

# FCC Test Report

**FCC ID** : 2ACIX-PI4  
**Equipment** : Wireless Neckband  
**Brand Name** : Bowers & Wilkins  
**Model Name** : PI4  
**Applicant** : B&W Group Ltd  
Dale Road, Worthing, West Sussex. BN11 2BH, United Kingdom  
**Manufacturer** : B&W Group Ltd  
Dale Road, Worthing, West Sussex. BN11 2BH, United Kingdom  
**Standard** : 47 CFR FCC Part 15.247

The product was received on Jun. 12, 2019, and testing was started from Jun. 20, 2019 and completed on Jul. 10, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 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 INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.



Approved by: Allen Lin

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

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



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### Summary of Test Result

Report Clause	Ref. Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	FCC 15.203
3.1	15.207	AC Power-line Conducted Emissions	PASS	FCC 15.207
3.2	15.247(a)	20dB Bandwidth	PASS	15.247(a)
3.2	15.247(a)	Carrier Frequency Separation	PASS	15.247(a)
3.3	15.247(b)	Maximum Conducted Output Power	PASS	15.247(b)
3.4	15.247(a)	Number of Hopping Frequencies and Hopping Bandedge	PASS	15.247(a)
3.5	15.247(a)	Time of Occupancy (Dwell Time)	PASS	15.247(a)
3.6	15.247(d)	Emissions in Non-restricted Frequency Bands	PASS	15.247(d)
3.7	15.247(d)	Emissions in Restricted Frequency Bands	PASS	Restricted Bands: FCC 15.209

<b>Declaration of Conformity:</b>
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
<b>Comments and explanations:</b>
None

Reviewed by: Sam Tsai

Report Producer: Debby Hung

# 1 General Description

## 1.1 Information

### 1.1.1 RF General Information

Frequency Range (MHz)	Bluetooth Version	Ch. Frequency (MHz)	Channel Number
2400-2483.5	BR / EDR	2402-2480	0-78 [79]

Band	Mode	BWch (MHz)	Nant
2.4-2.4835GHz	BT-BR(1Mbps)	1	1TX
2.4-2.4835GHz	BT-EDR(2Mbps)	1	1TX
2.4-2.4835GHz	BT-EDR(3Mbps)	1	1TX

Note:

- ◆ Bluetooth BR uses a GFSK (1Mbps).
- ◆ Bluetooth EDR uses a combination of  $\pi/4$ -DQPSK (2Mbps) and 8DPSK (3Mbps).
- ◆ Bluetooth BR/EDR uses as a system using FHSS modulation.
- ◆ BWch is the nominal channel bandwidth.

### 1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	ADVANCED-CONNECTEK INC.	AML00-000001	Dipole Antenna	Mini I-Pex	-0.91

For Bluetooth function:

For Bluetooth mode (1TX/1RX)

Only Ant.1 can be used as transmitting/receiving antenna.

### 1.1.3 EUT Information

Operational Condition	
EUT Power Type	From Host System
EUT Function	<input checked="" type="checkbox"/> Point-to-multipoint <input type="checkbox"/> Point-to-point
Type of EUT	
<input checked="" type="checkbox"/>	Stand-alone
<input type="checkbox"/>	Combined (EUT where the radio part is fully integrated within another device)
	Combined Equipment - Brand Name / Model No.: ...
<input type="checkbox"/>	Plug-in radio (EUT intended for a variety of host systems)
	Host System - Brand Name / Model No.: ...
<input type="checkbox"/>	Other:

### 1.1.4 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) $\geq 1/T$
BT-BR(1Mbps)	0.786	1.05	2.893m	1k
BT-EDR(2Mbps)	0.777	1.1	2.891m	1k
BT-EDR(3Mbps)	0.777	1.1	2.894m	1k

Note. If DC < 0.98, the DCF was added while measuring Output power and PSD.

## 1.2 Testing Applied Standards

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

- ◆ 47 CFR FCC Part 15
- ◆ KDB 558074 D01 v05r02
- ◆ ANSI C63.10-2013

## 1.3 Testing Location Information

Testing Location		
<input checked="" type="checkbox"/>	HWA YA	ADD : No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL : 886-3-327-3456      FAX : 886-3-327-0973
Test site Designation No. TW1190 with FCC.		
<input type="checkbox"/>	JHUBEI	ADD : No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County, Taiwan (R.O.C.) TEL : 886-3-656-9065      FAX : 886-3-656-9085
Test site Designation No. TW0006 with FCC.		

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
AC Conduction	CO04-HY	Jeff	21.2~23.9°C / 56.2~59.1%	20/Jun/2019
RF Conducted	TH01-HY	Andy	23.3~24.9°C / 63~65.5%	01/Jul/2019
Radiated	03CH01-HY	Edward	24.8~26.9°C / 56.1~63.4%	20/Jun/2019~10/Jul/2019



### 1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.54 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	1.6 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	4.3 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.9 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.3 dB	Confidence levels of 95%
Temperature	0.7 °C	Confidence levels of 95%
Humidity	4 %	Confidence levels of 95%



## 2 Test Configuration of EUT

### 2.1 Test Condition

RF Conducted	Abbreviation	Remark
TnomVnom	Tnom	20°C
-	Vnom	120V

### 2.2 Test Channel Mode

Test Software Version	Blue Test 3
-----------------------	-------------




Mode	PowerSetting
BT-BR(1Mbps)	-
2402MHz	7
2441MHz	5
2480MHz	3
BT-EDR(2Mbps)	-
2402MHz	7
2441MHz	4
2480MHz	3
BT-EDR(3Mbps)	-
2402MHz	7
2441MHz	5
2480MHz	3



### 2.3 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral
Operating Mode	CTX
1	USB Mode

The Worst Case Mode for Following Conformance Tests	
Tests Item	20dB Bandwidth Carrier Frequency Separation Maximum Conducted Output Power Number of Hopping Frequencies Hopping Bandedge Time of Occupancy (Dwell Time) Emissions in Non-restricted Frequency Bands
Test Condition	Conducted measurement at transmit chains

The Worst Case Mode for Following Conformance Tests			
Tests Item	Emissions in Restricted Frequency Bands		
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.		
Operating Mode < 1GHz	CTX		
1	USB Mode		
Operating Mode > 1GHz	CTX		
Orthogonal Planes of EUT	X Plane	Y Plane	Z Plane
			
Worst Planes of EUT		V	

## 2.4 Accessories and Support Equipment

Accessories				
Battery	Brand Name	VDL	Model Name	451034
	Manufacturer	VDL Electronics Co., LTD		
	Power Rating	3.8 Vdc, 150 mAh		
USB Cable	Brand Name	Liang Gang	Model Name	TG-D10128-0002
	Signal Line	0.2 meter, D-shielded cable, w/o ferrite core		

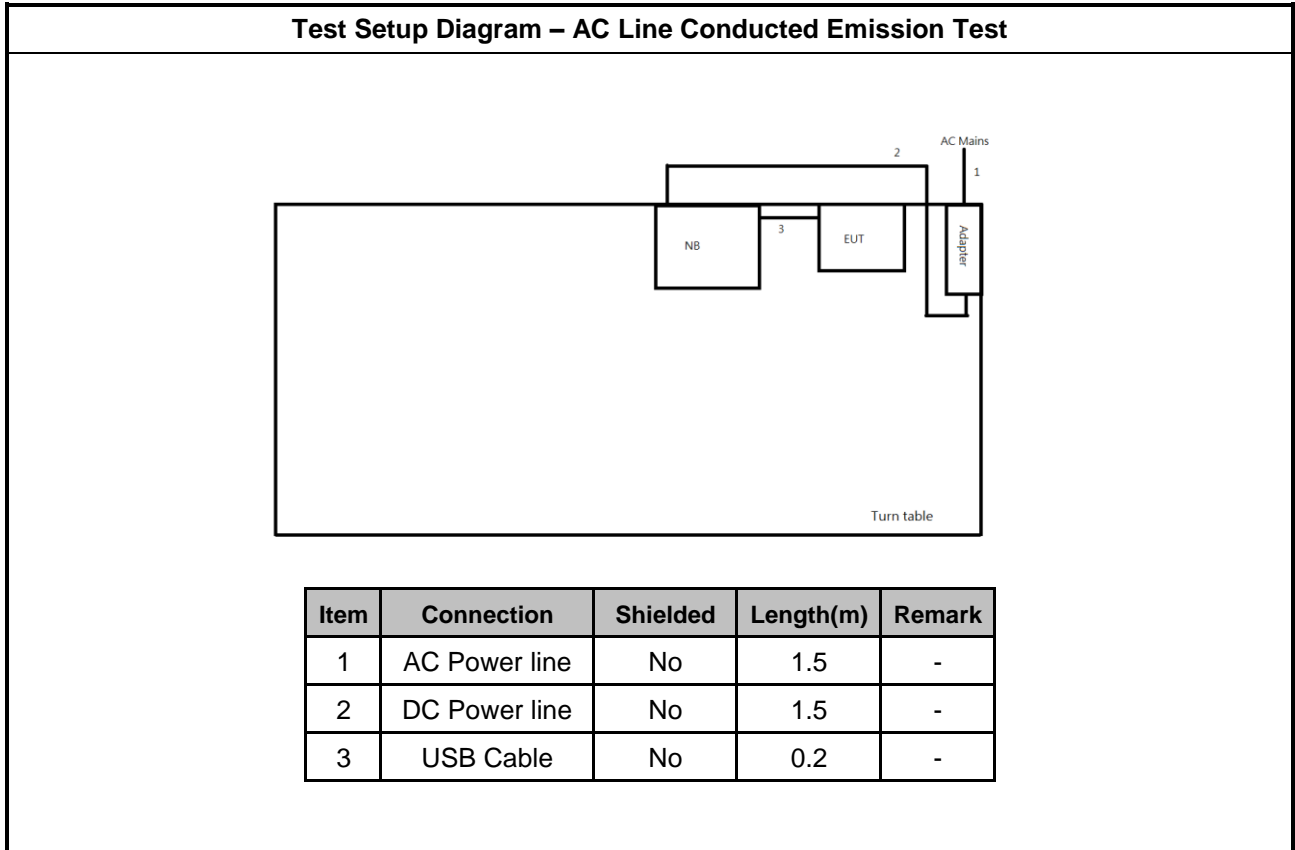
Reminder: Regarding to more detail and other information, please refer to user manual.

Support Equipment – AC Conduction				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E5570	-
2	AC Adapter for NB	DELL	LA90PS1-00	-

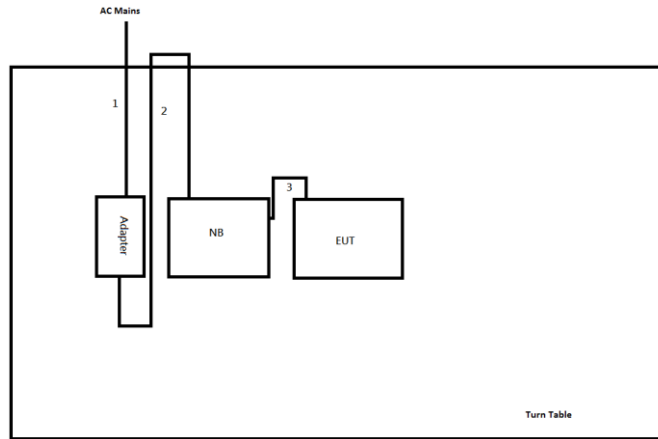
Support Equipment – RF Conducted				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E5410	R33002 / DOC
2	Adapter for NB	DELL	HA65NM130	R35737 / DOC
3	DC Power Supply	GW	GPS-3030DD	-

Support Equipment – Radiated Emission				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Adapter	DELL	AA65NM121	-

## 2.5 Test Setup Diagram



**Test Setup Diagram - Radiated Test**



Item	Connection	Shielded	Length(m)	Remark
1	AC Power line	No	1.5	-
2	DC Power line	No	1.5	-
3	Type C USB Cable	No	0.2	-

### 3 Transmitter Test Result

#### 3.1 AC Power-line Conducted Emissions

##### 3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line 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.

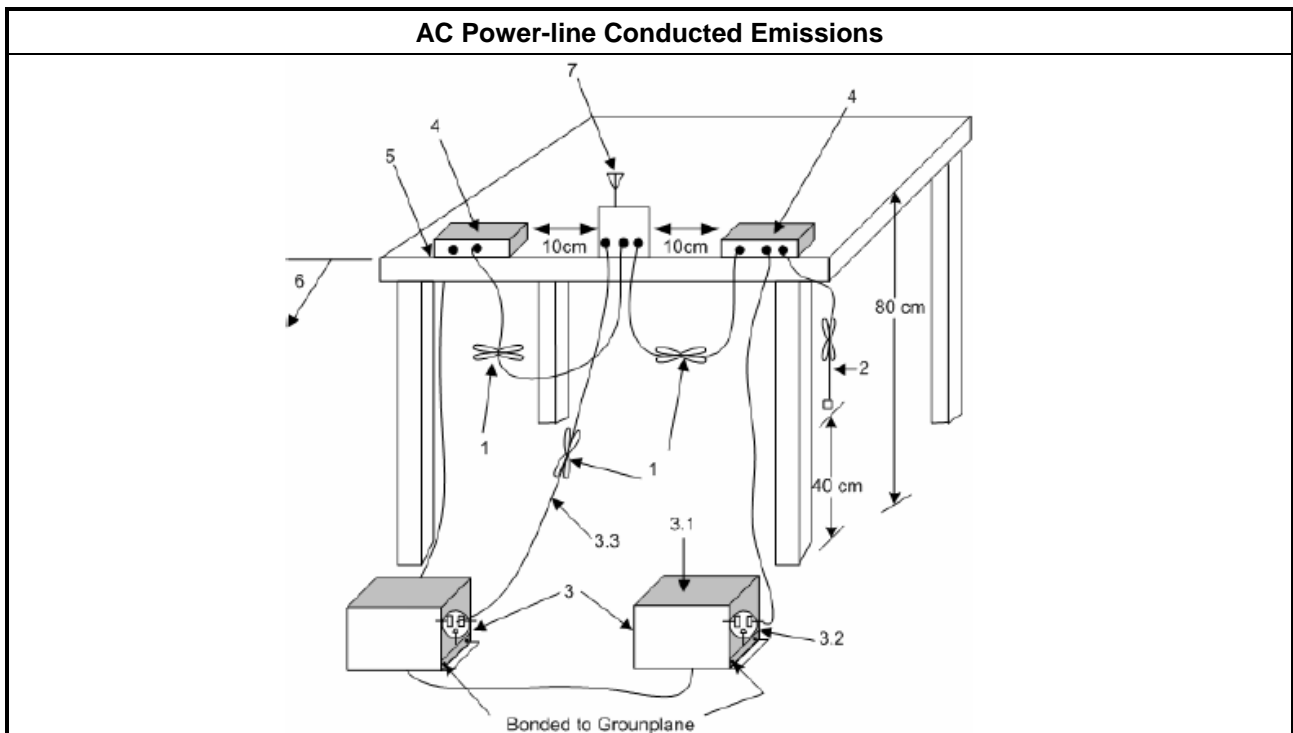
##### 3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

##### 3.1.3 Test Procedures

Test Method
<ul style="list-style-type: none"> <li>Refer as ANSI C63.10-2013, clause 6.2 foray power-line conducted emissions.</li> </ul>

##### 3.1.4 Test Setup



##### 3.1.5 Test Result of AC Power-line Conducted Emissions

Refer as Appendix A

### 3.2 20dB Bandwidth and Carrier Frequency Separation

#### 3.2.1 20dB Bandwidth and Carrier Frequency Separation Limit

20dB Bandwidth and Carrier Frequency Separation Limit for Frequency Hopping Systems	
<ul style="list-style-type: none"> <li>2400-2483.5 MHz Band:</li> </ul>	
	<ul style="list-style-type: none"> <li><math>N \geq 75</math> and <math>ChS \geq MAX</math> (20 dB bandwidth, 25 kHz).</li> </ul>
	<ul style="list-style-type: none"> <li><math>75 &gt; N \geq 15</math> and <math>ChS \geq MAX</math> (20 dB bandwidth 2/3,25 kHz).</li> </ul>
<b>N:</b> Number of Hopping Frequencies; <b>ChS:</b> Hopping Channel Separation	

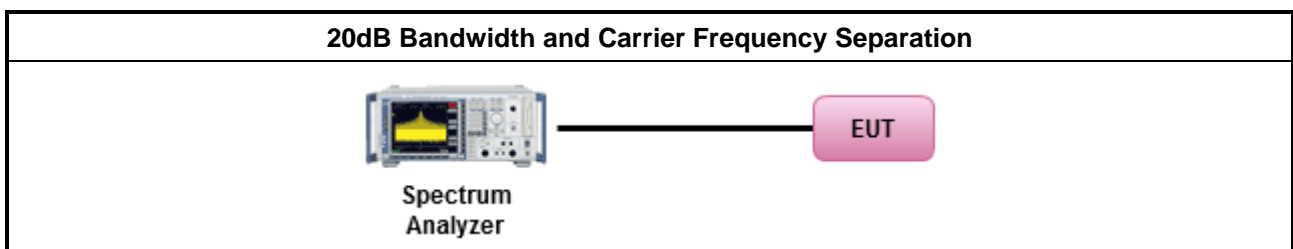
#### 3.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

#### 3.2.3 Test Procedures

Test Method
<ul style="list-style-type: none"> <li>Refer as ANSI C63.10-2013, clause 6.9.2 for 20 dB bandwidth measurement.</li> </ul>
<ul style="list-style-type: none"> <li>Refer as ANSI C63.10-2013, clause 7.8.2 for carrier frequency separation measurement.</li> </ul>

#### 3.2.4 Test Setup



#### 3.2.5 Test Result of 20dB Bandwidth

Refer as Appendix B

#### 3.2.6 Test Result of Carrier Frequency Separation

Refer as Appendix B

### 3.3 Maximum Conducted Output Power

#### 3.3.1 Maximum Conducted Output Power Limit

Maximum Conducted Output Power Limit	
<ul style="list-style-type: none"> <li>▪ 2400-2483.5 MHz Band:</li> </ul>	
	<ul style="list-style-type: none"> <li>▪ <math>N \geq 75</math>; Power 30dBm; EIRP 36dBm</li> </ul>
	<ul style="list-style-type: none"> <li>▪ <math>75 &gt; N \geq 15</math>; Power 21dBm; EIRP 27dBm</li> </ul>
<b>N:</b> Number of Hopping Frequencies	

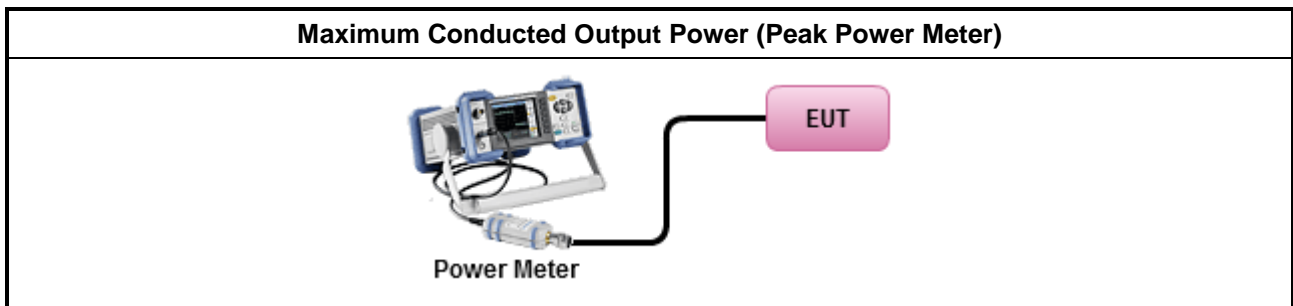
#### 3.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

#### 3.3.3 Test Procedures

Test Method
<ul style="list-style-type: none"> <li>▪ Refer as ANSI C63.10-2013, clause 7.8.5 for output power measurement.</li> </ul>

#### 3.3.4 Test Setup



#### 3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C

### 3.4 Number of Hopping Frequencies and Hopping Bandedge

#### 3.4.1 Number of Hopping Frequencies Limit

Number of Hopping Frequencies Limit	
<ul style="list-style-type: none"> <li>2400-2483.5 MHz Band:</li> </ul>	
	<ul style="list-style-type: none"> <li><math>N \geq 75</math> and <math>ChS \geq MAX</math> (20 dB bandwidth, 25 kHz).</li> </ul>
	<ul style="list-style-type: none"> <li><math>75 &gt; N \geq 15</math> and <math>ChS \geq MAX</math> (20 dB bandwidth 2/3, 25 kHz).</li> </ul>
<b>N:</b> Number of Hopping Frequencies; <b>ChS</b> : Hopping Channel Separation	

#### 3.4.2 Hopping Bandedge Limit

Refer clause 3.6.1 and clause 3.7.1

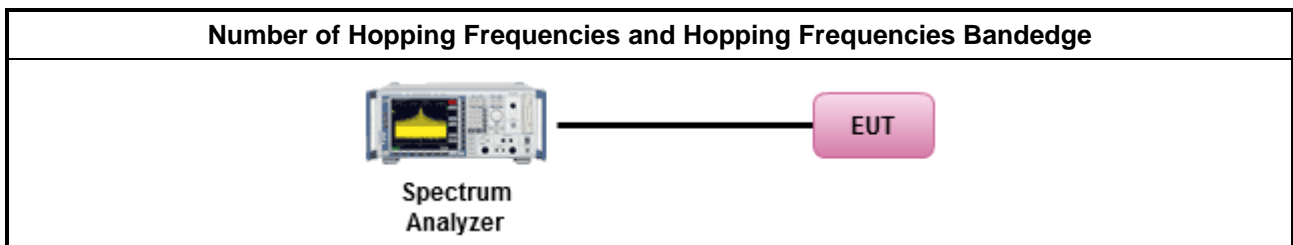
#### 3.4.3 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

#### 3.4.4 Test Procedures

Test Method
<ul style="list-style-type: none"> <li>Refer as ANSI C63.10-2013, clause 7.8.3 for number of hopping frequencies measurement.</li> </ul>
<ul style="list-style-type: none"> <li>Refer as ANSI C63.10-2013, clause 7.8.6 for hopping frequencies Bandedge measurement.</li> </ul>

#### 3.4.5 Test Setup



#### 3.4.6 Test Result of Number of Hopping Frequencies

Refer as Appendix D

#### 3.4.7 Test Result of Number of Hopping Frequencies Bandedge

Refer as Appendix D



### 3.5 Time of Occupancy (Dwell Time)

#### 3.5.1 Time of Occupancy (Dwell Time) Limit

Time of Occupancy (Dwell Time) Limit for Frequency Hopping Systems	
<ul style="list-style-type: none"> <li>2400-2483.5 MHz Band:</li> </ul>	
	<ul style="list-style-type: none"> <li><math>N \geq 75</math>; 0.4s in <math>N \times 0.4</math> period</li> </ul>
	<ul style="list-style-type: none"> <li><math>75 &gt; N \geq 15</math>; 0.4s in <math>N \times 0.4</math> period</li> </ul>
<b>N:</b> Number of Hopping Frequencies	

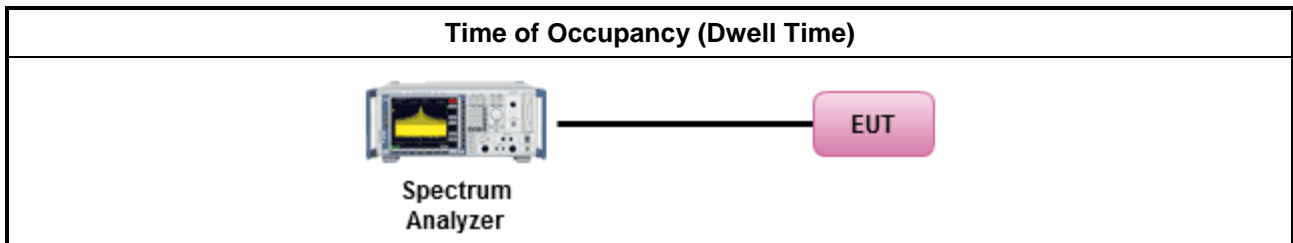
#### 3.5.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

#### 3.5.3 Test Procedures

Test Method	
<ul style="list-style-type: none"> <li>Refer as ANSI C63.10-2013, clause 7.8.4 for dwell time measurement.</li> </ul>	
<ul style="list-style-type: none"> <li>Bluetooth ACL packets can be 1, 3, or 5 time slots. Following as dwell time. Operate DH5 at maximum dwell time and maximum duty cycle.</li> </ul>	
	<ul style="list-style-type: none"> <li>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 <math>5/1600</math> seconds, or 3.125ms. DH5 Packet permit maximum <math>1600 / 79 / 6 = 3.37</math> hops per second in each channel.</li> </ul>

#### 3.5.4 Test Setup



#### 3.5.5 Test Result of Time of Occupancy (Dwell Time)

Refer as Appendix E

### 3.6 Emissions in Non-restricted Frequency Bands

#### 3.6.1 Emissions in Non-restricted Frequency Bands Limit

Un-restricted Band Emissions Limit	
RF output power procedure	Limit (dB)
Peak output power procedure	20
Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.	

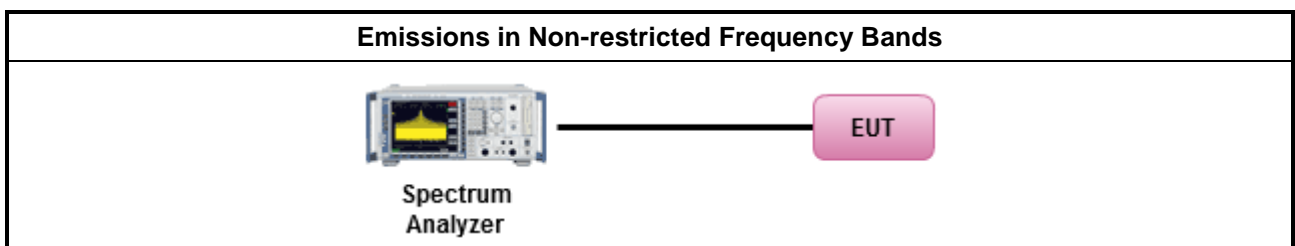
#### 3.6.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

#### 3.6.3 Test Procedures

Test Method
<ul style="list-style-type: none"> <li>Refer as ANSI C63.10-2013, clause 7.8.8 for unwanted emissions into non-restricted bands.</li> </ul>

#### 3.6.4 Test Setup



#### 3.6.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix F

### 3.7 Emissions in Restricted Frequency Bands

#### 3.7.1 Emissions in Restricted Frequency Bands Limit

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: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB / decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

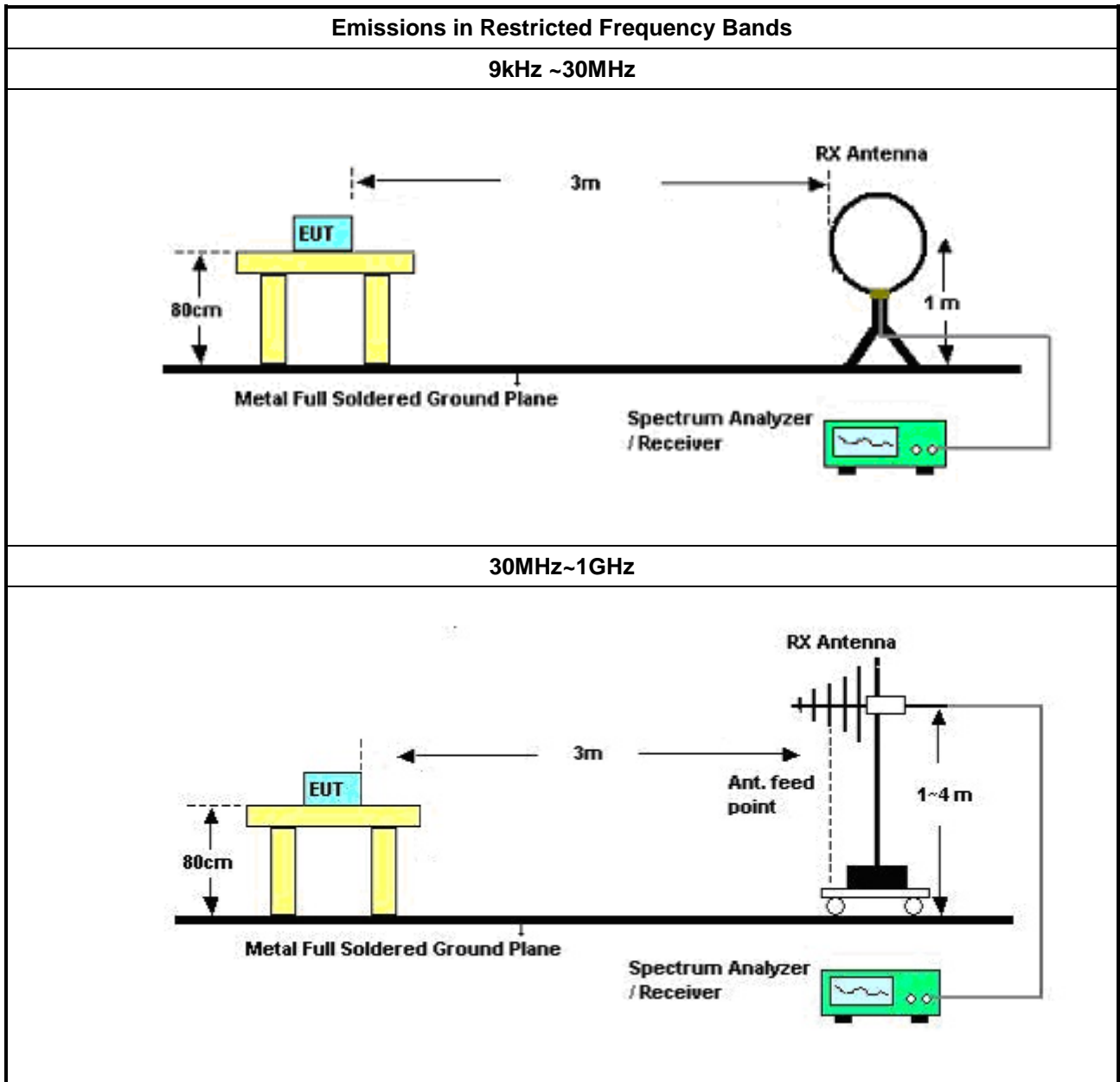
#### 3.7.2 Measuring Instruments

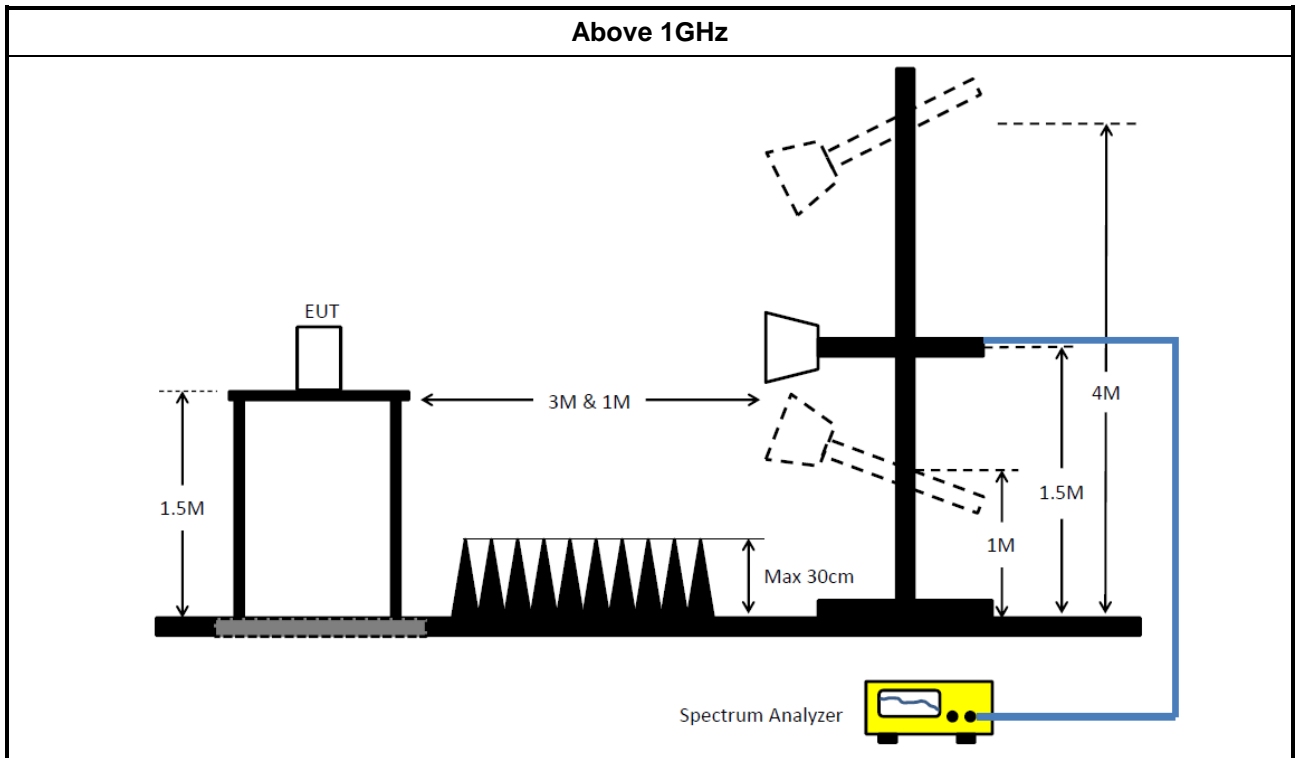
Refer a test equipment and calibration data table in this test report.

#### 3.7.3 Test Procedures

Test Method	
	<ul style="list-style-type: none"> <li>▪ The average emission levels shall be measured in [hopping duty factor].</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Refer as ANSI C63.10; clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.</li> </ul>
	<ul style="list-style-type: none"> <li>▪ For the transmitter unwanted emissions shall be measured using following options below:               <ul style="list-style-type: none"> <li>▪ Refer as ANSI C63.10, clause 4.1.4.2.1 QP value.</li> <li>▪ Refer as ANSI C63.10, clause 4.1.4.2.2 measurement procedure peak.</li> <li>▪ Refer as ANSI C63.10, clause 4.1.4.2.4 average value of hopping pulsed emissions.</li> </ul> </li> </ul>

### 3.7.4 Test Setup





### 3.7.5 Test Result of Emissions in Restricted Frequency Bands (Below 30MHz)

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

### 3.7.6 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix G

## 4 Test Equipment and Calibration Data

### Instrument for AC Conduction

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
EMC Receiver	R&S	ESR3	102052	9kHz ~ 3.6GHz	09/Apr/2019	08/Apr/2020
LISN	R&S	ENV216	101295	9kHz ~ 30MHz	08/Nov/2018	07/Nov/2019
RF Cable-CON	MTJ	RG142	CB002-CO	9kHz ~ 200MHz	17/Sep/2018	16/Sep/2019
AC POWER	APC	AFC-11005G	F310050055	47Hz~63Hz 5~300V	NCR	NCR
Impuls Begrenzer Puls e Limiter	SCHWARZBECK	VTSD 9561-F	9561-F041	9 kHz ~ 30 MHz	12/Oct/2018	11/Oct/2019

**NCR : Non-Calibration Require**

### Instrument for Conducted Test

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
Spectrum Analyzer	R&S	FSV 40	101013	10Hz~40GHz	13/Mar/2019	12/Mar/2020
Power Sensor	Anritsu	MA2411B	1339407	300MHz ~ 40GHz	17/Nov/2018	16/Nov/2019
Power Meter	Anritsu	ML2495A	1517010	300MHz ~ 40GHz	17/Nov/2018	16/Nov/2019
Cable 0.2m	HUBER	MY10710/4	RF Cable - 01	30MHz ~18G	10/Jan/2019	09/Jan/2020
Cable 0.2m	HUBER	MY10711/4	RF Cable - 02	30MHz ~18G	10/Jan/2019	09/Jan/2020
Cable 0.5m	HUBER	MY39470/4	RF Cable - 29	30MHz ~18G	10/Jan/2019	09/Jan/2020
SMB100A Signal Generator	R&S	SMB100A03	181147	100kHz~40GHz	12/Nov/2018	10/Nov/2020



Instrument for Radiated Test

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
3m Semi Anechoic Chamber	Riken	SAC-3M	03CH01-HY	30MHz ~ 1GHz 3m	11/Jan/2019	10/Jan/2020
3m Semi Anechoic Chamber	Riken	SAC-3M	03CH01-HY	1GHz ~ 18GHz 3m	09/Jan/2019	08/Jan/2020
PreAmplifier	COM-POWER	PA-103	161050	1 MHz ~ 1.0GHz	24/Jul/2018	23/Jul/2019
Microwave Preamp	Agilent	8449B	3008A02602	1GHz ~ 26.5GHz	27/Mar/2019	26/Mar/2020
Spectrum Analyzer	R&S	FSV40	101407	10Hz ~ 40GHz	16/Aug/2018	15/Aug/2019
RF Cable-R03m	Jye Bao	RG142	CB019	9kHz ~ 1GHz	14/Dec/2018	13/Dec/2019
RF Cable-HIGH	SUHNER	SUCOFLEX 104	SN805196/4+M Y39495	1 GHz ~ 18 GHz	13/Mar/2019	12/Mar/2020
Bilog Antenna & 5db Attenuator	SCHAFFNER/MT J	CBL6112D / MTJ6102-05	2678 / 001	30MHz ~ 2GHz	13/Mar/2019	12/Mar/2020
EMI Test Receiver	R&S	ESU-26	100422	20Hz ~ 26.5GHz	25/Oct/2018	24/Oct/2019
Loop Antenna	TESEQ	HLA 6120	31244	9k-30MHz	15/Mar/2019	14/Mar/2020
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170339	18GHz ~ 40GHz	19/Apr/2019	18/Apr/2020
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D-1130	1GHz ~ 18GHz	26/Oct/2018	25/Oct/2019

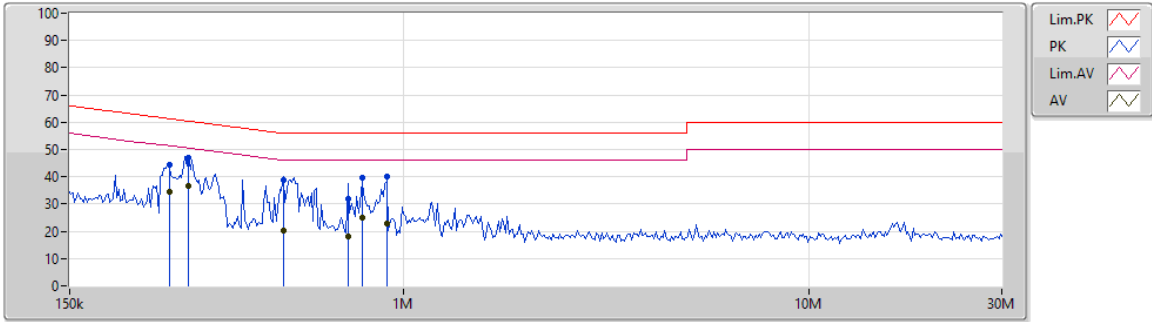


AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Neutral
Operating Function	USB mode		

AC Conduction\_Mode 1

20/06/2019



Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)
QP	264.49k	44.32	61.30	-16.98	19.47	Neutral	-	24.85	9.59	0.01	9.87
AV	264.49k	34.33	51.30	-16.97	19.47	Neutral	-	14.86	9.59	0.01	9.87
QP	295.083k	47.17	60.38	-13.21	19.48	Neutral	"Worst"	27.69	9.59	0.01	9.88
AV	295.083k	36.59	50.38	-13.79	19.48	Neutral	-	17.11	9.59	0.01	9.88
QP	505.009k	38.96	56.00	-17.04	19.48	Neutral	-	19.48	9.59	0.01	9.88
AV	505.009k	20.28	46.00	-25.72	19.48	Neutral	-	0.80	9.59	0.01	9.88
QP	729.776k	31.85	56.00	-24.15	19.49	Neutral	-	12.36	9.59	0.02	9.88
AV	729.776k	17.96	46.00	-28.04	19.49	Neutral	-	-1.53	9.59	0.02	9.88
QP	790.243k	39.49	56.00	-16.51	19.49	Neutral	-	20.00	9.59	0.02	9.88
AV	790.243k	24.99	46.00	-21.01	19.49	Neutral	-	5.50	9.59	0.02	9.88
QP	908.364k	39.91	56.00	-16.09	19.49	Neutral	-	20.42	9.59	0.02	9.88
AV	908.364k	22.98	46.00	-23.02	19.49	Neutral	-	3.49	9.59	0.02	9.88



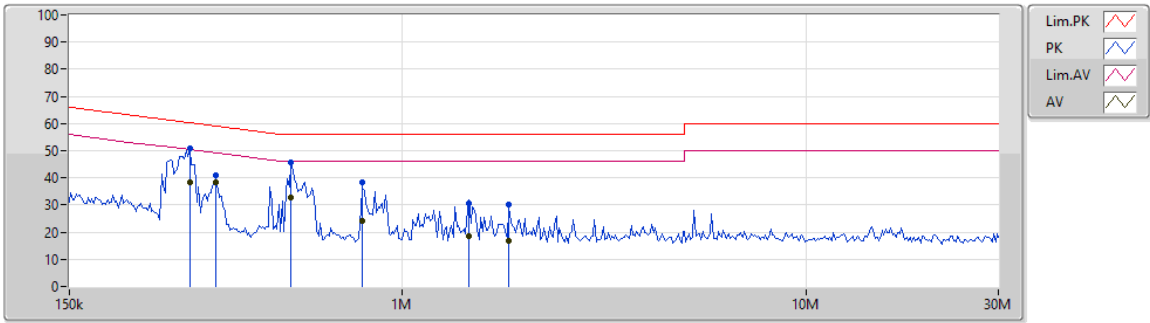


AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Line
Operating Function	USB mode		

AC Conduction\_Mode 1

20/06/2019



Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)
QP	298.034k	50.92	60.30	-9.38	19.48	Line	"Worst"	31.44	9.59	0.01	9.88
AV	298.034k	38.38	50.30	-11.92	19.48	Line	-	18.90	9.59	0.01	9.88
QP	346.008k	40.87	59.06	-18.19	19.48	Line	-	21.39	9.59	0.01	9.88
AV	346.008k	38.44	49.06	-10.62	19.48	Line	-	18.96	9.59	0.01	9.88
QP	530.769k	45.67	56.00	-10.33	19.48	Line	-	26.19	9.59	0.01	9.88
AV	530.769k	32.70	46.00	-13.30	19.48	Line	-	13.22	9.59	0.01	9.88
QP	798.145k	38.23	56.00	-17.77	19.50	Line	-	18.73	9.60	0.02	9.88
AV	798.145k	24.03	46.00	-21.97	19.50	Line	-	4.53	9.60	0.02	9.88
QP	1.464M	30.73	56.00	-25.27	19.53	Line	-	11.20	9.61	0.03	9.89
AV	1.464M	18.61	46.00	-27.39	19.53	Line	-	-0.92	9.61	0.03	9.89
QP	1.841M	30.34	56.00	-25.66	19.54	Line	-	10.80	9.62	0.03	9.89
AV	1.841M	16.66	46.00	-29.34	19.54	Line	-	-2.88	9.62	0.03	9.89



**Summary**

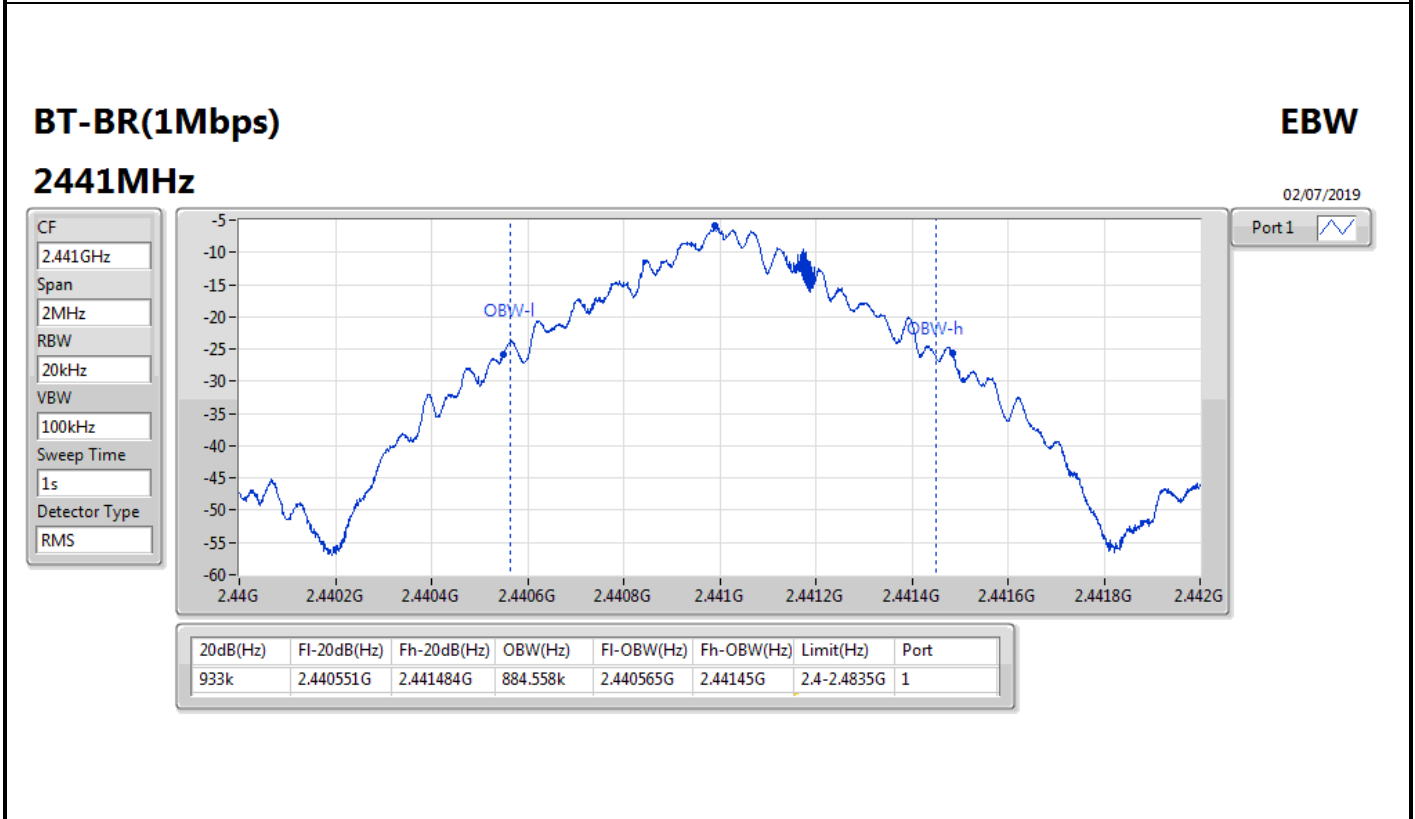
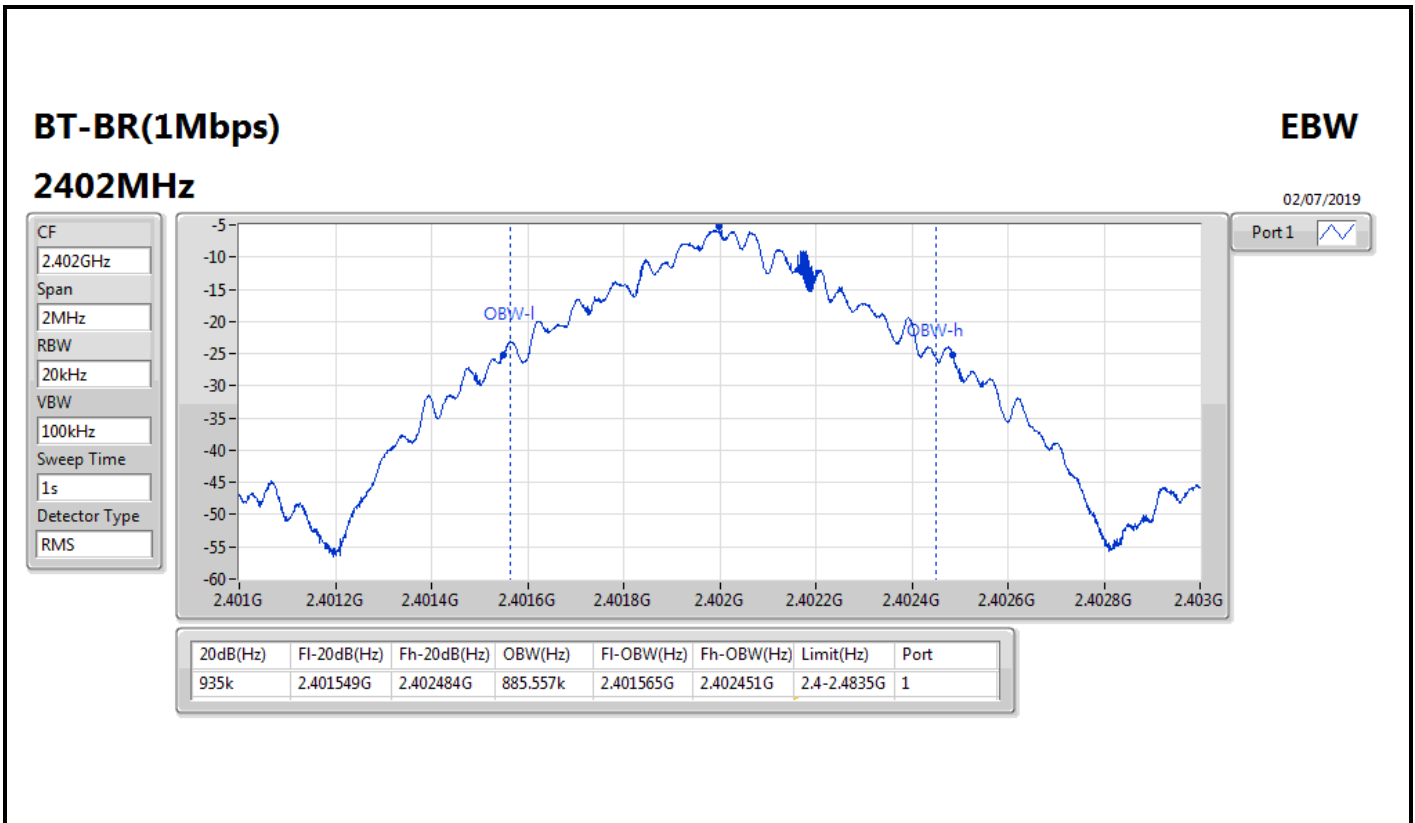
Mode	OBW (Hz)	ITU-Code
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	885.557k	886KF1D
BT-EDR(2Mbps)	544.428k	544KG1D
BT-EDR(3Mbps)	518.441k	518KG1D

**OBW** = 99% occupied bandwidth;

**Result**

Mode	Result	Limit (Hz)	fl-OBW (Hz)	fh-OBW (Hz)	OBW (Hz)	N dB (Hz)
BT-BR(1Mbps)	-	-	-	-	-	-
2402MHz_TnomVnom	Pass	2.4-2.4835G	2.401565G	2.402451G	885.557k	935k
2441MHz_TnomVnom	Pass	2.4-2.4835G	2.440565G	2.44145G	884.558k	933k
2480MHz_TnomVnom	Pass	2.4-2.4835G	2.479566G	2.480448G	881.559k	929k
BT-EDR(2Mbps)	-	-	-	-	-	-
2402MHz_TnomVnom	Pass	2.4-2.4835G	2.401734G	2.402278G	544.428k	377k
2441MHz_TnomVnom	Pass	2.4-2.4835G	2.440736G	2.441275G	539.23k	375.7k
2480MHz_TnomVnom	Pass	2.4-2.4835G	2.479738G	2.480275G	537.931k	375.7k
BT-EDR(3Mbps)	-	-	-	-	-	-
2402MHz_TnomVnom	Pass	2.4-2.4835G	2.401745G	2.402264G	518.441k	392.6k
2441MHz_TnomVnom	Pass	2.4-2.4835G	2.440747G	2.441264G	517.141k	393.9k
2480MHz_TnomVnom	Pass	2.4-2.4835G	2.479747G	2.480264G	517.141k	395.2k

**fl-OBW** = fl lower edge 99% occupied bandwidth; **fh-OBW** = fh higher edge 99% occupied bandwidth; **OBW** = 99% occupied bandwidth;  
**N dB** = 20dB down bandwidth;



**BT-BR(1Mbps)**

**EBW**

**2480MHz**

02/07/2019

CF  
2.48GHz

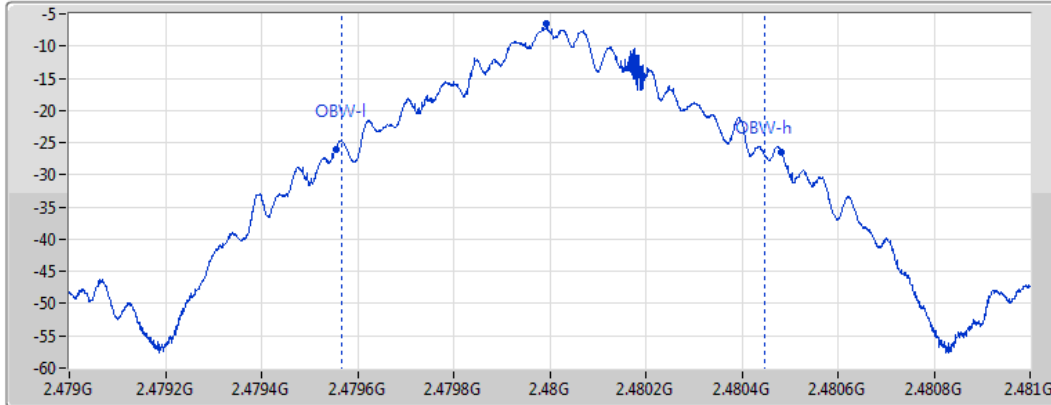
Span  
2MHz

RBW  
20kHz

VBW  
100kHz

Sweep Time  
1s

Detector Type  
RMS



**BT-EDR(2Mbps)**

**EBW**

**2402MHz**

02/07/2019

CF  
2.402GHz

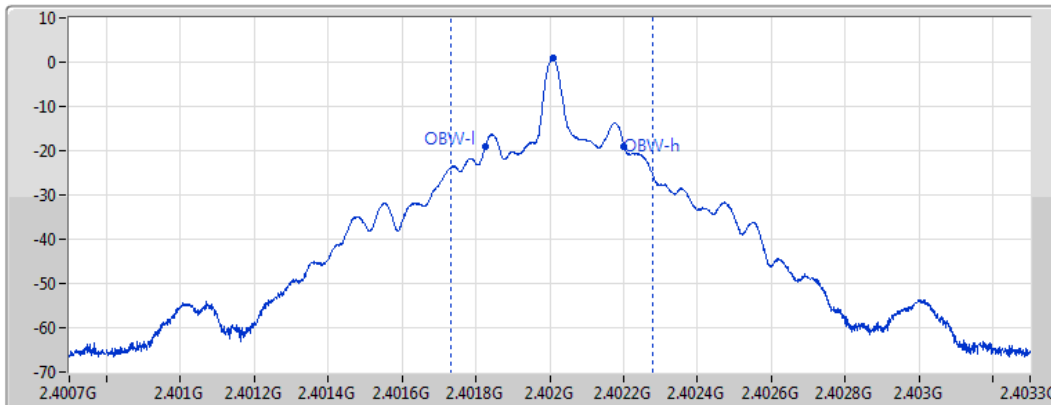
Span  
2.6MHz

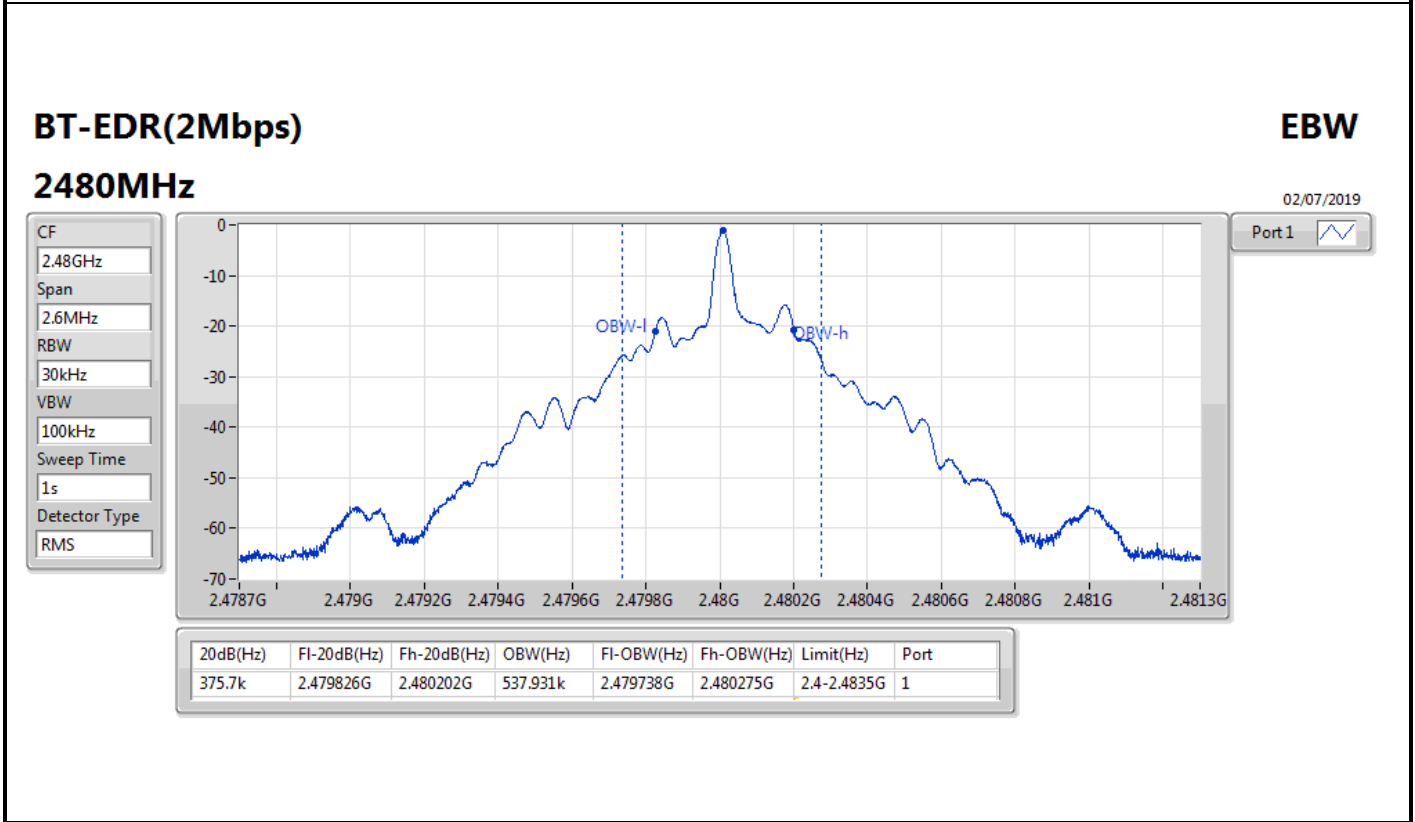
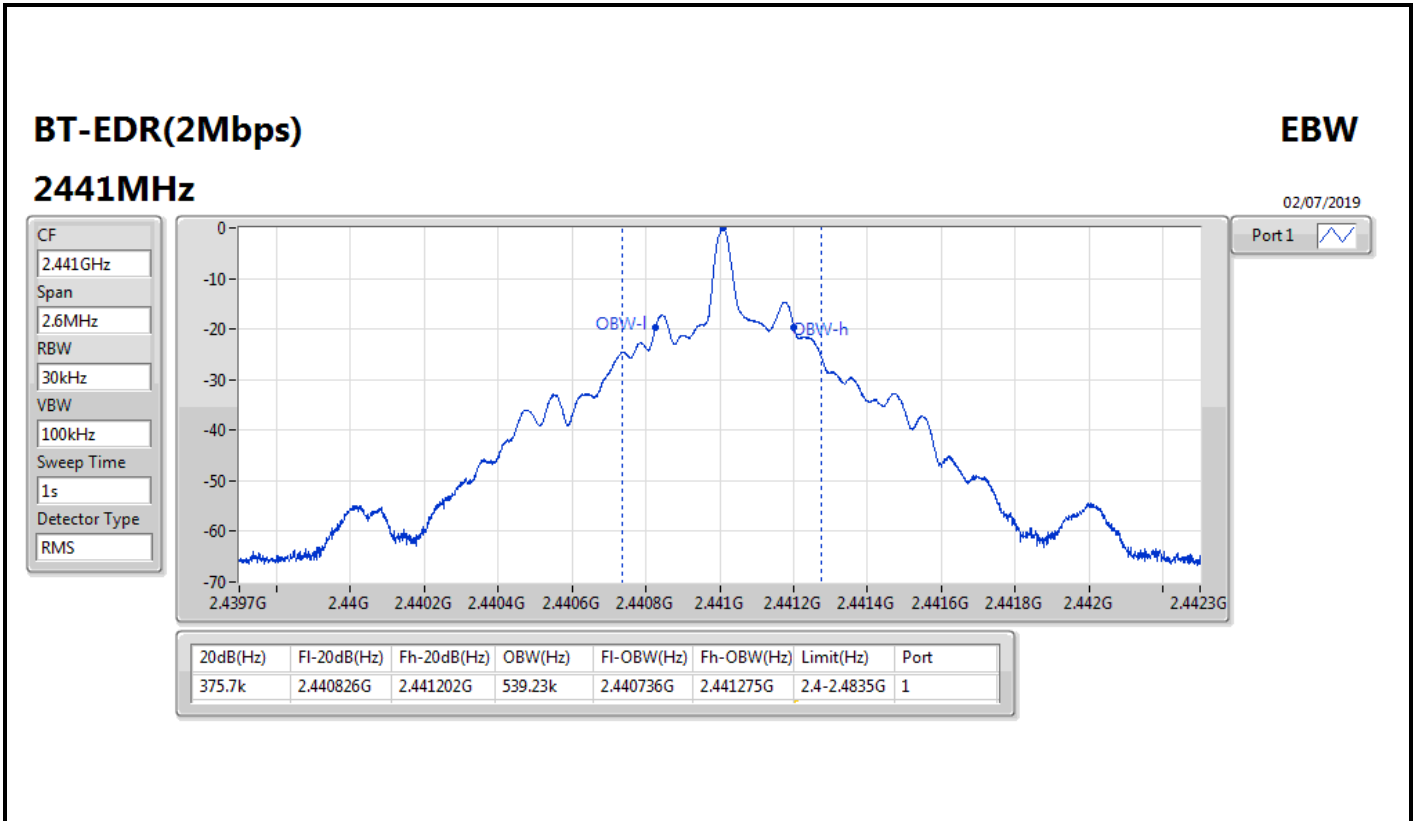
RBW  
30kHz

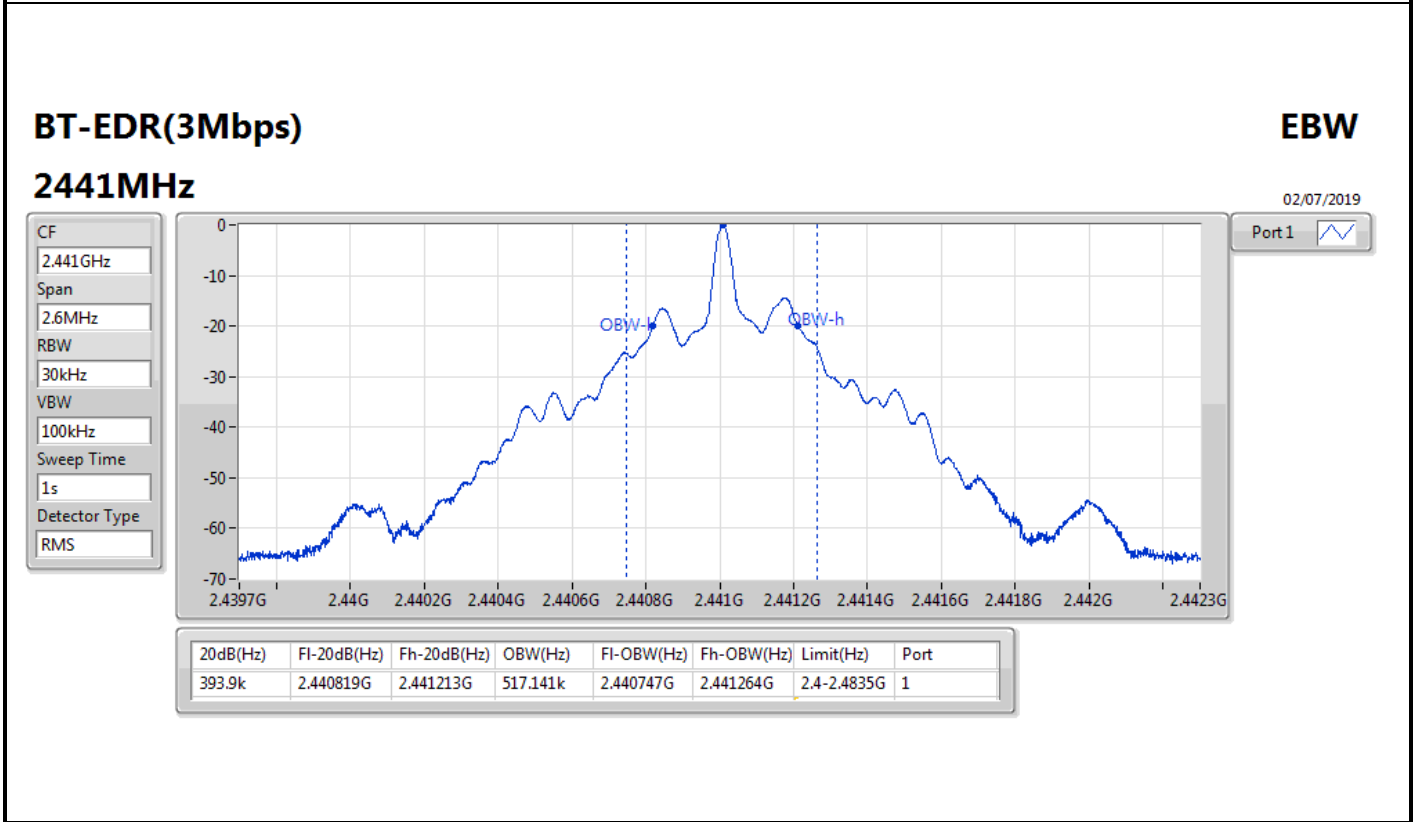
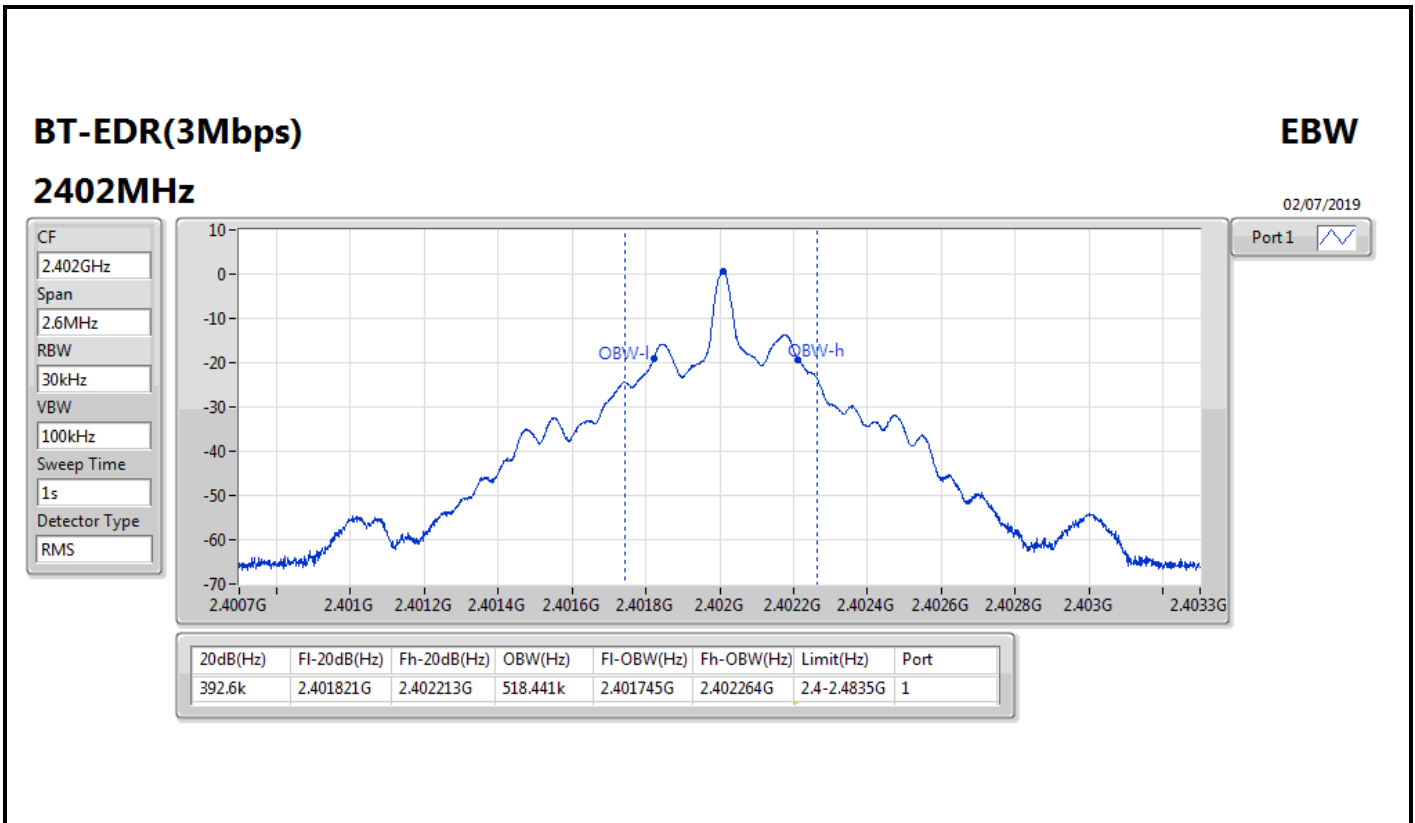
VBW  
100kHz

Sweep Time  
1s

Detector Type  
RMS







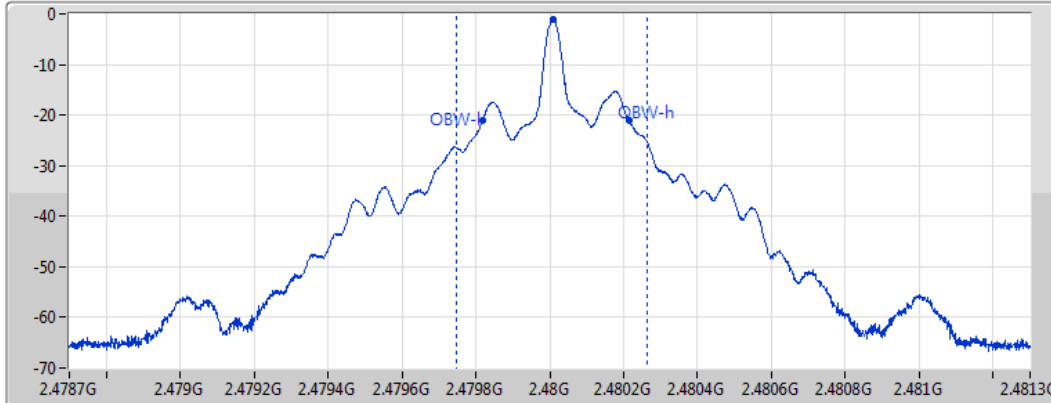
**BT-EDR(3Mbps)**


**EBW**

**2480MHz**

02/07/2019

CF  
2.48GHz  
Span  
2.6MHz  
RBW  
30kHz  
VBW  
100kHz  
Sweep Time  
1s  
Detector Type  
RMS



Port 1 

20dB(Hz)	F1-20dB(Hz)	Fh-20dB(Hz)	OBW(Hz)	F1-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
395.2k	2.479819G	2.480215G	517.141k	2.479747G	2.480264G	2.4-2.4835G	1





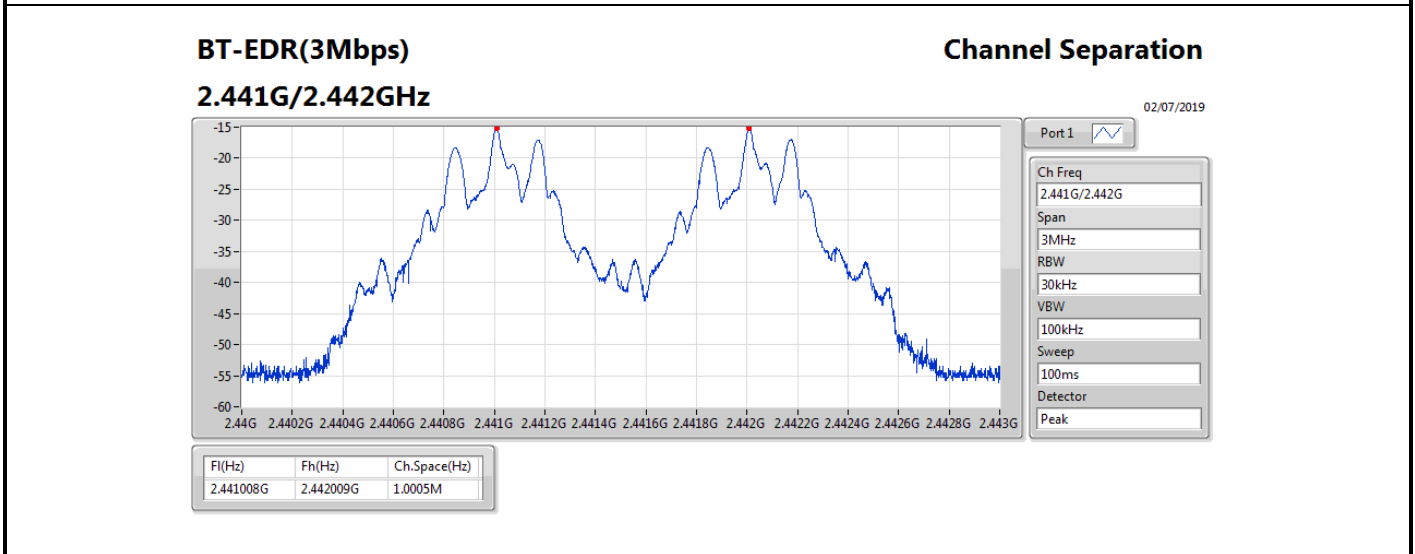
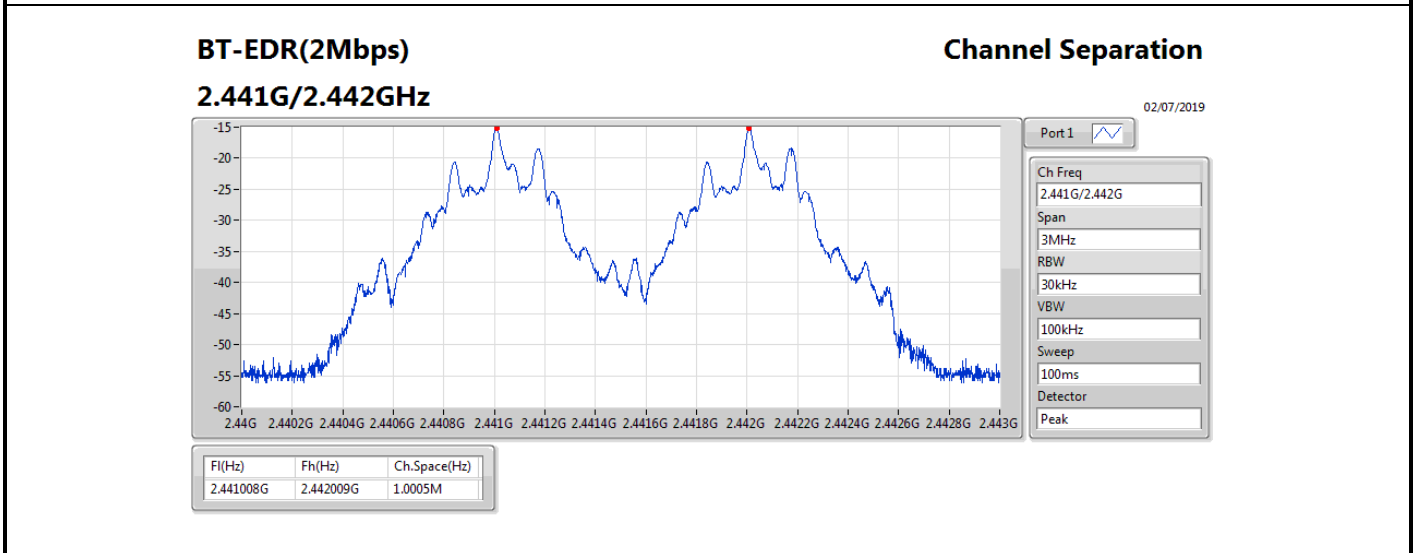
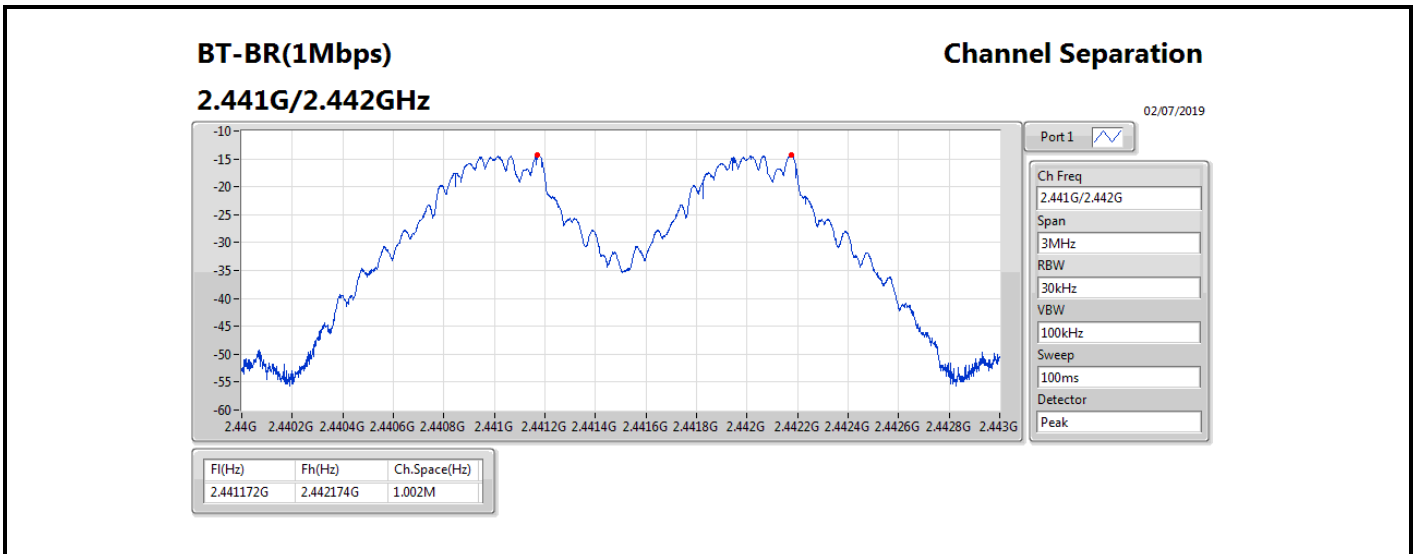
**Summary**

Mode	Max-Space (Hz)	Min-Space (Hz)
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	1.002M	1.002M
BT-EDR(2Mbps)	1.0005M	1.0005M
BT-EDR(3Mbps)	1.0005M	1.0005M



Result

Mode	Result	Fl (Hz)	Fh (Hz)	Ch.Space (Hz)	Limit (Hz)
BT-BR(1Mbps)	-	-	-	-	-
2441MHz_TnomVnom	Pass	2.441172G	2.442174G	1.002M	100k
BT-EDR(2Mbps)	-	-	-	-	-
2441MHz_TnomVnom	Pass	2.441008G	2.442009G	1.0005M	100k
BT-EDR(3Mbps)	-	-	-	-	-
2441MHz_TnomVnom	Pass	2.441008G	2.442009G	1.0005M	100k





**Summary**

Mode	EIRP (dBm)	EIRP (W)
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	2.83	0.00192
BT-EDR(2Mbps)	-0.98	0.00080
BT-EDR(3Mbps)	-0.85	0.00082



Result

Mode	Result	Gain (dBi)	Sum (dBm)	EIRP (dBm)	EIRP Lim. (dBm)
BT-BR(1Mbps)	-	-	-	-	-
2441MHz_TnomVnom	Pass	-0.91	3.40	2.49	20.00
2441MHz_TminVnom	Pass	-0.91	3.74	2.83	20.00
2441MHz_TmaxVnom	Pass	-0.91	2.92	2.01	20.00
BT-EDR(2Mbps)	-	-	-	-	-
2441MHz_TnomVnom	Pass	-0.91	-0.07	-0.98	20.00
2441MHz_TminVnom	Pass	-0.91	-0.11	-1.02	20.00
2441MHz_TmaxVnom	Pass	-0.91	-0.25	-1.16	20.00
BT-EDR(3Mbps)	-	-	-	-	-
2441MHz_TnomVnom	Pass	-0.91	0.06	-0.85	20.00
2441MHz_TminVnom	Pass	-0.91	-0.02	-0.93	20.00
2441MHz_TmaxVnom	Pass	-0.91	-0.34	-1.25	20.00

Port X = Port X output power; Total Power = Total power measure all transmit ports.



**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_TnomVnom	Pass	79	15
BT-EDR(2Mbps)	-	-	-
2441MHz_TnomVnom	Pass	79	15
BT-EDR(3Mbps)	-	-	-
2441MHz_TnomVnom	Pass	79	15



**Summary**

Mode	Max-Dwell (s)
2.4-2.4835GHz	-
BT-BR(1Mbps)	154.28369m
BT-EDR(2Mbps)	154.07037m
BT-EDR(3Mbps)	154.17703m





Result

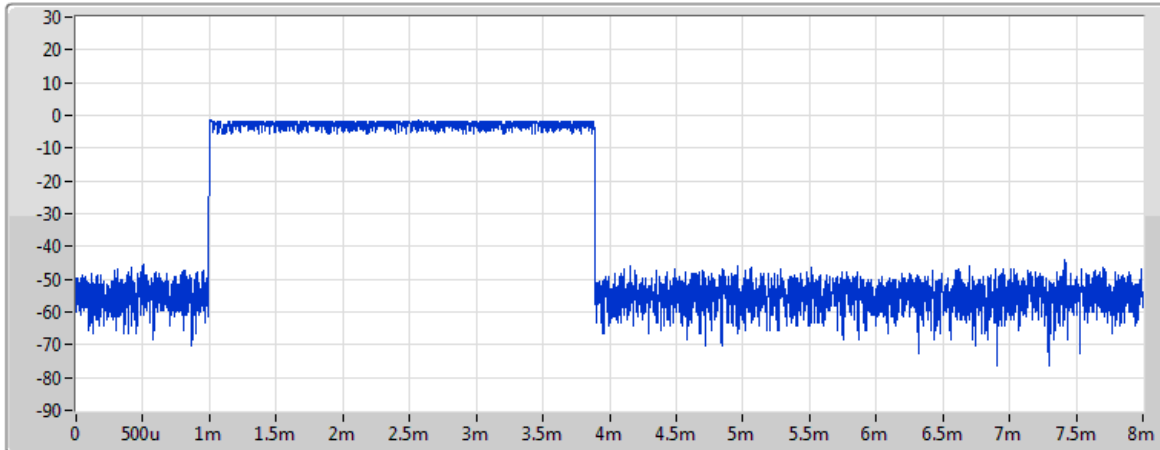
Mode	Result	Function	Hopping Ch	ATT Period (s)	ATT (s)	ATT Limit (s)	Dwell/Ch (s)	FO Period (s)	FO (Hop)	FO Limit (Hop)
BT-BR(1Mbps)	-	-	-	-	-	-	-	-	-	-
2441MHz_TnomVnom	Pass	Non-AFH	79	1.185	11.572m	15m	3.75m	1.185	4	1
2441MHz_TnomVnom	Pass	AFH	20	8	154.28369m	400m	7.5m	600m	4	1
BT-EDR(2Mbps)	-	-	-	-	-	-	-	-	-	-
2441MHz_TnomVnom	Pass	Non-AFH	79	1.185	11.556m	15m	3.75m	1.185	4	1
2441MHz_TnomVnom	Pass	AFH	20	8	154.07037m	400m	7.5m	600m	4	1
BT-EDR(3Mbps)	-	-	-	-	-	-	-	-	-	-
2441MHz_TnomVnom	Pass	Non-AFH	79	1.185	11.564m	15m	3.75m	1.185	4	1
2441MHz_TnomVnom	Pass	AFH	20	8	154.17703m	400m	7.5m	600m	4	1


**BT-BR(1Mbps)**

**ATT Non-AFH**

2441MHz

02/07/2019



Port 1 

CF  
2.441GHz

RBW  
300kHz

VBW  
1MHz

Sweep Time  
8ms

TX Time  
2.893ms

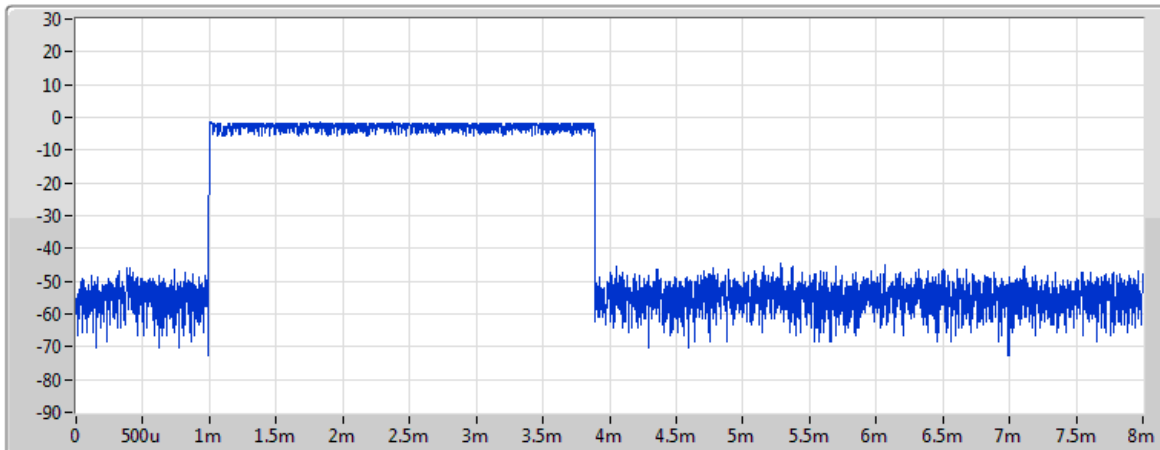
Function	Hopping Ch	ATT Period(s)	ATT(s)	ATT Limit(s)	Dwell/Ch(s)	FO Period(s)	FO(Hop)	FO Limit(Hop)
Non-AFH	79	1.185	11.572m	15m	3.75m	1.185	4	1


**BT-BR(1Mbps)**

**ATT AFH**

2441MHz

02/07/2019



Port 1 

CF  
2.441GHz

RBW  
300kHz

VBW  
1MHz

Sweep Time  
8ms

TX Time  
2.893ms

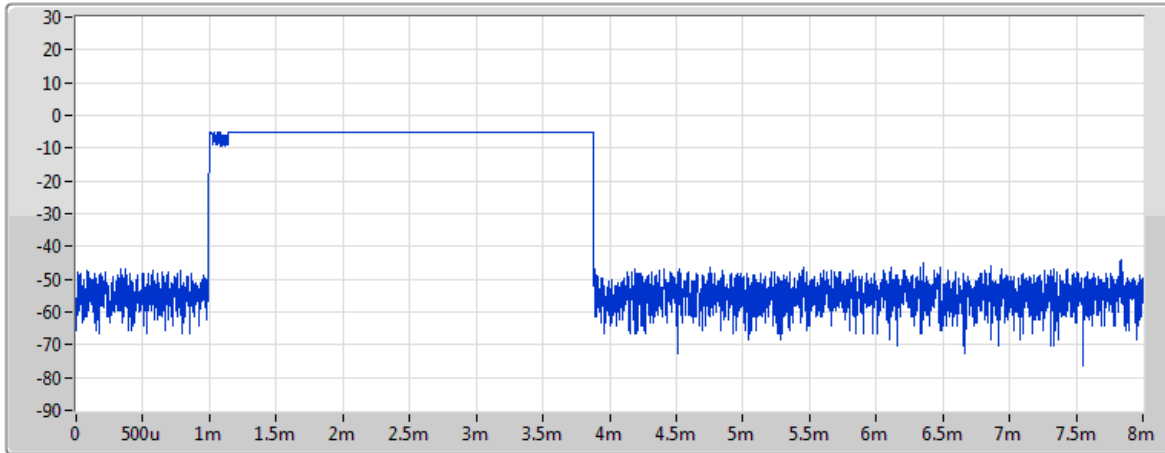
Function	Hopping Ch	ATT Period(s)	ATT(s)	ATT Limit(s)	Dwell/Ch(s)	FO Period(s)	FO(Hop)	FO Limit(Hop)
AFH	20	8	154.28369m	400m	7.5m	600m	4	1


**BT-EDR(2Mbps)**

**ATT Non-AFH**

2441MHz

02/07/2019



Port 1 

CF  
2.441GHz

RBW  
300kHz

VBW  
1MHz

Sweep Time  
8ms

TX Time  
2.888ms

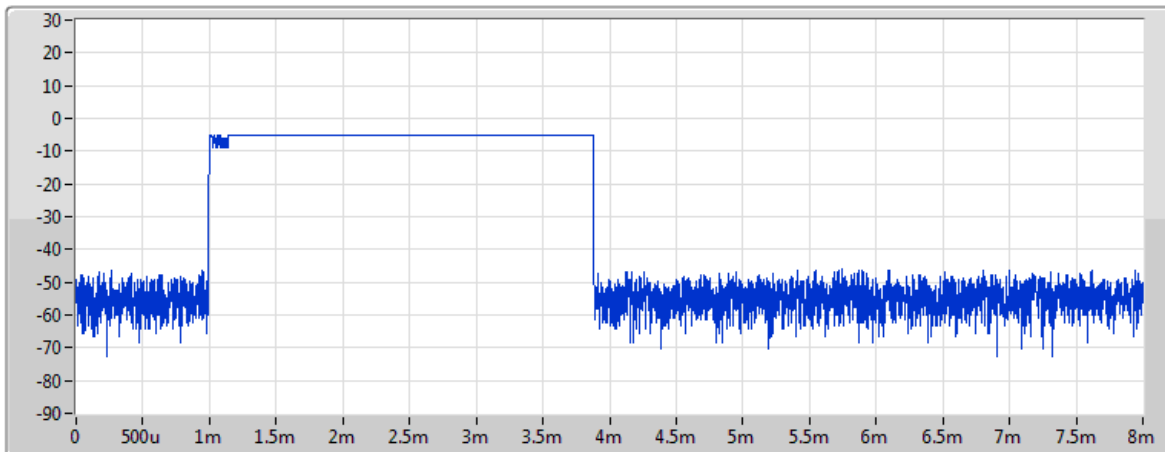
Function	Hopping Ch	ATT Period(s)	ATT(s)	ATT Limit(s)	Dwell/Ch(s)	FO Period(s)	FO(Hop)	FO Limit(Hop)
Non-AFH	79	1.185	11.556m	15m	3.75m	1.185	4	1


**BT-EDR(2Mbps)**

**ATT AFH**

2441MHz

02/07/2019



Port 1 

CF  
2.441GHz

RBW  
300kHz

VBW  
1MHz

Sweep Time  
8ms

TX Time  
2.889ms

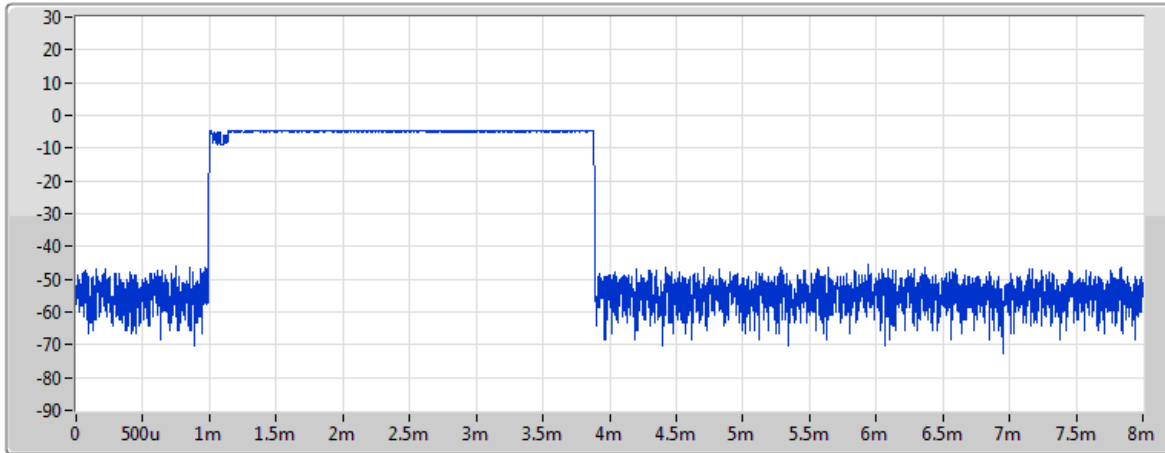
Function	Hopping Ch	ATT Period(s)	ATT(s)	ATT Limit(s)	Dwell/Ch(s)	FO Period(s)	FO(Hop)	FO Limit(Hop)
AFH	20	8	154.07037m	400m	7.5m	600m	4	1

**BT-EDR(3Mbps)**

**ATT Non-AFH**

2441MHz

02/07/2019



Port 1 

CF  
2.441GHz

RBW  
300kHz

VBW  
1MHz

Sweep Time  
8ms

TX Time  
2.891ms

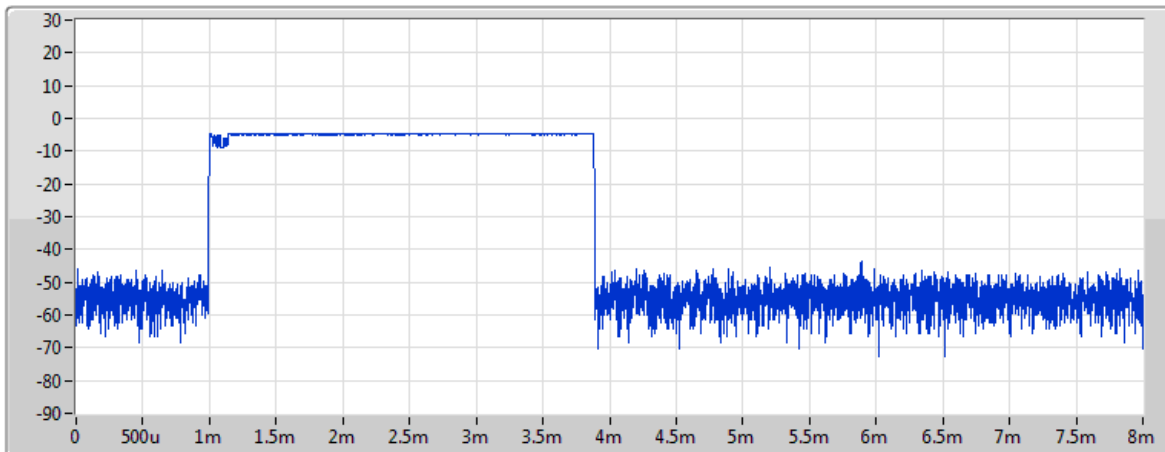
Function	Hopping Ch	ATT Period(s)	ATT(s)	ATT Limit(s)	Dwell/Ch(s)	FO Period(s)	FO(Hop)	FO Limit(Hop)
Non-AFH	79	1.185	11.564m	15m	3.75m	1.185	4	1


**BT-EDR(3Mbps)**

**ATT AFH**

2441MHz

02/07/2019



Port 1 

CF  
2.441GHz

RBW  
300kHz

VBW  
1MHz

Sweep Time  
8ms

TX Time  
2.891ms

Function	Hopping Ch	ATT Period(s)	ATT(s)	ATT Limit(s)	Dwell/Ch(s)	FO Period(s)	FO(Hop)	FO Limit(Hop)
AFH	20	8	154.17703m	400m	7.5m	600m	4	1



**Summary**

Mode	EIRP-A (dBm)	Limit-A (dBm)	EIRP-B (dBm)	Limit-B (dBm)
2.4-2.4835GHz	-	-	-	-
BT-BR(1Mbps)	-50.33	-10	-49.85	-20
BT-EDR(2Mbps)	-51.23	-10	-50.89	-20
BT-EDR(3Mbps)	-50.92	-10	-50.54	-20

**Result**

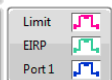
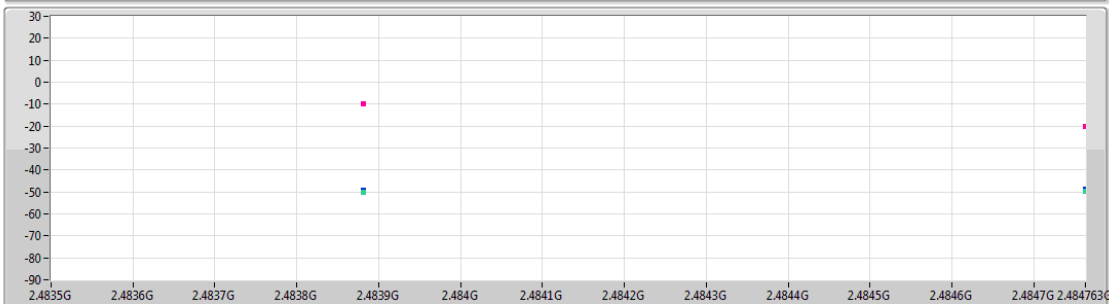
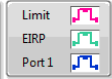
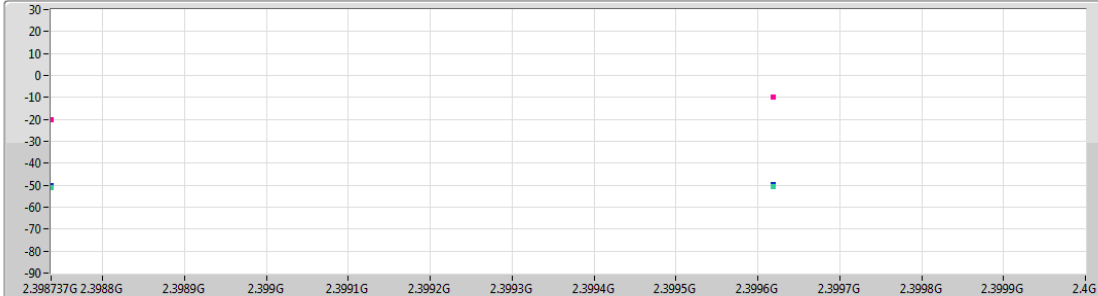
Mode	Result	Freq (Hz)	EIRP (dBm)	Limit (dBm)	Freq (Hz)	EIRP (dBm)	Limit (dBm)
BT-BR(1Mbps)	-	-	-	-	-	-	-
2441MHz_TnomVnom	Pass	2.398737G	-51.02	-20	2.399618G	-50.73	-10
2441MHz_TnomVnom	Pass	2.484763G	-49.85	-20	2.483882G	-50.33	-10
BT-EDR(2Mbps)	-	-	-	-	-	-	-
2441MHz_TnomVnom	Pass	2.399427G	-51.19	-20	2.399963G	-51.23	-10
2441MHz_TnomVnom	Pass	2.484073G	-50.89	-20	2.483537G	-51.37	-10
BT-EDR(3Mbps)	-	-	-	-	-	-	-
2441MHz_TnomVnom	Pass	2.399471G	-51.84	-20	2.399985G	-51.65	-10
2441MHz_TnomVnom	Pass	2.484029G	-50.54	-20	2.483515G	-50.92	-10

**BT-BR(1Mbps)**

**2441MHz\_TnomVnom**

**Mask**

02/07/2019



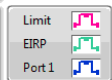
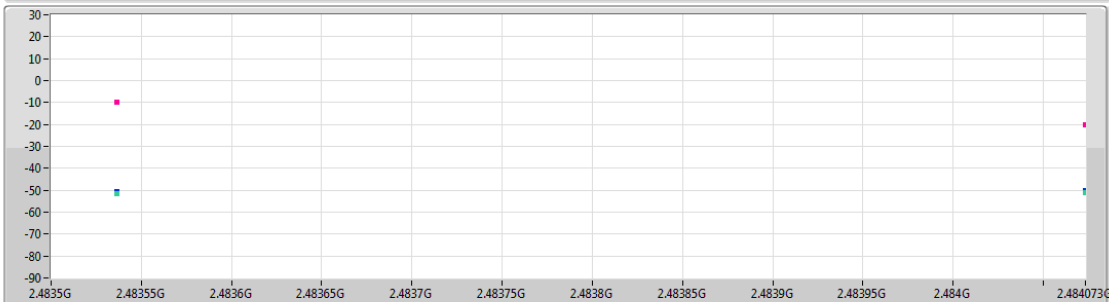
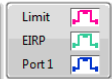
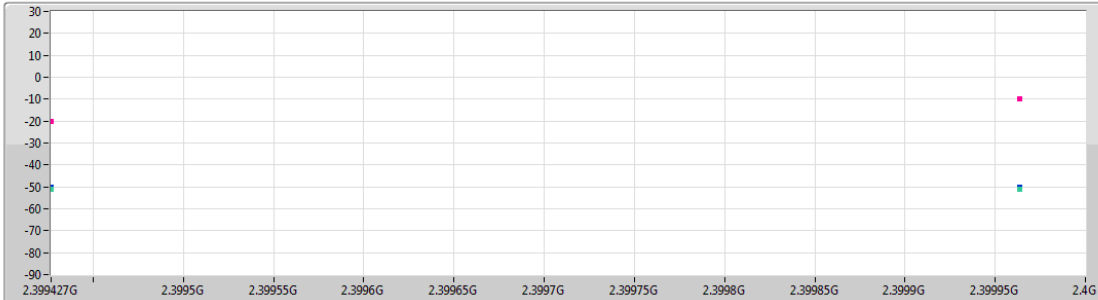
Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)
2.398737G	-51.02	-20	2.399618G	-50.73	-10	2.483882G	-50.33	-10	2.484763G	-49.85	-20

**BT-EDR(2Mbps)**

**2441MHz\_TnomVnom**

**Mask**

02/07/2019

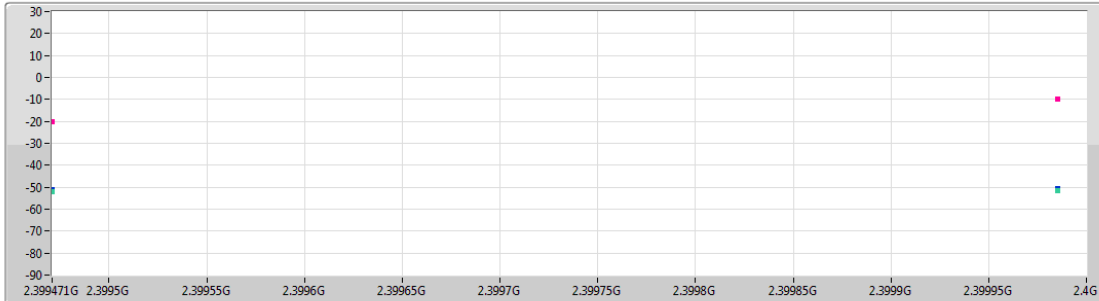





Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)
2.399427G	-51.19	-20	2.39963G	-51.23	-10	2.483537G	-51.37	-10	2.484073G	-50.89	-20

**BT-EDR(3Mbps)**  
**2441MHz\_TnomVnom**




**Mask**

02/07/2019



Limit   
 EIRP   
 Port1 



Limit   
 EIRP   
 Port1 

Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)
2.399471G	-51.84	-20	2.399985G	-51.65	-10	2.483515G	-50.92	-10	2.484029G	-50.54	-20





Summary

Mode	Result	Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
BT-BR(1Mbps)	Pass	AV	607.98M	-60.76	-54.00	-6.76	8.75	3	Horizontal	0	1.5	-



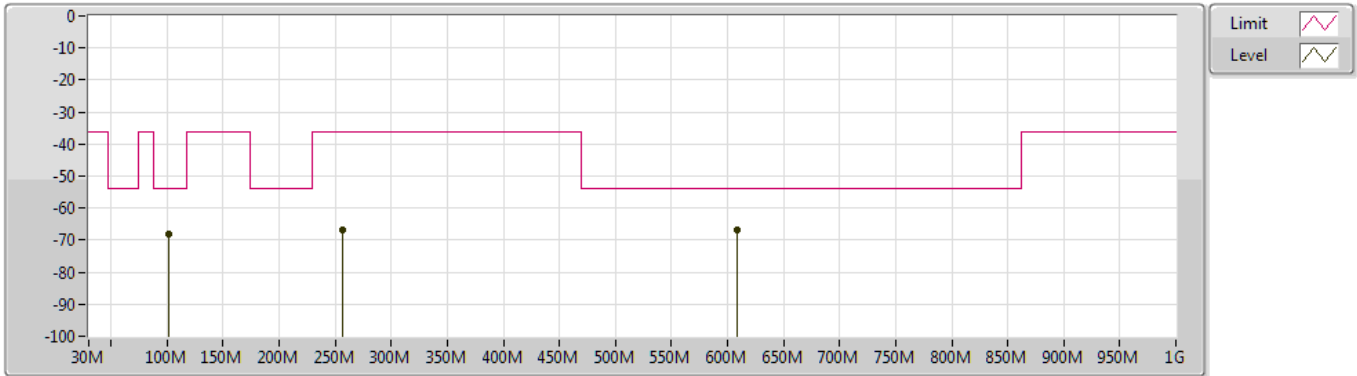
Result

Mode	Result	Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
BT-BR(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-
2480MHz_TX	Pass	AV	98.3M	-64.09	-54.00	-10.09	-1.72	3	Horizontal	0	1.5	-
2480MHz_TX	Pass	AV	256.01M	-65.24	-36.00	-29.24	0.43	3	Horizontal	0	1.5	-
2480MHz_TX	Pass	AV	607.98M	-60.76	-54.00	-6.76	8.75	3	Horizontal	0	1.5	-
2480MHz_TX	Pass	AV	101.1M	-68.22	-54.00	-14.22	2.55	3	Vertical	360	1.5	-
2480MHz_TX	Pass	AV	255.96M	-66.88	-36.00	-30.88	-0.13	3	Vertical	360	1.5	-
2480MHz_TX	Pass	AV	607.98M	-66.61	-54.00	-12.61	8.54	3	Vertical	360	1.5	-

**BT-BR(1Mbps)**

02/07/2019

**2480MHz\_TX**

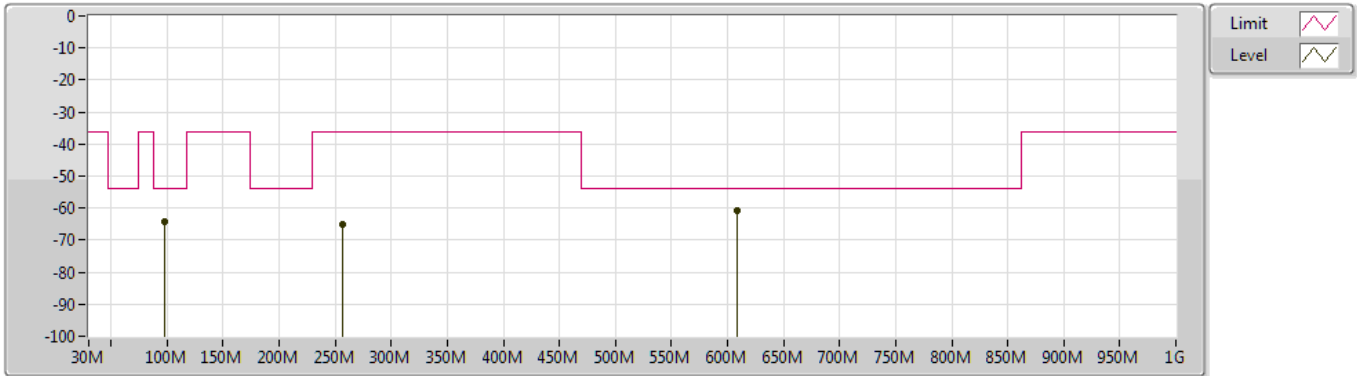


Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment
AV	101.1M	-68.22	-54.00	-14.22	2.55	3	Vertical	360	1.5	-
AV	255.96M	-66.88	-36.00	-30.88	-0.13	3	Vertical	360	1.5	-
AV	607.98M	-66.61	-54.00	-12.61	8.54	3	Vertical	360	1.5	-

**BT-BR(1Mbps)**

02/07/2019

**2480MHz\_TX**



Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment
AV	98.3M	-64.09	-54.00	-10.09	-1.72	3	Horizontal	0	1.5	-
AV	256.01M	-65.24	-36.00	-29.24	0.43	3	Horizontal	0	1.5	-
AV	607.98M	-60.76	-54.00	-6.76	8.75	3	Horizontal	0	1.5	-



Summary

Mode	Result	Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
BT-BR(1Mbps)	Pass	AV	4.95996G	-36.07	-30.00	-6.07	1.04	3	Vertical	0	1.5	-



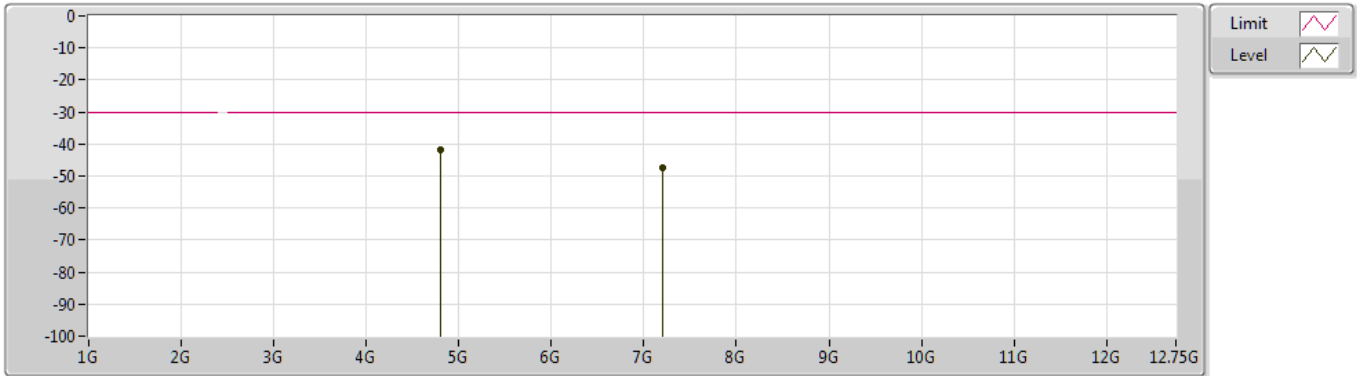
Result

Mode	Result	Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
BT-BR(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz_TX	Pass	AV	4.80395G	-40.76	-30.00	-10.76	1.09	3	Horizontal	10	1.5	TDP
2402MHz_TX	Pass	AV	7.20578G	-48.61	-30.00	-18.61	4.68	3	Horizontal	360	1.5	-
2402MHz_TX	Pass	AV	4.80394G	-41.61	-30.00	-11.61	1.04	3	Vertical	221	1.5	TDP
2402MHz_TX	Pass	AV	7.20661G	-47.60	-30.00	-17.60	4.53	3	Vertical	0	1.5	-
2480MHz_TX	Pass	AV	4.95954G	-37.50	-30.00	-7.50	0.91	3	Horizontal	360	1.5	-
2480MHz_TX	Pass	AV	7.44019G	-52.12	-30.00	-22.12	2.94	3	Horizontal	360	1.5	-
2480MHz_TX	Pass	AV	4.95996G	-36.07	-30.00	-6.07	1.04	3	Vertical	0	1.5	-
2480MHz_TX	Pass	AV	7.43978G	-52.08	-30.00	-22.08	2.84	3	Vertical	0	1.5	-

**BT-BR(1Mbps)**

02/07/2019

**2402MHz\_TX**

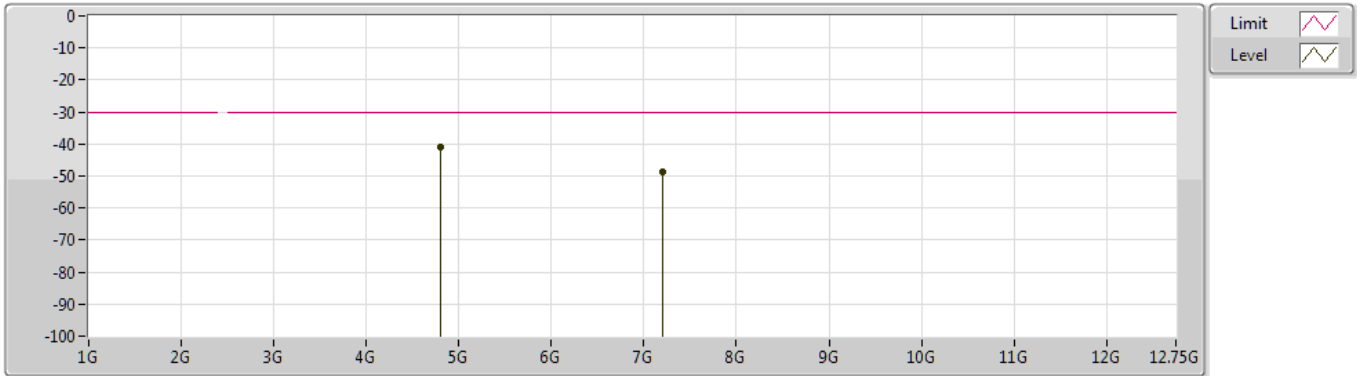


Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment
AV	4.80394G	-41.61	-30.00	-11.61	1.04	3	Vertical	221	1.5	TDP
AV	7.20661G	-47.60	-30.00	-17.60	4.53	3	Vertical	0	1.5	-

**BT-BR(1Mbps)**

02/07/2019

**2402MHz\_TX**



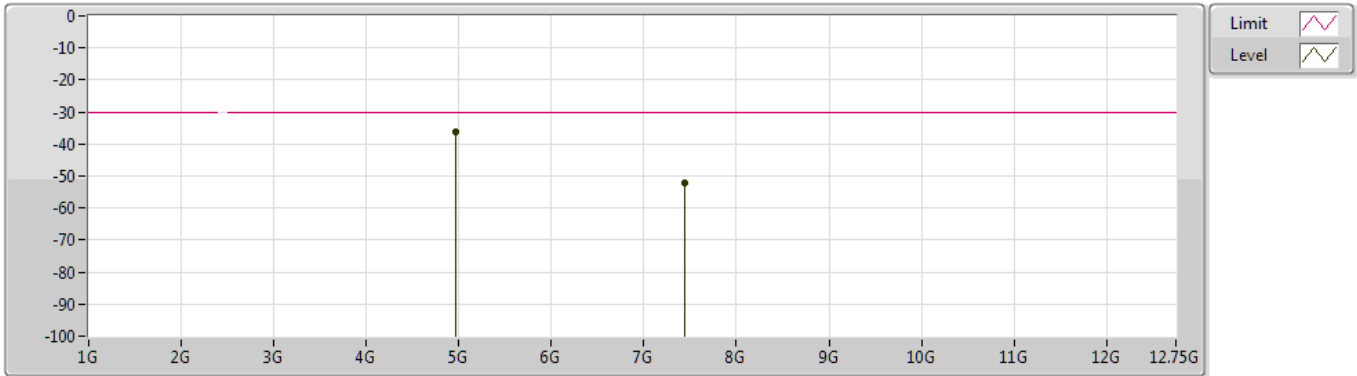
Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment
AV	4.80395G	-40.76	-30.00	-10.76	1.09	3	Horizontal	10	1.5	TDP
AV	7.20578G	-48.61	-30.00	-18.61	4.68	3	Horizontal	360	1.5	-



**BT-BR(1Mbps)**

02/07/2019

**2480MHz\_TX**

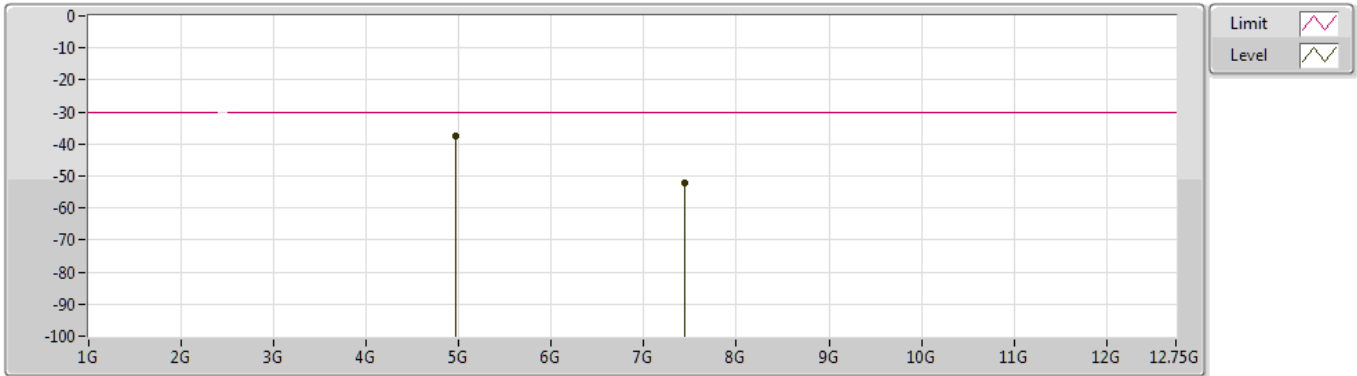


Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment
AV	4.95996G	-36.07	-30.00	-6.07	1.04	3	Vertical	0	1.5	-
AV	7.43978G	-52.08	-30.00	-22.08	2.84	3	Vertical	0	1.5	-

**BT-BR(1Mbps)**

02/07/2019

**2480MHz\_TX**



Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment
AV	4.95954G	-37.50	-30.00	-7.50	0.91	3	Horizontal	360	1.5	-
AV	7.44019G	-52.12	-30.00	-22.12	2.94	3	Horizontal	360	1.5	-