

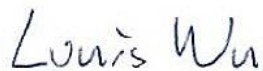


FCC CO-LOCATION RADIO TEST REPORT

FCC ID : A4RG1F8F
Equipment : Phone
Model Name : G1F8F
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. 11, 2020 and testing was started from Dec. 14, 2020 and completed on Feb. 09, 2021. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

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



Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory

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



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History of this test report

Report No.	Version	Description	Issued Date
FR093032-02G	01	Initial issue of report	Mar. 12, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.407(b)	Unwanted Emissions	Pass	Under limit 2.08 dB at 5150.00 MHz
3.2	15.203 15.407(a)	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 declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Ruby Zou



1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Phone
Model Name	G1F8F
FCC ID	A4RG1F8F
EUT supports Radios application	CDMA/EV-DO/GSM/EGPRS/WCDMA/HSPA/LTE/5G NR/ NFC/GNSS WLAN 11b/g/n HT20 WLAN 11a/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE

Remark: The above EUT's information was declared by manufacturer.

EUT Information List	
S/N	Performed Test Item
0C031FQCB00083 0C031FQCB00084	Radiated Spurious Emission

1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard			
Tx/Rx Channel Frequency Range	2400 MHz ~ 2483.5 MHz 5180 MHz ~ 5240 MHz 5500 MHz ~ 5720 MHz		
Antenna Type / Gain	<Bluetooth> IFA Antenna type with gain -4.7 dBi <2400 MHz ~ 2483.5 MHz> <Ant. 4> : IFA Antenna type with gain -4.7 dBi <Ant. 3> : IFA Antenna type with gain -2.0 dBi <5180 MHz ~ 5240 MHz> <Ant. 4> : IFA Antenna type with gain -1.5 dBi <Ant. 3> : IFA Antenna type with gain -3.0 dBi <5500 MHz ~ 5720 MHz> <Ant. 4> : IFA Antenna type with gain 0.0 dBi <Ant. 3> : IFA Antenna type with gain -1.3 dBi		
Type of Modulation	Bluetooth EDR (3Mbps) : 8-DPSK Bluetooth LE : GFSK 802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)		
Antenna Function for Transmitter		Ant. 4	Ant. 3
	802.11 b/a/ Bluetooth/ Bluetooth-LE	V	V
	802.11 a/n MIMO	V	V

Remark:

1. MIMO Ant. 4+3 is a calculated result from sum of the power MIMO Ant. 4 and MIMO Ant. 3.
2. The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.3 Modification of EUT

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

1.4 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. 03CH15-HY

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

FCC designation No.: TW0007

1.5 Applicable Standards

According to the specifications of 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 Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.
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). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X Plane for Bluetooth Ant. 4 + 802.11n HT40 MIMO Ant. 4+3; Y Plane for Bluetooth-LE Ant. 4 + 802.11a MIMO Ant. 4+3; Z Plane for 802.11b Ant. 4 + 802.11a Ant. 3) were recorded in this report.

2.1 Carrier Frequency and Channel

2400-2483.5 MHz Bluetooth EDR		2400-2483.5 MHz Bluetooth - LE		2400-2483.5 MHz 802.11b	
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
78	2480	39	2480	06	2437

5150-5250 MHz 802.11a		5470-5725 MHz 802.11n HT40	
Channel	Freq. (MHz)	Channel	Freq. (MHz)
36	5180	102	5510
48	5240	-	-

2.2 Test Mode

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

<Co-Location>

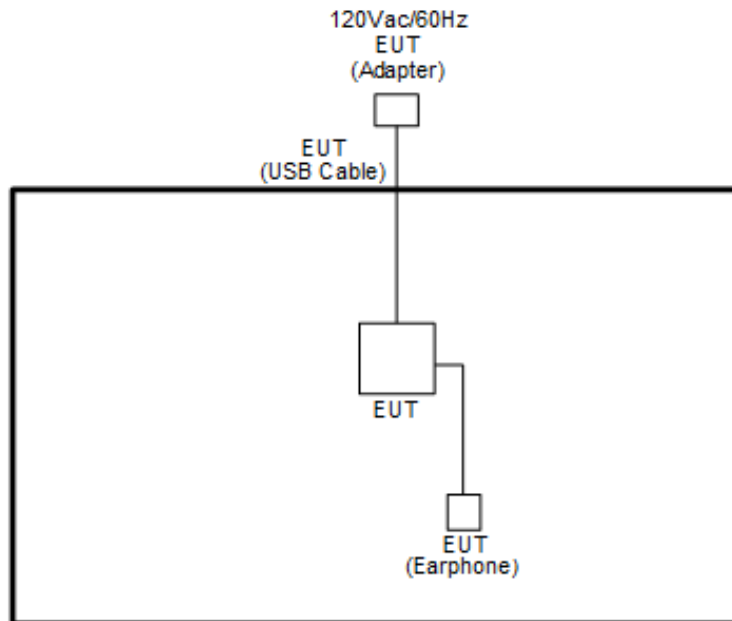
Modulation	Data Rate
Bluetooth EDR Ant. 4 + WLAN 5GHz 802.11n HT40 for MIMO <Ant. 4 + 3>	3Mbps + MCS0
Bluetooth LE Ant. 4 + WLAN 5GHz 802.11a for MIMO <Ant. 4 + 3>	1Mbps + 6Mbps
WLAN 2.4GHz 802.11b Ant. 4 + WLAN 5GHz 802.11a for Ant. 3	1Mbps + MCS0

Remark:

- For Radiated Test Cases, the tests were performed with Adapter 1 and USB Cable 1.
- BLE power has to reduce power level to 13.7 dBm for Co-Location mode.

2.3 Connection Diagram of Test System

<Co-Location Tx Mode>



2.4 EUT Operation Test Setup

The RF test items, utility "QRCT4.0.00158.0" 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.

<Limit of Unwanted Emissions>

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

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

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

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

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

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

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

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

3.1.1 Measuring Instruments

See list of measuring equipment of this test report.

3.1.2 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

<Method VB>

- 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.

<Method AD>

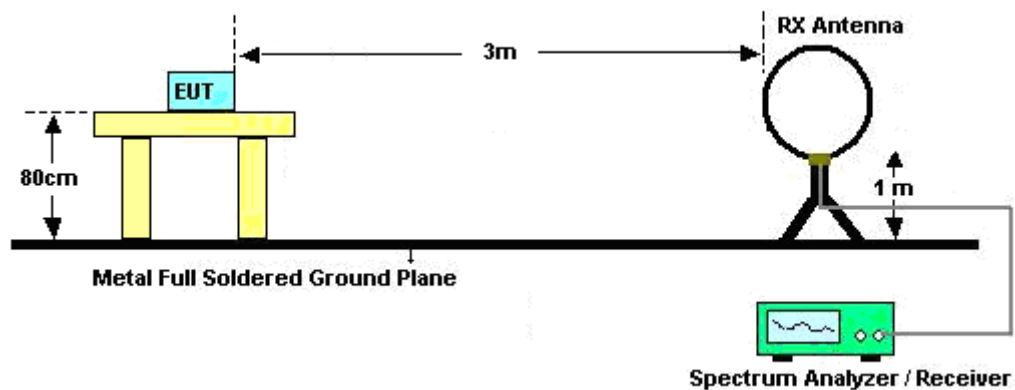
- RBW = 1 MHz
- VBW $\geq$ 3 MHz
- Detector = RMS
- Averaging type = PWR (RMS)
- Sweep time = auto
- Perform a trace average of at least 100 traces

2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.

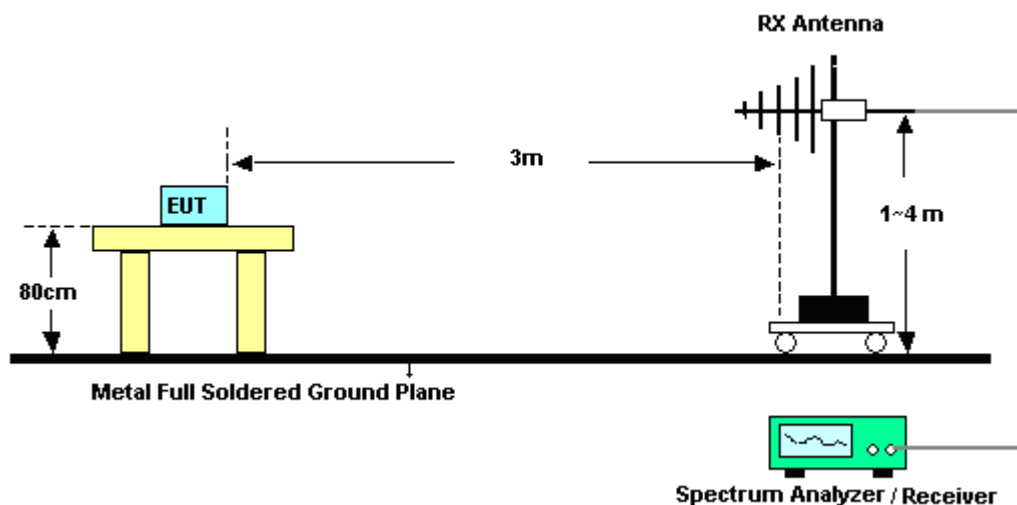
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.1.3 Test Setup

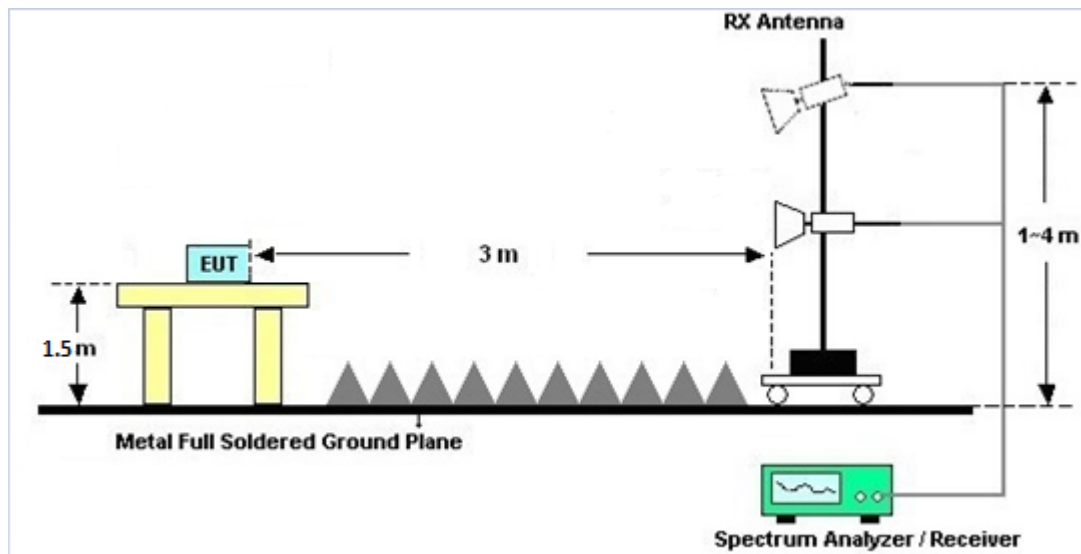
For radiated emissions below 30MHz



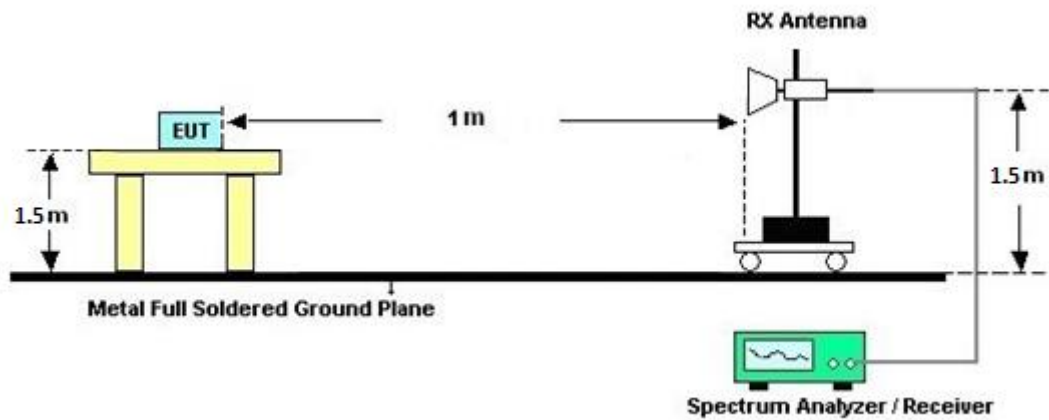
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



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

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data 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.

3.1.5 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

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

<Bluetooth-LE and WLAN 2.4GHz>

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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.

< WLAN 5GHz>

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

3.2.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.2.3 Antenna Gain

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



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Jul. 14, 2020	Dec. 25, 2020~ Jan. 19, 2021	Jul. 13, 2021	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01 N-06	41912 & 05	30MHz~1GHz	Feb. 09, 2020	Dec. 25, 2020~ Jan. 19, 2021	Feb. 08, 2021	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	187311	9kHz~1GHz	Oct. 21, 2020	Dec. 25, 2020~ Jan. 19, 2021	Oct. 20, 2021	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-016 20	1GHz~18GHz	Nov. 03, 2020	Dec. 25, 2020~ Feb. 09, 2021	Nov. 02, 2021	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170 251	18GHz~40GHz	Dec. 02, 2020	Dec. 25, 2020~ Feb. 09, 2021	Dec. 01, 2021	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA0118-55-3 03	171000180 0055006	1GHz~18GHz	May 07, 2020	Dec. 25, 2020~ Feb. 09, 2021	May 06, 2021	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY532701 95	1GHz~26.5GHz	Aug. 21, 2020	Dec. 25, 2020~ Feb. 09, 2021	Aug. 20, 2021	Radiation (03CH15-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Oct. 27, 2020	Dec. 25, 2020~ Feb. 09, 2021	Oct. 26, 2021	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY541300 85	20MHz~8.4GHz	Nov. 02, 2020	Dec. 25, 2020~ Jan. 19, 2021	Nov. 01, 2021	Radiation (03CH15-HY)
Spectrum Analyzer	Agilent	E4446A	MY501801 36	3Hz~44GHz	May 04, 2020	Dec. 25, 2020~ Feb. 09, 2021	May 03, 2021	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Dec. 25, 2020~ Feb. 09, 2021	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Dec. 25, 2020~ Feb. 09, 2021	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24(k 5)	RK-00045 1	N/A	N/A	Dec. 25, 2020~ Feb. 09, 2021	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104, 102E	MY36980/ 4, MY9838/4 PE,508405 /2E	30MHz~18G	Nov. 16, 2020	Dec. 25, 2020~ Feb. 09, 2021	Nov. 15, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz-40GHz	Feb. 25, 2020	Dec. 25, 2020~ Feb. 09, 2021	Feb. 24, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz-40GHz	Feb. 25, 2020	Dec. 25, 2020~ Feb. 09, 2021	Feb. 24, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4 PE	9kHz~30MHz	Mar. 12, 2020	Dec. 25, 2020~ Jan. 19, 2021	Mar. 11, 2021	Radiation (03CH15-HY)
Filter	Wainwright	WLJ4-1000-1 530-6000-40S T	SN4	1.53GHz Low Pass Filter	Jul. 03, 2020	Dec. 25, 2020~ Jan. 19, 2021	Jul. 02, 2021	Radiation (03CH15-HY)
Filter	Wainwright	WHKX8-5872. 5-6750-18000 -40ST	SN6	6.75GHz High Pass Filter	Jul. 01, 2020	Dec. 25, 2020~ Feb. 09, 2021	Jun. 30, 2021	Radiation (03CH15-HY)

5 Uncertainty of Evaluation

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.9
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Appendix A. Radiated Spurious Emission

Test Engineer :	Leo Lee, Mancy Chou and Bigshow Wang	Temperature :	20.1~26.1°C
		Relative Humidity :	46~65%

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

Ant 4_BT_Tx_Ch78 + Ant 4+3_11n HT40_Tx_Ch102_Co-location (Band Edge @ 3m)

Ant. 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)
BT CH78 2480MHz	*	2480	102.82	-	-	99.48	27.44	6.78	30.88	325	171	P	H
	*	2480	78.06	-	-	-	-	-	-	-	-	A	H
		2483.96	52.2	-21.8	74	48.86	27.43	6.79	30.88	325	171	P	H
		2483.96	27.44	-26.56	54	-	-	-	-	-	-	A	H
	*	2480	105.33	-	-	101.99	27.44	6.78	30.88	273	88	P	V
	*	2480	80.57	-	-	-	-	-	-	-	-	A	V
		2483.52	54.53	-19.47	74	51.19	27.43	6.79	30.88	273	88	P	V
		2483.52	29.77	-24.23	54	-	-	-	-	-	-	A	V
802.11n HT40 CH102 5510MHz		5452.87	54.91	-19.09	74	43.05	31.6	10.25	29.99	100	46	P	H
		5466.91	55.38	-12.82	68.2	43.5	31.6	10.27	29.99	100	46	P	H
		5458.81	45.91	-8.09	54	34.04	31.6	10.26	29.99	100	46	A	H
	*	5510	104.11	-	-	92.23	31.58	10.3	30	100	46	P	H
	*	5510	95.45	-	-	83.57	31.58	10.3	30	100	46	A	H
		5735.075	52.18	-16.02	68.2	40.04	31.77	10.53	30.16	100	46	P	H
		5455.3	54.36	-19.64	74	42.49	31.6	10.26	29.99	100	109	P	V
		5462.59	54.41	-13.79	68.2	42.54	31.6	10.26	29.99	100	109	P	V
		5457.73	46.17	-7.83	54	34.3	31.6	10.26	29.99	100	109	A	V
	*	5510	102.24	-	-	90.36	31.58	10.3	30	100	109	P	V
	*	5510	94.44	-	-	82.56	31.58	10.3	30	100	109	A	V
		5754.29	51.79	-16.41	68.2	39.61	31.8	10.55	30.17	100	109	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Ant 4_BT_Tx_Ch78 + Ant 4+3_11n HT40_Tx_Ch102_Co-location (Harmonic @ 3m)

Ant. 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)
Co-location		4960	51.75	-22.25	74	39.34	31.22	11.22	30.03	100	0	P	H
		4960	26.99	-27.01	54	-	-	-	-	-	-	A	H
		7440	44.69	-29.31	74	54.12	36.3	12.65	58.38	100	0	P	H
		7440	19.93	-34.07	54	-	-	-	-	-	-	A	H
		11020	49.89	-24.11	74	55.82	40.36	14.8	61.09	100	0	P	H
		16650	48.83	-19.37	68.2	50.84	39.25	18.05	59.31	100	0	P	H
		18000	60.64	-13.36	74	50.5	49	19.04	57.9	100	20	P	H
		18000	50.37	-3.63	54	40.23	49	19.04	57.9	100	20	A	H
		4960	51.31	-22.69	74	38.9	31.22	11.22	30.03	100	0	P	V
		4960	26.55	-27.45	54	-	-	-	-	-	-	A	V
		7440	44.49	-29.51	74	53.92	36.3	12.65	58.38	100	0	P	V
		4960	19.73	-34.27	54	-	-	-	-	-	-	A	V
		11020	49.93	-24.07	74	55.86	40.36	14.8	61.09	100	0	P	V
		16650	48.62	-19.58	68.2	50.63	39.25	18.05	59.31	100	0	P	V
		18000	61.54	-12.46	74	51.4	49	19.04	57.9	100	33	P	V
		18000	50.85	-3.15	54	40.71	49	19.04	57.9	100	33	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz + Band 1 - 5150~5250MHz

Ant 4_BLE_Tx_Ch39 + Ant. 4+3_11a_Tx_Ch36_Co-location (Band Edge @ 3m)

Ant. 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	*	2480	99.8	-	-	86.54	27.44	16.7	30.88	207	6	P	H
	*	2480	95.18	-	-	81.92	27.44	16.7	30.88	207	6	A	H
		2484.04	57.52	-16.48	74	44.26	27.43	16.71	30.88	207	6	P	H
		2484.28	47.72	-6.28	54	34.46	27.43	16.71	30.88	207	6	A	H
													H
													H
	*	2480	97.19	-	-	83.93	27.44	16.7	30.88	147	277	P	V
	*	2480	89.33	-	-	76.07	27.44	16.7	30.88	147	277	A	V
		2483.6	56.43	-17.57	74	43.17	27.43	16.71	30.88	147	277	P	V
		2483.84	44.94	-9.06	54	31.68	27.43	16.71	30.88	147	277	A	V
													V
													V
802.11a CH36 5180MHz		5149.5	62.37	-11.63	74	50.07	31.8	10.51	30.01	100	33	P	H
		5150	51.92	-2.08	54	39.62	31.8	10.51	30.01	100	33	P	H
	*	5180	108.67	-	-	96.49	31.62	10.57	30.01	100	33	A	H
	*	5180	100.2	-	-	88.02	31.62	10.57	30.01	100	33	P	H
													H
													H
		5149.24	64.17	-9.83	74	51.87	31.8	10.51	30.01	352	30	P	V
		5148.72	50.99	-3.01	54	38.69	31.8	10.51	30.01	352	30	P	V
	*	5180	109.24	-	-	97.06	31.62	10.57	30.01	352	30	A	V
	*	5180	100.73	-	-	88.55	31.62	10.57	30.01	352	30	P	V
													V
													V
Remark	1. No other spurious found.												
	2. All results are PASS against Peak and Average limit line.												



Ant 4_BLE_Tx_Ch39 + Ant. 4+3_11a_Tx_Ch36_Co-location (Harmonic @ 3m)

Ant. 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)
Co-location		4960	55.15	-18.85	74	42.74	31.22	11.22	30.03	400	54	P	H
		4960	47.04	-6.96	54	34.63	31.22	11.22	30.03	400	54	A	H
		7443.9	44.59	-29.41	74	54.03	36.3	12.64	58.38	100	0	P	H
		10360	48.27	-19.93	68.2	55.27	39.44	14.46	60.9	100	0	P	H
		15540	46.79	-27.21	74	54.39	37.82	17.29	62.71	100	0	P	H
		18000	59.95	-14.05	74	49.81	49	19.04	57.9	100	55	P	H
		18000	50.26	-3.74	54	40.12	49	19.04	57.9	100	55	A	H
													H
		4960	56.93	-17.07	74	44.52	31.22	11.22	30.03	152	294	P	V
		4960	50.7	-3.3	54	38.29	31.22	11.22	30.03	152	294	A	V
		7443.9	44.48	-29.52	74	53.92	36.3	12.64	58.38	100	0	P	V
		10360	47.87	-20.33	68.2	54.87	39.44	14.46	60.9	100	0	P	V
		15540	47.5	-26.5	74	55.1	37.82	17.29	62.71	100	0	P	V
		17988.9	59.84	-14.16	74	49.92	48.8	19.03	57.91	100	14	P	V
		17988.9	49.85	-4.15	54	39.93	48.8	19.03	57.91	100	14	A	V
													V
Remark		1. No other spurious found. 2. All results are PASS against Peak and Average limit line.											



2.4GHz 2400~2483.5MHz + Band 1 - 5150~5250MHz

Ant 4_11b_Tx_Ch06 + Ant 3_11a_Tx_Ch48_Co-location (Band Edge @ 3m)

Ant. 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)
802.11b CH06 2437MHz		2322.07	54.73	-19.27	74	41.46	27.76	16.45	30.94	139	205	P	H
		2390	43.92	-10.08	54	30.74	27.54	16.56	30.92	139	205	A	H
	*	2437	103.05	-	-	89.81	27.5	16.64	30.9	139	205	P	H
	*	2437	99.92	-	-	86.68	27.5	16.64	30.9	139	205	A	H
		2486.05	54.54	-19.46	74	41.28	27.43	16.71	30.88	139	205	P	H
		2485.87	43.96	-10.04	54	30.7	27.43	16.71	30.88	139	205	A	H
		2375.45	55.58	-18.42	74	42.36	27.6	16.54	30.92	398	160	P	V
		2339.24	43.78	-10.22	54	30.52	27.72	16.48	30.94	398	160	A	V
	*	2437	100.11	-	-	86.87	27.5	16.64	30.9	398	160	P	V
	*	2437	97.04	-	-	83.8	27.5	16.64	30.9	398	160	A	V
		2494.69	55.52	-18.48	74	42.25	27.41	16.73	30.87	398	160	P	V
		2484.16	43.86	-10.14	54	30.6	27.43	16.71	30.88	398	160	A	V
802.11a CH48 5240MHz		5092.3	52.03	-21.97	74	39.87	31.78	10.39	30.01	100	194	P	H
		5148.72	41.12	-12.88	54	28.82	31.8	10.51	30.01	100	194	A	H
	*	5240	106.01	-	-	94.12	31.26	10.64	30.01	100	194	P	H
	*	5240	97.7	-	-	85.81	31.26	10.64	30.01	100	194	A	H
		5381.32	51.13	-22.87	74	39.06	31.29	10.78	30	100	194	P	H
		5454.12	40.92	-13.08	54	28.46	31.6	10.85	29.99	100	194	A	H
		5129.74	51.48	-22.52	74	39.22	31.8	10.47	30.01	350	315	P	V
		5124.54	40.96	-13.04	54	28.72	31.8	10.45	30.01	350	315	A	V
	*	5240	100.73	-	-	88.84	31.26	10.64	30.01	350	315	P	V
	*	5240	92.21	-	-	80.32	31.26	10.64	30.01	350	315	A	V
		5362	51.35	-22.65	74	39.42	31.17	10.76	30	350	315	P	V
		5454.12	40.85	-13.15	54	28.39	31.6	10.85	29.99	350	315	A	V
Remark	1. No other spurious found.												
	2. All results are PASS against Peak and Average limit line.												



Ant 4_11b_Tx_Ch06 + Ant 3_11a_Tx_Ch48_Co-location (Harmonic @ 3m)

Ant. 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)
Co-location		4874	51.87	-22.13	74	39.73	31.05	11.15	30.06	100	197	P	H
		4874	41.98	-12.02	54	29.84	31.05	11.15	30.06	100	197	A	H
		7311	44.67	-29.33	74	54.31	36.3	12.62	58.56	100	0	P	H
		10480	48.44	-19.76	68.2	55.31	39.68	14.52	61.07	100	0	P	H
		15720	47.47	-26.53	74	54.57	37.34	17.4	61.84	100	0	P	H
		18000	60.52	-13.48	74	50.38	49	19.04	57.9	200	120	P	H
		18000	49.58	-4.42	54	39.44	49	19.04	57.9	200	120	A	H
													H
		4874	51.49	-22.51	74	39.35	31.05	11.15	30.06	400	284	P	V
		4874	40.8	-13.2	54	28.66	31.05	11.15	30.06	400	284	A	V
		7311	43.55	-30.45	74	53.19	36.3	12.62	58.56	100	0	P	V
		10480	49.62	-18.58	68.2	56.49	39.68	14.52	61.07	100	0	P	V
		15720	47.8	-26.2	74	54.9	37.34	17.4	61.84	100	0	P	V
		18000	61.36	-12.64	74	51.22	49	19.04	57.9	100	26	P	V
		18000	50.17	-3.83	54	40.03	49	19.04	57.9	100	26	A	V
													V
Remark		1. No other spurious found. 2. All results are PASS against Peak and Average limit line.											



Emission above 18GHz

Ant 4_BLE_Tx_Ch39 + Ant. 4+3_11a_Tx_Ch36_Co-location (SHF @ 3m)

Ant.	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Simultaneously				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Co-location		22224	39.37	-34.63	74	42.33	38.26	12.22	53.44	150	0	P	H
		37888	45.39	-22.81	68.2	39.91	43.01	18.6	56.13	150	0	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		24556	38.62	-29.58	68.2	38.92	40.07	13.13	53.5	150	0	P	V
		37932	44.75	-23.45	68.2	39.2	43.05	18.58	56.08	150	0	P	V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
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													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Emission below 1GHz

Ant 4_BLE_Tx_Ch39 + Ant. 4+3_11a_Tx_Ch36_Co-location (LF @ 3m)

Ant.	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Simultaneously				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Co-location		30	20.39	-19.61	40	29.76	22.45	0.67	32.49	-	-	P	H
		66.86	23.83	-16.17	40	42.86	12.39	1.12	32.54	-	-	P	H
		157.07	34.29	-9.21	43.5	48.12	16.88	1.79	32.5	-	-	P	H
		186.17	20.8	-22.7	43.5	36.23	15.06	1.98	32.47	-	-	P	H
		786.6	39.17	-6.83	46	39.85	27.71	3.85	32.24	-	-	P	H
		913.67	39.25	-6.75	46	37.75	28.83	4.21	31.54	100	0	P	H
													H
													H
													H
													H
													H
													H
		37.76	20.76	-19.24	40	32.03	20.51	0.77	32.55	-	-	P	V
		128.94	21.09	-22.41	43.5	34.4	17.6	1.62	32.53	-	-	P	V
		157.07	30.36	-13.14	43.5	44.19	16.88	1.79	32.5	-	-	P	V
		260.86	20.24	-25.76	46	30.71	19.65	2.3	32.42	-	-	P	V
		782.72	38.86	-7.14	46	39.6	27.68	3.84	32.26	-	-	P	V
		910.76	39.04	-6.96	46	37.69	28.71	4.2	31.56	100	0	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



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:

WIFI	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)
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. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

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



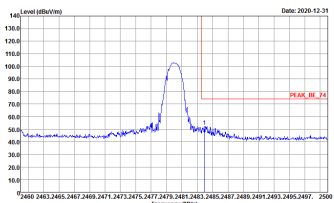
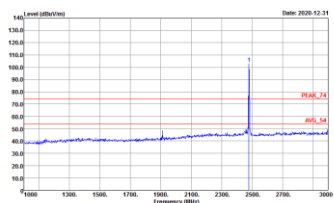
Appendix B. Radiated Spurious Emission Plots

Test Engineer :	Leo Lee, Mancy Chou and Bigshow Wang	Temperature :	20.1~26.1°C
		Relative Humidity :	46~65%

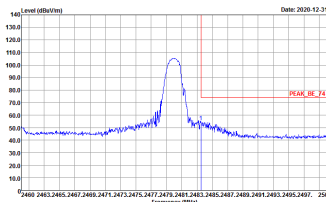
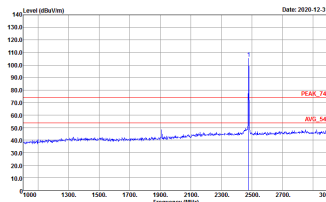
Note symbol

-L	Low channel location
-R	High channel location

2.4GHz 2400~2483.5MHz
BT (Band Edge @ 3m)

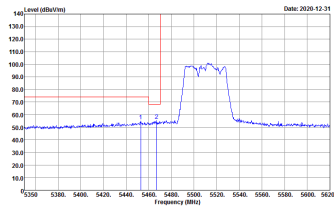
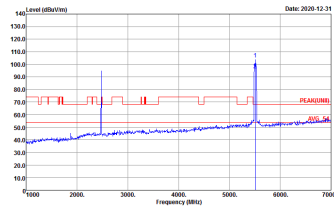
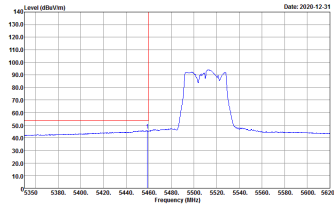
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH78 2480MHz	
4	Horizontal	Fundamental
Peak	 Site : 03CH15-HV Condition : PEAK_85_74 3m 91200_15_1620 HORIZONTAL Detector : Peak	 Site : 03CH15-HV Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL Detector : Peak

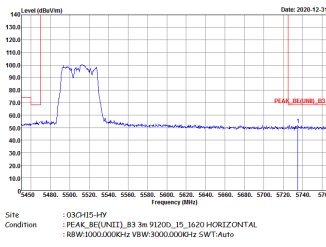


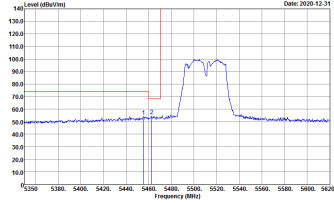
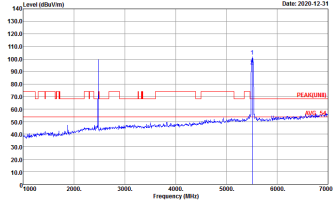
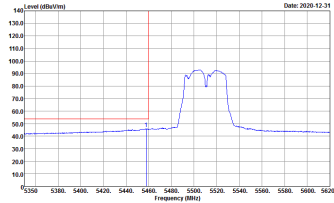
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH78 2480MHz	
4	Vertical	Fundamental
Peak	 Site : 03CH5-4FV Condition : PEAK_BE_74 3m 91200_15_1620 VERTICAL Detector : Peak	 Site : 03CH5-4FV Condition : PEAK_74 3m 91200_15_1620 VERTICAL Detector : Peak

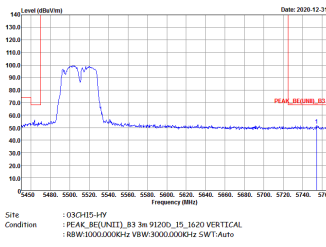


Band 3 - 5470~5725MHz
WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11n HT40 CH102 5510MHz - L	
4+3	Horizontal	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE(UNIT)_B3 3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK(UNIT)_3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto
Avg.	 Site : 03CH15-HY Condition : AVG_BE(UNIT)_B3 3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	Left blank

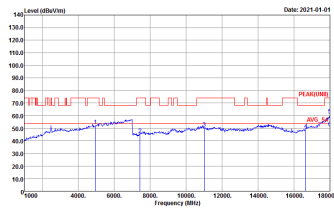
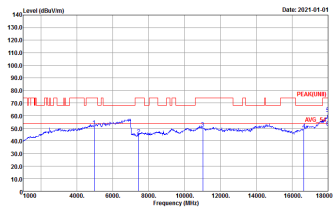
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11n HT40 CH102 5510MHz - R	
4+3	Horizontal	Fundamental
Peak		Left blank

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11n HT40 CH102 5510MHz - L	
4+3	Vertical	Fundamental
Peak	 Site : 03CH5-HY Condition : PEAK_BE(UNIT)_B3 3m 91200_15_1620 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH5-HY Condition : PEAK(UNIT)_B3 3m 91200_15_1620 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH5-HY Condition : AVG_BE(UNIT)_B3 3m 91200_15_1620 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

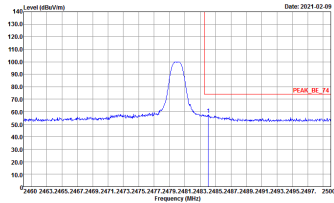
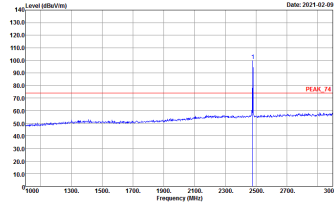
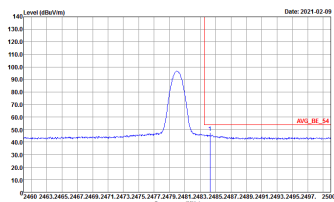
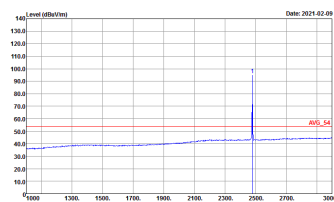
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11n HT40 CH102 5510MHz - R	
4+3	Horizontal	Fundamental
Peak		Left blank



Ant 4_BT_Tx_Ch78 + Ant 4+3_11n HT40_Tx_Ch102_Co-location (Harmonic @ 3m)

ANT	Ant 4_BT_Tx_Ch78 + Ant 4+3_11n HT40_Tx_Ch102	
Simultaneously	Horizontal	Vertical
Peak Avg.	 Site : 03CH15-HY Condition : PEAK(LINE1) 3m 91200_15_1620 HORIZONTAL Detector : Peak	 Site : 03CH15-HY Condition : PEAK(LINE1) 3m 91200_15_1620 VERTICAL Detector : Peak

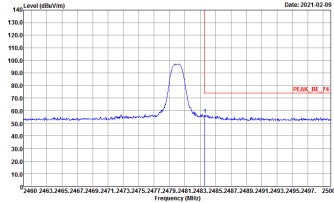
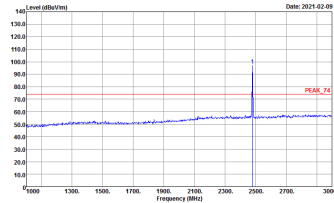
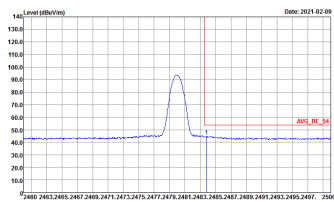
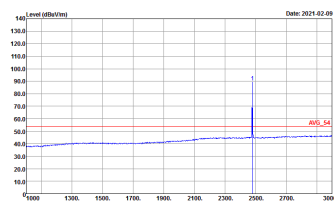
2.4GHz 2400~2483.5MHz
BLE (Band Edge @ 3m)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
4	Horizontal	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_RE_74 3m 91200_15_1620 HORIZONTAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : Peak	 Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : Peak
	 Site : 03CH15-HY Condition : AVG_RE_54 3m 91200_15_1620 HORIZONTAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : RMS	 Site : 03CH15-HY Condition : AVG_54 3m 91200_15_1620 HORIZONTAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : RMS
Avg.		



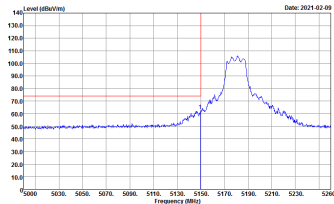
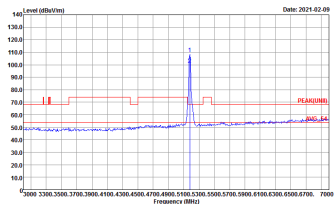
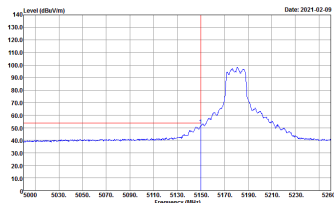
2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

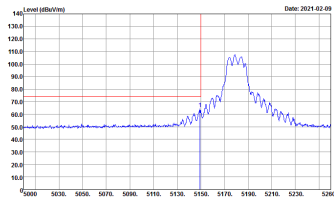
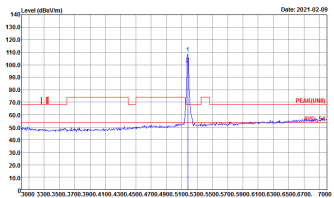
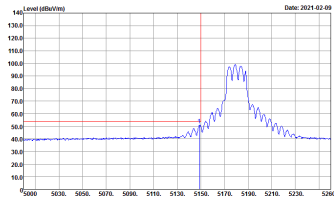
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
4	Vertical	Fundamental
Peak	 Site : 03CH15-HV Condition : PEAK_RE_74 3m 91200_15_1620 VERTICAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : Peak	 Site : 03CH15-HV Condition : PEAK_74 3m 91200_15_1620 VERTICAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : Peak
Avg.	 Site : 03CH15-HV Condition : AVG_RE_54 3m 91200_15_1620 VERTICAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : RMS	 Site : 03CH15-HV Condition : AVG_54 3m 91200_15_1620 VERTICAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : RMS



Band 1 5150~5250MHz
WIFI 802.11a (Band Edge @ 3m)

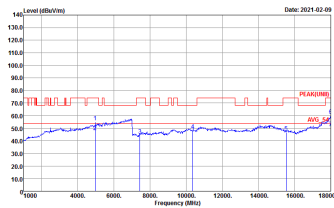
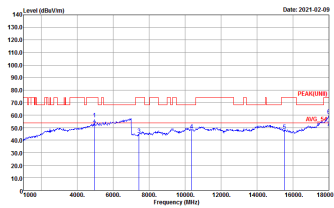
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH36 5180MHz	
4+3	Horizontal	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_RE_74 3m 91200_15_1620 HORIZONTAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : Peak	 Site : 03CH15-HY Condition : PEAK(UNIT) 3m 91200_15_1620 HORIZONTAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : Peak
Avg.	 Site : 03CH15-HY Condition : AVG_RE_54 3m 91200_15_1620 HORIZONTAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : RMS	Left blank



WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH36 5180MHz	
4+3	Vertical	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_RE_74 3m 91200_15_1620 VERTICAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : Peak	 Site : 03CH15-HY Condition : PEAK_UNE11 3m 91200_15_1620 VERTICAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : Peak
Avg.	 Site : 03CH15-HY Condition : AVG_RE_24 3m 91200_15_1620 VERTICAL Detector : RBW:3000.000KHz VBW:3000.000KHz SWT:Auto : RMS	Left blank



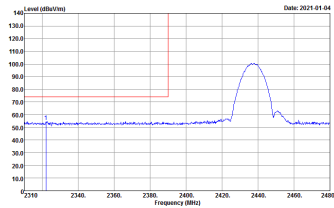
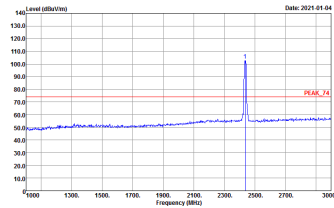
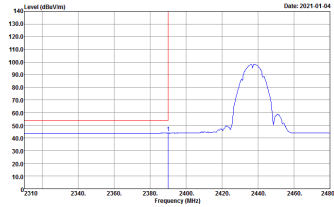
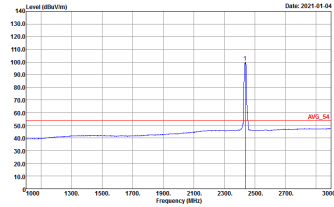
Ant 4_BLE_Tx_Ch39 + Ant. 4+3_11a_Tx_Ch36_Co-location (Harmonic @ 3m)

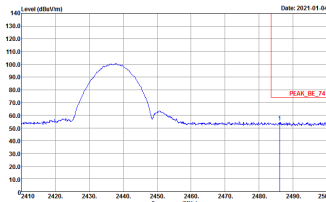
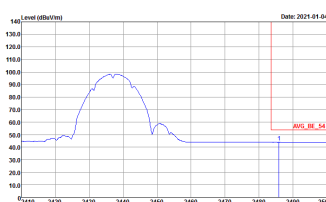
ANT	Ant 4_BLE_Tx_Ch39 + Ant. 4+3_11a_Tx_Ch36	
Simultaneously	Horizontal	Vertical
Peak Avg.	 Site : 03CH15-HY Condition : PEAK(LINE) 3m 91200_15_1620 HORIZONTAL Detector : Peak	 Site : 03CH15-HY Condition : PEAK(LINE) 3m 91200_15_1620 VERTICAL Detector : Peak



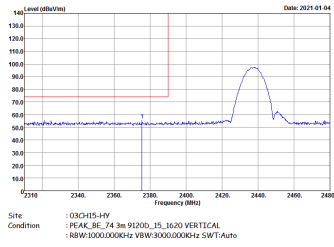
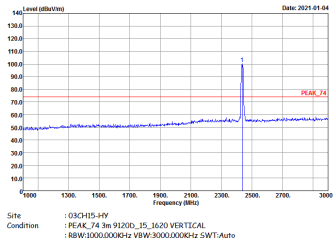
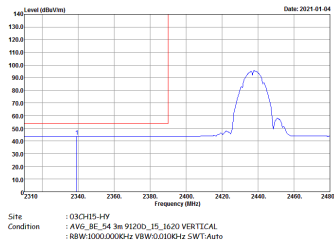
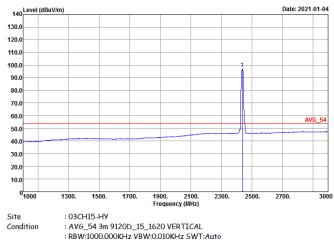
2.4GHz 2400~2483.5MHz

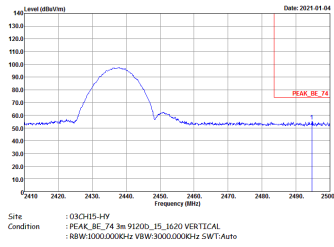
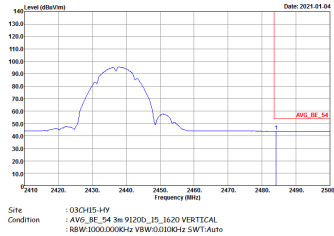
WIFI 802.11b (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz (Band Edge @ 3m)	
ANT	WIFI 802.11b Ch06 2437MHz - L	
4	Horizontal	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE_74 3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto
Avg.	 Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:10000kHz SWT:Auto	 Site : 03CH15-HY Condition : AVG_54 3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:10000kHz SWT:Auto

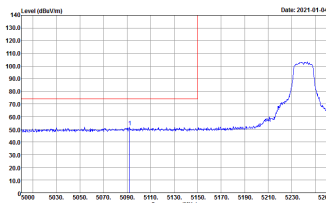
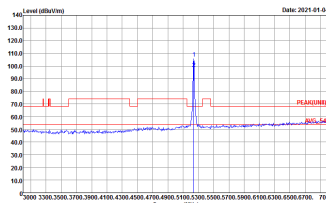
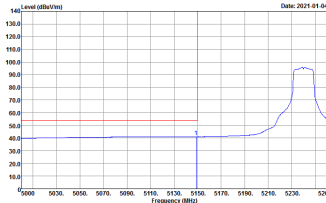
WIFI	2.4GHz 2400~2483.5MHz (Band Edge @ 3m)	
ANT	WIFI 802.11b Ch06 2437MHz - R	
4	Horizontal	Fundamental
Peak	 Site : 03CH5-HY Condition : PEAK_BE_74 3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	Left blank
Avg.	 Site : 03CH5-HY Condition : AVG_BE_54 3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	Left blank

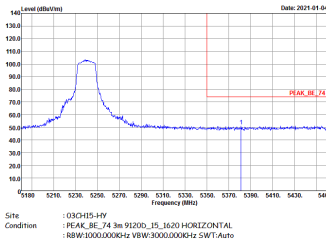
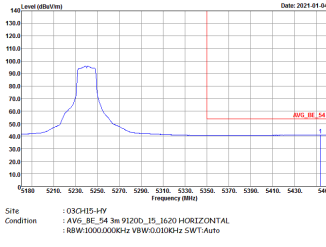


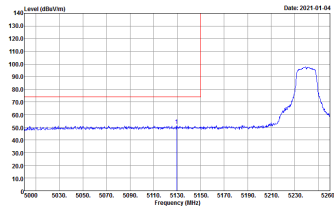
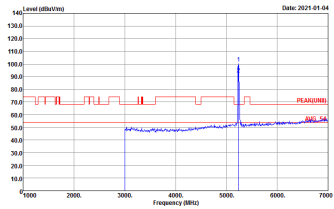
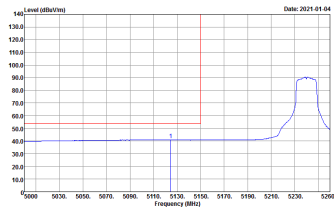
WIFI	2.4GHz 2400~2483.5MHz (Band Edge @ 3m)	
ANT	WIFI 802.11b Ch06 2437MHz - L	
4	Vertical	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE_74 3m 91200_15_1620 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK_F4 3m 91200_15_1620 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_15_1620 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH15-HY Condition : AVG_F4 3m 91200_15_1620 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

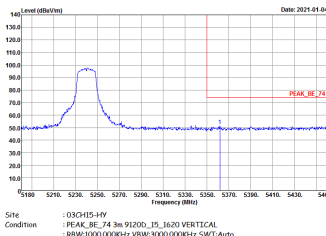
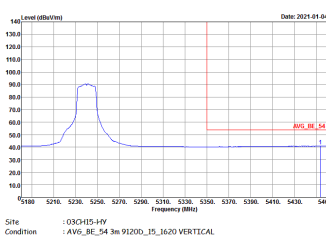
WIFI	2.4GHz 2400~2483.5MHz (Band Edge @ 3m)	
ANT	WIFI 802.11b Ch06 2437MHz - R	
4	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

Band 1 5150~5250MHz
WIFI 802.11a (Band Edge @ 3m)

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	WIFI 802.11a Ch48 5240MHz - L	
3	Horizontal	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE_74 3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK_FUND 3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto
Avg.	 Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_15_1620 HORIZONTAL : RBW:1000.000kHz VBW:10000kHz SWT:Auto	Left blank

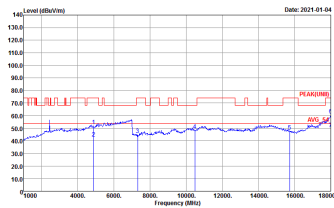
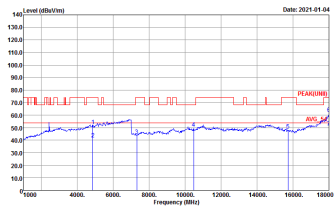
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	WIFI 802.11a Ch48 5240MHz - R	
3	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	WIFI 802.11a Ch48 5240MHz - L	
3	Vertical	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE_74 3m 91200_15_1620 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK(FUND) 3m 91200_15_1620 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_15_1620 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

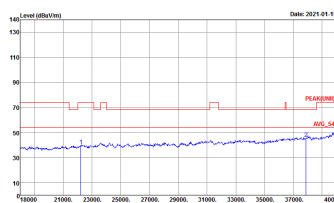
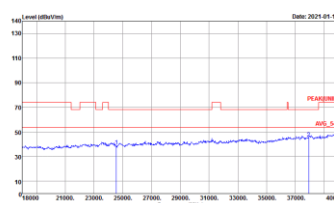
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	WIFI 802.11a Ch48 5240MHz - R	
3	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank



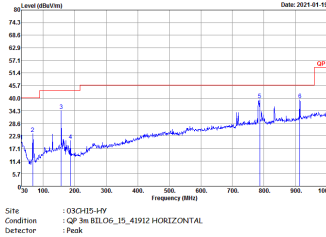
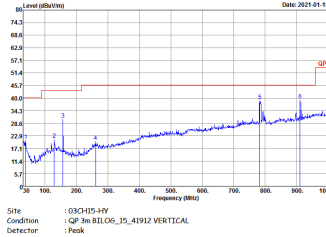
Ant 4_11b_Tx_Ch06 + Ant 3_11a_Tx_Ch48_Co-location (Harmonic @ 3m)

ANT	Ant 4_11b_Tx_Ch06 + Ant 3_11a_Tx_Ch48	
Simultaneously	Horizontal	Vertical
Peak Avg.	 Site : 03CH15-HV Condition : PEAK(LINE) 3m 91200_15_1620 HORIZONTAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto	 Site : 03CH15-HV Condition : PEAK(LINE) 3m 91200_15_1620 VERTICAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto

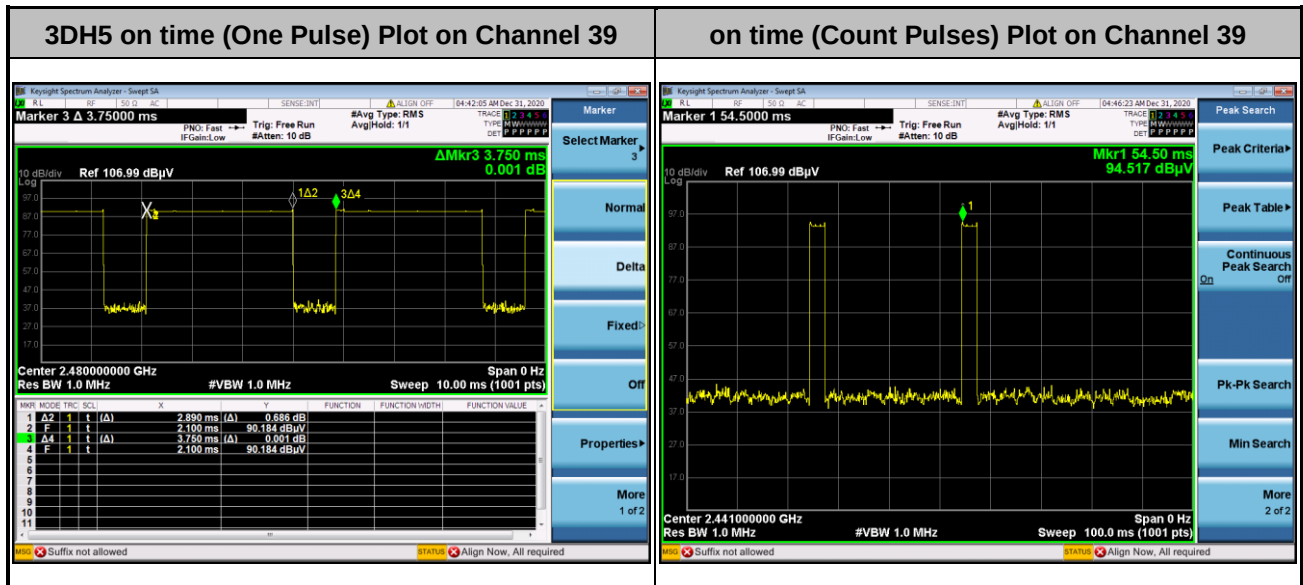
Emission above 18GHz
Ant 4_BLE_Tx_Ch39 + Ant. 4+3_11a_Tx_Ch36_Co-location (SHF)

ANT	Band 3 5470~5725MHz	
Simultaneously	802.11a SHF	
4+3	Horizontal	Vertical
QP / Peak		

Emission below 1GHz
Ant 4_BLE_Tx_Ch39 + Ant. 4+3_11a_Tx_Ch36_Co-location (LF @ 3m)

ANT	Ant 4_BLE_Tx_Ch39 + Ant. 4+3_11a_Tx_Ch36	
Simultaneously	Horizontal	Vertical
Peak Avg.		

Appendix C. Duty Cycle Plots



Note:

1. Worst case Duty cycle = on time/100 milliseconds = $2 \times 2.89 / 100 = 5.78 \%$
2. Worst case Duty cycle correction factor = $20 \times \log(\text{Duty cycle}) = -24.76 \text{ dB}$
3. **3DH5** has the highest duty cycle worst case and is reported.

Duty Cycle Correction Factor Consideration for AFH mode:

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

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

$$2.89 \text{ ms} \times 20 \text{ channels} = 57.8 \text{ ms}$$

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. $[100 \text{ ms} / 57.8 \text{ ms}] = 2 \text{ hops}$

Thus, the maximum possible ON time:

$$2.89 \text{ ms} \times 2 = 5.78 \text{ ms}$$

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

$$20 \times \log(5.78 \text{ ms}/100 \text{ ms}) = -24.76 \text{ dB}$$

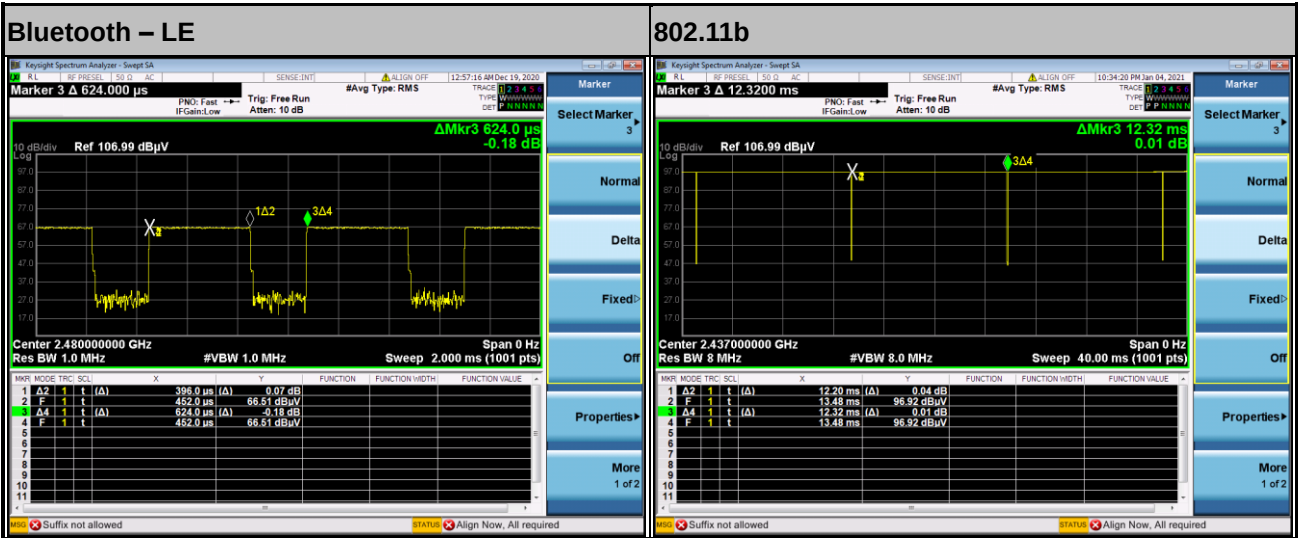
Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
4	802.11b	99.03	-	-	10Hz	0.04
3	802.11a	98.31	2030	0.49	1kHz	0.07
4+3	5GHz 802.11n HT40 for Ant 4	94.36	920	1.09	3kHz	0.25
4+3	5GHz 802.11n HT40 for Ant 3	94.36	930	1.08	3kHz	0.25

Antenna	Band	Duty Cycle(%)	Duty Factor(dB)
4	Bluetooth – LE for 1Mbps	63.46	1.97
4+3	802.11a	98.06	0

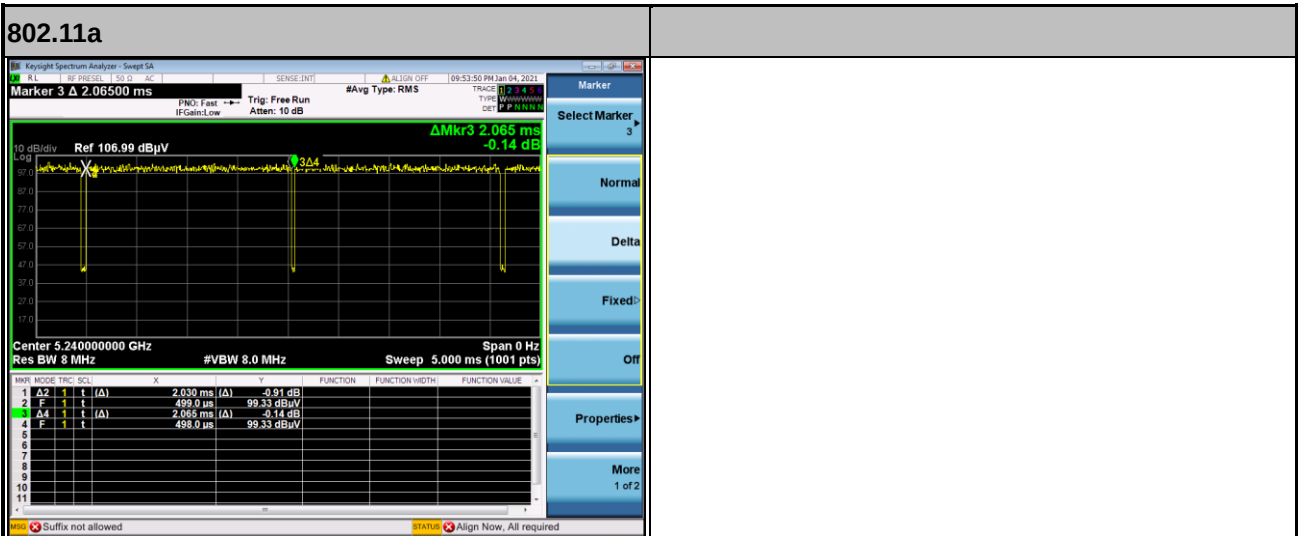
Remark: Duty factor is $10 \log(1/d)$, where d is the duty cycle.



<Ant. 4>



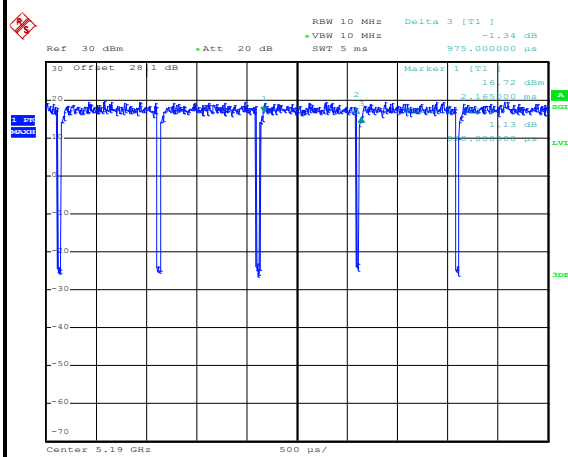
<Ant. 3>





MIMO <Ant. 4>

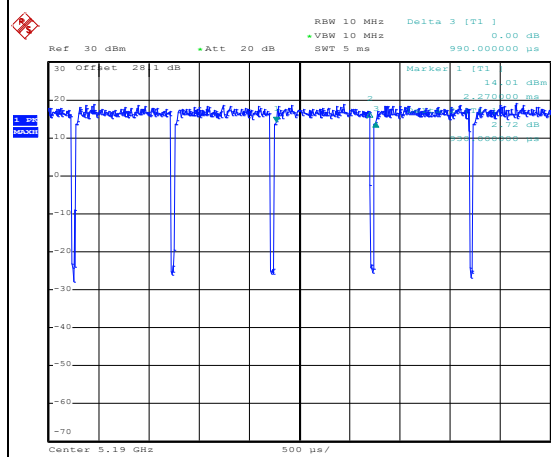
802.11n HT40



Date: 12.DEC.2020 09:37:41

MIMO <Ant. 3>

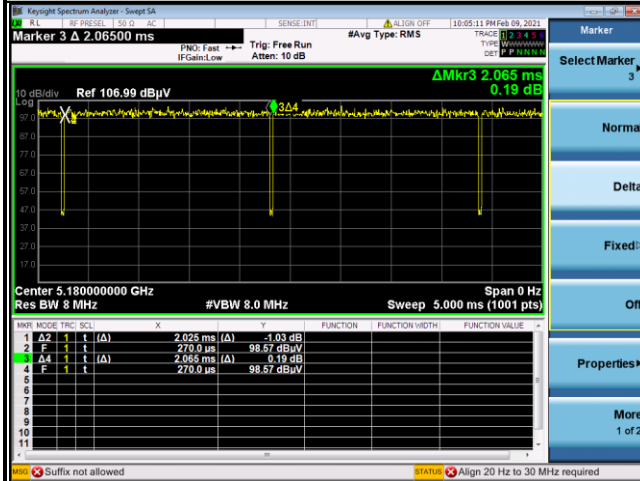
802.11n HT40



Date: 12.DEC.2020 09:38:05

MIMO <Ant. 4+3>

802.11a



—THE END—