

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 : DRTFCC1908-0218(1)

2. Customer

• Name : HYUNDAI MSYSTEMS Co.,LTD.

• Address : 102-805, 806, 88, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, South Korea

3. Use of Report : FCC Original Grant

4. Product Name / Model Name : RADAR SYSTEM / 21K8-31000

FCC ID : 2ASWA-21K8-31000

5. Test Method Used : ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB653005 D01v01r01

Test Specification : §2, 95(M)

6. Date of Test : 2019.05.02 ~ 2019.05.14

7. Testing Environment : Refer to appended test report.

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

Affirmation	Tested by		Reviewed by	
	Name : Jaejin Lee		Name : GeunKi Son	

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2019 . 09 . 17 .

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
DRTFCC1908-0218	Aug. 22, 2019	Initial issue
DRTFCC1908-0218(1)	Sep. 17, 2019	Add the note in section 4.1, 4.2

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1 GENERAL INFORMATION

Applicant Name : HYUNDAI MSYSTEMS Co.,LTD.
Address : 102-805, 806, 88, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, South Korea
FCC ID : 2ASWA-21K8-31000
FCC Classification : VRD - Part 95 Vehicular Radar Systems
EUT Type : RADAR SYSTEM
Model Name : 21K8-31000
Add Model Name : NA
Supplying power : DC 12 ~ 24 V
Antenna Information : Serial Feeding Antenna

Frequency Range(MHz)	Emission Designator	Modulation	EIRP(Peak detector)		EIRP(Average detector)	
			Max power (dBm)	Max power (W)	Max power (dBm)	Max power (W)
80000 ~ 81000	921MF1N	FMCW	7.27	0.005	-1.32	0.001

2 INTRODUCTION

2.1 EUT DESCRIPTION

The Equipment under Test (EUT) supports 80 ~ 81GHz vehicular radar.

2.2 TESTING ENVIRONMENT

Ambient Condition	
▪ Temperature	+20 °C ~ +23 °C
▪ Relative Humidity	38 % ~ 46 %

2.3 MEASURING 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.

2.4 MEASUREMENT UNCERTAINTY

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

Parameter	Measurement uncertainty
Radiated Disturbance (Below 1 GHz)	5.1 dB (The confidence level is about 95 %, $k = 2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, $k = 2$)
Radiated Disturbance (Above 18 GHz)	5.3 dB (The confidence level is about 95 %, $k = 2$)

2.5 TEST FACILITY

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 site is constructed in conformance with the requirements.		
- FCC MRA Accredited Test Firm No. : KR0034		
www.dtnet.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

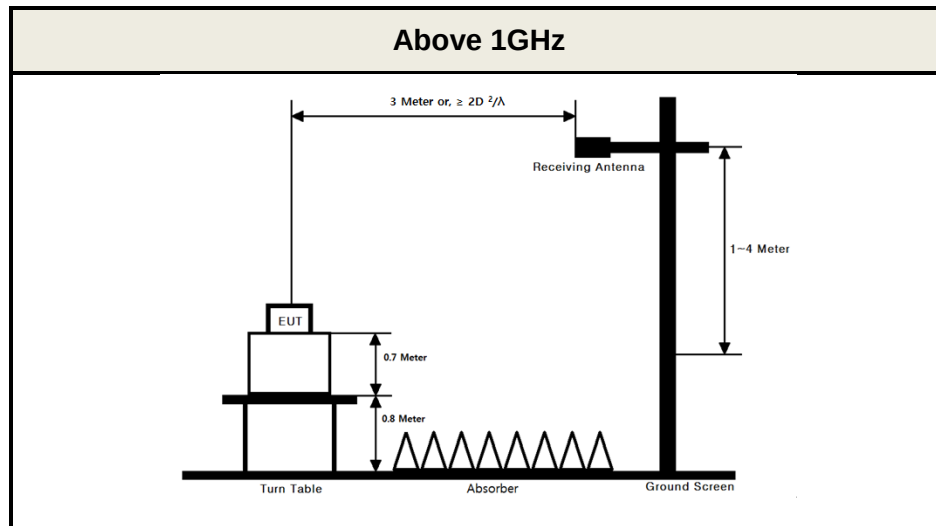
3 SUMMARY OF TEST RESULTS

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Status Note 1
2.1049	Occupied Bandwidth	N/A	Radiated	C
95.3367(a)	Maximum power(EIRP)	< 50 dBm (Averaging detector)		C
95.3367(b)	Maximum peak power(EIRP)	< 55 dBm (Peak detector)		C
2.1053 95.3379(a)	Undesirable Emissions	Below 40GHz < Part 95.3379 (a)(a) 40 ~ 200GHz < 600 pW/cm ² Above 200GHz < 1000 pW/cm ²		C
2.1055 95.3379(b)	Frequency Stability	Within the frequency bands		C
Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable				

4 TEST RESULTS

4.1 OCCUPIED BANDWIDTH

Test Configuration



These measurements were performed at 3 m test site. The equipment under test is placed on a non-conductive table 1.5-meters above a turntable which is flush with the ground plane and 3 meters from the receive antenna. 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.

Test Procedure

- ANSI C63.26-2015 – Section 5.4.4

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power of a given emission.

Test setting

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99 % occupied bandwidth and the 26 dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. $RBW = 1 \sim 5 \%$ of the expected OBW & $VBW \geq 3 \times RBW$
3. Detector = Peak
4. Trance mode = Max hold
5. Sweep = Auto couple
6. The trace was allowed to stabilize
7. If necessary, step 2 ~ 6 were repeated after changing the RBW such that it would be within 1 ~ 5 % of the 99 % occupied bandwidth observed in step 6.

Note: The RBW and VBW were setting up to the limitations of the test equipment.

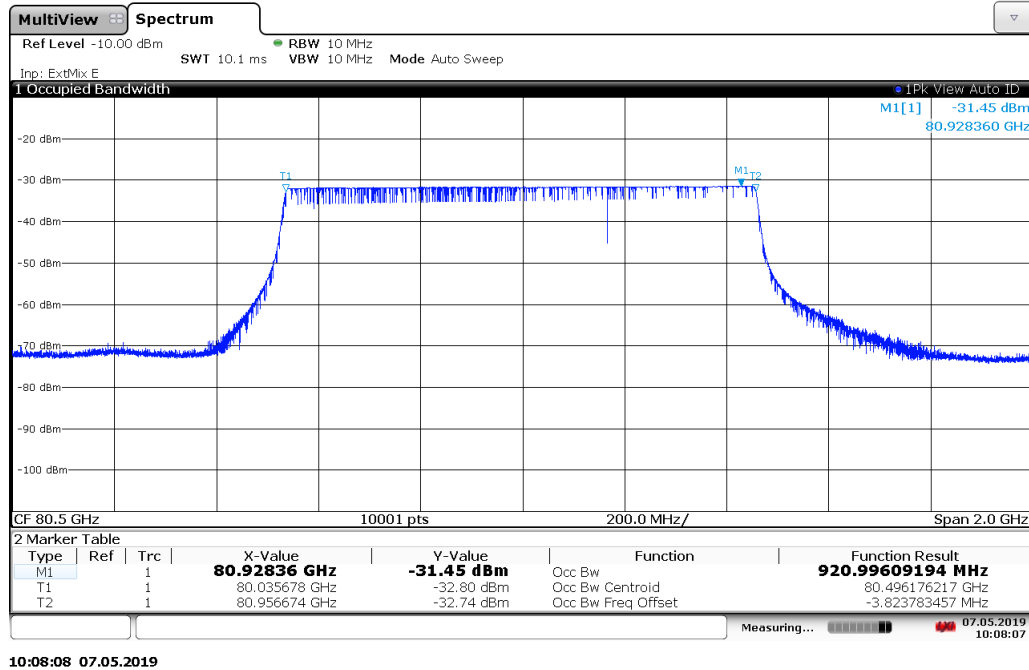
Limit

Within the designated 76~81GHz frequency band

Test Results

Frequency Range(MHz)	Occupied Bandwidth(MHz)
80000 ~ 81000	920.99

Occupied Bandwidth



Emission Designator

Emission Designator = **921MF1N**

OBW = 920.99 MHz

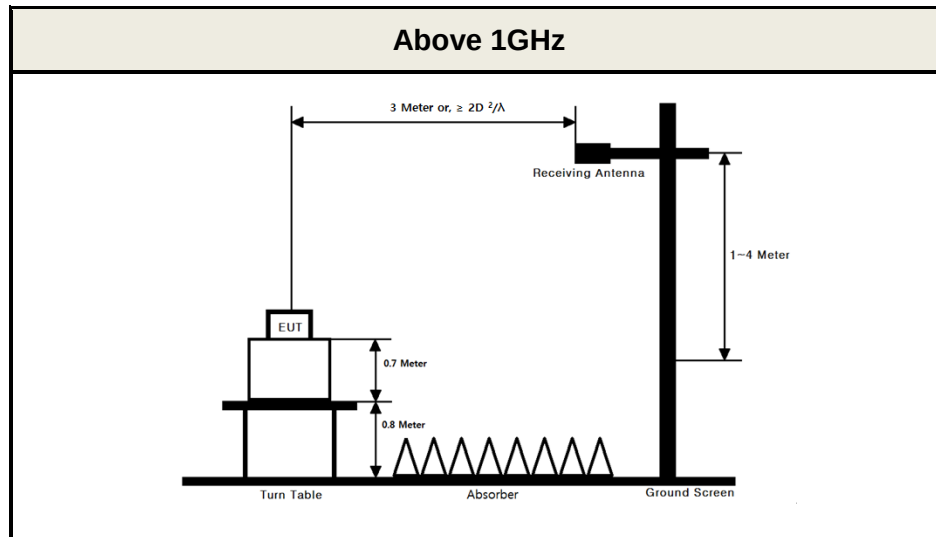
F = Frequency modulation

1 = A single channel containing quantized or digital information without the use of a modulating sub-carrier

N = No information transmitted

4.2 EIRP

Test Configuration



These measurements were performed at 3 m test site. The equipment under test is placed on a non-conductive table 1.5-meters above a turntable which is flush with the ground plane and 3 meters from the receive antenna. 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.

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)	R_m (m)	Measurement Distance(m)
80.0 ~ 81.0	0.37	1.25	1.50

Note: Dimension of EUT Antenna = 3.30cm, Dimension of Measurement Antenna = 4.82cm

Test Procedure

- ANSI C63.26-2015 – Section 5.
- KDB 653005 D01v01r01 – Section 4

Test setting**-Maximum power(EIRP) – Averaging detector**

Note: The maximum power(averaging detector) measurements are performed using the “channel power” measurement capability and integrated over the 99% OBW to obtain the result.

1. Measurement capability of instrument = channel power
2. Set RBW = 1MHz
3. Set VBW $\geq 3 \times$ RBW
4. span to 2 x to 3 x the OBW
5. Channel bandwidth setting of instrument $\geq$ OBW
6. Detector = power averaging (rms)
7. Set number of points in sweep $\geq 2 \times$ span / RBW
8. Sweep time = auto-couple
9. Trace = averaging

-Maximum peak power(EIRP) – Peak detector

1. Set RBW = 1MHz
2. Set VBW $\geq 3 \times$ RBW
3. span to 2 x to 3 x the OBW
4. Detector = Peak
5. Set number of points in sweep $\geq 2 \times$ span / RBW
6. Sweep time = auto-couple
7. Trace = max-hold

Limit

The fundamental radiated emission limits within the 76-81 GHz band are expressed in terms of Equivalent Isotropically Radiated Power (EIRP) and are as follows:

- (a) The maximum power (EIRP) within the 76-81 GHz band shall not exceed 50 dBm based on measurements employing a power averaging detector with a 1 MHz Resolution Bandwidth (RBW).
- (b) The maximum peak power (EIRP) within the 76-81 GHz band shall not exceed 55 dBm based on measurements employing a peak detector with a 1 MHz RBW.

Test Results

Maximum power(EIRP) – Averaging detector & Maximum peak power(EIRP) – Peak detector

Measurement distance(D)	Frequency (GHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Measured Level(dBm)	AFCL (dB/m)	E (dBuV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1.5m	80.950	V	Y	Peak	-42.56	44.11	108.55	7.27	55.00	47.73
1.5m	80.500	V	Y	Average	-51.11	44.07	99.96	-1.32	50.00	51.32

Note.

1. The EIRP was measured in each axis EUT positions and the worst case data was reported.
2. Sample Calculation.

$$E(\text{dBuV/m}) = \text{Measured level (dBuV)} + 107 + \text{AFCL}(\text{dB/m})$$

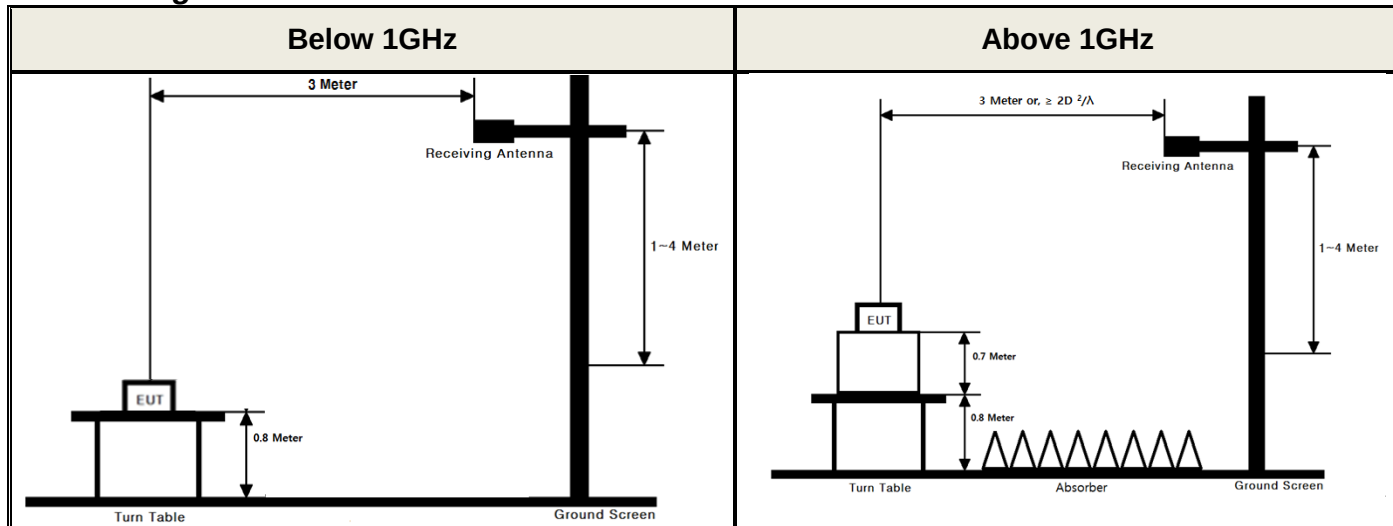
where, E=field strength / AFCL = Antenna Factor(dB/m) + Cable Loss(dB/m)

The mixer loss was applied to the measured level by SA correction factor.

$$\text{EIRP}(\text{dBm}) = E(\text{dBuV/m}) + 20\log(D) - 104.8; \text{ where, D is measurement distance (in the far field region) in m.}$$

4.3 UNDESIRABLE EMISSIONS

Test Configuration



These measurements were performed at 3 test site. The equipment under test is placed on a non-conductive table 1.5-meters above a turntable which is flush with the ground plane and 3 meters (for below 1GHz: 0.8-m) from the receive antenna. 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.

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)	D(cm)	λ (cm)	R_m (m)	Measurement Distance(m)
40 ~ 60	5.79	0.50	1.34	1.50
60 ~ 90	4.82	0.33	1.39	1.50
90 ~ 140	3.31	0.21	1.02	1.50
140 ~ 220	2.13	0.14	0.67	1.50
220 ~ 250	1.45	0.12	0.35	0.80

Test Procedure

- ANSI C63.26-2015 – Section 5.5

Test setting

Below 1GHz

RBW = 100 or 120 kHz, VBW = 3 x RBW, Detector = Peak or Quasi Peak

1~40 GHz

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 = 3 MHz, Detector = RMS, Sweep time = Auto, Trace mode = Averaging or Max hold

Above 40GHz

Average Measurement

RBW = 1 MHz, VBW = 3 MHz, Detector = RMS, Sweep time = Auto, Trace mode = Averaging or Max hold

Limit

Part 95.3379

(a) The power density of any emissions outside the 76-81 GHz band shall consist solely of spurious emissions and shall not exceed the following:

(1) Radiated emissions below 40 GHz shall not exceed the field strength as shown in the following emissions table.

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 – 0.490	2400/F (kHz)	300
0.490 – 1.705	24000/F (kHz)	30
1.705 – 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

- (i) In the emissions table in paragraph (a)(1) of this section, the tighter limit applies at the band edges.
 - (ii) The limits in the table in paragraph (a)(1) of this section are based on the frequency of the unwanted emissions and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
 - (iii) The emissions limits shown in the table in paragraph (a)(1) of this section are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9.0-90.0 kHz, 110.0-490.0 kHz, and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector with a 1 MHz RBW.
- (2) The power density of radiated emissions outside the 76-81 GHz band above 40.0 GHz shall not exceed the following, based on measurements employing an average detector with a 1 MHz RBW:
- (i) For radiated emissions outside the 76-81 GHz band between 40 GHz and 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 600 pW/cm² at a distance of 3 meters from the exterior surface of the radiating structure.
 - (ii) For radiated emissions above 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 1000 pW/cm² at a distance of 3 meters from the exterior surface of the radiating structure.
- (3) For field disturbance sensors and radar systems operating in the 76-81 GHz band, the spectrum shall be investigated up to 231.0 GHz.

Test Results

Frequency Range: 9 kHz ~ 1 GHz

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Measured Level(dBuV)	T.F (dB/m)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
31.20	V	Y	QP	40.60	-10.20	NA	30.40	40.00	9.60
58.04	V	Y	QP	36.90	-9.20	NA	27.70	40.00	12.30
328.76	V	Y	QP	34.40	-4.70	NA	29.70	46.00	16.30
332.89	H	Y	QP	36.90	-4.60	NA	32.30	46.00	13.70
495.60	H	Y	QP	44.90	-1.50	NA	43.40	46.00	2.60
500.40	V	Y	QP	43.00	-1.40	NA	41.60	46.00	4.40
503.92	H	Y	QP	44.60	-1.30	NA	43.30	46.00	2.70
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

Note.

1. No other spurious and harmonic emissions were found above listed frequencies.

2. Information of 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 = $20 \log(\text{applied distance} / \text{required distance})$

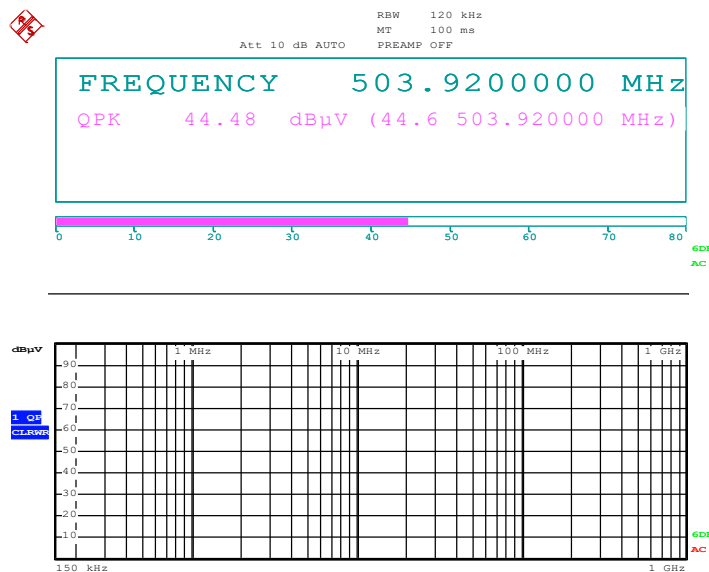
When distance factor is "N/A", the distance is 3 m and distance factor is not applied.

3. Sample Calculation.

Margin = Limit – Result / Result = Measured Level + T.F + Distance factor / T.F = AF + CL – AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

Worst data plot (Measured Level), Y axis & Hor



Date: 14.MAY.2019 19:23:40

Frequency Range: 1 ~ 40 GHz

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Measured Level(dBuV)	T.F (dB/m)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*1118.57	V	Y	PK	54.53	-1.12	NA	53.41	74.00	20.59
*4349.98	V	Y	PK	51.43	0.14	NA	51.57	74.00	22.43
*8915.00	V	Y	PK	48.53	2.66	NA	51.19	74.00	22.81
*16730.25	V	Y	PK	43.92	11.84	NA	55.76	74.00	18.24
28799.71	V	Z	PK	48.50	8.36	-6.02	50.84	74.00	23.16
28799.63	V	Z	AV	46.06	8.36	-6.02	48.40	54.00	5.60
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

Note.

1. No other spurious and harmonic emissions were found above listed frequencies.

2. Information of 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 = $20 \log(\text{applied distance} / \text{required distance})$

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

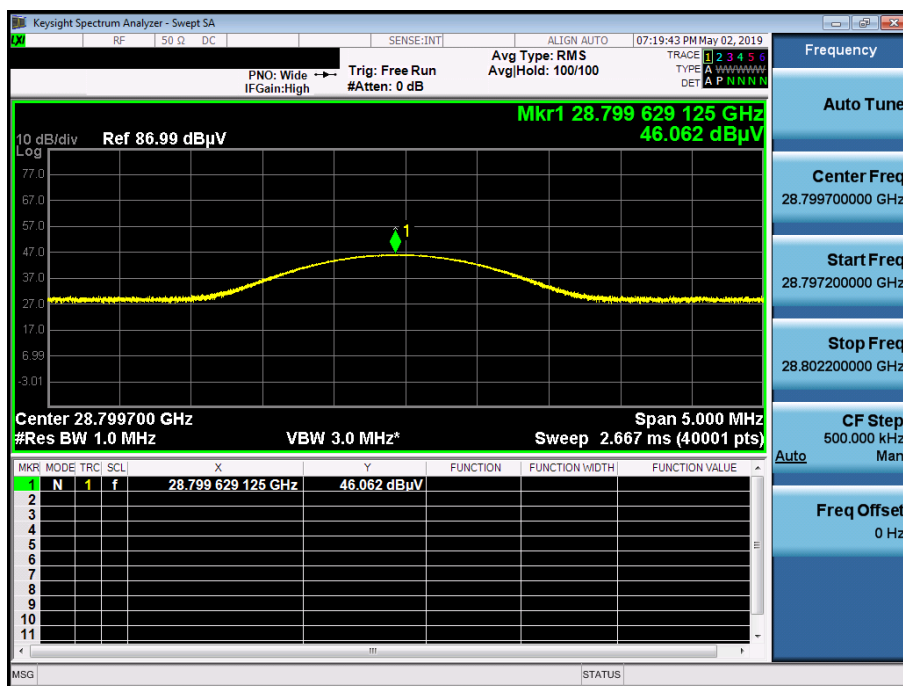
3. Sample Calculation.

Margin = Limit – Result / Result = Measured Level + T.F + Distance factor / T.F = AF + CL – AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,

4. * Noise floor.

Worst data plot (Measured Level), Z axis & Ver



Frequency Range: 40 ~ 250 GHz

Measurement distance(D)	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Measured Level(dBm)	AFCL (dB/m)	E (dBuV/m)	EIRP (dBm)	Power Density (pW/cm ²)	Limit (pW/cm ²)
1.5m	*57599.98	V	Y	-47.62	-5.14	54.24	-47.04	0.02	600.00
1.5m	*128712.77	V	Y	-62.95	47.79	91.84	-9.44	100.59	600.00
1.5m	*159613.20	V	Y	-71.11	50.84	86.73	-14.55	31.01	600.00
1.5m	*190517.59	V	Y	-66.87	51.26	91.39	-9.89	90.69	600.00
1.5m	*201119.78	Y	V	-69.78	51.53	88.75	-12.53	49.38	1000.00
0.8m	*240759.35	V	Y	-64.45	54.30	96.85	-9.89	90.69	1000.00
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

Note.

1. The radiated emissions were investigated up to 250GHz. And no other spurious and harmonic emissions were found above listed frequencies.

2. Sample Calculation.

$$E(\text{dBuV/m}) = \text{Measured level (dBuV)} + 107 + \text{AFCL}(\text{dB/m})$$

The mixer loss was applied to the measured level by SA correction factor.

where, E=field strength / AFCL = Antenna Factor(dB/m) + Cable Loss(dB/m)

$$\text{EIRP}(\text{dBm}) = E(\text{dBuV/m}) + 20\log(D) - 104.8; \text{ where, } D \text{ is measurement distance (in the far field region) in m.}$$

$$\text{PD} = \text{EIRP}_{\text{Linear}} / 4\pi d^2$$

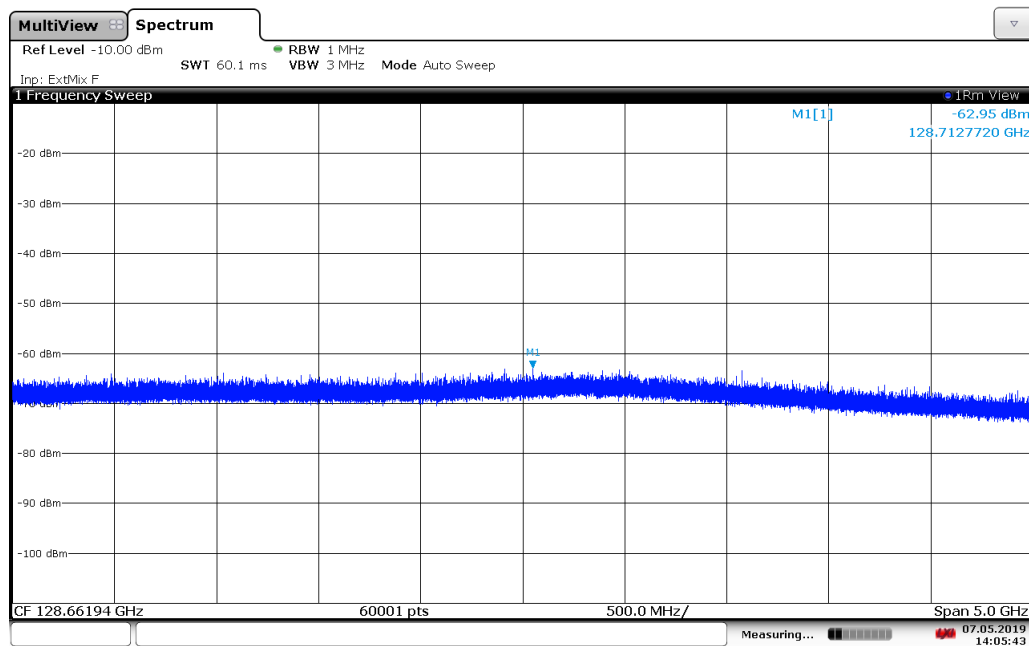
Where, PD = the power density at the distance specified by the limit, in W/m²

$$\text{EIRP}_{\text{Linear}} = \text{EIRP, in watts}$$

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

3. * Noise floor

Worst data plot (Measured Level), Y axis & Ver

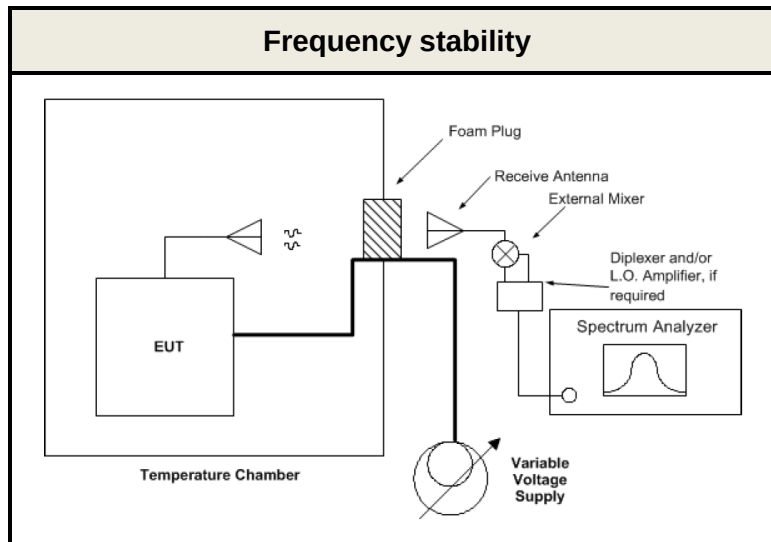


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Note: The mixer loss was applied to the measured level by SA correction factor.

4.4 FREQUENCY STABILITY

Test configuration



Test Procedure

- ANSI C63.26-2015 – Section 5.6

The frequency stability of the transmitter is measured by:

1. At 10 °C intervals of temperatures between –30 °C and +50 °C at the manufacturer's rated supply voltage, and
2. At +20 °C temperature and $\pm 15\%$ supply voltage variations. If a product is specified to operate over a range of input voltage then the –15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

Time Period and Procedure:

1. The carrier frequency of the transmitter is measured at room temperature.
(20 °C to provide a reference)
2. The equipment is turned on in a "standby" condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10 °C intervals ranging from -30 °C to +50 °C.
A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Limit

Fundamental emissions must be contained within the frequency bands specified in Part 95(M) 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 Results

VOLTAGE (%)	POWER (V DC)	TEMP (°C)	Measured low frequency(F _L) (MHz)	Measured high frequency(F _H) (MHz)
100%	24.00	+20(Ref)	80035.14	80955.54
100%		-30	80035.64	80956.61
100%		-20	80035.29	80956.42
100%		-10	80035.36	80955.84
100%		0	80035.34	80955.77
100%		+10	80035.22	80956.45
100%		+20	80035.14	80955.54
100%		+30	80035.17	80955.53
100%		+40	80034.95	80955.47
100%		+50	80035.04	80955.43
115%	27.60	+20	80035.05	80955.55
85%	10.20*	+20	80035.00	80955.52

Note: Fundamental emissions were contained within the frequency bands.

Note: * -15 % variation was applied to the lowermost voltage.

5 LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal. Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	18/12/19	19/12/19	MY48011700
Spectrum Analyzer	Agilent Technologies	N9030A	19/03/15	20/03/15	MY53310140
Spectrum Analyzer	KEYSIGHT	N9030B	18/12/27	19/12/27	MY55480168
Spectrum Analyzer	Rohde Schwarz	FSW67	18/08/16	19/08/16	104037
EMI Test Receiver	Rohde Schwarz	ESCi7	19/01/30	20/01/30	100910
DC Power Supply	SM techno	SDP30-5D	18/12/18	19/12/18	305DKA013
DC Power Supply	H.P	6633A	18/12/18	19/12/18	3524A06634
Multimeter	FLUKE	17B	18/12/18	19/12/18	26030065WS
Temp & Humi Test Chamber	SJ Science	SJ-TH-S50	18/12/20	19/12/20	SJ-TH-S50-120203
Thermohygrometer	BODYCOM	BJ5478	18/12/27	19/12/27	120612-1
Thermohygrometer	BODYCOM	BJ5478	18/12/27	19/12/27	120612-2
Thermohygrometer	BODYCOM	BJ5478	18/07/09	19/07/09	N/A
Thermohygrometer	BODYCOM	BJ5478	18/07/09	19/07/09	N/A
Signal Generator	Rohde Schwarz	SMBV100A	18/12/19	19/12/19	255571
Signal Generator	ANRITSU	MG3695C	18/12/20	19/12/20	173501
Loop Antenna	Schwarzbeck	FMZB1513	18/01/30	20/01/30	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9160	19/04/23	21/04/23	9160-3362
Horn Antenna	ETS-Lindgren	3115	19/01/11	21/01/11	9202-3820
Horn Antenna	Schwarzbeck	BBHA 9120C	17/12/04	19/12/04	9120C-561
Horn Antenna	A.H.Systems Inc.	SAS-574	17/07/31	19/07/31	155
*Horn Antenna	MI Wave	RX ANT-5 261U+410U	17/08/31	19/08/31	4
*Horn Antenna	MI Wave	RX ANT-6 261V+410V	17/08/31	19/08/31	5
*Horn Antenna	MI Wave	261W-25/387	18/11/29	20/11/29	743
*Horn Antenna	MI Wave	RX ANT-7 261E	17/08/31	19/08/31	1
*Horn Antenna	MI Wave	RX ANT-8 261F	17/08/31	19/08/31	2
*Horn Antenna	MI Wave	RX ANT-9 261G	17/08/31	19/08/31	3
*Horn Antenna	SAGE Millimeter	SAR-2507-03-S2	18/04/02	20/04/02	14614-01
PreAmplifier	H.P	8447D	18/12/18	19/12/18	2944A07774
PreAmplifier	tsj	MLA-0118-J01-45	18/12/19	19/12/19	17138
PreAmplifier	tsj	MLA-1840-J02-45	18/07/06	19/07/06	16966-10728
PreAmplifier	Norden Millimeter Inc.	NA4060G50N8P12	18/12/21	19/12/21	1003
*Harminoc mixer	KEYSIGHT	M1971V	18/06/11	20/06/11	MY56390168
*Harminoc mixer	Rohde Schwarz	FS-Z90	17/08/09	19/08/09	101714
*Harminoc mixer	Rohde Schwarz	FS-Z140	17/08/24	19/08/24	101009
*Harminoc mixer	Rohde Schwarz	FS-Z220	17/08/23	19/08/23	101012
*Harminoc mixer	Rohde Schwarz	FS-Z325	18/05/28	20/05/28	100925
Cable	Radiall	TESTPRO3	19/01/16	20/01/16	M-01
Cable	Junkosha	MWX315	19/01/16	20/01/16	M-05
Cable	Junkosha	MWX221	19/01/16	20/01/16	M-06
Cable	Junkosha	MWX241	19/01/14	20/01/14	G-04
Cable	Junkosha	MWX241	19/01/14	20/01/14	G-07
Cable	HUBER+SUHNER	SUCOFLEX 104	19/01/14	20/01/14	G-11
Cable	HUBER+SUHNER	SUCOFLEX 104	19/01/14	20/01/14	G-12
Cable	DTNC	Cable	19/01/14	20/01/14	G-13
Cable	DTNC	Cable	19/01/14	20/01/14	G-14
Cable	HUBER+SUHNER	SUCOFLEX 104	19/01/14	20/01/14	G-15

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.

Note3: * The mm-wave instruments were calibrated by the manufacturer.