

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 : DRTFCC2009-0298(1)

2. Customer

• Name : DASAN Networks Inc.

• Address (FCC) : DASAN Tower, 49, Daewangpangyo-ro644Beon-gil, Bundang-gu, Seongnam-si,
South Korea 13493

Address (IC) : DASAN Tower, 49, Daewangpangyo-ro644Beon-gil, Bundang-gu Seongnam-si/Gyeonggi-do
13493 Korea (Republic Of)

3. Use of Report : FCC & IC Certification

4. Product Name / Model Name : Vehicle Control Terminal / TMS 3.0 (300611-01930)

FCC ID : 2AXDMTMS30DUALTYPEB

IC: 26419-TMS30TYPEB

5. FCC Regulation(s) : Part 25

IC Standard(s) : RSS-170 Issue 3

Test Method Used : ANSI C63.26-2015

6. Date of Test : 2020.07.16 ~ 2020.09.10

7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

8. Testing Environment : See appended test report.

9. 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.

Affirmation	Tested by	Reviewed by
	Name : JaeHyeok Bang 	Name : GeunKi Son ¹³  (Signature)

2020 . 10 . 23 .

DT&C Co., Ltd.

Unconnected with KS Q ISO / IEC 17025 and KOLAS accreditation

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
DRTFCC2009-0298	Sep. 23, 2020	Initial issue	JaeHyeok Bang	JaeJin Lee
DRTFCC2009-0298(1)	Oct. 23, 2020	Update the FCC ID	JaeHyeok Bang	GeunKi Son

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1. GENERAL INFORMATION

Applicant Name : DASAN Networks, Inc.
Address(FCC) : DASAN Tower, 49, Daewangpangyo-ro644Beon-gil, Bundang-gu, Seongnam-si, South Korea 13493
Address(IC) : DASAN Tower, 49, Daewangpangyo-ro644Beon-gil, Bundang-gu Seongnam-si/Gyeonggi-do 13493 Korea (Republic Of)
FCC ID : 2AXDMTMS30DUALTYPEB
IC : 26419-TMS30TYPEB
FCC Classification : Licensed Non-Broadcast Station Transmitter (TNB)
Product : Vehicle Control Terminal
Model Name : TMS 3.0 (300611-01930)
Add Model Name : -
Serial Number : NA
Firmware Version Identification Number : V3.01.002
Supplying power : DC 12 V, 24 V
Antenna Type : LTCC Antenna

CH	Tx Frequency (MHz)	EIRP (Max. Power)	
		dBm	W
1	1 616.020833	30.04	1.009
150	1 622.229157	29.13	0.818
240	1 625.979151	29.24	0.839

2. INTRODUCTION

2.1 EUT DESCRIPTION

This EUT contains the following capabilities:

850/1900 GPRS/EDGE, 850/1700/1900 WCDMA/HSUPA, Multi-band LTE and IRIDIUM Satellite communication.

Operation test Setup for EUT

- Test Software: Tera term 4.87.0.0
- Power setting: Default

2.2 TESTING ENVIRONMENT

Ambient Condition	
▪ Temperature	+22 °C ~ +24 °C
▪ Relative Humidity	41 % ~ 45 %

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)	4.9 dB (The confidence level is about 95 %, $k = 2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.1 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 & IC MRA Designation No. : KR0034		
- ISSED #: 5740A		
www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

3. SUMMARY OF TEST RESULTS

FCC Part Section(s)	RSS Section(s)	Parameter	Test Condition	Status Note 1
2.1046	-	RF Power Output	Conducted	NA ^{Note2}
2.1049	RSS-GEN[6.7]	Occupied Bandwidth		NA ^{Note2}
2.1051 25.202(f)	RSS-170[5.4.3.1]	Unwanted Emissions		NA ^{Note2}
2.1055 25.202(d)	RSS-170[5.2]	Frequency Stability		NA ^{Note2}
25.204	RSS-170[5.3]	EIRP (Equivalent Isotropically Radiated Power)	Radiated	C
2.1053 25.202(f)	RSS-170[5.4.3.1]	Unwanted Emissions		C
25.216	RSS-170[5.4.3.2.1] RSS-170[5.4.4]	Unwanted Emissions in the RNSS band		C
Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable Note 2: These test items were not performed because this device uses the granted module. (FCC ID: Q639603N / IC: 4629A-9603N) Please refer to the test report of the granted module				

4. TEST RESULTS

4.1 EIRP (Equivalent Isotropically Radiated Power)

Limit

- FCC Part 25.204(a)

(a) In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (c) of this section:

+ 40 dBW in any 4 kHz band for $\theta \leq 0^\circ$

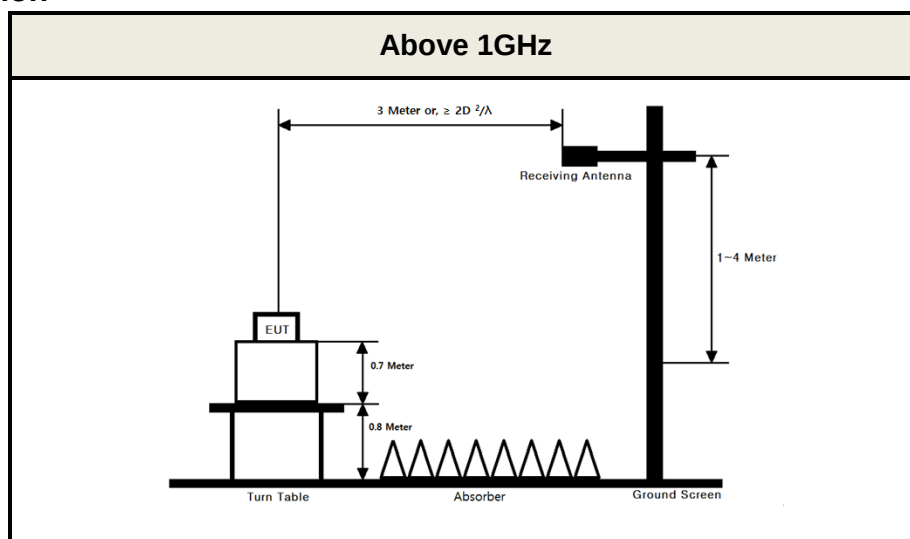
+ 40 + 3 θ dBW in any 4 kHz band for $0^\circ < \theta \leq 5^\circ$

where θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

- IC RSS-170[5.3.2]

The application for MES certification shall state the MES e.i.r.p. that is necessary for satisfactory communication. The maximum permissible e.i.r.p. will be the stated e.i.r.p. plus a 2 dB margin. If a detachable antenna is used, the certification application shall state the recommended antenna type and manufacturer, the antenna gain and the maximum transmitter output power at the antenna terminal.

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.

Test Procedure

- ANSI C63.26-2015 Section 5.2.3.3 and 5.2.7

1. Set the RBW $\geq$ OBW
2. Set VBW $\geq 3 \times$ RBW
3. Set span $\geq 2 \times$ OBW
4. Sweep time $\geq 10 \times$ (number of points in sweep) $\times$ (transmission symbol period)
5. Detector = peak
6. Trace mode = max hold.
7. Allow trace to fully stabilize

Test Results

- Test Notes

1. We have done x, y, z planes in EUT and horizontal and vertical polarization of detecting antenna.
2. The radiated test items were tested at DC 12 V and DC 24 V. And the worst case data is reported.
3. $EIRP\ (dBm) = E\ (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m.
 $E(dB\mu V/m) = \text{Measured level}\ (dB\mu V) + AFCL(dB/m)$
 where, $E = \text{field strength} / AFCL = \text{Antenna Factor}(dB/m) + \text{Cable Loss}(dB)$

- DC 12 V

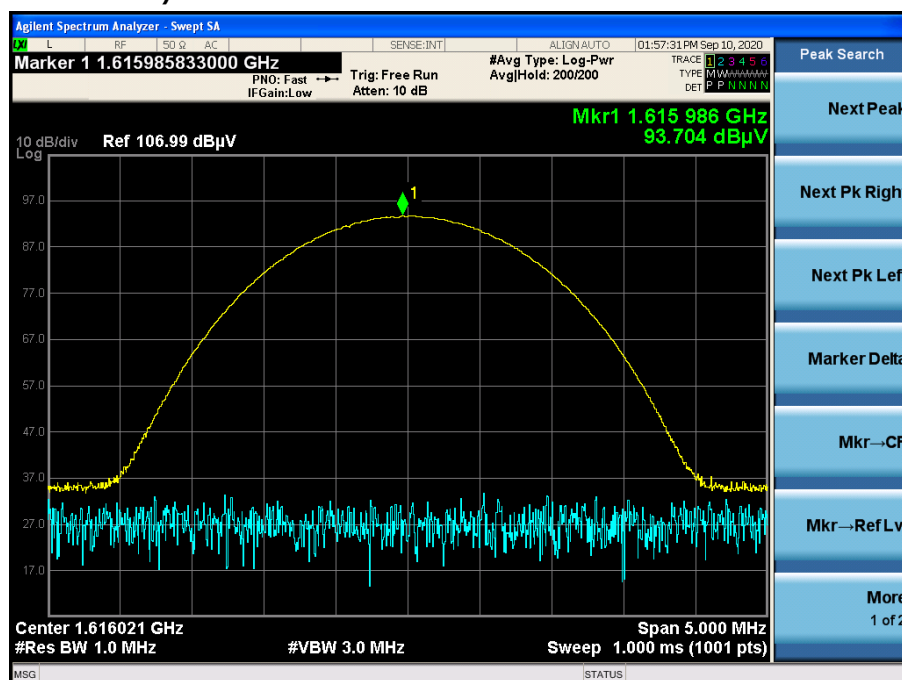
Measurement distance(d)	CH	Tx Freq [MHz]	Ant. Pol	Measured Level[dBuV]	AFCL [dB/m]	E [dBuV/m]	EIRP (dBm)	EIRP (W)
3 m	1	1616.0208	H	93.70	31.59	125.29	30.04	1.009
3 m	150	1622.2292	H	92.74	31.65	124.39	29.13	0.819
3 m	240	1625.9792	H	92.81	31.69	124.50	29.24	0.839

- DC 24 V

Measurement distance(d)	CH	Tx Freq [MHz]	Ant. Pol	Measured Level[dBuV]	AFCL [dB/m]	E [dBuV/m]	EIRP (dBm)	EIRP (W)
3 m	1	1616.0208	H	93.49	31.59	125.08	29.82	0.959

Worst case plot(Measured Level)

DC 12 V & 1616.0208 MHz & Hor



4.2 Unwanted Emissions (Radiated)

Limit

- FCC Part 25.202(f)

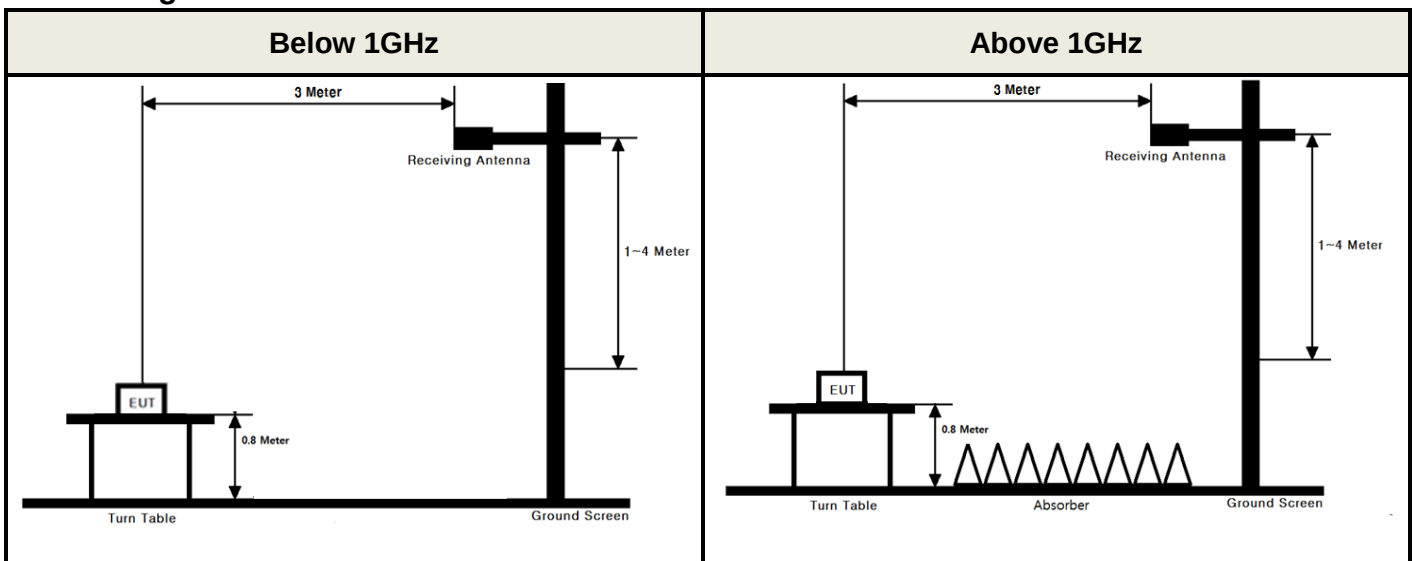
- (1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;
- (2) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;
- (3) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts;

- IC RSS-170[5.4.3]

The average power of unwanted emissions shall be attenuated below the average output power, P (dBW), of the transmitter, as specified below:

- (1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the occupied bandwidth or necessary bandwidth, whichever is greater;
- (2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the occupied bandwidth or necessary bandwidth, whichever is greater; and
- (3) $43 + 10 \log p$ (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the occupied bandwidth or necessary bandwidth, whichever is greater.

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 5.5 and 5.2.7

1. RBW = 100 kHz for below 1 GHz and 1 MHz for above 1 GHz / VBW $\geq 3 \times$ RBW
2. Detector = RMS
3. Trace mode = Max hold
4. Sweep time = Auto couple
5. Number of sweep point $\geq 2 \times$ span / RBW
6. The trace was allowed to stabilize

Test Results

- Test Notes

1. We have done x, y, z planes in EUT and horizontal and vertical polarization of detecting antenna.
2. The radiated test items were tested at DC 12 V and DC 24 V. And the worst case data is reported.
3. $EIRP\ (dBm) = E\ (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m.
 $E(dBuV/m) = \text{Measured level (dBm)} + 107 + AFCLAG(dB/m)$
 where, E=field strength / AFCLAG = Antenna Factor(dB/m) + Cable, High pass filter Loss(dB) – Amp Gain(dB)
 *The measurements were performed at a distance 3m.
4. The frequency spectrum is examined from 9 kHz to the 10th harmonic of the fundamental frequency of the transmitter.
 No other spurious and harmonic emissions were reported greater than listed emissions.

- DC 12 V

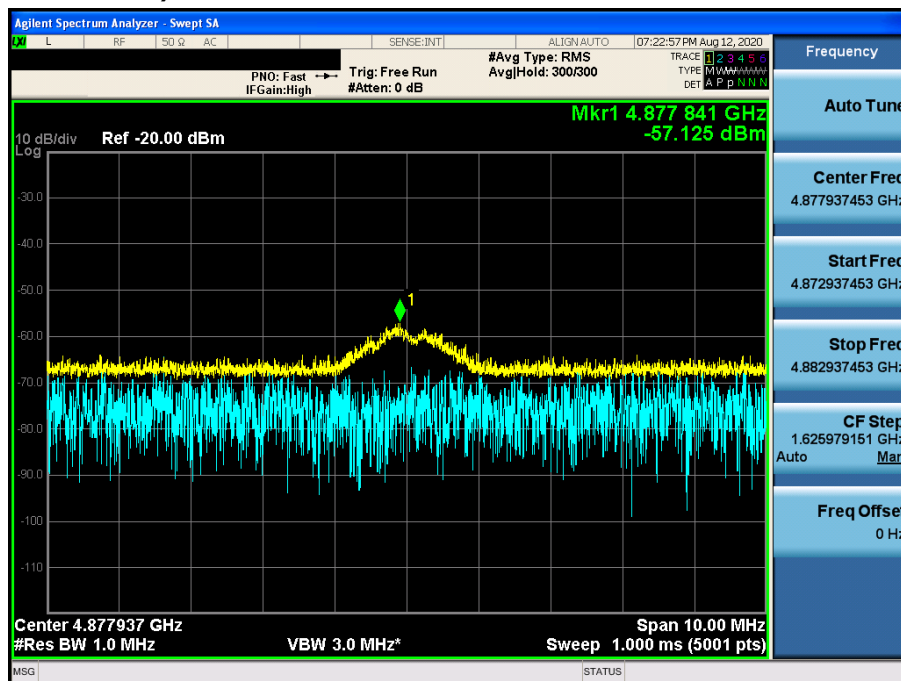
CH	Tx Freq [MHz]	Freq [MHz]	Ant. Pol	Measured Level[dBm]	AFCLAG [dB/m]	E [dBuV/m]	Result [dBm]	Limit [dBm]	Margin [dB]
1	1616.0208	3232.21	V	-53.70	3.35	56.65	-38.60	-13.00	25.60
		4847.92	V	-59.10	4.72	52.62	-42.64	-13.00	29.64
150	1622.2292	3244.50	V	-55.70	3.34	54.64	-40.62	-13.00	27.62
		4866.76	V	-57.20	6.83	56.63	-38.63	-13.00	25.63
240	1625.9792	3251.98	V	-54.93	3.31	55.38	-39.88	-13.00	26.88
		4877.84	V	-57.13	6.87	56.74	-38.52	-13.00	25.52

- DC 24 V

CH	Tx Freq [MHz]	Freq [MHz]	Ant. Pol	Measured Level[dBm]	AFCLAG [dB/m]	E [dBuV/m]	Result [dBm]	Limit [dBm]	Margin [dB]
1	1616.0208	3 251.98	V	-54.67	3.41	55.75	-39.51	-13.00	26.51
		4 877.84	V	-62.20	6.78	51.58	-43.68	-13.00	30.68

Worst case plot(Measured Level)

DC 12 V & 1625.9792 MHz & Ver



4.3 Unwanted Emissions in the RNSS band (Radiated)

Limit

- FCC Part 25.216

(1) 25.216(g) Mobile earth stations manufactured more than six months after FEDERAL REGISTER publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies in the 1610–1626.5 MHz band shall suppress the power density of emissions in the 1605–1610 MHz band-segment to an extent determined by linear interpolation from -70 dBW/MHz at 1605 MHz to -10 dBW/MHz at 1610 MHz averaged over any 2 millisecond active transmission interval. The e.i.r.p of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed a level determined by linear interpolation from -80 dBW at 1605 MHz to -20 dBW at 1610 MHz, averaged over any 2 millisecond active transmission interval.

(2) 25.216(i) The e.i.r.p density of carrier-off state emissions from mobile earth stations manufactured more than six months after FEDERAL REGISTER publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies between 1 and 3 GHz shall not exceed -80 dBW/MHz in the 1559–1610 MHz band averaged over any two millisecond interval.

- IC RSS-170[5.4.3.2.1]

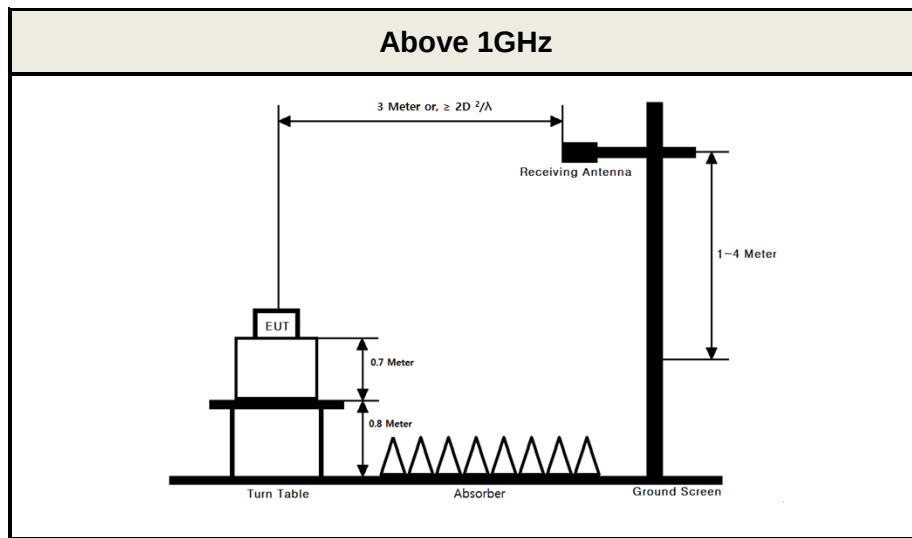
Mobile earth stations with transmitting frequencies between 1610 MHz and 1626.5 MHz shall have the e.i.r.p. density of unwanted emissions in the band 1605-1610 MHz, averaged over any 2-ms active transmission interval, not exceed the following limits:

- (1) -70 dBW/MHz at 1605 MHz, linearly interpolated to -10 dBW/MHz at 1610 MHz for broadband emissions; and
- (2) -80 dBW/kHz at 1605 MHz, linearly interpolated to -20 dBW/kHz at 1610 MHz for discrete emissions.

- IC RSS-170[5.4.4]

Mobile equipment with transmitting frequencies between 1 GHz and 3 GHz shall have the e.i.r.p. density of carrier-off state emissions in the band 1559-1610 MHz not exceed -80 dBW/MHz.

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.

Test Procedure

- ANSI C63.26-2015 Section 6.5.2.7

1. RBW =1 MHz / VBW $\geq 3 \times$ RBW
2. Detector = RMS
3. Trace mode = Max hold
4. Sweep time = slow enough to maintain instrument calibration
5. Number of sweep point $\geq 2 \times$ span / RBW
6. The trace was allowed to stabilize

Test Results

- Test Notes

1. We have done x, y, z planes in EUT and horizontal and vertical polarization of detecting antenna.
2. The radiated test items were tested at DC 12 V and DC 24 V. And the worst case data is reported.
3. EIRP (dBm) = E (dBμV/m) + 20log(D) – 104.8; where D is the measurement distance (in the far field region) in m.
 $E(\text{dB}\mu\text{V/m}) = \text{Measured level (dBm)} + 107 + \text{AFCLAG}(\text{dB/m})$
 where, E=field strength / AFCLAG = Antenna Factor(dB/m) + Cable Loss(dB) – Amp Gain(dB)
 *The measurements were performed at a distance 3m.

- DC 12 V & Carrier on

CH	Tx Freq [MHz]	Freq [MHz]	Ant. Pol	Measured Level[dBm]	AFCLAG [dB/m]	E [dBuV/m]	Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]
1	1616.0208	1603.88	H	-55.56	-2.54	48.90	-46.36	-40.00	6.36
150	1622.2292	1609.97	H	-56.48	-2.48	48.04	-47.22	-40.00	7.22
240	1625.9792	1600.87	H	-57.10	-2.56	47.34	-47.92	-40.00	7.92

Limit: -40 dBm/MHz at 1605 MHz, linearly interpolated to 20 dBm/MHz at 1610 MHz

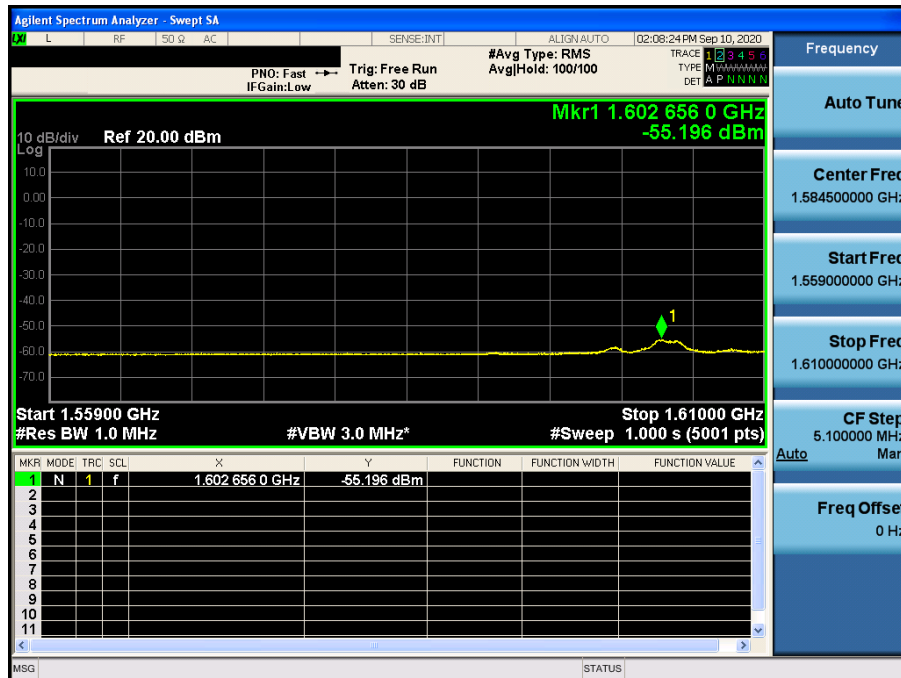
*The worst limit(-40 dBm/MHz) was applied in the examined band(1559-1610 MHz). And all emissions meet the limit.

- DC 24 V & Carrier on

CH	Tx Freq [MHz]	Freq [MHz]	Ant. Pol	Measured Level[dBm]	AFCLAG [dB/m]	E [dBuV/m]	Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]
1	1616.0208	1602.66	H	-55.20	-2.54	49.26	-45.99	-40.00	5.99

Worst case plot(Measured Level)

DC 24 V & 1616.0208 MHz & Hor



- DC 12 V & Carrier off

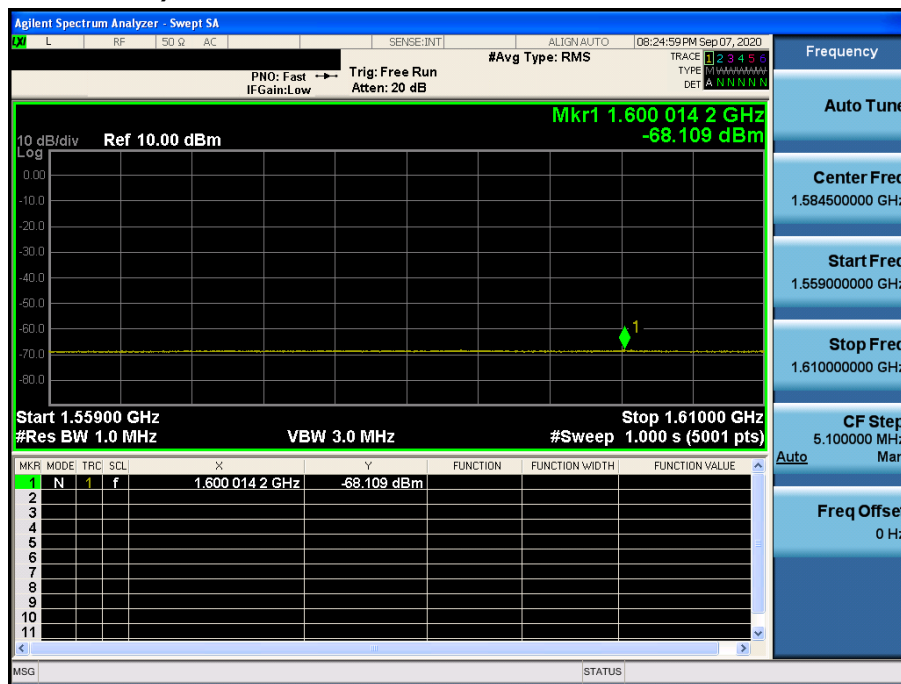
CH	Tx Freq [MHz]	Freq [MHz]	Ant. Pol	Measured Level[dBm]	AFCLAG [dB/m]	E [dBuV/m]	Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]
-	-	1597.94	H	-68.17	-2.56	36.27	-58.99	-50.00	8.99

- DC 24 V & Carrier off

CH	Tx Freq [MHz]	Freq [MHz]	Ant. Pol	Measured Level[dBm]	AFCLAG [dB/m]	E [dBuV/m]	Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]
-	-	1600.01	H	-68.11	-2.57	36.32	-58.94	-50.00	8.94

Worst case plot(Measured Level)

DC 24 V & Hor



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	19/12/16	20/12/16	MY50200828
Spectrum Analyzer	Agilent Technologies	N9020A	20/06/24	21/06/24	US47360812
DC power supply	Agilent Technologies	66332A	20/06/24	21/06/24	MY43001172
Multimeter	FLUKE	17B+	19/12/16	20/12/16	36390701WS
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-2
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-1
Signal Generator	Rohde Schwarz	SMBV100A	19/12/16	20/12/16	255571
Signal Generator	ANRITSU	MG3695C	19/12/16	20/12/16	173501
Loop Antenna	ETS-Lindgren	6502	19/09/18	21/09/18	00226186
Bilog Antenna	Schwarzbeck	VULB 9160	19/04/23	21/04/23	9160-3362
HORN ANT	ETS	3117	20/04/24	21/04/24	00140394
HORN ANT	A.H.Systems	SAS-574	20/06/24	21/06/24	155
PreAmplifier	H.P	8447D	19/12/16	20/12/16	2944A07774
PreAmplifier	Agilent	8449B	20/06/24	21/06/24	3008A02108
High-pass filter	Wainwright	WHKX12-935-1000-15000-40SS	20/06/24	21/06/24	7
High-pass filter	Wainwright	WHKX12-2580-3000-18000-80SS	20/06/24	21/06/24	3
High-pass filter	Wainwright	WHNX8.5/26.5G-6SS	20/06/24	21/06/24	1
Cable	DTNC	Cable	20/01/13	21/01/13	M-01
Cable	DTNC	Cable	20/01/13	21/01/13	M-03
Cable	DTNC	Cable	20/01/13	21/01/13	M-04
Cable	Junkosha	MWX315	20/01/13	21/01/13	M-05
Cable	Junkosha	MWX221	20/01/13	21/01/13	M-06
Test Software	tsj	Raidated Emission Measurement	NA	NA	Version 2.00.0177

Note 1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

Note 2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.