TEST REPORT

Dt&C

Dt&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC2412-0141

2. Customer

   • Name (FCC) : IS Technologies

   • Address (FCC) : M-dong-1602,1603, Songdo IT Center 32 Songdogwahak-ro, Yeonsu-gu, Incheon, South Korea

3. Use of Report : FCC Original Grant

4. Product Name / Model Name : Radar Level measurement / SA365RL

   FCC ID : 2BL7YSA365RL

5. FCC regulation(s): Part 15.255

   Test Method Used: ANSI C63.10-2020, KDB 364244 D01v01

6. Date of Test : 2024.10.18 ~ 2024.11.28

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 . 12 . 26 .

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
DRTFCC2412-0141	Dec. 26, 2024	Initial issue	Seokho Han	JaeJin Lee

Table of Contents

1. General Information

1.1. Description of EUT

FCC Equipment Class	Part 15 Field Disturbance Sensor (FDS)
Product	Radar Level measurement
Model Name	SA365RL
Add Model Name	-
Power Supply	DC 3.6 V
Frequency Range	57.0 ~ 64.0 GHz
Max. RF Output Power (EIRP)	13.81 dBm
Modulation Type	Pulse Modulation
Antenna Specification	**Antenna type**: Folded dipole antenna **Antenna gain(Max)**: 6.00 dBi

RADAR CERTIFICATION OPTIONS

☐ a. Any terrestrial radar transmitting in the 57-71 GHz frequency band can be certified under §15.255(c)(2) with a peak conducted output power limit of -10 dBm and a peak EIRP limit of 10 dBm.
☐ b. Any terrestrial radar transmitting within the 61.0-61.5 GHz ISM band segment, with a maximum EIRP output of 40 dBm (average) and 43 dBm (peak), can be certified under the §15.255(c)(2)(v) rules.
☐ c. Radars intended for operation onboard unmanned aircraft in the 60.0-64.0 GHz band segment can be certified under §15.255(b)(3) with a peak EIRP limit of 20 dBm and a required off-time of at least 16.5 milliseconds within any contiguous 33.0 millisecond interval.
☐ d. Terrestrial, including vehicular (in-cabin) radar devices in the 57.0-59.4 GHz band segment, can be certified under §15.255(c)(2)(i), with peak EIRP limits of 20 dBm for indoor operation and 30 dBm for outdoor operation.
☐ e. All terrestrial radar within the 57.0-61.56 GHz band segment can be certified under §15.255(c)(2)(ii), with a peak EIRP limit of 3 dBm with no off-time requirement, or 20 dBm with a corresponding off-time requirement of 16.5 milliseconds within any 33.0-millisecond interval.
☐ f. Any terrestrial radar operating within the 57.0-64.0 GHz band segment can be certified under §15.255(c)(2)(iii)(A), with a peak EIRP limit of 14 dBm and a corresponding off-time requirement of 25.5 milliseconds within any 33.0-millisecond interval.
☐ g. Permanent or temporary fixed radar intended solely for outdoor or other than in-cabin vehicular applications can be certified under §15.255(c)(2)(iii)(B) with a peak EIRP limit of 20 dBm and a corresponding off-time requirement of 16.5 milliseconds within any contiguous 33.0 millisecond interval.
☒ **h. Pulsed radar applications with a maximum pulse duration of 6 nanoseconds and transmitting within the 57-64 GHz band segment can be certified under §15.255(c)(3), with an average EIRP limit of 13 dBm, a peak EIRP limit of 33 dBm, and a transmit duty cycle limit of 10%; in addition, the average integrated EIRP within the 61.5-64.0 GHz band must not exceed 5 dBm in any 0.3-microsecond interval.**

1.2. Declaration by the applicant / manufacturer

N/A

1.3. Testing Laboratory

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 Part 2.948 according to ANSI C63.4-2014. **- FCC & IC MRA Designation No. : KR0034** **- ISED#: 5740A**		
www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

1.4. Testing Environment

Ambient Condition	
▪ Temperature	+20 ℃ ~ +23 ℃
▪ Relative Humidity	+38 % ~ +42 %

1.5. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.10-2020. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

Parameter	Measurement uncertainty
Radiated emission (1 GHz Below)	5.0 dB (The confidence level is about 95 %, k = 2)
Radiated emission (1 GHz ~ 18 GHz)	4.8 dB (The confidence level is about 95 %, k = 2)
Radiated emission (18 GHz Above)	5.0 dB (The confidence level is about 95 %, k = 2)

1.6. Test Equipment List

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	24/06/14	25/06/14	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	24/06/05	25/06/05	MY40000801
DC Power Supply	SM techno	SDP30-5D	24/06/05	25/06/05	305DMG291
Loop Antenna	ETS-Lindgren	6502	24/11/08	25/11/08	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	24/06/04	25/06/04	00143278
PreAmplifier	tsj	MLA-0118-B01-40	23/12/15	24/12/15	1852267
HORN ANT	A.H.Systems	SAS-574	24/06/11	25/06/11	155
PreAmplifier	tsj	MLA-1840-J02-45	24/06/03	25/06/03	16966-10728
Horn Antenna	MI Wave	RX ANT-5 261U+410U	24/06/18	25/06/18	108
PreAmplifier	Norden Millimeter Inc.	NA4060G50N8P12	22/12/15	24/12/15	1003
Horn Antenna	MI Wave	RX ANT-6 261V+410V	24/06/18	25/06/18	110
PreAmplifier	ERAVABT	SBL-5037533550-151-E1-ET	23/12/15	24/12/15	10394-01
Horn Antenna	MI Wave	RX ANT-7 261E	24/06/18	25/06/18	112
PreAmplifier	Norden Millimeter Inc.	NN6090G40N5P-2	23/12/15	25/12/15	1001
Harmonic mixer	Rohde Schwarz	FS-Z90	24/06/14	25/06/14	101714
Horn Antenna	MI Wave	RX ANT-8 261F	24/06/18	25/06/18	114
Harmonic mixer	Rohde Schwarz	FS-Z140	24/06/14	25/06/14	101009
Horn Antenna	MI Wave	RX ANT-9 261G	24/06/18	25/06/18	116
Harmonic mixer	Rohde Schwarz	FS-Z220	24/06/14	25/06/14	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
Digital Phosphor	Tektronix	DPO72304SX	23/12/15	24/12/15	8320256
Temp & Humi Test Chamber	SJ Science	SJ-TH-S50	23/12/14	24/12/14	SJ-TH-S50-140205
Multiplier	OML, Inc.	S15MS	24/06/14	25/06/14	170821-1
High Pass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	24/06/12	25/06/12	8
High Pass Filter	Wainwright Instruments	WHKX10-2838-3300-18000-60SS	24/06/12	25/06/12	1
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5-6SS	24/06/12	25/06/12	3
Attenuator	Hefei Shunze	SS5T2.92-10-40	24/06/12	25/06/12	16012202
Attenuator	Aeroflex/Weinschel	56-3	24/06/12	25/06/12	Y2370
Attenuator	SMAJK	SMAJK-2-3	24/06/12	25/06/12	3
Attenuator	SMAJK	SMAJK-2-3	24/06/12	25/06/12	2
Cable	DT&C	Cable	24/01/03	25/01/03	G-2
Cable	HUBER+SUHNER	SUCOFLEX 100	24/01/03	25/01/03	G-3
Cable	DT&C	Cable	24/01/03	25/01/03	G-4
Cable	OMT	YSS21S	24/01/03	25/01/03	G-5
Cable	Junkosha	MWX241	24/01/03	25/01/03	mmW-1
Cable	Junkosha	MWX241	24/01/03	25/01/03	mmW-4
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	J12J101757-00	24/01/03	25/01/03	M-7
Cable	HUBER+SUHNER	SUCOFLEX106	24/01/03	25/01/03	M-9
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-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

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.

2. Test Methodology

The measurement procedures described in the ANSI C63.10-2020 was used in measurement of the EUT.

2.1. 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.

2.2. 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.

2.3. 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.

2.4. 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.

2.5. 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.

Test Mode	Description	Test Frequency(GHz)
Pulse Modulation	Transmitting	60.50

3. Antenna Requirements

▣ **According to 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 device.
Therefore this E.U.T complies with the requirement of Part 15.203

4. Summary of Test Results

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Status Note 1
15.255(c)(3)	10 dB Bandwidth	NA	Radiated	C
15.255(c)(3)	Equivalent Isotropic Radiated Power	Peak < 33 dBm Average < 13 dBm		C Note2
15.255(d) 15.209	Radiated Spurious Emissions	Refer to the section 8.3		C Note2
15.255(f)	Frequency Stability	Within the frequency band		C
15.207	AC Power-Line Conducted Emissions	< Part 15.207 limits (Refer to the section 8.5)	AC Line Conducted	NA Note 3
15.203	Antenna Requirements	Part 15.203 (Refer to the section 7)	-	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: This device is a battery-powered product and does not have a port to connect to an AC power outlet.

5. Test Results

5.1. 10 dB Bandwidth

▣ Test Requirements and limit

Part 15.255(c)(3)

For pulsed field disturbance sensors/radars operating in the 57-64 GHz band that have a maximum pulse duration of 6 ns, the average EIRP shall not exceed 13 dBm and the transmit duty cycle shall not exceed 10% during any 0.3 µs time window. In addition, the average integrated EIRP within the frequency band 61.5-64.0 GHz shall not exceed 5 dBm in any 0.3 µs time window. Peak emissions shall not exceed 20 dB above the maximum permitted average emission limit applicable to the equipment under test. **The radar bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna.**

▣ Test Configuration:

Refer to the APPENDIX I.

▣ Test Procedure:

ANSI C63.10-2020 – Section 9.3

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

- Spectrum analyzer settings:
  1) Span equal to approximately 1.5 times the EBW, centered on the carrier frequency.
  2) RBW, prefer 1% to 5% of EBW.
  3) VBW approximately 3 × RBW.
  4) Sweep = No faster than coupled (auto) time.
  5) Detector function = peak.
  6) Trace = max-hold.
  7) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

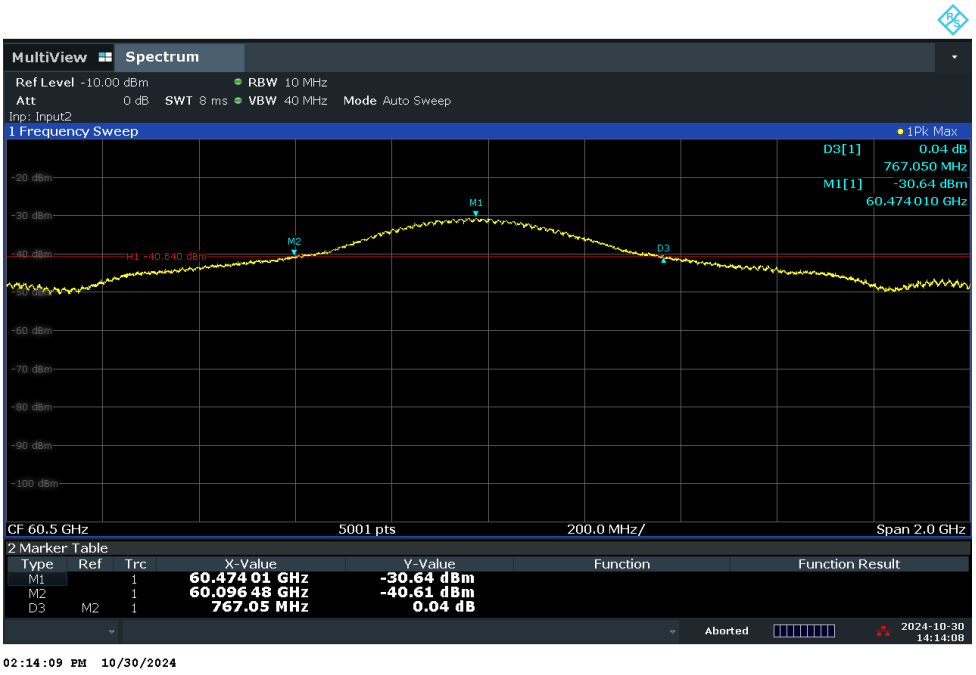
▣ Test Results: Comply

Frequency(GHz)	10 dB Bandwidth (MHz)
60.50	767.05

▣ Result plots

10 dB Bandwidth

Tested Frequency: 60.50 GHz



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5.2. Equivalent Isotropic Radiated Power

▣ Test Requirements and limit

Part 15.255(c)(3)

For pulsed field disturbance sensors/radars operating in the 57-64 GHz band that have a maximum pulse duration of 6 ns, the average EIRP shall not exceed 13 dBm and the transmit duty cycle shall not exceed 10% during any 0.3 µs time window. In addition, the average integrated EIRP within the frequency band 61.5-64.0 GHz shall not exceed 5 dBm in any 0.3 µs time window. Peak emissions shall not exceed 20 dB above the maximum permitted average emission limit applicable to the equipment under test. The radar bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna.

▣ Test Configuration:

Refer to the APPENDIX I.

▣ Test Procedure:

ANSI C63.10-2020 – Section 9.9

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 C63.10-2020 Section 9.7 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.

Note: Spectrum analyzer was used instead of power meter when measuring power in step 8~9.

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)
57.00 ~ 64.00	0.469	5.68	1.38	1.60

▣ Test Results: Comply

Peak e.i.r.p

Measurement distance(D)	Frequency (GHz)	ANT Pol	DSO Reading (mV)	Spectrum Analyzer Level(dBm)	Antenna Gain (dBi)	E (dBuV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1.6 m	60.50	H	1 100	-34.01	24.45	114.43	13.81	33.00	19.19

Average e.i.r.p

Peak e.i.r.p	Duty cycle	Pulse desensitization factor(dB)	Average e.i.r.p (dBm)	Limit (dBm)
13.81	1.99	-17.01	-3.20	13.00

Note.

1. Average e.i.r.p was determined form the peak e.i.r.p after correcting for the duty cycle.
   Please refer to the next page for transmit duty cycle.
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

Maximum pulse duration

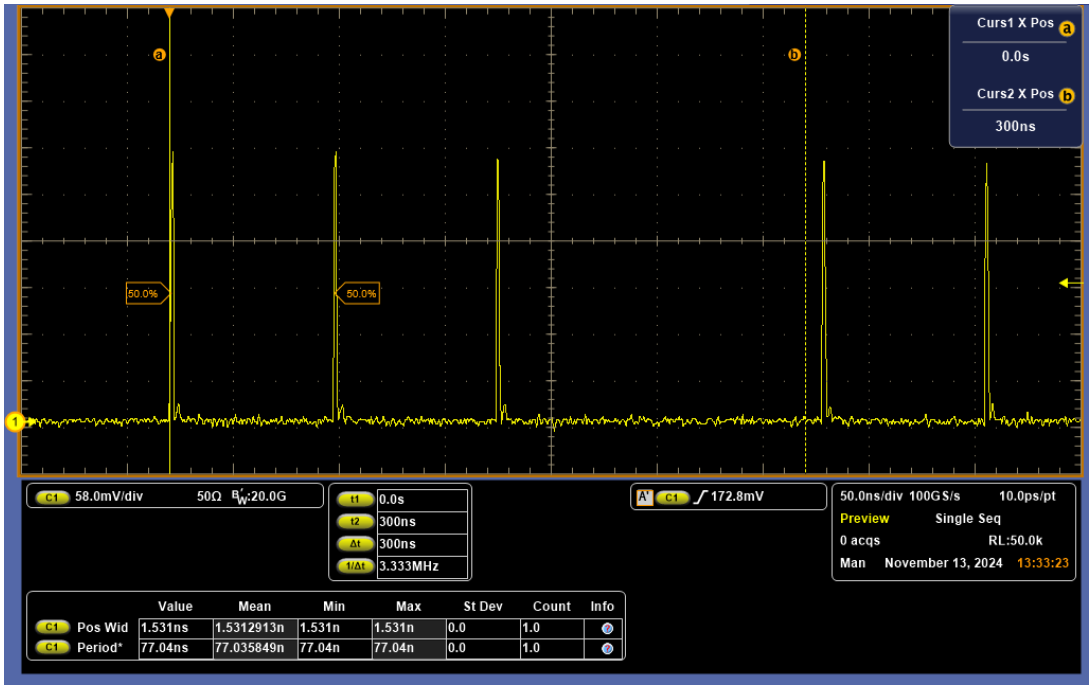
Maximum pulse duration (ns)	Limit (ns)
1.531	6

Pulse duration(ns)	Pulse Repetition Interval(ns)	Duty cycle(%)
1.531	77.04	1.99

Number of pulses in 0.3 us	Total pulse on time(ns) in 0.3us	Transmit duty cycle within 0.3us (%)	Limit (%)
3	4.593	1.531	10

Note: Total pulse on time(ns) in 0.3us = Maximum pulse duration(ns) x Number of pulses in 0.3 us
Transmit duty cycle within 0.3us (%) = Total pulse on time(ns) in 0.3us / 0.3us

Transmit duty cycle

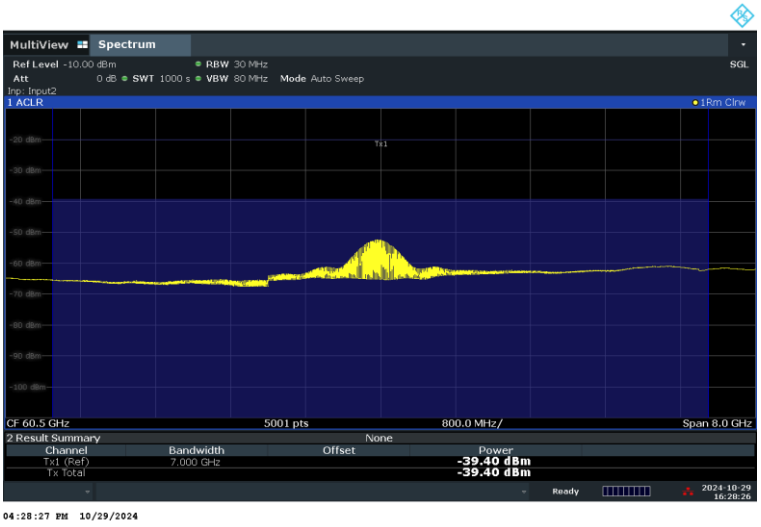


Average integrated EIRP within the frequency band 61.5 - 64.0 GHz and within 0.3us Calculation

Measurement		Note
Channel power full band (57 - 64 GHz)	-16.72 dBm	-
Channel power 61.5 – 64 GHz	-19.30 dBm	-
Difference	2.58 dBm	-
Average EIRP of EUT within 0.3us	-3.20 dBm	From RF detector measurement
Average EIRP of EUT within 0.3us and within 61.5 – 64 GHz	-5.78 dBm	Limit: 5dBm

Note: Difference = [Channel power full band (57 - 64 GHz)] – [Channel power 61.5 – 64 GHz]
Average EIRP of EUT within 0.3us and within 61.5 – 64 GHz = [Average EIRP of EUT within 0.3us] – [Difference]

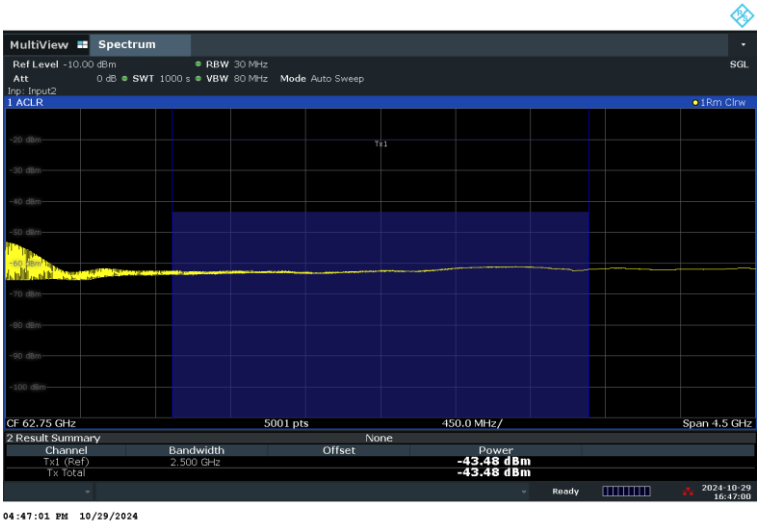
Channel power full band (57 - 64 GHz) **Measured Level**



Measurement distance(m)	SA Center Frequency (GHz)	ANT Pol	Measured Level(dBm)	TF (dB/m)	E (dBuV/m)	EIRP (dBm)
1.6 m	60.50	H	-39.40	16.30	83.90	-16.72

Note: Please refer to the test note on page 19 for sample calculation.

Channel power 61.5 – 64 GHz **Measured Level**



Measurement distance(m)	SA Center Frequency (GHz)	ANT Pol	Measured Level(dBm)	TF (dB/m)	E (dBuV/m)	EIRP (dBm)
1.6 m	62.75	H	-43.48	17.80	81.32	-19.30

5.3. Unwanted emissions

▣ Test Requirements and limit

FCC 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.

FCC 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.

▣ Test Configuration:

Refer to the APPENDIX I.

▣ Test Procedure:

ANSI C63.10-2020 – Section 9.10 & 9.11

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: 1 ~ 40GHz
Peak Measurement
RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes
Average Measurement
RBW = 1 MHz, VBW ≥ Reduce the video bandwidth until no significant variations in the displayed signal are observed in subsequent traces, provided the video bandwidth is no less than 1 Hz.
Detector = Peak, Sweep Time = Auto, Trace Mode = Max Hold until the trace stabilizes

3. Frequency Range: Above 40GHz
RBW = 1 MHz, VBW = 3 MHz, Detector = RMS, 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 ~ 50	0.500	6.24	1.56	1.60
50 ~ 70	0.429	5.68	1.51	1.60
70 ~ 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

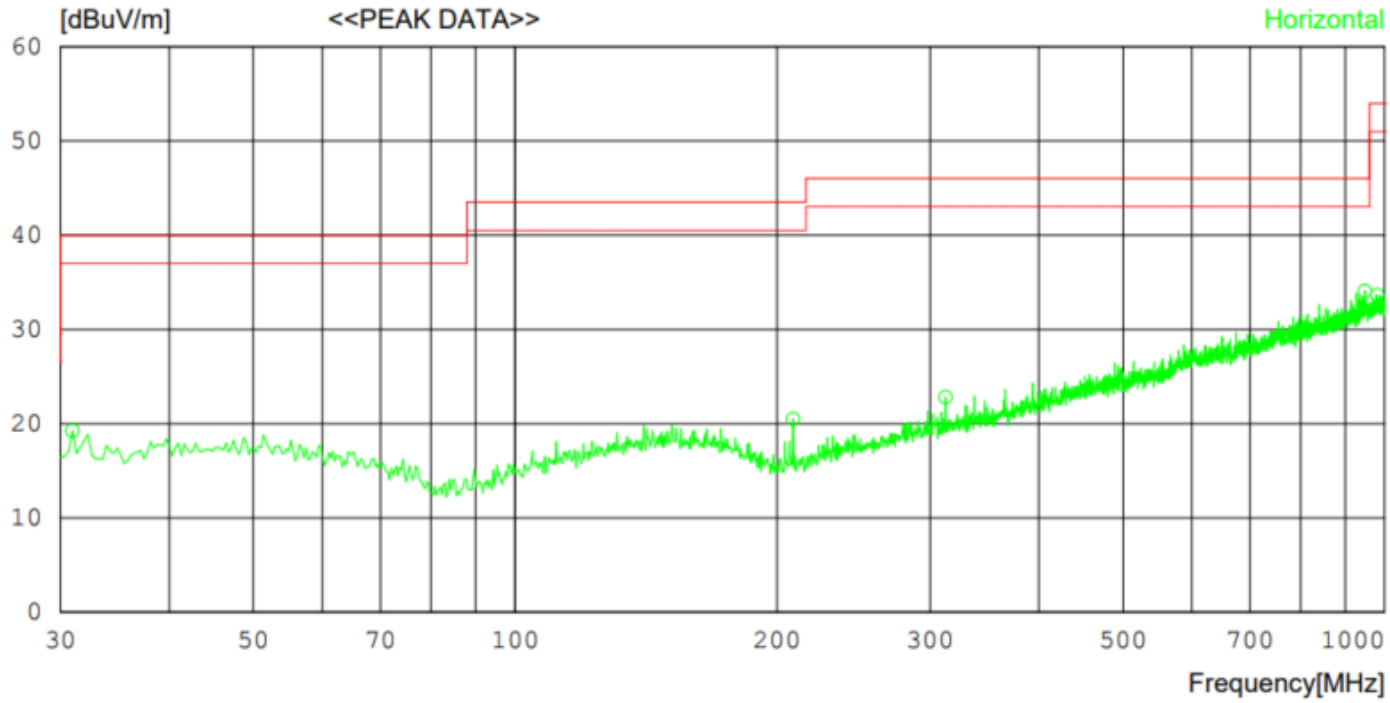
Test Note.

1. Radiated emissions 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: 60.50 GHz

Frequency (MHz)	ANT Pol	Detector Mode	Measured Level(dBuV)	TF (dB/m)	DCF(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*30.97	H	PK	29.10	-9.85	NA	19.25	40.00	20.75
208.80	H	PK	29.90	-9.41	NA	20.49	43.50	23.01
*312.59	H	PK	27.30	-4.48	NA	22.82	46.00	23.18
*948.23	H	PK	25.80	8.28	NA	34.08	46.00	11.92
*980.88	H	PK	24.90	8.73	NA	33.63	54.00	20.37
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

Worst data plot (Measured Level) Z axis & Hor



Frequency Range: 1 ~ 40 GHz

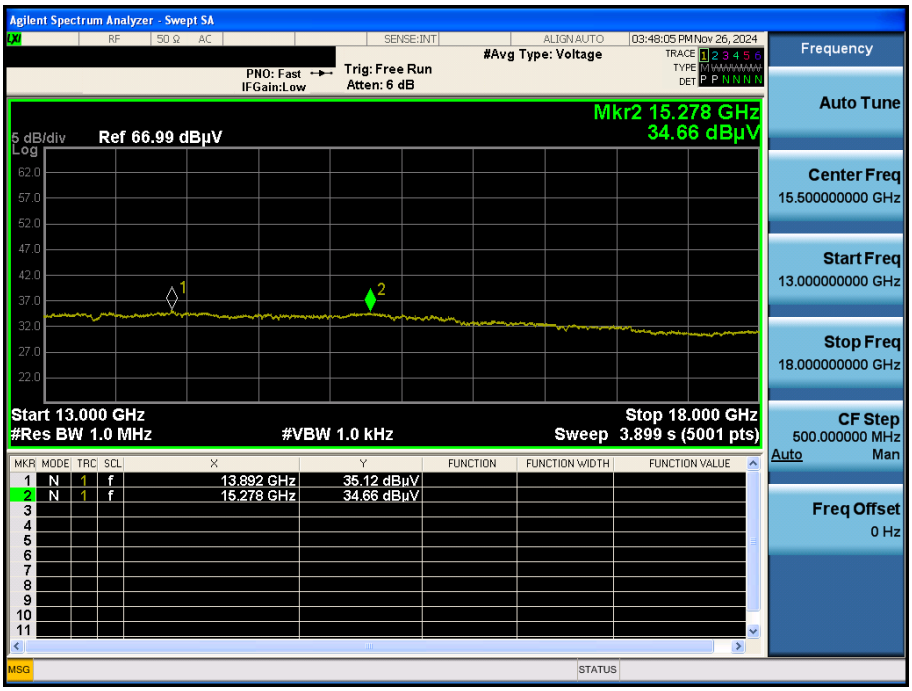
Test Note.

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(dBuV/m) = 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: 60.50 GHz

Frequency (MHz)	ANT Pol	Detector Mode	Measured Level(dBuV)	TF (dB/m)	DCF(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*15 258.00	H	PK	45.28	12.95	NA	58.23	74.00	15.77
*15 278.00	H	AV	34.66	12.95	NA	47.61	54.00	6.39
*39 264.55	H	PK	45.70	15.92	-5.46	56.16	74.00	17.84
*39 211.76	H	AV	32.39	15.66	-5.46	42.59	54.00	11.41
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

Worst data plot (Measured Level: Noise floor) Z axis & Hor



Frequency Range: 40 ~ 90 GHz

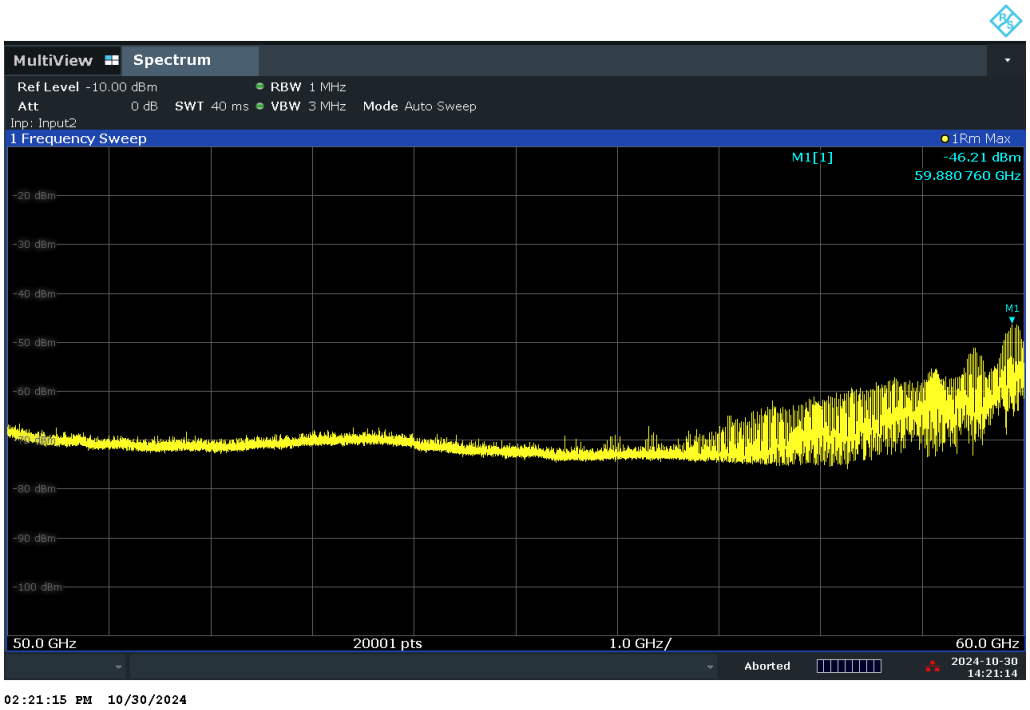
Note.

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.
   E(dBuV/m) = Measured level (dBm) + 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: 60.50 GHz

Measurement distance(m)	Frequency (MHz)	ANT Pol	Measured Level(dBm)	TF (dB/m)	E (dBuV/m)	EIRP (dBm)	Power Density (pW/cm^2)	Limit (pW/cm^2)
1.6 m	59 880.76	H	-46.21	16.02	76.81	-23.81	3.677	90.00
1.6 m	*83 972.78	H	-54.77	4.71	56.94	-43.68	0.038	90.00
-	-	-	-	-	-	-	-	-

Worst data plot (Measured Level: Noise floor) Z axis & Ver



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Frequency Range: 90 ~ 200 GHz

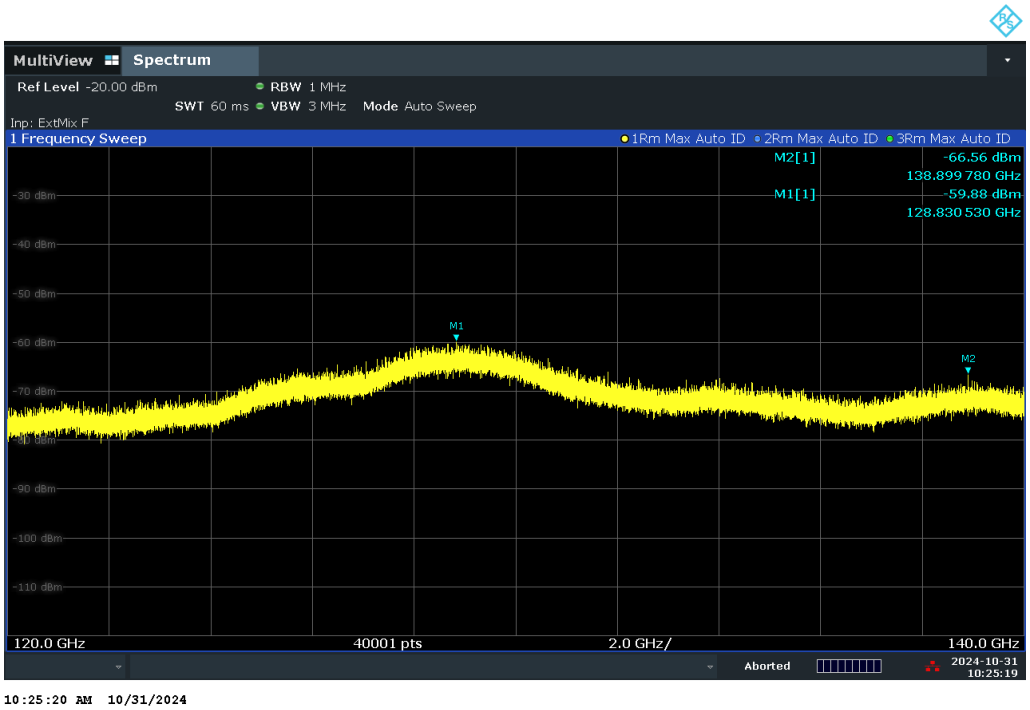
Test Note.

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 (dBm) + 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: 60.50 GHz

Measurement distance(m)	Frequency (MHz)	ANT Pol	Measured Level(dBm)	TF (dB/m)	E (dBuV/m)	EIRP (dBm)	Power Density (pW/cm^2)	Limit (pW/cm^2)
0.70 m	*128 830.53	H	-59.88	47.93	95.05	-12.75	46.94	90.00
0.50 m	*191 242.90	H	-66.32	51.93	92.61	-18.11	13.66	90.00
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

Worst data plot (Measured Level: Noise floor) Z axis & Ver



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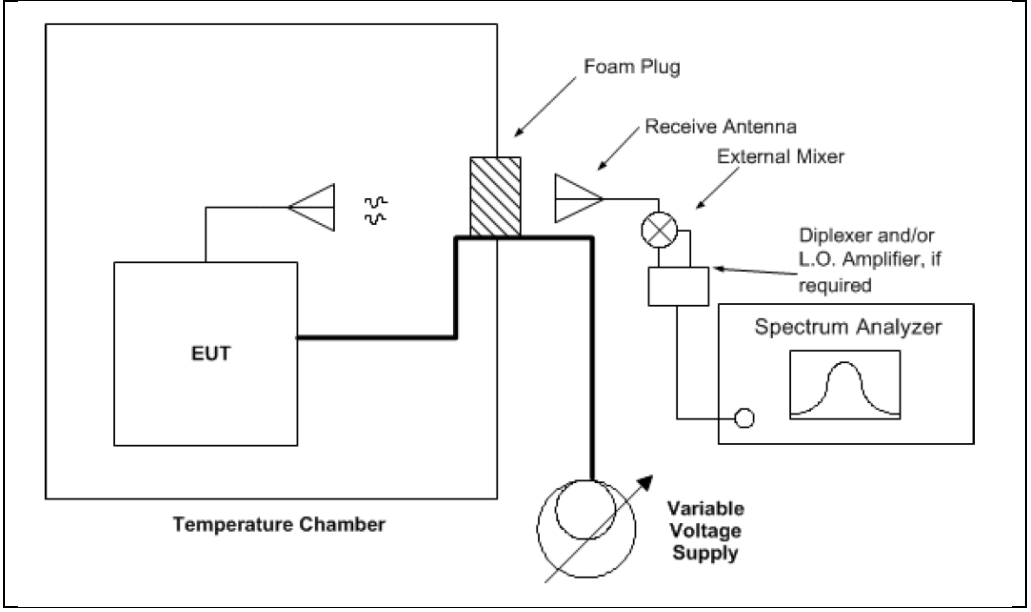
5.4. Frequency stability

▣ 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.

▣ Test Configuration:

Frequency stability



▣ Test Procedure:

ANSI C63.10-2020 – Section 9.5

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.

▣ Test Results: Comply

Tested Frequency: 60.50 GHz

VOLTAGE (%)	POWER (V DC)	TEMP (℃)	Measured low frequency(F_L)(GHz)	Measured high frequency(F_H)(GHz)
100%	3.60	+20'C	60.096480	60.863530
100%		-30	60.106480	60.873630
100%		-20	60.116880	60.875930
100%		-10	60.114480	60.874230
100%		0	60.116880	60.874830
100%		+10	60.104680	60.868430
100%		+20	60.096480	60.863530
100%		+30	60.110480	60.872630
100%		+40	60.094880	60.869530
100%		+50	60.118480	60.864730
115%	4.14	+20'C	60.114480	60.875930
85%	3.06	+20'C	60.108880	60.874730

Note: The frequency stability was measured based 10dB bandwidth.
And fundamental emission was contained within the frequency bands.

5.5. 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.

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 C63.10-2020.

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: NT

APPENDIX I

Test set up diagrams

Below 1GHz	Above 1GHz