TEST REPORT

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1. Report No : DRTFCC2405-0047(1)

2. Customer

- Name (FCC) : Smart Radar System, Inc. / Name (IC) : Smart Radar System
- Address (FCC) : 3rd Floor, Fine Venture Bldg, 41 Seongnam-daero 925gil, Bundang-gu Seongnam-si, Gyeonggi-do South Korea 13496
- Address (IC) : 3rd Floor, Fine Venture Bldg, 41, Seongnam-daero 925gil, Bundang-gu Seongnam-si Gyeonggi-do 13496 Korea (Republic Of)

3. Use of Report : FCC & ISED Class II Permissive Change

4. Product Name / Model Name : Millimeter wave Radar Module / RM68-NTA

FCC ID : 2AVKZRM68-NTA

IC : 26970-RM68NTA

5. FCC Regulation(s): Part 15.255

IC Standard(s): RSS-210 Issue 10

Test Method Used : RSS-210 Issue 10, ANSI C63.10-2013

6. Date of Test : 2024.04.04 ~ 2024.04.18

7. Testing Environment : Refer to appended test report.

8. Test Result : Refer to the attached test result.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test report is not related to KOLAS accreditation.

Affirmation	Tested by Name : SeokHo Han	(Signature)	Technical Manager Name : JaeJin Lee	(Signature)

2024 . 05 . 16 .

Dt&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description	Revised By	Reviewed By
DRTFCC2405-0047	May. 02, 2024	Initial issue	SeokHo Han	JaeJin Lee
DRTFCC2405-0047(1)	May. 16, 2024	Modify the equipment class	SeokHo Han	JaeJin Lee

Table of Contents

1. EUT DESCRIPTION

Equipment Class	Part 15 Low Power Communication Device Transmitter
Product Name	Millimeter wave Radar Module
Model Name	RM68-NTA
Add Model Name	-
Firmware Version Identification Number	2
Power Supply	DC 5 V
Frequency Range	61.0 ~ 61.5 GHz
Modulation Type	FMCW
Antenna Specification	**Antenna type**: Serial Feeding Antenna **Antenna gain(Max)**: 22 dBi

2. INFORMATION ABOUT TESTING

2.1. Transmitting configuration of EUT

Test Mode	Description	Test Frequency(GHz)
Sweep Active	FMCW	61.25
-	-	-

2.2. Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2.3. Tested environment

Temperature	:	20 ºC ~ 23 ºC
Relative humidity content	:	40 % ~ 43 %
Details of power supply	:	DC 5 V

2.4. EMI suppression Device(s) / Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

2.5. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C 63.4-2014 and ANSI C 63.10-2013. All measurement uncertainty values are shown with a coverage factor of *k* = 2 to indicate a 95 % level of confidence.

Test items	Measurement uncertainty
AC conducted emission	3.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz Below)	5.0 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz ~ 18 GHz)	4.8 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (18 GHz Above)	5.0 dB (The confidence level is about 95 %, k = 2)

3. SUMMARY OF TEST RESULTS

FCC Part Section(s)	RSS section(s)	Test Description	Test Limit	Test Condition	Status Note 1
15.255(e)(2)	RSS-210[J.4]	6 dB Bandwidth	NA	Radiated	C
-	RSS-Gen[6.7]	Occupied Bandwidth (99 %)	NA		C
15.255(c)(2)	RSS-210[J.2.1]	Equivalent Isotropic Radiated Power	< 43 dBm (Peak) < 40 dBm (Average)		C Note2, 3
15.255(e)(2)	RSS-210[J.4]	Peak Conducted Output power	< 500 mW		C
15.255(d) 15.255(c)(2) 15.209	RSS-210[J.3] RSS-210[J.2.1] RSS-Gen[8.9]	Radiated Spurious Emissions	Refer to the section 8.3		C Note2
15.255(f)	RSS-210[J.6]	Frequency Stability	Within the frequency band		C
15.207	RSS-Gen[8.8]	AC Line Conducted Emissions	Refer to the section 8.5	AC Line Conducted	C
15.203	-	Antenna Requirements	Part 15.203	-	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable
Note 2: This test item was performed in three orthogonal EUT positions and the worst case data was reported.
Note 3: No changes were made to the power configuration and the EIRP results were confirmed to be similar/equivalent to the original test results.

4. TEST METHODOLOGY

The measurement procedures described in the ANSI C63.10-2013 was used in measurement of the EUT.

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 test mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.255 under the FCC Rules Part 15 Subpart C.

4.3. General test procedures

Conducted Emissions

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector

Radiated Emissions

The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m 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 highest emission, the relative positions of the EUT were rotated through three orthogonal axes.

4.4. Description of test modes

The EUT has been tested with all modes of operating conditions to determine the worst case emission characteristics. A test program is used to control the EUT for staying in continuous transmitting mode.

EUT Operation test setup

- Test software: SRS_TrafficMonitor
- Power setting: Default

5. 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.

6. FACILITIES AND ACCREDITATIONS

6.1. Facilities

Dt&C Co., Ltd.		
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The test site complies with the requirements of § 2.948 according to ANSI C63.4-2014. **- FCC & ISED MRA Designation No.: KR0034** **- ISED#: 5740A**		
www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

6.2. Equipment

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, loop, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

7. ANTENNA REQUIREMENTS

7.1. According to FCC 47 CFR Part 15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The antenna is permanently attached on the main PCB.

Therefore this E.U.T Complies with the requirement of Part 15.203

8. TEST RESULTS

8.1. 6dB Bandwidth & Occupied Bandwidth

▣ Test Requirements and limit

Part 15.255(e)(2)

For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer.

RSS-210[J.4]

(C) For the purpose of this standard, emission bandwidth is defined as the instantaneous frequency range occupied by a steady radiated signal with modulation, outside which the radiated power spectral density shall be 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth. The centre frequency must be stationary during the measurement interval, even if not stationary during normal operation.

RSS-Gen[6.7]

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 % emission bandwidth, as calculated or measured.

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

6 dB Bandwidth

ANSI C63.10-2013 – Section 9.3

The following procedure was used for measurement of the bandwidth for millimeter-wave devices;

- Spectrum analyzer settings:
  1) Span equal to approximately two times to three times the EBW, centered on the carrier frequency.
  2) RBW = 100 kHz
  3) VBW = 300 kHz
  4) Sweep = auto.
  5) Detector function = peak.
  6) Trace = max hold. Allow the trace to stabilize.
  7) Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure the specified dB down one side of the emission.
  8) Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker- delta frequency reading at this point is the specified emission bandwidth.

Occupied Bandwidth

RSS-Gen[6.7]

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- Spectrum analyzer settings:

1) The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

2) RBW = 1 ~ 5 % of the occupied bandwidth

3) VBW ≥ 3 x RBW

4) Sweep = auto.

5) Detector function = peak.

6) Trace = max hold. Allow the trace to stabilize.

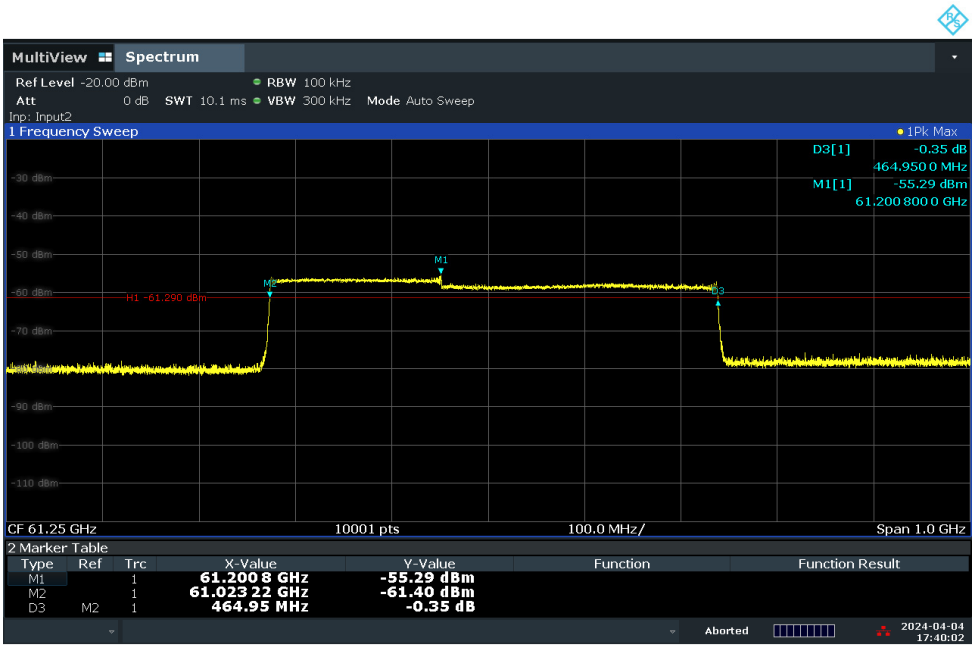
▣ Test Results: Comply

Tested Frequency (GHz)	6 dB Bandwidth(MHz)	Occupied Bandwidth(MHz)
61.25	464.95	467.53

▣ Result plots

6 dB Bandwidth

Tested Frequency: 61.25 GHz



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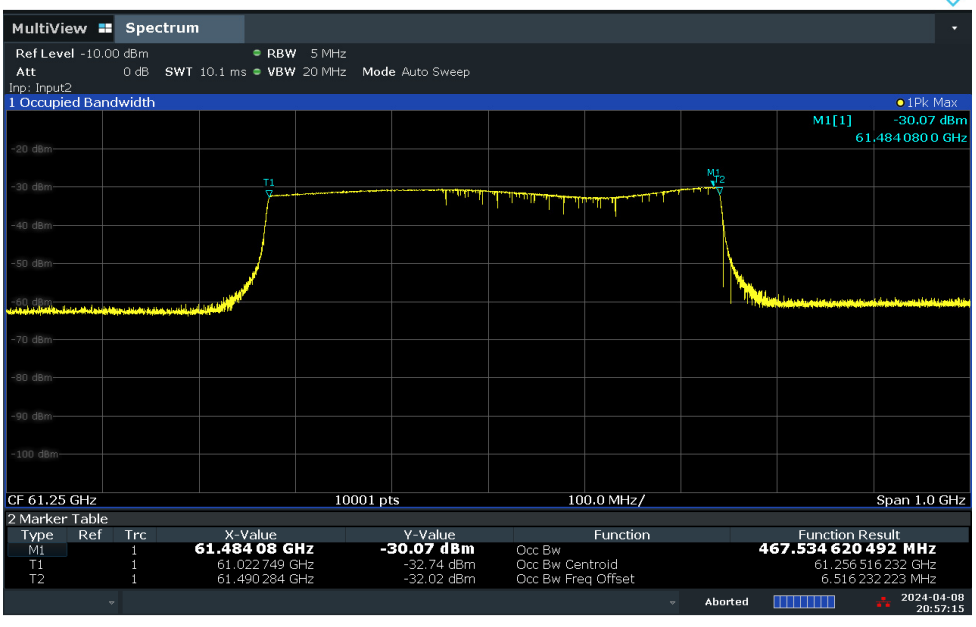
Occupied BW

Tested Frequency: 61.25 GHz



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8.2. Equivalent Isotropic Radiated Power & Peak Conducted Output Power

▣ Test Requirements and limit

Part 15.255(c)(2)(v)

For field disturbance sensors/radars that occupy 500 MHz bandwidth or less that are contained wholly within the frequency band 61.0-61.5 GHz, the average power of any emission, measured during the transmit interval, shall not exceed 40 dBm, and the peak power of any emission shall not exceed 43 dBm. In addition, the average power of any emission outside of the 61.0-61.5 GHz band, measured during the transmit interval, but still within the 57-71 GHz band, shall not exceed 10 dBm, and the peak power of any emission shall not exceed 13 dBm.

RSS-210[J.2.1]

(a) For fixed field disturbance sensors that occupy a bandwidth of 500 MHz or less and for which the bandwidth is contained wholly within the frequency band 61.0-61.5 GHz, the equipment's average and peak e.i.r.p. in the channel bandwidth shall not exceed 40 dBm and 43 dBm respectively. In addition, the average and peak e.i.r.p. of any emission outside of the band 61.0-61.5 GHz, but still within the band 57-71 GHz, shall not exceed 10 dBm and 13 dBm respectively.

RSS-210[J.4]

(a) For devices with an emission bandwidth greater than or equal to 100 MHz, the peak transmitter output power shall not exceed 500 mW. For devices with an emission bandwidth less than 100 MHz, the peak transmitter output power shall be less than the product of 500 mW and their emission bandwidth divided by 100 MHz.
(b) For the purposes of demonstrating compliance with this RSS, corrections to the transmitter output power may be made to compensate for antenna and circuit loss.

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

ANSI C63.10-2013 – Section 9.11

The following procedure was used for measurement of the output power for millimeter-wave devices;

1) The measurements were performed at 3m test site.
2) The EUT is placed on a non-conductive table is 1.5 meter above test site ground plane.
3) The measurement procedure described in ANSI C63.10-2013 Section 9.9 was followed, to find maximum signal.
4) The average and peak voltages was recorded from the DSO.
5) Replace the EUT with mm-wave source to the RF input port of the instrumentation system.
6) The mm-wave source is unmodulated.
7) Adjust the amplitude of the mm-wave source such that the DSO indicates a voltage equal to the peak voltage recorded in step 4).
8) Without changing any settings, replace the DSO with the mm-wave power meter.
9) Measure and note the power.

Far field distance (R_m)

$R_m = 2D^2 / \lambda$,

Where, D=the largest dimension of the antenna / λ=the wavelength of the emissions

Frequency Range(GHz)	λ (cm)	D (cm)	Rm (m)	Measurement Distance(m)
61.0 ~ 61.5	0.488	5.68	1.32	1.50

▣ Test Results: Comply

Peak power:

Measurement distance(D)	Frequency (GHz)	ANT Pol	DSO Reading [mV]	Power Meter Level[dBm]	Antenna Gain [dBi]	E (dBuV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1.5 m	61.25	H	5.90	-17.92	24.75	130.33	29.15	43.00	13.85

Note.

1. The Peak result meets the average limit as well as peak limit.
2. Sample calculation.

$E = 126.8 – 20\log(\lambda) + P – G$
where
E is the field strength of the emission at the measurement distance, in dBμV/m
P is the power measured at the output of the test antenna, in dBm
λ is the wavelength of the emission under investigation [300/fMHz], in m
G is the gain of the test antenna, in dBi
$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.7$
where
EIRP is the equivalent isotropically radiated power, in dBm
E_{Meas} is the field strength of the emission at the measurement distance, in dBμV/m
d_{Meas} is the measurement distance, in m

Peak Conducted Output Power:

Frequency (GHz)	EIRP(dBm)	EUT Antenna Gain(dBi)	Conducted Output Power(dBm)	Limit (dBm)	Margin (dB)
61.52	29.15	22.00	7.15	26.99	19.84

Note. Calculate the conducted output power (in watts) from the EIRP using Equation:

$P_{cond} = EIRP_{Linear} / G_{EUT}$
Where
P_{cond} is the conducted output power, in W
$EIRP_{Linear}$ is the equivalent isotropically radiated power, in W
G_{EUT} is numeric gain of the EUT radiating element (antenna)

8.3. Radiated spurious emissions

▣ Test Requirements and limit

Part 15.255(d): Limits on spurious emissions

(1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.

(2) Radiated emissions below 40 GHz shall not exceed the general limits in §15.209.

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

(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

Part 15.255(c)(2)(v)

For field disturbance sensors/radars that occupy 500 MHz bandwidth or less that are contained wholly within the frequency band 61.0-61.5 GHz, the average power of any emission, measured during the transmit interval, shall not exceed 40 dBm, and the peak power of any emission shall not exceed 43 dBm. In addition, the average power of any emission outside of the 61.0-61.5 GHz band, measured during the transmit interval, but still within the 57-71 GHz band, shall not exceed 10 dBm, and the peak power of any emission shall not exceed 13 dBm.

Part 15.209(a): the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 – 0.490	2 400/F (kHz)	300
0.490 – 1.705	2 4000/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

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

RSS-210[J.3]

The power of any emissions outside the band 57-71 GHz shall consist solely of spurious emissions and shall not exceed:

(a) the fundamental emission levels

(b) the general field strength limits specified in RSS-Gen for emissions below 40 GHz

(c) 90 pW/cm2 at a distance of 3 m for emissions between 40 GHz and 200 GHz

RSS-210[J.2.1]

(a) For fixed field disturbance sensors that occupy a bandwidth of 500 MHz or less and for which the bandwidth is contained wholly within the frequency band 61.0-61.5 GHz, the equipment's average and peak e.i.r.p. in the channel bandwidth shall not exceed 40 dBm and 43 dBm respectively. In addition, the average and peak e.i.r.p. of any emission outside of the band 61.0-61.5 GHz, but still within the band 57-71 GHz, shall not exceed 10 dBm and 13 dBm respectively.

RSS-Gen[8.9]

Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table below. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Frequency (MHz)	IC Limit (μA/m)	Measurement Distance (m)
0.009 – 0.490	6.37/F (F in kHz)	300
0.490 – 1.705	63.7/F (F in kHz)	30
1.705 – 30.0	0.08	30

Frequency (MHz)	IC Limit (uV/m)	Measurement Distance (m)
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure:

ANSI C63.10-2013 – Section 9.12 & 9.13

The following procedure was used for measurement of the radiated spurious emissions.

1) The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements at above 1 GHz, the table height is 1.5 m

2) The table was rotated 360 degrees to determine the position of the highest radiation.

3) During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 0.5 ~ 3 meter away from the interference-receiving antenna.

4) For measurements above 1GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.

5) The antenna is a broadband 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.

6) 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 table was turned from 0 degrees to 360 degrees to find the maximum reading.

7) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

- Spectrum analyzer settings:

1. Frequency Range: Below 1GHz
RBW = 100 or 120 kHz, VBW = 3 x RBW, Detector = Peak or Quasi Peak

2. Frequency Range: ≤ 40GHz
Peak Measurement
RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes
Average Measurement> 1GHz
RBW = 1 MHz, VBW ≥ 1/T, Detector = Peak, Sweep Time = Auto, Trace Mode = Max Hold until the trace stabilizes

3. Frequency Range: Above 40GHz
RBW = 1 MHz, VBW = 1 or 3 MHz, Detector = Peak or average, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes

Far field distance (R_m)

$R_m = 2D^2 / \lambda$,

Where, D=the largest dimension of the measurement antenna / λ=the wavelength of the emissions

Frequency Range(GHz)	λ (cm)	D(cm)	Rm (m)	Measurement Distance(m)
40 ~ 60	0.500	6.24	1.56	2.00
50 ~ 75	0.400	5.68	1.61	1.70
60 ~ 90	0.333	4.82	1.39	1.60
90 ~ 140	0.214	2.74	0.70	0.70
140 ~ 200	0.150	1.89	0.48	0.50

▣ Test Results: Comply

Frequency Range: 9 kHz ~ 1 GHz

Test Note.

1. The worst case data was reported.
   Radiated emissions below 30 MHz below 30 MHz were greater than 20 dB below limit.
2. Information of DCF(Distance Correction Factor)
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance correction factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is “NA”, the measurements were performed at the specified distance and distance factor is not applied.
3. Sample Calculation.
   Margin = Limit – Result / Result = Measured Level + TF + Distance factor / TF = AF + CL – AG
   Where, TF = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain
4. * Noise floor.

Tested Frequency: 61.25 GHz

Frequency (MHz)	ANT Pol	Detector Mode	Measured Level(dBuV)	TF (dB/m)	DCF(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
85.29	V	QP	44.30	-12.44	NA	31.86	40.00	8.14
89.72	V	QP	41.00	-12.30	NA	28.70	43.50	14.80
134.02	H	QP	39.00	-7.28	NA	31.72	43.50	11.78
240.46	H	QP	37.80	-6.92	NA	30.88	46.00	15.12

Worst-case plot (Measured Level) Z axis & Ver

Frequency Range: 1 ~ 40 GHz

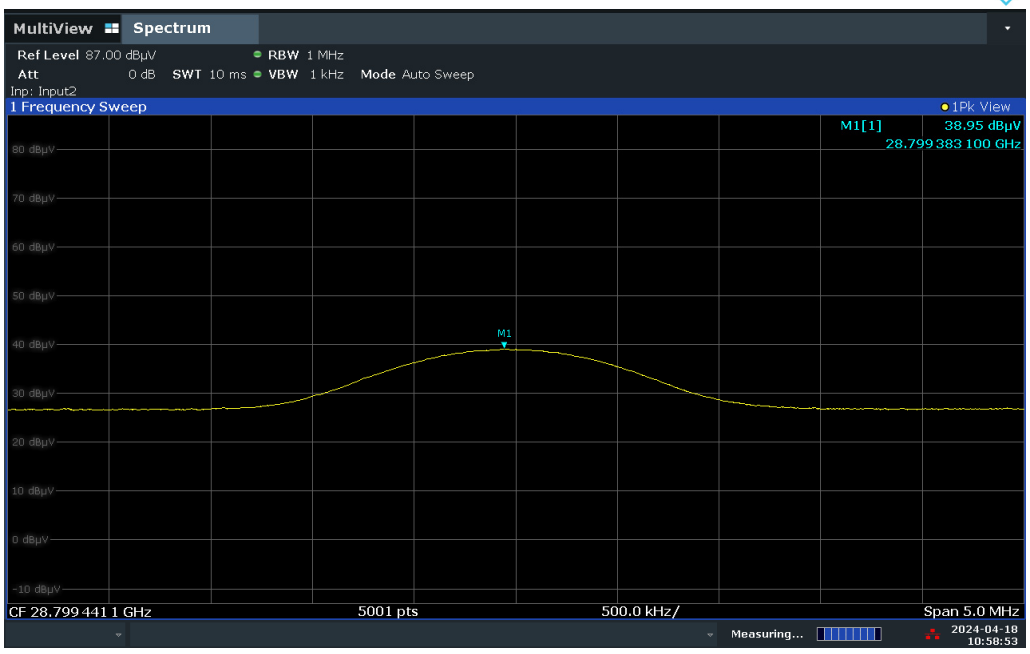
Test Note.

1. No other spurious and harmonic emissions were found above listed frequencies.
2. Information of DCF(Distance Factor)
For finding emissions, the test distance might be reduced. In this case, the distance factor is applied to the result.
- Calculation of distance factor = 20 log(applied distance / required distance)
When distance factor is “N/A”, the distance is 3 m and distance factor is not applied.
3. Sample Calculation.
Margin = Limit – Result / Result = Measured Level + TF + Distance factor / TF = AF + CL – AG
Where, TF = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain
4. * Noise floor.

Tested Frequency: 61.25 GHz

Frequency (MHz)	ANT Pol	Detector Mode	Measured Level(dBuV)	TF (dB/m)	DCF(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5 399.67	V	PK	41.55	8.71	NA	50.26	74.00	23.74
5 399.90	V	AV	30.86	8.71	NA	39.57	54.00	14.43
14 399.86	H	PK	40.67	20.40	-5.46	55.61	74.00	18.39
14 399.66	H	AV	30.61	20.40	-5.46	45.55	54.00	8.45
28 799.35	H	PK	45.01	10.77	NA	55.78	74.00	18.22
28 799.44	H	AV	38.95	10.77	NA	49.72	54.00	4.28

Worst-case plot (Measured Level) Z axis & Hor



Frequency Range: 40 ~ 200 GHz

Test Note.

1. The radiated emissions were investigated up to 200GHz. And no other spurious and harmonic emissions were found above listed frequencies.
2. Information of DCF(Distance Factor)

For finding emissions, the test distance might be reduced. In this case, the distance factor is applied to the result.

- Calculation of distance factor = 20 log(applied distance / required distance)

When distance factor is “N/A”, the distance is 3 m and distance factor is not applied.

3. Sample Calculation.

E(dBuV/m) = Measured level (dBuV) + 107 + TF(dB/m)

where, E=field strength / TF(Total Factor) = Antenna Factor(dB/m) + Cable Loss(dB/m) + Attenuator Loss(dB) – Amplifier Gain(dB)

EIRP(dBm) = E(dBuV/m) + 20log(D) - 104.7; where, D is measurement distance (in the far field region) in m.

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

Where, PD = the power density at the distance specified by the limit, in W/m^2

$EIRP_{Linear}$ = EIRP, in watts

D = is the distance at which the power density limit is specified, in m

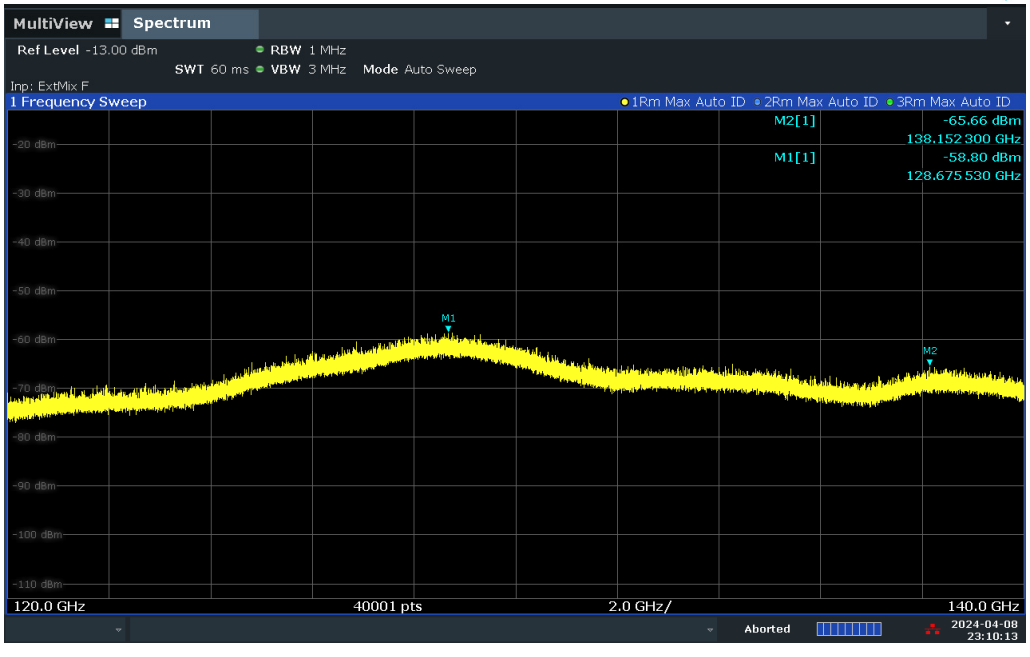
If the mixer is used, mixer loss was applied to the measured level by SA correction factor.

4. * Noise floor.

Tested Frequency: 61.25 GHz

Measurement distance(D)	Frequency (MHz)	ANT Pol	Measured Level(dBm)	TF (dB/m)	E (dBuV/m)	EIRP (dBm)	Power Density (pW/cm^2)	Limit (pW/cm^2)
0.7 m	*128 675.53	H	-58.80	47.94	96.14	-11.66	60.33	90.00
0.5 m	*191 058.90	H	-63.65	51.92	95.27	-15.45	25.21	90.00

Worst data plot (Measured Level) Z axis & Hor



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Frequency Range: 57 ~ 61 GHz, 61.5 ~ 71 GHz

Test Note.

1. Information of DCF(Distance Factor)

For finding emissions, the test distance might be reduced. In this case, the distance factor is applied to the result.

- Calculation of distance factor = 20 log(applied distance / required distance)

When distance factor is “N/A”, the distance is 3 m and distance factor is not applied.

2. Sample Calculation.

E(dBuV/m) = Measured level (dBuV) + 107 + TF(dB/m)

where, E=field strength / TF(Total Factor) = Antenna Factor(dB/m) + Cable Loss(dB/m) + Attenuator Loss(dB) – Amplifier Gain(dB)

EIRP(dBm) = E(dBuV/m) + 20log(D) - 104.7; where, D is measurement distance (in the far field region) in m.

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

Where, PD = the power density at the distance specified by the limit, in W/m^2

$EIRP_{Linear}$ = EIRP, in watts

D = is the distance at which the power density limit is specified, in m

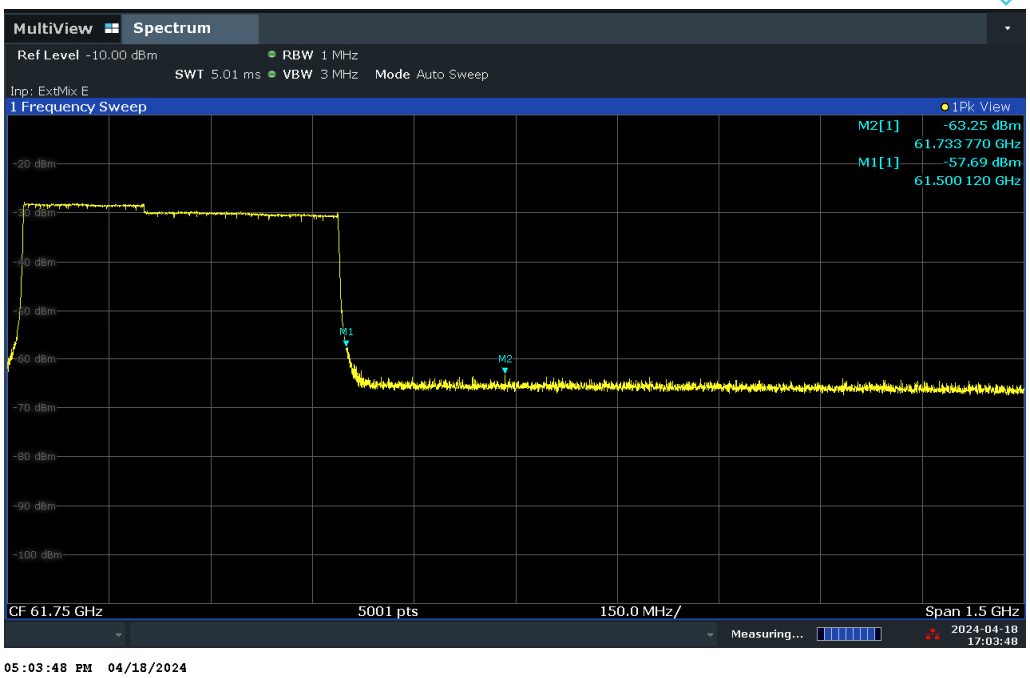
If the mixer is used, mixer loss was applied to the measured level by SA correction factor.

3. * Noise floor.

Tested frequency: 61.25 GHz

Measurement distance(D)	Frequency (MHz)	ANT Pol	Measured Level(dBm)	TF (dB/m)	E (dBuV/m)	Result-Peak (dBm)	Limit - Peak (dBm)	Margin (dB)
1.6 m	60 994.45	H	-60.60	43.67	90.07	-10.55	13.00	23.55
1.6 m	61 500.12	H	-57.69	43.72	93.03	-7.59	13.00	20.59
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

Worst data plot (Measured Level) **Z axis & Hor**



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8.4. Frequency stability

▣ Test Requirements and limit

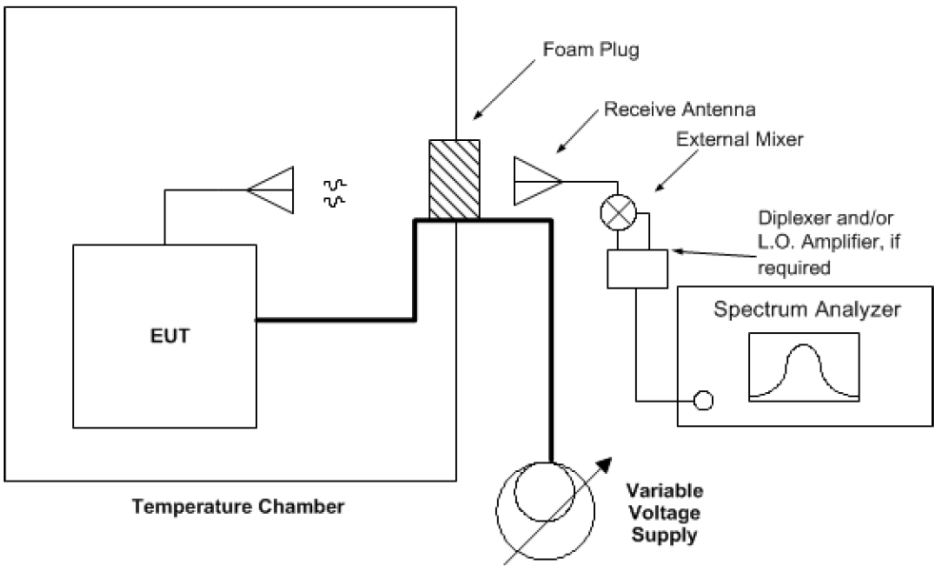
▪ **FCC Part 15.255(f):** Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to + 50 degrees Celsius with an input voltage variation of 85 % to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

▪ **RSS-210[J.6]**

Fundamental emissions shall be contained within the 57-71 GHz frequency band during all conditions of operation when tested at the temperature and voltage variations specified for the frequency stability measurement in RSS-Gen.

▣ Test Configuration:

Frequency stability



▣ Test Procedure:

ANSI C63.10-2013 – Section 9.14

1) With the EUT at ambient temperature (approximately 25 °C) and voltage source set to the EUT nominal operating voltage (100 %), record the spectrum mask of the EUT emission on the spectrum analyzer.
2) Vary EUT power supply between 85% and 115% of nominal, and record the frequency excursion of the EUT emission mask.
3) Set the power supply to 100 % nominal setting, and raise EUT operating temperature to 50 °C. Record the frequency excursion of the EUT emission mask.
4) Repeat step 3) at each 10 °C increment down to −20 °C.

RSS-Gen[6.11]

Frequency stability is a measure of frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage.
When the measurement method of transmitter frequency stability is not stated in the applicable RSS or reference standards, the following conditions apply:
(a) The reference temperature for radio transmitters is +20°C (+68°F).
(b)A hand-held device that is only capable of operating using internal batteries shall be tested at the battery's nominal voltage, and again at the battery's operating end-point voltage, which shall be specified by the equipment manufacturer. For this test, either a battery or an external power supply can be used.
(c)The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency-determining circuit element shall be made subsequent to this initial set-up.
For licence-exempt devices, the following conditions apply:
(a) at the temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage
(b) at the temperature of +20°C (+68°F) and at ±15% of the manufacturer's rated supply voltage

▣ **Test Results: Comply**

Tested frequency: 61.25 GHz

VOLTAGE (%)	POWER (V DC)	TEMP (℃)	Measured low frequency(F_L)(GHz)	Measured high frequency(F_H)(GHz)
100%	5.00	+20(Ref)	61.022 75	61.490 28
100%		-30	61.022 72	61.490 34
100%		-20	61.022 78	61.490 25
100%		-10	61.022 75	61.490 34
100%		0	61.022 75	61.490 28
100%		+10	61.022 72	61.490 25
100%		+20	61.022 75	61.490 28
100%		+30	61.022 78	61.490 25
100%		+40	61.022 78	61.490 34
100%		+50	61.022 72	61.490 32
115%	5.75	+20	61.022 78	61.490 25
85%	4.25	+20	61.022 72	61.490 34

Note: Fundamental emissions were contained within the frequency bands.(61 ~ 61.5 GHz)

8.5. AC line conducted emissions

▣ Test Requirements and limit

Part 15.207

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

RSS-Gen[8.8]

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

▣ Test Configuration

See test photographs for the actual connections between EUT and support equipment.

▣ Test Procedure

Conducted emissions from the EUT were measured according to the ANSI C63.10-2013.

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

▣ Test Results: Comply

AC Line Conducted Emissions (Graph) Tested Frequency: 61.25 GHz

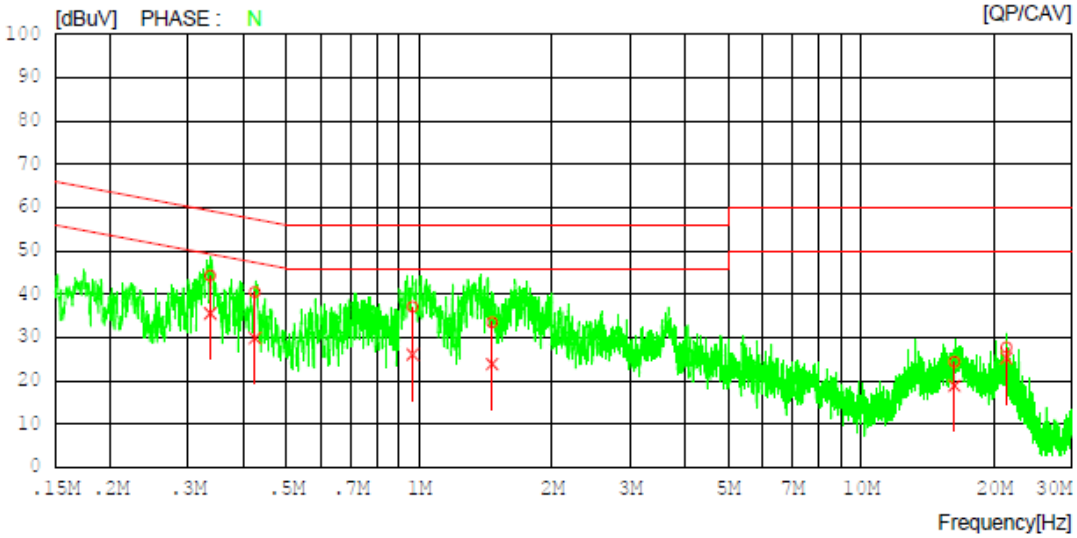
Results of Conducted Emission

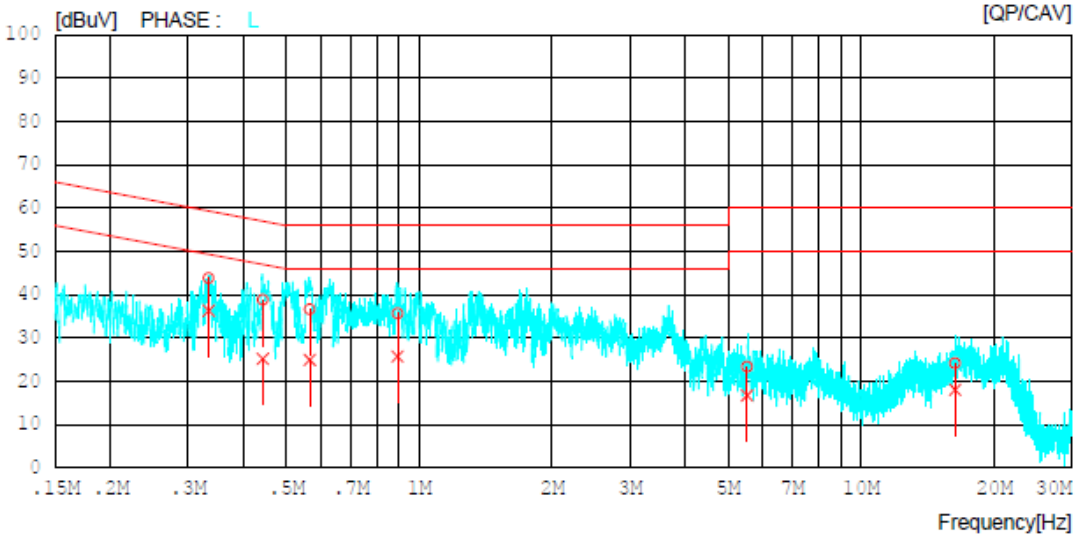
Date 2024-04-09

Order No.
Model Name RM68-NTA
Temp/Humi/Atm 21 °C / 41%
Test Condition mmW

LIMIT : FCC P15.207 AV
FCC P15.207 QP

Lisn Factor
1. NSLK 8128 RC-387_N_23.10.26
2. NSLK 8128 RC-387_L1_23.10.26
Cable Loss
1. C1_LISN TO RECIVER_2023-12-11
Pulse Lmitter
1. PULSE LIMITER_ESH3-Z2_101333_2023.08.21





AC Line Conducted Emissions (List) Tested Frequency: 61.25 GHz

Results of Conducted Emission

Date 2024-04-09

Order No.
Model Name RM68NTA
Temp/Humi/Atm 21 °C / 41%
Test Condition mmW

LIMIT : FCC P15.207 AV
FCC P15.207 QP

Lisn Factor
1. NSLK 8128 RC-387_N_23.10.26
2. NSLK 8128 RC-387_L1_23.10.26
Cable Loss
1. C1_LISN TO RECIVER_2023-12-11
Pulse Lmitter
1. PULSE LIMITER_ESH3-Z2_101333_2023.08.21

NO	FREQ	READING QP	READING CAV	C.FACTOR	RESULT QP	RESULT CAV	LIMIT QP	LIMIT CAV	MARGIN QP	MARGIN CAV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.33649	34.33	25.57	9.99	44.32	35.56	59.29	49.29	14.97	13.73	N
2	0.42467	30.53	19.88	10.00	40.53	29.88	57.36	47.36	16.83	17.48	N
3	0.96600	27.10	16.08	10.02	37.12	26.10	56.00	46.00	18.88	19.90	N
4	1.46240	23.47	13.86	10.03	33.50	23.89	56.00	46.00	22.50	22.11	N
5	16.26700	13.87	8.34	10.54	24.41	18.88	60.00	50.00	35.59	31.12	N
6	21.33720	17.13	14.71	10.58	27.71	25.29	60.00	50.00	32.29	24.71	N
7	0.33377	33.84	26.36	9.99	43.83	36.35	59.36	49.36	15.53	13.01	L
8	0.44263	28.84	15.21	10.00	38.84	25.21	57.01	47.01	18.17	21.80	L
9	0.56523	26.57	14.89	10.07	36.64	24.96	56.00	46.00	19.36	21.04	L
10	0.89309	25.58	15.63	10.12	35.70	25.75	56.00	46.00	20.30	20.25	L
11	5.52520	13.13	6.51	10.26	23.39	16.77	60.00	50.00	36.61	33.23	L
12	16.34240	13.58	7.49	10.61	24.19	18.10	60.00	50.00	35.81	31.90	L

9. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal. Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent	N9020A	23/12/15	24/12/15	MY50110097
Spectrum Analyzer	Rohde Schwarz	FSW85	23/06/23	24/06/23	101778
Thermohygrometer	XIAOMI	MHO-C201	23/12/15	24/12/15	00089675
Thermohygrometer	BODYCOM	BJ5478	23/12/15	24/12/15	120612-2
Multimeter	FLUKE	17B+	23/12/15	24/12/15	36390701WS
Signal Generator	Rohde Schwarz	SMBV100A	23/12/15	24/12/15	255571
Signal Generator	ANRITSU	MG3695C	23/12/15	24/12/15	173501
DC Power Supply	Agilent Technologies	6654A	23/06/23	24/06/23	MY40000801
DC Power Supply	SM techno	SDP30-5D	23/06/23	24/06/23	305DMG291
Loop Antenna	ETS-Lindgren	6502	23/11/09	24/11/09	00060496
Hybrid Antenna	Schwarzbeck	VULB 9160	23/12/15	24/12/15	3362
PreAmplifier	H.P	8447D	23/12/15	24/12/15	2944A07774
HORN ANT	ETS	3117	23/12/15	24/12/15	00140394
PreAmplifier	Agilent	8449B	23/12/15	24/12/15	3008A02108
HORN ANT	A.H.Systems	SAS-574	23/06/23	24/06/23	155
PreAmplifier	tsj	MLA-1840-J02-45	23/06/23	24/06/23	16966-10728
Horn Antenna	MI Wave	RX ANT-5 261U+410U	23/06/23	24/06/23	108
PreAmplifier	Norden Millimeter Inc.	NA4060G50N8P12	22/12/16	24/12/16	1003
Horn Antenna	MI Wave	RX ANT-6 261V+410V	23/06/23	24/06/23	110
PreAmplifier	ERAVABT	SBL-5037533550-151-E1-ET	23/12/15	24/12/15	10394-01
Horn Antenna	MI Wave	RX ANT-7 261E	23/06/23	24/06/23	112
Harmonic mixer	Rohde Schwarz	FS-Z90	23/06/23	24/06/23	101714
Horn Antenna	MI Wave	RX ANT-8 261F	23/06/23	24/06/23	114
Harmonic mixer	Rohde Schwarz	FS-Z140	23/06/23	24/06/23	101009
Horn Antenna	MI Wave	RX ANT-9 261G	23/06/23	24/06/23	116
Harmonic mixer	Rohde Schwarz	FS-Z220	23/06/23	24/06/23	101012
RF Detector	SAGE Millimeter	SFD-503753-15SF-P1	23/12/15	24/12/15	17841-01
Digital Phosphor	Tektronix	DPO2024B	23/12/15	24/12/15	C012114
Level setting Attenuator	SAGE Millimeter	STA-30-15-M1	23/12/15	24/12/15	10390-01
Level setting Attenuator	SAGE Millimeter	STA-30-12-M3-2	23/12/15	24/12/15	10391-01
Temp & Humi Test Chamber	SJ Science	SJ-TH-S50	23/12/14	24/12/14	SJ-TH-S50-140205
Multiplier	OML, Inc.	S15MS	23/06/23	24/06/23	170821-1
EMI Test Receiver	ROHDE&SCHWARZ	ESCI7	24/01/29	25/01/29	100910
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	23/08/21	24/08/21	101333
LISN	SCHWARZBECK	NNLK 8128 RC	23/10/26	24/10/26	8128 RC-387
High-pass filter	Wainwright	WHKX12-935-1000-15000-40SS	23/12/15	24/12/15	7
High-pass filter	Wainwright	WHKX10-2838-3300-18000-60SS	23/12/15	24/12/15	2
High-pass filter	Wainwright	WHKX6-6320-8000-26500-40CC	23/12/15	24/12/15	2
Cable	HUBER+SUHNER	SUCOFLEX100	24/01/03	25/01/03	M-1
Cable	HUBER+SUHNER	SUCOFLEX100	24/01/03	25/01/03	M-2
Cable	Junkosha	MWX241/B	24/01/03	25/01/03	M-3
Cable	Junkosha	MWX221	24/01/03	25/01/03	M-4
Cable	Junkosha	MWX221	24/01/03	25/01/03	M-5
Cable	JUNFLON	J12J101757-00	24/01/03	25/01/03	M-7
Cable	HUBER+SUHNER	SUCOFLEX104	24/01/03	25/01/03	M-8

Cable	HUBER+SUHNER	SUCOFLEX106	24/01/03	25/01/03	M-9
Cable	Junkosha	MWX315	24/01/03	25/01/03	M-10
Cable	DTNC	Cable	24/01/03	25/01/03	RFC-69
Cable	Junkosha	MWX241	24/01/03	25/01/03	mmW-1
Cable	Junkosha	MWX241	24/01/03	25/01/03	mmW-4
Cable	Junkosha	MWX261	24/01/03	25/01/03	mmW-7
Cable	Junkosha	MWX261	24/01/03	25/01/03	mmW-15
Cable	SAGE MILLIMETER Inc	SCW-1M1M024-F1	24/01/03	25/01/03	mmW-10
Cable	HUBER+SUHNER	SUCOFLEX 104	24/01/03	25/01/03	mmW-8
Cable	HUBER+SUHNER	SUCOFLEX 104	24/01/03	25/01/03	mmW-9
Test Software	tsj	Radiated Emission Measurement	NA	NA	Version 2.00.0185
Test Software	tsj	Noise Terminal Measurement	NA	NA	Version 2.00.0190

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.
Note2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.

APPENDIX I

Test set up diagrams

Below 1GHz	Above 1GHz