

# RADIO PERFORMANCE TEST REPORT

**Test Report No.** : OT-239-RWD-021

**Reception No.** : 2308002556

**Applicant** : RITS-N CO.,LTD

**Address** : 628 ITECO, 150, Jojeong-daero, Hanam-si, Gyeonggi-do, South Korea

**Manufacturer** : RITS-N CO.,LTD

**Address** : 628 ITECO, 150, Jojeong-daero, Hanam-si, Gyeonggi-do, South Korea

**Type of Equipment** : MICROWAVE SENSOR

**FCC ID** : 2A3C4-MS905

**Model Name** : MS905

**Multiple Model Name** : MS905-A, HR900, HR900-A

**Serial number** : N/A

**Total page of Report** : 24 pages (including this page)

**Date of Incoming** : August 07, 2023

**Date of Issuing** : September 13, 2023

## SUMMARY

The equipment complies with the requirements of *FCC CFR 47 PART 15 SUBPART C Section 15.249*

This test report contains only the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.



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## ***CONTENTS***

Page

<b>1. VERIFICATION OF COMPLIANCE .....</b>	<b>5</b>
<b>2. TEST SUMMARY.....</b>	<b>6</b>
<b>2.1 TEST ITEMS AND RESULTS .....</b>	<b>6</b>
<b>2.2 RELATED SUBMITTAL(S) / GRANT(S) .....</b>	<b>6</b>
<b>2.3 PURPOSE OF THE TEST .....</b>	<b>6</b>
<b>2.4 TEST METHODOLOGY.....</b>	<b>6</b>
<b>2.5 TEST FACILITY .....</b>	<b>6</b>
<b>3. GENERAL INFORMATION.....</b>	<b>7</b>
<b>3.1 PRODUCT DESCRIPTION.....</b>	<b>7</b>
<b>3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT.....</b>	<b>7</b>
<b>4. EUT MODIFICATIONS.....</b>	<b>7</b>
<b>5. SYSTEM TEST CONFIGURATION .....</b>	<b>8</b>
<b>5.1 JUSTIFICATION.....</b>	<b>8</b>
<b>5.2 PERIPHERAL EQUIPMENT .....</b>	<b>8</b>
<b>5.3 MODE OF OPERATION DURING THE TEST .....</b>	<b>9</b>
<b>5.4 CONFIGURATION OF TEST SYSTEM.....</b>	<b>10</b>
<b>5.5 ANTENNA REQUIREMENT .....</b>	<b>10</b>
<b>6. PRELIMINARY TEST .....</b>	<b>10</b>
<b>6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS.....</b>	<b>10</b>
<b>6.2 RADIATED EMISSIONS TESTS.....</b>	<b>10</b>
<b>7. MINIMUM 20 DB BANDWIDTH.....</b>	<b>11</b>
<b>7.1 OPERATING ENVIRONMENT .....</b>	<b>11</b>
<b>7.2 TEST SET-UP .....</b>	<b>11</b>
<b>7.3 TEST DATE .....</b>	<b>11</b>
<b>7.4 TEST DATA.....</b>	<b>12</b>
<b>8. RADIATED EMISSION TEST .....</b>	<b>13</b>
<b>8.1 OPERATING ENVIRONMENT .....</b>	<b>13</b>
<b>8.2 TEST SET-UP .....</b>	<b>13</b>
<b>8.3 MEASUREMENT UNCERTAINTY .....</b>	<b>13</b>

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<b>8.4 TEST DATE</b> .....	13
<b>8.5 FINAL RESULT OF MEASUREMENT</b> .....	14
<i>8.5.1 Field Strength of the Fundamental Frequency</i> .....	14
<i>8.5.2 Emissions Radiated Outside of the Specified Frequency Bands</i> .....	16
<i>8.5.3 Test Data for Frequency range: 30 MHz ~ 1 000 MHz</i> .....	17
<i>8.5.4 Test Data for Below 30 MHz</i> .....	18
<i>8.5.5 Test Data above 1 GHz except for harmonic</i> .....	18
<i>8.5.6 Test Data above 40 GHz except for harmonic</i> .....	18
<i>8.5.7 Band Edge</i> .....	19
<b>9. CONDUCTED EMISSION TEST</b> .....	<b>21</b>
<b>9.1 OPERATING ENVIRONMENT</b> .....	21
<b>9.2 TEST SET-UP</b> .....	21
<b>9.3 TEST DATE</b> .....	21
<b>9.4 TEST DATA</b> .....	22
<b>10. LIST OF TEST EQUIPMENT</b> .....	<b>24</b>

**Revision History**

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-239-RWD-021	September 13, 2023	Initial Release	All

**1. VERIFICATION OF COMPLIANCE**

Applicant : RITS-N CO.,LTD  
 Address : 628 ITECO, 150, Jojeong-daero, Hanam-si, Gyeonggi-do, South Korea  
 Contact Person : Jongsung Yoo / Manager  
 Telephone No. : +82-31-790-1641  
 FCC ID : 2A3C4-MS905  
 Model Name : MS905  
 Brand Name : -  
 Serial Number : N/A  
 Date : September 13, 2023

DEVICE TYPE	DXX – Low Power Communication Device Transmitter
E.U.T. DESCRIPTION	MICROWAVE SENSOR
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC CFR47 Part 15 Subpart C Section 15.249
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	3 m Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

## 2. TEST SUMMARY

### 2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.249 (a)	Field Strength of Emission	Met the Limit / PASS
15.249 (c)	Measurement distance	Met the Requirement / PASS
15.249 (d)	Emissions Radiated Outside of the Specified Frequency Band	Met the Limit / PASS
15.249, 15.215	Minimum 20 dB Bandwidth	Met the Limit / PASS
15.249 (e)	Radiated Emissions above 1 000 MHz	Met the Limit / PASS
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met the Requirement / PASS

### 2.2 Related Submittal(s) / Grant(s)

Original submittal only

### 2.3 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

### 2.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

### 2.5 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-20122/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

### 3. GENERAL INFORMATION

#### 3.1 Product Description

The RITS-N CO.,LTD, Model MS905 (referred to as the EUT in this report) is an MICROWAVE SENSOR, Product specification information described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	MICROWAVE SENSOR
OPERATING FREQUENCY	24.19 GHz
Field Strength of Fundamental	106.94 dB $\mu$ V/m
ANTENNA TYPE	Array Antenna
ANTENNA GAIN	6.455 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	8 MHz

#### 3.2 Alternative type(s)/model(s); also covered by this test report.

-. The following lists consist of the added model and their differences.

Model Name	Differences	Tested
MS905	Basic Model	<input checked="" type="checkbox"/>
MS905-A, HR900, HR900-A	The model is identical to basic model except for the model name only.	<input type="checkbox"/>

Note: 1. Applicant consigns only basic model to test. Therefore this test report just guarantees the units, which have been tested.

2. The Applicant/manufacture is responsible for the compliance of all variants.

### 4. EUT MODIFICATIONS

-. None

## 5. SYSTEM TEST CONFIGURATION

### 5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	RITS-N CO.,LTD	MS905M Ver.0.0.9	N/A

### 5.2 Peripheral equipment

-. None.



### 5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing, the EUT was set at 24.19 GHz to get a maximum emission levels from the EUT. The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis, but the worst data was recorded in this report.

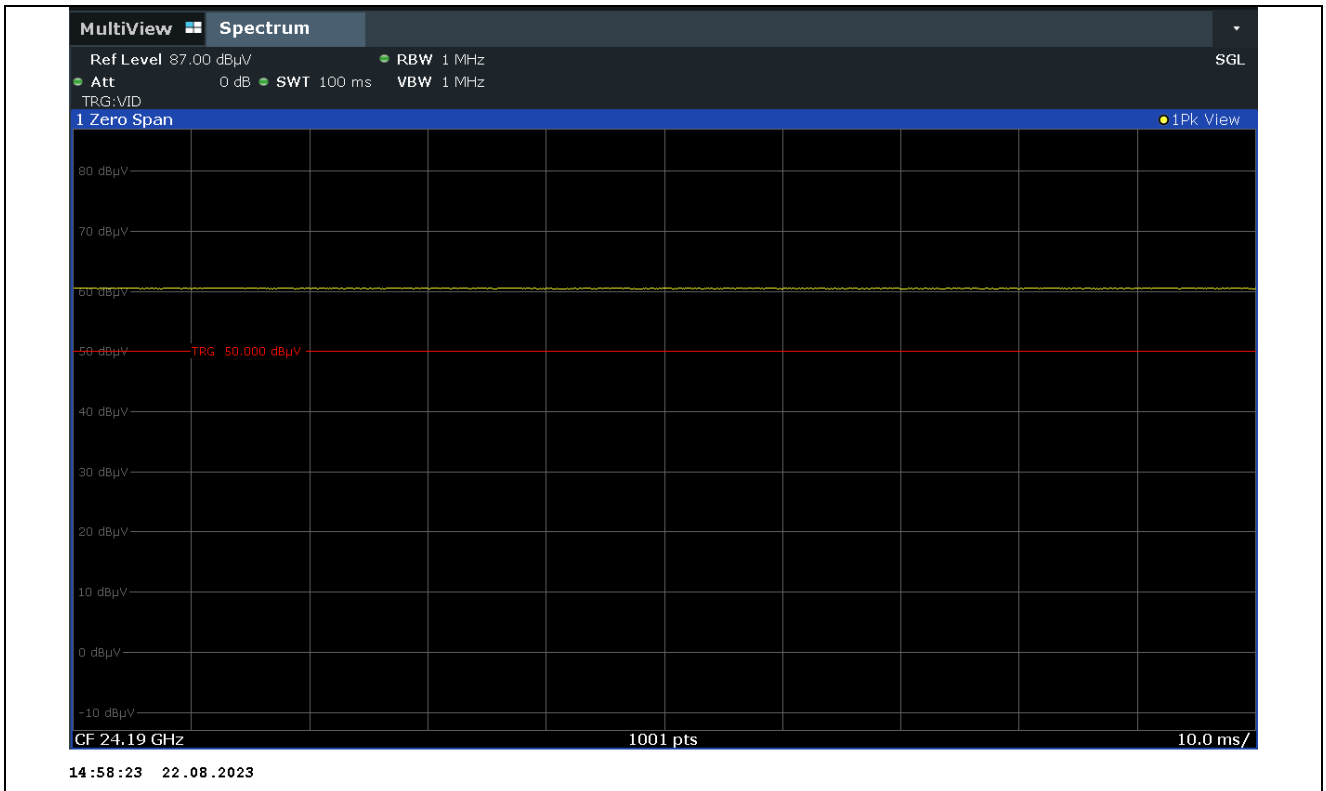
#### -. Duty Cycle

Mode	Tx On Time [ ms ]	Tx Off Time [ ms ]	Duty Cycle [ % ]	Correction Factor [ dB ]
-	-	-	100.00	-

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) \* 100

Correction Factor : 10 \* Log(1 / (Duty Cycle / 100))

#### -. Test Plot



### 5.4 Configuration of Test System

**Line Conducted Test:** The EUT was connected to DC power supply and the power of DC power supply was connected to LISN. All supporting equipment were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

**Radiated Emission Test :** Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. The radiated emissions measurements were performed on the 10 m Semi Anechoic Chamber. For frequencies from 150 kHz to 30 MHz measurements were made of the magnetic H field. The measuring antenna is an electrically screened loop antenna. The frequency spectrum from 30 MHz to 1 000 MHz was scanned and maximum emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

### 5.5 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

**Antenna Construction:**

The antenna of the EUT is Patch Antenna on the main board in the EUT, so no consideration of replacement by the user.

## 6. PRELIMINARY TEST

### 6.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

### 6.2 Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

## 7. MINIMUM 20 dB BANDWIDTH

### 7.1 Operating environment

Temperature : 22 °C  
Relative humidity : 46 % R.H.

### 7.2 Test set-up

20 dB bandwidth measurements were on the 3 m, semi anechoic chamber. The resolution bandwidth is set to 50 kHz, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.

### 7.3 Test Date

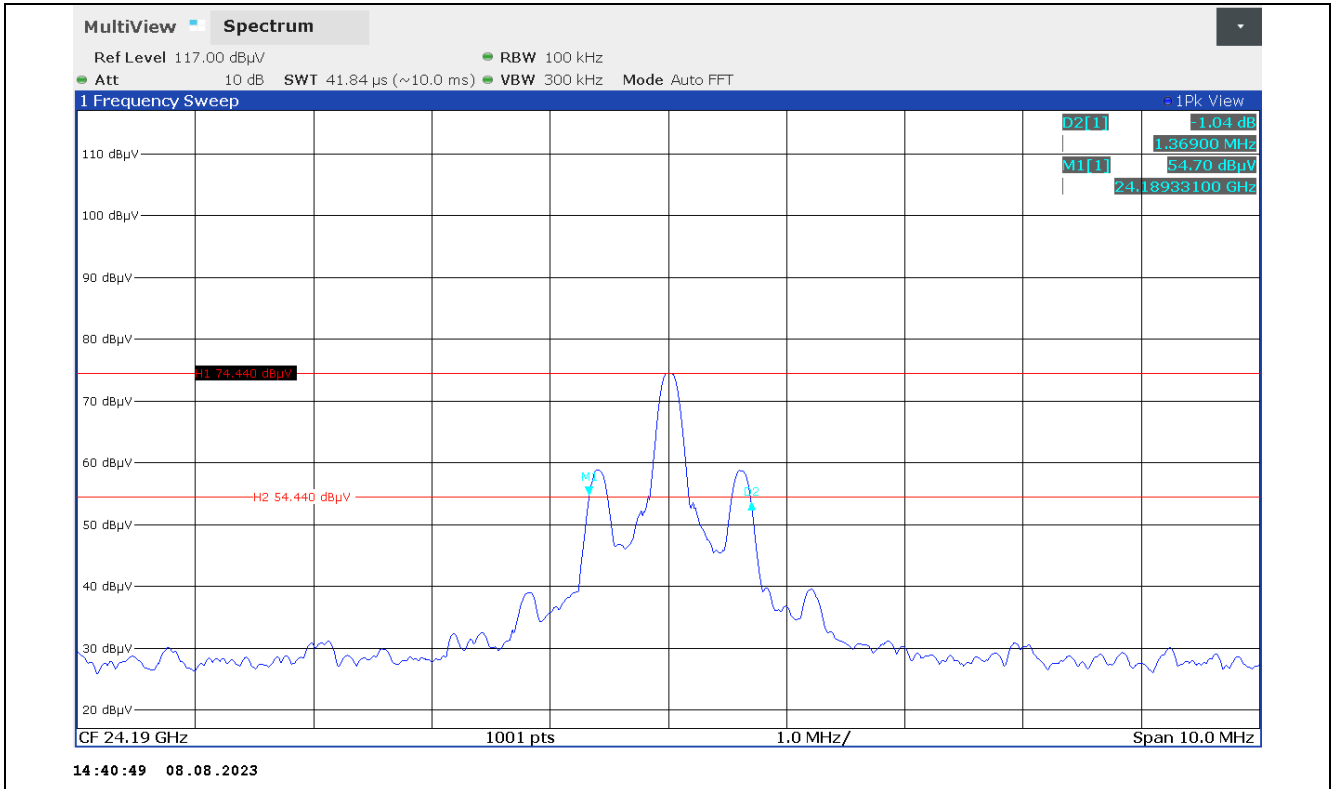
August 08, 2023 ~ August 21, 2023

### 7.4 Test data

-. Test Result : Pass

Mode	Frequency (GHz)	20 dB Bandwidth (MHz)
CW	24.19	1.369

Remark. Margin = Measured Value - Limit



## 8. RADIATED EMISSION TEST

### 8.1 Operating environment

Temperature : 22 °C  
Relative humidity : 46 % R.H.

### 8.2 Test set-up

The radiated emissions measurements were on the 3 m, semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from up to 40 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

Test set-up photos are included in appendix I.

### 8.3 Measurement uncertainty

Radiated emission electric field intensity, 0.15 MHz ~ 30 MHz : ± 2.61 dB

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ± 4.43 dB

Radiated emission electric field intensity, 300 MHz ~ 1 000 MHz : ± 3.80 dB

Radiated emission electric field intensity, 1 000 MHz ~ 3 000 MHz: ± 4.40 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2. The measurement uncertainty is given with a confidence of 95 % with the coverage factor,  $k = 2$ .

### 8.4 Test Date

August 08, 2023 ~ August 21, 2023

## 8.5 Final Result of Measurement

### 8.5.1 Field Strength of the Fundamental Frequency

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)

Result : PASSED

EUT : MICROWAVE SENSOR

Operating Condition : TX mode

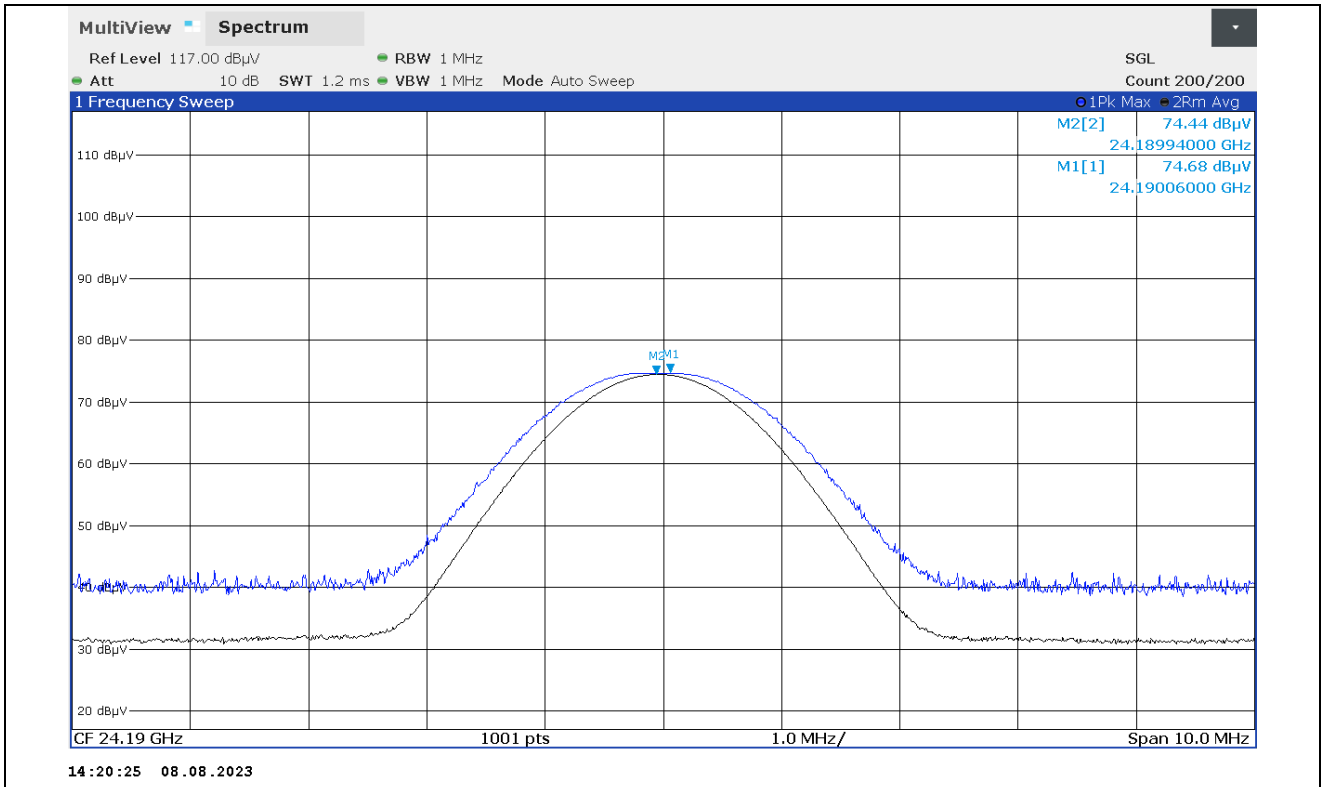
Distance : 1 m

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant Pol.	Ant. Factor (dB)	Cable Loss (dB)	Distance Factor (dB)	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
24.19	74.68	Peak	H	38.80	3.00	9.54	106.94	127.96	21.02
	74.44	Average	H	38.80	3.00	9.54	106.70	107.96	1.26
	74.48	Peak	V	38.80	3.00	9.54	106.74	127.96	21.22
	74.23	Average	V	38.80	3.00	9.54	106.49	107.96	1.47

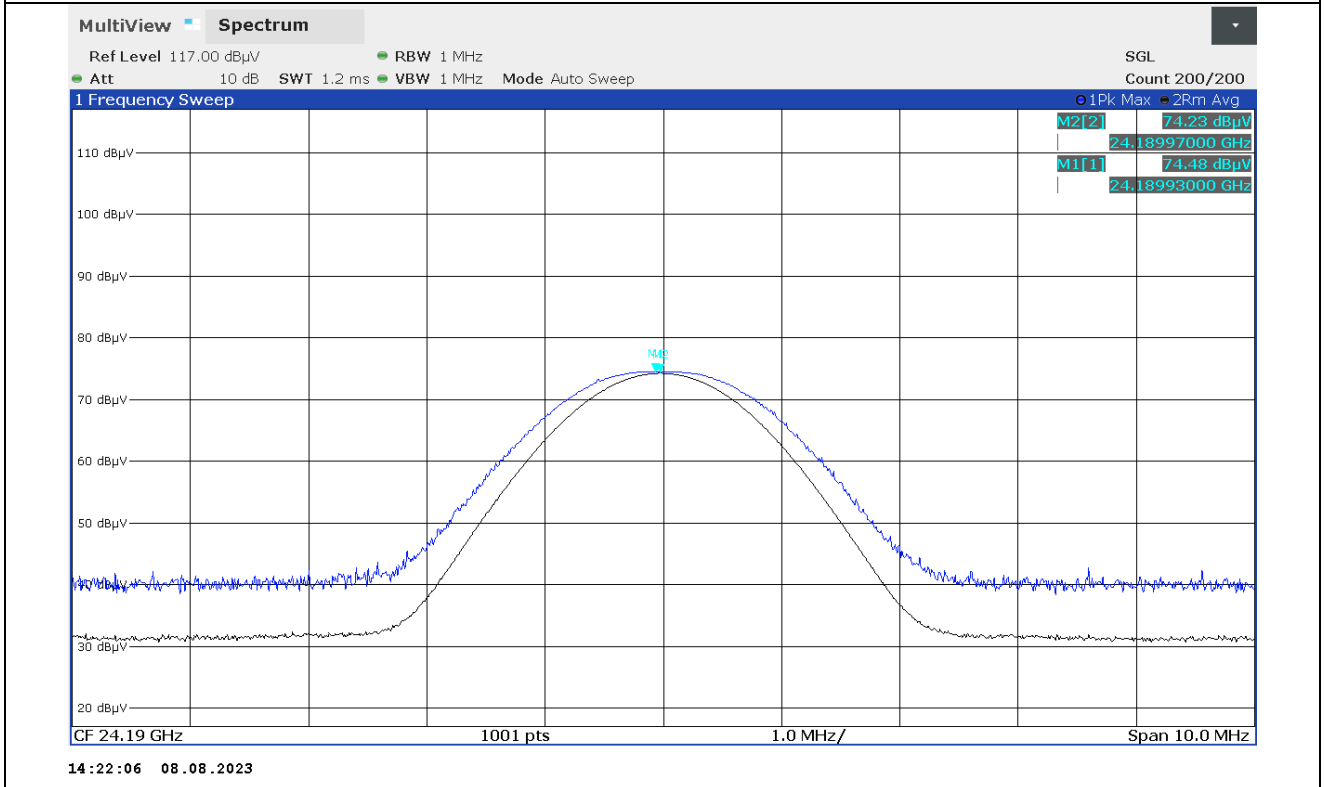
\*Remark: To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes, but the worst plane data were recorded in the report.

$$\text{Margin (dB)} = \text{Limit (dBuV/m)} - \text{Total (dBuV/m)}$$

$$\text{Total} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Distance Factor}$$



H



V

**8.5.2 Emissions Radiated Outside of the Specified Frequency Bands**

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)

Result : PASSED

EUT : MICROWAVE SENSOR

Operating Condition : TX mode

Distance : 0.5 m

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant Pol.	Ant. Factor (dB)	Cable Loss (dB)	Conversion Loss(dB)	Distance Factor (dB)	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
48.38	24.23	Peak	H	41.40	0.80	20.51	15.56	71.38	87.96	16.58
48.38	14.86	Average	H	41.40	0.80	20.51	15.56	62.01	67.96	5.95
48.38	24.26	Peak	V	41.40	0.80	20.51	15.56	71.41	87.96	16.55
48.38	14.74	Average	V	41.40	0.80	20.51	15.56	61.89	67.96	6.07

Remark: "H": Horizontal, "V": Vertical, "\*" Frequency fall in restricted band

$$\text{Margin (dB)} = \text{Limit (dBuV/m)} - \text{Total (dBuV/m)}$$

$$\text{Total} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} + \text{Conversion Loss} - \text{Distance Factor}$$



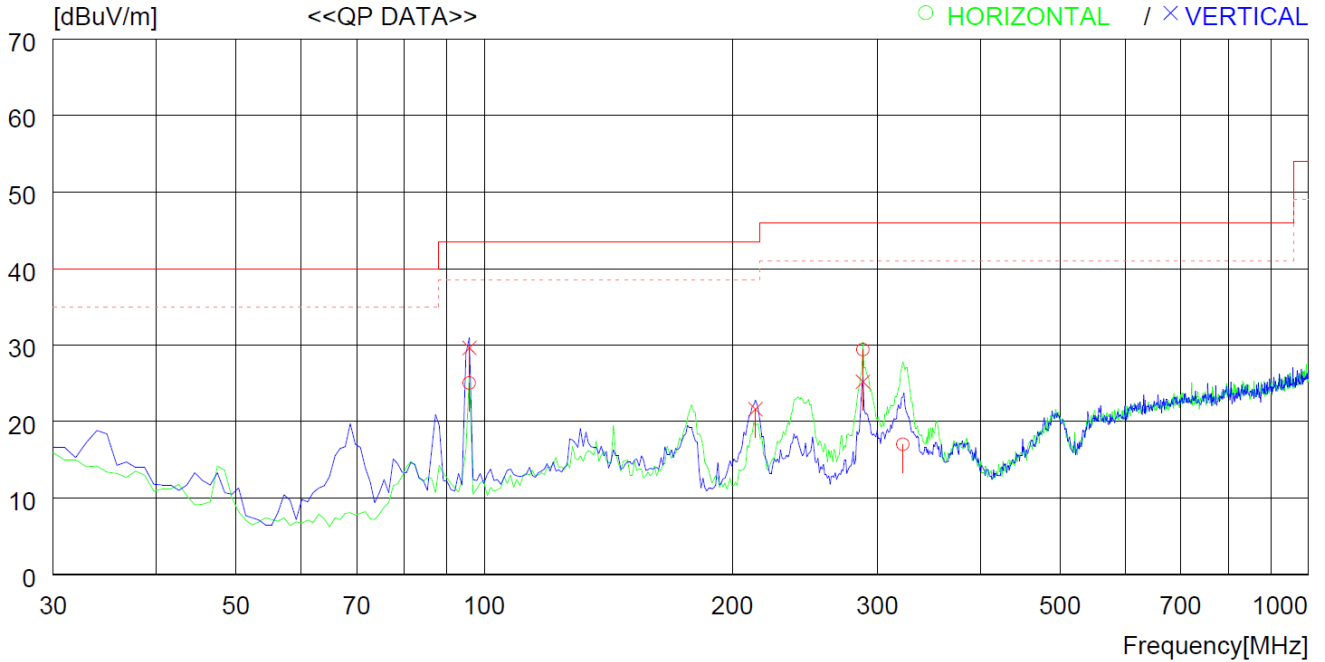
**8.5.3 Test Data for Frequency range: 30 MHz ~ 1 000 MHz**

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (d)

Result : PASSED

EUT : MICROWAVE SENSOR

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	95.960	41.6	14.6	1.9	33.1	25.0	43.5	18.5	200	82
2	288.020	40.5	18.7	3.4	33.2	29.4	46.0	16.6	100	359
3	321.970	27.3	19.4	3.5	33.2	17.0	46.0	29.0	100	359
----- Vertical -----										
4	95.960	46.2	14.6	1.9	33.1	29.6	43.5	13.9	100	58
5	213.330	36.0	16.0	2.8	33.2	21.6	43.5	21.9	100	0
6	288.020	36.3	18.7	3.4	33.2	25.2	46.0	20.8	100	113

**8.5.4 Test Data for Below 30 MHz**

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)  
 Frequency range : 9 kHz ~ 30 MHz  
 Measurement distance : 3 m  
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (d)  
 Result : PASSED

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

**8.5.5 Test Data above 1 GHz except for harmonic**

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
 1 MHz and RMS Detector for Average Mode  
 - Video bandwidth : 3 MHz for Peak and Average Mode  
 - Frequency range : 1 GHz ~ 40 GHz  
 - Measurement distance : 3 m  
 - Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (d)  
 - Result : PASSED

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

**8.5.6 Test Data above 40 GHz except for harmonic**

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
 1 MHz and RMS Detector for Average Mode  
 - Video bandwidth : 3 MHz for Peak and Average Mode  
 - Frequency range : 40 GHz ~ 100 GHz  
 - Measurement distance : 0.5 m  
 - Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (d)  
 - Result : PASSED

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

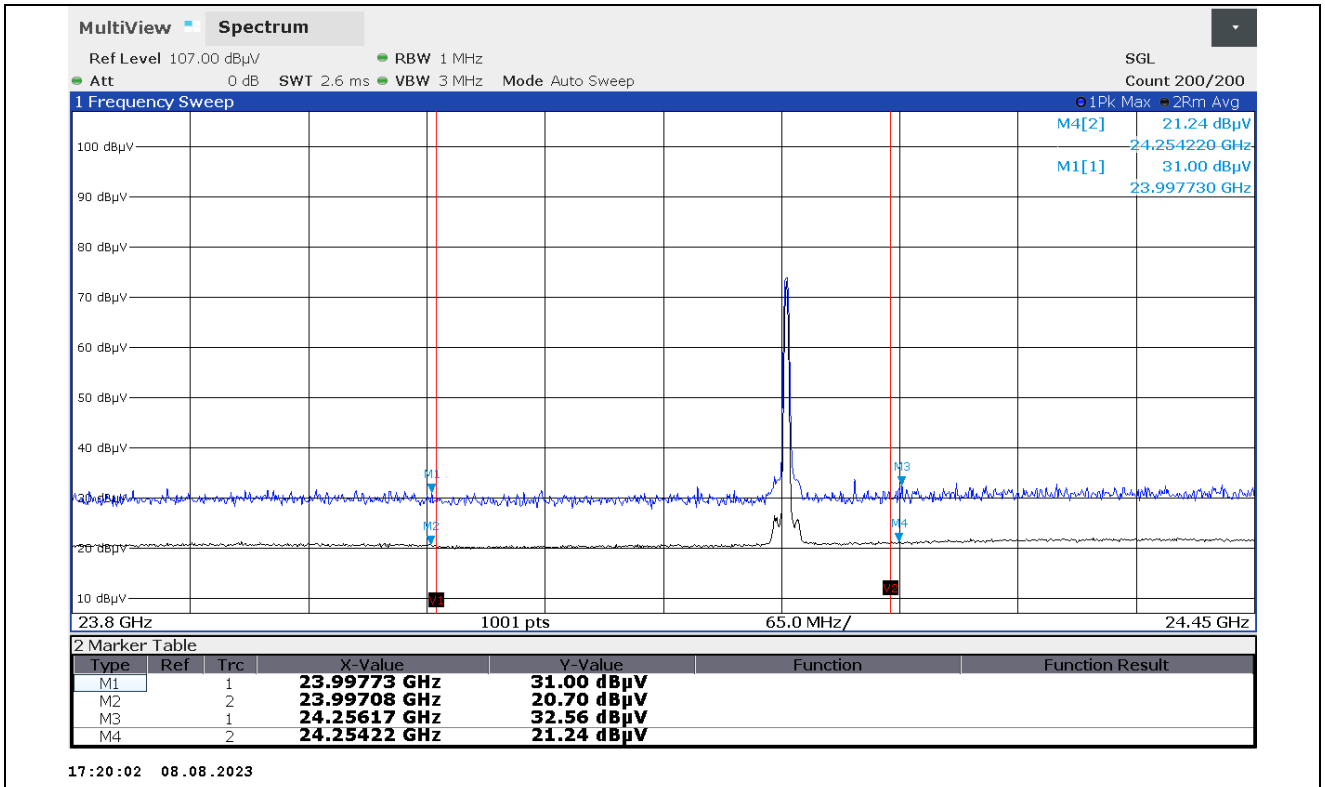
### 8.5.7 Band Edge

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 1 m
- Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (d)
- Result : PASSED

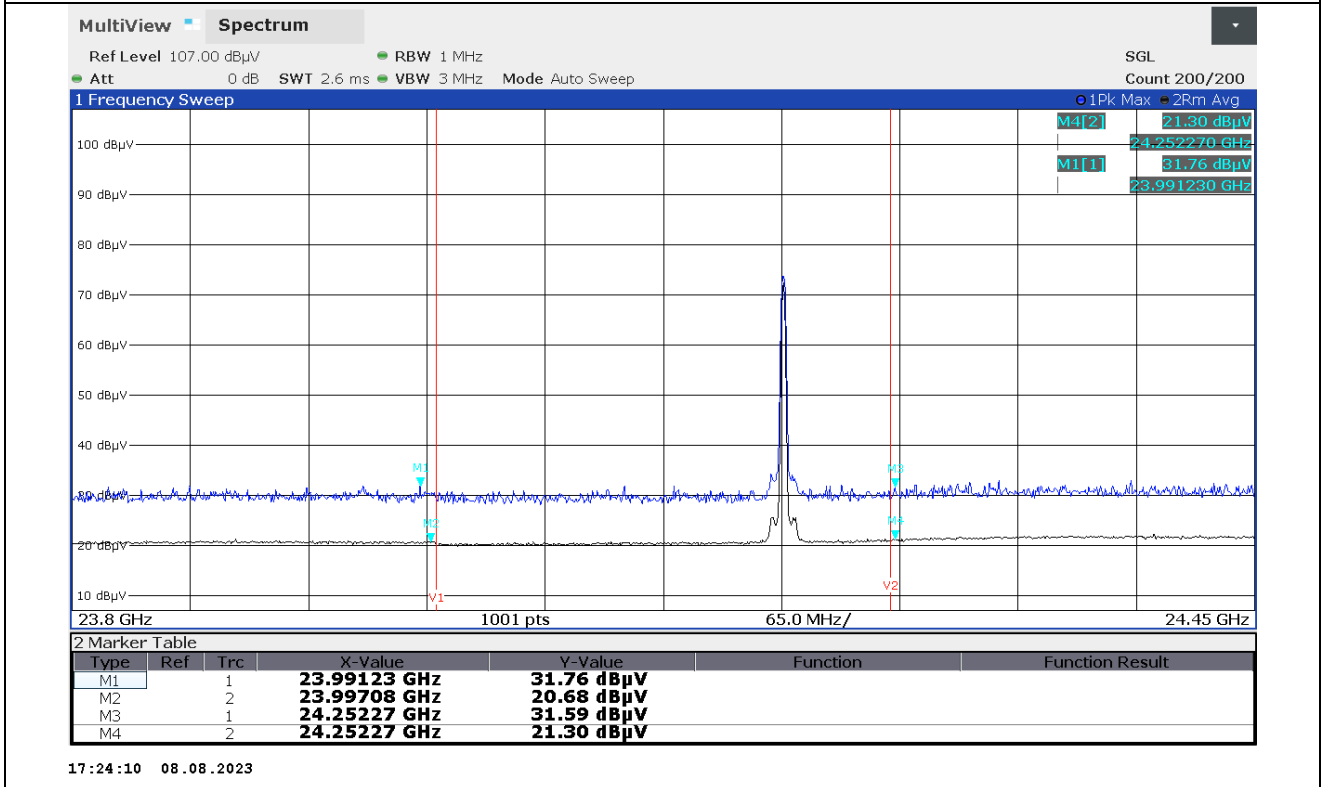
Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant Pol.	Ant. Factor (dB)	Cable Loss (dB)	Distance Factor (dB)	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
23.997	31.00	Peak	H	38.80	2.90	9.54	63.16	74.00	10.84
23.997	20.70	Average	H	38.80	2.90	9.54	52.86	54.00	1.14
23.991	31.76	Peak	V	38.80	2.90	9.54	63.92	74.00	10.08
23.997	20.68	Average	V	38.80	2.90	9.54	52.84	54.00	1.16
24.256	32.56	Peak	H	38.70	3.00	9.54	64.72	74.00	9.28
24.254	21.24	Average	H	38.70	3.00	9.54	53.40	54.00	0.60
24.252	31.59	Peak	V	38.70	3.00	9.54	63.75	74.00	10.25
24.252	21.30	Average	V	38.70	3.00	9.54	53.46	54.00	0.54

Remark. Margin (dB) = Limit (dBuV/m) – Total (dBuV/m)

$$\text{Total} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Distance Factor}$$



H



V

## 9. CONDUCTED EMISSION TEST

### 9.1 Operating environment

Temperature : 22 °C  
Relative humidity : 46 % R.H.

### 9.2 Test set-up

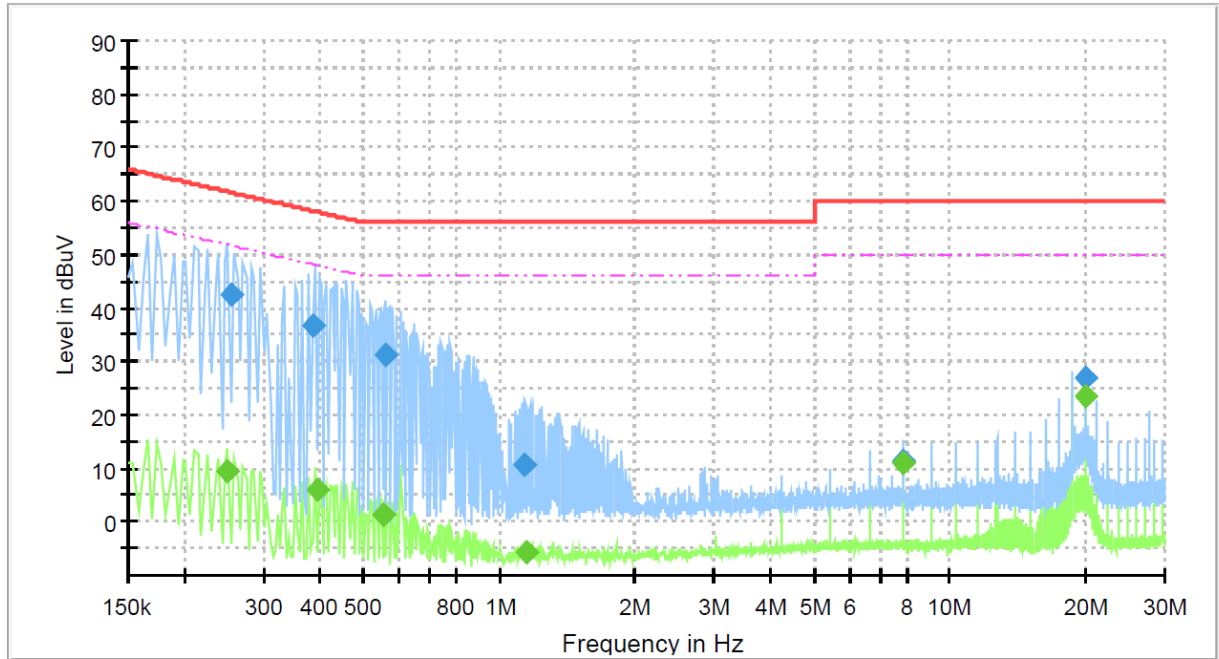
The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50  $\Omega$  / 50  $\mu$ H + 5  $\Omega$  Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

### 9.3 Test Date

August 08, 2023 ~ August 21, 2023

### 9.4 Test data

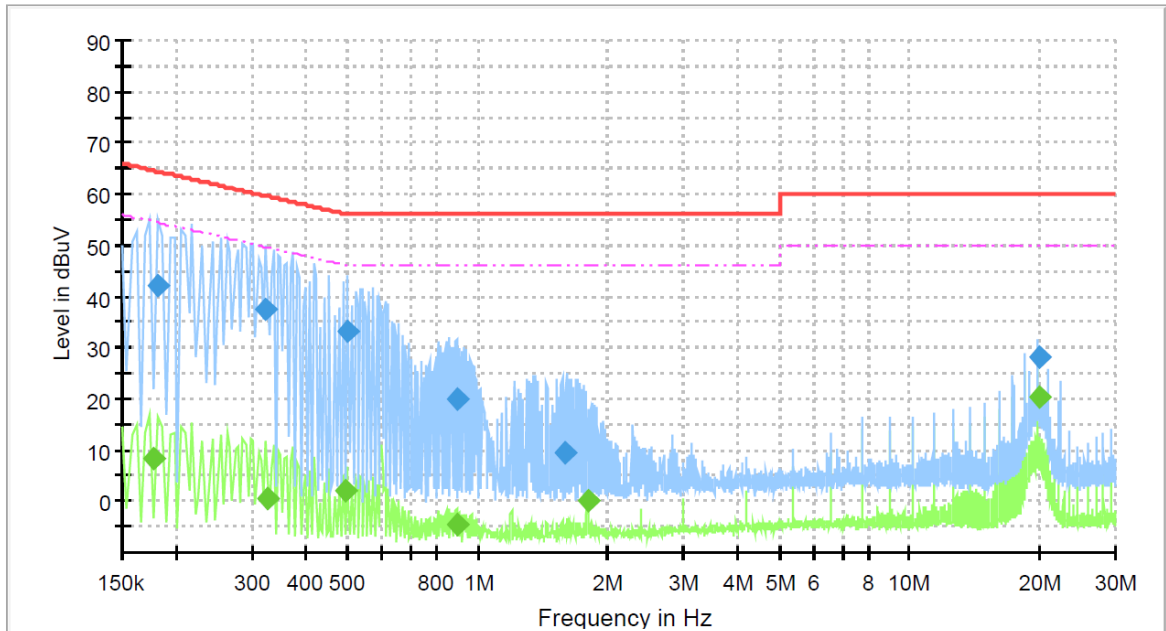
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



### Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.250	---	9.56	51.77	42.22	5000.0	9.0	L1	0.11
0.254	42.65	---	61.64	19.00	5000.0	9.0	L1	0.11
0.385	36.68	---	58.16	21.48	5000.0	9.0	L1	0.12
0.395	---	5.99	47.97	41.98	5000.0	9.0	L1	0.12
0.552	---	1.17	46.00	44.83	5000.0	9.0	L1	0.13
0.556	31.27	---	56.00	24.73	5000.0	9.0	L1	0.13
1.135	10.77	---	56.00	45.23	5000.0	9.0	L1	0.17
1.143	---	-5.85	46.00	51.85	5000.0	9.0	L1	0.17
7.867	---	11.09	50.00	38.91	5000.0	9.0	L1	0.50
7.871	11.50	---	60.00	48.50	5000.0	9.0	L1	0.50
19.971	---	23.49	50.00	26.51	5000.0	9.0	L1	1.00
19.971	26.97	---	60.00	33.03	5000.0	9.0	L1	1.00

-. Tested Line : NEUTRAL LINE



### Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.178	---	8.11	54.60	46.49	5000.0	9.0	N	0.15
0.182	41.95	---	64.42	22.47	5000.0	9.0	N	0.15
0.322	37.59	---	59.67	22.08	5000.0	9.0	N	0.11
0.326	---	0.42	49.57	49.15	5000.0	9.0	N	0.12
0.493	---	2.12	46.12	43.99	5000.0	9.0	N	0.12
0.501	33.10	---	56.00	22.90	5000.0	9.0	N	0.12
0.893	---	-4.65	46.00	50.65	5000.0	9.0	N	0.15
0.897	20.11	---	56.00	35.89	5000.0	9.0	N	0.15
1.590	9.30	---	56.00	46.70	5000.0	9.0	N	0.18
1.812	---	0.27	46.00	45.73	5000.0	9.0	N	0.19
19.916	28.06	---	60.00	31.94	5000.0	9.0	N	1.02
19.928	---	20.54	50.00	29.46	5000.0	9.0	N	1.02

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

**10. LIST OF TEST EQUIPMENT**

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
FSW43	Rohde & Schwarz	Signal & Spectrum Analyzer	104544	Jul. 14, 2023 (1Y)
ESW44	Rohde & Schwarz	EMI Test Receiver	101851	Mar. 07, 2023 (1Y)
HLP-2008	TDK RF Solutions	Hybrid Antenna	131313	Apr. 05, 2023 (2Y)
310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 14, 2023 (1Y)
BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1349	Jul. 04, 2023 (1Y)
SCU18	Rohde & Schwarz	Pre-Amplifier	102266	Jul. 11, 2023 (1Y)
FMZB 1513	Schwarzbeck	Loop Antenna	1513-235	Mar. 24, 2022 (2Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 25, 2023 (1Y)
M19RH	OML, Inc.	Millimeter Wave Horn Antenna	180912-1	Jul. 04, 2023 (1Y)
M12RH	OML, Inc.	Millimeter Wave Horn Antenna	180912-1	Jun. 28, 2023 (1Y)
M08RH	OML, Inc.	Millimeter Wave Horn Antenna	180912-1	Jun. 28, 2023 (1Y)
M19HWD	OML, Inc.	Harmonic Mixer	180912-1	Jun. 30, 2023 (1Y)
M12HWD	OML, Inc.	Harmonic Mixer	180912-1	Jun. 30, 2023 (1Y)
M08HWD	OML, Inc.	Harmonic Mixer	180912-1	Jun. 30, 2023 (1Y)
ESR 3	Rohde & Schwarz	EMI Test Receiver	102602	Mar. 15, 2023 (1Y)
NSLK8126	Schwarzbeck	AMN	8126-404	Mar. 15, 2023 (1Y)
ESH3Z2	Rohde & Schwarz	PULSE LIMITER	357.8810.52	Mar. 14, 2023 (1Y)
CO3000	Innco Systems GmbH	Controller	N/A	N/A
DT5000	Innco Systems GmbH	Turn Table	N/A	N/A
MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4000/509/ 37211215/L	N/A