



FCC ID: 2ACDX-MRR-20 Report No.: T200217W03-RP IC: 11988A-MRR20 Ref. No.: T171122I01-RP Page 1 / 39 Rev. 02

FCC 47 CFR PART 95 SUBPART M & INDUSTRY CANADA RSS-251 Issue 1

TEST REPORT

For

Automotive Radar

Model: MRR-20

Trade Name: Mando

Issued to

For FCC: MANDO corp. 21, Pangyo-ro 255beon-gil, Bundang-gu, Gyeonggi-do, Seongnam-si, 463-400, South Korea

For IC:

MANDO corp. 21, Pangyo-ro 255beon-gil, Bundang-gu, Gyeonggi-do, Seongnam-si, 463-400, Korea (Rep.)

Issued by

Compliance Certification Services Inc. No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.) Issued Date: March 2, 2020

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only. 除非另有說明,此報告結果僅對測試之樣品負責,同時此樣品僅保留90天。本報告未經本公司書面許可,不可部分複製。

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	February 8, 2018	Initial Issue	ALL	Angel Cheng
01	March 1, 2018	See the following note Rev.(01)	P.8-9, P.20	Angel Cheng
02	March 2, 2020	See the following note Rev.(02)	P.11, P.27-28, A-1	Allison Chen

Rev.(01)

1. Removed section 4.4

2. Add equipment in table

3. Add notes for limits in radiated emission.

Rev.(02)

1. Applicant change PCB version from A to B. Verify radiated emission test data below 1GHz in section 8.3. 2. The above test method for those measurements are in accordance with FCC Part 95 subpart M and IC RSS-251 Issue 1 refer to T171122I01, please see as below: frequency band, equivalent isotropically radiated power (EIRP), radiated spurious emission above 1GHz, and frequency stability.

3. Other information, please refer to T171122I01 and this test report.



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APPENDIX 1 - PHOTOGRAPHS OF EUT



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1. TEST RESULT CERTIFICATION

Applicant:	For FCC: MANDO corp. 21, Pangyo-ro 255beon-gil, Bundang-gu, Gyeonggi-do, Seongnam-si, 463-400, South Korea For IC: MANDO corp. 21, Pangyo-ro 255beon-gil, Bundang-gu, Gyeonggi-do, Seongnam-si, 463-400, Korea (Rep.)		
Manufacturer:	For FCC: MANDO corp. 21, Pangyo-ro 255beon-gil, Bundang-gu, Gyeonggi-do, Seongnam-si, 463-400, South Korea For IC: MANDO corp. 21, Pangyo-ro 255beon-gil, Bundang-gu, Gyeonggi-do, Seongnam-si, 463-400, Korea (Rep.)		
Equipment Under Test:	Automotive Radar		
Trade Name:	Mando		
Model:	MRR-20		
Date of Test:	November 27, 2017 ~ February 5, 2018; February 20, 2020		



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APPLICABLE STANDARDS					
STANDARD TEST RESULT					
FCC 47 CFR Part 95 Subpart M					
&	No non-compliance noted				
INDUSTRY CANADA RSS-251 issue 1					
Statements of Conformity					
Determination of compliance is based on the results of the compliance measurement					
not taking into account measureme	nt instrumentation uncertainty.				

We hereby certify that:

All test results conform to above mentioned standards.

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 95.3367 and 95.3379.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Komil Ison

Kevin Tsai Deputy Manager



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2. EUT DESCRIPTION

Product	Automotive Radar			
Trade Name	Mando			
Model Number	MRR-20			
Model Discrepancy	N/A			
Received Date	February 17, 2020			
Power Supply	12.0-Voc from power supply			
Frequency Band	76.0 – 77.0 GHz			
Modulation	FMCW			
Number of Channel	1 (76.5 GHz)			
Antenna Designation	Patch Antenna / Gain: 20 dBi			
Temperature Range	-40°C to +85 °C			

Remark:

1. The sample selected for test was production product and was provided by manufacturer.



3. TEST SUMMERY

Report Section	FCC Standard Section	IC Standard Section	Test Item	Result
8.1	95.3379(b)	RSS-251 Sec 5.1	Frequency band F	
8.2	95.3367	RSS-251 Sec 5.2.2	Equivalent Isotropically Radiated Power (EIRP)	
8.3	95.3379(a)	RSS-251 Sec 5.3	Radiated spurious emissions	
8.4	95.3379(b)	RSS-251 Sec 5.4	Frequency stability	



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4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013, ANSI 63.4 2014 and FCC CFR 47 Part 95.3367, 95.3379.

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4.1 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.

4.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

4.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in ANSI C63.10: 2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 1.5 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m 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 maximum emissions, exploratory radiated emission measurements were made according to the requirements in ANSI C63.10: 2013.



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4.4 DESCRIPTION OF TEST MODES

The EUT (model: MRR-20) had been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting mode was programmed. The worst case data rate is determined as the data rate with highest output power.

The product does not transmits in stop condition.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

Radiated Emission Measurement Above 1G				
Test Condition Radiated Emission Above 1G				
Voltage/Hz	Voltage/Hz 12V			
Test Mode	Test Mode Mode 1:EUT power by Battery.			
Worst Mode Mode 1 Mode 2 Mode 3 Mode 4				

Radiated Emission Measurement Below 1G				
Test Condition	Test Condition Radiated Emission Below 1G			
Voltage/Hz	Voltage/Hz 12V			
Test Mode	Test Mode Mode 1:EUT power by Battery.			
Worst Mode Mode 1 Mode 2 Mode 3 Mode 4				

Remark:

1. The worst mode was record in this test report.



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5. INSTRUMENT CALIBRATION

5.1 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.

5.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: Each piece of equipment is scheduled for calibration once a year.

Conducted Emissions Test Site						
Name of Equipment	Manufacturer	Model	Serial Number	Cal Date	Cal Due	
Spectrum Analyzer	R&S	FSV 40	101073	10/05/2017	10/04/2018	
Thermostatic/Hrgrosatic Chamber	GWINSTEK	GTC-288MH-CC	TH160402	05/23/2017	05/22/2018	
Harmonic Mixer	ROHDE&SCHWARZ	FH-PP-75 / FS-Z75	10001 / 100162	04/21/2017	04/20/2018	
Harmonic Mixer	ROHDE&SCHWARZ	FH-PP-110 / FS-Z110	10003 / 100096	04/23/2017	04/22/2018	
Harmonic Mixer	ROHDE&SCHWARZ	FH-PP-170 / SAM-170	10003 / 20011	04/26/2017	04/25/2018	
Harmonic Mixer	ROHDE&SCHWARZ	FH-PP-220 / SAM-220	10003 / 20013	04/29/2017	04/28/2018	
Harmonic Mixer	Radiometer Physics Gmbn	FH-PP-325 / SAM-325	10007 / 20048	05/04/2017	05/03/2018	
Harmonic Mixer	A-INFO / ROHDE&SCHWARZ		J202020872 / 100142	04/16/2017	04/15/2018	

3M 966 Chamber Test Site						
Name of Equipment	Manufacturer	Model	Serial Number	Cal Date	Cal Due	
Bilog Antenna	Sunol Sciences	JB3	A030105	06/20/2017	06/19/2018	
Horn Antenna	EMCO	3117	00055165	02/20/2017	02/19/2018	
Pre-Amplifier	EMCI	EMC 012635	980151	08/01/2017	07/31/2018	
Pre-Amplifier	EMEC	EM330	060609	06/07/2017	06/06/2018	
Cable	HUBER SUHNER	SUCOFLEX 104PEA	25157	7/31/2017	7/30/2018	
Cable	HUBER SUHNER	SUCOFLEX 104PEA	20995	7/31/2017	7/30/2018	
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R	
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R	
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R	



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Test date: Verify radiated emission test data below 1GHz in section 8.3

3M 966 Chamber Test Site						
Name of Equipment	Manufacturer	Model	Serial Number	Cal Date	Cal Due	
Bilog Antenna	Sunol Sciences	JB3	A030105	07/26/2019	07/25/2020	
Coaxial Cable	HUBER SUHNER	SUCOFLEX 104PEA	20995	02/26/2019	02/25/2020	
Coaxial Cable	EMCI	EMC105	190914+251 11	09/20/2019	09/19/2020	
Digital Thermo-Hygro Meter	WISEWIND	1206	D07	01/15/2020	01/14/2021	
Pre-Amplifier	EMEC	EM330	060609	02/26/2019	02/25/2020	
Pre-Amplifier	HP	8449B	3008A0096 5	02/26/2019	02/25/2020	
PSA Series Spectrum Analyzer	Agilent	E4446A	MY4618032 3	05/29/2019	05/28/2020	
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R	
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R	
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R	
Software		e3 6.11	20180413			



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5.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 1.2575
Emission bandwidth, 6dB bandwidth	+/- 1.4003
RF output power, conducted	+/- 1.1372
Power density, conducted	+/- 1.4003
3M Semi Anechoic Chamber / 30M~200M	+/- 4.0138
3M Semi Anechoic Chamber / 200M~1000M	+/- 3.9483
3M Semi Anechoic Chamber / 1G~8G	+/- 2.5975
3M Semi Anechoic Chamber / 8G~18G	+/- 2.6112
3M Semi Anechoic Chamber / 18G~26G	+/- 2.7389
3M Semi Anechoic Chamber / 26G~40G	+/- 2.9683
3M Semi Anechoic Chamber / 40G~60G	+/- 1.8509
3M Semi Anechoic Chamber / 60G~75G	+/- 1.9869
3M Semi Anechoic Chamber / 75G~110G	+/- 2.9651
3M Semi Anechoic Chamber / 110G~170G	+/- 2.7807
3M Semi Anechoic Chamber / 170G~220G	+/- 3.6437
3M Semi Anechoic Chamber / 220G~325G	+/- 4.2982

Remark: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



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6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
 Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)
 Tel: 886-2-2299-9720 / Fax: 886-2-2299-9721

No.81-1, Lane 210, Bade 2nd Rd., Lujhu Township, Taoyuan County 33841, TAIWAN, R.O.C.

Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

6.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."



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7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

7.2 SUPPORT EQUIPMENT

No.	Device Type	Device Type Brand Model		Series No.	FCC ID	
1.	. DC Power Source GWINSTE		SPS-3610	GPE880163	FCC DoC	
2.	DC Power Source	Agilent	E3640A	N/A	N/A	

Remark:

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



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8. TEST REQUIREMENTS

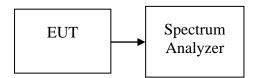
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8.1 FREQUENCY BAND

<u>LIMIT</u>

According to FCC 95.3379(b) and RSS-251 Sec 5.1, systems using digital modulation techniques may operate in the 76.0 GHz-77 GHz.

Test Configuration



TEST PROCEDURE

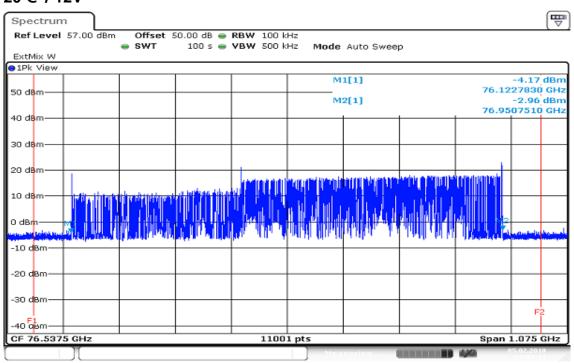
The transmitter output is connected to the spectrum analyzer. Set the RBW=1MHz the emission bandwidth, VBW \ge 3 x RBW, Detector = Peak, Trace mode = Max hold, Sweep = 100S. Mark point1 and point 2 to Measure the operation frequency range.

TEST RESULTS

No non-compliance noted

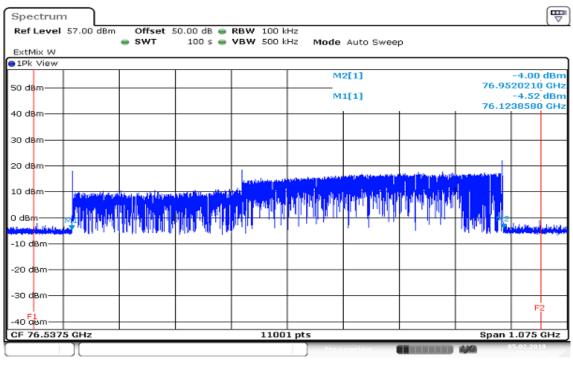


<u>Test Data</u> Test Plot 20°C / 12V



Date: 5.FEB.2018 11:58:49

-40°C / 12V



Date: 5.FEB.2018 15:32:39

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85°C / 12V **T** Spectrum Ref Level 57.00 dBm Offset 50.00 dB @ RBW 100 kHz 100 s 👄 VBW 500 kHz swt Mode Auto Sweep ExtMix W ●1Pk View M2[1] -4.50 dBm 76.9525100 GHz 50 d8m--5.25 dBm 76.1240530 GHz M1[1] 40 d8m 30 d8m-20 d8mt discription and high and high political data 10 d8m The and the ministry of a state and a state of a first of a first of 0 dBm 1 11 -10 dBm--20 dBm--30 d<mark>8</mark>m-F2 -40 qBm-Start 76.0 GHz 11001 pts Stop 77.075 GHz Date: 5.FEB.2018 16:01:02



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8.2 EQUIVALENT ISOTROPICALLY RADIATED POWER (EIRP)

<u>LIMIT</u>

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:

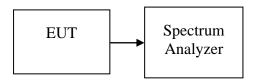
Ref. No.: T171122I01-RP

According to FCC 95.3367 and RSS-251 Sec 5.2.2

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).

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 Configuration



TEST RESULTS

No non-compliance noted.

Test Condition	Frequency(GHz)	Peak EIRP(dBm)	Limit (dBm)
20°C / 12V		23.99	
-40°C / 12V	76.2	23.22	55
85°C / 12V		23.00	

Test Condition	Frequency(GHz)	AVG EIRP (dBm)	Limit (dBm)
20°C / 12V		22.35	
-40°C / 12V	76.2	22.35	50
85°C / 12V		22.09	



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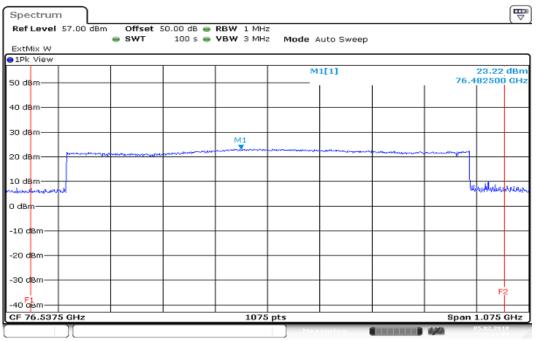
E

Test Data Peak Power

20°C / 12V Spectrum Ref Level 57.00 dBm Offset 50.00 dB 👄 RBW 1 MHz SWT 100 s 👄 VBW 3 MHz Mode Auto Sweep ExtMix W ⊖1Pk View M1[1] 23.99 dBm 76.932500 GHz 50 d8m-40 d8m· 30 dBm· M1 20 d8m-10 d8m المرد الكمار وساحيان 0 dBm -10 d<mark>B</mark>m· -20 d<mark>B</mark>m--30 d<mark>8</mark>m-40 abm-CF 76.5375 GHz 1075 pts Span 1.075 GHz

Date: 5.FEB.2018 12:02:13

-40°C / 12V



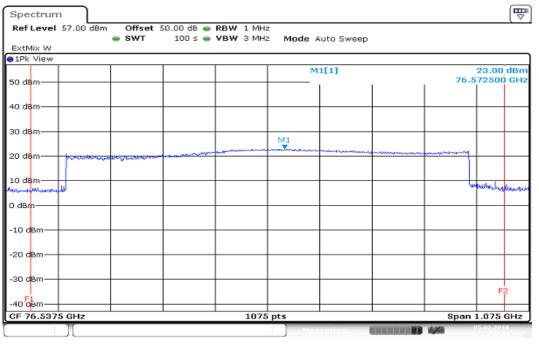
Date: 5.FEB.2018 13:13:09

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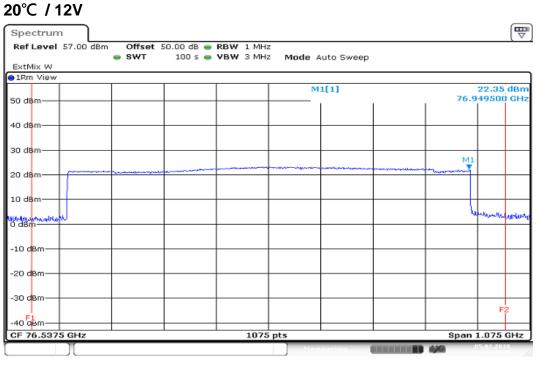
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85°C / 12V



Date: 5.FEB.2018 14:59:46

Average Power

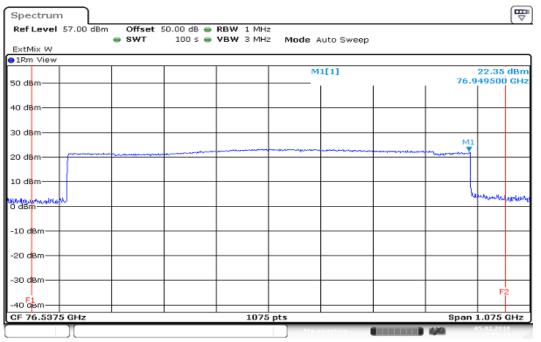


Date: 5.FEB.2018 13:09:29



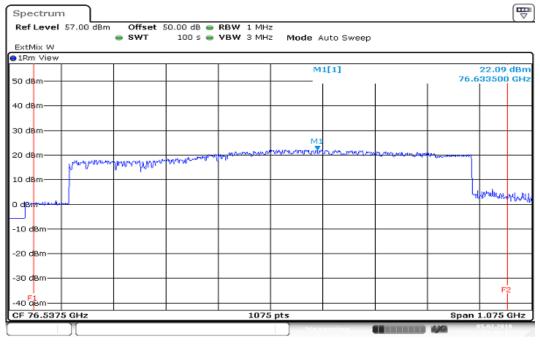
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-40°C / 12V



Date: 5.FEB.2018 13:09:12

85°C / 12V



Date: 5.FEB.2018 15:05:17



8.3 SPURIOUS EMISSIONS

8.3.1 Radiated Emissions

<u>LIMIT</u>

1. According to FCC PART 95.3379(a) and RSS-251 Sec 5.3, Radiated emissions below 40 GHz shall not exceed the field strength as shown in the following emissions table.

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)		
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		

- 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.
- 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.

Notes:

 $\begin{array}{l} P(mW) = Power \; density \; (mW/m^2) \; X \; 4\pi(r)^2 \\ 600 \; pW/cm^2 = -1.7 dBm \; @ \; 3m = 7.84 \; dBm \; @ \; 1m \\ 1000 \; pW/cm^2 = 0.5 \; dBm \; @ \; 3m = 10.04 \; dBm \; @ \; 1m \end{array}$

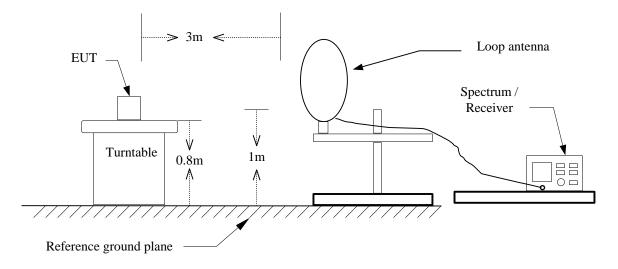
P: Power r: measurement distance(m)

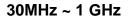


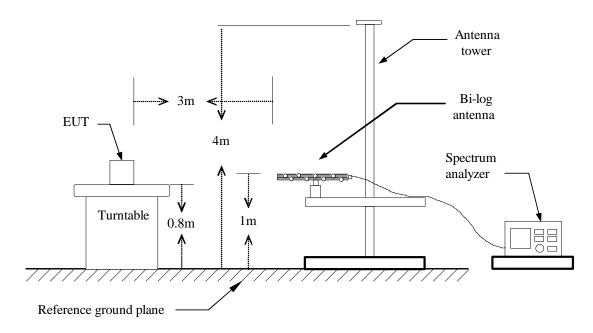
Ref. No.: T171122I01-RP

Test Configuration

9kHz ~ 30MHz





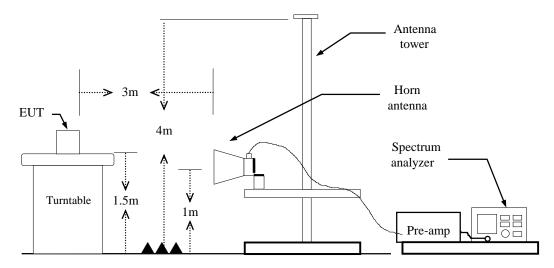




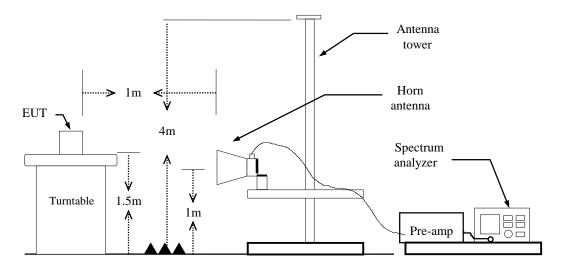
Ref. No.: T171122I01-RP

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Above 1 GHz ~ 18GHz



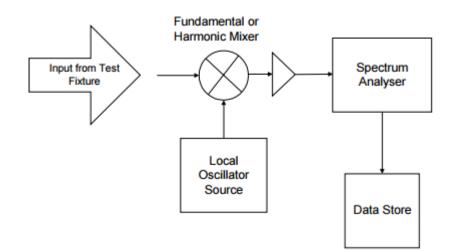
18GHz ~ 40GHz





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Above 40 GHz





TEST PROCEDURE

- 1. The EUT is placed on a turntable, which is 1.5m above ground plane.
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

```
RBW=100kHz / VBW=300kHz / Sweep=AUTO
```

Above 1GHz:

(a)PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO

(b)AVERAGE: RBW=1MHz,

Above 40GHz:

RBW = 1 MHz, VBW= 3 MHz,

Detector = Peak, Trace mode = max hold, Sweep = AUTO.

7. Repeat above procedures until the measurements for all frequencies are complete.



Ref. No.: T171122I01-RP

Below 1 GHz

Operation Mode: Normal Link

Temperature: 19.1°C

Humidity: 55% RH

Test Date:2020/02/20Tested by:Jerry ChangPolarity:Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
66.86	54.13	-15.16	38.97	40.00	-1.03	peak	V
124.09	50.03	-8.85	41.18	43.50	-2.32	peak	V
144.46	52.12	-9.92	42.20	43.50	-1.30	peak	V
170.65	48.81	-10.83	37.98	43.50	-5.52	peak	V
422.85	31.23	-4.65	26.58	46.00	-19.42	peak	V
978.66	25.85	5.60	31.45	54.00	-22.55	peak	V
66.86	53.84	-15.16	38.68	40.00	-1.32	peak	Н
104.69	50.65	-11.18	39.47	43.50	-4.03	peak	Н
124.09	50.21	-8.85	41.36	43.50	-2.14	peak	н
144.46	52.05	-9.92	42.13	43.50	-1.37	peak	н
173.56	47.74	-10.99	36.75	43.50	-6.75	peak	Н
422.85	31.41	-4.65	26.76	46.00	-19.24	peak	Н

Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).

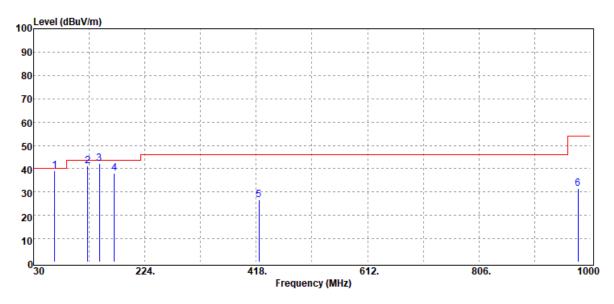
2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.

- 3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
- 4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 5. Margin (dB) = Remark result (dBuV/m) Quasi-peak limit (dBuV/m).

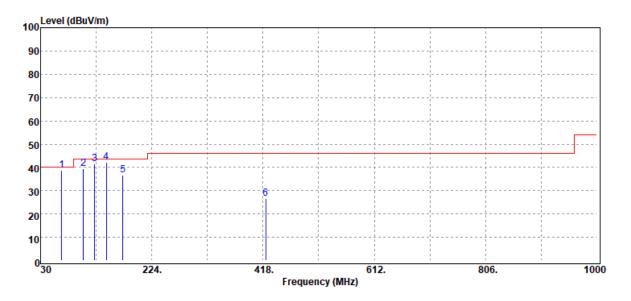


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Polarity : Vertical



Polarity : Horizontal





Ref. No.: T171122I01-RP

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<u>Above 1 GHz</u>

Operation Mode: Test Mode

Temperature: 28°C

Humidity: 53% RH

Test Date: 2017/11/27 Tested by: Jerry Chuang Polarity: Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1966.000	46.71	-4.44	42.27	74.00	-31.73	peak	V
2687.000	42.12	-2.27	39.85	74.00	-34.15	peak	V
3345.000	41.09	0.36	41.45	74.00	-32.55	peak	V
4668.000	38.69	4.10	42.79	74.00	-31.21	peak	V
9300.000	38.69	12.98	51.67	74.00	-22.33	peak	V
10210.000	38.31	13.94	52.25	74.00	-21.75	peak	V
18255.000	25.21	44.05	69.26	84.54	-15.28	peak	V
18255.000	17.41	44.05	61.46	64.54	-3.08	AVG	V
1966.000	52.92	-4.44	48.48	74.00	-25.52	peak	Н
3093.000	41.77	-1.10	40.67	74.00	-33.33	peak	Н
4591.000	38.92	3.96	42.88	74.00	-31.12	peak	Н
5354.000	39.05	5.56	44.61	74.00	-29.39	peak	Н
7755.000	38.34	11.12	49.46	74.00	-24.54	peak	Н
9170.000	38.64	12.96	51.60	74.00	-22.40	peak	Н
18195.000	22.50	43.99	66.49	84.54	-18.05	peak	Н
18195.000	17.04	43.99	61.03	64.54	-3.51	AVG	Н

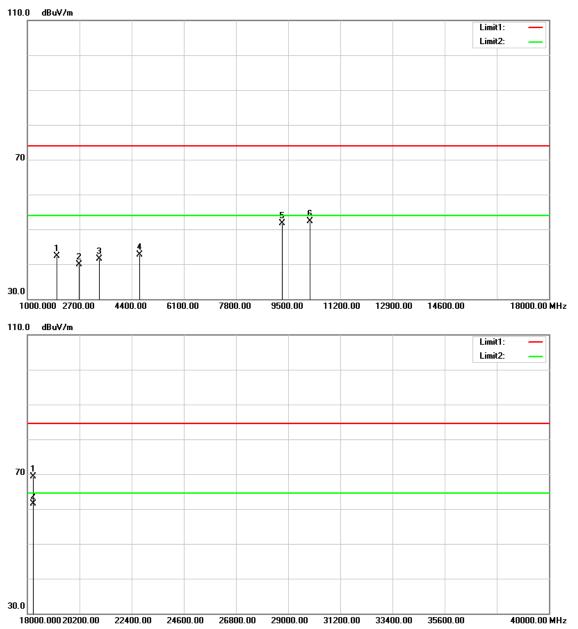
Remark:

- 1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- 2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
- 3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
- 4. Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 6. Margin (dB) = Remark result (dBuV/m) Average limit (dBuV/m).



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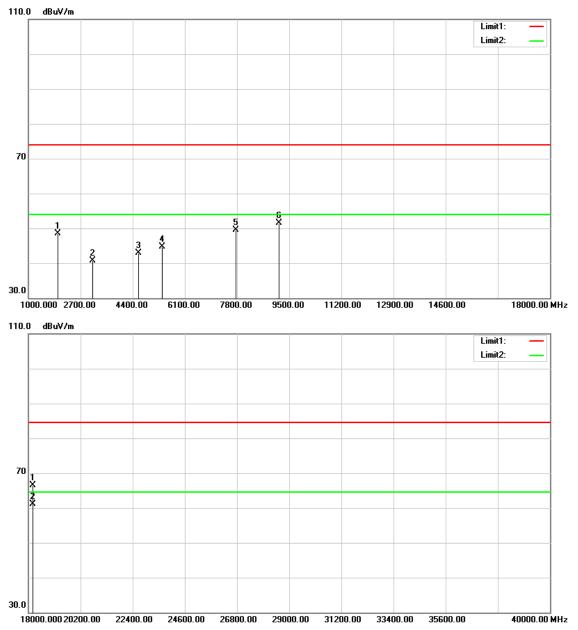
Polarity : Vertical





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Polarity : Horizontal





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Report No.: T200217W03-RP Ref. No.: T171122I01-RP

40G-50G

Operation Mode: Test Mode

28°C Temperature:

Humidity: 53% RH Test Date: 2017/11/27 Tested by: Jerry Chuang

Spectrum								
Ref Level 1.30 dBm	Offset 21	.30 dB 😑 RE	3W 1 MHz					
	SWT	40 ms 👄 ۷	3 MHz	Mode Au	ito Sweep			
ExtMix U								
●1Pk View		1						
				N	41[1]			40.65 dBm
					1	1	49	9.4430 GHz
-10 dBm								
-20 dBm								
-30 dBm								
								M1
-40 dBm								
			1	a des an and	and management	and a house	renew	
-40 dBm	monum	man	and the second second	0.00	· · · · · · · · · · · · · · · · · · ·			
-60 dBm								
-70 dBm								
-80 dBm								
-90 dBm								
-90 dom								
				L				
Start 40.0 GHz			691	pts				50.0 GHz
[]]				Me	asuring			27.11.2017 20:56:37

Date: 27.NOV.2017 20:56:38



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Report No.: T200217W03-RP Ref. No.: T171122I01-RP

50G-75G

Operation Mode: Test Mode

28°C Temperature:

Humidity: 53% RH Test Date: 2017/11/27 Tested by: Jerry Chuang

Spectrum								
Ref Level 13.40 dBm								
ExtMix V	SWT 10	10 ms 👄 🛛 🛛	SW 3 MHz	Mode Au	to Sweep			
●1Pk View								
10 dBm				M	1[1]			21.45 dBm 5.3580 GHz
0 dBm								
-10 dBm								
10 0.0								
-20 dBm					M1			
	Dry.	his			My pry			
-30 dBm	menumeran		Landreen	underson		mander	within a gold to the	mondand
-40 dBm	and reasons and a							
-50 dBm								
-60 dBm								
-60 aBm								
-70 dBm								
-80 dBm								
Start 50.0 GHz	I		691	pts			Stop	75.0 GHz
) Mea	suring (4/4 2	7.11.2017 20:59:02

Date: 27.NOV.2017 20:59:02



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Report No.: T200217W03-RP Ref. No.: T171122I01-RP

75G-110G

Operation Mode: Test Mode

Temperature:

Humidity:

28°C

53% RH

Test Date: 2017/11/27 Tested by: Jerry Chuang

Spectrur	n								
Ref Level	32.80 dBm	Offset	33.80 dB 🥌 R	BW 1 MHz					
		SWT	140 ms 👄 🎙	BW 3 MHz	Mode A	uto Sweep			
ExtMix W 1Pk View									
30 dBm					N	41[1]			-9.66 dBm
50 dbiii								109	9.9240 GHz
20 dBm—									
10 dBm									
0 dBm									
-10 dBm—									м
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-20 übiii									
-30 dBm—									
-40 dBm—									
-50 dBm—									
-60 dBm									
CF 92.5 G				691	ntc				35.0 GHz
CF 92.3 G				091				· · ·	27.11.2017
					me	asuring			21:05:14

Date: 27.NOV.2017 21:05:15



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Report No.: T200217W03-RP Ref. No.: T171122I01-RP

110G-170G

Operation Mode: Test Mode

28°C **Temperature:**

Humidity: 53% RH

Test Date: 2017/11/27 Tested by: Jerry Chuang

Spectrum									
Ref Level 37.00		i0.00 dB 👄 R		_					
ExtMix D	SWT	240 ms 👄 🖌	BW 3 MHz	Mode Au	uto Sweep				
●1Pk View									
				M	1[1]		-3.63 dBm		
30 dBm					1	1	169	9.8700 GHz	
20 dBm									
10 dBm									
0 dBm								M	
~10 dBm	hunder		wanterwarder	hundennen	hannada	hunder		who we how we	
-20 dBm	hubunat	A Marcolano C							
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm			(01						
Start 110.0 GHz			691					170.0 GHz	
				Mea	suring			21:17:52	

Date: 27.NOV.2017 21:17:53



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Report No.: T200217W03-RP Ref. No.: T171122I01-RP

170G-220G

Operation Mode: Test Mode

Temperature:

Humidity:

28°C

Test Date: 2017/11/27 Tested by: Jerry Chuang

53% RH

ef Level 44.00 dBm		.00 dB 👄 RB1 00 ms 👄 VB1		ode Auto Swee	ep			
xtMix G 1Pk View								
) dBm				M1[1]		-3.69 dBn 218.3000 GH		
) dBm								
) dBm								
) dBm								
dBm							<u>M1</u>	
o dBm	and and the second	week of the second	hellen under and	interentingenerations	white warmen warmen war	han har	rinna	
:0 dBm								
0 dBm								
-0 dBm								
i0 dBm								

Date: 27.NOV.2017 21:20:52



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Report No.: T200217W03-RP Ref. No.: T171122I01-RP

220G-325G

Operation Mode: Test Mode

28°C **Temperature:**

Humidity: 53% RH Test Date: 2017/11/27

Tested by: Jerry Chuang

Spectrun	Spectrum											
Ref Level	48.00 dBm		50.00 dB 👄 F		_							
ExtMix J		SWT	420 ms 👄 \	BW 3 MHz	Mode Au	ito Sweep						
●1Pk View												
					M	1[1]			3.80 dBm			
40 dBm						1	1	32	21.730 GHz			
30 dBm												
00.10												
20 dBm												
10 dBm			_									
									M1			
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-10 dBm—												
-20 dBm—												
-30 dBm												
00 00												
-40 dBm												
-50 dBm												
CF 272.5 (GHz			691	pts				105.0 GHz			
[11				Mea	suring		4/4 2	7.11.2017 21:22:31			

Date: 27.NOV.2017 21:22:31



Ref. No.: T171122I01-RP

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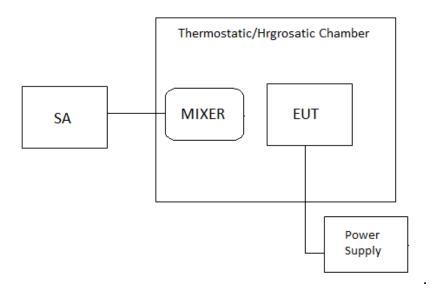
8.4 FREQUENCY STABILITY

Report No.: T200217W03-RP

<u>LIMIT</u>

According to FCC 95.3379(b) and RSS-251 Sec 5.4, 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



TEST PROCEDURE

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30° C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.



TEST RESULTS

No non-compliance noted.

Operating Frequency: 76.5 GHz								
Environment Temperature(°C)	Voltage (V)	Measured Frequency (GHz)	Margin	Limit Range(GHz)	Test Result			
50	12	76.9513	0.4513	76-77	Pass			
40	12	76.9498	0.4498	76-77	Pass			
30	12	76.9513	0.4513	76-77	Pass			
20	12	76.9498	0.4498	76-77	Pass			
10	12	76.9498	0.4498	76-77	Pass			
0	12	76.2481	-0.2519	76-77	Pass			
-10	12	76.9513	0.4513	76-77	Pass			
-20	12	76.2481	-0.2519	76-77	Pass			
-30	12	76.9513	0.4513	76-77	Pass			

Operating Frequency: 76.5 GHz								
Environment Temperature(°C)	Voltage (V)	Measured Frequency (GHz)	Margin	Limit Range(GHz)	Test Result			
20	10.8	76.9498	0.4498	76-77	Pass			
	12	76.9498	0.4498	76-77	Pass			
	13.2	76.9501	0.4501	76-77	Pass			