



FCC / ISED- TEST REPORT

Report Number : 64.790.21.05634.01-R2 Date of Issue: March 4, 2022

Model : US-SK106, EU-SK106, EU-OSK106, US-OSK106

Product Type : Smart kit

Applicant : GD Midea Air-conditioning Equipment Co., Ltd.

Address of applicant : Lingang Road, Beijiao, Shunde, Foshan, 528311, Guangdong, China

Manufacturer : GD Midea Air-conditioning Equipment Co., Ltd.

Test Result : **Positive** **Negative**



Total pages including Appendices : 33

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
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3 Description of the Equipment under Test

Product:	Smart Kit
PMN:	Smart Kit
Model no.:	US-OSK106, EU-OSK106, EU-SK106, US-SK106
Model difference:	All models are only difference in model name.
HVIN:	US-OSK106, EU-OSK106, EU-SK106, US-SK106
FVIN:	N/A
FCC ID:	2ADQQOMDNA22
IC:	12575A-MDNA22
Options and accessories:	N/A
Rating:	DC 5V (by USB port)
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	40
Modulation:	GFSK
Antenna Type:	PCB Antenna
Antenna Gain:	2.0dBi
Description of the EUT:	Products are smart kits with WIFI and Bluetooth function, they are only can be used in Midea Group's household appliances for controling function. It can not connect to computer for any other function.

4 Summary of Test Standards

Test Standards	
RSS-Gen Issue 5 Amendment 2 (February 2021)	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 2 February 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
FCC Part 15 Subpart C 10-1-2020 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB558074 D01 v05r02 and ANSI C63.10 (2013).

5 Summary of Test Results

Technical Requirements				
FCC Part 15 Subpart C, RSS-247 Issue 2				
Test Condition			Pages	Test Result
§15.207	RSS-GEN 8.8	Conducted emission AC power port	10	Pass
§15.247(b)(1)	RSS-247 Clause 5.4(d)	Conducted peak output power	13	Pass
§15.247(a)(2)	RSS-247 Clause 5.2(a)	6dB bandwidth and 99% Occupied Bandwidth	15	Pass
§15.247(e)	RSS-247 Clause 5.2(b)	Power spectral density	19	Pass
§15.247(d)	RSS-247 Clause 5.5	Spurious RF conducted emissions	21	Pass
§15.247(d)	RSS-247 Clause 5.5	Band edge	26	Pass
§15.247(d) & §15.209 &	RSS-247 Clause 5.5 & RSS-GEN 6.13	Spurious radiated emissions for transmitter	28	Pass
§15.203	RSS-GEN 6.8	Antenna requirement	See note 1	Pass

Note 1: N/A=Not Applicable.

Note 2: The EUT uses an PCB antenna, which gain is 2.0dBi. In accordance to §15.203 & RSS-Gen 6.8, It is considered sufficiently to comply with the provisions of this section.



6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID:2ADQOMDNA22 complies with Section 15.207, 15.209, 15.205, 15.247 of the FCC Part 15, Subpart C rules; and IC:12575A-MDNA22 complies with RSS-GEN issue 5 and RSS-247 issue 2.

All models are identical in circuit design, PCB layout and components used but only different in model name. Tests were only performed on US-SK106.

This report is only for the BLE part.

SUMMARY:

All tests according to the regulations cited on page 5 were

- Performed

- **Not** Performed

The Equipment under Test

- **Fulfills** the general approval requirements.

- **Does not** fulfill the general approval requirements.

Sample Received Date: November 20, 2021

Testing Start Date: November 29, 2021

Testing End Date: December 9, 2021

- TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch -

Reviewed by:

Tony Liu
Reviewer

Prepared by:

Kevin Ouyang
Project Handler

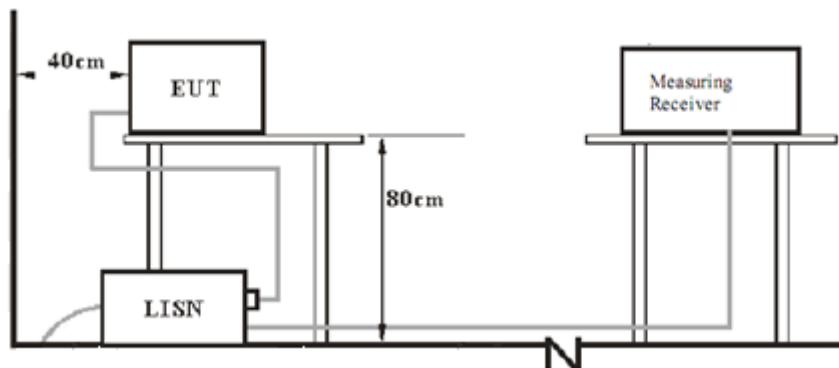
Test by:



Louise Liu
Test Engineer

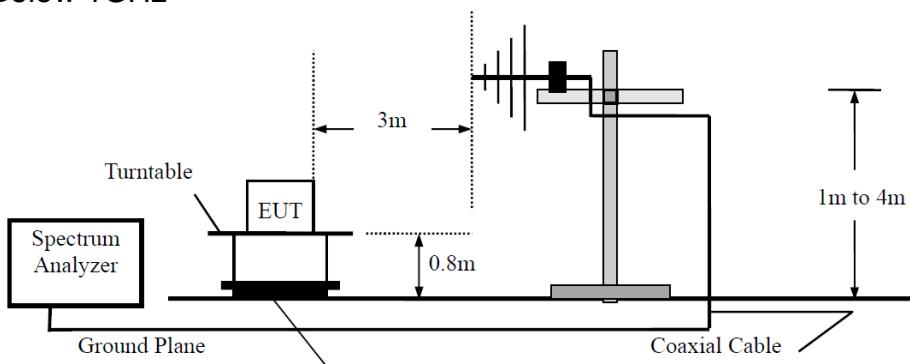
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

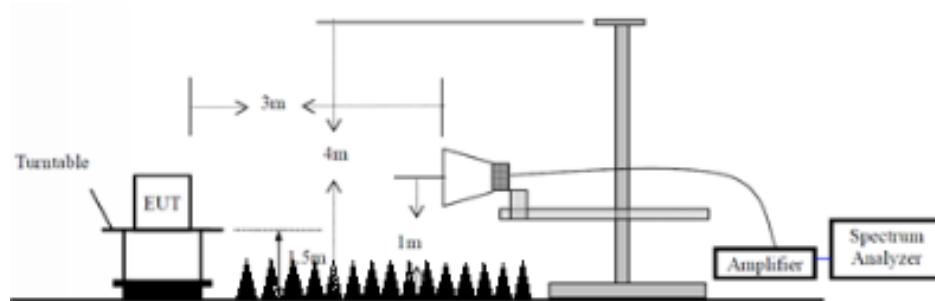


7.2 Radiated test setups

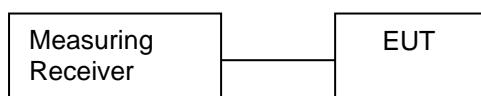
Below 1GHz



Above 1GHz



7.3 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Mobile Phone	Apple	iPhone 6	---
APP	Midea	MSmartHome	---
Mainboard	Midea	/	---
Laptop	Lenovo	X240	L34015282
Software	/	DOGO_VP2.0.1	---

9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through an Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Remark: “*” Decreasing linearly with logarithm of the frequency

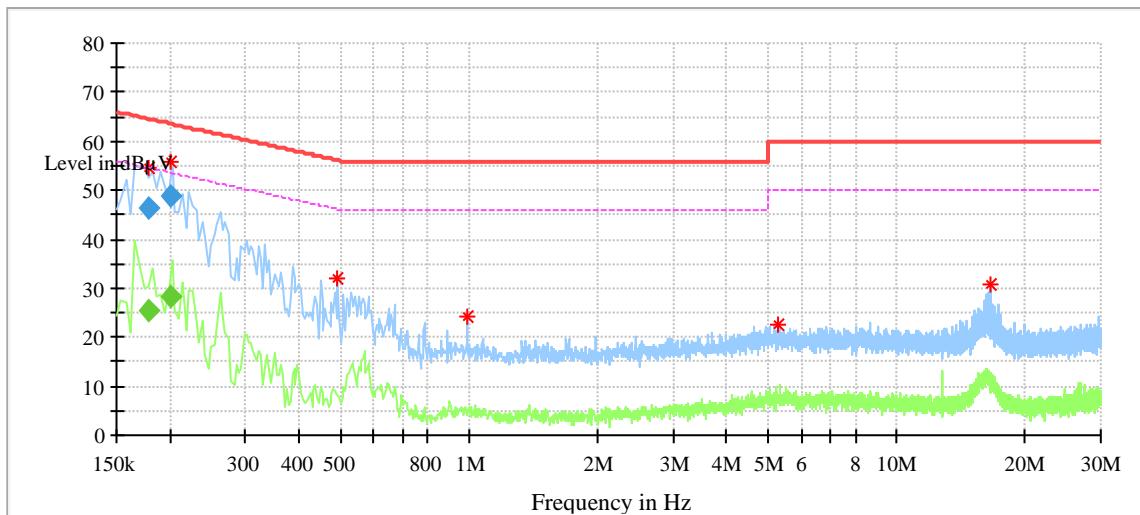
Conducted Emission Test 150kHz – 30MHz

M/N: US-SK106

Op Cond.: Bluetooth function on.

Test Spec.: Power Line, Live

Temperature (°C): 22.5 Relative Humidity (%): 46.7 Atmospheric Pressure(mbar) : 1012



Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Line	Corr. (dB)
0.177500	---	25.25	54.60	29.35	L1	9.25
0.177500	46.20	---	64.60	18.40	L1	9.25
0.201500	---	28.36	53.55	25.18	L1	9.23
0.201500	48.86	---	63.55	14.69	L1	9.23

Remark : Correct factor=cable loss + LISN factor

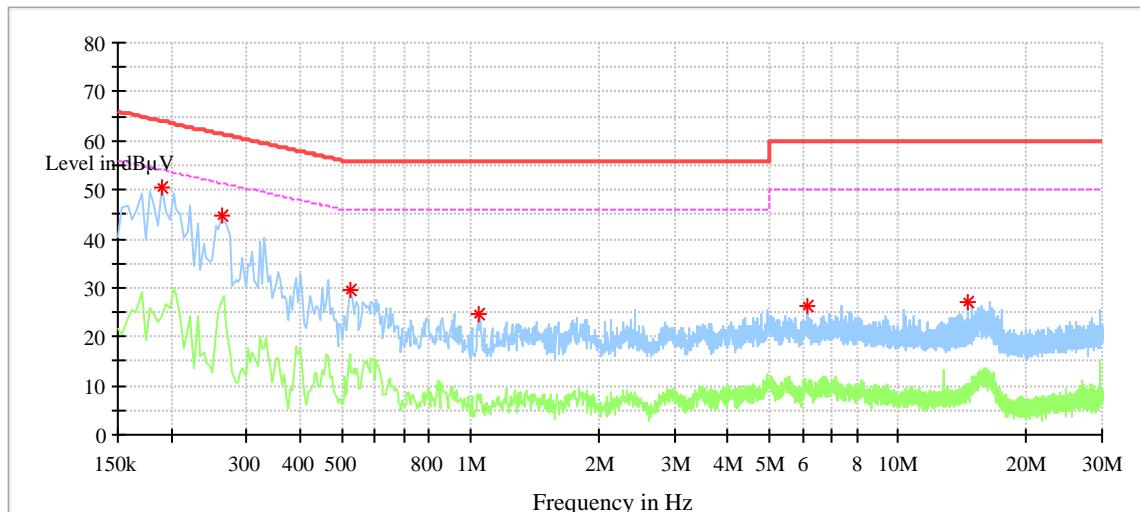
Conducted Emission Test 150kHz – 30MHz

M/N: US-SK106

Op Cond.: Bluetooth function on.

Test Spec.: Power Line, Neutral

Temperature (°C): 22.5 Relative Humidity (%): 46.7 Atmospheric Pressure(mbar) : 1012



No significant emission was detected within 10 dB to limit

9.2 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
RBW > the 6 dB bandwidth of the emission being measured, VBW \geq 3RBW, Span \geq 3RBW
Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

Limits

Conducted Peak Output Power Limit:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤ 1	≤ 30

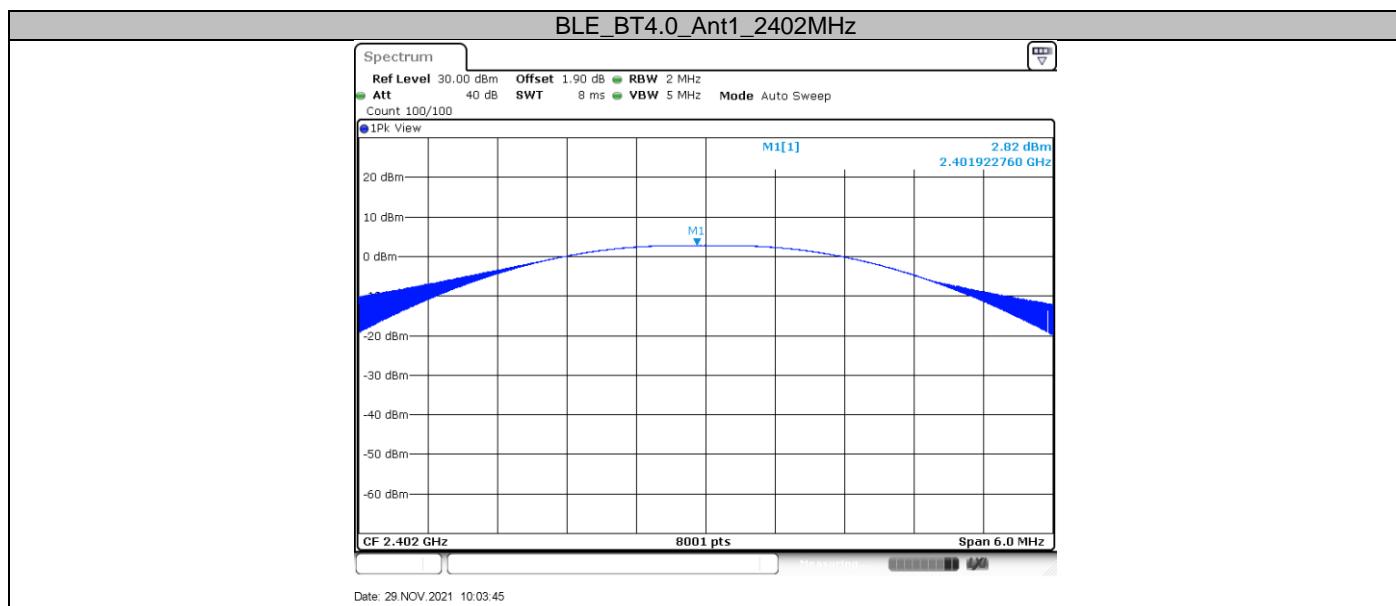
EIRP Limit :

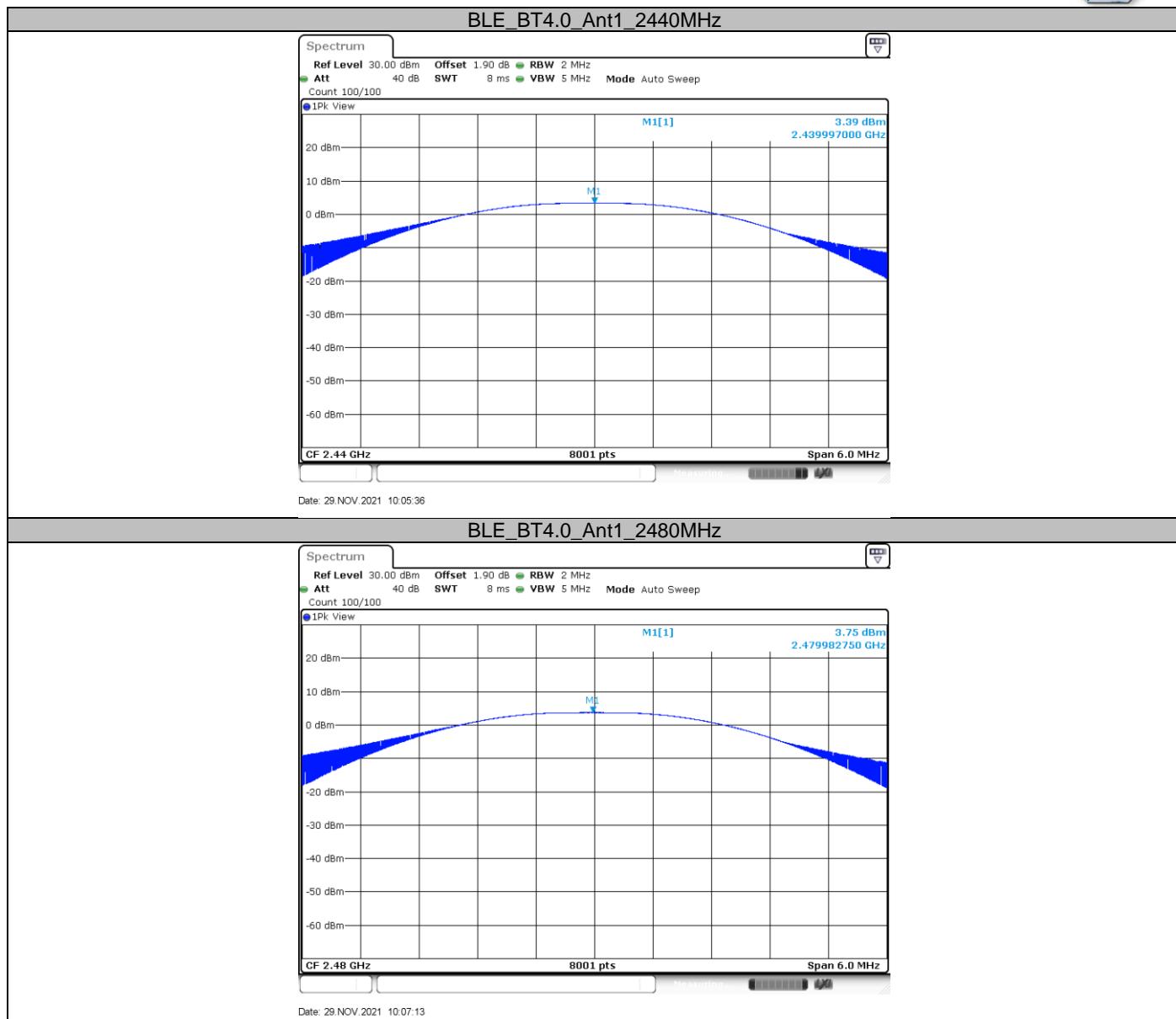
Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤ 4	≤ 36

Test Result

Channel (MHz)	Conducted output power (dBm)	E.I.R.P (dBm)	Limit (dBm)	Verdict
2402	2.82	4.82	≤ 30	PASS
2440	3.39	5.39	≤ 30	PASS
2480	3.75	5.75	≤ 30	PASS

Test Graphs





9.3 6dB bandwidth and 99% Occupied Bandwidth

Test Method

1. Use the following spectrum analyzer settings:
RBW=100K, VBW \geq 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be \geq 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

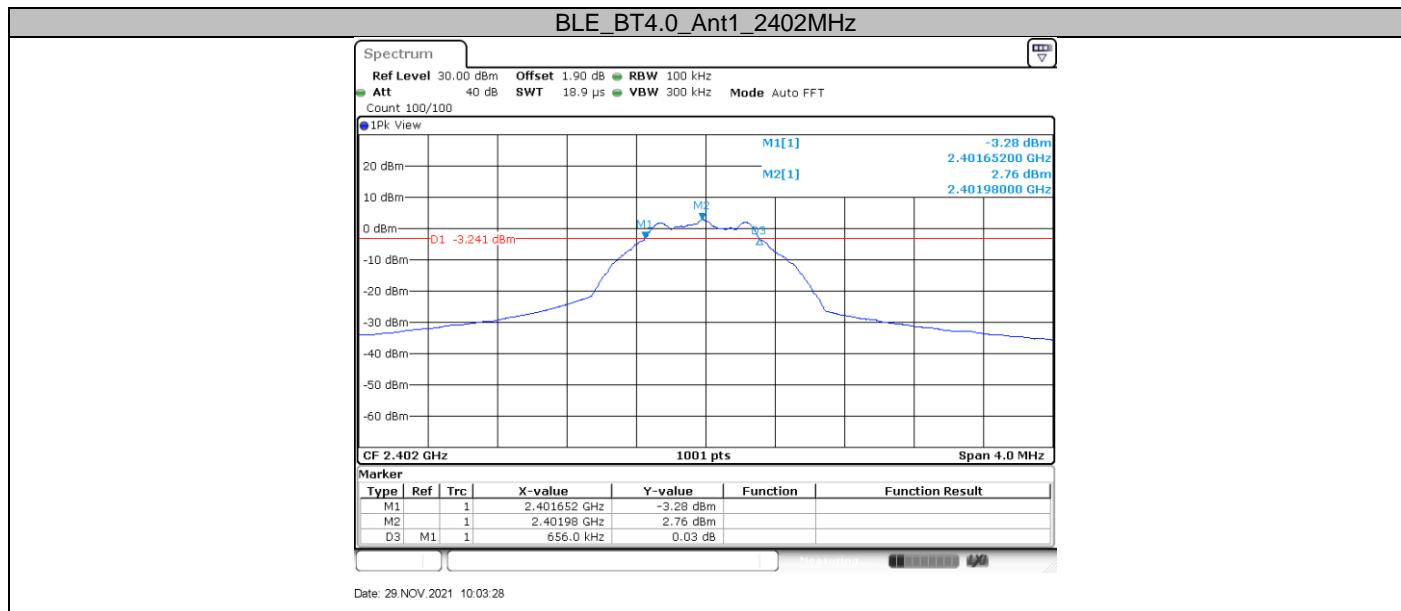
Limit [kHz]

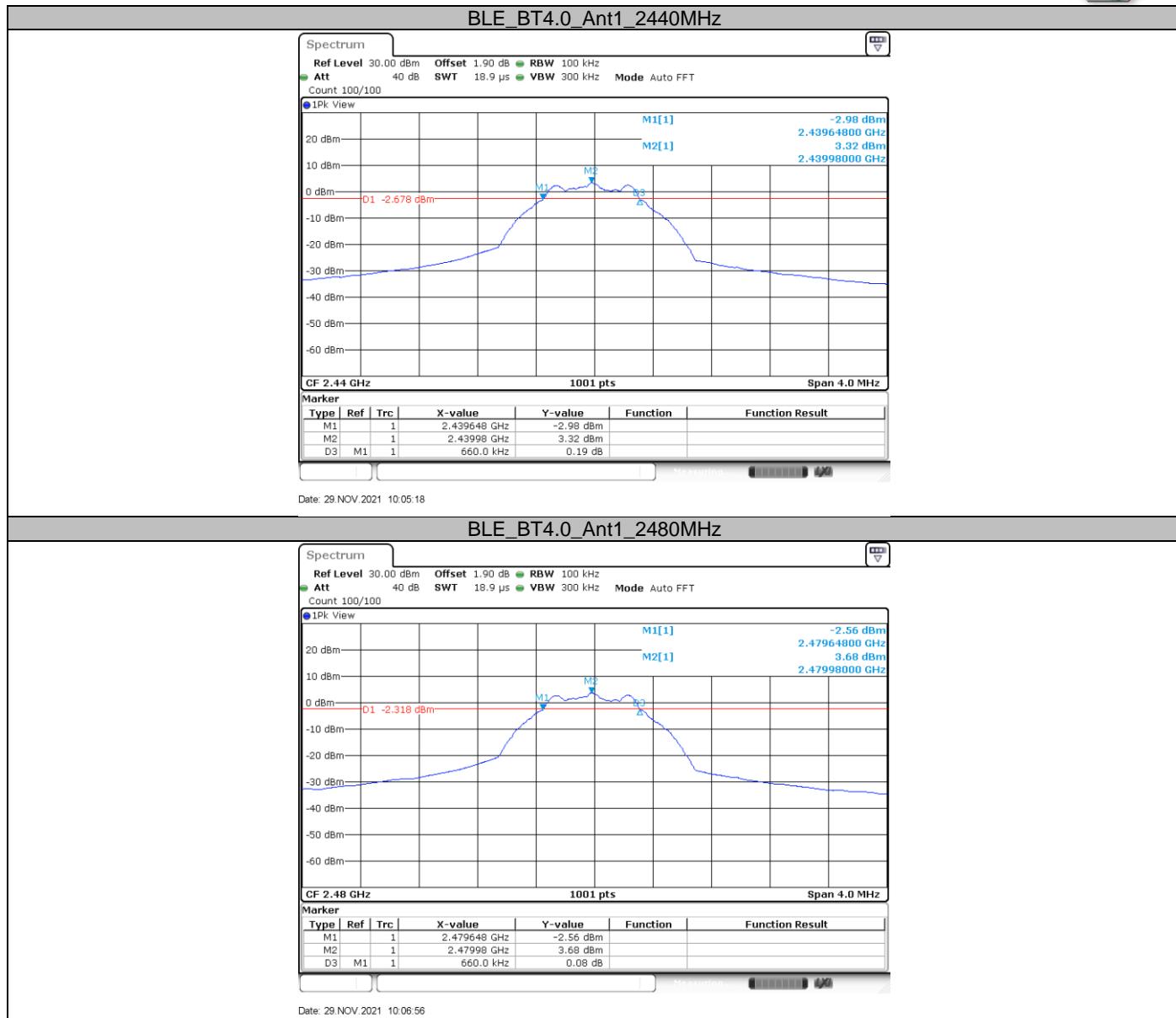
≥ 500

Test result

Channel(MHz)	6dB BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
2402	0.656	2401.652	2402.308	0.5	PASS
2440	0.660	2439.648	2440.308	0.5	PASS
2480	0.660	2479.648	2480.308	0.5	PASS

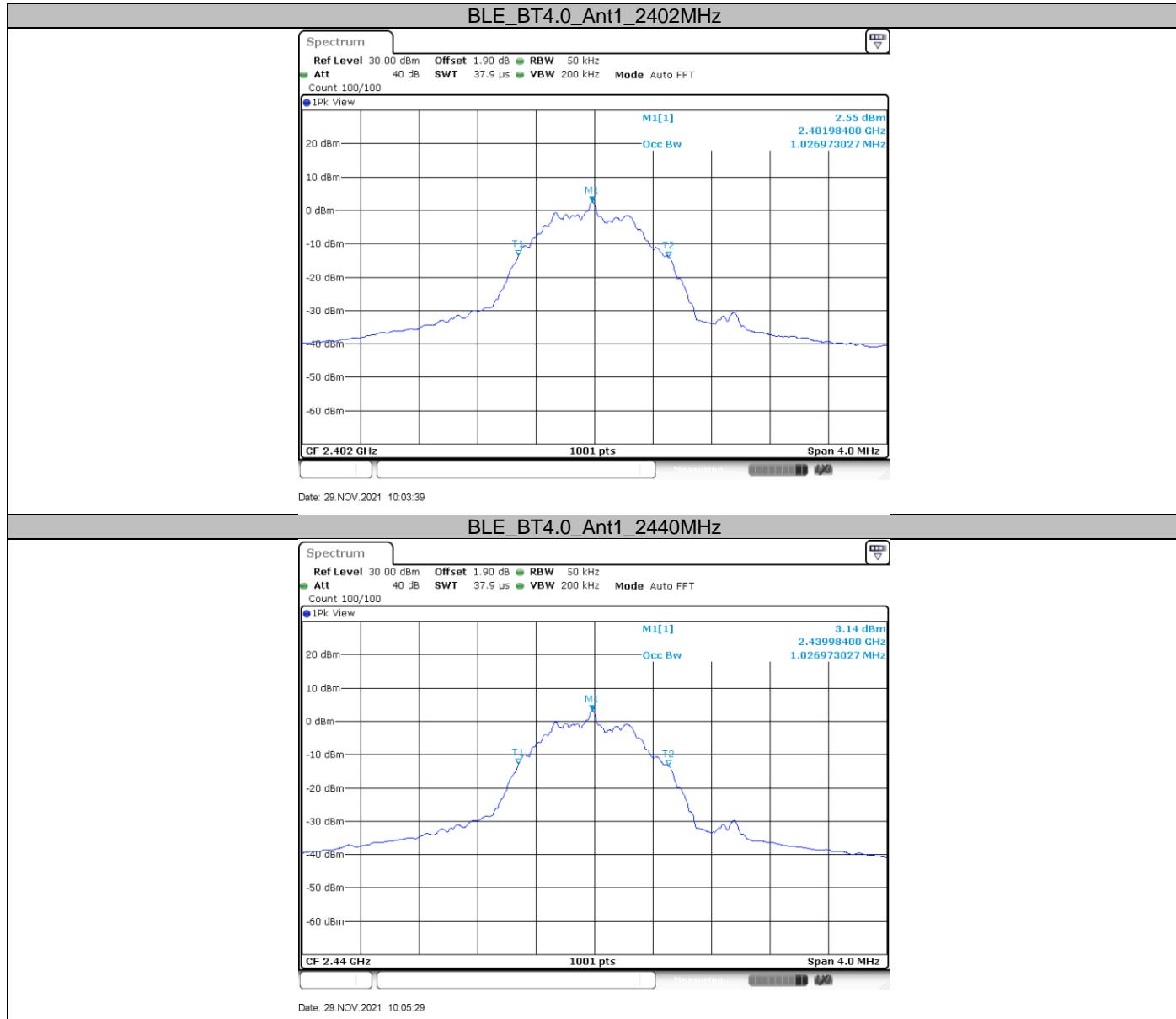
Test Graphs





Channel	99% OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
2402	1.027	2401.477	2402.503	---	PASS
2440	1.027	2439.477	2440.503	---	PASS
2480	1.031	2479.473	2480.503	---	PASS

Test Graphs





9.4 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. Set analyzer center frequency to DTS channel center frequency.
RBW=10kHz,VBW≥3RBW,Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures until other frequencies measured were completed.

Limit

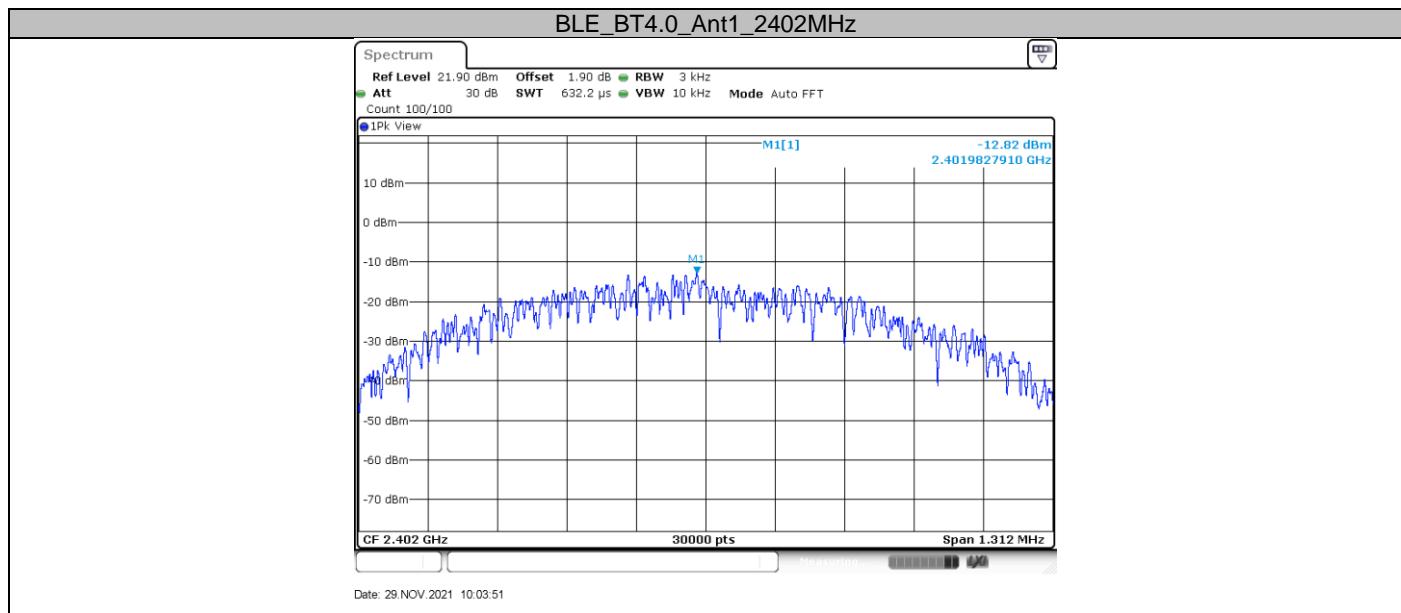
Limit [dBm/3KHz]

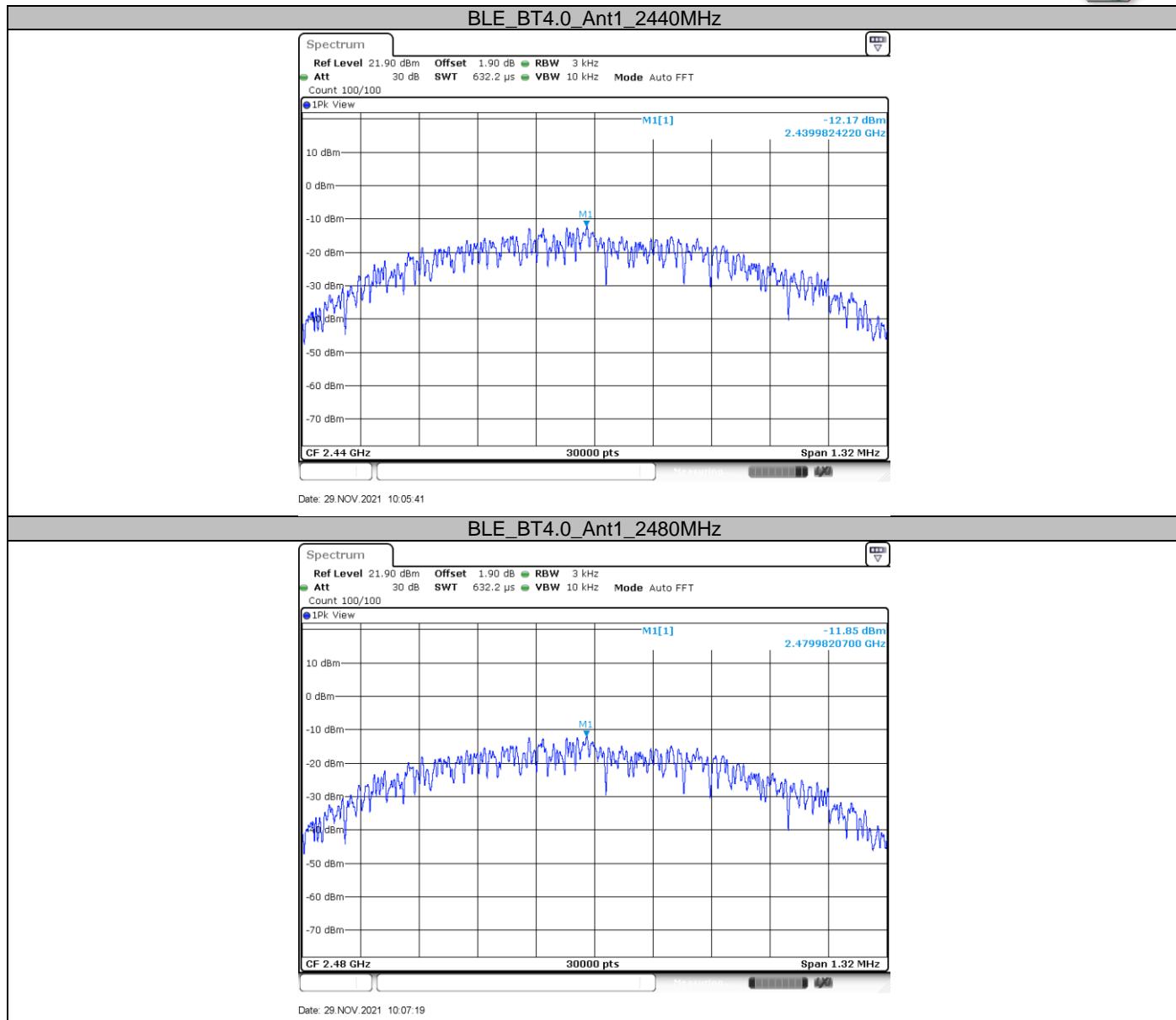
≤8

Test result

Channel(MHz)	Result(dBm/3KHz)	Limit(dBm/3KHz)	Verdict
2402	-12.82	≤8	PASS
2440	-12.17	≤8	PASS
2480	-11.85	≤8	PASS

Test Graphs





9.5 Spurious RF conducted emissions

Test Method

1. Establish a reference level by using the following procedure:
 - a. Set RBW=100 kHz. VBW \geq 3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
 - b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
2. Use the maximum PSD level to establish the reference level.
 - a. Set the center frequency and span to encompass frequency range to be measured.
 - b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
3. Repeat above procedures until other frequencies measured were completed.

Limit

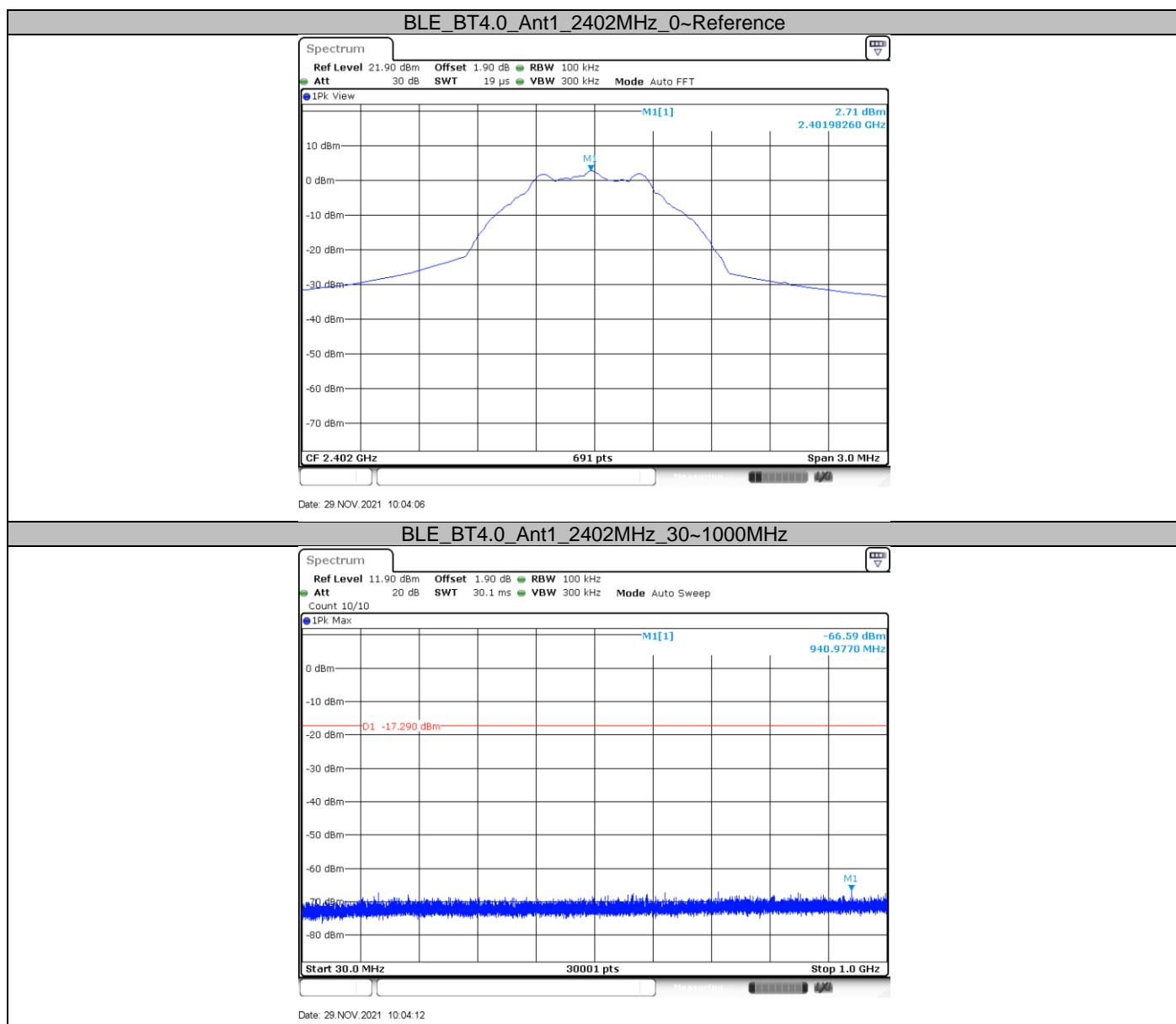
Frequency Range MHz	Limit (dBc)
30-25000	-20

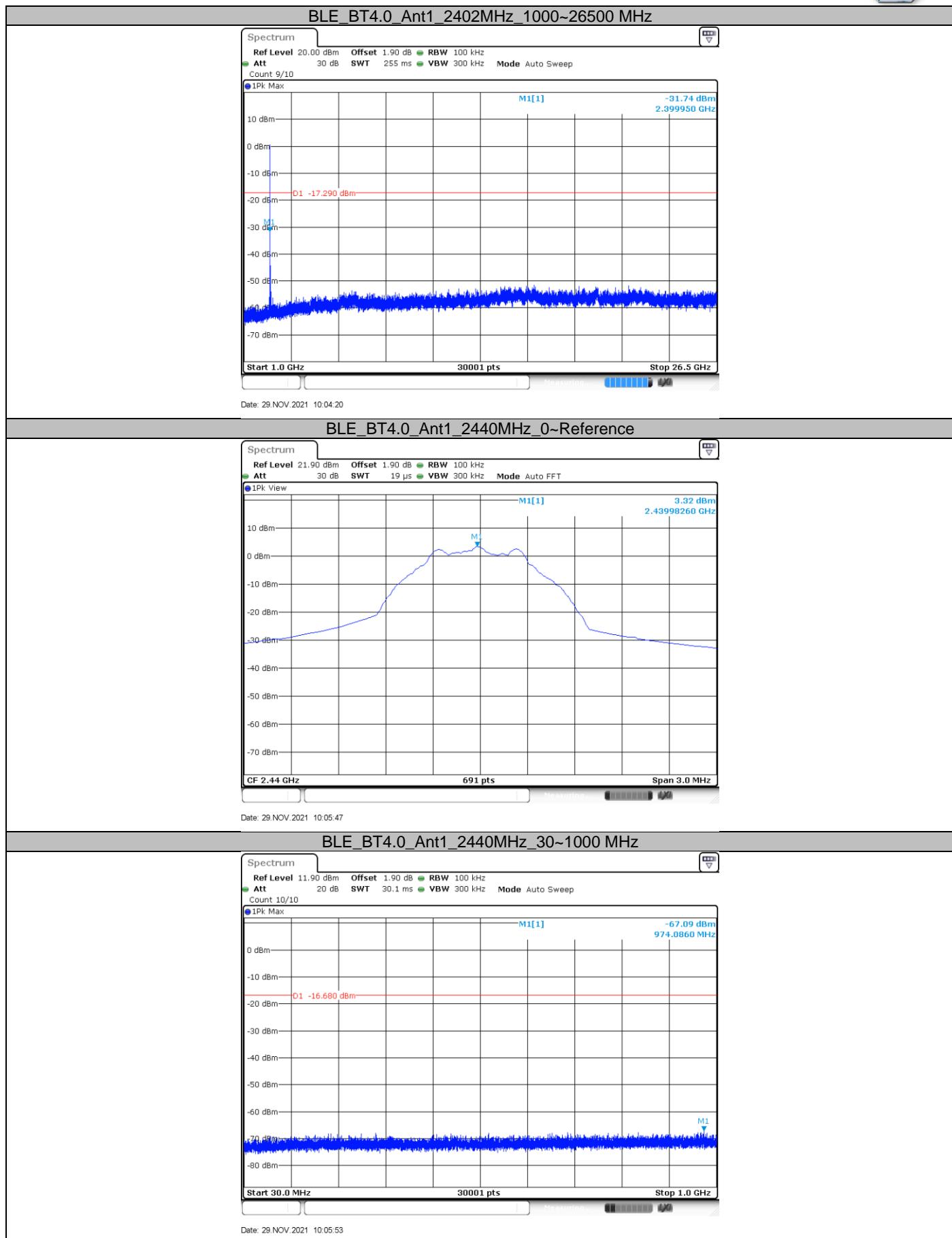
Spurious RF conducted emissions

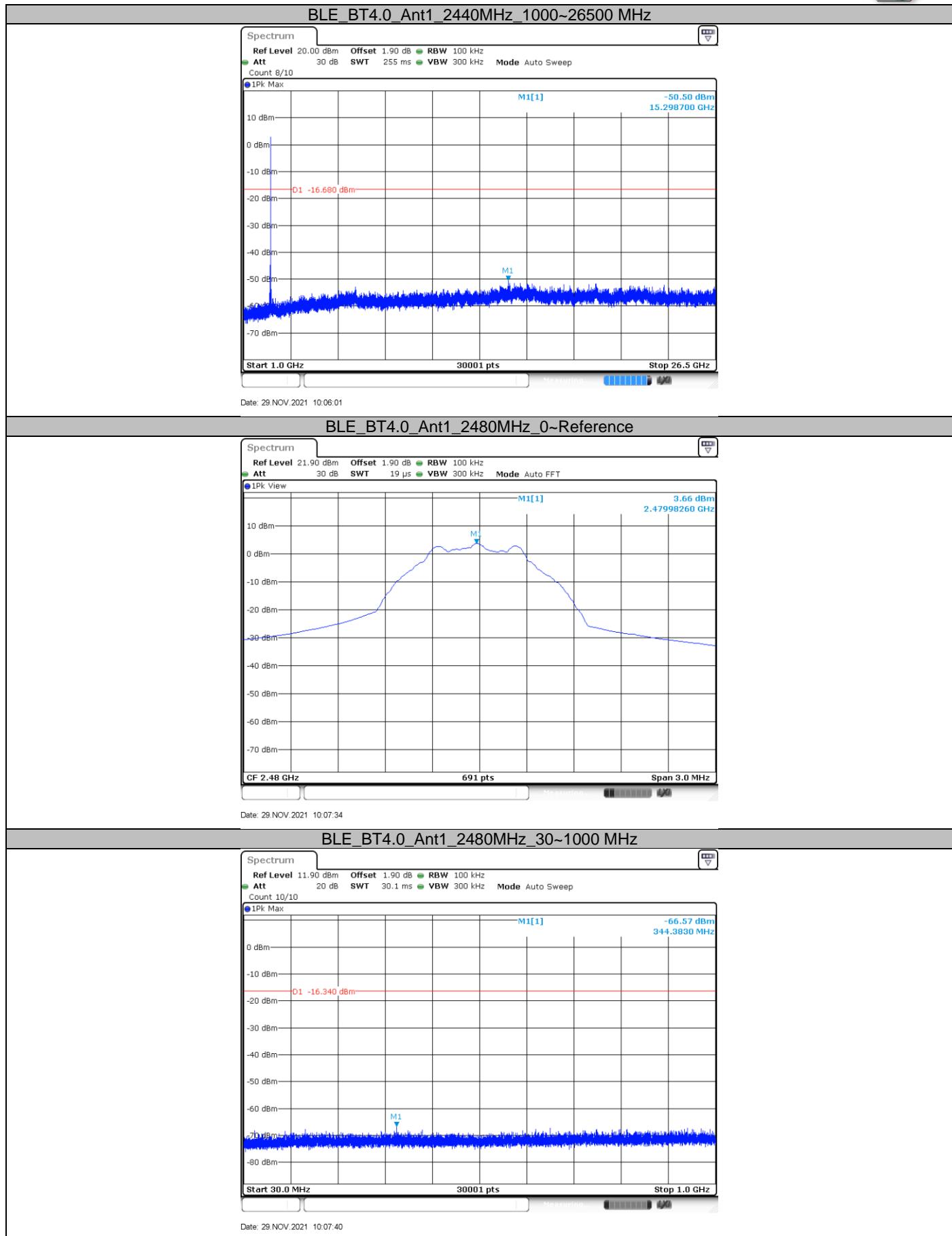
Test Result

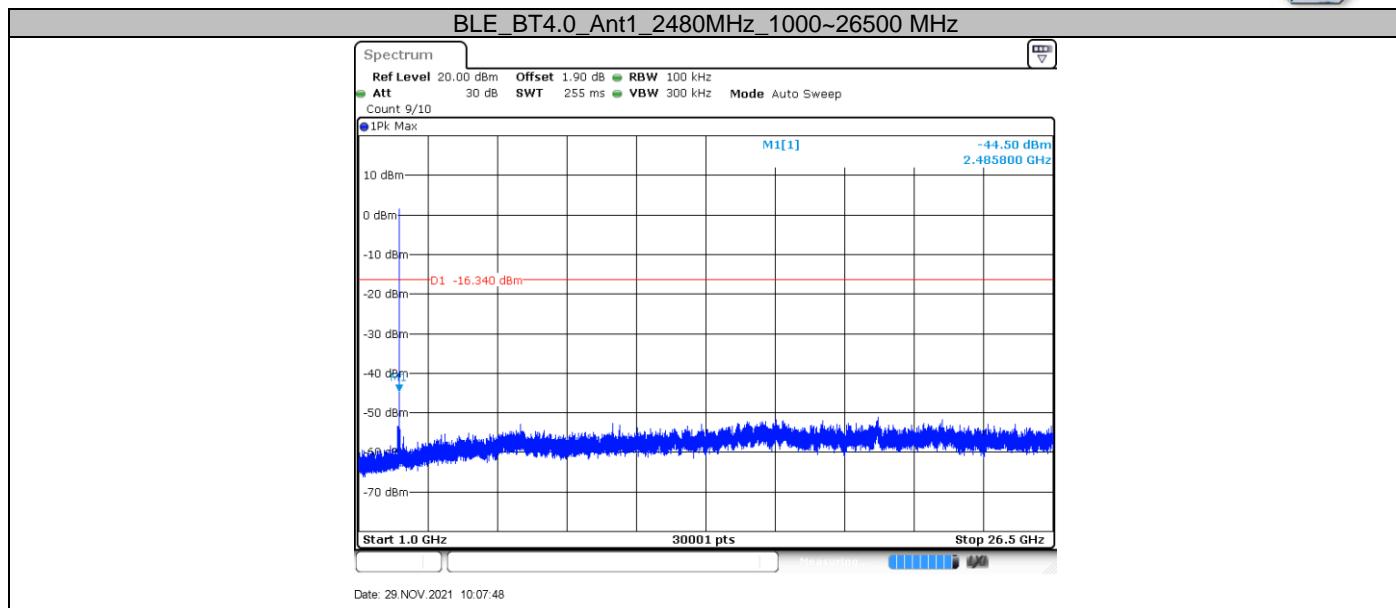
Channel(MHz)	Freq Range (MHz)	RefLevel(dBm)	Result(dBm)	Limit(dBm)	Verdict
2402	Reference	2.71	2.71	---	PASS
	30~1000	30~1000	-66.59	<=-17.29	PASS
	1000~26500	1000~26500	-31.74	<=-17.29	PASS
2440	Reference	3.32	3.32	---	PASS
	30~1000	30~1000	-67.09	<=-16.68	PASS
	1000~26500	1000~26500	-50.5	<=-16.68	PASS
2480	Reference	3.66	3.66	---	PASS
	30~1000	30~1000	-66.57	<=-16.34	PASS
	1000~26500	1000~26500	-44.5	<=-16.34	PASS

Test Graphs









9.6 Band edge

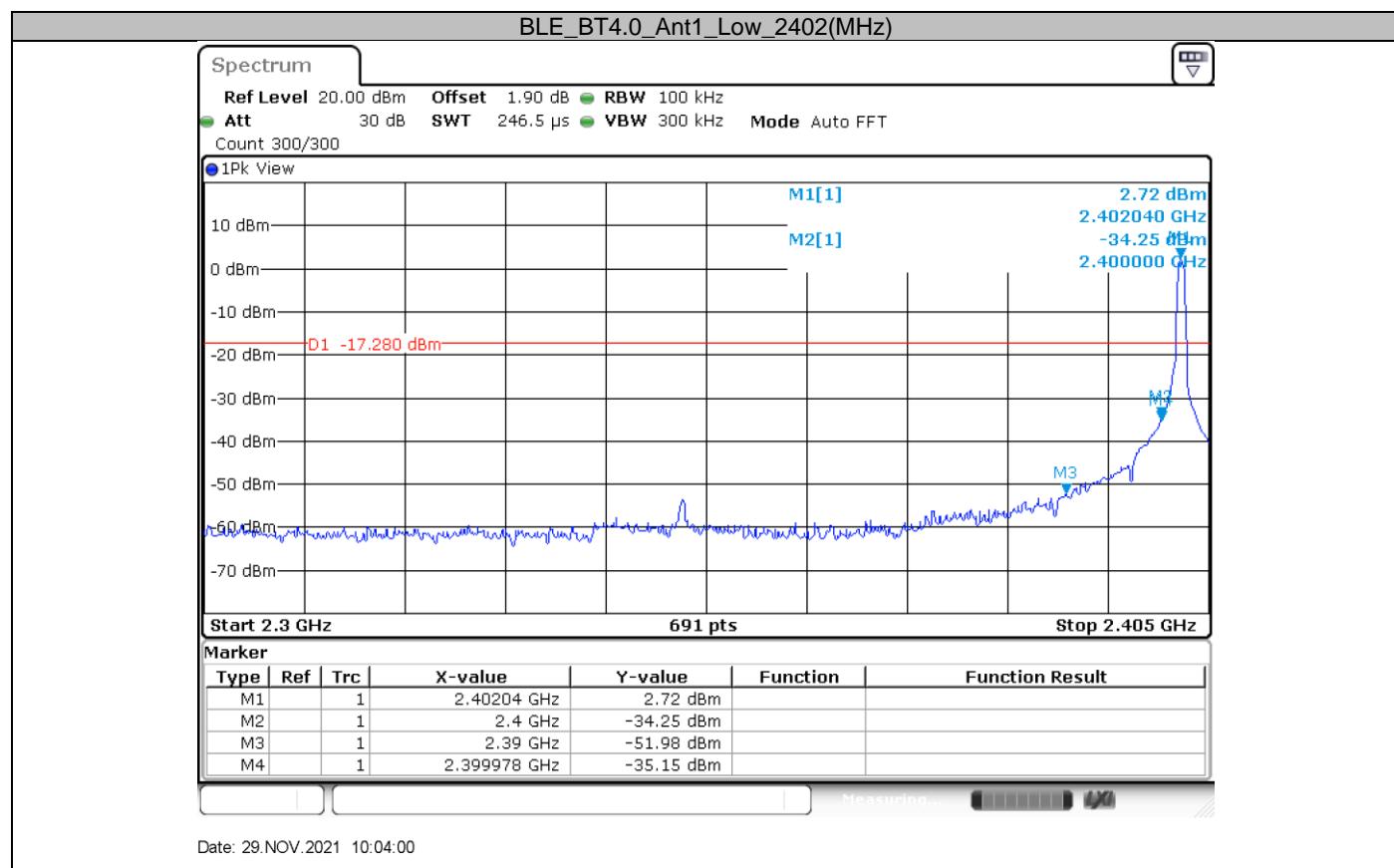
Test Method

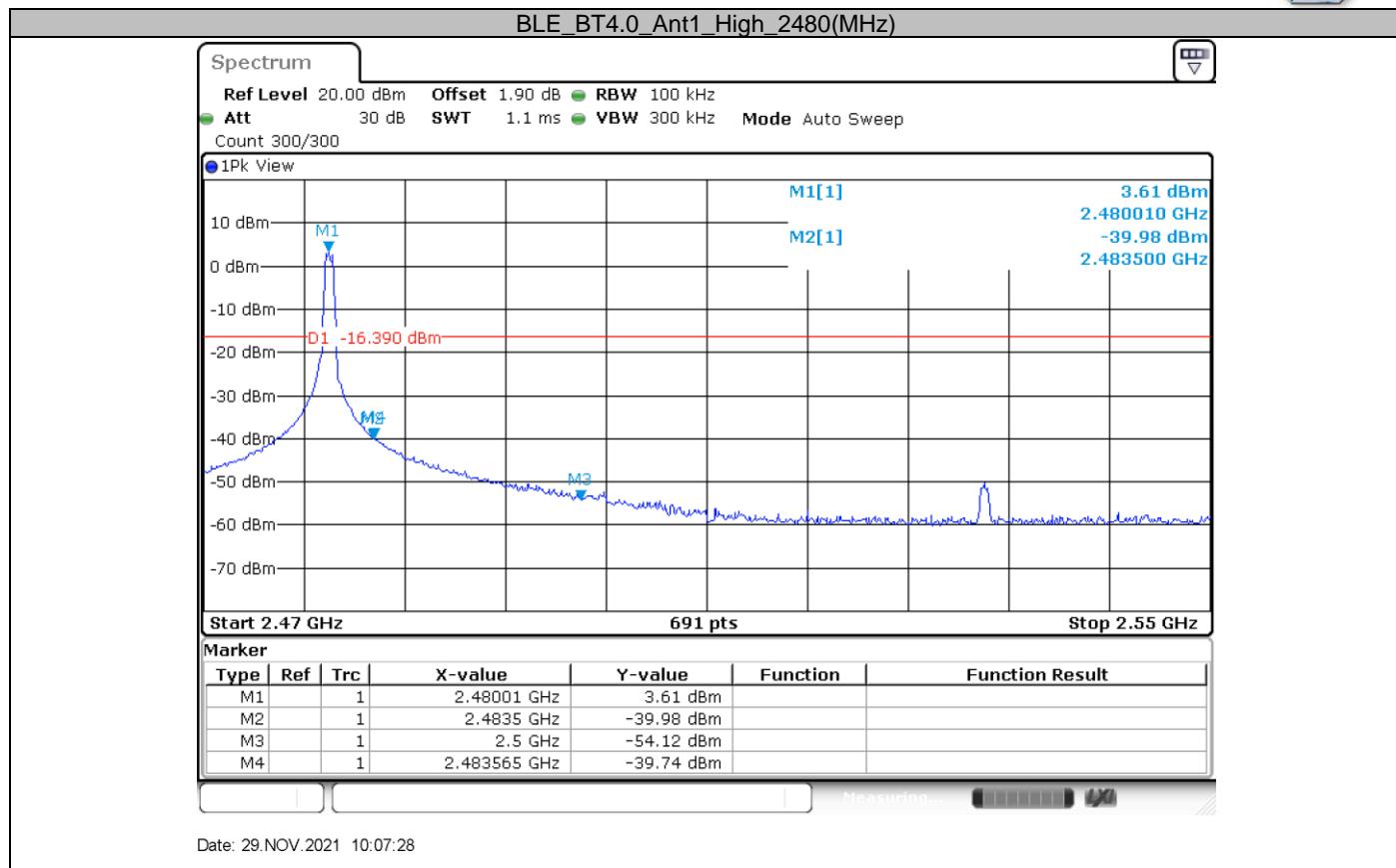
- 1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max hold.
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.

Limit

In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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 Section 15.205(c)).

Test result





9.7 Spurious radiated emissions for transmitter

Test Method

- 1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
- 3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5: Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 KHz to 120KHz, VBW \geq RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW \geq RBW for peak measurement ,Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

- a) RBW = 1 MHz.
- b) VBW \geq [3 \times RBW].
- c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
- d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
- e) Sweep time = auto.
- f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D,where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
- g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the

emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

- 1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is $[10 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.
- 2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is $[20 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
- 3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Frequency MHz	Field Strength uV/m	Field Strength dB μ V/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Transmitting spurious emission test result as below:

Transmitting spurious emission test result as below:

30MHz - 1GHz

Frequency (MHz)	QP (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Pol	Corr. (dB/m)
51.703750	19.45	40.00	20.55	H	20.91
130.880000	29.23	43.50	14.27	H	15.77
199.810625	22.26	43.50	21.24	H	19.38
296.022500	35.61	46.00	10.39	H	21.67
329.911875	34.09	46.00	11.91	H	22.54
480.019375	33.30	46.00	12.70	H	25.62
50.248750	30.08	40.00	9.92	V	21.00
126.818125	23.96	43.50	19.54	V	16.11
138.579375	22.59	43.50	20.91	V	15.50
194.778750	20.11	43.50	23.39	V	18.99
291.960625	29.46	46.00	16.54	V	21.53
334.822500	28.95	46.00	17.05	V	22.77

2402MHz (Above 1GHz)

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Pol	Corr. (dB/m)
2380.000000	42.00	74.00	32.00	V	-3.09
2391.428571	55.61	74.00	18.39	V	-3.12
2484.761905	43.45	74.00	30.55	V	-2.76
4804.500000	46.65	74.00	27.35	V	3.52
2380.000000	44.27	74.00	29.73	H	-3.09
2383.809524	56.39	74.00	17.61	H	-3.10
2483.809524	42.84	74.00	31.16	H	-2.76
4803.500000	46.24	74.00	27.76	H	3.52

2440MHz (Above 1GHz)

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Pol	Corr. (dB/m)
2380.952381	44.53	74.00	29.47	V	-3.09
2485.238095	42.43	74.00	31.57	V	-2.76
4879.500000	43.75	74.00	30.25	V	3.69
2379.047619	43.01	74.00	30.99	H	-3.09
2483.333333	44.00	74.00	30.00	H	-2.76
4880.000000	43.77	74.00	30.23	H	3.69

2480MHz (Above 1GHz)

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Pol	Corr. (dB/m)
4959.500000	43.29	74.00	30.71	H	3.82
9920.000000	49.34	74.00	24.66	H	10.79
4638.000000	39.08	74.00	34.92	V	3.24
12865.000000	46.42	74.00	27.58	V	12.82



Remark:

- (1) Data of measurement within frequency range 18-26GHz are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report.
- (2) Level = Reading Level + Correction Factor
Above 1GHz: Corrector factor = Antenna Factor + Cable Loss - Amplifier Gain
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
(The Reading level is recorded by software which is not shown in the sheet)

10 Test Equipment List

List of Test Instruments

Conducted Emission Test

Description	Manufacturer	Model no.	Serial no.	cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2022-6-4
LISN	Rohde & Schwarz	ENV216	100326	2022-6-5

Radiated Emission Test

Description	Manufacturer	Model no.	Serial no.	cal. due date
EMI Test Receiver	Schwarzbeck	VULB 9162	101269	2022-6-4
Trilog Super Broadband Test Antenna	ETS	3117	284	2022-2-2
Wave Guide Antenna	Rohde & Schwarz	SCU 18F	00218954	2022-5-24
Pre-amplifier	Rohde & Schwarz	SCU 18F	100745	2022-10-10
Pre-amplifier	Q-PAR	QWH-SL-18-40-K-SG	100746	2022-10-10
Sideband Horn Antenna	Rohde & Schwarz	SCU 40A	12827	2022-7-21
Pre-amplifier	Mini-circuits	UNAT-6+	100432	2022-7-27
Attenuator	TDK	SAC-3 #2	15542	2022-8-23
3m Semi-anechoic chamber	Rohde & Schwarz	EMC32	----	2023-5-28
Test software			Version10.35.02	N/A

RF conducted test

Description	Manufacturer	Model no.	Serial no.	cal. due date
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2022-6-3
Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	2022-6-3
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2022-6-3
Power Splitter	Weinschel	1580	SC319	2022-6-3
10dB Attenuator	Weinschel	4M-10	43152	2022-6-3
Test software	Rohde & Schwarz	EMC32	Version 10.60.10	N/A
Test software	Tonscend	System for BT/WIFI	Version 2.6.77.0518	N/A

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission 150kHz-30MHz	3.31dB
Uncertainty for Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.28dB; Vertical: 4.36dB;
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.26dB; Vertical: 4.25dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 4.51dB; Vertical: 4.50dB;
Uncertainty for Conducted RF test with TS 8997	Power level test involved: 1.27dB Frequency test involved: 0.6×10^{-7} or 1%

Remark:

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.