



FCC RF Test Report

APPLICANT : SHARP CORPORATION
EQUIPMENT : Smart Phone
TYPE NAME : Type-A
Type-B
FCC ID : APYHRO00249
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DSS) Spread Spectrum Transmitter

The product was received on Apr. 01, 2017 and testing was completed on May 11, 2017. 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 test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

**SPORTON INTERNATIONAL INC.**

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.

SPORTON INTERNATIONAL INC.

TEL : 886-3-327-3456

FAX : 886-3-328-4978

FCC ID : APYHRO00249

Page Number : 1 of 24

Report Issued Date : Jun. 14, 2017

Report Version : Rev. 02

Report Template No.: BU5-FR15CBT Version 2.0



TABLE OF CONTENTS

REVISION HISTORY.....	3
SUMMARY OF TEST RESULT	4
1 GENERAL DESCRIPTION.....	5
1.1 Applicant.....	5
1.2 Manufacturer.....	5
1.3 Product Feature of Equipment Under Test.....	5
1.4 Re-use of Measured Data	6
1.5 Modification of EUT	9
1.6 Testing Location	10
1.7 Applicable Standards.....	10
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST.....	11
2.1 Carrier Frequency Channel	11
2.2 Test Mode.....	12
2.3 Connection Diagram of Test System.....	13
2.4 Support Unit used in test configuration and system	13
2.5 EUT Operation Test Setup	13
3 TEST RESULT	14
3.1 Peak Output Power Measurement	14
3.2 Radiated Band Edges and Spurious Emission Measurement	16
3.3 AC Conducted Emission Measurement.....	20
3.4 Antenna Requirements.....	22
4 LIST OF MEASURING EQUIPMENT.....	23
5 UNCERTAINTY OF EVALUATION.....	24
APPENDIX A. AC CONDUCTED EMISSION TEST RESULT	
APPENDIX B. RADIATED SPURIOUS EMISSION	
APPENDIX C. RADIATED SPURIOUS EMISSION PLOTS	
APPENDIX D. DUTY CYCLE PLOTS	
APPENDIX E. SETUP PHOTOGRAPHS	
APPENDIX F. ORIGINAL REPORT	



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR740121A	Rev. 01	Initial issue of report	Jun. 12, 2017
FR740121A	Rev. 02	Remove WLAN 5GHz Band 4 information in section 1.4.2	Jun. 14, 2017



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(b)(1)	Peak Output Power	≤ 125 mW	Pass	-
3.2	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 13.19 dB at 957.300 MHz
3.3	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 4.60 dB at 0.518 MHz
3.4	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

SHARP CORPORATION

Takumi-Cho, Sakai-Ku, Sakai-Shi, 2, Osaka 590-852, Japan

1.2 Manufacturer

SHARP CORPORATION

Takumi-Cho, Sakai-Ku, Sakai-Shi, 2, Osaka 590-852, Japan

1.3 Product Feature of Equipment Under Test

GSM/WCDMA/LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac, Wi-Fi 5GHz 802.11a/n/ac, NFC, and GPS

Product Specification subjective to this standard	
Sample 1	EUT with Memory 1
Sample 2	EUT with Memory 2
Antenna Type	WWAN: ILA Antenna WLAN: ILA Antenna Bluetooth: ILA Antenna GPS/Glonass/Beidou/Galileo: ILA Antenna NFC: Loop Antenna

Remark: The deviations between type name: Type-A and type name: Type-B which can be referred Product Equality Declaration. The deviations were switched by Hardware.



1.4 Re-use of Measured Data

1.4.1 Introduction Section

The original model (FCC ID: APYHRO00248) and the variant model (FCC ID: APYHRO00249) has identical PCB layout, antenna, SW implementation for Bluetooth/Wi-Fi/GPS. Based on their similarity, the FCC Part 15C & 15E (equipment class: DTS, DSS, DXX, NII) test data issued for original model also apply for the variant model.

The applicant takes full responsibility that the test data as referenced in section 4 below represent compliance for this FCC ID (FCC ID: APYHRO00249).

1.4.2 Difference Section

The original model (FCC ID: APYHRO00248) and the variant model (FCC ID: APYHRO00249) has identical PCB layout, antenna, SW implementation for Bluetooth/Wi-Fi/GPS. The details of similarity and difference can be found in the Operating Description.

The product specification is outlined in the following table:

FCC ID			APYHRO00248	APYHRO00249
Wireless Tech	Mode		Frequency (MHz)	
GSM	GSM Voice GPRS (GMSK) EDGE (8PSK)	Multi-Slot Class 11 DTM: Yes	850/1900	850/1900
UMTS	AMR/RCM12.2Kbps HSDPA/HSUPA/DC-HSDPA		B5	B2/B4
LTE	QPSK/16QAM VoLTE		B5	B2/B4/B17
Wi-Fi	11b/11g/11n(HT20)		2412-2462 MHz/	
	11a/11n(HT20)/11n(HT40)		5180-5240 MHz 5260-5320 MHz 5500-5700 MHz	
Bluetooth	BR/EDR/LE		2402-2480 MHz	
NFC	NFC		13.56 MHz	



1.4.3 Spot Check Verification Data Section

Summary of the spot check:

Test Item	Mode	APYHRO00248 Worst Result	APYHRO00249 Worst Result	Difference (dB)
Average Conducted Power (dBm)	802.11b	14.34	13.84	0.5
	802.11g	13.41	13.16	0.25
	11n HT20	13.39	13.21	0.18
	11n HT40	13.26	13.24	0.02
	20MHz BW 5150-5250MHz	13.77	13.61	0.16
	20MHz BW 5250-5350MHz	13.51	13.65	-0.14
	20MHz BW 5470-5725MHz	13.50	13.71	-0.21
	40MHz BW 5150-5250MHz	13.85	13.74	0.11
	40MHz BW 5250-5350MHz	13.81	13.79	0.02
	40MHz BW 5470-5725MHz	13.67	13.78	-0.11
	80MHz BW 5150-5250MHz	13.84	13.53	0.31
	80MHz BW 5250-5350MHz	13.55	13.57	-0.02
	80MHz BW 5470-5725MHz	13.35	13.60	-0.25
	BT (1Mbps)	6.15	5.29	0.86
	BT (2Mbps)	2.96	2.19	0.77
	BT (3Mbps)	2.91	2.10	0.81
	BT-LE	5.24	4.84	0.4
	Test date	2017/04/14 – 2017/05/04	2017/04/20 – 2017/05/12	
Peak Radiated Spurious Emission (Band Edge) (dBuV/m)	802.11b	51.38	51.56	-0.18
	802.11g	56.65	56.81	-0.16
	11n HT40	56.84	58.6	-1.76
	20MHz BW 5150-5250MHz	51.99	50.93	1.06
	20MHz BW 5250-5350MHz	57.92	56.97	0.95
	20MHz BW 5470-5725MHz	47.9	47.6	0.3
	40MHz BW 5150-5250MHz	52.04	53.45	-1.41
	40MHz BW 5250-5350MHz	62.35	60.48	1.87
	40MHz BW 5470-5725MHz	61.35	59.27	2.08
	80MHz BW 5150-5250MHz	49.51	49.37	0.14
	80MHz BW 5250-5350MHz	60.13	60.06	0.07
	80MHz BW 5470-5725MHz	57.75	56.6	1.15
	BT (1Mbps)	42.26	42.63	-0.37
	BT-LE	51.58	51.65	-0.07
	Test date	2017/04/14 – 2017/05/04	2017/04/20 – 2017/05/12	
Average Radiated Spurious Emission (Band Edge) (dBuV/m)	802.11b	40.10	40.14	-0.04
	802.11g	42.97	43.72	-0.75
	11n HT40	45.24	47.52	-2.28
	20MHz BW 5150-5250MHz	41.12	40.45	-0.67
	20MHz BW 5250-5350MHz	43.9	42.01	1.89
	20MHz BW 5470-5725MHz	43.76	43.26	0.5
	40MHz BW 5150-5250MHz	44.73	43.88	0.85
	40MHz BW 5250-5350MHz	50.41	50.53	-0.12
	40MHz BW 5470-5725MHz	47.14	46.8	0.34
	80MHz BW 5150-5250MHz	41.41	42.24	-0.83
	80MHz BW 5250-5350MHz	50.02	50.09	-0.07
	80MHz BW 5470-5725MHz	48.24	46.97	1.27
	BT (1Mbps)	17.50	17.84	-0.34
	BT-LE	41.90	41.97	-0.07
	Test date	2017/04/14 – 2017/05/04	2017/04/20 – 2017/05/12	



Test Item	Mode	APYHRO00248 Worst Result	APYHRO00249 Worst Result	Difference (dB)
Peak Radiated Spurious Emission (Harmonic) (dBuV/m)	802.11b	49.89	49.49	0.4
	802.11g	49.52	49.59	-0.07
	11n HT40	49.62	49.46	0.16
	20MHz BW 5150-5250MHz	46.36	45.78	0.58
	20MHz BW 5250-5350MHz	45.13	45.86	-0.73
	20MHz BW 5470-5725MHz	45.95	46.66	-0.71
	40MHz BW 5150-5250MHz	47.29	46.25	1.04
	40MHz BW 5250-5350MHz	45.4	45.68	-0.28
	40MHz BW 5470-5725MHz	47.28	47.4	-0.12
	80MHz BW 5150-5250MHz	47.02	45.91	1.11
	80MHz BW 5250-5350MHz	46.85	48.23	-1.38
	80MHz BW 5470-5725MHz	49.17	48.18	0.99
	BT (1Mbps)	49.88	49.47	0.41
	BT-LE	49.36	49.60	-0.24
	Test date	2017/02/11 – 2017/02/24	2017/03/03 – 2017/03/11	

Conclusion:

WLAN Radiated spurious emission test against the variant model for non-cellular part based on the worst-case condition from the original model was performed in this filing to demonstrate the test data from original model remains representative for the variant model.

Based on the spot check test result (power levels measured are within 1dB, and the worst case of RSE spot check verification based on the worst condition from the original model is within 3dB, and are compliance with the limits), the test data from the original model is representative for the variant model.

The unwanted, harmonics, radiated spurious emission is reported peak measurement only due to spurious lower than 20dB than the limit.

The detail test results can be found in this document, Appendix A, hereafter.

1.4.4 Reference detail Section:

Equipment Class	Reference FCC ID	Type Grant/Permissive Change	Reference Application	Folder Test/RF Exposure	Report Title
DTS	APYHRO00248	Original Grant	FR740120B	Part 15C	All sections applicable
			FR740120C	Part 15C	All sections applicable
			FA740120	RF Exposure	All sections applicable
DSS	APYHRO00248	Original Grant	FR740120A	Part 15C	All sections applicable
			FA740120	RF Exposure	All sections applicable
NII	APYHRO00248	Original Grant	FR740120E FZ740120	Part 15E	All sections applicable
			FA740120	RF Exposure	All sections applicable

1.5 Modification of EUT

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

1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. 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, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	Sporton Site No.	
	TH05-HY	CO05-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.	
	03CH10-HY	

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

1.7 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
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	0	2402	27	2429	54	2456
	1	2403	28	2430	55	2457
	2	2404	29	2431	56	2458
	3	2405	30	2432	57	2459
	4	2406	31	2433	58	2460
	5	2407	32	2434	59	2461
	6	2408	33	2435	60	2462
	7	2409	34	2436	61	2463
	8	2410	35	2437	62	2464
	9	2411	36	2438	63	2465
	10	2412	37	2439	64	2466
	11	2413	38	2440	65	2467
	12	2414	39	2441	66	2468
	13	2415	40	2442	67	2469
	14	2416	41	2443	68	2470
	15	2417	42	2444	69	2471
	16	2418	43	2445	70	2472
	17	2419	44	2446	71	2473
	18	2420	45	2447	72	2474
	19	2421	46	2448	73	2475
	20	2422	47	2449	74	2476
	21	2423	48	2450	75	2477
	22	2424	49	2451	76	2478
	23	2425	50	2452	77	2479
	24	2426	51	2453	78	2480
	25	2427	52	2454	-	-
	26	2428	53	2455	-	-

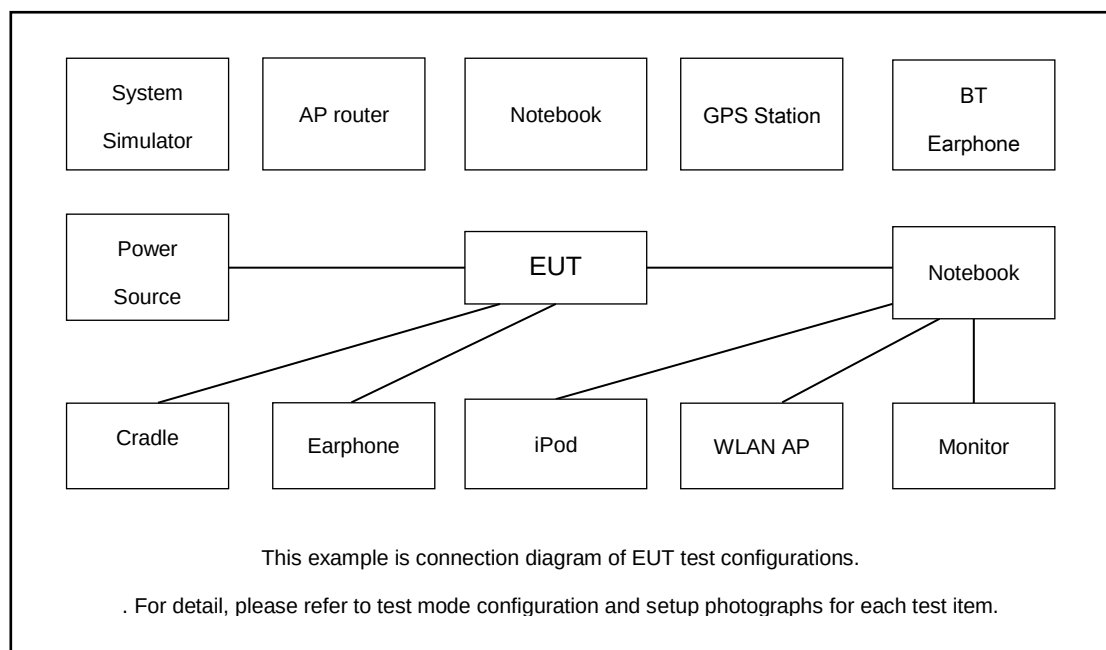
2.2 Test Mode

- 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: conduction emission (150 kHz to 30 MHz), 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 (Z plane) were recorded in this report, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

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

Summary table of Test Cases	
Radiated Test Cases	Bluetooth BR 1Mbps GFSK
	Mode 1: CH78_2480 MHz
AC Conducted Emission	Mode 1 :LTE Band 17 Idle + Bluetooth Link + WLAN (2.4GHz) Link + Earphone + USB Cable (Charging from Adapter) + Camera (Front) for Sample 2
Remark: For Radiated Test Cases, The tests were performance with Sample 1	

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.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
3.	Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
5.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, programmed RF utility, "Tera Term" installed in the notebook make the EUT provide functions like channel selection and power level for continuous transmitting and receiving signals.

3 Test Result

3.1 Peak Output Power Measurement

3.1.1 Limit of Peak Output Power

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts. The power limit for 1Mbps, 2Mbps, 3Mbps and AFH modes are 0.125 watts.

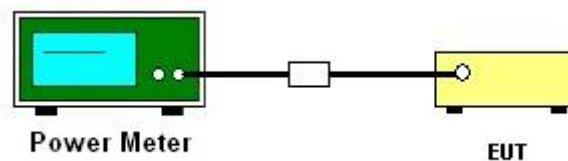
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
1. 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.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Measure the conducted output power with cable loss and record the results in the test report.
4. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of Peak Output Power

Test Mode :	1Mbps	Temperature :	24~26°C
Test Engineer :	Allen Lin	Relative Humidity :	48~51%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	5.62	20.97	Pass
39	2441	5.15	20.97	Pass
78	2480	5.66	20.97	Pass

Note: For AFH mode using 20 hopping channels, the maximum output power limit is 20.97dBm.

Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Allen Lin	Relative Humidity :	48~51%

Channel	Frequency (MHz)	RF Power (dBm)		
		$\pi/4$ -DQPSK	Max. Limits (dBm)	Pass/Fail
		2 Mbps		
00	2402	4.82	20.97	Pass
39	2441	5.15	20.97	Pass
78	2480	5.60	20.97	Pass

Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Allen Lin	Relative Humidity :	48~51%

Channel	Frequency (MHz)	RF Power (dBm)		
		8-DPSK	Max. Limits (dBm)	Pass/Fail
		3 Mbps		
00	2402	5.30	20.97	Pass
39	2441	5.06	20.97	Pass
78	2480	5.55	20.97	Pass



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. 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

The measuring equipment is listed in the section 4 of this test report.



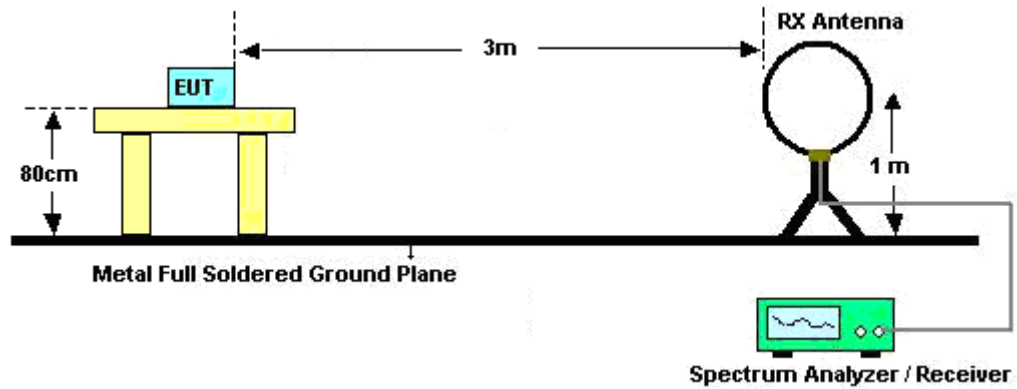
3.2.3 Test Procedures

1. 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.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, 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 to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. 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, RBW=1MHz for $f > 1$ GHz ; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c).
Duty cycle = On time/100 milliseconds
On time = $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$
Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
Average Emission Level = Peak Emission Level + $20 * \log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

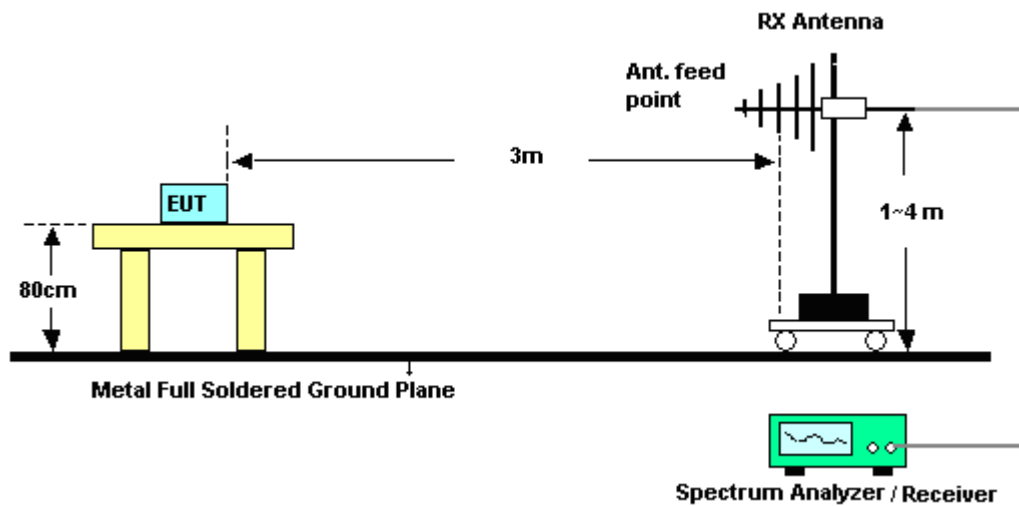
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from $20 \log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.2.4 Test Setup

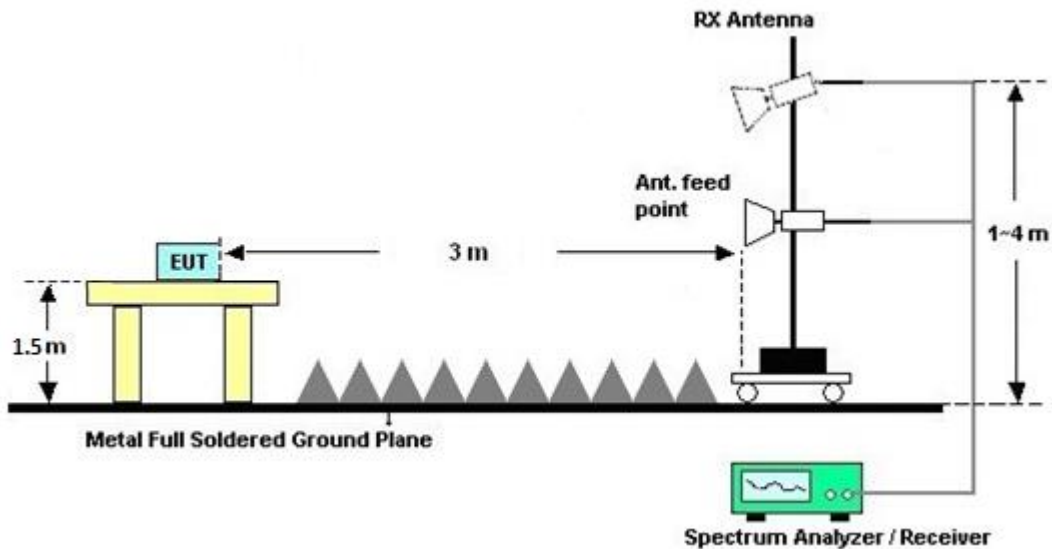
For radiated emissions below 30MHz



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 per 15.31(o) was not reported.

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 AC Conducted Emission Measurement

3.3.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

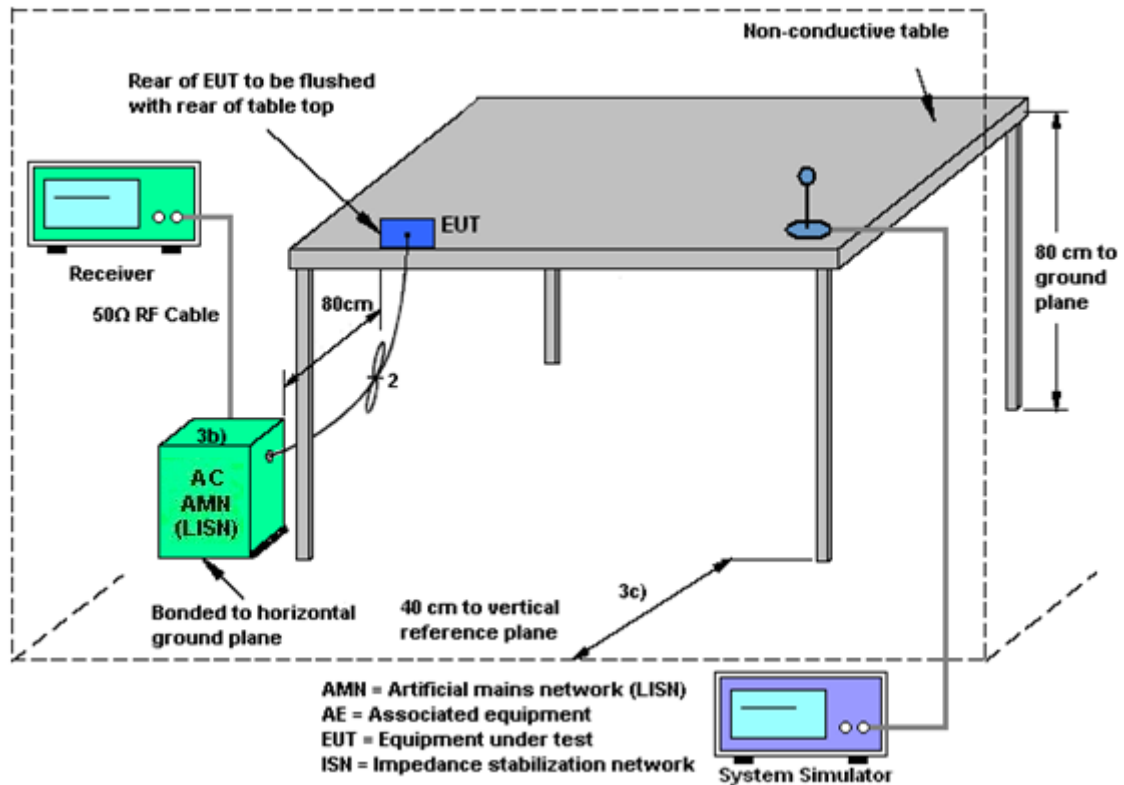
3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.3.4 Test Setup



3.3.5 Test Result of AC Conducted Emission

Please refer to Appendix A.



3.4 Antenna Requirements

3.4.1 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.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.4.3 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	300MHz~40GHz	Dec. 26, 2016	Apr. 21, 2017 ~ Apr. 29, 2017	Dec. 25, 2017	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US40441548	300MHz~40GHz	Dec. 26, 2016	Apr. 21, 2017 ~ Apr. 29, 2017	Dec. 25, 2017	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz-40GHz	Jul. 17, 2016	Apr. 21, 2017 ~ Apr. 29, 2017	Jul. 16, 2017	Conducted (TH05-HY)
BT Base Station (Measure)	Rohde & Schwarz	CBT	101136	BT 3.0	Sep. 21, 2016	Apr. 21, 2017 ~ Apr. 29, 2017	Sep. 20, 2017	Conducted (TH05-HY)
Amplifier	SONOMA	310N	187311	9kHz~1GHz	Oct. 26, 2016	May 09, 2017 ~ May 11, 2017	Oct. 25, 2017	Radiation (03CH10-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	35413&02	30MHz~1GHz	Jan. 07, 2017	May 09, 2017 ~ May 11, 2017	Jan. 06, 2018	Radiation (03CH10-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1325	1GHz ~ 18GHz	Sep. 30, 2016	May 09, 2017 ~ May 11, 2017	Sep. 29, 2017	Radiation (03CH10-HY)
Preamplifier	Keysight	83017A	MY53270078	1GHz~26.5GHz	Oct. 26, 2016	May 09, 2017 ~ May 11, 2017	Oct. 25, 2017	Radiation (03CH10-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz ~ 44GHz	Oct. 17, 2016	May 09, 2017 ~ May 11, 2017	Oct. 16, 2017	Radiation (03CH10-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	May 09, 2017 ~ May 11, 2017	N/A	Radiation (03CH10-HY)
Turn Table	EMEC	TT 2200	N/A	0~360 Degree	N/A	May 09, 2017 ~ May 11, 2017	N/A	Radiation (03CH10-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Oct. 20, 2016	May 09, 2017 ~ May 11, 2017	Oct. 19, 2018	Radiation (03CH10-HY)
EMI Test Receiver	Keysight	N9038A (MXE)	MY55420170	N/A	Mar. 03, 2017	May 09, 2017 ~ May 11, 2017	Mar. 02, 2018	Radiation (03CH10-HY)
Preamplifier	Jet-Power	JPA00101800-30-10P	1601180002	1GHz~18GHz	Jul. 27, 2016	May 09, 2017 ~ May 11, 2017	Jul. 26, 2017	Radiation (03CH10-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz ~ 40GHz	Apr. 27, 2017	May 09, 2017 ~ May 11, 2017	Apr. 26, 2018	Radiation (03CH10-HY)
Preamplifier	MITEQ	JS44-18004000-33-8P	1840917	18GHz ~ 40GHz	Jun. 14, 2016	May 09, 2017 ~ May 11, 2017	Jun. 13, 2017	Radiation (03CH10-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Apr. 30, 2017	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Aug. 30, 2016	Apr. 30, 2017	Aug. 29, 2017	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 29, 2016	Apr. 30, 2017	Nov. 28, 2017	Conduction (CO05-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.7
---	-----

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.6
---	-----

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.9
---	-----

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.2
---	-----



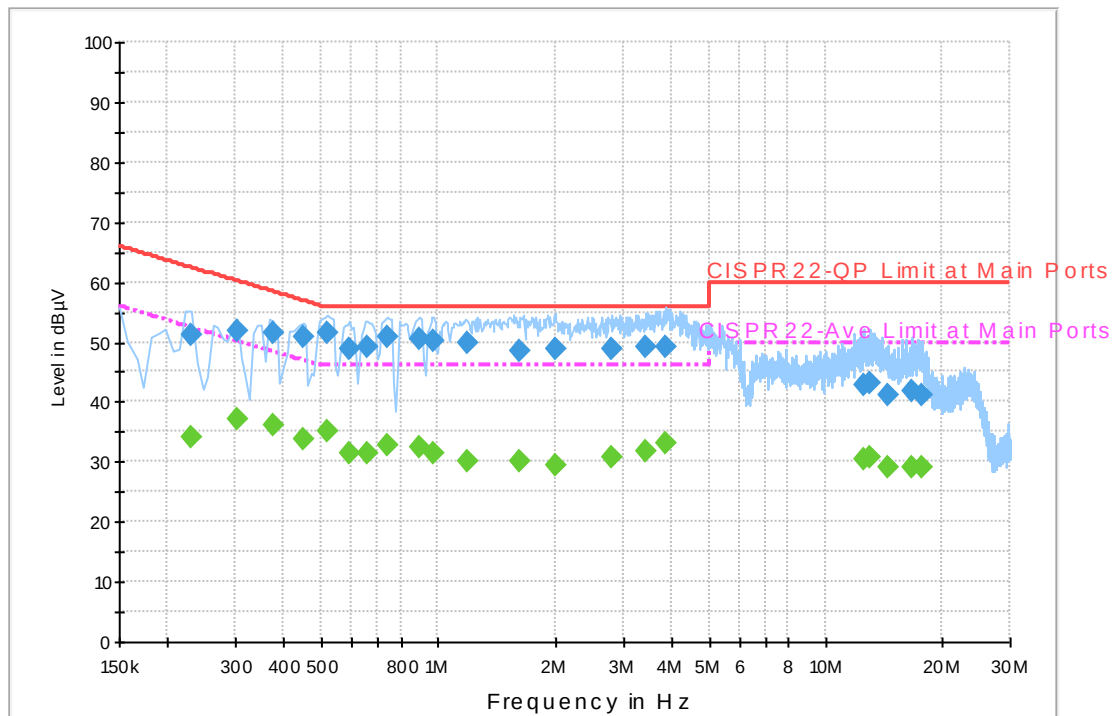
Appendix A. AC Conducted Emission Test Results

Test Engineer :	Arthur Hsieh	Temperature :	22~24℃
		Relative Humidity :	51~55%

EUT Information

Report NO : 740121
Test Mode : Mode 1
Test Voltage : 120Vac/60Hz
Phase : Line

ENV216 Auto Test FCC Power Bar - L



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.230000	51.1	Off	L1	19.6	11.3	62.4
0.302000	51.7	Off	L1	19.6	8.5	60.2
0.374000	51.6	Off	L1	19.6	6.8	58.4
0.446000	51.0	Off	L1	19.6	5.9	56.9
0.518000	51.4	Off	L1	19.6	4.6	56.0
0.590000	48.9	Off	L1	19.6	7.1	56.0
0.654000	49.3	Off	L1	19.6	6.7	56.0
0.742000	50.9	Off	L1	19.6	5.1	56.0
0.894000	50.4	Off	L1	19.6	5.6	56.0
0.974000	50.2	Off	L1	19.6	5.8	56.0
1.190000	49.8	Off	L1	19.6	6.2	56.0
1.630000	48.6	Off	L1	19.6	7.4	56.0
2.006000	48.9	Off	L1	19.6	7.1	56.0
2.798000	48.7	Off	L1	19.5	7.3	56.0
3.438000	49.0	Off	L1	19.7	7.0	56.0
3.870000	49.0	Off	L1	19.7	7.0	56.0
12.638000	42.8	Off	L1	20.2	17.2	60.0
12.974000	43.1	Off	L1	20.2	16.9	60.0
14.574000	41.1	Off	L1	20.3	18.9	60.0
16.806000	41.7	Off	L1	20.4	18.3	60.0
17.662000	41.0	Off	L1	20.5	19.0	60.0

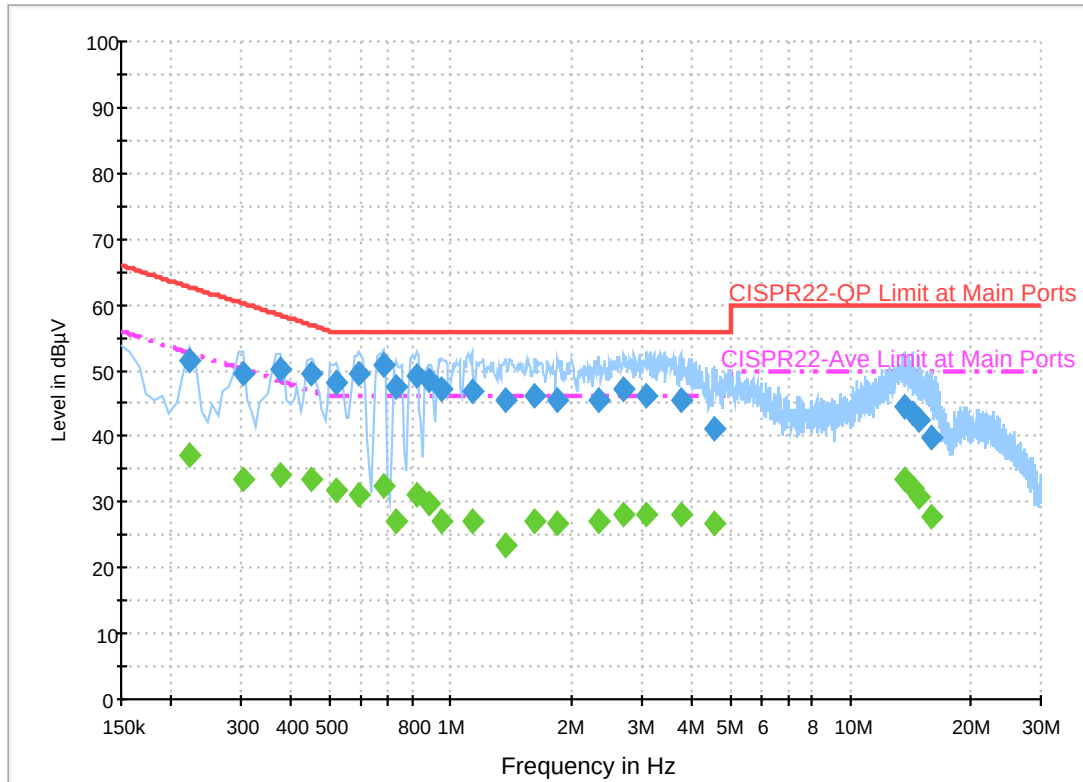
Final Result 2

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.230000	34.2	Off	L1	19.6	18.2	52.4
0.302000	37.2	Off	L1	19.6	13.0	50.2
0.374000	36.3	Off	L1	19.6	12.1	48.4
0.446000	33.9	Off	L1	19.6	13.0	46.9
0.518000	35.1	Off	L1	19.6	10.9	46.0
0.590000	31.3	Off	L1	19.6	14.7	46.0
0.654000	31.5	Off	L1	19.6	14.5	46.0
0.742000	32.6	Off	L1	19.6	13.4	46.0
0.894000	32.3	Off	L1	19.6	13.7	46.0
0.974000	31.5	Off	L1	19.6	14.5	46.0
1.190000	30.0	Off	L1	19.6	16.0	46.0
1.630000	29.9	Off	L1	19.6	16.1	46.0
2.006000	29.4	Off	L1	19.6	16.6	46.0
2.798000	30.7	Off	L1	19.5	15.3	46.0
3.438000	31.8	Off	L1	19.7	14.2	46.0
3.870000	33.0	Off	L1	19.7	13.0	46.0
12.638000	30.5	Off	L1	20.2	19.5	50.0
12.974000	30.8	Off	L1	20.2	19.2	50.0
14.574000	29.1	Off	L1	20.3	20.9	50.0
16.806000	29.0	Off	L1	20.4	21.0	50.0
17.662000	29.1	Off	L1	20.5	20.9	50.0

EUT Information

Report NO : 740121
Test Mode : Mode 1
Test Voltage : 120Vac/60Hz
Phase : Neutral

ENV216 Auto Test FCC Power Bar - N



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.222000	51.5	Off	N	19.5	11.2	62.7
0.302000	49.5	Off	N	19.5	10.7	60.2
0.374000	50.3	Off	N	19.5	8.1	58.4
0.446000	49.4	Off	N	19.5	7.5	56.9
0.518000	48.0	Off	N	19.5	8.0	56.0
0.590000	49.6	Off	N	19.5	6.4	56.0
0.678000	50.7	Off	N	19.5	5.3	56.0
0.734000	47.4	Off	N	19.5	8.6	56.0
0.822000	49.1	Off	N	19.6	6.9	56.0
0.886000	48.5	Off	N	19.5	7.5	56.0
0.950000	47.1	Off	N	19.6	8.9	56.0
1.134000	46.9	Off	N	19.6	9.1	56.0
1.374000	45.4	Off	N	19.6	10.6	56.0
1.630000	46.1	Off	N	19.6	9.9	56.0
1.854000	45.5	Off	N	19.6	10.5	56.0
2.342000	45.4	Off	N	18.9	10.6	56.0
2.718000	47.2	Off	N	19.4	8.8	56.0
3.102000	46.2	Off	N	19.6	9.8	56.0
3.758000	45.4	Off	N	19.7	10.6	56.0
4.550000	41.3	Off	N	19.7	14.7	56.0
13.638000	44.6	Off	N	20.3	15.4	60.0
14.382000	43.6	Off	N	20.3	16.4	60.0
14.902000	42.4	Off	N	20.4	17.6	60.0
16.046000	39.8	Off	N	20.5	20.2	60.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.222000	37.2	Off	N	19.5	15.5	52.7
0.302000	33.5	Off	N	19.5	16.7	50.2
0.374000	34.1	Off	N	19.5	14.3	48.4
0.446000	33.5	Off	N	19.5	13.4	46.9
0.518000	31.8	Off	N	19.5	14.2	46.0
0.590000	31.2	Off	N	19.5	14.8	46.0
0.678000	32.4	Off	N	19.5	13.6	46.0
0.734000	27.2	Off	N	19.5	18.8	46.0
0.822000	31.0	Off	N	19.6	15.0	46.0
0.886000	29.8	Off	N	19.5	16.2	46.0
0.950000	27.0	Off	N	19.6	19.0	46.0
1.134000	27.2	Off	N	19.6	18.8	46.0
1.374000	23.4	Off	N	19.6	22.6	46.0
1.630000	27.1	Off	N	19.6	18.9	46.0
1.854000	26.7	Off	N	19.6	19.3	46.0
2.342000	26.9	Off	N	18.9	19.1	46.0
2.718000	28.0	Off	N	19.4	18.0	46.0
3.102000	28.2	Off	N	19.6	17.8	46.0
3.758000	28.2	Off	N	19.7	17.8	46.0
4.550000	26.7	Off	N	19.7	19.3	46.0
13.638000	33.5	Off	N	20.3	16.5	50.0
14.382000	32.2	Off	N	20.3	17.8	50.0
14.902000	30.9	Off	N	20.4	19.1	50.0
16.046000	27.9	Off	N	20.5	22.1	50.0



Appendix B. Radiated Spurious Emission

Test Engineer :	Stan Hsieh and Kyle Chuang	Temperature :	22~24°C
		Relative Humidity :	43~44%

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 78 2480MHz	*	2480	93.37	-	-	94.79	27.24	4.51	33.17	328	137	P	H
	*	2480	68.58	-	-							A	H
		2483.52	42.18	-31.82	74	43.58	27.24	4.53	33.17	328	137	P	H
		2483.52	17.39	-36.61	54							A	H
													H
													H
	*	2480	96.4	-	-	97.82	27.24	4.51	33.17	100	303	P	V
	*	2480	71.61	-	-							A	V
		2483.72	42.63	-31.37	74	44.03	27.24	4.53	33.17	100	303	P	V
		2483.72	17.84	-36.16	54							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****BT (Harmonic @ 3m)**

BT	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 78 2480MHz		4960	44.81	-29.19	74	67.36	32.42	6.47	61.9	100	0	P	H
		4960	20.02	-33.98	54							A	H
		7440	49.47	-24.53	74	65.84	37.32	8.05	62.09	100	0	P	H
		7440	24.68	-29.32	54							A	H
		4960	44.81	-29.19	74	67.36	32.42	6.47	61.9	100	0	P	V
		4960	20.02	-33.98	54							A	V
		7440	49.17	-24.83	74	65.54	37.32	8.05	62.09	100	0	P	V
		7440	24.38	-29.62	54							A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz

2.4GHz BT (LF)

BT	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz BT LF		30.54	21.86	-18.14	40	30.23	23.78	0.53	32.76	-	-	P	H
		96.15	23.32	-20.18	43.5	39.41	15.47	0.97	32.77	-	-	P	H
		211.17	21.43	-22.07	43.5	37.26	15.09	1.44	32.75	-	-	P	H
		560.4	26.36	-19.64	46	30.33	26.18	2.21	32.95	-	-	P	H
		737.5	30.31	-15.69	46	32.16	28.04	2.48	32.96	-	-	P	H
		885.2	31.87	-14.13	46	31.68	29.13	2.74	32.38	100	0	P	H
													H
													H
													H
													H
													H
													H
		30.27	22.83	-17.17	40	30.76	24.22	0.53	32.76	-	-	P	V
		211.17	21.74	-21.76	43.5	37.57	15.09	1.44	32.75	-	-	P	V
		249.51	23.06	-22.94	46	35.48	18.36	1.53	32.73	-	-	P	V
		563.2	26.45	-19.55	46	30.53	26.09	2.21	32.96	-	-	P	V
		749.4	30.11	-15.89	46	31.71	28.24	2.51	32.95	-	-	P	V
		957.3	32.81	-13.19	46	29.87	31.01	2.79	31.67	100	0	P	V
													V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Note symbol

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



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

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

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

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

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable 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) + Cable 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

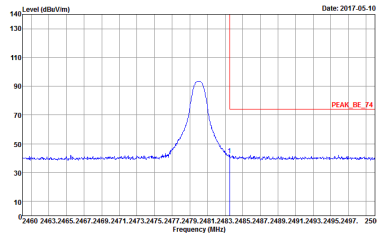
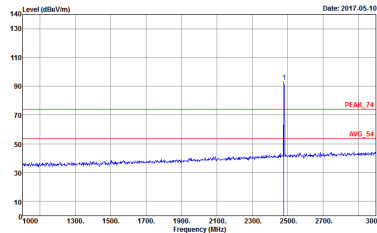
Test Engineer :	Stan Hsieh and Kyle Chuang	Temperature :	22~24°C
		Relative Humidity :	43~44%

Note symbol

-L	Low channel location
-R	High channel location

2.4GHz 2400~2483.5MHz

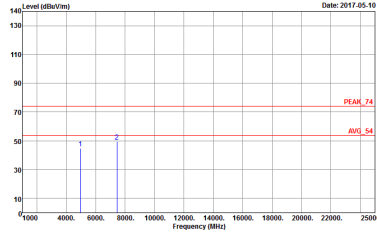
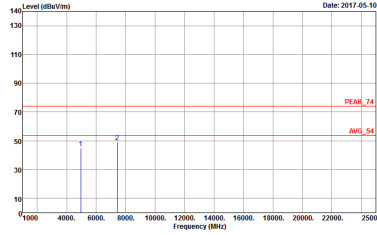
BT (Band Edge @ 3m)

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH78 2480MHz	
1+2	Horizontal	Fundamental
Peak	 Site : 03CH10-11Y Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740121 Mode : 1	 Site : 03CH10-11Y Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740121 Mode : 1

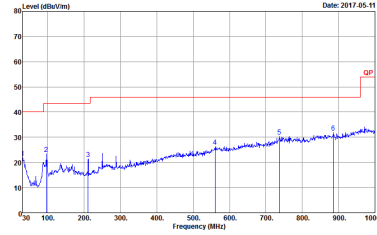
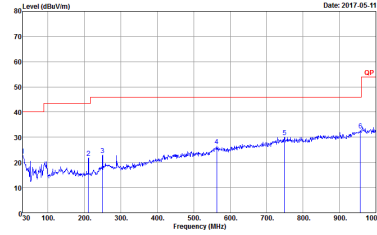


BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH78 2480MHz	
1+2	Vertical	Fundamental
Peak	Site : 03CH10-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 740121 Mode : 1	Site : 03CH10-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 740121 Mode : 1

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

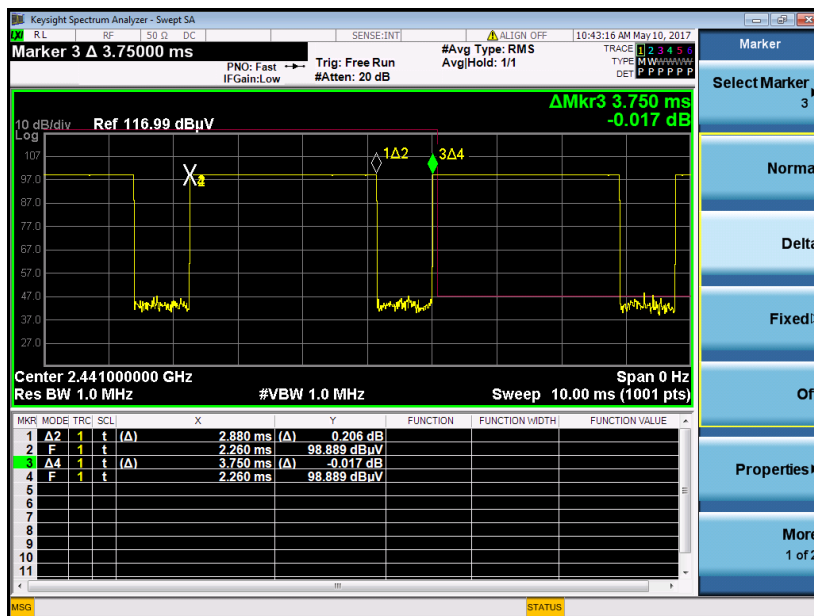
BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BT CH78 2480MHz	
1+2	Horizontal	Vertical
Peak Avg.	 Site : 03CH10-HY Condition : PEAK_74 3m HORN_9170_406_0584 HORIZONTAL Detector : Peak Project : 740121 Mode : 1	 Site : 03CH10-HY Condition : PEAK_74 3m HORN_9170_406_0584 VERTICAL Detector : Peak Project : 740121 Mode : 1

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

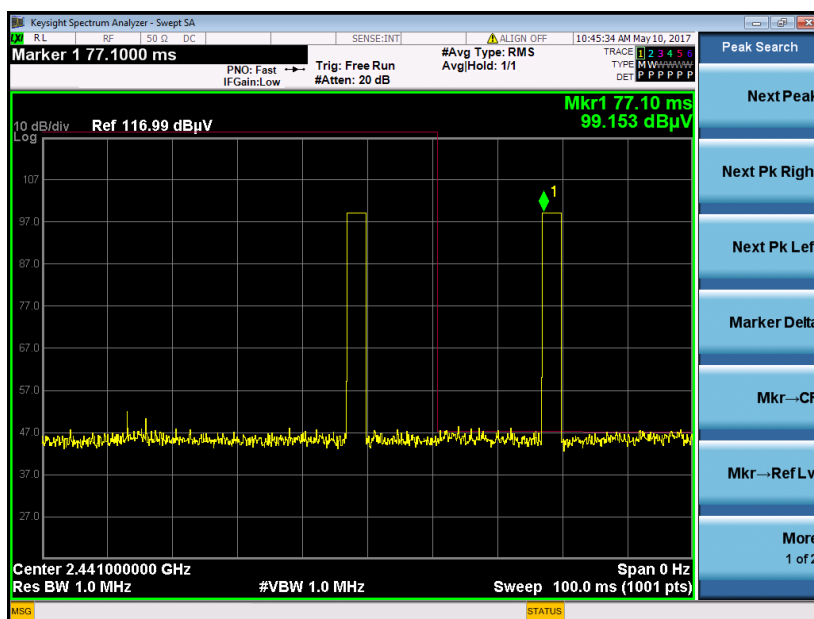
BT	2.4GHz 2400~2483.5MHz	
ANT	BT LF	
1+2	Horizontal	Vertical
QP / Peak	 Site : 03CH10-HY Condition : QP 5m BE-LOG 6111D-LF HORIZONTAL Detector : Peak Project : 740121 Mode : 1	 Site : 03CH10-HY Condition : QP 5m BE-LOG 6111D-LF VERTICAL Detector : Peak Project : 740121 Mode : 1

Appendix D. Duty Cycle Plots

DH5 on time (One Pulse) Plot on Channel 39



on time (Count Pulses) Plot on Channel 39



Note:

1. Worst case Duty cycle = on time/100 milliseconds = $2 * 2.88 / 100 = 5.76 \%$
2. Worst case Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.79 \text{ dB}$
3. DH5 has the highest duty cycle worst case and is reported.

Duty Cycle Correction Factor Consideration for AFH mode:

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

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

$$2.88 \text{ ms} \times 20 \text{ channels} = 57.6 \text{ ms}$$

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. $[100\text{ms} / 57.6\text{ms}] = 2 \text{ hops}$

Thus, the maximum possible ON time:

$$2.88 \text{ ms} \times 2 = 5.76 \text{ ms}$$

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

$$20 \times \log(5.76 \text{ ms}/100\text{ms}) = -24.79 \text{ dB}$$



Appendix F. Original Report

Please refer to Sporton report number FR740120A.



FCC RF Test Report

APPLICANT : SHARP CORPORATION
EQUIPMENT : Smart Phone
BRAND NAME : NTT docomo
MODEL NAME : SH-03J
FCC ID : APYHRO00248
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DSS) Spread Spectrum Transmitter

The product was received on Apr. 01, 2017 and testing was completed on Apr. 29, 2017. 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 test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.

SPORTON INTERNATIONAL INC.

TEL : 886-3-327-3456

FAX : 886-3-328-4978

FCC ID : APYHRO00248

Page Number : 1 of 63

Report Issued Date : Jun. 07, 2017

Report Version : Rev. 02

Report Template No.: BU5-FR15CBT Version 2.0



TABLE OF CONTENTS

REVISION HISTORY.....	3
SUMMARY OF TEST RESULT	4
1 GENERAL DESCRIPTION.....	5
1.1 Applicant.....	5
1.2 Manufacturer.....	5
1.3 Product Feature of Equipment Under Test.....	5
1.4 Modification of EUT	5
1.5 Testing Location	6
1.6 Applicable Standards.....	6
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST.....	7
2.1 Carrier Frequency Channel	7
2.2 Test Mode.....	8
2.3 Connection Diagram of Test System.....	9
2.4 Support Unit used in test configuration and system	9
2.5 UT Operation Test Setup.....	10
2.6 Measurement Results Explanation Example.....	10
3 TEST RESULT	11
3.1 Number of Channel Measurement	11
3.2 Hopping Channel Separation Measurement	13
3.3 Dwell Time Measurement.....	20
3.4 20dB and 99% Bandwidth Measurement	23
3.5 Peak Output Power Measurement	36
3.6 Conducted Band Edges Measurement.....	38
3.7 Conducted Spurious Emission Measurement	45
3.8 Radiated Band Edges and Spurious Emission Measurement	55
3.9 AC Conducted Emission Measurement.....	59
3.10 Antenna Requirements.....	61
4 LIST OF MEASURING EQUIPMENT.....	62
5 UNCERTAINTY OF EVALUATION.....	63
APPENDIX A. AC CONDUCTED EMISSION TEST RESULT	
APPENDIX B. RADIATED SPURIOUS EMISSION	
APPENDIX C. RADIATED SPURIOUS EMISSION PLOTS	
APPENDIX D. DUTY CYCLE PLOTS	
APPENDIX E. SETUP PHOTOGRAPHS	



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR740120A	Rev. 01	Initial issue of report	Jun. 02, 2017
FR740120A	Rev. 02	Revising Applicant and Manufacturer	Jun. 07, 2017

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(1)	Number of Channels	$\geq 15\text{Chs}$	Pass	-
3.2	15.247(a)(1)	Hopping Channel Separation	$\geq 2/3$ of 20dB BW	Pass	-
3.3	15.247(a)(1)	Dwell Time of Each Channel	$\leq 0.4\text{sec}$ in 31.6sec period	Pass	-
3.4	15.247(a)(1)	20dB Bandwidth	NA	Pass	-
3.4	-	99% Bandwidth	-	Pass	-
3.5	15.247(b)(1)	Peak Output Power	$\leq 125\text{ mW}$	Pass	-
3.6	15.247(d)	Conducted Band Edges	$\leq 20\text{dBc}$	Pass	-
3.7	15.247(d)	Conducted Spurious Emission	$\leq 20\text{dBc}$	Pass	-
3.8	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 12.55 dB at 958.000 MHz and 959.400 MHz
3.9	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 17.40 dB at 0.502 MHz
3.10	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-



1 General Description

1.1 Applicant

SHARP CORPORATION

2-13-1, Hachihonmatsu-Iida, Higashi-hiroshima-shi, Hiroshima, 739-0192, Japan

1.2 Manufacturer

SHARP CORPORATION

2-13-1, Hachihonmatsu-Iida, Higashi-hiroshima-shi, Hiroshima, 739-0192, Japan

1.3 Product Feature of Equipment Under Test

GSM/WCDMA/LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac, Wi-Fi 5GHz 802.11a/n/ac, NFC, and GPS

Product Specification subjective to this standard	
Sample 1	EUT with Memory 1
Sample 2	EUT with Memory 2
Antenna Type	WWAN: ILA Antenna WLAN: ILA Antenna Bluetooth: ILA Antenna GPS/Glonass/Beidou/Galileo: ILA Antenna NFC: Loop Antenna

1.4 Modification of EUT

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

1.5 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. 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, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	Sporton Site No.	
	TH05-HY	CO05-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.	
	03CH10-HY	

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

1.6 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
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	0	2402	27	2429	54	2456
	1	2403	28	2430	55	2457
	2	2404	29	2431	56	2458
	3	2405	30	2432	57	2459
	4	2406	31	2433	58	2460
	5	2407	32	2434	59	2461
	6	2408	33	2435	60	2462
	7	2409	34	2436	61	2463
	8	2410	35	2437	62	2464
	9	2411	36	2438	63	2465
	10	2412	37	2439	64	2466
	11	2413	38	2440	65	2467
	12	2414	39	2441	66	2468
	13	2415	40	2442	67	2469
	14	2416	41	2443	68	2470
	15	2417	42	2444	69	2471
	16	2418	43	2445	70	2472
	17	2419	44	2446	71	2473
	18	2420	45	2447	72	2474
	19	2421	46	2448	73	2475
	20	2422	47	2449	74	2476
	21	2423	48	2450	75	2477
	22	2424	49	2451	76	2478
	23	2425	50	2452	77	2479
	24	2426	51	2453	78	2480
	25	2427	52	2454	-	-
	26	2428	53	2455	-	-

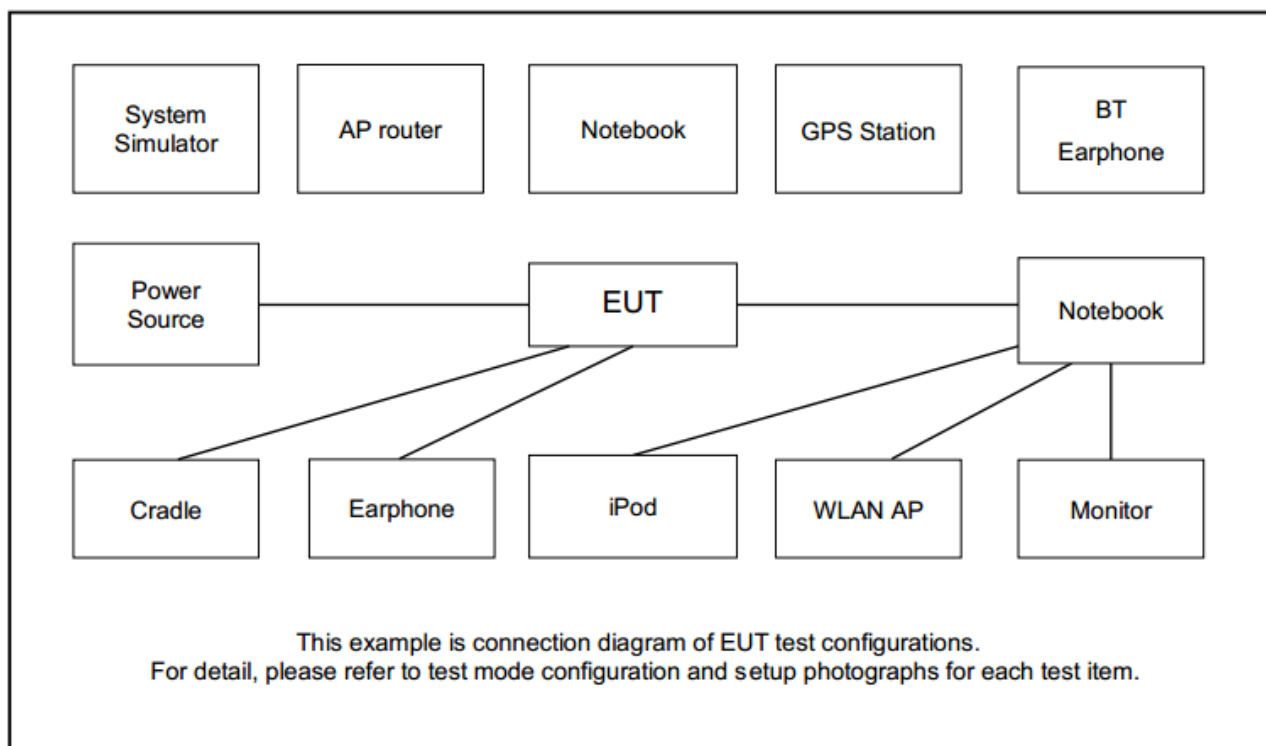
2.2 Test Mode

- 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: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). The worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

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 BR 1Mbps GFSK	Bluetooth EDR 2Mbps $\pi/4$ -DQPSK	Bluetooth EDR 3Mbps 8-DPSK
Conducted Test Cases	Mode 1: CH00_2402 MHz	Mode 4: CH00_2402 MHz	Mode 7: CH00_2402 MHz
	Mode 2: CH39_2441 MHz	Mode 5: CH39_2441 MHz	Mode 8: CH39_2441 MHz
	Mode 3: CH78_2480 MHz	Mode 6: CH78_2480 MHz	Mode 9: CH78_2480 MHz
Radiated Test Cases	Bluetooth BR 1Mbps GFSK		
	Mode 1: CH00_2402 MHz		
	Mode 2: CH39_2441 MHz		
	Mode 3: CH78_2480 MHz		
Summary table of Test Cases			
AC Conducted Emission	Mode 1 :GSM1900 Idle + Bluetooth Link + WLAN (2.4GHz) Link + Earphone + USB Cable (Charging from Adapter) + Camera (Rear) for Sample 1		
Remark:			
1. For radiated test cases, the worst mode data rate 1Mbps was reported only, because this data rate has the highest RF output power at preliminary tests, and the conducted spurious emissions and conducted band edge measurement for each data rate are no worse than 1Mbps, and no other significantly frequencies found in conducted spurious emission.			
2. For Radiated Test Cases, The tests were performance with Sample 1.			

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m
2.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
3.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
4.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
5.	Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
6.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A



2.5 UT Operation Test Setup

The RF test items, programmed RF utility, "Tera Term" installed in the notebook make the EUT get into the engineering modes to contact with Bluetooth base station for continuous transmitting and receiving signals.

2.6 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 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

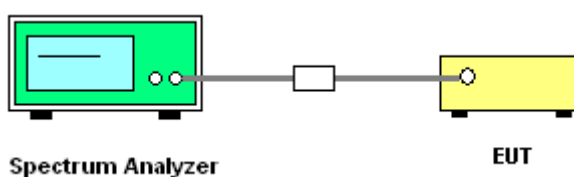
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.3.
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation;
RBW = 300kHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

3.1.4 Test Setup

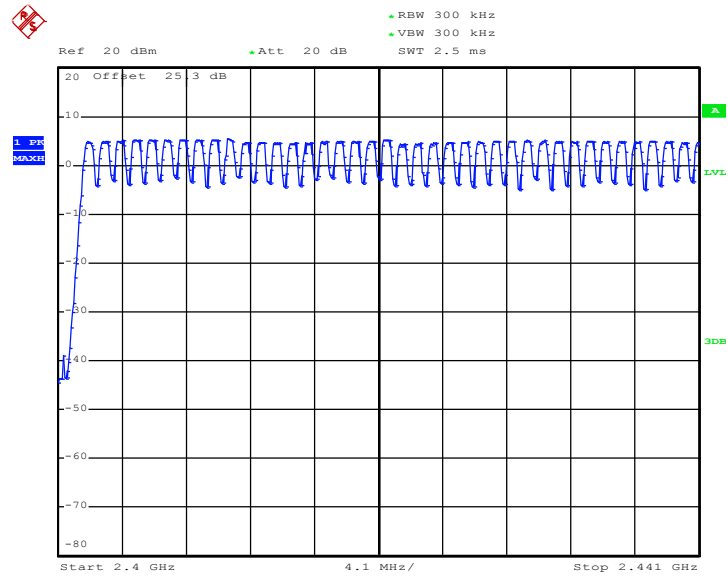


3.1.5 Test Result of Number of Hopping Frequency

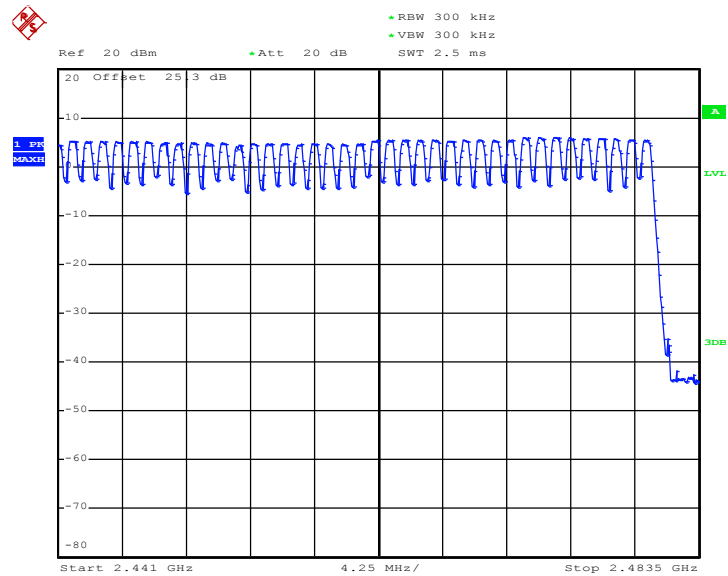
Test Mode :	1Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%
Number of Hopping (Channel)	Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail
79	20	> 15	Pass



Number of Hopping Channel Plot on Channel 00 - 78



Date: 16.APR.2017 14:21:31



Date: 16.APR.2017 14:22:39

3.2 Hopping Channel Separation Measurement

3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

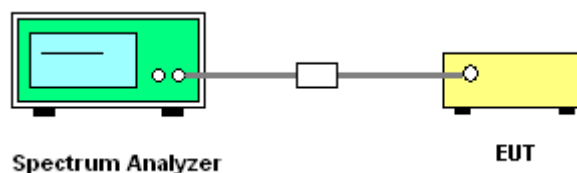
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.2.
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels;
RBW = 300kHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

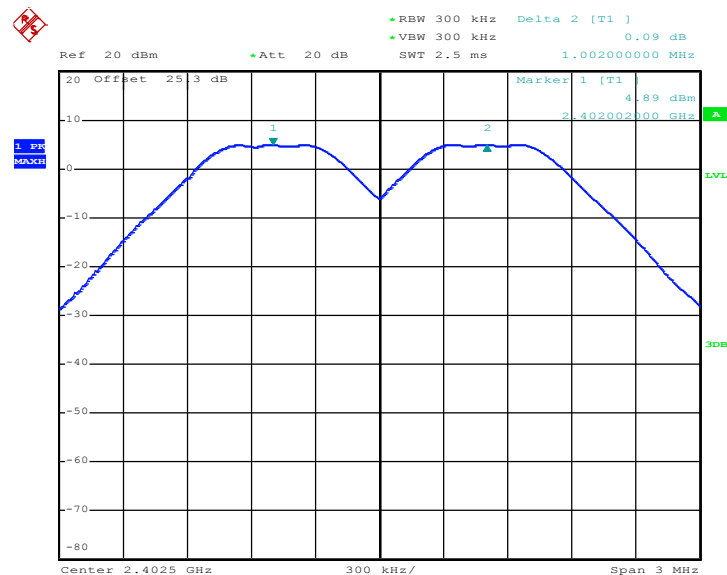
3.2.4 Test Setup



**3.2.5 Test Result of Hopping Channel Separation**

Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

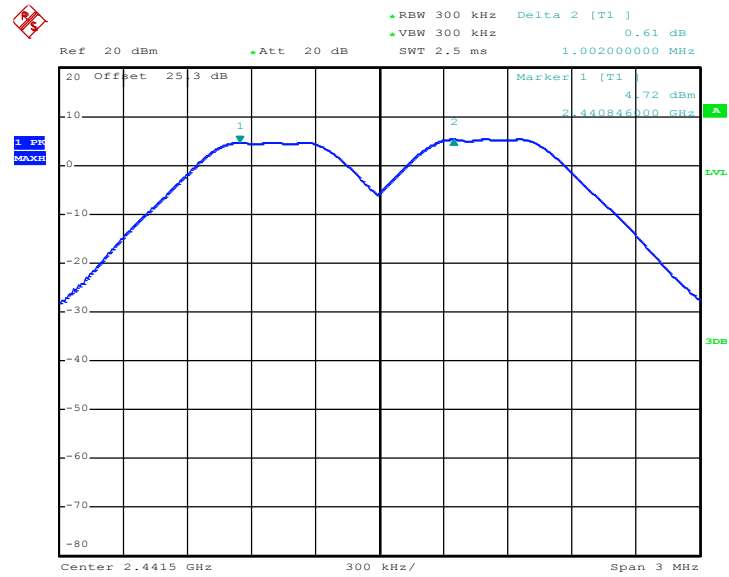
Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.5973	Pass
39	2441	1.002	0.5947	Pass
78	2480	1.002	0.5947	Pass

Channel Separation Plot on Channel 00 - 01

Date: 16.APR.2017 14:34:47

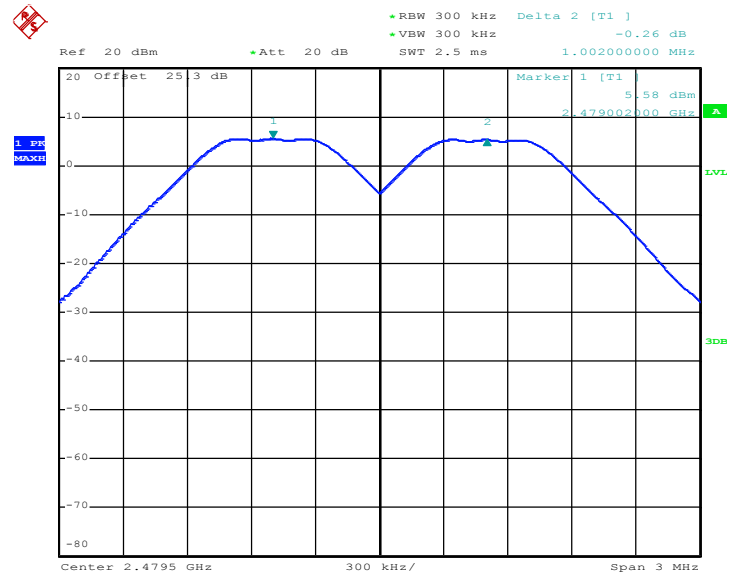


Channel Separation Plot on Channel 39 - 40



Date: 16.APR.2017 14:37:10

Channel Separation Plot on Channel 77 - 78

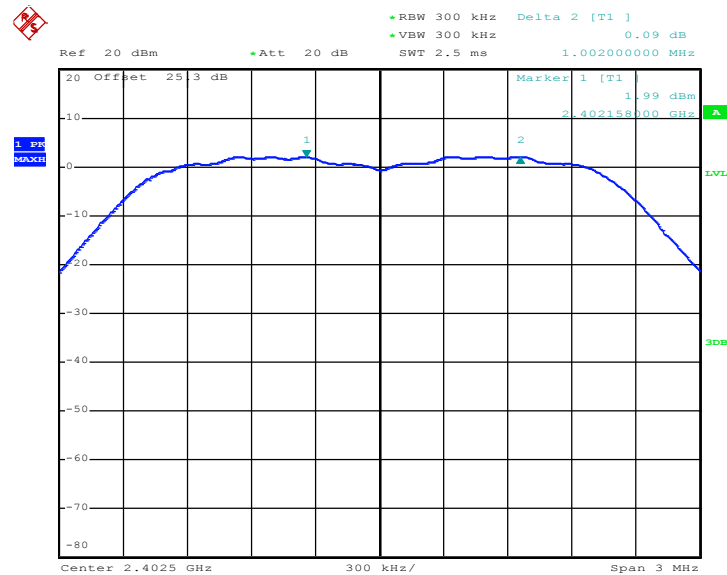


Date: 16.APR.2017 14:41:41



Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

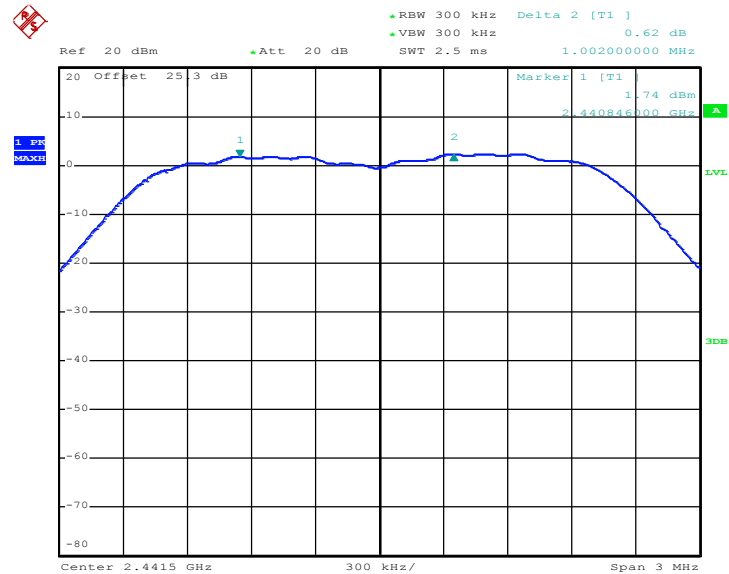
Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.8427	Pass
39	2441	1.002	0.8400	Pass
78	2480	1.002	0.8427	Pass

Channel Separation Plot on Channel 00 - 01

Date: 16.APR.2017 14:45:49

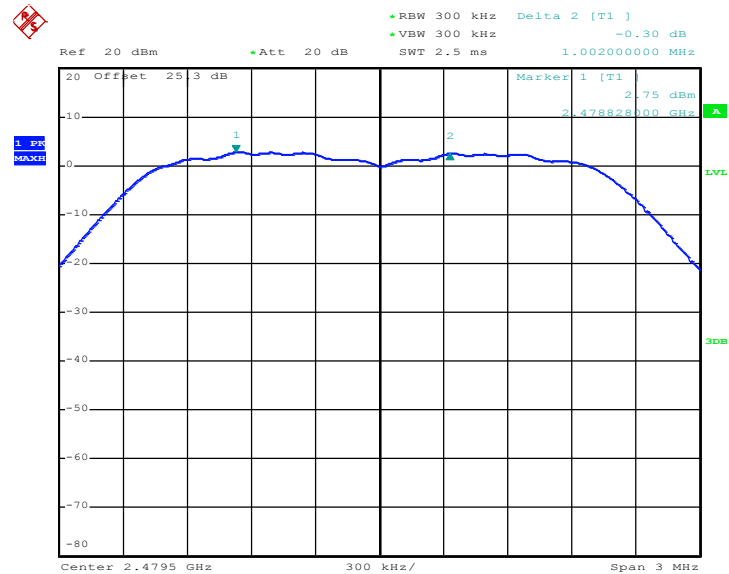


Channel Separation Plot on Channel 39 - 40



Date: 16.APR.2017 14:50:21

Channel Separation Plot on Channel 77 - 78

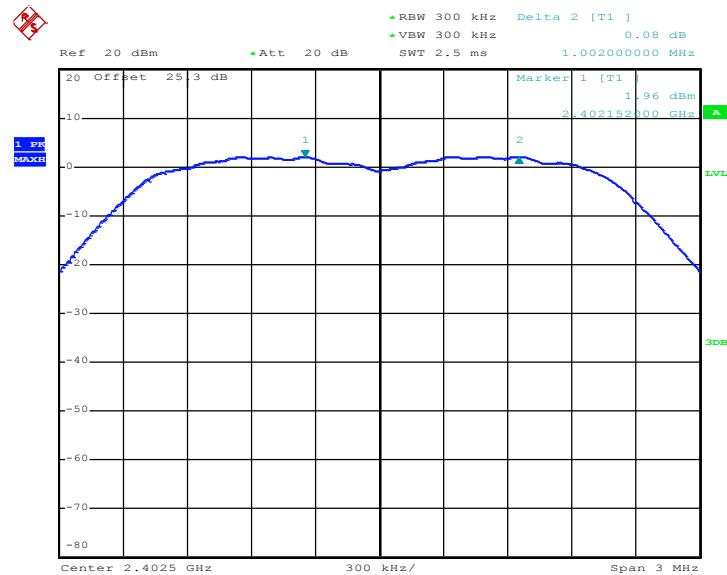


Date: 16.APR.2017 14:55:55



Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

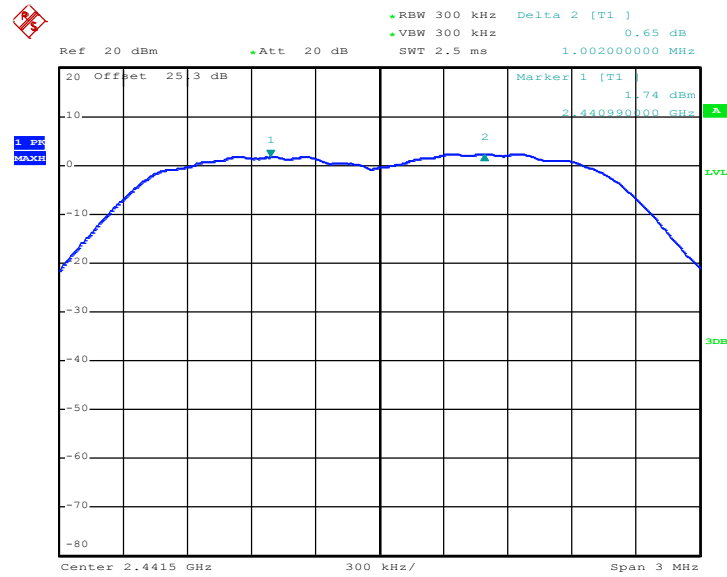
Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.8187	Pass
39	2441	1.002	0.8160	Pass
78	2480	1.002	0.8213	Pass

Channel Separation Plot on Channel 00 - 01

Date: 16.APR.2017 15:00:04

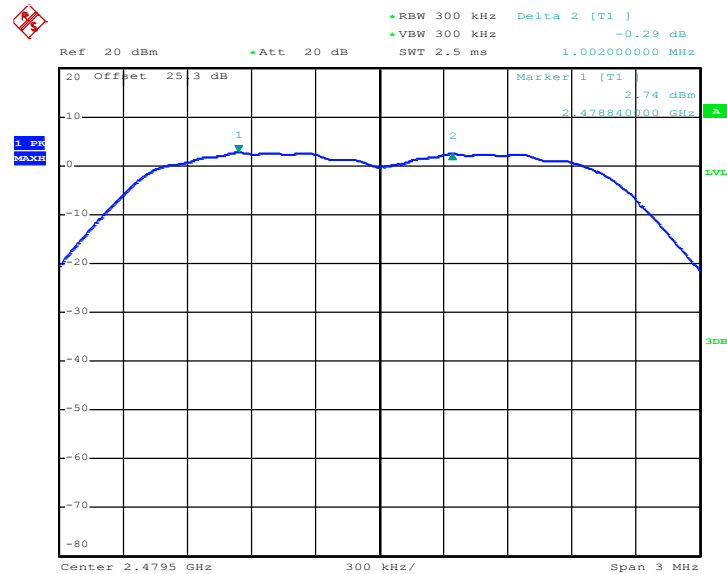


Channel Separation Plot on Channel 39 - 40



Date: 16.APR.2017 15:02:24

Channel Separation Plot on Channel 77 - 78



Date: 16.APR.2017 15:05:24

3.3 Dwell Time Measurement

3.3.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

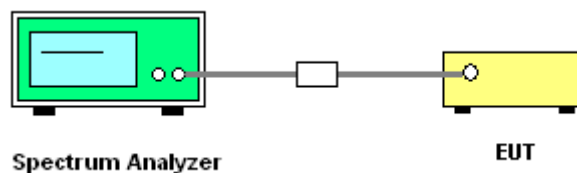
3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.4.
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW $\geq$ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.3.4 Test Setup



3.3.5 Test Result of Dwell Time

Test Mode :	DH5	Temperature :	24~26℃
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

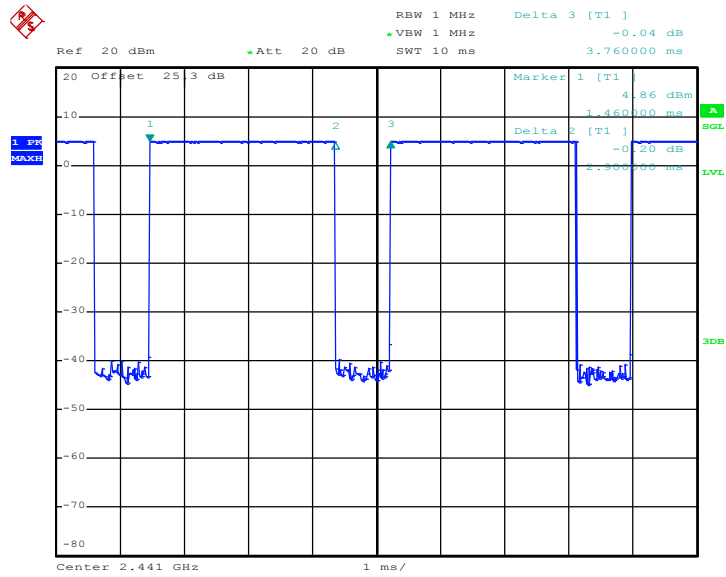
Mode	Hopping Channel Number	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Normal	79	106.67	2.90	0.31	0.4	Pass
AFH	20	53.33	2.90	0.15	0.4	Pass

Remark:

- In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels.
With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s),
Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.
- In AFH mode, hopping rate is 800 hops/s with 6 slots in 20 hopping channels.
With channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 x 20) (s),
Hops Over Occupancy Time comes to (800 / 6 / 20) x (0.4 x 20) = 53.33 hops.
- Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time



Package Transfer Time Plot



Date: 16.APR.2017 09:44:07

3.4 20dB and 99% Bandwidth Measurement

3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

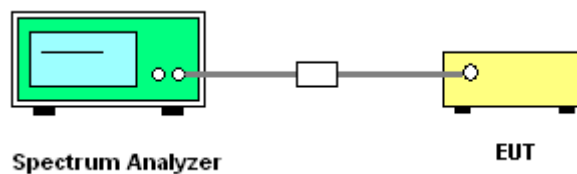
3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
RBW $\geq$ 1% of the 20 dB bandwidth; VBW $\geq$ RBW; Sweep = auto; Detector function = peak;
Trace = max hold.
5. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel;
RBW $\geq$ 1% of the 99% bandwidth; VBW $\geq$ RBW; Sweep = auto; Detector function = peak;
Trace = max hold.
6. Measure and record the results in the test report.

3.4.4 Test Setup

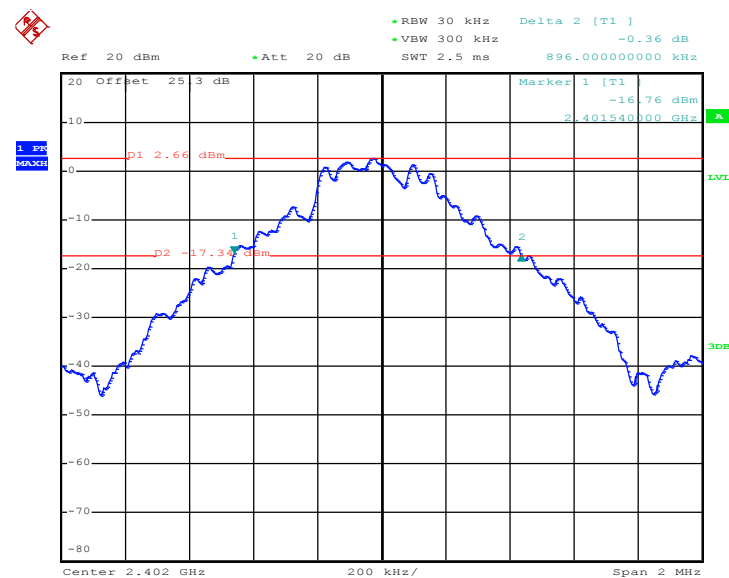


3.4.5 Test Result of 20dB Bandwidth

Test Mode :	1Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	0.896
39	2441	0.892
78	2480	0.892

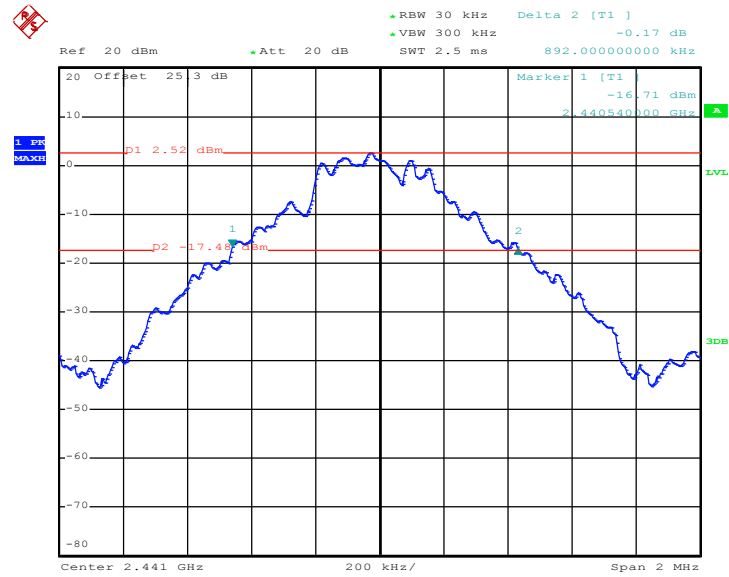
20 dB Bandwidth Plot on Channel 00



Date: 16.APR.2017 15:07:43

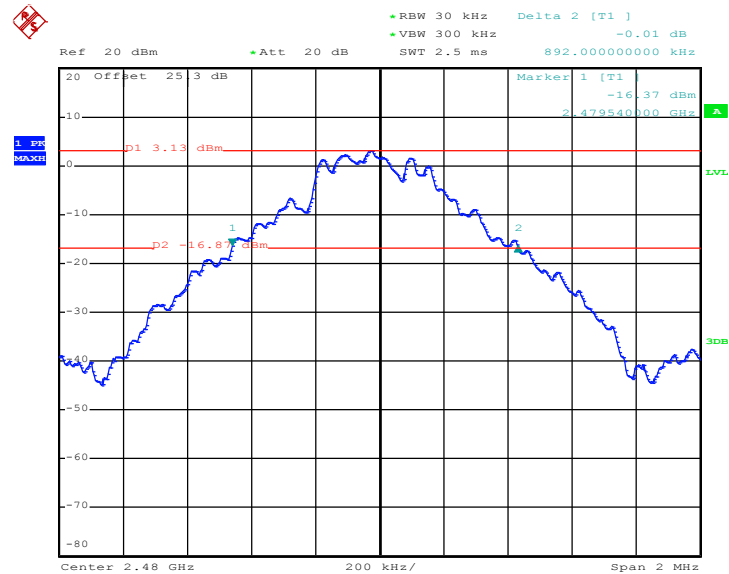


20 dB Bandwidth Plot on Channel 39



Date: 16.APR.2017 15:09:02

20 dB Bandwidth Plot on Channel 78

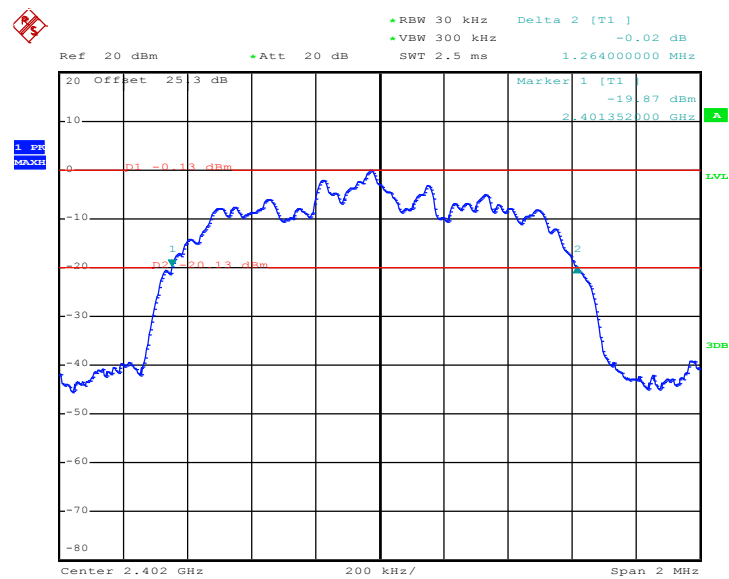


Date: 16.APR.2017 15:10:13



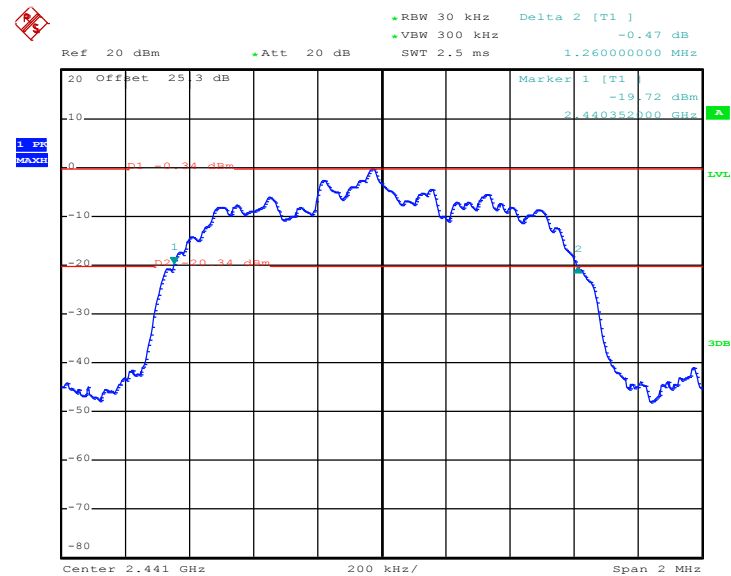
Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.264
39	2441	1.260
78	2480	1.264

20 dB Bandwidth Plot on Channel 00

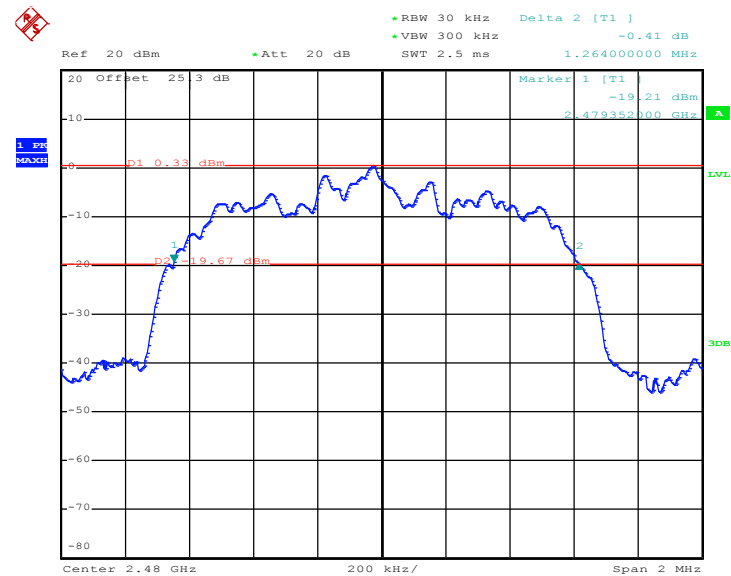
Date: 16.APR.2017 15:11:46

20 dB Bandwidth Plot on Channel 39



Date: 16.APR.2017 15:12:48

20 dB Bandwidth Plot on Channel 78

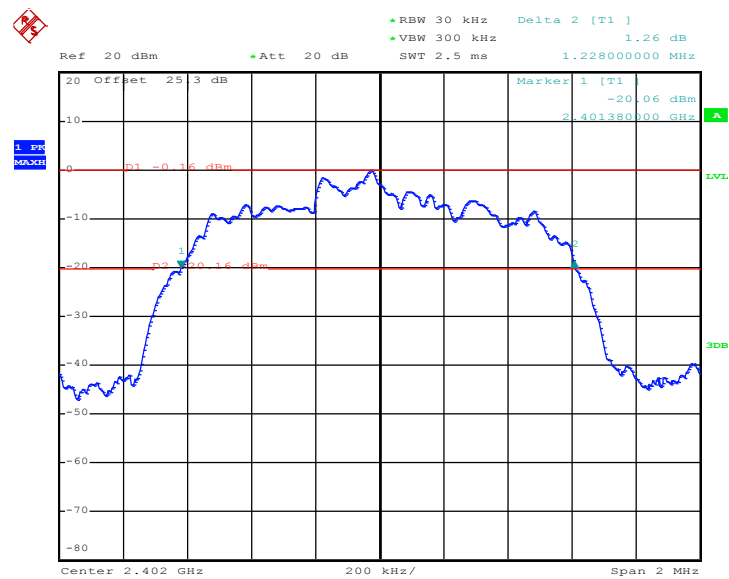


Date: 16.APR.2017 15:14:06



Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

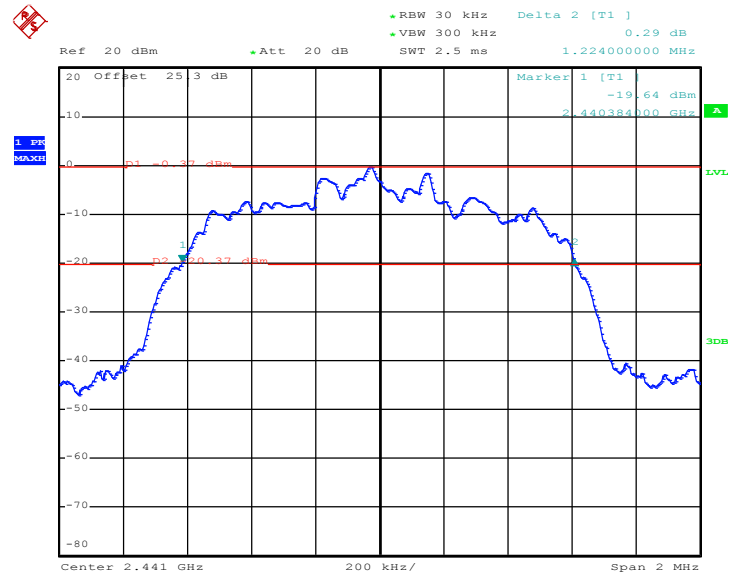
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.228
39	2441	1.224
78	2480	1.232

20 dB Bandwidth Plot on Channel 00

Date: 16.APR.2017 15:18:18

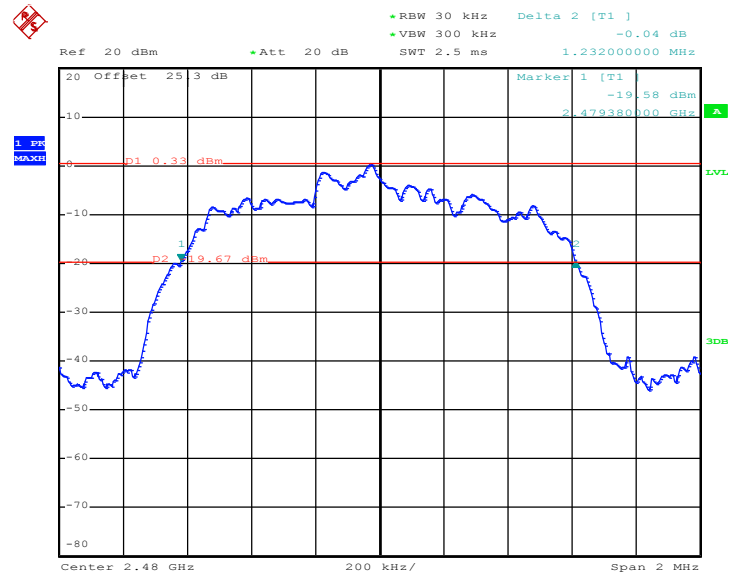


20 dB Bandwidth Plot on Channel 39



Date: 16.APR.2017 15:19:32

20 dB Bandwidth Plot on Channel 78



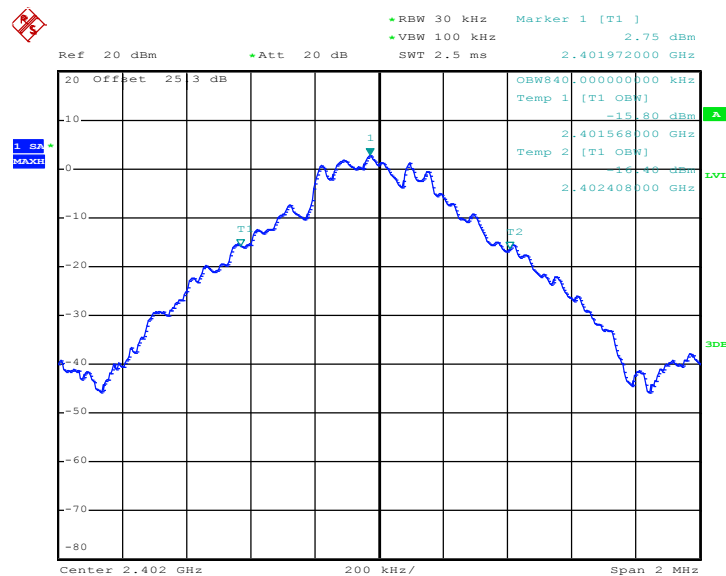
Date: 16.APR.2017 15:20:30

3.4.6 Test Result of 99% Occupied Bandwidth

Test Mode :	1Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	0.840
39	2441	0.844
78	2480	0.840

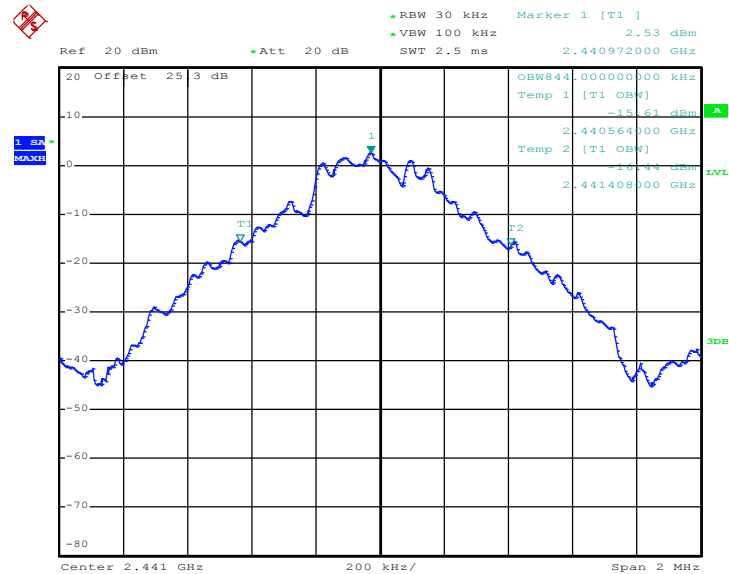
99% Occupied Bandwidth Plot on Channel 00



Date: 16.APR.2017 14:33:22

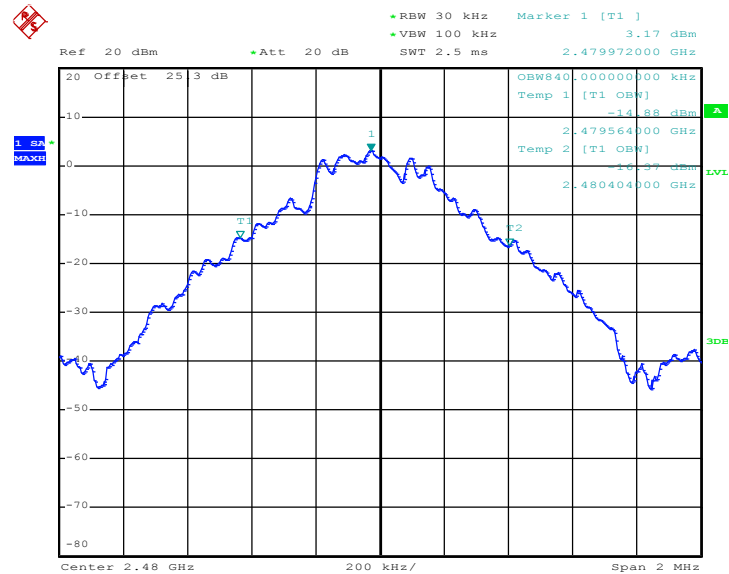


99% Occupied Bandwidth Plot on Channel 39



Date: 16.APR.2017 14:36:18

99% Occupied Bandwidth Plot on Channel 78

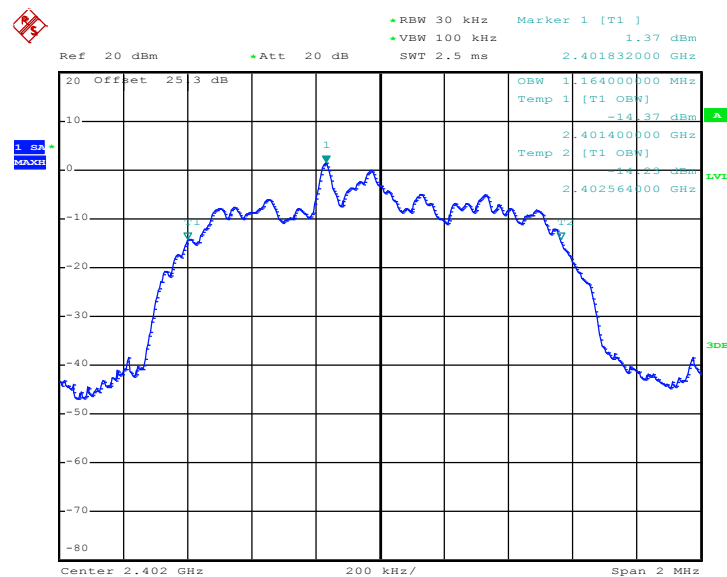


Date: 16.APR.2017 14:39:30



Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

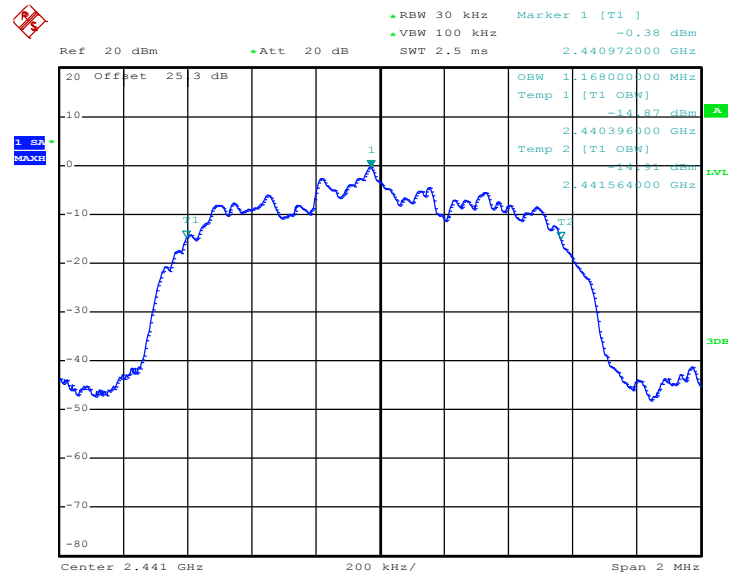
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	1.164
39	2441	1.168
78	2480	1.168

99% Occupied Bandwidth Plot on Channel 00

Date: 16.APR.2017 14:43:22

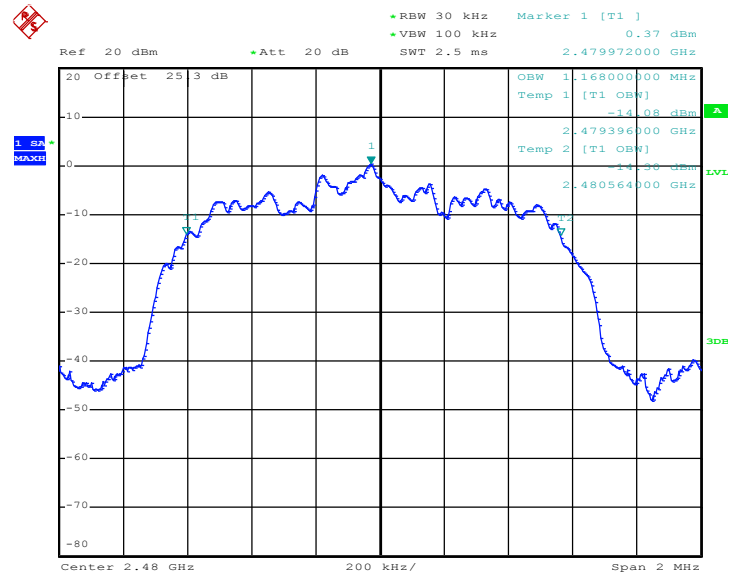


99% Occupied Bandwidth Plot on Channel 39



Date: 16.APR.2017 14:48:50

99% Occupied Bandwidth Plot on Channel 78

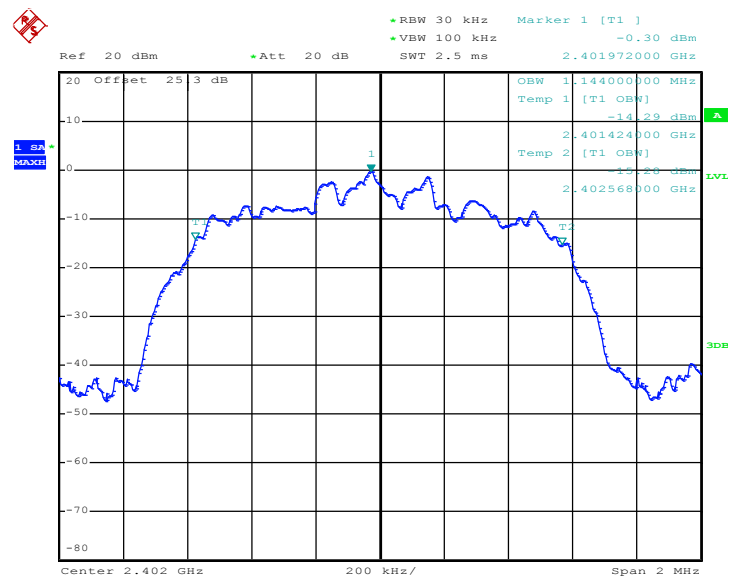


Date: 16.APR.2017 14:52:40

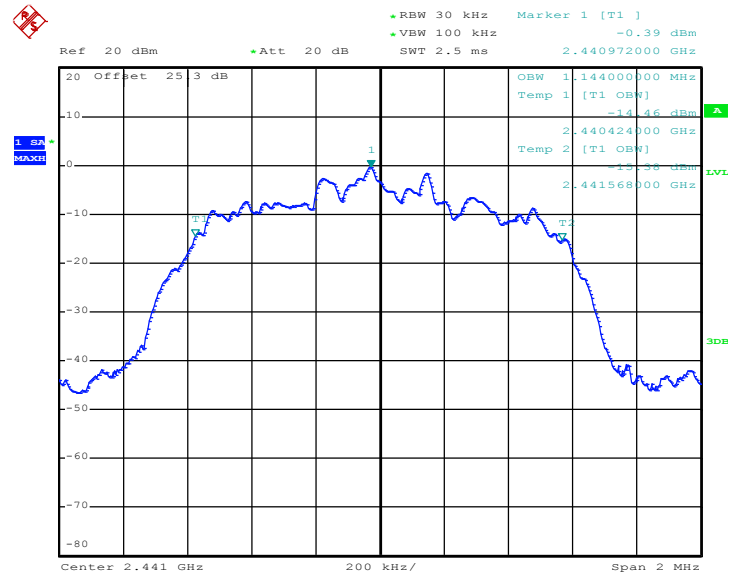


Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

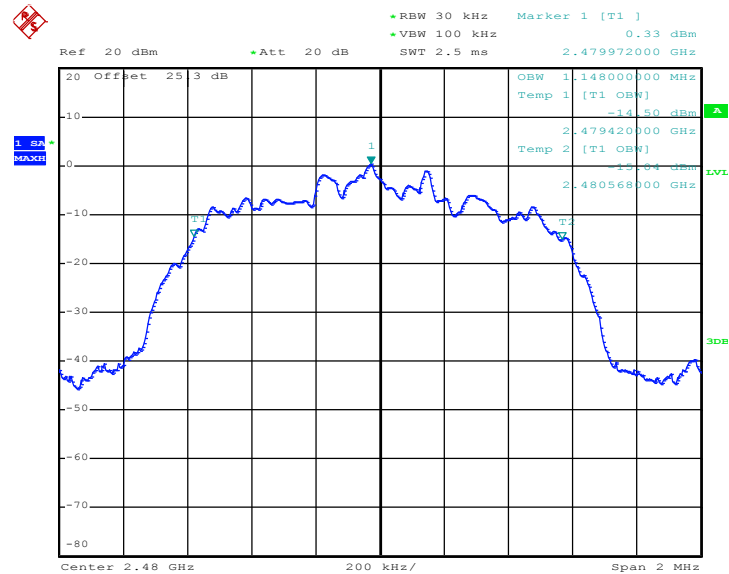
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	1.144
39	2441	1.144
78	2480	1.148

99% Occupied Bandwidth Plot on Channel 00

Date: 16.APR.2017 14:58:39

99% Occupied Bandwidth Plot on Channel 39


Date: 16.APR.2017 15:01:36

99% Occupied Bandwidth Plot on Channel 78


Date: 16.APR.2017 15:03:54

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

3.5 Peak Output Power Measurement

3.5.1 Limit of Peak Output Power

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts. The power limit for 1Mbps, 2Mbps, 3Mbps and AFH modes are 0.125 watts.

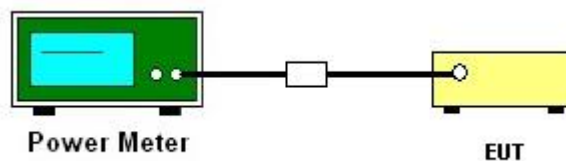
3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
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 with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

3.5.4 Test Setup



3.5.5 Test Result of Peak Output Power

Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	5.70	20.97	Pass
39	2441	5.67	20.97	Pass
78	2480	6.44	20.97	Pass

Note: For AFH mode using 20 hopping channels, the maximum output power limit is 20.97dBm.

Test Mode :	2Mbps	Temperature :	24~26℃
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

Channel	Frequency (MHz)	RF Power (dBm)		
		$\pi/4$ -DQPSK	Max. Limits (dBm)	Pass/Fail
		2 Mbps		
00	2402	4.87	20.97	Pass
39	2441	4.79	20.97	Pass
78	2480	5.61	20.97	Pass

Test Mode :	3Mbps	Temperature :	24~26℃
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

Channel	Frequency (MHz)	RF Power (dBm)		
		8-DPSK	Max. Limits (dBm)	Pass/Fail
		3 Mbps		
00	2402	5.31	20.97	Pass
39	2441	5.14	20.97	Pass
78	2480	6.05	20.97	Pass

3.6 Conducted Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

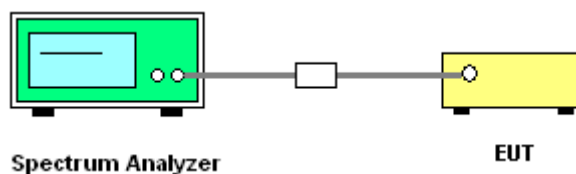
3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.6.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

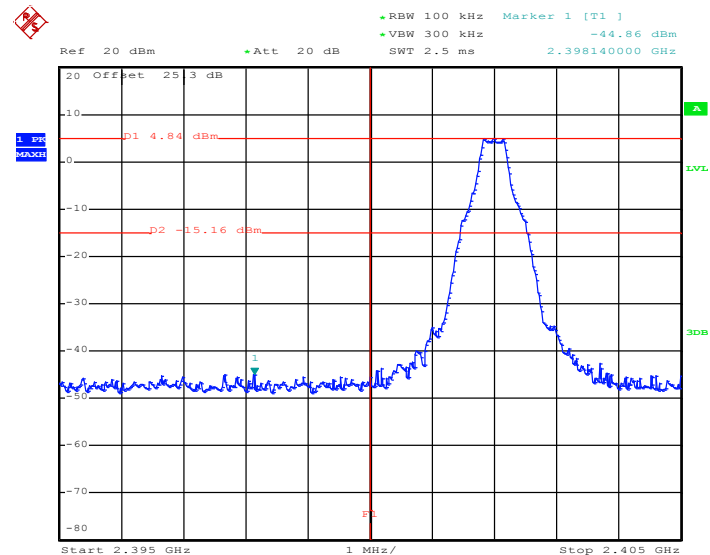
3.6.4 Test Setup



3.6.5 Test Result of Conducted Band Edges

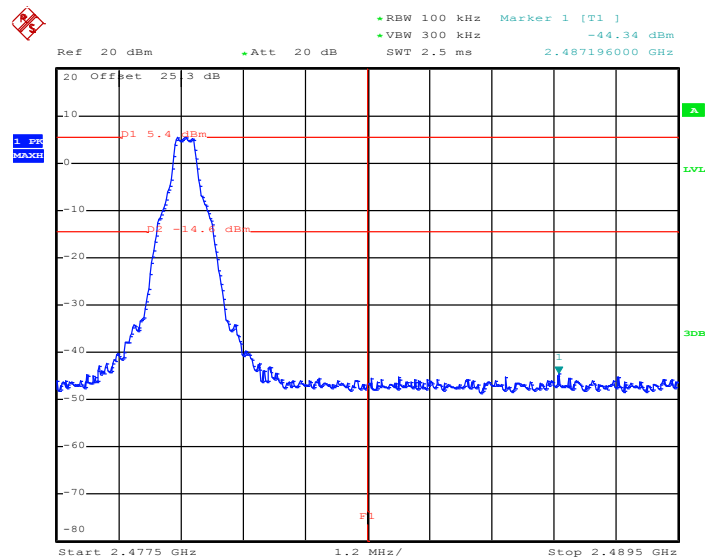
Test Mode :	1Mbps	Temperature :	24~26℃
Test Channel :	00 and 78	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

Low Band Edge Plot on Channel 00



Date: 16.APR.2017 14:33:51

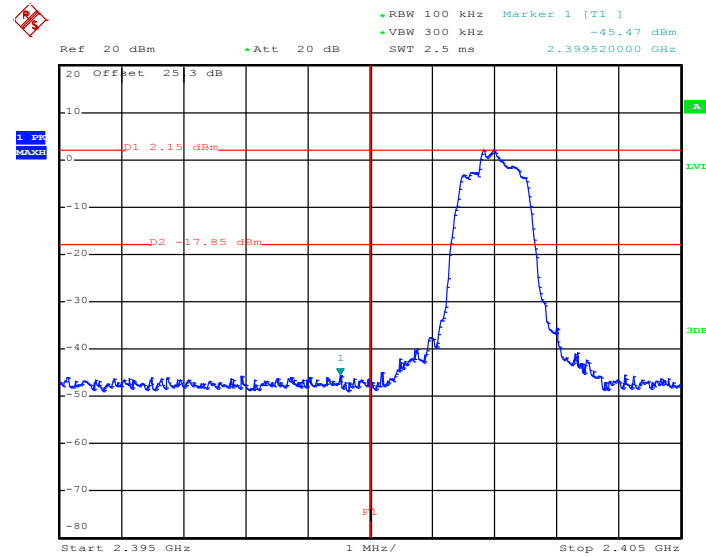
High Band Edge Plot on Channel 78



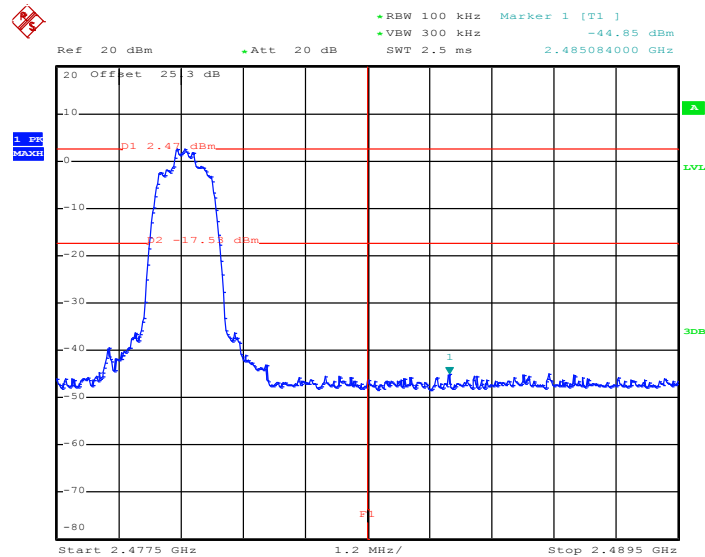
Date: 16.APR.2017 14:40:40



Test Mode :	2Mbps	Temperature :	24~26°C
Test Channel :	00 and 78	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

Low Band Edge Plot on Channel 00

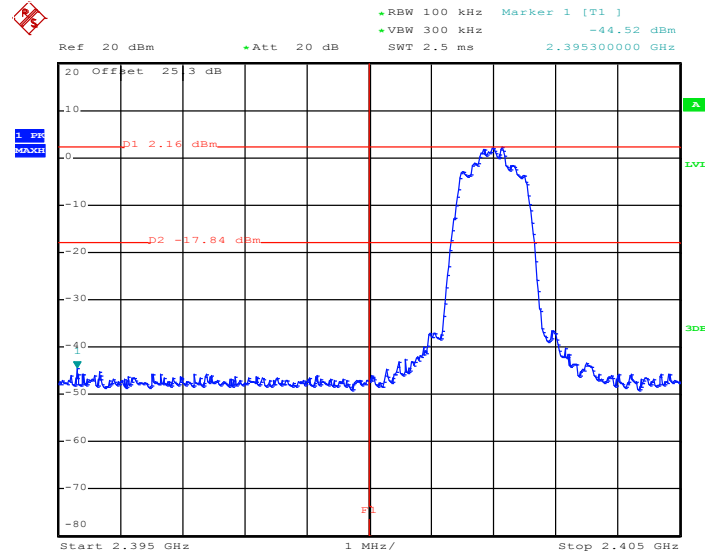
Date: 16.APR.2017 14:44:31

High Band Edge Plot on Channel 78

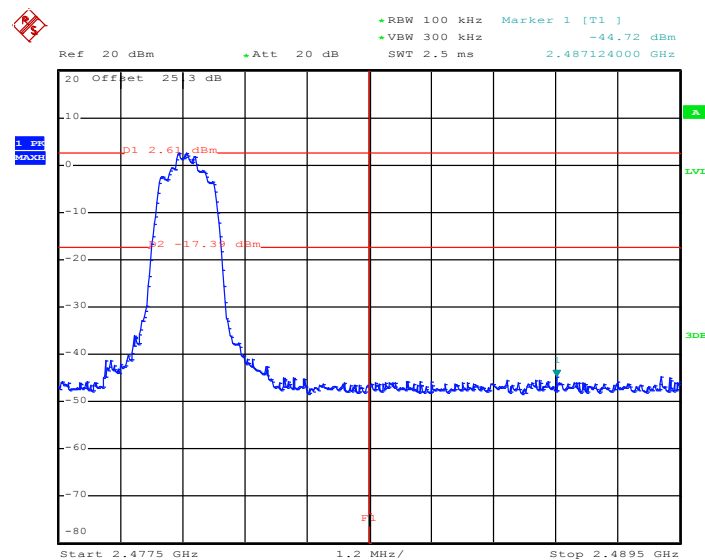
Date: 16.APR.2017 14:54:49



Test Mode :	3Mbps	Temperature :	24~26°C
Test Channel :	00 and 78	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

Low Band Edge Plot on Channel 00

Date: 16.APR.2017 14:59:00

High Band Edge Plot on Channel 78

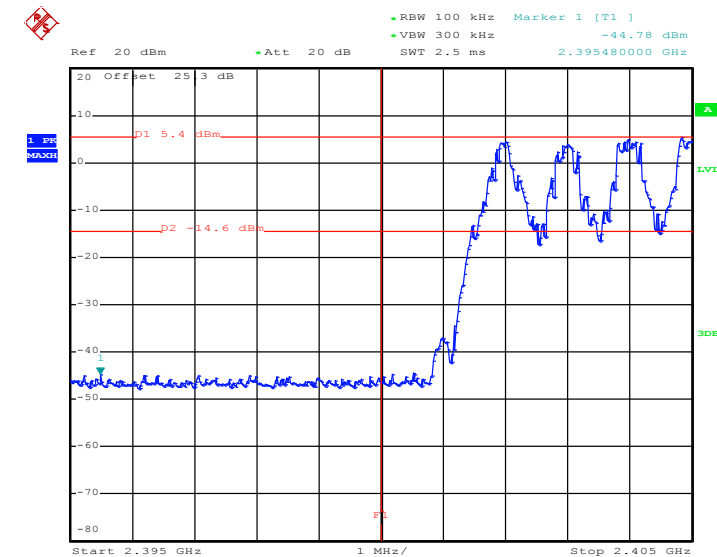
Date: 16.APR.2017 15:04:20



3.6.6 Test Result of Conducted Hopping Mode Band Edges

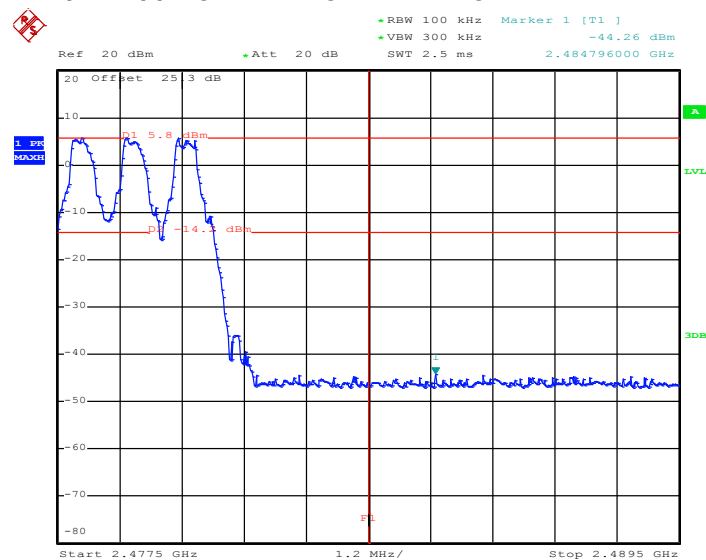
Test Mode :	1Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

1Mbps Hopping Mode Low Band Edge Plot



Date: 16.APR.2017 14:23:49

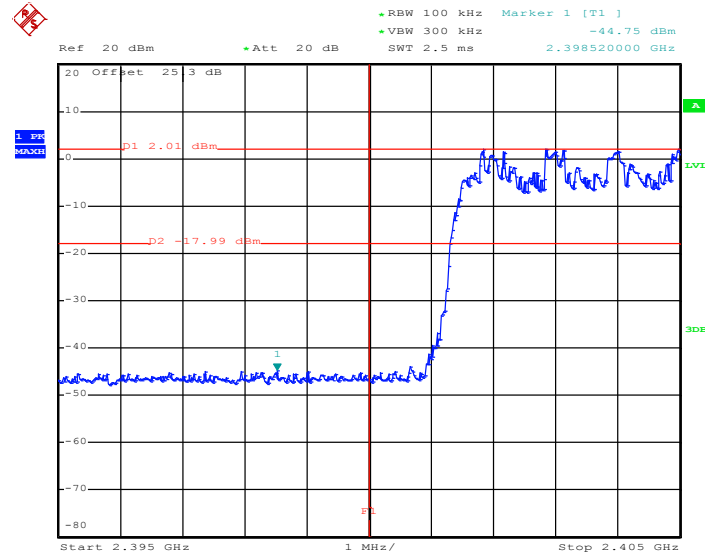
1Mbps Hopping Mode High Band Edge Plot



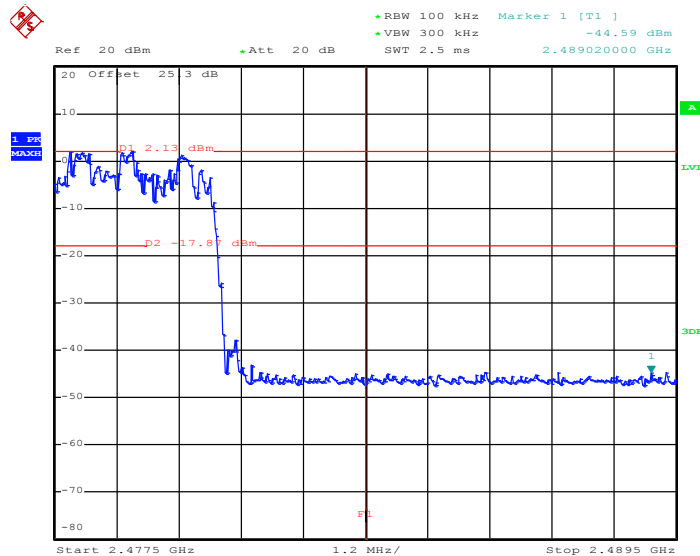
Date: 16.APR.2017 14:25:17



Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

2Mbps Hopping Mode Low Band Edge Plot

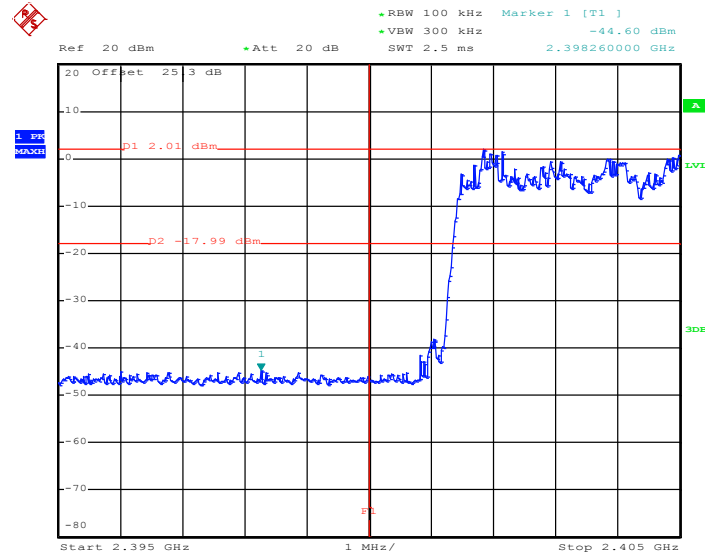
Date: 16.APR.2017 14:28:37

2Mbps Hopping Mode High Band Edge Plot

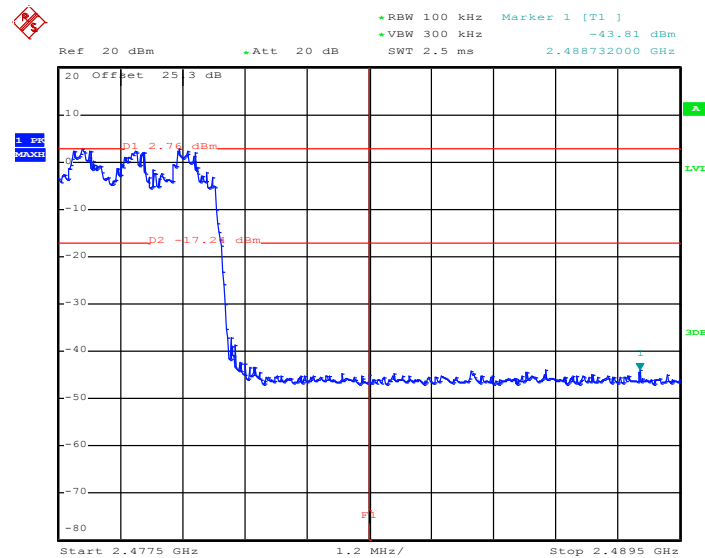
Date: 16.APR.2017 14:26:27



Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Aking Chang	Relative Humidity :	48~51%

3Mbps Hopping Mode Low Band Edge Plot

Date: 16.APR.2017 14:29:43

3Mbps Hopping Mode High Band Edge Plot

Date: 16.APR.2017 14:31:22

3.7 Conducted Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

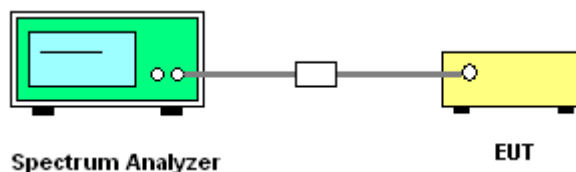
3.7.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.7.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.8.
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

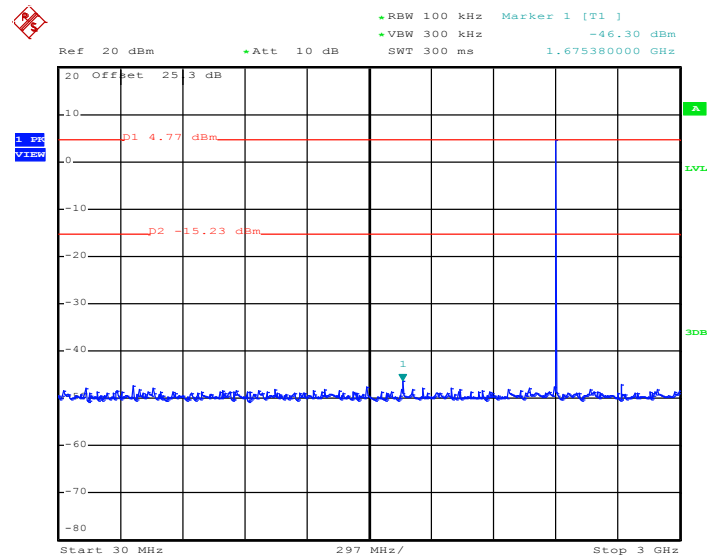
3.7.4 Test Setup



3.7.5 Test Result of Conducted Spurious Emission

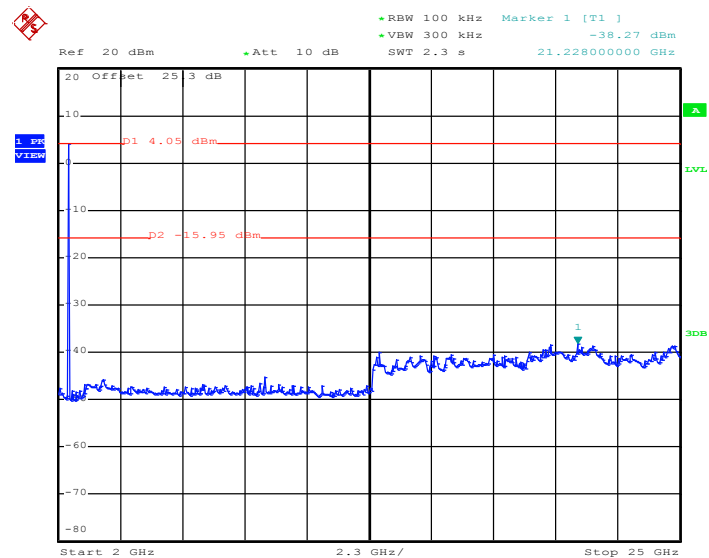
Test Mode :	1Mbps	Temperature :	24~26°C
Test Channel :	00	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

1Mbps CSE Plot on Ch 00 between 30MHz ~ 3 GHz



Date: 16.APR.2017 14:37:43

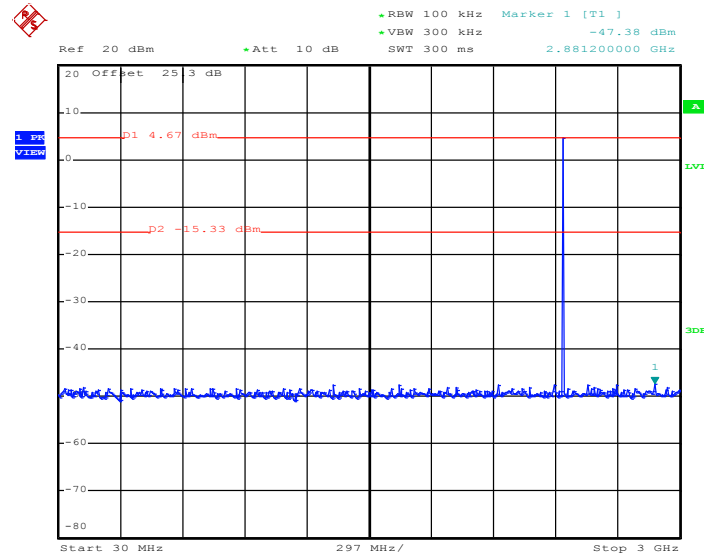
1Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



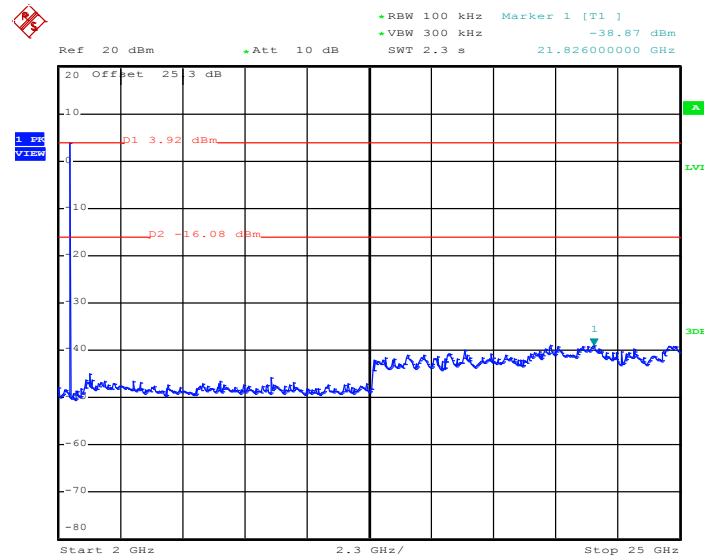
Date: 16.APR.2017 14:38:05



Test Mode :	1Mbps	Temperature :	24~26°C
Test Channel :	39	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

1Mbps CSE Plot on Ch 39 between 30MHz ~ 3 GHz

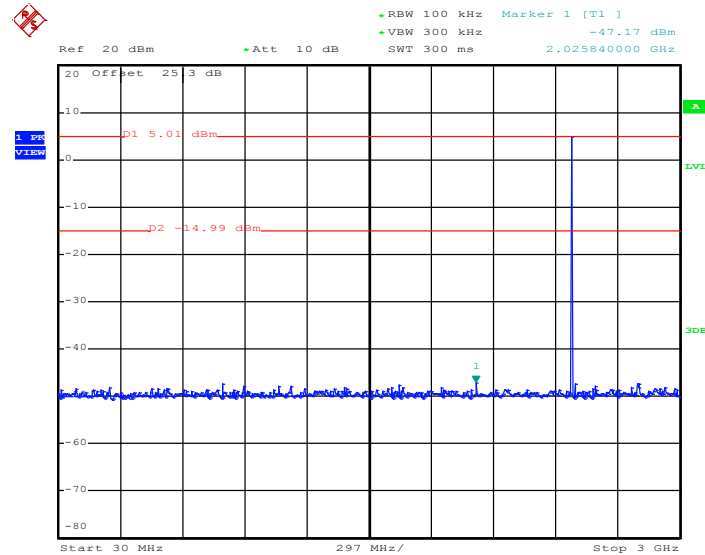
Date: 16.APR.2017 14:35:20

1Mbps CSE Plot on Ch 39 between 2 GHz ~ 25 GHz

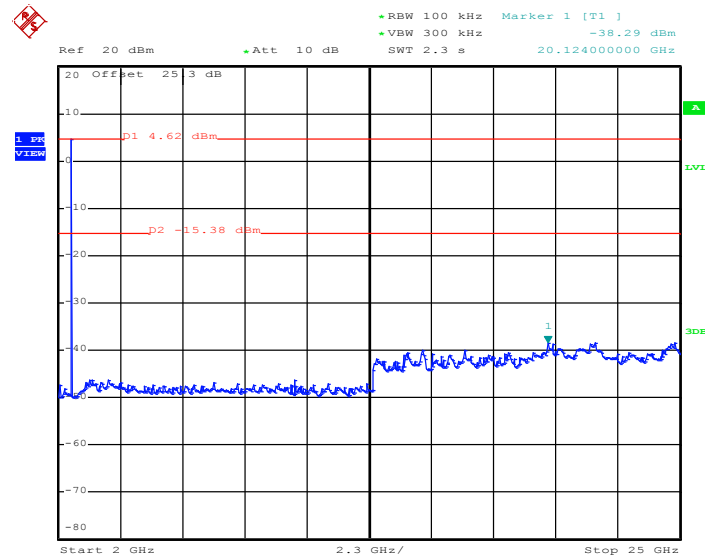
Date: 16.APR.2017 14:35:42



Test Mode :	1Mbps	Temperature :	24~26°C
Test Channel :	78	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

1Mbps CSE Plot on Ch 78 between 30MHz ~ 3 GHz

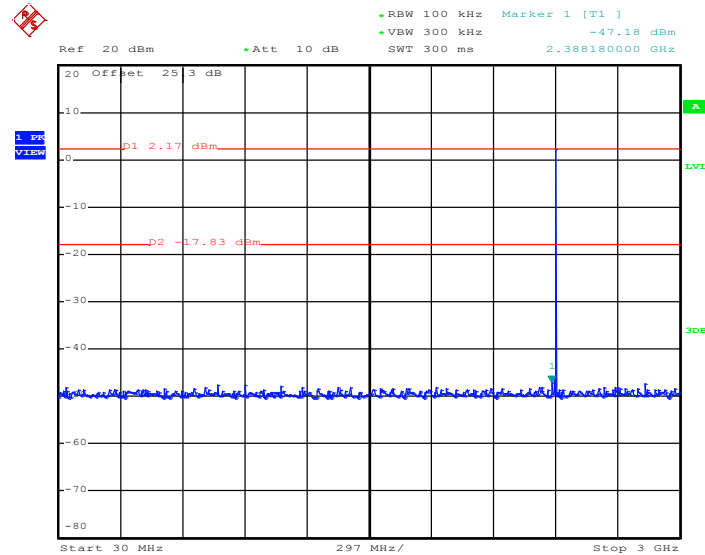
Date: 16.APR.2017 14:39:56

1Mbps CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

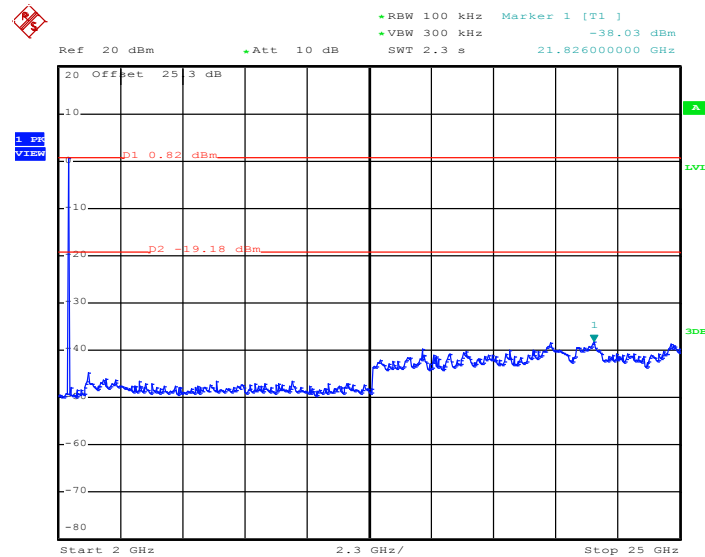
Date: 16.APR.2017 14:40:17



Test Mode :	2Mbps	Temperature :	24~26°C
Test Channel :	00	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

2Mbps CSE Plot on Ch 00 between 30MHz ~ 3 GHz

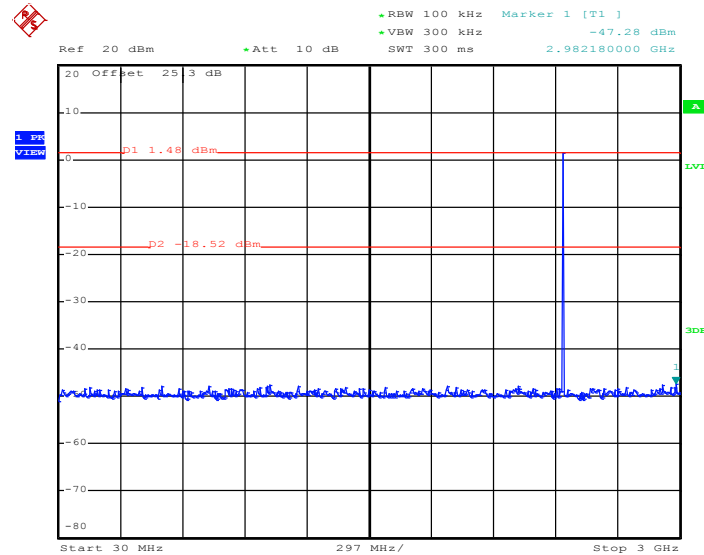
Date: 16.APR.2017 14:43:49

2Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz

Date: 16.APR.2017 14:44:11

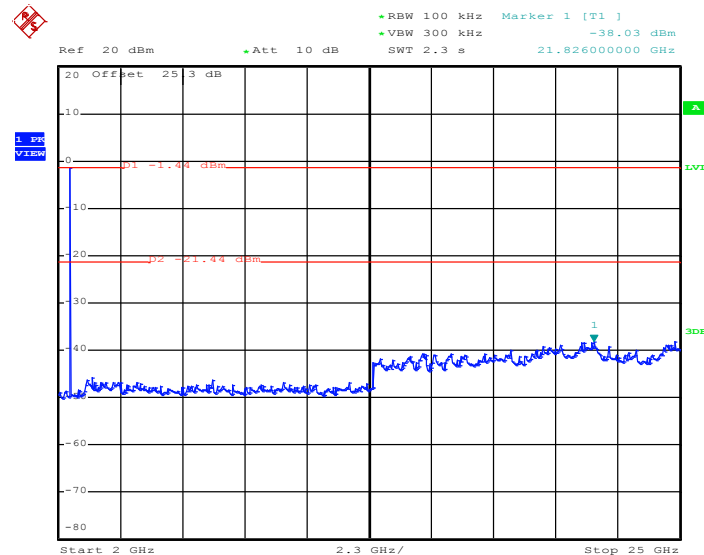
Test Mode :	2Mbps	Temperature :	24~26℃
Test Channel :	39	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

2Mbps CSE Plot on Ch 39 between 30MHz ~ 3 GHz



Date: 16.APR.2017 14:47:45

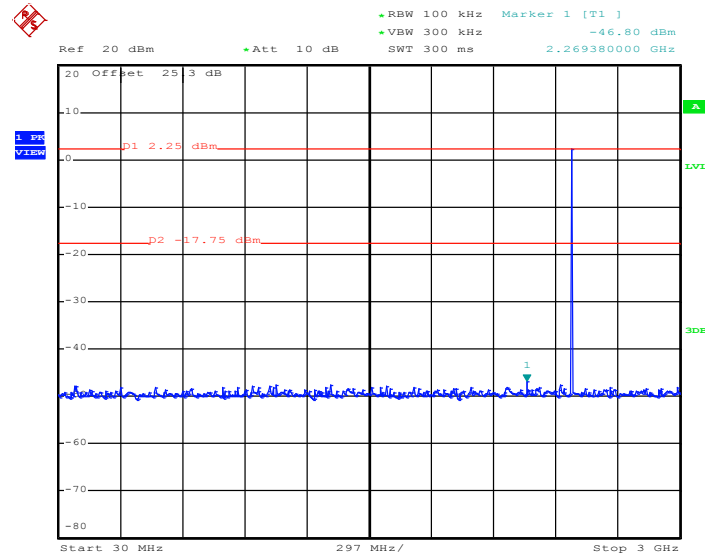
2Mbps CSE Plot on Ch 39 between 2 GHz ~ 25 GHz



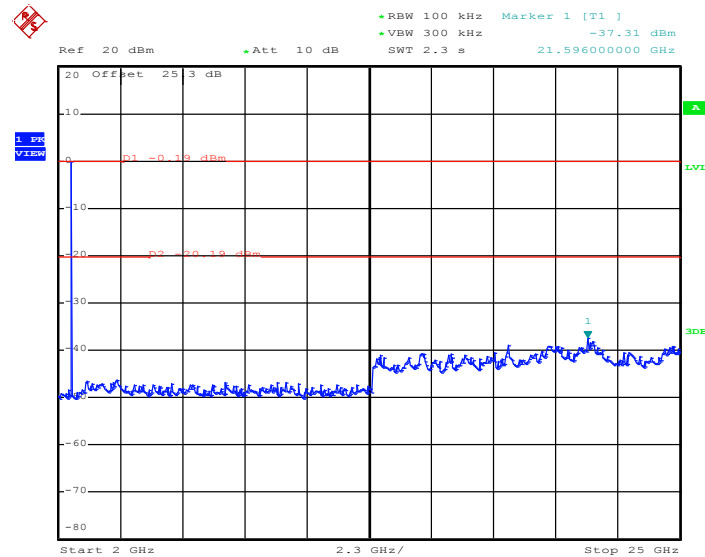
Date: 16.APR.2017 14:48:07



Test Mode :	2Mbps	Temperature :	24~26°C
Test Channel :	78	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

2Mbps CSE Plot on Ch 78 between 30MHz ~ 3 GHz

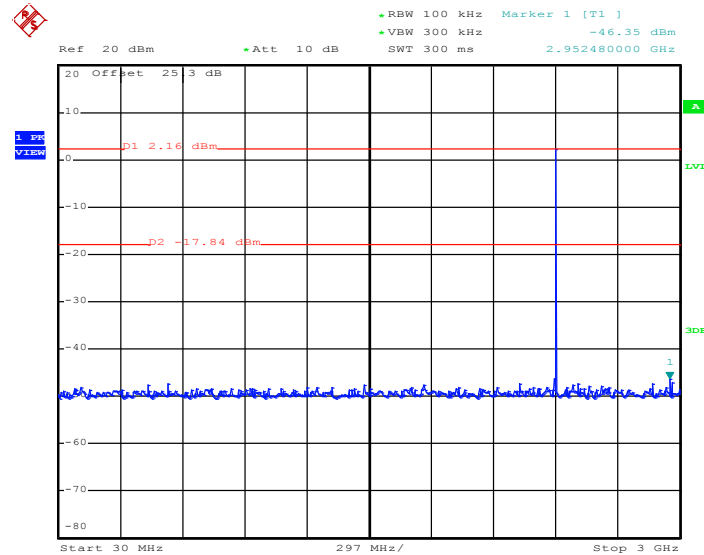
Date: 16.APR.2017 14:54:05

2Mbps CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

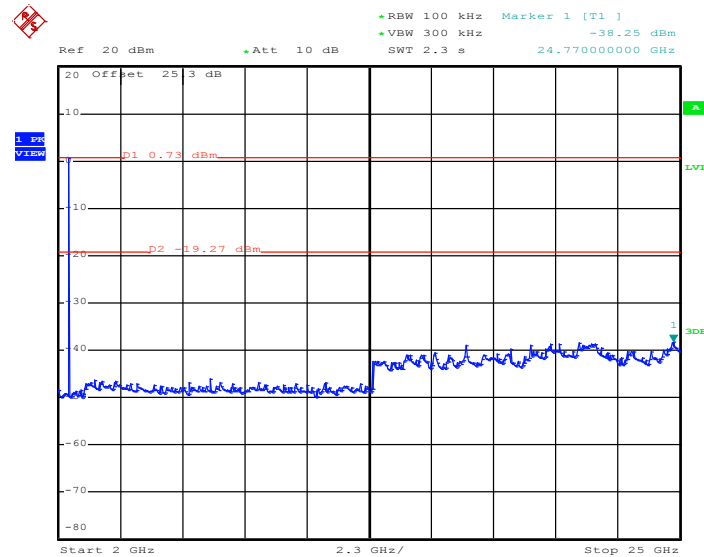
Date: 16.APR.2017 14:54:27



Test Mode :	3Mbps	Temperature :	24~26°C
Test Channel :	00	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

3Mbps CSE Plot on Ch 00 between 30MHz ~ 3 GHz

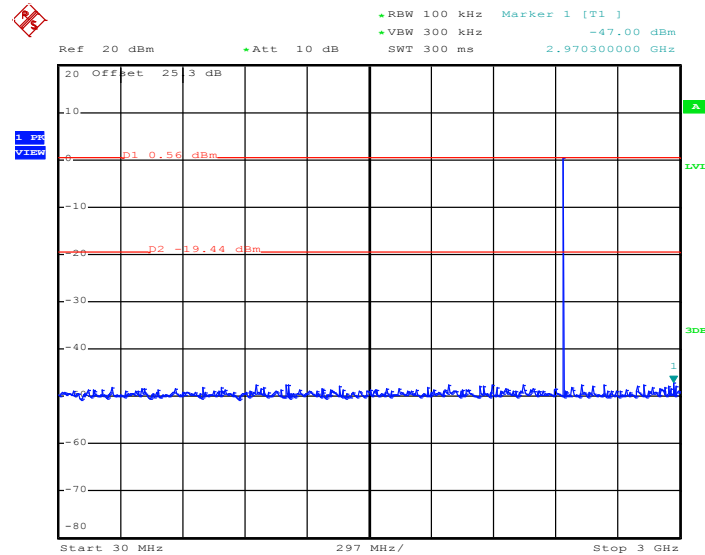
Date: 16.APR.2017 14:57:43

3Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz

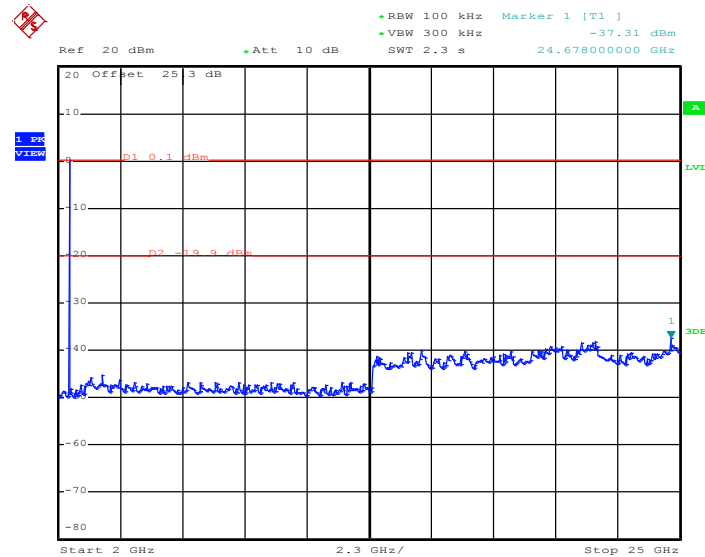
Date: 16.APR.2017 14:58:05



Test Mode :	3Mbps	Temperature :	24~26°C
Test Channel :	39	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

3Mbps CSE Plot on Ch 39 between 30MHz ~ 3 GHz

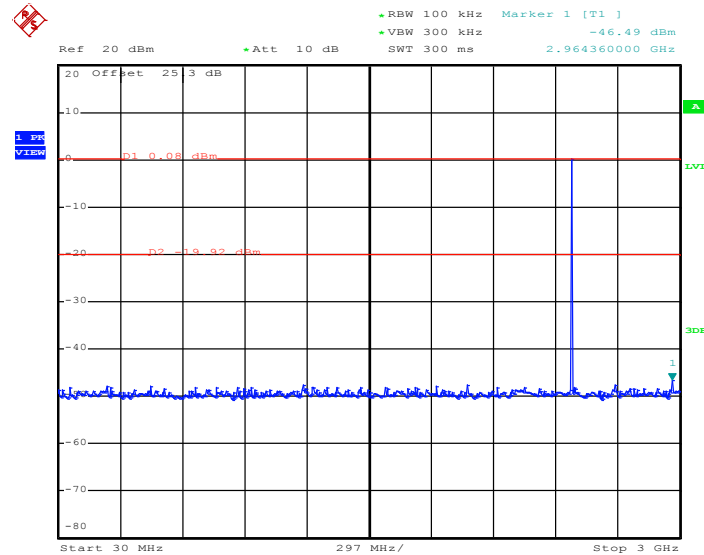
Date: 16.APR.2017 15:00:33

3Mbps CSE Plot on Ch 39 between 2 GHz ~ 25 GHz

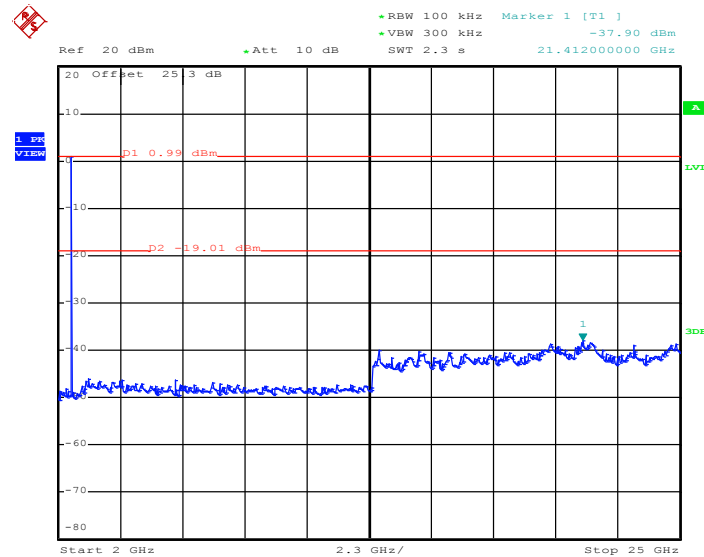
Date: 16.APR.2017 15:00:55



Test Mode :	3Mbps	Temperature :	24~26°C
Test Channel :	78	Relative Humidity :	48~51%
		Test Engineer :	Aking Chang

3Mbps CSE Plot on Ch 78 between 30MHz ~ 3 GHz

Date: 16.APR.2017 15:02:55

3Mbps CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

Date: 16.APR.2017 15:03:17

3.8 Radiated Band Edges and Spurious Emission Measurement

3.8.1 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. 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

3.8.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.



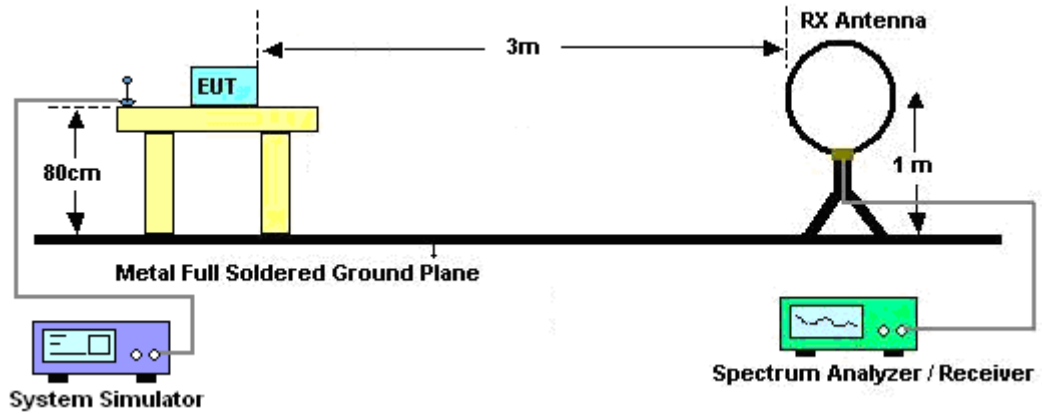
3.8.3 Test Procedures

1. 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.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, 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 to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. 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, RBW=1MHz for $f > 1$ GHz ; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c).
Duty cycle = On time/100 milliseconds
On time = $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$
Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
Average Emission Level = Peak Emission Level + $20 * \log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

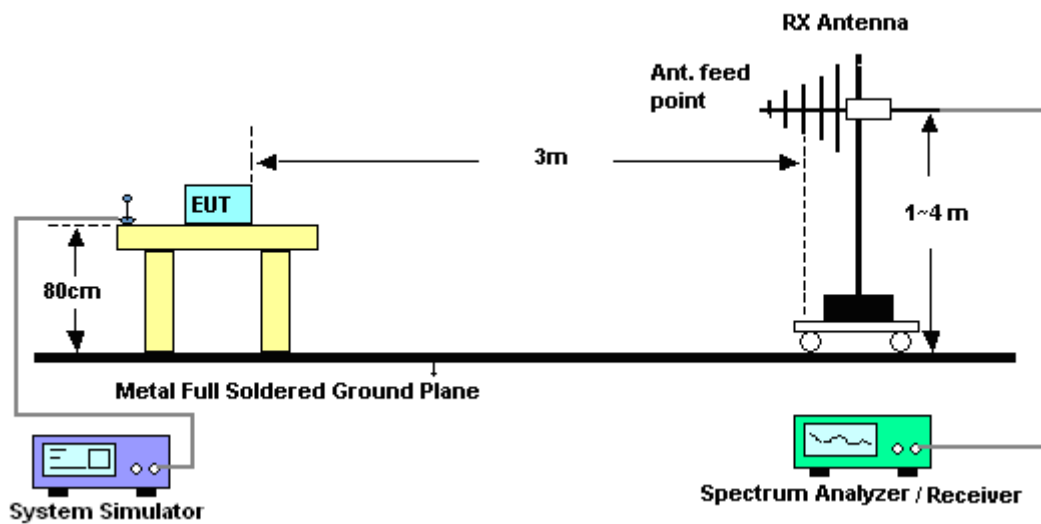
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (24.76dB) derived from $20 \log (\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.8.4 Test Setup

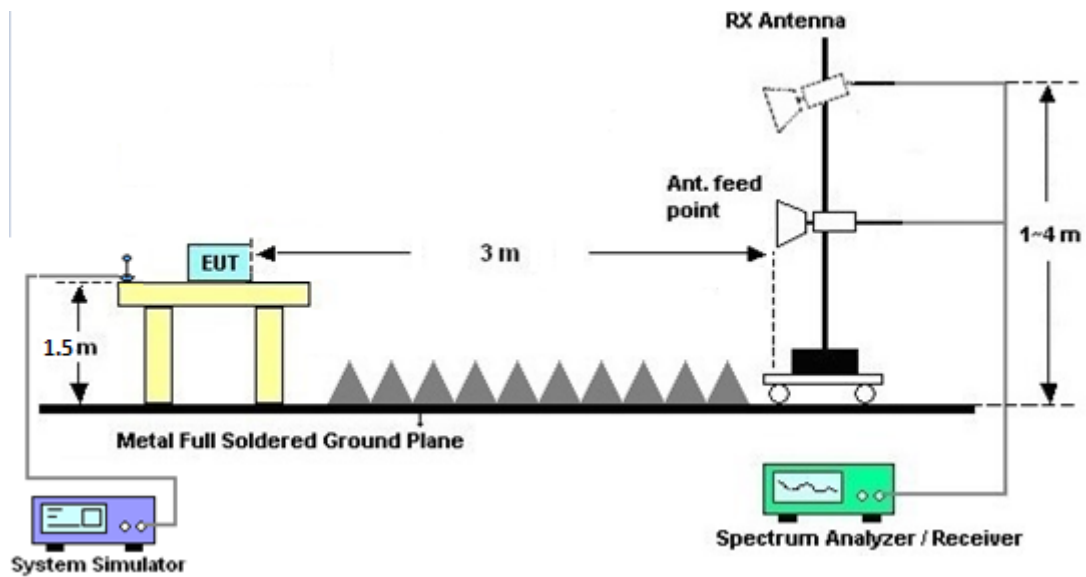
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.8.5 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 per 15.31(o) was not reported.

3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.8.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.

3.9 AC Conducted Emission Measurement

3.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

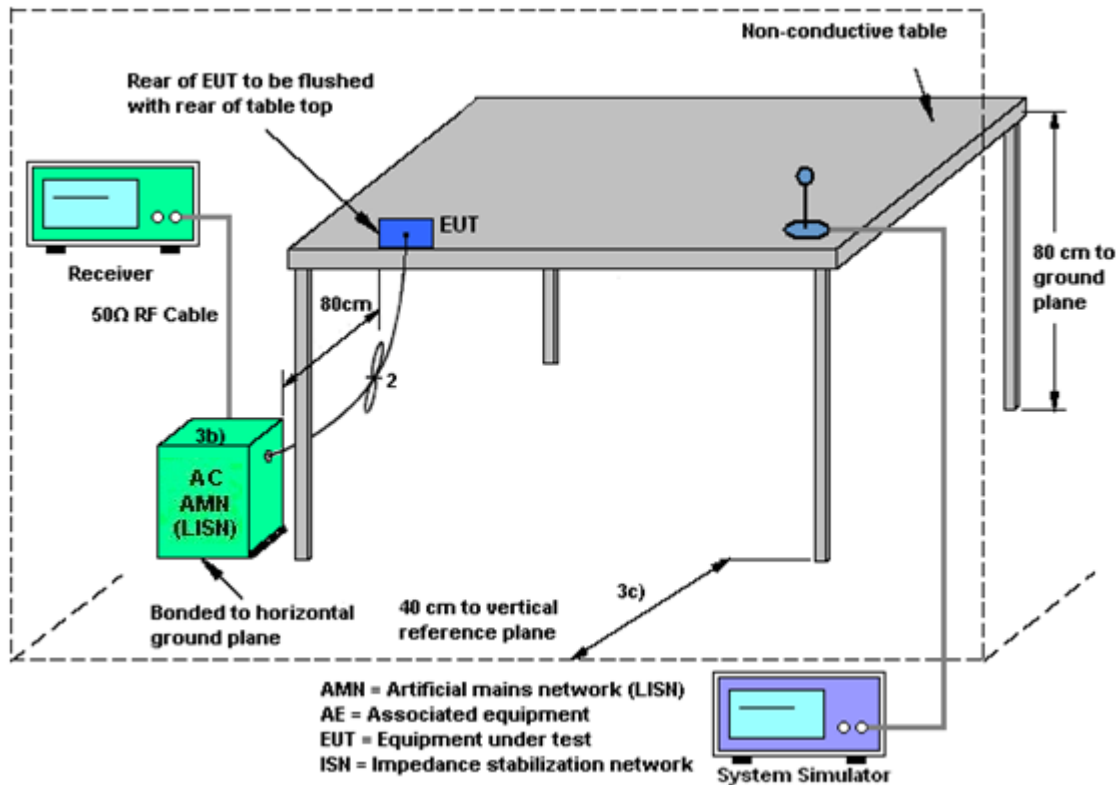
3.9.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.9.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.9.4 Test Setup



3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix A.



3.10 Antenna Requirements

3.10.1 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.

3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.10.3 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	GB412923 44	300MHz~40GHz	Dec. 26, 2016	Apr. 16, 2017	Dec. 25, 2017	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US404415 48	300MHz~40GHz	Dec. 26, 2016	Apr. 16, 2017	Dec. 25, 2017	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz-40GHz	Jul. 17, 2016	Apr. 16, 2017	Jul. 16, 2017	Conducted (TH05-HY)
BT Base Station(Measure)	Rohde & Schwarz	CBT	101136	BT 3.0	Sep. 21, 2016	Apr. 16, 2017	Sep. 20, 2017	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Apr. 29, 2017	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Aug. 30, 2016	Apr. 29, 2017	Aug. 29, 2017	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 29, 2016	Apr. 29, 2017	Nov. 28, 2017	Conduction (CO05-HY)
Amplifier	SONOMA	310N	187311	9kHz~1GHz	Oct. 26, 2016	Apr. 21, 2017 ~ Apr. 24, 2017	Oct. 25, 2017	Radiation (03CH10-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	35413&02	30MHz~1GHz	Jan. 07, 2017	Apr. 21, 2017 ~ Apr. 28, 2017	Jan. 06, 2018	Radiation (03CH10-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-132 5	1GHz ~ 18GHz	Sep. 30, 2016	Apr. 21, 2017 ~ Apr. 28, 2017	Sep. 29, 2017	Radiation (03CH10-HY)
Preamplifier	Keysight	83017A	MY532700 78	1GHz~26.5GHz	Oct. 26, 2016	Apr. 21, 2017 ~ Apr. 28, 2017	Oct. 25, 2017	Radiation (03CH10-HY)
Spectrum Analyzer	Keysight	N9010A	MY542004 85	10Hz ~ 44GHz	Oct. 17, 2016	Apr. 21, 2017 ~ Apr. 28, 2017	Oct. 16, 2017	Radiation (03CH10-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Apr. 21, 2017 ~ Apr. 28, 2017	N/A	Radiation (03CH10-HY)
Turn Table	EMEC	TT 2200	N/A	0~360 Degree	N/A	Apr. 21, 2017 ~ Apr. 28, 2017	N/A	Radiation (03CH10-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Oct. 20, 2016	Apr. 21, 2017 ~ Apr. 28, 2017	Oct. 19, 2018	Radiation (03CH10-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY554201 70	N/A	Mar. 03, 2017	Apr. 21, 2017 ~ Apr. 28, 2017	Mar. 02, 2018	Radiation (03CH10-HY)
Preamplifier	Jet-Power	JPA00101800 -30-10P	160118000 2	1GHz~18GHz	Jul. 27, 2016	Apr. 21, 2017 ~ Apr. 28, 2017	Jul. 26, 2017	Radiation (03CH10-HY)
Preamplifier	MITEQ	JS44-180040 00-33-8P	1840917	18GHz ~ 40GHz	Jun. 14, 2016	Apr. 21, 2017 ~ Apr. 28, 2017	Jun. 13, 2017	Radiation (03CH10-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170 584	18GHz- 40GHz	Nov. 08, 2016	Apr. 21, 2017 ~ Apr. 28, 2017	Nov. 07, 2017	Radiation (03CH10-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.70
--	------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.60
--	------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.90
--	------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.20
--	------



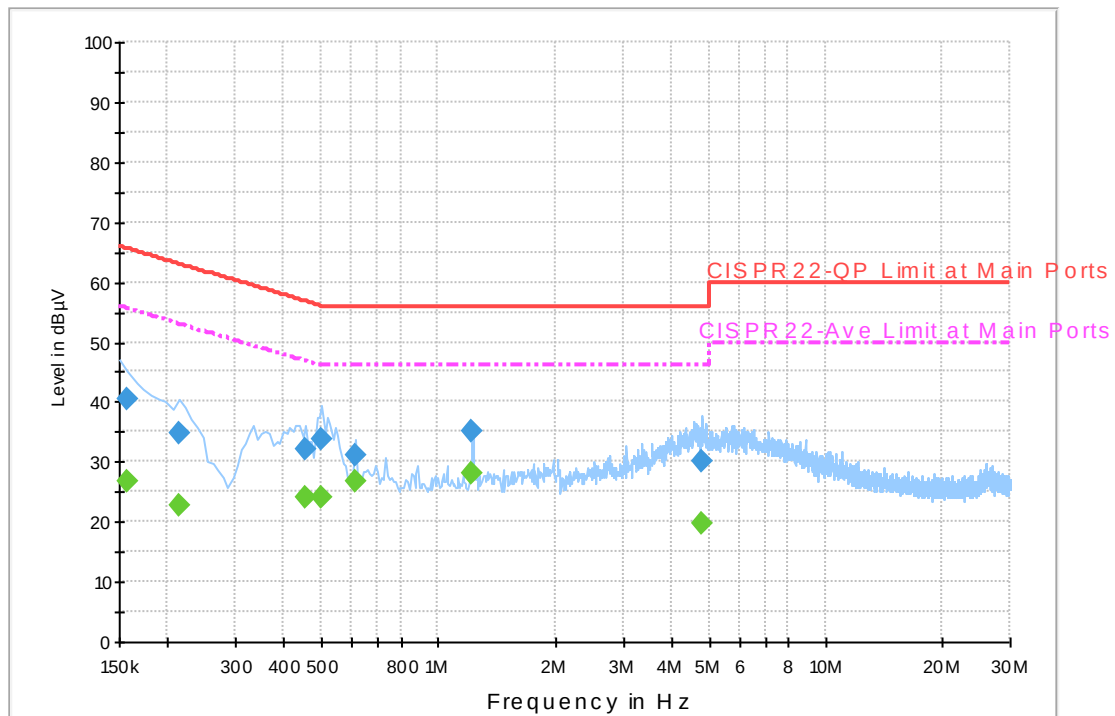
Appendix A. AC Conducted Emission Test Results

Test Engineer :	Eric Jeng	Temperature :	21~23°C
		Relative Humidity :	52~55%

EUT Information

Report NO : 740120
Test Mode : Mode 1
Test Voltage : 120Vac/60Hz
Phase : Line

ENV216 Auto Test FCC Power Bar - L



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	40.6	Off	L1	19.6	25.0	65.6
0.214000	34.7	Off	L1	19.6	28.3	63.0
0.454000	32.0	Off	L1	19.6	24.8	56.8
0.502000	33.8	Off	L1	19.6	22.2	56.0
0.614000	31.2	Off	L1	19.6	24.8	56.0
1.222000	35.0	Off	L1	19.6	21.0	56.0
4.822000	30.1	Off	L1	19.8	25.9	56.0

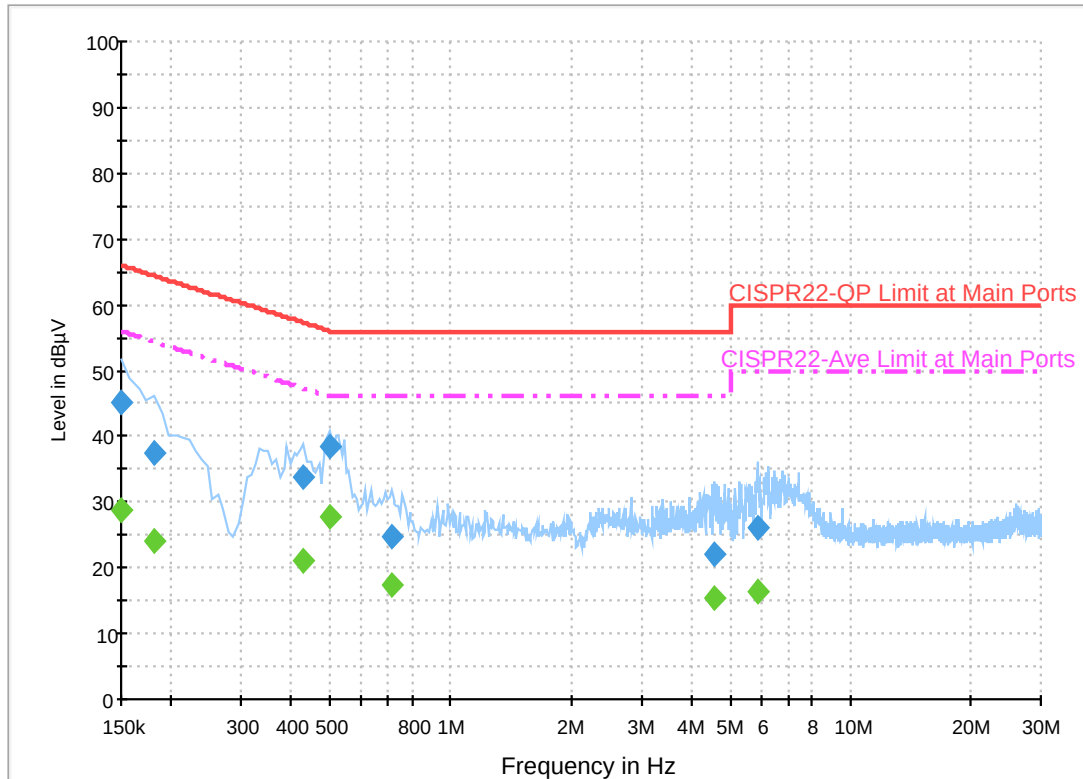
Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	26.7	Off	L1	19.6	28.9	55.6
0.214000	22.8	Off	L1	19.6	30.2	53.0
0.454000	24.0	Off	L1	19.6	22.8	46.8
0.502000	23.9	Off	L1	19.6	22.1	46.0
0.614000	26.6	Off	L1	19.6	19.4	46.0
1.222000	28.0	Off	L1	19.6	18.0	46.0
4.822000	19.8	Off	L1	19.8	26.2	46.0

EUT Information

Report NO : 740120
Test Mode : Mode 1
Test Voltage : 120Vac/60Hz
Phase : Neutral

ENV216 Auto Test FCC Power Bar - N



Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	45.0	Off	N	19.5	21.0	66.0
0.182000	37.5	Off	N	19.5	26.9	64.4
0.430000	33.7	Off	N	19.5	23.6	57.3
0.502000	38.6	Off	N	19.5	17.4	56.0
0.710000	24.9	Off	N	19.5	31.1	56.0
4.590000	22.0	Off	N	19.7	34.0	56.0
5.886000	25.9	Off	N	19.8	34.1	60.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	28.6	Off	N	19.5	27.4	56.0
0.182000	24.0	Off	N	19.5	30.4	54.4
0.430000	21.0	Off	N	19.5	26.3	47.3
0.502000	27.7	Off	N	19.5	18.3	46.0
0.710000	17.4	Off	N	19.5	28.6	46.0
4.590000	15.5	Off	N	19.7	30.5	46.0
5.886000	16.3	Off	N	19.8	33.7	50.0



Appendix B. Radiated Spurious Emission

Test Engineer :	Stan Hsieh and Kyle Chuang	Temperature :	22~24°C
		Relative Humidity :	43~44%

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
		(MHz)	(dBμV/m)	(dB)	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)
BT CH00 2402MHz		2365.335	41.45	-32.55	74	43.45	26.8	4.42	33.22	381	138	P	H
		2365.335	16.69	-37.31	54							A	H
	*	2402	95.33	-	-	97.16	26.93	4.45	33.21	381	138	P	H
	*	2402	70.57	-	-							A	H
													H
													H
		2343.6	41.52	-32.48	74	43.61	26.74	4.4	33.23	124	245	P	V
		2343.6	16.76	-37.24	54							A	V
	*	2402	98.76	-	-	100.59	26.93	4.45	33.21	124	245	P	V
	*	2402	74	-	-							A	V
													V
													V
BT CH 39 2441MHz		2332.68	41.29	-32.71	74	43.47	26.68	4.38	33.24	381	150	P	H
		2332.68	16.53	-37.47	54							A	H
	*	2441	95.63	-	-	97.22	27.11	4.48	33.18	381	150	P	H
	*	2441	70.87	-	-							A	H
		2485.23	42.08	-31.92	74	43.48	27.24	4.53	33.17	381	150	P	H
		2485.23	17.32	-36.68	54							A	H
		2388.68	40.9	-33.1	74	42.76	26.93	4.43	33.22	257	244	P	V
		2388.68	16.14	-37.86	54							A	V
	*	2441	97.81	-	-	99.4	27.11	4.48	33.18	257	244	P	V
	*	2441	73.05	-	-							A	V
		2492.02	41.88	-32.12	74	43.21	27.3	4.53	33.16	257	244	P	V
		2492.02	17.12	-36.88	54							A	V



BT CH 78 2480MHz	*	2480	94.48	-	-	95.9	27.24	4.51	33.17	328	144	P	H
	*	2480	69.72	-	-							A	H
		2484.92	42.26	-31.74	74	43.66	27.24	4.53	33.17	328	144	P	H
		2484.92	17.5	-36.5	54							A	H
													H
													H
	*	2480	97.32	-	-	98.74	27.24	4.51	33.17	281	244	P	V
	*	2480	72.56	-	-							A	V
		2483.64	44.2	-29.8	74	45.6	27.24	4.53	33.17	281	244	P	V
		2483.64	19.44	-34.56	54							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

BT (Harmonic @ 3m)

BT	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 00 2402MHz		4804	45.02	-28.98	74	68.04	32.04	6.34	61.9	100	0	P	H
		4804	20.26	-33.74	54								H
													H
													H
		4804	44.72	-29.28	74	67.74	32.04	6.34	61.9	100	0	P	V
		4804	19.96	-34.04	54								V
													V
													V
BT CH 39 2441MHz		4882	45.05	-28.95	74	67.85	32.21	6.41	61.9	100	0	P	H
		4882	20.29	-33.71	54							A	H
		7323	49.83	-24.17	74	66.62	36.91	7.98	62.07	100	0	P	H
		7323	25.07	-28.93	54							A	H
		4882	43.84	-30.16	74	66.64	32.21	6.41	61.9	100	0	P	V
		4882	19.08	-34.92	54							A	V
		7323	48.28	-25.72	74	65.07	36.91	7.98	62.07	100	0	P	V
		7323	23.52	-30.48	54							A	V
BT CH 78 2480MHz		4960	44.87	-29.13	74	67.42	32.42	6.47	61.9	100	0	P	H
		4960	20.11	-33.89	54							A	H
		7440	49.88	-24.12	74	66.25	37.32	8.05	62.09	100	0	P	H
		7440	25.12	-28.88	54							A	H
		4960	44.45	-29.55	74	67	32.42	6.47	61.9	100	0	P	V
		4960	19.69	-34.31	54							A	V
		7440	48.17	-25.83	74	64.54	37.32	8.05	62.09	100	0	P	V
		7440	23.41	-30.59	54							A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz BT (LF)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	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 BT LF		31.62	21.44	-18.56	40	30.24	23.34	0.53	32.75	-	-	P	H
		37.56	18.35	-21.65	40	30.01	20.46	0.53	32.75	-	-	P	H
		211.17	26.79	-16.71	43.5	42.62	15.09	1.44	32.75	-	-	P	H
		397.3	23.69	-22.31	46	32.53	21.67	1.84	32.76	-	-	P	H
		809.6	29.71	-16.29	46	31.12	28.18	2.61	32.84	-	-	P	H
		958	33.45	-12.55	46	30.46	31.05	2.79	31.66	100	0	P	H
													H
													H
													H
													H
													H
													H
													H
		32.7	24.48	-15.52	40	33.72	22.89	0.53	32.75	-	-	P	V
		40.26	23.22	-16.78	40	36.27	18.9	0.69	32.75	-	-	P	V
		57.54	21.03	-18.97	40	40.68	12.19	0.77	32.74	-	-	P	V
		444.2	23.31	-22.69	46	30.71	22.98	1.98	32.81	-	-	P	V
		835.5	30.53	-15.47	46	31.06	28.86	2.65	32.69	-	-	P	V
		959.4	33.45	-12.55	46	30.42	31.08	2.79	31.65	100	0	P	V
													V
													V
													V
													V
													V
												V	
												V	
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Note symbol

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



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

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

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

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

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable 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) + Cable 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

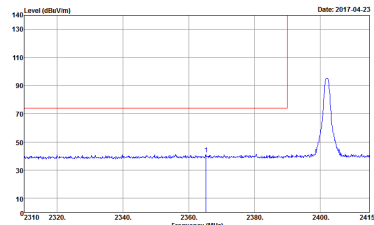
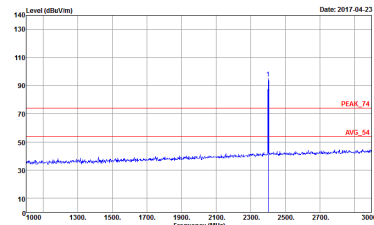
Test Engineer :	Stan Hsieh and Kyle Chuang	Temperature :	22~24°C
		Relative Humidity :	43~44%

Note symbol

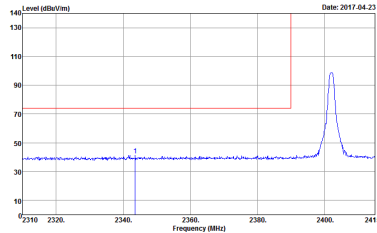
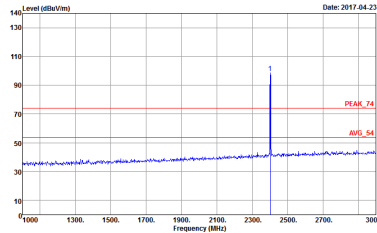
-L	Low channel location
-R	High channel location

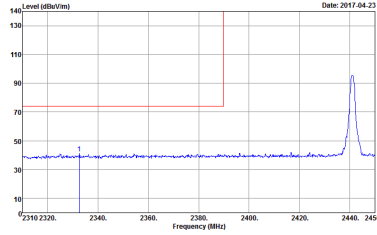
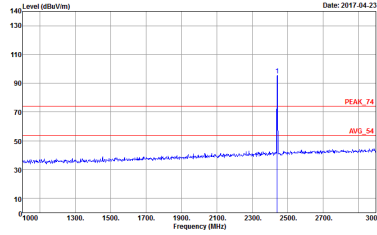
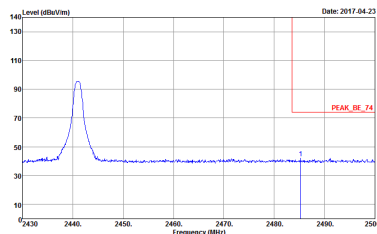
2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

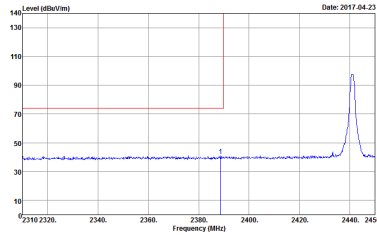
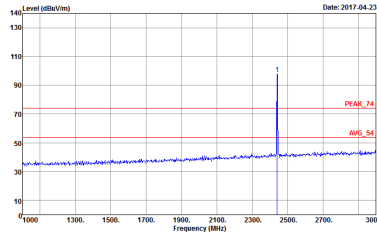
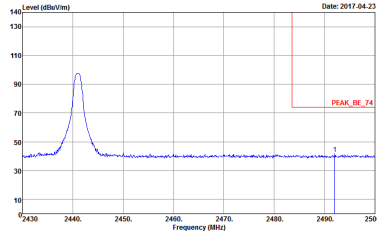
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH00 2402MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH10-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL RBW:1000.000GHz VBW:3000.000GHz SWT:Auto Detector : Peak Project : 740120 Mode : 1	 Site : 03CH10-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL RBW:1000.000GHz VBW:3000.000GHz SWT:Auto Detector : Peak Project : 740120 Mode : 1



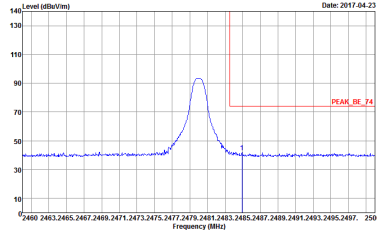
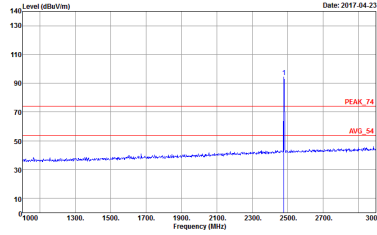
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH00 2402MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH10-11Y Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740120 Mode : 1	 Site : 03CH10-11Y Condition : PEAK_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740120 Mode : 1

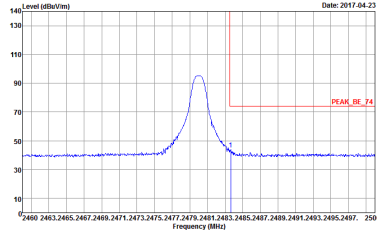
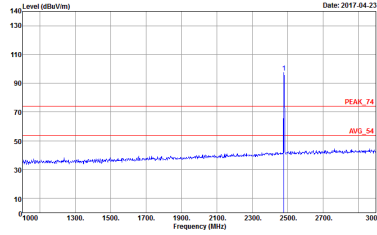
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH39 2441MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH10-HY Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 740120 Mode : 2	 Site : 03CH10-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 740120 Mode : 2
	 Site : 03CH10-HY Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 740120 Mode : 2	Left blank



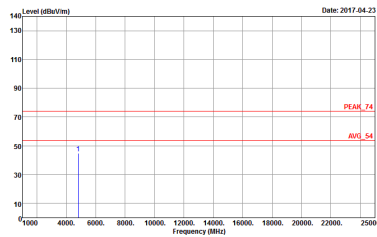
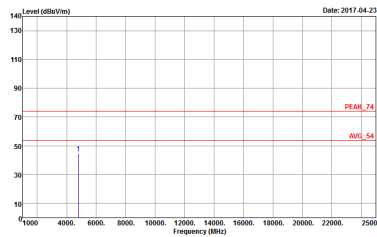
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH39 2441MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH10-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740120 Mode : 2	 Site : 03CH10-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740120 Mode : 2
Peak	 Site : 03CH10-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740120 Mode : 2	Left blank

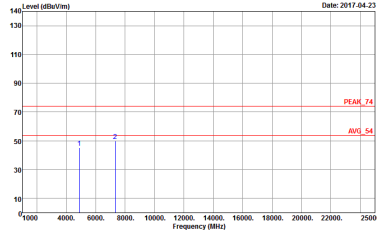
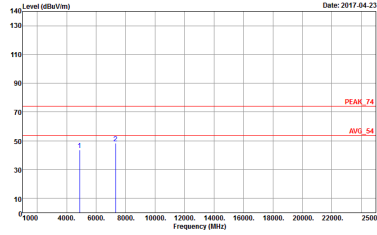


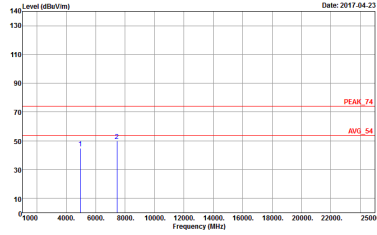
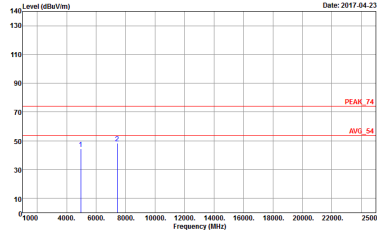
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH78 2480MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH10-11Y Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740120 Mode : 3	 Site : 03CH10-11Y Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740120 Mode : 3

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH78 2480MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH10-11Y Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740120 Mode : 3	 Site : 03CH10-11Y Condition : PEAK_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740120 Mode : 3

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

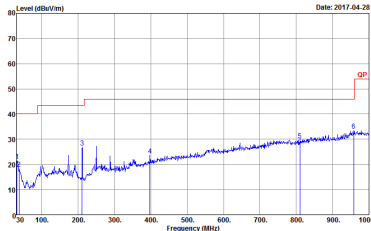
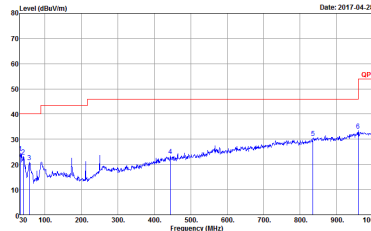
BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BT CH00 2402MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH10-11Y Condition : PEAK_74 3m HORN_9170_406_0584 HORIZONTAL Detector : Peak Project : 740120 Mode : 1	 Site : 03CH10-11Y Condition : PEAK_74 3m HORN_9170_406_0584 VERTICAL Detector : Peak Project : 740120 Mode : 1

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BT CH39 2441MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH10-11Y Condition : PEAK_74 3m HORN_9170_406_0584 HORIZONTAL Detector : Peak Project : 740120 Mode : 2	 Site : 03CH10-11Y Condition : PEAK_74 3m HORN_9170_406_0584 VERTICAL Detector : Peak Project : 740120 Mode : 2

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BT CH78 2480MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH10-11Y Condition : PEAK_74 3m HORN_9170_406_0584 HORIZONTAL Detector : Peak Project : 740120 Mode : 3	 Site : 03CH10-11Y Condition : PEAK_74 3m HORN_9170_406_0584 VERTICAL Detector : Peak Project : 740120 Mode : 3

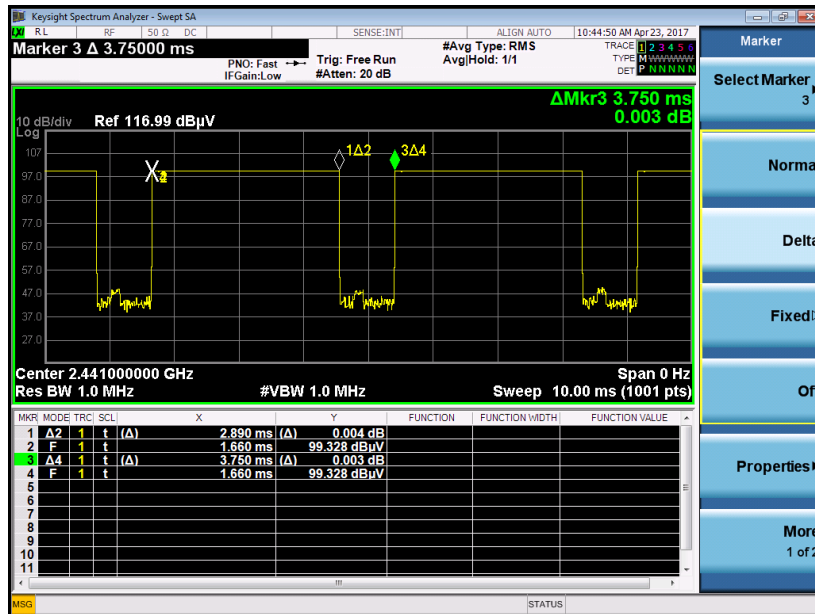
Emission below 1GHz

2.4GHz BT (LF)

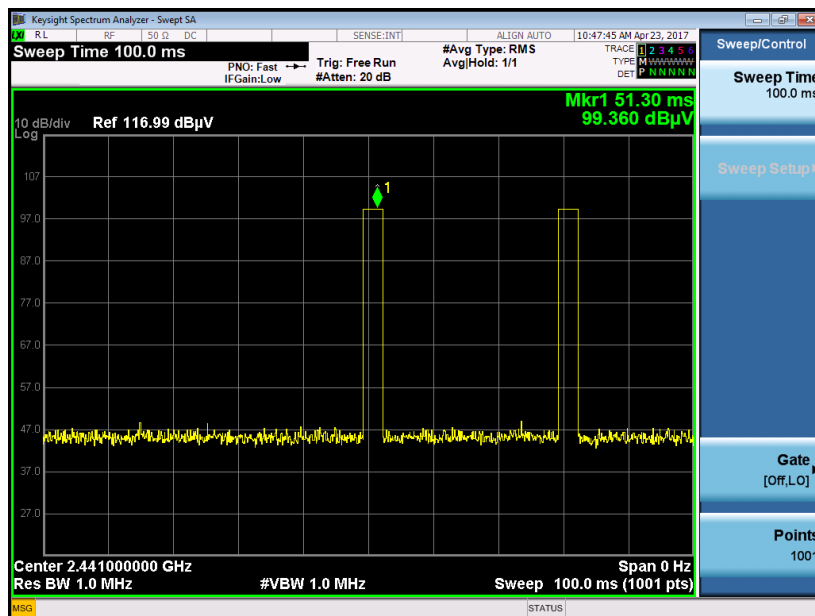
BT	2.4GHz 2400~2483.5MHz	
ANT	BT LF	
1	Horizontal	Vertical
QP / Peak	 Site : 03CH10-14V Condition : QP 3m BT-LOG 6111D-LF HORIZONTAL Detector : Peak Project : 740120 Mode : 19	 Site : 03CH10-14V Condition : QP 3m BT-LOG 6111D-LF VERTICAL Detector : Peak Project : 740120 Mode : 19

Appendix D. Duty Cycle Plots

DH5 on time (One Pulse) Plot on Channel 39



on time (Count Pulses) Plot on Channel 39



Note:

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

Duty Cycle Correction Factor Consideration for AFH mode:

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

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

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

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. $[100\text{ms} / 57.6\text{ms}] = 2 \text{ hops}$

Thus, the maximum possible ON time:

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

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

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