

Project No: TM-2412000436P

Report No.: TMWK2412004779KR

FCC ID: 2AGBW9290038165X

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Rev.: 01

RADIO TEST REPORT

FCC 47 CFR PART 15 SUBPART C

Test Standard	FCC Part 15.247
Product name	Digital device
Brand Name	PHILIPS , hue, @ignify
Model No.	9290038165
Test Result	Pass
Statements of Conformity	Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10-2020 and compliance standards.

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

The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc.(Wugu Laboratory)

Approved by:



Shawn Wu
Supervisor

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	August 22, 2025	Initial Issue	ALL	Peggy Tsai
01	September 2, 2025	See the following Note Rev. (01)	P.37, 38	Peggy Tsai

Rev. (01)

1. Added note in section 4.6.4.

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1. GENERAL INFORMATION

1.1 EUT INFORMATION

Applicant	Signify (China) Investment Co., Ltd. Building no.9, Lane 888, Tianlin Road, Minhang District, Shanghai, 200233, China
Manufacturer	Signify (China) Investment Co., Ltd. Building no.9, Lane 888, Tianlin Road, Minhang District, Shanghai, 200233, China
Equipment	Digital device
Model No.	9290038165
Model Discrepancy	N/A
Trade Name	PHILIPS, hue, ©signify
Received Date	December 31, 2024
Date of Test	January 14 ~ 20, 2025
Power Operation	12V-24VAC, 10VA, 50/60Hz
HW Version	MB: C version SB: B version LB: B version
FW Version	V5.0.10R10DK

Remark:

1. For more details, please refer to the User's manual of the EUT.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

1.2 EUT CHANNEL INFORMATION

Frequency Range	2405MHz-2480MHz
Modulation Type	OQPSK
Number of channel	16 Channels

Remark:

Refer as ANSI C63.10-2020 for test channels

Number of frequencies to be tested		
Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
<input type="checkbox"/> 1 MHz or less	1	Middle
<input type="checkbox"/> 1 MHz to 10 MHz	2	1 near top and 1 near bottom
<input checked="" type="checkbox"/> More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom

1.3 ANTENNA INFORMATION

Antenna Type	<input checked="" type="checkbox"/> PIFA <input type="checkbox"/> PCB <input type="checkbox"/> Dipole <input type="checkbox"/> Coils
Antenna Gain	2 dBi
Antenna Connector	i-pex

Notes:

1.The antenna(s) of the EUT are permanently attached and there are no provisions for connection to an external antenna. So the EUT complies with the requirements of §15.203.

1.4 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 2.21 dB
Channel Bandwidth	+/- 2.79 dB
RF output power (Power Meter + Power sensor)	+/- 0.24 dB
Power Spectral density	+/- 2.74 dB
Conducted Bandedge	+/- 2.74 dB
Conducted Spurious Emission	+/- 2.74 dB
Radiated Emission_9kHz-30MHz	+/- 3.492 dB
Radiated Emission_30MHz-200MHz	+/- 3.62 dB
Radiated Emission_200MHz-1GHz	+/- 3.899 dB
Radiated Emission_1GHz-6GHz	+/- 5.063 dB
Radiated Emission_6GHz-18GHz	+/- 5.122 dB
Radiated Emission_18GHz-26GHz	+/- 3.032 dB
Radiated Emission_26GHz-40GHz	+/- 3.271 dB

Remark:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

1.5 FACILITIES AND TEST LOCATION

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

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan.

CAB identifier: TW1309

Test site	Test Engineer	Remark
AC Conduction Room	Ben Yang	-
Radiation	Ray Li	-
RF Conducted	Jerry Chang	-

Remark: The lab has been recognized as the FCC accredited lab. under the KDB 974614 D01 and is listed in the FCC public Access Link (PAL) database, FCC Registration No. :444940, the FCC Designation No.:TW1309

1.6 INSTRUMENT CALIBRATION

Conducted FCC/IC/NCC (All)					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
PXA Signal Analyzer	Keysight	N9030B	MY62291089	2024-10-04	2025-10-03
Power Sensor	Anritsu	MA2411B	1911387	2024-08-30	2025-08-29
Power Sensor	Anritsu	MA2411B	1911386	2024-07-19	2025-07-18
Power Meter	Anritsu	ML2496A	2136002	2024-07-19	2025-07-18
DC Blocks	Marvelous Microwave	MVE6411	MVE-001	2024-08-08	2025-08-07
Software	Radio Test Software Ver. 21				

966A Radiated					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Analyzer	KEYSIGHT	N9010A	MY52220817	2024-03-15	2025-03-14
Thermo-Hygro Meter	WISEWIND	1206	D07	2024-11-26	2025-11-25
Active Loop Antenna	SCHWARZBEC K	FMZB 1513-60	1513-60-028	2024-12-11	2025-12-10
Bi-Log Antenna	Sunol Sciences	JB3	A030105	2024-07-12	2025-07-11
Preamplifier	EMEC	EM330	060609	2024-02-21	2025-02-20
Cable	Huber+Suhner	104PEA	20995+21000+182330	2024-08-07	2025-08-06
Horn Antenna	ETC	MCTD 1209	DRH13M02003	2024-12-20	2025-12-19
Preamplifier	HP	8449B	3008A00965	2024-12-18	2025-12-17
Cable	EMCI	EMC101G	221011+221012+221213	2024-10-11	2025-10-10
Attenuator	Mini-Circuits	BW-S9W5	BWS9W5-09-966A-01	2024-02-07	2025-02-06
High Pass Filters	Titan Microwave	T04H30001800 070S01	22011402-4	2024-06-12	2025-06-11
Horn Antenna	SCHWARZBEC K	BBHA9170	1047	2024-12-06	2025-12-05
Pre-Amplifier	EMCI	EMC184045SE	980860	2024-12-02	2025-12-01
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Site Validation	CCS	966A	N/A	2024-08-03	2025-08-02
Software	e3 V9-210616c				

Remark:

- Each piece of equipment is scheduled for calibration once a year.
- N.C.R. = No Calibration Required.

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AC Mains Conduction					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESCI	100064	2024-06-14	2025-06-13
LISN	TESEQ	LN2-16N	22012	2024-02-29	2025-02-27
Cable	Woken	SFL402	185A	2024-07-08	2025-07-07
Software	e3 V6-110812				

Remark:

1. Each piece of equipment is scheduled for calibration once a year.
2. N.C.R. = No Calibration Required.

1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT

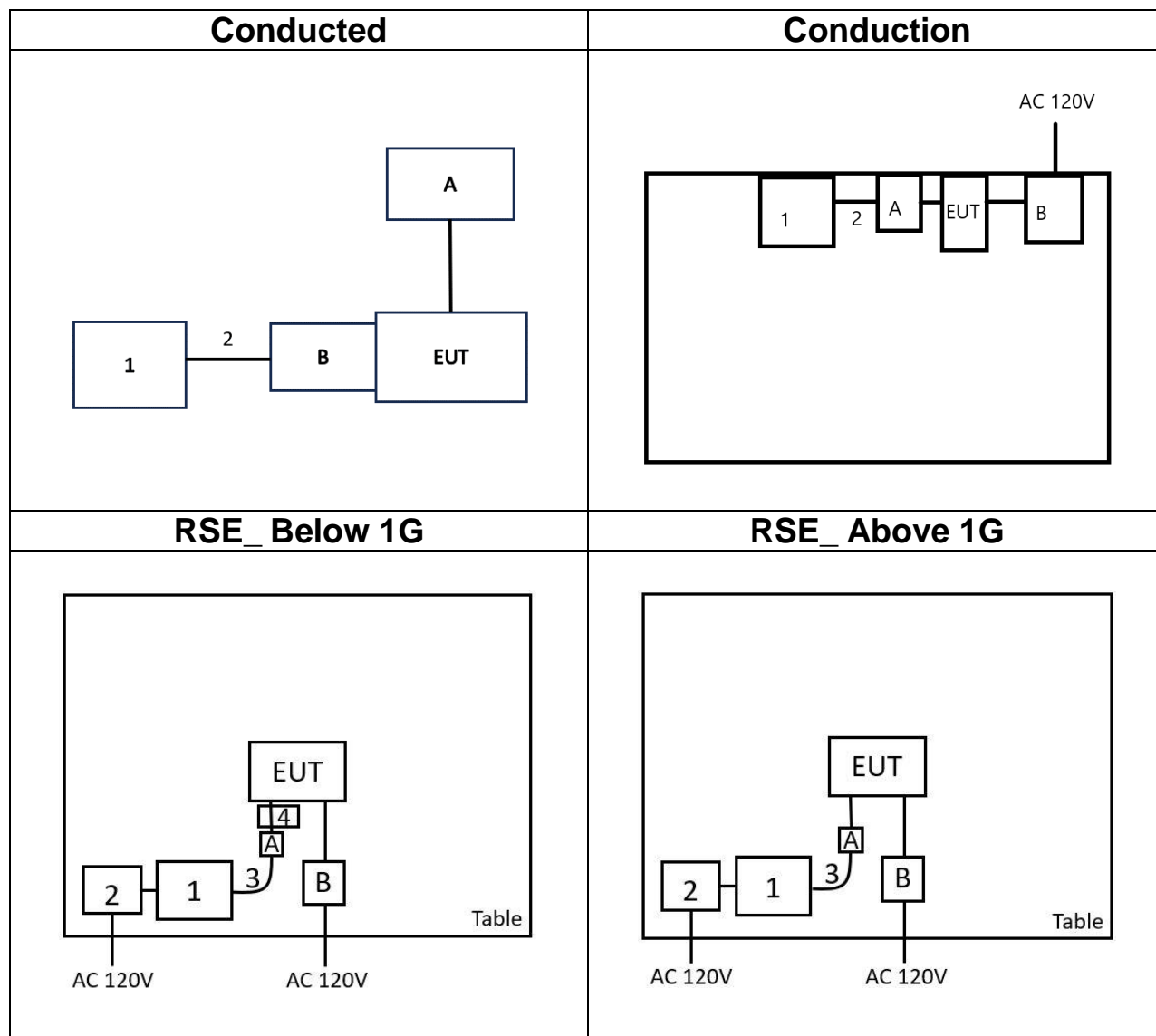
EUT Accessories Equipment						
No.	Equipment	Brand	Model	Series No.	FCC ID	IC
	N/A					

Support Equipment (Conducted)					
No.	Equipment	Brand	Model	Series No.	FCC ID
1	NB(I)	Lenovo	X260	N/A	N/A
2	USB to RS232	SUNBOX	USC-232G	N/A	N/A
A	Adapter	WUYELIN	PS-AC2440	N/A	N/A
B	Test kit	N/A	N/A	N/A	N/A

Support Equipment (Conduction)					
No.	Equipment	Brand	Model	Series No.	FCC ID
1	NB(D)	Lenovo	ThinkPad X260	N/A	N/A
2	USB to RS232	SUNBOX	USC-232G	N/A	N/A
A	Test kit	N/A	N/A	N/A	N/A
B	Adapter	WUYELIN	PS-AC2440	N/A	N/A

Support Equipment (RSE)					
No.	Equipment	Brand	Model	Series No.	FCC ID
1	NB(D)	Lenovo	ThinkPad X260	N/A	N/A
2	Adapter	Lenovo	ADLX45DLC3A	N/A	N/A
3	USB to RS232	SUNBOX	USC-232G	N/A	N/A
4	SUPPRESSION CORES	KINGCORE	RC 16*16*8-M	N/A	N/A
A	Test jig	N/A	N/A	N/A	N/A
B	Adapter	WUYELIN	PS-AC2440	N/A	N/A

1.8 TEST SET UP DIAGRAM



1.9 TEST PROGRAM

The EUT connection corresponds to the surrounding fixture control board. This EUT uses "Tera Term" software and setup command to set the frequency, modulation, and power to allow the sample to continuously transmit.

1.10 TEST METHODOLOGY AND APPLIED STANDARDS

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10-2020, FCC Part 2, FCC Part 15.247, KDB 558074.

2. TEST SUMMERY

FCC Standard Section	Report Section	Test Item	Result
15.203	1.3	Antenna Requirement	Pass
15.207(a)	4.1	AC Conducted Emission	Pass
15.247(a)(2)	4.2	6 dB Bandwidth	Pass
-	4.2	Occupied Bandwidth (99%)	Pass
15.247(b)(3)	4.3	Output Power Measurement	Pass
15.247(e)	4.4	Power Spectral Density	Pass
15.247(d)	4.5	Conducted Band Edge	Pass
15.247(d)	4.5	Conducted Spurious Emission	Pass
15.247(d) 15.205, 15.209	4.6	Radiation Band Edge	Pass
15.247(d) 15.205, 15.209	4.6	Radiation Spurious Emission	Pass

3. DESCRIPTION OF TEST MODES

3.1 THE WORST MODE OF OPERATING CONDITION

Operation mode	Zigbee
Test Channel Frequencies	1.Lowest Channel : 2405MHz 2.Middle Channel : 2440MHz 3.Highest Channel : 2480MHz

Remark:

1. EUT pre-scanned data rate of output power for each mode, the worst data rate were recorded in this report.
2. Based on FCC Part 15.31(m), the laboratory conducts a comprehensive evaluation of CH low, CH middle, and CH high. Other additional channels only evaluate the radiated restricted bands of operation and powers.

3.2 THE WORST MODE OF MEASUREMENT

AC Power Line Conduction Emission	
Test Condition	AC Power line conduction emission for line and neutral
Power supply Mode	Mode 1: EUT Power by Adapter
Worst Mode	<input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4

Radiated Emission Measurement Above 1G	
Test Condition	Radiated Emission Above 1G
Power supply Mode	Mode 1: EUT power by Adapter
Worst Mode	<input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4
Worst Position	<input type="checkbox"/> Placed in fixed position. <input type="checkbox"/> Placed in fixed position at X-Plane (E2-Plane) <input checked="" type="checkbox"/> Placed in fixed position at Y-Plane (E1-Plane) <input type="checkbox"/> Placed in fixed position at Z-Plane (H-Plane)

Radiated Emission Measurement Below 1G	
Test Condition	Radiated Emission Below 1G
Power supply Mode	Mode 1: EUT power by Adapter
Worst Mode	<input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4

Remark:

1. The worst mode was record in this test report.
2. AC power line conducted emission were performed the EUT transmit at the highest output power channel as worse case.
3. EUT pre-scanned in three axis ,X,Y, Z and two polarity, for radiated measurement. The worst case(Y-Plane) were recorded in this report

3.3 EUT DUTY CYCLE

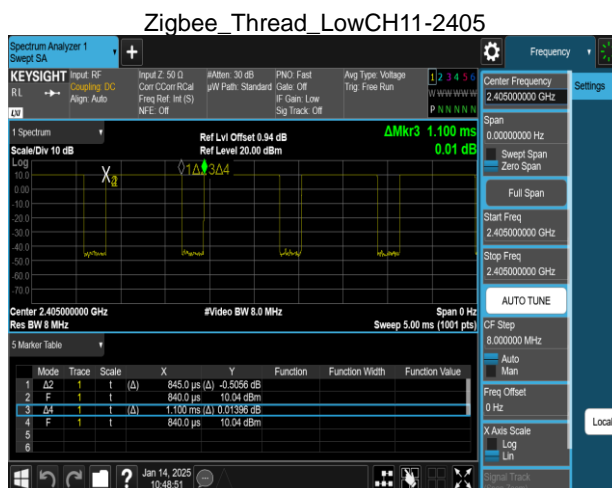
Temperature: 18.6°C

Test date: January 14, 2025

Humidity: 48% RH

Tested by: Jerry Chang

Mode	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
Zigbee/Thread	76.82	1.15	1.18	2.00



4. TEST RESULT

4.1 AC POWER LINE CONDUCTED EMISSION

4.1.1 Test Limit

According to §15.207(a),

Frequency Range (MHz)	Limits(dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

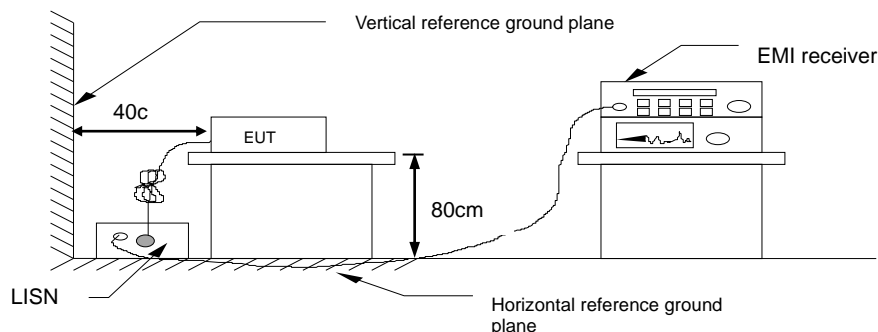
* Decreases with the logarithm of the frequency.

4.1.2 Test Procedure

Test method Refer as ANSI C63.10-2020,

1. The EUT was placed on a non-conducted table, which is 0.8m above horizontal ground plane and 0.4m above vertical ground plane.
2. EUT connected to the line impedance stabilization network (LISN)
3. Receiver set RBW of 9kHz and Detector Peak, and note as quasi-peak and average.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Recorded Line for Neutral and Line.

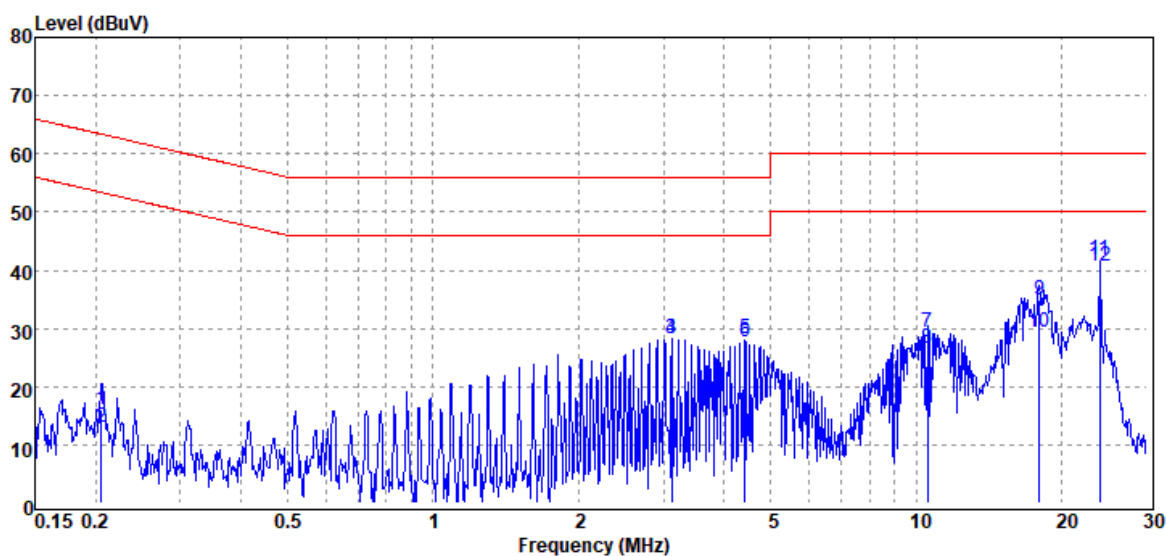
4.1.3 Test Setup



4.1.4 Test Result

Project No : TM-2412000436P
Operation Mode : Zigbee
Test Chamber : Conduction
Probe : LINE
Note :

Test Date : 2025-01-20
Temp./Humi. : 23.4°C / 54%
Engineer : Ben Yang
Test Voltage : AC 120V/60Hz



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Read Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.206	QP	15.66	0.39	16.05	63.38	-47.33
0.206	Average	12.62	0.39	13.01	53.38	-40.37
3.117	QP	27.98	0.22	28.20	56.00	-27.80
3.117	Average	27.93	0.22	28.15	46.00	-17.85
4.418	QP	27.95	0.26	28.21	56.00	-27.79
4.418	Average	27.53	0.26	27.79	46.00	-18.21
10.553	QP	28.88	0.36	29.24	60.00	-30.76
10.553	Average	26.33	0.36	26.69	50.00	-23.31
17.987	QP	34.38	0.46	34.84	60.00	-25.16
17.987	Average	28.86	0.46	29.32	50.00	-20.68
24.000	QP	41.24	0.54	41.78	60.00	-18.22
24.000	Average	40.27	0.54	40.81	50.00	-9.19

Note: 1. Actual FS= Spectrum Read Level + Factor

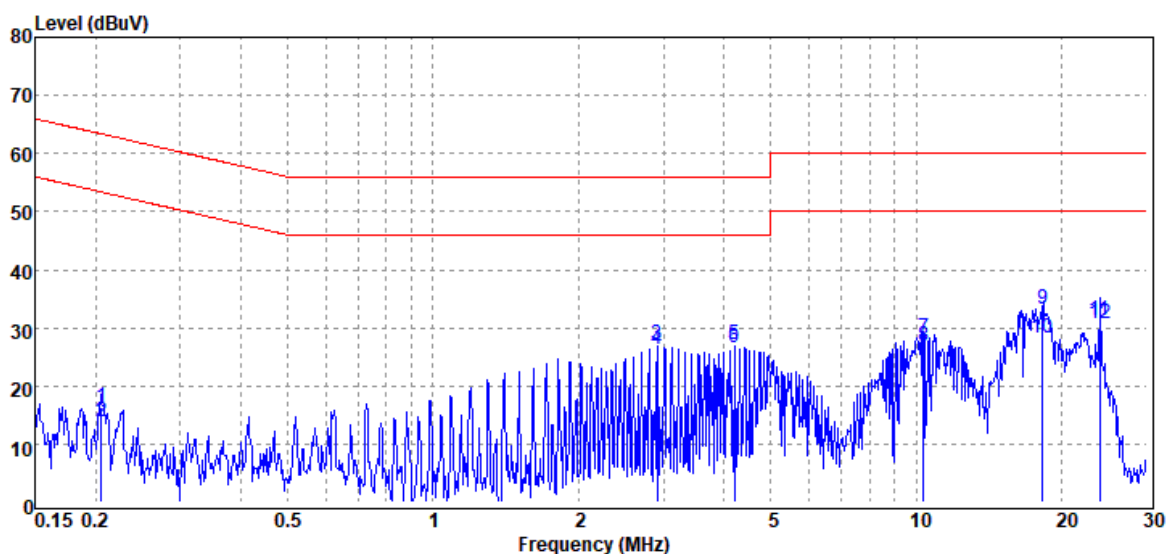
Note: 2. Margin= Actual FS - Limit

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Project No : TM-2412000436P
Operation Mode : Zigbee
Test Chamber : Conduction
Probe : NEUTRAL
Note :

Test Date : 2025-01-20
Temp./Humi. : 23.4°C / 54%
Engineer : Ben Yang
Test Voltage : AC 120V/60Hz



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Read Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.206	QP	15.99	0.36	16.35	63.37	-47.02
0.206	Average	13.48	0.36	13.84	53.37	-39.53
2.912	QP	26.82	0.19	27.01	56.00	-28.99
2.912	Average	26.12	0.19	26.31	46.00	-19.69
4.209	QP	26.82	0.21	27.03	56.00	-28.97
4.209	Average	26.40	0.21	26.61	46.00	-19.39
10.343	QP	27.95	0.34	28.29	60.00	-31.71
10.343	Average	26.42	0.34	26.76	50.00	-23.24
18.295	QP	32.80	0.43	33.23	60.00	-26.77
18.295	Average	27.84	0.43	28.27	50.00	-21.73
24.001	QP	30.87	0.50	31.37	60.00	-28.63
24.001	Average	30.35	0.50	30.85	50.00	-19.15

Note: 1. Actual FS= Spectrum Read Level + Factor

Note: 2. Margin= Actual FS - Limit

4.2 6dB BANDWIDTH AND OCCUPIED BANDWIDTH(99%)

4.2.1 Test Limit

According to §15.247(a)(2),

6 dB Bandwidth :

Limit	Shall be at least 500kHz
-------	--------------------------

Occupied Bandwidth(99%) : For reporting purposes only.

4.2.2 Test Procedure

Test method Refer as KDB 558074 D01 and ANSI C63.10-2020.

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW = 100kHz, VBW = 300kHz and Detector = Peak, to measurement 6 dB Bandwidth.
4. SA set RBW = 1% ~ 5% OBW, VBW = three times the RBW and Detector = Peak, to measurement 99% Bandwidth
5. Measure and record the result of 6 dB Bandwidth and 99% Bandwidth. in the test report.

4.2.3 Test Setup

Refer to section 1.8.

4.2.4 Test Result

Temperature: 18.6°C Test date: January 14, 2025
Humidity: 48% RH Tested by: Jerry Chang

6dB BANDWIDTH

Zigbee/Thread mode

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2405	1.436	≥ 0.5	PASS
2440	1.436	≥ 0.5	PASS
2480	1.436	≥ 0.5	PASS

BANDWIDTH 99%

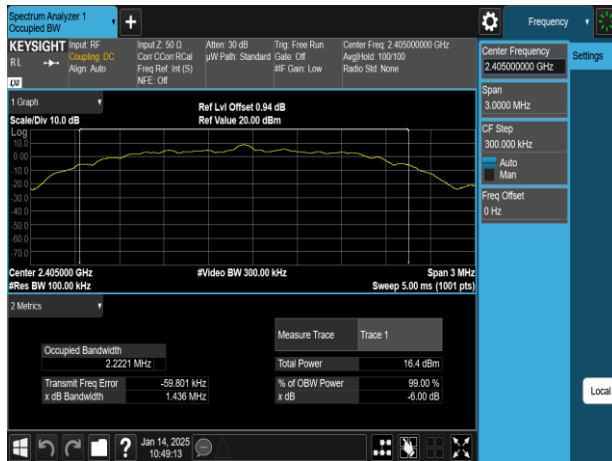
Zigbee/Thread mode

Frequency (MHz)	99%Bandwidth (MHz)
2405	2.2144
2440	2.2146
2480	2.2138

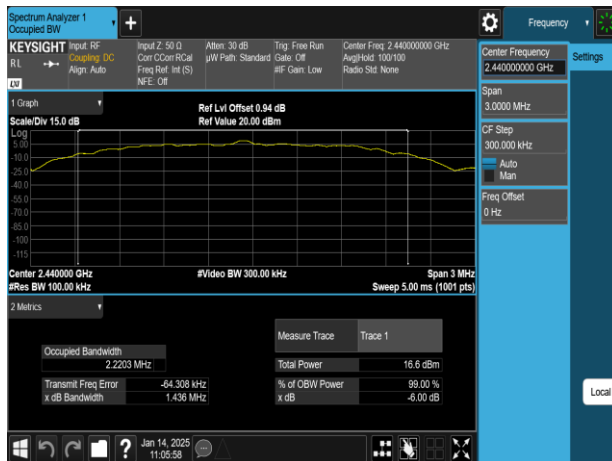
Test Data

6dB BANDWIDTH

OBW_ZIGBEE_THREAD_LowCH11-2405MHz



OBW_ZIGBEE_THREAD_MidCH18-2440MHz

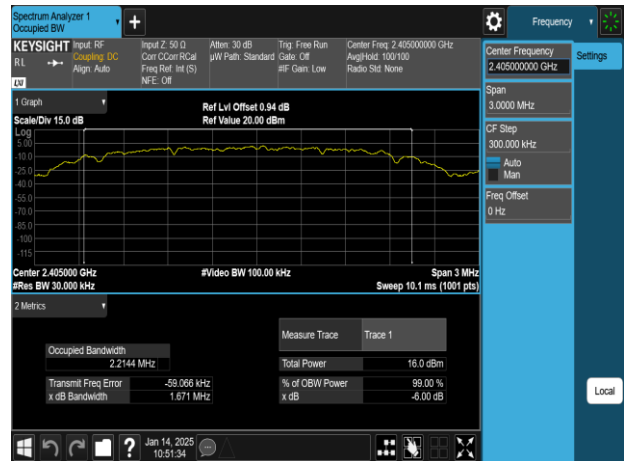


OBW_ZIGBEE_THREAD_HighCH26-2480MHz



BANDWIDTH 99%

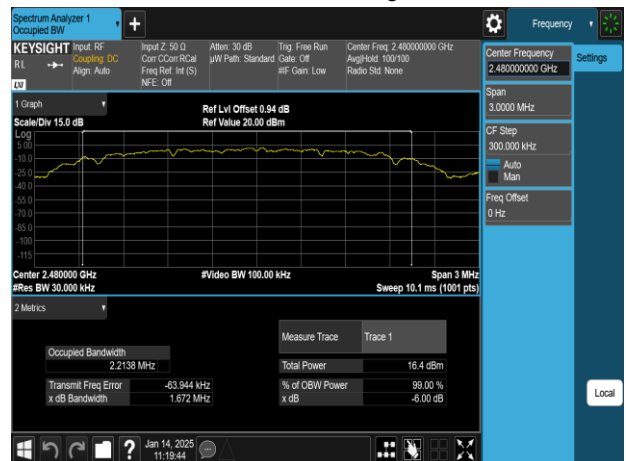
IC OBW_ZIGBEE_THREAD_LowCH11-2405MHz



IC OBW_ZIGBEE_THREAD_MidCH18-2440MHz



IC OBW_ZIGBEE_THREAD_HighCH26-2480MHz



4.3 OUTPUT POWER MEASUREMENT

4.3.1 Test Limit

According to §15.247(b)(3),

Peak output power :

FCC

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

Limit	<input checked="" type="checkbox"/> Antenna not exceed 6 dBi : 30dBm <input type="checkbox"/> Antenna with DG greater than 6 dBi [Limit = 30 – (DG – 6)] <input type="checkbox"/> Point-to-point operation
-------	---

Average output power : For reporting purposes only.

4.3.2 Test Procedure

Test method Refer as KDB 558074 D01

1. The EUT RF output connected to the power meter by RF cable.
2. Setting maximum power transmit of EUT.
3. The path loss was compensated to the results for each measurement.
4. Measure and record the result of Peak output power and Average output power. in the test report.

4.3.3 Test Setup

Refer to section 1.8.

4.3.4 Test Result

Temperature: 18.6°C

Test date: January 14, 2025

Humidity: 48% RH

Tested by: Jerry Chang

Peak & Average output power :

Zigbee/Thread mode:

CH	Frequency (MHz)	Power Setting	Peak Output Power (dBm)	Required Limit (dBm)
11	2405	10	9.93	30
18	2440	10	10.14	30
26	2480	10	10.39	30
CH	Frequency (MHz)	Power Setting	Avg. Output Power (dBm)	Required Limit (dBm)
11	2405	10	9.89	30
18	2440	10	10.11	30
26	2480	10	10.36	30

***Note:**

1.Measured by power meter, cable loss 0.94 dB + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.

4.4 POWER SPECTRAL DENSITY

4.4.1 Test Limit

According to §15.247(e),

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Limit	<input checked="" type="checkbox"/> Antenna not exceed 6 dBi : 8dBm <input type="checkbox"/> Antenna with DG greater than 6 dBi [Limit = 8 – (DG – 6)] <input type="checkbox"/> Point-to-point operation :
-------	---

4.4.2 Test Procedure

Test method Refer as KDB 558074 D01

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW = 3kHz, VBW = 10kHz, Span = 1.5 times DTS Bandwidth (6 dB BW), Detector = Peak, Sweep Time = Auto and Trace = Max hold.
4. The path loss was compensated to the results for each measurement by SA.
5. Mark the maximum level.
6. Measure and record the result of power spectral density. in the test report.

4.4.3 Test Setup

Refer to section 1.8.

4.4.4 Test Result

Temperature: 18.6°C **Test date:** January 14, 2025
Humidity: 48% RH **Tested by:** Jerry Chang

Zigbee/Thread mode

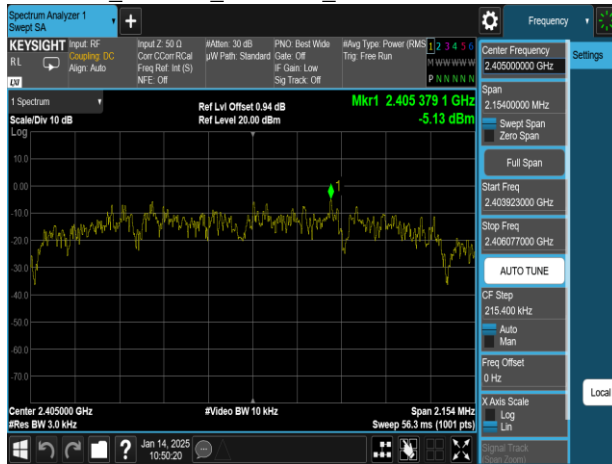
Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2405	-5.13	8	PASS
2440	-4.90	8	PASS
2480	-4.75	8	PASS

***Note:**

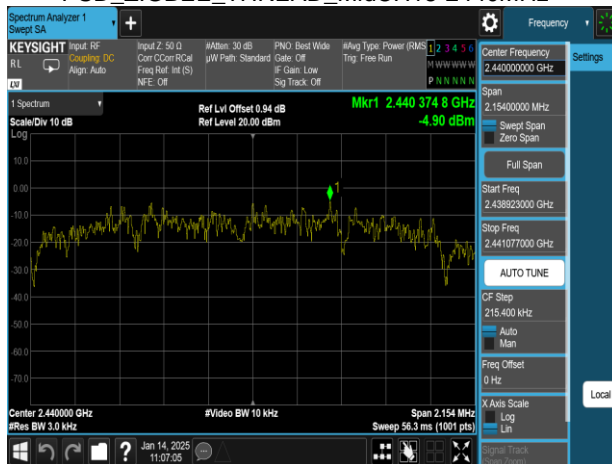
1.cable loss as 0.94dB that offsets in the spectrum

Test Data

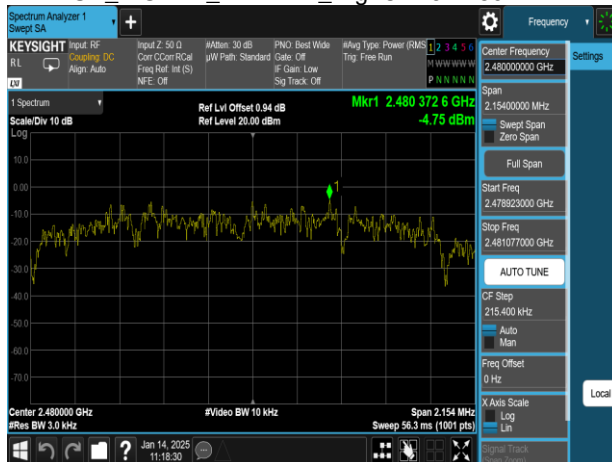
PSD_ZIGBEE_THREAD_LowCH11-2405MHz



PSD_ZIGBEE_THREAD_MidCH18-2440MHz



PSD_ZIGBEE_THREAD_HighCH26-2480MHz



4.5 CONDUCTED BAND EDGE AND SPURIOUS EMISSION

4.5.1 Test Limit

According to §15.247(d),

FCC: In any 100 kHz bandwidth outside the authorized frequency band, Non-restricted bands shall be attenuated at least 20 dB/30 dB relative to the maximum PSD level in 100 kHz by RF conducted or a radiated measurement 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).

4.5.2 Test Procedure

Test method Refer as KDB 558074 D01

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.
2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.
3. In any 100 kHz bandwidth outside the authorized frequency band, shall be attenuated at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when conducted power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

4.5.3 Test Setup

Refer to section 1.8.

4.5.4 Test Result

Temperature: 18.6°C

Test date: January 14, 2025

Humidity: 48% RH

Tested by: Jerry Chang

Test Data

Reference Level

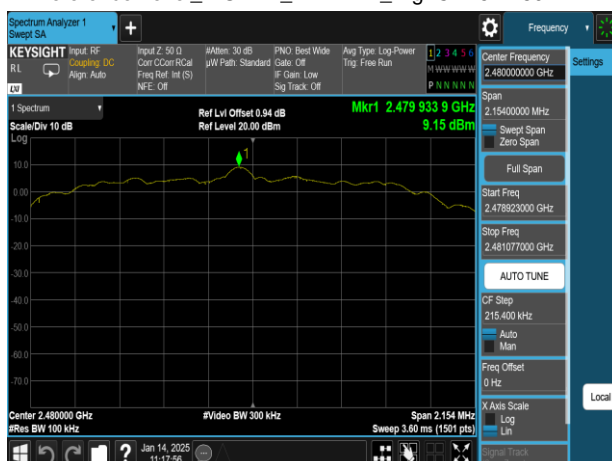
Reference Level_ZIGBEE_THREAD_LowCH11-2405MHz



Reference Level_ZIGBEE_THREAD_MidCH18-2440MHz



Reference Level_ZIGBEE_THREAD_HighCH26-2480MHz



BANDWIDTH 99%

Band Edge_ZIGBEE_THREAD_LowCH11-2405MHz



Band Edge_ZIGBEE_THREAD_HighCH26-2480MHz



Spurious Emission

Spurious Emission_ZIGBEE_THREAD_LowCH11-2405MHz



Spurious Emission_ZIGBEE_THREAD_MidCH18-2440MHz



Spurious Emission_ZIGBEE_THREAD_HighCH26-2480MHz



4.6 RADIATION BANDEDGE AND SPURIOUS EMISSION

4.6.1 Test Limit

FCC according to §15.247(d), §15.209 and §15.205,

In any 100 kHz bandwidth outside the authorized frequency band, all harmonic and spurious must be least 20 dB below the highest emission level with the authorized frequency band. Radiation emission which fall in the restricted bands must also follow the FCC section 15.209 as below limit in table.

Below 30 MHz

Frequency	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/F (F in kHz)	30
1.705-30 MHz	30	N/A	30

Above 30 MHz

Frequency (MHz)	Field Strength microvolts/m at 3 metres (watts, e.i.r.p.)	
	Transmitters	Receivers
30-88	100 (3 nW)	100 (3 nW)
88-216	150 (6.8 nW)	150 (6.8 nW)
216-960	200 (12 nW)	200 (12 nW)
Above 960	500 (75 nW)	500 (75 nW)

Remark:

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

4.6.2 Test Procedure

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m and below 1 GHz is 0.8m above ground plane. The EUT Configured un accordance with ANSI C63.10-2020, and the EUT set in a continuous mode.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. And EUT is set 3m away from the receiving antenna, which is scanned from 1m to 4m above the ground plane to find out the highest emissions. Measurement are made polarized in both the vertical and the horizontal positions with antenna.
3. Span shall wide enough to full capture the emission measured. The SA from 9KHz to 26.5GHz set to the low, Mid and High channels with the EUT transmit.
4. No emission found between lowest internal used/generated frequency to 30MHz (9KHz~30MHz).

Radiated emission below 30MHz is measured in a 9m*6m*6m semi-ane choic chamber, the measurements correspond to those obtained at an open-field test site. There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

5. The SA setting following :

- (1) Below 30MHz :

(1.1) 9KHz-490KHz : RBW=200Hz / VBW=1kHz / Sweep=AUTO

(1.2) 490KHz-30MHz : RBW=10kHz / VBW=30kHz / Sweep=AUTO

- (2) 30MHz to 1GHz : RBW = 100kHz, VBW $\geq 3 \times$ RBW, Sweep = Auto,

Detector = Peak, Trace = Max hold.

- (3) Above 1GHz :

(3.1) For Peak measurement : RBW = 1MHz, VBW $\geq 3 \times$ RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.

(3.2) For Average measurement : RBW = 1MHz, VBW

·If Duty Cycle $\geq 98\%$, VBW=10Hz.

·If Duty Cycle $< 98\%$, VBW=1/T.

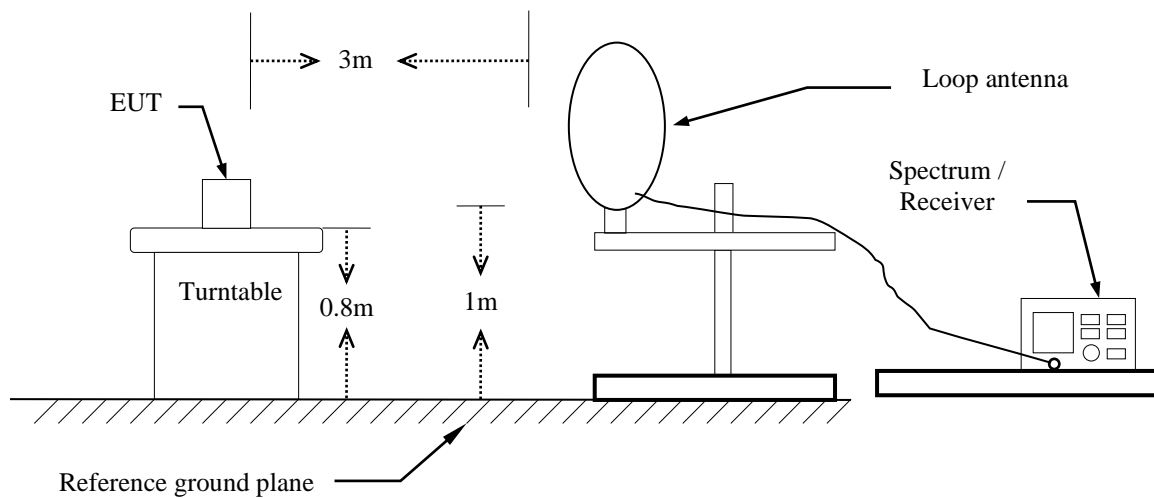
6. Data result :

Actual FS=Spectrum Reading Level + Factor

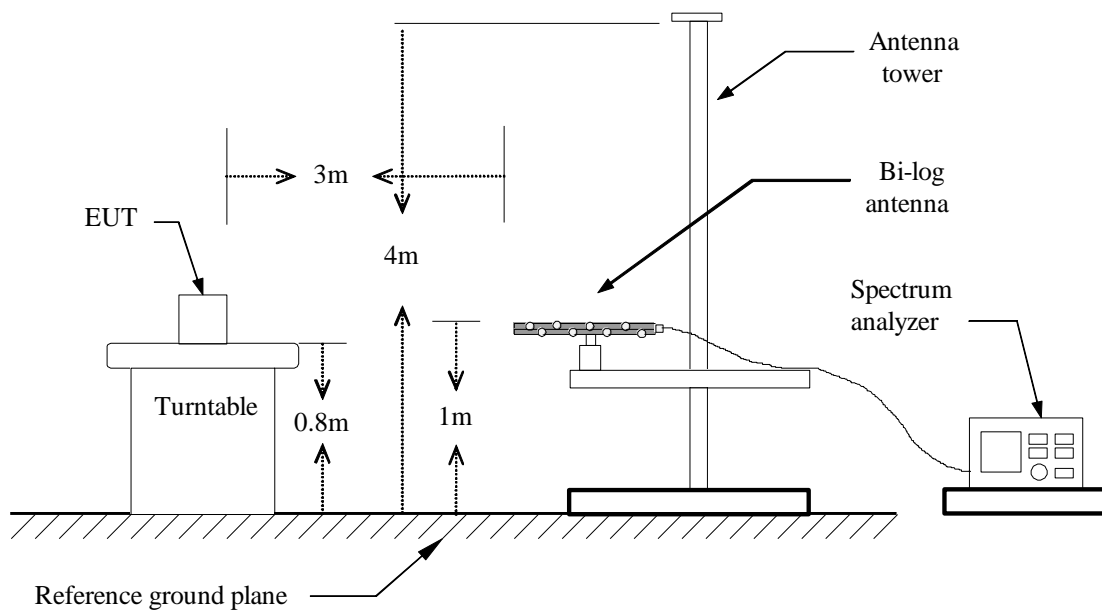
Margin=Actual FS- Limit

4.6.3 Test Setup

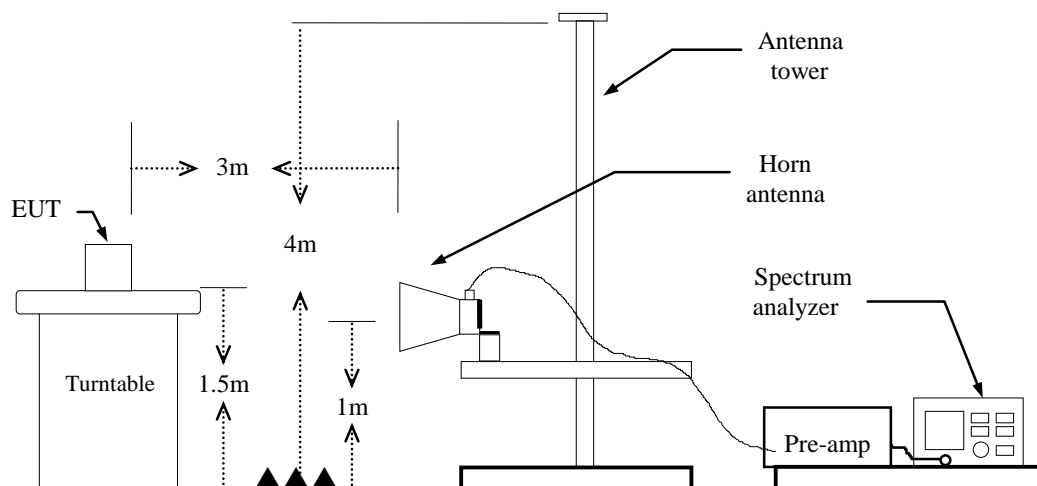
9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1 GHz

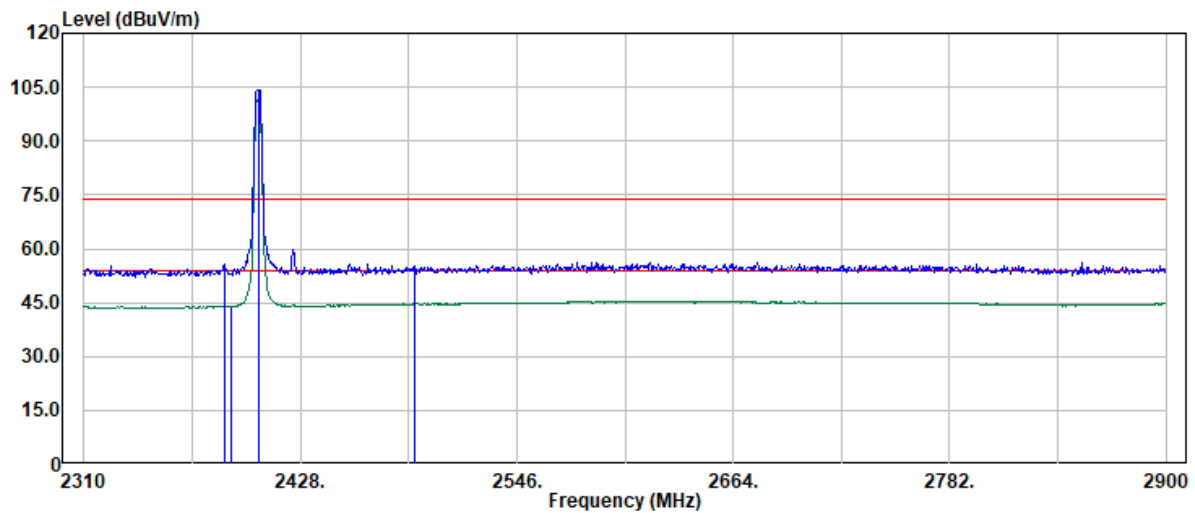


4.6.4 Test Result

Band Edge Test Data

Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2405 MHz
Operation Mode : Bandedge
EUT Pol : E1
Setting : 10

Test Date : 2025-01-17
Temp./Humi. : 24.6/57
Antenna Pol. : VERTICAL
Engineer : Ray.Li
Test Chamber : 966A



Trace: 1

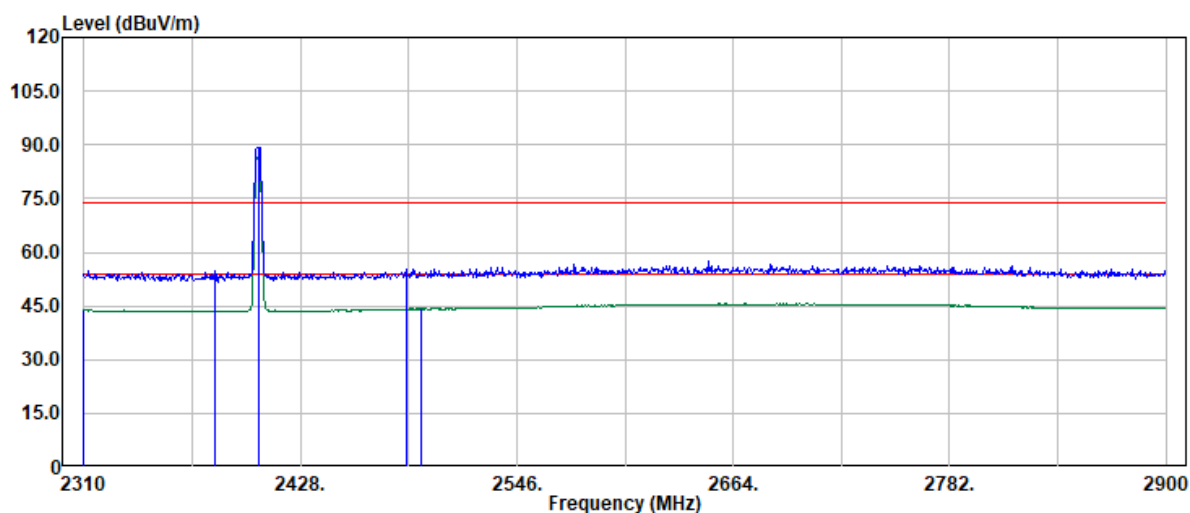
Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
2386.44	49.76	6.06	55.82	74.00	-18.18	Peak
2389.93	37.88	6.08	43.96	54.00	-10.04	Average
2405.00	98.16	6.13	104.29	--	--	Peak
2405.00	95.83	6.13	101.96	--	--	Average
2490.35	48.57	6.58	55.15	74.00	-18.85	Peak
2490.35	38.16	6.58	44.74	54.00	-9.26	Average

Project No: TM-2412000436P
Report No.: TMWK2412004779KR

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Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2405 MHz
Operation Mode : Bandedge
EUT Pol : E1
Setting : 10

Test Date : 2025-01-17
Temp./Humi. : 24.6/57
Antenna Pol. : HORIZONTAL
Engineer : Ray.Li
Test Chamber : 966A



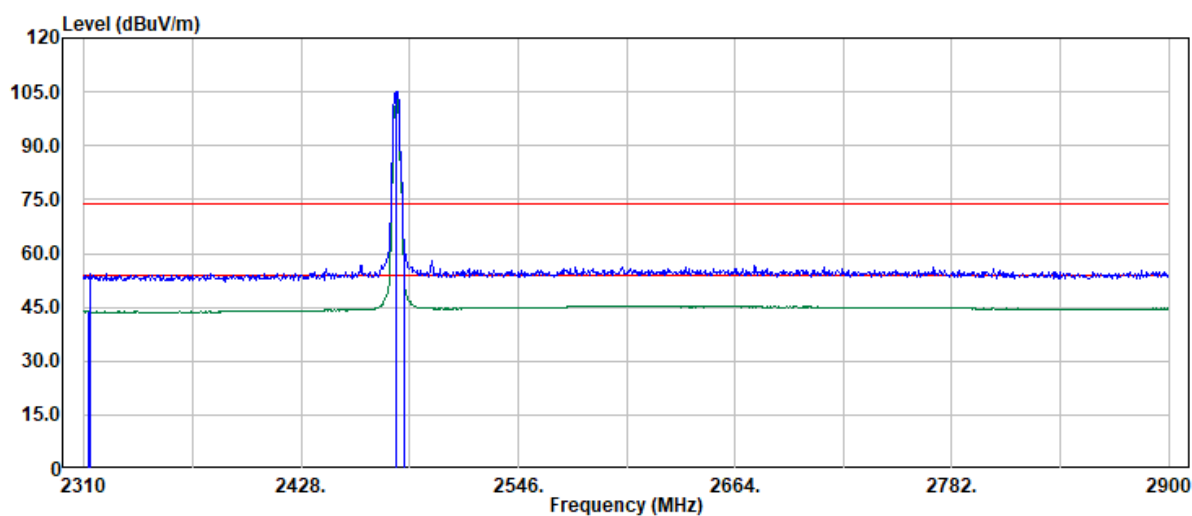
Trace: 1						
Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
2310.00	37.67	6.20	43.87	54.00	-10.13	Average
2381.44	48.71	6.03	54.74	74.00	-19.26	Peak
2405.00	83.24	6.13	89.37	--	--	Peak
2405.00	80.88	6.13	87.01	--	--	Average
2485.85	48.65	6.55	55.20	74.00	-18.80	Peak
2493.84	37.66	6.57	44.23	54.00	-9.77	Average

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Report No.: TMWK2412004779KR

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Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2480 MHz
Operation Mode : Bandedge
EUT Pol : E1
Setting : 10

Test Date : 2025-01-17
Temp./Humi. : 24.6/57
Antenna Pol. : VERTICAL
Engineer : Ray.Li
Test Chamber : 966A



Trace: 1

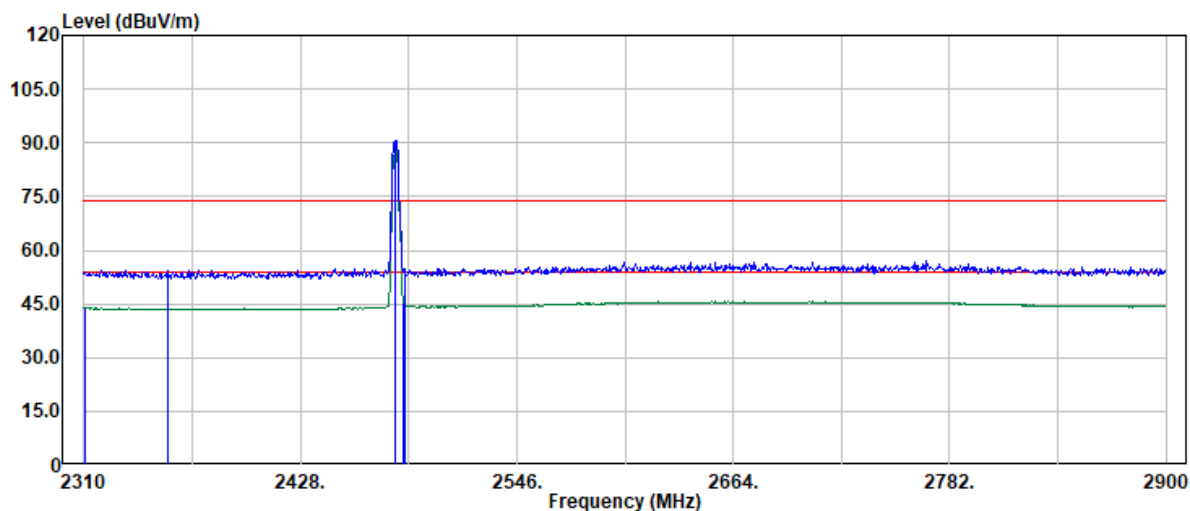
Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
2312.00	37.74	6.17	43.91	54.00	-10.09	Average
2313.00	48.17	6.15	54.32	74.00	-19.68	Peak
2480.00	98.67	6.49	105.16	--	--	Peak
2480.00	96.36	6.49	102.85	--	--	Average
2483.85	55.15	6.53	61.68	74.00	-12.32	Peak
2483.85	47.29	6.53	53.82	54.00	-0.18	Average

Project No: TM-2412000436P
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Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2480 MHz
Operation Mode : Bandedge
EUT Pol : E1
Setting : 10

Test Date : 2025-01-17
Temp./Humi. : 24.6/57
Antenna Pol. : HORIZONTAL
Engineer : Ray.Li
Test Chamber : 966A

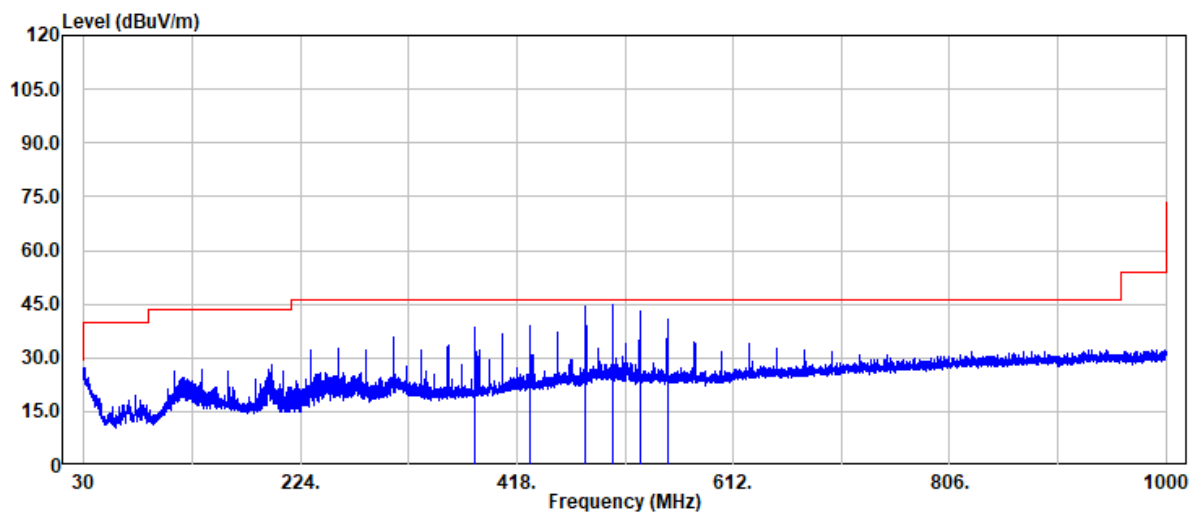


Trace: 1						
Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
2311.00	37.66	6.18	43.84	54.00	-10.16	Average
2355.46	48.44	5.89	54.33	74.00	-19.67	Peak
2480.00	83.97	6.49	90.46	--	--	Peak
2480.00	81.58	6.49	88.07	--	--	Average
2483.85	38.93	6.53	45.46	54.00	-8.54	Average
2484.85	48.05	6.53	54.58	74.00	-19.42	Peak

TX Test Data

Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2480 MHz
Operation Mode : TX
EUT Pol : E1
Setting :

Test Date : 2025-01-17
Temp./Humi. : 24.5/57
Antenna Pol. : VERTICAL
Engineer : Ray.Li
Test Chamber : 966A



Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
380.90	45.89	-7.48	38.41	46.00	-7.59	Peak
430.10	44.73	-5.94	38.79	46.00	-7.21	Peak
479.20	49.13	-4.57	44.56	46.00	-1.44	Peak
503.90	49.19	-4.43	44.76	46.00	-1.24	Peak
528.40	47.11	-3.97	43.14	46.00	-2.86	Peak
553.00	44.41	-3.65	40.76	46.00	-5.24	Peak

Note:

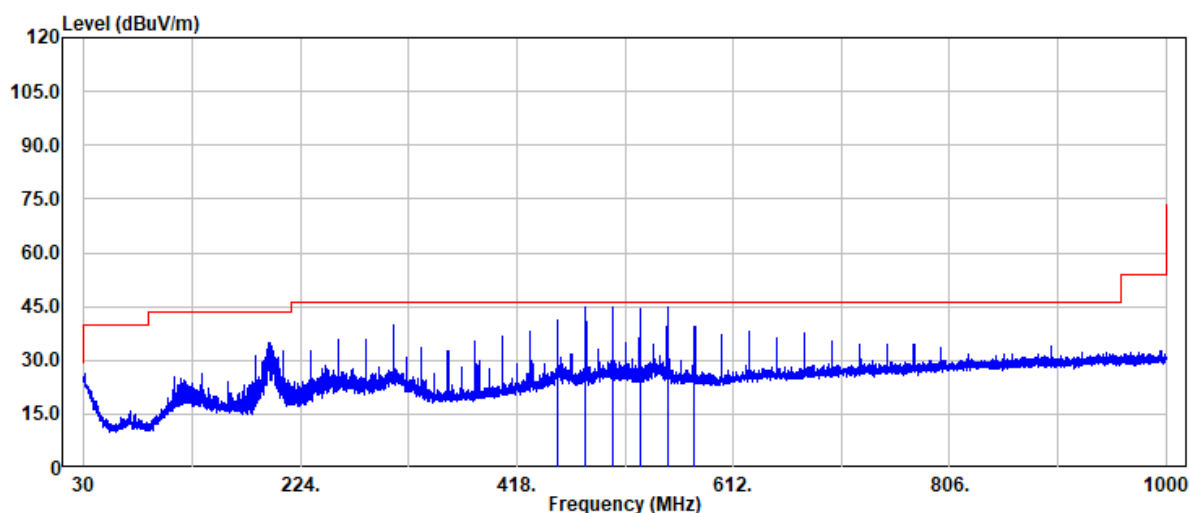
A suppression core was applied between the EUT and test fixture cable to suppress fixture-related noise below 1 GHz; it is not part of the EUT or product package.

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Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2480 MHz
Operation Mode : TX
EUT Pol : E1
Setting :

Test Date : 2025-01-17
Temp./Humi. : 24.5/57
Antenna Pol. : HORIZONTAL
Engineer : Ray.Li
Test Chamber : 966A



Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
454.70	46.58	-5.30	41.28	46.00	-4.72	Peak
479.20	49.25	-4.57	44.68	46.00	-1.32	Peak
503.80	49.35	-4.43	44.92	46.00	-1.08	Peak
528.30	48.52	-3.98	44.54	46.00	-1.46	Peak
553.00	48.40	-3.65	44.75	46.00	-1.25	Peak
577.50	42.80	-3.22	39.58	46.00	-6.42	Peak

Note:

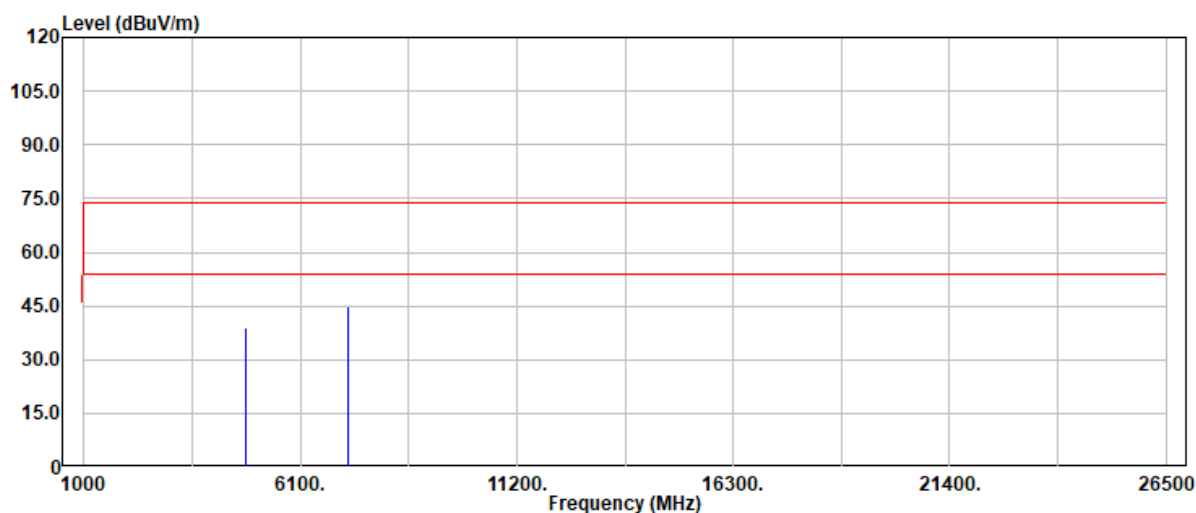
A suppression core was applied between the EUT and test fixture cable to suppress fixture-related noise below 1 GHz; it is not part of the EUT or product package.

Project No: TM-2412000436P
Report No.: TMWK2412004779KR

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Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2405 MHz
Operation Mode : TX
EUT Pol : E1
Setting : 10

Test Date : 2025-01-17
Temp./Humi. : 24.6/57
Antenna Pol. : Vertical
Engineer : Ray.Li
Test Chamber : 966A



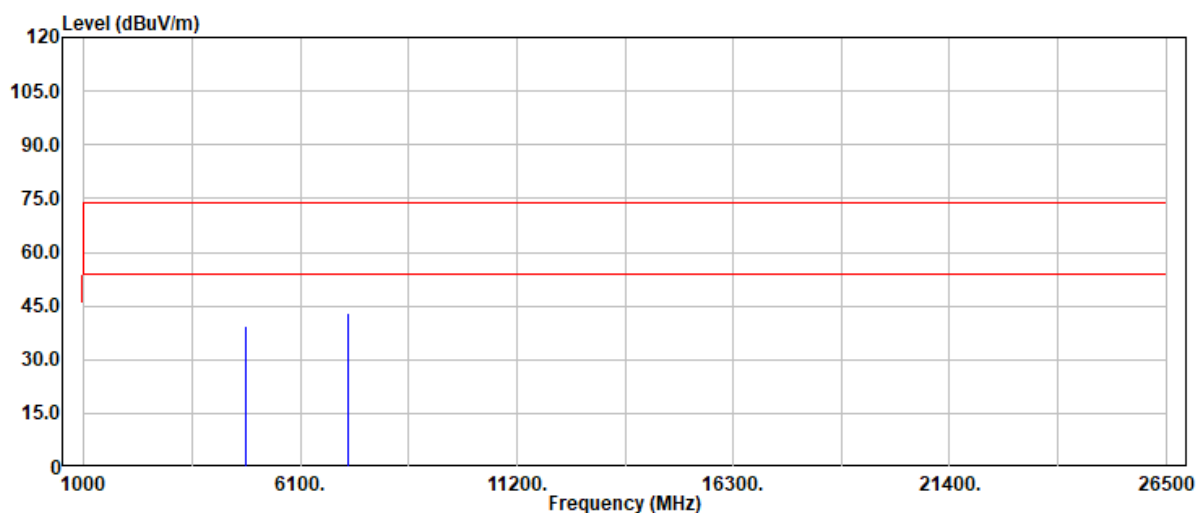
Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
4810.00	37.29	1.79	39.08	74.00	-34.92	Peak
4810.00	30.71	1.79	32.50	54.00	-21.50	Average
7215.00	36.23	8.41	44.64	74.00	-29.36	Peak
7215.00	31.50	8.41	39.91	54.00	-14.09	Average

Project No: TM-2412000436P
Report No.: TMWK2412004779KR

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Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2405 MHz
Operation Mode : TX
EUT Pol : E1
Setting : 10

Test Date : 2025-01-17
Temp./Humi. : 24.6/57
Antenna Pol. : Horizontal
Engineer : Ray.Li
Test Chamber : 966A



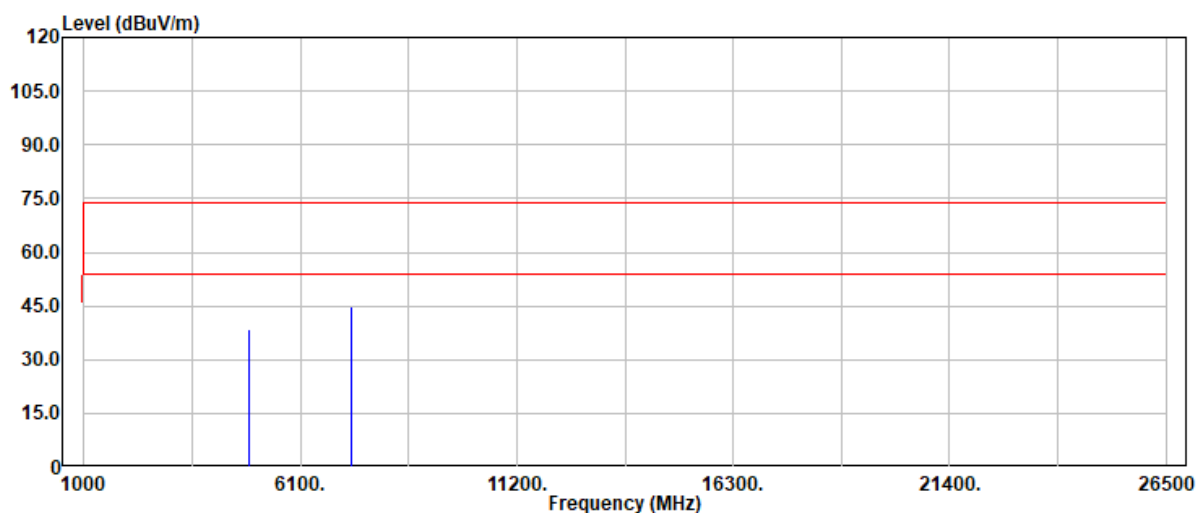
Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
4810.00	37.43	1.79	39.22	74.00	-34.78	Peak
4810.00	29.81	1.79	31.60	54.00	-22.40	Average
7215.00	34.41	8.41	42.82	74.00	-31.18	Peak
7215.00	28.60	8.41	37.01	54.00	-16.99	Average

Project No: TM-2412000436P
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Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2440 MHz
Operation Mode : TX
EUT Pol : E1
Setting : 10

Test Date : 2025-01-17
Temp./Humi. : 24.6/57
Antenna Pol. : Vertical
Engineer : Ray.Li
Test Chamber : 966A



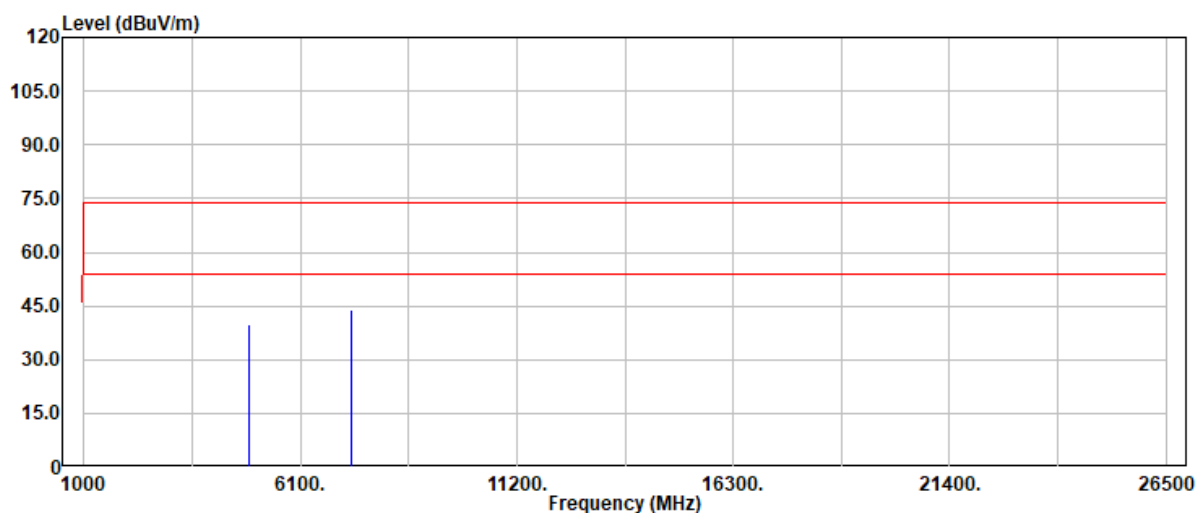
Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
4880.00	36.35	2.11	38.46	74.00	-35.54	Peak
4880.00	30.28	2.11	32.39	54.00	-21.61	Average
7320.00	36.12	8.70	44.82	74.00	-29.18	Peak
7320.00	31.84	8.70	40.54	54.00	-13.46	Average

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Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2440 MHz
Operation Mode : TX
EUT Pol : E1
Setting : 10

Test Date : 2025-01-17
Temp./Humi. : 24.6/57
Antenna Pol. : Horizontal
Engineer : Ray.Li
Test Chamber : 966A



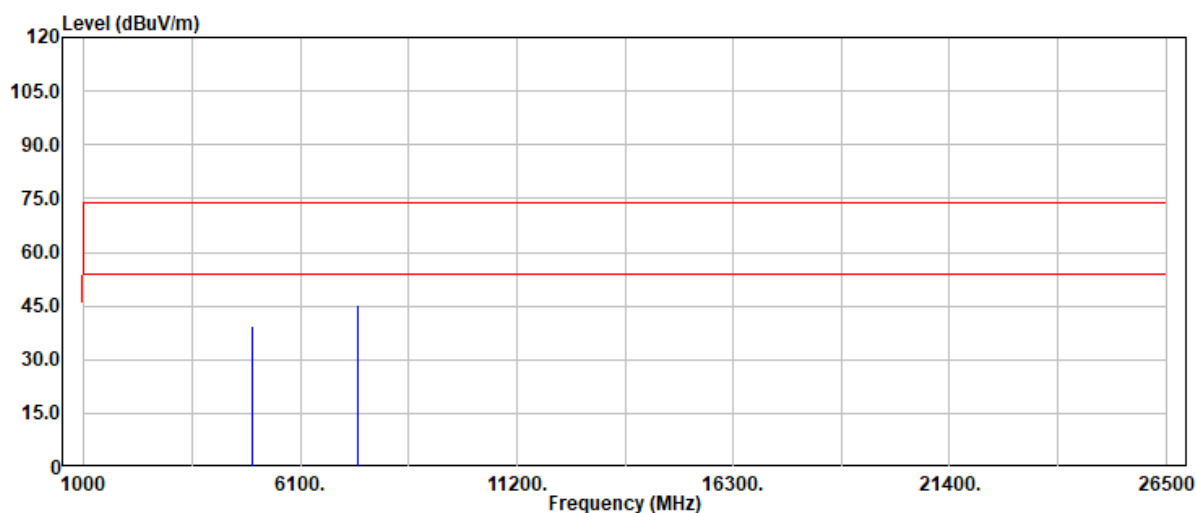
Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
4880.00	37.81	2.11	39.92	74.00	-34.08	Peak
4880.00	30.15	2.11	32.26	54.00	-21.74	Average
7320.00	35.22	8.70	43.92	74.00	-30.08	Peak
7320.00	28.48	8.70	37.18	54.00	-16.82	Average

Project No: TM-2412000436P
Report No.: TMWK2412004779KR

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Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2480 MHz
Operation Mode : TX
EUT Pol : E1
Setting : 10

Test Date : 2025-01-17
Temp./Humi. : 24.6/57
Antenna Pol. : Vertical
Engineer : Ray.Li
Test Chamber : 966A



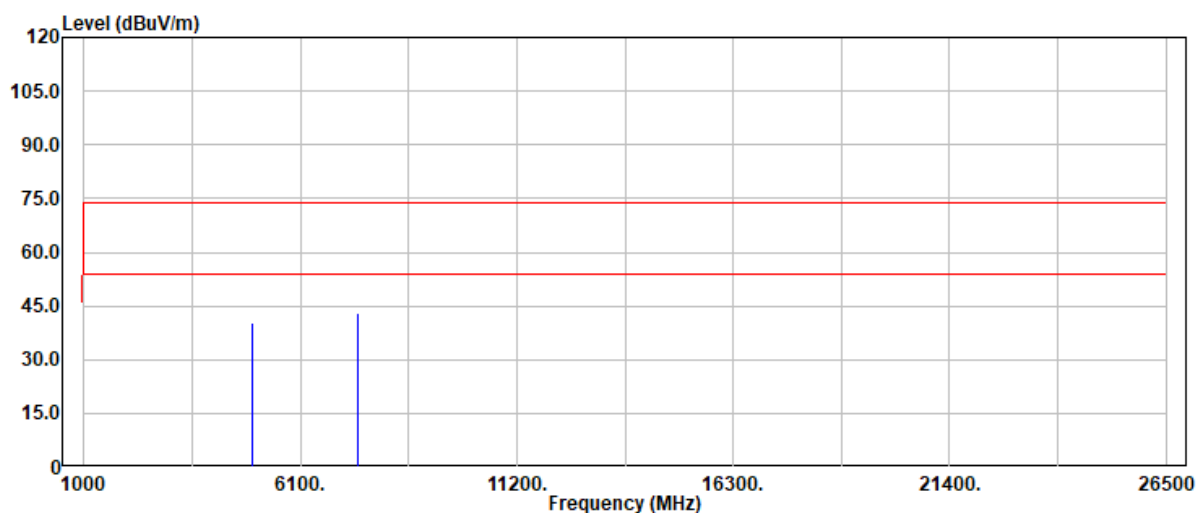
Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
4960.00	36.66	2.92	39.58	74.00	-34.42	Peak
4960.00	30.76	2.92	33.68	54.00	-20.32	Average
7440.00	36.81	8.65	45.46	74.00	-28.54	Peak
7440.00	31.05	8.65	39.70	54.00	-14.30	Average

Project No: TM-2412000436P
Report No.: TMWK2412004779KR

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Project No : TM-2412000436P
Operation Band : Zigbee
Frequency : 2480 MHz
Operation Mode : TX
EUT Pol : E1
Setting : 10

Test Date : 2025-01-17
Temp./Humi. : 24.6/57
Antenna Pol. : Horizontal
Engineer : Ray.Li
Test Chamber : 966A



Freq	Read Level	Factor	Actual FS	Limit @3m	Margin	Detector Mode
-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	PK/QP/AV
4960.00	37.60	2.92	40.52	74.00	-33.48	Peak
4960.00	30.60	2.92	33.52	54.00	-20.48	Average
7440.00	34.22	8.65	42.87	74.00	-31.13	Peak
7440.00	28.55	8.65	37.20	54.00	-16.80	Average

- End of Test Report -