FCC Test Report

Report No.:	2405Y102391EB
Applicant:	Shenzhen Intellirocks Tech. Co., Ltd.
Address:	No. 3301, Block C, Section 1, ChuangzhiYuncheng Building, Liuxian Avenue, Xili Community, Xili Street, Nanshan District, Shenzhen, China
Product Name:	Smart Thermo-Hygrometer
Product Model:	H5074
Multiple Models:	N/A
Trade Mark:	Govee
FCC ID:	2AQA6-H5074A
Standards:	FCC CFR Title 47 Part 15C (§15.247)
Test Date:	2024-11-04 to 2024-11-08
Test Result:	Complied
Report Date:	2024-11-08

Reviewed by: Abel Chen — Project Engineer

Approved by: 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

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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	*2024-11-08*	*Original*

Contents

1 General Information

1.1 Client Information

Applicant:	Shenzhen Intellirocks Tech. Co., Ltd.
Address:	No. 3301, Block C, Section 1, ChuangzhiYuncheng Building, Liuxian Avenue, Xili Community, Xili Street, Nanshan District, Shenzhen, China
Manufacturer:	Shenzhen Intellirocks Tech. Co., Ltd.
Address:	No. 3301, Block C, Section 1, ChuangzhiYuncheng Building, Liuxian Avenue, Xili Community, Xili Street, Nanshan District, Shenzhen, China

1.2 Product Description of EUT

The EUT is Smart Thermo-Hygrometer that contains BLE radio, this report covers the full testing of the BLE radio.

Sample Serial Number	2TSU-1 for RE test, 2TSU-2 for RF conducted test (assigned by WATC)
Sample Received Date	2024-10-31
Sample Status	Good Condition
Frequency Range	2402MHz - 2480MHz(BLE1M/2M)
Maximum Conducted Peak Output Power	-0.91dBm
Modulation Technology	GFSK
Spatial Streams	SISO (1TX, 1RX)
Antenna Gain#	1.73dBi
Power Supply	DC 3.0V 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)

No related submittal(s)/Grant(s)

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#:	SSCOM			
Mode	**Data rate**	**Power Level Setting#**		
		Low Channel	**Middle Channel**	**High Channel**
BLE 1M	1Mbps	-5	-5	-5
BLE 2M	2Mbps	0	0	0
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. For radiated emissions below 30MHz, three antenna orientations (parallel, perpendicular, gound-parallel) were tested, only record the worse case test data in report.

2.2 Test Auxiliary Equipment

Manufacturer	Description	Model	Serial Number
/	/	/	/

2.3 Interconnecting Cables

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

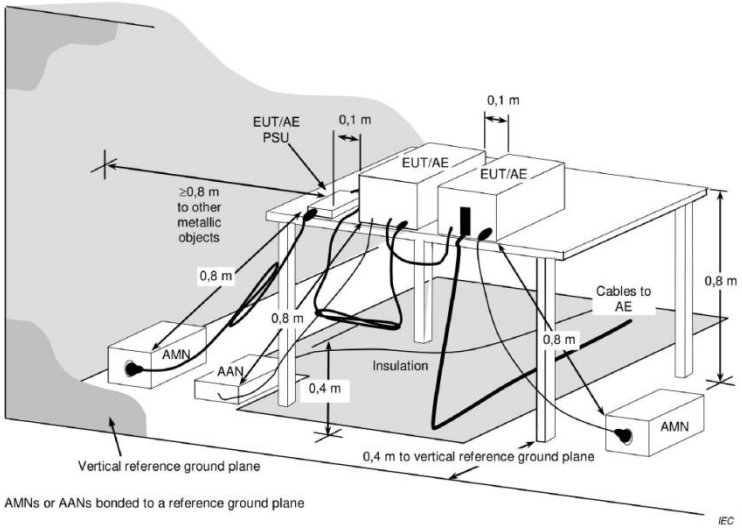
2.4 Block Diagram of Connection between EUT and AE

EUT

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

2.5 Test Setup

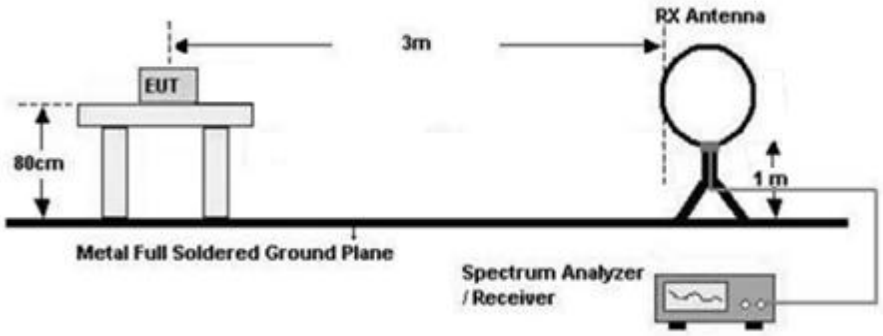
1) Conducted emission measurement:



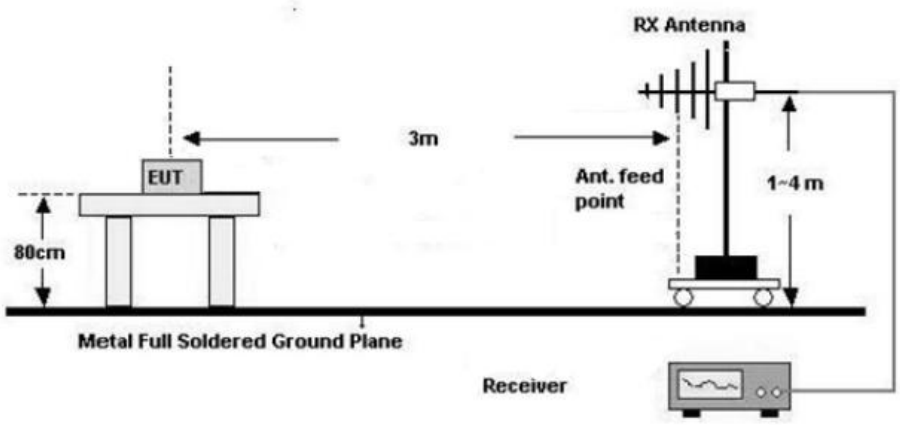
Note: The 0.8 m distance specified between EUT/AE/PSU and AMN/AAN, is applicable only to the EUT being measured. If the device is AE then it shall be >0.8 m.

2) Radiated emission measurement:

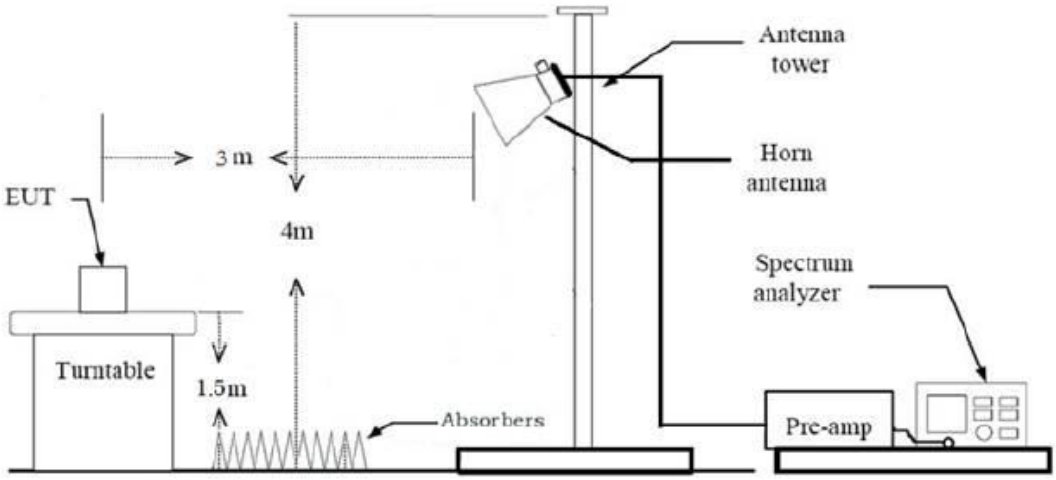
Below 30MHz (3m SAC)



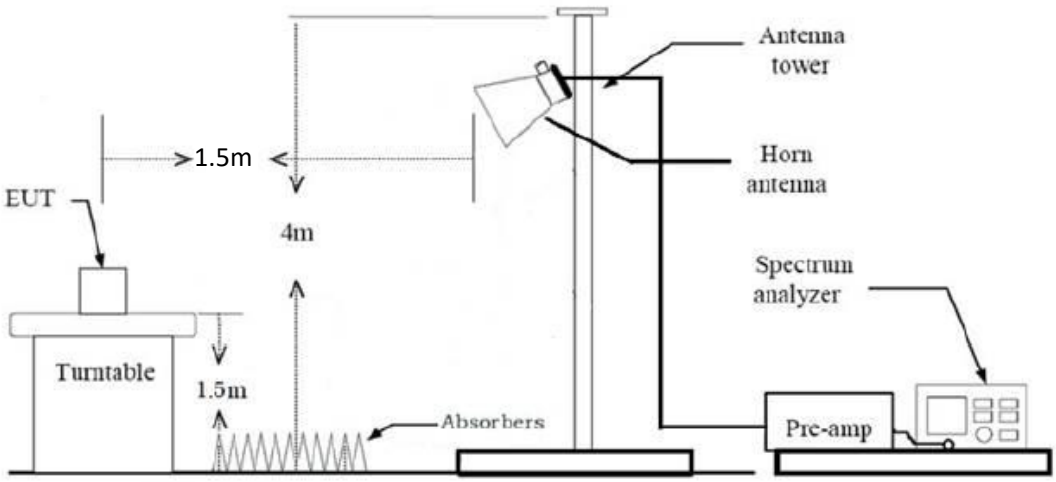
30MHz-1GHz (3m SAC)



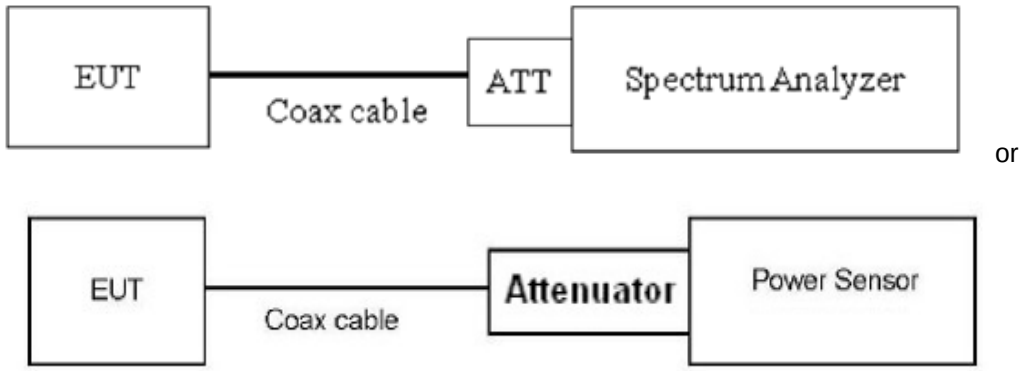
1GHz-18GHz(3m FAC)



Above 18GHz (3m FAC)



3) RF Conducted Test



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)
3. The RBW/VBW of receiver is set to 300Hz/1kHz for 9kHz to 150kHz range, to 10kHz/30kHz for 150kHz to 30MHz range for scan Peak emission, 200Hz/9kHz IF BW was used for final measurement in the Quasi-peak or average detection mode for frequency range 9~150kHz/150kHz~30MHz respectively.
4. If the Peak emission complies with the QP limit, then perform final measurement is optional.

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.

3. The RBW/VBW of receiver is set to 100kHz/300kHz for scan Peak emission, 120kHz IF BW was used for final measurement in the Quasi-peak detection mode.
4. If the Peak emission complies with the QP limit, then perform final measurement is optional.

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. The RBW/VBW of spectrum analyzer is set to 1MHz/3MHz for scan Peak emission, for measured average emission, reduce the VBW to 10Hz(for duty cycle≥98%), or ≥1/T(for duty cycle<98%). T is minimum transmission duration. (Note: a high VBW (for example 1kHz, not less than 1/T) may used to scan average emissions to avoid long sweep time.)
4. If the Peak emission complies with the Average limit, then perform average measurement is optional.
5. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
6. 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 7.0dB (including 6.0 dB Attenuator and 1.0 dB 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 1.0dB 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

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)).

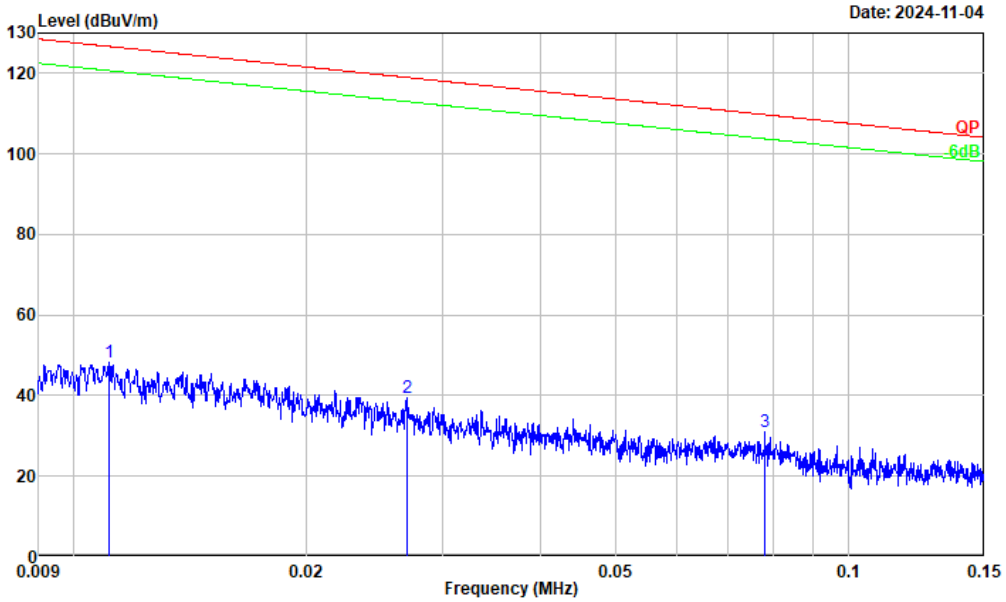
3.3 AC Line Conducted Emissions Test Data

Not Applicable, the device only powered by battery

3.4 Radiated emission Test Data

9 kHz-30MHz:

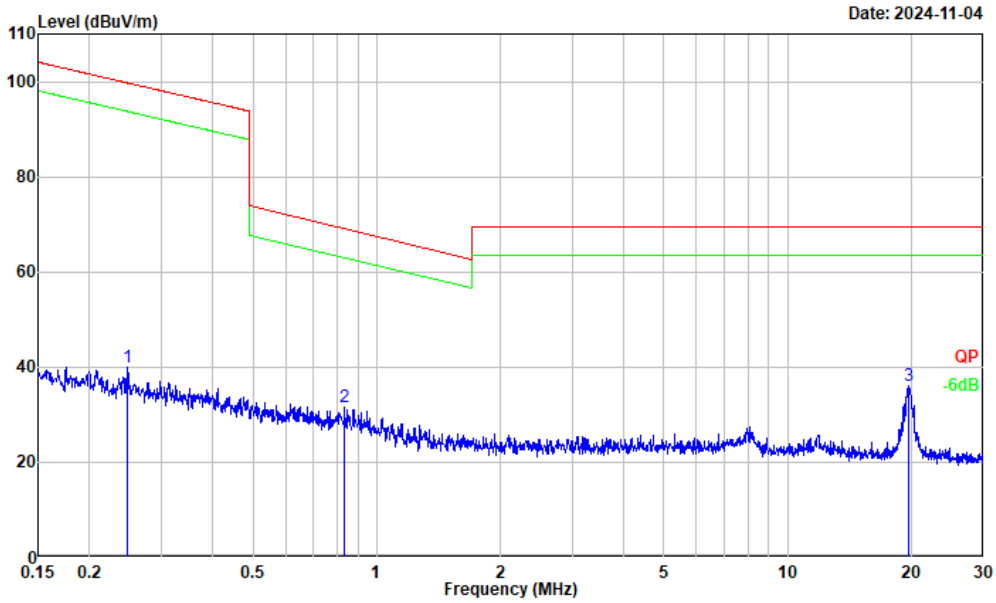
Test Date:	2024-11-04	Test By:	Bard Huang
Environment condition:	Temperature: 24.1°C; Relative Humidity:54%; ATM Pressure: 100.9kPa		



Project No. : 2405Y102391E-RF
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.1℃/54%R.H./100.9kPa
Tested by : Bard Huang
Polarization : PARALLEL
Remark : BLE 2M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	0.011	11.66	36.50	48.16	126.69	-78.53	Peak
2	0.027	12.90	26.48	39.38	119.01	-79.63	Peak
3	0.078	14.49	16.53	31.02	109.77	-78.75	Peak

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



Project No. : 2405Y102391E-RF
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.1℃/54%R.H./100.9kPa
Tested by : Bard Huang
Polarization : PARALLEL
Remark : BLE 2M low channel

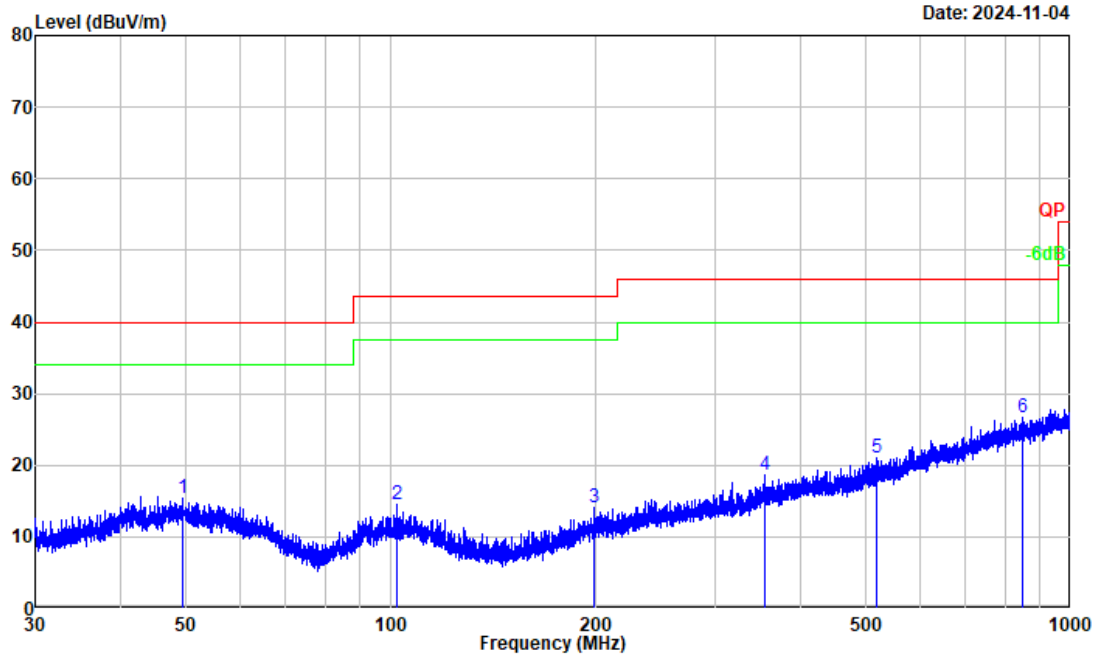
--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	0.248	29.16	10.80	39.96	99.73	-59.77	Peak
2	0.833	29.60	2.03	31.63	69.09	-37.46	Peak
3	19.736	39.30	-3.22	36.08	69.54	-33.46	Peak

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

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

30MHz-1GHz:

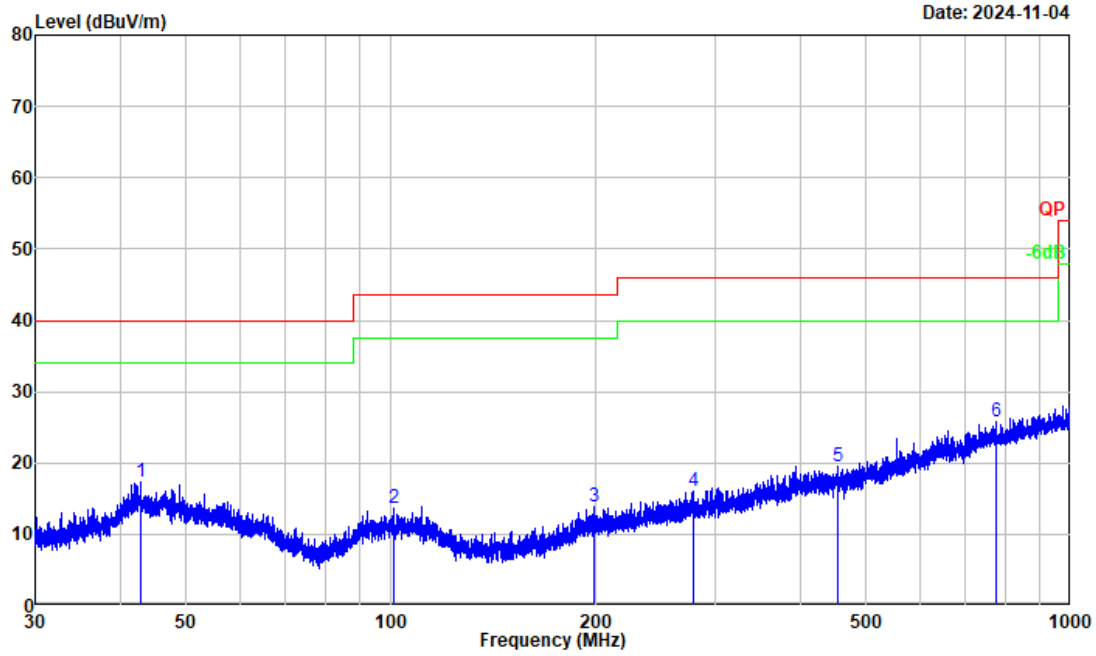
Test Date:	2024-11-04	Test By:	Bard Huang
Environment condition:	Temperature: 24.1°C; Relative Humidity:54%; ATM Pressure: 100.9kPa		



Project No. : 2405Y102391E-RF
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.1℃/54%R.H./100.9kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : BLE 2M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	49.533	27.61	-12.15	15.46	40.00	-24.54	Peak
2	102.270	28.47	-14.03	14.44	43.50	-29.06	Peak
3	198.675	27.93	-13.85	14.08	43.50	-29.42	Peak
4	355.895	28.25	-9.70	18.55	46.00	-27.45	Peak
5	517.248	28.15	-7.14	21.01	46.00	-24.99	Peak
6	850.662	28.48	-1.79	26.69	46.00	-19.31	Peak

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



Project No. : 2405Y102391E-RF
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 24.1℃/54%R.H./100.9kPa
Tested by : Bard Huang
Polarization : vertical
Remark : BLE 2M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	42.806	29.68	-12.41	17.27	40.00	-22.73	Peak
2	101.111	27.68	-14.13	13.55	43.50	-29.95	Peak
3	199.373	27.69	-13.82	13.87	43.50	-29.63	Peak
4	278.799	27.81	-11.85	15.96	46.00	-30.04	Peak
5	455.307	27.83	-8.38	19.45	46.00	-26.55	Peak
6	777.900	28.43	-2.62	25.81	46.00	-20.19	Peak

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

Above 1GHz:

Test Date:	2024-11-05	**Test By:**	Luke Li
Environment condition:	Temperature: 22.9°C; Relative Humidity:51%; ATM Pressure: 100.4kPa		

Frequency (MHz)	**Reading level (dBμV)**	**Polar (H/V)**	**Corrected Factor (dB/m)**	**Corrected Amplitude (dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**	**Remark**
BLE 1M							
Low Channel							
4804.000	56.21	horizontal	-2.87	53.34	74.00	-20.66	Peak
4804.000	51.62	vertical	-2.87	48.75	74.00	-25.25	Peak
Middle Channel							
4880.000	56.06	horizontal	-2.34	53.72	74.00	-20.28	Peak
4880.000	51.15	vertical	-2.34	48.81	74.00	-25.19	Peak
High Channel							
4960.000	55.84	horizontal	-2.18	53.66	74.00	-20.34	Peak
4960.000	51.57	vertical	-2.18	49.39	74.00	-24.61	Peak
BLE 2M							
Low Channel							
4804.000	53.57	horizontal	-2.87	50.70	54.00	-3.30	Average
4804.000	60.54	horizontal	-2.87	57.67	74.00	-16.33	Peak
4804.000	53.22	vertical	-2.87	50.35	74.00	-23.65	Peak
Middle Channel							
4880.000	52.81	horizontal	-2.34	50.47	54.00	-3.53	Average
4880.000	60.27	horizontal	-2.34	57.93	74.00	-16.07	Peak
4880.000	53.38	vertical	-2.34	51.04	74.00	-22.96	Peak
High Channel							
4960.000	52.21	horizontal	-2.18	50.03	54.00	-3.97	Average
4960.000	59.10	horizontal	-2.18	56.92	74.00	-17.08	Peak
4960.000	53.63	vertical	-2.18	51.45	74.00	-22.55	Peak

Remark:

Corrected Amplitude= Reading level + corrected Factor

Corrected Factor = Antenna factor + Cable loss – Amplifier gain

Margin = Corrected Amplitude – Limit

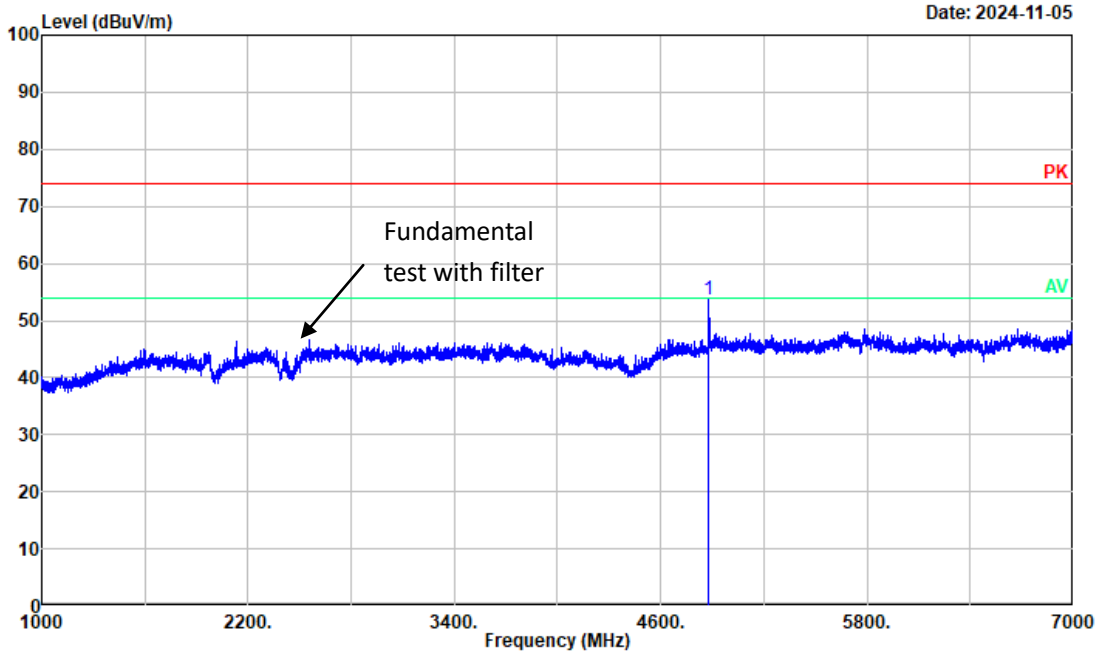
For the test result of Peak below the Peak limit more than 20dB, which can compliance with the average limit, just the Peak level was recorded.

The emission levels of other frequencies that were lower than the limit 20dB, not show in test report.

For emissions in 18GHz-25GHz range, all emissions were investigated and in the noise floor level.

Test plot for example as below:

Mode:	BLE 1M	Channel:	2440MHz

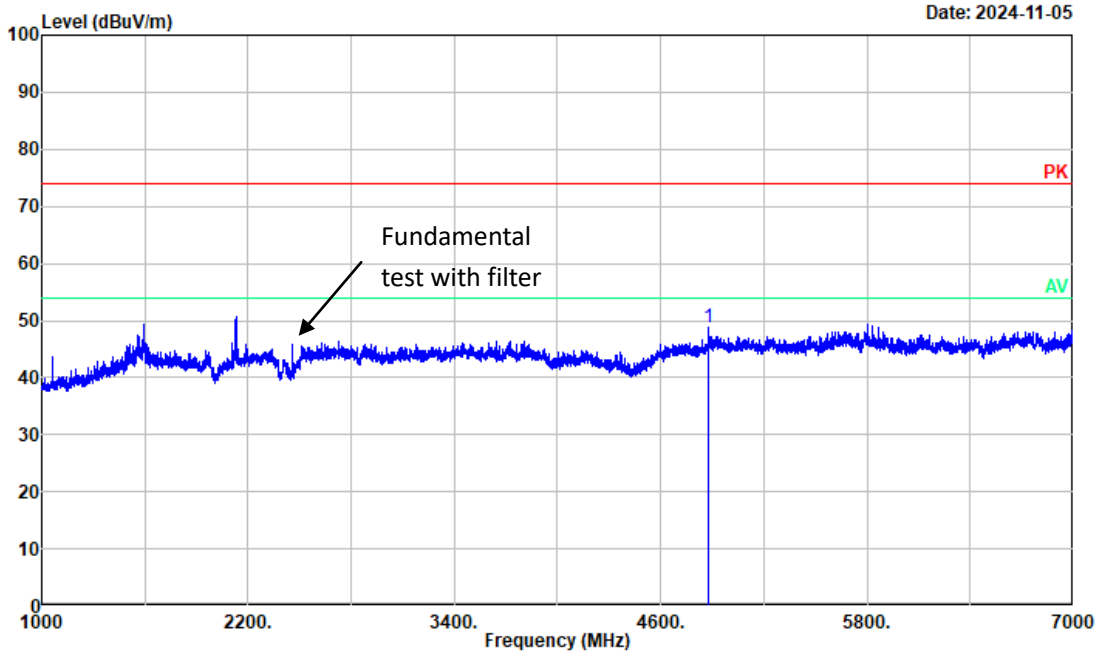


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : horizontal
Remark : BLE 1M middle channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	4880.000	56.06	-2.34	53.72	74.00	-20.28	Peak

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

Mode:	BLE 1M	Channel:	2440MHz

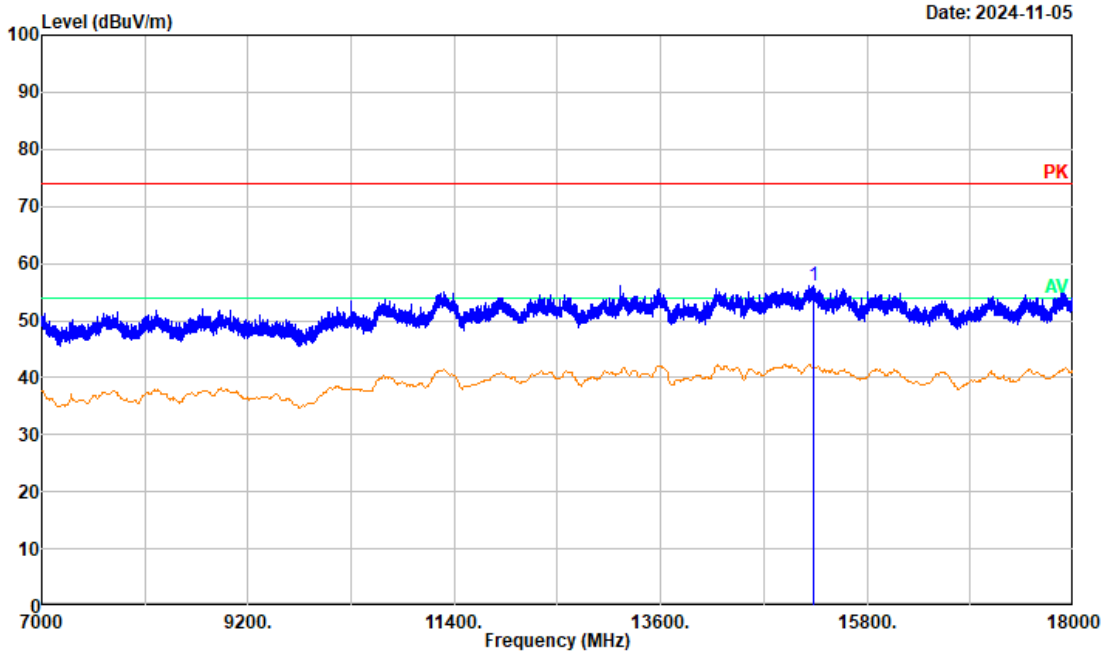


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : vertical
Remark : BLE 1M middle channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	4880.000	51.15	-2.34	48.81	74.00	-25.19	Peak

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

Mode:	BLE 1M	Channel:	2440MHz



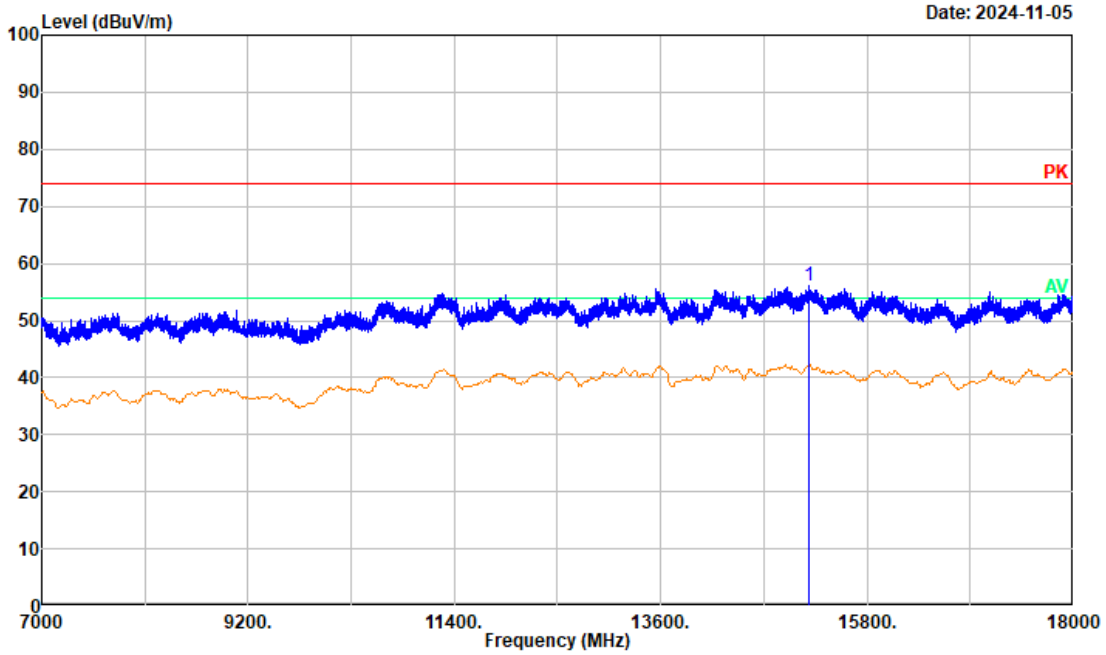
Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : horizontal
Remark : BLE 1M middle channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	15229.000	50.81	5.24	56.05	74.00	-17.95	Peak

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

Note: SA setting for Average trace: RBW: 1MHz, VBW: 1kHz, Detector: PK

Mode:	BLE 1M	Channel:	2440MHz



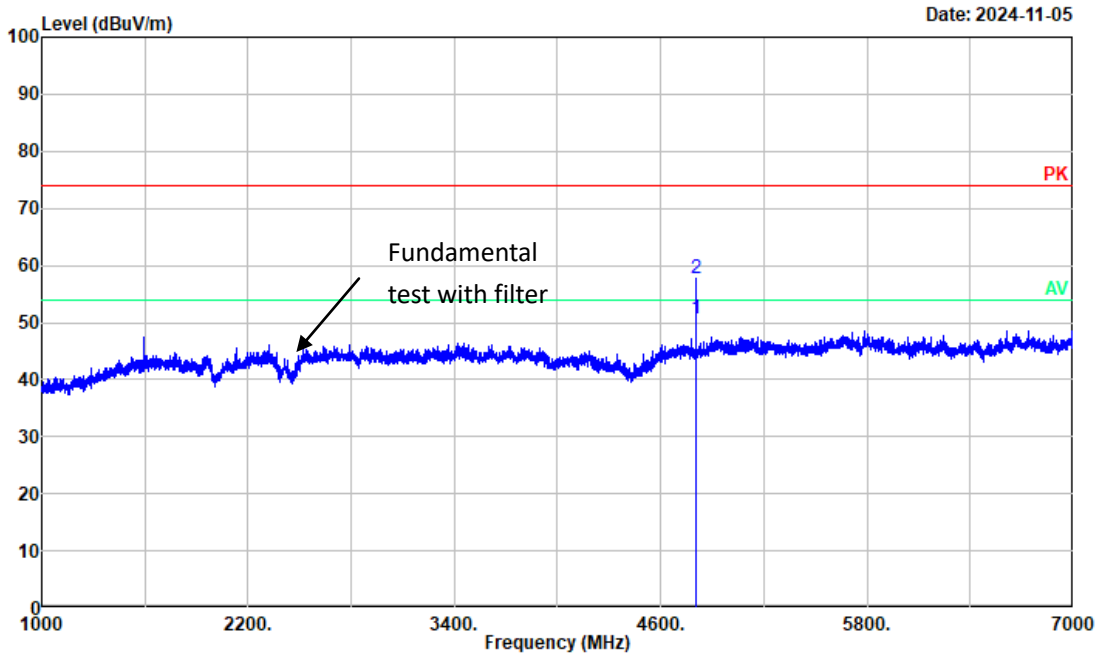
Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : vertical
Remark : BLE 1M middle channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	15184.000	50.81	5.25	56.06	74.00	-17.94	Peak

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

Note: SA setting for Average trace: RBW: 1MHz, VBW: 1kHz, Detector: PK

Mode:	BLE 2M	Channel:	2402MHz

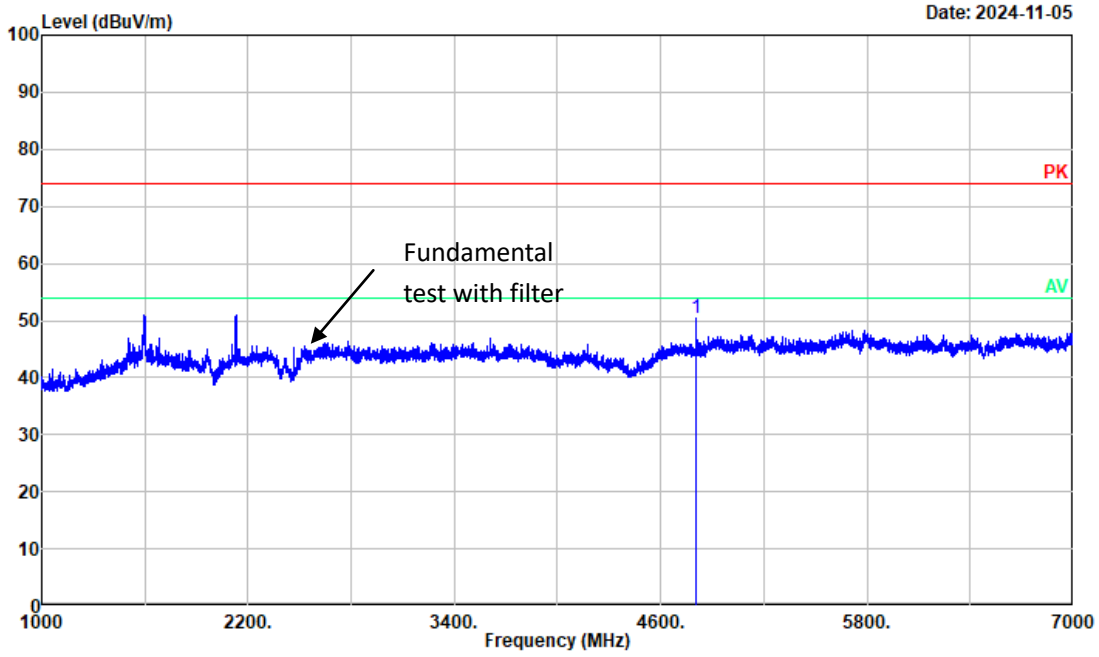


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : horizontal
Remark : BLE 2M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	4804.000	53.57	-2.87	50.70	54.00	-3.30	Average
2	4804.000	60.54	-2.87	57.67	74.00	-16.33	Peak

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

Mode:	BLE 2M	Channel:	2402MHz

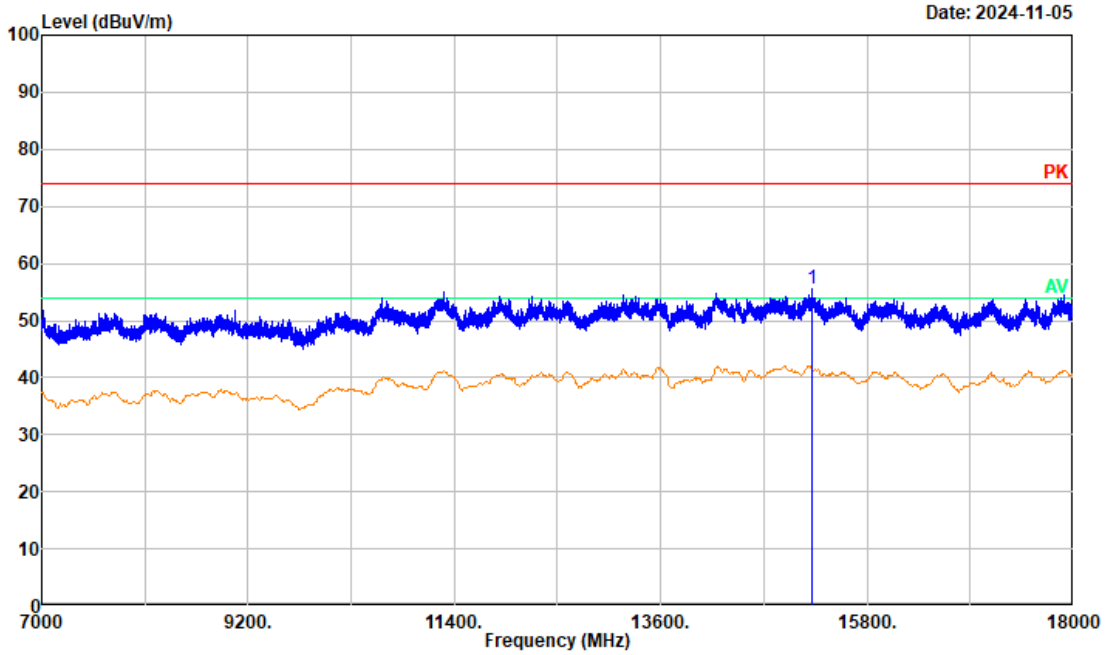


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : vertical
Remark : BLE 2M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	4804.000	53.22	-2.87	50.35	74.00	-23.65	Peak

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

Mode:	BLE 2M	Channel:	2402MHz



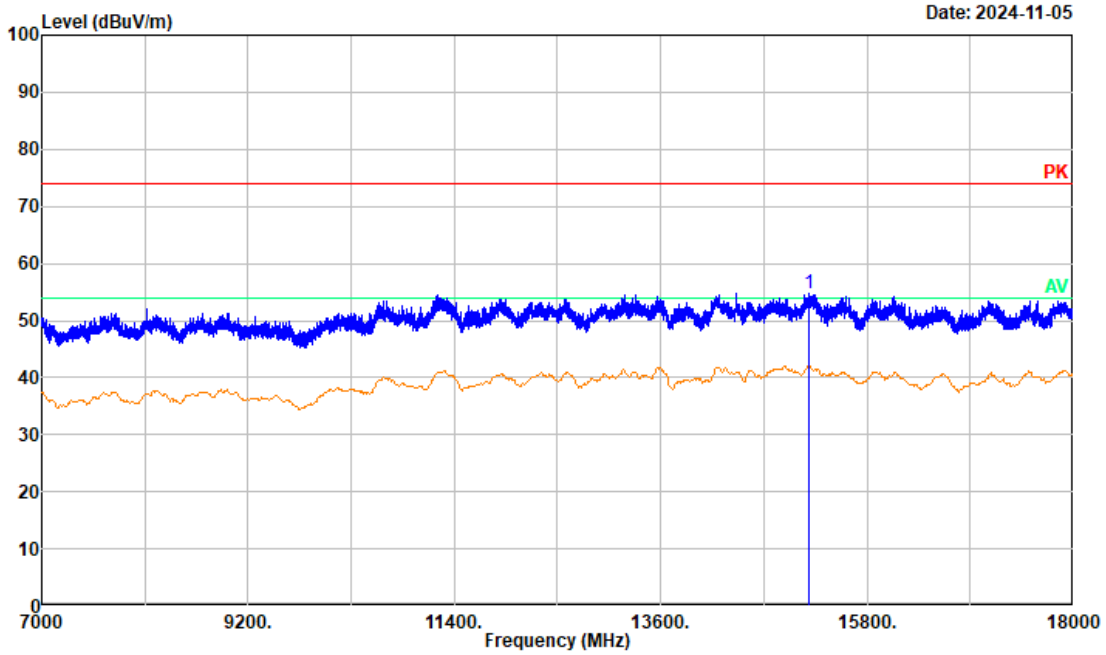
Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : horizontal
Remark : BLE 2M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	15216.000	50.42	5.26	55.68	74.00	-18.32	Peak

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

Note: SA setting for Average trace: RBW: 1MHz, VBW: 1kHz, Detector: PK

Mode:	BLE 2M	Channel:	2402MHz



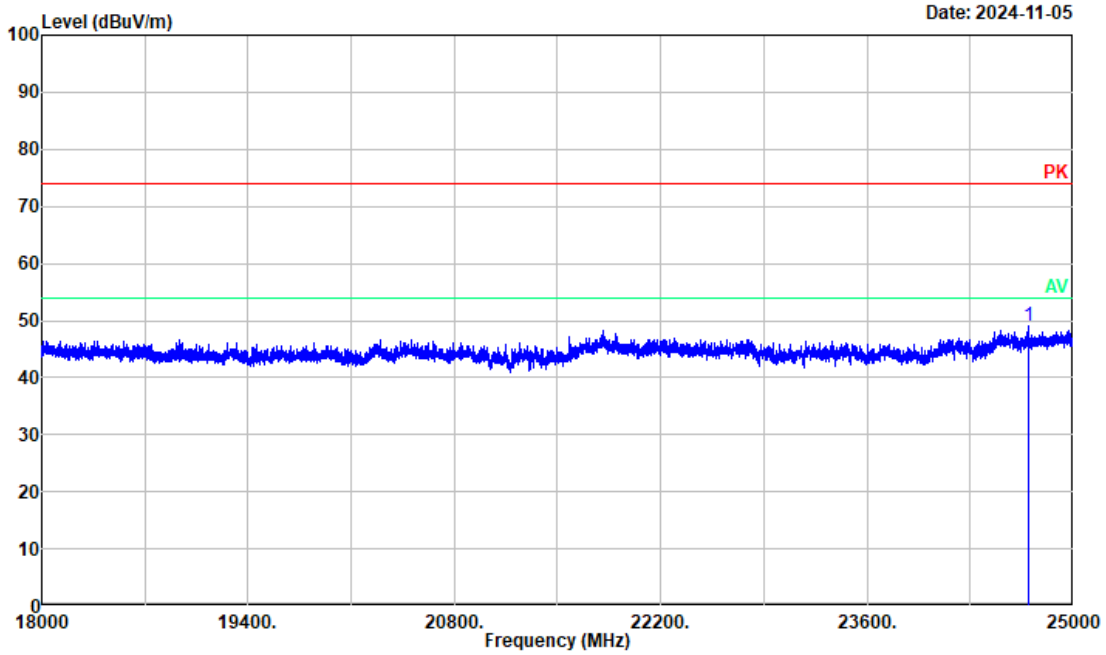
Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : vertical
Remark : BLE 2M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	15173.000	49.43	5.23	54.66	74.00	-19.34	Peak

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

Note: SA setting for Average trace: RBW: 1MHz, VBW: 1kHz, Detector: PK

Mode:	BLE 2M	Channel:	2402MHz

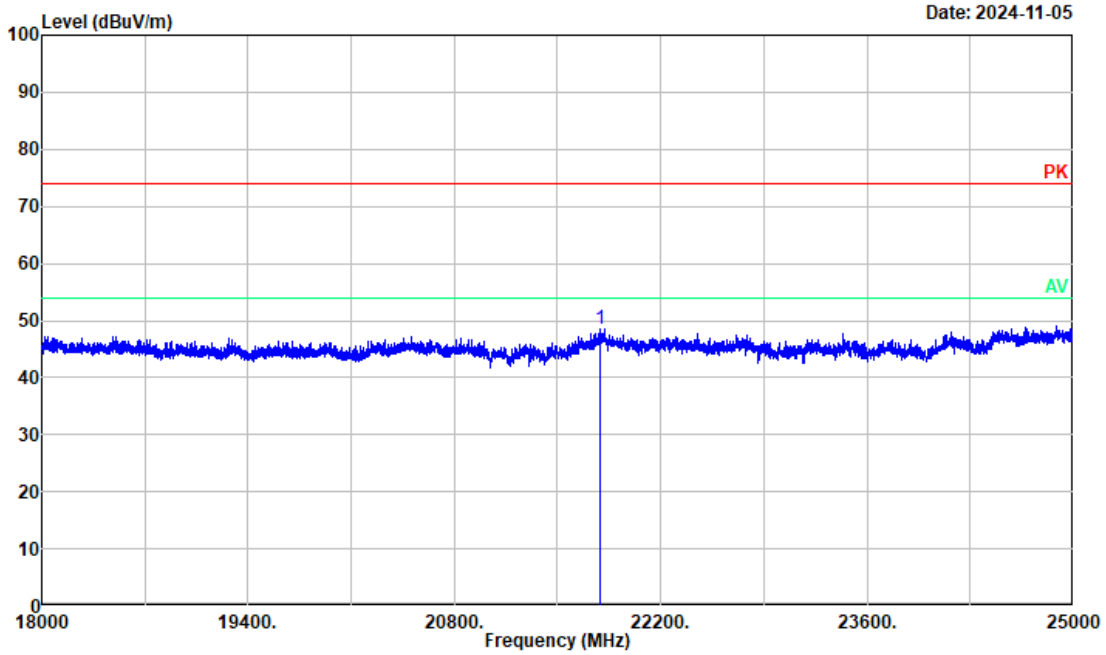


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : horizontal
Remark : BLE 2M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	24691.000	53.63	-4.70	48.93	74.00	-25.07	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain - Distance extrapolate factor
Distance extrapolate factor = 20*log(specified distance/measured distance)
Specified distance = 3 meters, measured distance = 1.5 meters
Result = Reading + Factor
Over Limit = Result - Limit

Mode:	BLE 2M	Channel:	2402MHz



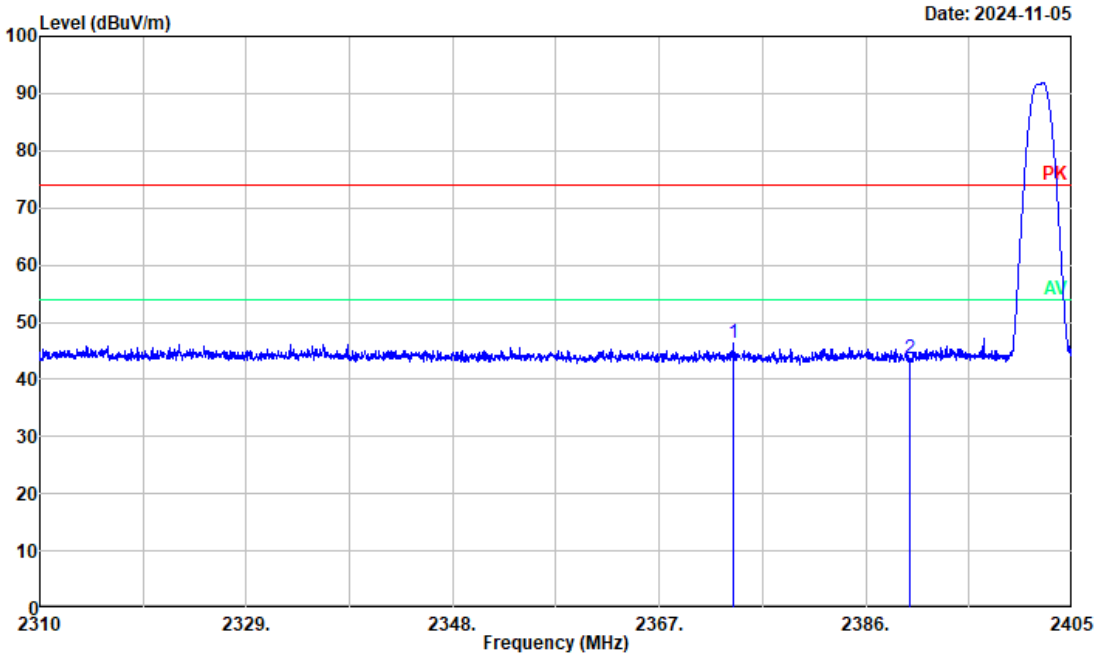
Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : vertical
Remark : BLE 2M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	21791.000	55.55	-6.99	48.56	74.00	-25.44	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain - Distance extrapolate factor
Distance extrapolate factor = 20*log(specified distance/measured distance)
Specified distance = 3 meters, measured distance = 1.5 meters
Result = Reading + Factor
Over Limit = Result - Limit

Radiated band edge:

Mode:	BLE 1M	Channel:	2402MHz

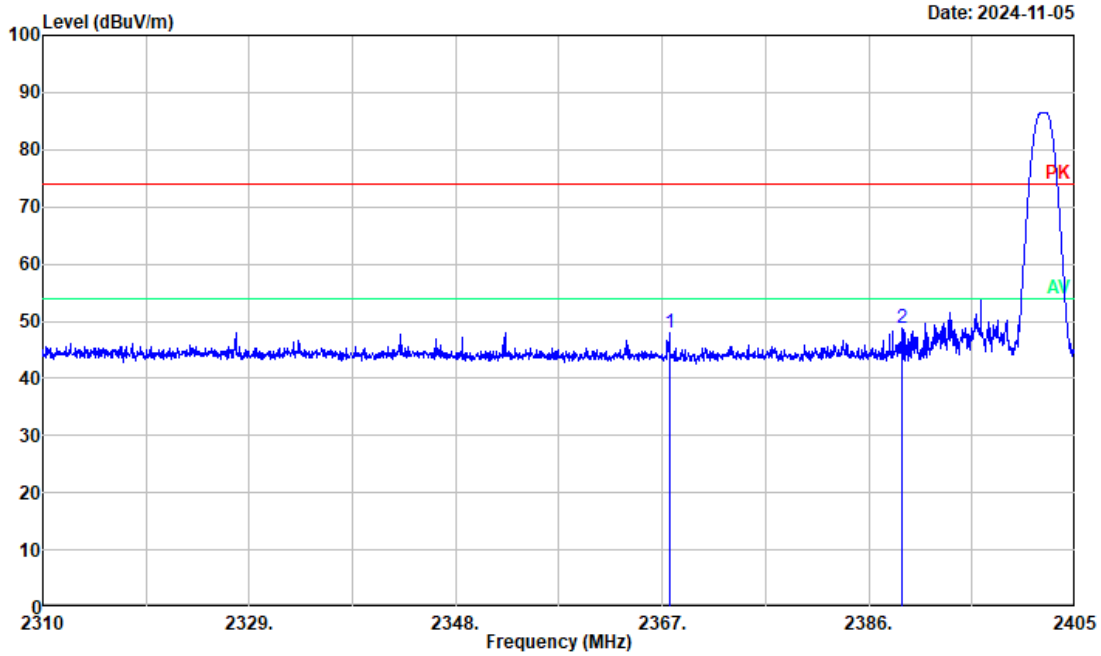


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : horizontal
Remark : BLE 1M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	2373.872	49.51	-3.20	46.31	74.00	-27.69	Peak
2	2390.000	46.76	-3.18	43.58	74.00	-30.42	Peak

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

Mode:	BLE 1M	Channel:	2402MHz

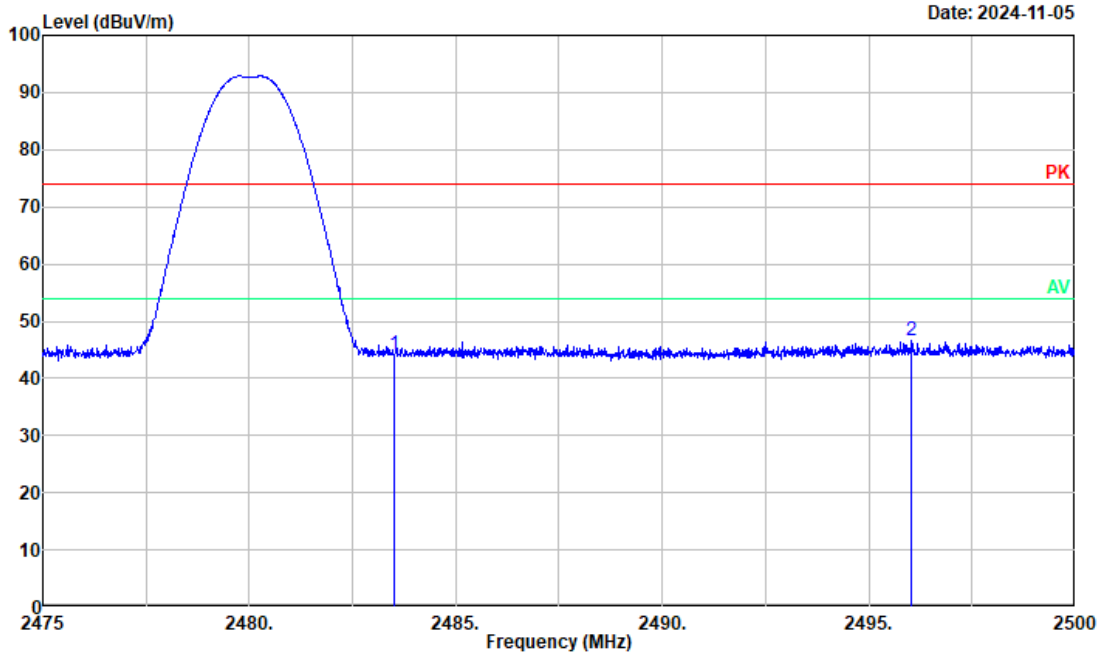


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : vertical
Remark : BLE 1M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	2367.694	51.24	-3.20	48.04	74.00	-25.96	Peak
2	2389.080	51.86	-3.18	48.68	74.00	-25.32	Peak

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

Mode:	BLE 1M	Channel:	2480MHz

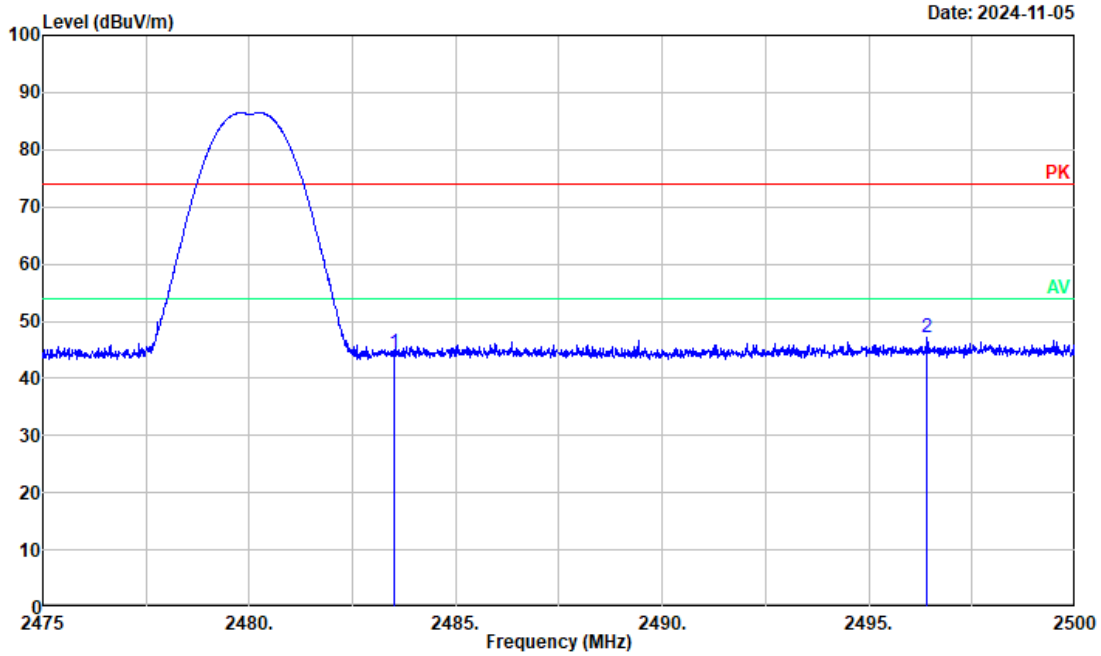


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : horizontal
Remark : BLE 1M high channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	2483.500	47.11	-2.98	44.13	74.00	-29.87	Peak
2	2496.023	49.68	-2.94	46.74	74.00	-27.26	Peak

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

Mode:	BLE 1M	Channel:	2480MHz

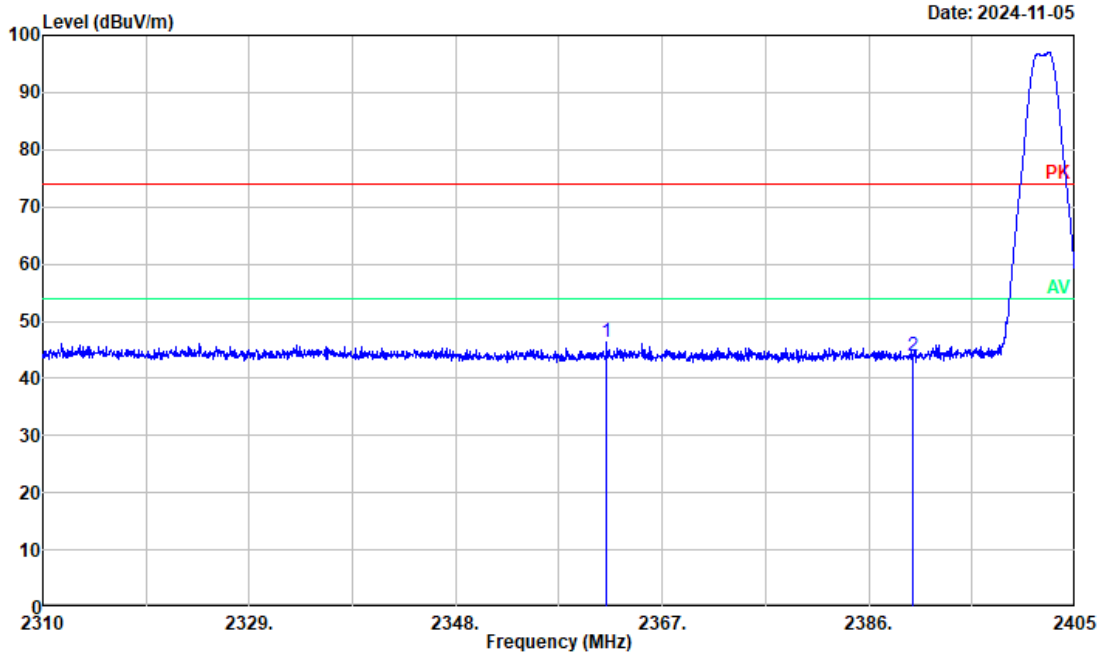


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : vertical
Remark : BLE 1M high channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	2483.500	47.48	-2.98	44.50	74.00	-29.50	Peak
2	2496.398	50.00	-2.94	47.06	74.00	-26.94	Peak

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

Mode:	BLE 2M	Channel:	2402MHz

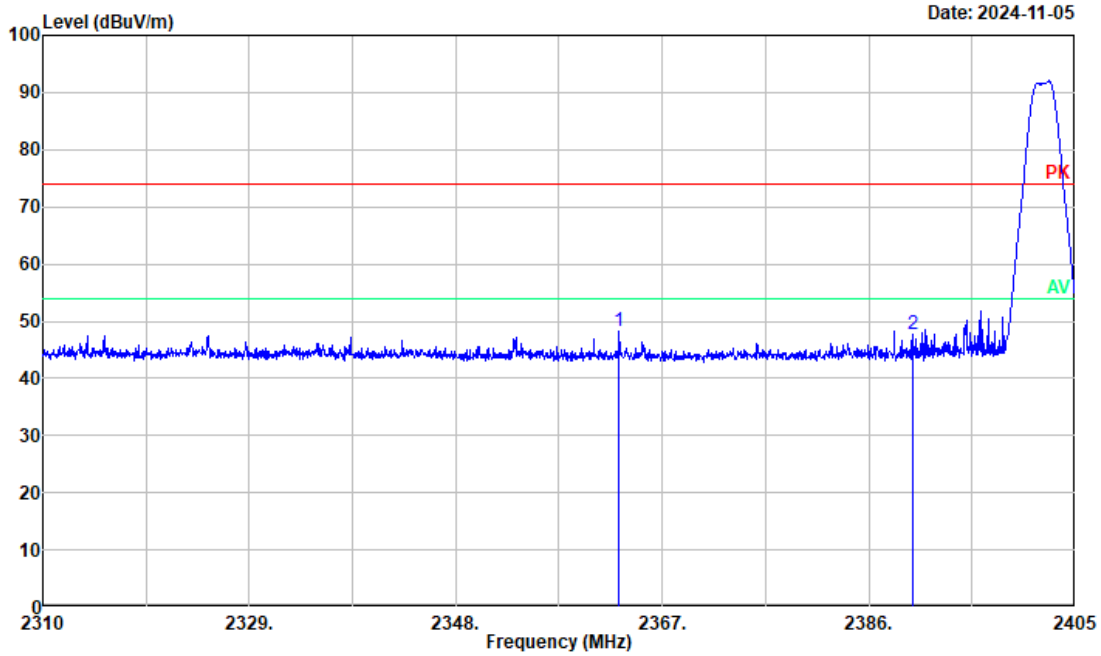


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : horizontal
Remark : BLE 2M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	2361.896	49.43	-3.20	46.23	74.00	-27.77	Peak
2	2390.000	47.06	-3.18	43.88	74.00	-30.12	Peak

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

Mode:	BLE 2M	Channel:	2402MHz

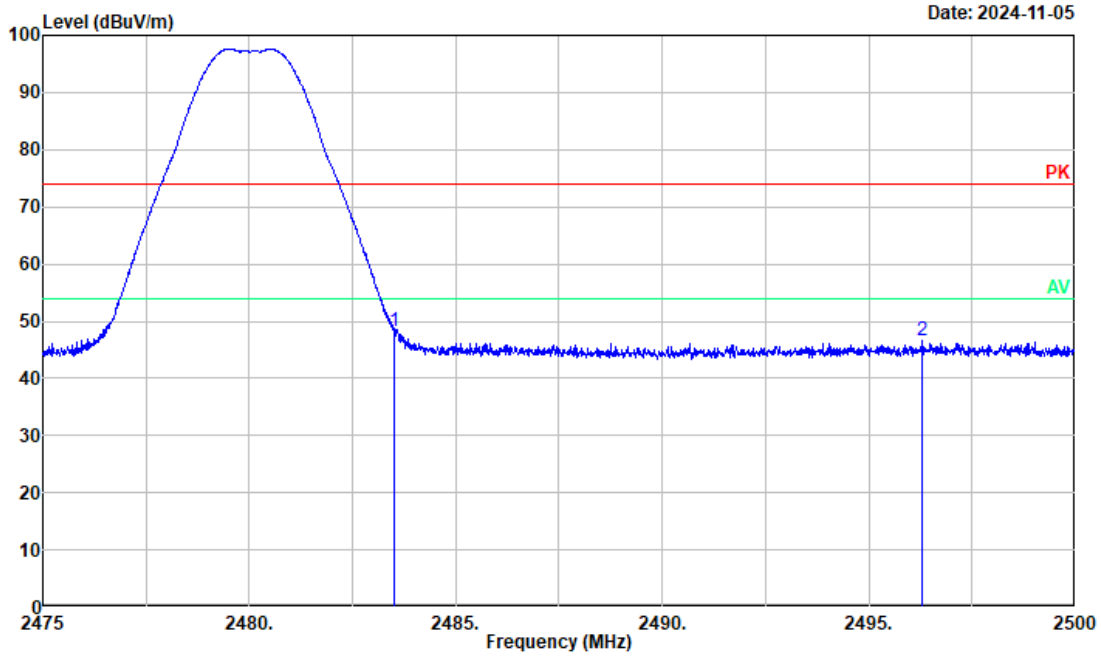


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : vertical
Remark : BLE 2M low channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	2362.989	51.43	-3.20	48.23	74.00	-25.77	Peak
2	2390.000	50.97	-3.18	47.79	74.00	-26.21	Peak

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

Mode:	BLE 2M	Channel:	2480MHz

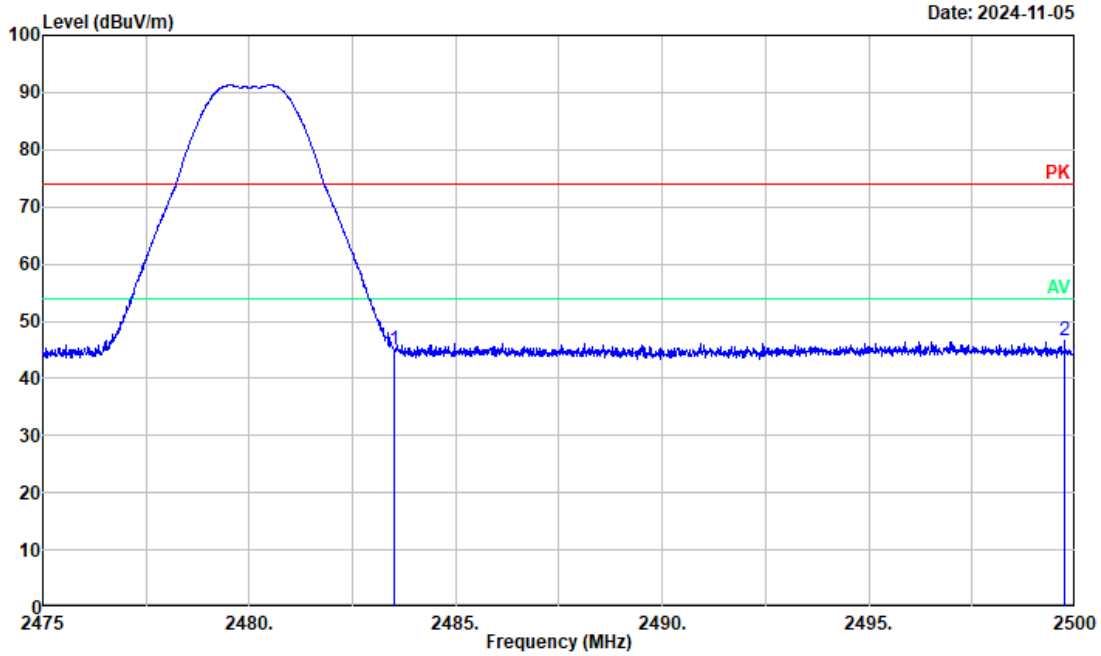


Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : horizontal
Remark : BLE 2M high channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	2483.504	51.29	-2.98	48.31	74.00	-25.69	Peak
2	2496.298	49.46	-2.94	46.52	74.00	-27.48	Peak

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

Mode:	BLE 2M	Channel:	2480MHz



Project No. : 2405Y102391E
Test Mode : Transmitting
Test Voltage : Power by battery
Environment : 22.9℃/51%R.H./100.4kPa
Tested by : Luke Li
Polarization : vertical
Remark : BLE 2M high channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	2483.500	48.00	-2.98	45.02	74.00	-28.98	Peak
2	2499.737	49.42	-2.92	46.50	74.00	-27.50	Peak

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

3.5 RF Conducted Test Data

Test Date:	2024-11-05~2024-11-08	Test By:	Ryan Zhang
Environment condition:	Temperature: 25.2~25.4°C; Relative Humidity:51~55%; ATM Pressure:100.0~ 100.8kPa		

3.5.1 6 dB Emission Bandwidth and 99% Occupied Bandwidth

BLE 1M

Channel	6dB BW (MHz)	99% OBW (MHz)	6dB BW Limit (MHz)	Verdict
Low	0.684	1.020	≥0.5	Pass
Middle	0.692	1.026	≥0.5	Pass
High	0.688	1.026	≥0.5	Pass

BLE 2M

Channel	6dB BW (MHz)	99% OBW (MHz)	6dB BW Limit (MHz)	Verdict
Low	1.352	2.028	≥0.5	Pass
Middle	1.440	2.040	≥0.5	Pass
High	1.396	2.040	≥0.5	Pass

3.5.2 Maximum Conducted Peak Output Power

BLE 1M

Channel	Result (dBm)	Limit (dBm)	Verdict
Low	-6.02	30.00	Pass
Middle	-6.17	30.00	Pass
High	-6.34	30.00	Pass

BLE 2M

Channel	Result (dBm)	Limit (dBm)	Verdict
Low	-0.91	30.00	Pass
Middle	-1.04	30.00	Pass
High	-1.23	30.00	Pass

3.5.3 Power Spectral Density

BLE 1M

Channel	Result (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low	-16.56	8	Pass
Middle	-16.40	8	Pass
High	-16.54	8	Pass

BLE 2M

Channel	Result (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low	-13.62	8	Pass
Middle	-12.56	8	Pass
High	-14.38	8	Pass

3.5.4 100 kHz Bandwidth of Frequency Band Edge

BLE 1M

Channel	Result (dB)	Limit (dB)	Verdict
Low	41.43	20	Pass
High	40.59	20	Pass

BLE 2M

Channel	Result (dB)	Limit (dB)	Verdict
Low	32.98	20	Pass
High	44.77	20	Pass

3.5.5 Duty Cycle

BLE 1M

Channel	Ton (ms)	Ton+Toff (ms)	Duty Cycle (%)	Duty Cycle Factor(dB)	1/Ton (Hz)	VBW Setting (kHz)
Middle	100	100	100	0	NA	0.010

BLE 2M

Channel	Ton (ms)	Ton+Toff (ms)	Duty Cycle (%)	Duty Cycle Factor(dB)	1/Ton (Hz)	VBW Setting (kHz)
Middle	100	100	100	0	NA	0.010

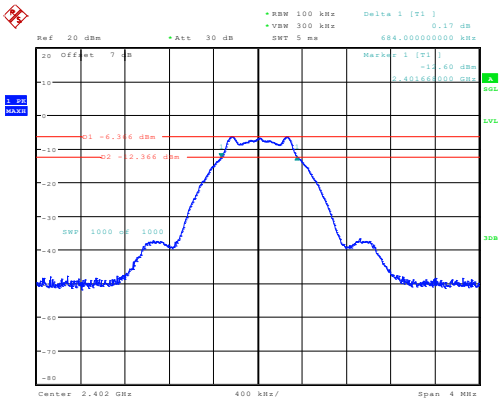
Duty Cycle = Ton/(Ton+Toff)*100%

Test Plots:

6 dB Emission Bandwidth

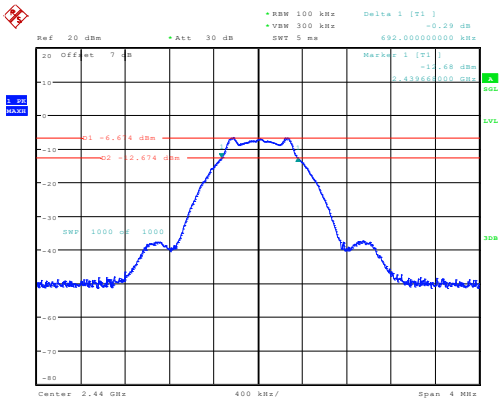
BLE 1M

BLE_1M_Low_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:38:25

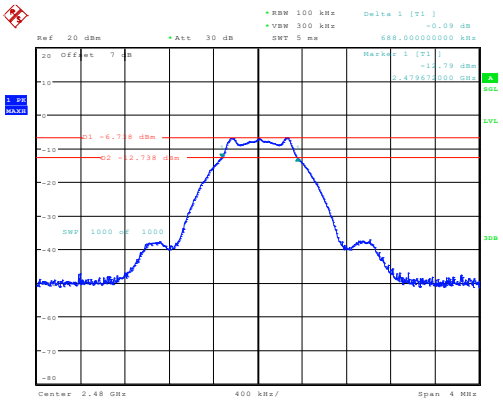
BLE_1M_Middle_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:40:23

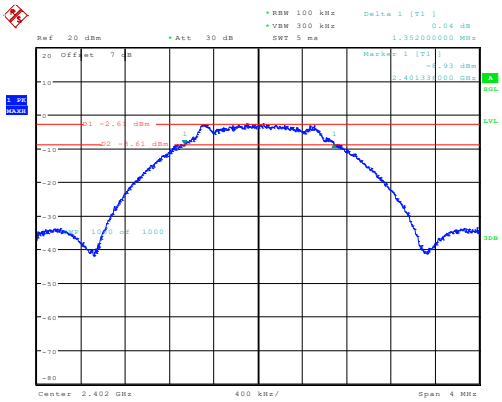
BLE 2M

BLE_1M_High_Channel



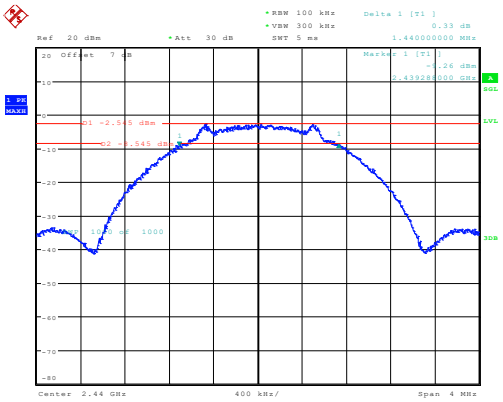
ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:43:58

BLE_2M_Low_Channel



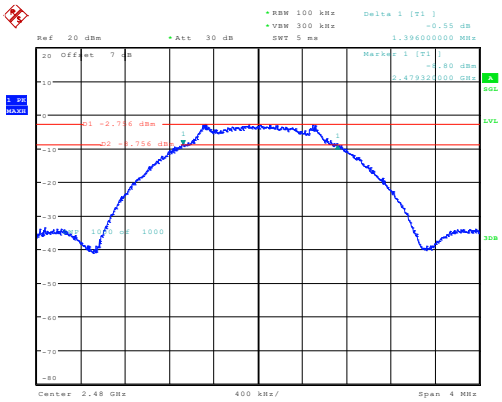
ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:47:25

BLE_2M_Middle_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:49:59

BLE_2M_High_Channel

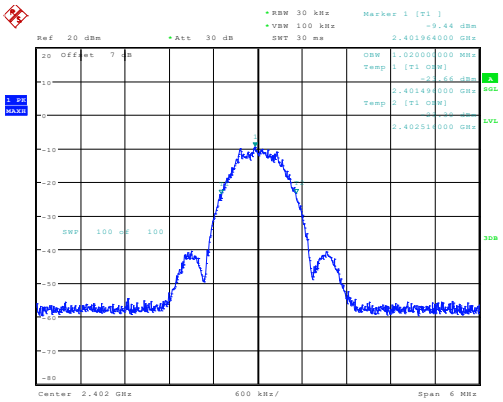


ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:53:57

99% Occupied Bandwidth

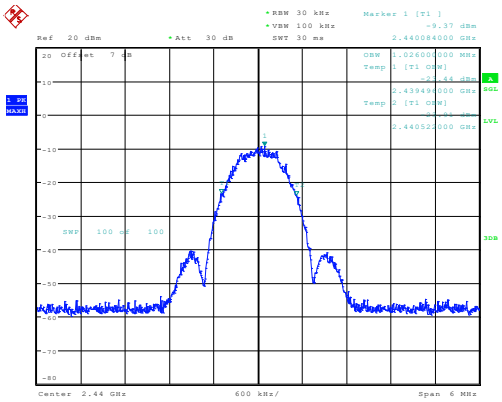
BLE 1M

BLE_1M_Low_Channel



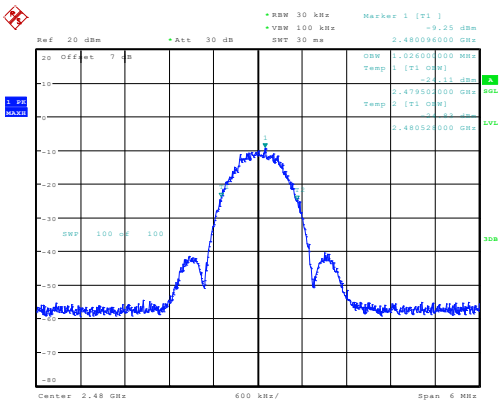
ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:38:39

BLE_1M_Middle_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:40:36

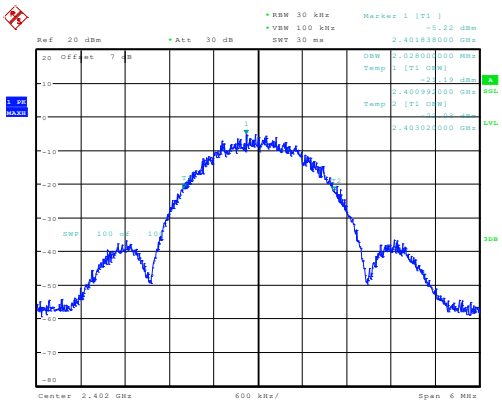
BLE_1M_High_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:44:15

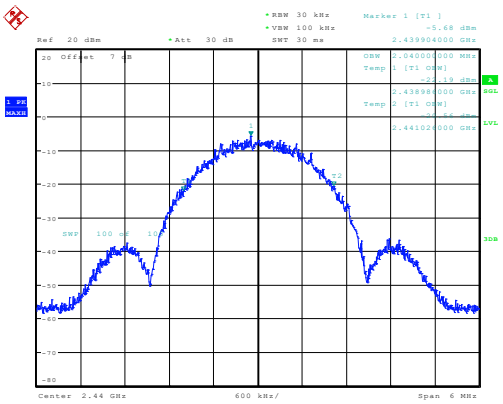
BLE 2M

BLE_2M_Low_Channel



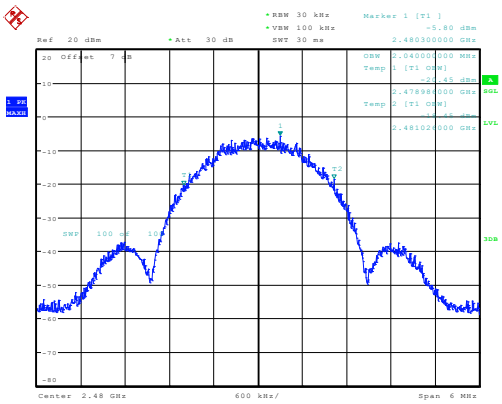
ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:47:39

BLE_2M_Middle_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:50:13

BLE_2M_High_Channel

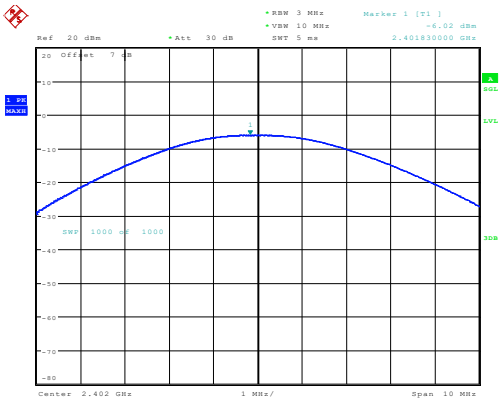


ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:54:14

Maximum Conducted Peak Output Power

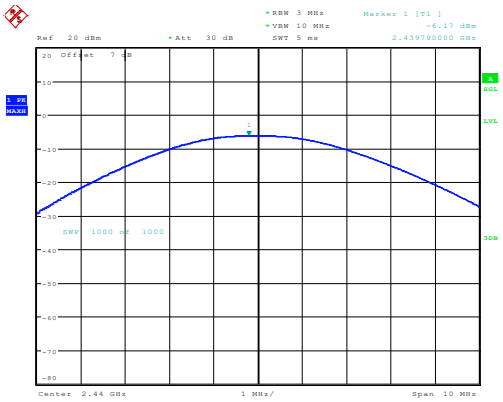
BLE 1M

BLE_1M_Low_Channel



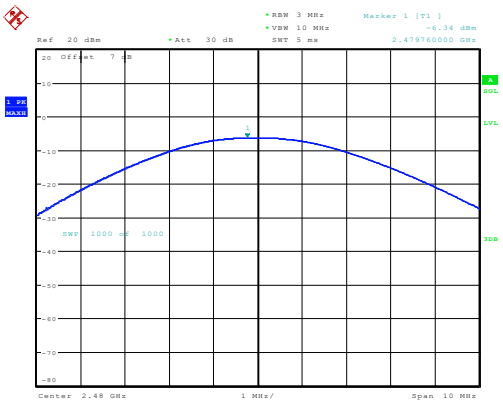
ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:39:07

BLE_1M_Middle_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:41:25

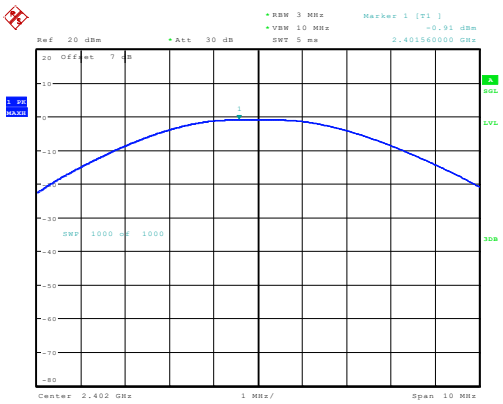
BLE_1M_High_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:44:58

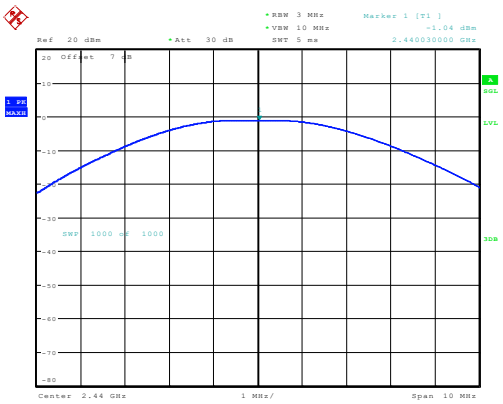
BLE 2M

BLE_2M_Low_Channel



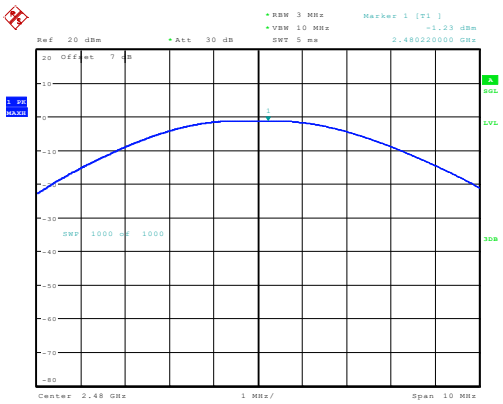
ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:48:08

BLE_2M_Middle_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:51:02

BLE_2M_High_Channel

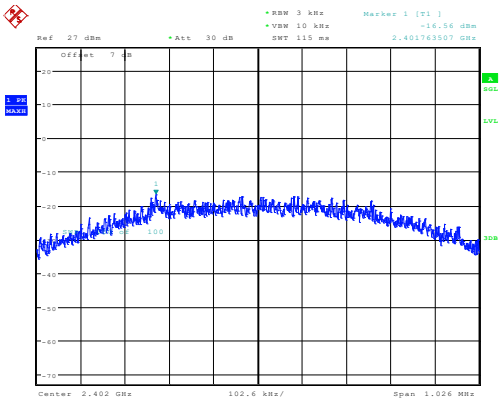


ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:54:45

Power Spectral Density

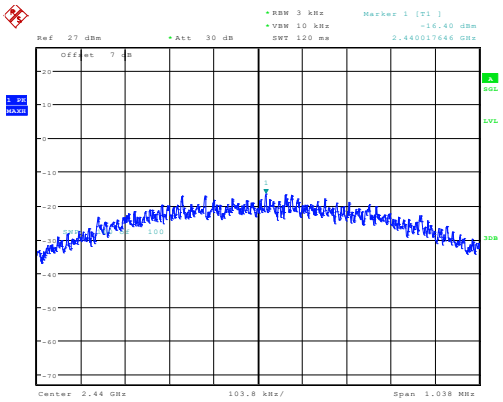
BLE 1M

BLE_1M_Low_Channel



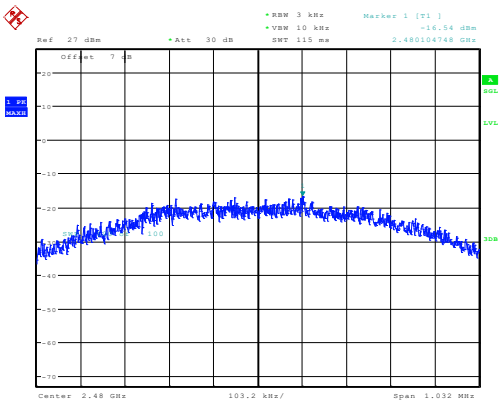
ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:39:30

BLE_1M_Middle_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:41:49

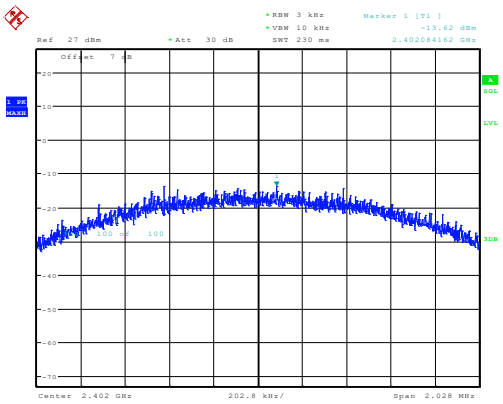
BLE_1M_High_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:45:21

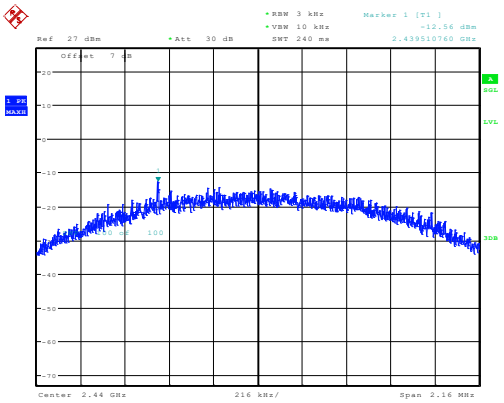
BLE 2M

BLE_2M_Low_Channel



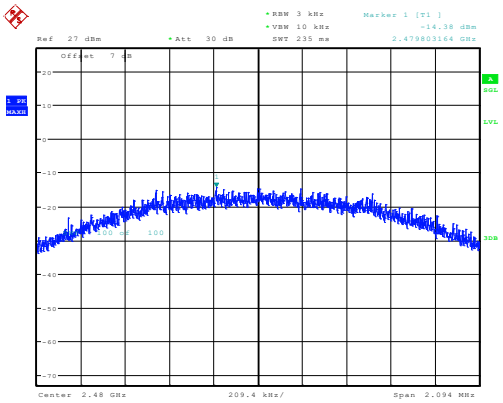
ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:48:43

BLE_2M_Middle_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:51:39

BLE_2M_High_Channel

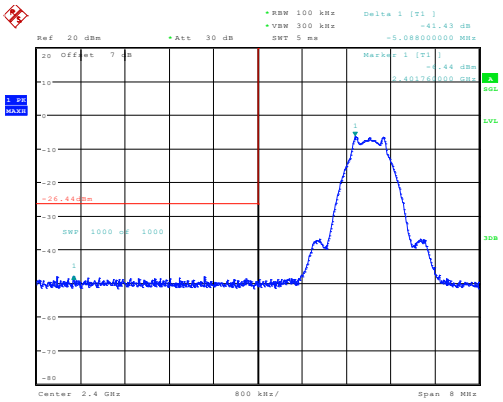


ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:55:20

100kHz Bandwidth of Frequency Band Edge

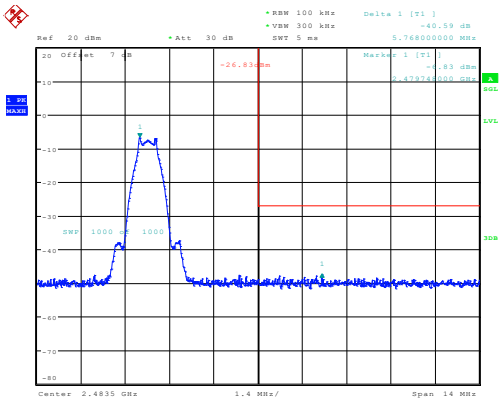
BLE 1M

BLE_1M_Low_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:37:51

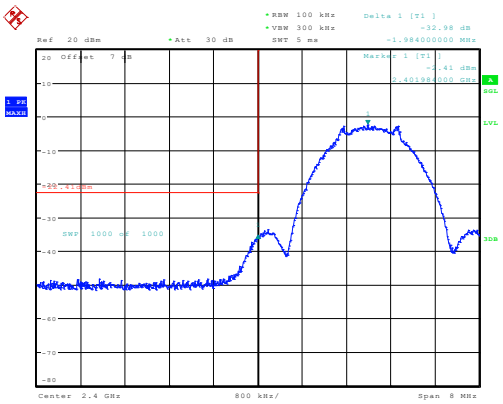
BLE_1M_High_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:43:11

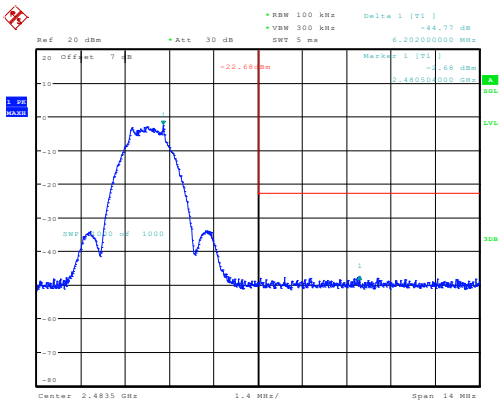
BLE 2M

BLE_2M_Low_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:46:51

BLE_2M_High_Channel

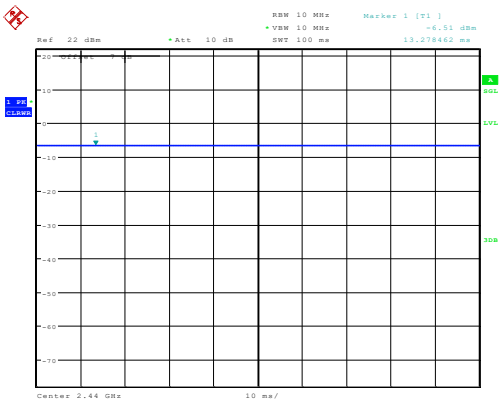


ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 5.NOV.2024 14:53:09

Duty cycle

BLE 1M

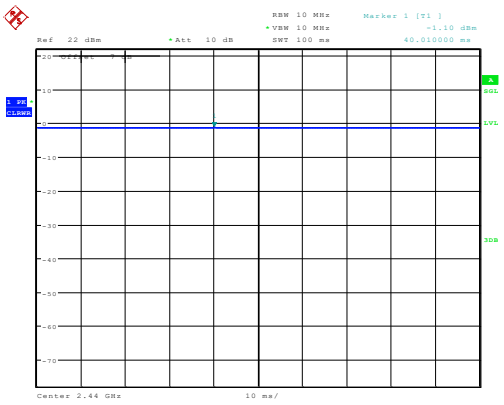
BLE_1M_Middle_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 8.NOV.2024 13:29:39

BLE 2M

BLE_2M_Middle_Channel



ProjectNo.:2405Y102391E-RF Tester:Ryan Zhang
Date: 8.NOV.2024 13:30:29

4 Test Setup Photo

Please refer to the attachment 2405Y102391E Test Setup photo.

5 E.U.T Photo

Please refer to the attachment 2405Y102391E External photo and 2405Y102391E Internal photo.

---End of Report---