FCC 47 CFR PART 95 SUBPART M

TEST REPORT

For

77G Front Radar

Model: ARS-ST01

Trade Name: ALPHA

Issued to
Alpha Networks Inc.
No. 8, Li-Hsin 7th Rd., Hsinchu Science Park, Hsinchu 300094, Taiwan

Issued by

Compliance Certification Services Inc.
Wugu Laboratory
No.11, Wugong 6th Rd., Wugu Dist.,
New Taipei City, Taiwan.
Issued Date: December 5, 2024

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	December 5, 2024	Initial Issue	ALL	Peggy Tsai

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1. TEST RESULT CERTIFICATION

Applicant: Alpha Networks Inc.
No. 8, Li-Hsin 7th Rd., Hsinchu Science Park, Hsinchu 300094, Taiwan
Equipment Under Test: 77G Front Radar
Trade Name: ALPHA
Model: ARS-ST01
Date of Test: October 9 ~ 21, 2024

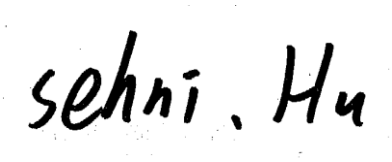
APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 95 Subpart M	Compliance
Statements of Conformity	
Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.	

We hereby certify that:

All test results conform to above mentioned standards.
The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.26: 2015 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 95.3367, 95.3379 and FCC KDB 653005 D01.

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

Approved by:



Sehni Hu
Supervisor

2. EUT DESCRIPTION

Product	77G Front Radar
Trade Name	ALPHA
Model Number	ARS-ST01
Model Discrepancy	N/A
Received Date	September 27, 2024
Power Supply	Power from power supply. (DC 12V)
DC current	140mA
Frequency Range	MRR: 76.10-76.34GHz SRR: 76.12-76.77GHz
Radar type	FMCW
Number of Channel	1
Antenna Designation	Type: Patch Antenna Brand: ALPHA Model-1: ARS-ST01_MRR; Gain: 22.36 dBi Model-2: ARS-ST01_SRR; Gain: 18.41 dBi
H.W Version	8ARSST01.1A1G
S.W Version	0000001772.37080
S/N	116M21O700032
Sweep Characteristics	MRR: Sweep Bandwidth: 243MHz (Total) Sweep Rate: 100ms Sweep Time: 22.2us SRR: Sweep Bandwidth: 680MHz (Total) Sweep Rate: 100ms Sweep Time: 29.2us

Remark:

1. The sample selected for test was production product and was provided by manufacturer.
2. Disclaimer: Antenna and Sweep Characteristic's information is provided by the applicant, test results of this report are applicable to the sample EUT received.

3. TEST SUMMARY

Report Section	FCC Standard Section	Test Item	Result
8.1	§2.1046 95.3367	Equivalent Isotropically Radiated Power (EIRP)	Pass
8.2	§2.1053 95.3379(a)	Field Strength of Spurious Radiation	Pass
8.3	§2.1055 95.3379(b)	Frequency stability	Pass
8.4	§2.1049	Occupied bandwidth (99%)	Pass

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2020, ANSI 63.26:2015 and FCC CFR 47 Part 95.3367, 95.3379, FCC KDB 653005 D01.

4.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

4.3 GENERAL TEST PROCEDURES

Radiated Emissions

The EUT is placed on a turn table, which is 1.5 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made.

4.4 DESCRIPTION OF TEST MODES

The EUT (model: ARS-ST01) had been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting mode was programmed.

Radiated Emission Measurement Above 1G	
Test Condition	**Radiated Emission Above 1G**
Power supply Mode	**Mode 1: EUT power by Power supply**
Worst Mode	☒ **Mode 1** ☐ **Mode 2** ☐ **Mode 3** ☐ **Mode 4**
Worst Position	☐ **Placed in fixed position.** ☐ **Placed in fixed position at X-Plane (E2-Plane)** ☐ **Placed in fixed position at Y-Plane (E1-Plane)** ☒ **Placed in fixed position at Z-Plane (H-Plane)**

Radiated Emission Measurement Below 1G	
Test Condition	**Radiated Emission Below 1G**
Power supply Mode	**Mode 1: EUT power by Power supply**
Worst Mode	☒ **Mode 1** ☐ **Mode 2** ☐ **Mode 3** ☐ **Mode 4**

Remark:

1. The worst mode was record in this test report.
2. EUT pre-scanned in three axis ,X,Y, Z and two polarity, for radiated measurement. The worst case(Z-Plane) were recorded in this report
3. This device supports two sensing modes. are MRR and SRR respectively, and are fully evaluated for both modes.

4.5 FAR FIELD CONDITION FOR FREQUENCY ABOVE 40GHZ

The equipment under test was transmitting while connected to its integral antenna and is placed on a turn table. The measurement antenna is in the far field of the EUT per formula 2D2/λ where D is the larger between the dimension of the measurement antenna and the transmitting antenna of the EUT.

In this case, "D" is the largest dimension of the measurement antenna. The EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

Model	Frequency Range (GH)	Largest Dimension of the Horn Antenna (mm)	Minimum Test Distance Rm (m)
RCHO19R	40~60	31	0.38
RCHO12R	60~90	21	0.26
RCHO08R	90~140	15	0.21
RCHO05R	140~220	10	0.15
FH-PP-325	220~325	8	0.14

5. INSTRUMENT CALIBRATION

5.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

5.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: Each piece of equipment is scheduled for calibration once a year.

Thermostat test room					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Cal Date**	**Cal Due**
Constant Temperature Humidity Chamber	TERCHY	MHG-150LF	930619	2023-10-26	2024-10-25
Cable	EMCI	EMC101G	221213+221011 +221012	2024-03-01	2025-02-28
DC Power Source	GWINSTEK	SPS-3610	GPE880163	2023-11-16	2024-11-15
STANDARD GAIN HORN ANTENNA	CMI	RCHO12R	RCHO12R	2024-06-16	2025-06-15
Signal Analyzer	KEYSIGHT	N9030B	MY62291089	2024-10-04	2025-10-03
SA EXTENSION MODULE	VDI	SAX WR12	SAX983	2024-06-14	2025-06-13
Software	N/A				

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

3M 966 Chamber Test Site					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Cal Date**	**Cal Due**
Pre-Amplifier	MITEQ	AMF-6F-18004000-37-8P	985646	2024-08-13	2025-08-12
Active Loop Antenna	SCHWARZBECK	FMZB 1513-60	1513-60-028	2023-12-13	2024-12-12
Preamplifier	EMEC	EM330	060609	2024-02-21	2025-02-20
Thermo-Hygro Meter	WISEWIND	1206	D07	2023-12-08	2024-12-07
Signal Analyzer	Agilent	N9010A	MY52220817	2024-03-15	2025-03-14
Preamplifier	HP	8449B	3008A00965	2023-12-22	2024-12-21
Cable	EMCI	EMC101G	221213+221011+221012	2023-10-17	2024-10-16
				2024-10-11	2025-10-10
Signal Generator	Agilent	E8257C	US42340383	2024-06-15	2025-06-14
STANDARD GAIN HORN ANTENNA	CMI	RCHO05R	RCHO05R	2024-06-22	2025-06-21
STANDARD GAIN HORN ANTENNA	CMI	RCHO08R	RCHO08R	2024-06-16	2025-06-15
STANDARD GAIN HORN ANTENNA	CMI	RCHO12R	RCHO12R	2024-06-16	2025-06-15
STANDARD GAIN HORN ANTENNA	CMI	RCHO19R	RCHO19R	2024-06-15	2025-06-14
STANDARD GAIN HORN ANTENNA	RADIOMETER PHYSICS	FH-PP-325	FH-PP-325	2024-06-22	2025-06-21
SA EXTENSION MODULE	VDI	SAX WR8.0	SAX982	2024-06-14	2025-06-13
SA EXTENSION MODULE	VDI	SAX WR12	SAX983	2024-06-14	2025-06-13
SA EXTENSION MODULE	VDI	SAX WR19	SAX993	2024-06-14	2025-06-13
SA EXTENSION MODULE	VDI	SAX WR5.1	SAX995	2024-06-16	2025-06-15
SA EXTENSION MODULE	VDI	SAX WR3.4	SAX996	2024-07-16	2025-07-15
Bi-Log Antenna	Sunol Sciences	JB3	A030105	2024-07-12	2025-07-11
Horn Antenna	ETC	MCTD 1209	DRH13M02003	2023-12-28	2024-12-27
Horn Antenna	SCHWARZBECK	BBHA9170	1047	2023-12-13	2024-12-12
Pre-Amplifier	EMCI	EMC184045SE	980860	2023-12-12	2024-12-11
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Software	e3 V9-210616c				

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

5.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	± 2.21 dB
Channel Bandwidth	± 2.79 %
Radiated Emission_9kHz-30MHz	± 3.492 dB
Radiated Emission_30MHz-200MHz	± 3.683 dB
Radiated Emission_200MHz-1GHz	± 3.966 dB
Radiated Emission_1GHz-6GHz	± 5.063 dB
Radiated Emission_6GHz-18GHz	± 5.122 dB
Radiated Emission_18GHz-26GHz	± 3.032 dB
Radiated Emission_26GHz-40GHz	± 3.271 dB
Radiated Emission_40GHz-60GHz	± 2.294 dB
Radiated Emission_60GHz-90GHz	± 2.209 dB
Radiated Emission_90GHz-140GHz	± 2.208 dB
Radiated Emission_140GHz-220GHz	± 2.217 dB
Radiated Emission_220GHz-325GHz	± 2.306 dB

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

6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

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

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

Tel: 886-2-2299-9720 / Fax: 886-2-2299-9721

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

7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

7.2 SUPPORT EQUIPMENT

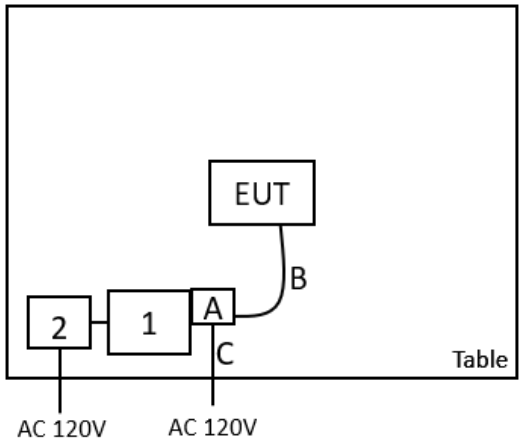
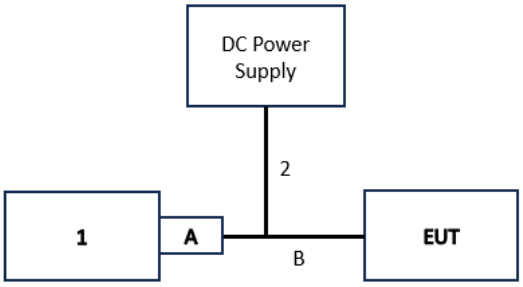
Radiated Support Equipment					
No.	**Device Type**	**Brand**	**Model**	**Series No.**	**FCC ID**
1	NB(D)	Lenovo	ThinkPad X260	N/A	N/A
2	Adapter	Lenovo	ADLX45DLC3A	N/A	N/A
A	Test Kit	N/A	N/A	N/A	N/A
B	RS-232 Cable	N/A	N/A	N/A	N/A
C	Adapter	CWT	2ABN036F	N/A	N/A

Thermostat test room Support Equipment					
No.	**Device Type**	**Brand**	**Model**	**Series No.**	**FCC ID**
1	NB(I)	Lenovo	X260	N/A	N/A
2	DC Power Cable	MISUMI	MCR3S-RE	N/A	N/A
A	Test Kit	N/A	N/A	N/A	N/A
B	RS-232 Cable	N/A	N/A	N/A	N/A

Remark:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer’s requirements and conditions for the intended use.

7.3 TEST SETUP DIAGRAM(S)

Radiated Setup	Thermostat test room setup
	

7.4 TEST PROGRAM

This EUT uses"AlphaRadarGUI_Installer_ v180813" to set the frequency, modulation, and power to allow the sample to continuously transmit.

For power setting: the default value

8. TEST REQUIREMENTS

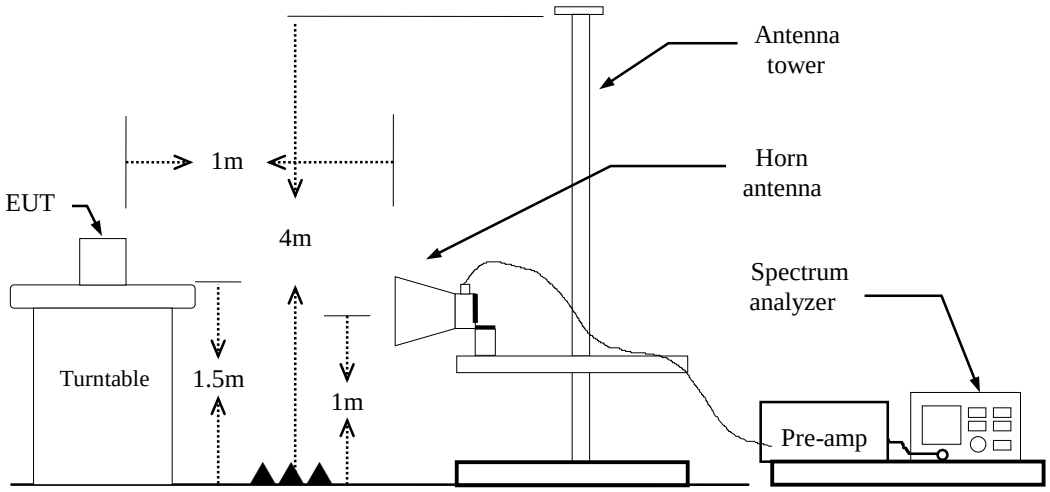
8.1 EQUIVALENT ISOTROPICALLY RADIATED POWER (EIRP)

LIMIT

The fundamental radiated emission limits within the 76-81 GHz band are expressed in terms of Equivalent Isotropically Radiated Power (EIRP) and are as follows:

According to FCC 95.3367.
The maximum power (EIRP) within the 76-81 GHz band shall not exceed 50 dBm based on measurements employing a power averaging detector with a 1 MHz Resolution Bandwidth (RBW).
The maximum peak power (EIRP) within the 76-81 GHz band shall not exceed 55 dBm based on measurements employing a peak detector with a 1 MHz RBW.

TEST CONFIGURATION



TEST PROCEDURE

Refer to ANSI C63.26-2015 Clause 5.2.7, KDB 653005 D01 76-81 GHz Radars v01r02
Connect the test antenna for the fundamental frequency band to a spectrum analyzer via an external mixer.
Set spectrum analyzer RBW, VBW, detector, span, and so on, to the proper values.
Maximize the fundamental emission, noting that multiple peaks may be found at different beam orientations and/or polarizations A pulse desensitization factor must be applied to the measured peak pulse power amplitude.
Consult the relevant instrumentation manufacturers' Application Note(s) for more detailed information, including how to determine the magnitude of the FMCW- and pulse-desensitization factors.

Calculate the EIRP from the measured field strength using equation as follows:

For Peak Measurement:
EIRP (dBm) = E (dBμV/m) + 20log(D) − 104.8+ Chirps Correction Factor

For Average Measurement:
EIRP (dBm) = E (dBμV/m) + 20log(D) − 104.8
EIRP is the equivalent isotropically radiated power
E is the field strength of the emission at the measurement distance
D is the measurement distance
E (dBμV/m) = Reading(dBμV) + Factor(dB/m)

TEST RESULTS

Compliance.

Temperature: 21.2 ~ 23.5℃ **Test date:** October 15 ~ 21, 2024

Humidity: 50 ~ 59% RH **Tested by:** Jerry Chang

Far Field Condition for EUT

Model	Frequency Range (GHz)	Largest Dimension of the Horn Antenna (mm)	Minimum Test Distance Rm (m)
MRR	77	32	0.53
SRR	77	20	0.21

(1) MRR

Mode	Frequency (GHz)	SA Reading (dBuV)	Antenna Factor	Mixer	Cable	Distance (m)	Level (dBuV/m)	FMCW desensit-ization factor	EIRP (dBm)	Limit (dBm)	Margin (dB)	Remark	Result
NTNV	76.11	73.13	46.10	11.00	2.05	1	132.28	-6.93	34.44	55.00	-20.56	Peak	Pass
	76.11	58.36	46.10	11.00	2.05	1	117.51	0.00	12.74	50.00	-37.26	AVG	Pass

(2) SRR

Mode	Frequency (GHz)	SA Reading (dBuV)	Antenna Factor	Mixer	Cable	Distance (m)	Level (dBuV/m)	FMCW desensit-ization factor	EIRP (dBm)	Limit (dBm)	Margin (dB)	Remark	Result
NTNV	76.77	64.76	46.30	10.78	2.07	1	123.91	-10.14	29.27	55.00	-25.73	Peak	Pass
	76.77	55.66	46.30	10.78	2.07	1	114.81	0.00	10.04	50.00	-39.96	AVG	Pass

Note:

1. Level=Reading+antenna factor+mixer loss+cable
   EIRP=Level +20log(d)[d=1m]-104.77 - desensitization factor
2. Follow Annex L of the C63.10-2020 standard.
   FMCW desensitization factor =20 * Log(α)

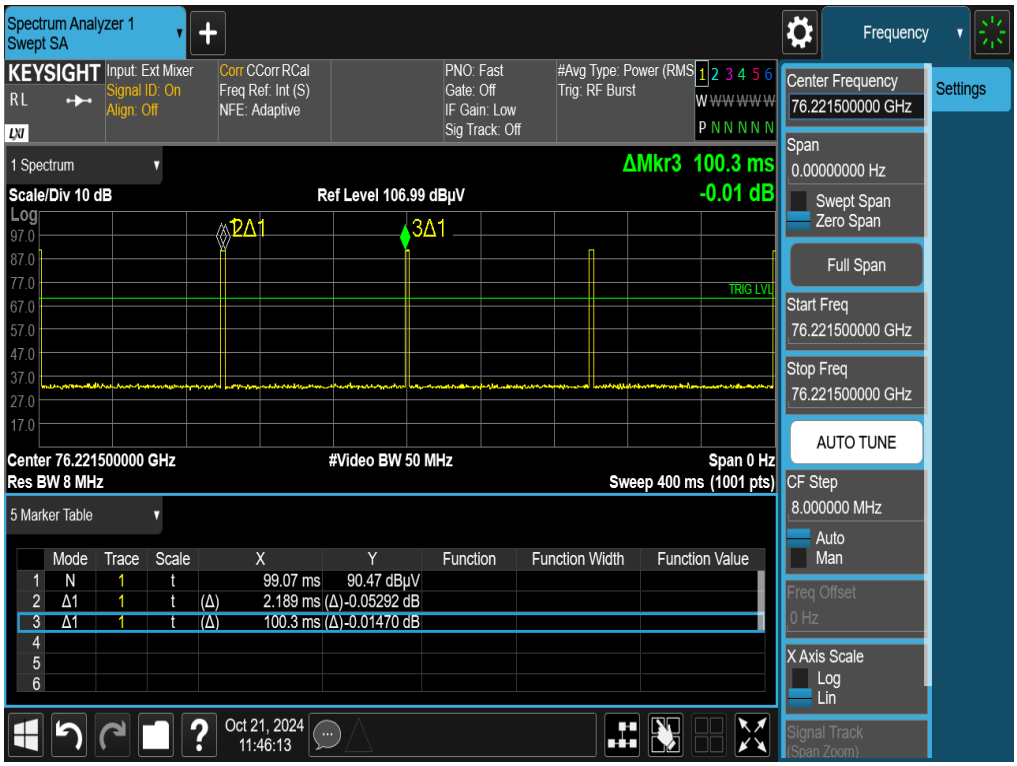
$$\alpha = \frac{1}{\left(1+\left[\left(\frac{2\times\ln(2)}{\pi}\right)^2\times\left(\frac{BW_{Chirp}}{T_{Chirp}\times RBW^2}\right)^2\right]\right)^{0.25}}$$

BW_{chirp}: Follow report sec 2.
T_{Chirp}: Follow report sec 2.
RBW:1MHz

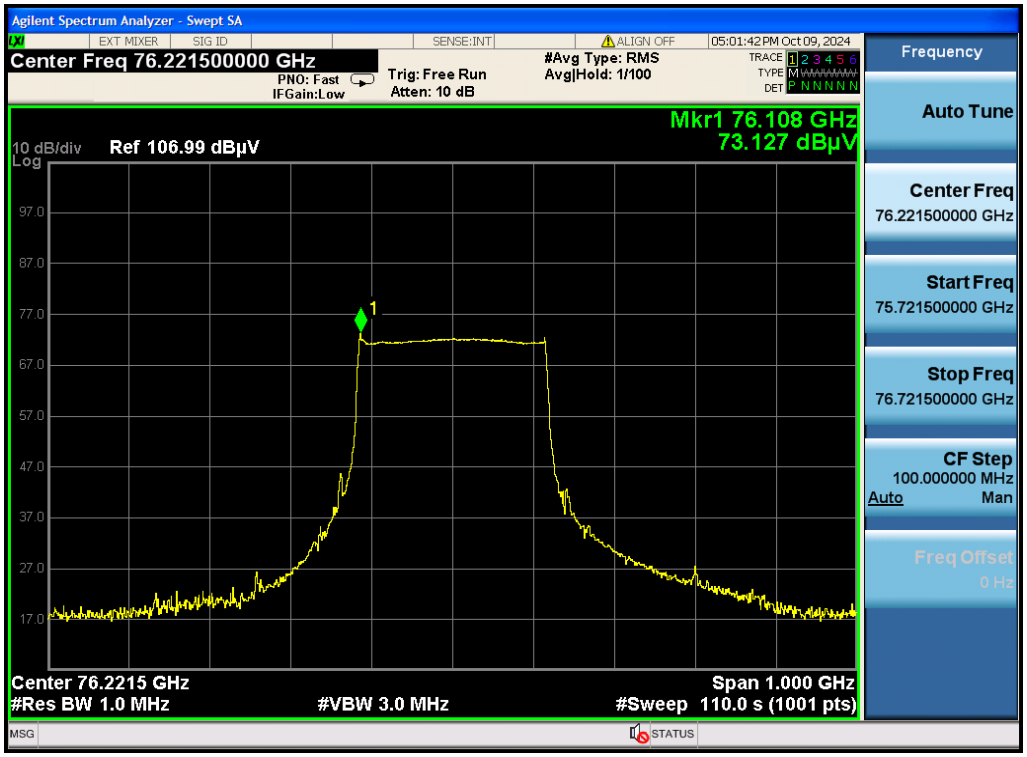
Test Data
(1) MRR

Duty

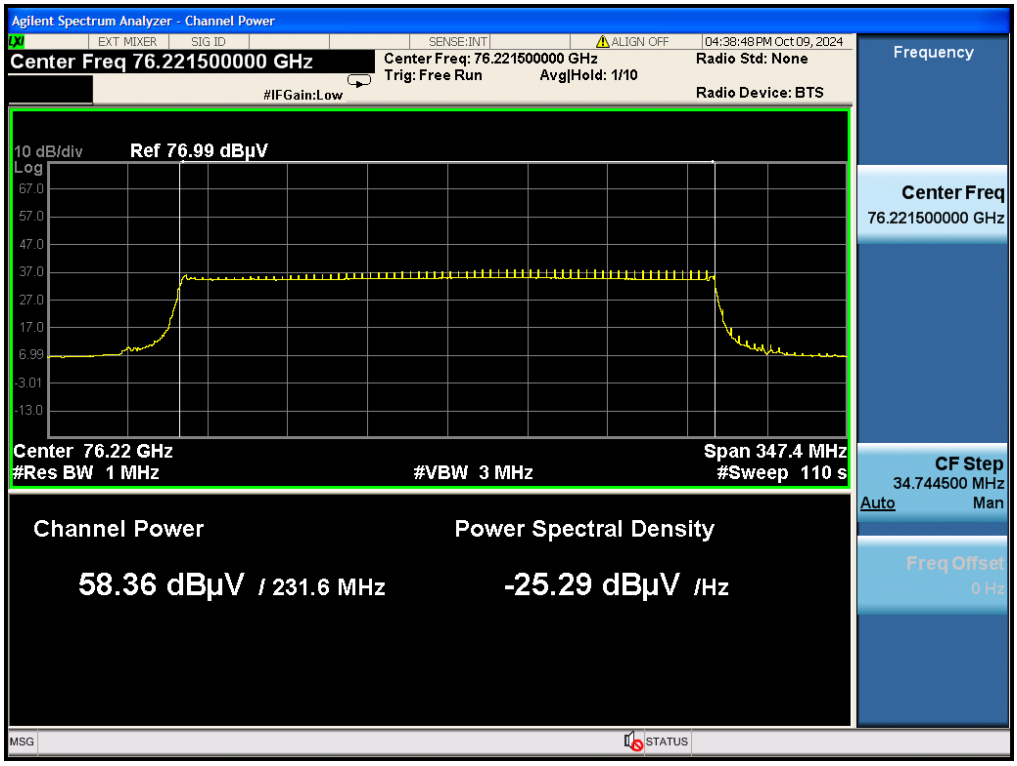
Duty Cycle On (ms)	Duty Cycle On+Off (ms)	Duty Cycle (%)	Duty Factor (dB)
2.19	100.3	2.18%	16.61



Peak Power



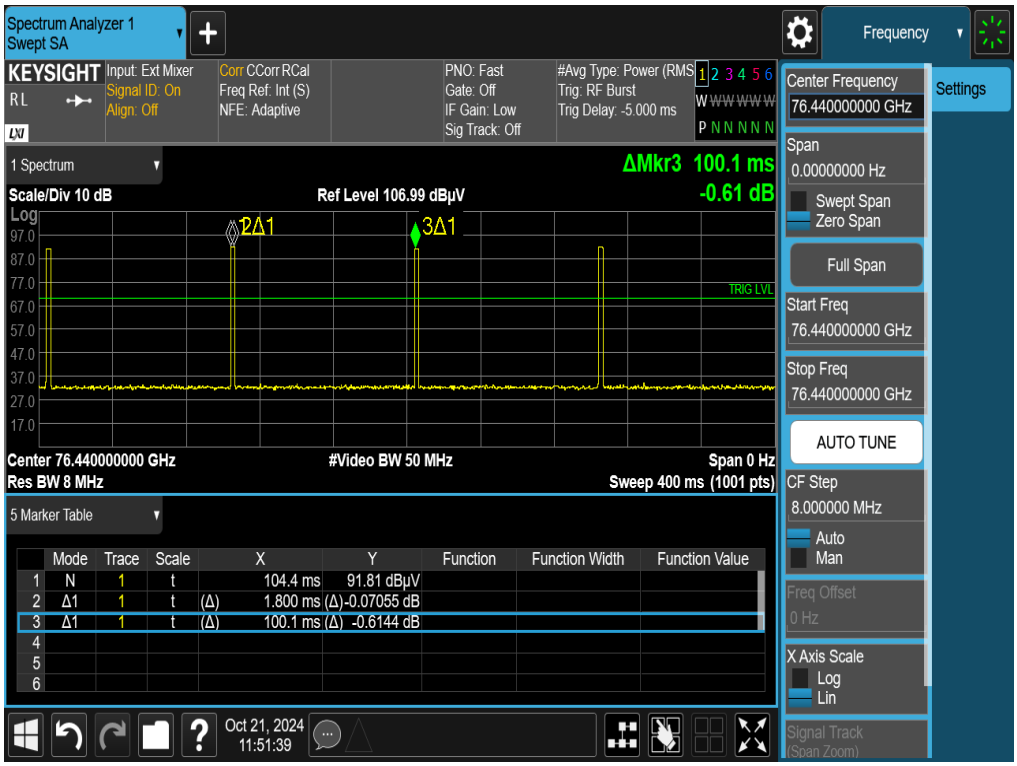
RMS Power



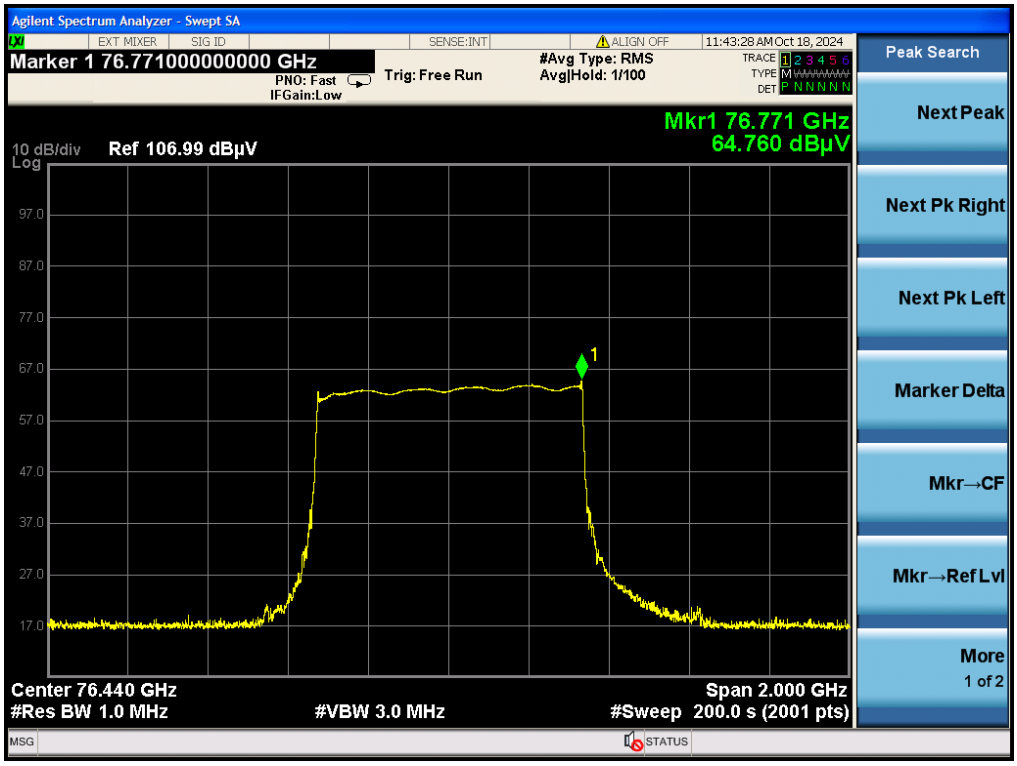
(2) SRR

Duty

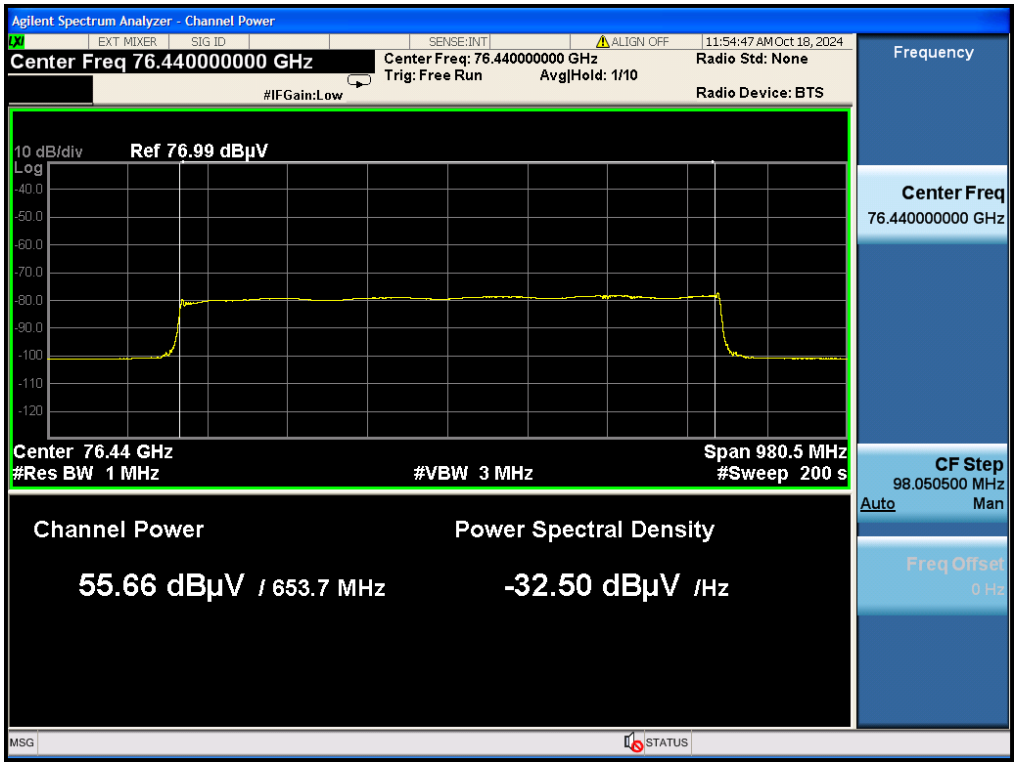
Duty Cycle On (ms)	Duty Cycle On+Off (ms)	Duty Cycle (%)	Duty Factor (dB)
1.80	100.1	1.80%	17.45



Peak Power



RMS Power



8.2 SPURIOUS EMISSIONS

8.2.1 Radiated Emissions

LIMIT

1. According to FCC PART 95.3379(a), Radiated emissions below 40 GHz shall not exceed the field strength as shown in the following emissions table.

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

2. For radiated emissions outside the 76-81 GHz band between 40 GHz and 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 600 pW/cm^2 at a distance of 3 meters from the exterior surface of the radiating structure.
3. For radiated emissions above 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 1000 pW/cm^2 at a distance of 3 meters from the exterior surface of the radiating structure.

Notes:

Calculate correction
Power density (mW/m2)X 4π(r)2=P(mW)
P(mW)-20log(d)+104.77=dBuV/m
600 pW/cm2= -1.7dBm @ 3m = 93.54dBuV/m@3m
1000 pW/cm2= 0.5 dBm @ 3m = 95.76dBuV/m@3m
P: Power
r: measurement distance(m)

Field Strength = Reading + Factor
EIRP (dBm) = Field Strength (dBμV/m) + 20log(D) − 104.8
D is the measurement distance

$$EIRP_{Linear} = 10^{\left[(EIRP_{Log} - 30)/10\right]}$$

where

$EIRP_{Linear}$ is the equivalent isotropically radiated power, in watts
$EIRP_{Log}$ is the equivalent isotropically radiated power, in dBm

$$PD = \frac{EIRP_{Linear}}{4\pi d^2}$$

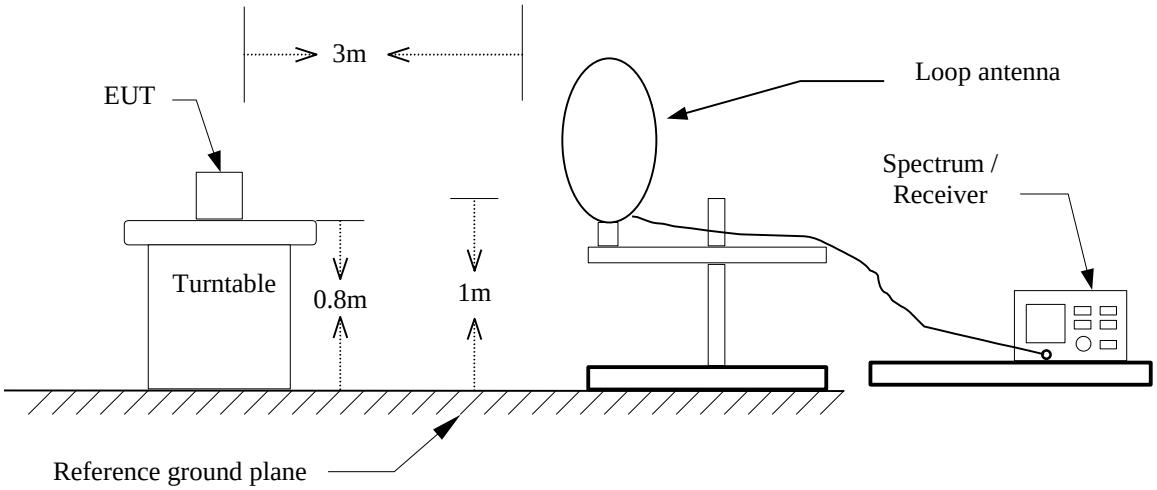
where

PD is the power density at the distance specified by the limit, in W/m^2
$EIRP_{Linear}$ is the equivalent isotropically radiated power, in watts
d is the distance at which the power density limit is specified, in m

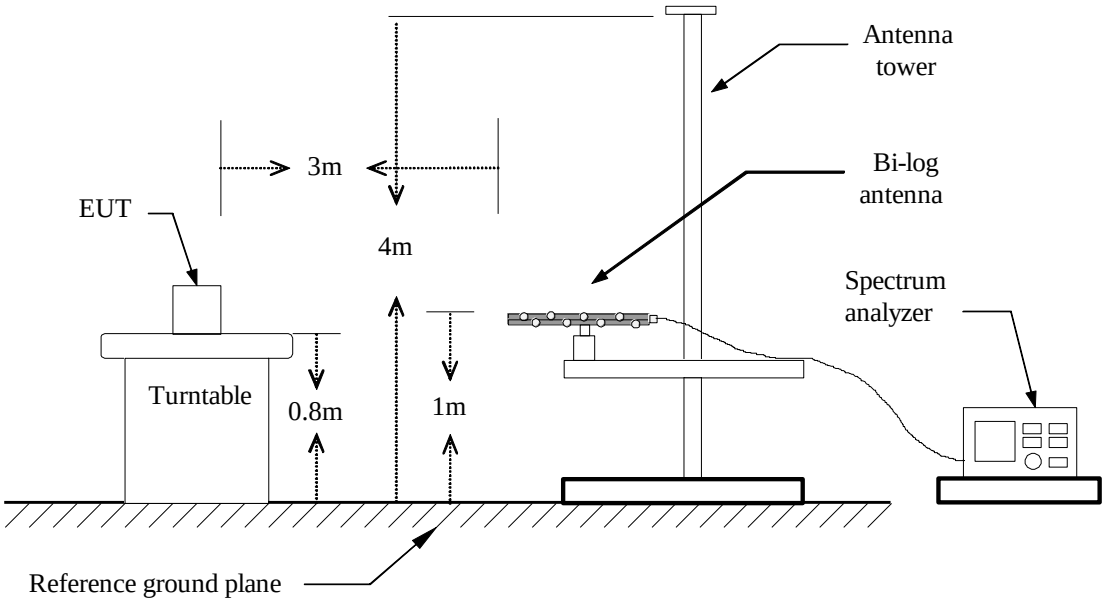
The Specified distance is 3m.

TEST CONFIGURATION

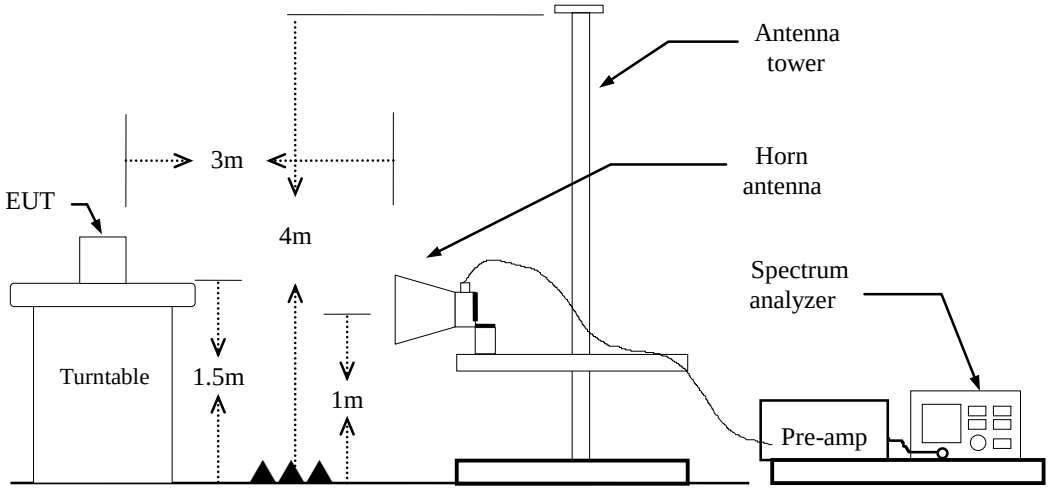
9kHz ~ 30MHz



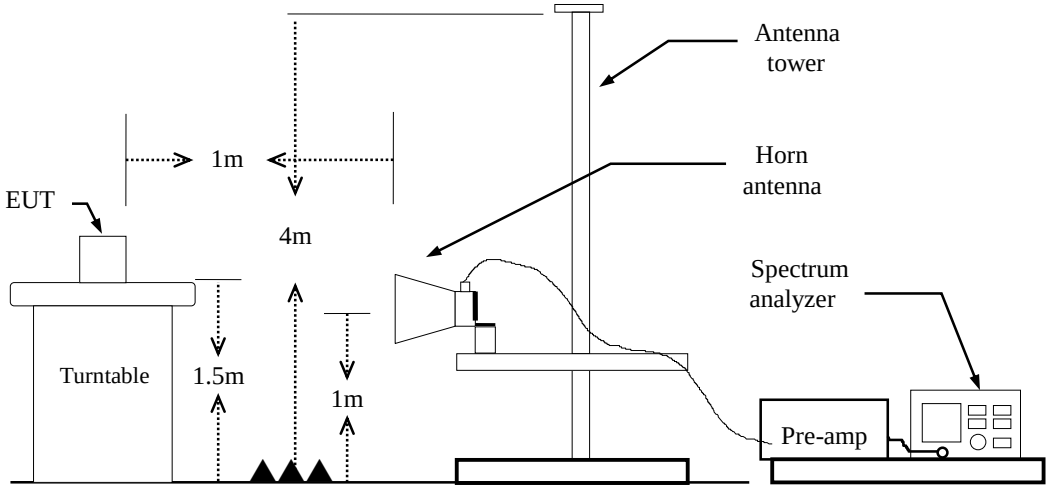
30MHz ~ 1 GHz



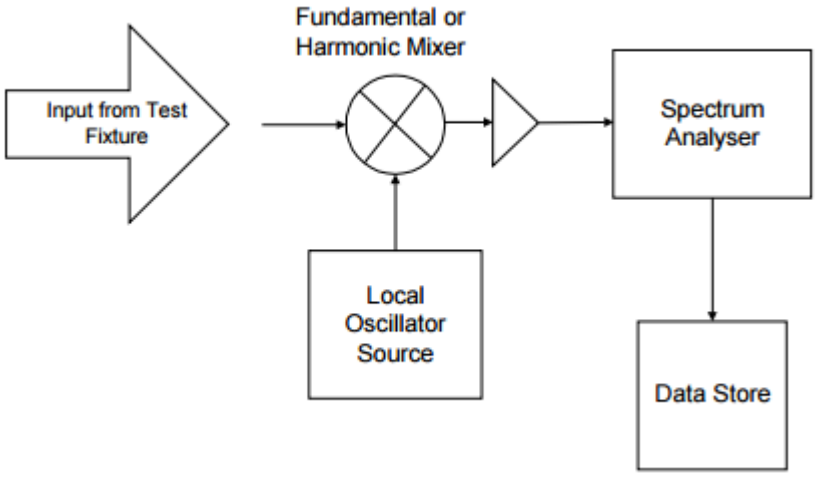
Above 1 GHz ~ 18GHz



18GHz ~ 40GHz



Above 40 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m and below 1 GHz is 0.8m above ground plane. The EUT Configured un accordance with ANSI C63.26: 2015, and the EUT set in a continuous mode.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m or 1m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. The system was investigated from 9kHz to 243 GHz.

During the radiated emission test, the Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W
9kHz-150kHz	300 Hz	1 kHz
150 kHz-30MHz	10 kHz	30 kHz
30MHz-1000MHz	100 kHz	300 kHz
1-40GHz	1 MHz	3 MHz
Above 40GHz	1 MHz	3 MHz

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

7. Repeat above procedures until the measurements for all frequencies are complete.
8. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
9. Radiated emission below 30MHz is measured in a 9m*6m*6m semi-ane choic chamber, the measurements correspond to those obtained at an open-field test site. There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

Below 1 GHz

(1) MRR

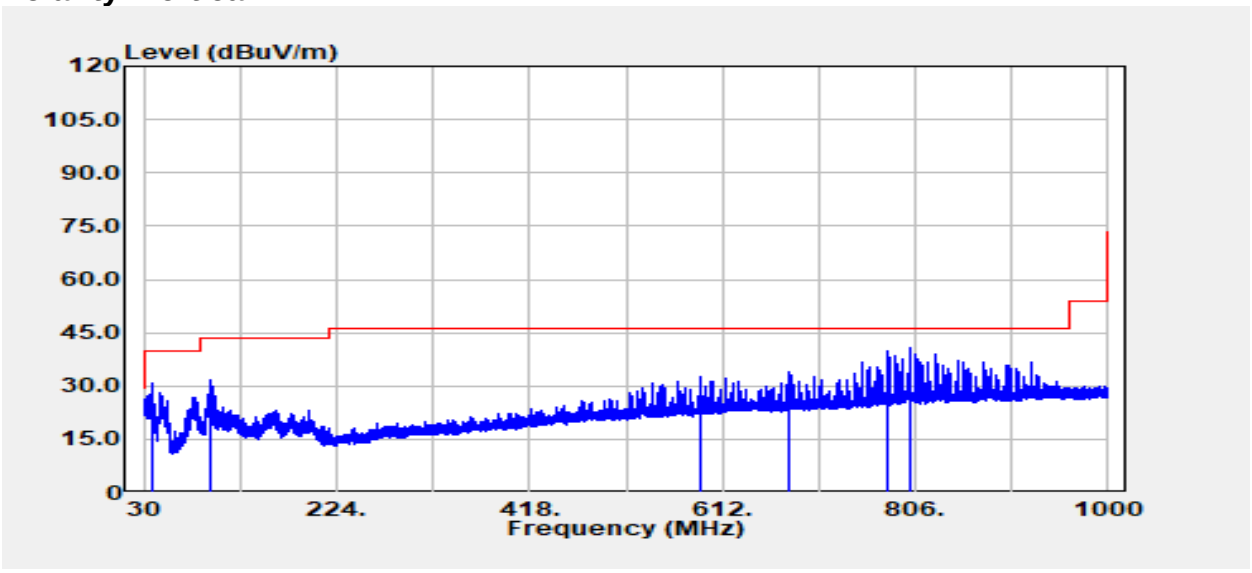
Test Mode:	TX	**Antenna Pol.:**	Vertical / Horizontal
Temperature:	24.6℃	**Tested by:**	October 12, 2024
Humidity:	57% RH	**Test Date:**	Ray Li

Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB	Ant. Pol. (H/V)
37.99	Peak	39.68	-8.74	30.94	40.00	-9.06	V
96.07	Peak	46.43	-14.56	31.87	43.50	-11.63	V
591.12	Peak	36.10	-3.41	32.69	46.00	-13.31	V
679.96	Peak	35.49	-1.54	33.95	46.00	-12.05	V
777.01	Peak	39.59	0.09	39.69	46.00	-6.31	V
801.49	Peak	40.21	0.52	40.73	46.00	-5.27	V
96.02	Peak	41.52	-14.58	26.94	43.50	-16.56	H
169.28	Peak	37.50	-11.70	25.79	43.50	-17.71	H
270.50	Peak	32.99	-9.63	23.36	46.00	-22.64	H
591.12	Peak	34.15	-3.41	30.75	46.00	-15.25	H
728.51	Peak	41.45	-0.55	40.91	46.00	-5.09	H
777.30	Peak	41.08	0.09	41.17	46.00	-4.83	H

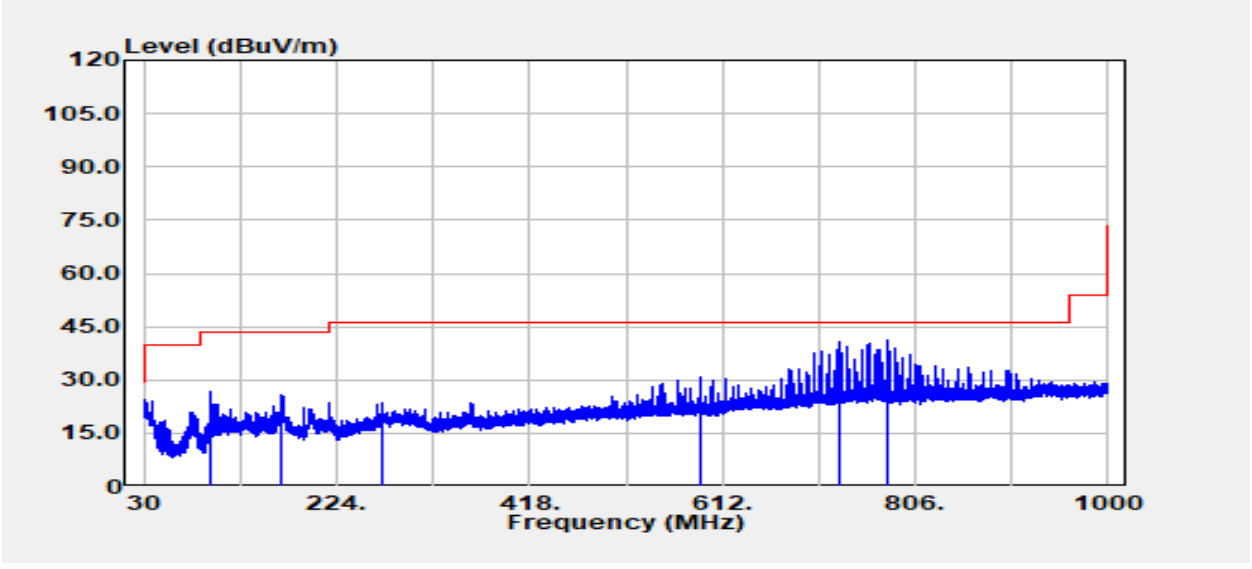
Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak 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.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).
6. Factor=antenna factor-amp gain+ cable loss

Polarity: Vertical



Polarity: Horizontal



(2) SRR

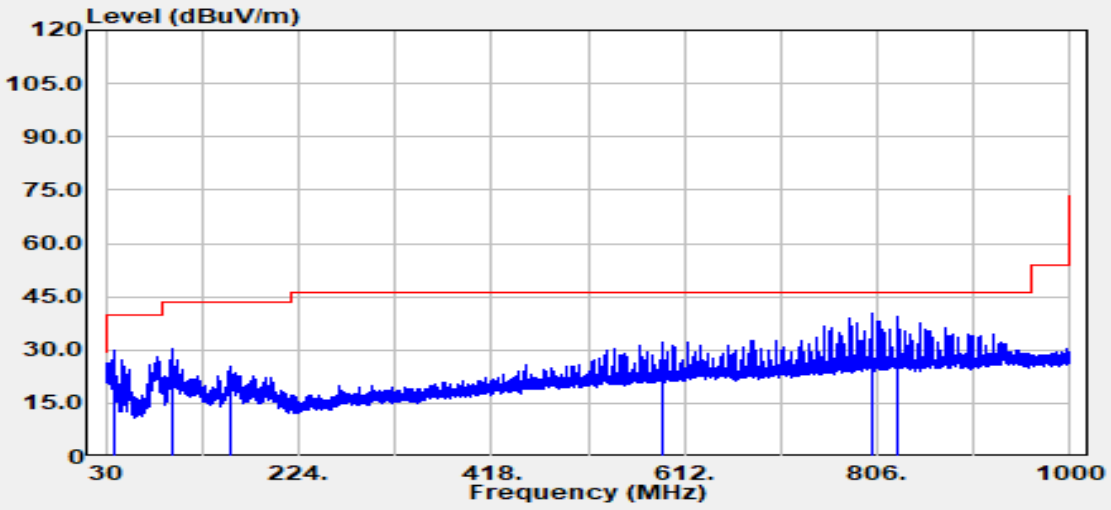
Test Mode:	TX	**Antenna Pol.:**	Vertical / Horizontal
Temperature:	24.6℃	**Tested by:**	October 10, 2024
Humidity:	57% RH	**Test Date:**	Ray Li

Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB	Ant. Pol. (H/V)
37.99	Peak	38.68	-8.74	29.95	40.00	-10.05	V
96.02	Peak	44.80	-14.58	30.22	43.50	-13.28	V
156.61	Peak	36.53	-11.11	25.42	43.50	-18.08	V
591.12	Peak	35.74	-3.41	32.33	46.00	-13.67	V
801.38	Peak	39.66	0.52	40.18	46.00	-5.82	V
825.86	Peak	38.14	1.10	39.24	46.00	-6.76	V
82.72	Peak	39.51	-16.48	23.03	40.00	-16.97	H
167.23	Peak	40.92	-11.59	29.32	43.50	-14.18	H
264.00	Peak	34.43	-10.19	24.25	46.00	-21.75	H
591.12	Peak	30.70	-3.41	27.29	46.00	-18.71	H
728.57	Peak	41.93	-0.54	41.39	46.00	-4.61	H
752.82	Peak	42.93	-0.25	42.68	46.00	-3.32	H

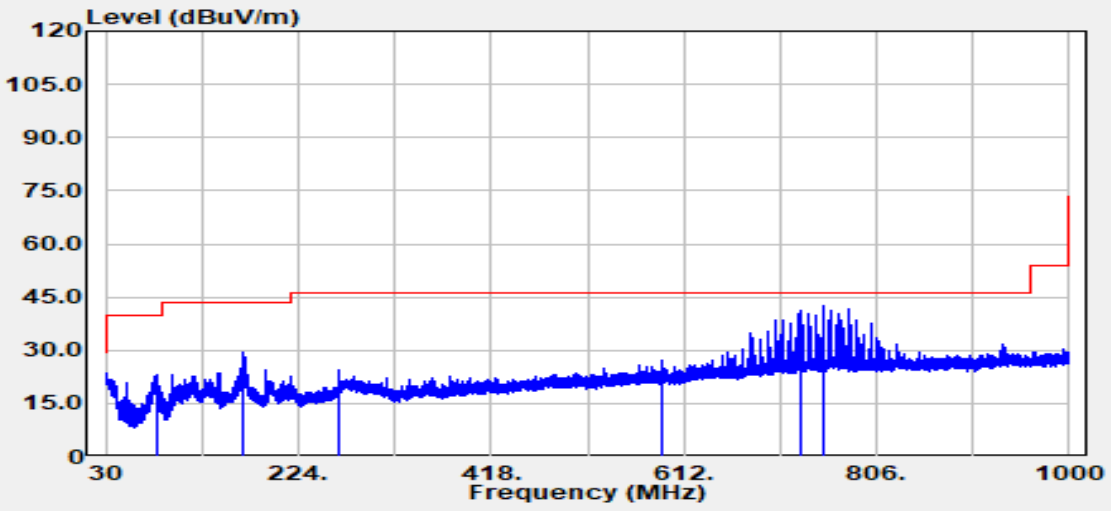
Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak 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.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).
6. Factor=antenna factor-amp gain+ cable loss

Polarity: Vertical



Polarity: Horizontal



1GHz~40GHz

(1) MRR

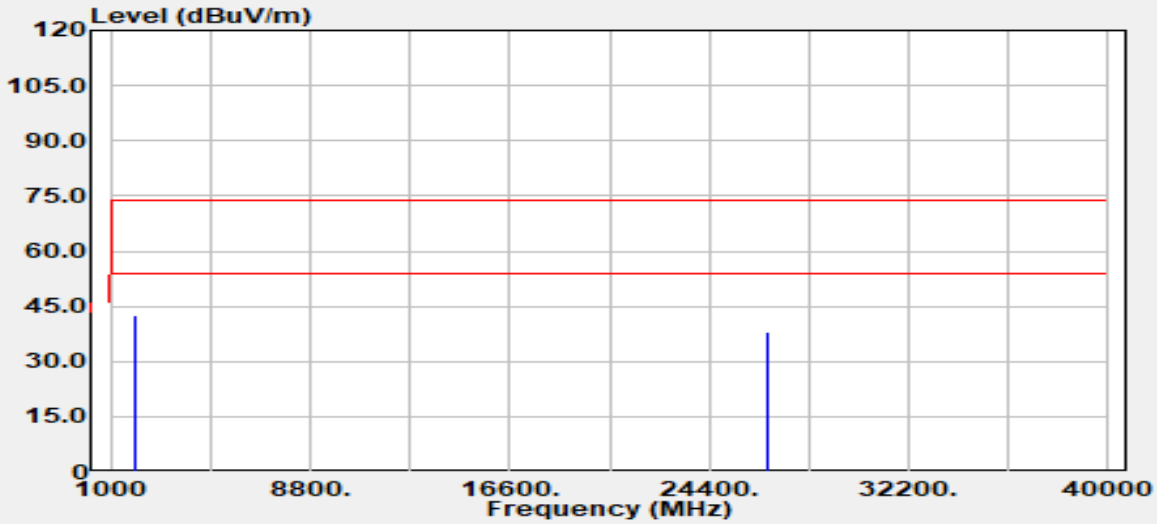
Test Mode:	TX	**Antenna Pol.:**	Vertical / Horizontal
Temperature:	24.6℃	**Tested by:**	October 12, 2024
Humidity:	57% RH	**Test Date:**	Ray Li

Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB	Ant. Pol. (H/V)
1997.00	Peak	46.86	-4.28	42.58	54.00	-11.42	V
26730.00	Peak	45.49	-7.39	38.10	54.00	-15.9	V
N/A							
12223.00	Peak	35.30	13.98	49.28	54.00	-4.72	H
26712.00	Peak	45.40	-7.38	38.02	54.00	-15.98	H
N/A							

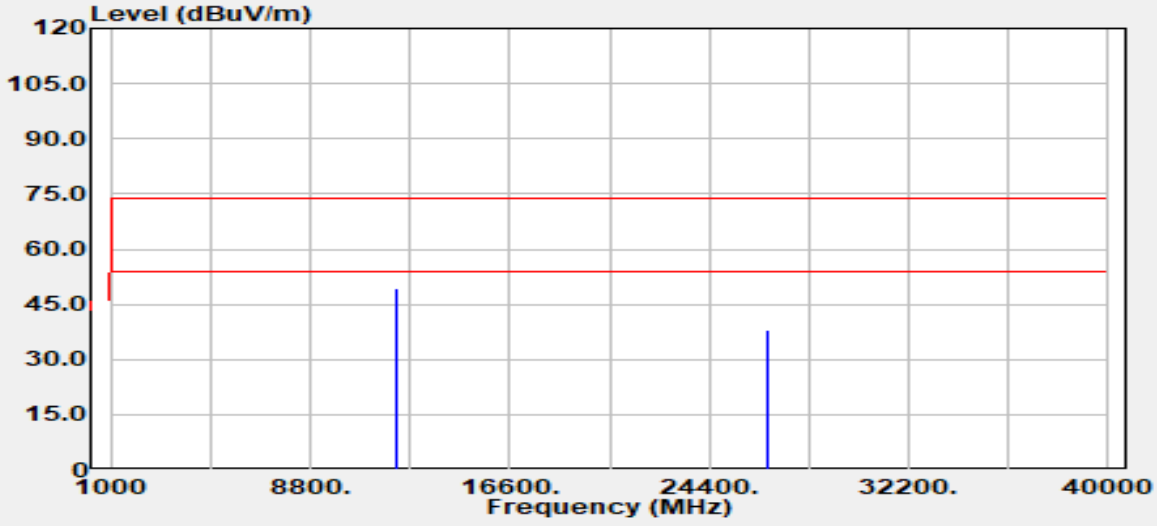
Note:

1. Actual FS (dBuV/m) = Factor + Spectrum Reading Level
2. Margin (dB) = Actual FS – Limit
3. measurement distance: 3m@1-18G、measurement distance: 1m@18-40G
4. Factor:
   Antenna factor+Cable loss -amp gain @1-18GHz
   Antenna factor+Cable loss -amp gain + distance factor [20LOG(3/1)=9.54]@18-40GHz
5. The measurement result is PK, but it also meets the RMS limit value.

Polarity: Vertical



Polarity: Horizontal



(2) SRR

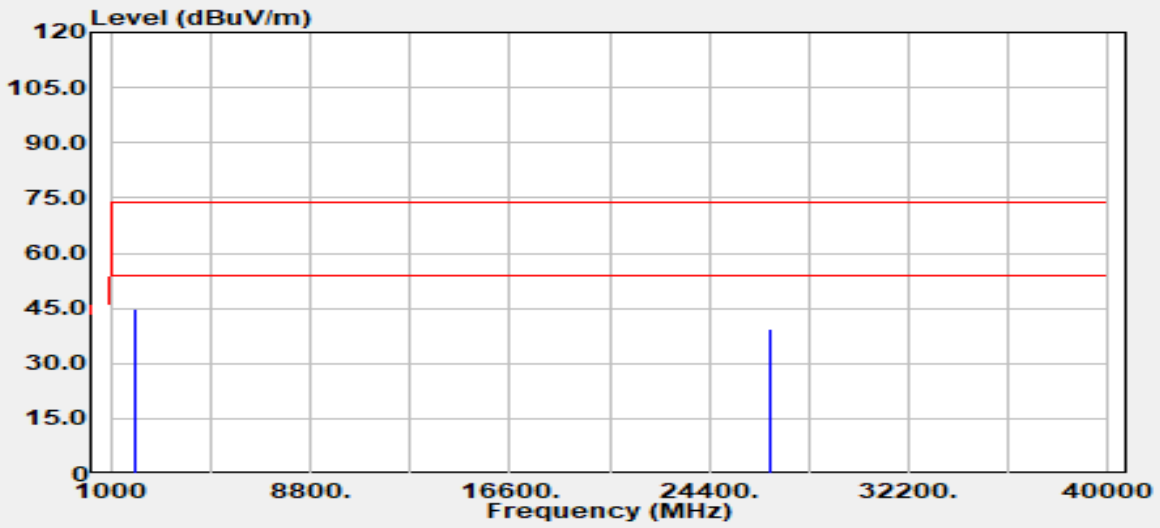
Test Mode:	TX	**Antenna Pol.:**	Vertical / Horizontal
Temperature:	24.6℃	**Tested by:**	October 10, 2024
Humidity:	57% RH	**Test Date:**	Ray Li

Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB	Ant. Pol. (H/V)
1998.00	Peak	49.07	-4.26	44.81	54.00	-9.19	V
26780.00	Peak	47.07	-7.67	39.40	54.00	-14.60	V
N/A							
11071.00	Peak	35.45	13.96	49.41	54.00	-4.59	H
26704.00	Peak	46.74	-7.37	39.37	54.00	-14.63	H
N/A							

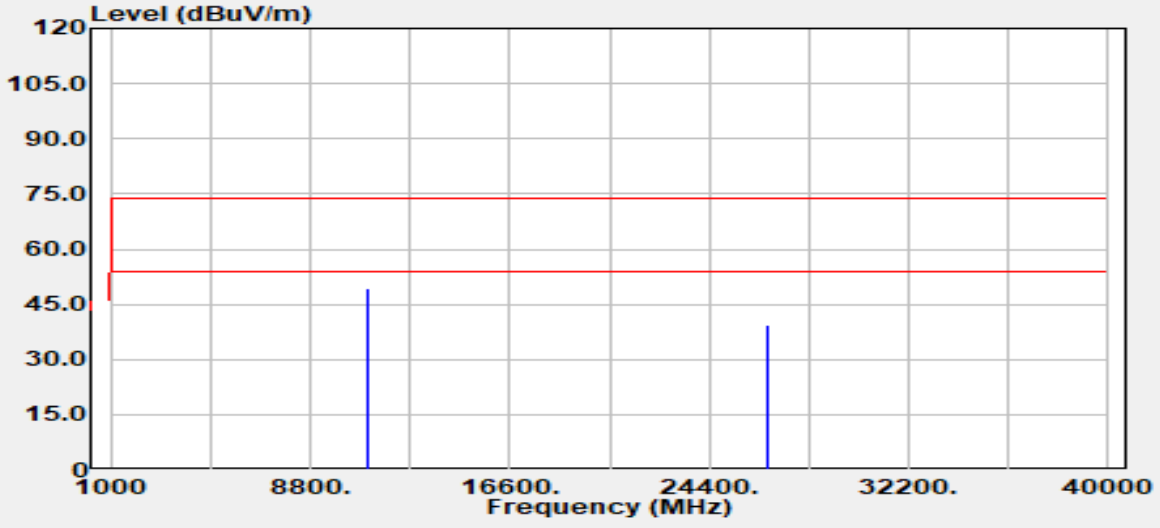
Note:

1. Actual FS (dBuV/m) = Factor + Spectrum Reading Level
2. Margin (dB) = Actual FS – Limit
3. measurement distance: 3m@1-18G、measurement distance: 1m@18-40G
4. Factor:
   Antenna factor+Cable loss -amp gain @1-18GHz
   Antenna factor+Cable loss -amp gain + distance factor [20LOG(3/1)=9.54]@18-40GHz
5. The measurement result is PK, but it also meets the RMS limit value.

Polarity: Vertical



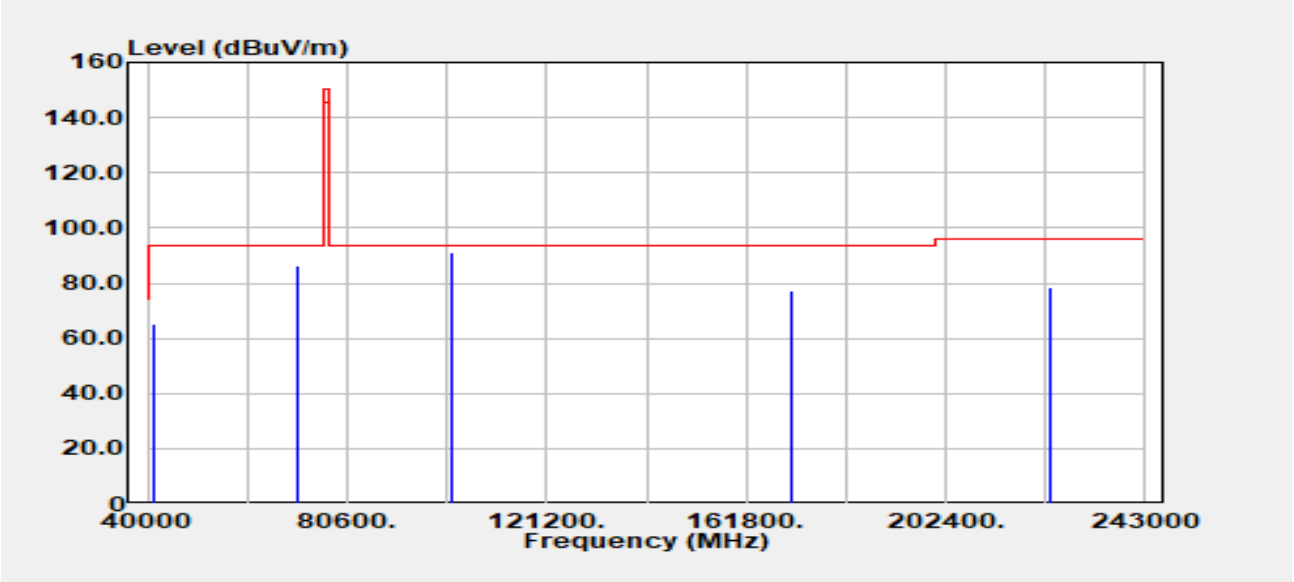
Polarity: Horizontal



40GHz~243GHz

(1) MRR

Test Mode:	TX	**Antenna Pol.:**	Vertical
Temperature:	24.6℃	**Tested by:**	October 11, 2024
Humidity:	57% RH	**Test Date:**	Ray Li



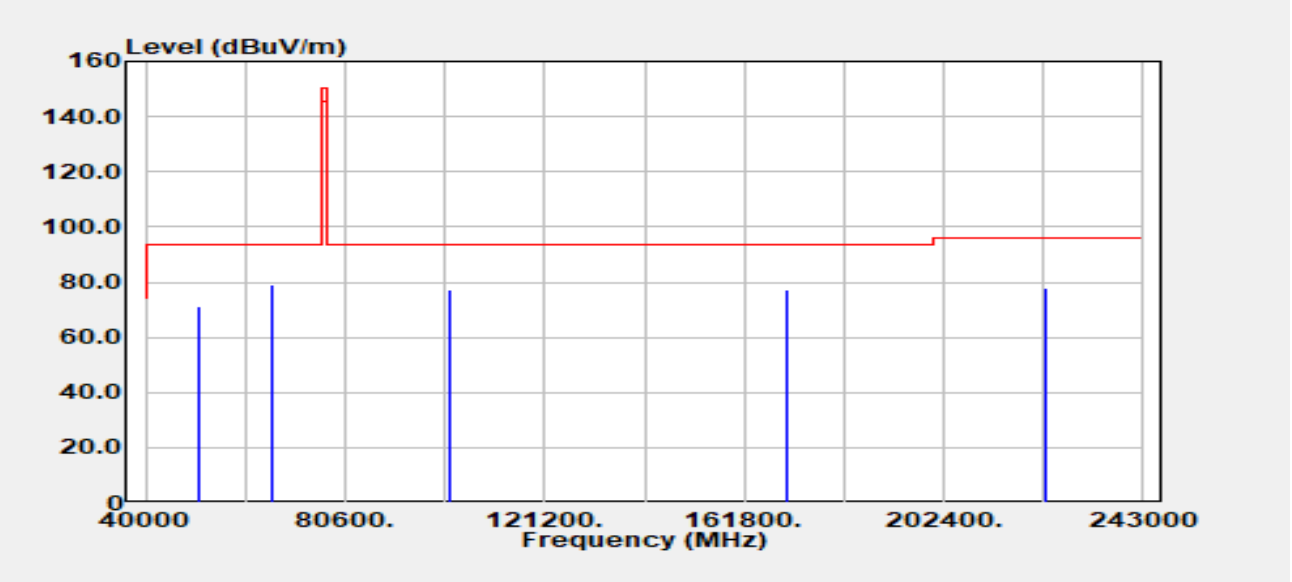
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit dBµV/m	Margin dB
41300.00	Peak	14.94	50.46	65.41	93.54	-28.13
70320.00	Peak	35.55	50.88	86.43	93.54	-7.11
101640.00	Peak	35.62	55.41	91.03	93.54	-2.51
170900.00	Peak	15.19	61.94	77.12	93.54	-16.42
223850.00	Peak	21.88	56.62	78.49	95.76	-17.27

Note:

1. Actual FS (dBuV/m) = Factor + Spectrum Reading Level
2. Margin (dB) = Actual FS – Limit
3. Factor = antenna factor+cable loss+mixer loss+ distance factor [20LOG(3/1)=9.54]
4. Measurement distance: above 40G@1m
5. After pre-scanning, the worst mode (Pol: V) is recorded in the report.

(2) SRR

Test Mode:	TX	**Antenna Pol.:**	Vertical
Temperature:	24.6℃	**Tested by:**	October 9, 2024
Humidity:	57% RH	**Test Date:**	Ray Li



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
51010.00	Peak	22.93	48.05	70.99	93.54	-22.55
65730.00	Peak	29.10	50.21	79.31	93.54	-14.23
101630.00	Peak	21.96	55.42	77.38	93.54	-16.16
170680.00	Peak	15.42	61.85	77.27	93.54	-16.27
222900.00	Peak	21.45	56.52	77.97	95.76	-17.79

Note:

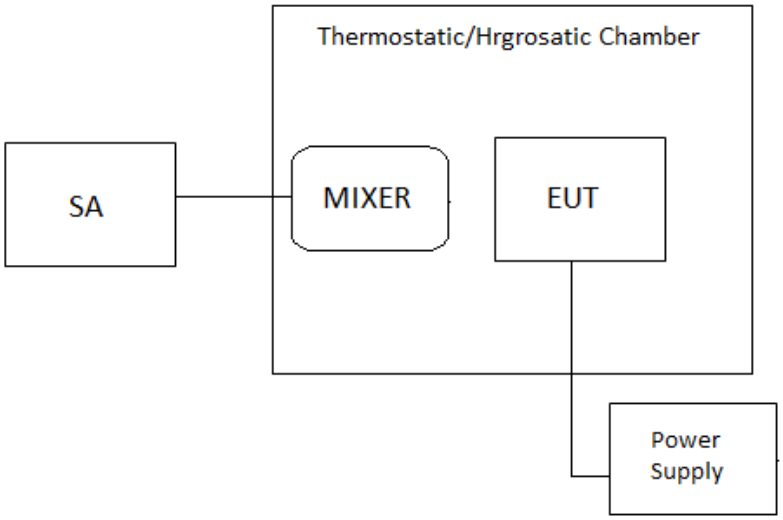
1. Actual FS (dBuV/m) = Factor + Spectrum Reading Level
2. Margin (dB) = Actual FS – Limit
3. Factor = antenna factor+cable loss+mixer loss+ distance factor [20LOG(3/1)=9.54]
4. Measurement distance: above 40G@1m
5. After pre-scanning, the worst mode (Pol: V) is recorded in the report.

8.3 FREQUENCY STABILITY

LIMIT

According to FCC 95.3379(b), Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −40 to + 85 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

Test Configuration



TEST PROCEDURE

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to –40°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +85°C reached.

TEST RESULTS

Compliance.

Temperature:	21.2 ~ 23.5℃	**Test date:**	October 15 ~ 21, 2024
Humidity:	50 ~ 59% RH	**Tested by:**	Jerry Chang

(1) MRR

Operating Frequency					
Environment Temperature(ºC)	**Voltage (V)**	**FL (GHz)**	**FH (GHz)**	**Limit Range (GHz)**	**Test Result**
85	12	76.107004694	76.337779056	76-81	Pass
80		76.105791499	76.337579118		Pass
70		76.104891126	76.337643039		Pass
60		76.103835426	76.337477701		Pass
50		76.104769671	76.338361700		Pass
40		76.104450513	76.338421742		Pass
30		76.106667265	76.339181531		Pass
20		76.103472256	76.337644651		Pass
10		76.104037135	76.338011216		Pass
0		76.104893020	76.338689773		Pass
-10		76.106101509	76.339438654		Pass
-20		76.107027027	76.339651020		Pass
-30		76.107856397	76.339759406		Pass
-40		76.108444079	76.340217064		Pass

Operating Frequency					
Environment Temperature(ºC)	**Voltage (V)**	**FL (GHz)**	**FH (GHz)**	**Limit Range (GHz)**	**Test Result**
25	13.8	76.103525336	76.337458795	76-81	Pass
	12	76.103248160	76.337699369		Pass
	10.2	76.103567566	76.337533270		Pass

Note: The extreme voltage and extreme temperature is specified by the manufacturer

(2) SRR

Operating Frequency					
Environment Temperature(ºC)	**Voltage (V)**	**FL (GHz)**	**FH (GHz)**	**Limit Range (GHz)**	**Test Result**
85	12	76.118275761	76.773894263	76-81	Pass
80		76.117749536	76.773916858		Pass
70		76.118519385	76.771285355		Pass
60		76.118766603	76.771704134		Pass
50		76.117792721	76.769830959		Pass
40		76.117171690	76.768259542		Pass
30		76.116017550	76.769664155		Pass
20		76.116658681	76.770539431		Pass
10		76.116738340	76.770068043		Pass
0		76.117753128	76.772434572		Pass
-10		76.118580370	76.772336924		Pass
-20		76.119379927	76.772919856		Pass
-30		76.119729414	76.772715059		Pass
-40		76.119016250	76.772126186		Pass

Operating Frequency					
Environment Temperature(ºC)	**Voltage (V)**	**FL (GHz)**	**FH (GHz)**	**Limit Range (GHz)**	**Test Result**
25	13.8	76.116499287	76.770642179	76-81	Pass
	12	76.116814166	76.770482875		Pass
	10.2	76.116549569	76.771315928		Pass

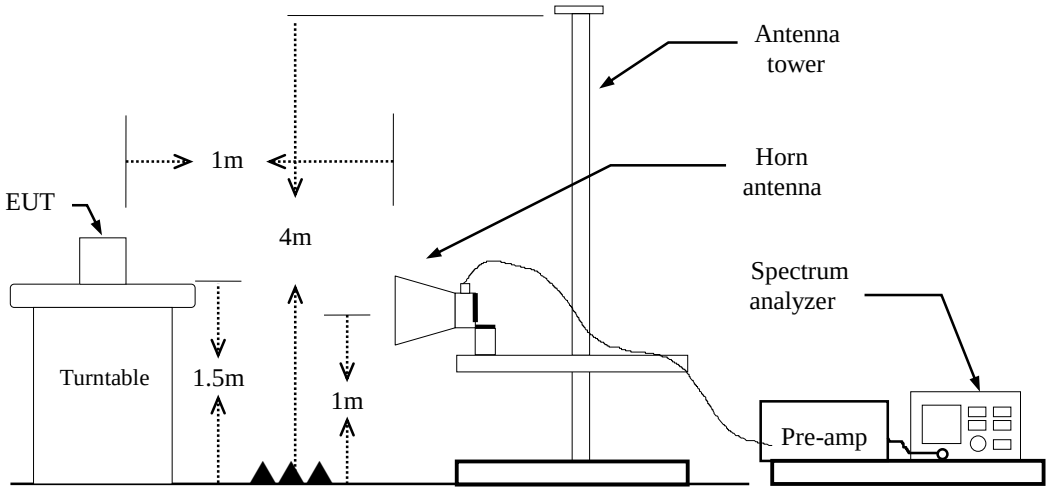
Note: The extreme voltage and extreme temperature is specified by the manufacturer

8.4 OCCUPIED BANDWIDTH (99%)

According to FCC 2.1049

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.
653005 D01 76-81 GHz Radars v01r02 clause 4 d)
The occupied bandwidth of the radar device shall be measured, reported, and shown to be fully contained within the designated 76-81 GHz frequency band under normal operating conditions as well as under those extreme ambient temperature and input voltage conditions as described in Section 2.1057.

TEST CONFIGURATION



TEST PROCEDURE

C63.26-2015, Clause 5.4.4
The OBW is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

The following procedure shall be used for measuring (99%) power bandwidth:
a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient).
b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
NOTE—Step a), step b), and step c) may require iteration to adjust within the specified tolerances.
d) Set the detection mode to peak, and the trace mode to max-hold.
e) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.
f) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

TEST RESULTS

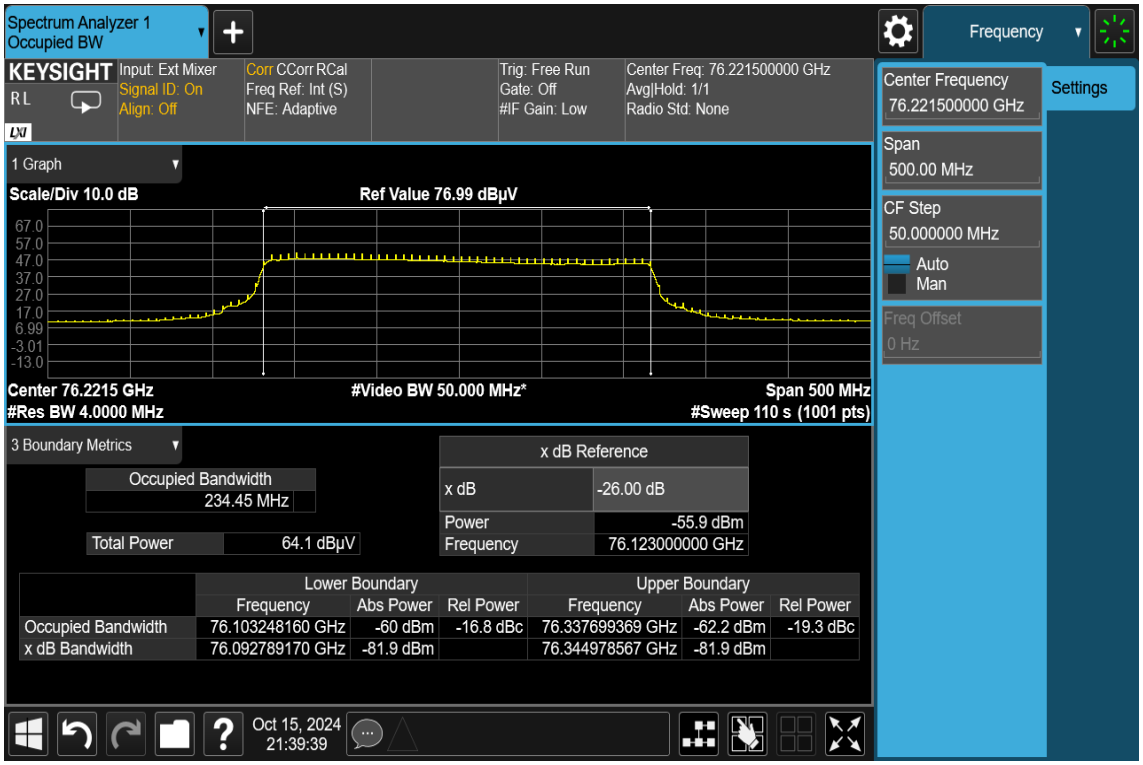
Compliance.

Temperature: 21.2 ~ 23.5℃ **Test date:** October 15 ~ 21, 2024

Humidity: 50 ~ 59% RH **Tested by:** Jerry Chang

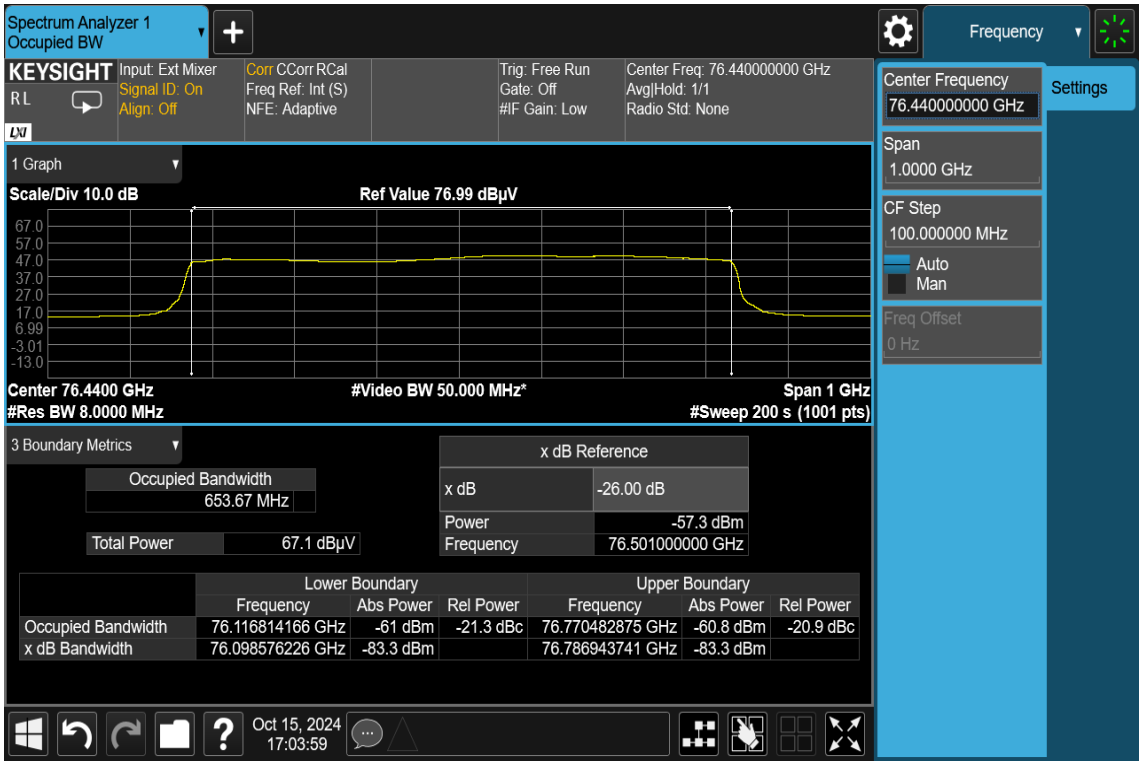
(1) MRR

Freq(GHz)		Limit Range (GHz)	OBW (MHz)	Test Result
CF	**76.22**			
FL	76.10324816	**FL ≧ 76GHz**	**234.45**	**PASS**
FH	76.33769937	**FH ≦ 81GHz**		



(2) SRR

Freq(GHz)		Limit Range (GHz)	OBW (MHz)	Test Result
CF	76.44			
FL	76.11681417	FL ≧ 76GHz	653.67	PASS
FH	76.77048288	FH ≦ 81GHz		



- End of Test Report -