



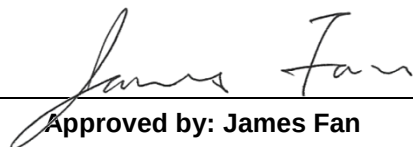
NCC RADIO TEST REPORT

Equipment : Active Loud Speaker
Brand Name : Marshall
Model Name : ACTON MULTI-ROOM
Applicant : 百滋國際股份有限公司
台北市松山區寶清街 17 號 5 樓之 1
Manufacturer : Zound Industries International AB
Room 411-412, 4th Floor, Main Building,
No. 99 Qiao Cheng East Road, Nanshan
District, Shenzhen City, China
Standard : NCC LP0002 (2018-01-10)

The product was received on May. 09, 2018, and testing was started from Jun. 28, 2018 and completed on Jul. 05, 2018. We, SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in NCC LP0002 (2018-01-10) and shown compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

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


Approved by: James Fan

SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory

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

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History of this test report

Report No.	Version	Description	Issue Date
TR850940AD	01	Initial issue of report	Jul. 13, 2018

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	3.10.1.6(1)(A)	Number of Channels	Pass	-
3.2	3.10.1.6(1)(A)	Hopping Channel Separation	Pass	-
3.3	3.10.1.6(1)(A)	Dwell Time of Each Channel	Pass	-
3.4	3.10.1.6(1)(A)	20dB Bandwidth	Pass	-
3.4	-	99% Bandwidth	Pass	-
3.5	3.10.1.6(1)(A)	Peak Output Power	Pass	-
3.6	LP0002 3.10.1.5	Conducted Band Edges	Pass	-
3.6	LP0002 3.10.1.5	Conducted Spurious Emission	Pass	-
3.7	LP0002 3.10.1.5	Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit -4.73 dB at 934.04 MHz
3.8	LP0002 2.11	Receiver Radiated Emission	Pass	Under limit -4.85 dB at 934.08 MHz
3.9	LP0002 2.3	AC Conducted Emission	Pass	Under limit -12.78 dB at 0.273 MHz
3.10	LP0002 2.2 3.10.1.3 3.10.1.4	Antenna Requirement	Pass	-

Reviewed by: Along Chen

Report Producer: Jing Chen



1 General Description

1.1 Product Feature of Equipment Under Test

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

Product Specification subjective to this standard	
Antenna Type	WLAN: FPCB Antenna Bluetooth: FPCB Antenna

1.2 Modification of EUT

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

1.3 Testing Location

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

Test Site No.	Sporton Site No.		
	TH05-HY	CO05-HY	03CH15-HY

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

1.4 Applicable Standards

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

- NCC LP0002 (2018-01-10)
- ANSI C63.10-2013

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

2 Test Configuration of Equipment Under Test

2.1 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, the worst mode of radiated spurious emissions is Bluetooth 3Mbps mode, and recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

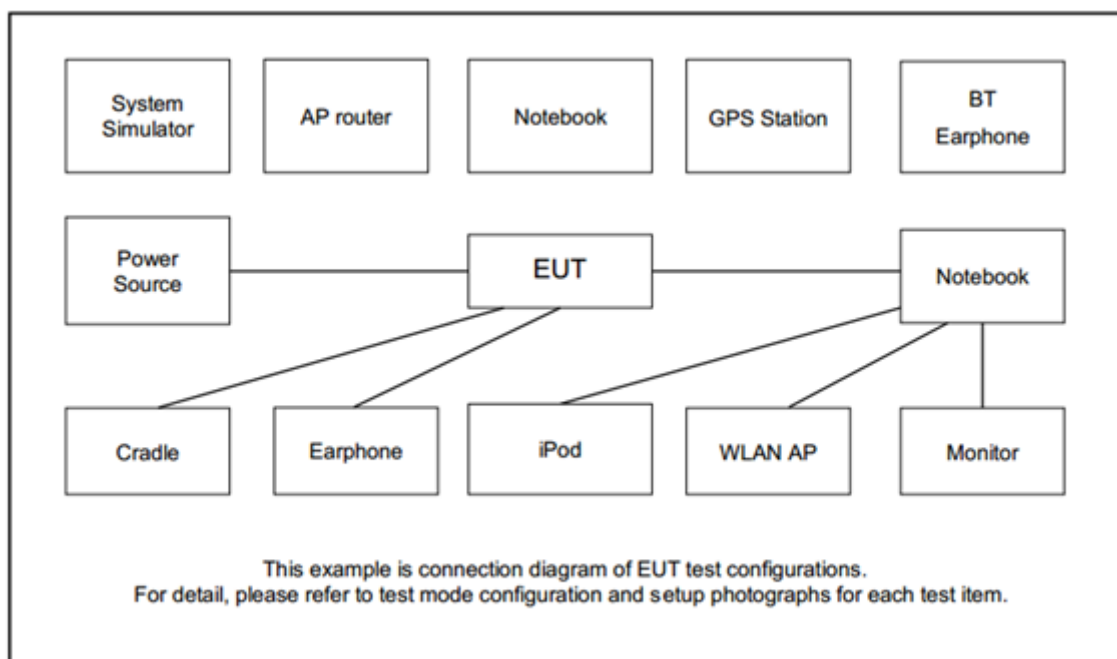
The following summary table is showing all test modes to demonstrate in compliance with the standard.

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 EDR 3Mbps 8-DPSK		
	Mode 1: CH00_2402 MHz for Tx mode Mode 2: CH39_2441 MHz for Tx mode Mode 3: CH78_2480 MHz for Tx mode Mode 4: CH00_2402 MHz for Rx Mode		
AC Conducted Emission	Mode 1: CH00_2402 MHz for Tx mode Mode 2: CH00_2402 MHz for Rx Mode		



Summary table of Test Cases	
Receiver Radiated Emission	Mode 1: CH00_2402 MHz for Rx Mode
Remark: 1. For radiated test cases, the worst mode data rate 3Mbps 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 3Mbps, and no other significantly frequencies found in conducted spurious emission.	

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	DELL	Latitude E6430	FCC DoC	N/A	N/A
2.	iPod Nano	Apple	A1446	FCC DoC	Shielded, 1.5 m	N/A

Note: The support notebook is disconnected from EUT and removed from test table when EUT is set to transmit continuously.

2.4 EUT Operation Test Setup

Bluetooth simulator is used to control EUT to transmit and receive continuously.

2.5 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.

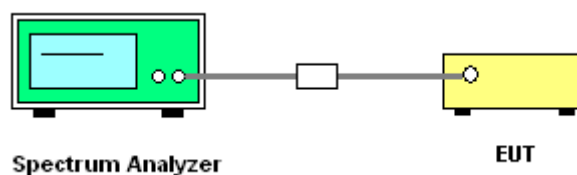
3.1.2 Measuring Instruments

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 = 100kHz; VBW = 300 kHz; 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



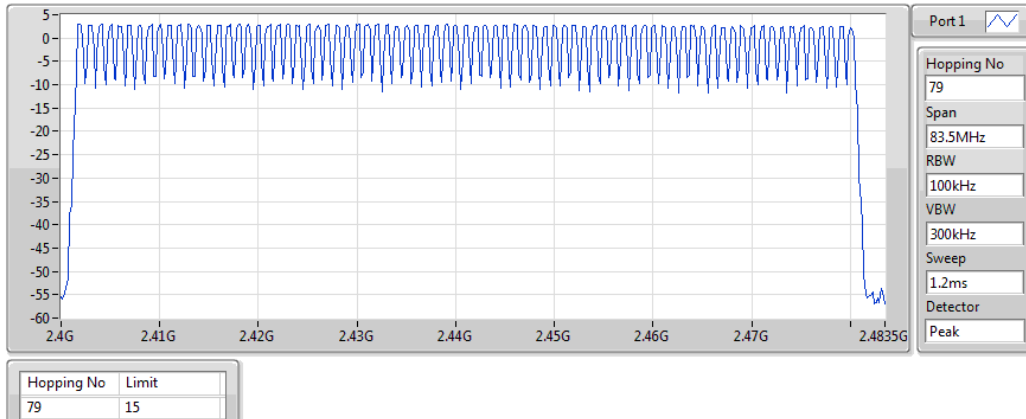
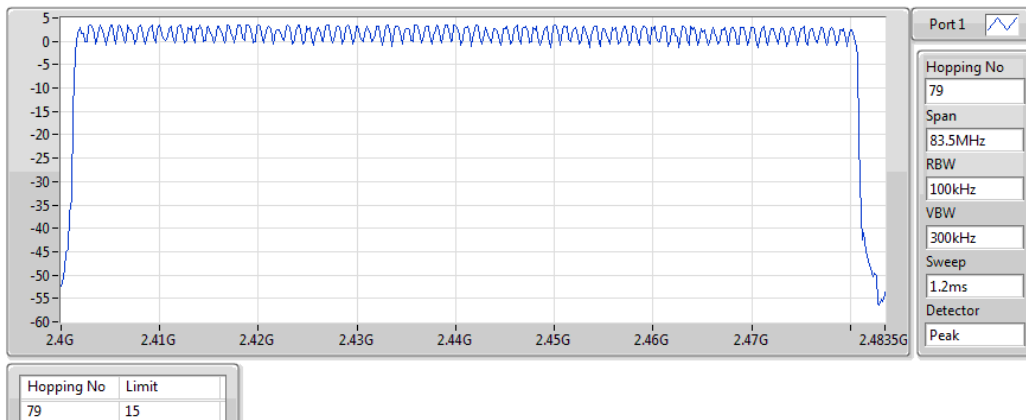
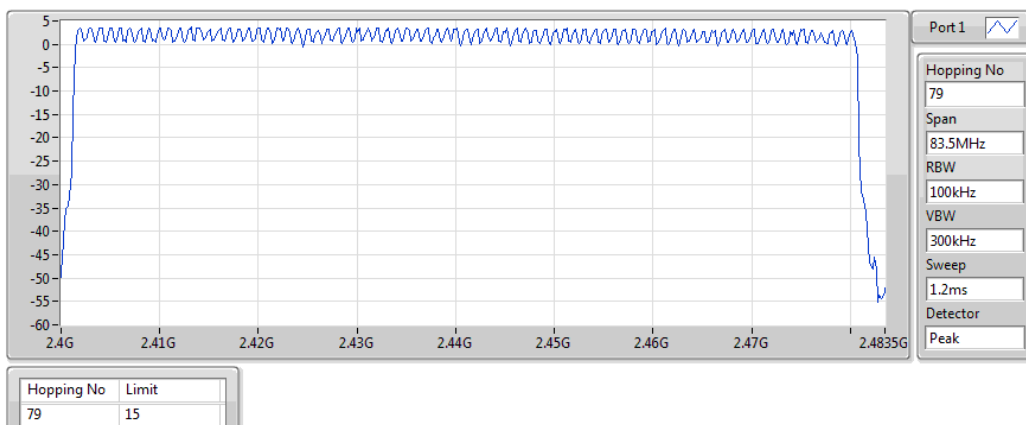
3.1.5 Test Result of Number of Hopping Frequency

Summary

Mode	Max-Hop No
2.4-2.4835GHz	-
BT-BR(1Mbps)	79
BT-EDR(2Mbps)	79
BT-EDR(3Mbps)	79

Result

Mode	Result	Hopping No	Limit
BT-BR(1Mbps)	-	-	-
2441MHz	Pass	79	15
BT-EDR(2Mbps)	-	-	-
2441MHz	Pass	79	15
BT-EDR(3Mbps)	-	-	-
2441MHz	Pass	79	15

**BT-BR(1Mbps)
2441MHz**
Hopping Ch

**BT-EDR(2Mbps)
2441MHz**
Hopping Ch

**BT-EDR(3Mbps)
2441MHz**
Hopping Ch


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.

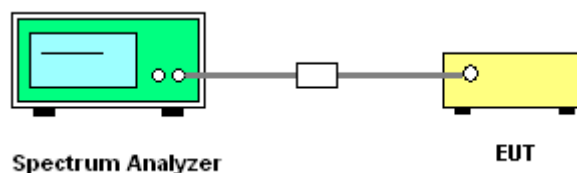
3.2.2 Measuring Instruments

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 = 30kHz; VBW = 100 kHz; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.2.4 Test Setup



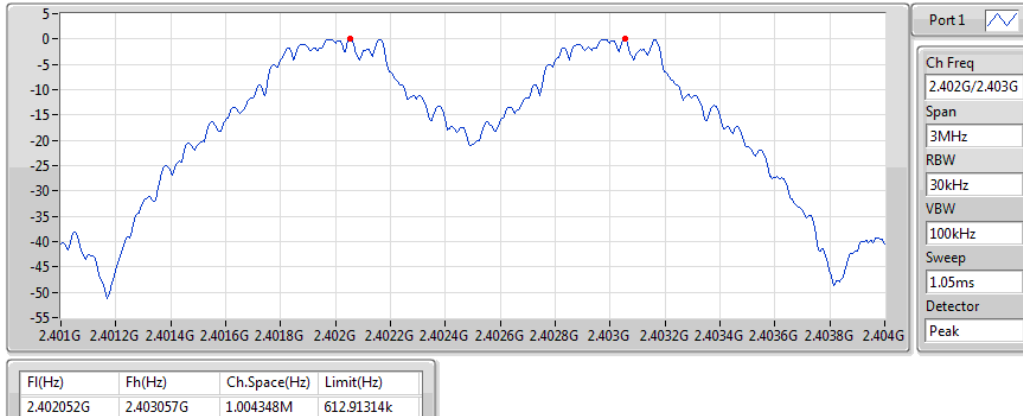
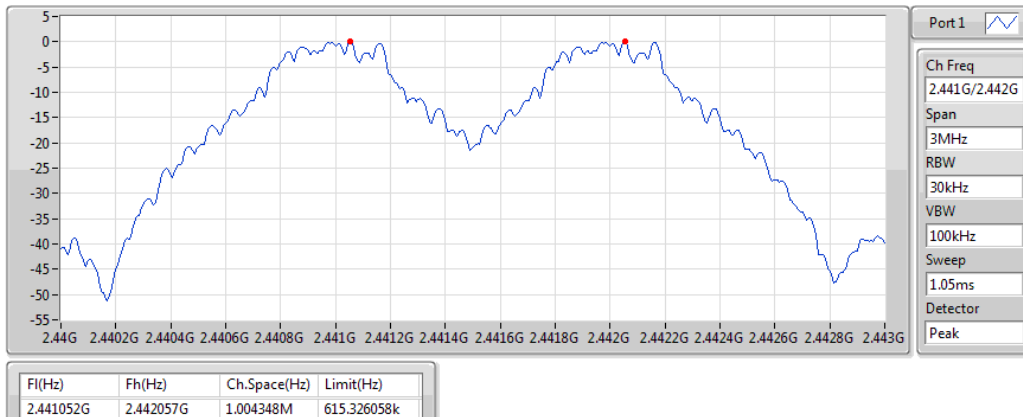
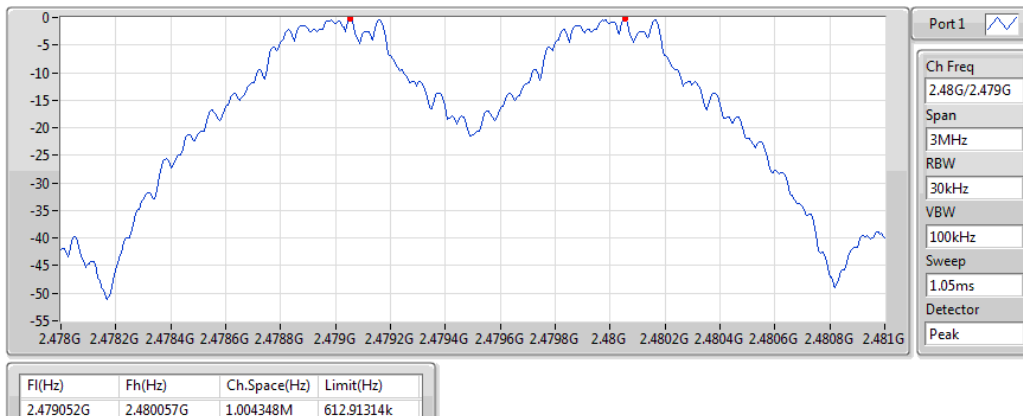
3.2.5 Test Result of Hopping Channel Separation

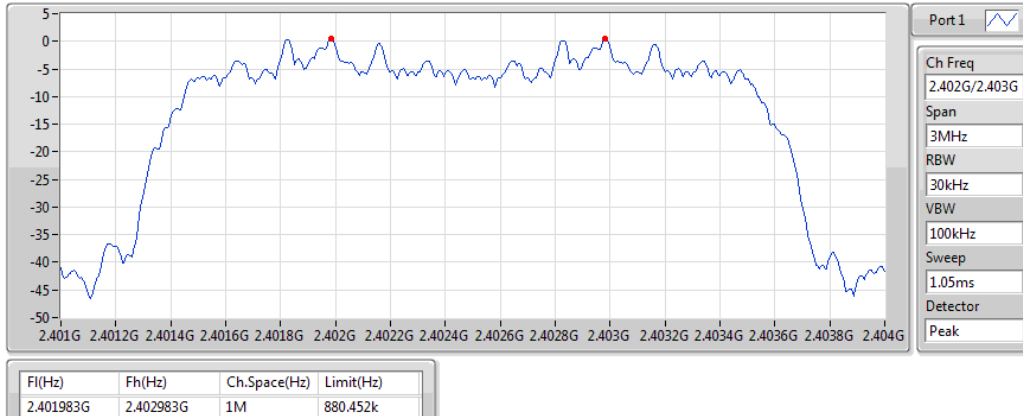
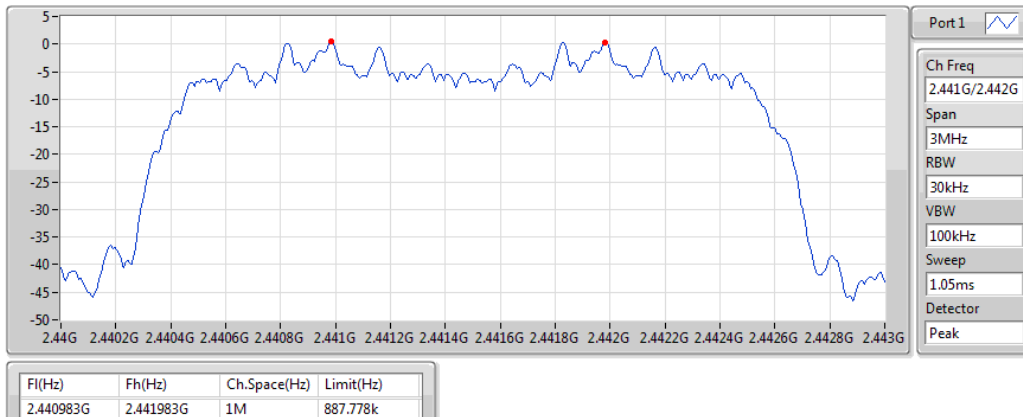
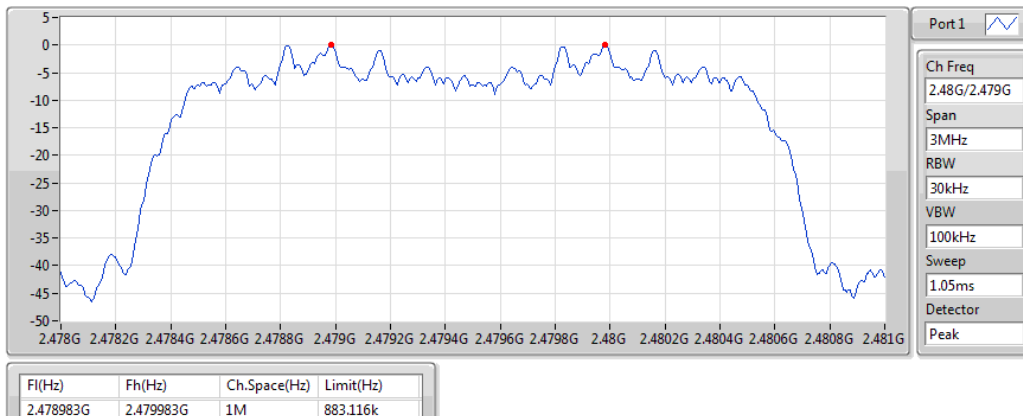
Summary

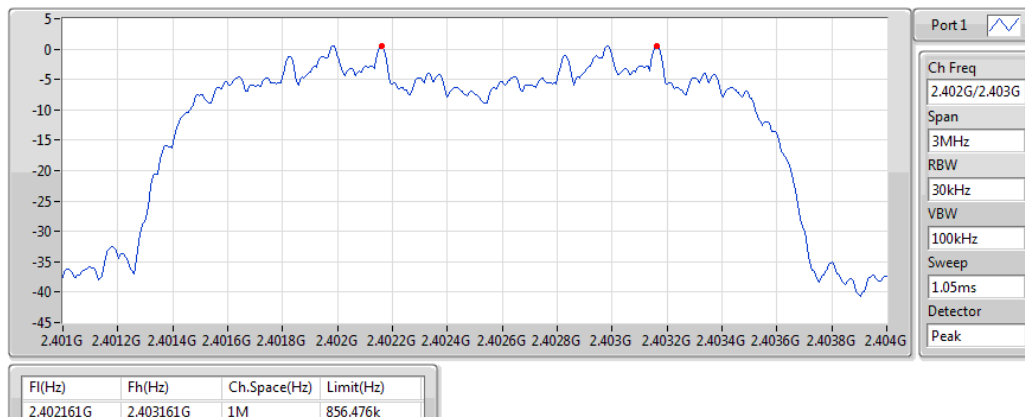
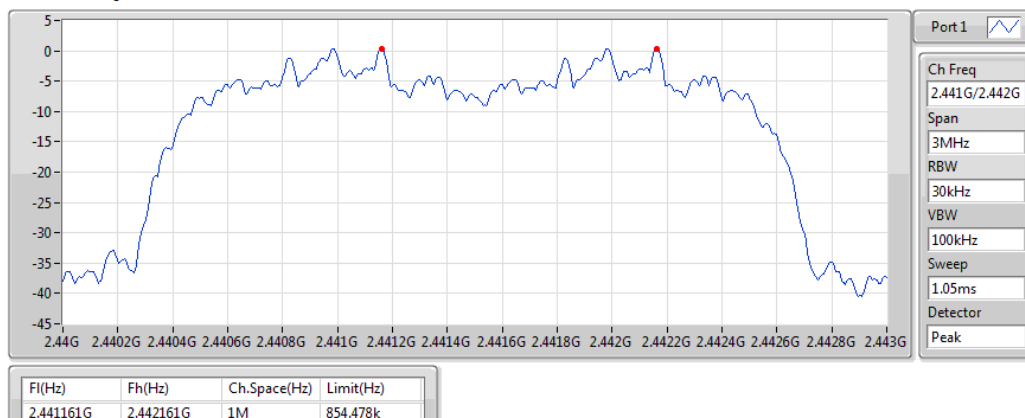
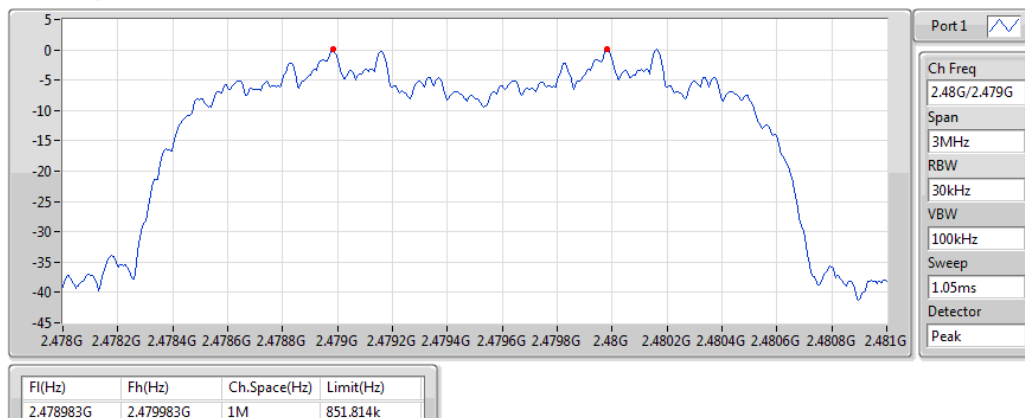
Mode	Max-Space (Hz)	Min-Space (Hz)
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	1.004348M	1.004348M
BT-EDR(2Mbps)	1M	1M
BT-EDR(3Mbps)	1M	1M

Result

Mode	Result	FI (Hz)	Fh (Hz)	Ch.Space (Hz)	Limit (Hz)
BT-BR(1Mbps)	-	-	-	-	-
2402MHz	Pass	2.402052G	2.403057G	1.004348M	612.91314k
2441MHz	Pass	2.441052G	2.442057G	1.004348M	615.326058k
2480MHz	Pass	2.479052G	2.480057G	1.004348M	612.91314k
BT-EDR(2Mbps)	-	-	-	-	-
2402MHz	Pass	2.401983G	2.402983G	1M	880.452k
2441MHz	Pass	2.440983G	2.441983G	1M	887.778k
2480MHz	Pass	2.478983G	2.479983G	1M	883.116k
BT-EDR(3Mbps)	-	-	-	-	-
2402MHz	Pass	2.402161G	2.403161G	1M	856.476k
2441MHz	Pass	2.441161G	2.442161G	1M	854.478k
2480MHz	Pass	2.478983G	2.479983G	1M	851.814k

BT-BR(1Mbps)
Channel Separation
2.402G/2.403GHz

BT-BR(1Mbps)
Channel Separation
2.441G/2.442GHz

BT-BR(1Mbps)
Channel Separation
2.48G/2.479GHz


BT-EDR(2Mbps)
Channel Separation
2.402G/2.403GHz

BT-EDR(2Mbps)
Channel Separation
2.441G/2.442GHz

BT-EDR(2Mbps)
Channel Separation
2.48G/2.479GHz


BT-EDR(3Mbps)
Channel Separation
2.402G/2.403GHz

BT-EDR(3Mbps)
Channel Separation
2.441G/2.442GHz

BT-EDR(3Mbps)
Channel Separation
2.48G/2.479GHz


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.

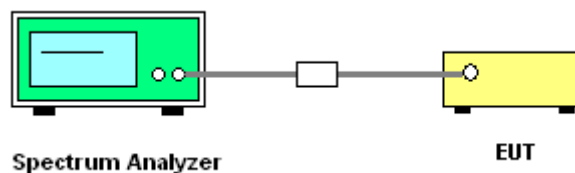
3.3.2 Measuring Instruments

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 = 300 kHz; VBW = 1 MHz; 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



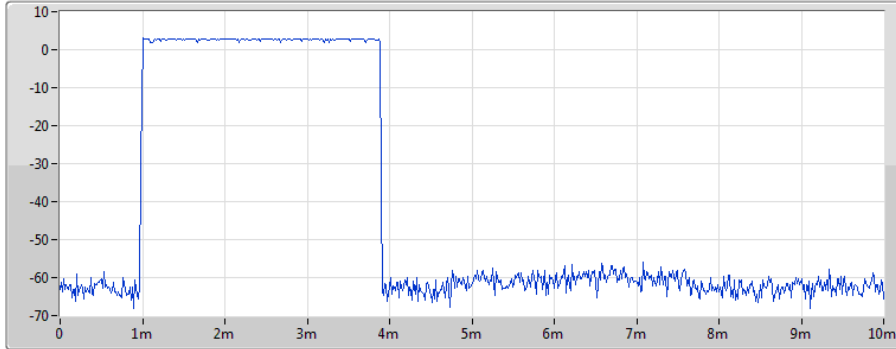
3.3.5 Test Result of Dwell Time

Summary

Mode	Max-Dwell (s)
2.4-2.4835GHz	-
BT-BR(1Mbps)	308.985507m_DH5
BT-EDR(2Mbps)	310.530435m_DH5
BT-EDR(3Mbps)	310.530435m_DH5

Result

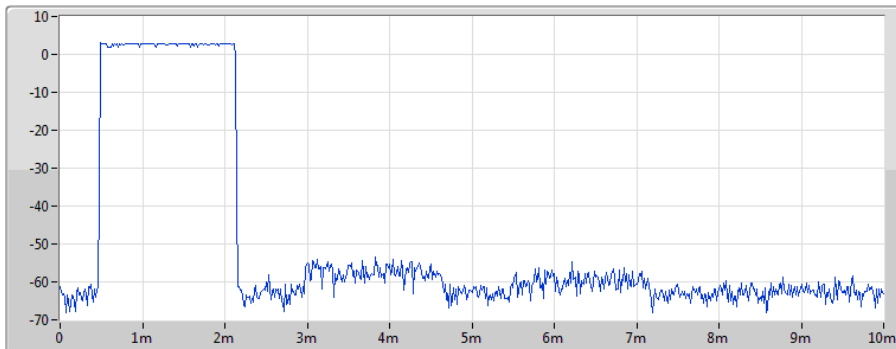
Mode	Result	Period (s)	Dwell (s)	Limit (s)	Tx On (s)
BT-BR(1Mbps)	-	-	-	-	-
2441MHz	Pass	31.6	308.985507m_DH5	400m	2.898551m
2441MHz	Pass	31.6	176.121739m_DH3	400m	1.652174m
2441MHz	Pass	31.6	43.257971m_DH1	400m	405.797101u
BT-EDR(2Mbps)	-	-	-	-	-
2441MHz	Pass	31.6	310.530435m_DH5	400m	2.913043m
2441MHz	Pass	31.6	176.121739m_DH3	400m	1.652174m
2441MHz	Pass	31.6	44.802899m_DH1	400m	420.289855u
BT-EDR(3Mbps)	-	-	-	-	-
2441MHz	Pass	31.6	310.530435m_DH5	400m	2.913043m
2441MHz	Pass	31.6	177.666667m_DH3	400m	1.666667m
2441MHz	Pass	31.6	43.257971m_DH1	400m	405.797101u

BT-BR(1Mbps)
Dwell
2441MHz


Port 1	
Ch Freq	2.441GHz
RBW	300kHz
VBW	1MHz
Sweep Time	10ms
TX Time	2.898551ms

DH5

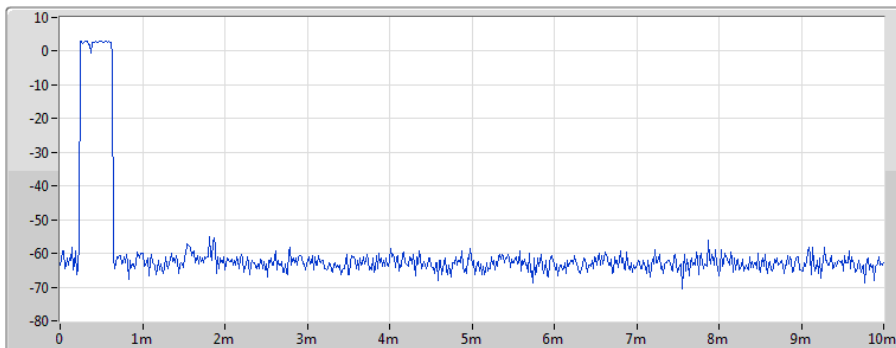
Period(s)	Dwell(s)	Limit(s)	Tx On(s)
31.6	308.985507m_C	400m	2.898551m

BT-BR(1Mbps)
Dwell
2441MHz


Port 1	
Ch Freq	2.441GHz
RBW	300kHz
VBW	1MHz
Sweep Time	10ms
TX Time	1.652174ms

DH3

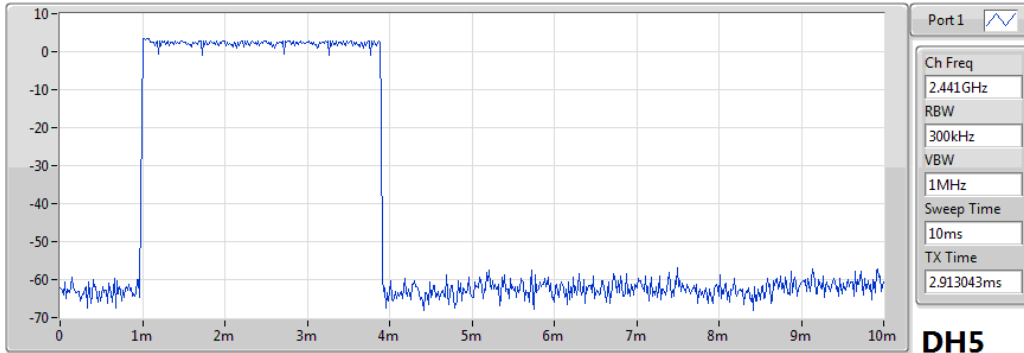
Period(s)	Dwell(s)	Limit(s)	Tx On(s)
31.6	176.121739m_C	400m	1.652174m

BT-BR(1Mbps)
Dwell
2441MHz


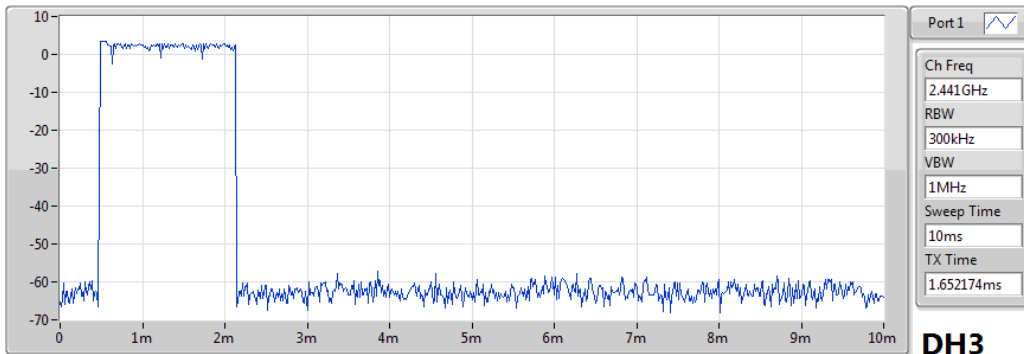
Port 1	
Ch Freq	2.441GHz
RBW	300kHz
VBW	1MHz
Sweep Time	10ms
TX Time	405.797101us

DH1

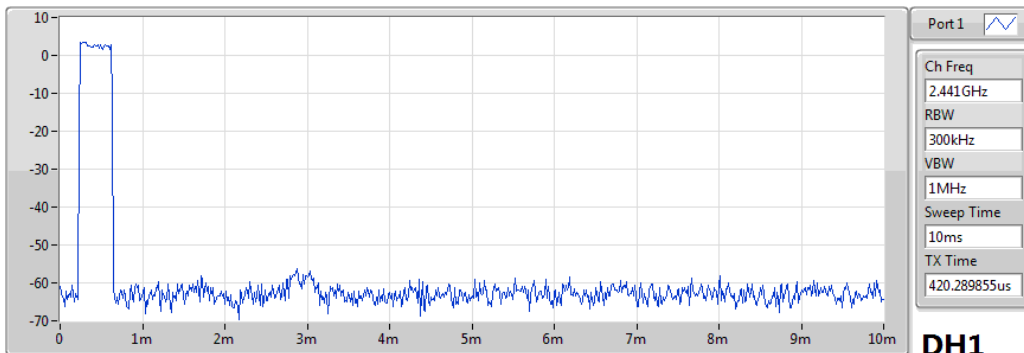
Period(s)	Dwell(s)	Limit(s)	Tx On(s)
31.6	43.257971m_DH	400m	405.797101u

BT-EDR(2Mbps)
Dwell
2441MHz


Period(s)	Dwell(s)	Limit(s)	Tx On(s)
31.6	310.530435m_C	400m	2.913043m

BT-EDR(2Mbps)
Dwell
2441MHz


Period(s)	Dwell(s)	Limit(s)	Tx On(s)
31.6	176.121739m_C	400m	1.652174m

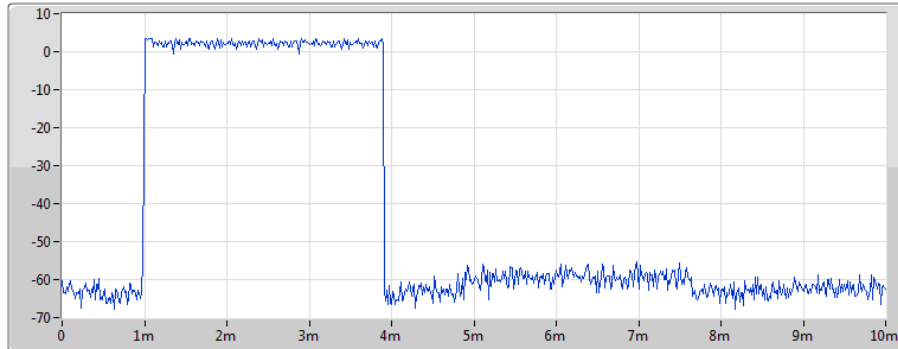
BT-EDR(2Mbps)
Dwell
2441MHz


Period(s)	Dwell(s)	Limit(s)	Tx On(s)
31.6	44.802899m_DH	400m	420.289855u

BT-EDR(3Mbps)

Dwell

2441MHz



Port 1 

Ch Freq
2.441GHz

RBW
300kHz

VBW
1MHz

Sweep Time
10ms

TX Time
2.913043ms

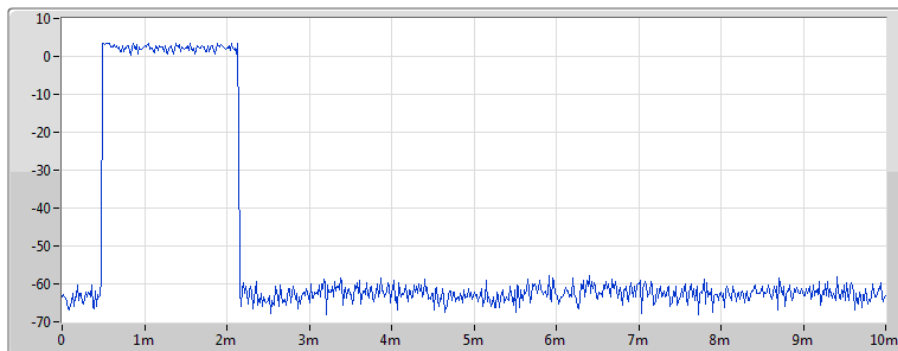
DH5

Period(s)	Dwell(s)	Limit(s)	Tx On(s)
31.6	310.530435m	400m	2.913043m

BT-EDR(3Mbps)

Dwell

2441MHz



Port 1 

Ch Freq
2.441GHz

RBW
300kHz

VBW
1MHz

Sweep Time
10ms

TX Time
1.666667ms

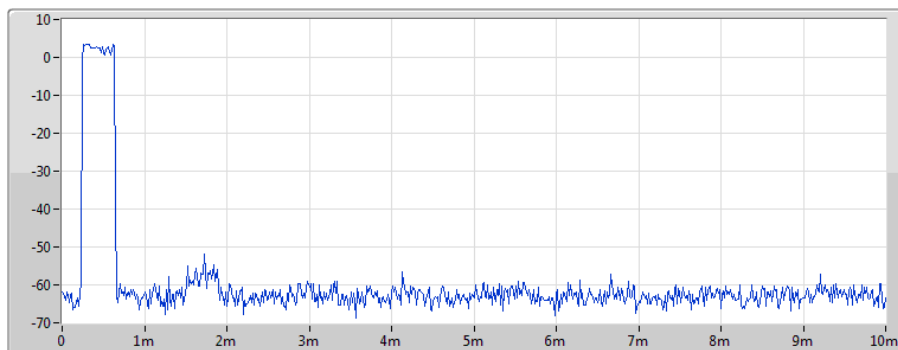
DH3

Period(s)	Dwell(s)	Limit(s)	Tx On(s)
31.6	177.666667m	400m	1.666667m

BT-EDR(3Mbps)

Dwell

2441MHz



Port 1 

Ch Freq
2.441GHz

RBW
300kHz

VBW
1MHz

Sweep Time
10ms

TX Time
405.797101us

DH1

Period(s)	Dwell(s)	Limit(s)	Tx On(s)
31.6	43.257971m	400m	405.797101u

3.4 20dB and 99% Bandwidth Measurement

3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

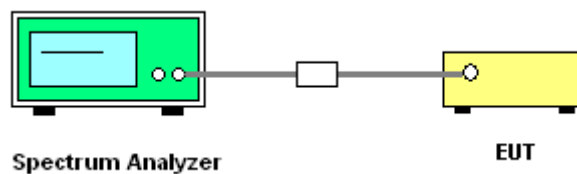
3.4.2 Measuring Instruments

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

Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
BT-BR(1Mbps)	923.913k	871.925k	872KF1D	920.29k	861.071k
BT-EDR(2Mbps)	1.333M	1.187M	1M19G1D	1.322M	1.183M
BT-EDR(3Mbps)	1.286M	1.194M	1M19G1D	1.279M	1.176M

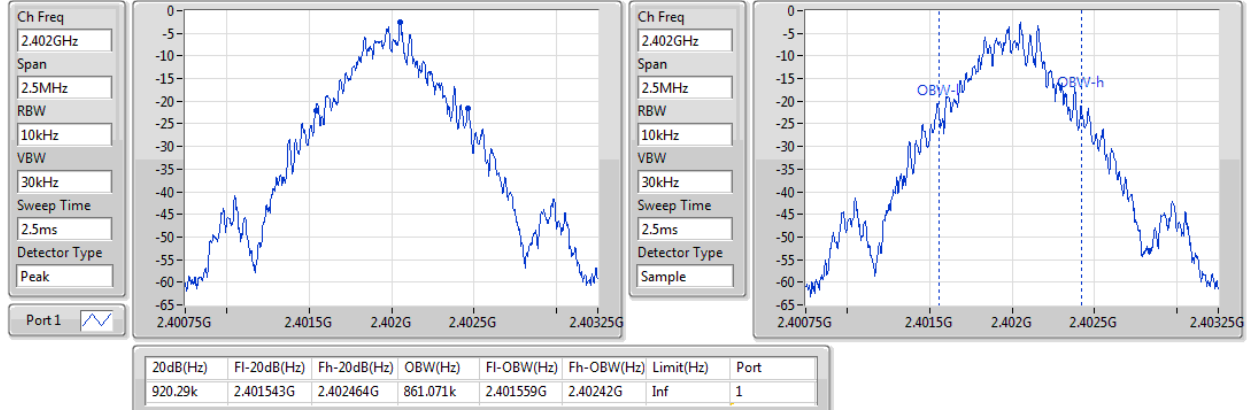
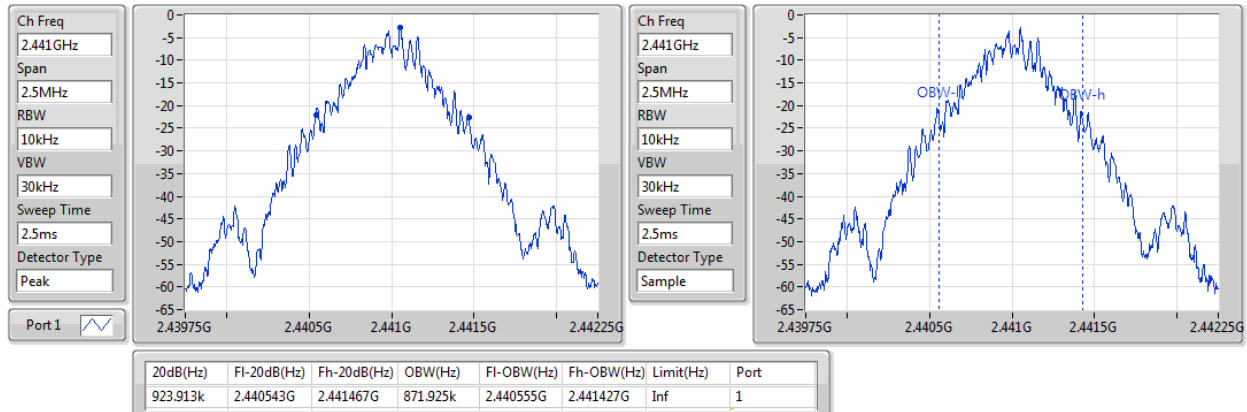
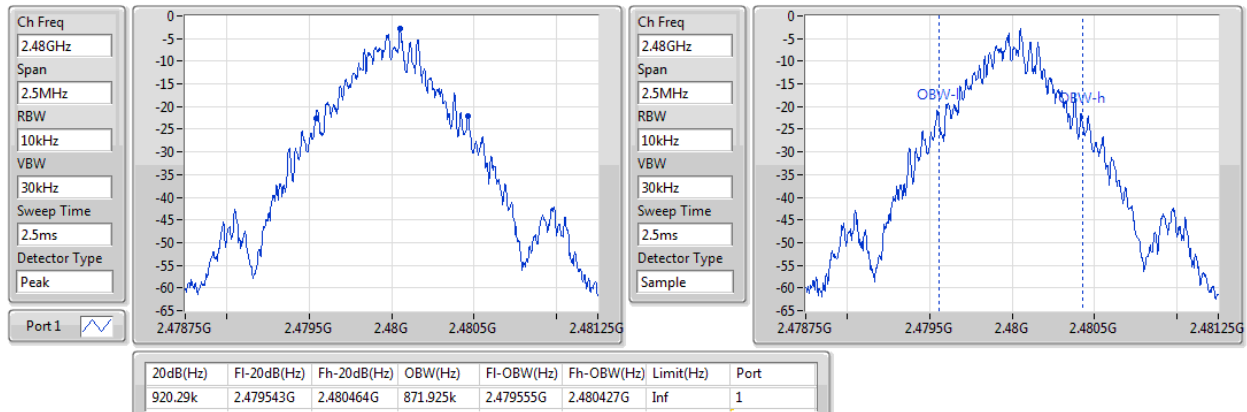
Max-N dB = Maximum 20dB down bandwidth; **Max-OBW** = Maximum 99% occupied bandwidth;

Min-N dB = Minimum 20dB down bandwidth; **Min-OBW** = Minimum 99% occupied bandwidth;

Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
BT-BR(1Mbps)	-	-	-	-
2402MHz	Pass	Inf	920.29k	861.071k
2441MHz	Pass	Inf	923.913k	871.925k
2480MHz	Pass	Inf	920.29k	871.925k
BT-EDR(2Mbps)	-	-	-	-
2402MHz	Pass	Inf	1.322M	1.183M
2441MHz	Pass	Inf	1.333M	1.183M
2480MHz	Pass	Inf	1.326M	1.187M
BT-EDR(3Mbps)	-	-	-	-
2402MHz	Pass	Inf	1.286M	1.183M
2441MHz	Pass	Inf	1.283M	1.194M
2480MHz	Pass	Inf	1.279M	1.176M

Port X-N dB = Port X 20dB down bandwidth; **Port X-OBW** = Port X 99% occupied bandwidth;

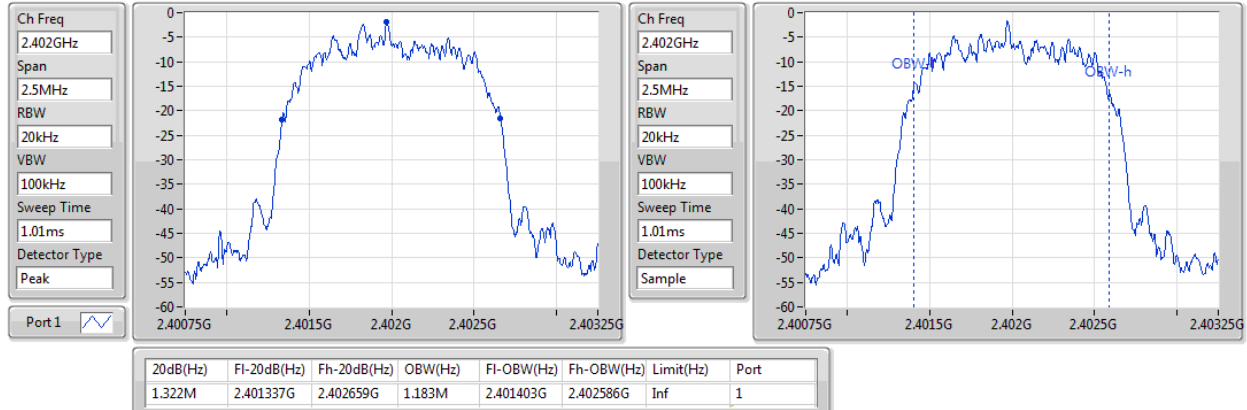
BT-BR(1Mbps)
EBW
2402MHz

BT-BR(1Mbps)
EBW
2441MHz

BT-BR(1Mbps)
EBW
2480MHz




BT-EDR(2Mbps)

EBW

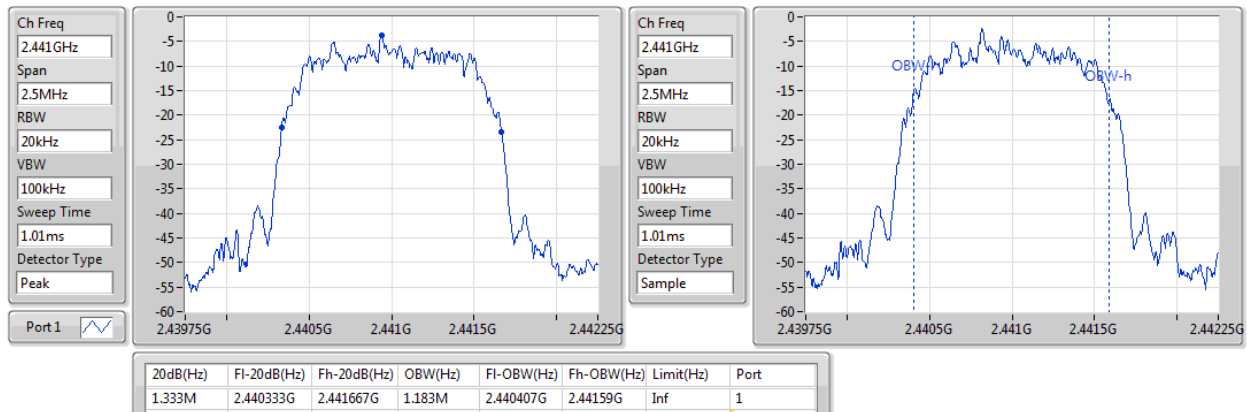
2402MHz



BT-EDR(2Mbps)

EBW

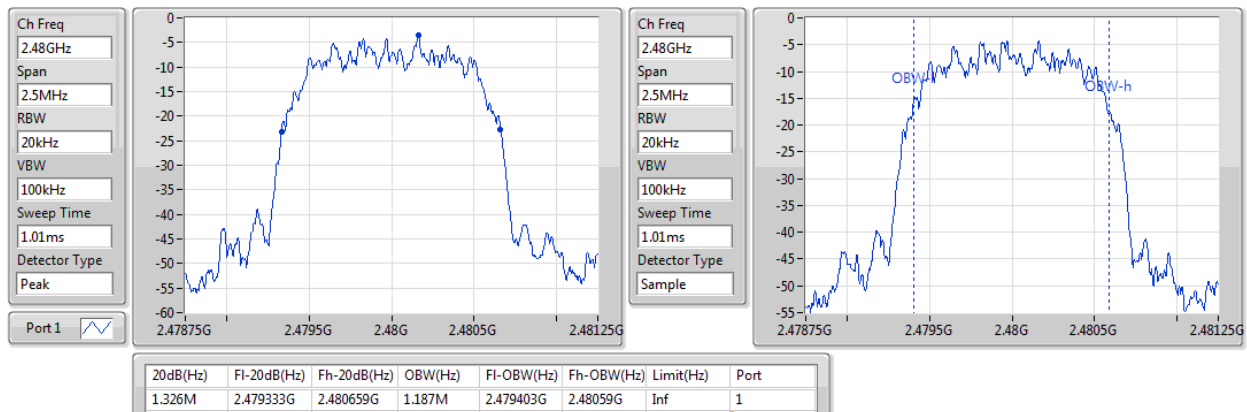
2441MHz



BT-EDR(2Mbps)

EBW

2480MHz

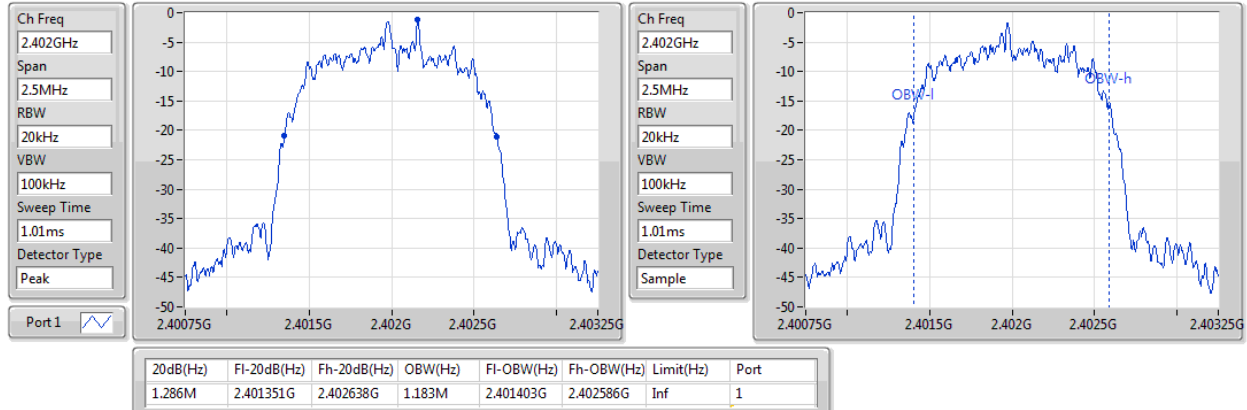




BT-EDR(3Mbps)

EBW

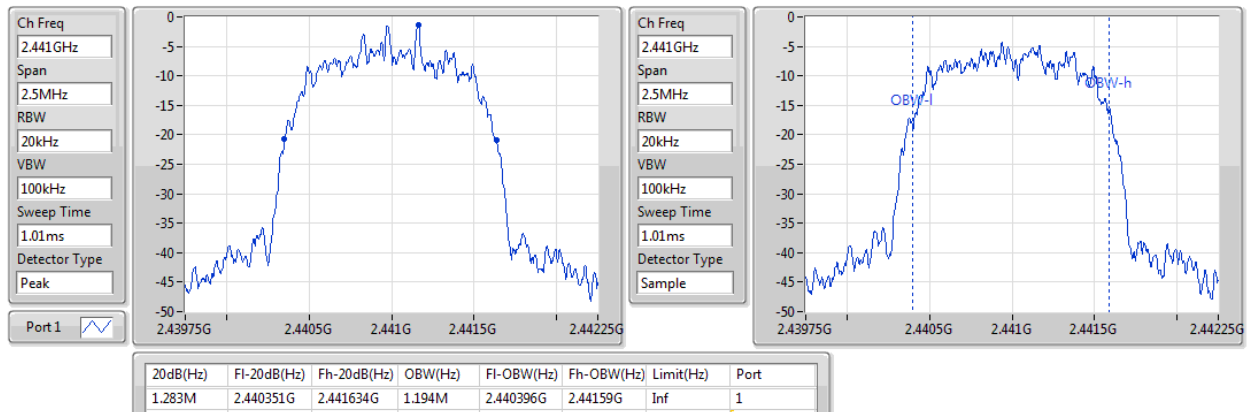
2402MHz



BT-EDR(3Mbps)

EBW

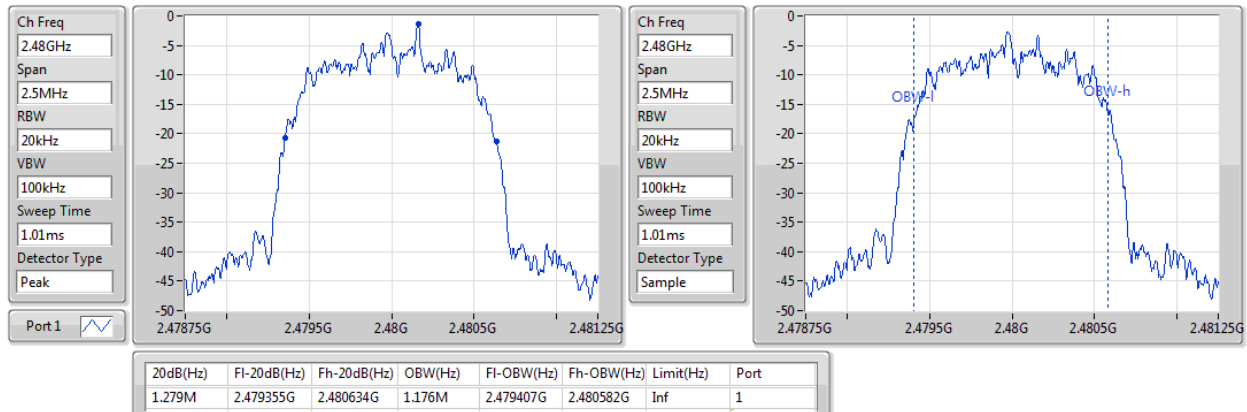
2441MHz



BT-EDR(3Mbps)

EBW

2480MHz



3.5 Output Power Measurement

3.5.1 Limit of Output Power

The maximum peak conducted output power of the intentional radiator shall not exceed the following:
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.

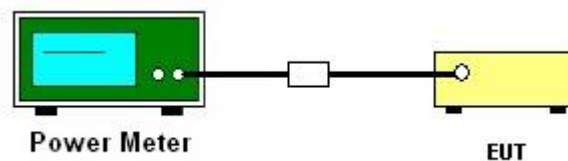
3.5.2 Measuring Instruments

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

Summary

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	3.38	0.00218
BT-EDR(2Mbps)	6.15	0.00412
BT-EDR(3Mbps)	6.46	0.00443

Result

Mode	Result	Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-BR(1Mbps)	-	-	-	-
2402MHz	Pass	1.90	3.38	21.00
2441MHz	Pass	1.90	3.33	21.00
2480MHz	Pass	1.90	3.02	21.00
BT-EDR(2Mbps)	-	-	-	-
2402MHz	Pass	1.90	6.15	21.00
2441MHz	Pass	1.90	6.10	21.00
2480MHz	Pass	1.90	5.77	21.00
BT-EDR(3Mbps)	-	-	-	-
2402MHz	Pass	1.90	6.46	21.00
2441MHz	Pass	1.90	6.41	21.00
2480MHz	Pass	1.90	6.11	21.00

3.5.6 Test Result of Average Output Power (Reporting Only)

Summary

Mode	Power	Power
	(dBm)	(W)
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	3.04	0.00201
BT-EDR(2Mbps)	3.46	0.00222
BT-EDR(3Mbps)	3.47	0.00222

Result

Mode	Result	Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-BR(1Mbps)	-	-	-	-
2402MHz	Pass	1.90	3.04	
2441MHz	Pass	1.90	2.98	
2480MHz	Pass	1.90	2.65	
BT-EDR(2Mbps)	-	-	-	
2402MHz	Pass	1.90	3.46	
2441MHz	Pass	1.90	3.39	
2480MHz	Pass	1.90	3.04	
BT-EDR(3Mbps)	-	-	-	
2402MHz	Pass	1.90	3.47	
2441MHz	Pass	1.90	3.40	
2480MHz	Pass	1.90	3.04	

Note: Average power is for reference only.

3.6 Conducted Band Edge and Spurious Emission Measurement

3.6.1 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.

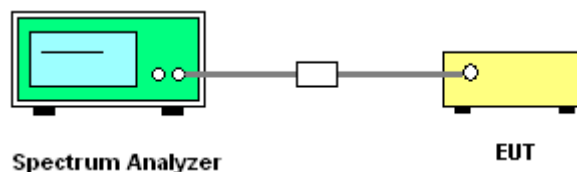
3.6.2 Measuring Instruments

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

3.6.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.6 and 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.

3.6.4 Test Setup



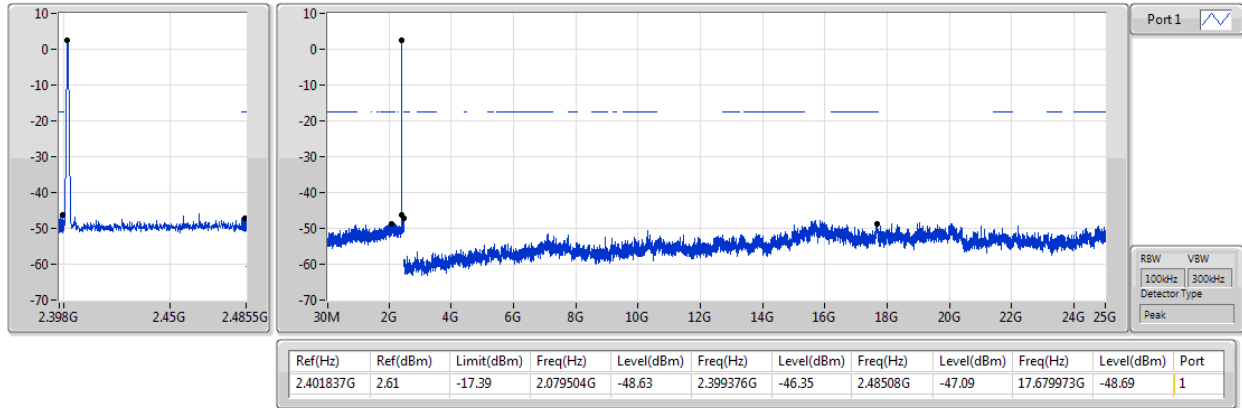
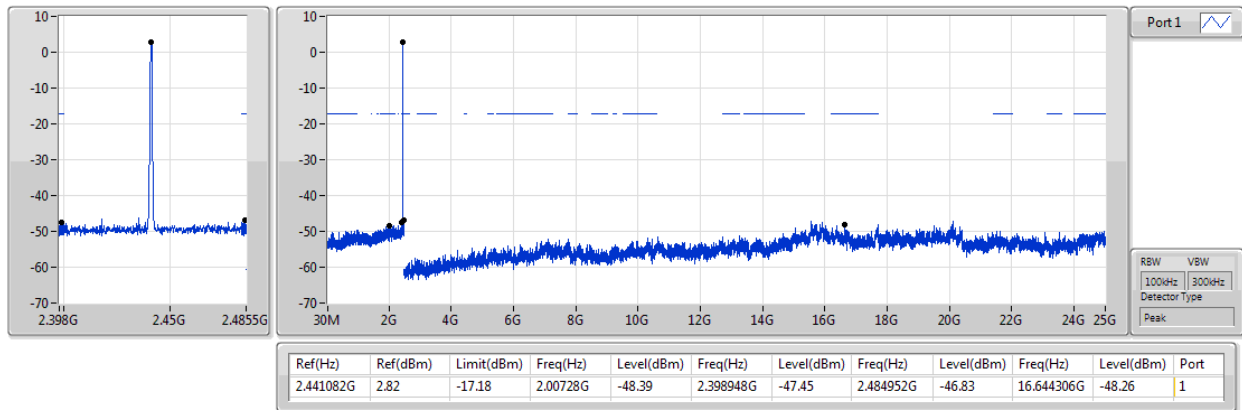
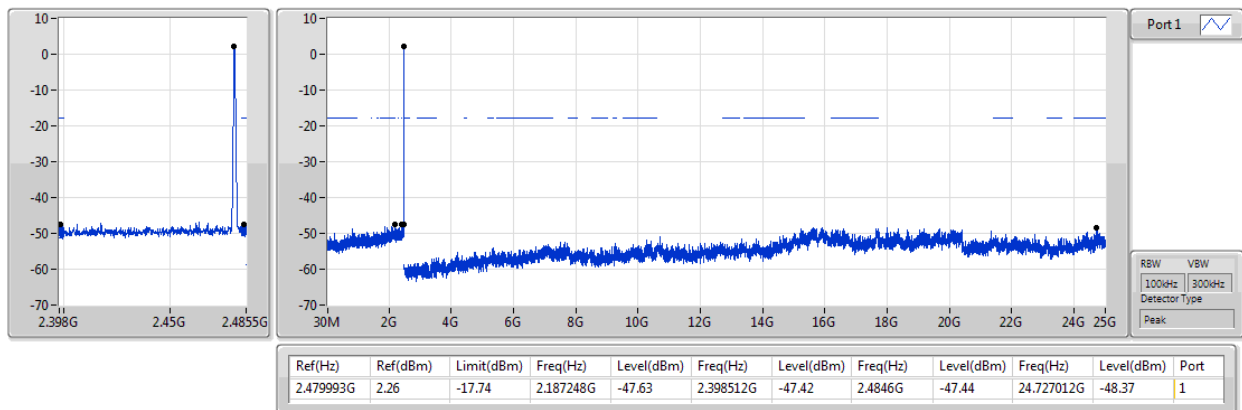
3.6.5 Test Result of Conducted Spurious Emission

Summary

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-	-
BT-BR(1Mbps)	Pass	2.401837G	2.61	-17.39	2.079504G	-48.63	2.399376G	-46.35	2.48508G	-47.09	17.679973G	-48.69	1
BT-EDR(2Mbps)	Pass	2.479826G	2.24	-17.76	2.175408G	-48.08	2.398176G	-47.77	2.485032G	-46.94	15.262479G	-47.94	1
BT-EDR(3Mbps)	Pass	2.402004G	3.09	-16.91	2.394448G	-48.54	2.39964G	-44.30	2.48452G	-46.48	15.037334G	-46.91	1

Result

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
BT-BR(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	2.401837G	2.61	-17.39	2.079504G	-48.63	2.399376G	-46.35	2.48508G	-47.09	17.679973G	-48.69	1
2441MHz	Pass	2.441082G	2.82	-17.18	2.00728G	-48.39	2.398948G	-47.45	2.484952G	-46.83	16.644306G	-48.26	1
2480MHz	Pass	2.479993G	2.26	-17.74	2.187248G	-47.63	2.398512G	-47.42	2.4846G	-47.44	24.727012G	-48.37	1
BT-EDR(2Mbps)	-	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	2.402004G	3.40	-16.60	2.118576G	-48.44	2.399984G	-46.45	2.483696G	-47.00	16.236231G	-48.58	1
2441MHz	Pass	2.440915G	3.14	-16.86	1.967024G	-48.05	2.398108G	-47.05	2.4839G	-47.14	17.657459G	-48.14	1
2480MHz	Pass	2.479826G	2.24	-17.76	2.175408G	-48.08	2.398176G	-47.77	2.485032G	-46.94	15.262479G	-47.94	1
BT-EDR(3Mbps)	-	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	2.402004G	3.09	-16.91	2.394448G	-48.54	2.39964G	-44.30	2.48452G	-46.48	15.037334G	-46.91	1
2441MHz	Pass	2.441249G	3.14	-16.86	2.124496G	-48.43	2.398348G	-46.98	2.485152G	-46.89	17.618058G	-47.94	1
2480MHz	Pass	2.48016G	2.24	-17.76	2.086608G	-48.14	2.398316G	-47.07	2.483768G	-46.69	17.65183G	-48.45	1

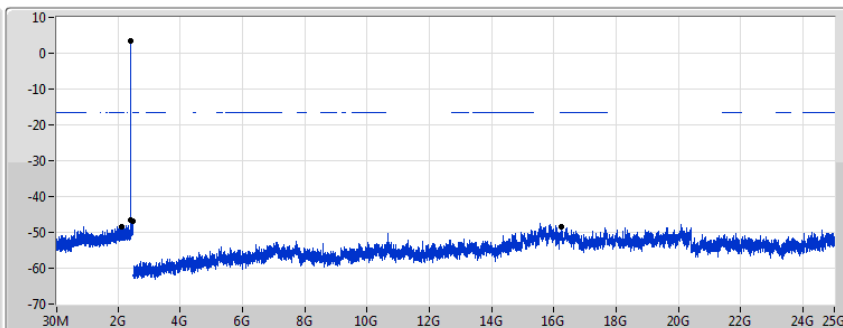
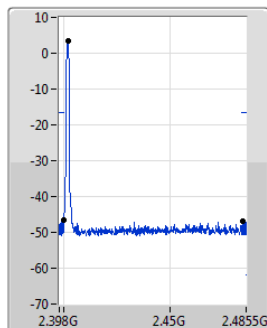
BT-BR(1Mbps)
CSE NdB
2402MHz

BT-BR(1Mbps)
CSE NdB
2441MHz

BT-BR(1Mbps)
CSE NdB
2480MHz




BT-EDR(2Mbps)

CSE NdB

2402MHz



Port1

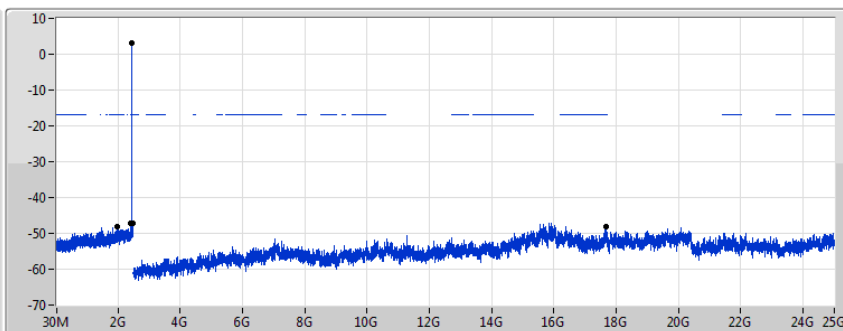
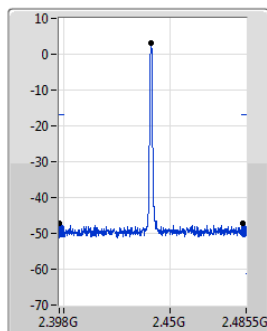
RBW VSW
100kHz 300kHz
Detector Type
Peak

Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.402004G	3.40	-16.60	2.118576G	-48.44	2.399984G	-46.45	2.483696G	-47.00	16.236231G	-48.58	1

BT-EDR(2Mbps)

CSE NdB

2441MHz



Port1

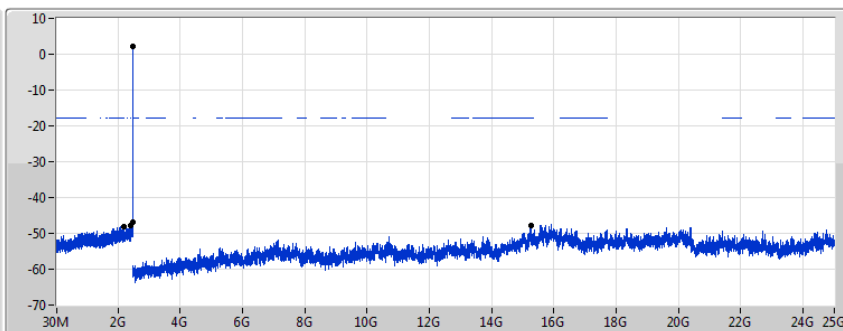
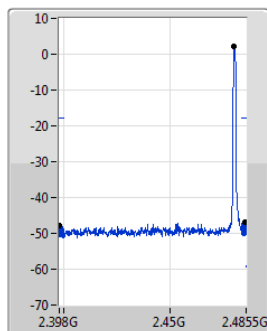
RBW VSW
100kHz 300kHz
Detector Type
Peak

Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.440915G	3.14	-16.86	1.967024G	-48.05	2.398108G	-47.05	2.4839G	-47.14	17.657459G	-48.14	1

BT-EDR(2Mbps)

CSE NdB

2480MHz



Port1

RBW VSW
100kHz 300kHz
Detector Type
Peak

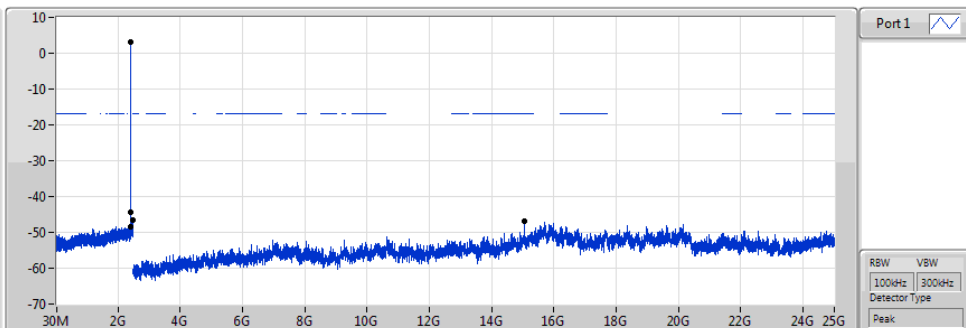
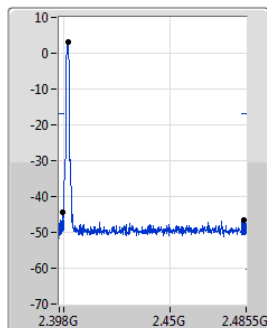
Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.479826G	2.24	-17.76	2.175408G	-48.08	2.398176G	-47.77	2.485032G	-46.94	15.262479G	-47.94	1



BT-EDR(3Mbps)

CSE NdB

2402MHz

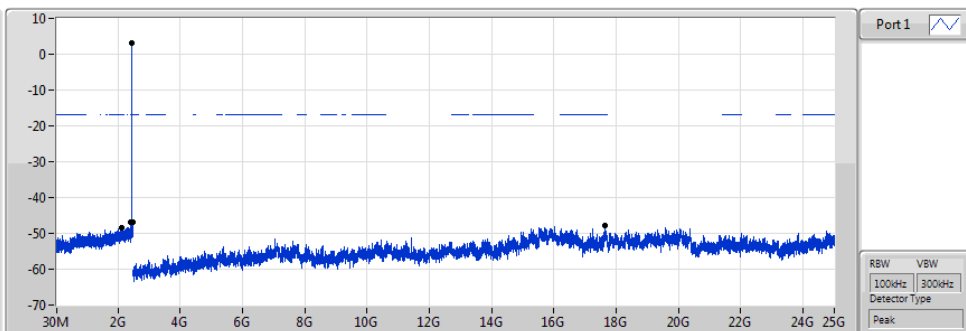
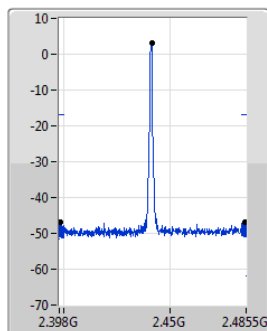


Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.402004G	3.09	-16.91	2.394448G	-48.54	2.39964G	-44.30	2.48452G	-46.48	15.037334G	-46.91	1

BT-EDR(3Mbps)

CSE NdB

2441MHz

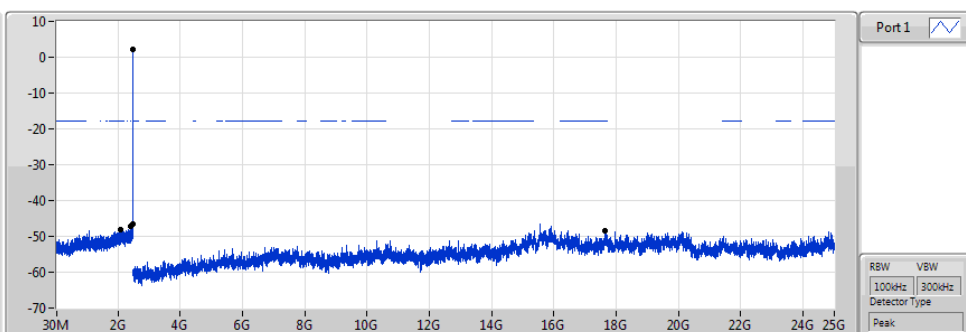
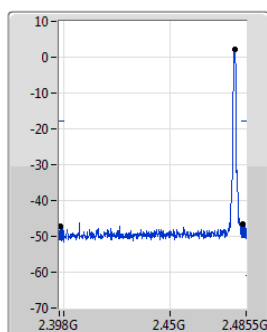


Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.441249G	3.14	-16.86	2.124496G	-48.43	2.398348G	-46.98	2.485152G	-46.89	17.618058G	-47.94	1

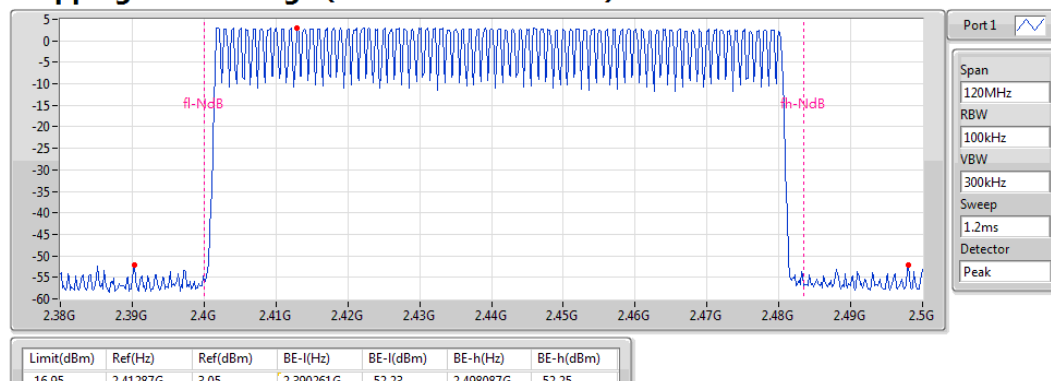
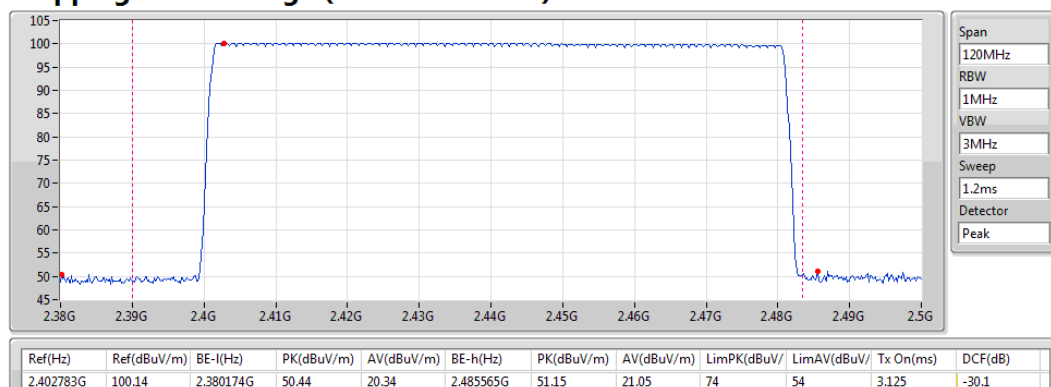
BT-EDR(3Mbps)

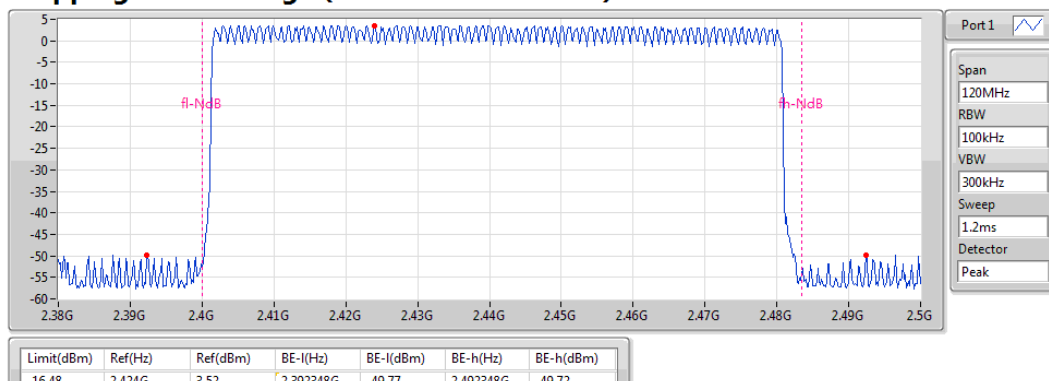
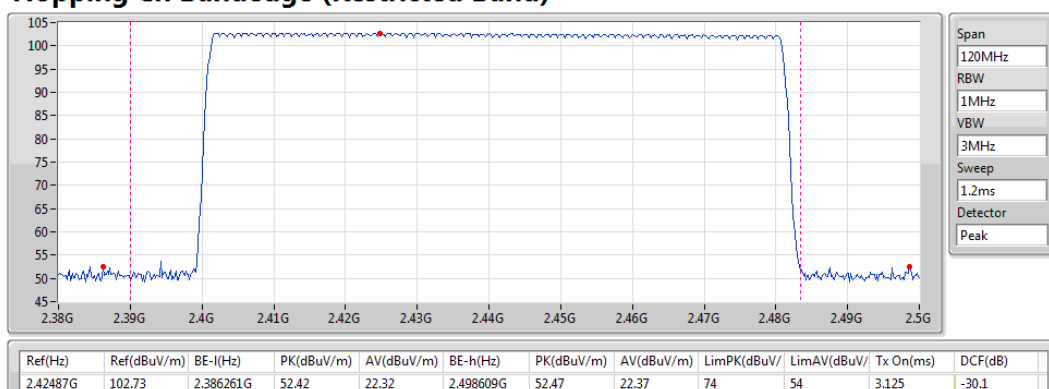
CSE NdB

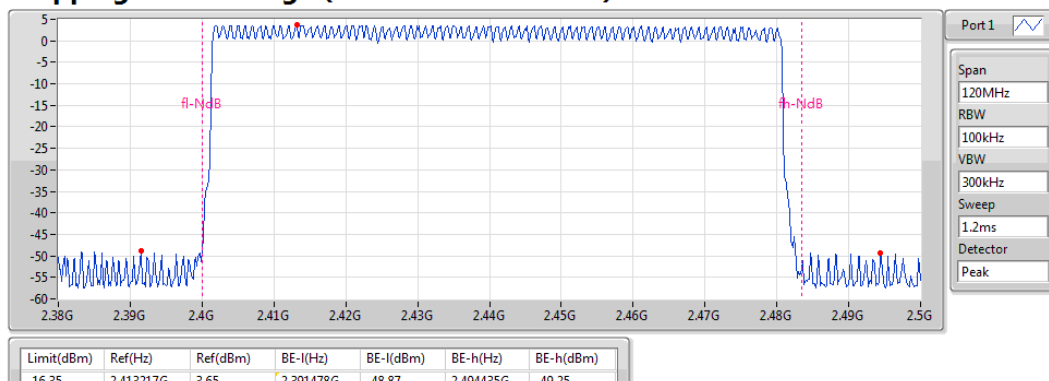
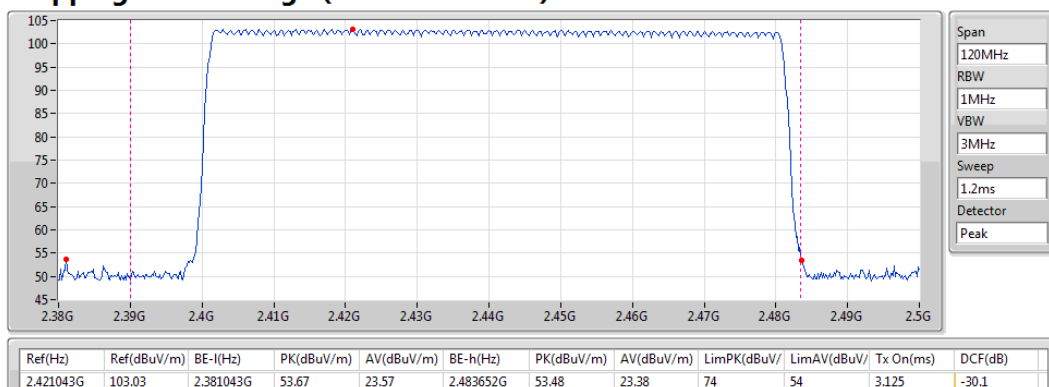
2480MHz



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.48016G	2.24	-17.76	2.086608G	-48.14	2.398316G	-47.07	2.483768G	-46.69	17.65183G	-48.45	1

BT-BR(1Mbps)
2441MHz
Hopping Ch Bandedge (Non-restricted Band)

BT-BR(1Mbps)
2441MHz
Hopping Ch Bandedge (Restricted Band)


BT-EDR(2Mbps)
2441MHz
Hopping Ch Bandedge (Non-restricted Band)

BT-EDR(2Mbps)
2441MHz
Hopping Ch Bandedge (Restricted Band)


BT-EDR(3Mbps)
2441MHz
Hopping Ch Bandedge (Non-restricted Band)

BT-EDR(3Mbps)
2441MHz
Hopping Ch Bandedge (Restricted Band)


3.7 Radiated Band Edges and Spurious Emission Measurement

3.7.1 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 NCC LP0002 section 2.8 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

3.7.2 Measuring Instruments

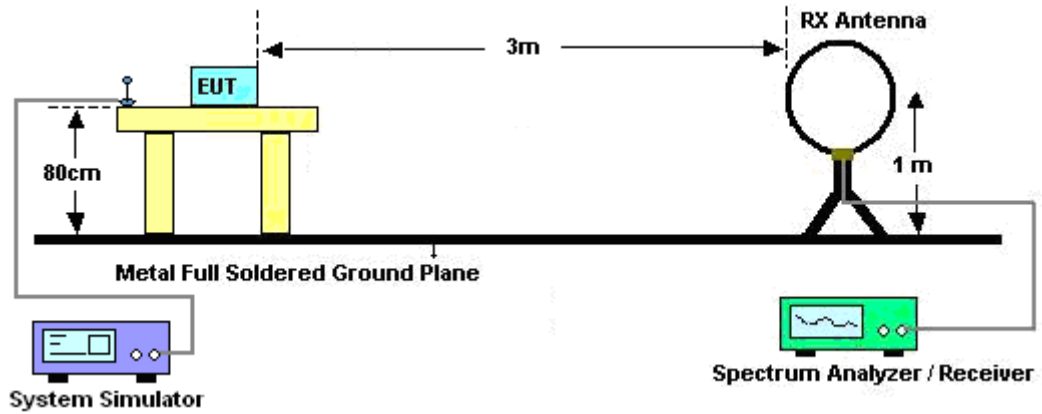
The measuring equipment is listed in the section 4 of this test report.

3.7.3 Test Procedures

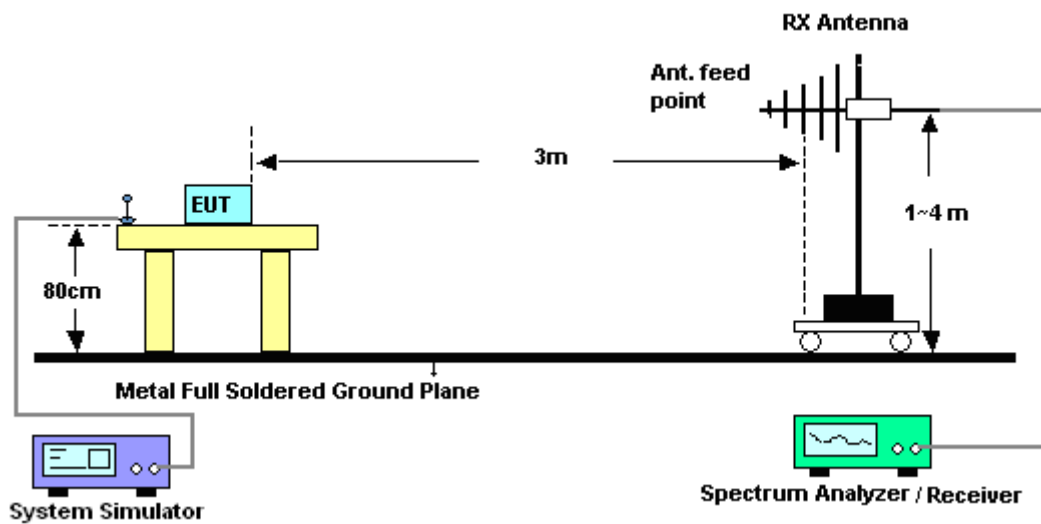
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, 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 $f < 1 \text{ GHz}$, RBW=1MHz for $f > 1\text{GHz}$; 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
The DH5 packet can cover up to 5 time slots. Operate DH5 at maximum dwell time and maximum duty cycle. A maximum length packet has duration of 5 time slots. The hopping rate is 1600 hops/second so the maximum dwell time is 5/1600 seconds, or 3.125ms
Duty factor = $20 * \log(3.125 / 100) = -30.1 \text{ dB}$
Average Emission Level = Peak Emission Level + $20*\log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.
7. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.7.4 Test Setup

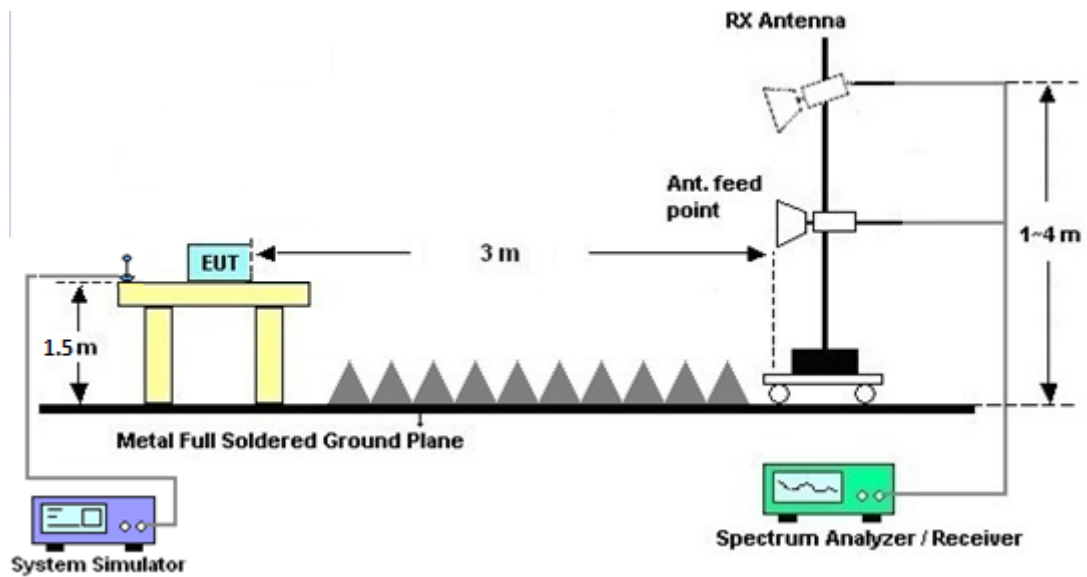
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz

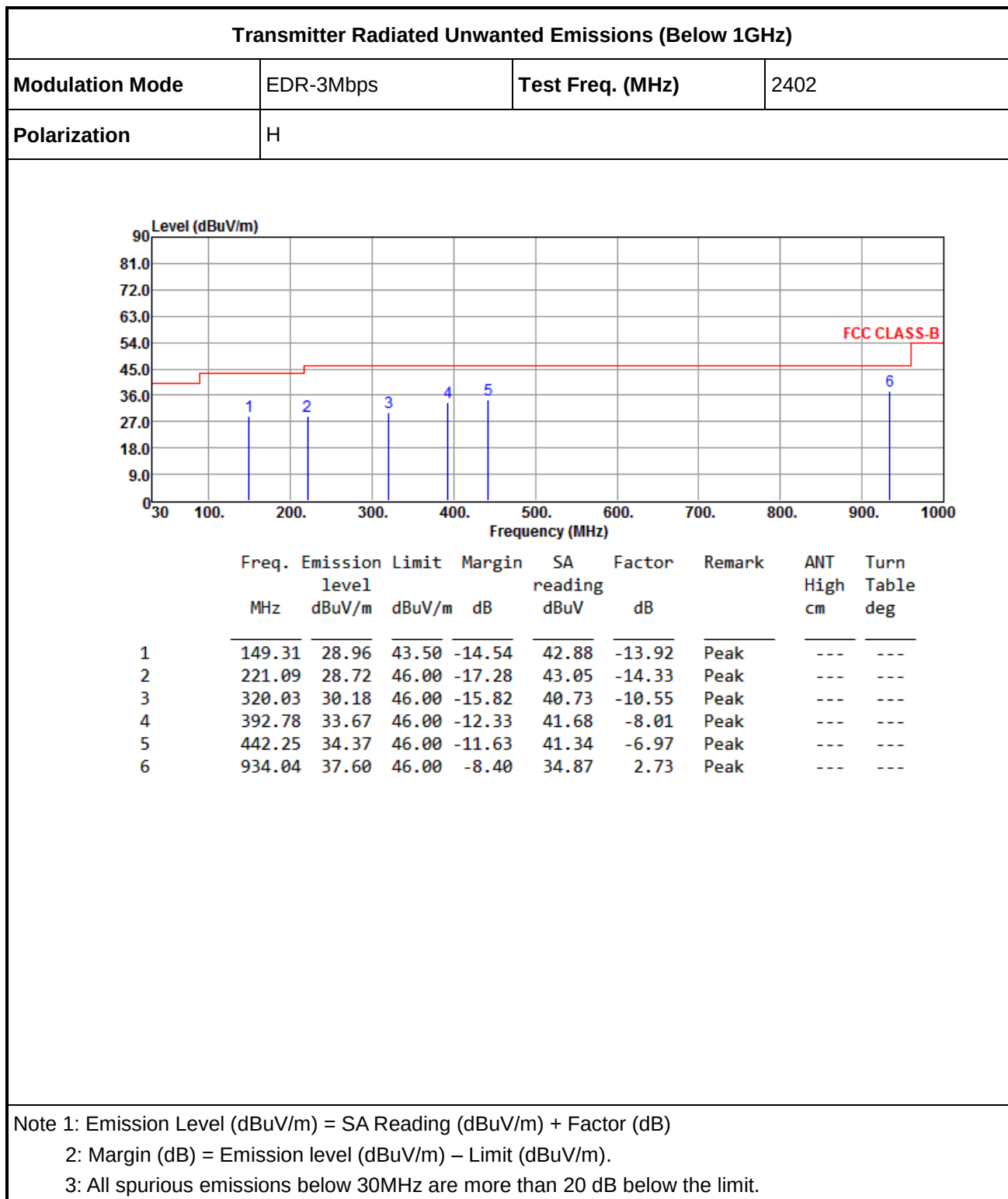


3.7.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

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 NCC LP0002 section 5.13 was not reported.

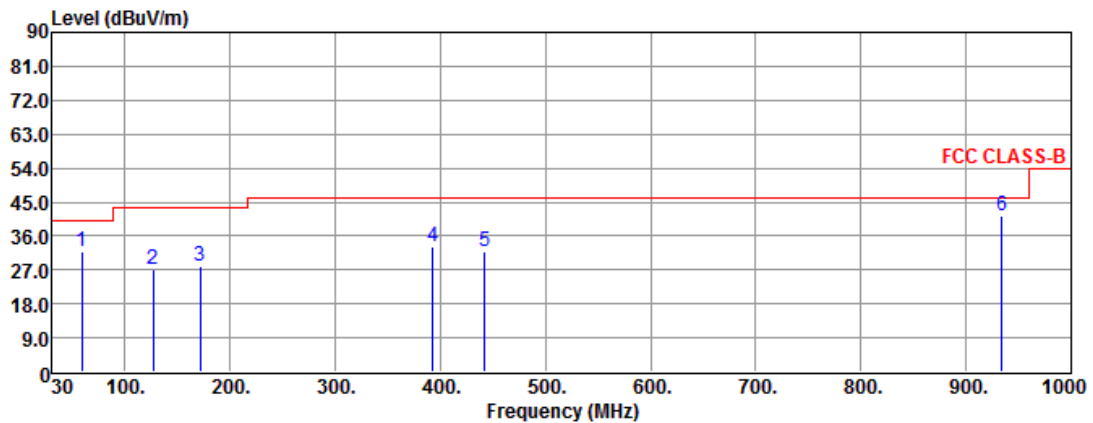
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.7.6 Test Result of Transmitter Radiated Unwanted Emissions (Below 1GHz)



Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation Mode	EDR-3Mbps	Test Freq. (MHz)	2402
Polarization	V		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	59.10	32.01	40.00	-7.99	51.65	-19.64	Peak	---	---
2	127.00	27.14	43.50	-16.36	40.73	-13.59	Peak	---	---
3	171.62	27.94	43.50	-15.56	43.28	-15.34	Peak	---	---
4	392.78	33.00	46.00	-13.00	41.01	-8.01	Peak	---	---
5	442.25	31.72	46.00	-14.28	38.69	-6.97	Peak	---	---
6	934.04	41.27	46.00	-4.73	38.54	2.73	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor (dB)

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

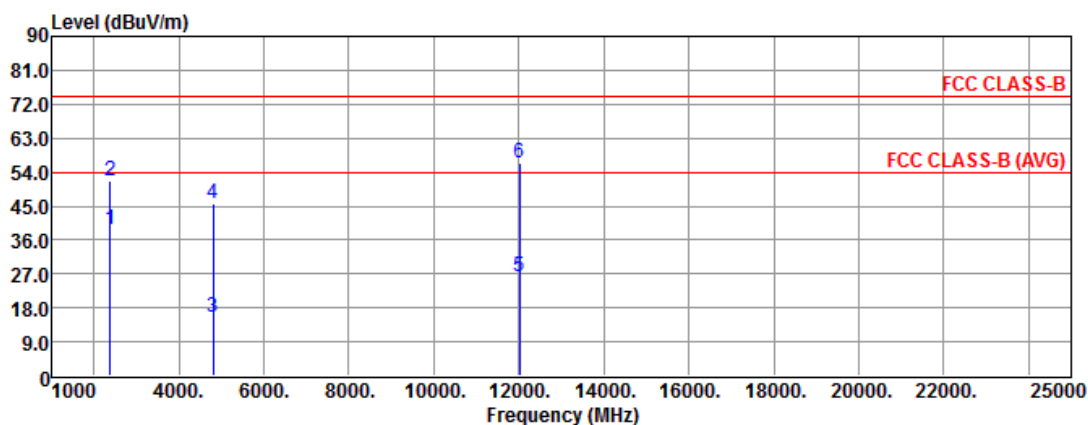
3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.7.7 Test Result of Transmitter Radiated Unwanted Emissions (Above 1GHz)

Transmitter Radiated Unwanted Emissions (Above 1GHz)									
Modulation Mode	EDR-3Mbps				Test Freq. (MHz)	2402			
Operating Function	Transmit				Polarization	H			
Level (dBUV/m) <									

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	EDR-3Mbps	Test Freq. (MHz)	2402
Operating Function	Transmit	Polarization	V

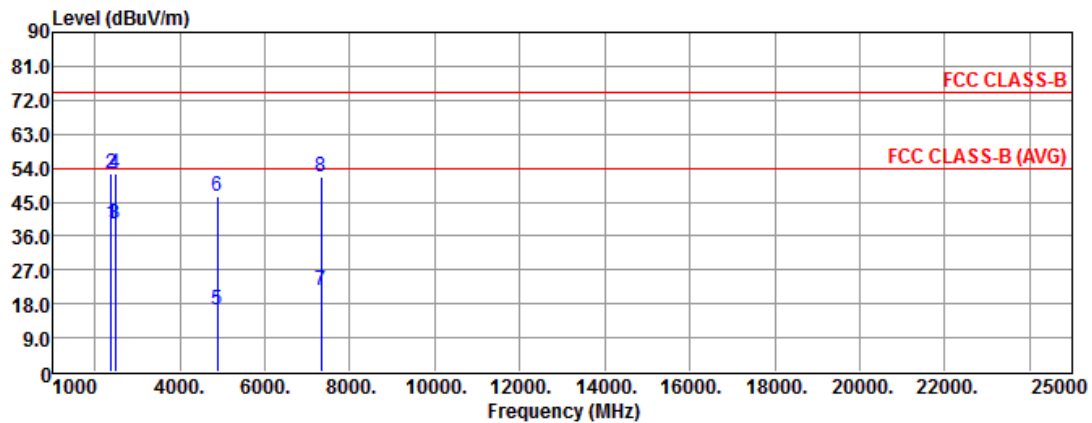


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	38.86	54.00	-15.14	36.54	2.32	Average	100	343
2	2390.00	51.68	74.00	-22.32	49.36	2.32	Peak	100	343
3	4804.00	15.69	54.00	-38.31	6.53	9.16	Average	100	132
4	4804.00	45.79	74.00	-28.21	36.63	9.16	Peak	100	132
5	12010.00	26.11	54.00	-27.89	5.08	21.03	Average	100	105
6	12010.00	56.21	74.00	-17.79	35.18	21.03	Peak	100	105

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).
 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	EDR-3Mbps	Test Freq. (MHz)	2441
Operating Function	Transmit	Polarization	H



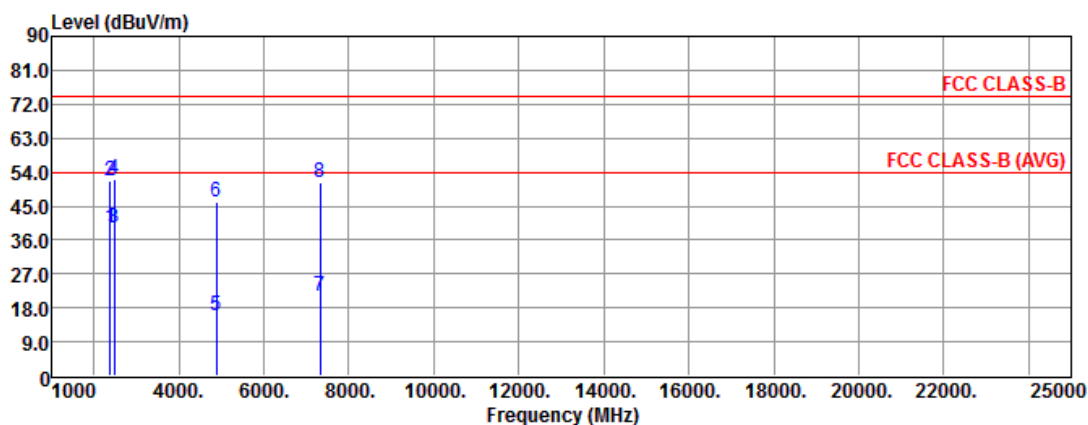
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	39.12	54.00	-14.88	36.80	2.32	Average	100	118
2	2390.00	52.65	74.00	-21.35	50.33	2.32	Peak	100	118
3	2483.50	39.04	54.00	-14.96	36.32	2.72	Average	100	118
4	2483.50	52.40	74.00	-21.60	49.68	2.72	Peak	100	118
5	4882.00	16.32	54.00	-37.68	6.77	9.55	Average	100	303
6	4882.00	46.42	74.00	-27.58	36.87	9.55	Peak	100	303
7	7323.00	21.65	54.00	-32.35	5.97	15.68	Average	100	129
8	7323.00	51.75	74.00	-22.25	36.07	15.68	Peak	100	129

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	EDR-3Mbps	Test Freq. (MHz)	2441
Operating Function	Transmit	Polarization	V

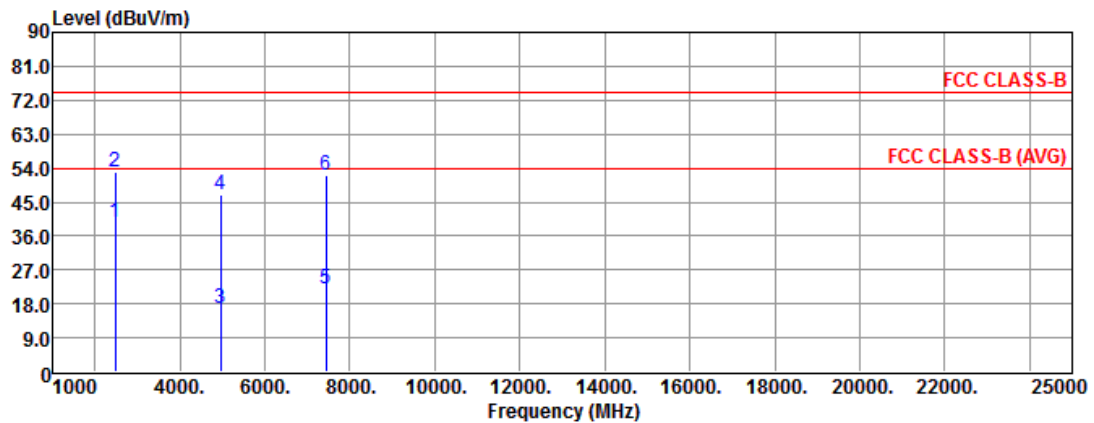


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	39.09	54.00	-14.91	36.77	2.32	Average	116	350
2	2390.00	51.67	74.00	-22.33	49.35	2.32	Peak	116	350
3	2483.50	39.02	54.00	-14.98	36.30	2.72	Average	116	350
4	2483.50	52.10	74.00	-21.90	49.38	2.72	Peak	116	350
5	4882.00	15.92	54.00	-38.08	6.37	9.55	Average	100	125
6	4882.00	46.02	74.00	-27.98	36.47	9.55	Peak	100	125
7	7323.00	21.29	54.00	-32.71	5.61	15.68	Average	100	105
8	7323.00	51.39	74.00	-22.61	35.71	15.68	Peak	100	105

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).
 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	EDR-3Mbps	Test Freq. (MHz)	2480
Operating Function	Transmit	Polarization	H



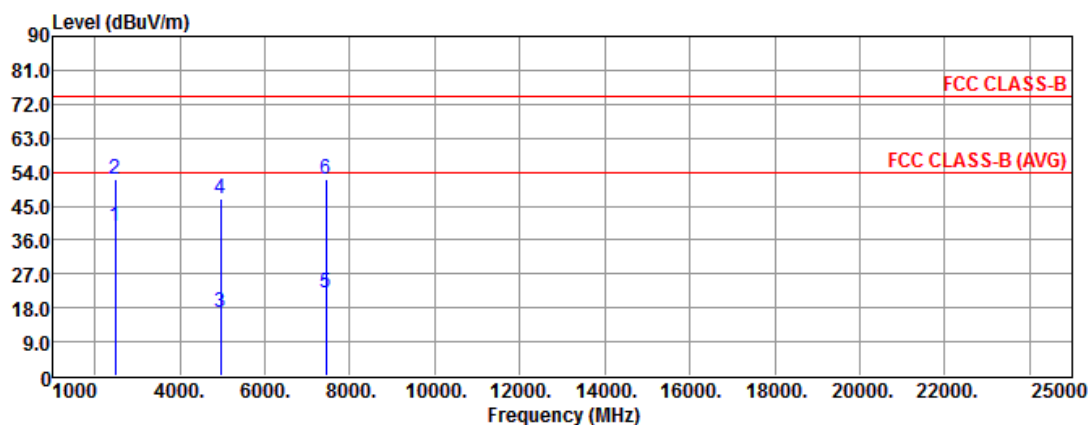
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	39.74	54.00	-14.26	37.02	2.72	Average	106	85
2	2483.50	52.87	74.00	-21.13	50.15	2.72	Peak	106	85
3	4960.00	16.72	54.00	-37.28	6.74	9.98	Average	100	298
4	4960.00	46.82	74.00	-27.18	36.84	9.98	Peak	100	298
5	7440.00	21.99	54.00	-32.01	6.01	15.98	Average	100	153
6	7440.00	52.09	74.00	-21.91	36.11	15.98	Peak	100	153

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	EDR-3Mbps	Test Freq. (MHz)	2480
Operating Function	Transmit	Polarization	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	39.59	54.00	-14.41	36.87	2.72	Average	100	347
2	2483.50	52.21	74.00	-21.79	49.49	2.72	Peak	100	347
3	4960.00	16.67	54.00	-37.33	6.69	9.98	Average	100	136
4	4960.00	46.77	74.00	-27.23	36.79	9.98	Peak	100	136
5	7440.00	21.80	54.00	-32.20	5.82	15.98	Average	100	185
6	7440.00	51.90	74.00	-22.10	35.92	15.98	Peak	100	185

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).
 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

3.8 Test of Receiver Radiated Emission Measurement

3.8.1 Limit of Receiver Radiated Emission

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

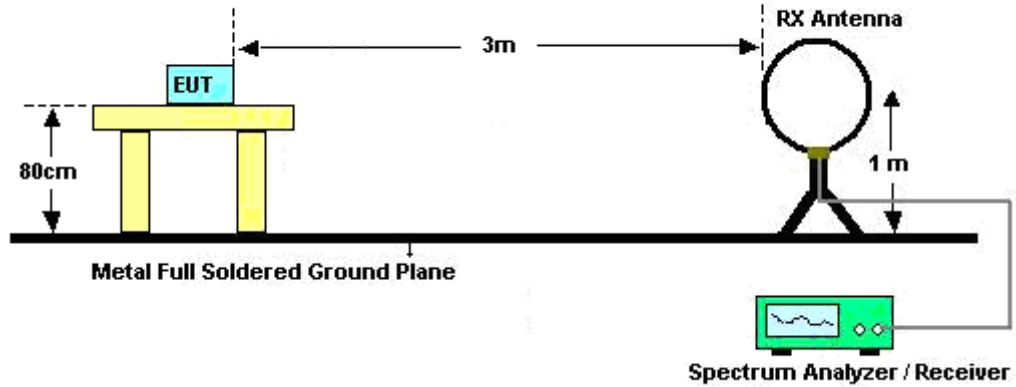
The measuring equipment is listed in the section 4 of this test report.

3.8.3 Test Procedures

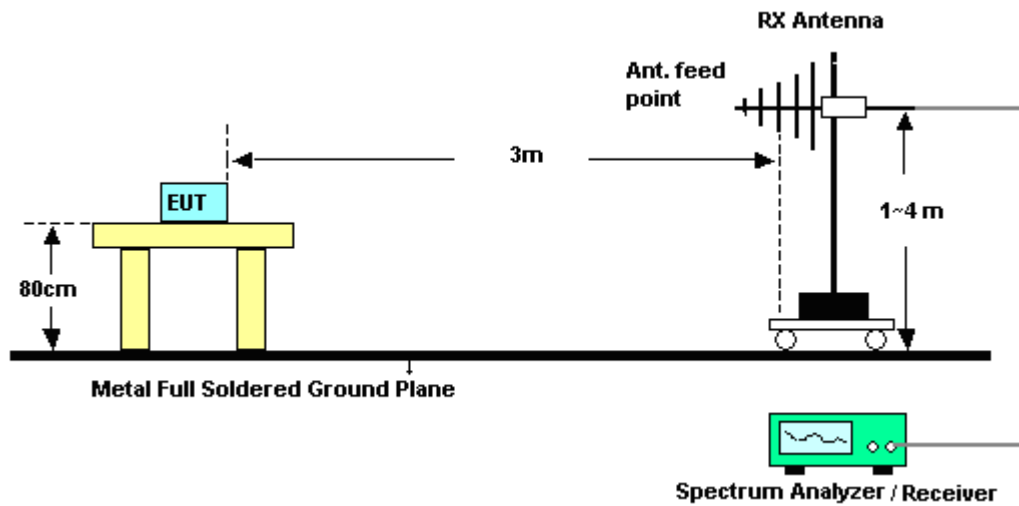
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The EUT was set 10 meters instead of 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower for frequency from 30MHz to 1GHz.
4. The table was rotated 360 degrees to determine the position of the highest radiation.
5. The antenna is a Bi-Log antenna and its height is adjusted between one to four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
6. 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.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120kHz/VBW=300kHz for frequency below 1GHz; RBW=1MHz VBW=3MHz (Peak), RBW=1MHz/VBW=10Hz (Average) for frequency above 1GHz).
8. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.
9. Emission level (dBμV/m) = 20 log Emission level (μV/m)
10. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

3.8.4 Test Setup

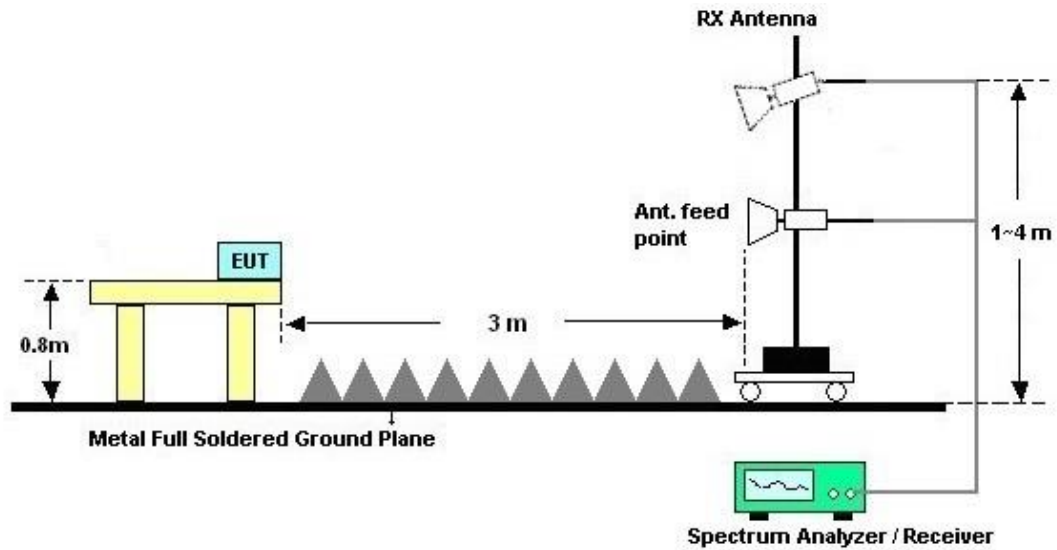
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz

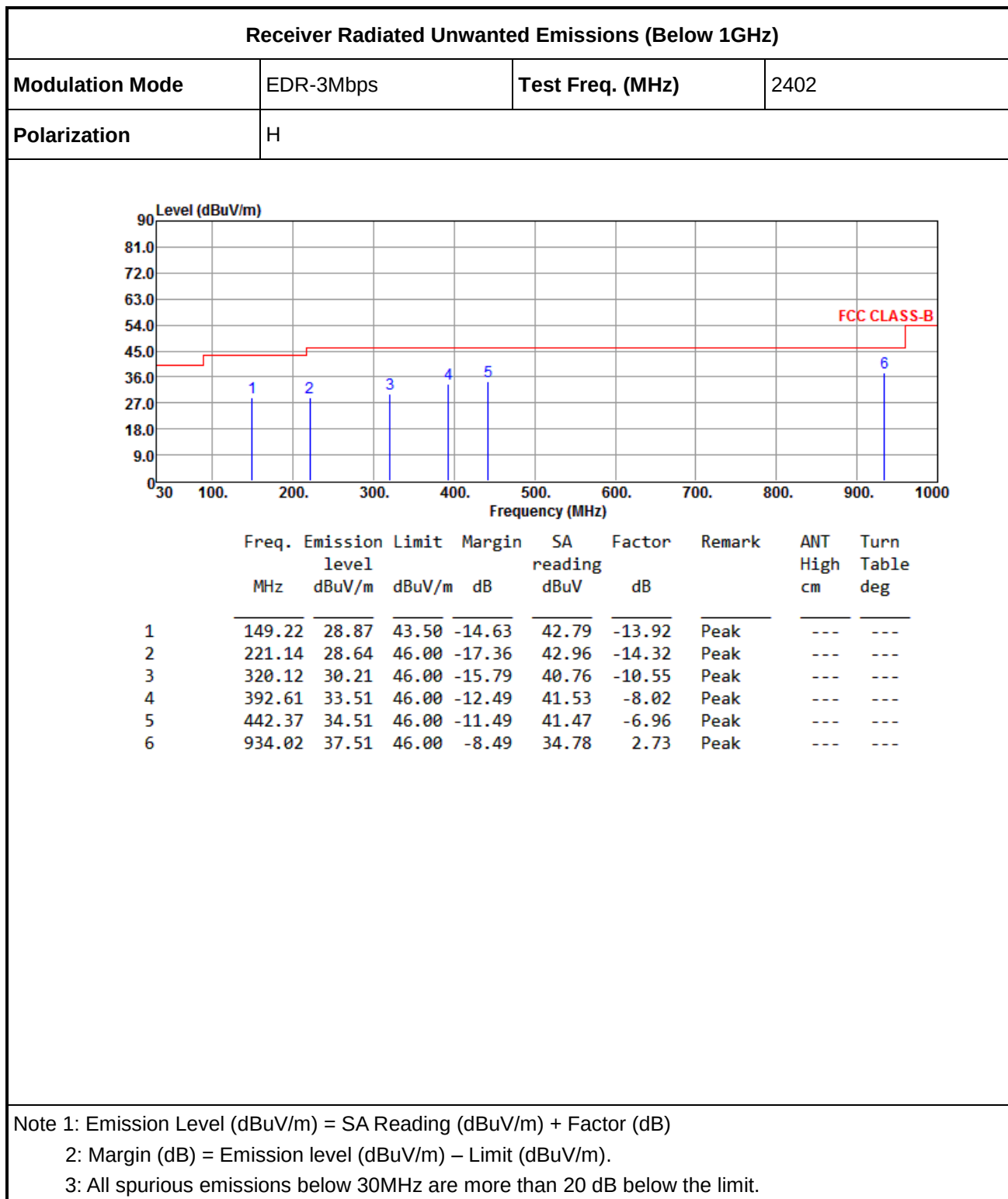


3.8.5 Test Result of Receiver Radiated Spurious Emissions (9kHz ~ 30MHz)

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 NCC LP0002 clause 5.13 was not reported.

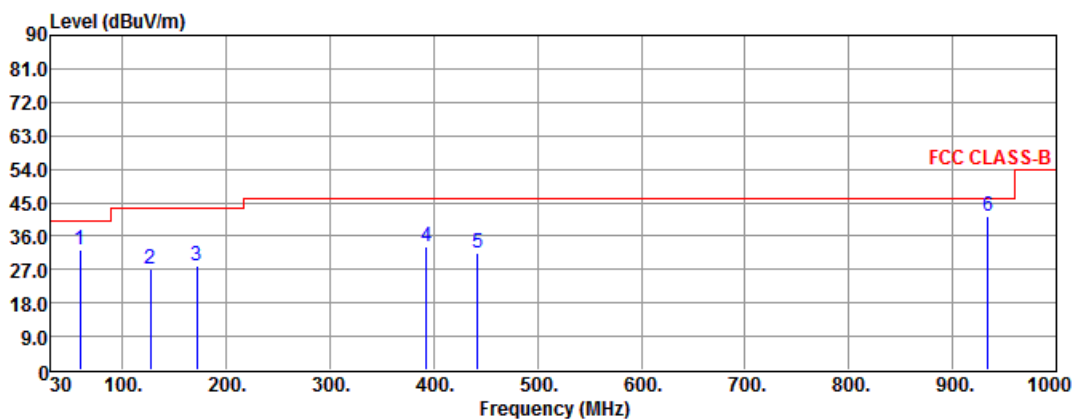
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.8.6 Test Result of Receiver Radiated Spurious Emission (Below 1GHz)



Receiver Radiated Unwanted Emissions (Below 1GHz)

Modulation Mode	EDR-3Mbps	Test Freq. (MHz)	2402
Polarization	V		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	59.21	32.16	40.00	-7.84	51.80	-19.64	Peak	---	---
2	127.02	27.29	43.50	-16.21	40.88	-13.59	Peak	---	---
3	171.55	27.81	43.50	-15.69	43.14	-15.33	Peak	---	---
4	392.66	33.13	46.00	-12.87	41.15	-8.02	Peak	---	---
5	442.31	31.64	46.00	-14.36	38.61	-6.97	Peak	---	---
6	934.08	41.15	46.00	-4.85	38.41	2.74	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor (dB)

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

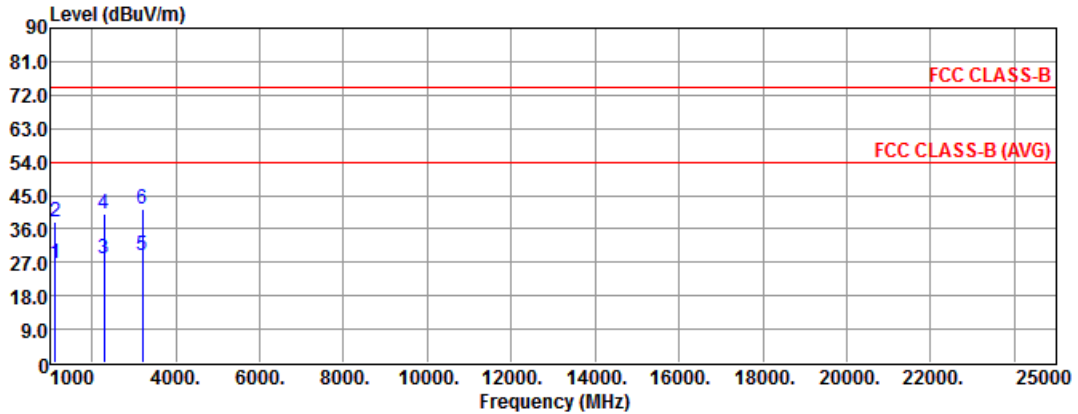
3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.8.7 Test Result of Receiver Radiated Unwanted Emissions (Above 1GHz)

Receiver Radiated Unwanted Emissions (Above 1GHz)									
Modulation Mode	EDR-3Mbps			Test Freq. (MHz)			2402		
Operating Function	Receive			Polarization			H		
Level (dBuV/m) 90 81.0 72.0 63.0 54.0 45.0 36.0 27.0 18.0 9.0 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000 12000 13000 14000 15000 16000 17000 18000 19000 20000 21000 22000 23000 24000 25000 1 2 3 4 5 6 1130.00 2295.00 3200.00 24.94 36.31 28.57 40.19 33.36 42.58 54.00 74.00 54.00 74.00 54.00 74.00 -29.06 -37.69 -25.43 -33.81 -20.64 -31.42 29.61 40.98 26.74 38.36 28.68 37.90 -4.67 -4.67 1.83 1.83 4.68 4.68 Average Peak Average Peak Average Peak 100 100 100 100 215 215 315 315 74 74 102 102 Freq. Emission Limit Margin SA Factor Remark ANT Turn MHz level dBuV/m dB reading dB High Table cm deg 1 2 3 4 5 6 1130.00 2295.00 3200.00 24.94 36.31 28.57 40.19 33.36 42.58 54.00 74.00 54.00 74.00 54.00 74.00 -29.06 -37.69 -25.43 -33.81 -20.64 -31.42 29.61 40.98 26.74 38.36 28.68 37.90 -4.67 -4.67 1.83 1.83 4.68 4.68 Average Peak Average Peak Average Peak 100 100 100 100 215 215 315 315 74 74 102 102 Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB). 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m). </									

Receiver Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	EDR-3Mbps	Test Freq. (MHz)	2402
Operating Function	Receive	Polarization	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1130.00	26.61	54.00	-27.39	31.28	-4.67	Average	146	28
2	1130.00	37.79	74.00	-36.21	42.46	-4.67	Peak	146	28
3	2295.00	28.03	54.00	-25.97	26.20	1.83	Average	100	223
4	2295.00	39.89	74.00	-34.11	38.06	1.83	Peak	100	223
5	3200.00	28.83	54.00	-25.17	24.15	4.68	Average	100	264
6	3200.00	41.38	74.00	-32.62	36.70	4.68	Peak	100	264

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).
 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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.

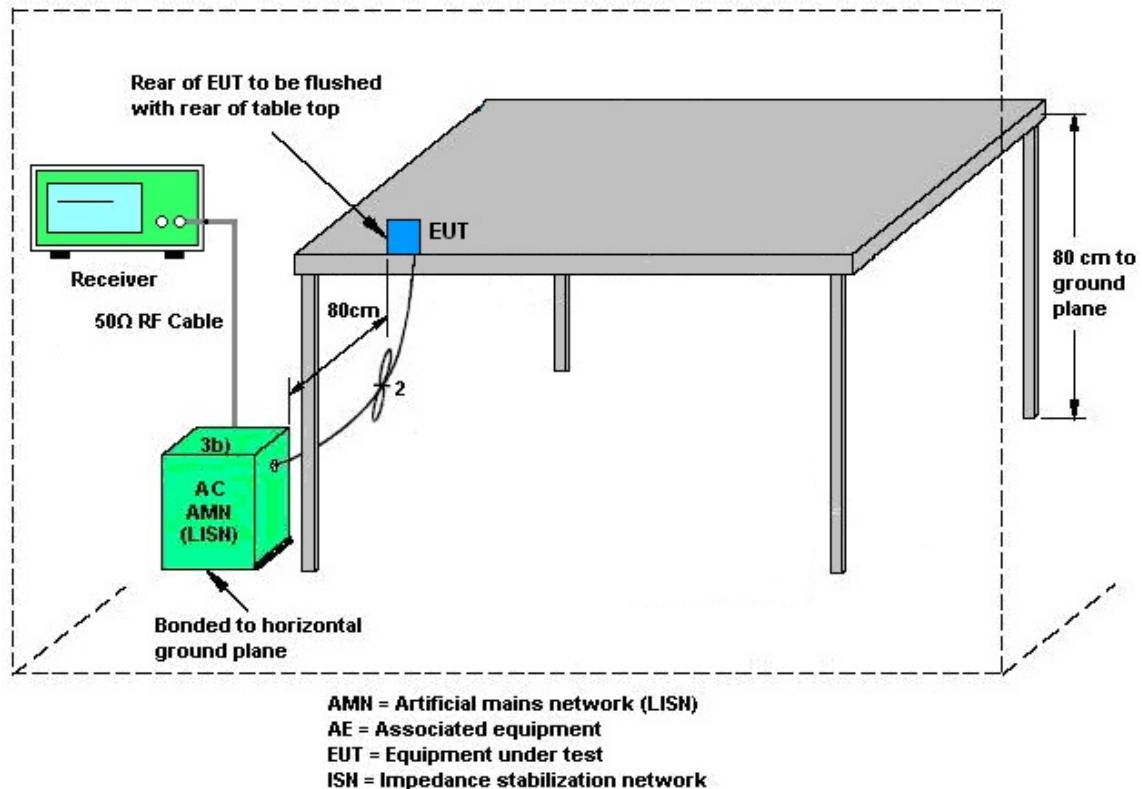
3.9.2 Measuring Instruments

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

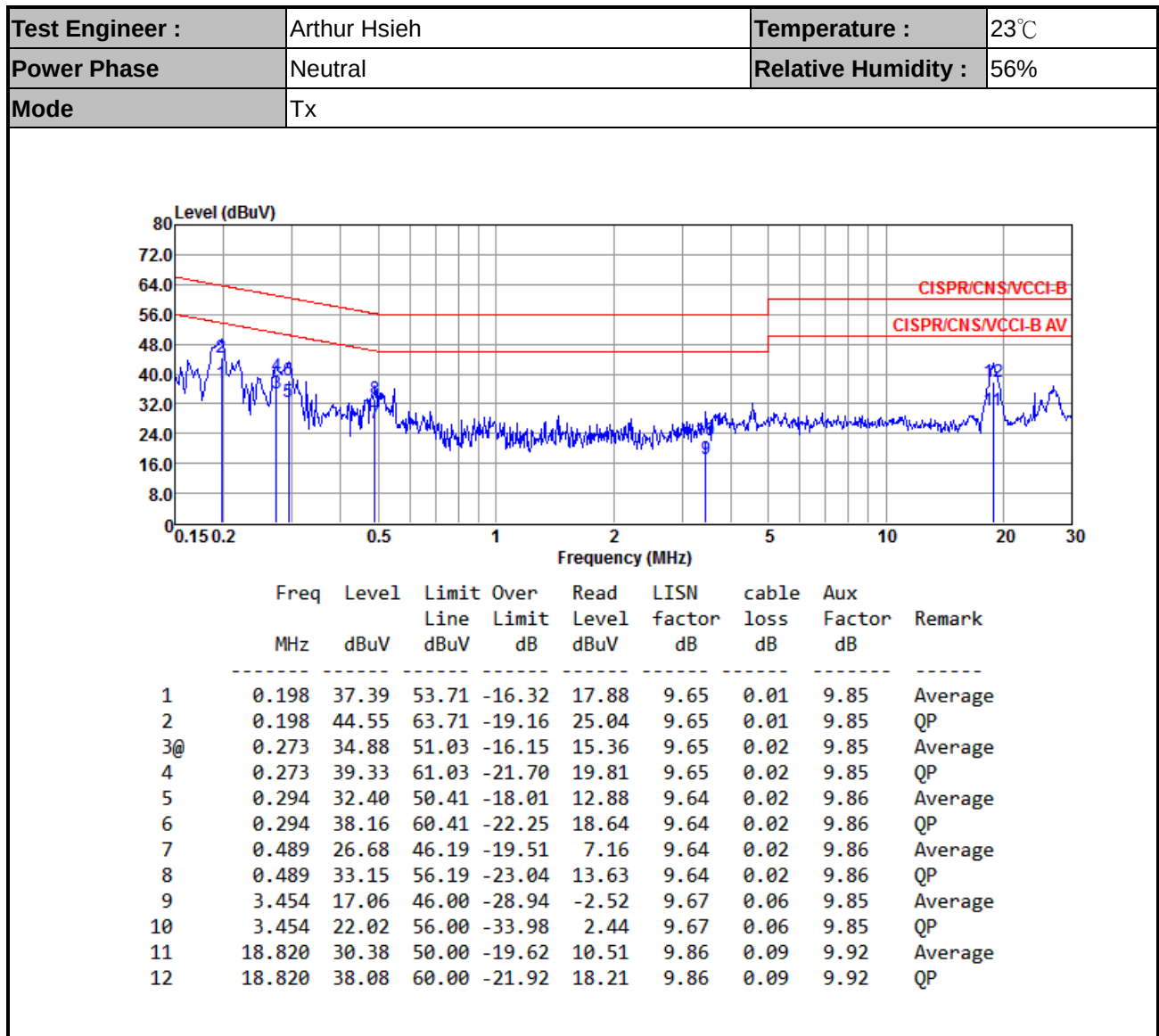
3.9.3 Test Procedures

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.

3.9.4 Test Setup

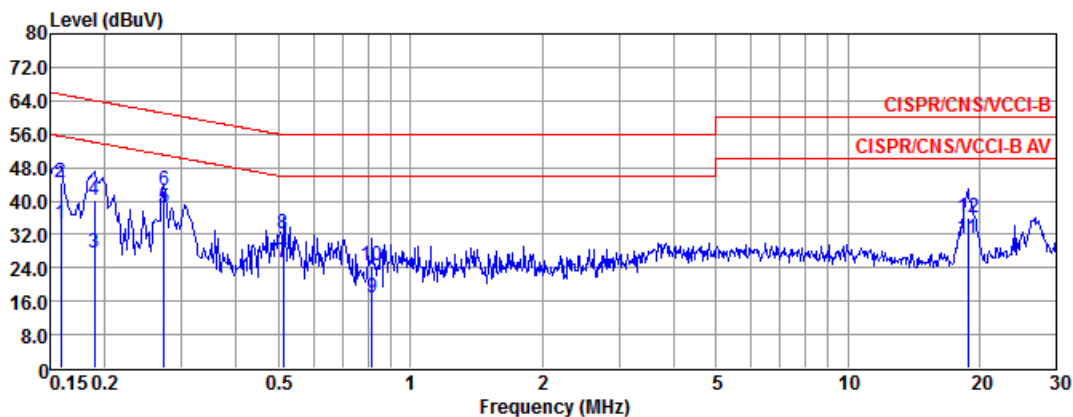


3.9.5 Test Result of AC Conducted Emission





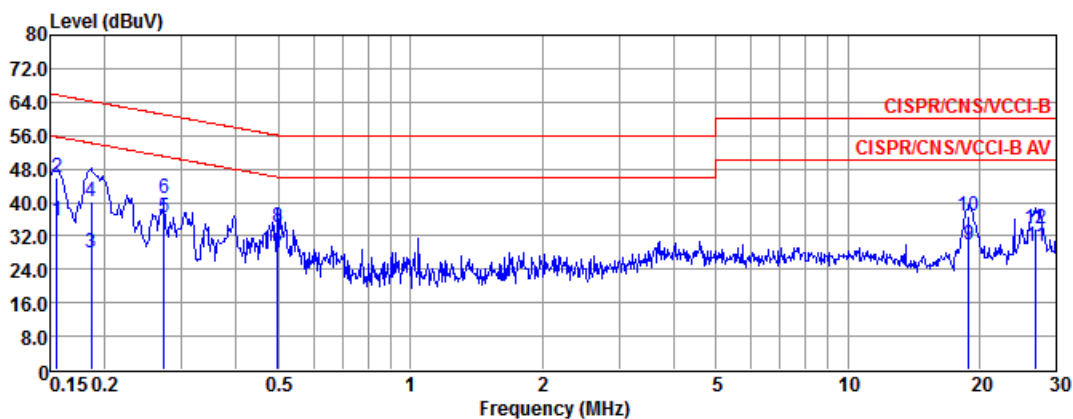
Test Engineer :	Arthur Hsieh	Temperature :	23°C
Power Phase	Line	Relative Humidity :	56%
Mode	Tx		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Aux Factor dB	Remark
1	0.159	34.30	55.52	-21.22	14.78	9.66	0.01	9.85	Average
2	0.159	44.24	65.52	-21.28	24.72	9.66	0.01	9.85	QP
3	0.189	27.39	54.06	-26.67	7.88	9.65	0.01	9.85	Average
4	0.189	40.03	64.06	-24.03	20.52	9.65	0.01	9.85	QP
5	0.273	38.25	51.03	-12.78	18.73	9.65	0.02	9.85	Average
6	0.273	42.67	61.03	-18.36	23.15	9.65	0.02	9.85	QP
7	0.513	25.21	46.00	-20.79	5.68	9.65	0.02	9.86	Average
8	0.513	32.16	56.00	-23.84	12.63	9.65	0.02	9.86	QP
9	0.817	17.03	46.00	-28.97	-2.51	9.66	0.03	9.85	Average
10	0.817	24.59	56.00	-31.41	5.05	9.66	0.03	9.85	QP
11	18.820	30.98	50.00	-19.02	11.19	9.78	0.09	9.92	Average
12	18.820	35.81	60.00	-24.19	16.02	9.78	0.09	9.92	QP



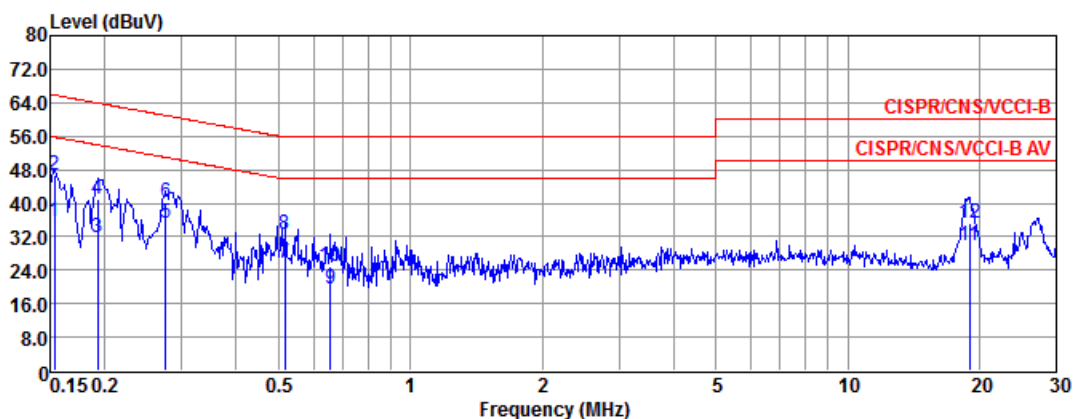
Test Engineer :	Arthur Hsieh	Temperature :	23°C
Power Phase	Neutral	Relative Humidity :	56%
Mode	Rx		



	Freq MHz	Level dBuV	Limit dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Aux Factor dB	Remark
1	0.156	35.60	55.69	-20.09	16.09	9.65	0.01	9.85	Average
2	0.156	46.10	65.69	-19.59	26.59	9.65	0.01	9.85	QP
3	0.186	27.83	54.20	-26.37	8.31	9.65	0.02	9.85	Average
4	0.186	40.01	64.20	-24.19	20.49	9.65	0.02	9.85	QP
5@	0.273	36.55	51.03	-14.48	17.03	9.65	0.02	9.85	Average
6	0.273	40.94	61.03	-20.09	21.42	9.65	0.02	9.85	QP
7	0.497	27.29	46.05	-18.76	7.77	9.64	0.02	9.86	Average
8	0.497	34.21	56.05	-21.84	14.69	9.64	0.02	9.86	QP
9	18.920	29.89	50.00	-20.11	10.02	9.86	0.09	9.92	Average
10	18.920	36.90	60.00	-23.10	17.03	9.86	0.09	9.92	QP
11	26.984	29.29	50.00	-20.71	9.27	9.95	0.11	9.96	Average
12	26.984	33.67	60.00	-26.33	13.65	9.95	0.11	9.96	QP



Test Engineer :	Arthur Hsieh	Temperature :	23°C
Power Phase	Line	Relative Humidity :	56%
Mode	Rx		



	Freq MHz	Level dBuV	Limit dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Aux Factor dB	Remark
1	0.153	35.47	55.82	-20.35	15.95	9.66	0.01	9.85	Average
2	0.153	46.63	65.82	-19.19	27.11	9.66	0.01	9.85	QP
3	0.192	31.64	53.93	-22.29	12.13	9.65	0.01	9.85	Average
4	0.192	40.95	63.93	-22.98	21.44	9.65	0.01	9.85	QP
5@	0.276	35.34	50.94	-15.60	15.82	9.65	0.02	9.85	Average
6	0.276	40.14	60.94	-20.80	20.62	9.65	0.02	9.85	QP
7	0.516	25.82	46.00	-20.18	6.29	9.65	0.02	9.86	Average
8	0.516	32.64	56.00	-23.36	13.11	9.65	0.02	9.86	QP
9	0.658	19.61	46.00	-26.39	0.07	9.66	0.02	9.86	Average
10	0.658	25.02	56.00	-30.98	5.48	9.66	0.02	9.86	QP
11	19.021	30.03	50.00	-19.97	10.23	9.78	0.10	9.92	Average
12	19.021	35.23	60.00	-24.77	15.43	9.78	0.10	9.92	QP

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 LP0002 Section 2.2, Section 3.10.1.3, and Section 3.10.1.4.

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
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	Jun. 28, 2018 Jul. 01, 2018	Nov. 22, 2018	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA00101800 -30-10P	160118000 2	1GHz~18GHz	Jul. 31, 2017	Jun. 28, 2018 Jul. 01, 2018	Jul. 30, 2018	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 26, 2017	Jun. 28, 2018 Jul. 01, 2018	Dec. 25, 2018	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL6111D&0 0800N1D01N- 06	41912&05	30MHz to 1GHz	Jan. 10, 2018	Jun. 28, 2018 Jul. 01, 2018	Jan. 09, 2019	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY541300 85	20Hz ~ 8.4GHz	Oct. 31, 2017	Jun. 28, 2018 Jul. 01, 2018	Oct. 30, 2018	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120D	9120D-162 0	1G~18GHz	Oct. 03, 2017	Jun. 28, 2018 Jul. 01, 2018	Oct. 02, 2018	Radiation (03CH15-HY)
Hygrometer	TECPEL	DTM-303B	TP162976	N/A	Oct. 12, 2017	Jun. 28, 2018 Jul. 01, 2018	Oct. 11, 2018	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY532701 95	1GHz~26.5GHz	Aug. 21, 2017	Jun. 28, 2018 Jul. 01, 2018	Aug. 20, 2018	Radiation (03CH15-HY)
Spectrum Analyzer	Agilent	E4446A	MY501801 36	3Hz~44GHz	Apr. 25, 2018	Jun. 28, 2018 Jul. 01, 2018	Apr. 24, 2019	Radiation (03CH15-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Jun. 28, 2018 Jul. 01, 2018	N/A	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Jun. 28, 2018 Jul. 01, 2018	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Jun. 28, 2018 Jul. 01, 2018	N/A	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170 584	18GHz- 40GHz	Nov. 27, 2017	Jun. 28, 2018 Jul. 01, 2018	Nov. 26, 2018	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24	RK-00104 2	N/A	N/A	Jun. 28, 2018 Jul. 01, 2018	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER / MTJ Cooperation	SUCOFLEX 104 / 000000-MT18 A-100	MY36980/ 4, MY9838/4 PE, D3210	30MHz~1GHz	Mar. 15, 2018	Jun. 28, 2018 Jul. 01, 2018	Mar. 14, 2019	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER / MTJ Cooperation	SUCOFLEX 104 / 000000-MT18 A-100	MY36980/ 4, MY9838/4 PE, D3210	1GHz~18GHz	Mar. 15, 2018	Jun. 28, 2018 Jul. 01, 2018	Mar. 14, 2019	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Oct. 17, 2017	Jun. 28, 2018 Jul. 01, 2018	Oct. 16, 2018	Radiation (03CH15-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Jul. 05, 2018	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	3.6GHz	Dec. 08, 2017	Jul. 05, 2018	Dec. 07, 2018	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Mar. 06, 2018	Jul. 05, 2018	Mar. 05, 2019	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 30, 2017	Jul. 05, 2018	Nov. 29, 2018	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Dec. 08, 2017	Jul. 05, 2018	Dec. 07, 2018	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Jul. 05, 2018	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 03, 2018	Jul. 05, 2018	Jan. 02, 2019	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Jan. 03, 2018	Jul. 05, 2018	Jan. 02, 2019	Conduction (CO05-HY)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	Testo	DTM-303A	TP157075	N/A	Mar. 06, 2018	Jun. 02~Jul. 04, 2018	Mar. 05, 2019	Conducted (TH05-HY)
Power Meter	Agilent	E4416A	GB412923 44	N/A	Dec. 20, 2017	Jun. 02~Jul. 04, 2018	Dec. 19, 2018	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US404415 48	50MHz~18GHz	Dec. 20, 2017	Jun. 02~Jul. 04, 2018	Dec. 19, 2018	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100057	9kHz-40GHz	Nov. 21, 2017	Jun. 02~Jul. 04, 2018	Nov. 20, 2018	Conducted (TH05-HY)
BT Base Station(Measure)	Rohde & Schwarz	CBT	101136	BT 3.0	Sep. 20, 2017	Jun. 02~Jul. 04, 2018	Sep. 19, 2018	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC130048 4	N/A	Mar. 01, 2018	Jun. 02~Jul. 04, 2018	Feb. 28, 2019	Conducted (TH05-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
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.20
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.00
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

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