

Report No.: XEWM2303000130RG04

Rev.: 01

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TEST REPORT

Application No.: XEWM2303000130RG
Applicant: KonnectONE Inc.
Address of Applicant: 40 Lake Bellevue, Suite 340, Bellevue, WA 98005
Manufacturer: KonnectONE Inc.
Address of Manufacturer: 40 Lake Bellevue, Suite 340, Bellevue, WA 98005
EUT Description: Moxee T2310
Model No.: T2310
Trade Mark: Moxee
FCC ID: 2APQU-T2310
Standards: FCC 47 CFR Part 2, Subpart J
FCC 47 CFR Part 15, Subpart E
Date of Receipt: 2023/04/10
Date of Test: 2023/04/14 to 2023/04/28
Date of Issue: 2023/05/09

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:



Peter Tan
Regulatory Technical Manager



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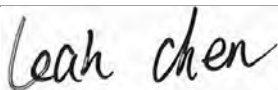
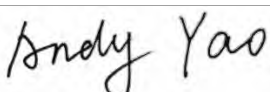
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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023/05/09		Original

Prepared By	 (Leah Chen) / Test Engineer
Checked By	 (Andy Yao) / 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 Band II-A Band II-C	15.407(a)(1) 15.407(a)(2) 15.407(a)(2)	No limit.	Clause 4.5	Reporting only
6dB Emission Bandwidth	Band III	15.407(e)	≥ 500 kHz.	Clause 4.6	PASS
99% Occupied Bandwidth	Band I Band II-A Band II-C Band III	KDB 789033 D02§ D	No limit.	Clause 4.7	Reporting only
Duty Cycle	Band I Band II-A Band II-C Band III	--	No limit.	Clause 4.3	Reporting only
Maximum Conducted Output Power	Band I Band II-A Band II-C Band III	15.407(a)(iv) 15.407(a)(2) 15.407(a)(3)	< 250mW <MIN{250mW, 11dBm+10*lg(EBW)} < 1W	Clause 4.4	PASS
Maximum Power Spectral Density	Band I Band II-A Band II-C Band III	15.407(a)(iv) 15.407(a)(2) 15.407(a)(3)	<11dBm/MHz <11dBm/MHz <30dBm/500KHz	Clause 4.8	PASS
Unwanted Emissions that fall Out of the Restricted Bands (Radiated)	Band I	15.209 15.407(b)	F<1GHz: §15.209/§7.2.5 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/§7.2.5 limit (AV&PK).		PASS
	Band II-A	15.407(b) 15.209	F<1GHz: §15.209/§7.2.5 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/§7.2.5 limit (AV&PK).	Clause 4.9	PASS
	Band II-C	15.407(b) 15.209	F<1GHz: §15.209/§7.2.5 limit (QP). F≥1GHz & out-restricted: <-27dBm/MHz PK e.i.r.p. (exl. 5.47-5.725 GHz). F≥1GHz & in-restricted:		PASS



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			§15.209/§7.2.5 limit (AV&PK). F<1GHz: §15.209/§7.2.5 limit (QP) F≥1GHz & out-restricted:(QP) a) 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges; b) 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges; c) 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and d) -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges. F≥1GHz & in-restricted: §15.209/§7.2.5 limit (AV&PK).			
	Band III	15.407(b) 15.209				PASS
Unwanted Emissions in the Restricted Bands (Radiated)	Band I Band II-A Band II-C Band III	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:	KonnectONE Inc.
Address of Applicant:	40 Lake Bellevue, Suite 340, Bellevue, WA 98005
Manufacturer:	KonnectONE Inc.
Address of Manufacturer:	40 Lake Bellevue, Suite 340, Bellevue, WA 98005

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd.
Address:	1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi' an, Shaanxi China
Post code:	710086
Test engineer:	Qiang Zhang, Jacky Xue

3.3 Test Facility

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

• **A2LA (Certificate No. 4854.01)**

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

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

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0095.

IC#: 25613.

• **FCC –Designation Number: CN1337**

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Designation Number: CN1337.

Test Firm Registration Number: 917410



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3.4 General Description of EUT

EUT Description:	Moxee T2310	
Model No.:	T2310	
Trade Mark:	Moxee	
Hardware Version:	V1.0	
Software Version:	Moxee_T2310_13.0_06	
IMEI:	RF Conducted	350119040005906
	RSE & AC power line	350119040005898
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:	PIFA Antenna	
Antenna Gain:	5150MHz to 5250MHz: 3.3dBi(Ant2); 5250MHz to 5350MHz: 3.3dBi(Ant2); 5470MHz to 5725MHz: 3.3dBi(Ant2); 5725MHz to 5850MHz: 3.3dBi(Ant2);	
	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	



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DFS Function:	☐ Master	
	☐ Slave with radar detection	☒ Slave without radar detection
RF Cable:	1.8dB	
Remark: 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.		

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



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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

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 Lowest channel	5530
	The Highest channel	5610

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



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3.5 Test Environment and Mode

Environment Parameter	96~101 kPa Selected Values During Tests	
Relative Humidity	40-60 % RH Ambient	
Value	Temperature(°C)	Voltage(V)
NTNV	22~25	3.85
Remark: NV: Normal Voltage NT: Normal Temperature		

3.6 Description of Support Units

The EUT has been tested as an independent unit.

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	CDD/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 PIFA Antenna and no consideration of replacement. The best case gain of the antenna is 5150MHz to 5250MHz: 3.3dBi(Ant2);* 5250MHz to 5350MHz: 3.3dBi(Ant2);* 5470MHz to 5725MHz: 3.3dBi(Ant2);* 5725MHz to 5850MHz: 3.3dBi(Ant2);* <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>	



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4.2 AC Power Line Conducted Emissions

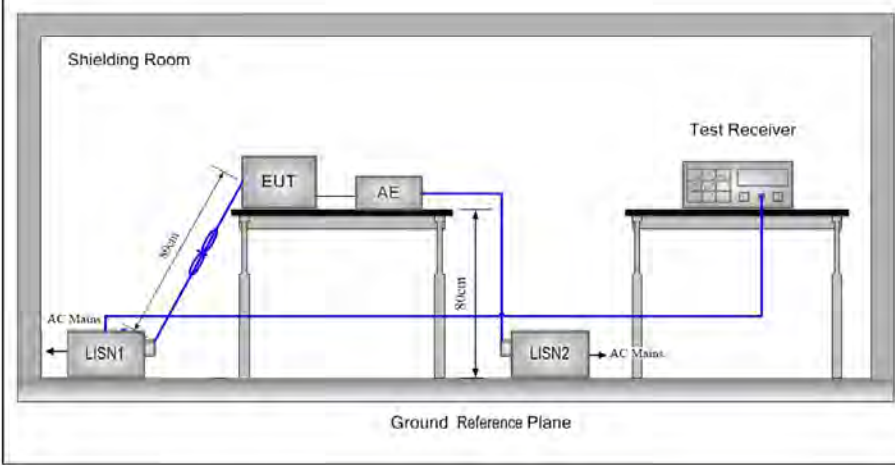
Test Requirement:	47 CFR Part 15 Section 15.207		
Test Method:	ANSI C63.10-2020 Section 6.2		
Test Frequency Range:	150kHz to 30MHz		
Receiver Setup:	RBW = 9kHz, VBW = 30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
* Decreases 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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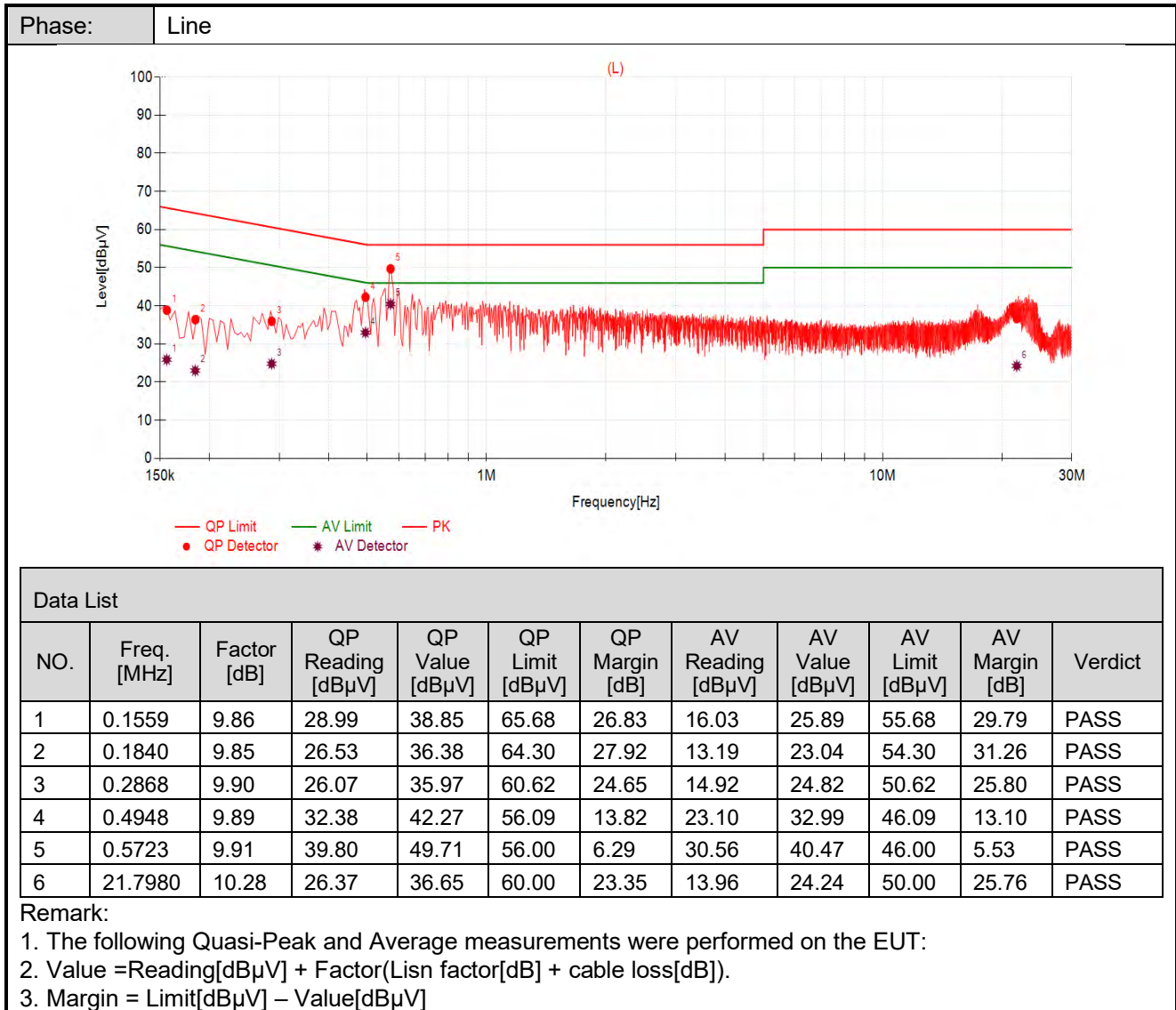
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Measurement Data

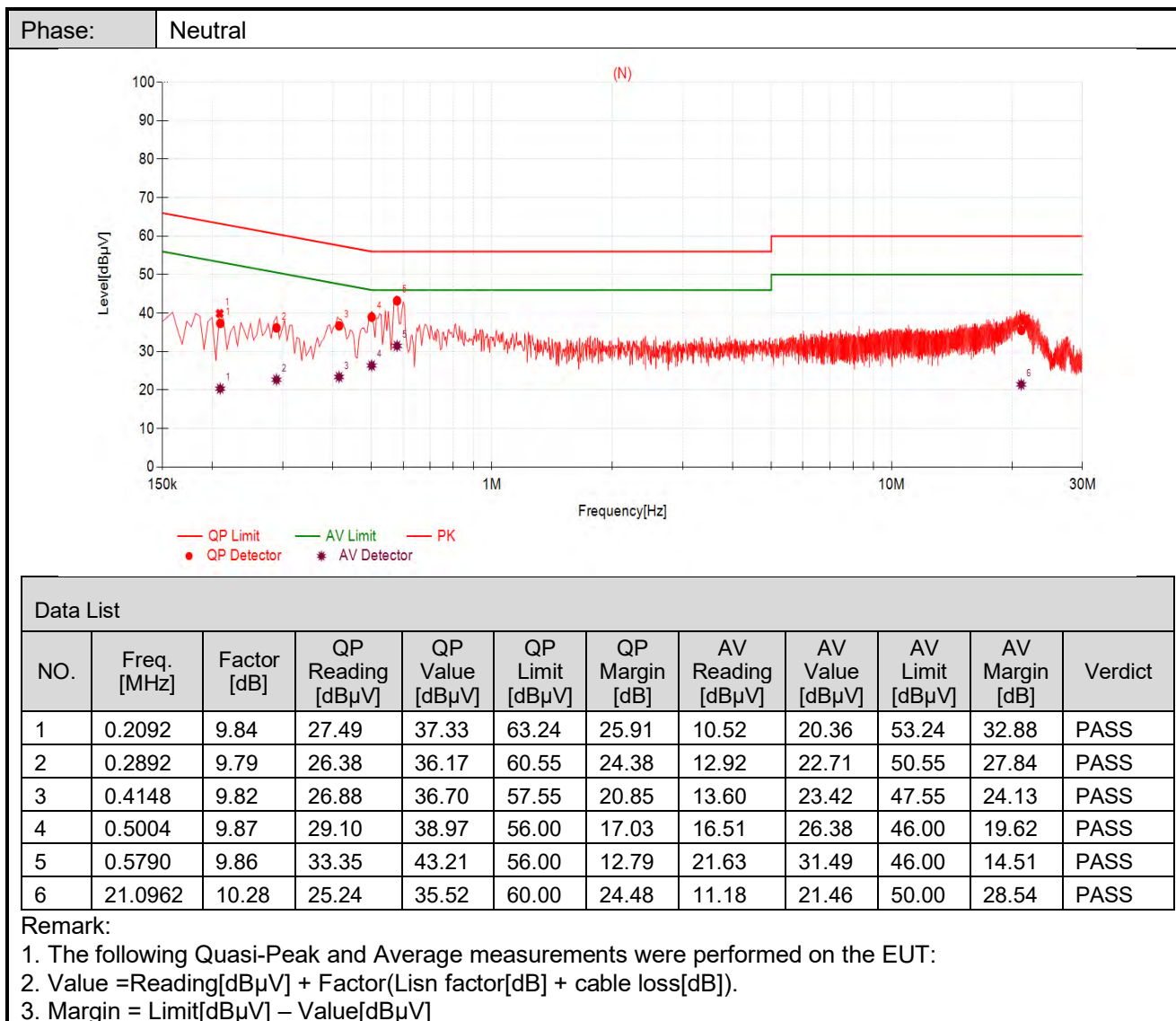
An initial pre-scan was performed on the live and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.



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4.3 Duty Cycle

The detailed test data see: **Appendix**



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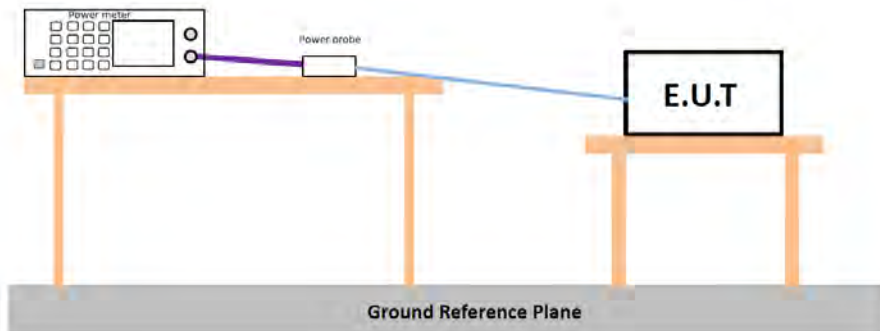
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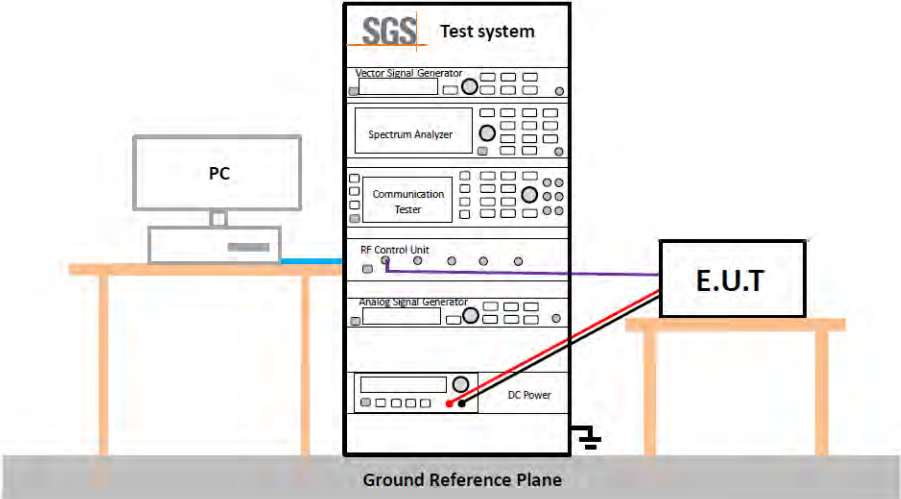
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4.4 Conducted Output Power

Test Requirement:	47 CFR Part 15 Section 15.407(a)(iv)	
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(24dBm)
	5250-5350MHz	The lesser of 250mW(24dBm) or 11+ 10logB
	5470-5725MHz	The lesser of 250mW(24dBm) 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

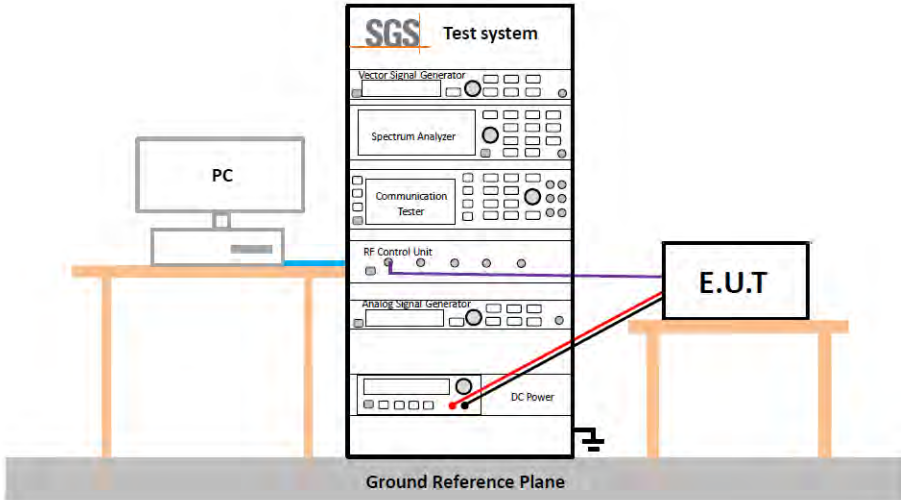
Test Requirement:	47 CFR Part 15 Section 15.407(a), KDB 789033 D02& C
Test Method:	ANSI C63.10-2020 Section 12.5.2
Test Setup:	
Instruments Used:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.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

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4.6 6dB Emission Bandwidth

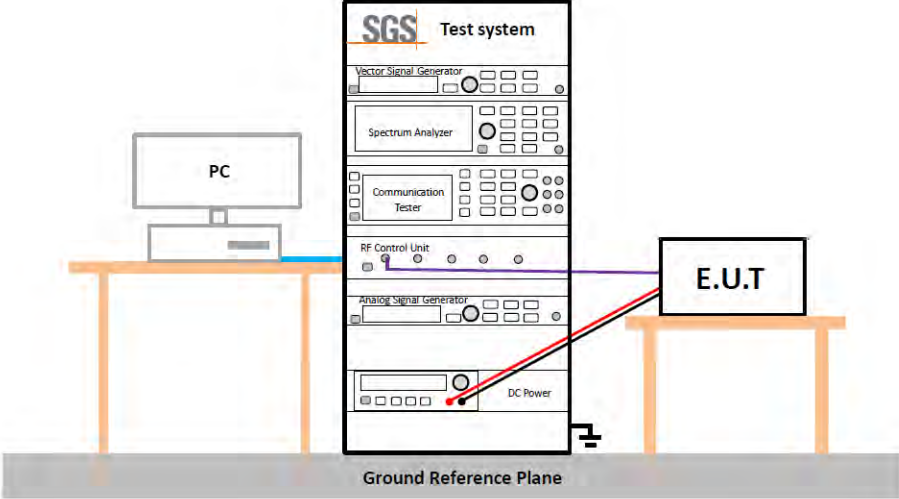
Test Requirement:	47 CFR Part 15 Section 15.407(e)	
Test Method:	ANSI C63.10-2020 Section 12.5.1	
Test Setup:		
Test Instruments:	Refer to section 6 for details.	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates	
Final Test Mode:	Refer to section 3.7 for details.	
Limit:	Frequency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

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4.7 99% Occupied Bandwidth

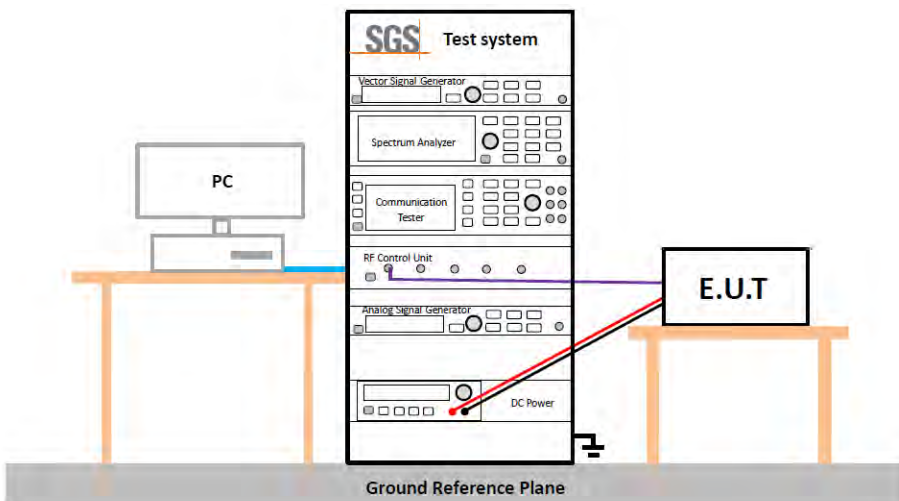
Test Requirement:	KDB 789033 D02§ D
Test Method:	ANSI C63.10-2020 Section 12.5.3
Test Setup:	
Instruments Used:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	No restriction limits
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)(iv)	
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 and 15.209
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:

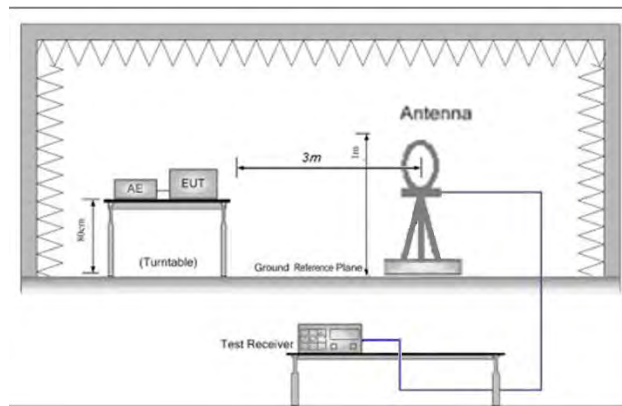


Figure 1. 9kHz to 30MHz

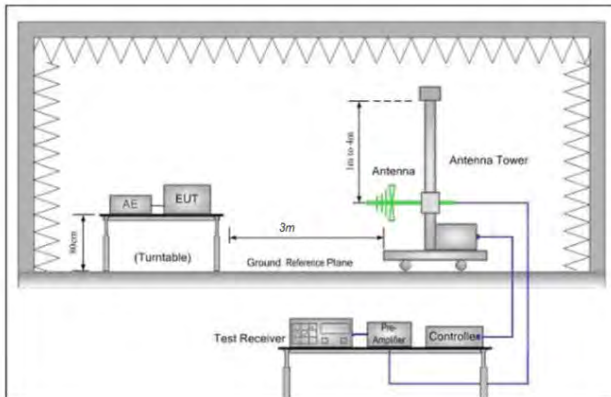


Figure 1. 30MHz to 1GHz

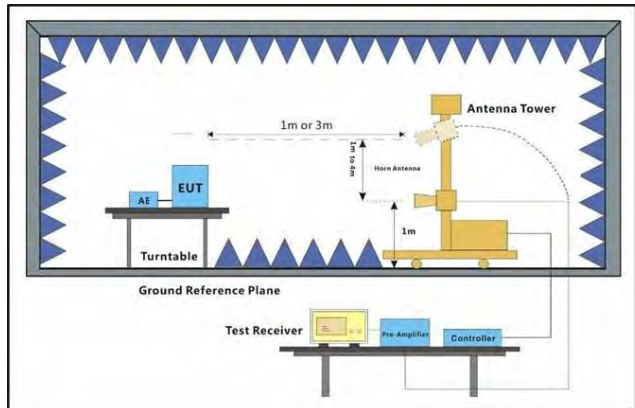


Figure 2. Above 1 GHz

Test Procedure:	a. 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 camber. The table was rotated 360 degrees to determine the position of the highest radiation. b. 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 camber. The table was rotated 360 degrees to determine the position of the highest radiation. (Distance from antenna to EUT is 1m for measurements >18GHz). c. 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.
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	d. 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. 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 Y 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.



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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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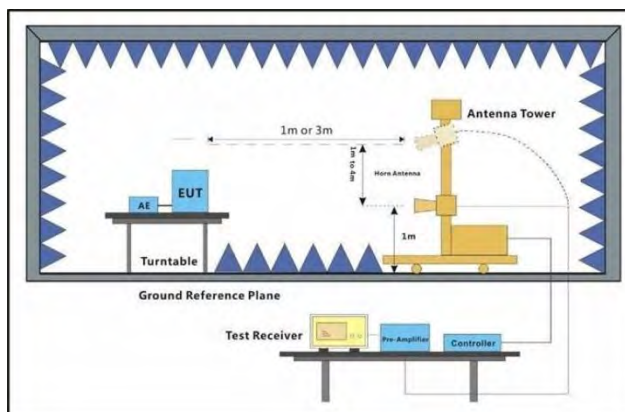
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4.10 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15 Section 15.407(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

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	modulation for lowest and highest channel 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 Y 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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t (86-29) 6282 7885 www.sgs.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

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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中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086

t (86-29) 6282 7885 www.sgs.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

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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.					



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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**



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

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$ GHz
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 0.2\%$
4	RF conducted power	± 0.21 dB
5	RF power density	± 2.84 dB
6	Conducted Spurious emissions	± 0.75 dB
7	Conduction Emission	± 3.0 dB (150kHz to 30MHz)
8	Radiated Emission	± 4.6 dB (9kHz to 30MHz)
		± 4.9 dB (30MHz to 1GHz)
		± 4.9 dB (1GHz to 6GHz)
		± 4.7 dB (6GHz to 18GHz)
		± 5.26 dB (Above 18GHz)
Remark: The U_{lab} (lab Uncertainty) is less than $U_{CISPR/ETSI}$ (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 System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
MXA signal analyzer	Agilent	N9020A	XAW01-06-07	2023/02/16	2024/02/15
MXG vector signal Generator	Agilent	N5182B	XAW01-07-16	2023/02/16	2024/02/15
Measurement Software	Tonscend	JS1120-3 (3.2.18)	XAW02-14-01	NCR	NCR
RF control unit	Tonscend	JS0806-2	XAW03-37-01	NCR	NCR
Power Meter	Anritsu	ML2495A	XAW01-25-03	2023/02/16	2024/02/15
Power Supply	Agilent	66311B	XAW01-17-01	2023/02/16	2024/02/15
Temperature and humidity meter	MingGao	T809	XAW01-01-16	2022/09/18	2023/09/17

CE Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	XAW04-03-01	N/A	N/A
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2022/09/08	2023/09/07
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-01	2022/06/30	2023/06/29
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2022/09/18	2023/09/17
Measurement Software	Tonscend	TS+ V4.0.0.0	XAW02-07-01	NCR	NCR
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-02	2023/02/16	2024/02/15
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-02	2022/06/30	2023/06/29



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RSE Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/d d)	Cal.Due date (yyyy/mm/d d)
Semi-Anechoic Chamber	Brilliant-emc	N/A	XAW03-35-01	2021/09/09	2024/09/08
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2023/02/16	2024/02/15
Spectrum Analyzer	ROHDE &SCHWARZ	FSV3044	XAW01-13-05	2022/05/24	2023/05/23
Test receiver	ROHDE &SCHWARZ	ESR	XAW01-08-01	2022/09/08	2023/09/07
Receiving antenna (30MHz-3GHz)	Schwarzbeck	VULB 9163	XAW01-09-01	2022/07/28	2024/07/27
Receiving antenna(1GHz~18GH z)	Schwarzbeck	BBHA 9120D	XAW01-09-02	2022/07/28	2024/07/27
Receiving antenna (15GHz~40GHz)	Schwarzbeck	BBHA 9170	XAW01-09-03	2022/07/23	2024/07/22
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR
Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP9K3G32	XAW01-41-01	2022/05/24	2023/05/23
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2022/09/14	2023/09/13
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2022/09/14	2023/09/13
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2022/09/14	2023/09/13
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2022/09/18	2023/09/17
Radio communication analyzer	ROHDE&SCH WARZ	CMW 500	XAW01-03-02	2023/02/16	2024/02/15
Measurement Software	Tonscend	TS+ V4.0.0.0	XAW02-05-01	NCR	NCR
Loop Antenna	Schwarzbeck	FMZB 1519B	XAW01-48-02	2022/05/26	2023/05/25



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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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中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086

t (86-29) 6282 7885 www.sgs.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

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Emission Bandwidth Test Result

TestMode	Antenna	Frequency[MHz]	26db EBW [MHz]	FL[MHz]	FH[MHz]	Verdict
11a	Ant2	5180	20.920	5170.080	5191.000	Reporting only
		5200	19.920	5189.920	5209.840	
		5240	20.840	5229.160	5250.000	
		5260	20.320	5250.080	5270.400	
		5280	20.120	5269.640	5289.760	
		5320	19.840	5310.120	5329.960	
		5500	21.520	5490.080	5511.600	
		5580	20.360	5569.760	5590.120	
		5700	22.880	5687.640	5710.520	
		5745	19.720	5735.200	5754.920	
		5785	19.560	5775.280	5794.840	
		5825	21.920	5814.400	5836.320	
11n20SISO	Ant2	5180	22.400	5168.760	5191.160	
		5200	20.120	5189.840	5209.960	
		5240	22.240	5228.040	5250.280	
		5260	21.440	5249.440	5270.880	
		5280	20.120	5269.920	5290.040	
		5320	21.880	5309.160	5331.040	
		5500	20.000	5490.040	5510.040	
		5580	20.600	5569.720	5590.320	
		5700	20.920	5689.080	5710.000	
		5745	20.960	5734.160	5755.120	
		5785	22.800	5773.640	5796.440	
		5825	20.040	5814.960	5835.000	
11n40SISO	Ant2	5190	39.920	5169.920	5209.840	
		5230	40.160	5209.920	5250.080	
		5270	39.920	5250.000	5289.920	
		5310	40.480	5289.760	5330.240	
		5510	39.840	5490.000	5529.840	
		5550	40.000	5529.840	5569.840	
		5670	40.640	5649.520	5690.160	
		5755	40.480	5734.920	5775.400	
		5795	39.840	5775.080	5814.920	
11ac20SISO	Ant2	5180	20.040	5169.960	5190.000	
		5200	20.280	5189.840	5210.120	
		5240	20.240	5229.800	5250.040	
		5260	20.200	5250.040	5270.240	
		5280	20.440	5269.680	5290.120	
		5320	19.960	5310.000	5329.960	
		5500	20.560	5489.600	5510.160	
		5580	20.200	5569.840	5590.040	
		5700	19.960	5689.960	5709.920	
		5745	20.080	5734.920	5755.000	
		5785	19.960	5775.120	5795.080	
		5825	19.960	5815.040	5835.000	
11ac40SISO	Ant2	5190	40.560	5169.600	5210.160	
		5230	40.160	5210.000	5250.160	
		5270	40.320	5250.080	5290.400	



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		5310	40.000	5290.000	5330.000	
		5510	39.840	5490.160	5530.000	
		5550	42.640	5529.920	5572.560	
		5670	40.400	5649.680	5690.080	
		5755	40.400	5734.760	5775.160	
		5795	41.600	5775.000	5816.600	
11ac80SISO	Ant2	5210	81.280	5169.360	5250.640	
		5290	80.320	5250.160	5330.480	
		5530	80.480	5489.680	5570.160	
		5610	81.280	5569.520	5650.800	
		5775	80.960	5734.680	5815.640	



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Test Graphs

11a Ant2 5180



11a Ant2 5200



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11a Ant2 5240



11a Ant2 5260



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11a Ant2 5280



11a Ant2 5320



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11a Ant2 5500



11a Ant2 5580



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11a Ant2 5700



11a Ant2 5745



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11a Ant2 5785



11a Ant2 5825



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11n20SISO_Ant2_5180



11n20SISO_Ant2_5200



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11n20SISO_Ant2_5240



11n20SISO_Ant2_5260



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11n20SISO_Ant2_5280



11n20SISO_Ant2_5320



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中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086

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中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086

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中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086

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t (86-29) 6282 7885 sgs.china@sgs.com

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11ac40SISO Ant2 5755



11ac40SISO Ant2 5795



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Wireless Laboratory

1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086

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11ac80SISO Ant2 5210



11ac80SISO Ant2 5290



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中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086

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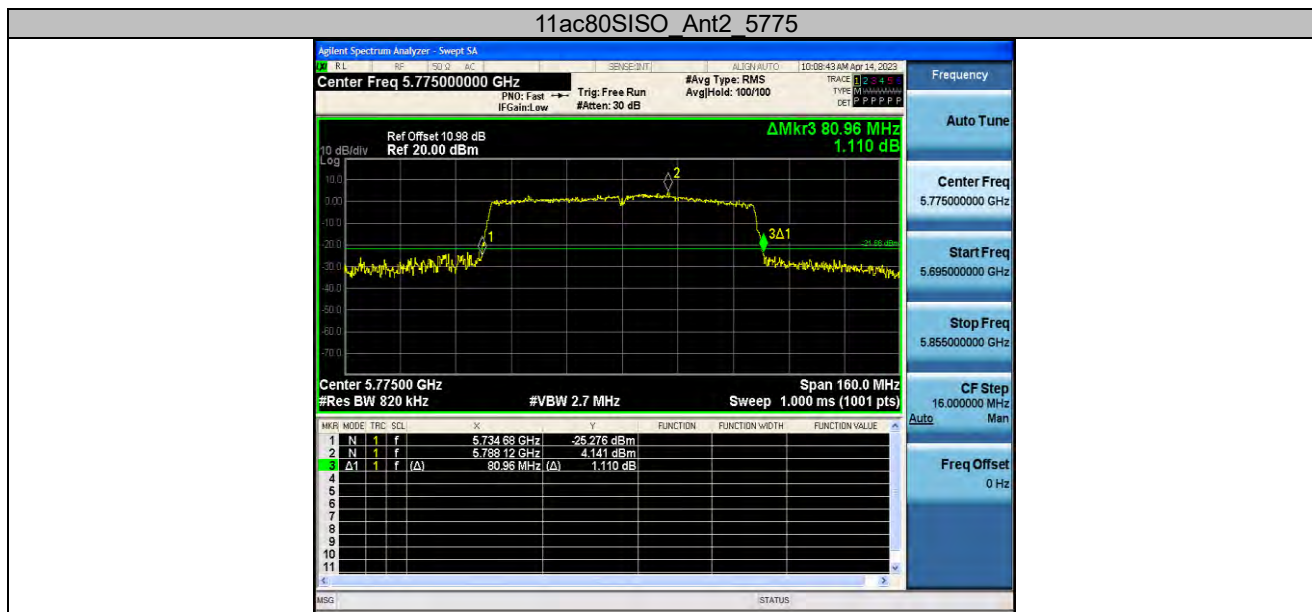
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中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086

t (86-29) 6282 7885 www.sgs.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

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1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086

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Occupied channel bandwidth Test Result

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
11a	Ant2	5180	17.085	5171.4292	5188.5142	Reporting only
		5200	17.213	5191.2938	5208.5068	
		5240	17.149	5231.3189	5248.4679	
		5260	17.017	5251.5623	5268.5793	
		5280	16.991	5271.4652	5288.4562	
		5320	16.942	5311.5379	5328.4799	
		5500	17.071	5491.5462	5508.6172	
		5580	17.172	5571.4265	5588.5985	
		5700	17.011	5691.4405	5708.4515	
		5745	16.855	5736.5092	5753.3642	
		5785	16.987	5776.5371	5793.5241	
		5825	17.100	5816.4850	5833.5850	
11n20SISO	Ant2	5180	18.051	5170.9290	5188.9800	
		5200	18.217	5190.7837	5209.0007	
		5240	18.113	5230.8792	5248.9922	
		5260	18.102	5251.0047	5269.1067	
		5280	18.051	5270.9277	5288.9787	
		5320	17.942	5311.0234	5328.9654	
		5500	18.072	5491.0421	5509.1141	
		5580	18.163	5570.9243	5589.0873	
		5700	18.034	5690.9176	5708.9516	
		5745	18.040	5735.9422	5753.9822	
		5785	18.048	5776.0491	5794.0971	
		5825	18.082	5816.0055	5834.0875	
11n40SISO	Ant2	5190	36.442	5171.6915	5208.1335	
		5230	36.275	5211.8858	5248.1608	
		5270	36.320	5251.8895	5288.2095	
		5310	36.447	5291.8441	5328.2911	
		5510	36.200	5491.9487	5528.1487	
		5550	36.271	5531.8387	5568.1097	
		5670	36.718	5651.6506	5688.3686	
		5755	36.528	5736.6307	5773.1587	
11ac20SISO	Ant2	5795	36.313	5776.8701	5813.1831	
		5180	17.917	5171.0390	5188.9560	
		5200	18.033	5190.9313	5208.9643	
		5240	18.041	5230.9221	5248.9631	
		5260	17.984	5251.0760	5269.0600	
		5280	17.807	5271.0776	5288.8846	
		5320	17.883	5311.0612	5328.9442	
		5500	17.990	5491.0990	5509.0890	
		5580	18.070	5570.9558	5589.0258	
		5700	17.884	5691.0073	5708.8913	
		5745	17.890	5735.9790	5753.8690	
		5785	17.830	5776.1403	5793.9703	
11ac40SISO	Ant2	5825	17.953	5816.0800	5834.0330	
		5190	36.212	5171.8214	5208.0334	
		5230	36.168	5211.9511	5248.1191	
		5270	36.110	5251.9857	5288.0957	



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		5310	36.329	5291.8970	5328.2260	
		5510	36.111	5491.9829	5528.0939	
		5550	36.205	5531.8875	5568.0925	
		5670	36.525	5651.7510	5688.2760	
		5755	36.280	5736.7774	5773.0574	
		5795	36.186	5776.9270	5813.1130	
11ac80SISO	Ant2	5210	75.508	5172.1443	5247.6523	
		5290	75.375	5252.4334	5327.8084	
		5530	75.258	5492.4076	5567.6656	
		5610	75.471	5572.3646	5647.8356	
		5775	75.496	5737.1652	5812.6612	



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Test Graphs



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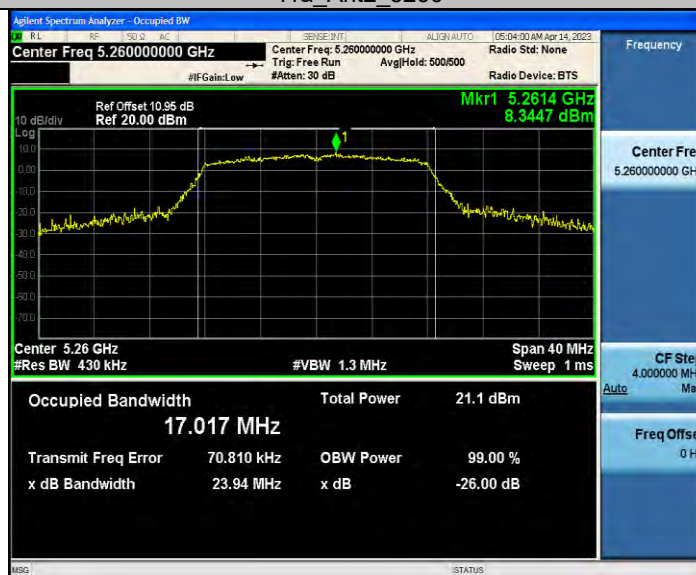
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11a_Ant2_5240



11a_Ant2_5260



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