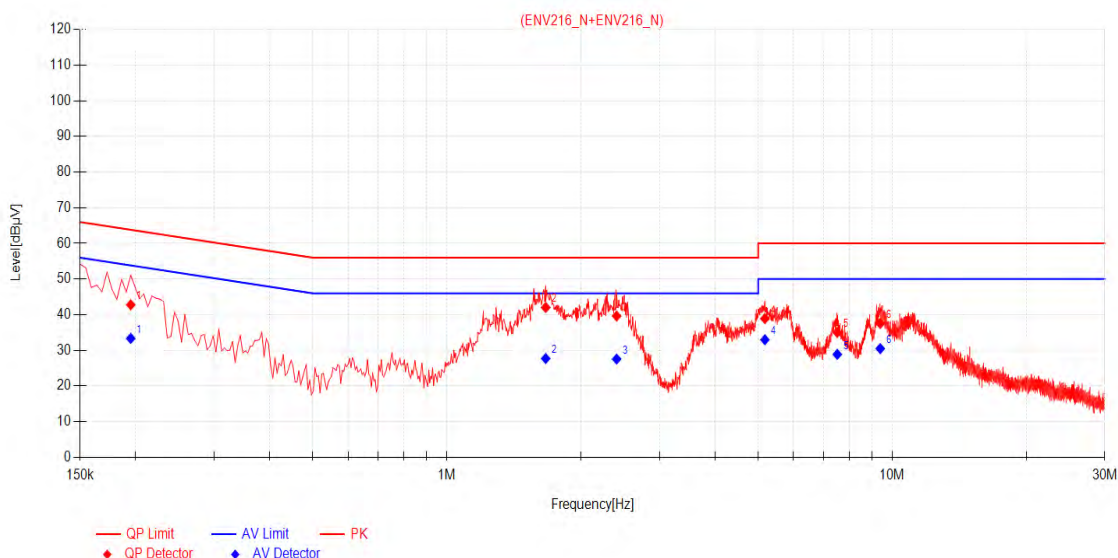
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Phase: Neutral



Data List

NO.	Frequency [MHz]	Factor [dB]	QP Reading [dBμV]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading [dBμV]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.1950	10.67	32.10	42.77	63.82	21.05	22.68	33.35	53.82	20.47	PASS
2	1.6665	10.77	31.26	42.03	56.00	13.97	16.95	27.72	46.00	18.28	PASS
3	2.4045	10.78	28.85	39.63	56.00	16.37	16.78	27.56	46.00	18.44	PASS
4	5.1765	10.63	28.29	38.92	60.00	21.08	22.36	32.99	50.00	17.01	PASS
5	7.5255	10.54	24.49	35.03	60.00	24.97	18.33	28.87	50.00	21.13	PASS
6	9.3975	10.64	26.89	37.53	60.00	22.47	19.86	30.50	50.00	19.50	PASS

Remark:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Value = Reading[dBμV] + Factor(Lin factor[dB] + cable loss[dB]).
3. Margin = Limit[dBμV] – Value[dBμV]



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4.3 Duty Cycle

The detailed test data see: **Appendix**



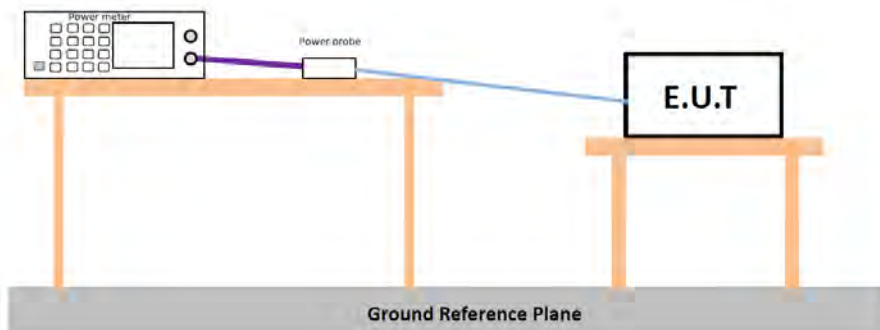
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4.4 Conducted Output Power

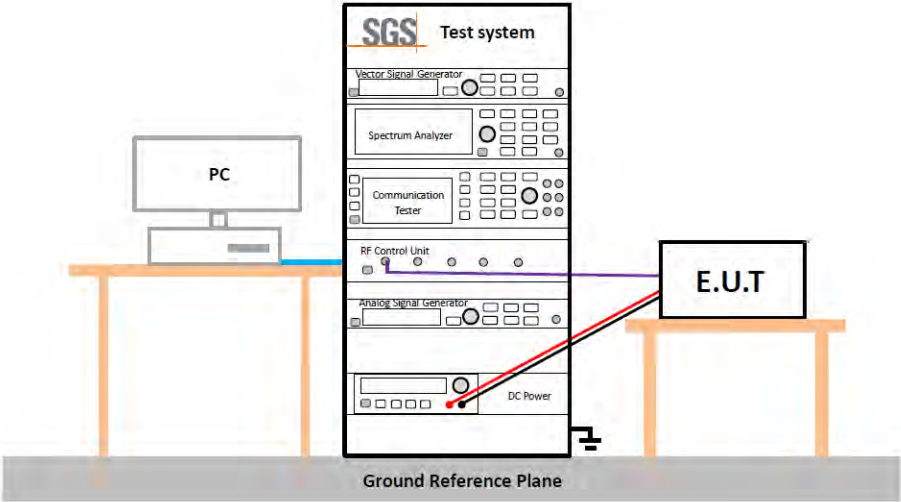
Test Requirement:	47 CFR Part 15 Section 15.407(a)	
Test Method:	ANSI C63.10-2020 Section 12.4.3.2	
Test Setup:	 * Test with power meter (Detector function: Average) Method PM-G is measurement using a gated RF average power meter. Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Because the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.	
Test Instruments:	Refer to section 6 for details.	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates	
Final Test Mode:	Refer to section 3.7 for details.	
Limit:	Frequency Band	Limit
	5150-5250MHz	Not exceed 250mW(23.98dBm)
	5250-5350MHz	The lesser of 250mW(23.98dBm) or 11+ 10logB
	5470-5725MHz	The lesser of 250mW(23.98dBm) or 11+ 10logB
	5725-5850MHz	Not exceed 1W(30dBm)
	*Where B is the 26dB emission bandwidth in MHz	
Test Results:	Pass	
The detailed test data see: Appendix		

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4.5 26dB Emission Bandwidth

Test Requirement:	47 CFR Part 15 Section 15.407(a), KDB 789033 D02& C
Test Method:	ANSI C63.10-2020 Section 12.5.2
Test Setup:	
Instruments Used:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	No restriction limits
Test Results:	Pass
The detailed test data see: Appendix	



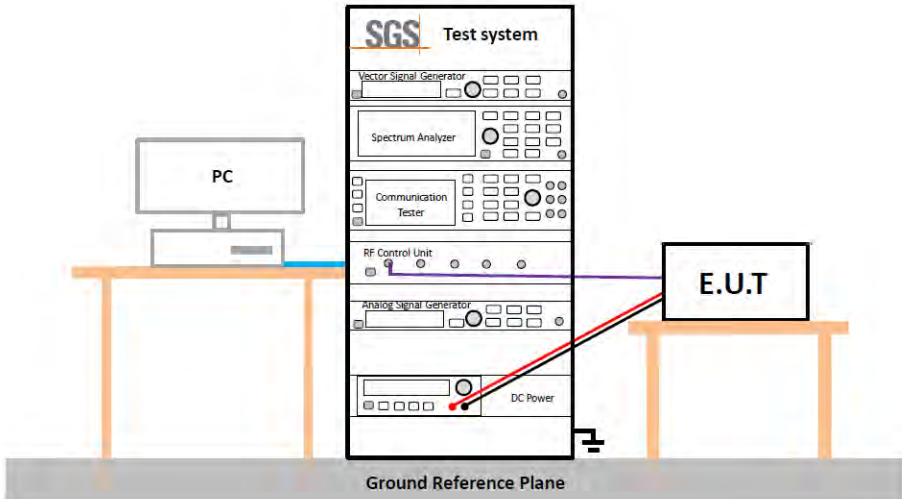
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4.6 6dB Emission Bandwidth

Test Requirement:	47 CFR Part 15 Section 15.407(e)	
Test Method:	ANSI C63.10-2020 Section 12.5.1	
Test Setup:		
Test Instruments:	Refer to section 6 for details.	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates	
Final Test Mode:	Refer to section 3.7 for details.	
Limit:	Frequency Band	Limit
	5725-5850MHz	At lease 500kHz
Test Results:	Pass	
The detailed test data see: Appendix		



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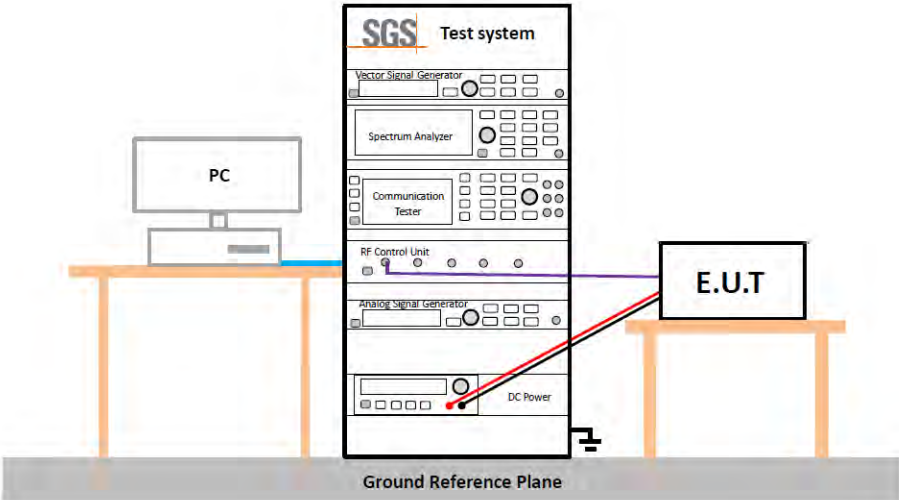
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4.7 99% Occupied Bandwidth

Test Requirement:	KDB 789033 D02§ D
Test Method:	ANSI C63.10-2020 Section 12.5.3
Test Setup:	
Instruments Used:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	No restriction limits
Test Results:	Pass
The detailed test data see: Appendix	

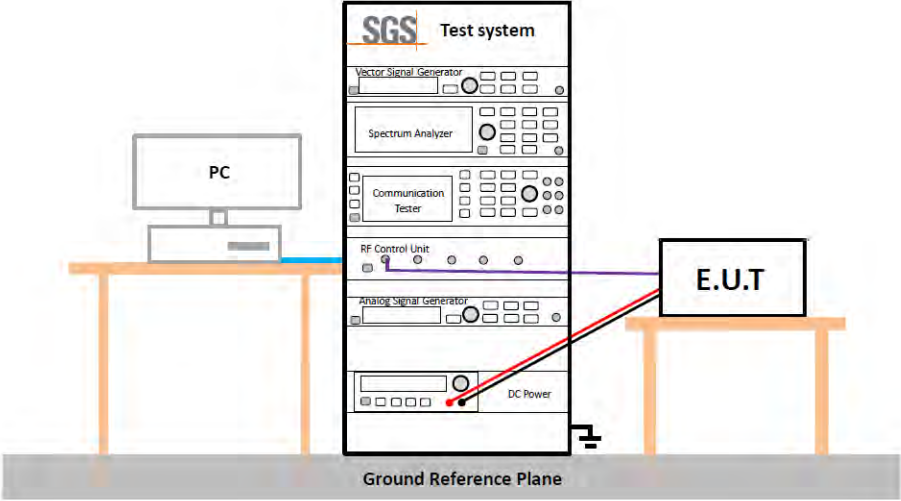


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4.8 Power Spectral Density

Test Requirement:	47 CFR Part 15 Section 15.407(a)	
Test Method:	ANSI C63.10-2020 Section 12.6 KDB 789033 D02 v02r01, Section F.	
Test Setup:		
Instruments Used:	Refer to section 6 for details.	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates	
Final Test Mode:	Refer to section 3.7 for details.	
Limit:	Frequency Band	Limit
	5150-5250MHz	The power spectral density less than 11dBm/1MHz
	5250-5350MHz	The power spectral density less than 11dBm/1MHz
	5470-5725MHz	The power spectral density less than 11dBm/1MHz
	5725-5850MHz	The power spectral density less than <30dBm/500KHz
Test Results:	Pass	
The detailed test data see: Appendix		



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4.9 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15 Section 15.205/15.209/15.407(b)
Test Method:	ANSI C63.10-2020 Section 6.4 / 6.5 / 6.6
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)
Test frequency:	9kHz ~ 40GHz(or 10 Harmonic)

Test Setup:

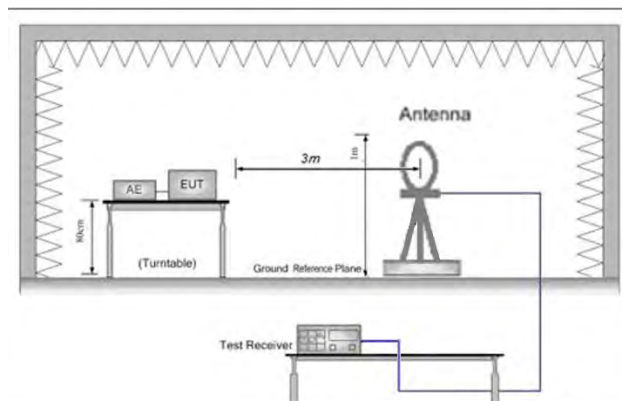


Figure 1. 9kHz to 30MHz

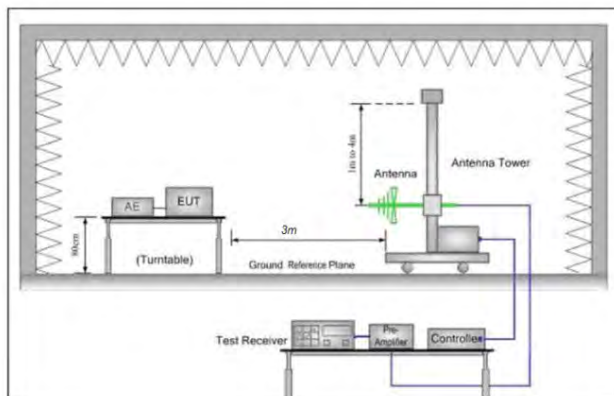


Figure 1. 30MHz to 1GHz

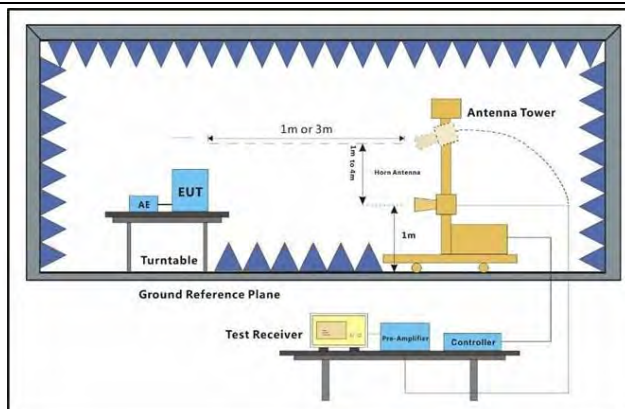


Figure 2. Above 1 GHz

Test Procedure:

- For below 1GHz test, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz test, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. (Distance from antenna to EUT is 1m for measurements >18GHz).
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

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	e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. Test the EUT in the outermost channels. h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case. i. Repeat above procedures until all frequencies measured was complete. j. The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported k. The disturbance above 18GHz was very low, and the harmonics were the highest point could be found when testing, so only the harmonics had been displayed. l. At a measurement distance of 1 meter the limit line was increased by $20 \cdot \text{LOG}(3/1) = 9.54 \text{ dB}$.
Test Configuration:	Measurements below 30MHz • RBW = 10 kHz • VBW = 30 kHz • Detector = Peak & Average & Quasi-peak • Trace mode = max hold Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Quasi-peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW $\geq 3 \text{ MHz}$ • Detector = Peak • Sweep time = auto • Trace mode = max hold Average Measurements Above 1000MHz • RBW = 1 MHz • VBW = 10Hz, when duty cycle is no less than 98 percent. • VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is 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.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates.
Final Test Mode:	Refer to section 3.7 for details.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass
The detailed test data see: Appendix	



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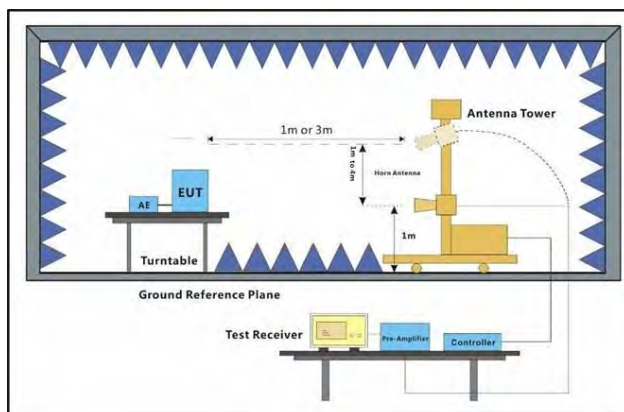
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4.10 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15 Section 15.205/15.209/15.407(b)		
Test Method:	ANSI C63.10-2020 Section 12.7		
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m)	Remark
	30MHz-88MHz	40.0	Quasi-peak
	88MHz-216MHz	43.5	Quasi-peak
	216MHz-960MHz	46.0	Quasi-peak
	960MHz-1GHz	54.0	Quasi-peak
	Above 1GHz	54.0	Average Value
		74.0	Peak Value

Test Setup:



Test Procedure:

- The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel
- Test the EUT in the outermost channels.
- The radiation measurements are performed in X, Y, Z axis positioning for

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	Transmitting mode, And found the X axis positioning which it is worse case. i. Repeat above procedures until all frequencies measured was complete.
Test Configuration:	Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Quasi-peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW $\geq$ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold Average Measurements Above 1000MHz • RBW = 1 MHz • VBW = 10Hz, when duty cycle is no less than 98 percent. • VBW $\geq$ 1/T, when duty cycle is less than 98 percent where T is 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.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates.
Final Test Mode:	Refer to section 3.7 for details.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass
The detailed test data see: Appendix	



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4.11 Dynamic Frequency Selection

4.11.1 DFS Overview

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
<i>Non-Occupancy Period</i>	Yes	Not required	Yes
<i>DFS Detection Threshold</i>	Yes	Not required	Yes
<i>Channel Availability Check Time</i>	Yes	Not required	Not required
<i>U-NII Detection Bandwidth</i>	Yes	Not required	Yes

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>DFS Detection Threshold</i>	Yes	Not required
<i>Channel Closing Transmission Time</i>	Yes	Yes
<i>Channel Move Time</i>	Yes	Yes
<i>U-NII Detection Bandwidth</i>	Yes	Not required
Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>U-NII Detection Bandwidth and Statistical Performance Check</i>	All BW modes must be tested	Not required
<i>Channel Move Time and Channel Closing Transmission Time</i>	Test using widest BW mode available	Test using the widest BW mode available for the link
<i>All other tests</i>	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		



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4.11.2 DFS Detection Thresholds

**Table 3: DFS Detection Thresholds for Master Devices
and Client Devices with Radar Detection**

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP $\geq$ 200 milliwatt	-64 dBm
EIRP $<$ 200 milliwatt and power spectral density $<$ 10 dBm/MHz	-62 dBm
EIRP $<$ 200 milliwatt that do not meet the power spectral density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	



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4.11.3 RADAR TEST WAVEFORMS

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	Roundup $\left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{sec}}} \right) \right\}$	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A			
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					



Table 5a - Pulse Repetition Intervals Values for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

The aggregate is the average of the percentage of successful detections of Short Pulse Radar Types 1-4. For example, the following table indicates how to compute the aggregate of percentage of successful detections.

Radar Type	Number of Trials	Number of Successful Detections	Minimum Percentage of Successful Detection
1	35	29	82.9%
2	30	18	60%
3	30	27	90%
4	50	44	88%
Aggregate $(82.9\% + 60\% + 90\% + 88\%) / 4 = 80.2\%$			



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Table 6 – Long Pulse Radar Test Waveform

Radar Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Number of Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

Table 7 – Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (μsec)	PRI (μsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

4.11.4 Response Requirements

Table 4: DFS Response Requirement Values

Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.

Note 1: *Channel Move Time* and the *Channel Closing Transmission Time* should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.

Note 2: The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate a *Channel* move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Note 3: During the *U-NII Detection Bandwidth* detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

The detailed test data see: **Appendix**



5 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	$\pm 0.54\text{dB}$
2	RF power density, conducted	$\pm 1.03\text{dB}$
3	Spurious emissions, conducted	$\pm 0.54\text{dB}$
4	Radio Frequency	$\pm 1.0\%$
5	Duty Cycle	$\pm 0.37\%$
6	Occupied Bandwidth	$\pm 1.0\%$
7	Conduction Emission	$\pm 2.90\text{dB}$ (150kHz to 30MHz)
8	Radiated Emission	$\pm 3.13\text{dB}$ (9k to 30MHz)
		$\pm 4.88\text{dB}$ (30M to 1GHz)
		$\pm 4.75\text{dB}$ (1GHz to 18GHz)
		$\pm 4.77\text{dB}$ (Above 18GHz)

Remark:

The U_{lab} (lab Uncertainty) is less than $U_{\text{CISPR/ETSI}}$ (CISPR/ETSI Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.



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6 Equipment List

RF Test Equipment					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	SUWI-04-01-06	2021/05/08	2024/05/07
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-07	2023/02/06	2024/02/05
Measurement Software	Tonscend	JS1120-3 Test System V 3.3.20	SUWI-02-09-09	NCR	NCR
Signal Analyzer	ROHDE& SCHWARZ	FSW43	SUWI-01-02-04	2023/05/11	2024/05/10
Wideband Radio Communication Tester	ROHDE& SCHWARZ	CMW500	SUWI-01-16-05	2023/02/06	2024/02/05
DC Power Supply	HYELEC	HY3005B	SUWI-01-18-01	2023/02/06	2024/02/05
Power meter	Anritsu	ML2495A	SUWI-01-31-01	2022/11/23	2023/11/22
Pulse power sensor	Anritsu	MA2411B	SUWI-01-32-01	2022/11/23	2023/11/22
MXG Vector signal genitor	KEYSIGHT	N5182B	SUWI-01-38-01	2023/02/06	2024/02/05
Temperature Chamber	ESPEC	SU-242	SUWI-01-13-01	2023/02/06	2024/02/05

Conduction Test Equipment					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	SUWI-04-03-01	2021/05/08	2024/05/07
Test receiver	ROHDE&SCHWARZ	ESR7	SUWI-01-10-01	2023/02/08	2024/02/07
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-06	2023/02/07	2024/02/06
Artificial network	ROHDE&SCHWARZ	ENV216	SUWI-01-19-03	2023/02/08	2024/02/07
Artificial network	ROHDE&SCHWARZ	ENV216	SUWI-01-19-04	2023/02/08	2024/02/07
Measurement Software	Tonscend	JS32-CE V4.0.0.2	SUWI-02-09-05	NCR	NCR



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RSE Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Semi-Anechoic Chamber	Brilliant-emc	N/A	SUWI-04-02-02	2021/11/25	2024/11/24
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-13	2023/02/07	2024/02/06
Signal Analyzer	ROHDE&SCHWARZ	FSW43	SUWI-01-02-04	2023/05/11	2024/05/10
Signal Analyzer	KEYSIGHT	N9020A	SUWI-01-02-06	2022/11/23	2023/11/22
Test receiver	ROHDE&SCHWARZ	ESR7	SUWI-01-10-01	2023/02/08	2024/02/07
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	VULB 9168	SUWI-01-11-04	2021/12/05	2023/12/04
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9120D	SUWI-01-11-05	2021/12/05	2023/12/04
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9170	SUWI-01-11-03	2023/05/12	2024/05/11
Active Loop Antenna	SCHWRZBECK MESS-ELEKTRONIK	FMZB 1519B	SUWI-01-21-01	2023/05/13	2024/05/12
Amplifier	Tonscend	TAP9K3G32	SUWI-01-14-06	2022/11/23	2023/11/22
Amplifier	Tonscend	TAP01018050	SUWI-01-14-04	2022/11/23	2023/11/22
Amplifier	Tonscend	TAP30M7G30	SUWI-01-14-05	2022/11/23	2023/11/22
Measurement Software	Tonscend	JS32-RE V4.0.0.0	SUWI-02-09-04	NCR	NCR



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7 Photographs - Setup Photos

Refer to Appendix A.2 WLAN Setup Photos.



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Appendix



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Emission Bandwidth Test Result

TestMode	Antenna	Frequency[MHz]	26dB EBW [MHz]	FL[MHz]	FH[MHz]	Verdict
11a	Ant0	5180	35.60	5162.48	5198.08	For Report Purpose
11a	Ant0	5220	38.84	5201.08	5239.92	
11a	Ant0	5240	37.04	5222.48	5259.52	
11a	Ant0	5260	36.24	5242.44	5278.68	
11a	Ant0	5300	37.64	5281.40	5319.04	
11a	Ant0	5320	37.72	5301.08	5338.80	
11a	Ant0	5500	37.68	5481.24	5518.92	
11a	Ant0	5580	37.04	5561.56	5598.60	
11a	Ant0	5700	39.32	5680.64	5719.96	
11a	Ant0	5720	39.36	5700.40	5739.76	
11a	Ant0	5720 UNII-2C	24.6	5700.40	5725	
11a	Ant0	5720 UNII-3	14.76	5725	5739.76	
11a	Ant0	5745	39.80	5725.12	5764.92	
11a	Ant0	5785	37.56	5766.20	5803.76	
11a	Ant0	5825	37.32	5806.44	5843.76	
11ac20SISO	Ant0	5180	37.32	5162.36	5199.68	
11ac20SISO	Ant0	5220	34.96	5203.76	5238.72	
11ac20SISO	Ant0	5240	39.32	5220.32	5259.64	
11ac20SISO	Ant0	5260	36.84	5242.36	5279.20	
11ac20SISO	Ant0	5300	36.60	5281.96	5318.56	
11ac20SISO	Ant0	5320	35.12	5302.92	5338.04	
11ac20SISO	Ant0	5500	38.44	5481.56	5520.00	
11ac20SISO	Ant0	5580	38.88	5561.12	5600.00	
11ac20SISO	Ant0	5700	39.20	5680.76	5719.96	
11ac20SISO	Ant0	5720	38.72	5700.64	5739.36	
11ac20SISO	Ant0	5720 UNII-2C	24.36	5700.64	5725	
11ac20SISO	Ant0	5720 UNII-3	14.36	5725	5739.36	
11ac20SISO	Ant0	5745	38.48	5725.16	5763.64	
11ac20SISO	Ant0	5785	38.56	5765.16	5803.72	
11ac20SISO	Ant0	5825	37.24	5806.88	5844.12	
11ac40SISO	Ant0	5190	78.64	5151.12	5229.76	
11ac40SISO	Ant0	5230	68.56	5199.12	5267.68	
11ac40SISO	Ant0	5270	68.80	5238.72	5307.52	
11ac40SISO	Ant0	5310	70.32	5276.56	5346.88	
11ac40SISO	Ant0	5510	75.60	5474.40	5550.00	
11ac40SISO	Ant0	5550	78.64	5510.00	5588.64	
11ac40SISO	Ant0	5670	77.28	5632.72	5710.00	
11ac40SISO	Ant0	5710	74.40	5672.80	5747.20	
11ac40SISO	Ant0	5710 UNII-2C	52.2	5672.80	5725	
11ac40SISO	Ant0	5710 UNII-3	22.2	5725	5747.20	
11ac40SISO	Ant0	5755	76.72	5717.32	5794.04	
11ac40SISO	Ant0	5795	78.32	5756.68	5835.00	
11ac80SISO	Ant0	5210	143.52	5145.52	5289.04	
11ac80SISO	Ant0	5290	111.84	5238.80	5350.64	
11ac80SISO	Ant0	5530	132.16	5473.52	5605.68	
11ac80SISO	Ant0	5610	144.32	5542.80	5687.12	
11ac80SISO	Ant0	5690	131.52	5632.72	5764.24	
11ac80SISO	Ant0	5690 UNII-2C	92.28	5632.72	5725	
11ac80SISO	Ant0	5690 UNII-3	39.24	5725	5764.24	
11ac80SISO	Ant0	5775	131.04	5719.32	5850.36	



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Remark:

For 802.11n HT20/ac VHT20 and 802.11n HT40/ac VHT40 mode, the whole testing have assessed only, 802.11ac VHT20/40 by referring to their higher output power.



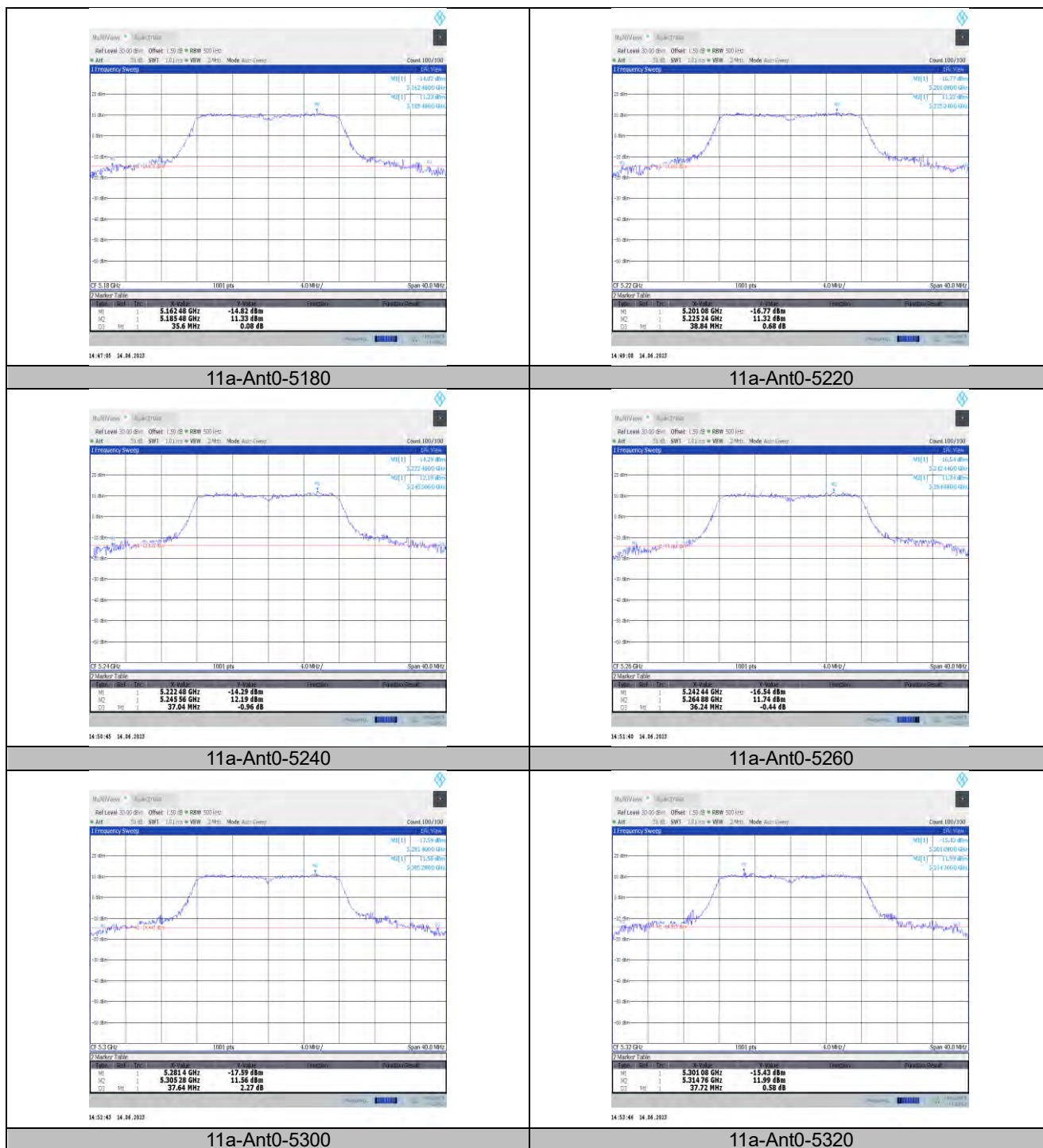
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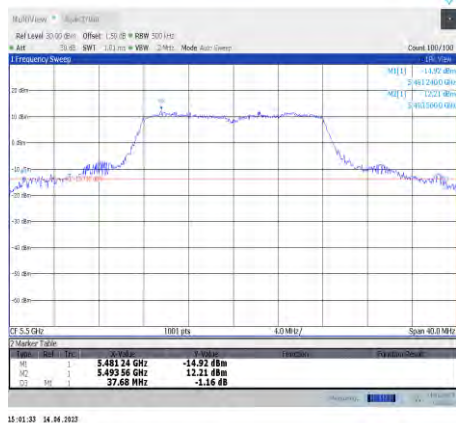
Test Graphs



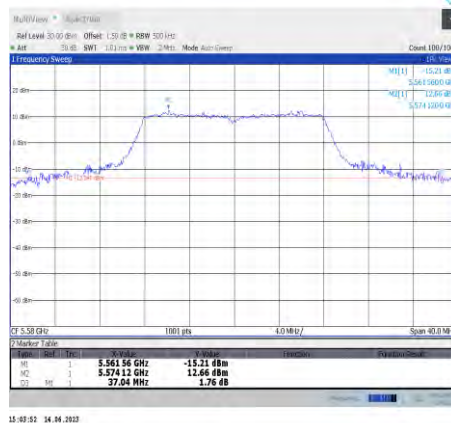
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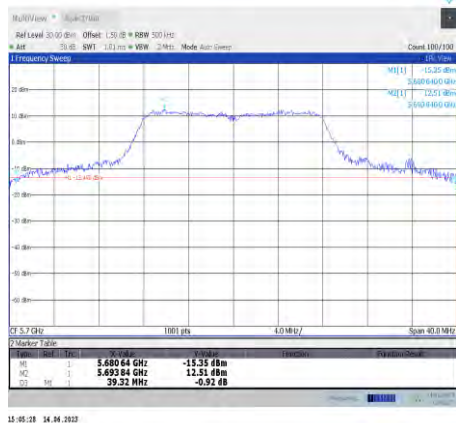
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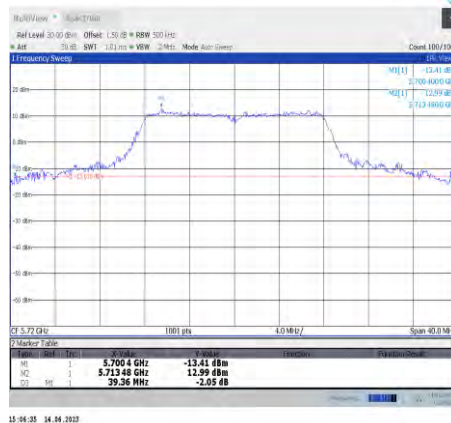
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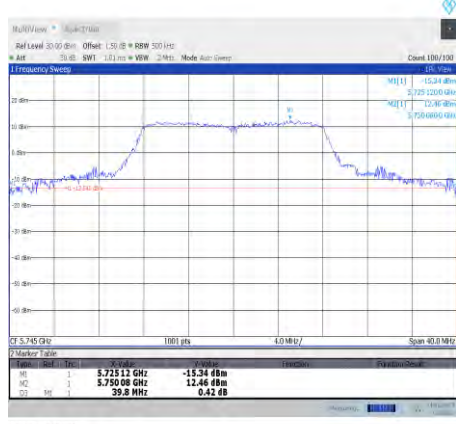
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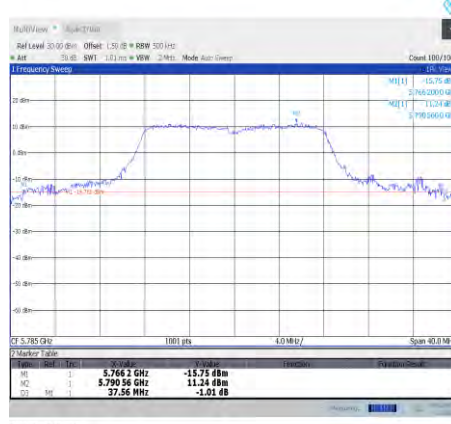
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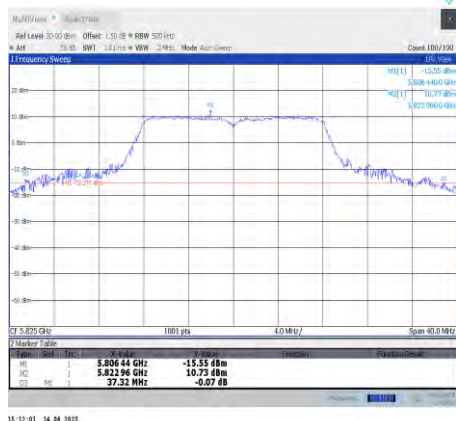


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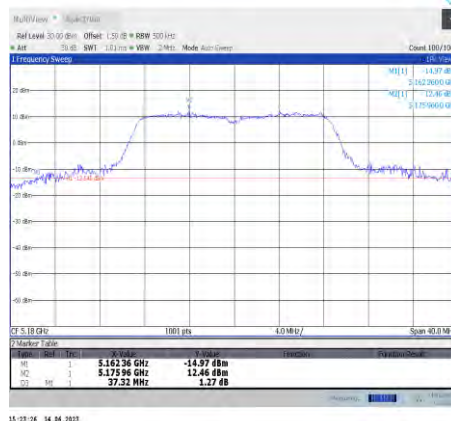


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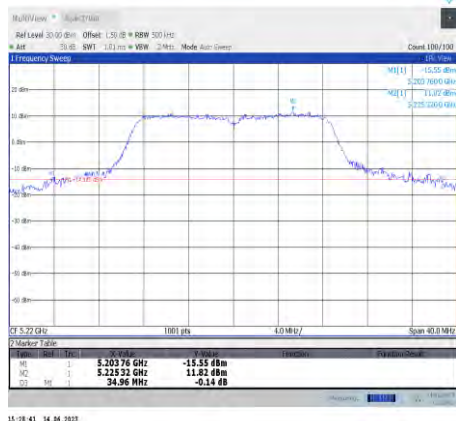




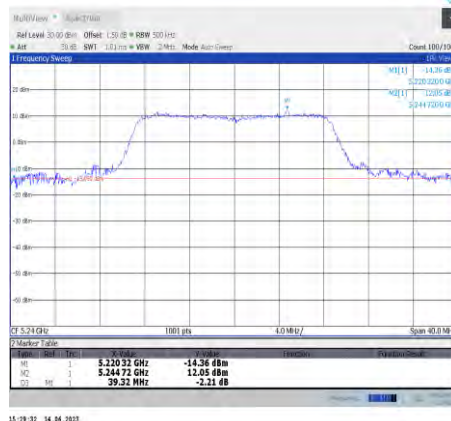
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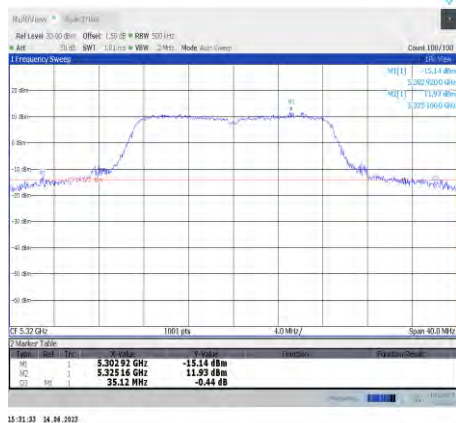


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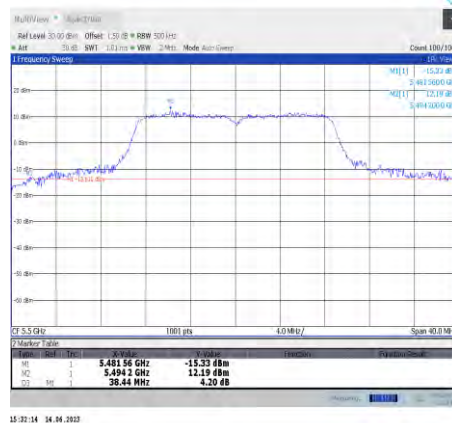


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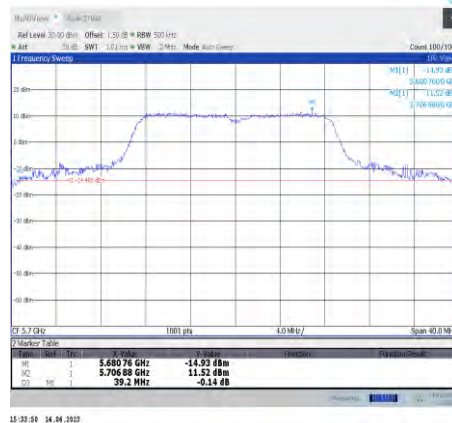
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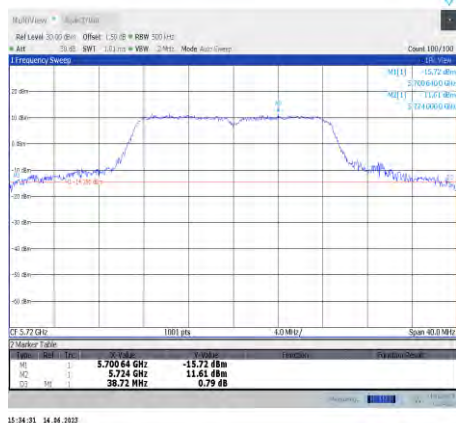
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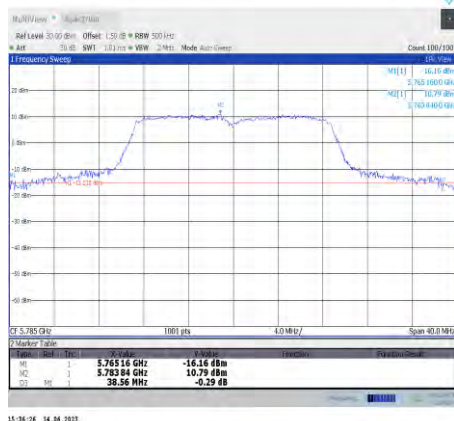
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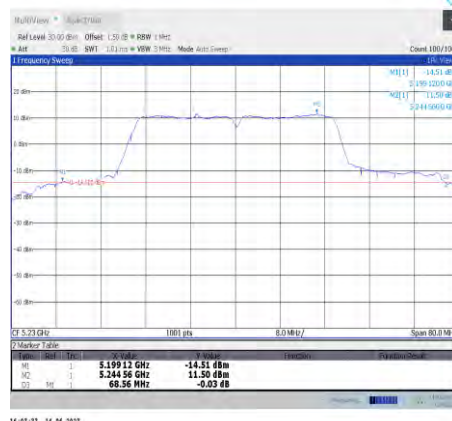
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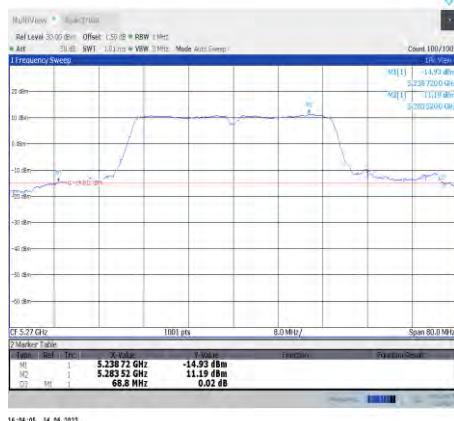
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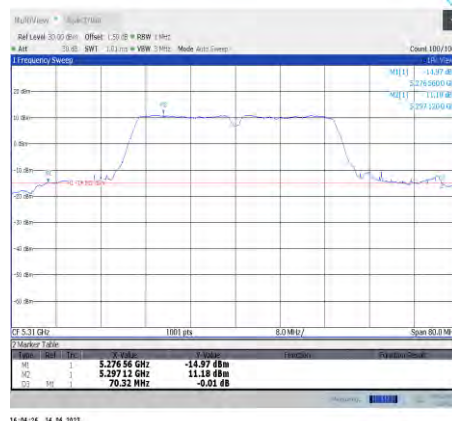
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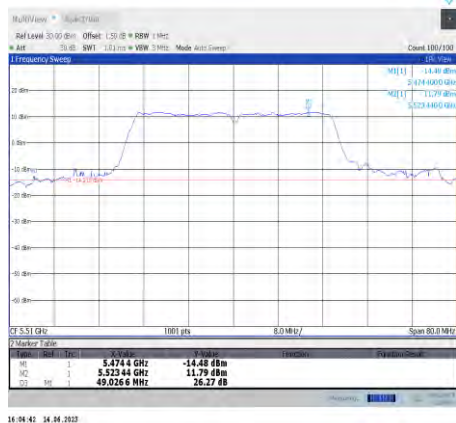
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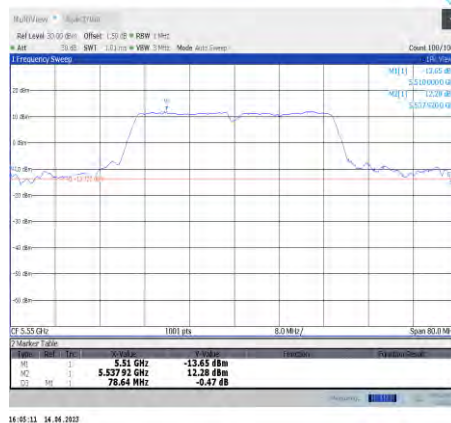
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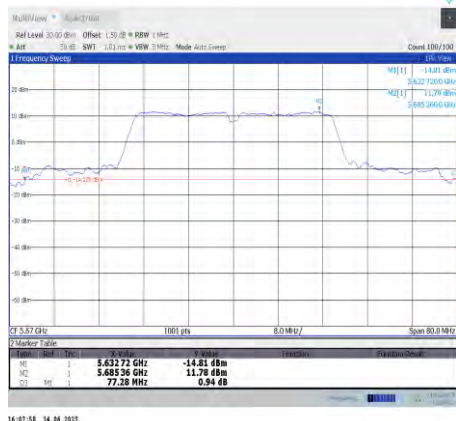
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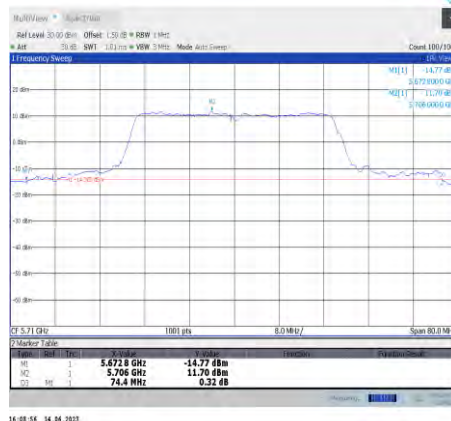
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11ac40SISO-Ant0-5550



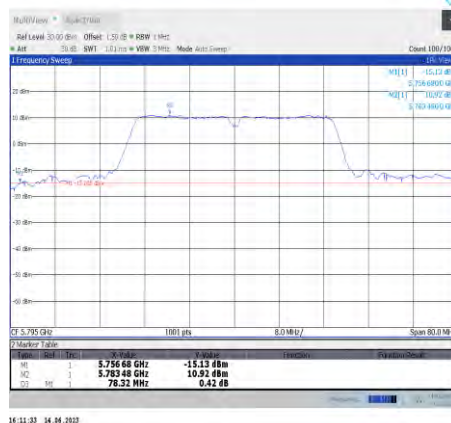
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11ac40SISO-Ant0-5710



11ac40SISO-Ant0-5755



11ac40SISO-Ant0-5795





14-14-07 14.04.2023

11ac80SISO-Ant0-5210



14-13-12 14.04.2023

11ac80SISO-Ant0-5290



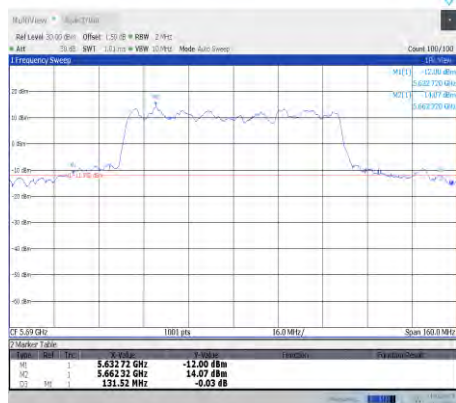
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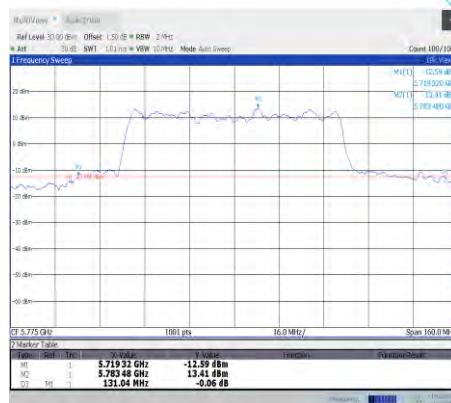
14-13-19 14.04.2023

11ac80SISO-Ant0-5610



14-17-07 14.04.2023

11ac80SISO-Ant0-5690



14-13-13 14.04.2023

11ac80SISO-Ant0-5775



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Occupied channel bandwidth Test Result

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
11a	Ant0	5180	17.755	5171.0971	5188.8523	For Report Purpose
11a	Ant0	5220	17.818	5211.2439	5229.0615	
11a	Ant0	5240	17.83	5231.1979	5249.0284	
11a	Ant0	5260	17.749	5251.2656	5269.0149	
11a	Ant0	5300	18.015	5291.0956	5309.1111	
11a	Ant0	5320	17.805	5311.1397	5328.9448	
11a	Ant0	5500	18.013	5491.1612	5509.1745	
11a	Ant0	5580	18.278	5570.9113	5589.1888	
11a	Ant0	5700	19.354	5690.4719	5709.8264	
11a	Ant0	5720	18.925	5710.6416	5729.5662	
11a	Ant0	5720 UNII-2C	14.358	5710.6416	5725	
11a	Ant0	5720 UNII-3	4.566	5725	5729.5662	
11a	Ant0	5745	19.58	5735.5252	5755.1050	
11a	Ant0	5785	18.042	5775.9935	5794.0355	
11a	Ant0	5825	17.973	5816.0099	5833.9828	
11ac20SISO	Ant0	5180	19.052	5170.6050	5189.6567	
11ac20SISO	Ant0	5220	18.774	5210.6757	5229.4493	
11ac20SISO	Ant0	5240	18.695	5230.7903	5249.4857	
11ac20SISO	Ant0	5260	18.657	5250.6980	5269.3545	
11ac20SISO	Ant0	5300	18.804	5290.6795	5309.4834	
11ac20SISO	Ant0	5320	18.68	5310.6407	5329.3212	
11ac20SISO	Ant0	5500	18.871	5490.6933	5509.5646	
11ac20SISO	Ant0	5580	19.419	5570.4865	5589.9054	
11ac20SISO	Ant0	5700	19.314	5690.3452	5709.6593	
11ac20SISO	Ant0	5720	19.074	5710.5538	5729.6278	
11ac20SISO	Ant0	5720 UNII-2C	14.446	5710.5538	5725	
11ac20SISO	Ant0	5720 UNII-3	4.628	5725	5729.6278	
11ac20SISO	Ant0	5745	18.804	5735.6395	5754.4433	
11ac20SISO	Ant0	5785	18.645	5775.6745	5794.3198	
11ac20SISO	Ant0	5825	18.608	5815.6749	5834.2830	
11ac40SISO	Ant0	5190	37.591	5171.3656	5208.9561	
11ac40SISO	Ant0	5230	37.562	5211.4627	5249.0247	
11ac40SISO	Ant0	5270	37.855	5251.2397	5289.0946	
11ac40SISO	Ant0	5310	37.293	5291.4273	5328.7201	
11ac40SISO	Ant0	5510	38.175	5491.1529	5529.3279	
11ac40SISO	Ant0	5550	38.522	5531.1172	5569.6392	
11ac40SISO	Ant0	5670	38.002	5651.1046	5689.1070	
11ac40SISO	Ant0	5710	37.857	5691.3347	5729.1912	
11ac40SISO	Ant0	5710 UNII-2C	33.665	5691.3347	5725	
11ac40SISO	Ant0	5710 UNII-3	4.191	5725	5729.1912	
11ac40SISO	Ant0	5755	37.866	5736.2886	5774.1549	
11ac40SISO	Ant0	5795	37.596	5776.1922	5813.7880	
11ac80SISO	Ant0	5210	79.766	5171.3374	5251.1036	
11ac80SISO	Ant0	5290	76.642	5251.7864	5328.4279	
11ac80SISO	Ant0	5530	77.377	5491.6958	5569.0724	
11ac80SISO	Ant0	5610	77.401	5571.6179	5649.0186	
11ac80SISO	Ant0	5690	77.463	5651.3505	5728.8132	
11ac80SISO	Ant0	5690 UNII-2C	73.65	5651.3505	5725	
11ac80SISO	Ant0	5690 UNII-3	3.813	5725	5728.8132	
11ac80SISO	Ant0	5775	76.907	5736.6790	5813.5861	



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Remark:

For 802.11n HT20/ac VHT20 and 802.11n HT40/ac VHT40 mode, the whole testing have assessed only, 802.11ac VHT20/40 by referring to their higher output power.



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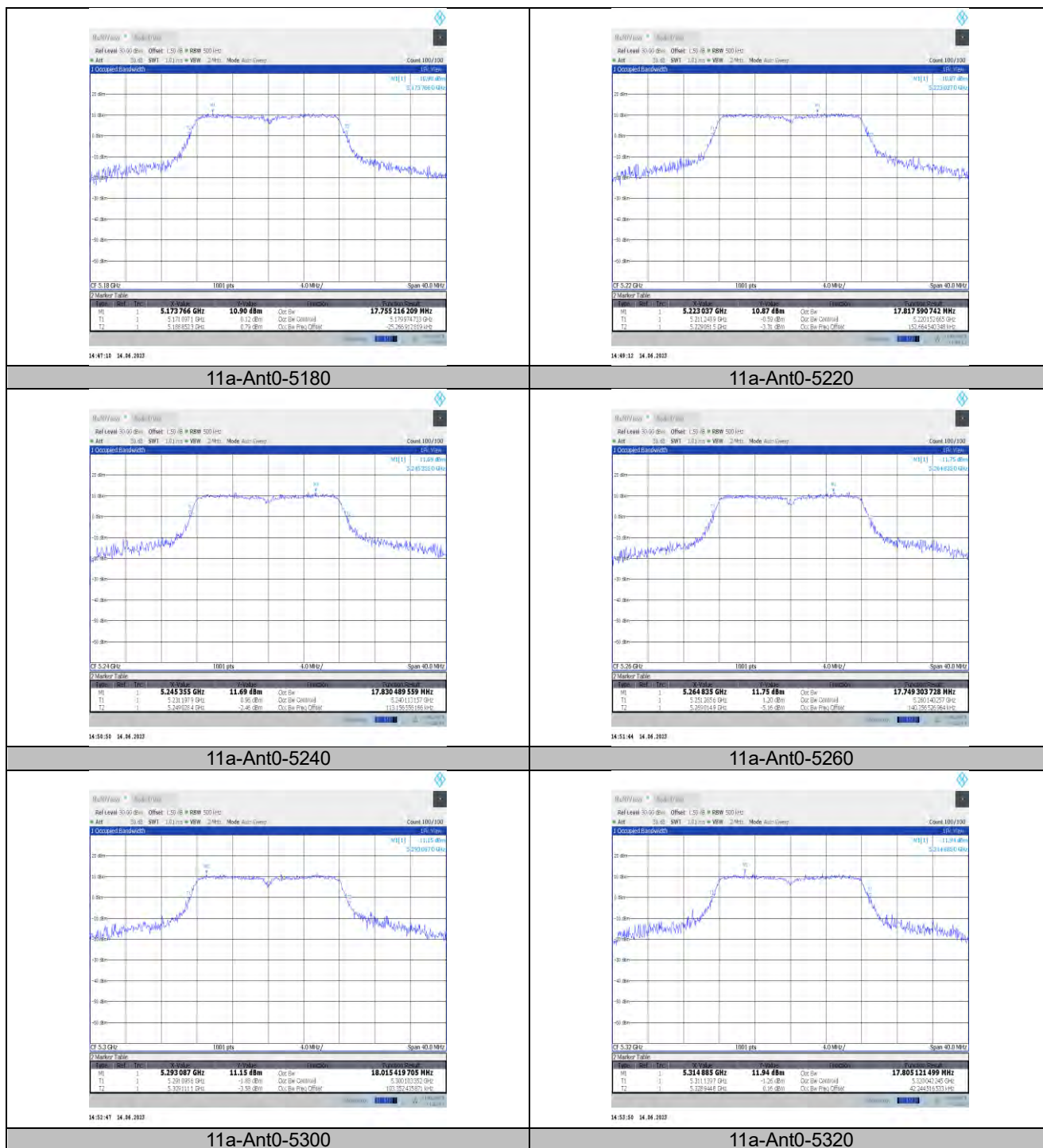
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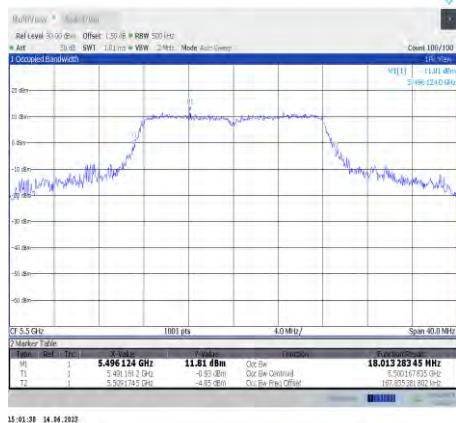
Test Graphs



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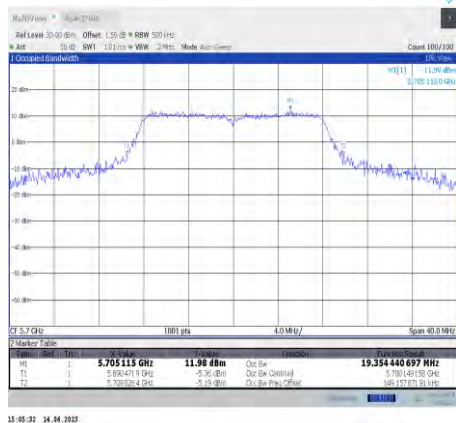
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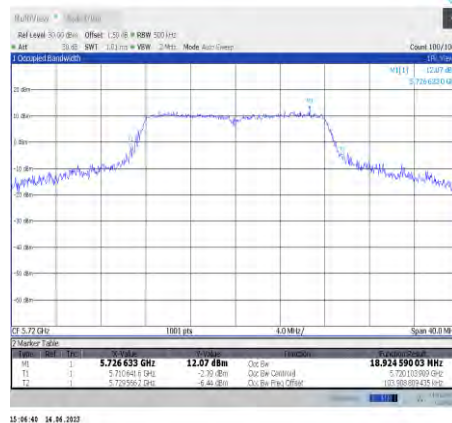
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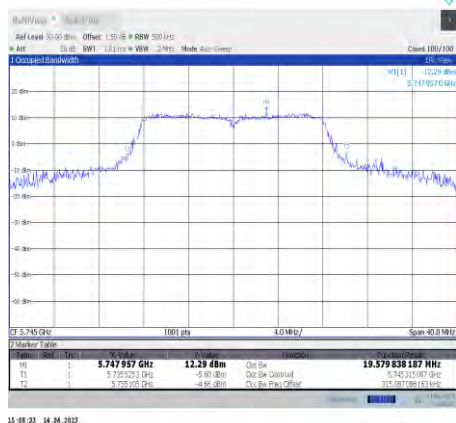
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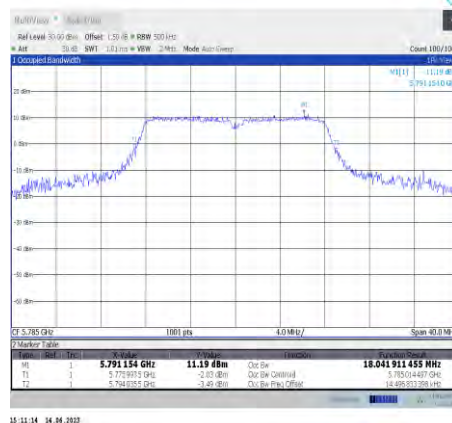
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11a-Ant0-5720



11a-Ant0-5745



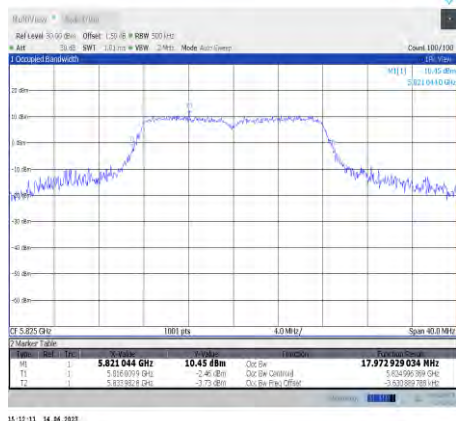
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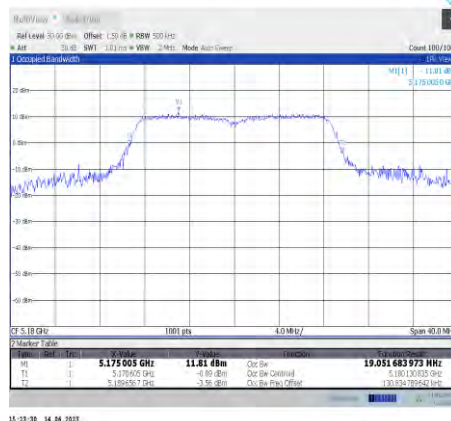
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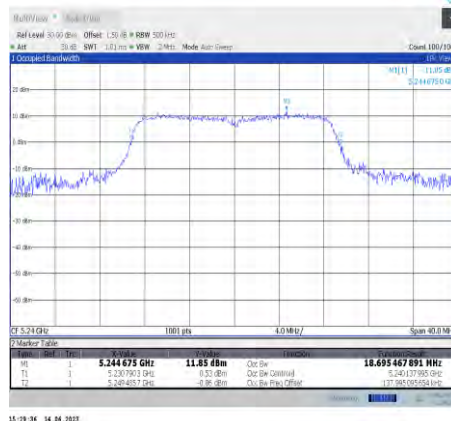
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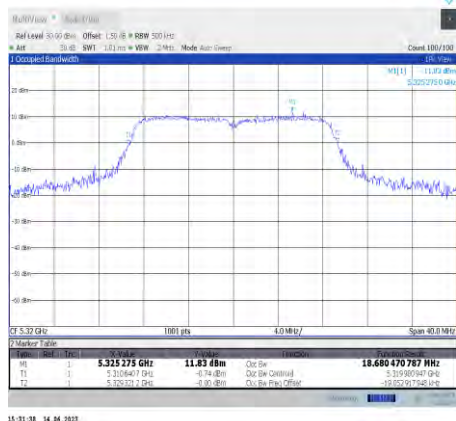
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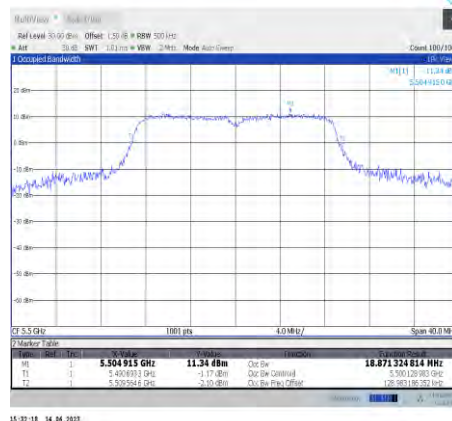
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11ac20SISO-Ant0-5320



11ac20SISO-Ant0-5500



11ac20SISO-Ant0-5580



11ac20SISO-Ant0-5700

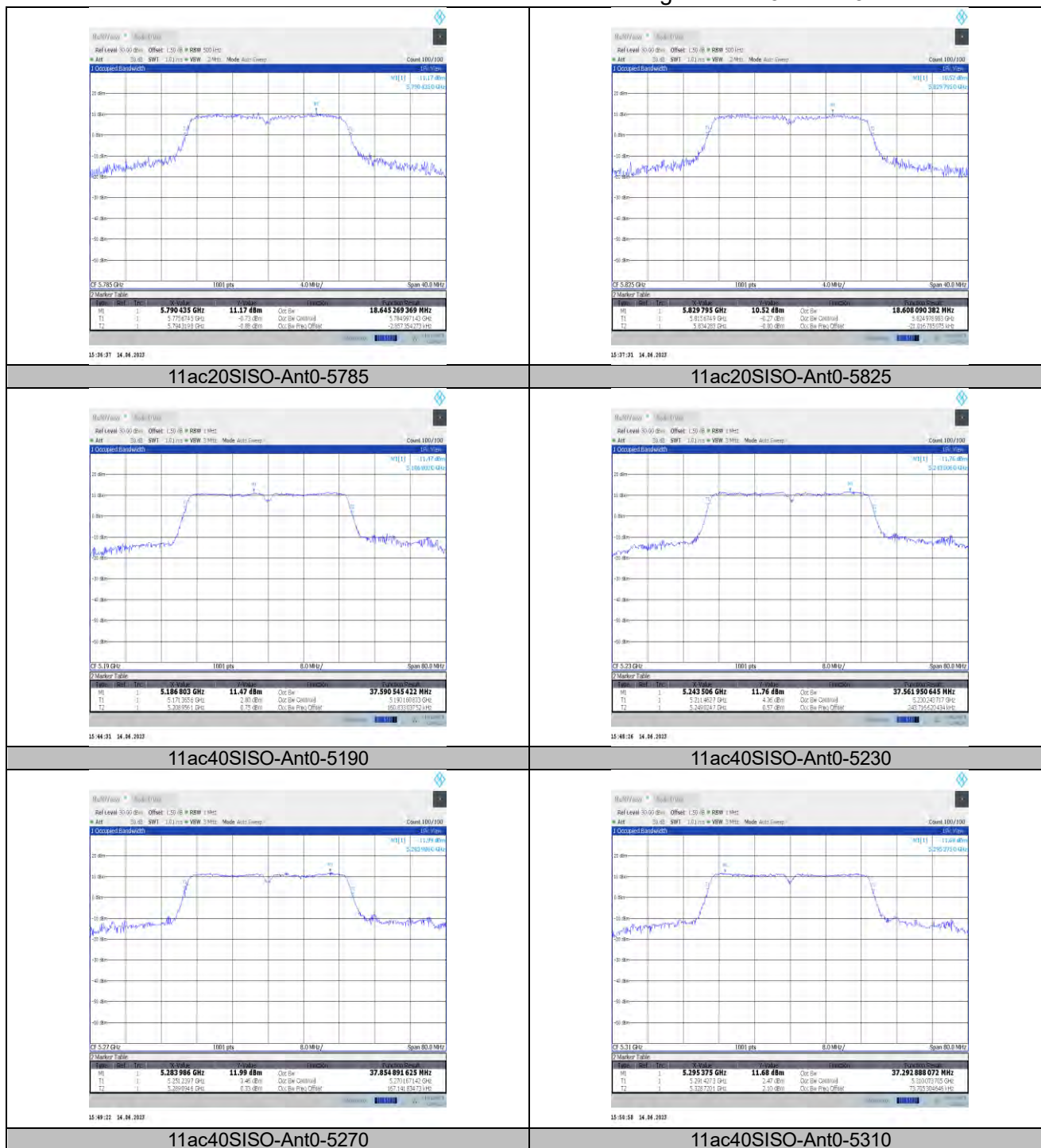


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11ac20SISO-Ant0-5745

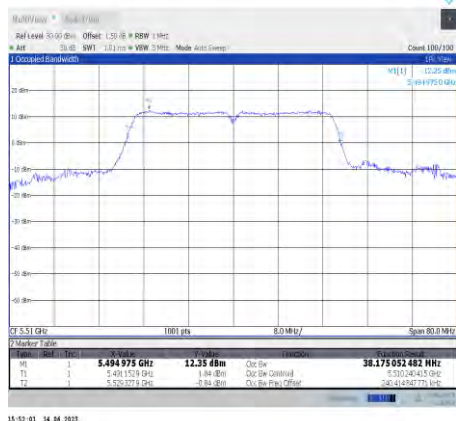




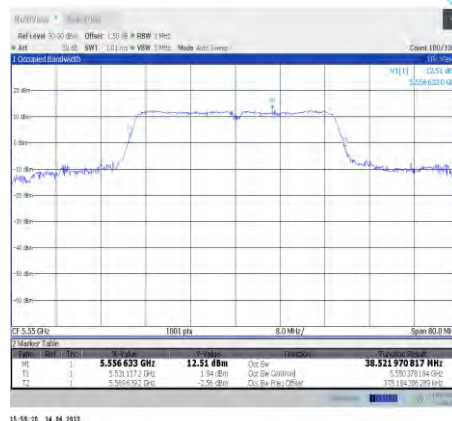
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11ac40SISO-Ant0-5510



11ac40SISO-Ant0-5550



11ac40SISO-Ant0-5670



11ac40SISO-Ant0-5710



11ac40SISO-Ant0-5755



11ac40SISO-Ant0-5795





11ac80SISO-Ant0-5210



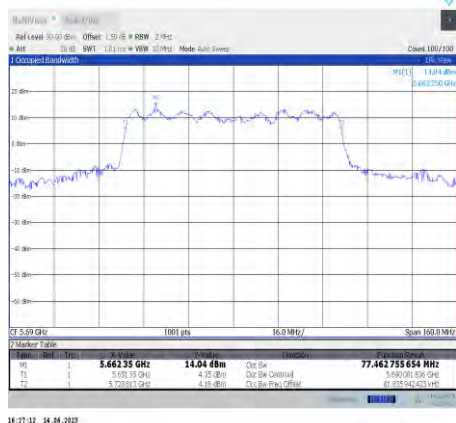
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11ac80SISO-Ant0-5530



11ac80SISO-Ant0-5610



11ac80SISO-Ant0-5690



11ac80SISO-Ant0-5775



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6dB emission bandwidth Test Result B4

TestMode	Antenna	Frequency[MHz]	6dB EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11a	Ant0	5745	16.40	5736.80	5753.20	≥0.5	PASS
11a	Ant0	5785	16.40	5776.80	5793.20	≥0.5	PASS
11a	Ant0	5825	16.40	5816.80	5833.20	≥0.5	PASS
11ac20SISO	Ant0	5745	17.36	5736.44	5753.80	≥0.5	PASS
11ac20SISO	Ant0	5785	17.60	5776.20	5793.80	≥0.5	PASS
11ac20SISO	Ant0	5825	16.88	5816.56	5833.44	≥0.5	PASS
11ac40SISO	Ant0	5755	35.04	5737.64	5772.68	≥0.5	PASS
11ac40SISO	Ant0	5795	35.84	5777.16	5813.00	≥0.5	PASS
11ac80SISO	Ant0	5775	75.52	5737.24	5812.76	≥0.5	PASS

Remark:

For 802.11n HT20/ac VHT20 and 802.11n HT40/ac VHT40 mode, the whole testing have assessed only, 802.11ac VHT20/40 by referring to their higher output power.



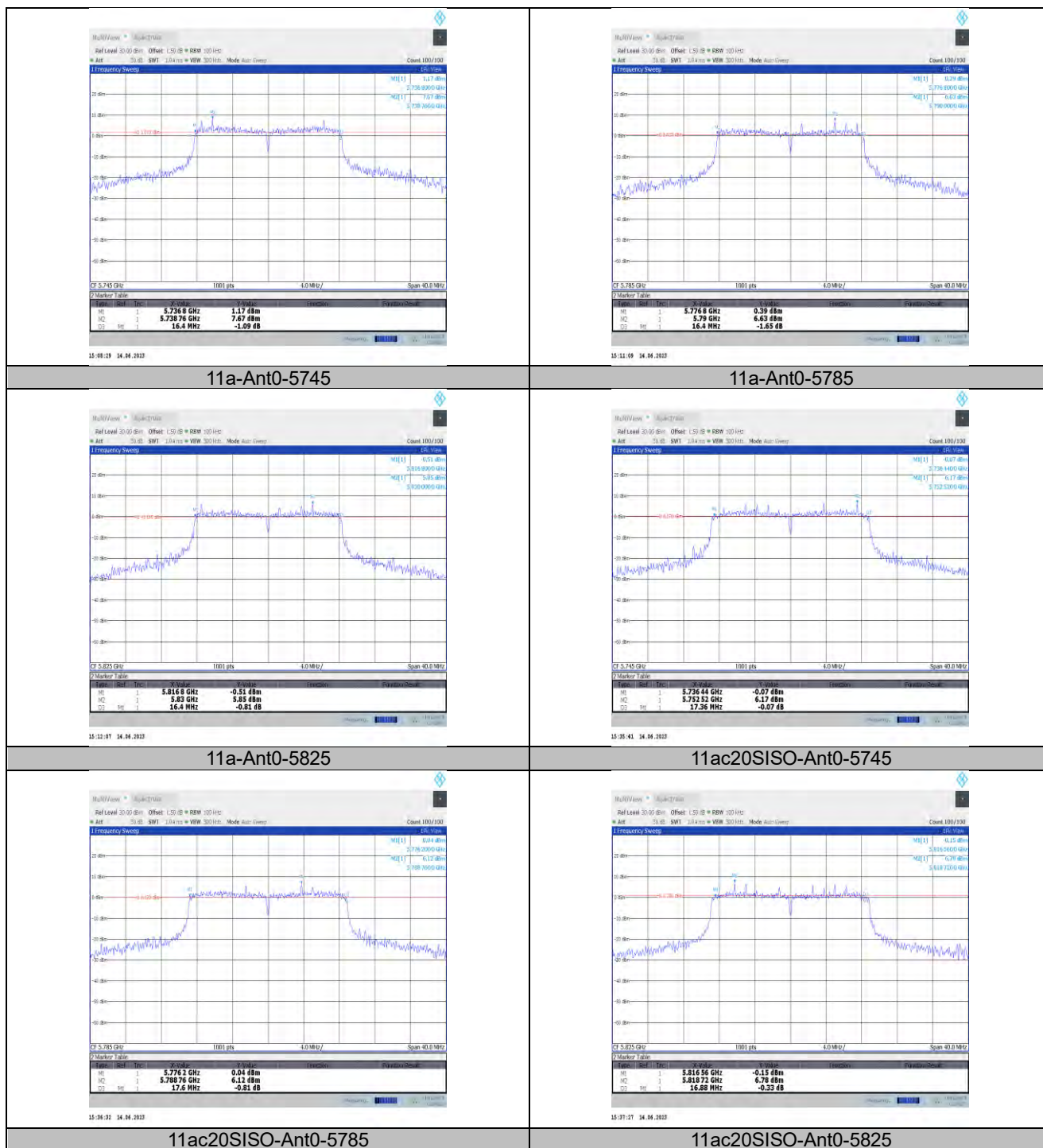
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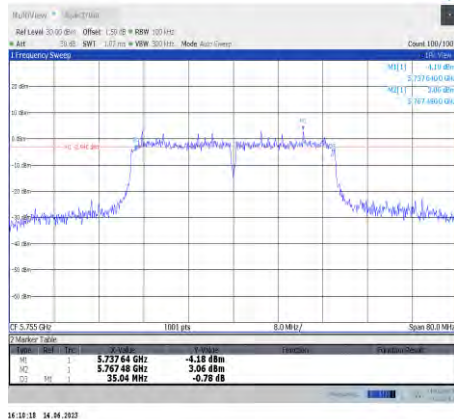
Test Graphs B4



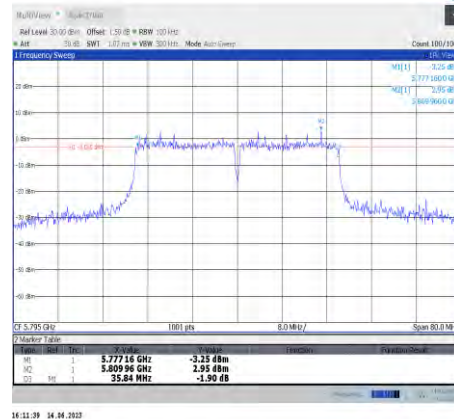
Report No.: SEWM2306000197RG04

Rev.: 01

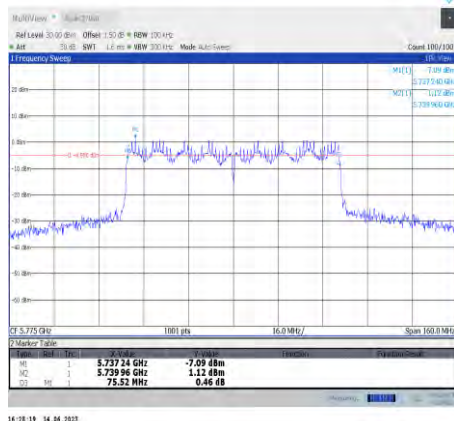
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11ac40SISO-Ant0-5755



11ac40SISO-Ant0-5795



11ac80SISO-Ant0-5775



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Duty Cycle Test Result

TestMode	Antenna	Frequency[MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11a	Ant0	5180	2.06	2.18	94.50
11a	Ant0	5220	2.07	2.24	92.41
11n20SISO	Ant0	5180	1.92	2.04	94.12
11n40SISO	Ant0	5190	0.96	1.12	85.71
11ac20SISO	Ant0	5180	1.92	2.06	93.20
11ac40SISO	Ant0	5190	0.96	1.12	85.71
11ac80SISO	Ant0	5210	0.45	0.62	72.58

Note:

Radiated Emission Average VBW = 1 / T

TestMode	T[ms]	Period[ms]	Duty Cycle[%]	1/T[kHz]	VBW Setting
11a	2.06	2.18	94.50	0.48544	0.51KHz
11ac20SISO	1.92	2.06	93.20	0.52083	0.54KHz
11ac40SISO	0.96	1.12	85.71	1.04167	1.1KHz
11ac80SISO	0.45	0.62	72.58	2.22222	2.3KHz



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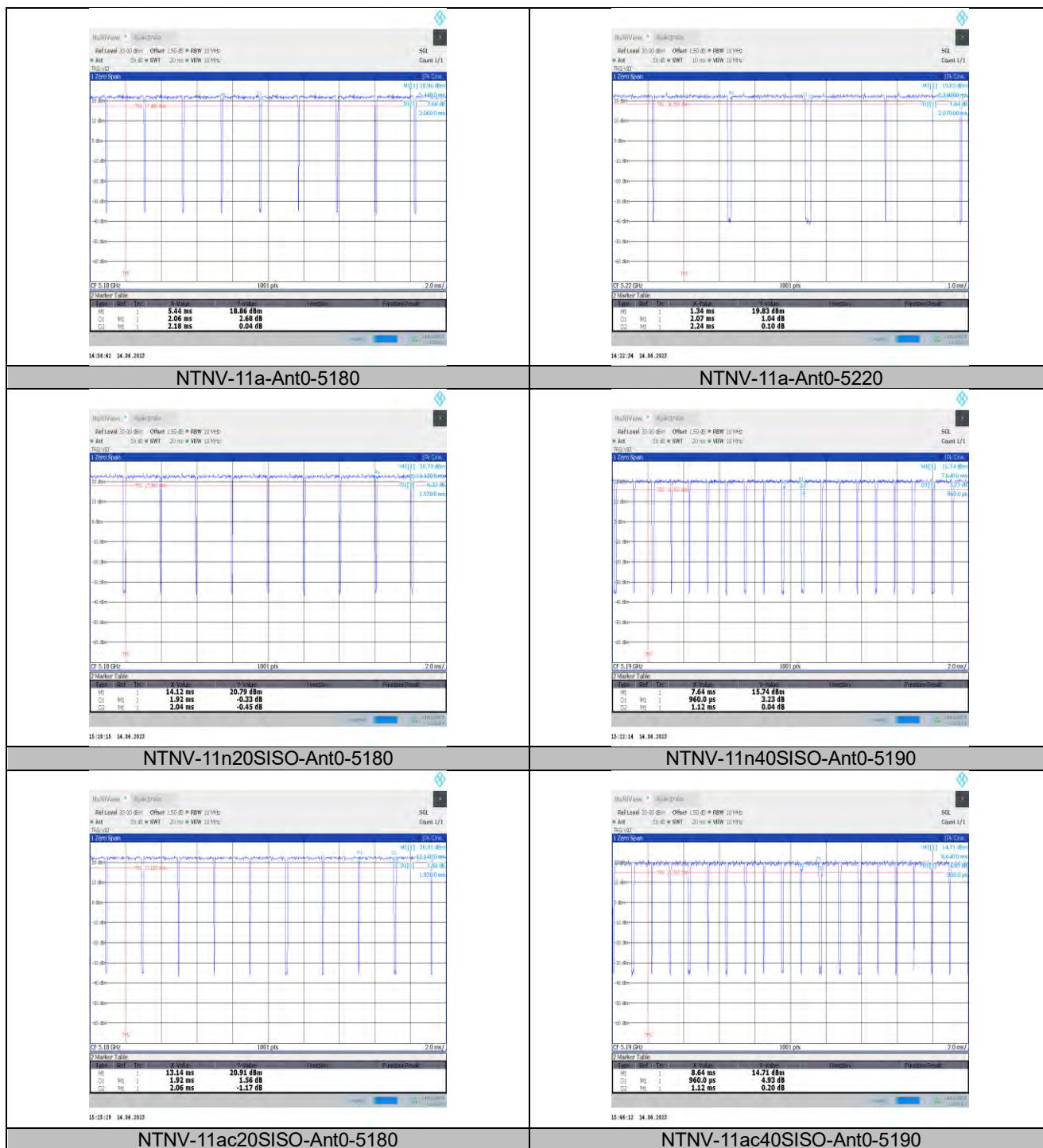
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Test Graphs



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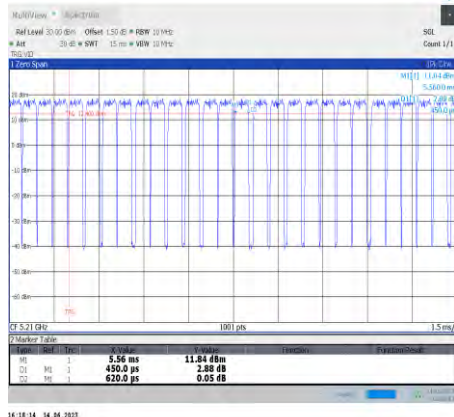
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NTNV-11ac80SISO-Ant0-5210



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Maximum conducted output power Test Result Channel Power

TestMode	Antenna	Frequency[MHz]	Result [dBm]	Limit [dBm]	Verdict
11a	Ant0	5180	16.45	≤23.98	PASS
11a	Ant0	5220	16.71	≤23.98	PASS
11a	Ant0	5240	16.8	≤23.98	PASS
11a	Ant0	5260	18.05	≤23.98	PASS
11a	Ant0	5300	18.18	≤23.98	PASS
11a	Ant0	5320	18.01	≤23.98	PASS
11a	Ant0	5500	16.98	≤23.98	PASS
11a	Ant0	5580	16.99	≤23.98	PASS
11a	Ant0	5700	17.03	≤23.98	PASS
11a	Ant0	5720	16.87	≤23.98	PASS
11a	Ant0	5745	18.26	≤30.00	PASS
11a	Ant0	5785	17.75	≤30.00	PASS
11a	Ant0	5825	17.64	≤30.00	PASS
11n20SISO	Ant0	5180	16.63	≤23.98	PASS
11n20SISO	Ant0	5220	16.74	≤23.98	PASS
11n20SISO	Ant0	5240	16.98	≤23.98	PASS
11n20SISO	Ant0	5260	17.95	≤23.98	PASS
11n20SISO	Ant0	5300	18.08	≤23.98	PASS
11n20SISO	Ant0	5320	17.91	≤23.98	PASS
11n20SISO	Ant0	5500	16.99	≤23.98	PASS
11n20SISO	Ant0	5580	17.03	≤23.98	PASS
11n20SISO	Ant0	5700	17.01	≤23.98	PASS
11n20SISO	Ant0	5720	16.78	≤23.98	PASS
11n20SISO	Ant0	5745	17.87	≤30.00	PASS
11n20SISO	Ant0	5785	17.89	≤30.00	PASS
11n20SISO	Ant0	5825	17.78	≤30.00	PASS
11n40SISO	Ant0	5190	17.32	≤23.98	PASS
11n40SISO	Ant0	5230	17.46	≤23.98	PASS
11n40SISO	Ant0	5270	15.69	≤23.98	PASS
11n40SISO	Ant0	5310	15.32	≤23.98	PASS
11n40SISO	Ant0	5510	15.56	≤23.98	PASS
11n40SISO	Ant0	5550	15.59	≤23.98	PASS
11n40SISO	Ant0	5670	15.62	≤23.98	PASS
11n40SISO	Ant0	5710	15.34	≤23.98	PASS
11n40SISO	Ant0	5755	17.79	≤30.00	PASS
11n40SISO	Ant0	5795	17.93	≤30.00	PASS
11ac20SISO	Ant0	5180	16.65	≤23.98	PASS
11ac20SISO	Ant0	5220	16.78	≤23.98	PASS
11ac20SISO	Ant0	5240	16.99	≤23.98	PASS
11ac20SISO	Ant0	5260	17.99	≤23.98	PASS
11ac20SISO	Ant0	5300	18.18	≤23.98	PASS
11ac20SISO	Ant0	5320	17.98	≤23.98	PASS
11ac20SISO	Ant0	5500	17.03	≤23.98	PASS
11ac20SISO	Ant0	5580	17.05	≤23.98	PASS
11ac20SISO	Ant0	5700	17.00	≤23.98	PASS
11ac20SISO	Ant0	5720	16.77	≤23.98	PASS
11ac20SISO	Ant0	5745	17.89	≤30.00	PASS
11ac20SISO	Ant0	5785	17.93	≤30.00	PASS
11ac20SISO	Ant0	5825	17.79	≤30.00	PASS
11ac40SISO	Ant0	5190	17.33	≤23.98	PASS
11ac40SISO	Ant0	5230	17.48	≤23.98	PASS
11ac40SISO	Ant0	5270	15.73	≤23.98	PASS



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11ac40SISO	Ant0	5310	15.43	≤23.98	PASS
11ac40SISO	Ant0	5510	15.59	≤23.98	PASS
11ac40SISO	Ant0	5550	15.61	≤23.98	PASS
11ac40SISO	Ant0	5670	15.64	≤23.98	PASS
11ac40SISO	Ant0	5710	15.43	≤23.98	PASS
11ac40SISO	Ant0	5755	17.83	≤30.00	PASS
11ac40SISO	Ant0	5795	17.94	≤30.00	PASS
11ac80SISO	Ant0	5210	16.32	≤23.98	PASS
11ac80SISO	Ant0	5290	15.78	≤23.98	PASS
11ac80SISO	Ant0	5530	16.01	≤23.98	PASS
11ac80SISO	Ant0	5610	16.03	≤23.98	PASS
11ac80SISO	Ant0	5690	16.01	≤23.98	PASS
11ac80SISO	Ant0	5775	17.91	≤30.00	PASS



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Maximum power spectral density Test Result

TestMode	Antenna	Frequency[MHz]	Result	Limit	Verdict
11a	Ant0	5180	6.75	≤11.00	PASS
11a	Ant0	5220	7.16	≤11.00	PASS
11a	Ant0	5240	7.13	≤11.00	PASS
11a	Ant0	5260	6.83	≤11.00	PASS
11a	Ant0	5300	7.23	≤11.00	PASS
11a	Ant0	5320	7.03	≤11.00	PASS
11a	Ant0	5500	7.18	≤11.00	PASS
11a	Ant0	5580	7.49	≤11.00	PASS
11a	Ant0	5700	7.67	≤11.00	PASS
11a	Ant0	5720 UNII-2C	7.44	≤11.00	PASS
11a	Ant0	5720 UNII-3	4.45	≤30.00	PASS
11a	Ant0	5745	3.85	≤30.00	PASS
11a	Ant0	5785	3.93	≤30.00	PASS
11a	Ant0	5825	3.49	≤30.00	PASS
11ac20SISO	Ant0	5180	7.11	≤11.00	PASS
11ac20SISO	Ant0	5220	6.68	≤11.00	PASS
11ac20SISO	Ant0	5240	6.87	≤11.00	PASS
11ac20SISO	Ant0	5260	6.75	≤11.00	PASS
11ac20SISO	Ant0	5300	6.97	≤11.00	PASS
11ac20SISO	Ant0	5320	6.89	≤11.00	PASS
11ac20SISO	Ant0	5500	7.36	≤11.00	PASS
11ac20SISO	Ant0	5580	7.51	≤11.00	PASS
11ac20SISO	Ant0	5700	7.03	≤11.00	PASS
11ac20SISO	Ant0	5720 UNII-2C	6.8	≤11.00	PASS
11ac20SISO	Ant0	5720 UNII-3	4	≤30.00	PASS
11ac20SISO	Ant0	5745	3.69	≤30.00	PASS
11ac20SISO	Ant0	5785	3.7	≤30.00	PASS
11ac20SISO	Ant0	5825	3.33	≤30.00	PASS
11ac40SISO	Ant0	5190	3.6	≤11.00	PASS
11ac40SISO	Ant0	5230	3.91	≤11.00	PASS
11ac40SISO	Ant0	5270	3.96	≤11.00	PASS
11ac40SISO	Ant0	5310	3.94	≤11.00	PASS
11ac40SISO	Ant0	5510	4.67	≤11.00	PASS
11ac40SISO	Ant0	5550	4.06	≤11.00	PASS
11ac40SISO	Ant0	5670	3.67	≤11.00	PASS
11ac40SISO	Ant0	5710 UNII-2C	3.54	≤11.00	PASS
11ac40SISO	Ant0	5710 UNII-3	0.28	≤30.00	PASS
11ac40SISO	Ant0	5755	0.63	≤30.00	PASS
11ac40SISO	Ant0	5795	0.17	≤30.00	PASS
11ac80SISO	Ant0	5210	3.69	≤11.00	PASS
11ac80SISO	Ant0	5290	1.84	≤11.00	PASS
11ac80SISO	Ant0	5530	2.55	≤11.00	PASS
11ac80SISO	Ant0	5610	2.54	≤11.00	PASS
11ac80SISO	Ant0	5690 UNII-2C	2.31	≤11.00	PASS
11ac80SISO	Ant0	5690 UNII-3	-1.82	≤30.00	PASS
11ac80SISO	Ant0	5775	-1.22	≤30.00	PASS



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Note:

- 1.The Result and Limit Unit is dBm/1MHz in the band 5150-5250 MHz, 5.250-5350 MHz, 5470-5725 MHz.
- 2.The Result and Limit Unit is dBm/500 kHz in the band 5725-5850 MHz.
- 3.The Duty Cycle Factor and RBW Factor is compensated in the graph.

Remark:

For 802.11n HT20/ac VHT20 and 802.11n HT40/ac VHT40 mode, the whole testing have assessed only, 802.11ac VHT20/40 by referring to their higher output power.



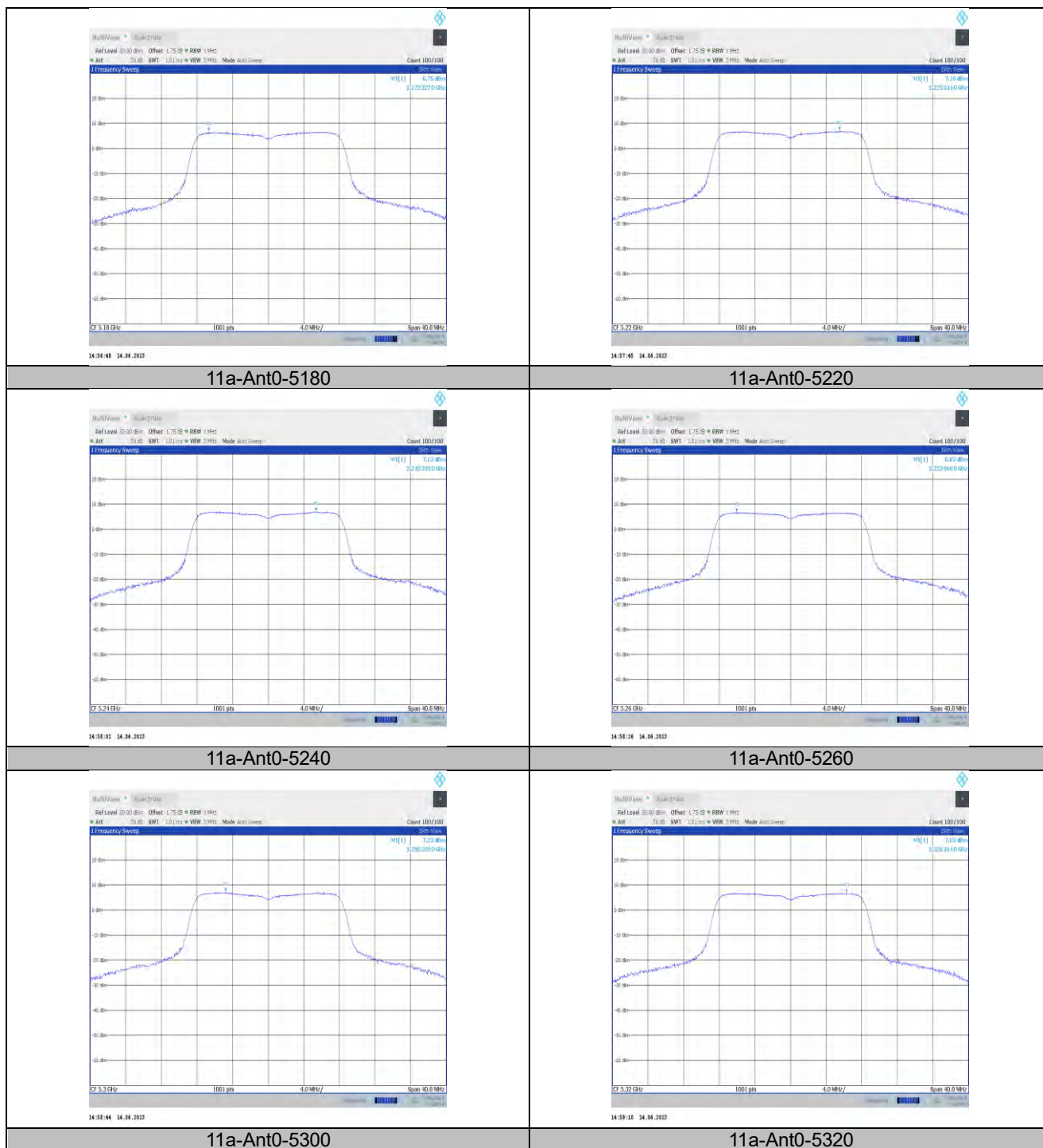
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Test Graphs



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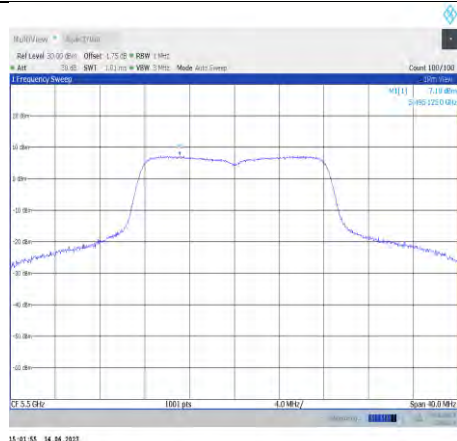
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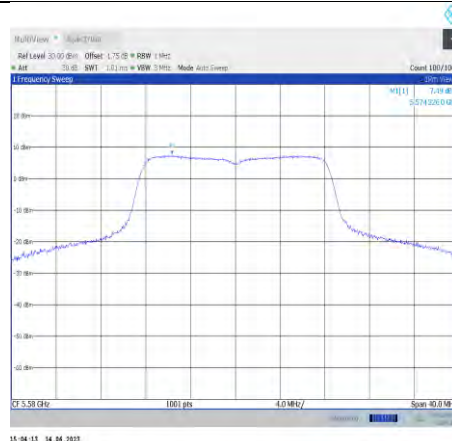
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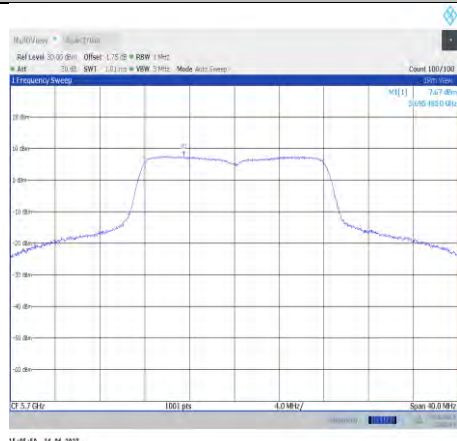
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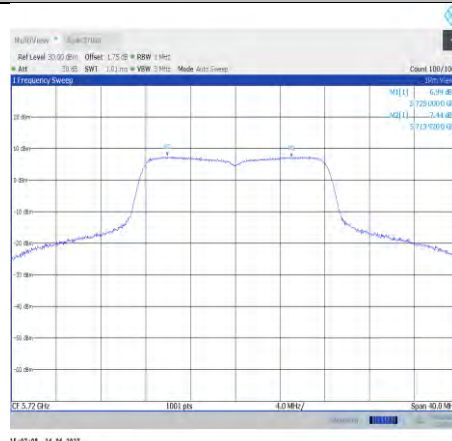
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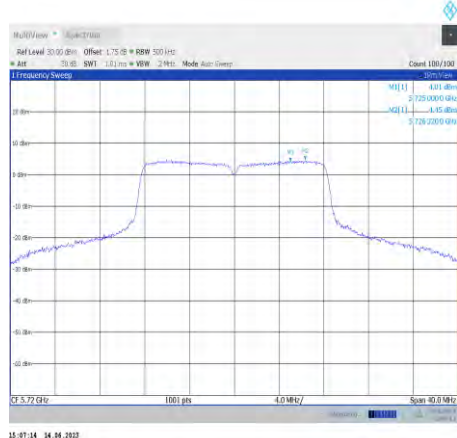
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11a-Ant0-5745



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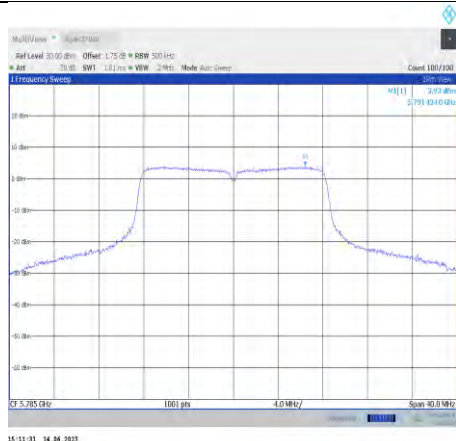
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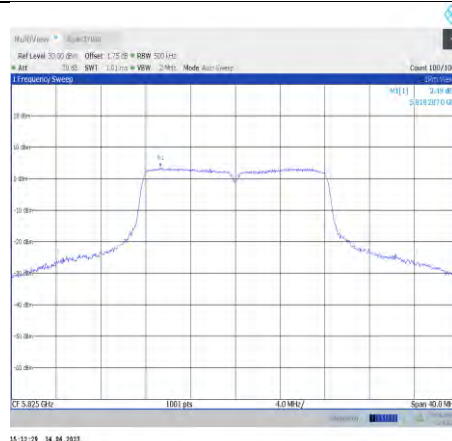
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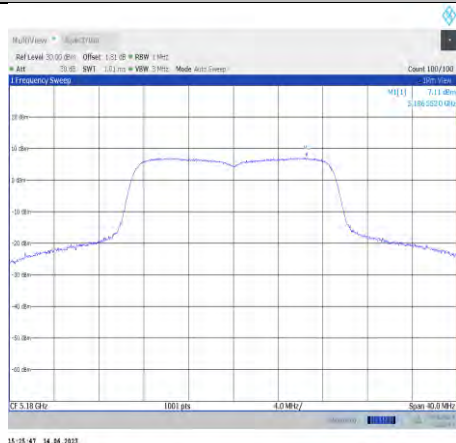
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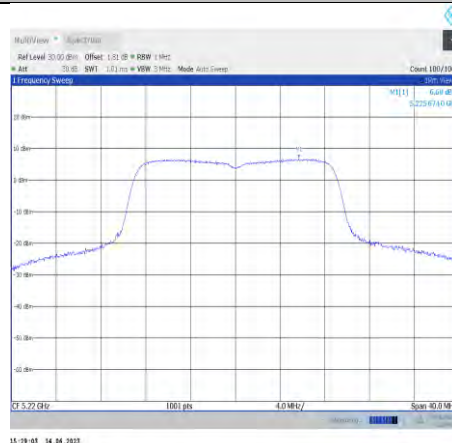
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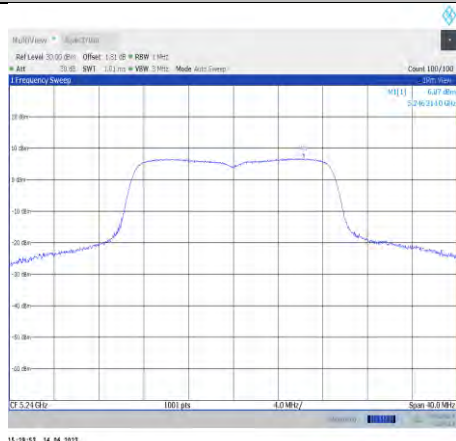
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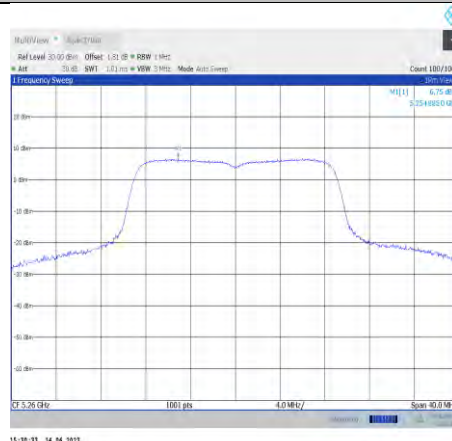
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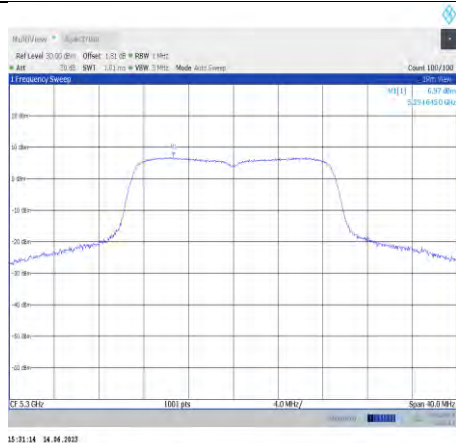
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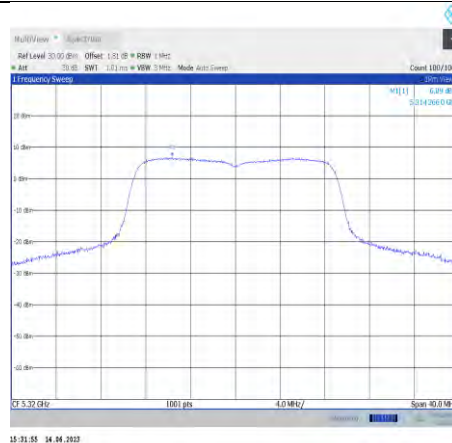
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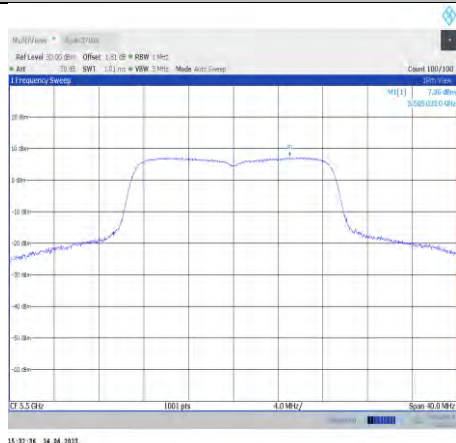
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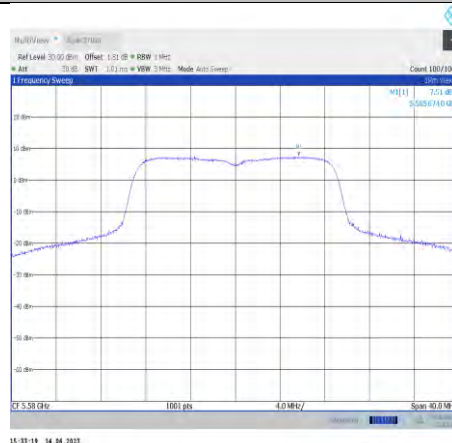
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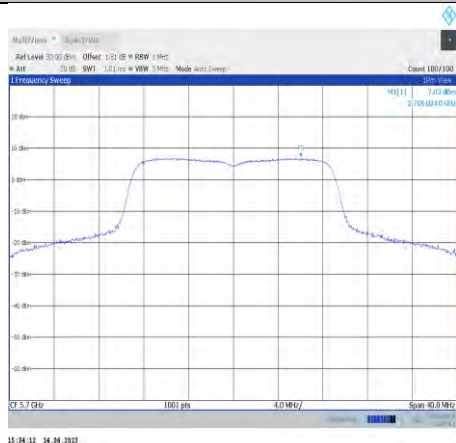
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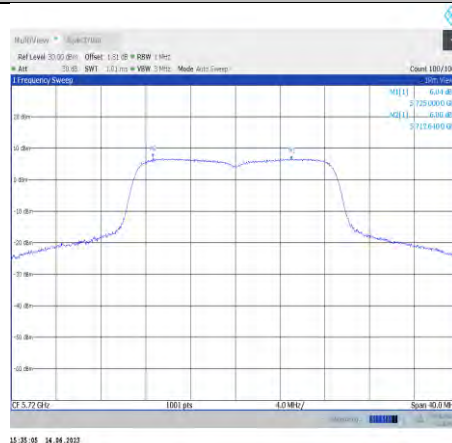
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11ac20SISO-Ant0-5700



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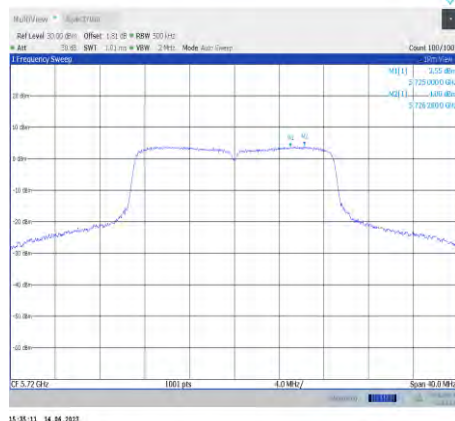
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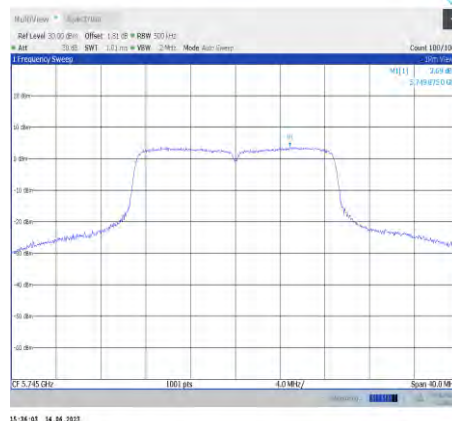
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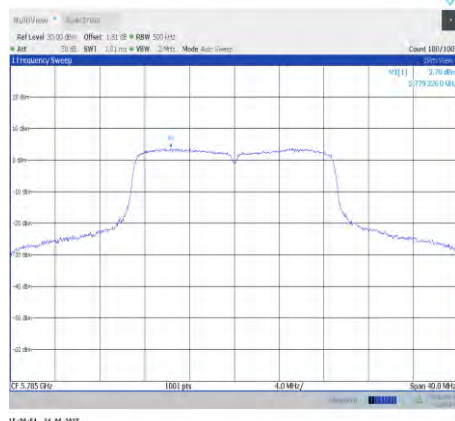
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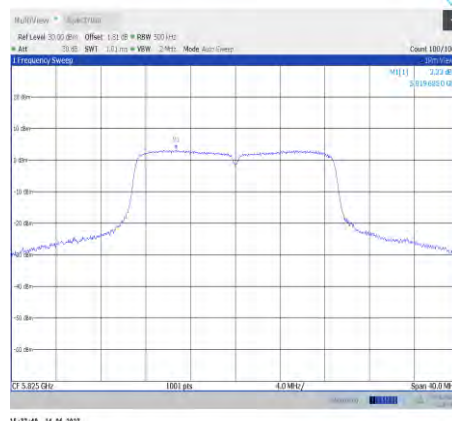
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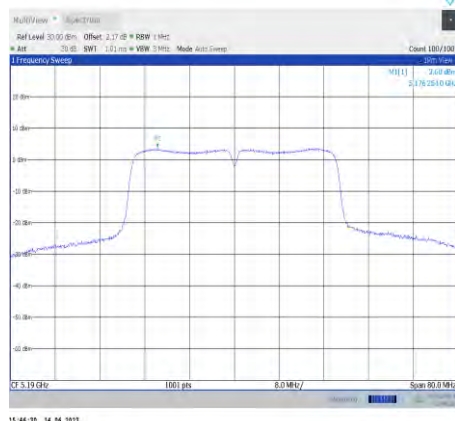
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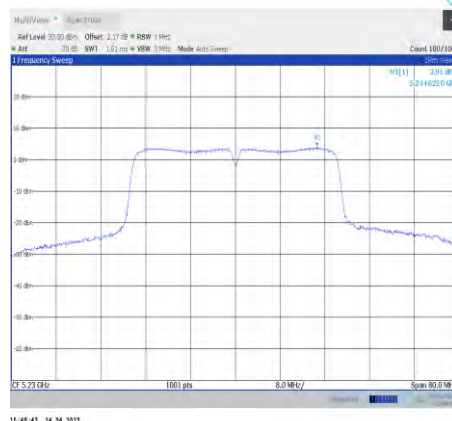
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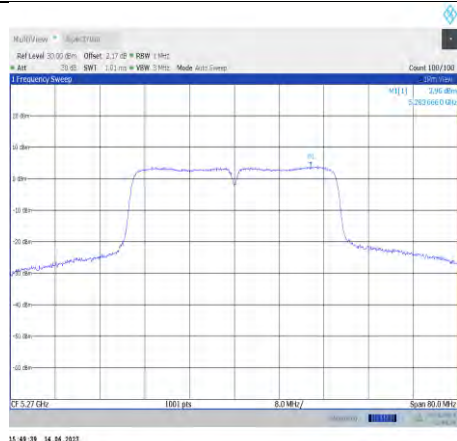
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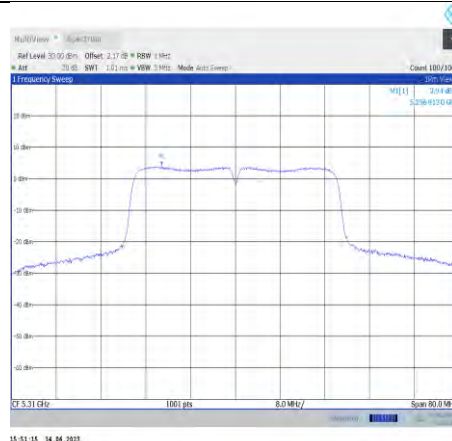
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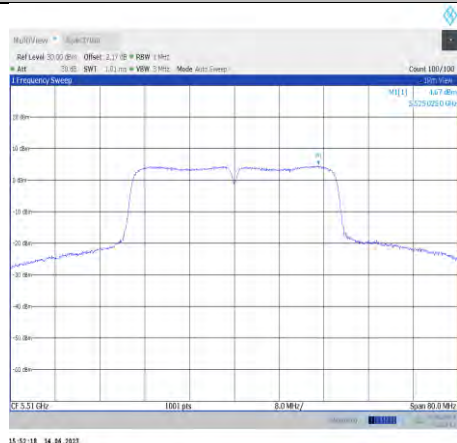
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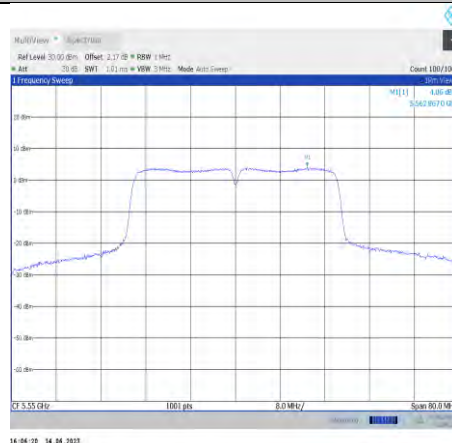
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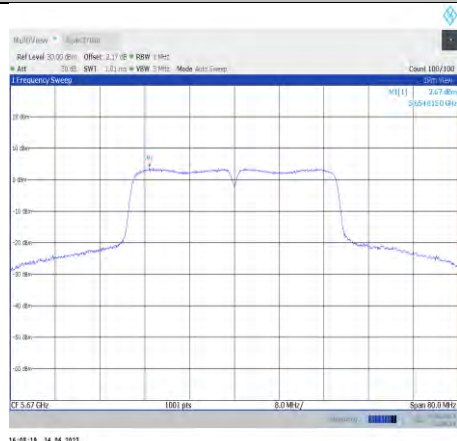
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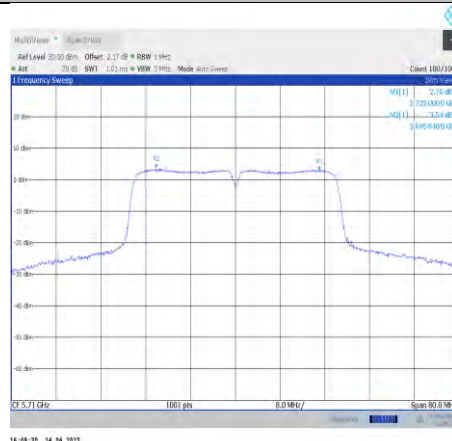
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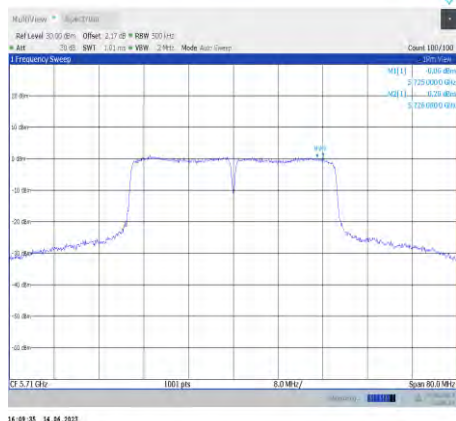
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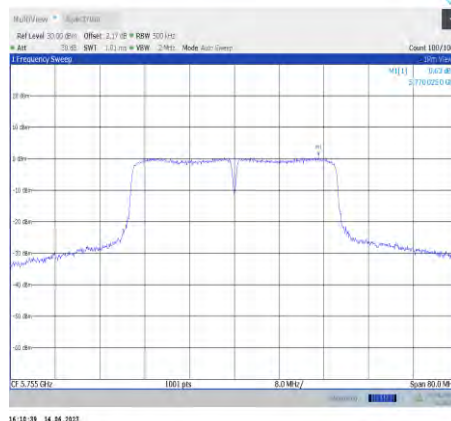
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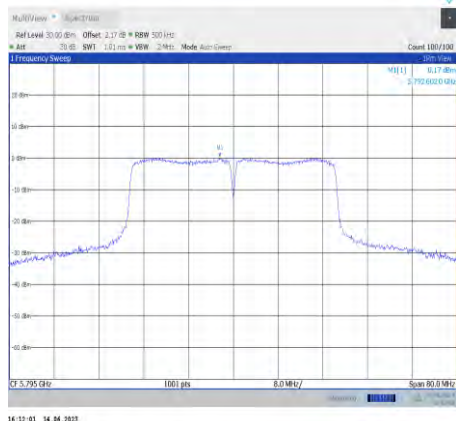
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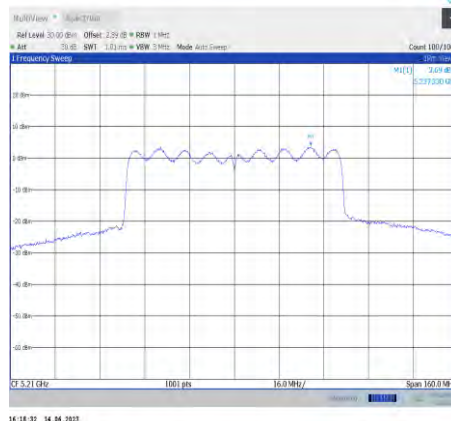
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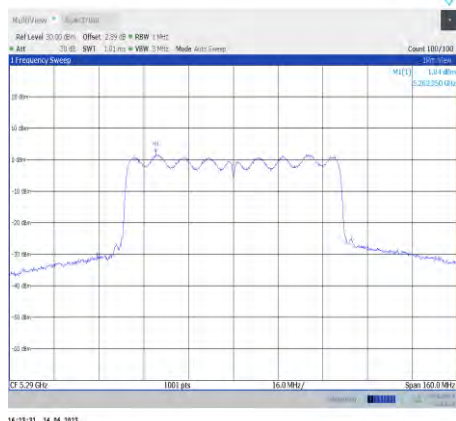
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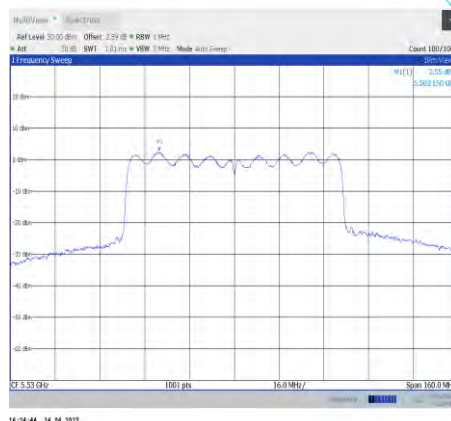
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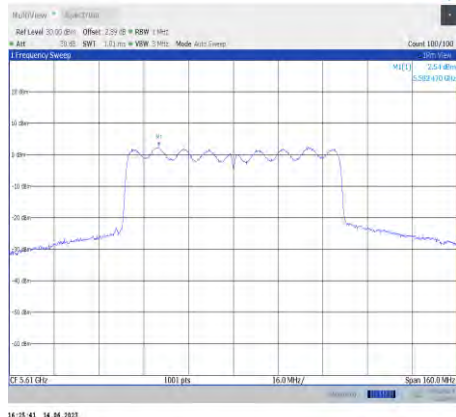
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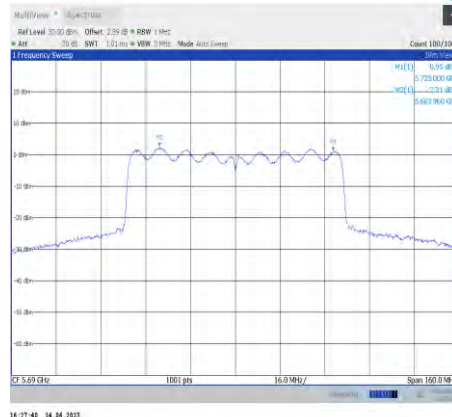
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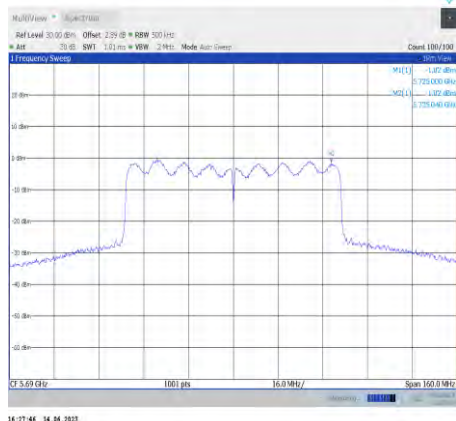
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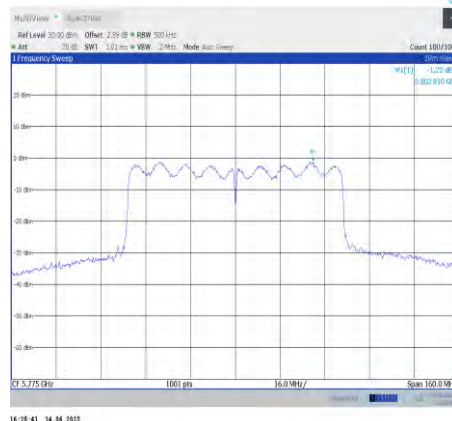
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Channel Move Time and Channel Closing Transmission Time Test Result

TestMode	Frequency[MHz]	CCTT[ms]	Limit[ms]	CMT[ms]	Limit[ms]	Verdict
11ac80SISO	5530	200+13	200+60	751.1	10000	PASS



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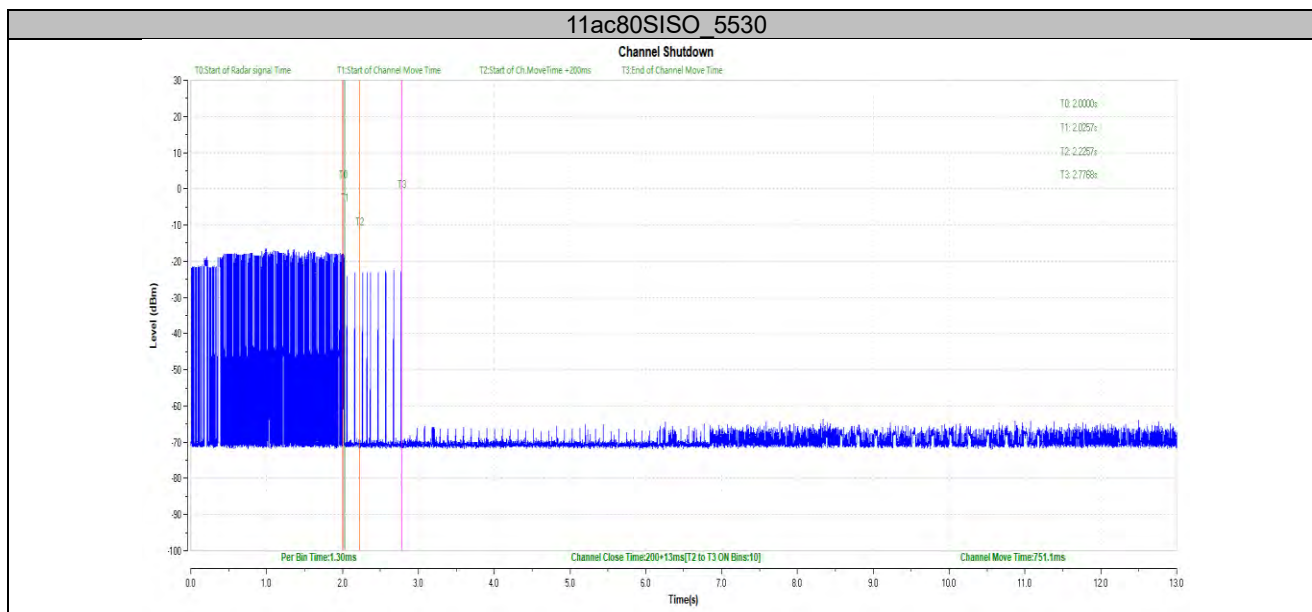
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Test Graphs



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Non-Occupancy Period

Test Result

TestMode	Frequency[MHz]	Result	Limit[s]	Verdict
11ac80SISO	5530	see test graph	≥1800	PASS



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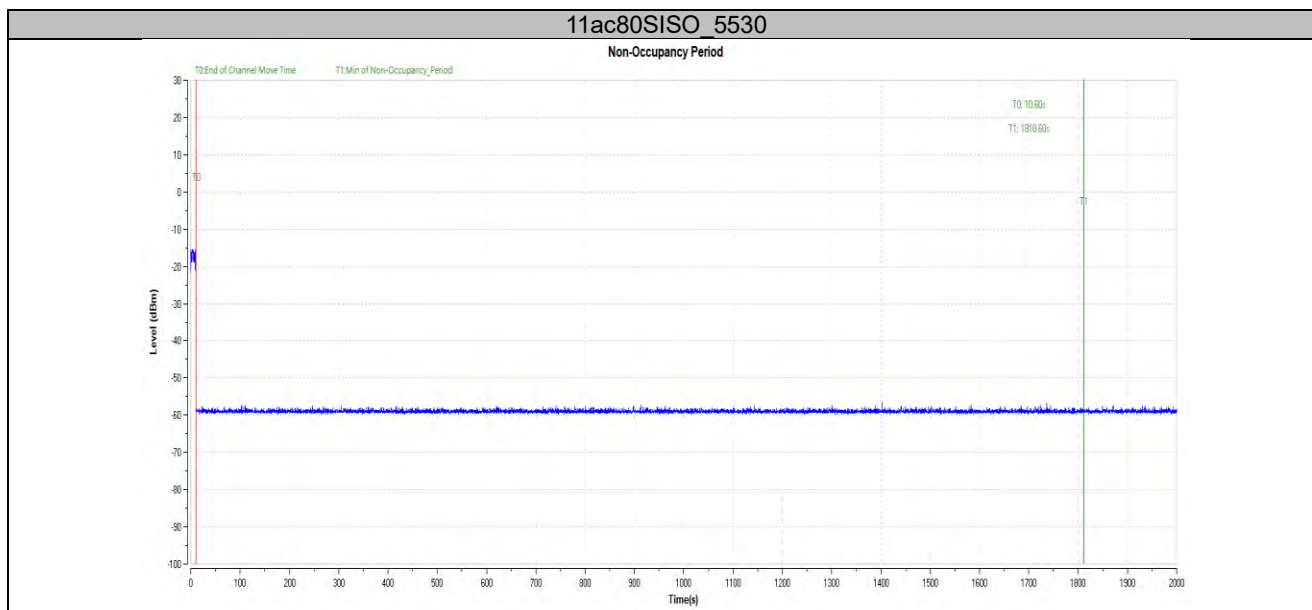
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Test Graphs



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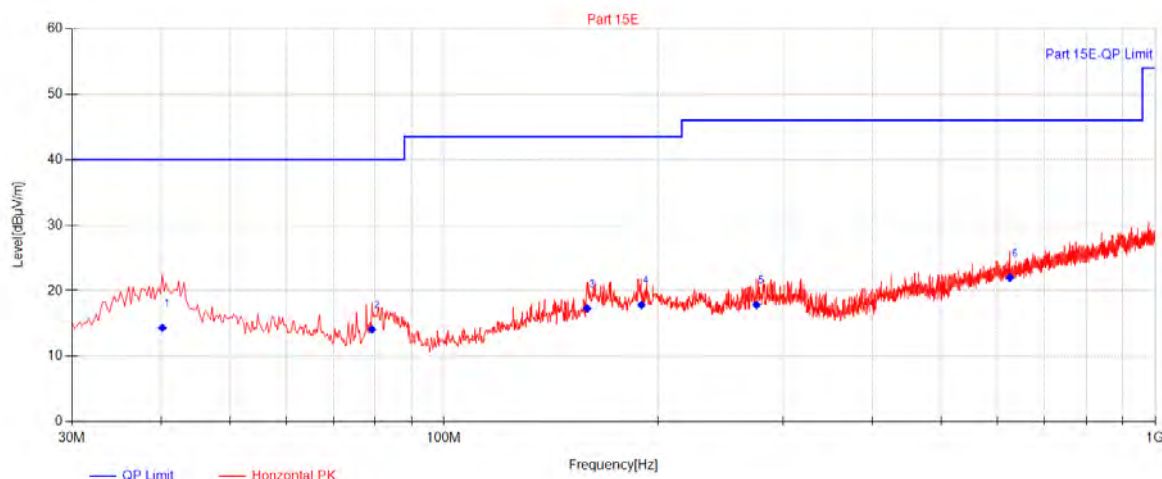
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Radiated Spurious Emissions

Radiated emission below 1GHz

Worst case Mode: 802.11ac20_Channel 100

Data List

NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF [dB/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.185	36.55	-36.27	14.05	14.34	40.00	25.66	156	202	Horizontal
2	79.2275	40.39	-35.70	9.41	14.10	40.00	25.90	231	161	Horizontal
3	159.01	38.49	-35.31	14.11	17.29	43.50	26.21	142	349	Horizontal
4	189.565	40.85	-35.41	12.39	17.83	43.50	25.67	189	233	Horizontal
5	275.1675	39.96	-34.32	12.19	17.83	46.00	28.17	216	10	Horizontal
6	625.095	35.60	-32.27	18.65	21.98	46.00	24.02	144	294	Horizontal



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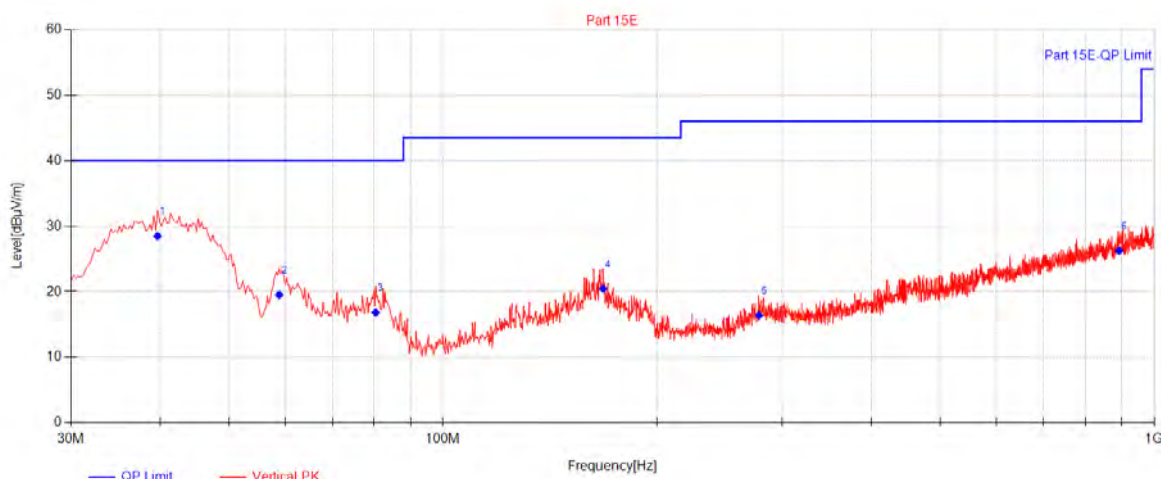
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Data List

NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF [dB/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	39.7	50.74	-36.28	14.03	28.49	40.00	11.51	156	127	Vertical
2	58.8575	43.06	-36.37	12.84	19.53	40.00	20.47	231	269	Vertical
3	80.44	43.20	-35.67	9.30	16.83	40.00	23.17	129	230	Vertical
4	167.9825	41.27	-35.18	14.36	20.45	43.50	23.05	188	108	Vertical
5	278.32	38.58	-34.46	12.27	16.38	46.00	29.62	219	281	Vertical
6	893.3	34.93	-30.24	21.56	26.25	46.00	19.75	153	11	Vertical

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier gain. The basic equation with a sample calculation is as follows:

Value = Reading(dBμV) + AF(dB/m) + Factor(dB):

AF = Antenna Factor(dB/m)

Factor = Cable Factor(dB) - Preamplifier gain(dB)

Margin = Limit(dBμV/m) – Value(dBμV/m)

- 2) All channels have been tested, but only the worst case data displayed in this report.



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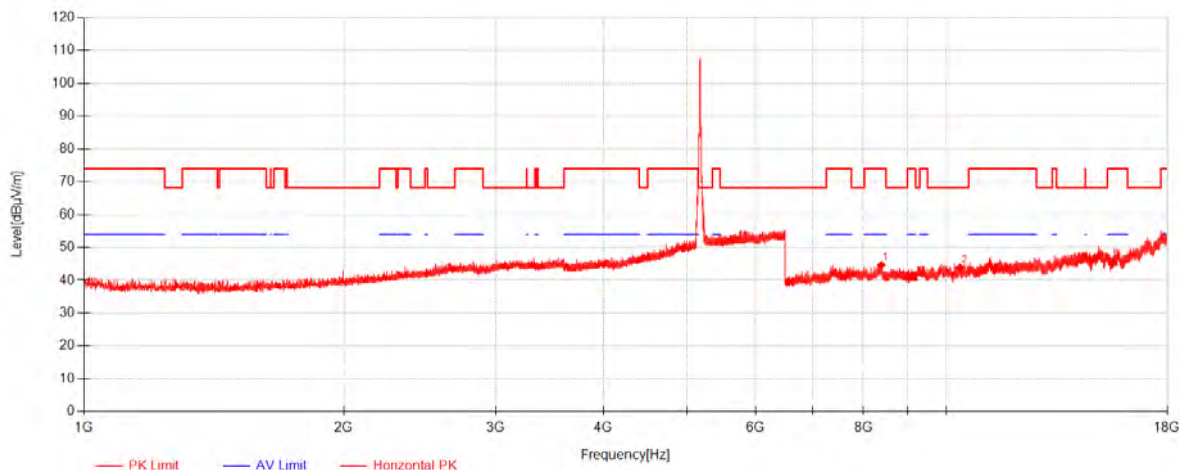
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Transmitter emission Above 1GHz

802.11a_Channel 36



Data List

NO.	Frequency [MHz]	Reading [dBμV]	AF [dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	8394.1458	49.41	36.60	-41.40	44.61	74.00	29.39	211	21	Horizontal
2	10360.0000	44.24	38.38	-38.82	43.80	68.30	24.50	187	38	Horizontal
3	15540.0000	39.52	40.17	-34.81	44.87	74.00	29.13	169	360	Horizontal



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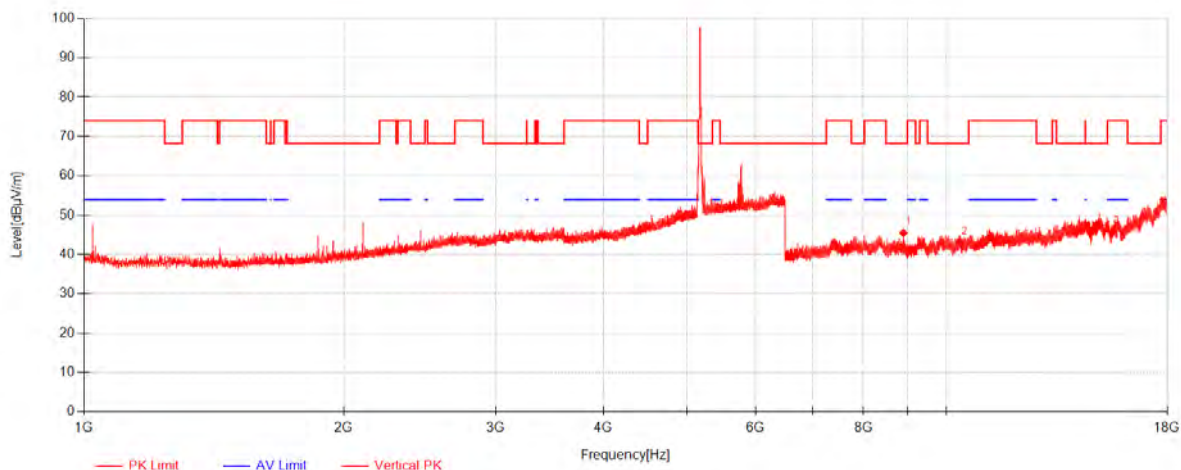
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802.11a_Channel 36



Data List

NO.	Frequency [MHz]	Reading [dBμV]	AF [dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	8906.375	50.07	36.35	-40.91	45.51	68.30	22.79	154	94	Vertical
2	10360.0000	43.55	38.38	-38.82	43.11	68.30	25.19	121	94	Vertical
3	15540.0000	40.40	40.17	-34.81	45.75	74.00	28.25	187	58	Vertical



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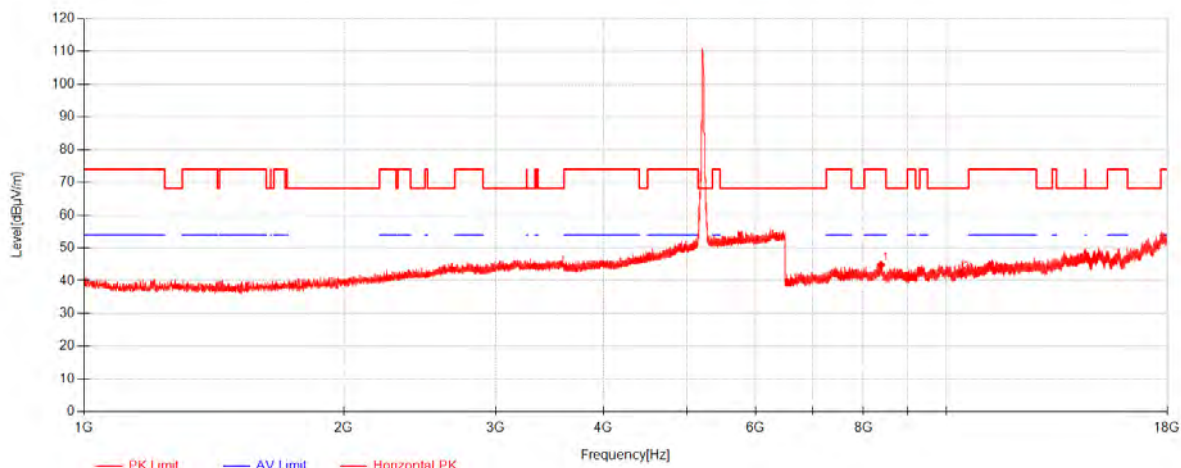
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802.11a_Channel 44



Data List

NO.	Frequency [MHz]	Reading [dBμV]	AF [dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	8387.4375	49.66	36.61	-41.43	44.83	74.00	29.17	215	75	Horizontal
2	10400.0000	42.46	38.40	-38.72	42.14	68.30	26.16	122	148	Horizontal
3	15600.0000	40.27	40.04	-34.37	45.94	74.00	28.06	189	294	Horizontal



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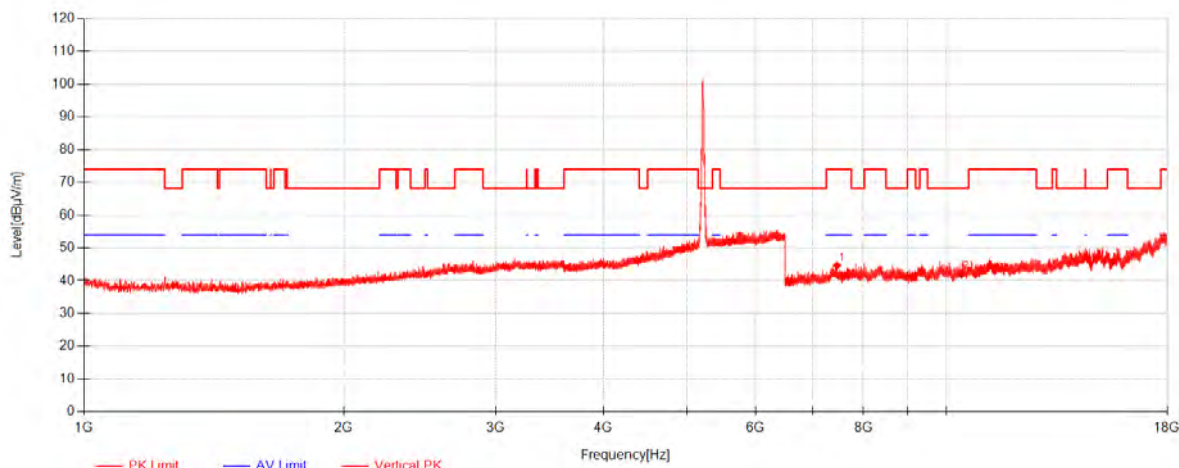
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802.11a_Channel 44



Data List										
NO.	Frequency [MHz]	Reading [dBμV]	AF [dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	7460.25	51.15	36.49	-43.02	44.62	74.00	29.38	214	295	Vertical
2	10400.0000	42.52	38.40	-38.72	42.20	68.30	26.10	269	167	Vertical
3	15600.0000	40.26	40.04	-34.37	45.93	74.00	28.07	132	58	Vertical



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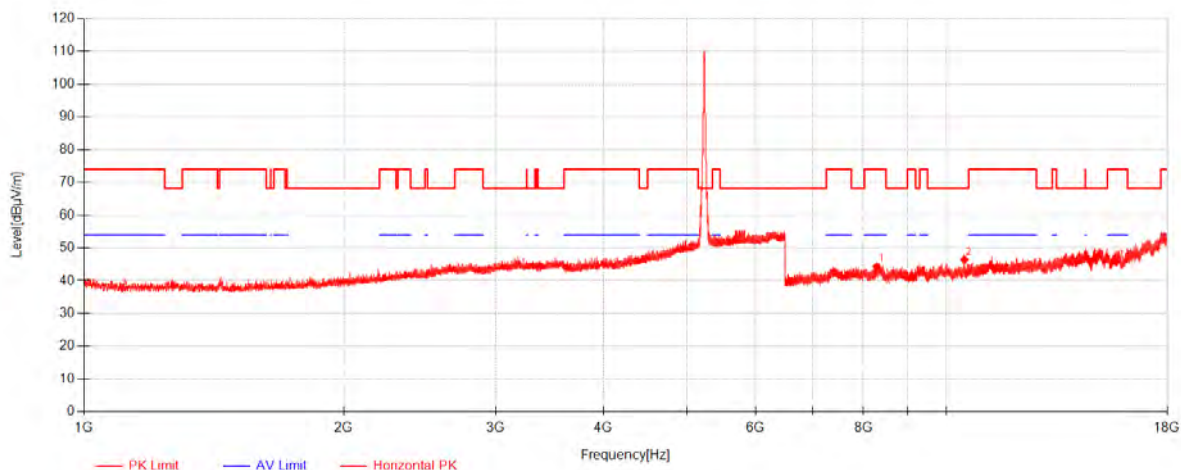
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802.11a_Channel 48



Data List

NO.	Frequency [MHz]	Reading [dBμV]	AF [dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	8290.6458	49.55	36.65	-41.90	44.31	74.00	29.69	203	149	Horizontal
2	10480.0000	46.75	38.44	-38.75	46.44	68.30	21.86	196	315	Horizontal
3	15720.0000	39.08	39.79	-33.22	45.65	74.00	28.35	154	93	Horizontal



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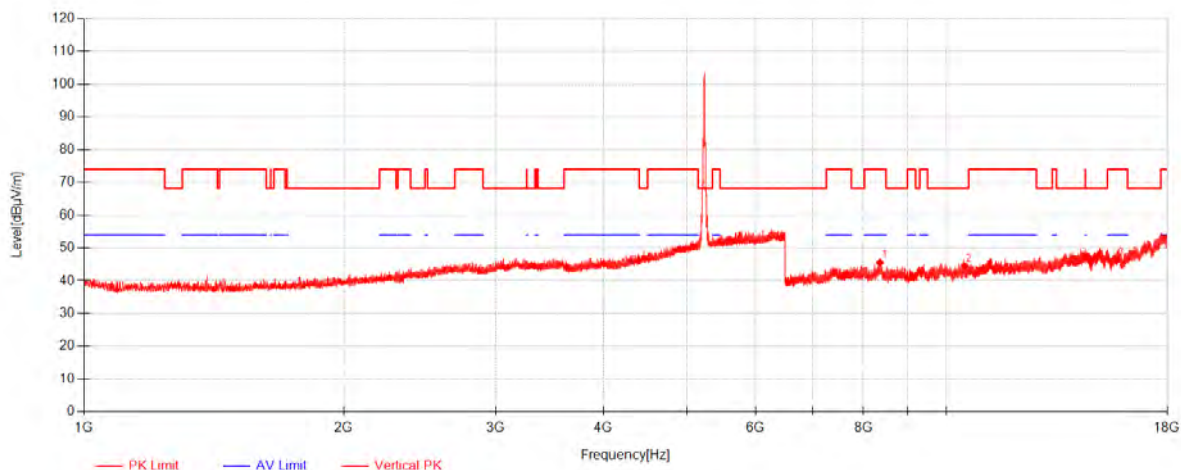
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Data List

NO.	Frequency [MHz]	Reading [dBμV]	AF [dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	8363.9583	50.42	36.62	-41.55	45.49	74.00	28.51	221	3	Vertical
2	10480.0000	44.74	38.44	-38.75	44.43	68.30	23.87	187	92	Vertical
3	15720.0000	39.64	39.79	-33.22	46.21	74.00	27.79	269	3	Vertical



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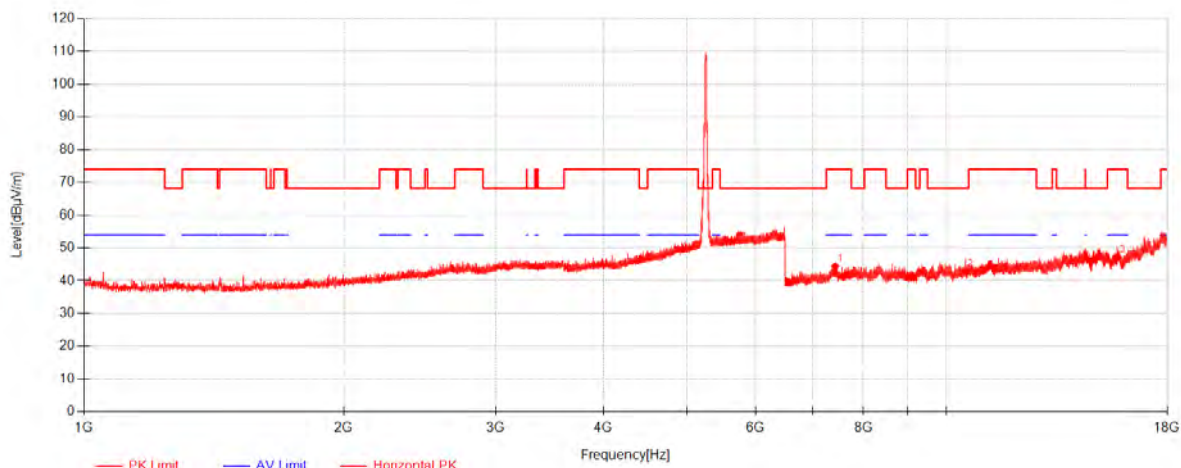
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802.11a_Channel 52



Data List

NO.	Frequency [MHz]	Reading [dBμV]	AF [dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	7423.8333	50.87	36.39	-42.88	44.38	74.00	29.62	254	209	Horizontal
2	10520.0000	42.99	38.46	-38.61	42.84	68.30	25.46	169	23	Horizontal
3	15780.0000	40.61	39.66	-33.10	47.17	74.00	26.83	121	283	Horizontal



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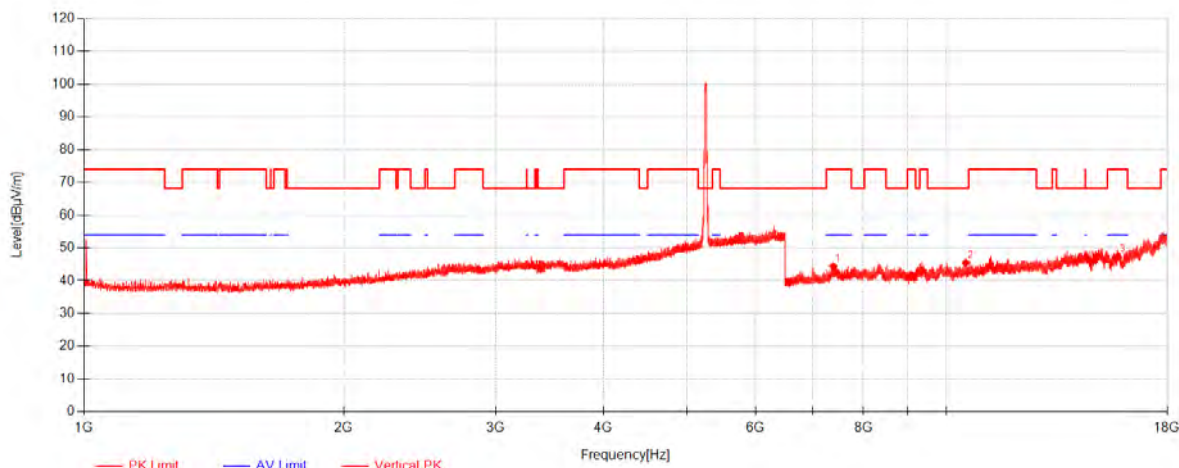
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Data List

NO.	Frequency [MHz]	Reading [dBμV]	AF [dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	7384.0625	51.00	36.28	-42.88	44.40	74.00	29.60	155	40	Vertical
2	10520.0000	45.59	38.46	-38.61	45.44	68.30	22.86	269	257	Vertical
3	15780.0000	40.73	39.66	-33.10	47.29	74.00	26.71	132	222	Vertical



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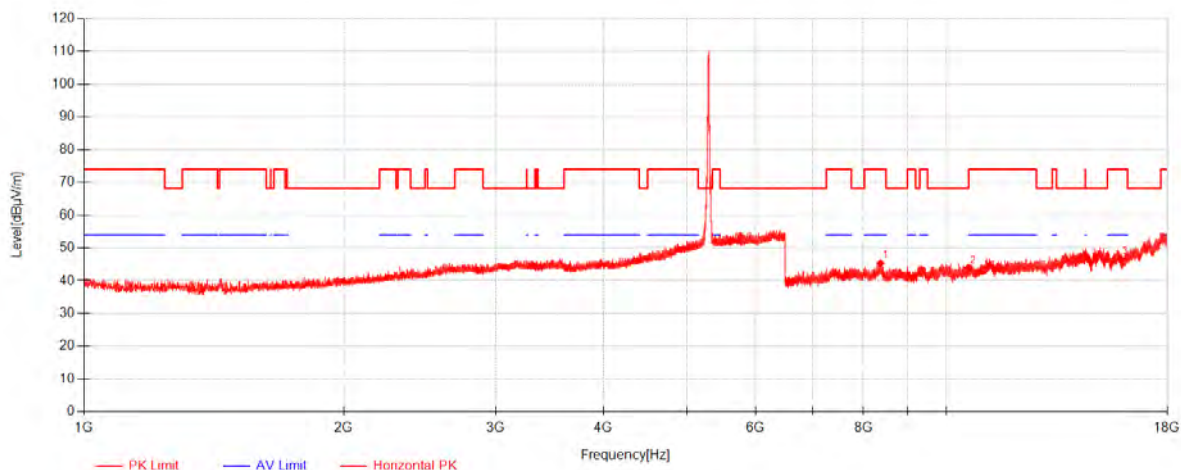
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802.11a_Channel 60



Data List

NO.	Frequency [MHz]	Reading [dBμV]	AF [dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	8376.8958	50.16	36.61	-41.49	45.29	74.00	28.71	112	212	Horizontal
2	10600.0000	43.42	38.50	-38.01	43.91	54.00	10.09	169	176	Horizontal
3	15900.0000	41.34	39.41	-34.13	46.62	54.00	7.38	247	48	Horizontal



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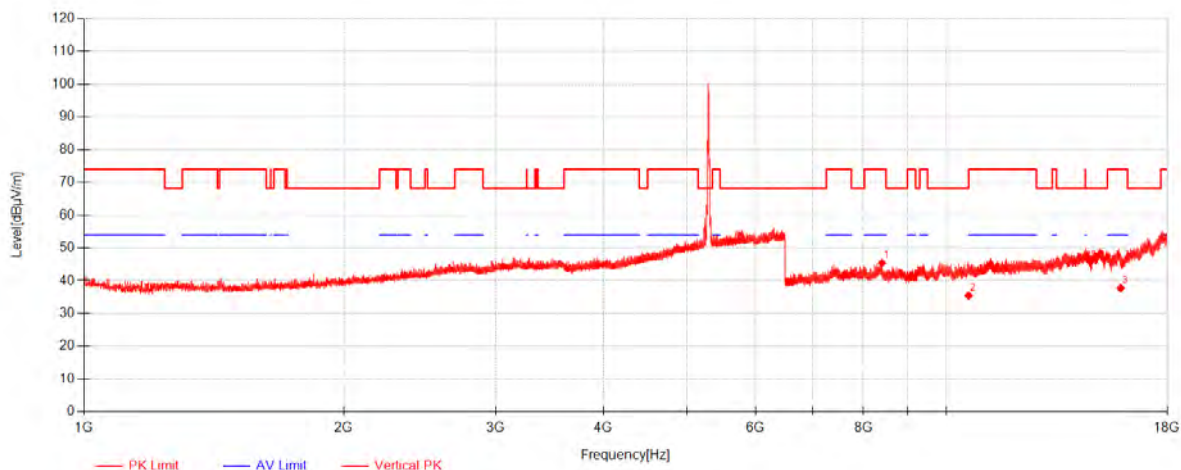
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Data List										
NO.	Frequency [MHz]	Reading [dBμV]	AF [dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	8410.9167	50.20	36.59	-41.42	45.38	74.00	28.62	108	293	Vertical
2	10600.0000	34.96	38.50	-38.01	35.45	54.00	18.55	256	21	Vertical
3	15900.0000	32.49	39.41	-34.13	37.77	54.00	16.23	199	110	Vertical



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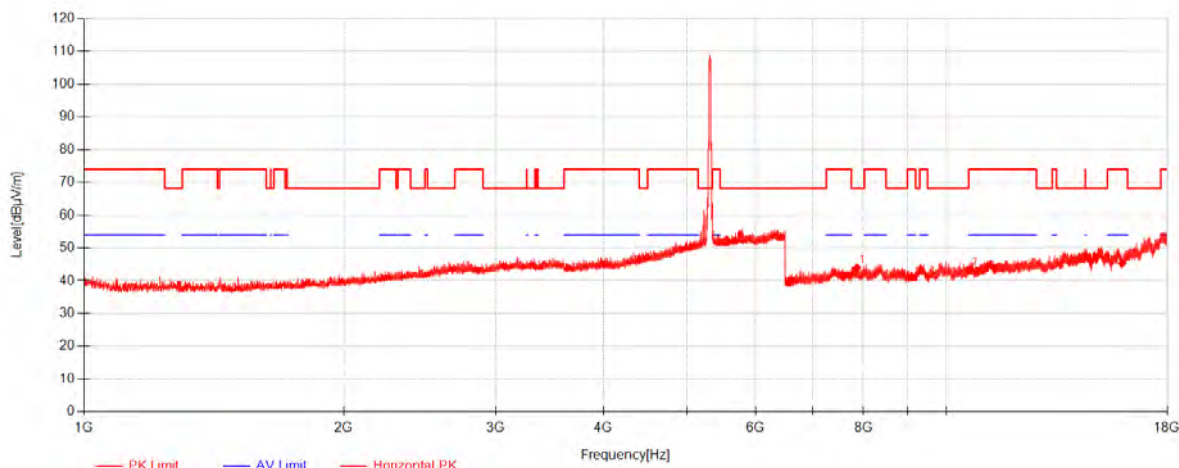
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Data List

NO.	Frequency [MHz]	Reading [dBμV]	AF [dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	7866.5833	49.88	36.75	-42.69	43.94	68.30	24.36	201	147	Horizontal
2	10640.0000	42.69	38.52	-37.80	43.41	74.00	30.59	154	357	Horizontal
3	15960.0000	40.65	39.28	-34.63	45.30	74.00	28.70	269	330	Horizontal



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