



# FCC RADIO TEST REPORT

**FCC ID** : PPD-QCNFA435  
**Equipment** : Single Stream 802.11a/b/g/n/ac + BT 4.1 M.2 Type Card  
**Brand Name** : Qualcomm Atheros  
**Model Name** : QCNFA435  
**Applicant** : Qualcomm Atheros, Inc  
1700 Technology Drive, San Jose, CA 95110  
**Manufacturer** : Qualcomm Atheros, Inc  
1700 Technology Drive, San Jose, CA 95110  
**Standard** : FCC Part 15 Subpart C §15.247

The product was received on Jun. 27, 2018 and testing was started from Jul. 23, 2018 and completed on Aug. 08, 2018. We, SPORTON INTERNATIONAL INC., 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 partial 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: Jones Tsai

**SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory**

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



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## History of this test report



## Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(b)(3)	Peak Output Power	Pass	-
3.2	15.247(d)	Radiated Band Edges and Spurious Emission	Pass	Under limit 5.22 dB at 30.270 MHz
3.3	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Reviewed by: Joseph Lin

Report Producer: Maggie Chiang



## 1 General Description

### 1.1 Product Feature of Equipment Under Test

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

Product Specification subjective to this standard	
Sample 1	EUT with Host 1
Sample 2	EUT with Host 2

The product was installed into Portable Computer (Brand Name: DELL, Model Name: P93G) during test, and the host information was recorded in the following table.

Host Information	
Host 1	Host with WNC Antenna
Host 2	Host with HB Antenna

Antenna Information									
Mode	Manufacturer	Antenna type	Antenna	2.4G	5G B1	5G B2	5G B3	5G B4	
Notebook	HB	PIFA	1(main)	0.86	-0.24	-1.62	-0.75	-0.21	
			2(aux)	-0.53	-0.24	0.05	1.14	0.38	
	WNC	PIFA	1(main)	-0.87	-4.57	-4	-5.76	-5.19	
			2(aux)	-0.16	-2.63	-2.7	-1.12	-1.12	

Antenna Information									
Mode	Manufacturer	Antenna type	Antenna	2.4G	5G B1	5G B2	5G B3	5G B4	
Tablet	HB	PIFA	1(main)	0.38	-1.58	-1.7	-0.65	0.05	
			2(aux)	-1.66	-0.7	-0.35	-0.7	0.47	
	WNC	PIFA	1(main)	-2	-4.41	-4.41	-4.67	-4.39	
			2(aux)	-0.57	-3.1	-3.1	-3.46	-3.31	

### 1.2 Modification of EUT

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



### 1.3 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1190 and TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

<b>Test Site</b>	SPORTON INTERNATIONAL INC.
<b>Test Site Location</b>	No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
<b>Test Site No.</b>	<b>Sporton Site No.</b> TH05-HY

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

<b>Test Site</b>	SPORTON INTERNATIONAL INC.
<b>Test Site Location</b>	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
<b>Test Site No.</b>	<b>Sporton Site No.</b> 03CH12-HY

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

### 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 v04
- ♦ ANSI C63.10-2013

**Remark:** All test items were verified and recorded according to the standards and without any deviation during the test.



## 2 Test Configuration of Equipment Under Test

### 2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 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
	8	2418	29	2460
	9	2420	30	2462
	10	2422	31	2464
	11	2424	32	2466
	12	2426	33	2468
	13	2428	34	2470
	14	2430	35	2472
	15	2432	36	2474
	16	2434	37	2476
	17	2436	38	2478
	18	2438	39	2480
	19	2440	-	-
	20	2442	-	-

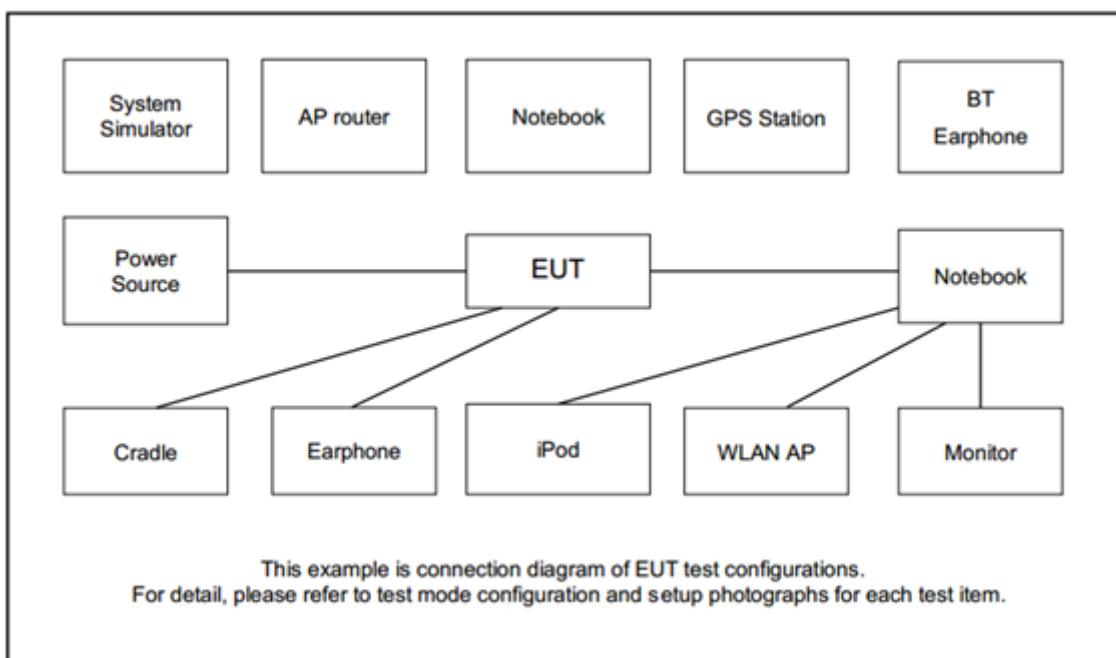
## 2.2 Test Mode

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 (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in orthogonal panels, X, Y, Z, and Notebook type, the worst cases (Notebook type) 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
Radiated Test Cases	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps for Sample 1 Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps for Sample 1 Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps for Sample 1 Mode 4: Bluetooth Tx CH19_2440 MHz_1Mbps for Sample 2
<b>Remark:</b>	
1. For Radiated Test Cases, the tests were performed with Adapter 1. 2. The test configuration was designated by manufacturer.	

## 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.	iPod Earphone	Apple	N/A	Verification	N/A	N/A

## 2.5 EUT Operation Test Setup

The RF test items, utility “QRCT” was installed in Portable Computer 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 peak 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 6dBi.

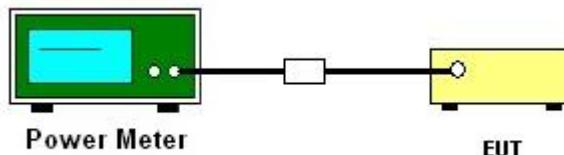
##### 3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

##### 3.1.3 Test Procedures

1. For Peak Power, the testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.1.3 PKPM1 Peak power meter method.
2. For Average Power, the testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.2.3.1 Method AVGPM.
3. The RF output of EUT was connected to the power meter by RF cable and attenuator.
4. The path loss was compensated to the results for each measurement.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Measure the conducted output power and record the results in the test report.

##### 3.1.4 Test Setup



##### 3.1.5 Test Result of Peak Output Power

Please refer to Appendix A.

##### 3.1.6 Test Result of Average Output Power (Reporting Only)

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 (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

### 3.2.2 Measuring Instruments

See list of measuring equipment of this test report.



### 3.2.3 Test Procedures

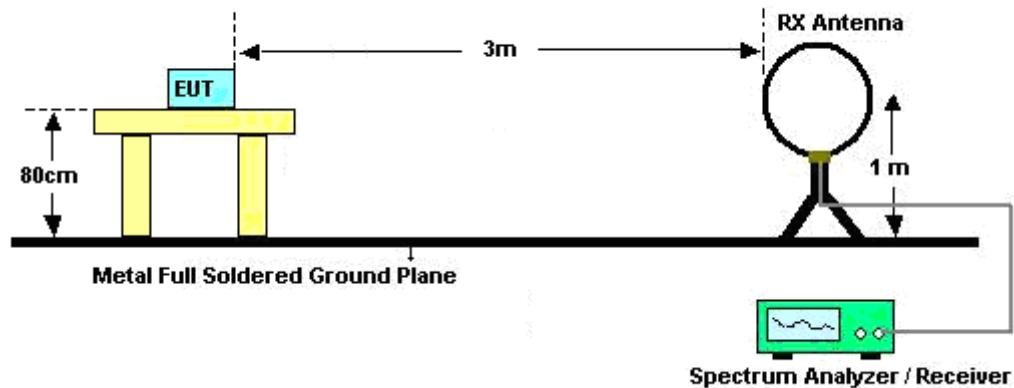
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 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 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.
8. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW=100 kHz for  $f < 1$  GHz; VBW  $\geq$  RBW; Sweep = auto; Detector function = peak; Trace = max hold;
  - (3) Set RBW = 1 MHz, VBW= 3MHz for  $f \geq 1$  GHz for peak measurement.

For average measurement:

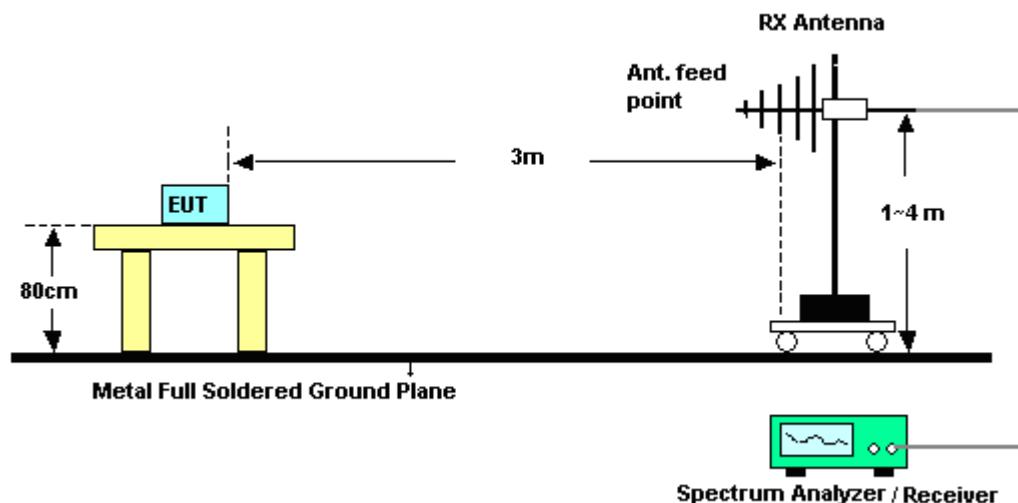
  - VBW = 10 Hz, when duty cycle is no less than 98 percent.
  - VBW  $\geq 1/T$ , when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

### 3.2.4 Test Setup

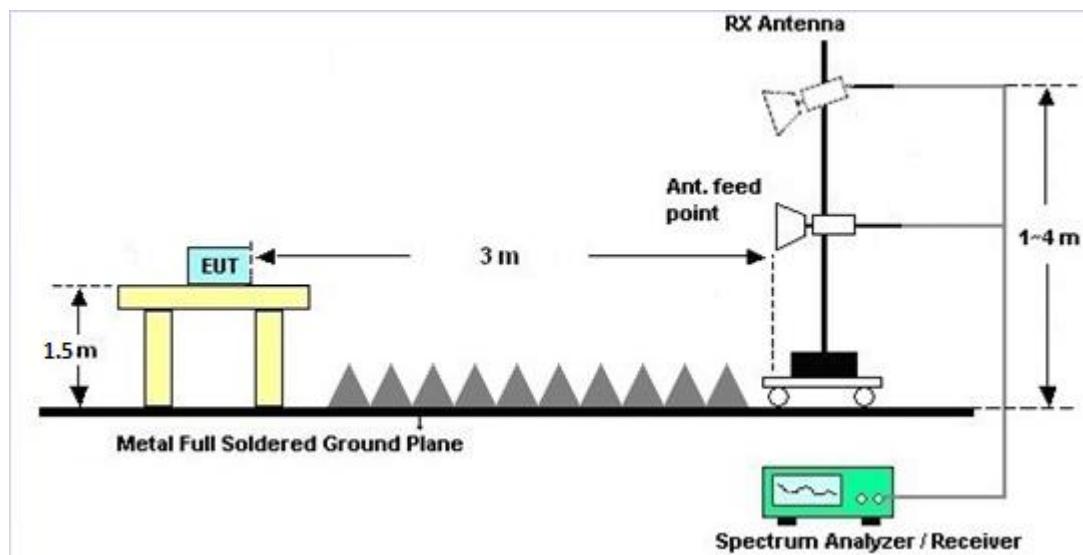
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



### 3.2.5 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 semi-Anechoic chamber, and the result came out very similar.

### 3.2.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

### 3.2.7 Duty Cycle

Please refer to Appendix D.

### 3.2.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

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	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Meter	Agilent	E4416A	GB41292344	N/A	Dec. 20, 2017	Jul. 24, 2018	Dec. 19, 2018	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US40441548	50MHz~18GHz	Dec. 20, 2017	Jul. 24, 2018	Dec. 19, 2018	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101067	9kHz ~ 30GHz	Nov. 13, 2017	Jul. 24, 2018	Nov. 12, 2018	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1300484	N/A	Mar. 01, 2018	Jul. 24, 2018	Feb. 28, 2019	Conducted (TH05-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	Jul. 23, 2018~Aug. 08, 2018	Nov. 22, 2018	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800N1 D01N-06	37059&01	30MHz~1GHz	Oct. 14, 2017	Jul. 23, 2018~Aug. 08, 2018	Oct. 13, 2018	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1328	1GHz ~ 18GHz	Oct. 20, 2017	Jul. 23, 2018~Aug. 08, 2018	Oct. 19, 2018	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz ~ 40GHz	Nov. 27, 2017	Jul. 23, 2018~Aug. 08, 2018	Nov. 26, 2018	Radiation (03CH12-HY)
Preamplifier	COM-POWER	PA-103	161075	10MHz~1GHz	Mar. 26, 2018	Jul. 23, 2018~Aug. 08, 2018	Mar. 25, 2019	Radiation (03CH12-HY)
Preamplifier	Keysight	83017A	MY53270148	1GHz~26.5GHz	Jan. 15, 2018	Jul. 23, 2018~Aug. 08, 2018	Jan. 14, 2019	Radiation (03CH12-HY)
Preamplifier	MITEQ	AMF-7D-001018 00-30-10P	1590074	1GHz~18GHz	May 21, 2018	Jul. 23, 2018~Aug. 08, 2018	May 20, 2019	Radiation (03CH12-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 16, 2018	Jul. 23, 2018~Aug. 08, 2018	Jul. 15, 2019	Radiation (03CH12-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100390	20Hz~26.5GHz	Dec. 25, 2017	Jul. 23, 2018~Aug. 08, 2018	Dec. 24, 2018	Radiation (03CH12-HY)
Filter	Wainwright	WFKX12-2700-3000-18000-60SS	SN3	2.7G High Pass	Sep. 18, 2017	Jul. 23, 2018~Aug. 08, 2018	Sep. 17, 2018	Radiation (03CH12-HY)
Filter	Wainwright	WLK4-1000-153 0-8000-40SS	SN11	1G Low Pass	Sep. 18, 2017	Jul. 23, 2018~Aug. 08, 2018	Sep. 17, 2018	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30M-18G	Mar. 14, 2018	Jul. 23, 2018~Aug. 08, 2018	Mar. 13, 2019	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Oct. 17, 2017	Jul. 23, 2018~Aug. 08, 2018	Oct. 16, 2018	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30M~40GHz	Oct. 17, 2017	Jul. 23, 2018~Aug. 08, 2018	Oct. 16, 2018	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Jul. 23, 2018~Aug. 08, 2018	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Jul. 23, 2018~Aug. 08, 2018	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	Jul. 23, 2018~Aug. 08, 2018	N/A	Radiation (03CH12-HY)



## 5 Uncertainty of Evaluation

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

<b>Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))</b>	<b>5.1</b>
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### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

<b>Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))</b>	<b>5.2</b>
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### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

<b>Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))</b>	<b>4.7</b>
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## Appendix A. Test Result of Conducted Test Items

Test Engineer:	Luffy Lin	Temperature:	21~25	°C
Test Date:	2018/7/24	Relative Humidity:	51~54	%

<b><u>TEST RESULTS DATA</u></b>						
<b><u>Peak Power Table</u></b>						
Mod.	Data Rate	N <sub>TX</sub>	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)
BLE	1Mbps	1	0	2402	3.23	30.00
BLE	1Mbps	1	19	2440	3.46	30.00
BLE	1Mbps	1	39	2480	3.64	30.00

<b><u>TEST RESULTS DATA</u></b>						
<b><u>Average Power Table</u></b>						
<b><u>(Reporting Only)</u></b>						
Mod.	Data Rate	N <sub>TX</sub>	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	1Mbps	1	0	2402	1.92	-1.14
BLE	1Mbps	1	19	2440	1.92	-0.91
BLE	1Mbps	1	39	2480	1.92	-0.85



## Appendix B. Radiated Spurious Emission

Test Engineer :	Jack Cheng and Peter Liao	Temperature :		22~25°C	
		Relative Humidity :	58~65%		

&lt;For Sample 1&gt;

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB/m )	Path Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Peak Avg. (P/A)	Pol.
BLE CH 00 2402MHz		2386.23	56.26	-17.74	74	44.01	27.15	16.68	31.58	201	114	P	H
		2382.87	45.54	-8.46	54	33.34	27.11	16.67	31.58	201	114	A	H
	*	2402	92.81	-	-	80.53	27.15	16.7	31.57	201	114	P	H
	*	2402	91.33	-	-	79.05	27.15	16.7	31.57	201	114	A	H
													H
		2341.71	56.95	-17.05	74	44.89	27.03	16.61	31.58	284	88	P	V
		2360.4	45.57	-8.43	54	33.44	27.07	16.64	31.58	284	88	A	V
	*	2402	93.81	-	-	81.53	27.15	16.7	31.57	284	88	P	V
	*	2402	92.35	-	-	80.07	27.15	16.7	31.57	284	88	A	V
													V
BLE CH 19 2440MHz		2343.46	55.85	-18.15	74	43.78	27.03	16.62	31.58	154	63	P	H
		2383.78	45.52	-8.48	54	33.31	27.11	16.68	31.58	154	63	A	H
	*	2440	92.33	-	-	79.86	27.28	16.76	31.57	154	63	P	H
	*	2440	90.85	-	-	78.38	27.28	16.76	31.57	154	63	A	H
		2485.16	56.82	-17.18	74	44.2	27.36	16.82	31.56	154	63	P	H
		2495.1	45.75	-8.25	54	33.06	27.4	16.84	31.55	154	63	A	H
		2385.18	56.25	-17.75	74	44.04	27.11	16.68	31.58	283	89	P	V
		2369.92	45.36	-8.64	54	33.18	27.11	16.65	31.58	283	89	A	V
	*	2440	93.41	-	-	80.94	27.28	16.76	31.57	283	89	P	V
	*	2440	92.02	-	-	79.55	27.28	16.76	31.57	283	89	A	V
		2488.24	56.71	-17.29	74	44.04	27.4	16.83	31.56	283	89	P	V
		2495.17	45.53	-8.47	54	32.84	27.4	16.84	31.55	283	89	A	V



BLE CH 39 2480MHz	*	2480	91.11	-	-	78.49	27.36	16.82	31.56	114	119	P	H	
	*	2480	89.66	-	-	77.04	27.36	16.82	31.56	114	119	A	H	
		2495.24	56.72	-17.28	74	44.03	27.4	16.84	31.55	114	119	P	H	
		2494.28	45.58	-8.42	54	32.89	27.4	16.84	31.55	114	119	A	H	
													H	
													H	
	*	2480	91.82	-	-	79.2	27.36	16.82	31.56	250	91	P	V	
	*	2480	90.5	-	-	77.88	27.36	16.82	31.56	250	91	A	V	
		2499.88	56.73	-17.27	74	44.04	27.4	16.84	31.55	250	91	P	V	
		2499.64	45.59	-8.41	54	32.9	27.4	16.84	31.55	250	91	A	V	
													V	
													V	
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.													



## 2.4GHz 2400~2483.5MHz

## BLE (Harmonic @ 3m)

BLE	Note	Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB/m )	Path Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		4804	41.37	-32.63	74	57.22	31.32	10.42	57.59	100	0	P	H
													H
													H
													H
		4804	47.17	-26.83	74	63.02	31.32	10.42	57.59	100	0	P	V
													V
													V
													V
BLE CH 19 2440MHz		4880	41.09	-32.91	74	56.6	31.46	10.47	57.44	100	0	P	H
		7320	45.03	-28.97	74	53.38	36.15	12.78	57.28	100	0	P	H
													H
													H
		4880	43.16	-30.84	74	58.67	31.46	10.47	57.44	100	0	P	V
		7320	45.58	-28.42	74	53.93	36.15	12.78	57.28	100	0	P	V
													V
													V
BLE CH 39 2480MHz		4960	41.27	-32.73	74	56.41	31.63	10.51	57.28	100	0	P	H
		7440	45.64	-28.36	74	53.8	36.47	12.8	57.43	100	0	P	H
													H
													H
		4960	44.1	-29.9	74	59.24	31.63	10.51	57.28	100	0	P	V
		7440	46.55	-27.45	74	54.71	36.47	12.8	57.43	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

## 2.4GHz BLE (LF)



&lt;For Sample 2&gt;

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB/m )	Path Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 19 2440MHz		2363.9	56.1	-17.9	74	43.96	27.07	16.65	31.58	100	124	P	H
		2387.42	45.37	-8.63	54	33.12	27.15	16.68	31.58	100	124	A	H
	*	2440	94.31	-	-	81.84	27.28	16.76	31.57	100	124	P	H
	*	2440	92.76	-	-	80.29	27.28	16.76	31.57	100	124	P	H
		2490.97	56.71	-17.29	74	44.04	27.4	16.83	31.56	100	124	P	H
		2489.78	45.68	-8.32	54	33.01	27.4	16.83	31.56	100	124	A	H
		2368.8	56.67	-17.33	74	44.49	27.11	16.65	31.58	295	271	P	V
		2386.02	45.58	-8.42	54	33.33	27.15	16.68	31.58	295	271	A	V
	*	2440	94.86	-	-	82.39	27.28	16.76	31.57	295	271	P	V
	*	2440	93.32	-	-	80.85	27.28	16.76	31.57	295	271	A	V
		2488.8	56.55	-17.45	74	43.88	27.4	16.83	31.56	295	271	P	V
		2494.61	45.72	-8.28	54	33.03	27.4	16.84	31.55	295	271	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



## 2.4GHz 2400~2483.5MHz

## BLE (Harmonic @ 3m)

BLE	Note	Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB/m )	Path Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 19 2440MHz		4880	41.14	-32.86	74	56.65	31.46	10.47	57.44	100	0	P	H
		7320	46.15	-27.85	74	54.5	36.15	12.78	57.28	100	0	P	H
													H
													H
		4880	43.65	-30.35	74	59.16	31.46	10.47	57.44	100	0	P	V
		7320	45.36	-28.64	74	53.71	36.15	12.78	57.28	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

## 2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
												Avg.	
												( P/A )	( H/V )
2.4GHz BLE LF		69.15	25.71	-14.29	40	44.82	12.2	1.18	32.49	-	-	P	H
		203.34	24.58	-18.92	43.5	39.92	14.97	2.08	32.39	-	-	P	H
		244.11	27.73	-18.27	46	40.08	17.74	2.29	32.38	-	-	P	H
		360.2	29.75	-16.25	46	38.82	20.61	2.67	32.35	-	-	P	H
		829.9	31	-15	46	31.14	27.85	4.04	32.03	-	-	P	H
		955.9	33.1	-12.9	46	29	30.81	4.44	31.15	100	0	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



**Note symbol**

*	<b>Fundamental Frequency</b> which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is <b>over limit</b> line.
P/A	<b>Peak or Average</b>
H/V	<b>Horizontal or Vertical</b>



**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 )	( dB $\mu$ V/m )	( dB )	( dB $\mu$ V/m )	( dB $\mu$ V )	( dB/m )	( dB )	( dB )	( cm )	( deg )	(P/A)	(H/V)
<b>BLE CH 00 2402MHz</b>		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		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(dB $\mu$ V/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dB $\mu$ V) - Preamp Factor(dB)

3. Over Limit(dB) = Level(dB $\mu$ V/m) – Limit Line(dB $\mu$ V/m)

#### For Peak Limit @ 2390MHz:

1. Level(dB $\mu$ V/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dB $\mu$ V) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dB $\mu$ V) – 35.86 (dB)

= 55.45 (dB $\mu$ V/m)

2. Over Limit(dB)

= Level(dB $\mu$ V/m) – Limit Line(dB $\mu$ V/m)

= 55.45(dB $\mu$ V/m) – 74(dB $\mu$ V/m)

= -18.55(dB)

#### For Average Limit @ 2390MHz:

1. Level(dB $\mu$ V/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dB $\mu$ V) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dB $\mu$ V) – 35.86 (dB)

= 43.54 (dB $\mu$ V/m)

2. Over Limit(dB)

= Level(dB $\mu$ V/m) – Limit Line(dB $\mu$ 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

<b>Test Engineer :</b>	Jack Cheng and Peter Liao	<b>Temperature :</b>	22~25°C
		<b>Relative Humidity :</b>	58~65%

### Note symbol

-L	Low channel location
-R	High channel location

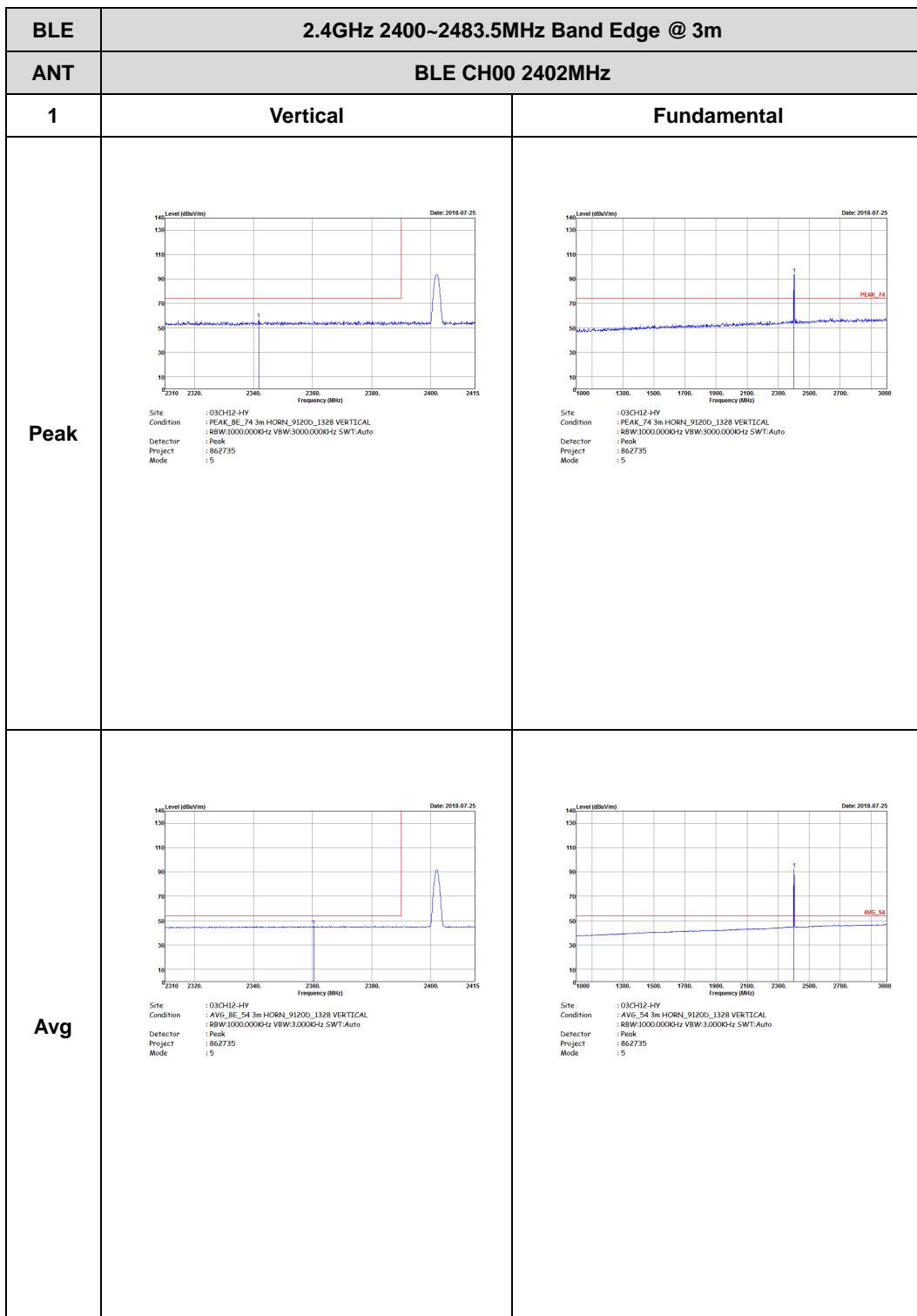


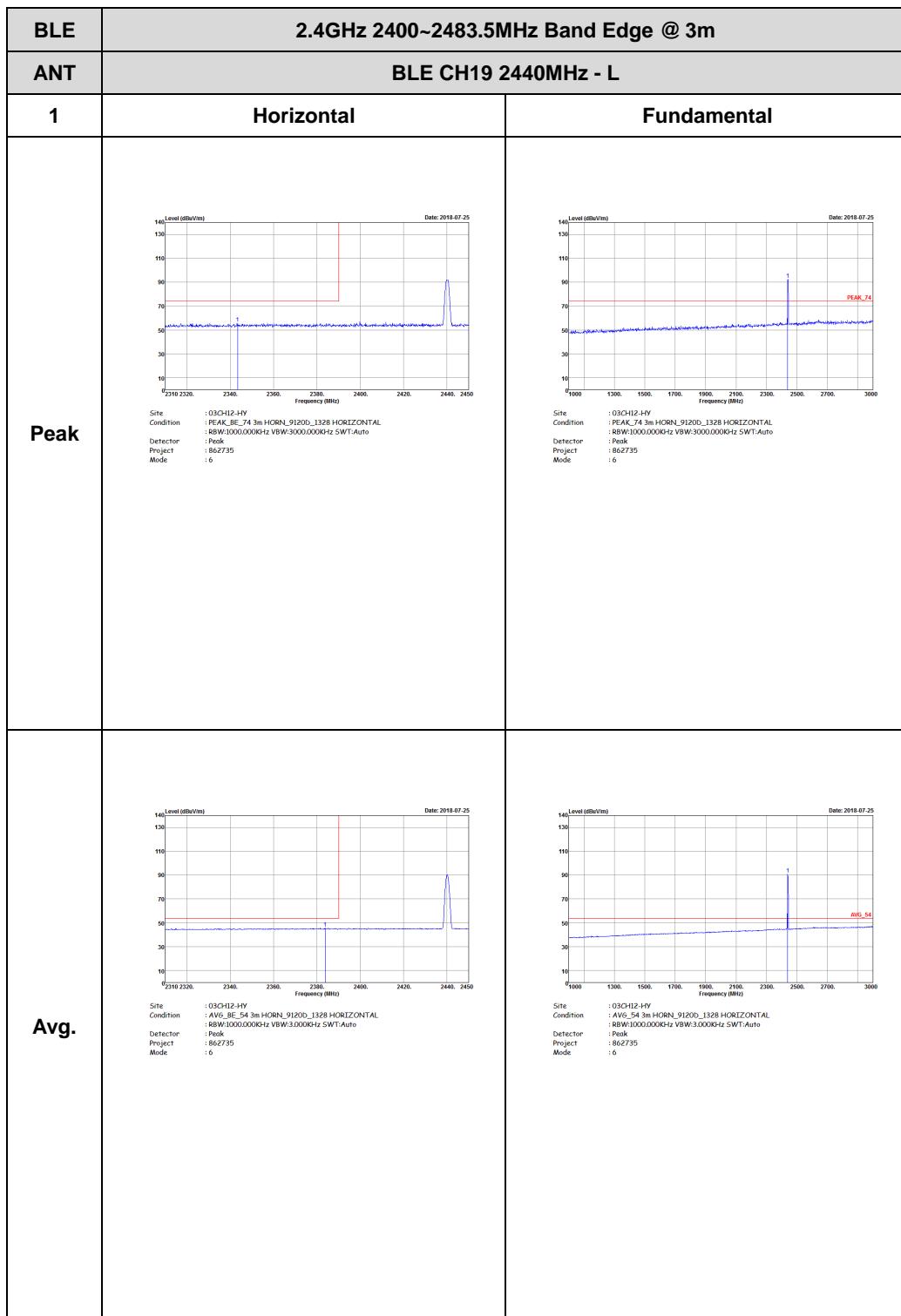
## &lt;For Sample 1&gt;

2.4GHz 2400~2483.5MHz

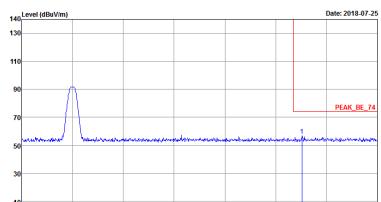
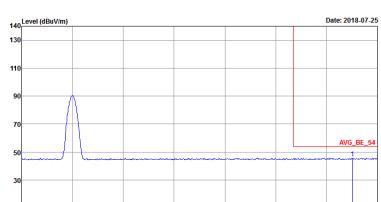
BLE (Band Edge @ 3m)

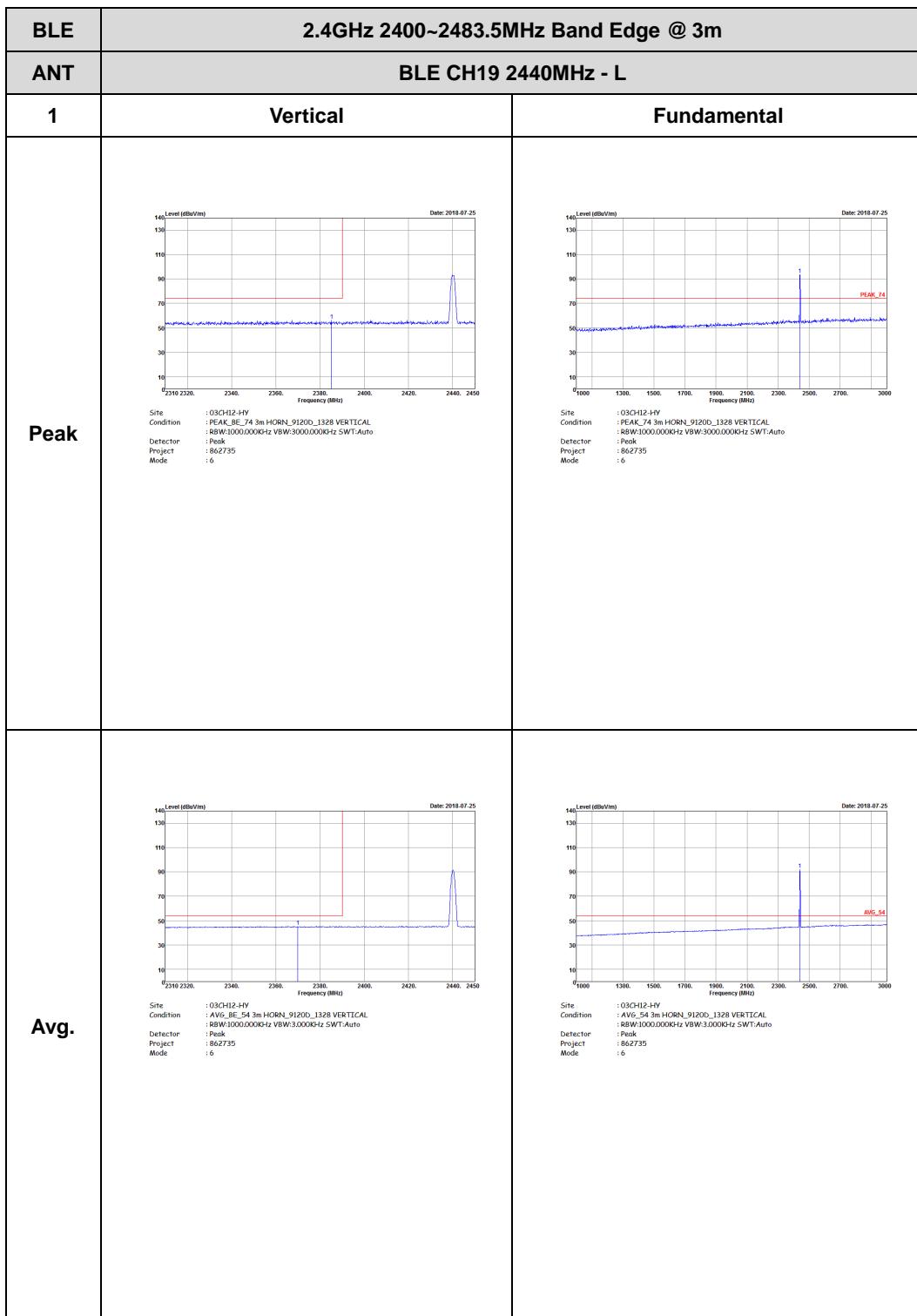
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH12-HY Condition : PEAK_BE_74 3m HORN_91200_1328 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto Detector : Peak Project : 862735 Mode : 5 Date: 2018.07.25	 Site : 03CH12-HY Condition : PEAK_74 3m HORN_91200_1328 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto Detector : Peak Project : 862735 Mode : 5 Date: 2018.07.25 PEAK_74
Avg.	 Site : 03CH12-HY Condition : AVG_BE_54 3m HORN_91200_1328 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto Detector : Peak Project : 862735 Mode : 5 Date: 2018.07.25	 Site : 03CH12-HY Condition : AVG_54 3m HORN_91200_1328 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto Detector : Peak Project : 862735 Mode : 5 Date: 2018.07.25 AVG_54



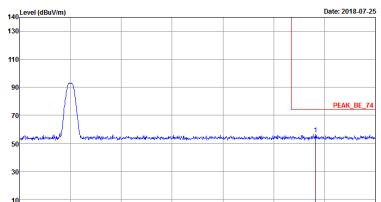
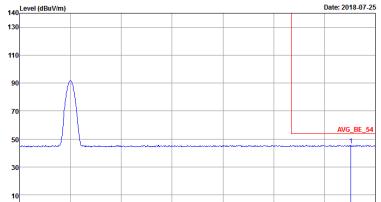


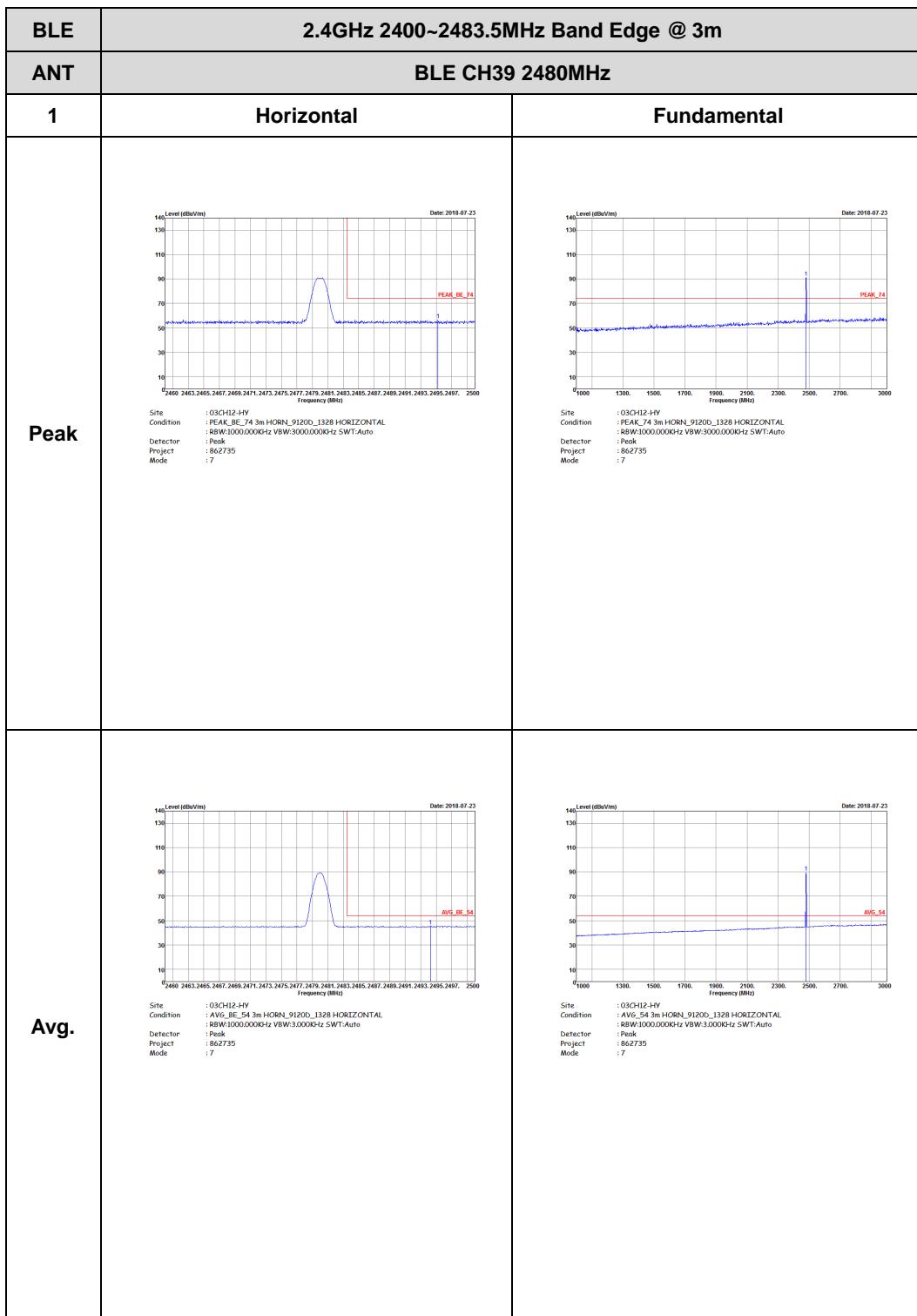


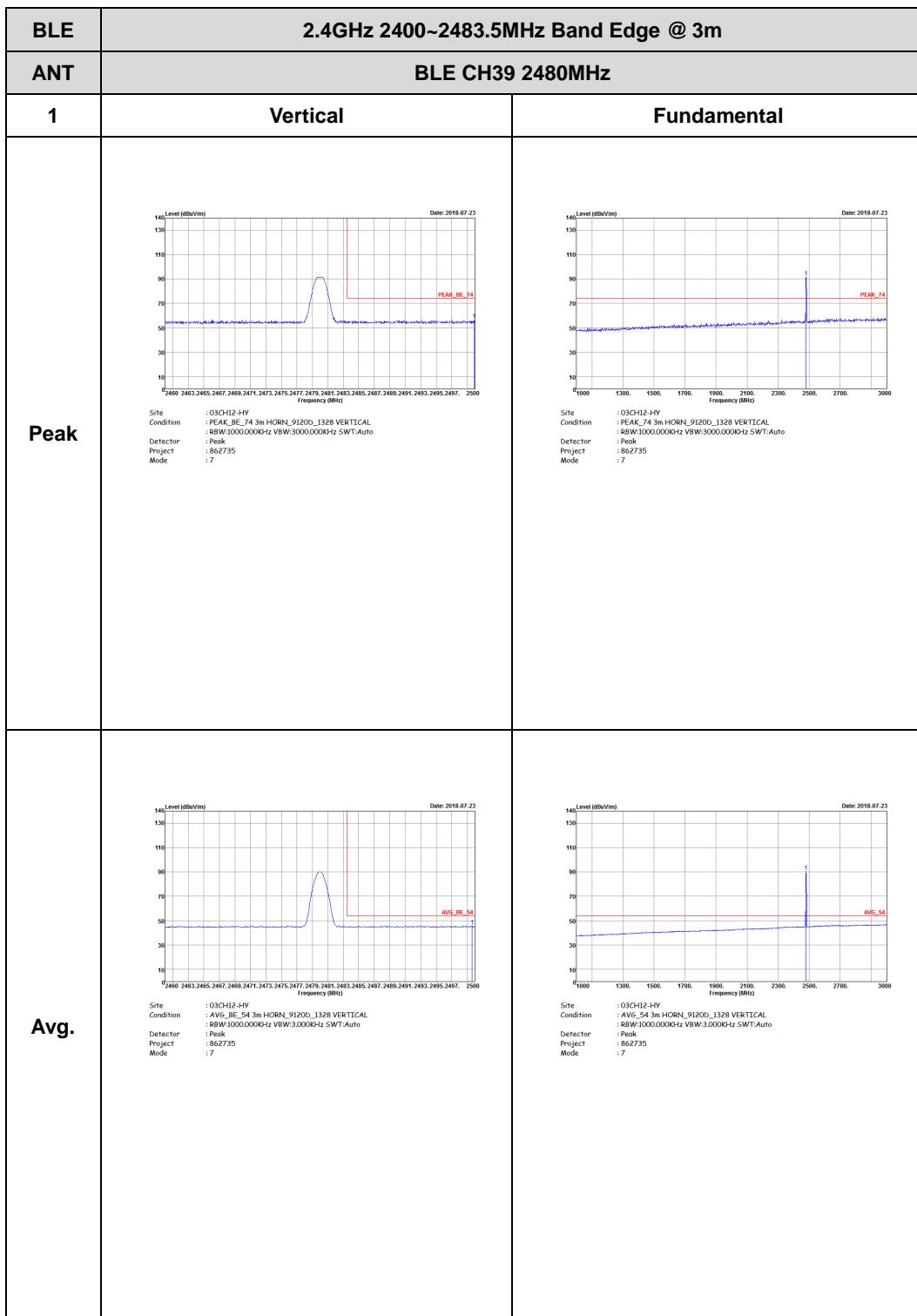
<b>BLE</b>	<b>2.4GHz 2400~2483.5MHz Band Edge @ 3m</b>	
<b>ANT</b>	<b>BLE CH19 2440MHz - R</b>	
<b>1</b>	<b>Horizontal</b>	<b>Fundamental</b>
<b>Peak</b>	 <p>Level (dBuV/m)</p> <p>Date: 2018.07.25</p> <p>Site : 03CH12-HV</p> <p>Condition : PEAK_BE_74 3m HORN_9120D_132B HORIZONTAL</p> <p>: RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p> <p>Detector : Peak</p> <p>Project : 862735</p> <p>Mode : 6</p>	Left blank
<b>Avg.</b>	 <p>Level (dBuV/m)</p> <p>Date: 2018.07.25</p> <p>Site : 03CH12-HV</p> <p>Condition : AVG_BE_54 3m HORN_9120D_132B HORIZONTAL</p> <p>: RBW:1000.000kHz VBW:3.000kHz SWT:Auto</p> <p>Detector : Peak</p> <p>Project : 862735</p> <p>Mode : 6</p>	Left blank





<b>BLE</b>	<b>2.4GHz 2400~2483.5MHz Band Edge @ 3m</b>	
<b>ANT</b>	<b>BLE CH19 2440MHz - R</b>	
<b>1</b>	<b>Vertical</b>	<b>Fundamental</b>
<b>Peak</b>	 <p>Level (dBuV/m)</p> <p>Date: 2018.07.25</p> <p>Site : 03CH12-HV Condition : PEAK_BE_74 3m HORN_9120D_132B VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Detector : Peak Project : 862735 Mode : 6</p>	Left blank
<b>Avg.</b>	 <p>Level (dBuV/m)</p> <p>Date: 2018.07.25</p> <p>Site : 03CH12-HV Condition : AVG_BE_54 3m HORN_9120D_132B VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto Detector : Peak Project : 862735 Mode : 6</p>	Left blank

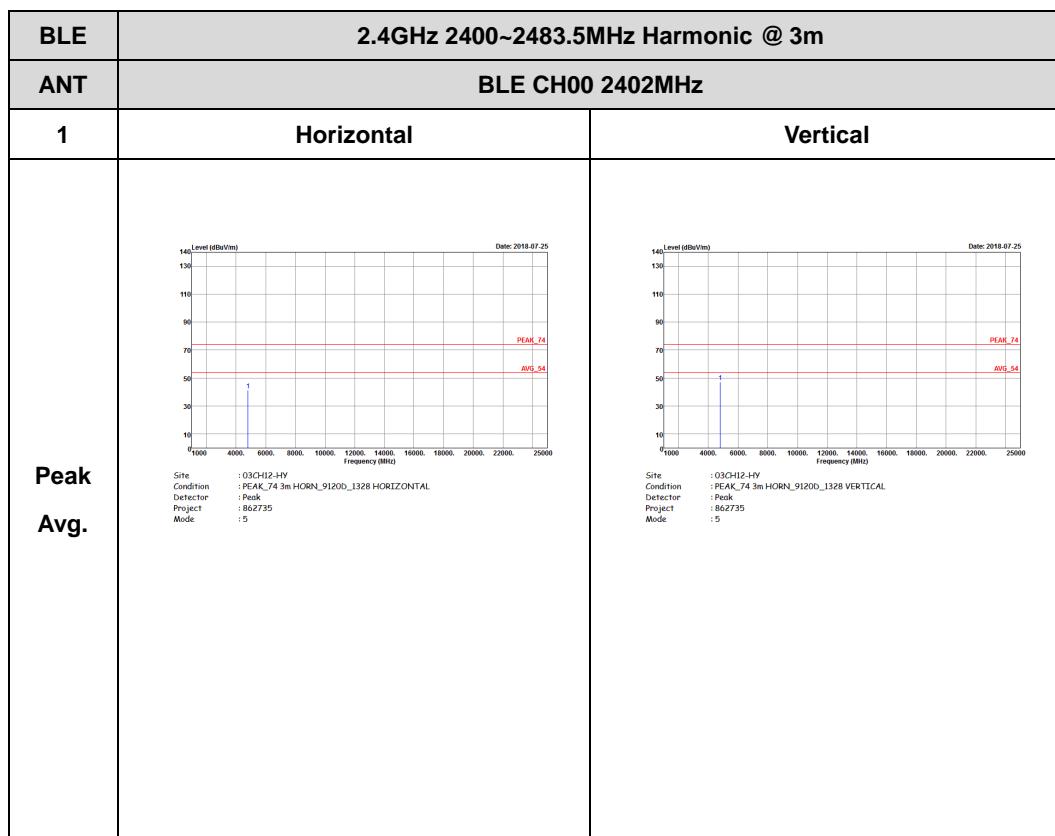


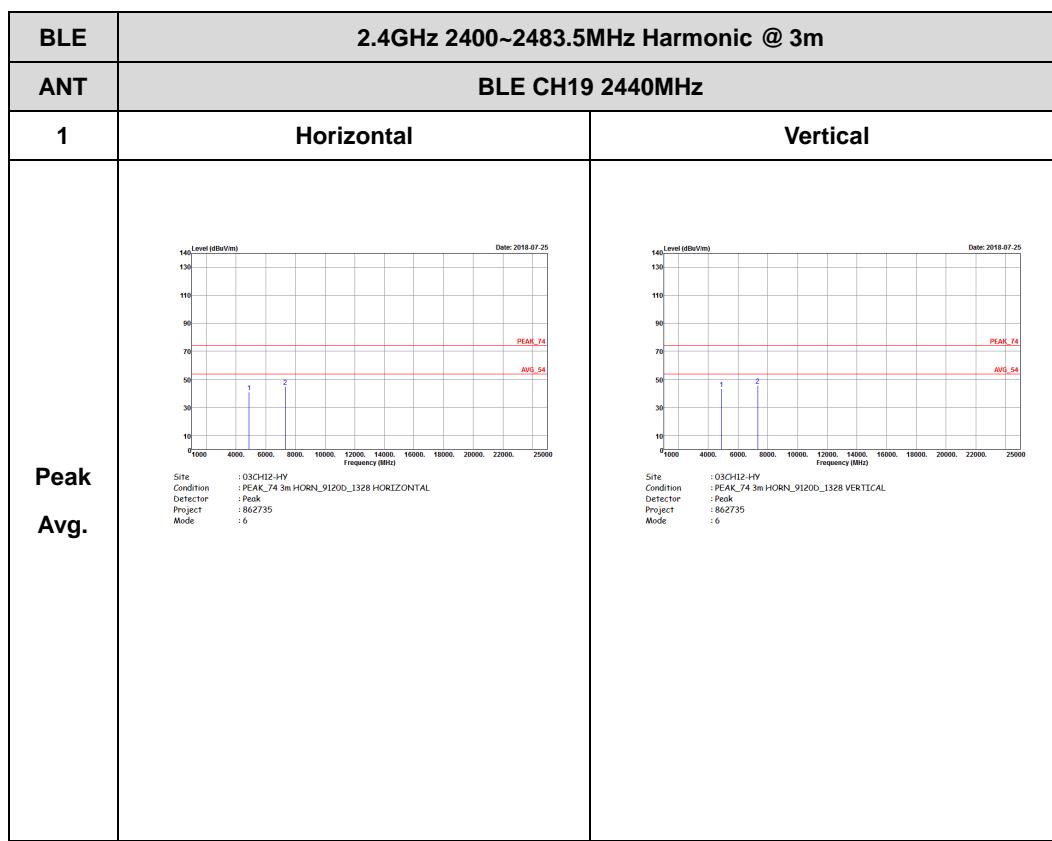


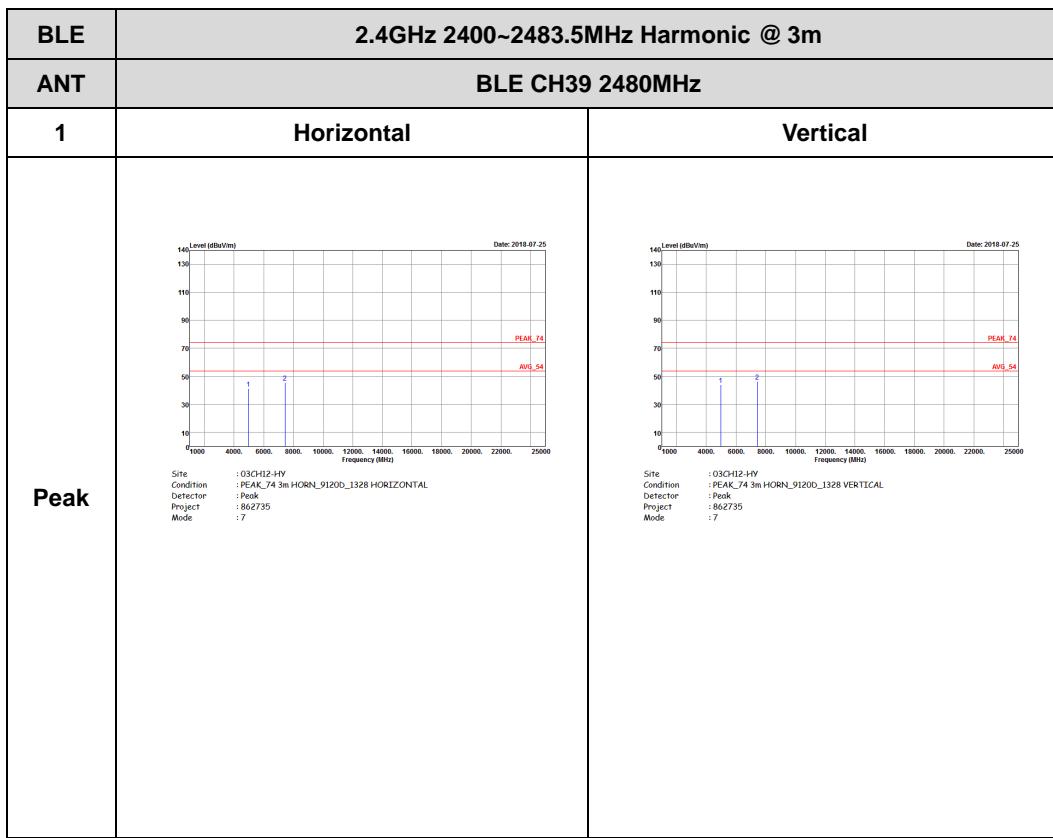


## 2.4GHz 2400~2483.5MHz

## BLE (Harmonic @ 3m)



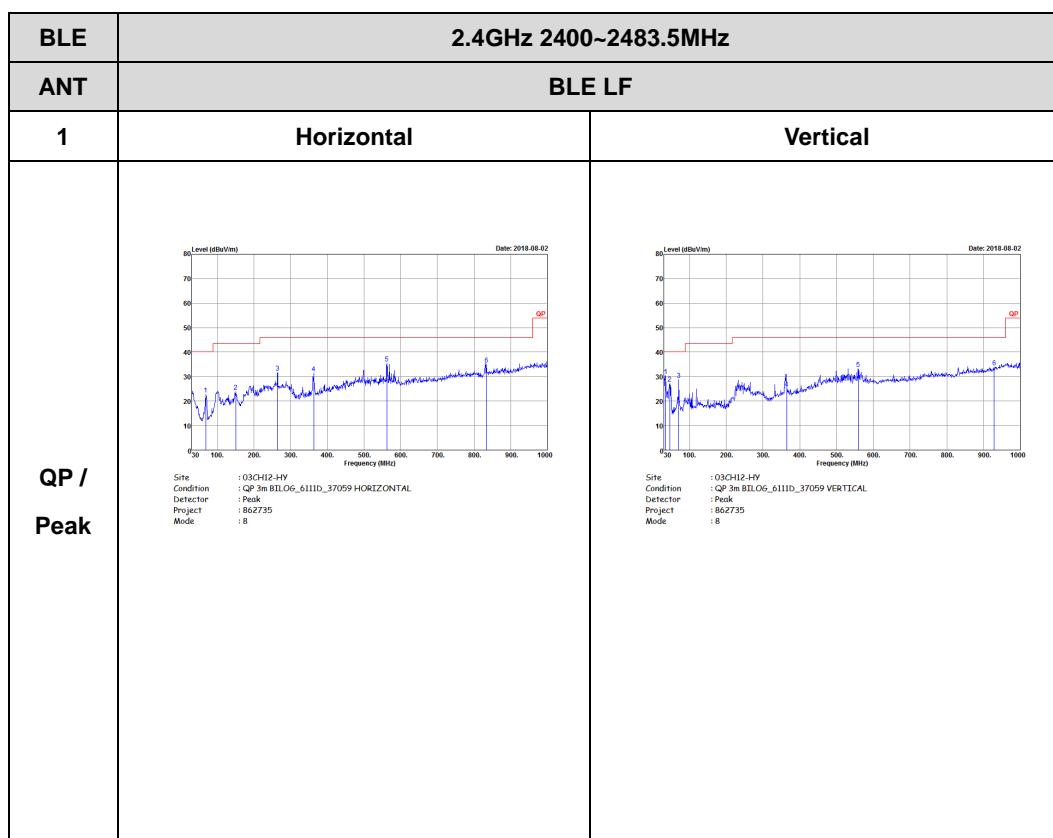






## Emission below 1GHz

## 2.4GHz BLE (LF)

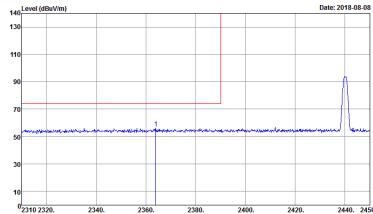
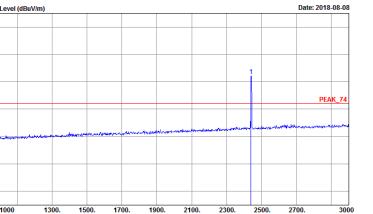
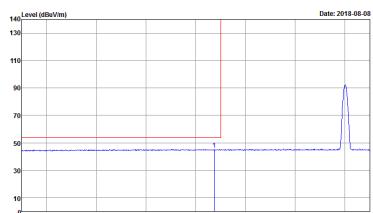




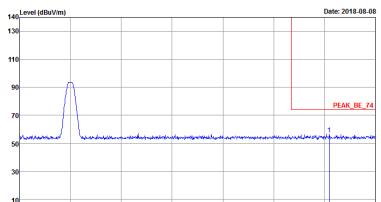
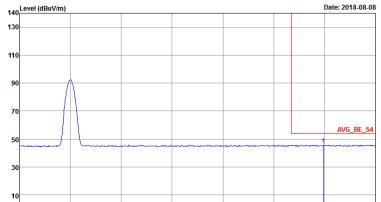
&lt;For Sample 2&gt;

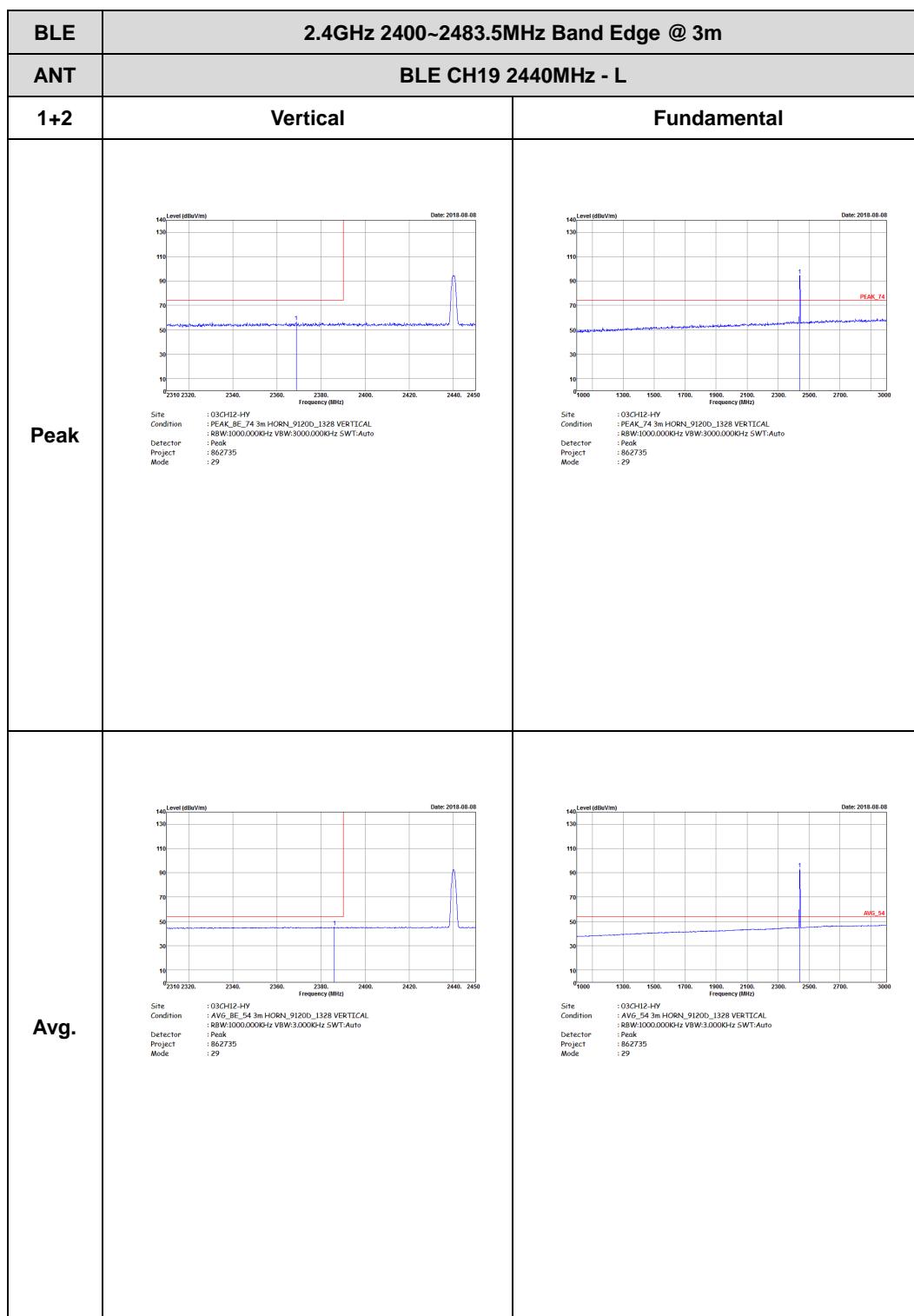
2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

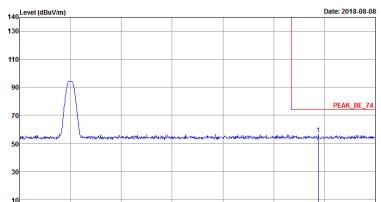
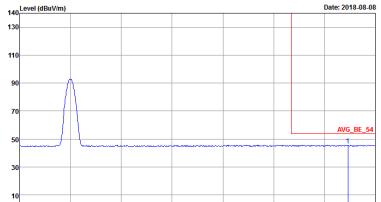
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - L	
1+2	Horizontal	Fundamental
Peak	 <p>Level (dBuV/m) vs Frequency (MHz) from 2310 to 2450. The plot shows a flat baseline at approximately 55 dBuV/m, a sharp vertical peak at 2440 MHz reaching about 95 dBuV/m, and a horizontal line at 74 dBuV/m. The date is 2018-08-08.</p> <p>Site: 03CH12-HY Condition: PEAK_BE_74 3m HORN_9120D_1328 HORIZONTAL RBW:1000.000KHz VBW:3000.0000Hz SWT:Auto Detector: Peak Project: 862735 Mode: 29</p>	 <p>Level (dBuV/m) vs Frequency (MHz) from 1000 to 3000. The plot shows a flat baseline at approximately 55 dBuV/m, a sharp vertical peak at 2440 MHz reaching about 95 dBuV/m, and a horizontal line at 74 dBuV/m. The date is 2018-08-08.</p> <p>Site: 03CH12-HY Condition: PEAK_74 3m HORN_9120D_1328 HORIZONTAL RBW:1000.000KHz VBW:3000.0000Hz SWT:Auto Detector: Peak Project: 862735 Mode: 29</p>
Avg.	 <p>Level (dBuV/m) vs Frequency (MHz) from 2310 to 2450. The plot shows a flat baseline at approximately 55 dBuV/m, a sharp vertical peak at 2440 MHz reaching about 95 dBuV/m, and a horizontal line at 54 dBuV/m. The date is 2018-08-08.</p> <p>Site: 03CH12-HY Condition: AVG_BE_54 3m HORN_9120D_1328 HORIZONTAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector: Peak Project: 862735 Mode: 29</p>	 <p>Level (dBuV/m) vs Frequency (MHz) from 1000 to 3000. The plot shows a flat baseline at approximately 55 dBuV/m, a sharp vertical peak at 2440 MHz reaching about 95 dBuV/m, and a horizontal line at 54 dBuV/m. The date is 2018-08-08.</p> <p>Site: 03CH12-HY Condition: AVG_54 3m HORN_9120D_1328 HORIZONTAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector: Peak Project: 862735 Mode: 29</p>



<b>BLE</b>	<b>2.4GHz 2400~2483.5MHz Band Edge @ 3m</b>	
<b>ANT</b>	<b>BLE CH19 2440MHz - R</b>	
<b>1+2</b>	<b>Horizontal</b>	<b>Fundamental</b>
<b>Peak</b>	 <p>Level (dBuV/m)</p> <p>Date: 2018.08.08</p> <p>Site : 03CH12-HV</p> <p>Condition : PEAK_BE_74 3m HORN_9120D_132B HORIZONTAL</p> <p>Detector : R8W:1000.000KHz VBW:3000.000KHz SWT:Auto</p> <p>Project : Peak</p> <p>Mode : 862735</p> <p>Project : 29</p>	Left blank
<b>Avg.</b>	 <p>Level (dBuV/m)</p> <p>Date: 2018.08.08</p> <p>Site : 03CH12-HV</p> <p>Condition : AVG_BE_54 3m HORN_9120D_132B HORIZONTAL</p> <p>Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto</p> <p>Project : Peak</p> <p>Mode : 862735</p> <p>Project : 29</p>	Left blank



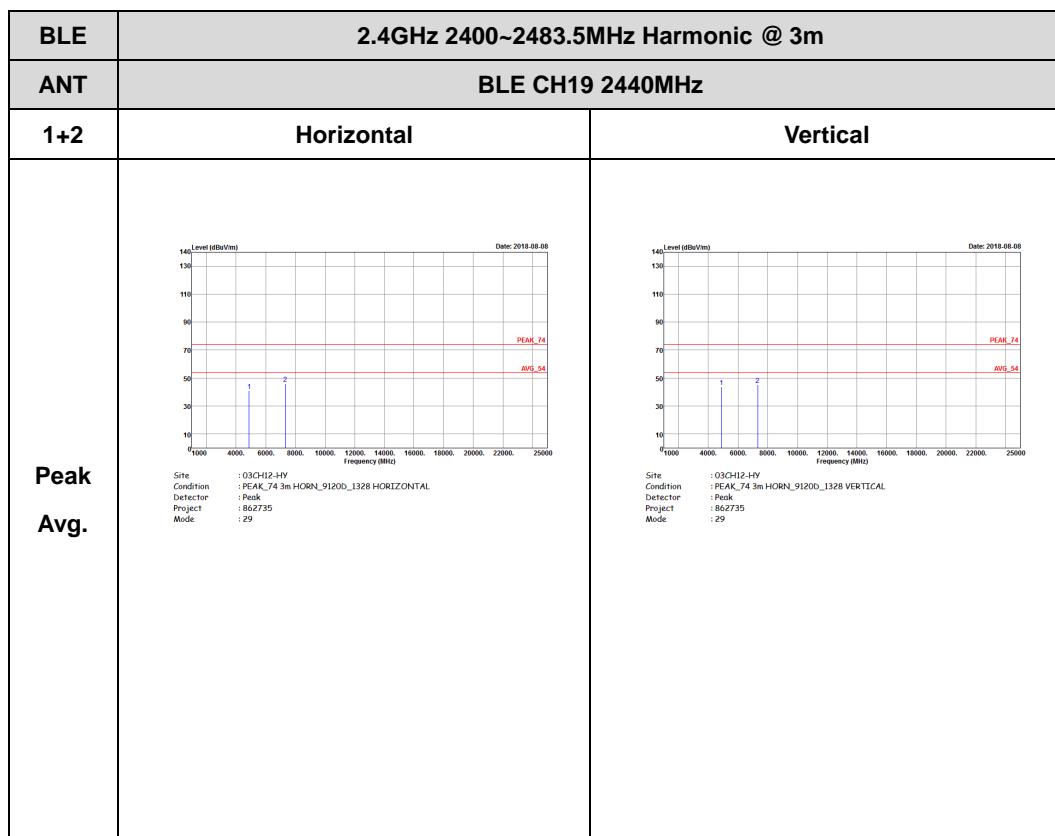


<b>BLE</b>	<b>2.4GHz 2400~2483.5MHz Band Edge @ 3m</b>	
<b>ANT</b>	<b>BLE CH19 2440MHz - R</b>	
<b>1+2</b>	<b>Vertical</b>	<b>Fundamental</b>
<b>Peak</b>	 <p>Level (dBuV/m)</p> <p>Date: 2018.08.08</p> <p>Site : 03CH12-HV</p> <p>Condition : PEAK_BE_74 3m HORN_9120D_132B VERTICAL</p> <p>Detector : R8W:1000.000KHz VBW:3000.000KHz SWT:Auto</p> <p>Project : Peak</p> <p>Mode : 862735</p> <p>Project : 862735</p> <p>Mode : 29</p>	Left blank
<b>Avg.</b>	 <p>Level (dBuV/m)</p> <p>Date: 2018.08.08</p> <p>Site : 03CH12-HV</p> <p>Condition : AVG_BE_54 3m HORN_9120D_132B VERTICAL</p> <p>Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto</p> <p>Project : Peak</p> <p>Mode : 862735</p> <p>Project : 862735</p> <p>Mode : 29</p>	Left blank



## 2.4GHz 2400~2483.5MHz

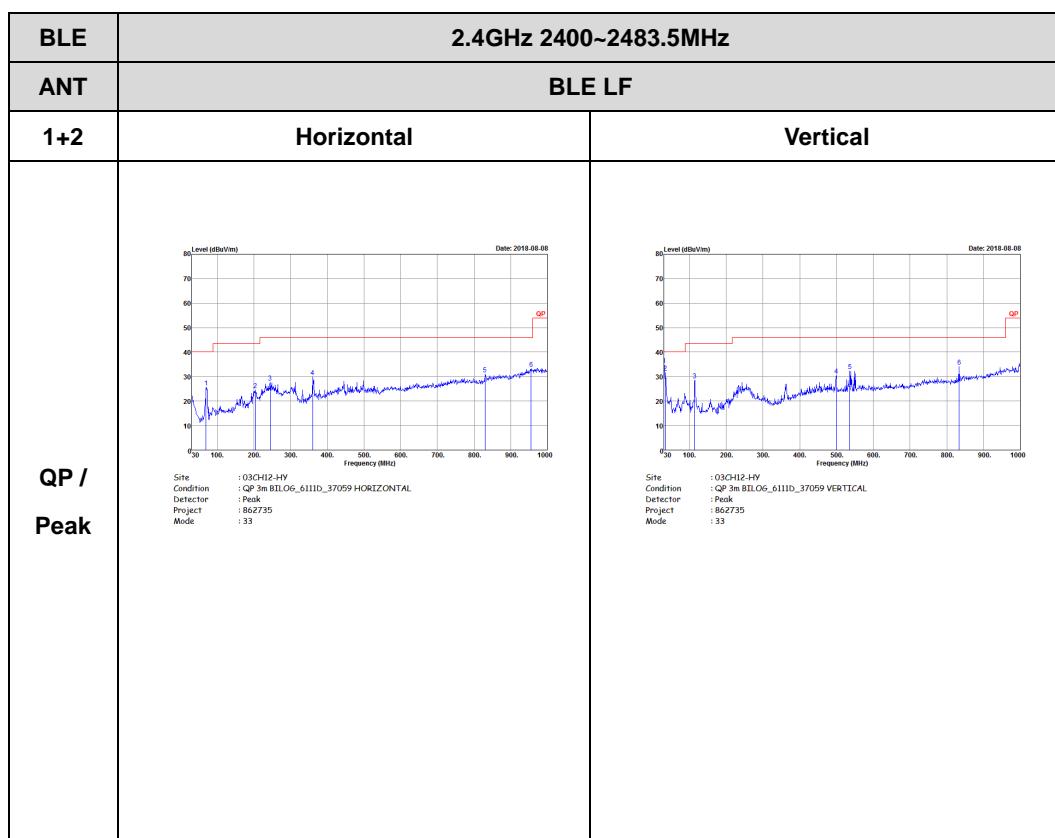
## BLE (Harmonic @ 3m)





## Emission below 1GHz

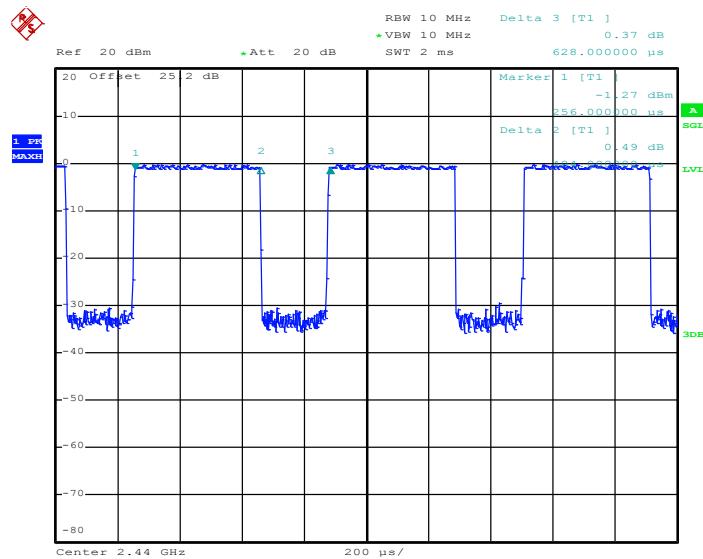
## 2.4GHz BLE (LF)



## Appendix D. Duty Cycle Plots

Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor (dB)
Bluetooth -LE	64.33	404.00	2.48	3kHz	1.92

## Bluetooth - LE



Date: 24.JUL.2018 06:23:07