

FCC CERTIFICATION TEST REPORT

FOR

Applicant	:	PEAG, LLC dba JLab Audio
Address	:	5927 Landau Ct. Carlsbad, CA 92008, USA
Equipment under Test	:	TWS Earbuds
Model No.	:	Epic Lab Edition
Trade Mark	:	JLAB
FCC ID	:	2AHYV-EPICLE
Manufacturer	:	GuangDong Simpreal Intelligent Technology Co., Ltd
Address	:	Room 2408, JiaHong ZhenXing DaSha, DongGuan Avenue #13, DongCheng District, DongGuan City, GuangDong Province, P.R. China

Issued By: Dongguan Dongdian Testing Service Co., Ltd.

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REPORT

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Test Report Declare

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Model No.	:	Epic Lab Edition
Trade Mark	:	JLAB
Manufacturer	:	GuangDong Simpreal Intelligent Technology Co., Ltd
Address	:	Room 2408, JiaHong ZhenXing DaSha, DongGuan Avenue #13, DongCheng District, DongGuan City, Guangdong Province, P.R. China

Test Standard Used:

FCC Rules and Regulations Part 15 Subpart C.

Test Procedure Used:

ANSI C63.10:2013.

We Declare:

The equipment described above is tested by Dongguan Dongdian Testing Service Co., Ltd. and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and Dongguan Dongdian Testing Service Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above FCC standards.

Report No.:	DDT-RE23071128-2E02		
Date of Receipt:	Jul. 19, 2023	Date of Test:	Jul. 19, 2023 ~ Aug. 09, 2023

Prepared By:**Johnny Wang/Engineer****Approved By:****Damon Hu/EMC Manager**

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Dongguan Dongdian Testing Service Co., Ltd.

Revision History

Rev.	Revisions	Issue Date	Revised By
---	Initial issue	Aug. 09, 2023	

1. Summary of Test Results

The EUT have been tested according to the applicable standards as referenced below.		
Description of Test Item	Standard	Verdict
6dB Bandwidth and 99% Bandwidth	FCC Part 15: 15.247(a)(2)	Pass
Peak Output Power	FCC Part 15: 15.247(b)(3)	Pass
Power Spectral Density	FCC Part 15:15.247(e)	Pass
Band Edge Compliance (conducted method)	FCC Part 15: 15.247(d)	Pass
RF Conducted Spurious Emissions	FCC Part 15: 15.247(d)	Pass
Radiation Emission	FCC Part 15: 15.205 FCC Part 15: 15.209 FCC Part 15: 15.247(d)	Pass
Emission in Restricted Frequency Bands	FCC Part 15: 15.205 FCC Part 15: 15.209 FCC Part 15: 15.247(d)	Pass
Power Line Conducted Emission	FCC Part 15: 15.207(a)	Pass
Antenna Requirement	FCC Part 15: 15.203	Pass

2. General Test Information

2.1. Description of EUT

EUT Name	: TWS Earbuds
Model Number	: Epic Lab Edition
EUT Function Description	: Please reference user manual of this device
Power Supply	: Charging case: DC 5V by an external adapter or a 3.7V built-in lithium battery. Wireless headphones: DC 3.7V built-in lithium battery.
Radio Specification	: Bluetooth V5.3
Operation Frequency	: 2402 MHz - 2480 MHz
Modulation	: GFSK
Data Rate	: 1 Mbps, 2 Mbps
Antenna	: Left side: -4.99 dBi Right side: -1.42 dBi
Sample Number	: S23071128-06 for conductive, S23071128-07 for radiation

Note: EUT is the ab. of equipment under test.

Channel information					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	14	2430	28	2458
1	2404	15	2432	29	2460
2	2406	16	2434	30	2462
3	2408	17	2436	31	2464
4	2410	18	2438	32	2466
5	2412	19	2440	33	2468
6	2414	20	2442	34	2470
7	2416	21	2444	35	2472
8	2418	22	2446	36	2474
9	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	39	2480
12	2426	26	2454		
13	2428	27	2456		

2.2. Accessories of EUT

Description of Accessories	Manufacturer	Model number	Description	Remark
N/A	N/A	N/A	N/A	N/A

2.3. Assistant equipment used for test

Assistant equipment	Manufacturer	Model number	EMC Compliance	SN
Adapter	SAMSUNG	EP-TA200	N/A	Input: 100-240~, 50/60Hz, 0.5A; Output: 9V/1.67A or 5V/2A
NoteBook	Lenovo	I7-4810MQ	N/A	00331-1000-00001-AA816

2.4. Block diagram of EUT configuration for test

EUT

Test software: AB1565_AB1568_Airoha_Tool_Kit(ATK)_v3.6.1.exe

The test software was used to control EUT work in Continuous Tx mode, and select test channel, wireless mode as below table:

The pathloss of external cable: 0.5dB (According to the manufacturer's claims)

Tested mode, channel, information			
Mode	Setting Tx Power	Channel	Frequency (MHz)
GFSK 1M	61	CH0	2402
	61	CH19	2440
	61	CH39	2480
GFSK 2M	61	CH1	2404
	61	CH19	2440
	61	CH38	2478

Note: The channel 2402MHz, 2426MHz and 2480MHz of BLE 2M are shielded by software.

2.5. Test environment conditions

Temperature range:	+15°C to +35 °C
Humidity range:	20% to 75%
Pressure range:	86 kPa to 106 kPa

2.6. Deviations of test standard

No deviation.

2.7. Test laboratory

Dongguan Dongdian Testing Service Co., Ltd.

Add.: No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China, 523808.

Tel.: +86-0769-38826678, <http://www.dgddt.com>, Email: ddt@dgddt.com.

CNAS Accreditation No. L6451; A2LA Accreditation Number: 3870.01

FCC Designation Number: CN1182, Test Firm Registration Number: 540522

Innovation, Science and Economic Development Canada Site Registration Number: 10288A

Conformity Assessment Body identifier: CN0048

VCCI facility registration number: C-20087, T-20088, R-20123, R-20155, G-20118

2.8. Measurement uncertainty

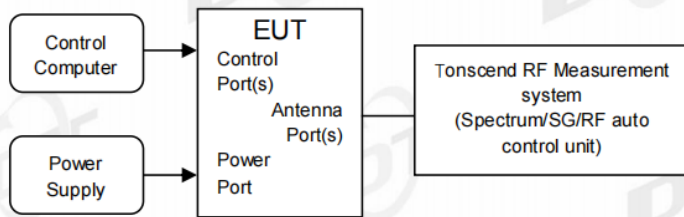
Test Item	Uncertainty
Bandwidth	1.1%
Peak Output Power (Conducted) (Spectrum analyzer)	0.86 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$); 1.38 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$)
Peak Output Power (Conducted) (Power Sensor)	0.74 dB
Power Spectral Density	0.74 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$); 1.38 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$)
Frequencies Stability	6.7×10^{-8} (Antenna couple method) 5.5×10^{-8} (Conducted method)
Conducted spurious emissions	0.86 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$); 1.40 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$) 1.66 dB ($8 \text{ GHz} \leq f < 26.5 \text{ GHz}$)
Uncertainty for radio frequency (RBW < 20 kHz)	3×10^{-8}
Temperature	0.4 °C
Humidity	2 %
Uncertainty for Radiation Emission test (9 kHz – 30 MHz)	3.44 dB
Uncertainty for Radiation Emission test (30 MHz - 1 GHz)	4.70 dB (Antenna Polarize: V) 4.84 dB (Antenna Polarize: H)
Uncertainty for Radiation Emission test (1 GHz - 40 GHz)	4.10 dB (1 - 6 GHz) 4.40 dB (6 GHz - 18 GHz) 3.54 dB (18 GHz - 26 GHz) 4.30 dB (26 GHz - 40 GHz)
Uncertainty for Power line conduction emission test	3.34dB (150KHz-30MHz) 3.72dB (9KHz-150KHz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

3. Equipment Used During Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
☑RF Connected Test (Tonscend RF Measurement System 2#)					
Spectrum analyzer	R&S	FSU26	201124	Jun. 12, 2023	1 Year
MULTIMETER	FLUKE	15B PRO	55060005WS	Jul. 15, 2023	1 Year
Test Software	JS Tonscend	JS1120-3	Ver.3.2.22	N/A	N/A
☑Radiation 3#chamber					
EMI Test Receiver	R&S	ESU26	100472	Apr. 23, 2023	1 Year
Spectrum analyzer	Agilent	E4447A	MY50180031	Apr. 23, 2023	1 Year
Active Loop antenna	Schwarzbeck	FMZB-1519	1519-038	Sep. 29, 2022	1 Year
Trilog Broadband Antenna	Schwarzbeck	VULB 9163	01429	Jul. 12, 2023	1 Year
Double Ridged Horn Antenna	Schwarzbeck	BBHA9120 D	02468	Sep. 29, 2022	1 Year
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	790	Apr. 26, 2023	1 Year
Pre-amplifier	COM-POWER	PAM-118A	18040084	Jul. 15, 2023	1 Year
Pre-amplifier	COM-POWER	PAM-840A	461369	Apr. 27, 2023	1 Year
RE Cable	N/A	W23.02 CP1-X2 + W23.09 AP1-X8+ JCT26S-NJ-NJ-1.5M	4.5M+8M+1.5M	Apr. 21, 2023	1 Year
RF Cable	Yuhu Technology	JCTB810-NJ-NJ-9M+ ZT26S-SMAJ-SMAJ-1M	21123964	Apr. 23, 2023	1 Year
Micro-Tronics filters	REBES	BRM50702	G555	N/A	N/A
Micro-Tronics filters	REBES	BRM50716	G392	N/A	N/A
High Pass filter	XB	XBLBQ-GTA67	210820-2-3	N/A	N/A
Test software	Tonscend	JS32-RE	V 5.0.0.1	N/A	N/A
☑Power Line Conducted Emissions Test 2#					
Test Receiver	R&S	ESCI	101032	Apr. 23, 2023	1 Year
LISN 1	R&S	ENV216	101170	Jul. 12, 2023	1 Year
LISN 2	R&S	ENV216	101209	Jul. 12, 2023	1 Year
Pulse Limiter	R&S	KH43101	431011801568-12#	May 05, 2023	1 Year
CE Cable 2	HUBSER	RG214-5	N/A	Apr. 27, 2023	1 Year
Test software	Audix	E3	V 6.11111b	N/A	N/A

4. 6 dB Bandwidth

4.1. Block diagram of test setup



4.2. Limits

For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz

4.3. Test procedure

- (1) The test according to ANSI C63.10-2013 clause 11.8.
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results
- (3) Set the EUT as maximum power setting and enable the EUT transmit continuously
- (4) Use the following spectrum analyzer settings for 6 dB Bandwidth:

RBW: 100 kHz
 VBW: $\geq [3 \times \text{RBW}]$
 Detector Mode: Peak
 Sweep time: Auto
 Trace mode: Max hold

- (5) Allow the trace to stabilize, measure the 6 dB bandwidth of signal, and record the results in the report.

4.4. Test result

Left side:

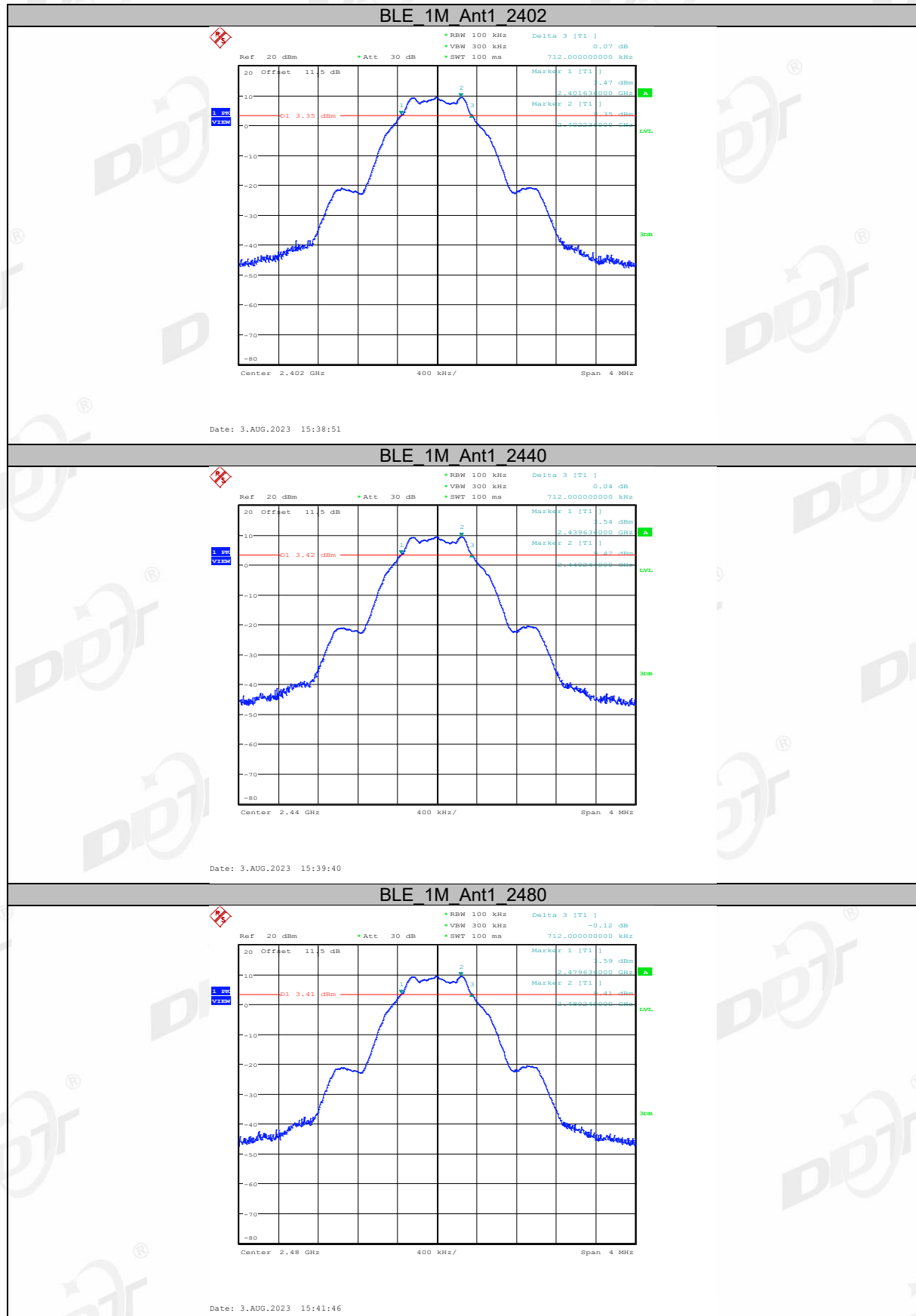
Test Mode	Antenna	Frequency [MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit [MHz]	Verdict
BLE_1M	Ant1	2402	0.71	2401.64	2402.35	0.5	PASS
		2440	0.71	2439.64	2440.35	0.5	PASS
		2480	0.71	2479.64	2480.35	0.5	PASS
BLE_2M	Ant1	2404	1.25	2403.34	2404.59	0.5	PASS
		2440	1.24	2439.34	2440.59	0.5	PASS
		2478	1.24	2477.34	2478.59	0.5	PASS

Right side:

Test Mode	Antenna	Frequency [MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit [MHz]	Verdict
BLE_1M	Ant1	2402	0.72	2401.63	2402.35	0.5	PASS
		2440	0.72	2439.64	2440.35	0.5	PASS
		2480	0.72	2479.63	2480.35	0.5	PASS
BLE_2M	Ant1	2404	1.24	2403.35	2404.59	0.5	PASS
		2440	1.25	2439.34	2440.59	0.5	PASS
		2478	1.24	2477.35	2478.59	0.5	PASS

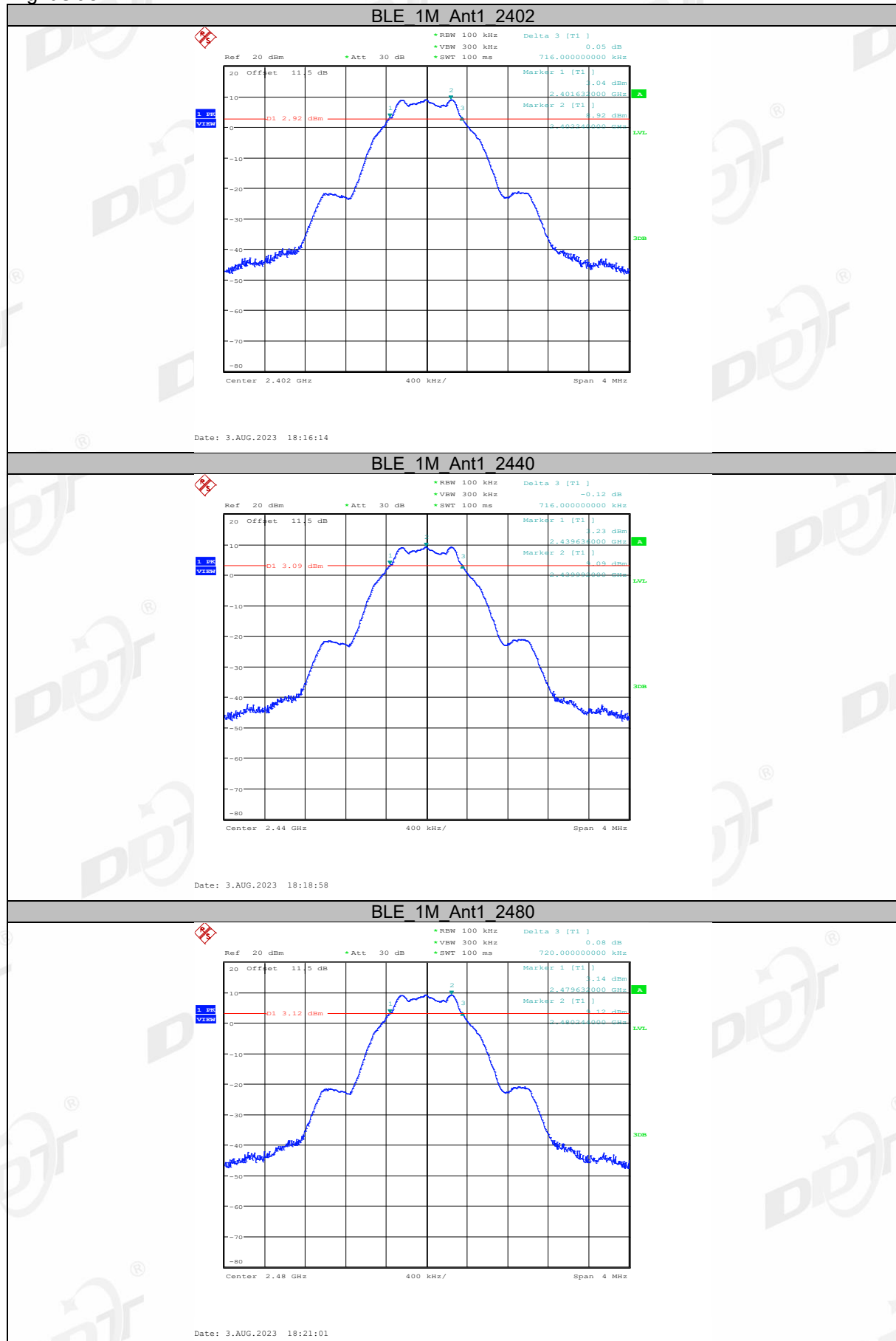
4.5. Test graphs

Left side:

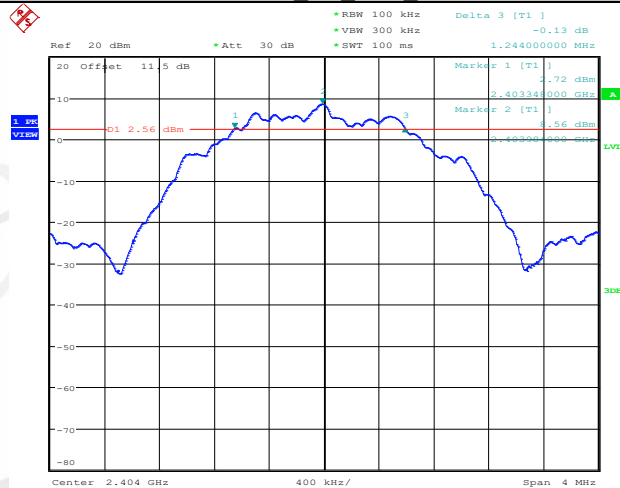




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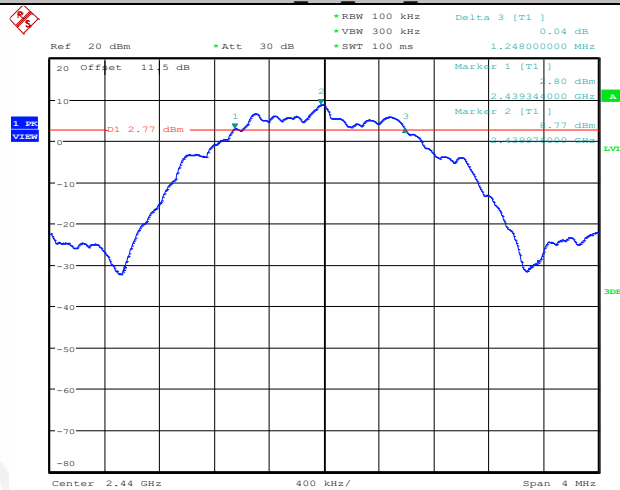


BLE 2M Ant1 2404



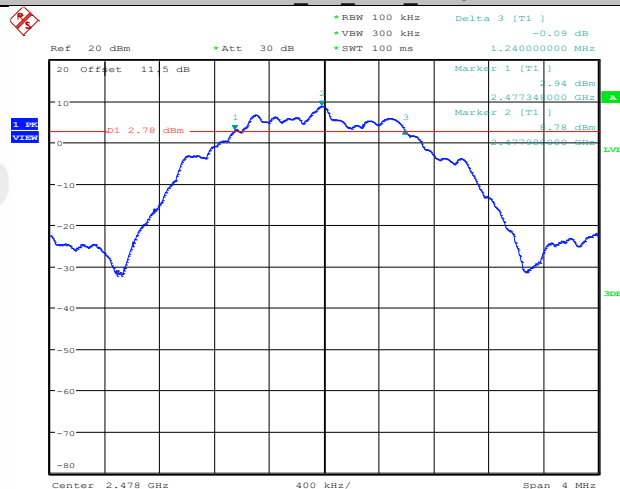
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BLE 2M Ant1 2440



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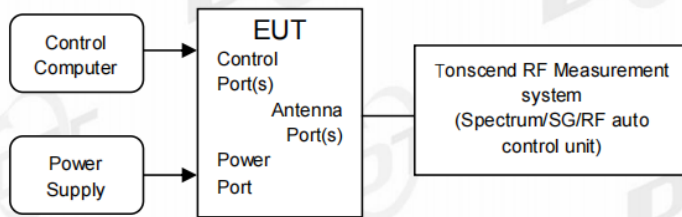
BLE 2M Ant1 2478



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5. 99% Bandwidth

5.1. Block diagram of test setup



5.2. Limits

Just for Report.

5.3. Test procedure

- (1) The test according to ANSI C63.10-2013 clause 6.9.3.
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results
- (3) Set the EUT as maximum power setting and enable the EUT transmit continuously
- (4) Use the following spectrum analyzer settings for the 99% Bandwidth:

RBW:	1% to 5% of the OBW
VBW:	approximately three times RBW
Span:	between 1.5 times and 5.0 times the OBW
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold
- (5) Allow the trace to stabilize, measure the 99% bandwidth of signal, and record the results in the report.

5.4. Test Result

Left side:

Test Mode	Antenna	Frequency [MHz]	OCB [MHz]	FL[MHz]	FH[MHz]
BLE_1M	Ant1	2402	1.036	2401.4840	2402.5200
		2440	1.032	2439.4880	2440.5200
		2480	1.036	2479.4840	2480.5200
BLE_2M	Ant1	2404	2.064	2402.9800	2405.0440
		2440	2.064	2438.9800	2441.0440
		2478	2.064	2476.9800	2479.0440

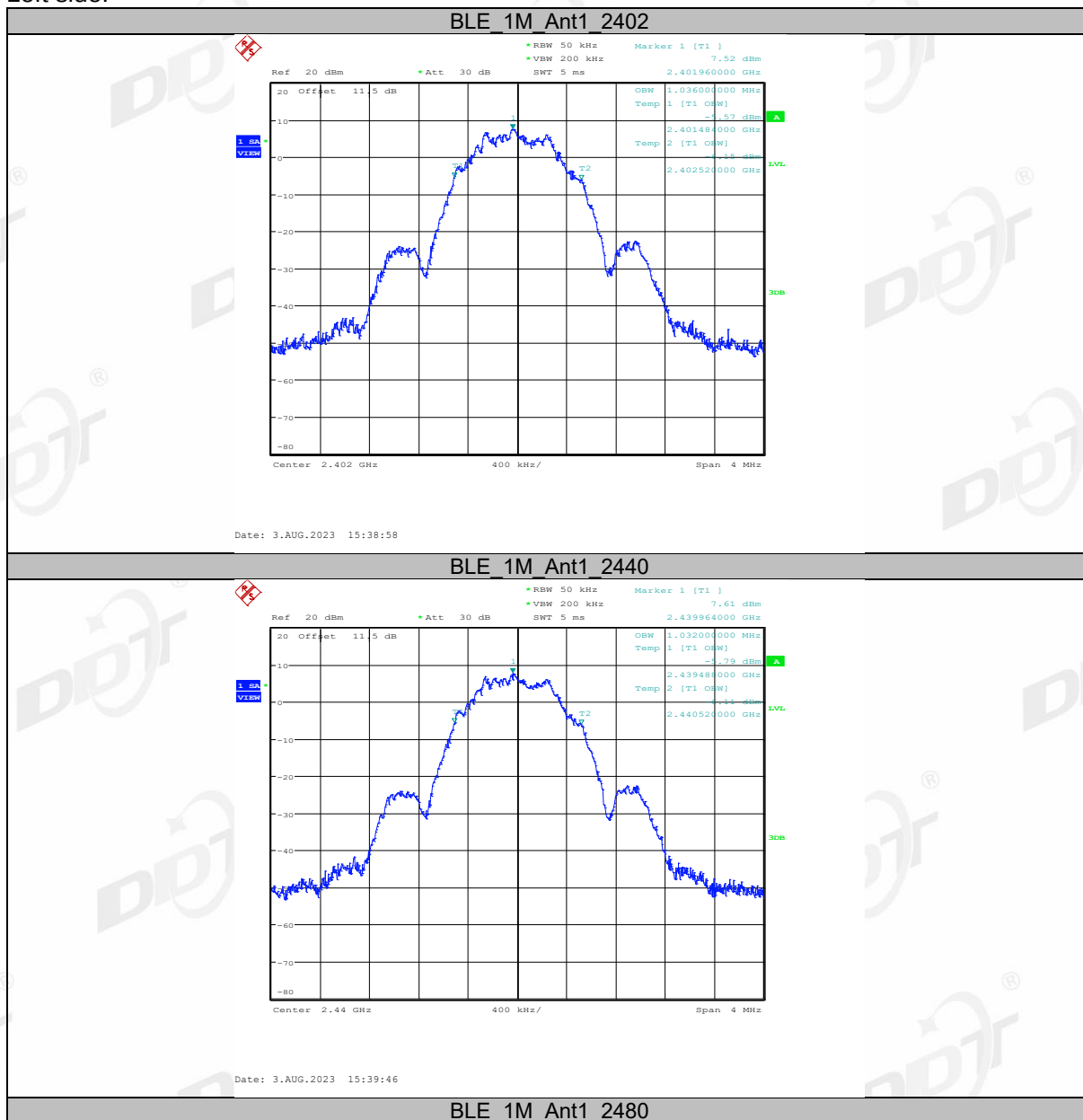
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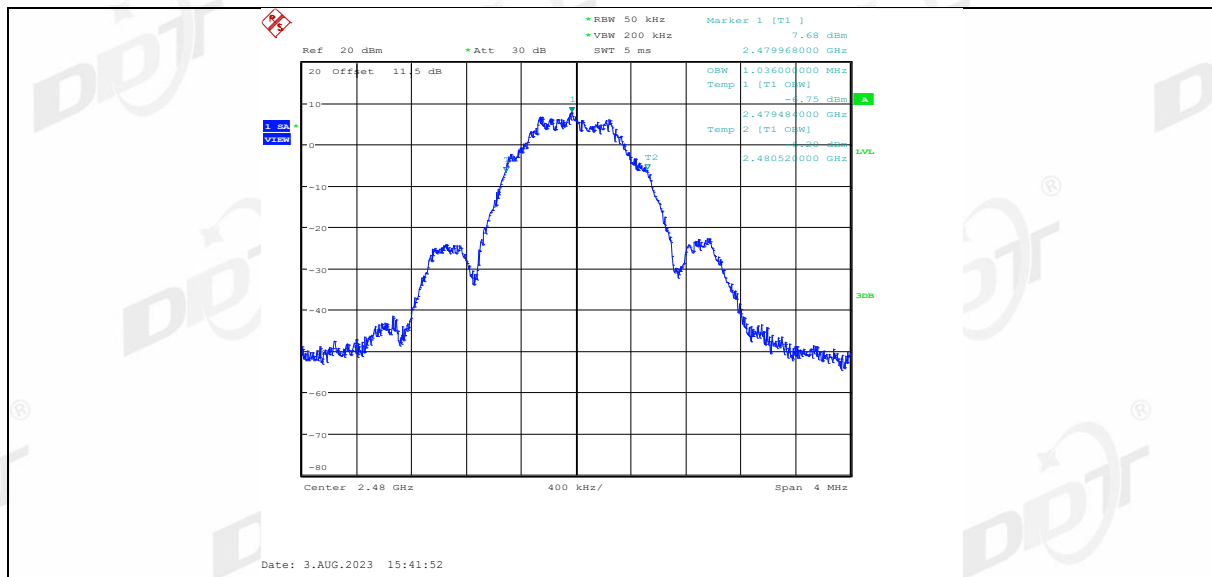
Test Mode	Antenna	Frequency [MHz]	OCB [MHz]	FL[MHz]	FH[MHz]
BLE_1M	Ant1	2402	1.040	2401.4840	2402.5240
		2440	1.036	2439.4840	2440.5200
		2480	1.036	2479.4840	2480.5200
BLE_2M	Ant1	2404	2.064	2402.9800	2405.0440

		2440	2.064	2438.9800	2441.0440
		2478	2.068	2476.9800	2479.0480

5.5. Test Graphs

Left side:

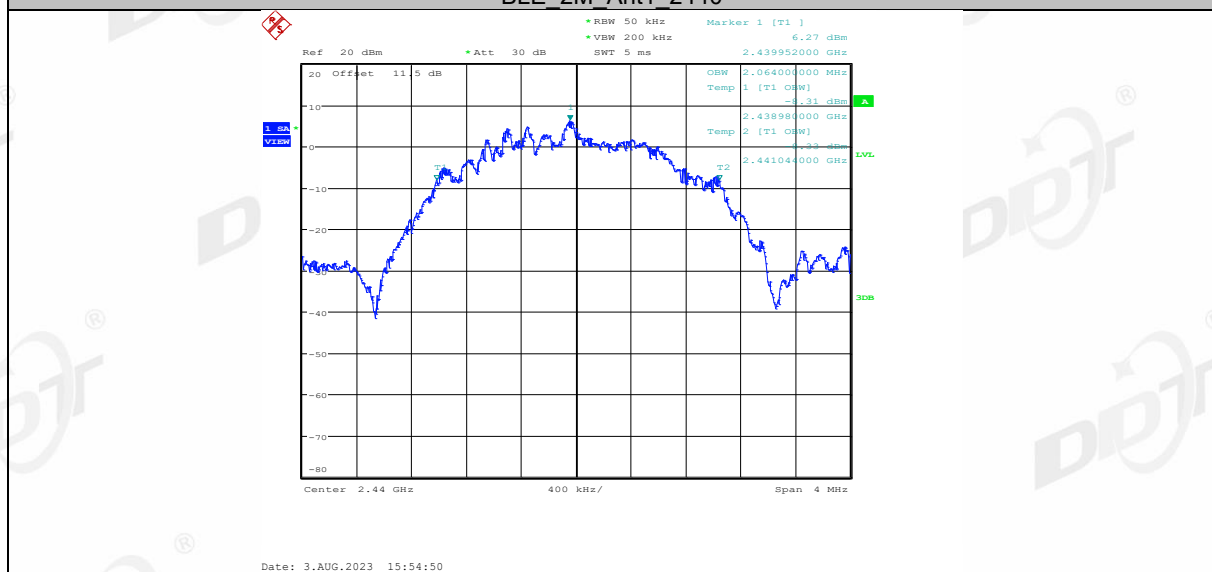




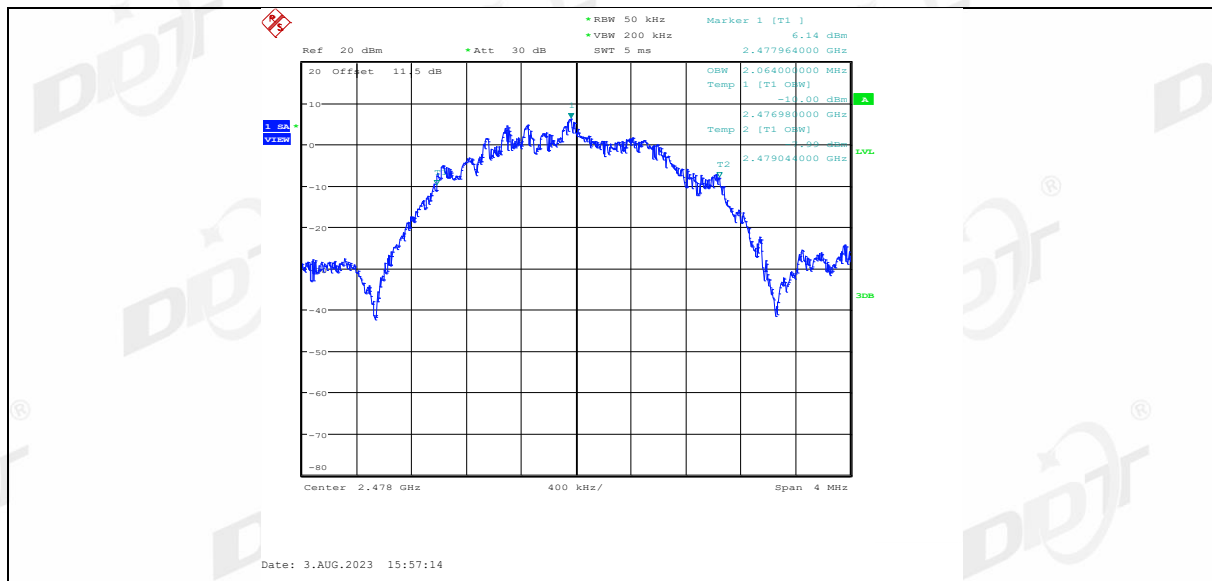
BLE 2M Ant1 2404



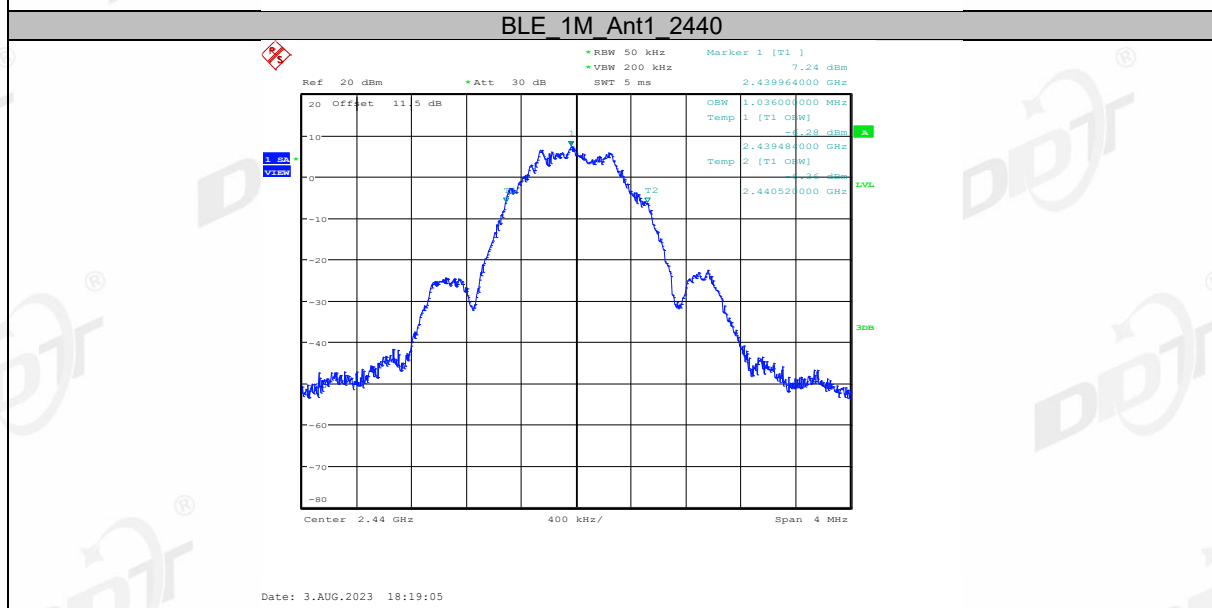
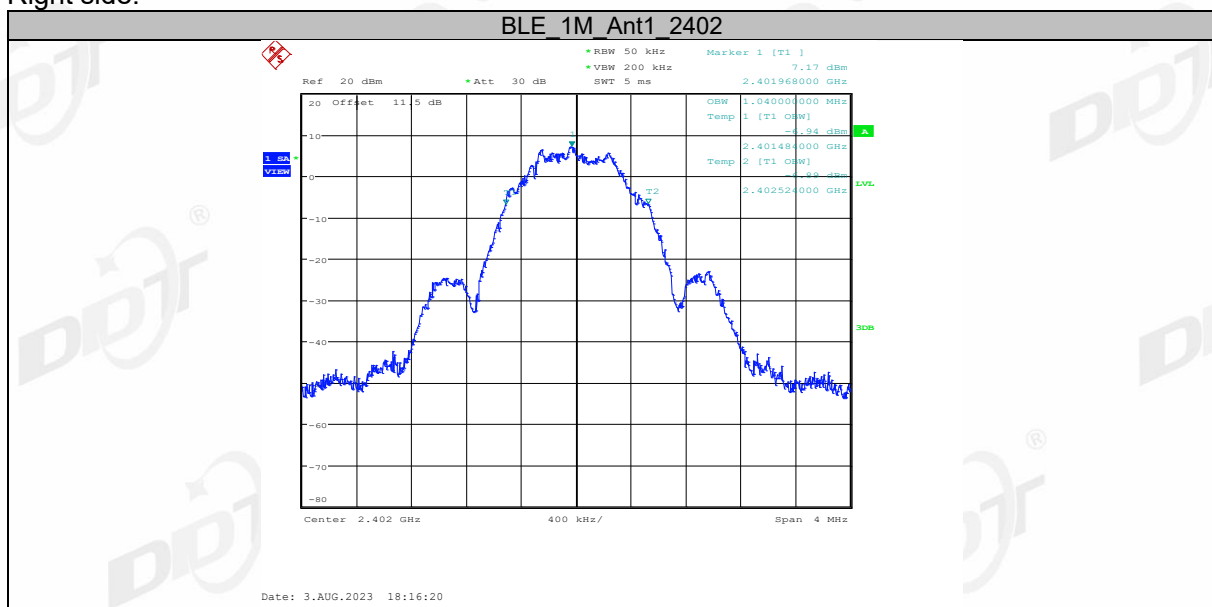
BLE 2M Ant1 2440



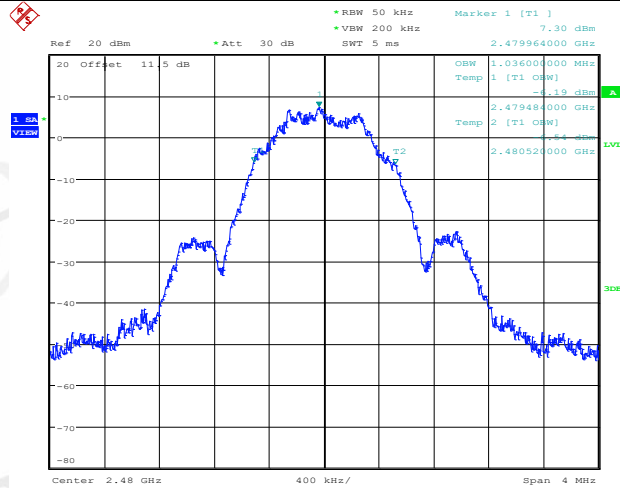
BLE 2M Ant1 2478



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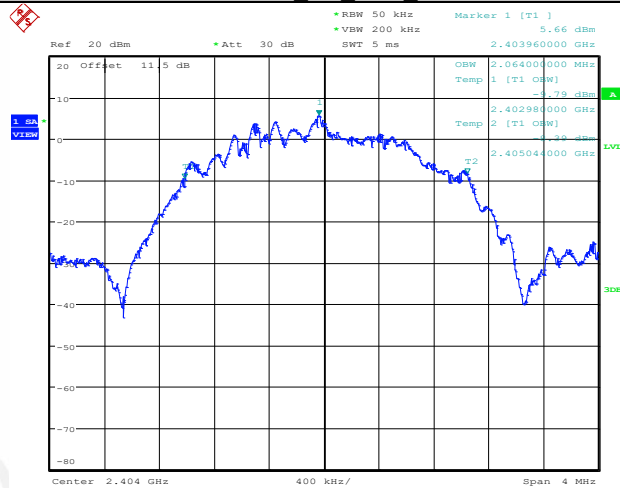


BLE 1M Ant1 2480



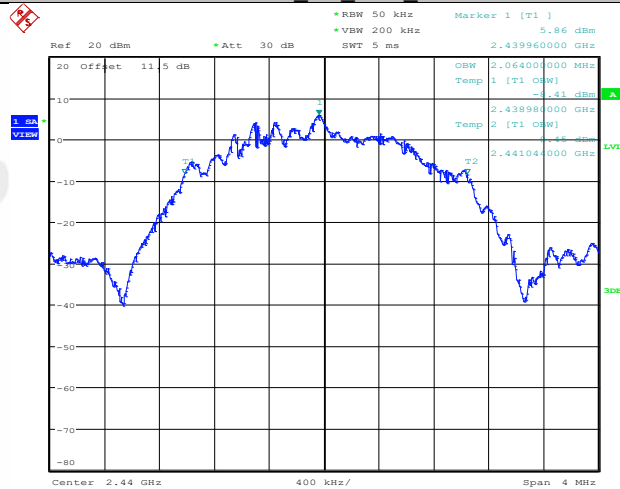
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BLE 2M Ant1 2404



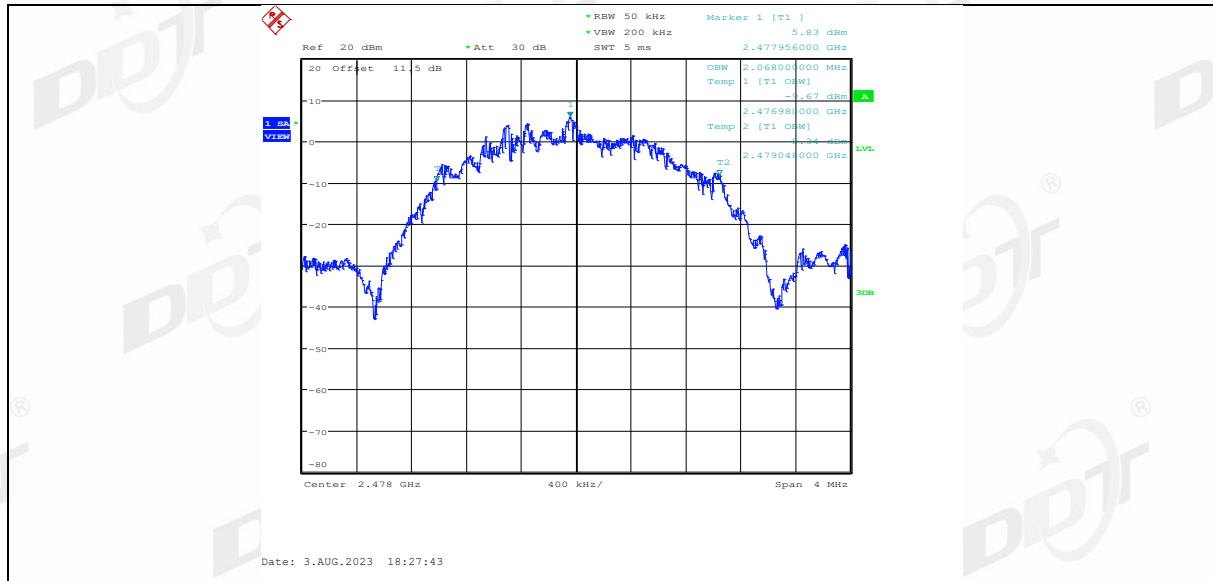
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BLE 2M Ant1 2440



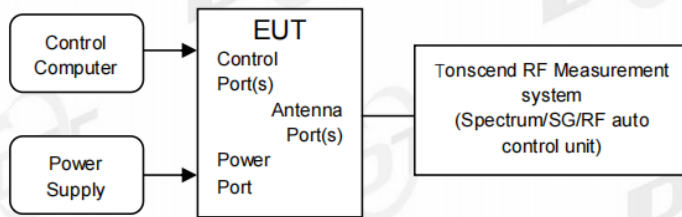
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BLE 2M Ant1 2478



6. Maximum Peak Output Power

6.1. Block diagram of test setup



6.2. Limits

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. If transmitting antennas of directional gain greater than 6dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi, the e.i.r.p shall not exceed 4W.

6.3. Test procedure

- (1) The test according to ANSI C63.10-2013 clause 11.9.1.1.
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results.
- (3) Set the EUT as maximum power setting and enable the EUT transmit continuously.
- (4) Use the following spectrum analyzer settings for the maximum peak output power measurement:

RBW:	≥DTS bandwidth
VBW:	≥3 x RBW
Span	≥3 x RBW
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold

- (5) Allow the trace to stabilize, use peak marker function to determine the peak amplitude level.

6.4. Test result peak

Left side:

Test Mode	Antenna	Frequency [MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	EIRP[dBm]	EIRP Limit[dBm]	Verdict
BLE_1M	Ant1	2402	10.85	≤30	5.86	≤36	PASS
		2440	10.92	≤30	5.93	≤36	PASS
		2480	10.93	≤30	5.94	≤36	PASS
BLE_2M	Ant1	2404	10.94	≤30	5.95	≤36	PASS
		2440	11.02	≤30	6.03	≤36	PASS
		2478	11.02	≤30	6.03	≤36	PASS

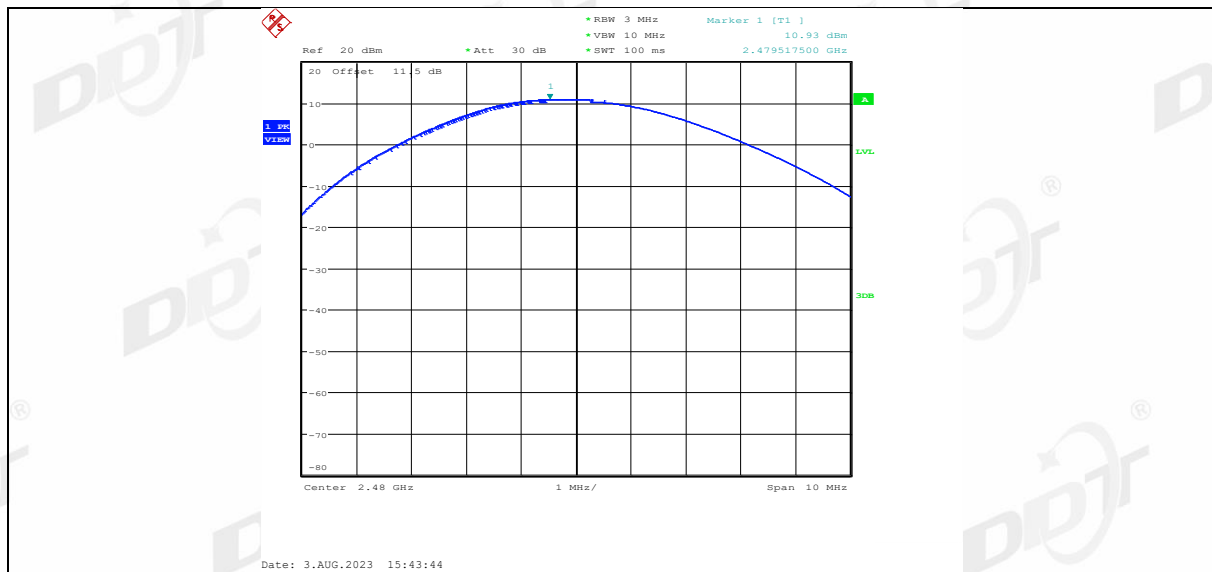
Right side:

Test Mode	Antenna	Frequency [MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	EIRP[dBm]	EIRP Limit[dBm]	Verdict
BLE_1M	Ant1	2402	10.45	≤30	9.03	≤36	PASS
		2440	10.63	≤30	9.21	≤36	PASS
		2480	10.68	≤30	9.26	≤36	PASS
BLE_2M	Ant1	2404	10.48	≤30	9.06	≤36	PASS
		2440	10.68	≤30	9.26	≤36	PASS
		2478	10.71	≤30	9.29	≤36	PASS

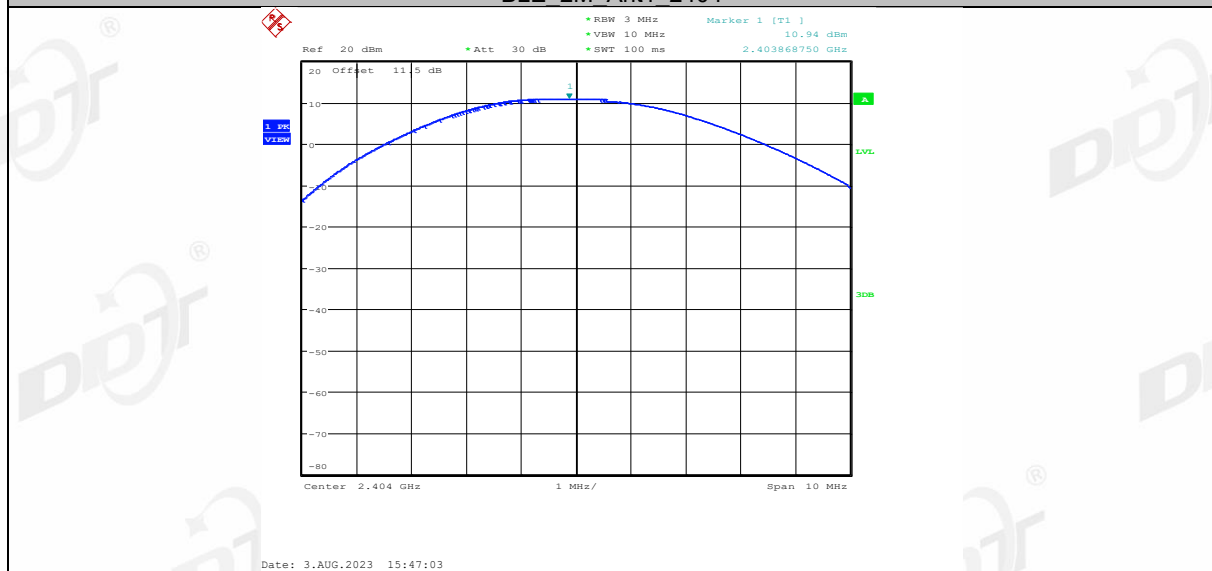
6.5. Test graphs peak

Left side:

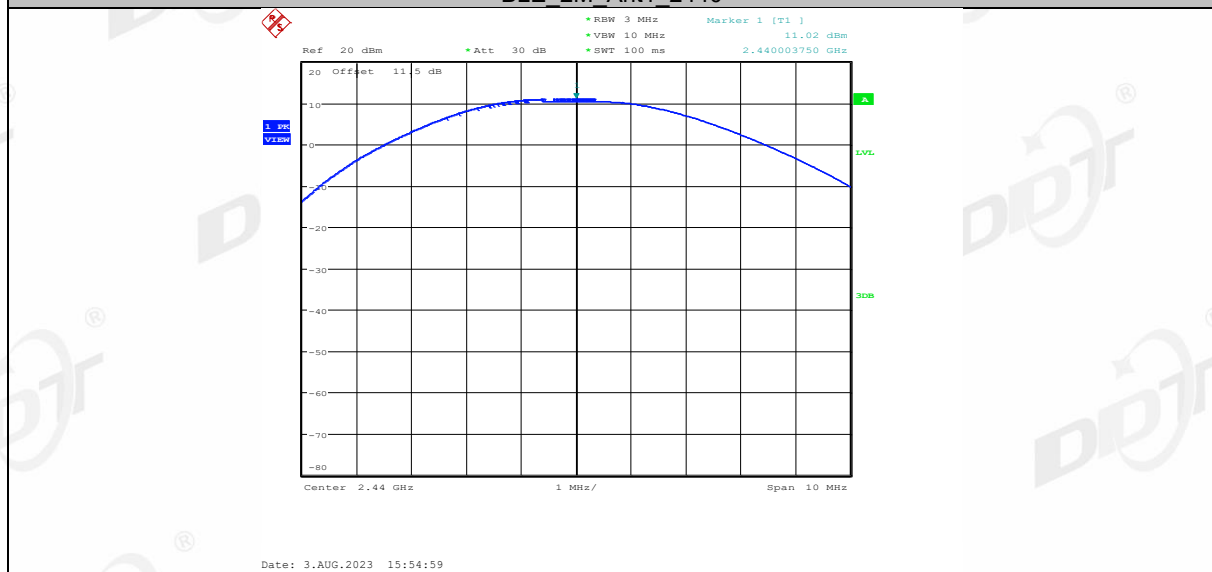




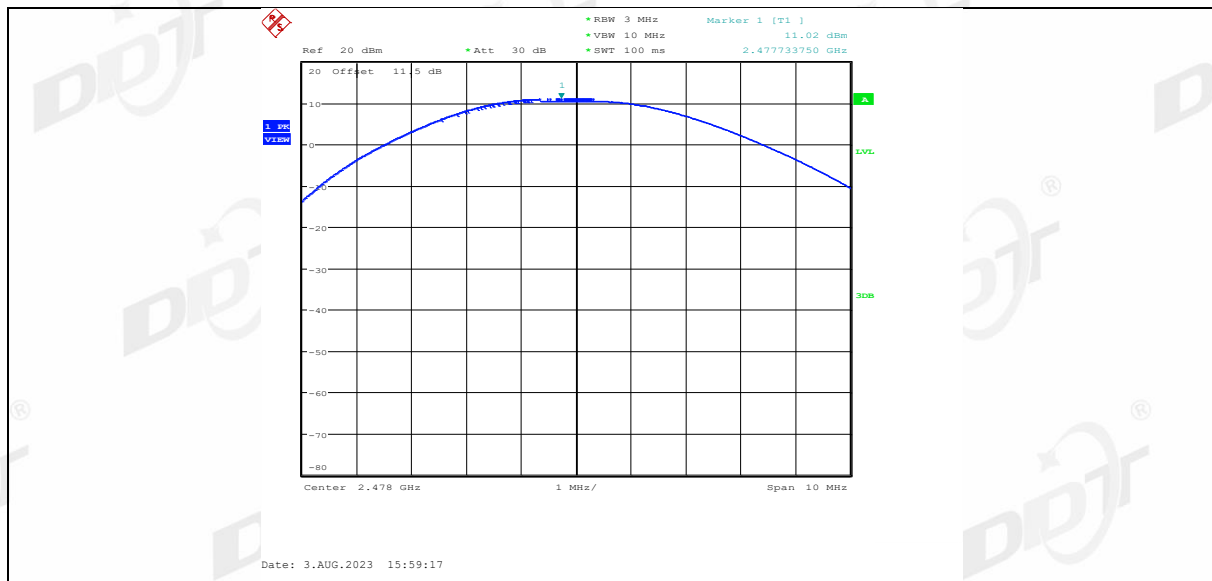
BLE 2M Ant1 2404



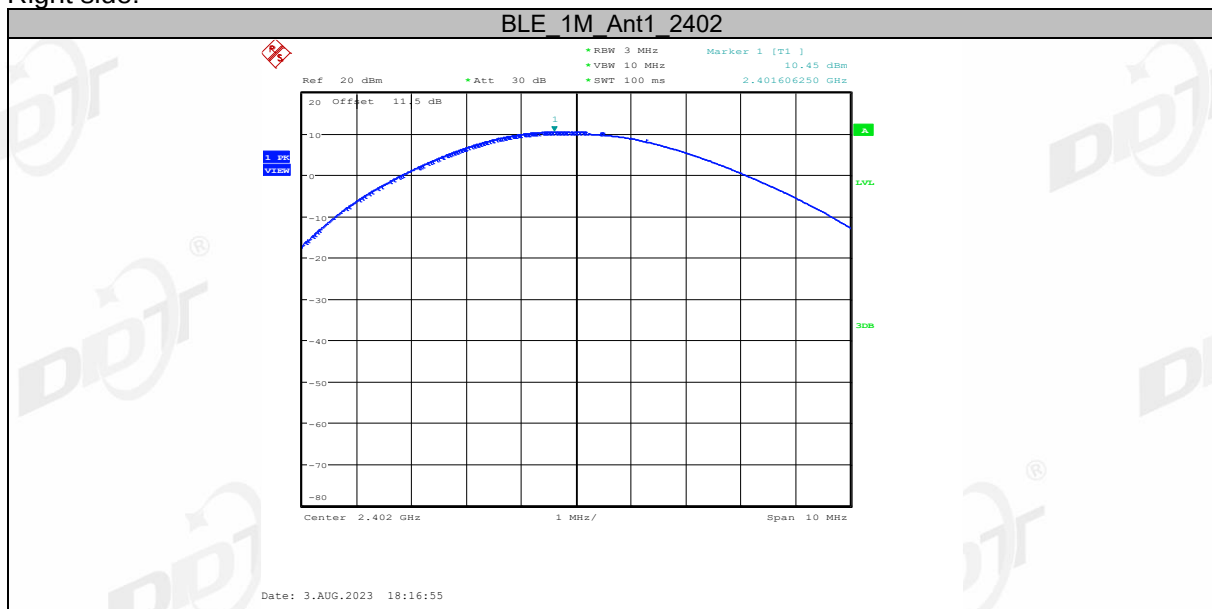
BLE 2M Ant1 2440

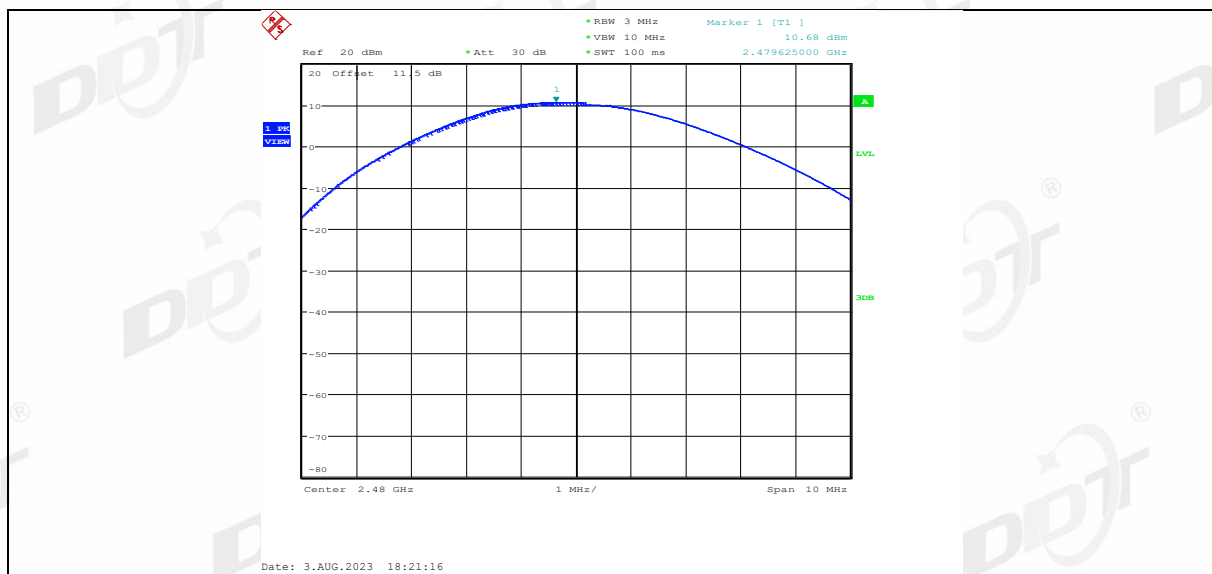


BLE 2M Ant1 2478

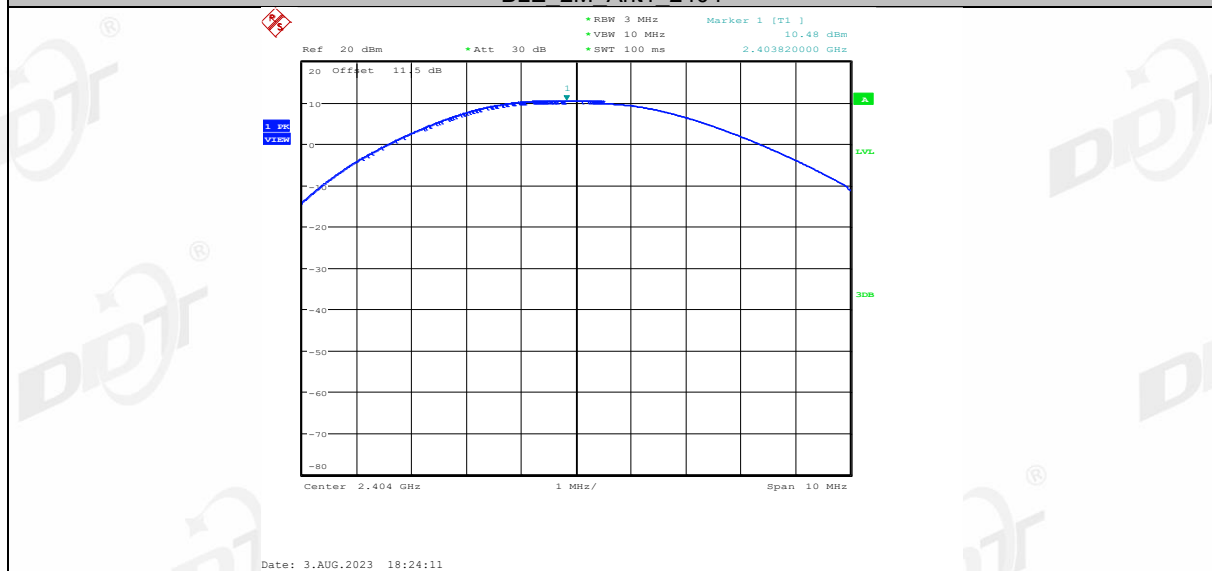


Right side:

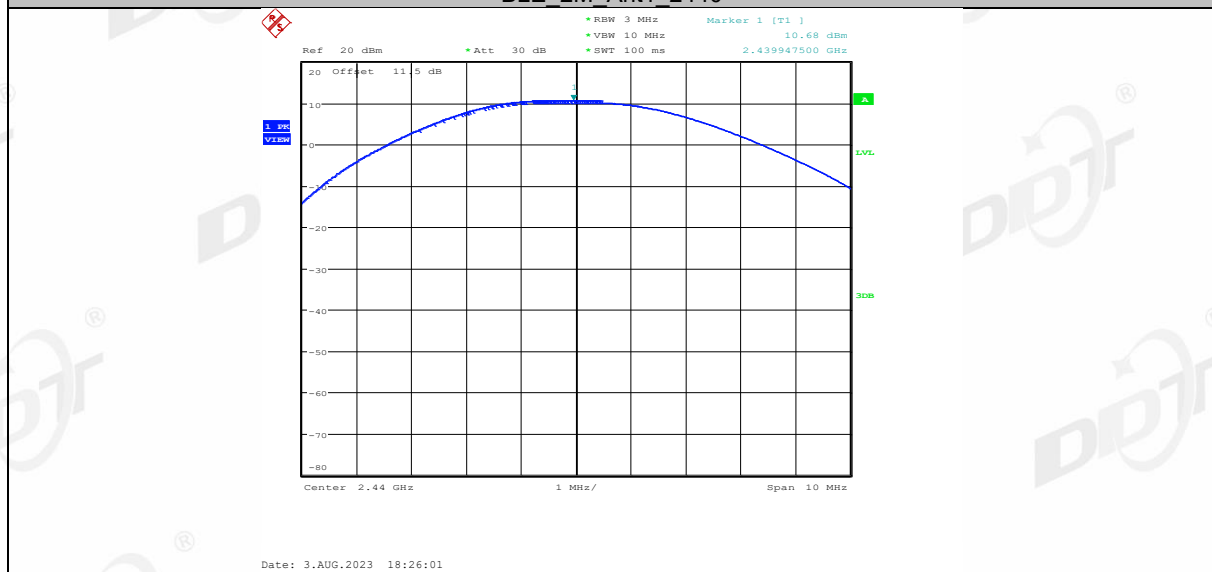




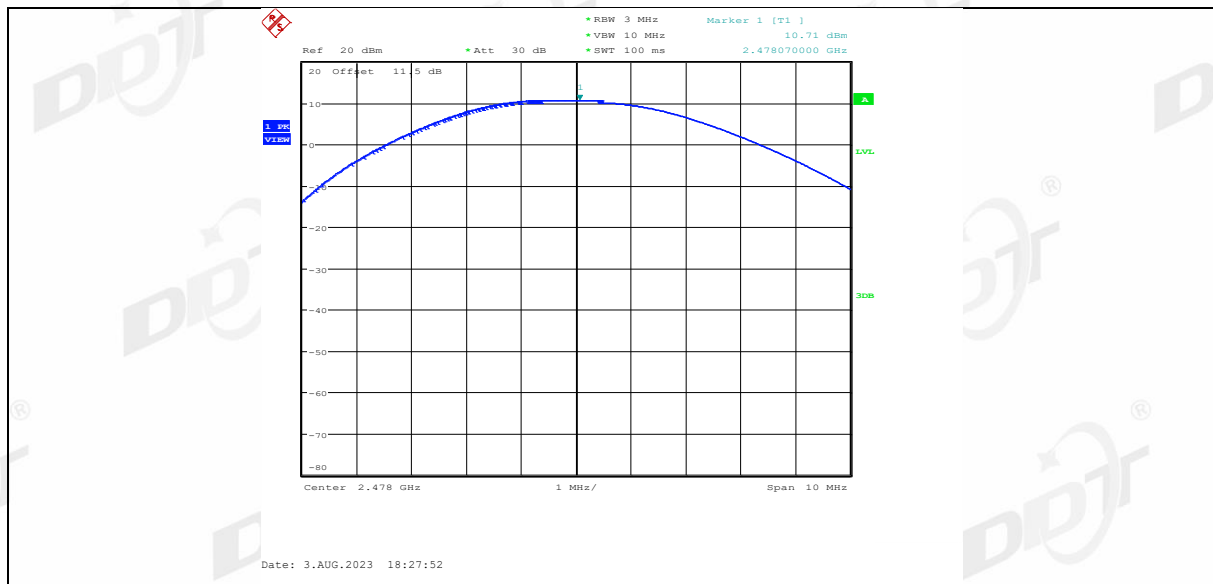
BLE 2M Ant1 2404



BLE 2M Ant1 2440

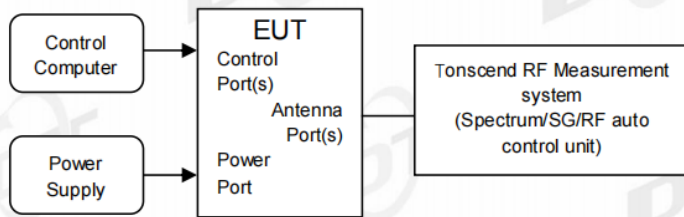


BLE 2M Ant1 2478



7. Power Spectral Density

7.1. Block diagram of test setup



7.2. Limits

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

7.3. Test procedure

- (1) The test according to ANSI C63.10-2013 clause 11.10.2.
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results.
- (3) Set the EUT as maximum power setting and enable the EUT transmit continuously.
- (4) Use the following spectrum analyzer settings for Power Spectral Density measurement:

Center frequency	DTS Channel center frequency
RBW:	$3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$
VBW:	$\geq 3\text{RBW}$
Span	1.5 times the DTS bandwidth
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold
- (5) Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

7.4. Test result

Left side:

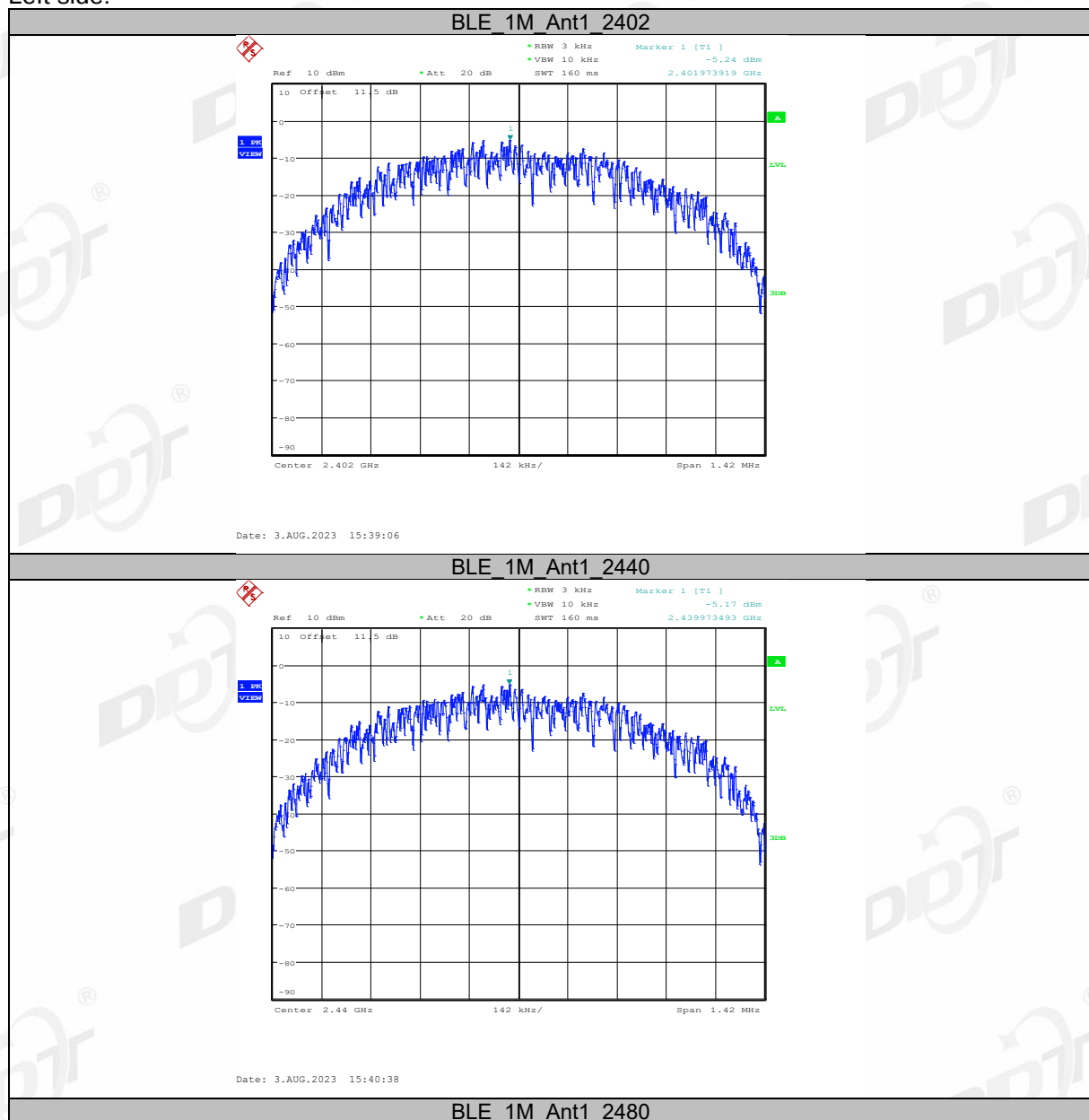
Test Mode	Antenna	Frequency [MHz]	Result [dBm/3kHz]	Limit [dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-5.24	≤ 8.00	PASS
		2440	-5.17	≤ 8.00	PASS
		2480	-5.12	≤ 8.00	PASS
BLE_2M	Ant1	2404	-7.39	≤ 8.00	PASS
		2440	-7.31	≤ 8.00	PASS
		2478	-7.33	≤ 8.00	PASS

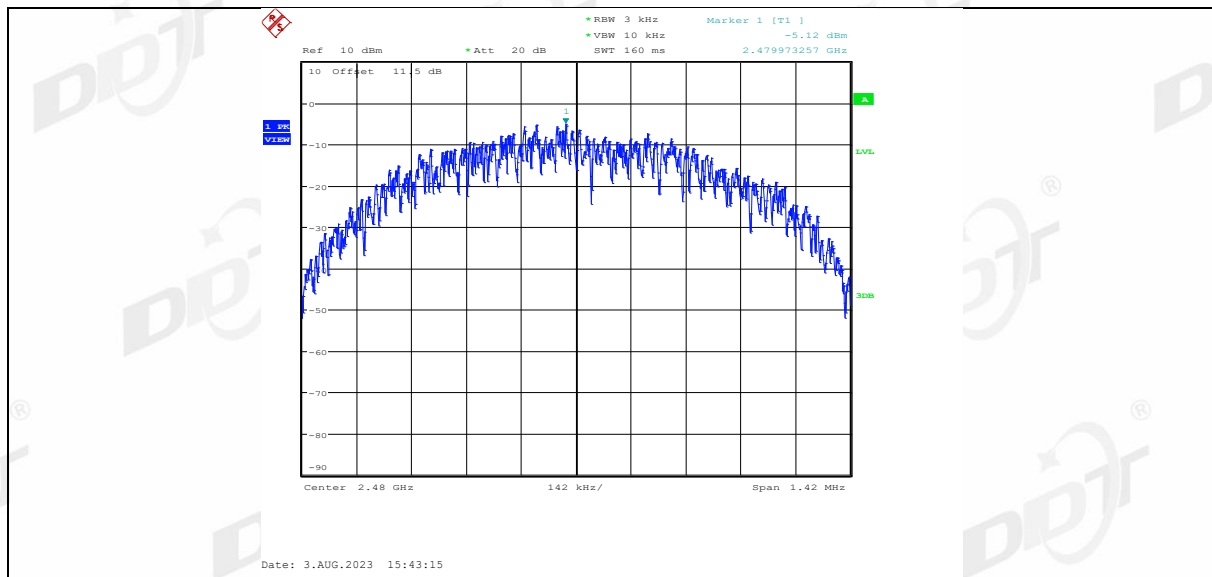
Right side:

Test Mode	Antenna	Frequency [MHz]	Result [dBm/3kHz]	Limit [dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-5.67	≤8.00	PASS
		2440	-5.42	≤8.00	PASS
		2480	-5.36	≤8.00	PASS
BLE_2M	Ant1	2404	-7.87	≤8.00	PASS
		2440	-7.77	≤8.00	PASS
		2478	-7.71	≤8.00	PASS

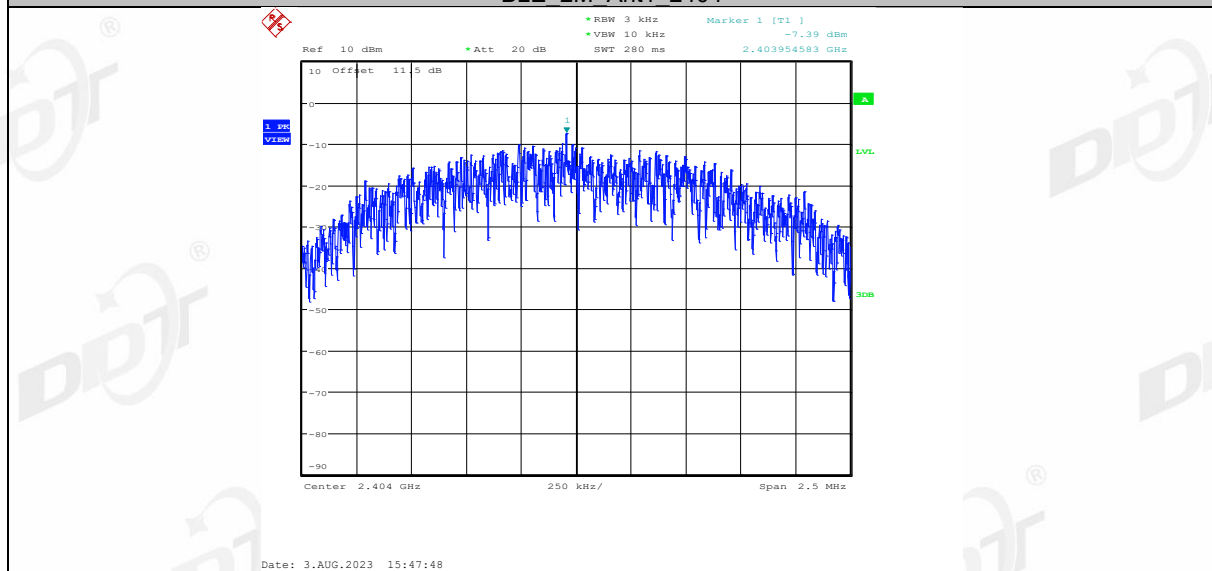
7.5. Test graphs

Left side:

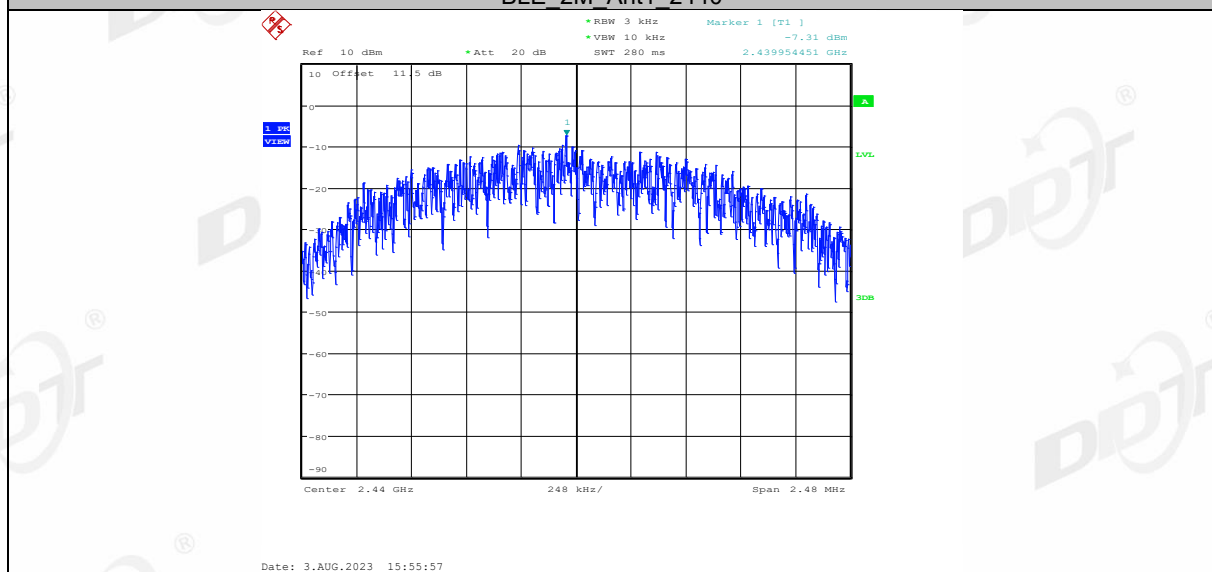




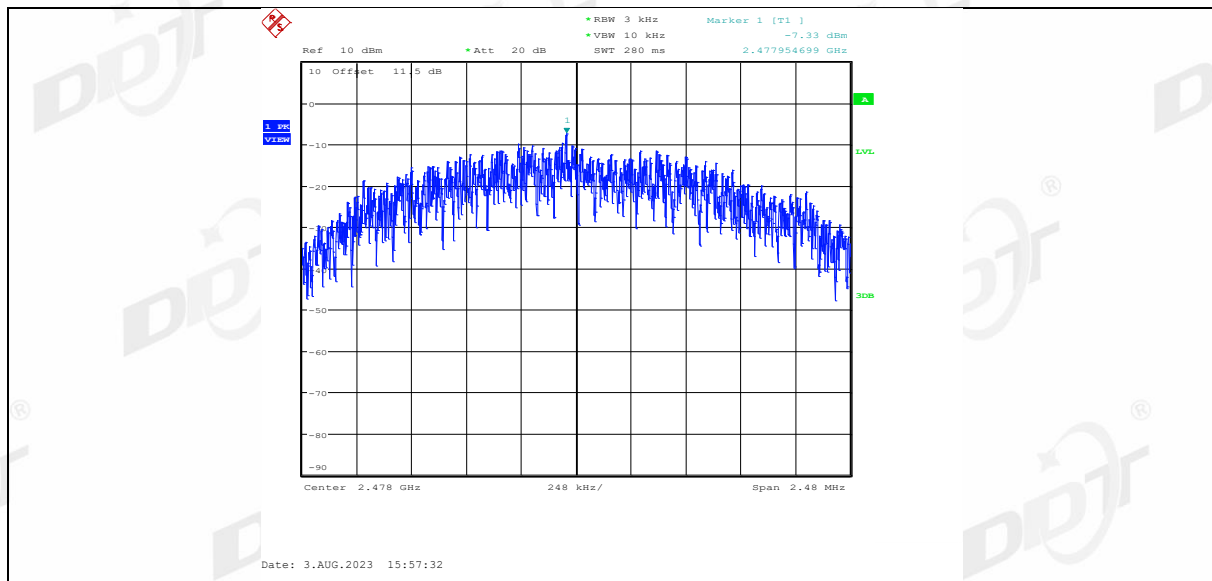
BLE 2M Ant1 2404



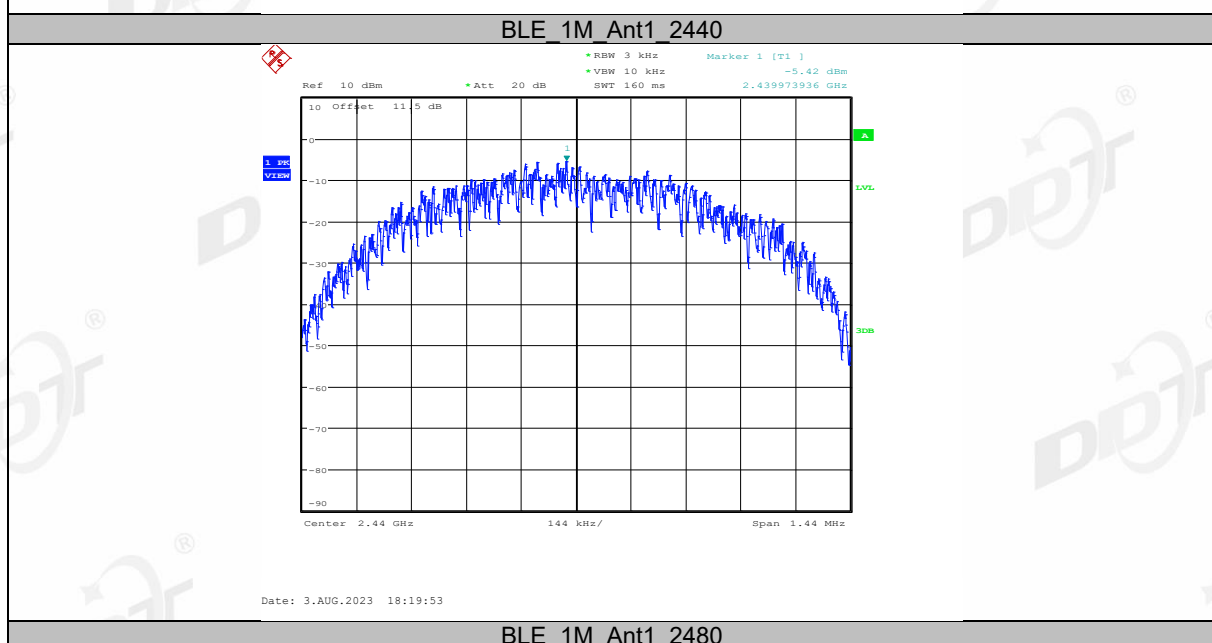
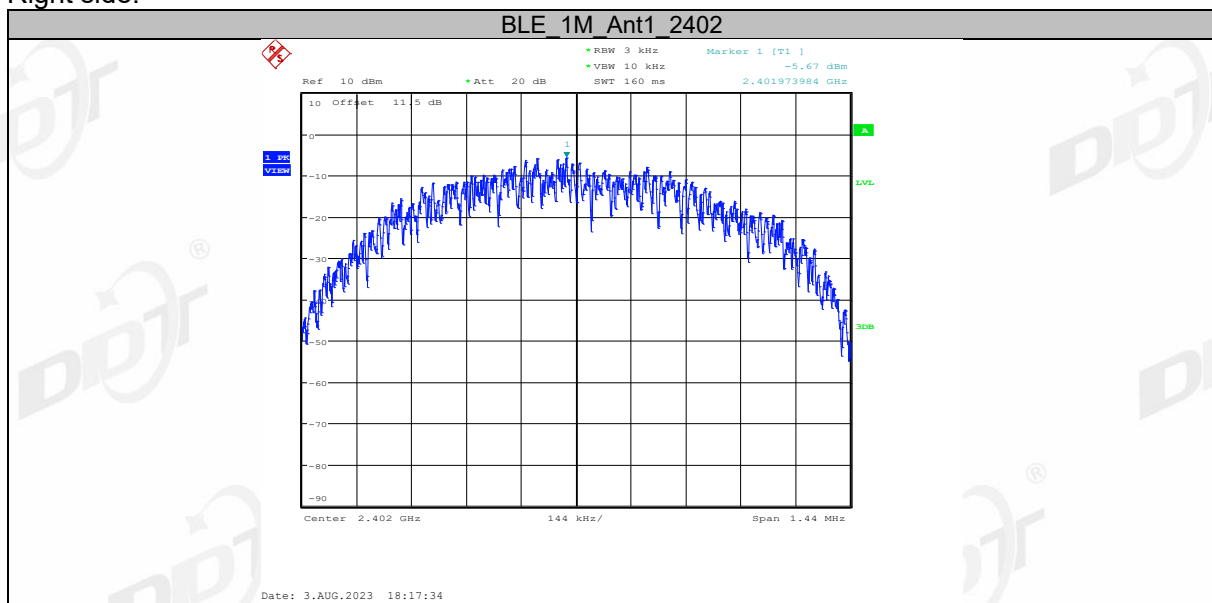
BLE 2M Ant1 2440

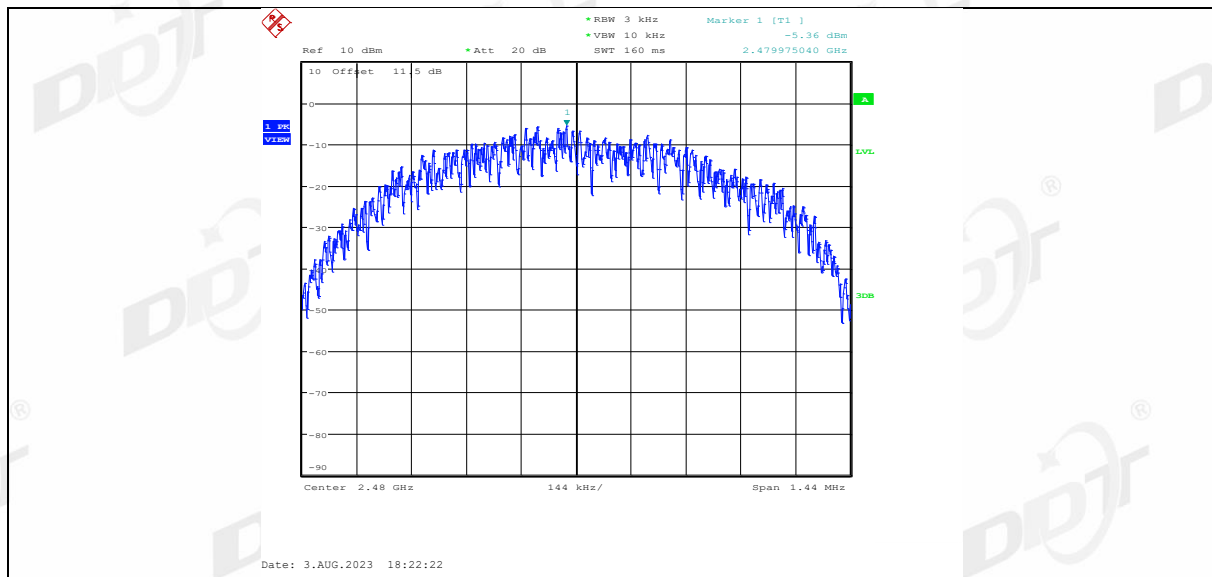


BLE 2M Ant1 2478

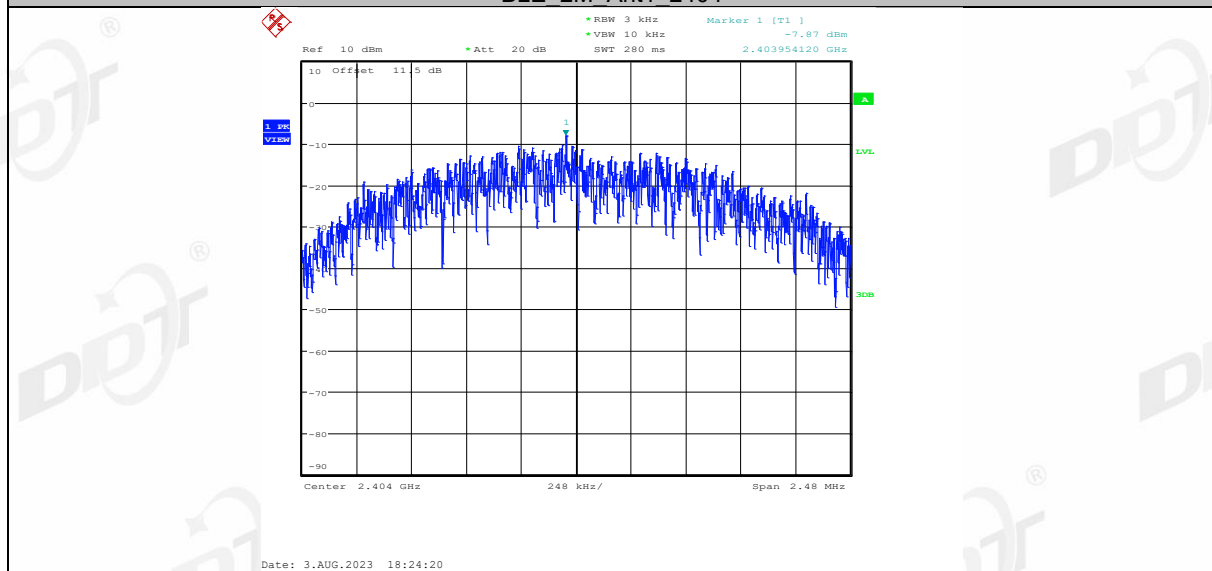


Right side:

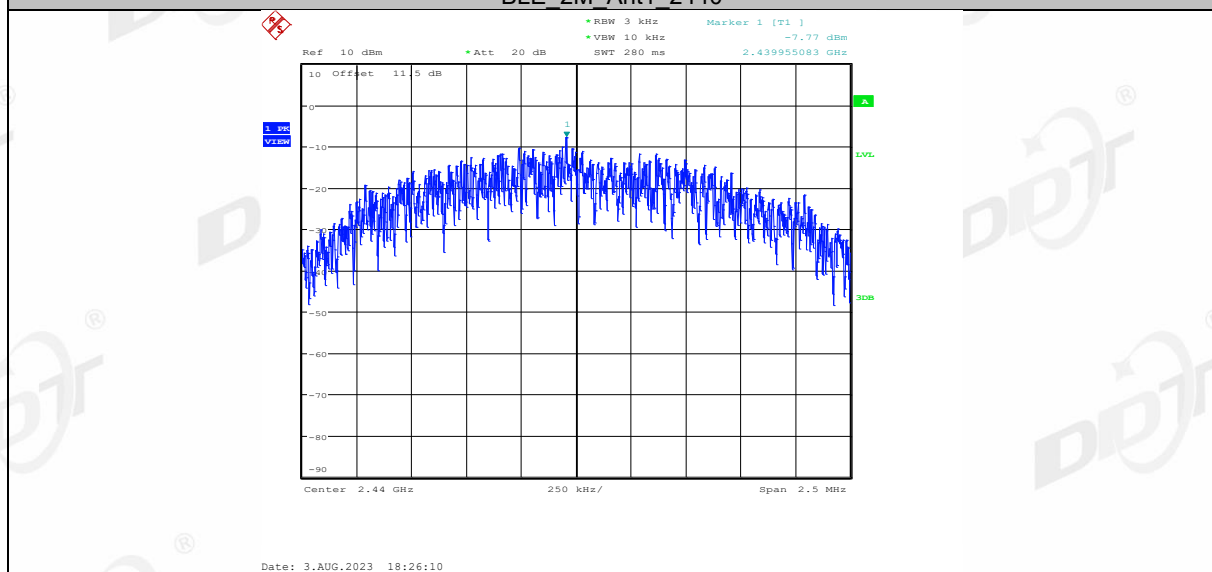




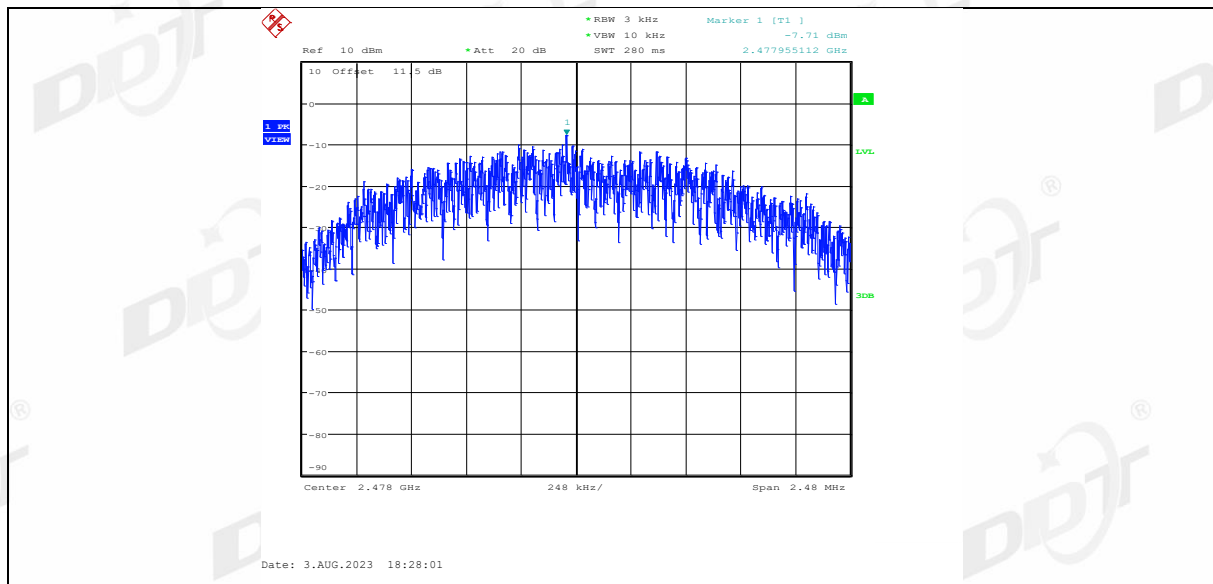
BLE 2M Ant1 2404



BLE 2M Ant1 2440

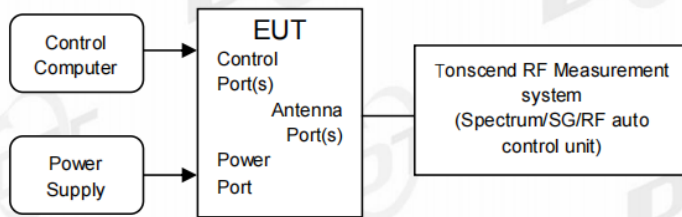


BLE 2M Ant1 2478



8. Band Edge Compliance (Conducted Method)

8.1. Block diagram of test setup



8.2. Limits

In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

8.3. Test procedure

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.

(2) Establish a reference level by using the following procedure:

RBW:	100 kHz
VBW:	300 kHz
Span	Encompass frequency range to be measured
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold

(3) Allow the trace to stabilize, use the peak marker function to determine the maximum peak power level to establish the reference level.

(4) Then mark the maximum amplitude of all unwanted emissions outside of the authorized frequency band.

8.4. Test result

Left side:

EUT Set Mode	CH or Frequency	Measured Range	Verdict
BLE1M	CH0	2.310 GHz - 2.410 GHz	Pass
	CH39	2.470 GHz - 2.500 GHz	Pass
BLE 2M	CH1	2.310 GHz - 2.410 GHz	Pass
	CH38	2.470 GHz - 2.500 GHz	Pass

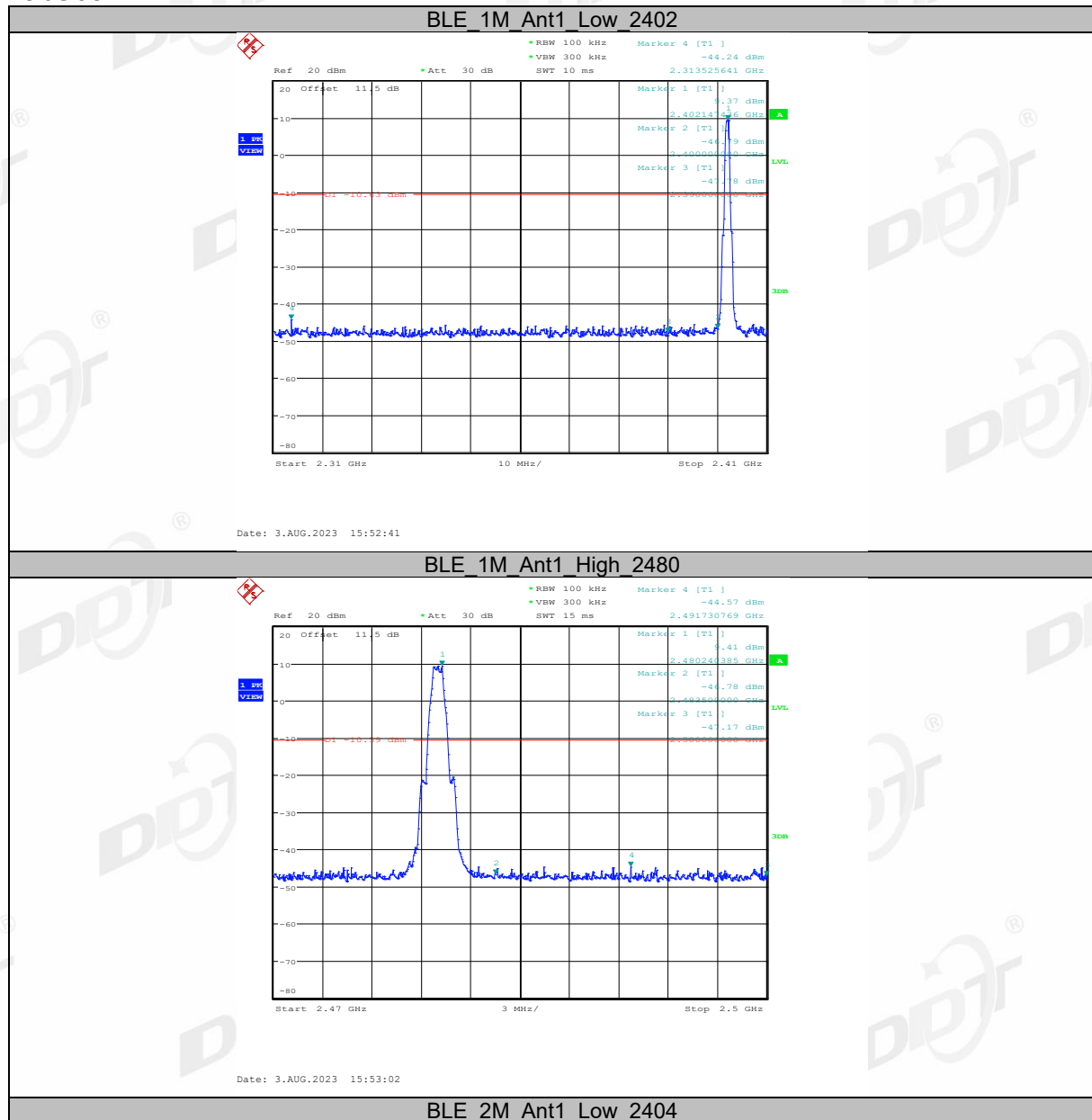
Right side:

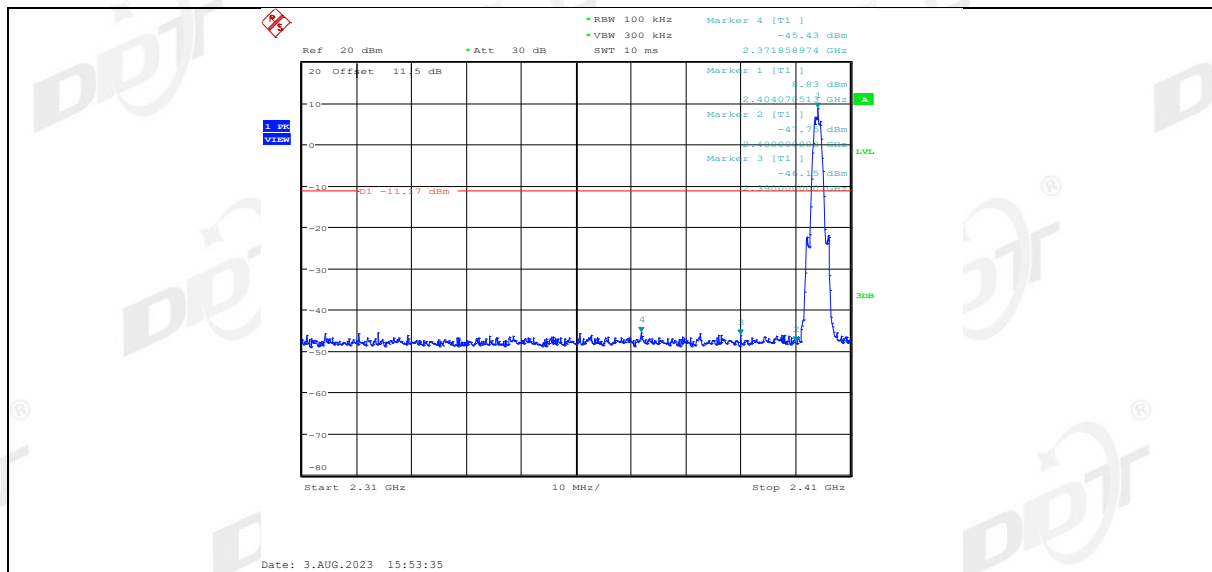
EUT Set Mode	CH or Frequency	Measured Range	Verdict
BLE1M	CH0	2.310 GHz - 2.410 GHz	Pass
	CH39	2.470 GHz - 2.500 GHz	Pass

EUT Set Mode	CH or Frequency	Measured Range	Verdict
BLE 2M	CH1	2.310 GHz - 2.410 GHz	Pass
	CH38	2.470 GHz - 2.500 GHz	Pass

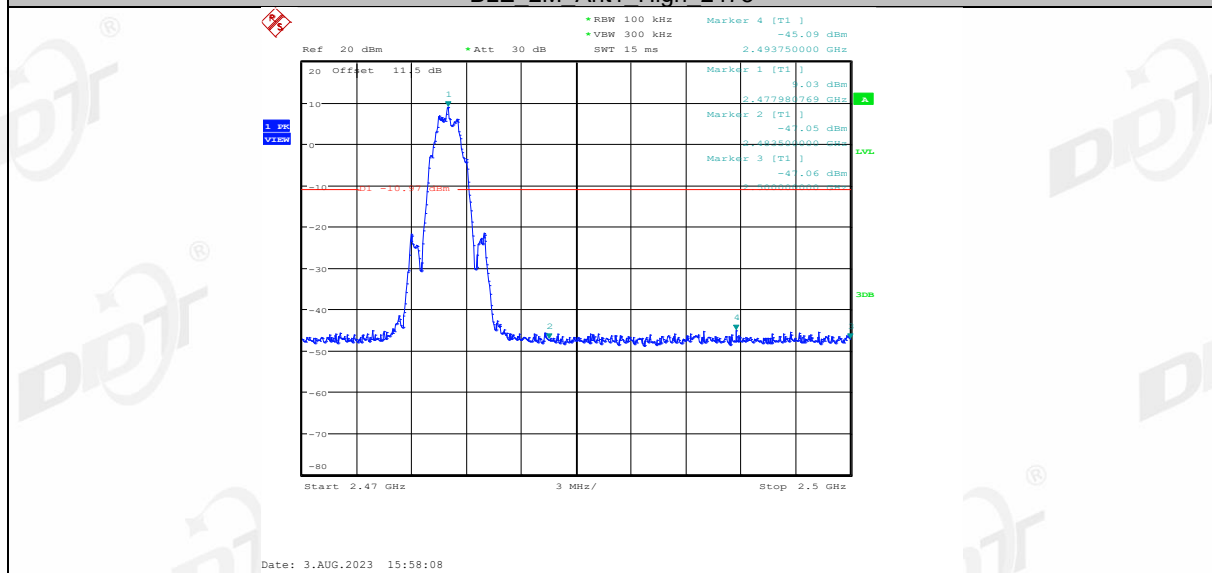
8.5. Test graphs

Left side:



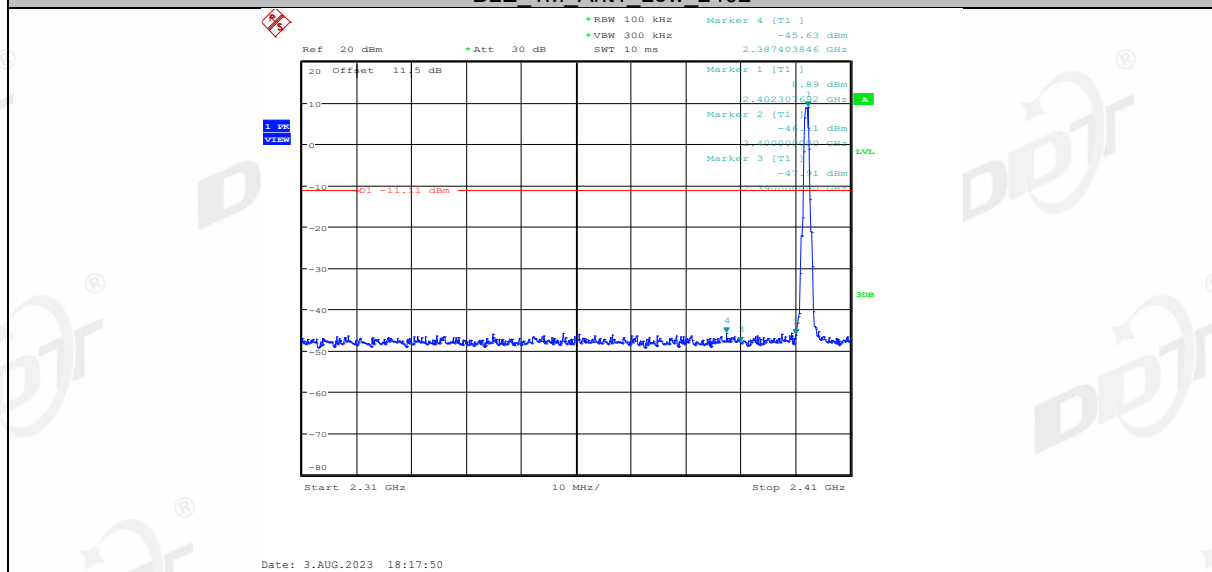


BLE 2M Ant1 High 2478

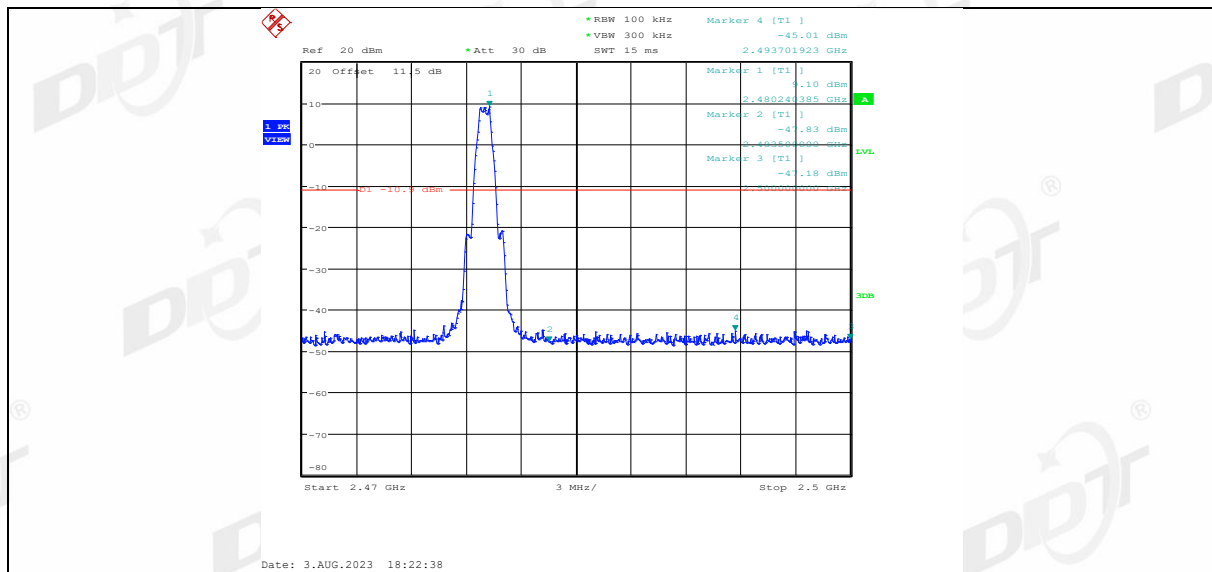


Right side:

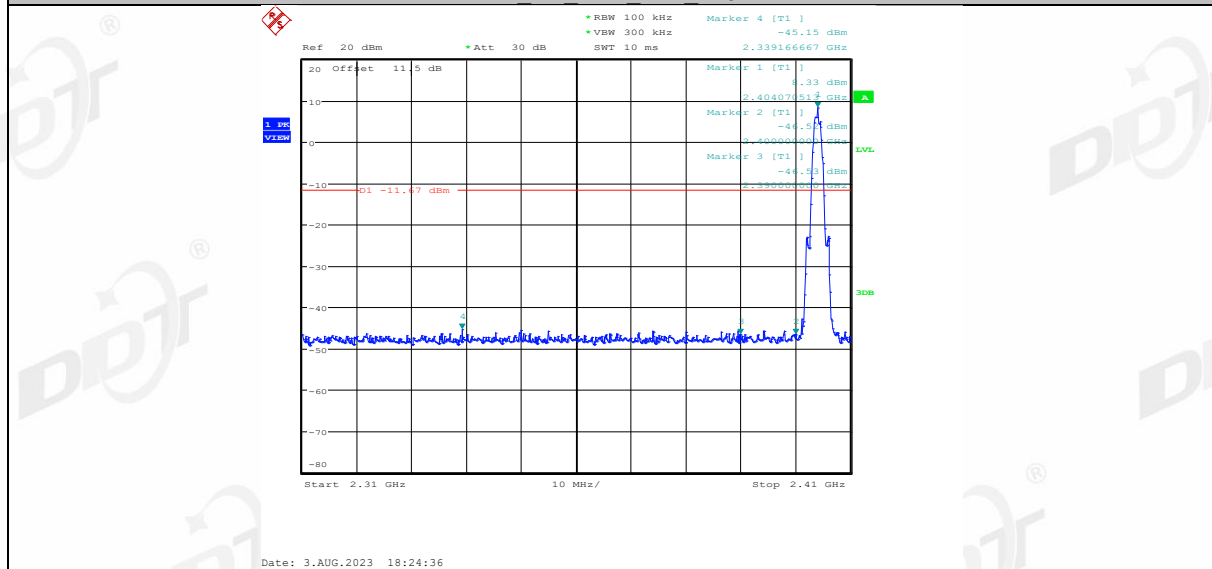
BLE 1M Ant1 Low 2402



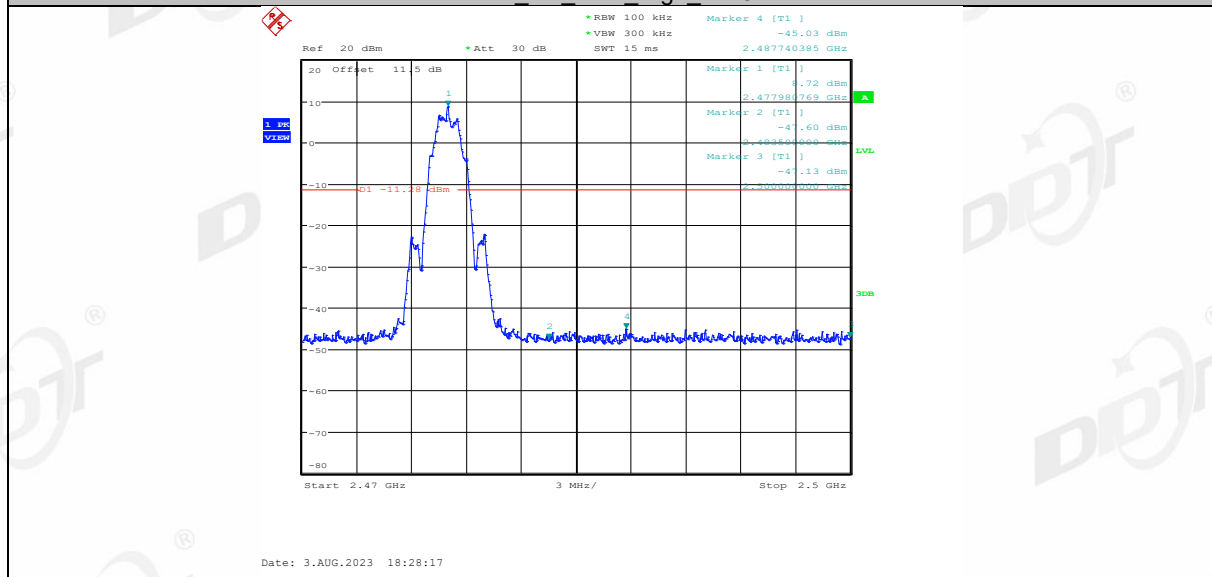
BLE 1M Ant1 High 2480



BLE 2M Ant1 Low 2404

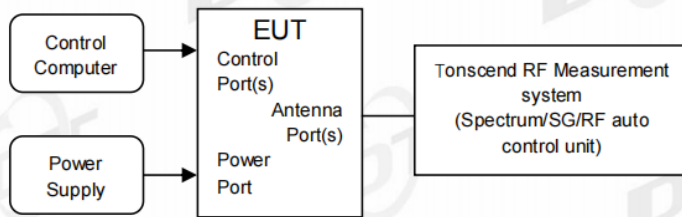


BLE 2M Ant1 High 2478



9. RF Conducted Spurious Emissions

9.1. Block diagram of test setup



9.2. Limits

In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

9.3. Test procedure

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.

(2) Establish a reference level by using the following procedure:

Center frequency	Test frequency
RBW:	100 kHz
VBW:	300 kHz
Span	Wide enough to capture the peak level of the in-band emission
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold

(3) Allow the trace to stabilize, use the peak marker function to determine the maximum peak power level to establish the reference level.

(4) Set the spectrum analyzer as follows:

RBW:	100 kHz
VBW:	300 kHz
Span	Encompass frequency range to be measured
Number of measurement points	$\geq \text{span/RBW}$
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold

Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude of all unwanted emissions outside of the authorized frequency band

9.4. Test result

Left side:

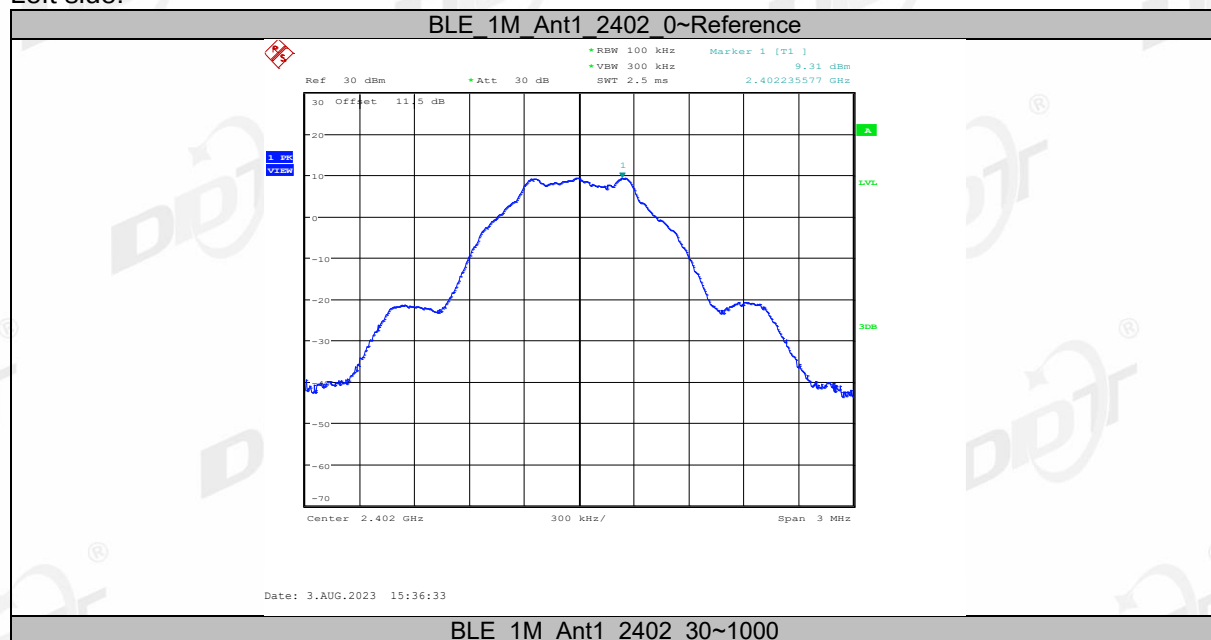
Mode	Freq. (MHz)	Verdict
GFSK 1M	2402	Pass
	2440	Pass
	2480	Pass
GFSK 2M	2404	Pass
	2440	Pass
	2478	Pass

Right side:

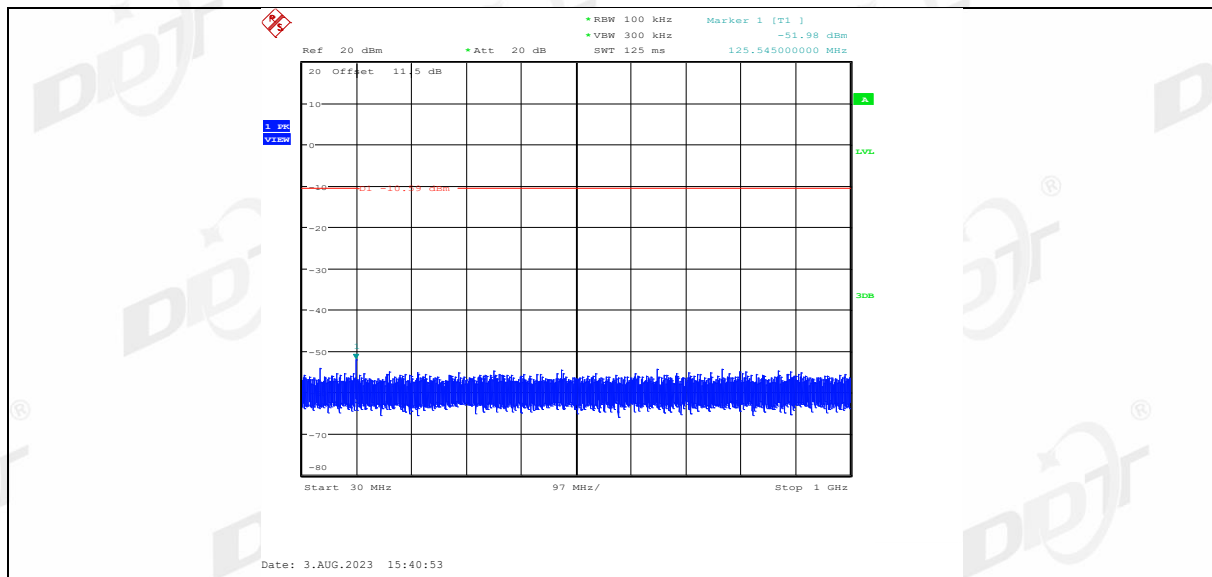
Mode	Freq. (MHz)	Verdict
GFSK 1M	2402	Pass
	2440	Pass
	2480	Pass
GFSK 2M	2404	Pass
	2440	Pass
	2478	Pass

9.5. Test graphs

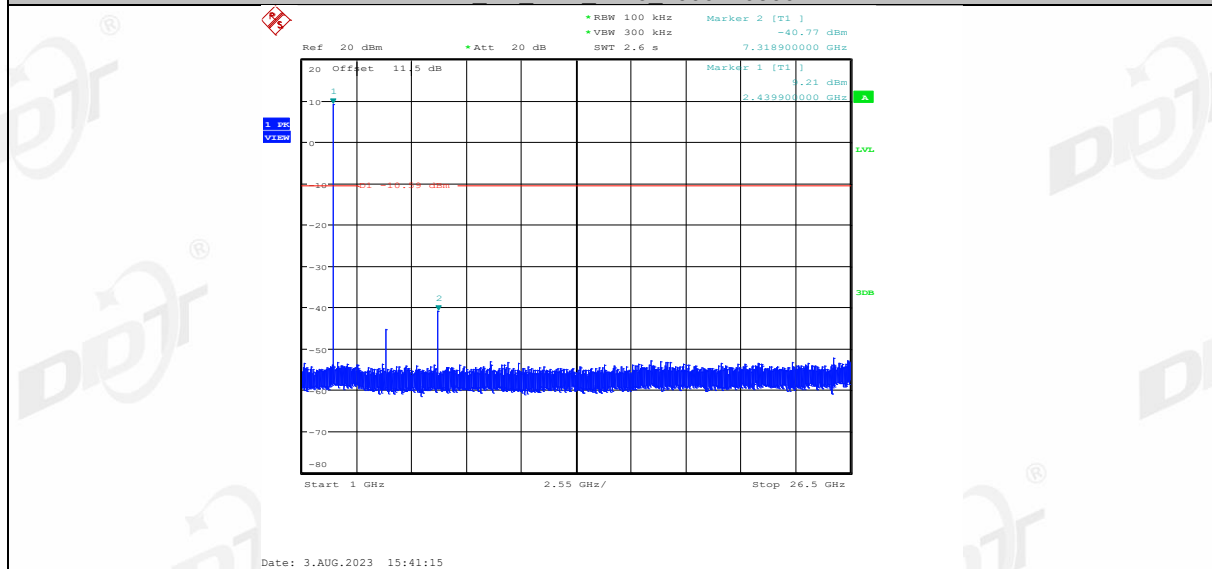
Left side:



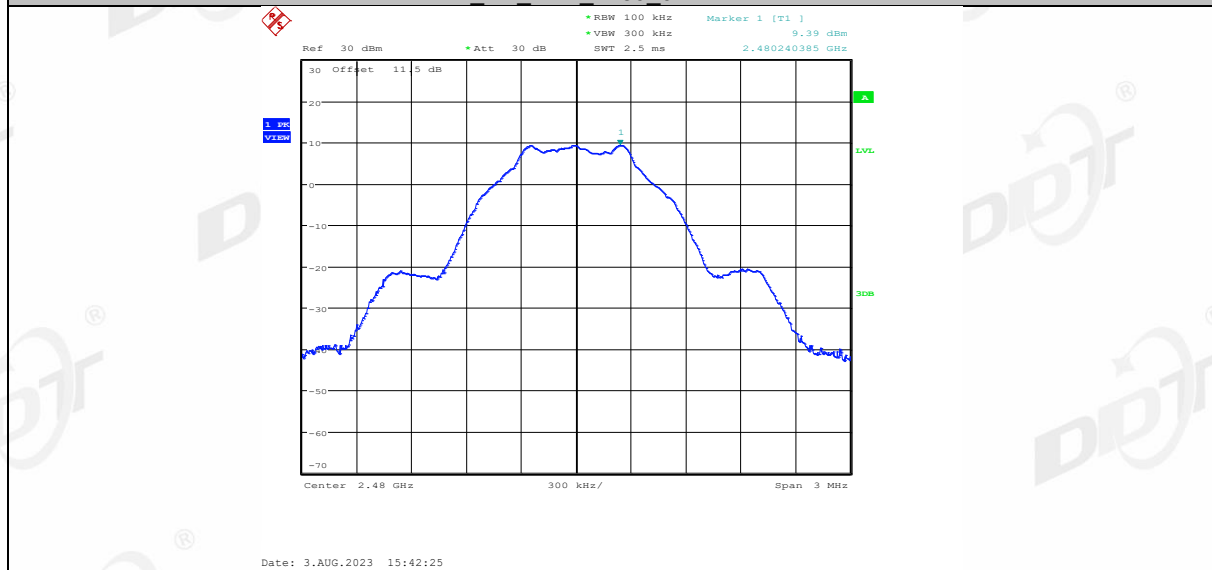




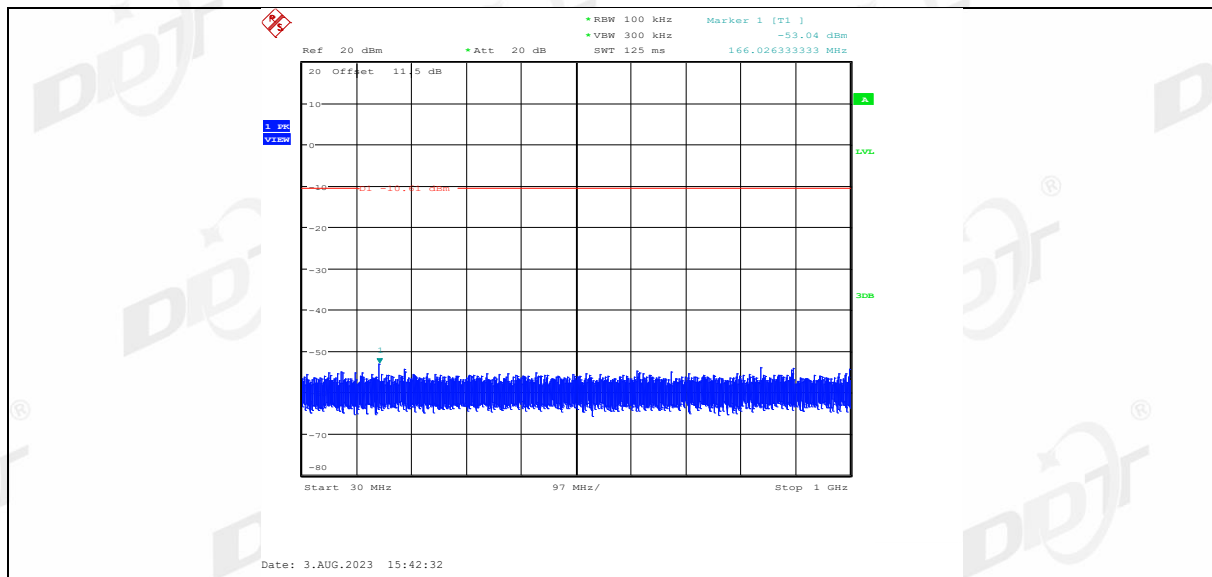
BLE 1M Ant1 2440 1000~26500



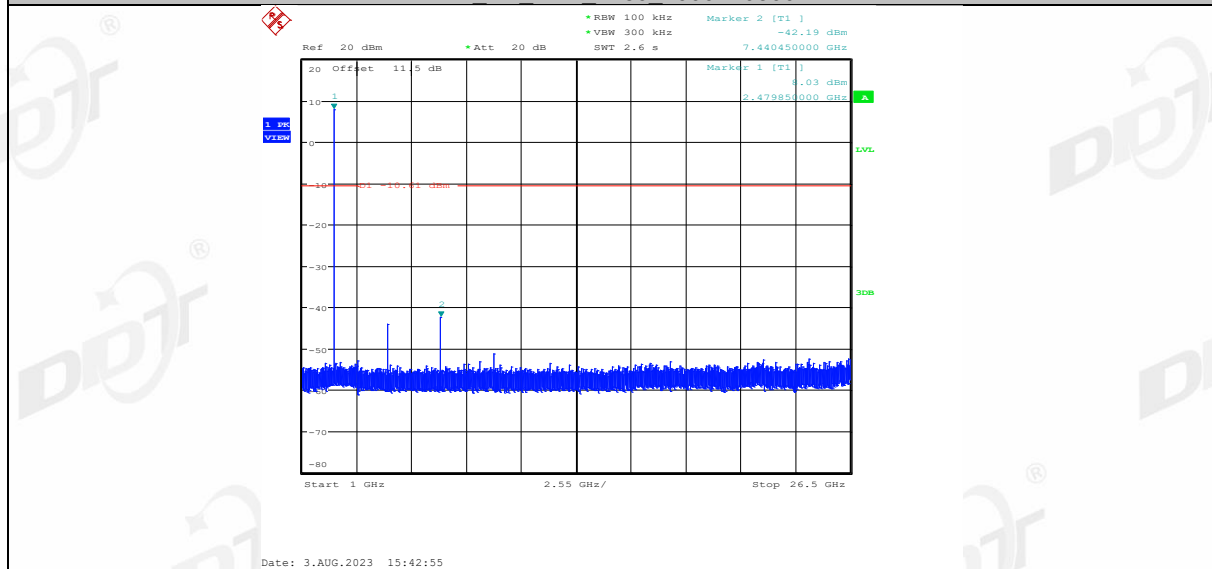
BLE 1M Ant1 2480 0~Reference



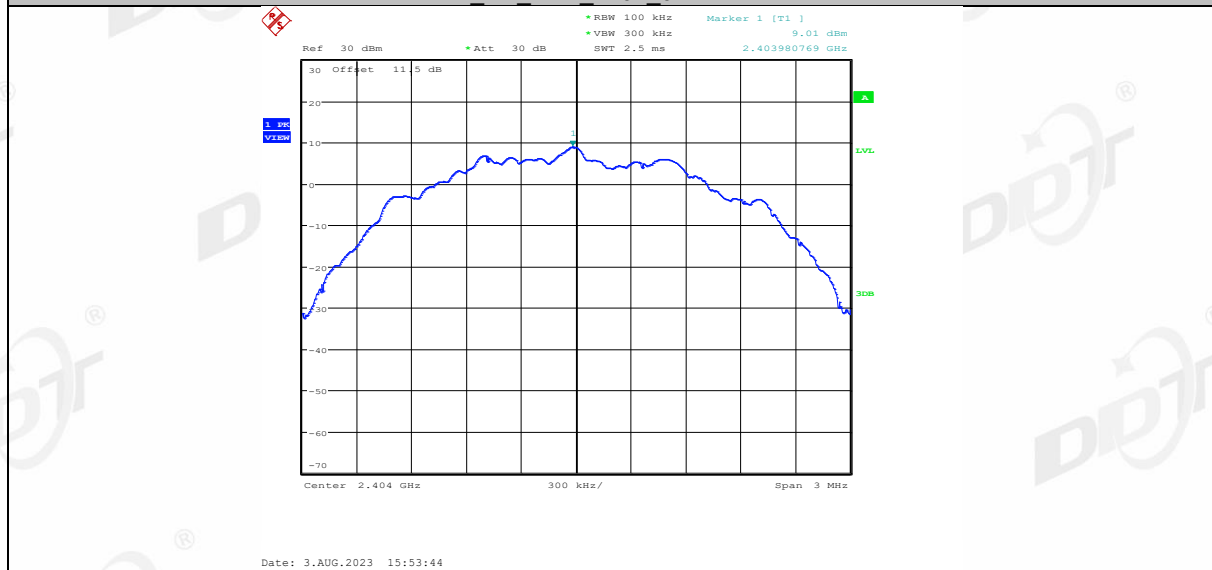
BLE 1M Ant1 2480 30~1000



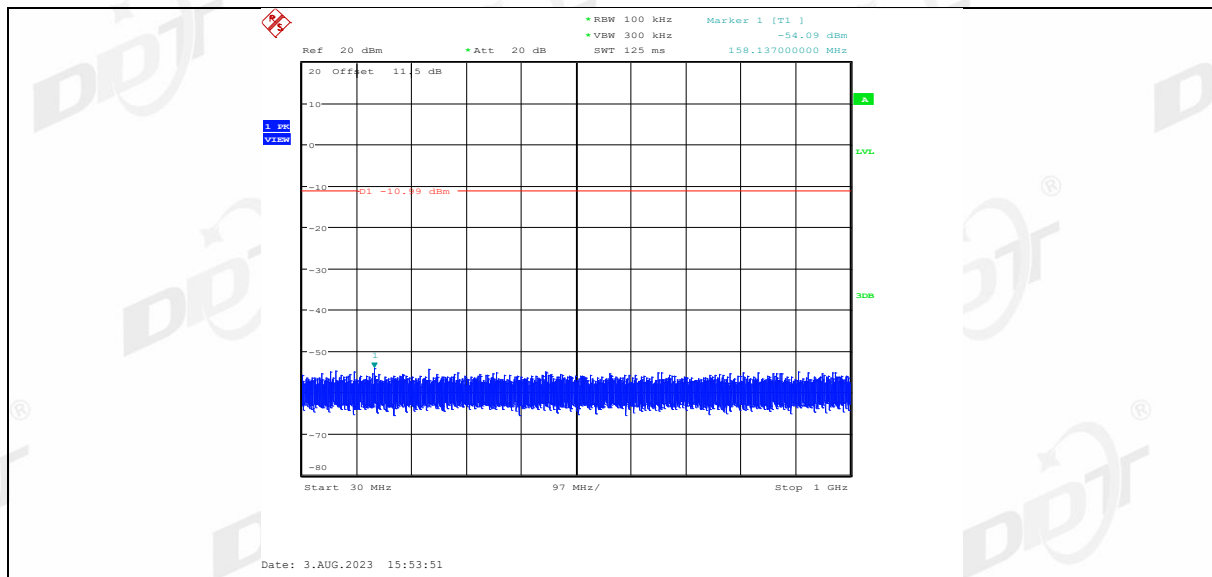
BLE 1M Ant1 2480 1000~26500



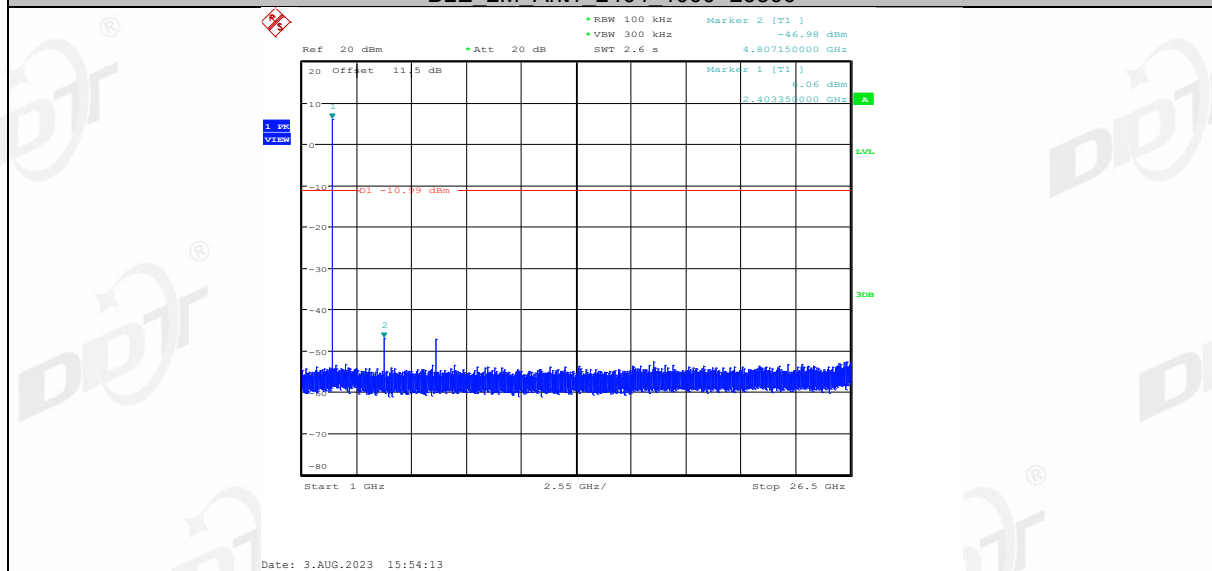
BLE 2M Ant1 2404 0~Reference



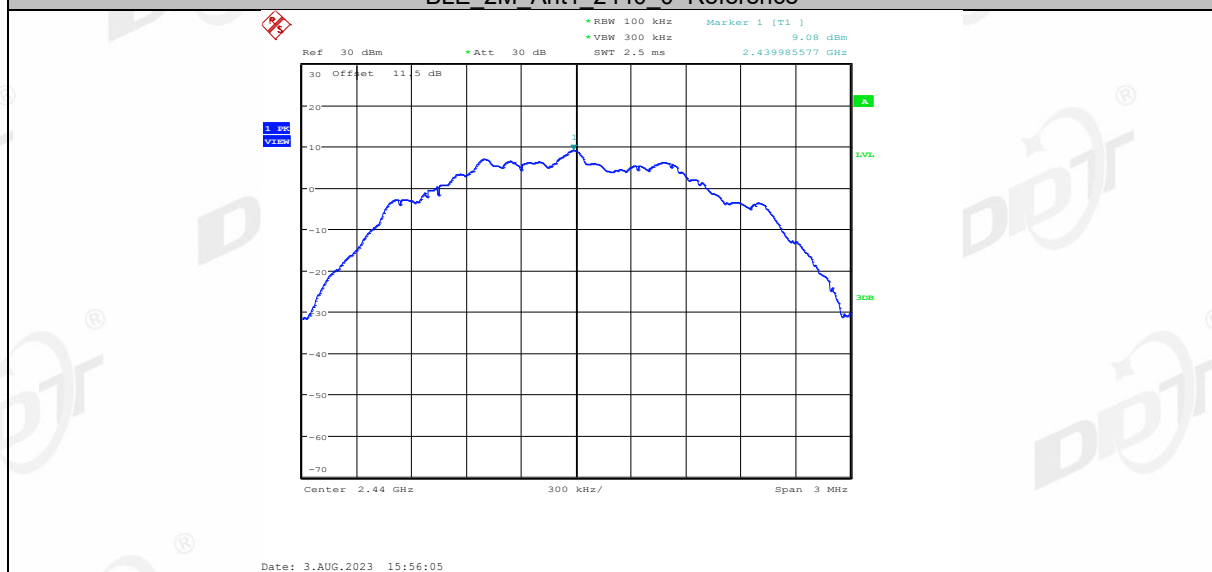
BLE 2M Ant1 2404 30~1000



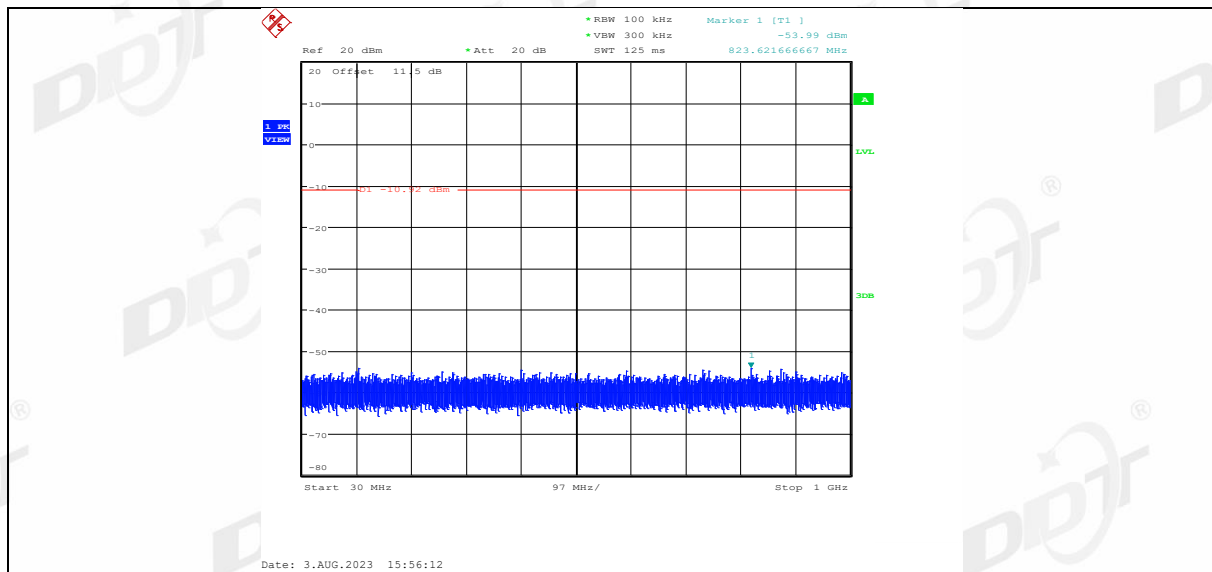
BLE 2M Ant1 2404 1000~26500



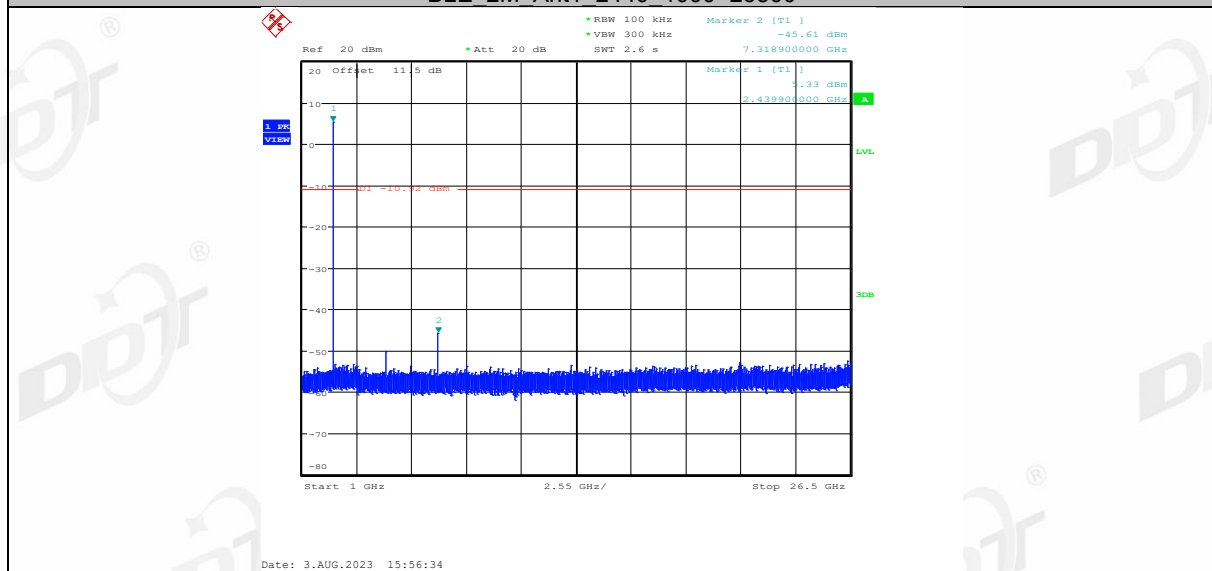
BLE 2M Ant1 2440 0~Reference



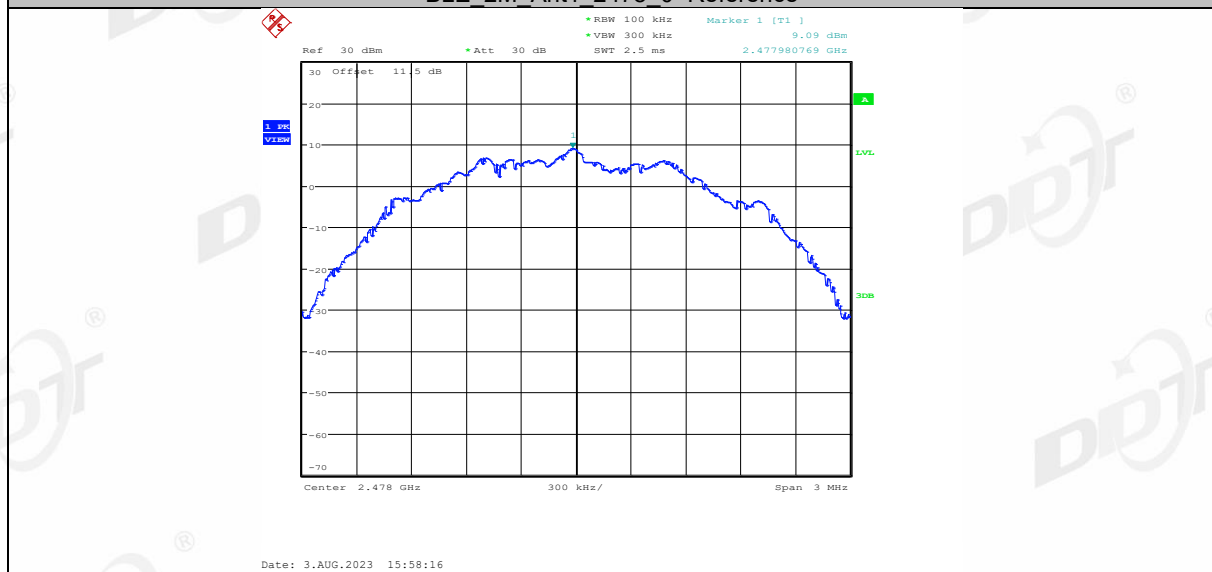
BLE 2M Ant1 2440 30~1000



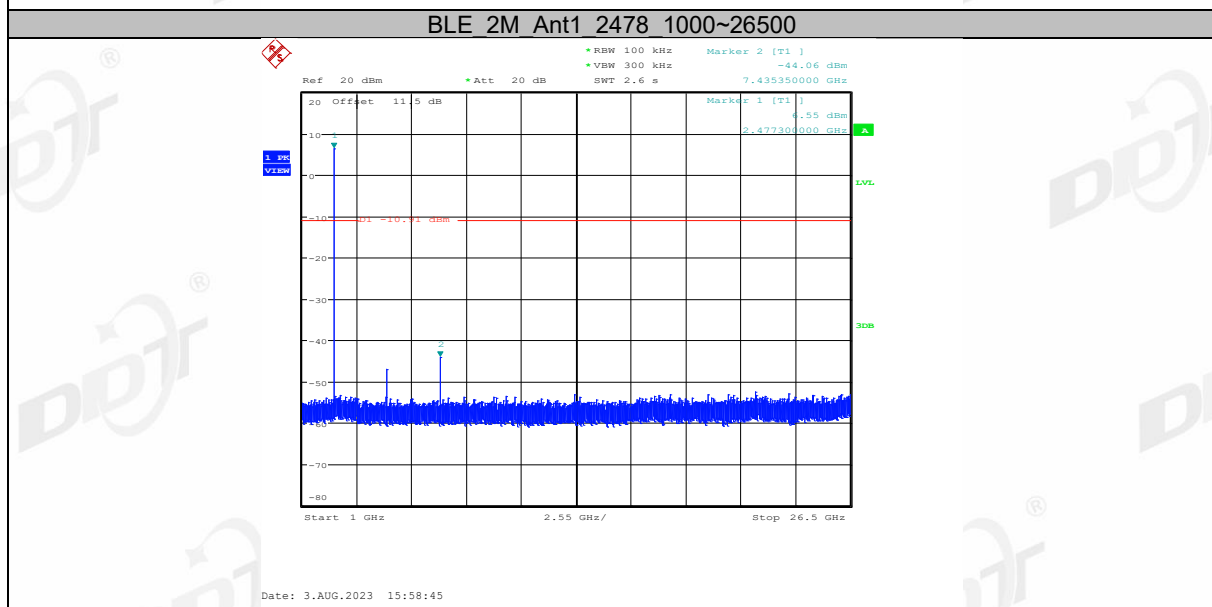
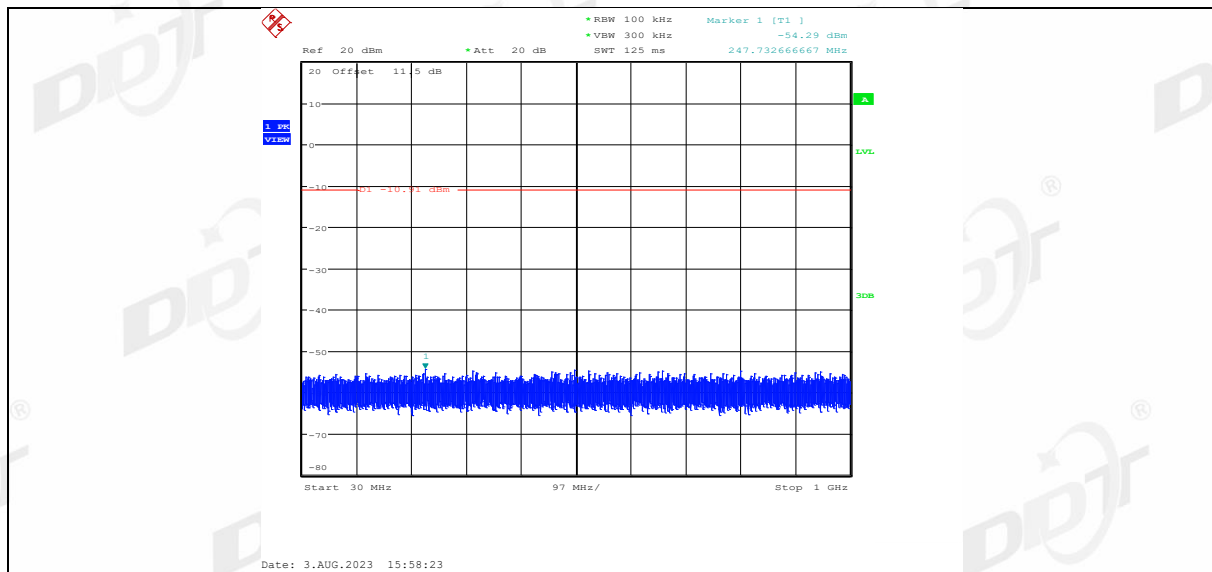
BLE 2M Ant1 2440 1000~26500



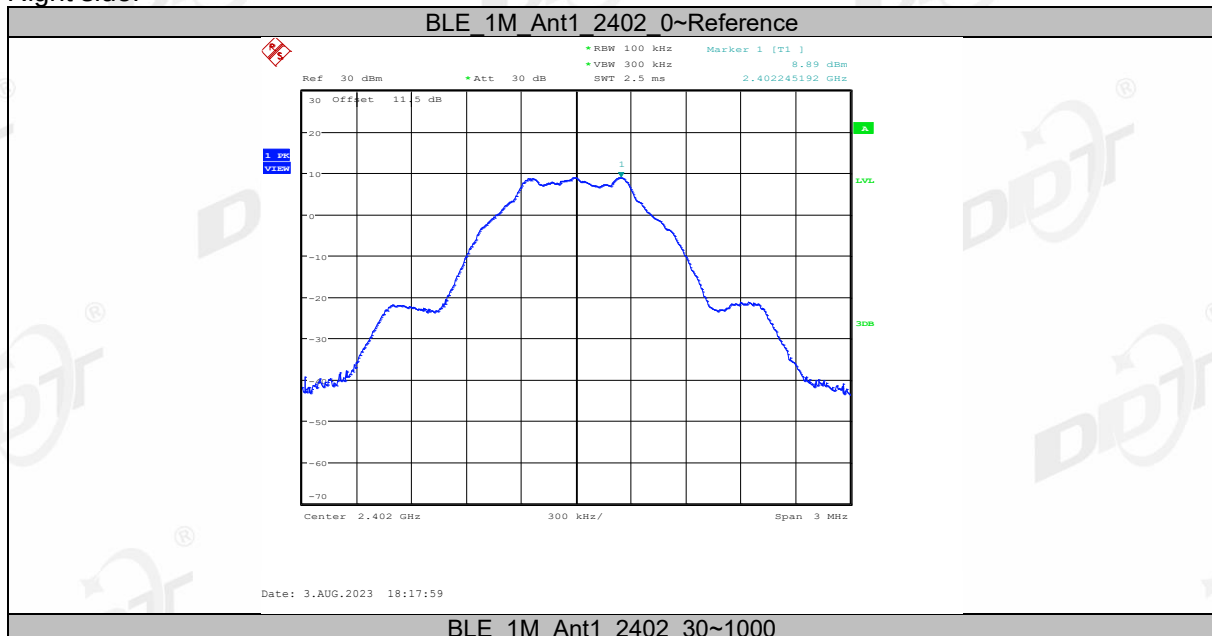
BLE 2M Ant1 2478 0~Reference

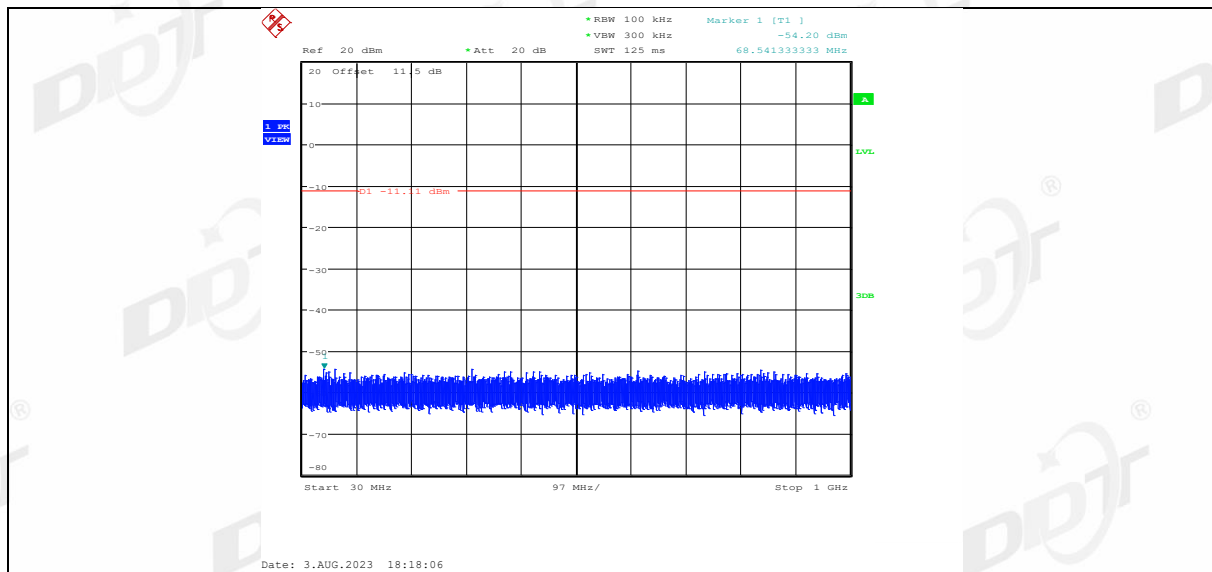


BLE 2M Ant1 2478 30~1000

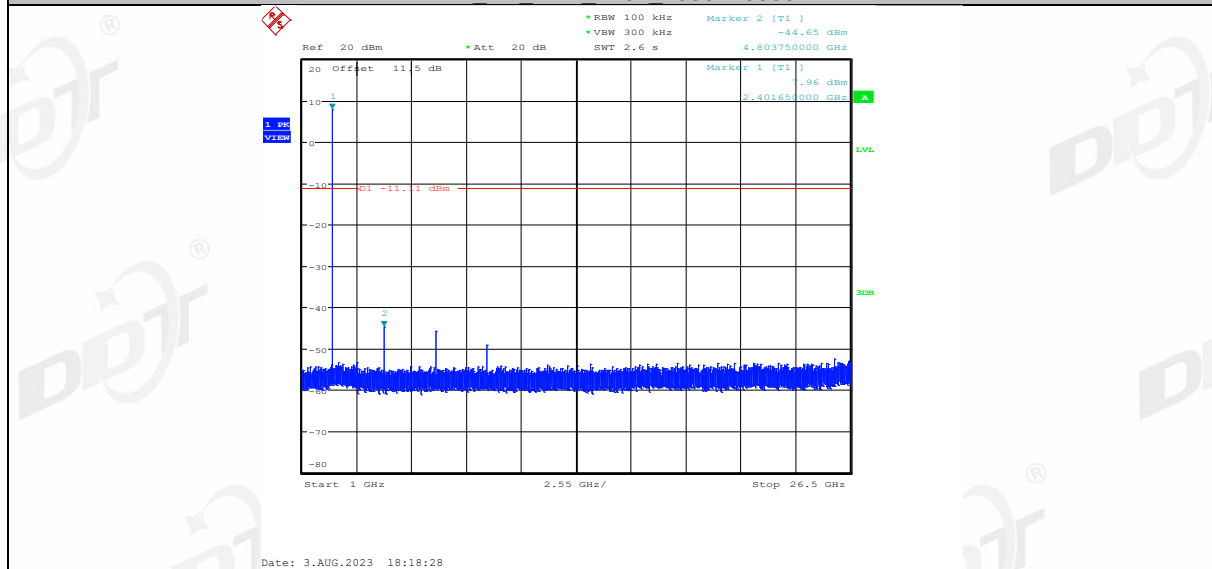


Right side:

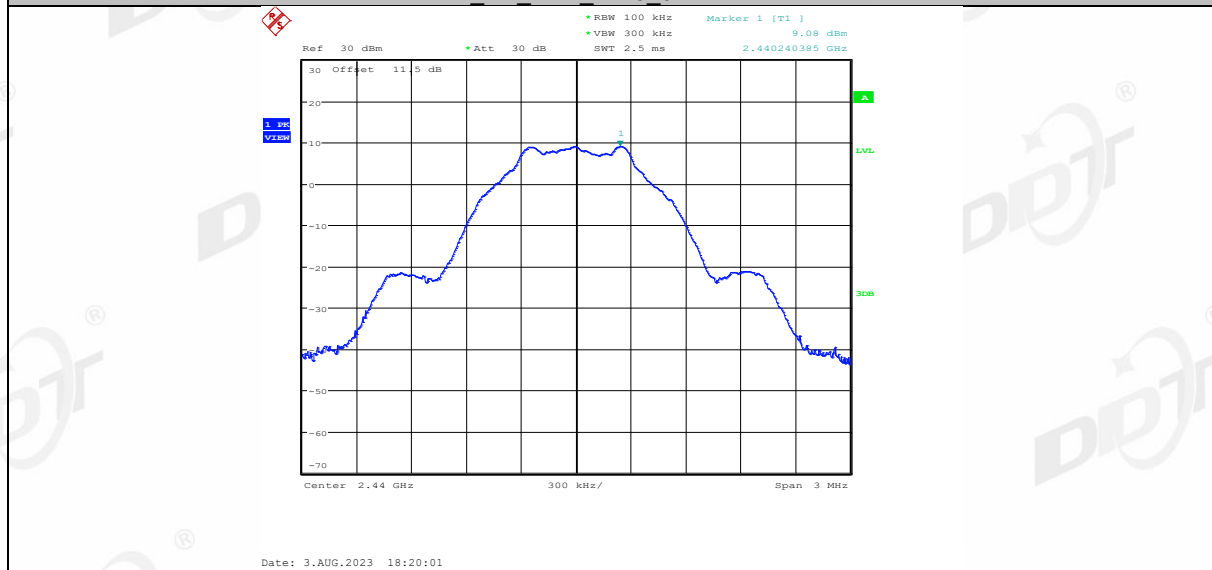




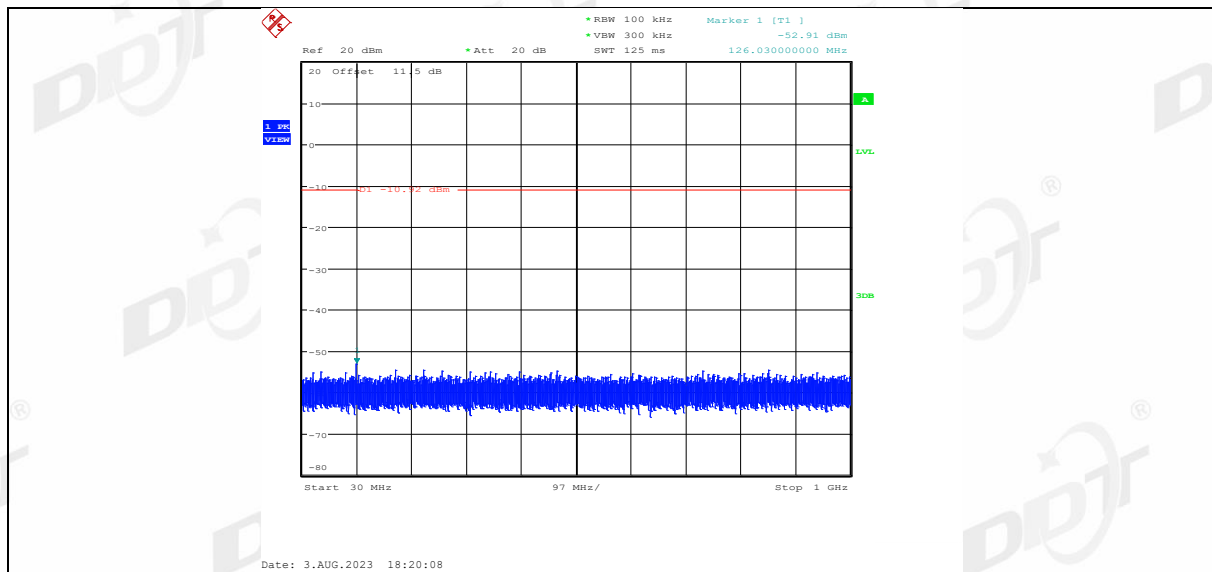
BLE 1M Ant1 2402 1000~26500



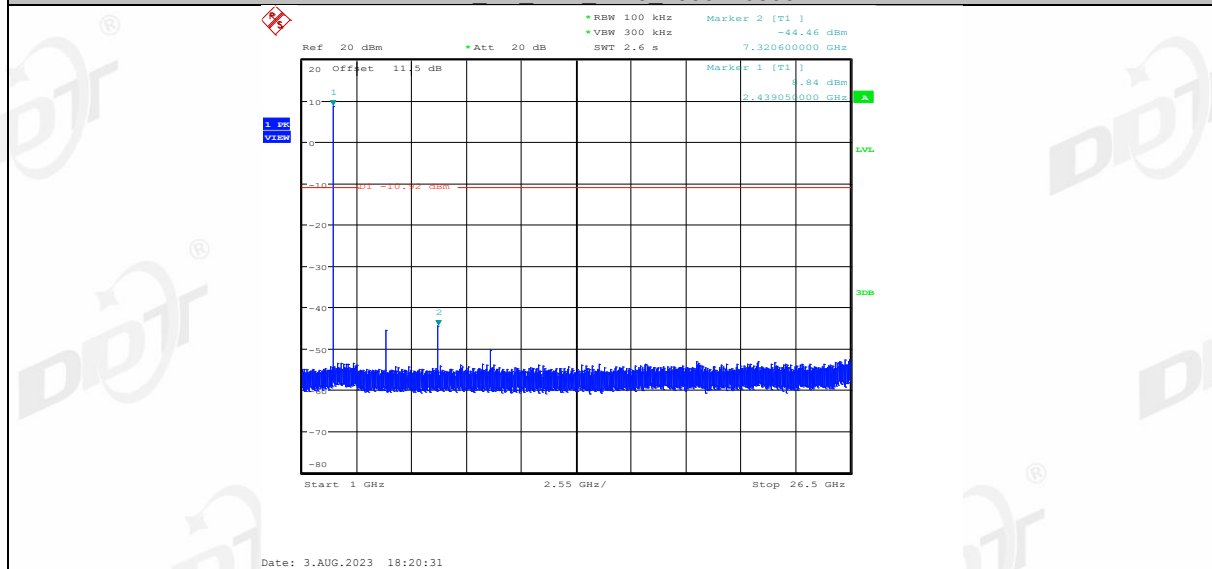
BLE 1M Ant1 2440 0~Reference



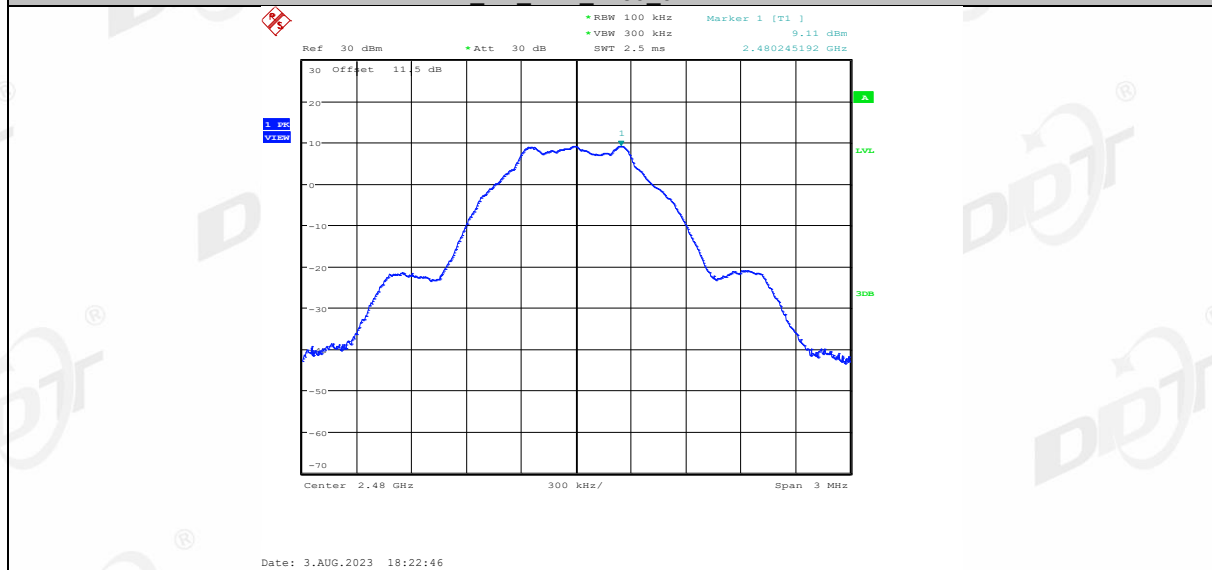
BLE 1M Ant1 2440 30~1000



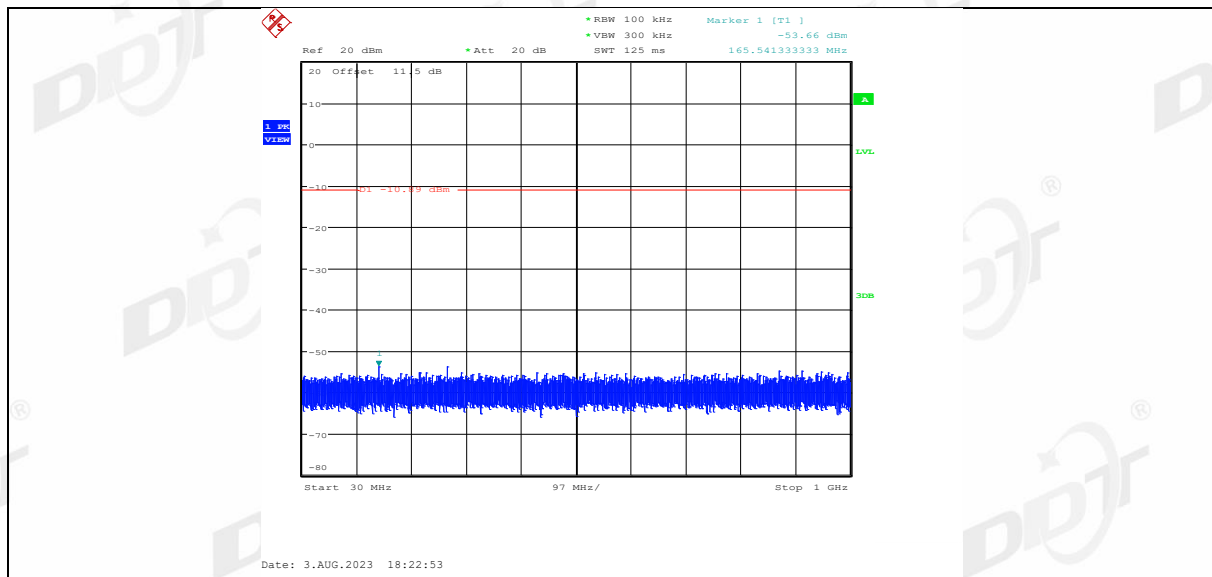
BLE 1M Ant1 2440 1000~26500



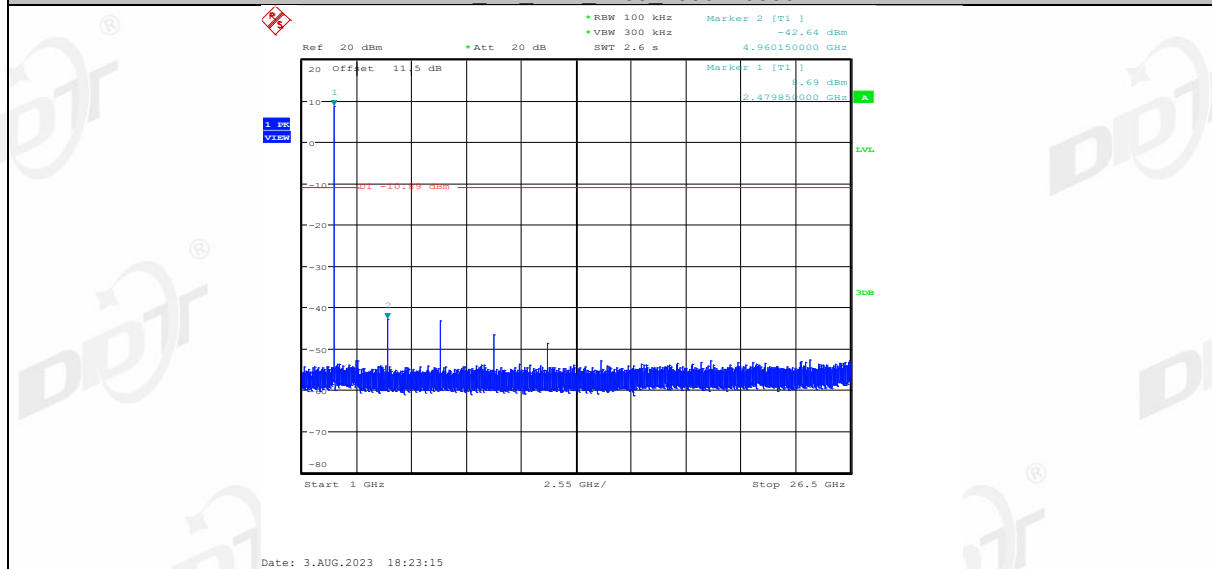
BLE 1M Ant1 2480 0~Reference



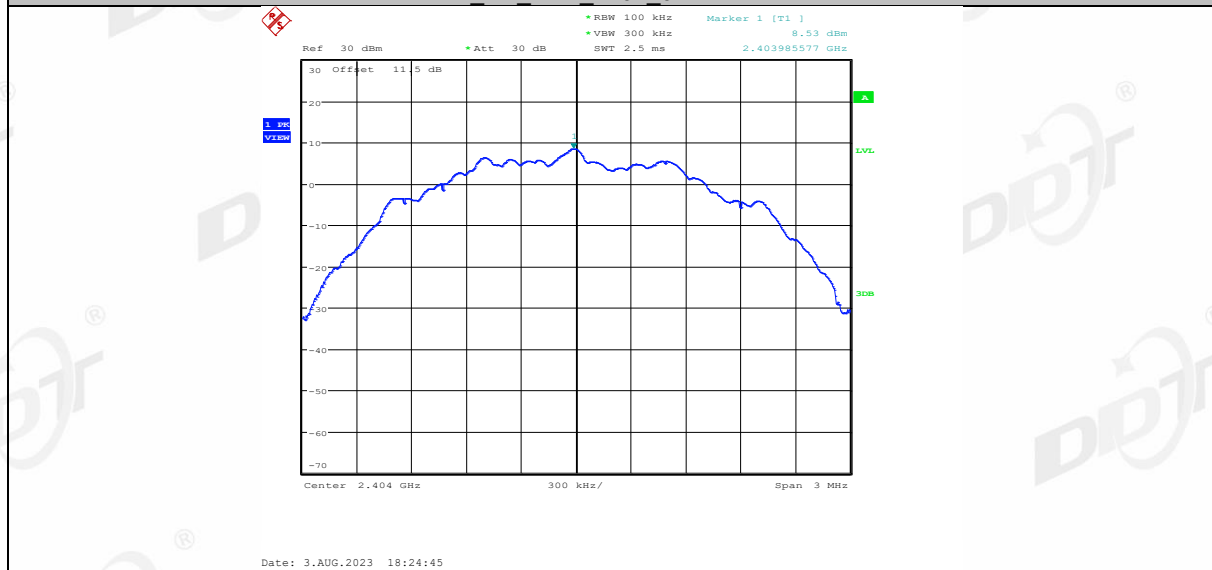
BLE 1M Ant1 2480 30~1000



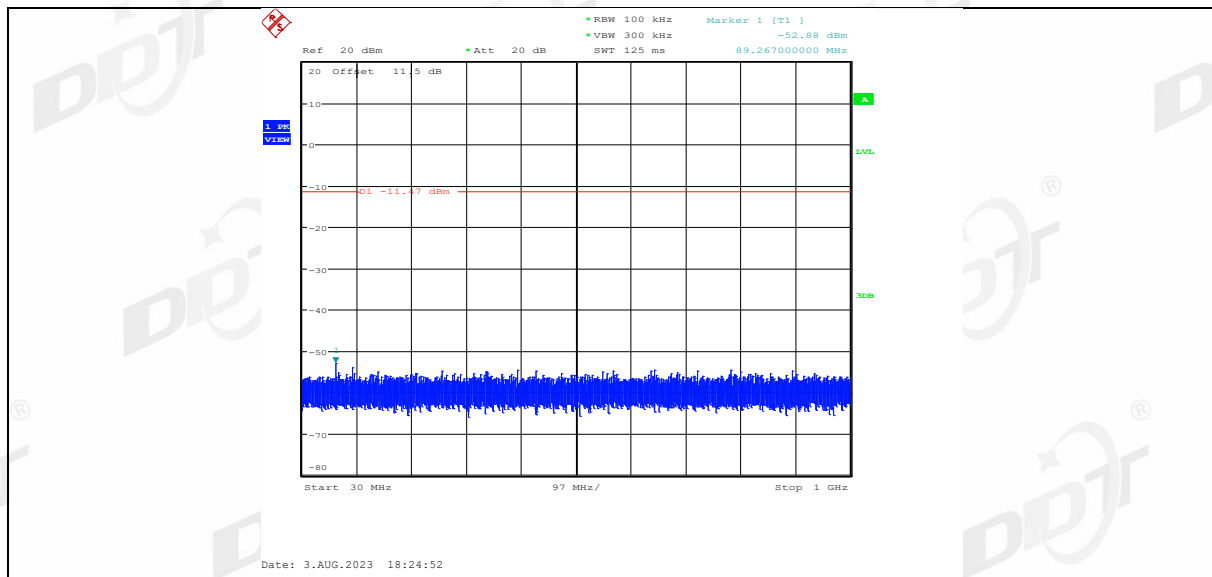
BLE 1M Ant1 2480 1000~26500



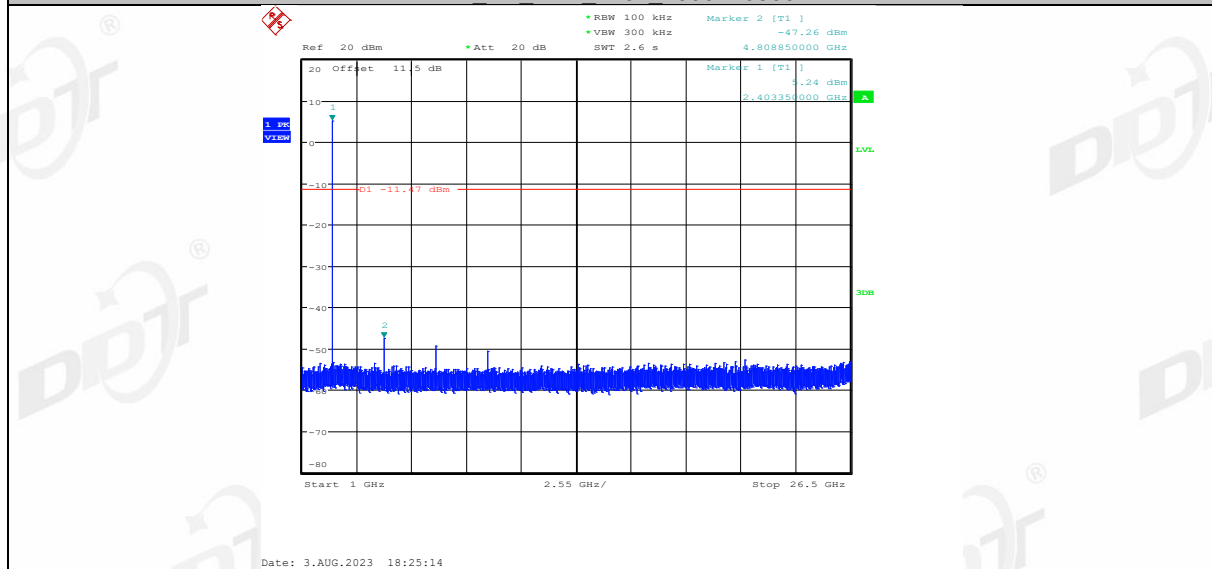
BLE 2M Ant1 2404 0~Reference



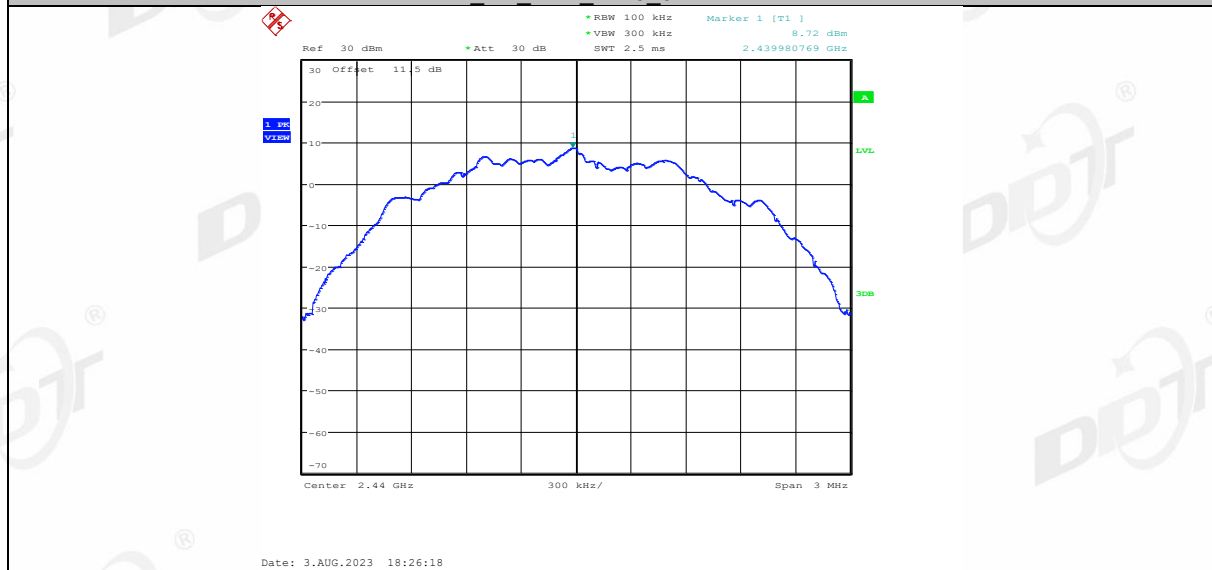
BLE 2M Ant1 2404 30~1000



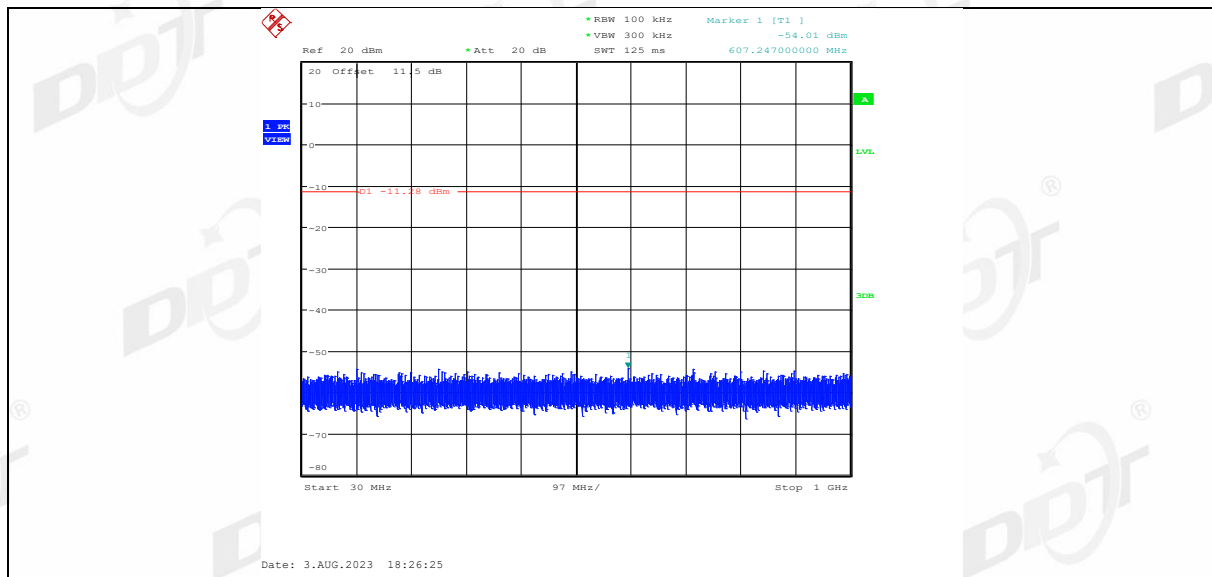
BLE 2M Ant1 2404 1000~26500



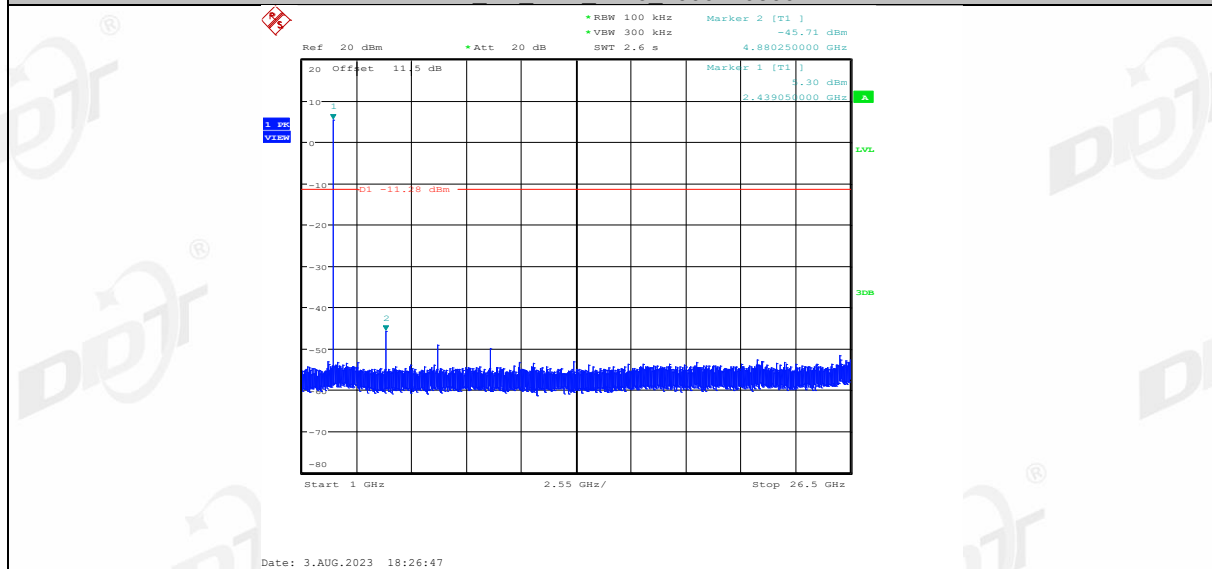
BLE 2M Ant1 2440 0~Reference



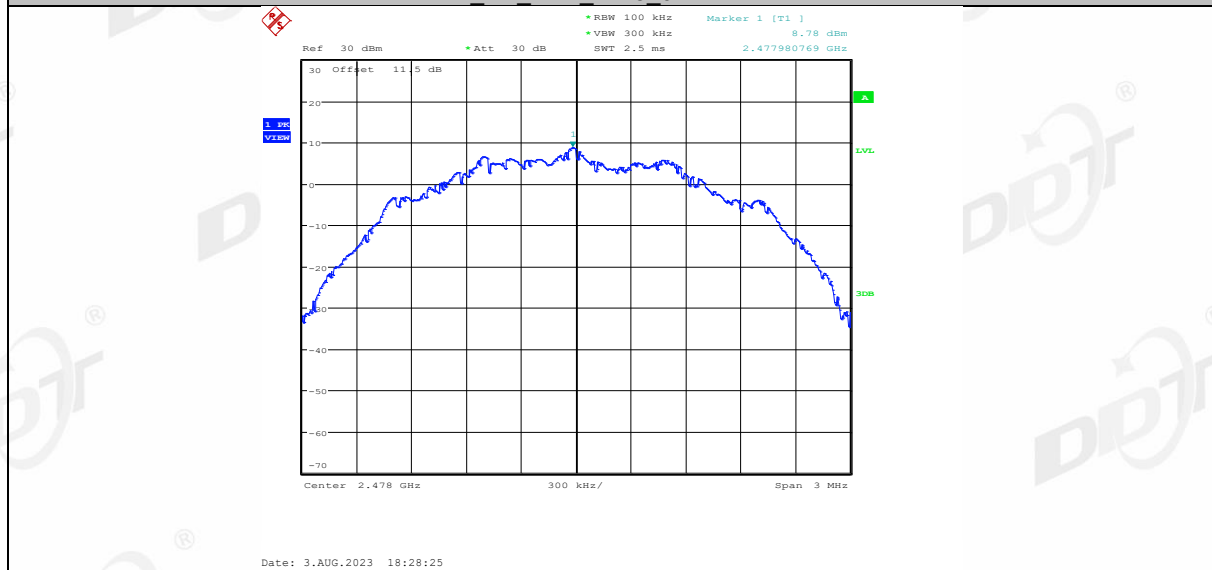
BLE 2M Ant1 2440 30~1000



BLE 2M Ant1 2440 1000~26500



BLE 2M Ant1 2478 0~Reference

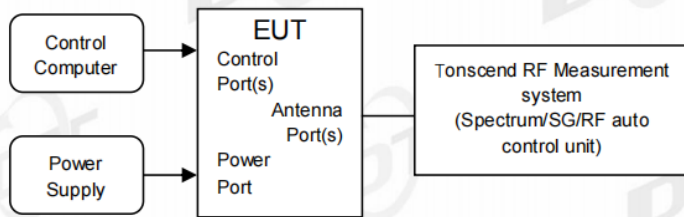


BLE 2M Ant1 2478 30~1000



10. Duty Cycle

10.1. Block diagram of test setup



10.2. Limit

Just for Report.

10.3. Test procedure

- (1) Connected the EUT's antenna port to the Spectrum Analyzer by suitable attenuator, The cable loss and attenuator loss have been put into spectrum analyzer as amplitude offset.

set the Spectrum Analyzer as below:

Centre Frequency: The centre frequency of the middle hopping channel.

Resolution BW: 10 MHz.

Video BW: 10 MHz.

Span: Zero span.

Detector: Peak.

Trace Mode: Clear Write.

Sweep: Video Trigger

- (2) When the trace is complete, measure the sending time of 1 burst and the duty cycle of 1 burst cycle.

- (3) Calculate dwell time follow below formula:

Duty cycle= Pulse's on time / Burst cycle

10.4. Test result

Left side:

Test Mode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor[dB]
BLE_1M	Ant1	2402	0.38	0.63	60.32	2.20
		2440	0.38	0.63	60.32	2.20
		2480	0.38	0.63	60.32	2.20
BLE_2M	Ant1	2404	0.20	0.63	31.75	4.98
		2440	0.20	0.63	31.75	4.98
		2478	0.20	0.63	31.75	4.98

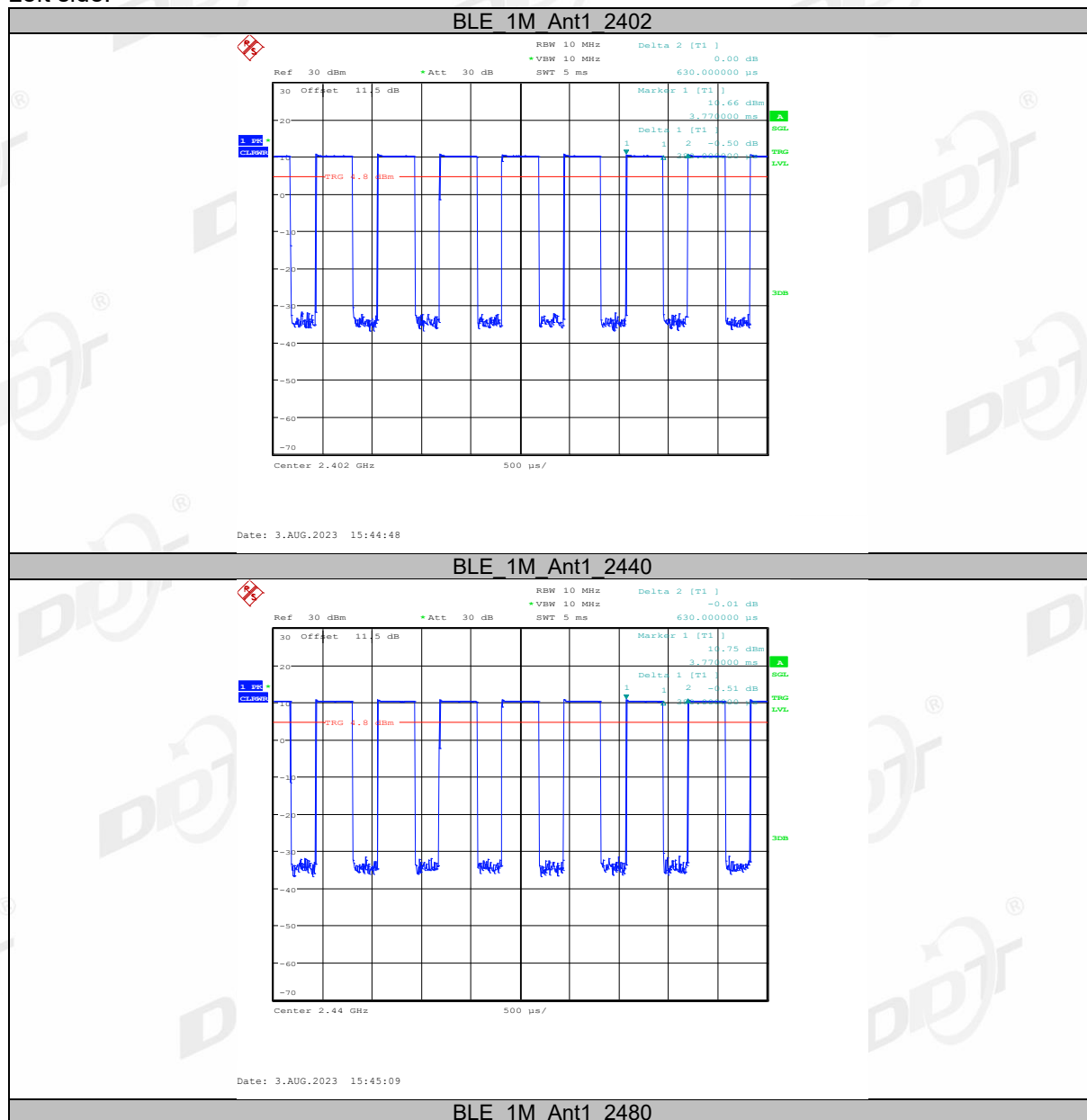
Right side:

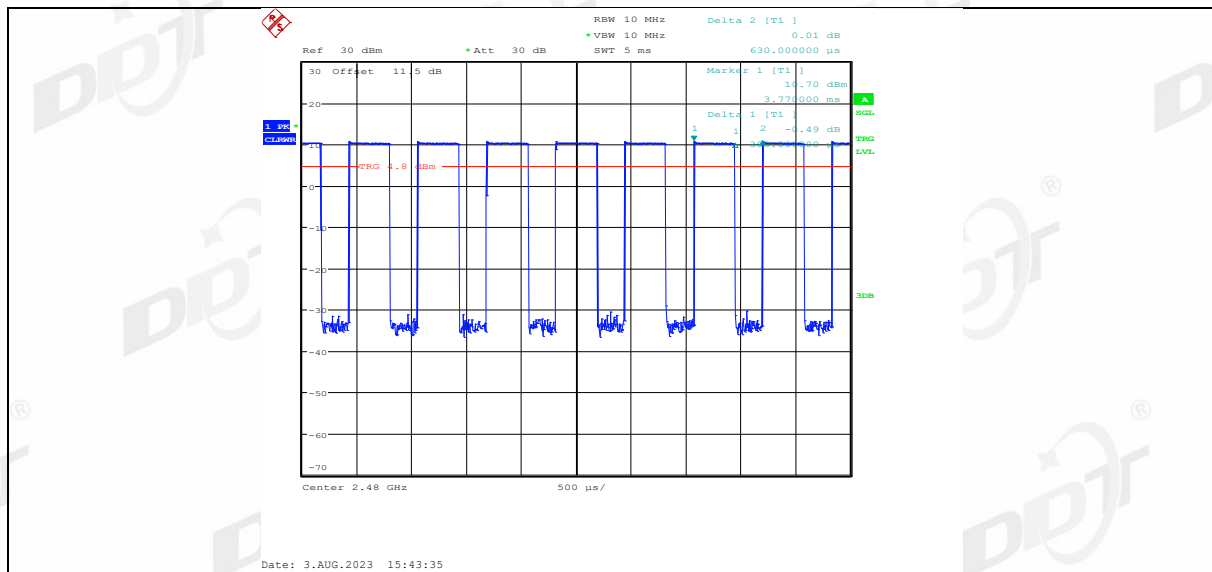
Test Mode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor[dB]
BLE_1M	Ant1	2402	0.38	0.63	60.32	2.20

BLE_2M	Ant1	2440	0.38	0.63	60.32	2.20
		2480	0.38	0.63	60.32	2.20
		2404	0.20	0.63	31.75	4.98
		2440	0.20	0.63	31.75	4.98
		2478	0.20	0.63	31.75	4.98

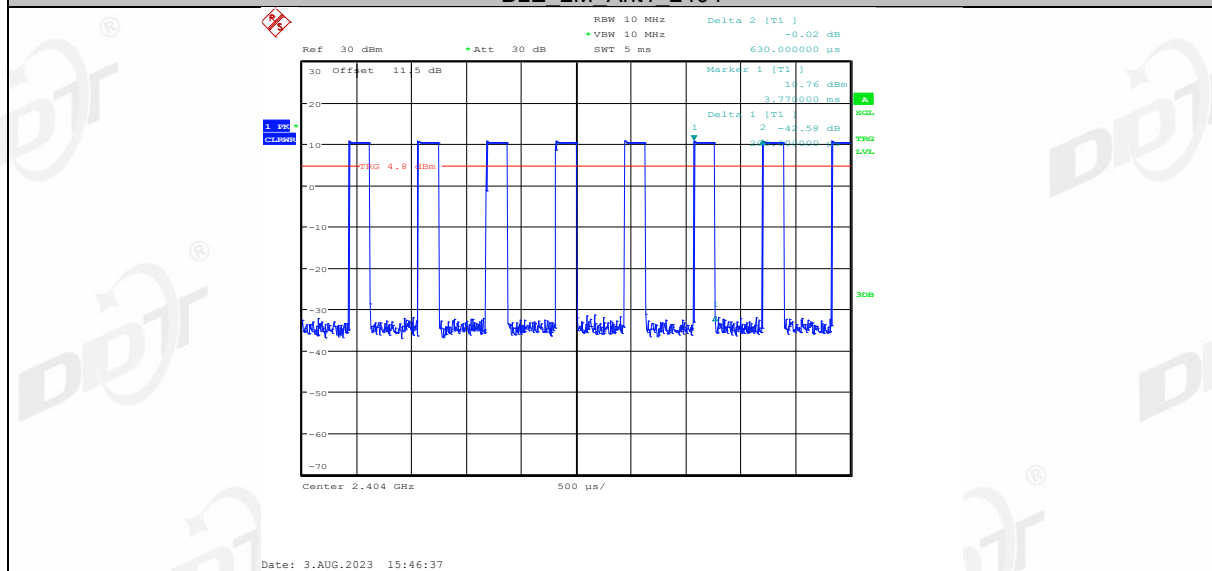
10.5. Test graphs

Left side:

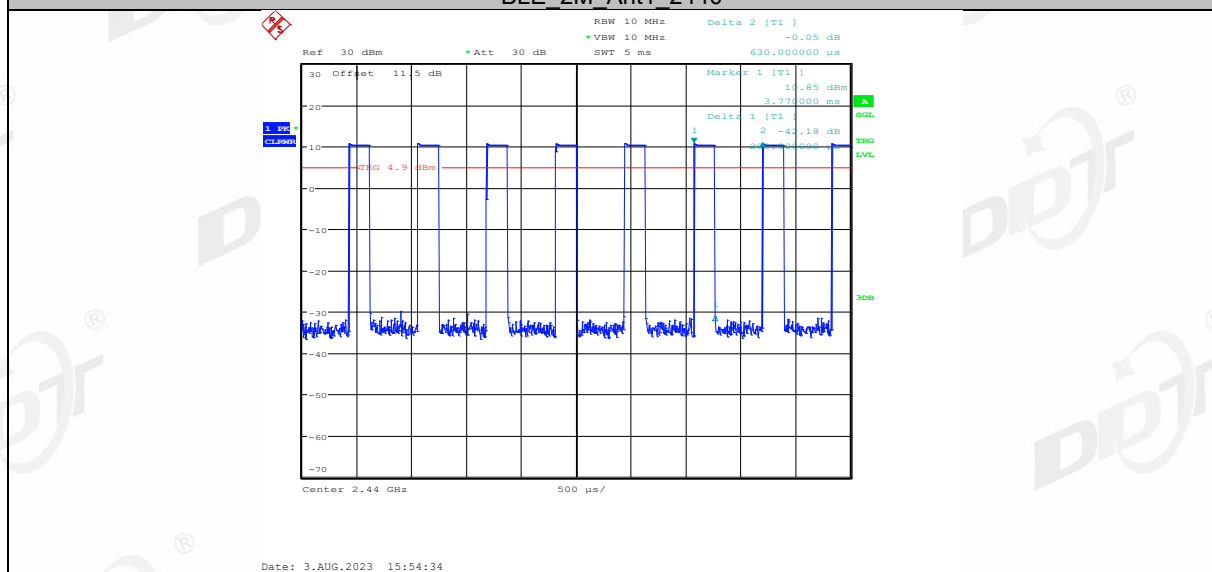




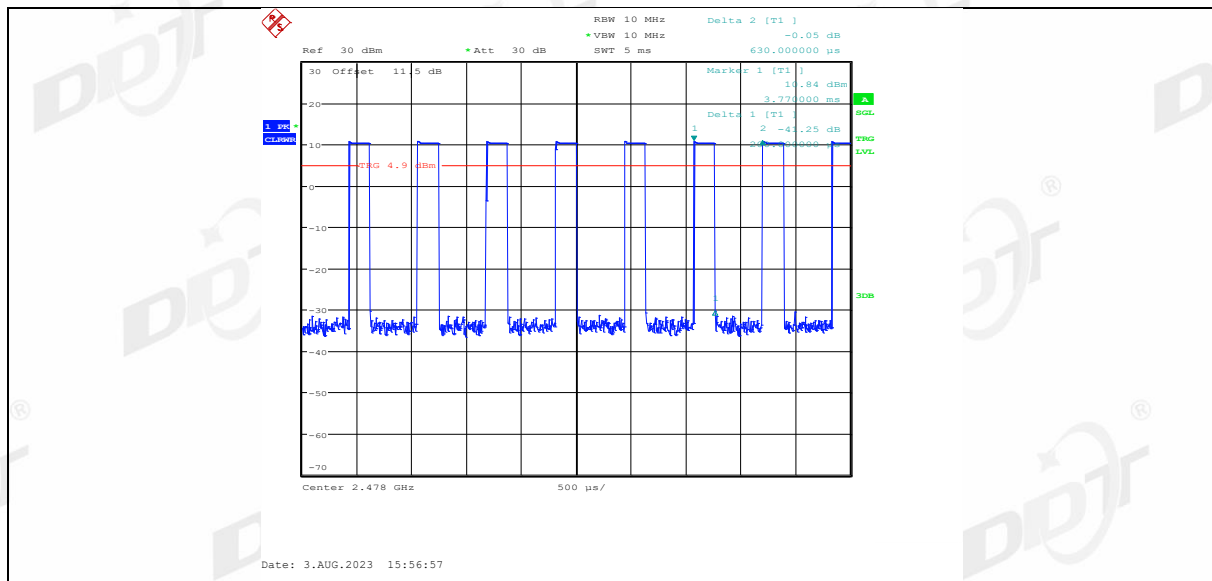
BLE 2M Ant1 2404



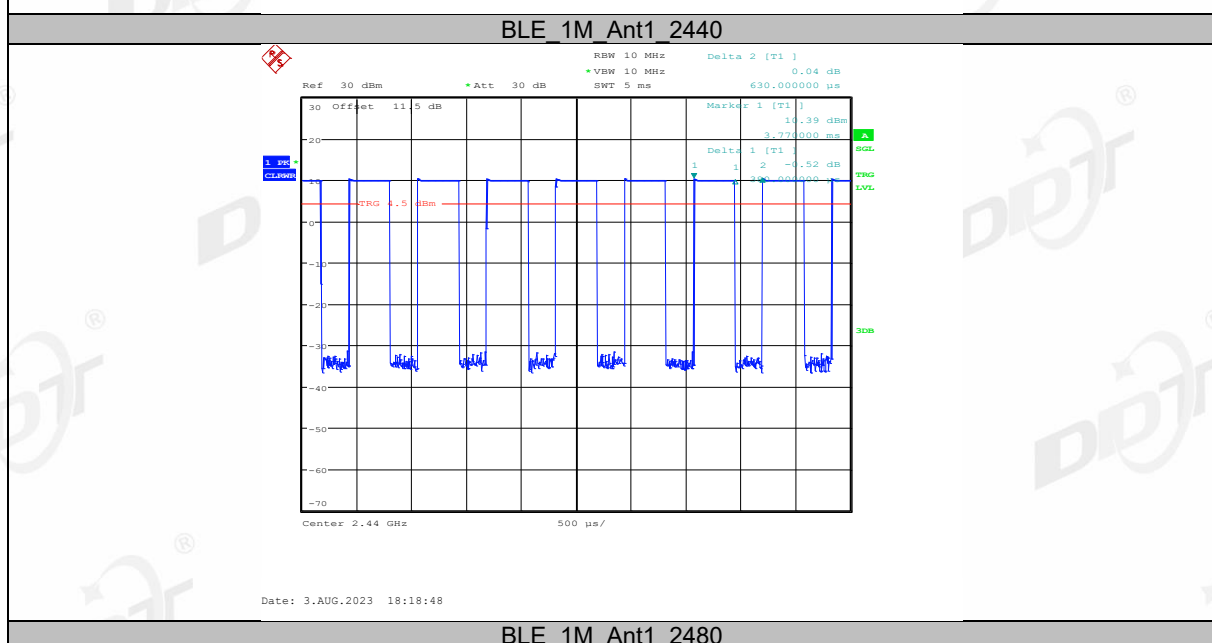
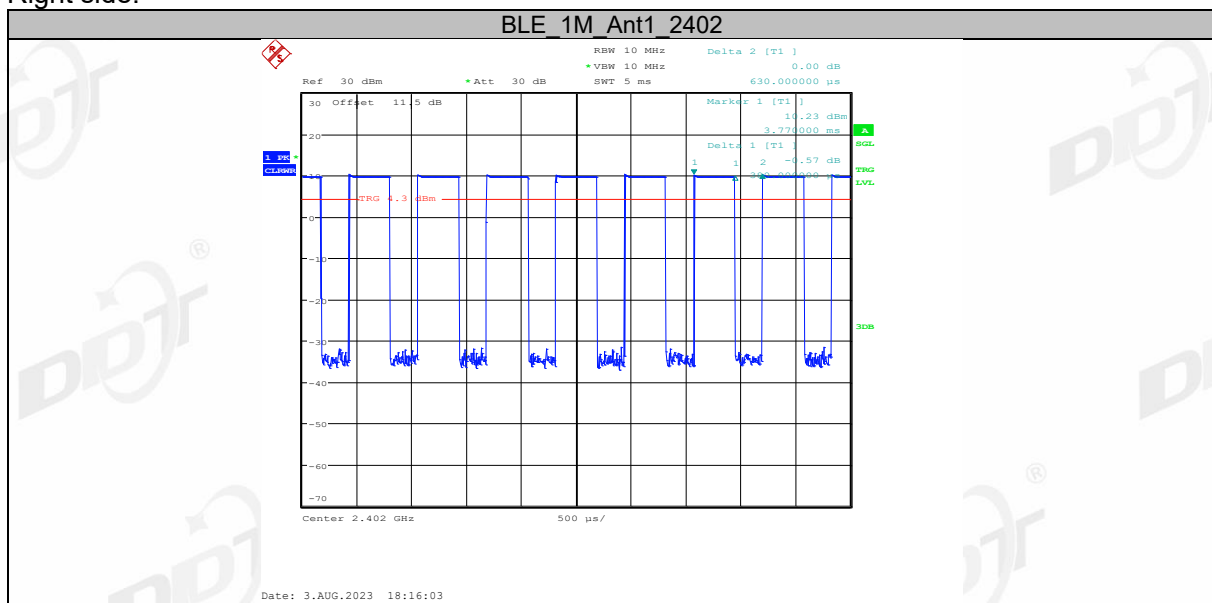
BLE 2M Ant1 2440

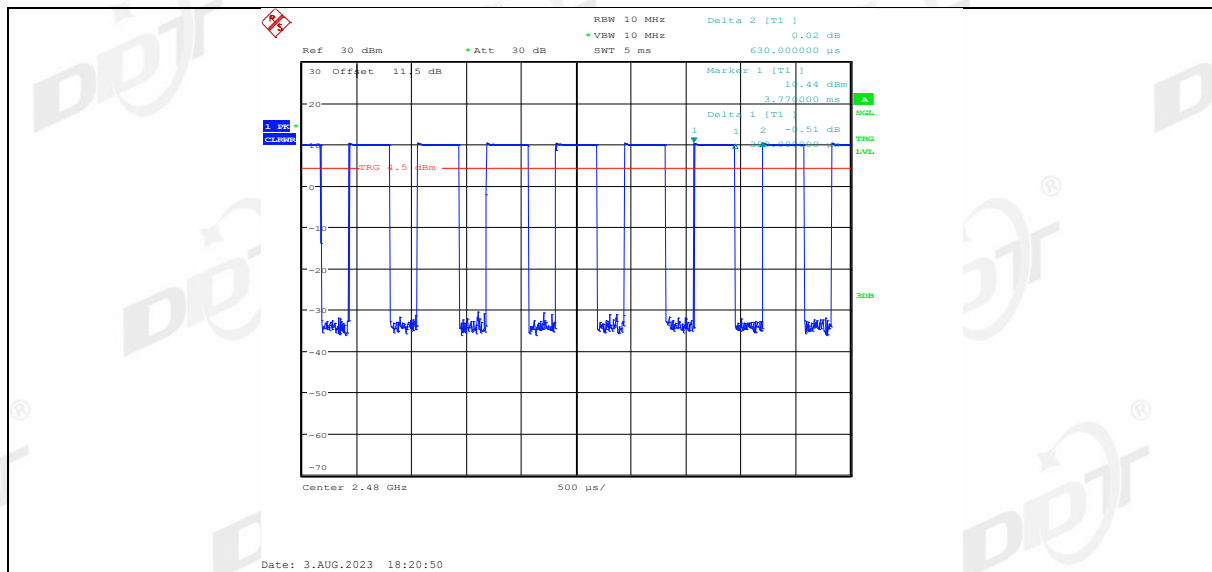


BLE 2M Ant1 2478

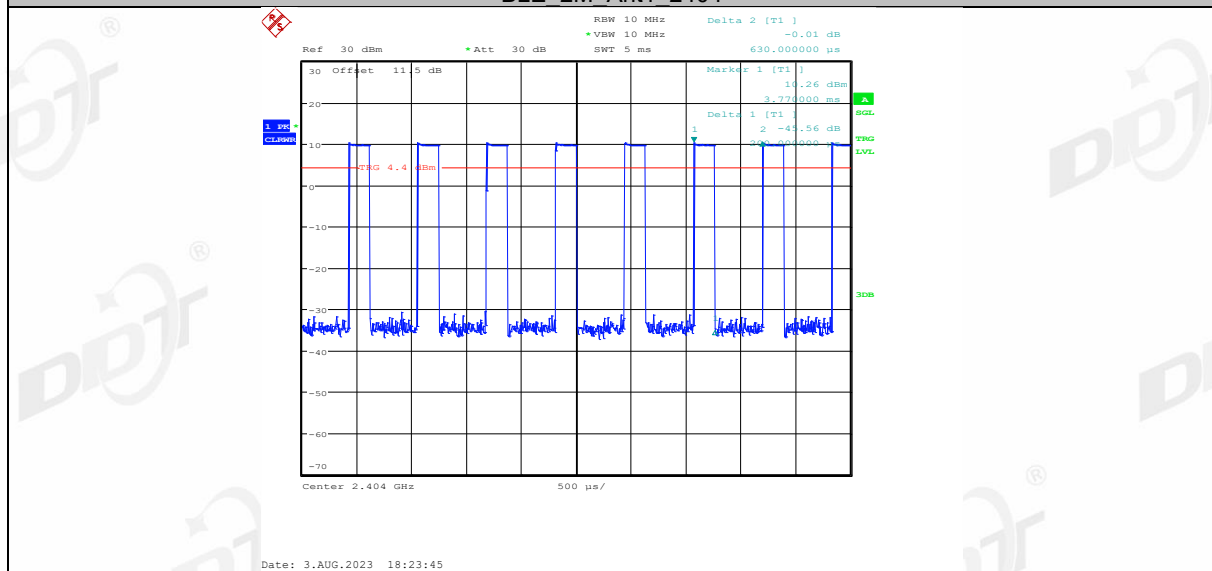


Right side:

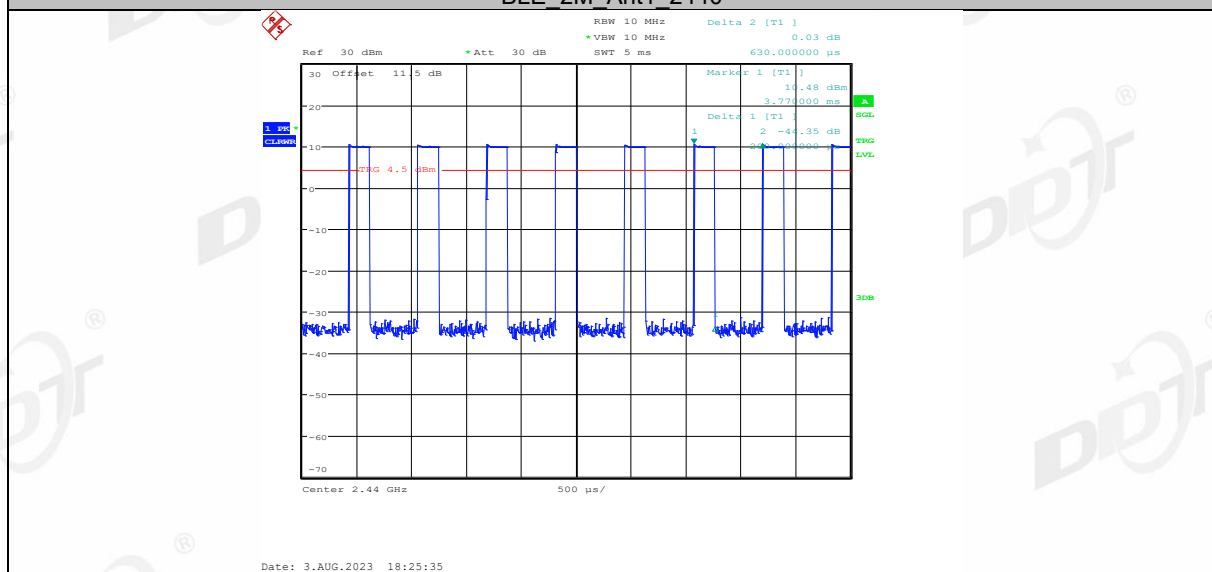




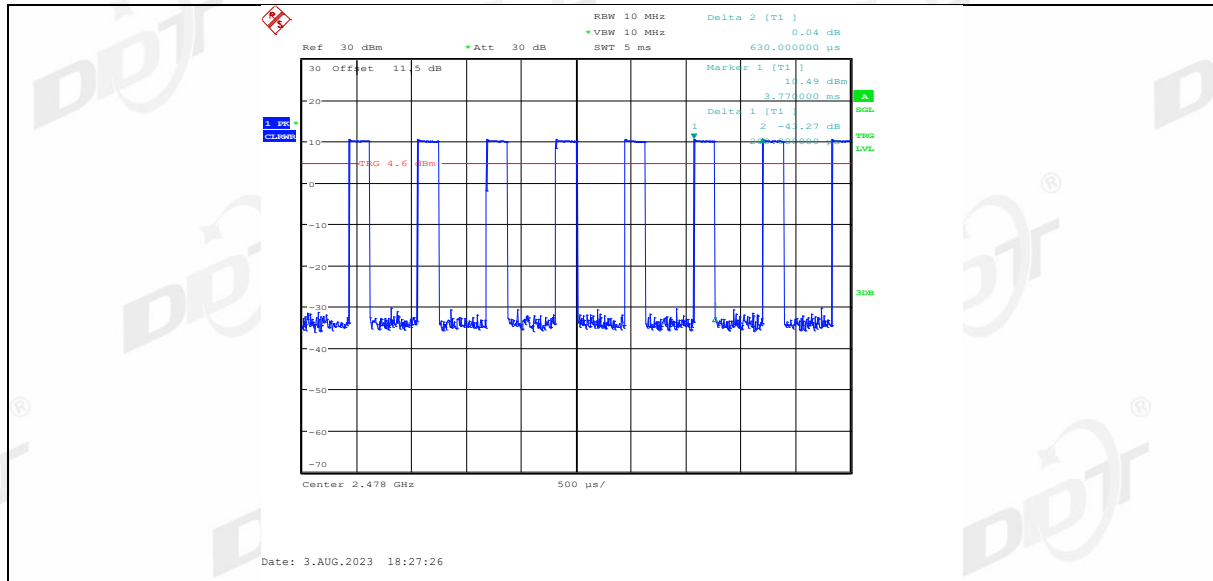
BLE 2M Ant1 2404



BLE 2M Ant1 2440



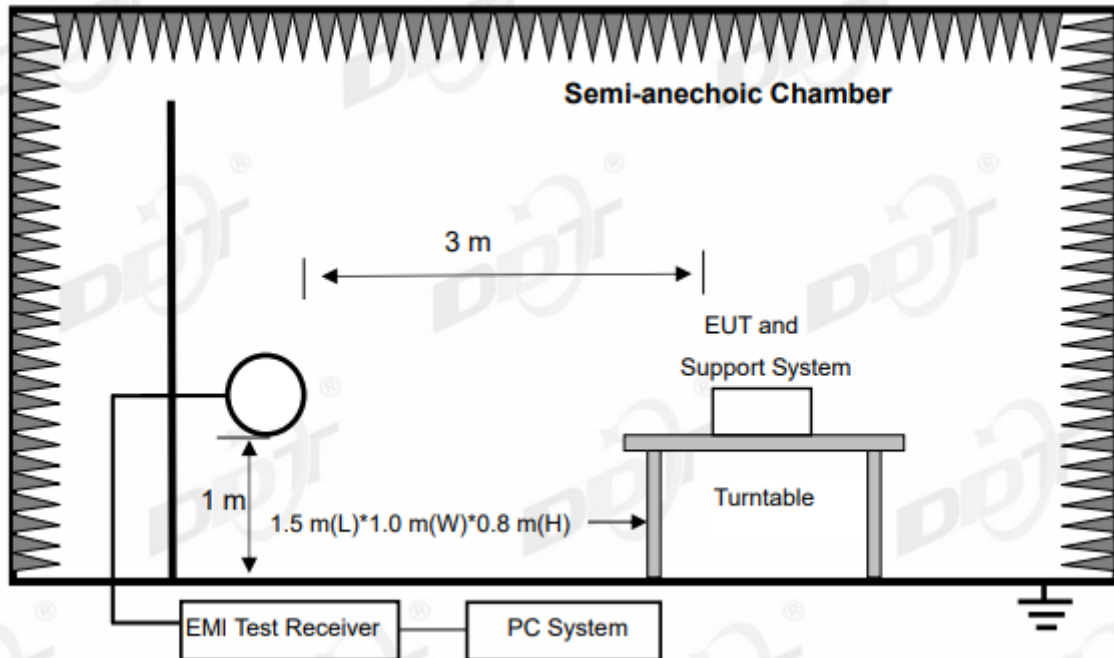
BLE 2M Ant1 2478



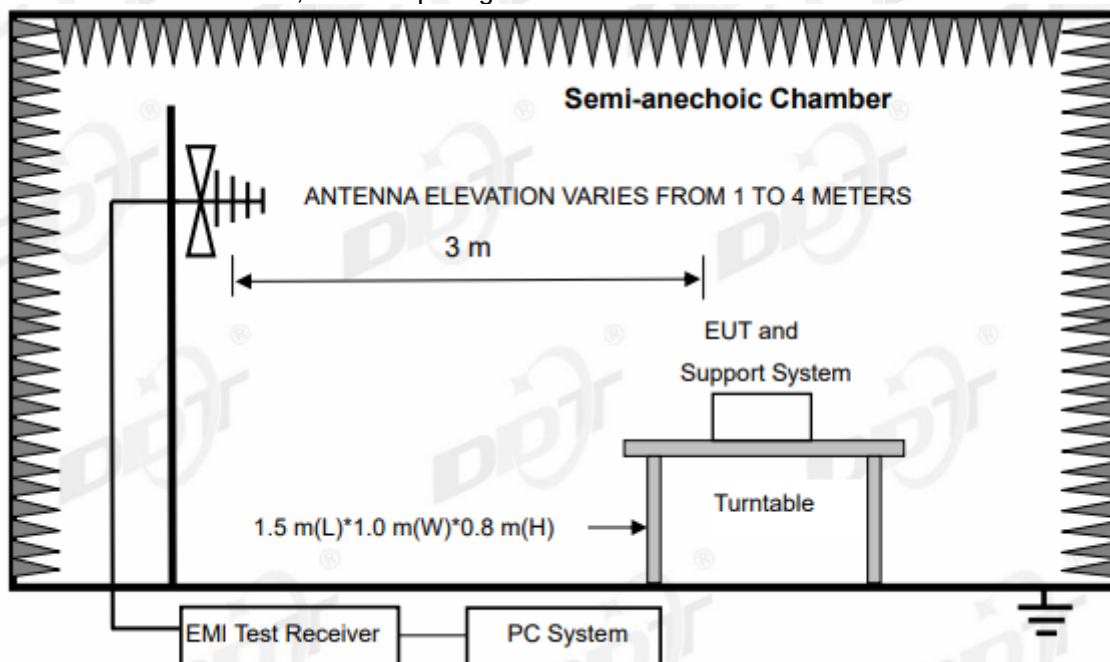
11. Radiated Emission

11.1. Block diagram of test setup

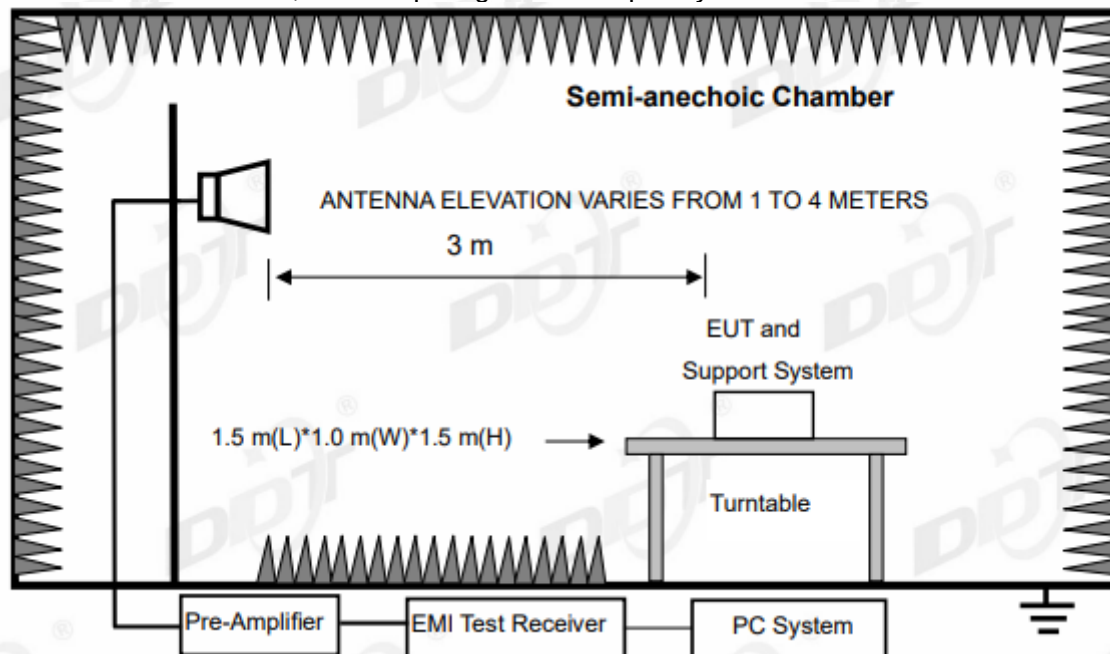
In 3 m Anechoic Chamber, test setup diagram for 9 kHz - 30 MHz:



In 3 m Anechoic Chamber, test setup diagram for 30 MHz - 1 GHz:



In 3 m Anechoic Chamber, test setup diagram for frequency above 1 GHz:



Note: For harmonic emissions test an appropriate high pass filter was inserted in the input port of AMP.

11.2. Limit

(1) FCC 15.205 Restricted frequency band

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.1772&4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.2072&4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(²)
13.36-13.41			

¹Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

²Above 38.6

(2) FCC 15.209 Limit

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		$\mu\text{V/m}$	$\text{dB}(\mu\text{V})/\text{m}$
0.009 ~ 0.490	300	2400/F(kHz)	67.6-20log(F)
0.490 ~ 1.705	30	24000/F(kHz)	87.6-20log(F)
1.705 ~ 30.0	30	30	29.54
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Note: (1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9 - 90 kHz, 110 - 490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

(2) At frequencies below 30 MHz, measurement may be performed at a distance closer than that specified, and the limit at closer measurement distance can be extrapolated by below formula:

$$\text{Limit}_{3\text{m}}(\text{dB}\mu\text{V}/\text{m}) = \text{Limit}_{30\text{m}}(\text{dB}\mu\text{V}/\text{m}) + 40\text{Log}(30\text{m}/3\text{m})$$

(3) Limit for this EUT

The emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20 dB below the fundamental emissions or comply with 15.209 limits.

11.3. Test Procedure

(1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber for below 1 G and 150 cm above the ground plane inside a semi-anechoic chamber for above 1 G.

(2) Test antenna was located 3 m from the EUT on an adjustable mast, and the antenna used as below table.

Test frequency range	Test antenna used	Test antenna distance
9 kHz - 30 MHz	Active Loop antenna	3 m
30 MHz - 1 GHz	Trilog Broadband Antenna	3 m
1 GHz - 18 GHz	Double Ridged Horn Antenna (1 GHz - 18 GHz)	3 m
18 GHz - 40 GHz	Horn Antenna (18 GHz - 40 GHz)	1 m

According ANSI C63.10:2013 clause 6.4.6 and 6.5.3, for measurements below 30 MHz, Antenna was located 3 m from EUT, the loop antenna was positioned in three antenna orientations (parallel, perpendicular, and round-parallel), for each measurement antenna alignment, the EUT shall be rotated through 0° to 360° on a turntable, and the lowest height of the magnetic

antenna shall be 1 m above the ground. For measurement above 30 MHz, the Trilog Broadband Antenna or Horn Antenna was located 3 m from EUT, Measurements were made with the antenna positioned in both the horizontal and vertical planes of Polarization, and the measurement antenna was varied from 1 m to 4 m. in height above the reference ground plane to obtain the maximum signal strength.

(3) Below pre-scan procedure was first performed in order to find prominent frequency spectrum radiated emissions from 9 kHz to 25 GHz:

(a) Scanning the peak frequency spectrum with the antenna specified in step (3), and the EUT was rotated 360 degree, the antenna height was varied from 1 m to 4 m (Except loop antenna, it's fixed 1 m above ground.)

(b) Change work frequency or channel of device if practicable.

(c) Change modulation type of device if practicable.

(d) Change power supply range from 85% to 115% of the rated supply voltage

(e) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions.

Spectrum frequency from 9 kHz to 25 GHz (tenth harmonic of fundamental frequency) was investigated, and no any obvious emission were detected from 9 kHz to 30 MHz and 18 GHz to 25 GHz, so below final test was performed with frequency range from 30 MHz to 18 GHz.

(4) For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10:2013 on Radiated Emission test.

(5) The emissions from 9 kHz to 1 GHz were measured based on CISPR QP detector except for the frequency bands 9 - 90 kHz, 110 - 490 kHz, for emissions from 9 kHz - 90 kHz, 110 kHz - 490 kHz and above 1 GHz were measured based on average detector, for emissions above 1 GHz, peak emissions also be measured and need comply with Peak limit.

(6) The emissions from 9 kHz to 1 GHz, QP or average values were measured with EMI receiver with below RBW

Frequency band	RBW
9 kHz - 150 kHz	200 Hz
150 kHz - 30 MHz	9 kHz
30 MHz - 1 GHz	120 kHz

For emissions above 1 GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1 MHz, VBW is set at 3 MHz for Peak measure; According ANSI C63.10:2013 clause 4.1.4.2.2 procedure for average measure.

11.4. Test result

Pass. (See below detailed test result)

All the emissions except fundamental emission from 9 kHz to 25 GHz were comply with 15.209 limits.

Note1: According exploratory test, the emission levels are 20 dB below the limit detected from 9 kHz to 30 MHz and 18 GHz to 25 GHz, so the final test was performed with frequency range from 30 MHz to 18 GHz and recorded in below.

Note2: 30 MHz ~ 25 GHz: (Scan with GFSK 1M, GFSK 2M, the worst case is reported)

Note3: For emissions below 1 GHz, according exploratory explorer test, when change Tx mode and channel, have no distinct influence on emissions level, so for emissions below 1 GHz, the final test was only performed with EUT working in GFSK 2M Tx 2440 MHz mode.

Note4: For emissions above 1 GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

Radiated Emission test (below 1 GHz)

TR-4-E-009 Radiated Emission Test Result

Test Date: 2023-08-01

Tested By: Bairong

EUT: TWS Earbuds

Model Number: Epic Lab Edition

Test Mode: TX Mode

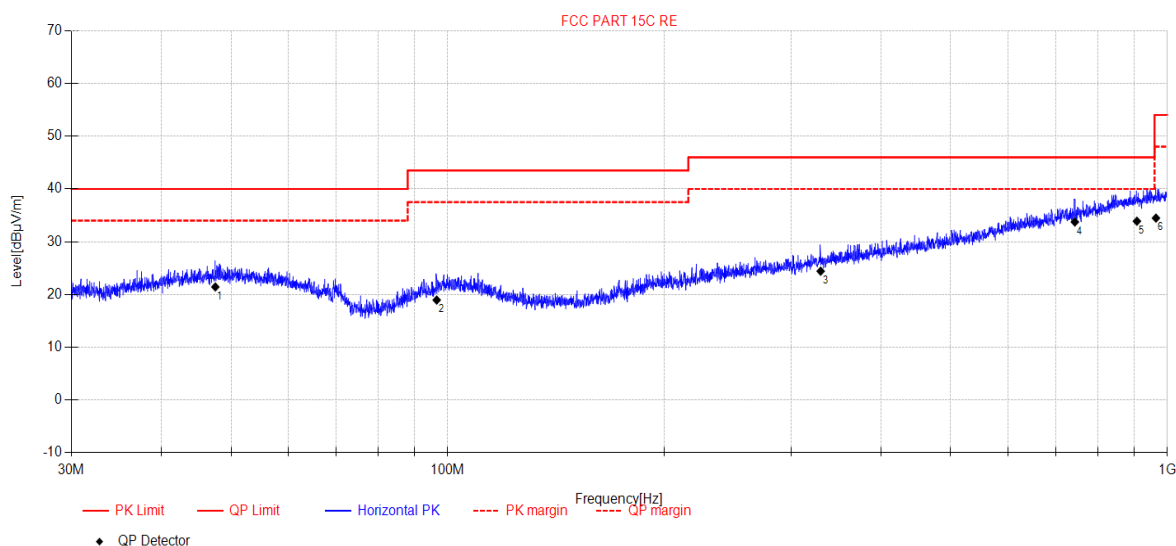
Power Supply: Battery

Condition: Temp:23.2°C;Humi:58.3%

Test Site: DDT 3# Chamber

File Path: d:\ts\2023 report data\Q23071128-2E Epic Lab Edition\FCC BELOW 1G\20230801-194540_H

Memo: BLE 2M L

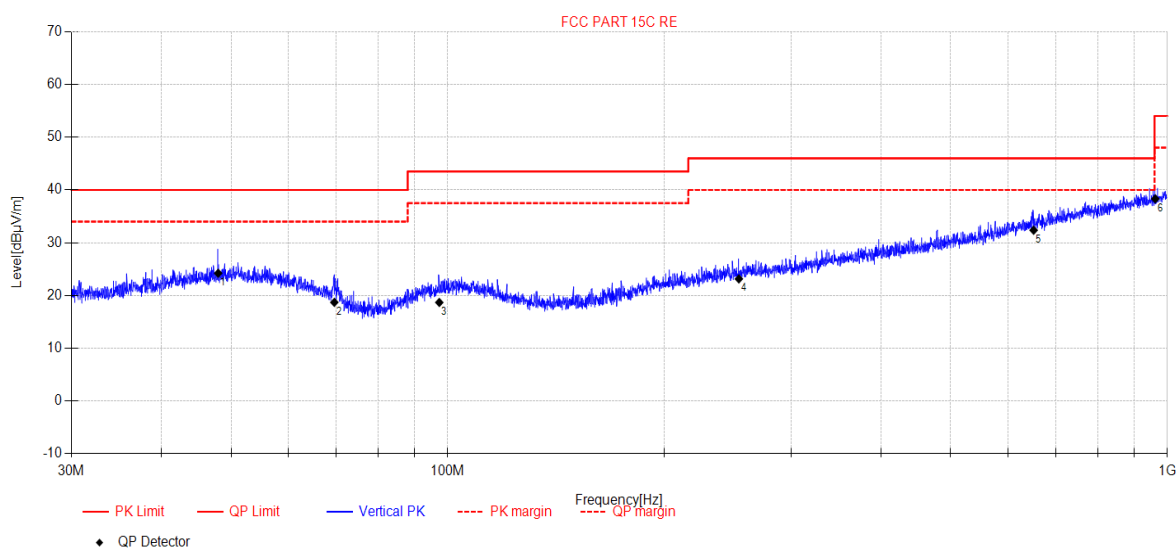


Final Data List										
NO.	Freq. [MHz]	Reading [dBµV/m]	Antenna Factor [dB]	Cable Loss [dB]	AMP [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Polarity
1	47.55	3.53	13.20	4.70	0.00	21.43	40.00	18.57	QP	Horizontal
2	96.55	3.37	10.55	5.03	0.00	18.95	43.50	24.55	QP	Horizontal
3	329.81	4.01	14.10	6.31	0.00	24.42	46.00	21.58	QP	Horizontal
4	743.87	5.28	20.60	7.86	0.00	33.74	46.00	12.26	QP	Horizontal
5	907.14	3.09	22.44	8.36	0.00	33.89	46.00	12.11	QP	Horizontal
6	964.20	3.14	22.78	8.56	0.00	34.48	54.00	19.52	QP	Horizontal

Note:

1. Result Level = Reading + Cable loss + Antenna Factor + AMP
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

TR-4-E-009 Radiated Emission Test Result

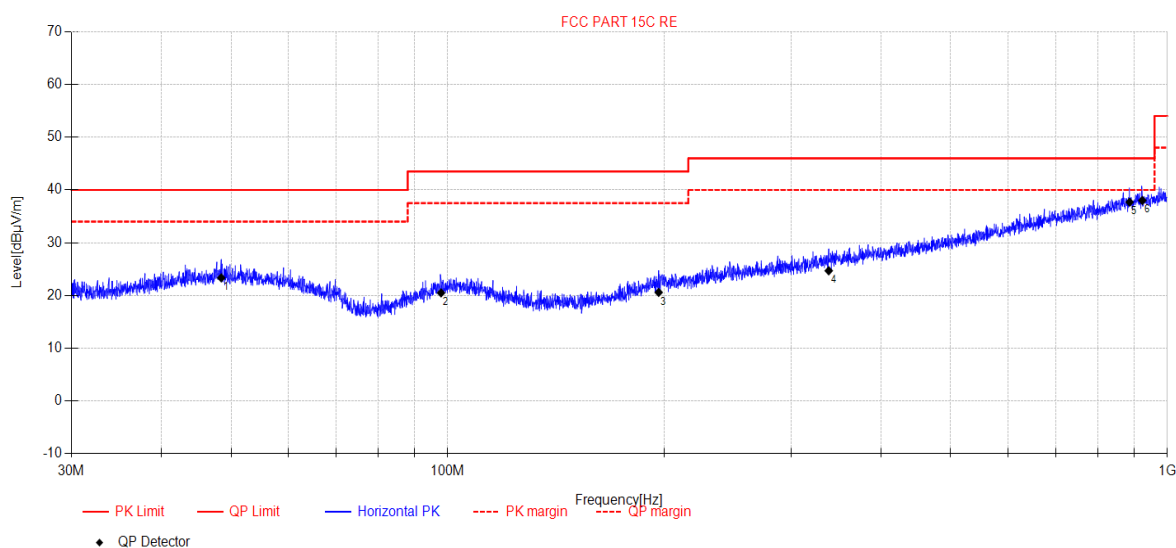
Test Date: 2023-08-01**Tested By:** Bairong**EUT:** TWS Earbuds**Model Number:** Epic Lab Edition**Test Mode:** TX Mode**Power Supply:** Battery**Condition:** Temp:23.2°C;Humi:58.3%**Test Site:** DDT 3# Chamber**File Path:** d:\ts\2023 report data\Q23071128-2E Epic Lab Edition\FCC BELOW 1G\20230801-194625_V**Memo:** BLE 2M L

Final Data List										
NO.	Freq. [MHz]	Reading [dBμV/m]	Antenna Factor [dB]	Cable Loss [dB]	AMP [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Polarity
1	47.99	6.31	13.20	4.70	0.00	24.21	40.00	15.79	QP	Vertical
2	69.59	5.25	8.66	4.79	0.00	18.70	40.00	21.30	QP	Vertical
3	97.36	3	10.64	5.04	0.00	18.68	43.50	24.82	QP	Vertical
4	253.91	4.81	12.38	5.96	0.00	23.15	46.00	22.85	QP	Vertical
5	652.00	5.58	19.24	7.55	0.00	32.37	46.00	13.63	QP	Vertical
6	962.17	7.02	22.74	8.56	0.00	38.32	54.00	15.68	QP	Vertical

Note:

- Result Level = Reading + Cable loss + Antenna Factor + AMP
- If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
- Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

TR-4-E-009 Radiated Emission Test Result

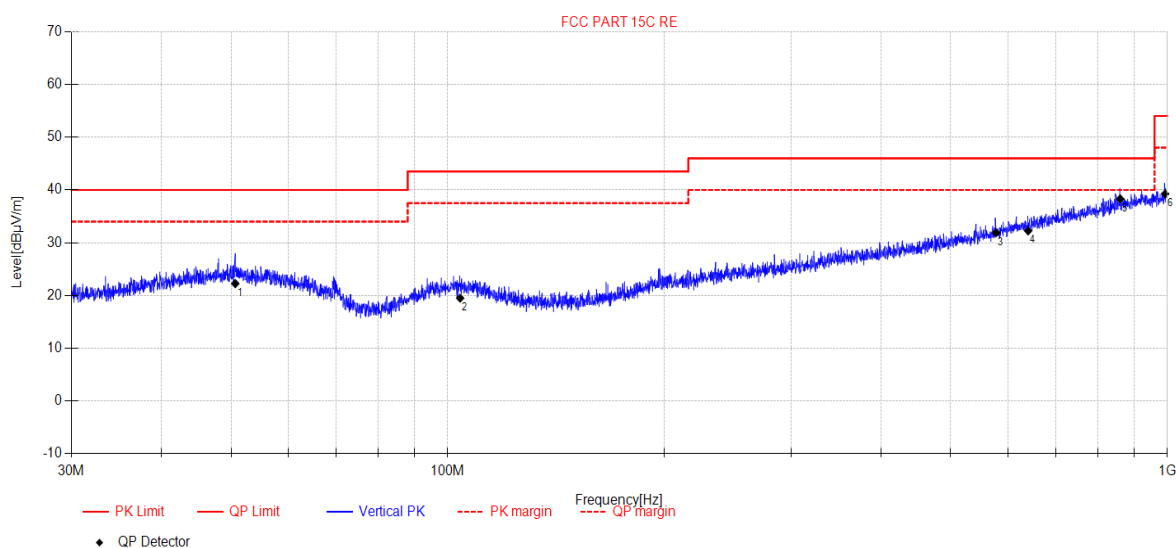
Test Date: 2023-08-01**Tested By:** Bairong**EUT:** TWS Earbuds**Model Number:** Epic Lab Edition**Test Mode:** TX Mode**Power Supply:** Battery**Condition:** Temp:23.2°C;Humi:58.3%**Test Site:** DDT 3# Chamber**File Path:** d:\ts\2023 report data\Q23071128-2E Epic Lab Edition\FCC BELOW 1G\20230801-195028_H**Memo:** BLE 2M R

Final Data List										
NO.	Freq. [MHz]	Reading [dBμV/m]	Antenna Factor [dB]	Cable Loss [dB]	AMP [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Polarity
1	48.46	5.43	13.20	4.71	0.00	23.34	40.00	16.66	QP	Horizontal
2	97.91	4.76	10.69	5.04	0.00	20.49	43.50	23.01	QP	Horizontal
3	196.44	4.29	10.60	5.70	0.00	20.59	43.50	22.91	QP	Horizontal
4	338.47	3.99	14.34	6.36	0.00	24.69	46.00	21.31	QP	Horizontal
5	886.39	7.07	22.33	8.29	0.00	37.69	46.00	8.31	QP	Horizontal
6	923.18	7.09	22.50	8.42	0.00	38.01	46.00	7.99	QP	Horizontal

Note:

1. Result Level = Reading + Cable loss + Antenna Factor + AMP
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

TR-4-E-009 Radiated Emission Test Result

Test Date: 2023-08-01**Tested By:** Bairong**EUT:** TWS Earbuds**Model Number:** Epic Lab Edition**Test Mode:** TX Mode**Power Supply:** Battery**Condition:** Temp:23.2°C;Humi:58.3%**Test Site:** DDT 3# Chamber**File Path:** d:\ts\2023 report data\Q23071128-2E Epic Lab Edition\FCC BELOW 1G\20230801-195113_V**Memo:** BLE 2M R

Final Data List										
NO.	Freq. [MHz]	Reading [dBμV/m]	Antenna Factor [dB]	Cable Loss [dB]	AMP [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Polarity
1	50.69	4.42	13.10	4.73	0.00	22.25	40.00	17.75	QP	Vertical
2	104.07	3.42	10.99	5.09	0.00	19.50	43.50	24.00	QP	Vertical
3	577.92	6.39	18.26	7.24	0.00	31.89	46.00	14.11	QP	Vertical
4	640.67	5.64	19.11	7.50	0.00	32.25	46.00	13.75	QP	Vertical
5	860.06	8	22.10	8.20	0.00	38.30	46.00	7.70	QP	Vertical
6	993.01	7.59	23.00	8.67	0.00	39.26	54.00	14.74	QP	Vertical

Note:

1. Result Level = Reading + Cable loss + Antenna Factor + AMP
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

Radiated Emission test (above 1 GHz)

TR-4-E-009 Radiated Emission Test Result

Test Date: 2023-07-31

Tested By: Bairong

EUT: TWS Earbuds

Model Number: Epic Lab Edition

Test Mode: TX Mode

Power Supply: Battery

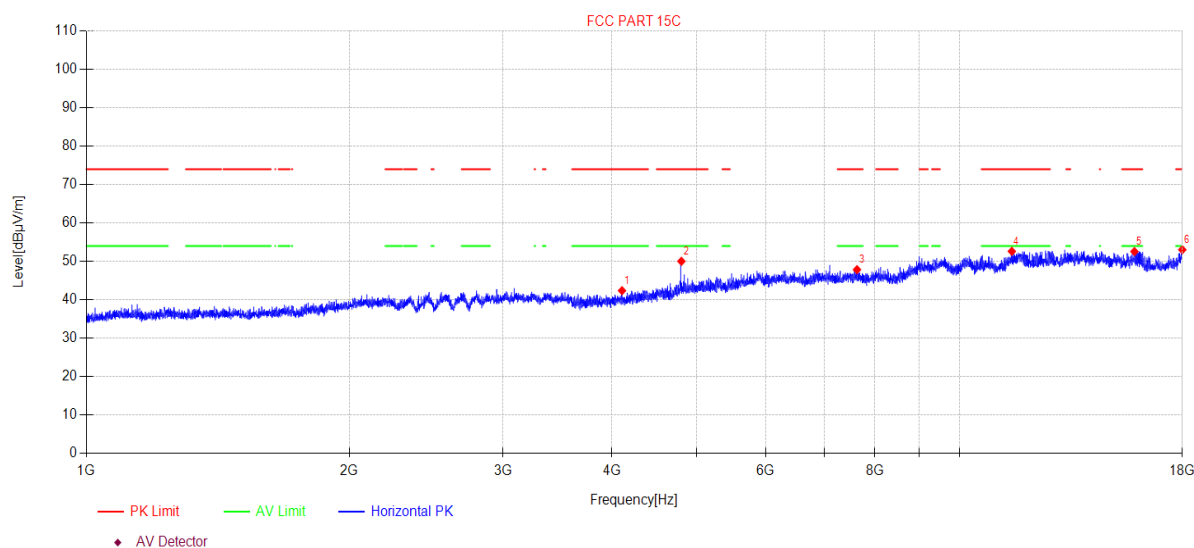
Condition: Temp:23.2°C;Humi:58.3%

Test Site: DDT 3# Chamber

File Path: d:\ts\2023 report data\Q23071128-2E Epic Lab Edition\FCC ABOVE 1G\7

Memo: BLE 1M 2402 L

Test Graph



Suspected Data List

N O.	Freq. [MHz]	Reading [dBμV/m]	Cable loss [dB]	Antenna Factor [dB]	AMP [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Polarity
1	4106.92	46.77	6.07	30.91	-41.37	42.38	74.00	31.62	PK	Horizontal
2	4803.36	51.40	7.47	32.31	-41.16	50.02	74.00	23.98	PK	Horizontal
3	7631.67	44.74	7.65	36.46	-41.00	47.85	74.00	26.15	PK	Horizontal
4	11480.79	43.25	10.08	39.02	-39.73	52.62	74.00	21.38	PK	Horizontal
5	15864.36	39.46	15.27	38.14	-40.31	52.56	74.00	21.44	PK	Horizontal
6	18000.00	38.80	13.13	41.80	-40.70	53.03	74.00	20.97	PK	Horizontal

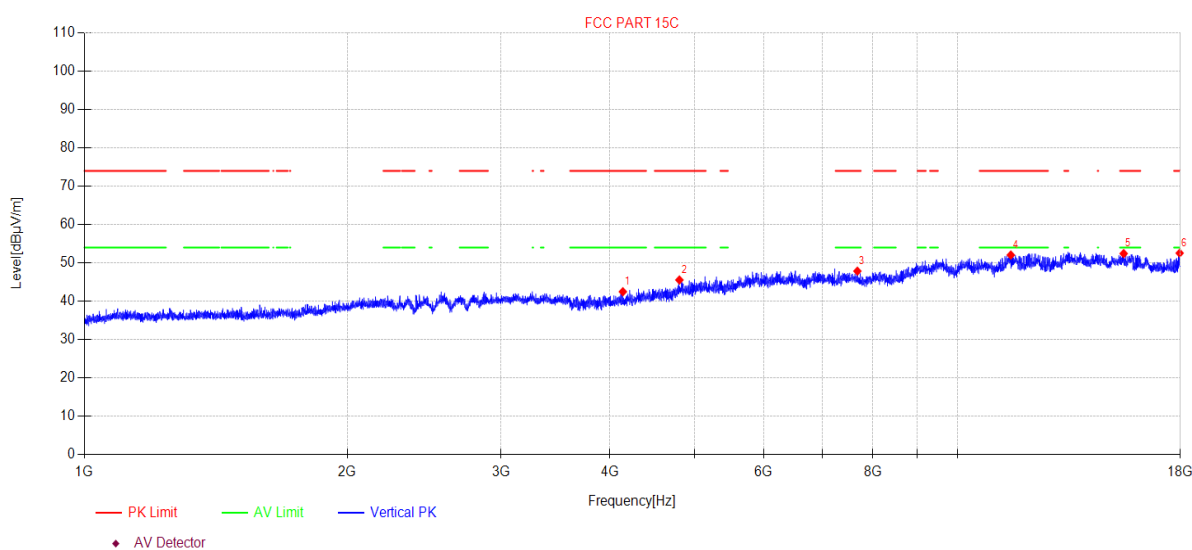
Note:

1. Level = Reading + Cable loss + Antenna Factor + AMP
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

TR-4-E-009 Radiated Emission Test Result

Test Date: 2023-07-31 **Tested By:** Bairong
EUT: TWS Earbuds **Model Number:** Epic Lab Edition
Test Mode: TX Mode **Power Supply:** Battery
Condition: Temp:23.2°C;Humi:58.3% **Test Site:** DDT 3# Chamber
File Path: d:\ts\2023 report data\Q23071128-2E Epic Lab Edition\FCC ABOVE 1G\8
Memo: BLE 1M 2402 L

Test Graph



Suspected Data List										
N O.	Freq. [MHz]	Reading [dBμV/m]	Cable loss [dB]	Antenna Factor [dB]	AMP [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Polarity
1	4137.89	46.74	6.13	30.98	-41.36	42.49	74.00	31.51	PK	Vertical
2	4803.36	46.93	7.47	32.31	-41.16	45.55	74.00	28.45	PK	Vertical
3	7680.34	44.65	7.66	36.56	-41.00	47.87	74.00	26.13	PK	Vertical
4	11510.69	42.65	10.10	38.99	-39.68	52.06	74.00	21.94	PK	Vertical
5	15501.77	40.26	13.62	38.60	-40.05	52.43	74.00	21.57	PK	Vertical
6	17968.81	38.54	13.09	41.61	-40.69	52.55	74.00	21.45	PK	Vertical

Note:

- Level = Reading + Cable loss + Antenna Factor + AMP
- If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
- Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.