TEST REPORT

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 : DRTFCC2412-0140
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 : Verification test for simultaneous transmission
4. Product Name / Model Name : Radar Level measurement / RM150

   FCC ID : 2BL7YRM150
5. FCC Regulation(s): Part 15.247, Part 15.255

   Test Method used: KDB558074 D01v05r02, ANSI C63.10-2020
6. Date of Test : 2024.12.06 ~ 2024.12.13
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 . 20 .

Dt&C Co., Ltd.

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

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Test Report Version

Test Report No.	Date	Description	Revised by	Reviewed by
DRTFCC2412-0140	Dec. 20, 2024	Initial issue	Seokho Han	JaeJin Lee

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1. General Information

1.1 Description of EUT

Product Name	Radar Level measurement	
Model Name(s)	RM150, RLT50, RLM-60	
Power Supply	DC 24 V	
Frequency band	60GHz Radar	57 ~ 64 GHz
	Bluetooth LE	2 402 MHz ~ 2 480 MHz
Antenna Specification	60GHz Radar	Antenna type: Folded dipole antenna Gain(Max): 6.0 dBi
	Bluetooth LE	Antenna Type: PCB Antenna Gain(Max): -1.61 dBi

1.2. Declaration by the applicant / manufacturer

N/A

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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	+21 ℃ ~ +24 ℃
▪ Relative Humidity	+41 % ~ +45 %

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
AC power-line conducted emission	3.4 dB (The confidence level is about 95 %, k = 2)
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)

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1.6. Test Equipment List

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal. Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	23/12/15	24/12/15	MY50410399
Spectrum Analyzer	Rohde Schwarz	FSW85	24/06/14	25/06/14	101778
Receiver	Rohde Schwarz	ESCI3	24/06/04	25/06/04	100798
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	154
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	22/12/16	24/12/16	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	22/12/16	24/12/16	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
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	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	JUNFLON	J12J101757-00	24/01/03	25/01/03	M-7
Cable	HUBER+SUHNER	SUCOFLEX106	24/01/03	25/01/03	M-9
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	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 (Radiated)	tsj	EMI 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.

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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

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. Description of test modes

The EUT configured for simultaneous transmission in the following mode of operation;

-	Technology	Mode	TX Frequency
Transmitting Configuration	Bluetooth LE	Normal operating mode	2 402 ~ 2 480 MHz
	60 GHz Radar	Continuously transmitting mode	60.5 GHz

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3. Summary of Test Results

FCC Part	Test Description	Limit	Test Condition	Status Note 1
15.247(d) 15.205 15.209	Unwanted Emissions(Radiated)	Part 15.209 limits	Radiated	C Note 2
15.255(d) 15.209	Unwanted Emissions	Below 40GHz < Part 15.209 limits 40 ~ 200GHz < 90 pW/cm^2		C Note 2

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

4. Unwanted Emissions (Radiated)

▣ 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 15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of Part 15.247 the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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.

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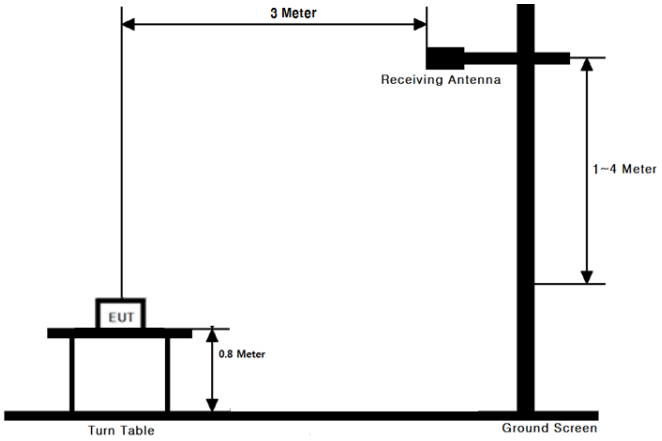
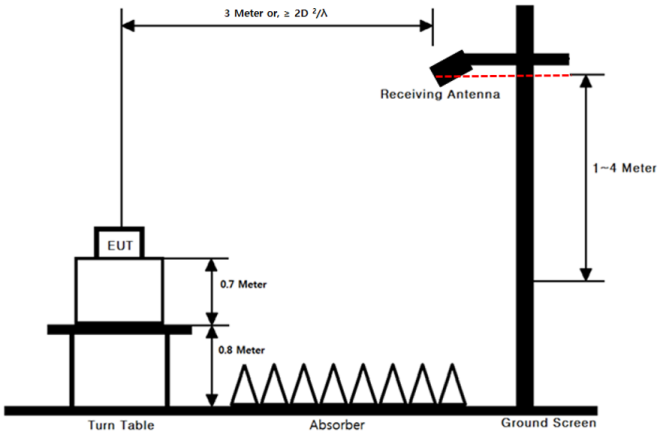
▣ Test Configuration

Below 1GHz	Above 1GHz
	

▣ 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

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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

Note:
Unwanted emissions from the Bluetooth LE was measured by setting the spectrum analyzer as below:
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 = 3 MHz, Detector = RMS, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes

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▣ 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.

Frequency (MHz)	ANT Pol	Detector Mode	Measured Level(dBuV)	TF (dB/m)	DCF(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
58.94	V	QP	40.80	-8.77	N/A	32.03	40.00	7.97
62.94	V	QP	42.60	-9.20	N/A	33.40	40.00	6.60
64.94	V	QP	42.40	-9.47	N/A	32.93	40.00	7.07
264.72	H	QP	43.30	-5.77	N/A	37.53	46.00	8.47
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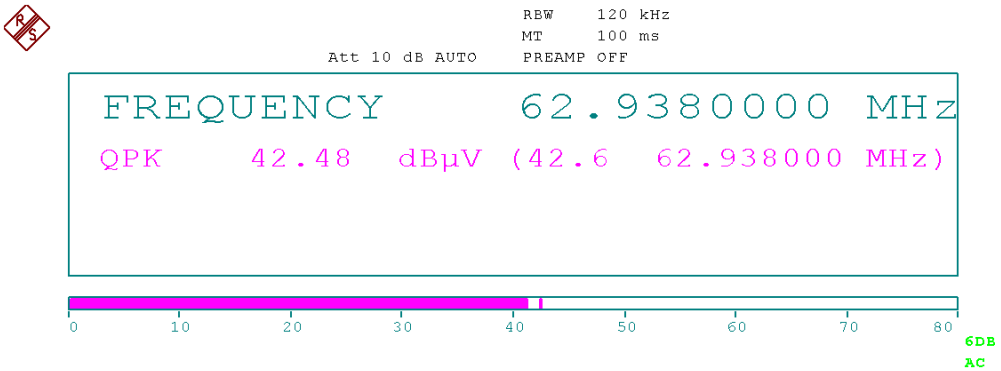
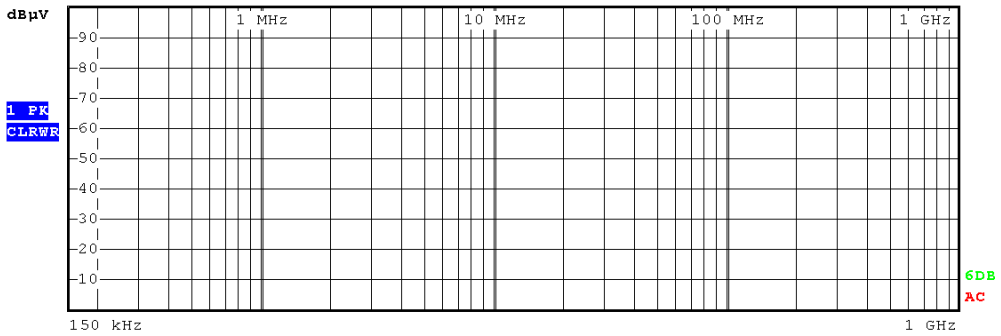
Worst data plot (Measured Level) **Z axis & Ver**





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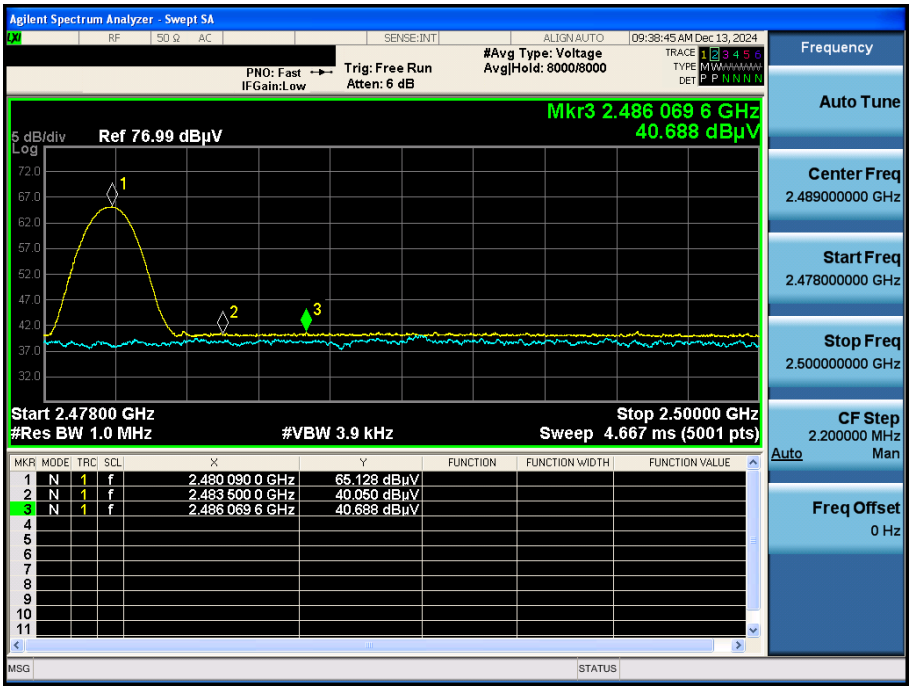
Frequency Range: 1 ~ 40 GHz

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.

Frequency (MHz)	ANT Pol	Detector Mode	Measured Level (dBuV)	TF (dB/m)	DCF(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 387.88	V	PK	50.69	4.96	N/A	55.65	74.00	18.35
2 387.55	V	AV	40.61	4.96	N/A	45.57	54.00	8.43
2 485.98	V	PK	50.70	5.70	N/A	56.40	74.00	17.60
2 486.07	V	AV	40.69	5.70	N/A	46.39	54.00	7.61
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

Worst data plot (Measured Level) Z axis & Ver



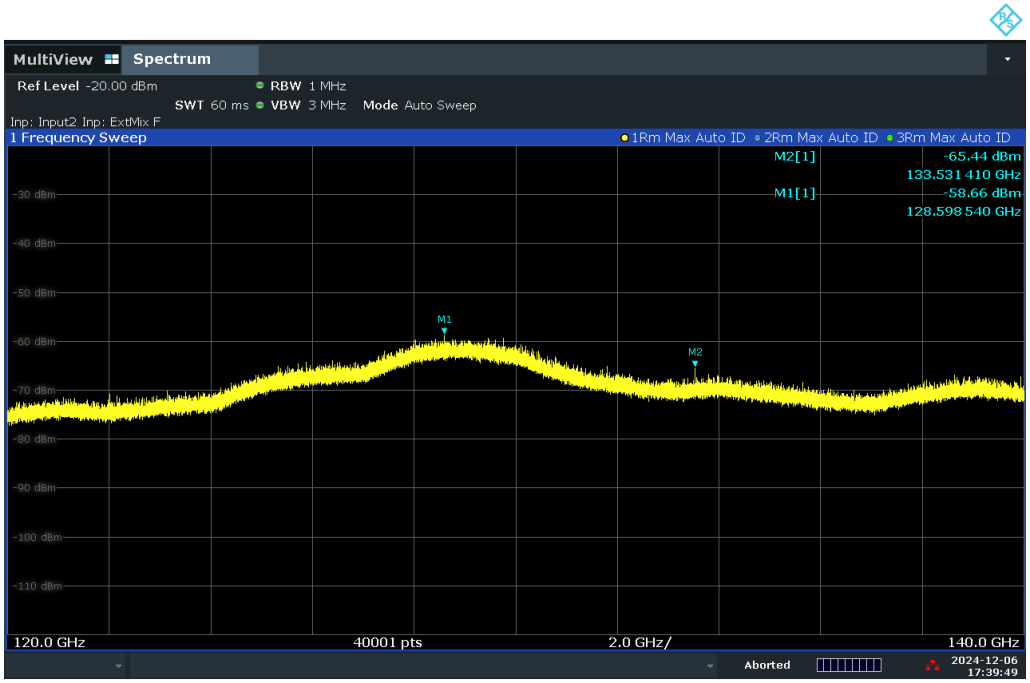
Frequency Range: 40 ~ 200 GHz

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.

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	*12 8598.54	V	-58.66	47.94	96.28	-11.62	60.89	90.00
0.5	*15 6563.97	V	-62.71	51.07	95.36	-15.46	25.15	90.00
0.5	*19 1503.89	V	-65.30	51.94	93.64	-17.18	16.93	90.00
-	-	-	-	-	-	-	-	-

Worst-case plot (Noise floor) Z axis & Ver



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