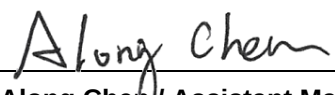


FCC Test Report

FCC ID : 2AWC2-AIRH203
Equipment : Kebbi Air S
(Please refer to section 1.1.1 for more details)
Model No. : AIR-H203
(Please refer to section 1.1.1 for more details)
Brand Name : NUWAROBOTICS
Applicant : NUWA ROBOTICS (HK) LIMITED TAIWAN
BRANCH
Address : 3F., No. 102, Dunhua N. Rd., Songshan Dist.,
Taipei City , Taiwan (R.O.C.)
Standard : 47 CFR FCC Part 15.247
Received Date : Apr. 07, 2021
Tested Date : May 04 ~ May 13, 2022

We, International Certification Corporation, would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:


Along Chen / Assistant Manager

Approved by:

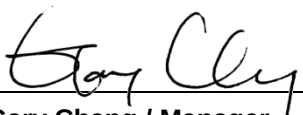

Gary Chang / Manager

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Appendix A. Unwanted Emissions into Restricted Frequency Bands

Appendix B. Unwanted Emissions into Non-Restricted Frequency Bands

Appendix C. Conducted Output Power

Appendix D. Number of Hopping Frequency

Appendix E. 20dB and Occupied Bandwidth

Appendix F. Channel Separation

Appendix G. Number of Dwell Time

Appendix H. AC Power Line Conducted Emissions

Release Record

Report No.	Version	Description	Issued Date
FR240701AD	Rev. 01	Initial issue	Jun. 06, 2022

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emission	[dBuV]: 14.517MHz 34.03 (Margin -15.97dB) - AV	Pass
15.247(d) 15.209	Unwanted Emissions	[dBuV/m at 3m]: 245.16MHz 41.05 (Margin -4.95dB) - PK	Pass
15.247(d)	Band Edge	Meet the requirement of limit	Pass
15.247(b)(1)	Conducted Output Power	Power [dBm]: 12.52	Pass
15.247(a)(1)(iii)	Number of Hopping Channels	Meet the requirement of limit	Pass
15.247(a)(1)	Hopping Channel Separation	Meet the requirement of limit	Pass
15.247(a)(1)(iii)	Dwell Time	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Information

1.1.1 Product Details

The following models are provided to this EUT.

Brand Name	Model Name	Product Name	Description
NUWAROBOTICS	AIR-H203	Kebbi Air S	Outer appearance: white
NUWAROBOTICS	AIR-H204	Robot Creator DX	Outer appearance: black
✦ All models are electrically identical, different model names are for marketing purpose. ✦ The above models, model AIR-H203 was selected as a representative one for the final test and only its data was recorded in this report.			

1.1.2 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (MHz)	Bluetooth Mode	Ch. Frequency (MHz)	Channel Number	Data Rate
2400-2483.5	BR V4.2	2402-2480	0-78 [79]	1 Mbps
2400-2483.5	EDR V4.2	2402-2480	0-78 [79]	2 Mbps
2400-2483.5	EDR V4.2	2402-2480	0-78 [79]	3 Mbps
Note 1: RF output power specifies that Maximum Peak Conducted Output Power. Note 2: Bluetooth BR uses a GFSK. Note 3: Bluetooth EDR uses a combination of $\pi/4$-DQPSK and 8DPSK.				

1.1.3 Antenna Details

Ant. No.	Type	Connector	Gain (dBi)
1	PIFA	N/A	2.4

1.1.4 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	DC 3.7V from battery DC 5V=3A/10V=2A/12V=1.67A from adapter DC 5V=3A/9V=2A/12V=1.5A from adapter
-------------------	--

1.1.5 Accessories

Accessories		
No.	Equipment	Description
1	AC adapter	Brand: JIANGSU CHENYANG Model: MC-201 I/P: 100-240Vac, 50/60Hz, 0.7A Max O/P: 5V=3A, 15.0W / 10.0V=2.0A, 20W / 12V=1.67A, 20W
2	AC adapter	Brand: Jiangxi Jian Aohai Model: A138A-120150U-UK3 I/P: 100-240Vac, 50/60Hz, 0.5A Max O/P: 5V=3A, 15.0W / 9.0V=2.0A, 18W / 12V=1.5A, 18W
3	AC adapter	Brand: SHENZHEN KEYU Model: KA1803A-US I/P: 100-240Vac, 50/60Hz, 0.5A Max O/P: 5V=3A / 9.0V=2.0A / 12V=1.5A
4	AC adapter	Brand: JIANGSU CHENYANG Model: MC-203 I/P: 100-240Vac, 50/60Hz, 0.7A Max O/P: 5V=3A, 15.0W / 10V=2.0A, 20W / 12V=1.67A, 20W
5	Li-ion Battery	Brand: Shenzhen GUANGWEI Electronic Technology Co., Ltd Model: NB2 Rating: 3.7Vdc, 9100mA, 33.67Wh
6	USB charger Cable	1.2m non-shielded without core

1.1.6 Channel List

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

1.1.7 Test Tool and Duty Cycle

Test Tool	Qualcomm Radio Control Tool, V4.0.00185.0 Bluetooth simulator: Brand: R&S, Model: CMW270	
Modulation Mode	Duty Cycle Of Test Signal (%)	Duty Factor (dB)
DH5	78.49%	1.05
2DH5	78.03%	1.08
3DH5	78.03%	1.08

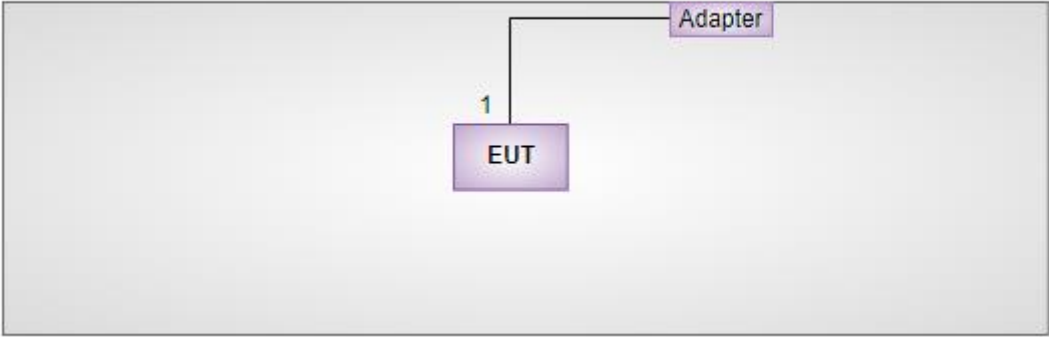
1.1.8 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)		
	2402	2441	2480
GFSK / 1Mbps	Default	Default	Default
$\pi/4$ -DQPSK / 2Mbps	Default	Default	Default
8DPSK / 3Mbps	Default	Default	Default

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Notebook	DELL	Latitude E5470	DoC	---

1.3 Test Setup Chart

Test Setup Diagram	
 The diagram shows a rectangular box representing the test setup area. Inside, a purple box labeled 'EUT' is connected to a purple box labeled 'Adapter' by a line. A green number '1' is placed near the connection point, indicating the signal cable.	
No.	Signal cable / Length (m)
1	USB charger cable, 1.2m non-shielded.

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

1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	May 12, 2022				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101658	Feb. 16, 2022	Feb. 15, 2023
LISN	R&S	ENV216	101579	Apr. 21, 2022	Apr. 20, 2023
LISN (Support Unit)	SCHWARZBECK	Schwarzbeck 8127	8127667	Jan .07, 2022	Jan .06, 2023
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 19, 2021	Oct. 18, 2022
50 ohm terminal (Support Unit)	NA	50	04	May 25, 2021	May 24, 2022
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission below 1GHz				
Test Site	966 chamber3 / (03CH03-WS)				
Tested Date	May. 04, 2022				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Mar. 15, 2022	Mar. 14, 2023
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 08, 2021	Nov. 07, 2022
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	May 06, 2021	May 05, 2022
Preamplifier	EMC	EMC02325	980187	Jul. 26, 2021	Jul. 25, 2022
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 05, 2021	Oct. 04, 2022
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Sep. 24, 2021	Sep. 23, 2022
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Sep. 24, 2021	Sep. 23, 2022
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Sep. 24, 2021	Sep. 23, 2022
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission above 1GHz				
Test Site	966 chamber3 / (03CH03-WS)				
Tested Date	May. 10, 2022				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101499	Mar. 08, 2022	Mar. 07, 2023
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Dec. 20, 2021	Dec. 19, 2022
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170508	Jan. 11, 2022	Jan. 10, 2023
Preamplifier	Agilent	83017A	MY39501309	Sep. 06, 2021	Sep. 05, 2022
Preamplifier	EMC	EMC184045B	980192	Jul. 14, 2021	Jul. 13, 2022
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Sep. 24, 2021	Sep. 23, 2022
RF cable-8M	EMC	EMC104-SM-SM-80 00	181107	Sep. 24, 2021	Sep. 23, 2022
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Tested Date	May 13, 2022				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101910	Apr. 18, 2022	Apr. 17, 2023
Power Meter	Anritsu	ML2495A	1241002	Nov. 07, 2021	Nov. 06, 2022
Power Sensor	Anritsu	MA2411B	1207366	Nov. 07, 2021	Nov. 06, 2022
Measurement Software	Sporton	SENSE-15247_FS	V5.10.7.11	NA	NA
Wireless connectivity tester	R&S	CMW270	100856	Nov. 01, 2021	Oct. 31, 2022
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

47 CFR FCC Part 15.247

ANSI C63.10-2013

1.6 Reference Guidance

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

1.7 Deviation from Test Standard and Measurement Procedure

None

1.8 Measurement Uncertainty

The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor ($k=2$)).

Measurement Uncertainty	
Parameters	Uncertainty
Bandwidth	± 34.130 Hz
Conducted power	± 0.808 dB
Power density	± 0.583 dB
Conducted emission	± 2.715 dB
AC conducted emission	± 2.92 dB
Unwanted Emission ≤ 1 GHz	± 3.96 dB
Unwanted Emission > 1 GHz	± 4.51 dB
Time	$\pm 0.1\%$

2 Test Configuration

2.1 Testing Facility

Test Laboratory	International Certification Corporation
Test Site	CO01-WS, TH01-WS
Address of Test Site	No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)
Test Site	03CH03-WS
Address of Test Site	No.14-1, Lane 19, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 333, Taiwan (R.O.C.)

- FCC Designation No.: TW0009
- FCC site registration No.: 207696
- ISSED#: 10807C
- CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Data Rate (Mbps)	Test Configuration
AC Power Line Conducted Emissions	8DPSK	2402	3Mbps	2
Unwanted Emissions ≤ 1GHz	8DPSK	2402	3Mbps	1
Unwanted Emissions > 1GHz	GFSK 8DPSK	2402, 2441, 2480 2402, 2441, 2480	1Mbps 3Mbps	1
Conducted Output Power	GFSK 1/4 DQPSK 8DPSK	2402, 2441, 2480 2402, 2441, 2480 2402, 2441, 2480	1Mbps 2Mbps 3Mbps	1
Number of Hopping Channels	GFSK 1/4 DQPSK 8DPSK	2402~2480 2402~2480 2402~2480	1Mbps 2Mbps 3Mbps	1
Hopping Channel Separation 20dB and Occupied bandwidth	GFSK 1/4 DQPSK 8DPSK	2402, 2441, 2480 2402, 2441, 2480 2402, 2441, 2480	1Mbps 2Mbps 3Mbps	1
Dwell Time	GFSK 1/4 DQPSK 8DPSK	2402 2402 2402	1Mbps 2Mbps 3Mbps	1

NOTE:

1. Four adapters (Model: MC-201, A138A-120150U-UK3, KA1803A-US and MC-203) had been covered during the pretest, and found that Model: A138A-120150U-UK was worst case of AC power line conducted emission and Model: MC-203 was worst case of Radiated emission.
2. Test configurations are listed as below:
 - 1) Configuration 1: Model:MC-201 adapter
 - 2) Configuration 2: Model:A138A-120150U-UK3 adapter

3 Transmitter Test Results

3.1 Unwanted Emissions into Restricted Frequency Bands

3.1.1 Limit of Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:
Qusai-Peak value is measured for frequency below 1GHz except for 9~90 kHz, 110~490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

Note 2:
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.1.2 Test Procedures

1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

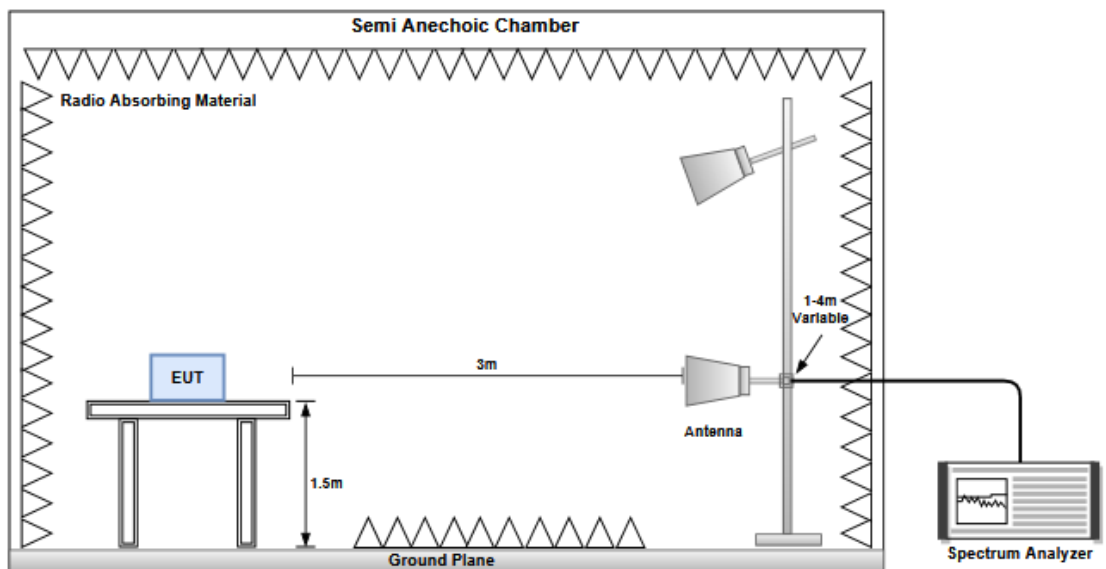
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. Radiated emission above 1GHz / Peak value
RBW=1MHz, VBW=3MHz and Peak detector
Radiated emission above 1GHz / Average value for harmonics
The average value is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula for DH5 packet type which has worst duty factor:
3.
$$20\log (\text{Duty cycle}) = 20\log \frac{1s / 1600 * 5}{100 \text{ ms}} = -30.1\text{dB}$$
4. Radiated emission above 1GHz / Average value for other emissions
RBW=1MHz, VBW=1/T and Peak detector

3.1.3 Test Setup

Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz



3.1.4 Test Results

Refer to Appendix A.

3.2 Unwanted Emissions into Non-Restricted Frequency Bands

3.2.1 Limit of Unwanted Emissions into Non-Restricted Frequency Bands

Peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz.

3.2.2 Test Procedures

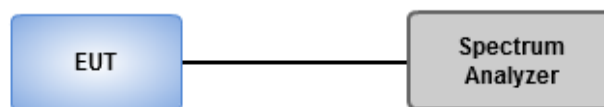
Reference level measurement

1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Use the peak marker function to determine the maximum PSD level

Emission level measurement

1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Scan Frequency range is up to 25GHz
4. Use the peak marker function to determine the maximum amplitude level

3.2.3 Test Setup



3.2.4 Test Results

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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Refer to Appendix B.

3.3 Conducted Output Power

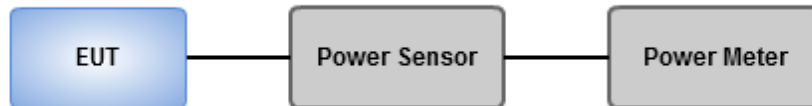
3.3.1 Limit of Conducted Output Power

- ☐ 1 Watt
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.
- ☒ 0.125 Watt
For all other frequency hopping systems in the 2400–2483.5 MHz band.
- ☐ 0.125 Watt
For Frequency hopping systems operating in the 2400–2483.5 MHz band have hopping channel carrier frequencies that are separated by two-thirds of the 20 dB bandwidth of the hopping channel.

3.3.2 Test Procedures

1. A wideband power meter is used for power measurement. Bandwidth of power sensor and meter is 50MHz
2. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power

3.3.3 Test Setup



3.3.4 Test Results

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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Refer to Appendix C.

3.4 Number of Hopping Frequency

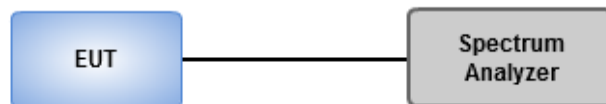
3.4.1 Limit of Number of Hopping Frequency

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

3.4.2 Test Procedures

1. Set RBW = 100kHz, VBW = 300kHz, Sweep time = Auto, Detector = Peak Trace max hold.
2. Allow trace to stabilize.

3.4.3 Test Setup



3.4.4 Test Results

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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Refer to Appendix D.

3.5 20dB and Occupied Bandwidth

3.5.1 Test Procedures

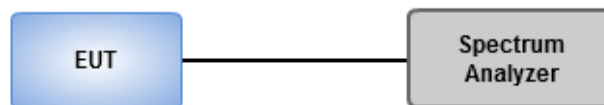
20dB Bandwidth

1. Set RBW=20kHz, VBW=100kHz, Sweep time = Auto, Detector=Peak , Trace max hold
2. Allow trace to stabilize
3. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

1. Set RBW=20kHz, VBW=100kHz, Sweep time = Auto, Detector=Sample , Trace max hold
2. Allow trace to stabilize
3. Use Occupied bandwidth function of spectrum analyzer to measuring 99% occupied bandwidth

3.5.2 Test Setup



3.5.3 Test Results

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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Refer to Appendix E.

3.6 Channel Separation

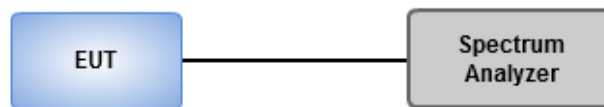
3.6.1 Limit of Channel Separation

- ☐ Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.
- ☒ 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.

3.6.2 Test Procedures

1. Set RBW=30kHz, VBW=100kHz, Sweep time = Auto, Detector=Peak Trace max hold
2. Allow trace to stabilize
3. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The EUT shall show compliance with the appropriate regulatory limit

3.6.3 Test Setup



3.6.4 Test Results

Ambient Condition	24°C / 67%	Tested By	Aska Huang
-------------------	------------	-----------	------------

Refer to Appendix F.

3.7 Number of Dwell Time

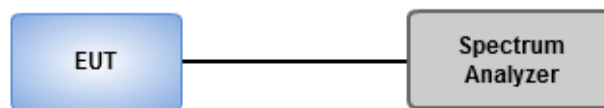
3.7.1 Limit of Dwell time

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.

3.7.2 Test Procedures

1. Set RBW=300 kHz, VBW=1 MHz, Sweep time=8 ms, Detector=Peak, Span=0 Hz, Trace max hold.
2. Enable gating and trigger function of spectrum analyzer to measure burst on time.
3. Set RBW=300 kHz, VBW=1 MHz, Sweep time=5 s / 2 s, Detector=Peak, Span=0 Hz, Trace max hold.
4. Enable gating and trigger function of spectrum analyzer to measure burst on number of transmission.
5. Set RBW=300 kHz, VBW=1 MHz, Sweep time=31.6 s / 8 s, Detector=Peak, Span=0 Hz, Trace max hold.
6. Enable gating and trigger function of spectrum analyzer to measure burst on number of transmission of entire time cycle.

3.7.3 Test Setup



3.7.4 Test Results

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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Refer to Appendix G.

3.8 AC Power Line Conducted Emissions

3.8.1 Limit of AC Power Line Conducted Emissions

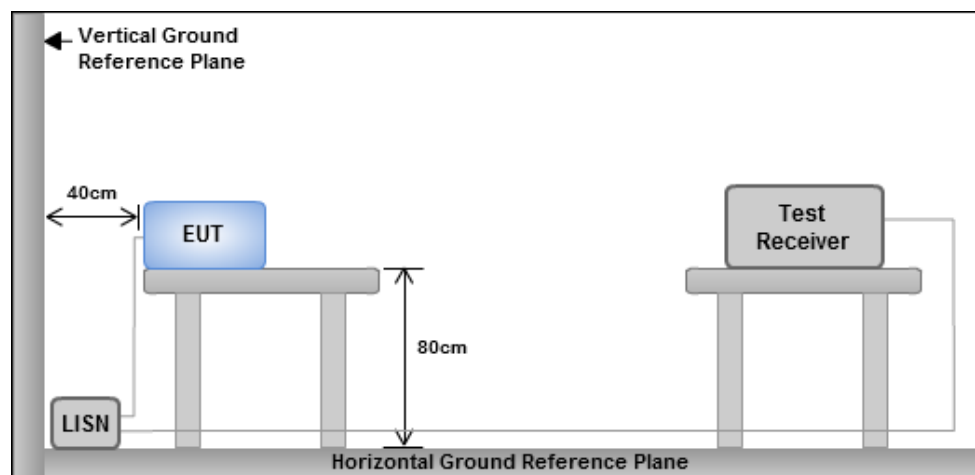
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: * Decreases with the logarithm of the frequency.

3.8.2 Test Procedures

1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50 Ω LISN port.
3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
4. This measurement was performed with AC 120V/60Hz

3.8.3 Test Setup



- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.8.4 Test Results

Refer to Appendix H.

4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corporation (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

Tel: 886-2-2601-1640

No.30-2, Ding Fwu Tsuen, Lin Kou
District, New Taipei City, Taiwan
(R.O.C.)

Kwei Shan

Tel: 886-3-271-8666

No.3-1, Lane 6, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)
No.2-1, Lane 6, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)

Kwei Shan Site II

Tel: 886-3-271-8640

No.14-1, Lane 19, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 333, Taiwan (R.O.C.)

If you have any suggestion, please feel free to contact us as below information.

Tel: 886-3-271-8666

Fax: 886-3-318-0345

Email: ICC_Service@icertifi.com.tw

==END==

Emissions (Below 1GHz)

Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Horizontal		
Test By :Akun Chung Temperature(°C):25 Humidity(%):65			
Level (dBuV/m) </			



Modulation	8DPSK		Test Freq. (MHz)		2402	
Polarization	Vertical					
Test By :Akun Chung Temperature(°C):25 Humidity(%):65						
Level (dBUV/m)						

Emissions (Above 1GHz) for GFSK

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Horizontal		
Test By :Akun Chung Temperature(°C):25 Humidity(%):66			
Level (dBUV/m)			



Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		
Test By :Akun Chung Temperature(°C):25 Humidity(%):66			
Level (dBuV/m) <			

Modulation	GFSK	Test Freq. (MHz)	2441
Polarization	Horizontal		
Test By :Akun Chung Temperature(°C):25 Humidity(%):66			
Level (dBuV/m)			



Modulation	GFSK	Test Freq. (MHz)	2441
Polarization	Vertical		
Test By :Akun Chung Temperature(°C):25 Humidity(%):66			
Level (dBuV/m) <			



Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Horizontal		
Test By :Akun Chung Temperature(°C):25 Humidity(%):66			
Level (dBUV/m) <			

Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Vertical		
Test By :Akun Chung Temperature(°C):25 Humidity(%):66			
Level (dBUV/m) </			

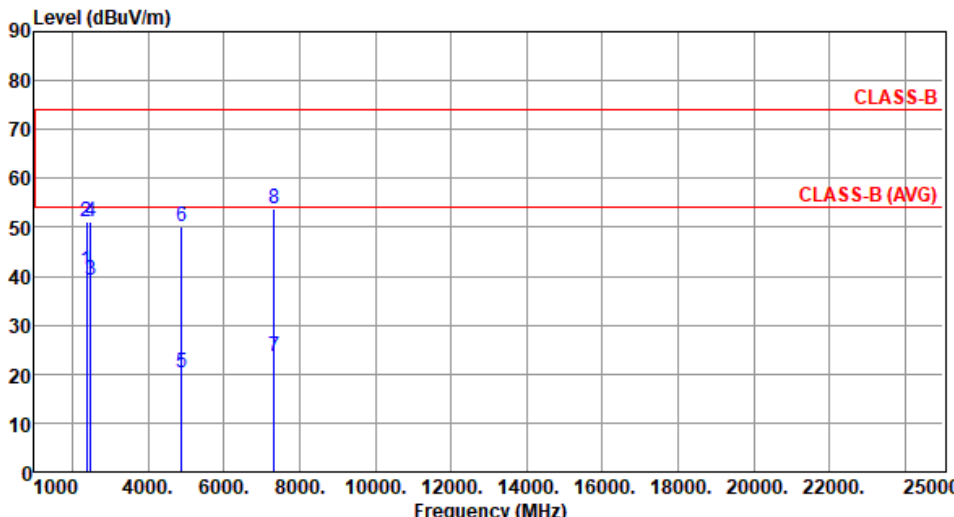
Emissions (Above 1GHz) for 8DPSK

Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Horizontal		
Test By :Akun Chung Temperature(°C):25 Humidity(%):66			
Level (dBUV/m) <			



Modulation	8DPSK		Test Freq. (MHz)		2402	
Polarization	Vertical					
Test By :Akun Chung Temperature(°C):25 Humidity(%):66						
Level (dBuV/m) <						

Modulation	8DPSK	Test Freq. (MHz)	2441
Polarization	Horizontal		
Test By :Akun Chung Temperature(°C):25 Humidity(%):66			
Level (dBuV/m)			

Modulation	8DPSK	Test Freq. (MHz)	2441						
Polarization	Vertical								
Test By :Akun Chung Temperature(°C):25 Humidity(%):66									
Level (dBuV/m)  Frequency (MHz)									
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2390.00	41.30	54.00	-12.70	42.79	-1.49	Average	317	277
2	2390.00	51.27	74.00	-22.73	52.76	-1.49	Peak	317	277
3	2483.50	39.17	54.00	-14.83	40.75	-1.58	Average	317	277
4	2483.50	51.08	74.00	-22.92	52.66	-1.58	Peak	317	277
5	4882.00	20.10	54.00	-33.90			Average	100	259
6	4882.00	50.20	74.00	-23.80	44.88	5.32	Peak	100	259
7	7323.00	23.67	54.00	-30.33			Average	100	254
8	7323.00	53.77	74.00	-20.23	42.95	10.82	Peak	100	254

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor* (dB/m)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: When average value is calculated not measured, no SA reading and factor value are listed.



Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Horizontal		
Test By :Akun Chung Temperature(°C):25 Humidity(%):66			
Level (dBUV/m)			

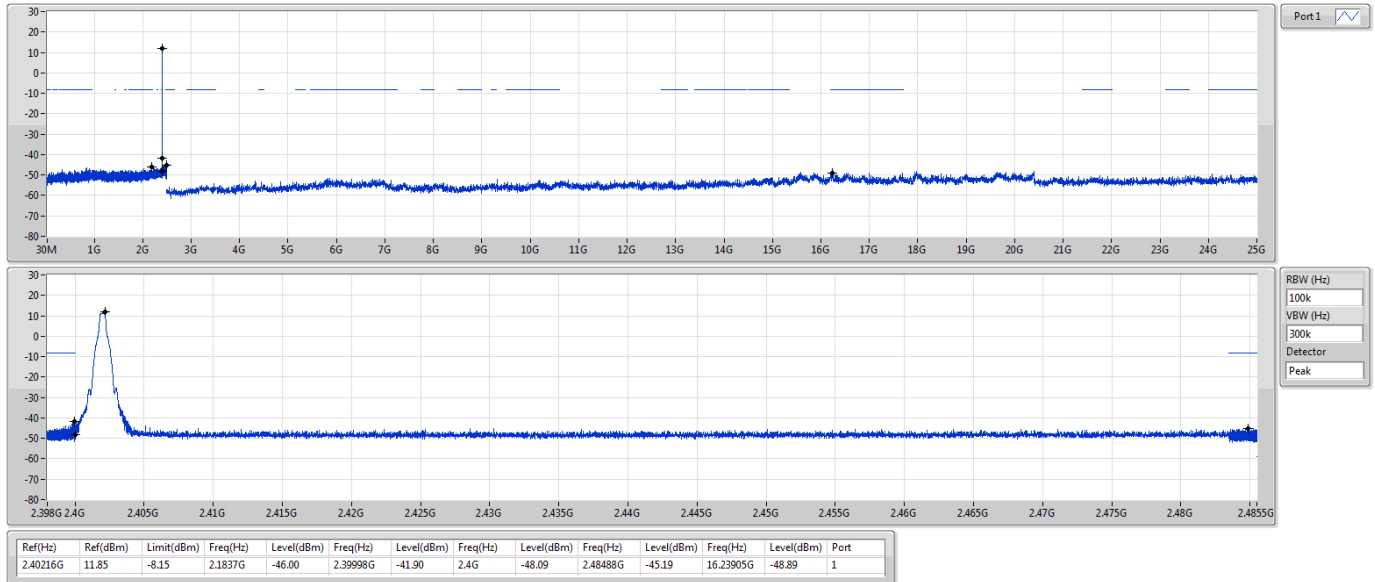


Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Vertical		
Test By :Akun Chung Temperature(°C):25 Humidity(%):66			
Level (dBUV/m)			

BT-BR(1Mbps)

CSENdB-FS

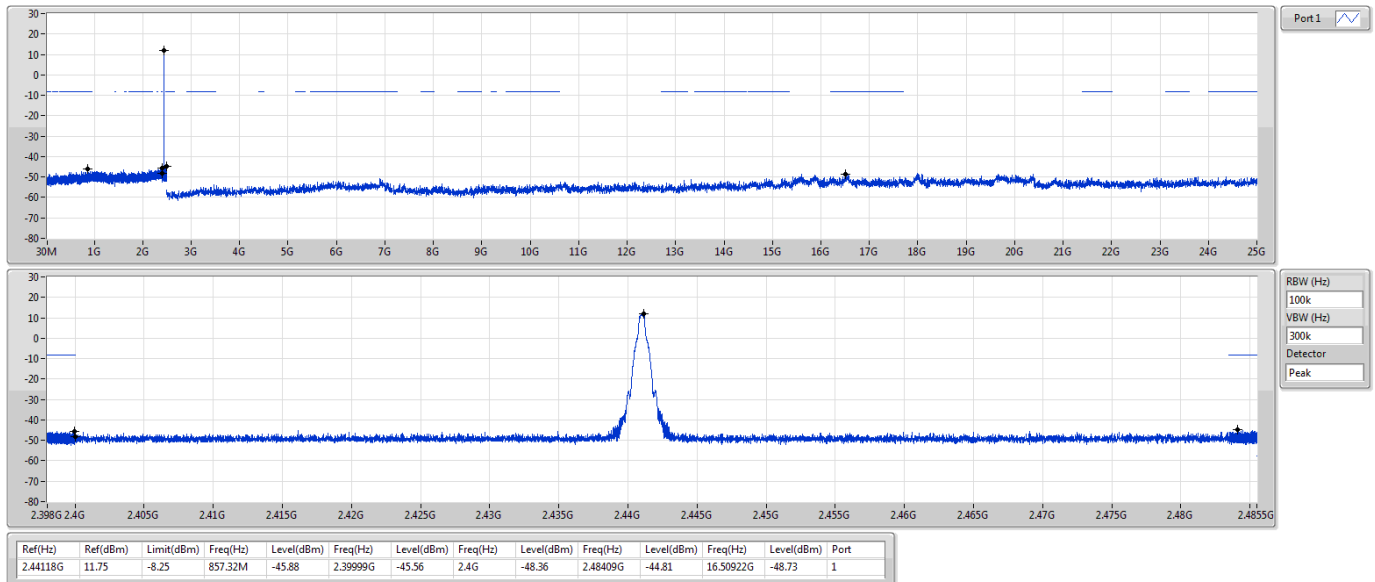
2402MHz



BT-BR(1Mbps)

CSENdB-FS

2441MHz

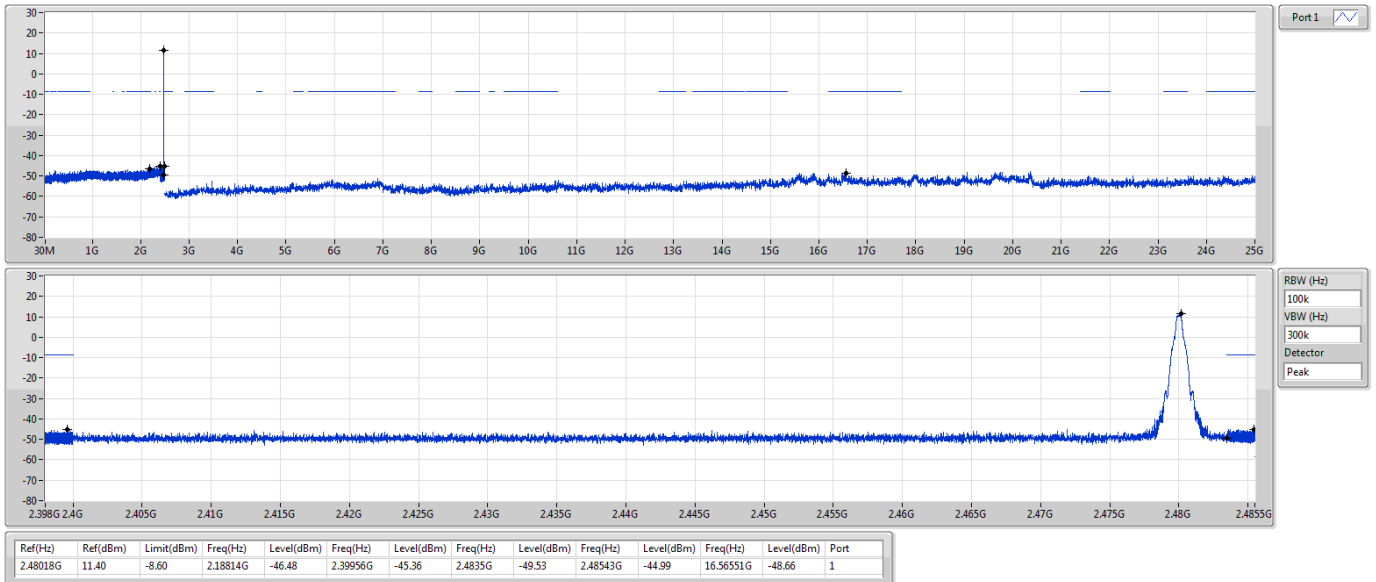




BT-BR(1Mbps)

CSEndB-FS

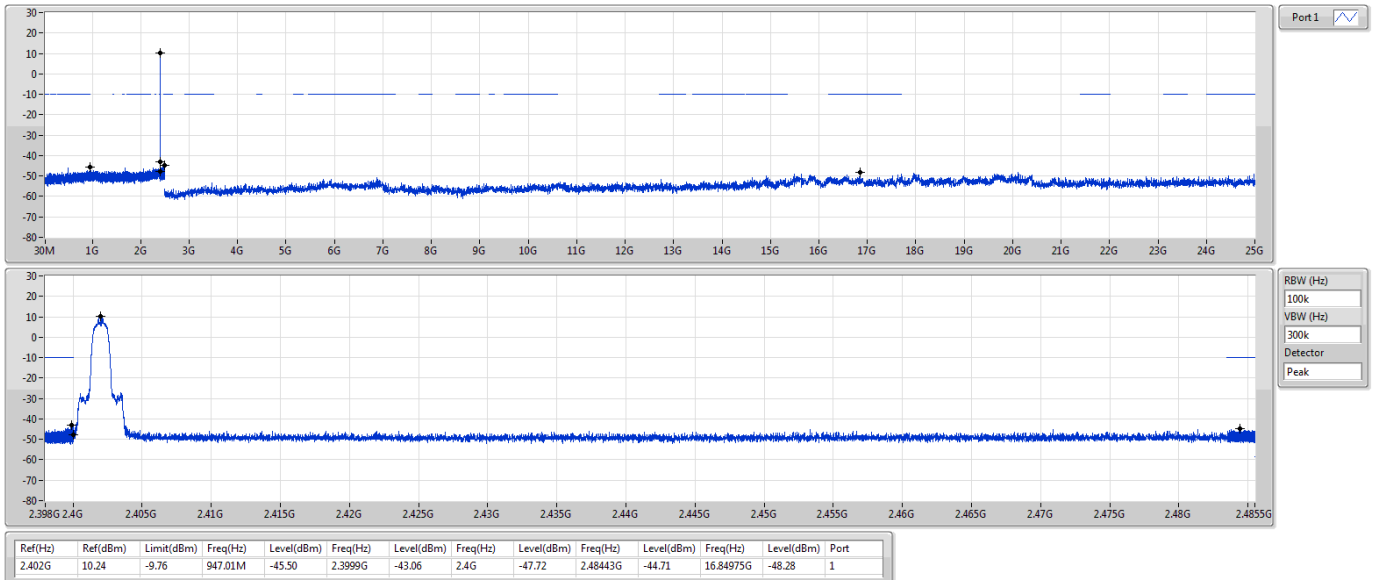
2480MHz



BT-EDR(2Mbps)

CSEndB-FS

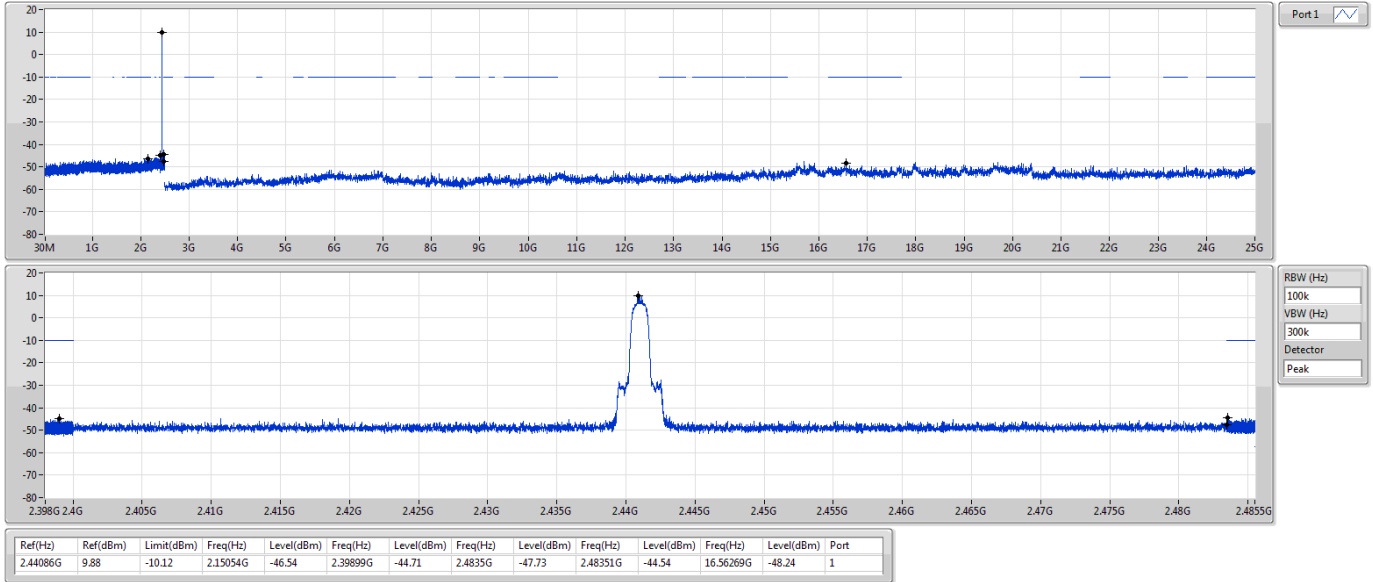
2402MHz



BT-EDR(2Mbps)

CSEndB-FS

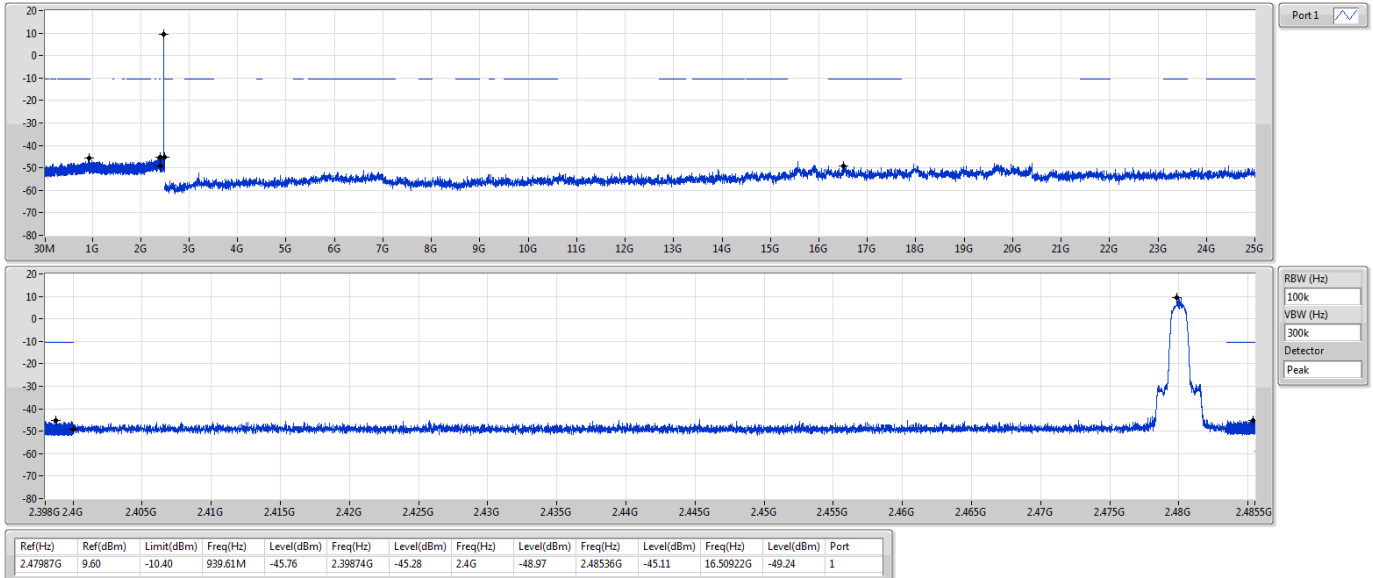
2441MHz



BT-EDR(2Mbps)

CSEndB-FS

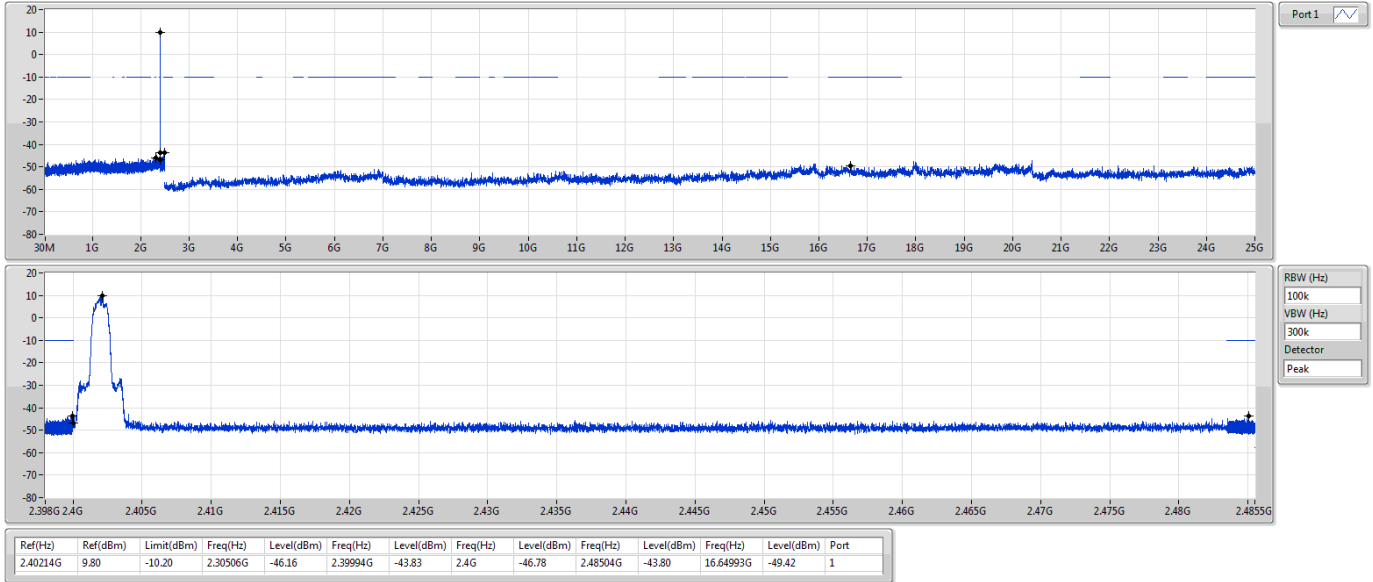
2480MHz



BT-EDR(3Mbps)

CSEndB-FS

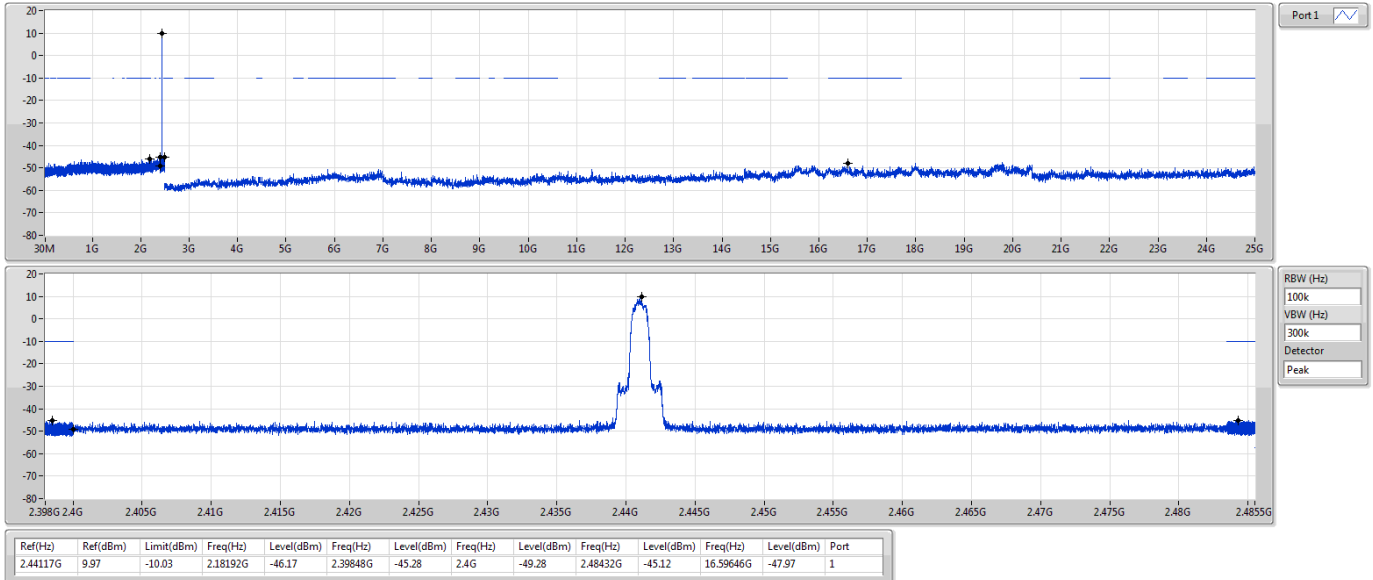
2402MHz



BT-EDR(3Mbps)

CSEndB-FS

2441MHz

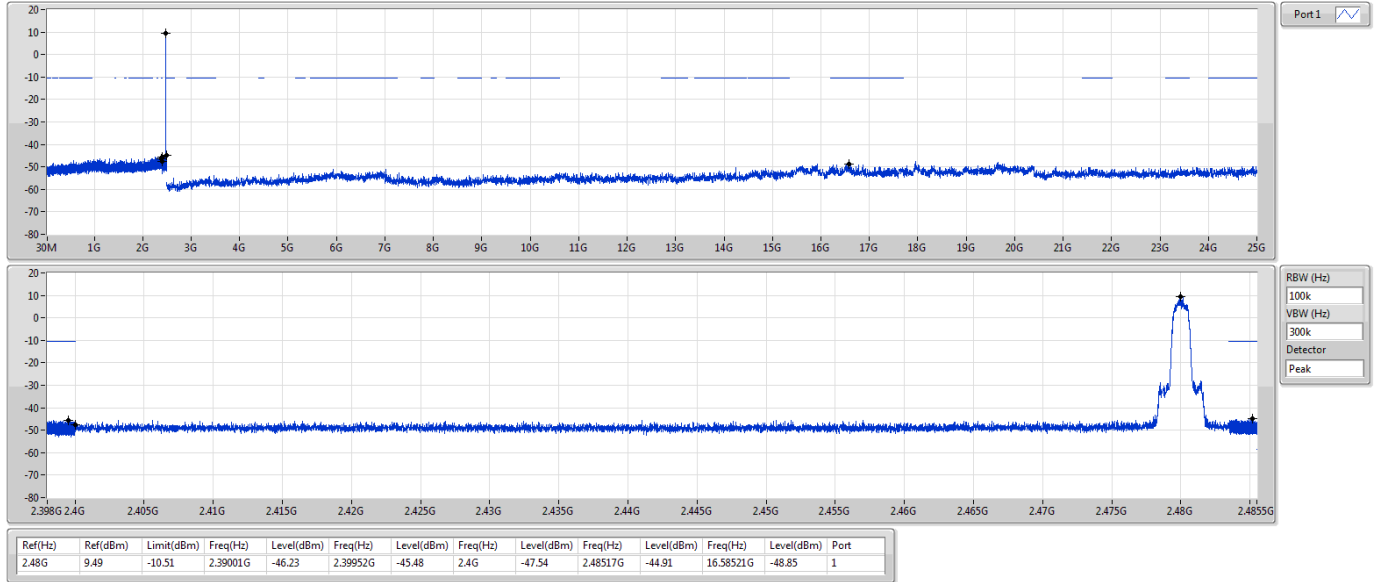




BT-EDR(3Mbps)

CSEndB-FS

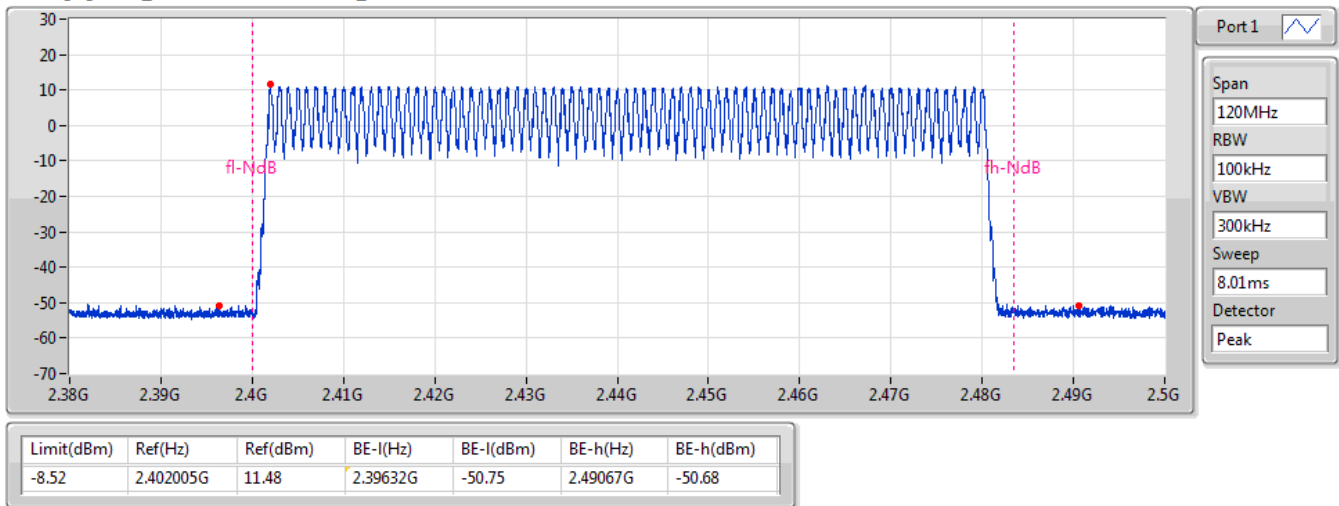
2480MHz



BT-BR(1Mbps)

2402MHz

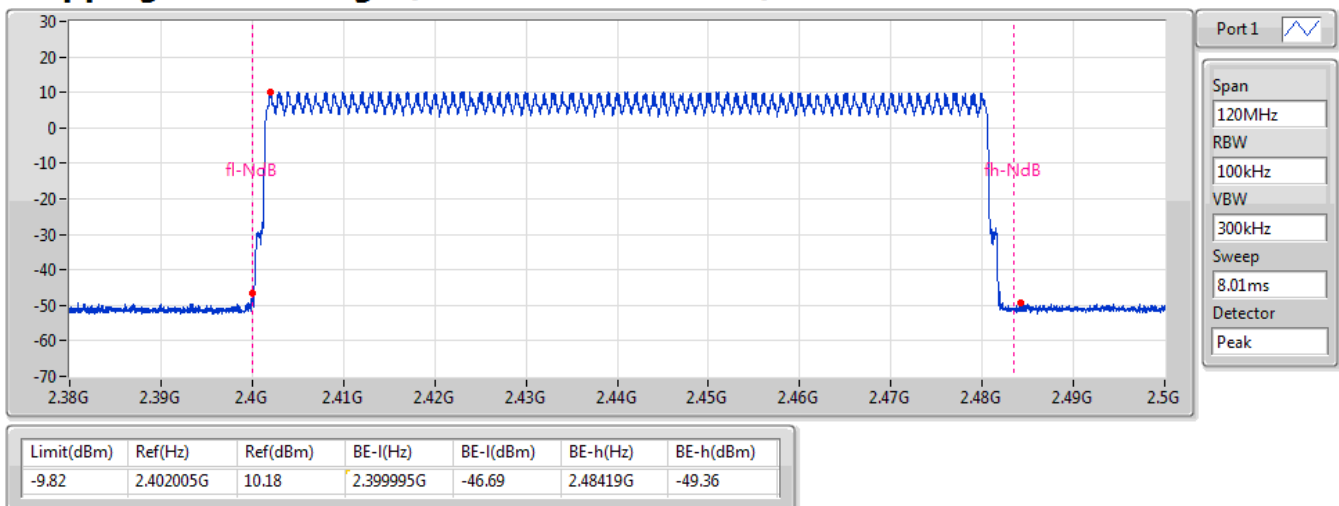
Hopping Ch Bandedge (Non-restricted Band)



BT-EDR(2Mbps)

2402MHz

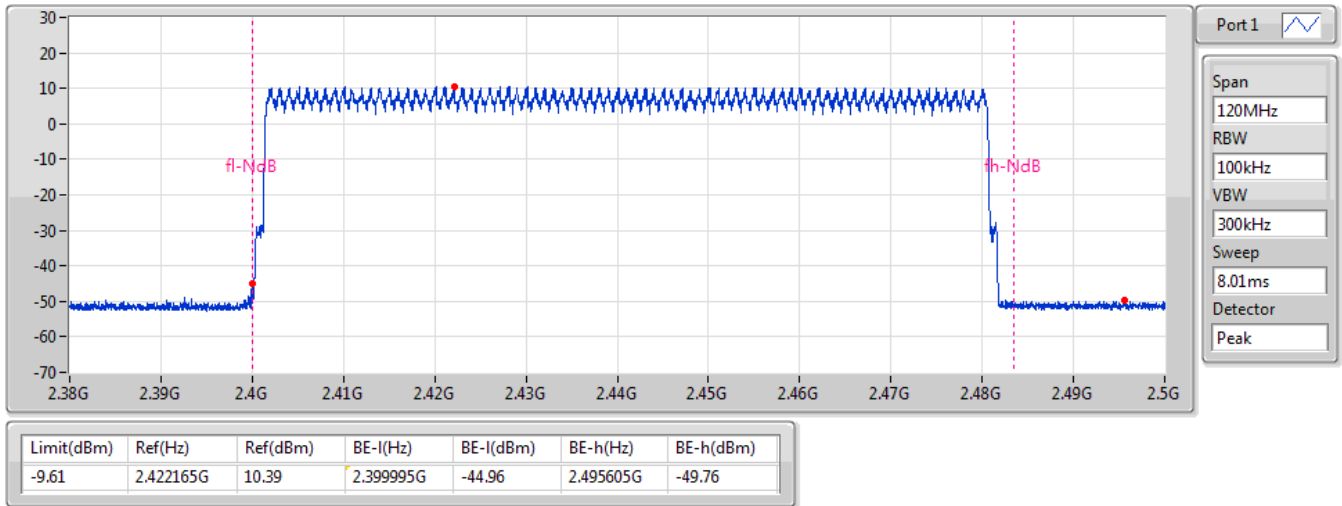
Hopping Ch Bandedge (Non-restricted Band)



BT-EDR(3Mbps)

2402MHz

Hopping Ch Bandedge (Non-restricted Band)



**Summary**

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	12.19	0.01656
BT-EDR(2Mbps)	12.22	0.01667
BT-EDR(3Mbps)	12.52	0.01786

Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-BR(1Mbps)	-	-	-	-
2402MHz	Pass	2.40	12.19	21.00
2441MHz	Pass	2.40	12.11	21.00
2480MHz	Pass	2.40	11.90	21.00
BT-EDR(2Mbps)	-	-	-	-
2402MHz	Pass	2.40	12.22	21.00
2441MHz	Pass	2.40	12.16	21.00
2480MHz	Pass	2.40	11.96	21.00
BT-EDR(3Mbps)	-	-	-	-
2402MHz	Pass	2.40	12.52	21.00
2441MHz	Pass	2.40	12.45	21.00
2480MHz	Pass	2.40	12.28	21.00

**Summary**

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	12.07	0.01611
BT-EDR(2Mbps)	9.92	0.00982
BT-EDR(3Mbps)	9.92	0.00982

Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-BR(1Mbps)	-	-	-	-
2402MHz	Pass	2.40	12.07	-
2441MHz	Pass	2.40	12.00	-
2480MHz	Pass	2.40	11.79	-
BT-EDR(2Mbps)	-	-	-	-
2402MHz	Pass	2.40	9.92	-
2441MHz	Pass	2.40	9.81	-
2480MHz	Pass	2.40	9.58	-
BT-EDR(3Mbps)	-	-	-	-
2402MHz	Pass	2.40	9.92	-
2441MHz	Pass	2.40	9.81	-
2480MHz	Pass	2.40	9.59	-

Note: Average power is for reference only.

**Summary**

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

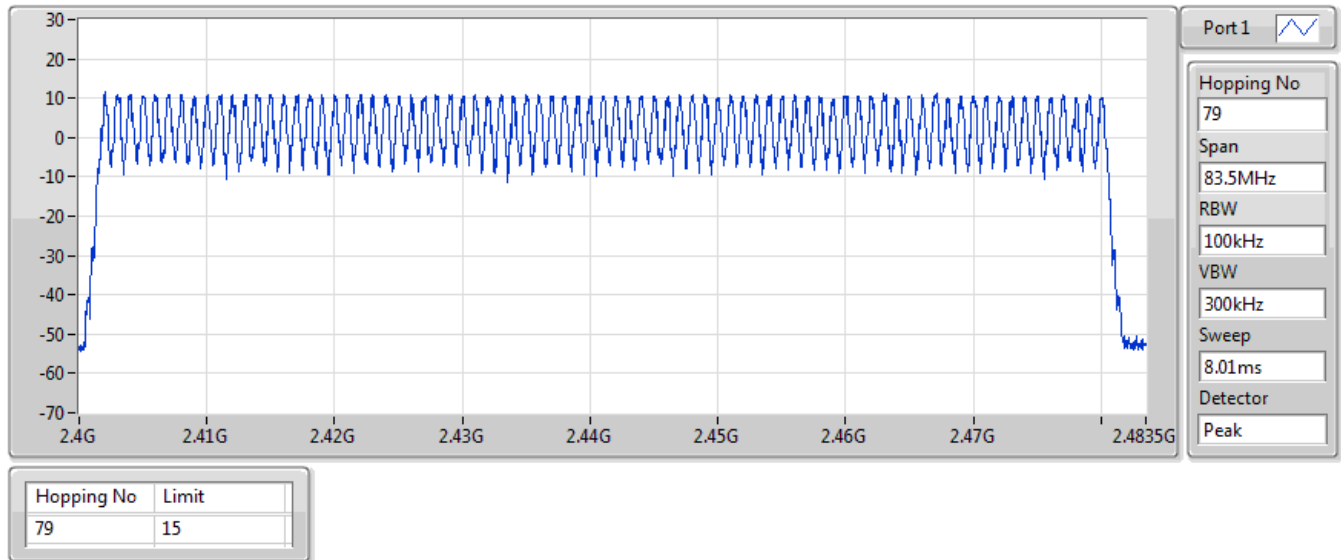
Result

Mode	Result	Hopping No	Limit
BT-BR(1Mbps)	-	-	-
2402MHz	Pass	79	15
BT-EDR(2Mbps)	-	-	-
2402MHz	Pass	79	15
BT-EDR(3Mbps)	-	-	-
2402MHz	Pass	79	15

BT-BR(1Mbps)

Hopping-FS

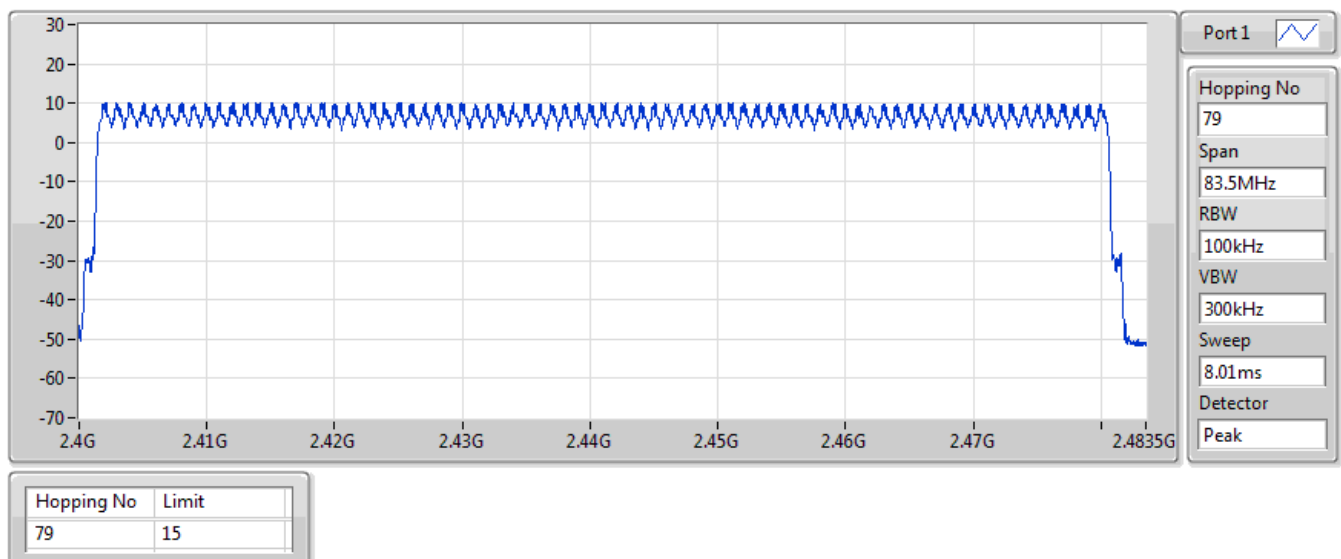
2402MHz



BT-EDR(2Mbps)

Hopping-FS

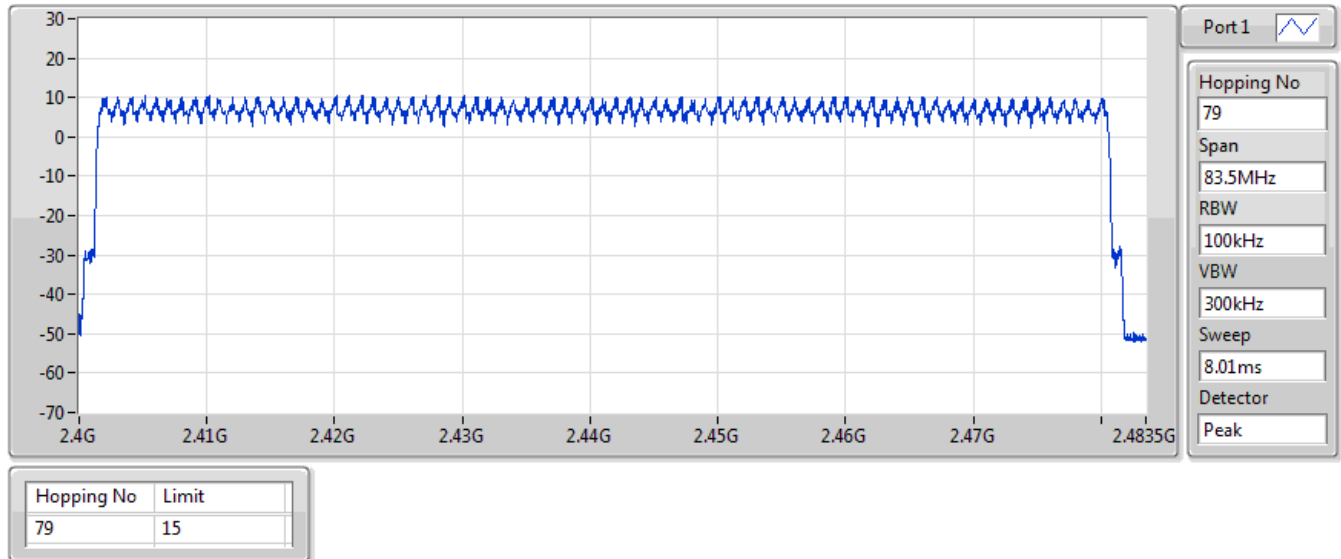
2402MHz



BT-EDR(3Mbps)

Hopping-FS

2402MHz



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)	934.783k	890.014k	890KF1D	927.536k	886.397k
BT-EDR(2Mbps)	1.322M	1.183M	1M18G1D	1.315M	1.179M
BT-EDR(3Mbps)	1.33M	1.187M	1M19G1D	1.283M	1.179M

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

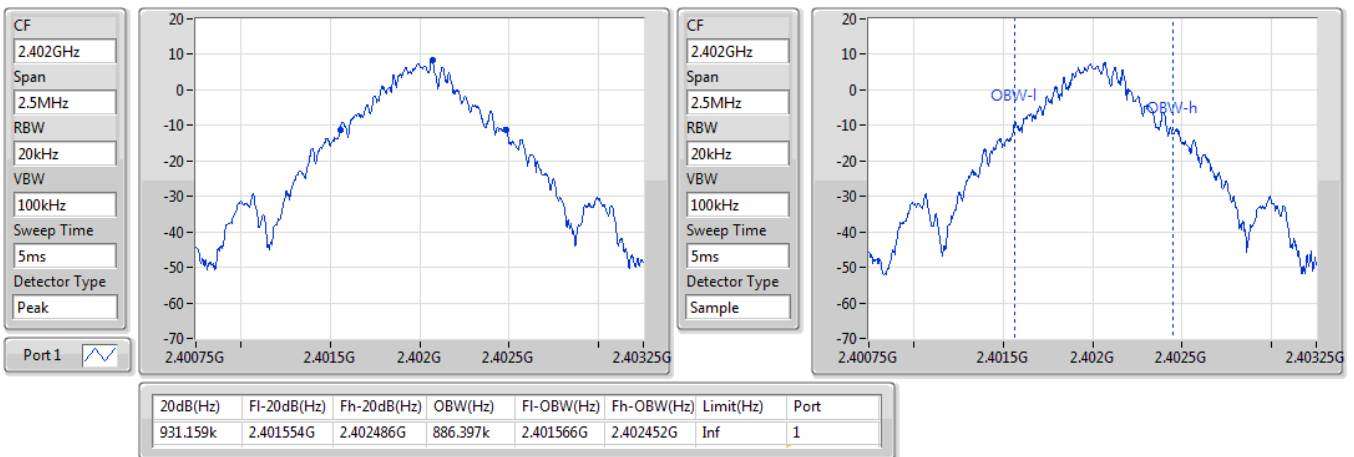
Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
BT-BR(1Mbps)	-	-	-	-
2402MHz	Pass	Inf	931.159k	886.397k
2441MHz	Pass	Inf	927.536k	886.397k
2480MHz	Pass	Inf	934.783k	890.014k
BT-EDR(2Mbps)	-	-	-	-
2402MHz	Pass	Inf	1.322M	1.179M
2441MHz	Pass	Inf	1.315M	1.179M
2480MHz	Pass	Inf	1.319M	1.183M
BT-EDR(3Mbps)	-	-	-	-
2402MHz	Pass	Inf	1.283M	1.183M
2441MHz	Pass	Inf	1.33M	1.187M
2480MHz	Pass	Inf	1.293M	1.179M

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

BT-BR(1Mbps)

EBW-FS

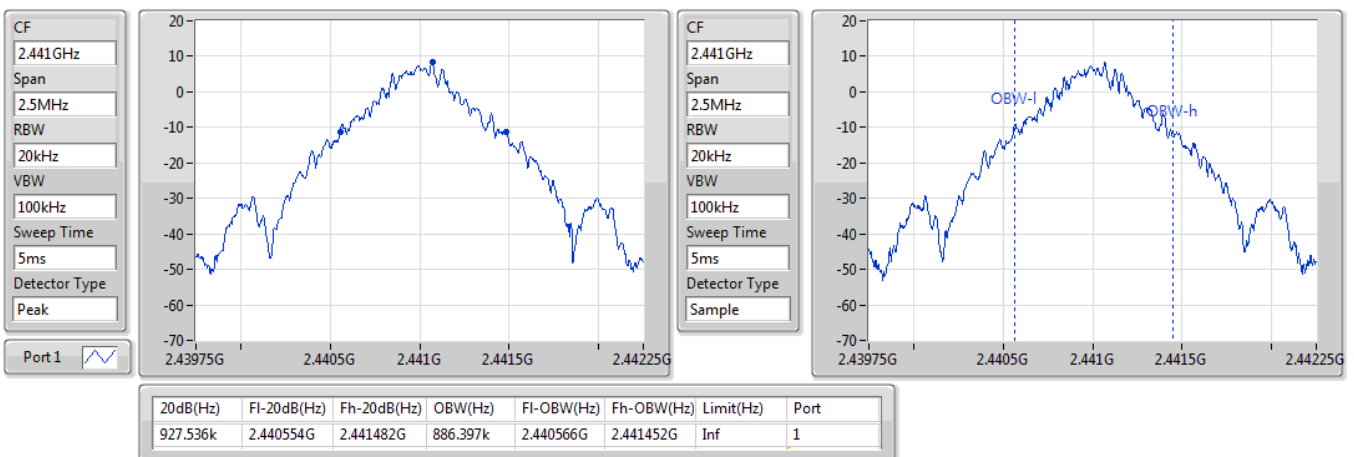
2402MHz



BT-BR(1Mbps)

EBW-FS

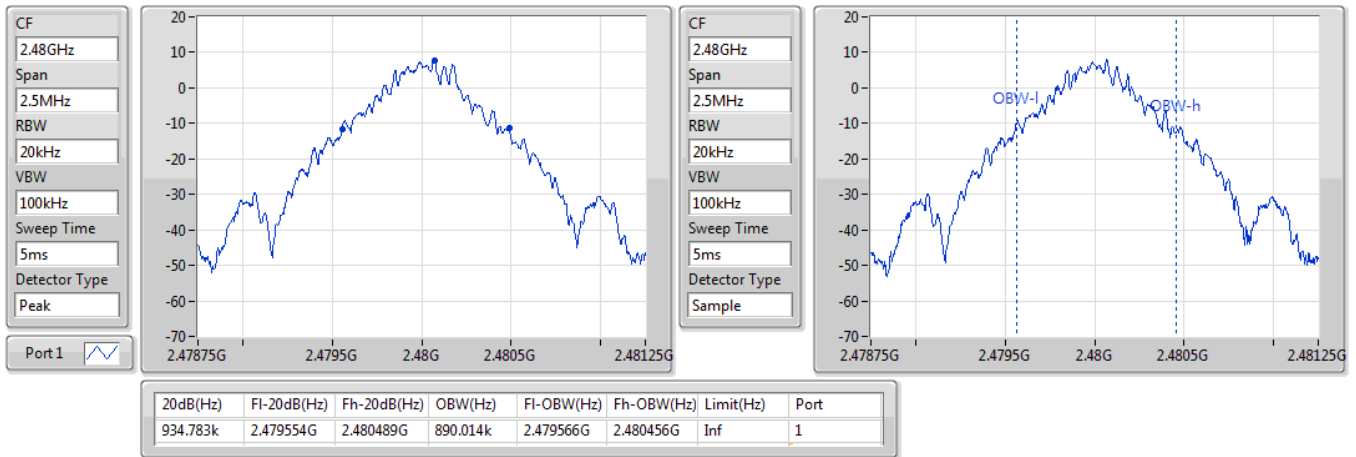
2441MHz



BT-BR(1Mbps)

EBW-FS

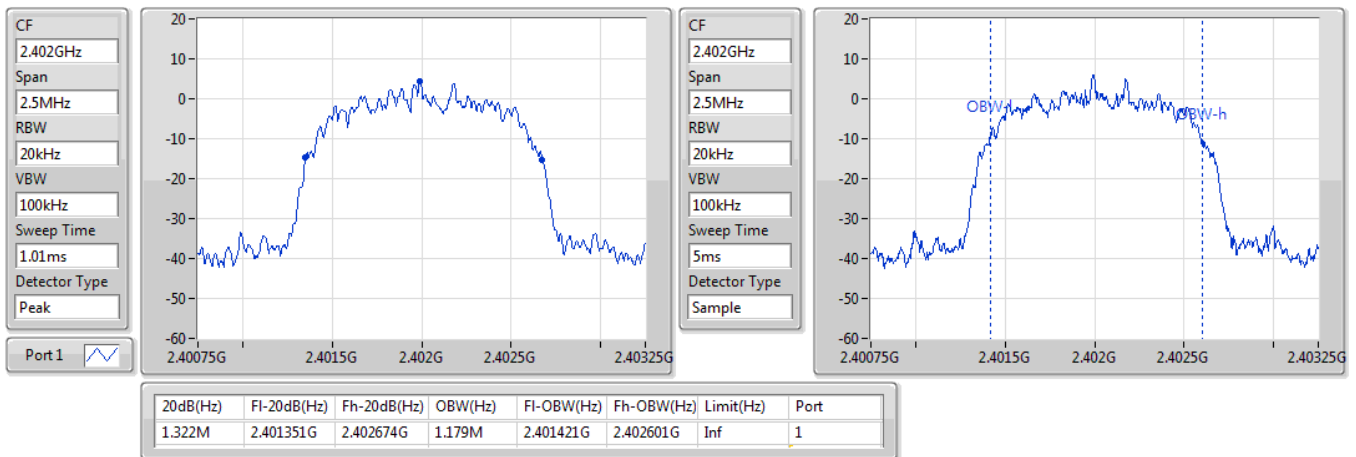
2480MHz



BT-EDR(2Mbps)

EBW-FS

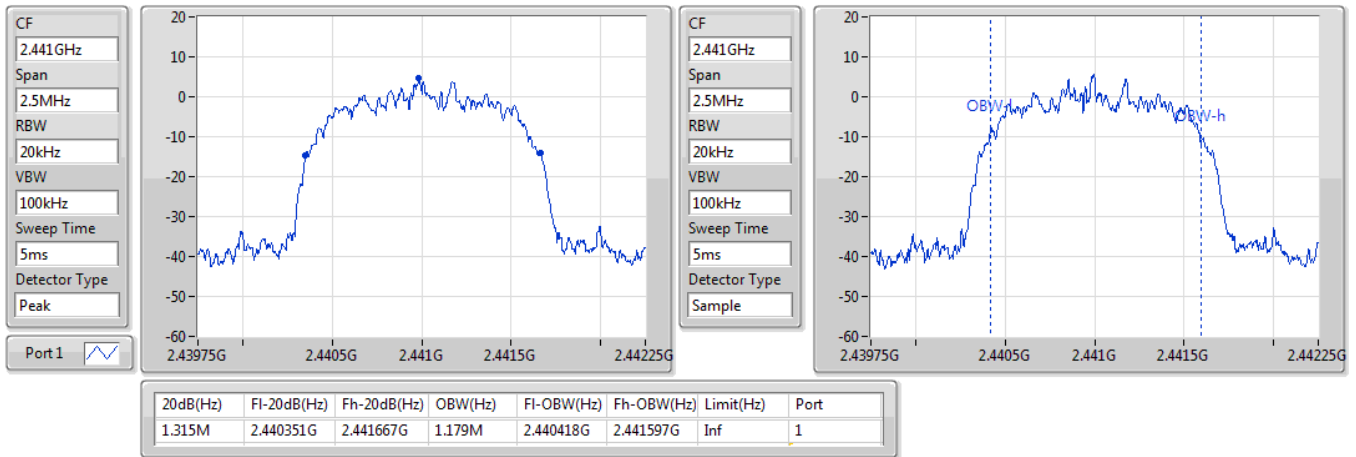
2402MHz



BT-EDR(2Mbps)

EBW-FS

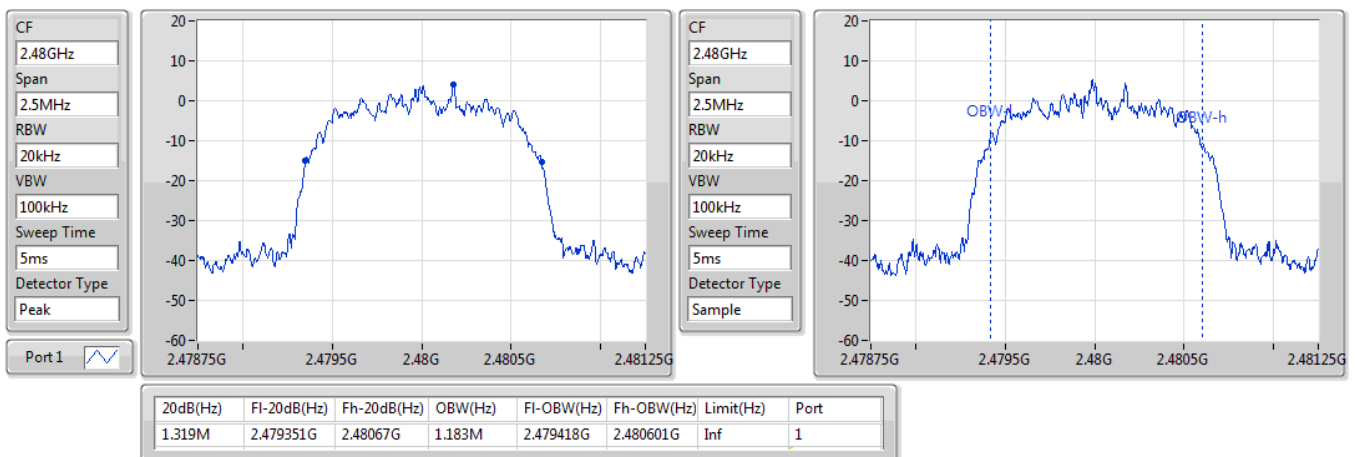
2441MHz



BT-EDR(2Mbps)

EBW-FS

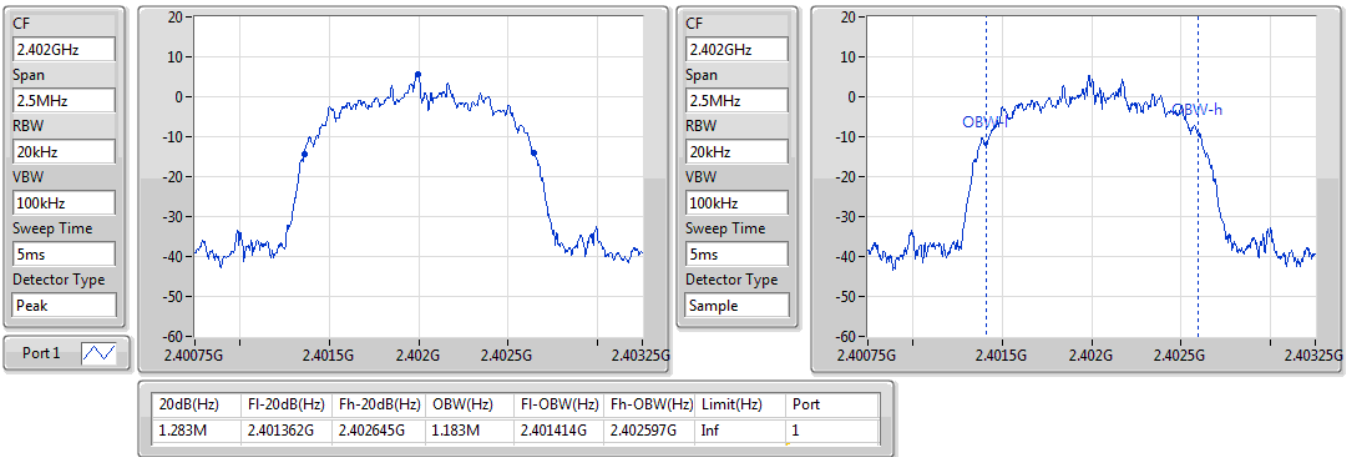
2480MHz



BT-EDR(3Mbps)

EBW-FS

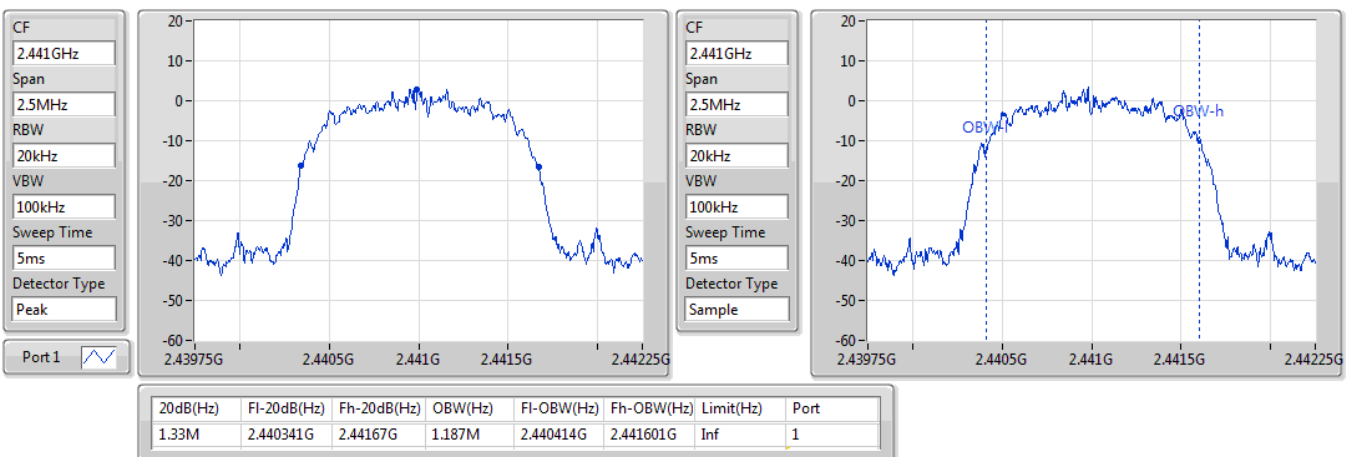
2402MHz



BT-EDR(3Mbps)

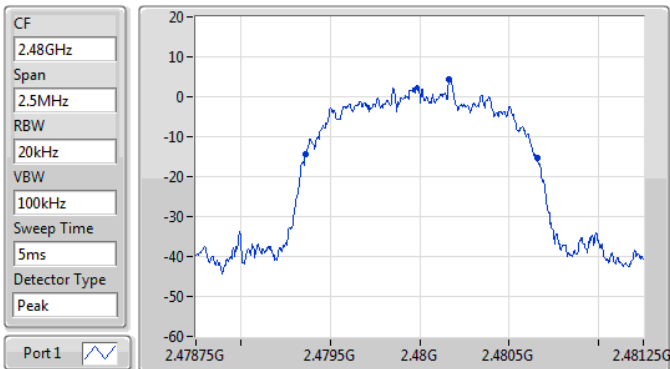
EBW-FS

2441MHz



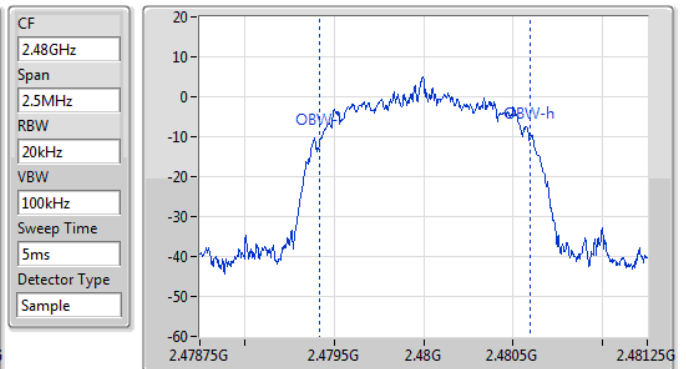
BT-EDR(3Mbps)

2480MHz



20dB(Hz)	Fl-20dB(Hz)	Fh-20dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.293M	2.479362G	2.480656G	1.179M	2.479418G	2.480597G	Inf	1

EBW-FS



Summary

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

Result

Mode	Result	Fl (Hz)	Fh (Hz)	Ch.Space (Hz)	Limit (Hz)
BT-BR(1Mbps)	-	-	-	-	-
2402MHz	Pass	2.402G	2.403G	1M	620.151894k
2441MHz	Pass	2.441G	2.442G	1M	617.738976k
2480MHz	Pass	2.479G	2.480004G	1.004348M	622.565478k
BT-EDR(2Mbps)	-	-	-	-	-
2402MHz	Pass	2.402G	2.403G	1M	880.452k
2441MHz	Pass	2.441G	2.442G	1M	875.79k
2480MHz	Pass	2.478996G	2.48G	1.004348M	878.454k
BT-EDR(3Mbps)	-	-	-	-	-
2402MHz	Pass	2.401996G	2.403G	1.004348M	854.478k
2441MHz	Pass	2.441G	2.442G	1M	885.78k
2480MHz	Pass	2.478996G	2.48G	1.004348M	861.138k

BT-BR(1Mbps)

Channel Separation-FS

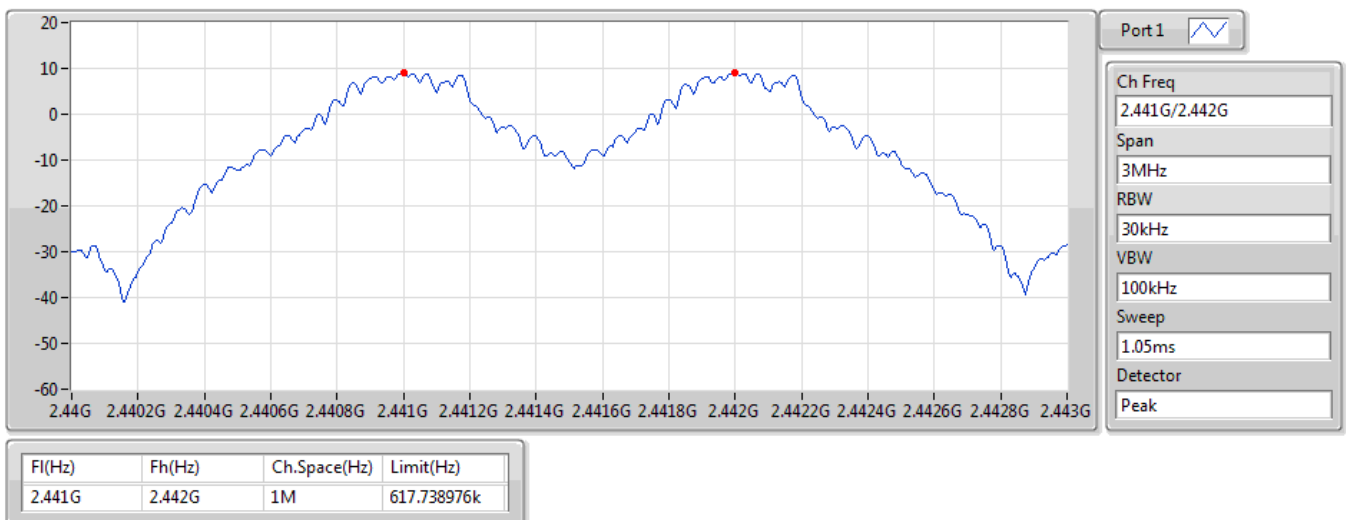
2.402G/2.403GHz



BT-BR(1Mbps)

Channel Separation-FS

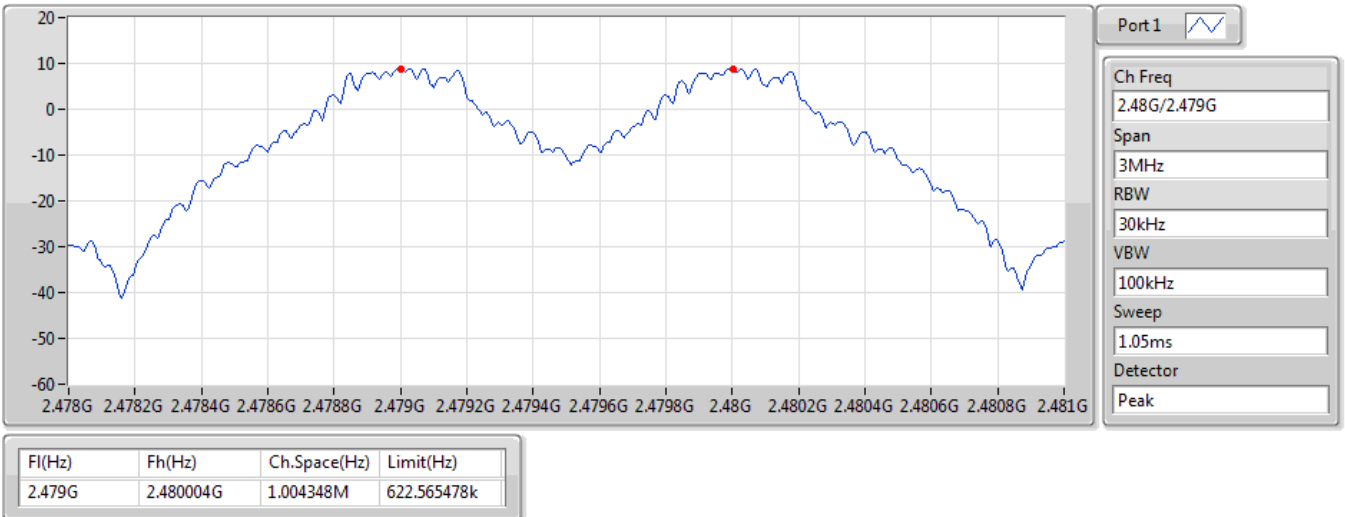
2.441G/2.442GHz



BT-BR(1Mbps)

2.48G/2.479GHz

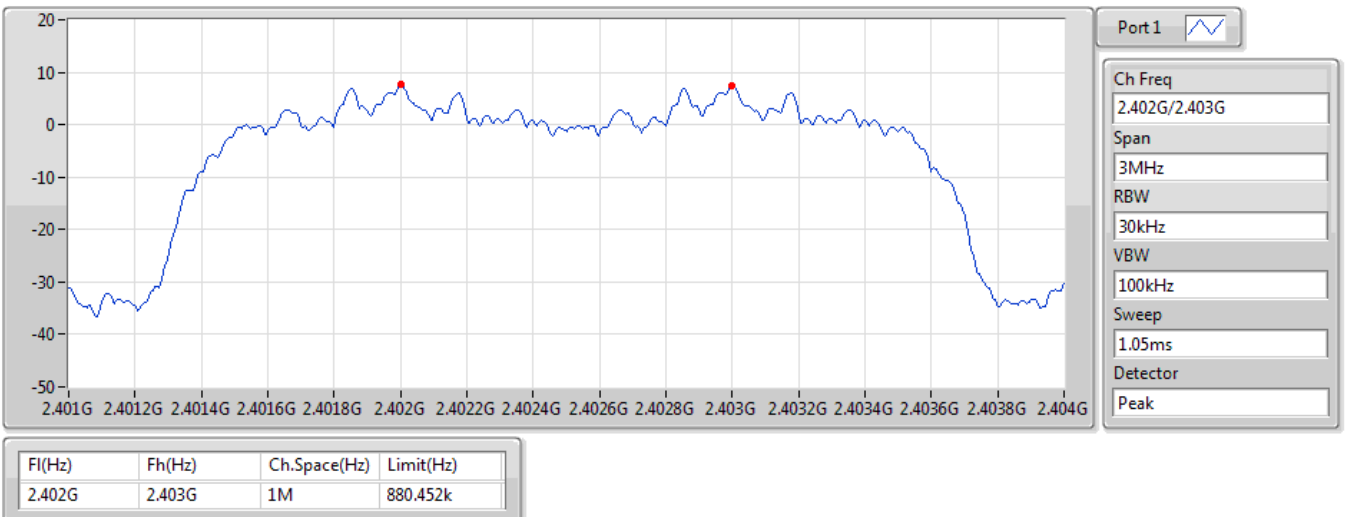
Channel Separation-FS



BT-EDR(2Mbps)

2.402G/2.403GHz

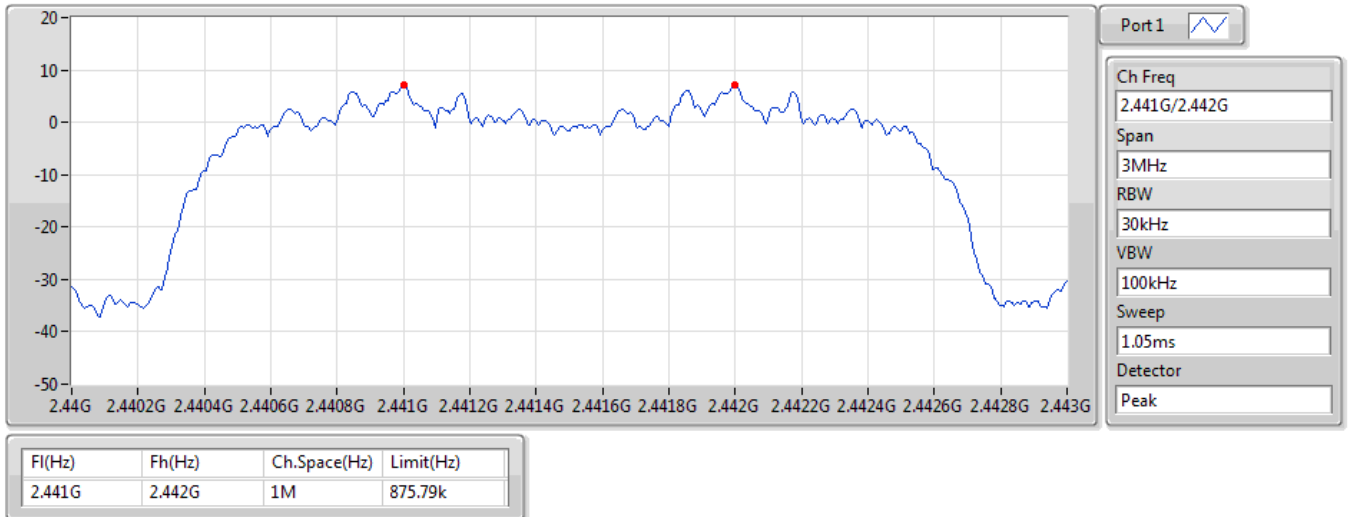
Channel Separation-FS



BT-EDR(2Mbps)

Channel Separation-FS

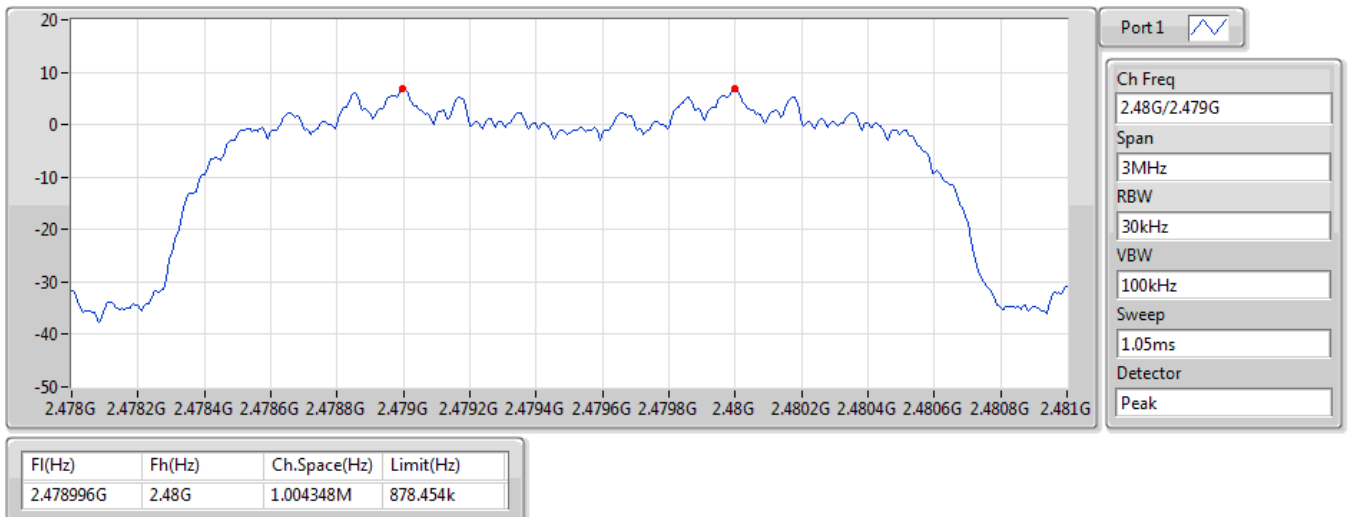
2.441G/2.442GHz



BT-EDR(2Mbps)

Channel Separation-FS

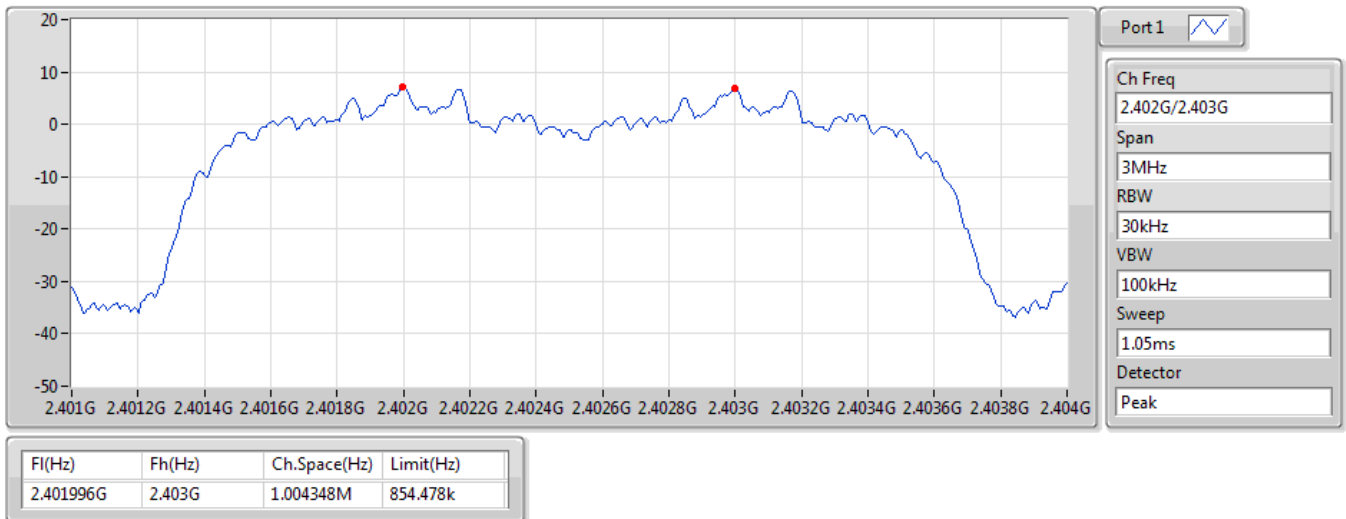
2.48G/2.479GHz



BT-EDR(3Mbps)

Channel Separation-FS

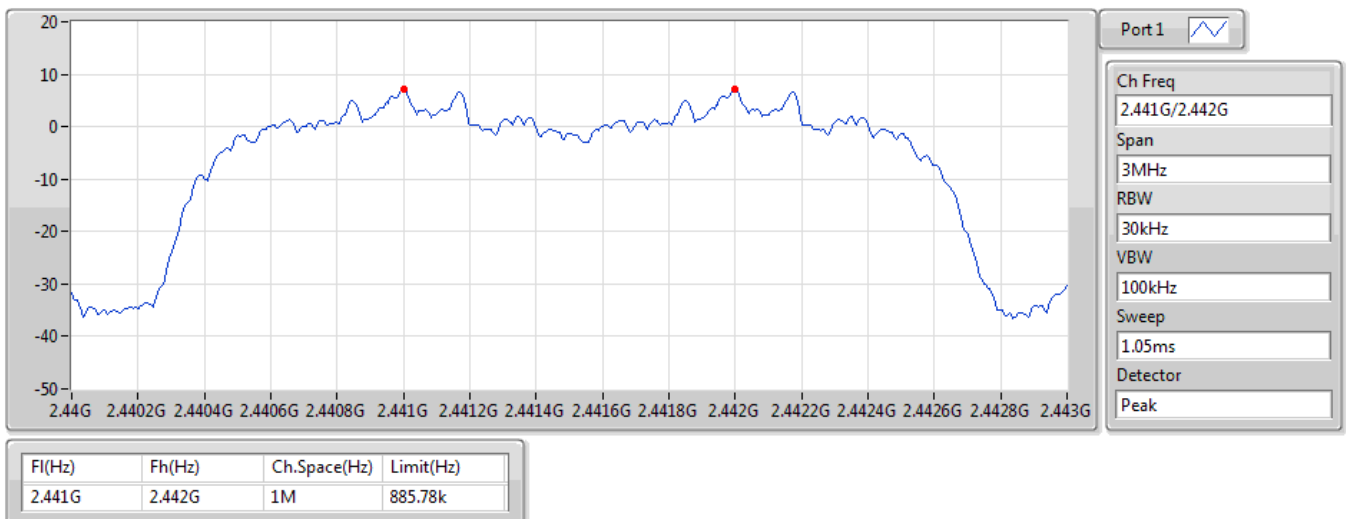
2.402G/2.403GHz



BT-EDR(3Mbps)

Channel Separation-FS

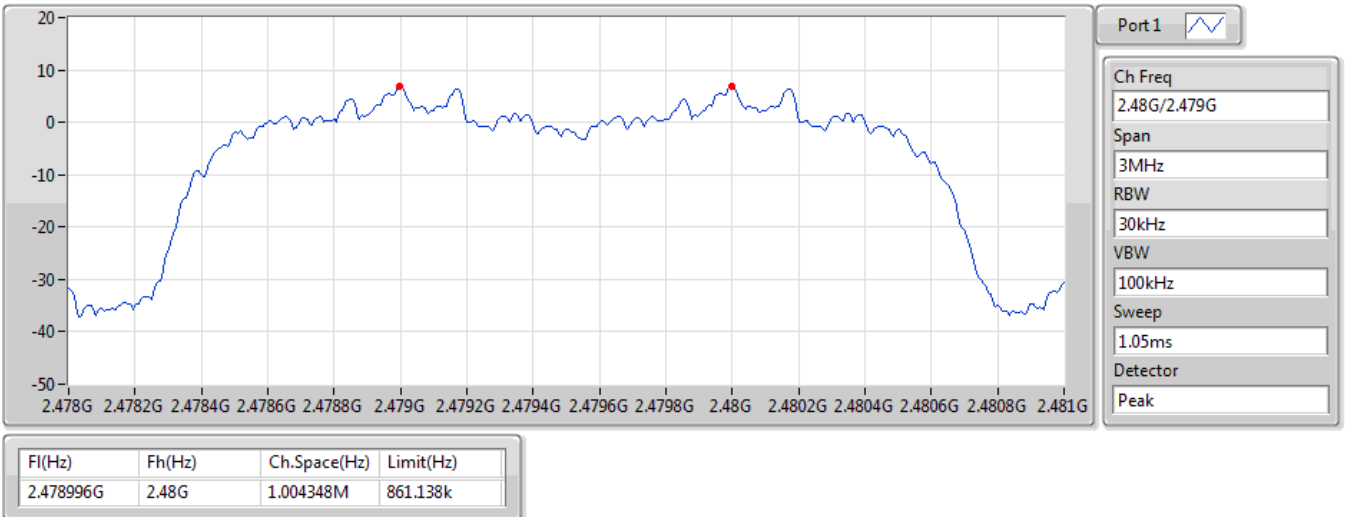
2.441G/2.442GHz



BT-EDR(3Mbps)

2.48G/2.479GHz

Channel Separation-FS



Summary

Mode	Max-Dwell (s)
2.4-2.4835GHz	-
BT-BR(1Mbps)	348.50218m_DH5
BT-EDR(2Mbps)	348.9825m_DH5
BT-EDR(3Mbps)	330.615m_DH5
BT-BR-AFH(1Mbps)	313.416m_DH5-AFH
BT-EDR-AFH(2Mbps)	313.686m_DH5-AFH
BT-EDR-AFH(3Mbps)	314.091m_DH5-AFH

Result/ Non AFH mode

Mode	Result	Period (s)	Dwell (s)	Limit (s)	Tx On (ms)	Number of transmission in a 5 s
BT-BR(1Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	31.6	0.34850	0.4	2.90225	19
BT-EDR(2Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	31.6	0.34898	0.4	2.90625	19
BT-EDR(3Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	31.6	0.33062	0.4	2.90625	18

Note 1: Dwell time =Number of transmission in a 5 second x Tx On Time x 6.32

Note 2: DH5 was the worst mode.

Result/ AFH mode

Mode	Result	Period (s)	Dwell (s)	Limit (s)	Tx On (ms)	Number of transmission in a 2 s
BT-BR-AFH(1Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	8	0.31342	0.4	2.90200	27
BT-EDR-AFH(2Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	8	0.31369	0.4	2.90450	27
BT-EDR-AFH(3Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	8	0.31409	0.4	2.90825	27

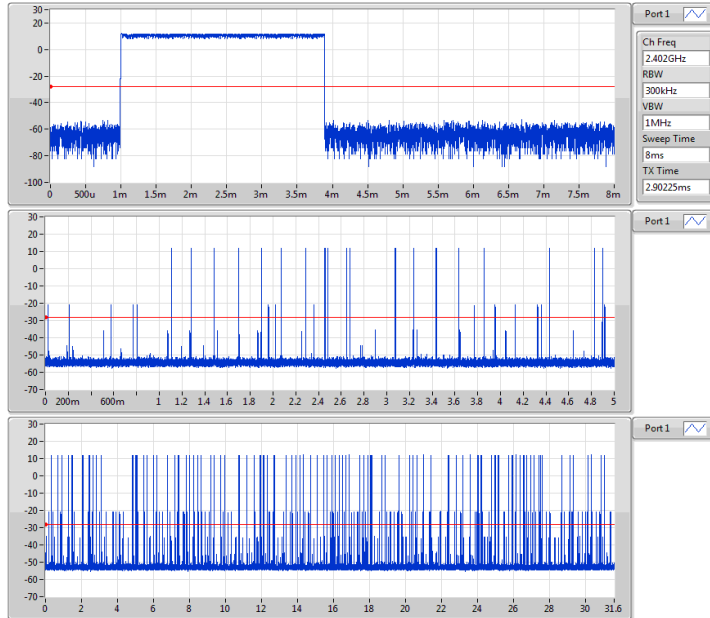
Note 1: Dwell time =Number of transmission in a 2 second x Tx On Time x 4

Note 2: DH5 was the worst mode.

BT-BR(1Mbps)

Dwell-FS

2402MHz



BT-EDR(2Mbps)

Dwell-FS

2402MHz



BT-EDR(3Mbps)

Dwell-FS

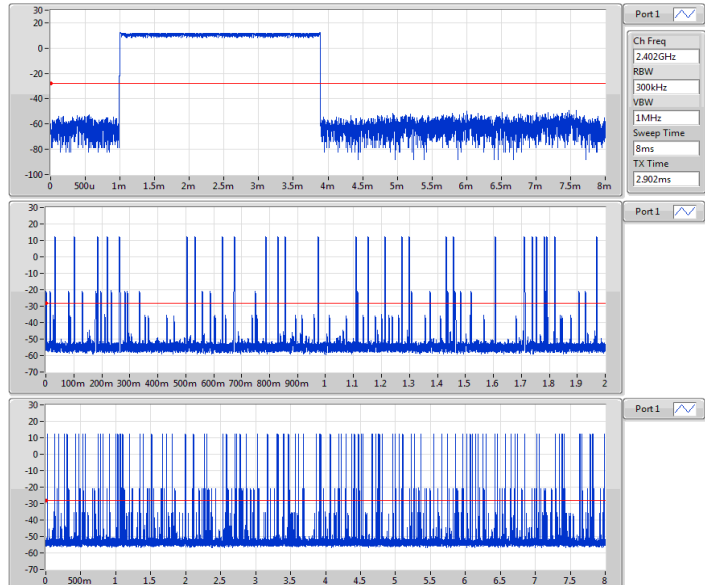
2402MHz

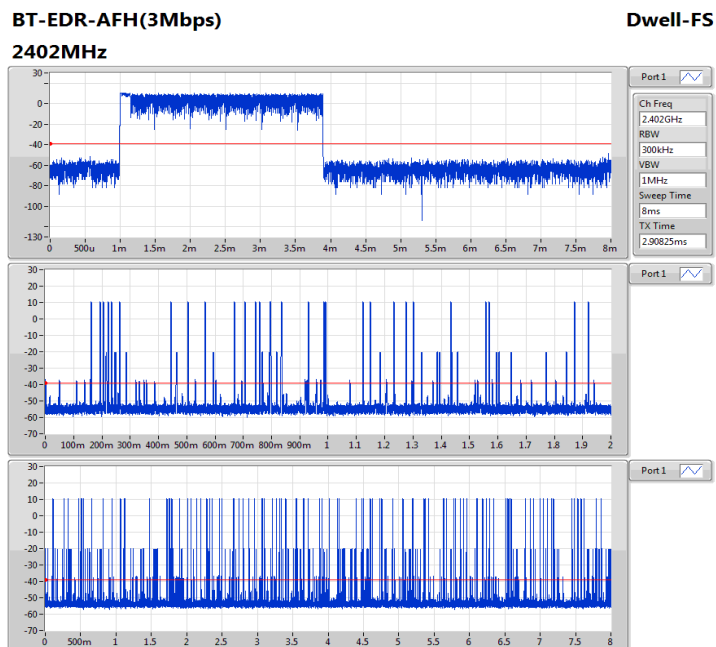
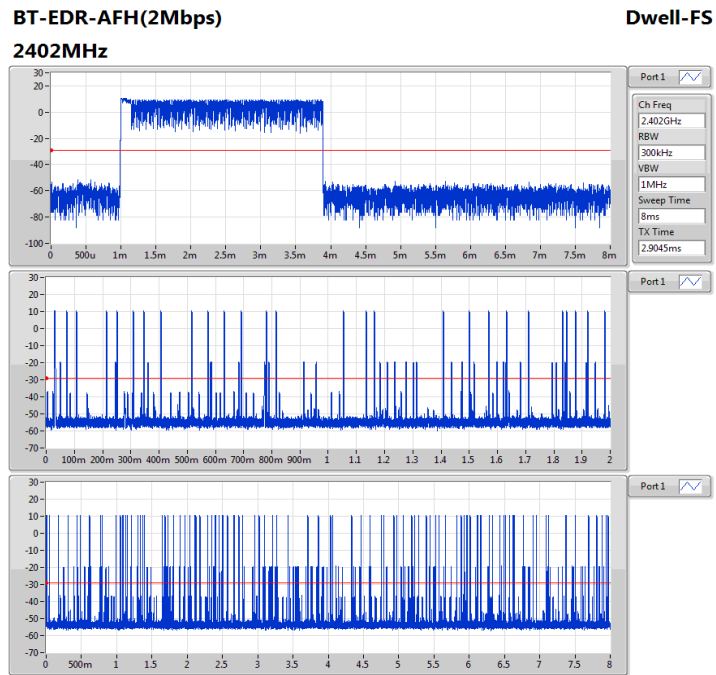


BT-BR-AFH(1Mbps)

Dwell-FS

2402MHz





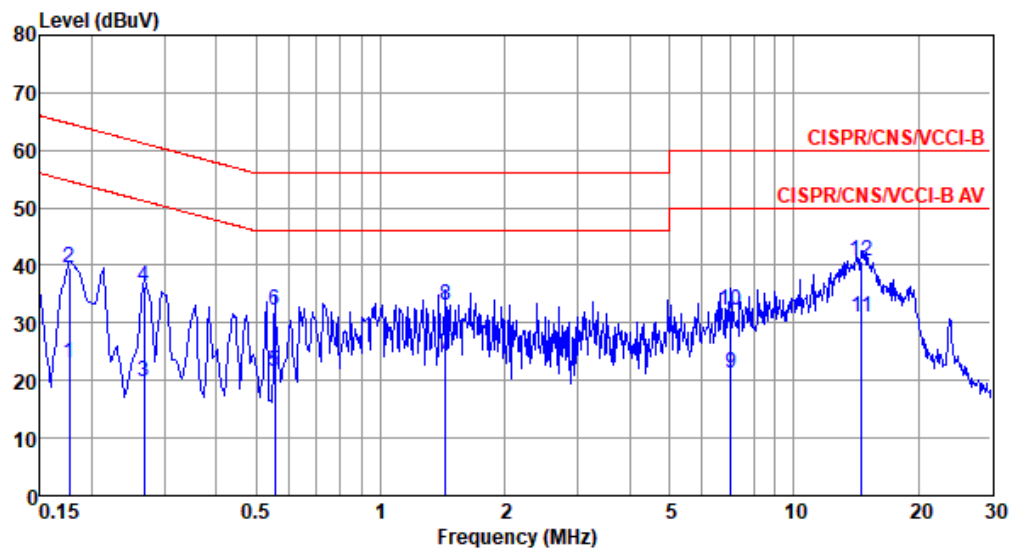


Modulation	8DPSK	Test Freq. (MHz)	2402
Power Phase	Line		

Test by : Joe Liao

Temperature: 22°C

Humidity: 61%



	Freq MHz	Level dBUV	Limit dBUV	Over Limit dB	Read Level dBUV	Factor dB	Cable loss dB	Aux dB	Remark
1	0.177	22.94	54.64	-31.70	12.97	9.68	0.08	0.21	Average
2	0.177	39.44	64.64	-25.20	29.47	9.68	0.08	0.21	QP
3	0.267	19.84	51.20	-31.36	9.80	9.68	0.08	0.28	Average
4	0.267	36.36	61.20	-24.84	26.32	9.68	0.08	0.28	QP
5	0.555	21.63	46.00	-24.37	11.49	9.67	0.11	0.36	Average
6	0.555	32.29	56.00	-23.71	22.15	9.67	0.11	0.36	QP
7	1.433	24.63	46.00	-21.37	14.38	9.69	0.18	0.38	Average
8	1.433	33.10	56.00	-22.90	22.85	9.69	0.18	0.38	QP
9	7.025	21.17	50.00	-28.83	10.66	9.72	0.36	0.43	Average
10	7.025	32.25	60.00	-27.75	21.74	9.72	0.36	0.43	QP
11*	14.594	30.97	50.00	-19.03	20.17	9.73	0.55	0.52	Average
12	14.594	40.81	60.00	-19.19	30.01	9.73	0.55	0.52	QP

Note 1: Level (dBUV) = Read Level (dBUV) + LISN Factor (dB) + Cable Loss (dB) + Aux (dB).

2: Over Limit (dB) = Level (dBUV) - Limit Line (dBUV).



AC Power Line Conducted Emissions

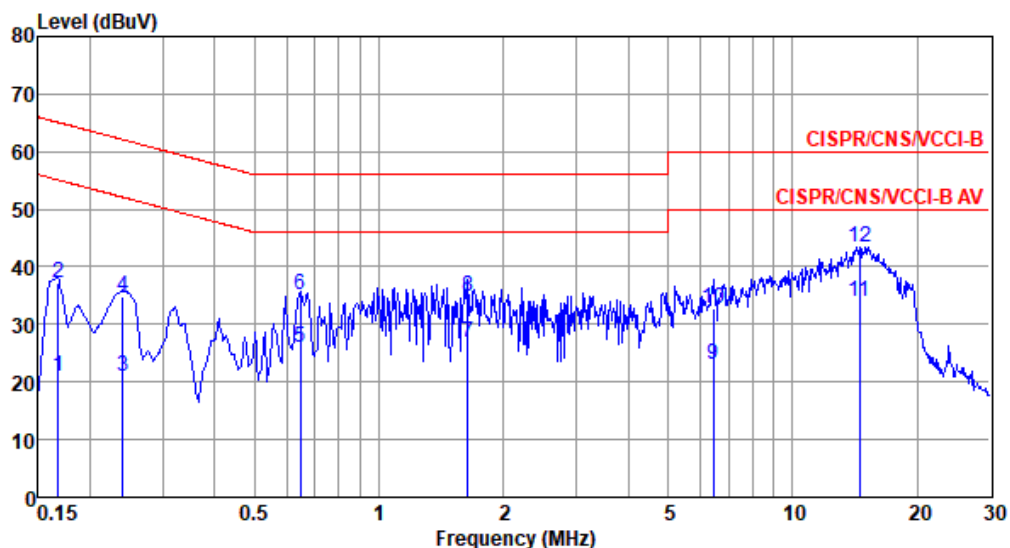
Appendix H

Modulation	8DPSK	Test Freq. (MHz)	2402
Power Phase	Neutral		

Test by : Joe Liao

Temperature: 22°C

Humidity: 61%



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Aux dB	Remark
1	0.168	20.99	55.08	-34.09	11.13	9.61	0.08	0.17	Average
2	0.168	37.25	65.08	-27.83	27.39	9.61	0.08	0.17	QP
3	0.240	21.10	52.08	-30.98	11.23	9.61	0.08	0.18	Average
4	0.240	34.96	62.08	-27.12	25.09	9.61	0.08	0.18	QP
5	0.644	25.94	46.00	-20.06	15.97	9.61	0.12	0.24	Average
6	0.644	35.02	56.00	-20.98	25.05	9.61	0.12	0.24	QP
7	1.636	26.85	46.00	-19.15	16.75	9.62	0.19	0.29	Average
8	1.636	34.84	56.00	-21.16	24.74	9.62	0.19	0.29	QP
9	6.420	23.07	50.00	-26.93	12.72	9.67	0.33	0.35	Average
10	6.420	32.86	60.00	-27.14	22.51	9.67	0.33	0.35	QP
11*	14.517	34.03	50.00	-15.97	23.28	9.74	0.55	0.46	Average
12	14.517	43.45	60.00	-16.55	32.70	9.74	0.55	0.46	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB) + Aux (dB).

2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).