FCC PART 15.247

TEST REPORT

For

Ringway Tech(Jiangsu) Co.,Ltd.

No. 101 West Hanjiang Road, Changzhou, Jiangsu, China

FCC ID:OCDAB5301A01

Report Type:	**Product Name:**
Original Report	Bluetooth module

Report Number:	RSHA240108001-00B
Report Date:	2024-04-05
Reviewed By:	Jenny Yang
Approved By:	Kyle Xu
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu Province, China Tel: +86-512-86175000 Fax: +86-512-88934268 www.baclcorp.com.cn

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REPORT REVISION HISTORY

Number of Revisions	Report No.	Version	Issue Date	Description
0	RSHA240108001-00B	R1V1	2024-04-05	Initial Release

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	Ringway Tech(Jiangsu) Co.,Ltd.
Tested Model:	AB5301A01
Product Name:	Bluetooth module
Power Supply:	DC 3~5V
RF Function:	BLE (1Mbps)
Maximum Output Power:	-1.52 dBm
Operating Band/Frequency:	2402-2480MHz
Channel Number:	40
Channel Separation:	2 MHz
Modulation Type	GFSK
Antenna Type:	Ceramic Antenna
★Maximum Antenna Gain:	2.5 dBi

Note: The maximum antenna gain was declared by the manufacturer.

All measurement and test data in this report was gathered from production sample serial number: RSHA240108001-1 (Assigned by the BACL (Kunshan). The EUT supplied by the applicant was received on 2024-01-08.)

Objective

This report is prepared for *Ringway Tech(Jiangsu) Co.,Ltd.* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communications Commission rules.

The tests were performed in order to determine Compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emissions	9 kHz~150 kHz	3.8dB
	150 kHz~30 MHz	3.4dB
	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	5.65dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu Province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) is accredited in accordance with ISO/IEC 17025:2017 by NVLAP (Lab code: 600338-0), and the lab has been recognized as the FCC accredited lab under the KDB 974614 D01, the FCC Designation No. : CN5055.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Channel List for BLE mode:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	…	…
…	…	…	…
…	…	…	…
18	2438	38	2478
19	2440	39	2480

EUT was tested with channel 0, 19 and 39.

EUT Exercise Software

RF Test Tool: BT_Tool.exe

★Power level: Default

Note: The power level was declared by the applicant.

Special Accessories

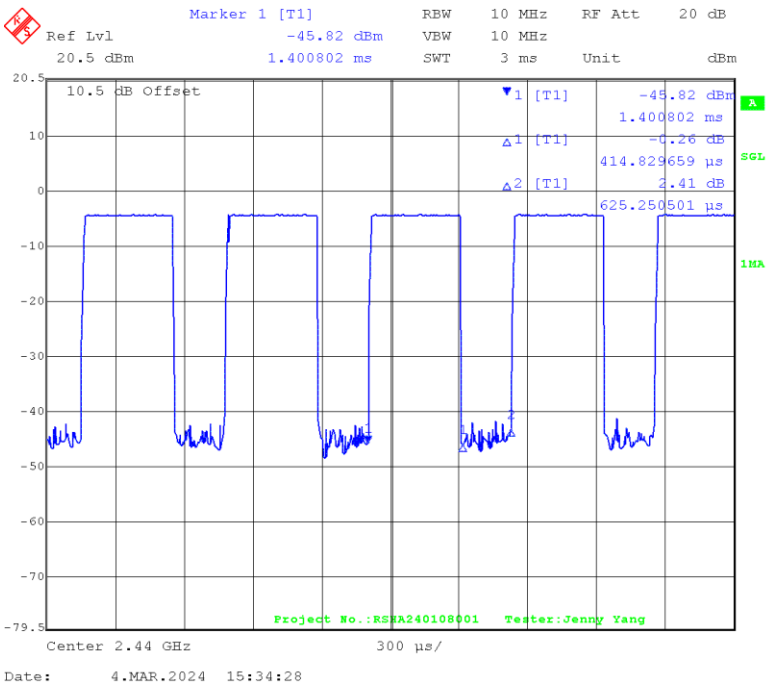
No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Duty Cycle:

BLE (1Mbps): Middle Channel



Mode	Duty Cycle (%)	T_{on}(ms)	T_{on+off}(ms)	10log(1/x)
BLE (1Mbps)	66.40	0.415	0.625	1.78

Note: “x” means the Duty Cycle.

Support Equipment List and Details

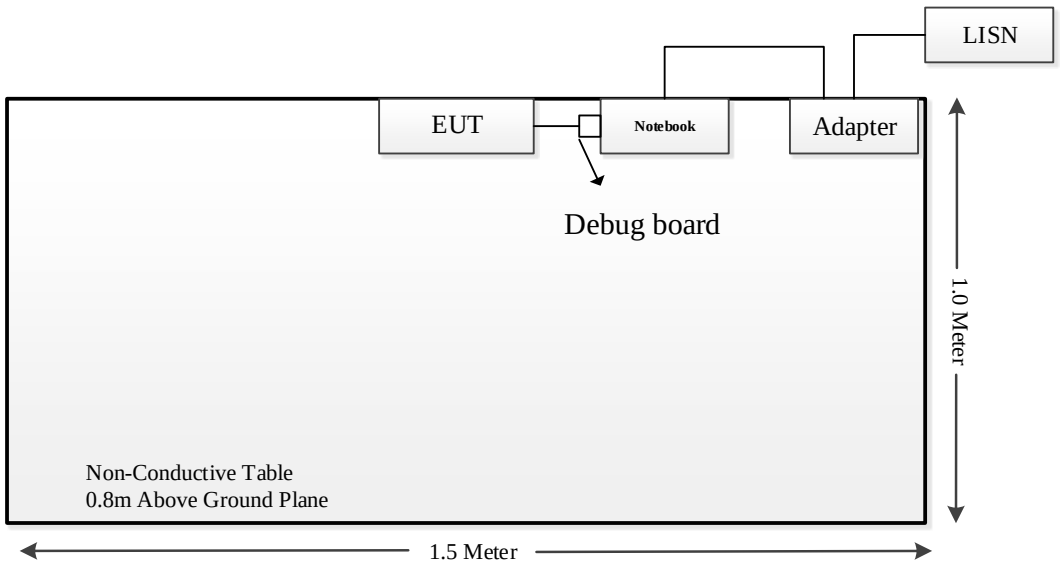
Manufacturer	Description	Model	Serial Number
Unknown	Adapter	Unknown	Unknown
Unknown	Debug board	Unknown	Unknown
Lenovo	Notebook	Y700P	PF2B7PL5

External I/O Cable

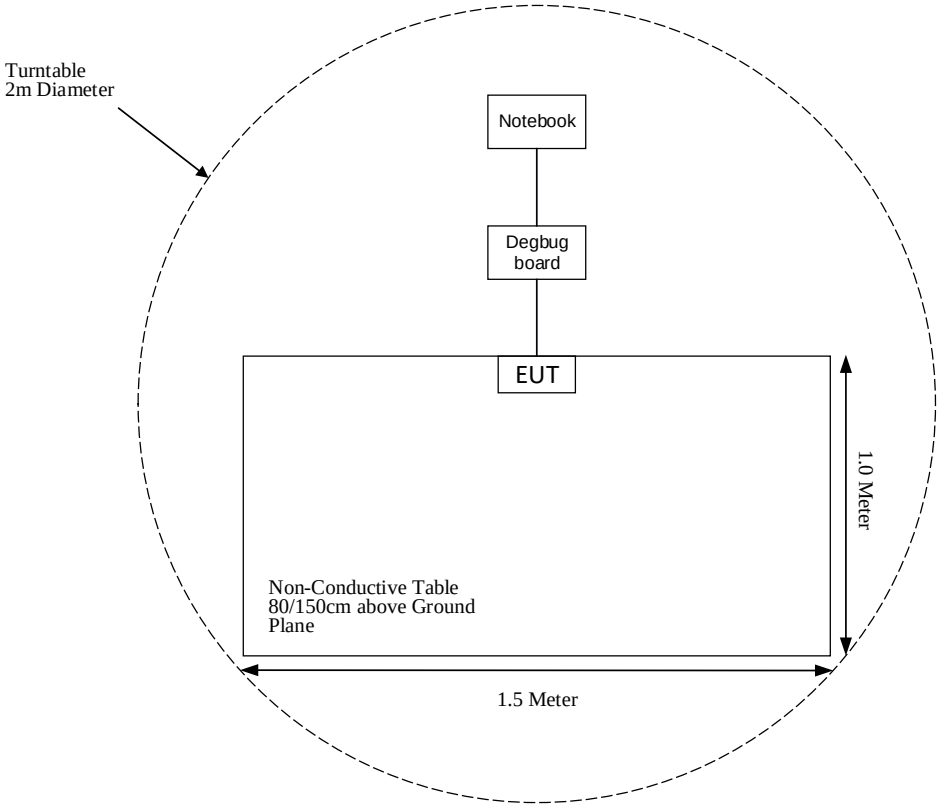
Cable Description	Length (m)	From Port	To
Power Cable 1	2.0	LISN	Adapter
USB cable	5.0	Debug board	Notebook
Data Cable	0.1	EUT	Debug board

Block Diagram of Test Setup

For Conducted Emissions:



For Radiated Emissions(Below 1GHz & Above 1 GHz):



TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test（Chamber #1）					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2023-05-23	2024-05-22
Sunol Sciences	Broadband Antenna	JB3	A090314-1	2023-11-11	2024-11-10
ETS-LINDGREN	Loop Antenna	6512	108100	2023-11-09	2024-11-08
Narda	6 dB Attenuator	773-6	10690812-2-1	2023-11-11	2024-11-10
Sonoma Instrument	Pre-amplifier	310N	171205	2023-05-23	2024-05-22
Rohde & Schwarz	Auto Test Software	EMC32	100361	N/A	N/A
MICRO-COAX	Coaxial Cable	Cable-8	008	2023-05-23	2024-05-22
MICRO-COAX	Coaxial Cable	Cable-9	009	2023-05-23	2024-05-22
Radiated Emission Test（Chamber #2）					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207/040	2023-05-19	2024-05-18
ETS-LINDGREN	Horn Antenna	3115	9311-4159	2023-12-02	2024-12-01
ETS-LINDGREN	Horn Antenna	3116	2516	2023-12-08	2024-12-07
A.H.Systems,inc	Amplifier	2641-1（PAM-0118P）	512	2023-05-23	2024-05-22
MICRO-TRONICS	Band Reject Filter	BRM50702	G024	2023-08-05	2024-08-04
Narda	Attenuator	10dB	010	2023-08-15	2024-08-14
SELECTOR	Amplifier	EM18G40G	60726	2023-05-23	2024-05-22
Rohde & Schwarz	Auto test Software	EMC32	100361	N/A	N/A
MICRO-COAX	Coaxial Cable	Cable-6	006	2023-05-23	2024-05-22
MICRO-COAX	Coaxial Cable	Cable-11	011	2023-05-23	2024-05-22
MICRO-COAX	Coaxial Cable	Cable-12	012	2023-05-23	2024-05-22
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2023-05-23	2024-05-22
Rohde & Schwarz	Spectrum Analyzer	FSIQ26	100048	2023-05-23	2024-05-22
Narda	Attenuator	10dB	010	2023-08-15	2024-08-14
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESR	101746	2023-05-23	2024-05-22
Rohde & Schwarz	LISN	ENV216	101115	2023-05-23	2024-05-22
Audix	Test Software	e3	V9	N/A	N/A
Rohde & Schwarz	Pulse Limiter	ESH3-Z2	0357.8810.54	2023-05-23	2024-05-22
MICRO-COAX	Coaxial Cable	Cable-15	015	2023-05-23	2024-05-22

Statement of Traceability: Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has a Ceramic antenna for BLE, and the antenna gain is 2.5 dBi, which permanently attached to EUT ,fulfill the requirement of this section. Please refer to the EUT photos.

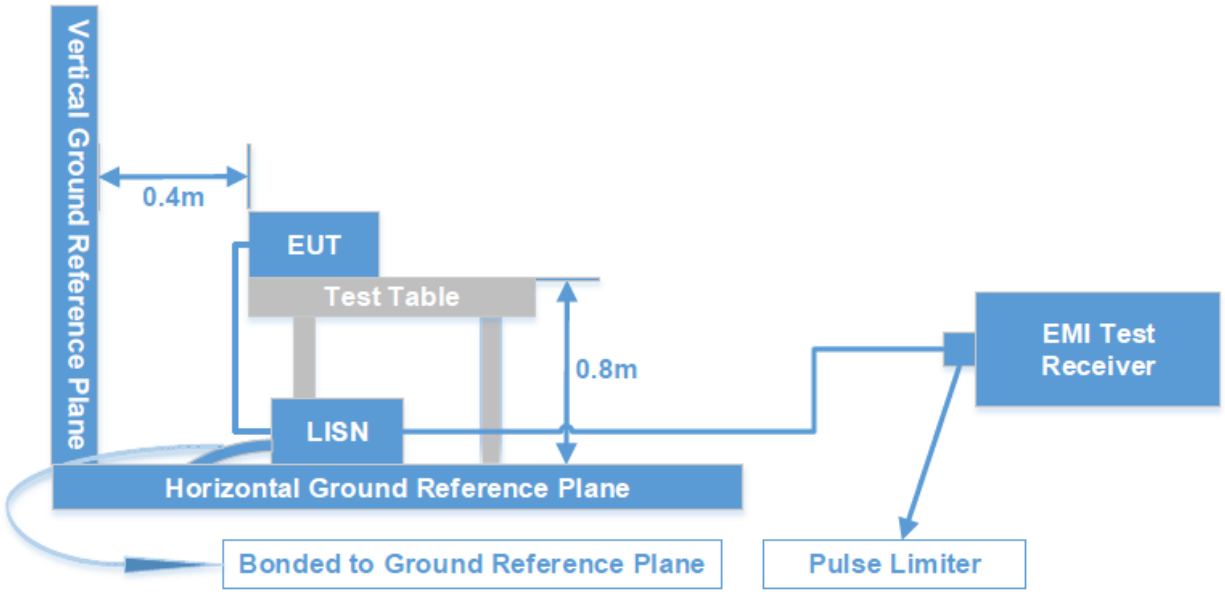
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

Test System Setup



The measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	RBW	VBW
150 kHz – 30 MHz	9 kHz	30 kHz

Test Procedure

ANSI C63.10-2013 clause 6.2

During the conducted emission test, the adapter or EUT was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

If the maximum peak value of the emissions is below the average limit, the QP value and average value measurement will not need to be performed and only record the maximum peak measured value to meet the requirements.

Level & Over Limit Calculation

The Level is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation from the Meter Reading. The basic equation is as follows:

Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
Level (dBμV) = Read level (dBμV) + Factor (dB)

The "**Over Limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over Limit of 7 dB means the emission is 7 dB above the limit. The equation for Over Limit calculation is as follows:

Over Limit (dB) = Level (dBμV) - Limit (dBμV)

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data: See Appendix

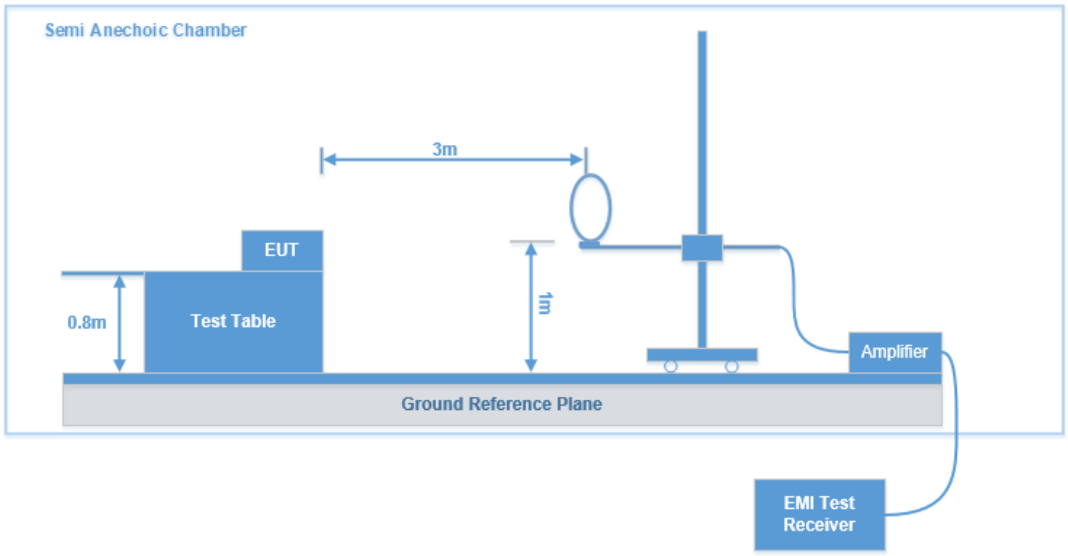
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

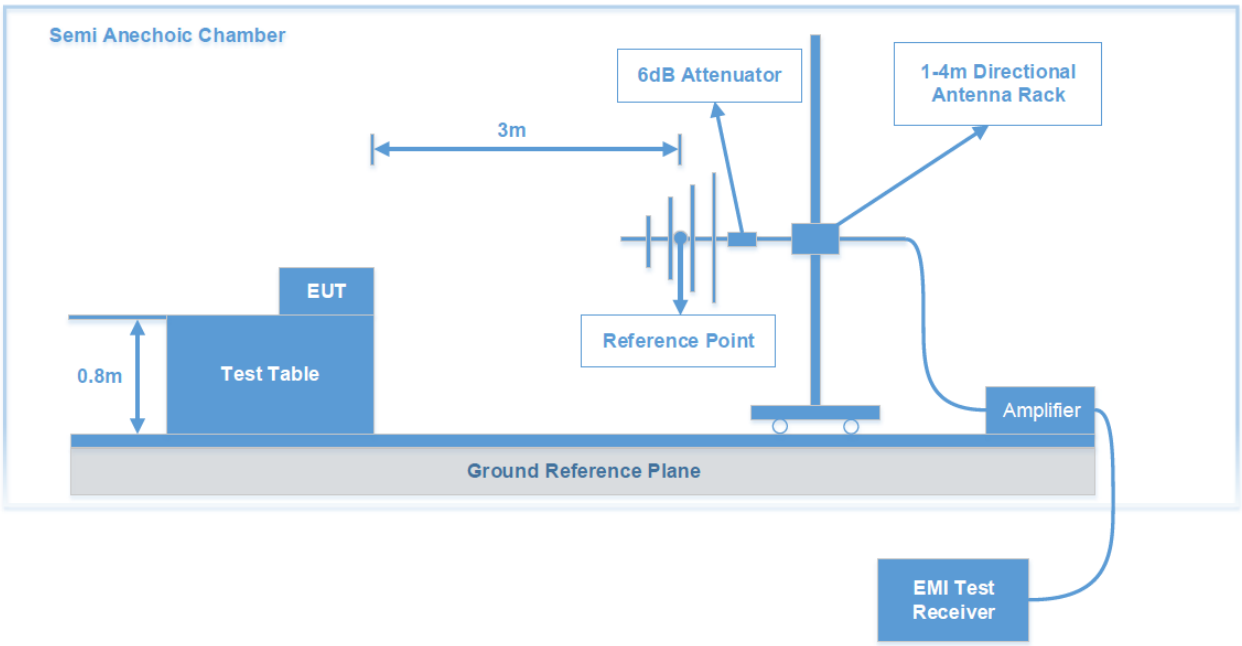
FCC §15.247 (d); §15.209; §15.205;

Test System Setup

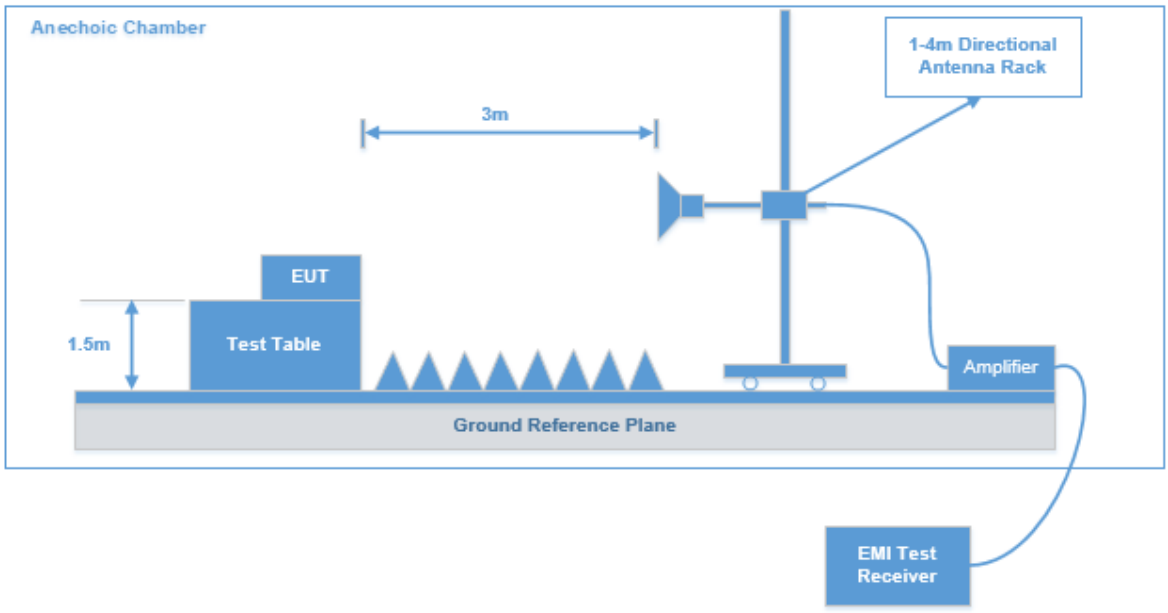
9kHz~30MHz:



30MHz~1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

EMI Test Receiver Setup

The system was investigated from 9 kHz to 25 GHz.

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

Frequency Range	RBW	VBW	IF B/W	Detector
9 kHz – 150 kHz	200 Hz	1 kHz	200 Hz	QP/Average
150 kHz – 30 MHz	9 kHz	30 kHz	9 kHz	QP/ Average
30 MHz – 1000 MHz	100 kHz	300 kHz	/	Peak
	/	/	120 kHz	QP
Above 1GHz	1MHz	3 MHz	/	Peak
	1MHz	3 MHz	/	Average

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

If the measured peak level of the emissions that the measuring receiver reading level plus corrected factor is at least 6 dB below the QP emission limit, there's no need to record the measured QP level of the emissions in the report.

For 9 kHz-30MHz test, the lowest height of the magnetic antenna shall be 1 m above the ground and

three antenna orientations (parallel, perpendicular, and ground-parallel) shall be measured.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude (dBμV/m) = Meter Reading (dBμV) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV/m)

Note: The QuasiPeak (dBμV/m), MaxPeak (dBμV/m), Average (dBμV/m) which shown in the data table are all Corrected Amplitude.

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Test Data: See Appendix

FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

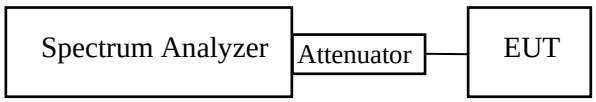
Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.8.1

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 * RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



Test Data: See Appendix

FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

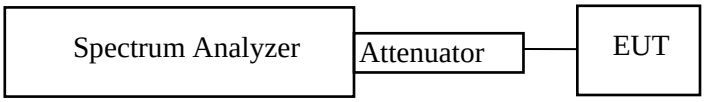
Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.9.1.1

1. Set the RBW ≥ DTS bandwidth.
2. Set VBW ≥ 3 * RBW.
3. Set span ≥ 3 * RBW
4. Sweep time = auto couple.
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use peak marker function to determine the peak amplitude level.



Test Data: See Appendix

FCC §15.247(d) – BAND EDGE

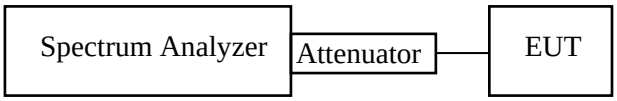
Applicable Standard

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)).

Test Procedure

According to ANSI C63.10-2013 sub-clause 6.10.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.



Test Data: See Appendix

FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

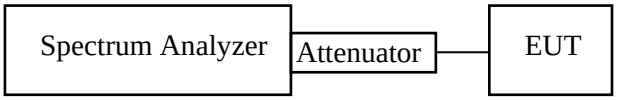
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.10.2

The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

1. Set the RBW to: 3kHz≤ RBW≤100 kHz.
2. Set the VBW ≥ 3*RBW.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level within the RBW.
9. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test Data: See Appendix

EUT PHOTOGRAPHS

Please refer to the attachment EXHIBIT A - EUT EXTERNAL PHOTOGRAPHS and EXHIBIT B - EUT INTERNAL PHOTOGRAPHS.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment EXHIBIT C - TEST SETUP PHOTOGRAPHS.

Appendix - TEST DATA

Environmental Conditions & Test Information

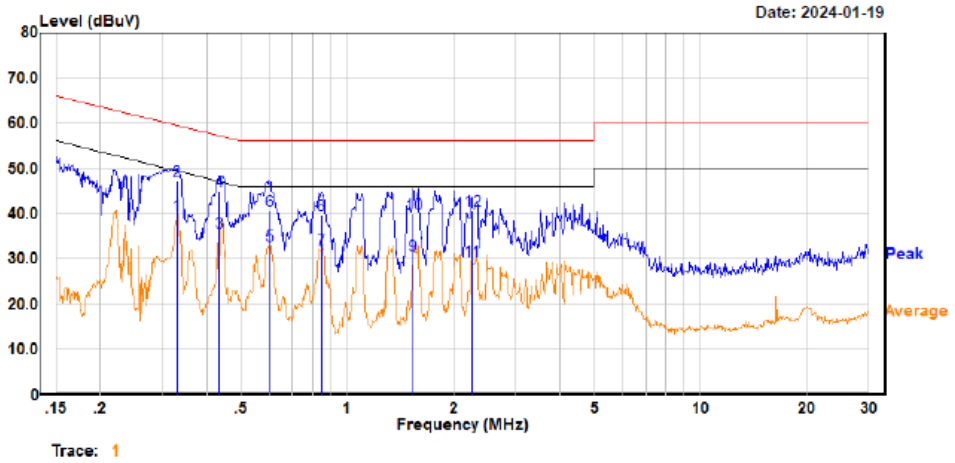
Test Item:	AC LINE CONDUCTED EMISSIONS	SPURIOUS EMISSIONS		
		9kHz - 1GHz	1 GHz - 18 GHz	18 GHz - 25 GHz
Test Date:	2024-01-19	2024-01-22	2024-02-04 to 2024-03-08	2024-03-07
Temperature:	21.0 ℃	16.2 ℃	20.3 ℃	16.8 ℃
Relative Humidity:	25 %	44 %	52 %	48 %
ATM Pressure:	102.4 kPa	103.5 kPa	101.5-102.6 kPa	101.8 kPa
Test Result:	Pass	Pass	Pass	Pass
Test Engineer:	Aaron Sun	Joe Zhang	Peter Wang	Peter Wang

Test Item:	6 DB EMISSION BANDWIDTH	MAXIMUM CONDUCTED OUTPUT POWER	BAND EDGE	POWER SPECTRAL DENSITY
Test Date:	2024-02-27	2024-02-27	2024-02-27	2024-02-27
Temperature:	16.5 ℃	16.5 ℃	16.5 ℃	16.5 ℃
Relative Humidity:	45 %	45 %	45 %	45 %
ATM Pressure:	102.7kPa	102.7kPa	102.7kPa	102.7kPa
Test Result:	Pass	Pass	Pass	Pass
Test Engineer:	Jenny Yang	Jenny Yang	Jenny Yang	Jenny Yang

AC LINE CONDUCTED EMISSIONS

EUT operation mode: Transmitting in low channel (maximum output power)

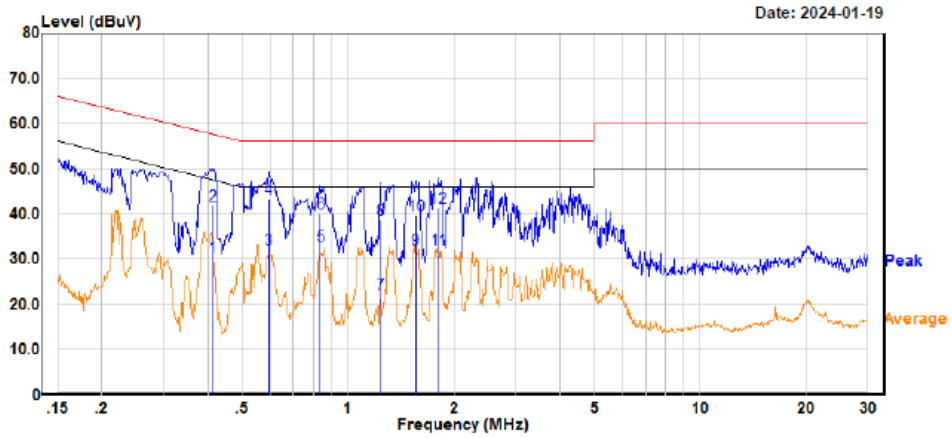
AC 120V/60 Hz, Line



Site : CE
Condition : FCC PART 15C
: DET:Peak
Model : AB5301A01
Voltage : 120V/60Hz
Phase : L
Mode : BLE
Test Equipment : ENV216,ESR
Temperature : 21.0℃
Humidity : 25%
Atmospheric pressure: 102.4kPa
Test Engineer : Aaron

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.330	19.70	20.03	39.73	49.46	-9.73	Average
2	0.330	27.20	20.03	47.23	59.46	-12.23	QP
3	0.434	15.70	20.08	35.78	47.18	-11.40	Average
4	0.434	24.80	20.08	44.88	57.18	-12.30	QP
5	0.606	12.89	20.09	32.98	46.00	-13.02	Average
6	0.606	20.59	20.09	40.68	56.00	-15.32	QP
7	0.846	12.10	19.90	32.00	46.00	-14.00	Average
8	0.846	19.80	19.90	39.70	56.00	-16.30	QP
9	1.538	10.70	20.03	30.73	46.00	-15.27	Average
10	1.538	19.80	20.03	39.83	56.00	-16.17	QP
11	2.258	9.30	20.22	29.52	46.00	-16.48	Average
12	2.258	20.50	20.22	40.72	56.00	-15.28	QP

AC 120V/60 Hz, Neutral



Trace: 1

Site : CE
Condition : FCC PART 15C
: DET:Peak
Model : AB5301A01
Voltage : 120V/60Hz
Phase : N
Mode : BLE
Test Equipment : ENV216,ESR
Temperature : 21.0℃
Humidity : 25%
Atmospheric pressure: 102.4kPa
Test Engineer : Aaron

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.415	10.50	20.07	30.57	47.55	-16.98	Average
2	0.415	21.80	20.07	41.87	57.55	-15.68	QP
3	0.597	12.00	20.09	32.09	46.00	-13.91	Average
4	0.597	23.10	20.09	43.19	56.00	-12.81	QP
5	0.837	12.90	19.91	32.81	46.00	-13.19	Average
6	0.837	20.20	19.91	40.11	56.00	-15.89	QP
7	1.235	2.40	19.89	22.29	46.00	-23.71	Average
8	1.235	18.80	19.89	38.69	56.00	-17.31	QP
9	1.561	12.00	20.04	32.04	46.00	-13.96	Average
10	1.561	19.60	20.04	39.64	56.00	-16.36	QP
11	1.804	12.10	20.14	32.24	46.00	-13.76	Average
12	1.804	21.30	20.14	41.44	56.00	-14.56	QP

SPURIOUS EMISSIONS

Test Result: Compliant.

EUT operation mode: Transmitting

After pre-scan in the X, Y and Z axes of orientation, the worst case is below:

9 kHz-30 MHz: *(Transmitting in maximum output power low channel)*

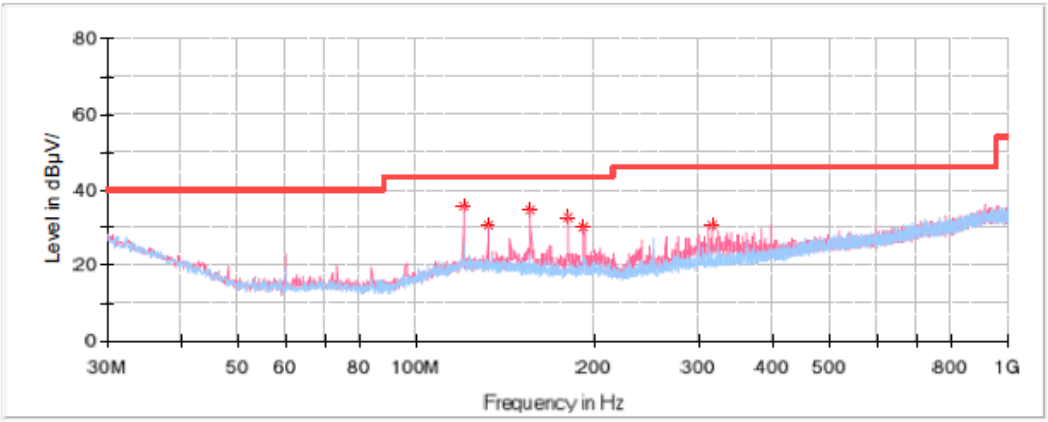
The amplitude of spurious emissions attenuated more than 20 dB below the limit was not be recorded.

30 MHz - 1 GHz:

Low Channel: 2402 MHz

Common Information

Project No:	RSHA240108001
EUT Model:	AB5301A01
Test Mode:	BLE 1M
Standard:	FCC Part 15.247 & FCC Part 15.205 & Part 15.209
Test Equipment:	ESCI、JB3、310N
Temperature:	16.2℃
Humidity:	44%
Barometric Pressure:	103.5kPa
Test Engineer:	Joe Zhang
Test Date:	2024/1/22



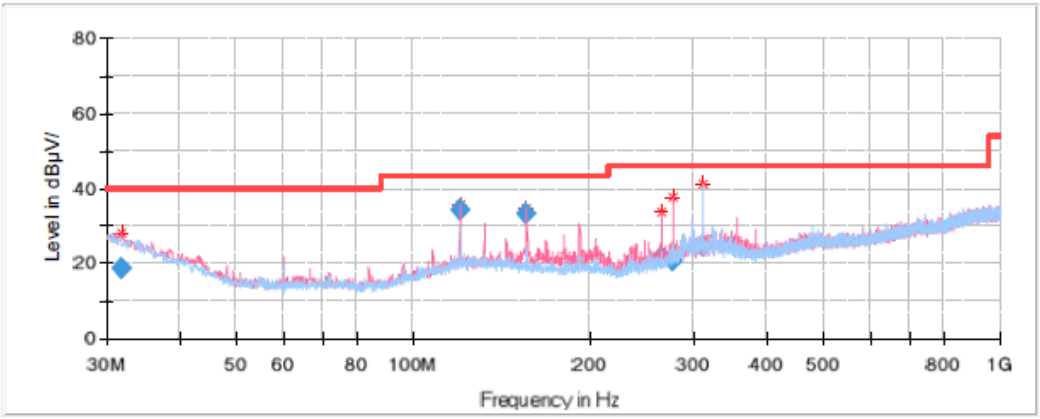
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Pol	Corr. (dB/m)
119.967500	35.96	43.50	7.54	V	-11.2
131.971250	30.83	43.50	12.67	V	-11.4
155.978750	34.77	43.50	8.73	V	-12.4
179.986250	32.81	43.50	10.69	V	-13.3
191.868750	30.25	43.50	13.25	V	-12.8
315.180000	30.62	46.00	15.38	V	-10.7

Middle Channel: 2440 MHz

Common Information

Project No:	RSHA240108001
EUT Model:	AB5301A01
Test Mode:	BLE 1M
Standard:	FCC Part 15.247 & FCC Part 15.205 & Part 15.209
Test Equipment:	ESCI、JB3、310N
Temperature:	16.2℃
Humidity:	44%
Barometric Pressure:	103.5kPa
Test Engineer:	Joe Zhang
Test Date:	2024/1/22



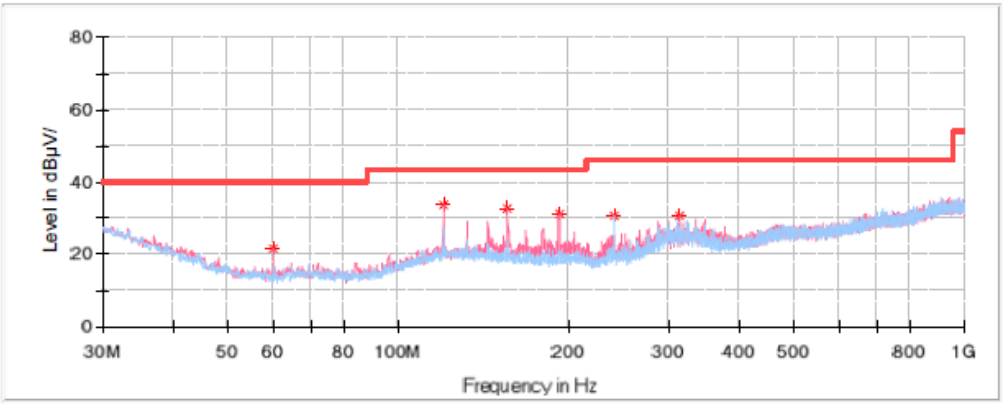
Final_Result

Frequency (MHz)	QuasiPeak (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Pol	Corr. (dB/m)
31.810000	18.64	40.00	21.36	V	-5.3
119.960000	34.01	43.50	9.49	V	-11.2
155.970000	33.25	43.50	10.25	V	-12.4
264.010000	21.39	46.00	24.61	V	-12.1
276.010000	20.43	46.00	25.57	V	-11.3
312.140000	24.71	46.00	21.29	H	-10.7

High Channel:2480 MHz

Common Information

Project No:	RSHA240108001
EUT Model:	AB5301A01
Test Mode:	BLE 1M
Standard:	FCC Part 15.247 & FCC Part 15.205 & Part 15.209
Test Equipment:	ESCI、JB3、310N
Temperature:	16.2℃
Humidity:	44%
Barometric Pressure:	103.5kPa
Test Engineer:	Joe Zhang
Test Date:	2024/1/22



Critical_Freqs

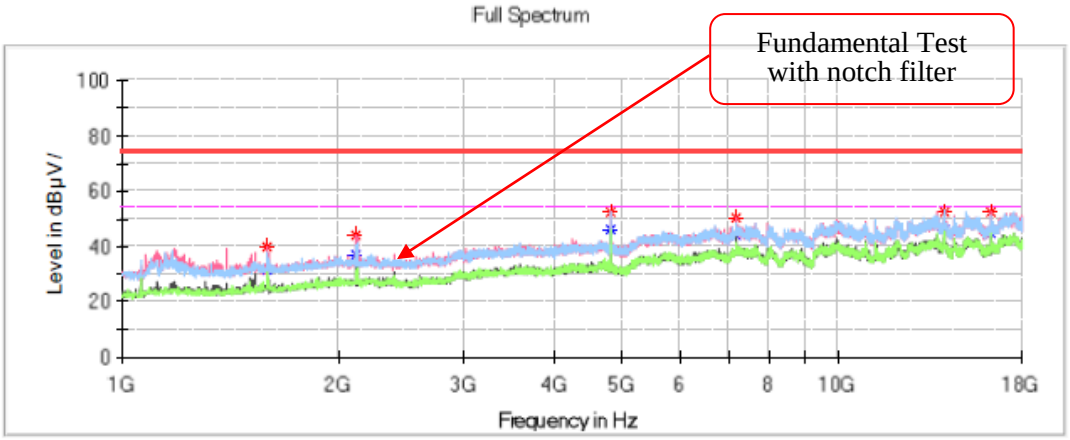
Frequency (MHz)	MaxPeak (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Pol	Corr. (dB/m)
59.948750	21.87	40.00	18.13	V	-17.5
119.967500	33.72	43.50	9.78	V	-11.2
155.978750	32.47	43.50	11.03	V	-12.4
192.111250	31.10	43.50	12.40	V	-12.8
240.247500	30.93	46.00	15.07	H	-13.0
314.331250	30.89	46.00	15.11	V	-10.7

1GHz-18GHz:

Low Channel: 2402 MHz

Common Information

Project No.:	RSHA240108001
EUT Model:	AB5301A01
Test Mode:	BLE 1M
Standard:	FCC Part 15.247 & FCC Part 15.205 & Part 15.209
Test Equipment:	ESU40、3115、2641-1
Temperature:	20.3℃
Humidity:	52%
Atmospheric pressure:	101.5KPa
Test Engineer:	Peter Wang
Test Date	2024/2/4



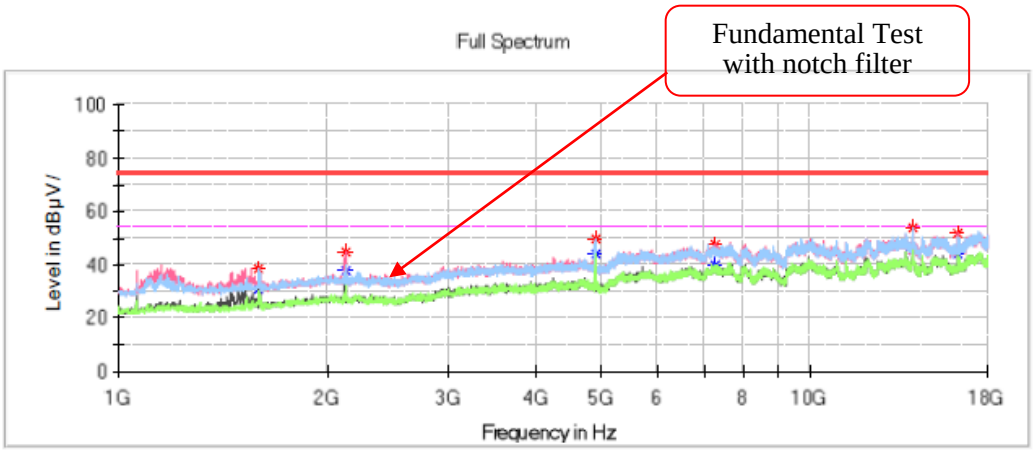
Critical_Freqs

Frequency (MHz)	MaxPeak (dB µ V/m)	Average (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Pol	Corr. (dB/m)
1591.600000	---	31.13	54.00	22.87	V	-13.3
1591.600000	40.07	---	74.00	33.93	V	-13.3
2123.700000	---	37.19	54.00	16.81	V	-10.4
2123.700000	44.07	---	74.00	29.93	V	-10.4
4802.900000	52.55	---	74.00	21.45	H	-2.2
4802.900000	---	46.10	54.00	7.90	H	-2.2
7205.000000	50.55	---	74.00	23.45	V	4.0
7205.000000	---	43.96	54.00	10.04	V	4.0
14001.600000	---	46.08	54.00	7.92	V	10.5
14001.600000	52.62	---	74.00	21.38	V	10.5
16301.700000	---	44.61	54.00	9.39	V	9.7
16301.700000	52.47	---	74.00	21.53	V	9.7

Middle Channel: 2440 MHz

Common Information

Project No.:	RSHA240108001
EUT Model:	AB5301A01
Test Mode:	BLE 1M
Standard:	FCC Part 15.247 & FCC Part 15.205 & Part 15.209
Test Equipment:	ESU40、3115、2641-1
Temperature:	20.3℃
Humidity:	52%
Atmospheric pressure:	101.5KPa
Test Engineer:	Peter Wang
Test Date	2024/2/4



Critical_Freqs

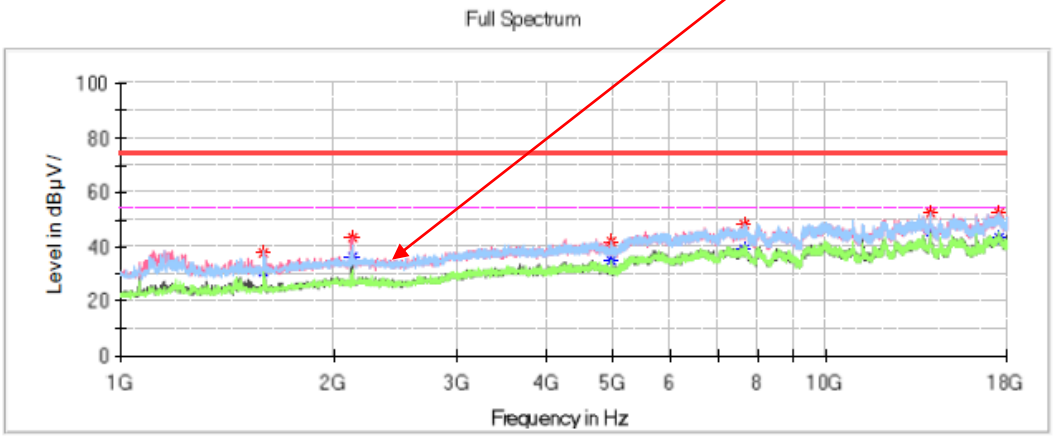
Frequency (MHz)	MaxPeak (dB µ V/m)	Average (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Pol	Corr. (dB/m)
1591.600000	---	30.44	54.00	23.56	V	-13.3
1591.600000	38.77	---	74.00	35.23	V	-13.3
2130.500000	44.78	---	74.00	29.22	V	-10.4
2130.500000	---	37.75	54.00	16.25	V	-10.4
4879.400000	49.60	---	74.00	24.40	H	-1.8
4879.400000	---	43.95	54.00	10.05	H	-1.8
7264.500000	---	39.58	54.00	14.42	H	4.0
7264.500000	47.83	---	74.00	26.17	H	4.0
14003.300000	53.55	---	74.00	20.45	H	10.5
14003.300000	---	45.63	54.00	8.37	H	10.5
16301.700000	---	43.92	54.00	10.08	V	9.7
16301.700000	51.73	---	74.00	22.27	V	9.7

High Channel: 2480 MHz

Common Information

Project No.:	RSHA240108001
EUT Model:	AB5301A01
Test Mode:	BLE 1M
Standard:	FCC Part 15.247 & FCC Part 15.205 & Part 15.209
Test Equipment:	ESU40、3115、2641-1
Temperature:	20.3℃
Humidity:	52%
Atmospheric pressure:	101.5KPa
Test Engineer:	Peter Wang
Test Date	2024/2/4

Fundamental Test with notch filter



Critical_Freqs

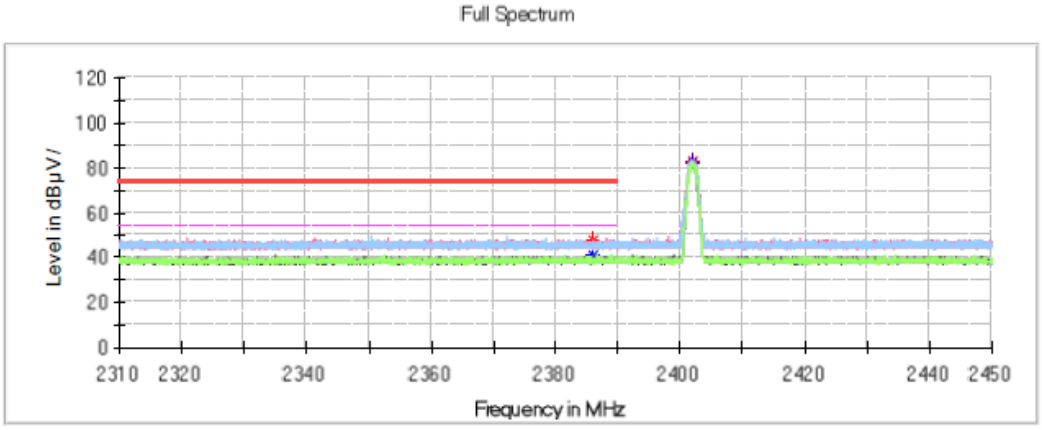
Frequency (MHz)	MaxPeak (dB µ V/m)	Average (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Pol	Corr. (dB/m)
1596.700000	38.07	---	74.00	35.93	V	-13.3
1596.700000	---	30.93	54.00	23.07	V	-13.3
2127.100000	43.34	---	74.00	30.66	V	-10.4
2127.100000	---	36.38	54.00	17.62	V	-10.4
4959.300000	41.68	---	74.00	32.32	H	-1.4
4959.300000	---	34.63	54.00	19.37	H	-1.4
7643.600000	---	39.41	54.00	14.59	H	4.1
7643.600000	48.59	---	74.00	25.41	H	4.1
14001.600000	---	45.27	54.00	8.73	V	10.5
14001.600000	52.10	---	74.00	21.90	V	10.5
17590.300000	---	43.36	54.00	10.64	H	13.2
17590.300000	52.58	---	74.00	21.42	H	13.2

Band Edge:

Left Side

Common Information

Project No.:	RSHA240108001
EUT Model:	AB5301A01
Test Mode:	BLE 1M
Standard:	FCC Part 15.247 & FCC Part 15.205 & Part 15.209
Test Equipment:	ESU40,3115, 2641-1
Temperature:	20.3℃
Humidity:	52%
Atmospheric pressure:	102.6kPa
Test Engineer:	Peter Wang
Test Date	2024/3/8



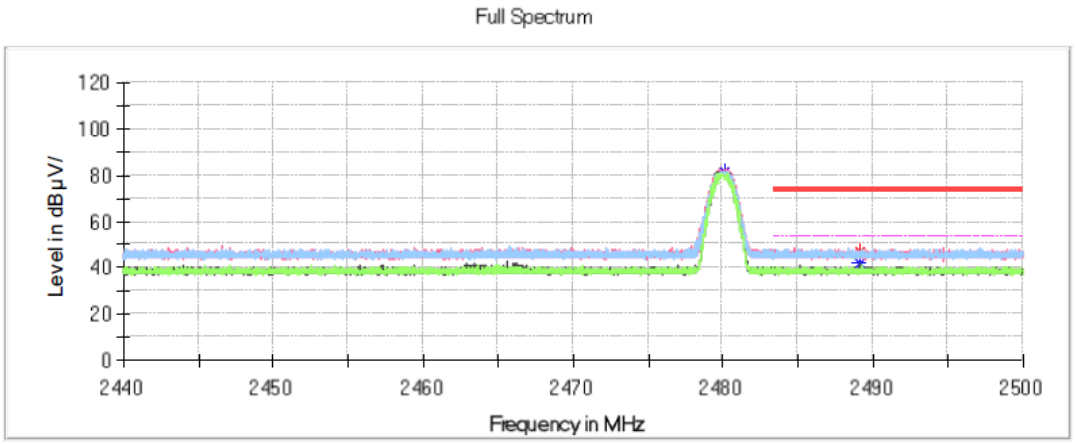
Critical_Freqs

Frequency (MHz)	MaxPeak (dB µ V/m)	Average (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Pol	Corr. (dB/m)
2386.048000	48.09	---	74.00	25.91	V	0.1
2386.048000	---	41.15	54.00	12.85	V	0.1
2401.966000	---	82.20	---	---	H	0.1
2401.966000	82.69	---	---	---	H	0.1

Right Side

Common Information

Project No.:	RSHA240108001
EUT Model:	AB5301A01
Test Mode:	BLE 1M
Standard:	FCC Part 15.247 & FCC Part 15.205 & Part 15.209
Test Equipment:	ESU40,3115, 2641-1
Temperature:	20.3℃
Humidity:	52%
Atmospheric pressure:	102.6kPa
Test Engineer:	Peter Wang
Test Date	2024/3/8

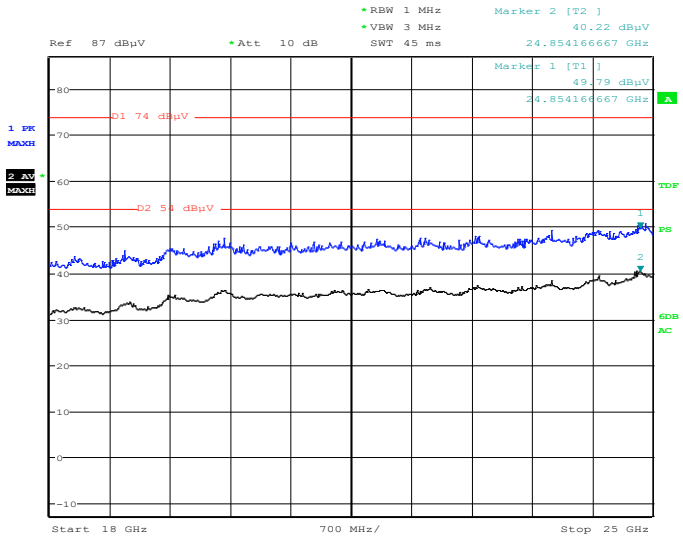


Critical_Freqs

Frequency (MHz)	MaxPeak (dB µ V/m)	Average (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Pol	Corr. (dB/m)
2480.032000	---	81.25	---	---	V	0.2
2480.032000	81.79	---	---	---	V	0.2
2489.158000	46.92	---	74.00	27.08	V	0.2
2489.158000	---	42.10	54.00	11.90	V	0.2

18 GHz - 25 GHz (low channel was worst):

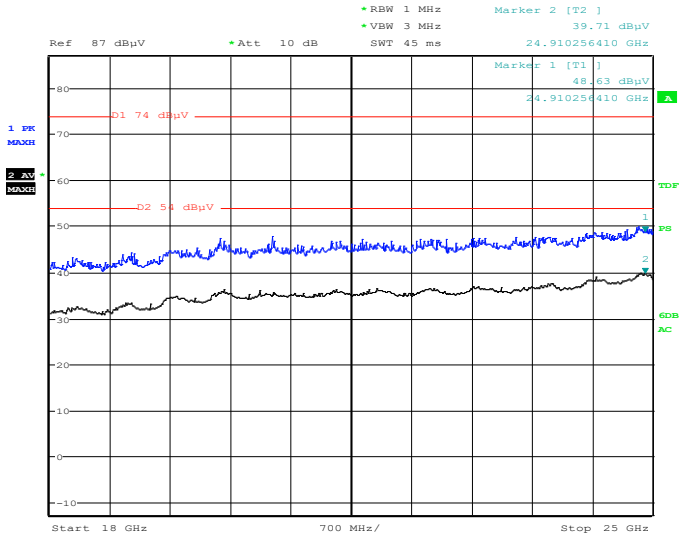
Horizontal



Project No.: RSHA240108001 Tester: Peter Wang

Date: 7.MAR.2024 14:47:14

Vertical



Project No.: RSHA240108001 Tester: Peter Wang

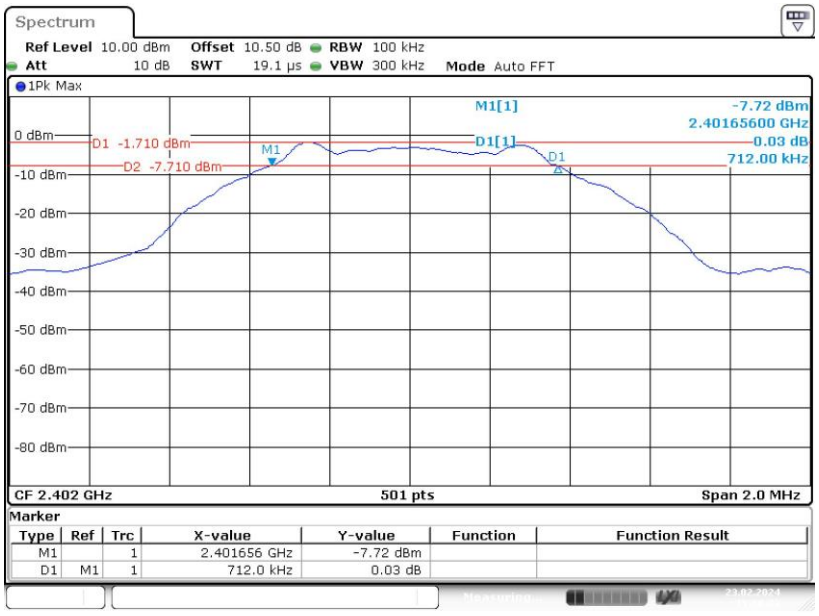
Date: 7.MAR.2024 14:27:24

Note: The test distance is 3m. The limit is 74dBµV/m(Peak) and 54dBµV/m(Average).

6 dB EMISSION BANDWIDTH

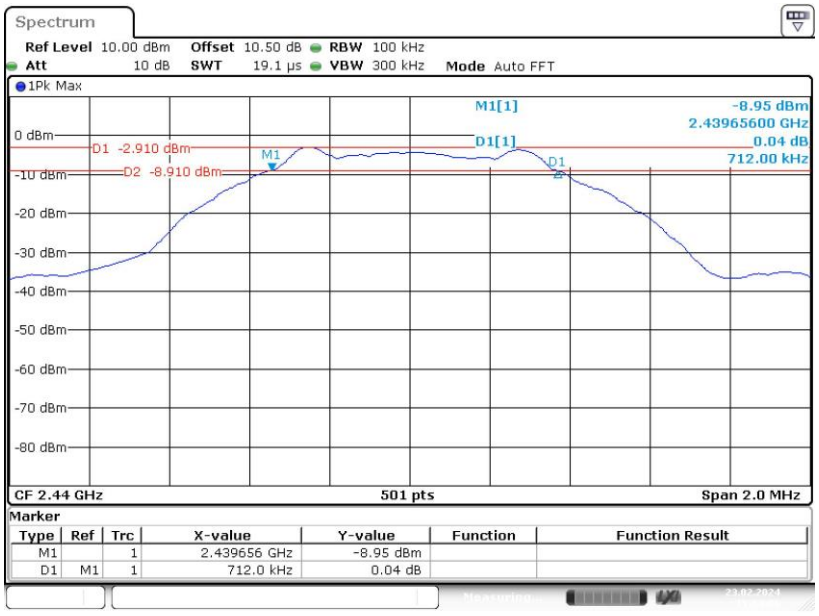
Mode	Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
BLE (1Mbps)	Low	2402	0.712	≥0.5
	Middle	2440	0.712	≥0.5
	High	2480	0.712	≥0.5

Low Channel



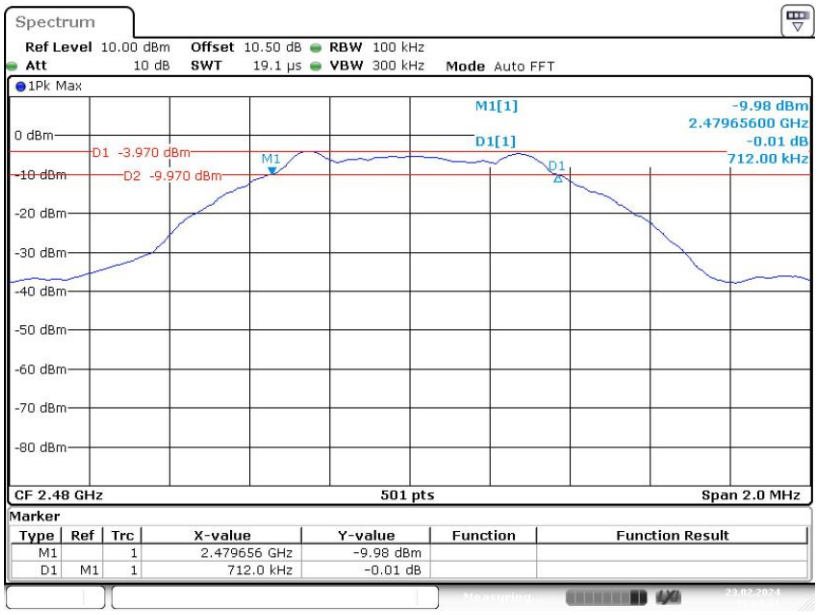
ProjectNo.:RSHA240108001 Tester:Jenny Yang
Date: 23.FEB.2024 15:50:23

Middle Channel



ProjectNo.:RSHA240108001 Tester:Jenny Yang
Date: 23.FEB.2024 15:53:06

High Channel



ProjectNo.:RSHA240108001 Tester:Jenny Yang
Date: 23.FEB.2024 15:59:32

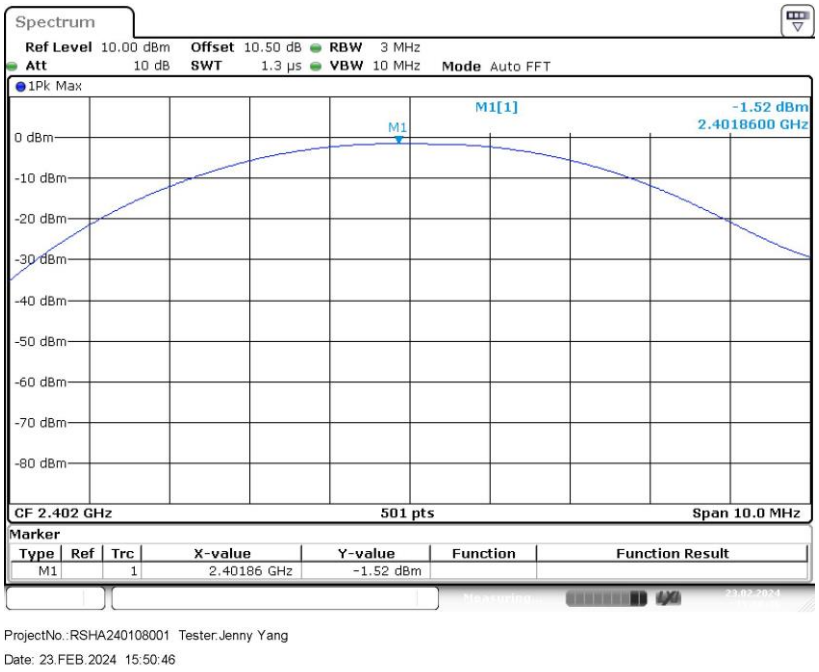
MAXIMUM CONDUCTED OUTPUT POWER

Test Result: Compliant.

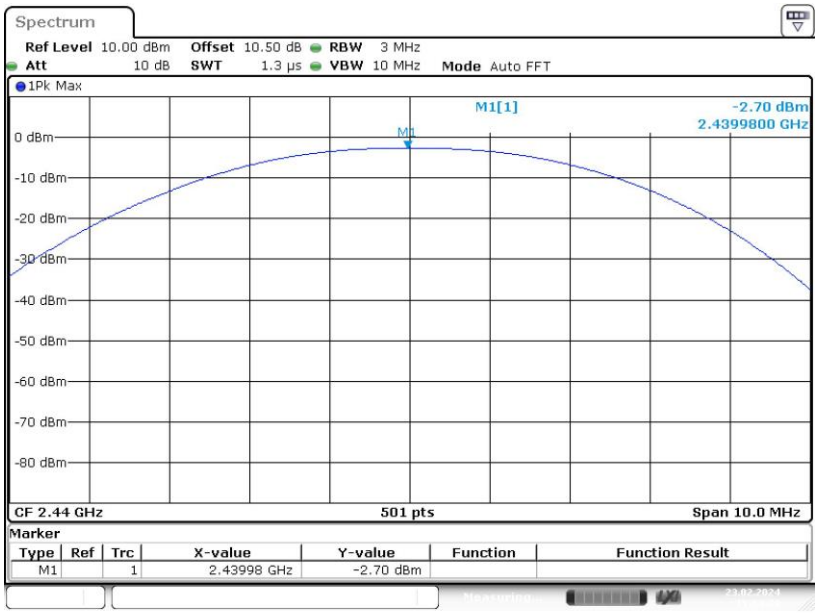
EUT operation mode: Transmitting

Mode	Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	Result
BLE (1Mbps)	Low	2402	-1.52	30	Pass
	Middle	2440	-2.70	30	Pass
	High	2480	-3.70	30	Pass

Low Channel

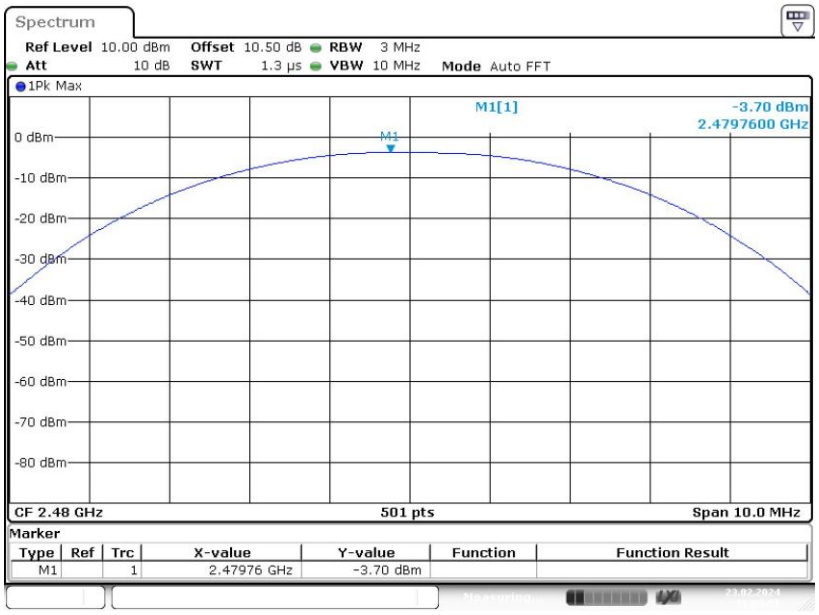


Middle Channel



ProjectNo.:RSHA240108001 Tester:Jenny Yang
Date: 23.FEB.2024 15:53:29

High Channel



ProjectNo.:RSHA240108001 Tester:Jenny Yang
Date: 23.FEB.2024 15:59:55

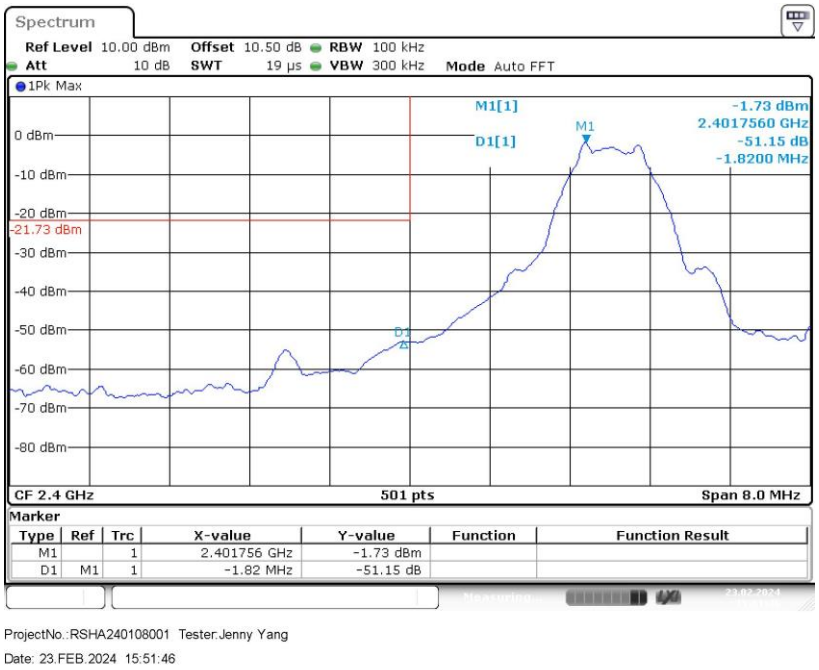
BAND EDGE

Test Result: Compliant.

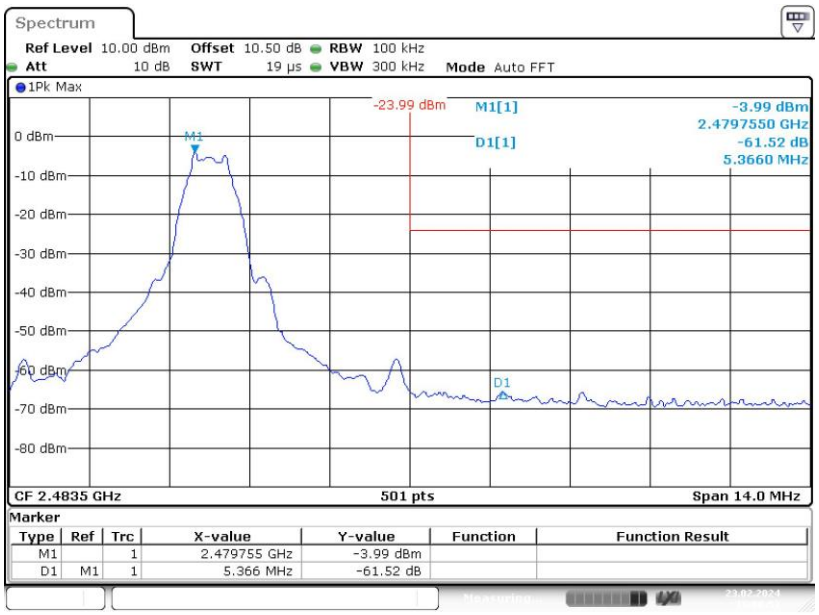
EUT operation mode: Transmitting

Mode	Channel	Frequency (MHz)	Result (dBc)	Limit (dBc)
BLE (1Mbps)	Low	2402	51.15	20
	High	2480	61.52	

Left Side



Right Side



ProjectNo.:RSHA240108001 Tester:Jenny Yang
Date: 23.FEB.2024 16:00:54

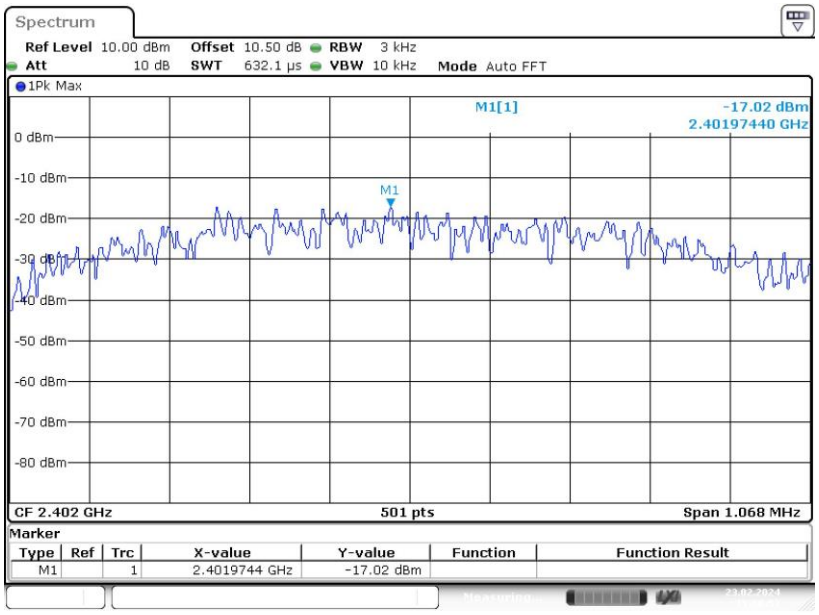
POWER SPECTRAL DENSITY

Test Result: Compliant.

EUT operation mode: Transmitting

Mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
BLE (1Mbps)	Low	2402	-17.02	≤8
	Middle	2440	-18.15	≤8
	High	2480	-19.20	≤8

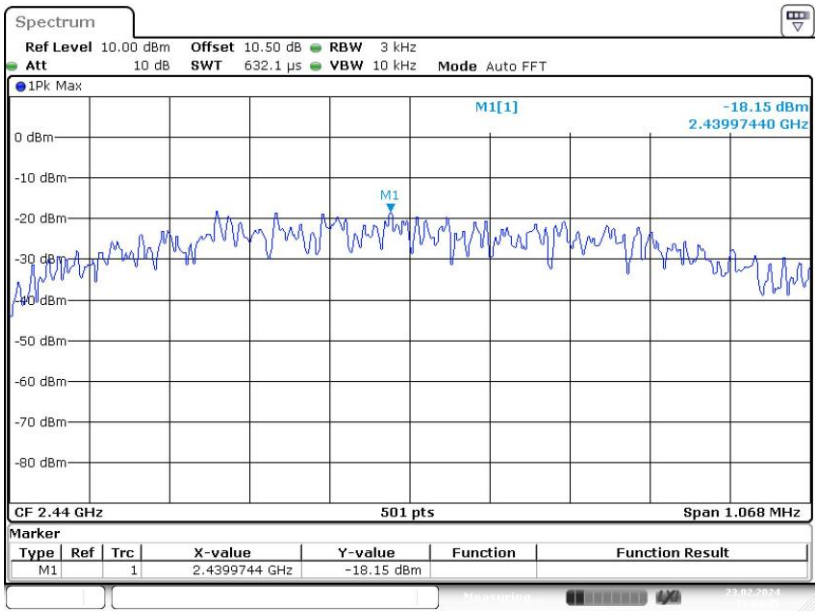
Low Channel



ProjectNo.:RSHA240108001 Tester:Jenny Yang

Date: 23.FEB.2024 15:50:53

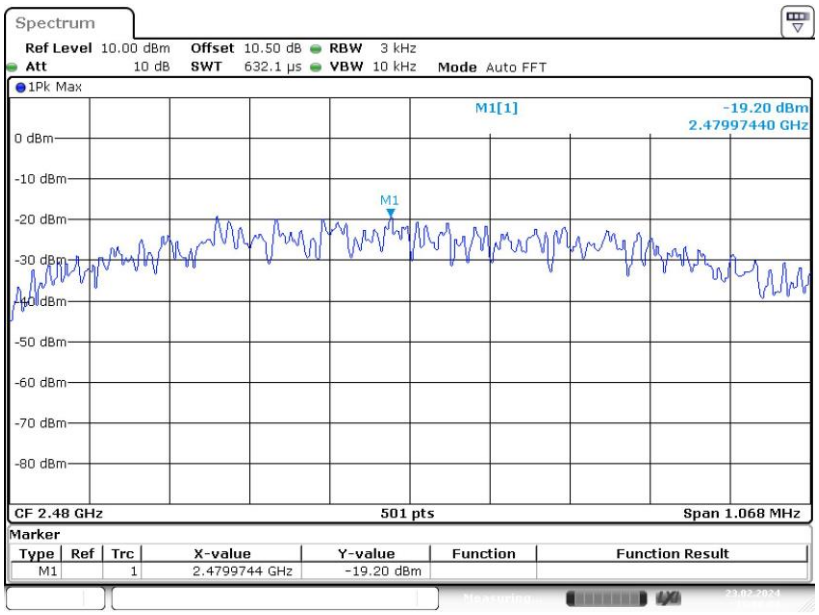
Middle Channel



ProjectNo.:RSHA240108001 Tester:Jenny Yang

Date: 23.FEB.2024 15:53:35

High Channel



ProjectNo.:RSHA240108001 Tester:Jenny Yang
Date: 23.FEB.2024 16:00:04

Declarations

1. The laboratory is not responsible for the authenticity of any information provided by the applicant. Information from the applicant that may affect test results is marked with "★".

2. The test data was only valid for the test sample(s).

3. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

4. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

5. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor k=2 with the 95.45% confidence interval.

******* END OF REPORT *******