FCC Test Report

Report No.:	LDF-ESH-P25122081B-2
FCC ID:	DWNTDBU25ZB
Product:	TDBU 25 WF ZIGBEE HP
Test Model:	5183668
Received Date:	May.12, 2026
Test Date:	May.12 to Jun.02, 2026
Issued Date:	Jun.03, 2026
Applicant:	Somfy Systems Inc
Address:	121 Herrod Blvd., Dayton, NJ 08810
Manufacturer:	Somfy Activités SA
Address:	50 avenue du Nouveau Monde 74300 CLUSES - FRANCE
Issued By:	BUREAU VERITAS LCIE CHINA COMPANY LIMITED
Lab Address:	No. 829, Xinzhuan Road, Shanghai, P.R.China (201612)

ACCREDITED
Test Lab
Cert 2343.01

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification.

Table of Contents

Release Control Record 5
1 Certificate of Conformity 6
2 Summary of Test Results 7
2.1 Test Instruments 8
2.2 Test Facility 9
2.3 Measurement Uncertainty 10
2.4 Modification Record 10
3 General Information 11
3.1 General Description of EUT 11
3.2 Description of Test Modes 12
3.2.1 Test Mode Applicability: 13
3.2.2 Test Condition: 14
3.3 Duty Cycle of Test Signal 15
3.4 Description of Support Units 17
3.5 General Description of Applied Standards 17
4 Test Procedure and Results 18
4.1 AC Power Conducted Emission 18
4.1.1 Limits 18
4.1.2 Test Procedures 18
4.1.3 Deviation from Test Standard 18
4.1.4 Test Setup 19
4.1.5 EUT Operating Conditions 19
4.1.6 Test Results 20
4.2 Minimum 6dB Bandwidth 22
4.2.1 Limit 22
4.2.2 Test Setup 22
4.2.3 Test Procedures 22
4.2.4 Deviation of Test Standard 22
4.2.5 Test Results 23
4.3 Conducted Output Power 25
4.3.1 Limit 25
4.3.2 Test Setup 25

4.3.3 Test Procedures 25
4.3.4 Deviation of Test Standard 25
4.3.5 Test Results 26
4.4 Power Spectral Density 28
4.4.1 Limit 28
4.4.2 Test Setup 28
4.4.3 Test Procedures 28
4.4.4 Deviation of Test Standard 28
4.4.5 Test Results 29
4.5 Conducted Band Edges Measurement 31
4.5.1 Limit 31
4.5.2 Test Setup 31
4.5.3 Test Procedures 31
4.5.4 Deviation of Test Standard 31
4.5.5 Test Results 32
4.6 Conducted Spurious Emissions 33
4.6.1 Limit 33
4.6.2 Test Setup 33
4.6.3 Test Procedures 33
4.6.4 Deviation of Test Standard 33
4.6.5 Test Results 34
4.7 Emissions in restricted frequency bands 38
4.7.1 Test Limit 38
4.7.2 Test Procedure Reference 39
4.7.3 Test Procedures 39
4.7.4 Test Setup 40
4.7.5 Test Results 41
4.8 Radiated Emission Measurement 45
4.8.1 Limits 45
4.8.2 Test Procedures 45
4.8.3 Deviation from Test Standard 46
4.8.4 Test Setup 47
4.8.5 EUT Operating Conditions 48

4.8.6 Test Results 48
5 Pictures of Test Arrangements 57

Release Control Record

Issue No.	Description	Date Issued
LDF-ESH-P25122081B-2	Original release	Jun.03, 2026

1 Certificate of Conformity

Product: TDBU 25 WF ZIGBEE HP

Brand: somfy

Test Model: 5183668

Applicant: Somfy Systems Inc

Test Date: May.12 to Jun.02, 2026

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2020

The above equipment has been tested by BUREAU VERITAS LCIE CHINA COMPANY LIMITED, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

The test results in this report apply exclusively to the tested model / sample. Without written approval of BUREAU VERITAS LCIE CHINA COMPANY LIMITED, the test report shall not be reproduced except in full.

BUREAU VERITAS LCIE CHINA COMPANY LIMITED lab is not responsible for the incorrect test results caused by the incorrect information provided by the applicant (such as the maximum internal operating frequency, antenna gain, cable loss, etc.)

Prepared by : Yan.Zhou , **Date:** Jun.03, 2026

Yan ZHOU

Project Engineer

Approved by : Sean Yu , **Date:** Jun.03, 2026

Sean YU

RF Supervisor

2 Summary of Test Results

The EUT has been tested according to the following specifications:

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.203	Antenna Requirement	PASS	No antenna connector is used.
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit.
15.247(a)(2)	Minimum 6dB Bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted Output Power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.247(d)	Conducted Band Edges Measurement	PASS	Meet the requirement of limit.
15.247(d)	Conducted Spurious Emissions	PASS	Meet the requirement of limit.
15.247(d)	Emissions in restricted frequency bands	PASS	Meet the requirement of limit.
15.205 / 15.209 / 15.247(d)	Radiated Emissions Measurement	PASS	Meet the requirement of limit.

2.1 Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Loop Antenna	ETS-LINDGREN	6502	E1A1039	Jul.30,24	Jul.29,26
Hybrid Antenna(25MHz-1.5GHz)	Schwarzbeck	VULB9168	E1A1001	Mar.30,26	Mar.29,28
Horn Antenna(1GHz -18GHz)	Schwarzbeck	BBHA9120D	E1A1017	Jul.31,24	Jul.30,26
Double Ridge Horn Antenna(18G-40G)	COM-POWER	AH-840	E1A1040	Jul.31,24	Jul.30,26
Pre-Amplifier(100kHz-1.3GHz)	Agilent	8447D	E1A2001	Feb.02,26	Feb.01,27
Pre-Amplifier(0.5GHz-18GHz)	EMCI	EMC184045SE	E1A2009	Jun.26,25	Jun.25,26
Pre-Amplifier(18GHz-40GHz)	Tonscend	TAP18040048	E1A2014	May.27,26	May.26,27
EMI test recerver	R&S	ESR26	E1R1009	Aug.12,25	Aug.11,26
Spectrum Analyzer	Keysight	N9030B	E1S1003	May.22,26	May.21,27
Spectrum Analyzer	Keysight	N9020A	E1S1004	Feb.10,26	Feb.09,27
EMI test recerver	R&S	ESR3	E1R1008	Aug.12,25	Aug.11,26
LISN	R&S	ENV216	E1L1013	Aug.18,25	Aug.17, 26
RF cable(30MHz~26.5GHz)	--	--	--	Mar.31,26	Mar.30,27
RF cable(9kHz~1GHz)	--	--	E3T4104/05/06/07	Mar.19,26	Mar.18,27
RF cable(1GHz~40GHz)	--	--	E3T4108/09/10/11	Mar.31,26	Mar.30,27
Humidity&Temp Tester	ESPEC	SE TH-Z-042U	C1TH002	Jun.04,26	Jun.03,27
RF Control Unit	Toscend	JS0806-2	E1C5003	N/A	N/A
Test Software	Toscend	JS32-CE	N/A	N/A	N/A
Test Software	Toscend	JS32-RE	N/A	N/A	N/A
Test Software	Toscend	JS1120	N/A	N/A	N/A
Test Software	Toscend	JS1120-3	N/A	N/A	N/A

2.2 Test Facility

Laboratory Name: BUREAU VERITAS LCIE CHINA COMPANY LIMITED

Laboratory Address: No.829, Xin Zhuan Road, Song Jiang District, Shanghai, China

Test Location: No.829, Xin Zhuan Road, Song Jiang District, Shanghai, China

A2LA Lab Code: 2343.01

FCC-Recognized Accredited Testing Lab: CN1213

ISED Recognized Lab: 6392A

FCC Accredited Test Site Number: 176467

CAB identifier: CN0070

2.3 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.56 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.08 dB
Radiated Emissions above 1 GHz	Above 1GHz	5.12 dB

2.4 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	TDBU 25 WF ZIGBEE HP
Brand	somfy
Test Model	5183668
Power Rating	12V⎓;
Modulation Type	O-QPSK
Modulation Technology	6LoWPAN
Operating Frequency	2405MHz to 2480MHz
Number of Channel	16
Output Power	15.71 dBm
Antenna Type	External Antenna
Antenna Connector	--
Antenna Gain	1 dBi
Product SW/HW version	--
Radio SW/HW version	--
Test SW version	--
RF power setting in Test SW	--

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

3.2 Description of Test Modes

16 channels are provided for Zigbee.

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

3.2.1 Test Mode Applicability:

EUT Configure Mode	Applicable to				Description
	RE ≥ 1G	RE < 1G	PLC	APCM	
-	√	√	√	√	-

Where **RE≥1G:** Radiated Emission above 1GHz **RE< 1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

Radiated Emission Test (Above 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	Zigbee	11 to 26	11,18, 26	DSSS	OQPSK	250kbps

Radiated Emission Test (Below 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	Zigbee	11 to 26	11	DSSS	OQPSK	250kbps

Power Line Conducted Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	Zigbee	11 to 26	11	DSSS	OQPSK	250kbps

Antenna Port Conducted Measurement

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	Zigbee	11 to 26	11,18, 26	DSSS	OQPSK	250kbps

3.2.2 Test Condition:

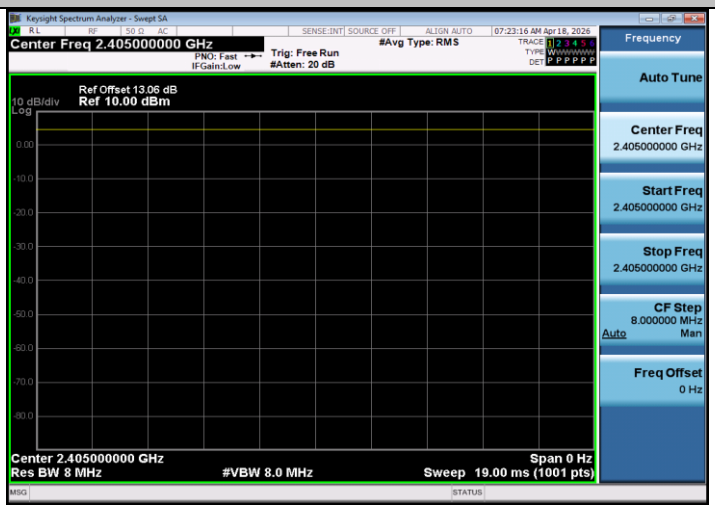
Applicable to	Normal Environmental Conditions	Normal Input Power
RE ≥ 1G	23deg. C, 58%RH	DC 12V
RE < 1G	23deg. C, 58%RH	DC 12V
PLC	23deg. C, 58%RH	DC 12V
APCM	25deg. C, 60%RH	DC 12V

3.3 Duty Cycle of Test Signal

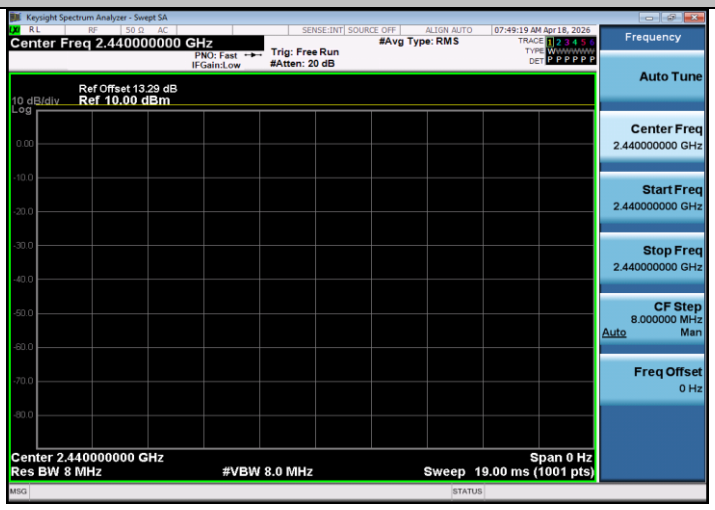
TestMode	Antenna	Freq(MHz)	DC [%]	xFactor
ZIG_1M	Ant1	2405	100	0
		2440	100	0
		2480	100	0

Note: Duty Cycle Factor=10* Log[1/Duty Cycle(%)*100], Duty Cycle= Ton/Tperiod *100%

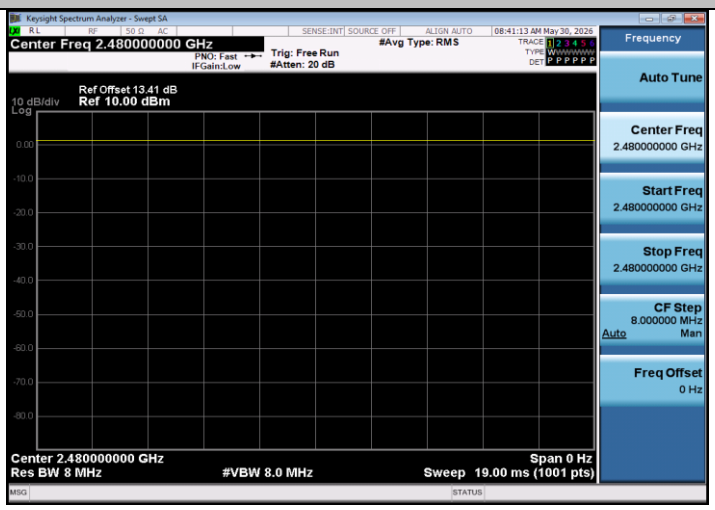
ZIG _1M_Ant1_2405



ZIG _1M_Ant1_2440



ZIG _1M_Ant1_2480



3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

FCC Part 15, Subpart C (15.247)

KDB 558074 D01 DTS Meas Guidance v05r02

ANSI C63.10: 2020

All relaxed test items have been performed and recorded as per the above standard.

4 Test Procedure and Results

4.1 AC Power Conducted Emission

4.1.1 Limits

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 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.

4.1.2 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

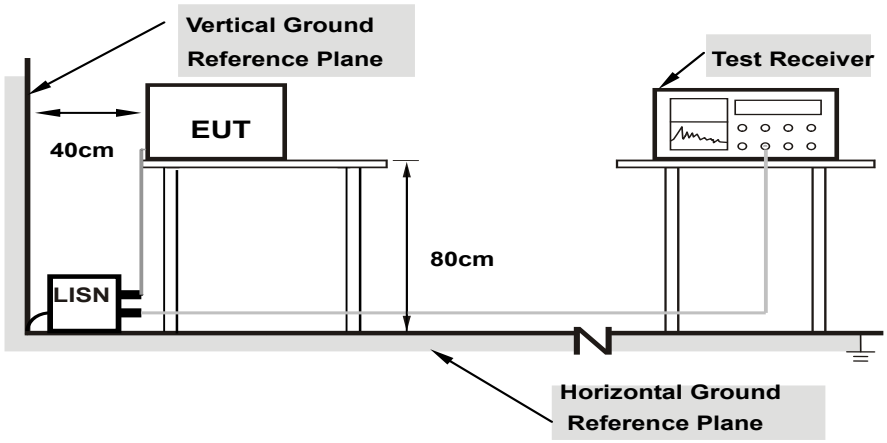
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.1.3 Deviation from Test Standard

No deviation.

4.1.4 Test Setup



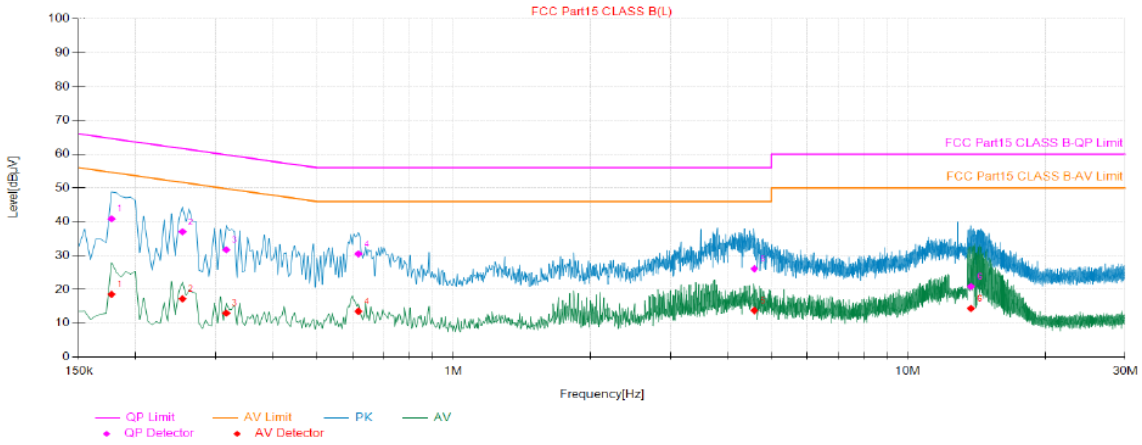
Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.5 EUT Operating Conditions

Same as 4.1.6.

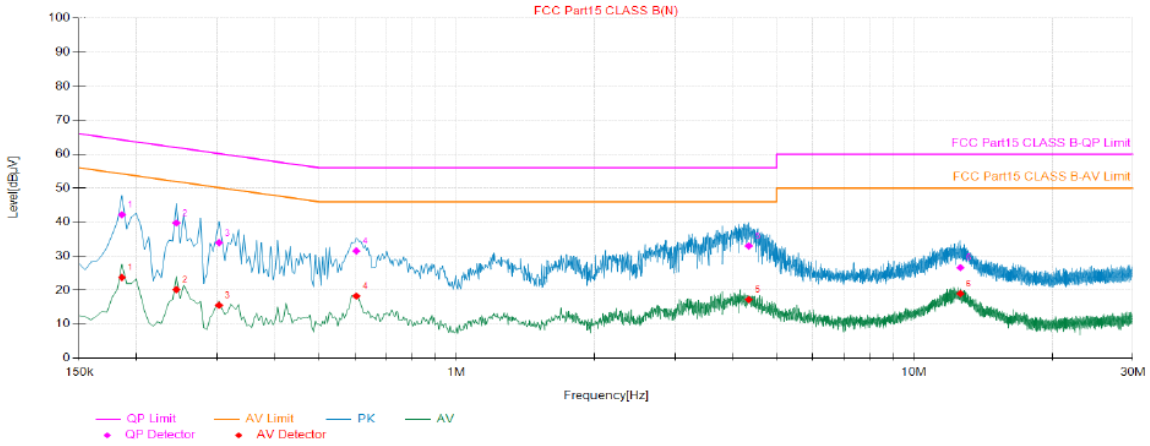
4.1.6 Test Results



Final Data List										
NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]
1	0.18	19.88	20.97	40.85	64.63	23.78	-1.32	18.56	54.63	36.07
2	0.25	19.74	17.30	37.04	61.64	24.60	-2.54	17.20	51.64	34.44
3	0.32	19.65	12.03	31.68	59.80	28.12	-6.68	12.97	49.80	36.83
4	0.62	19.62	10.85	30.47	56.00	25.53	-6.11	13.51	46.00	32.49
5	4.59	19.88	6.21	26.09	56.00	29.91	-6.13	13.75	46.00	32.25
6	13.74	20.08	0.81	20.89	60.00	39.11	-5.71	14.37	50.00	35.63

Remarks:1. Margin=Limit - Value, Value=Reading + Factor.

2. Factor=AMN Factor + Cable Loss.



Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]
1	0.19	19.85	22.32	42.17	64.21	22.04	3.89	23.74	54.21	30.47
2	0.24	19.78	19.97	39.75	61.94	22.19	0.37	20.15	51.94	31.79
3	0.30	19.72	14.20	33.92	60.16	26.24	-4.19	15.53	50.16	34.63
4	0.60	19.63	11.86	31.49	56.00	24.51	-1.36	18.27	46.00	27.73
5	4.35	19.82	13.15	32.97	56.00	23.03	-2.60	17.22	46.00	28.78
6	12.60	20.11	6.49	26.60	60.00	33.40	-1.13	18.98	50.00	31.02

Remarks:1. Margin=Limit - Value, Value=Reading + Factor.

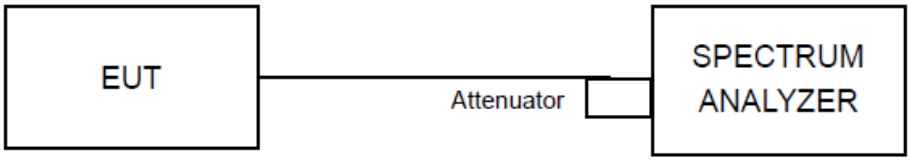
2. Factor=AMN Factor + Cable Loss.

4.2 Minimum 6dB Bandwidth

4.2.1 Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz

4.2.2 Test Setup



4.2.3 Test Procedures

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” for compliance to FCC 47CFR 15.247 requirements (clause 8.2).

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW $\geqslant$ 3 RBW, peak detector with maximum hold) is implemented by the instrumentation function.

4.2.4 Deviation of Test Standard

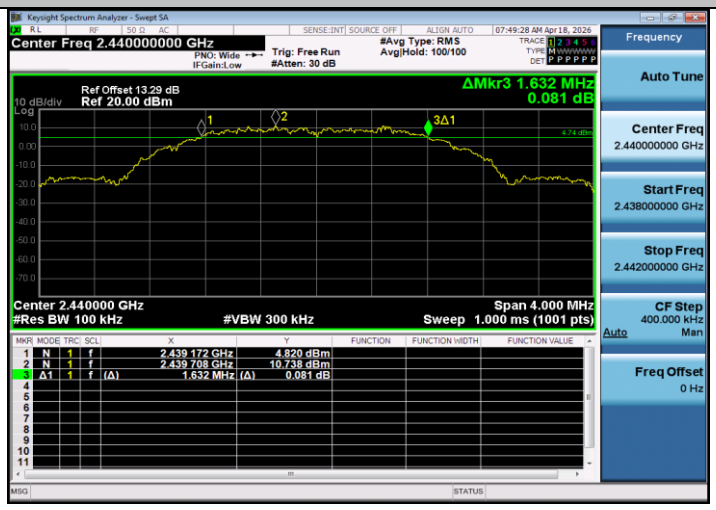
No deviation.

4.2.5 Test Results

TestMode	Antenna	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
ZIG_1M	Ant1	2405	1.612	2404.176	2405.788	0.5	PASS
		2440	1.632	2439.172	2440.804	0.5	PASS
		2480	1.600	2479.192	2480.792	0.5	PASS

ZIG _1M_Ant1_2405

ZIG _1M_Ant1_2440



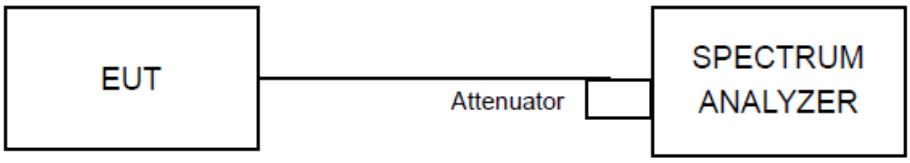
ZIG _1M_Ant1_2480

4.3 Conducted Output Power

4.3.1 Limit

For systems using digital modulation in the 2400 – 2483.5 MHz bands: 1 Watt (30 dBm)

4.3.2 Test Setup



4.3.3 Test Procedures

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” for compliance to FCC 47CFR 15.247 requirements (clause 9.2.2.4).

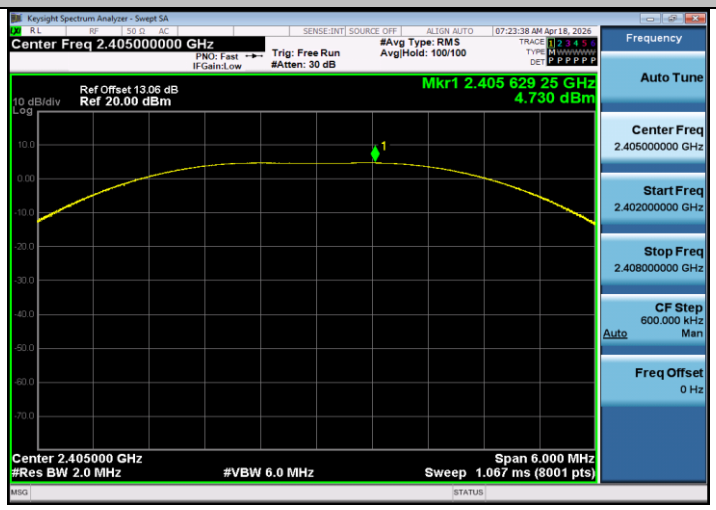
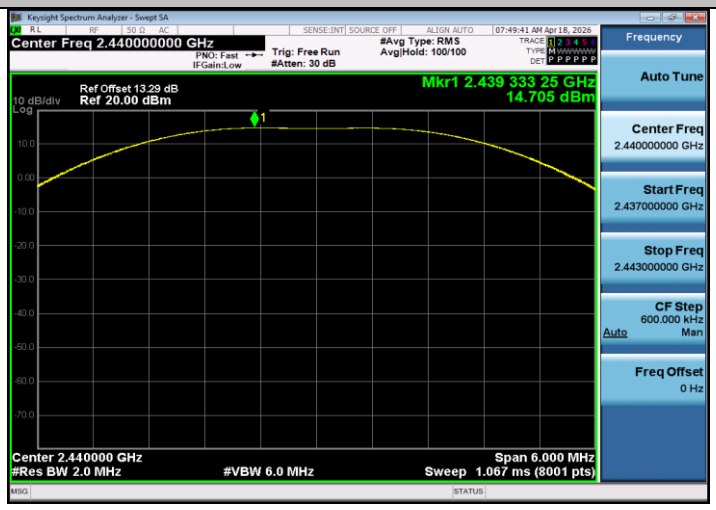
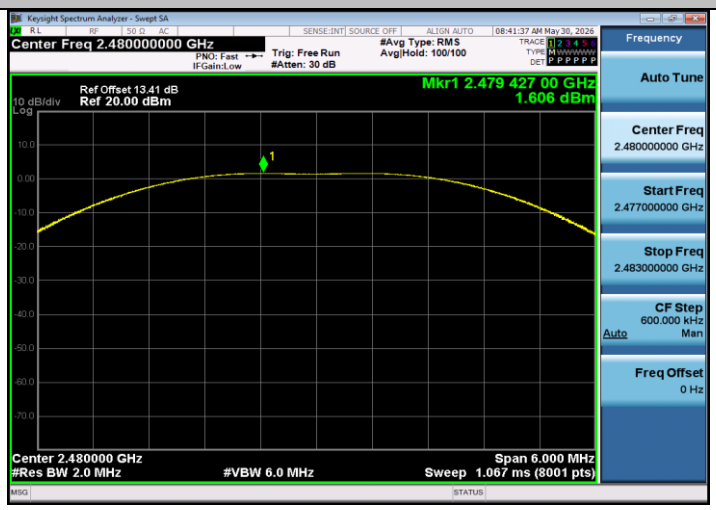
1. Set RBW ⩾ DTS bandwidth
2. Set VBW ⩾ 3 RBW.
3. Set Span ⩾ 3 RBW.
4. Sweep time = No faster than coupled (auto) time.
5. Detector = peak
6. Trace mode = max hold.
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level.

4.3.4 Deviation of Test Standard

No deviation.

4.3.5 Test Results

TestMode	Antenna	Freq(MHz)	Conducted Peak Powert[dBm]	Conducted Limit[dBm]	EIRP[dBm]	EIRP Limit[dBm]	Verdict
ZIG_1M	Ant1	2405	4.73	≤30	5.73	≤36	PASS
		2440	14.71	≤30	15.71	≤36	PASS
		2480	1.61	≤30	2.61	≤36	PASS

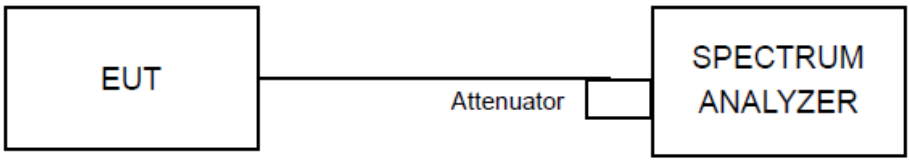
ZIG_1M_Ant1_2405

ZIG _1M_Ant1_2440

ZIG _1M_Ant1_2480


4.4 Power Spectral Density

4.4.1 Limit

The Maximum of Power Spectral Density Measurement is 8 dBm.

4.4.2 Test Setup



4.4.3 Test Procedures

The power output per FCC § 15.247(e) was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" (clause 10.5) for compliance to FCC 47CFR 15.247 requirements.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz $\leqslant$ RBW $\leqslant$ 100 kHz.
4. Set the VBW $\geqslant$ 3 ×RBW.
5. Detector = peak.
6. Sweep time = No faster than couped (auto) time.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

4.4.4 Deviation of Test Standard

No deviation.

4.4.5 Test Results

TestMode	Antenna	Freq(MHz)	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
ZIG _1M	Ant1	2405	-11.09	≤8.00	PASS
		2440	-1.43	≤8.00	PASS
		2480	-13.78	≤8.00	PASS

ZIG _1M_Ant1_2405

ZIG _1M_Ant1_2440

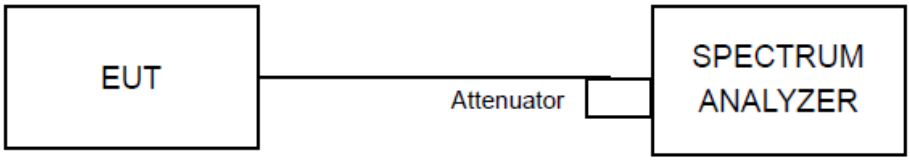
ZIG _1M_Ant1_2480

4.5 Conducted Band Edges Measurement

4.5.1 Limit

Below 20 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

4.5.2 Test Setup



4.5.3 Test Procedures

The EUT was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

MEASUREMENT PROCEDURE REF

1. Set instrument center frequency to DTS channel center frequency.
2. Set the span to ≥ 1.5 times the DTS bandwidth.
3. Set the RBW = 100 kHz.
4. Set the VBW ≥ [3*RBW]
5. Detector = peak.
6. Sweep time = No faster than coupled (auto) time.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. 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.

MEASUREMENT PROCEDURE OOBE

1. Set the center frequency and span to encompass frequency range to be measured. Note that the frequency range might need to be divided into multiple frequency ranges to retain frequency resolution.
NOTE—the number of points can also be increased for large spans to retain frequency resolution
2. Set RBW = 100 kHz.
3. Set VBW ≥ [3*RBW]
4. Detector = peak.
5. Sweep = No faster than coupled (auto) time.
6. Trace Mode = max hold.
7. Allow trace to fully stabilize.
8. 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) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

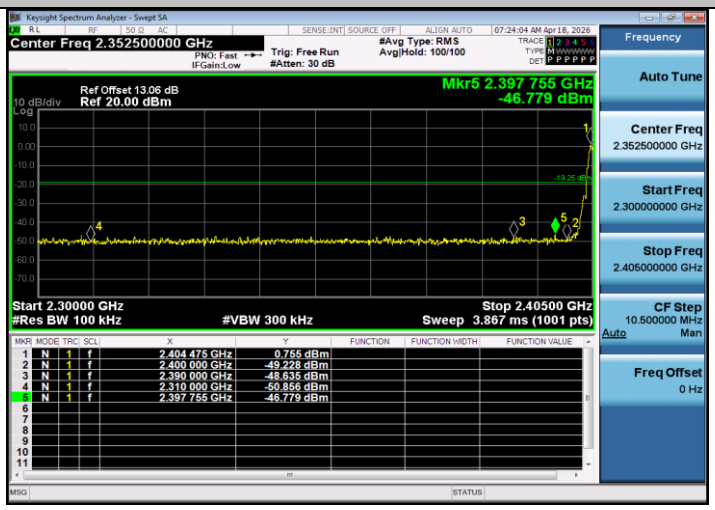
4.5.4 Deviation of Test Standard

No deviation.

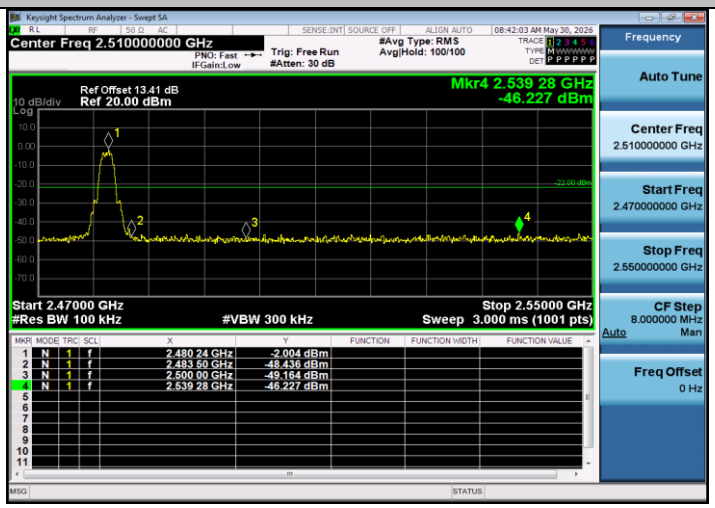
4.5.5 Test Results

TestMode	Antenna	ChName	Freq(MHz)	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
ZIG _1M	Ant1	Low	2405	0.76	-46.78	≤-19.25	PASS
		High	2480	-2.00	-46.23	≤-22	PASS

ZIG _1M_Ant1_Low_2405



ZIG _1M_Ant1_High_2480

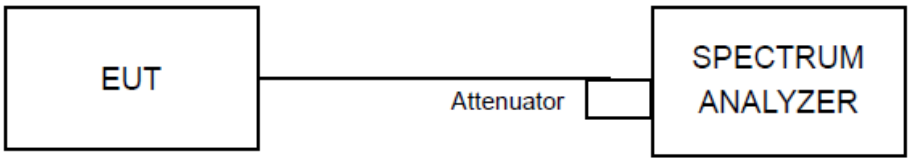


4.6 Conducted Spurious Emissions

4.6.1 Limit

Below 20 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

4.6.2 Test Setup



4.6.3 Test Procedures

The EUT was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

MEASUREMENT PROCEDURE REF

1. Set instrument center frequency to DTS channel center frequency.
2. Set the span to ≥ 1.5 times the DTS bandwidth.
3. Set the RBW = 100 kHz.
4. Set the VBW ≥ [3*RBW].
5. Detector = peak.
6. Sweep time = No faster than coupled (auto) time.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. 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

MEASUREMENT PROCEDURE OOBE

1. Set the center frequency and span to encompass frequency range to be measured. Note that the frequency range might need to be divided into multiple frequency ranges to retain frequency resolution.

NOTE—the number of points can also be increased for large spans to retain frequency resolution.

2. Set RBW = 100 kHz.
3. Set VBW ≥ [3*RBW].
4. Detector = peak.
5. Sweep = No faster than coupled (auto) time.
6. Trace Mode = max hold.
7. Allow trace to fully stabilize.
8. 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) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

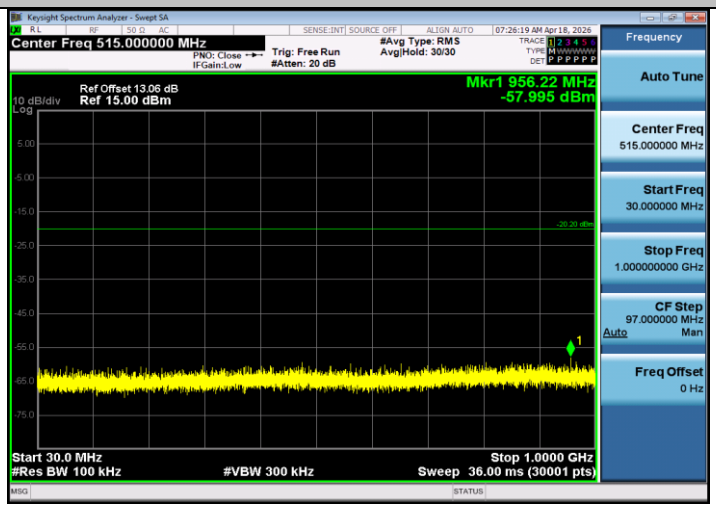
4.6.4 Deviation of Test Standard

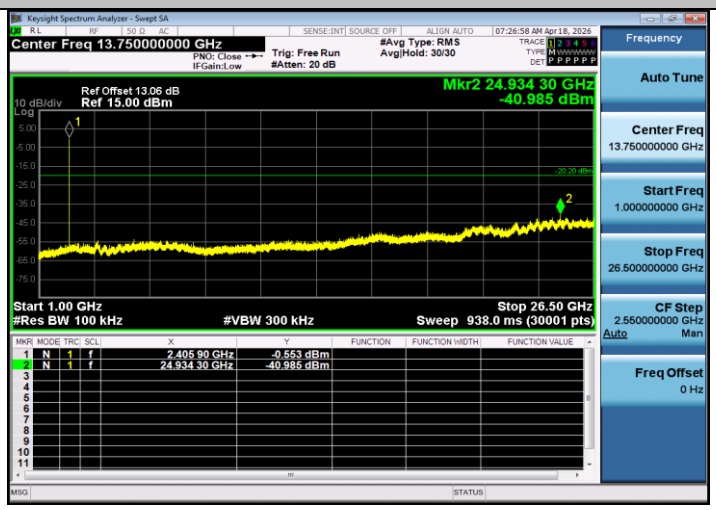
No deviation.

4.6.5 Test Results

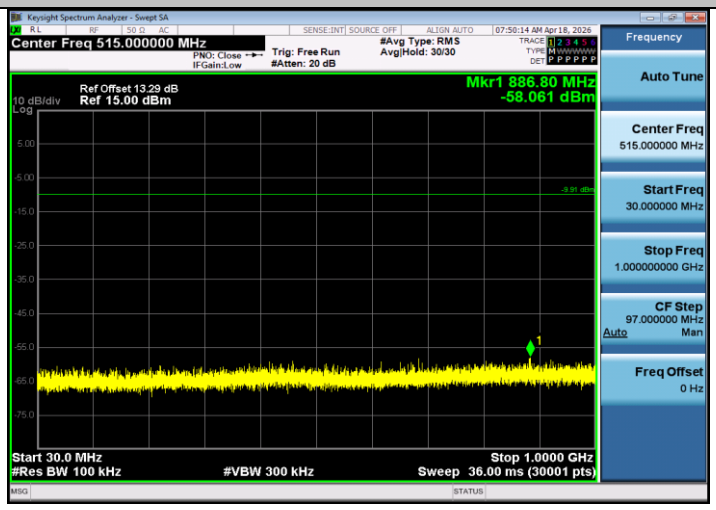
TestMode	Antenna	Freq(MHz)	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
ZIG _1M	Ant1	2405	Reference	-0.20	-0.20	---	PASS
			30~1000	-0.20	-58	≤-20.2	PASS
			1000~26500	-0.20	-40.99	≤-20.2	PASS
		2440	Reference	10.09	10.09	---	PASS
			30~1000	10.09	-58.06	≤-9.91	PASS
			1000~26500	10.09	-42.28	≤-9.91	PASS
		2480	Reference	-3.89	-3.89	---	PASS
			30~1000	-3.89	-57.66	≤-23.89	PASS
			1000~26500	-3.89	-41.16	≤-23.89	PASS

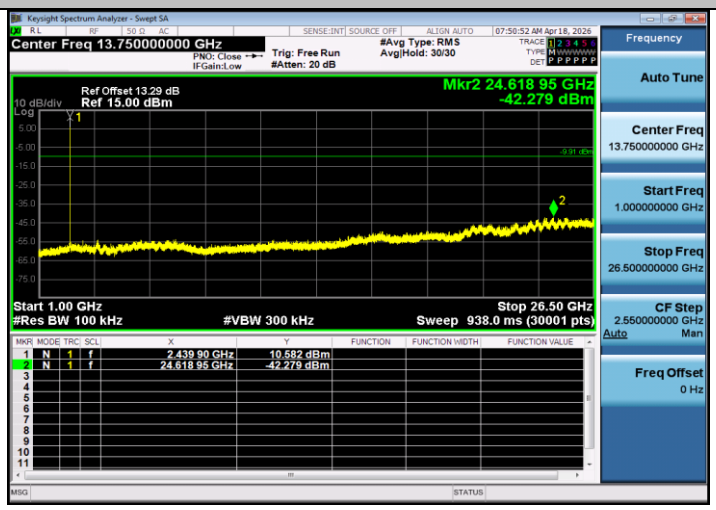
ZIG _1M_Ant1_2405_0~Reference

ZIG _1M_Ant1_2405_30~1000


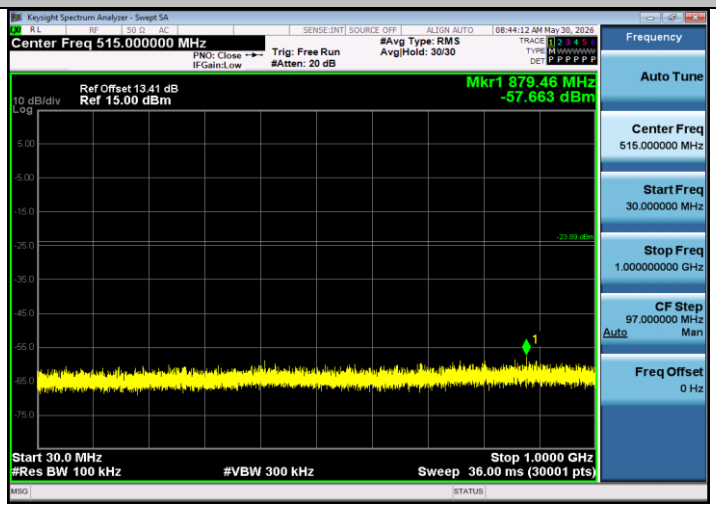
ZIG _1M_Ant1_2405_1000~26500


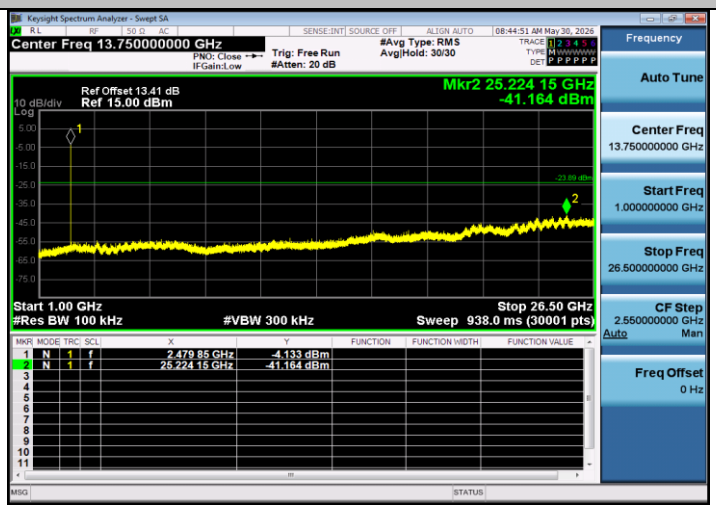
ZIG _1M_Ant1_2440_0~Reference

ZIG _1M_Ant1_2440_30~1000


ZIG _1M_Ant1_2440_1000~26500


ZIG _1M_Ant1_2480_0~Reference

ZIG _1M_Ant1_2480_30~1000


ZIG _1M_Ant1_2480_1000~26500


4.7 Emissions in restricted frequency bands

4.7.1 Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 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	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	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 - 156.525	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	--	--	--

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 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
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

4.7.2 Test Procedure Reference

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

4.7.3 Test Procedures

Peak Field Strength Measurements

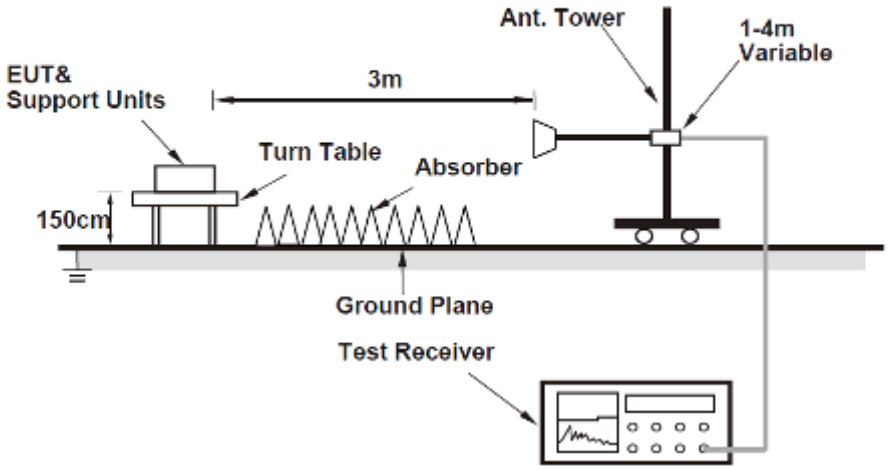
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = No faster than coupled (auto) time.
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW ≥ 3MHz
4. Detector = RMS (power averaging), Averaging Type= power (RMS)
5. Sweep time = auto
6. Trace mode = max hold
7. Perform a trace average of at least 100 traces.
8. A correction factor [10 log (1 / D)] shall be added to the measurement results, where D is the duty cycle.

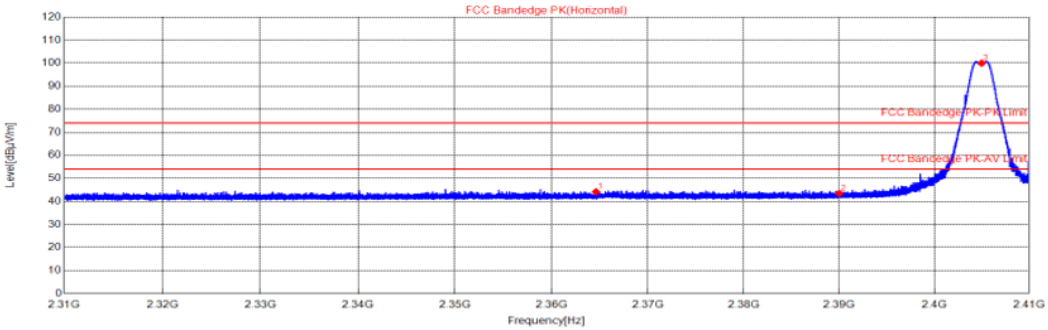
4.7.4 Test Setup

For Radiated emission above 1GHz



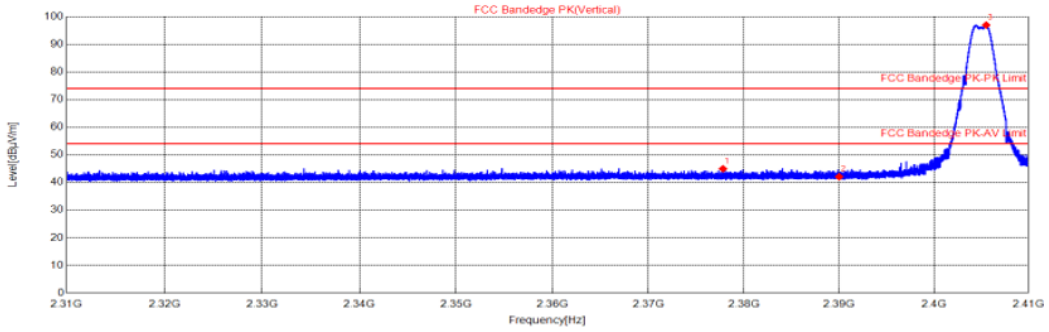
4.7.5 Test Results

Zigbee_Ant1_2405 / Horizontal



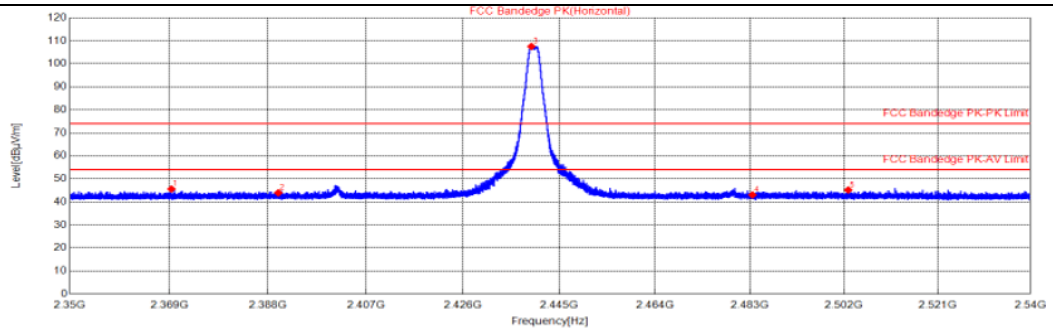
Suspected List										
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	2364.60	54.48	-10.36	44.12	74.00	29.88	PK	155	108	Horizontal
2	2390.00	53.76	-10.32	43.44	74.00	30.56	PK	155	259	Horizontal
3	2405.00	110.32	-10.33	99.99	74.00	-25.99	PK	155	234	Horizontal

Zigbee_Ant1_2405 / Vertical



Suspected List										
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	2377.80	55.27	-10.35	44.92	74.00	29.08	PK	155	184	Vertical
2	2390.00	52.37	-10.32	42.05	74.00	31.95	PK	155	3	Vertical
3	2405.53	107.27	-10.33	96.94	74.00	-22.94	PK	155	291	Vertical

Zigbee_Ant1_2440 / Horizontal

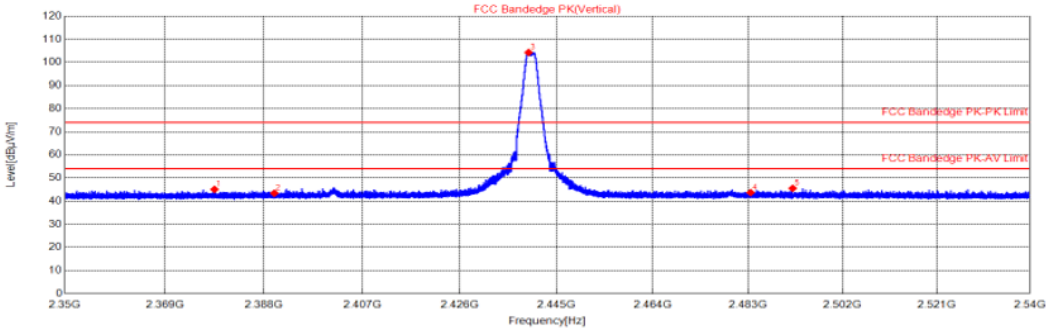


AV Detector

Suspected List

NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	2369.41	55.92	-10.35	45.57	74.00	28.43	PK	155	78	Horizontal
2	2390.00	54.25	-10.32	43.93	74.00	30.07	PK	155	336	Horizontal
3	2439.46	117.98	-10.45	107.53	74.00	-33.53	PK	155	229	Horizontal
4	2483.50	53.63	-10.61	43.02	74.00	30.98	PK	155	109	Horizontal
5	2502.84	55.76	-10.63	45.13	74.00	28.87	PK	155	298	Horizontal

Zigbee_Ant1_2440 / Vertical

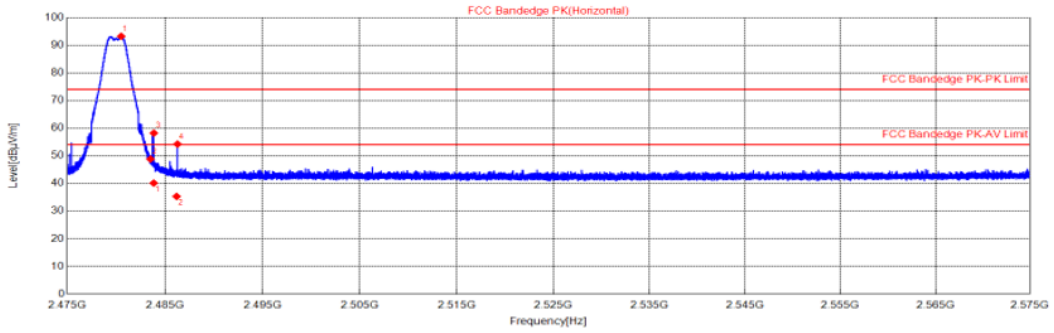


AV Detector

Suspected List

NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	2378.50	55.37	-10.34	45.03	74.00	28.97	PK	155	360	Vertical
2	2390.00	53.70	-10.32	43.38	74.00	30.62	PK	155	163	Vertical
3	2439.47	114.73	-10.45	104.28	74.00	-30.28	PK	155	170	Vertical
4	2483.50	54.26	-10.61	43.65	74.00	30.35	PK	155	201	Vertical
5	2491.94	56.12	-10.63	45.49	74.00	28.51	PK	155	290	Vertical

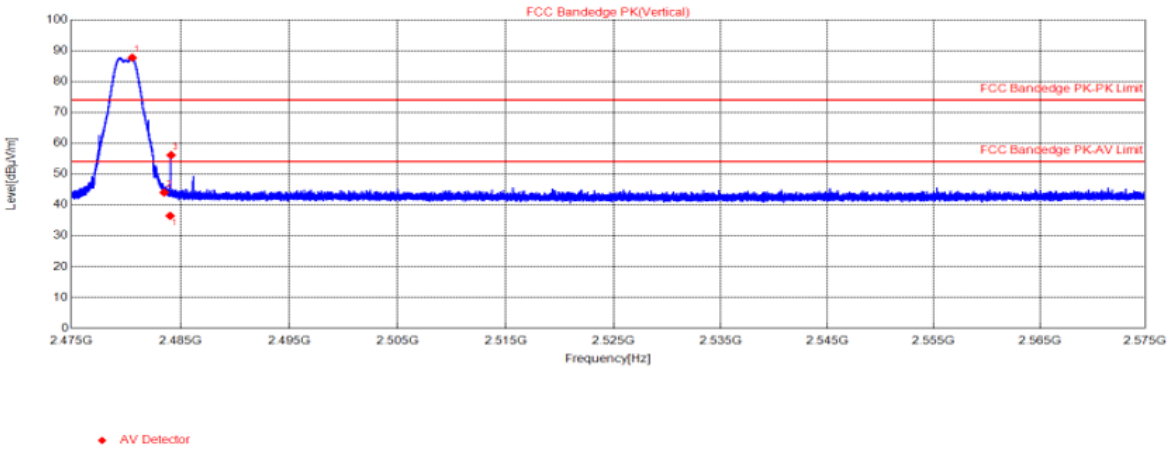
Zigbee_Ant1_2480 / Horizontal PK



Suspected List										
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	2480.51	103.82	-10.60	93.22	74.00	-19.22	PK	155	233	Horizontal
2	2483.50	59.41	-10.61	48.80	74.00	25.20	PK	155	228	Horizontal
3	2483.85	68.79	-10.61	58.18	74.00	15.82	PK	155	82	Horizontal
4	2486.27	64.82	-10.62	54.20	74.00	19.80	PK	155	278	Horizontal

Final Data List										
NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB]	Value [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	2483.83	50.71	-10.61	40.10	54.00	13.90	AV	130.3	231.7	Horizontal
2	2486.17	45.91	-10.62	35.29	54.00	18.71	AV	191.9	228.9	Horizontal

Zigbee_Ant1_2480 /Vertical PK



Suspected List

NO.	Freq. [MHz]	Reading [dBuV/m]	Factor [dB]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	2480.57	98.29	-10.61	87.68	74.00	-13.68	PK	155	171	Vertical
2	2483.50	54.59	-10.61	43.98	74.00	30.02	PK	155	171	Vertical
3	2484.13	66.69	-10.61	56.08	74.00	17.92	PK	155	20	Vertical

Final Data List

NO.	Freq. [MHz]	Reading [dBuV]	Factor [dB]	Value [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	2484.04	47.04	-10.61	36.43	54.00	17.57	AV	183.9	156.9	Vertical

4.8 Radiated Emission Measurement

4.8.1 Limits

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (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

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

4.8.2 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degree to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Both X and Y axes of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotate table was turned from 0 degree to 360 degree to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. 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.

d. 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.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

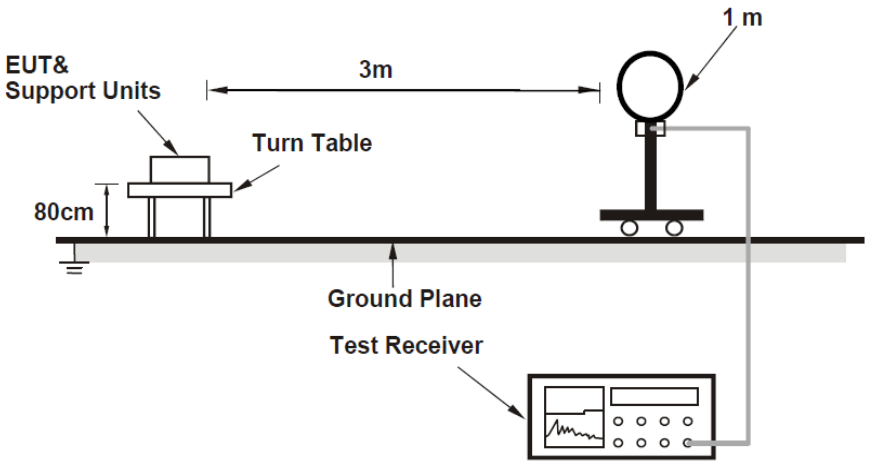
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1/T for RMS Average (Duty cycle < 98 %) for Peak detection at frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.8.3 Deviation from Test Standard

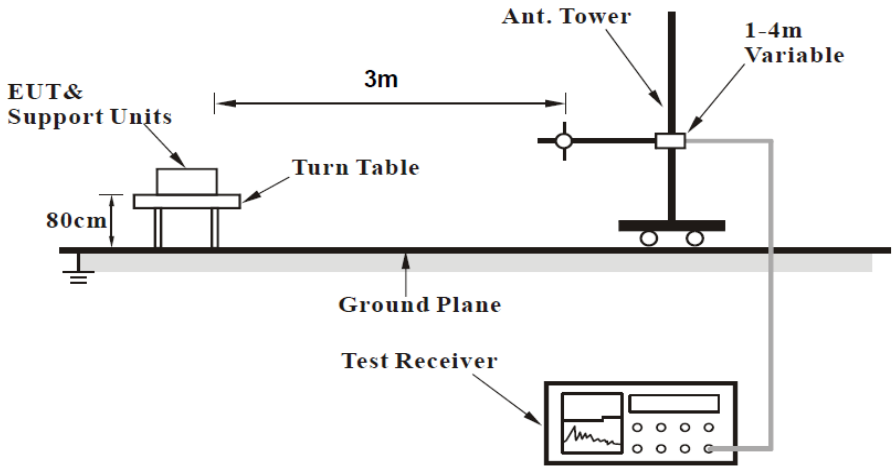
No deviation.

4.8.4 Test Setup

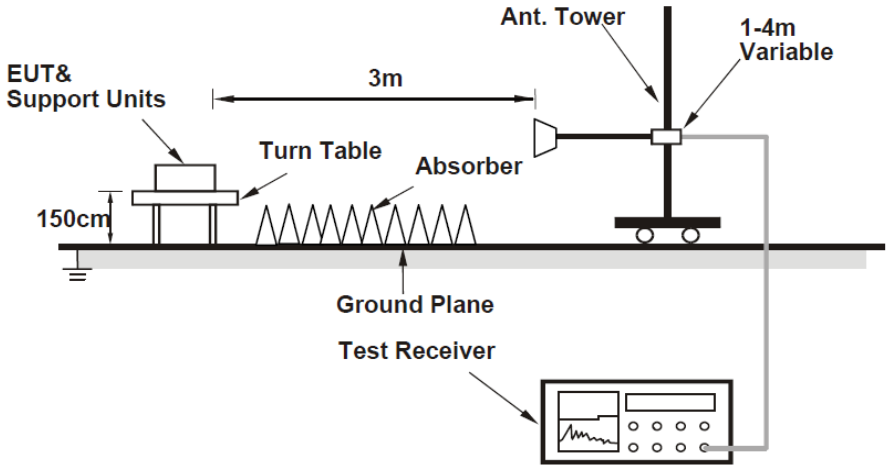
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.8.5 EUT Operating Conditions

a. Placed the EUT on a testing table.

b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.8.6 Test Results

Radiated Emissions Range 9kHz~30MHz & 18GHz~25GHz

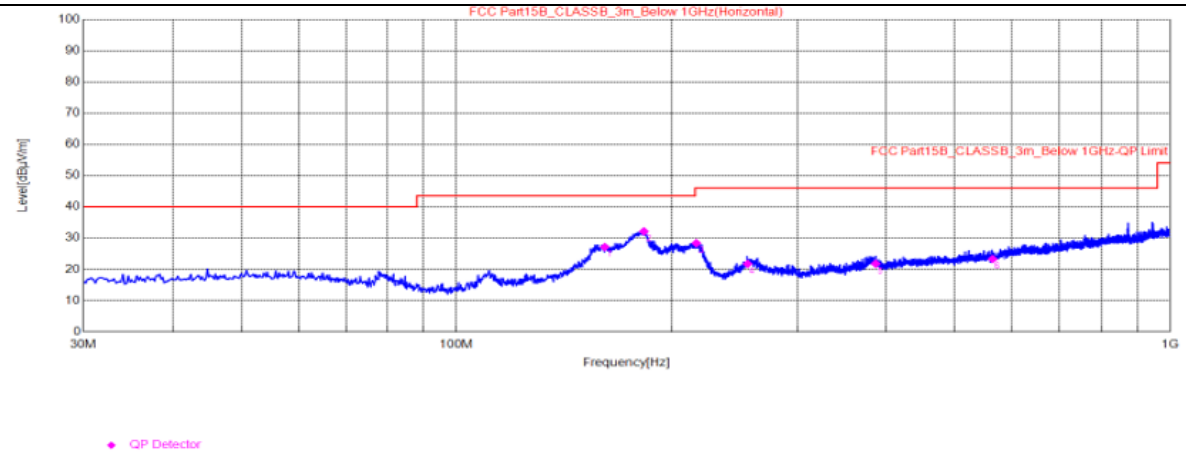
The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Radiated Emissions Range 30MHz~1GHz

Below is the worst test data

Channel	Zigbee _Ant1_2405	**Detector Function**	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	**Antenna Polarity**	Horizontal

Test Plot:



Final Data List

NO.	Freq.[MHz]	Reading [dBuV]	Factor [dB]	Value [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detector	Height [cm]	Angle[°]	Polarity
1	161.34	37.44	-10.32	27.12	43.50	16.38	QP	125	169	Horizontal
2	183.07	43.79	-11.67	32.12	43.50	11.38	QP	134	169	Horizontal
3	216.82	41.25	-12.91	28.34	46.00	17.66	QP	112	203	Horizontal
4	255.82	32.23	-10.51	21.72	46.00	24.28	QP	115	198	Horizontal
5	386.77	28.77	-6.99	21.78	46.00	24.22	QP	134	188	Horizontal
6	564.08	27.06	-3.78	23.28	46.00	22.72	QP	150	104	Horizontal

REMARKS:

1. Emission Level(dBuV/m) = Spectrum reading (dBuV) + Correction Factor(Db/m)

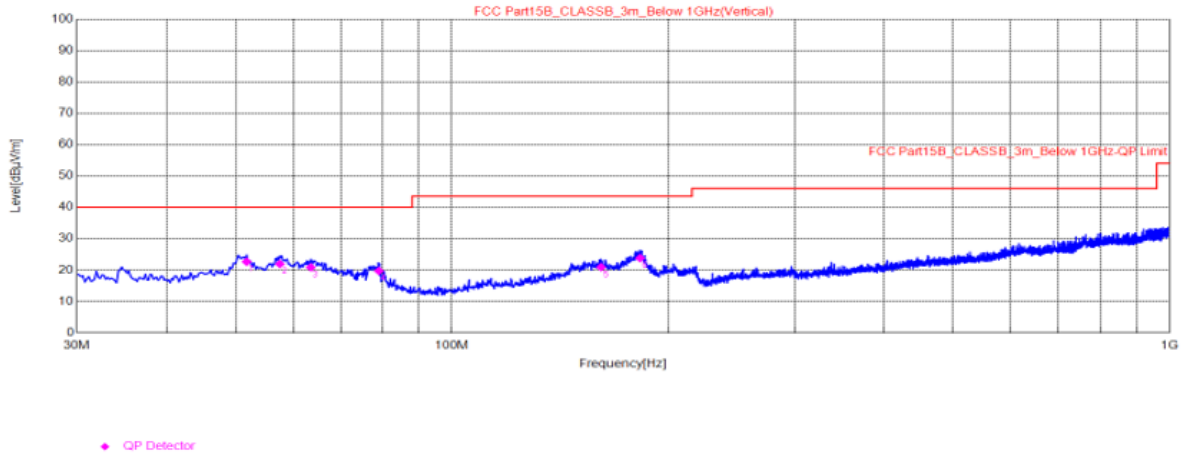
2. Correction Factor(Db/m) = Antenna Factor(Db/m) + Cable Factor(Db) – Pre-Amplifier Factor(Db)

3. The other emission levels were very low against the limit.

4. Margin value = Limit value – Emission Level

Channel	Zigbee _Ant1_2405	**Detector Function**	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	**Antenna Polarity**	Vertical

Test Plot:



Final Data List

NO.	Freq.[MHz]	Reading [dBµV]	Factor [dB]	Value [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle[°]	Polarity
1	51.73	33.31	-10.68	22.63	40.00	17.37	QP	125	70	Vertical
2	57.55	32.72	-10.80	21.92	40.00	18.08	QP	136	0	Vertical
3	63.56	32.15	-11.31	20.84	40.00	19.16	QP	150	360	Vertical
4	79.08	34.08	-14.38	19.70	40.00	20.30	QP	127	46	Vertical
5	161.34	31.22	-10.32	20.90	43.50	22.60	QP	149	92	Vertical
6	182.87	35.44	-11.65	23.79	43.50	19.71	QP	132	46	Vertical

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

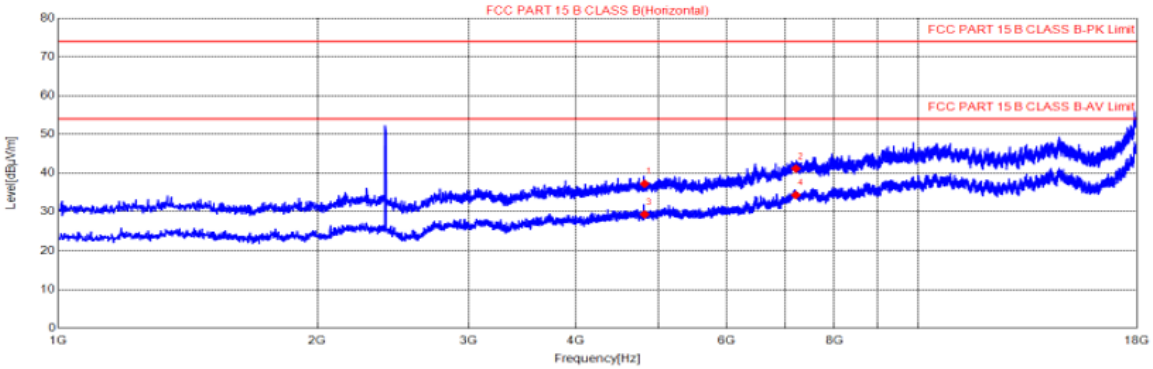
3. The other emission levels were very low against the limit.

4. Margin value = Limit value – Emission Level

Radiated Emission Range 1GHz~10th Harmonic

Below is the worst test data

Channel	Zigbee _Ant1_2405	**Detector Function**	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)



Suspected List										
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	4811.40	40.16	-2.93	37.23	74.00	36.77	PK	100	235	Horizontal
2	7215.20	37.16	4.00	41.16	74.00	32.84	PK	100	214	Horizontal
3	4811.40	32.27	-2.93	29.34	54.00	24.66	AV	100	354	Horizontal
4	7215.20	30.33	4.00	34.33	54.00	19.67	AV	100	177	Horizontal

REMARKS:

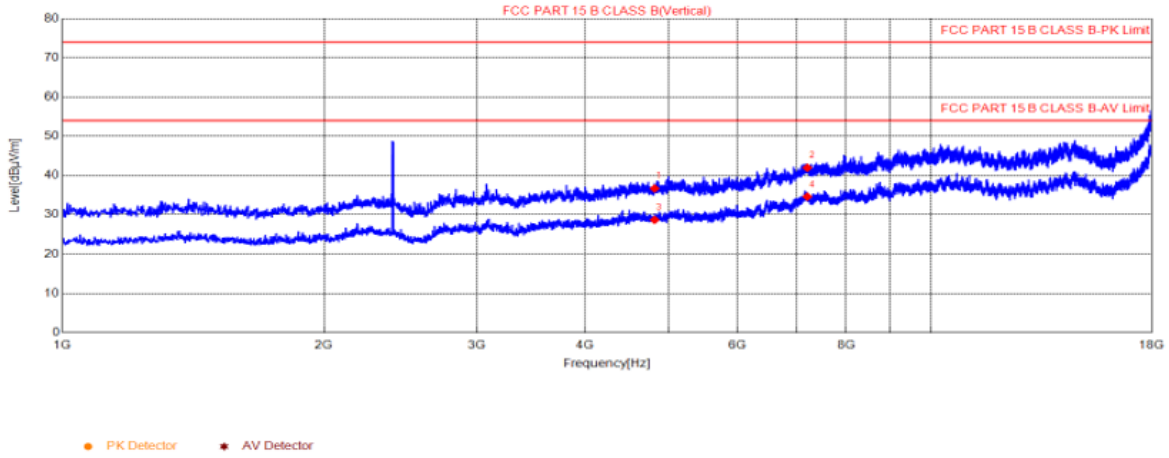
1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Limit value – Emission Level

Channel	Zigbee _Ant1_2405	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)



Suspected List										
NO.	Freq. [MHz]	Reading [dBuV/m]	Factor [dB]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	4811.40	39.62	-2.93	36.69	74.00	37.31	PK	100	360	Vertical
2	7215.20	37.97	4.00	41.97	74.00	32.03	PK	100	337	Vertical
3	4811.40	31.63	-2.93	28.70	54.00	25.30	AV	100	203	Vertical
4	7215.20	30.61	4.00	34.61	54.00	19.39	AV	100	131	Vertical

REMARKS:

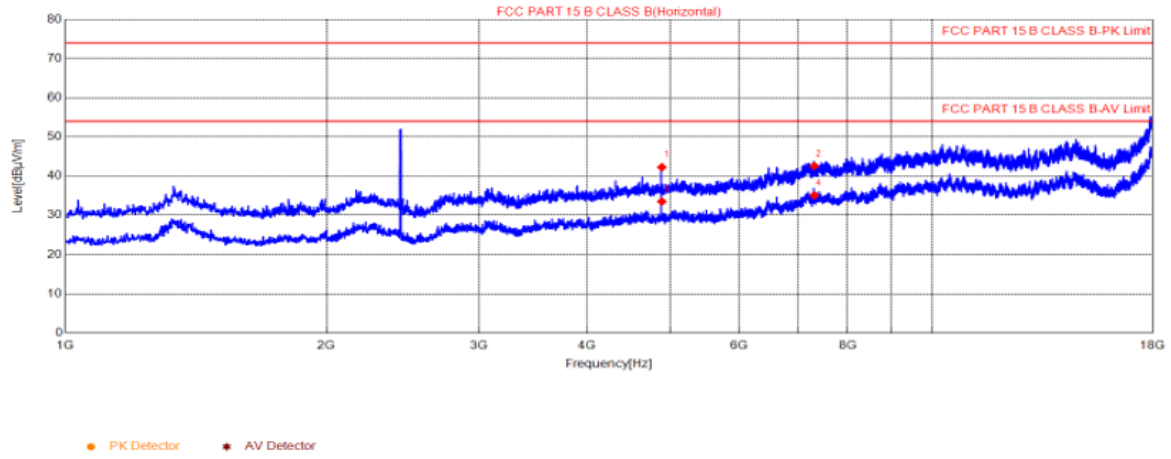
1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Limit value – Emission Level

Channel	Zigbee _Ant1_2440	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)



Suspected List										
NO.	Freq. [MHz]	Reading [dBuV/m]	Factor [dB]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	4881.10	45.00	-2.74	42.26	74.00	31.74	PK	100	241	Horizontal
2	7320.60	39.02	3.55	42.57	74.00	31.43	PK	100	175	Horizontal
3	4881.10	36.25	-2.74	33.51	54.00	20.49	AV	100	234	Horizontal
4	7320.60	31.52	3.55	35.07	54.00	18.93	AV	100	123	Horizontal

REMARKS:

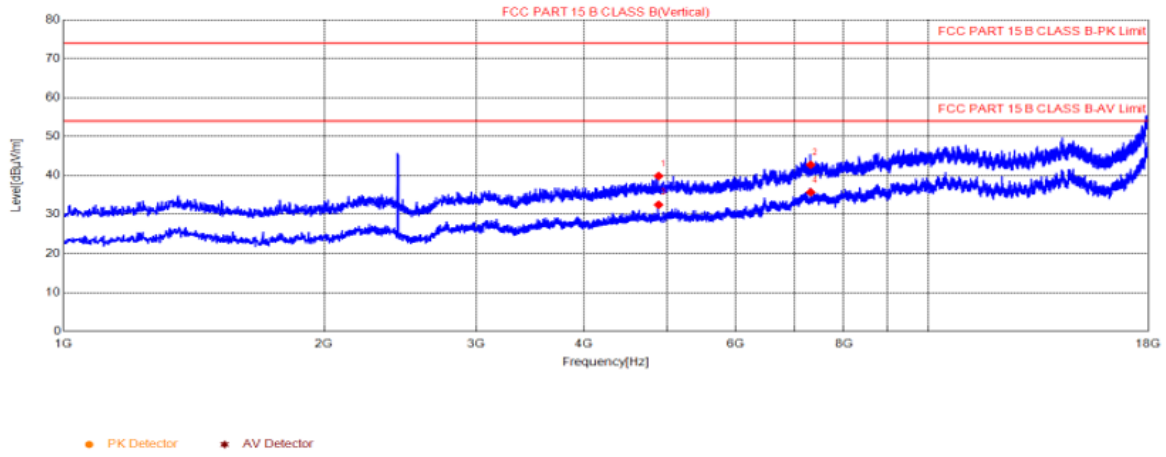
1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Limit value – Emission Level

Channel	Zigbee _Ant1_2440	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)



Suspected List										
NO.	Freq. [MHz]	Reading [dBuV/m]	Factor [dB]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	4881.10	42.60	-2.74	39.86	74.00	34.14	PK	100	221	Vertical
2	7320.60	39.20	3.55	42.75	74.00	31.25	PK	100	177	Vertical
3	4881.10	35.22	-2.74	32.48	54.00	21.52	AV	100	221	Vertical
4	7320.60	32.13	3.55	35.68	54.00	18.32	AV	100	251	Vertical

REMARKS:

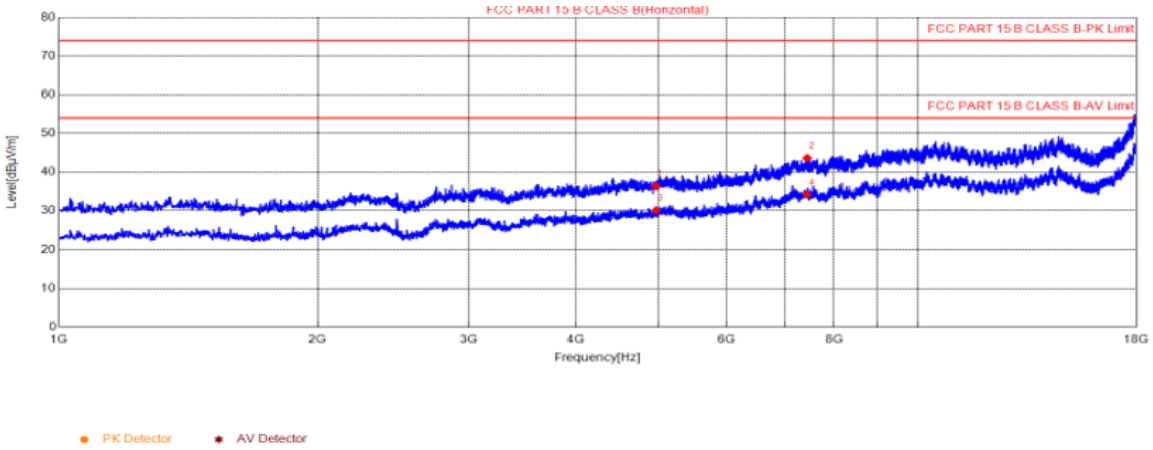
1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Limit value – Emission Level

Channel	Zigbee _Ant1_2480	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)



Suspected List

NO.	Freq. [MHz]	Reading [dBuV/m]	Factor [dB]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	4961.00	38.85	-2.51	36.34	74.00	37.66	PK	100	81	Horizontal
2	7441.30	39.47	4.14	43.61	74.00	30.39	PK	100	0	Horizontal
3	4961.00	32.62	-2.51	30.11	54.00	23.89	AV	100	214	Horizontal
4	7441.30	30.07	4.14	34.21	54.00	19.79	AV	100	37	Horizontal

REMARKS:

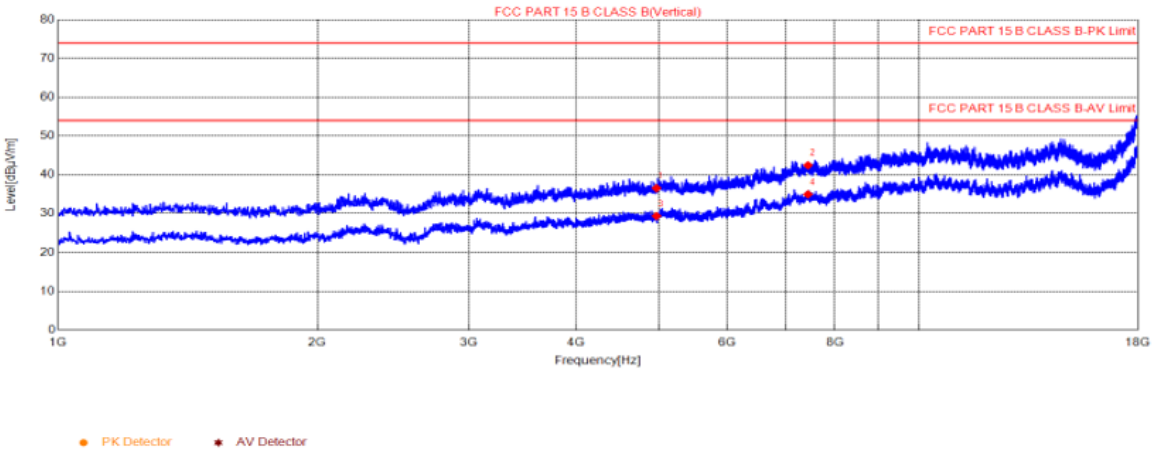
1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Limit value – Emission Level

Channel	Zigbee _Ant1_2480	**Detector Function**	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)



Suspected List										
NO.	Freq. [MHz]	Reading [dBuV/m]	Factor [dB]	Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detector	Height [cm]	Angle [°]	Polarity
1	4961.00	39.05	-2.51	36.54	74.00	37.46	PK	100	203	Vertical
2	7441.30	38.30	4.14	42.44	74.00	31.56	PK	100	13	Vertical
3	4961.00	31.88	-2.51	29.37	54.00	24.63	AV	100	305	Vertical
4	7441.30	30.81	4.14	34.95	54.00	19.05	AV	100	13	Vertical

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Limit value – Emission Level

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

--- END ---