

# TEST REPORT

**Product Name** : BEEBEST Q bluetooth intercom communication system  
**Model Number** : BE700  
**FCC ID** : 2BCYIBE700

**Prepared for** : HONGKONG BEEBEST INFORMATION TECHNOLOGY CO., LIMITED  
**Address** : WORKSHOP 60, 3/F, BLOCK A, EAST SUN INDUSTRIAL CENTRE NO. 16 SHING YIP STREET KOWLOON Hong Kong

**Prepared by** : EMTEK (SHENZHEN) CO., LTD.  
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**Report Number** : ENS2306190211W00203R  
**Date(s) of Tests** : July 1, 2023 to November 29, 2023  
**Date of issue** : December 1, 2023

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## 1 TEST RESULT CERTIFICATION

Applicant : HONGKONG BEEBEST INFORMATION TECHNOLOGY CO., LIMITED  
Address : WORKSHOP 60, 3/F, BLOCK A, EAST SUN INDUSTRIAL CENTRE NO. 16 SHING YIP STREET KOWLOON Hong Kong  
Manufacturer : Xi'an Fengyu Information Technology Co., Ltd.  
Address : Room A-506, STRC, Zhangba Subdistrict Office, High-tech Zone, Xi'an, Shaanxi, China  
EUT : BEEBEST Q bluetooth intercom communication system  
Model Name : BE700  
Trademark : **BEEBEST**


Measurement Procedure Used:


APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 2, Subpart J	PASS
FCC 47 CFR Part 15, Subpart C	


The above equipment was tested by SHENZHEN EMTEK CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2014) and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.247

The test results of this report relate only to the tested sample identified in this report.

Date of Test : July 1, 2023 to November 29, 2023

Prepared by :   
Una Yu /Editor

Reviewer :   
Joe Xia/Editor

Approve & Authorized Signer :   
Lisa Wang/Manager



## 2 EUT TECHNICAL DESCRIPTION

Characteristics	Description
Device Type:	2.4G ISM Band
Standards:	IEEE802.15.4
Modulation:	ZIGBEE
Operating Frequency Range(s):	2405-2480MHz
Number of Channels:	16 Channels
Channel Separation:	5MHz
Transmit Power Max:	19.18 dBm
Antenna Type :	PCB Antenna
Antenna Gain:	0.49 dBi
Power supply:	DC 5V from Type-C port DC 3.7V from battery
Date of Received:	June 30, 2023
Temperature Range:	0°C ~ +45°C

**Note:** for more details, please refer to the User's manual of the EUT.

### 3 SUMMARY OF TEST RESULT

FCC Part Clause	Test Parameter	Verdict	Remark
15.247(a)(2)	DTS (6dB) Bandwidth	PASS	
15.247(b)(3)	Maximum Peak Conducted Output Power	PASS	
15.247(e)	Maximum Power Spectral Density Level	PASS	
15.247(d)	Unwanted Emission Into Non-Restricted Frequency Bands	PASS	
15.247(d) 15.209	Unwanted Emission Into Restricted Frequency Bands (conducted)	PASS	
15.247(d) 15.209	Radiated Spurious Emission	PASS	
15.207	Conducted Emission Test	PASS	
15.247(b)	Antenna Application	PASS	
NOTE1: N/A (Not Applicable) NOTE2: According to FCC OET KDB 558074, the report use radiated measurements in the restricted frequency bands. In addition, the radiated test is also performed to ensure the emissions emanating from the device cabinet also comply with the applicable limits.			

#### RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for **FCC ID: 2BCYIBE700** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.  
 The system is compliance with Subpart B is authorized under a DOC procedure

## 4 TEST METHODOLOGY

### 4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

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

FCC 47 CFR Part 2, Subpart J

FCC 47 CFR Part 15, Subpart C

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

### 4.2 MEASUREMENT EQUIPMENT USED

#### Conducted Emission Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
EMI Test Receiver	Rohde & Schwarz	ESCI	101384	2023/5/13	1Year
AMN	Rohde & Schwarz	ENV216	101161	2023/5/13	1Year

#### For Spurious Emissions Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
EMI Test Receiver	Rohde & Schwarz	ESU 26	100154	2023/5/13	1Year
Pre-Amplifie	Lunar EM	LNA30M3G-25	J10100000070	2023/5/13	1Year
Bilog Antenna	Schwarzbeck	VULB9163	659	2021/8/31	2 Year
Bilog Antenna	Schwarzbeck	VULB9163	659	2023/9/1	2 Year
Horn antenna	Schwarzbeck	BBHA9120D	9120D-1177	2023/5/12	2 Year
Pre-Amplifie	SKET	LNPA_0118G-45	SK2019051801	2023/5/10	1Year
Loop Antenna	Schwarzbeck	FMZB1519	1519-012	2023/5/12	2 Year
Spectrum Analyzer	Rohde & Schwarz	FSV40	100967	2023/5/10	1Year
Horn antenna	Schwarzbeck	BBHA9170	9170-399	2023/5/12	2 Year
Band reject Filter(50dB)	WI/DE	WRCGV-2400(2400-2485MHz)	2	2023/5/13	1 Year

#### For other test items:

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Wideband Radio Communication Tester	R&S	CMW500	171168	2022/9/13	1Year
Wideband Radio Communication Tester	R&S	CMW500	171168	2023/9/14	1Year
Frequency Extender	R&S	CMW-Z800A	100430	2022/11/1	1Year
Frequency Extender	R&S	CMW-Z800A	100430	2023/11/2	1Year
Spectrum Analyzer	R&S	FSV3044	101289	2022/9/13	1Year
Spectrum Analyzer	R&S	FSV3044	101289	2023/9/14	1Year
Analog Signal Generator	R&S	SMB100A	183237	2022/9/15	1Year
Analog Signal Generator	R&S	SMB100A	183237	2023/9/16	1Year
Vector Signal Generator	R&S	SMM100A	101808	2022/9/15	1Year
Vector Signal Generator	R&S	SMM100A	101808	2023/9/16	1Year
RF Control Unit(Power Meter)	Tonscend	JS0806-2	22C8060567	2022/9/13	1Year
RF Control Unit(Power Meter)	Tonscend	JS0806-2	22C8060567	2023/9/14	1Year
Temperature&Humidity Chamber	ESPEC	EL-02KA	12107166	2023/5/10	1 Year

#### 4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

☒ Frequency and Channel list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2405	7	2435	13	2465
2	2410	8	2440	14	2470
3	2415	9	2445	15	2475
4	2420	10	2450	16	2480
5	2425	11	2455		
6	2430	12	2460		

☒ Test Frequency and Channel:

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2405	8	2440	16	2480

## 5 FACILITIES AND ACCREDITATIONS

### 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

Bldg 69, Majialong Industry Zone District, Nanshan District, Shenzhen, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

### 5.2 LABORATORY ACCREDITATIONS AND LISTINGS

#### Site Description

EMC Lab.	: <b>Accredited by CNAS</b> The Certificate Registration Number is L2291. The Laboratory has been assessed and proved to be in compliance with CNAS-CL01 (identical to ISO/IEC 17025:2017)
	<b>Accredited by FCC</b> Designation Number: CN1204 Test Firm Registration Number: 882943
	<b>Accredited by A2LA</b> The Certificate Number is 4321.01.
	Accredited by Industry Canada The Conformity Assessment Body Identifier is CN0008
Name of Firm	: EMTEK (SHENZHEN) CO., LTD.
Site Location	: Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China



## 6 TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Maximum Peak Output Power Test	$\pm 1.0\text{dB}$
Conducted Emissions Test	$\pm 2.0\text{dB}$
Radiated Emission Test	$\pm 2.0\text{dB}$
Power Density	$\pm 2.0\text{dB}$
Occupied Bandwidth Test	$\pm 1.0\text{dB}$
Band Edge Test	$\pm 3\text{dB}$
All emission, radiated	$\pm 3\text{dB}$
Antenna Port Emission	$\pm 3\text{dB}$
Temperature	$\pm 0.5^\circ\text{C}$
Humidity	$\pm 3\%$

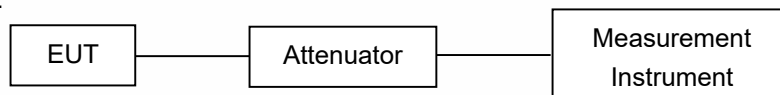
Measurement Uncertainty for a level of Confidence of 95%



## 7 SETUP OF EQUIPMENT UNDER TEST

### 7.1 RADIO FREQUENCY TEST SETUP 1

The ZIGBEE component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



### 7.2 RADIO FREQUENCY TEST SETUP 2

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.4. The test distance is 3m. The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.4-2014 and CAN/CSA-CEI/IEC CISPR 22.

Below 30MHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1 m above the ground. For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT.

Above 30MHz:

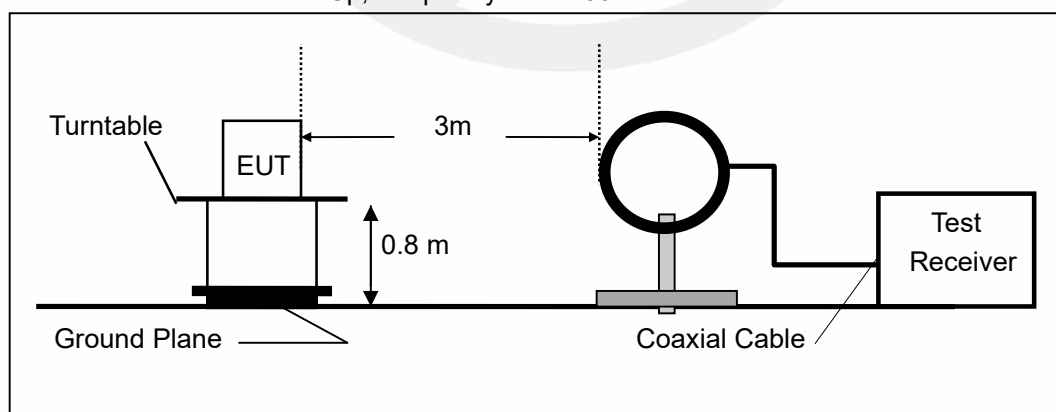
The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

Above 1GHz:

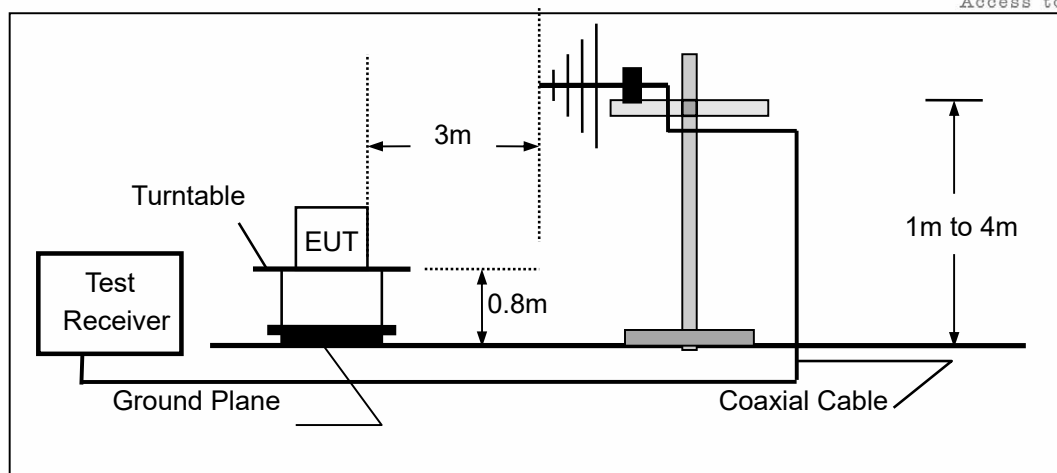
(Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.)

The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

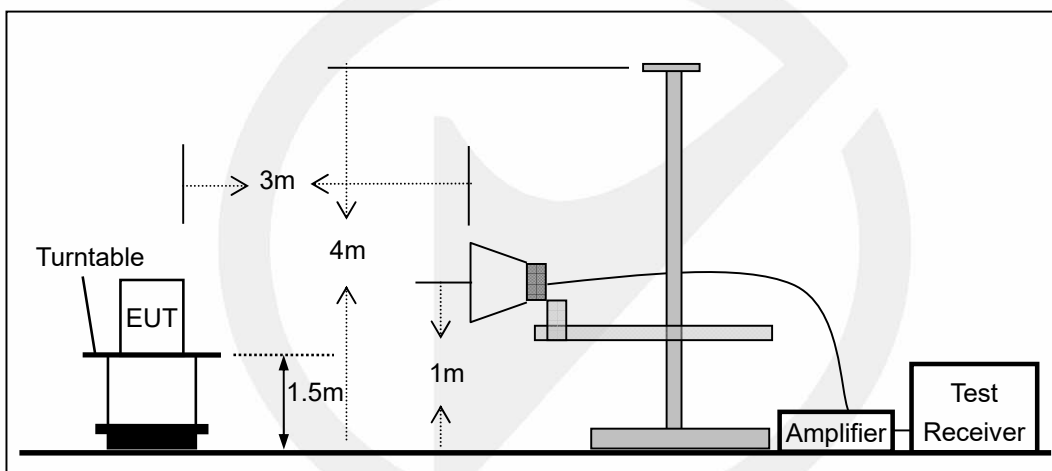
#### (a) Radiated Emission Test Set-Up, Frequency Below 30MHz



(b) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(c) Radiated Emission Test Set-Up, Frequency above 1000MHz

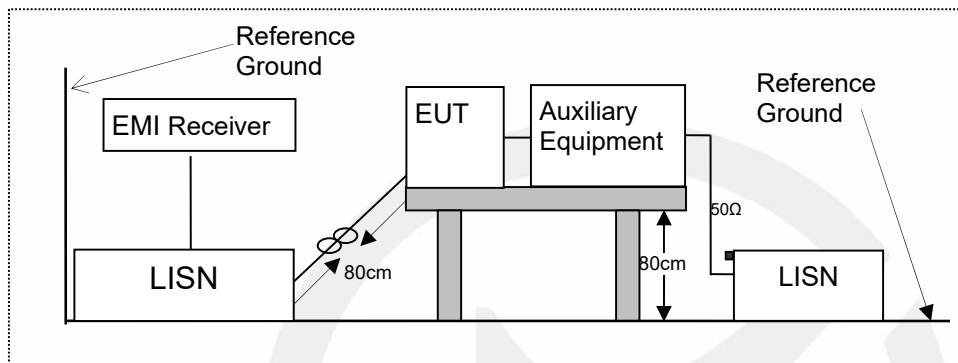


### 7.3 CONDUCTED EMISSION TEST SETUP

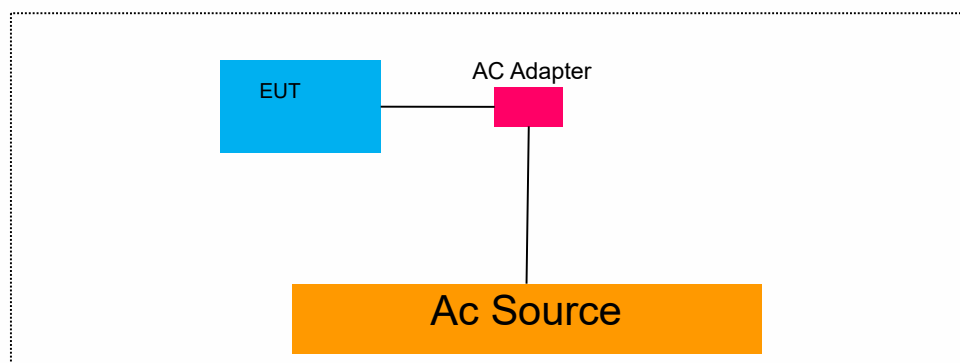
The mains cable of the EUT (maybe per AC/DC Adapter) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN.

Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.1 m.

According to the requirements in Section 13.1.4.1 of ANSI C63.4-2014 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.



## 7.4 BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM



## 7.5 SUPPORT EQUIPMENT

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/
/	/	/	/

### Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

## 8 TEST REQUIREMENTS

### 8.1 DTS (6DB) BANDWIDTH

#### Applicable Standard

According to FCC Part 15.247(a)(2) and KDB 558074 DTS 01 Meas. Guidance v04

#### Conformance Limit

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

#### Test Configuration

Test according to clause 7.1 radio frequency test setup 1

#### Test Procedure

The EUT was operating in ZIGBEE mode and controlled its channel. Printed out the test result from the spectrum by hard copy function.

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.

Set to the maximum power setting and enable the EUT transmit continuously

Set RBW = 100 kHz.

Set the video bandwidth (VBW) =300 kHz.

Set Span=2 times OBW

Set Detector = Peak.

Set Trace mode = max hold.

Set Sweep = auto couple.

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

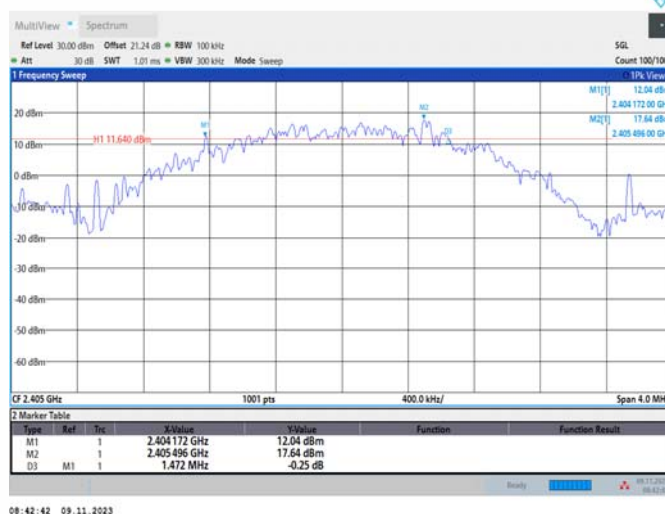
Measure and record the results in the test report.

#### Test Results

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

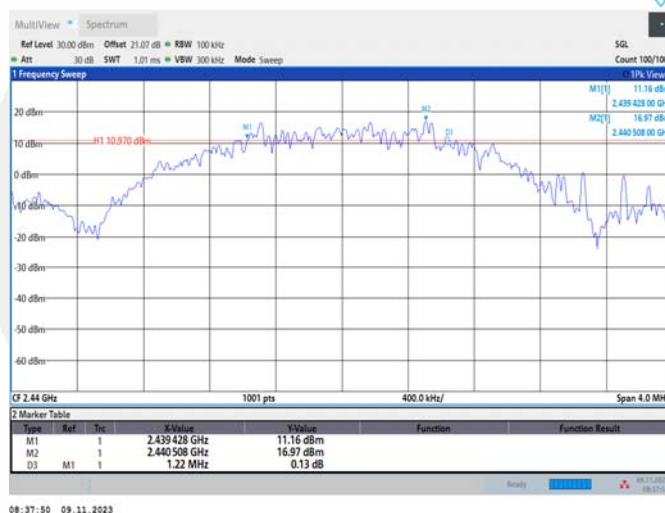
TestMode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
ZIGBEE	Ant1	2405	1.47	2404.17	2405.64	0.5	PASS
		2440	1.22	2439.43	2440.65	0.5	PASS
		2480	1.28	2479.40	2480.68	0.5	PASS

### ZIGBEE\_Ant1\_2405



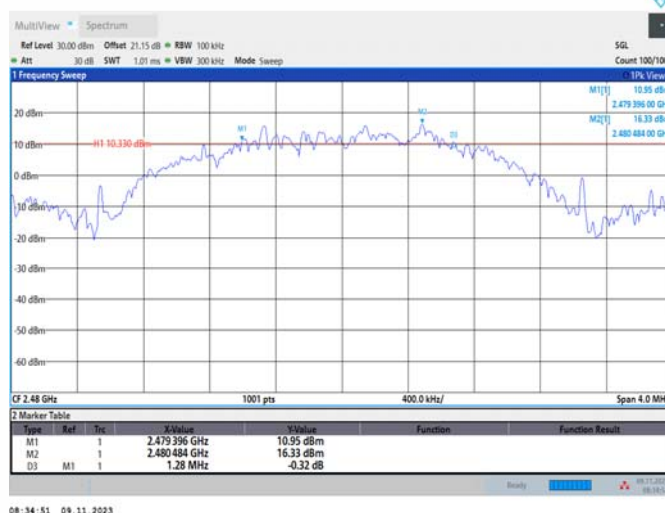
08:42:42 09.11.2023

### ZIGBEE\_Ant1\_2440



08:37:50 09.11.2023

### ZIGBEE\_Ant1\_2480



08:34:51 09.11.2023

## 8.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER

### 8.2.1 Applicable Standard

According to FCC Part 15.247(b)(3) and KDB 558074 DTS 01 Meas. Guidance v04

Conformance Limit

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 2400 - 2483.5 MHz bands shall not exceed: 1 Watt (30dBm).

### 8.2.2 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

### 8.2.3 Test Procedure

■ According to FCC Part 15.247(b)(3)

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

The testing follows FCC public Notice DA 00-705 Measurement Guidelines.

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.

Set to the maximum output power setting and enable the EUT transmit continuously.

Measure the conducted output power with cable loss and record the results in the test report.

Measure and record the results in the report.

■ According to FCC Part 15.247(b)(4):

Conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note: If antenna Gain exceeds 6 dBi, then Output power Limit = 30 - (Gain - 6)

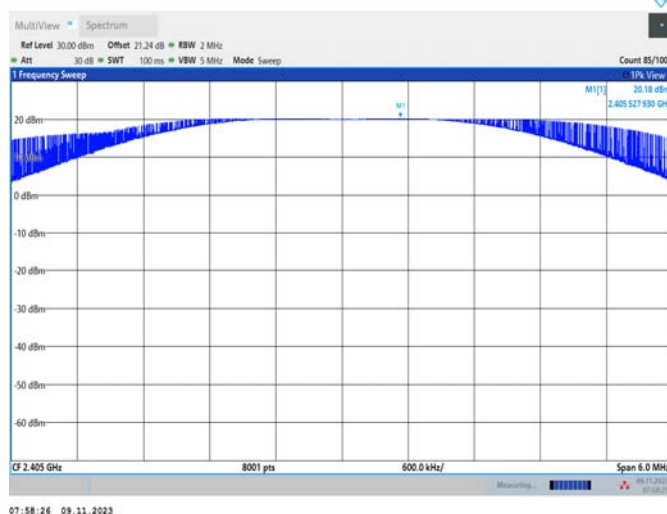
### 8.2.4 Test Results

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

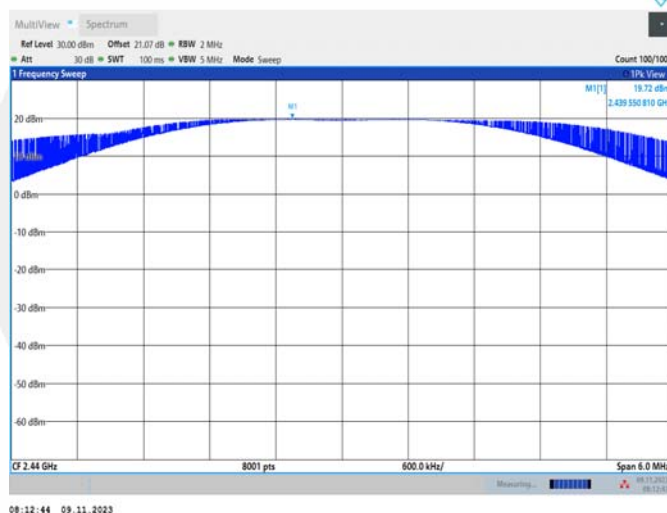
TestMode	Antenna	Frequency[MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	EIRP[dBm]	EIRP Limit[dBm]	Verdict
ZIGBEE	Ant1	2405	20.18	≤30	19.18	≤36	PASS
		2440	19.72	≤30	18.72	≤36	PASS
		2480	19.15	≤30	18.15	≤36	PASS



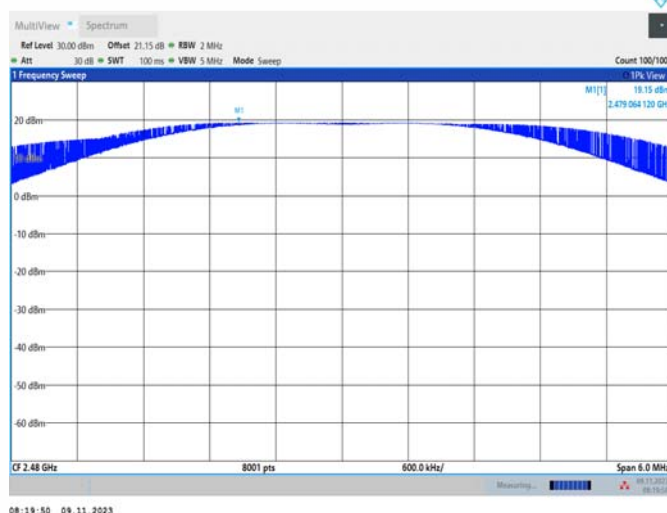
ZIGBEE\_Ant1\_2405



ZIGBEE\_Ant1\_2440



ZIGBEE\_Ant1\_2480



### 8.3 MAXIMUM POWER SPECTRAL DENSITY

#### 8.3.1 Applicable Standard

According to FCC Part 15.247(e) and KDB 558074 DTS 01 Meas. Guidance v04

#### 8.3.2 Conformance Limit

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

#### 8.3.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

#### 8.3.4 Test Procedure

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

The transmitter output (antenna port) was connected to the spectrum analyzer

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to: 3 kHz

Set the VBW to: 10 kHz.

Set Detector = peak.

Set Sweep time = auto couple.

Set Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

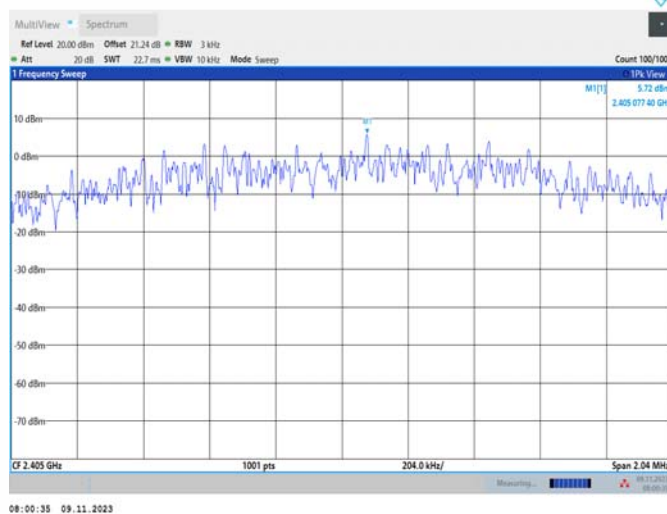
Note: If antenna Gain exceeds 6 dBi, then PSD Limit=8-(Gain - 6)

#### 8.3.5 Test Results

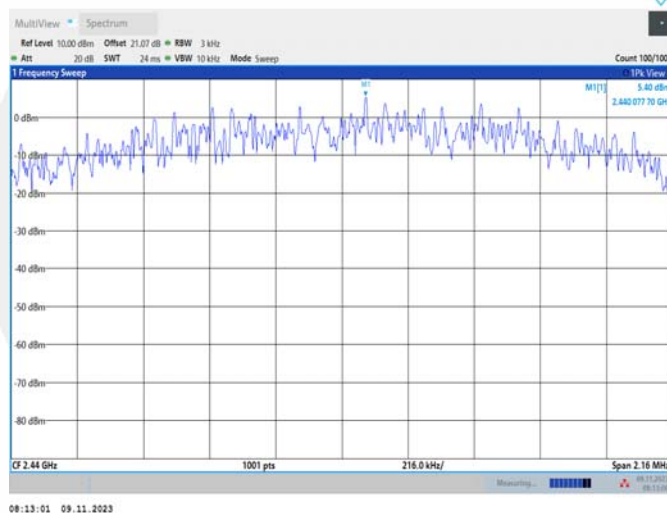
Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

TestMode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
ZIGBEE	Ant1	2405	5.72	≤8.00	PASS
		2440	5.40	≤8.00	PASS
		2480	3.95	≤8.00	PASS

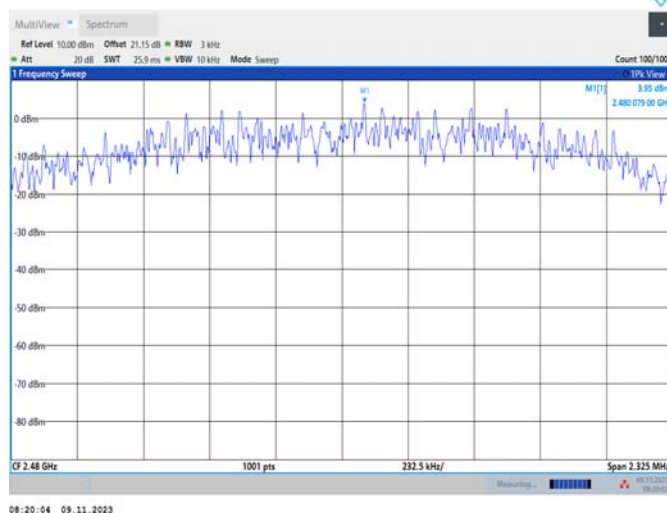
# ZIGBEE\_Ant1\_2405



# ZIGBEE\_Ant1\_2440



# ZIGBEE\_Ant1\_2480



## 8.4 UNWANTED EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS

### 8.4.1 Applicable Standard

According to FCC Part 15.247(d) and KDB 558074 DTS 01 Meas. Guidance v04

### 8.4.2 Conformance Limit

According to FCC Part 15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

### 8.4.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

### 8.4.4 Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer

#### ■ Reference level measurement

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to  $\geq 1.5$  times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW  $\geq 3 \times$  RBW.

Set Detector = peak.

Set Sweep time = auto couple.

Set Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

#### ■ Emission level measurement

Set the center frequency and span to encompass frequency range to be measured.

Set the RBW = 100 kHz.

Set the VBW = 300 kHz.

Set Detector = peak

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

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.

### 8.4.5 Test Results

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

#### Reference level measurement

TestMode	Antenna	Freq(MHz)	Max.Point[MHz]	Result[dBm]
ZIGBEE	Ant1	2405	2405.51	17.60
		2440	2440.52	17.16
		2480	2480.50	16.62

#### Band edge measurements

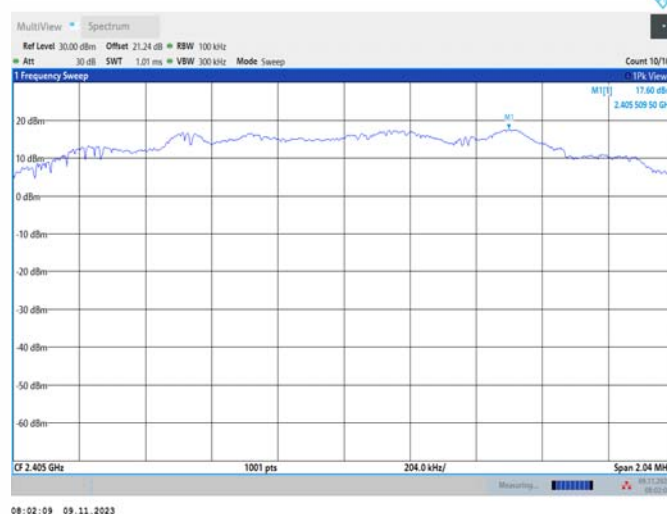
TestMode	Antenna	ChName	Frequency[MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
ZIGBEE	Ant1	Low	2405	17.60	-22.64	≤-2.4	PASS
		High	2480	16.62	-20.56	≤-3.38	PASS

#### Conducted Spurious Emission

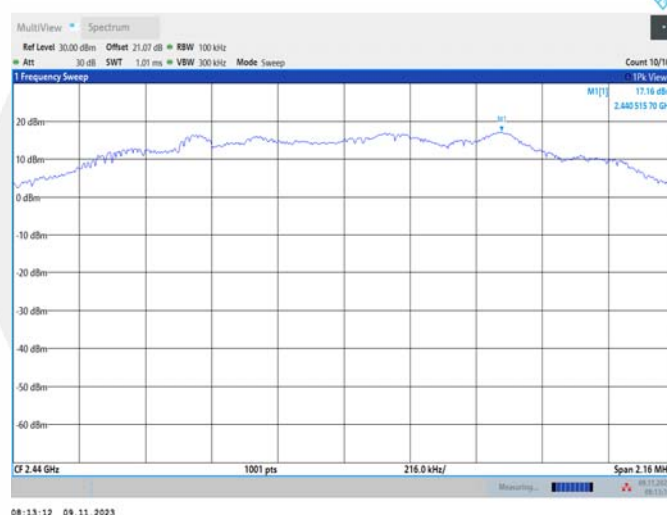
TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
ZIGBEE	Ant1	2405	30~1000	17.60	-62.52	≤-2.4	PASS
			1000~26500	17.60	-49.67	≤-2.4	PASS
		2440	30~1000	17.16	-62.98	≤-2.84	PASS
			1000~26500	17.16	-49.36	≤-2.84	PASS
		2480	30~1000	16.62	-62.41	≤-3.38	PASS
			1000~26500	16.62	-50.95	≤-3.38	PASS

## Reference level measurement

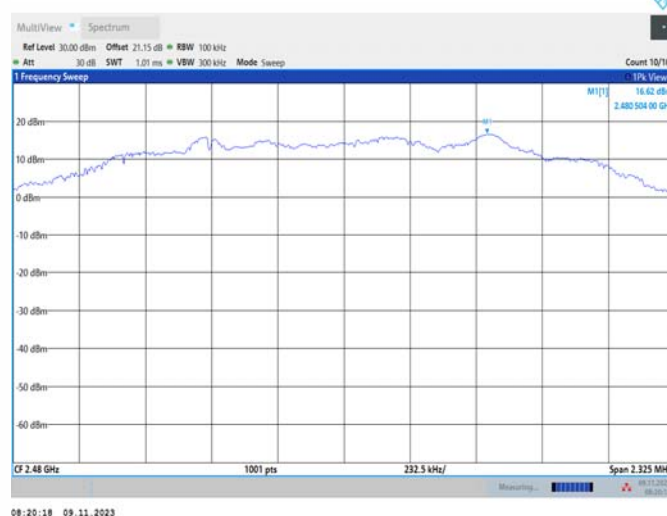
### ZIGBEE\_Ant1\_2405



### ZIGBEE\_Ant1\_2440

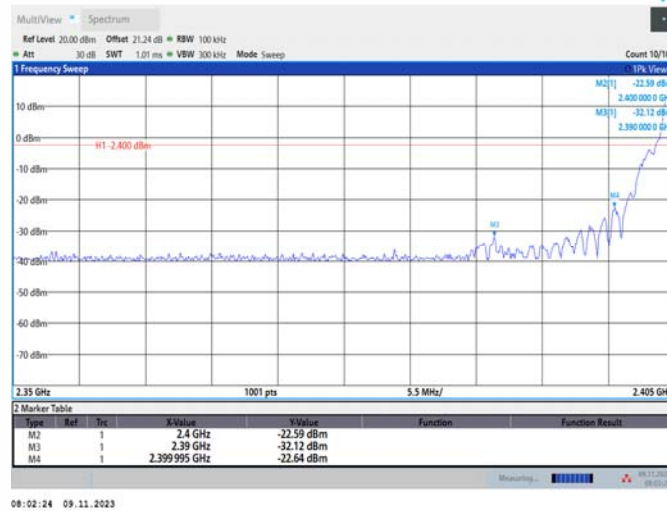


### ZIGBEE\_Ant1\_2480



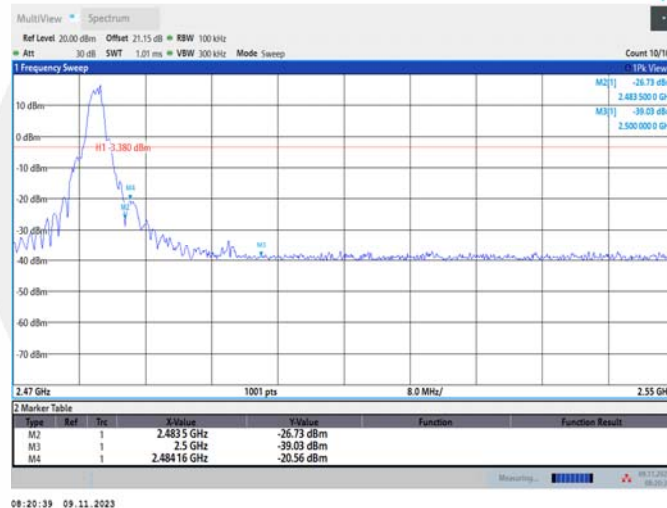
## Band edge measurements

### ZIGBEE\_Ant1\_Low\_2405



08:02:24 09.11.2023

### ZIGBEE\_Ant1\_High\_2480

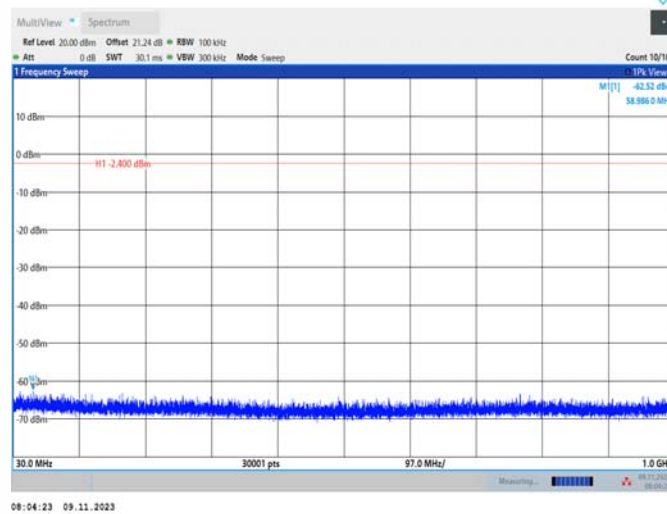


08:20:39 09.11.2023

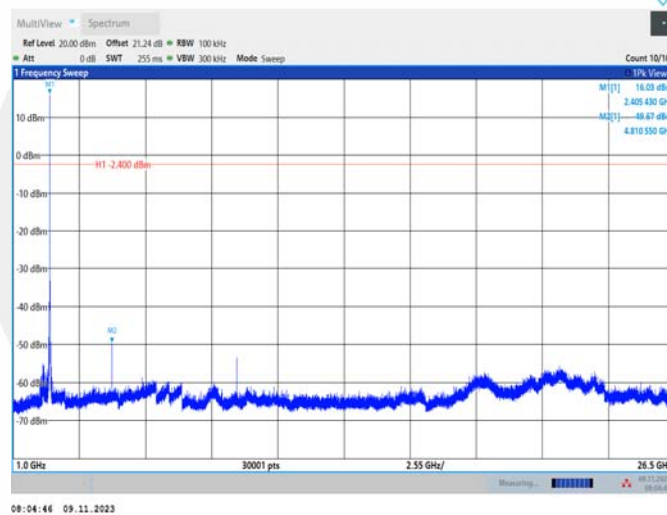


## Conducted Spurious Emission

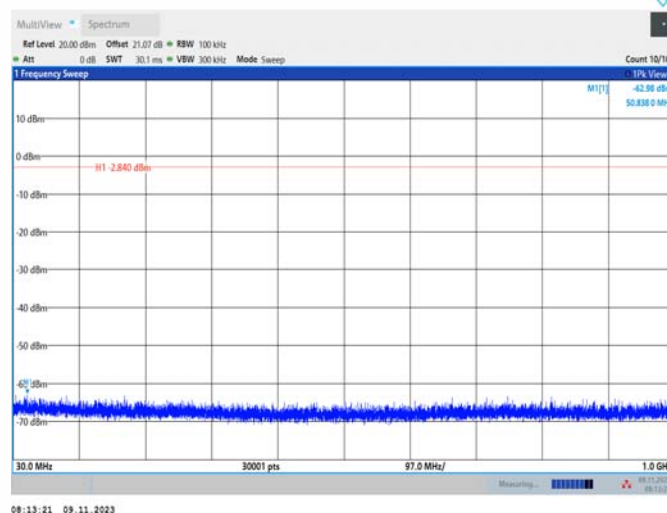
ZIGBEE\_Ant1\_2405\_30~1000



ZIGBEE\_Ant1\_2405\_1000~26500



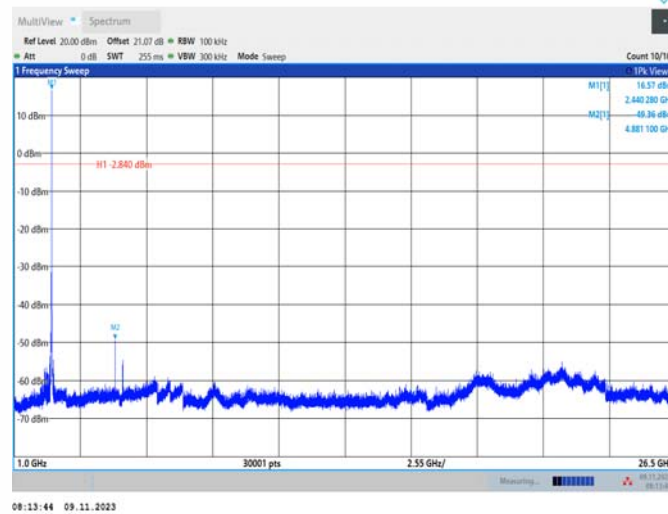
ZIGBEE\_Ant1\_2440\_30~1000



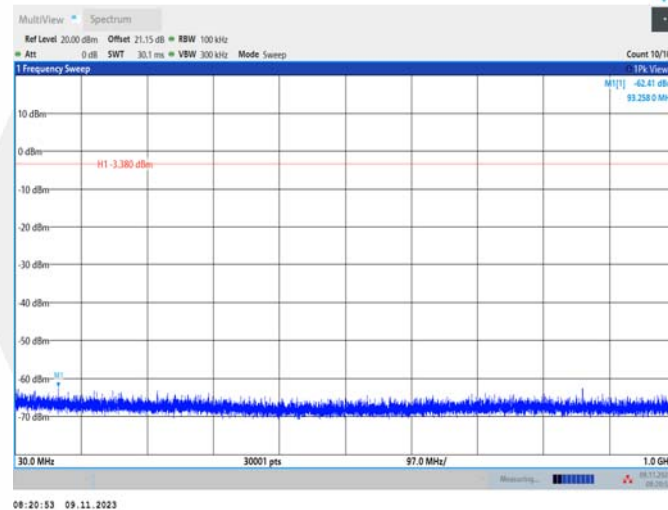


ZIGBEE\_Ant1\_2440\_1000~26500

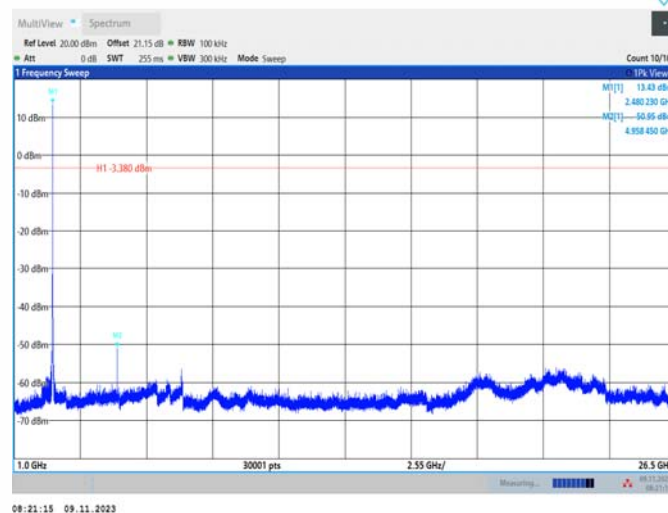
Access to the World



ZIGBEE\_Ant1\_2480\_30~1000



ZIGBEE\_Ant1\_2480\_1000~26500



## 8.5 RADIATED SPURIOUS EMISSION

### 8.5.1 Applicable Standard

According to FCC Part 15.247(d) and 15.209 and KDB 558074 DTS 01 Meas. Guidance v04

### 8.5.2 Conformance Limit

According to FCC Part 15.247(d): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

According to FCC Part 15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

According to FCC Part 15.205, the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

Restricted Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log (uV/m)	300
0.490-1.705	2400/F(KHz)	20 log (uV/m)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

### 8.5.3 Test Configuration

Test according to clause 7.2 radio frequency test setup 2

### 8.5.4 Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

For Above 1GHz:

The EUT was placed on a turn table which is 1.5m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 1GHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 100 kHz for

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 30MHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 9kHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 150KHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 200Hz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from  $20\log(\text{dwell time}/100 \text{ ms})$ , in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Repeat above procedures until all frequency measured was complete.

## 8.5.5 Test Results

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

### ■ Spurious Emission below 30MHz (9KHz to 30MHz)

Test mode: TX Mode

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
--	--	--	--	--	--	--	--

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor =  $40 \log(\text{Specific distance} / \text{test distance})$  (dB);

Limit line = Specific limits(dBuV) + distance extrapolation factor

### ■ Spurious Emission Above 1GHz (1GHz to 25GHz)

Test mode: ZIGBEE Frequency: Channel 1: 2405MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4807.5	V	58.21	39.13	74	54	15.79	14.87
14551.8	V	64.58	46.85	74	54	9.42	7.15
17940	V	71.54	47.66	74	54	2.46	6.34
4809.3	H	56.98	47.86	74	54	17.02	6.14
14617.5	H	65.42	47.99	74	54	8.58	6.01
17613.7	H	71.03	48.24	74	54	2.97	5.76

Test mode: ZIGBEE Frequency: Channel 8: 2440MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4880.6	V	57.49	51.82	74	54	16.51	2.18
14649.3	V	64.26	47.27	74	54	9.74	6.73
17634.3	V	69.63	49.24	74	54	4.37	4.76
4878.7	H	57.13	50.15	74	54	16.87	3.85
14634.3	H	64.03	47.60	74	54	9.97	6.40
17632.5	H	69.88	49.62	74	54	4.12	4.38

Test mode: ZIGBEE Frequency: Channel 16: 2480MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4957.5	V	60.45	41.43	74	54	13.55	12.57
14711.2	V	63.91	46.55	74	54	10.09	7.45
17962.5	V	69.44	47.58	74	54	4.56	6.42
4961.2	H	58.82	51.94	74	54	15.18	2.06
14557.5	H	64.05	47.36	74	54	9.95	6.64
17645.6	H	69.47	47.26	74	54	4.53	6.74

**Note:** (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).  
 (2) Emission Level= Reading Level+Probe Factor +Cable Loss.  
 (3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

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Test mode: ZIGBEE Frequency: Channel 1: 2405MHz

Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	PK(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2310.49	H	44.27	74.00	42.87	54.00
2312.86	V	44.68	74.00	41.99	54.00

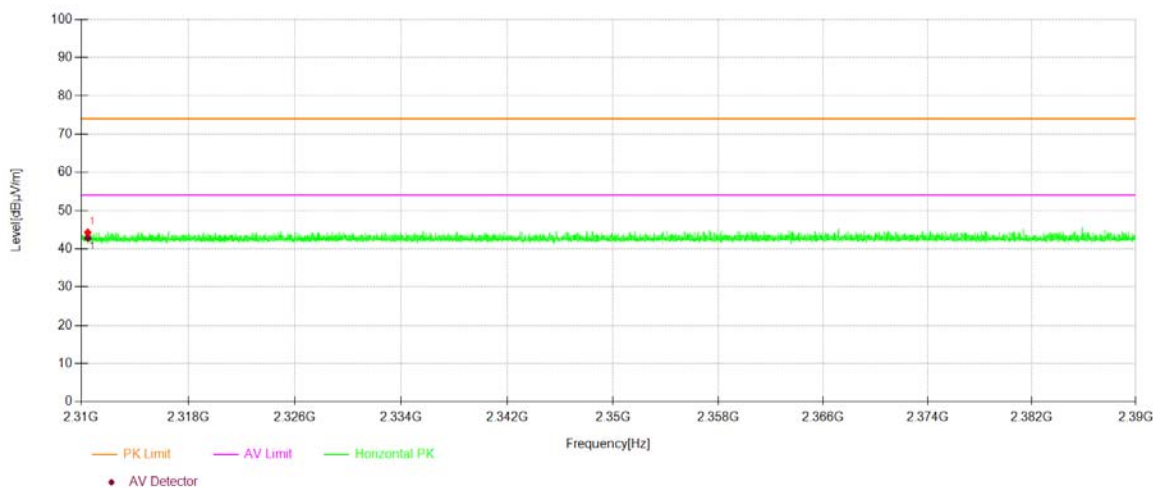
Test mode: ZIGBEE Frequency: Channel 16: 2480MHz

Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	PK(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2483.58	H	55.78	74.00	42.56	54.00
2483.55	V	50.24	74.00	42.50	54.00

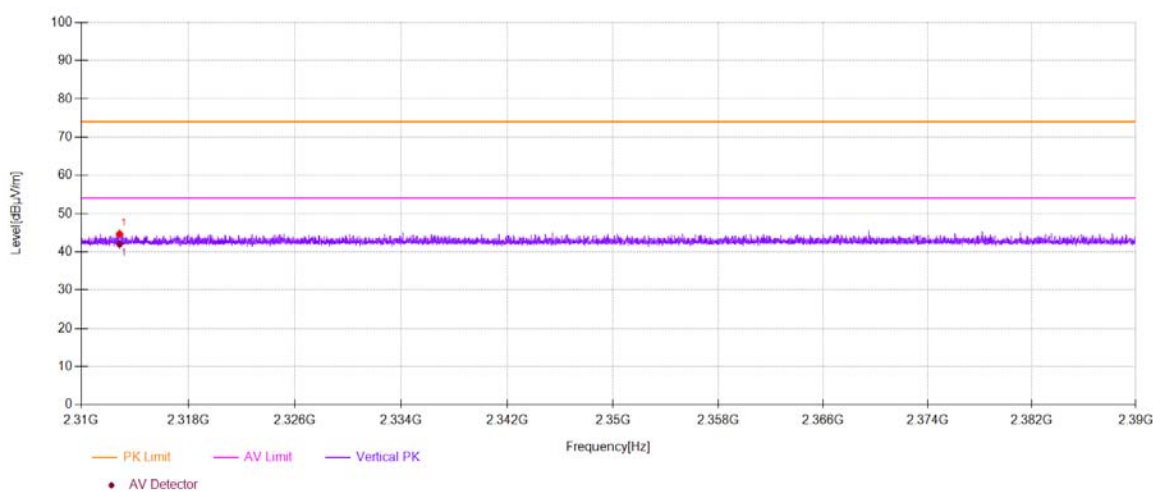
- Note:** (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).  
 (2) Emission Level= Reading Level+Probe Factor +Cable Loss.  
 (3) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

All the modulation modes were tested, the data of the worst mode are described in the following table

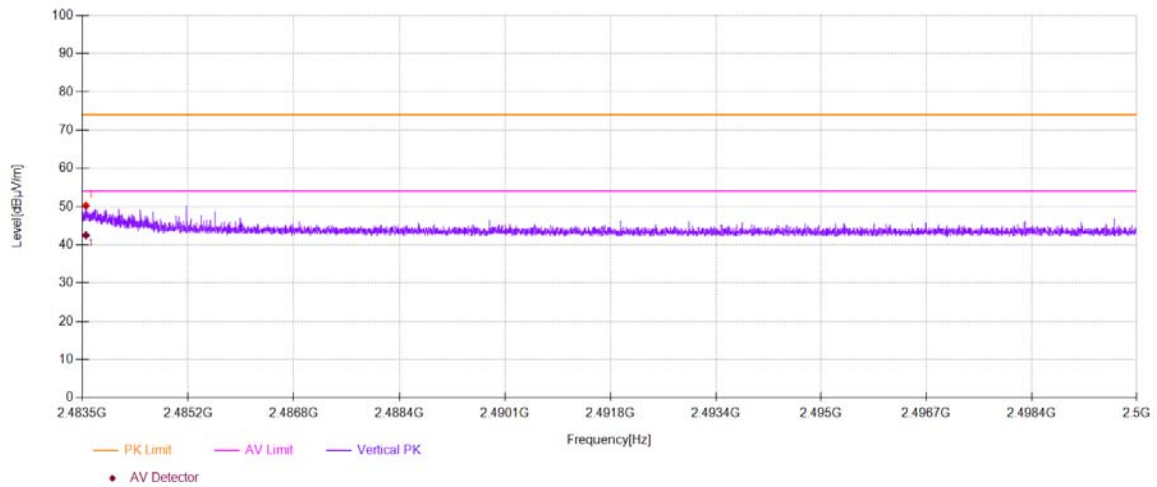
Test Model	Spurious Emission in Restricted Band 2310-2390MHz		
	ZIGBEE		
	<input checked="" type="checkbox"/> Channel 1: 2405MHz	<input type="checkbox"/> Channel 16: 2480MHz	Polarity: H



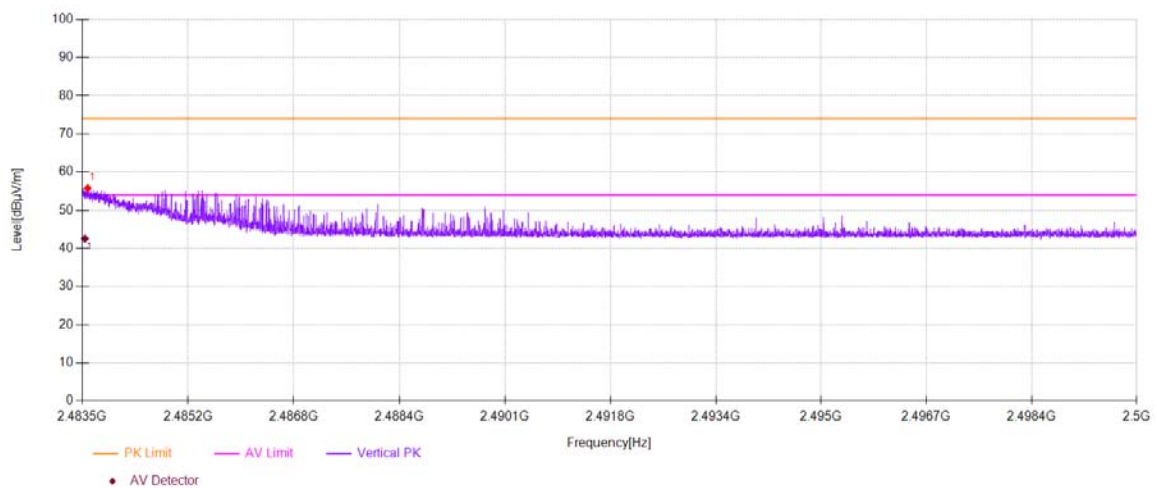
Test Model	Spurious Emission in Restricted Band 2310-2390MHz		
	ZIGBEE		
	<input checked="" type="checkbox"/> Channel 1: 2405MHz	<input type="checkbox"/> Channel 16: 2480MHz	Polarity: V



Test Model Spurious Emission in Restricted Band 2483.5-2500MHz  
ZIGBEE  
☐ Channel 1: 2405MHz ☒ Channel 16: 2480MHz Polarity: H



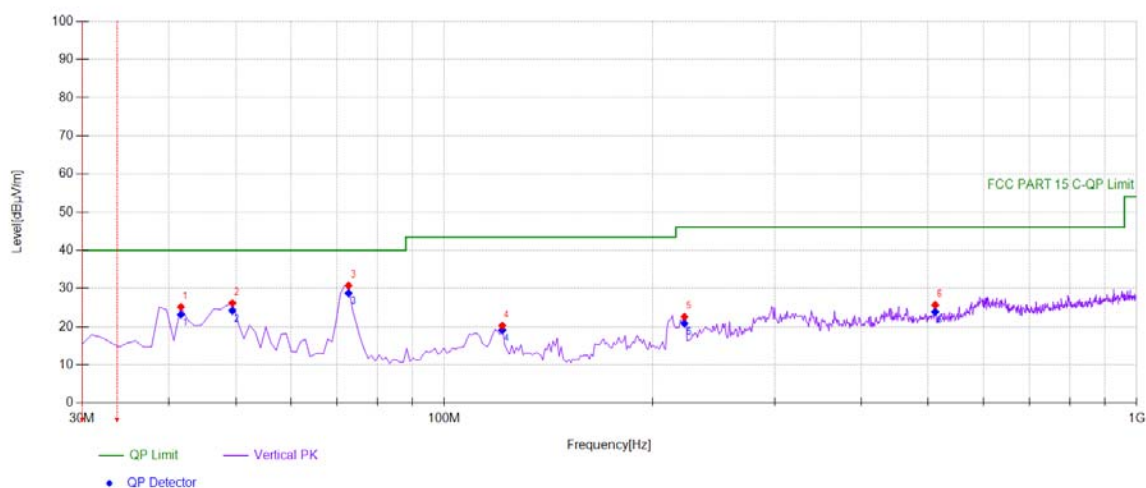
Test Model Spurious Emission in Restricted Band 2483.5-2500MHz  
ZIGBEE  
☐ Channel 1: 2405MHz ☒ Channel 16: 2480MHz Polarity: V





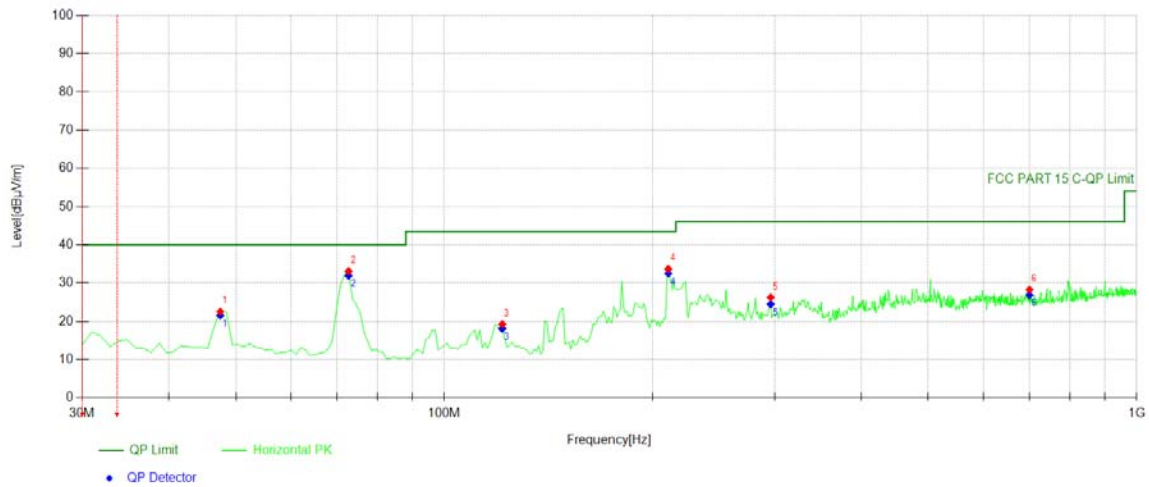
■ Spurious Emission below 1GHz (30MHz to 1GHz)

2405



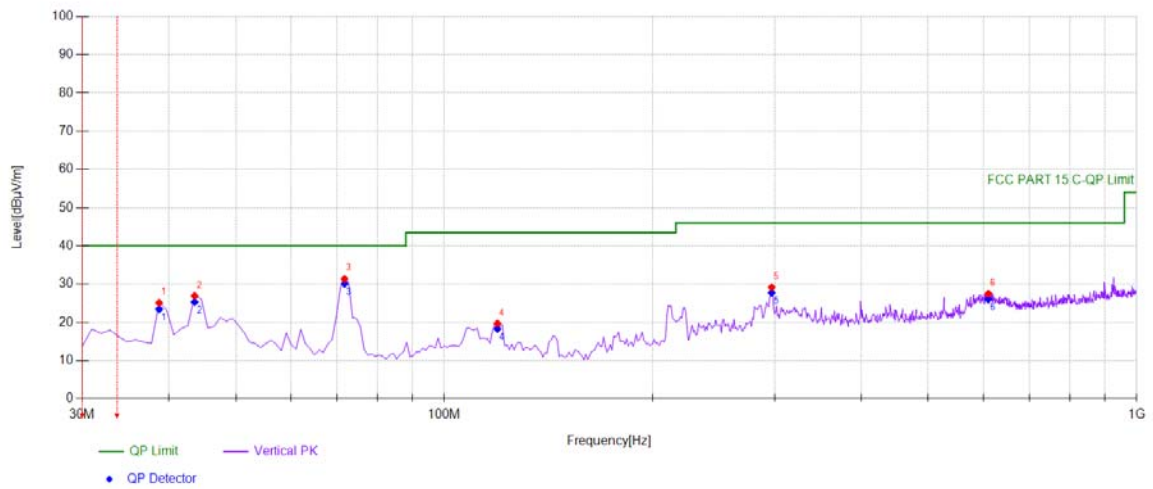
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	41.6517	42.95	-17.80	25.15	PK	40.00	14.85	Vertical
2	49.4194	43.43	-17.25	26.18	PK	40.00	13.82	Vertical
3	72.7227	51.14	-20.38	30.76	PK	40.00	9.24	Vertical
4	121.271	38.30	-18.06	20.24	PK	43.50	23.26	Vertical
5	222.252	39.50	-16.89	22.61	PK	46.00	23.39	Vertical
6	511.601	35.45	-9.78	25.67	PK	46.00	20.33	Vertical



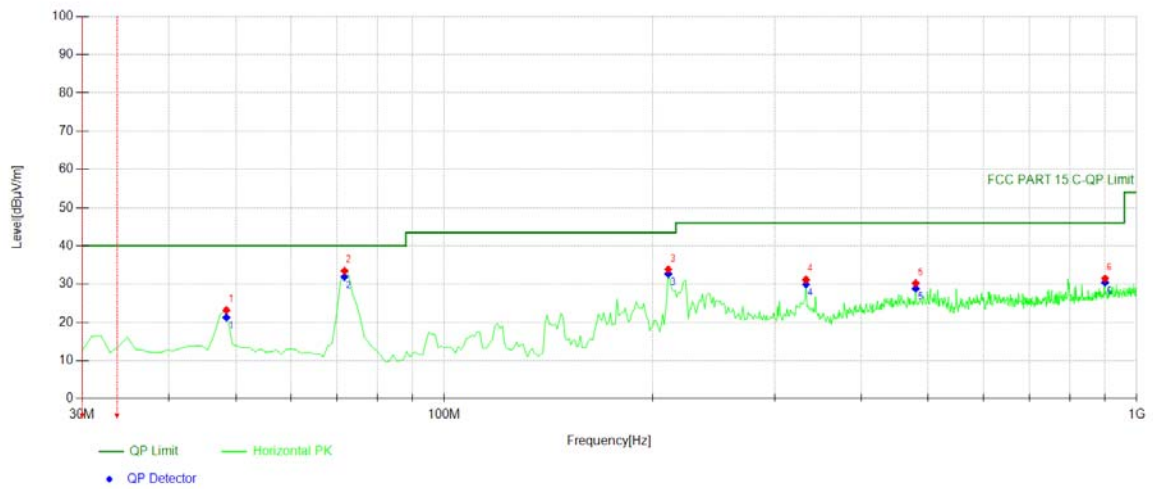


#### Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	47.4775	39.93	-17.39	22.54	PK	40.00	17.46	Horizontal
2	72.7227	53.49	-20.38	33.11	PK	40.00	6.89	Horizontal
3	121.271	37.31	-18.06	19.25	PK	43.50	24.25	Horizontal
4	210.600	50.82	-17.13	33.69	PK	43.50	9.81	Horizontal
5	296.046	40.41	-14.15	26.26	PK	46.00	19.74	Horizontal
6	699.97	34.23	-5.94	28.29	PK	46.00	17.71	Horizontal


**Suspected Data List**

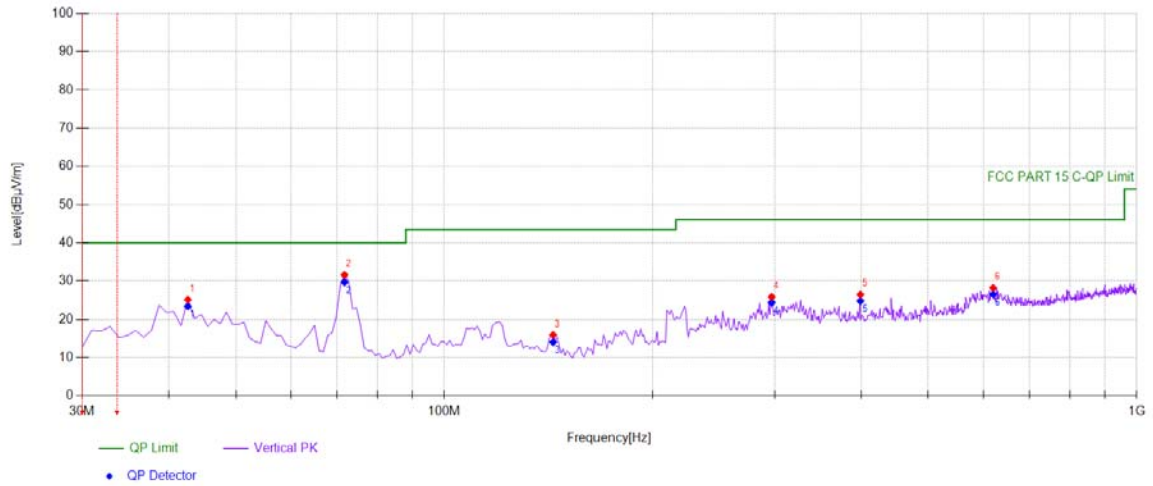
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	38.7387	43.05	-17.99	25.06	PK	40.00	14.94	Vertical
2	43.5936	44.56	-17.66	26.90	PK	40.00	13.10	Vertical
3	71.7518	51.57	-20.23	31.34	PK	40.00	8.66	Vertical
4	119.329	37.57	-17.88	19.69	PK	43.50	23.81	Vertical
5	297.017	43.32	-14.15	29.17	PK	46.00	16.83	Vertical
6	610.640	34.56	-7.08	27.48	PK	46.00	18.52	Vertical



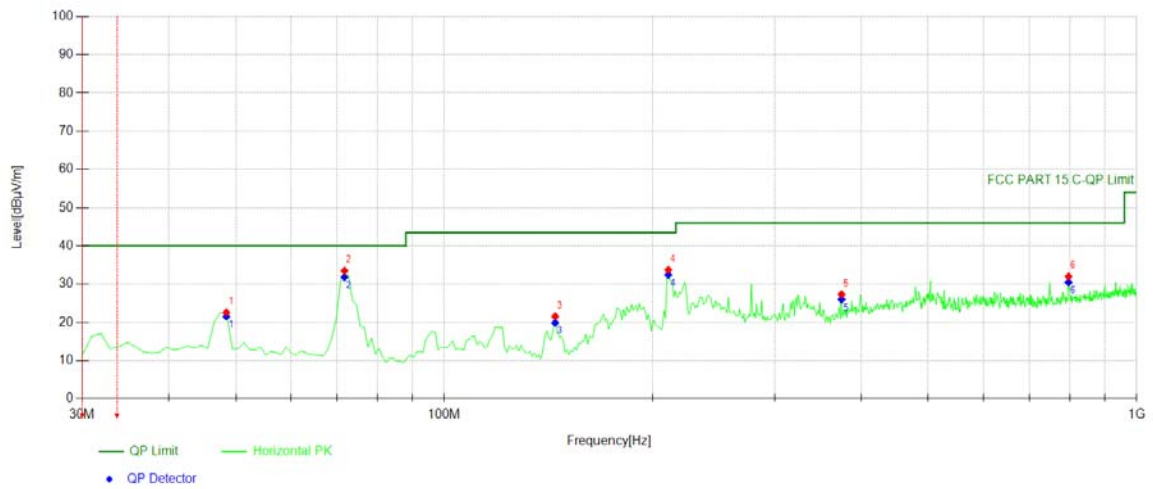
#### Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	48.4484	40.51	-17.32	23.19	PK	40.00	16.81	Horizontal
2	71.7518	53.70	-20.23	33.47	PK	40.00	6.53	Horizontal
3	210.600	50.97	-17.13	33.84	PK	43.50	9.66	Horizontal
4	332.942	44.83	-13.67	31.16	PK	46.00	14.84	Horizontal
5	479.559	40.03	-9.81	30.22	PK	46.00	15.78	Horizontal
6	899.99	34.24	-2.81	31.43	PK	46.00	14.57	Horizontal

2480



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	42.6226	42.85	-17.73	25.12	PK	40.00	14.88	Vertical
2	71.7518	51.85	-20.23	31.62	PK	40.00	8.38	Vertical
3	143.603	35.82	-19.92	15.90	PK	43.50	27.60	Vertical
4	297.017	40.02	-14.15	25.87	PK	46.00	20.13	Vertical
5	398.969	38.28	-11.79	26.49	PK	46.00	19.51	Vertical
6	620.350	35.35	-7.11	28.24	PK	46.00	17.76	Vertical



#### Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	48.4484	39.91	-17.32	22.59	PK	40.00	17.41	Horizontal
2	71.7518	53.73	-20.23	33.50	PK	40.00	6.50	Horizontal
3	144.574	41.44	-19.89	21.55	PK	43.50	21.95	Horizontal
4	210.600	50.86	-17.13	33.73	PK	43.50	9.77	Horizontal
5	374.694	39.57	-12.26	27.31	PK	46.00	18.69	Horizontal
6	797.067	36.44	-4.45	31.99	PK	46.00	14.01	Horizontal

## 8.6 CONDUCTED EMISSIONS TEST

Applicable Standard

According to FCC Part 15.207(a)

Conformance Limit

Frequency(MHz)	Conducted Emission Limit	
	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

Test Configuration

Test according to clause 7.3 conducted emission test setup

Test Procedure

The EUT was placed on a table which is 0.8m above ground plane.

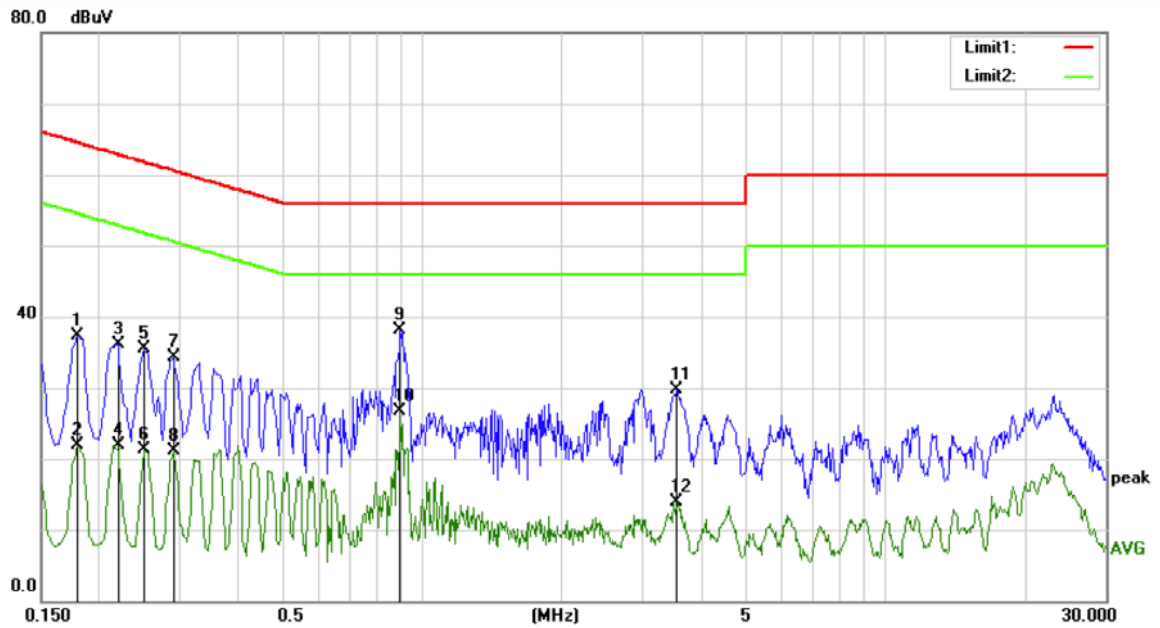
Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Repeat above procedures until all frequency measured were complete.

Test Results

Pass

The 120V & 240V voltage have been tested, and the worst result recorded was report as below:



Site Conduction #1

Phase: **L1**

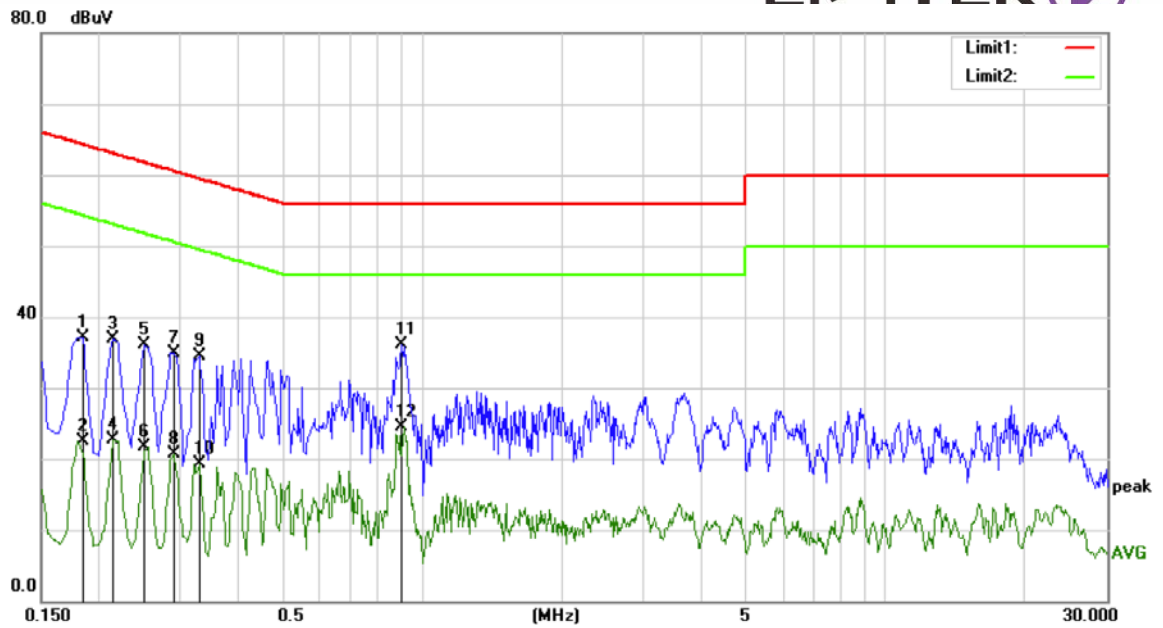
Temperature: 21.9

Limit: (CE)FCC PART 15 class B\_QP

Power: AC 120V/60Hz

Humidity: 58 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1800	27.43	9.86	37.29	64.49	-27.20	QP	
2		0.1800	11.95	9.86	21.81	54.49	-32.68	AVG	
3		0.2200	26.08	10.09	36.17	62.82	-26.65	QP	
4		0.2200	11.75	10.09	21.84	52.82	-30.98	AVG	
5		0.2500	25.35	10.06	35.41	61.76	-26.35	QP	
6		0.2500	11.34	10.06	21.40	51.76	-30.36	AVG	
7		0.2900	24.19	10.04	34.23	60.52	-26.29	QP	
8		0.2900	11.07	10.04	21.11	50.52	-29.41	AVG	
9	*	0.8950	28.40	9.78	38.18	56.00	-17.82	QP	
10		0.8950	16.97	9.78	26.75	46.00	-19.25	AVG	
11		3.5650	19.81	9.80	29.61	56.00	-26.39	QP	
12		3.5650	4.12	9.80	13.92	46.00	-32.08	AVG	



Site Conduction #1

Phase: **N**

Temperature: 21.9

Limit: (CE)FCC PART 15 class B\_QP

Power: AC 120V/60Hz

Humidity: 58 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1850	27.27	9.92	37.19	64.26	-27.07	QP	
2		0.1850	12.60	9.92	22.52	54.26	-31.74	AVG	
3		0.2150	26.84	10.09	36.93	63.01	-26.08	QP	
4		0.2150	12.66	10.09	22.75	53.01	-30.26	AVG	
5		0.2500	25.97	10.06	36.03	61.76	-25.73	QP	
6		0.2500	11.62	10.06	21.68	51.76	-30.08	AVG	
7		0.2900	24.88	10.04	34.92	60.52	-25.60	QP	
8		0.2900	10.61	10.04	20.65	50.52	-29.87	AVG	
9		0.3300	24.50	9.97	34.47	59.45	-24.98	QP	
10		0.3300	9.39	9.97	19.36	49.45	-30.09	AVG	
11	*	0.9000	26.37	9.78	36.15	56.00	-19.85	QP	
12		0.9000	14.65	9.78	24.43	46.00	-21.57	AVG	



## 8.7 ANTENNA APPLICATION

### Antenna Requirement

Standard	Requirement
FCC CRF Part 15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### Result

PASS.

Note: ☒ Antenna use a permanently attached antenna which is not replaceable.  
☐ Not using a standard antenna jack or electrical connector for antenna replacement  
☐ The antenna has to be professionally installed (please provide method of installation)

Please refer to the attached document Internal Photos to show the antenna connector.

## Detail of factor for radiated emission

Frequency(MHz)	Ant F(dB)	Cab L(dB)	Preamp(dB)	Correct Factor(dB)
0.009	20.6	0.03	\	20.63
0.15	20.7	0.1	\	20.8
1	20.9	0.15	\	21.05
10	20.1	0.28	\	20.38
30	18.8	0.45	\	19.25
30	11.7	0.62	27.9	-15.58
100	12.5	1.02	27.8	-14.28
300	12.9	1.91	27.5	-12.69
600	19.2	2.92	27	-4.88
800	21.1	3.54	26.6	-1.96
1000	22.3	4.17	26.2	0.27
1000	25.6	1.76	41.4	-14.04
3000	28.9	3.27	43.2	-11.03
5000	31.1	4.2	44.6	-9.3
8000	36.2	5.95	44.7	-2.55
10000	38.4	6.3	43.9	0.8
12000	38.5	7.14	42.3	3.34
15000	40.2	8.15	41.4	6.95
18000	45.4	9.02	41.3	13.12
18000	37.9	1.81	47.9	-8.19
21000	37.9	1.95	48.7	-8.85
25000	39.3	2.01	42.8	-1.49
28000	39.6	2.16	46.0	-4.24
31000	41.2	2.24	44.5	-1.06
34000	41.5	2.29	46.6	-2.81
37000	43.8	2.30	46.4	-0.3
40000	43.2	2.50	42.2	3.5

----- END OF REPORT -----