

Report No.: XEWM2304000191RG04  
 Rev.: 01  
 Page: 1 of 752

# TEST REPORT

**Application No.:** XEWM2304000191RG  
**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.:** FC06E  
**Trade Mark:** Quectel  
**FCC ID:** XMR2023FC06E  
**Standards:** FCC 47 CFR Part 2, Subpart J  
 FCC 47 CFR Part 15, Subpart E  
**Date of Receipt:** 2023/04/20  
**Date of Test:** 2023/04/23 to 2023/05/19  
**Date of Issue:** 2023/05/31

<b>Test Result :</b>	<b>PASS *</b>
----------------------	---------------

\* 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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# 1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023/05/31		Original

<b>Prepared By</b>	 <hr/> (Leah Chen) / Test Engineer
<b>Checked By</b>	 <hr/> (Andy Yao) / Reviewer



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## 2 Test Summary

Test Item	Band <sup>[1]</sup>	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)(ii)	<1W	Clause 4.4	PASS
	Band II-A	15.407(a)(2)	<MIN{250mW, 11dBm+10*lg(EBW)}		
	Band II-C				
	Band III	15.407(a)(3)	< 1W		
Maximum Power Spectral Density	Band I	15.407(a)(ii)	< 17dBm/MHz	Clause 4.8	PASS
	Band II-A	15.407(a)(2)	<11dBm/MHz		
	Band II-C				
	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:		PASS



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			<-27dBm/MHz PK e.i.r.p. (exl. 5.25-5.35 GHz). F≥1GHz & in-restricted: §15.209 limit (AV&PK).		
	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) 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).		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
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</p>					



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Report No.: XEWM2304000191RG04  
Rev.: 01  
Page: 5 of 752

Band III: 5725-5850MHz



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## Contents

1	Version .....	2
2	Test Summary .....	3
3	General Information .....	7
3.1	Details of Client .....	7
3.2	Test Location .....	7
3.3	Test Facility .....	7
3.4	General Description of EUT .....	8
3.5	Test Environment and Mode .....	11
3.6	Description of Support Units .....	11
3.7	Worst-case configuration and mode .....	11
4	Test results and Measurement Data .....	12
4.1	Antenna Requirement .....	12
4.2	AC Power Line Conducted Emissions .....	14
4.3	Duty Cycle .....	18
4.4	Conducted Output Power .....	19
4.5	26dB Emission Bandwidth .....	20
4.6	6dB Emission Bandwidth .....	21
4.7	99% Occupied Bandwidth .....	22
4.8	Power Spectral Density .....	23
4.9	Radiated Spurious Emissions .....	24
4.10	Restricted bands around fundamental frequency .....	27
5	Measurement Uncertainty (95% confidence levels, k=2) .....	29
6	Equipment List .....	30
7	Photographs - Setup Photos .....	32



Report No.: XEWM2304000191RG04  
 Rev.: 01  
 Page: 7 of 752

### 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, Ken Liu

#### 3.3 Test Facility

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

<p>• <b>A2LA (Certificate No. 4854.01)</b>          SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.</p> <p>• <b>Innovation, Science and Economic Development Canada</b>          SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. has been recognized by ISED as an accredited testing laboratory.          CAB identifier: CN0095.          IC#: 25613.</p> <p>• <b>FCC –Designation Number: CN1337</b>          SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. has been recognized as an accredited testing laboratory.          Designation Number: CN1337.          Test Firm Registration Number: 917410</p>
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### 3.4 General Description of EUT

EUT Description:	Wi-Fi & Bluetooth Module	
Model No.:	FC06E	
Trade Mark:	Quectel	
Hardware Version:	R1.2	
Software Version:	NA	
SN:	RF Conducted	E1N23CE0B000004
	RSE & AC power line	E1N23CE0B000027
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
	802.11ax:	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)
	802.11ax:	OFDM/OFDMA (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)
	80MHz:	802.11ac(VHT80)/ax(HE80)
Antenna Type:	<input checked="" type="checkbox"/> External, <input type="checkbox"/> Integrated	
Antenna Gain:	5150MHz to 5250MHz: 1dBi(Ant0); 1dBi(Ant1); 5250MHz to 5350MHz: 1dBi(Ant0); 1dBi(Ant1); 5470MHz to 5725MHz: 1dBi(Ant0); 1dBi(Ant1); 5725MHz to 5850MHz: 1dBi(Ant0); 1dBi(Ant1);	
	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
	<input checked="" type="checkbox"/> MIMO	802.11n/ac/ax: 2Tx & 2Rx
	<input checked="" type="checkbox"/> Diversity	CDD:802.11a: 2Tx & 2Rx



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Report No.: XEWM2304000191RG04  
 Rev.: 01  
 Page: 9 of 752

TPC Function:	<input checked="" type="checkbox"/> Support, <input type="checkbox"/> Not Support
Use Conditions:	Indoor
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
IEEE 802.11ac/ax 80MHz	The Middle channel	5210



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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
IEEE 802.11ac/ax 80MHz	The Middle channel	5290

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
IEEE 802.11ac/ax 80MHz	The Lowest channel	5530
	The Highest channel	5610

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
IEEE 802.11ac/ax 80MHz	The Middle channel	5775



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### 3.5 Test Environment and Mode

<b>Environment Parameter</b>	96~101 kPa Selected Values During Tests	
<b>Relative Humidity</b>	40-60 % RH Ambient	
<b>Value</b>	<b>Temperature(°C)</b>	<b>Voltage(V)</b>
NTNV	22~25	5
Remark: NV: Normal Voltage NT: Normal Temperature		

### 3.6 Description of Support Units

Description	Manufacturer	Model No.
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	CDD/MIMO - Data Rate
802.11a	6 Mbps	12 Mbps
802.11n (HT 20)	MCS0 (6.5 Mbps)	MCS0 (13 Mbps)
802.11n (HT 40)	MCS0 (13.5 Mbps)	MCS0 (27 Mbps)
802.11ac (VHT 20)	MCS0 (6.5 Mbps)	MCS0 (13 Mbps)
802.11ac (VHT 40)	MCS0 (13.5 Mbps)	MCS0 (27 Mbps)
802.11ac (VHT 80)	MCS0 (29.3 Mbps)	MCS0 (58.5 Mbps)
802.11ax (HE 20)	MCS0 (8 Mbps)	MCS0 (16 Mbps)
802.11ax (HE 40)	MCS0 (16 Mbps)	MCS0 (32 Mbps)
802.11ax (HE 80)	MCS0 (34 Mbps)	MCS0 (68 Mbps)



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## 4 Test results and Measurement Data

### 4.1 Antenna Requirement

<b>Standard requirement:</b>	47 CFR Part 15 Section 15.203
<p>The antenna is External Antenna and no consideration of replacement. The best case gain of the antenna are</p> <p>5150MHz to 5250MHz: 1dBi(Ant0); 1dBi(Ant1);*</p> <p>5250MHz to 5350MHz: 1dBi(Ant0); 1dBi(Ant1);*</p> <p>5470MHz to 5725MHz: 1dBi(Ant0); 1dBi(Ant1);*</p> <p>5725MHz to 5850MHz: 1dBi(Ant0); 1dBi(Ant1);*</p>	
<p><i>*Note:</i>  <i>The antenna gain are derived from the gain information report provided by the manufacturer.</i></p> <p><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></p>	



**Cyclic Delay Diversity (CDD) System:**

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

If all antennas have the same gain,  $G_{ANT}$ , Directional gain =  $G_{ANT}$  + Array Gain, where Array Gain is as follows.

- For power spectral density (PSD) measurements on all devices,  
 Array Gain =  $10 \log(N_{ANT}/N_{SS} = 1)$  dB.
- For power measurements on IEEE 802.11 devices:  
 Array Gain = 0 dB (i.e., no array gain) for  $N_{ANT} \leq 4$ ;

Directional gain may be calculated by using the formulas applicable to equal gain antennas with  $G_{ANT}$  set equal to the gain of the antenna having the highest gain.

**The Power and PSD limit should be modified if the directional gain of eut is over 6dBi.**

Power Limit Reduction =

The EUT supports CDD System.

All antennas have the same gain:

Operation Frequency	ANT Gain1 (dBi)	ANT Gain2 (dBi)	Directional gain For Power (dBi)	Directional gain For PSD (dBi)	Power Limit Reduction (dBm)	PSD Limit Reduction (dBm)
5150MHz to 5250MHz	1.00	1.00	1.00	4.01	0	0
5250MHz to 5350MHz	1.00	1.00	1.00	4.01	0	0
5470MHz to 5725MHz	1.00	1.00	1.00	4.01	0	0
5725MHz to 5850MHz	1.00	1.00	1.00	4.01	0	0

5150MHz to 5250MHz:

Power Limit Reduction = Directional gain – 6dBi, (Directional gain < 6dBi ) =0

PSD Limit Reduction = Directional gain – 6dBi, (Directional gain < 6dBi ) =0

5250MHz to 5350MHz:

Power Limit Reduction = Directional gain – 6dBi, (Directional gain < 6dBi ) =0

PSD Limit Reduction = Directional gain – 6dBi, (Directional gain < 6dBi ) =0

5470MHz to 5725MHz:

Power Limit Reduction = Directional gain – 6dBi, (Directional gain < 6dBi ) =0

PSD Limit Reduction = Directional gain – 6dBi, (Directional gain < 6dBi ) =0

5725MHz to 5850MHz:

Power Limit Reduction = Directional gain – 6dBi, (Directional gain < 6dBi ) =0

PSD Limit Reduction = Directional gain – 6dBi, (Directional gain < 6dBi ) =0



### 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"> <li>1) The mains terminal disturbance voltage test was conducted in a shielded room.</li> <li>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.</li> <li>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,</li> <li>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.</li> <li>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.</li> </ol>		



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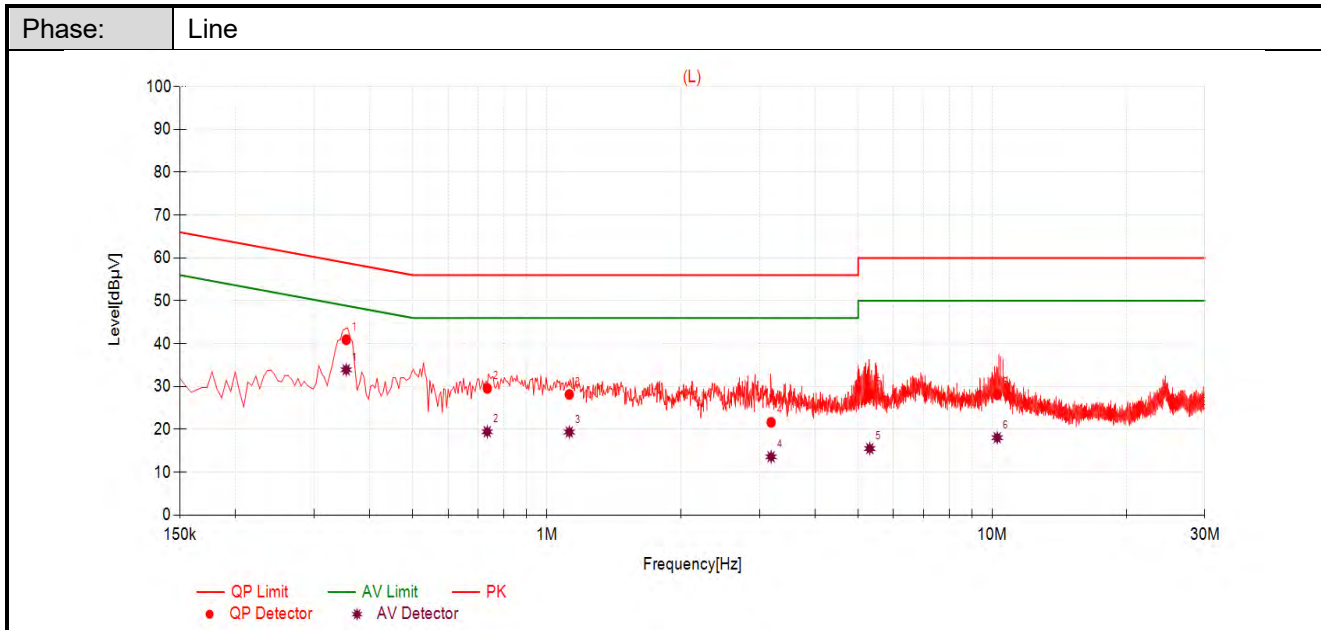
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<p>Test Setup:</p>	
<p>Exploratory Test Mode:</p>	<p>Transmitting with all kind of modulations, data rates at lowest, middle and highest channel.</p>
<p>Final Test Mode:</p>	<p>Refer to section 3.7 for details.          Only the worst case is recorded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



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.



Final 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	0.3542	9.87	31.06	40.93	58.86	17.93	24.05	33.92	48.86	14.94	PASS
2	0.7345	9.94	19.63	29.57	56.00	26.43	9.51	19.45	46.00	26.55	PASS
3	1.1226	9.83	18.34	28.17	56.00	27.83	9.55	19.38	46.00	26.62	PASS
4	3.1871	9.85	11.81	21.66	56.00	34.34	3.76	13.61	46.00	32.39	PASS
5	5.3085	9.90	18.25	28.15	60.00	31.85	5.64	15.54	50.00	34.46	PASS
6	10.2626	9.94	18.14	28.08	60.00	31.92	8.13	18.07	50.00	31.93	PASS

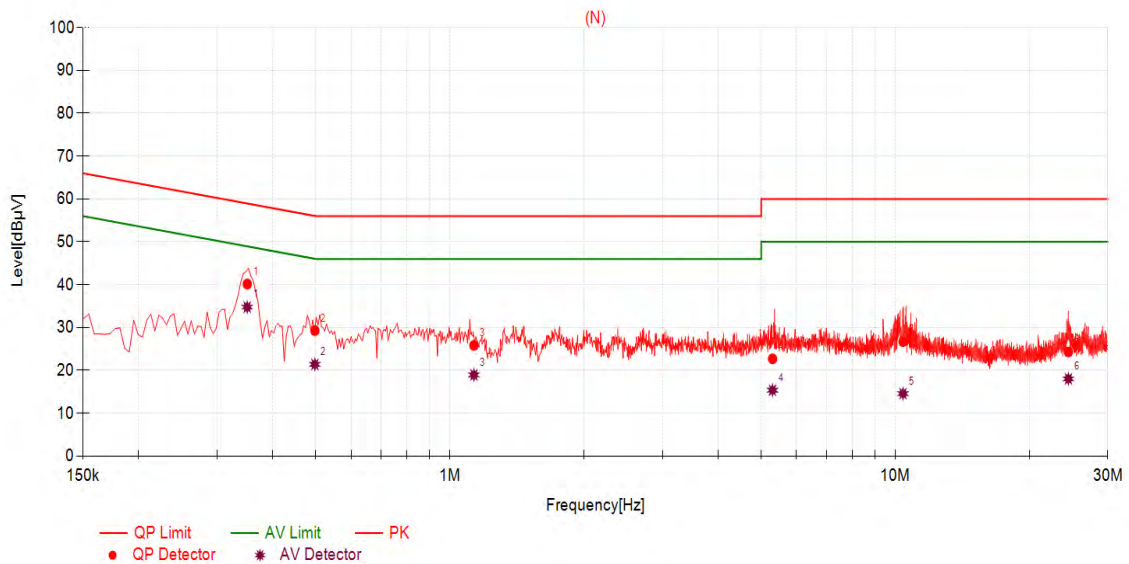
Remark:

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





Phase: Neutral



Final 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	0.3506	9.79	30.37	40.16	58.95	18.79	24.98	34.77	48.95	14.18	PASS
2	0.4974	9.87	19.42	29.29	56.04	26.75	11.54	21.41	46.04	24.63	PASS
3	1.1320	9.81	16.03	25.84	56.00	30.16	9.14	18.95	46.00	27.05	PASS
4	5.3013	9.99	12.72	22.71	60.00	37.29	5.39	15.38	50.00	34.62	PASS
5	10.4077	10.09	16.65	26.74	60.00	33.26	4.50	14.59	50.00	35.41	PASS
6	24.4788	10.31	14.00	24.31	60.00	35.69	7.71	18.02	50.00	31.98	PASS

Remark:

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



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Report No.: XEWM2304000191RG04  
Rev.: 01  
Page: 18 of 752

### 4.3 Duty Cycle

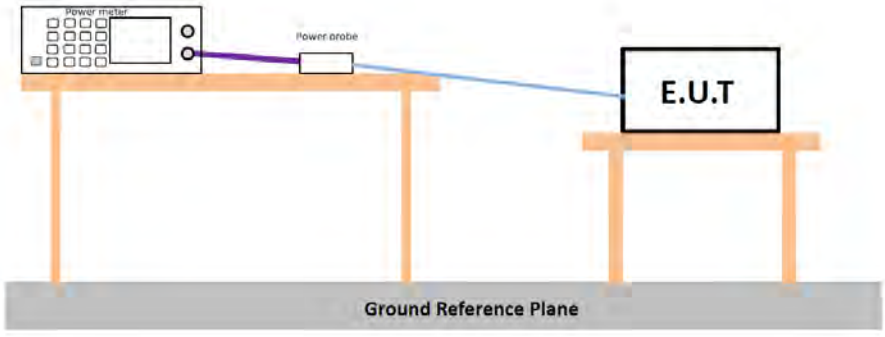
The detailed test data see: **Appendix**



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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:	 <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 1W(30dBm)
	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: <b>Appendix</b>		



### 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: <b>Appendix</b>	



### 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 least 500kHz
Test Results:	Pass	
The detailed test data see: <b>Appendix</b>		



### 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: <b>Appendix</b>	



### 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 17dBm/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: <b>Appendix</b>		



### 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:

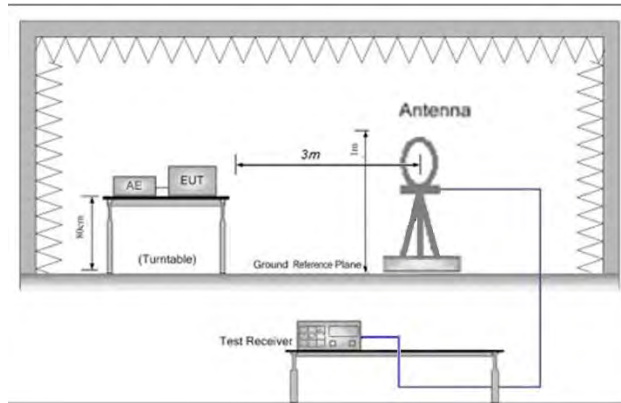


Figure 1. 9kHz to 30MHz

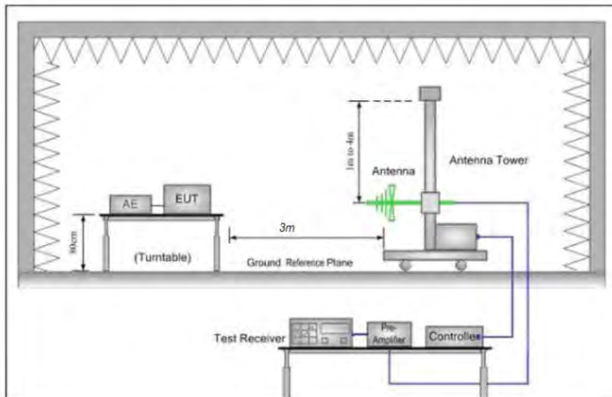


Figure 1. 30MHz to 1GHz

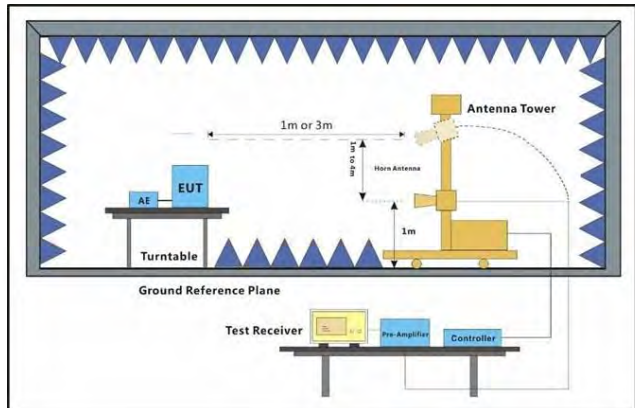


Figure 2. Above 1 GHz

Test Procedure:	<ol style="list-style-type: none"> <li>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.</li> <li>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 &gt;18GHz).</li> <li>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.</li> </ol>
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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 <math>20 \cdot \text{LOG}(3/1) = 9.54 \text{ dB}</math>.</p>
<p>Test Configuration:</p>	<p>Measurements below 30MHz</p> <ul style="list-style-type: none"> <li>• RBW = 10 kHz</li> <li>• VBW = 30 kHz</li> <li>• Detector = Peak &amp; Average &amp; Quasi-peak</li> <li>• Trace mode = max hold</li> </ul> <p>Measurements Below 1000MHz</p> <ul style="list-style-type: none"> <li>• RBW = 120 kHz</li> <li>• VBW = 300 kHz</li> <li>• Detector = Quasi-peak</li> <li>• Trace mode = max hold</li> </ul> <p>Peak Measurements Above 1000 MHz</p> <ul style="list-style-type: none"> <li>• RBW = 1 MHz</li> <li>• VBW <math>\geq 3 \text{ MHz}</math></li> <li>• Detector = Peak</li> <li>• Sweep time = auto</li> <li>• Trace mode = max hold</li> </ul> <p>Average Measurements Above 1000MHz</p> <ul style="list-style-type: none"> <li>• RBW = 1 MHz</li> <li>• VBW = 10Hz, when duty cycle is no less than 98 percent.</li> <li>• VBW <math>\geq 1/T</math>, 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.</li> </ul>
<p>Exploratory Test Mode:</p>	<p>Transmitting with all kind of modulations, data rates.</p>



Report No.: XEWM2304000191RG04  
 Rev.: 01  
 Page: 26 of 752

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: <b>Appendix</b>	



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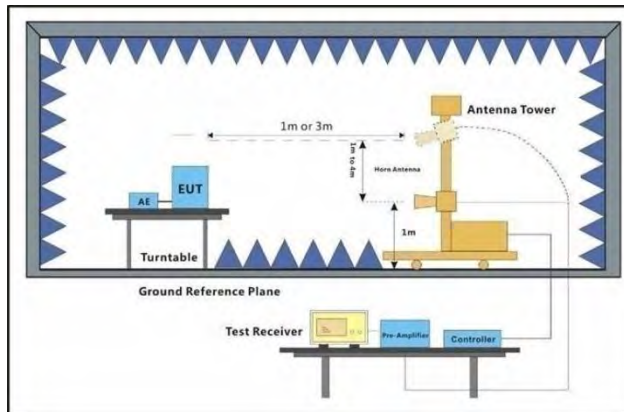
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### 4.10 Restricted bands around fundamental frequency

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



	<p>modulation for lowest and highest channel</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>
Test Configuration:	<p>Measurements Below 1000MHz</p> <ul style="list-style-type: none"> <li>• RBW = 120 kHz</li> <li>• VBW = 300 kHz</li> <li>• Detector = Quasi-peak</li> <li>• Trace mode = max hold</li> </ul> <p>Peak Measurements Above 1000 MHz</p> <ul style="list-style-type: none"> <li>• RBW = 1 MHz</li> <li>• VBW ≥ 3 MHz</li> <li>• Detector = Peak</li> <li>• Sweep time = auto</li> <li>• Trace mode = max hold</li> </ul> <p>Average Measurements Above 1000MHz</p> <ul style="list-style-type: none"> <li>• RBW = 1 MHz</li> <li>• VBW = 10Hz, when duty cycle is no less than 98 percent.</li> <li>• 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.</li> </ul>
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: <b>Appendix</b>	



### 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	$\pm 0.21$ dB
5	RF power density	$\pm 2.84$ dB
6	Conducted Spurious emissions	$\pm 0.75$ dB
7	Conduction Emission	$\pm 3.0$ dB (150kHz to 30MHz)
8	Radiated Emission	$\pm 4.6$ dB (9kHz to 30MHz)
		$\pm 4.9$ dB (30MHz to 1GHz)
		$\pm 4.9$ dB (1GHz to 6GHz)
		$\pm 4.7$ dB (6GHz to 18GHz)
		$\pm 5.26$ 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



Report No.: XEWM2304000191RG04  
 Rev.: 01  
 Page: 31 of 752

RSE Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/d)	Cal. Due date (yyyy/mm/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~18GHz)	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&SCHWARZ	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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Report No.: XEWM2304000191RG04  
Rev.: 01  
Page: 32 of 752

## 7 Photographs - Setup Photos

Refer to Appendix A.2 WLAN Setup Photos.



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Report No.: XEWM2304000191RG04

Rev.: 01

Page: 33 of 752

# Appendix



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**Emission Bandwidth  
 Test Result**

TestMode	Antenna	Frequency[MHz]	26dB EBW [MHz]	FL[MHz]	FH[MHz]	Verdict
11a-CDD	Ant0	5180	18.880	5170.520	5189.400	For Report Purpose
	Ant1	5180	18.800	5170.640	5189.440	
	Ant0	5200	19.160	5190.200	5209.360	
	Ant1	5200	19.120	5190.520	5209.640	
	Ant0	5240	19.040	5230.240	5249.280	
	Ant1	5240	19.000	5230.480	5249.480	
	Ant0	5260	19.120	5250.520	5269.640	
	Ant1	5260	18.720	5250.720	5269.440	
	Ant0	5280	19.080	5270.400	5289.480	
	Ant1	5280	19.280	5270.360	5289.640	
	Ant0	5320	18.920	5310.400	5329.320	
	Ant1	5320	18.760	5310.680	5329.440	
	Ant0	5500	19.000	5490.640	5509.640	
	Ant1	5500	19.000	5490.600	5509.600	
	Ant0	5580	19.120	5570.480	5589.600	
	Ant1	5580	19.080	5570.480	5589.560	
	Ant0	5700	18.800	5690.480	5709.280	
	Ant1	5700	18.800	5690.680	5709.480	
	Ant0	5745	19.040	5735.320	5754.360	
	Ant1	5745	19.040	5735.600	5754.640	
Ant0	5785	18.960	5775.520	5794.480		
Ant1	5785	18.960	5775.640	5794.600		
Ant0	5825	18.800	5815.600	5834.400		
Ant1	5825	19.120	5815.560	5834.680		
11n20MIMO	Ant0	5180	20.160	5170.080	5190.240	
	Ant1	5180	20.080	5169.880	5189.960	
	Ant0	5200	20.720	5189.640	5210.360	
	Ant1	5200	20.280	5189.840	5210.120	
	Ant0	5240	20.200	5229.720	5249.920	
	Ant1	5240	20.280	5229.840	5250.120	
	Ant0	5260	20.240	5249.800	5270.040	
	Ant1	5260	20.080	5250.160	5270.240	
	Ant0	5280	20.120	5269.880	5290.000	
	Ant1	5280	20.080	5269.960	5290.040	
	Ant0	5320	20.400	5309.920	5330.320	
	Ant1	5320	19.760	5310.200	5329.960	
	Ant0	5500	20.200	5489.960	5510.160	
	Ant1	5500	19.920	5490.120	5510.040	
	Ant0	5580	20.240	5569.840	5590.080	
	Ant1	5580	20.120	5570.040	5590.160	
	Ant0	5700	20.400	5689.840	5710.240	
	Ant1	5700	19.920	5690.080	5710.000	
	Ant0	5745	20.040	5735.000	5755.040	
	Ant1	5745	20.040	5735.000	5755.040	
Ant0	5785	20.160	5775.080	5795.240		
Ant1	5785	20.560	5774.960	5795.520		
Ant0	5825	19.960	5815.120	5835.080		
Ant1	5825	20.520	5815.000	5835.520		



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11n40MIMO	Ant0	5190	39.360	5170.320	5209.680
	Ant1	5190	39.200	5170.400	5209.600
	Ant0	5230	39.440	5210.240	5249.680
	Ant1	5230	39.280	5210.480	5249.760
	Ant0	5270	39.280	5250.640	5289.920
	Ant1	5270	39.360	5250.480	5289.840
	Ant0	5310	39.920	5290.080	5330.000
	Ant1	5310	39.440	5290.400	5329.840
	Ant0	5510	39.920	5490.080	5530.000
	Ant1	5510	39.520	5490.160	5529.680
	Ant0	5550	39.040	5530.480	5569.520
	Ant1	5550	39.520	5530.400	5569.920
	Ant0	5670	39.440	5650.240	5689.680
	Ant1	5670	39.760	5650.160	5689.920
	Ant0	5755	39.600	5735.240	5774.840
	Ant1	5755	39.120	5735.560	5774.680
Ant0	5795	39.200	5775.240	5814.440	
Ant1	5795	39.360	5775.400	5814.760	
11ac20MIMO	Ant0	5180	20.160	5170.080	5190.240
	Ant1	5180	19.960	5170.080	5190.040
	Ant0	5200	20.160	5189.840	5210.000
	Ant1	5200	20.200	5189.760	5209.960
	Ant0	5240	20.120	5229.880	5250.000
	Ant1	5240	19.960	5230.000	5249.960
	Ant0	5260	20.080	5250.000	5270.080
	Ant1	5260	20.160	5249.960	5270.120
	Ant0	5280	20.080	5270.040	5290.120
	Ant1	5280	19.920	5269.960	5289.880
	Ant0	5320	20.040	5310.080	5330.120
	Ant1	5320	20.120	5309.920	5330.040
	Ant0	5500	19.920	5490.040	5509.960
	Ant1	5500	19.960	5490.120	5510.080
	Ant0	5580	20.520	5569.800	5590.320
	Ant1	5580	20.200	5569.960	5590.160
	Ant0	5700	19.960	5690.040	5710.000
	Ant1	5700	19.920	5690.040	5709.960
	Ant0	5745	20.360	5734.720	5755.080
	Ant1	5745	20.120	5735.000	5755.120
Ant0	5785	20.200	5775.040	5795.240	
Ant1	5785	19.960	5775.200	5795.160	
Ant0	5825	20.080	5815.120	5835.200	
Ant1	5825	20.120	5815.080	5835.200	
11ac40MIMO	Ant0	5190	39.440	5170.320	5209.760
	Ant1	5190	39.360	5170.320	5209.680
	Ant0	5230	39.760	5210.080	5249.840
	Ant1	5230	38.960	5210.560	5249.520
	Ant0	5270	39.360	5250.400	5289.760
	Ant1	5270	39.440	5250.320	5289.760
	Ant0	5310	39.600	5290.240	5329.840
	Ant1	5310	39.360	5290.400	5329.760
	Ant0	5510	39.520	5490.240	5529.760
	Ant1	5510	39.440	5490.160	5529.600
Ant0	5550	39.680	5530.080	5569.760	



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	Ant1	5550	39.840	5530.080	5569.920
	Ant0	5670	39.760	5650.160	5689.920
	Ant1	5670	39.760	5650.160	5689.920
	Ant0	5755	39.440	5735.160	5774.600
	Ant1	5755	39.360	5735.240	5774.600
	Ant0	5795	39.120	5775.400	5814.520
	Ant1	5795	39.360	5775.320	5814.680
11ac80MIMO	Ant0	5210	81.440	5169.200	5250.640
	Ant1	5210	81.920	5168.880	5250.800
	Ant0	5290	82.240	5248.880	5331.120
	Ant1	5290	81.120	5249.520	5330.640
	Ant0	5530	81.440	5489.520	5570.960
	Ant1	5530	81.120	5489.360	5570.480
	Ant0	5610	82.240	5568.880	5651.120
	Ant1	5610	81.280	5569.360	5650.640
	Ant0	5775	81.600	5734.200	5815.800
Ant1	5775	81.280	5734.680	5815.960	
11ax20MIMO	Ant0	5180	20.920	5169.640	5190.560
	Ant1	5180	20.960	5169.440	5190.400
	Ant0	5200	20.760	5189.720	5210.480
	Ant1	5200	21.000	5189.600	5210.600
	Ant0	5240	20.760	5229.680	5250.440
	Ant1	5240	20.680	5229.840	5250.520
	Ant0	5260	20.920	5249.600	5270.520
	Ant1	5260	21.160	5249.560	5270.720
	Ant0	5280	20.720	5269.640	5290.360
	Ant1	5280	20.760	5269.600	5290.360
	Ant0	5320	20.880	5309.640	5330.520
	Ant1	5320	20.840	5309.480	5330.320
	Ant0	5500	20.600	5489.720	5510.320
	Ant1	5500	21.000	5489.520	5510.520
	Ant0	5580	20.880	5569.680	5590.560
	Ant1	5580	20.600	5569.720	5590.320
	Ant0	5700	20.840	5689.760	5710.600
	Ant1	5700	21.400	5689.400	5710.800
	Ant0	5745	21.000	5734.680	5755.680
	Ant1	5745	21.040	5734.400	5755.440
	Ant0	5785	20.600	5774.720	5795.320
	Ant1	5785	20.520	5774.840	5795.360
	Ant0	5825	20.680	5814.760	5835.440
	Ant1	5825	21.320	5814.280	5835.600
11ax40MIMO	Ant0	5190	40.080	5169.920	5210.000
	Ant1	5190	40.320	5169.760	5210.080
	Ant0	5230	40.560	5209.760	5250.320
	Ant1	5230	40.080	5210.080	5250.160
	Ant0	5270	40.560	5249.600	5290.160
	Ant1	5270	40.560	5249.920	5290.480
	Ant0	5310	40.480	5289.840	5330.320
	Ant1	5310	40.320	5289.760	5330.080
	Ant0	5510	40.400	5489.840	5530.240
	Ant1	5510	40.400	5489.840	5530.240
	Ant0	5550	40.320	5529.920	5570.240
	Ant1	5550	40.320	5529.760	5570.080



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Report No.: XEWM2304000191RG04  
 Rev.: 01  
 Page: 37 of 752

	Ant0	5670	40.480	5649.840	5690.320
	Ant1	5670	40.320	5649.840	5690.160
	Ant0	5755	40.320	5734.840	5775.160
	Ant1	5755	40.400	5734.840	5775.240
	Ant0	5795	40.480	5775.000	5815.480
	Ant1	5795	40.240	5774.840	5815.080
11x80MIMO	Ant0	5210	81.440	5169.200	5250.640
	Ant1	5210	81.280	5169.360	5250.640
	Ant0	5290	81.600	5249.200	5330.800
	Ant1	5290	81.760	5249.520	5331.280
	Ant0	5530	81.440	5489.360	5570.800
	Ant1	5530	81.760	5489.040	5570.800
	Ant0	5610	81.280	5569.680	5650.960
	Ant1	5610	81.920	5569.200	5651.120
	Ant0	5775	82.080	5733.560	5815.640
	Ant1	5775	81.920	5734.200	5816.120

**Remark:**

For WLAN SISO & CDD/MIMO mode for 802.11a/n/ac/ax mode, the whole testing has assessed only CDD/MIMO mode by referring to their higher output power.



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Test Graphs



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11a-CDD Ant0 5200



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11a-CDD Ant1 5500

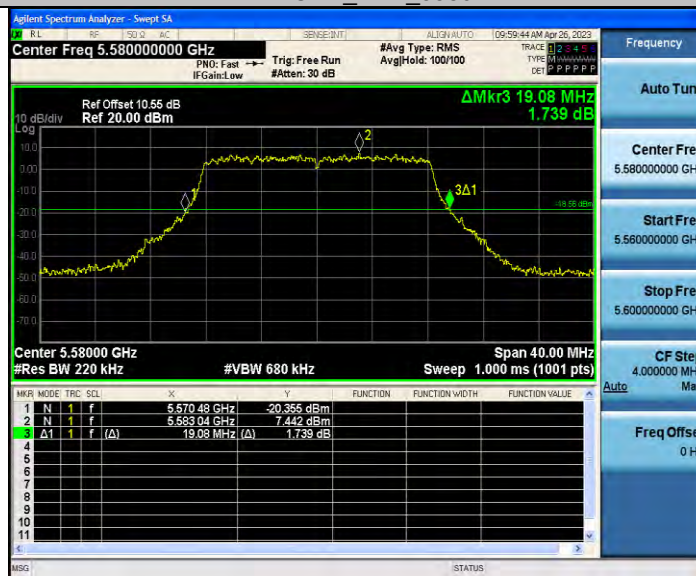


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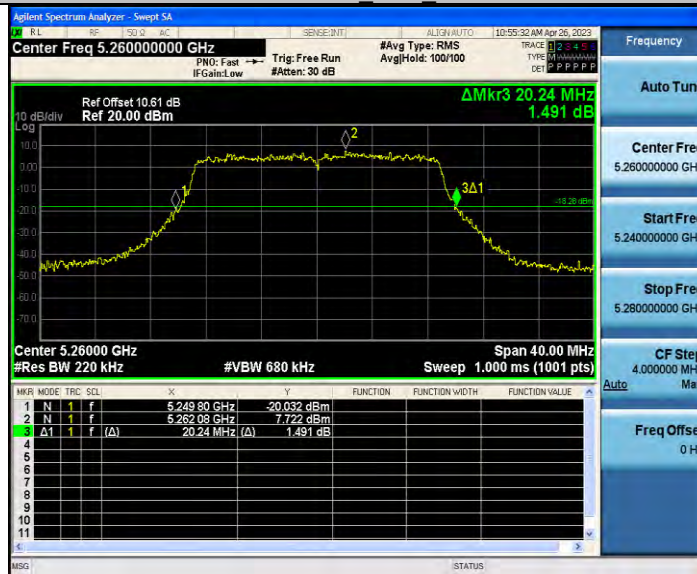


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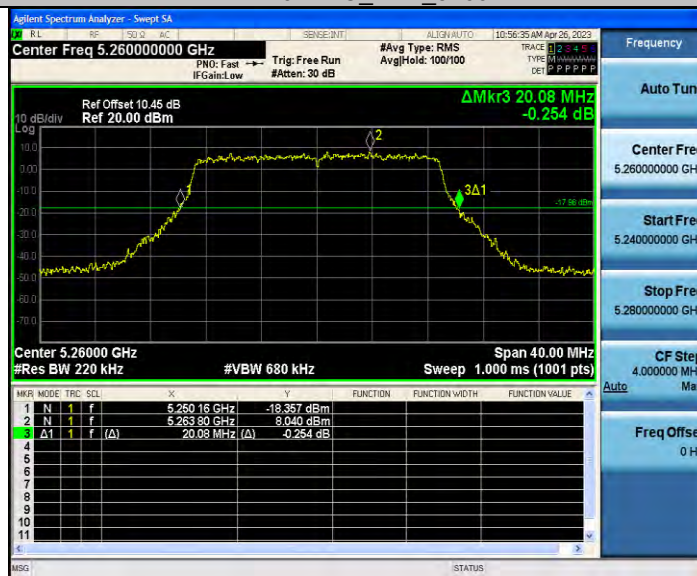
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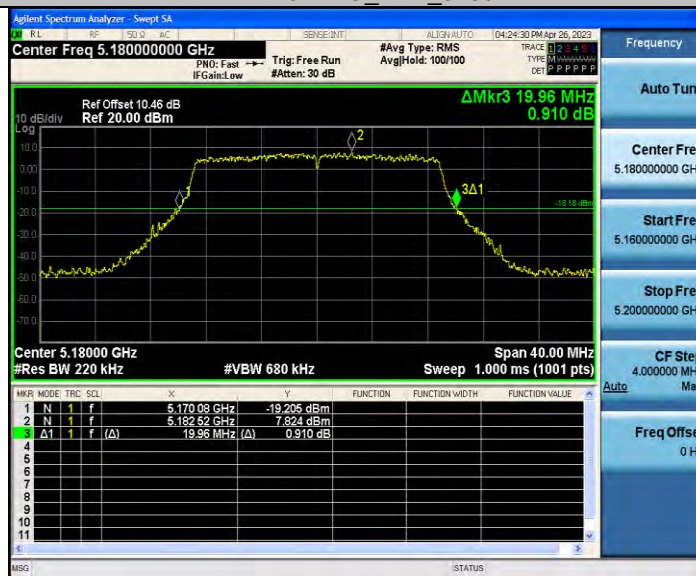
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