Test Report

Verified code: 509058

Report No.: E20211222698901-4

Customer:	Lumi United Technology Co., Ltd.
Address:	B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen, China
Sample Name:	Motion Sensor P1
Sample Model:	MS-S02
Receive Sample Test Date:	Dec.24,2021
Test Date:	Dec.27,2021 ~ Mar.22,2022
Reference Document:	CFR 47 FCC Part 15 Subpart C RADIO FREQUENCY DEVICES:Subpart C—Intentional Radiators
Test Result:	Pass

Prepared by: Yang Zhaoyun Reviewed by: Jiang Tao Approved by: Xiao Liang

GUANGZHOU GRG METROLOGY & TEST CO., LTD

Issued Date: 2022-03-28

GUANGZHOU GRG METROLOGY & TEST CO., LTD.
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5. Without the agreement of the laboratory, the client is not authorized to use the test results for unapproved propaganda.

---------- **The following blanks** ----------

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1. TEST RESULT SUMMARY

Technical Requirements		
CFR 47 FCC Part 15 Subpart C (§15.247)		
Limit / Severity	**Item**	**Result**
§15.207	Conducted emission AC power port	Pass
§15.247(b)(3)	Conducted output power for DTS	Pass
§15.247(e)	Power spectral density	Pass
§15.247(a)(2)	6dB bandwidth	Pass
§15.247(d)	Spurious RF conducted emissions	Pass
§15.247(d)	Band edge	Pass
§15.247(d) & §15.209 & §15.205	Spurious radiated emissions for transmitter	Pass
§15.203	Antenna requirement	Pass

The EUT has one antenna. The antenna is internal antenna.
The max gain of antenna is 0.5dBi.which accordance 15.203.is considered sufficient to comply with the provisions of this section.

---------- **The following blanks** ----------

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, China

2.2 MANUFACTURER

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

2.3 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Equipment:	Motion Sensor P1
Model No.:	MS-S02
Adding Model:	/
Trade Name:	Aqara
FCC ID:	2AKIT-MSS02
Power Supply:	Power Supply By Button batteries
Battery Specification:	Button batteries: CR2450 DC 3V, 3mA
Frequency Range:	2405MHz-2475MHz
Transmit Power:	8.36dBm
Modulation type:	OQPSK
Antenna Specification:	Internal antenna 0.5dBi gain (Max.)
Temperature Range:	-10 ℃~55 ℃
Hardware Version:	X3
Software Version:	0.0.0_0005
Sample No:	E20211222698901-0006，E20211222698901-0007
Note:	/

2.4 CHANNEL LIST

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	/	/

2.5 TEST OPERATION MODE

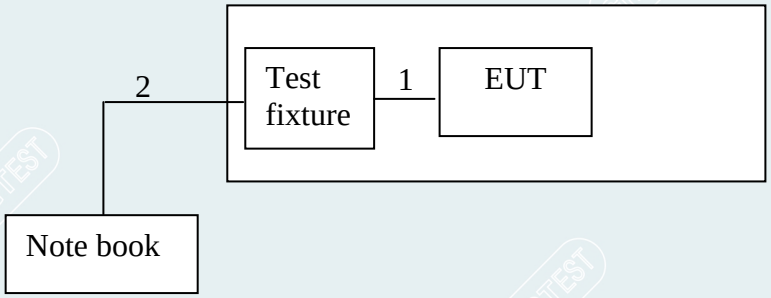
Test Item	Mode No.	Description of the modes
Radiated Emission	1	Zigbee TX mode

2.6 LOCAL SUPPORTIVE

Name of Equipment	Manufacturer	Model	Serial Number	Note
Notebook	LENOVO	TianYi 310-14ISK	MP18DLC6	/
/	/	/	/	/
Cable				
1	/	/	/	UnShielded, 0.2m
2	/	/	/	UnShielded, 1.0m

Note :The notebook is just used to produce fixed frequency transmitting.

2.7 CONFIGURATION OF SYSTEM UNDER TEST



Test software:

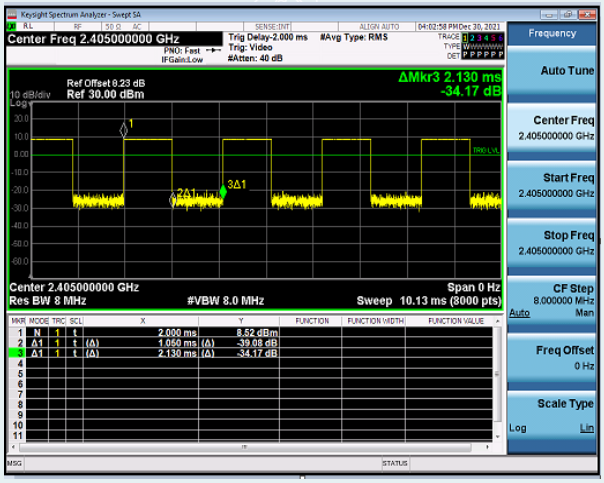
Software version	Test level
QCOM_V1.0	2405MHz: 8 2440MHz: 8 2475MHz: 8

2.8 DUTY CYCLE

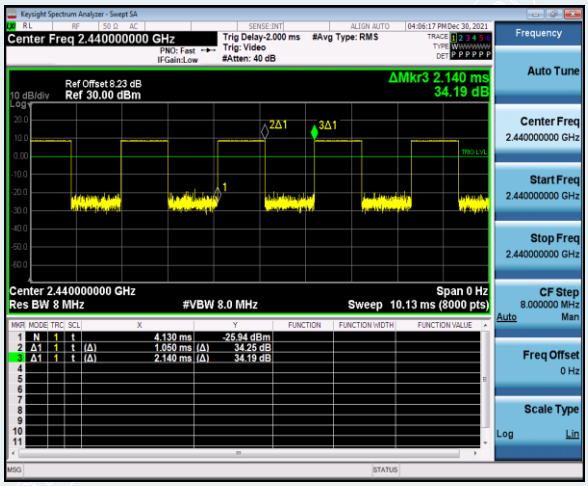
EUT Name	Motion Sensor P1	Model	MS-S02
Environmental Conditions	23.5℃/48%RH	Test Voltage	DC3V
Tested By	Lu Wei	Tested Date	2021/12/30 to 2022/03/21

Test Mode	Antenna	Frequency (MHz)	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	T [s]
Zigbee	Ant1	2405	1.05	2.13	49.30	0.00105
		2440	1.05	2.14	49.07	0.00105
		2475	1.04	2.13	48.83	0.00104

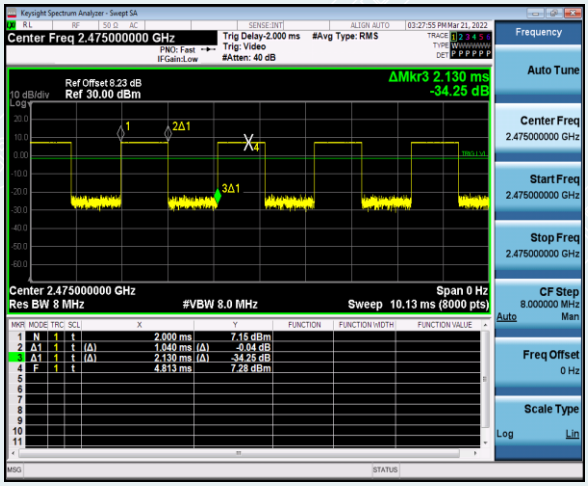
Zigbee_2405MHz



Zigbee_2440MHz



Zigbee_2475MHz



3. LABORATORY AND ACCREDITATIONS

3.1 LABORATORY

The tests & measurements refer to this report were performed by Shenzhen EMC Laboratory of Guangzhou GRG Metrology & Test Co., Ltd.

Add	:	Address: No.1301 Guanguang Road Xinlan Community, Guanlan Street, Longhua District Shenzhen, 518110, People's Republic of China
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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)
China	CNAS(L0446)

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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3.3 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	Horizontal	9kHz～30MHz	4.46dB
		30MHz～1000MHz	4.3dB
		1GHz～18GHz	5.6dB
		18GHz～26.5GHz	3.65dB
	Vertical	9kHz～30MHz	4.46dB
		30MHz～1000MHz	4.3dB
		1GHz～18GHz	5.6dB
		18GHz～26.5GHz	3.65dB

Measurement	Uncertainty
RF frequency	6.0×10^{-6}
RF power conducted	0.78 dB
Occupied channel bandwidth	0.4 dB
Unwanted emission, conducted	0.68 dB
Humidity	6 %
Temperature	2℃

This uncertainty represents an expanded uncertainty factor of *k*=2.

---------- **The following blanks** ----------

4. LIST OF USED TEST EQUIPMENT AT GRGT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Radiated Spurious Emission&Restricted bands of operation				
Spectrum Analyzer	R&S	ESU26	EMC26-G260	2022-08-20
Loop Antenna	TESEQ	HLA6121	52599	2022-04-21
Bi-log Antenna	Schwarzbeck	VULB 9163	01279	2023-01-22
Horn Antenna	Schwarzbeck	BBHA9120D (1201)	02143	2022-10-22
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-497	2022-10-16
Amplifier	Tonscend	TAP9E6343	AP20E806065	2022-06-03
Amplifier	Tonscend	TAP01018048	AP20E8060075	2022-05-09
Amplifier	Tonscend	TAP184050	AP20E806071	2022-05-17
Test S/W	Tonscend	JS32-RE/2.5.2.4		
Test S/W	Tonscend	JS36-RSE/2.5.1.5		
6dB Bandwidth				
Spectrum Analyzer	Agilent	N9020A	MY50510140	2022-11-08
Maximum Peak Output Power				
Pulse power sensor	Agilent	MA2411B	1126150	2023-03-01
Power meter	Anritsu	ML2495A	1204003	2023-02-28
Conducted band edges and Spurious Emission				
Spectrum Analyzer	Agilent	N9020A	MY50510140	2022-11-08
Peak Output Spectral Density Measurement				
Spectrum Analyzer	Agilent	N9020A	MY50510140	2022-11-08

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

5. RADIATED SPURIOUS EMISSIONS

5.1 LIMITS

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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 lower limit shall apply at the transition frequencies.
(2) 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).

5.2 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 0.8 m height is used.

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

--- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.

--- The EUT is placed on a desktop position in the center of 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 height is 1.0 meter.

--- 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 0.8 m 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.

--- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.

--- The EUT is placed on a desktop position in the center of 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 premeasurement 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 premeasurement 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 1.5 m height is used.

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

--- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.

--- The EUT is placed on a desktop position in the center of 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 premeasurement 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.

--- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.

--- The EUT is placed on a desktop position in the center of the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Pre measurement:

--- The antenna is moved spherical over the EUT in different polarisations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

NOTE:

(a).The frequency from 9kHz to 150kHz, Set RBW=300Hz(for Peak&AVG), RBW=300Hz(for Peak&AVG). the frequency from 150kHz to 30MHz, Set RBW=9kHz, RBW=9kHz, (for QP Detector).

(b).The frequency from 30MHz to 1GHz, Set RBW=120kHz, RBW=300kHz, (for QP Detector).

(c).The frequency above 1GHz, for Peak detector: Set RBW=1MHz, RBW=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.

5.3 TEST SETUP

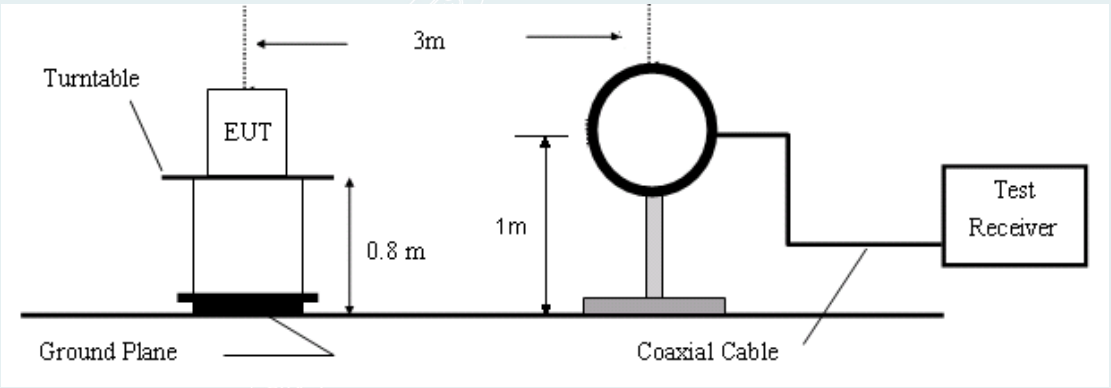


Figure 1. 9kHz to 30MHz radiated emissions test configuration

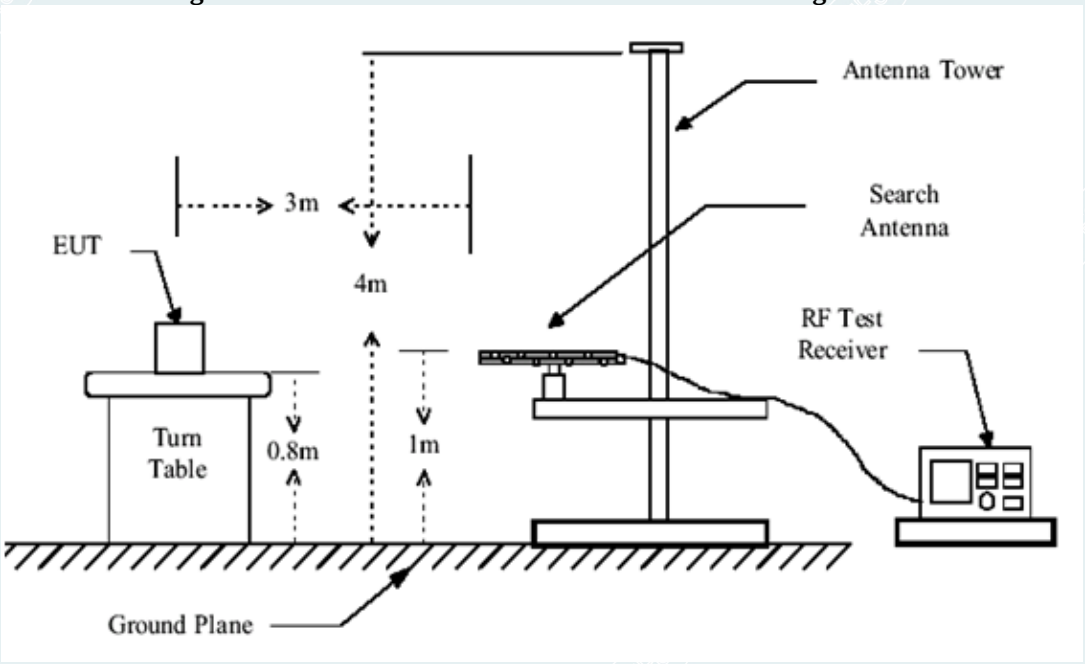


Figure 2. 30MHz to 1GHz radiated emissions test configuration

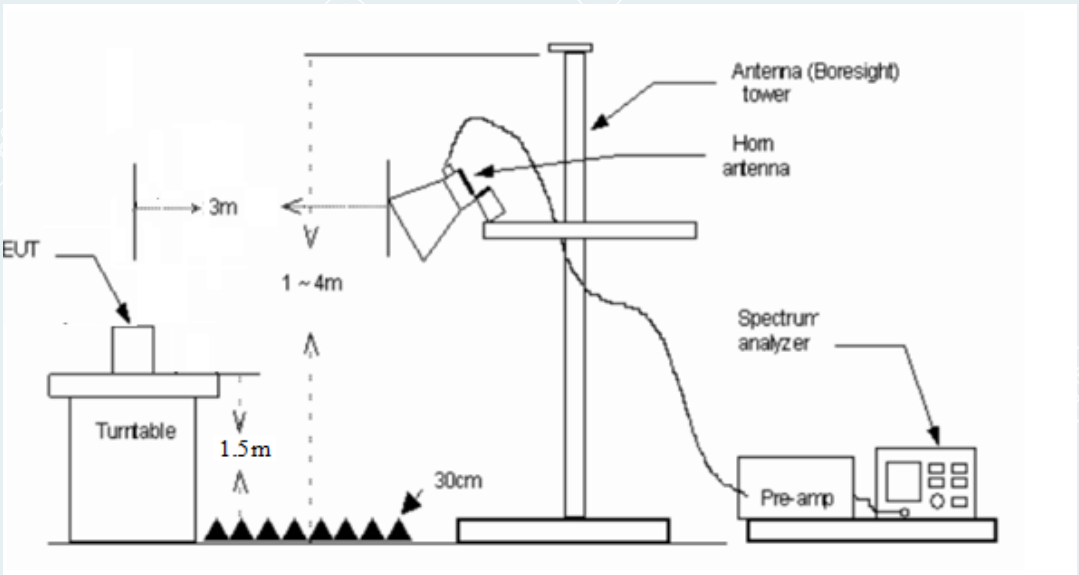


Figure 3. 1GHz-18GHz radiated emissions test configuration

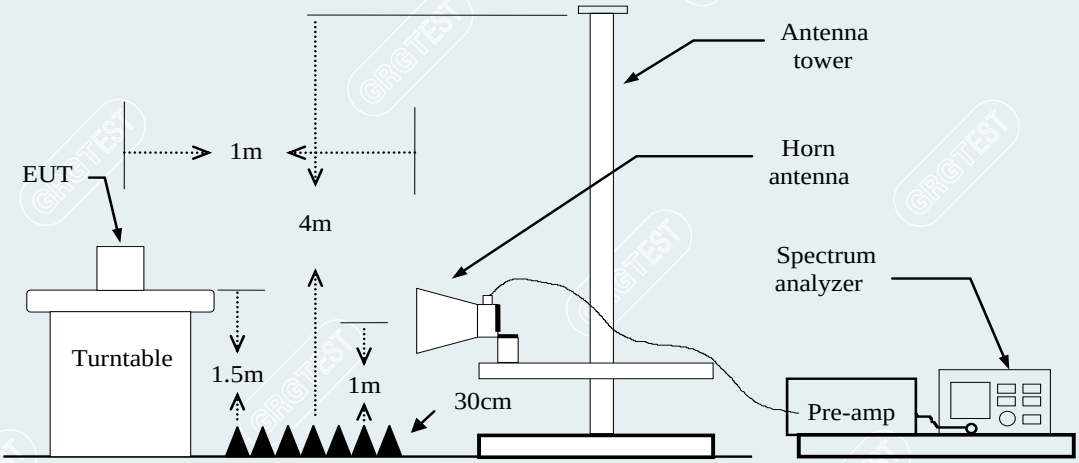


Figure 4. 18GHz-26.5GHz radiated emissions test configuration

5.4 DATA SAMPLE

30MHz to 1GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	37.06	-15.48	21.58	40.00	-18.42	QP	Vertical

1GHz to 18GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	65.45	-11.12	54.33	74.00	-19.67	Peak	Vertical
xxx	xxx	63.00	-11.12	51.88	54.00	-2.12	AVG	Vertical

Above 18GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	68.86	57.66	-11.20	83.54	25.88	peak	Vertical
xxx	xxx	68.89	-11.20	57.69	63.54	5.85	AVG	Vertical

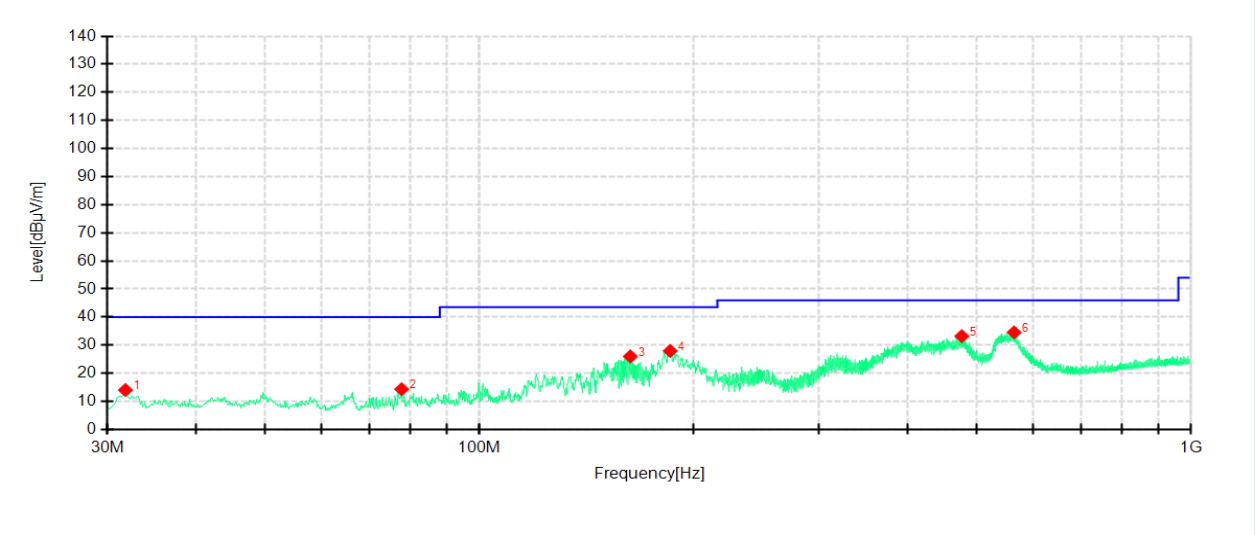
Frequency (MHz)	= Emission frequency in MHz
Ant.Pol. (H/V)	= Antenna polarization
Reading (dBuV)	= Uncorrected Analyzer / Receiver reading
Correction Factor (dB/m)	= Antenna factor + Cable loss – Amplifier gain
Result (dBuV/m)	= Reading (dBuV) + Correction Factor (dB/m)
Limit (dBuV/m)	= Limit stated in standard
Margin (dB)	= Remark Result (dBuV/m) – Limit (dBuV/m)
Peak	= Peak Reading
QP	= Quasi-peak Reading
AVG	= Average Reading

5.5 TEST RESULTS

Below 1GHz

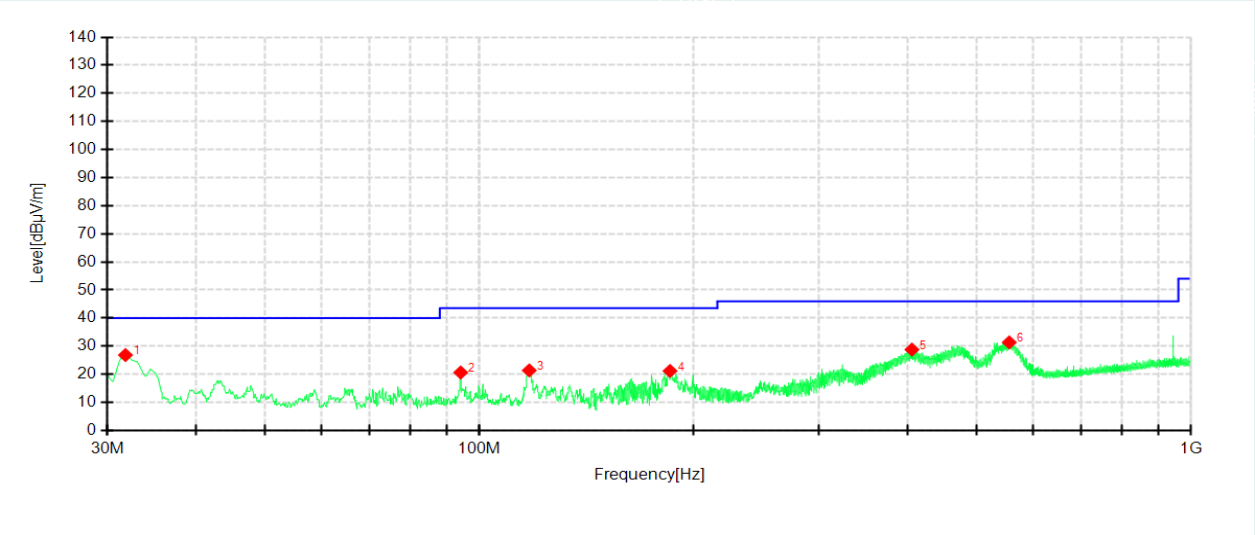
Low-Channel , Mid-Channel , Hight-Channel were pretested and only the worst channels were recorded in this report. (2405MHz)

EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0007
Test Engineer:	Lu Qiang	Test Date:	2022-02-17
Channel	Lowest channel (2405MHz)	Polarity:	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	31.8188	44.04	14.03	-30.01	40.00	25.97	200	137	Horizontal
2	77.7725	45.01	14.33	-30.68	40.00	25.67	200	1	Horizontal
3	163.0113	56.61	25.99	-30.62	43.50	17.51	200	245	Horizontal
4	185.4425	57.47	27.94	-29.53	43.50	15.56	200	255	Horizontal
5	476.4425	54.44	33.21	-21.23	46.00	12.79	200	331	Horizontal
6	564.3488	53.80	34.55	-19.25	46.00	11.45	200	310	Horizontal

EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0007
Test Engineer:	Lu Qiang	Test Date:	2022-02-17
Channel	Lowest channel (2405MHz)	Polarity:	Vertical



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	31.8188	56.84	26.83	-30.01	40.00	13.17	100	46	Vertical
2	94.1413	48.79	20.63	-28.16	43.50	22.87	100	360	Vertical
3	117.5425	50.80	21.37	-29.43	43.50	22.13	100	46	Vertical
4	185.3213	50.71	21.17	-29.54	43.50	22.33	200	168	Vertical
5	405.3900	51.50	28.79	-22.71	46.00	17.21	200	62	Vertical
6	555.4975	50.83	31.35	-19.48	46.00	14.65	100	13	Vertical

Remark:

1 No emission found between lowest internal used/generated frequency to 30MHz.

2 Radiated emissions measured in frequency range from 9 kHz to 1GHz were made with an instrument using Quasi-peak detector mode.

3 Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

4 The IF bandwidth of Receiver between 30MHz to 1GHz was 120 kHz.

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.

EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0007
Test Engineer:	Lu Qiang	Test Date:	2022-02-17
Channel	Lowest channel (2405MHz)	/	/

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1115.2644	59.74	34.95	-24.79	74.00	39.05	200	326	Horizontal
2	1416.3020	62.86	39.48	-23.38	74.00	34.52	200	211	Horizontal
3	1593.0741	67.56	44.65	-22.91	74.00	29.35	100	244	Horizontal
4	2389.1736	70.42	50.38	-20.04	74.00	23.62	200	28	Horizontal
5	3200.6501	55.66	39.82	-15.84	74.00	34.18	100	197	Horizontal
6	3988.2485	57.46	42.82	-14.64	74.00	31.18	100	109	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	1031.5039	60.41	35.31	-25.10	74.00	38.69	100	27	Vertical
2	1594.8244	63.21	40.30	-22.91	74.00	33.70	200	14	Vertical
3	2380.9226	75.59	55.46	-20.13	74.00	18.54	100	135	Vertical
4	2990.4988	55.31	37.61	-17.70	74.00	36.39	100	319	Vertical
5	3191.2739	56.31	40.29	-16.02	74.00	33.71	100	332	Vertical
6	3990.1238	55.61	40.95	-14.66	74.00	33.05	100	318	Vertical

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EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0007
Test Engineer:	Lu Qiang	Test Date:	2022-02-17
Channel	Middle channel (2440MHz)	/	/

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1103.5129	69.25	44.39	-24.86	74.00	29.61	200	225	Horizontal
2	1596.0745	67.65	44.74	-22.91	74.00	29.26	100	251	Horizontal
3	1991.8740	62.07	40.46	-21.61	74.00	33.54	100	272	Horizontal
4	3198.7748	57.31	41.45	-15.86	74.00	32.55	100	122	Horizontal
5	3986.3733	56.77	42.15	-14.62	74.00	31.85	100	109	Horizontal
6	4989.6237	54.53	44.72	-9.81	74.00	29.28	100	116	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	1274.2843	64.17	40.11	-24.06	74.00	33.89	200	8	Vertical
2	1515.3144	63.90	41.02	-22.88	74.00	32.98	200	20	Vertical
3	2055.1319	61.43	39.96	-21.47	74.00	34.04	100	359	Vertical
4	2375.9220	69.60	49.41	-20.19	74.00	24.59	100	143	Vertical
5	2992.2490	65.82	48.12	-17.70	74.00	25.88	100	319	Vertical
6	4880.8601	52.62	42.73	-9.89	74.00	31.27	100	231	Vertical

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EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0007
Test Engineer:	Lu Qiang	Test Date:	2022-03-22
Channel	Highest channel (2475MHz)	/	/

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1237.0296	57.64	35.25	-22.39	74.00	38.75	100	311	Horizontal
2	1906.1133	56.11	35.51	-20.60	74.00	38.49	200	84	Horizontal
3	3699.4624	53.63	37.87	-15.76	74.00	36.13	200	5	Horizontal
4	5111.5139	50.05	39.96	-10.09	74.00	34.04	200	2	Horizontal
5	6527.3159	49.67	40.95	-8.72	74.00	33.05	100	314	Horizontal
6	9143.2679	46.25	46.47	0.22	74.00	27.53	200	143	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	1066.5083	57.57	35.03	-22.54	74.00	38.97	200	245	Vertical
2	1395.0494	57.19	35.76	-21.43	74.00	38.24	100	295	Vertical
3	1927.3659	67.17	45.50	-21.67	74.00	28.50	200	280	Vertical
4	3054.3818	54.84	38.56	-16.28	74.00	35.44	100	312	Vertical
5	4948.3685	52.42	41.37	-11.05	74.00	32.63	100	239	Vertical
6	7903.7380	48.15	44.86	-3.29	74.00	29.14	200	325	Vertical

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Above 18GHz-26.5GHz:

EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0007
Test Engineer:	Lu Qiang	Test Date:	2022-02-22
Channel	Lowest channel (2405MHz)	/	/

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18362.9500	59.73	48.19	-11.54	83.54	35.35	150	204	Vertical
2	18901.0000	58.69	47.50	-11.19	83.54	36.04	150	88	Vertical
3	20965.6500	57.51	47.20	-10.31	83.54	36.34	150	352	Vertical
4	22955.0750	57.13	48.16	-8.97	83.54	35.38	150	336	Vertical
5	23936.8250	57.74	49.42	-8.32	83.54	34.12	150	47	Vertical
6	26460.9000	57.93	50.42	-7.51	83.54	33.12	150	55	Vertical

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18447.1000	58.99	47.49	-11.50	83.54	36.05	150	359	Horizontal
2	18895.0500	58.64	47.44	-11.20	83.54	36.10	150	288	Horizontal
3	20353.6500	58.27	47.68	-10.59	83.54	35.86	150	263	Horizontal
4	21633.7500	57.48	47.56	-9.92	83.54	35.98	150	156	Horizontal
5	23420.4500	57.63	48.88	-8.75	83.54	34.66	150	280	Horizontal
6	25253.0500	56.96	49.30	-7.66	83.54	34.24	150	322	Horizontal

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EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0007
Test Engineer:	Lu Qiang	Test Date:	2022-02-22
Channel	Middle channel (2440MHz)	/	/

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18032.3000	59.08	47.43	-11.65	83.54	36.11	150	297	Vertical
2	19381.6750	59.28	48.30	-10.98	83.54	35.24	150	256	Vertical
3	20220.6250	57.64	46.95	-10.69	83.54	36.59	150	206	Vertical
4	21555.5500	57.11	47.15	-9.96	83.54	36.39	150	74	Vertical
5	23881.1500	57.67	49.29	-8.38	83.54	34.25	150	57	Vertical
6	25530.5750	57.03	49.19	-7.84	83.54	34.35	150	99	Vertical

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18194.2250	58.58	46.98	-11.60	83.54	36.56	150	229	Horizontal
2	19438.6250	58.48	47.53	-10.95	83.54	36.01	150	88	Horizontal
3	20492.2000	57.47	46.98	-10.49	83.54	36.56	150	320	Horizontal
4	21646.0750	57.72	47.79	-9.93	83.54	35.75	150	104	Horizontal
5	23380.9250	57.38	48.62	-8.76	83.54	34.92	150	47	Horizontal
6	26182.9500	57.40	49.44	-7.96	83.54	34.10	150	245	Horizontal

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EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0007
Test Engineer:	Lu Qiang	Test Date:	2022-03-22
Channel	Highest channel (2475MHz)	/	/

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18817.2750	58.84	47.57	-11.27	83.54	35.97	150	229	Vertical
2	19714.8750	57.55	46.68	-10.87	83.54	36.86	150	329	Vertical
3	20952.4750	57.59	47.28	-10.31	83.54	36.26	150	88	Vertical
4	22377.0750	56.42	46.91	-9.51	83.54	36.63	150	1	Vertical
5	23518.6250	57.29	48.59	-8.70	83.54	34.95	150	113	Vertical
6	25567.5500	56.95	49.08	-7.87	83.54	34.46	150	220	Vertical

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18330.6500	58.61	47.06	-11.55	83.54	36.48	150	322	Horizontal
2	19285.6250	58.05	47.01	-11.04	83.54	36.53	150	7	Horizontal
3	20550.8500	57.07	46.61	-10.46	83.54	36.93	150	198	Horizontal
4	21687.7250	57.03	47.10	-9.93	83.54	36.44	150	198	Horizontal
5	24063.4750	57.18	48.94	-8.24	83.54	34.60	150	247	Horizontal
6	25764.7500	57.67	49.58	-8.09	83.54	33.96	150	148	Horizontal

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6. 6dB BANDWIDTH

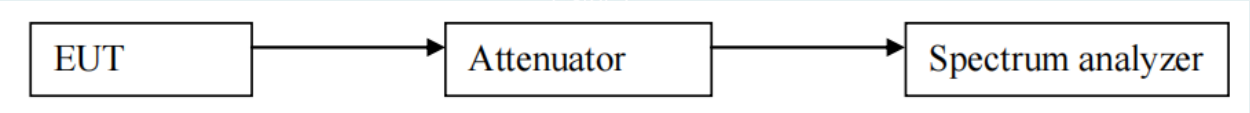
6.1 LIMITS

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

6.2 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.

6.3 TEST SETUP

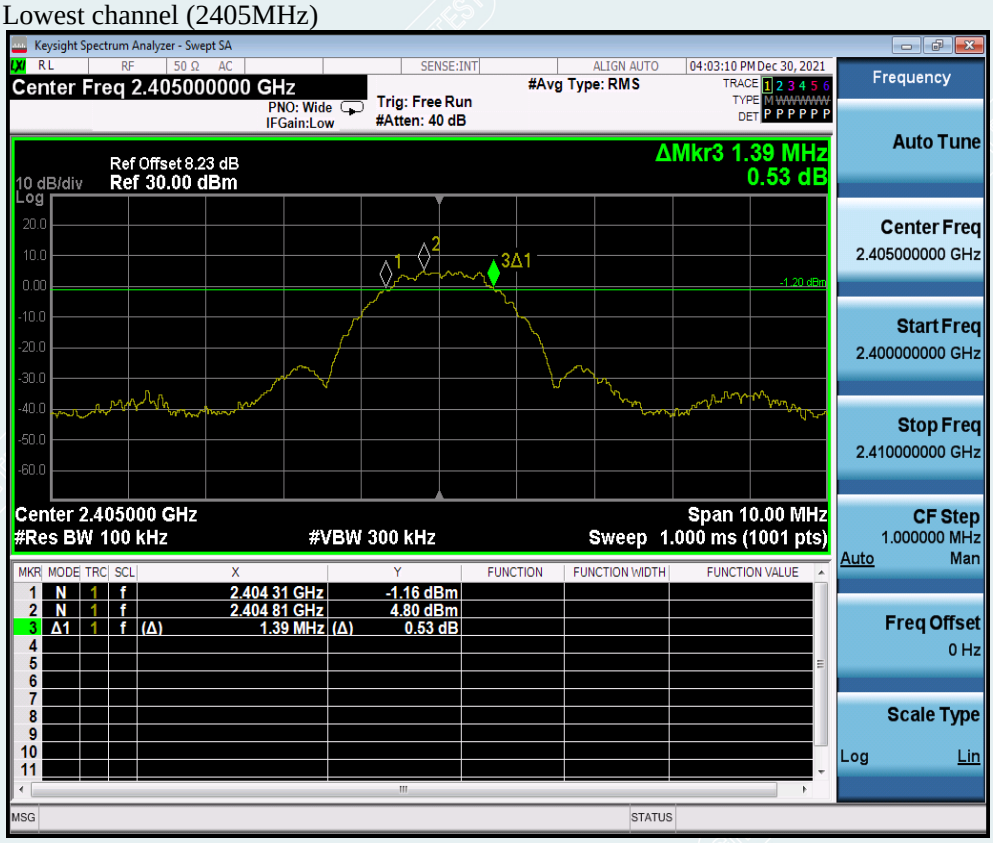


6.4 TEST RESULTS

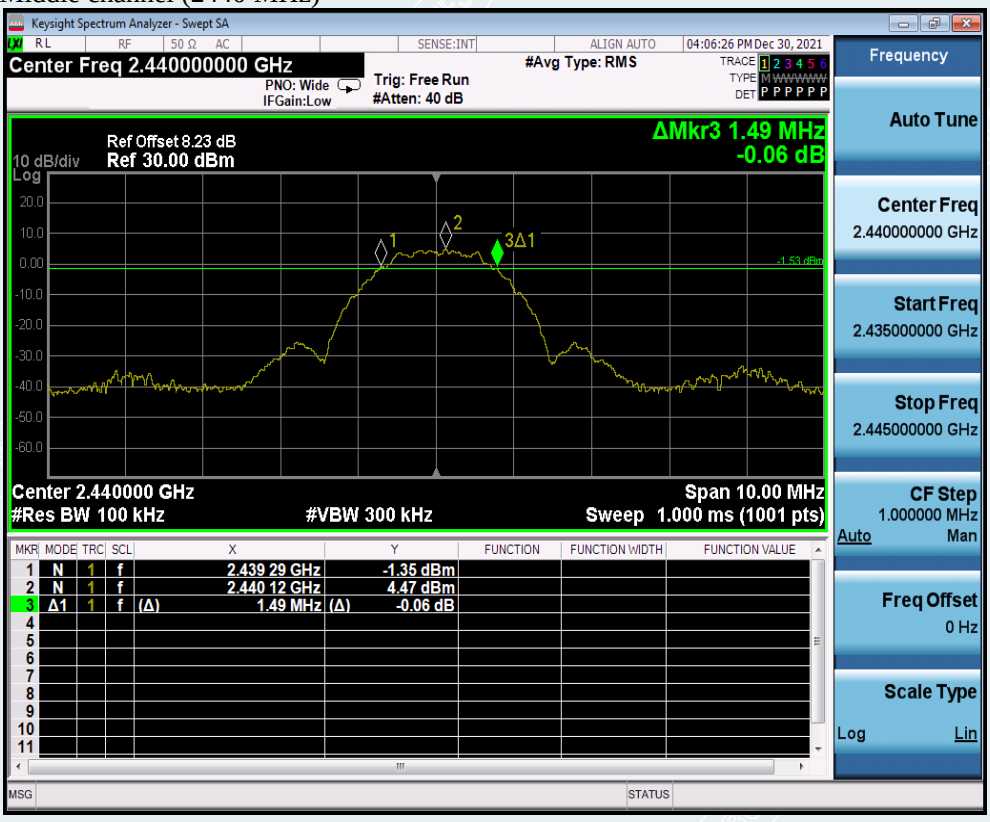
EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0006
Test Engineer:	Lu wei	Test Date:	2021-12-30 to 2022-03-21

ChName	Frequency (MHz)	Bandwidth [kHz]	Limit[kHz]	Verdict
Lowest	2405	1390	≥500	PASS
Middle	2440	1490		PASS
Highest	2475	1470		PASS

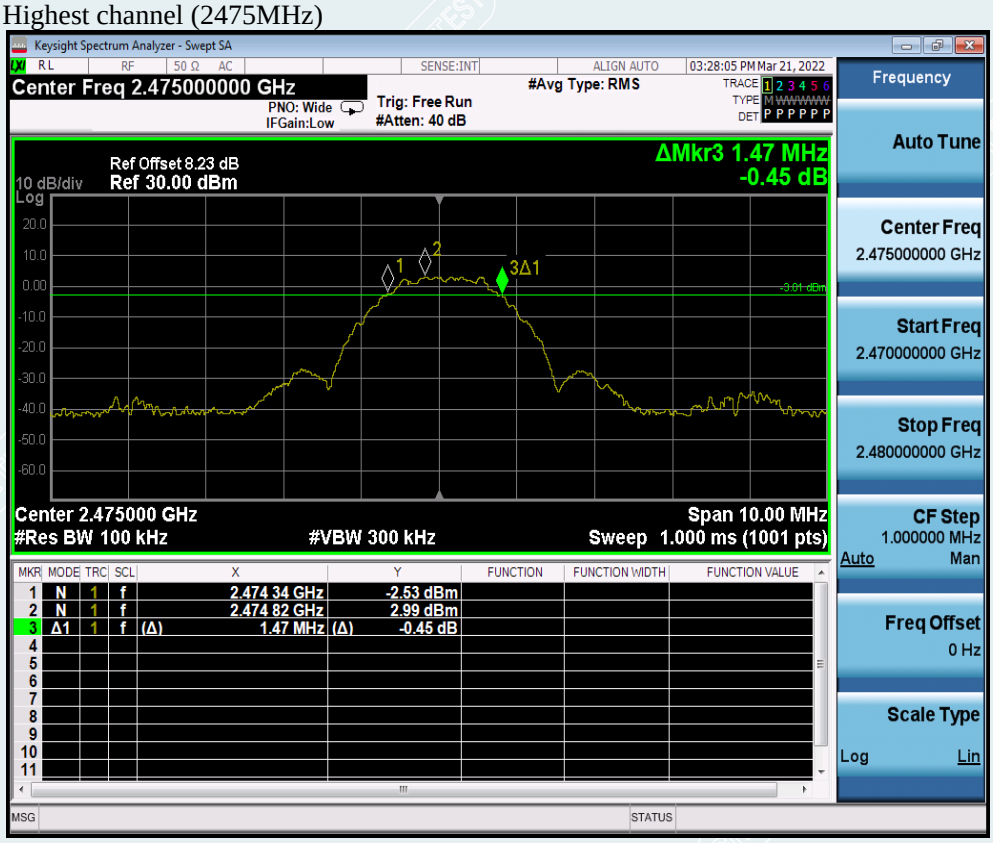
Lowest channel (2405MHz)



Middle channel (2440 MHz)



Highest channel (2475MHz)



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7. MAXIMUM PEAK OUTPUT POWER

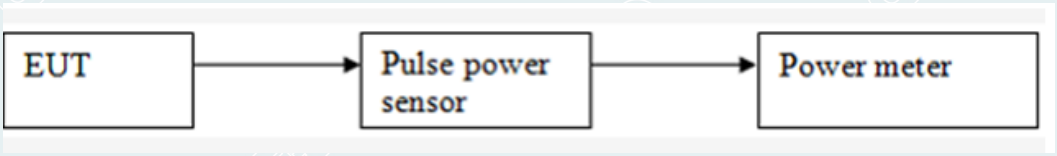
7.1 LIMITS

The maximum Peak output power measurement is 1W

7.2 TEST PROCEDURES

1) According to the test mode, the channel requirements set EUT to continuous transmission mode.
2) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.

7.3 TEST SETUP



7.4 TEST RESULTS

EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0006
Test Engineer:	Lu wei	Test Date:	2022-02-23 to 2022-03-21

ChName	Frequency (MHz)	Measured Channel Power (dBm)	Limit	Peak/ Average	Result
Lowest	2405	8.36	1W (30dBm)	Peak	Pass
Middle	2440	8.33			Pass
Highest	2475	8.22			Pass

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8. POWER SPECTRAL DENSITY

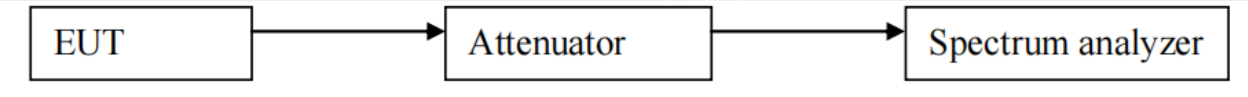
8.1 LIMITS

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. 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.

8.2 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) The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:
   a) Set analyzer center frequency to DTS channel center frequency.
   b) Set the span to 1.5 times the DTS bandwidth.
   c) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
   d) Set the VBW ≥ [3 × RBW].
   e) Detector = peak
   f) Sweep time = auto couple.
   g) Trace mode = max hold.
   h) Allow trace to fully stabilize.
   i) Use the peak marker function to determine the maximum amplitude level within the RBW.
   j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.
4) Repeat above procedures until all frequencies measured were complete.

8.3 TEST SETUP

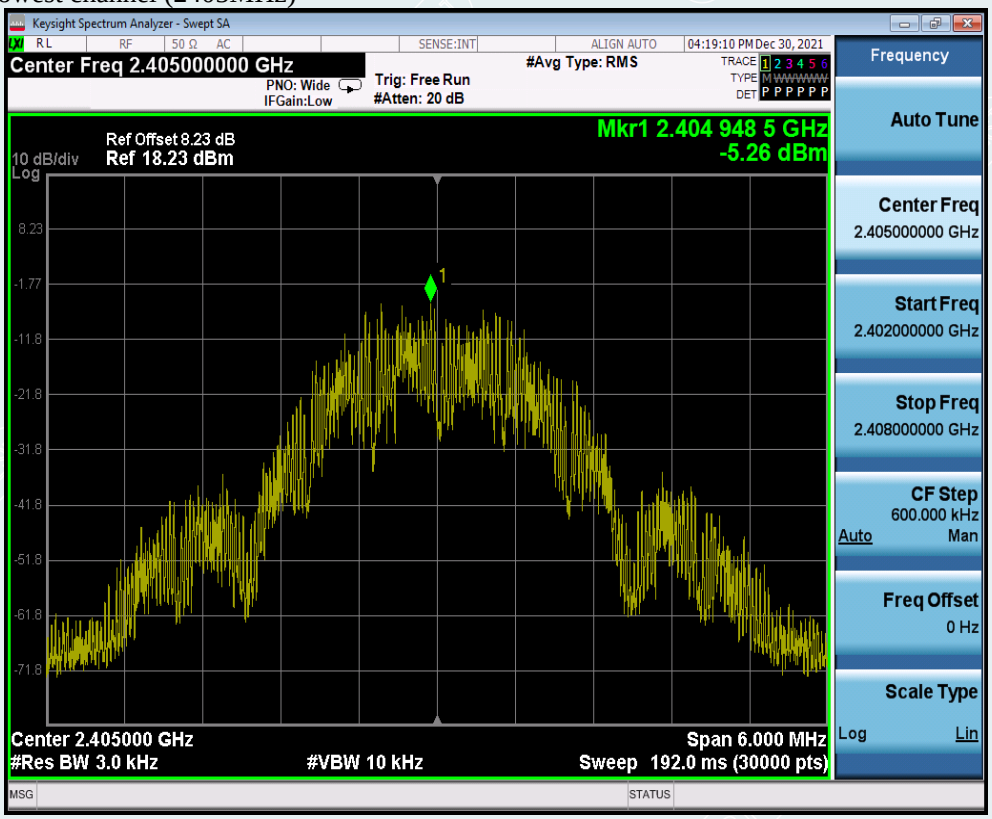


8.4 TEST RESULTS

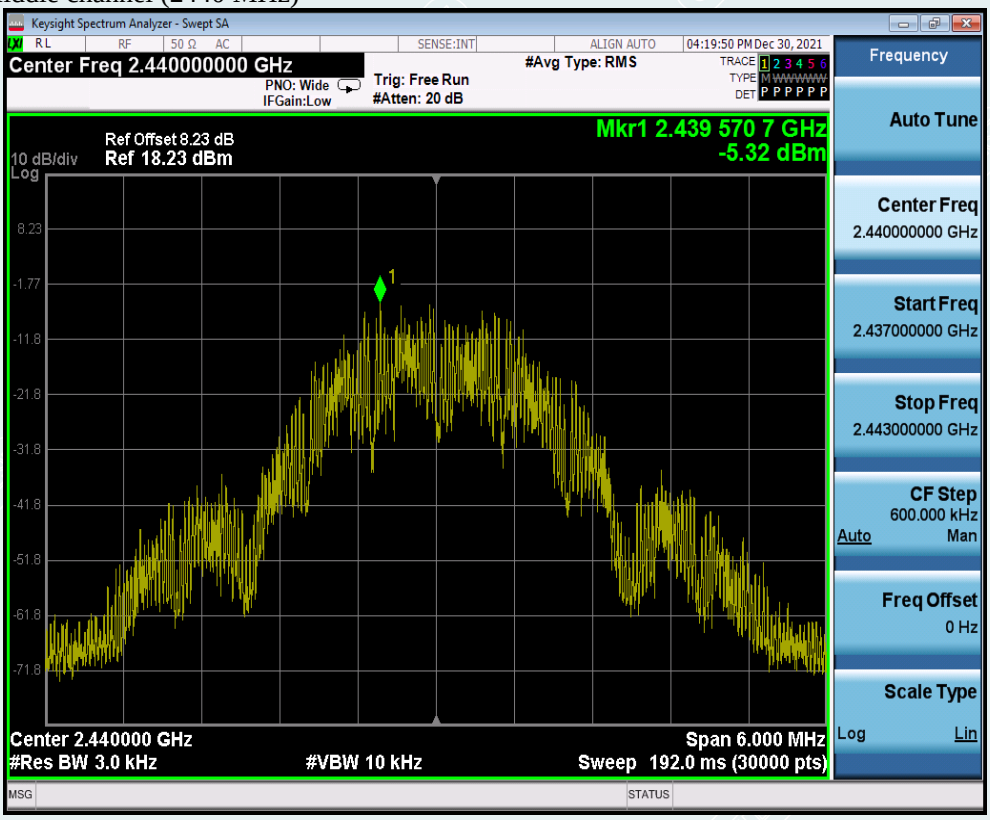
EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0006
Test Engineer:	Lu wei	Test Date:	2021-12-30 to 2022-03-21

ChName	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
Lowest	2405	-5.26	8.00	Pass
Middle	2440	-5.32	8.00	Pass
Highest	2475	-6.53	8.00	Pass

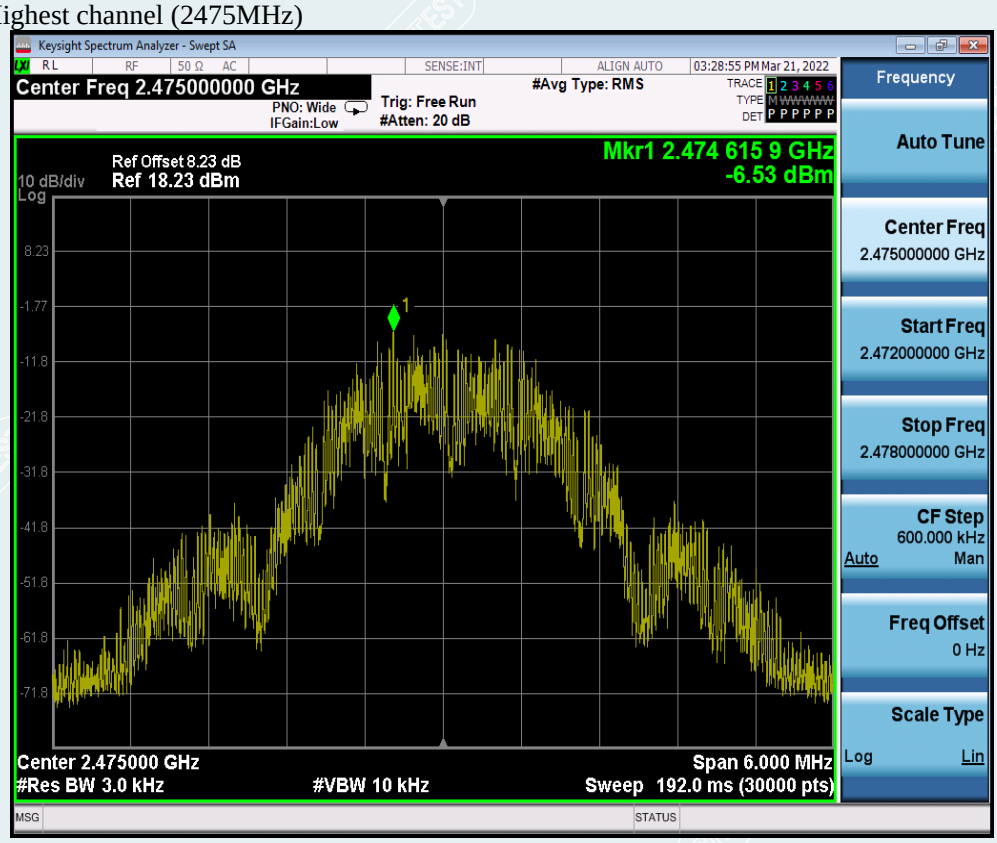
Lowest channel (2405MHz)



Middle channel (2440 MHz)



Highest channel (2475MHz)



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9. CONDUCTED BAND EDGES AND SPURIOUS EMISSIONS

9.1 LIMITS

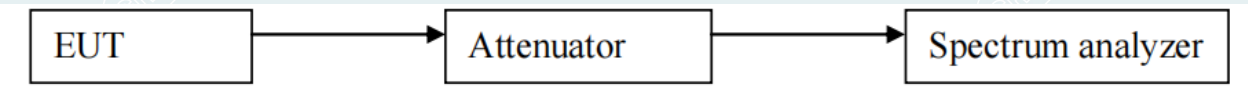
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains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

9.2 TEST PROCEDURES

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, Span=10MHz 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.
5) Measurements are made from 30MHz to 26.5GHz with the transmitter set to the lowest, middle, and highest channels.

9.3 TEST SETUP



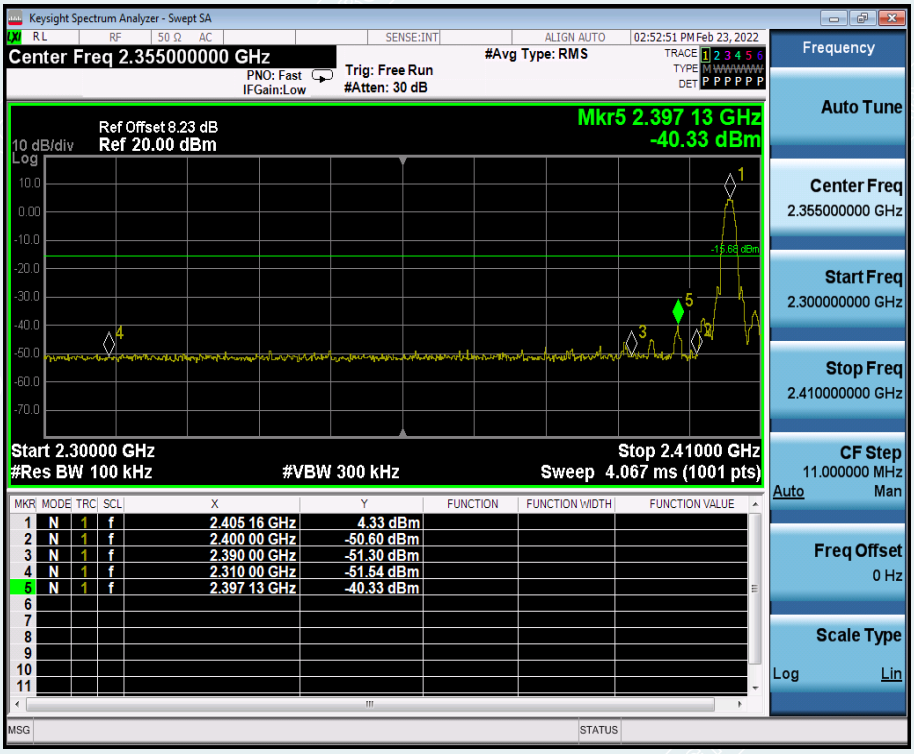
9.4 TEST RESULTS

EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0006
Test Engineer:	Lu wei	Test Date:	2021-12-30 to 2022-03-21

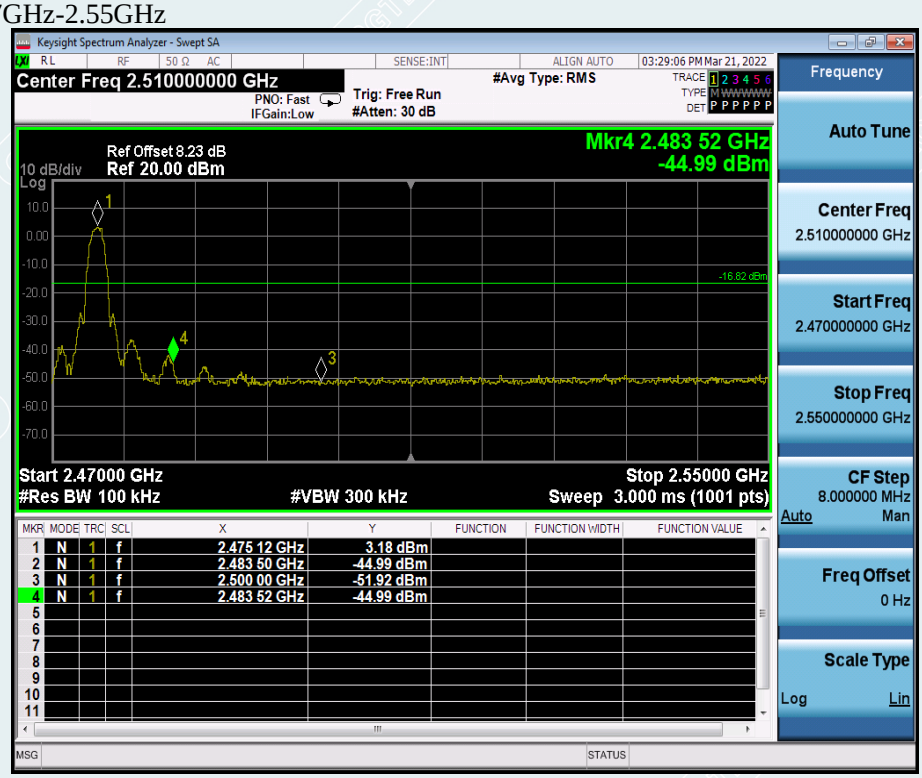
Band edge

TestMode	Antenna	ChName	Frequency [MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
Zigbee	Ant1	Lowest	2405	4.33	-40.33	≤-15.68	PASS
		Highest	2475	3.18	-44.99	≤-16.82	PASS

Lowest channel (2405MHz)
2.30GHz-2.41GHz



Highest channel (2475MHz)
2.47GHz-2.55GHz

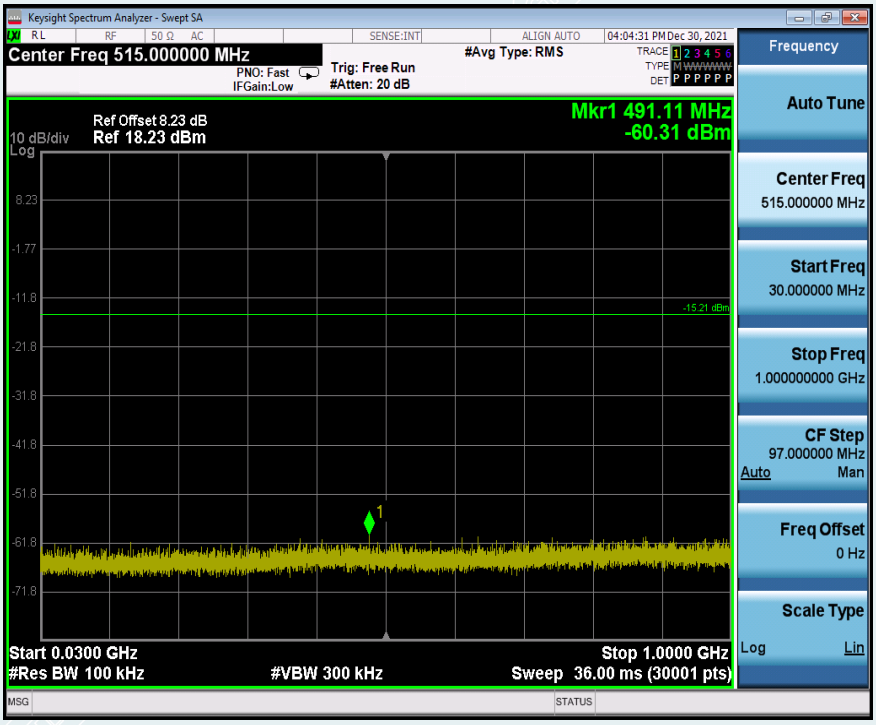


Conducted Spurious Emission

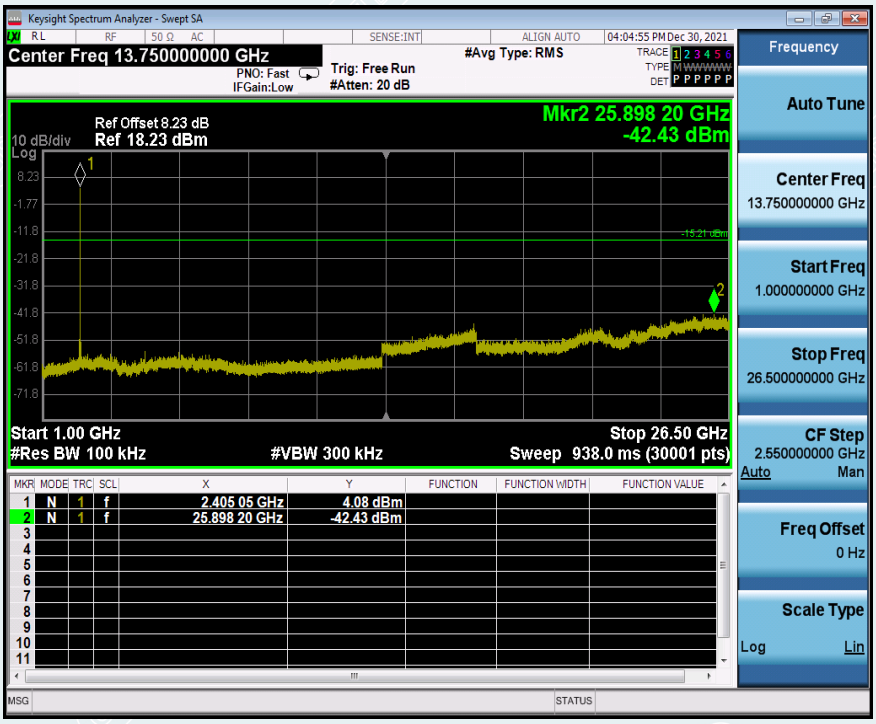
TestMode	Antenna	Frequency [MHz]	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
Zigbee	Ant1	2405	Reference	4.79	4.79	---	PASS
			30~1000	4.79	-60.31	≤-15.21	PASS
			1000~26500	4.79	-42.43	≤-15.21	PASS
		2440	Reference	4.50	4.50	---	PASS
			30~1000	4.50	-60.02	≤-15.5	PASS
			1000~26500	4.50	-42.91	≤-15.5	PASS
		2475	Reference	3.25	3.25	---	PASS
			30~1000	3.25	-60.3	≤-16.75	PASS
			1000~26500	3.25	-41.44	≤-16.75	PASS

Lowest channel (2405MHz)

0.03GHz-1GHz

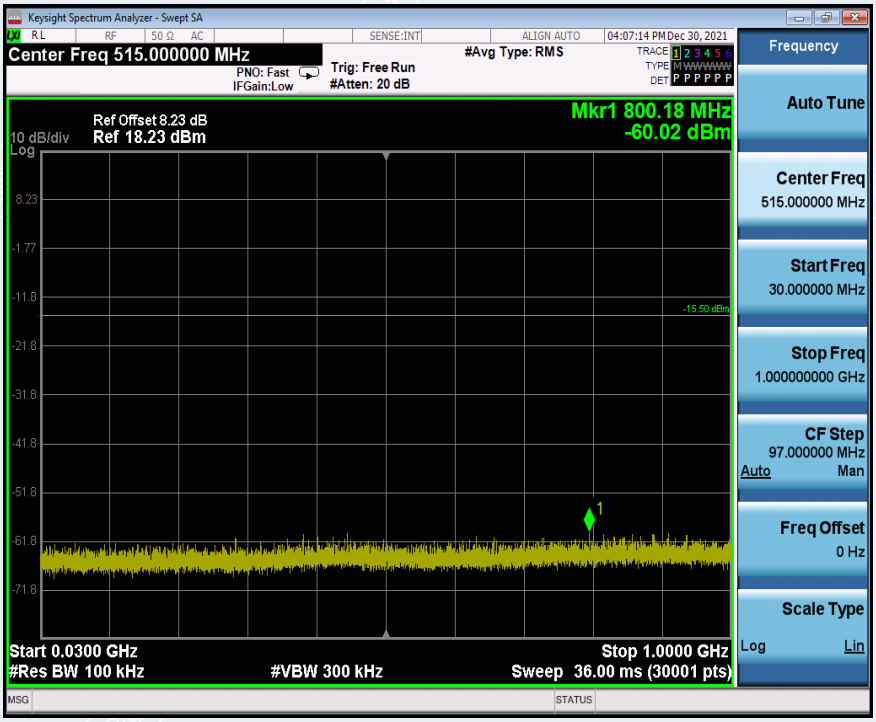


1GHz-26.5GHz

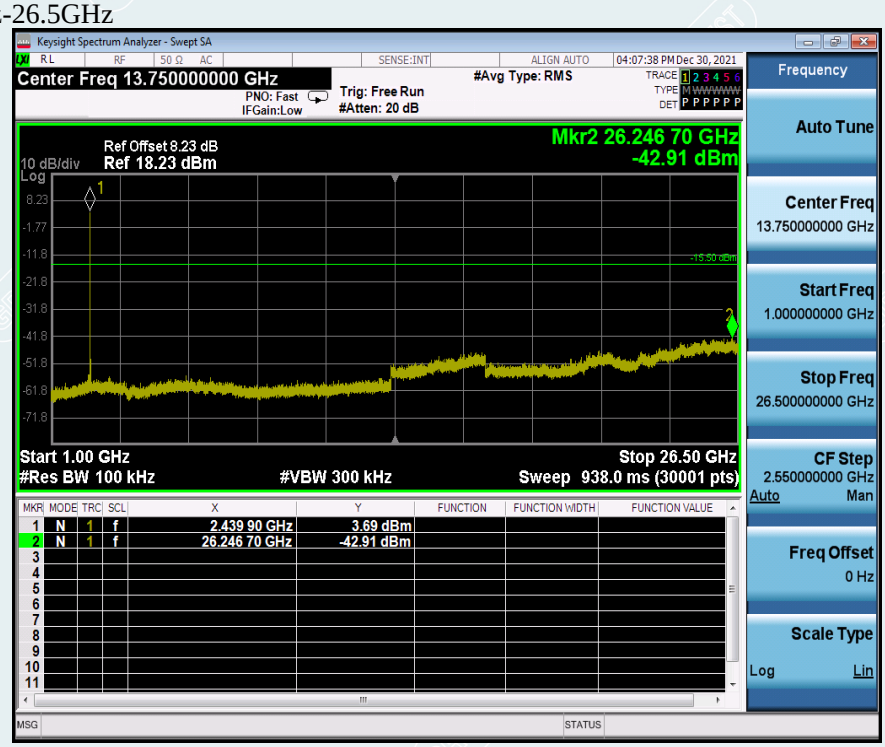


Middle channel (2440MHz)

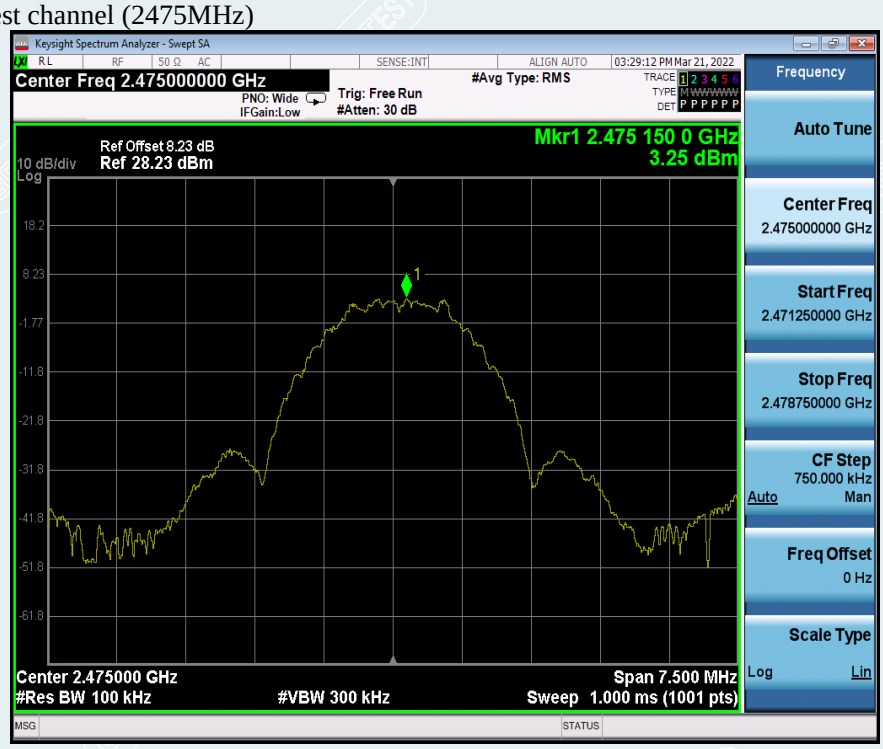
0.03GHz-1GHz



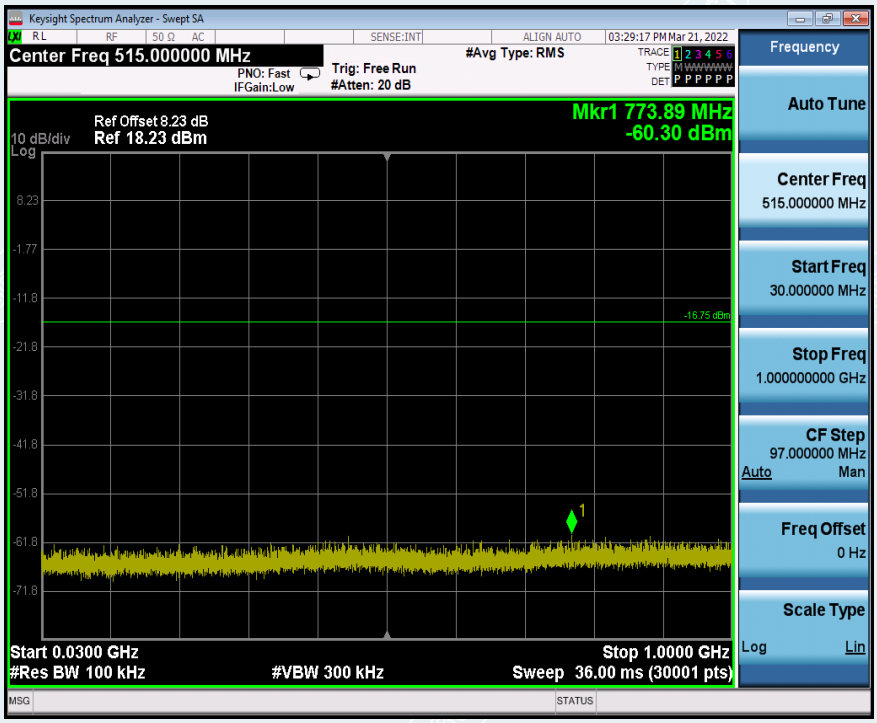
1GHz-26.5GHz



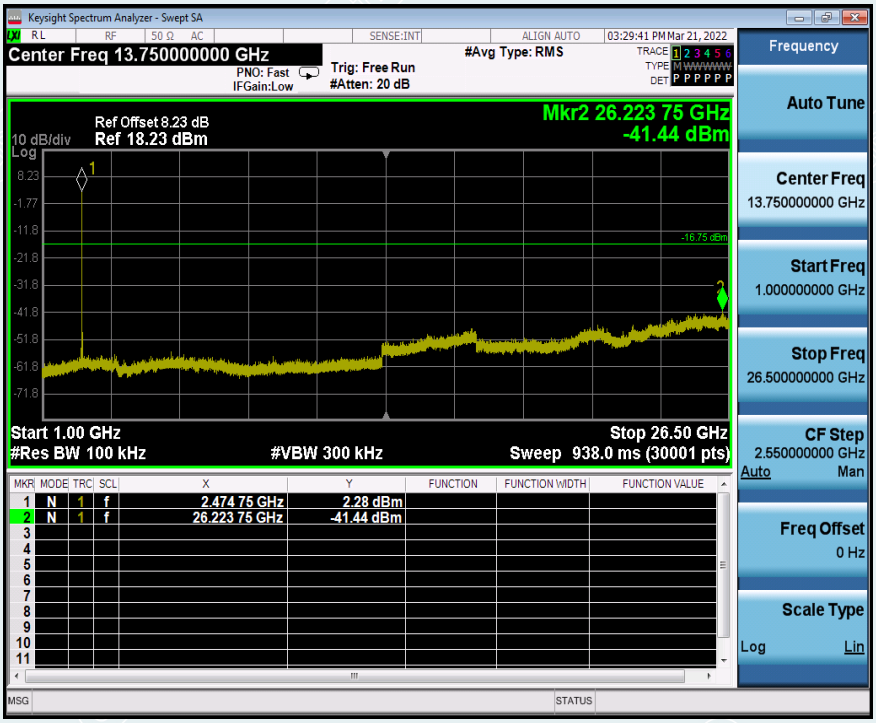
Highest channel (2475MHz)



0.03GHz-1GHz



1GHz-26.5GHz



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10. RESTRICTED BANDS OF OPERATION

10.1 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)).

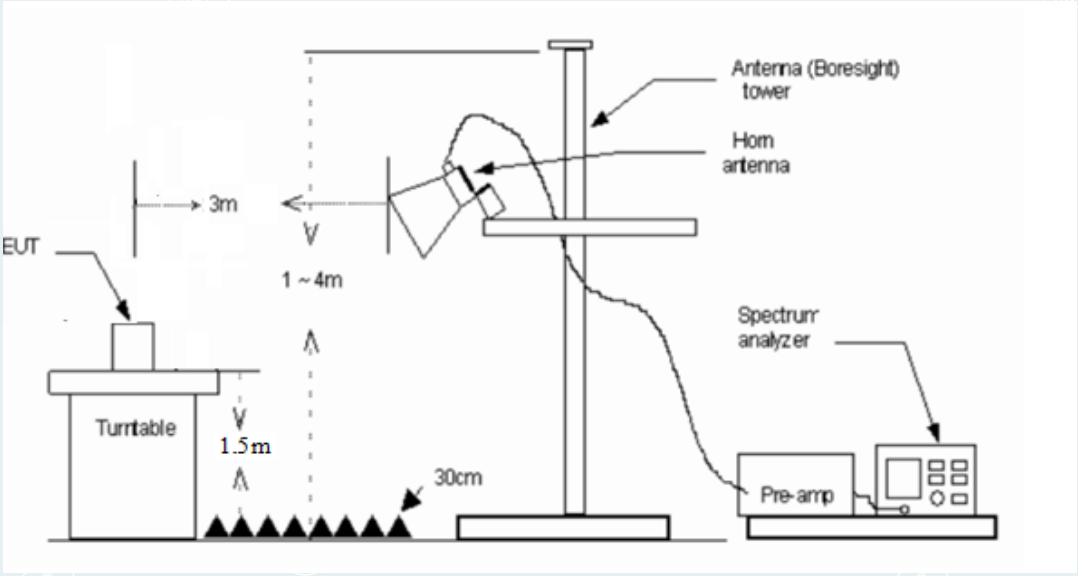
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 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	156.52480 - 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	88.5~53.8
0.490-1.705	24000/F(kHz)	30	69~43
1.705-30.0	30	30	49.5
30 ~ 88	100	3	40
88~216	150	3	43.5
216 ~ 960	200	3	46
Above 960	500	3	54

10.2 TEST PROCEDURES

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
   c) If the EUT is configured to transmit with duty cycle ≥98%，set VBW≤RBW/100 (i.e.,10kHz) but not less than 10 Hz.
   d) 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.

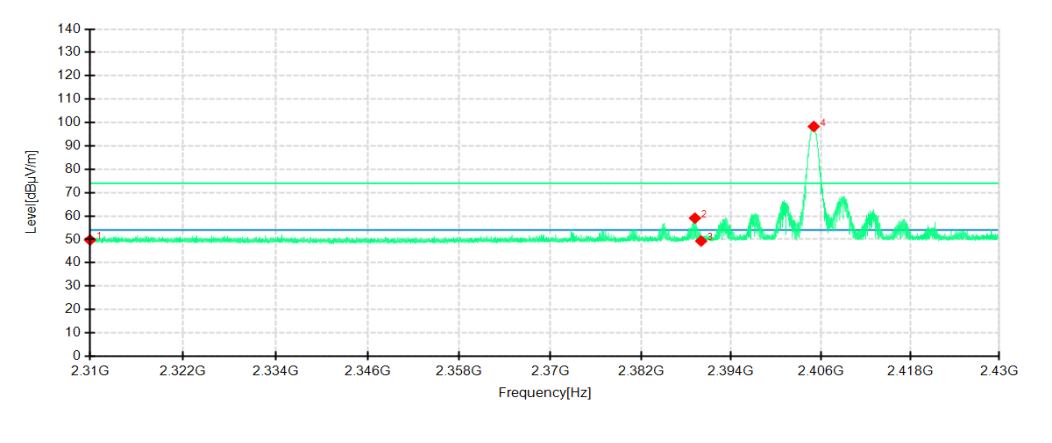
10.3 TEST SETUP



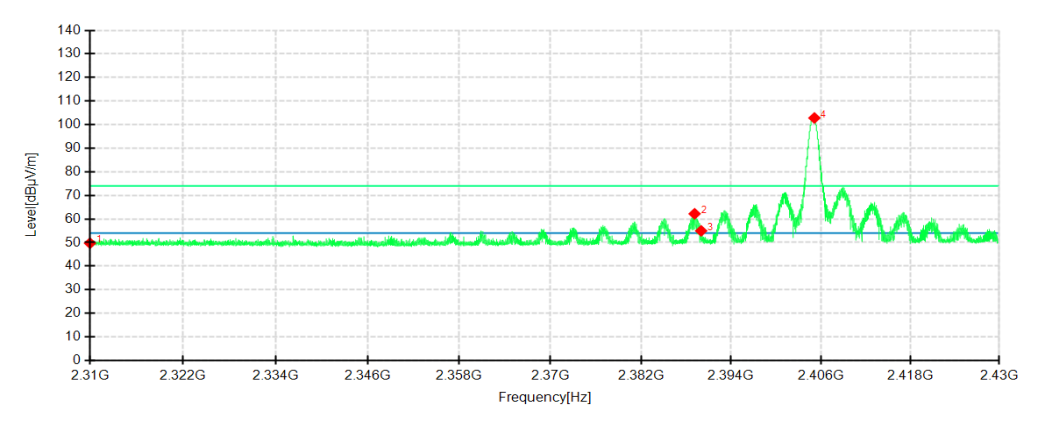
10.4 TEST RESULTS

EUT Name:	Motion Sensor P1	Test Mode:	Mode 1
Model:	MS-S02	Sample No:	E20211222698901-0007
Test Engineer:	Lu Qiang	Test Date:	2022-02-17 to 2022-03-22

Lowest Channel
Channel 2405MHz
Detector mode: Peak Polarity: Horizontal

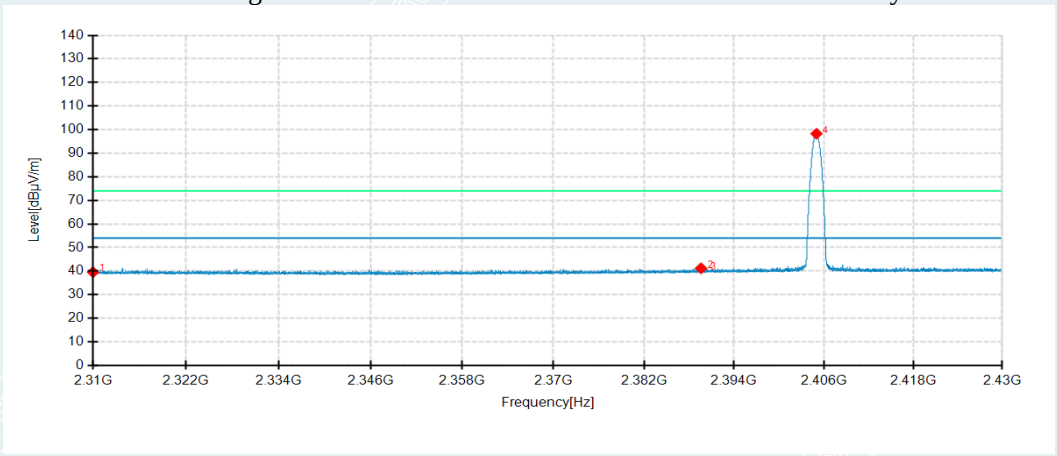


Detector mode: Peak Polarity: Vertical

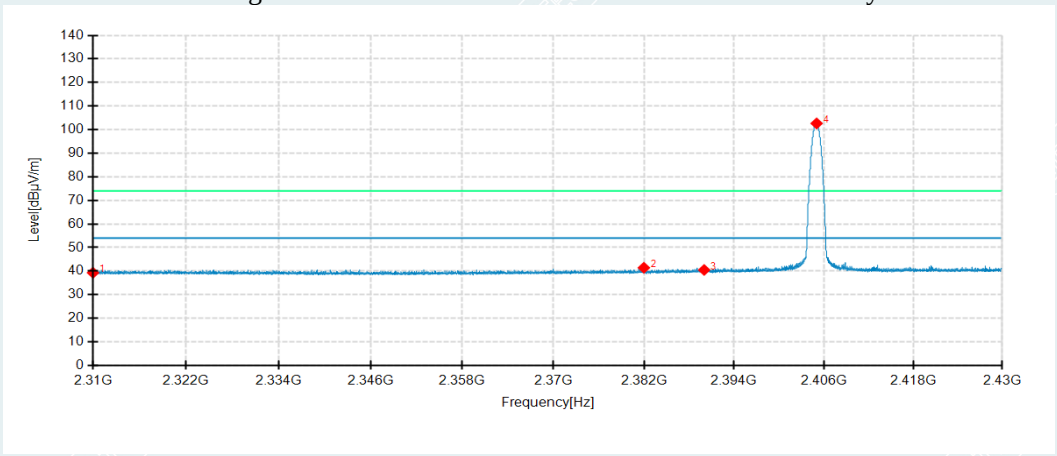


No.	Frequency MHz	Reading dBµV/m	Level dBµV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Comment
1	2310.0000	46.24	49.72	3.48	74.00	24.28	200	142	Horizontal	/
2	2389.1760	55.28	59.08	3.80	74.00	14.92	100	52	Horizontal	/
3	2390.0000	45.47	49.28	3.81	74.00	24.72	200	273	Horizontal	
4	2405.0400	94.29	98.30	4.01	74.00	-24.30	100	17	Horizontal	No limit
1	2310.0000	46.24	49.72	3.48	74.00	24.28	200	218	Vertical	/
2	2389.1280	58.38	62.18	3.80	74.00	11.82	200	142	Vertical	/
3	2390.0000	51.13	54.94	3.81	74.00	19.06	200	87	Vertical	/
4	2405.1240	98.81	102.82	4.01	74.00	-28.82	100	149	Vertical	No limit

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



Detector mode: Average Polarity: Vertical

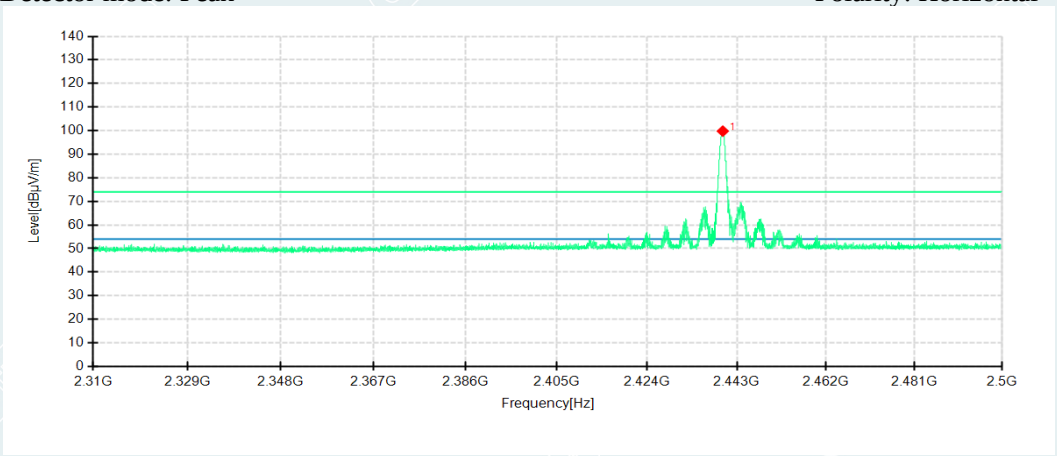


No.	Frequency MHz	Reading dBµV/m	Level dBµV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Comment
1	2310.0000	36.08	39.56	3.48	54.00	14.44	200	142	Horizontal	/
2	2389.5840	37.38	41.18	3.80	54.00	12.82	100	218	Horizontal	/
3	2390.0000	36.42	40.23	3.81	54.00	13.77	100	218	Horizontal	/
4	2405.0040	94.27	98.28	4.01	54.00	-44.28	100	18	Horizontal	No limit
1	2310.0000	35.82	39.30	3.48	54.00	14.70	100	218	Vertical	/
2	2381.9880	37.75	41.42	3.67	54.00	12.58	200	123	Vertical	/
3	2390.0000	36.69	40.50	3.81	54.00	13.50	200	184	Vertical	/
4	2405.0280	98.63	102.64	4.01	54.00	-48.64	100	149	Vertical	No limit

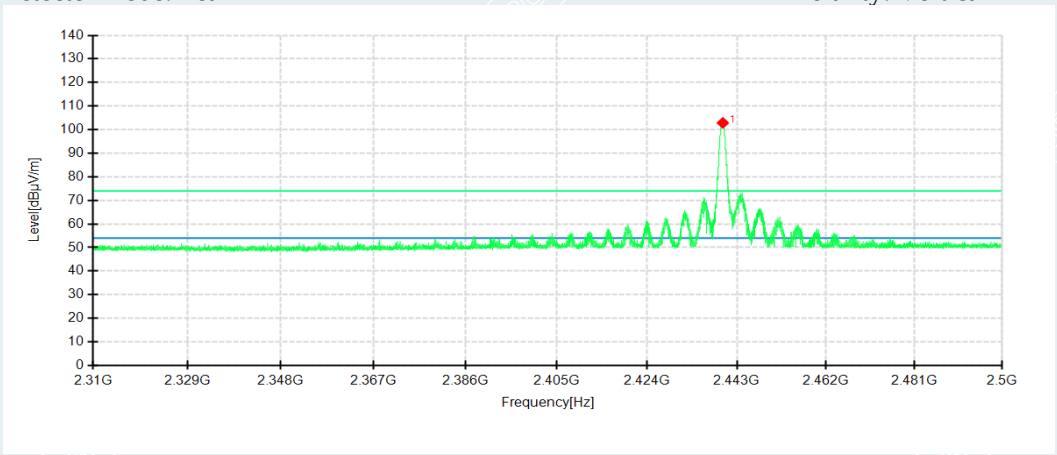
Middle channel

Channel 2440MHz

Detector mode: Peak Polarity: Horizontal



Detector mode: Peak Polarity: Vertical

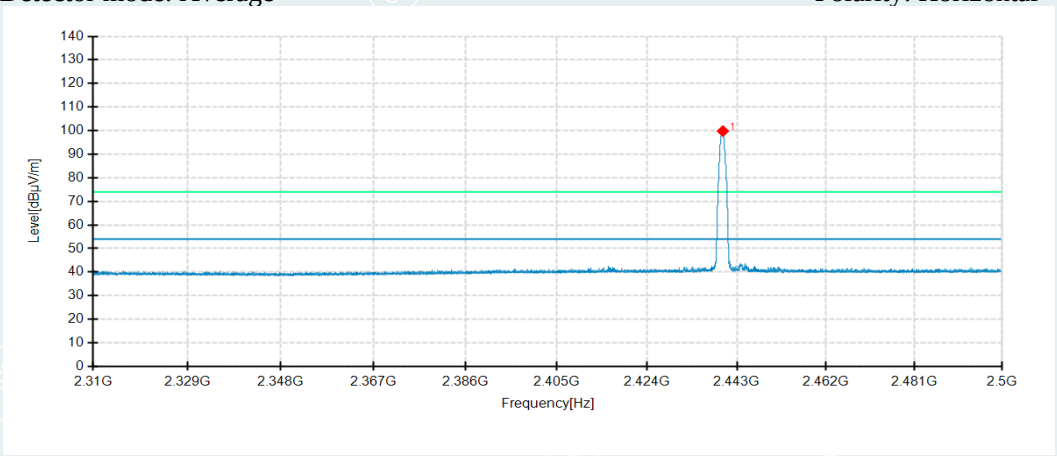


No.	Frequency MHz	Reading dBµV/m	Level dBµV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Comment
1	2440.0170	95.61	99.79	4.18	74.00	-25.79	100	46	Horizontal	No limit
1	2440.0360	98.68	102.86	4.18	74.00	-28.86	200	156	Vertical	No limit

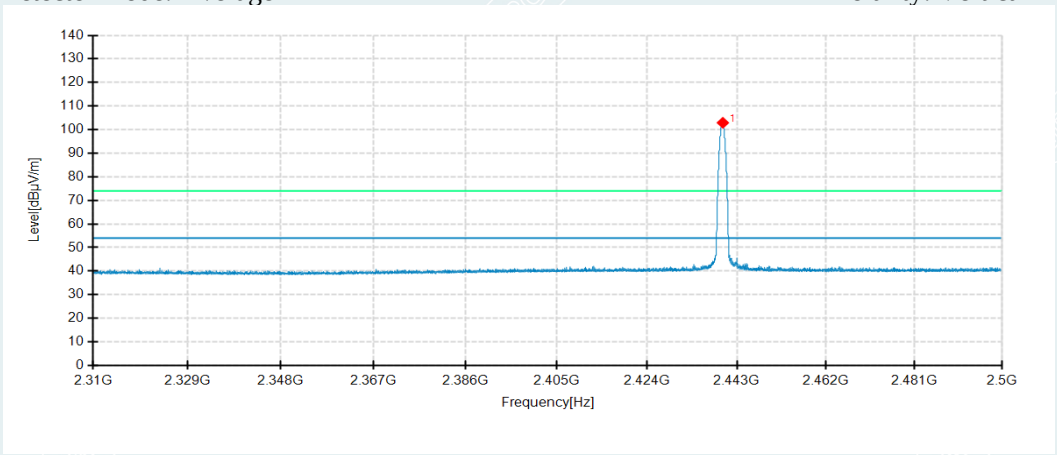
Middle channel

Channel 2440MHz

Detector mode: Average Polarity: Horizontal

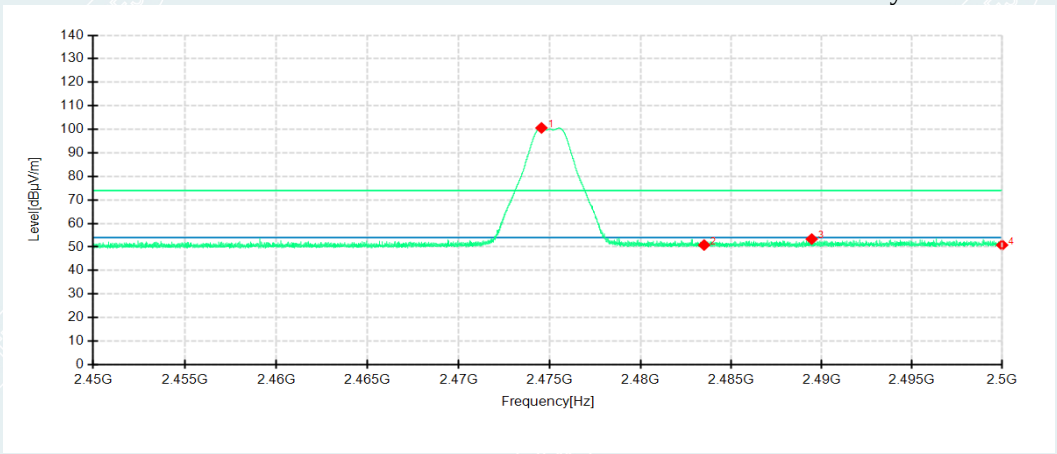


Detector mode: Average Polarity: Vertical

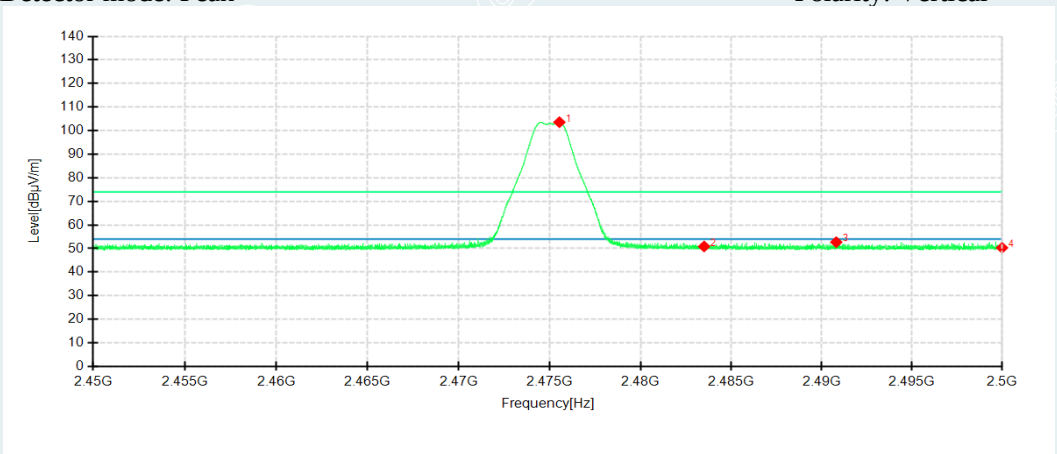


No.	Frequency MHz	Reading dBµV/m	Level dBµV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Comment
1	2440.0360	95.63	99.81	4.18	54.00	-45.81	100	45	Horizontal	No limit
1	2440.0360	98.74	102.92	4.18	54.00	-48.92	200	156	Vertical	No limit

Highest Channel
Channel 2475MHz
Detector mode: Peak Polarity: Horizontal



Detector mode: Peak Polarity: Vertical

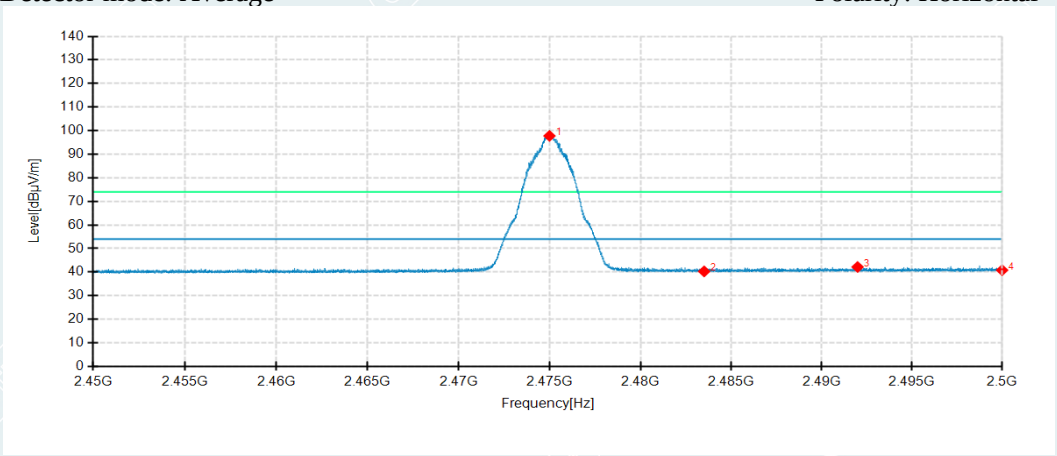


No.	Frequency MHz	Reading dBµV/m	Level dBµV/m	Factor dB	Limit dBuV/m	Margin dB	Height cm	Angle °	Pole	Comment
1	2474.5400	96.46	100.61	4.15	74.00	-26.61	100	138	Horizontal	No limit
2	2483.5000	46.50	50.83	4.33	74.00	23.17	100	276	Horizontal	/
3	2489.4450	48.94	53.38	4.44	74.00	20.62	200	19	Horizontal	/
4	2500.0000	46.16	50.81	4.65	74.00	23.19	200	280	Horizontal	/
1	2475.5250	99.91	103.57	3.66	74.00	-29.57	200	216	Vertical	No limit
2	2483.5000	47.18	50.87	3.69	74.00	23.13	200	153	Vertical	/
3	2490.8050	48.99	52.71	3.72	74.00	21.29	100	198	Vertical	/
4	2500.0000	46.56	50.31	3.75	74.00	23.69	200	238	Vertical	/

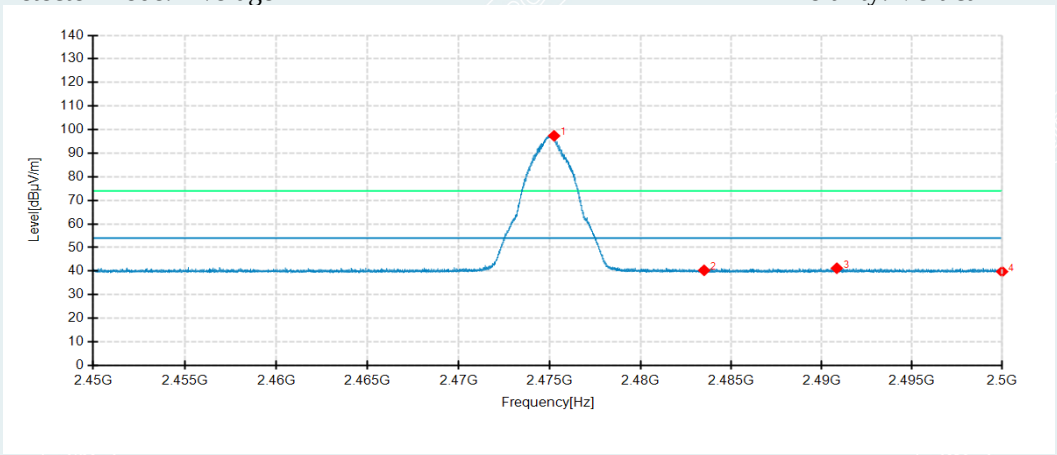
Highest Channel

Channel 2475MHz

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	Comment
1	2474.9800	93.62	97.78	4.16	54.00	-43.78	100	140	Horizontal	No limit
2	2483.5000	35.97	40.30	4.33	54.00	13.70	200	7	Horizontal	/
3	2491.9850	37.68	42.17	4.49	54.00	11.83	200	206	Horizontal	/
4	2500.0000	36.16	40.81	4.65	54.00	13.19	200	81	Horizontal	/
1	2475.2350	93.71	97.37	3.66	54.00	-43.37	100	139	Vertical	No limit
2	2483.5000	36.64	40.33	3.69	54.00	13.67	200	115	Vertical	/
3	2490.8350	37.50	41.22	3.72	54.00	12.78	100	104	Vertical	/
4	2500.0000	36.02	39.77	3.75	54.00	14.23	100	281	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 E20211222698901-10-Test photo.

APPENDIX B. PHOTOGRAPH OF THE EUT

Please refer to the attached document E20211222698901-11-EUT photo.

---------- End of Report ----------