Test Report

Verified code: 041663

Report No.: E20241111636501-11EN

Customer:	Lumi United Technology Co., Ltd
Address:	B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen
Sample Name:	Climate Sensor W100
Sample Model:	TH-S04E
Receive Sample Date:	Nov.12,2024
Test Date:	Nov.20,2024 ~ Nov.29,2024
Reference Document:	47 CFR Part 15 Subpart C Intentional Radiators
Test Result:	Pass

Prepared by: Huang Lifang Reviewed by: Jiang Tao Approved by: Xiao Liang

GRG METROLOGY & TEST GROUP CO., LTD

Issued Date: 2024-12-16

GRG METROLOGY & TEST GROUP CO., LTD.
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Statement

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3. When there are reports in both Chinese and English, the Chinese version will prevail when the language problems are inconsistent.

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5. This testing report is only for scientific research, teaching, internal quality control, etc.

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REPORT ISSUED HISTORY

Report Version	Report No.	Description	Compile Date
1.0	E20241111636501-11EN	Original Issue	2024-12-06

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1. TEST RESULT SUMMARY

Technical Requirements		
47 CFR Part 15 Subpart C 15.247 ANSI C63.10-2020 KDB 558074 D01 15.247 measurement guidance v05r02		
Limit / Severity	**Item**	**Result**
§15.203	Antenna Requirement	Pass[1)]
§15.207(a)	Conducted Emission	Not Applicable[2)]
§15.247(d)&15.205& 15.209	Radiated Spurious Emission	Pass
§15.247(b)(3)	Maximum Peak Output Power	Pass
§15.247(e)	Power Spectral Density	Pass
§15.247(a)(2)	6dB bandwidth	Pass
§15.247(d)	Conducted band edges and Spurious Emission	Pass
§15.247(d)&15.205& 15.209	Restricted bands of operation	Pass

Note:

1) The antenna is PCB antenna. The max gain of antenna is 1dBi.which accordance 15.203.is considered sufficient to comply with the provisions of this section.

2) Test is not applicable to this Equipment. This EUT is no AC mains power ports.

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2. GENERAL DESCRIPTION OF EUT

2.1 APPLICANT

Name:	Lumi United Technology Co., Ltd
Address:	B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen

2.2 MANUFACTURER

Name:	Lumi United Technology Co., Ltd
Address:	B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen

2.3 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Equipment:	Climate Sensor W100
Model No.:	TH-S04E
Adding Model:	TH-S04D
Models Difference:	The model No.TH-S04E & TH-S04D have the same technical construction including circuitdiagram,PCB LAYOUT, hardware version and software version identical, except sales area and packaging are different.
Trade Name:	Aqara
FCC ID:	2AKIT-THS04
Power supply:	DC 3V
Battery Specification:	Button batteries; Model: CR2450; Nominal Voltage: 3V.
Frequency Band:	2405MHz-2480MHz
Transmit Power:	7.37dBm
Modulation type:	O-QPSK
Channel space:	5MHz
Antenna Specification:	PCB antenna with 1dBi gain (Max.)
Temperature Range:	-20℃ ~ +60℃
Hardware Version:	V12
Software Version:	V0.0.2.0

Sample No: E20241111636501-0002, E20241111636501-0004

Note:
1.The EUT antenna gain is provided by the applicant. This report is made solely on the basis of such data and/or information. We accept no responsibility for the authenticity and completeness of the above data and information and the validity of the results and/or conclusions.
2. Based on the differences in models, the model TH-S04E was tested and recorded in this report.

2.4 CHANNELLIST

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
***11**	**2405**	12	2410	13	2415	14	2420
15	2425	16	2430	17	2435	***18**	**2440**
19	2445	20	2450	21	2455	22	2460
23	2465	24	2470	25	2475	***26**	**2480**

* is the test frequency

2.5 TEST OPERATION MODE

Mode No.	Description of the modes
1	Thread fixed frequency transmitting

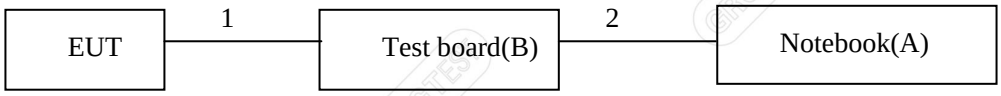
2.6 LOCAL SUPPORTIVE

No.	Name of equipment	Manufacturer	Model	Serial number	Note
A	Notebook	DELL	Latitude3300	2C6CFW2	/
B	Test board	/	/	/	/

No.	Cable Type	Qty.	Shielded Type	Ferrite Core(Qty.)	Length
1	Serial cable	1	No	0	0.2m
2	USB cable	1	No	0	0.5m

2.7 CONFIGURATION OF SYSTEM UNDER TEST

For 6dB bandwidth, Maximum Peak Output Power, Power Spectral Density, Conducted band edges and Spurious Emission



For Radiated Spurious Emission, Restricted bands of operation

Test software:

Software version	Test level
QCOM_V1.0	60

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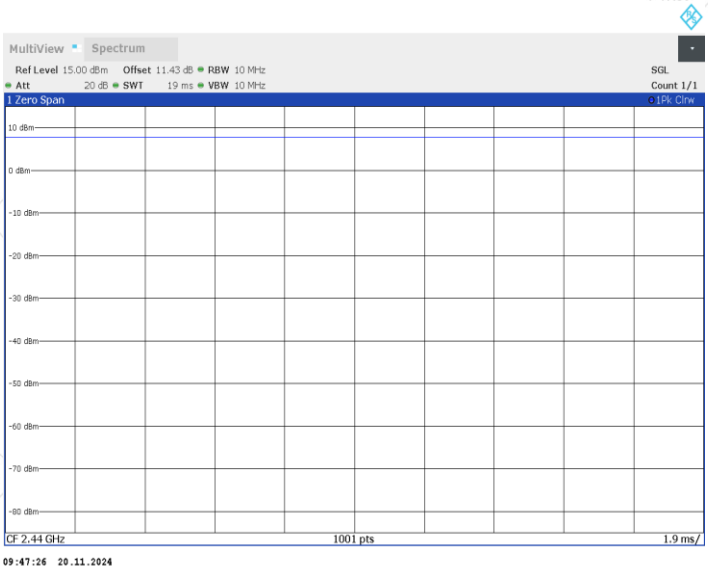
2.8 DUTY CYCLE

Environment: 22.8℃/50%RH/101.0kPa Voltage: DC 3V

Tested By: Qin Tingting Date: 2024-11-20

Test Mode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	DC [%]
Thread	Ant1	2440	19	19	100

Thread _2440MHz



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3. LABORATORY AND ACCREDITATIONS

3.1 LABORATORY

The tests & measurements refer to this report were performed by Shenzhen EMC Laboratory of GRG METROLOGY & TEST GROUP CO., LTD.

Add	:	No.1301 Guanguang Road Xinlan Community, Guanlan Street, Longhua District Shenzhen, 518110, People's Republic of China
P.C.	:	518110
Tel	:	0755-61180008
Fax	:	0755-61180008

3.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to GB/T 27025(ISO/IEC 17025:2017)

USA	A2LA(Certificate #2861.01)

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	ISED (Company Number: 24897，CAB identifier:CN0069)
USA	FCC (Registration Number: 759402，Designation Number:CN1198)

Copies of granted accreditation certificates are available for downloading from our web site, http://www.grgtest.com

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4. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement		Frequency	Uncertainty
Radiated Emission	X	9kHz～30MHz	4.4dB[1)]
	Y	9kHz～30MHz	4.4dB[1)]
	Z	9kHz～30MHz	4.4dB[1)]
	Horizontal	30MHz～200MHz	4.6dB[1)]
		200MHz～1000MHz	4.8dB[1)]
		1GHz～18GHz	5.0dB[1)]
		18GHz～26.5GHz	5.2dB[1)]
	Vertical	30MHz～200MHz	4.7dB[1)]
		200MHz～1000MHz	4.7dB[1)]
		1GHz～18GHz	5.1dB[1)]
		18GHz～26.5GHz	5.4dB[1)]

Measurement	Uncertainty
RF frequency	6.0×10^{-6}
RF power conducted	0.80dB
Power spectral density conducted	0.80dB
Occupied channel bandwidth	0.40dB
Unwanted emission, conducted	0.70dB
Humidity	6.0%
Temperature	2.0℃

Note:

[1)] This uncertainty represents an expanded uncertainty expressed at approximately the 95%. This uncertainty represents an expanded uncertainty factor of *k*=2.

5. LIST OF USED TEST EQUIPMENT AT GRGT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Radiated Spurious Emission&Restricted bands of operation				
Test Receiver	R&S	ESR26	101758	2025-09-10
Test S/W	FARAD	EZ_EMC	CCS-03A1	/
Bi-log Antenna	Schwarzbeck	VULB 9160	VULB9160-3402	2025-09-11
Loop Antenna	Schwarzbeck	FMZB 1513-60	1513-60-56	2025-05-07
Preamplifier	EMEC	EM330	060662	2025-06-14
Horn antenna	Schwarzbeck	BBHA 9120D	02143	2025-09-07
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-497	2025-08-30
Amplifier	Tonscend	TAP01018048	AP20E8060075	2025-03-01
Amplifier	Tonscend	TAP184050	AP20E806071	2025-03-01
Preamplifier	SHIRONG ELECTRONIC	DLNA-1G18G-G40	20200928005	2025-07-19
Test S/W	Tonscend	JS32-RE/5.0.0		
6dB Bandwidth&Conducted band edges and Spurious Emission&Power Spectral Density				
Spectrum Analyzer	R&S	FSW43	102072	2025-06-14
Automatic power measuring unit	TONSCEND	JS0806-2	21B8060365	2024-12-28
BT/WIFI System	Tonscend	JS1120-3		
Maximum Peak Output Power				
Pulse power sensor	Anritsu	MA2411B	1126150	2025-01-11
Power meter	Anritsu	ML2495A	1204003	2025-01-11

Note: The calibration cycle of the above instruments is 12 months.

6. RADIATED SPURIOUS EMISSIONS

6.1 LIMITS

In any 100kHz 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 20dB below that in the 100kHz 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 30dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required.

Frequency (MHz)	Quasi-peak(μV/m)	Measurement distance(m)	Quasi-peak(dBμV/m)@distance 3m
0.009-0.490	2400/F(kHz)	300	128.5~93.8
0.490-1.705	24000/F(kHz)	30	73.8~63
1.705-30.0	30	30	69.5
30 ~ 88	100	3	40
88~216	150	3	43.5
216 ~ 960	200	3	46
Above 960	500	3	54

NOTE:

(1) The emission limits for the ranges 9-90kHz and 110-490kHz are based on measurements employing a linear average detector.

(2) The lower limit shall apply at the transition frequencies.

(3) Above 18GHz test distance is 1m, so the Peak Limit=74+20*log(3/1)=83.54 (dBμV/m). The Avg Limit=54+20*log(3/1)=63.54 (dBμV/m).

6.2 TEST PROCEDURES

1) Sequence of testing 9kHz to 30MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate fixed frequency transmitting conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3meter.

--- The EUT was set into operation.

Pre measurement:

--- The turntable rotates from 0 °to 360 °.

--- The antenna height is 1.0 meter.

--- The antenna is polarized X,Y and Z.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the pre measurement the software maximizes by rotating the turntable

position (0 °to 360 °) and by rotating the elevation axes (0 °to 360 °).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QP detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement and the limit will be stored.

2) Sequence of testing 30MHz to 1GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate fixed frequency transmitting conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

---- The measurement distance is 3 meter.

--- The EUT was set into operation.

Pre measurement:

--- The turntable rotates from 0 °to 360 °.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 4 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of pre measurement the software maximize the peaks by changing turntable rotates from 0 °to 360 °and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1GHz to 18GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate fixed frequency transmitting conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Pre measurement:

--- The turntable rotates from 0 °to 360 °.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 4 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of pre measurement the software maximize the peaks by changing turntable rotates from 0 °to 360 °and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18GHz
Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate fixed frequency transmitting conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Pre measurement:

--- The turntable rotates from 0 °to 360 °.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 4 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:
--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of pre measurement the software maximize the peaks by changing turntable rotates from 0 °to 360 °and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement with marked maximum final measurements and the limit will be stored.

NOTE:
(a).The frequency from 9kHz to 150kHz, Set RBW=300Hz(for Peak&AVG), VBW=300Hz(for Peak&AVG). The frequency from 150kHz to 30MHz, Set RBW=9kHz, VBW=9kHz, (for QP Detector).
(b).The frequency from 30MHz to 1GHz, Set RBW=120kHz, VBW=300kHz, (for QP Detector).
(c).The frequency above 1GHz, for Peak detector: Set RBW=1MHz,VBW=3MHz.
(d). The frequency above 1GHz, for Avg detector: Set RBW=1MHz,if the EUT is configured to transmit with duty cycle ≥98%， set VBW≤RBW/100 (i.e.,10kHz) but not less than 10 Hz. If the EUT duty cycle is ＜98%, set VBW≥1/T, Where T is defined in section 2.8.

6.3 TEST SETUP

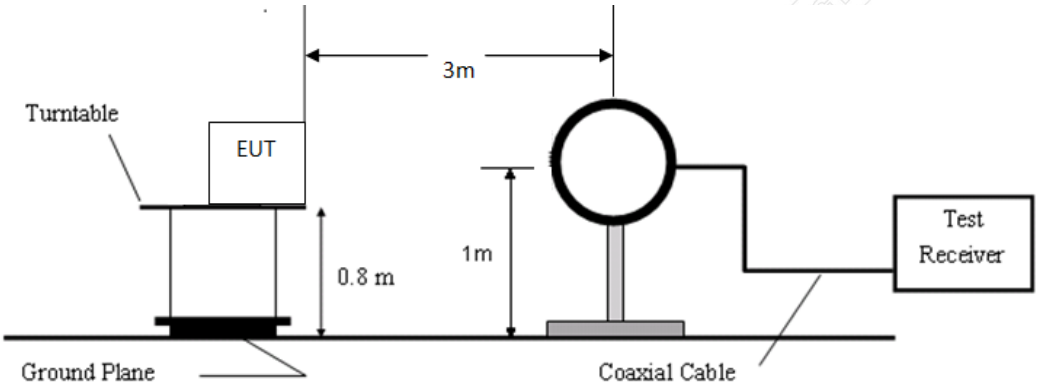

Figure 1. 9kHz to 30MHz radiated emissions test configuration

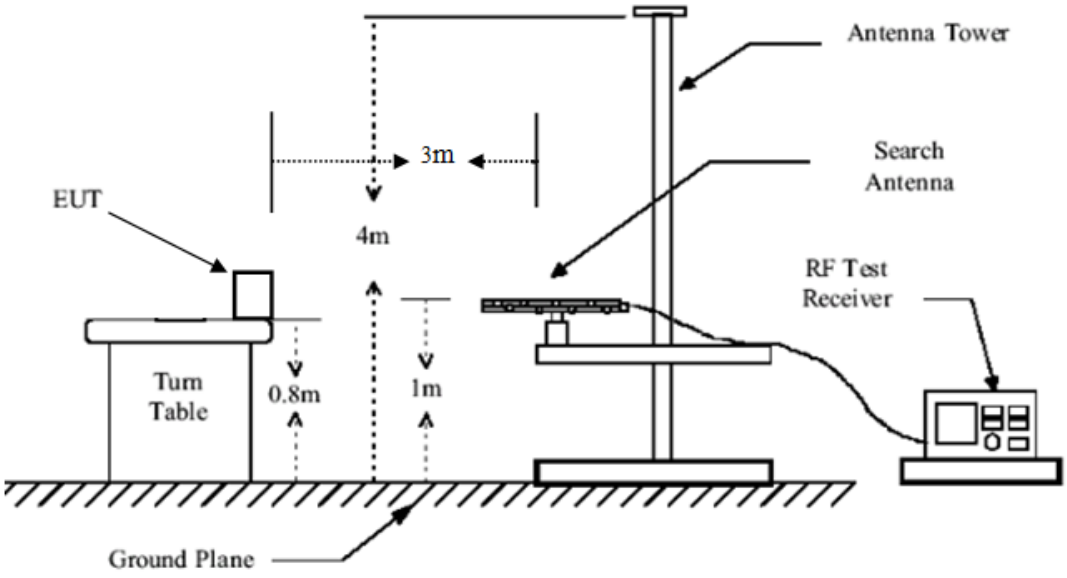

Figure 2. 30MHz to 1GHz radiated emissions test configuration

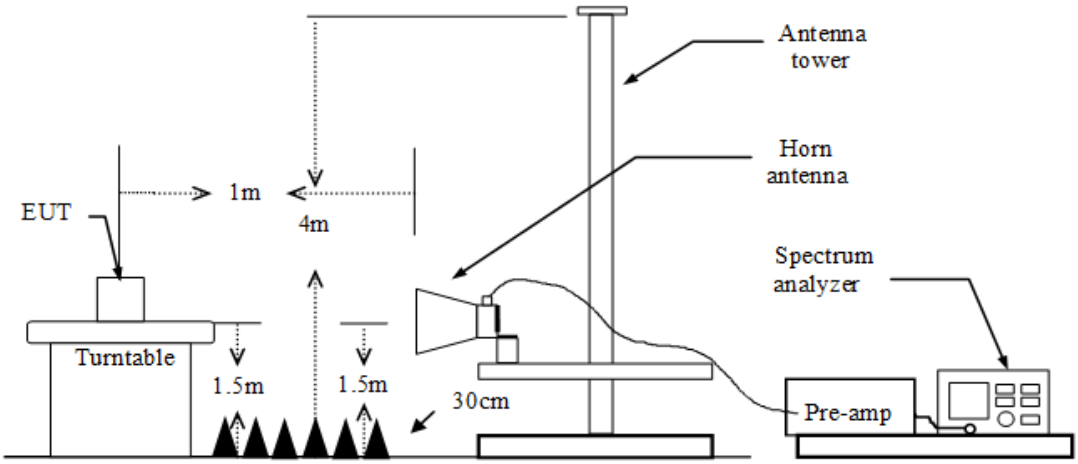

Figure 3. 1GHz to 18GHz radiated emissions test configuration

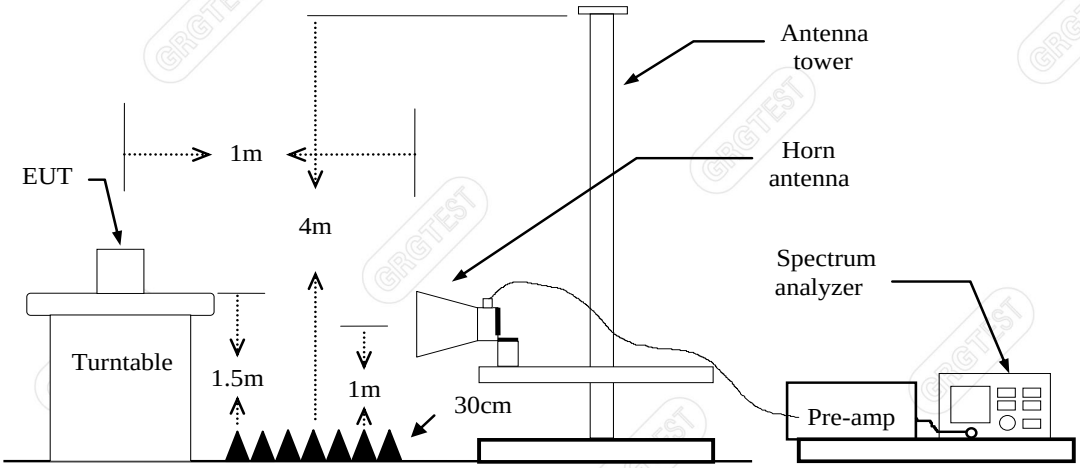

Figure 4. 18GHz to 26.5GHz radiated emissions test configuration

6.4 DATA SAMPLE

30MHz to 1GHz

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Detector type
XXXX	63.53	-27.15	36.38	43.50	-7.12	0	100	QP

Frequency (MHz) = Emission frequency in MHz

Reading (dBuV) = Uncorrected Analyzer / Receiver reading

Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)

Limit (dBuV/m) = Limit stated in standard

Margin (dB) = Result (dBuV/m) – Limit(dBuV/m)

QP = Quasi-peak Reading

1GHz-18GHz

No.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Remark
xxx	xxxx	78.01	55.30	-22.71	74.00	18.70	100	50	Horizontal	Peak
xxx	xxxx	66.37	43.66	-22.71	54.00	10.34	100	50	Horizontal	AVG

Above 18GHz

No.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Remark
xxx	xxxx	54.49	42.38	-12.11	83.54	41.16	100	211	Vertical	Peak
xxx	xxxx	43.99	31.88	-12.11	63.54	31.66	100	211	Vertical	AVG

Frequency (MHz) = Emission frequency in MHz

Reading (dBuV/m) = Uncorrected Analyzer / Receiver reading

Factor (dB) = Antenna factor + Cable loss – Amplifier gain

Level (dBuV/m) = Reading (dBuV/m) + Factor (dB)

Limit (dBuV/m) = Limit stated in standard

Margin (dB) = Limit (dBuV/m) – Level (dBuV/m)

Polarity = Antenna polarization

Peak = Peak Reading

AVG = Average Reading

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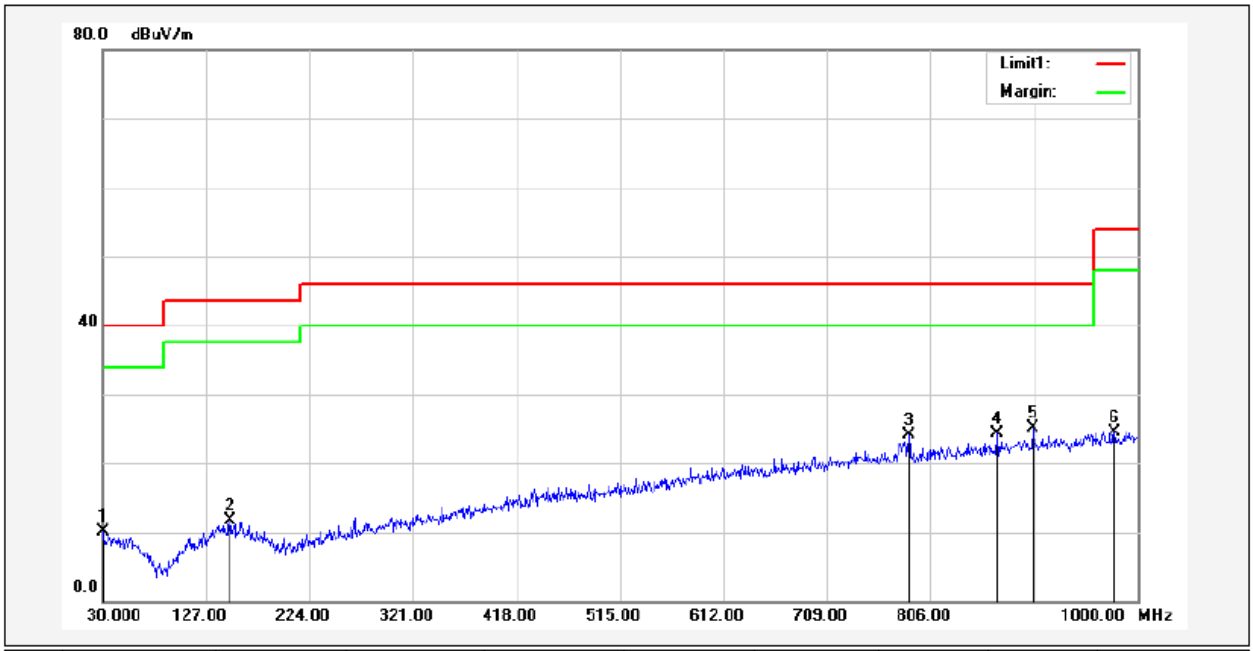
6.5 TEST RESULTS

Below 1GHz

The chart below shows the highest readings taken from the final data.

Mode: Mode 1
Highest Frequency (2480MHz) Date: 2024-11-28
Environment: 25.1℃/55%RH 101.0kPa Test Voltage: DC 3V
Test Engineer: Qin Tingting Probe : Horizontal

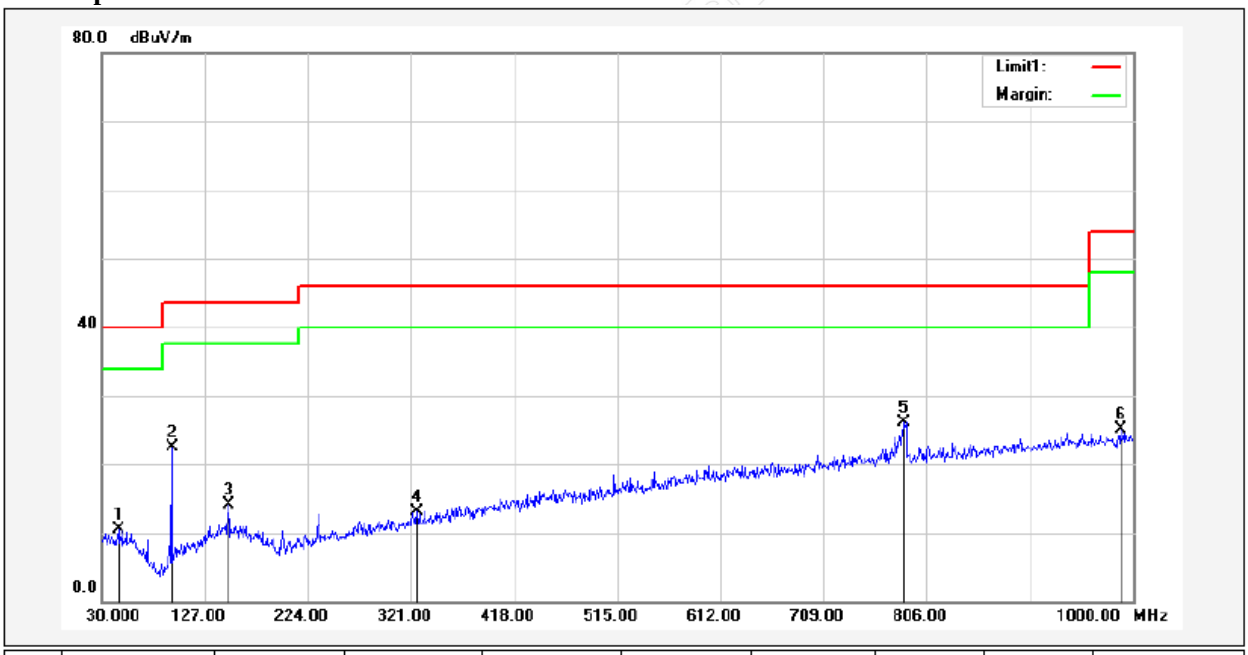
Test Graph



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Detector type
1	30.0000	27.58	-17.42	10.16	40.00	-29.84	137	200	QP
2	149.3100	27.43	-15.64	11.79	43.50	-31.71	268	200	QP
3	785.6300	27.95	-3.76	24.19	46.00	-21.81	333	100	QP
4	869.0500	26.92	-2.63	24.29	46.00	-21.71	128	200	QP
5*	902.0300	27.31	-2.13	25.18	46.00	-20.82	0	189	QP
6	978.6600	25.63	-1.03	24.60	54.00	-29.40	359	200	QP

Mode: Mode 1
Highest Frequency (2480MHz) Date: 2024-11-28
Environment: 25.1℃/55%RH 101.0kPa Test Voltage: DC 3V
Test Engineer: Qin Tingting Probe : Vertical

Test Graph



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Detector type
1	45.5200	27.56	-17.13	10.43	40.00	-29.57	0	164	QP
2	95.9600	42.98	-20.50	22.48	43.50	-21.02	0	107	QP
3	149.3100	29.70	-15.64	14.06	43.50	-29.44	99	100	QP
4	326.8200	27.27	-14.12	13.15	46.00	-32.85	235	200	QP
5*	784.6600	29.91	-3.76	26.15	46.00	-19.85	307	100	QP
6	988.3600	26.09	-0.91	25.18	54.00	-28.82	81	100	QP

Remark:

1 No emission found between lowest internal used/generated frequency to 30MHz.
2 Pre-scan all mode and recorded the worst case results in this report (TX- Highest Channel(Thread)).
3 Measuring frequencies from 9kHz to the 1GHz.
4 Radiated emissions measured in frequency range from 30MHz to 1GHz were made with an instrument using Peak/Quasi-peak detector mode.
5 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.
6 The IF bandwidth of SPA between 30MHz to 1GHz was 120kHz.
7 If the margin of the pre-test results is greater than 6dB, it meets the requirements of quasi peak value, and final testing is no longer required.

1GHz-18GHz:
According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Mode: Mode 1
Lowest Frequency (2405MHz)
Environment: 23.5℃/51%RH/101.0kPa Voltage: DC 3V
Tested By:Qin Tingting Date: 2024-11-21

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1799.0000	50.78	44.16	-6.62	74.00	29.84	100	22	Horizontal
2	2367.2000	55.62	51.74	-3.88	74.00	22.26	100	220	Horizontal
3	3196.5000	57.92	44.51	-13.41	74.00	29.49	100	207	Horizontal
4	4810.5000	59.58	52.05	-7.53	74.00	21.95	100	77	Horizontal
5	6177.0000	49.83	46.49	-3.34	74.00	27.51	100	219	Horizontal
6	13093.5000	35.39	51.33	15.94	74.00	22.67	200	262	Horizontal

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2366.5830	-3.88	50.16	46.28	54.00	7.72	100	225.4	Horizontal
2	4810.7785	-7.53	45.17	37.64	54.00	16.36	100	0	Horizontal
3	13093.5000	15.94	25.15	41.09	54.00	12.91	200	262	Horizontal

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1110.8000	56.13	44.49	-11.64	74.00	29.51	100	152	Vertical
2	2523.4000	48.72	47.27	-1.45	74.00	26.73	100	324	Vertical
3	4807.5000	54.70	47.66	-7.04	74.00	26.34	100	64	Vertical
4	6370.5000	51.42	48.38	-3.04	74.00	25.62	100	276	Vertical
5	7216.5000	48.92	49.61	0.69	74.00	24.39	100	313	Vertical
6	14703.0000	35.23	53.45	18.22	74.00	20.55	200	76	Vertical

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	6392.3495	-3.04	34.21	31.17	54.00	22.83	100	22.5	Vertical
2	7245.4275	0.69	31.92	32.61	54.00	21.39	100	21.2	Vertical
3	14699.1650	18.22	23.71	41.93	54.00	12.07	200	53.6	Vertical

Mode: Mode 1
Middle Frequency (2440MHz)
Environment: 23.5℃/51%RH/101.0kPa Voltage: DC 3V
Tested By:Qin Tingting Date: 2024-11-21

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1121.8000	51.96	41.21	-10.75	74.00	32.79	100	257	Horizontal
2	1874.6000	48.68	43.89	-4.79	74.00	30.11	200	49	Horizontal
3	2493.8000	47.45	47.21	-0.24	74.00	26.79	200	128	Horizontal
4	4881.0000	54.83	47.60	-7.23	74.00	26.40	100	37	Horizontal
5	7321.5000	45.45	46.62	1.17	74.00	27.38	200	37	Horizontal
6	13119.0000	35.79	51.44	15.65	74.00	22.56	200	182	Horizontal

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	13119.0000	15.65	26.27	41.92	54.00	12.08	200	182	Horizontal

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1246.2000	51.30	42.70	-8.60	74.00	31.30	100	311	Vertical
2	1798.0000	53.82	47.80	-6.02	74.00	26.20	100	286	Vertical
3	4878.0000	51.93	44.86	-7.07	74.00	29.14	100	30	Vertical
4	6376.5000	50.41	47.54	-2.87	74.00	26.46	100	315	Vertical
5	7318.5000	49.31	50.87	1.56	74.00	23.13	100	301	Vertical
6	14707.5000	35.46	53.48	18.02	74.00	20.52	200	286	Vertical

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	7347.5175	1.56	31.79	33.35	54.00	20.65	100	23.2	Vertical
2	14704.0925	18.02	25.51	43.53	54.00	10.47	200	93.1	Vertical

Mode: Mode 1
Highest Frequency (2480MHz)
Environment: 23.5℃/51%RH/101.0kPa Voltage: DC 3V
Tested By:Qin Tingting Date: 2024-11-21

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1118.6000	50.38	39.62	-10.76	74.00	34.38	100	152	Horizontal
2	2519.0000	54.27	53.12	-1.15	74.00	20.88	100	241	Horizontal
3	3412.5000	53.50	40.48	-13.02	74.00	33.52	100	206	Horizontal
4	4960.5000	55.47	48.71	-6.76	74.00	25.29	200	43	Horizontal
5	6822.0000	46.37	45.65	-0.72	74.00	28.35	200	314	Horizontal
6	14688.0000	36.97	51.25	14.28	74.00	22.75	100	127	Horizontal

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2518.7450	-1.15	48.70	47.55	54.00	6.45	100	227.4	Horizontal
2	4980.2415	-6.76	35.29	28.53	54.00	25.47	200	21.5	Horizontal
3	14688.0000	14.28	25.13	39.41	54.00	14.59	100	127	Horizontal

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1117.2000	53.42	42.04	-11.38	74.00	31.96	100	190	Vertical
2	1797.6000	52.49	46.47	-6.02	74.00	27.53	100	190	Vertical
3	4959.0000	52.09	45.11	-6.98	74.00	28.89	100	119	Vertical
4	6388.5000	53.36	50.81	-2.55	74.00	23.19	100	197	Vertical
5	7438.5000	48.91	50.18	1.27	74.00	23.82	100	327	Vertical
6	14701.5000	36.15	54.43	18.28	74.00	19.57	200	339	Vertical

AV Final Data List									
NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	6384.6165	-2.55	44.70	42.15	54.00	11.85	100	268.4	Vertical
2	7443.2375	1.27	30.33	31.60	54.00	22.40	100	21.3	Vertical
3	14713.2025	18.28	24.69	42.97	54.00	11.03	200	17.9	Vertical

Remark:

1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
2 Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3 Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4 Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

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18GHz to 26.5GHz
According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Only the worst mode and channel were recorded in this report. (Thread 2405MHz)

Mode: Mode 1
Highest Frequency (2405MHz)
Environment: 25.6℃/53%RH/101.0kPa Voltage: DC 3V
Tested By: Qin Tingting Date: 2024-11-29

Suspected Data List										
NO.	Freq. [MHz]	Reading [dBμV/m]	Level for 1m [dBμV/m]	Level for 3m [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18923.5250	47.49	50.50	40.96	3.01	74	33.04	200	78	Horizontal
2	20234.2250	45.27	49.12	39.58	3.85	74	34.42	100	36	Horizontal
3	21054.4750	44.28	48.34	38.80	4.06	74	35.20	100	159	Horizontal
4	23278.0750	42.43	47.13	37.59	4.70	74	36.41	100	199	Horizontal
5	24732.0000	41.76	47.28	37.74	5.52	74	36.26	100	339	Horizontal
6	25880.7750	42.31	47.46	37.92	5.15	74	36.08	100	138	Horizontal

Suspected Data List										
NO.	Freq. [MHz]	Reading [dBμV/m]	Level for 1m [dBμV/m]	Level for 3m [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18848.3000	46.15	49.23	39.69	3.08	74	34.31	100	122	Vertical
2	20097.3750	45.18	49.47	39.93	4.29	74	34.07	100	20	Vertical
3	21210.8750	44.07	48.42	38.88	4.35	74	35.12	100	341	Vertical
4	23005.6500	43.41	48.44	38.90	5.03	74	35.10	100	319	Vertical
5	24194.8000	42.24	47.72	38.18	5.48	74	35.82	200	122	Vertical
6	25613.0250	41.79	47.85	38.31	6.06	74	35.69	100	20	Vertical

Remark:

1 Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

2 Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

3 Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.

4 Above 18G test distance is 1m, so the Level for 3m= Level for 1m + 20*log(1/3)

7. 6dB BANDWIDTH

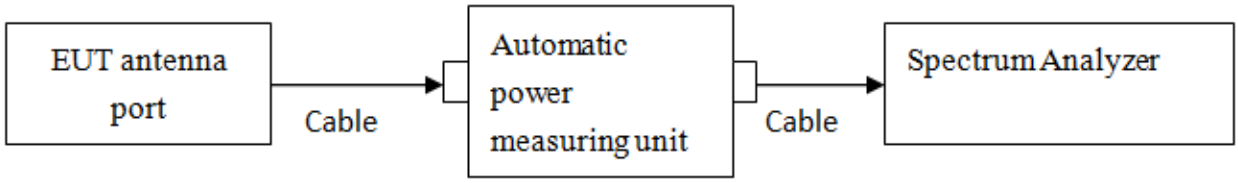
7.1 LIMITS

Systems using digital modulation techniques may operate in the 902–928MHz, 2400–2483.5MHz, and 5725–5850MHz bands. The minimum 6dB bandwidth shall be at least 500kHz.

7.2 TEST PROCEDURES

1) Remove the antenna from the EUT, and then connect a low loss RF cable from antenna port to the spectrum analyzer**.**
2) Set resolution bandwidth (RBW) = 100kHz.Set the video bandwidth (VBW) ≥ 3 x RBW. Detector = Peak. Trace mode = max hold. Sweep = auto couple. Allow the trace to stabilize, record 6dB bandwidth value.
3) Repeat above procedures until all frequencies measured were complete.

7.3 TEST SETUP



7.4 TEST RESULTS

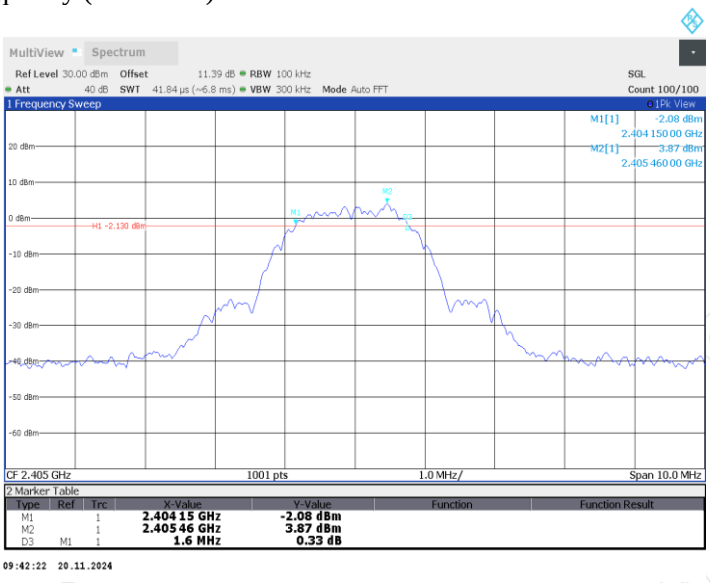
Environment: 22.8℃/50%RH/101.0kPa Voltage: DC 3V
Tested By: Qin Tingting Date: 2024-11-20

Thread

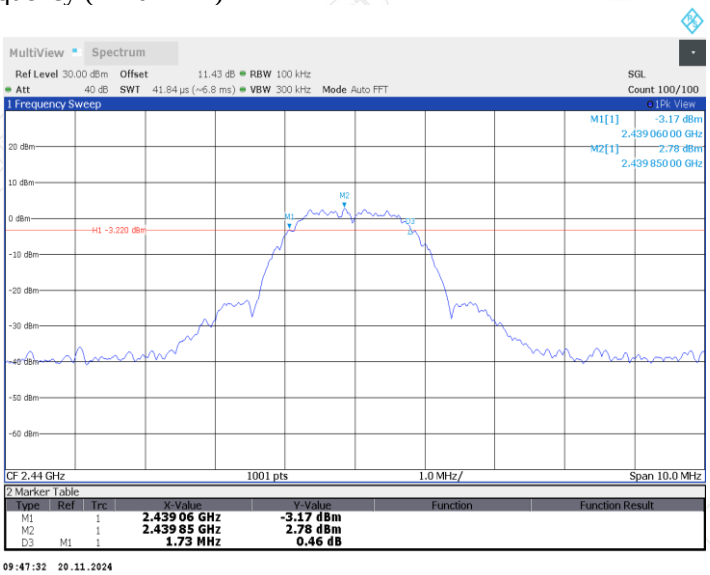
Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Lowest	2405	1600	≥500	PASS
Middle	2440	1730		PASS
Highest	2480	1660		PASS

Thread

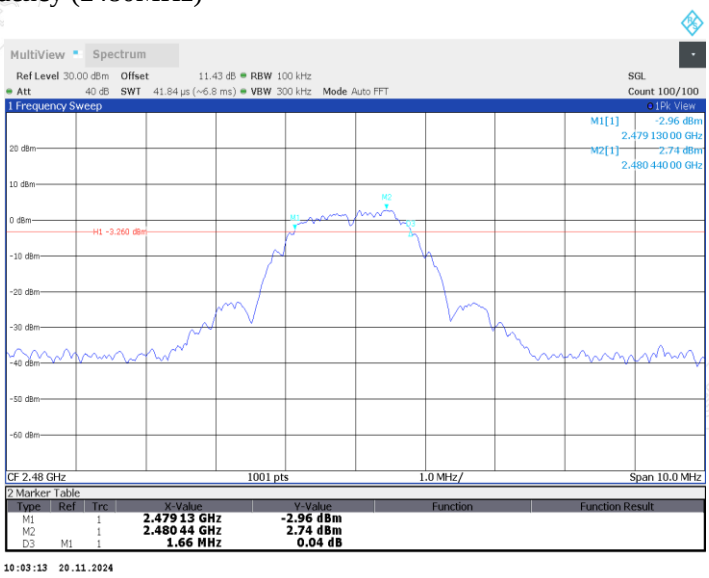
Lowest Frequency (2405MHz)



Middle Frequency (2440 MHz)



Highest Frequency (2480MHz)



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8. MAXIMUM PEAK OUTPUT POWER

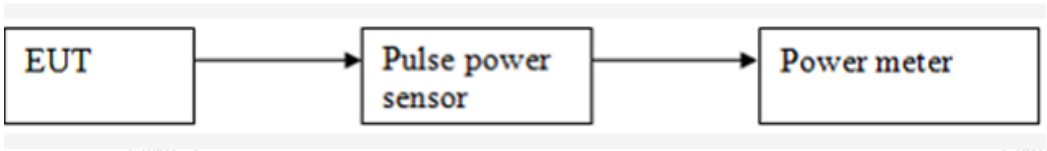
8.1 LIMITS

The maximum Peak output power measurement is 1W

8.2 TEST PROCEDURES

1) RF output of EUT was connected to the broadband peak RF power meter by RF cable. The path loss was compensated to the results for each measurement.
2) Set to the maximum power setting and enable the EUT transmit continuously.
3) Measure the conducted output power and record the results in the test report.

8.3 TEST SETUP



8.4 TEST RESULTS

Environment: 23.2℃/51%RH/101.0kPa Voltage: DC 3V
Tested By: Qin Tingting Date: 2024-11-21

Thread

Channel	Frequency (MHz)	Measured Channel Power (dBm)	Limit	Peak/ Average	Result
Lowest	2405	7.21	1W (30dBm)	Peak	Pass
Middle	2440	7.27			Pass
Highest	2480	7.37			Pass

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9. POWER SPECTRAL DENSITY

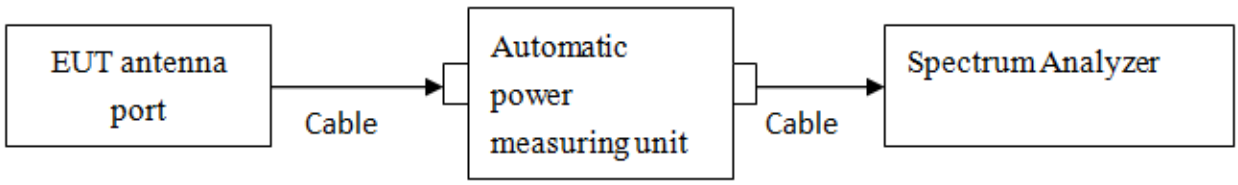
9.1 LIMITS

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

9.2 TEST PROCEDURES

1) Remove the antenna from the EUT, and then connect a low loss RF cable from antenna port to the spectrum analyzer.
2) Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3) Set the analyzer span to 1.5 times the DTS bandwidth. Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz. Set the VBW ≥ [3 × RBW]. 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 within the RBW. If measured value exceeds requirement, then reduce RBW (but no less than 3kHz) and repeat.
4) Repeat above procedures until all frequencies measured were complete.

9.3 TEST SETUP



9.4 TEST RESULTS

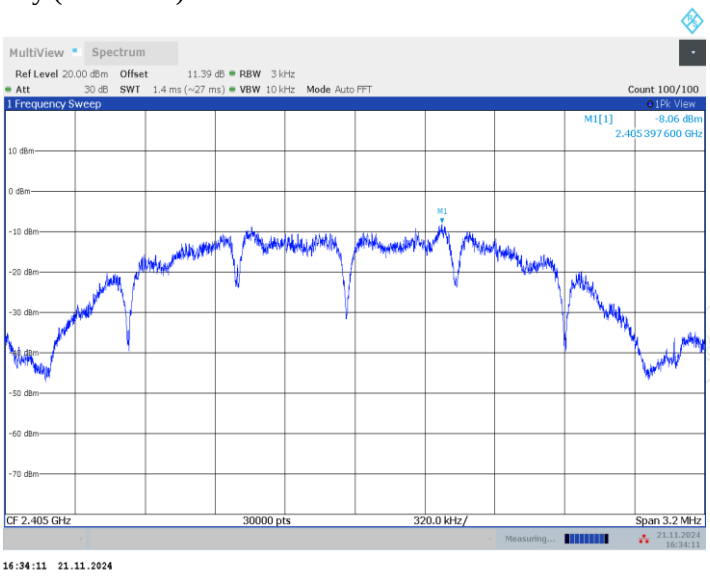
Environment: 23.2℃/51%RH/101.0kPa Voltage: DC 3V
Tested By: Qin Tingting Date: 2024-11-21

Thread

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Test Result
Lowest	2405	-8.06	8.00	PASS
Middle	2440	-8.42		PASS
Highest	2480	-8.63		PASS

Thread

Lowest Frequency (2405MHz)



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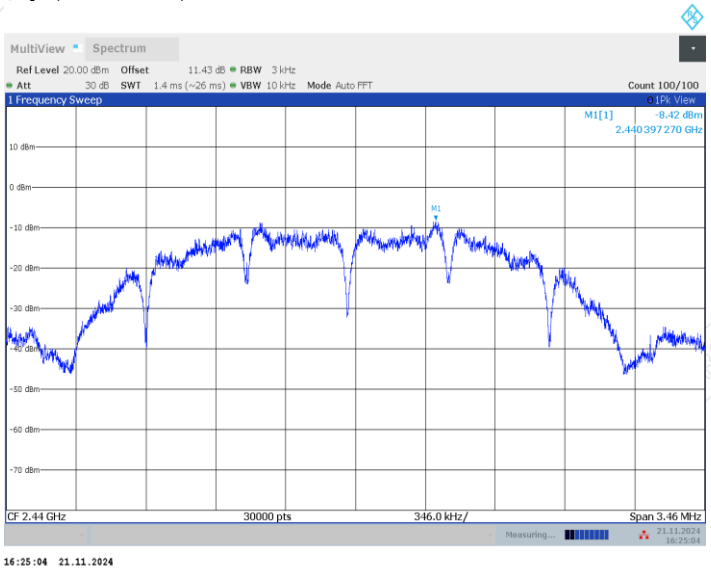
Middle Frequency (2440 MHz)



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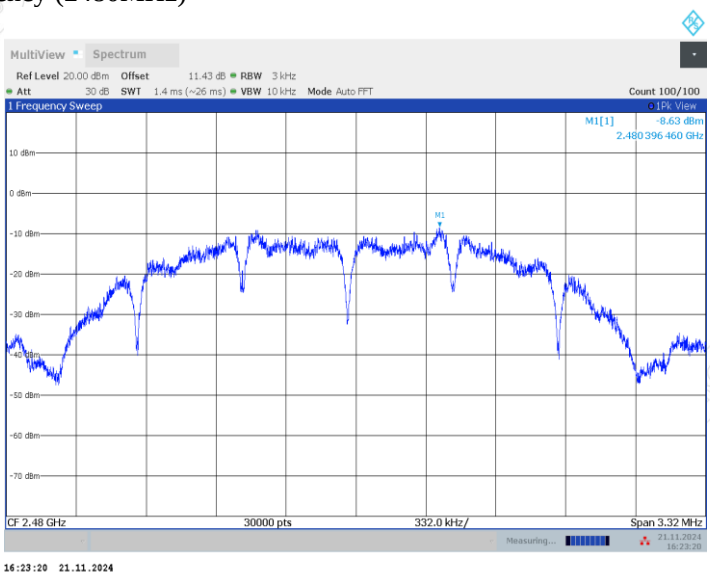
Highest Frequency (2480MHz)



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10. CONDUCTED BAND EDGES AND SPURIOUS EMISSIONS

10.1 LIMITS

In any 100kHz 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 20dB below that in the 100kHz 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 30dB instead of 20dB.

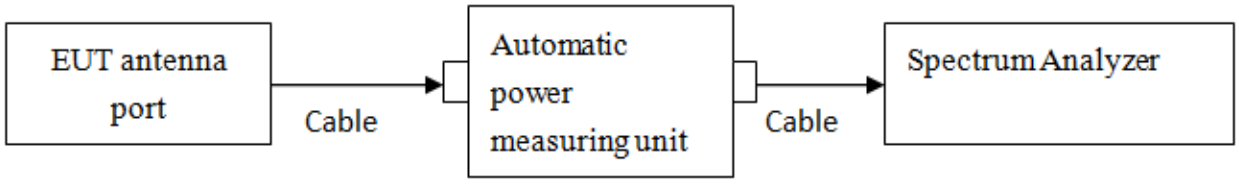
10.2 TEST PROCEDURES

Test procedures follow KDB 558074 D01 15.247 Measurement Guidance v05r02.

Remove the antenna from the EUT and then connect a low attenuation cable from the antenna port to the spectrum.

1) Remove the antenna from the EUT and then connect a low attenuation cable from the antenna port to the spectrum.
2) Set the spectrum analyzer: RBW =100kHz; VBW =300kHz, Frequency range = 30MHz to 26.5GHz; Sweep = auto; Detector Function = Peak. Trace = Max, hold.
3) Measure and record the results in the test report.
4) The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

10.3 TEST SETUP



10.4 TEST RESULTS

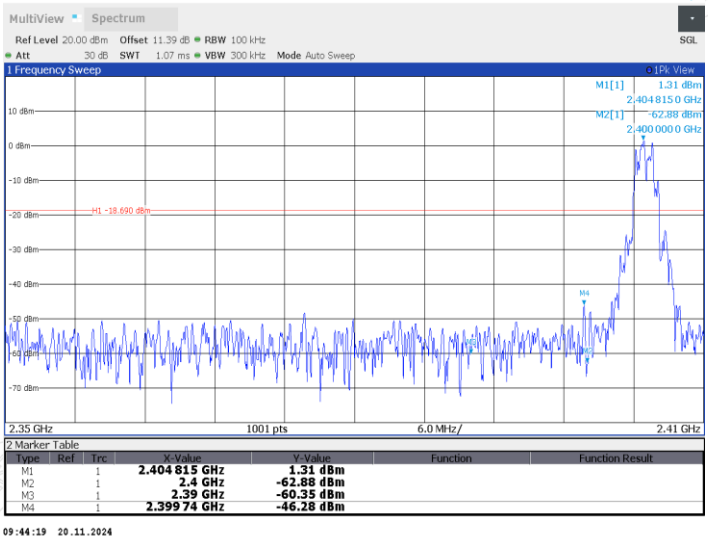
Tested By: Qin Tingting
Environment: 22.8℃/50%RH/101.0kPa
Environment: 23.2℃/51%RH/101.0kPa

Voltage: DC 3V
Date: 2024-11-20
Date: 2024-11-21

Band edge measurements

Thread

Lowest Frequency (2405MHz)
2.35GHz-2.405GHz



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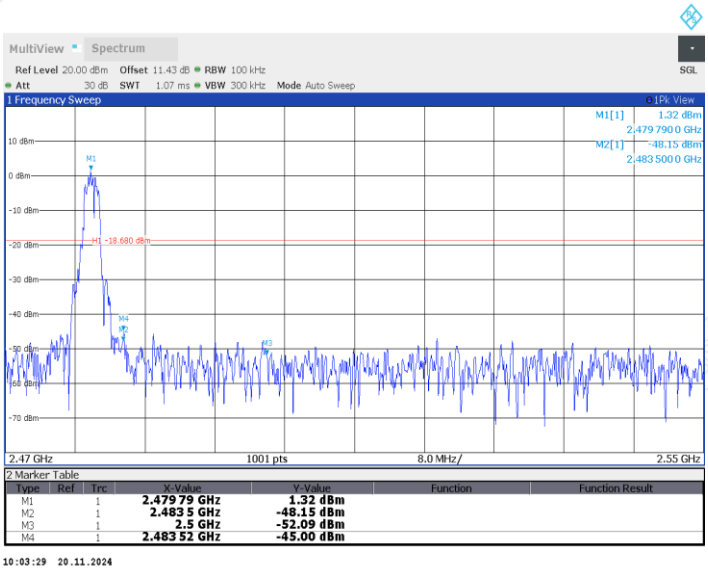
Highest Frequency (2480MHz)
2.47GHz-2.55GHz



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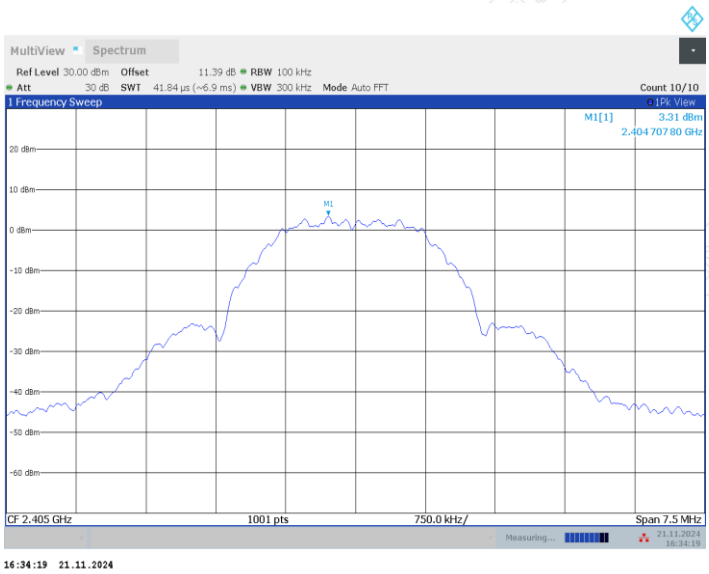
Conducted Spurious Emission
Thread

Lowest Frequency (2405MHz)



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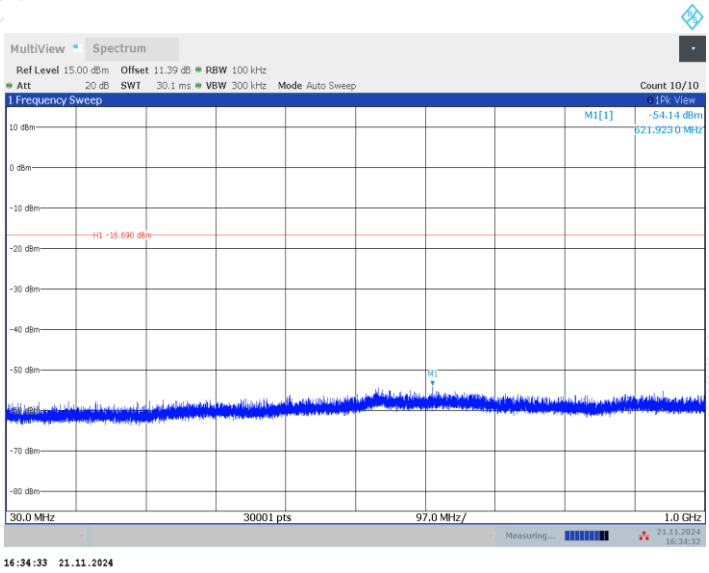
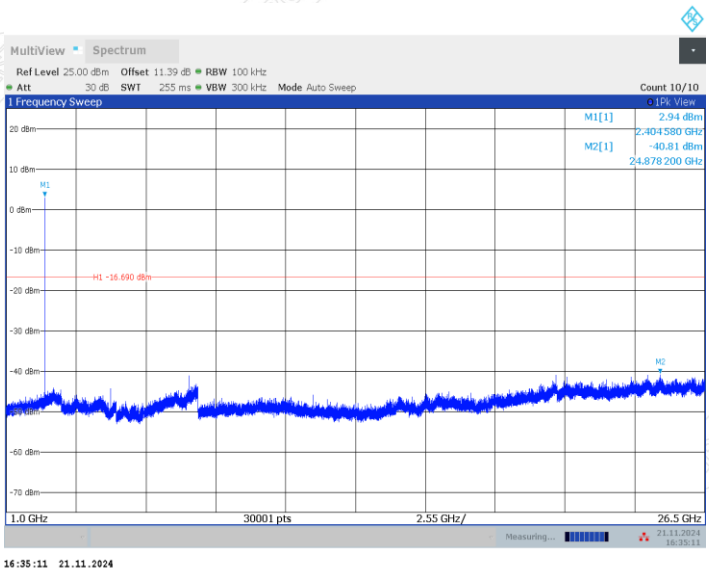
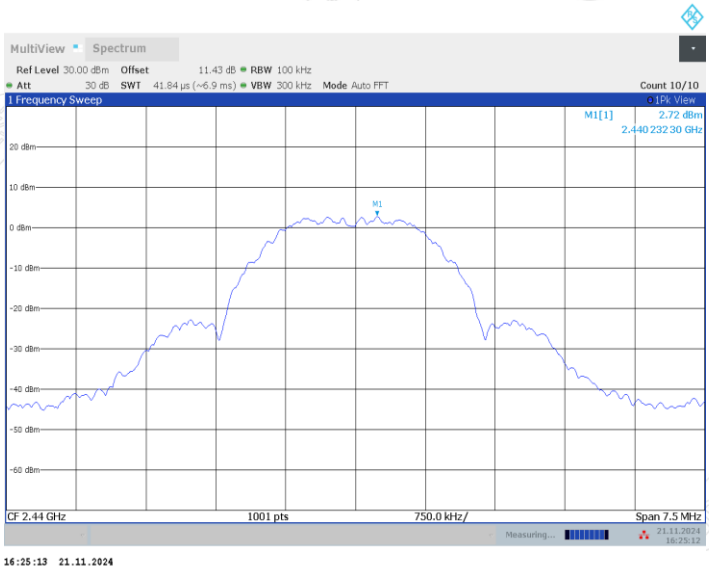
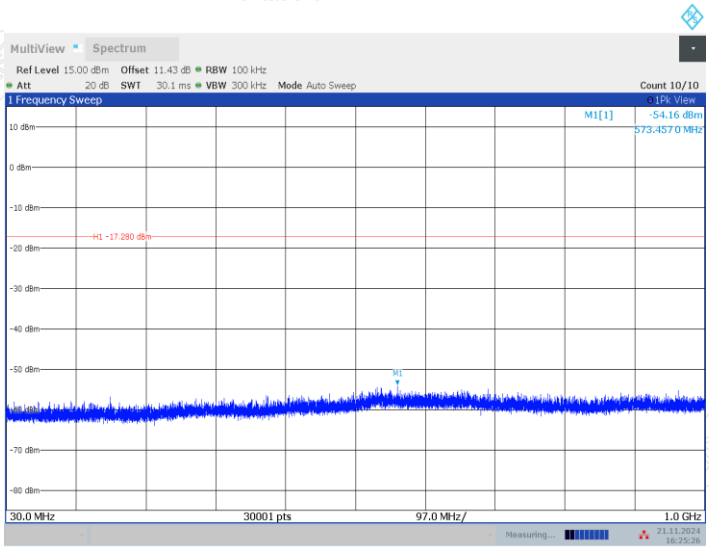


16:34:33 21.11.2024



Middle Frequency (2440MHz)





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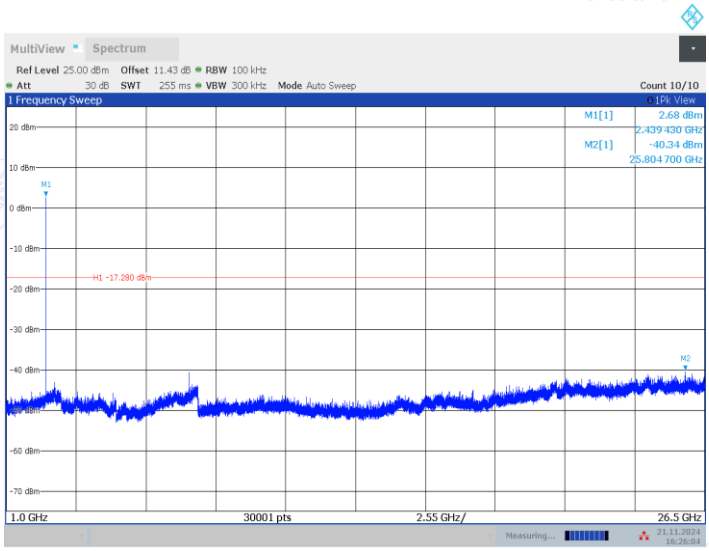

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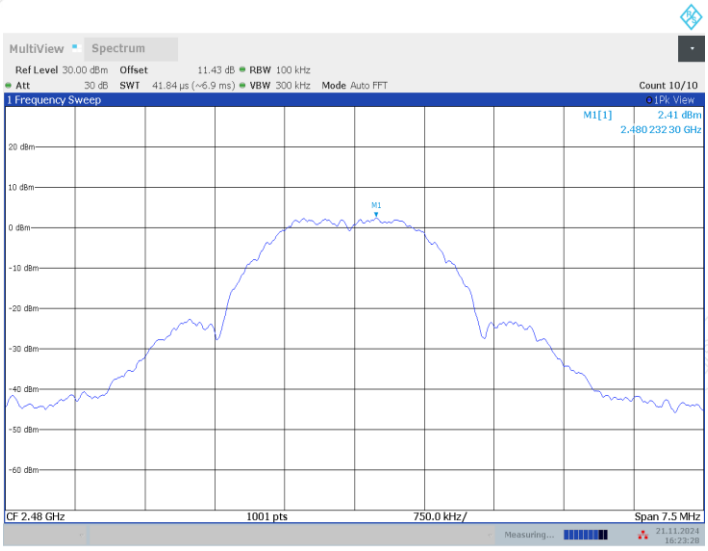
Highest Frequency (2480MHz)



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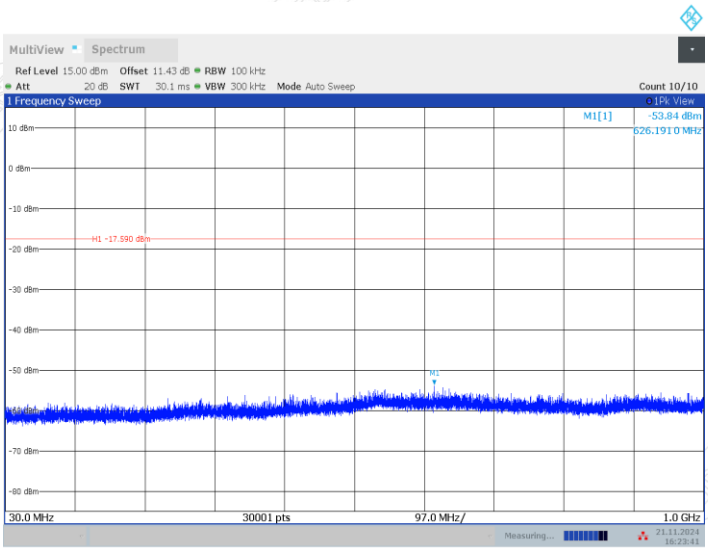

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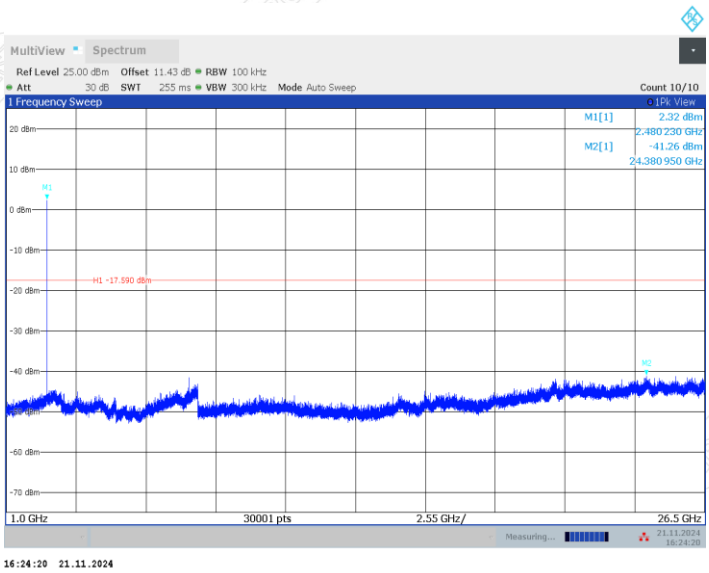

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11. RESTRICTED BANDS OF OPERATION

11.1 LIMITS

Section 15.247(d) In addition, 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)).

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]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 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 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	
13.36 - 13.41			

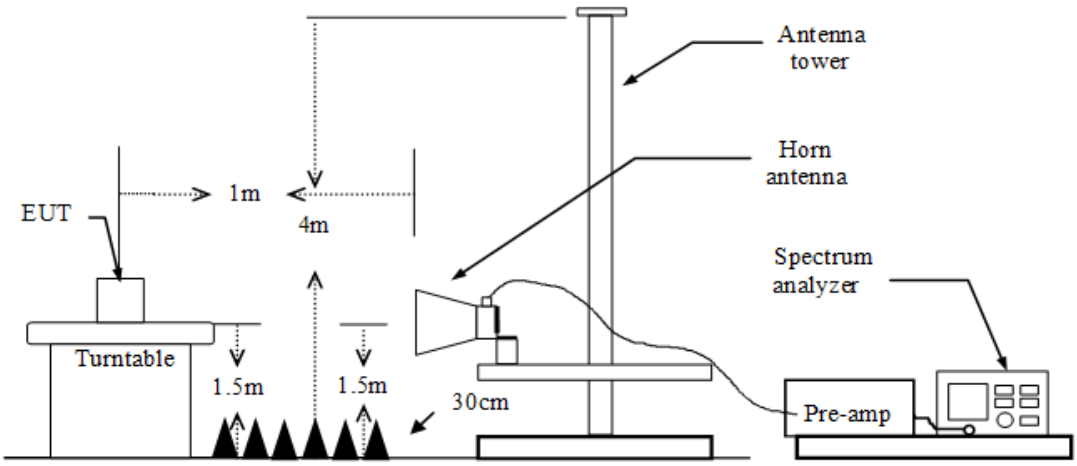
Frequency (MHz)	Quasi-peak(μV/m)	Measurement distance(m)	Quasi-peak(dBμV/m)@distance 3m
0.009-0.490	2400/F(kHz)	300	128.5~93.8
0.490-1.705	24000/F(kHz)	30	73.8~63
1.705-30.0	30	30	69.5
30 ~ 88	100	3	40
88~216	150	3	43.5
216 ~ 960	200	3	46
Above 960	500	3	54

11.2 TEST PROCEDURES

Test procedures follow KDB 558074 D01 15.247 Meas Guidance v05r02.

1) The EUT is placed on a turntable, which is 1.5m above the ground plane.
2) The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3) EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4) Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   a) PEAK: RBW=1MHz / VBW=1MHz / Sweep=AUTO.
   b) AVERAGE: RBW=1MHz / VBW=1/T / Sweep=AUTO.
   If the EUT is configured to transmit with duty cycle ≥98%，set VBW≤RBW/100 (i.e.,10kHz) but not less than 10 Hz. If the EUT duty cycle is ＜98%，set VBW≥1/T, Where T is defined in section 2.8.
5) Repeat the procedures until all the PEAK and AVERAGE versus polarization are measured.

11.3 TEST SETUP



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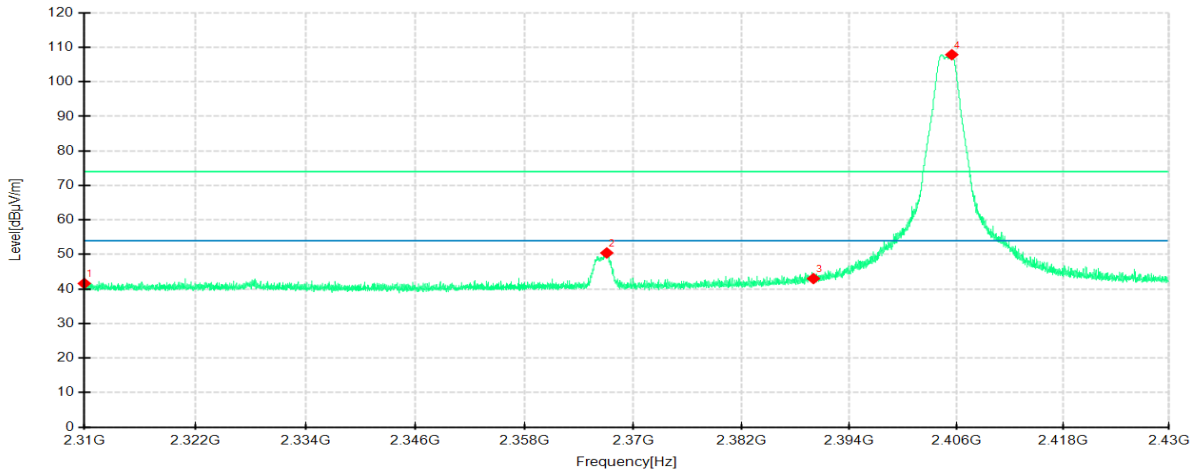
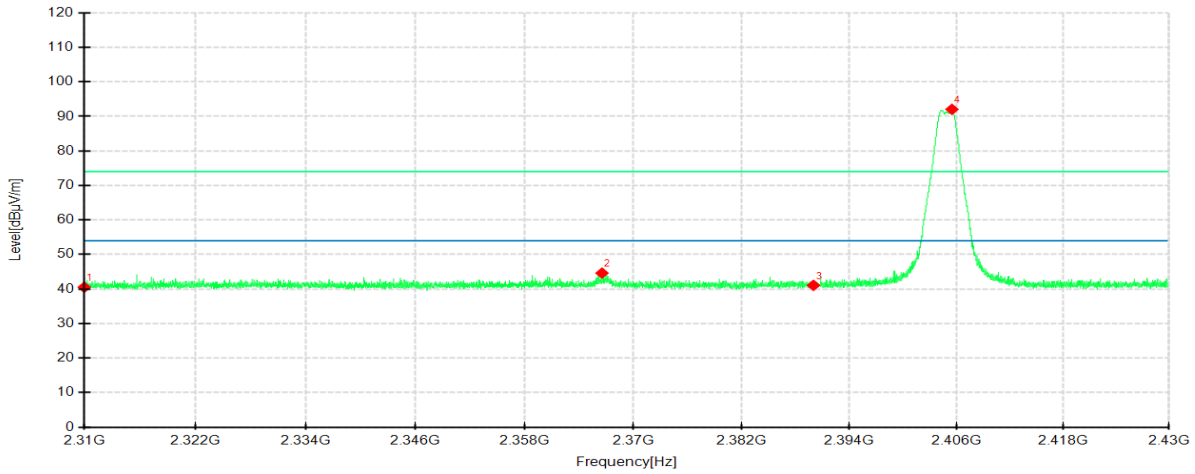
11.4 TEST RESULTS

Equipment:	Climate Sensor W100	Test Date	2024-11-28
Model No.:	TH-S04E	Test Engineer:	Qin Tingting
Test Voltage:	DC 3V	Environmental Conditions	25.1℃/55%RH/101.0kPa

Thread
Lowest Frequency
Frequency 2405MHz
Detector mode: Peak Polarity: Horizontal



Detector mode: Peak Polarity: Vertical



No.	Frequency MHz	Reading dBμV/m	Level dBμV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2310.0000	47.50	41.60	-5.90	74.00	32.40	200	88	Horizontal	/
2	2367.0450	56.55	50.45	-6.10	74.00	23.55	100	323	Horizontal	/
3	2390.0000	48.74	43.01	-5.73	74.00	30.99	200	253	Horizontal	/
4	2405.4900	113.33	107.89	-5.44	74.00	-33.89	100	146	Horizontal	No limit
1	2310.0000	45.81	40.51	-5.30	74.00	33.49	100	24	Vertical	/
2	2366.5200	50.01	44.61	-5.40	74.00	29.39	100	353	Vertical	/
3	2390.0000	46.51	41.06	-5.45	74.00	32.94	200	231	Vertical	/
4	2405.5050	97.50	92.06	-5.44	74.00	-18.06	100	24	Vertical	No limit

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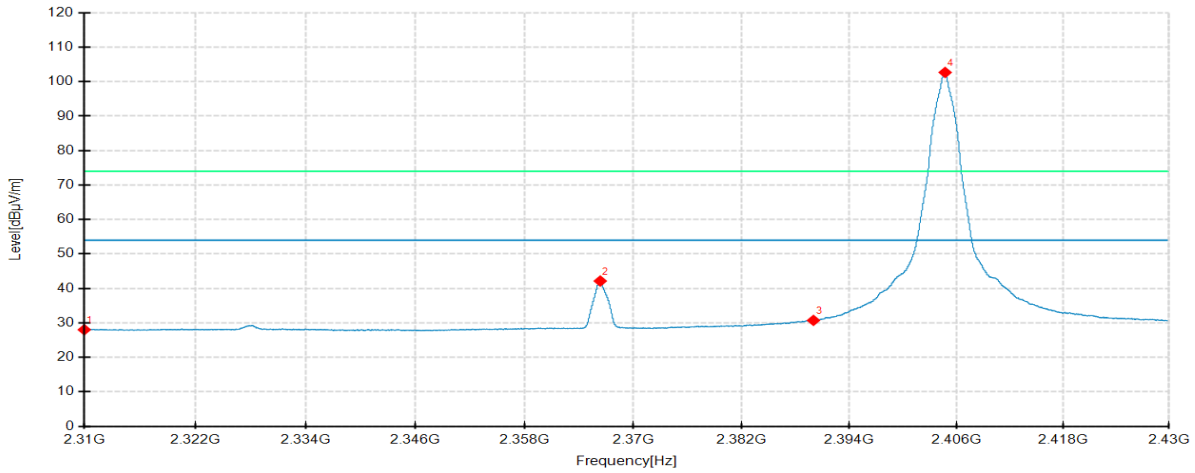
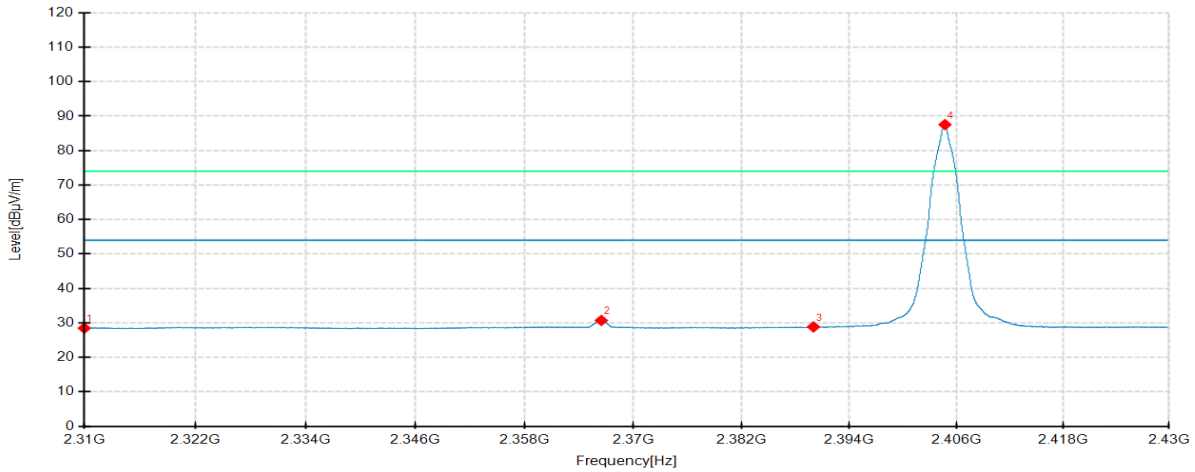
Lowest Frequency
Frequency 2405MHz
Detector mode: Average Polarity: Horizontal

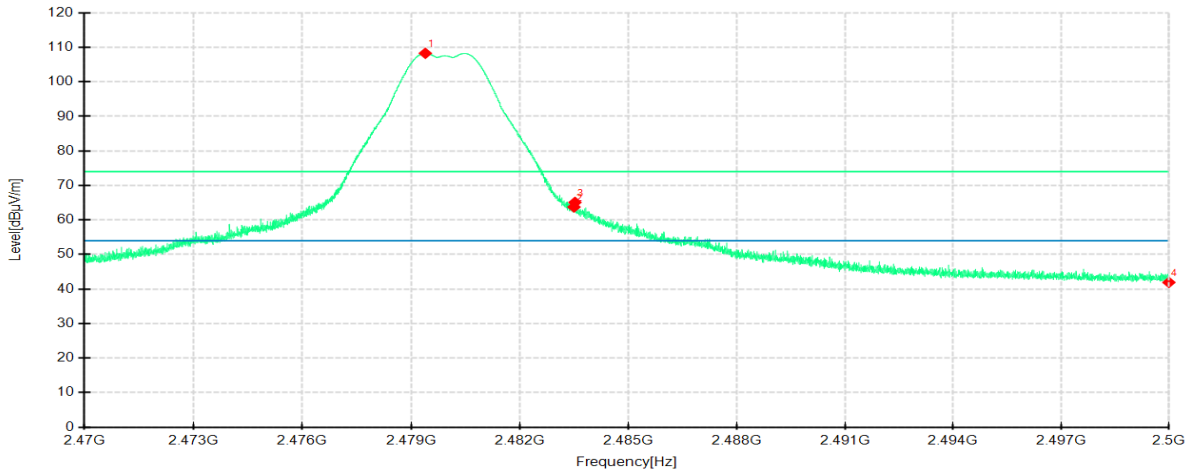


Detector mode: Average Polarity: Vertical

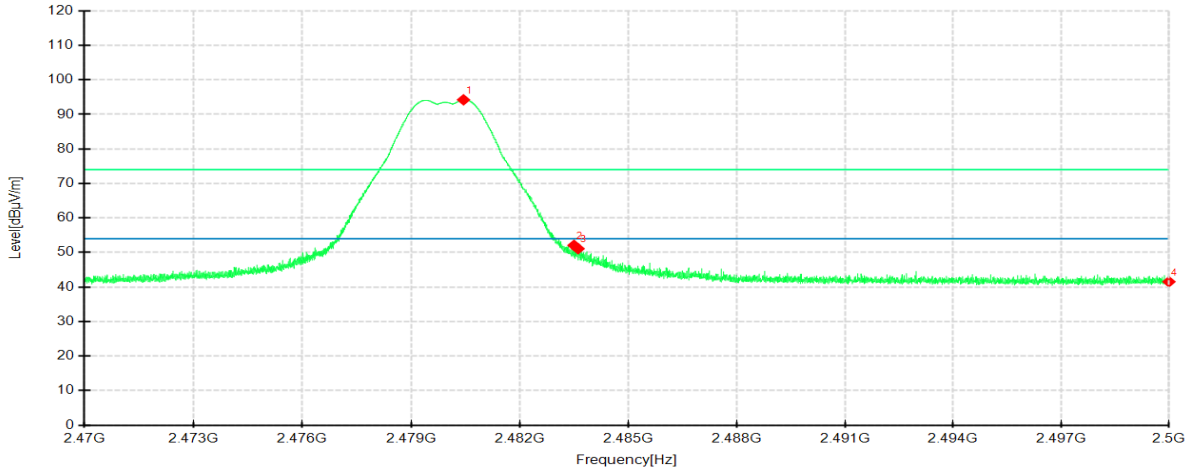


No.	Frequency MHz	Reading dBµV/m	Level dBµV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2310.0000	33.91	28.01	-5.90	54.00	25.99	200	212	Horizontal	/
2	2366.3250	48.26	42.15	-6.11	54.00	11.85	200	326	Horizontal	/
3	2390.0000	36.45	30.72	-5.73	54.00	23.28	100	208	Horizontal	/
4	2404.7400	108.16	102.69	-5.47	54.00	-48.69	100	58	Horizontal	No limit
1	2310.0000	33.76	28.46	-5.30	54.00	25.54	100	216	Vertical	/
2	2366.4450	36.10	30.70	-5.40	54.00	23.30	100	230	Vertical	/
3	2390.0000	34.28	28.83	-5.45	54.00	25.17	200	208	Vertical	/
4	2404.7250	93.00	87.55	-5.45	54.00	-33.55	100	204	Vertical	No limit

Highest Frequency
Frequency 2480MHz
Detector mode: Peak Polarity: Horizontal

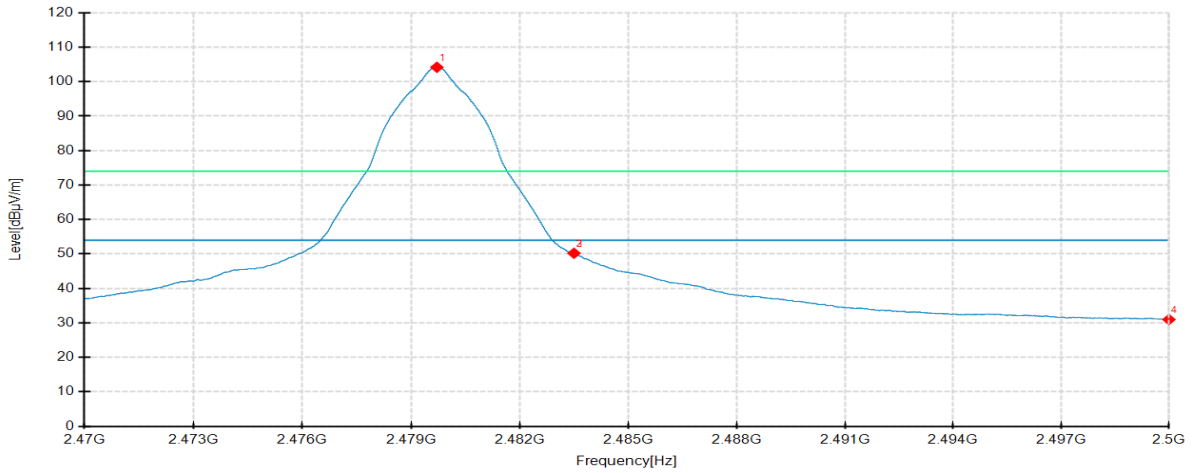


Detector mode: Peak Polarity: Vertical

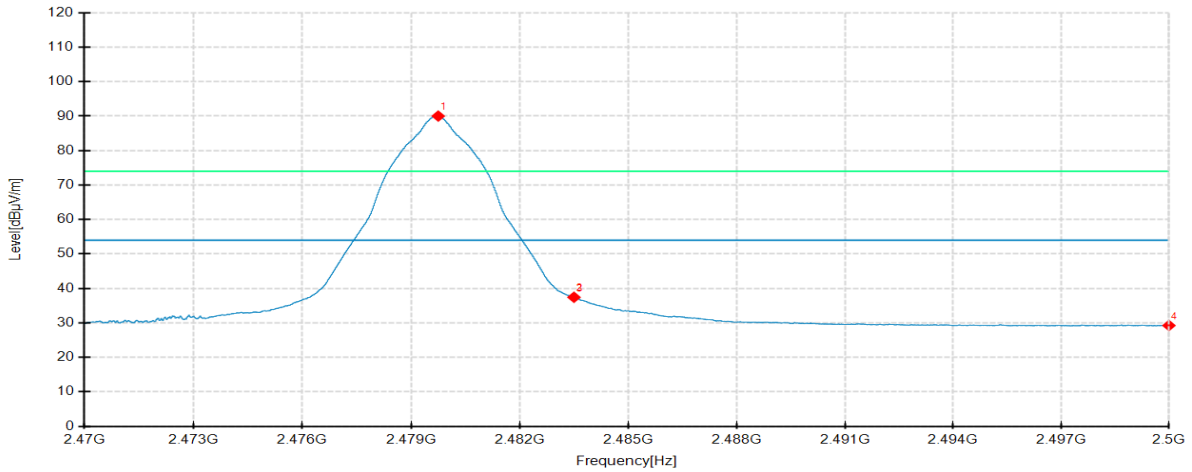


No.	Frequency MHz	Reading dBµV/m	Level dBµV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2479.3938	112.94	108.29	-4.65	74.00	-34.29	100	244	Horizontal	No limit
2	2483.5000	68.42	63.75	-4.67	74.00	10.25	100	56	Horizontal	/
3	2483.5263	69.77	65.10	-4.67	74.00	8.90	200	53	Horizontal	/
4	2500.0000	46.70	41.91	-4.79	74.00	32.09	100	42	Horizontal	/
1	2480.4475	99.39	94.24	-5.15	74.00	-20.24	100	26	Vertical	No limit
2	2483.5000	57.21	52.08	-5.13	74.00	21.92	100	26	Vertical	/
3	2483.6125	56.23	51.10	-5.13	74.00	22.90	100	26	Vertical	/
4	2500.0000	46.61	41.52	-5.09	74.00	32.48	200	218	Vertical	/

Highest Frequency
Frequency 2480MHz
Detector mode: Average Polarity: Horizontal



Detector mode: Average Polarity: Vertical



No.	Frequency MHz	Reading dBµV/m	Level dBµV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Remark
1	2479.7125	108.84	104.19	-4.65	54.00	-50.19	100	246	Horizontal	No limit
2	2483.5000	54.88	50.21	-4.67	54.00	3.79	100	246	Horizontal	/
3	2483.5038	54.89	50.22	-4.67	54.00	3.78	100	246	Horizontal	/
4	2500.0000	35.76	30.97	-4.79	54.00	23.03	100	321	Horizontal	/
1	2479.7500	95.18	90.03	-5.15	54.00	-36.03	100	24	Vertical	No limit
2	2483.5000	42.56	37.43	-5.13	54.00	16.57	100	24	Vertical	/
3	2483.5038	42.50	37.37	-5.13	54.00	16.63	100	24	Vertical	/
4	2500.0000	34.32	29.23	-5.09	54.00	24.77	200	10	Vertical	/

Remark: Max field strength in 3m distance. No any other emission which falls in restricted bands can be detected and be reported.

APPENDIX A. PHOTOGRAPH OF THE TEST CONNECTION DIAGRAM

Please refer to the attached document E20241111636501-Test Photo.

APPENDIX B. PHOTOGRAPH OF THE EUT

Please refer to the attached document E20241111636501-EUT Photo.

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