

Report No.: XEWA2310000070RG03
 Rev.: 01
 Page: 1 of 296

TEST REPORT

Application No.: XEWA2310000070RG
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.: AF66T
Trade Mark: Quectel
FCC ID: XMR202309AF66T
Standards: FCC 47 CFR Part 2, Subpart J
 FCC 47 CFR Part 15, Subpart C
Date of Receipt: 2023/09/26
Date of Test: 2023/10/11 to 2023/10/23
Date of Issue: 2023/11/13

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

Authorized Signature:



Peter Tan
 Regulatory Technical Manager



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Report No.: XEWA2310000070RG03

Rev.: 01

Page: 2 of 296

1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023/11/13		Original

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



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2 Test Summary

Test Item	FCC Rule No.	Test Method	Test Result	Result
Antenna Requirement	15.203/15.247(b)	--	Clause 4.1	PASS
AC Power Line Conducted Emission	15.207	ANSI C63.10-2020 Section 6.2	Clause 4.2	PASS
Duty Cycle	--	ANSI C63.10-2020 Section 11.6	Clause 4.3	For Report Purpose
Conducted Output Power	15.247 (b)(3)	ANSI C63.10-2020 Section 11.9.1.2	Clause 4.4	PASS
DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	15.247 (a)(2)	ANSI C63.10-2020 Section 11.8 Option 2 / 6.9.3	Clause 4.5	PASS
Power Spectral Density	15.247 (e)	ANSI C63.10-2020 Section 11.10.2	Clause 4.6	PASS
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10-2020 Section 11.11	Clause 4.7	PASS
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10-2020 Section 11.11	Clause 4.8	PASS
Radiated Spurious Emissions	15.247(d);15.205/15.209	ANSI C63.10-2020 Section 11.12	Clause 4.9	PASS
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d);15.205/15.209	ANSI C63.10-2020 Section 11.12	Clause 4.10	PASS



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Contents

1	Version	2
2	Test Summary	3
3	General Information	5
3.1	Details of Client	5
3.2	Test Location	5
3.3	Test Facility	5
3.4	General Description of EUT	6
3.5	Test Environment and Mode	8
3.6	Description of Support Units	8
3.7	Worst-case configuration and mode	8
4	Test results and Measurement Data	9
4.1	Antenna Requirement	9
4.2	AC Power Line Conducted Emissions	11
4.3	Duty Cycle	15
4.4	Conducted Output Power	16
4.5	DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	17
4.6	Power Spectral Density	18
4.7	Band-edge for RF Conducted Emissions	19
4.8	RF Conducted Spurious Emissions	20
4.9	Radiated Spurious Emissions	21
4.10	Restricted bands around fundamental frequency	25
5	Measurement Uncertainty (95% confidence levels, k=2)	28
6	Equipment List	29
7	Photographs - Setup Photos	31



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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**
 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



3.4 General Description of EUT

EUT Description:	Wi-Fi & Bluetooth Module	
Model No.:	AF66T	
Trade Mark:	Quectel	
Hardware Version:	R1.0	
Software Version:	NA	
Power Supply:	DV 12V	
SN:	RF Conducted	D1C23G416000834
	RSE & AC power line	D1C23G416000499
Operation Frequency:	802.11b/g/n(HT20)/ax(HE20):	2412MHz to 2462MHz
	802.11n(HT40)/ax(HE40):	2422MHz to 2452MHz
Modulation Type:	802.11b:	DSSS (DBPSK, DQPSK, CCK)
	802.11g/n:	OFDM (BPSK, QPSK, 16QAM, 64QAM)
	802.11ax:	OFDM/OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Number of Channels:	802.11b/g/n(HT20)/ax(HE20): 11	
	802.11n(HT40)/ax(HE40): 7	
Channel Spacing:	5MHz	
Smart System:	<input checked="" type="checkbox"/> SISO	802.11b/g/n/ax
	<input checked="" type="checkbox"/> MIMO	802.11n/ax: 2Tx & 2Rx
	<input checked="" type="checkbox"/> Diversity	802.11b/g: 2Tx & 2Rx
Antenna Type:	Dipole Antenna	
Antenna Gain:	0.73dBi(Ant0); 0.73dBi(Ant1)	
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.	
RF Cable:	1.2dB	
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.	



Operation Frequency of each channel (802.11b/g/n HT20/ax HE20)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		
Operation Frequency of each channel (802.11n HT40/ax HE40)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
3	2422MHz	6	2437MHz	9	2452MHz		
4	2427MHz	7	2442MHz				
5	2432MHz	8	2447MHz				
Remark: In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:							
Channel	Frequency for 802.11 b/g/n (HT20) /ax (HE20)			Frequency for 802.11n (HT40) /ax(HE40)			
The Lowest channel	2412MHz			2422MHz			
The Middle channel	2437MHz			2437MHz			
The Highest channel	2462MHz			2452MHz			
Remark: 1. 802.11ax support OFDMA full RU tone and partial RU tone, both full RU and partial RU-left (for low CH) and partial RU-right (for high CH) test output power, the full RU power > partial RU, therefore the full RU perform full test to cover partial RU except for PSD/Duty cycle/BE.							



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

Description	Manufacturer	Model No.
Mother board	Quectel	N/A
Adapter	Quectel	N/A
Test Antenna	Quectel	YE0038AA
Remark: All above the information of table 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
802.11b	1 Mbps	2 Mbps
802.11g	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)
802.11ax (HE 20)	MCS0 (8 Mbps)	MCS0 (16 Mbps)
802.11ax (HE 40)	MCS0 (16 Mbps)	MCS0 (32 Mbps)



4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(b)
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p>	
<p>The antenna is Dipole Antenna and no consideration of replacement. The best case gain of the antenna is 0.73dBi(Ant0); 0.73dBi(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.

The EUT supports CDD System.

All antennas have the same gain:

ANT Gain9 (dBi)	ANT Gain10 (dBi)	Power DG (dBi)	PSD DG (dBi)	Power Limit Reduction(dB)	PSD Limit Reduction(dB)
0.73	0.73	0.73	3.74	0	0

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

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



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4.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C 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:	<p>1) The mains terminal disturbance voltage test was conducted in a shielded room.</p> <p>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.</p> <p>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,</p> <p>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. 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.</p>		



<p>Test Setup:</p>	
<p>Exploratory Test Mode:</p>	<p>Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. DC supply + Transmitting mode.</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>



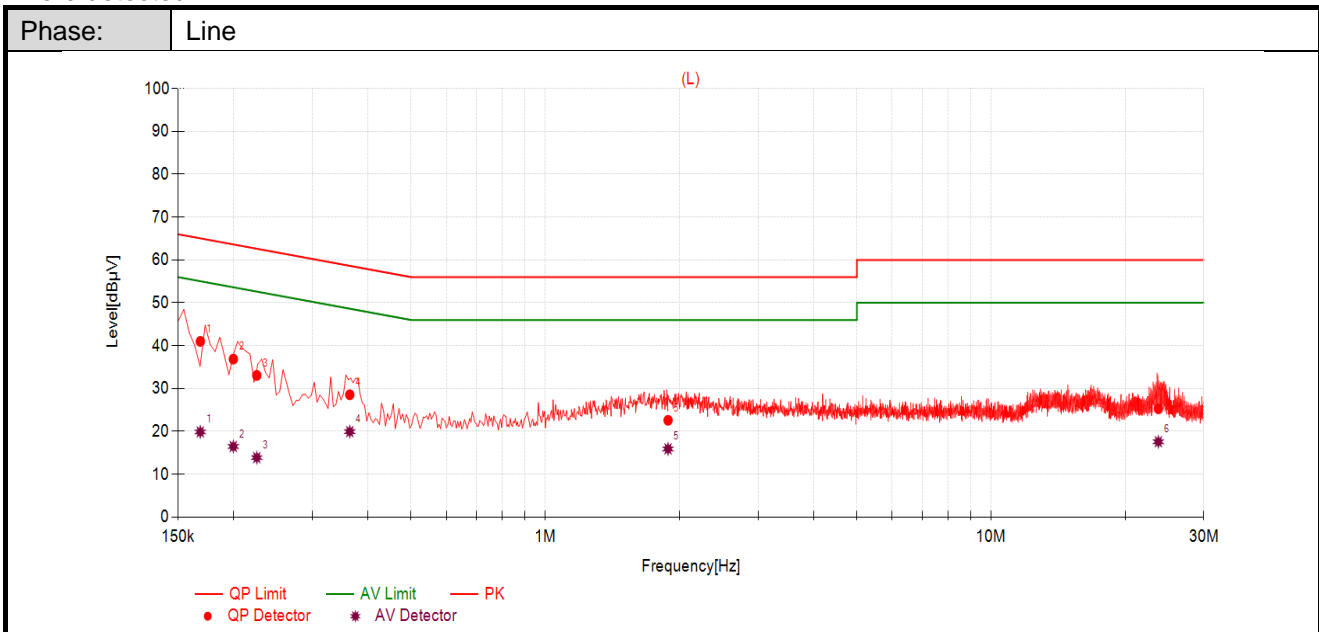
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Measurement Data

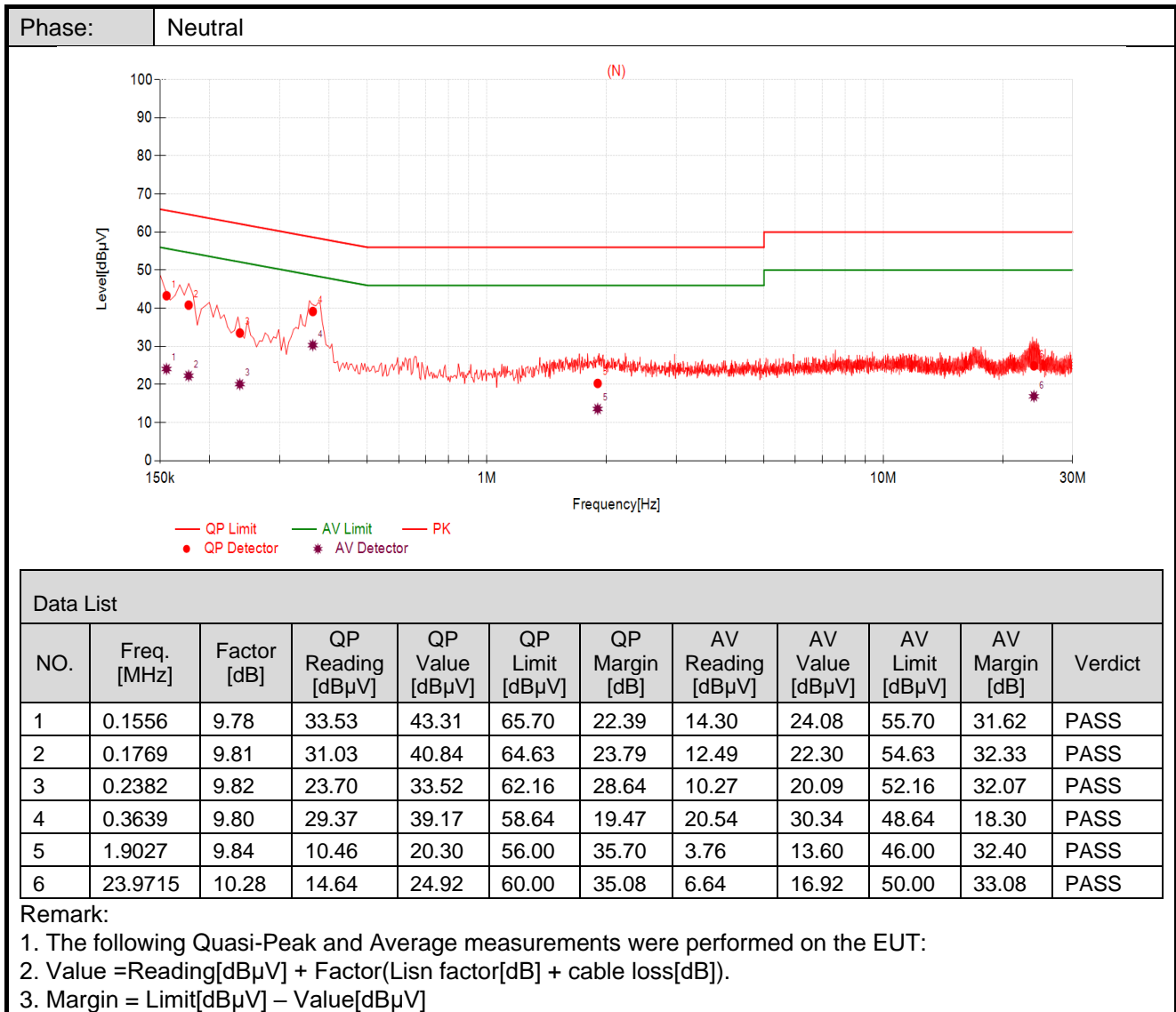
An initial pre-scan was performed on the live and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.



Data List											
NO.	Freq. [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	0.1682	9.85	31.16	41.01	65.05	24.04	10.03	19.88	55.05	35.17	PASS
2	0.1995	9.84	27.04	36.88	63.63	26.75	6.64	16.48	53.63	37.15	PASS
3	0.2252	9.86	23.21	33.07	62.62	29.55	4.02	13.88	52.62	38.74	PASS
4	0.3641	9.87	18.69	28.56	58.64	30.08	10.08	19.95	48.64	28.69	PASS
5	1.8847	9.85	12.74	22.59	56.00	33.41	6.06	15.91	46.00	30.09	PASS
6	23.7353	10.29	14.99	25.28	60.00	34.72	7.30	17.59	50.00	32.41	PASS

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





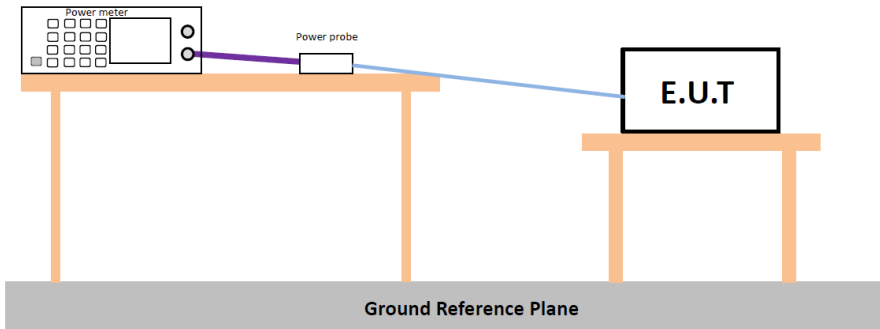
4.3 Duty Cycle

Test Requirement:	ANSI C63.10-2020 Section 11.6
Test Method:	ANSI C63.10-2020 Section 11.6
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:	For Report Purpose
The detailed test data see: Appendix	



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4.4 Conducted Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)
Test Method:	ANSI C63.10-2020 Section 11.9.1.2
Test Setup:	 <p>* Test with power meter (Detector function: Peak)</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:	30dBm
Test Results:	Pass
The detailed test data see: Appendix	



4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10-2020 Section 11.8 Option 2 / 6.9.3
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:	≥ 500 kHz for DTS Bandwidth
Test Results:	Pass
The detailed test data see: Appendix	



4.6 Power Spectral Density

Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10-2020 Section 11.10.2
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:	≤8.00dBm/3kHz
Test Results:	Pass
The detailed test data see: Appendix	



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4.7 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10-2020 Section 11.11
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:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test Results:	Pass
The detailed test data see: Appendix	



4.8 RF Conducted Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10-2020 Section 11.11
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:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test Results:	Pass
The detailed test data see: Appendix	



4.9 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10-2020 Section 11.12				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Test Frequency:	9kHz ~ 25GHz				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak	
	Peak	1MHz	3MHz	Peak	
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
Remark: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.					



Test Setup:

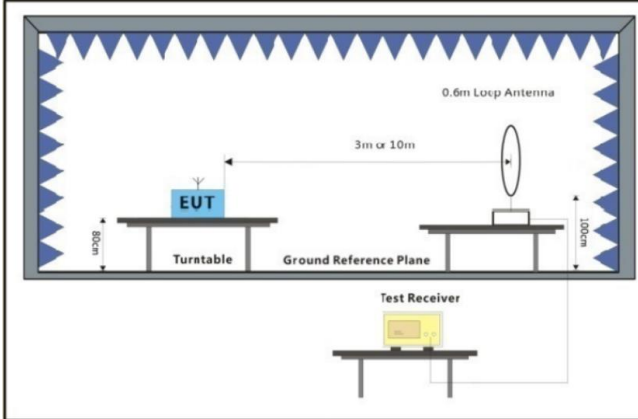


Figure 1. Below 30MHz

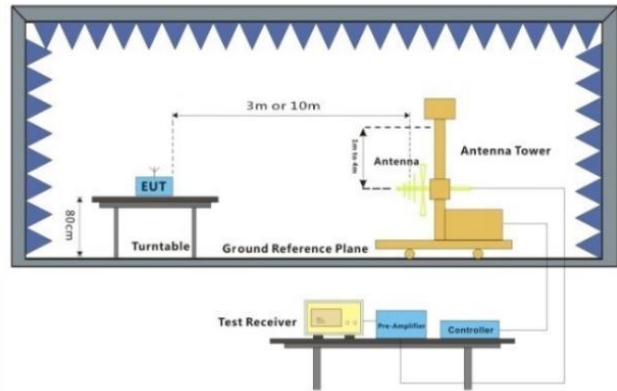


Figure 2. 30MHz to 1GHz

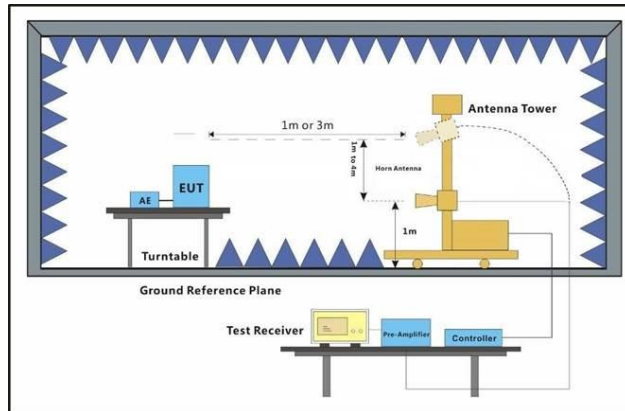


Figure 3. Above 1 GHz

Test Procedure:

- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation (Distance from antenna to EUT is 1m for measurements >18GHz).
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and



	<p>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 lowest channel, the middle channel ,the Highest channel.</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>
<p>Test Configuration:</p>	<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 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 = 10 Hz, 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.
<p>Exploratory Test Mode:</p>	<p>Transmitting with all kind of modulations, data rates. DC supply + Transmitting mode.</p>
<p>Final Test Mode:</p>	<p>Refer to section 3.7 for details. For below 1GHz part, through pre-scan all channels, but only the worst case is recorded in the report.</p>



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Report No.: XEWA2310000070RG03
 Rev.: 01
 Page: 24 of 296

Instruments Used:	Refer to section 6 for details.
Test Results:	Pass
The detailed test data see: Appendix	



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4.10 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10-2020 Section 11.12		
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:

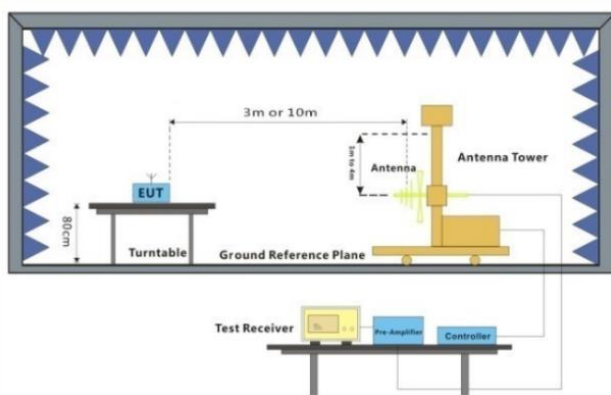


Figure 1. 30MHz to 1GHz

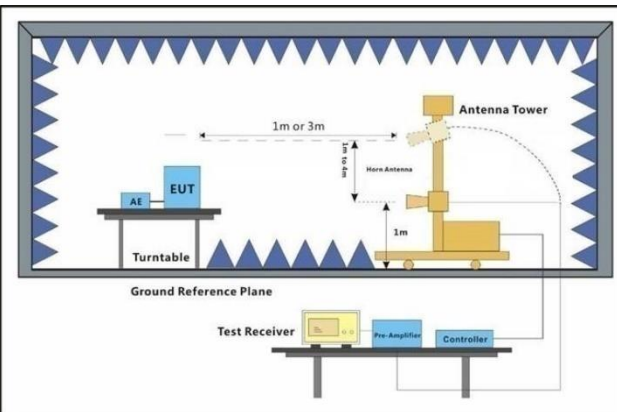


Figure 2. Above 1 GHz



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<p>Test Procedure:</p>	<ol style="list-style-type: none"> a. For below 1GHz, 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. b. For above 1GHz, 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. 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. 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. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel h. Test the EUT in the lowest channel , the Highest channel i. 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. j. Repeat above procedures until all frequencies measured was complete.
<p>Test Configuration:</p>	<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 ≥ 3 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 = 10 Hz, 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.
<p>Exploratory Test Mode:</p>	<p>Transmitting with all kind of modulations, data rates. DC supply + Transmitting mode.</p>



Report No.: XEWA2310000070RG03
 Rev.: 01
 Page: 27 of 296

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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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.



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	2023/08/30	2024/08/29
Power Supply	Agilent	66311B	XAW01-17-01	2023/02/16	2024/02/15
Temperature and humidity meter	MingGao	T809	XAW01-01-16	2023/09/04	2024/09/03

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	2023/08/30	2024/08/29
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-01	2023/06/30	2024/06/29
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2023/08/30	2024/08/29
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	2023/06/30	2024/06/29



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Report No.: XEWA2310000070RG03

Rev.: 01

Page: 30 of 296

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	2023/05/15	2024/05/14
Test receiver	ROHDE &SCHWARZ	ESR	XAW01-08-01	2023/08/30	2024/08/29
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	2023/05/15	2024/05/14
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2023/08/30	2024/08/29
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2023/08/30	2024/08/29
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2023/08/30	2024/08/29
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2023/09/04	2024/09/03
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	2024/05/25



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Report No.: XEWA2310000070RG03

Rev.: 01

Page: 31 of 296

7 Photographs - Setup Photos

Refer to Appendix A.2 WLAN Setup Photos.



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Page: 32 of 296

Appendix



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**DTS Bandwidth
Test Result**

TestMode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11b-CDD	Ant0	2412	7.560	2408.480	2416.040	0.5	PASS
	Ant1	2412	8.080	2407.960	2416.040	0.5	PASS
	Ant0	2437	8.080	2432.960	2441.040	0.5	PASS
	Ant1	2437	8.080	2432.960	2441.040	0.5	PASS
	Ant0	2462	7.600	2458.440	2466.040	0.5	PASS
	Ant1	2462	8.080	2458.440	2466.520	0.5	PASS
11g-CDD	Ant0	2412	15.920	2404.240	2420.160	0.5	PASS
	Ant1	2412	15.720	2404.440	2420.160	0.5	PASS
	Ant0	2437	15.960	2428.840	2444.800	0.5	PASS
	Ant1	2437	16.360	2428.800	2445.160	0.5	PASS
	Ant0	2462	16.080	2454.080	2470.160	0.5	PASS
	Ant1	2462	16.040	2454.120	2470.160	0.5	PASS
11n20MIMO	Ant0	2412	16.880	2403.880	2420.760	0.5	PASS
	Ant1	2412	17.560	2403.240	2420.800	0.5	PASS
	Ant0	2437	17.560	2428.200	2445.760	0.5	PASS
	Ant1	2437	17.560	2428.200	2445.760	0.5	PASS
	Ant0	2462	17.560	2453.240	2470.800	0.5	PASS
	Ant1	2462	17.120	2453.640	2470.760	0.5	PASS
11n40MIMO	Ant0	2422	34.880	2404.880	2439.760	0.5	PASS
	Ant1	2422	34.080	2405.680	2439.760	0.5	PASS
	Ant0	2437	35.760	2418.840	2454.600	0.5	PASS
	Ant1	2437	36.320	2418.840	2455.160	0.5	PASS
	Ant0	2452	36.320	2433.840	2470.160	0.5	PASS
	Ant1	2452	36.320	2433.840	2470.160	0.5	PASS
11ax20MIMO	Ant0	2412	18.880	2402.640	2421.520	0.5	PASS
	Ant1	2412	17.800	2403.720	2421.520	0.5	PASS
	Ant0	2437	17.240	2427.560	2444.800	0.5	PASS
	Ant1	2437	18.720	2427.720	2446.440	0.5	PASS
	Ant0	2462	18.560	2452.880	2471.440	0.5	PASS
	Ant1	2462	17.720	2453.120	2470.840	0.5	PASS
11ax40MIMO	Ant0	2422	37.200	2403.520	2440.720	0.5	PASS
	Ant1	2422	36.400	2404.240	2440.640	0.5	PASS
	Ant0	2437	37.440	2418.040	2455.480	0.5	PASS
	Ant1	2437	38.080	2417.960	2456.040	0.5	PASS
	Ant0	2452	37.920	2433.120	2471.040	0.5	PASS
	Ant1	2452	37.920	2433.040	2470.960	0.5	PASS



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Test Graphs



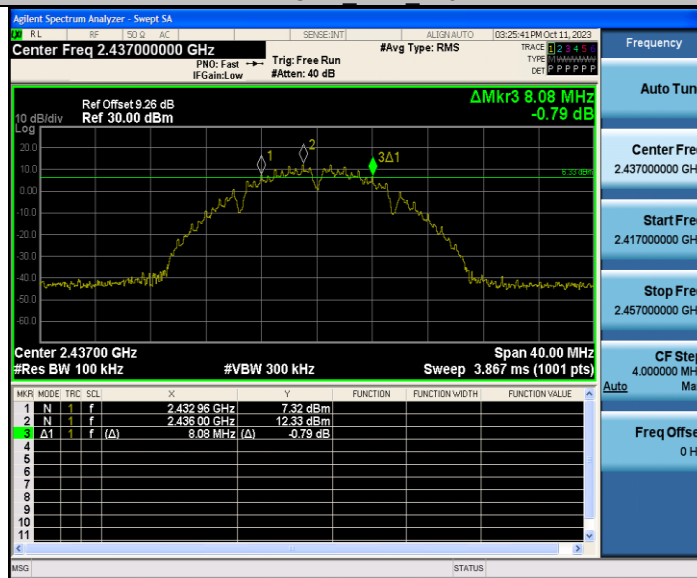
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11b-CDD Ant0 2437



11b-CDD Ant1 2437

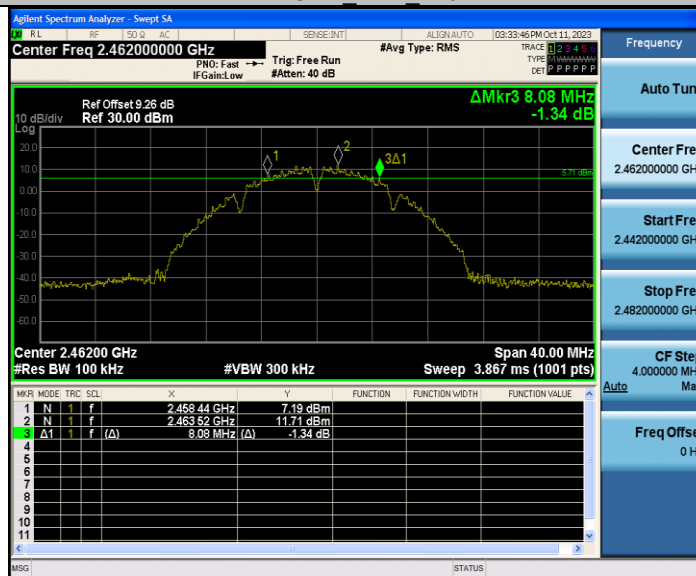


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11b-CDD Ant0 2462

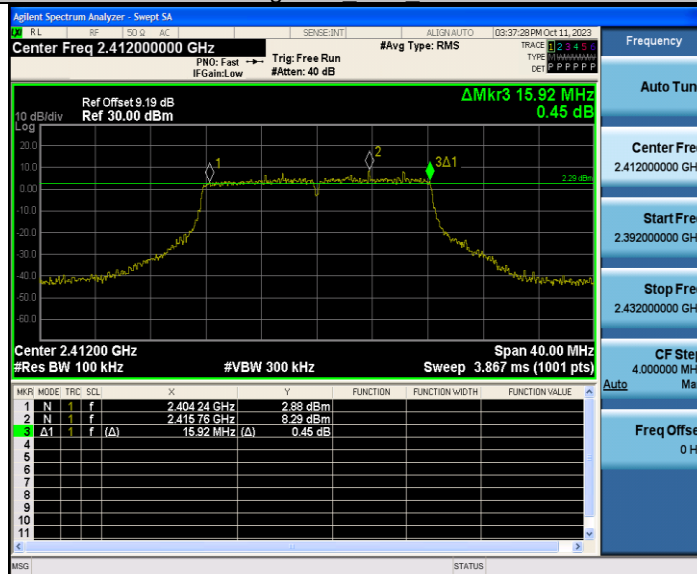


11b-CDD Ant1 2462

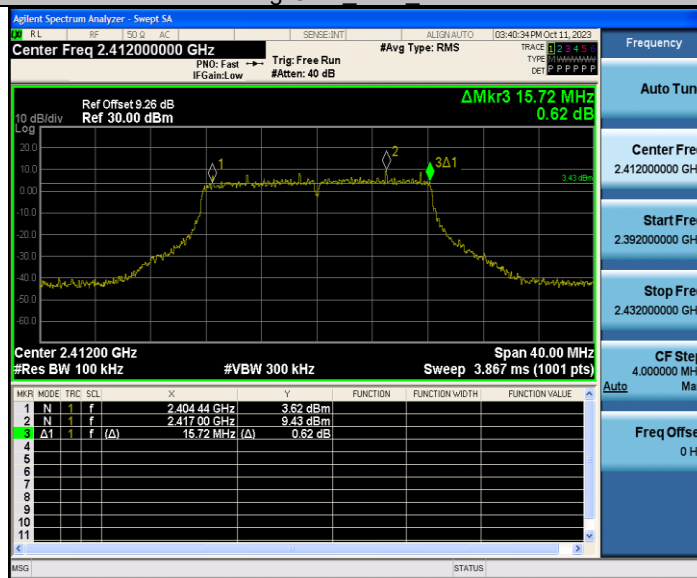


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11g-CDD Ant0 2412



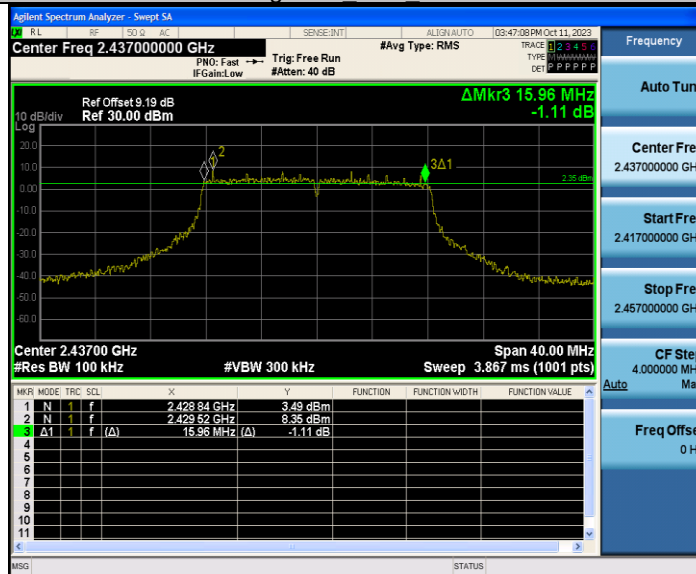
11g-CDD Ant1 2412



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11g-CDD Ant0 2437



11g-CDD Ant1 2437



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11g-CDD Ant0 2462



11g-CDD Ant1 2462

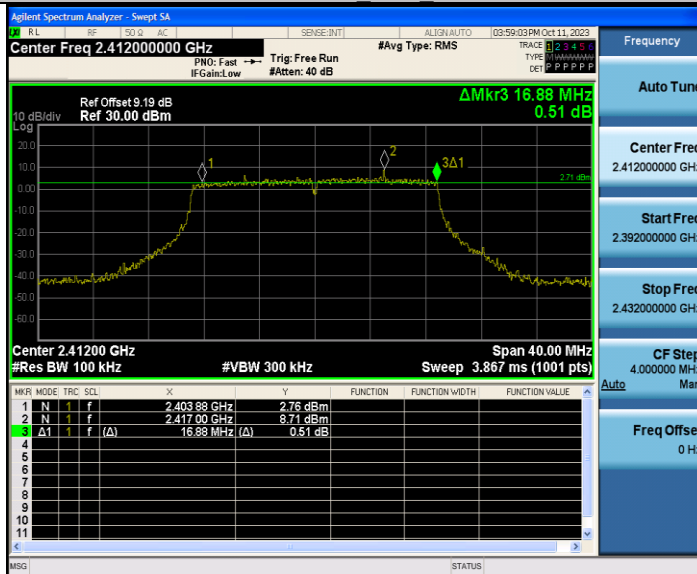


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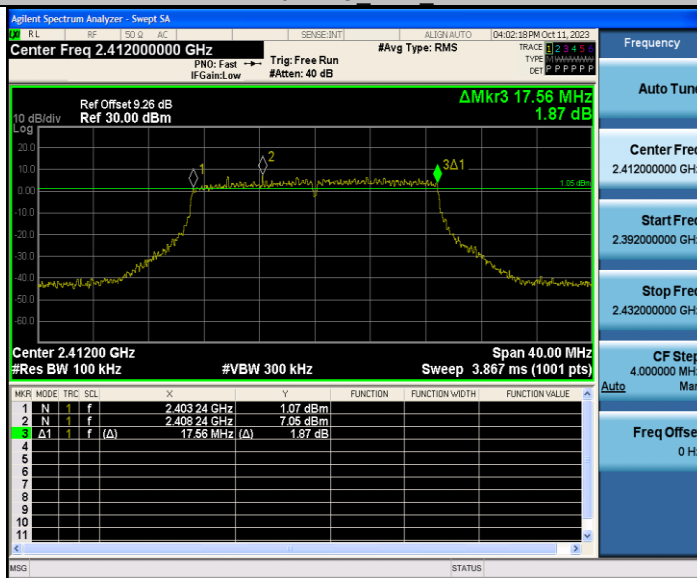
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11n20MIMO Ant0 2412

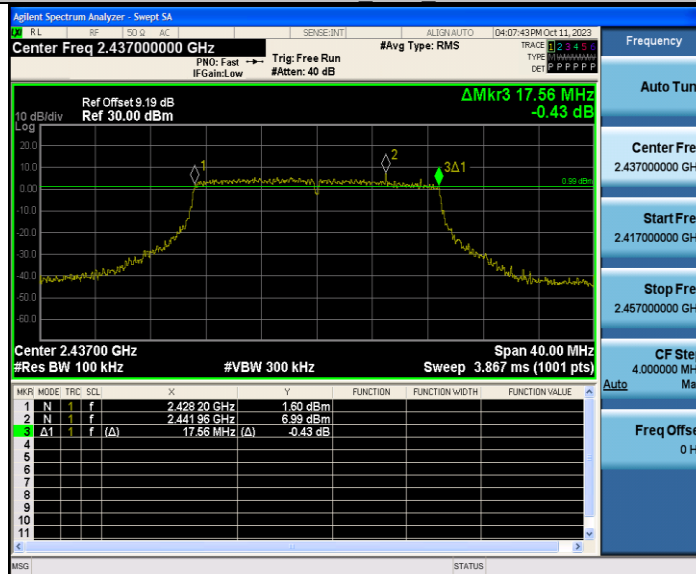


11n20MIMO Ant1 2412



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11n20MIMO Ant0 2437

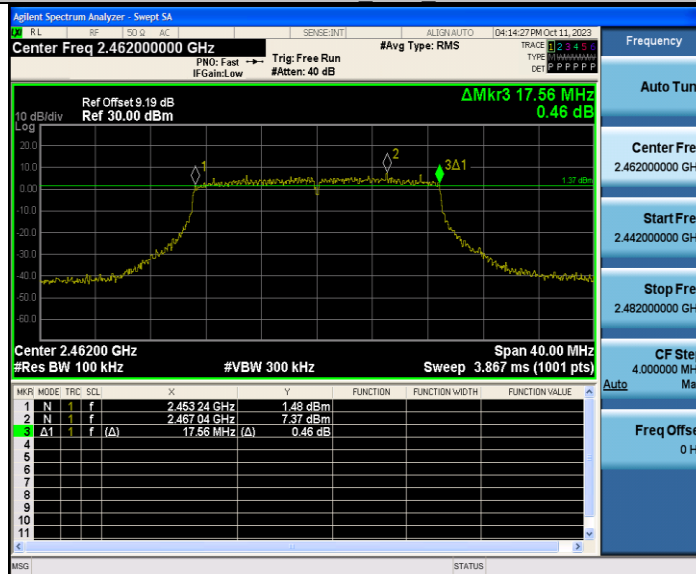


11n20MIMO Ant1 2437



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11n20MIMO Ant0 2462

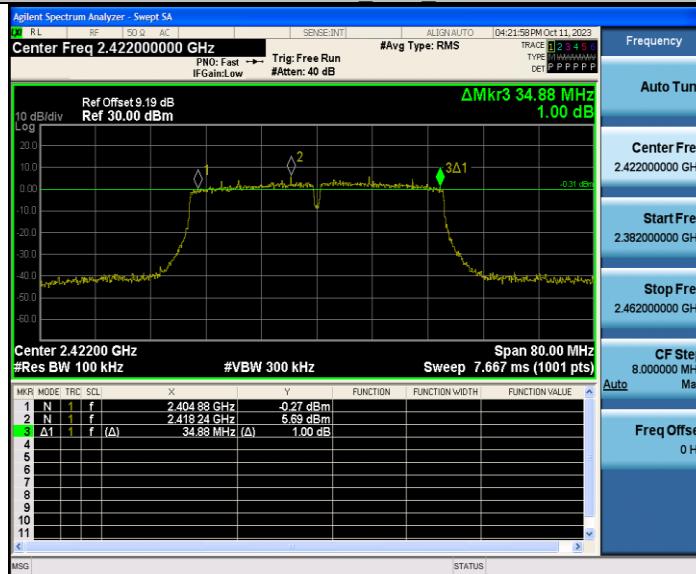


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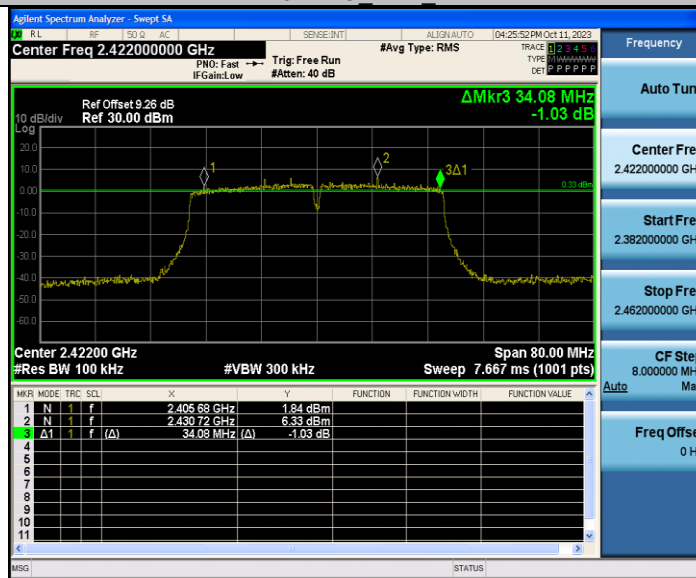


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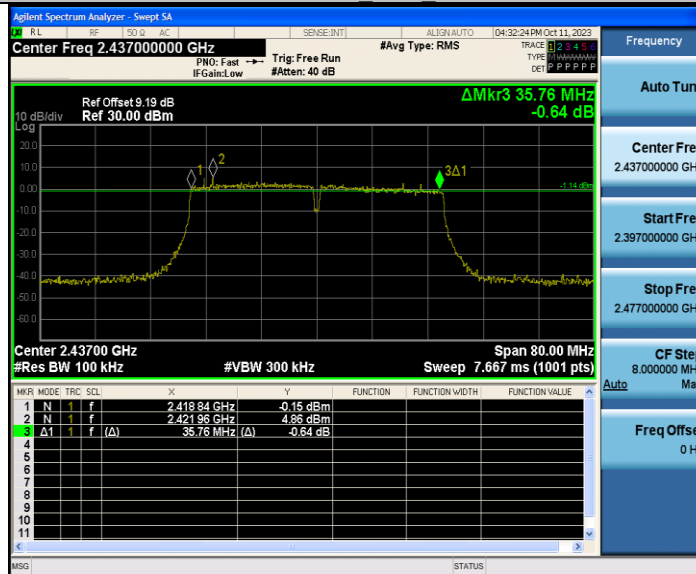


11n40MIMO Ant1 2422

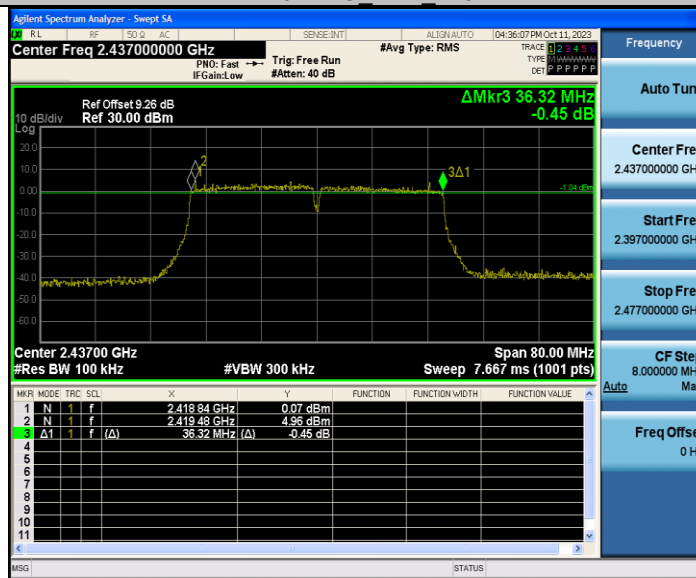


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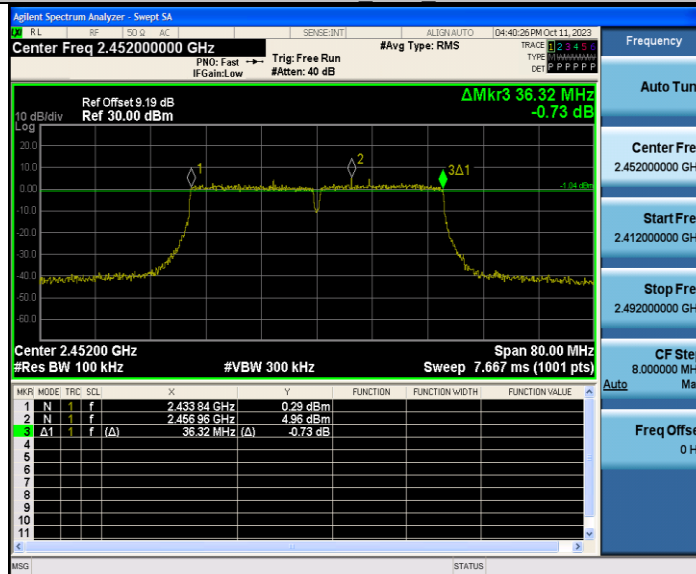
11n40MIMO Ant1 2437



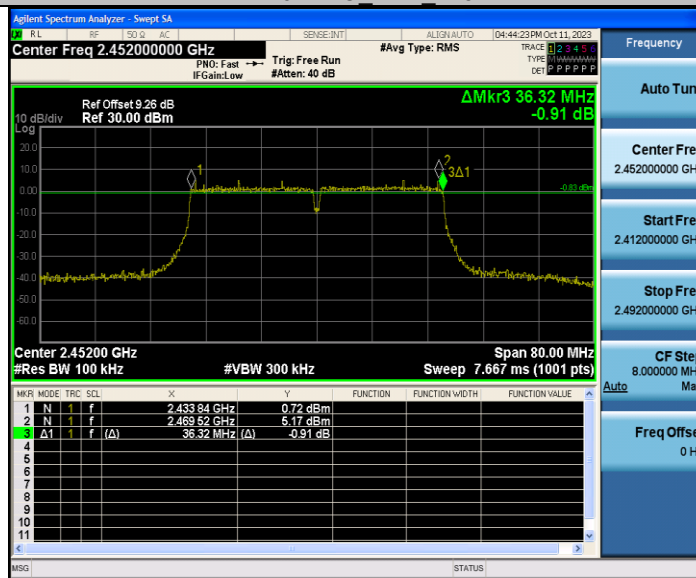
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11n40MIMO Ant0 2452



11n40MIMO Ant1 2452



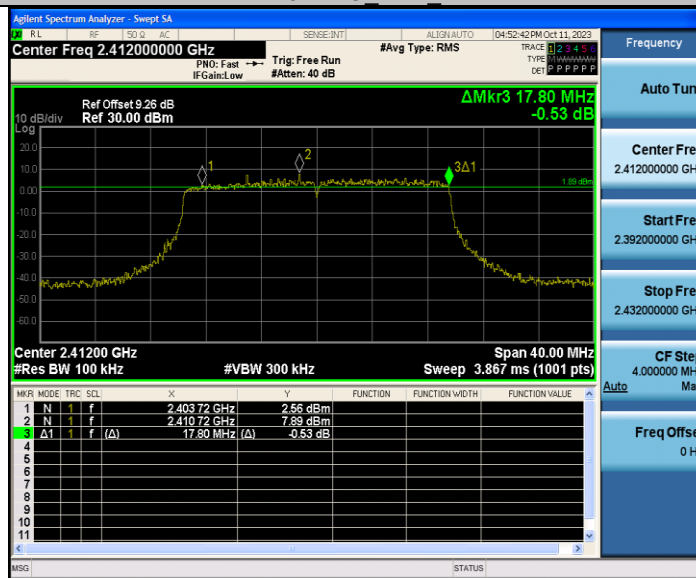
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11ax20MIMO Ant0 2412



11ax20MIMO Ant1 2412



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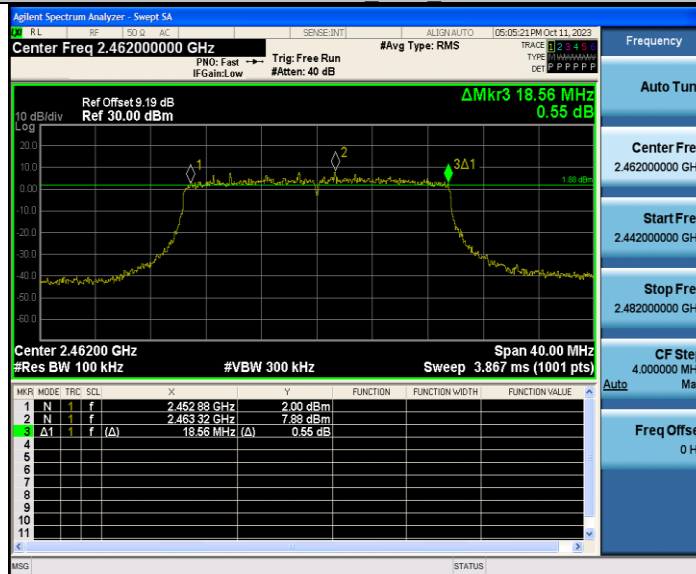


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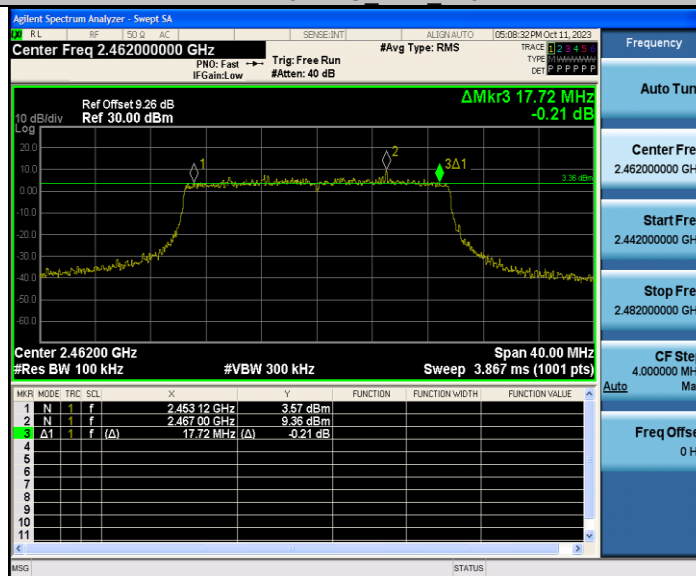


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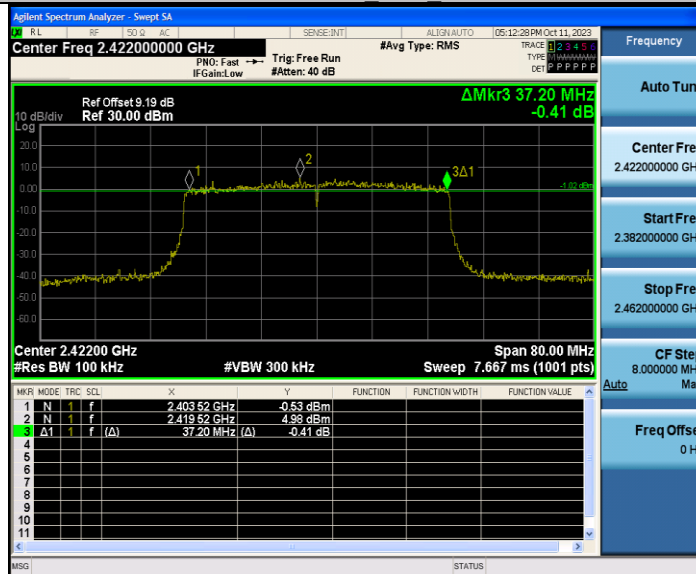


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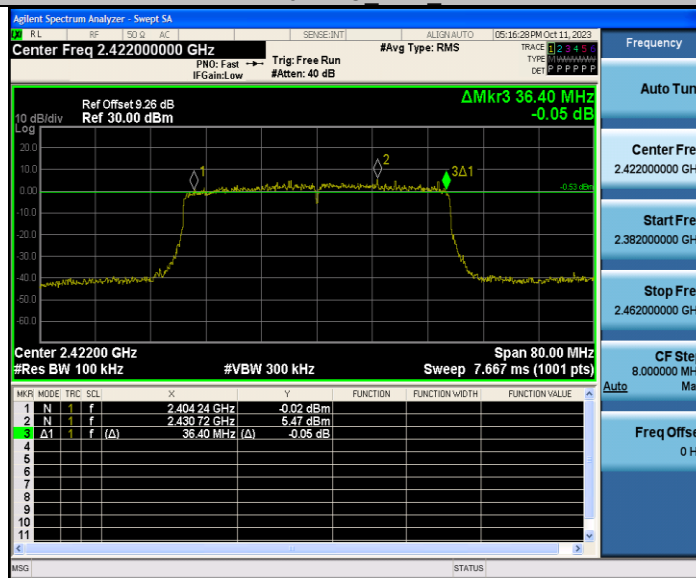


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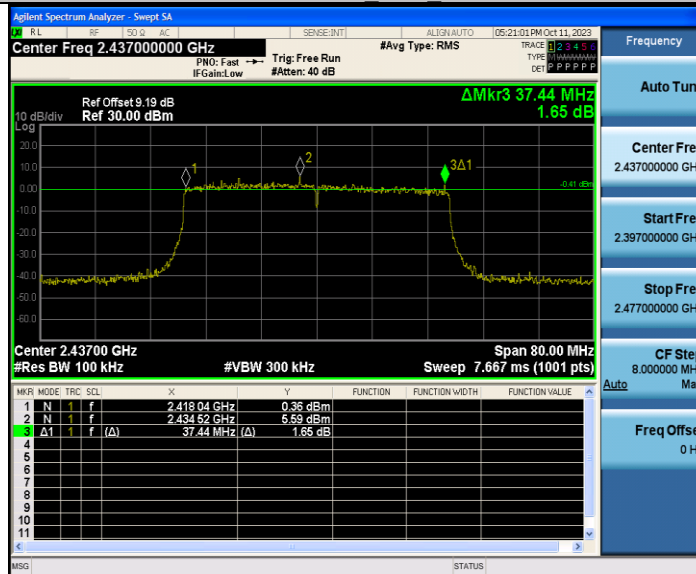
11ax40MIMO Ant1 2422



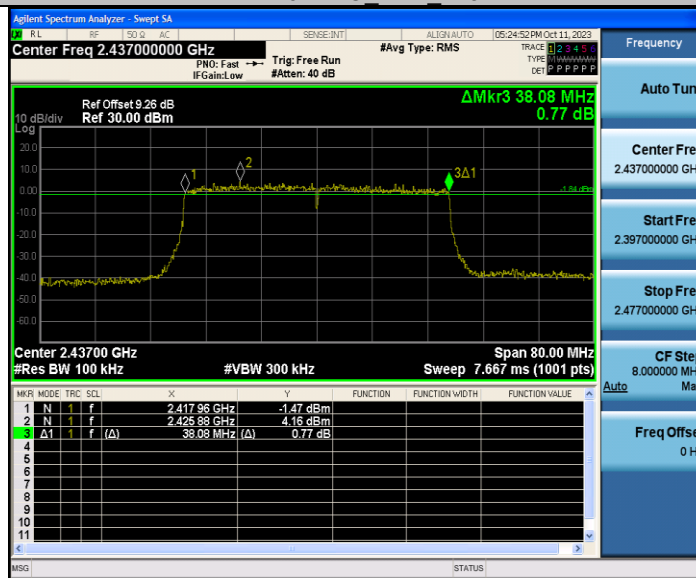
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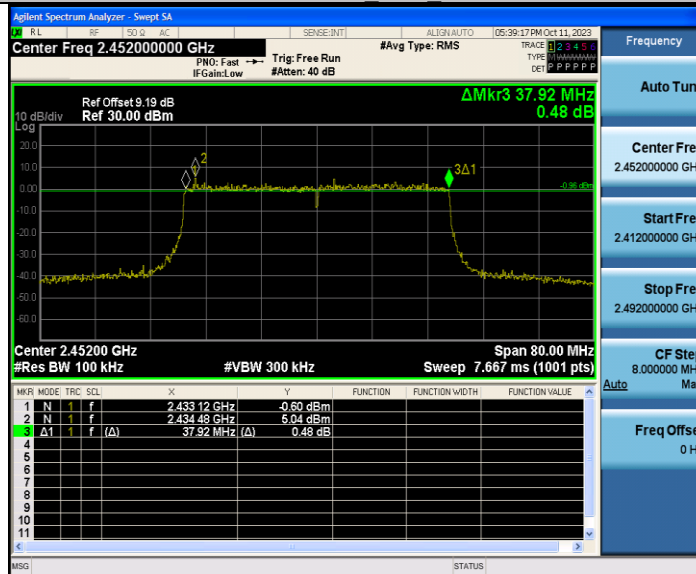
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**99% Occupied Bandwidth
 Test Result**

TestMode	Antenna	Channel Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
11b-CDD	Ant0	2412	13.203	2405.5320	2418.7350	For Report Purpose
	Ant1	2412	13.061	2405.6206	2418.6816	
	Ant0	2437	13.146	2430.2934	2443.4394	
	Ant1	2437	13.055	2430.3746	2443.4296	
	Ant0	2462	13.015	2455.5766	2468.5916	
	Ant1	2462	13.129	2455.4850	2468.6140	
11g-CDD	Ant0	2412	16.505	2403.7986	2420.3036	
	Ant1	2412	16.471	2403.8396	2420.3106	
	Ant0	2437	16.542	2428.6577	2445.1997	
	Ant1	2437	16.502	2428.7403	2445.2423	
	Ant0	2462	16.488	2453.7844	2470.2724	
	Ant1	2462	16.535	2453.7618	2470.2968	
11n20MIMO	Ant0	2412	17.662	2403.2312	2420.8932	
	Ant1	2412	17.649	2403.2421	2420.8911	
	Ant0	2437	17.660	2428.1176	2445.7776	
	Ant1	2437	17.674	2428.1432	2445.8172	
	Ant0	2462	17.656	2453.2106	2470.8666	
	Ant1	2462	17.664	2453.2035	2470.8675	
11n40MIMO	Ant0	2422	35.979	2404.0445	2440.0235	
	Ant1	2422	35.893	2404.1511	2440.0441	
	Ant0	2437	36.040	2418.9258	2454.9658	
	Ant1	2437	36.138	2418.9028	2455.0408	
	Ant0	2452	36.323	2433.8470	2470.1700	
	Ant1	2452	36.258	2433.8923	2470.1503	
11ax20MIMO	Ant0	2412	19.004	2402.5414	2421.5454	
	Ant1	2412	19.006	2402.5830	2421.5890	
	Ant0	2437	18.982	2427.4555	2446.4375	
	Ant1	2437	19.003	2427.4890	2446.4920	
	Ant0	2462	18.971	2452.5393	2471.5103	
	Ant1	2462	18.983	2452.5496	2471.5326	
11ax40MIMO	Ant0	2422	37.707	2403.1694	2440.8764	
	Ant1	2422	37.663	2403.2639	2440.9269	
	Ant0	2437	37.903	2418.0214	2455.9244	
	Ant1	2437	37.942	2418.0156	2455.9576	
	Ant0	2452	38.017	2432.9897	2471.0067	
	Ant1	2452	37.885	2433.0785	2470.9635	



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Test Graphs

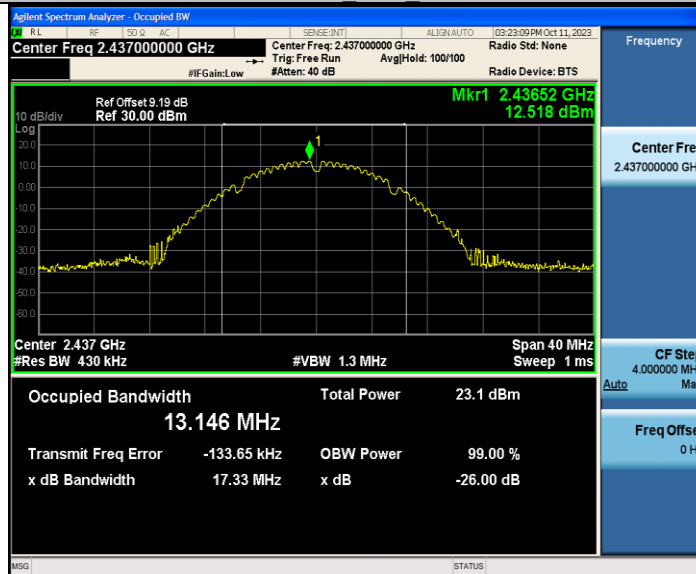


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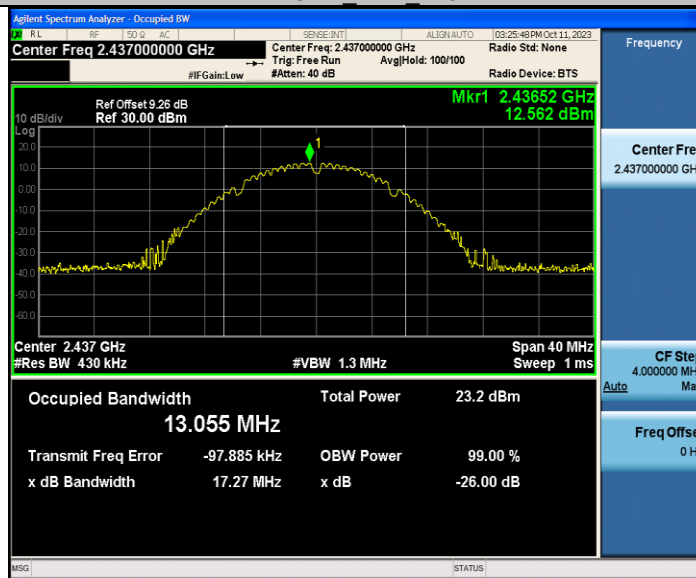
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11b-CDD Ant0 2437



11b-CDD Ant1 2437

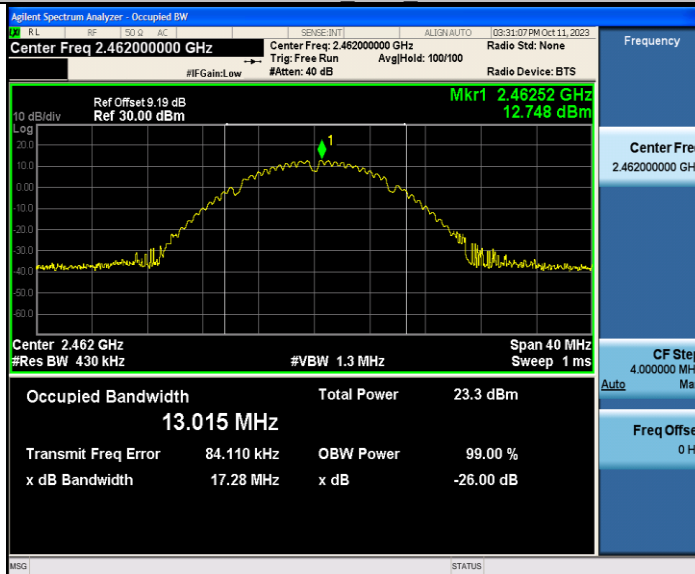


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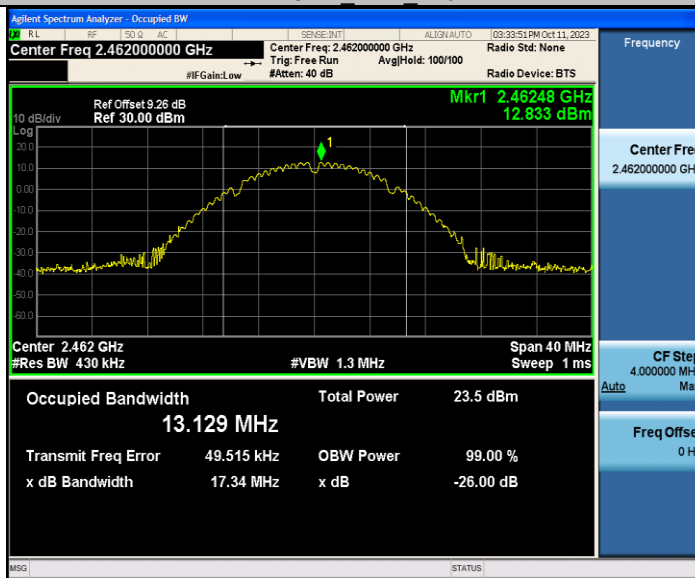
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