



Test report No.: 2340502R-RFUSV10S-A

# TEST REPORT

Product Name	60GHz mmwave radar
Trademark	C-Media
Model and /or type reference	K60168-M
FCC ID	2A9BM-K60168-M
Applicant's name / address	C-MEDIA ELECTRONICS INC. 6F., 100, Sec. 4, Civil Blvd., Daan Dist Taipei City, Taiwan, R.O.C.
Manufacturer's name	C-MEDIA ELECTRONICS INC.
Test method requested, standard	FCC CFR Title 47 Part 15 Subpart C ANSI C63.4: 2014, ANSI C63.10: 2013
Verdict Summary	IN COMPLIANCE
Documented By <u>(Senior Project Specialist / April Chen)</u>	
Tested By <u>(Senior Engineer / Ivan Chuang)</u>	
Approved By <u>(Senior Engineer / Alan Chen)</u>	
Date of Receipt	2023/04/18
Date of Issue	2023/09/22
Report Version	V1.0

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Appendix 1: EUT Test Photographs

Appendix 2: Product Photos-Please refer to the file: 2340502R-Product Photos

## Competences and Guarantees

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DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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## General conditions

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1. The test results relate only to the samples tested.
2. The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.
3. This report must not be used to claim product endorsement by TAF or any agency of the government.
4. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.
5. Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

## Revision History

Report No.	Version	Description	Issued Date
2340502R-RFUSV10S-A	V1.0	Initial issue of report.	2023/09/22

## 1. General Information

### 1.1. EUT Description

Product Name	60GHz mmwave radar
Trademark	C-Media
Model and /or type reference	K60168-M
EUT Rated Voltage	DC 5V by USB
EUT Test Voltage	AC 120V/60Hz
Frequency Range	57 - 64 GHz
Channel Number	1
Type of Modulation	FMCW
Channel Control	Auto
USB-C Cable	Shielded, 1.5m
Test Platform	Product Name: Kuro™ X-Ear 1 AI Gesture-Controlled Headset Trademark: C-Media Model Name: X-Ear 1

#### Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	C-Media	K60168-M	AiP	9.36 dBi for 60 GHz

Note: 1. The antenna of EUT is conform to FCC 15.203.

2. The antenna gain as by the manufacturer provided.

#### Center Frequency of Each Channel:

Channel	Frequency (GHz)
01	60.5

#### Note:

1. The EUT is a 60GHz mmwave radar with a built-in 60.5 GHz wireless transceiver.
2. This module is “Limited Modular Approval” (LMA).
3. These tests are conducted on a sample of the equipment for the purpose of demonstrating compliance of transmitter with Part 15 Subpart C Paragraph 15.255(a), (c)(2) for used as short-range devices for interactive motion sensing.

Test Mode	Mode 1	Transmit
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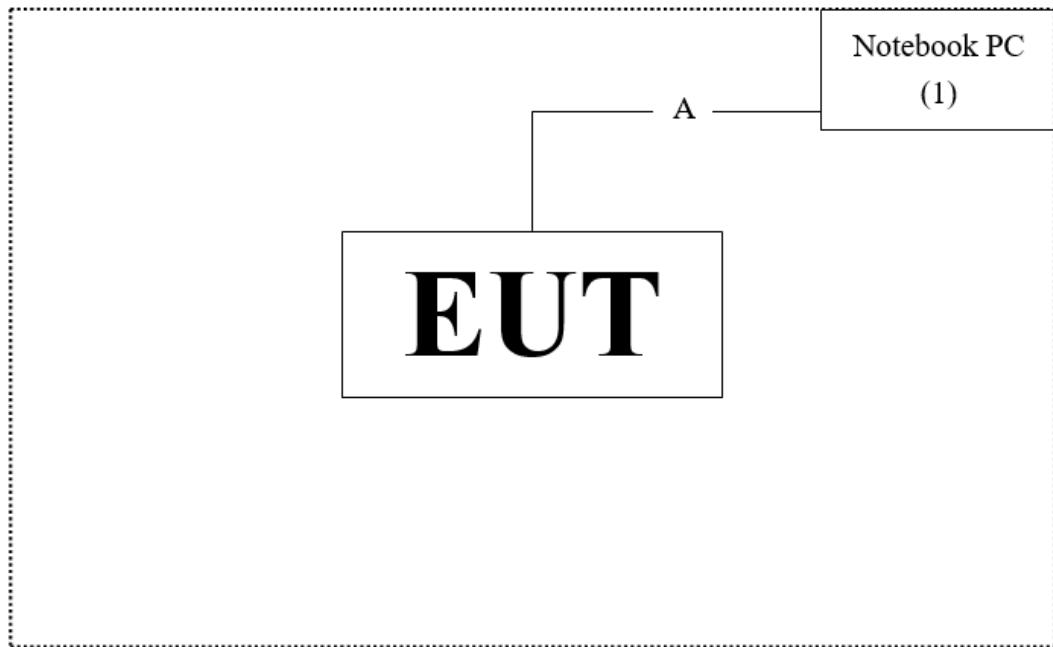
## 1.2. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 Notebook PC	DELL	Latitude 5491	1PL56S2	N/A

Cable Type	Manufacturer	Model No.	Cable Description
A USB-C Cable	C-Media	X-Ear 1	Shielded, 1.5m

## 1.3. Configuration of Test System



## 1.4. EUT Exercise Software

1	Setup the EUT as shown in Section 1.3.
2	Execute "SimpleHIDWrite Ver. 0.0" on the Notebook PC.
3	Configure the test mode and the test channel.
4	Start the continuous transmit.
5	Verify that the EUT works properly.

### 1.5. Test Facility

Ambient conditions in the laboratory:

Performed Item	Items	Required	Actual
Conducted Emission	Temperature (°C)	10~40 °C	25.7 °C
	Humidity (%RH)	10~90 %	52.0 %
Radiated Emission	Temperature (°C)	10~40 °C	24.4 °C
	Humidity (%RH)	10~90 %	63.5 %
Conductive	Temperature (°C)	10~40 °C	22.1 °C
	Humidity (%RH)	10~90 %	57.0 %

Site Description	Accredited by TAF Accredited Number: 3023
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Test Laboratory	DEKRA Testing and Certification Co., Ltd. Linkou Laboratory
Address	No.5-22, Ruishukeng Linkou District, New Taipei City, 24451, Taiwan, R.O.C.
Performed Location	No. 26, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan, R.O.C.
Phone Number	+886-3-275-7255
Fax Number	+886-3-327-8031

## 1.6. List of Test Equipment

### For Conduction Measurements / HY-SR01

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	EMI Test Receiver	R&S	ESR7	101601	2022/06/23	2023/06/22
V	Two-Line V-Network	R&S	ENV216	101306	2023/03/16	2024/03/15
V	Two-Line V-Network	R&S	ENV216	101307	2022/07/04	2023/07/03
V	Coaxial Cable	SUHNER	RG400_BNC	RF001	2022/05/24	2023/05/23

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with “V” are used to measure the final test results.
3. Test Software Version: e3 230303 dekra V9.

### For Test Site number: HY-SR03

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	Temperature Chamber	KSON	THS-D4T-100	A0606	2022/08/23	2023/08/22
V	DC Power Supply	GW Instek	SPD-3606	GEQ820915	2022/07/05	2023/07/04
V	Spectrum Analyzer	Keysight	N9030B	MY56320509	2022/08/02	2023/08/01
V	Horn Antenna	VDI	RCH015 (50-75GHz)	N/A	2020/11/02	2023/11/01

Note:

1. The mm-Wave VDI equipment (above 50GHz) is calibrated every three years, the other equipments are calibrated every one year.
2. The test instruments marked with “V” are used to measure the final test results.

**For Radiated Measurements / HY-CB02**

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	Signal Analyzer	R&S	FSV3044	101113	2023/02/04	2024/02/03
V	Spectrum Analyzer	Keysight	N9030B	MY56320509	2022/08/02	2023/08/01
V	Oscilloscope	R&S	RTO 2022	330016	2022/07/15	2023/07/14
V	Horn Antenna	Millitech	SGH-15-RP000	447	2020/11/02	2023/11/01
V	RF Detector	Millitech	DET-15-RPFW0	081	2020/11/02	2023/11/01
V	Horn Antenna	VDI	RCH015RL (50-75GHz)	--	2022/03/10	2025/03/09
V	Horn Antenna	VDI	RCH012RL(60-90GHz)	--	2022/03/10	2025/03/09
V	Horn Antenna	VDI	RCH08RL(90-140GHz)	--	2022/03/10	2025/03/09
V	Horn Antenna	VDI	RCH05RL(140-220GHz)	--	2022/03/10	2025/03/09
	Horn Antenna	VDI	2-43/2-44(220-330GHz)	--	2022/03/10	2025/03/09
V	Down Convertor(SAX405)	VDI	N9029AV15(AT0-55847)	US54250164	2022/03/10	2025/03/09
V	Down Convertor(SAX404)	VDI	N9029AV12(AT0-59570)	US54250170	2022/03/10	2025/03/09
V	Down Convertor(SAX403)	VDI	N9029AV08(AT0-59571)	US53250012	2022/03/10	2025/03/09
V	Down Convertor(SAX402)	VDI	N9029AV05(AT0-60029)	US53250019	2022/03/10	2025/03/09
	Down Convertor(SAX401)	VDI	N9029AV03(AT0-57775)	US53250021	2022/03/10	2025/03/09
V	Loop Antenna	AMETEK	HLA6121	49611	2023/02/21	2024/02/20
V	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-0657	2021/08/11	2023/08/10
V	Horn Antenna	RF SPIN	DRH18-E	210503A18ES	2023/02/24	2024/02/23
V	Horn Antenna	Com-Power	AH-840	101101	2021/11/30	2023/11/29
V	Pre-Amplifier	SGH	EM330	60736	2023/01/10	2024/01/09
V	Pre-Amplifier	EMCI	EMC051835SE	980312	2022/07/28	2023/07/27
V	Pre-Amplifier	EMCI	EMC05820SE	980361	2022/07/28	2023/07/27
	Pre-Amplifier	EMCI	EMC184045SE	980369		
V	Coaxial Cable	EMCI	EMC102-KM-KM-600	1160314	2023/01/10	2024/01/09
	Coaxial Cable	EMCI	EMC102-KM-KM-7000	170242		
V	EMI Test Receiver	R&S	ESR3	102792	2022/12/29	2023/12/28
V	Coaxial Cable	SGH	HA800	GD20110223-2	2023/01/10	2024/01/09
		SGH	HA800	GD20110222-4		
		SGH	SGH18	2021005-2		
		SGH	SGH18	202108-5		

Note:

1. Bi-Log Antenna and Horn Antenna(AH-840) is calibrated every two years, VDI and Millitech equipments is calibrated every three years, the other equipments are calibrated every one year.
2. The test instruments marked with "V" are used to measure the final test results.
3. Test Software version: e3 230303 dekra V9.

## 1.7. Uncertainty

Uncertainties have been calculated according to the DEKRA internal document.

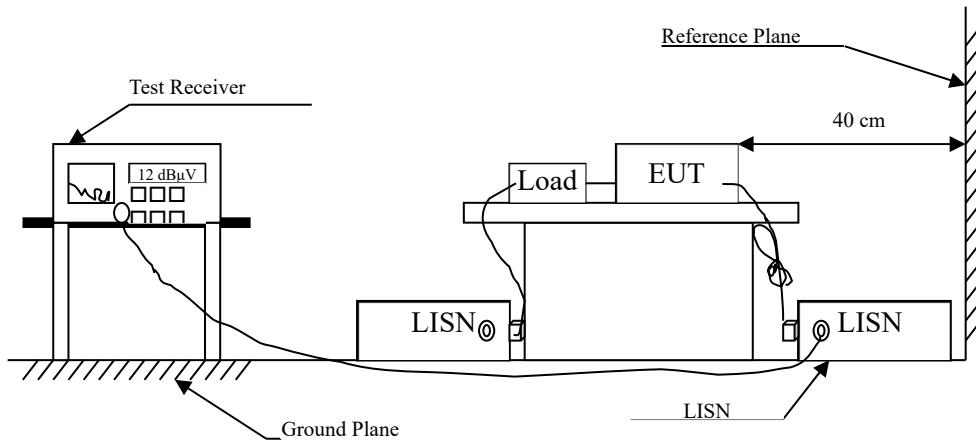
The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95 %.

Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Test Item	Uncertainty
Conducted Emission	$\pm 3.50$ dB
Radiated Emission	9 kHz~30 MHz: $\pm 3.88$ dB 30 MHz~1 GHz: $\pm 4.06$ dB 1 GHz~18 GHz: $\pm 3.71$ dB 18 GHz~40 GHz: $\pm 3.73$ dB 40 GHz~50 GHz: $\pm 3.75$ dB 50 GHz~325 GHz: $\pm 4.39$ dB
Frequency stability	$\pm 1580.61$ Hz

## 2. Conducted Emission

### 2.1. Test Setup



### 2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dB $\mu$ V ) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50 - 5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

### 2.3. Test Procedure

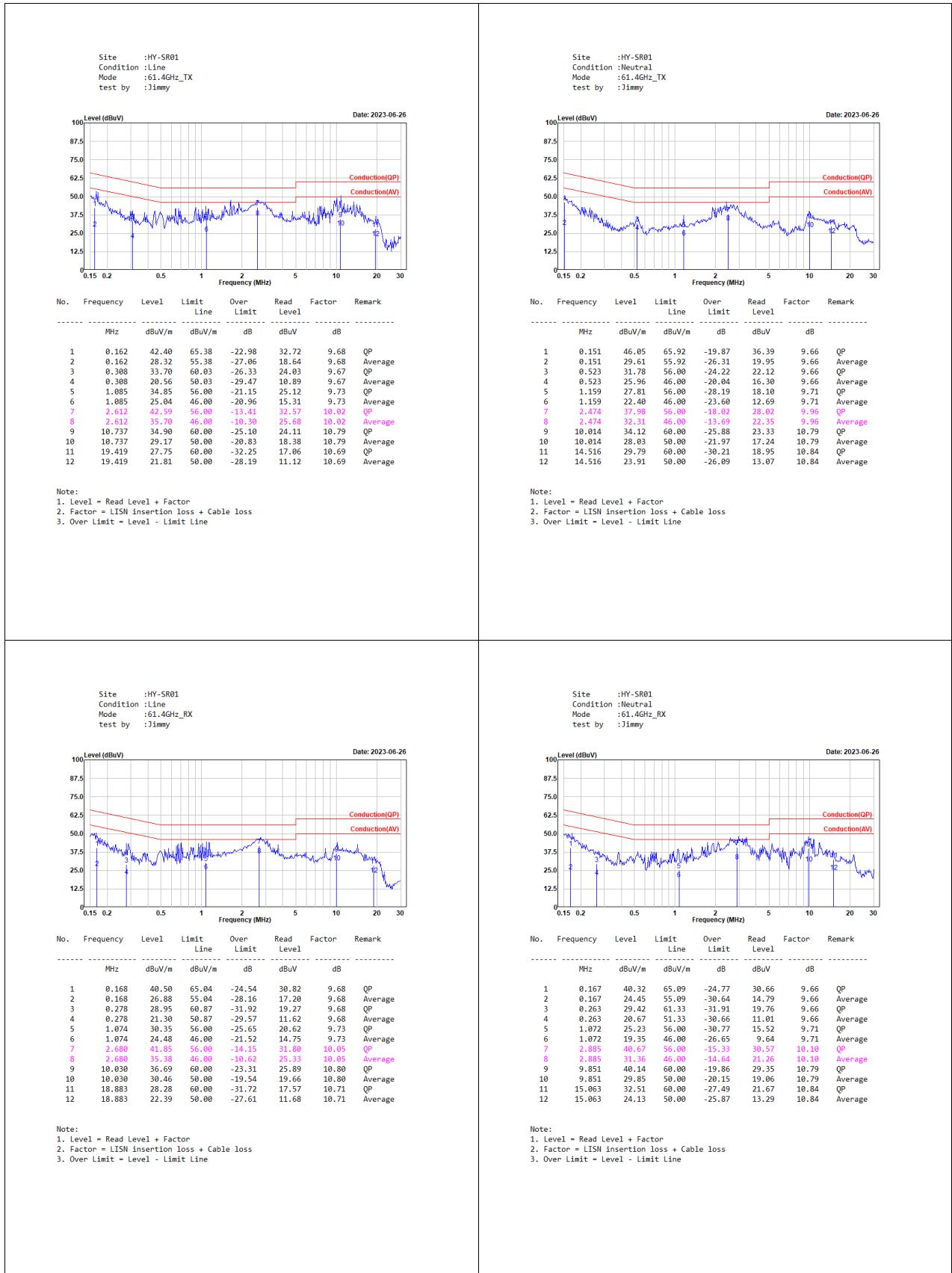
The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50  $\mu$ H coupling impedance for the measuring equipment.

The peripheral devices are also connected to the main power through a LISN that provides a 50 ohm / 50  $\mu$ H coupling impedance with 50 ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

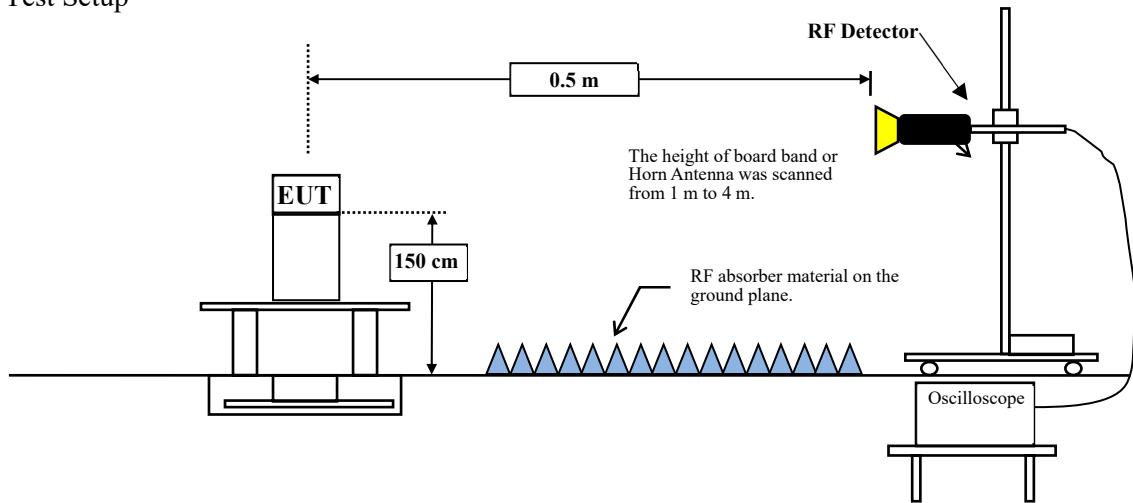
Conducted emissions were invested over the frequency range from 0.15 MHz to 30 MHz using a receiver bandwidth of 9 kHz.

## 2.4. Test Result of Conducted Emission



### 3. Equivalent Isotropically Radiated Power

#### 3.1. Test Setup



#### 3.2. Limits

FCC 15.255(c)(2): Within the 57-71 GHz band, emission levels shall not exceed the following equivalent isotropically radiated power:

For Field disturbance sensors/radars shall not exceed -10 dBm peak conducted output power and 10 dBm peak EIRP

### 3.3. Test Procedure

Placing EUT on the non-conductive surface which is 150 cm high(place floor-standing product on the ground) and the surface can be rotated 360 degrees. The distance between EUT and receiving antenna should be 0.5 m for measuring the maximum radiated electric field strength of EUT. The vertical and horizontal polarization should be tested severally once under the EUT normal operation.

The RF detector connecting with oscilloscope could reveal the power reading value, the equation below would be adopted to calculate EIRP.

The EIRP obtained on the section 3.4 would be adopted to calculate the peak output power.

The measurement method refers to ANSI C63.10, 2013 and FCC KDB200443.

$$E = 126.8 - 20\log(\lambda) + P - G$$

where

$E$  is the field strength of the emission at the measurement distance, in  $\text{dB}\mu\text{V}/\text{m}$ .

$\lambda$  is the wavelength of the emission under investigation [300/fMHz], in m.

$G$  is the gain of the test antenna, in dBi.

$$\text{EIRP} = E + 20\log(d_{\text{meas}}) - 104.7$$

where

$\text{EIRP}$  is the equivalent isotropically radiated power, in dBm.

$E_{\text{meas}}$  is the field strength of the emission at the measurement distance, in  $\text{dB}\mu\text{V}/\text{m}$ .

$d_{\text{Meas}}$  is the measurement distance, in m.

### 3.4. Test Result of Equivalent Isotropically Radiated Power

Product : 60GHz mmwave radar  
 Test Item : Equivalent Isotropically Radiated Power  
 Test Mode : Transmit  
 Test Date : 2023/05/02

Peak E.I.R.P

Test Frequency (GHz)	DSO (mV)	Power Measured (dBm)	E <sub>meas</sub> (dB $\mu$ V/m)	EIRP (dBm)	Limit (dBm)	Result
60.5	1.502	-46.47	105.53	-5.19	10	Pass

Conducted output power

Frequency (GHz)	EIRP (dBm)	G <sub>EUT</sub> (dBi)	P <sub>cond</sub> (dBm)	Limit (dBm)	Result
60.5	-5.19	9.36	-14.55	-10	Pass

Note:

$$E = 126.8 - 20\log(\lambda) + P - G$$

where

E is the field strength of the emission at the measurement distance, in dB $\mu$ V/m

$\lambda$  is the wavelength of the emission under investigation [300/fMHz], in m

G is the gain of the test antenna, in dBi

$$EIRP = E + 20\log(d_{meas}) - 104.7$$

where

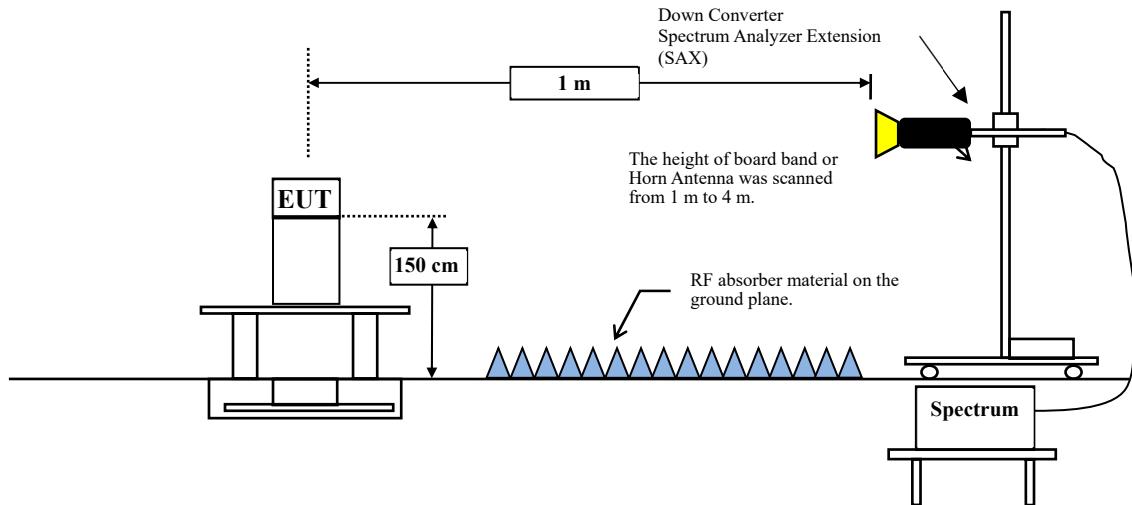
EIRP is the equivalent isotropically radiated power, in dBm

E<sub>Meas</sub> is the field strength of the emission at the measurement distance, in dB $\mu$ V/m

d<sub>Meas</sub> is the measurement distance, in m

## 4. Occupied Bandwidth

### 4.1. Test Setup



### 4.2. Limits

N/A

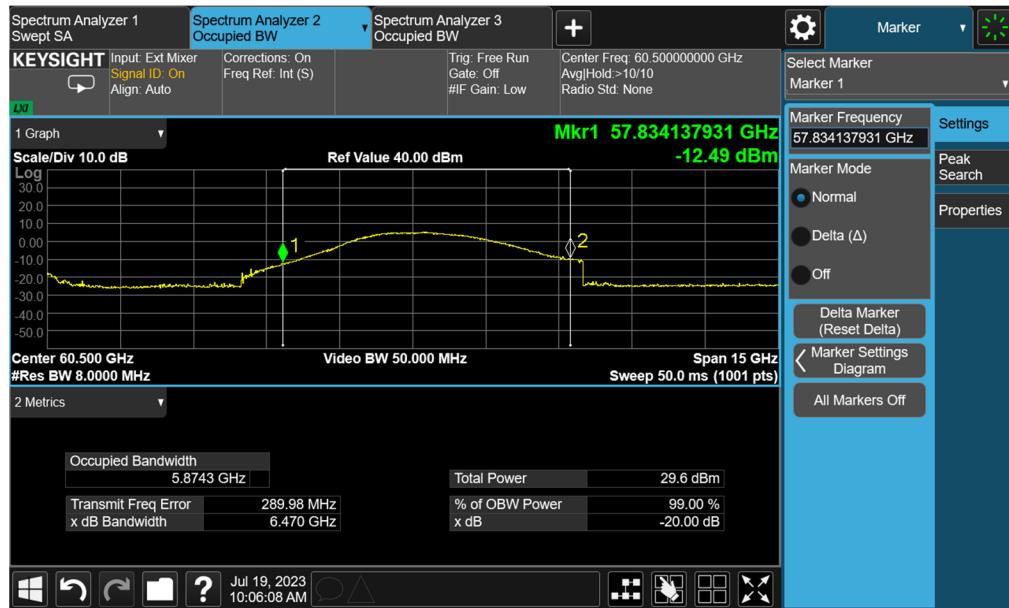
### 4.3. Test Procedure

For measuring the 20dB emission bandwidth of EUT, the peak hold function should be employed. The measurement method refers to ANSI C63.10, 2013 and FCC KDB200443.

#### 4.4. Test Result of 20dB Occupied Bandwidth

Product : 60GHz mmwave radar  
 Test Item : 20 dB Occupied Bandwidth  
 Test Site : No.3 OATS  
 Test Mode : Transmit  
 Test Date : 2023/05/16

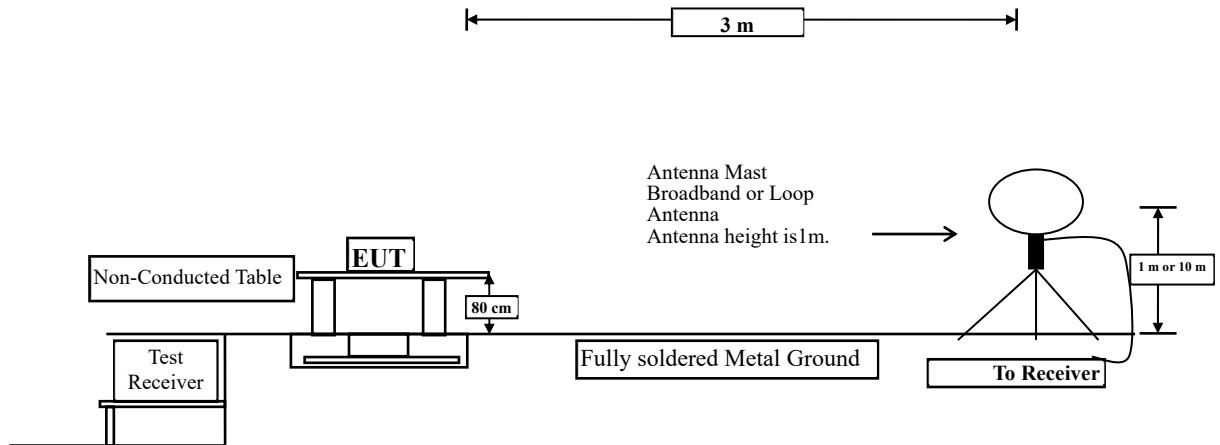
Frequency (GHz)	Measurement Bandwidth (MHz)
60.5	6470



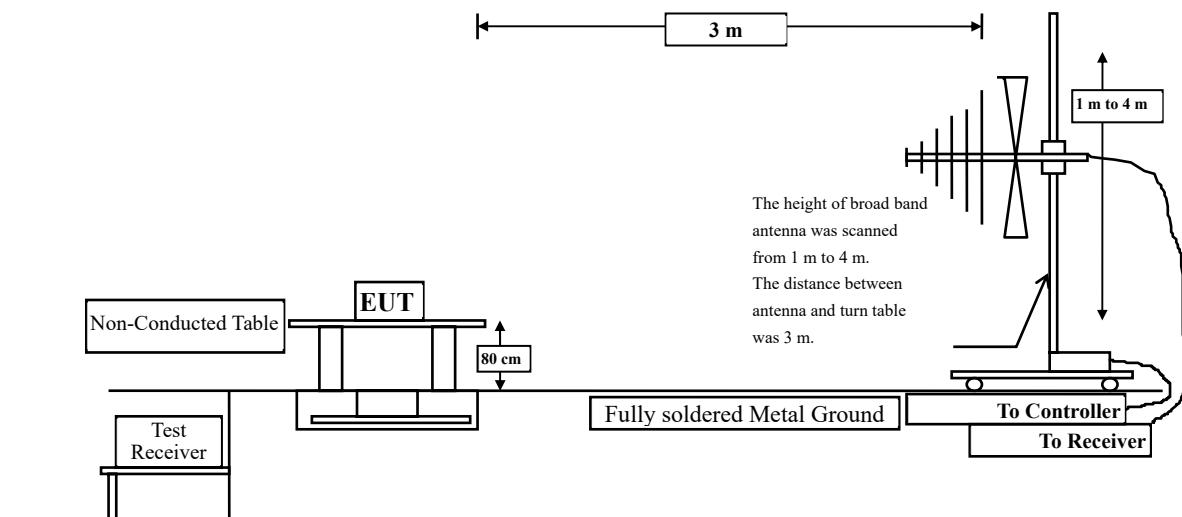
## 5. Radiated Emission

### 5.1. Test Setup

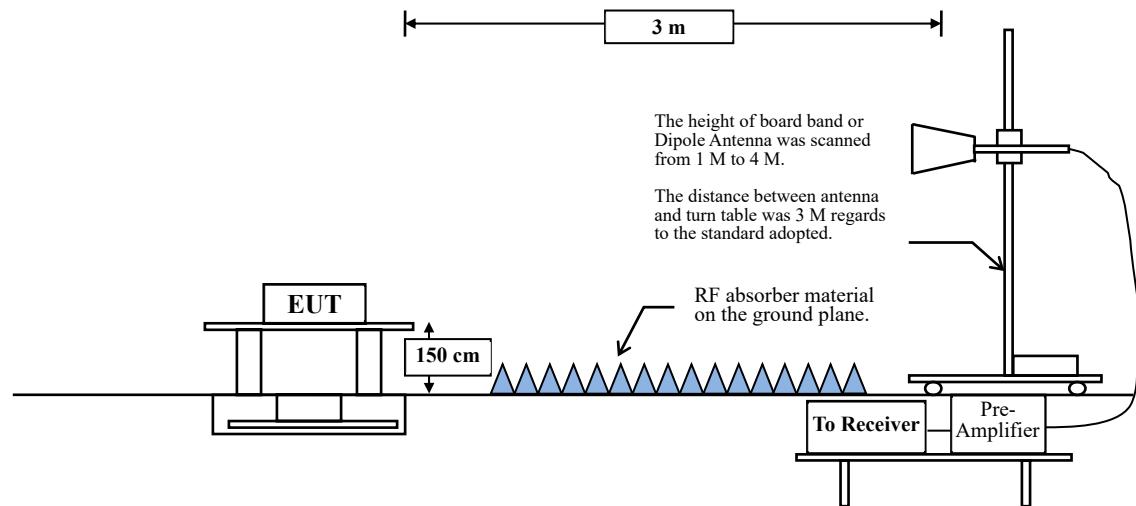
#### Radiated Emission Under 30 MHz



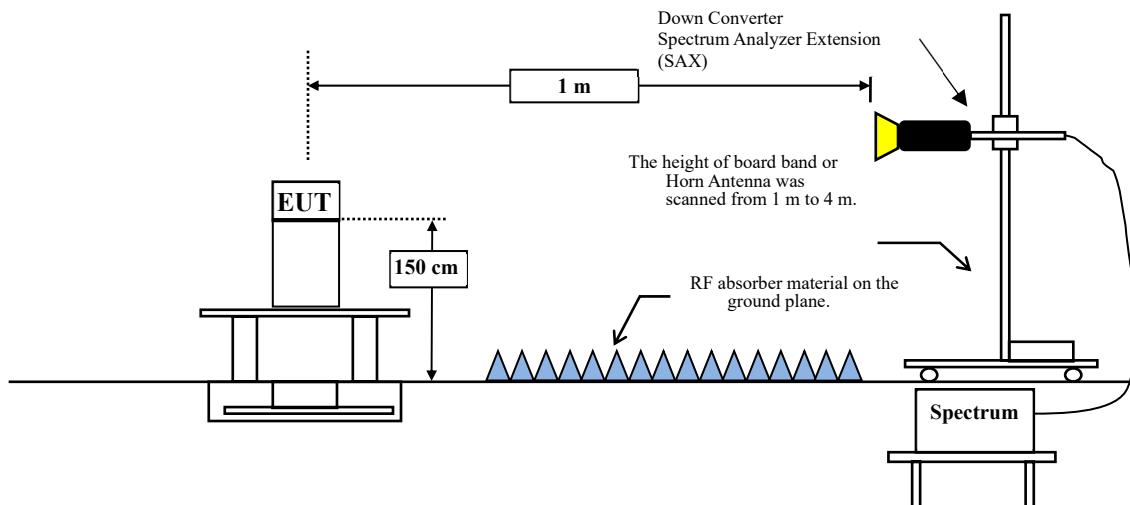
#### Radiated Emission Below 1 GHz



### Radiated Emission Above 1 GHz



### Above 1 GHz (50 GHz-200 GHz)



## 5.2. Limits

### ➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209.

15.255(d)(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm<sup>2</sup> at a distance of 3 meters.

whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209(a) Limits		
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meter)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remarks: E field strength (dB $\mu$ V /m) = 20 log E field strength ( $\mu$ V/m).

### 5.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested compliance to FCC 47CFR 15.255 requirements.

#### **For 30 MHz to 40 GHz(from 30 MHz to 40 GHz)**

Measuring the frequency range below 1 GHz, the EUT is placed on a turn table which is 0.8 meter above ground, when measuring the frequency range above 1 GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

#### **For 40 GHz to 200 GHz(from 40 GHz to 200 GHz)**

Placing EUT on the non-conductive surface which is 80 cm high (place floor-standing product on the ground) and the surface can be rotated 360 degrees. The distance between EUT and receiving antenna should be 1 m for measuring the maximum radiated electric field strength of EUT.

The resolution bandwidth below 30 MHz setting on the field strength meter is 9 kHz and 30 MHz~1 GHz is 120 kHz and above 1 GHz is 1 MHz.

Radiated emission measurements below 30 MHz are made using Loop Antenna and 30 MHz~1 GHz are made using broadband Bilog antenna and above 1 GHz are made using Horn Antennas.

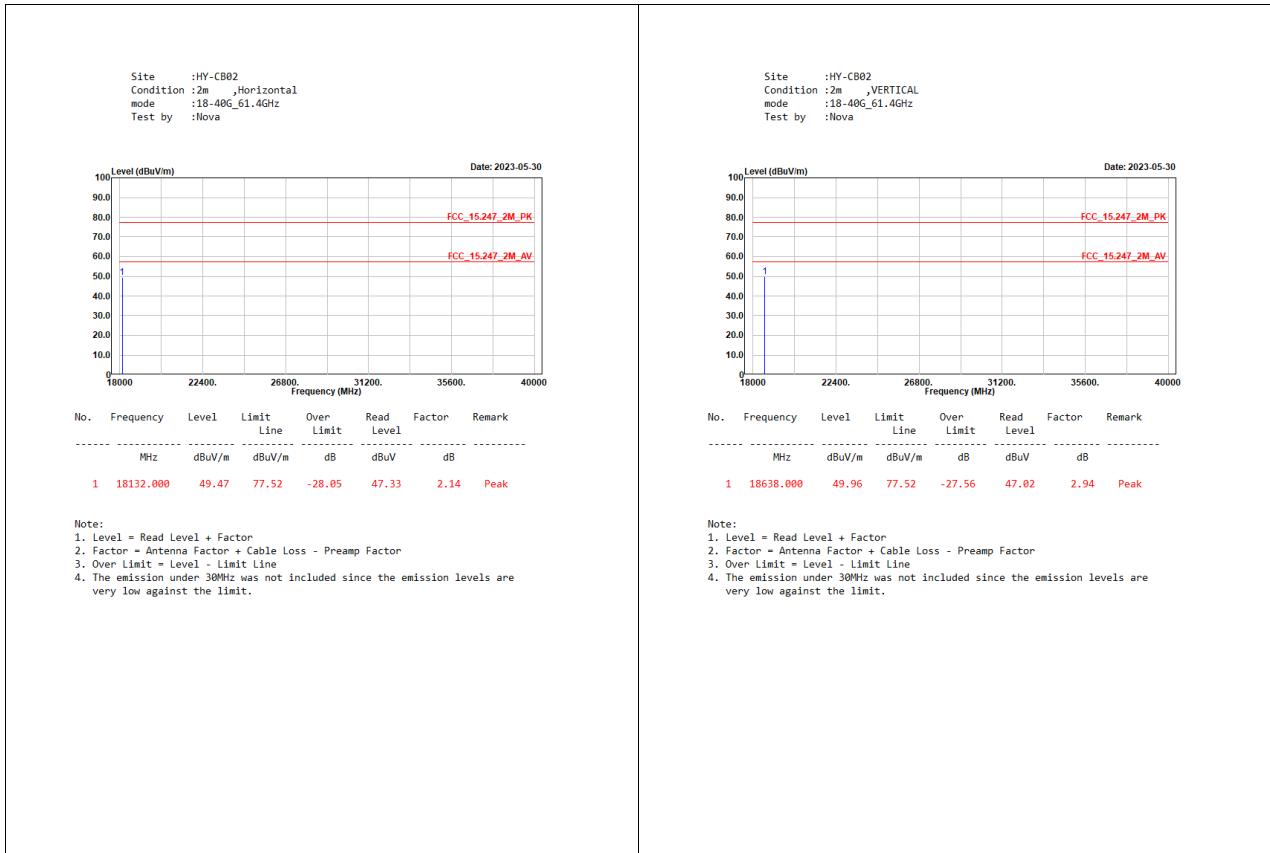
The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The measurement frequency range from 9 kHz - 10th Harmonic of fundamental was investigated.

## 5.4. Test Result of Radiated Emission





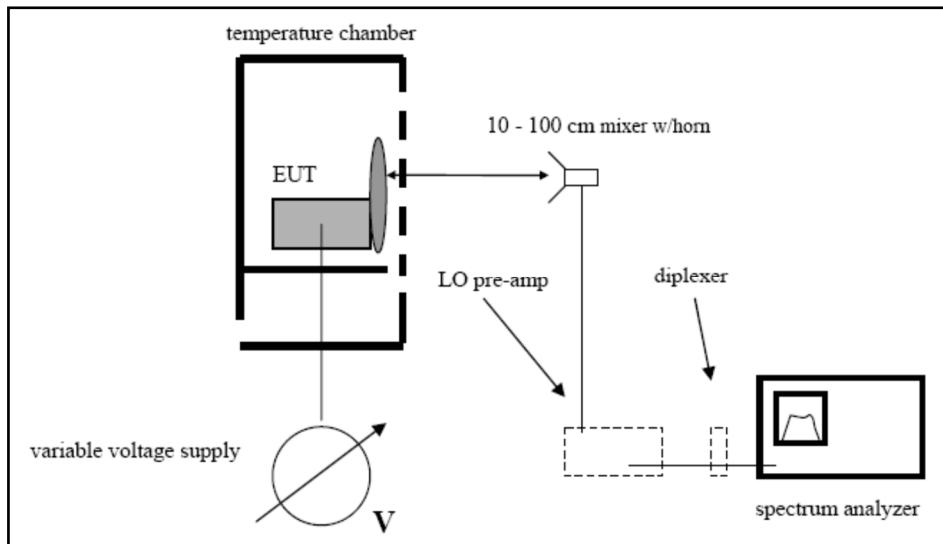
Product : 60GHz mmwave radar  
Test Item : Radiated Emission  
Test Mode : Transmit  
Test Date : 2023/05/29

## 60.5 GHz

Frequency (GHz)	Measurement Distance (m)	Peak output Power (dBm)	RX Antenna Gain (dBi)	EIRP (dBm)
140.78	1	-76.57	19.53	-20.57
EIRP (W)	Specification Distance (m)	Power Density (W / m <sup>2</sup> )	Power Density (pW / cm <sup>2</sup> )	Limit (pW / cm <sup>2</sup> )
0.000009	3	7.7555E-08	7.76	90

## 6. Frequency Stability

### 6.1. Test Setup



### 6.2. Limits

FCC15.255(f) 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.

### 6.3. Test Procedure

- a) As the EUT and test equipment setup shown below, a environmental test chamber with a window or other opening allows receiving antenna to be placed outdoor.
- b) The EUT frequency offset revealed on spectrum analyzer should be recorded while EUT is under the specified temperature(about 25 °C) and the voltage source is equal to the EUT nominal operating voltage (100 %).
- c) Change the EUT nominal operating voltage from 85 % to 115 % and record the results.
- d) Return the EUT nominal operating voltage to 100 % and enhance the operation temperature to 50 °C, record the results.
- e) Repeat step d, record results each 10 °C until -20 °C.

The measurement method refers to ANSI C63.10, 2013 and FCC KDB200443.

Product : 60GHz mmwave radar  
 Test Item : Frequency Stability  
 Test Mode : Transmit  
 Test Date : 2023/05/30

60.5 GHz

Voltage (V)	Temperature (°C)	Observe Time	Measurement Frequency (MHz)	Limit
AC 120 V	50	start	60882.50	Within band
		2mins	60882.50	Within band
		5mins	60882.50	Within band
		10mins	60882.50	Within band
	40	start	60710.00	Within band
		2mins	60710.00	Within band
		5mins	60710.00	Within band
		10mins	60710.00	Within band
	30	start	61225.00	Within band
		2mins	61225.00	Within band
		5mins	61225.00	Within band
		10mins	61225.00	Within band
	20	start	61145.00	Within band
		2mins	61145.00	Within band
		5mins	61145.00	Within band
		10mins	61145.00	Within band
	10	start	61134.00	Within band
		2mins	61134.00	Within band
		5mins	61134.00	Within band
		10mins	61134.00	Within band
	0	start	61145.00	Within band
		2mins	61145.00	Within band
		5mins	61145.00	Within band
		10mins	61145.00	Within band
	-10	start	60552.50	Within band
		2mins	60552.50	Within band
		5mins	60552.50	Within band
		10mins	60552.50	Within band
	-20	start	60605.00	Within band
		2mins	60605.00	Within band
		5mins	60605.00	Within band
		10mins	60605.00	Within band

Temperature (°C)	Voltage (V)	Measurement Frequency (MHz)	Limit
20 °C	AC 138 V	61235.00	Within band
	AC 120V	61145.00	Within band
	AC 102 V	61265.00	Within band

## 7. EMI Reduction Method During Compliance Testing

No modification was made during testing.

Voltage (V)	Temperature (°C)	Measurement Frequency (MHz)	Limit
AC 110 V	50	60882.50	Within band
	40	60710.00	Within band
	30	61225.00	Within band
	20	61145.00	Within band
	10	61134.00	Within band
	0	61145.00	Within band
	-10	60552.50	Within band
	-20	60605.00	Within band