

Report No.: XEWA2305000017RG04

Rev.: 01

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TEST REPORT

Application No.: XEWA2305000017RG
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.: FCM360K
Trade Mark: Quectel
FCC ID: XMR2023FCM360K
Standards: FCC 47 CFR Part 2, Subpart J
FCC 47 CFR Part 15, Subpart E
Date of Receipt: 2023/05/19
Date of Test: 2023/06/04 to 2023/06/21
Date of Issue: 2023/06/26

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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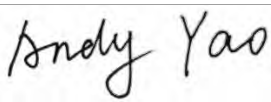
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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023/06/26		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	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*Ig(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



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	Band III	15.407(b) 15.205/15.209	<p>F<1GHz: §15.209 limit (QP) F≥1GHz & out-restricted:(PK) 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.</p> <p>F≥1GHz & in-restricted: §15.209 limit (AV&PK).</p>		PASS
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
<p>Note 1: Band I: 5150-5250MHz Band II-A: 5250-5350MHz Band II-C: 5470-5725MHz Band III: 5725-5850MHz</p>					



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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 (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:	Wi-Fi & Bluetooth Module	
Model No.:	FCM360K	
Trade Mark:	Quectel	
Hardware Version:	R1.0	
Software Version:	FCM360KAAR01A03	
SN:	RF Conducted	E1M23D806000131
	RSE & AC power line	E1M23D806000169
WLAN Mode Supported:	802.11a:	20 MHz channel bandwidth
	802.11n:	20 MHz / 40 MHz channel bandwidth
	802.11ac:	20 MHz / 40 MHz channel bandwidth
	802.11ax:	20 MHz / 40 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)
	802.11ax:	OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Channel Spacing:	20MHz:	802.11a/n(HT20)/ac(VHT20)/ax(HE20)
	40MHz:	802.11n(HT40)/ac(VHT40)/ax(HE40)
Antenna Type:	PCB Antenna	
Antenna Gain:	5150MHz to 5250MHz: 0.9dBi(Ant0); 5250MHz to 5350MHz: 0.9dBi(Ant0); 5470MHz to 5725MHz: 0.9dBi(Ant0); 5725MHz to 5850MHz: 0.9dBi(Ant0);	
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.	
Smart System:	<input checked="" type="checkbox"/> SISO	802.11a/n/ac/ax
		CDD: 802.11a/n/ac/ax: Tx & Rx
	<input type="checkbox"/> MIMO	STBC: 802.11n/ac/ax: Tx & Rx
		TXBF: 802.11n/ac/ax: Tx & Rx
	<input type="checkbox"/> Diversity	802.11a: Tx & Rx



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TPC Function:	<input type="checkbox"/> Support, <input checked="" type="checkbox"/> Not Support	
DFS Function:	<input type="checkbox"/> Master	
	<input type="checkbox"/> Slave with radar detection	<input checked="" type="checkbox"/> Slave without radar detection
RF Cable:	1.5dB	
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/ax 20MHz	The Lowest channel	5180
	The Middle channel	5200
	The Highest channel	5240
IEEE 802.11n/ac/ax 40MHz	The Lowest channel	5190
	The Highest channel	5230

For UNII Band II-A:		
Mode	Channel	Frequency(MHz)
IEEE 802.11a/n/ac/ax 20MHz	The Lowest channel	5260
	The Middle channel	5280
	The Highest channel	5320
IEEE 802.11n/ac/ax 40MHz	The Lowest channel	5270
	The Highest channel	5310



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

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



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Wireless Laboratory

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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	3.3
Remark: NV: Normal Voltage NT: Normal Temperature		

3.6 Description of Support Units

Description	Manufacturer	Model No.
Router	Netgear	R7800
Mother board*	Quectel	N/A
Remark: the information with"*" are provided by client.		

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)	/
802.11ax (HE 20)	MCS0 (8 Mbps)	/
802.11ax (HE 40)	MCS0 (16 Mbps)	/



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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15 Section 15.203
<p>The antenna is PCB Antenna on the main PCB and no consideration of replacement.</p> <p>The best case gain of the antenna is</p> <p>5150MHz to 5250MHz: 0.9dBi(Ant0);*</p> <p>5250MHz to 5350MHz: 0.9dBi(Ant0);*</p> <p>5470MHz to 5725MHz: 0.9dBi(Ant0);*</p> <p>5725MHz to 5850MHz: 0.9dBi(Ant0);*</p> <p><i>*Note:</i></p> <p><i>The antenna gain are derived from the gain information report provided by the manufacturer.</i></p> <p><i>Remark:</i></p> <p><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></p>	



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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:	<ol style="list-style-type: none"> 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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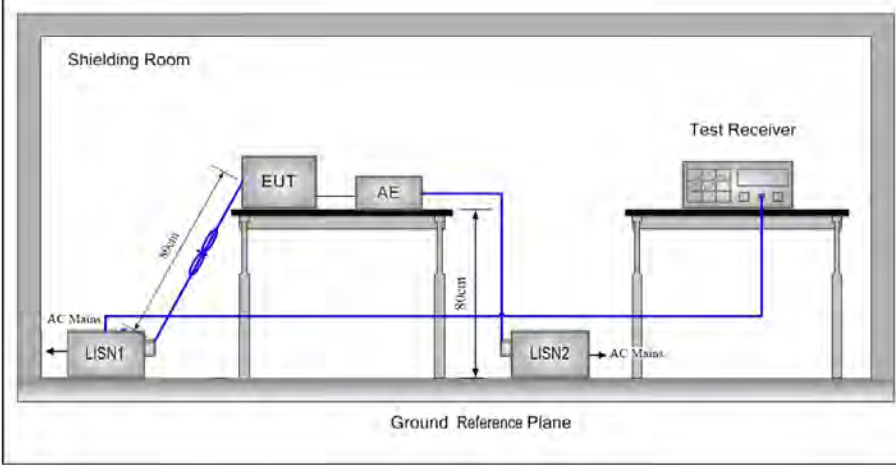
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Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel.
Final Test Mode:	Refer to section 3.7 for details. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass



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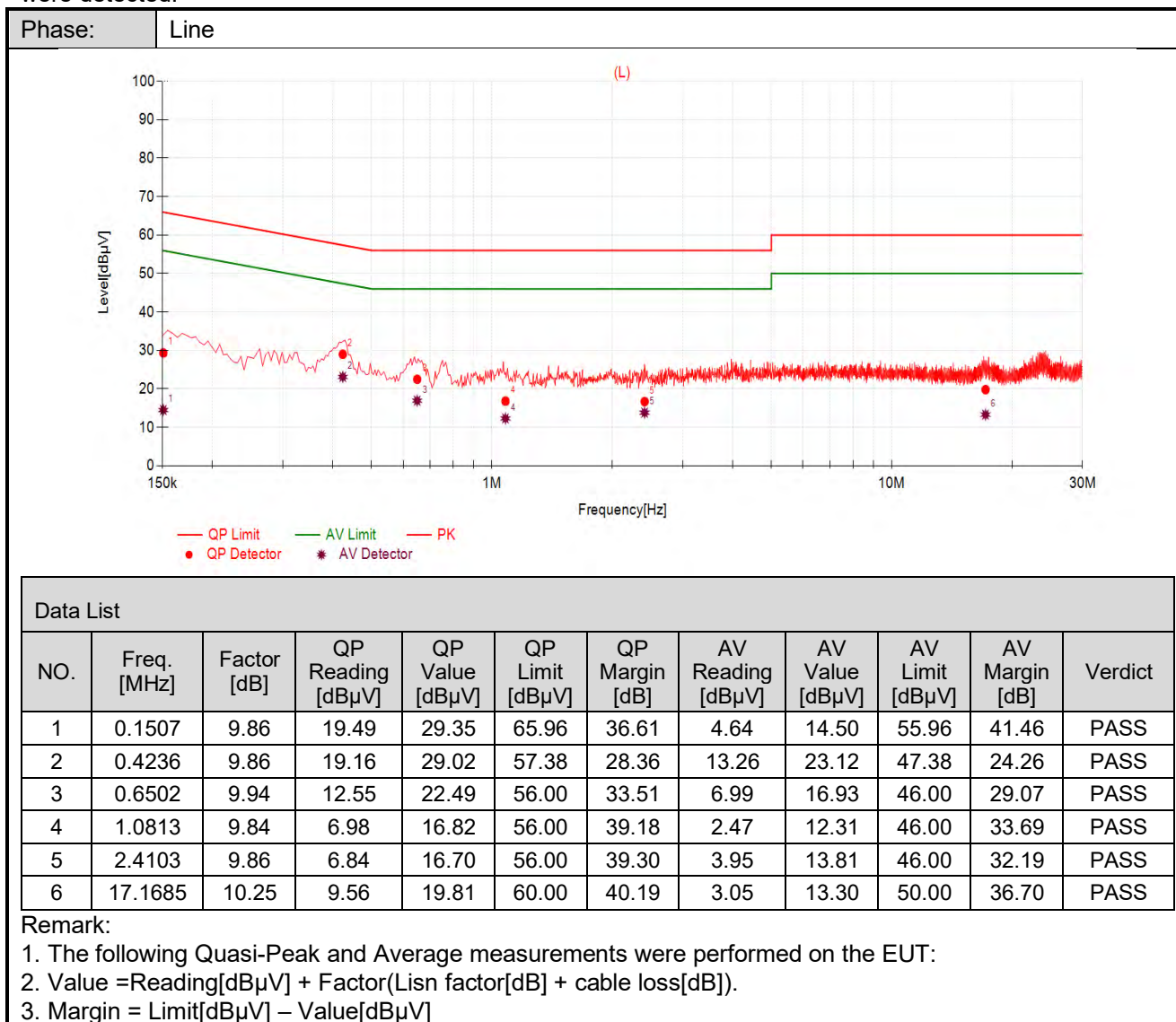
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Measurement Data

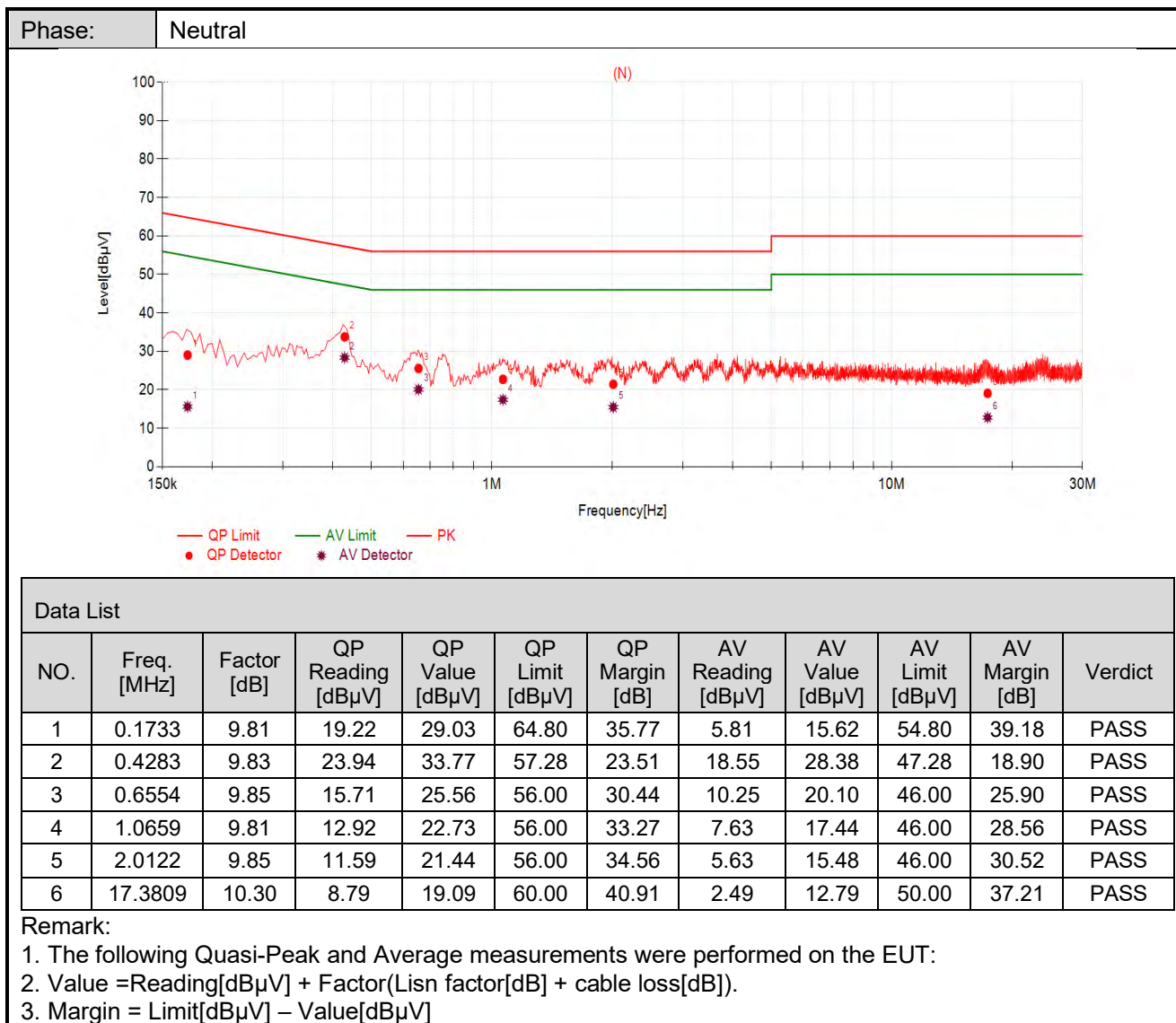
An initial pre-scan was performed on the live and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.



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4.3 Duty Cycle

The detailed test data see: **Appendix**



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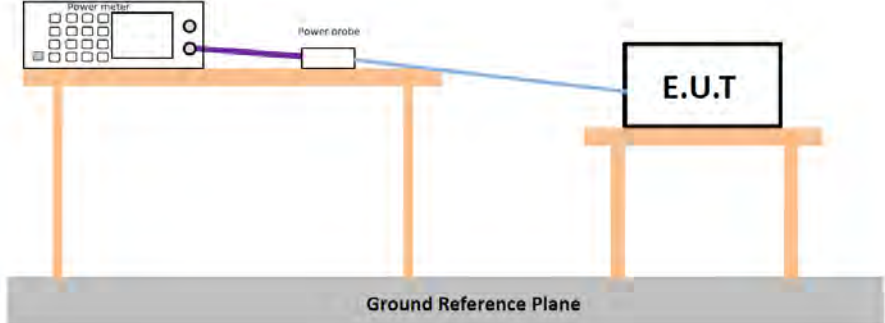
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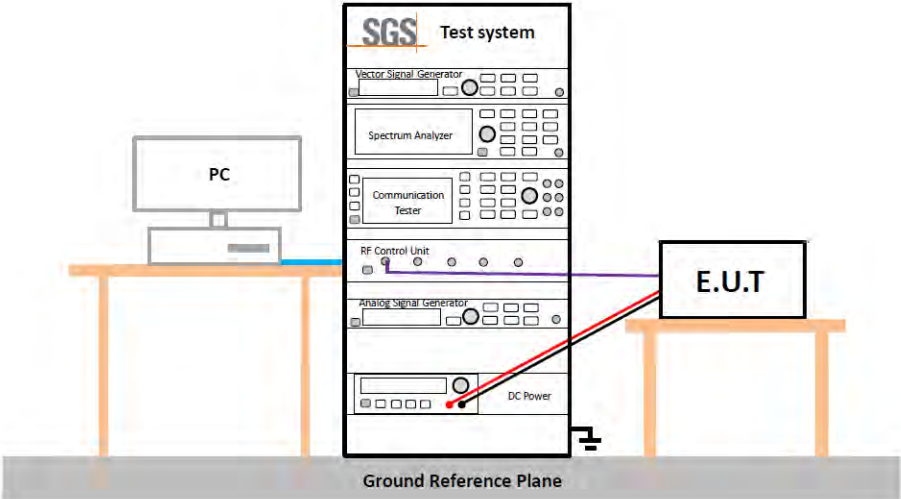
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4.4 Conducted Output Power

Test Requirement:	47 CFR Part 15 Section 15.407(a)(iv)	
Test Method:	ANSI C63.10-2020 Section 12.4.3.2	
Test Setup:	<div></div> <p>* 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.</p>	
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

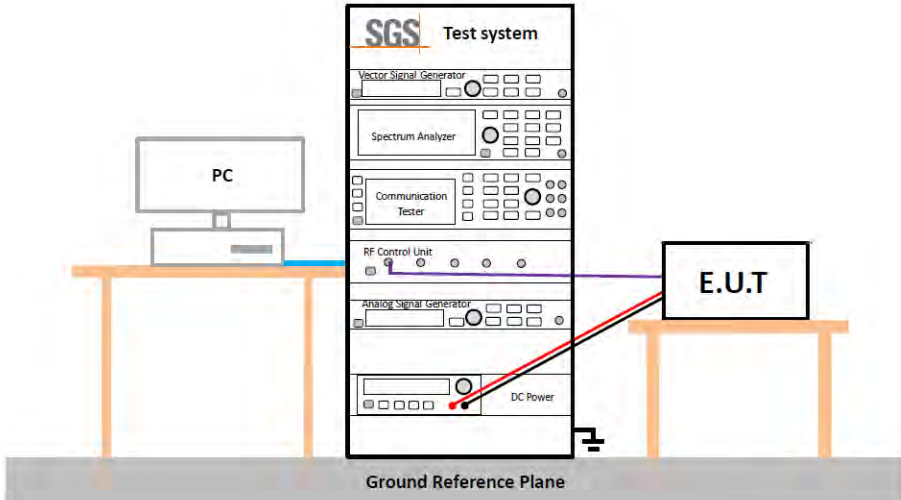
Test Requirement:	47 CFR Part 15 Section 15.407(a), KDB 789033 D02& C
Test Method:	ANSI C63.10-2020 Section 12.5.2
Test Setup:	
Instruments Used:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.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

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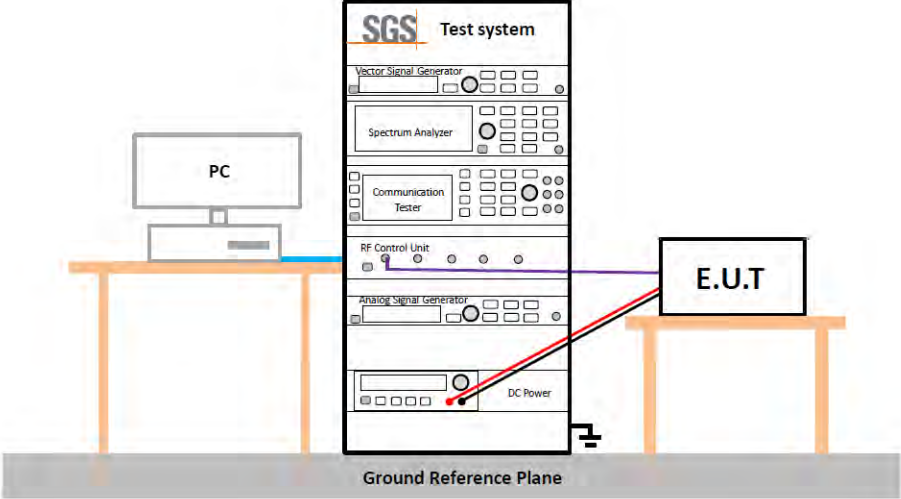
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4.6 6dB Emission Bandwidth

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

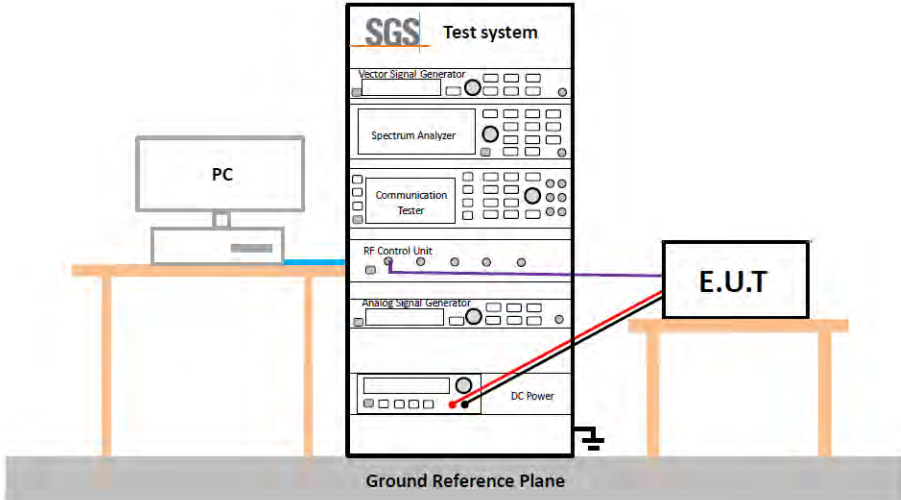
Test Requirement:	KDB 789033 D02§ D
Test Method:	ANSI C63.10-2020 Section 12.5.3
Test Setup:	
Instruments Used:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	No restriction limits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

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:

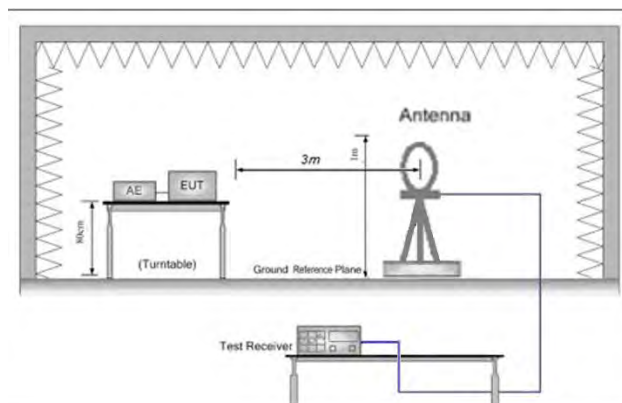


Figure 1. 9kHz to 30MHz

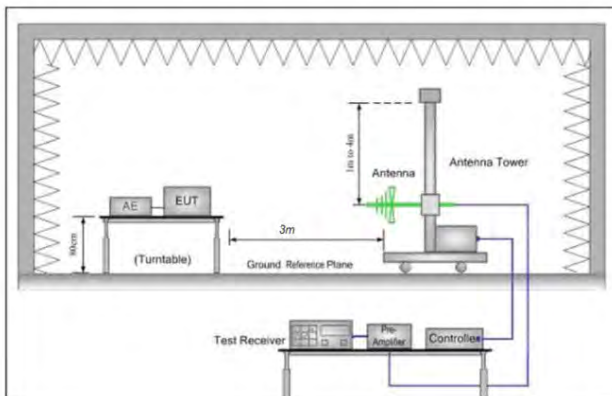


Figure 1. 30MHz to 1GHz

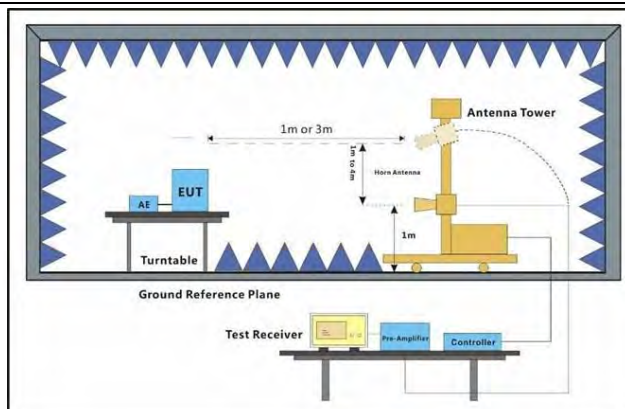


Figure 2. Above 1 GHz

Test Procedure:	<p>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.</p> <p>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).</p> <p>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.</p>
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	<p>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.</p> <p>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.</p> <p>f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>g. Test the EUT in the outermost channels.</p> <p>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.</p> <p>i. Repeat above procedures until all frequencies measured was complete.</p> <p>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</p> <p>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.</p> <p>l. At a measurement distance of 1 meter the limit line was increased by $20 \cdot \text{LOG}(3/1) = 9.54 \text{ dB}$.</p>
Test Configuration:	<p>Measurements below 30MHz</p> <ul style="list-style-type: none"> • RBW = 10 kHz • VBW = 30 kHz • Detector = Peak & Average & Quasi-peak • Trace mode = max hold <p>Measurements Below 1000MHz</p> <ul style="list-style-type: none"> • RBW = 120 kHz • VBW = 300 kHz • Detector = Quasi-peak • Trace mode = max hold <p>Peak Measurements Above 1000 MHz</p> <ul style="list-style-type: none"> • RBW = 1 MHz • VBW $\geq 3 \text{ MHz}$ • Detector = Peak • Sweep time = auto • Trace mode = max hold <p>Average Measurements Above 1000MHz</p> <ul style="list-style-type: none"> • 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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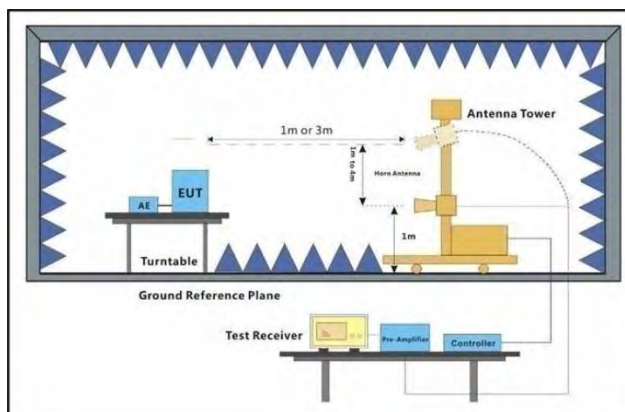
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4.10 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15 Section 15.205/15.209/15.407(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

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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 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 ≥ 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 ≥ 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
<p>Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.</p> <p>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.</p> <p>Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.</p>	



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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	$\text{Roundup} \left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{sec}}} \right) \right\}$	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	2023/05/15	2024/05/14
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	2023/05/15	2024/05/14
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	2024/05/25



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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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Emission Bandwidth Test Result

TestMode	Antenna	Frequency[MHz]	26dB EBW [MHz]	FL[MHz]	FH[MHz]	Verdict
11a	Ant0	5180	24.000	5168.120	5192.120	For Report Purpose
		5200	24.920	5187.000	5211.920	
		5240	24.040	5227.560	5251.600	
		5260	24.960	5247.200	5272.160	
		5280	23.680	5268.280	5291.960	
		5320	23.840	5307.520	5331.360	
		5500	26.080	5486.840	5512.920	
		5580	25.840	5567.160	5593.000	
		5700	24.560	5687.400	5711.960	
		5745	23.800	5732.560	5756.360	
		5785	24.120	5772.720	5796.840	
		5825	23.720	5813.200	5836.920	
11n20SISO	Ant0	5180	24.320	5167.720	5192.040	
		5200	25.680	5186.720	5212.400	
		5240	24.520	5227.680	5252.200	
		5260	25.680	5247.280	5272.960	
		5280	24.960	5267.080	5292.040	
		5320	24.360	5307.880	5332.240	
		5500	27.280	5486.640	5513.920	
		5580	28.720	5565.600	5594.320	
		5700	26.680	5686.280	5712.960	
		5745	25.720	5731.720	5757.440	
		5785	26.680	5771.800	5798.480	
		5825	26.000	5812.360	5838.360	
11n40SISO	Ant0	5190	44.320	5168.000	5212.320	
		5230	45.520	5207.520	5253.040	
		5270	44.720	5247.440	5292.160	
		5310	44.800	5287.600	5332.400	
		5510	47.280	5486.160	5533.440	
		5550	44.640	5527.680	5572.320	
		5670	49.840	5644.480	5694.320	
		5755	45.440	5732.040	5777.480	
11ac20SISO	Ant0	5795	46.160	5772.040	5818.200	
		5180	25.160	5167.360	5192.520	
		5200	25.200	5187.320	5212.520	
		5240	24.280	5227.720	5252.000	
		5260	24.440	5247.960	5272.400	
		5280	24.200	5267.760	5291.960	
		5320	24.880	5307.680	5332.560	
		5500	24.840	5487.560	5512.400	
		5580	30.320	5564.360	5594.680	
		5700	25.480	5686.760	5712.240	
		5745	25.000	5732.280	5757.280	
		5785	25.640	5772.440	5798.080	
11ac40SISO	Ant0	5825	26.200	5812.480	5838.680	
		5190	47.680	5165.120	5212.800	
		5230	46.080	5207.120	5253.200	
		5270	47.040	5246.080	5293.120	



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		5310	47.600	5285.840	5333.440
		5510	47.360	5485.920	5533.280
		5550	49.840	5524.320	5574.160
		5670	52.160	5642.720	5694.880
		5755	50.080	5729.000	5779.080
		5795	49.520	5769.720	5819.240
11ax20SISO	Ant0	5180	24.720	5167.320	5192.040
		5200	24.840	5187.640	5212.480
		5240	26.280	5226.760	5253.040
		5260	24.200	5248.120	5272.320
		5280	24.280	5267.680	5291.960
		5320	23.760	5308.280	5332.040
		5500	25.800	5487.680	5513.480
		5580	26.680	5566.840	5593.520
		5700	24.600	5687.760	5712.360
		5745	25.080	5732.480	5757.560
		5785	24.960	5772.600	5797.560
		5825	25.440	5812.320	5837.760
11ax40SISO	Ant0	5190	44.800	5166.480	5211.280
		5230	44.320	5208.400	5252.720
		5270	45.120	5237.920	5283.040
		5310	44.800	5287.520	5332.320
		5510	44.240	5487.440	5531.680
		5550	44.320	5527.760	5572.080
		5670	46.080	5646.960	5693.040
		5755	44.320	5732.200	5776.520
		5795	45.840	5772.280	5818.120



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Test Graphs



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