

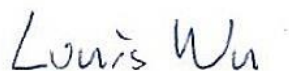
FCC CO-LOCATION RADIO TEST REPORT

FCC ID : ACJFZA3A
Equipment : Tablet Computer
Brand Name : Panasonic
Model Name : FZ-A3
Marketing Name : FZ-A3
Applicant : Panasonic Corporation of North America
Two Riverfront Plaza, 9th Floor, Newark, NJ
07102-5490
Manufacturer : Panasonic Mobile Communications Co., Ltd.
600 Saedo-cho, Tsuzuki-ku, Yokohama City
224-8539, Japan
Standard : FCC Part 15 Subpart E §15.407

The product was received on May 19, 2020 and testing was started from Jun. 26, 2020 and completed on Jun. 27, 2020. 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 report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.



Approved by: Louis Wu

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

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



Table of Contents

History of this test report.....	3
Summary of Test Result.....	4
1 General Description	5
1.1 Product Feature of Equipment Under Test.....	5
1.2 Modification of EUT	5
1.3 Testing Location	6
1.4 Applicable Standards.....	6
2 Test Configuration of Equipment Under Test	7
2.1 Carrier Frequency and Channel	7
2.2 Test Mode.....	7
2.3 Connection Diagram of Test System.....	8
2.4 Support Unit used in test configuration and system	8
2.5 EUT Operation Test Setup	8
3 Test Result	9
3.1 Unwanted Emissions Measurement.....	9
3.2 Antenna Requirements.....	13
4 List of Measuring Equipment.....	14
5 Uncertainty of Evaluation.....	15
Appendix A. Radiated Spurious Emission	
Appendix B. Radiated Spurious Emission Plots	
Appendix C. Duty Cycle Plots	
Appendix D. Setup Photographs	



History of this test report

Report No.	Version	Description	Issued Date
FR992410-06D	01	Initial issue of report	Jun. 27, 2020

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 8.32 dB at 2390.000 MHz
3.2	15.203 15.407(a)	Antenna Requirement	Pass	-

Note: This is a variant report by adding Vehicle Dock and External Antenna.

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: Yvonne Cheng

1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n/ac, NFC, and GNSS.

Product Specification subjective to this standard	
Antenna Type	WLAN: <Ant. 0> Monopole Antenna <Ant. 1> Monopole Antenna Bluetooth: <Ant. 0> Monopole Antenna GNSS: Monopole Antenna NFC: Loop Antenna

Accessories Information		
AC Adapter	Brand Name	Panasonic
	Model Name	CF-AA6413A
Battery 1 (Small)	Brand Name	Panasonic
	Model Name	FZ-VZSUT10U
Battery 2 (Large)	Brand Name	Panasonic
	Model Name	FZ-VZSUT11U
USB Cable 1	Brand Name	Panasonic
	Model Name	K1HY24YY0021
USB Cable 2	Brand Name	ELECOM
	Model Name	USB3-AC10BK
Gadget 1 (2nd USB)	Brand Name	Panasonic
	Model Name	N/A
Gadget 2 (BCR)	Brand Name	Panasonic
	Model Name	N/A
Cradle	Brand Name	Panasonic
	Model Name	FZ-VEBA21U
Shoulder Strap	Brand Name	Panasonic
	Model Name	CF-VNS331U
Stylus Pen	Brand Name	Panasonic
	Model Name	CF-VNP025U
Vehicle Dock	Brand Name	Havis
	Model Name	DS-PAN-1401-2
External antenna (2.4G+5G+GNSS)	Brand Name	Airgain
	Model Name	AP-PAN-MMF WG-Q-BL

Remark: The WLAN external antenna can only be connected to the WLAN ant 1 external antenna port of EUT.

1.2 Modification of EUT

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



1.3 Testing Location

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No.
	03CH11-HY

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

FCC designation No.: TW0007

1.4 Applicable Standards

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

- ♦ FCC Part 15 Subpart E
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ 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. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.
3. 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, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X Plane for Bluetooth + 802.11n HT20 Mode; Y Plane for Bluetooth + 802.11g Mode) were recorded in this report.

2.1 Carrier Frequency and Channel

2400-2483.5 MHz Bluetooth			
Channel		Freq. (MHz)	
78		2480	

2400-2483.5 MHz 802.11g		5470-5725 MHz 802.11n HT20	
Channel	Freq. (MHz)	Channel	Channel
01	2412	140	5700

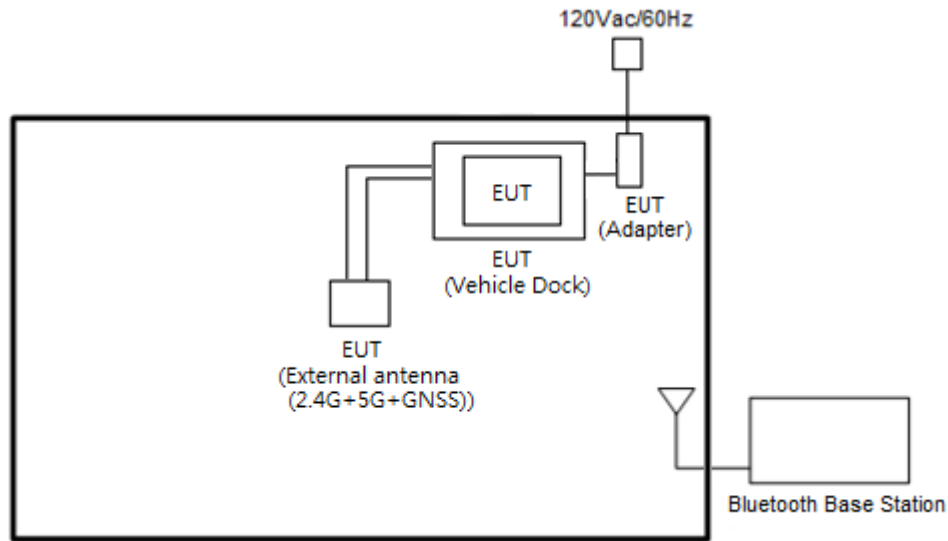
2.2 Test Mode

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

<Co-Location>

Modulation	Data Rate
Bluetooth + 2.4GHz 802.11g	1Mbps + 6Mbps
Bluetooth + 5GHz 802.11n HT20	1Mbps + MCS0

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m

2.5 EUT Operation Test Setup

The Bluetooth test items, utility "QRCT4 V4.0-00156" was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to contact with base station to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

The RF test items, utility "QRCT4 V4.0-00156" 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

3.1.1 Limit of Unwanted Emissions

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

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

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

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

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

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

- (i) Sections 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz.
- (ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are based on the use of a peak detector.

3.1.2 Measuring Instruments

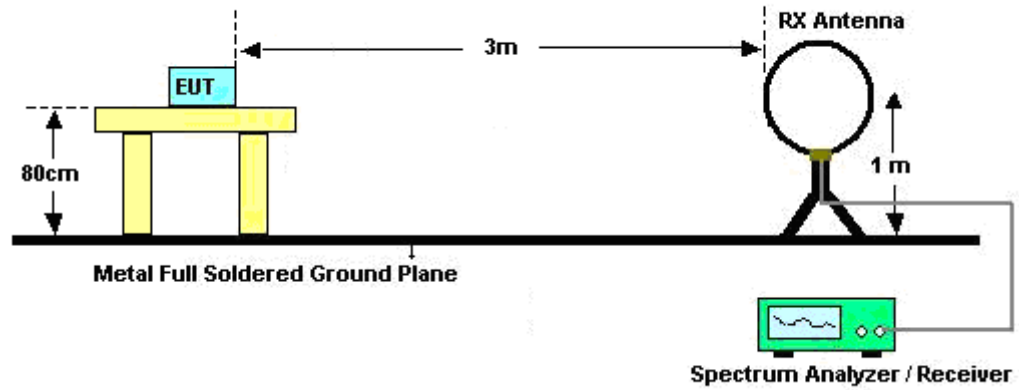
See list of measuring equipment of this test report.

3.1.3 Test Procedures

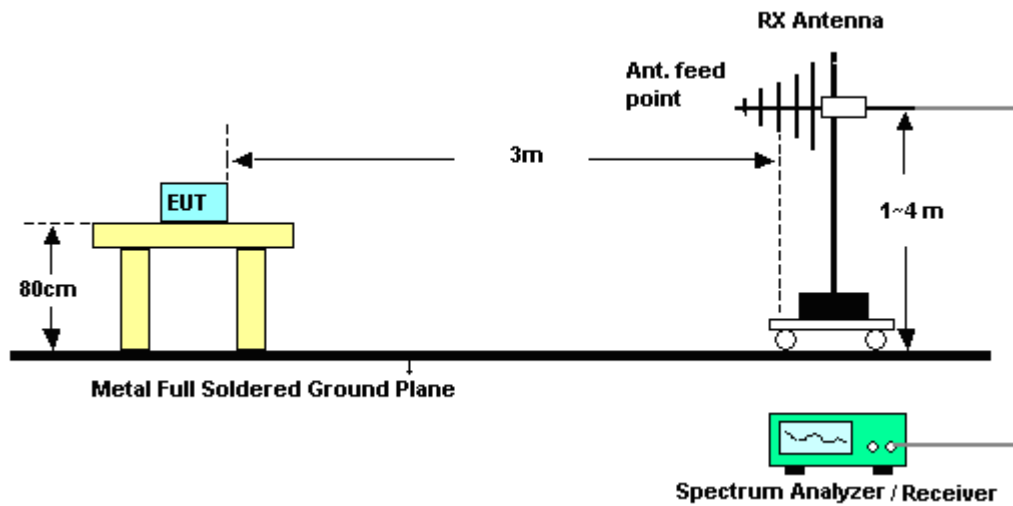
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section G) Unwanted emissions measurement.
(1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
(2) Procedure for Peak Unwanted 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 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.

3.1.4 Test Setup

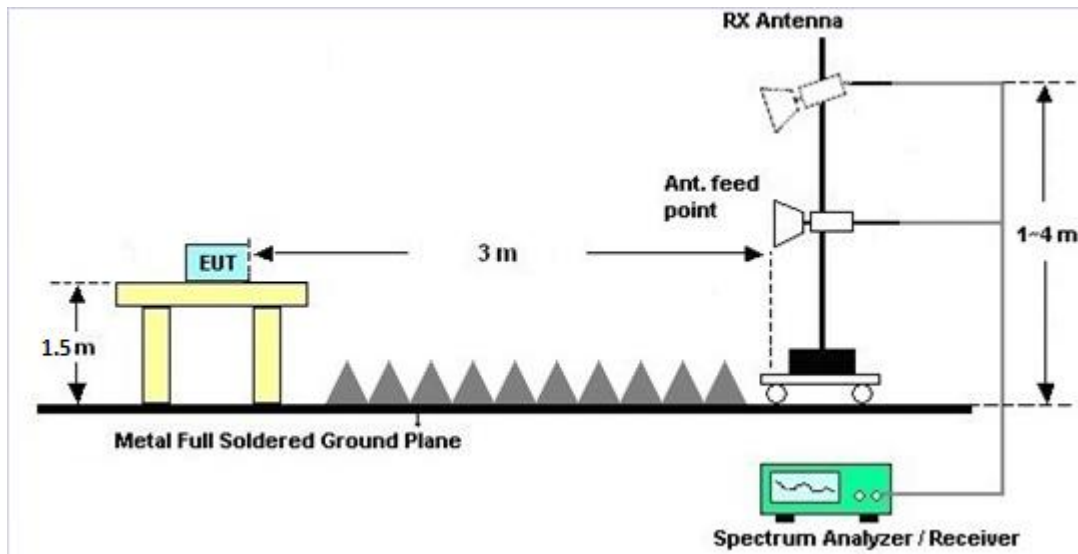
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

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

There is 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.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

3.1.7 Duty Cycle

Please refer to Appendix C.

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

Please refer to Appendix A and B.



3.2 Antenna Requirements

3.2.1 Standard Applicable

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

3.2.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.2.3 Antenna Gain

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



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Preamplifier	EMCE	EM18G40G	060715	18GHz ~ 40GHz	Dec. 13, 2019	Jun. 26, 2020~ Jun. 27, 2020	Dec. 12, 2020	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY532700 80	1GHz~26.5GHz	Nov. 13, 2019	Jun. 26, 2020~ Jun. 27, 2020	Nov. 12, 2020	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55 303K	171000180 0054002	1GHz~18GHz	Feb. 07, 2020	Jun. 26, 2020~ Jun. 27, 2020	Feb. 06, 2021	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170 576	18GHz- 40GHz	May. 22, 2020	Jun. 26, 2020~ Jun. 27, 2020	May. 21, 2021	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-132 6	1GHz ~ 18GHz	Nov. 04, 2019	Jun. 26, 2020~ Jun. 27, 2020	Nov. 03, 2020	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY542004 86	10Hz ~ 44GHz	Oct. 28, 2019	Jun. 26, 2020~ Jun. 27, 2020	Oct. 27, 2020	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Jun. 26, 2020~ Jun. 27, 2020	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500- B	N/A	1~4m	N/A	Jun. 26, 2020~ Jun. 27, 2020	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Jun. 26, 2020~ Jun. 27, 2020	N/A	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-00105 3	N/A	N/A	Jun. 26, 2020~ Jun. 27, 2020	N/A	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4 PE	9kHz-30MHz	Mar. 12, 2020	Jun. 26, 2020~ Jun. 27, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz-40GHz	Mar. 12, 2020	Jun. 26, 2020~ Jun. 27, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4 PE	30M-18G	Mar. 12, 2020	Jun. 26, 2020~ Jun. 27, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY4274/2	30MHz-40GHz	Mar. 12, 2020	Jun. 26, 2020~ Jun. 27, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-270 0-3000-18000 -60SS	SN3	3GHz High Pass Filter	Sep. 15, 2019	Jun. 26, 2020~ Jun. 27, 2020	Sep. 14, 2020	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTN-303B	TP140325	N/A	Nov. 07, 2019	Jun. 26, 2020~ Jun. 27, 2020	Nov. 06, 2020	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTN-303B	TP161237	N/A	Oct. 25, 2019	Jun. 26, 2020~ Jun. 27, 2020	Oct. 24, 2020	Radiation (03CH11-HY)



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	52
--	----

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	52
--	----

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	53
--	----



Appendix A. Radiated Spurious Emission

Test Engineer :	Fu Chen and Troye Hsieh	Temperature :	20.1~26.4 °C
		Relative Humidity :	51.7~68.3 %

Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11g_Tx_Ch01 (Band Edge @ 3m)

WIFI 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)
Bluetooth_Tx Ch78 + 802.11g_Tx Ch01	*	2480	101.04	-	-	100.18	27.28	6.79	33.21	184	167	P	H
	*	2480	76.28	-	-	-	-	-	-	-	-	A	H
		2483.64	47.79	-26.21	74	46.94	27.27	6.79	33.21	184	167	P	H
		2483.64	23.03	-30.97	54	-	-	-	-	-	-	A	H
													H
													H
	*	2480	95.48	-	-	94.62	27.28	6.79	33.21	100	23	P	V
	*	2480	70.72	-	-	-	-	-	-	-	-	A	V
		2483.5	44.65	-29.35	74	43.8	27.27	6.79	33.21	100	23	P	V
		2483.5	19.89	-34.1	54	-	-	-	-	-	-	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11g_Tx_Ch01 (Band Edge @ 3m)

WIFI 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)
Bluetooth_Tx Ch78 + 802.11g_Tx Ch01		2389.065	58.88	-15.12	74	47.97	27.52	16.62	33.23	300	97	P	H
		2390	45.68	-8.32	54	34.77	27.52	16.62	33.23	300	97	A	H
	*	2412	106.94	-	-	96.05	27.48	16.64	33.23	300	97	P	H
	*	2412	99.3	-	-	88.41	27.48	16.64	33.23	300	97	A	H
													H
													H
		2388.75	56.42	-17.58	74	45.51	27.52	16.62	33.23	110	50	P	V
		2390	45.36	-8.64	54	34.45	27.52	16.62	33.23	110	50	A	V
	*	2412	105.76	-	-	94.87	27.48	16.64	33.23	110	50	P	V
	*	2412	98.19	-	-	87.3	27.48	16.64	33.23	110	50	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11g_Tx_Ch01 ((Harmonic @ 3m)

WIFI 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)
Bluetooth_Tx Ch78 + 802.11g_Tx Ch01		4830	41.17	-32.83	74	59.66	31	10.95	60.44	100	0	P	H
		4960	41.11	-32.89	74	59.29	31.14	11.01	60.33	100	0	P	H
		7440	43.77	-30.23	74	53.22	36.38	13.21	59.04	100	0	P	H
													H
													H
													H
		4824	39.97	-34.03	74	58.47	31	10.94	60.44	100	0	P	V
		4960	40.81	-33.19	74	58.99	31.14	11.01	60.33	100	0	P	V
		7440	42.94	-31.06	74	52.39	36.38	13.21	59.04	100	0	P	V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11g_Tx_Ch01 (LF)

[illegible]



Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11n HT20_Tx_Ch140 (Band Edge @ 3m)

WIFI 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)
Bluetooth_Tx Ch78 + 802.11n HT20_Tx Ch140	*	2480	101.42	-	-	100.56	27.28	6.79	33.21	174	148	P	H
	*	2480	76.66	-	-	-	-	-	-	-	-	P	H
		2483.6	49.09	-24.91	74	48.24	27.27	6.79	33.21	174	148	A	H
		2483.6	24.33	-29.67	54	-	-	-	-	-	-	P	H
												A	H
												P	H
	*	2480	95.36	-	-	94.5	27.28	6.79	33.21	300	0	P	V
	*	2480	70.6	-	-	-	-	-	-	-	-	P	V
		2483.52	44.23	-29.77	74	43.38	27.27	6.79	33.21	300	0	A	V
		2483.52	19.47	-34.53	54	-	-	-	-	-	-	P	V
												A	V
												P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11n HT20_Tx_Ch140 (Band Edge @ 3m)

WIFI 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)
Bluetooth_Tx Ch78 + 802.11n HT20_Tx Ch140	*	5700	91.47	-	-	81.45	32.1	10.45	32.53	351	30	P	H
	*	5700	83.34	-	-	73.32	32.1	10.45	32.53	351	30	A	H
		5737.24	51.38	-16.82	68.2	41.24	32.17	10.49	32.52	351	30	A	H
													H
													H
													H
	*	5700	91.37	-	-	81.35	32.1	10.45	32.53	245	9	P	V
	*	5700	83.3	-	-	73.28	32.1	10.45	32.53	245	9	A	V
		5751.8	51.88	-16.32	68.2	41.69	32.2	10.51	32.52	245	9	A	V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11n HT20_Tx_Ch140 ((Harmonic @ 3m)

WIFI 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)
Bluetooth_Tx Ch78 + 802.11n HT20_Tx Ch140		4960	53.79	-20.21	74	43.84	31.14	11.68	32.87	100	0	P	H
		7440	44.82	-29.18	74	53.86	36.38	13.62	59.04	100	0	P	H
		11400	49.12	-24.88	74	53.85	39.7	17.93	62.36	100	0	P	H
		17100	48.64	-19.56	68.2	44.99	39.7	22.67	58.72	100	0	P	H
													H
													H
		4960	53.35	-20.65	74	43.4	31.14	11.68	32.87	100	0	P	V
		7440	44.34	-29.66	74	53.38	36.38	13.62	59.04	100	0	P	V
		11400	47.58	-26.42	74	52.31	39.7	17.93	62.36	100	0	P	V
		17100	48.2	-20	68.2	44.55	39.7	22.67	58.72	100	0	P	V
													V
													V
	Remark 1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11n HT20_Tx_Ch140 (LF @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Bluetooth_Tx Ch78 + 802.11n HT20_Tx Ch140 LF		30	23.55	-16.45	40	31.06	24.15	0.76	32.42			P	H
		53.28	21.59	-18.41	40	40.38	12.68	1.06	32.53			P	H
		119.24	23.49	-20.01	43.5	37.23	17.13	1.55	32.42			P	H
		857.41	29.6	-16.4	46	28.34	28.95	4.22	31.91			P	H
		877.78	30.36	-15.64	46	28.87	29.07	4.25	31.83			P	H
		957.32	31.21	-14.79	46	27.22	30.51	4.45	30.97	100	0	P	H
													H
													H
													H
													H
													H
													H
		30	25.5	-14.5	40	33.01	24.15	0.76	32.42			P	V
		53.28	30.4	-9.6	40	49.19	12.68	1.06	32.53	100	0	P	V
		119.24	25.72	-17.78	43.5	39.46	17.13	1.55	32.42			P	V
		936.95	29.91	-16.09	46	27.33	29.42	4.4	31.24			P	V
		951.5	30.06	-15.94	46	26.52	30.15	4.44	31.05			P	V
		959.26	31.4	-14.6	46	27.25	30.64	4.46	30.95			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	Peak or Average
H/V	Horizontal or Vertical

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”.

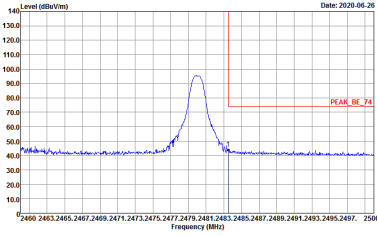
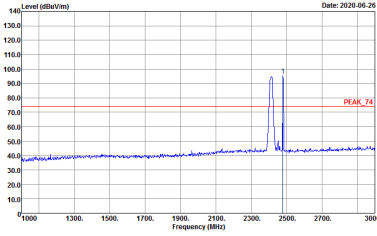


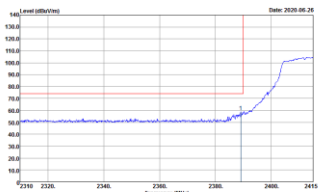
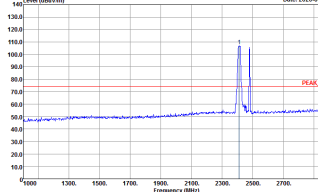
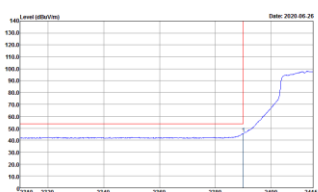
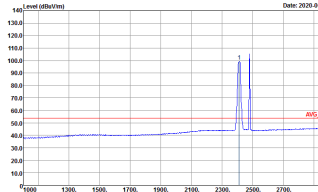
Appendix B. Radiated Spurious Emission Plots

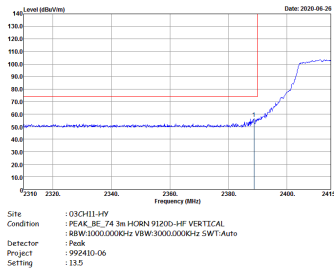
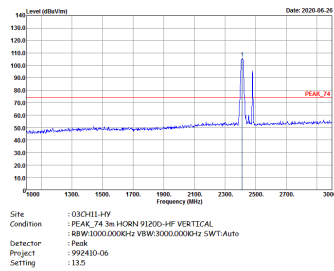
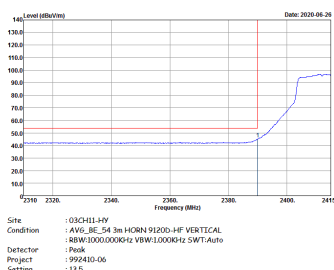
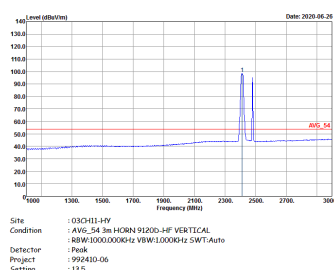
Test Engineer :	Fu Chen and Troye Hsieh	Temperature :	20.1~26.4 °C
		Relative Humidity :	51.7~68.3 %

Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11g_Tx_Ch01 (Band Edge @ 3m)

Ant.	Bluetooth_Tx_Ch78+802.11g_Tx_Ch01	
Simultaneously	Horizontal	Fundamental
Peak	Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 992410-06 Setting : B	Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 992410-06 Setting : B

Ant.	Bluetooth_Tx_Ch78+802.11g_Tx_Ch01	
Simultaneously	Vertical	Fundamental
Peak	 Site : 03CH11-1FV Condition : PEAK_BE_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 992410-06 Setting : 8	 Site : 03CH11-1FV Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 992410-06 Setting : 8

ANT	Bluetooth_Tx_Ch78+802.11g_Tx_Ch01	
Simultaneously	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto Detector : Peak Project : 992410-06 Setting : 13.5	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto Detector : Peak Project : 992410-06 Setting : 13.5
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL RBW:1000.0000Hz VBW:1.0000Hz SWT:Auto Detector : Peak Project : 992410-06 Setting : 13.5	 Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF HORIZONTAL RBW:1000.0000Hz VBW:1.0000Hz SWT:Auto Detector : Peak Project : 992410-06 Setting : 13.5

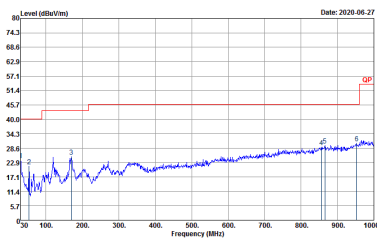
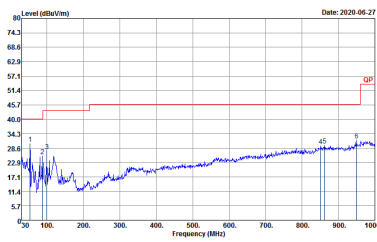
ANT	Bluetooth_Tx_Ch78+802.11g_Tx_Ch01	
Simultaneously	Vertical	Fundamental
Peak		
Avg.		



Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11g_Tx_Ch01 (Harmonic @ 3m)

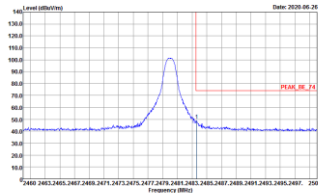
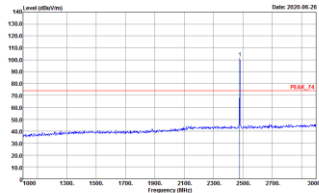
ANT	Bluetooth_Tx_Ch78+802.11g_Tx_Ch01	
Simultaneously	Horizontal	Vertical
Peak Avg.	Site : 030H11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 992410-06 Ant 0 : BT_Tx_Ch78(8) + Ant 1 : 11g_Tx_Ch01(13.5)	Site : 030H11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 992410-06 Ant 0 : BT_Tx_Ch78(8) + Ant 1 : 11g_Tx_Ch01(13.5)

Emission below 1GHz
Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11g_Tx_Ch01 (LF)

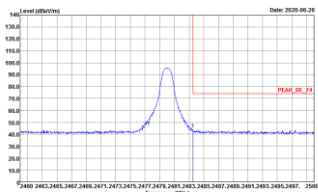
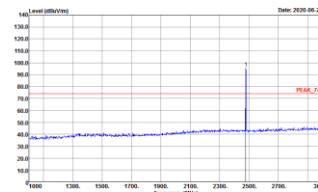
Ant.	Bluetooth_Tx_Ch78+802.11g_Tx_Ch01 LF	
Simultaneously	Horizontal	Vertical
QP / Peak	 Site : 03CH11-HY Condition : QP 3m BI-LO6 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 992410-06 Ant 0 : BT_Tx_Ch78(8) + + Ant 1 : 11g_Tx_Ch01(13.5)	 Site : 03CH11-HY Condition : QP 3m BI-LO6 6111D-LF_ETC VERTICAL Detector : Peak Project : 992410-06 Ant 0 : BT_Tx_Ch78(8) + + Ant 1 : 11g_Tx_Ch01(13.5)



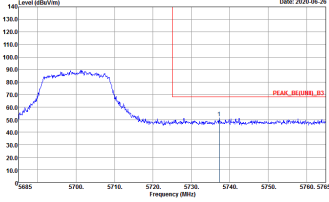
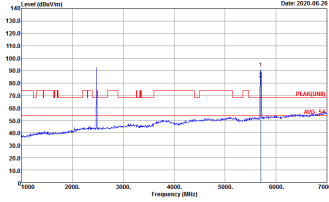
Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11n HT20_Tx_Ch140 (Band Edge @ 3m)

ANT	Bluetooth_Tx_Ch78+802.11n HT20_Tx_Ch140	
Simultaneously	Horizontal	Fundamental
Peak	 Site : :03CH11-HY Condition : :PEAK_BE_74 3m HORN 91200-HF HORIZONTAL Detector : :Peak Project : :992410-06 Setting : :8	 Site : :03CH11-HY Condition : :PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : :Peak Project : :992410-06 Setting : :8

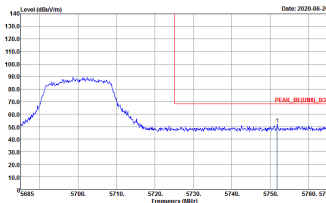
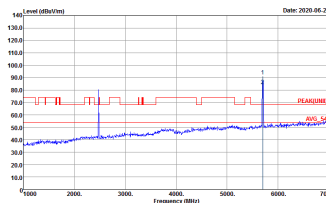


ANT	Bluetooth_Tx_Ch78+802.11n HT20_Tx_Ch140	
Simultaneously	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_78 3m HORN 92200-MF VERTICAL Detector : Peak Project : 992410-06 Setting : 8	 Site : 03CH11-HY Condition : PEAK_78 3m HORN 92200-MF VERTICAL Detector : Peak Project : 992410-06 Setting : 8

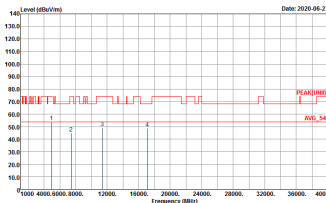
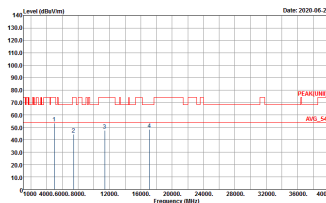


ANT	Bluetooth_Tx_Ch78+802.11n HT20_Tx_Ch140	
Simultaneously	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_360[UNIT]_B3 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 992410-06 Setting : 9.5	 Site : 03CH11-HY Condition : PEAK_360[UNIT]_B3 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 992410-06 Setting : 9.5



ANT	Bluetooth_Tx_Ch78+802.11n HT20_Tx_Ch140	
Simultaneously	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_3RDUNIT_83 3m HORN 91200-HF VERTICAL Detector : RBW:3000.000kHz VBW:3000.000kHz SWT:Auto Project : 992410-06 Setting : 9.5	 Site : 03CH11-HY Condition : PEAK_3RDUNIT_83 3m HORN 91200-HF VERTICAL Detector : RBW:3000.000kHz VBW:3000.000kHz SWT:Auto Project : 992410-06 Setting : 9.5

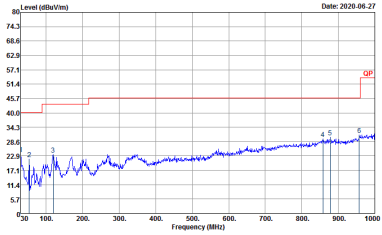
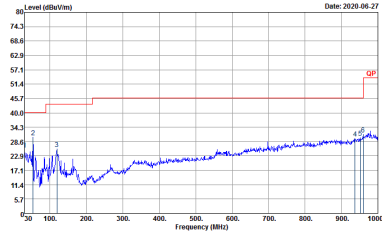
Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11n HT20_Tx_Ch140 (Harmonic @ 3m)

ANT	Bluetooth_Tx_Ch78+802.11n HT20_Tx_Ch140	
Simultaneously	Horizontal	Vertical
Peak Avg.	 Site : 03/CH11-HY Condition : PEAK(LINE1) 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 992410-06 Ant 0 : BT_Tx_Ch78(8) + Ant 1 : 11a(n20)_Tx_Ch140(9.5)	 Site : 03/CH11-HY Condition : PEAK(LINE1) 3m HORN 91200-HF VERTICAL Detector : Peak Project : 992410-06 Ant 0 : BT_Tx_Ch78(8) + Ant 1 : 11a(n20)_Tx_Ch140(9.5)



Emission below 1GHz

Ant 0_Bluetooth_Tx_Ch78 + Ant 1_802.11n HT20_Tx_Ch140 (LF)

Ant.	Bluetooth_Tx_Ch78+802.11n HT20_Tx_Ch140	
Simultaneously	Horizontal	Vertical
QP / Peak	 Site : 03CH11-HY Condition : QP 3m BI-LO6 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 992410-06 Ant 0 : BT_Tx_Ch78(8) + + Ant 1 : 11a(n20)_Tx_Ch140(9.5)	 Site : 03CH11-HY Condition : QP 3m BI-LO6 6111D-LF_ETC VERTICAL Detector : Peak Project : 992410-06 Ant 0 : BT_Tx_Ch78(8) + + Ant 1 : 11a(n20)_Tx_Ch140(9.5)



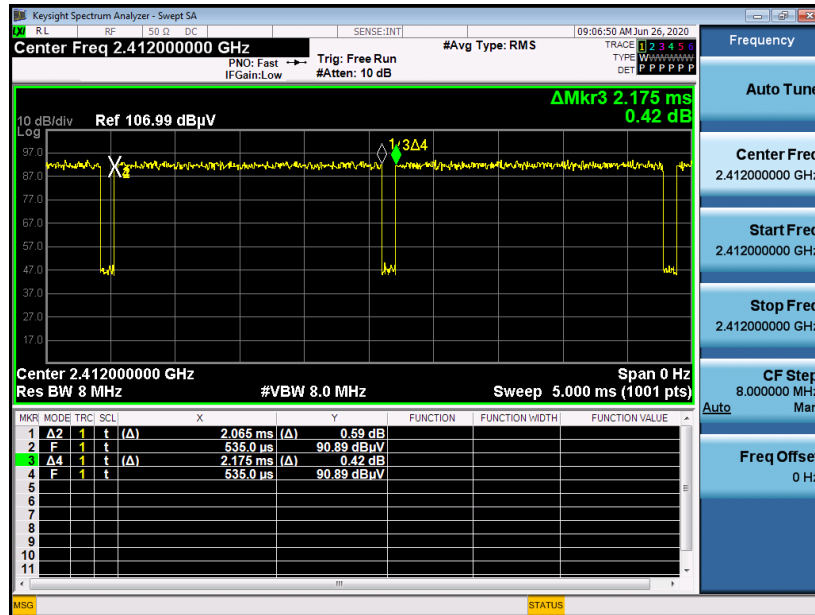
Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
1	802.11g	94.94	2065	0.48	1kHz	0.23
1	5GHz 802.11n HT20	94.26	1725	0.58	1kHz	0.26

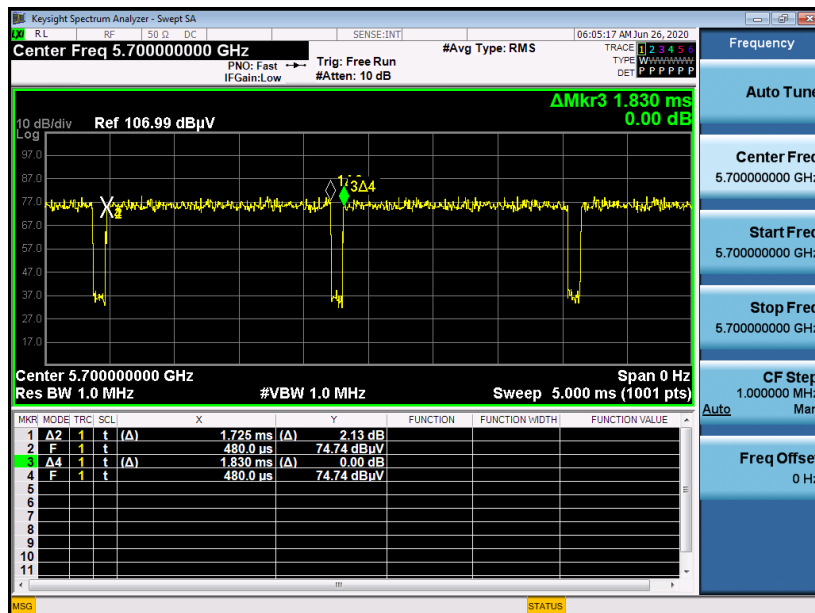


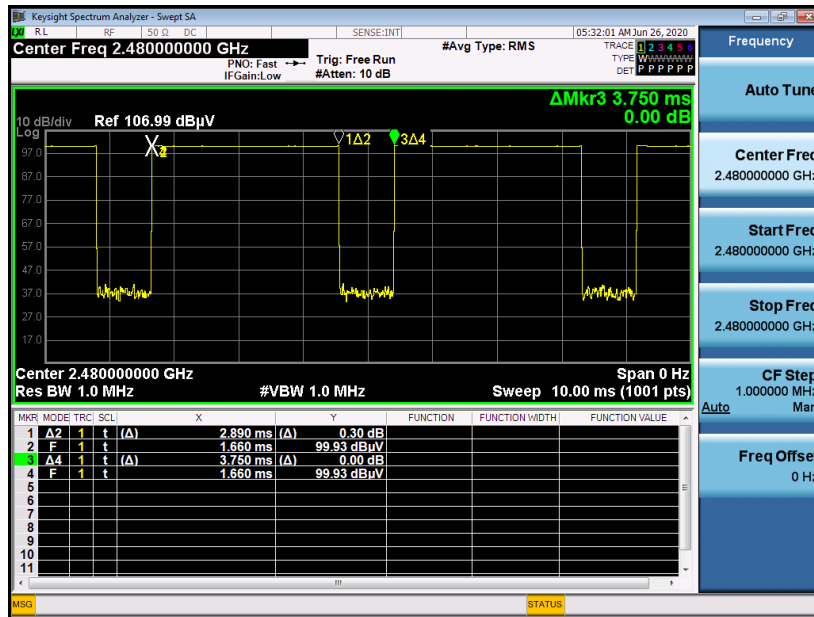
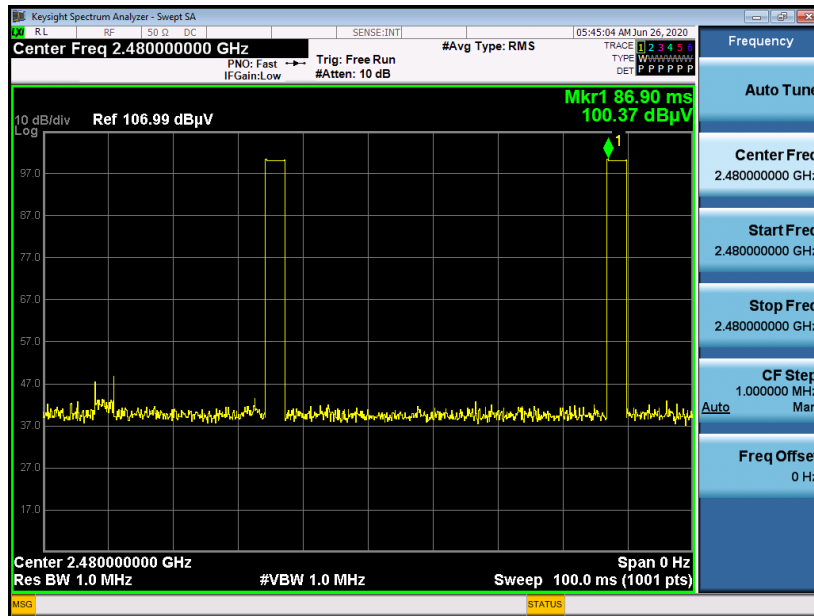
<Ant. 1>

802.11g



802.11n HT20



DH5 on time (One Pulse) Plot on Channel 78

on time (Count Pulses) Plot on Channel 78

Note:

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

**Duty Cycle Correction Factor Consideration for AFH mode:**

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

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

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

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. $[100\text{ms} / 57.6\text{ms}] = 2$ 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,

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