

FCC RF Test Report

APPLICANT	: Zhejiang Lingzhu Technology Co., Ltd.
EQUIPMENT	: Smart Control Panel L
MODEL NAME	: TPP05-Z(US)
FCC ID	: 2BEWX-TPP05
STANDARD	: 47 CFR Part 15 Subpart C §15.247
CLASSIFICATION	: (DTS) Digital Transmission System
TEST DATE(S)	: Jul. 28, 2023 ~ Aug. 28, 2023

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

JasonJia

Approved by: Jason Jia



Sporton International Inc. (Kunshan) No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR372501-02B	Rev. 01	Initial issue of report	Jul. 23, 2024



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.1	-	99% Bandwidth	-	Pass	-
3.2	15.247(b)(3)	Output Power	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	≤ 20dBc	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 3.39 dB at 2483.52 MHz
3.6	15.207	AC Conducted Emission 15.207(a)		Pass	Under limit 9.35 dB at 0.476 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Note: This is a change FCC ID report. Since no changes have been made to this device, therefore, all test cases were

leveraged from original report (FCC ID: 2A789-TPP05, report number FR372501B)

Conformity Assessment Condition:

- The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
- 2. The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty"

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.



1 General Description

1.1 Applicant

Zhejiang Lingzhu Technology Co., Ltd.

Room 302,No 1 Building Huace Center,Xihu District, Hangzhou City, Zhejiang Province,China

1.2 Manufacturer

Zhejiang Lingzhu Technology Co., Ltd.

Room 302,No 1 Building Huace Center,Xihu District, Hangzhou City, Zhejiang Province,China

1.3 Product Feature of Equipment Under Test

Product Feature					
Equipment Smart Control Panel L					
Model Name TPP05-Z(US)					
FCC ID 2BEWX-TPP05					
SN Code	Conducted: NSZEE18MK00008 Conduction: NSZEE18MK0005A Radiation: NSZEE18MK00008				

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification				
Tx/Rx Frequency Range	2405 MHz ~ 2480 MHz			
Number of Channels	16			
Channel Spacing	5 MHz			
Carrier Frequency of Each Channel	2405 MHz, 2410MHz,, 2480MHz			
Maximum Output Power to Antenna	17.29 dBm (0.0536 W)			
99% Occupied Bandwidth 2.25 MHz				
Antenna Type / Gain	IPEX Antenna type with gain -0.95 dBi			
Type of Modulation	QPSK/O-QPSK			

1.5 Modification of EUT

No modifications are made to the EUT during all test items.



1.6 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)					
	No. 1098, Pengxi North	n Road, Kunshan Econom	ic Development Zone			
Test Site Location	Jiangsu Province 215300 People's Republic of China					
	TEL : +86-512-57900158					
	Sporton Site No.	FCC Designation No.	FCC Test Firm			
Test Site No.	Sporton Site No.	FCC Designation No.	Registration No.			
Test one NU.	CO01-KS 03CH07-KS TH01-KS	CN1257	314309			

1.7 Test Software

ltem	Site	Manufacturer	Name	Version
1.	03CH07-KS	AUDIX	E3	210616
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05
- ANSI C63.10-2013

Remark:

- 1. All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
	11	2405	19	2445
	12	2410	20	2450
	13	2415	21	2455
2400-2483.5 MHz	14	2420	22	2460
2400-2403.3 IVINZ	15	2425	23	2465
	16	2430	24	2470
	17	2435	25	2475
	18	2440	26	2480

2.1 Carrier Frequency Channel

2.2 Test Mode

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction (150 kHz to 30 MHz), radiation (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). Pre-scanned tests, X, Y, Z in three orthogonal panels to determine the final configuration (X plane as worst plane) from all possible combinations.
- b. AC power line Conducted Emission was tested under maximum output power.

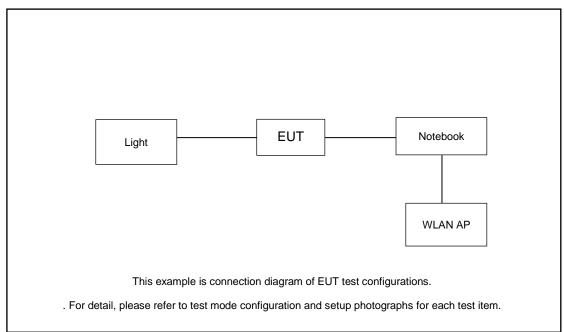
The following summary table is showing all test modes to demonstrate in compliance with the standard.

	Summary table of Test Cases					
Test Item	Data Rate / Modulation					
Test item	250kbps / Zigbee					
	Mode 1: Zigbee Tx CH11_2405 MHz					
Conducted	Mode 2: Zigbee Tx CH18_2440 MHz					
TCs	Mode 3: Zigbee Tx CH25_2475 MHz					
	Mode 4: Zigbee Tx CH26_2480 MHz					
	Mode 1: Zigbee Tx CH11_2405 MHz					
Radiated	Mode 2: Zigbee Tx CH18_2440 MHz					
TCs	Mode 3: Zigbee Tx CH25_2475 MHz					
	Mode 4: Zigbee Tx CH26_2480 MHz					
AC Conducted Emission	Mode 1: Zigbee Link + WLAN Link(2.4G) + L1+L2 light link + RS485 Link + AC Power					

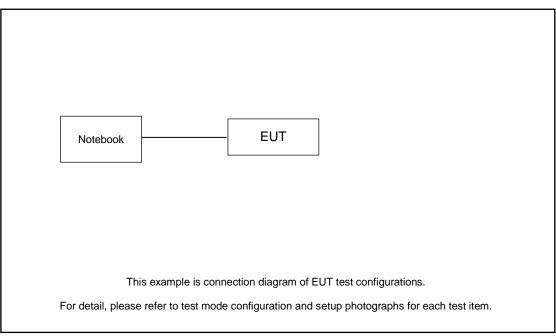


2.3 Connection Diagram of Test System

Conducted Emission:



Radiated Emission:





2.4 Support Unit used in test configuration and system

ltem	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
						shielded cable DC
1	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	O/P 1.8m ,
1.						Unshielded AC I/P
						cable 1.8m
2.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
3.	Light	NA	NA	NA	NA	NA
4.	AC Power	NA	NA	NA	NA	NA

2.5 EUT Operation Test Setup

For ZigBee function, the engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 5.80 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 5.80 + 10 = 15.80 (dB)



3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

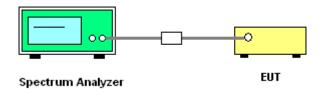
3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.1.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 11.8
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
- 5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 30kHz and set the Video bandwidth (VBW) = 100kHz.
- 6. Measure and record the results in the test report.

3.1.4 Test Setup





3.1.5 Test Result of 6dB Bandwidth

Test data refer to Appendix A.



6 dB Bandwidth Plot on Channel 11

Date: 28.JUL.2023 19:07:29

6 dB Bandwidth Plot on Channel 18



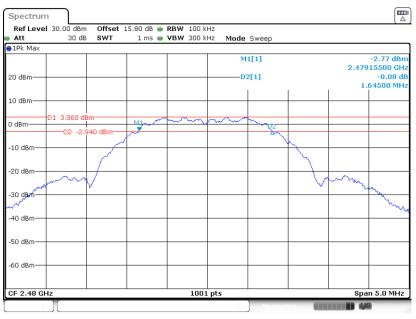




6 dB Bandwidth Plot on Channel 25

Date: 2.AUG.2023 15:36:26

6 dB Bandwidth Plot on Channel 26

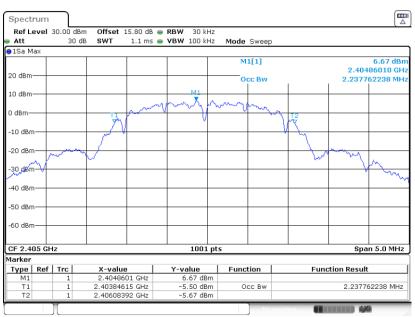


Date: 28.JUL.2023 19:14:35



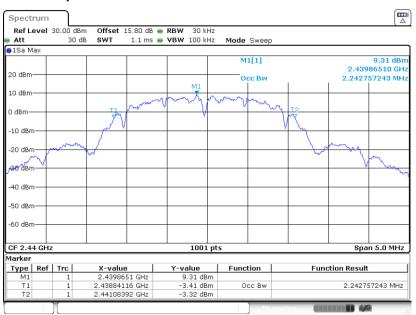
3.1.6 Test Result of 99% Occupied Bandwidth

Test data refer to Appendix A.



99% Bandwidth Plot on Channel 11

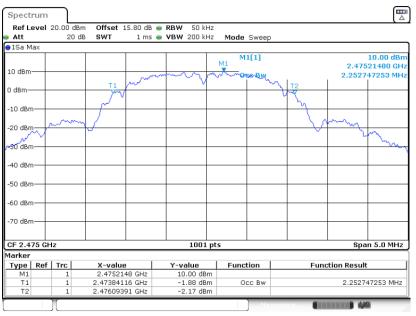
Date: 28.JUL.2023 19:09:15



99% Occupied Bandwidth Plot on Channel 18

Date: 28.JUL.2023 19:13:06

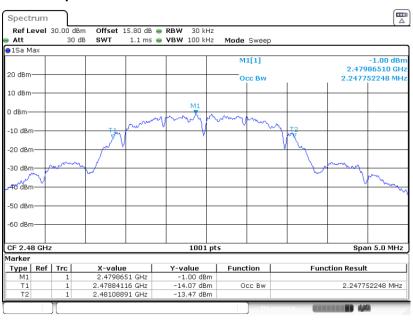




99% Occupied Bandwidth Plot on Channel 25

Date: 2.AUG.2023 15:38:13

99% Occupied Bandwidth Plot on Channel 26



Date: 28.JUL.2023 19:16:21

Note : The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



3.2 Output Power Measurement

3.2.1 Limit of Peak Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

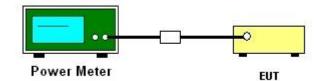
3.2.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.2.3 Test Procedures

- The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM method.
- 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Test data refers to Appendix A.

3.2.6 Test Result of Average Output Power (Reporting Only)

Test data refers to Appendix A.



3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

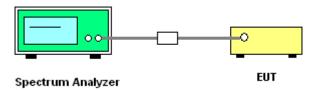
3.3.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.3.3 Test Procedures

- 1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz.
 Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
- 5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
- 6. Measure and record the results in the test report.
- 7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup

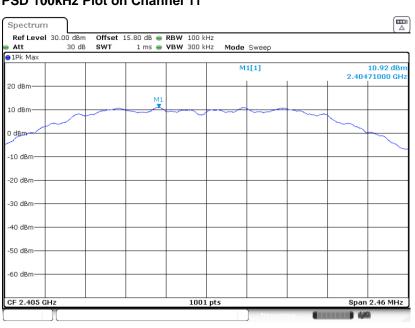


3.3.5 Test Result of Power Spectral Density

Test data refers to Appendix A.



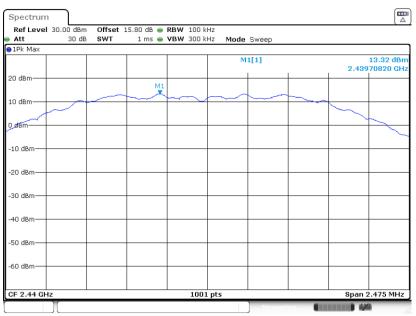
3.3.6 Test Result of Power Spectral Density Plots (100kHz)



PSD 100kHz Plot on Channel 11

Date: 28.JUL.2023 19:08:07

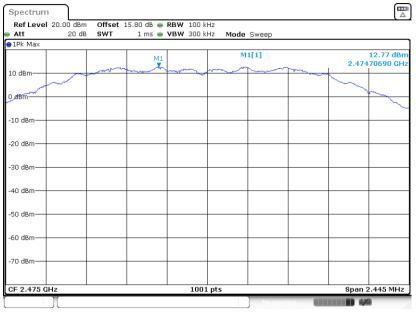
PSD 100kHz Plot on Channel 18



Date: 28.JUL.2023 19:12:17

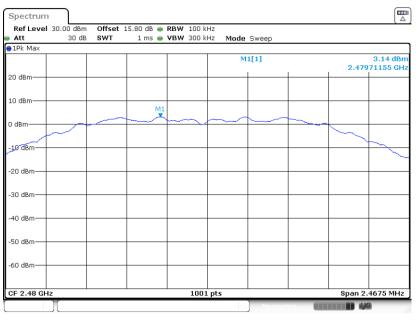


PSD 100kHz Plot on Channel 25



Date: 2.AUG.2023 15:37:04

PSD 100kHz Plot on Channel 26



Date: 28.JUL.2023 19:15:13



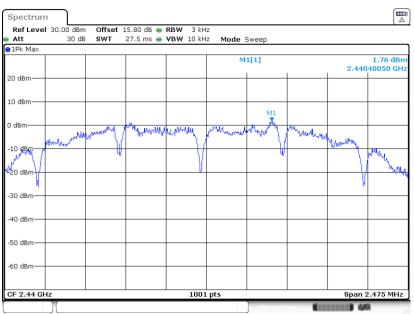
3.3.7 Test Result of Power Spectral Density Plots (3kHz)



PSD 3kHz Plot on Channel 11

Date: 28.JUL.2023 19:07:48

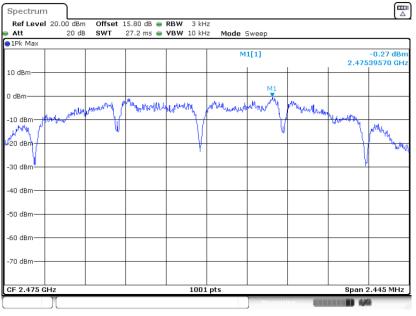
PSD 3kHz Plot on Channel 18



Date: 28.JUL.2023 19:11:58

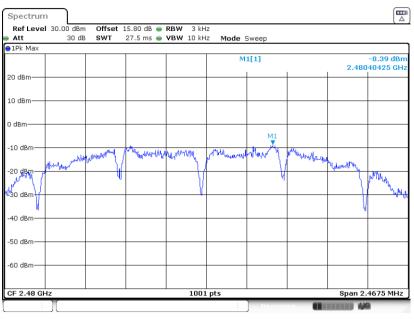


PSD 3kHz Plot on Channel 25



Date: 25.AUG.2023 16:52:20

PSD 3kHz Plot on Channel 26



Date: 28.JUL.2023 19:14:54



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

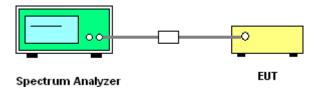
3.4.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.4.3 Test Procedure

- 1. The testing follows ANSI C63.10-2013 clause 11.13
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
- 5. Measure and record the results in the test report.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup





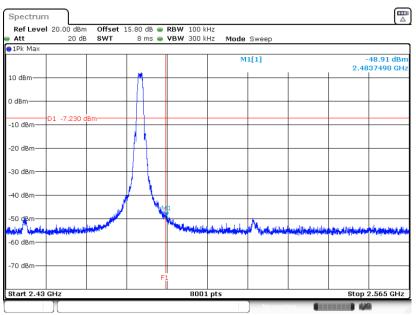
3.4.5 Test Result of Conducted Band Edges Plots

Spectrum Ref Level 30.00 dBm Offset 15.80 dB 🖷 RBW 100 kHz Att 30 dB SWT 8 ms 👄 **VBW** 300 kHz Mode Sweep ●1Pk Max M1[1] -42.17 dBn 2.3998400 GHa 20 dBm 10 dBm 0 dBm -10 dBm D1 -9.080 -20 dBm -30 dBm -40 dBrr للطليقات -50 dBr -60 dBm Fİ Start 2.31 GHz 8001 pts Stop 2.445 GHz n

Low Band Edge Plot on Channel 11

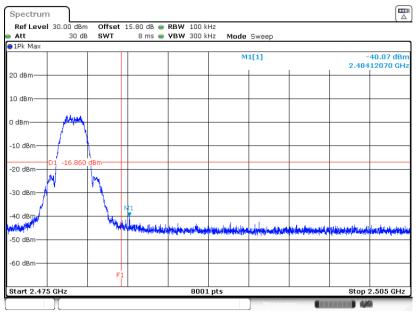
Date: 28.JUL.2023 19:09:40





Date: 2.AUG.2023 15:37:23





High Band Edge Plot on Channel 26

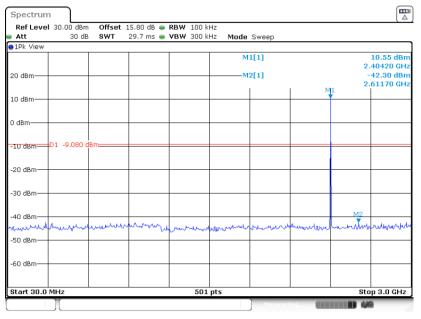
Date: 28.JUL.2023 19:16:43



3.4.6 Test Result of Conducted Spurious Emission Plots

Conducted Spurious Emission Plot on

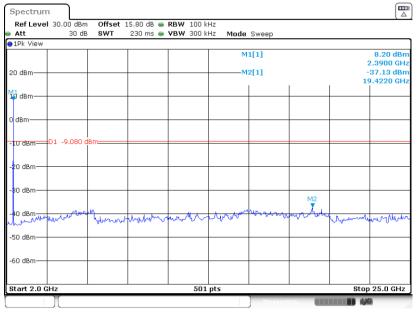
Zigbee Channel 11



Date: 28.JUL.2023 19:08:46

Conducted Spurious Emission Plot on

Zigbee Channel 11

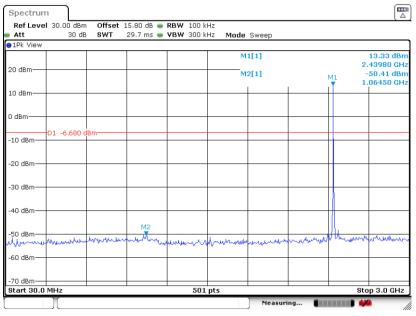


Date: 28.JUL.2023 19:09:06



Conducted Spurious Emission Plot on

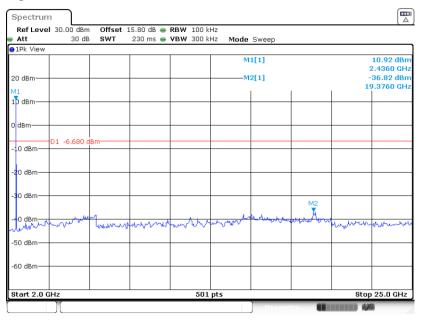
Zigbee Channel 18



Date: 3.AUG.2023 13:16:47

Conducted Spurious Emission Plot on

Zigbee Channel 18



Date: 28.JUL.2023 19:12:58



Conducted Spurious Emission Plot on

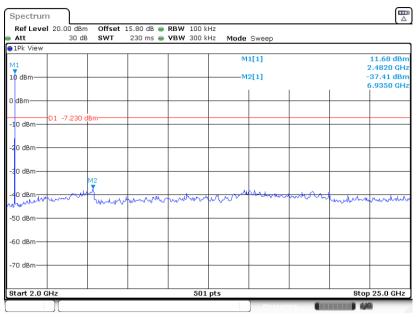
Zigbee Channel 25

Ref Level 20.00 Att 3		15.80 dB 👄 RBW 1 29.7 ms 👄 VBW 3		Sweep		
1Pk View						
			м	1[1]	M1	12.07 dBn 2.47540 GH
LO dBm			M	2[1]	Ť	-42.12 dBr
						525.00 MH
) dBm						
10 dBm 01 -7.2	230 dBm					
20 dBm						
30 dBm						
					11	
	12					
www.burnhet	the month	walnow for when	monum	amana	mounder	Munderwood
50 dBm						
60 dBm						
70 dBm						
Start 30.0 MHz			501 pts	· · · · ·		Stop 3.0 GHz

Date: 2.AUG.2023 15:37:44

Conducted Spurious Emission Plot on

Zigbee Channel 25



Date: 2.AUG.2023 15:38:04



Conducted Spurious Emission Plot on

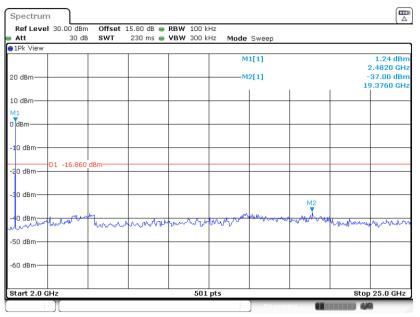
Zigbee Channel 26

Ref Level 30.		et 15.80 dB 👄 R				
Att	30 dB SW	Γ 29.7 ms 👄 V	BW 300 kHz Mo	de Sweep		
1Pk View				M1[1] -M2[1]		1.92 dBn 2.48130 GH: -41.85 dBn
10 dBm						2.79550 GH:
) dBm					M1	
10 dBm						
20 dBm 01	-16.860 dBm					
30 dBm						
40 dBm	manhahard	-molloude	hunnahala	in hunder	and abuild a survey by	M2
50 dBm			ana marine and			
60 dBm						
start 30.0 MHz	.		501 pts		s	top 3.0 GHz

Date: 28.JUL.2023 19:15:52

Conducted Spurious Emission Plot on

Zigbee Channel 26



Date: 28.JUL.2023 19:16:12



3.5 Spurious Emission Measurement in the Restricted Band

3.5.1 Limit of Spurious Emission Measurement in the Restricted Band

Emissions which fall in the restricted bands must also comply with the limits as below.

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.



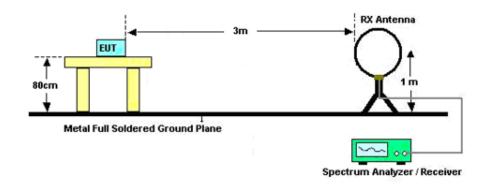
3.5.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
- 3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 5. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- For conducted spurious emission measurement in the restricted band, the RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 7. For measurement below 1GHz, if the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- 8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for f < 1 GHz; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \ge 1$ GHz for peak measurement. For average measurement:
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.



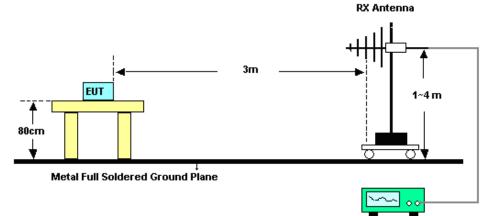
3.5.4 Test Setup

For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz

For radiated emissions above 1GHz



Spectrum Analyzer / Receiver

RX Antenna FUT 1.5m Metal Full Soldered Ground Plane

Spectrum Analyzer / Receiver

Sporton International Inc. (Kunshan) TEL : +86-512-57900158 FCC ID : 2BEWX-TPP05 Page Number: 30 of 36Report Issued Date: Jul. 23, 2024Report Version: Rev. 01Report Template No.: BU5-FR15CBT4.0 Version 2.0



3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

3.5.6 Test Results of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.5.7 Test Result of Cabinet Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.

3.5.8 Duty Cycle

Please refer to Appendix D.



3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBµV)		
Frequency of emission (MHZ)	Quasi-peak	Average	
0.15-0.5	66 to 56*	56 to 46*	
0.5-5	56	46	
5-30	60	50	

*Decreases with the logarithm of the frequency.

3.6.2 Measuring Instruments

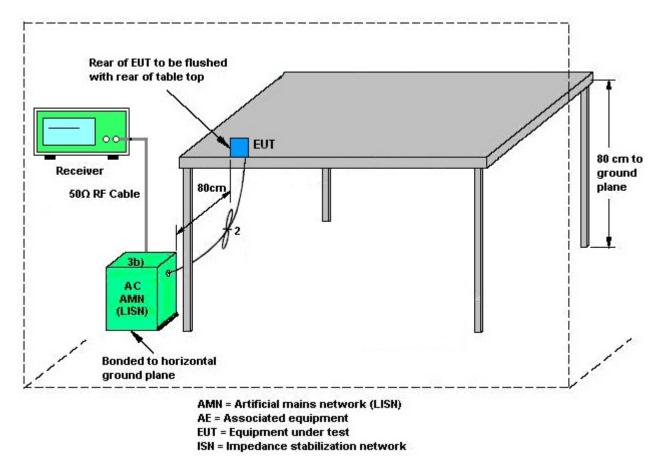
The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.6.3 Test Procedures

- The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.



3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 16, 2023	Aug. 11, 2023	May 15, 2024	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 13, 2022	Aug. 11, 2023	Oct. 12, 2023	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 16, 2023	Aug. 11, 2023	May 15, 2024	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2022	Aug. 11, 2023	Oct. 11, 2023	Conduction (CO01-KS)
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 12, 2022	Jul. 28, 2023~ Aug. 02, 2023	Oct. 11, 2023	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 05, 2023	Jul. 28, 2023~ Aug. 02, 2023	Jan. 04, 2024	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2023	Jul. 28, 2023~ Aug. 02, 2023	Jan. 04, 2024	Conducted (TH01-KS)
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz;Max 30dBm	Oct. 12, 2022	Jul. 28, 2023~ Aug. 28, 2023	Oct. 11, 2023	Radiation (03CH07-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY553705 28	10Hz-44G,MAX 30dB	Oct. 12, 2022	Jul. 28, 2023~ Aug. 28, 2023	Oct. 11, 2023	Radiation (03CH07-KS)
Loop Antenna	R&S	HFH2-Z2E	101125	9kHz~30MHz	Sep. 22, 2022	Jul. 28, 2023~ Aug. 28, 2023	Sep. 21, 2023	Radiation (03CH07-KS)
Bilog Antenna	TeseQ	CBL6111D	59913	30MHz-1GHz	Aug. 12, 2023	Jul. 28, 2023~ Aug. 28, 2023	Aug. 11, 2024	Radiation (03CH07-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218642	1GHz~18GHz	Apr. 06, 2023	Jul. 28, 2023~ Aug. 28, 2023	Apr. 05, 2024	Radiation (03CH07-KS)
high gain Amplifier	EM	EM01G18GA	060840	1Ghz-18Ghz	Oct. 12, 2022	Jul. 28, 2023~ Aug. 28, 2023	Oct. 11, 2023	Radiation (03CH07-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Oct. 17, 2022	Jul. 28, 2023~ Aug. 28, 2023	Oct. 16, 2023	Radiation (03CH07-KS)
Amplifier	SONOMA	310N	413740	9KHz-1GHz	Jan. 05, 2023	Jul. 28, 2023~ Aug. 28, 2023	Jan. 04, 2024	Radiation (03CH07-KS)
Amplifier	EM	EM01G18GA	060834	1Ghz-18Ghz	Oct. 12, 2022	Jul. 28, 2023~ Aug. 28, 2023	Oct. 11, 2023	Radiation (03CH07-KS)
Amplifier	EM	EM18G40GG A	060851	18~40GHz	Jan. 05, 2023	Jul. 28, 2023~ Aug. 28, 2023	Jan. 04, 2024	Radiation (03CH07-KS)
AC Power Source	Chroma	61601	616010002 473	N/A	NCR	Jul. 28, 2023~ Aug. 28, 2023	NCR	Radiation (03CH07-KS)
Turn Table	EM	EM 1000-T	N/A	0~360 degree	NCR	Jul. 28, 2023~ Aug. 28, 2023	NCR	Radiation (03CH07-KS)
Antenna Mast	EM	EM 1000-A	N/A	1 m~4 m	NCR	Jul. 28, 2023~ Aug. 28, 2023	NCR	Radiation (03CH07-KS)

NCR: No Calibration Required



5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Test Item	Uncertainty
Conducted Power	±0.46 dB
Conducted Emissions	±2.26 dB
Occupied Channel Bandwidth	±0.001 %
Conducted Power Spectral Density	±0.88 dB

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence	2.94 dB
of 95% (U = 2Uc(y))	2.54 UB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a L of 95% (U = 2U		6.20 dB
	(y /)	

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.86 dB
--	---------

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence	5.24 dB
of 95% (U = 2Uc(y))	5.24 dB

----- THE END ------



Appendix A. Conducted Test Results

Report Number : FR372501-02B

Test Engineer:	Jacob Zhang	Temperature:	20~26	°C
Test Date:	2023/7/28~2023/8/2	Relative Humidity:	40~51	%

	<u>TEST RESULTS DATA</u> 6dB and 99% Occupied Bandwidth								
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail	
Zigbee	250K	1	11	2405	2.24	1.64	0.50	Pass	
Zigbee	250K	1	18	2440	2.24	1.65	0.50	Pass	
Zigbee	250K	1	25	2475	2.25	1.63	0.50	Pass	
Zigbee	250K	1	26	2480	2.25	1.65	0.50	Pass	

<u>TEST RESULTS DATA</u>	
<u>Peak Power Table</u>	

Mod.	Data Rate	N⊤x	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
Zigbee	250K	1	11	2405	14.95	30.00	-0.95	14.00	36.00	Pass
Zigbee	250K	1	18	2440	17.29	30.00	-0.95	16.34	36.00	Pass
Zigbee	250K	1	25	2475	15.47	30.00	-0.95	14.52	36.00	Pass
Zigbee	250K	1	26	2480	6.89	30.00	-0.95	5.94	36.00	Pass

TEST RESULTS DATA Average Power Table (Reporting Only)

Mod.	Data Rate	Ντx	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
Zigbee	250K	1	11	2405	0.00	14.87
Zigbee	250K	1	18	2440	0.00	17.18
Zigbee	250K	1	25	2475	0.00	15.28
Zigbee	250K	1	26	2480	0.00	6.74

Mod. Data Rate NTX CH. Freq. (MHz) Peak PSD (dBm /100kHz) Peak PSD (dBm /3kHz) DG Peak PSD Limit (dBm /3kHz) Peak/PSD (dBm /3kHz) Peak/PSD (dBm /3kHz) Peak/PSD (dBm /3kHz) Peak/PSD (dBm
Zigbee 250K 1 11 2405 10.92 -0.56 -0.95 8.00 Pass
Zigbee 250K 1 18 2440 13.32 1.76 -0.95 8.00 Pass
Zigbee 250K 1 25 2475 12.77 -0.27 -0.95 8.00 Pass
Zigbee 250K 1 26 2480 3.14 -8.39 -0.95 8.00 Pass

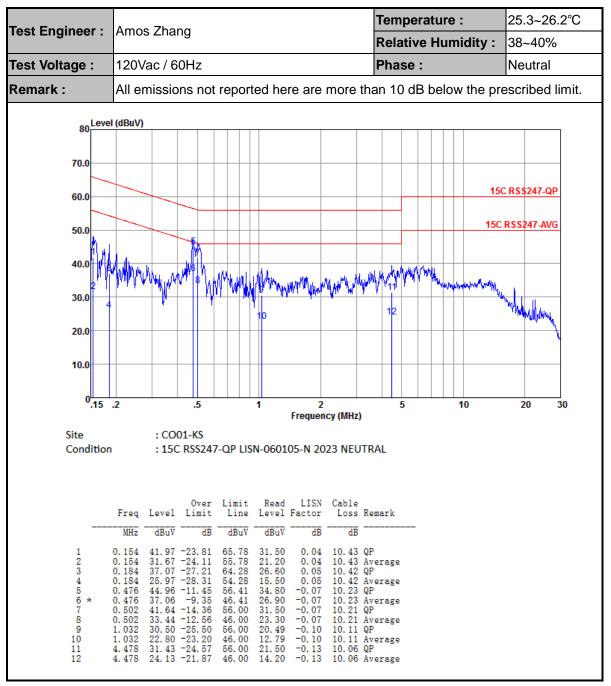
Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc limit.



Appendix B. AC Conducted Emission Test Results

Tost Engineer	Amos Zhang	Temperature :	25.3~26.2°C
Test Engineer :	Amos Zhang	Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Remark :	All emissions not reported here are more the	nan 10 dB below the pr	escribed limit.
Leve	el (dBuV)		
80			
70.0			
60.0		15	C RSS247-QP
		15C	RSS247-AVG
50.0			
40.0			
30.0 2	TT TY VINA VITY & NAMAJAN JAHANA JAMANAMATA	My MAN Hall	
30.0		1012	MANNIN .
20.0			
10.0			
0 ^L .15	.2 .5 1 2 Frequency (MHz)	5 10	20 30
Site	: CO01-KS		
Condition			
	Over Limit Read LISN Cable Freq Level Limit Line Level Factor Loss F	lemark	
1 2 3	0.162 41.67 -23.71 65.38 31.20 0.04 10.43 0 0.162 28.97 -26.41 55.38 18.50 0.04 10.43 A		
4 *	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	verage	
5 6 7	0.507 42.38 -13.62 56.00 32.20 -0.03 10.21 0 0.507 34.38 -11.62 46.00 24.20 -0.03 10.21 A 1.100 32.50 -23.50 56.00 22.51 -0.11 10.10 0	lverage	
8 9	1.100 25.50 -20.50 46.00 15.51 -0.11 10.10 A 4.092 30.44 -25.56 56.00 20.50 -0.12 10.06 Q	lverage P	
10 11 12	4.092 22.14 -23.86 46.00 12.20 -0.12 10.06 A 4.574 32.13 -23.87 56.00 22.20 -0.13 10.06 A 4.574 22.53 -23.47 46.00 12.60 -0.13 10.06 A	P	
12			





Note:

- 1. Level(dB μ V) = Read Level(dB μ V) + LISN Factor(dB) + Cable Loss(dB)
- 2. Over Limit(dB) = Level(dB μ V) Limit Line(dB μ V)



Appendix C. Radiated Spurious Emission Test Data

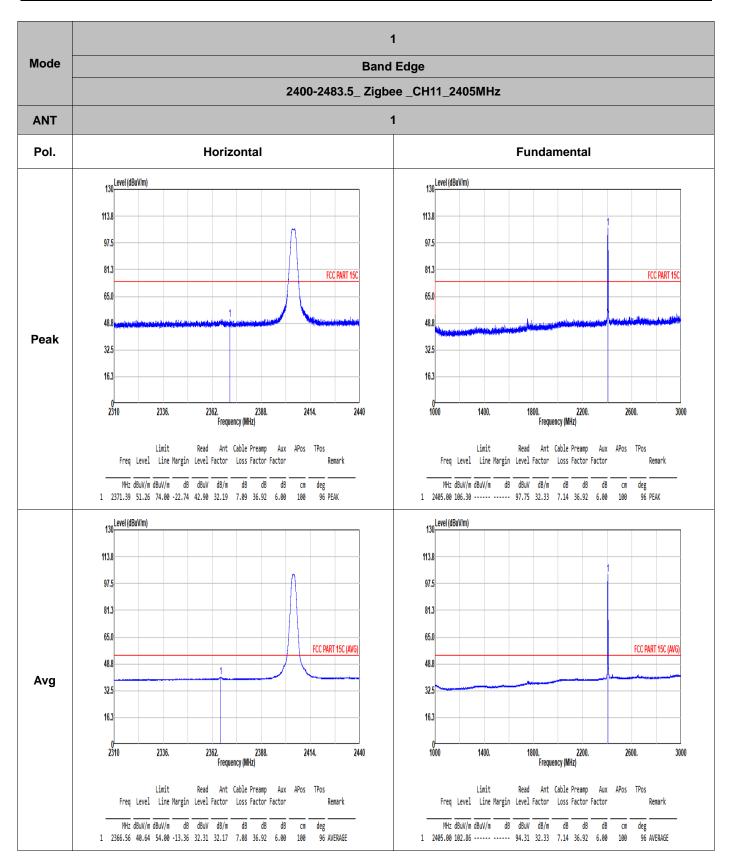
Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	Remark
Mode 1	2400-2483.5	1	Zigbee	11	2405	250Kbps	-
Mode 2	2400-2483.5	1	Zigbee	18	2440	250Kbps	-
Mode 3	2400-2483.5	1	Zigbee	26	2480	250Kbps	-
Mode 4	2400-2483.5	1	Zigbee	25	2475	250Kbps	
Mode 5	2400-2483.5	1	Zigbee	26	2480	250Kbps	LF

Radiated Spurious Emission Test Mode

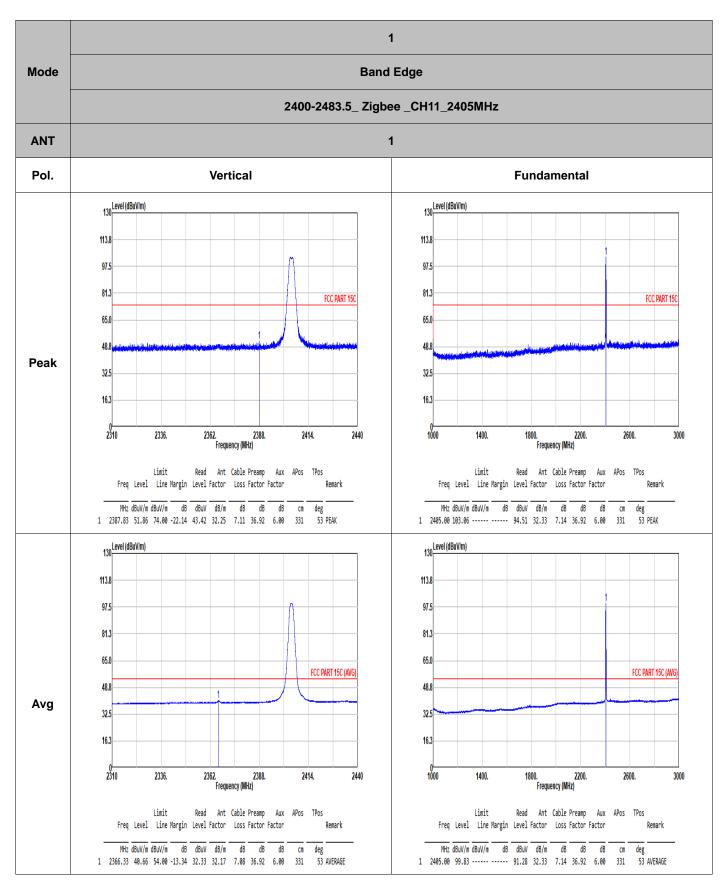
Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	Zigbee	11	2366.33	40.66	54.00	-13.34	V	AVERAGE	Pass	Band Edge
1	Zigbee	11	5014.00	40.22	54.00	-13.78	V	Average	Pass	Harmonic
2	Zigbee	18	-	-	-	-	-	-	-	Band Edge
2	Zigbee	18	7321.00	44.21	54.00	-9.79	V	Average	Pass	Harmonic
3	Zigbee	26	2483.52	50.61	54.00	-3.39	Н	AVERAGE	Pass	Band Edge
3	Zigbee	26	7440.00	39.44	54.00	-14.56	V	Average	Pass	Harmonic
4	Zigbee	25	2483.50	46.30	54.00	-7.70	н	AVERAGE	Pass	Band Edge
4	Zigbee	25	7425.00	51.42	54.00	-3.50	V	Average	Pass	Harmonic
5	Zigbee	26	62.01	33.96	40	-6.04	V	PEAK	Pass	LF

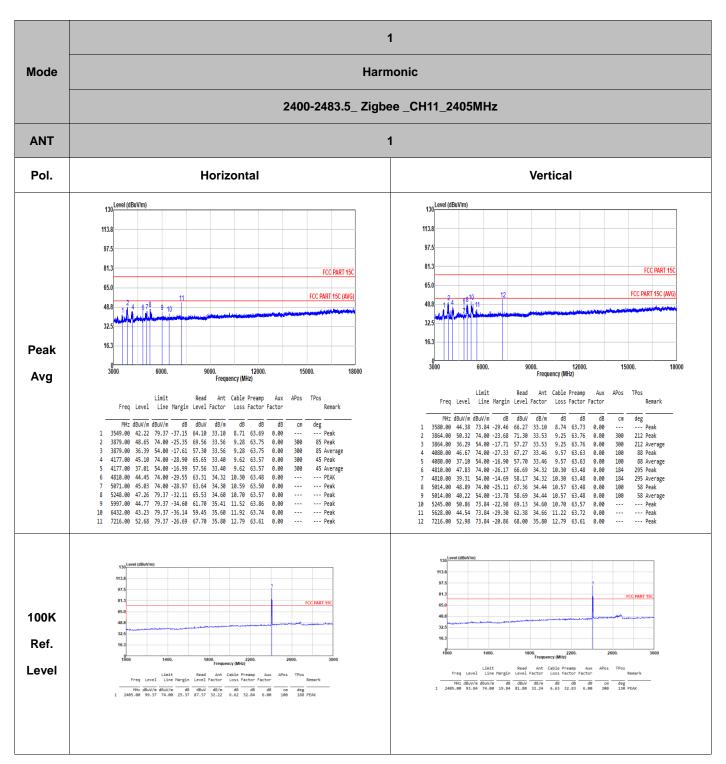




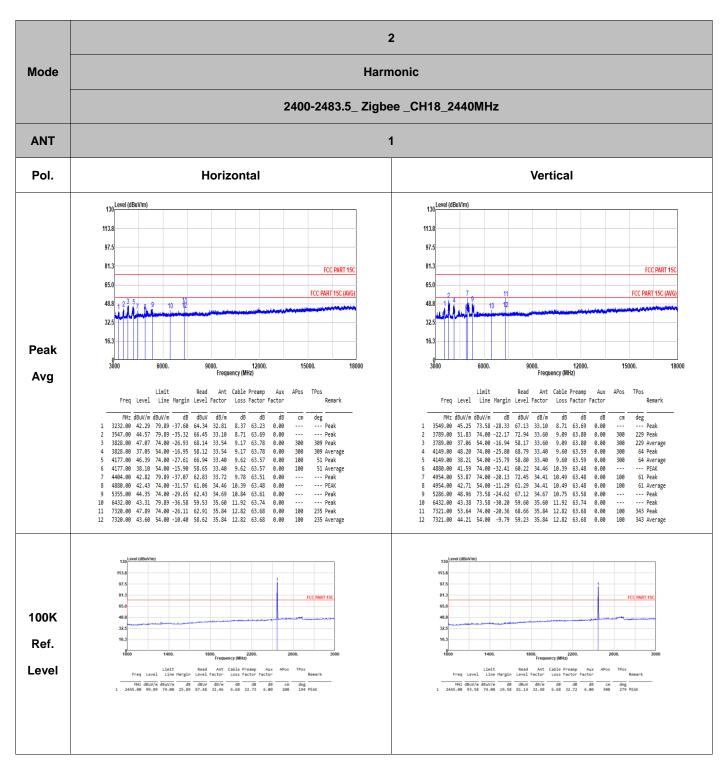




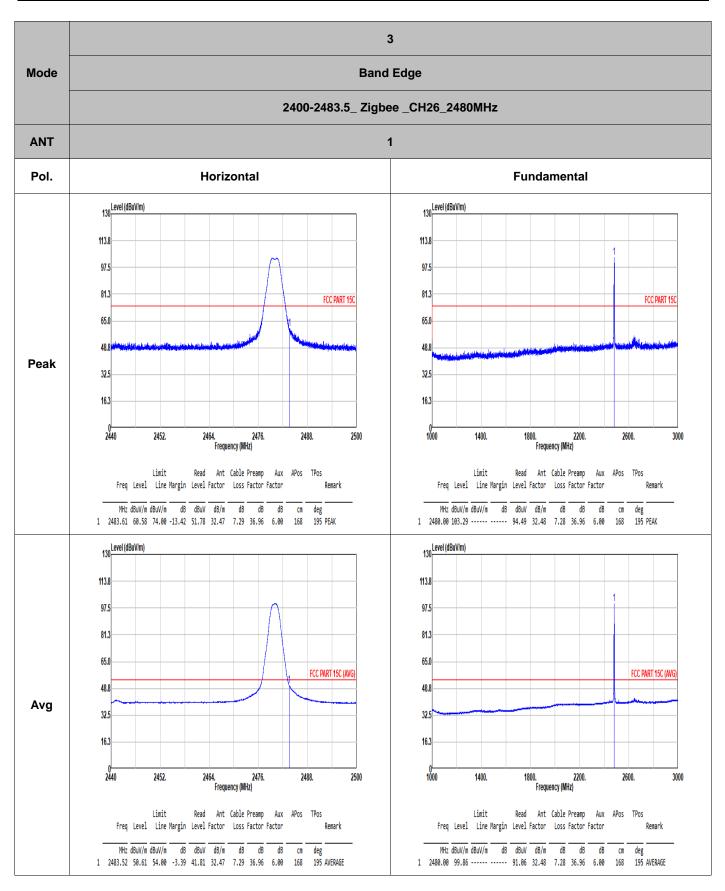






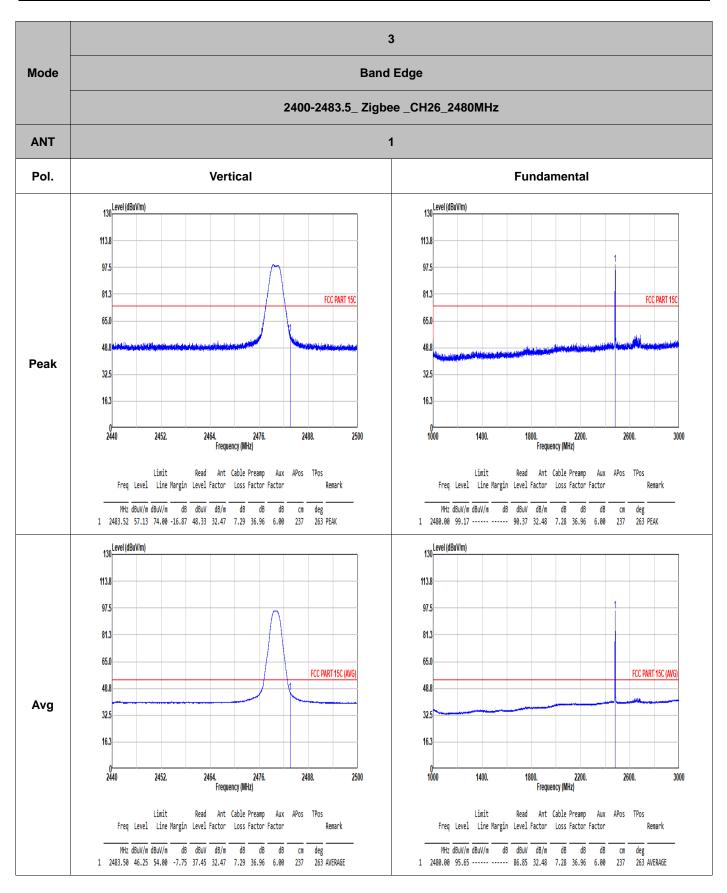






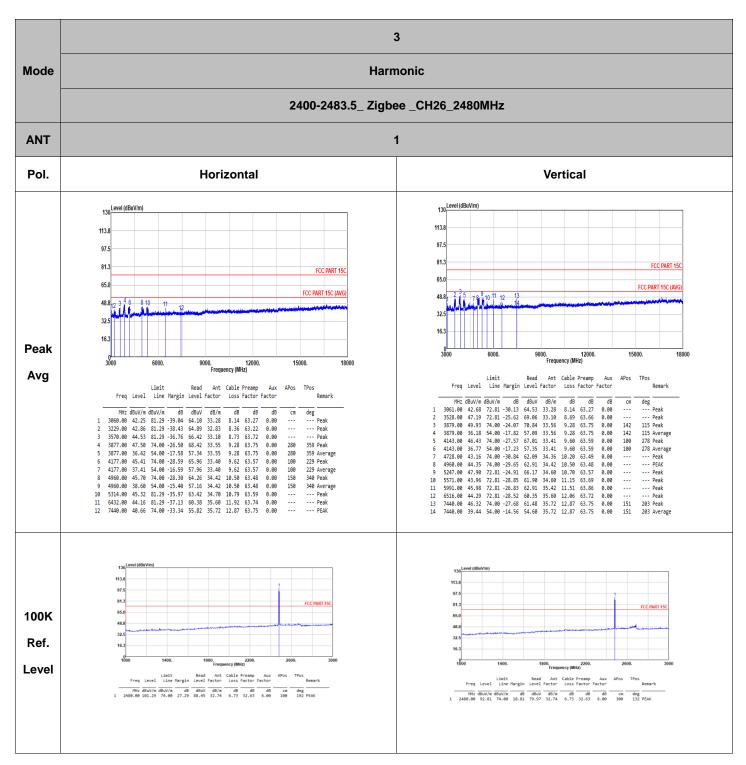
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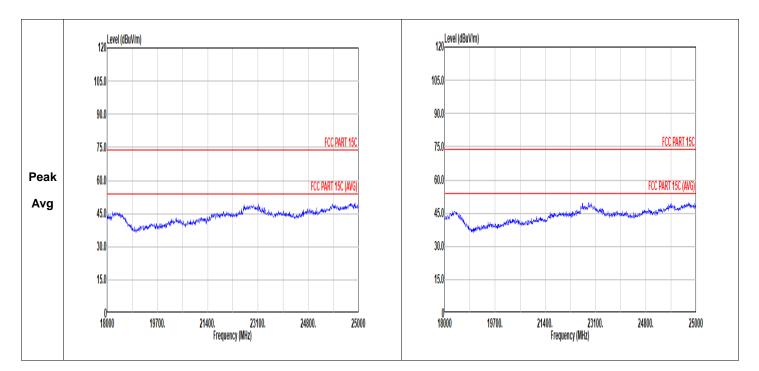


Sporton International Inc. (Kunshan) TEL : +86-512-57900158 FCC ID : 2BEWX-TPP05

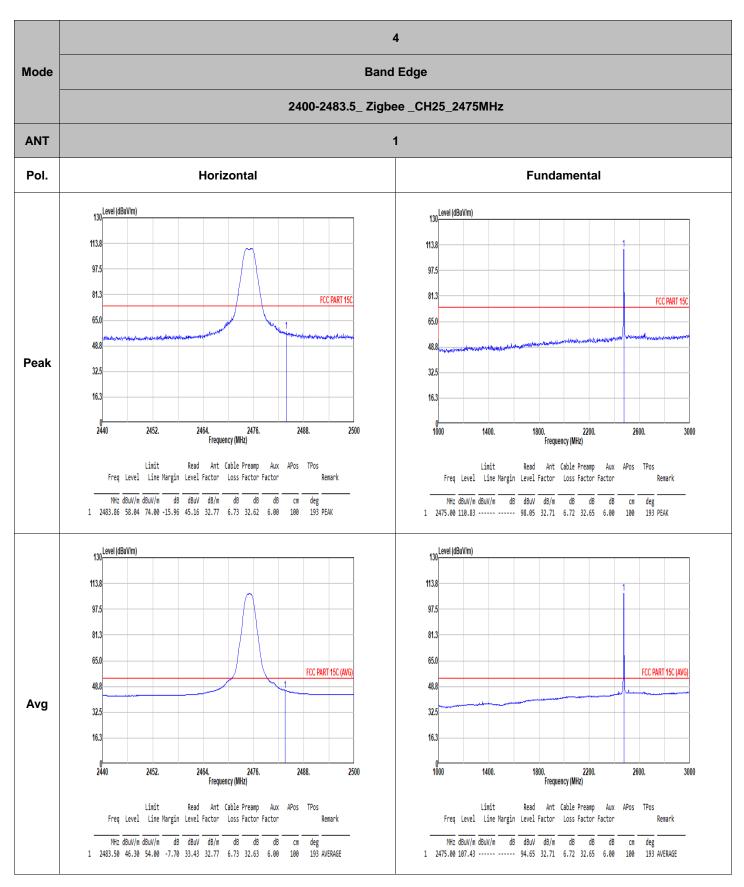






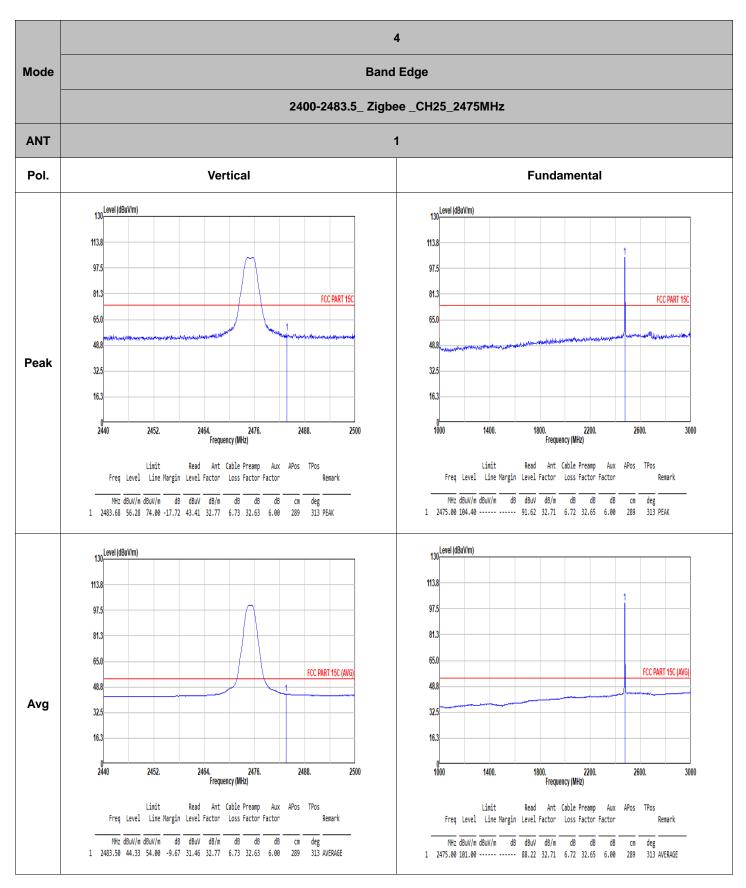




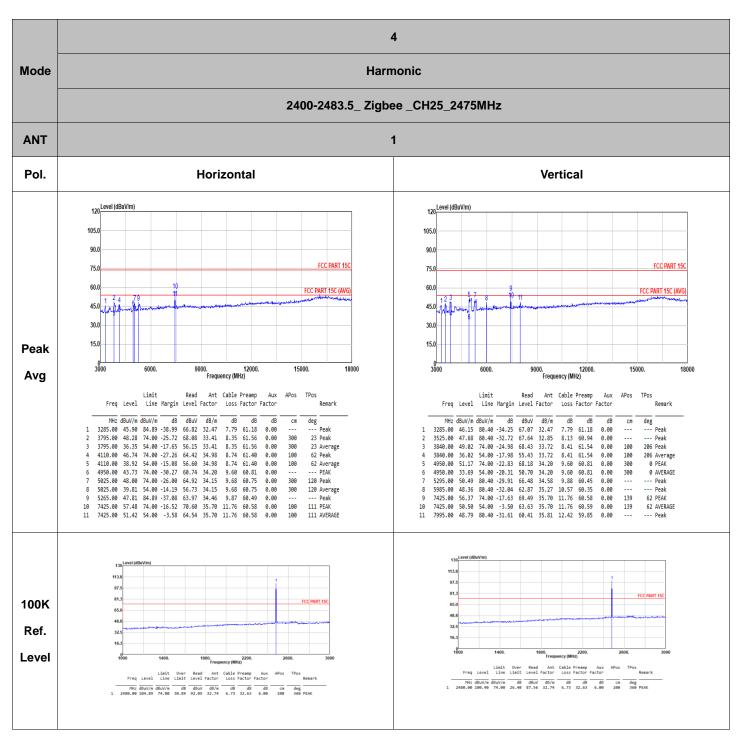


Sporton International Inc. (Kunshan) TEL : +86-512-57900158 FCC ID : 2BEWX-TPP05

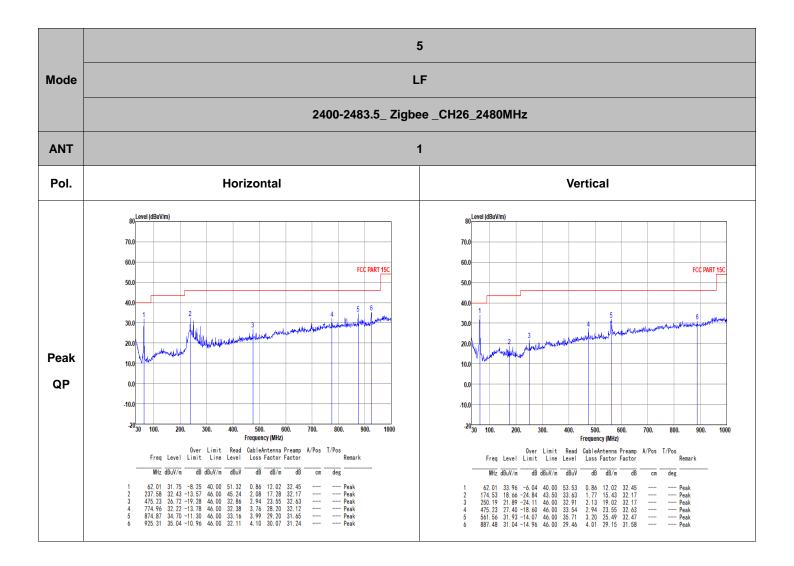














Appendix D. Duty Cycle Plots

Mode	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
Zigbee	100	-	-	10Hz

Zigbee mode

Spectrum Ref Level 35.80 dBm Off	set 15.80 dB 👄 RB	U 1 MU>		
Att 30 dB = SW				
SGL				
1Pk Max				
30 dBm				
20 dBm				 +
				-
LO dBm				
) dBm				
10 dBm				+
-20 dBm				+
-30 dBm				+
40 dBm				 -
-50 dBm				
60 dBm				+
CF 2.44 GHz		691 pts		2.0 ms/
			Ready	

Date: 28.JUL.2023 18:26:42