

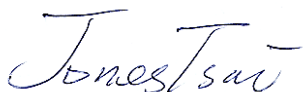
FCC RADIO TEST REPORT

FCC ID : 2AN7U-5463
Equipment : Wireless Remote
Model Name : L5B83H
Applicant : X-Marks LLC
X-Marks LLC, 4400 NE 77th Avenue, Suite 275,
Vancouver, Washington, 98662
Standard : FCC Part 15 Subpart C §15.247

The testing was started from May 10, 2018 and completed on May 12, 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 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

Report No.	Version	Description	Issued Date
FR7D2920-01	01	Initial issue of report	May 18, 2018

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)
3.1	15.247(a)(2)	6dB Bandwidth	Pass
3.1	2.1049	99% Occupied Bandwidth	Reporting only
3.2	15.247(b)(3)	Peak Output Power	Pass
3.3	15.247(e)	Power Spectral Density	Pass
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	Pass
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	Pass
-	15.207	AC Conducted Emission	Not Required
3.6	15.203 & 15.247(b)	Antenna Requirement	Pass
Remark: Not required means after assessing, test items are not necessary to carry out.			

Reviewed by: Joseph Lin

Report Producer: Nancy Yang

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Wireless Remote
Model Name	L5B83H
FCC ID	2AN7U-5463
EUT supports Radios application	Bluetooth LE

1.2 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	40
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)
Maximum Output Power to Antenna	4.97 dBm (0.0031 W)
99% Occupied Bandwidth	2.112MHz
Antenna Type / Gain	Fixed Internal Antenna with gain 4.54 dBi
Type of Modulation	Bluetooth LE : GFSK

1.3 Modification of EUT

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

1.4 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.

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.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.
	TH05-HY

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

Test Site	SPORTON INTERNATIONAL INC.
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.

1.5 Applicable Standards

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

- ♦ FCC Part 15 Subpart 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 Descriptions of Test Mode

The RF output power was recorded in the following table:

Channel	Frequency	Bluetooth – LE RF Output Power
		Data Rate / Modulation
		GFSK
		1Mbps
Ch00	2402MHz	4.44 dBm
Ch19	2440MHz	4.28 dBm
Ch39	2480MHz	3.93 dBm

Channel	Frequency	Bluetooth – LE RF Output Power
		Data Rate / Modulation
		GFSK
		2Mbps
Ch00	2402MHz	4.93 dBm
Ch19	2440MHz	4.97 dBm
Ch39	2480MHz	4.58 dBm

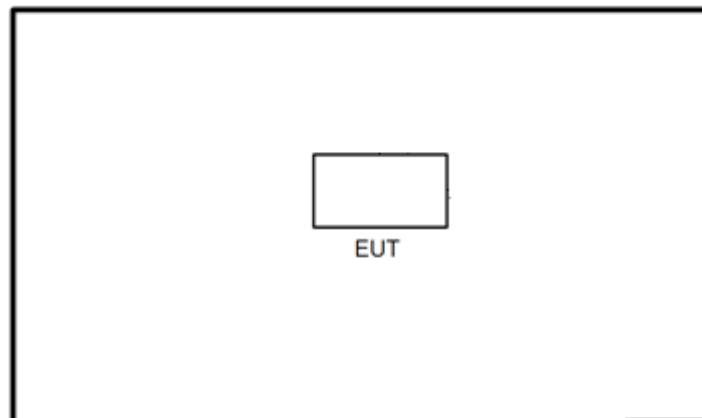
- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated:, radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

2.3 Test Mode

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
Conducted Test Cases	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps
	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps
	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
	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 Test Cases	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps
	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps
	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
	Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps
	Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps
	Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps

2.4 Connection Diagram of Test System



2.5 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	CMW270 WIRELESS CONN. TESTER	Rohde & Schwarz	CMW270	101067	N/A	N/A



2.6 EUT Operation Test Setup

For Bluetooth – LE 1Mbps test items, utility “special software tool” 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.

For Bluetooth – LE 2Mbps test items, EUT was linked with MW270 WIRELESS CONN. TESTER 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.

2.7 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 4.2 + 10 = 14.2 \text{ (dB)}\end{aligned}$$

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

3.1.2 Measuring Instruments

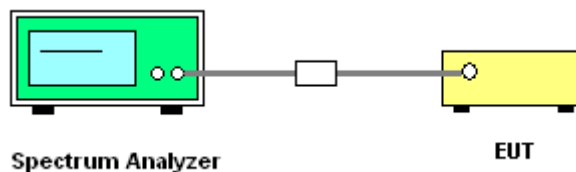
See list of measuring equipment of this test report.

3.1.3 Test Procedures

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04

1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
4. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 30kHz and set the Video bandwidth (VBW) = 100kHz.
5. Measure and record the results in the test report.

3.1.4 Test Setup



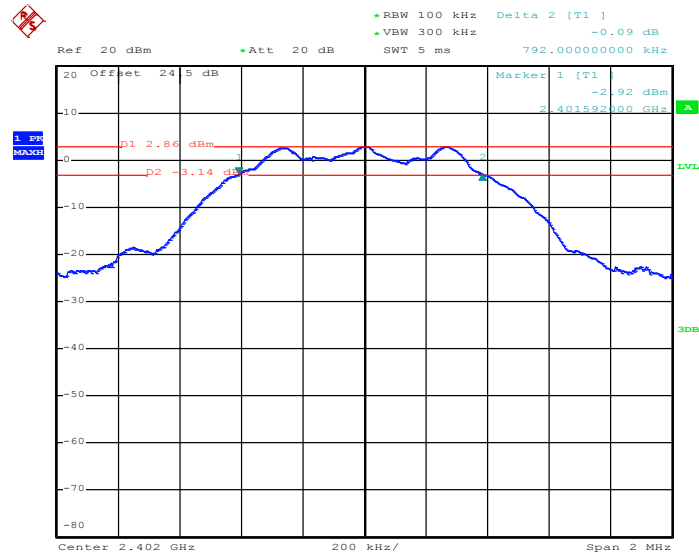


3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

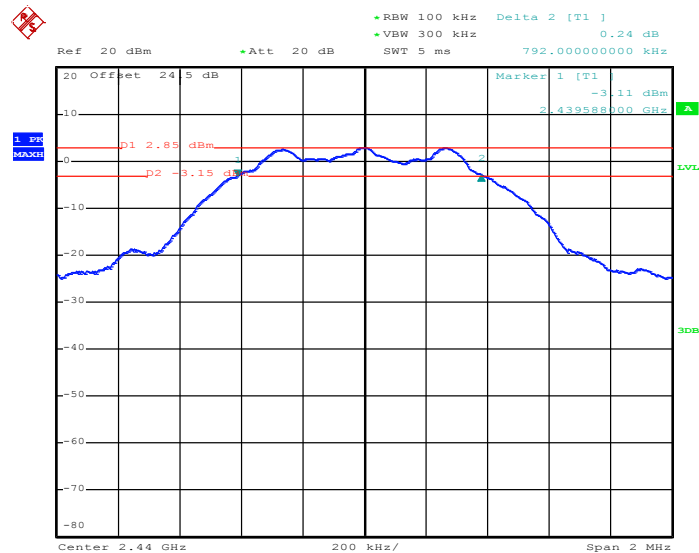
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6 dB Bandwidth Plot on Channel 00



Date: 10.MAY.2018 23:22:29

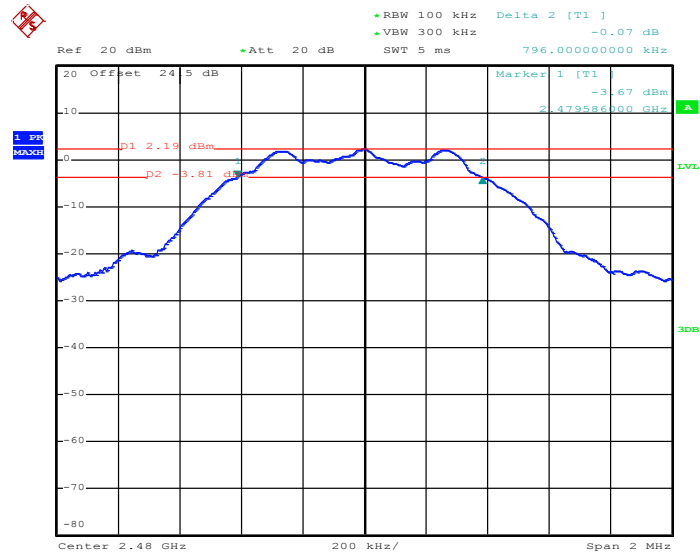
6 dB Bandwidth Plot on Channel 19



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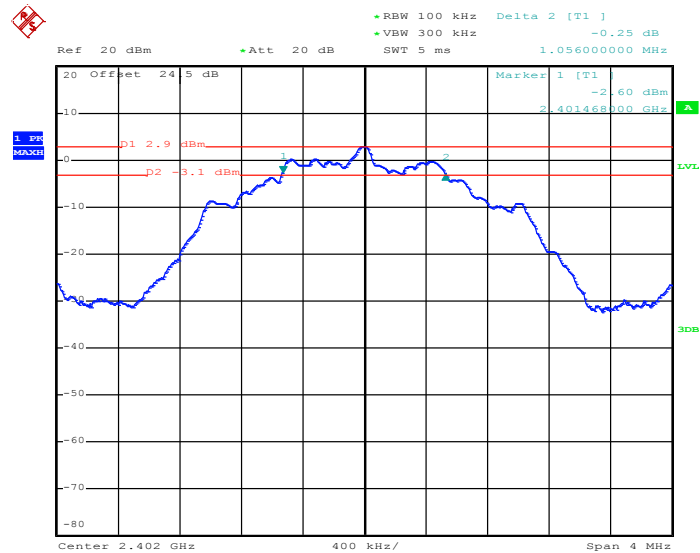
6 dB Bandwidth Plot on Channel 39



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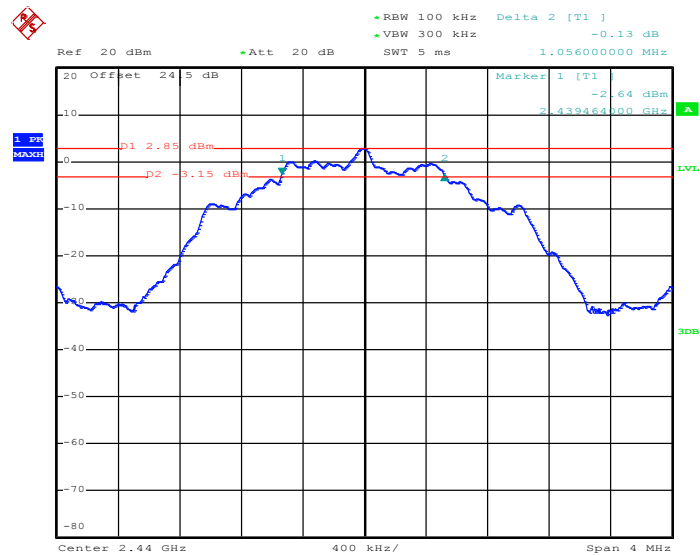
6 dB Bandwidth Plot on Channel 00



Date: 11.MAY.2018 00:27:26

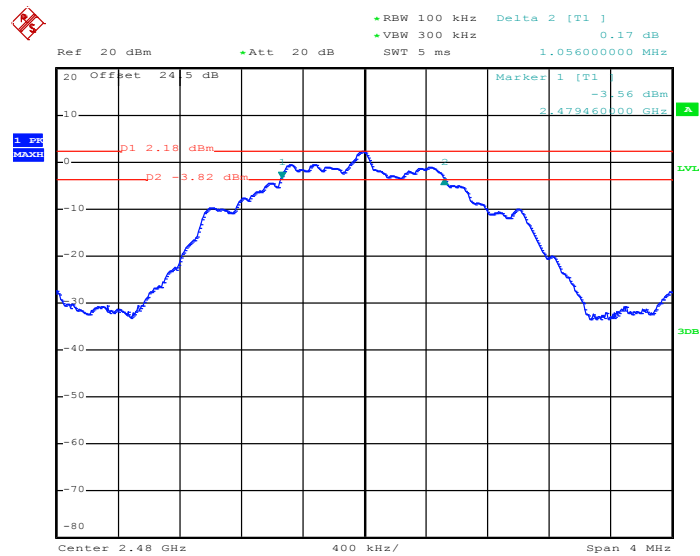


6 dB Bandwidth Plot on Channel 19



Date: 11.MAY.2018 00:46:55

6 dB Bandwidth Plot on Channel 39



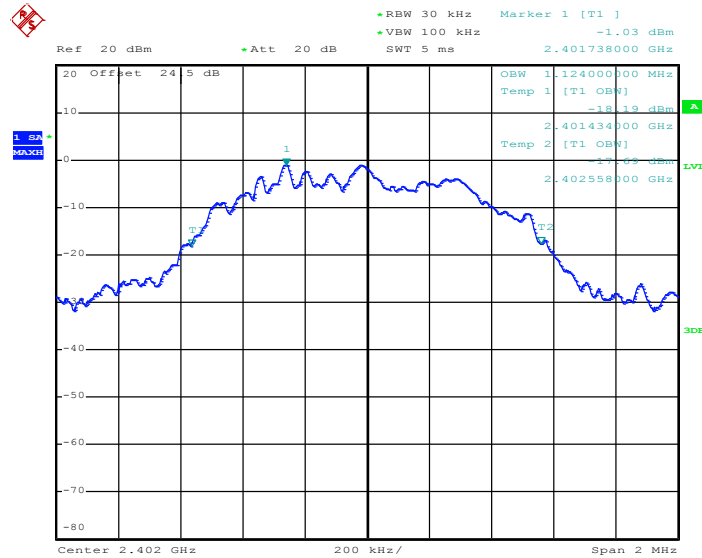
Date: 11.MAY.2018 00:51:25

3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

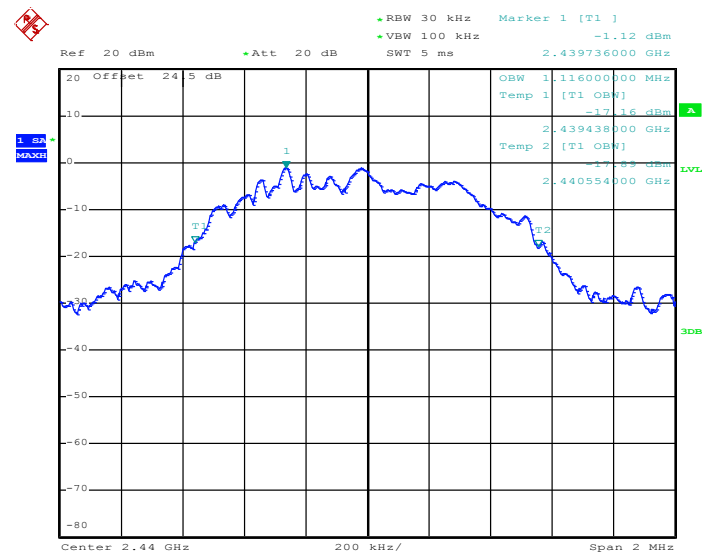
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99% Bandwidth Plot on Channel 00



Date: 10.MAY.2018 23:26:12

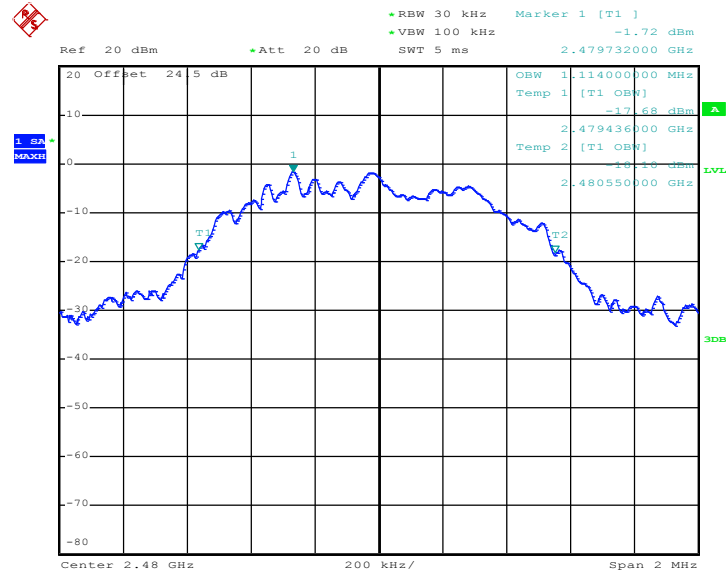
99% Occupied Bandwidth Plot on Channel 19



Date: 10.MAY.2018 23:42:38



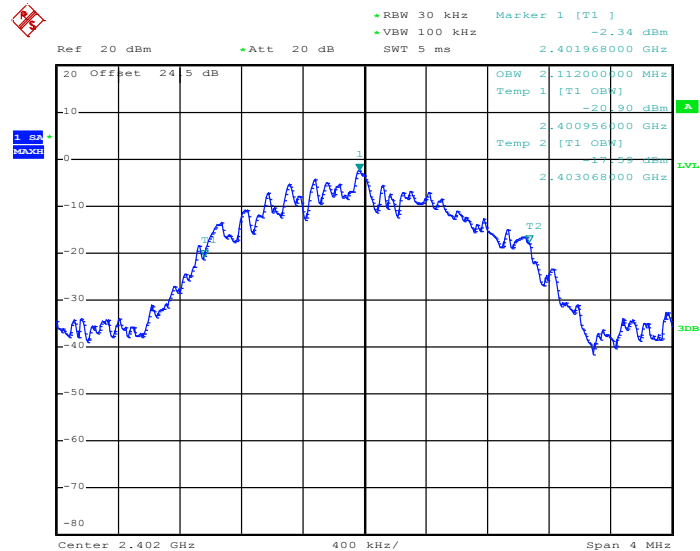
99% Occupied Bandwidth Plot on Channel 39



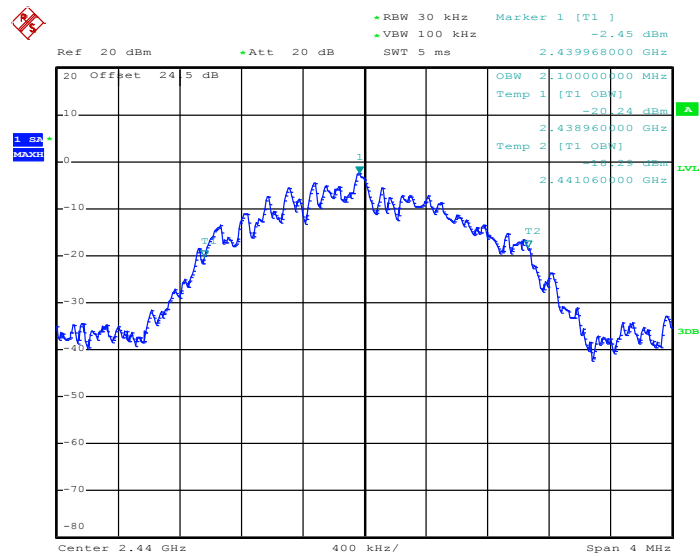
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<2 Mbps>

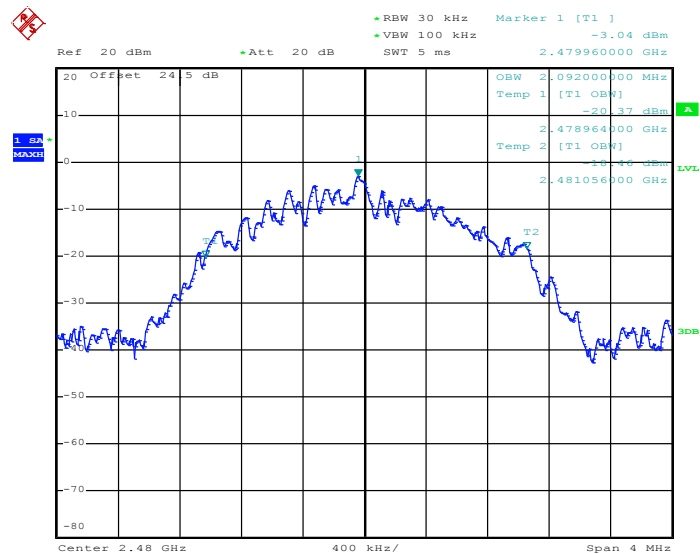
99% Bandwidth Plot on Channel 00



Date: 11.MAY.2018 00:29:55

99% Occupied Bandwidth Plot on Channel 19


Date: 11.MAY.2018 00:49:58

99% Occupied Bandwidth Plot on Channel 39


Date: 11.MAY.2018 00:54:11

Note : The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Output Power Measurement

3.2.1 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.

3.2.2 Measuring Instruments

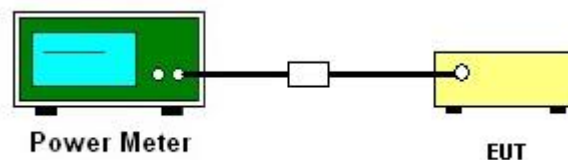
See list of measuring equipment of this test report.

3.2.3 Test Procedures

The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04

1. 0 section 9.1.3 PKPM1 Peak power meter method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.2.6 Test Result of Average Output Power (Reporting Olnty)

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

3.3.2 Measuring Instruments

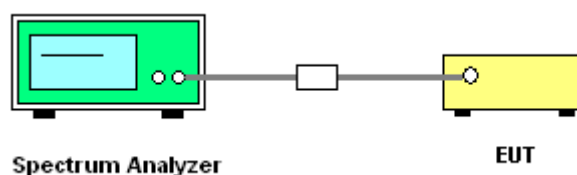
See list of measuring equipment of this test report.

3.3.3 Test Procedures

The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04

1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
4. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
5. Measure and record the results in the test report.
6. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup



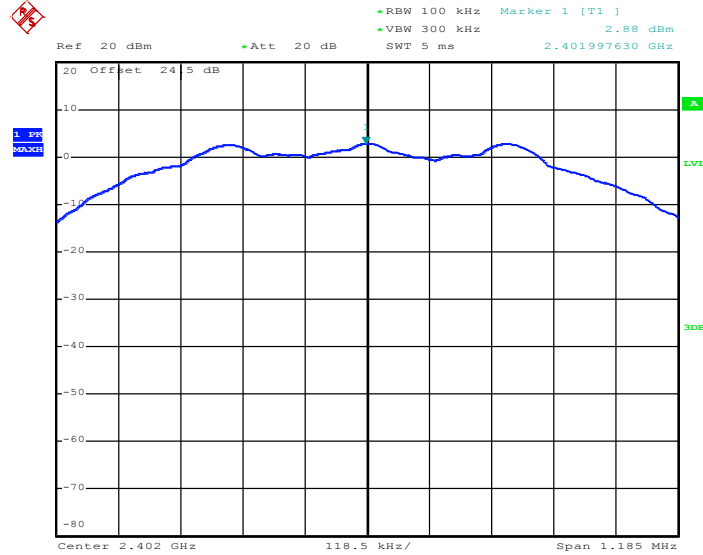
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

3.3.6 Test Result of Power Spectral Density Plots (100kHz)

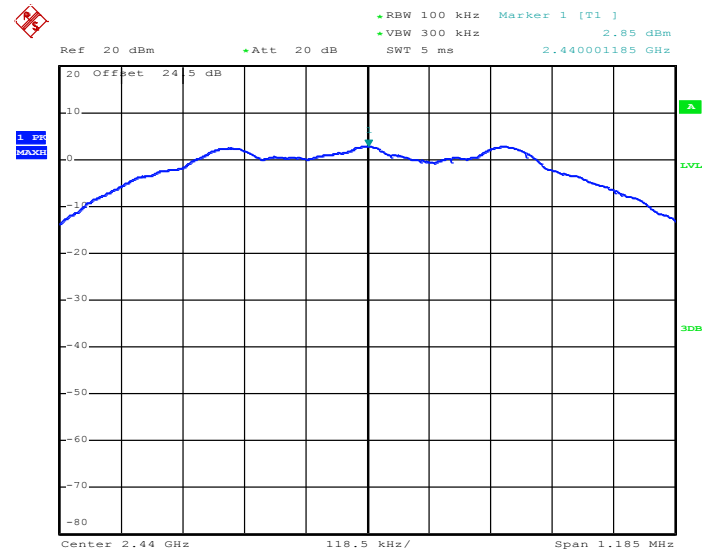
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PSD 100kHz Plot on Channel 00

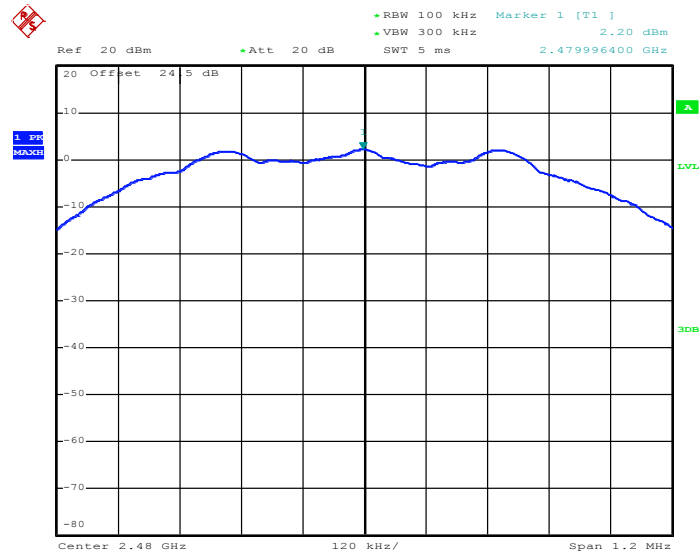


Date: 10.MAY.2018 23:23:48

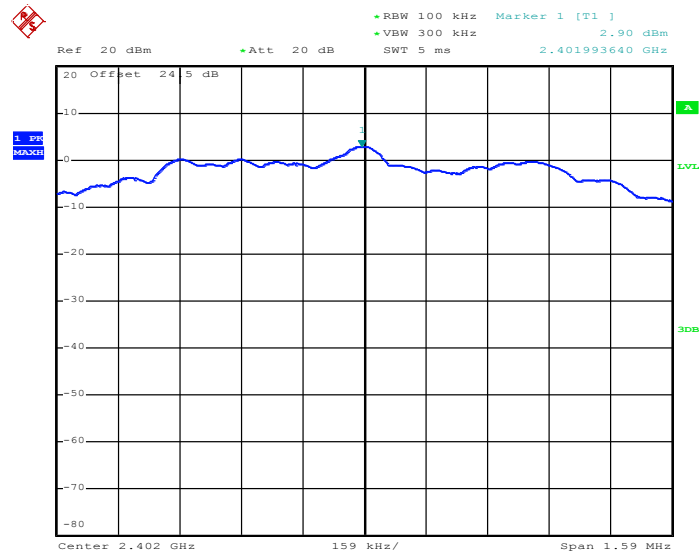
PSD 100kHz Plot on Channel 19



Date: 10.MAY.2018 23:41:30

PSD 100kHz Plot on Channel 39


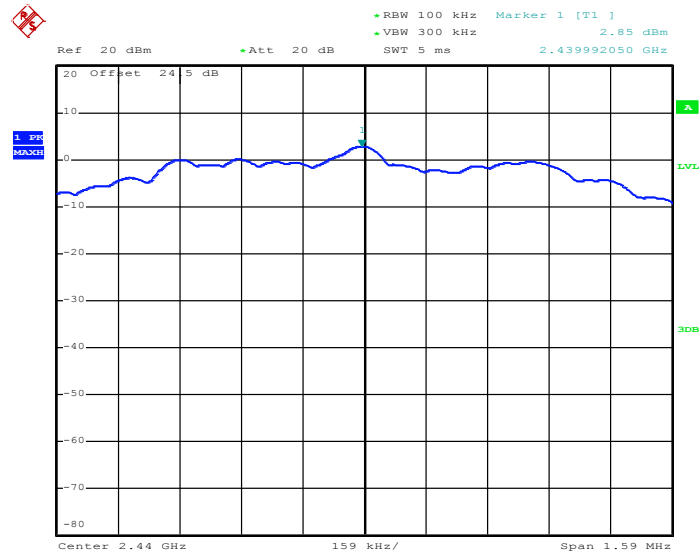
Date: 10.MAY.2018 23:46:53

<2 Mbps>
PSD 100kHz Plot on Channel 00


Date: 11.MAY.2018 00:28:20

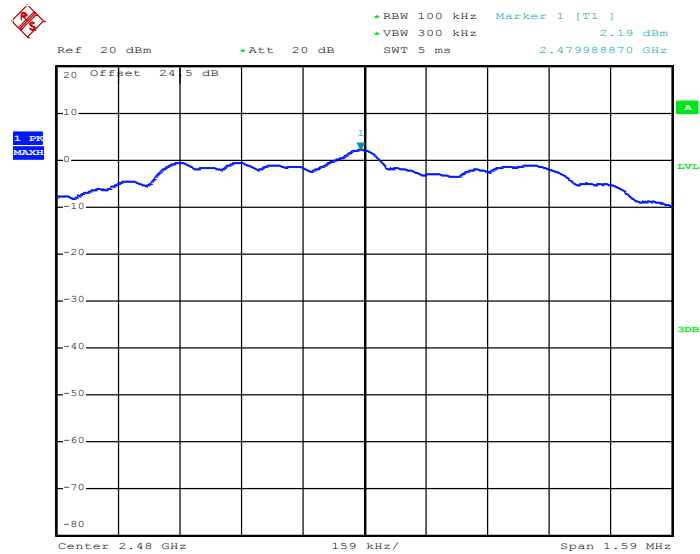


PSD 100kHz Plot on Channel 19



Date: 11.MAY.2018 00:48:52

PSD 100kHz Plot on Channel 39



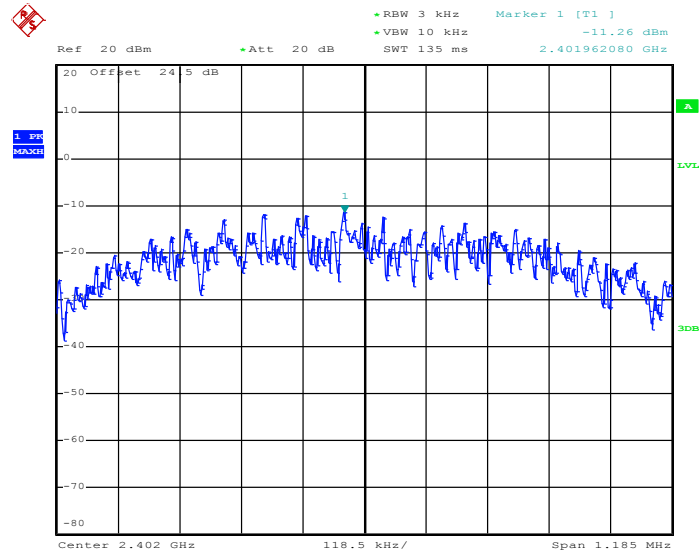
Date: 11.MAY.2018 00:52:13



3.3.7 Test Result of Power Spectral Density Plots (3kHz)

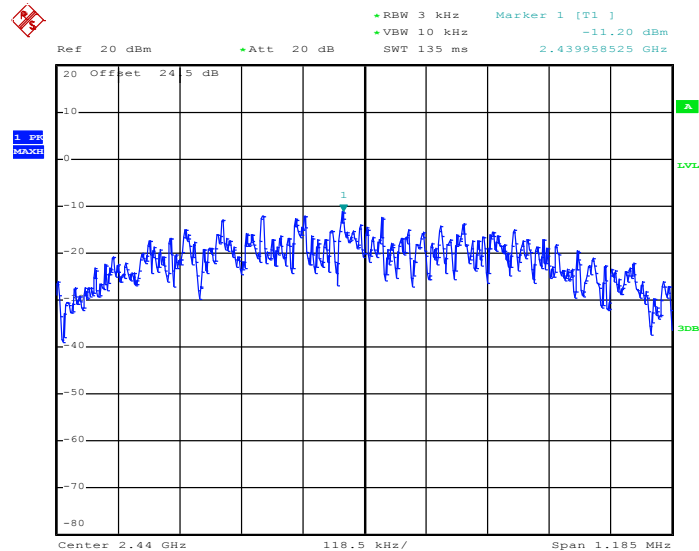
<1 Mbps>

PSD 3kHz Plot on Channel 00



Date: 10.MAY.2018 23:23:13

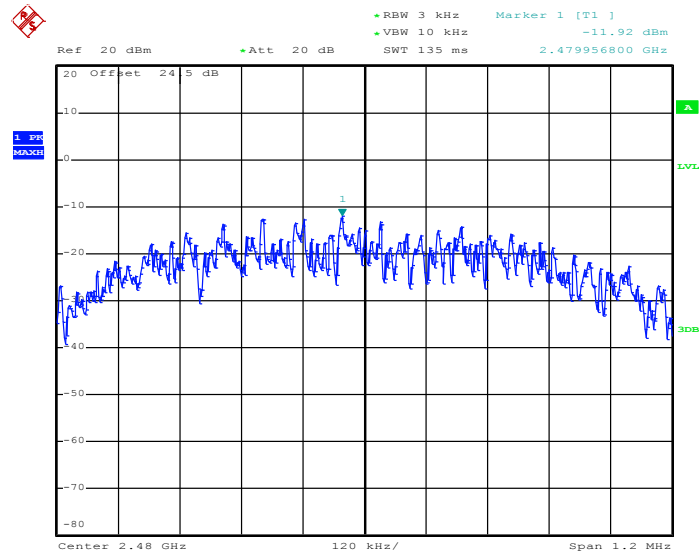
PSD 3kHz Plot on Channel 19



Date: 10.MAY.2018 23:41:13



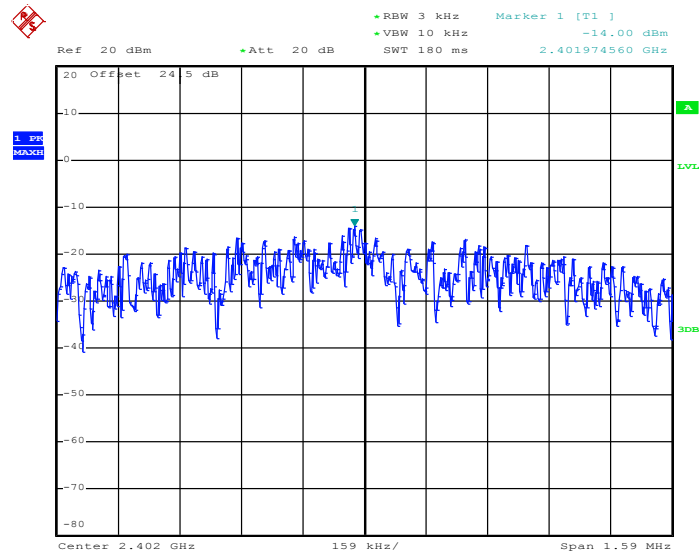
PSD 3kHz Plot on Channel 39



Date: 10.MAY.2018 23:46:10

<2 Mbps>

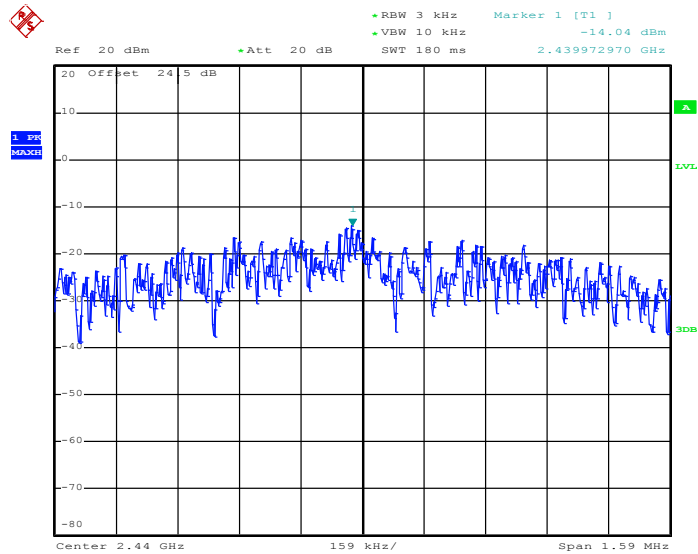
PSD 3kHz Plot on Channel 00



Date: 11.MAY.2018 00:27:52

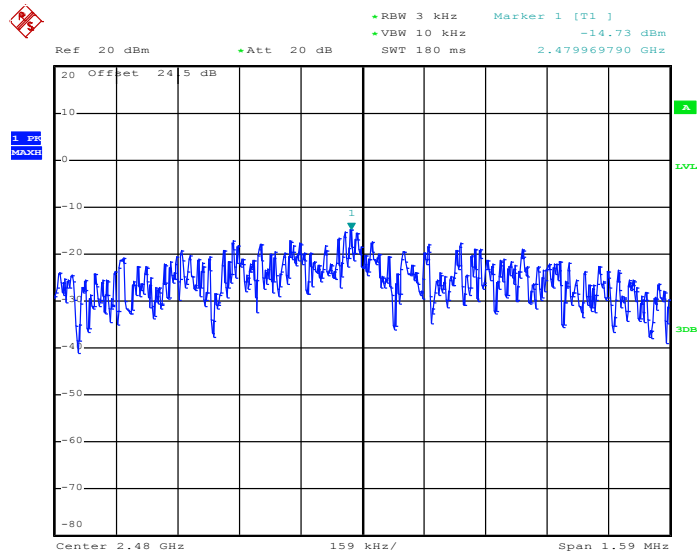


PSD 3kHz Plot on Channel 19



Date: 11.MAY.2018 00:47:24

PSD 3kHz Plot on Channel 39



Date: 11.MAY.2018 00:51:47

3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

3.4.2 Measuring Instruments

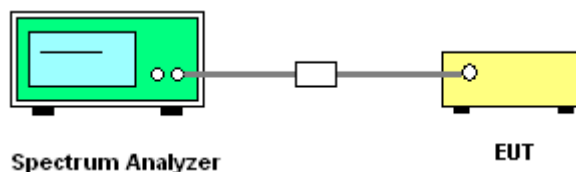
See list of measuring equipment of this test report.

3.4.3 Test Procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04

1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
4. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

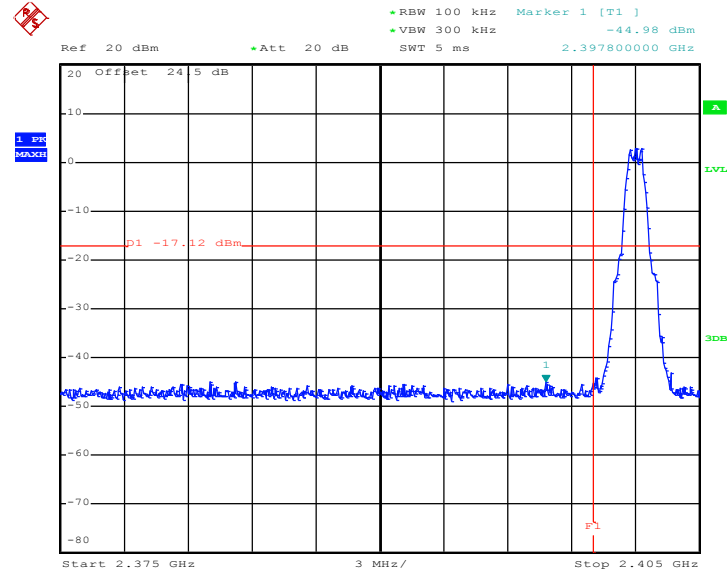
3.4.4 Test Setup



3.4.5 Test Result of Conducted Band Edges Plots

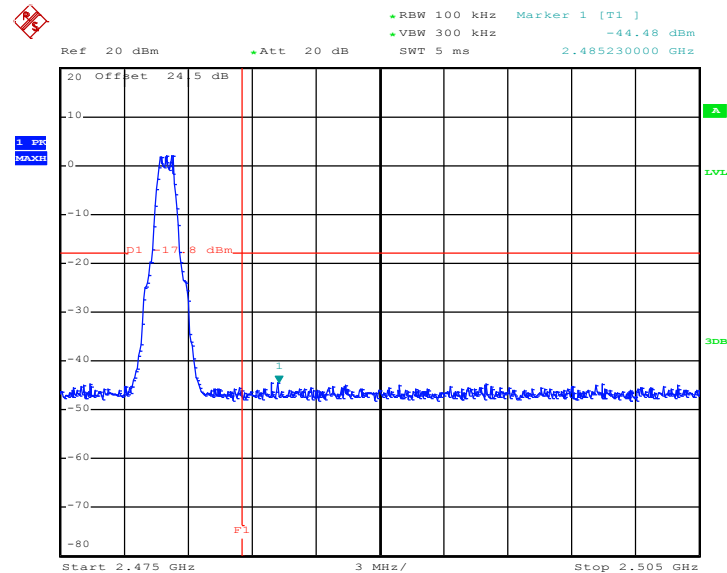
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Low Band Edge Plot on Channel 00



Date: 10.MAY.2018 23:24:45

High Band Edge Plot on Channel 39

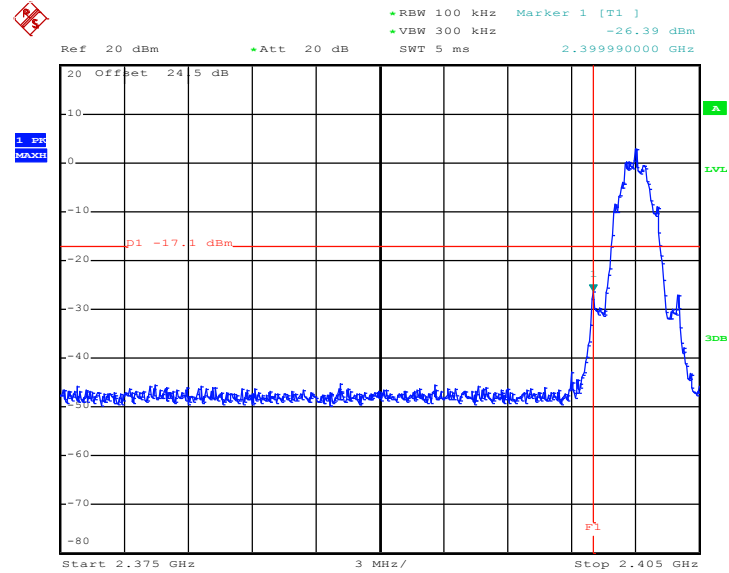


Date: 10.MAY.2018 23:48:38



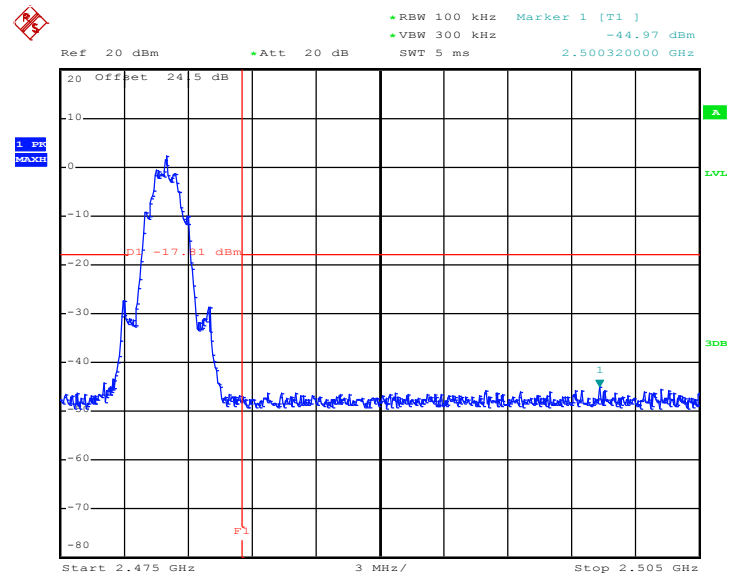
<2 Mbps>

Low Band Edge Plot on Channel 00



Date: 11.MAY.2018 00:28:39

High Band Edge Plot on Channel 39



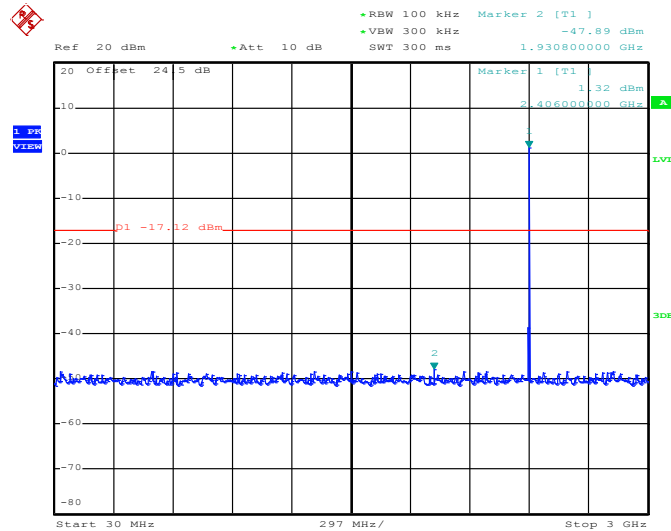
Date: 11.MAY.2018 00:52:36

3.4.6 Test Result of Conducted Spurious Emission Plots

<1 Mbps>

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

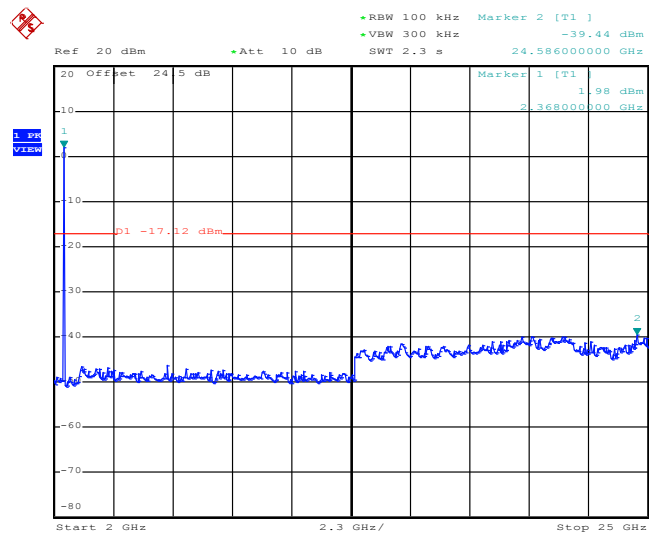
GFSK Channel 00



Date: 10.MAY.2018 23:25:14

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

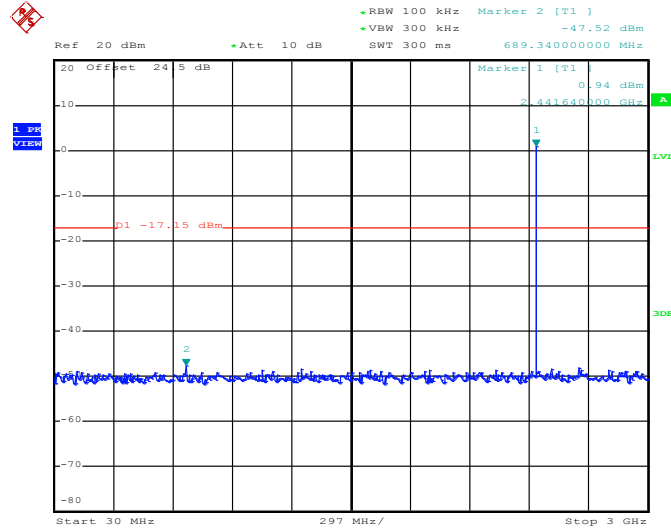
GFSK Channel 00



Date: 10.MAY.2018 23:25:40

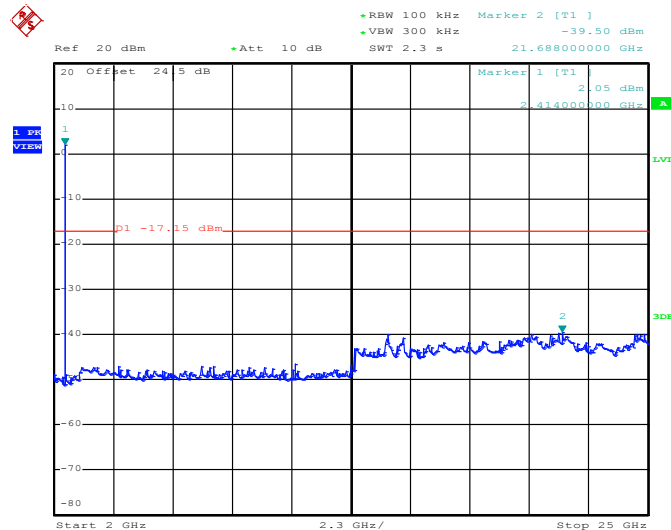


Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 19



Date: 10.MAY.2018 23:41:53

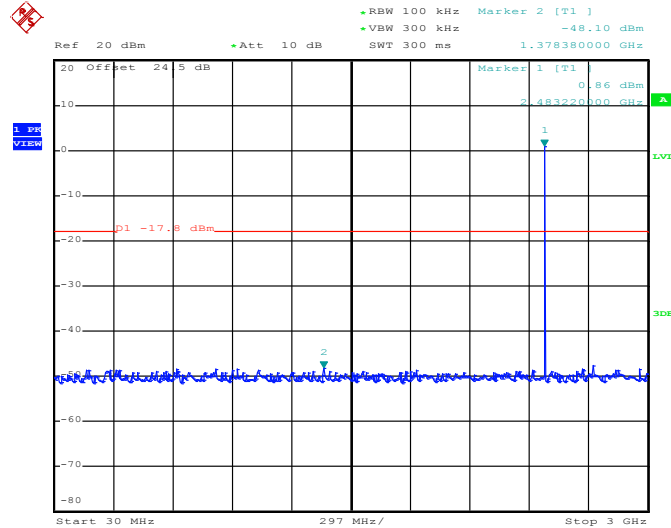
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 19



Date: 10.MAY.2018 23:42:17

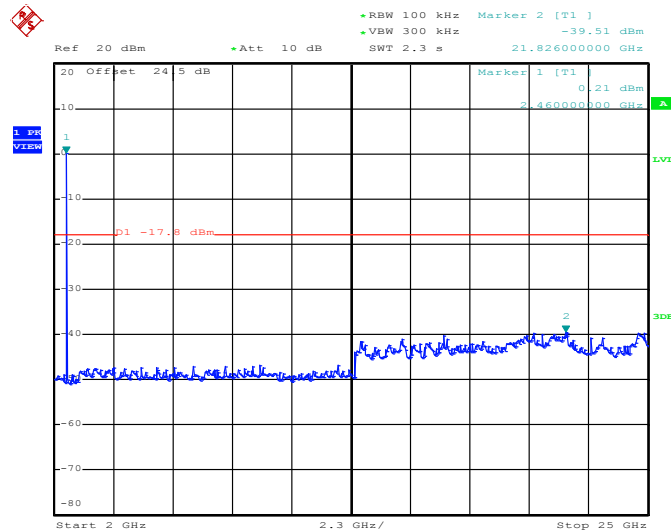


Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 39



Date: 10.MAY.2018 23:49:23

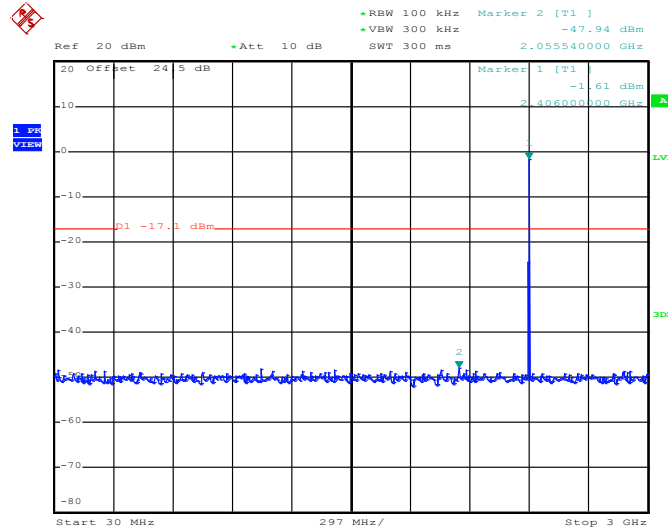
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 39



Date: 10.MAY.2018 23:49:47

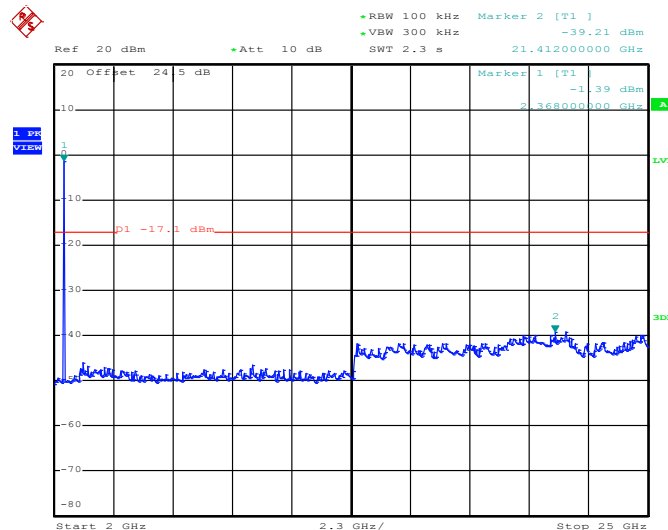
<2 Mbps>

**Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 00**



Date: 11.MAY.2018 00:29:10

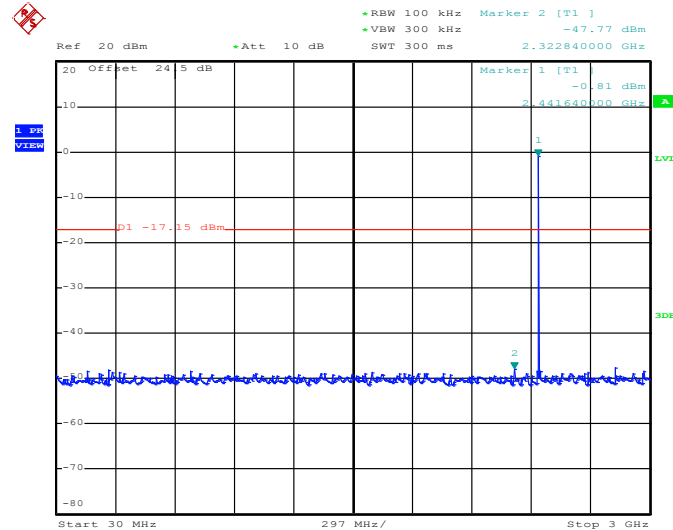
**Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 00**



Date: 11.MAY.2018 00:29:34

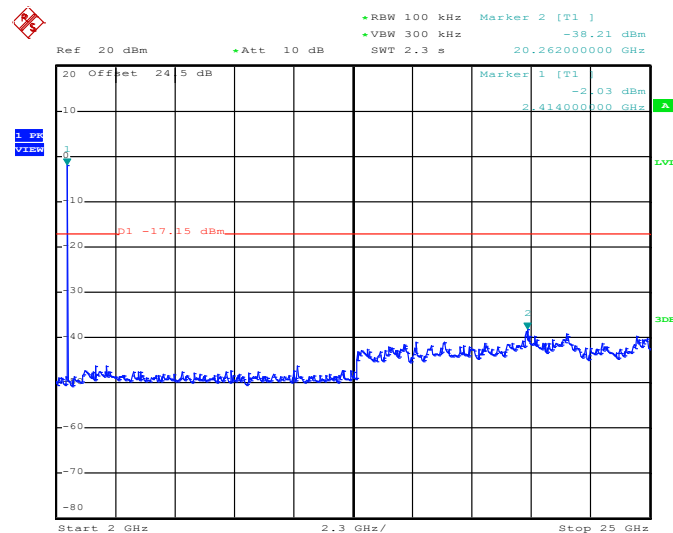


Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 19



Date: 11.MAY.2018 00:49:22

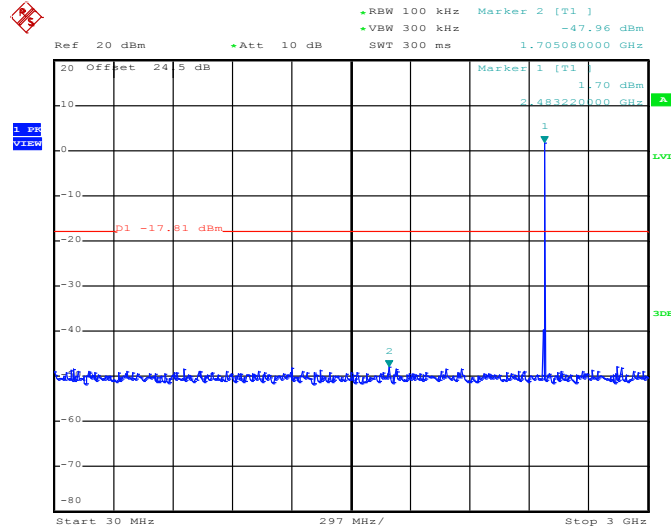
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 19



Date: 11.MAY.2018 00:49:41

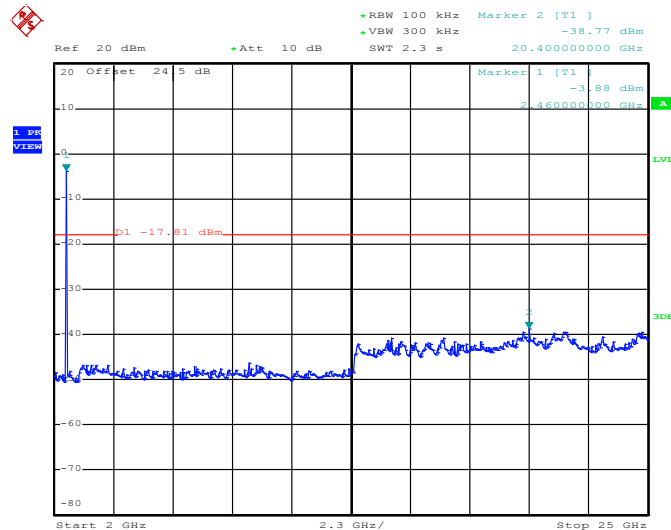


Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 39



Date: 11.MAY.2018 00:52:53

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 39



Date: 11.MAY.2018 00:53:49

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 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

3.5.2 Measuring Instruments

See list of measuring equipment of this test report.

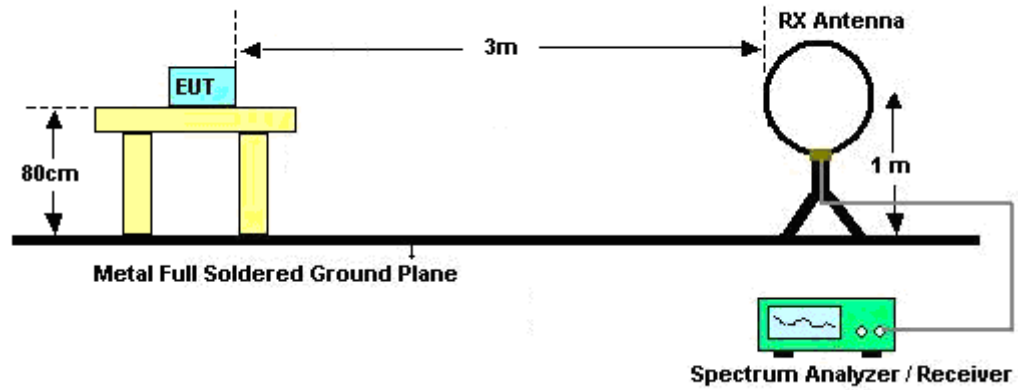
3.5.3 Test Procedures

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04

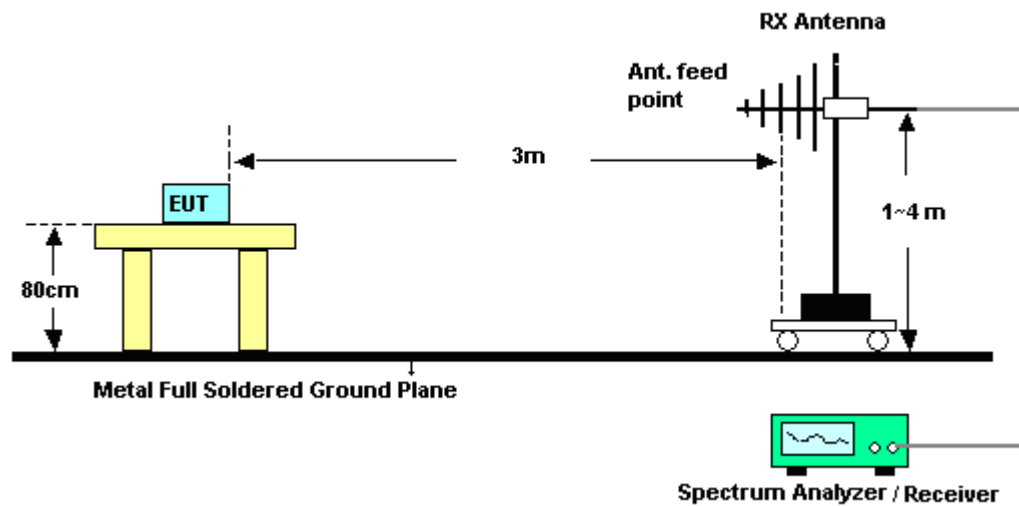
1. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
2. The EUT was placed on a turntable with 0.8 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. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
5. 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.
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=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.

3.5.4 Test Setup

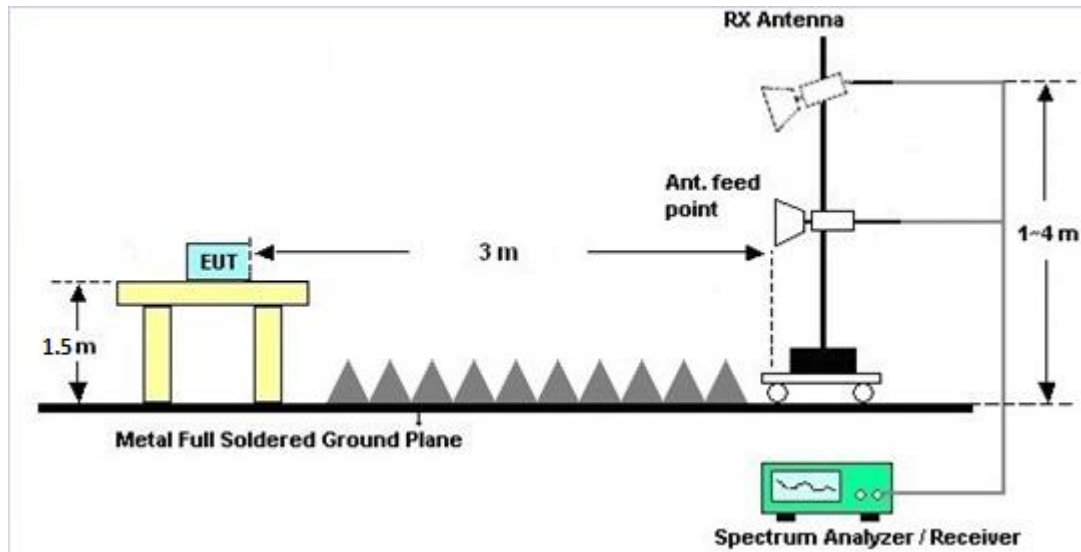
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.5.5 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.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.5.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.



3.6 Antenna Requirements

3.6.1 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.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.6.3 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	May 10, 2018~ May 11, 2018	Dec. 19, 2018	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US40441548	50MHz~18GHz	Dec. 20, 2017	May 10, 2018~ May 11, 2018	Dec. 19, 2018	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101067	9kHz ~ 30GHz	Nov. 13, 2017	May 10, 2018~ May 11, 2018	Nov. 12, 2018	Conducted (TH05-HY)
CMW270 WIRELESS CONN. TESTER	Rohde & Schwarz	CMW270	101067	N/A	Jul. 20, 2017	May 10, 2018~ May 11, 2018	Jul. 19, 2018	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1300484	N/A	Mar. 01, 2018	May 10, 2018~ May 11, 2018	Feb. 28, 2019	Conducted (TH05-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 18, 2017	May.12, 2018	Jul. 17, 2018	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Jan. 16, 2018	May.12, 2018	Jan. 15, 2019	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 14, 2017	May.12, 2018	Oct. 13, 2018	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 16, 2017	May.12, 2018	Oct. 15, 2018	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	May.12, 2018	Nov. 22, 2018	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Jan. 16, 2018	May.12, 2018	Jan. 15, 2020	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 19, 2017	May.12, 2018	Oct. 18, 2018	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	May.12, 2018	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	May.12, 2018	N/A	Radiation (03CH11-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590074	1GHz~18GHz	May. 22, 2017	May.12, 2018	May. 21, 2018	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 27, 2017	May.12, 2018	Nov. 26, 2018	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800054001	1GHz~18GHz	Apr. 16, 2018	May.12, 2018	Apr. 15, 2019	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4	9K-30M	Mar. 20, 2018	May.12, 2018	Mar. 19, 2019	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4	30M-18G	Mar. 15, 2018	May.12, 2018	Mar. 14, 2019	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2589/2	30M-18G	Mar. 15, 2018	May.12, 2018	Mar. 14, 2019	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-270 0-3000-18000-60SS	SN3	2.7G High Pass	Sep. 18, 2017	May.12, 2018	Sep. 17, 2018	Radiation (03CH11-HY)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Filter	Wainwright	WLK4-1000-1 530-8000-40S S	SN11	1G Low Pass	Sep. 18, 2017	May.12, 2018	Sep. 17, 2018	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-00104 2	N/A	N/A	May.12, 2018	N/A	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% ($U = 2Uc(y)$)	5.2
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.5
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.2
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Appendix A. Test Result of Conducted Test Items

Test Engineer:	Ethan Lin / Luffy Lin	Temperature:	21~25	°C
Test Date:	2018/05/10 ~ 2018/05/11	Relative Humidity:	51~54	%

<1Mbps>

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	2402	1.124	0.792	0.50	Pass
BLE	1Mbps	1	19	2440	1.116	0.792	0.50	Pass
BLE	1Mbps	1	39	2480	1.114	0.796	0.50	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	4.44	30.00	4.54	8.98	36.00	Pass
BLE	1Mbps	1	19	2440	4.28	30.00	4.54	8.82	36.00	Pass
BLE	1Mbps	1	39	2480	3.93	30.00	4.54	8.47	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	1Mbps	1	0	2402	2.04	3.35
BLE	1Mbps	1	19	2440	2.04	3.26
BLE	1Mbps	1	39	2480	2.04	2.75

TEST RESULTS DATA
Peak Power Density

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE	1Mbps	1	0	2402	2.88	-11.26	4.54	8.00	Pass
BLE	1Mbps	1	19	2440	2.85	-11.20	4.54	8.00	Pass
BLE	1Mbps	1	39	2480	2.20	-11.92	4.54	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc limit.

<2Mbps>

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE5.0	2Mbps	1	0	2402	2.112	1.056	0.50	Pass
BLE5.0	2Mbps	1	19	2440	2.100	1.056	0.50	Pass
BLE5.0	2Mbps	1	39	2480	2.092	1.056	0.50	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE5.0	2Mbps	1	0	2402	4.93	30.00	4.54	9.47	36.00	Pass
BLE5.0	2Mbps	1	19	2440	4.97	30.00	4.54	9.51	36.00	Pass
BLE5.0	2Mbps	1	39	2480	4.58	30.00	4.54	9.12	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE5.0	2Mbps	1	0	2402	4.86	3.40
BLE5.0	2Mbps	1	19	2440	4.86	3.32
BLE5.0	2Mbps	1	39	2480	4.86	2.83

TEST RESULTS DATA
Peak Power Density

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE5.0	2Mbps	1	0	2402	2.90	-14.00	4.54	8.00	Pass
BLE5.0	2Mbps	1	19	2440	2.85	-14.04	4.54	8.00	Pass
BLE5.0	2Mbps	1	39	2480	2.19	-14.73	4.54	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc limit.



Appendix B. Radiated Spurious Emission

Test Engineer :	Hao Hsu and Ken Wu	Temperature :	21~26°C
		Relative Humidity :	51~56%

2.4GHz 2400~2483.5MHz

BLE_1Mbps (Band Edge @ 3m)

BLE	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		2385.915	52.06	-21.94	74	42.24	27.13	16.29	33.6	313	71	P	H
		2387.385	42.99	-11.01	54	33.17	27.13	16.29	33.6	313	71	A	H
	*	2402	102.69	-	-	92.86	27.13	16.29	33.59	313	71	P	H
	*	2402	101.76	-	-	91.93	27.13	16.29	33.59	313	71	A	H
		2352.735	52.12	-21.88	74	42.53	27.04	16.15	33.6	351	97	P	V
		2387.805	42.71	-11.29	54	32.89	27.13	16.29	33.6	351	97	A	V
	*	2402	99.68	-	-	89.85	27.13	16.29	33.59	351	97	P	V
	*	2402	98.87	-	-	89.04	27.13	16.29	33.59	351	97	A	V
BLE CH 19 2440MHz		2380.5	51.35	-22.65	74	41.57	27.09	16.29	33.6	305	72	P	H
		2364	42.94	-11.06	54	33.28	27.04	16.22	33.6	305	72	A	H
	*	2440	102.27	-	-	92.28	27.27	16.31	33.59	305	72	P	H
	*	2440	101.58	-	-	91.59	27.27	16.31	33.59	305	72	A	H
		2485.2	51.79	-22.21	74	41.69	27.36	16.32	33.58	305	72	P	H
		2489.28	42.82	-11.18	54	32.68	27.4	16.32	33.58	305	72	A	H
		2311.2	52.25	-21.75	74	42.87	26.91	16.08	33.61	338	116	P	V
		2362.65	42.6	-11.4	54	32.94	27.04	16.22	33.6	338	116	A	V
	*	2440	98.59	-	-	88.6	27.27	16.31	33.59	338	116	P	V
	*	2440	97.55	-	-	87.56	27.27	16.31	33.59	338	116	A	V
		2495.36	51.52	-22.48	74	41.37	27.4	16.32	33.57	338	116	P	V
		2492.24	42.94	-11.06	54	32.79	27.4	16.32	33.57	338	116	A	V



BLE CH 39 2480MHz	*	2480	101.82	-	-	91.73	27.36	16.31	33.58	291	70	P	H
	*	2480	100.96	-	-	90.87	27.36	16.31	33.58	291	70	A	H
		2492	52.99	-21.01	74	42.84	27.4	16.32	33.57	291	70	P	H
		2484.16	43.61	-10.39	54	33.52	27.36	16.31	33.58	291	70	A	H
	*	2480	98.75	-	-	88.66	27.36	16.31	33.58	328	97	P	V
	*	2480	98.03	-	-	87.94	27.36	16.31	33.58	328	97	A	V
		2486.04	51.91	-22.09	74	41.81	27.36	16.32	33.58	328	97	P	V
		2492.8	43.15	-10.85	54	33	27.4	16.32	33.57	328	97	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_1Mbps (Harmonic @ 3m)

BLE	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		4804	45	-29	74	60.98	31.26	10.03	57.27	100	0	P	H
		4804	43.84	-30.16	74	59.82	31.26	10.03	57.27	100	0	P	V
BLE CH 19 2440MHz		4880	43.59	-30.41	74	59.39	31.38	9.99	57.17	100	0	P	H
		7320	41.97	-32.03	74	51.17	36.32	11.77	57.29	100	0	P	H
		4880	44.79	-29.21	74	60.59	31.38	9.99	57.17	100	0	P	V
		7320	42.13	-31.87	74	51.33	36.32	11.77	57.29	100	0	P	V
BLE CH 39 2480MHz		4960	44.62	-29.38	74	60.16	31.54	9.97	57.05	100	0	P	H
		7440	43.35	-30.65	74	52.48	36.59	11.72	57.44	100	0	P	H
		4960	45.38	-28.62	74	60.92	31.54	9.97	57.05	100	0	P	V
		7440	41.93	-32.07	74	51.06	36.59	11.72	57.44	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

**Emission below 1GHz
2.4GHz BLE_1Mbps (LF)**

BLE	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)
2.4GHz BLE LF		45.93	25.78	-14.22	40	41.11	16.14	1.02	32.49	100	0	P	H
		81.84	17.91	-22.09	40	35.84	13.32	1.23	32.48	-	-	P	H
		123.15	16.57	-26.93	43.5	30.22	17.26	1.55	32.46	-	-	P	H
		473.6	24.02	-21.98	46	30.23	23.35	2.81	32.37	-	-	P	H
		612.9	26.66	-19.34	46	30.43	25.51	3.18	32.46	-	-	P	H
		802.6	30.56	-15.44	46	30.94	28.09	3.69	32.16	-	-	P	H
		46.47	36.13	-3.87	40	51.88	15.72	1.02	32.49	100	0	P	V
		63.21	31.25	-8.75	40	51.07	11.64	1.03	32.49	-	-	P	V
		81.84	25.6	-14.4	40	43.53	13.32	1.23	32.48	-	-	P	V
		559	26.48	-19.52	46	29.87	25.97	3.07	32.43	-	-	P	V
		719.3	28.82	-17.18	46	30.84	26.86	3.53	32.41	-	-	P	V
		932.8	33.65	-12.35	46	31.22	29.8	3.99	31.36	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



2.4GHz 2400~2483.5MHz
BLE_2Mbps (Band Edge @ 3m)

BLE	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		2383.29	51.77	-22.23	74	41.99	27.09	16.29	33.6	100	67	P	H
		2383.605	44.56	-9.44	54	34.78	27.09	16.29	33.6	100	67	A	H
	*	2402	102.11	-	-	92.28	27.13	16.29	33.59	100	67	P	H
	*	2402	101.14	-	-	91.31	27.13	16.29	33.59	100	67	A	H
		2386.23	51.68	-22.32	74	41.86	27.13	16.29	33.6	350	97	P	V
		2359.035	43.86	-10.14	54	34.2	27.04	16.22	33.6	350	97	A	V
	*	2402	98.58	-	-	88.75	27.13	16.29	33.59	350	97	P	V
	*	2402	97.61	-	-	87.78	27.13	16.29	33.59	350	97	A	V
BLE CH 19 2440MHz		2365.58	52.04	-21.96	74	42.38	27.04	16.22	33.6	100	61	P	H
		2325.96	43.9	-10.1	54	34.48	26.95	16.08	33.61	100	61	A	H
	*	2440	101.7	-	-	91.71	27.27	16.31	33.59	100	61	P	H
	*	2440	100.59	-	-	90.6	27.27	16.31	33.59	100	61	A	H
		2488.8	52.5	-21.5	74	42.36	27.4	16.32	33.58	100	61	P	H
		2496.99	44.41	-9.59	54	34.26	27.4	16.32	33.57	100	61	A	H
		2358.44	51.49	-22.51	74	41.83	27.04	16.22	33.6	389	87	P	V
		2346.4	44.68	-9.32	54	35.13	27	16.15	33.6	389	87	A	V
	*	2440	98.6	-	-	88.61	27.27	16.31	33.59	389	87	P	V
	*	2440	97.63	-	-	87.64	27.27	16.31	33.59	389	87	A	V
		2486.14	51.93	-22.07	74	41.83	27.36	16.32	33.58	389	87	P	V
		2498.67	44.71	-9.29	54	34.56	27.4	16.32	33.57	389	87	A	V
BLE CH 39 2480MHz	*	2480	101.9	-	-	91.81	27.36	16.31	33.58	100	60	P	H
	*	2480	100.88	-	-	90.79	27.36	16.31	33.58	100	60	A	H
		2495.52	52.09	-21.91	74	41.94	27.4	16.32	33.57	100	60	P	H
		2483.8	45.5	-8.5	54	35.41	27.36	16.31	33.58	100	60	A	H
	*	2480	98.04	-	-	87.95	27.36	16.31	33.58	367	98	P	V
	*	2480	96.66	-	-	86.57	27.36	16.31	33.58	367	98	A	V
		2499.92	52.06	-21.94	74	41.91	27.4	16.32	33.57	367	98	P	V
		2494.64	44.85	-9.15	54	34.7	27.4	16.32	33.57	367	98	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_2Mbps (Harmonic @ 3m)

BLE	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		4804	45.85	-28.15	74	61.83	31.26	10.03	57.27	100	0	P	H
		4804	43.47	-30.53	74	59.45	31.26	10.03	57.27	100	0	P	V
BLE CH 19 2440MHz		4880	43.78	-30.22	74	59.58	31.38	9.99	57.17	100	0	P	H
		7320	42.83	-31.17	74	52.03	36.32	11.77	57.29	100	0	P	H
		4880	43.67	-30.33	74	59.47	31.38	9.99	57.17	100	0	P	V
		7320	43.45	-30.55	74	52.65	36.32	11.77	57.29	100	0	P	V
BLE CH 39 2480MHz		4960	46.8	-27.2	74	62.34	31.54	9.97	57.05	100	0	P	H
		7440	42.44	-31.56	74	51.57	36.59	11.72	57.44	100	0	P	H
		4960	43.87	-30.13	74	59.41	31.54	9.97	57.05	100	0	P	V
		7440	42.66	-31.34	74	51.79	36.59	11.72	57.44	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz

2.4GHz BLE_2Mbps (LF)

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)
2.4GHz BLE LF		46.47	25.32	-14.68	40	41.07	15.72	1.02	32.49	-	-	P	H
		147.18	16.52	-26.98	43.5	30.39	16.88	1.69	32.44	-	-	P	H
		266.79	19.25	-26.75	46	30.05	19.41	2.17	32.38	-	-	P	H
		511.4	24.37	-21.63	46	30.05	23.74	2.97	32.39	-	-	P	H
		748	29.02	-16.98	46	29.99	27.79	3.57	32.33	-	-	P	H
		942.6	32.14	-13.86	46	29.21	30.2	3.99	31.26	100	0	P	H
		46.47	36.74	-3.26	40	52.49	15.72	1.02	32.49	100	0	P	V
		140.97	17.79	-25.71	43.5	31.49	17.17	1.57	32.44	-	-	P	V
		262.2	18.97	-27.03	46	29.5	19.68	2.17	32.38	-	-	P	V
		454.7	23.51	-22.49	46	30.07	23.06	2.74	32.36	-	-	P	V
		633.2	27	-19	46	30.13	26.08	3.25	32.46	-	-	P	V
		944	34.17	-11.83	46	31.19	30.25	3.99	31.26	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Note symbol

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is over limit line.
P/A	P eak or A verage
H/V	H orizontal or V ertical

A calculation example for radiated spurious emission is shown as below:

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 CH 00 2402MHz		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(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”.



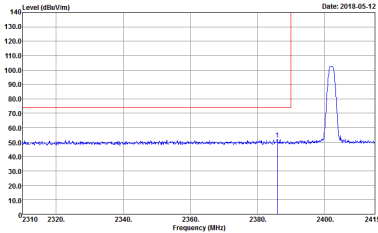
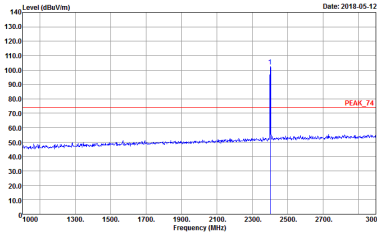
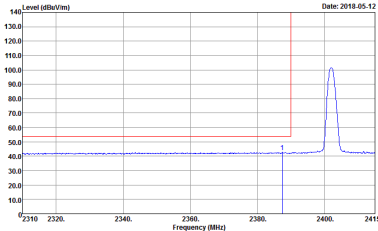
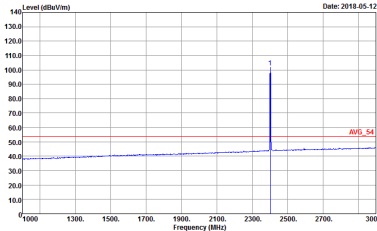
Appendix C. Radiated Spurious Emission Plots

Test Engineer :	Hao Hsu and Ken Wu	Temperature :	21~26°C
		Relative Humidity :	51~56%

Note symbol

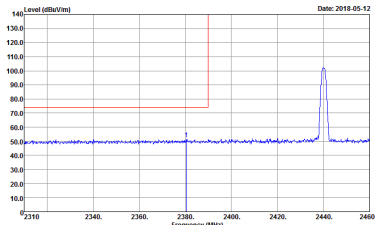
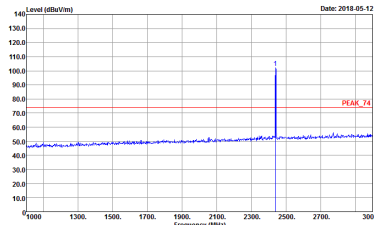
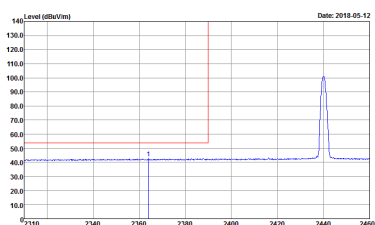
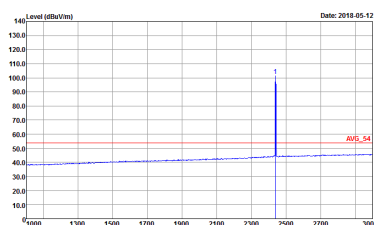
-L	Low channel location
-R	High channel location

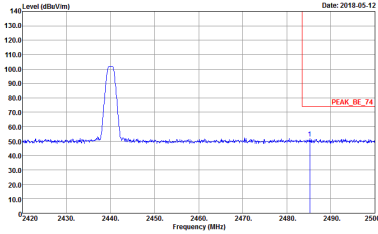
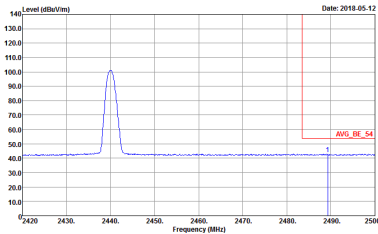
2.4GHz 2400~2483.5MHz
BLE_1Mbps (Band Edge @ 3m)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
1	Horizontal	Fundamental
Peak	 <p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>	 <p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>
Avg.	 <p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>	 <p>Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>

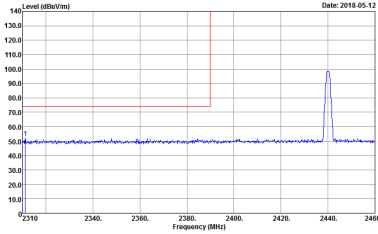
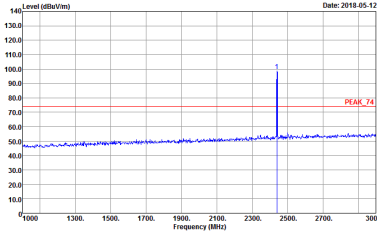
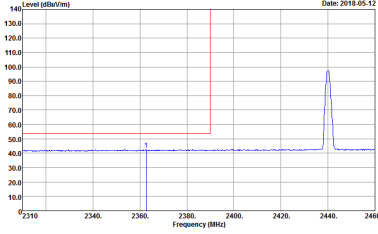
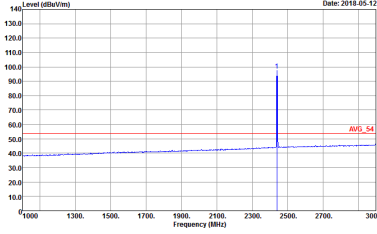


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
1	Vertical	Fundamental
Peak	<p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>
	<p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>	<p>Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>

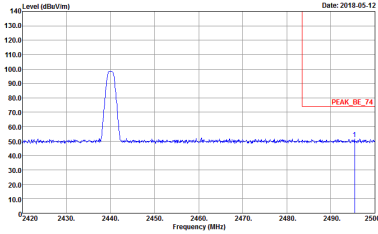
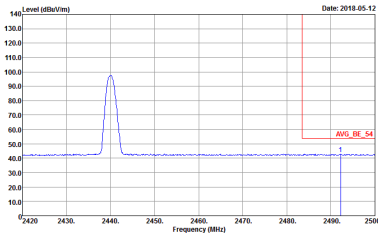
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - L	
1	Horizontal	Fundamental
Peak	 <p> Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01 </p>	 <p> Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01 </p>
	 <p> Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01 </p>	 <p> Site : 03CH11-HY Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01 </p>

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - R	
1	Horizontal	Fundamental
Peak	 <p> Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01 </p>	Left blank
Avg.	 <p> Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01 </p>	Left blank

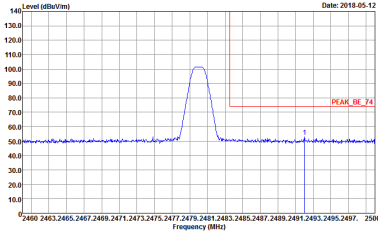
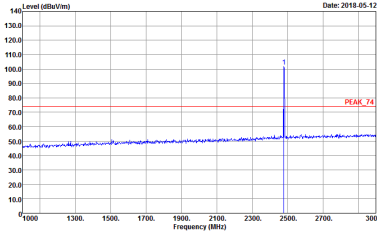
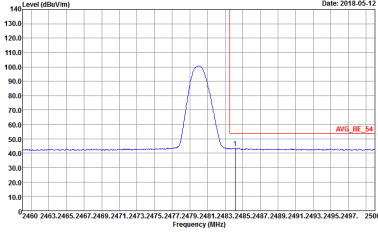
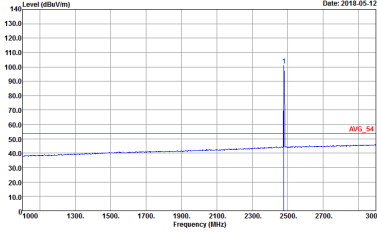


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - L	
1	Vertical	Fundamental
Peak	<div><p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>
Avg.	<div><p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>

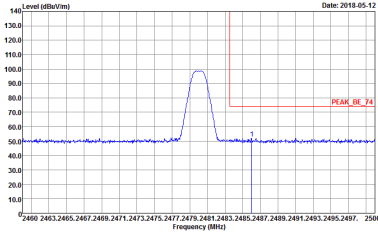
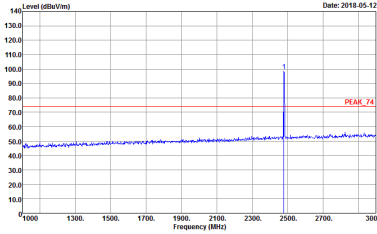
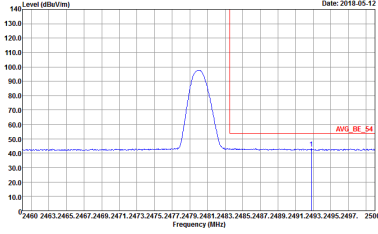
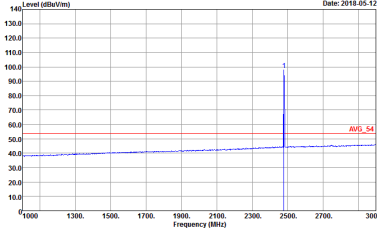


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - R	
1	Vertical	Fundamental
Peak	<div><p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	Left blank
Avg.	<div><p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	Left blank



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
1	Horizontal	Fundamental
Peak	 <p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>	 <p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>
Avg.	 <p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>	 <p>Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>



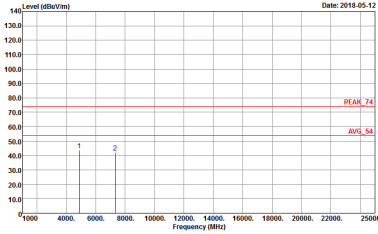
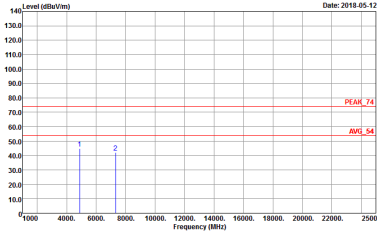
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
1	Vertical	Fundamental
Peak	<div><p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>
Avg.	<div><p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>



2.4GHz 2400~2483.5MHz
BLE_1Mbps (Harmonic @ 3m)

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH00 2402MHz	
1	Horizontal	Vertical
Peak Avg.	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 7D2920-01</p>	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 7D2920-01</p>

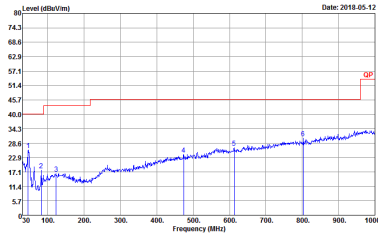
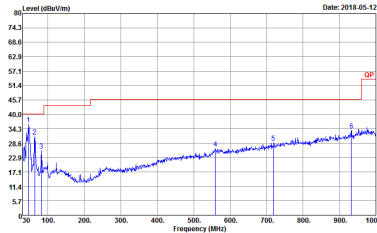


BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH19 2440MHz	
1	Horizontal	Vertical
Peak Avg.	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 7D2920-01</p></div>



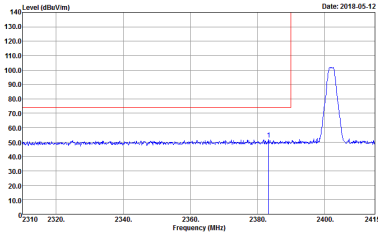
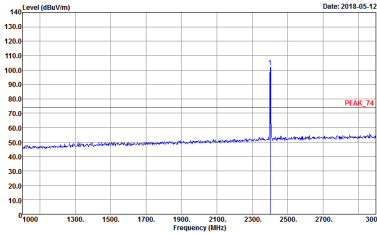
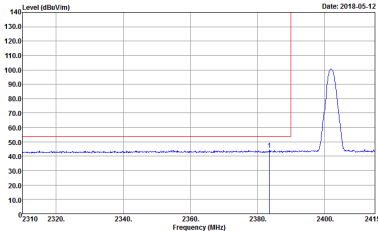
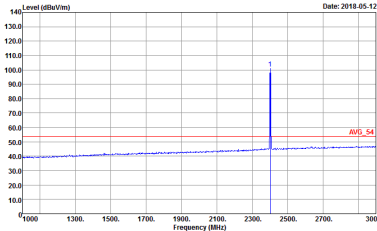
BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH39 2480MHz	
1	Horizontal	Vertical
Peak	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 7D2920-01</p></div>

**Emission below 1GHz
2.4GHz BLE_1Mbps (LF)**

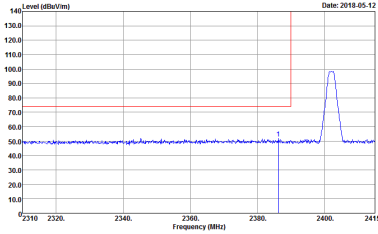
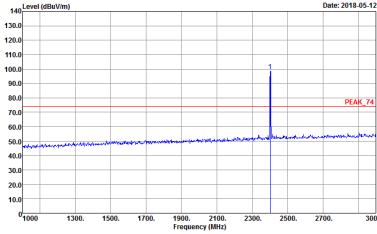
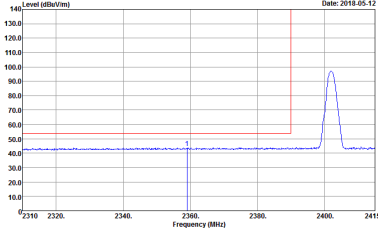
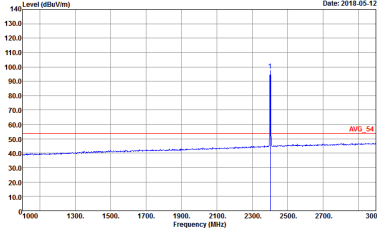
BLE	2.4GHz 2400~2483.5MHz	
ANT	BLE LF	
1	Horizontal	Vertical
QP / Peak	 <p> Site : 03CH11-HY Condition : QP 3m BE-LO6 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 7D2920-01 </p>	 <p> Site : 03CH11-HY Condition : QP 3m BE-LO6 6111D-LF_ETC VERTICAL Detector : Peak Project : 7D2920-01 </p>

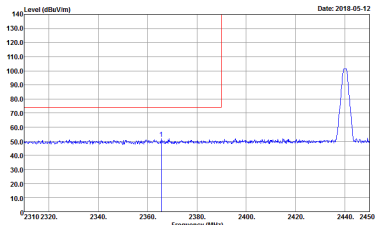
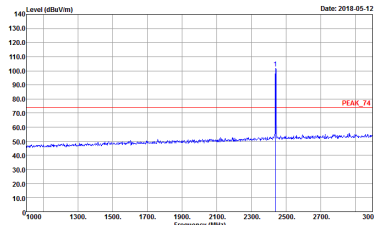
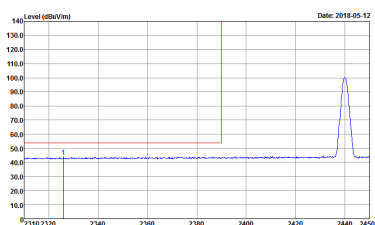
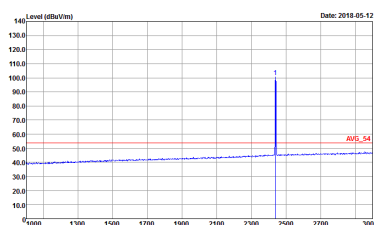


2.4GHz 2400~2483.5MHz
BLE_2Mbps (Band Edge @ 3m)

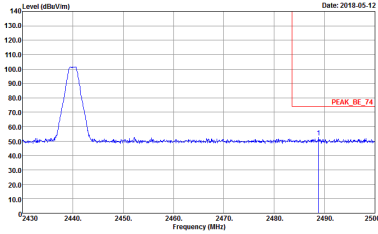
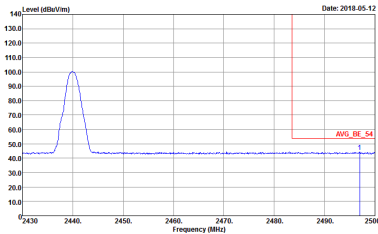
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
1	Horizontal	Fundamental
Peak	 <p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>	 <p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>
Avg.	 <p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>	 <p>Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>



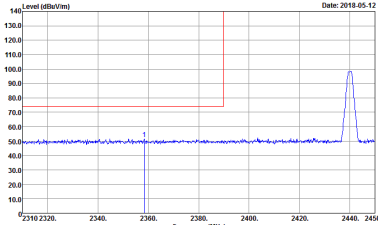
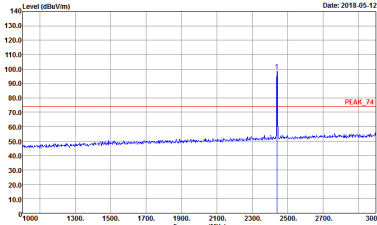
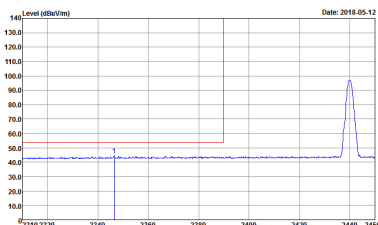
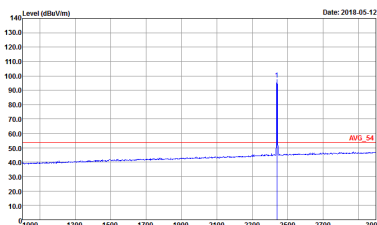
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
1	Vertical	Fundamental
Peak	<div><p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>
Avg	<div><p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - L	
1	Horizontal	Fundamental
Peak	 <p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 7D2920-01</p>	 <p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 7D2920-01</p>
	 <p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 7D2920-01</p>	 <p>Site : 03CH11-HY Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 7D2920-01</p>

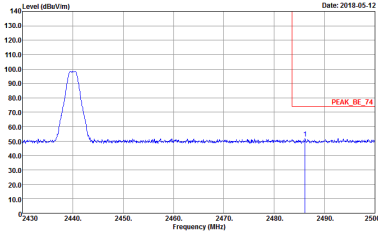
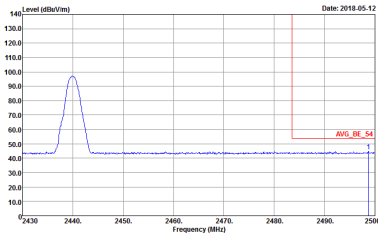


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - R	
1	Horizontal	Fundamental
Peak	<div><p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	Left blank
Avg.	<div><p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	Left blank



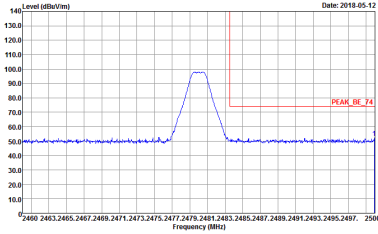
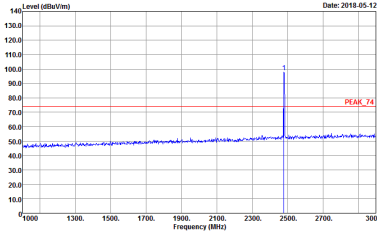
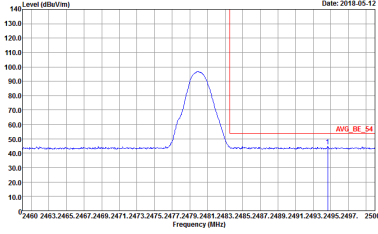
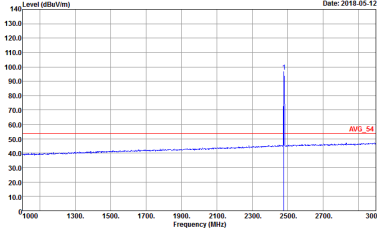
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - L	
1	Vertical	Fundamental
Peak	<div><p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>
Avg.	<div><p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - R	
1	Vertical	Fundamental
Peak	<div><p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	Left blank
Avg.	<div><p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p></div>	Left blank



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
1	Horizontal	Fundamental
Peak	<p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>
Avg.	<p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>	<p>Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01</p>

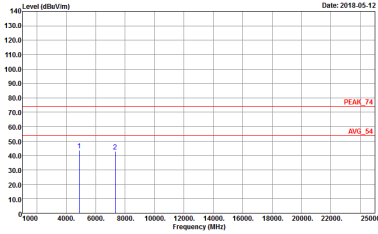
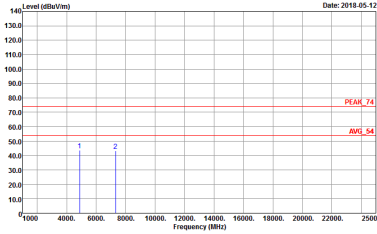
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
1	Vertical	Fundamental
Peak	 <p> Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01 </p>	 <p> Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7D2920-01 </p>
	 <p> Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01 </p>	 <p> Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 7D2920-01 </p>



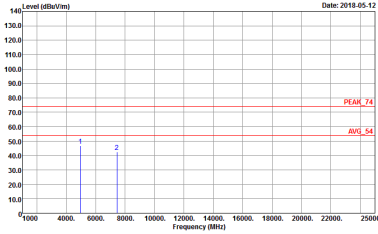
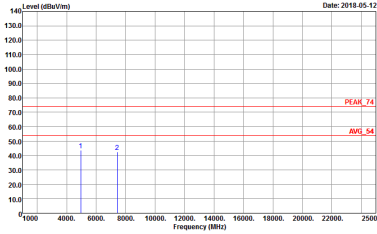
2.4GHz 2400~2483.5MHz
BLE_2Mbps (Harmonic @ 3m)

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH00 2402MHz	
1	Horizontal	Vertical
Peak Avg.	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 7D2920-01</p>	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 7D2920-01</p>

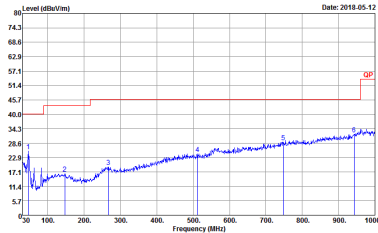
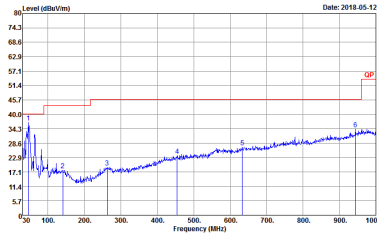


BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH19 2440MHz	
1	Horizontal	Vertical
Peak Avg.	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 7D2920-01</p></div>



BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH39 2480MHz	
1	Horizontal	Vertical
Peak	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 7D2920-01</p></div>	<div><p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 7D2920-01</p></div>

**Emission below 1GHz
2.4GHz BLE_2Mbps (LF)**

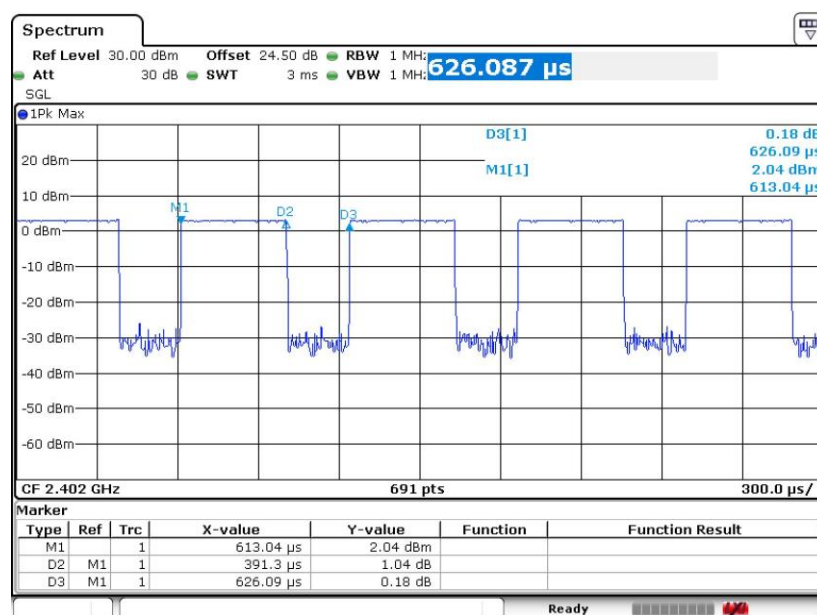
BLE	2.4GHz 2400~2483.5MHz	
ANT	BLE LF	
1	Horizontal	Vertical
QP / Peak	 <p>Site : 03CH11-HY Condition : QP 3m BE-LO6 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 7D2920-01</p>	 <p>Site : 03CH11-HY Condition : QP 3m BE-LO6 6111D-LF_ETC VERTICAL Detector : Peak Project : 7D2920-01</p>

Appendix D. Duty Cycle Plots

Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor (dB)
Bluetooth LE for 1 Mbps	62.50	391.30	2.56	3kHz	2.04
Bluetooth LE for 2 Mbps	32.64	204.35	4.89	10kHz	4.86

Bluetooth - LE

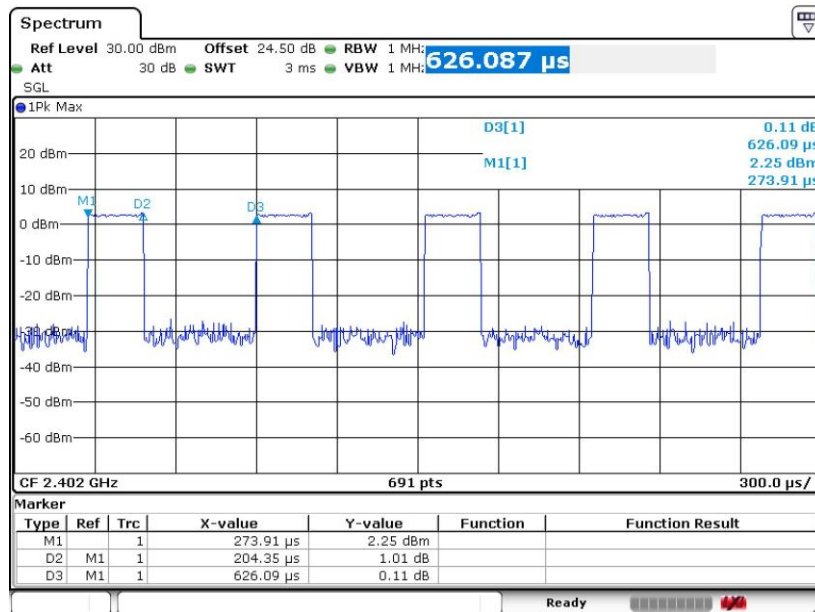
<1 Mbps>



Date: 10.MAY.2018 09:25:17



<2 Mbps>



Date: 10.MAY.2018 17:02:57

————THE END————