

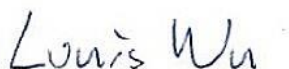


FCC CO-LOCATION RADIO TEST REPORT

FCC ID : 2AFZZ12AG
Equipment : Mobile Phone
Brand Name : XIAOMI
Model Name : 22071212AG
Applicant : Xiaomi Communications Co., Ltd.
#019, 9th Floor, Building 6, 33 Xi'erqi Middle
Road, Haidian District, Beijing, China, 100085
Manufacturer : Xiaomi Communications Co., Ltd.
#019, 9th Floor, Building 6, 33 Xi'erqi Middle
Road, Haidian District, Beijing, China, 100085
Standard : FCC Part 15 Subpart E §15.407

The product was received on May 23, 2022 and testing was started from Jun. 16, 2022 to Jun. 17, 2022. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.



Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan



Table of Contents

History of this test report.....	3
Summary of Test Result.....	4
1 General Description	5
1.1 Product Feature of Equipment Under Test.....	5
1.2 Modification of EUT	5
1.3 Testing Location	6
1.4 Applicable Standards.....	6
2 Test Configuration of Equipment Under Test	7
2.1 Carrier Frequency and Channel	7
2.2 Test Mode.....	7
2.3 Connection Diagram of Test System.....	8
2.4 EUT Operation Test Setup	8
3 Test Result	9
3.1 Unwanted Emissions Measurement	9
3.2 Antenna Requirements.....	14
4 List of Measuring Equipment.....	15
5 Uncertainty of Evaluation	16
Appendix A. Radiated Spurious Emission	
Appendix B. Radiated Spurious Emission Plots	
Appendix C. Duty Cycle Plots	
Appendix D. Setup Photographs	



History of this test report

Report No.	Version	Description	Issued Date
FR251212G	01	Initial issue of report	Jun. 21, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(d) 15.407(b)	Unwanted Emissions	Pass	3.10 dB under the limit at 2483.520 MHz
3.2	15.203 15.247(b) 15.407(a)	Antenna Requirement	Pass	-

Declaration of Conformity:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Lewis Ho

Report Producer: Rachel Hsieh

1 General Description

1.1 Product Feature of Equipment Under Test

GSM/WCDMA/LTE/5G NR, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ax, Wi-Fi 5GHz 802.11a/n/ac/ax, NFC, and GNSS.

Product Feature		
Sample 1	8G+128G	
Sample 2	8G+256G	
Antenna Type	WWAN: PIFA Antenna WLAN <Ant. 16>: PIFA Antenna <Ant. 17>: PIFA Antenna <Ant. 18>: PIFA Antenna Bluetooth <Ant. 16>: PIFA Antenna GPS / Glonass / BDS / Galileo / QZSS / NavIC: PIFA Antenna NFC: Coil Antenna	
Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	Ant. 16: -1.27 Ant. 18: 0.00
5470 MHz ~ 5725 MHz	Peak Gain (dBi)	Ant. 17: -0.49 Ant. 18: -1.27

Remark: The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Modification of EUT

No modifications are made to the EUT during all test items.



1.3 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No.
	03CH15-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW3786

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC Part 15 Subpart E
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated:

2.1 Carrier Frequency and Channel

2400-2483.5 MHz Bluetooth		2400-2483.5 MHz 802.11ax HE20		5470-5725 MHz 802.11ax HE80	
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
78	2480	11	2462	106	5530

Remark: During the Radiated Spurious Emission test, the EUT turn on the WWAN functions simultaneously.

2.2 Test Mode

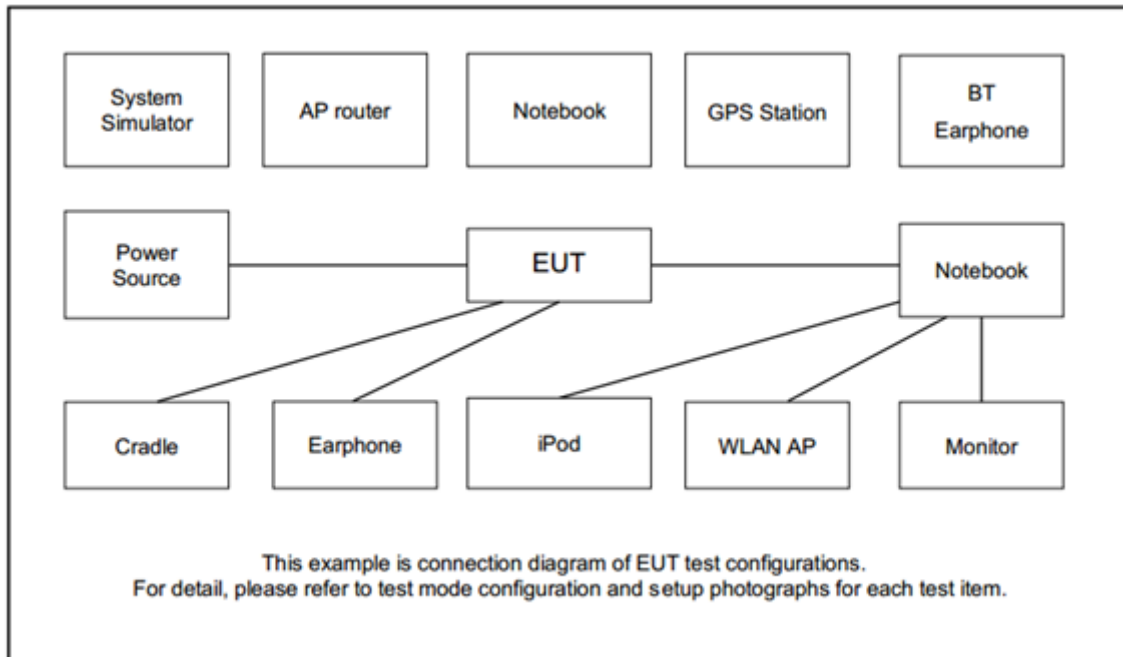
Final test modes are considering the modulation and worse data rates as below table.

<Co-Location>

Test Mode	Modulation	Data Rate
Mode 1	WLAN 2.4GHz 802.11ax HE20 for MIMO <Ant. 16+18> + LTE Band 7	MCS0 + QPSK
Mode 2	Bluetooth for Ant. 16 + 5GHz 802.11ax HE80 for MIMO <Ant. 17+18> + LTE Band 7	GFSK + MCS0 + QPSK

Remark: For Radiated Test Cases, the tests were performed with USB Cable 1 and Sample 1.

2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

The RF test items, make the EUT (SW: MIUI 13 Global 0.0.0) get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

3 Test Result

3.1 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.1.1 Limit of Unwanted Emissions

(1) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

Note: The following formula is used to convert the EIRP to field strength.

$$E = \frac{1000000\sqrt{30P}}{3} \text{ } \mu\text{V/m, where P is the eirp (Watts)}$$

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.3

(2) KDB789033 D02 v02r01 G)2)c)

(i) Sections 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz.

(ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are based on the use of a peak detector.

3.1.2 Measuring Instruments

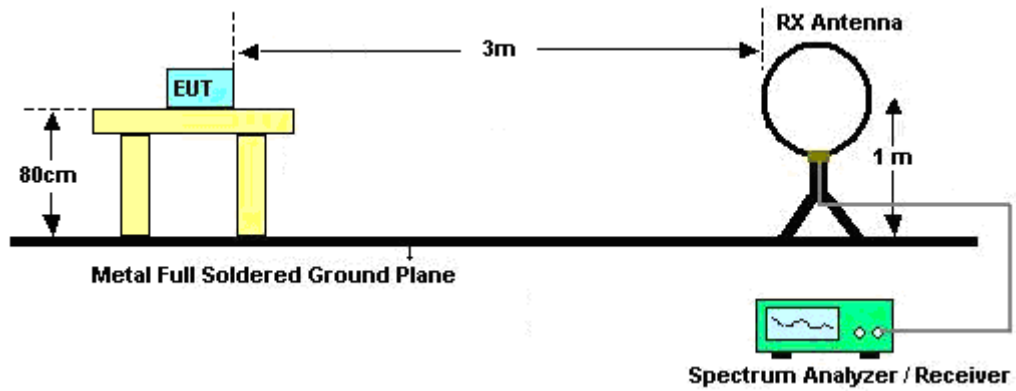
See list of measuring equipment of this test report.

3.1.3 Test Procedures

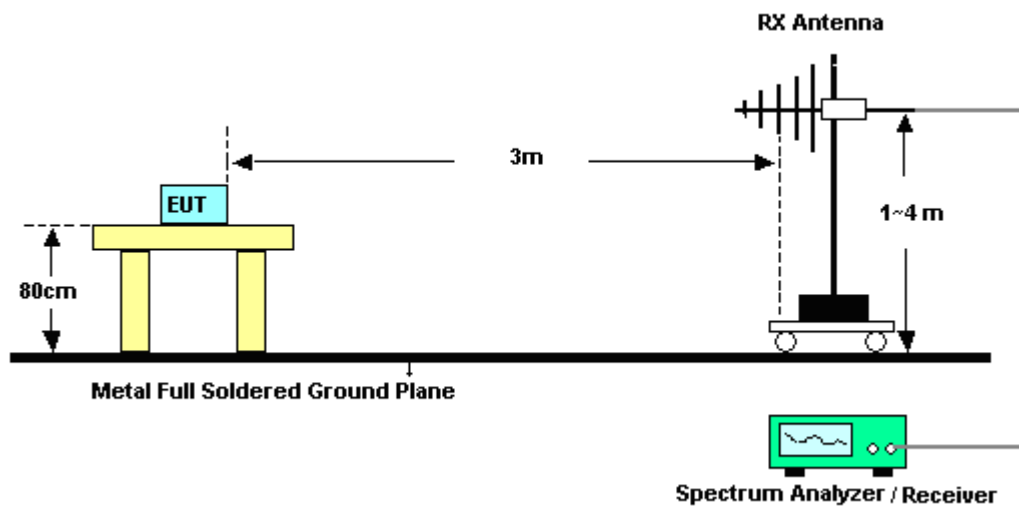
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section G) Unwanted emissions measurement.
(1) Procedure for Unwanted Emissions Measurements Below 1000 MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
(2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW $\geq$ 3 MHz
 - Detector = Peak
 - Sweep time = auto
 - Trace mode = max hold
(3) Procedures for Average Unwanted Emissions Measurements Above 1000 MHz
 - 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.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1 GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.1.4 Test Setup

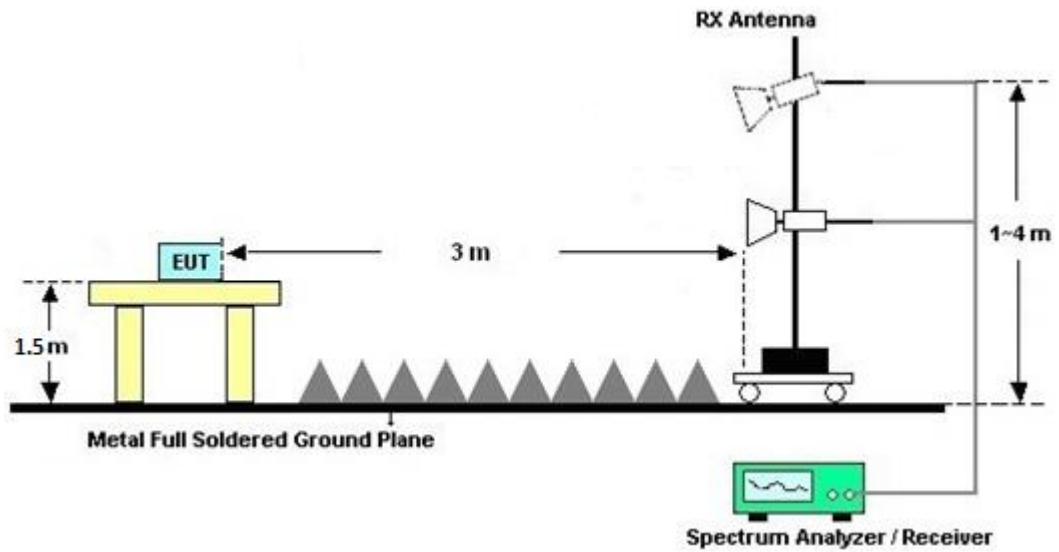
For radiated emissions below 30MHz



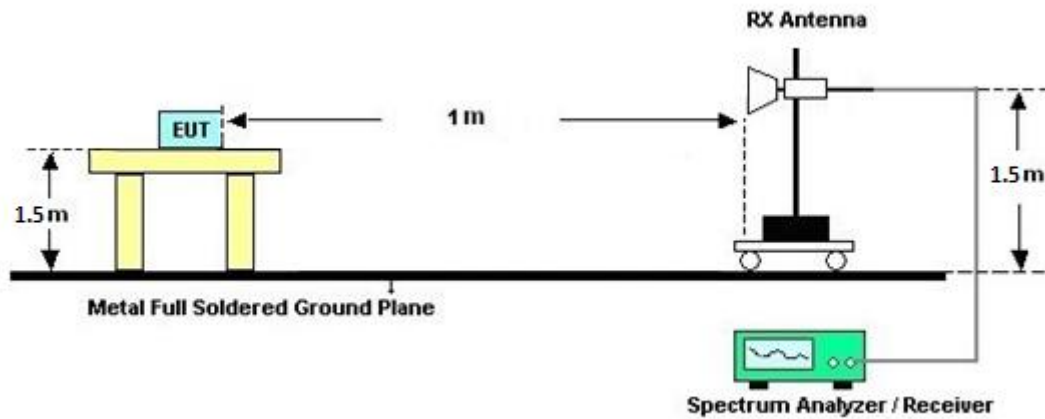
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



**3.1.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)**

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.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

3.1.7 Duty Cycle

Please refer to Appendix C.

3.1.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix A and B.



3.2 Antenna Requirements

3.2.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.2.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.2.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 09, 2021	Jun. 16, 2022~ Jun. 17, 2022	Sep. 08, 2022	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N- 06	41912 & 05	30MHz~1GHz	Feb. 06, 2022	Jun. 16, 2022~ Jun. 17, 2022	Feb. 05, 2023	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 27, 2021	Jun. 16, 2022~ Jun. 17, 2022	Dec. 26, 2022	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-02038	1GHz~18GHz	Aug. 04, 2021	Jun. 16, 2022~ Jun. 17, 2022	Aug. 03, 2022	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA917025 1	18GHz~40GHz	Nov. 30, 2021	Jun. 16, 2022~ Jun. 17, 2022	Nov. 29, 2022	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA0118-55-3 03	17100018000 55006	1GHz~18GHz	May 05, 2022	Jun. 16, 2022~ Jun. 17, 2022	May 04, 2023	Radiation (03CH15-HY)
Preamplifier	EM Electronics	EM01G18G	060803	1GHz-18GHz	Dec. 16, 2021	Jun. 16, 2022~ Jun. 17, 2022	Dec. 15, 2022	Radiation (03CH15-HY)
Preamplifier	EMEC	EM18G40G	060801	18-40GHz	Jun. 22, 2021	Jun. 16, 2022~ Jun. 17, 2022	Jun. 21, 2022	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	20MHz~8.4GHz	Oct. 21, 2021	Jun. 16, 2022~ Jun. 17, 2022	Oct. 20, 2022	Radiation (03CH15-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz~44GHz	Mar. 07, 2022	Jun. 16, 2022~ Jun. 17, 2022	Mar. 06, 2023	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Jun. 16, 2022~ Jun. 17, 2022	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Jun. 16, 2022~ Jun. 17, 2022	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24(k 5)	RK-000451	N/A	N/A	Jun. 16, 2022~ Jun. 17, 2022	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104, 102E	MY36980/4, MY9838/4PE, 508405/2E	30MHz~18G	Nov. 15, 2021	Jun. 16, 2022~ Jun. 17, 2022	Nov. 14, 2022	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	804011/2,804 012/2	30MHz-40GHz	Jan. 04, 2022	Jun. 16, 2022~ Jun. 17, 2022	Jan. 03, 2023	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 10, 2022	Jun. 16, 2022~ Jun. 17, 2022	Mar. 09, 2023	Radiation (03CH15-HY)
Filter	Wainwright	WLJ4-1000-153 0-6000-40ST	SN4	1.53GHz Low Pass Filter	Jul. 02, 2021	Jun. 16, 2022~ Jun. 17, 2022	Jul. 01, 2022	Radiation (03CH15-HY)
Filter	Wainwright	WHKX12-270 0-3000-18000 -60ST	SN4	3GHz High Pass Filter	Sep. 15, 2021	Jun. 16, 2022~ Jun. 17, 2022	Sep. 14, 2022	Radiation (03CH15-HY)
Filter	Wainwright	WHKX8-5872.5- 6750-18000-40 ST	SN6	6.75GHz High Pass Filter	Jun. 30, 2021	Jun. 16, 2022~ Jun. 17, 2022	Jun. 29, 2022	Radiation (03CH15-HY)



5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.8 dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.3 dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.6 dB
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Appendix A. Radiated Spurious Emission

Test Engineer :	Leo Lee and Bigshow Wang	Temperature :	22.1~23.1°C
		Relative Humidity :	55~60%

2.4GHz 2400~2483.5MHz

802.11ax HE20_Tx_Ch11 MIMO <Ant. 16+18> + LTE Band 7 (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant. 16+18		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	Factor (dB/m)	Loss (dB)	Factor (dB)	Pos (cm)	Pos (deg)	Avg. (P/A)	(H/V)
802.11ax HE20 Full CH 11 2462MHz	*	2462	108.39	-	-	100.96	27.55	16.68	36.8	320	311	P	H
	*	2462	99.32	-	-	91.89	27.55	16.68	36.8	320	311	A	H
		2484.16	61.55	-12.45	74	53.99	27.64	16.71	36.79	320	311	P	H
		2483.52	50.83	-3.17	54	43.28	27.63	16.71	36.79	320	311	A	H
												P	H
												A	H
	*	2462	109.53	-	-	102.1	27.55	16.68	36.8	200	284	P	V
	*	2462	101.63	-	-	94.2	27.55	16.68	36.8	200	284	A	V
		2483.68	62.43	-11.57	74	54.88	27.63	16.71	36.79	200	284	P	V
		2483.52	50.9	-3.1	54	43.35	27.63	16.71	36.79	200	284	A	V
												P	V
												A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

802.11ax HE20_Tx_Ch11 MIMO <Ant. 16+18> + LTE Band 7 (Harmonic @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)	
11ax(HE20)_Tx _Ch11 + LTE Band 7		4924	42.43	-31.57	74	58.65	32.7	9.7	58.62	-	-	P	H	
		7386	45.86	-28.14	74	56.45	36.18	11.26	58.03	-	-	P	H	
		12630	50.52	-23.48	74	59.05	38.86	14.28	61.67	-	-	P	H	
		12630	40.71	-13.29	54	49.24	38.86	14.28	61.67	-	-	A	H	
		14475	51.06	-22.94	74	58.77	40.53	15.22	63.46	-	-	P	H	
		14475	41.27	-12.73	54	48.98	40.53	15.22	63.46	-	-	A	H	
		17910	56.29	-17.71	74	54.28	42.29	17.01	57.29	-	-	P	H	
		17910	46.4	-7.6	54	44.39	42.29	17.01	57.29	-	-	A	H	
														H
														H
														H
														H
		4924	43.24	-30.76	74	59.46	32.7	9.7	58.62	-	-	P	V	
		7386	46.98	-27.02	74	57.57	36.18	11.26	58.03	-	-	P	V	
		12630	50.67	-23.33	74	59.2	38.86	14.28	61.67	-	-	P	V	
		12630	40.81	-13.19	54	49.34	38.86	14.28	61.67	-	-	A	V	
		14490	50.59	-23.41	74	58.33	40.51	15.23	63.48	-	-	P	V	
		14490	40.72	-13.28	54	48.46	40.51	15.23	63.48	-	-	A	V	
		17910	55.43	-18.57	74	53.42	42.29	17.01	57.29	-	-	P	V	
		17910	45.62	-8.38	54	43.61	42.29	17.01	57.29	-	-	A	V	
													V	
													V	
													V	
													V	
Remark	1. No other spurious found.													
	2. All results are PASS against Peak and Average limit line.													
	3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.													
	4. The emission level close to 18GHz is checked that the average emission level is noise floor only.													

Emission above 18GHz

802.11ax HE20_Tx_Ch11 MIMO <Ant. 16+18> + LTE Band 7 (SHF)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
11ax(HE20) _Tx_Ch11 + LTE Band 7		23008	41.55	-32.45	74	59.69	38.9	-2.94	54.1	-	-	P	H
													H
													H
													H
													H
													H
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													H
													H
		24840	42.38	-31.62	74	58.51	39.07	-2.17	53.03	-	-	P	V
													V
													V
													V
													V
													V
													V
												V	
												V	
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												



Emission below 1GHz

802.11ax HE20_Tx_Ch11 MIMO <Ant. 16+18> + LTE Band 7 (LF)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
11ax(HE20) _Tx_Ch11 + LTE Band 7		59.1	30.2	-9.8	40	50.03	11.73	0.99	32.55	-	-	P	H
		161.92	28.05	-15.45	43.5	42.57	16.24	1.69	32.45	-	-	P	H
		220.12	20.74	-25.26	46	36.21	15.09	1.92	32.48	-	-	P	H
		707.06	35.88	-10.12	46	38.58	26.35	3.33	32.38	-	-	P	H
		824.43	33.56	-12.44	46	34.2	27.83	3.63	32.1	-	-	P	H
		903.97	33.62	-12.38	46	32.43	28.86	3.82	31.49	-	-	P	H
													H
													H
													H
													H
													H
													H
		59.1	33.75	-6.25	40	53.58	11.73	0.99	32.55	-	-	P	V
		161.92	23.47	-20.03	43.5	37.99	16.24	1.69	32.45	-	-	P	V
		215.27	19.1	-24.4	43.5	34.87	14.82	1.89	32.48	-	-	P	V
		711.91	34.83	-11.17	46	37.39	26.47	3.34	32.37	-	-	P	V
		827.34	31.73	-14.27	46	32.21	27.97	3.64	32.09	-	-	P	V
		896.21	32.76	-13.24	46	31.74	28.76	3.8	31.54	-	-	P	V
													V
													V
													V
													V
													V
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													V
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.												

**2.4GHz 2400~2483.5MHz****BT_TX_Ch78 Ant.16 + 802.11ax HE80_Tx_Ch106 MIMO <Ant. 17+18> + LTE Band 7 (Band Edge @ 3m)**

BT Ant. 16	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 78 2480MHz	*	2480	107.82	-	-	110.32	27.62	6.67	36.79	100	123	P	H
	*	2480	83.03	-	-	-	-	-	-	-	-	A	H
		2483.72	50.94	-23.06	74	53.42	27.63	6.68	36.79	100	123	P	H
		2483.72	26.15	-27.85	54	-	-	-	-	-	-	A	H
													H
													H
	*	2480	103.7	-	-	106.2	27.62	6.67	36.79	400	222	P	V
	*	2480	78.91	-	-	-	-	-	-	-	-	A	V
		2483.68	45.94	-28.06	74	48.42	27.63	6.68	36.79	400	222	P	V
		2483.68	21.15	-32.85	54	-	-	-	-	-	-	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 3 5470~5725MHz

BT_TX_Ch78 Ant.16 + 802.11ax HE80_Tx_Ch106 MIMO <Ant. 17+18> + LTE Band 7 (Band Edge @ 3m)

WIFI Ant. 17+18	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ax CH 106 5530MHz		5439.04	55.57	-18.43	74	49.64	32.7	9.97	36.74	118	298	P	H
		5469.28	56.23	-11.97	68.2	50.19	32.74	10.03	36.73	118	298	P	H
		5458.48	50.37	-3.63	54	44.37	32.72	10.01	36.73	118	298	A	H
	*	5530	101.9	-	-	95.7	32.8	10.13	36.73	118	298	P	H
	*	5530	93.37	-	-	87.17	32.8	10.13	36.73	118	298	A	H
		5754.92	47.66	-20.54	68.2	40.74	33.43	10.38	36.89	118	298	P	H
		5457.52	52.61	-21.39	74	46.63	32.72	9.99	36.73	300	255	P	V
		5470	54.36	-13.84	68.2	48.31	32.74	10.03	36.72	300	255	P	V
		5439.04	47.89	-	-	41.96	32.7	9.97	36.74	300	255	A	V
	*	5530	100.01	-	-	93.81	32.8	10.13	36.73	300	255	P	V
	*	5530	92.61	38.61	54	86.41	32.8	10.13	36.73	300	255	A	V
		5730.035	48.36	-19.84	68.2	41.6	33.28	10.36	36.88	300	255	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 3 5470~5725MHz

BT_TX_Ch78 Ant.16 + 802.11ax HE80_Tx_Ch106 MIMO <Ant. 17+18> + LTE Band 7 (Harmonic @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT_TX_Ch78 + 11ax(HE80)_Tx _Ch106 + LTE Band 7		4960	53.97	-20.03	74	48.4	32.84	9.72	36.99			P	H
		4960	29.18	-24.82	54	-	-	-	-	-	-	A	H
		7440	47.42	-26.58	74	57.85	36.02	11.54	57.99			P	H
		7440	22.63	-31.37	54	-	-	-	-	-	-	A	H
		11060	49.34	-24.66	74	58.19	38.6	13.56	61.01			P	H
		11378	52.08	-21.92	74	60.19	39.06	13.65	60.82			P	H
		11378	42.32	-11.68	54	50.43	39.06	13.65	60.82			A	H
		14491	50.53	-23.47	74	58.65	40.51	14.85	63.48			P	H
		14491	40.75	-13.25	54	48.87	40.51	14.85	63.48			A	H
		16590	49.9	-18.3	68.2	54.3	38.33	16.16	58.89			P	H
		17989	56.02	-17.98	74	53.16	43	17.04	57.18			P	H
		17989	46.28	-7.72	54	43.42	43	17.04	57.18			A	H
													H
		4960	54.04	-19.96	74	48.47	32.84	9.72	36.99			P	V
		4960	29.25	-24.75	54	-	-	-	-	-	-	A	V
		7440	52.22	-21.78	74	62.65	36.02	11.54	57.99			P	V
		7440	27.43	-26.57	54	-	-	-	-	-	-	A	V
		11060	48.76	-25.24	74	57.61	38.6	13.56	61.01			P	V
		11521	51.86	-22.14	74	60.18	38.76	13.69	60.77			P	V
		11521	42.19	-11.81	54	50.51	38.76	13.69	60.77			A	V
		14491	49.96	-24.04	74	58.08	40.51	14.85	63.48			P	V
		14491	40.22	-13.78	54	48.34	40.51	14.85	63.48			A	V
		16590	48.68	-19.52	68.2	53.08	38.33	16.16	58.89			P	V
		17923	55.36	-18.64	74	53.22	42.41	17	57.27			P	V
		17923	45.98	-8.02	54	43.84	42.41	17	57.27			A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only. 4. The emission level close to 18GHz is checked that the average emission level is noise floor only.												

Emission above 18GHz

BT_TX_Ch78 Ant.16 + 802.11ax HE80_Tx_Ch106 MIMO <Ant. 17+18> + LTE Band 7 (SHF)

[illegible]

Emission below 1GHz

BT_TX_Ch78 Ant.16 + 802.11ax HE80_Tx_Ch106 MIMO <Ant. 17+18> + LTE Band 7 (LF)

[illegible]



Note symbol

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is over limit line.
P/A	Peak or Average
H/V	Horizontal or Vertical

A calculation example for radiated spurious emission is shown as below:

WIFI Ant. 16+18	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =
Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)
= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)
= 55.45 (dBμV/m)
2. Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 55.45(dBμV/m) – 74(dBμV/m)
= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)
= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)
= 43.54 (dBμV/m)
2. Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 43.54(dBμV/m) – 54(dBμV/m)
= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.



Appendix B. Radiated Spurious Emission Plots

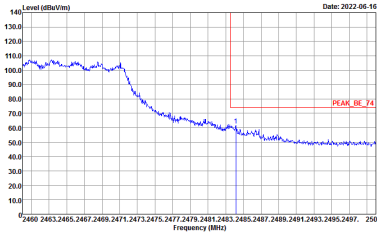
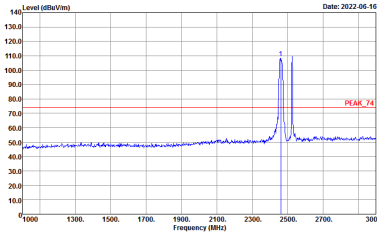
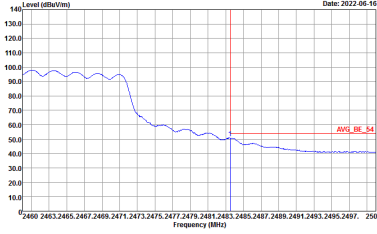
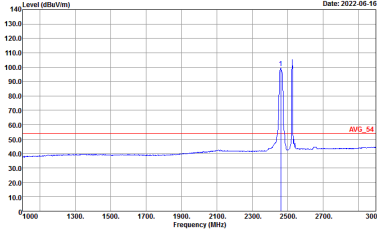
Test Engineer :	Leo Lee and Bigshow Wang	Temperature :	22.1~23.1°C
		Relative Humidity :	55~60%

Note symbol

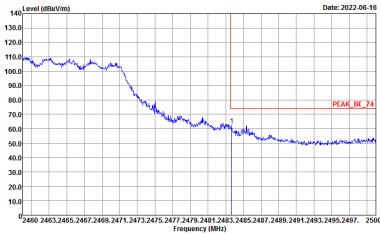
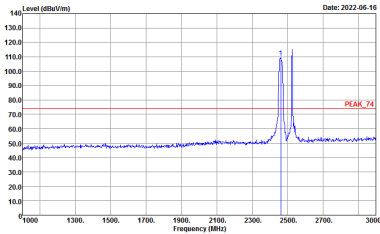
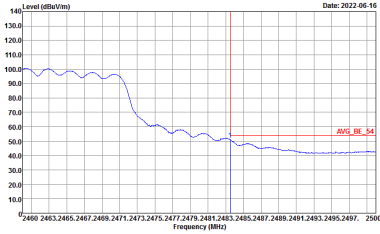
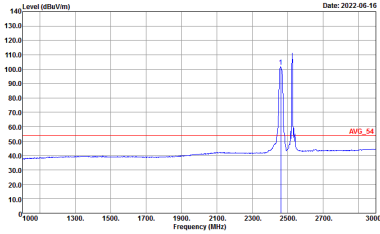
-L	Low channel location
-R	High channel location

2.4GHz 2400~2483.5MHz

802.11ax HE20_Tx_Ch11 MIMO <Ant. 16+18> + LTE Band 7 (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11ax HE20 Full CH11 2462MHz - R	
16+18	Horizontal	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE_74 3m 90120_02038_20210804 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK_74 3m 90120_02038_20210804 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH15-HY Condition : AVG_BE_54 3m 90120_02038_20210804 HORIZONTAL RBW:1000.000KHz VBW:1000KHz SWT:Auto	 Site : 03CH15-HY Condition : AVG_54 3m 90120_02038_20210804 HORIZONTAL RBW:1000.000KHz VBW:1000KHz SWT:Auto

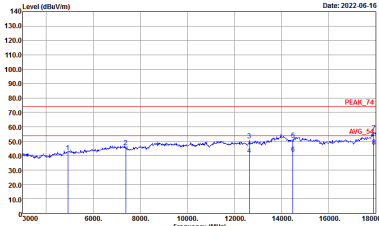
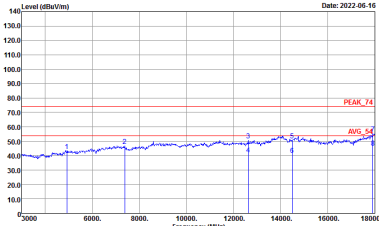


WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11ax HE20 Full CH11 2462MHz - R	
16+18	Vertical	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE_74 3m 90120_02038_20210804 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK_74 3m 90120_02038_20210804 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
	 Site : 03CH15-HY Condition : AVG_BE_54 3m 90120_02038_20210804 VERTICAL : RBW:1000.000KHz VBW:1000KHz SWT:Auto	 Site : 03CH15-HY Condition : AVG_54 3m 90120_02038_20210804 VERTICAL : RBW:1000.000KHz VBW:1000KHz SWT:Auto
Avg.		



2.4GHz 2400~2483.5MHz

802.11ax HE20_Tx_Ch11 MIMO <Ant. 16+18> + LTE Band 7 (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	11ax(HE20)_Tx_Ch11+LTE Band 7	
Simultaneously	Horizontal	Vertical
Peak Avg.	 Site : 03CH15-HY Condition : PEAK_74 3m 9D120_02038_20210804 HORIZONTAL	 Site : 03CH15-HY Condition : PEAK_74 3m 9D120_02038_20210804 VERTICAL

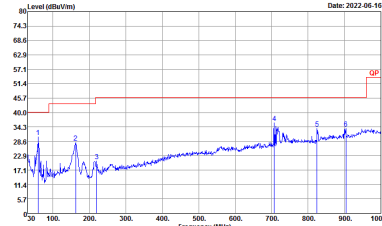
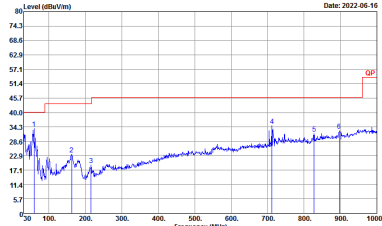


Emission above 18GHz

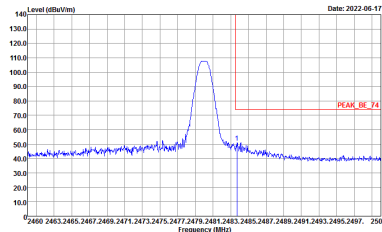
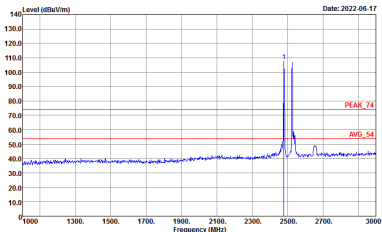
802.11ax HE20_Tx_Ch11 MIMO <Ant. 16+18> + LTE Band 7 (SHF)

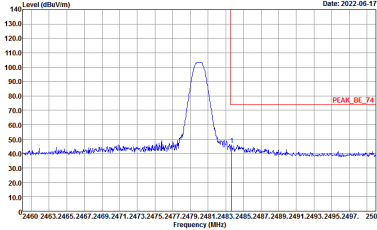
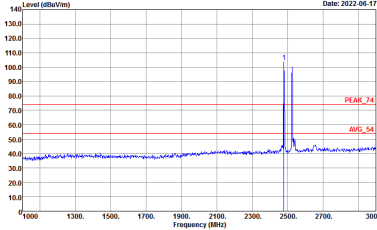
WIFI	2.4GHz 2400~2483.5MHz	
ANT	11ax(HE20)_Tx_Ch11+LTE Band 7 SHF	
Simultaneously	Horizontal	Vertical
Peak Avg.	Level (dBuV/m) Date: 2022-06-17 Site : 03CH15-HY Condition : PEAK_74 1m SHF ANT_9170_00993 HORIZONTAL	Level (dBuV/m) Date: 2022-06-17 Site : 03CH15-HY Condition : PEAK_74 1m SHF ANT_9170_00993 VERTICAL

Emission below 1GHz
802.11ax HE20_Tx_Ch11 MIMO <Ant. 16+18> + LTE Band 7 (LF)

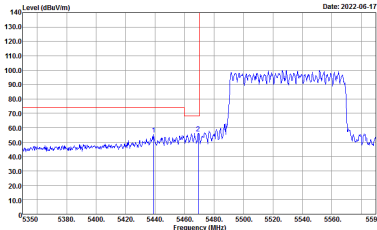
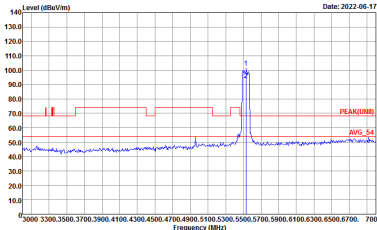
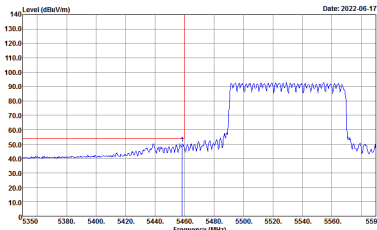
WIFI	2.4GHz 2400~2483.5MHz	
ANT	11ax(HE20)_Tx_Ch11+LTE Band 7 LF	
Simultaneously	Horizontal	Vertical
QP / Peak	 Site : 03CH15-HY Condition : QP 3m B1LO6_41912_20220206 HORIZONTAL	 Site : 03CH15-HY Condition : QP 3m B1LO6_41912_20220206 VERTICAL

2.4GHz 2400~2483.5MHz
BT_TX_Ch78 Ant.16 + 802.11ax HE80_Tx_Ch106 MIMO <Ant. 17+18>
+ LTE Band 7 (Band Edge @ 3m)

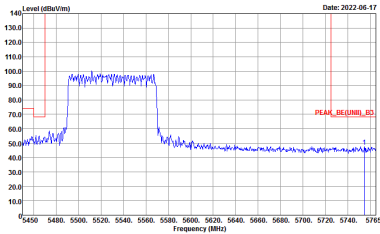
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH78 2480MHz	
16	Horizontal	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE_74 3m 9D120_02038_20210804 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK_74 3m 9D120_02038_20210804 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH78 2480MHz	
16	Vertical	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BC_74 3m 90120_02038_20210804 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK_74 3m 90120_02038_20210804 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

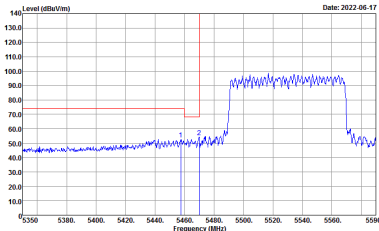
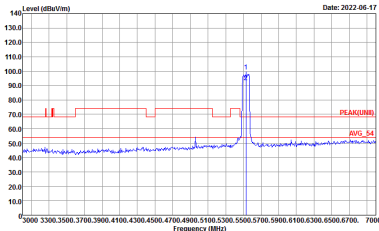
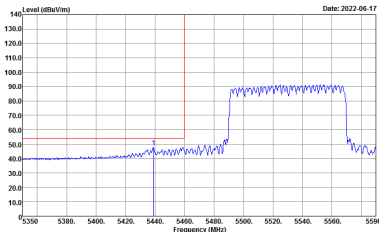
Band 3 5470~5725MHz
BT_TX_Ch78 Ant.16 + 802.11ax HE80_Tx_Ch106 MIMO <Ant. 17+18>
+ LTE Band 7 (Band Edge @ 3m)

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH106 5530MHz - L	
17+18	Horizontal	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE(UNIT)_B3 3m 90120_02038_20210804 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK(UNIT) 3m 90120_02038_20210804 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH15-HY Condition : AVG_BE(UNIT)_B3 3m 90120_02038_20210804 HORIZONTAL RBW:1000.000KHz VBW:30.000KHz SWT:Auto	Left blank

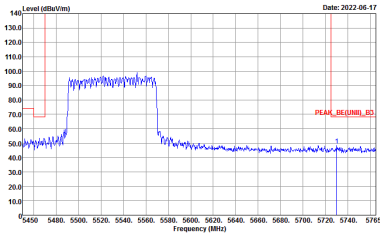


WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH106 5530MHz - R	
17+18	Horizontal	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_SE(UNIT)_B3 3m 90120_02038_20210804 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	Left blank



WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH106 5530MHz - L	
17+18	Vertical	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE(UNIT)_B3 3m 90120_02038_20210804 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK(UNIT)_B3 3m 90120_02038_20210804 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH15-HY Condition : AVG_BE(UNIT)_B3 3m 90120_02038_20210804 VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto	Left blank



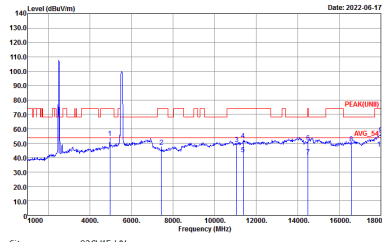
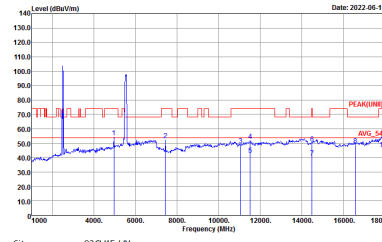
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH106 5530MHz - R	
17+18	Horizontal	Fundamental
Peak	 Site : 03CHI5-HY Condition : PEAK_SE(UNIT)_B3 3m 90120_02038_20210804 VERTICAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	Left blank



2.4GHz 2400~2483.5MHz+Band 3 5470~5725MHz

BT_TX_Ch78 Ant.16 + 802.11ax HE80_Tx_Ch106 MIMO <Ant. 17+18>

+ LTE Band 7 (Harmonic @ 3m)

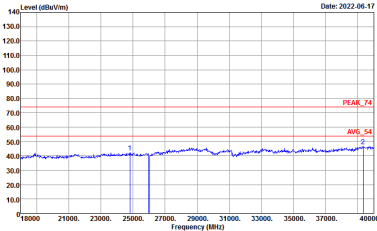
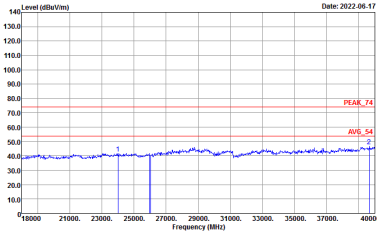
WIFI	2.4GHz 2400~2483.5MHz+Band 3 5470~5725MHz Harmonic @ 3m	
ANT	BT_TX_Ch78+11ax(HE80)_Tx_Ch106+LTE Band 7	
Simultaneously	Horizontal	Vertical
Peak Avg.	 Site : 03CH15-HY Condition : PEAR(UNIT) 3m 9D120_02038_20210804 HORIZONTAL	 Site : 03CH15-HY Condition : PEAR(UNIT) 3m 9D120_02038_20210804 VERTICAL



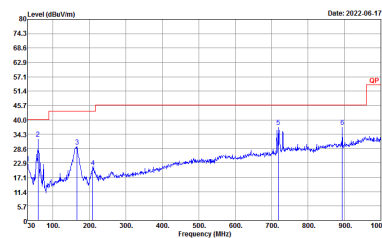
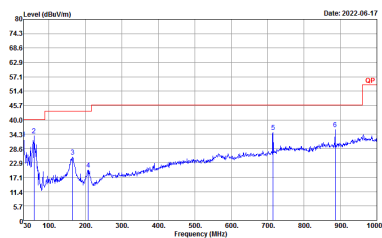
Emission above 18GHz

BT_TX_Ch78 Ant.16 + 802.11ax HE80_Tx_Ch106 MIMO <Ant. 17+18>

+ LTE Band 7 (SHF)

WIFI	2.4GHz 2400~2483.5MHz+Band 3 5470~5725MHz	
ANT	BT_TX_Ch78+11ax(HE80)_Tx_Ch106+LTE Band 7 SHF	
Simultaneously	Horizontal	Vertical
Peak Avg.	 Site : 03CH15-HY Condition : PEAK_74 1m SHF ANT_9170_00993 VERTICAL Detector : Peak Project : 251212	 Site : 03CH15-HY Condition : PEAK_74 1m SHF ANT_9170_00993 HORIZONTAL Detector : Peak Project : 251212

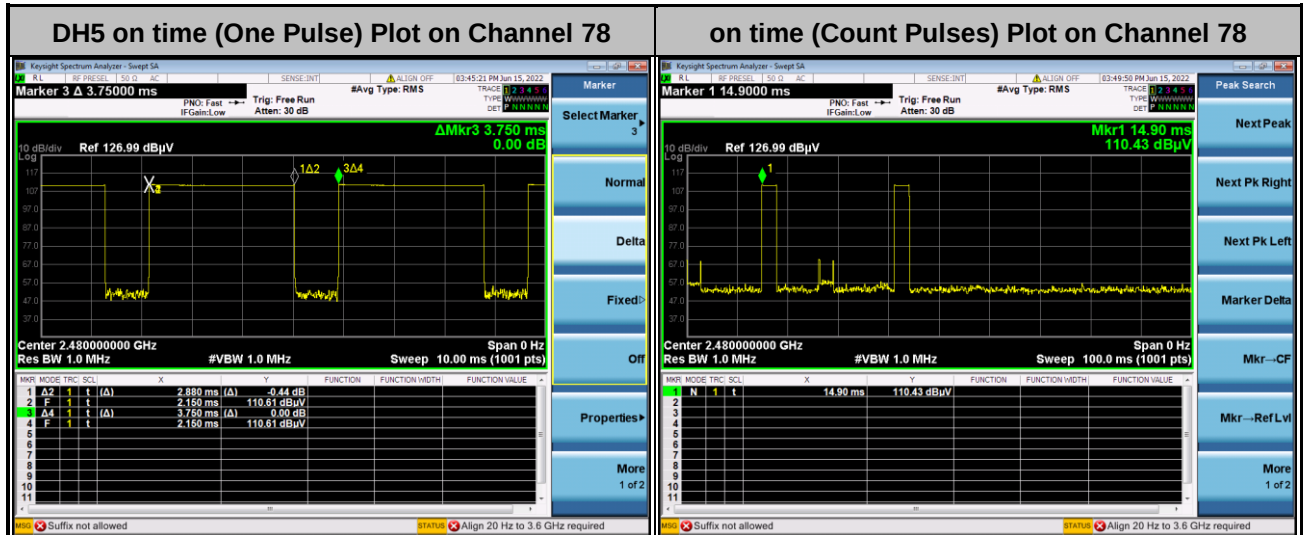
Emission below 1GHz
BT_TX_Ch78 Ant.16 + 802.11ax HE80_Tx_Ch106 MIMO <Ant. 17+18>
+ LTE Band 7 (LF)

WIFI	2.4GHz 2400~2483.5MHz+Band 3 5470~5725MHz	
ANT	BT_TX_Ch78+11ax(HE80)_Tx_Ch106+LTE Band 7 LF	
Simultaneously	Horizontal	Vertical
QP / Peak	 Site : 03CH15-HY Condition : QP 3m B1LO6_41912_20220206 HORIZONTAL Detector : Peak Project : 251212 Mode : BT_TX_Ch78	 Site : 03CH15-HY Condition : QP 3m B1LO6_41912_20220206 VERTICAL Detector : Peak Project : 251212 Mode : BT_TX_Ch78



Appendix C. Duty Cycle Plots

<Ant. 16>



Note:

1. Worst case Duty cycle = on time/100 milliseconds = $2 * 2.88 / 100 = 5.76 \%$
2. Worst case Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.79 \text{ dB}$
3. DH5 has the highest duty cycle worst case and is reported.

Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the period to have DH5 packet completing one hopping sequence is

$$2.88 \text{ ms} \times 20 \text{ channels} = 57.6 \text{ ms}$$

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. $[100 \text{ ms} / 57.6 \text{ ms}] = 2 \text{ hops}$

Thus, the maximum possible ON time:

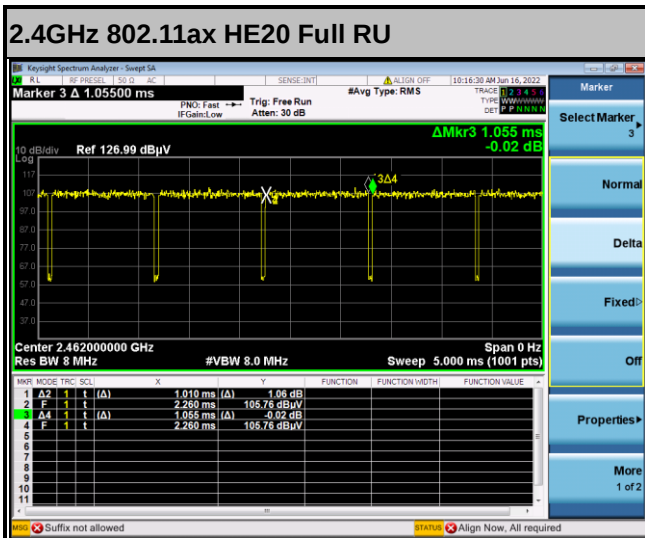
$$2.88 \text{ ms} \times 2 = 5.76 \text{ ms}$$

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

$$20 \times \log(5.76 \text{ ms}/100 \text{ ms}) = -24.79 \text{ dB}$$



Antenna	Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting
16+18	2.4GHz 802.11ax HE20 Full RU	95.73	1010	0.99	1kHz
17+18	5GHz 802.11ax HE80 Full RU	89.51	290	3.45	10kHz

MIMO <Ant. 16+18>**MIMO <Ant. 17+18>**