FCC CO-LOCATION RADIO TEST REPORT

FCC ID	:	**A4RGR83Y**
Equipment	:	**Phone**
Model Name	:	**GR83Y**
Applicant	:	**Google LLC** **1600 Amphitheatre Parkway,** **Mountain View, California, 94043 USA**
Standard	:	**FCC Part 15 Subpart E §15.407**

The product was received on Dec. 20, 2023 and testing was performed from Jan. 19, 2024 to Feb. 20, 2024. 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 from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory
No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issue Date
FR3N2325G	01	Initial issue of report	Apr. 08, 2024
FR3N2325G	02	Revise Antenna information, Appendix A and Appendix B This report is an updated version, replacing the report issued on Apr. 08, 2024.	May 06, 2024
FR3N2325G	03	Revise Antenna information This report is an updated version, replacing the report issued on May 06, 2024.	May 09, 2024

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	6.14 dB under the limit at 4874.00 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: William Chen

Report Producer: Clio Lo

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature
General Specs GSM/WCDMA/LTE/5G NR, Bluetooth, BLE, BLE channel sounding, Thread, Wi-Fi 802.11be, UWB, NFC, WPT, NTN and GNSS. **Antenna Type** WLAN: **<Ant. 3>:** IFA Antenna **<Ant. 4>:** ILA Antenna Bluetooth: **<Ant. 3>:** IFA Antenna **<Ant. 4>:** ILA Antenna

EUT Information List	
S/N	**Performed Test Item**
3B131FDAP0007E 41051FDAP0001T	Radiated Spurious Emission

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	Ant.3: -0.10 Ant.4: -0.30
5150 MHz ~ 5250 MHz	Peak Gain (dBi)	Ant. 3: -2.20 Ant. 4: -7.00
5925 MHz ~ 6425 MHz	Peak Gain (dBi)	Ant. 3: -3.20 Ant. 4: -3.70

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. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH16-HY

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

FCC designation No.: TW3786

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 E
- FCC Part 15 Subpart C §15.247
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- 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.

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 antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape) and accessory (Adapter or Earphone), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures.

2.1 Carrier Frequency and Channel

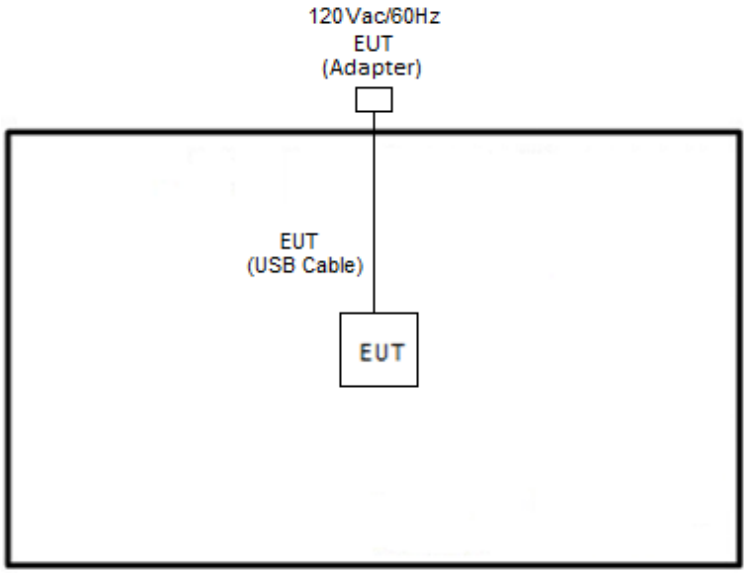
2400-2483.5 MHz			
Bluetooth – LE 2Mbps		802.11be EHT20	
Channel	Channel	Channel	Freq. (MHz)
39	2480	06	2437

5150-5250 MHz		5925-6425 MHz	
802.11be EHT20		802.11be EHT20	
Channel	Freq. (MHz)	Channel	Freq. (MHz)
36	5180	01	5955

<Co-Location>

Modulation	Data Rate	Worst Plane
2.4GHz 802.11be EHT20 for MIMO <Ant. 3+4> + 5GHz 802.11be EHT20 for MIMO <Ant. 3+4>	6 Mbps + 6 Mbps	Z Plane with Adapter
2.4GHz 802.11be EHT20 for MIMO <Ant. 3+4> + 6GHz 802.11be EHT20 for MIMO <Ant. 3+4>	6 Mbps + 6 Mbps	X Plane with Adapter
Bluetooth – LE for <Ant. 3+4> + 5GHz 802.11be EHT20 for MIMO < Ant. 3+4>	GFSK + 6 Mbps	Z Plane with Adapter

2.2 Connection Diagram of Test System



2.3 EUT Operation Test Setup

The RF test items, utility “RF Compliance v1.2_11-29-23” 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 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

<For 2402 MHz ~ 2480 MHz>

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.

<For 5150 MHz ~ 5250 MHz>

For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.

<For 5925 MHz ~ 6425 MHz>

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

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.

$$E=\frac{1000000\sqrt{30P}}{3}$$ μV/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

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 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 ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

   (3) Procedures for Average Unwanted Emissions Measurements Above 1000 MHz

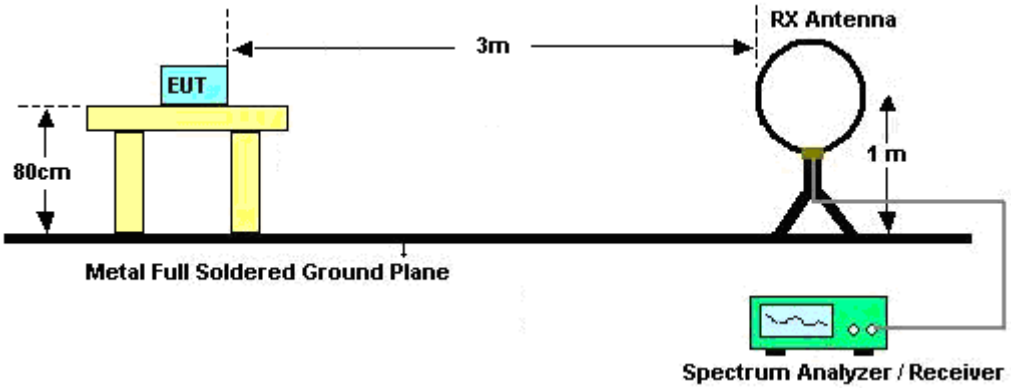
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

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 "-".

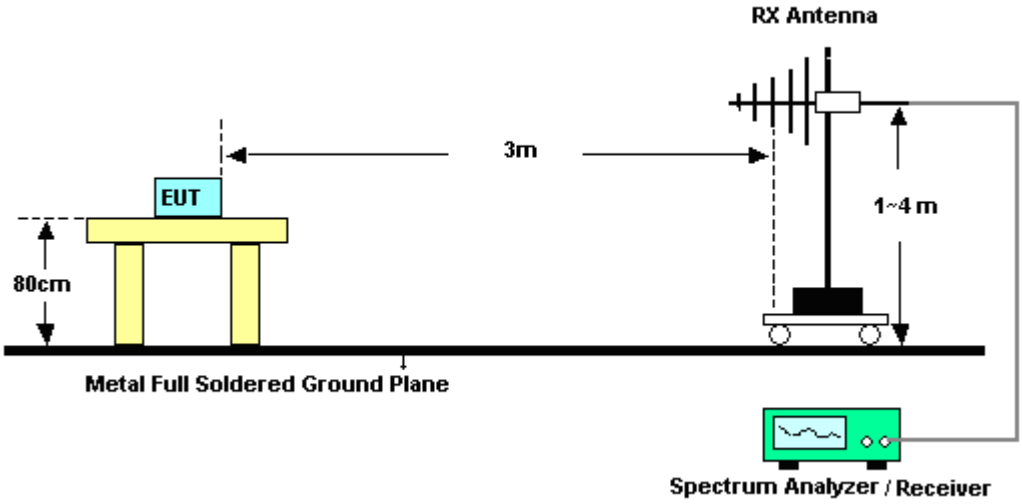
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".

3.1.4 Test Setup

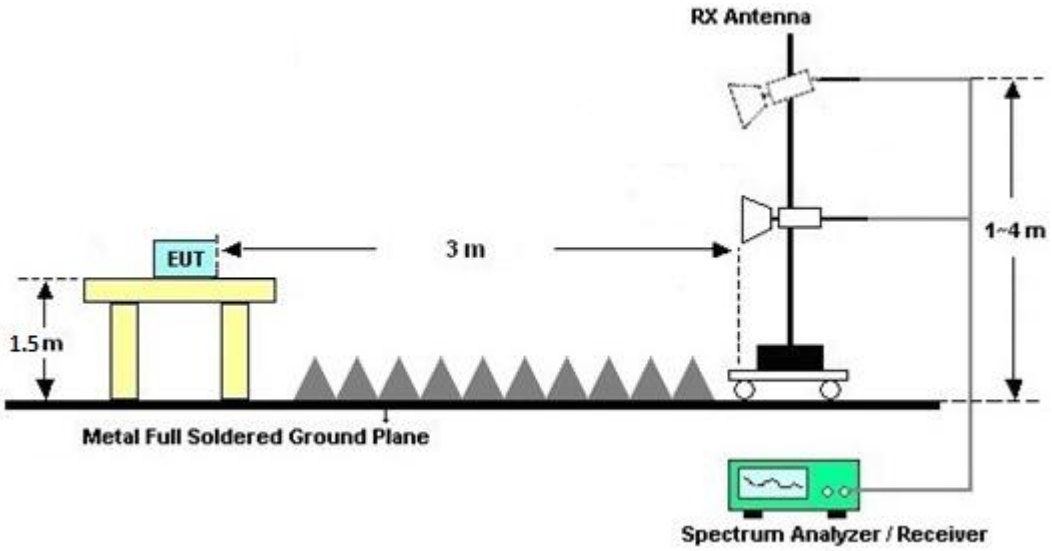
For radiated emissions below 30MHz



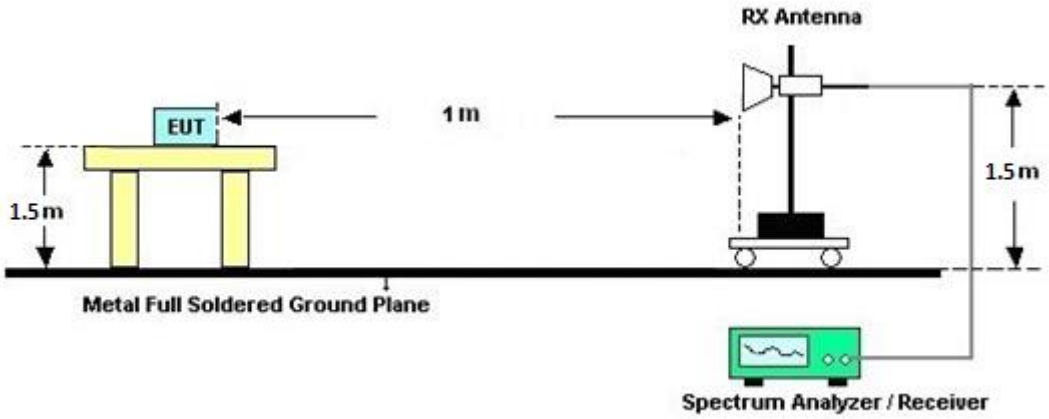
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



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

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 came out very similar.

3.1.6 Duty Cycle

Please refer to Appendix C.

3.1.7 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

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
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 12, 2023	Jan. 19, 2024~ Feb. 20, 2024	Sep. 11, 2024	Radiation (03CH16-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	1224	18GHz-40GHz	Jul. 10, 2023	Jan. 19, 2024~ Feb. 20, 2024	Jul. 09, 2024	Radiation (03CH16-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY57290111	3Hz~26.5GHz	Dec. 04, 2023	Jan. 19, 2024~ Feb. 20, 2024	Dec. 03, 2024	Radiation (03CH16-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00802N1D01N -06	47020 & 06	30MHz to 1GHz	Oct. 07, 2023	Jan. 19, 2024~ Feb. 20, 2024	Oct. 06, 2024	Radiation (03CH16-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1522	1G~18GHz	Mar. 23, 2023	Jan. 19, 2024~ Feb. 20, 2024	Mar. 22, 2024	Radiation (03CH16-HY)
Amplifier	SONOMA	310N	371607	9kHz~1GHz	Jul. 03, 2023	Jan. 19, 2024~ Feb. 20, 2024	Jul. 02, 2024	Radiation (03CH16-HY)
Preamplifier	Keysight	83017A	MY53270264	1GHz~26.5GHz	Dec. 07, 2023	Jan. 19, 2024~ Feb. 20, 2024	Dec. 06, 2024	Radiation (03CH16-HY)
Preamplifier	EMEC	EM1G18G	060812	1GHz~18GHz	Dec. 25, 2023	Jan. 19, 2024~ Feb. 20, 2024	Dec. 24, 2024	Radiation (03CH16-HY)
Preamplifier	EMEC	EM18G40G	060801	18GHz~40GHz	Jun. 27, 2023	Jan. 19, 2024~ Feb. 20, 2024	Jun. 26, 2024	Radiation (03CH16-HY)
Filter	Wainwright	WLK4-1000-1530-8000-40SS	SN17	1.53GHz Low Pass Filter	Jan. 15, 2024	Jan. 19, 2024~ Feb. 20, 2024	Jan. 14, 2025	Radiation (03CH16-HY)
Filter	Wainwright	WHKX8-5872.5-6750-18000-40ST	SN27	6.75GHz High Pass Filter	Nov. 13, 2023	Jan. 19, 2024~ Feb. 20, 2024	Nov. 12, 2024	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803951/2	9K~30M	Mar. 07, 2023	Jan. 19, 2024~ Feb. 20, 2024	Mar. 06, 2024	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102/SUCOFLEX 104	EC-A5-300-5757,805935/4,802434/4	30MHz~18GHz	Aug. 08, 2023	Jan. 19, 2024~ Feb. 20, 2024	Aug. 07, 2024	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	804011/2,804012/2	18-40GHz	Jan. 02, 2024	Jan. 19, 2024~ Feb. 20, 2024	Jan. 01, 2025	Radiation (03CH16-HY)
Software	Audix	E3 6.2009-8-24	RK-001136	N/A	N/A	Jan. 19, 2024~ Feb. 20, 2024	N/A	Radiation (03CH16-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Jan. 19, 2024~ Feb. 20, 2024	N/A	Radiation (03CH16-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Jan. 19, 2024~ Feb. 20, 2024	N/A	Radiation (03CH16-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Jan. 19, 2024~ Feb. 20, 2024	N/A	Radiation (03CH16-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))	**6.50 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.50 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.50 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.50 dB**

Appendix A. Radiated Spurious Emission

Test Engineer :	Jack Tsai, Gary Guo and Steven Wu	Temperature :	18.2~20.2°C
		Relative Humidity :	54.2~56.1%

2.4GHz 2400~2483.5MHz

WLAN (2.4GHz) 802.11be EHT20_Tx_Ch06 + WLAN (5GHz) 802.11be EHT20_Tx_Ch36

(Harmonic @ 3m)

WIFI Ant.	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
3+4		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11be EHT20_Tx_Ch06 + 802.11be EHT20_Tx_Ch36	*	2437	115.07	-	-	99.49	27.6	17.88	29.9	-	-	P	H
		4874	55.77	-18.23	74	41.26	32.65	11.3	29.44	100	61	P	H
		4874	47.37	-6.63	54	32.86	32.65	11.3	29.44	100	61	A	H
	*	5180	105.57	-	-	90.12	33	11.84	29.39	-	-	P	H
		7311	48.82	-25.18	74	63.13	36.88	14.26	65.45	290	351	P	H
		7311	37.54	-16.46	54	51.85	36.88	14.26	65.45	290	351	A	H
		10360	46.15	-22.05	68.2	57.42	38.7	16.56	66.53	-	-	P	H
		15540	46.95	-27.05	74	55.39	37.54	20.36	66.34	-	-	P	H
		39173.5	47.72	-26.28	74	59.77	45.1	-0.45	56.7	-	-	P	H
													H
	*	2437	114.36	-	-	98.78	27.6	17.88	29.9	-	-	P	V
		4874	56.86	-17.14	74	42.35	32.65	11.3	29.44	289	31	P	V
		4874	47.86	-6.14	54	33.35	32.65	11.3	29.44	289	31	A	V
	*	5180	105.51	-	-	90.06	33	11.84	29.39	-	-	P	V
		7311	49.21	-24.79	74	63.52	36.88	14.26	65.45	100	241	P	V
		7311	37.49	-16.51	54	51.8	36.88	14.26	65.45	100	241	A	V
		10360	46.22	-21.98	68.2	57.49	38.7	16.56	66.53	-	-	P	V
		15540	46.45	-27.55	74	54.89	37.54	20.36	66.34	-	-	P	V
		39202.5	47.37	-26.63	74	59.4	45.09	-0.44	56.68	-	-	P	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.

Band 1 - 5150~5250MHz

Bluetooth-LE_Tx_Ch39 + WLAN (5GHz) 802.11be EHT20_Tx_Ch36 (Harmonic @ 3m)

WIFI	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
3+4		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Bluetooth-LE_Tx_Ch39 + 802.11be EHT20_Tx_Ch36	*	2480	95.06	-	-	89.28	27.7	7.97	29.89	-	-	P	H
		4960	55.85	-18.15	74	40.85	32.88	11.54	29.42	396	113	P	H
		4960	47.28	-6.72	54	32.28	32.88	11.54	29.42	396	113	A	H
	*	5180	106.58	-	-	91.13	33	11.84	29.39	-	-	P	H
		7440	44.24	-29.76	74	58.84	36.44	14.43	65.47	-	-	P	H
		10360	47.9	-20.3	68.2	59.17	38.7	16.56	66.53	-	-	P	H
		15540	47.06	-26.94	74	55.5	37.54	20.36	66.34	387	35	P	H
		15540	36.9	-17.1	54	45.34	37.54	20.36	66.34	387	35	A	H
		38840	47.13	-26.87	74	60.07	44.46	-0.5	56.9	-	-	P	H
													H
													H
													H
	*	2480	94.5	-	-	88.72	27.7	7.97	29.89	-	-	P	V
		4960	56.54	-17.46	74	41.54	32.88	11.54	29.42	312	304	P	V
		4960	47.23	-6.77	54	32.23	32.88	11.54	29.42	312	304	A	V
	*	5180	108.75	-	-	93.3	33	11.84	29.39	-	-	P	V
		7440	43.94	-30.06	74	58.54	36.44	14.43	65.47	-	-	P	V
		10360	46.91	-21.29	68.2	58.18	38.7	16.56	66.53	-	-	P	V
		15540	47.26	-26.74	74	55.7	37.54	20.36	66.34	398	92	P	V
		15540	37.23	-16.77	54	45.67	37.54	20.36	66.34	398	92	A	V
		39434.5	48.04	-25.96	74	59.15	45.77	-0.5	56.54	-	-	P	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.

Band 5 5925~6425MHz

WLAN (2.4GHz) 802.11be EHT20_Tx_Ch06 + WLAN (6GHz) 802.11be EHT20_Tx_Ch01

(Harmonic @ 3m)

WIFI Ant.	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
3+4		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11be EHT20_Tx_Ch06 + 802.11be EHT20_Tx_Ch01	*	2437	114.11	-	-	98.76	27.6	17.65	29.9	-	-	P	H
		4874	56.27	-17.73	74	41.76	32.65	11.3	29.44	119	58	P	H
		4874	43.27	-10.73	54	28.76	32.65	11.3	29.44	119	58	A	H
	*	5955	112.83	-	-	95.23	34.18	12.86	29.44	-	-	P	H
		7311	45.11	-28.89	74	59.42	36.88	14.26	65.45	-	-	P	H
		11910	47.39	-26.61	74	56.84	38.72	17.81	65.98	-	-	P	H
		17865	51.85	-22.15	74	53.4	41.31	22.24	65.1	301	57	P	H
		17865	41.95	-12.05	54	43.5	41.31	22.24	65.1	301	57	A	H
		39913	48.73	-25.27	74	60.4	44.55	-0.22	56	-	-	P	H
													H
													H
													H
	*	2437	109.35	-	-	94	27.6	17.65	29.9	-	-	P	V
		4874	56.83	-17.17	74	42.32	32.65	11.3	29.44	372	190	P	V
		4874	43.19	-10.81	54	28.68	32.65	11.3	29.44	372	190	A	V
	*	5955	109.93	-	-	92.33	34.18	12.86	29.44	-	-	P	V
		7311	46.1	-27.9	74	60.41	36.88	14.26	65.45	-	-	P	V
		11910	46.51	-27.49	74	55.96	38.72	17.81	65.98	-	-	P	V
		17865	52.28	-21.72	74	53.83	41.31	22.24	65.1	113	226	P	V
		17865	41.92	-12.08	54	43.47	41.31	22.24	65.1	113	226	A	V
		39797	48.29	-25.71	74	60.35	44.32	-0.24	56.14	-	-	P	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.

Emission below 1GHz

WLAN (2.4GHz) 802.11be EHT20_Tx_Ch06 + WLAN (5GHz) 802.11be EHT20_Tx_Ch36

(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.
3+4		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11be EHT20_Tx_Ch06 + 802.11be EHT20_Tx_Ch36		30	21.83	-18.17	40	29.12	24.4	0.75	32.44	-	-	P	H
		94.8	36.79	-6.71	43.5	52.6	15.23	1.38	32.42	-	-	P	H
		181.2	32.34	-11.16	43.5	47.71	15.03	1.94	32.34	-	-	P	H
		475.7	24.95	-21.05	46	30.82	23.51	3.23	32.61	-	-	P	H
		650	28.61	-17.39	46	30.95	26.32	3.94	32.6	-	-	P	H
		935.6	33.51	-12.49	46	30.13	30.23	4.79	31.64	-	-	P	H
													H
													H
													H
													H
													H
													H
		35.13	24.54	-15.46	40	34.08	22.11	0.81	32.46	-	-	P	V
		92.64	30.59	-12.91	43.5	46.7	14.95	1.35	32.41	-	-	P	V
		180.93	28.44	-15.06	43.5	43.81	15.03	1.94	32.34	-	-	P	V
		465.9	24.55	-21.45	46	30.54	23.37	3.21	32.57	-	-	P	V
		699.7	30.15	-15.85	46	32.25	26.51	4.15	32.76	-	-	P	V
		922.3	33.34	-12.66	46	30.64	29.73	4.72	31.75	-	-	P	V
													V
													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 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 **Margin** 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:

WIFI	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
3+4		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 169 5845MHz		5945	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		5945	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/m)

For Peak Limit @ 5945MHz:

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 @ 5945MHz:

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)

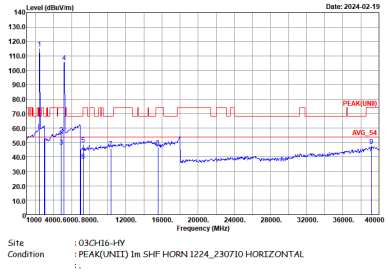
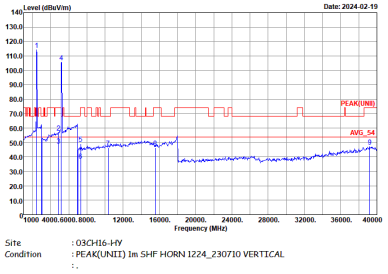
Both peak and average measured complies with the limit line, so test result is "PASS".

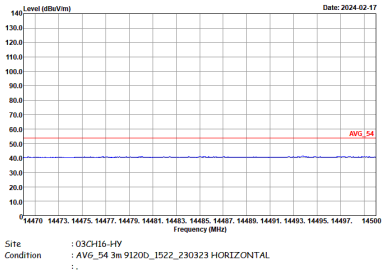
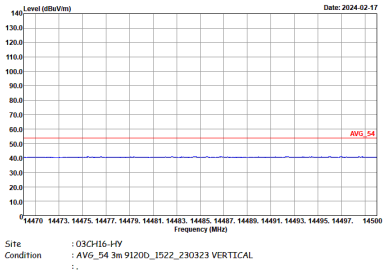
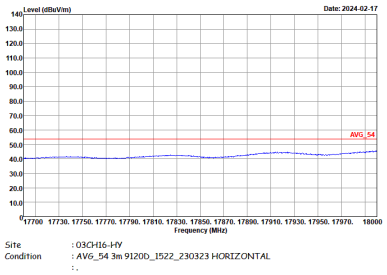
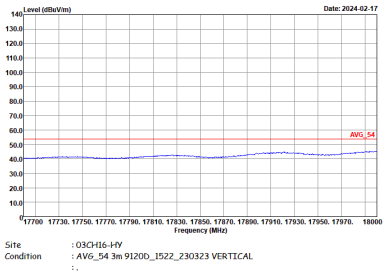
Appendix B. Radiated Spurious Emission Plots

Test Engineer :	Jack Tsai, Gary Guo and Steven Wu	Temperature :	18.2~20.2°C
		Relative Humidity :	54.2~56.1%

2.4GHz 2400~2483.5MHz

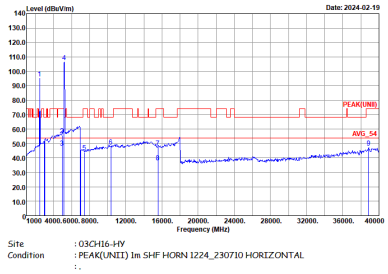
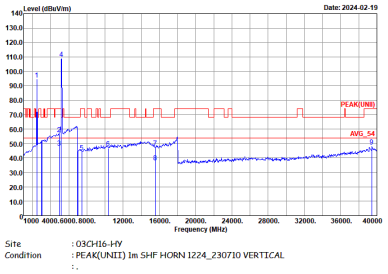
WLAN (2.4GHz) 802.11be EHT20_Tx_Ch06 + WLAN (5GHz) 802.11be EHT20_Tx_Ch36 (Harmonic @ 3m)

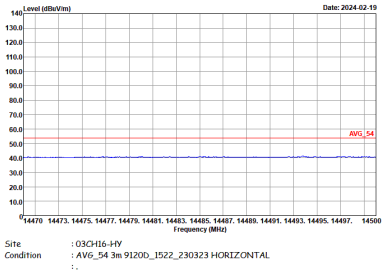
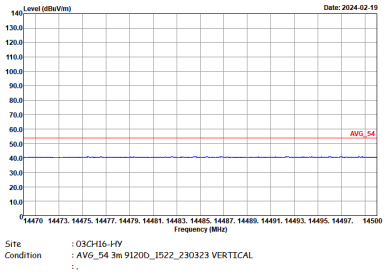
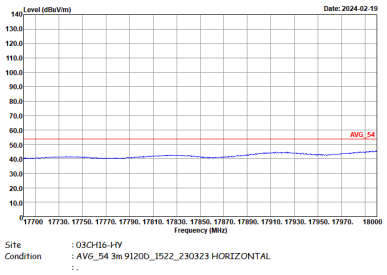
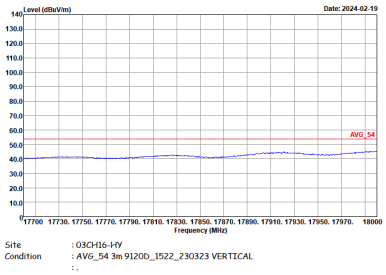
WIFI	802.11be EHT20_Tx_Ch06 + 802.11be EHT20_Tx_Ch36 Harmonic @ 3m	
ANT	802.11be EHT20_Tx_Ch06 + 802.11be EHT20_Tx_Ch36	
3+4	Horizontal	Vertical
Peak Avg.		

WIFI	802.11be EHT20_Tx_Ch06 + 802.11be EHT20_Tx_Ch36 Harmonic @ 3m	
ANT	802.11be EHT20_Tx_Ch06 + 802.11be EHT20_Tx_Ch36	
3+4	Horizontal	Vertical
14.47G ~14.5G Avg.		
17.7G ~18G Avg		

Band 1 - 5150~5250MHz

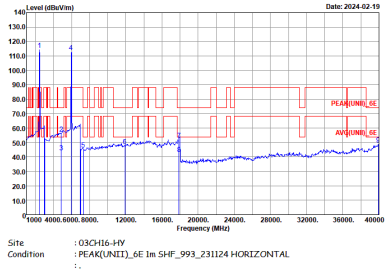
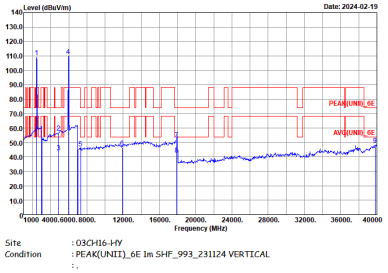
Bluetooth-LE_Tx_Ch39 + WLAN (5GHz) 802.11be EHT20_Tx_Ch36 (Harmonic @ 3m)

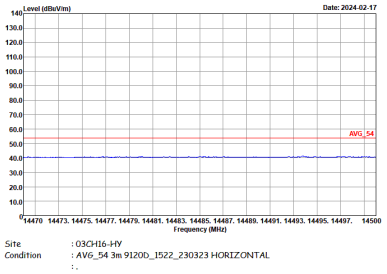
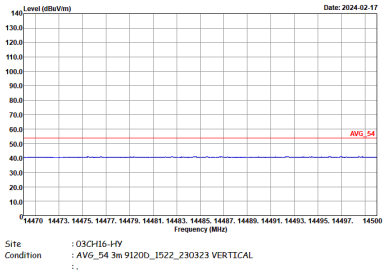
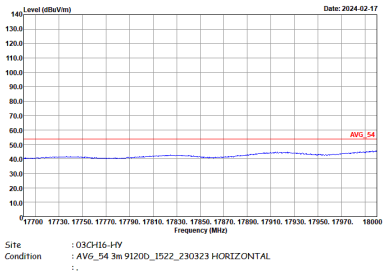
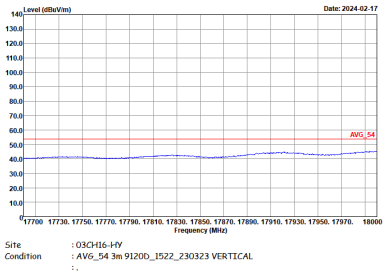
WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	Bluetooth-LE_Tx_Ch39 + 802.11be EHT20_Tx_Ch36	
3+4	Horizontal	Vertical
Peak Avg.		

WIFI	Bluetooth-LE_Tx_Ch39 + 802.11be EHT20_Tx_Ch36 Harmonic @ 3m	
ANT	Bluetooth-LE_Tx_Ch39 + 802.11be EHT20_Tx_Ch36	
3+4	Horizontal	Vertical
14.47G ~14.5G Avg.		
17.7G ~18G Avg		

Band 5 5925~6425MHz

WLAN (2.4GHz) 802.11be EHT20_Tx_Ch06 + WLAN (6GHz) 802.11be EHT20_Tx_Ch01 (Harmonic @ 3m)

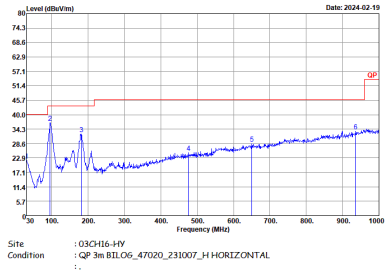
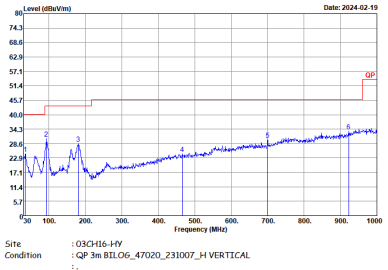
WIFI	Band 5 5925~6425MHz Harmonic @ 3m	
ANT	802.11be EHT20_Tx_Ch06 + 802.11be EHT20_Tx_Ch01	
3+4	Horizontal	Vertical
Peak Avg.		

WIFI	802.11be EHT20_Tx_Ch06 + 802.11be EHT20_Tx_Ch01 Harmonic @ 3m	
ANT	802.11be EHT20_Tx_Ch06 + 802.11be EHT20_Tx_Ch01	
3+4	Horizontal	Vertical
14.47G ~14.5G Avg.		
17.7G ~18G Avg		

Emission below 1GHz

WLAN (2.4GHz) 802.11be EHT20_Tx_Ch06 + WLAN (5GHz) 802.11be EHT20_Tx_Ch36

(LF @ 3m)

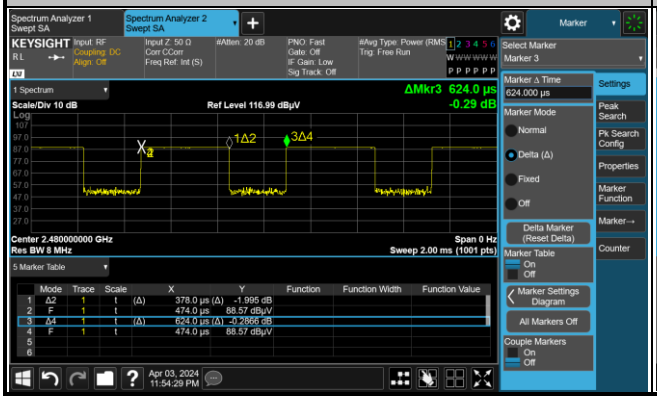
WIFI	2.4GHz 2400~2483.5MHz	
ANT	802.11be EHT20_Tx_Ch06 + 802.11be EHT20_Tx_Ch36	
3+4	Horizontal	Vertical
QP / Peak		

Appendix C. Duty Cycle Plots

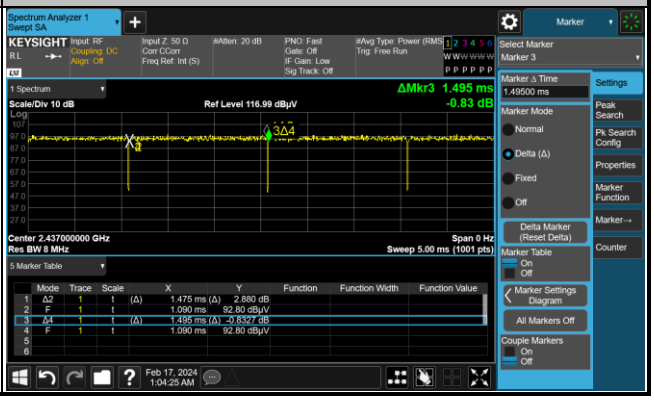
Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
3+4	Bluetooth - LE for 1Mbps	60.58	378	2.65	2.7KHz
3+4	2.4GHz 802.11be EHT20 Full RU	98.66	-	-	10Hz
3+4	5GHz 802.11be EHT20 Full RU	99.31	-	-	10Hz
3+4	6GHz 802.11be EHT20 Full RU	99.31	-	-	10Hz

MIMO <Ant. 3+4>

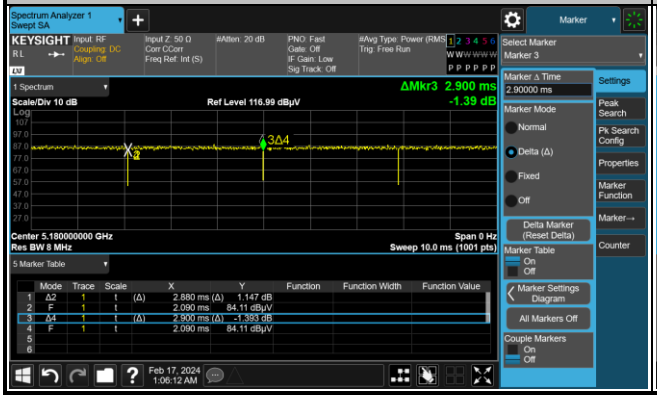
Bluetooth-LE for 1Mbps



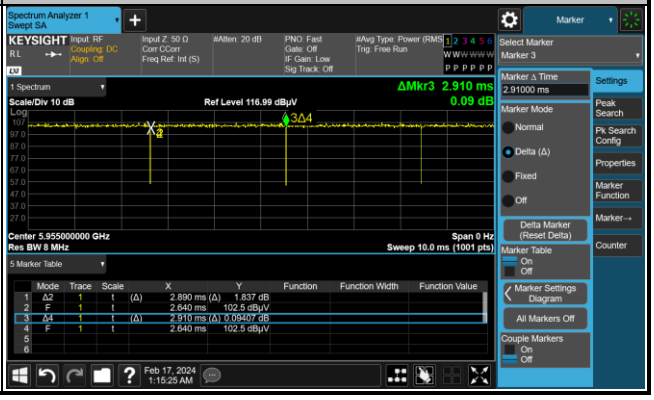
2.4GHz 802.11be EHT20 Full RU



5GHz 802.11be EHT20 Full RU



6GHz 802.11be EHT20 Full RU



———THE END———