



FCC RADIO TEST REPORT

FCC ID	: ZL5S62PRO
Equipment	: Rugged Smart Phone
Brand Name	: CAT
Model Name	: S62 Pro
Applicant	: Bullitt Group
	One Valpy, Valpy Street, Reading, Berkshire, England RG1 1AR
Standard	: FCC Part 15 Subpart C §15.247

The product was received on Dec. 07, 2020 and testing was started from Dec. 15, 2020 and completed on Dec. 22, 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 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.

Lunis Win

Approved by: Louis Wu SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

Page Number: 1 of 16Issued Date: Jan. 26, 2021Report Version: 02



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History of this test report

Report No.	Version	Description	Issued Date
FR042406-07B	01	Initial issue of report	Jan. 07, 2021
FR042406-07B	02	Revising remark description.	Jan. 26, 2021



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.247(a)(2)	6dB Bandwidth	Not Required	-
-	2.1049	99% Occupied Bandwidth	Not Required	-
3.1	15.247(b)(3)	Output Power	Pass	-
-	15.247(e)	Power Spectral Density	Not Required	-
-	15.247(d)	Conducted Band Edges and Spurious Emission	Not Required	-
3.2	15.247(d)	Radiated Band Edges and Spurious Emission	Pass	Under limit 4.93 dB at 2366.595 MHz
-	15.207	AC Conducted Emission Not Require		-
3.3	15.203 & 15.247(b)	Antenna Requirement Pass		

Note:

- 1. Not required means after assessing, test items are not necessary to carry out.
- 2. This is a variant report which can be referred to change list. After spot-checking the tests, the parent test results were worse than variant test results, thus this test report was reuse parent test data, all the test cases were performed on original report which can be referred to Sporton Report Number FR042406-02B (FCC ID: ZL5S62PROE).

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: Lucy Wu



1 General Description

1.1 Product Feature of Equipment Under Test

GSM/WCDMA/LTE, 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				
Sample 1 Dual SIM				
Sample 2 Single SIM				
	WWAN			
	<main 1="">: PIFA Antenna</main>			
	<main 2="">: PIFA Antenna</main>			
	<diversity 1="">: PIFA Antenna</diversity>			
	<diversity 2="">: Loop Antenna</diversity>			
Antenna Type	WLAN 2.4GHz: PIFA Antenna			
	WLAN 5GHz: Mono Pole Antenna			
	Bluetooth: PIFA Antenna			
	GPS/Glonass/BDS/Galileo/SBAS: PIFA Antenna			
	NFC: Loop Antenna			

Antenna information				
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	1.20		

Remark:

- 1. The samples have same layout, circuit and components but different SIM tray. The phone software will identify the loaded sim card combinations whether with single sim card or dual sim cards.
- 2. The tests were performed with Sample 1.
- 3. The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

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 LocationNo.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978			
Test Site No.	Sporton Site No.		
Test one No.	TH05-HY		
Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory		
Test Site Test Site Location			
	Laboratory No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868		

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

FCC designation No.: TW1190 and 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 C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- 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

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
	0	2402	21	2444
	1	2404	22	2446
	2	2406	23	2448
	3	2408	24	2450
	4	2410	25	2452
	5	2412	26	2454
	6	2414	27	2456
	7	2416	28	2458
2400-2483.5 MHz	5 MHz 10 11 12 13	2418	29	2460
		2420	30	2462
		2422	31	2464
		2424	32	2466
		2426	33	2468
		2428	34	2470
	14	2430	35	2472
	15	2432	36	2474
	16 17 18	2434	37	2476
		2436	38	2478
		2438	39	2480
	19	2440	-	-
	20	2442	-	-



2.2 Test Mode

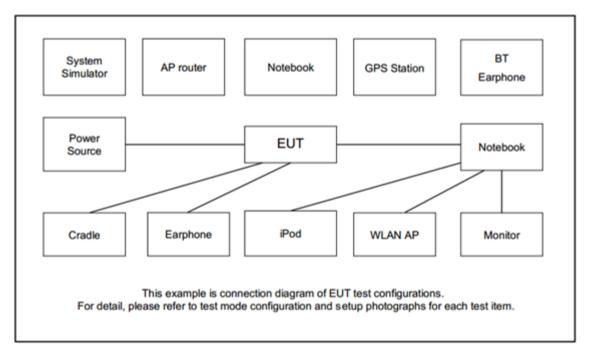
The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (1 GHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Z plane) were recorded in this report.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

	Summary table of Test Cases						
Test Item	Data Rate / Modulation						
	Bluetooth – LE / GFSK						
	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps						
Conducted	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps						
Test Cases	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps						
Test Cases	Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps						
	Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps						
	Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps						
Radiated	Mode 1: Plueteeth Ty CH00, 2402 MHz, 2Mbae						
Test Cases	Mode 1: Bluetooth Tx CH00_2402 MHz_2Mbps						



2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

The RF test items, utility "QRCT 4.0.00156.0" 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 Output Power Measurement

3.1.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6 dBi.

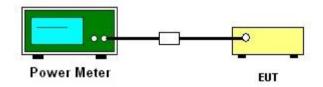
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

- 1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
- 2. The RF output of EUT was connected to the power meter by RF cable and attenuator.
- 3. The path loss was compensated to the results for each measurement.
- 4. Set to the maximum power setting and enable the EUT transmit continuously.
- 5. Measure the conducted output power and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of Average Output Power

Please refer to Appendix A.

3.2 Radiated Band Edges and Spurious Emission Measurement

3.2.1 Limit of Radiated Band Edges and Spurious Emission

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 was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

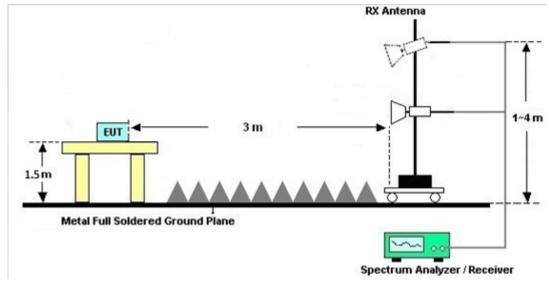
3.2.3 Test Procedures

- 1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
- 3. The EUT was placed on a turntable with 1.5 meter for frequency above 1GHz respectively above ground.
- 4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 5. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 6. 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.
- 7. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW = 1 MHz, VBW= 3MHz for $f \ge 1$ GHz for peak measurement. For average measurement:
 - 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.



3.2.4 Test Setup

For radiated test above 1GHz



3.2.5 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.2.6 Duty Cycle

Please refer to Appendix D.

3.2.7 Test Result of Radiated Spurious Emission

Please refer to Appendix B and C.



3.3 Antenna Requirements

3.3.1 Standard Applicable

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.

3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.3.3 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
Power Sensor	DARE	RPR3006W	17100015 SNO37	10MHz~6GHz	Dec. 02, 2020	Dec. 15, 2020	Dec. 01, 2021	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSP7	101131	9kHz~7GHz	Aug. 12, 2020	Dec. 15, 2020	Aug. 11, 2021	Conducted (TH05-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW191204	N/A	Jan. 13, 2020	Dec. 15, 2020	Jan. 12, 2021	Conducted (TH05-HY)
Hygrometer	Testo	HTC-1	2	N/A	Mar. 02, 2020	Dec. 15, 2020	Mar. 01, 2021	Conducted (TH05-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-152 2	1G~18GHz	Sep. 29, 2020	Dec. 18, 2020~ Dec. 22, 2020	Sep. 28, 2021	Radiation (03CH16-HY)
Preamplifier	Jet-Power	JPA0118-55-3 03	171000180 0054001	1GHz~18GHz	Sep. 04, 2020	Dec. 18, 2020~ Dec. 22, 2020	Sep. 03, 2021	Radiation (03CH16-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170 576	18GHz ~40GHz	May 22, 2020	Dec. 18, 2020~ Dec. 22, 2020	May 21, 2021	Radiation (03CH16-HY)
Preamplifier	Keysight	83017A	MY532702 64	1GHz~26.5GHz	Dec. 10, 2020	Dec. 18, 2020~ Dec. 22, 2020	Dec. 09, 2021	Radiation (03CH16-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY572901 11	3Hz~26.5GHz	Dec. 11, 2020	Dec. 18, 2020~ Dec. 22, 2020	Dec. 10, 2021	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11680/ 4PE	NA	Aug. 29, 2020	Dec. 18, 2020~ Dec. 22, 2020	Aug. 28, 2021	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11688/ 4PE	NA	Aug. 29, 2020	Dec. 18, 2020~ Dec. 22, 2020	Aug. 28, 2021	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	EC-A5-300 -5757	NA	Aug. 29, 2020	Dec. 18, 2020~ Dec. 22, 2020	Aug. 28, 2021	Radiation (03CH16-HY)
Hygrometer	TECPEL	DTM-303B	TP200881	QA-3-031	Oct. 22, 2020	Dec. 18, 2020~ Dec. 22, 2020	Oct. 21, 2021	Radiation (03CH16-HY)
Software	Audix	E3 6.2009-8-24	RK-001136	N/A	N/A	Dec. 18, 2020~ Dec. 22, 2020	N/A	Radiation (03CH16-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Dec. 18, 2020~ Dec. 22, 2020	N/A	Radiation (03CH16-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Dec. 18, 2020~ Dec. 22, 2020	N/A	Radiation (03CH16-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Dec. 18, 2020~ Dec. 22, 2020	N/A	Radiation (03CH16-HY)



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence	6.2
of 95% (U = 2Uc(y))	6.3

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

Measuring Uncertainty for a Level of Confidence	4.7
of 95% (U = 2Uc(y))	4.7

Report Number : FR042406-07B

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Ching Chen	Temperature:	20.9~23.4	°C
Test Date:	2020/12/15	Relative Humidity:	54~57.7	%

<u>TEST RESULTS DATA</u> <u>Average Power Table</u>						
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)	
BLE	1Mbps	1	0	2402	0.60	
BLE	1Mbps	1	19	2440	0.80	
BLE	1Mbps	1	39	2480	1.50	

	<u>TEST RESULTS DATA</u> <u>Average Power Table</u>						
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)		
BLE	2Mbps	1	0	2402	0.60		
BLE	2Mbps	1	19	2440	0.80		
BLE	2Mbps	1	39	2480	1.50		



Appendix B. Radiated Spurious Emission

Test Engineer :	Andy Yang, Karl Hou and Caster Liao	Temperature :	20~25°C
rest Engineer .		Relative Humidity :	50~65%

<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				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)
		2352.525	57.07	-16.93	74	41.17	27.78	18.41	30.29	176	52	Р	Н
		2335.935	48.53	-5.47	54	32.62	27.83	18.38	30.3	176	52	А	н
	*	2402	97.9	-	-	82.18	27.5	18.5	30.28	176	52	Р	Н
	*	2402	96.45	-	-	80.73	27.5	18.5	30.28	176	52	А	Н
													н
BLE													Н
CH 00 2402MHz		2362.395	56.43	-17.57	74	40.56	27.73	18.43	30.29	103	84	Ρ	V
240210172		2366.595	49.07	-4.93	54	33.22	27.7	18.44	30.29	103	84	А	V
	*	2402	97.64	-	-	81.92	27.5	18.5	30.28	103	84	Ρ	V
	*	2402	96.25	-	-	80.53	27.5	18.5	30.28	103	84	А	V
													V
													V



BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
		(MHz)	(dBµV/m)	Limit (dB)	Line (dBµV/m)	Level (dBµV)	Factor (dB/m)	Loss (dB)	Factor (dB)	Pos (cm)	Pos (deg)	Avg. (P/A)	(H/V)
		4804	38.73	-35.27	74	53.74	31.11	13.36	59.48	100	0	P	н
													Н
BLE													Н
CH 00													Н
2402MHz		4804	38.56	-35.44	74	53.57	31.11	13.36	59.48	100	0	Ρ	V
													V
													V
													V
Remark	1. No	o other spurious	s found.										
Remark	2. Al	l results are PA	SS against F	eak and	Average lim	it line.							

BLE (Harmonic @ 3m)



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:

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				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)
BLE		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	Р	н
CH 00													
2402MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	А	Н

- 1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
- 2. Level($dB\mu V/m$) =

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

3. Over Limit(dB) = Level(dB μ V/m) – Limit Line(dB μ V/m)

For Peak Limit @ 2390MHz:

- 1. Level(dBµV/m)
- = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBµV) Preamp Factor(dB)
- $= 32.22(dB/m) + 4.58(dB) + 54.51(dB\mu V) 35.86 (dB)$
- = 55.45 (dBµV/m)
- 2. Over Limit(dB)
- = Level(dBµV/m) Limit Line(dBµV/m)
- $= 55.45(dB\mu V/m) 74(dB\mu V/m)$
- = -18.55(dB)

For Average Limit @ 2390MHz:

- 1. Level(dBµV/m)
- = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBµV) Preamp Factor(dB)
- $= 32.22(dB/m) + 4.58(dB) + 42.6(dB\mu V) 35.86 (dB)$
- = 43.54 (dBµV/m)
- 2. Over Limit(dB)
- = Level(dB μ V/m) Limit Line(dB μ V/m)
- $= 43.54(dB\mu V/m) 54(dB\mu V/m)$
- = -10.46(dB)

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



Appendix C. Radiated Spurious Emission Plots

Toot Engineer -		Temperature :	20~25°C
Test Engineer :	Andy Yang, Karl Hou and Caster Liao	Relative Humidity :	50~65%

Note symbol

-L	Low channel location
-R	High channel location

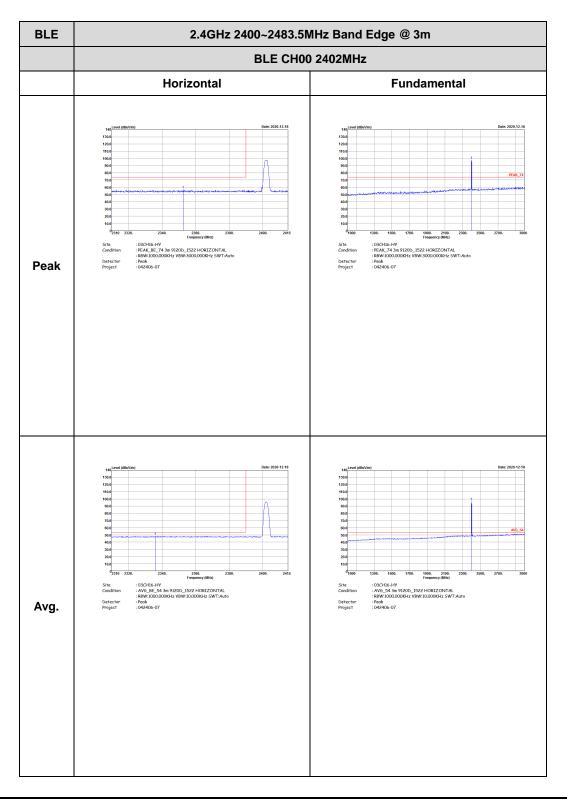




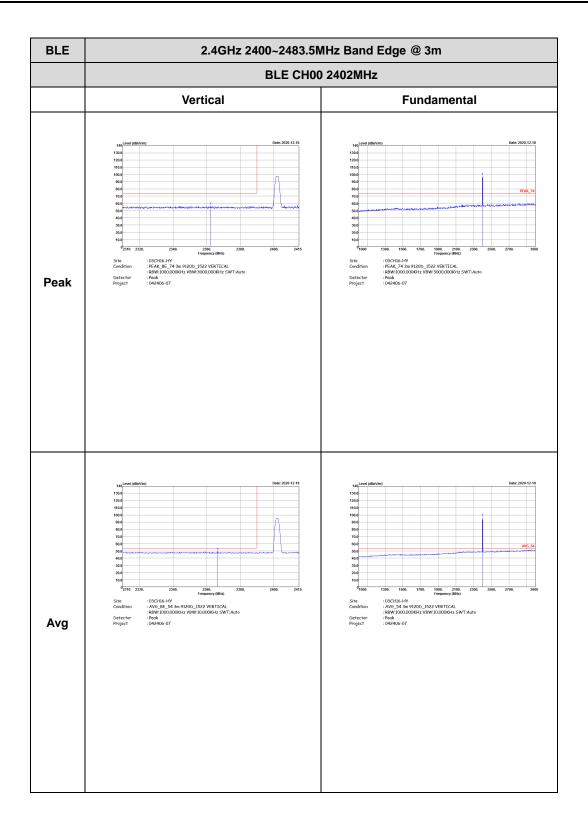
<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)



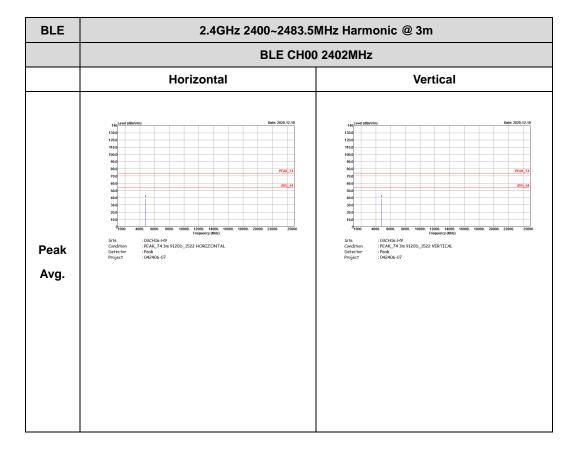






2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)







Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
Bluetooth –LE for 2Mbps	32	200	5.00	10kHz	4.95

