FCC Test Report

Report No.:	2405X67746EB
Applicant:	Dragino Technology Co., Limited.
Address:	Room 202,BaoChengTai industrial park,No.8 CaiYun LongCheng Street,LongGang District,Shenzhen China
Product Name:	LoRaWAN CO2 Sensor
Product Model:	AQS01-L
Multiple Models:	N/A
Trade Mark:	DRAGINO
FCC ID:	ZHZAQS01-L
Standards:	FCC CFR Title 47 Part 15C (§15.247)
Test Date:	2024-09-23 to 2024-09-24
Test Result:	Complied
Report Date:	2024-09-29

Reviewed by: Abel Chen — Abel Chen, Project Engineer

Approved by: Jacob Kong — Jacob Kong, Manager

Prepared by:

World Alliance Testing & Certification (Shenzhen) Co., Ltd

No. 1002, East Block, Laobing Building, Xingye Road 3012, Xixiang street, Bao'an District, Shenzhen, Guangdong, People's Republic of China

NVLAP TESTING NVLAP LAB CODE 600335-0

ilac-MRA

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Announcement

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2. The results in this report apply only to the sample tested.

3. This sample tested is in compliance with the limits of the above regulation.

4. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

5. The information marked "#" is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report. Customer model name, addresses, names, trademarks etc. are included.

Revision History

Version No.	Issued Date	Description
00	*2024-09-29*	*Original*

Contents

1 General Information

1.1 Client Information

Applicant:	Dragino Technology Co., Limited.
Address:	Room 202,BaoChengTai industrial park,No.8 CaiYun LongCheng Street, LongGang District, Shenzhen China
Manufacturer:	Dragino Technology Co., Limited.
Address:	Room 202,BaoChengTai industrial park,No.8 CaiYun LongCheng Street, LongGang District, Shenzhen China

1.2 Product Description of EUT

The EUT is LoRaWAN CO2 Sensor that contains BLE and LoRa radios, this report covers the full testing of the BLE radio.

Sample Serial Number	2R1C-3 for RE test, 2R1C-4for RF conducted test (assigned by WATC)
Sample Received Date	2024-09-05
Sample Status	Good Condition
Frequency Range	2402MHz - 2480MHz(BLE1M)
Maximum Conducted Peak Output Power	0.72dBm
Modulation Technology	GFSK
Spatial Streams	SISO (1TX, 1RX)
Antenna Gain#	0.37dBi
Power Supply	DC 3.6V from battery
Adapter Information	N/A
Modification	Sample No Modification by the test lab

1.3 Antenna information

15.203 requirement:

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, 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.

Device Antenna information:	

The BLE antenna is an internal antenna which cannot replace by end-user, please see product internal photos for details.

1.4 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart C, Equipment Class: DSS, FCC ID: ZHZAQS01-L

1.5 Measurement Uncertainty

Parameter		Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
AC Power Lines Conducted Emissions		±3.14dB
Emissions, Radiated	Below 30MHz	±2.78dB
	Below 1GHz	±4.84dB
	Above 1GHz	±5.44dB
Emissions, Conducted		1.75dB
Conducted Power		0.74dB
Frequency Error		150Hz
Bandwidth		0.34%
Power Spectral Density		0.74dB
Note: *The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.*		

1.6 Laboratory Location

World Alliance Testing & Certification (Shenzhen) Co., Ltd

No. 1002, East Block, Laobing Building, Xingye Road 3012, Xixiang street, Bao'an District, Shenzhen, Guangdong, People's Republic of China

Tel: +86-755-29691511, Email: qa@watc.com.cn

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 463912, the FCC Designation No. : CN5040.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0160.

1.7 Test Methodology

FCC CFR 47 Part 2

FCC CFR 47 Part 15

KDB 558074 D01 DTS Meas Guidance v05r02

ANSI C63.10-2020

2 Description of Measurement

2.1 Test Configuration

Operating channels:					
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	19	2440	38	2478
1	2404	20	2442	39	2480
…	…	…	…	/	/
18	2438	…	…	/	/
According to ANSI C63.10-2020 chapter 5.6.1 Table 11 requirement, select lowest channel, middle channel, and highest channel in the frequency range in which device operates for testing. The detailed frequency points are as follows:					
Lowest channel		Middle channel		Highest channel	
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	19	2440	39	2480

Test Mode:				
Transmitting mode:	Keep the EUT in continuous transmitting with modulation			
Exercise software#:	SmartSnippets_Toolbox			
Mode	**Data rate**	**Power Level Setting#**		
		Low Channel	**Middle Channel**	**High Channel**
BLE 1M	1Mbps	default	default	default
The exercise software and the maximum power setting that provided by manufacturer.				

Worst-Case Configuration:
For radiated emissions, EUT was investigated in three orthogonal orientation, the worst-case orientation was recorded in report For radiated emission 9kHz-1GHz and above 18GHz were performed with the EUT transmits at the channel with highest output power as worst-case scenario.

2.2 Test Auxiliary Equipment

Manufacturer	Description	Model	Serial Number
/	/	/	/

2.3 Interconnecting Cables

Manufacturer	Description	Length(m)	From	To
/	/	/	/	/

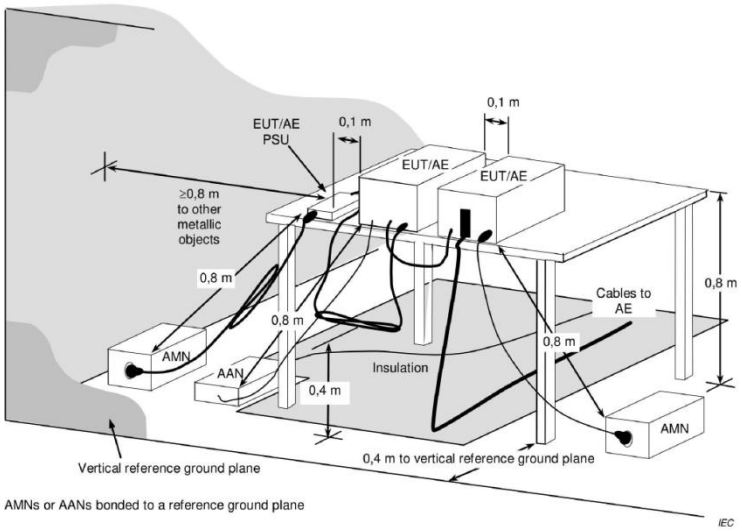
2.4 Block Diagram of Connection between EUT and AE

EUT

Note: for reference only, the actual connection setup used for testing please refer to the test photos.

2.5 Test Setup

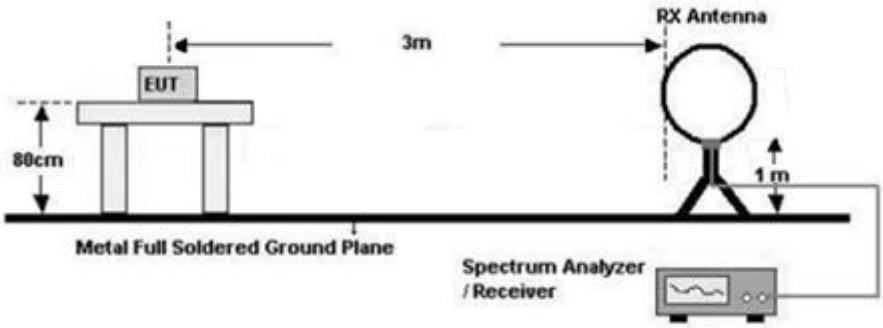
1) Conducted emission measurement:



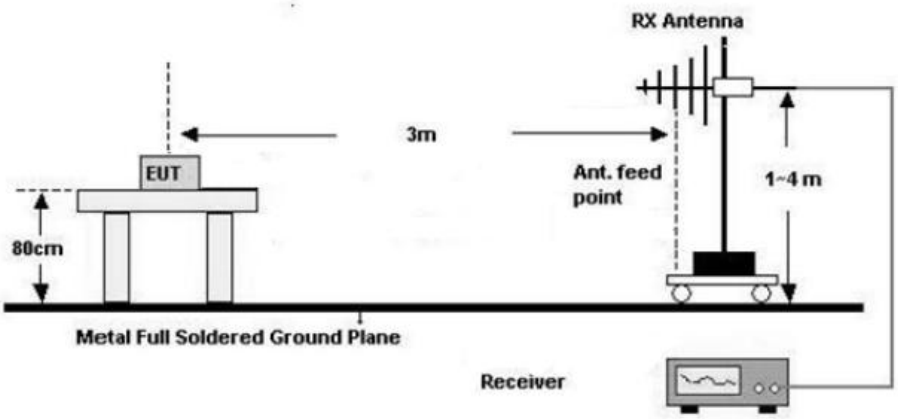
Note: The 0.8 m distance specified between EUT/AE/PSU and AMN/AAN, is applicable only to the EUT being measured. If the device is AE then it shall be >0.8 m.

2) Radiated emission measurement:

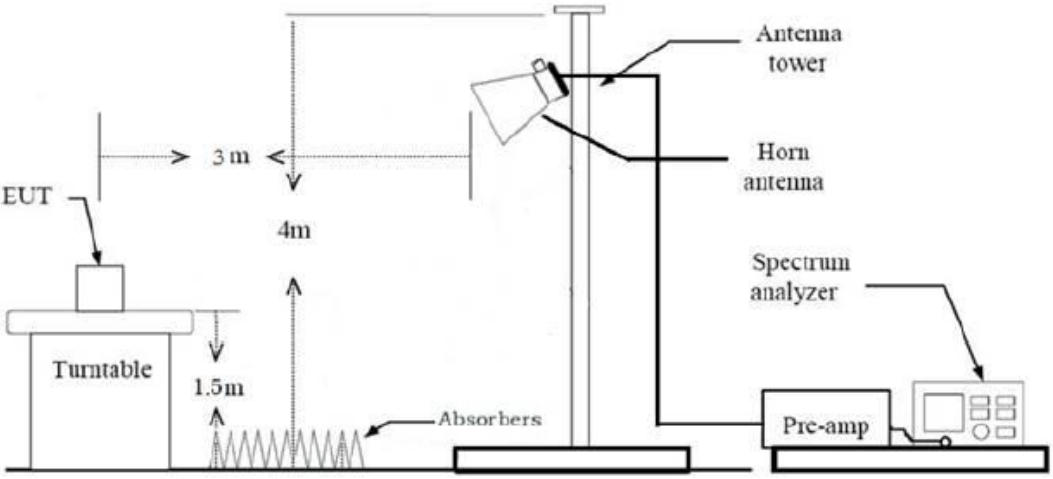
Below 30MHz (3m SAC)



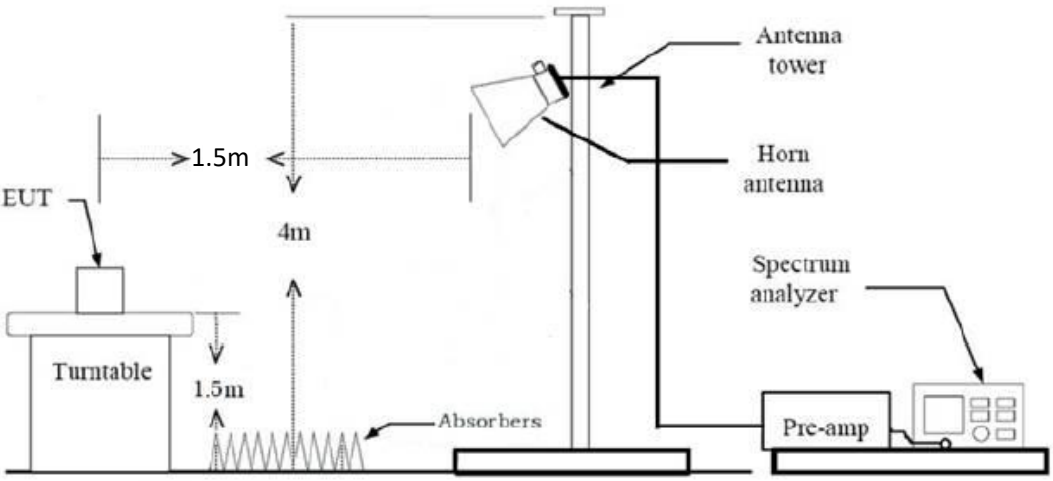
30MHz-1GHz (3m SAC)



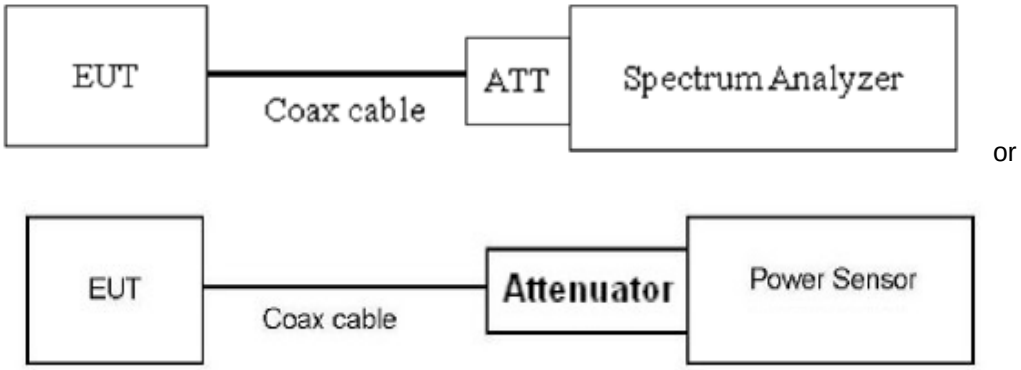
1GHz-18GHz(3m FAC)



Above 18GHz (3m FAC)



3) RF Conducted Test



or

2.6 Test Procedure

Conducted emission:

1. The E.U.T is placed on a non-conducting table 40cm from the vertical ground plane and 80cm above the horizontal ground plane (Please refer to the block diagram of the test setup and photographs).
2. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.
3. Line conducted data is recorded for both Line and Neutral

Radiated Emission Procedure:

a) For below 30MHz

1. All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz- 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (test distance / specification distance).
2. Loop antenna use, investigation was done on the three antenna orientations (parallel, perpendicular, gound-parallel)

b) For 30MHz-1GHz:

1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m.
2. EUT works in each mode of operation that needs to be tested. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.

c) For above 1GHz:

1. The EUT was placed on the tabletop of a rotating table 1.5 m the ground at a 3 m fully anechoic room. The measurement distance from the EUT to the receiving antenna is 3 m (1-18GHz) and 1.5 m (above 18GHz).

2. EUT works in each mode of operation that needs to be tested，and having the EUT continuously working. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.
3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
4. Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

RF Conducted Test:

1. The antenna port of EUT was connected to the RF port of the test equipment (Power Meter or Spectrum analyzer) through Attenuator and RF cable.
2. The cable assembly insertion loss of 6.5dB (including 6.0 dB Attenuator and 0.5dB cable) was entered as an offset in the power meter. Note: Actual cable loss was unavailable at the time of testing, therefore a loss of 0.5dB was assumed as worst case. This was later verified to be true by laboratory. (if the RF cable provided by client, the cable loss declared by client)
3. The EUT is keeping in continuous transmission mode and tested in all modulation modes.

2.7 Measurement Method

Description of Test	Measurement Method
AC Line Conducted Emissions	ANSI C63.10-2020 Section 6.2
Maximum Conducted Output Power	ANSI C63.10-2020 Section 11.9.1.1
Power Spectral Density	ANSI C63.10-2020 Section 11.10.2
6 dB Emission Bandwidth	ANSI C63.10-2020 Section 11.8.1
99% Occupied Bandwidth	ANSI C63.10-2020 Section 6.9.3
100kHz Bandwidth of Frequency Band Edge	ANSI C63.10-2020 Section 6.10
Radiated emission	ANSI C63.10-2020 Section 11.11&11.12.1
Duty Cycle	ANSI C63.10-2020 Section 11.6

2.8 Measurement Equipment

Manufacturer	Description	Model	Management No.	Calibration Date	Calibration Due Date
Radiated Emission Test					
R&S	EMI test receiver	ESR3	102758	2024/6/4	2025/6/3
ROHDE& SCHWARZ	SPECTRUM ANALYZER	FSV40-N	101608	2024/6/4	2025/6/3
SONOMA INSTRUMENT	Low frequency amplifier	310	186014	2024/6/4	2025/6/3
A.H. Systems	PREAMPLIFIER	PAM-0118P	531	2024/6/4	2025/6/3
COM-POWER	Amplifier	PAM-840A	461306	2024/8/7	2025/8/6
BACL	Loop Antenna	1313-1A	4010611	2024/2/7	2027/2/6
SCHWARZBECK	Log - periodic wideband antenna	VULB 9163	9163-872	2023/7/7	2026/7/6
Astro Antenna Ltd	Horn antenna	AHA-118S	3015	2023/7/6	2026/7/5
Ducommun technologies	Horn Antenna	ARH-4223-02	1007726-03	2023/7/10	2026/7/9
Oulitong	Band Reject Filter	OBSF-2400-248 3.5-50N	OE02103119	2024/6/4	2025/6/3
Unknown	6.7G High Pass Filter	Unknown	6.7G	2024/6/4	2025/6/3
N/A	Coaxial Cable	NO.9	N/A	2024/6/4	2025/6/3
N/A	Coaxial Cable	NO.13	N/A	2024/8/7	2025/8/6
N/A	Coaxial Cable	NO.15	N/A	2024/6/4	2025/6/3
N/A	Coaxial Cable	NO.16	N/A	2024/6/4	2025/6/3
N/A	Coaxial Cable	NO.17	N/A	2024/6/4	2025/6/3
Audix	Test Software	E3	191218 V9	/	/
RF Conducted Test					
ROHDE& SCHWARZ	SPECTRUM ANALYZER	FSU-26	200680/026	2024/6/4	2025/6/3
narda	6dB attenuator	603-06-1	N/A	2024/6/4	2025/6/3

Note: All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or International standards.

3 Test Results

3.1 Test Summary

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	N/A
§15.247(b)(3)	Maximum Conducted Output Power	Compliance
§15.247(e)	Power Spectral Density	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
-	99% Occupied Bandwidth	Report only
§15.247(d)	100kHz Bandwidth of Frequency Band Edge	Compliance
§15.205, §15.209, §15.247(d)	Radiated emission	Compliance
-	Duty Cycle	Report only

N/A: the device only powered by battery.

3.2 Limit

Test items	Limit
AC Line Conducted Emissions	See details §15.207 (a)
Conducted Output Power	For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.
6dB Emission Bandwidth	The minimum 6 dB bandwidth shall be at least 500 kHz.
Power Spectral Density	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.
Spurious Emissions, 100kHz Bandwidth of Frequency Band Edge	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

3.3 AC Line Conducted Emissions Test Data

Not Applicable, the device only powered by battery

3.4 Radiated emission Test Data

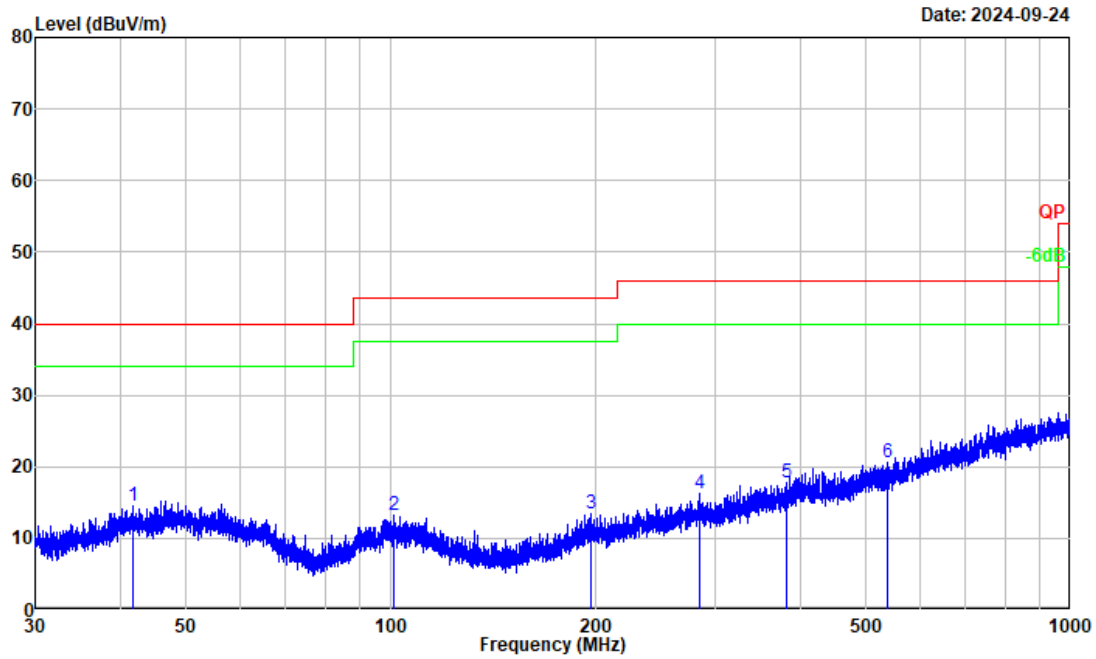
9 kHz-30MHz:

Test Date:	2024-09-24	**Test By:**	Luke Li
Environment condition:	Temperature: 24.4°C; Relative Humidity:63%; ATM Pressure: 100.4kPa		

For radiated emissions below 30MHz, there were no emissions found within 20dB of limit.

30MHz-1GHz:

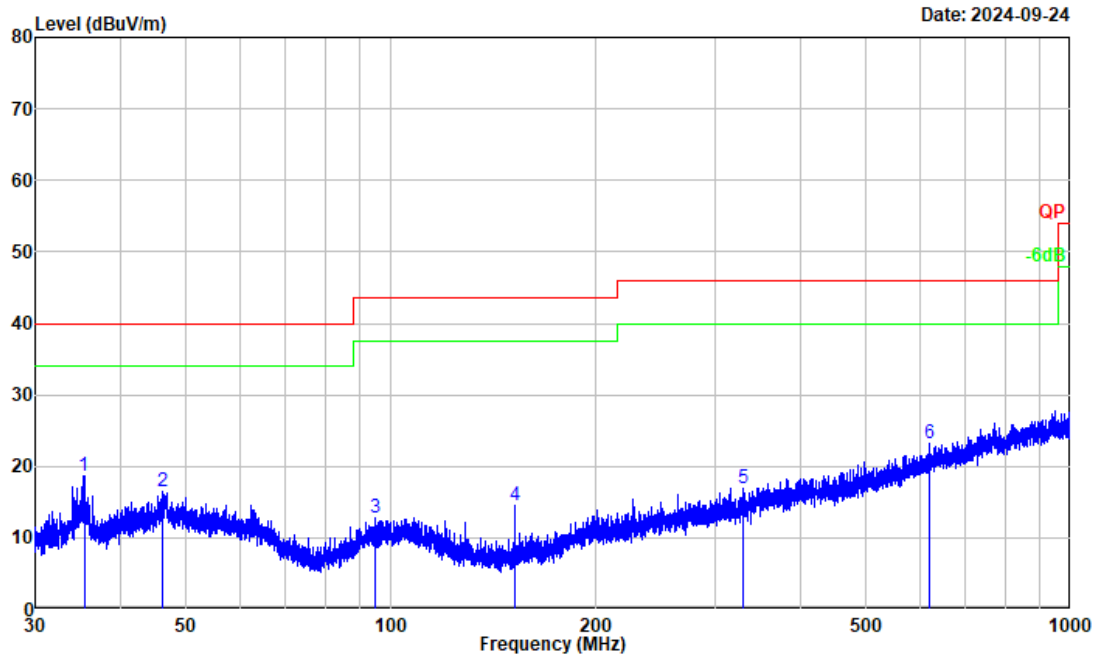
Test Date:	2024-09-24	Test By:	Luke Li
Environment condition:	Temperature: 24.4°C; Relative Humidity:63%; ATM Pressure: 100.4kPa		



Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Luke Li
Polarization : horizontal
Remark : BLE 1M

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	41.861	27.14	-12.52	14.62	40.00	-25.38	Peak
2	101.260	27.35	-14.11	13.24	43.50	-30.26	Peak
3	196.815	27.43	-13.96	13.47	43.50	-30.03	Peak
4	284.059	27.90	-11.74	16.16	46.00	-29.84	Peak
5	383.045	27.07	-9.23	17.84	46.00	-28.16	Peak
6	538.963	27.35	-6.79	20.56	46.00	-25.44	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit



Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Luke Li
Polarization : vertical
Remark : BLE 1M

--No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)	Detector
1	35.407	33.25	-14.62	18.63	40.00	-21.37	Peak
2	46.079	28.62	-12.17	16.45	40.00	-23.55	Peak
3	94.691	27.51	-14.82	12.69	43.50	-30.81	Peak
4	151.961	31.74	-17.32	14.42	43.50	-29.08	Peak
5	329.571	27.45	-10.52	16.93	46.00	-29.07	Peak
6	619.042	28.01	-4.87	23.14	46.00	-22.86	Peak

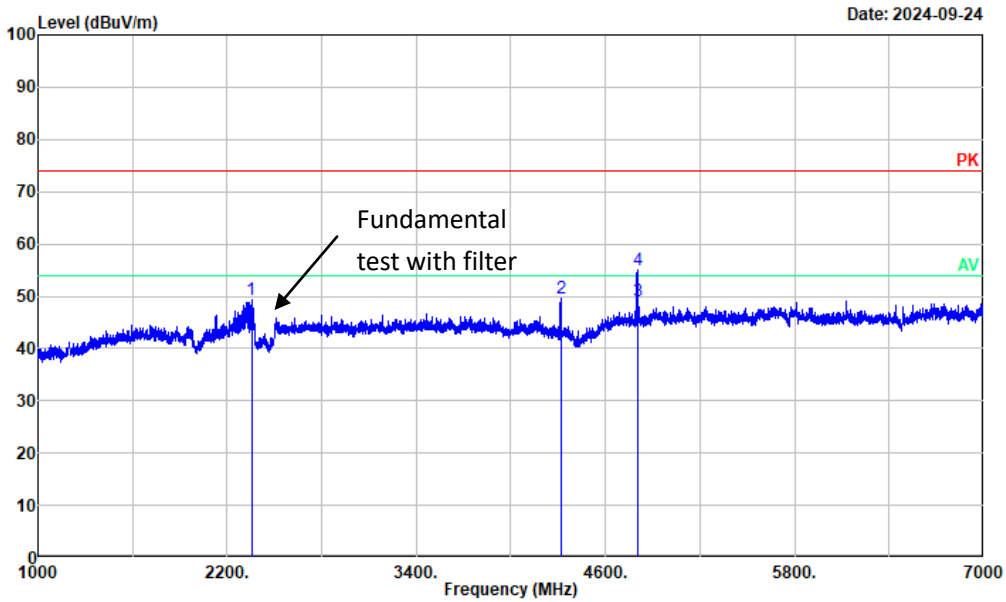
Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Above 1GHz:

Test Date:	2024-09-24	Test By:	Bard Huang
Environment condition:	Temperature: 24.4°C; Relative Humidity:63%; ATM Pressure: 100.4kPa		

1-25GHz:

Mode:	BLE 1M	Channel:	2402MHz

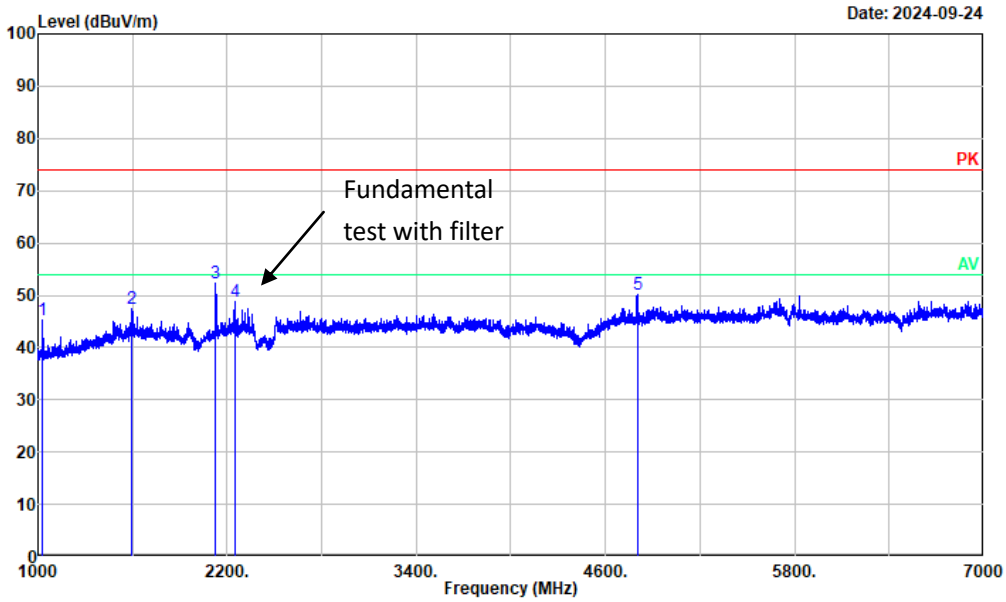


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : BLE 1M low channel

--No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)	Detector
1	2354.000	52.50	-3.22	49.28	74.00	-24.72	Peak
2	4316.000	54.50	-4.86	49.64	74.00	-24.36	Peak
3	4804.000	51.80	-2.87	48.93	54.00	-5.07	Average
4	4804.000	57.76	-2.87	54.89	74.00	-19.11	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2402MHz

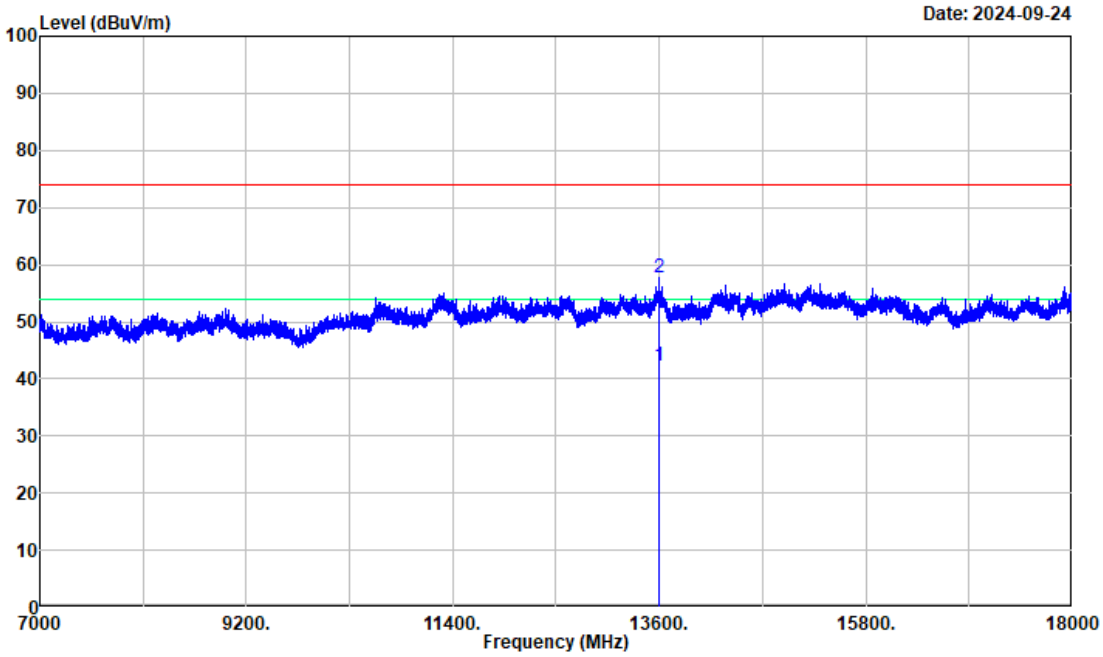


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : vertical
Remark : BLE 1M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	1031.000	53.43	-8.11	45.32	74.00	-28.68	Peak
2	1594.000	52.01	-4.50	47.51	74.00	-26.49	Peak
3	2123.000	56.67	-4.27	52.40	74.00	-21.60	Peak
4	2247.000	52.20	-3.37	48.83	74.00	-25.17	Peak
5	4804.000	52.92	-2.87	50.05	74.00	-23.95	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2402MHz

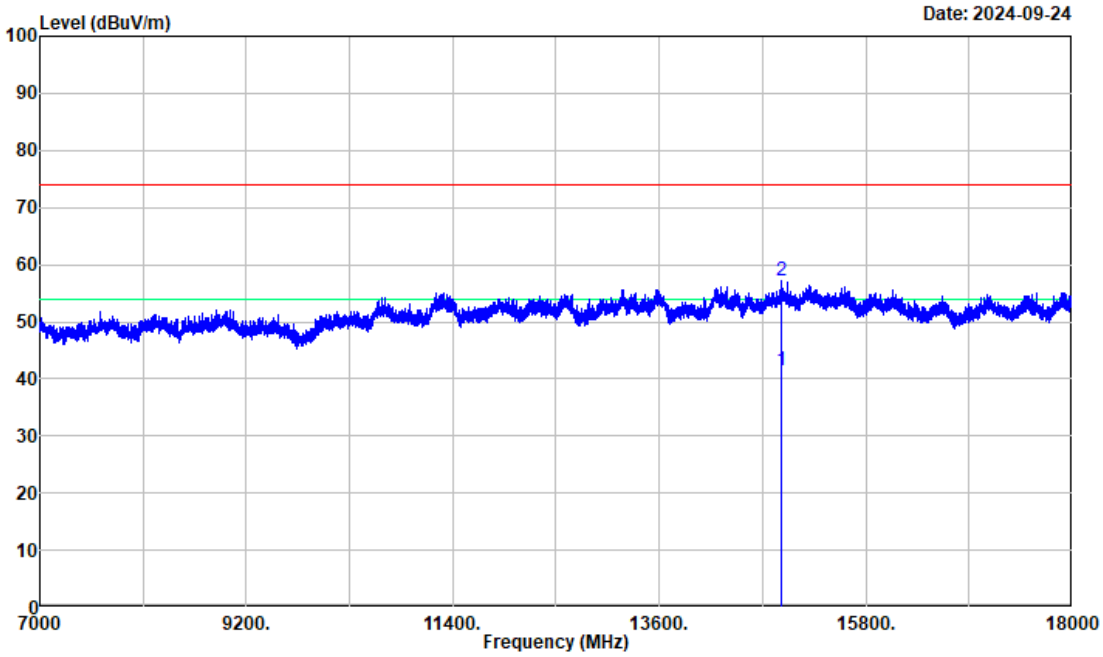


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : BLE 1M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	13592.000	35.77	6.43	42.20	54.00	-11.80	Average
2	13592.000	51.42	6.43	57.85	74.00	-16.15	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2402MHz

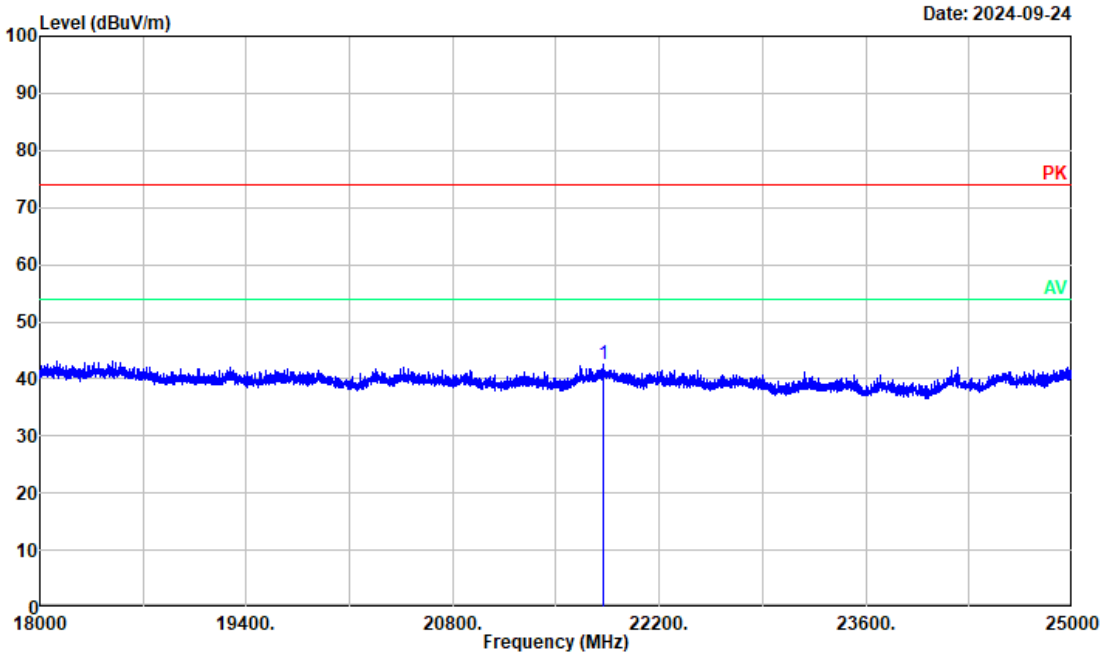


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : vertical
Remark : BLE 1M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	14896.000	35.84	5.55	41.39	54.00	-12.61	Average
2	14896.000	51.71	5.55	57.26	74.00	-16.74	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2402MHz



Project No. : 2405X67746E
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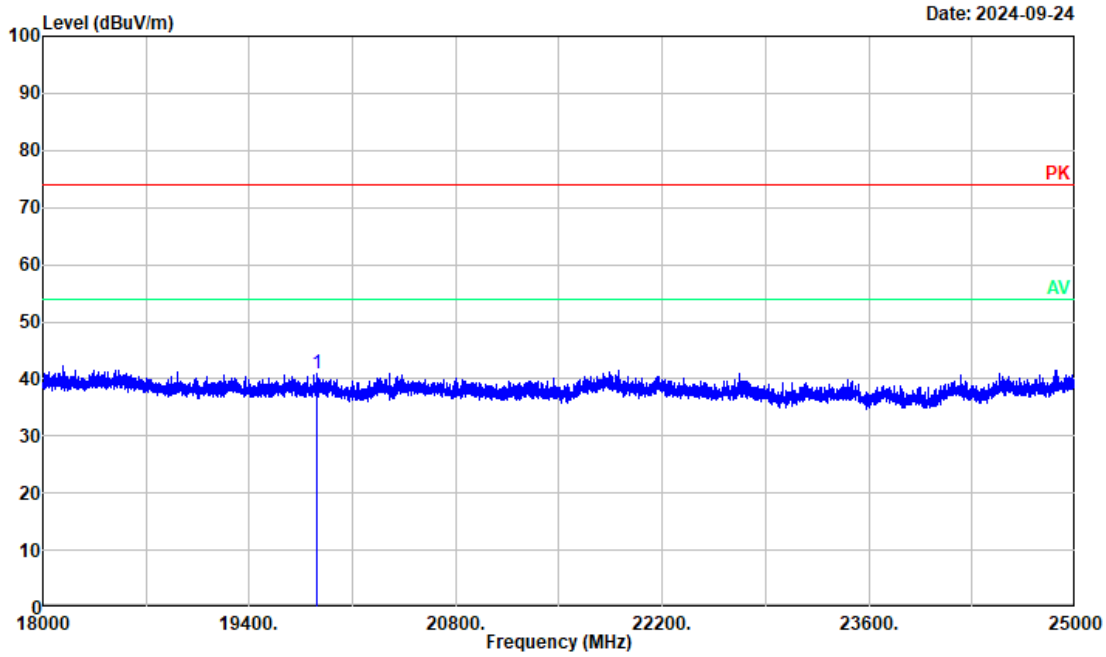
Polarization : horizontal
Remark : BLE 1M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	21824.550	49.46	-6.95	42.51	74.00	-31.49	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2402MHz

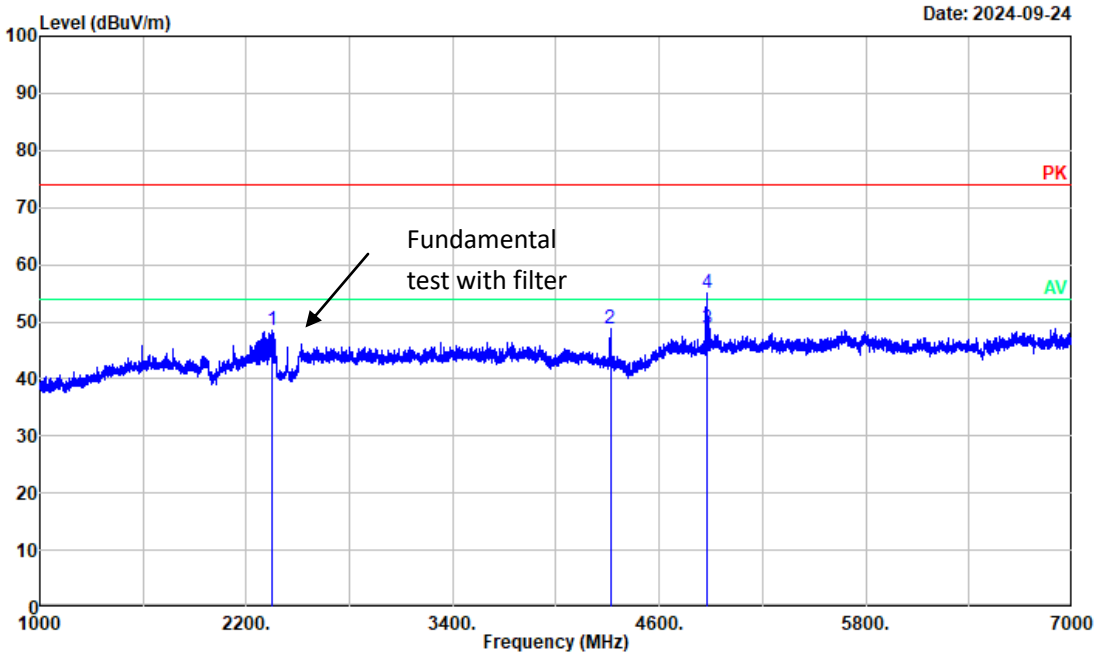


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : vertical
Remark : BLE 1M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	19853.270	48.23	-7.30	40.93	74.00	-33.07	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2440MHz

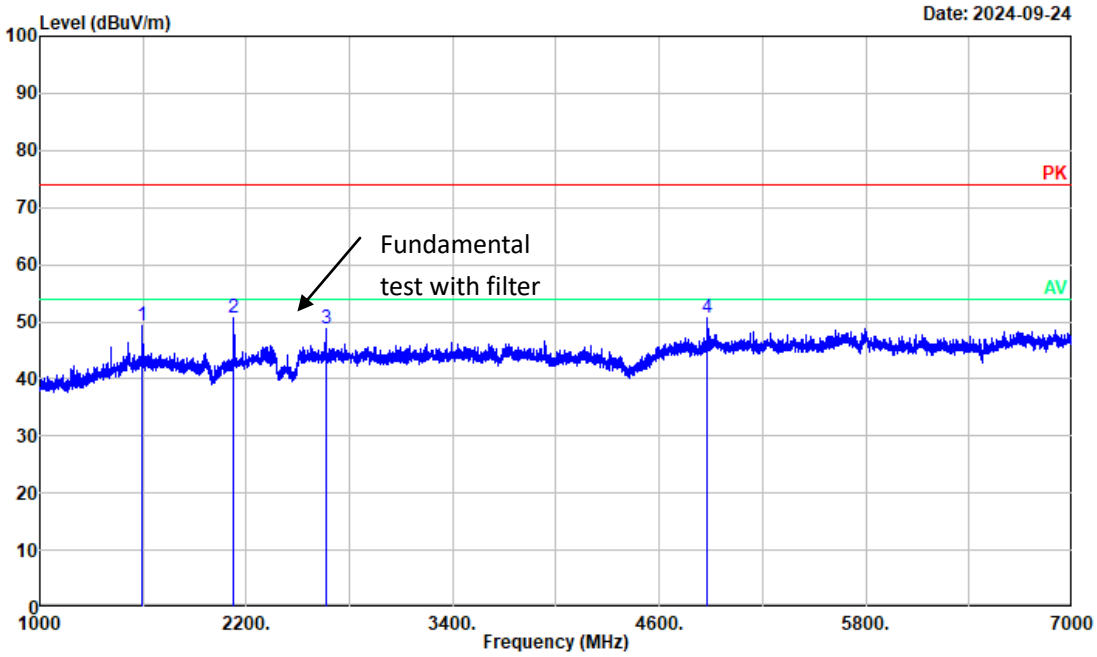


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : BLE 1M middle channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	2353.000	51.86	-3.22	48.64	74.00	-25.36	Peak
2	4315.000	53.54	-4.86	48.68	74.00	-25.32	Peak
3	4880.000	51.24	-2.34	48.90	54.00	-5.10	Average
4	4880.000	57.22	-2.34	54.88	74.00	-19.12	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2440MHz

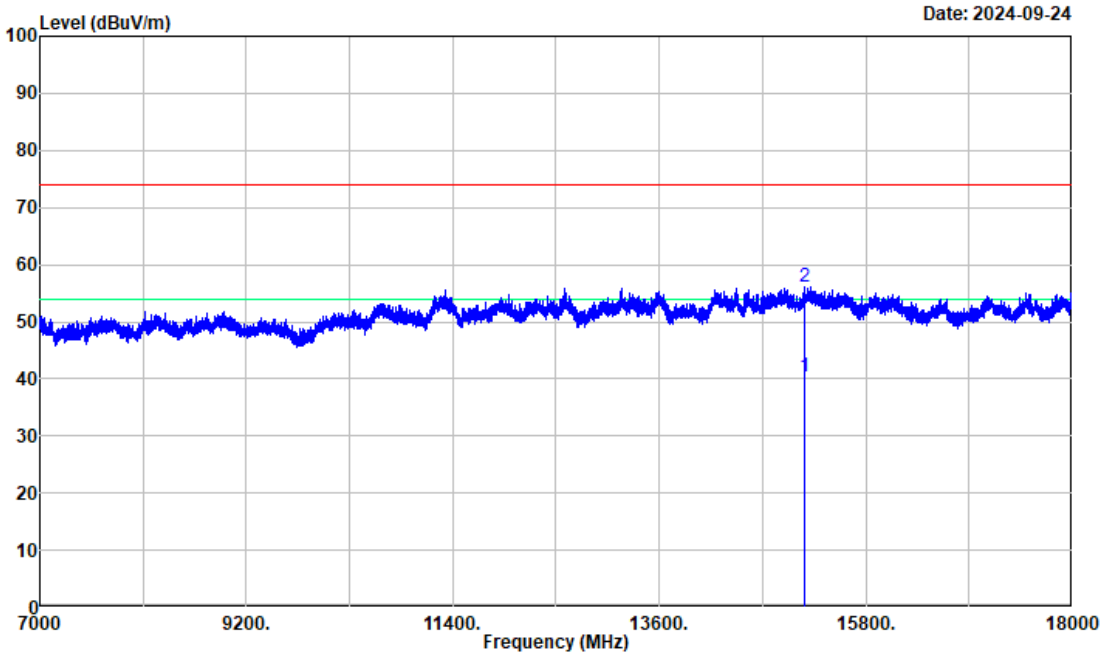


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : vertical
Remark : BLE 1M middle channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	1594.000	53.70	-4.50	49.20	74.00	-24.80	Peak
2	2127.000	54.82	-4.24	50.58	74.00	-23.42	Peak
3	2665.000	51.40	-2.70	48.70	74.00	-25.30	Peak
4	4880.000	53.05	-2.34	50.71	74.00	-23.29	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2440MHz

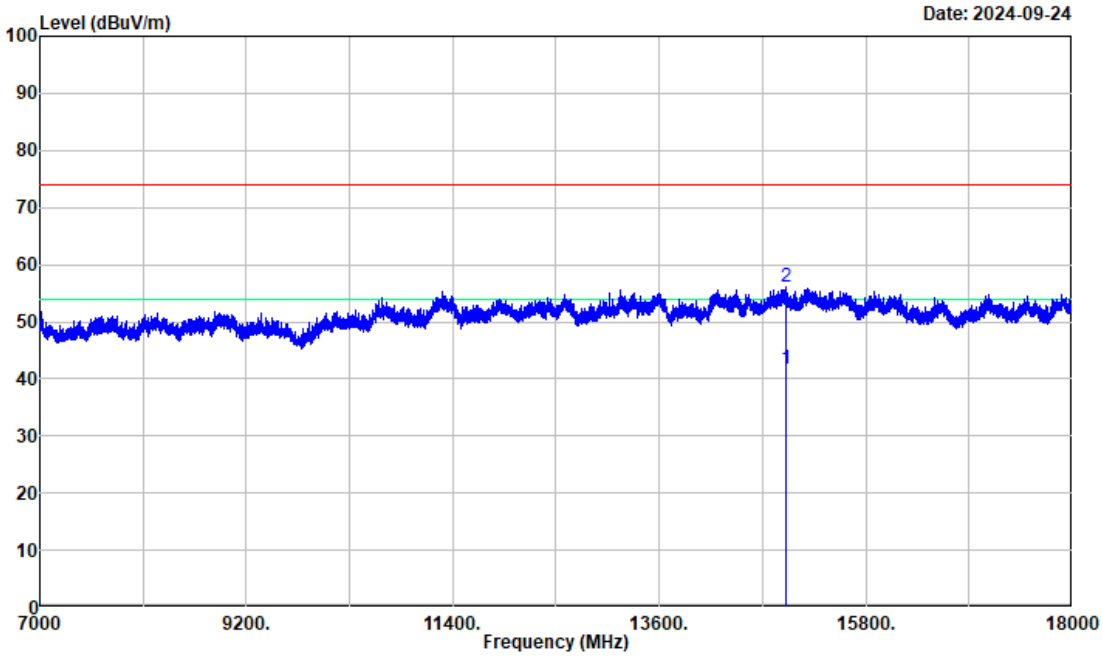


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : BLE 1M middle channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	15150.000	35.31	5.20	40.51	54.00	-13.49	Average
2	15150.000	50.93	5.20	56.13	74.00	-17.87	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2440MHz

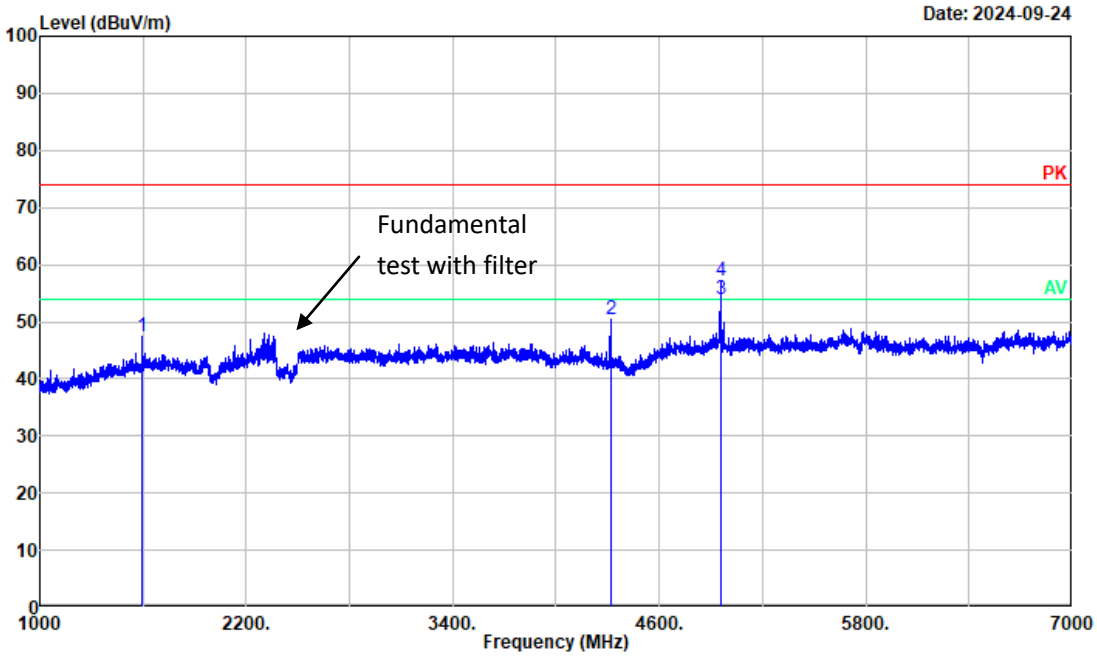


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : vertical
Remark : BLE 1M middle channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	14950.000	36.23	5.58	41.81	54.00	-12.19	Average
2	14950.000	50.58	5.58	56.16	74.00	-17.84	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2480MHz

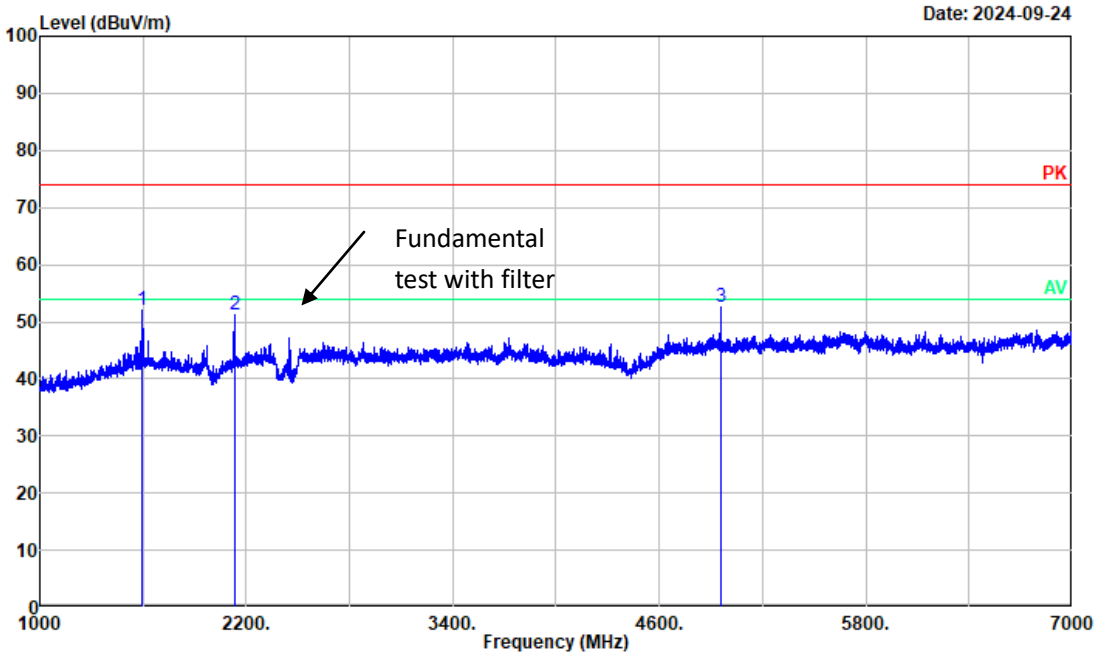


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : BLE 1M high channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	1595.000	51.87	-4.49	47.38	74.00	-26.62	Peak
2	4317.000	55.15	-4.87	50.28	74.00	-23.72	Peak
3	4960.000	56.12	-2.18	53.94	54.00	-0.06	Average
4	4960.000	59.27	-2.18	57.09	74.00	-16.91	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2480MHz

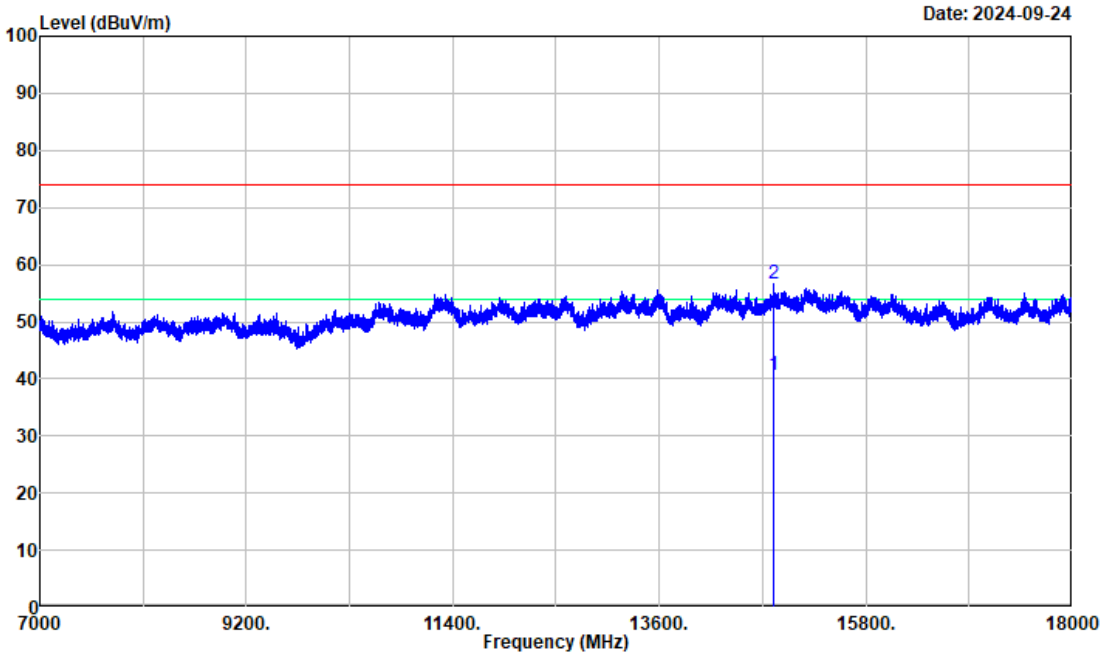


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : vertical
Remark : BLE 1M high channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	1592.000	56.44	-4.52	51.92	74.00	-22.08	Peak
2	2131.000	55.46	-4.23	51.23	74.00	-22.77	Peak
3	4960.000	54.69	-2.18	52.51	74.00	-21.49	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2480MHz

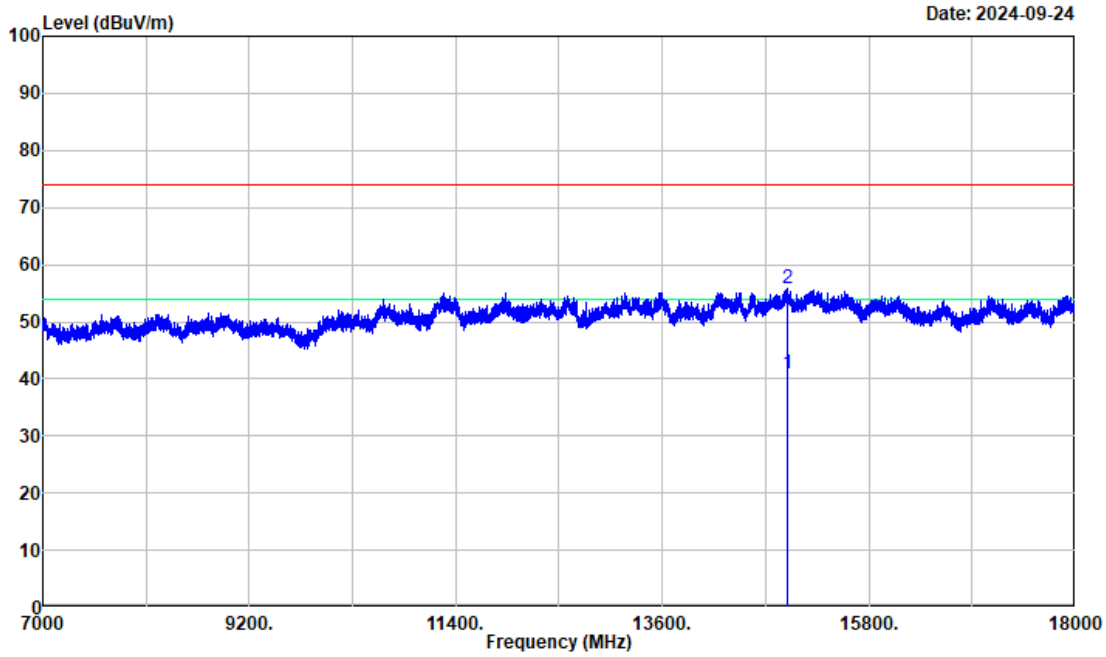


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : BLE 1M high channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	14819.000	35.17	5.60	40.77	54.00	-13.23	Average
2	14819.000	51.06	5.60	56.66	74.00	-17.34	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2480MHz



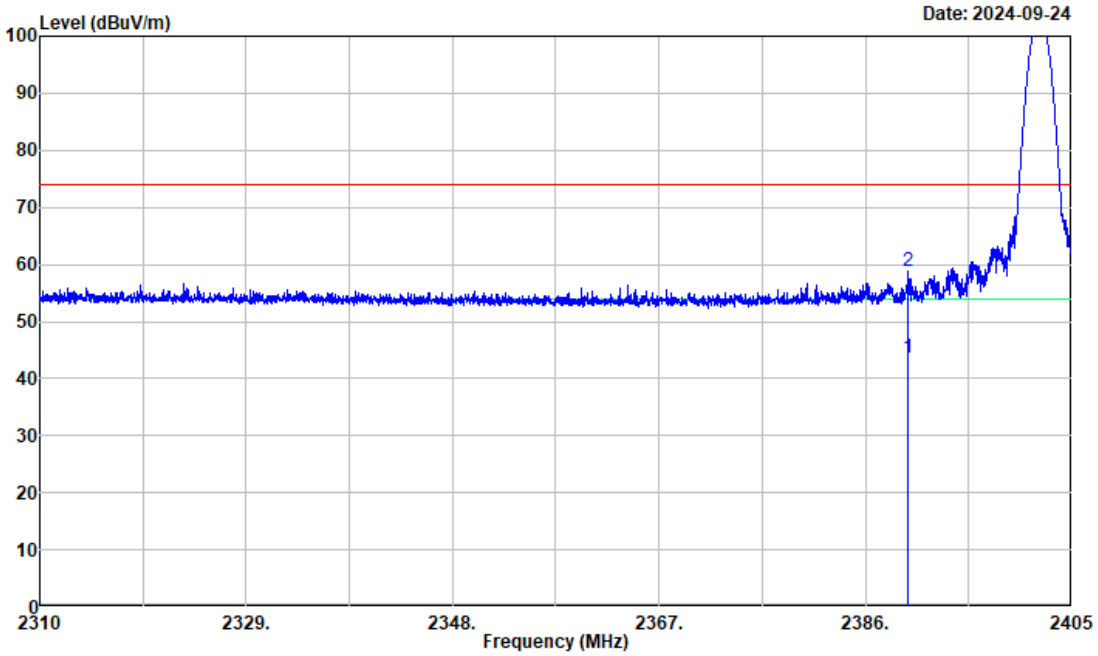
Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : vertical
Remark : BLE 1M high channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	14935.000	35.34	5.58	40.92	54.00	-13.08	Average
2	14935.000	50.24	5.58	55.82	74.00	-18.18	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Band edge:

Mode:	BLE 1M	Channel:	2402MHz

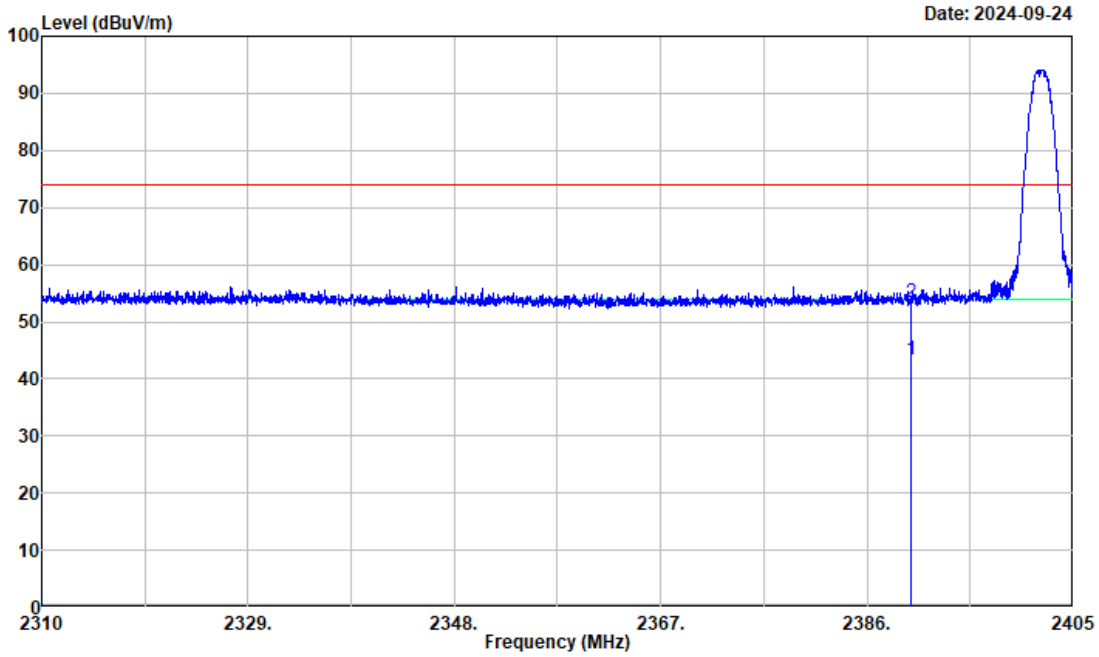


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : BLE 1M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	2389.941	36.72	6.82	43.54	54.00	-10.46	Average
2	2389.941	51.89	6.82	58.71	74.00	-15.29	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2402MHz

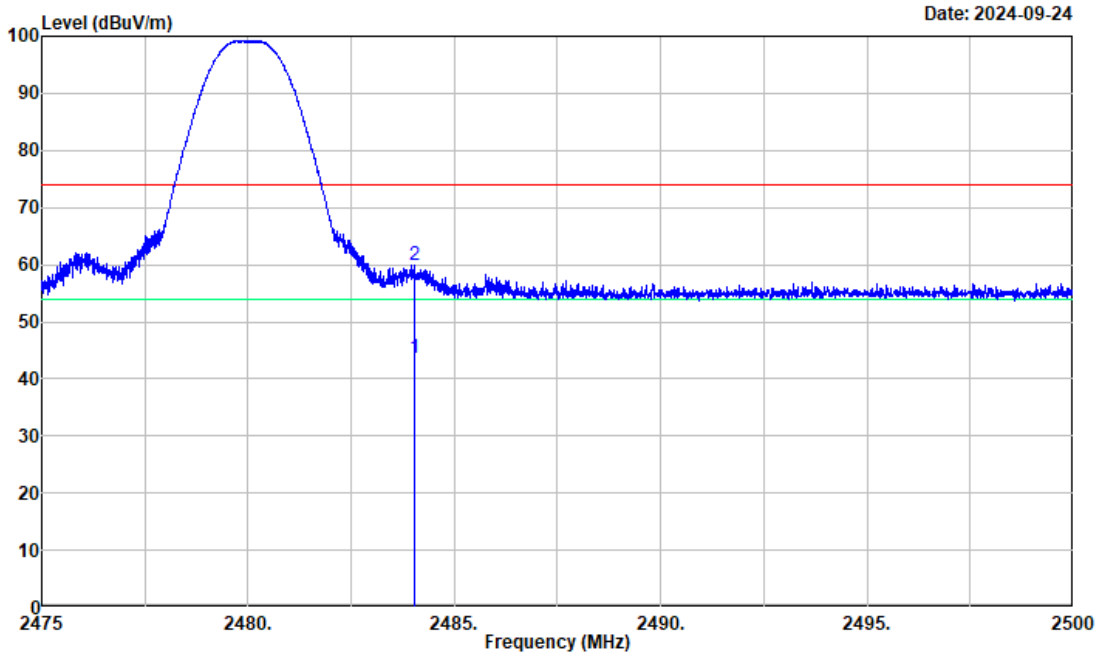


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : vertical
Remark : BLE 1M low channel

--No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)	Detector
1	2390.000	36.65	6.82	43.47	54.00	-10.53	Average
2	2390.000	46.54	6.82	53.36	74.00	-20.64	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2480MHz

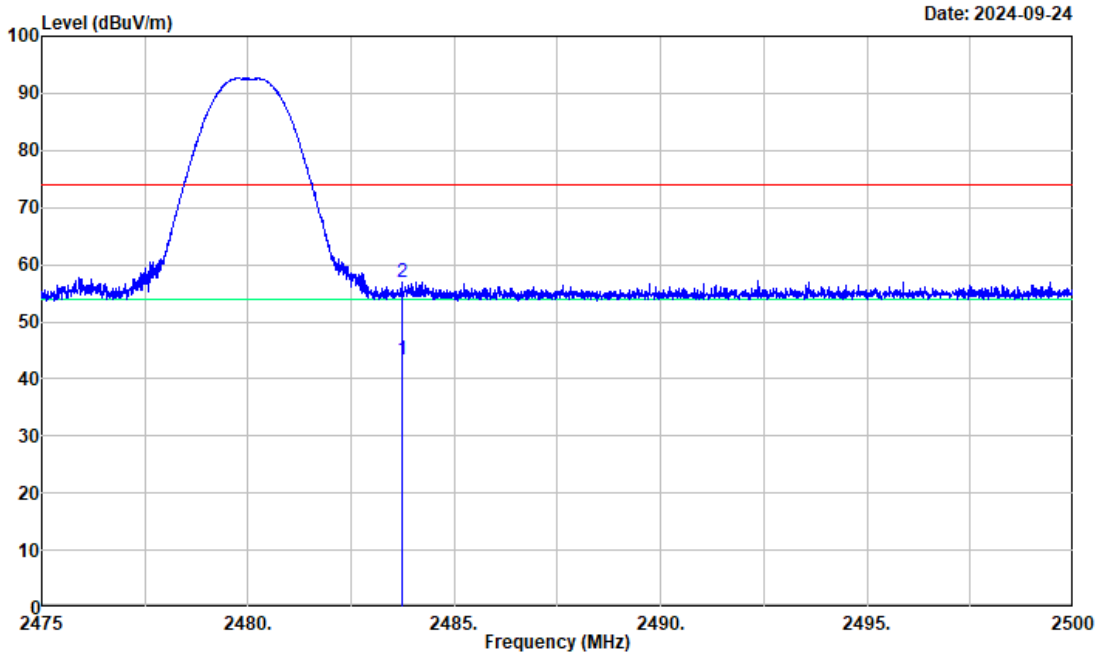


Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : BLE 1M high channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	2484.019	36.74	7.02	43.76	54.00	-10.24	Average
2	2484.019	52.89	7.02	59.91	74.00	-14.09	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 1M	Channel:	2480MHz



Project No. : 2405X67746E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.4℃/63%R.H./100.4kPa
Tested by : Bard Huang
Polarization : vertical
Remark : BLE 1M high channel

--No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)	Detector
1	2483.722	36.24	7.02	43.26	54.00	-10.74	Average
2	2483.722	49.90	7.02	56.92	74.00	-17.08	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain
Result = Reading + Factor
Over Limit = Result - Limit

3.5 RF Conducted Test Data

Test Date:	2024-09-23	Test By:	Ryan Zhang
Environment condition:	Temperature: 25.8°C; Relative Humidity:49%; ATM Pressure: 100.2kPa		

3.5.1 6 dB Emission Bandwidth

Mode	Value (MHz)	Limit (MHz)	Result
Low	0.696	≥0.5	Pass
Middle	0.700	≥0.5	Pass
High	0.696	≥0.5	Pass

3.5.2 99% Occupied Bandwidth

Mode	99% OBW (MHz)
Low	1.050
Middle	1.056
High	1.050

3.5.3 Maximum Conducted Peak Output Power

Mode	Value (dBm)	Limit (dBm)	Result
Low	0.72	30.00	Pass
Middle	0.68	30.00	Pass
High	0.65	30.00	Pass

3.5.4 Power Spectral Density

Mode	Value (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low	-14.49	8	Pass
Middle	-15.11	8	Pass
High	-15.09	8	Pass

3.5.5 100 kHz Bandwidth of Frequency Band Edge

Mode	Value (dB)	Limit (dB)	Result
Low	39.07	20	Pass
High	44.23	20	Pass

3.5.6 Duty Cycle

Mode	Ton (ms)	Ton+Toff (ms)	Duty Cycle (%)	Duty Cycle Factor(dB)	1/Ton (Hz)	VBW Setting (kHz)
Middle	0.410	0.625	65.60	1.83	2439	3

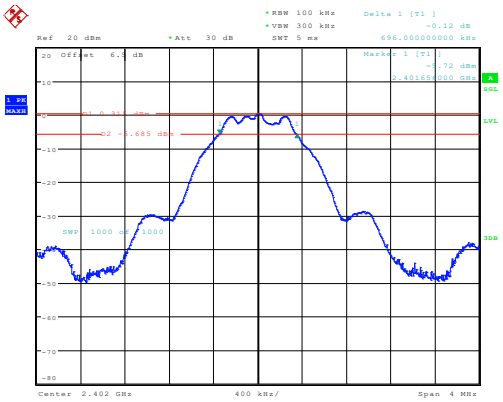
Duty Cycle = Ton/(Ton+Toff)*100%

Test Plots:

6dB Emission Bandwidth

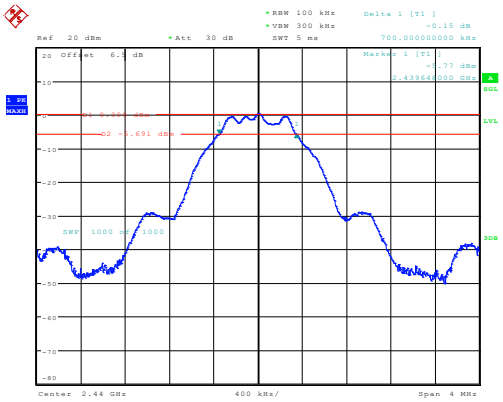
BLE 1M

Low 0.696MHz



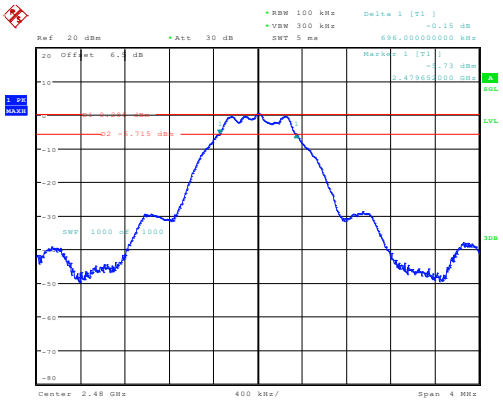
ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 10:58:10

Middle 0.700MHz



ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 11:01:05

High 0.696MHz

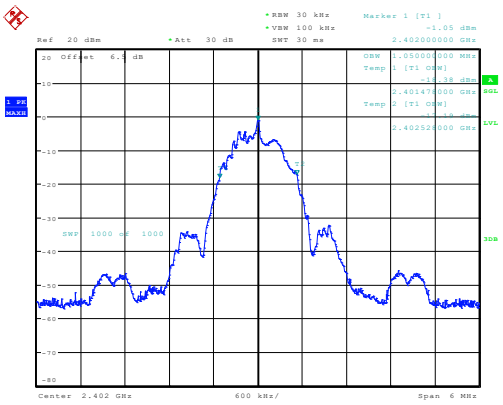


ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 11:04:49

99% Occupied Bandwidth

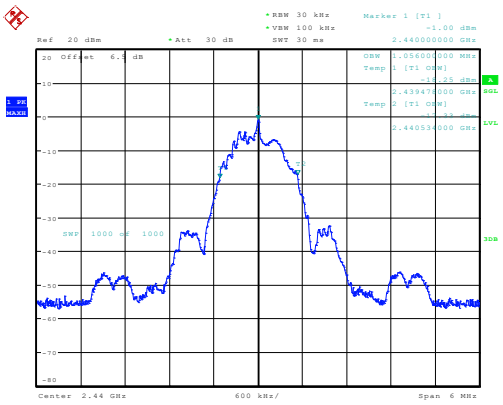
BLE 1M

Low 1.050MHz



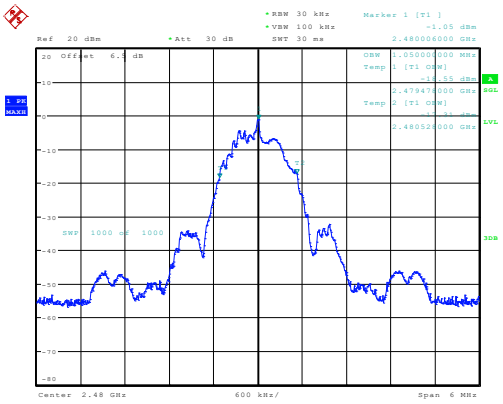
ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 10:59:07

Middle 1.056MHz



ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 11:01:59

High 1.050MHz

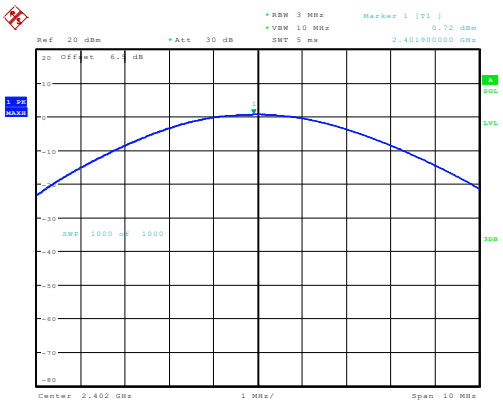


ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 11:06:01

Maximum Conducted Output Power

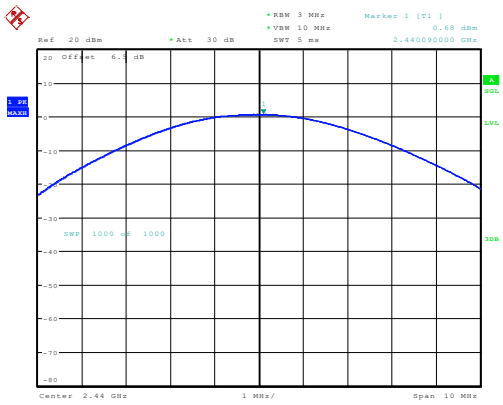
BLE 1M

Low 0.72dBm



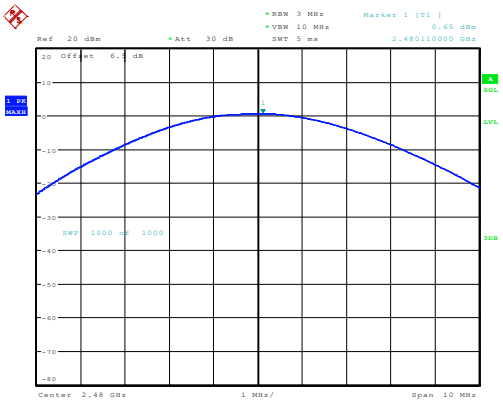
ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 10:59:33

Middle 0.68dBm



ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 11:02:25

High 0.65dBm

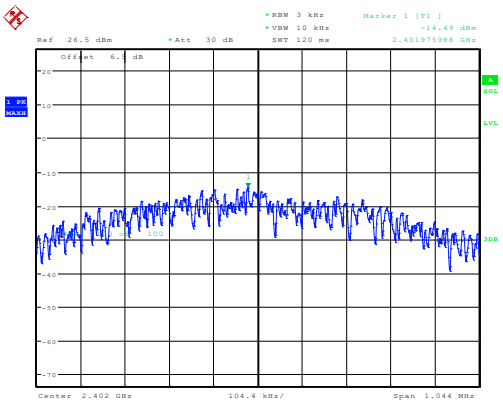


ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 11:06:51

Power Spectral Density

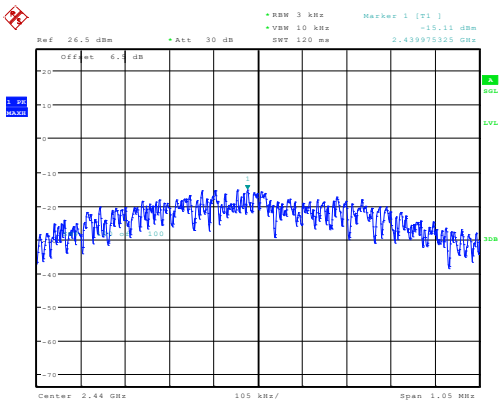
BLE 1M

Low -14.49dBm/3kHz



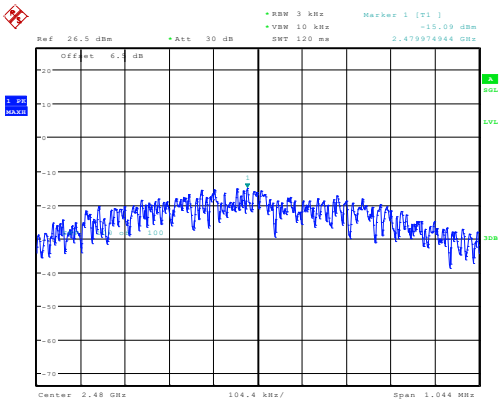
ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 10:59:55

Middle -15.11dBm/3kHz



ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 11:02:47

High -15.09dBm/3kHz

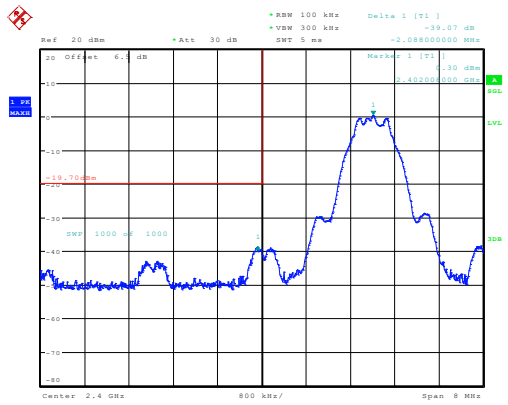


ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 11:07:13

100 kHz Bandwidth of Frequency Band Edge

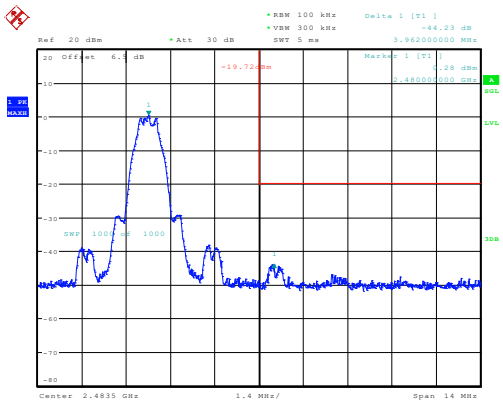
BLE 1M

Low 39.07dB



ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 10:57:38

High 44.23dB

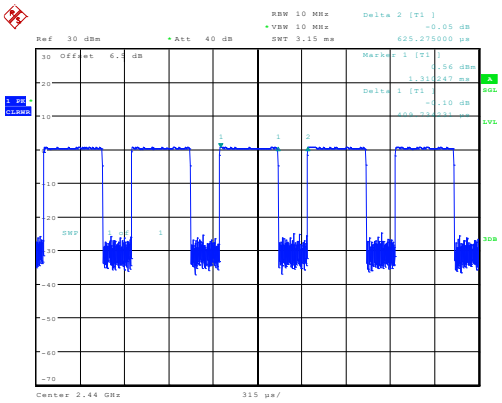


ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 11:04:04

Duty Cycle

BLE 1M

Middle



ProjectNo.:2405X67746E-RF Tester:Ryan Zhang
Date: 23.SEP.2024 11:08:37

4 Test Setup Photo

Please refer to the attachment 2405X67746EB Test Setup photo.

5 E.U.T Photo

Please refer to the attachment 2405X67746E External photo and 2405X67746E Internal photo.

---End of Report---