



FCC CO-LOCATION RADIO TEST REPORT

FCC ID : S9GR760
Equipment : R760 Access Point
Brand Name : RUCKUS
Model Name : R760
Applicant : Ruckus Wireless Inc.
350 W. Java Dr., Sunnyvale CA 94089 USA
Manufacturer : Ruckus Wireless Inc.
350 W. Java Dr., Sunnyvale CA 94089 USA
Standard : FCC Part 15 Subpart C §15.247

The product was received on Jul. 28, 2021 and testing was performed from Dec.14, 2021 to Dec.18, 2021. We, Sporton International (USA) Inc., 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 from Sporton International (USA) Inc., the test report shall not be reproduced except in full.

Approved by: Neil Kao

Sporton International (USA) Inc.

1175 Montague Expressway, Milpitas, CA 95035



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History of this test report

Report No.	Version	Description	Issue Date
FR210728001G	01	Initial issue of report	Mar. 09, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	0.42 dB under the limit at 2483.520 MHz
3.2	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

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.

1 General Description

1.1 Product Feature of Equipment Under Test

The EUT is an indoor AP with radios including Bluetooth - LE, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax, Wi-Fi 5GHz 802.11a/n/ac/ax, Wi-Fi 6GHz 802.11a/n/ac/ax, 802.15.4 (Zigbee), equipped with integrated antennas configured below:

Antenna Configuration			
Antenna Type	WLAN 2.4GHz <Ant. A>: Omni Antenna <Ant. B>: Omni Antenna <Ant. C>: Omni Antenna <Ant. D>: Omni Antenna		
	WLAN 5GHz Radio 1 and Radio 2: <Ant. A>: Omni Antenna <Ant. B>: Omni Antenna <Ant. C>: Omni Antenna <Ant. D>: Omni Antenna		
	Radio 3: <Ant. E>: Omni Antenna <Ant. F>: Omni Antenna <Ant. G>: Omni Antenna <Ant. H>: Omni Antenna		
	WLAN 6GHz <Ant. E>: Omni Antenna <Ant. F>: Omni Antenna <Ant. G>: Omni Antenna <Ant. H>: Omni Antenna		
	Bluetooth-LE: <Ant. 1>Omni Antenna		
	Zigbee: <Ant. 1>Omni Antenna		
	Antenna information		
2400 MHz ~ 2483.5 MHz for Zigbee, Bluetooth-LE	Peak Gain (dBi)	Zigbee: 3 Bluetooth-LE: 3	
2400 MHz ~ 2483.5 MHz for WLAN 2.4GHz	Peak Gain (dBi)	Vertical	<Ant. A>: 2.5 <Ant. D>: 2.5
		Horizontal	<Ant. B>: 0.1 <Ant. C>: 0.1

Remark:

1. The above EUT's information is declared by manufacturer. Please refer to Comments and Explanations in report summary.
2. The device is a special case of MIMO system with four outputs driving a cross-polarized pair of linearly polarized antennas (noted as "vertical" and "horizontal").

The antenna printed on the secondary board which is vertically/horizontally mounted on the main board.



1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 Testing Location

Test Site	Sporton International (USA) Inc.
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL : 408 9043300
Test Site No.	Sporton Site No. 03CH02-CA

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

1.4 Applicable Standards

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

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ ANSI C63.10-2013

Remark: All the test items were validated and recorded in accordance with the standards without any modification during the testing.

2 Test Configuration of Equipment Under Test

- a. 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: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find Y Plane for Bluetooth – LE + WLAN 802.11ax HE20; Z Plane for Zigbee + WLAN 802.11ax HE20 plane as worst plane.

2.1 Carrier Frequency and Channel

2400-2483.5 MHz Bluetooth – LE		2400-2483.5 MHz Zigbee		2400-2483.5 MHz WIFI 802.11ax HE20	
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
39	2480	26	2480	1	2412

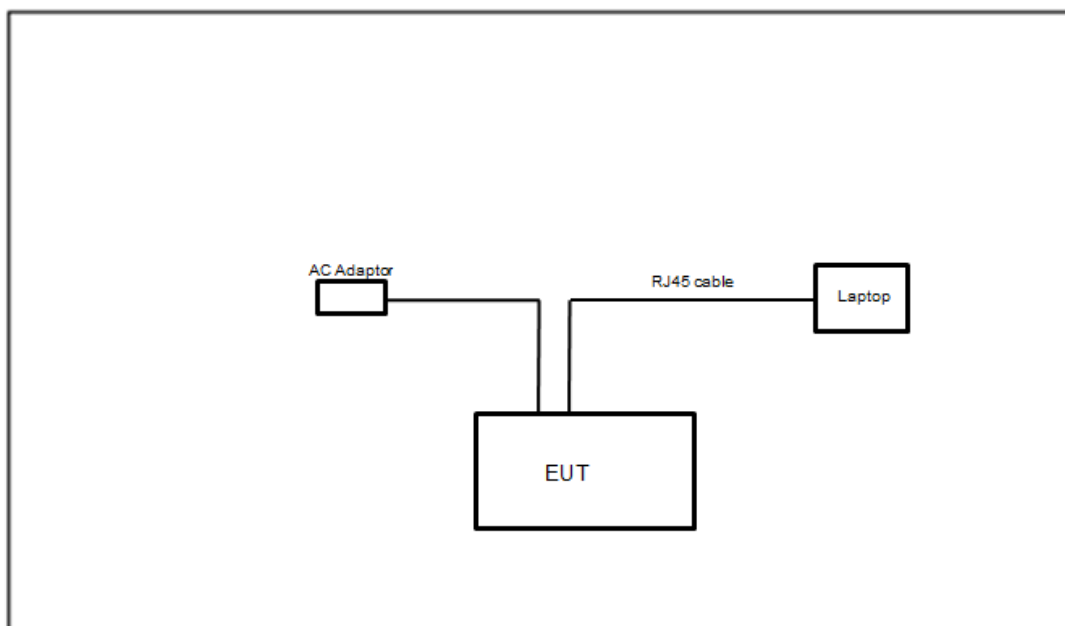
2.2 Test Mode

The final test modes consider the modulation and the worst data rates as shown in the table below.

<Co-Location>

Modulation	Data Rate
Bluetooth - LE for <Ant. 1> + WIFI 802.11ax HE20 for MIMO <Ant. A+D+B+C>	1Mbps + MCS0
Zigbee for <Ant. 1> + WIFI 802.11ax HE20 for MIMO <Ant. A+D+B+C>	250Kbps + MCS0

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	ACER	Altos PS548-G1	FCC DoC	N/A	AC I/P : Unshielded, 1.2m DC O/P : Shielded, 1.8m
2.	AC Adapter	Ruckus	740-64277-001	FCC DoC	NA	AC I/P: Unshielded, 1.2m

2.5 EUT Operation Test Setup

The RF test items, utility “PuTTY Release 0.75” was installed in Notebook which was programmed in order to make the EUT 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 Radiated Band Edges and Spurious Emission Measurement

3.1.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device is measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

3.1.2 Measuring Instruments

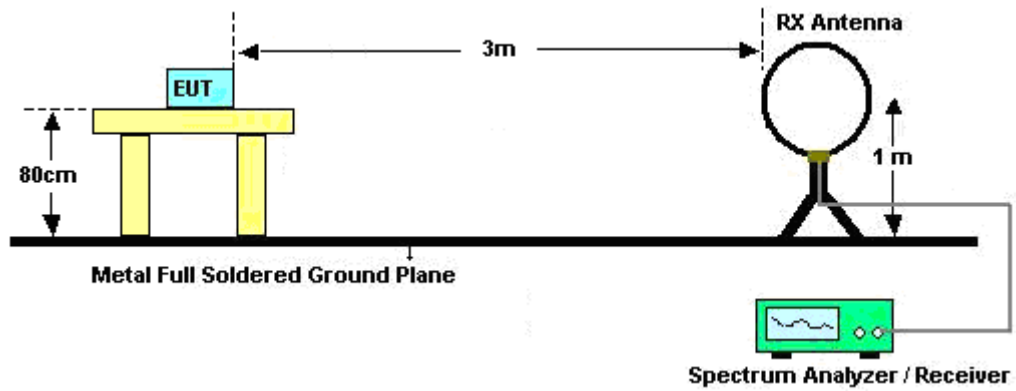
Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedures

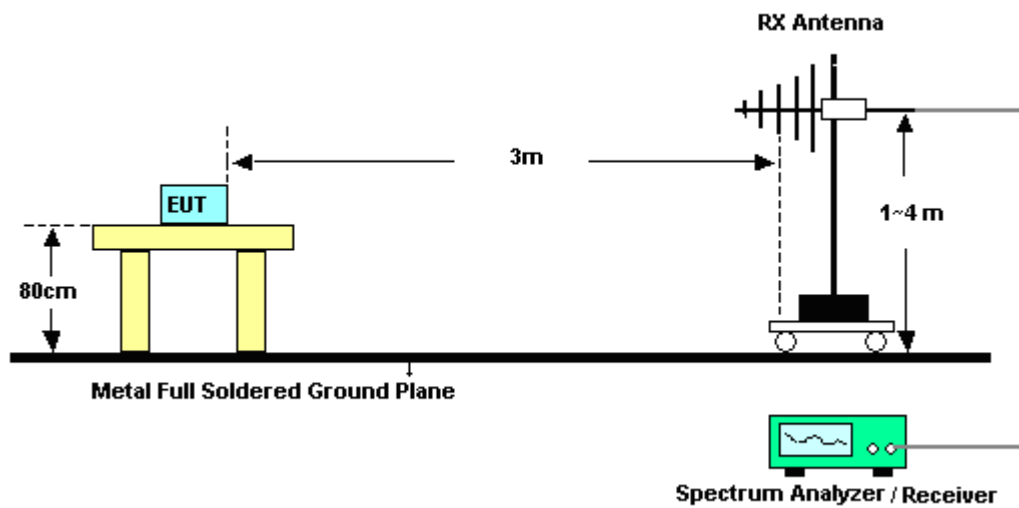
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT is 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.
4. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-”.
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as “-”.
8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW = 100 kHz for $f < 1$ GHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3 MHz for $f \geq 1$ GHz for peak measurement.For average measurement:
 - 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.

3.1.4 Test Setup

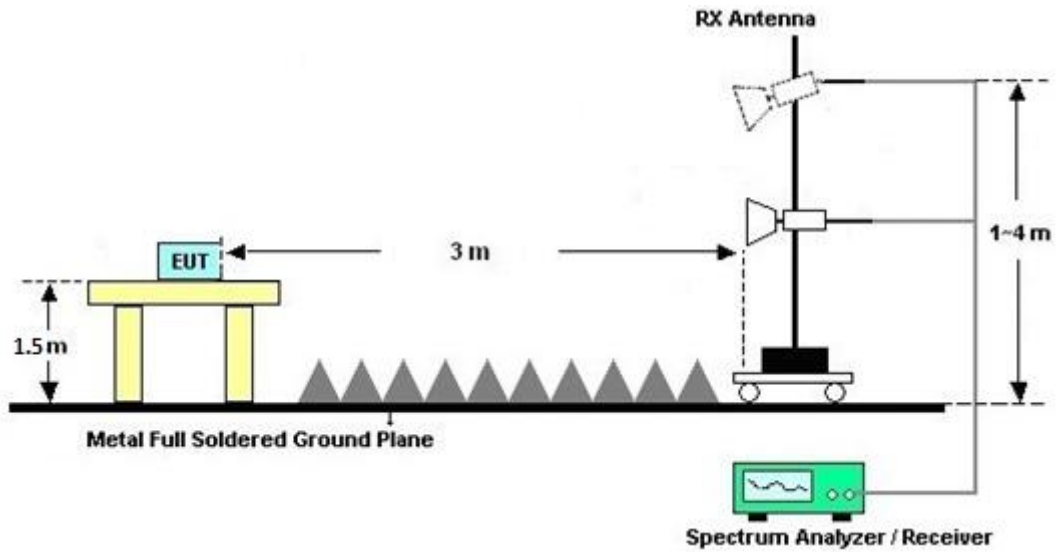
For radiated emissions below 30MHz



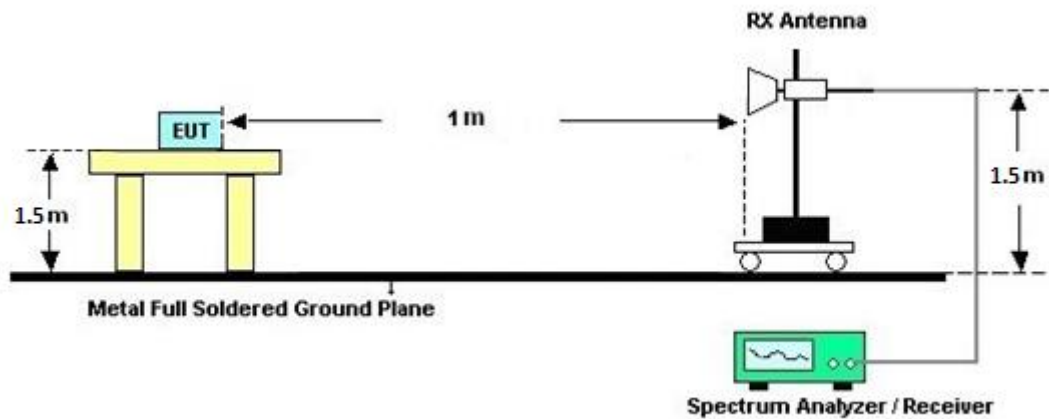
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



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

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is 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 comes 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 Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix A and B.



3.2 Antenna Requirements

3.2.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

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	R&S	HFH2-Z2E	100840	9kHz~30MHz	Jun. 21, 2021	Dec.14, 2021~ Dec. 18, 2021	Jun. 20, 2022	Radiation (03CH02-CA)
Bilog Antenna	TESEQ	6111D	54683	30MHz~1GHz	Oct. 15, 2021	Dec.14, 2021~ Dec. 18, 2021	Oct. 14, 2022	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	01895	1GHz~18GHz	Aug. 25, 2021	Dec.14, 2021~ Dec. 18, 2021	Aug. 24, 2022	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9170D	00842	18GHz~40GHz	Jul. 20, 2021	Dec.14, 2021~ Dec. 18, 2021	Jul. 19, 2022	Radiation (03CH02-CA)
Amplifier	SONOMA	310N	372240	N/A	Aug. 09, 2021	Dec.14, 2021~ Dec. 18, 2021	Aug. 08, 2022	Radiation (03CH02-CA)
Preamplifier	Keysight	83017A	MY53270323	1GHz~26.5GHz	Jul. 27, 2021	Dec.14, 2021~ Dec. 18, 2021	Jul. 26, 2022	Radiation (03CH02-CA)
Preamplifier	E-instrument	ERA-100M-18 G-56-01-A70	EC1900251	1GHz~18GHz	Mar. 30, 2021	Dec.14, 2021~ Dec. 18, 2021	Mar. 29, 2022	Radiation (03CH02-CA)
Preamplifier	EMEC	EMC18G40G	60725	18GHz~40GHz	Jul. 21, 2021	Dec.14, 2021~ Dec. 18, 2021	Jul. 20, 2022	Radiation (03CH02-CA)
EMI Test Receiver	Rohde & Schwarz	ESU26	100049	20Hz~26.5GHz	Jun. 05, 2021	Dec.14, 2021~ Dec. 18, 2021	May 31, 2022	Radiation (03CH02-CA)
Spectrum Analyzer	Keysight	N9010A	MY57420221	10Hz~44GHz	Sep. 22, 2021	Dec.14, 2021~ Dec. 18, 2021	Sep. 21, 2022	Radiation (03CH02-CA)
Filter	Wainwright	WHKX12-2700 -3000-18000-6 OST	SN10	3G Highpass	Jul. 23, 2021	Dec.14, 2021~ Dec. 18, 2021	Jul. 22, 2022	Radiation (03CH02-CA)
Filter	Wainwright	WLK12-1200-1 272-11000-40 SS	SN1	1.2G Low Pass	Jul. 23, 2021	Dec.14, 2021~ Dec. 18, 2021	Jul. 22, 2022	Radiation (03CH02-CA)
Hygrometer	TESEO	608-H1	45142602	N/A	Aug. 04, 2021	Dec.14, 2021~ Dec. 18, 2021	Aug. 03, 2022	Radiation (03CH02-CA)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Dec.14, 2021~ Dec. 18, 2021	N/A	Radiation (03CH02-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Dec.14, 2021~ Dec. 18, 2021	N/A	Radiation (03CH02-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Dec.14, 2021~ Dec. 18, 2021	N/A	Radiation (03CH02-CA)
Software	Audix	E3	N/A	N/A	N/A	Dec.14, 2021~ Dec. 18, 2021	N/A	Radiation (03CH02-CA)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.7 dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	6.2 dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	6.4 dB
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Appendix A. Radiated Spurious Emission

Test Engineer :	Michael Bui and Daniel Lee Fu Chen	Temperature :	20~23°C
		Relative Humidity :	40~43%

2.4GHz 2400~2483.5MHz

BLE_1Mbps_Tx_CH 39 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>

(Band Edge @ 3m)

BLE+WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamplifier Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 39 2480MHz	*	2480	112.09	-	-	98.14	27.63	17.56	31.24	342	308	P	H
	*	2480	111.84	-	-	97.89	27.63	17.56	31.24	342	308	A	H
		2483.56	62.17	-11.83	74	48.22	27.62	17.57	31.24	342	308	P	H
		2483.52	53.58	-0.42	54	39.63	27.62	17.57	31.24	342	308	A	H
	*	2480	107.02	-	-	93.19	27.51	17.56	31.24	212	24	P	V
	*	2480	106.71	-	-	92.88	27.51	17.56	31.24	212	24	A	V
		2483.84	58.74	-15.26	74	44.9	27.51	17.57	31.24	212	24	P	V
		2483.52	49.15	-4.85	54	35.31	27.51	17.57	31.24	212	24	A	V



WIFI WIFI 802.11ax HE20 CH01 2412MHz		2359.035	55.92	-18.08	74	42.08	27.76	17.38	31.3	371	0	P	H
		2389.38	44.36	-9.64	54	30.53	27.68	17.43	31.28	371	0	A	H
	*	2412	117.46	-	-	103.6	27.66	17.47	31.27	371	0	P	H
	*	2412	114.74	-	-	100.88	27.66	17.47	31.27	371	0	A	H
													H
													H
		2343.6	56.95	-17.05	74	43.01	27.91	17.34	31.31	104	57	P	V
		2343.915	45.29	-8.71	54	31.35	27.91	17.34	31.31	104	57	A	V
	*	2412	120.41	-	-	10.6.51	27.7	17.47	31.27	104	57	P	V
	*	2412	117.41	-	-	103.51	27.7	17.47	31.27	104	57	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

BLE_1Mbps_Tx_CH 39 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>

(Harmonic @ 3m)

BLE+WIFI Simultaneously	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)
BLE CH39 2480MHz + WIFI 802.11ax HE20 CH01 2412MHz SHF		4824	45.27	-28.73	74	70.4	31.49	11.29	67.91	-	-	P	H
		4960	55.79	-18.21	74	80.69	31.51	11.61	68.02	204	356	P	H
		4960	52.88	-1.12	54	77.78	31.51	11.61	68.02	204	356	A	H
		7320	44.68	-29.32	74	61.38	36.33	13.8	66.83	-	-	P	H
		10965	49.78	-24.22	74	60.91	40.17	16.86	68.16	-	-	P	H
		10965	38.94	-15.06	54	50.07	40.17	16.86	68.16	-	-	A	H
		14490	51.28	-22.72	74	57.49	41.94	19.59	67.74	-	-	P	H
		14490	42.04	-11.96	54	48.25	41.94	19.59	67.74	-	-	A	H
		17985	59.95	-14.05	74	58.69	48.43	22.42	69.59	-	-	P	H
		17985	49.84	-4.16	54	48.58	48.43	22.42	69.59	-	-	A	H
		4824	43.51	-30.49	74	68.59	31.54	11.29	67.91	-	-	P	V
		4960	53.46	-20.54	74	78.41	31.46	11.61	68.02	193	16	P	V
		4960	50.51	-3.49	54	75.46	31.46	11.61	68.02	193	16	A	V
		7320	44.89	-29.11	74	61.52	36.4	13.8	66.83	-	-	P	V
		10980	49.97	-24.03	74	61.1	40.1	16.87	68.1	-	-	P	V
		10980	38.72	-15.28	54	49.85	40.1	16.87	68.1	-	-	A	V
		14490	51.02	-22.98	74	57.23	41.94	19.59	67.74	-	-	P	V
		14490	42.12	-11.88	54	48.33	41.94	19.59	67.74	-	-	A	V
		17985	60.31	-13.69	74	58.78	48.7	22.42	69.59	-	-	P	V
		17985	50.18	-3.82	54	48.65	48.7	22.42	69.59	-	-	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 and emission level has at least 6dB margin against limit 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

BLE_1Mbps_Tx_CH 39 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant.

A+D+B+C> (SHF @ 1m)

	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
BLE+WIFI		(MHz)	(dBμV/m)	Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH39 2480MHz + WIFI 802.11ax HE20 CH01 2412MHz SHF		22550	39.2	-34.8	74	37.33	38.72	14.83	51.68	-	-	P	H
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 noise floor only.												



Emission below 1GHz

BLE_1Mbps_Tx_CH 39 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>
(LF @ 3m)

	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
BLE+WIFI Simultaneously		(MHz)	(dBμV/m)	Limit (dB)	Line (dBμV/m)	Level (dBμV)	Factor (dB/m)	Loss (dB)	Factor (dB)	Pos (cm)	Pos (deg)	Avg. (P/A)	(H/V)
BLE CH39 2480MHz + WIFI 802.11ax HE20 CH01 2412MHz LF		41.64	31.7	-8.3	40	44.4	18.68	0.97	32.44	-	-	P	H
		94.02	35.57	-7.93	43.5	51.16	15.2	1.47	32.42	-	-	P	H
		235.64	39.09	-6.91	46	52.07	16.98	2.33	32.4	-	-	P	H
		375.32	35.37	-10.63	46	43.55	21.21	2.95	32.48	-	-	P	H
		500.45	34.96	-11.04	46	39.82	24.1	3.44	32.58	-	-	P	H
		624.61	35.56	-10.44	46	38.22	25.98	3.78	32.59	-	-	P	H
		41.64	31.7	-8.3	40	44.4	18.68	0.97	32.44	-	-	P	H
		42.61	33.06	-6.94	40	46.3	18.13	1.07	32.44	100	164	QP	V
		105.66	37.21	-6.29	43.5	51.13	16.77	1.72	32.41	-	-	P	V
		256.01	36.04	-9.96	46	46.39	19.48	2.58	32.41	-	-	P	V
		499.48	34.36	-11.64	46	39.23	24.09	3.62	32.58	-	-	P	V
		624.61	37.25	-8.75	46	39.91	25.98	3.95	32.59	-	-	P	V
		878.75	37.83	-8.17	46	35.55	29.2	4.84	31.76	-	-	P	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 noise floor only.												



2.4GHz 2400~2483.5MHz

Zigbee_Tx_CH 26 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>

(Band Edge @ 3m)

BLE+WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preampl Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Zigbee CH 26 2480MHz	*	2480	102.89	-	-	88.94	27.63	17.56	31.24	201	41	P	H
	*	2480	101.07	-	-	87.12	27.63	17.56	31.24	201	41	A	H
		2484.04	58.16	-15.84	74	44.21	27.62	17.57	31.24	201	41	P	H
		2483.52	50.82	-3.18	54	36.87	27.62	17.57	31.24	201	41	A	H
	*	2480	105.5	-	-	91.67	27.51	17.56	31.24	205	323	P	V
	*	2480	103.7	-	-	89.87	27.51	17.56	31.24	205	323	A	V
		2483.68	60.55	-13.45	74	46.71	27.51	17.57	31.24	205	323	P	V
		2483.52	52.96	-1.04	54	39.12	27.51	17.57	31.24	205	323	A	V
WIFI 802.11ax HE20 CH01 2412MHz		2345.91	54.82	-19.18	74	40.99	27.8	17.34	31.31	400	360	P	H
		2388.855	44.54	-9.46	54	30.71	27.68	17.43	31.28	400	360	A	H
	*	2412	114.08	-	-	100.22	27.66	17.47	31.27	400	360	P	H
	*	2412	111.63	-	-	97.77	27.66	17.47	31.27	400	360	A	H
		2316.51	55.62	-18.38	74	41.72	27.93	17.29	31.32	182	46	P	V
		2389.275	44.78	-9.22	54	30.85	27.78	17.43	31.28	182	46	A	V
	*	2412	116.35	-	-	102.45	27.7	17.47	31.27	182	46	P	V
	*	2412	113.71	-	-	99.81	27.7	17.47	31.27	182	46	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

Zigbee_Tx_CH 26 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>

(Harmonic @ 3m)

BLE+WIFI Simultaneously	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)
Zigbee CH 26 2480MHz + WIFI 802.11ax HE20 CH01 2412MHz		4824	39.23	-34.77	74	64.36	31.49	11.29	67.91	-	-	P	H
		4960	54.89	-19.11	74	79.79	31.51	11.61	68.02	202	348	P	H
		4960	50.41	-3.59	54	75.31	31.51	11.61	68.02	202	348	A	H
		7440	44.22	-29.78	74	61.11	36.49	13.9	67.28	-	-	P	H
		10920	49.94	-24.06	74	61.27	40.18	16.82	68.33	-	-	P	H
		10920	38.69	-15.31	54	50.02	40.18	16.82	68.33	-	-	A	H
		14490	50.93	-23.07	74	57.14	41.94	19.59	67.74	-	-	P	H
		14490	42.01	-11.99	54	48.22	41.94	19.59	67.74	-	-	A	H
		18000	59.49	-14.51	74	57.65	48.82	22.44	69.42	-	-	P	H
		18000	50.4	-3.6	54	48.56	48.82	22.44	69.42	-	-	A	H
		4824	39.97	-34.03	74	65.05	31.54	11.29	67.91	-	-	P	V
		4960	51.16	-22.84	74	76.11	31.46	11.61	68.02	293	360	P	V
		4960	46.36	-7.64	54	71.31	31.46	11.61	68.02	293	360	A	V
		7440	45.18	-28.82	74	62.09	36.47	13.9	67.28	-	-	P	V
		11565	49.86	-24.14	74	60.01	40.02	17.34	67.51	-	-	P	V
		11565	38.65	-15.35	54	48.8	40.02	17.34	67.51	-	-	A	V
		14490	51.04	-22.96	74	57.25	41.94	19.59	67.74	-	-	P	V
		14490	41.94	-12.06	54	48.15	41.94	19.59	67.74	-	-	A	V
		17985	59.12	-14.88	74	57.59	48.7	22.42	69.59	-	-	P	V
		17985	50.01	-3.99	54	48.48	48.7	22.42	69.59	-	-	A	V
Remark	1. No other spurious found.												
	2. All results are PASS against Peak and Average limit line.												
Remark	3. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit 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

Zigbee_Tx_CH 26 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>

(SHF @ 1m)

BLE+WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz Zigbee CH26 2480MHz + WIFI 802.11ax HE20 CH01 2412MHz SHF		22550	39.2	-34.8	74	37.33	38.72	14.83	51.68	-	-	P	H
WIFI 802.11ax HE20 CH01 2412MHz SHF		22788	39.86	-34.14	74	37.86	38.8	14.88	51.68	-	-	P	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 noise floor only.												



Emission below 1GHz

Zigbee_Tx_CH 26 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>

(LF @ 3m)

BLE+WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz Zigbee CH26 2480MHz + WIFI 802.11ax HE20 CH01 2412MHz LF		37.76	33.94	-6.06	40	44.41	20.94	1.03	32.44	-	-	P	H
		97.9	35.59	-7.91	43.5	50.51	15.78	1.72	32.42	-	-	P	H
		238.55	39.16	-6.84	46	51.79	17.33	2.45	32.41	-	-	P	H
		375.32	38.38	-7.62	46	46.56	21.21	3.09	32.48	-	-	P	H
		500.45	39.91	-6.09	46	44.77	24.1	3.62	32.58	-	-	P	H
		624.61	39.76	-6.24	46	42.42	25.98	3.95	32.59	-	-	P	H
		42.61	34.36	-5.64	40	47.6	18.13	1.07	32.44	100	180	QP	V
		97.9	37.2	-6.3	43.5	52.12	15.78	1.72	32.42	-	-	P	V
		167.74	36.92	-6.58	43.5	51.33	15.93	2.06	32.4	-	-	P	V
		624.61	37.46	-8.54	46	40.12	25.98	3.95	32.59	-	-	P	V
		749.74	35.91	-10.09	46	35.77	28.1	4.42	32.38	-	-	P	V
		950.53	33.79	-12.21	46	28.77	31.22	4.99	31.19	-	-	P	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 noise floor only.												



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	P eak or A verage
H/V	H orizontal or V ertical

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

Zigbee	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
ANT				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Zigbee		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 11		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H
2405MHz													

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”.

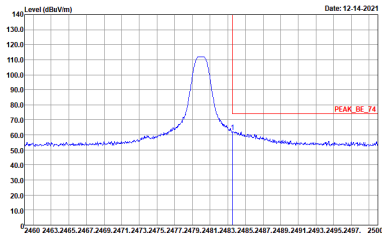
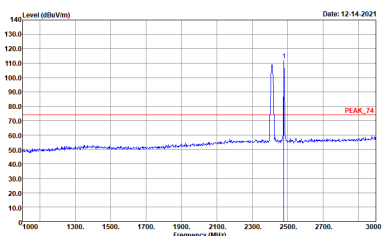
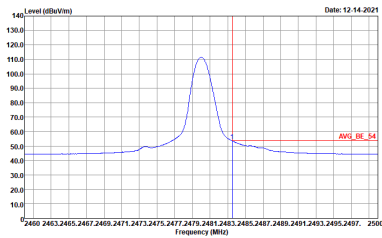
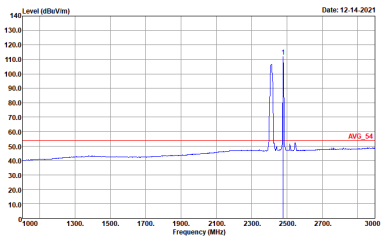


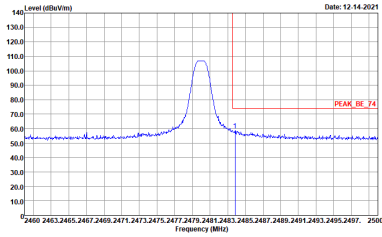
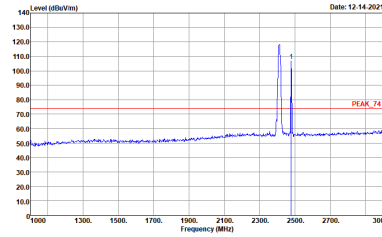
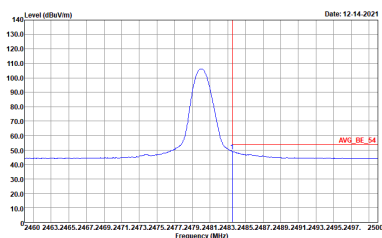
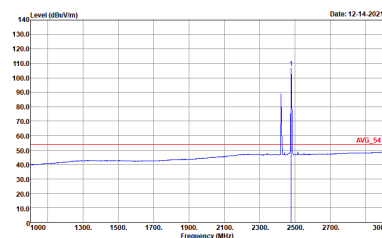
Appendix B. Radiated Spurious Emission Plots

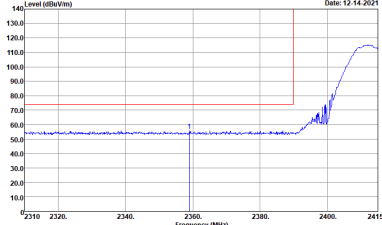
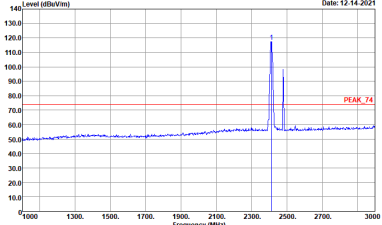
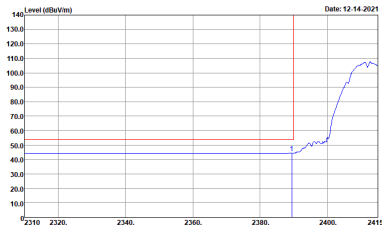
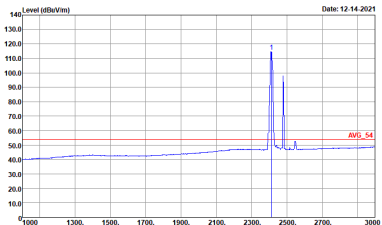
Test Engineer :	Michael Bui and Daniel Lee Fu Chen	Temperature :	20~23°C
		Relative Humidity :	40~43%

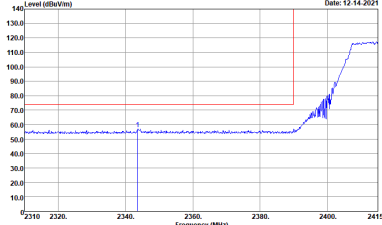
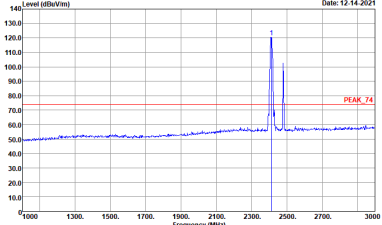
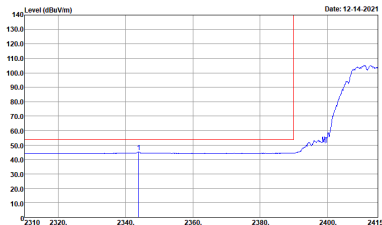
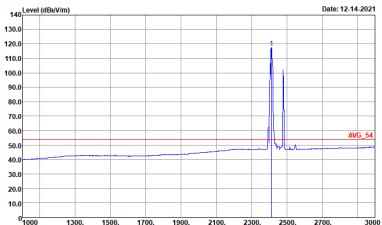
2.4GHz 2400~2483.5MHz

BLE_1Mbps_Tx_CH 39 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>
(Band Edge @ 3m)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE 1Mbps CH39 2480MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000kHz VBW:0.010kHz SWT:Auto	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000kHz VBW:0.010kHz SWT:Auto

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE 1Mbps CH39 2480MHz	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN+HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN+HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN+HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH02-CA Condition : AVG_54 3m HORN+HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:1.000KHz SWT:Auto

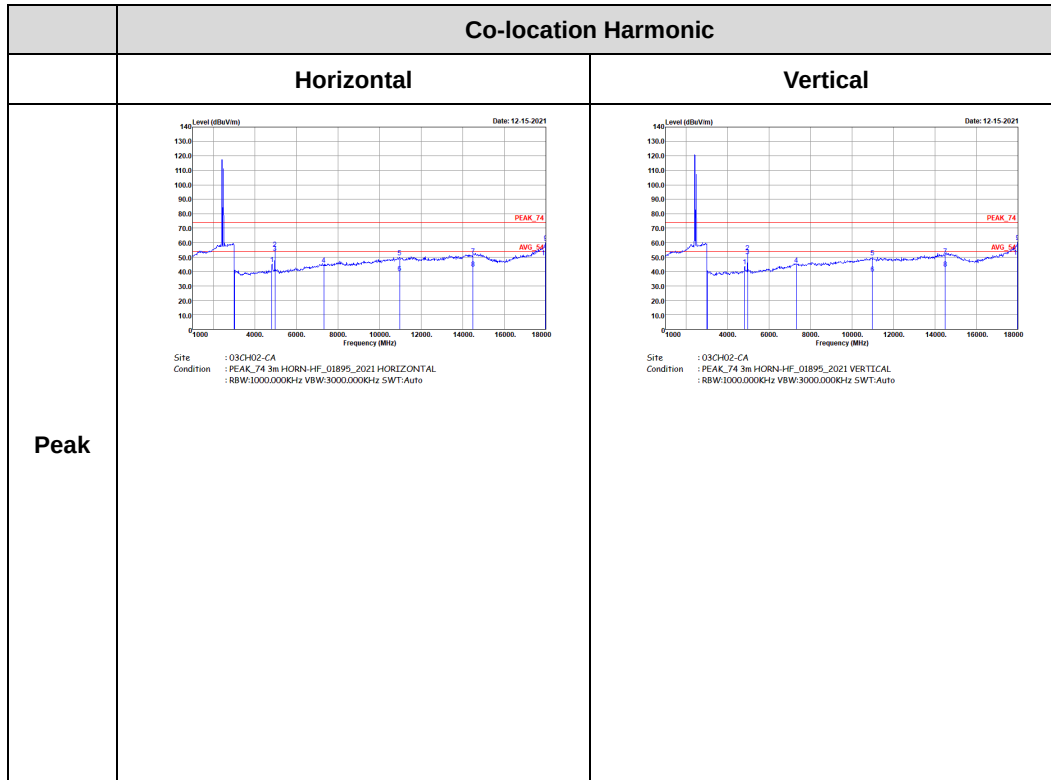
WLAN	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	WIFI 802.11ax HE20 CH01 2412MHz	
A+D+ B+C	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN+HF_01895_2021 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN+HF_01895_2021 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN+HF_01895_2021 HORIZONTAL RBW:1000.000KHz VBW:0.300KHz SWT:Auto	 Site : 03CH02-CA Condition : AVG_54 3m HORN+HF_01895_2021 HORIZONTAL RBW:1000.000KHz VBW:0.300KHz SWT:Auto

WLAN	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	WIFI 802.11ax HE20 CH01 2412MHz	
A+D+ B+C	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN+HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN+HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN+HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : AVG_54 3m HORN+HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto



2.4GHz 2400~2483.5MHz

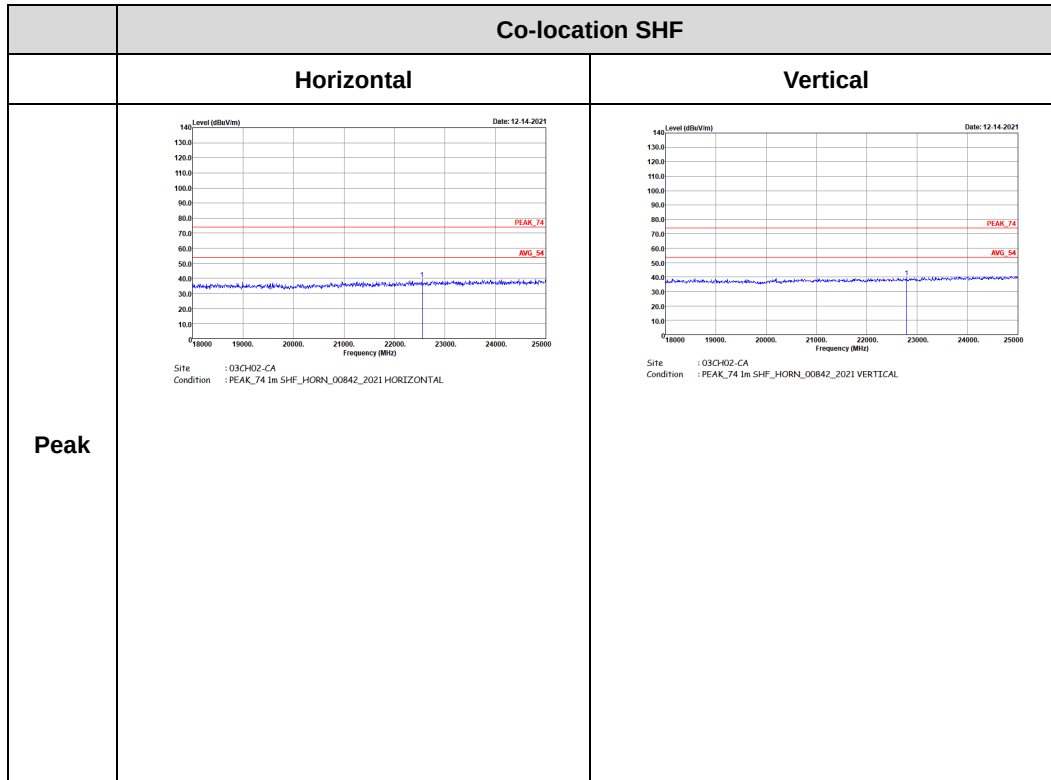
BLE_1Mbps_Tx_CH 39 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>
(Harmonic @ 3m)





Emission above 18GHz

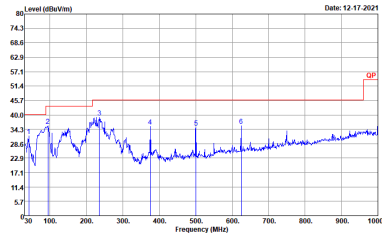
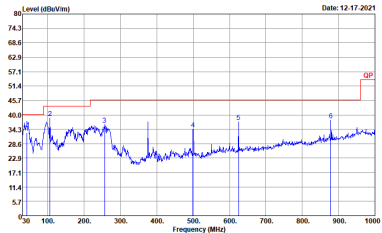
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(SHF @ 1m)





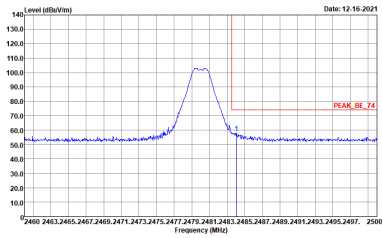
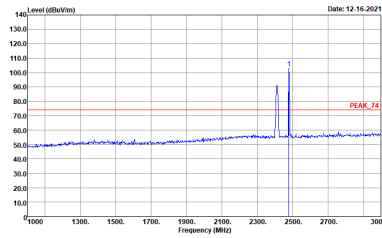
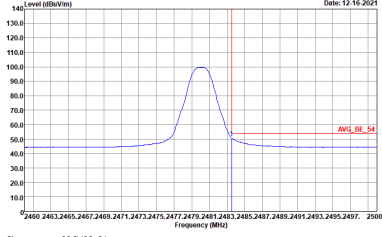
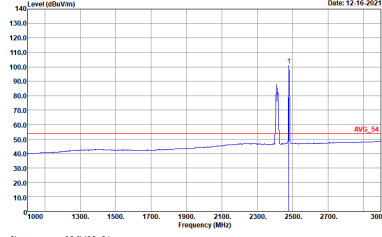
Emission below 1GHz

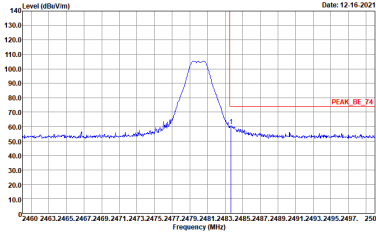
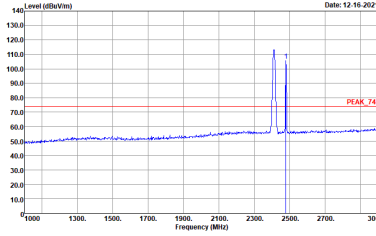
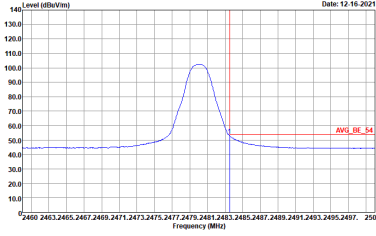
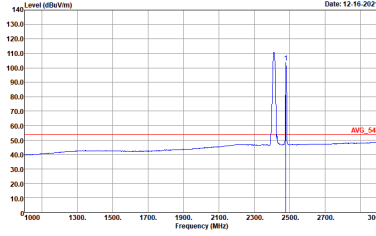
BLE_1Mbps_Tx_CH 39 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>
(LF @ 3m)

	Co-location LF	
	Horizontal	Vertical
Peak	 Site : 03CH02-CA Condition : QP 3m BIL06_54683_2021 HORIZONTAL	 Site : 03CH02-CA Condition : QP 3m BIL06_54683_2021 VERTICAL

2.4GHz 2400~2483.5MHz

Zigbee_Tx_CH 26 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>
(Band Edge @ 3m)

Zigbee	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Zigbee CH26 2480MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto

Zigbee	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Zigbee CH26 2480MHz	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN-HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:0.300KHz SWT:Auto	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:0.300KHz SWT:Auto



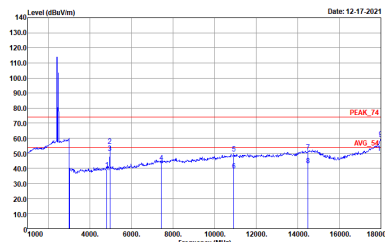
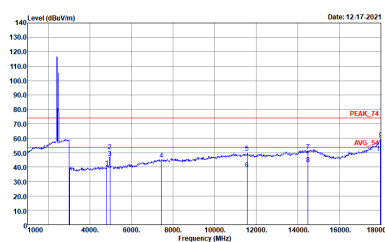
WLAN	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	WIFI 802.11ax HE20 CH01 2412MHz	
A+D+ B+C	Horizontal	Fundamental
Peak	Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	Site : 03CH02-CA Condition : AVG_BE_54 3m HORN-HF_01895_2021 HORIZONTAL RBW:1000.000KHz VBW:0.300KHz SWT:Auto	Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 HORIZONTAL RBW:1000.000KHz VBW:0.300KHz SWT:Auto



WLAN	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	WIFI 802.11ax HE20 CH01 2412MHz	
A+D+ B+C	Vertical	Fundamental
Peak	Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	Site : 03CH02-CA Condition : AV6_BE_54 3m HORN-HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:0.300KHz SWT:Auto	Site : 03CH02-CA Condition : AV6_54 3m HORN-HF_01895_2021 VERTICAL RBW:1000.000KHz VBW:0.300KHz SWT:Auto

2.4GHz 2400~2483.5MHz

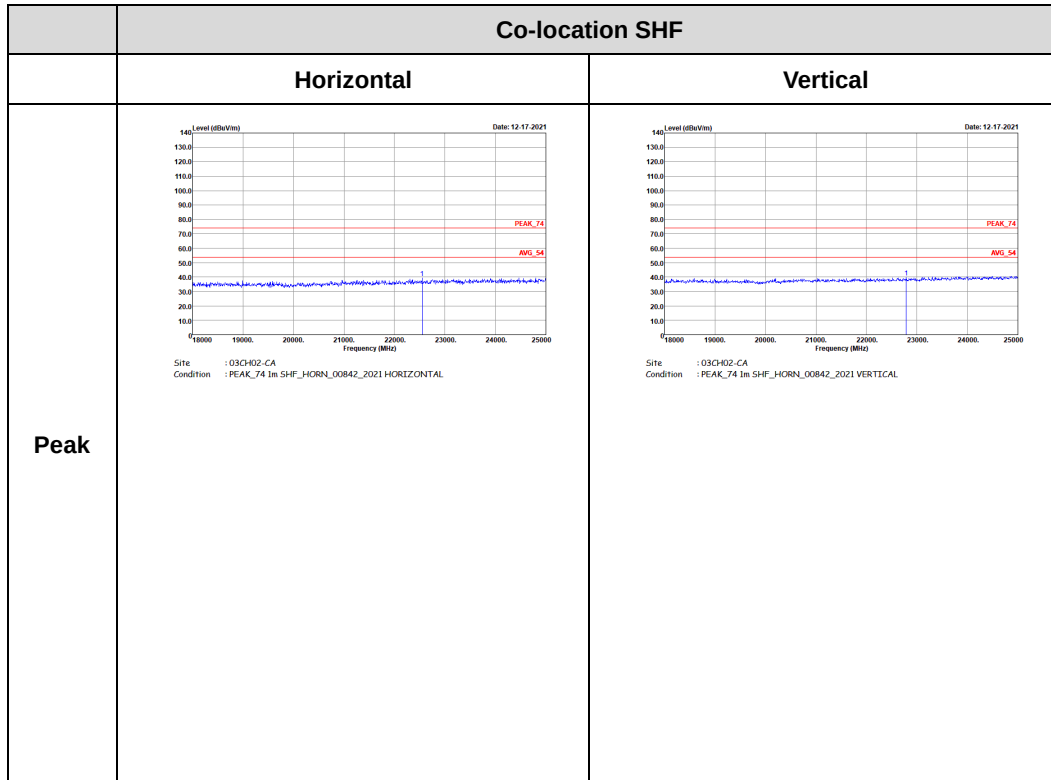
Zigbee_Tx_CH 26 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>
(Harmonic @ 3m)

	Co-location Harmonic	
	Horizontal	Vertical
Peak	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 HORIZONTAL	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 VERTICAL

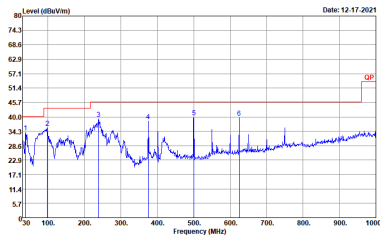
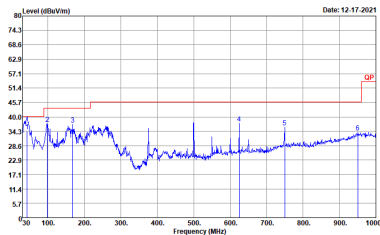


Emission above 8GHz

Zigbee_Tx_CH 26 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>
(SHF @ 1m)



Emission below GHz
Zigbee_Tx_CH 26 for <Ant. 1> + WIFI 802.11ax HE20_Tx_CH 01 for MIMO <Ant. A+D+B+C>
(LF @ 3m)

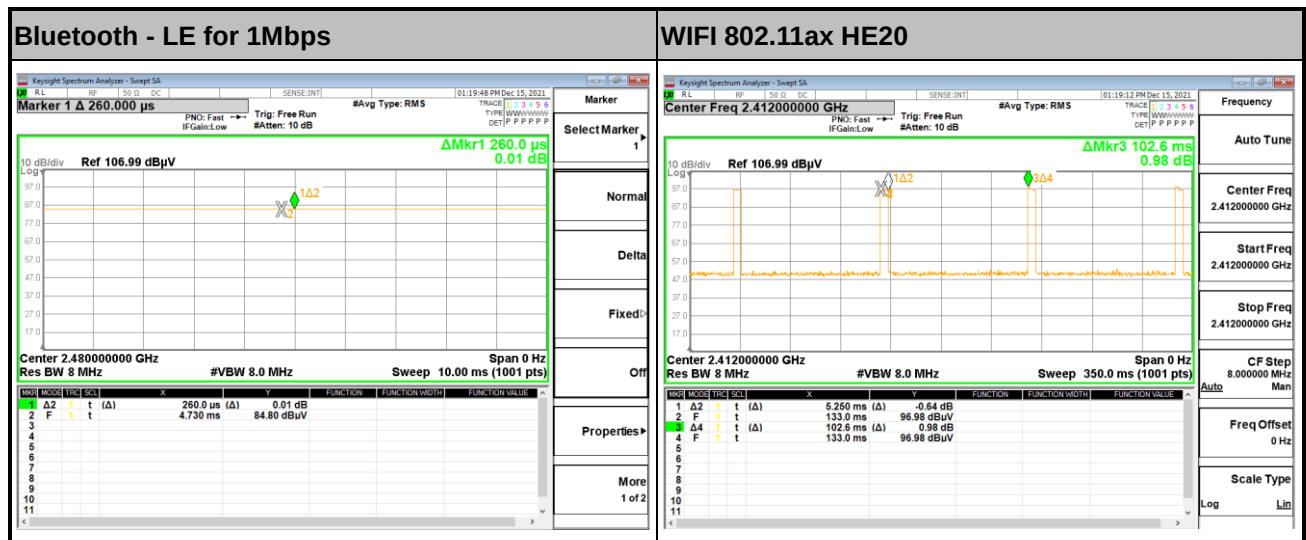
	Co-location LF	
	Horizontal	Vertical
Peak	 Site : 03CH02-CA Condition : QP 3m BIL06_54683_2021 HORIZONTAL	 Site : 03CH02-CA Condition : QP 3m BIL06_54683_2021 VERTICAL



Appendix C. Duty Cycle Plots

<Bluetooth – LE + WLAN 802.11ax HE20>

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
1	Bluetooth - LE for 1Mbps	100.00	-	-	10Hz
A+D+B+C	WIFI 802.11ax HE20	5.12	5250	0.19	300Hz



**<Zigbee + WLAN 802.11ax HE20>**

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
1	Zigbee	10.59	3400	0.29	300Hz
A+D+B+C	WIFI 802.11ax HE20	5.08	5200	0.19	300Hz

