# 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 : 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<br>Name : Jaejin Lee (Signature) | Reviewed by<br>Name : GeunKi Son (Signature) |
|---|---|---|



**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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# Table of Contents



# 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 ℃ ~ +23 ℃ |
| ▪ 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.dtnc.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<br>95.3379(a) | Undesirable Emissions | Below 40GHz < Part 95.3379 (a)(a)<br>40 ~ 200GHz < 600 pW/cm$^2$<br>Above 200GHz < 1000 pW/cm$^2$ | | **C** |
| 2.1055<br>95.3379(b) | Frequency Stability | Within the frequency bands | | **C** |

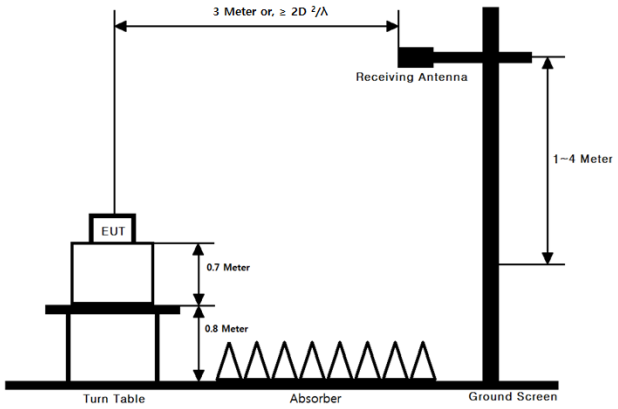
Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

# 4 TEST RESULTS

## 4.1 OCCUPIED BANDWIDTH

### *Test Configuration*

**Above 1GHz**




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 ~ 5 % of the expected OBW & VBW ≥ 3 X 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.

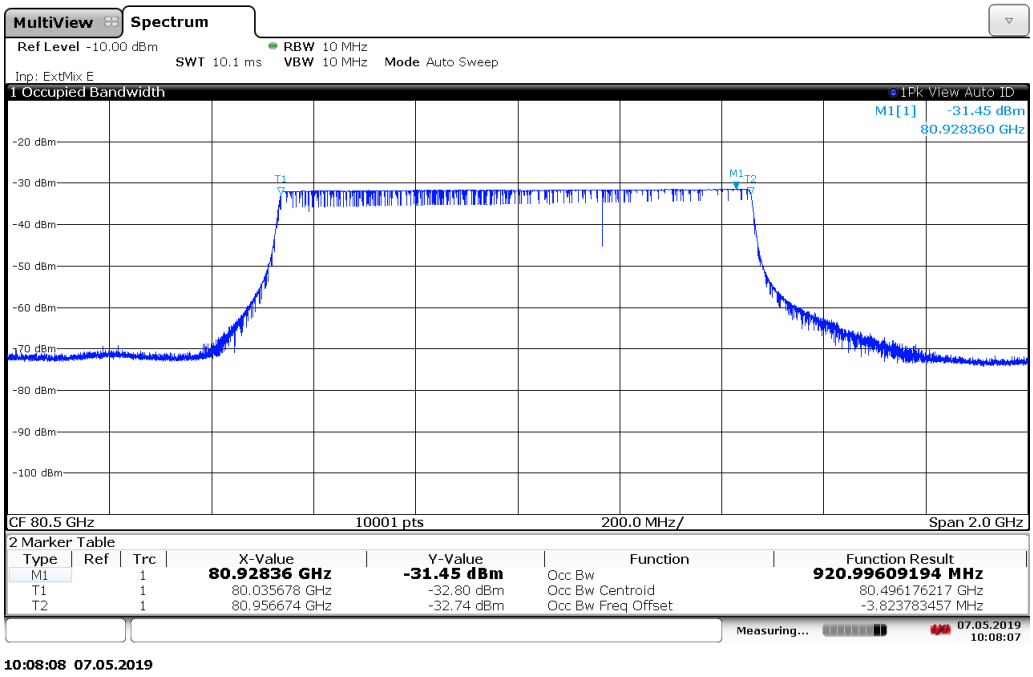
### *Limit*

Within the designated 76~81GHz frequency band

## *Test Results*

| Frequency Range(MHz) | Occupied Bandwidth(MHz) |
|---|---|
| **80000 ~ 81000** | 920.99 |

### Occupied Bandwidth



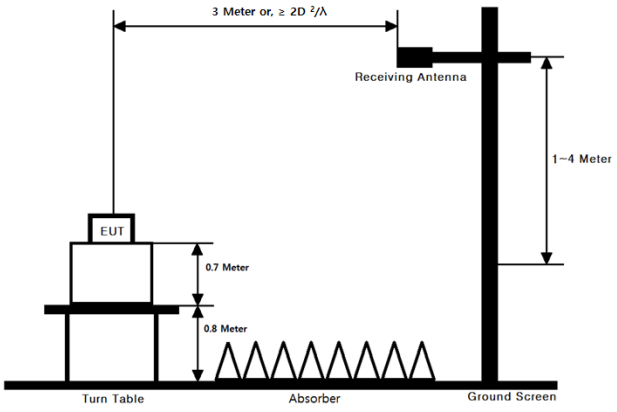

## *Emission Designator*

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*

**Above 1GHz**




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) | Rm (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 ≥ 3 x RBW
4. span to 2 x to 3 x the OBW
5. Channel bandwidth setting of instrument ≥ OBW
6. Detector = power averaging (rms)
7. Set number of points in sweep ≥ 2 × span / RBW
8. Sweep time = auto-couple
9. Trace = averaging

-Maximum peak power(EIRP) – Peak detector

1. Set RBW = 1MHz
2. Set VBW ≥ 3 x RBW
3. span to 2 x to 3 x the OBW
4. Detector = Peak
5. Set number of points in sweep ≥ 2 × 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(dBuV/m) = Measured level (dBuV) + 107 + AFCL(dB/m)

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

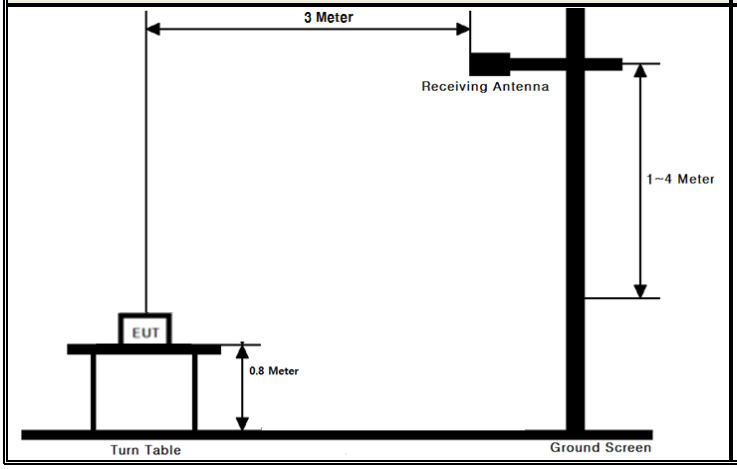
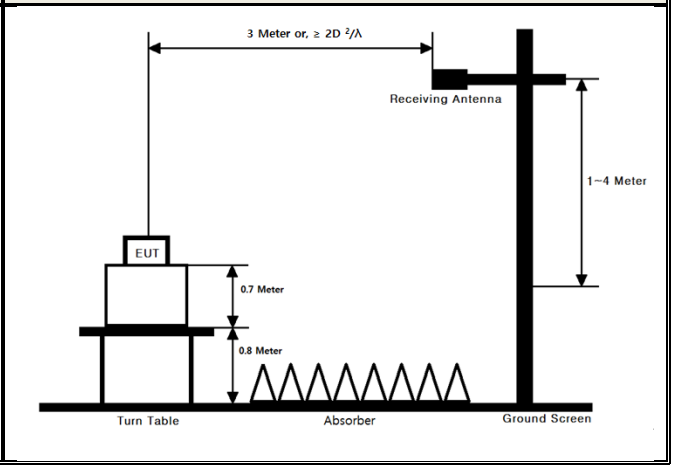
The mixer loss was applied to the measured level by SA correction factor.

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

## 4.3 UNDESIRABLE EMISSIONS

### *Test Configuration*

| Below 1GHz | Above 1GHz |
|---|---|
|  |  |





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) | Rm (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/cm$^2$ 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/cm$^2$ 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.

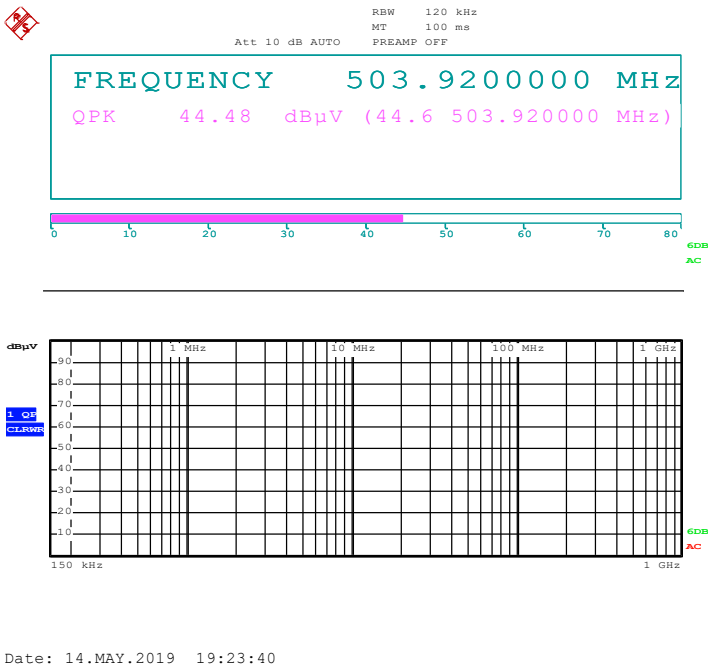
   - Calculation of distance factor = 20 log( applied distance / required distance )

   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 + 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**

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**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.

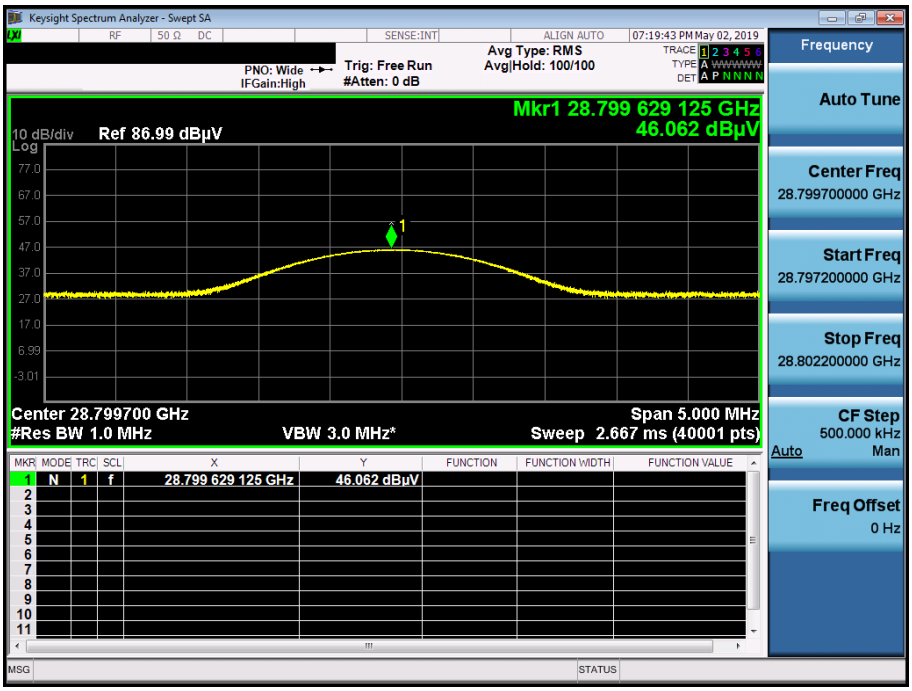
   - Calculation of distance factor = 20 log( applied distance / required distance )

   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 + 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(dBuV/m) = Measured level (dBuV) + 107 + AFCL(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)

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

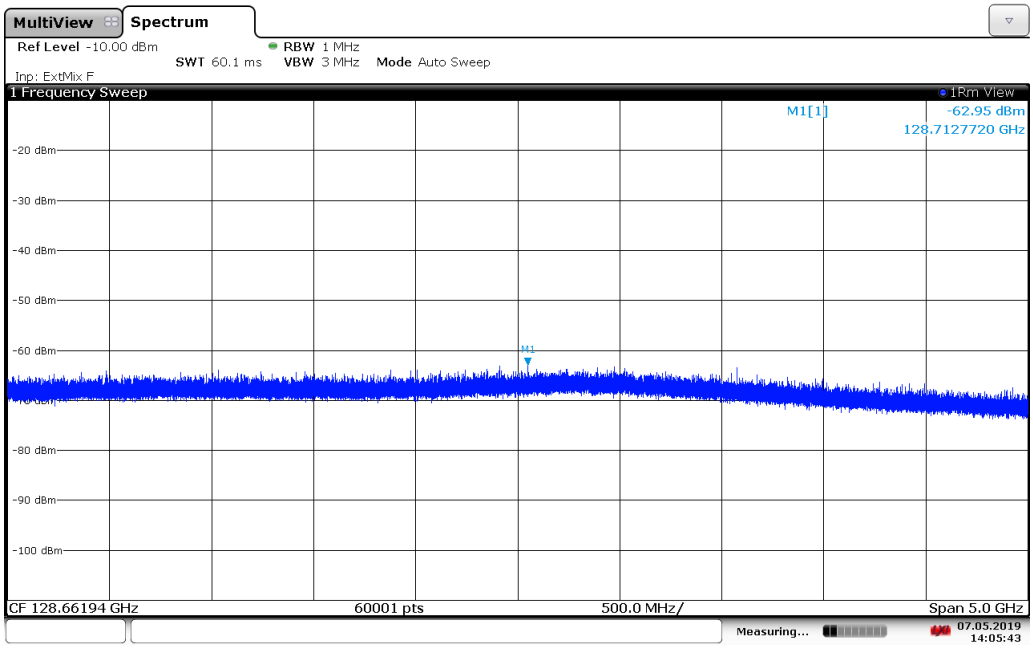
   $PD = EIRP_{Linear} / 4\pi d^2$

   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
3. ***** Noise floor

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

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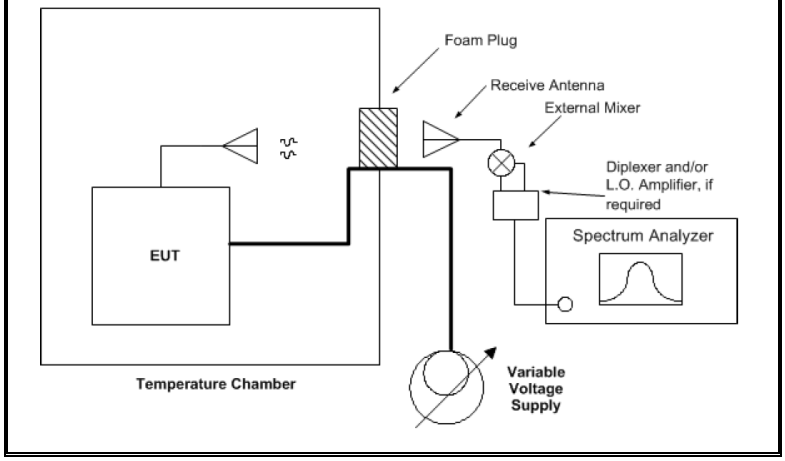
Note: The mixer loss was applied to the measured level by SA correction factor.

## 4.4 FREQUENCY STABILITY

### *Test configuration*

**Frequency stability**




### *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 ±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 (℃) | 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.