CERT #5473.03

Test Report No.:
FCCSZ2024-0080-RF

RF Test Report

FCC ID	:	**2A7HDIRM231**
NAME OF SAMPLE	:	**mmWave Radar module**
APPLICANT	:	**Nanjing Chuhang Technology Co., Ltd.**
CLASSIFICATION OF TEST	:	**N/A**

CVC Testing Technology (Shenzhen) Co., Ltd.

Applicant	**Name : Nanjing Chuhang Technology Co., Ltd.** **Address : 12F, Building A, No. 9, Yunzheng Street, Nanjing, China**
Manufacturer	**Name : Nanjing Chuhang Technology Co., Ltd.** **Address : 12F, Building A, No. 9, Yunzheng Street, Nanjing, China**
Equipment Under Test	**Name : mmWave Radar module** **Model/Type: IRM2.31** **Trade mark :** **Serial NO.:N/A** **Sampe NO.:2-1**

Date of Receipt.	**2024.11.25**	Date of Testing	**2024.11.25～2024.12.02**

Test Specification	**Test Result**
47 CFR Part 95	PASS

Evaluation of Test Result	The equipment under test was found to comply with the requirements of the standards applied. Seal of CVC **Issue Date: 2024-12-02**

Compiled by:	Reviewed by:	Approved by:
Liang Jiatong	Mo Xianbiao	Dong Sanbi
Name Signature	Name Signature	Name Signature

Other Aspects: NONE.

Abbreviations:OK, Pass= passed Fail = failed N/A= not applicable EUT= equipment, sample(s) under tested

This test report relates only to the EUT, and shall not be reproduced except in full, without written approval of CVC.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
FCCSZ2024-0080-RF	Original release	2024.12.02

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 95M			
FCC STANDARD SECTION	**TEST TYPE AND LIMIT**	**RESULT**	**REMARK**
FCC 15.207	AC Power Conducted Emission	N/A	DC power supply
FCC 2.1046 FCC 95.3367 (a) (b)	RF Output Power	PASS	See section 3.2
FCC 2.1047	Modulation Characteristics	PASS	See section 3.3
FCC 2.1049 FCC 95.3379 (b)	Occupied bandwidth(99%)	PASS	See section 3.4
FCC 2.1053 FCC 95.3379 (a) (1) FCC 95.3379 (a) (2) FCC 95.3379 (a) (3)	Field Strength of Spurious Radiation	PASS	See section 3.5
FCC 2.1055 FCC 95.3379 (b)	Frequency Stability	PASS	See section 3.6

1.1 LIST OF TEST AND MEASUREMENT INSTRUMENTS

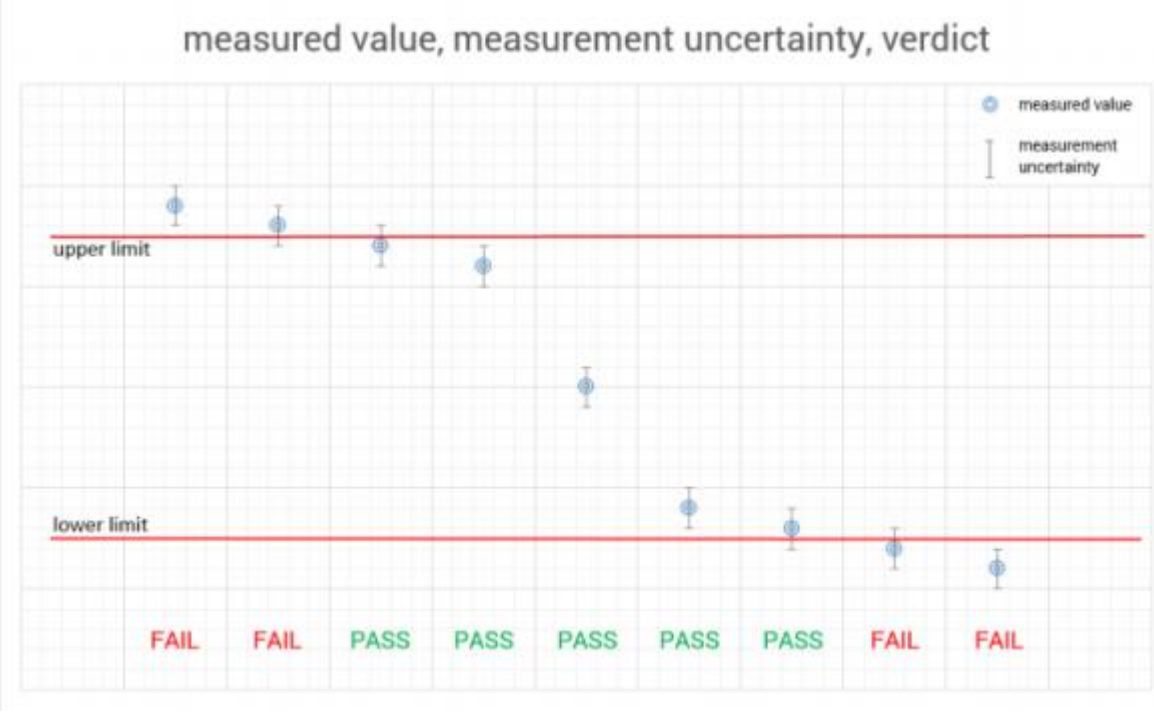
Equipment	Manufacturer	Model No.	Serial Number	Cal. interval	Cal. Due
Radiation Spurious(1GHz-40GHz)					/
Signal&Spectrum Analyzer	Rohde&Schwarz	FSV 40	101898	1 year	2025/4/28
EMI Test Receiver	Rohde&Schwarz	ESR3	102693	1 year	2025/4/28
Antenna(30MHz~1001MHz)	SCHWARZBECK	VULB 9168	1133	1 year	2025/2/20
Horn antenna(1GHz-18GHz)	ETS	3117	227611	1 year	2025/2/04
Horn antenna(18GHz-40GHz)	QMS	QMS-00880	22051	1 year	2025/3/24
3m anechoic chamber	MORI	966	CS0300011	3 year	2026/5/18
Filter group(RSE-BT/WiFi)	Rohde&Schwarz	WiFi /BT Variant 1	100820	1 year	2025/4/28
Filter group(RSE-Cellular)	Rohde&Schwarz	Cellular Variant 1	100768	1 year	2025/4/28
Preamplifier(10kHz-1GHz)	Rohde&Schwarz	SCU-01F	100299	1 year	2025/4/28
Preamplifier(1GHz-18GHz)	Rohde&Schwarz	SCU-18F	100799	1 year	2025/4/28
Preamplifier(1GHz-18GHz)	Rohde&Schwarz	SCU-18F	100801	1 year	2025/4/28
Preamplifier(18GHz-40GHz)	Rohde&Schwarz	SCU-40A	101209	1 year	2025/4/28
Temperature and humidity meter	/	C193561517	C193561517	1 year	2025/4/27
Radiation Spurious(Below 1GHz)					/
EMI Test Receiver	Rohde&Schwarz	ESR 26	101718	1 year	2025.5.24
Loop antenna（8.3k~30MHz）	Rohde&Schwarz	HFH2-Z2E	100951	1 year	2025.6.03
Antenna(30MHz~1000MHz)	SCHWARZBECK	VULB 9168	01132	1 year	2025.4.25
Horn antenna(1GHz-18GHz)	ETS	3117	227634	1 year	2025.3.24
Horn antenna(18GHz-40GHz)	SCHWARZBECK	BBHA 9170	01003	1 year	2025.3.25
3m anechoic chamber	MORI	966	CS0200019	3 year	2026.5.18
Preamplifier(1GHz-18GHz)	Tonscend	TAP-051845	AP22G806257	1 year	2025.4.28
Attenuator	/	SJ-5dB	607684	1 year	2025.2.21
#1 control room	MORI	433	CS0300028	3 year	2026.5.16
Temperature and humidity meter	UNI-T	A10T	C193561473	1 year	2025.4.27
Radiation Spurious(Above 40GHz)					/
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. interval**	**Cal. Due**
3m anechoic chamber	MORI	966	CS0300011	3 year	2026.5.18
Temperature and humidity meter	/	C193561517	C193561517	1 year	2025.5.21
Signal&Spectrum Analyzer	keysight	N9040B	CS0300074	1 year	2025.7.02
SA Expansion Module(40-60GHz)	VDI	N9029AV19	CS0300075	3 year	2025.9.14
SA Expansion Module(60-90GHz)	VDI	N9029AV12	CS0300076	3 year	2025.9.14
SA Expansion Module(90-140GHz)	VDI	N9029AV08	CS0300077	3 year	2025.9.14
SA Expansion Module(140-220GHz)	VDI	N9029AV05	CS0300078	3 year	2025.9.14
SA Expansion Module(220-330GHz)	VDI	N9029AV03	CS0300079	3 year	2025.9.14
Horn antenna(40-60GHz)	CMI	HO19R	CS0300086	3 year	2025.9.14
Horn antenna(60-90GHz)	CMI	HO12R	CS0300088	3 year	2025.9.14
Horn antenna(90-140GHz)	CMI	HO08R	CS0300090	3 year	2025.9.14
Horn antenna(140-220GHz)	CMI	HO05R	CS0300092	3 year	2025.9.14
Horn antenna(220-330GHz)	CMI	HO03R	CS0300094	3 year	2025.9.14

1.2 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 Uncertainty		
No.	**Item**	**Measurement Uncertainty**
1	Occupied Channel Bandwidth	±1.86%
	Radiated Emission (9kHz-30MHz)	±5.6 dB
2	Radiated Emissions(30MHz-1GHz)	±5.0dB
3	Radiated Emissions(1GHz-18GHz)	±4.8dB
4	Radiated Emissions(18GHz-40GHz)	±5.1dB
5	Radiated Emissions(40GHz-60GHz)	±4.8dB
6	Radiated Emissions(60GHz-90GHz)	±4.8dB
7	Radiated Emissions(90GHz-140GHz)	±5.0dB
8	Radiated Emissions(140GHz-220GHz)	±5.1dB
9	Radiated Emissions(220GHz-300GHz)	±4.8dB
10	Temperature	±0.73°C
11	Supply voltages	±0.37 %
12	Humidity	±3.9 %
Remark: 95% Confidence Levels, k=2.		

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed.
The measurement uncertainty is mentioned in this test report, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong.



1.3 TEST LOCATION

The tests and measurements refer to this report were performed by EMC testing Lab of CVC Testing Technology (Shenzhen) Co., Ltd.

Lab Address: No. 1301-14&16, Guanguang Road, Xinlan Community, Guanlan Subdistrict, Longhua District, Shenzhen, Guangdong, China
Post Code：518110 Tel：0755-23763060-8805
Fax：0755-23763060 E-mail：sz-kf@cvc.org.cn
FCC(Test firm designation number：CN1363)
IC(Test firm CAB identifier number：CN0137)
CNAS(Test firm designation number：L16091

2 GENERAL INFORMATION

2.1 GENERAL PRODUCT INFORMATION

PRODUCT	mmWave Radar module
BRAND	CHUHANG TECH
TEST MODEL	IRM2.31
ADDITIONAL MODEL	N/A
POWER SUPPLY	DC 9~16V
MODULATIONTECHNOLOGY	FMCW
FREQUENCY RANGE	76~77GHz
PEAK OUTPUT POWER	28.35dBm
ANTENNA TYPE(Note 3)	Array patch antenna: 15dBi
I/O PORTS	Refer to user’s manual
CABLE SUPPLIED	N/A

Note:

1. For more detailed features description, please refer to the manufacturer’s specifications or the User's Manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
3. Since the above data and/or information is provided by the client, CVC is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.

2.2 TEST MODE

MODE	DESCRIPTION	ANTENNA	TEST ITEM
TM 1	FMCW	Array Antenna	ALL

2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product, according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

FCC PART 95, Subpart M
ANSI C63.10-2020
TCBC Workshop(2023.10.25) Part 15.255 Rules Amendment
Keysight Application Note 5952-1039

All test items have been performed and recorded as per the above standards.

2.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Support Equipment					
NO	**Description**	**Brand**	**Model No.**	**Serial Number**	**Supplied by**
1	Laptop	Lenovo	K4e-ARE120	MP20kshe	Lab

Support Cable							
NO	**Description**	**Quantity (Number)**	**Length (cm)**	**Detachable (Yes/ No)**	**Shielded (Yes/ No)**	**Cores (Number)**	**Supplied by**

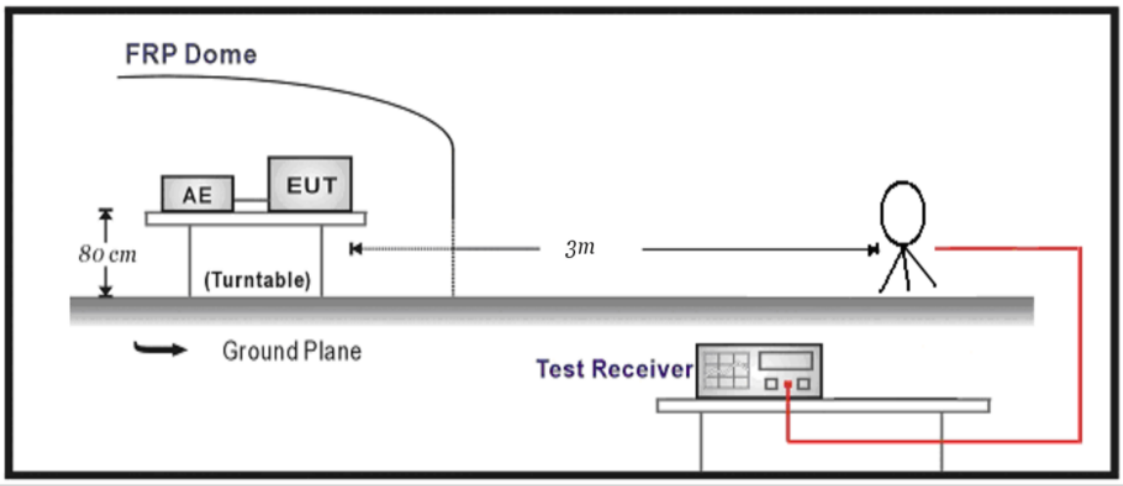
2.5 FAR FIELD CONDITION FOR FREQUENCY ABOVE 18GHZ

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.

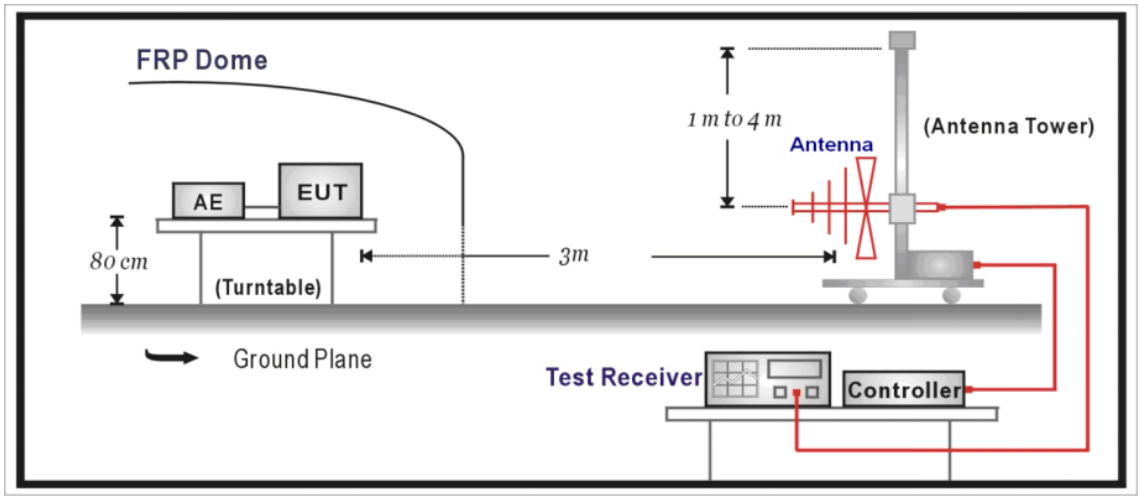
HornAntenna	Frequency (GHz)	Antenna Dimension A(m)	Wavelength (λ)(m)	Far field $R(m)>=2D^2/\lambda$	Measurement Distance(D)(m)
QMS-00880	18	0.08	0.0167	0.77	3
	40	0.08	0.0075	1.71	
HO19R	40	0.046	0.0075	0.56	1
	60	0.046	0.005	0.85	
HO12R	60	0.03	0.005	0.36	1
	90	0.03	0.0033	0.55	
HO8R	90	0.019	0.0033	0.22	1
	140	0.019	0.0021	0.34	
HO5R	140	0.012	0.0021	0.14	1
	220	0.012	0.0014	0.21	
HO3R	220	0.008	0.0014	0.09	1
	330	0.008	0.0009	0.14	

2.6 RADIATED TEST SETUP

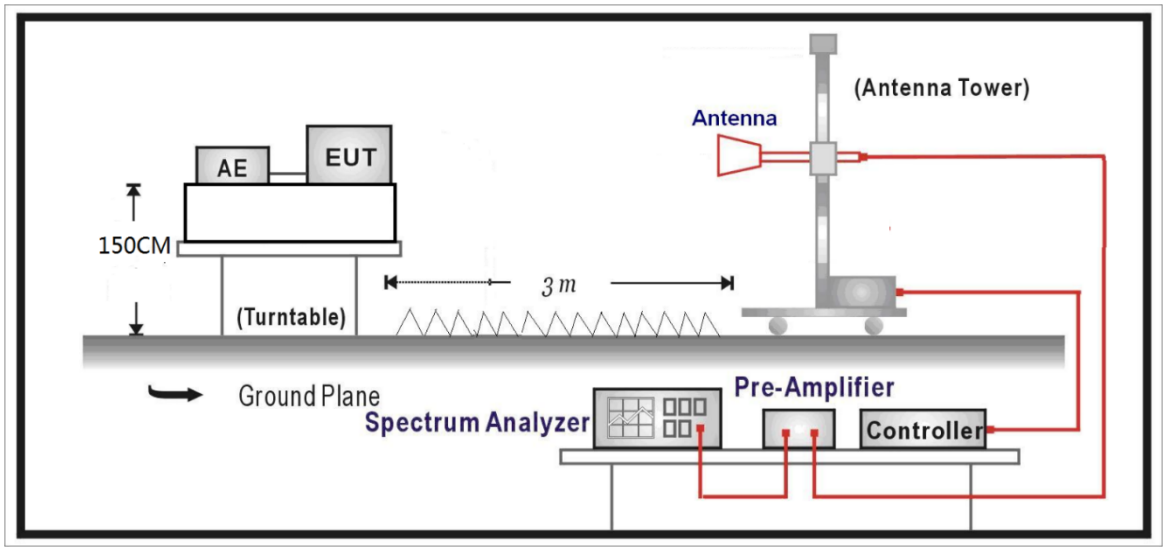
Below 30MHz Test Setup:



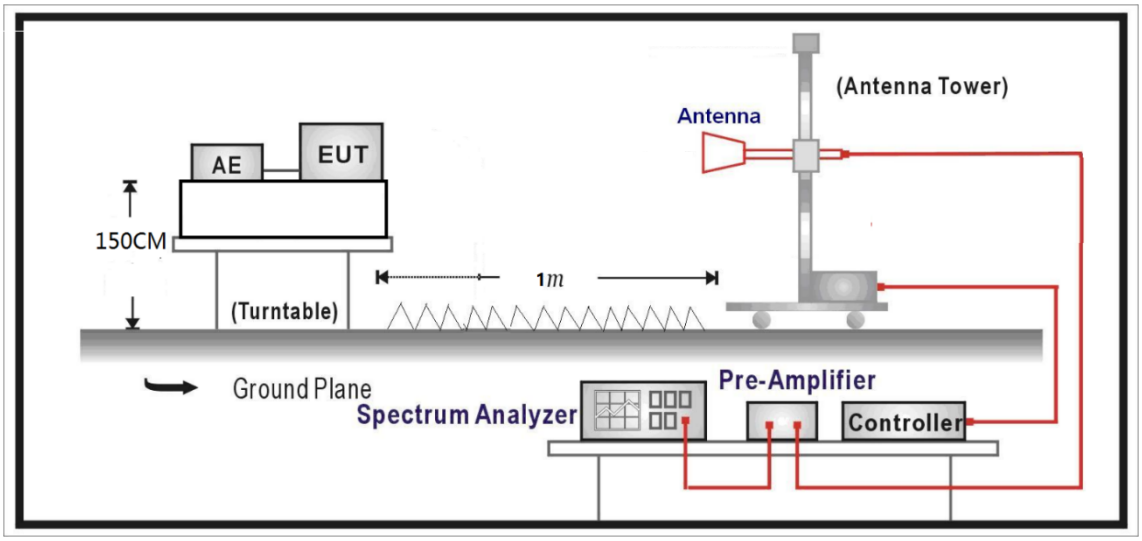
30MHz-1GHz Test Setup:



1GHz -40GHz Test Setup:



Above 40GHz Test Setup:



3 TEST TYPES AND RESULTS

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 Limit

Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50
NOTE: 1. The lower limit shall apply at the transition frequencies. NOTE: 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.		

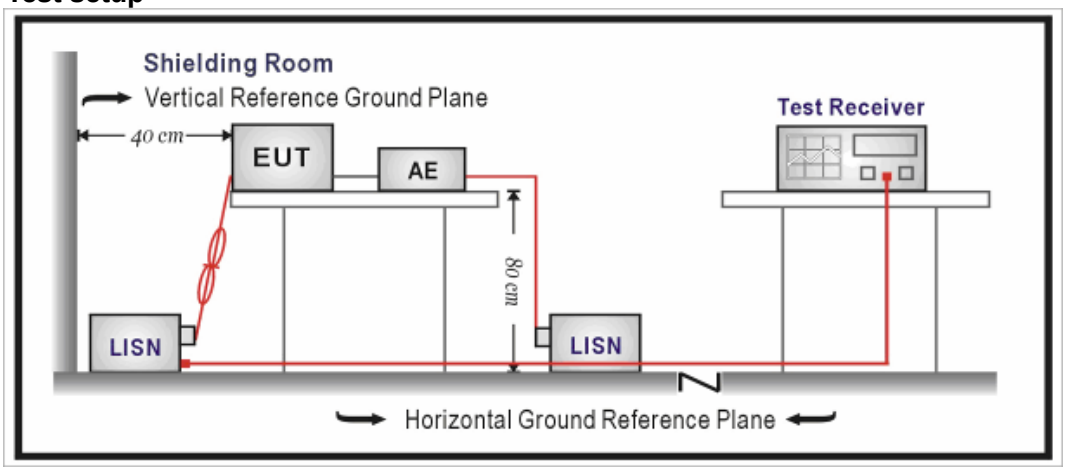
3.1.2 Measurement procedure

a. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the Test photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.The equipment under test shall be placed on a support of non-metallic material, the height of which shall be1.5m above the ground,

b. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.

c. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

3.1.3 Test setup



3.1.4 Test results

N/A, DC power supply

3.2 EIRP POWER MEASUREMENT

3.2.1 Limits

According to § 95.3367: 71–81 GHz Band Radar Service Radiated Power Limits

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:
(a) 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).
(b) 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.

According to § 2.1046: Measurements required: RF Power Output

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033 (c) (8). The electrical characteristics of the radio frequency load attached to the output terminals.

Frequency band of Operation	Average emission limit (EIRP in dBm measured in 1 MHz)	Peak emission limit (EIRP in dBm measured in 1MHz)
77 to 81GHz	50dBm	55dBm

3.2.2 Measurement procedure

PEAK Power Test Method

1. Radiated power measurements are performed using the signal analyzer's swept mode measurement capability for signals with continuous operation.
2. RBW = 1MHz
3. VBW ≥ 3 x RBW
4. Span as required, enough to observe the fundamental
5. No. of sweep points ≥ 2 x span / RBW
6. Detector and Trace mode = Suitable for peak and average measurements respectively over 100 sweeps
7. The trace was allowed to stabilize

Method of measurement:

Refer as TCBC Workshop(2023.10.25) Part 15.255 Rules Amendment

FMCW desensitization factor:

Desensitization factor and sweep time considerations for measurements of FMCW signals in ANSI C63.10-2020 Annex L

The derivation of the FMCW desensitization factor is given in Keysight Application Note 5952-1039 Appendix B.

RMS detector, channel power Test Method

A spectrum analyser with the following settings is used as measuring receiver in the test setup:
Start frequency: lower than the lower edge of the operating frequency range.
Stop frequency: higher than the upper edge of the operating frequency range.
Resolution bandwidth: 1 MHz
Video bandwidfh: 3 MHz
Detector mode: RMS
Display mode: clear write
Averaging time: averaging time x number of sweep points
Channel Power Function needs to be used to calculate the average power. Boundaries for the calculation needs to be defined. This is typically the operating frequency range.

3.2.3 Test setup

See section 2.5 of this report.

3.2.4 Test results

According to the manufacturer’s declaration, the parameter of the FMCW modulation as below:

Test Mode	Sweep time (T_S) (us)	Sweep width(F_S) (MHz)	3 dB IF bandwidth (MHz)	Cycle time (ms)
TM1	49.04	326.39	10	149.7

PK POWER

Test Mode	Power (dBm)	Desensitization factor(dB)	Peak EIRP (dBm)	Peak EIRP Limit(dBm)	Marin (dB)	Verdict
TM1	28.35	0	28.35	55	26.65	PASS

Remark:

1. Peak EIRP = Power +desensitization factor

2. FMCW desensitization factor =-20 * Log(α)

where

$$\alpha = \frac{1}{\sqrt[4]{1+\left(\frac{2\ln(2)}{\pi}\right)^2\left(\frac{F_s}{T_s B^2}\right)^2}}$$

Remark:

1. $T_D = T_S/F_S$

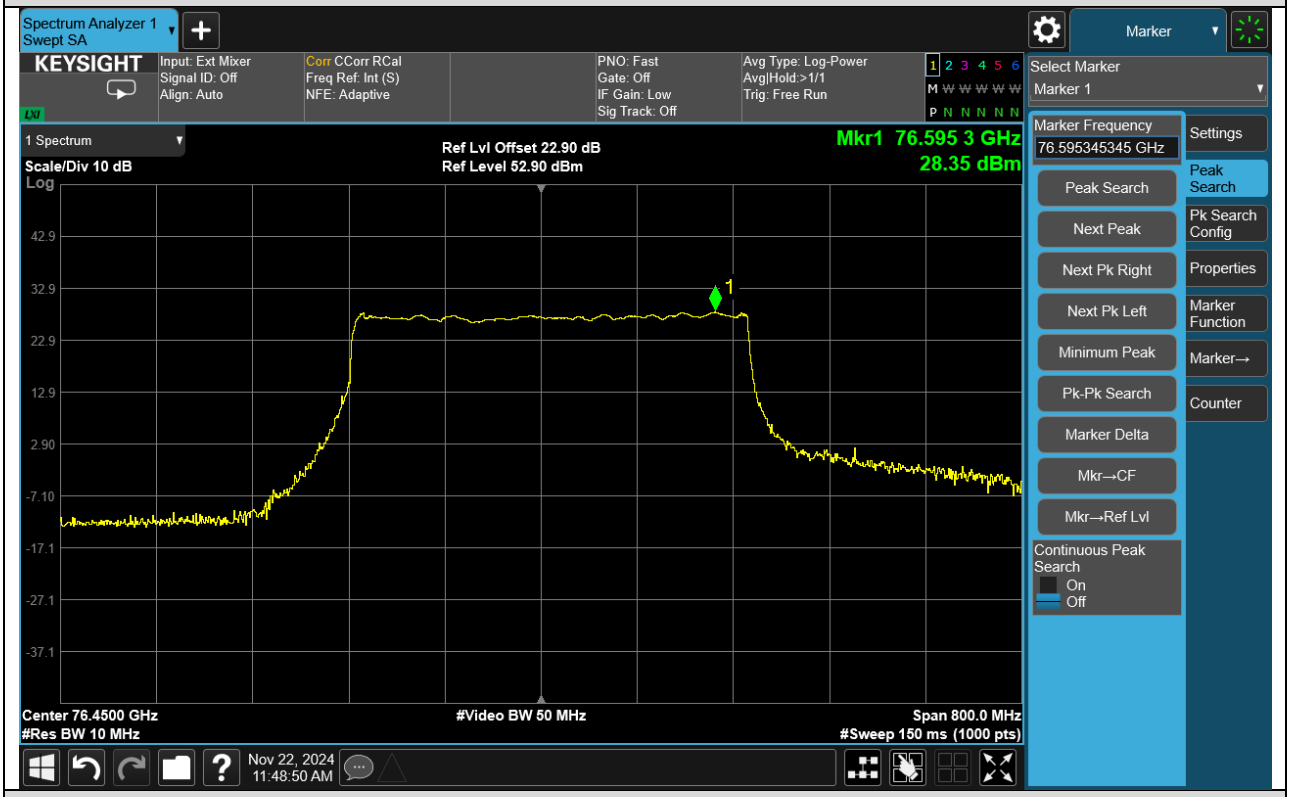
2. B is 3 dB IF bandwidth

3. Average factor = 10*log[(T_D) / cycle time]

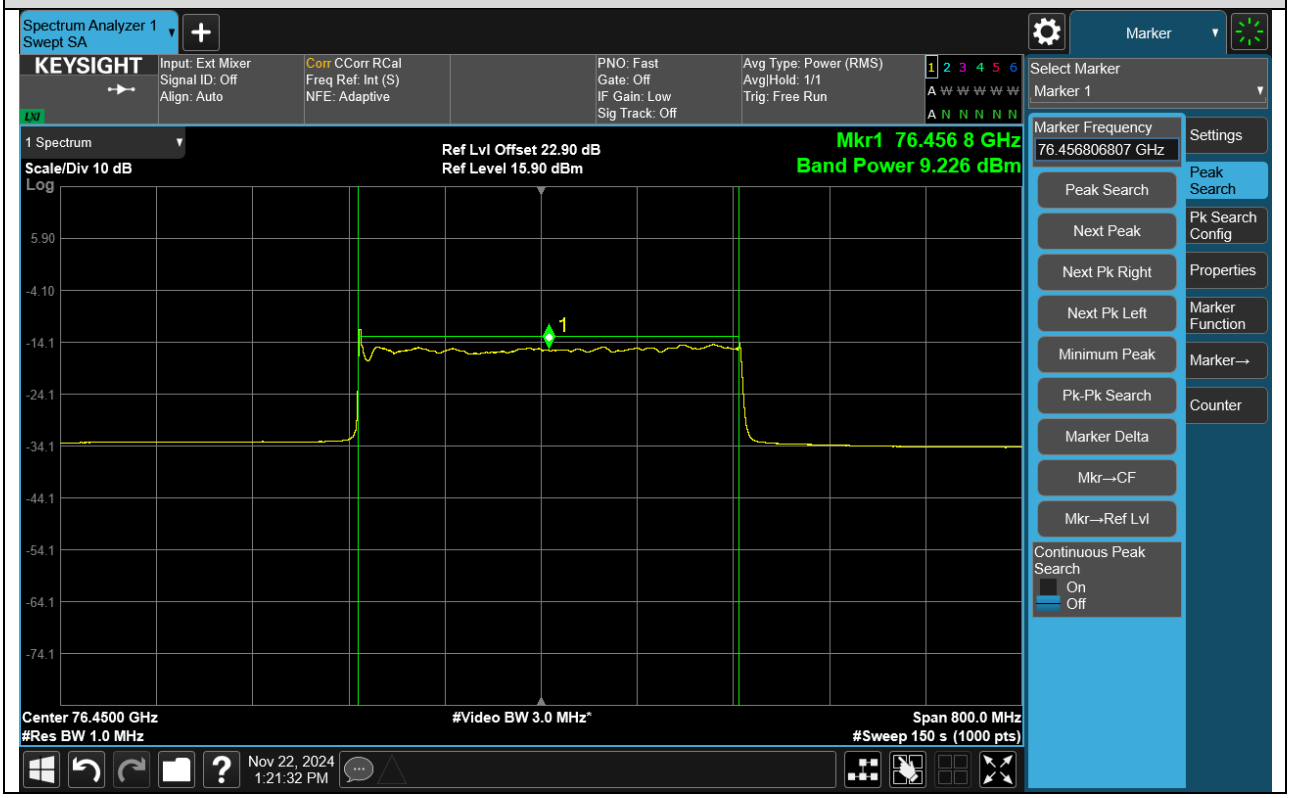
AV POWER

Test Mode	RMS detector, channel power (dBm)	AV EIRP Limit (dBm)	Marin (dB)	Verdict
TM1	9.226	50	41.083	PASS

Peak EIRP-TM1



RMS detector, channel power-TM1



3.3 MODULATION CHARACTERISTICS

3.3.1 LIMITS

According to § 2.1047 Modulation Characteristics

Start and stop frequency was measured for all operating modes and all frequency bands with nominal conditions. Wave form and sweep characteristics were supplied by applicant

According to KDB 653005 D01 76 – 81 GHz Radars v01r02, 3.g

Concerning the Section 2.1047 modulation characteristics requirement, the following information should be provided:
1) Pulsed radar: pulse width and pulse repletion frequency (if PRF is variable, then report maximum and minimum values).
2) Non-pulsed radar (e.g., FMCW): modulation type (i.e., sawtooth, sinusoid, triangle, or square wave) and sweep characteristics (sweep bandwidth, sweep rate, sweep time).

3.3.2 VERDICT

The EUT meets §2.1047 Modulation Characteristics requirement as declared by the applicant (applicant provide technical documents).

3.4 BANDWIDTH MEASUREMENT

3.4.1 Limits

According to §95.3379 (b):

Fundamental emission (i.e. 99% emission bandwidth) must be contained within the frequency bands specfied in this section during all conditions of operation.

According to §2.1049

Measurements required: Occupied bandwidth: The occupied bandwdith, 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.

3.4.2 Measurement procedure

99% OCCUPIED BANDWIDTH MEASUREMENT PARAMETER	
Detector:	Peak
Resolution bandwidth:	8 MHz (The analyzer limits maximum RBW at 8 MHz.)
Video bandwidth:	50 MHz
Trace-Mode:	Max Hold
Sweep	Auto couple.

Measurement procedures:Bandwidth: ANSI C63.10-2020 6.9 / 9.3
Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower)

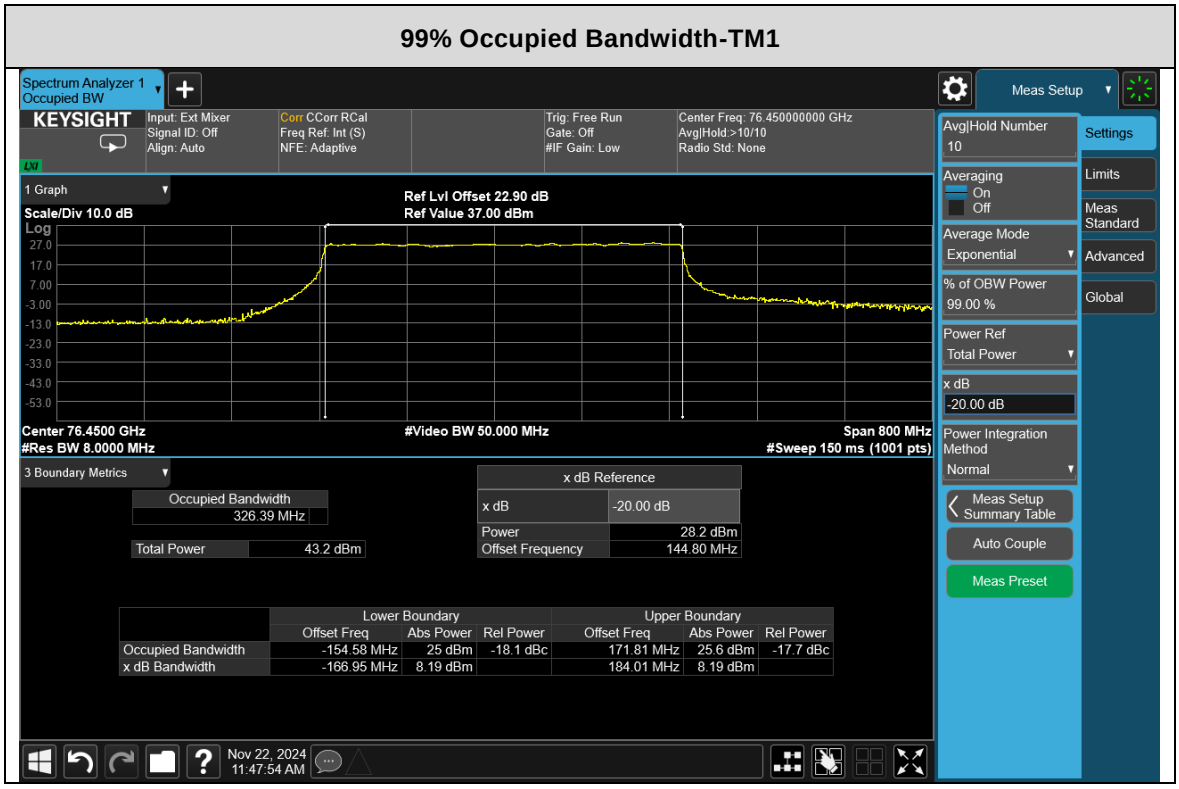
3.4.3 Test setup

See section 2.5 of this report.

3.4.4 Test results

Test Mode	99% Bandwidth Lower(GHz)	99% Bandwidth Upper(GHz)	Lower limit (GHz)	Upper limit (GHz)	99% Occupied Bandwidth (MHz)	Verdict
TM1	76.12361	76.62181	76	81	326.39	PASS

99% Occupied Bandwidth-TM1



3.5 TRANSMITTER SPURIOUS EMISSIONS MEASUREMENT

3.5.1 Limit

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

FREQUENCIES (MHz)	FIELD STRENGTH (Microvolts/Meter)	MEASUREMENT DISTANCE (Meters)
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
NOTE: 1. The lower limit shall apply at the transition frequencies. NOTE: 2. Emission level (dBuV/m) = 20 log Emission level (uV/m). NOTE: 3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.		

The power density of radiated emissions outside the 76-81 GHz band above 40.0 GHz shall not exceed the following, based on measurements employing an average detector with a 1 MHz RBW:

(i) 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/cm2 at a distance of 3 meters from the exterior surface of the radiating structure.
(ii) For radiated emissions above 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 1000 pW/cm2 at a distance of 3 meters from the exterior surface of the radiating structure.

FCC Frequency [GHz]	FCC EIRP [dBm]	ISED Frequency [GHz]	ISED EIRP [dBm]
40 - 200	600 pW/cm^2 ~ -1.7	40 - 162	-30
200 - 240	1000 pW/cm^2 ~ 0.5	73.5 - 76	0
Limit conversion (pW/cm^2 to dBm):	$P[dBm]=10*\log(4*pi*d^2*P[W/m^2])$ d- distance of the limit defined in W/m^2. Here: 3 m. --- 600 pW/cm^2: $P[dBW]= 10*\log(4*pi*(3m)^2*6*10^{-6}W/m^2)$ 600 pW/cm^2: P[dBW]= -31.7 dBW P[dBm] = P[dBW] + 30 600 pW/cm^2: P[dBm]= -31.7 dBW + 30 600 pW/cm^2: P[dBm]= -1.7 dBm --- 1000 pW/cm^2: $P[dBW]= 10*\log(4*pi*(3m)^2*1*10^{-5}W/m^2)$ 1000 pW/cm^2: P[dBW]= -29.5 dBW P[dBm] = P[dBW] + 30 1000 pW/cm^2: P[dBm]= -29.5 dBW + 30 1000 pW/cm^2: P[dBm]= +0.5 dBm		

3.5.2 Measurement procedure

Measurement of harmonic and spurious emissions below 40 GHz

a. The EUT was placed on the top of a rotating table 1.5 meters(above 1GHz) and 0.8 meters(below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. For below 1GHz was used bilog antenna, and above 1GHz was used horn antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.
g. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ⩾ 1/T (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file test setup photo.

Measurement of harmonic and spurious emissions above 40 GHz

a. Connect the test antenna covering the appropriate frequency range to a spectrum analyzer via an external mixer.
b. Set spectrum analyzer RBW = 1MHz, VBW = 3MHz, peak/average detector.
c. Maximize all observed emissions. Note the maximum power indicated on the spectrum analyzer. Adjust this reading, if necessary, by the conversion loss of the external mixer used at the frequency under investigation and the external mixer IF cable loss.
d. Calculate the maximum field strength of the emission at the measurement distance
e. Calculate the power density at the distance specified by the limit from the field strength at the distance specified by the limit
f. Repeat the preceding sequence for every emission observed in the frequency band under investigation.

3.5.3 Test setup

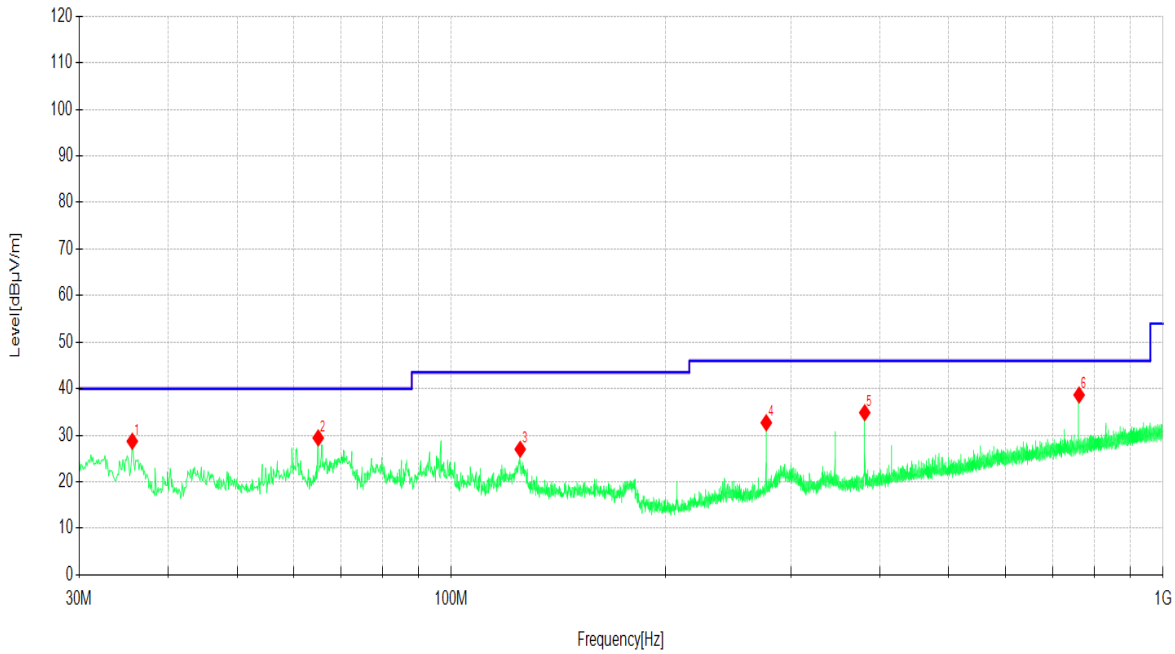
See section 2.5 of this report.

3.5.4 Test results(9kHz-30MHz)

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

3.5.5 Test results(30MHz-1GHz)-SHOWING THE HIGHEST VALUE, "WORST CASE"

Radiated Emission, 30MHz to 1GHz, Horizontal / Vertical Polarization



NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Polarity
1	35.63	9.23	19.48	28.71	40.00	11.29	PK	Vertical
2	65.02	11.61	17.82	29.43	40.00	10.57	PK	Vertical
3	124.97	7.88	19.12	27.00	43.50	16.50	PK	Vertical
4	277.08	13.23	19.46	32.69	46.00	13.31	PK	Vertical
5	380.98	12.70	22.15	34.85	46.00	11.15	PK	Vertical
6	762.23	9.39	29.26	38.65	46.00	7.35	PK	Vertical

Remark: 1. Level (dBuV/m) = Reading (dBuV) + Factor (dB/m).
2. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]

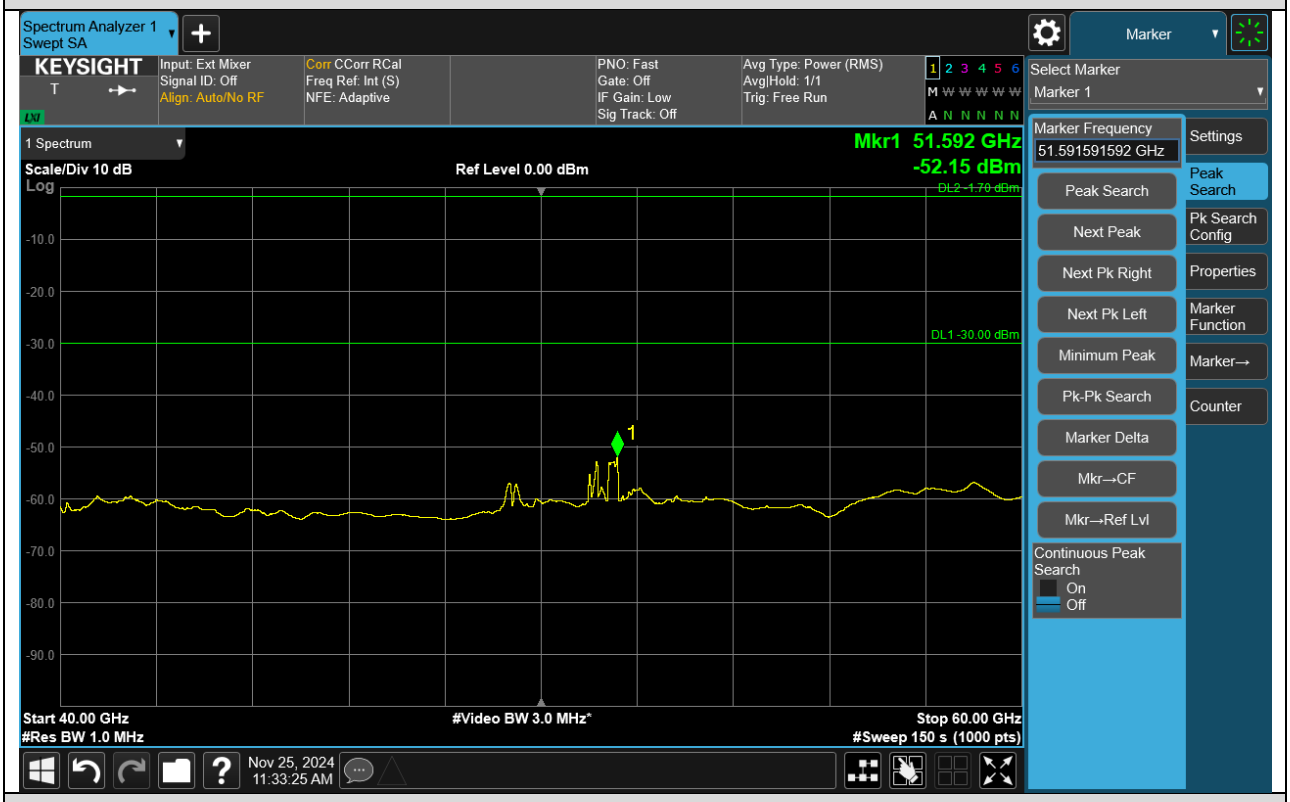
3.5.6 Test results(1GHz-40GHz)- SHOWING THE HIGHEST VALUE, “WORST CASE”

Radiated Emission, 1GHz to 40 GHz, Horizontal / Vertical Polarization								
NO.	Freq.	Reading	Factor	Level	Limit	Margin	Detector	Polarity
1	1316.06	48.33	1.28	49.61	74.00	24.39	PK	Vertical
2	1316.06	41.46	1.28	42.74	54.00	11.26	AV	Vertical
3	3030.38	45.06	9.46	54.52	74.00	19.48	PK	Vertical
4	3072.39	35.02	9.65	44.67	54.00	9.33	AV	Vertical
5	7993.72	25.25	9.83	35.08	54.00	18.92	AV	Vertical
6	8250.16	34.34	9.42	43.76	74.00	30.24	PK	Vertical
1	19097.91	59.66	-5.59	54.07	74.00	19.93	PK	Vertical
2	19097.91	49.46	-5.59	43.87	54.00	10.13	AV	Vertical
3	25058.31	53.35	-4.35	49.00	74.00	25.00	PK	Vertical
4	25617.16	44.69	-3.91	40.78	54.00	13.22	AV	Vertical
5	33918.59	54.38	-0.79	53.59	74.00	20.41	PK	Vertical
6	34325.63	47.76	-0.88	46.88	54.00	7.12	AV	Vertical

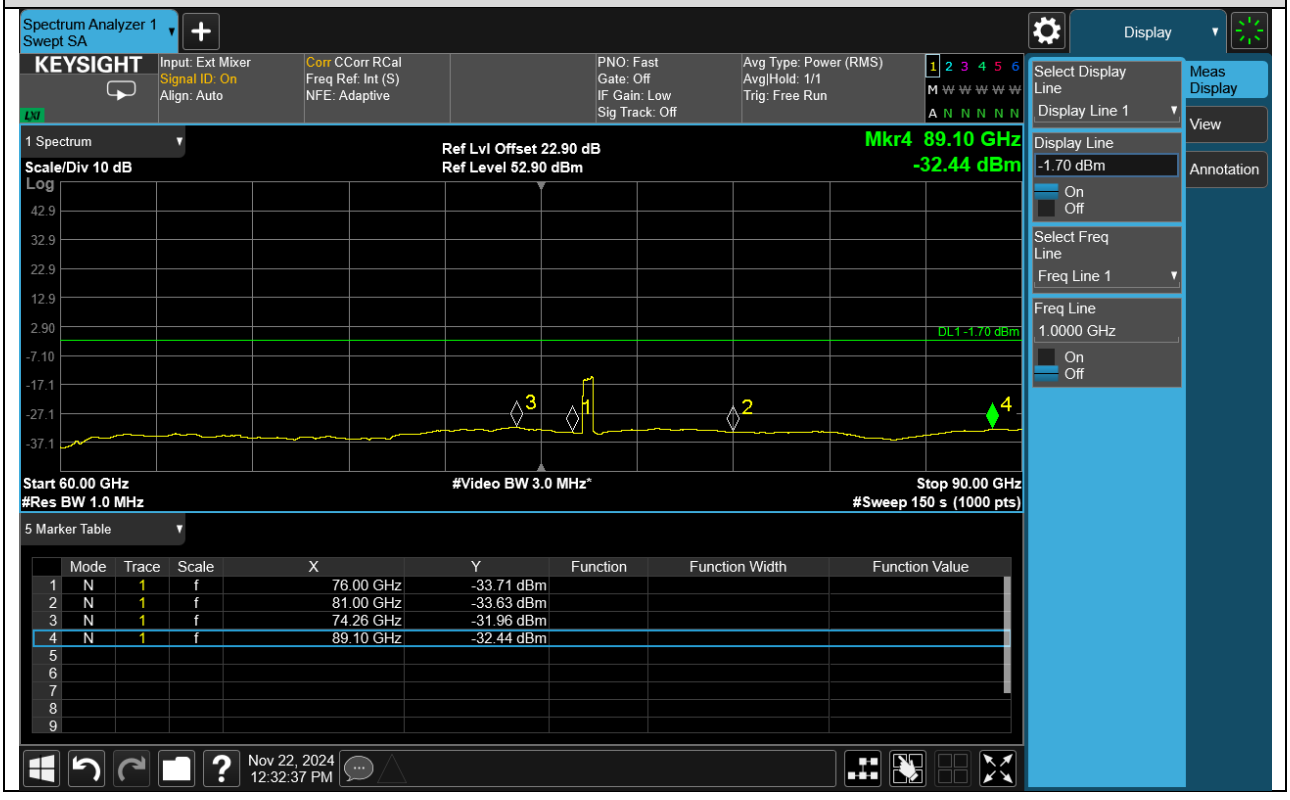
Remark:1. The emission levels of other frequencies were greater than 20dB margin.
2. Level (dBuV/m) = Reading (dBuV) + Factor (dB/m).
3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
4. Margin(dB) = Limit(dBuV/m) - Level (dBuV/m)

3.5.7 Test results(40GHz-240GHz)-SHOWING THE HIGHEST VALUE, "WORST CASE"

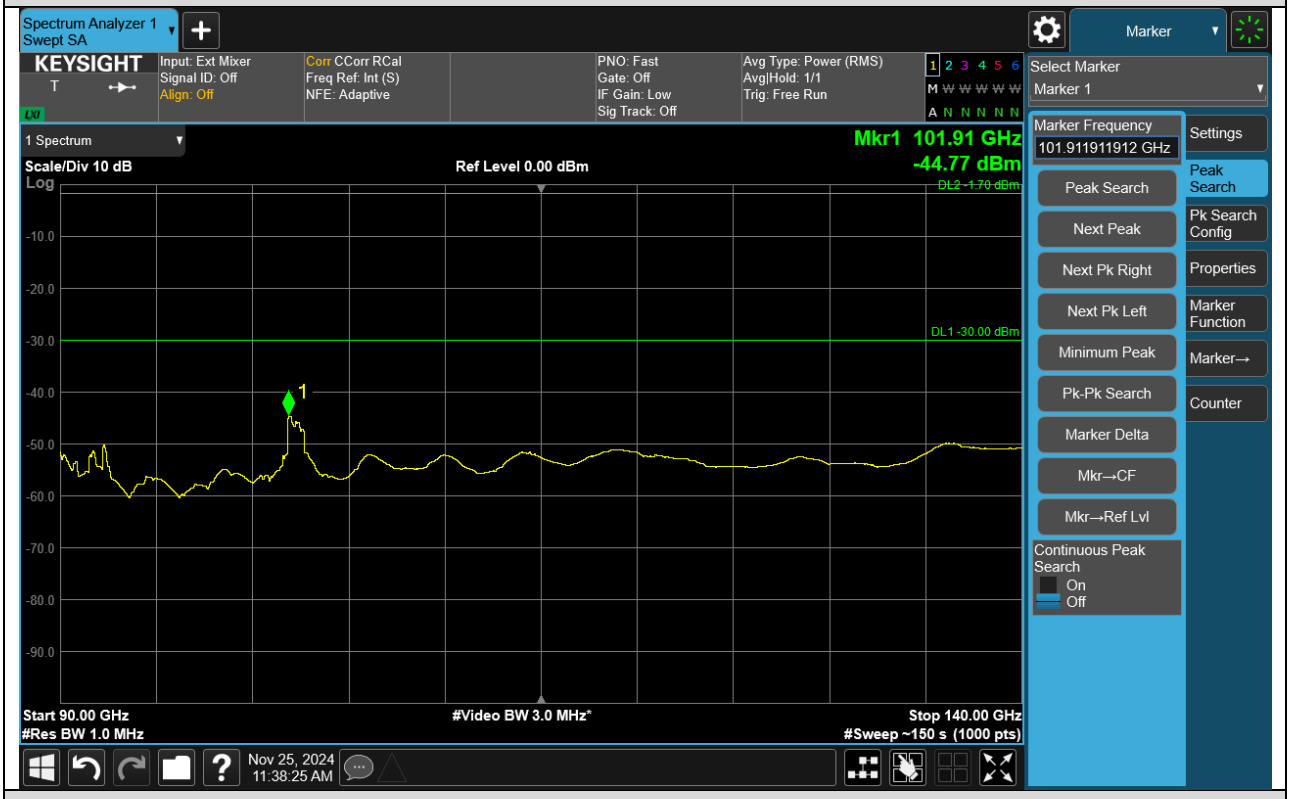
Radiated Emission, 40 GHz to 60 GHz, Horizontal / Vertical Polarization



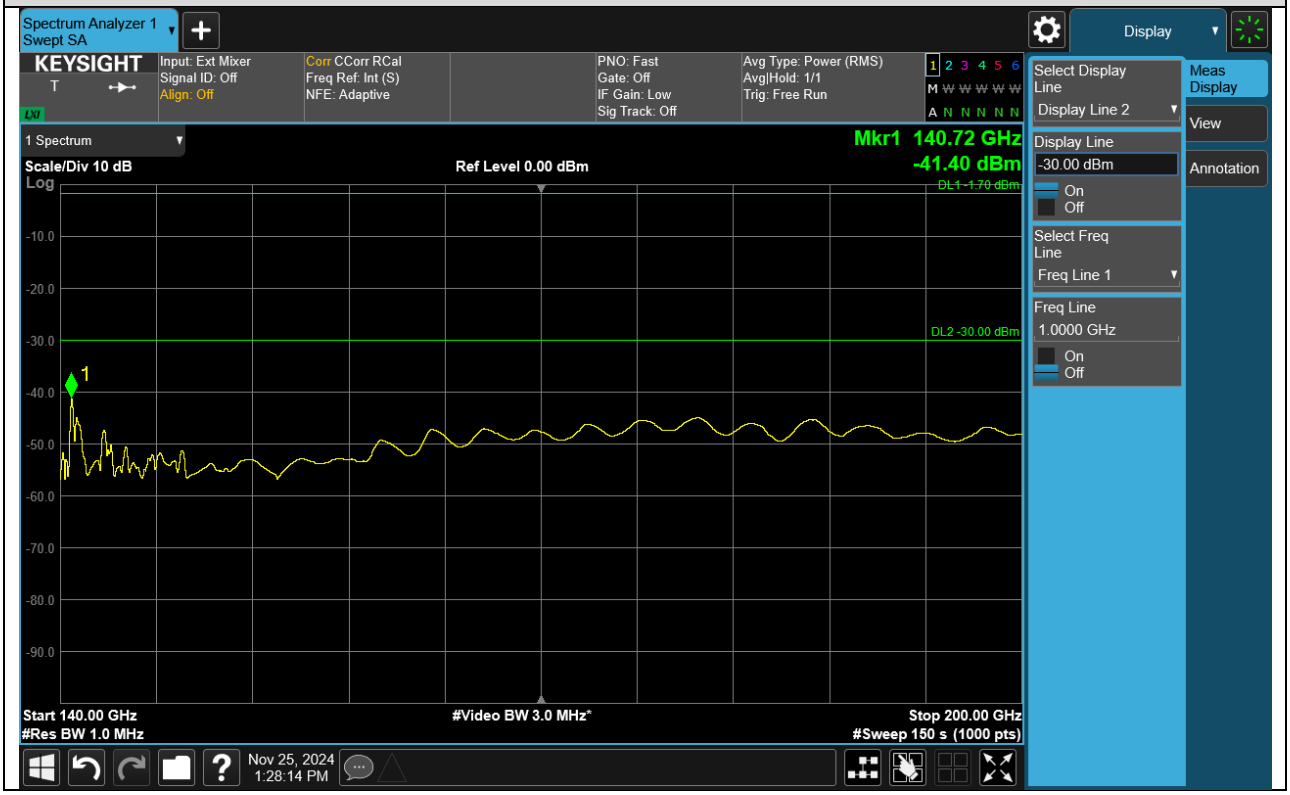
Radiated Emission, 60 GHz to 90 GHz, Horizontal / Vertical Polarization



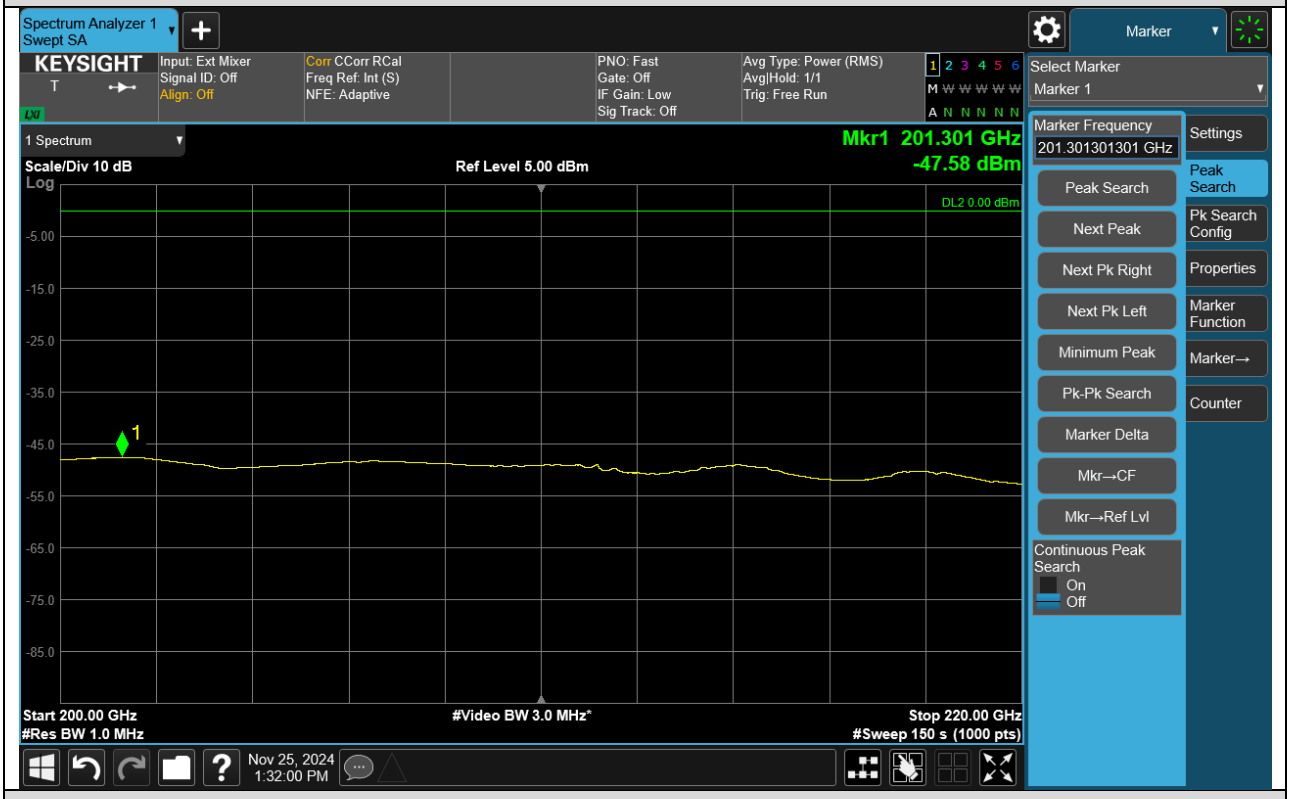
Radiated Emission, 90 GHz to 140 GHz, Horizontal / Vertical Polarization



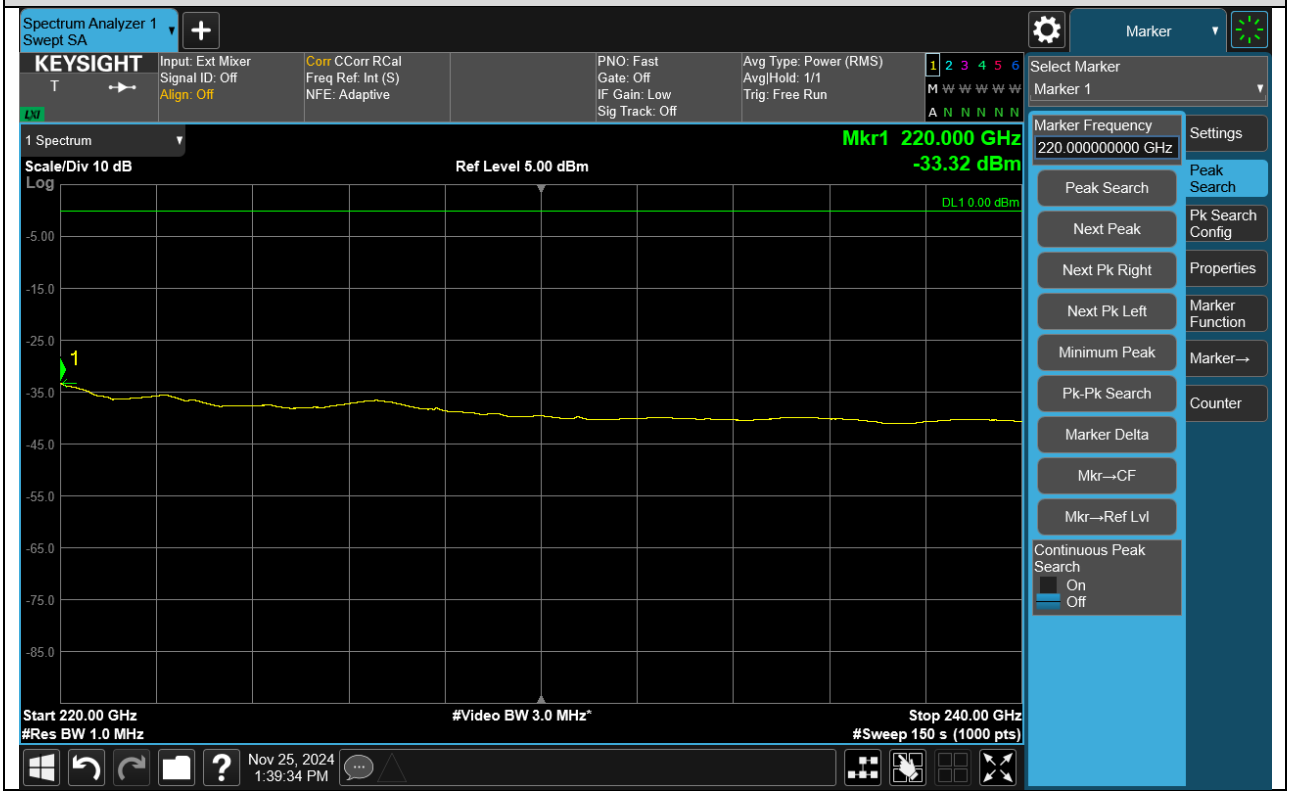
Radiated Emission, 140 GHz to 200 GHz, Horizontal / Vertical Polarization



Radiated Emission, 200 GHz to 220 GHz, Horizontal / Vertical Polarization



Radiated Emission, 220 GHz to 240 GHz, Horizontal / Vertical Polarization



3.6 FREQUENCY STABILITY

3.6.1 Description of Frequency Stability Measurement

According to § 95.3379 76–81 GHz Band Radar Service unwanted emission limits.

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 −20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

According to §2.1055 Measurement required: Frequency Stability.

(a) The frequency stability shall be measured with variation of ambient temperature as follows:
(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.
(2) From −20° to + 50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.
(3) From 0° to + 50° centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.
(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.
(c) The frequency stability shall be measured with variation of primary supply voltage as follows:
(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.
(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

3.6.2 Measurement Procedure

99% OCCUPIED BANDWIDTH MEASUREMENT PARAMETER	
Detector:	Peak
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Trace-Mode:	Max Hold
Sweep	≥ 2 * (Span / RBW) * Cycle time

3.6.3 Test setup

See section 2.5 of this report.

3.6.4 Test results

TM1

FREQUENCY STABILITY					
Temperature (°C)	Voltage (Volt)	FL (GHz)	FH (GHz)	Limit (GHz)	Result
50	Normal Voltage	76.29944	76.61703	76-81GHz	PASS
40		76.29884	76.61503		
30		76.29934	76.61793		
20		76.30114	76.61813		
10		76.30134	76.61863		
0		76.29894	76.61623		
-10		76.29974	76.61773		
-20		76.29884	76.61853		
-30		76.29794	76.61653		
20	115%	76.29944	76.61683		
20	85%	76.30004	76.61673		

4 PHOTOGRAPHS OF TEST SETUP

Please refer to the attached file (Test Setup Photo).

5 PHOTOGRAPHS OF THE EUT

Please refer to the attached file (External Photos report and Internal Photos).

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

Important

(1) The test report is invalid without the official stamp of CVC;

(2) Any part photocopies of the test report are forbidden without the written permission from CVC;

(3) The test report is invalid without the signatures of Approval and Reviewer;

(4) The test report is invalid if altered;

(5) Objections to the test report must be submitted to CVC within 15 days.

(6) Generally, commission test is responsible for the tested samples only.

(7) As for the test result “-” or “N” means “not applicable”, “/” means “not test”, “P” means “pass” and “F” means “fail”

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