



FCC COLOCATION RADIO TEST REPORT

FCC ID : 2ADZRBEACON24
Equipment : NOKIA WiFi Beacon 24
Brand Name : NOKIA
Model Name : Beacon 24
Applicant : Nokia Shanghai Bell Co., Ltd.
No.388, Ningqiao Rd, Pilot Free Trade Zone,
Shanghai, 201206 P.R. China
Manufacturer : Nokia of America Corporation
2301 Sugar Bush Rd. Raleigh, NC 27612
Standard : FCC Part 15 Subpart C §15.247
FCC Part 15 Subpart E §15.407

The product was received on Jan. 02, 2024 and testing was performed from Feb. 01, 2024 to Feb. 01, 2024. We, Sporton International Inc. EMC & Wireless Communications 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 from Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issue Date
FR3N0940D	01	Initial issue of report	Feb. 02, 2024



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(d) 15.407(b) (5)	Radiated Band Edges and Radiated Spurious Emission	Pass	0.52 dB under the limit at 5355.60 MHz
3.2	15.203	Antenna Requirement	Pass	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty".

Disclaimer:

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

Reviewed by: Wei Chen

Report Producer: Clio Lo



1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
General Specs Wi-Fi 2.4GHz 802.11b/g/n/ax/be, Wi-Fi 5GHz 802.11a/n/ac/ax/be, and Wi-Fi 6GHz 802.11ax/be.	
Antenna Type WLAN: PCB Antenna	

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	<AOT gain> : Ant. A: 3.14 Ant. B: 2.67 Ant. C: 3.71 Ant. D: 2.25
5250 MHz ~ 5350 MHz	Peak Gain (dBi)	<AOT gain> : Ant. 1: 2.97 Ant. 2: 5.09 Ant. 3: 4.67 Ant. 4: 3.85
6875 MHz ~ 7125 MHz	Peak Gain (dBi)	Ant. 5: 4.99 Ant. 6: 4.54 Ant. 7: 4.38 Ant. 8: 5.32

Remark: The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.

1.2 Modification of EUT

No modifications made to the EUT during the testing.



1.3 Testing Location

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	Sporton Site No. 03CH07-HY

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

FCC designation No.: TW1190

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 Part 15 Subpart E
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- ♦ FCC KDB 987594 D02 U-NII 6 GHz EMC Measurement v02r01
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ ANSI C63.10-2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



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).
- b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

2400-2483.5 MHz		5250-5350 MHz		6875-7125 MHz	
802.11b		802.11be EHT80		802.11be EHT20	
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	2412	58	5290	233	7115

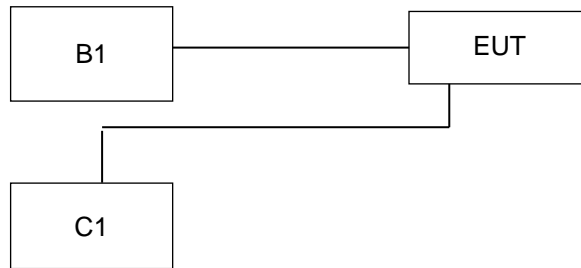
2.2 Test Mode

<Co-Location>

Modulation	Data Rate
2.4GHz 802.11b for MIMO <Ant. A+B+C+D> + 5GHz 802.11be EHT80 for MIMO <Ant. 1+2+3+4> + 6GHz 802.11be EHT20 OFDMA RU52*4 for MIMO <Ant. 5+6+7+8>	1Mbps + MCS0 + MCS0



2.3 Connection Diagram of Test System



RF Test Setup									
No.	Power Source	Connection Type	Test Mode						
			1	2	-	-	-	-	-
B1	AC : 120V/60Hz	AC Power Cable	X	X	-	-	-	-	-
No.	Setup Peripherals	Connection Type	1	2	-	-	-	-	-
C1	Notebook	RJ-45 Cable	X	X	-	-	-	-	-

2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Dell	E3340	N/A	N/A	AC I/P : Unshielded, 1.2m DC O/P : Shielded, 1.8m

2.5 EUT Operation Test Setup

The RF test items, utility “QSPR v 5.0-00202” 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



- (1) For transmitters operating within the 5.925-7.125 GHz band: Any emissions outside of the 5.925-7.125 GHz band must not exceed an e.i.r.p. of -27 dBm/MHz.

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27 (RMS)	68.3
- 7 (Peak)	88.3

According 987594 D02 U-NII 6GHz EMC Measurement v01 section G:

Unwanted emissions outside of restricted bands are measured with a RMS detector.

In addition, 15.35(b) applies where the peak emissions must be limited to no more than 20 dB above the average limit

- (2) 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.

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

3.1.2 Measuring Instruments

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

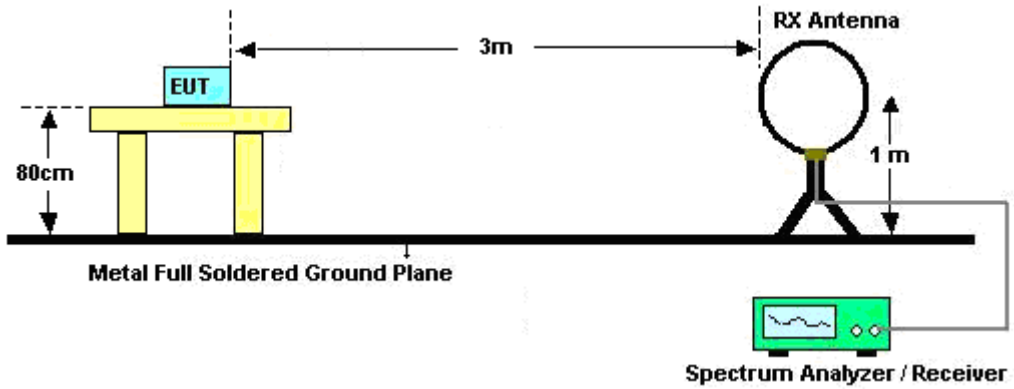


3.1.3 Test Procedures

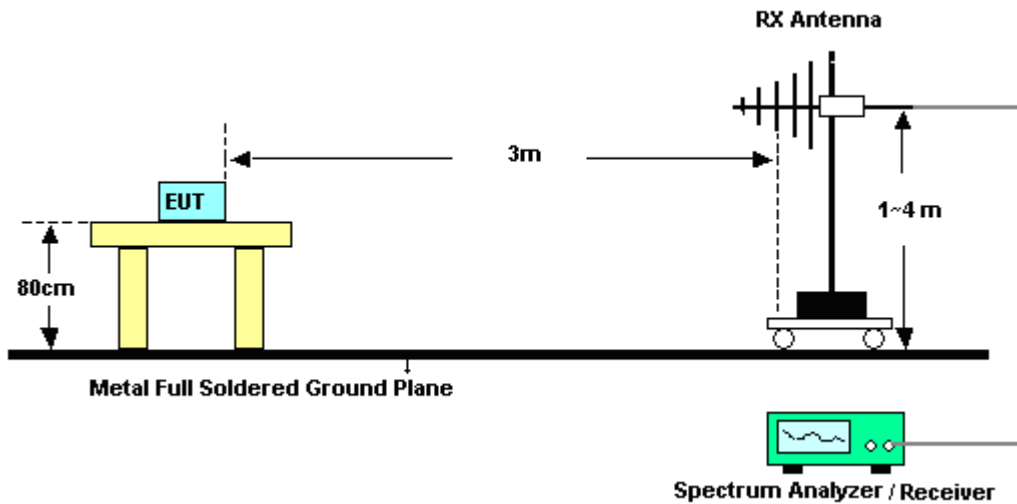
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
 - (2) Procedure for Peak 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 1000MHz
 - 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 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.
3. The EUT is set 3 meters away from the receiving antenna which is 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 is 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. 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 “-“.

3.1.4 Test Setup

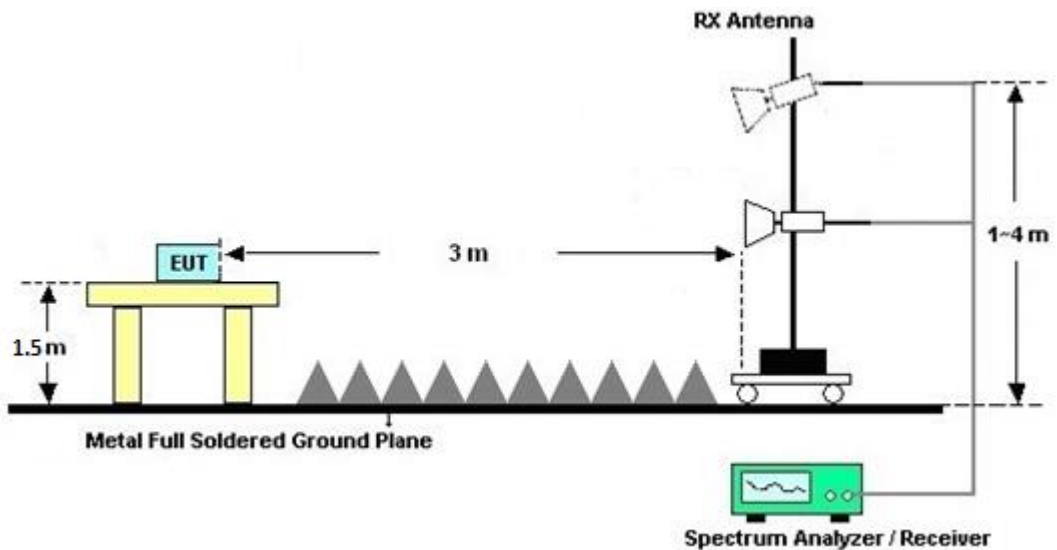
For radiated emissions below 30MHz



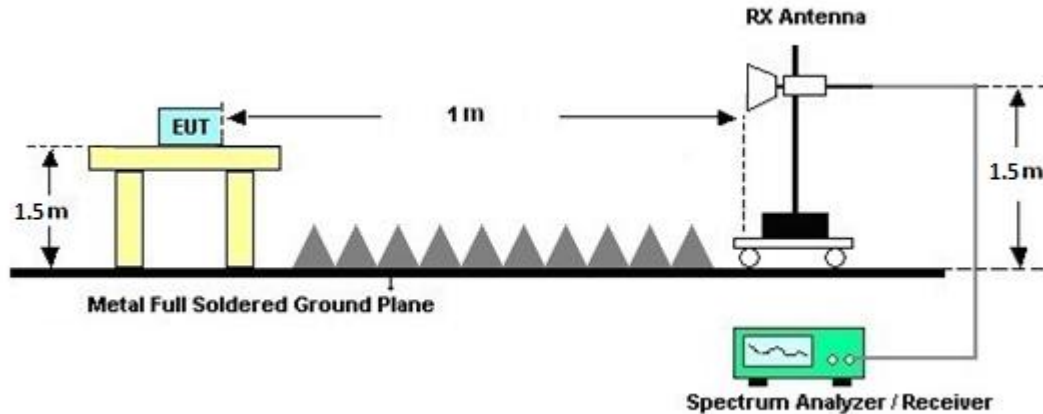
For radiated emissions from 30MHz to 1GHz



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

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.



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver	Rohde & Schwarz	ESU26	100472	20Hz~26.5GHz	Feb. 13, 2023	Feb. 01, 2024	Feb. 12, 2024	Radiation (03CH07-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	35419 & 03	30MHz~1GHz	Apr. 23, 2023	Feb. 01, 2024	Apr. 22, 2024	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Nov. 27, 2023	Feb. 01, 2024	Nov. 26, 2024	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Feb. 28, 2023	Feb. 01, 2024	Feb. 27, 2024	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-00101 800-30-10P	1590075	1GHz~18GHz	Apr. 20, 2023	Feb. 01, 2024	Apr. 19, 2024	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	Oct. 02, 2023	Feb. 01, 2024	Oct. 01, 2024	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Mar. 24, 2023	Feb. 01, 2024	Mar. 23, 2024	Radiation (03CH07-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Jul. 25, 2023	Feb. 01, 2024	Jul. 24, 2024	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9030A	MY52350276	3Hz~44GHz	Mar. 28, 2023	Feb. 01, 2024	Mar. 27, 2024	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682/4	30MHz to 18GHz	Feb. 22, 2023	Feb. 01, 2024	Feb. 21, 2024	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971/4	9kHz to 18GHz	Feb. 22, 2023	Feb. 01, 2024	Feb. 21, 2024	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4	9kHz to 18GHz	Feb. 22, 2023	Feb. 01, 2024	Feb. 21, 2024	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126	532078/126E	30MHz~18GHz	Sep. 15, 2023	Feb. 01, 2024	Sep. 14, 2024	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2	18GHz~40GHz	Feb. 22, 2023	Feb. 01, 2024	Feb. 21, 2024	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801606/2	9KHz ~ 40GHz	Apr. 20, 2023	Feb. 01, 2024	Apr. 19, 2024	Radiation (03CH07-HY)
Controller	EMEC	EM1000	N/A	Control Ant Mast	N/A	Feb. 01, 2024	N/A	Radiation (03CH07-HY)
Controller	MF	MF-7802	N/A	Control Turn table	N/A	Feb. 01, 2024	N/A	Radiation (03CH07-HY)
Antenna Mast	EMEC	AM-BS-4500E	N/A	Boresight mast 1M~4M	N/A	Feb. 01, 2024	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Feb. 01, 2024	N/A	Radiation (03CH07-HY)
Attenuator	HONOVA	5910 SMA-50-005-19-NE	ATT-36	N/A	Oct. 28, 2023	Feb. 01, 2024	Oct. 27, 2024	Radiation (03CH07-HY)
Software	Audix	E3	N/A	N/A	N/A	Feb. 01, 2024	N/A	Radiation (03CH07-HY)
USB Data Logger	TECPEL	TR-32	HE17XB2495	N/A	Mar. 14, 2023	Feb. 01, 2024	Mar. 13, 2024	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Nov. 24, 2023	Feb. 01, 2024	Nov. 23, 2024	Radiation (03CH07-HY)



5 Measurement Uncertainty

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	6.30 dB
-------------------------------------------------------------------------	---------

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.60 dB
-------------------------------------------------------------------------	---------

Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.30 dB
-------------------------------------------------------------------------	---------

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.30 dB
-------------------------------------------------------------------------	---------



Appendix A. Radiated Spurious Emission

Test Engineer :	Jesse Wang and Ken Wu	Temperature :	22.5~23.8°C
		Relative Humidity :	62.3~65.8%

WLAN (2.4GHz) 802.11b_Tx_CH01 + WLAN (5GHz) 802.11be EHT80_Tx_CH58 + WLAN (6GHz) 802.11be EHT20 OFDMA RU52*4_Tx_CH233 Link

WLAN (2.4GHz) 802.11b_Tx_CH01 (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
A+B+C+D		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2385.81	56.85	-17.15	74	41.03	31.96	18.06	34.2	195	232	P	H
		2386.335	50.59	-3.41	54	34.76	31.96	18.07	34.2	195	232	A	H
	*	2412	110.29	-	-	94.37	32	18.12	34.2	195	232	P	H
	*	2412	107.23	-	-	91.31	32	18.12	34.2	195	232	A	H
		2386.545	59.24	-14.76	74	43.4	31.97	18.07	34.2	300	36	P	V
		2386.23	53.38	-0.62	54	37.56	31.96	18.06	34.2	300	36	A	V
*		2412	113.72	-	-	97.8	32	18.12	34.2	300	36	P	V
*		2412	110.36	-	-	94.44	32	18.12	34.2	300	36	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



WLAN (5GHz) 802.11be EHT80_Tx_CH58 (Band Edge @ 3m)

WIFI Ant. 1+2+3+4	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)	
802.11be EHT80 CH 58 5290MHz		5014.7	51.15	-22.85	74	38.91	34.28	11.86	33.9	100	222	P	H	
		5000	42.44	-11.56	54	30.1	34.4	11.84	33.9	100	222	A	H	
	*	5290	106.23	-	-	93.38	34.62	12.11	33.88	100	222	P	H	
	*	5290	97.3	-	-	84.45	34.62	12.11	33.88	100	222	A	H	
		5351.76	56.64	-17.36	74	43.6	34.8	12.12	33.88	100	222	P	H	
		5351.52	48.23	-5.77	54	35.19	34.8	12.12	33.88	100	222	A	H	
		5145.25	51.98	-22.02	74	39.57	34.27	12.03	33.89	155	359	P	V	
		5145.95	43.45	-10.55	54	31.03	34.28	12.03	33.89	155	359	A	V	
	*	5290	109.61	-	-	96.76	34.62	12.11	33.88	155	359	P	V	
	*	5290	100.94	-	-	88.09	34.62	12.11	33.88	155	359	A	V	
		5355.6	62.15	-11.85	74	49.12	34.79	12.12	33.88	155	359	P	V	
		5355.6	53.48	-0.52	54	40.45	34.79	12.12	33.88	155	359	A	V	
	Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



WLAN (6GHz) 802.11be EHT20 OFDMA RU52*4_Tx_CH233 (Band Edge @ 3m)

WIFI Ant. 5+6+7+8	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)
802.11be EHT20 OFDMA RU52*4 CH 233 7115MHz	*	7115	97.89	-	-	82.3	35.6	14.07	34.08	366	146	P	H
	*	7115	88.49	-	-	72.9	35.6	14.07	34.08	366	146	A	H
		7125.02	71.19	-17.01	88.2	55.59	35.6	14.08	34.08	366	146	P	H
		7125.02	59.95	-8.25	68.2	44.35	35.6	14.08	34.08	366	146	A	H
	*	7115	103.65	-	-	88.06	35.6	14.07	34.08	200	360	P	V
	*	7115	96.83	-	-	81.24	35.6	14.07	34.08	200	360	A	V
		7125.02	79.05	-9.15	88.2	63.45	35.6	14.08	34.08	259	184	P	V
		7125.02	67.44	-0.76	68.2	51.84	35.6	14.08	34.08	259	184	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



WLAN (2.4GHz) 802.11b_Tx_CH01 + WLAN (5GHz) 802.11be EHT80_Tx_CH58 + WLAN (6GHz)
802.11be EHT20 OFDMA RU52*4_Tx_CH233 (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)	
802.11b CH 01 2412MHz + 802.11be EHT80 CH 58 5290MHz + 802.11be EHT20 OFDMA RU52*4 CH 233 7115MHz		4824	50.44	-23.56	74	38.49	34.2	11.72	33.97	-	-	P	H	
		4824	41.85	-12.15	54	29.9	34.2	11.72	33.97	-	-	A	H	
		10580	42.64	-45.56	88.2	45.61	37.56	18.16	58.69	-	-	P	H	
		14230	47.59	-40.61	88.2	45.17	38.98	21.07	57.63	-	-	P	H	
		15870	46.12	-27.88	74	39.65	40.82	22.05	56.4	-	-	P	H	
		21345	35.93	-38.07	74	50.33	37.86	7.56	59.82	-	-	P	H	
														H
														H
														H
														H
														H
														H
			4824	51.15	-22.85	74	39.2	34.2	11.72	33.97	-	-	P	V
			4824	42.15	-11.85	54	30.2	34.2	11.72	33.97	-	-	A	V
			10580	41.97	-46.23	88.2	44.94	37.56	18.16	58.69	-	-	P	V
			14230	48.57	-39.63	88.2	46.15	38.98	21.07	57.63	-	-	P	V
			15870	46.42	-27.58	74	39.95	40.82	22.05	56.4	-	-	P	V
			21345	36.03	-37.97	74	50.43	37.86	7.56	59.82	-	-	P	V
													V	
													V	
													V	
													V	
													V	
													V	
Remark	<ol style="list-style-type: none"> No other spurious found. All results are PASS against Peak and Average limit line. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only. 													



Emission below 1GHz

WLAN (2.4GHz) 802.11b_Tx_CH01 + WLAN (5GHz) 802.11be EHT80_Tx_CH58 + WLAN (6GHz)
802.11be EHT20 OFDMA RU52*4_Tx_CH233 (LF @ 3m)

WIFI Ant.	Note	Frequency	Level	Margin	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)	
802.11b CH 01 2412MHz + 802.11be EHT80 CH 58 5290MHz + 802.11be EHT20 OFDMA RU52*4 CH 233 7115MHz		30	28.98	-11.02	40	33.36	24.51	1.05	29.94	-	-	P	H	
		91.02	32.95	-10.55	43.5	46.41	14.72	1.73	29.91	-	-	P	H	
		290.55	23.06	-22.94	46	30.93	19.08	2.86	29.81	-	-	P	H	
		359.5	32.94	-13.06	46	38.84	20.62	3.29	29.81	-	-	P	H	
		643	29.32	-16.68	46	28.54	26.14	4.31	29.67	-	-	P	H	
		958.7	33.08	-12.92	46	25.48	30.66	5.54	28.6	-	-	P	H	
														H
														H
														H
														H
														H
			30	32.92	-7.08	40	37.3	24.51	1.05	29.94	-	-	P	V
			53.49	31.74	-8.26	40	47.48	12.77	1.41	29.92	100	199	QP	V
			93.72	29.27	-14.23	43.5	42.44	14.96	1.77	29.9	-	-	P	V
			746.6	30.12	-15.88	46	27.19	27.65	4.77	29.49	-	-	P	V
			874	32.16	-13.84	46	27.21	28.71	5.25	29.01	-	-	P	V
			947.5	33.58	-12.42	46	26.63	30.14	5.5	28.69	-	-	P	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 and emission level has at least 6dB margin against limit or emission is 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	Peak or Average
H/V	Horizontal or Vertical



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

WIFI	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
A+B+C+D		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
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. Margin Limit(dB) = Level(dBμV/m) – Limit Line(dBμV)

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. Margin 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. Margin 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 :	Jesse Wang and Ken Wu	Temperature :	22.5~23.8°C
		Relative Humidity :	62.3~65.8%

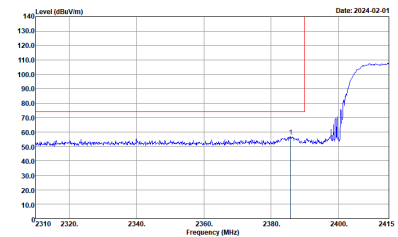
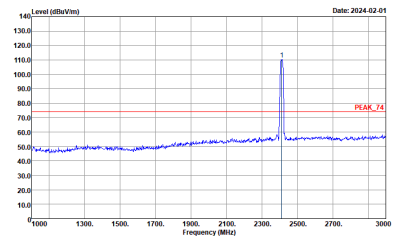
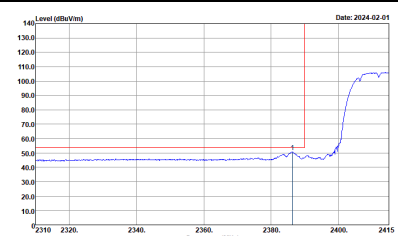
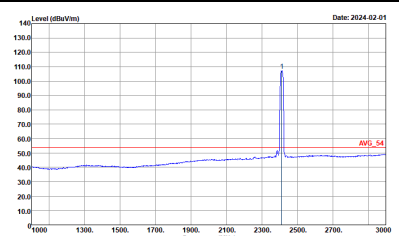
Note symbol

-L	Low channel location
-R	High channel location



WLAN (2.4GHz) 802.11b_Tx_CH01 + WLAN (5GHz) 802.11be EHT80_Tx_CH58 + WLAN (6GHz) 802.11be EHT20 OFDMA RU52*4_Tx_CH233 Link

WLAN (2.4GHz) 802.11b_Tx_CH01 (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH 01 2412MHz	
A+B+C+D	Horizontal	Fundamental
Peak	 <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>	 <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>
Avg.	 <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWTA:Auto</p>	 <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWTA:Auto</p>



WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH 01 2412MHz	
A+B+C+D	Vertical	Fundamental
Peak	<p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	<p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>
Avg.	<p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto</p>	<p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto</p>



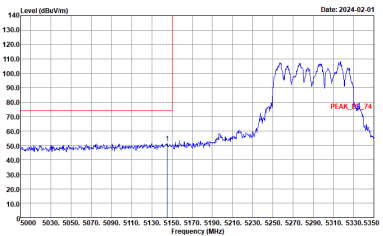
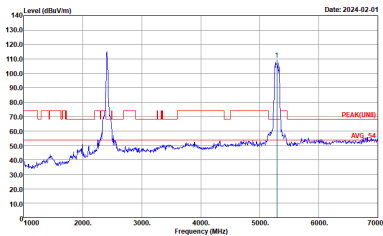
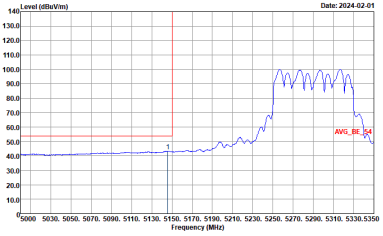
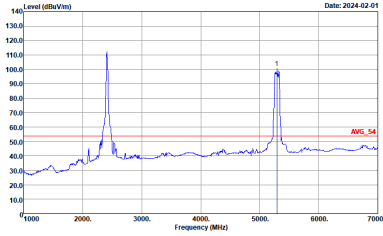
WLAN (5GHz) 802.11be EHT80_Tx_CH58 (Band Edge @ 3m)

WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11be EHT80 CH 58 5290MHz - L	
1+2+3+4	Horizontal	Fundamental
Peak	<p>Date: 2024-02-01</p> <p>Site : 03CH07-HY Condition : PEAK_BE_24 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz; VBW:3000.000kHz; SWTA:Auto</p>	<p>Date: 2024-02-01</p> <p>Site : 03CH07-HY Condition : PEAK(LN11) 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz; VBW:3000.000kHz; SWTA:Auto</p>
Avg.	<p>Date: 2024-02-01</p> <p>Site : 03CH07-HY Condition : AVG_BE_24 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz; VBW:3.000kHz; SWTA:Auto</p>	<p>Date: 2024-02-01</p> <p>Site : 03CH07-HY Condition : AVG_24 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz; VBW:3.000kHz; SWTA:Auto</p>



WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11be EHT80 CH 58 5290MHz - L	
1+2+3+4	Horizontal	Fundamental
<p style="text-align: center;">Peak</p>		<p style="text-align: center;">Left blank</p>
<p style="text-align: center;">Avg.</p>		<p style="text-align: center;">Left blank</p>



WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11be EHT80 CH 58 5290MHz - L	
1+2+3+4	Vertical	Fundamental
Peak	 <p>Site : 03CH07-HY Condition : PEAK_BE_76 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>	 <p>Site : 03CH07-HY Condition : PEAK(FUN)1 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>
Avg.	 <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>	 <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>



WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11be EHT80 CH 58 5290MHz - R	
1+2+3+4	Vertical	Fundamental
Peak	<p>Site : 03CH07-HY Condition : PEAK_BE_76 3m HF_ANT_00075962 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWTA:Auto</p>	Left blank
Avg.	<p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWTA:Auto</p>	Left blank



WLAN (6GHz) 802.11be EHT20 OFDMA RU52*4_Tx_CH233 (Band Edge @ 3m)

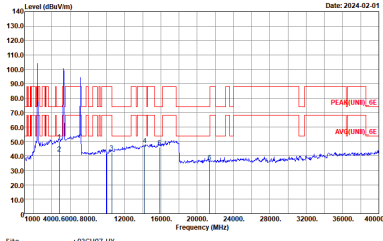
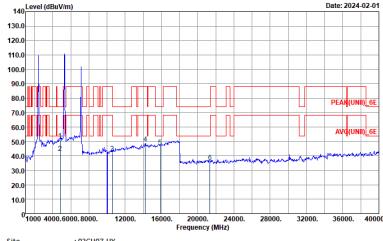
WIFI	Band 8 6875~7125MHz Band Edge @ 3m	
ANT	802.11be EHT20 OFDMA RU52*4 CH 233 7115MHz	
5+6+7+8	Horizontal	Fundamental
Peak	<p>Level (dBm/100MHz) vs Frequency (MHz) plot for Horizontal. The plot shows a sharp peak at 7115 MHz reaching approximately 130 dBm/100MHz. A red horizontal line indicates the peak level at approximately 90 dBm/100MHz. The x-axis ranges from 7155 to 7245 MHz, and the y-axis ranges from 10.0 to 140.0 dBm/100MHz.</p> <p>Site : 03CH07-HY Condition : PEAK_BE(LINM)_E 3m HF_ANT_00075963 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	<p>Level (dBm/100MHz) vs Frequency (MHz) plot for Fundamental. The plot shows a complex signal with multiple peaks between 1000 and 7200 MHz. A red horizontal line indicates the peak level at approximately 90 dBm/100MHz. The x-axis ranges from 1000 to 7200 MHz, and the y-axis ranges from 10.0 to 140.0 dBm/100MHz.</p> <p>Site : 03CH07-HY Condition : PEAK(LINM)_E 3m HF_ANT_00075963 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>
Avg.	<p>Level (dBm/100MHz) vs Frequency (MHz) plot for Horizontal. The plot shows a sharp peak at 7115 MHz reaching approximately 130 dBm/100MHz. A red horizontal line indicates the average level at approximately 70 dBm/100MHz. The x-axis ranges from 7155 to 7245 MHz, and the y-axis ranges from 10.0 to 140.0 dBm/100MHz.</p> <p>Site : 03CH07-HY Condition : AVG_BE(LINM)_E 3m HF_ANT_00075963 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	<p>Level (dBm/100MHz) vs Frequency (MHz) plot for Fundamental. The plot shows a complex signal with multiple peaks between 1000 and 7200 MHz. A red horizontal line indicates the average level at approximately 70 dBm/100MHz. The x-axis ranges from 1000 to 7200 MHz, and the y-axis ranges from 10.0 to 140.0 dBm/100MHz.</p> <p>Site : 03CH07-HY Condition : AVG(LINM)_E 3m HF_ANT_00075963 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>



WIFI	Band 8 6875~7125MHz Band Edge @ 3m	
ANT	802.11be EHT20 OFDMA RU52*4 CH 233 7115MHz	
5+6+7+8	Vertical	Fundamental
Peak	<p>Site : 03CH07-HY Condition : PEAK_BE(UNID)_E 3m HF_ANT_000759Q2 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>	<p>Site : 03CH07-HY Condition : PEAK(UNID)_E 3m HF_ANT_000759Q2 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>
Avg.	<p>Site : 03CH07-HY Condition : AVG_BE(UNID)_E 3m HF_ANT_000759Q2 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>	<p>Site : 03CH07-HY Condition : AVG(UNID)_E 3m HF_ANT_000759Q2 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>



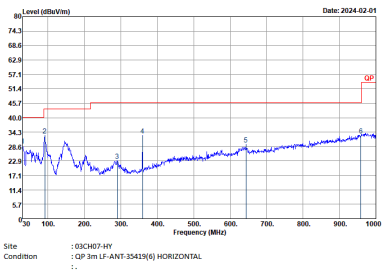
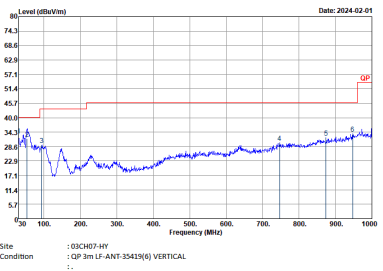
WLAN (2.4GHz) 802.11b_Tx_CH01 + WLAN (5GHz) 802.11be EHT80_Tx_CH58 + WLAN (6GHz) 802.11be EHT20 OFDMA RU52*4_Tx_CH233 (Harmonic @ 3m)

WIFI	11b_CH01+11be(80)_Ch58+11be(20)_Ch233	
ANT	Harmonic	
Simultaneously	Horizontal	Vertical
<p>Peak Avg.</p>	 <p>Date: 2024-02-01</p> <p>Site : 03CH07-HY Condition : PEAK[UNII]_6E 1m SHF_EHF_9170231 HORIZONTAL ..</p>	 <p>Date: 2024-02-01</p> <p>Site : 03CH07-HY Condition : PEAK[UNII]_6E 1m SHF_EHF_9170231 VERTICAL ..</p>



Emission below 1GHz

WLAN (2.4GHz) 802.11b_Tx_CH01 + WLAN (5GHz) 802.11be EHT80_Tx_CH58 + WLAN (6GHz)
802.11be EHT20 OFDMA RU52*4_Tx_CH233
(LF @ 3m)

WIFI	11b_CH01+11be(80)_Ch58+11be(20)_Ch233	
ANT	LF	
Simultaneously	Horizontal	Vertical
QP / Peak		

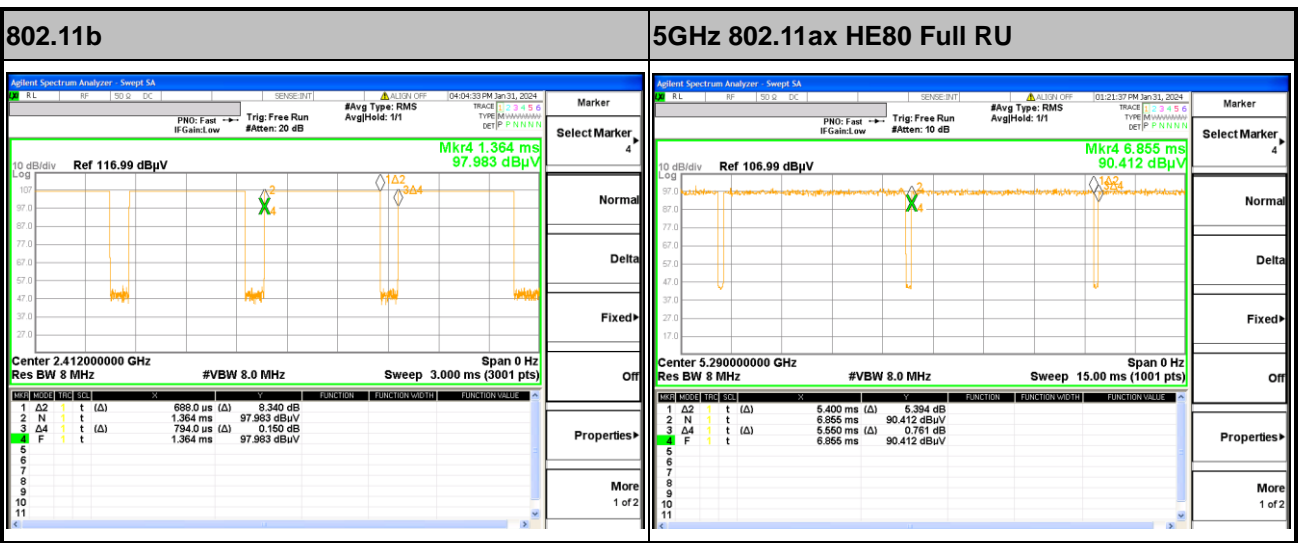


Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
A+B+C+D	802.11b	86.65	688	1.45	3kHz
1+2+3+4	5GHz 802.11ax HE80 Full RU	97.30	5400	0.19	200Hz
5+6+7+8	6GHz 802.11ax HE20 52 RU	90.84	5205	0.19	200Hz

MIMO <Ant. A+B+C+D >

MIMO <Ant. 1+2+3+4 >



MIMO <Ant. 5+6+7+8 >

