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检测
TESTING
CNAS L6451



RADIO TEST REPORT

Applicant	:	Tsingoal (Beijing) Technology Co., Ltd.
Address of Applicant	:	Room A1002-1,Block A, 10th Floor,Building 1,Yard 1, Zhongguancun East Road,Haidian District,Beijing, China
Manufacturer	:	Tsingoal (Beijing) Technology Co., Ltd.
Address of Manufacturer	:	Room A1002-1,Block A, 10th Floor,Building 1,Yard 1, Zhongguancun East Road,Haidian District,Beijing, China
Equipment under Test	:	Positioning Device
Model No.	:	TB5000-AS
FCC ID	:	2BK5RTB5000-AS
Test Standard(s)	:	FCC Rules and Regulations Part 15 Subpart C, ANSI C63.10-2020
Report No.	:	DDT-RE26011512-1E01
Issue Date	:	2026/04/09
Issue By	:	Guangdong Dongdian Testing Service Co., Ltd. Unit 2, Building 1, No. 17, Zongbu 2nd Road, Songshan Lake Park, Dongguan, Guangdong, China, 523808

REPORT

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Test Report Declare

Applicant	:	Tsingoal (Beijing) Technology Co., Ltd.
Address of Applicant	:	Room A1002-1,Block A, 10th Floor,Building 1,Yard 1, Zhongguancun East Road,Haidian District,Beijing, China
Equipment under Test	:	Positioning Device
Model No.	:	TB5000-AS
Manufacturer	:	Tsingoal (Beijing) Technology Co., Ltd.
Address of Manufacturer	:	Room A1002-1,Block A, 10th Floor,Building 1,Yard 1, Zhongguancun East Road,Haidian District,Beijing, China

Test Standard Used:
FCC Rules and Regulations Part 15 Subpart C,
ANSI C63.10-2020

We Declare:
The equipment described above is tested by Guangdong 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 Guangdong Dongdian Testing Service Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

Report No.:	DDT-RE26011512-1E01		
Date of Receipt:	2026/01/29	Date of Test:	2026/01/29 - 2026/04/03

Created: Chen Ziqin	Reviewed: Zoe Peng	Approved: Ella Gong
		
2026/03/16	2026/04/09	2026/04/09

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

Revision History

Version	Revision Content	Issue Date	Approved
V0	Initial issue	2026/04/09	Ella Gong

1. Summary of Test Results

No.	Test Parameter	Clause No.	Condition	Result
1	6 dB Bandwidth and 99% Bandwidth	47 CFR Part 15 15.247(a)(2)	/	Pass
2	Peak Output Power	47 CFR Part 15 15.247(b)(3)	/	Pass
3	Power Spectral Density	47 CFR Part 15 15.247(e)	/	Pass
4	RF Conducted Spurious Emissions	47 CFR Part 15 15.247(d)	/	Pass
5	Radiated Emission	47 CFR Part 15 15.205, 47 CFR Part 15 15.209, 47 CFR Part 15 15.247(d)	/	Pass
6	Band Edge Compliance	47 CFR Part 15 15.205, 47 CFR Part 15 15.209, 47 CFR Part 15 15.247(d),	/	Pass
7	Antenna Requirement	47 CFR Part 15 15.203	/	Pass
8	Power Line Conducted Emissions	47 CFR Part 15 15.207(a)	/	N/A
Note: N/A is an abbreviation for Not Applicable, and means this item is not applicable for this device or no need to test according to standard.				

2. General Test Information

2.1. Description of EUT

EUT Name	: Positioning Device
Model Number	: TB5000-AS
Difference of model number	: /
EUT Function Description	: Please reference user manual of this device
Power Supply	: Battery 3.6V
Antenna Type	: metal antenna
Max Antenna Gain(dBi)	: 2 dBi

Radio Specification	: Bluetooth LE
Operation Frequency	: 2402 MHz to 2480 MHz
Modulation	: GFSK

Bluetooth LE 1Mbps 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		
Bluetooth LE 2Mbps 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	/	
The channels denoted with the grey background are excluded, because they are primary advertising channel only for the Bluetooth LE 1Mbps according to the Bluetooth Core Specification.					

Note: The above EUT information is declared by manufacturer and for more detailed features description please refer to the manufacturer's specifications or User's Manual. The above Antenna information is declared by manufacturer and for more detailed features description please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

“☑” means to be chosen or applicable; “☐” means don't to be chosen or not applicable; This note applies to entire report.

2.2. Accessories of EUT

Accessories	Manufacturer	Model number	Description
/	/	/	/

2.3. Block diagram of EUT configuration for test



2.4. Decision of final test mode

According pre-test, the worst test modes were reported as below:

Test software: nRF_DTM.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, Tx Power Setting, Channel, and Frequency			
Mode	Setting Tx Power	Channel	Frequency (MHz)
GFSK 1M	0	CH0	2402
	0	CH19	2440
	0	CH39	2480
GFSK 2M	0	CH1	2404
	0	CH19	2440
	0	CH38	2478

2.5. Deviations of test standard

No deviation.

2.6. Test environment conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature range:	+15°C to +35 °C
Humidity range:	20% to 75%
Pressure range:	86 kPa to106 kPa

Note: The specific temperature and humidity information of each test item refers to the temperature and humidity record in the corresponding test data.

2.7. Test laboratory

Guangdong Dongdian Testing Service Co., Ltd.

Add.: Unit 2, Building 1, No. 17, Zongbu 2nd Road, Songshan Lake Park, Dongguan, Guangdong, 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-20240, G-20118

2.8. Measurement uncertainty

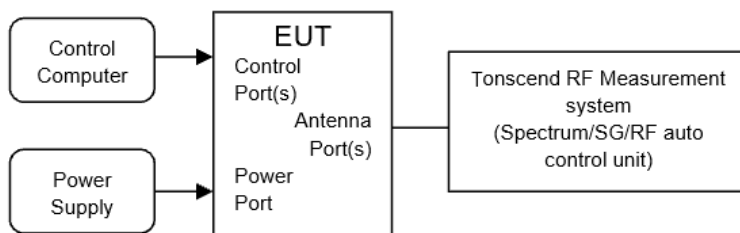
Test Item	Uncertainty
Bandwidth	1.9%
Peak Output Power (Conducted) (Spectrum analyzer)	0.98 dB
Peak Output Power (Conducted) (Power Sensor)	1.18 dB
Power Spectral Density (Base EIRP)	1.51 dB
Power Spectral Density (Spectrum analyzer)	0.98 dB
Frequencies Stability	1.9 kHz
Conducted spurious emissions	1.21 dB ($9\text{ kHz} \leq f < 7\text{ GHz}$);
	3.31 dB ($7\text{ GHz} \leq f < 40\text{ GHz}$)
Uncertainty for radio frequency (RBW < 20 kHz)	5.5×10^{-8}
Time	0.11%
Temperature	0.3 °C
Humidity	2 %
Uncertainty for Radiation Emission test (9 kHz – 30 MHz)	3.44 dB
Uncertainty for Radiation Emission test (30 MHz - 1 GHz)	4.28 dB (Antenna Polarize: V)
	4.14 dB (Antenna Polarize: H)
Uncertainty for Radiation Emission test (1 GHz - 40 GHz)	4.22 dB (1 - 6 GHz)
	4.52 dB (6 GHz - 18 GHz)
	4.58 dB (18 GHz - 40 GHz)
Uncertainty for Power line conduction emission test	3.32dB (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 Conductive Test

Equipment	Manufacturer	Model No.	Serial Number	Due Date
☒ RF Connected Test (RF Measurement System 3#)				
SIGNAL ANALYZER	R&S	FSV40	101407	2026/07/06
Wideband Radio Communication Tester	R&S	CMW500	117491	2027/02/27
EXG Analog Signal Generator	KEYSIGHT	N5173B	MY62153058	2026/07/06
MXG Vector Signal Generator	Agilent	N5182A	MY48180912	2027/02/27
RF Control Unit	Tonscend	JS0806-2	20C8060230	2027/03/16
TEMP&HUMI Programmable Chamber	ZHIXIANG	ZXGDJS-150L	ZX170110-A	2027/02/27
Test Software	Tonscend	JS1120-3	V3.6.21	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 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.

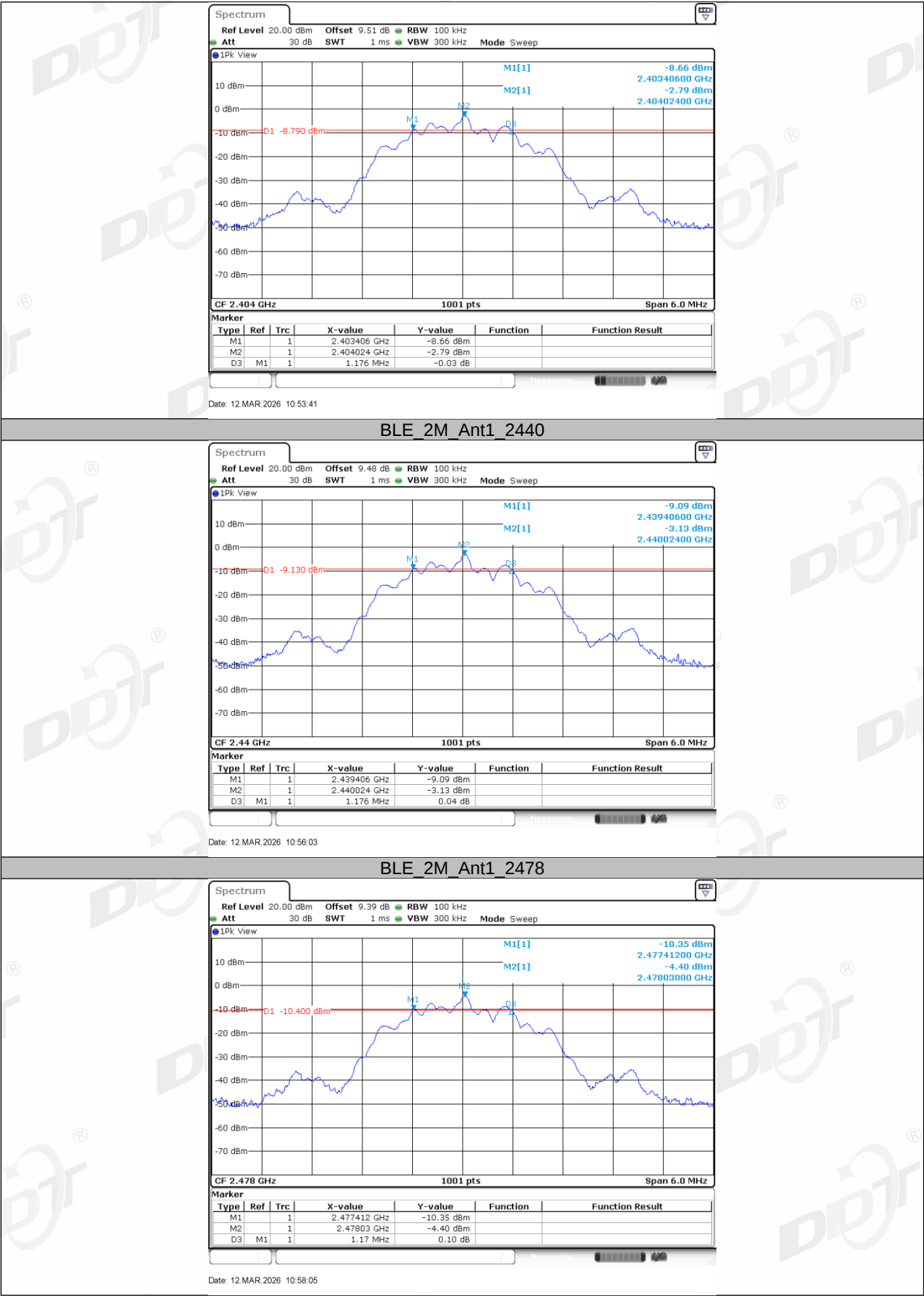
4.4. Test result

Test Engineer:	Zeng Zhongyao	Test Site:	RF Measurement System 3#
Ambient Condition:	26.4°C,34.6%RH	Test Date:	2026.03.12
Test Power Supply:	Battery	Sample Number:	S26011512-003

Test Mode	Antenna	Frequency [MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit [MHz]	Verdict
BLE_1M	Ant1	2402	0.69	2401.67	2402.36	0.5	PASS
		2440	0.69	2439.67	2440.36	0.5	PASS
		2480	0.69	2479.67	2480.36	0.5	PASS
BLE_2M	Ant1	2404	1.18	2403.41	2404.58	0.5	PASS
		2440	1.18	2439.41	2440.58	0.5	PASS
		2478	1.17	2477.41	2478.58	0.5	PASS

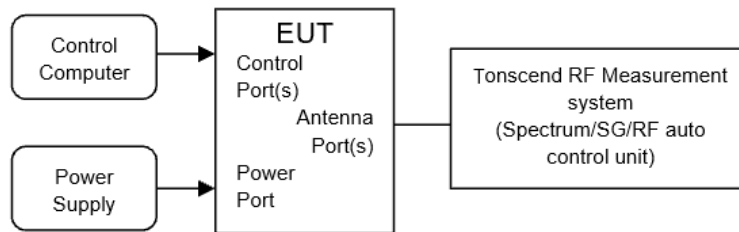
4.5. Test graphs





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 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.

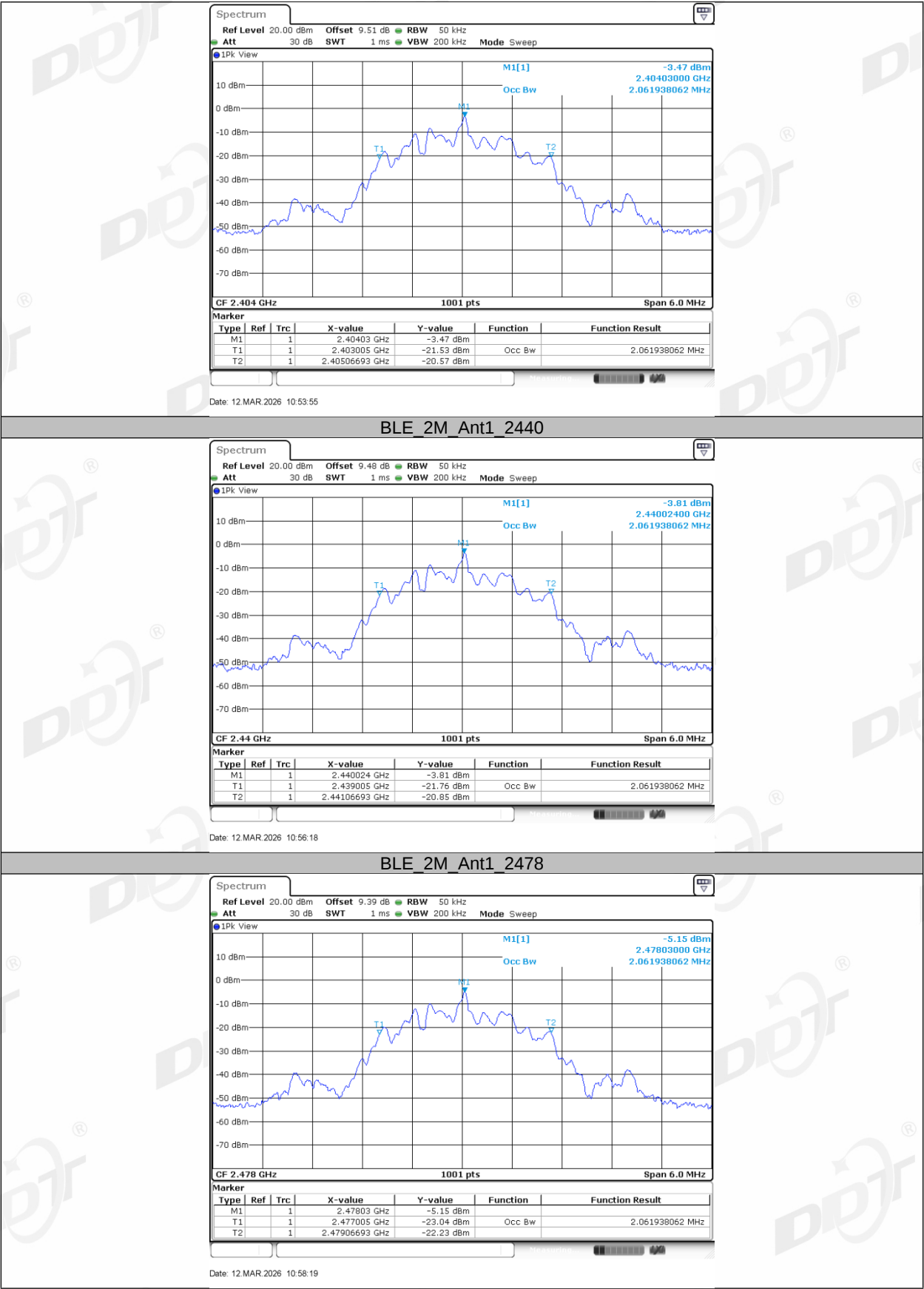
5.4. Test result

Test Engineer:	Zeng Zhongyao	Test Site:	RF Measurement System 3#
Ambient Condition:	26.4°C,34.6%RH	Test Date:	2026.03.12
Test Power Supply:	Battery	Sample Number:	S26011512-003

Test Mode	Antenna	Frequency [MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit [MHz]	Verdict
BLE_1M	Ant1	2402	1.0549	2401.5045	2402.5594	---	---
		2440	1.0549	2439.5045	2440.5594	---	---
		2480	1.0629	2479.5005	2480.5634	---	---
BLE_2M	Ant1	2404	2.0619	2403.0050	2405.0669	---	---
		2440	2.0619	2439.0050	2441.0669	---	---
		2478	2.0619	2477.0050	2479.0669	---	---

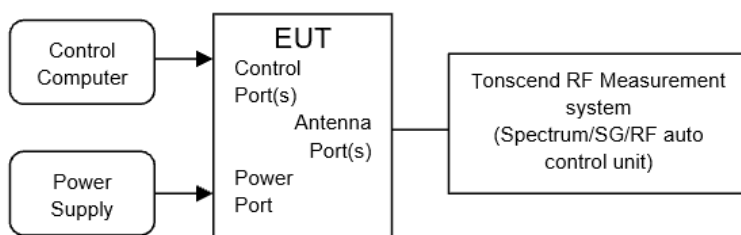
5.5. Test graphs





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 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:

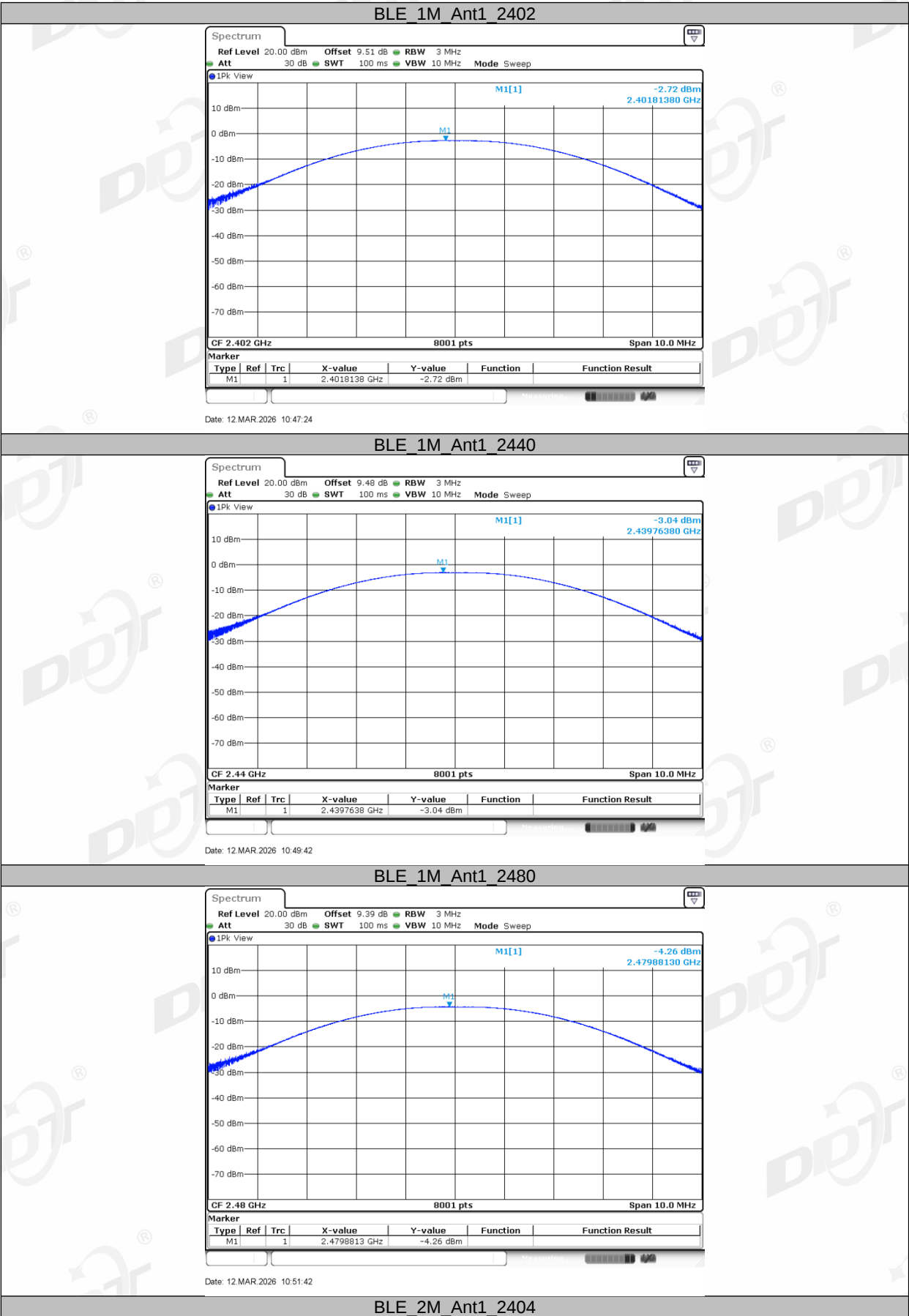
RBW:	≥DTS bandwidth
VBW:	≥3 x RBW
Span	≥3 x RBW
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold
- (5) Allow the trace to stabilize, use peak marker function to determine the peak amplitude level.

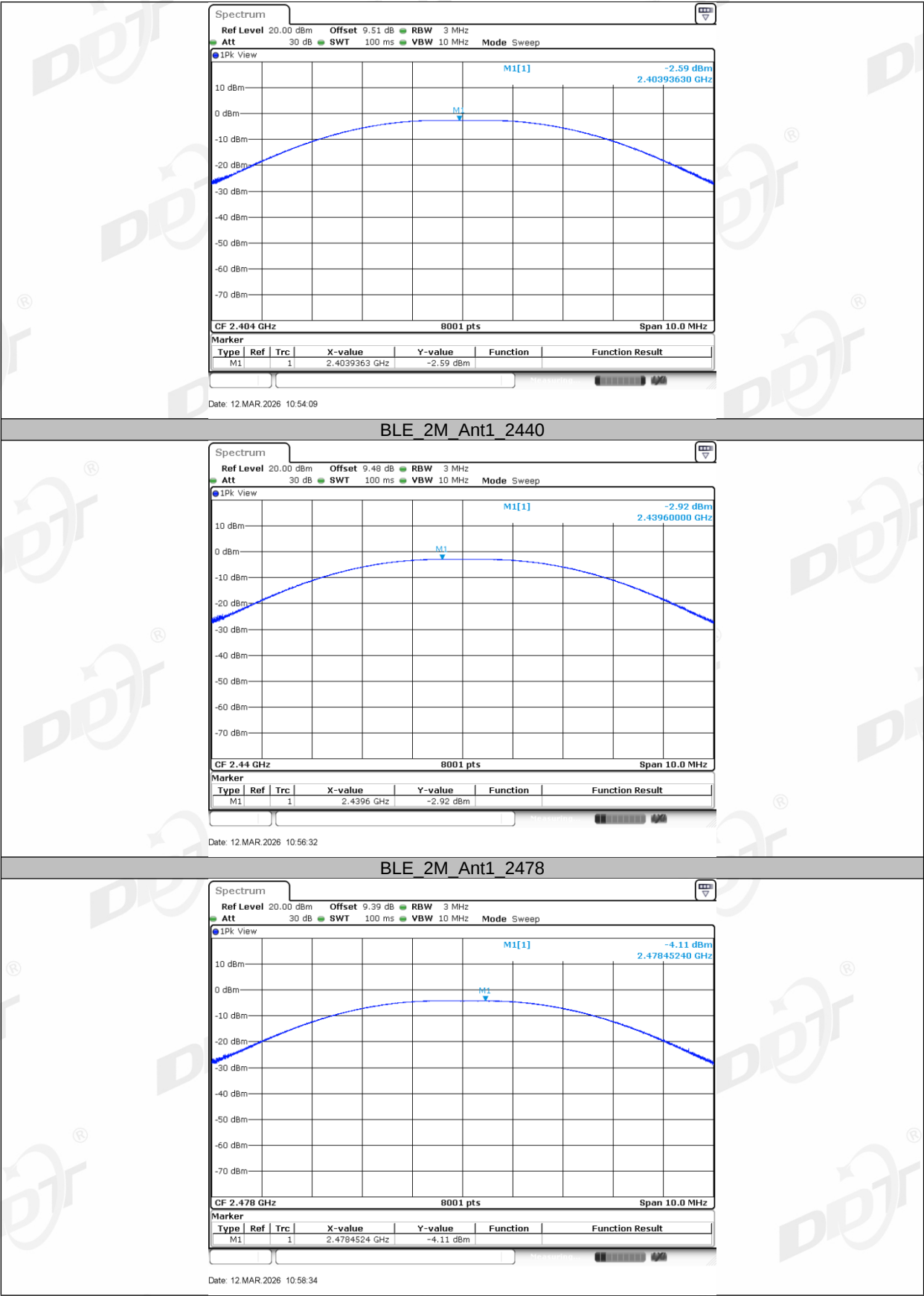
6.4. Test result

Test Engineer:	Zeng Zhongyao	Test Site:	RF Measurement System 3#
Ambient Condition:	26.4°C,34.6%RH	Test Date:	2026.03.12
Test Power Supply:	Battery	Sample Number:	S26011512-003

Test Mode	Antenna	Frequency [MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	EIRP[dBm]	EIRP Limit[dBm]	Verdict
BLE_1M	Ant1	2402	-2.72	≤30	-0.72	≤36	PASS
		2440	-3.04	≤30	-1.04	≤36	PASS
		2480	-4.26	≤30	-2.26	≤36	PASS
BLE_2M	Ant1	2404	-2.59	≤30	-0.59	≤36	PASS
		2440	-2.92	≤30	-0.92	≤36	PASS
		2478	-4.11	≤30	-2.11	≤36	PASS

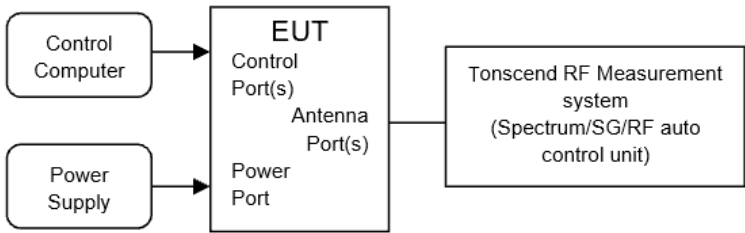
6.5. Test graphs





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 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:

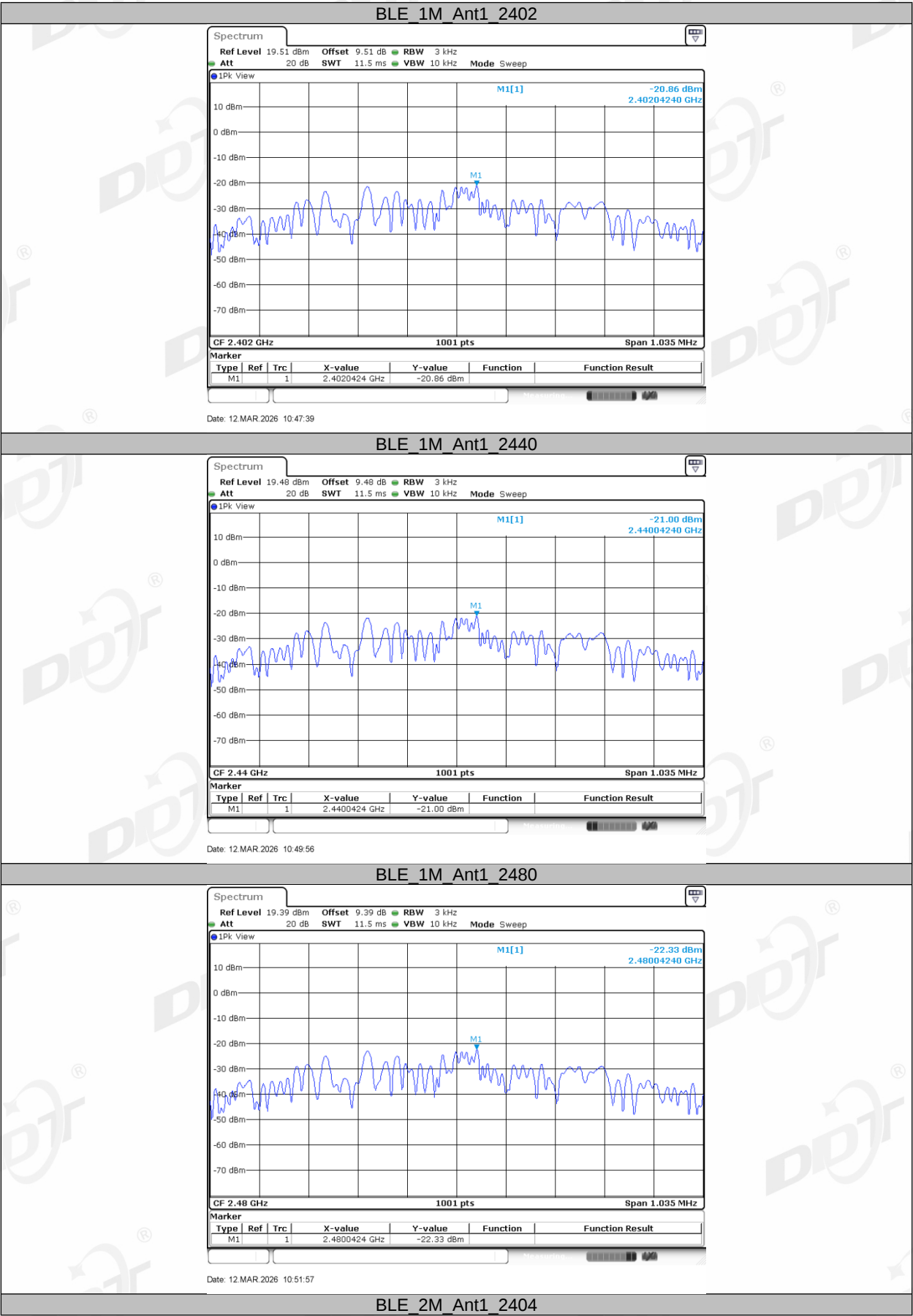
Center frequency	DTS Channel center frequency
RBW:	$3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$
VBW:	$\geq 3\text{RBW}$
Span	1.5 times the DTS bandwidth
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold
 - (5) Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

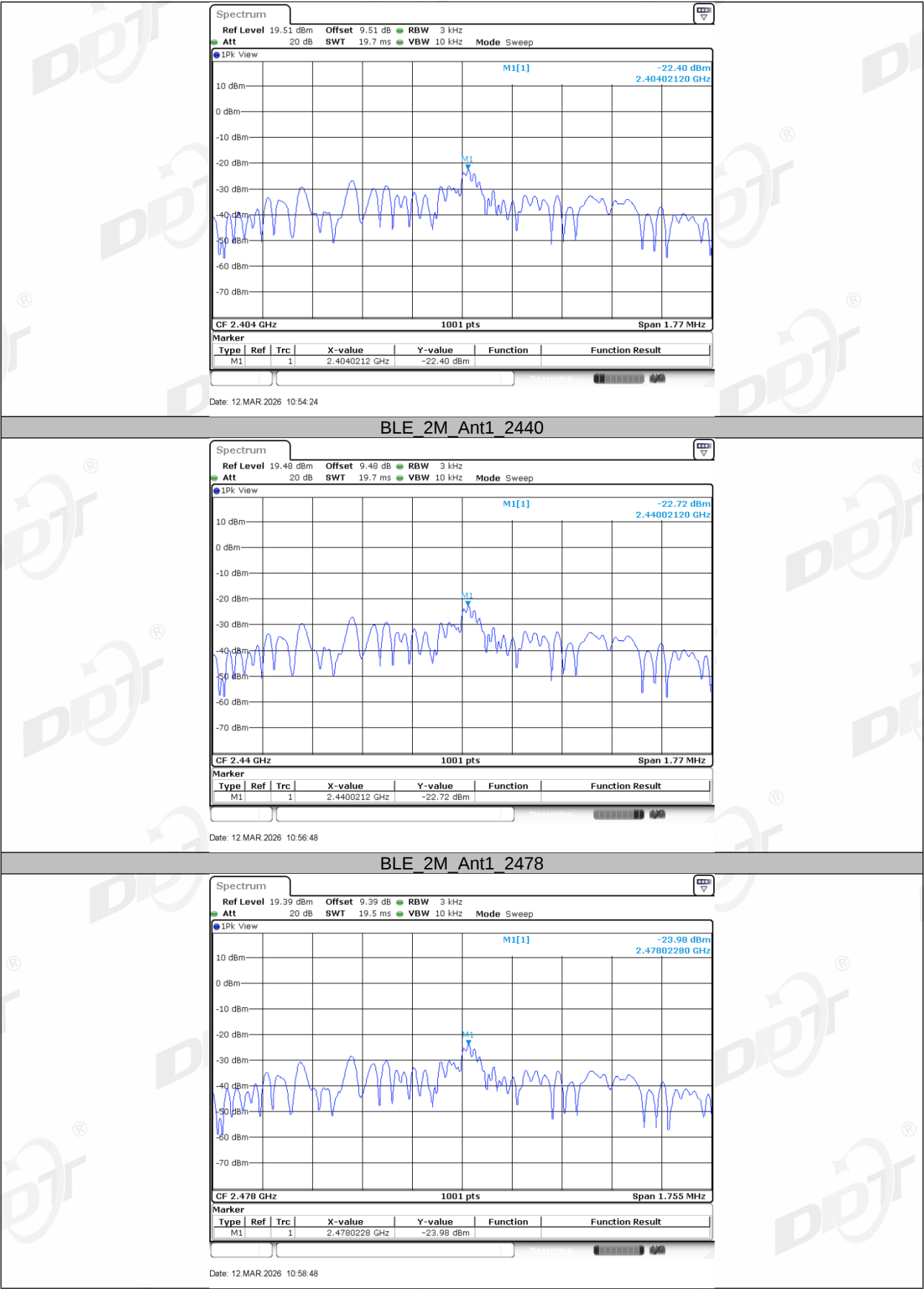
7.4. Test result

Test Engineer:	Zeng Zhongyao	Test Site:	RF Measurement System 3#
Ambient Condition:	26.4°C,34.6%RH	Test Date:	2026.03.12
Test Power Supply:	Battery	Sample Number:	S26011512-003

Test Mode	Antenna	Frequency [MHz]	Result [dBm/3kHz]	Limit [dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-20.86	≤8.00	PASS
		2440	-21.00	≤8.00	PASS
		2480	-22.33	≤8.00	PASS
BLE_2M	Ant1	2404	-22.40	≤8.00	PASS
		2440	-22.72	≤8.00	PASS
		2478	-23.98	≤8.00	PASS

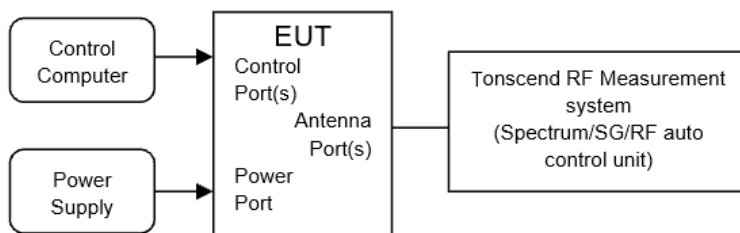
7.5. Test graphs





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

Test Engineer:	Zeng Zhongyao	Test Site:	RF Measurement System 3#
Ambient Condition:	26.4°C,34.6%RH	Test Date:	2026.03.12
Test Power Supply:	Battery	Sample Number:	S26011512-003

Mode	Frequency [MHz]	Measured Range	Verdict
GFSK 1M	2402	2.310 GHz - 2.410 GHz	Pass
	2480	2.470 GHz - 2.500 GHz	Pass
GFSK 2M	2404	2.310 GHz - 2.410 GHz	Pass
	2478	2.470 GHz - 2.500 GHz	Pass

BLE 1M Ant1 Low 2402

Spectrum

Ref Level 19.51 dBm Offset 9.51 dB RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Sweep

1Pk View

10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm

M1[1] -3.22 dBm
2.401970 GHz
M2[1] -49.82 dBm
2.400000 GHz

D1 -23.220 dBm

Start 2.31 GHz 691 pts Stop 2.41 GHz

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1	1		2.40197 GHz	-3.22 dBm		
M2	1		2.4 GHz	-49.82 dBm		
M3	1		2.39 GHz	-60.51 dBm		
M4	1		2.39971 GHz	-49.20 dBm		

Marker

Date: 12.MAR.2026 10:47:55

BLE 1M Ant1 High 2480

Spectrum

Ref Level 19.39 dBm Offset 9.39 dB RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Sweep

1Pk View

10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm

M1[1] -4.59 dBm
2.4800510 GHz
M2[1] -57.02 dBm
2.4835000 GHz

D1 -24.590 dBm

Start 2.47 GHz 691 pts Stop 2.5 GHz

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1	1		2.480051 GHz	-4.59 dBm		
M2	1		2.4835 GHz	-57.02 dBm		
M3	1		2.5 GHz	-60.59 dBm		
M4	1		2.4835217 GHz	-58.64 dBm		

Marker

Date: 12.MAR.2026 10:52:13

BLE 2M Ant1 Low 2404

Spectrum

Ref Level 19.51 dBm Offset 9.51 dB RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Sweep

1Pk View

10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm

M1[1] -2.89 dBm
2.403990 GHz
M2[1] -53.87 dBm
2.400000 GHz

D1 -22.890 dBm

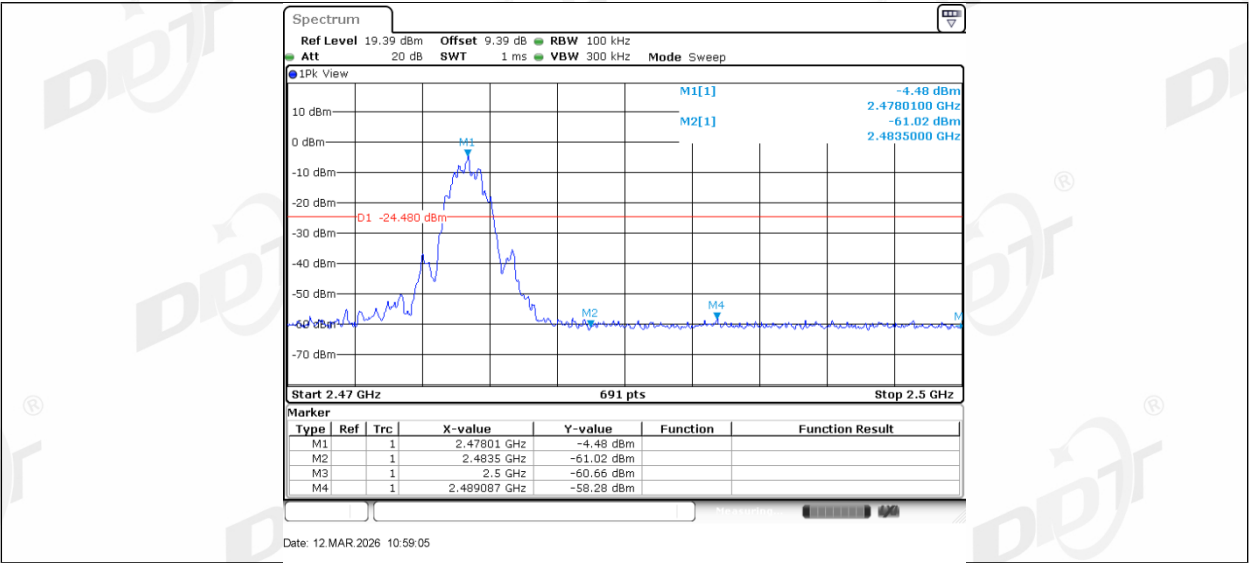
Start 2.31 GHz 691 pts Stop 2.41 GHz

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1	1		2.40399 GHz	-2.89 dBm		
M2	1		2.4 GHz	-53.87 dBm		
M3	1		2.39 GHz	-59.11 dBm		
M4	1		2.399855 GHz	-55.03 dBm		

Marker

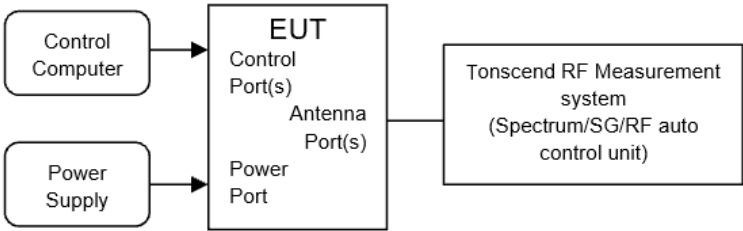
Date: 12.MAR.2026 10:54:40

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	$\geq \text{Span}/\text{RBW}$
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold

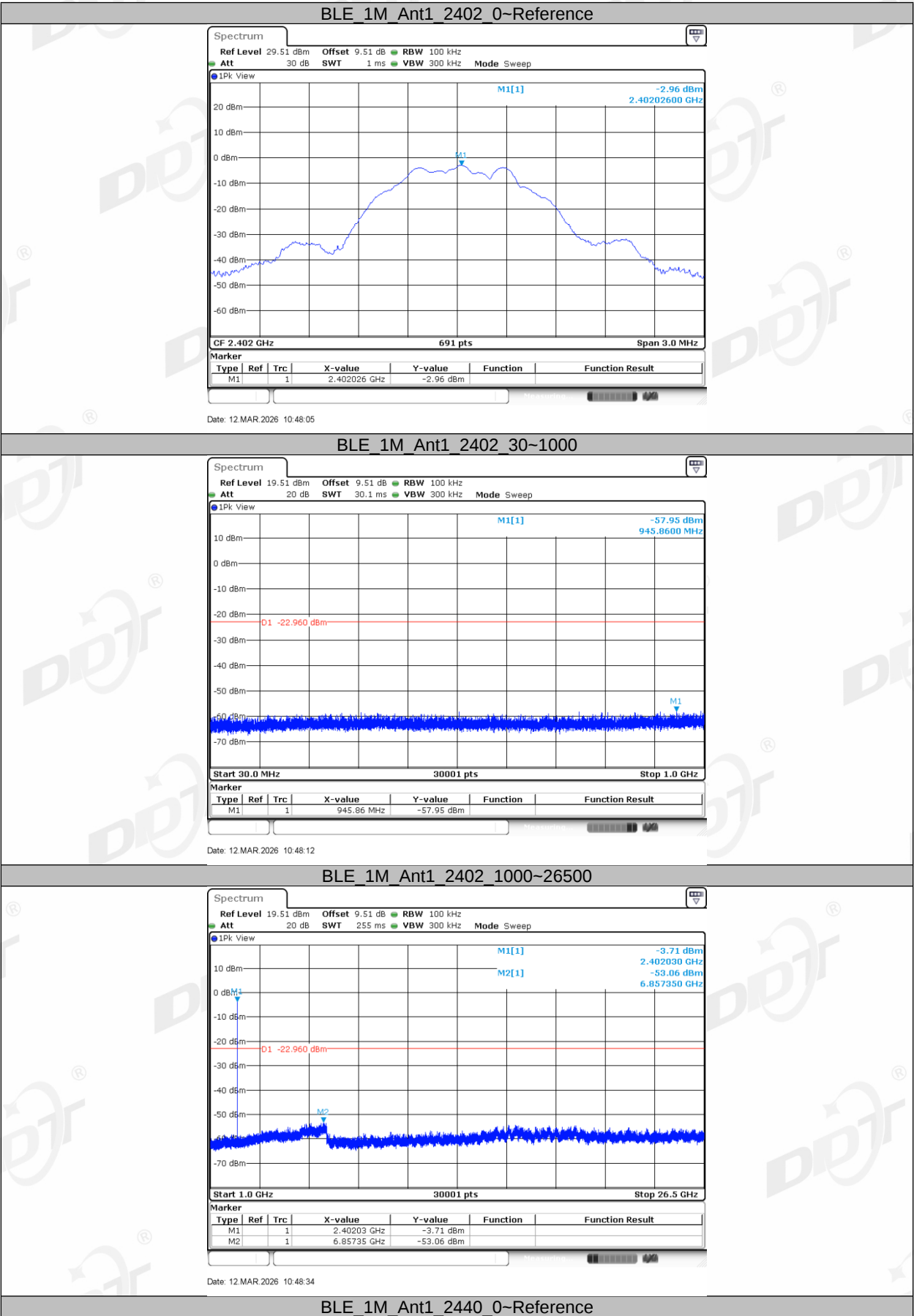
Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude of all unwanted emissions outside of the authorized frequency band

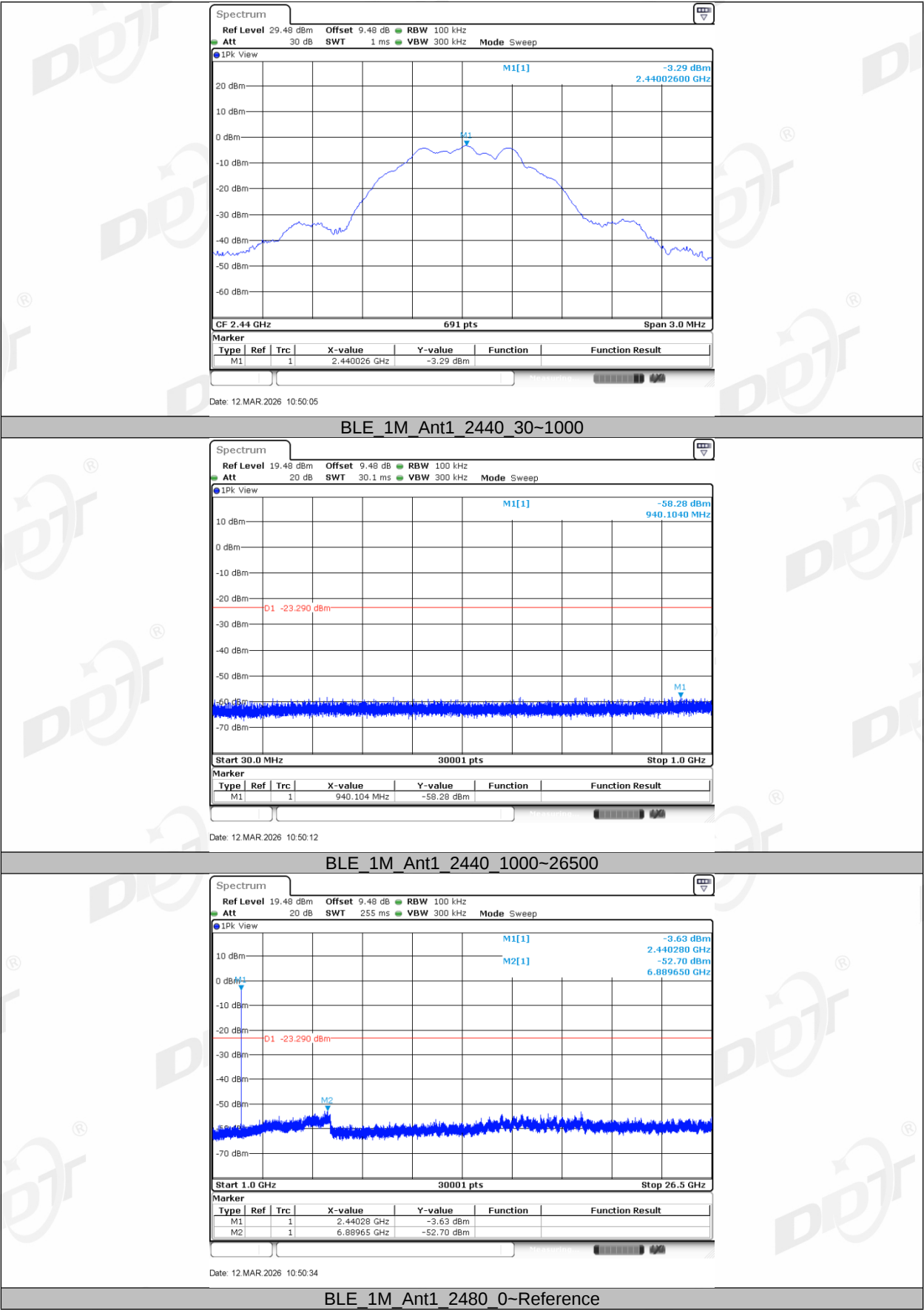
9.4. Test result

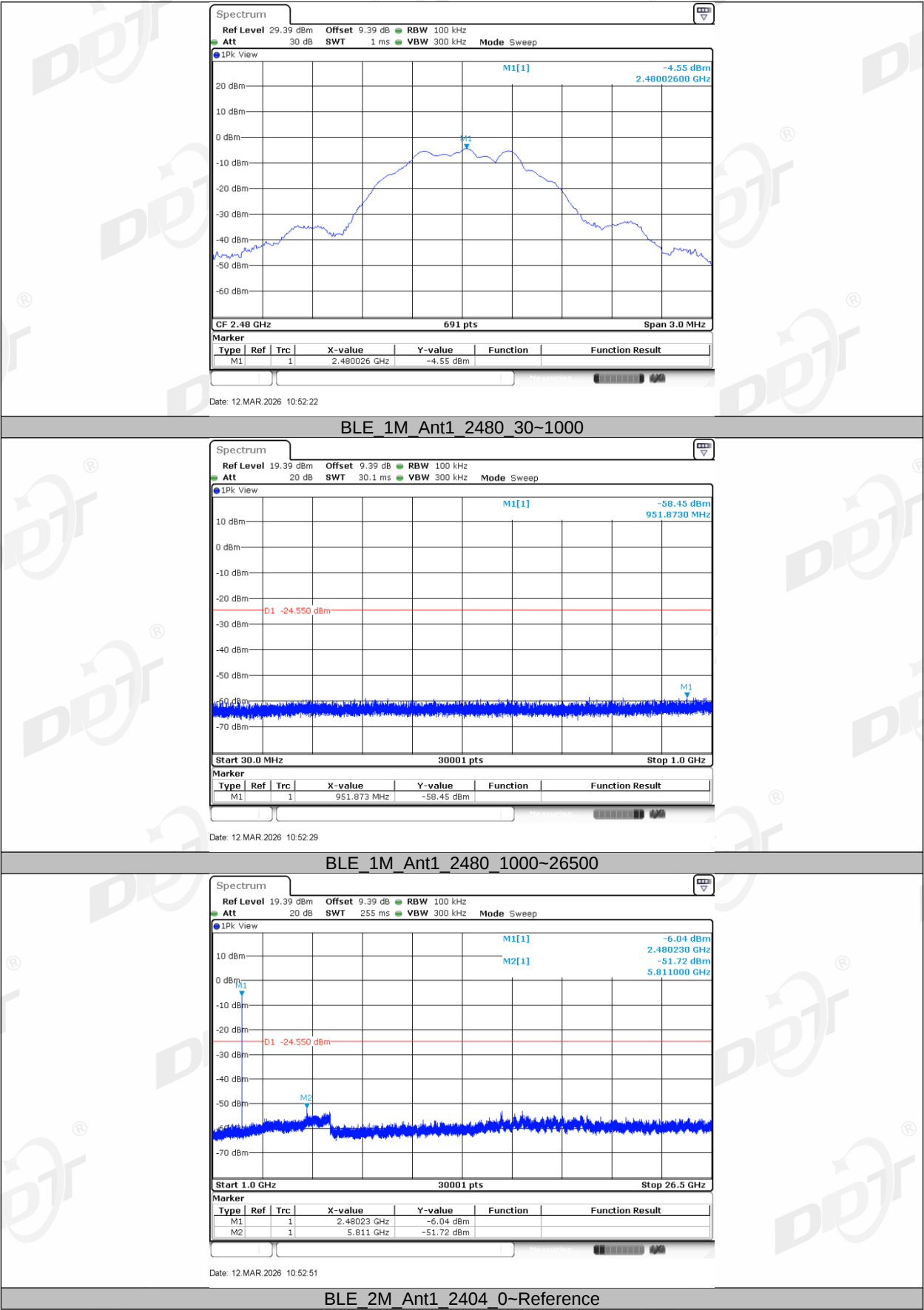
Test Engineer:	Zeng Zhongyao	Test Site:	RF Measurement System 3#
Ambient Condition:	26.4°C,34.6%RH	Test Date:	2026.03.12
Test Power Supply:	Battery	Sample Number:	S26011512-003

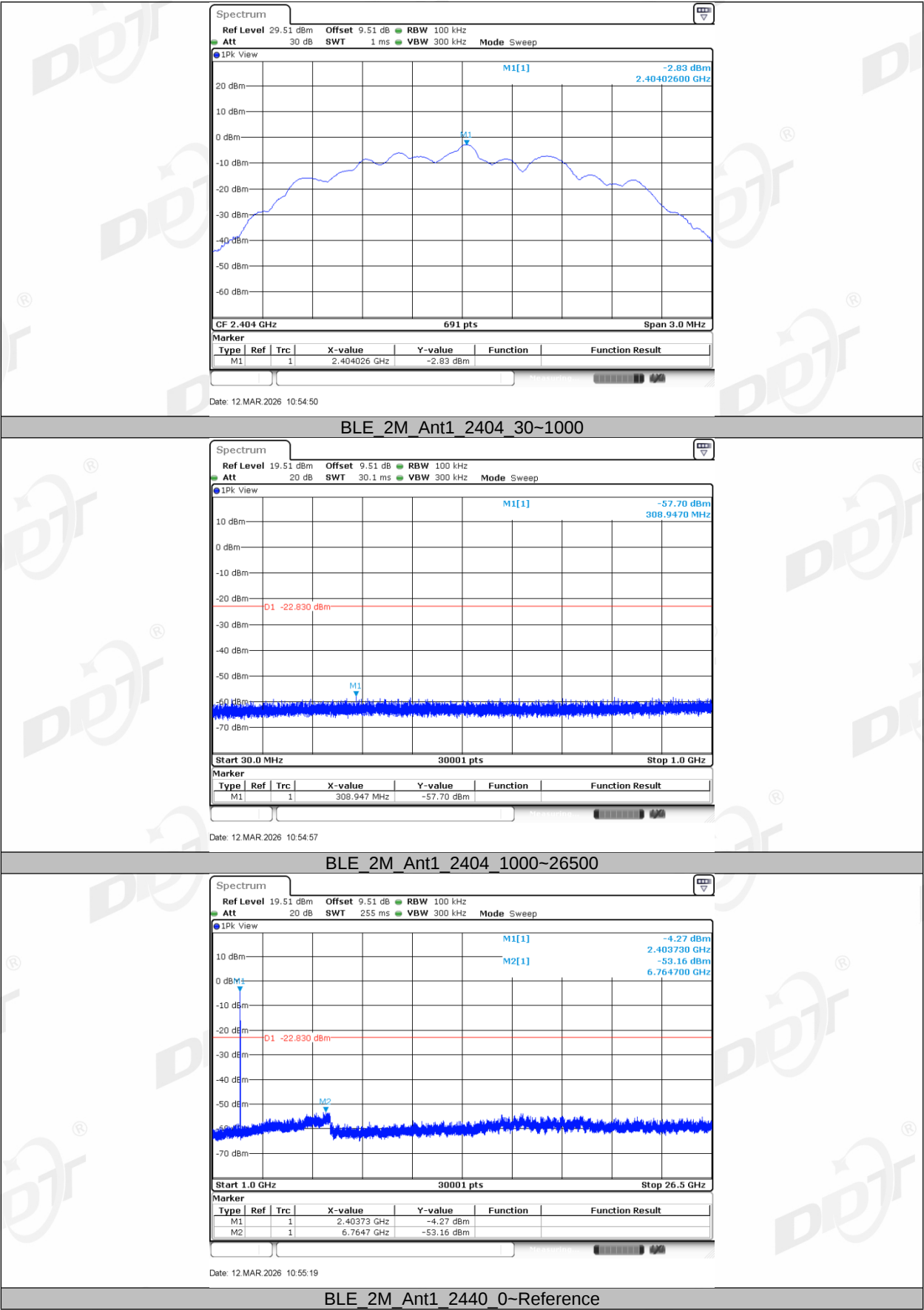
Mode	Frequency [MHz]	Verdict
GFSK 1M	2402	Pass
	2440	Pass
	2480	Pass
GFSK 2M	2404	Pass
	2440	Pass
	2478	Pass

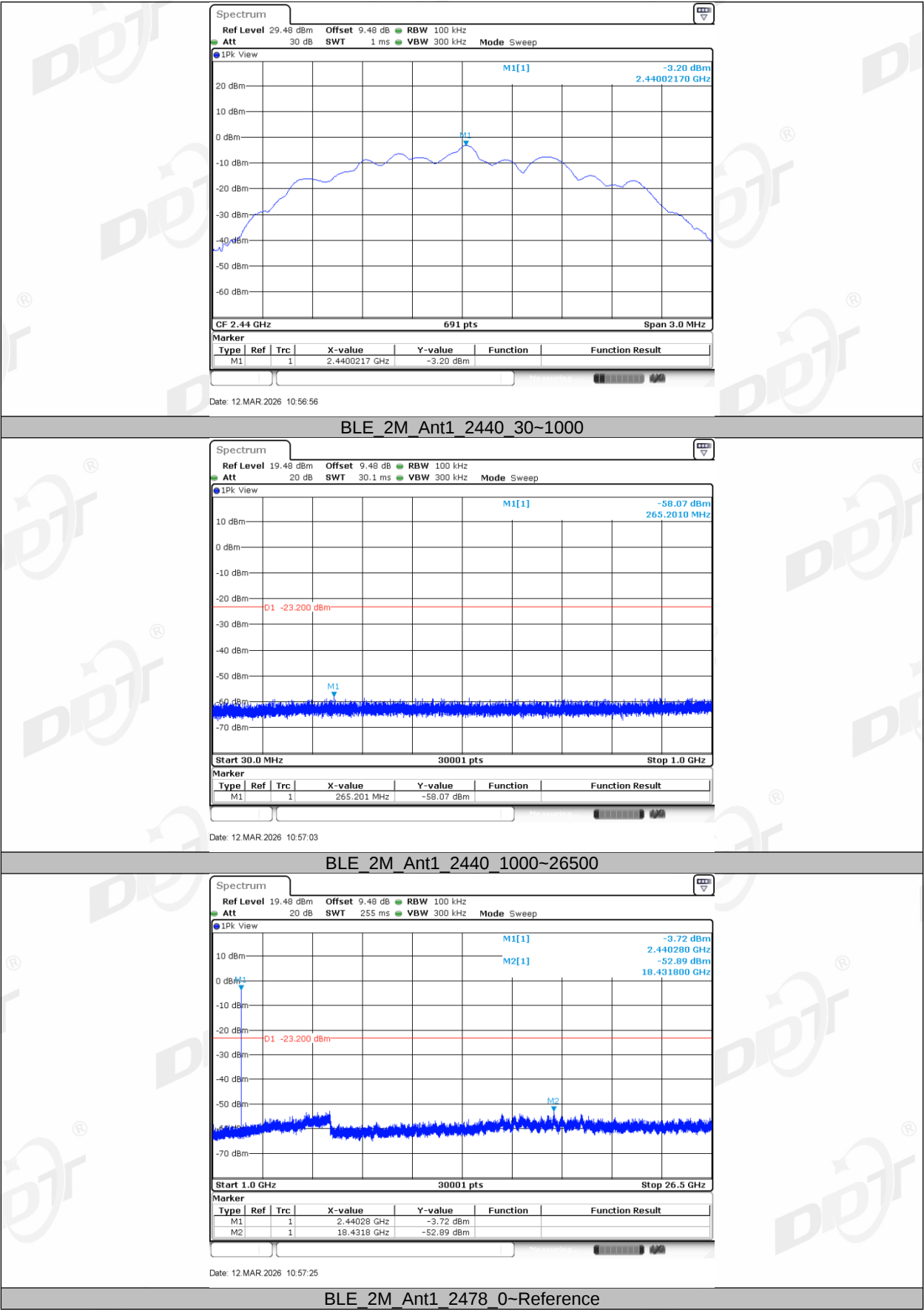
9.5. Test graphs

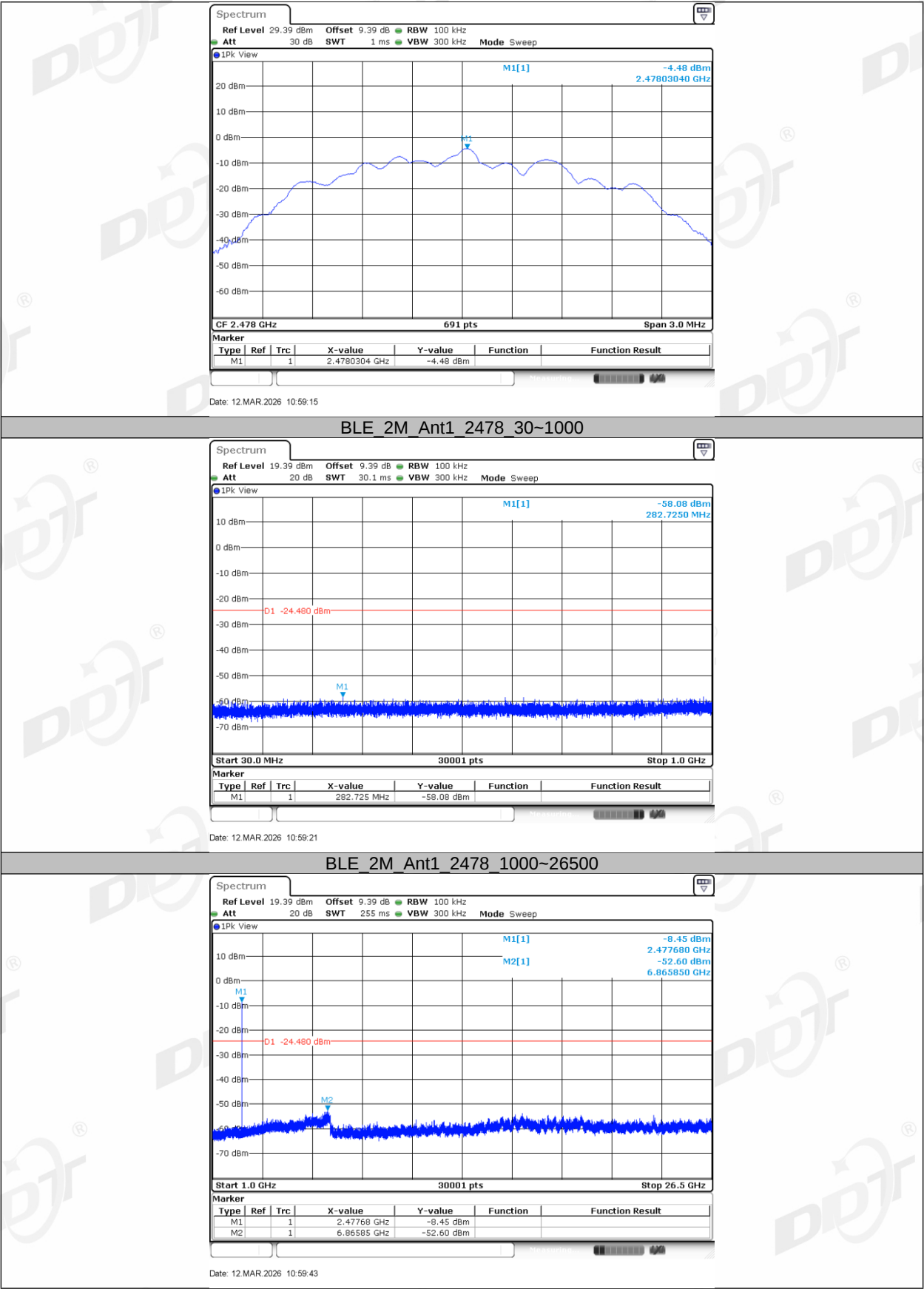






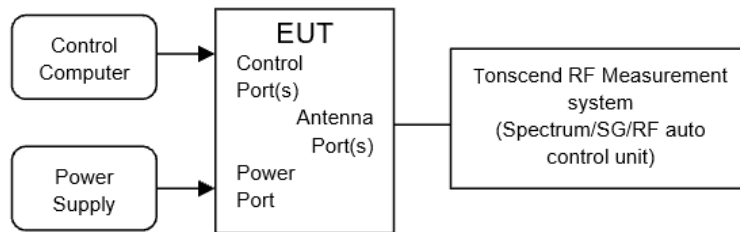






10. Duty Cycle

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

Test Engineer:	Zeng Zhongyao	Test Site:	RF Measurement System 3#
Ambient Condition:	26.4°C,34.6%RH	Test Date:	2026.03.12
Test Power Supply:	Battery	Sample Number:	S26011512-003

Test Mode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor[dB]
BLE_1M	Ant1	2402	0.10	0.62	16.13	7.92
		2440	0.10	0.62	16.13	7.92
		2480	0.10	0.62	16.13	7.92
BLE_2M	Ant1	2404	0.07	0.63	11.11	9.54
		2440	0.07	0.63	11.11	9.54
		2478	0.07	0.63	11.11	9.54

10.5. Test graphs





11. Antenna Requirements

11.1. Limit

For intentional device, according to FCC 47 CFR Section 15.203, 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

11.2. Result

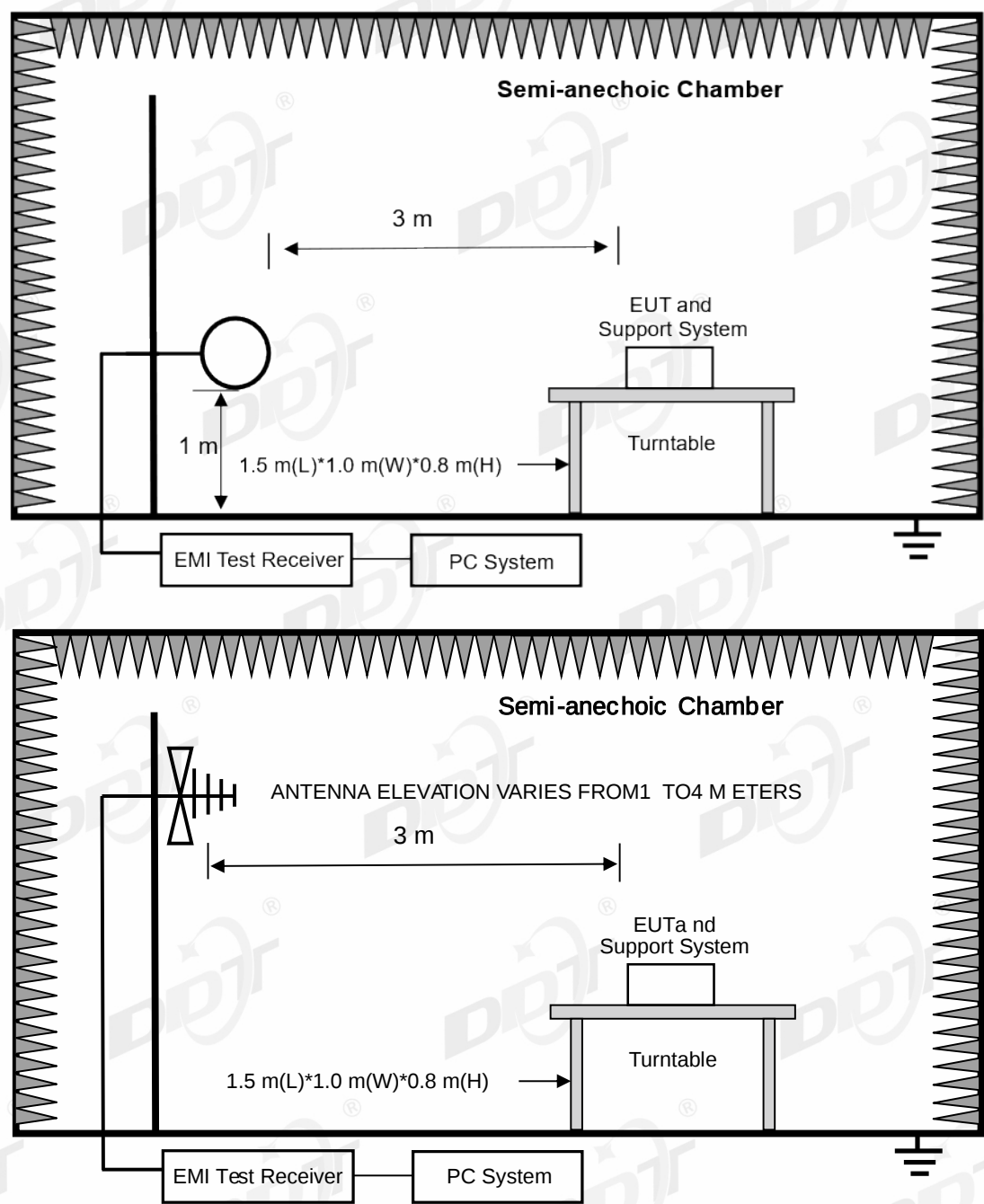
The antenna used for this product as Antenna information described in section 2.1 of the report, and there is no other antenna than that furnished by the responsible party shall be used with the device.

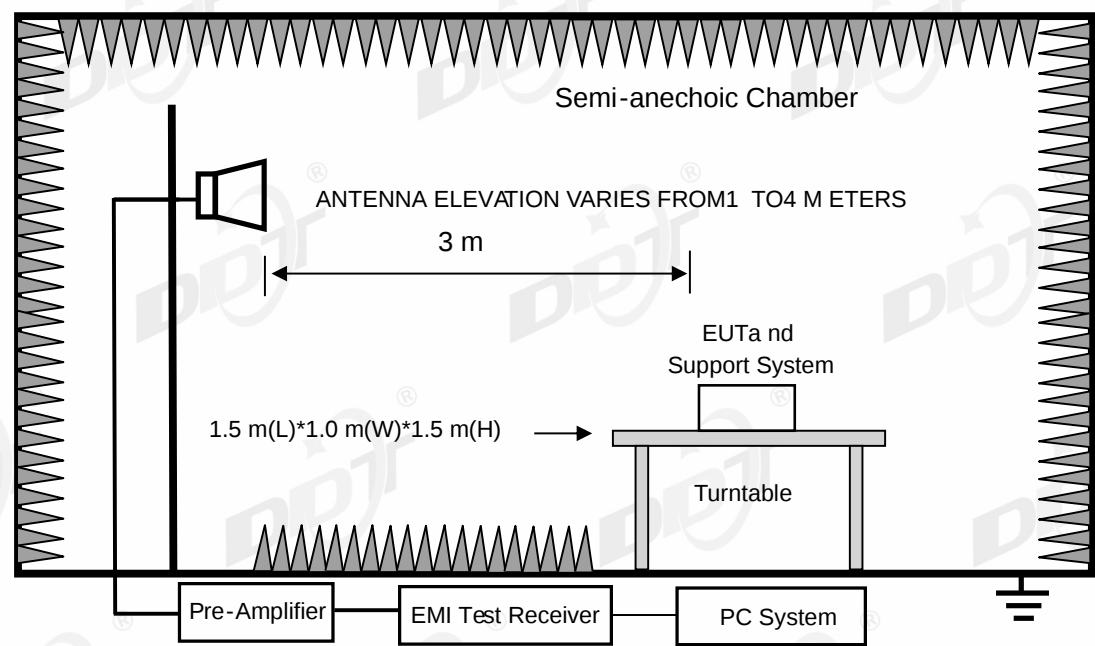
12. Radiated Emission

12.1. Test equipment

Equipment	Manufacturer	Model No.	Serial No.	Cal Due To
Band Reject Filter Group	Tonscend	JS0806-F	DDT-ZC05733	/
Hochgewinn-Hornantenne	SCHWARZBEC K	BBHA 9120 D	DDT-ZC05922	2027/01/06
Broadband Preamplifier	HPX	BP-01G-18G	DDT-ZC05923	2027/01/06
Pre-amplifier	COM-POWER	PAM-840A	DDT-ZC01693	2027/03/05
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	DDT-ZC00506	2027/03/04
Signal & Spectrum analyzer	R&S	FSV40-N	DDT-ZC04979	2026/07/04
SPECTRUM ANALYZER	R&S	FSU26	DDT-ZC00236	2026/07/06
High pass filter	Micro-Tronics	HPM50102	DDT-ZC00561	2027/02/27
Radiation disturbance fully automated test software	Tonscend	JS32-RE	DDT-ZC02739	/
Pre-amplifier	SONOMA	310N	DDT-ZC01969	2026/07/06
RF Cable	N/A	W24.02 HL-562	DDT-ZC04022	2027/03/28
RF cable	Yuhu Technology	JCTB810-NJ-NJ-9M	DDT-ZC02538	2027/03/28
RF cable	Zhongke Junchuang	JCT26S-NJ-NJ-1.5M	DDT-ZC02762	/
RF cable	Yuhu Technology	ZT26S-SMAJ-SMAJ-1M	DDT-ZC02037	2026/10/10
RF Cable	N/A	W13.02 AP1-X2	DDT-ZC04023	2027/03/28
Pre-amplifier	COM-POWER	PAM-840A	DDT-ZC01693	2027/03/05
Pre-amplifier	COM-POWER	PAM-118A	DDT-ZC01293	2026/08/10
EMI TEST RECEIVER	R&S	ESU26	DDT-ZC01909	2027/02/27
Micro-Tronics filters	REBES	BRM50702	DDT-ZC03242	/
High pass filter	Micro-Tronics	HPM50108	DDT-ZC00560	2027/02/27
High Pass filter	Xi'an Xingbo	XBLBQ-GTA67	DDT-ZC02179	2027/02/27
Micro-Tronics filters	REBES	BRM50716	DDT-ZC03240	/
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	DDT-ZC00506	2027/03/04
Trilog Broadband Antenna	Schwarzbeck	VULB 9163	DDT-ZC02050	2026/07/25
Hochgewinn-Hornantenne	SCHWARZBEC K	BBHA 9120 D	DDT-ZC02129	2026/08/11
Active Loop Antenna	Schwarzbeck	FMZB1519	DDT-ZC00524	2026/08/18
PSA Series Spectrum Analyzer	Agilent	E4447A	DDT-ZC00517	2027/02/27

12.2. Block diagram of test setup





12.3. Limits

(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
10.495-0.505	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	DISTANCE	FIELD STRENGTHS LIMIT	
		uV/m	dBuV/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 dBuV/m(Peak)	
		54.0 dBuV/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:

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

(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.

12.4. Assistant equipment used for test

Assistant equipment	Manufacturer	Model number	Description	other
/	/	/	/	/

12.5. Test procedure

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

(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 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 3m 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 18 GHz to 25 GHz, so below final test was performed with frequency range from 9 kHz 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 equipment and all of the interface cables were changed according to ANSI C63.10 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

- (7) For emissions above 1GHz, 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 clause 4.1.5.2.2 procedure for average measure.
- (8) For portable device, X axis, Y axis, Z axis are tested, and worse setup is reported.
- (9) 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.
- (10) For 30 MHz ~ 25 GHz: (Scan with all mode, the worst case is reported)
- (11) 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 worst mode.

12.6. Test result

PASS. (See below detailed test result)