



FCC/ISED - TEST REPORT

Report Number : **709502203708-00B** Date of Issue: January 26, 2022

Model : 9290031348

Product Type : LED light

Trademark : PHILIPS

FCC ID: : 2AGBW9290031348X

IC: : 20812-31348X

Applicant : Signify (China) Investment Co., Ltd.

Address : Building no.9, Lane 888, Tianlin Road, Minhang District Shanghai, 200233 China

Production Facility : Ningbo Klite Electric Manufacture Co., Ltd

Address : No.5 Dapu River, Beilun, 315800 Ningbo
PEOPLE'S REPUBLIC OF CHINA

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

Total pages including Appendices : 38

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch is a subcontractor to TÜV SÜD Product Service GmbH according to the principles outlined in ISO 17025.

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch reports apply only to the specific samples tested under stated test conditions. Construction of the actual test samples has been documented. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. The manufacturer/importer is responsible to the Competent Authorities in Europe for any modifications made to the production units which result in non-compliance to the relevant regulations. TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval.



1 Table of Contents

1	Table of Contents.....	2
2	Details about the Test Laboratory.....	3
3	Description of the Equipment under Test.....	4
4	Summary of Test Standards.....	5
5	Summary of Test Results.....	6
6	General Remarks.....	7
7	Test Setups.....	8
8	Systems test configuration.....	11
9	Technical Requirement.....	12
9.1	Conducted Emission.....	12
9.2	Conducted peak output power.....	15
9.3	6dB bandwidth and 99% Occupied Bandwidth.....	17
9.4	Power spectral density.....	21
9.5	Spurious RF conducted emissions.....	23
9.6	Band edge.....	28
9.7	Spurious radiated emissions for transmitter.....	30
10	Test Equipment List.....	35
11	System Measurement Uncertainty.....	36
12	Photographs of Test Set-ups.....	37
13	Photographs of EUT.....	38



2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
No.16 Lane, 1951 Du Hui Road,
Shanghai 201108,
P.R. China

Telephone: +86 21 6141 0123

Fax: +86 21 6140 8600

FCC Registration No.: 820234

FCC Designation Number: CN1183

ISED#: 25988

CAB identifier CN0101



3 Description of the Equipment under Test

Description of the Equipment Under Test

Product: LED light

Model no.: 9290031348

FCC ID: 2AGBW9290031348X

IC: 20812-31348X

Options and accessories: 6" metal can

Rating: 120 Vac, 60Hz

RF Transmission Frequency: 2405-2480MHz for Zigbee

No. of Operated Channel: 16

Zigbee Working Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
11	2405 MHz	12	2410 MHz	13	2415 MHz	14	2420 MHz
15	2425 MHz	16	2430 MHz	17	2435 MHz	18	2440 MHz
19	2445 MHz	20	2450 MHz	21	2455 MHz	22	2460 MHz
23	2465 MHz	24	2470 MHz	25	2475 MHz	26	2480 MHz

Modulation: 16-ary orthogonal modulation, O-QPSK PHY for Zigbee

Data transmission rate: 250kbps Max for Zigbee

Antenna Type: Integral PCB Antenna

Antenna Gain: 0.59dBi

Description of the EUT: The Equipment Under Test (EUT) is a LED light support Bluetooth 5.0 and Zigbee.
We tested it and listed the worst data in this report.

Test sample no.: SHA-616767-3 for RF conducted test
SHA-616767-4 for RF radiated test and Conducted emission AC power port test

The sample's mentioned in this report is supplied by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2014 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5 Amendment 1 March 2019	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 2 February 2017	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10 (2013).

5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C						
Test Condition	Pages	Test Site	Test Result			
			Pass	Fail	N/A	
§15.207 & RSS-GEN 8.8	Conducted emission AC power port	12-14	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247 (b) (3) & RSS-247 5.4(d)	Conducted peak output power	15-16	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(a)(1) & RSS-247 5.1(b)	20dB bandwidth	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1) & RSS-247 5.1(b)	Carrier frequency separation	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1)(iii) & RSS-247 5.1(d)	Number of hopping frequencies	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1)(iii) & RSS-247 5.1(d)	Dwell Time	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(2) & RSS-247 5.2(a) & RSSGEN 6.7	6dB bandwidth and 99% Occupied Bandwidth	17-20	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(e) & RSS-247 5.2(b)	Power spectral density	21-22	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d) & RSS-247 5.5	Spurious RF conducted emissions	23-27	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d) & RSS-247 5.5	Band edge	28-29	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d) & §15.209 & RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	30-34	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.203 & RSS-Gen 6.8	Antenna requirement	See note 1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Remark 1: N/A – Not Applicable.

Note 1: The EUT uses an Integral PCB Antenna, which gain is 0.59dBi. In accordance to §15.203 and 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: 2AGBW9290031348X, IC: 20812-31348X complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules and RSS-247, RSS-GEN.

This report is only for the 2.4GHz Zigbee test report, for the 2.4GHz Bluetooth 5.0 LE test report please refer to 709502203708-00A.

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 18, 2021

Testing Start Date: November 19, 2021

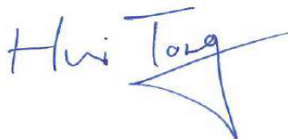
Testing End Date: January 6, 2022

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

Reviewed by:

Prepared by:

Tested by:



Hui TONG
EMC Section Manager

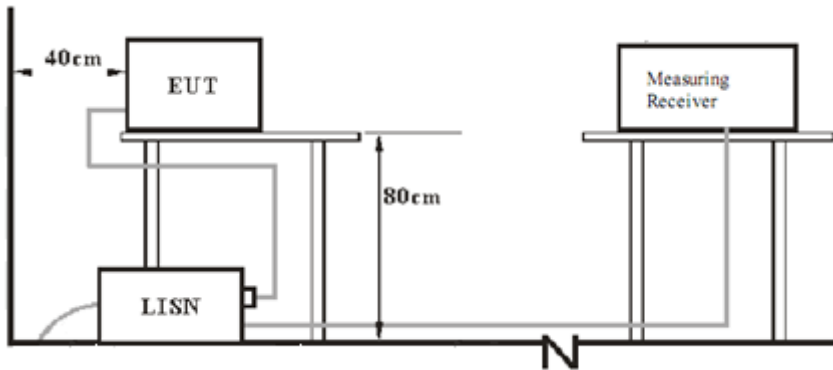


Zhining ZHANG
EMC Project Engineer

Chengjie GUO
EMC Test Engineer

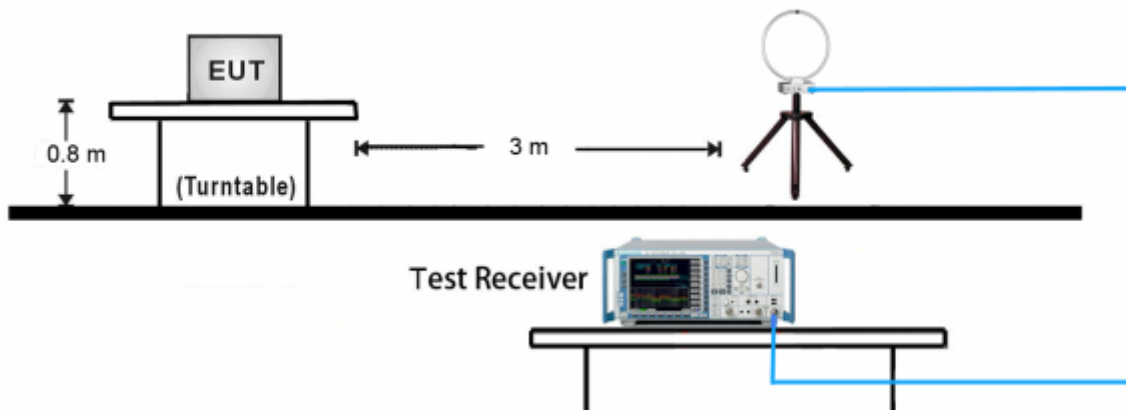
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

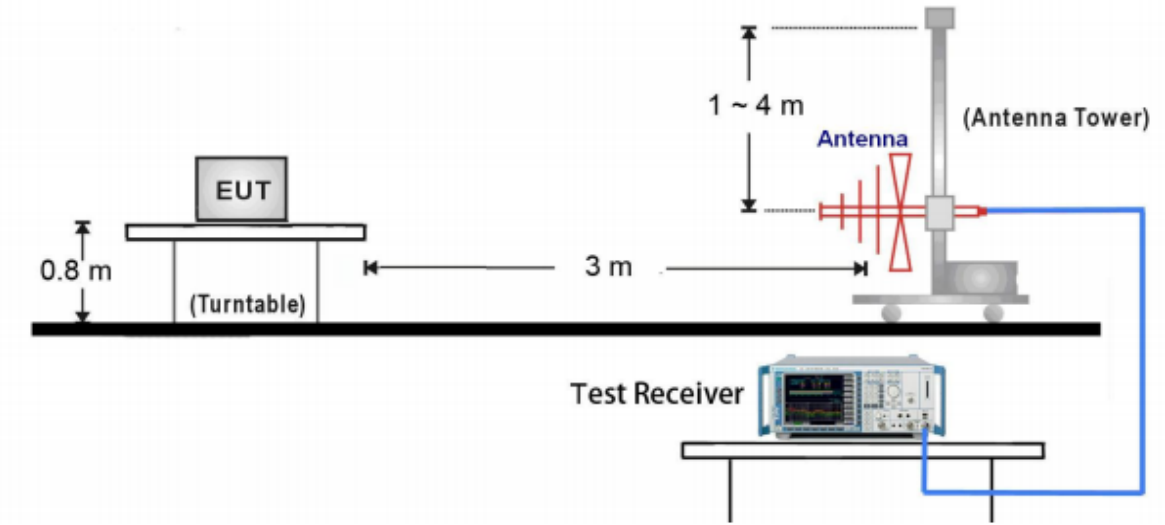


7.2 Radiated test setups

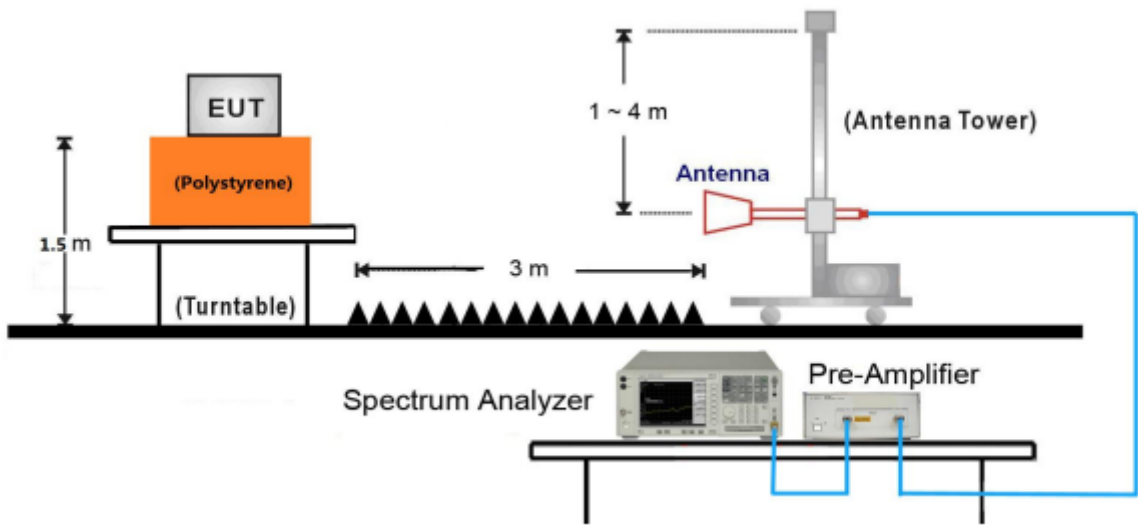
9kHz ~ 30MHz Test Setup:



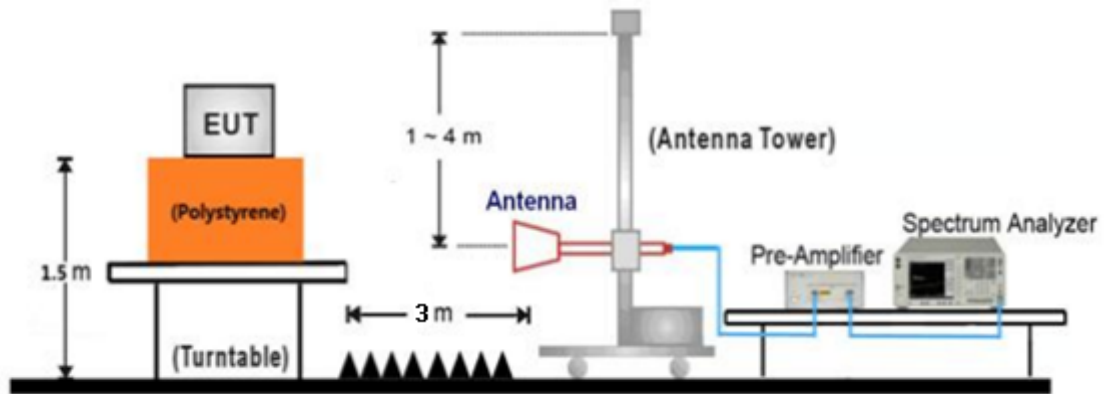
30MHz ~ 1GHz Test Setup:



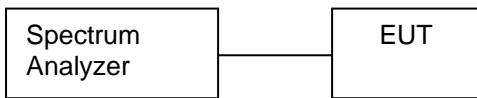
1GHz ~ 18GHz Test Setup:



18GHz ~ 25GHz Test Setup:



7.2 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenovo	E470	PF-OU5TS7 17/09

Test software: HueApprobatonTool, which used to control the EUT in continues transmitting mode.

Power level setting at 8dBm.

The system was configured to channel 11, 18, and 26 for the test.

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 a 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

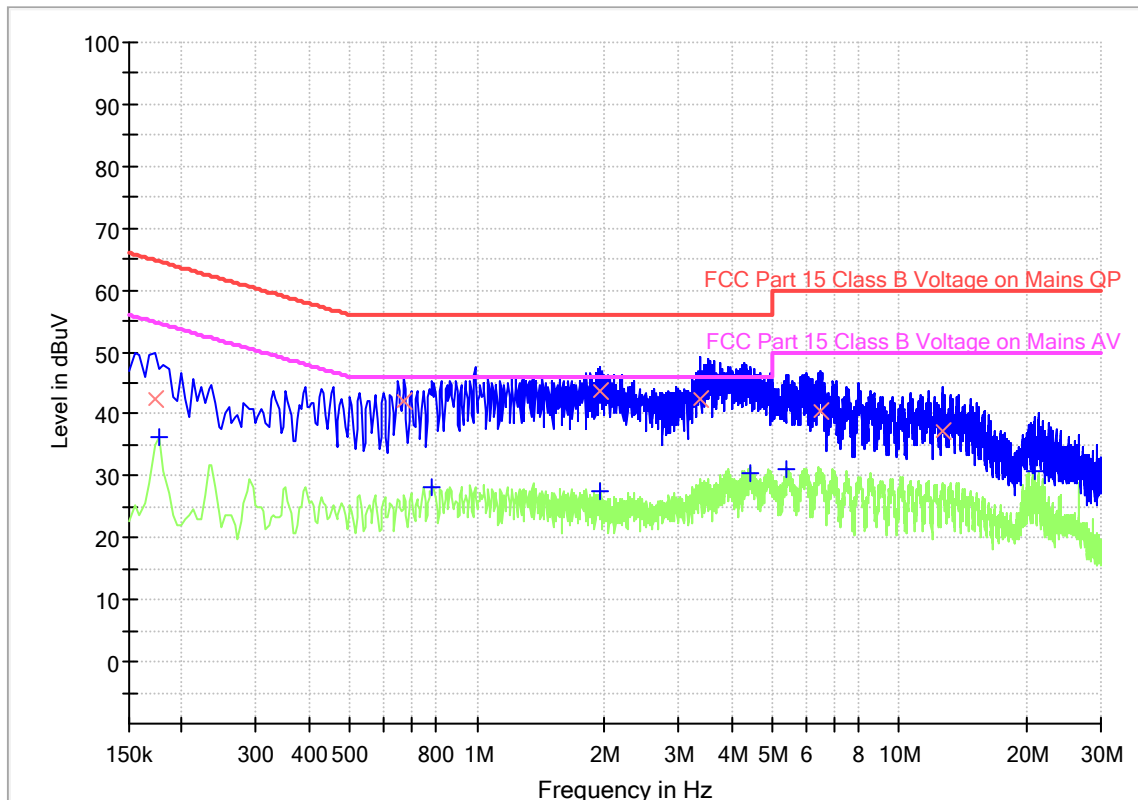
Limit

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

Decreasing linearly with logarithm of the frequency

Conducted Emission

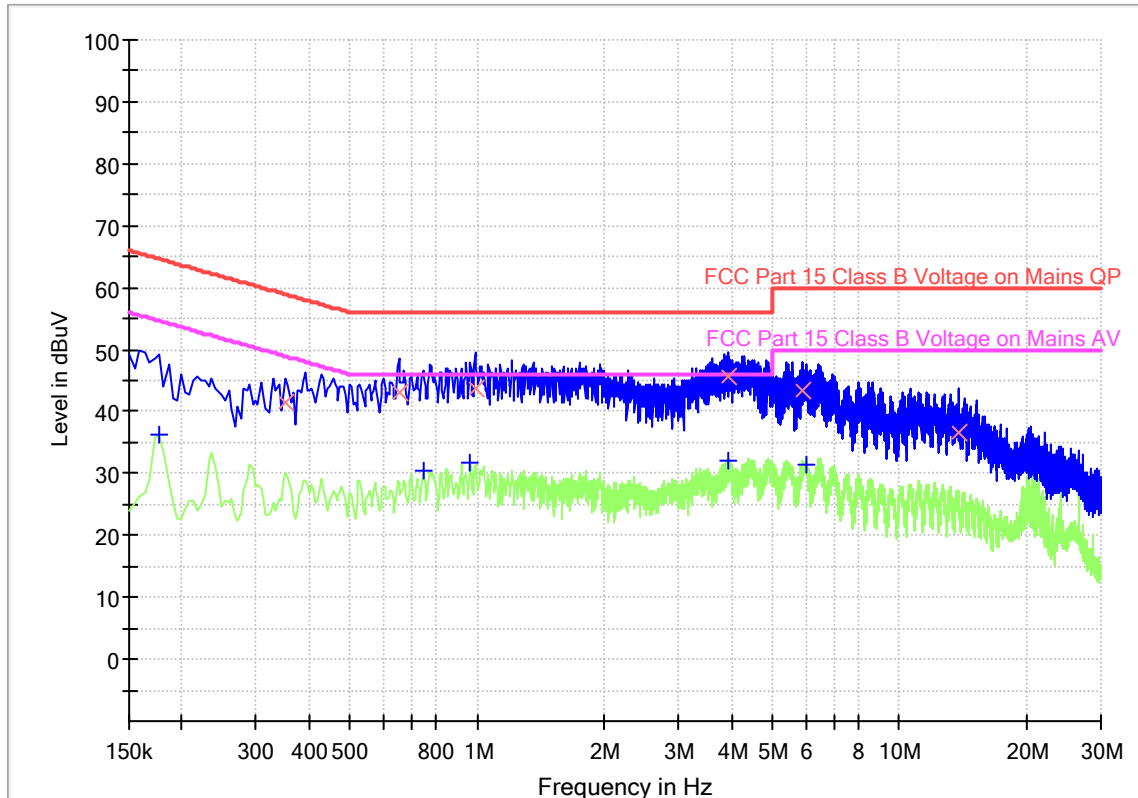
Product Type : LED light
 M/N : 9290031348
 Operating Condition : Mode 1: Tx_2480MHz Zigbee
 Test Specification : L-Line
 Comment : AC 120V 60Hz



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.172500	42.35	---	64.84	22.49	1000.0	9.000	L1	19.5
0.177000	---	36.12	54.63	18.51	1000.0	9.000	L1	19.5
0.672000	42.01	---	56.00	13.99	1000.0	9.000	L1	19.5
0.784500	---	28.31	46.00	17.69	1000.0	9.000	L1	19.5
1.959000	---	27.68	46.00	18.32	1000.0	9.000	L1	19.5
1.959000	43.67	---	56.00	12.33	1000.0	9.000	L1	19.5
3.381000	42.37	---	56.00	13.63	1000.0	9.000	L1	19.6
4.452000	---	30.49	46.00	15.51	1000.0	9.000	L1	19.6
5.410500	---	31.01	50.00	18.99	1000.0	9.000	L1	19.6
6.504000	40.44	---	60.00	19.56	1000.0	9.000	L1	19.6
12.682500	37.15	---	60.00	22.85	1000.0	9.000	L1	19.7
20.841000	---	30.81	50.00	19.19	1000.0	9.000	L1	19.8

Product Type : LED light
 M/N : 9290031348
 Operating Condition : Mode 1: Tx_2480MHz Zigbee
 Test Specification : N-Line
 Comment : AC 120V 60Hz



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.177000	---	36.39	54.63	18.24	1000.0	9.000	N	19.5
0.352500	41.38	---	58.90	17.52	1000.0	9.000	N	19.5
0.654000	42.93	---	56.00	13.07	1000.0	9.000	N	19.5
0.744000	---	30.38	46.00	15.62	1000.0	9.000	N	19.5
0.964500	---	31.79	46.00	14.21	1000.0	9.000	N	19.5
0.991500	43.79	---	56.00	12.21	1000.0	9.000	N	19.5
3.916500	45.59	---	56.00	10.41	1000.0	9.000	N	19.5
3.916500	---	32.20	46.00	13.80	1000.0	9.000	N	19.5
5.901000	43.42	---	60.00	16.58	1000.0	9.000	N	19.6
6.045000	---	31.37	50.00	18.63	1000.0	9.000	N	19.6
13.753500	36.53	---	60.00	23.47	1000.0	9.000	N	19.7
20.202000	---	30.33	50.00	19.67	1000.0	9.000	N	19.8

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
 Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

9.2 Conducted peak output power

Test Method

- 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.
- Add a correction factor to the display.
- 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

According to §15.247 (b) (1) & RSS-247 5.4(d), conducted peak output power limit as below:

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

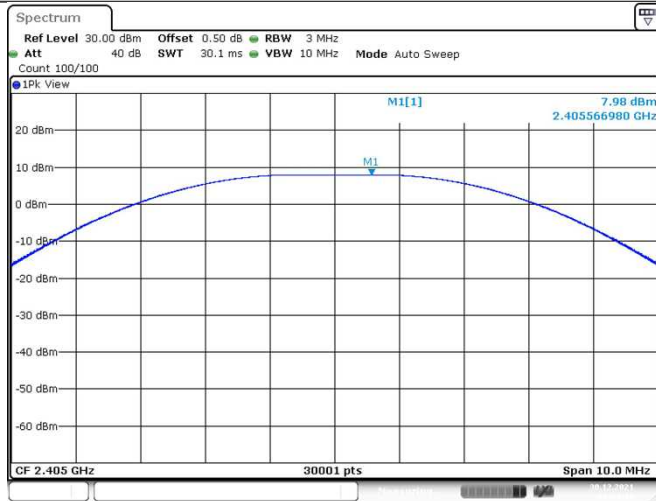
Frequency Range MHz	Limit (EIRP) W	Limit dBm
2400-2483.5	≤ 4	≤ 36

Test result

TestMode	Channel	Conducted Peak Output Power Result[dBm]	Limit[dBm]	Verdict
Zigbee	2405	7.98	≤ 30	PASS
	2440	8.04	≤ 30	PASS
	2480	8.15	≤ 30	PASS

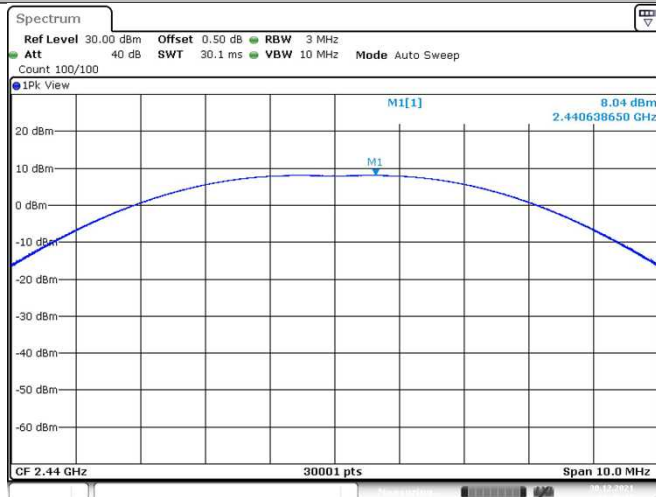
TestMode	Channel	EIRP Result[dBm]	Limit[dBm]	Verdict
Zigbee	2405	8.57	≤ 36	PASS
	2440	8.63	≤ 36	PASS
	2480	8.74	≤ 36	PASS

Test Graphs
ZIGB_Ant1_2405



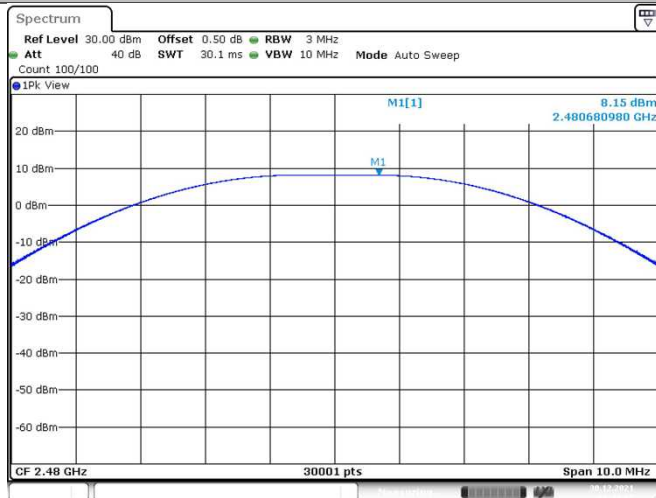
Date: 30 DEC 2021 08:38:13

ZIGB_Ant1_2440



Date: 30 DEC 2021 08:46:11

ZIGB_Ant1_2480



Date: 30 DEC 2021 08:48:31

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.

Test Method for 99 % Bandwidth

1. Use the following spectrum analyzer settings:
RBW=1% to 5% of the actual occupied, VBW \geq 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, 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]

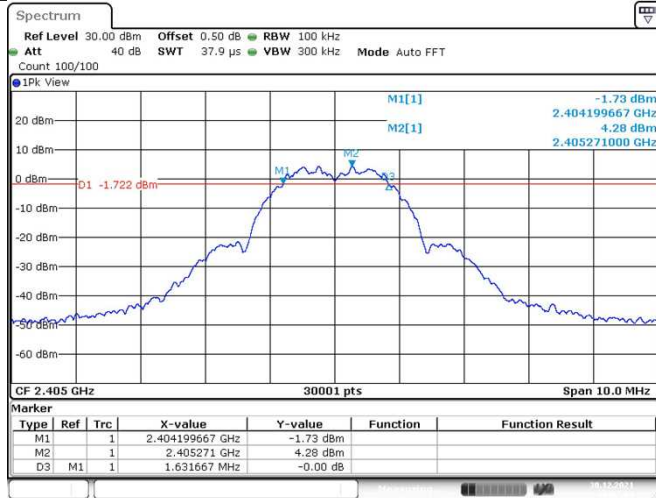
\geq 500

Test result

6dB Bandwidth

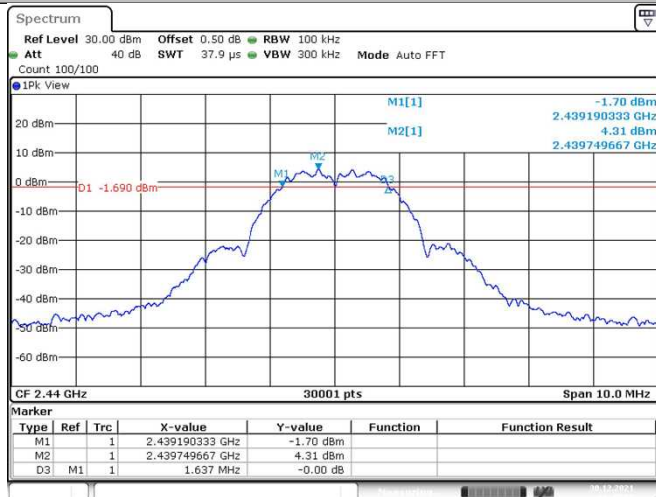
TestMode	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
Zigbee	2405	1.632	2404.200	2405.831	0.5	PASS
	2440	1.637	2439.190	2440.827	0.5	PASS
	2480	1.642	2479.192	2480.833	0.5	PASS

ZIGB_Ant1_2405



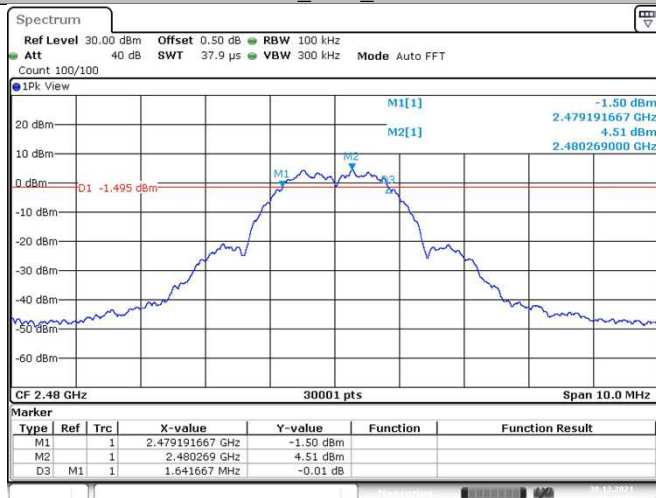
Date: 30 DEC 2021 08:37:54

ZIGB_Ant1_2440



Date: 30 DEC 2021 08:45:52

ZIGB_Ant1_2480

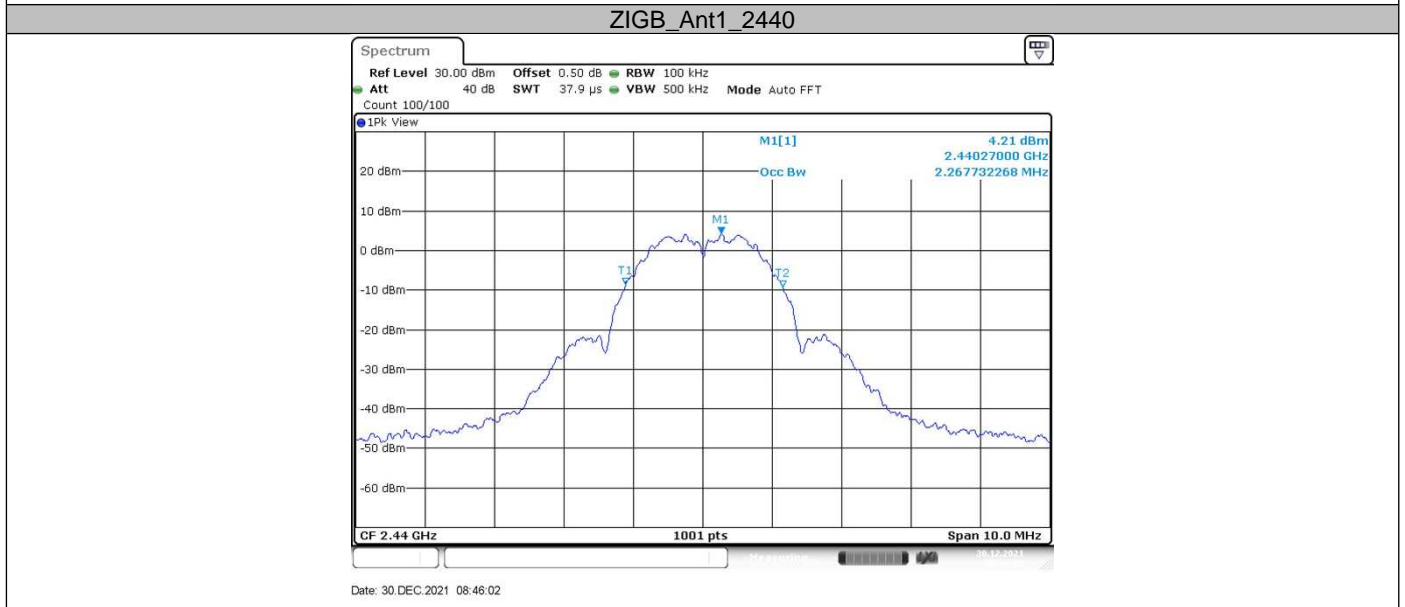
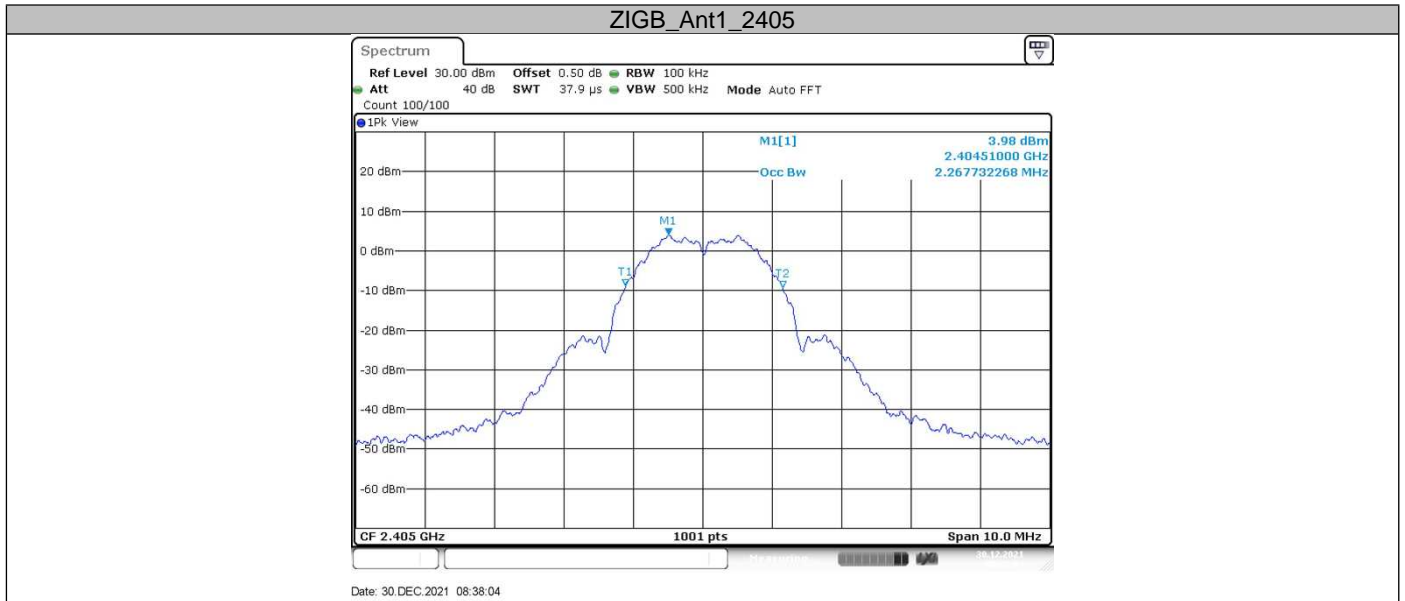


Date: 30 DEC 2021 08:48:13



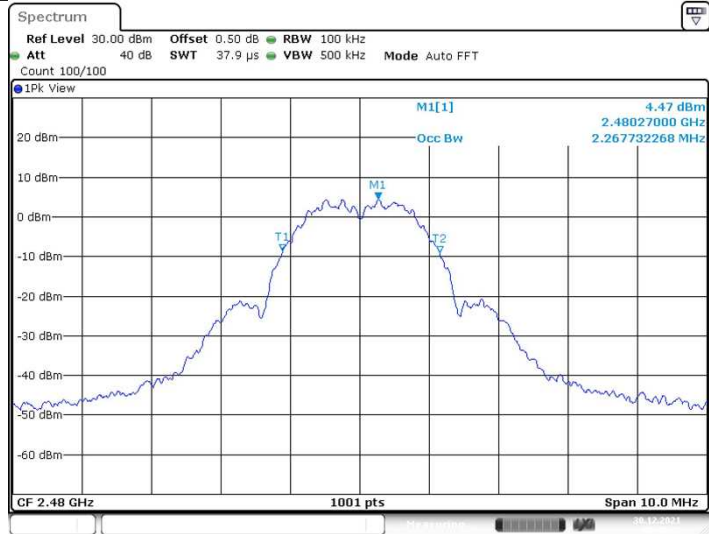
99% Occupied Bandwidth

TestMode	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
Zigbee	2405	2.268	2403.881	2406.149	---	PASS
	2440	2.268	2438.881	2441.149	---	PASS
	2480	2.268	2478.881	2481.149	---	PASS





ZIGB_Ant1_2480



Date: 30.DEC.2021 08:48:23

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=3kHz, VBW \geq 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]

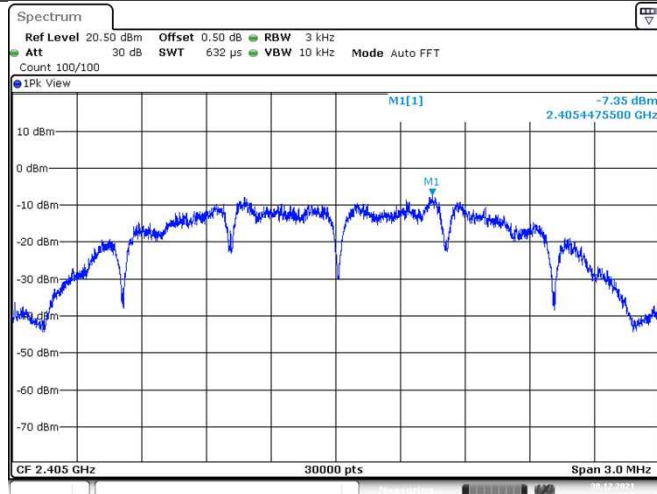
≤ 8

Test result

TestMode	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
Zigbee	2405	-7.35	≤ 8	PASS
	2440	-7.35	≤ 8	PASS
	2480	-7.2	≤ 8	PASS

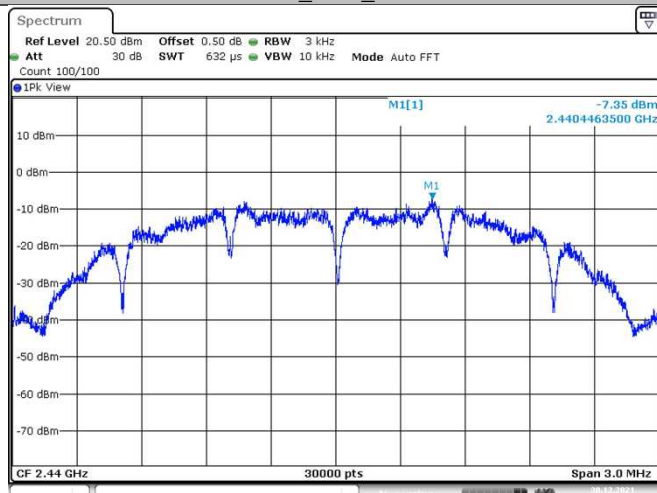
Test Graphs

ZIGB_Ant1_2405



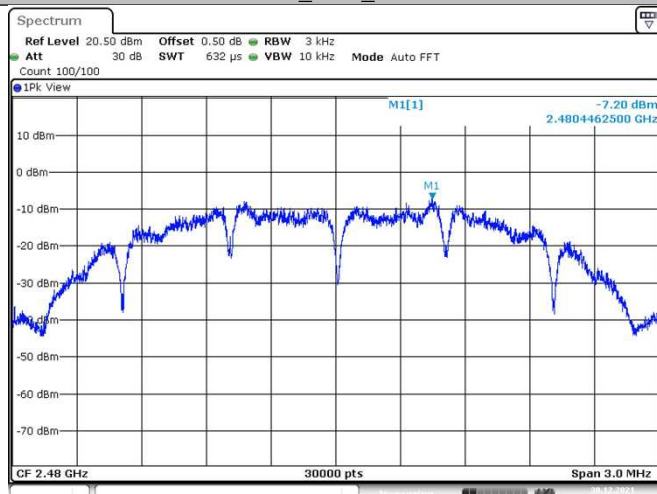
Date: 30 DEC 2021 08:38:19

ZIGB_Ant1_2440



Date: 30 DEC 2021 08:46:16

ZIGB_Ant1_2480



Date: 30 DEC 2021 08:48:37

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)
30-26500	-20

Test Result

TestMode	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict	
Zigbee	2405	Reference	4.10	4.10	---	PASS	
		30~1000	4.10	-57.57	≤ -15.9	PASS	
		1000~5000	4.10	-54.91	≤ -15.9	PASS	
		5000~26500	4.10	-49.04	≤ -15.9	PASS	
	2440	Reference	4.28	4.28	4.28	---	PASS
		30~1000	4.28	-58.33	-58.33	≤ -15.72	PASS
		1000~5000	4.28	-55.49	-55.49	≤ -15.72	PASS
		5000~26500	4.28	-48.96	-48.96	≤ -15.72	PASS
	2480	Reference	4.40	4.40	4.40	---	PASS
		30~1000	4.40	-58	-58	≤ -15.6	PASS
		1000~5000	4.40	-55.52	-55.52	≤ -15.6	PASS
		5000~26500	4.40	-47.86	-47.86	≤ -15.6	PASS

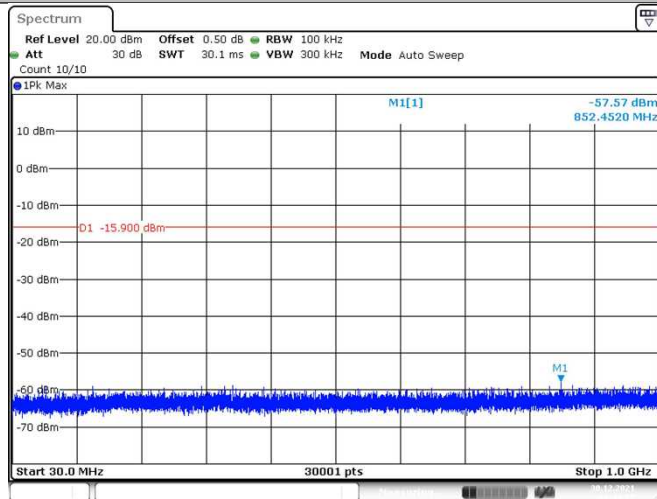
Test Graphs

ZIGB_Ant1_2405_0-Reference



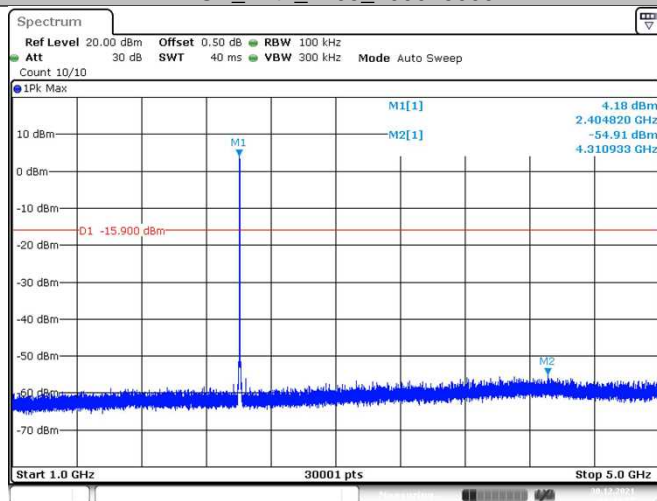
Date: 30 DEC 2021 08:43:51

ZIGB_Ant1_2405_30~1000



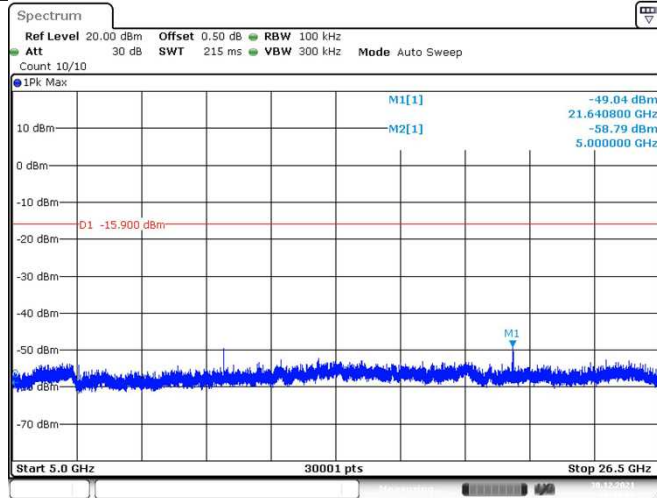
Date: 30 DEC 2021 08:43:55

ZIGB_Ant1_2405_1000~5000



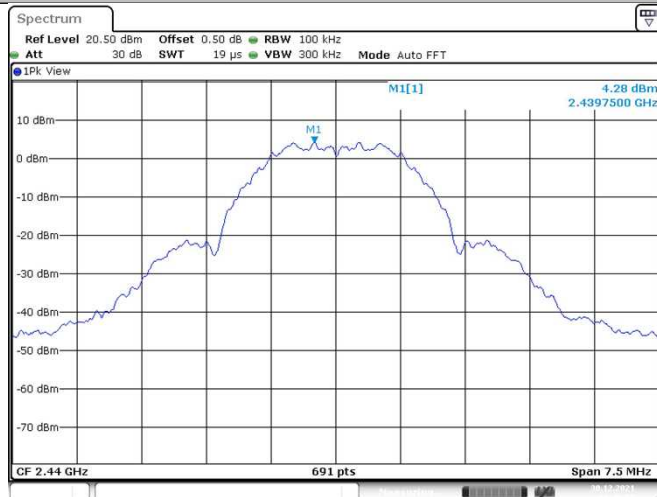
Date: 30 DEC 2021 08:44:07

ZIGB_Ant1_2405_5000~26500



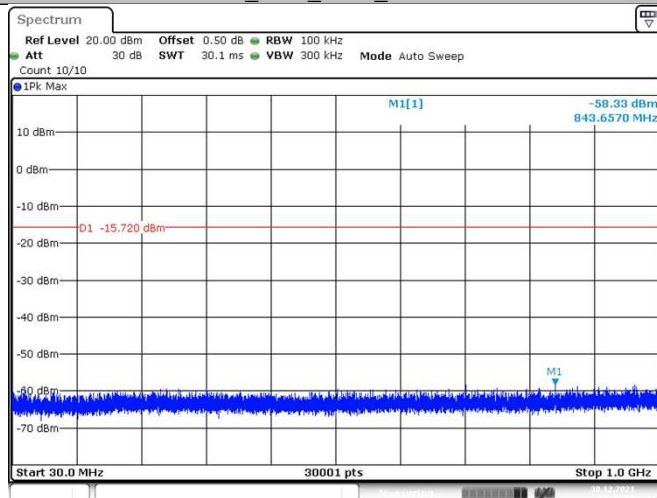
Date: 30 DEC 2021 08:44:38

ZIGB_Ant1_2440_0-Reference



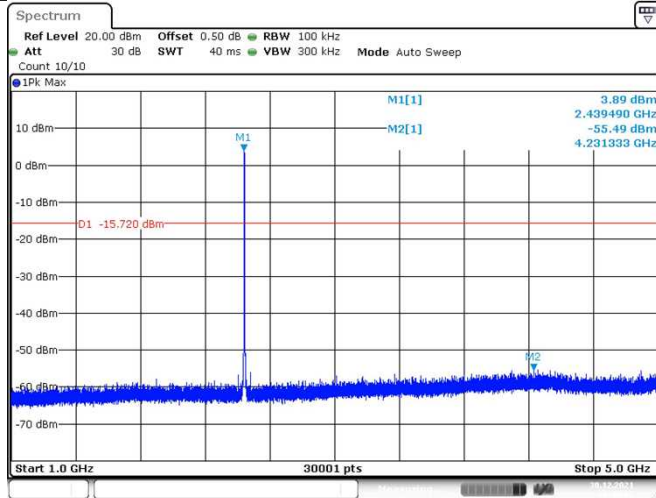
Date: 30 DEC 2021 08:46:21

ZIGB_Ant1_2440_30~1000



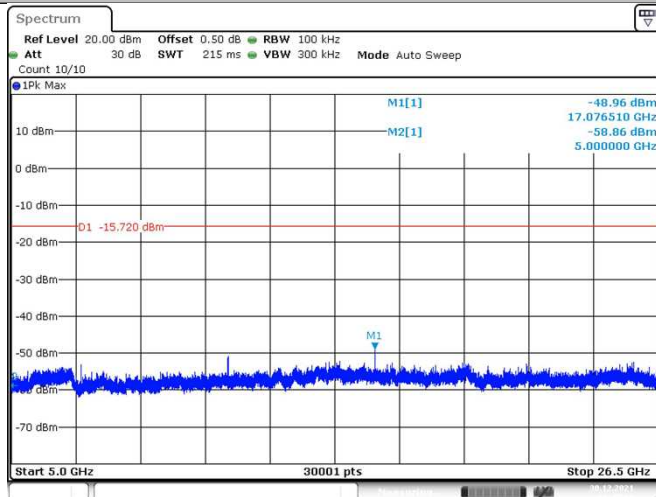
Date: 30 DEC 2021 08:46:25

ZIGB_Ant1_2440_1000~5000



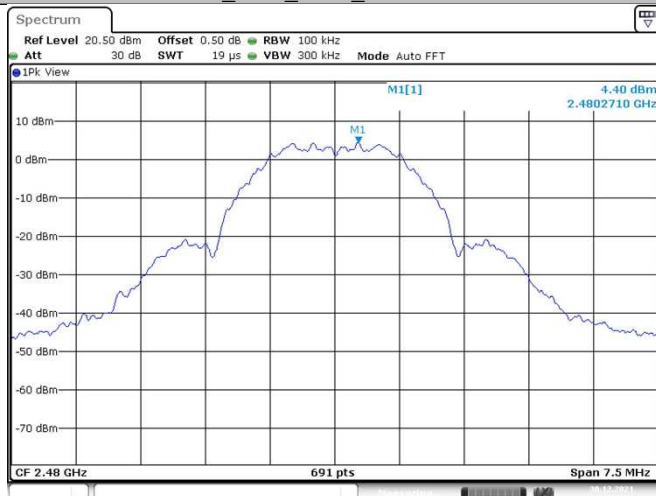
Date: 30.DEC.2021 08:46:37

ZIGB_Ant1_2440_5000~26500



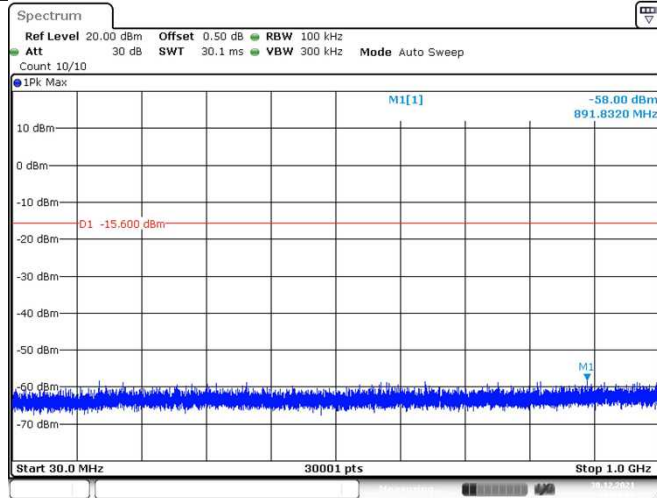
Date: 30.DEC.2021 08:47:09

ZIGB_Ant1_2480_0~Reference



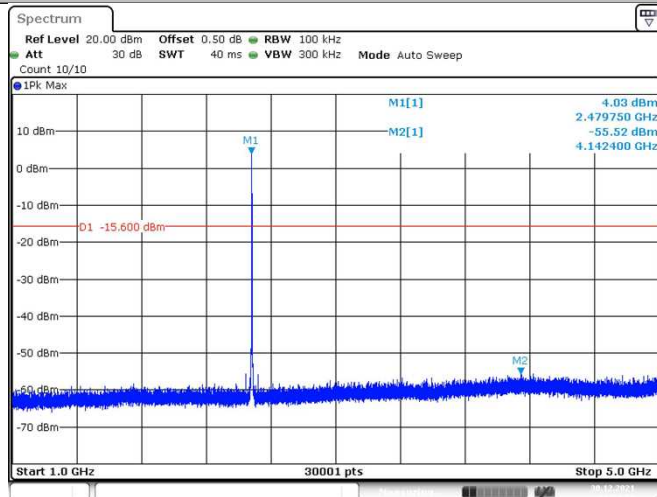
Date: 30.DEC.2021 08:53:04

ZIGB_Ant1_2480_30~1000



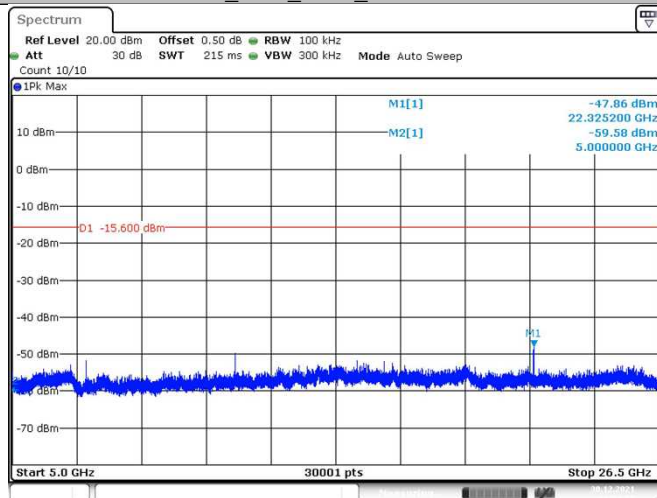
Date: 30 DEC 2021 08:53:08

ZIGB_Ant1_2480_1000~5000



Date: 30 DEC 2021 08:53:20

ZIGB_Ant1_2480_5000~26500



Date: 30 DEC 2021 08:53:52

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

According to §15.247(d) and RSS-247 5.5, 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) and RSS-Gen 8.10, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)) and RSS-Gen.

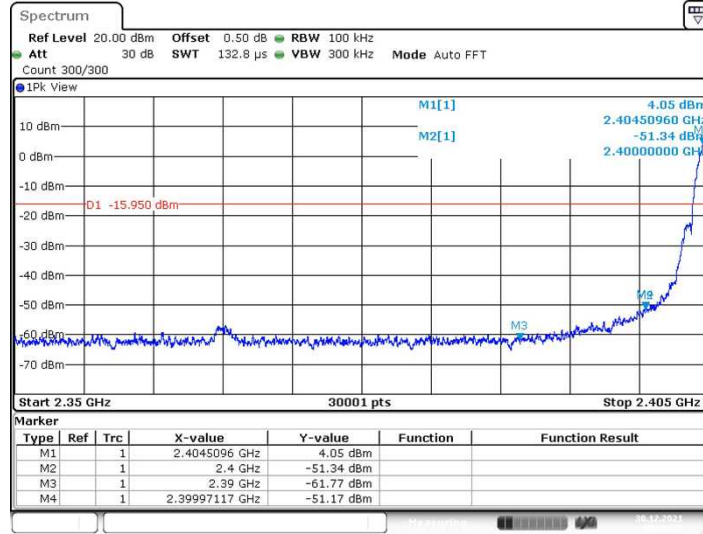
Test result

TestMode	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
Zigbee	Low	2405	4.05	-51.17	≤ -15.95	PASS
	High	2480	4.07	-46.79	≤ -15.93	PASS



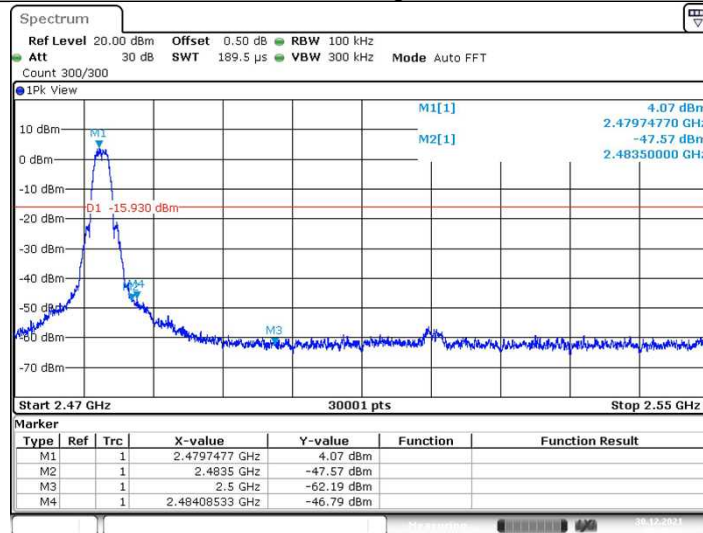
Test Graphs

ZIGB_Ant1_Low_2405



Date: 30.DEC.2021 08:38:28

ZIGB_Ant1_High_2480



Date: 30.DEC.2021 08:48:46

9.7 Spurious radiated emissions for transmitter

Test Method

1. The EUT was placed 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 120 kHz, VBW ≥ 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 ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

- a) RBW = 1MHz.
- b) VBW ≥ [3 × RBW].
- c) Detector = RMS (power averaging), if $[\text{span} / (\# \text{ of points in sweep})] \leq \text{RBW} / 2$. 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

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section 15.205 and RSS-GEN 8.10 must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Measured Distance Meters
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30	30	30

Frequency MHz	Field Strength uV/m	Field Strength dBµV/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:

Test mode: O-QPSK Zigbee Channel (2405MHz)

Frequency MHz	Mmission Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polarization
2384.2	43.68	74.0	30.32	Peak	Horizontal
7219.9	48.03	74.0	25.97	Peak	Horizontal
2383.2	43.43	74.0	30.57	Peak	Vertical
7219.9	48.89	74.0	25.11	Peak	Vertical

Test mode: O-QPSK Zigbee Channel (2440MHz)

Frequency MHz	Mmission Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polarization
7321.7	47.78	74.0	26.22	Peak	Horizontal
7321.1	49.46	74.0	24.54	Peak	Vertical

Test mode: O-QPSK Zigbee Channel (2480MHz)

Frequency MHz	Mmission Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polarization
2483.5	48.12	74.0	25.88	Peak	Horizontal
7438.4	52.21	74.0	21.79	Peak	Horizontal
7438.4	48.62	74.0	25.38	AV	Horizontal
2483.5	51.98	74.0	22.02	Peak	Vertical
2483.5	44.16	54.0	9.84	AV	Vertical
7438.4	51.91	74.0	22.09	Peak	Vertical
7438.4	48.75	54.0	5.25	AV	Vertical

Remark:

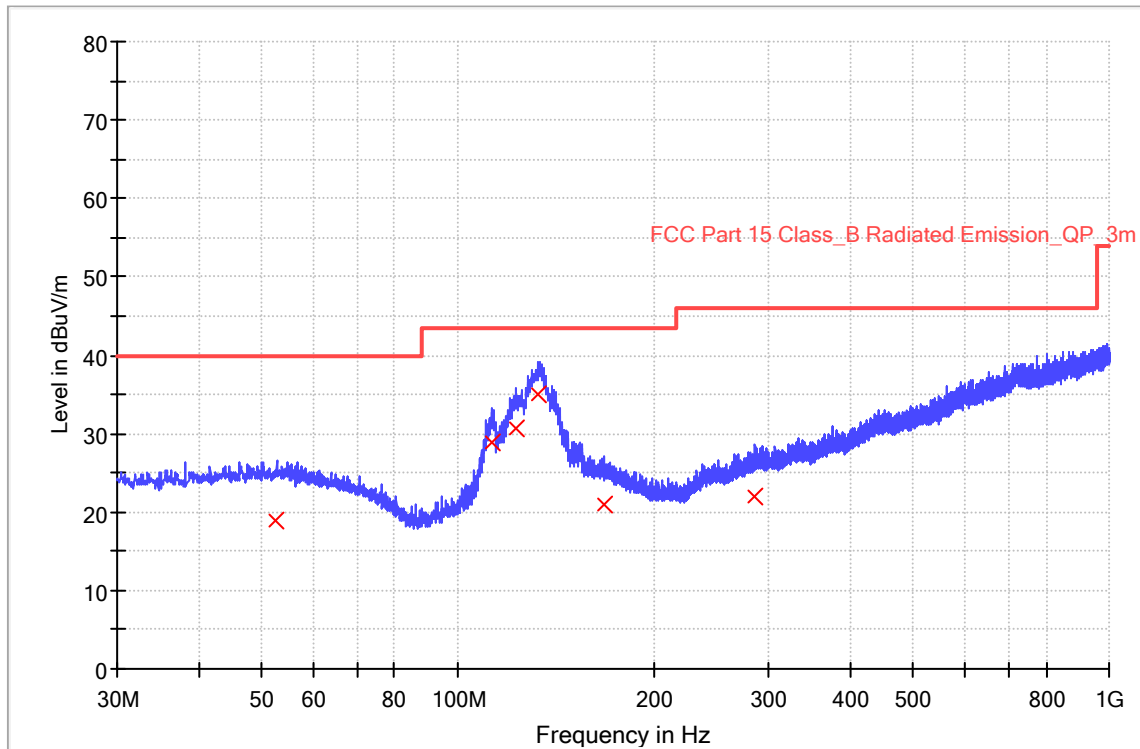
- (1) Emission level= Original Receiver Reading + Correct Factor
- (2) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
- (3) Margin = limit – Corrected Reading



The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2022/01/06 - 16:31
Limit: FCC_Part15.209 and RSS-GEN 8.8_RE(3m)	Engineer: Chengjie Guo
Probe: VULB9168	Polarity: Horizontal
EUT: LED light, Model no: 9290031348	Power: AC 120V, 60Hz
Note: Transmit by at channel 2440MHz, Zigbee.	

RE_VULB9168_pre_Cont_30-1000

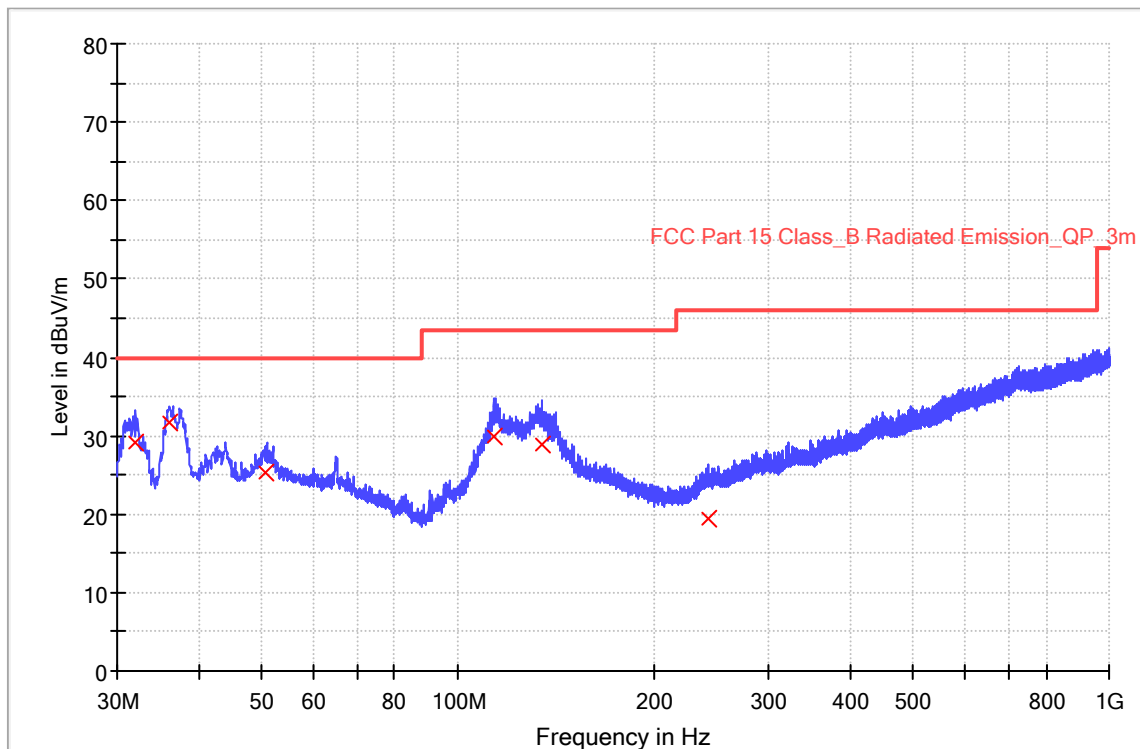


Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
52.680000	19.0	1000.0	120.000	150.0	H	60.0	20.5	21.0	40.0
112.920000	28.9	1000.0	120.000	150.0	H	116.0	17.6	14.6	43.5
122.800000	30.7	1000.0	120.000	150.0	H	84.0	18.4	12.8	43.5
133.120000	34.9	1000.0	120.000	200.0	H	146.0	19.6	8.6	43.5
167.400000	21.0	1000.0	120.000	150.0	H	1.0	20.5	22.6	43.5
286.360000	22.1	1000.0	120.000	100.0	H	27.0	21.2	23.9	46.0

Site: 3 meter chamber	Time: 2022/01/06 - 16:38
Limit: FCC_Part15.209 and RSS-GEN 8.8_RE(3m)	Engineer: Chengjie Guo
Probe: VULB9168	Polarity: Vertical
EUT: LED light, Model no: 9290031348	Power: AC 120V, 60Hz
Note: Transmit by at channel 2440MHz Zigbee.	

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
32.040000	29.1	1000.0	120.000	100.0	V	1.0	19.4	10.9	40.0
36.120000	31.8	1000.0	120.000	200.0	V	42.0	19.7	8.2	40.0
50.840000	25.3	1000.0	120.000	100.0	V	114.0	20.6	14.7	40.0
114.000000	29.9	1000.0	120.000	200.0	V	25.0	17.6	13.6	43.5
134.520000	29.0	1000.0	120.000	100.0	V	175.0	19.8	14.5	43.5
243.000000	19.4	1000.0	120.000	100.0	V	64.0	19.7	26.6	46.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 26.5GHz), therefore no data appear in the report.

10 Test Equipment List

List of Test Instruments

Test Site1

TEST ITEM	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE	CAL. DUE DATE
C	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2021-8-2	2022-8-1
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2021-8-2	2022-8-1
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2021-8-2	2022-8-1
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2019-3-16	2022-3-15
	Horn Antenna	Rohde & Schwarz	HF907	102393	2021-3-15	2022-3-14
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2021-8-2	2022-8-1
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2021-5-21	2022-5-20
	DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ)	ETS-Lindgren	3116C-PA	002222727	2020-9-23	2023-9-22
	3m Semi-anechoic chamber	TDK	9X6X6	----	2021-5-8	2024-5-7
	EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2021-8-2	2022-8-1
	LISN	Rohde & Schwarz	ENV216	101924	2021-8-2	2022-8-1

Measurement Software Information

Test Item	Software	Manufacturer	Version
C	Bluetooth and WiFi Test System	Shenzhen JS tonscond co.,ltd	2.6.77.0518
RE	EMC 32	Rohde & Schwarz	V9.15.00
CE	EMC 32	Rohde & Schwarz	V9.15.03

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth and 99% Occupied Bandwidth
- Power spectral density*
- Spurious RF conducted emissions
- Band edge

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:

Items	Extended Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, ± 3.16 dB
Radiated Disturbance	30MHz to 1GHz, ± 5.03 dB (Horizontal) ± 5.12 dB (Vertical) 1GHz to 18GHz, ± 5.49 dB 18GHz to 40GHz, ± 5.63 dB
Carrier power conducted measurement	50MHz~18GHz, ± 1.238 dB
Spurious Emission Conducted Measurement	9kHz ~40GHz, ± 1.224 dB



12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.



13 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

THE END