

# RF TEST REPORT

For

**Wireless Earbuds**

**Model Number: E509A**

**FCC ID: 2ABZ2-E509A**

**IC: 12739A-E509A**

**Report Number : WT238001740**

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Inspection  
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## Revision History

No	Date	Remark
V1.0	2023.10.26	Initial issue

## TEST REPORT DECLARATION

Applicant : OnePlus Technology (shenzhen) Co.,Ltd.  
Address : 18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building,  
Binhe Avenue North,Futian District, Shenzhen, China  
Manufacturer : OnePlus Technology (shenzhen) Co.,Ltd.  
Address : 18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building,  
Binhe Avenue North,Futian District, Shenzhen, China  
EUT Description : Wireless Earbuds  
Model No. : E509A  
Trade mark : ONEPLUS  
Serial Number : /  
FCC ID : 2ABZ2-E509A  
IC : 12739A-E509A  
HVIN : E509A

Test Standards:

**FCC Part 15 Subpart C**  
**RSS-247 Issue 3 (2023-08)**  
**RSS-GEN Issue 5 (2021-02)**

The EUT described above is tested by Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory to determine the maximum emissions from the EUT. Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory is assumed full responsibility for the accuracy of the test results.

The test report is valid for above tested sample only and shall not be reproduced in part without written approval of the laboratory.

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# 1. TEST RESULTS SUMMARY

Table 1 Test Results Summary

Test Items	FCC Rules	IC Rules	Test Results
6dB DTS Bandwidth	15.247 (a) (2)	RSS-247 Clause 5.2(a)	Pass
Maximum Peak Conducted Power	15.247 (b) (3)	RSS-247 Clause 5.4(d)	Pass
Maximum Power Spectral Density Level	15.247 (e)	RSS-247 Clause 5.2(b)	Pass
Conducted Bandedge and Spurious	15.247 (d)	RSS-247 Clause 5.5	Pass
Radiated Bandedge and Spurious	15.247 (d) 15.209 15.205	RSS-Gen Clause 8.9 & RSS-247 Clause 5.5	Pass
Conducted Emission Test for AC Power Port	15.207	RSS-Gen Clause 8.8	Pass
99% Bandwidth	N/A	RSS-Gen Clause 6.7	Pass
Antenna Requirements	15.203	RSS-GEN Clause 6.8	Pass

Remark: "N/A" means "Not applicable."

## **2. GENERAL INFORMATION**

### **2.1. Report Information**

This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that SMQ approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that SMQ in any way guarantees the later performance of the product/equipment.

The sample/s mentioned in this report is/are supplied by Applicant, SMQ therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture or any information supplied.

Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through SMQ, unless the applicant has authorized SMQ in writing to do so.

The lab will not be liable for any loss or damage resulting for false, inaccurate, inappropriate or incomplete product information provided by the applicant/manufacturer.

### **2.2. Laboratory Accreditation and Relationship to Customer**

The testing report were performed by the Shenzhen Academy of Metrology and quality Inspection EMC Laboratory (Guangdong EMC compliance testing center), in their facilities located at NETC Building, No.4 Tongfa Rd., Xili, Nanshan, Shenzhen, China. At the time of testing, Laboratory is accredited by the following organizations:

China National Accreditation Service for Conformity Assessment (CNAS) accredits the Laboratory for conformance to FCC standards, EMC international standards and EN standards. The Registration Number is CNAS L0579.

The Laboratory is Accredited Testing Laboratory of FCC with Designation number CN1165 and Site registration number 582918.

The Laboratory is registered to perform emission tests with Innovation, Science and Economic Development (ISED), and the registration number is 11177A.

The Laboratory is registered to perform emission tests with VCCI, and the registration number are C-20048, G20076, R-20077, R-20078 and T-20047.

The Laboratory is Accredited Testing Laboratory of American Association for Laboratory Accreditation (A2LA) and certificate number is 3292.01.

### 2.3. Measurement Uncertainty

Conducted Emission

9 kHz~150 kHz  $U=3.7\text{dB}$   $k=2$

150 kHz~30MHz  $U=3.3\text{dB}$   $k=2$

Radiated Emission

30MHz~1000MHz  $U=4.3\text{dB}$   $k=2$

1GHz~6GHz  $U=4.6\text{ dB}$   $k=2$

6GHz~40GHz  $U=5.1\text{dB}$   $k=2$





Bluetooth low energy  
Test mode is configured to be with duty cycle >98%

### 3.5. Directional Antenna Gain

Directional gain need NOT to be considered.

### 3.6. Support Equipment List

Table 3 Support Equipment List

Name	Model No	S/N	Manufacturer
Adapter 1# for EUT	VCB3HDUH	---	HUIZHOU GOLDEN LAKE INDUSTRIAL CO., LTD.
Rechargeable Li-ion Polymer Battery for Charging Case	631940	---	Xinyu Ganfeng Electronics Co.,LTD.
Rechargeable Li-ion Polymer Battery for Earbuds	112570		Xinyu Ganfeng Electronics Co.,LTD.
USB Cable for EUT	DL129	---	Dongguan City Falin Electronic Co.,Ltd

### 3.7. Test Conditions

Date of test: Oct.13, 2023- Oct.25, 2023

Date of EUT Receive: Oct.09, 2023

Temperature: 20°C-23°C

Relative Humidity: 49%-55%

### 3.8. Special Accessories

Not available for this EUT intended for grant.

### 3.9. Equipment Modifications

Not available for this EUT intended for grant.

#### 4. TEST EQUIPMENT USED

Table 4 Test Equipment

No.	Equipment	Manufacturer	Model No.	Last Cal.	Cal. Interval
SB90584/05	Test Receiver	R&S	ESCI	Jun.30,2023	1 Year
SB8501/06	AMN	R&S	ESH2-Z5	Jan.19,2023	1 Year
SB9548	Shielded Room	Albatross	SR	Aug.30,2023	1 Year
SB17366	Test Receiver	R&S	ESR26	May 30,2023	1 Year
SB3345	Loop Antenna	Schwarzbeck	FMZB1516-113	Jan.19,2023	1 Year
SB3955	Broadband Antenna	SCHWARZBECK	VULB9163	May 30,2023	1 Year
SB13958	Horn Antenna	R&S	HF907	May 30,2023	1 Year
SB9555/01	Semi Anechoic Chamber	Albatross	9×6×6(m)	Aug.15,2023	1 Year
SB8501/09	Test Receiver	R&S	ESU40	Jan.19,2023	1 Year
SB3435	Horn Antenna	R&S	HF906	Nov.28,2022	1 Year
SB9058/03	Pre-Amplifier	R&S	SCU 18	Jan.19,2023	1 Year
SB8501/11	Antenna	R&S	3160-09	Feb.22,2023	3 Years
SB8501/12	Antenna	R&S	3160-10	Feb.22,2023	3 Years
SB8501/16	Pre-Amplifier	R&S	SCU-26	Jan.19,2023	1 Year
SB9059	Pre-Amplifier	R&S	SCU-40	Aug.21,2023	1 Year
SB9555/02	Fully Anechoic Chamber	Albatross	10.0×5.2× 5.4(m)	Aug.15,2023	1 Year
SB9060	Signal Analyzer	R&S	FSQ40	Apr.24, 2023	1 Year

Table 5 Test software

Name	Manufacturer	Version
Bluetooth and WiFi Test System	Shenzhen JS tonscond co.,ltd	3.2.22

## 5. 6DB BANDWIDTH MEASUREMENT

### 5.1.Limits of 6dB Bandwidth Measurement

CFR 47 (FCC) part 15.247 (a) (2), 558074 D01 DTS Meas Guidance v05r02  
 RSS-247 Clause 5.2(a) the minimum 6 dB bandwidth shall be 500 kHz

### 5.2.Test Procedure

The transmitter output was connected to the spectrum analyzer.

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 5.3.Test Setup



### 5.4.Test Data

Left:

Table 6 6dB Bandwidth Test Data

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_BT4.0	Ant1	2402	0.66	2401.66	2402.32	0.5	PASS
		2440	0.66	2439.66	2440.32	0.5	PASS
		2480	0.66	2479.66	2480.32	0.5	PASS
BLE_BT5.0	Ant1	2402	1.14	2401.42	2402.55	0.5	PASS
		2440	1.14	2439.42	2440.56	0.5	PASS
		2480	1.14	2479.42	2480.56	0.5	PASS

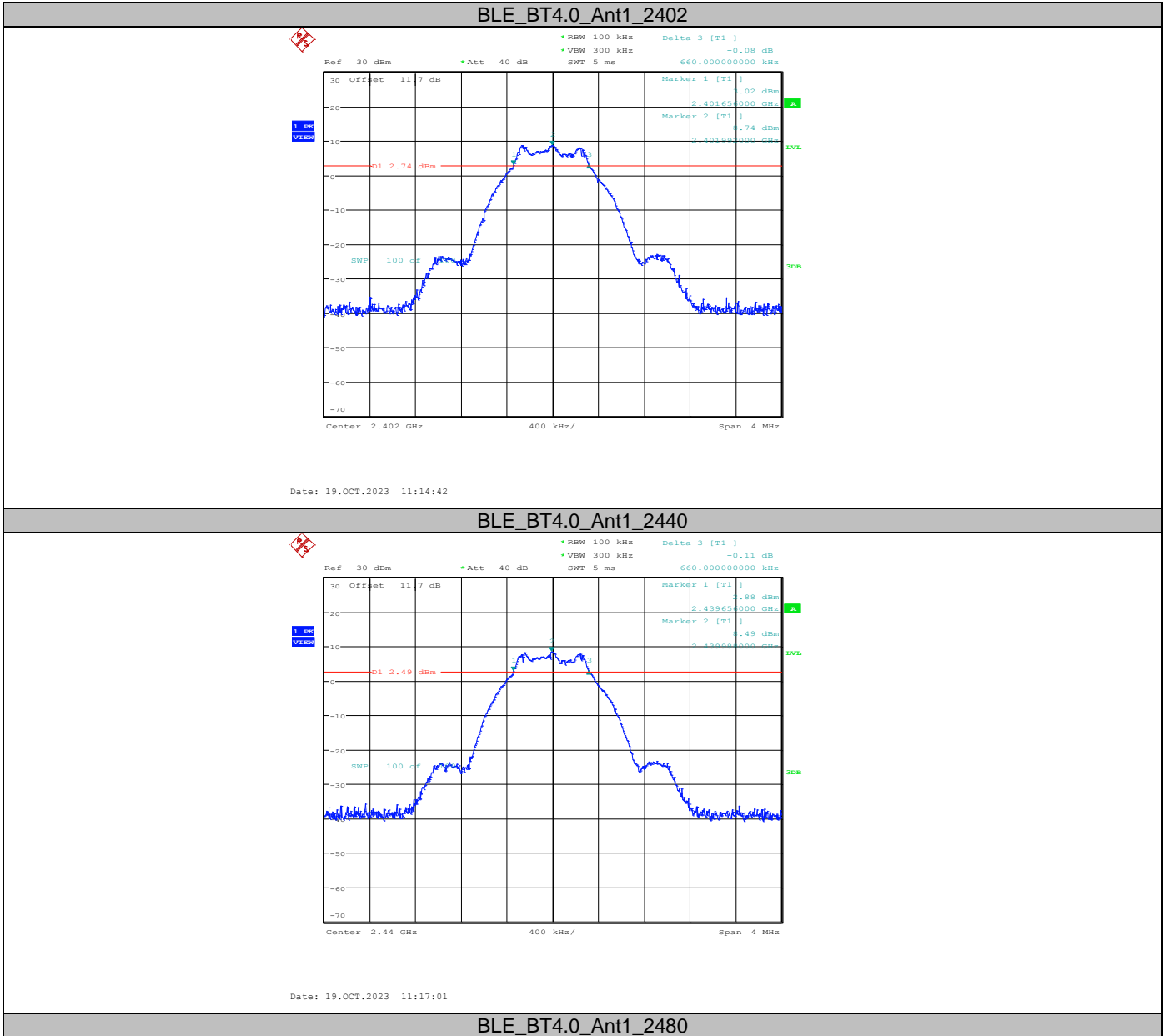
Right:

Table 7 6dB Bandwidth Test Data

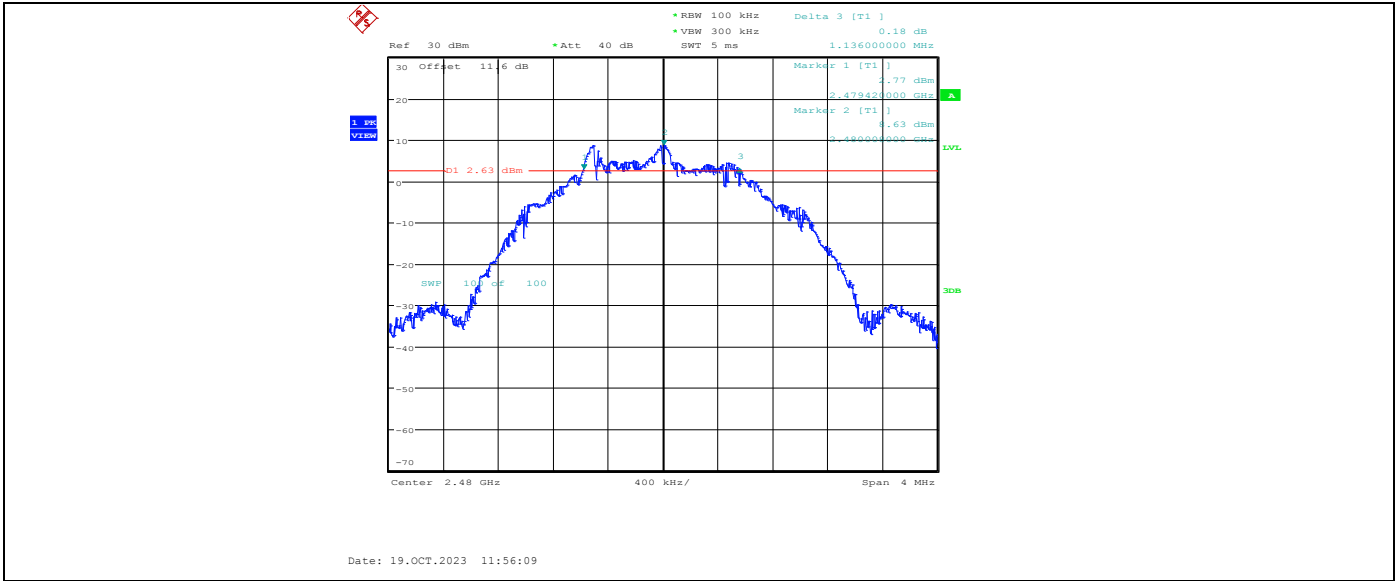
TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_BT4.0	Ant1	2402	0.66	2401.65	2402.32	0.5	PASS
		2440	0.66	2439.66	2440.32	0.5	PASS
		2480	0.66	2479.66	2480.32	0.5	PASS
BLE_BT5.0	Ant1	2402	1.14	2401.42	2402.55	0.5	PASS

		2440	1.14	2439.42	2440.55	0.5	PASS
		2480	1.14	2479.42	2480.56	0.5	PASS

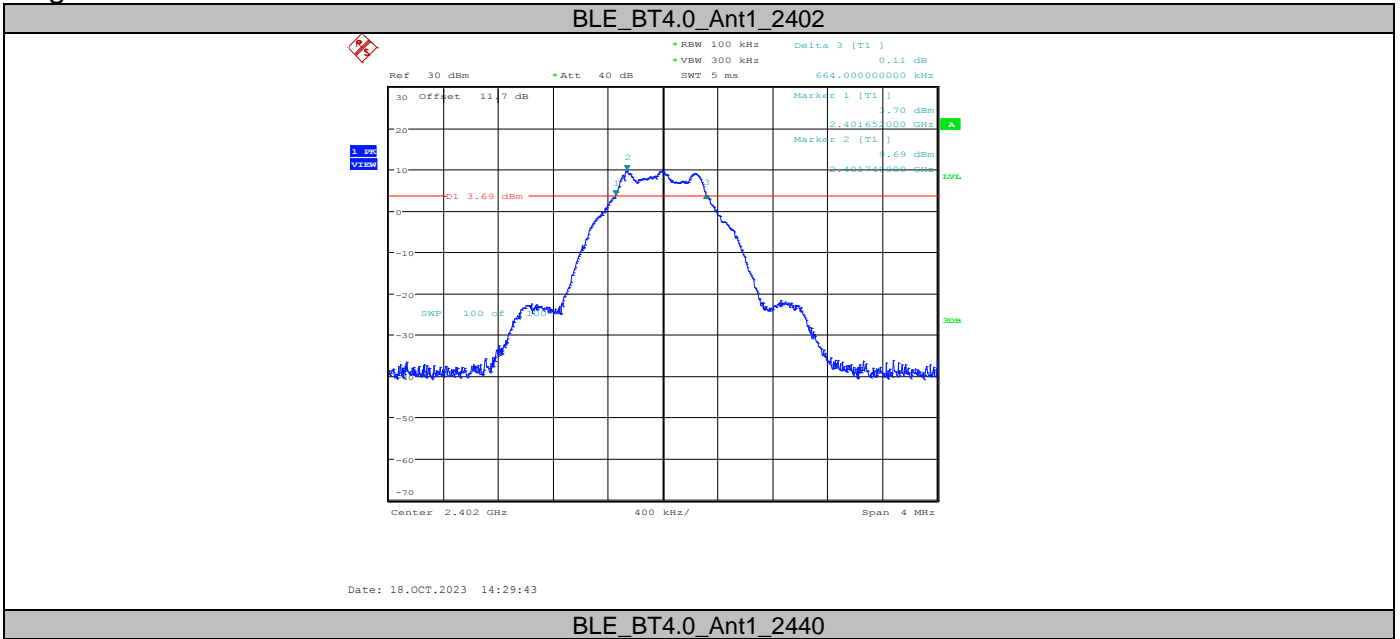
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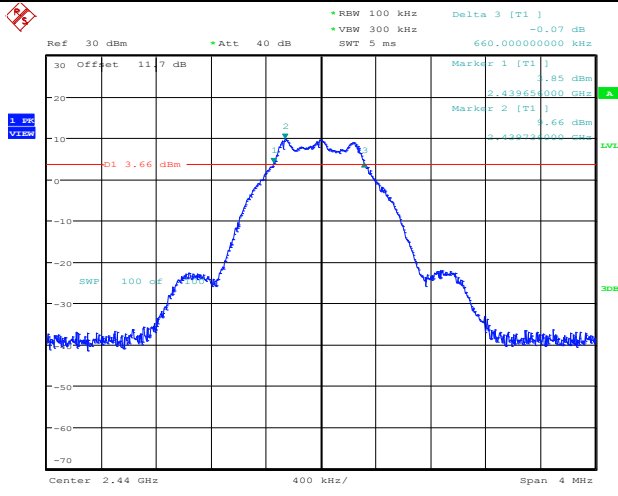






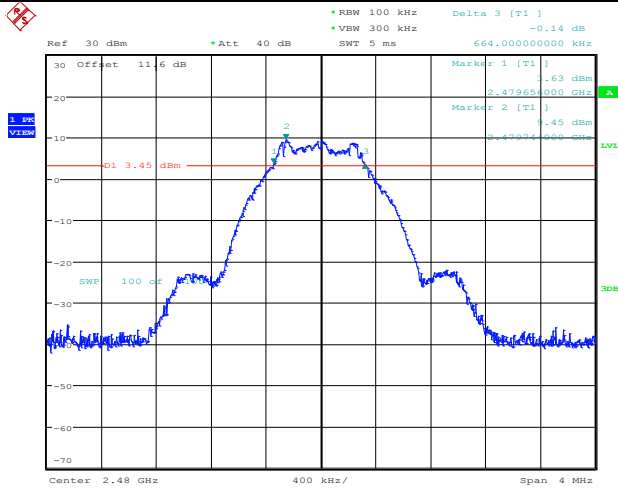
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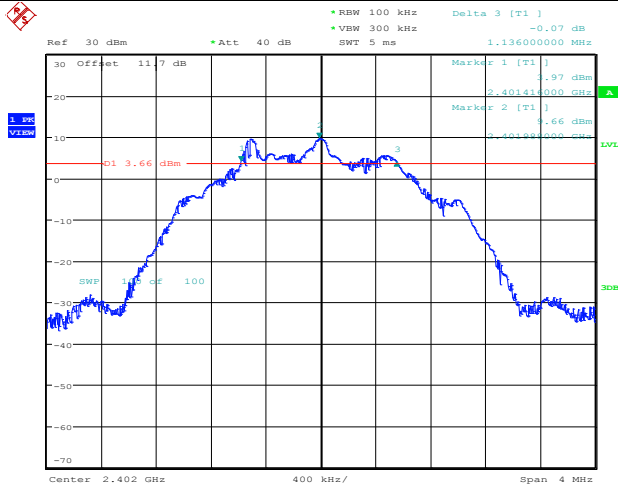
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BLE\_BT4.0\_Ant1\_2480



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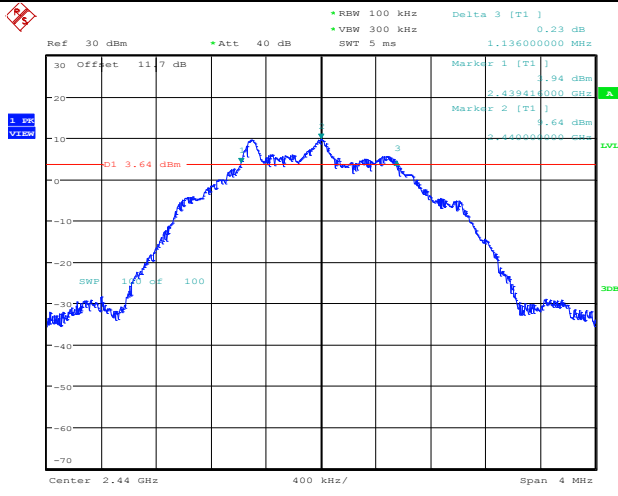
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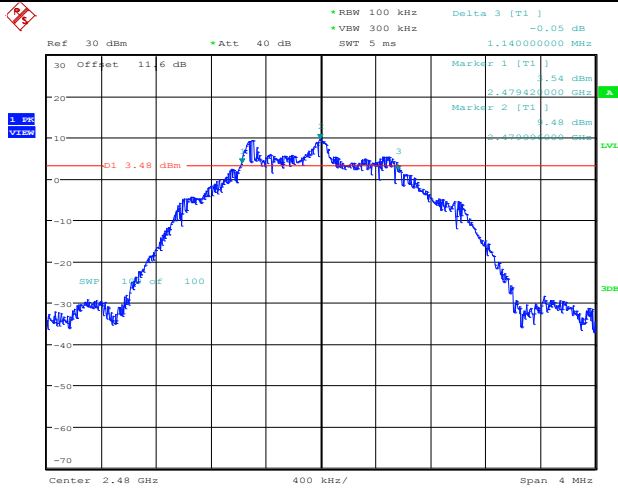
BLE\_BT5.0\_Ant1\_2440





Date: 18.OCT.2023 14:48:21

**BLE\_BT5.0\_Ant1\_2480**



Date: 18.OCT.2023 14:53:38

## 6. MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT

### 6.1.Limits of Maximum Conducted Output Power Measurement

CFR 47 (FCC) part 15.247 (b) (3), 558074 D01 DTS Meas Guidance v05r02  
 RSS-247 Clause 5.4(d), For DTSs employing digital modulation techniques operating in the bands 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W.

The e.i.r.p. shall not exceed 4 W

### 6.2. Test Procedure

The transmitter output was connected to the spectrum analyzer.

- a)Set the RBW  $\geq$  DTS bandwidth.
- b)Set VBW  $\geq$  3 x RBW.
- c)Set span  $\geq$  3 x RBW
- d)Sweep time = auto couple.
- e)Detector = peak.
- f)Trace mode = max hold.
- g)Allow trace to fully stabilize.
- h)Use peak marker function to determine the peak amplitude level.

### 6.3. Test Setup



### 6.4. Test Data

Left:

Table 8 Maximum Conducted Output Power Test Data

TestMode	Antenna	Channel	Result	Limit	Verdict
BLE_BT4.0	Ant1	2402	9.43	$\leq 30$	PASS
		2440	9.24	$\leq 30$	PASS
		2480	9.12	$\leq 30$	PASS
BLE_BT5.0	Ant1	2402	9.47	$\leq 30$	PASS
		2440	9.62	$\leq 30$	PASS
		2480	9.48	$\leq 30$	PASS

Table 9 E.I.R.P Test Data

TestMode	Antenna	Channel	Result	Limit	Verdict
BLE_BT4.0	Ant1	2402	10.63	≤36.02	PASS
		2440	10.44	≤36.02	PASS
		2480	10.32	≤36.02	PASS
BLE_BT5.0	Ant1	2402	10.67	≤36.02	PASS
		2440	10.82	≤36.02	PASS
		2480	10.68	≤36.02	PASS

Right:

Table 10 Maximum Conducted Output Power Test Data

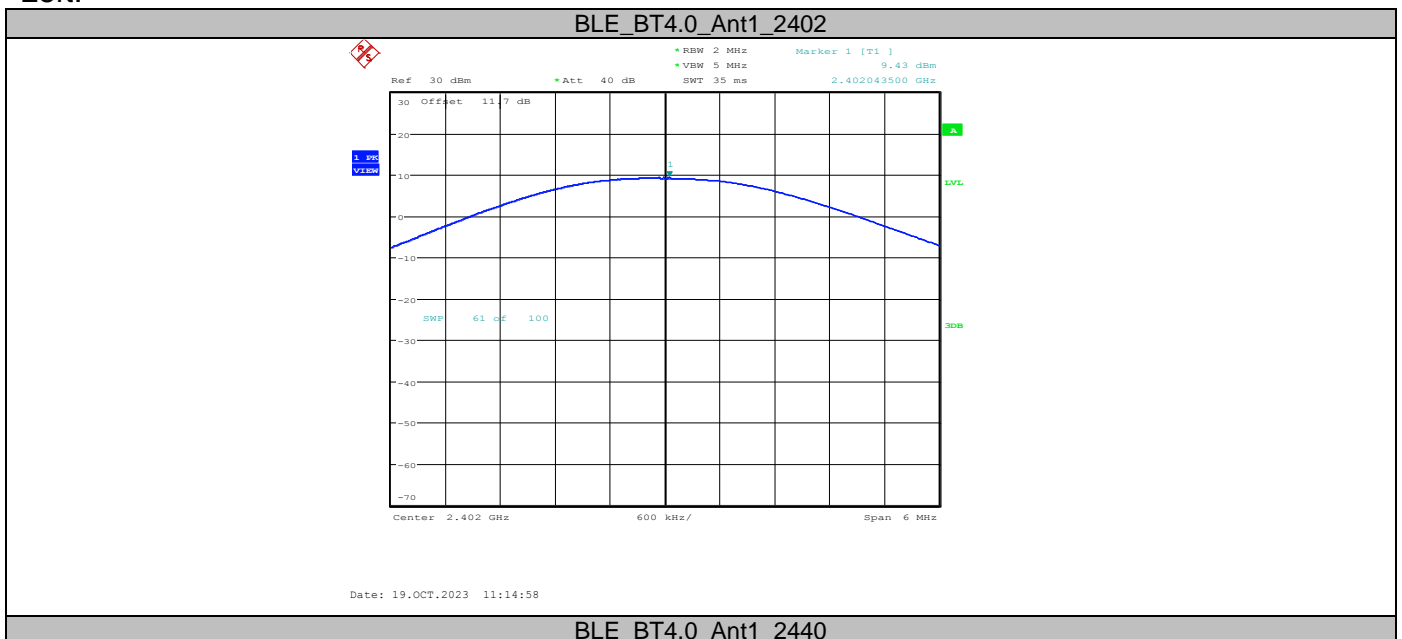
TestMode	Antenna	Channel	Result	Limit	Verdict
BLE_BT4.0	Ant1	2402	10.3	≤30	PASS
		2440	10.24	≤30	PASS
		2480	10.1	≤30	PASS
BLE_BT5.0	Ant1	2402	10.38	≤30	PASS
		2440	10.34	≤30	PASS
		2480	10.18	≤30	PASS

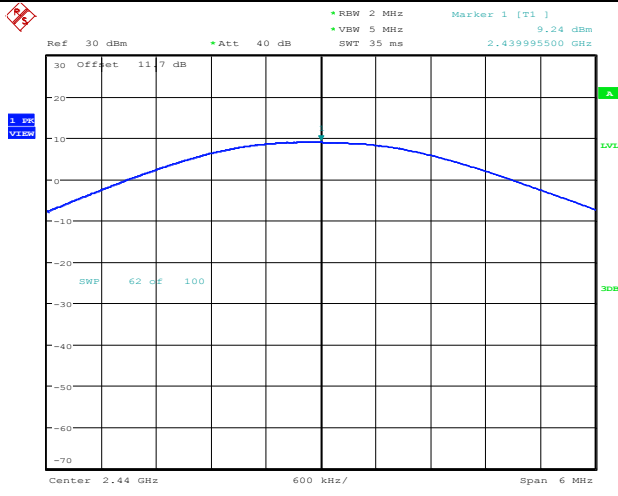
Right:

Table 11 E.I.R.P Test Data

TestMode	Antenna	Channel	Result	Limit	Verdict
BLE_BT4.0	Ant1	2402	11.5	≤30	PASS
		2440	11.44	≤30	PASS
		2480	11.3	≤30	PASS
BLE_BT5.0	Ant1	2402	11.58	≤30	PASS
		2440	11.54	≤30	PASS
		2480	11.38	≤30	PASS

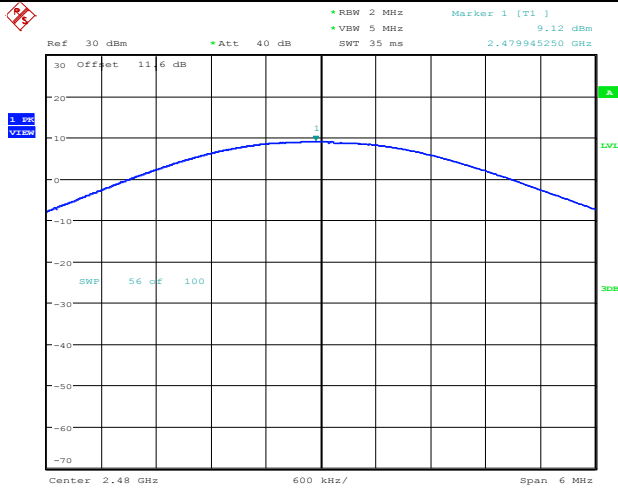
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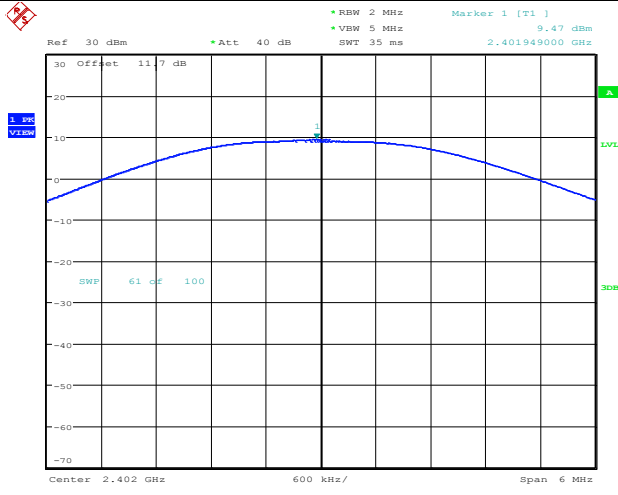
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**BLE\_BT4.0\_Ant1\_2480**



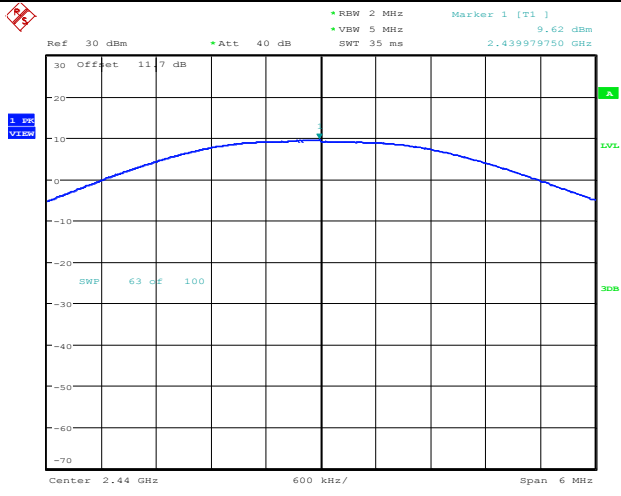
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**BLE\_BT5.0\_Ant1\_2402**



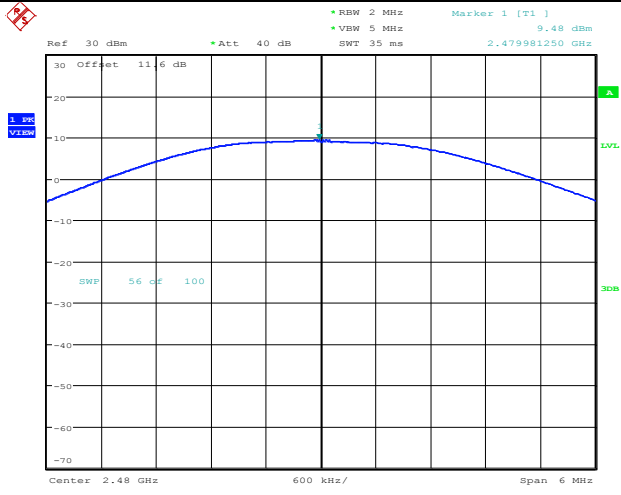
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**BLE\_BT5.0\_Ant1\_2440**



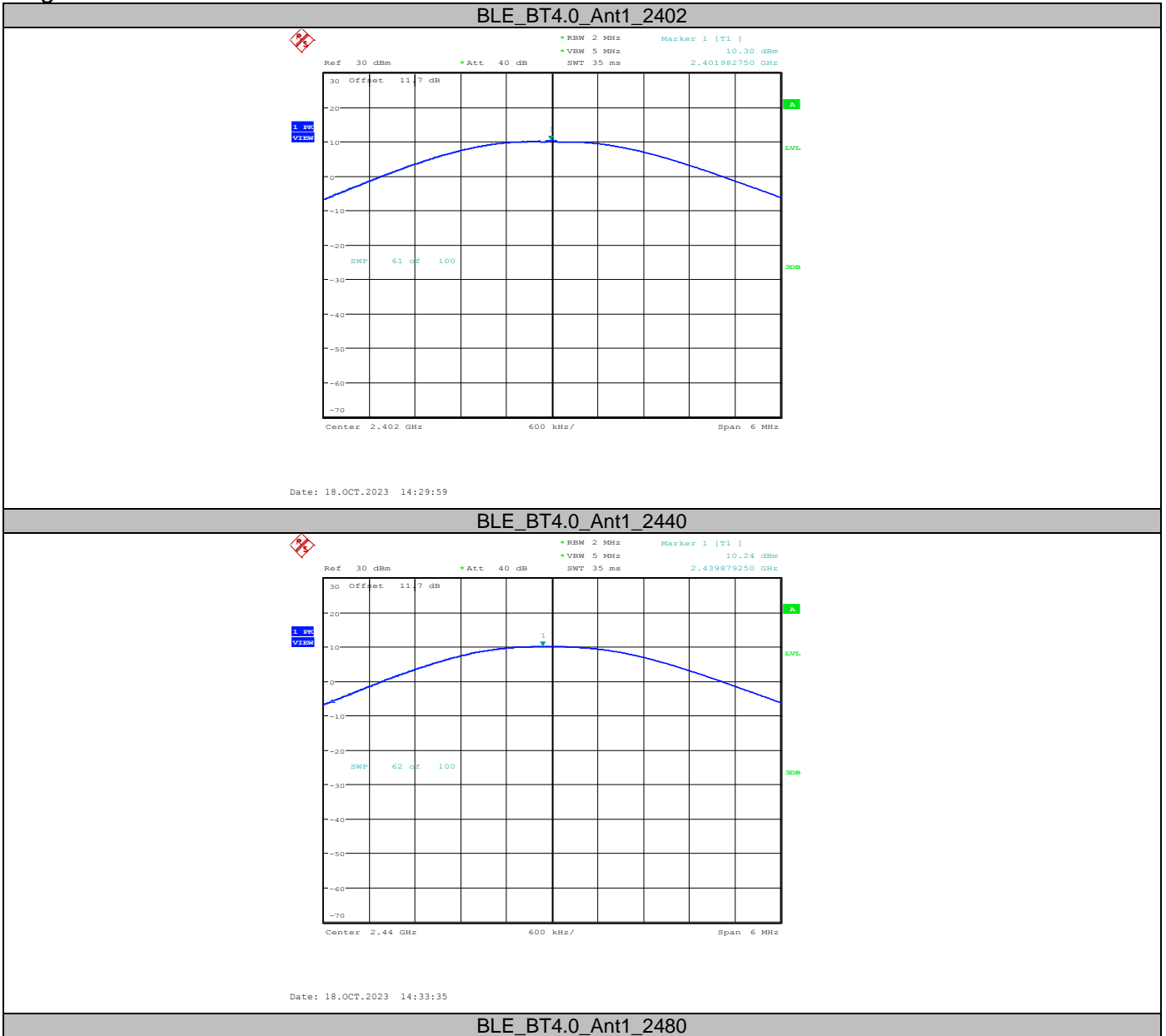
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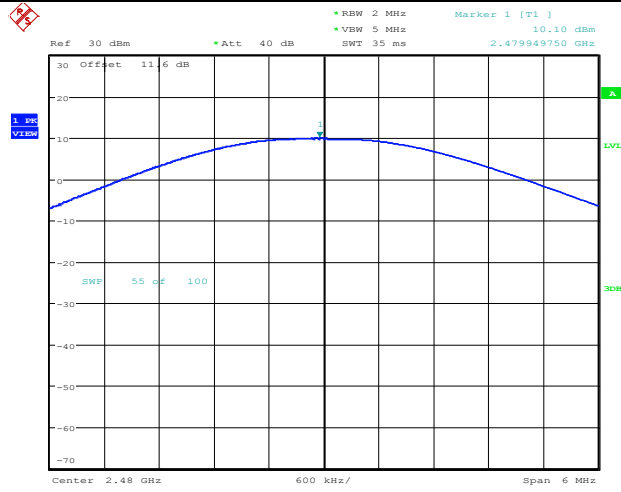
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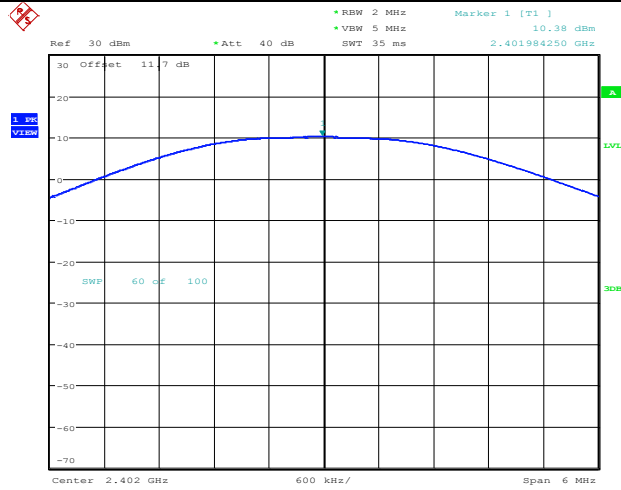
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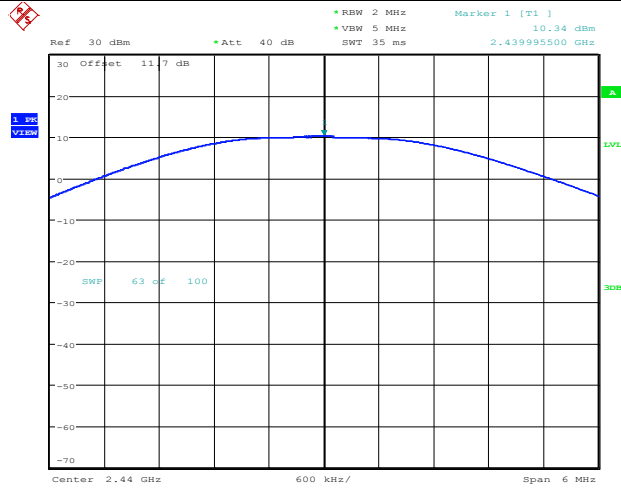
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BLE\_BT5.0\_Ant1\_2402



Date: 18.OCT.2023 14:40:15

BLE\_BT5.0\_Ant1\_2440



Date: 18.OCT.2023 14:48:38

BLE\_BT5.0\_Ant1\_2480





## 7. MAXIMUM POWER SPECTRAL DENSITY LEVEL MEASUREMENT

### 7.1.Limits of Maximum Power Spectral Density Level Measurement

CFR 47 (FCC) part 15.247 (e) , 558074 D01 DTS Meas Guidance v05r02  
RSS-247 Clause 5.2(b)

### 7.2.Test Procedure

The transmitter output was connected to the spectrum analyzer.

- a)Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set RBW to:  $3\text{kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set VBW  $\geq 3 \times \text{RBW}$ .
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h)Allow trace to fully stabilize.
- i)Use the peak marker function to determine the maximum amplitude level within the RBW.
- j)If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### 7.3.Test Data

Left:

Table 12 Maximum Power Spectral Density Level Test Data

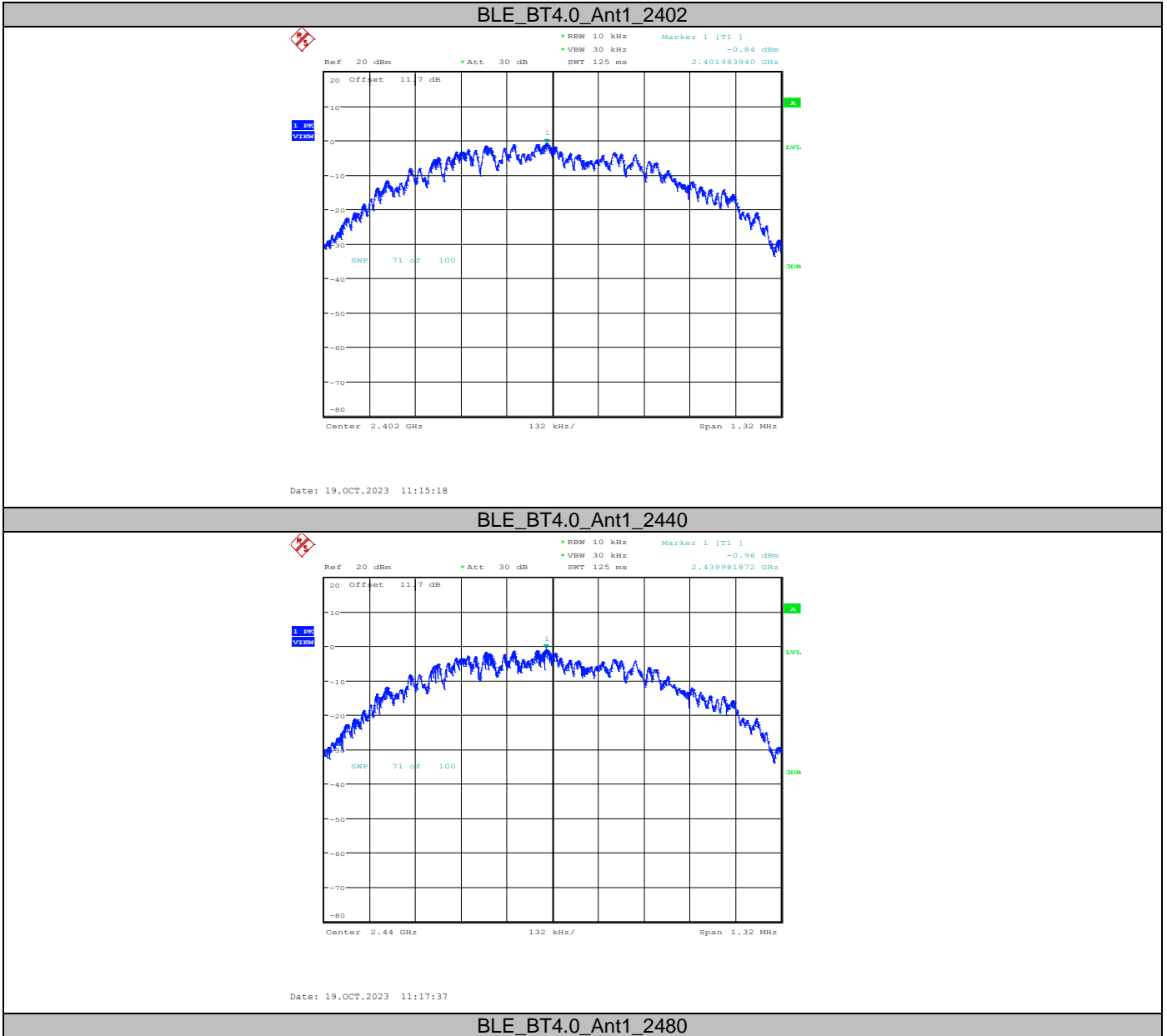
TestMode	Antenna	Channel	Result	Limit	Verdict
BLE_BT4.0	Ant1	2402	-0.84	$\leq 8.00$	PASS
		2440	-0.96	$\leq 8.00$	PASS
		2480	-1.28	$\leq 8.00$	PASS
BLE_BT5.0	Ant1	2402	-1.47	$\leq 8.00$	PASS
		2440	-1.2	$\leq 8.00$	PASS
		2480	-1.41	$\leq 8.00$	PASS

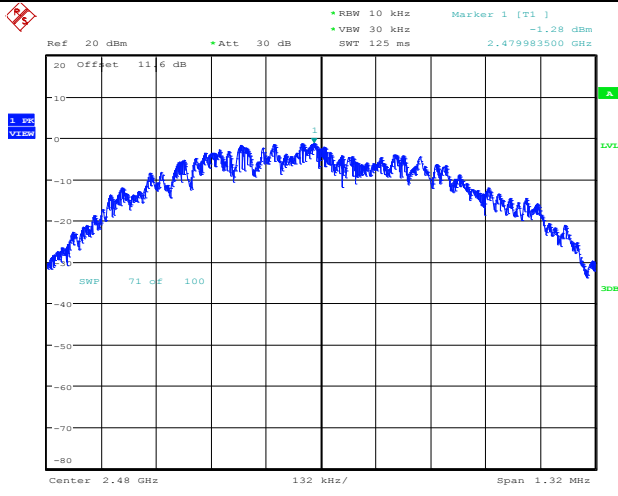
Right:

Table 13 Maximum Power Spectral Density Level Test Data

TestMode	Antenna	Channel	Result	Limit	Verdict
BLE_BT4.0	Ant1	2402	-0.09	$\leq 8.00$	PASS
		2440	-0.12	$\leq 8.00$	PASS
		2480	-0.26	$\leq 8.00$	PASS
BLE_BT5.0	Ant1	2402	-0.66	$\leq 8.00$	PASS
		2440	-0.72	$\leq 8.00$	PASS
		2480	-0.77	$\leq 8.00$	PASS

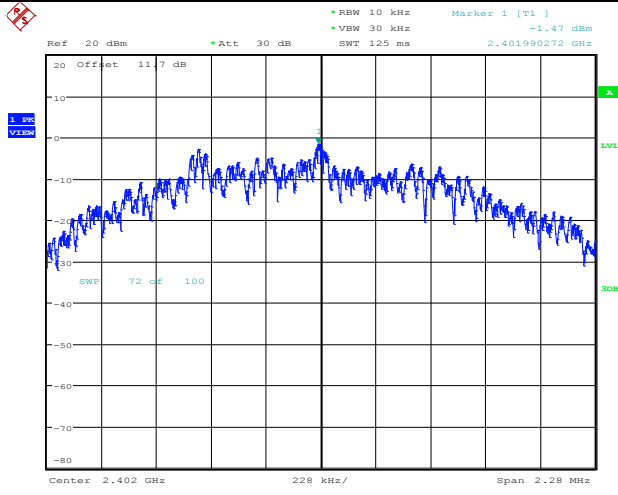
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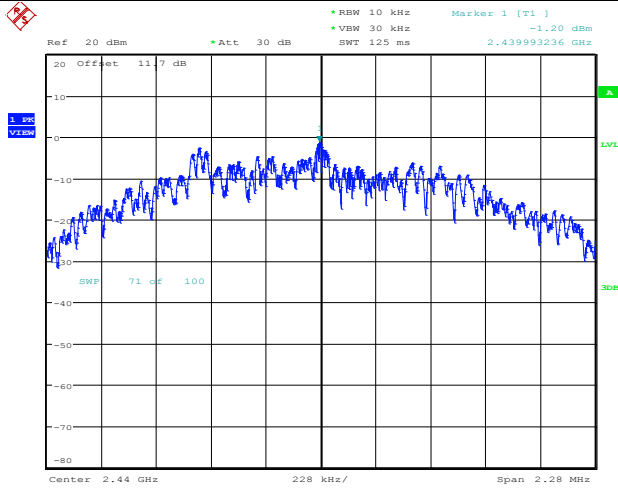
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BLE\_BT5.0\_Ant1\_2402



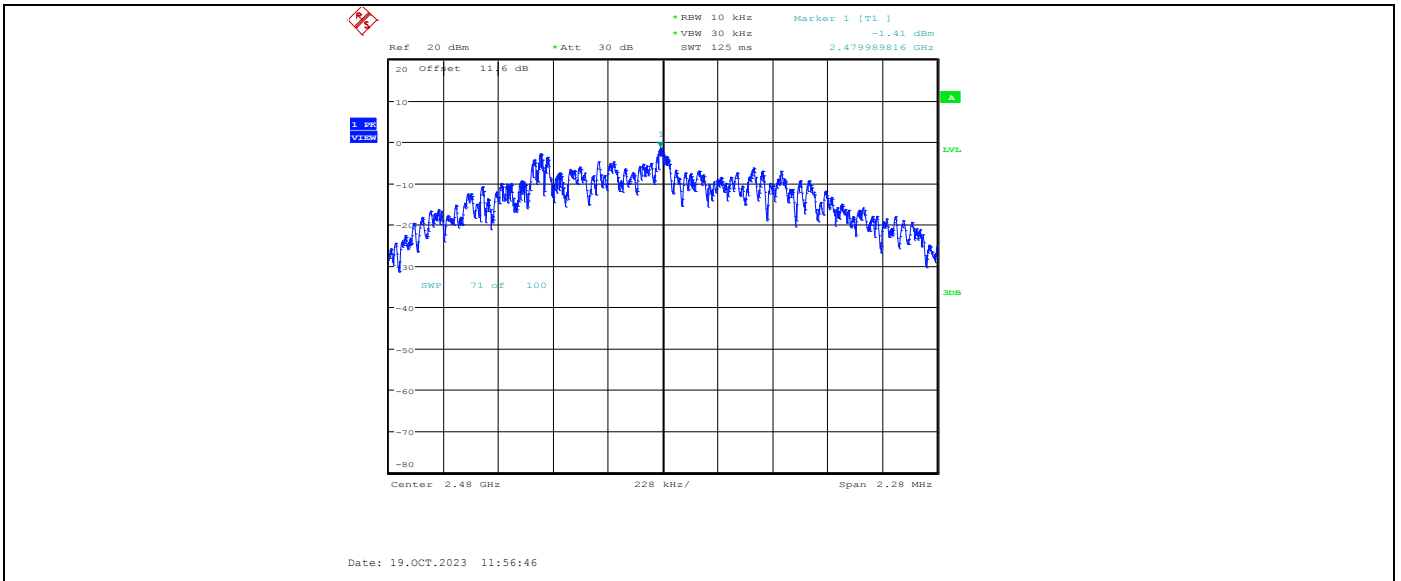
Date: 19.OCT.2023 11:23:48

BLE\_BT5.0\_Ant1\_2440

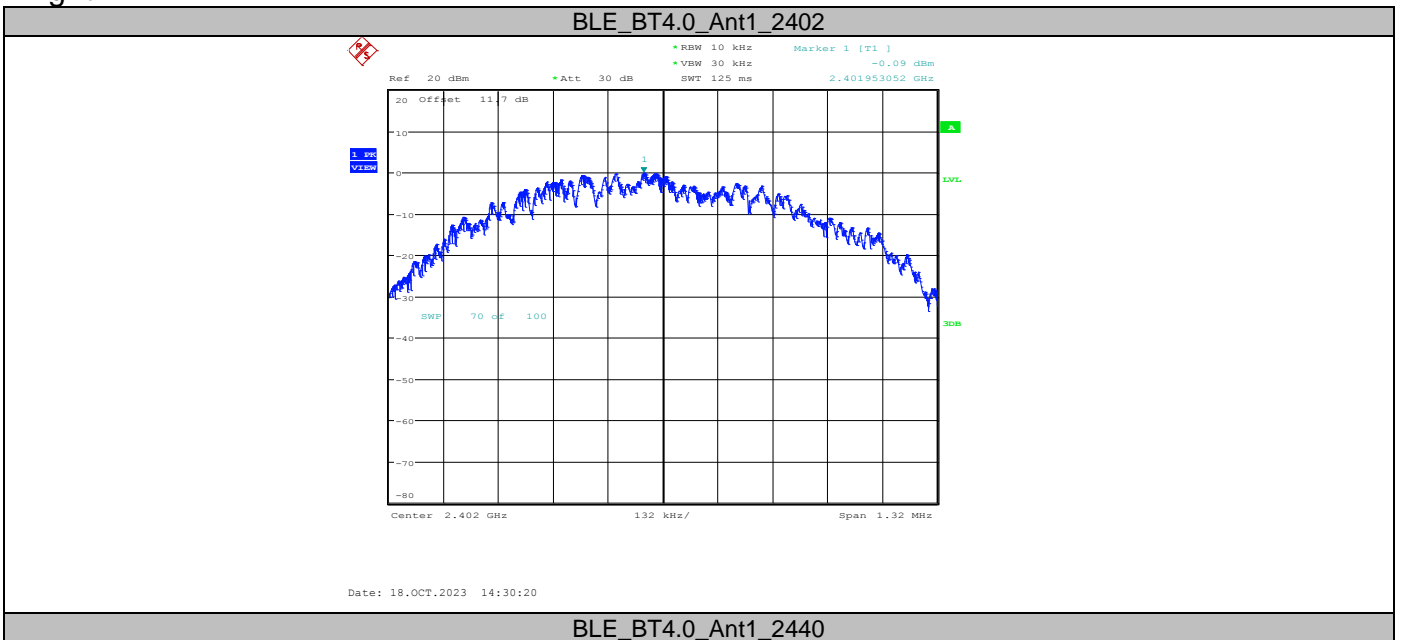


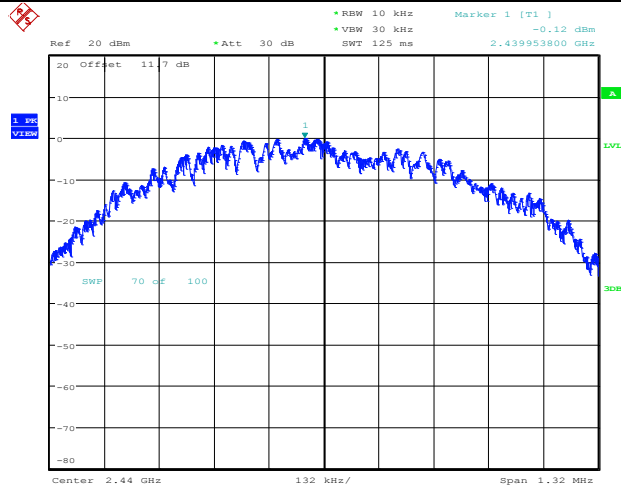
Date: 19.OCT.2023 11:38:15

BLE\_BT5.0\_Ant1\_2480



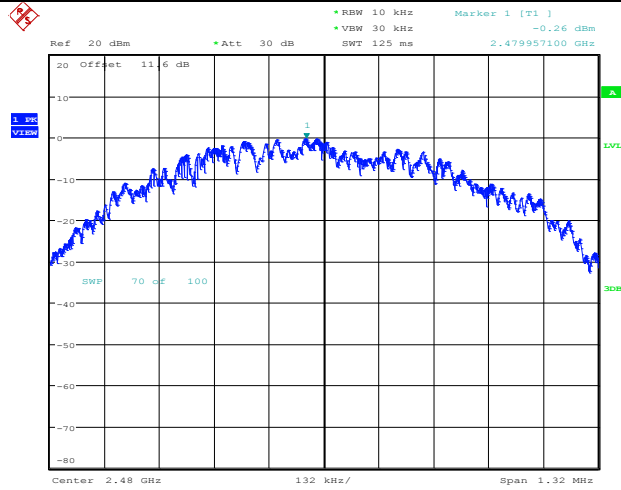
Right:





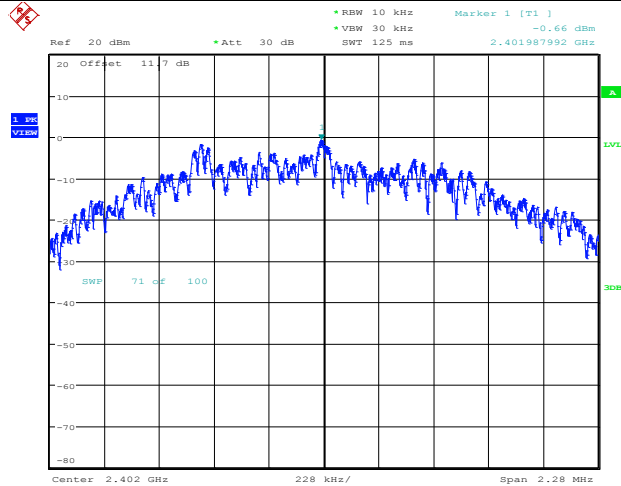
Date: 18.OCT.2023 14:33:56

### BLE\_BT4.0\_Ant1\_2480



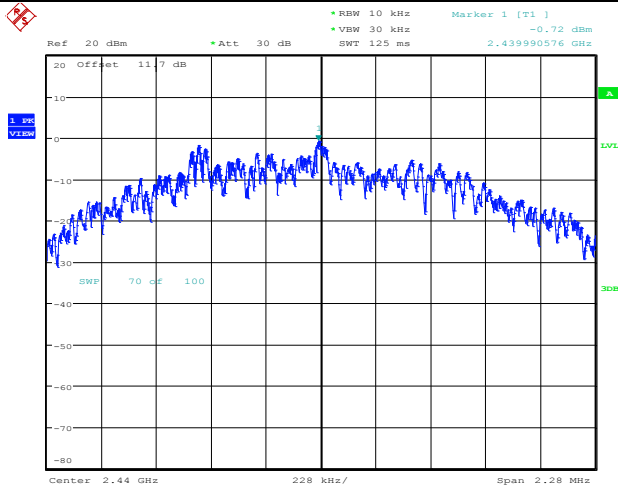
Date: 18.OCT.2023 14:37:21

### BLE\_BT5.0\_Ant1\_2402



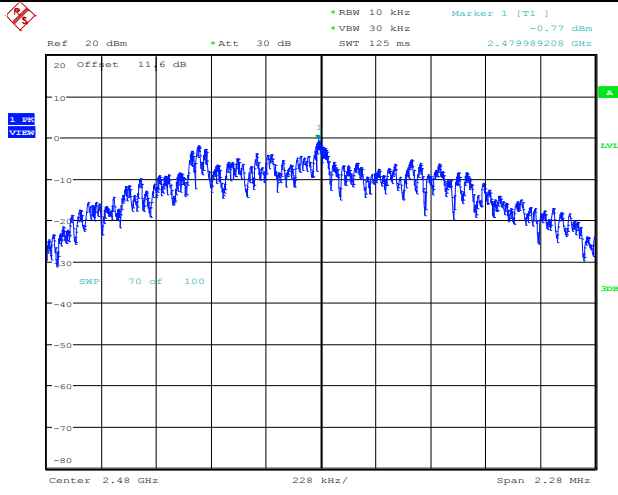
Date: 18.OCT.2023 14:40:36

### BLE\_BT5.0\_Ant1\_2440



Date: 18.OCT.2023 14:48:58

**BLE\_BT5.0\_Ant1\_2480**



Date: 18.OCT.2023 14:54:15

## 8. CONDUCTED BANDEDGE AND SPURIOUS MEASUREMENT

### 8.1.Limits of Conducted Bandedge and Spurious Measurement

CFR 47 (FCC) part 15.247 (d) and 558074 D01 DTS Meas Guidance v05r02  
RSS-247 Clause 5.5

### 8.2.Test Procedure

The transmitter output was connected to the spectrum analyzer.

Establish a reference level by using the following procedure:

- a)Set instrument center frequency to DTS channel center frequency.
- b)Set the span to  $\geq 1.5$  times the DTS bandwidth.
- c)Set the RBW = 100 kHz.
- d)Set the VBW  $\geq 3 \times$  RBW.
- e)Detector = peak.
- f)Sweep time = auto couple.
- g)Trace mode = max hold.
- h)Allow trace to fully stabilize.
- i)Use the peak marker function to determine the maximum PSD level.

Emission level measurement

- a)Set the center frequency and span to encompass frequency range to be measured.
- b)Set the RBW = 100 kHz.
- c)Set the VBW  $\geq 3 \times$  RBW.
- d)Detector = peak.
- e)Ensure that the number of measurement points  $\geq$  span/RBW
- f)Sweep time = auto couple.
- g)Trace mode = max hold.
- h)Allow trace to fully stabilize.
- i)Use the peak marker function to determine the maximum amplitude level.

### 8.3.Test Data

Left:

Table 14 Band edge Test Data

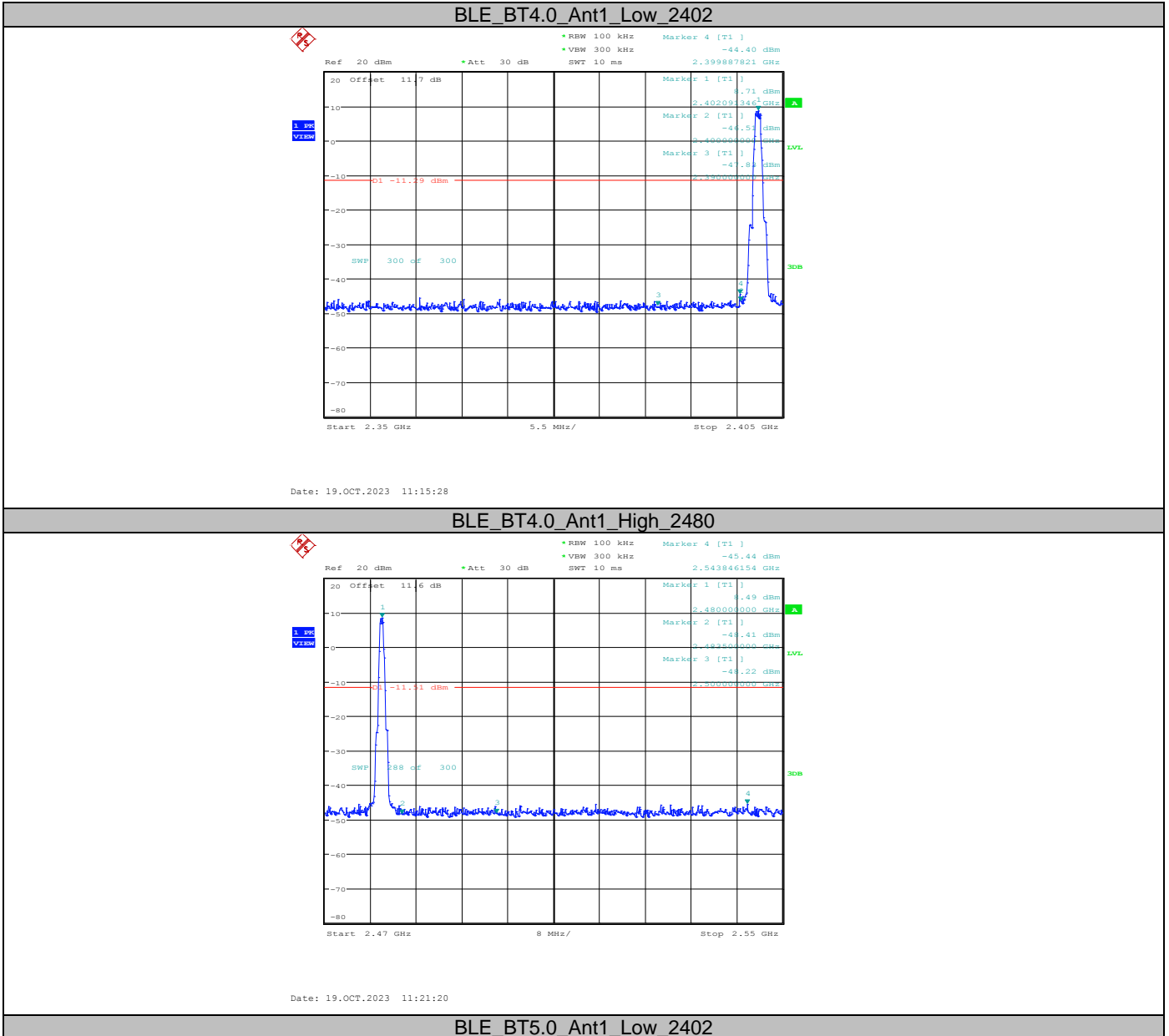
TestMode	Antenna	ChName	Channel	RefLevel	Result	Limit	Verdict
BLE_BT4.0	Ant1	Low	2402	8.71	-44.4	$\leq -11.29$	PASS
		High	2480	8.49	-45.44	$\leq -11.51$	PASS
BLE_BT5.0	Ant1	Low	2402	8.68	-38.2	$\leq -11.32$	PASS
		High	2480	8.91	-45.04	$\leq -11.09$	PASS

Right:

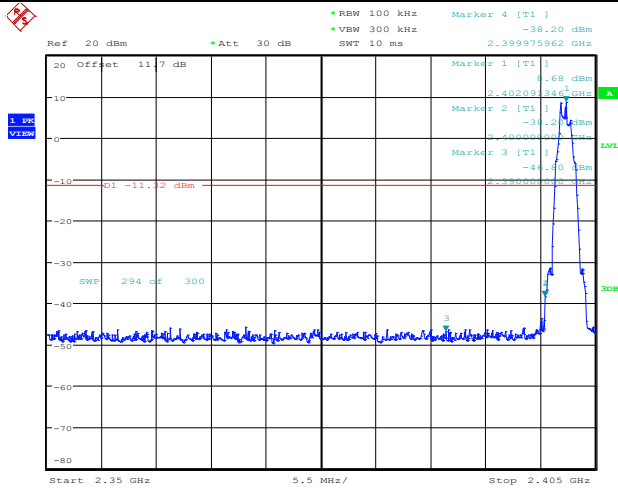
Table 15 Band edge Test Data

TestMode	Antenna	ChName	Channel	RefLevel	Result	Limit	Verdict
BLE_BT4.0	Ant1	Low	2402	9.65	-43.7	$\leq -10.35$	PASS
		High	2480	9.50	-45.02	$\leq -10.5$	PASS
BLE_BT5.0	Ant1	Low	2402	9.75	-36.5	$\leq -10.25$	PASS
		High	2480	9.66	-44.83	$\leq -10.34$	PASS

Left:

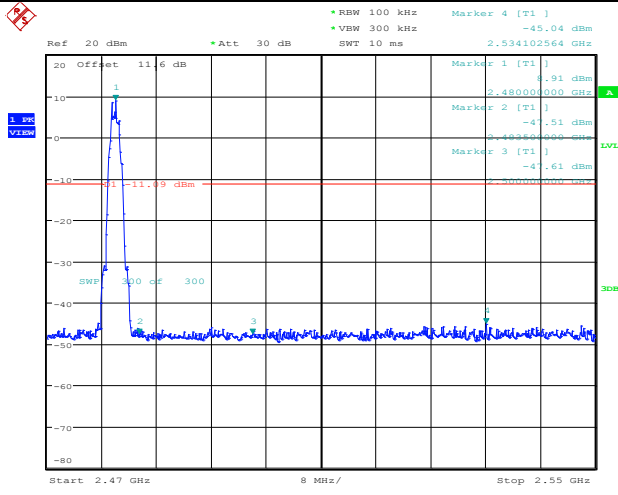






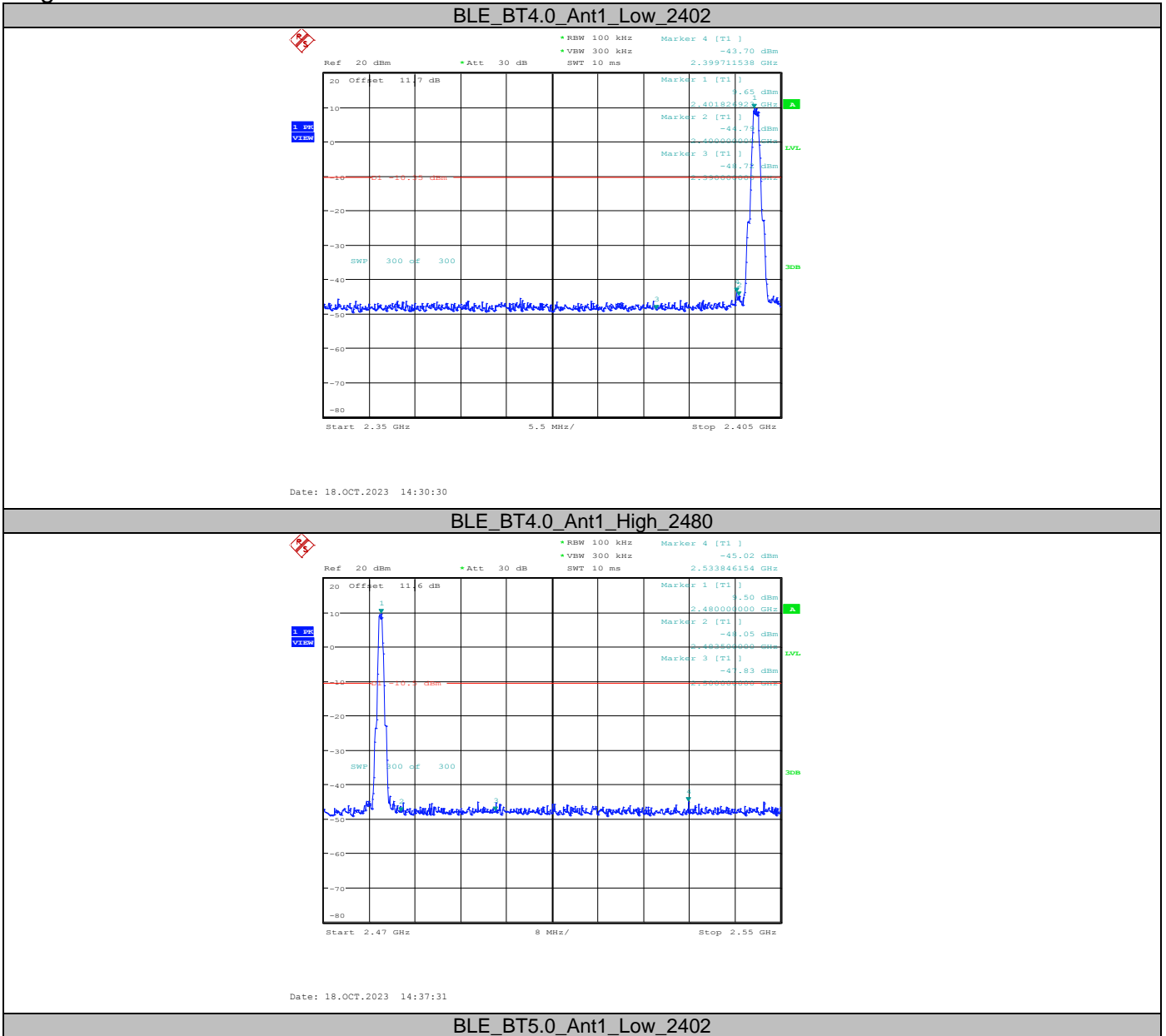
Date: 19.OCT.2023 11:23:58

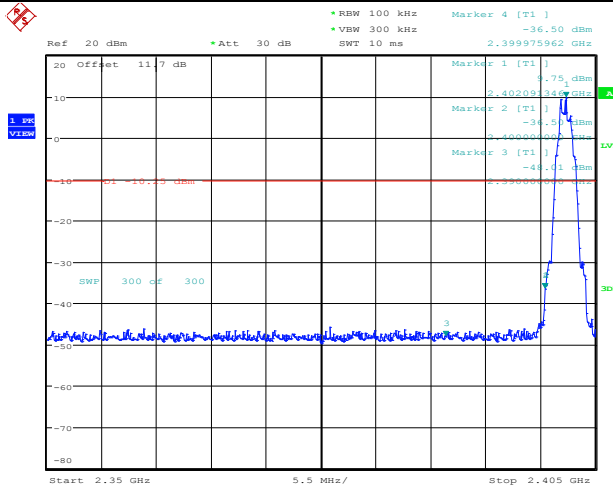
BLE\_BT5.0\_Ant1\_High\_2480



Date: 19.OCT.2023 11:56:56

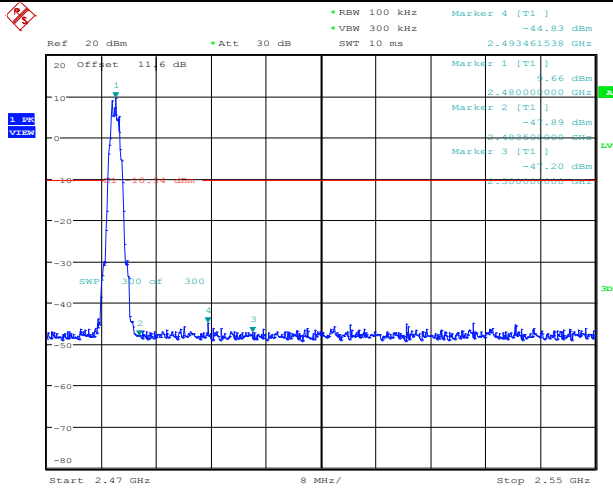
Right:





Date: 18.OCT.2023 14:40:46

BLE\_BT5.0\_Ant1\_High\_2480



Date: 18.OCT.2023 14:54:25

Left:

Table 16 Conducted Spurious Emission Test Data

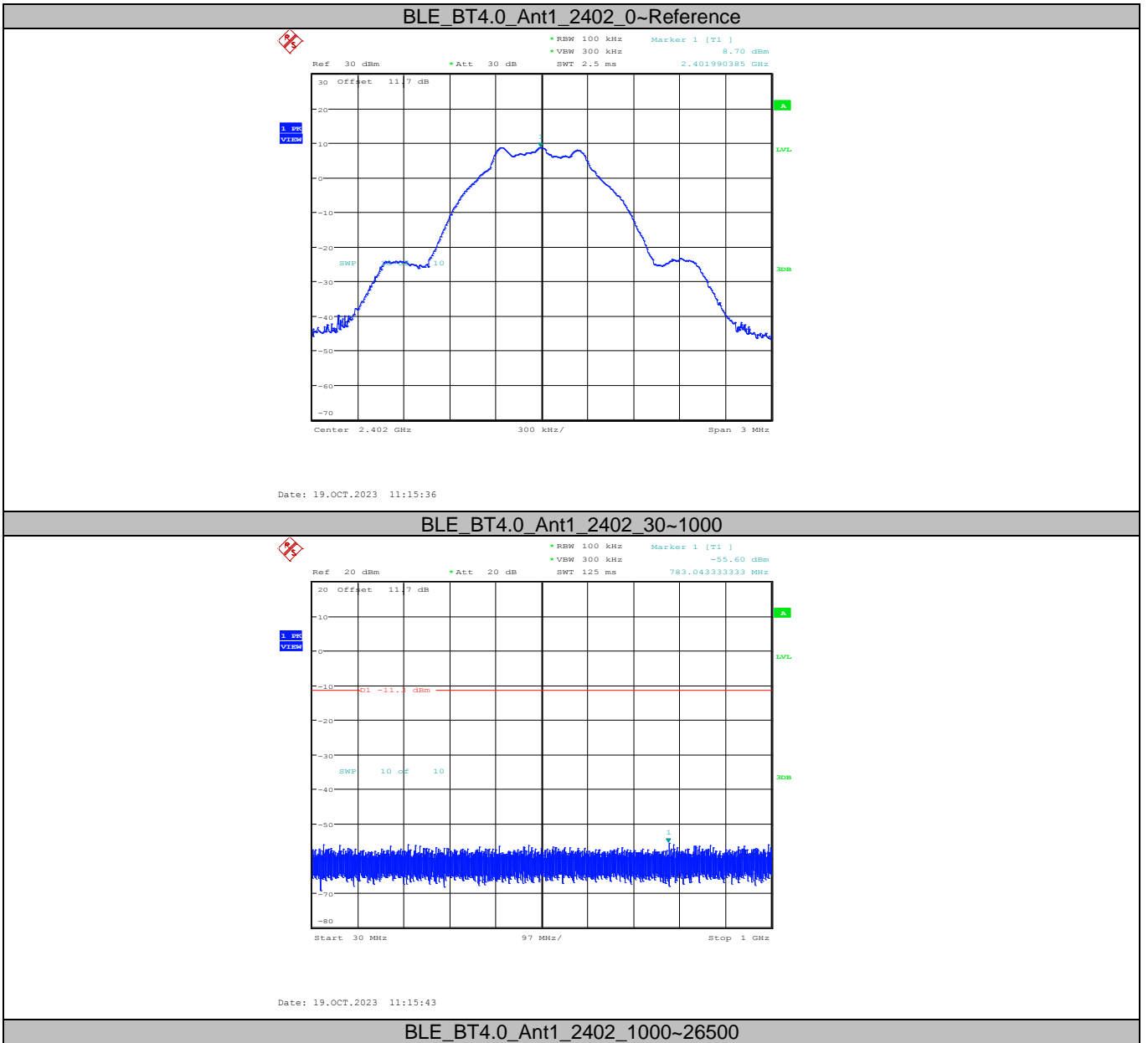
TestMode	Antenna	Channel	FreqRange	RefLevel	Result	Limit	Verdict
BLE_BT4.0	Ant1	2402	Reference	8.70	8.70	---	PASS
			30~1000	8.70	-55.6	≤-11.3	PASS
			1000~26500	8.70	-52.5	≤-11.3	PASS
		2440	Reference	8.52	8.52	---	PASS
			30~1000	8.52	-55.08	≤-11.48	PASS
			1000~26500	8.52	-51.38	≤-11.48	PASS
		2480	Reference	8.41	8.41	---	PASS
			30~1000	8.41	-55.08	≤-11.59	PASS
			1000~26500	8.41	-51.15	≤-11.59	PASS
BLE_BT5.0	Ant1	2402	Reference	8.68	8.68	---	PASS
			30~1000	8.68	-54.44	≤-11.32	PASS
			1000~26500	8.68	-52.48	≤-11.32	PASS
		2440	Reference	8.86	8.86	---	PASS
			30~1000	8.86	-54.8	≤-11.14	PASS
			1000~26500	8.86	-52.7	≤-11.14	PASS
		2480	Reference	8.75	8.75	---	PASS
			30~1000	8.75	-54.63	≤-11.25	PASS
			1000~26500	8.75	-52.92	≤-11.25	PASS

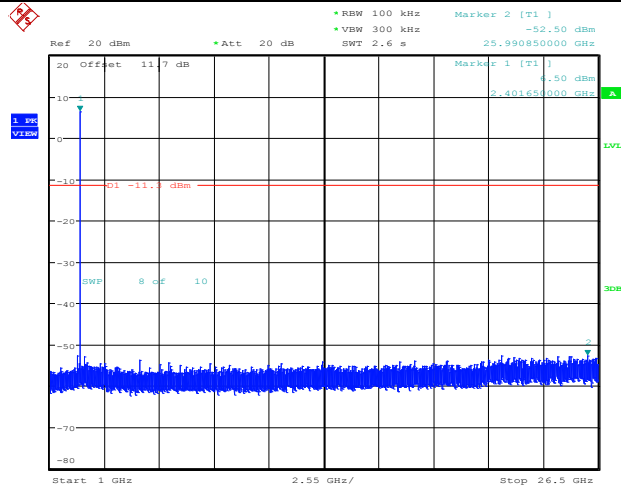
Right:

Table 17 Conducted Spurious Emission Test Data

TestMode	Antenna	Channel	FreqRange	RefLevel	Result	Limit	Verdict
BLE_BT4.0	Ant1	2402	Reference	9.67	9.67	---	PASS
			30~1000	9.67	-55.29	≤-10.33	PASS
			1000~26500	9.67	-51.2	≤-10.33	PASS
		2440	Reference	9.63	9.63	---	PASS
			30~1000	9.63	-54.44	≤-10.37	PASS
			1000~26500	9.63	-51.86	≤-10.37	PASS
		2480	Reference	9.43	9.43	---	PASS
			30~1000	9.43	-55.16	≤-10.57	PASS
			1000~26500	9.43	-52.08	≤-10.57	PASS
BLE_BT5.0	Ant1	2402	Reference	9.66	9.66	---	PASS
			30~1000	9.66	-55.34	≤-10.34	PASS
			1000~26500	9.66	-45.85	≤-10.34	PASS
		2440	Reference	9.64	9.64	---	PASS
			30~1000	9.64	-55.63	≤-10.36	PASS
			1000~26500	9.64	-52.35	≤-10.36	PASS
		2480	Reference	9.46	9.46	---	PASS
			30~1000	9.46	-55.26	≤-10.54	PASS
			1000~26500	9.46	-52.2	≤-10.54	PASS

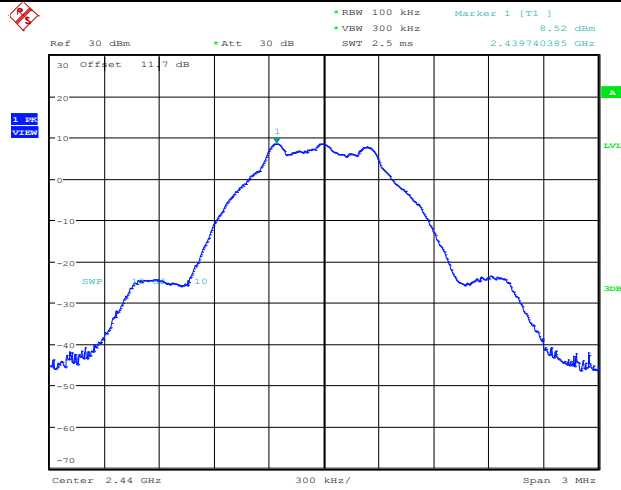
Left:





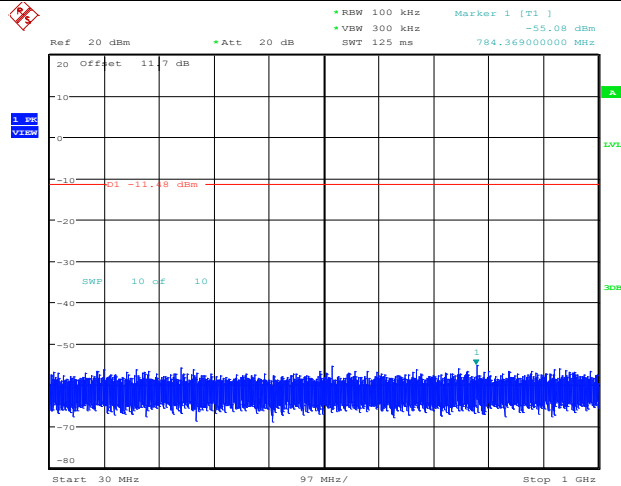
Date: 19.OCT.2023 11:16:06

### BLE\_BT4.0\_Ant1\_2440\_0~Reference



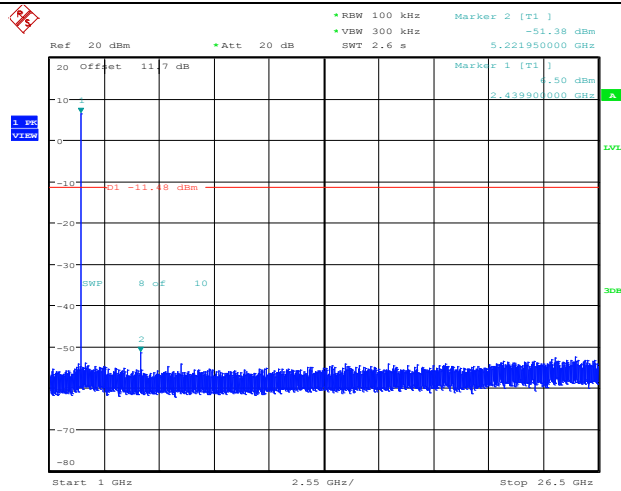
Date: 19.OCT.2023 11:17:45

### BLE\_BT4.0\_Ant1\_2440\_30~1000



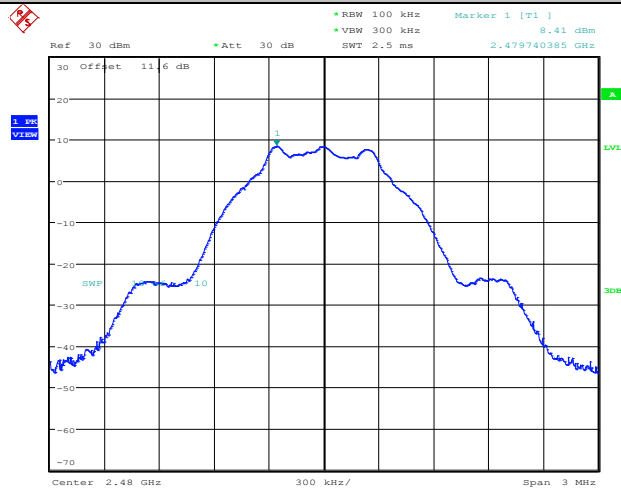
Date: 19.OCT.2023 11:17:52

### BLE\_BT4.0\_Ant1\_2440\_1000~26500



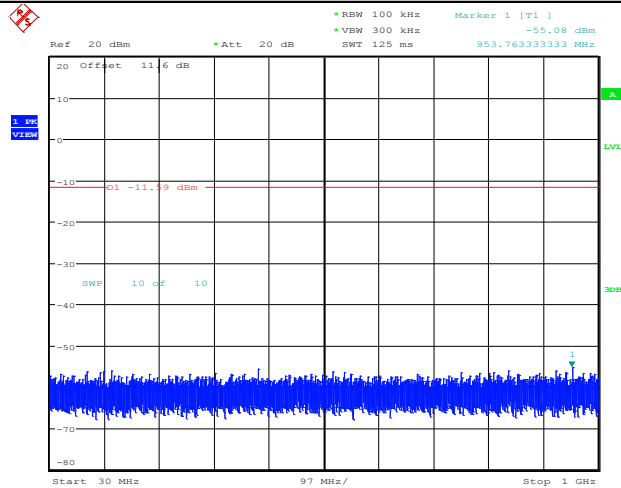
Date: 19.OCT.2023 11:18:15

BLE\_BT4.0\_Ant1\_2480\_0~Reference



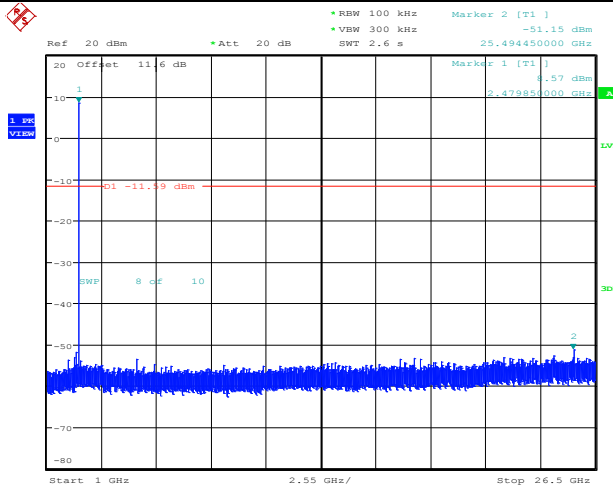
Date: 19.OCT.2023 11:21:28

BLE\_BT4.0\_Ant1\_2480\_30~1000



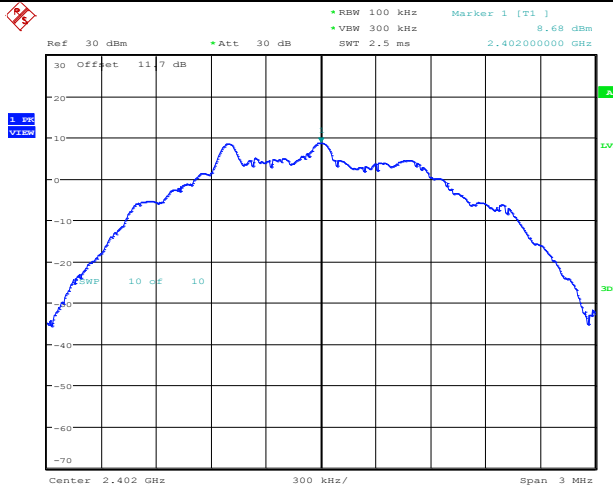
Date: 19.OCT.2023 11:21:35

BLE\_BT4.0\_Ant1\_2480\_1000~26500



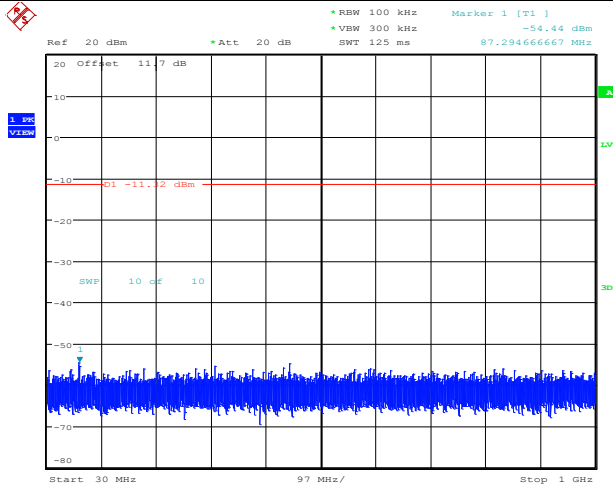
Date: 19.OCT.2023 11:21:58

BLE BT5.0 Ant1\_2402\_0~Reference



Date: 19.OCT.2023 11:24:06

BLE BT5.0 Ant1\_2402\_30~1000



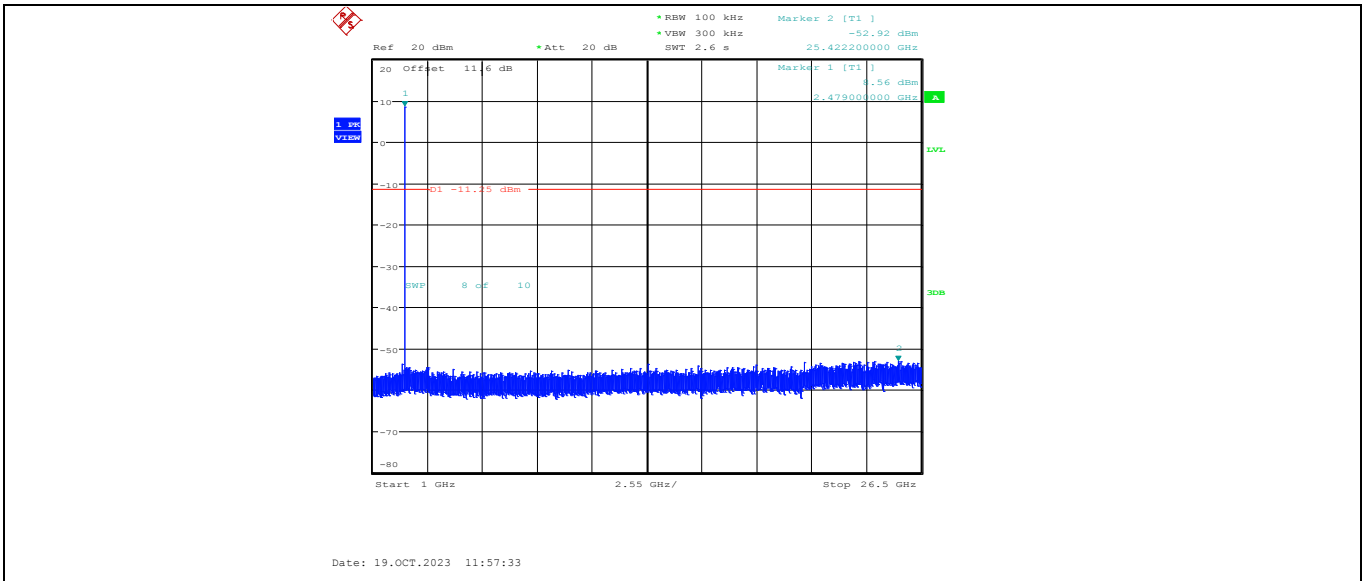
Date: 19.OCT.2023 11:24:13

BLE BT5.0 Ant1\_2402\_1000~26500

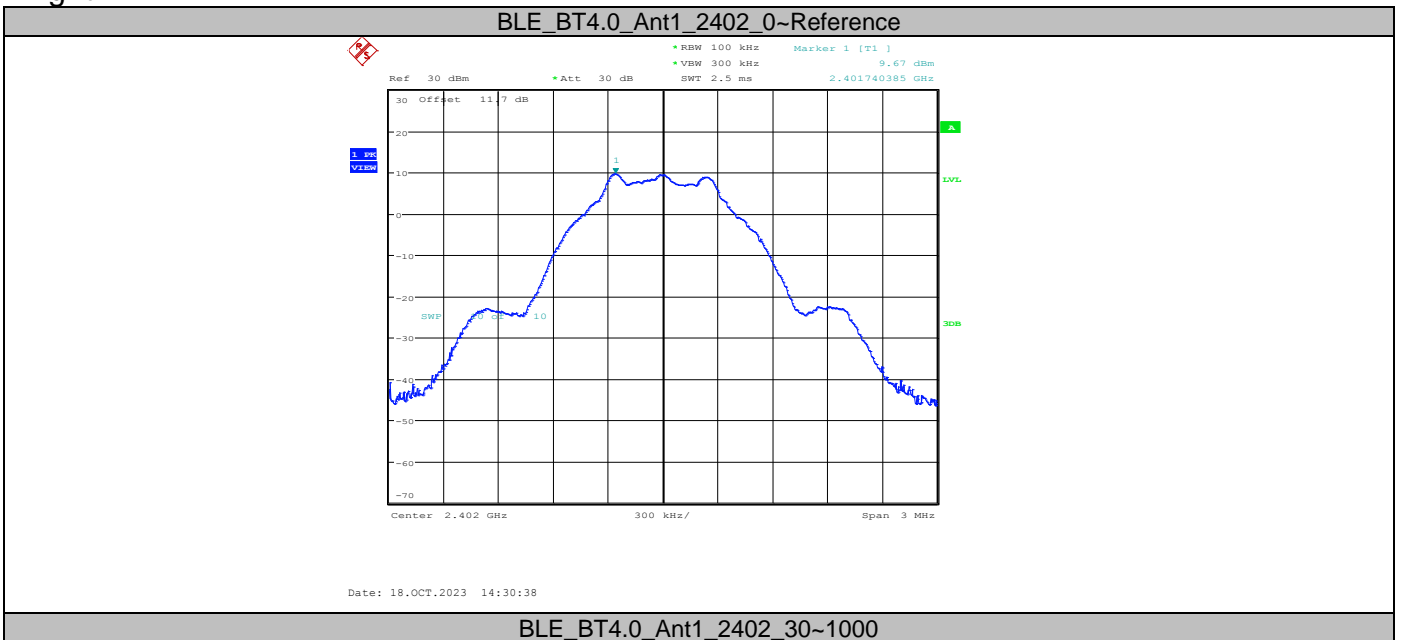


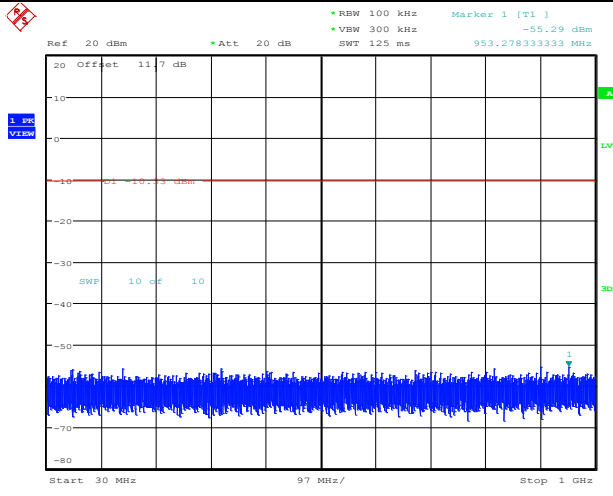






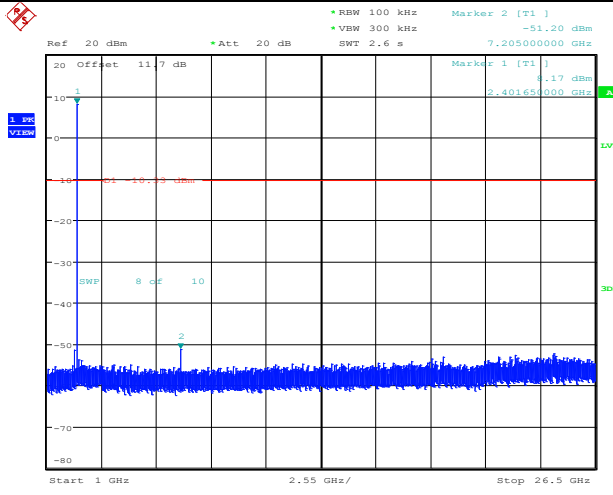
Right:





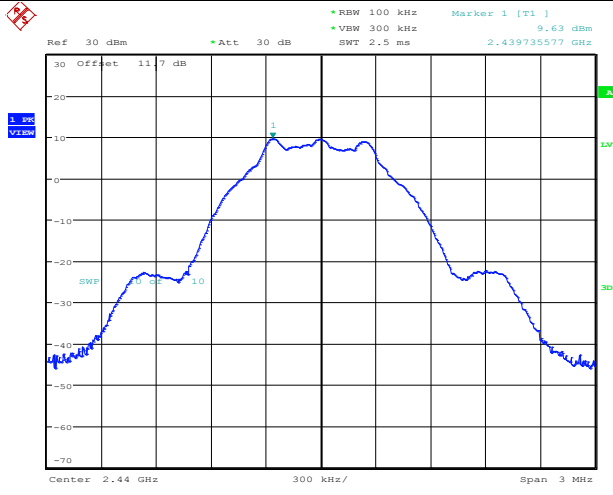
Date: 18.OCT.2023 14:30:45

BLE\_BT4.0\_Ant1\_2402\_1000~26500



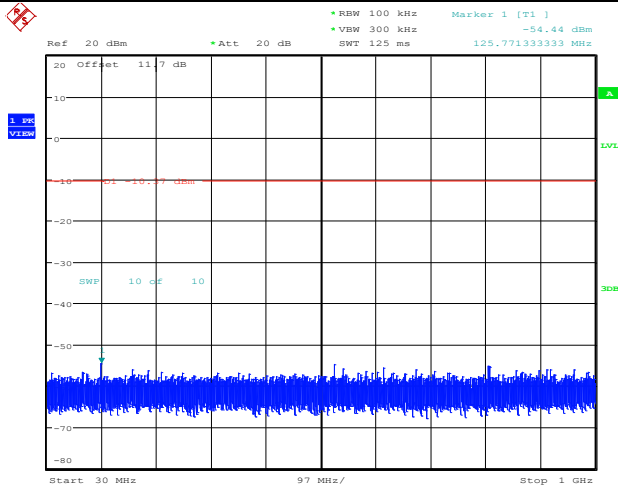
Date: 18.OCT.2023 14:31:08

BLE\_BT4.0\_Ant1\_2440\_0~Reference



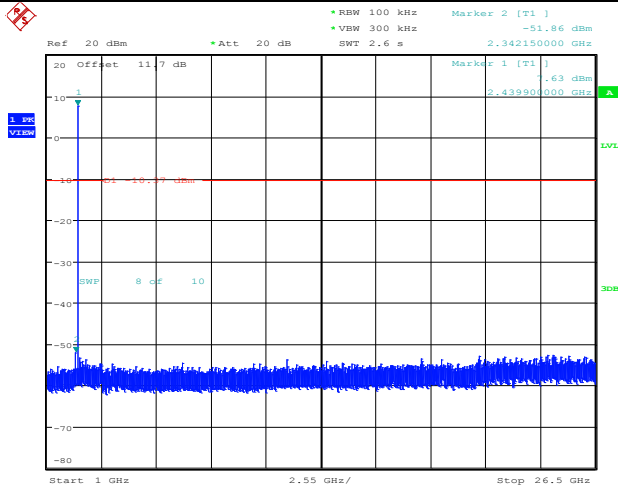
Date: 18.OCT.2023 14:34:04

BLE\_BT4.0\_Ant1\_2440\_30~1000



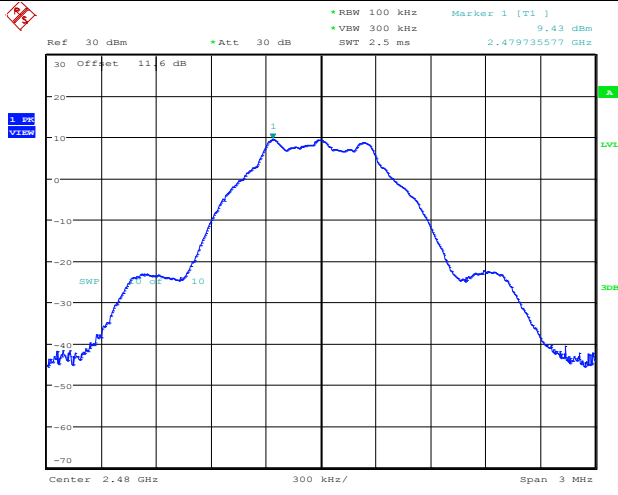
Date: 18.OCT.2023 14:34:11

BLE\_BT4.0\_Ant1\_2440\_1000~26500



Date: 18.OCT.2023 14:34:34

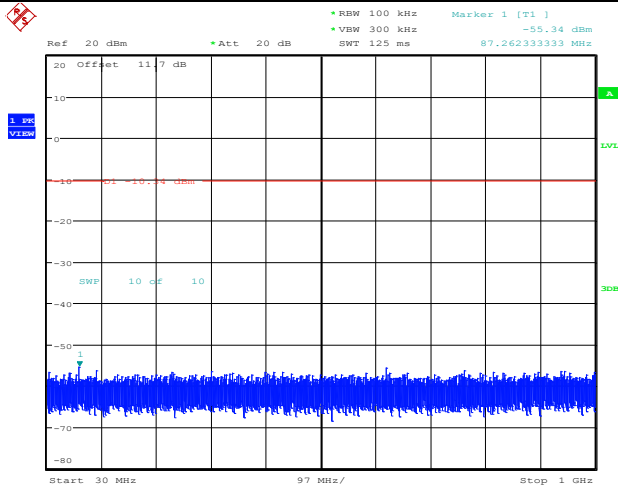
BLE\_BT4.0\_Ant1\_2480\_0~Reference



Date: 18.OCT.2023 14:37:39

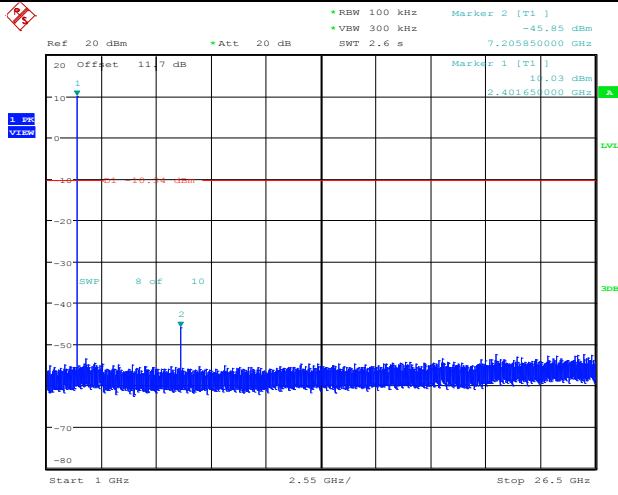
BLE\_BT4.0\_Ant1\_2480\_30~1000





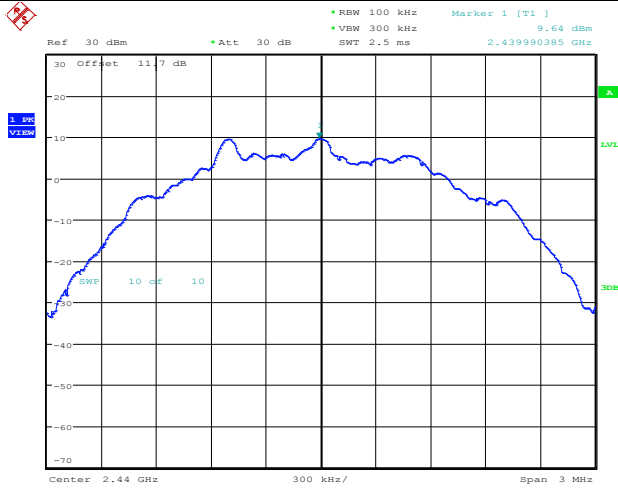
Date: 18.OCT.2023 14:41:01

**BLE BT5.0 Ant1\_2402\_1000-26500**



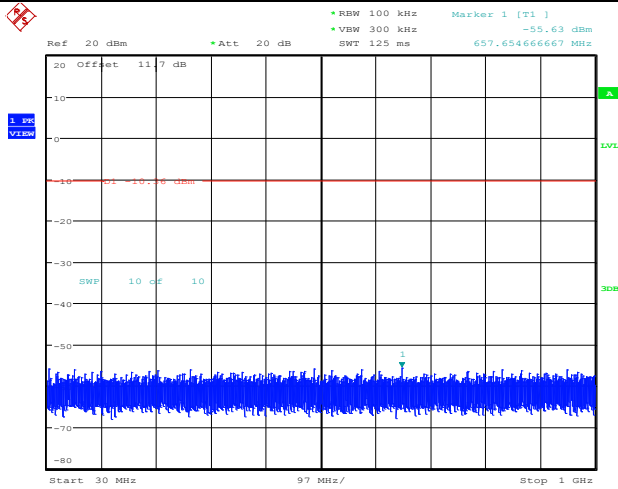
Date: 18.OCT.2023 14:41:24

**BLE BT5.0 Ant1\_2440\_0-Reference**



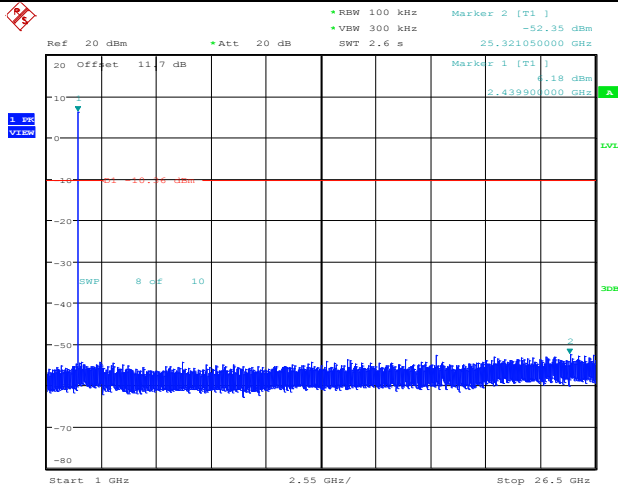
Date: 18.OCT.2023 14:49:06

**BLE BT5.0 Ant1\_2440\_30-1000**



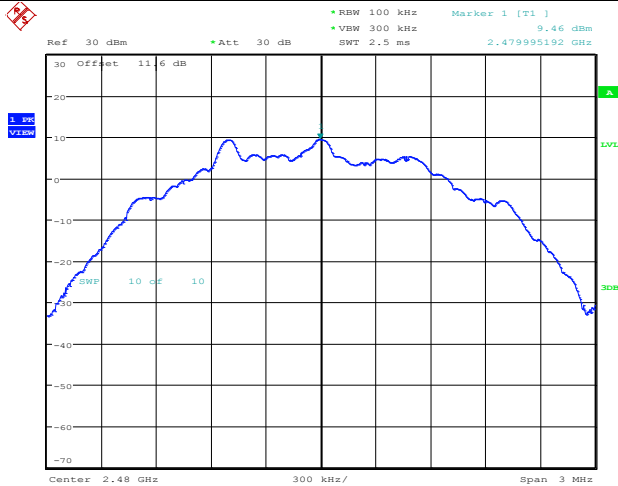
Date: 18.OCT.2023 14:49:13

**BLE\_BT5.0\_Ant1\_2440\_1000-26500**



Date: 18.OCT.2023 14:49:36

**BLE\_BT5.0\_Ant1\_2480\_0-Reference**



Date: 18.OCT.2023 14:54:33

**BLE\_BT5.0\_Ant1\_2480\_30-1000**





## 9. RADIATED BANDEDGE AND SPURIOUS MEASUREMENT

### 9.1.Limits of Radiated Bandedge and Spurious Measurement

CFR 47 (FCC) part 15.247 (d) and 558074 D01 DTS Meas Guidance v05r02  
RSS-247 Clause 5.5 & RSS GEN Clause 8.9

Table 18 Radiation Emission Test Limit for FCC (Class B) (9 kHz-1GHz)

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
960~1000	500	3

Table 19 Radiation Emission Test Limit for FCC (Class B) (Above 1G)

Frequency (MHz)	(dBuV/m) (at 3 meters)	
	PEAK	AVERAGE
Above 1000	74	54

\* The lower limit shall apply at the transition frequency.

\* The test distance is 3m.

### 9.2. Test Procedure

1. The testing follows the guidelines in ANSI C63.10-2013.
2. 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.
3. For measurement below 1GHz, the EUT was placed on a turntable with 0.8meter, above ground. For measurement above 1 GHz, test at FAR, the EUT is placed on a non-conductive table, which is 1.5 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;

- (2) Set RBW=100 kHz for  $f < 1$  GHz; VBW  $\geq$  RBW; Sweep = auto; Detector function = peak; Trace = max hold;
- (3) Set RBW = 1 MHz, VBW= 3MHz for  $f > 1$  GHz for peak measurement.  
Set RBW = 1 MHz, and 1/T (on time) for average measurement.

### **9.3. Test Data**

9 kHz-30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

Table 20 Radiated Emission Test Data 9k Hz-30MHz

Frequency (MHz)	Cable Loss +preamp (dB)	Antenna Factor (dB)	Reading (dBµV/m)	Level (dBµV/m)	Polarity (H/V)	Limit (dBµV/m)	Margin (dB)	Note
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--

30 MHz-1 GHz

Worst case is shown below for 30MHz-1GHz only.

The emissions don't show in following result tables are more than 20dB below the limits.

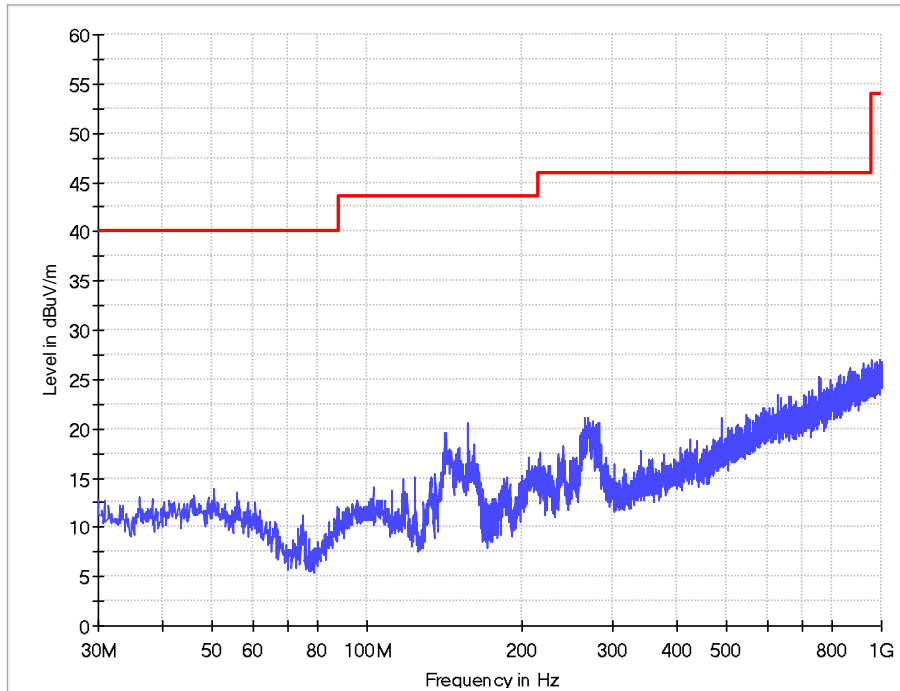
Table 21 Radiated Emission Test Data 30MHz-1GHz

Frequency (MHz)	Cable Loss +preamp (dB)	Antenna Factor (dB)	Reading (dBµV/m)	Level (dBµV/m)	Polarity (Horizontal/Vertical)	Limit (dBµV/m)	Margin (dB)	Note
75.105	1.0	7.8	10.8	19.6	Vertical	40.0	20.4	QP
117.785	1.3	12.3	8.1	21.7	Vertical	43.5	21.8	QP
123.896	1.2	10.5	6.8	18.5	Vertical	43.5	25.0	QP
147.661	1.4	8.2	11.2	20.8	Vertical	43.5	22.7	QP
181.126	1.6	9.7	9.5	20.8	Vertical	43.5	22.7	QP
205.376	1.6	10.6	7.4	19.6	Vertical	43.5	23.9	QP
141.938	1.3	8.2	5.6	15.1	Horizontal	43.5	28.4	QP
149.601	1.5	8.2	3.5	13.2	Horizontal	43.5	30.3	QP
156.973	1.4	8.3	6.0	15.7	Horizontal	43.5	27.8	QP
161.629	1.5	8.7	1.0	11.2	Horizontal	43.5	32.3	QP
241.169	1.9	12.1	-6.0	8.0	Horizontal	46	38.0	QP
268.232	2.0	12.1	2.2	16.3	Horizontal	46	29.7	QP

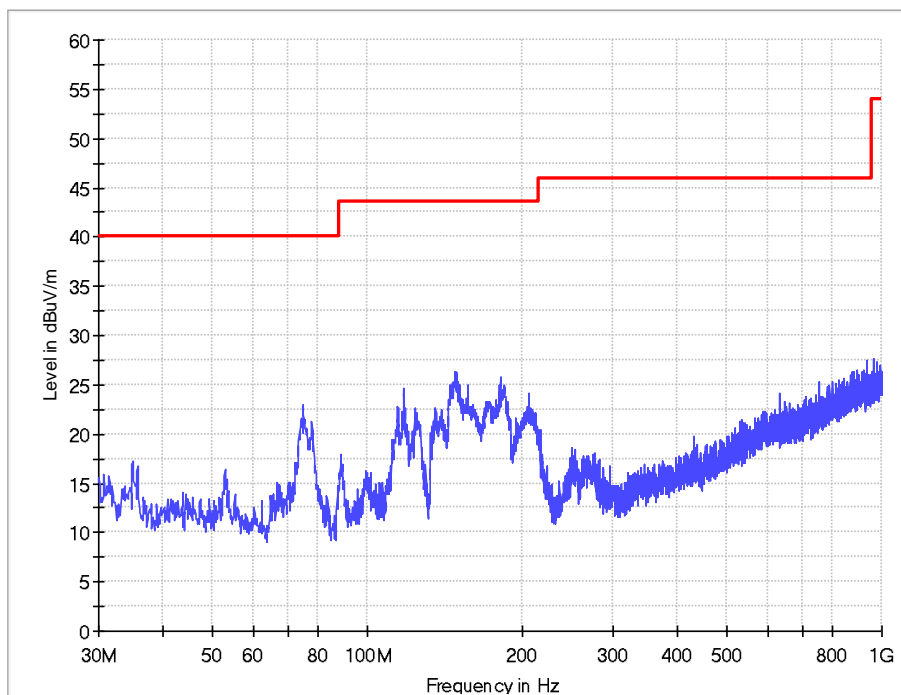
Remark: Emission level (dBµV) =Read Value(dBµV/m) + Antenna Factor(dB)+ Cable Loss +preamp(dB)

30MHz-1GHz

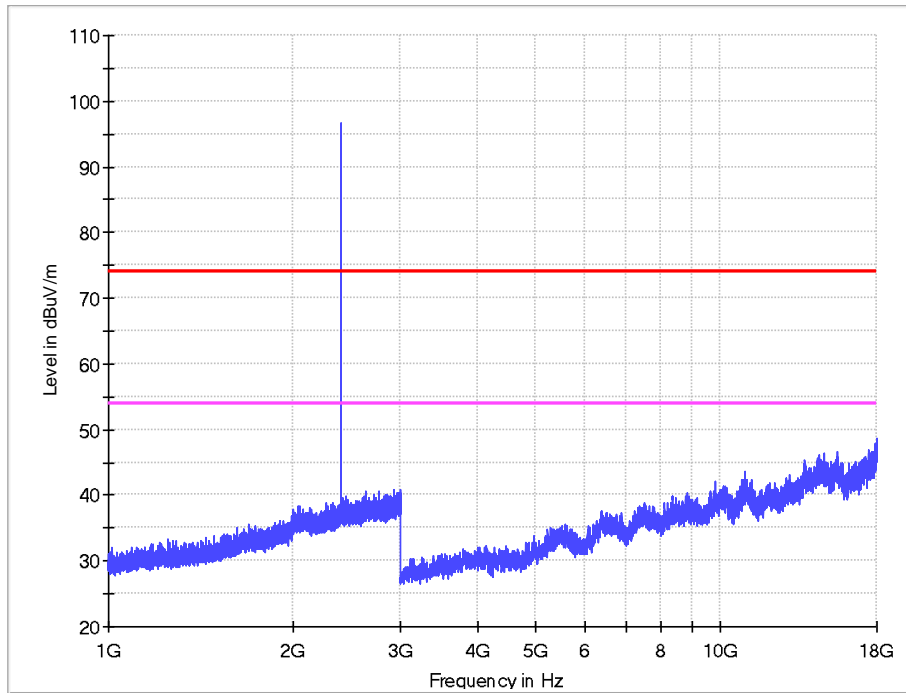
Horizontal



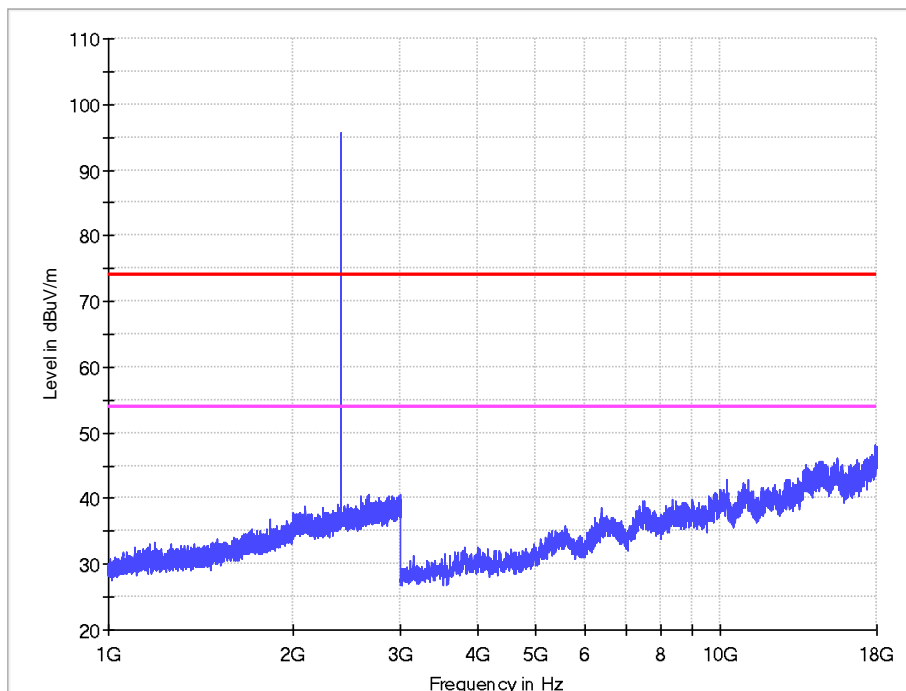
Vertical



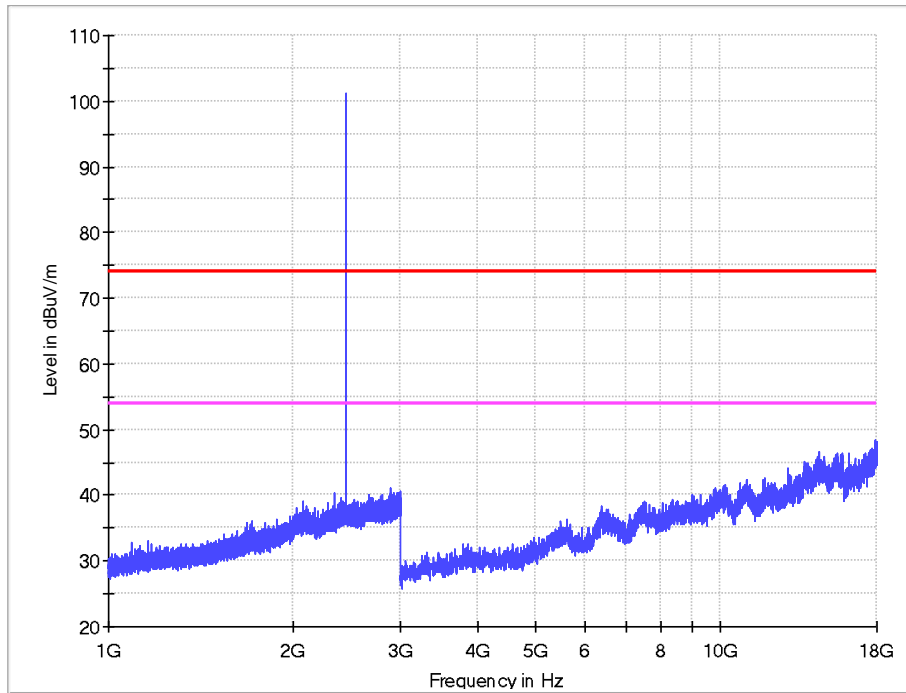
Left:  
1-18 GHz  
BLE\_1Mbps CH0  
Horizontal



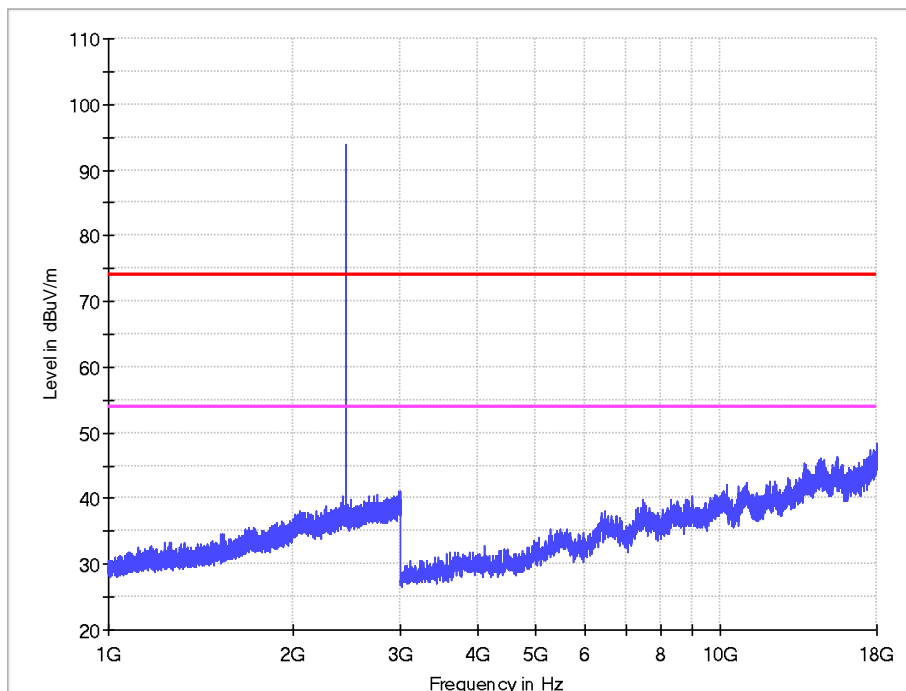
Vertical



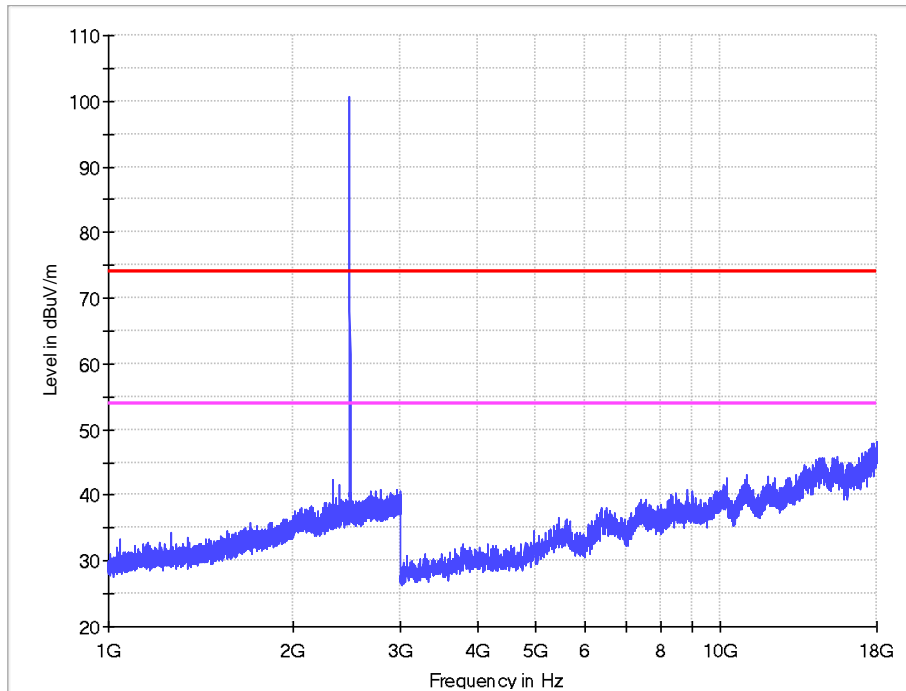
Left:  
1-18 GHz  
BLE\_1Mbps BLE CH19  
Horizontal



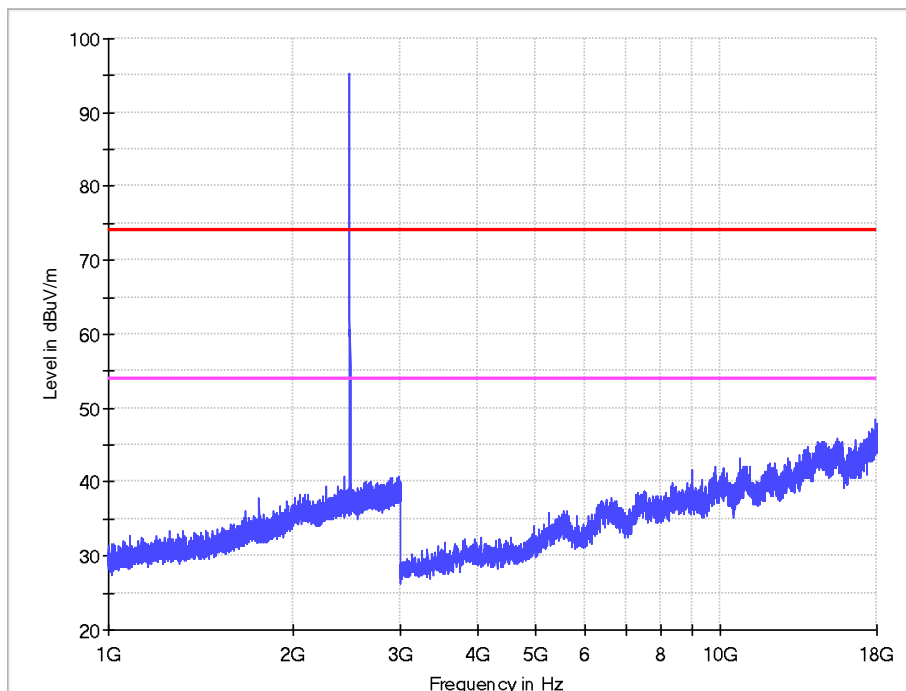
Vertical



Left:  
1-18 GHz  
BLE\_1Mbps BLE CH39  
Horizontal

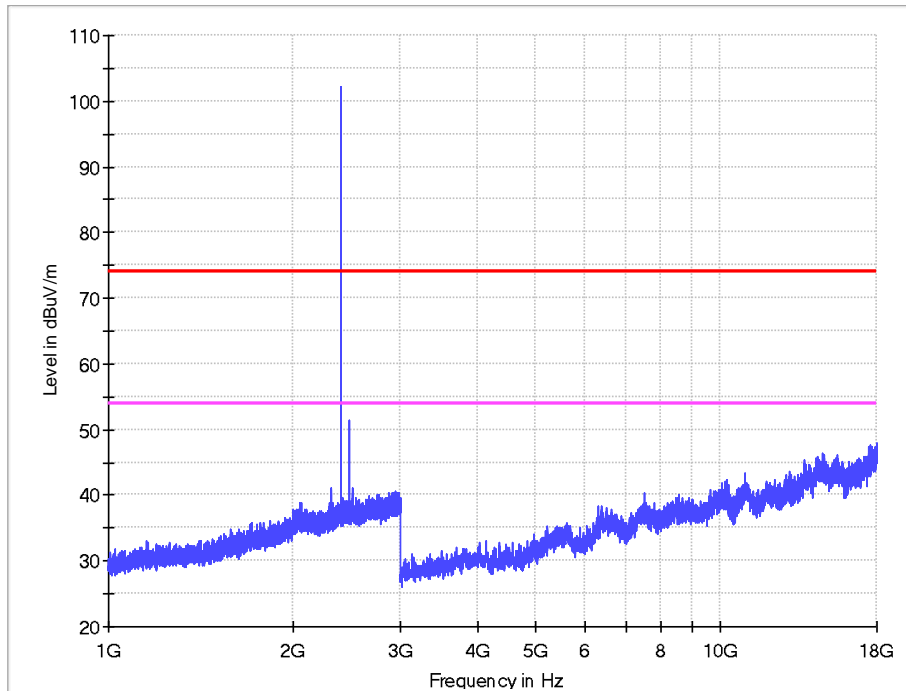


Vertical

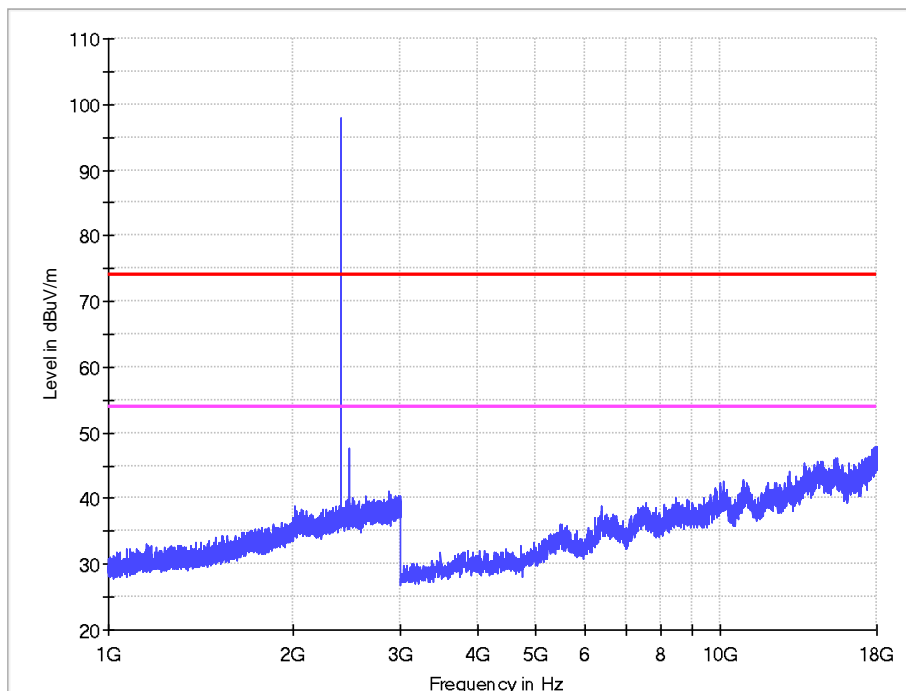




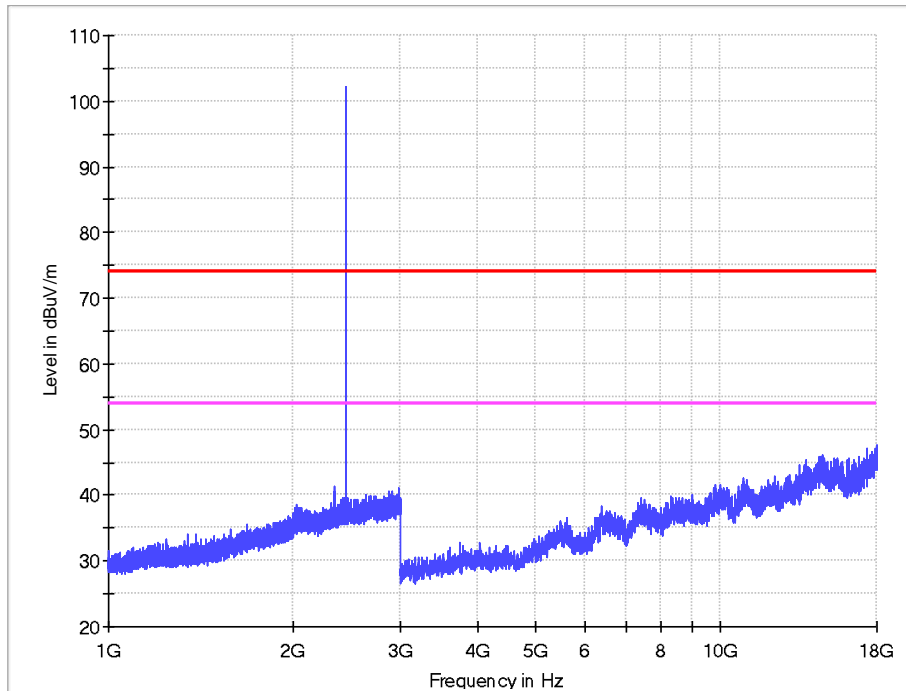
Left:  
1-18 GHz  
BLE\_2Mbps CH0  
Horizontal



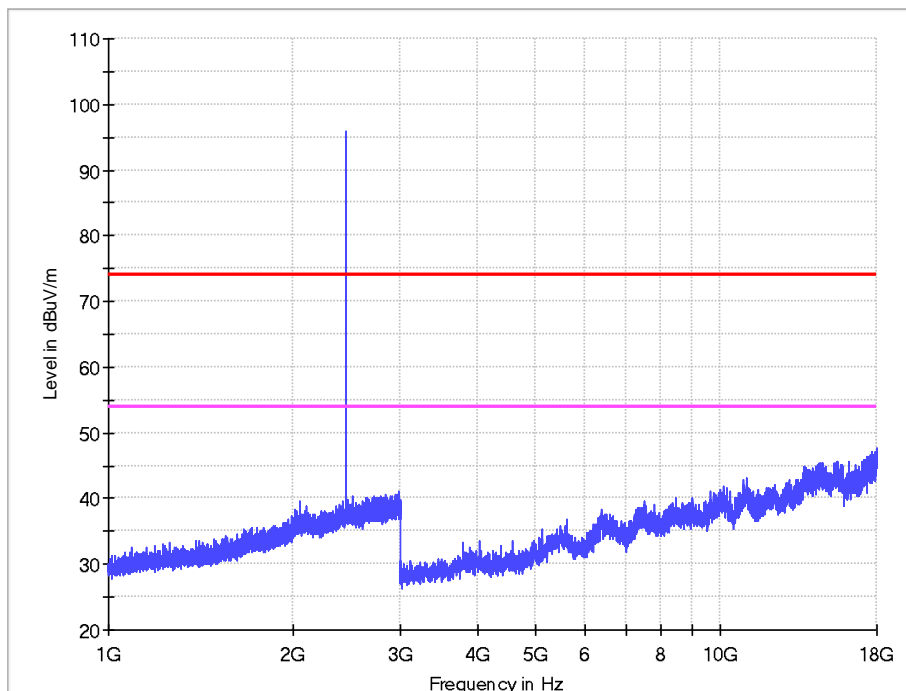
Vertical



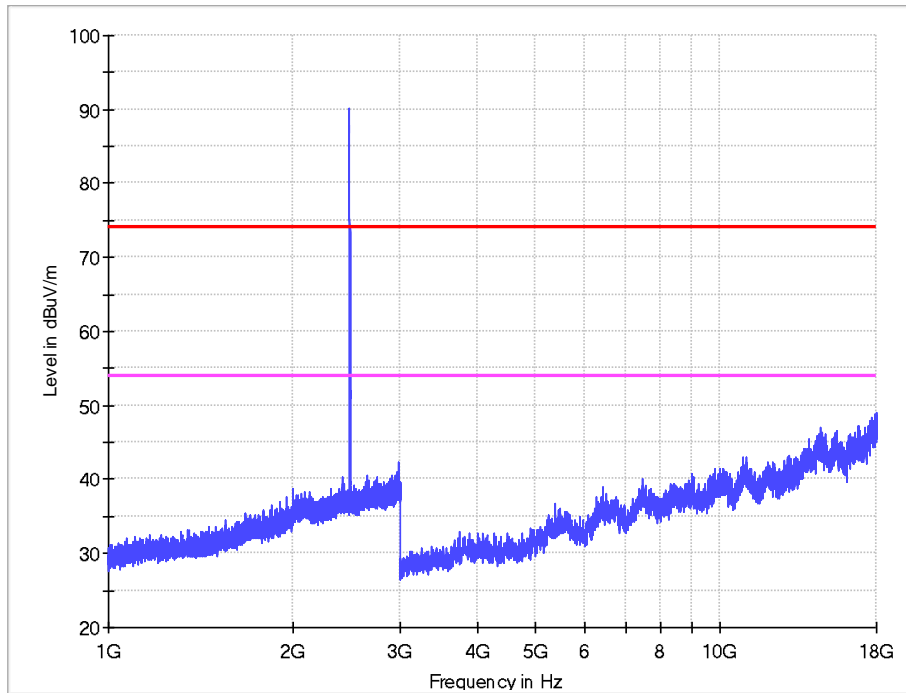
Left:  
1-18 GHz  
BLE\_2Mbps CH19  
Horizontal



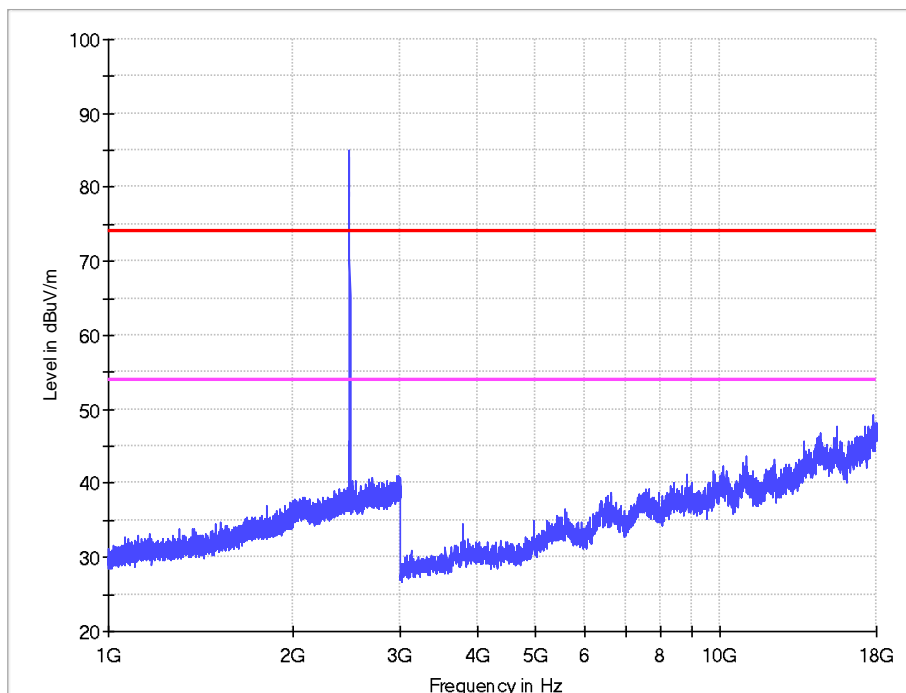
Vertical



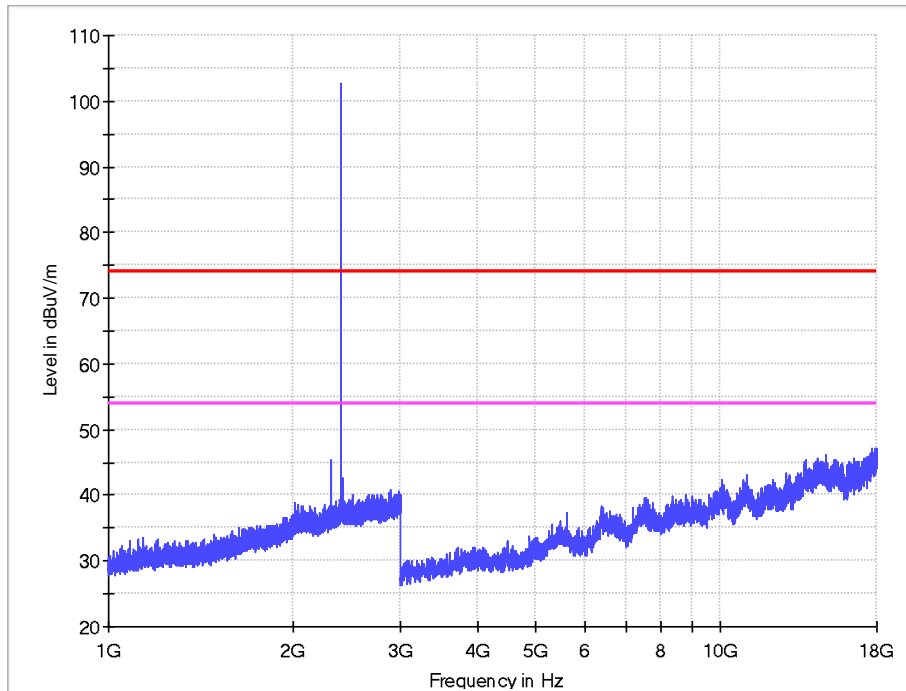
Left:  
1-18 GHz  
BLE\_2Mbps CH39  
Horizontal



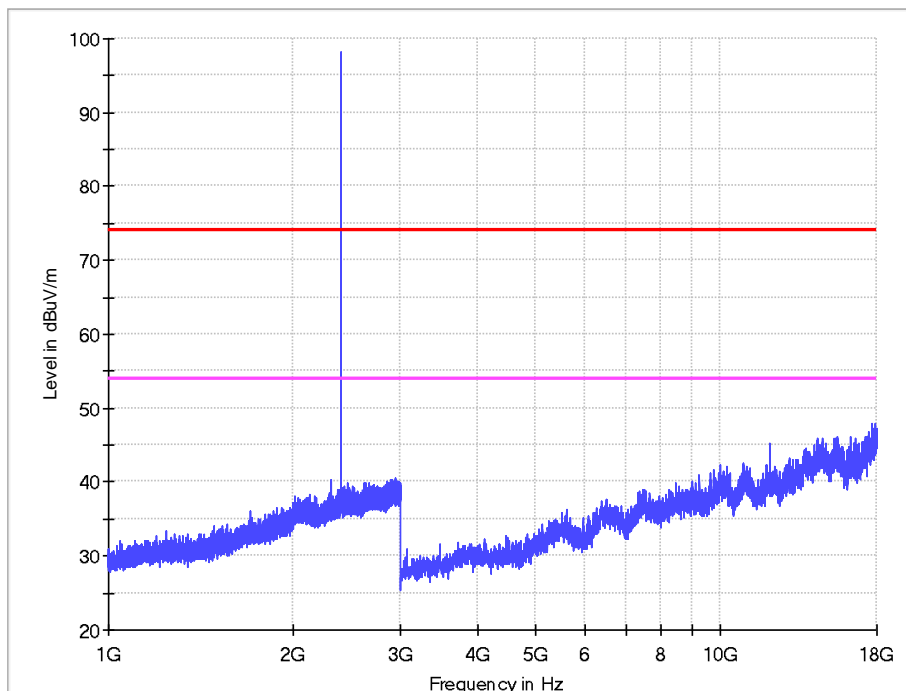
Vertical



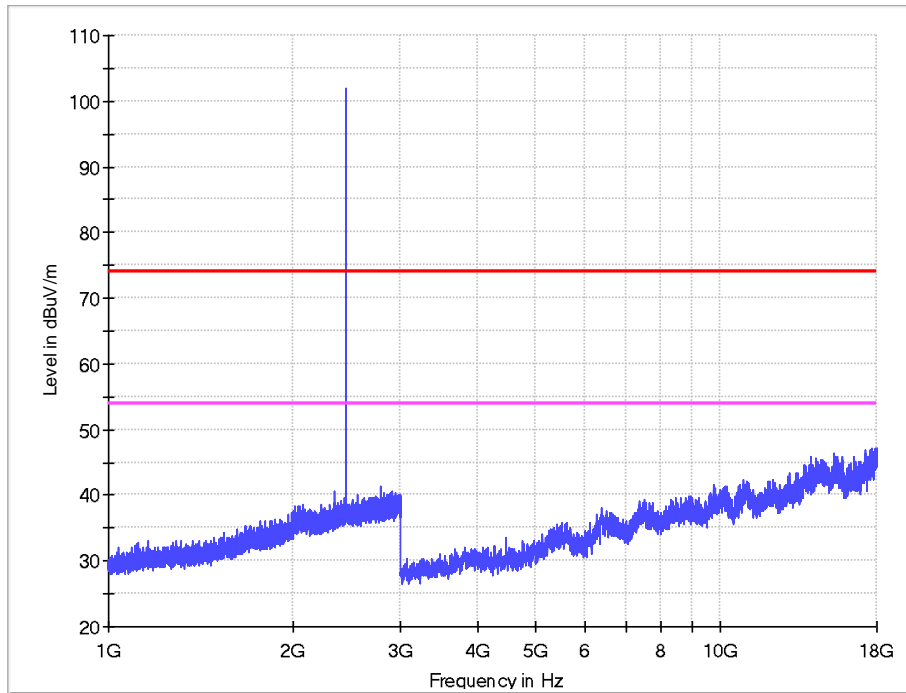
Right:  
1-18 GHz  
BLE\_1Mbps CH0  
Horizontal



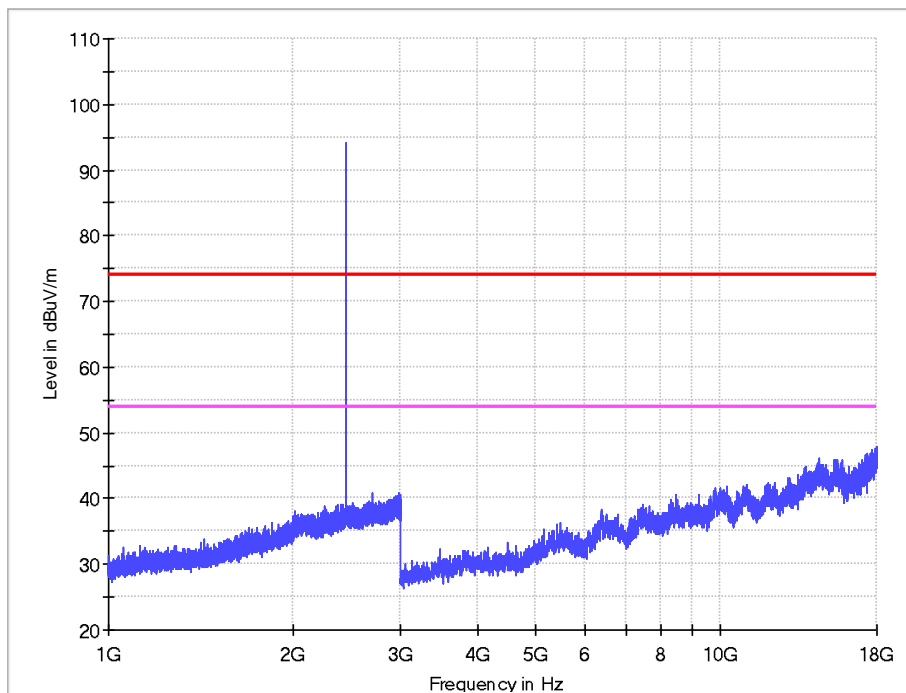
Vertical



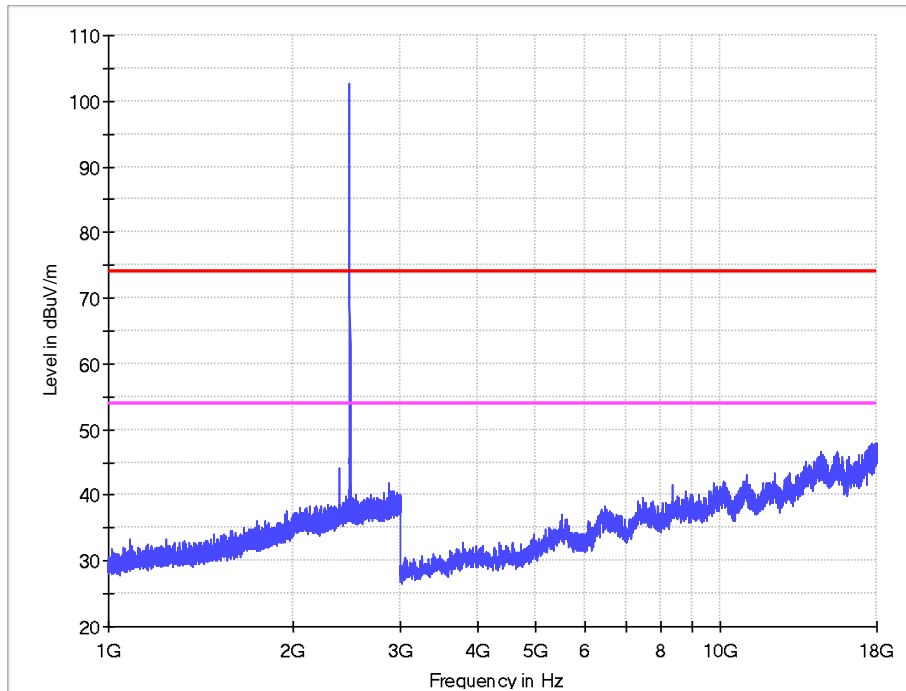
Right:  
1-18 GHz  
BLE\_1Mbps BLE CH19  
Horizontal



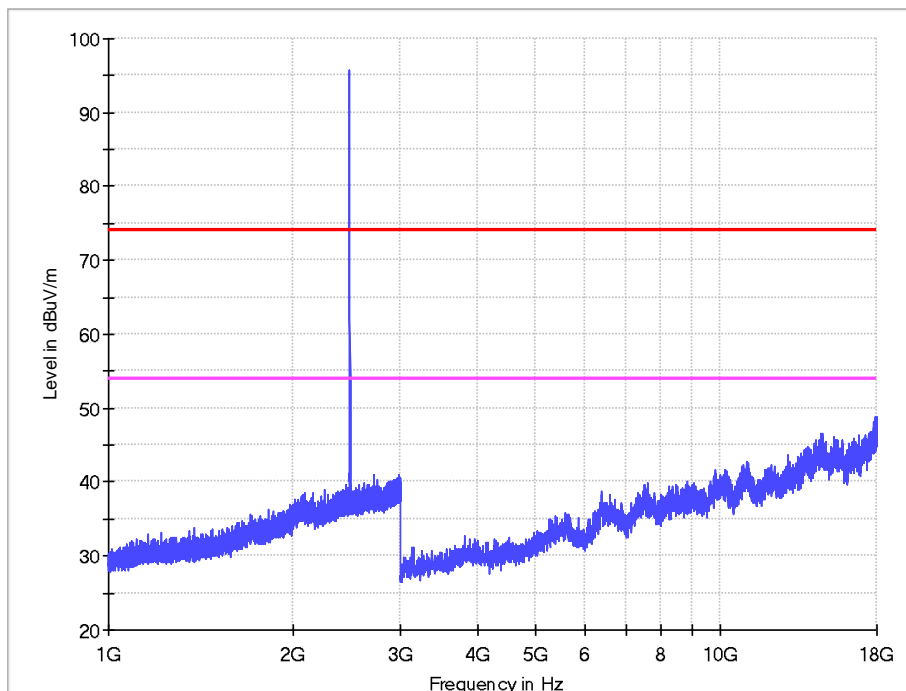
Vertical



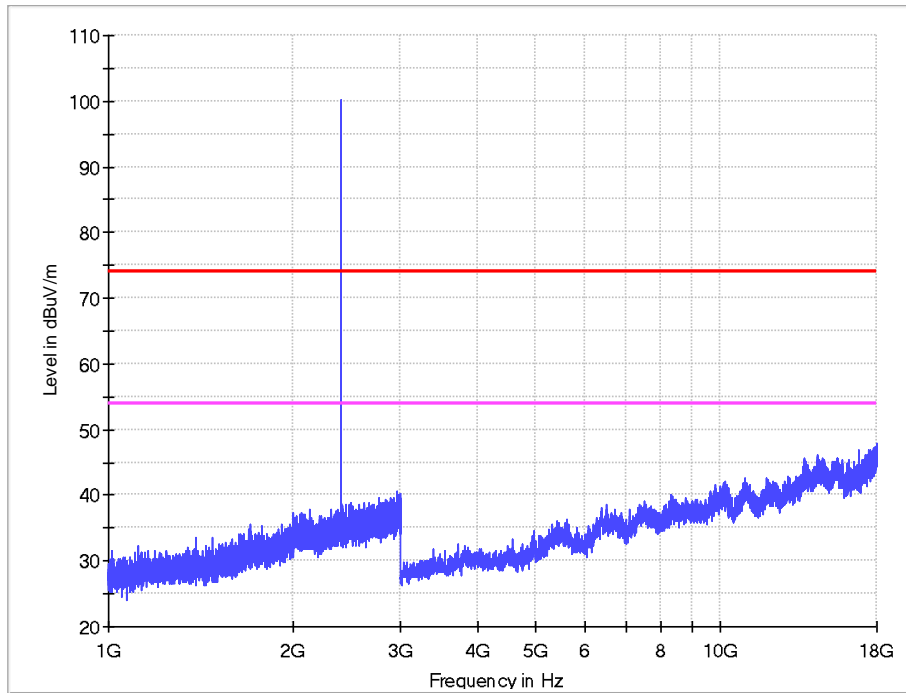
Right:  
1-18 GHz  
BLE\_1Mbps BLE CH39  
Horizontal



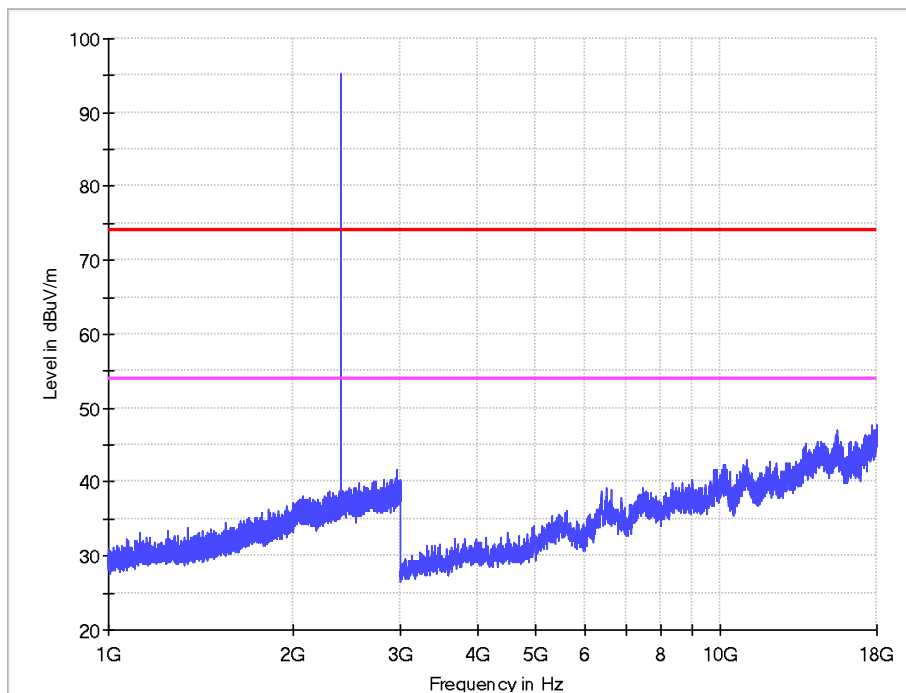
Vertical



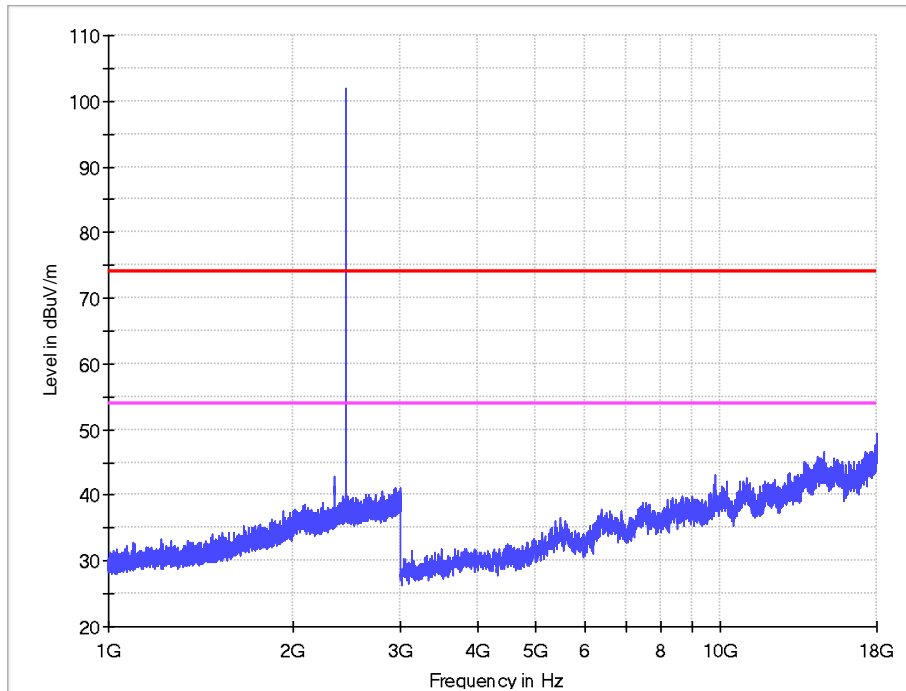
Right:  
1-18 GHz  
BLE\_2Mbps CH0  
Horizontal



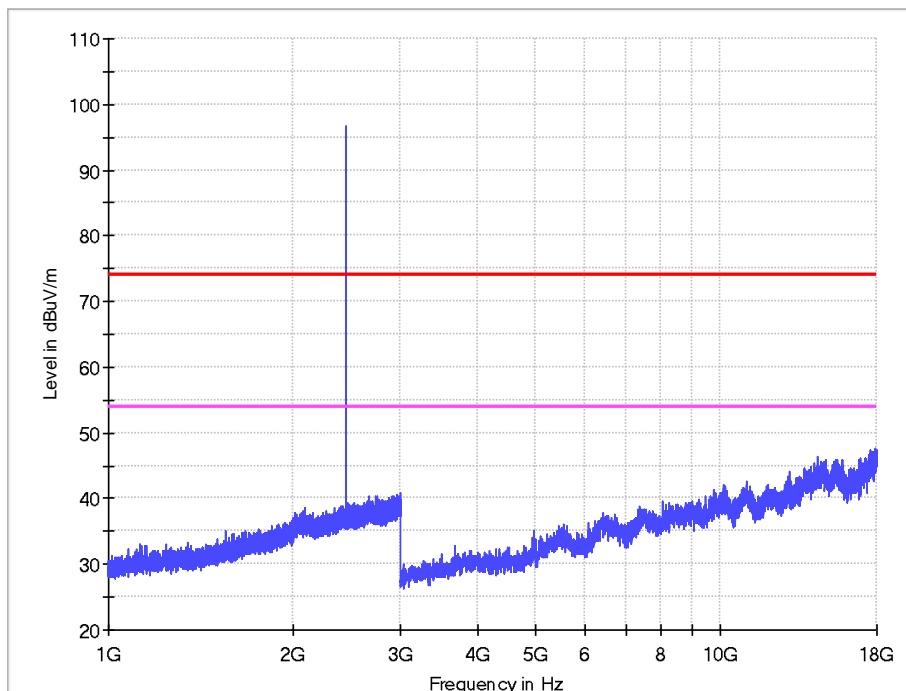
Vertical



Right:  
1-18 GHz  
BLE\_2Mbps CH19  
Horizontal

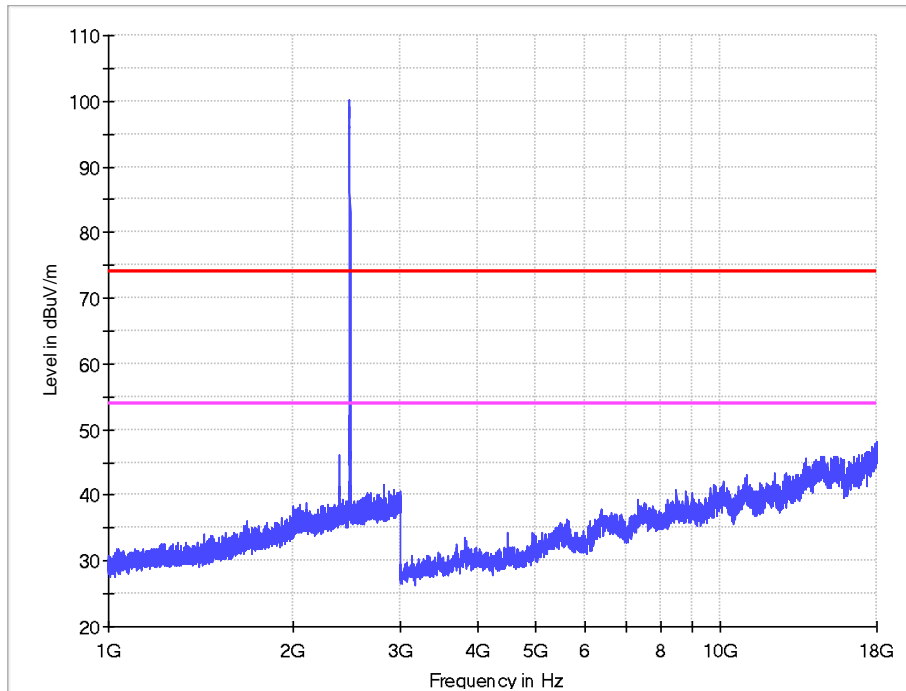


Vertical

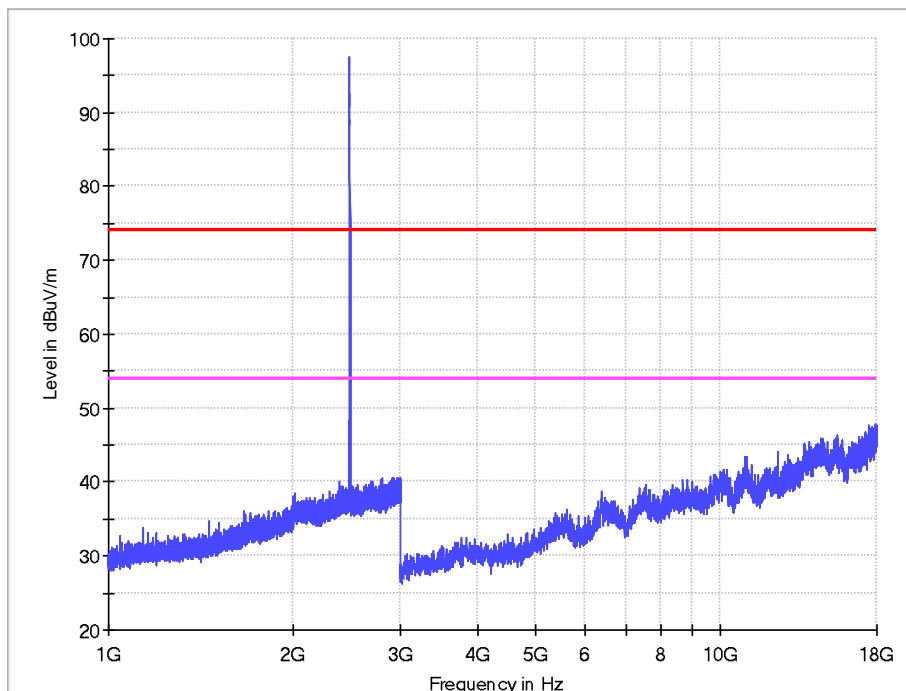




Right:  
1-18 GHz  
BLE\_2Mbps CH39  
Horizontal



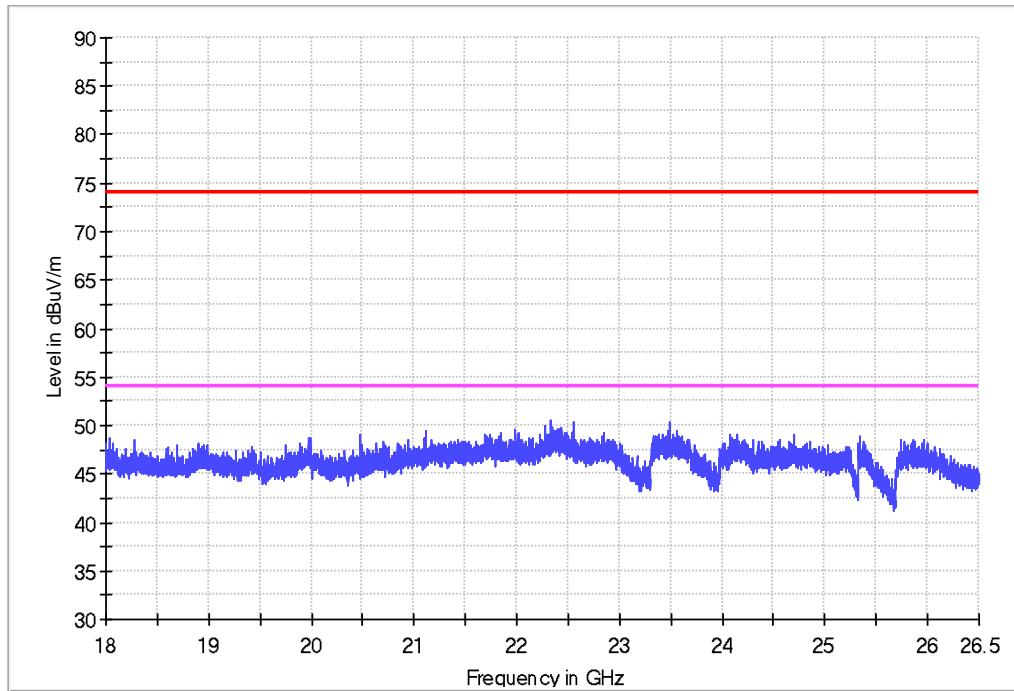
Vertical



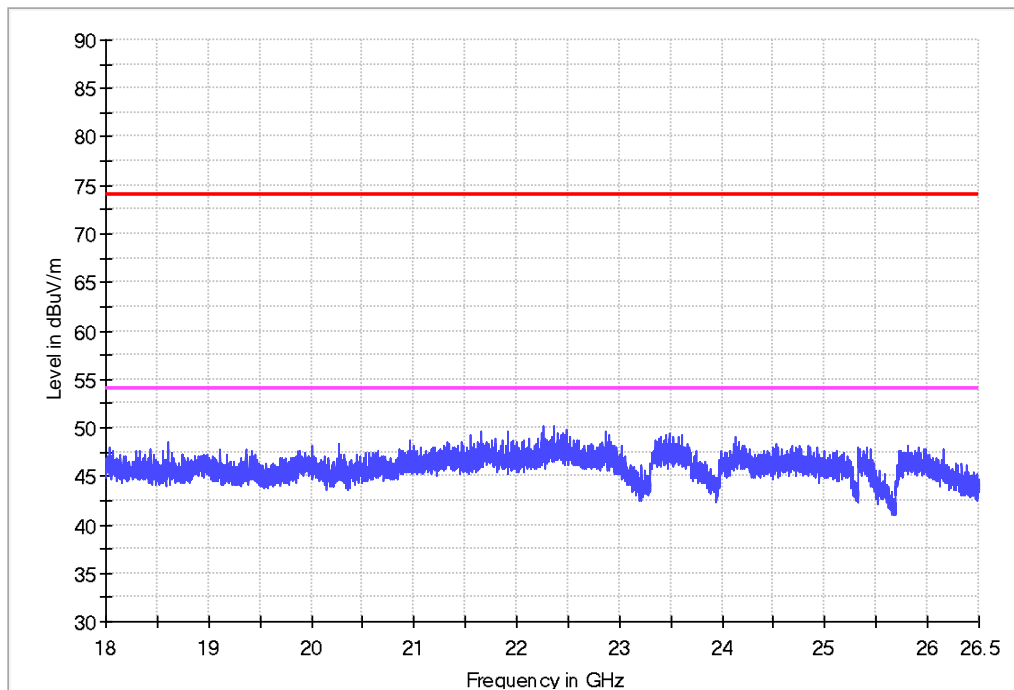
18-26.5 GHz

No Peak found in pre-scan, only worst case result is listed in this report.

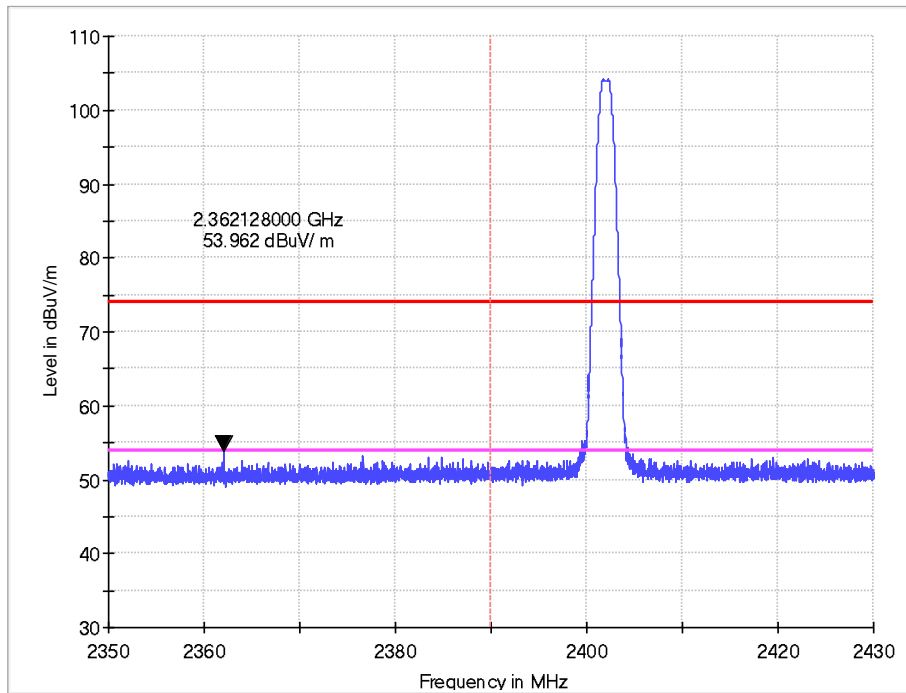
Horizontal



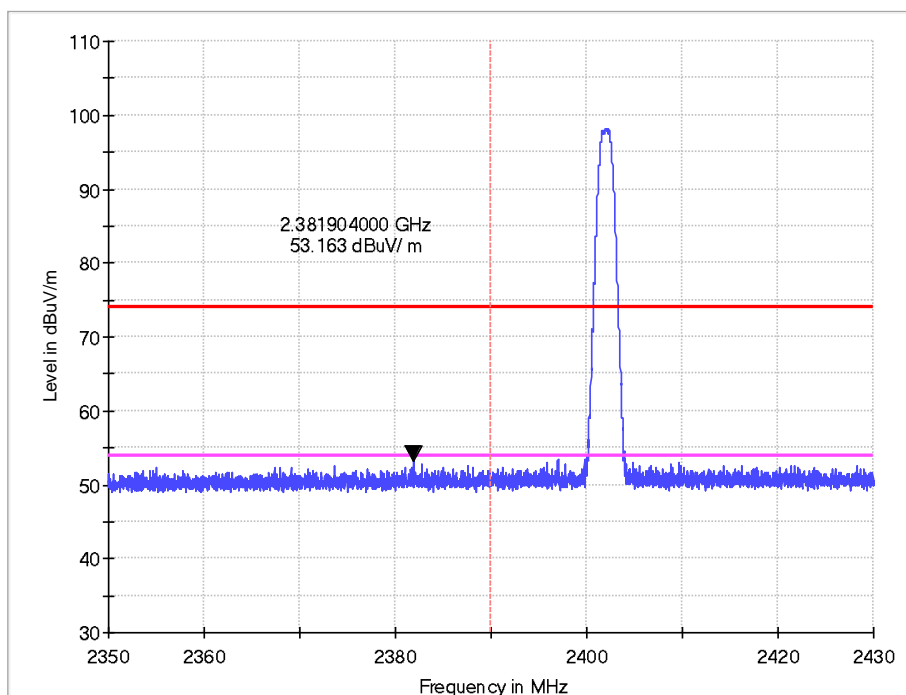
Vertical



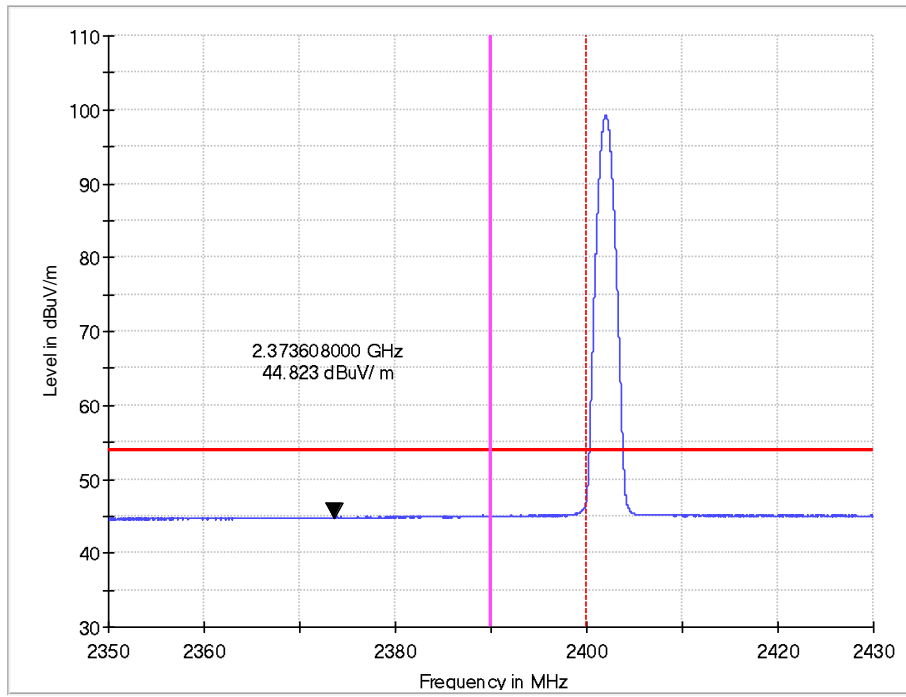
Left:  
Band Edge  
BLE\_1Mbps BLE CH0  
PK  
Horizontal



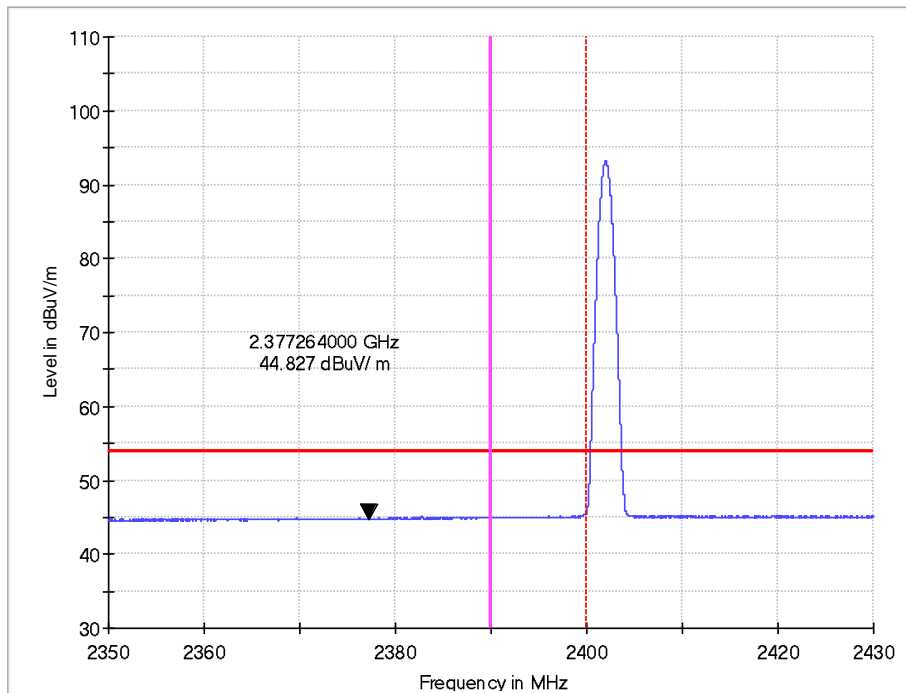
Vertical



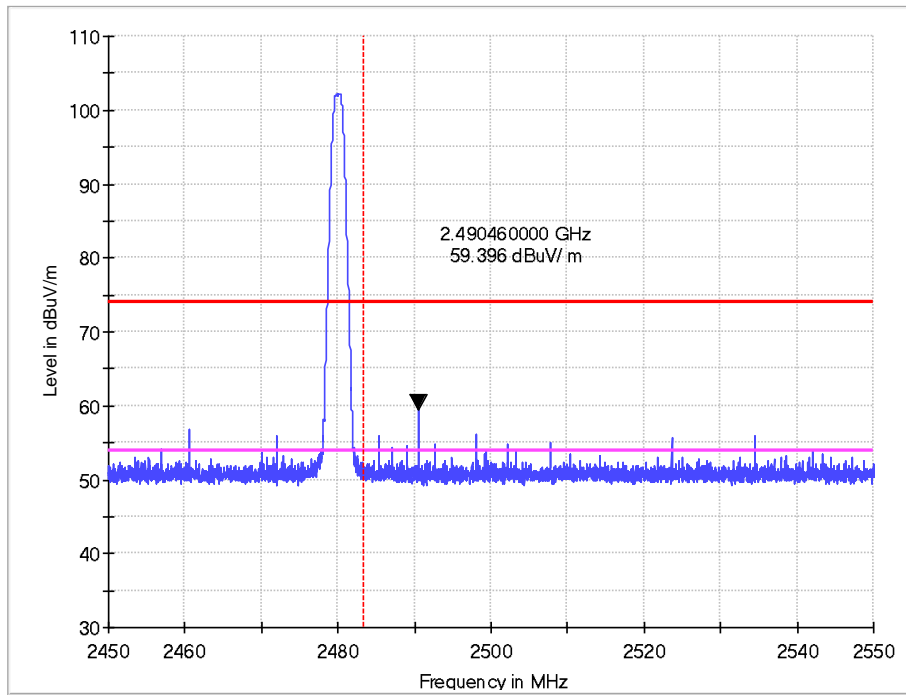
AV  
Horizontal



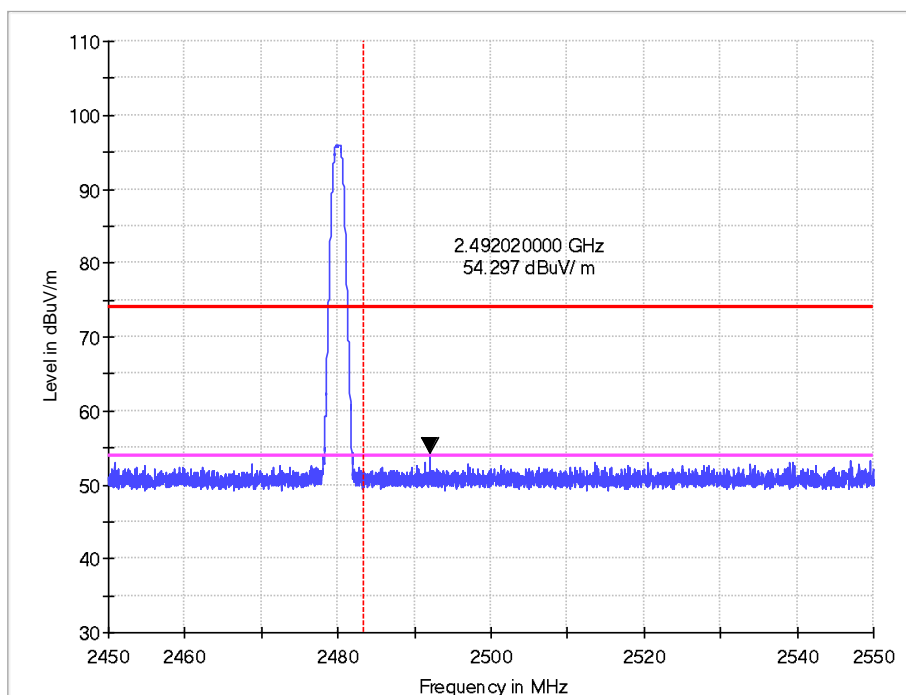
Vertical



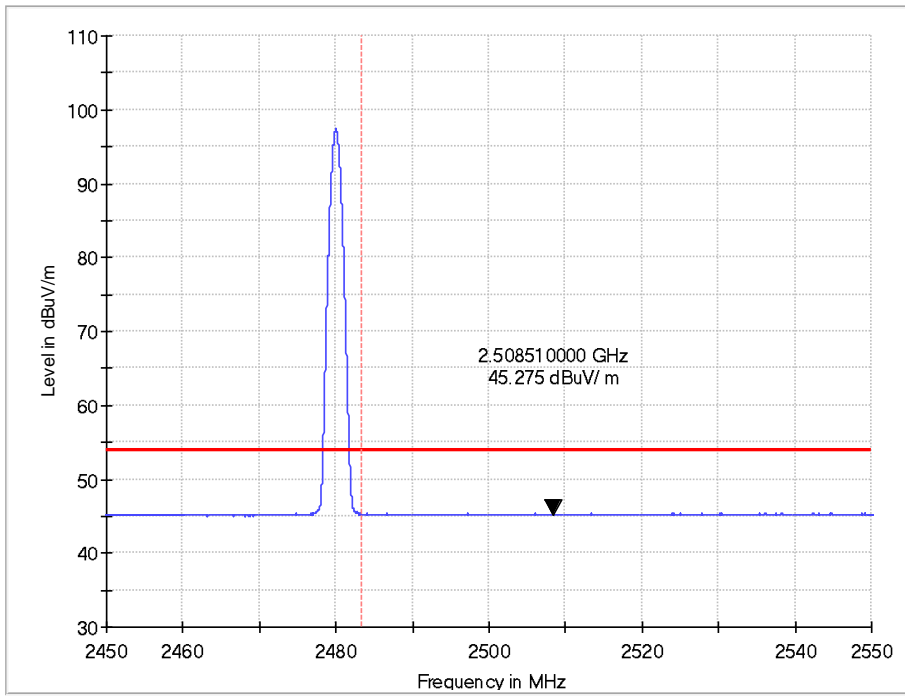
Left:  
Band Edge  
BLE\_1Mbps BLE CH39  
PK  
Horizontal



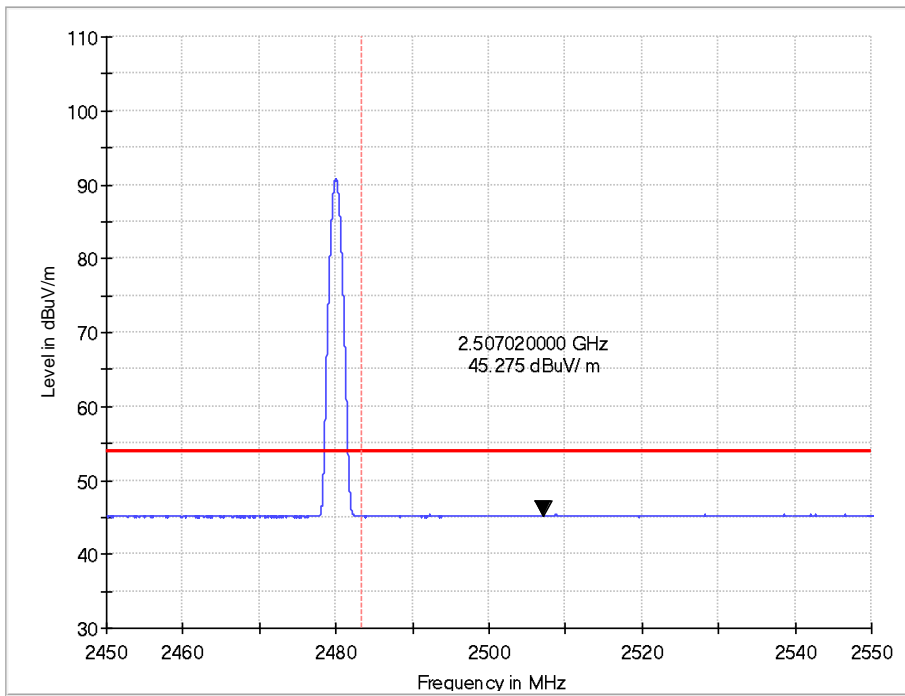
Vertical



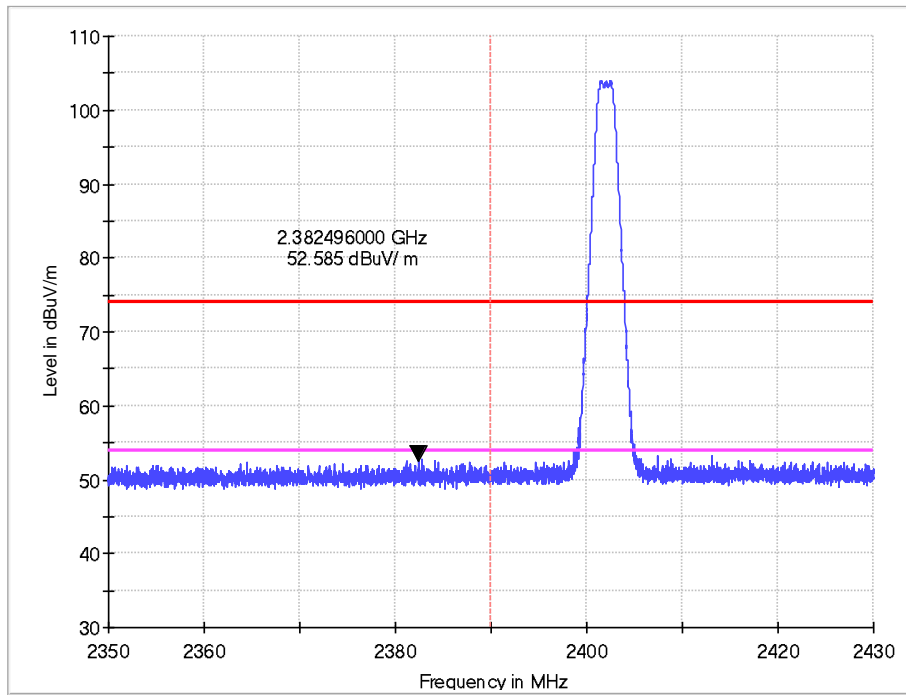
AV  
Horizontal



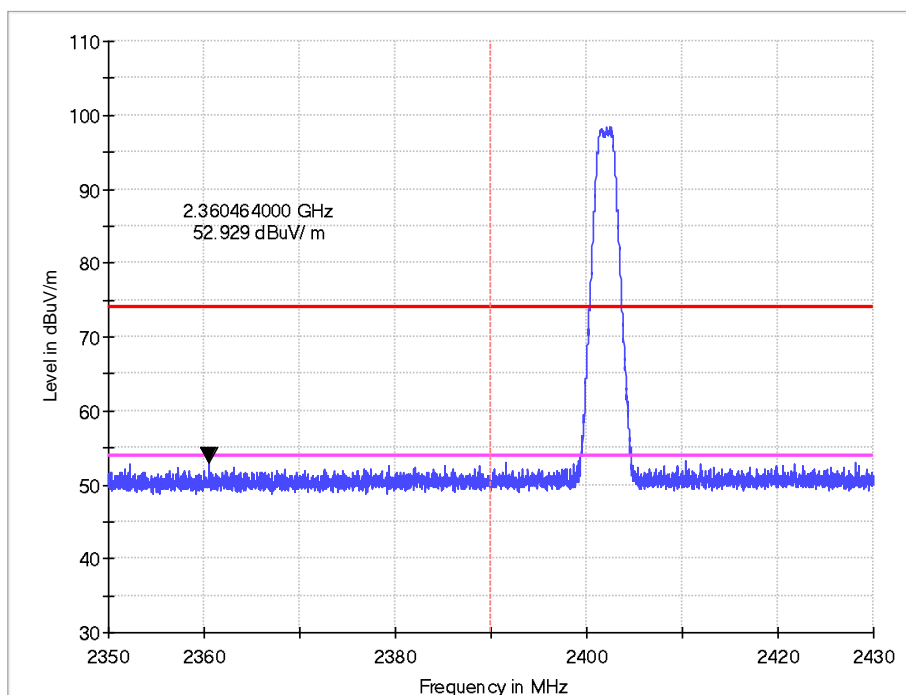
Vertical



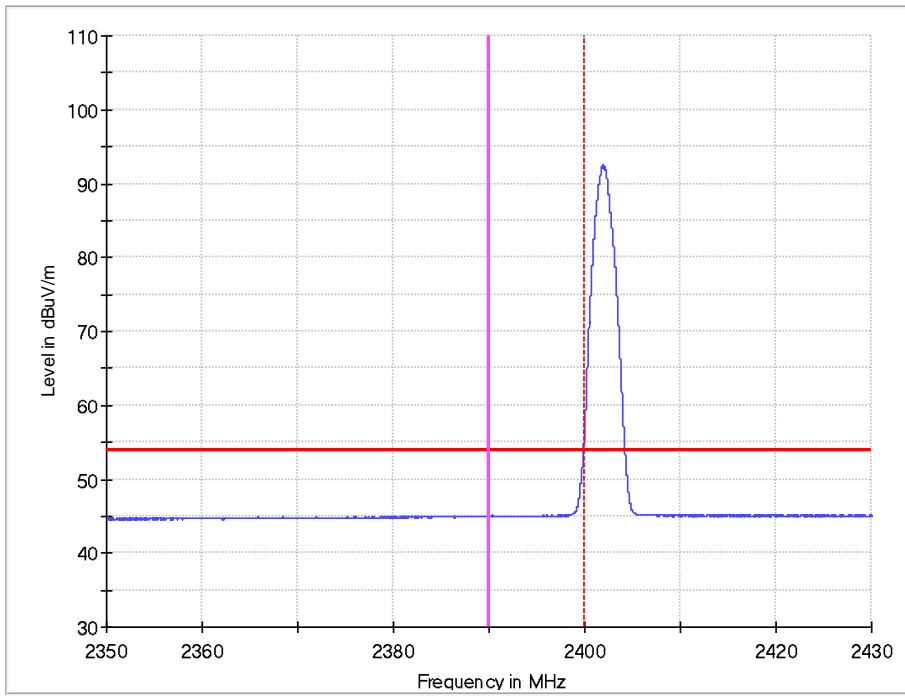
Left:  
Band Edge  
BLE\_2Mbps BLE CH0  
PK  
Horizontal



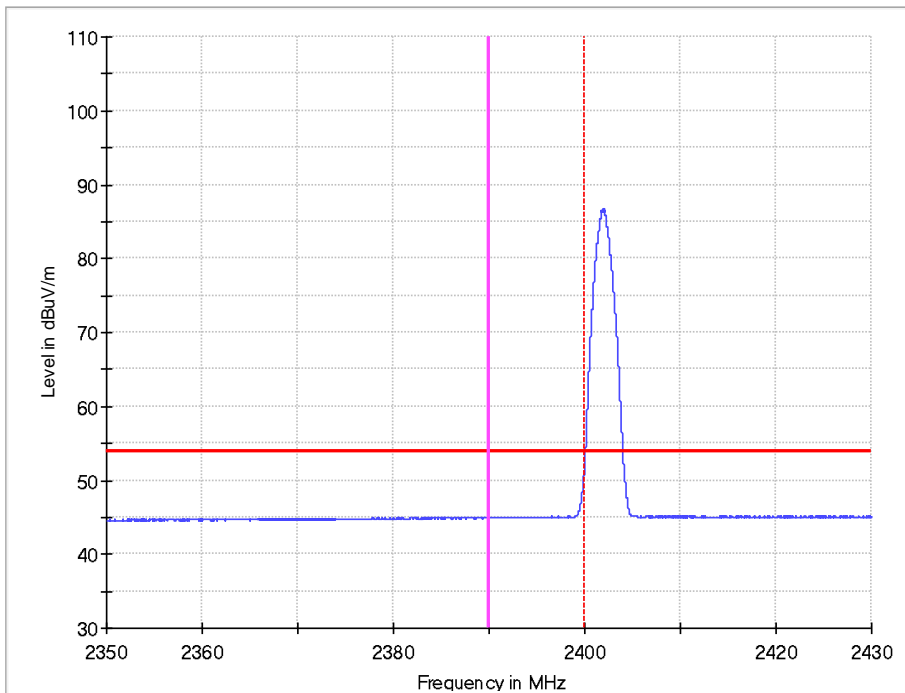
Vertical



AV  
Horizontal

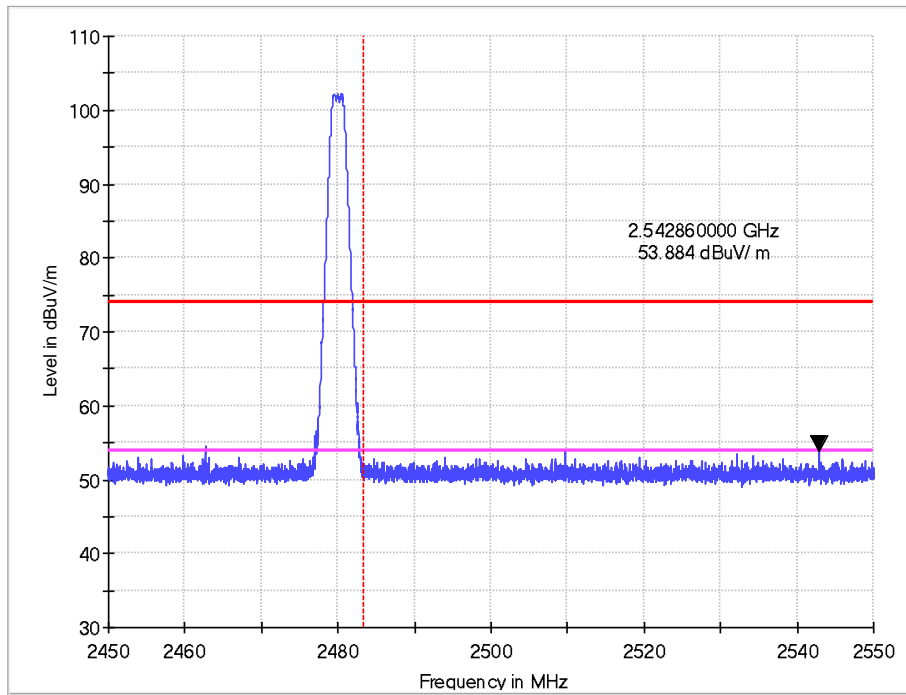


Vertical

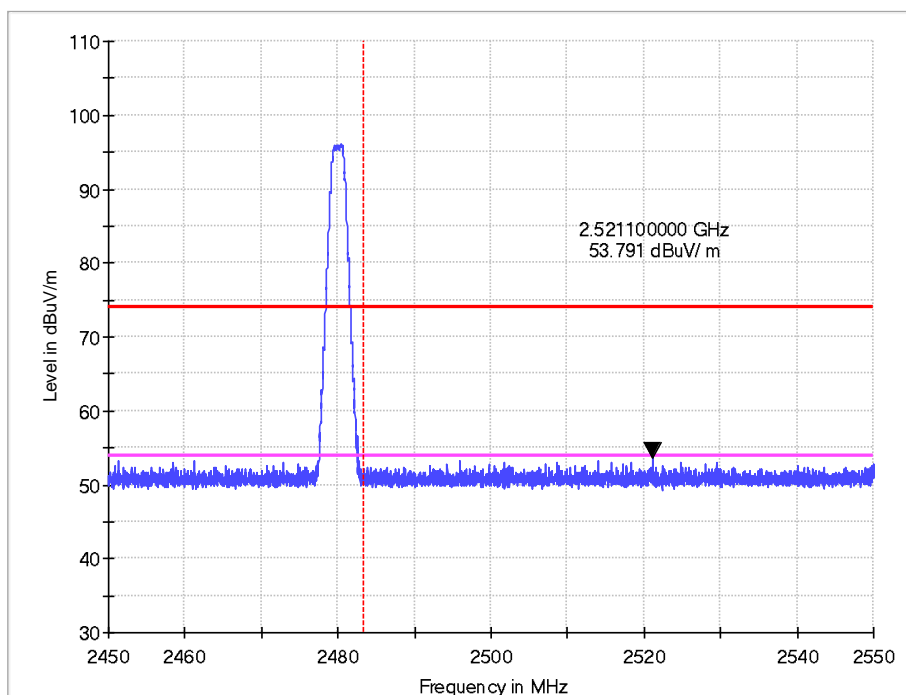




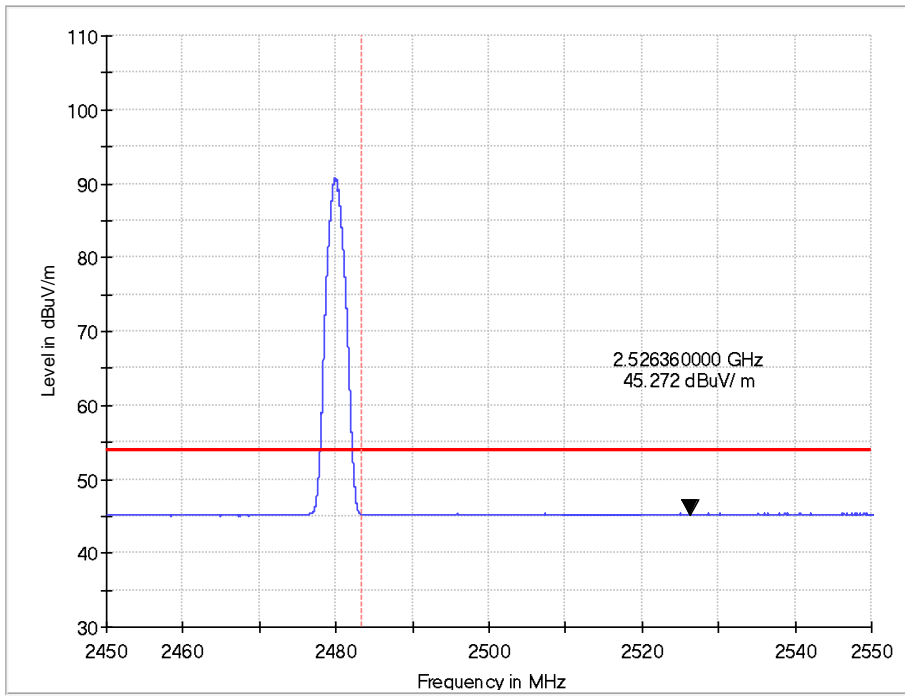
Left:  
Band Edge  
BLE\_2Mbps BLE CH39  
PK  
Horizontal



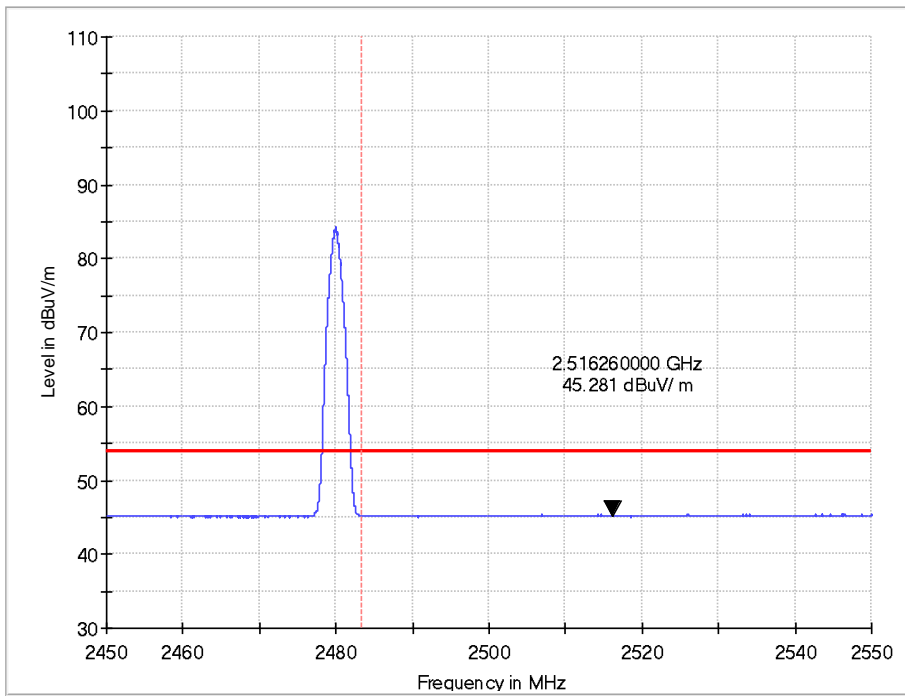
Vertical



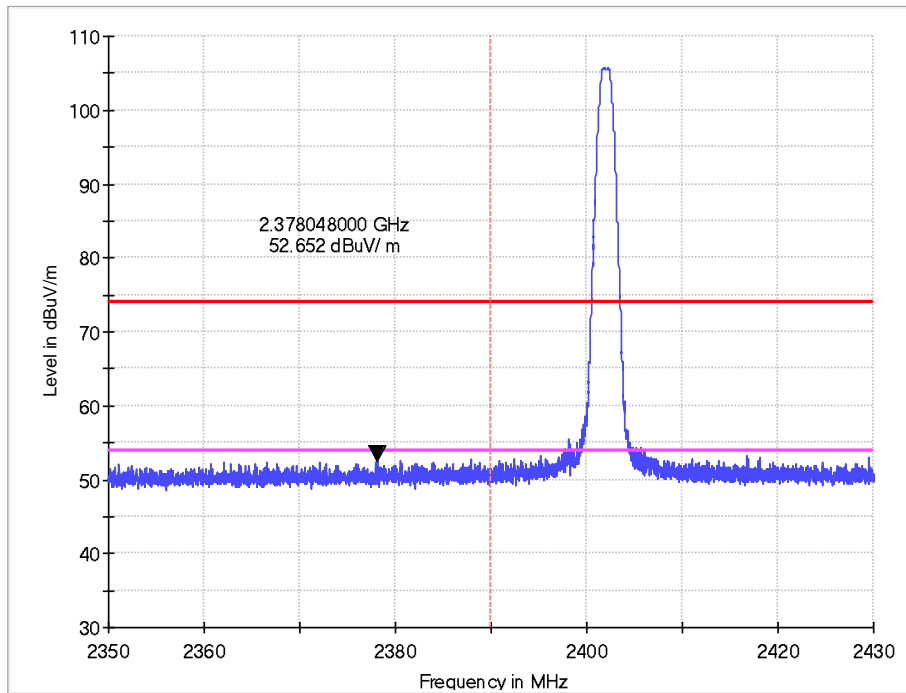
AV  
Horizontal



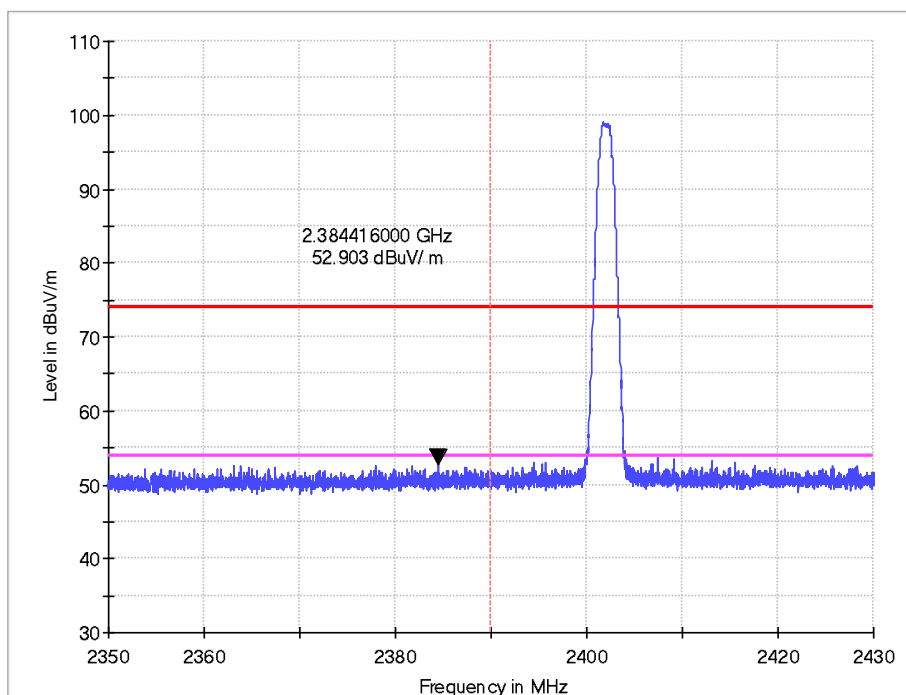
Vertical



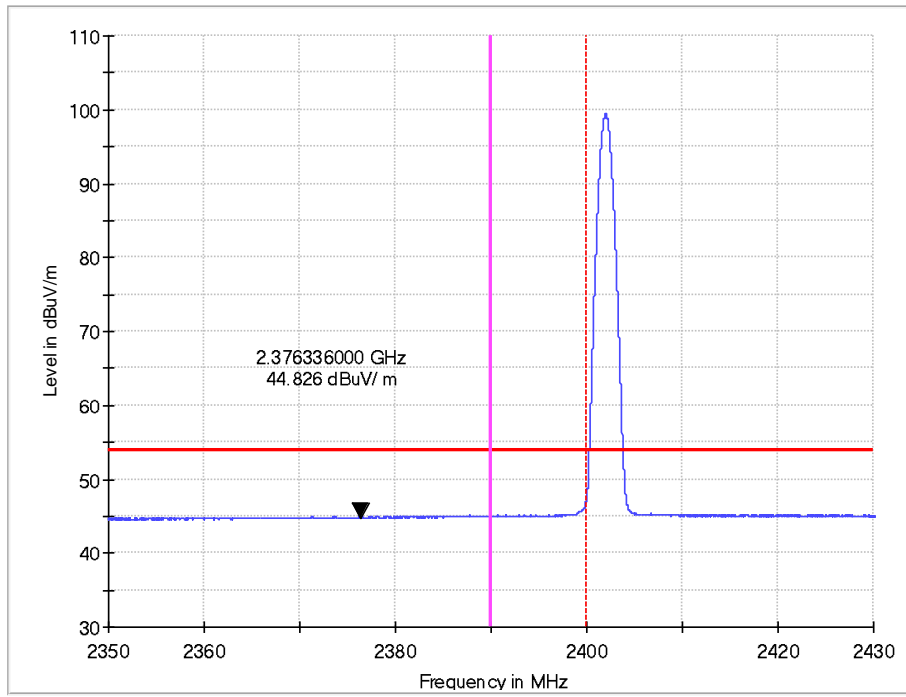
Right:  
Band Edge  
BLE\_1Mbps BLE CH0  
PK  
Horizontal



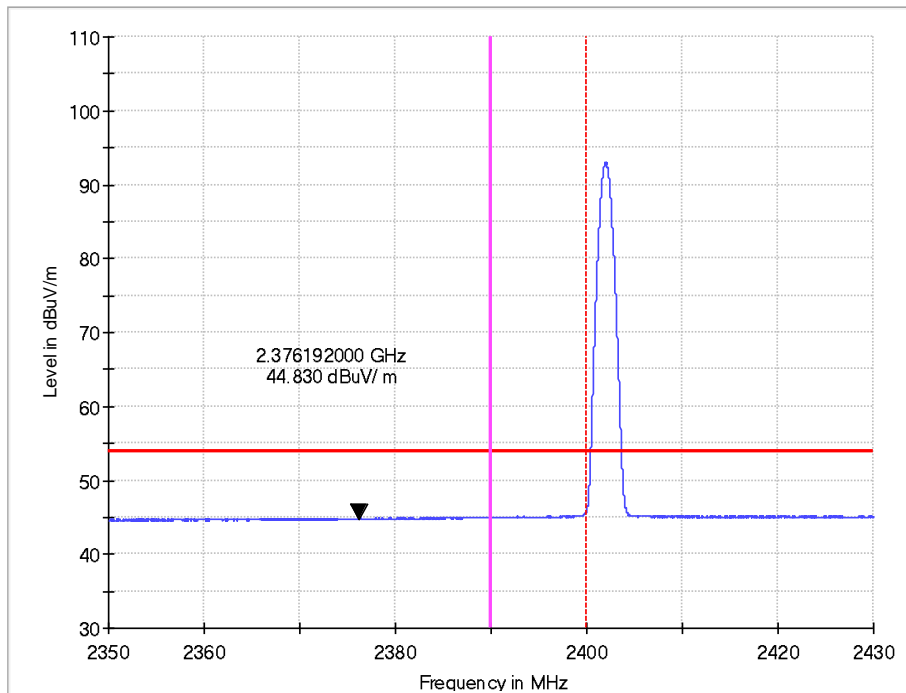
Vertical



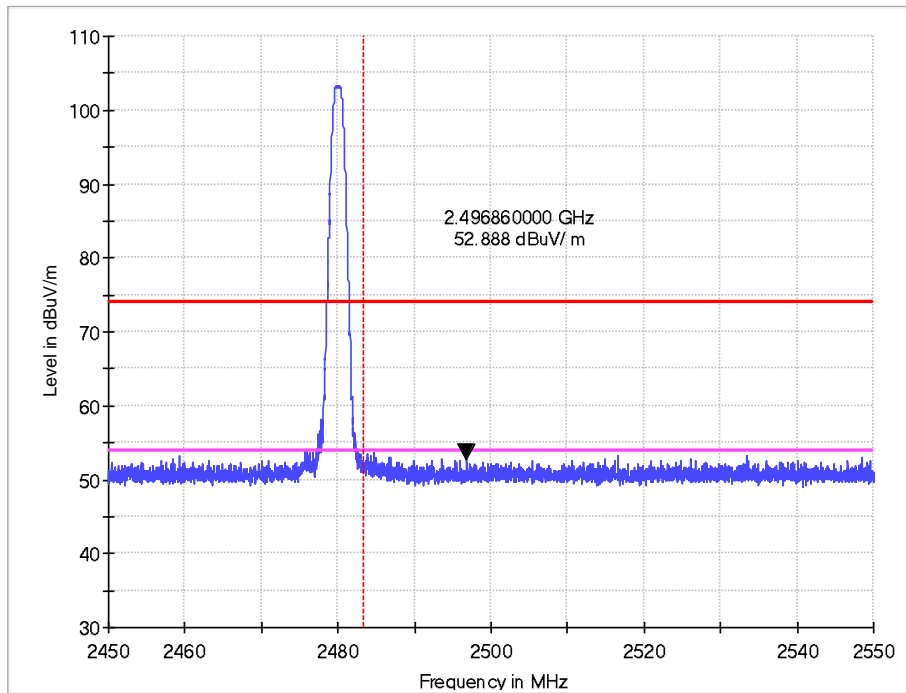
AV  
Horizontal



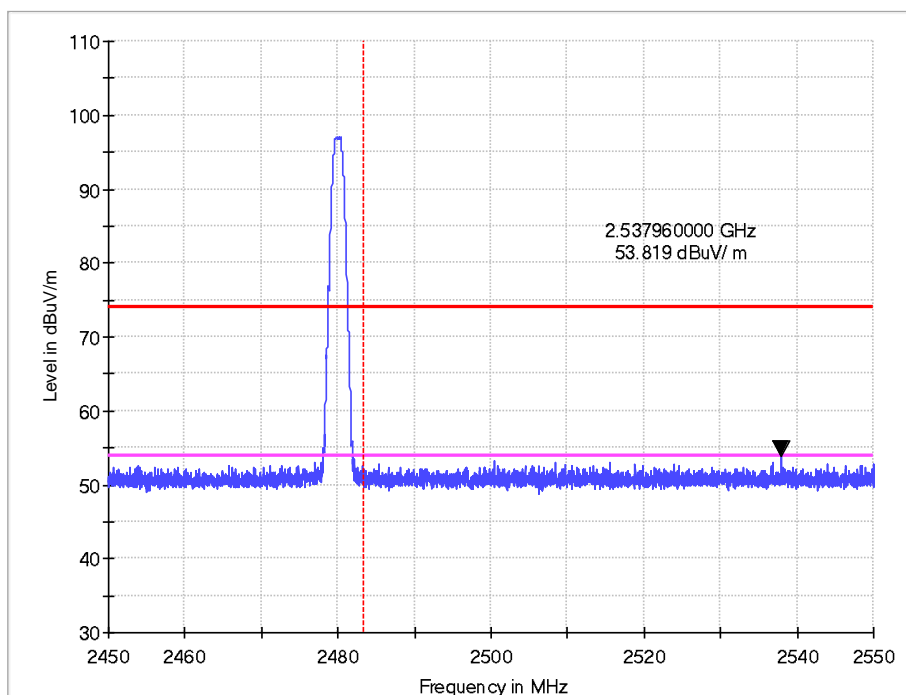
Vertical



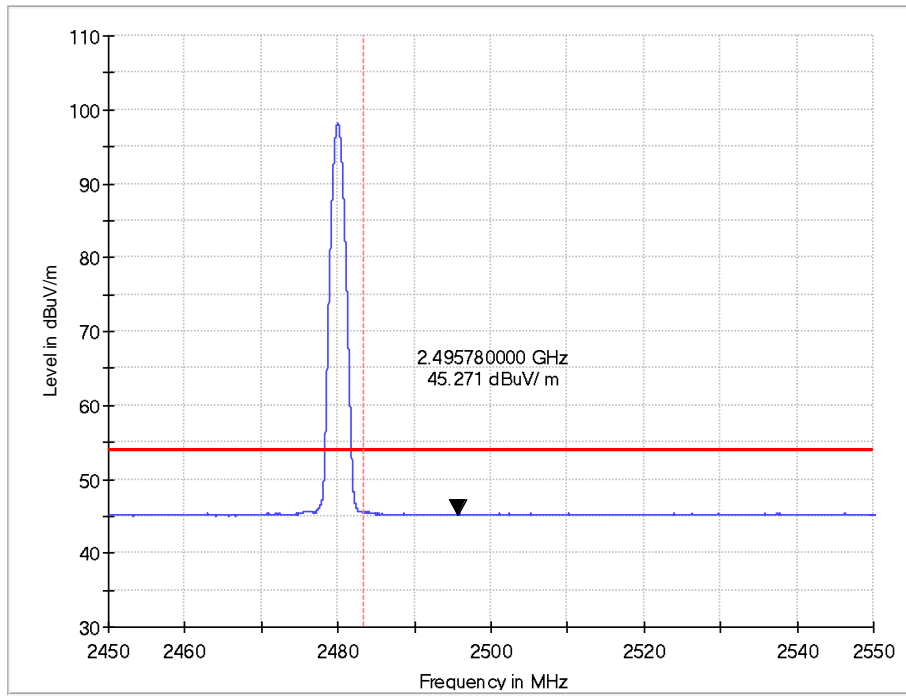
Right:  
Band Edge  
BLE\_1Mbps BLE CH39  
PK  
Horizontal



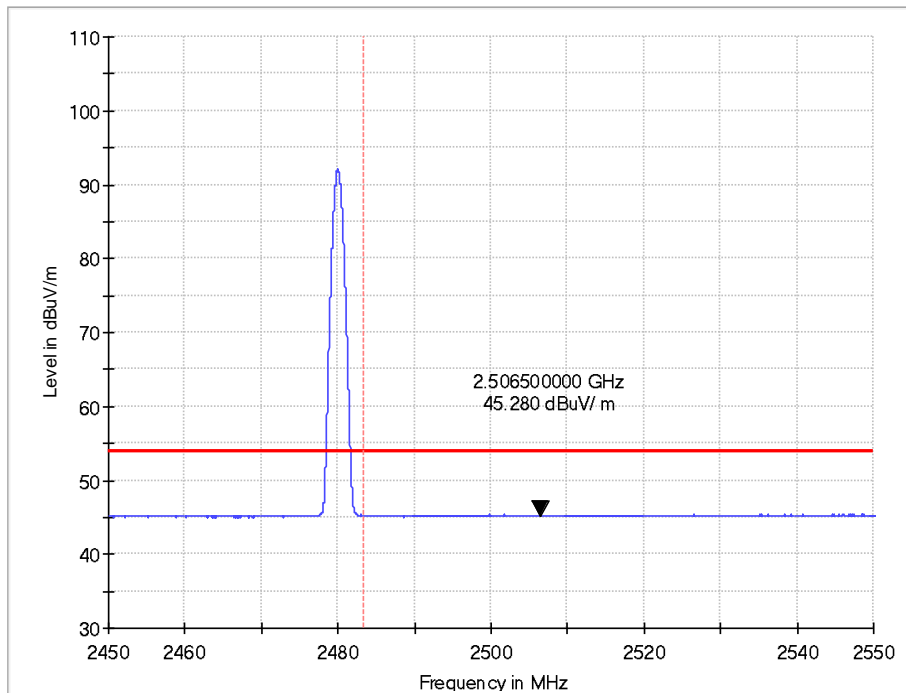
Vertical



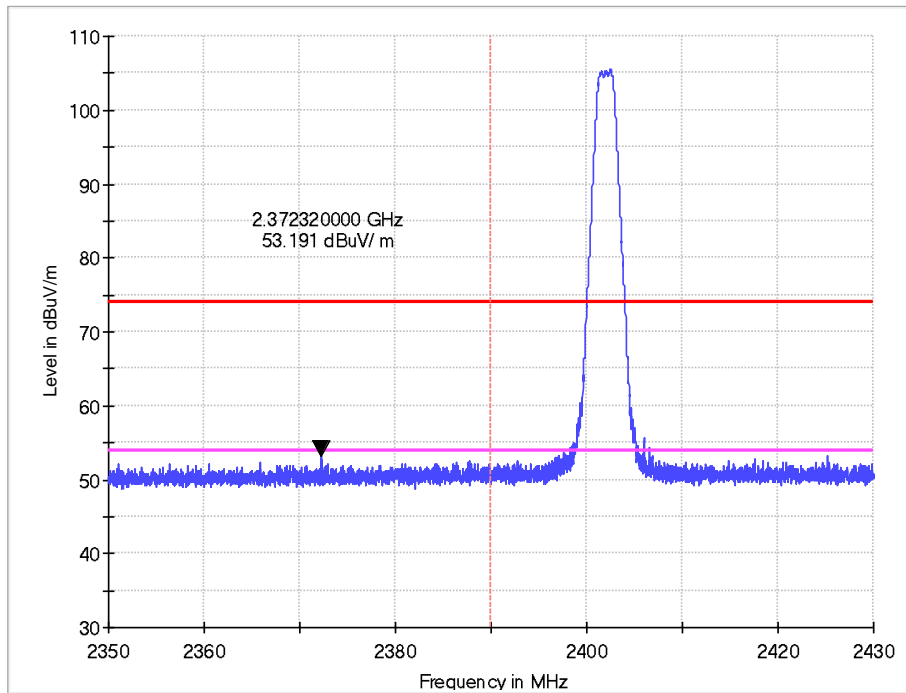
AV  
Horizontal



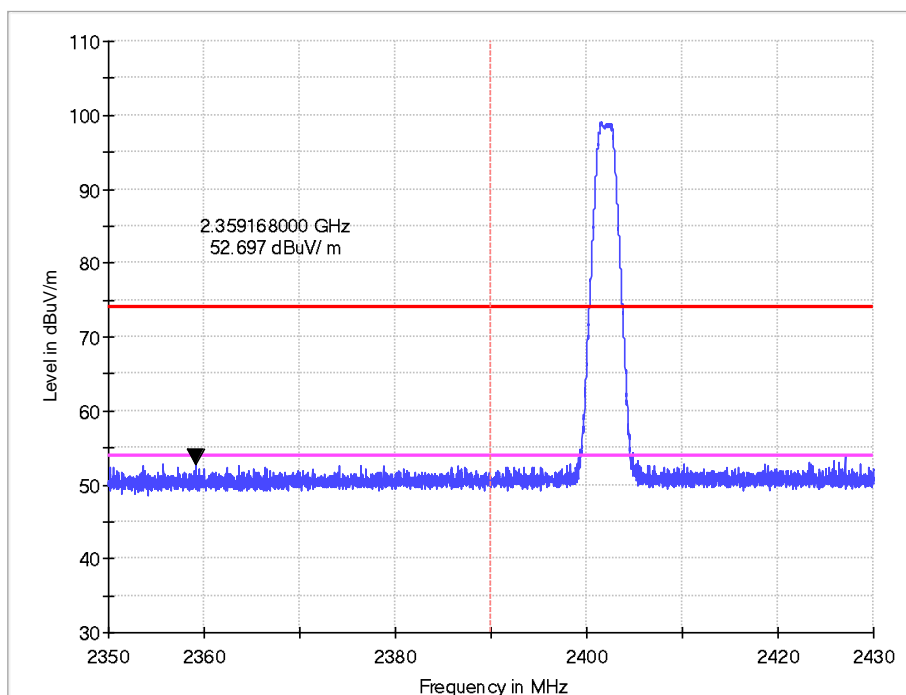
Vertical



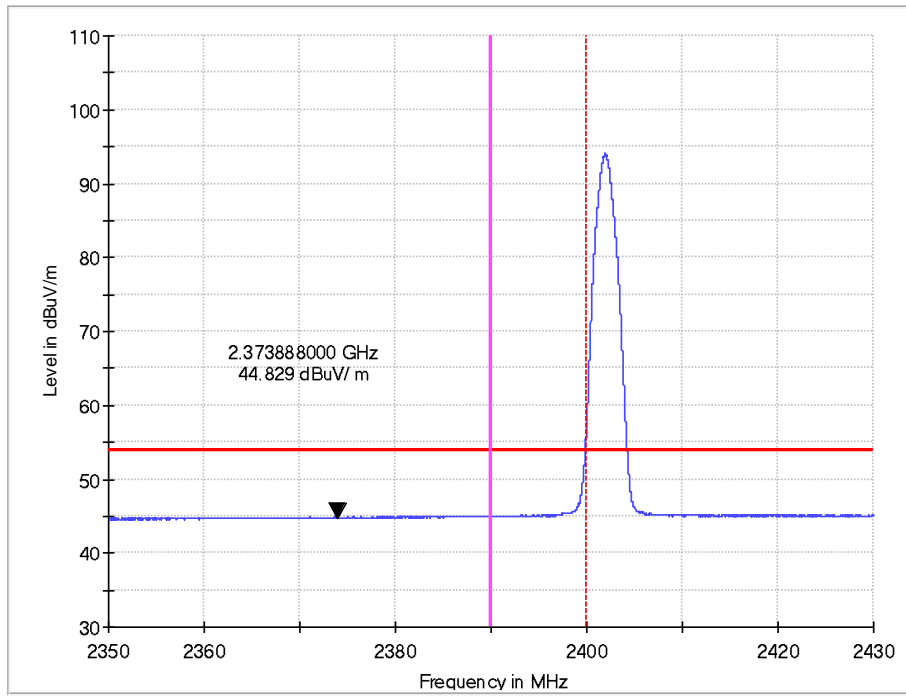
Right:  
Band Edge  
BLE\_2Mbps BLE CH0  
PK  
Horizontal



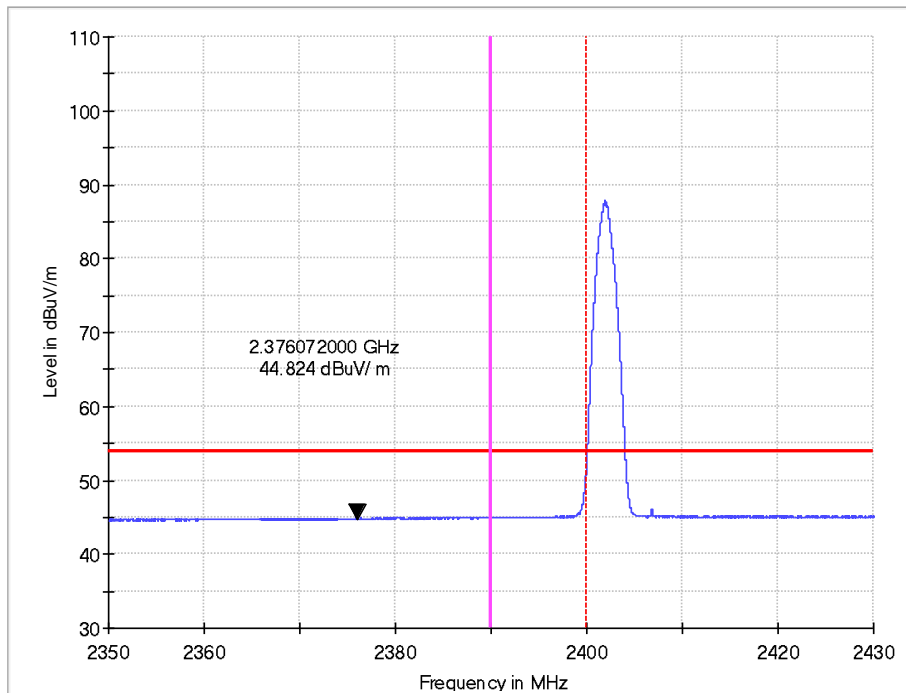
Vertical



AV  
Horizontal

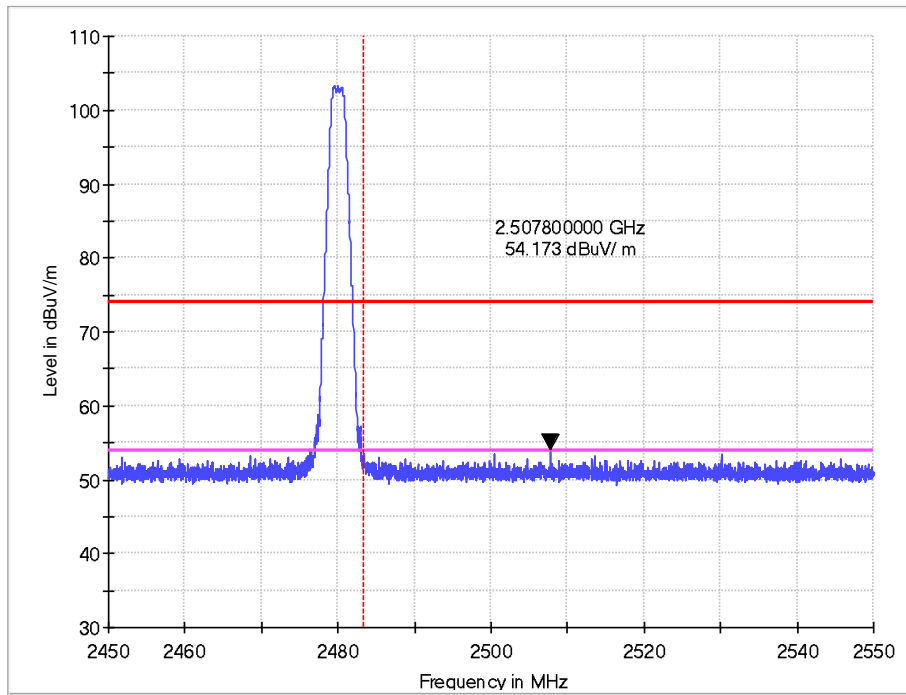


Vertical

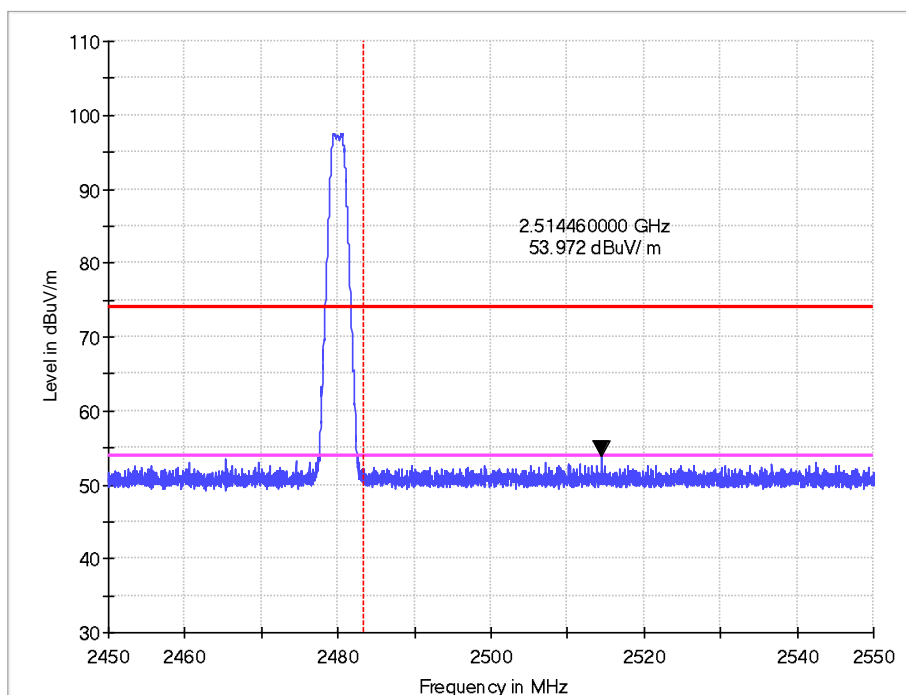




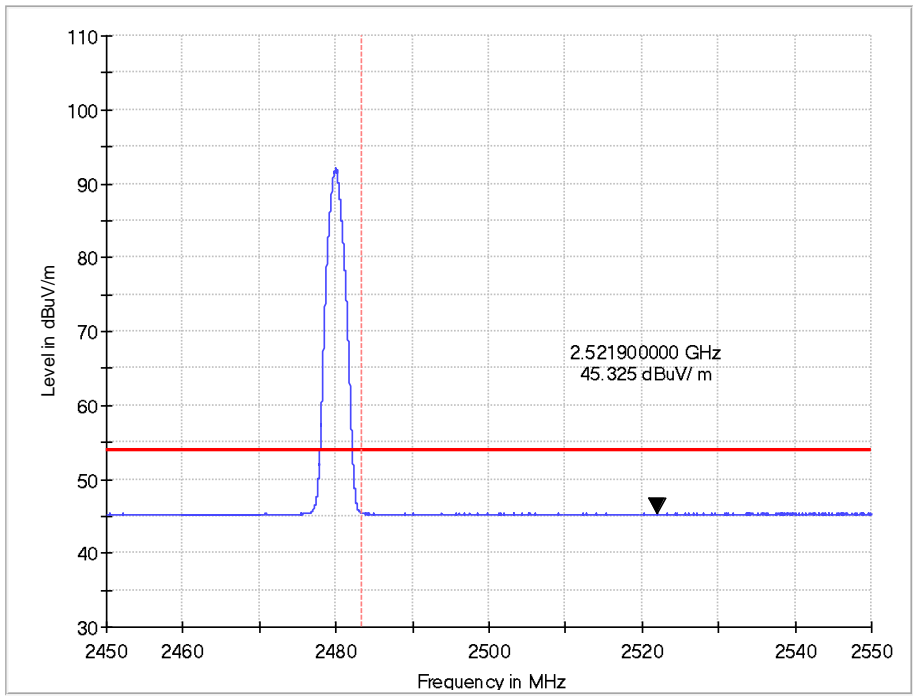
Right:  
Band Edge  
BLE\_2Mbps BLE CH39  
PK  
Horizontal



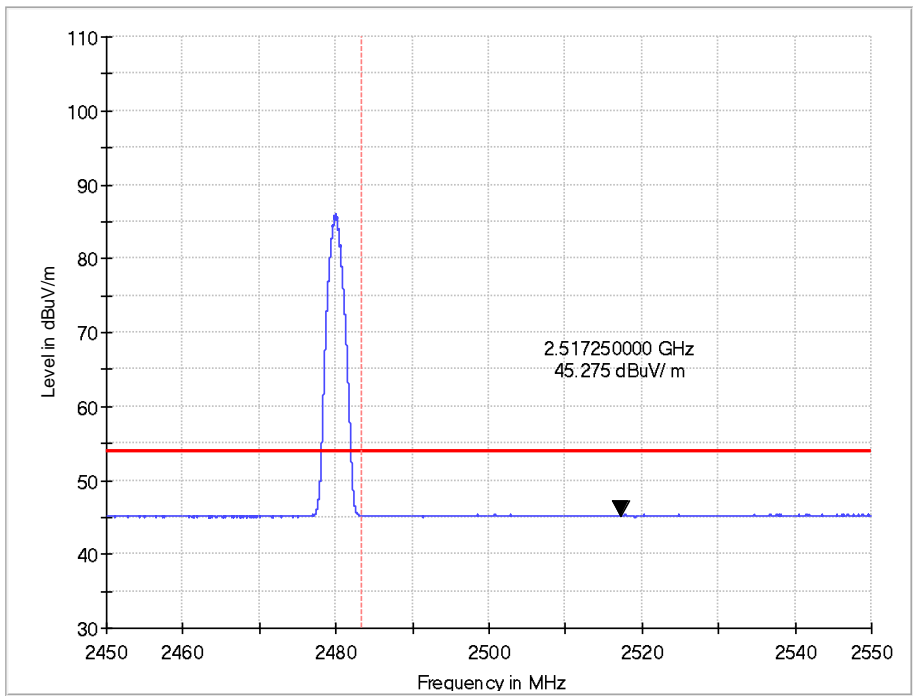
Vertical



AV  
Horizontal



Vertical



## 10. CONDUCTED EMISSION TEST FOR AC POWER PORT MEASUREMENT

### 10.1. Test Standard and Limit

#### 10.1.1. Test Standard

FCC Part 15.207  
IC RSS-Gen Clause 8.8

#### 10.1.2. Test Limit

Table 22 Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dB $\mu$ V)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

\* Decreasing linearly with logarithm of the frequency

\* The lower limit shall apply at the transition frequency.

### 10.2. Test Procedure

The EUT is put on a table of non-conducting material that is 80cm high. The vertical conducting wall of shielding is located 40cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI test receiver is used to test the emissions from both sides of AC line. According to the requirements of ANSI C63.10-2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode.

The bandwidth of EMI test receiver is set at 9 kHz.

### 10.3. Test Arrangement

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture.

### 10.4. Test Data

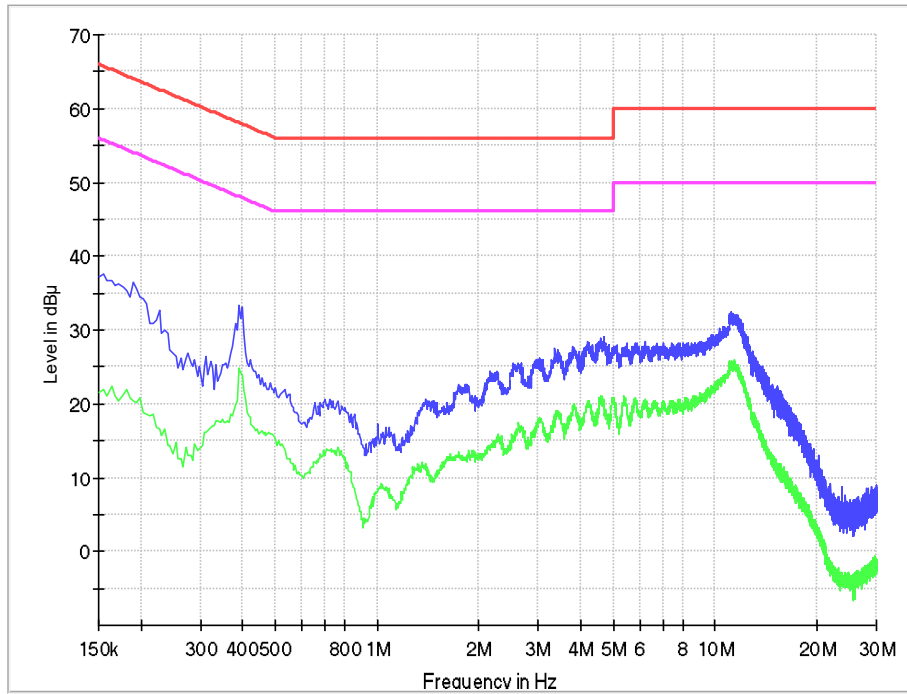
The emissions don't show in below are too low against the limits. Refer to the test curves.

Table 23 Conducted Emission Test Data

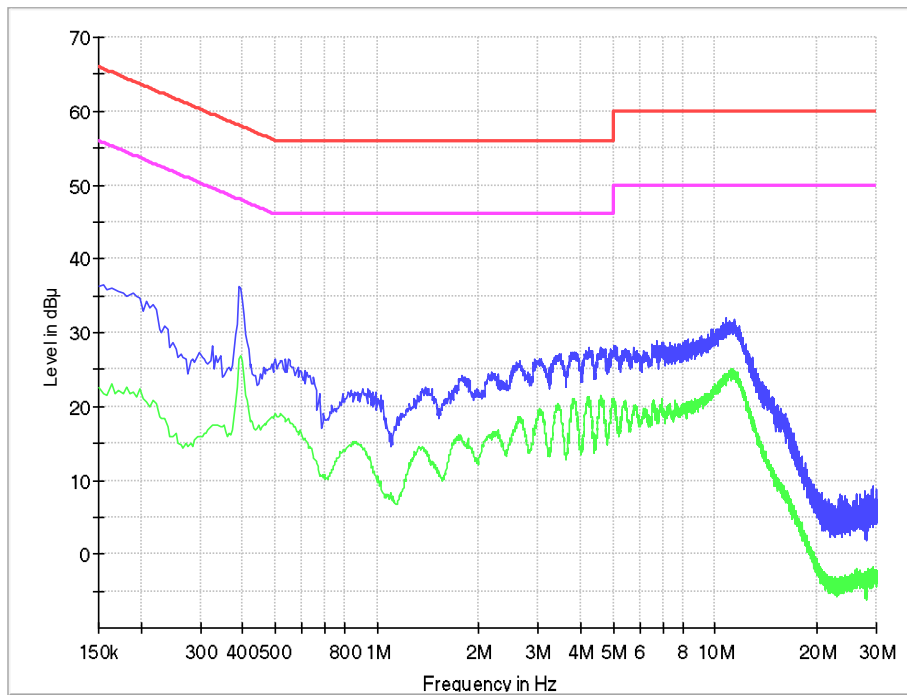
Test mode: Charging and Transmitting								
	Frequency (MHz)	Correction Factor (dB)	Quasi-Peak			Average		
			Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V)	Limit (dB $\mu$ V)
Line	0.19	9.7	22.2	31.9	64.0	11.3	21	54.0
	0.388	9.7	20.8	30.5	58.1	14.6	24.3	48.1
	2.989	9.9	13.4	23.3	56	7.7	17.6	46
	3.849	9.9	13.9	23.8	56	9.4	19.3	46
	4.6	9.9	15.0	24.9	56	10.8	20.7	46
	11.044	9.9	19.7	29.6	60	15.5	25.4	50
Neutral	0.163	9.7	24.5	34.2	65.3	13.8	23.5	55.3
	0.388	9.7	23.1	32.8	58.1	17.9	27.6	48.1
	3.003	9.9	14.8	24.7	56	9.3	19.2	46
	3.826	9.9	15.3	25.2	56	11.0	20.9	46
	4.609	9.9	15.4	25.3	56	11.2	21.1	46
	10.819	9.9	18.5	28.4	60	14.2	24.1	50

REMARKS: 1. Emission level (dB $\mu$ V) =Read Value (dB $\mu$ V) + Correction Factor (dB)  
 2. Correction Factor (dB) =LISN Factor (dB) + Cable Factor (dB) +Limiter Factor (dB)  
 3. The other emission levels were very low against the limit.

## Line



## Neutral



## 11.99% BANDWIDTH

### 11.1.LIMITS OF 99% Bandwidth

RSS-GEN Clause 6.7, for reporting purposes only

### 11.2.TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer.

The transmitter output is connected to a spectrum analyzer.

The RBW is set to  $\geq 1\%$  to 5% of the actual occupied.

The VBW is set to  $\geq 3\text{RBW}$ . The sweep time is coupled

### 11.3.TEST SETUP



### 11.4.TEST DATA

Left:

Table 24 99% Bandwidth Test Data

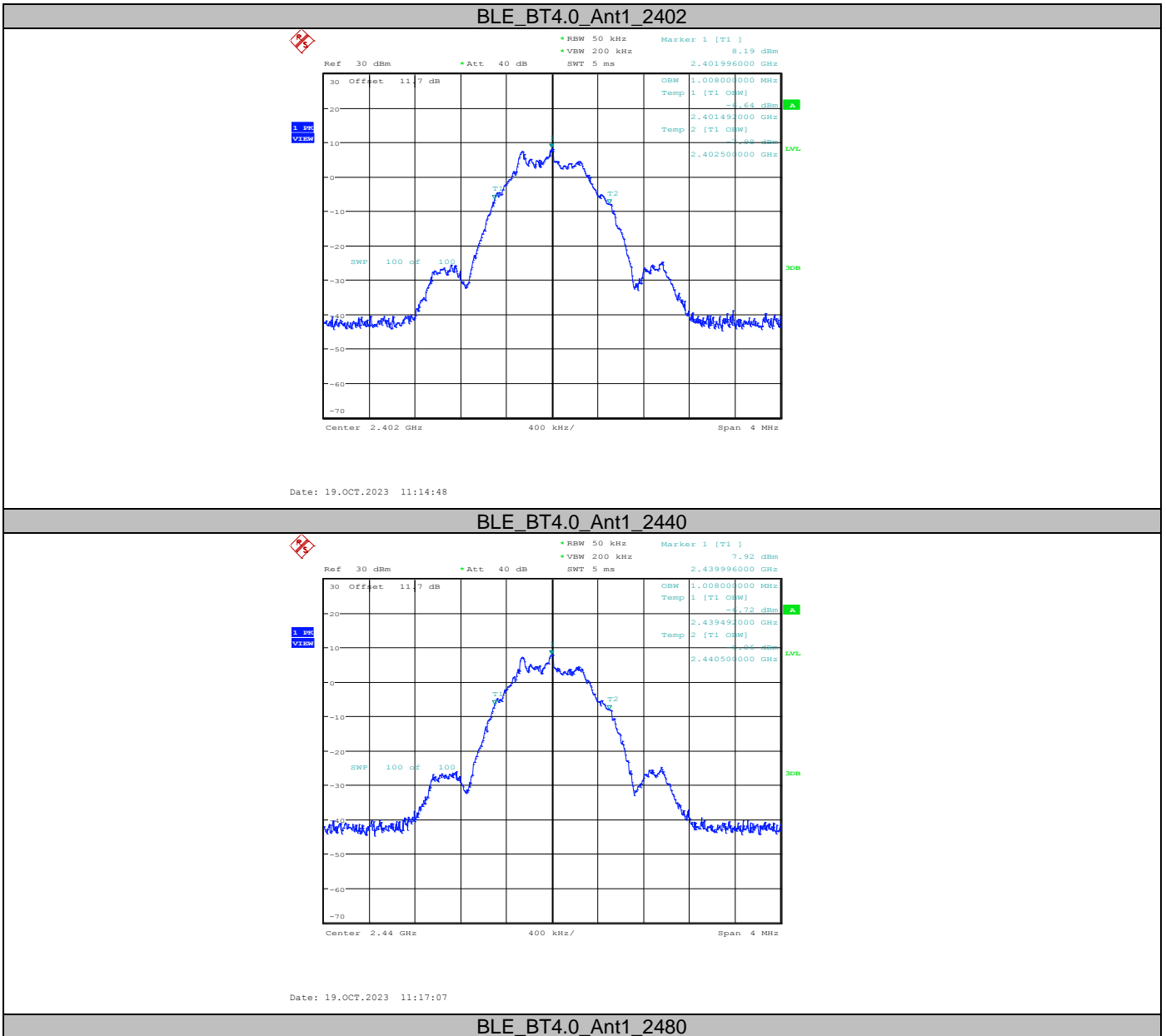
TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_BT4.0	Ant1	2402	1.008	2401.4920	2402.5000	---	---
		2440	1.008	2439.4920	2440.5000	---	---
		2480	1.004	2479.4960	2480.5000	---	---
BLE_BT5.0	Ant1	2402	1.98	2401.0160	2402.9960	---	---
		2440	1.976	2439.0240	2441.0000	---	---
		2480	1.976	2479.0200	2480.9960	---	---

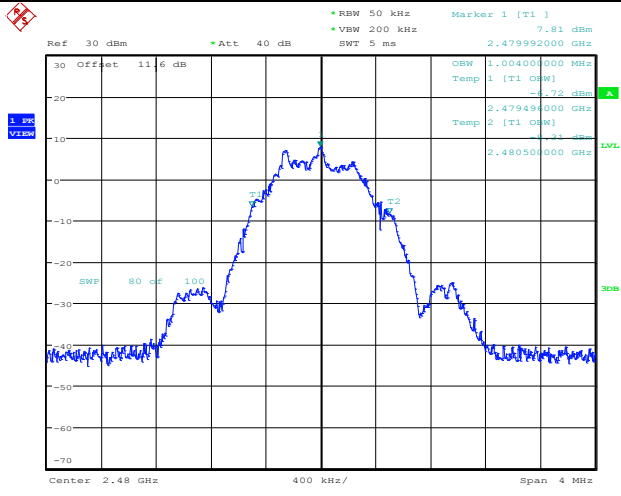
Right:

Table 25 99% Bandwidth Test Data

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_BT4.0	Ant1	2402	1.008	2401.4920	2402.5000	---	---
		2440	1.012	2439.4880	2440.5000	---	---
		2480	1.012	2479.4920	2480.5040	---	---
BLE_BT5.0	Ant1	2402	1.984	2401.0120	2402.9960	---	---
		2440	1.984	2439.0160	2441.0000	---	---
		2480	1.976	2479.0160	2480.9920	---	---

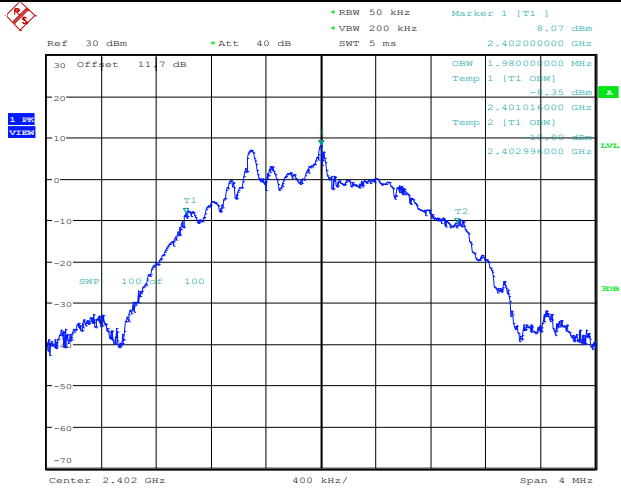
Left:





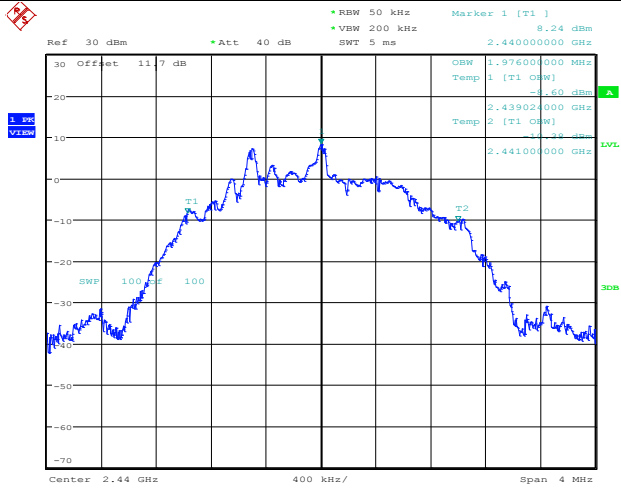
Date: 19.OCT.2023 11:20:40

### BLE\_BT5.0\_Ant1\_2402



Date: 19.OCT.2023 11:23:18

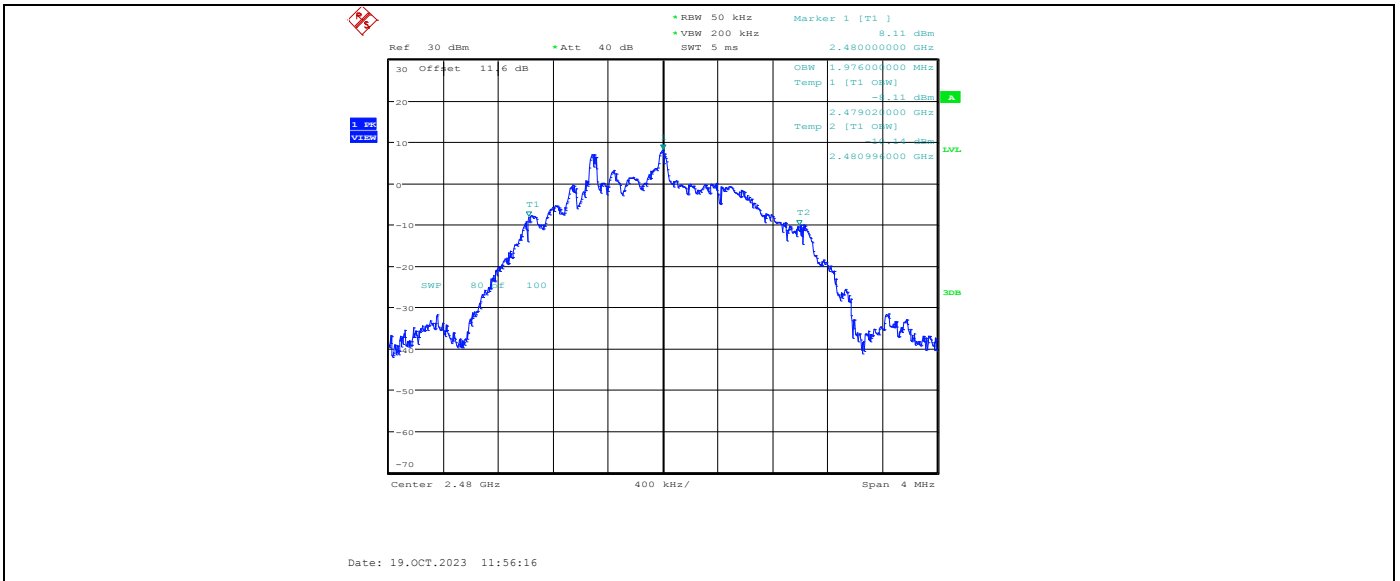
### BLE\_BT5.0\_Ant1\_2440



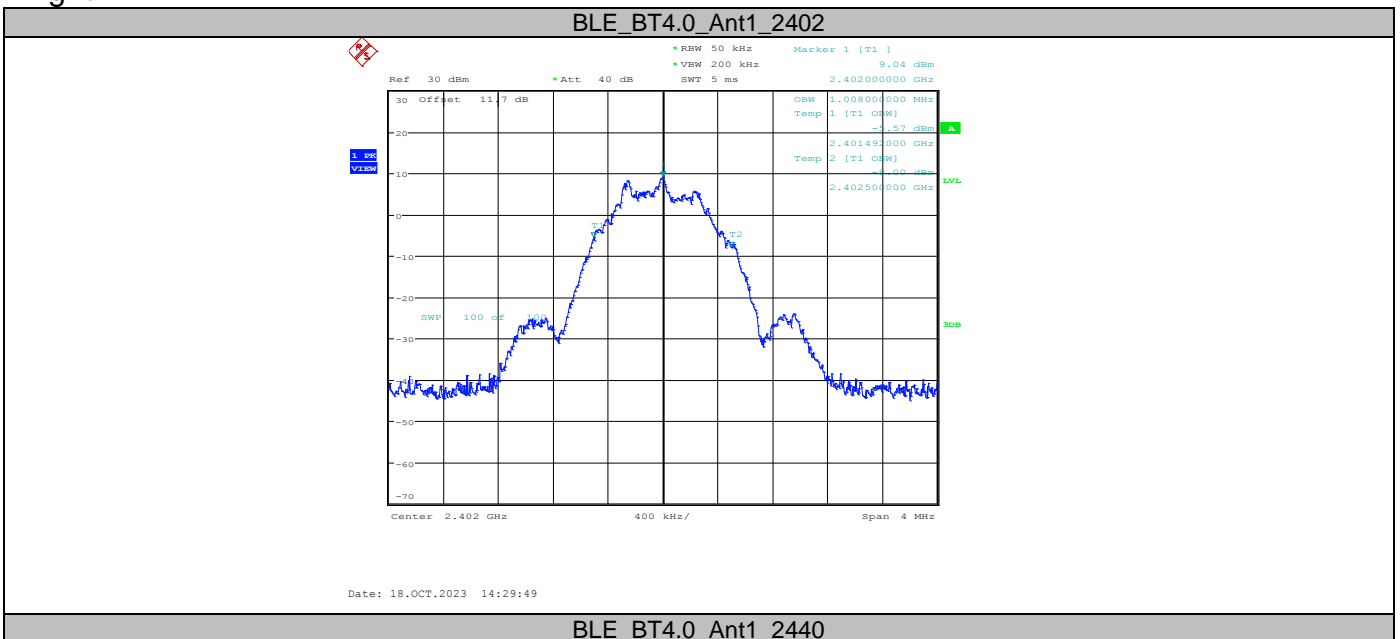
Date: 19.OCT.2023 11:37:45

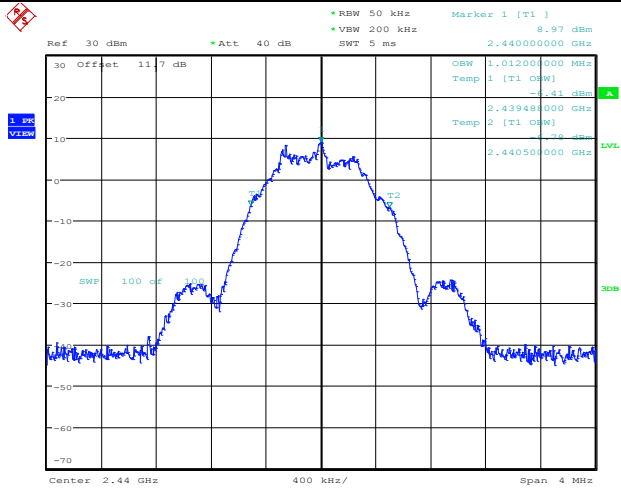
### BLE\_BT5.0\_Ant1\_2480





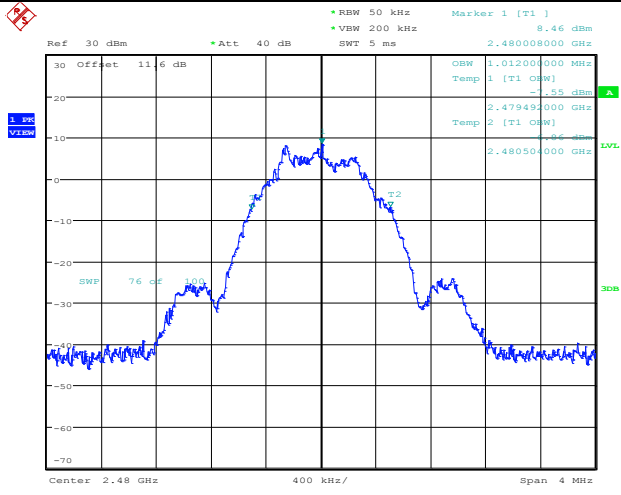
Right:





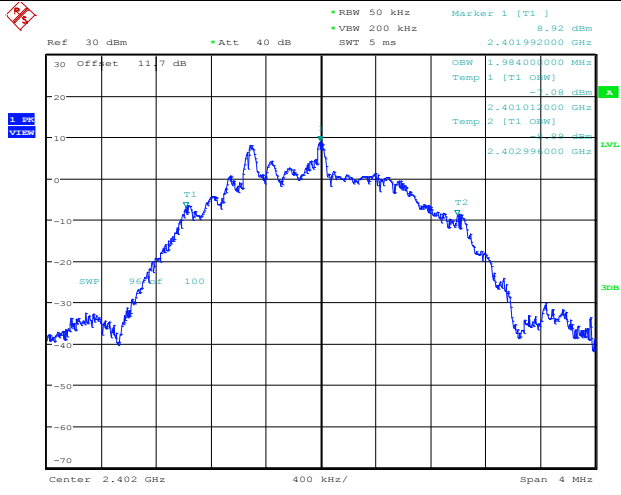
Date: 18.OCT.2023 14:33:25

BLE\_BT4.0\_Ant1\_2480



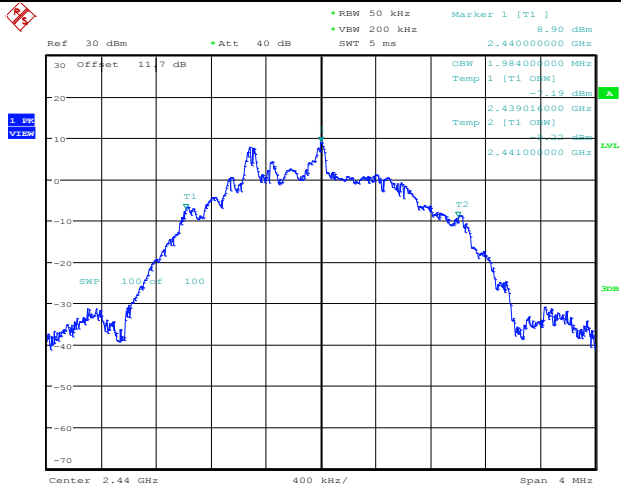
Date: 18.OCT.2023 14:36:50

BLE\_BT5.0\_Ant1\_2402



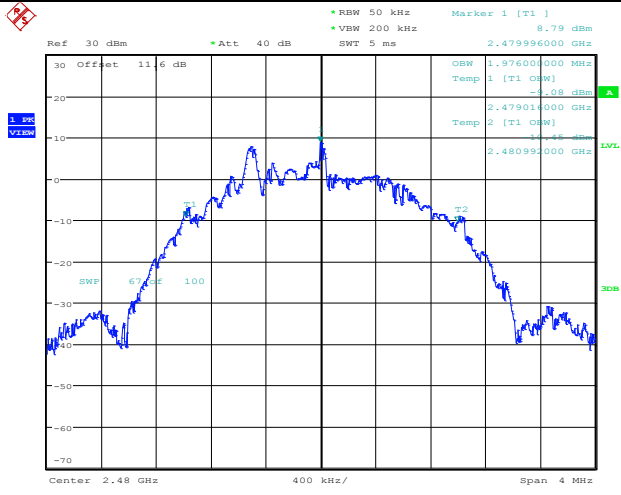
Date: 18.OCT.2023 14:40:05

BLE\_BT5.0\_Ant1\_2440



Date: 18.OCT.2023 14:48:28

### BLE\_BT5.0\_Ant1\_2480



Date: 18.OCT.2023 14:53:44

## **12. ANTENNA REQUIREMENTS**

15.203 requirements:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirements:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to RSS-GEN Section 6.8, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

### **12.1. Antenna Connector**

Antenna Connector is on the PCB within enclosure and not accessible to user.

### **12.2. Antenna Gain**

The antenna gain of EUT is less than 6 dBi.

**END OF REPORT**