

# **FCC Test Report**

# Report No.: AGC08218190701FE02

FCC ID		2ASFYMR04DHAMBL0000
APPLICATION PURPOSE	0	Original Equipment
PRODUCT DESIGNATION	:	R.A.T. AIR
BRAND NAME	:	MAD CATZ
MODEL NAME		R.A.T. AIR
APPLICANT	i	MAD CATZ GLOBAL LIMITED
DATE OF ISSUE	:	Sep. 05, 2019
STANDARD(S)	÷	FCC Part 15.247
REPORT VERSION	:	V1.0

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# **REPORT REVISE RECORD**

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0		Sep. 05, 2019	Valid	Initial Release



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# **1. VERIFICATION OF COMPLIANCE**

MAD CATZ GLOBAL LIMITED			
Office H on 22nd Floor, Kings Wing Plaza 2, No.1 on Kwan Street, Sha Tin, N.T., HK.Sha TinHong Kong			
Dexin Electronic Co., LTD			
No.2, Jianye Second, ShiTan Pu Industrial, Tangxia Town, Dongguan Guangdong, China			
Dexin Electronic Co., LTD			
No.2, Jianye Second, ShiTan Pu Industrial, Tangxia Town, Dongguan Guangdong, China			
R.A.T. AIR			
MAD CATZ			
R.A.T. AIR			
Aug. 16, 2019 to Sep. 04, 2019			
None			
Normal			
Pass			
AGCRT-US-BLE/RF			

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. 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 radiated emission limits of FCC part 15.247.

Draven.li

Draven Li (Project Engineer)

Sep. 04, 2019

Reviewed By

Prepared By

Max Zhang

Max Zhang (Reviewer)

Sep. 05, 2019

Forrest in

Approved By

Forrest Lei (Authorized Officer)

Sep. 05, 2019



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# 2.GENERAL INFORMATION

# 2.1PRODUCT DESCRIPTION

The EUT is designed as a "R.A.T. AIR". It is designed by way of utilizing the GFSK technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.406 GHz to 2.478GHz			
RF Output Power	-1.911dBm(Max)			
Modulation	GFSK			
Number of channels	5 Channels			
Antenna Designation	PCB Antenna(Comply with requirements of the FCC part 15.203)			
Antenna Gain	0dBi			
Hardware Version	34			
Software Version	1.0.2.10			
Power Supply	DC 5V			

#### 2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency	
	0 0	2406MHz	
		2430MHz	
2400~2483.5MHZ	2	2445MHz	
	3	2460MHz	
G <sup>O</sup> C	4	2478MHz	



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#### 2.3 RELATED SUBMITTAL(S)/GRANT(S)

This submittal(s) (test report) is intended for **FCC ID: 2ASFYMR04DHAMBL0000** filing to comply with the FCC Part 15.247 requirements.

#### 2.4TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

#### 2.5 SPECIAL ACCESSORIES

Refer to section 2.2.

#### **2.6 EQUIPMENT MODIFICATIONS**

Not available for this EUT intended for grant.



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# **3. MEASUREMENT UNCERTAINTY**

The reported uncertainty of measurement y  $\pm U$ , where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, Uc = ±3.2 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB
- Uncertainty of total RF power, conducted,  $Uc = \pm 0.8$ dB
- Uncertainty of RF power density, conducted,  $Uc = \pm 2.6 dB$
- Uncertainty of spurious emissions, conducted, Uc = ±2.7dB
- Uncertainty of Occupied Channel Bandwidth: Uc = ±2 %



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# 4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION					
1	Low channel TX					
2	Middle channel TX					
3	High channel TX					

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.

2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

3. For Conducted Test method, a temporary antenna connector is provided by the manufacture.

4. The test software is the SmartRF studio 2.11.0 which can set the EUT into the individual test modes.



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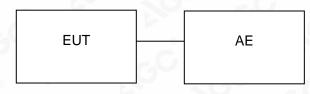
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# 5. SYSTEM TEST CONFIGURATION

# **5.1 CONFIGURATION OF TESTED SYSTEM**



#### **5.2 EQUIPMENT USED IN TESTED SYSTEM**

ltem	Equipment	Model No.	ID or Specification	Remark	
1	R.A.T. AIR	R.A.T. AIR	2ASFYMR04DHAMBL0000	EUT	
2	PC	XIAOMI	N/A	Support	
3	PC adapter	XIAOMI ADC6501TM	DC20V/3A	Support	

#### **5.3. SUMMARY OF TEST RESULTS**

FCC RULES	DESCRIPTION OF TEST	RESULT
15.247 (b)(3)	Peak Output Power	Compliant
15.247 (a)(2)	6 dB Bandwidth	Compliant
15.247 (d)	Conducted Spurious Emission	Compliant
15.247 (e)	Maximum Conducted Output Power Density	Compliant
15.209 Radiated Emission		Compliant
15.207 Conducted Emission		Compliant



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# 6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

# **TEST EQUIPMENT OF CONDUCTED EMISSION TEST**

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	Jun. 10, 2019	Jun. 09, 2020
LISN	R&S	ESH2-Z5	100086	Aug. 26, 2019	Aug. 25, 2020

# TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Jun. 12, 2019	Jun. 11, 2020
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 20, 2018	Dec. 19, 2019
2.4GHz Fliter	EM Electronics	2400-2500MHz	N/A	Feb. 27, 2019	Feb. 26, 2020
Attenuator	ZHINAN	E-002	N/A	Aug. 26, 2019	Aug. 25, 2020
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 21, 2017	Sep. 20, 2020
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Jun. 14, 2018	Jun. 13, 2020
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May. 26, 2018	May. 25, 2020
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 25, 2018	Oct. 24, 2019
ANTENNA	SCHWARZBECK	VULB9168	D69250	Sep. 28, 2017	Sep. 27, 2019



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# 7. PEAK OUTPUT POWER

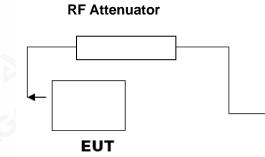
# 7.1. MEASUREMENT PROCEDURE

For peak power test:

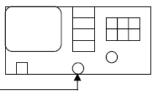
- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. RBW > DTS bandwidth
- 3. VBW≥3\*RBW.
- 4. SPAN≥VBW.
- 5. Sweep: Auto.
- 6. Detector function: Peak.
- 7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

# 7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) PEAK POWER TEST SETUP



#### Spectrum Analyzer



RF Cable



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#### 7.3. LIMITS AND MEASUREMENT RESULT

	PEAK OUTPUT POWER MEASUREMENT RESULT									
	FOR GFSK MOUDULA	ΓΙΟΝ								
Frequency (GHz)	Pass of Fail									
2.406	-1.911	30	Pass							
2.445	-2.727	30	Pass							
2.478	-3.209	30	Pass							

CH0

Keysight Spectrum Analyz								
<mark>¤</mark> Marker 1 2.4062			SENSE:INT	Avg Type: Avg Hold:>		09:02:48 AM	Sep 03, 2019 1 2 3 4 5 6 MWWWWW	Peak Search
10 dB/div Ref 20	PN IFG .00 dBm		g: Free Run tten: 30 dB	Avginoid:>		DET	PNNNNN	Next Peak
10.0								Next Pk Right
-10.0			<b>.</b>					Next Pk Lef
-20.0								Marker Delta
-40.0								Mkr→Cl
-60.0								Mkr→RefLv
- <sup>-70.0</sup> Center 2.406000 ( #Res BW 1.5 MHz		#VBW 5.0	MHz	s	weep 1.0	Span 5.0	000 MHz 001 pts)	<b>Mor</b> 1 of:
MSG					STATUS			



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CH19



CH39





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# 8.6 DB BANDWIDTH

#### **8.1. MEASUREMENT PROCEDURE**

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 KHz, VBW $\ge$ 3×RBW.
- 4. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

# 8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 7.2.

#### **8.3. LIMITS AND MEASUREMENT RESULTS**

	LIMITS AND MEASUR	REMENT RESULT	
Applicable Limite		Applicable Limits	
Applicable Limits	Test Data	(kHz)	Criteria
	Low Channel	819.4	PASS
>500KHZ	Middle Channel	847.7	PASS
	High Channel	818.0	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

#### 09:03:44 AM Sep 03, 2019 Radio Std: None Center Freq: 2.406000000 GHz Trig: Free Run Avg|Hol #Atten: 30 dB Frequency 2 40600000 GHz Avg|Hold:>10/10 Radio Device: BTS #IFGain:Low Ref 20.00 dBm **Center Freq** 2.406000000 GHz Center 2.406 GHz #Res BW 100 kHz Span 5 MHz CF Step #VBW 300 kHz Sweep 1 ms 500.000 kH Auto Ma **Total Power** 5.09 dBm Occupied Bandwidth 1.9187 MHz Freq Offset 0 H; -17.249 kHz Transmit Freq Error % of OBW Power 99.00 % x dB Bandwidth 819.4 kHz x dB -6.00 dB



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#### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

#### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL





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# 9. CONDUCTED SPURIOUS EMISSION

#### 9.1. MEASUREMENT PROCEDURE

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

#### 9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 7.2.

#### 9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.

#### 9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT								
Angliaghta Limita	Measurement Result							
Applicable Limits	Test Data	Criteria						
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power.	At least -20dBc than the reference level	PASS PASS						



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# TEST RESULT FOR ENTIRE FREQUENCY RANGE GFSK MODULATION IN LOW CHANNEL

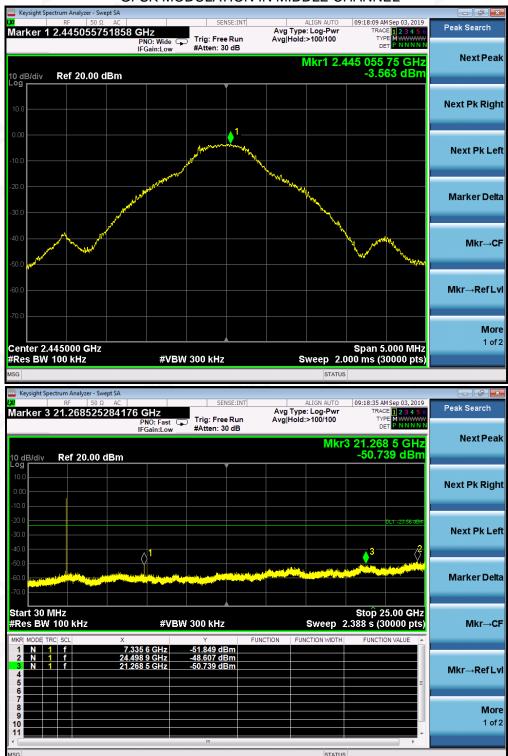
Attestation of Global Compliance

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#### GFSK MODULATION IN MIDDLE CHANNEL

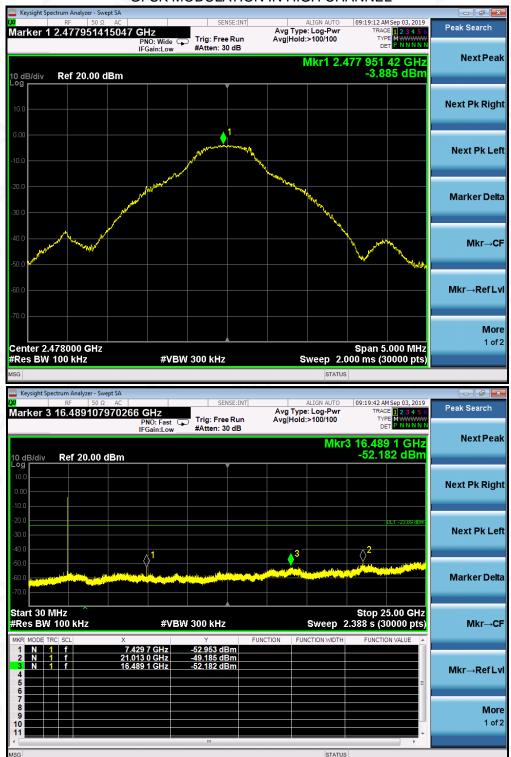


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# GFSK MODULATION IN HIGH CHANNEL

Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit.



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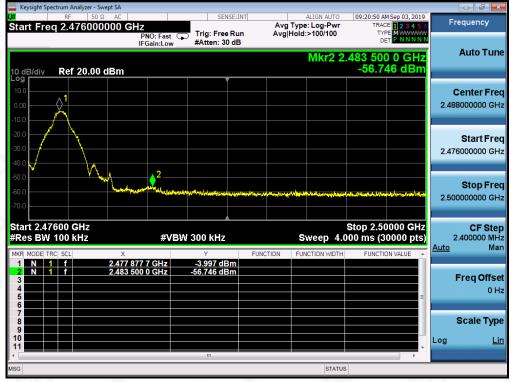
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# TEST RESULT FOR BAND EDGE GFSK MODULATION IN LOW CHANNEL

#### GFSK MODULATION IN HIGH CHANNEL





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# **10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY**

#### **10.1 MEASUREMENT PROCEDURE**

- (1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- (2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- (3). Set SPA Trace 1 Max hold, then View.

Note: The method of PKPSD in the KDB 558074 item 10.2 was used in this testing.

#### **10.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)**

Refer To Section 7.2.

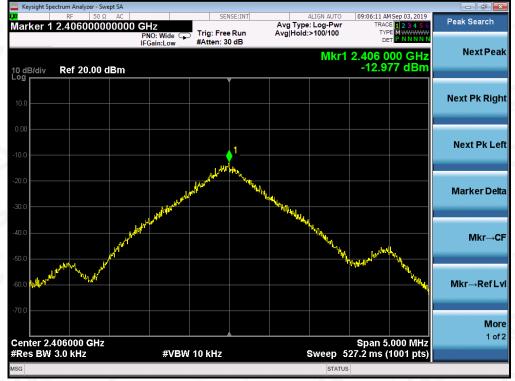
#### **10.3 MEASUREMENT EQUIPMENT USED**

Refer To Section 6.

#### **10.4 LIMITS AND MEASUREMENT RESULT**

Channel No.	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	-12.977	8	Pass
Middle Channel	-13.118	8	Pass
High Channel	-14.796	8	Pass

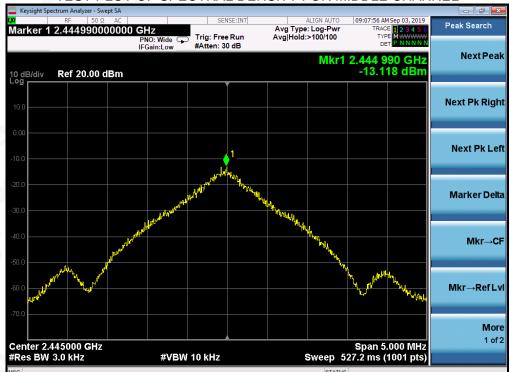
## TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL





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#### TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

© TE	ST PLOT	OF SPEC	TRAL DE	INSITY	FOR	HIGH (	CHANN	EL
Keysight Spectrum Ana RF Marker 1 2.477	50 Ω AC 980000000 G	NO: Wide 🗔 🛛 Trig	SENSE:INT		ALIGN AUTO : Log-Pwr >100/100	TRAC	M Sep 03, 2019 E <b>1 2 3 4 5 6</b> PE <b>M WWWWW</b>	Peak Search
10 dB/div Ref 2	.0.00 dBm	Gain:Low #At	ten: 30 dB		Mkr'	1 2.477 9		Next Peak
10.0								Next Pk Right
-10.0			1					Next Pk Left
-20.0		ah Avilant Fard	nor and the state of the state	uquilities				Marker Delta
-40.0	and a start of the	Are Comment		And	M			Mkr→Cf
-50.0	ny al and a start of the start				¥	he water	The age of the second s	Mkr→RefLv
-70.0								<b>Mor</b> 1 of 2
Center 2.478000 #Res BW 3.0 kH		#VBW 10 k	Hz		Sweep :	527.2 ms (	.000 MHz 1001 pts)	





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# **11. RADIATED EMISSION**

#### **11.1. MEASUREMENT PROCEDURE**

- 1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
- 2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
- 3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
- 4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
- 5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
- 6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- 7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
- 8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
- 9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High Low scan is not required in this case.



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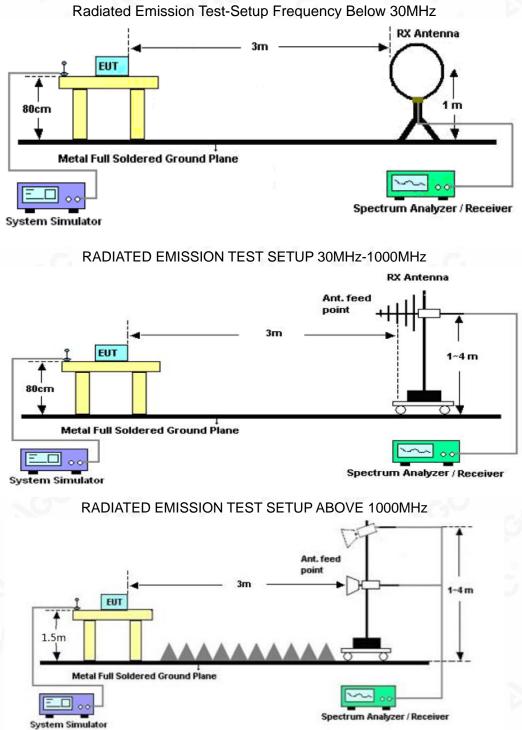
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#### **11.2. TEST SETUP**





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# **11.3. LIMITS AND MEASUREMENT RESULT**

15.209 Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
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

Note: All modes were tested For restricted band radiated emission, the test records reported below are the worst result compared to other modes.

# 11.4. TEST RESULT

# **RADIATED EMISSION BELOW 30MHZ**

No emission found between lowest internal used/generated frequencies to 30MHz.



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nperature         25° C         Relative Humidity         55.4%           ssure         960hPa         Test Voltage         Normal Voltage           tMode         Mode 1         Antenna         Horizontal           06.9         dBw/m				R.A.T. AIR				M	Model Name			R.A.T. AIR		
Mode         Mode 1         Antenna         Horizontal           66.9         dBwV/m         Immit:         Horizontal         Horizontal           7         3         3         4         4         4         4         4         4         46.20         40.00         3.10         418.00         515.00         612.00         709.00         806.00         1000.00         MHz           No.         Mk         Freq.         Reading         Factor         Measurement         Limit         Over         Detector         Antenna         Height         Degree         Comment           1         *         510.1067         16.56         19.64         36.20         40.00         3.80         QP          Comment           1         *         510.1067         16.56         19.64         36.20         40.00         3.80         QP          Comment           3         1         264.4166         22.16         18.67         40.83         46.00         5.17         peak             3         1         264.4166         22.16         18.67         40.83         46.00         5.17         peak	pera	itur	е	25°	С			R	elative	Humidi	t <b>y</b> 5	55.4%		
66.9       dBuV/m         7       3       4 <td< th=""><th>sure</th><th>e</th><th></th><th>960</th><th>hPa</th><th>200</th><th></th><th>Т</th><th>est Volta</th><th>age</th><th>N</th><th colspan="3" rowspan="2"></th></td<>	sure	e		960	hPa	200		Т	est Volta	age	N			
No.         Mk         Freq.         Reading         Factor         Measurement         Limit         Over         Over         Antenna         Table           1         *         51.0167         16.56         19.64         36.20         40.00         -3.80         QP         Comment           2         149.6333         13.89         19.21         33.10         43.50         -10.40         peak	Мос	de		Мос	de 1		N	A	ntenna		Н			
30.000         127.00         224.00         321.00         418.00         515.00         612.00         709.00         806.00         1000.00         MHz           No.         Mk         Freq.         Reading         Factor         Measurement         Limit         Over Detector         Antenna Height         Table Degree         Comment           1         *         51.0167         16.56         19.64         36.20         40.00         -3.80         QP          Comment           2         149.6333         13.89         19.21         33.10         43.50         -10.40         peak             3         !         264.4166         22.16         18.67         40.83         46.00         -5.17         peak             4         463.2667         15.09         24.25         39.34         46.00         -6.66         peak             5         754.2667         4.32         29.38         33.70         46.00         -12.30         peak	8	66.9	dBuW7m		***	~~~	h promoti				an and hold			
No.         Mk         Freq.         Reading         Factor         Measurement         Limit         Over         Detector         Height         Degree         Comment           Mk         MHz         dBuV         dB/m         dBuV/m         dBuV/m         dB		27	- Water	WW		~ yyyar		- Nopen	harlostorium					
1       *       51.0167       16.56       19.64       36.20       40.00       -3.80       QP         2       149.6333       13.89       19.21       33.10       43.50       -10.40       peak         3       !       264.4166       22.16       18.67       40.83       46.00       -5.17       peak         4       463.2667       15.09       24.25       39.34       46.00       -6.66       peak         5       754.2667       4.32       29.38       33.70       46.00       -12.30       peak		13	1						1.00 70x				IHz	
2       149.6333       13.89       19.21       33.10       43.50       -10.40       peak         3       !       264.4166       22.16       18.67       40.83       46.00       -5.17       peak         4       463.2667       15.09       24.25       39.34       46.00       -6.66       peak         5       754.2667       4.32       29.38       33.70       46.00       -12.30       peak	· · ·	13 30.0	Freq.	Reading	Factor	Measurement	Limit	Over		Antenna Height	Table Degree			
3       !       264.4166       22.16       18.67       40.83       46.00       -5.17       peak         4       463.2667       15.09       24.25       39.34       46.00       -6.66       peak         5       754.2667       4.32       29.38       33.70       46.00       -12.30       peak	-1 No.	13 30.0	Freq. MHz	Reading dBuV	Factor dB/m	Measurement dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height	Table Degree			
4       463.2667       15.09       24.25       39.34       46.00       -6.66       peak         5       754.2667       4.32       29.38       33.70       46.00       -12.30       peak	-1 No.	13 30.0	Freq. MHz 51.0167	Reading dBuV 16.56	Factor dB/m 19.64	Measurement dBuV/m 36.20	Limit dBuV/m 40.00	Over dB -3.80	Detector QP	Antenna Height	Table Degree			
5 754.2667 4.32 29.38 33.70 46.00 -12.30 peak	-1 No. 1 2	13 30.0	Freq. MHz 51.0167 149.6333	Reading dBuV 16.56 13.89	Factor dB/m 19.64 19.21	Measurement dBuV/m 36.20 33.10	Limit dBuV/m 40.00 43.50	Over dB -3.80 -10.40	Detector QP peak	Antenna Height	Table Degree			
	-1 No. 1 2 3	13 30.0	Freq. MHz 51.0167 149.6333 264.4166	Reading dBuV 16.56 13.89 22.16	Factor dB/m 19.64 19.21 18.67	Measurement dBuV/m 36.20 33.10 40.83	Limit dBuV/m 40.00 43.50 46.00	Over dB -3.80 -10.40 -5.17	Detector QP peak peak	Antenna Height	Table Degree			
	-1 No. 1 2 3 4	13 30.0	Freq. MHz 51.0167 149.6333 264.4166 463.2667	Reading dBuV 16.56 13.89 22.16 15.09	Factor dB/m 19.64 19.21 18.67 24.25	Measurement dBuV/m 36.20 33.10 40.83 39.34	Limit dBuV/m 40.00 43.50 46.00 46.00	Over dB -3.80 -10.40 -5.17 -6.66	Detector QP peak peak peak	Antenna Height	Table Degree			

**RESULT: PASS** 



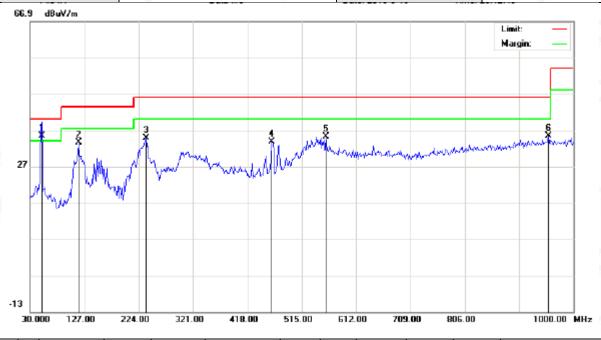
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EUT	R.A.T. AIR	Model Name	R.A.T. AIR
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	•	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	51.0167	15.85	19.64	35.49	40.00	-4.51	QP			
2		117.3000	15.81	17.71	33.52	43.50	-9.98	peak			
3		236.9333	16.43	18.44	34.87	46.00	-11.13	peak			
4		461.6500	9.49	24.22	33.71	46.00	-12.29	peak			
5		558.6500	9.08	26.14	35.22	46.00	-10.78	peak			
6		954.7333	3.28	32.17	35.45	46.00	-10.55	peak			

#### RESULT: PASS Note:

- 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.
- 2. All test modes had been tested. The mode 1 is the worst case and recorded in the report.



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# **RADIATED EMISSION ABOVE 1GHZ**

EUT	R.A.T. AIR	Model Name	R.A.T. AIR
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

Meter Reading	Factor	Emission Level	Limits	Margin	
(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Value Type
50.47	0.08	50.55	74.00	-23.45	peak
48.85	0.08	48.93	54.00	-5.07	AVG
42.66	2.21	44.87	74.00	-29.13	peak
39.42	2.21	41.63	54.00	-12.37	AVG
8			- C.	ß	
	3				3
	1	0			e.G
enna Factor + Ca	ble Loss –	Pre-amplifier.			
	(dBµV) 50.47 48.85 42.66 39.42	(dBµV)         (dB)           50.47         0.08           48.85         0.08           42.66         2.21           39.42         2.21	(dBµV)         (dB)         (dBµV/m)           50.47         0.08         50.55           48.85         0.08         48.93           42.66         2.21         44.87	(dBµV)         (dB)         (dBµV/m)         (dBµV/m)           50.47         0.08         50.55         74.00           48.85         0.08         48.93         54.00           42.66         2.21         44.87         74.00           39.42         2.21         41.63         54.00	(dBµV)         (dB)         (dBµV/m)         (dBµV/m)         (dB)           50.47         0.08         50.55         74.00         -23.45           48.85         0.08         48.93         54.00         -5.07           42.66         2.21         44.87         74.00         -29.13           39.42         2.21         41.63         54.00         -12.37

EUT	R.A.T. AIR	Model Name	R.A.T. AIR
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

-		·	I E I I I I	1.1.1.1		
Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	<sup>⊘</sup> (dBµV/m)	(dBµV/m)	(dB)	value Type
4812.03	50.69	0.08	50.77	74.00	-23.23	peak
4812.03	46.77	0.08	46.85	54.00	-7.15	AVG
7218.045	44.52	2.21	46.73	74.00	-27.27	peak
7218.045	42.81	2.21	45.02	54.00	-8.98	AVG
		-66-	-			6
emark:			6.0	C.	0	

Factor = Antenna Factor + Cable Loss – Pre-amplifier.



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EUT	R.A.T. AIR	Model Name	R.A.T. AIR
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4890.03	50.14	0.14	50.28	74.00	-23.72	peak
4890.03	45.66	0.14	45.80	54.00	-8.20	AVG
7335.045	46.04	2.36	48.40	74.00	-25.60	peak
7335.045	43.87	2.36	46.23	54.00	-7.77	AVG
C.	0			- C.	ß	
						8

EUT	R.A.T. AIR	Model Name	R.A.T. AIR
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Value Type
4890.03	51.58	0.14	51.72	74.00	-22.28	peak
4890.03	47.47	0.14	47.61	54.00	-6.39	AVG
7335.045	46.96	2.36	49.32	74.00	-24.68	peak
7335.045	42.88	2.36	45.24	54.00	-8.76	AVG
				.C	6	
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EUT	R.A.T. AIR	Model Name	R.A.T. AIR
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Value Type
4956.03	50.58	0.22	50.80	74.00	-23.20	peak
4956.03	48.04	0.22	48.26	54.00	-5.74	AVG
7434.045	45.33	2.64	47.97	74.00	-26.03	peak
7434.045	43.65	2.64	46.29	54.00	-7.71	AVG
C.	0			<u> </u>	ß	
6		3		- 62	- C.	®
Remark:			8			- 6
actor = Ante	enna Factor + Ca	ble Loss –	Pre-amplifier.			

EUT	R.A.T. AIR	Model Name	R.A.T. AIR
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
51.71	0.22	51.93	74.00	-22.07	peak
48.69	0.22	48.91	54.00	-5.09	AVG
44.21	2.64	46.85	74.00	-27.15	peak
42.95	2.64	45.59	54.00	-8.41	AVG
	- 61				
		C	®		
	(dBµV) 51.71 48.69 44.21	(dBµV)         (dB)           51.71         0.22           48.69         0.22           44.21         2.64	(dBµV)         (dB)         (dBµV/m)           51.71         0.22         51.93           48.69         0.22         48.91           44.21         2.64         46.85	(dBµV)         (dB)         (dBµV/m)         (dBµV/m)           51.71         0.22         51.93         74.00           48.69         0.22         48.91         54.00           44.21         2.64         46.85         74.00	(dBµV)         (dB)         (dBµV/m)         (dBµV/m)         (dBµV/m)           51.71         0.22         51.93         74.00         -22.07           48.69         0.22         48.91         54.00         -5.09           44.21         2.64         46.85         74.00         -27.15

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

#### **RESULT: PASS**

#### Note:

Other emissions from 1G to 25 GHz are considered as ambient noise. No recording in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The "Factor" value can be calculated automatically by software of measurement system.



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EUT	R.A.T. AIR	Model Name	R.A.T. AIR
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

# 

ΡK



AV



**RESULT: PASS** 



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EUT	R.A.T. AIR	Model Name	R.A.T. AIR
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

ΡK Avg Type: Log-Pwr Avg|Hold:>100/100 Peak Sear 2.406240000000 GH Trig: Free Run Atten: 10 dB NextPe Mkr1 2.406 24 G 91.079 dBµV Ref 106.00 dBµV/m Next Pk Righ Next Pk L Marker Del tart 2.37000 GHz Res BW 1.<u>0 MHz</u> 1.000 ms (1001 pts) #VBW 3.0 MHz Mkr→C Sweep 2.406 24 GHz 91.079 dBµV/m 2.390 00 GHz 33.130 dBµV/m Mkr→RefL More 1 of 2

AV



**RESULT: PASS** 



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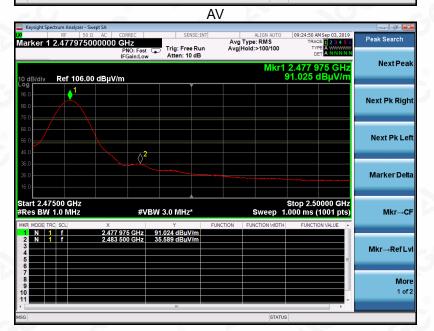
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EUT	R.A.T. AIR	SOO .	Model Name	R.A.T. AIR
Temperature	25° C		Relative Humidity	55.4%
Pressure	960hPa		Test Voltage	Normal Voltage
Test Mode	Mode 3		Antenna	Horizontal
		DI		





**RESULT: PASS** 



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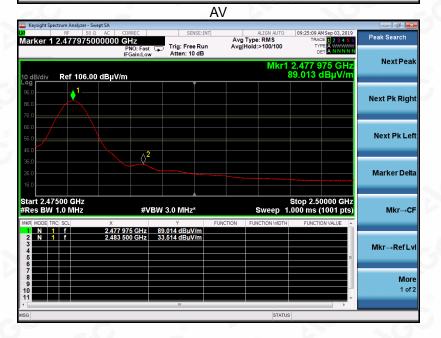
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EUT	R.A.T. AIR	Model Name	R.A.T. AIR
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical
		DI	





#### **RESULT: PASS**

Note: The factor had been edited in the "Input Correction" of the Spectrum Analyzer.



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# **12. FCC LINE CONDUCTED EMISSION TEST**

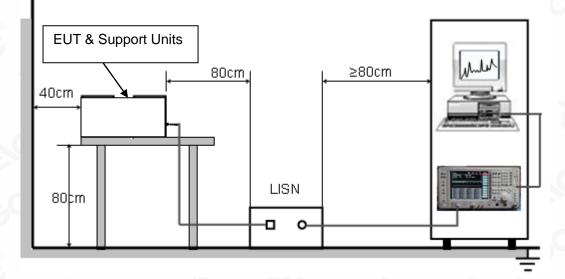
# **12.1. LIMITS OF LINE CONDUCTED EMISSION TEST**

Franciscov	Maximum RF Line Voltage		
Frequency	Q.P.( dBuV)	Average( dBuV)	
150kHz~500kHz	66-56	56-46	
500kHz~5MHz	56	46	
5MHz~30MHz	60	50	

Note:

- 1. The lower limit shall apply at the transition frequency.
- 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

# 12.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST





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# 12.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

- The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- 2. Support equipment, if needed, was placed as per ANSI C63.10.
- 3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
- 4. All support equipments received AC120V/60Hz power from a LISN, if any.
- 5. The EUT received DC charging voltage by PC which received AC120V/60Hz power by a LISN..
- 6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
- 8. During the above scans, the emissions were maximized by cable manipulation.
- 9. The test mode(s) were scanned during the preliminary test.

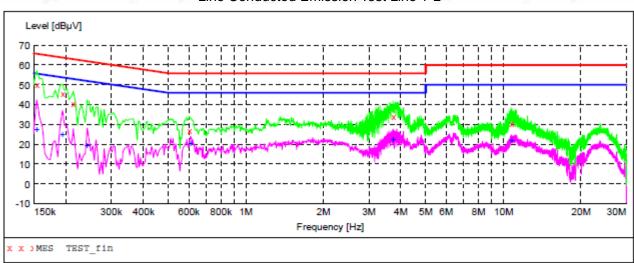
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

# 12.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

- 1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
- A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less -2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
- 3. The test data of the worst case condition(s) was reported on the Summary Data page.







## 12.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

Line Conducted Emission Test Line 1-L

#### MEASUREMENT RESULT: "TEST\_fin"

8/19/2019 7:55PM									
Frequency	Level	Transd	Limit	Margin	Detector	Line	PE		
MHz	dBµV	dB	dBµV	dB					
0.154000	50.30	10.8	66	15.5	QP	L1	FLO		
0.194000	45.80	10.9	64	18.1	QP	L1	FLO		
0.214000	40.90	10.9	63	22.1	QP	L1	FLO		
0.602000	27.10	10.7	56	28.9	QP	L1	FLO		
3.726000	34.40	11.6	56	21.6	QP	L1	FLO		
10.758000	30.60	11.9	60	29.4	QP	L1	FLO		

#### MEASUREMENT RESULT: "TEST fin2"

8/19/2019 7:55PM									
Frequency	Level	Transd	Limit	Margin	Detector	Line	PE		
MHz	dBµV	dB	dBµV	dB					
0.154000	27.50	10.8	56	28.3	AV	L1	FLO		
0.194000	25.20	10.9	54	28.7	AV	L1	FLO		
0.242000	19.40	10.9	52	32.6	AV	L1	FLO		
0.610000	20.50	10.7	46	25.5	AV	L1	FLO		
3.726000	22.30	11.6	46	23.7	AV	L1	FLO		
10.750000	21.80	11.9	50	28.2	AV	L1	FLO		

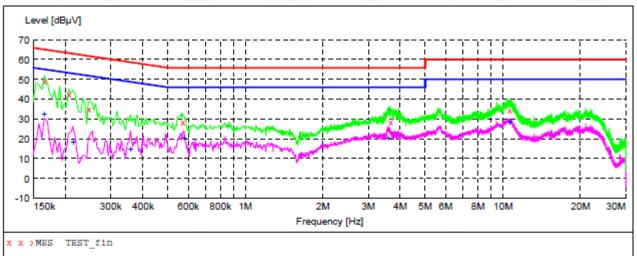


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Line Conducted Emission Test Line 2-N



#### MEASUREMENT RESULT: "TEST fin"

3/19/2019 7:59PM									
Frequency	Level	Transd	Limit	Margin	Detector	Line	PE		
MHz	dBuV	dB	dBµV	dB					
	-		-						
0.166000	49.10	10.8	65	16.1	OP	N	FLO		
0.206000	42.80	10.9	63	20.6	ÕP	N	FLO		
0.246000		10.9	62	26.9	ÕP	N	FLO		
0.570000		10.9	56	27.3	0P	N	FLO		
3,650000		11.6	56	27.7	OP OP	N	FLO		
10.574000	34.70	11.9	60	25.3	QP	N	FLO		

#### MEASUREMENT RESULT: "TEST fin2"

8/19/2019 7:59PM								
	Frequency	Level	Transd	Limit	Margin	Detector	Line	PE
	MHz	dBµV	dB	dBµV	dB			
	0.166000	32.60	10.8	55	22.6	AV	N	FLO
	0.214000	18.50	10.9	53	34.5	AV	N	FLO
	0.358000	14.80	10.5	49	34.0	AV	N	FLO
	0.578000	20.30	10.8	46	25.7	AV	N	FLO
	3.590000	20.80	11.6	46	25.2	AV	N	FLO
	10.598000	28.50	11.9	50	21.5	AV	N	FLO

### **RESULT: PASS**

Note: All the test modes had been tested, the mode 1 was the worst case. Only the data of the worst case would be record in this test report.



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RADIATED EMISSION TEST SETUP ABOVE 1GHZ





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# **APPENDIX A: PHOTOGRAPHS OF TEST SETUP**

RADIATED EMISSION TEST SETUP BELOW 1GHZ



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CONDUCTED EMISSION TEST SETUP



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# **APPENDIX B: PHOTOGRAPHS OF EUT**

ALL VIEW OF EUT





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TOP VIEW OF EUT



BOTTOM VIEW OF EUT





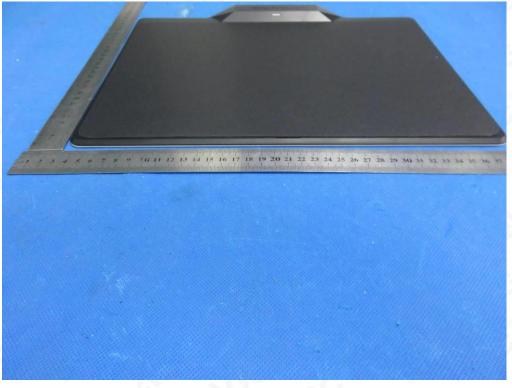
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# FRONT VIEW OF EUT



BACK VIEW OF EUT



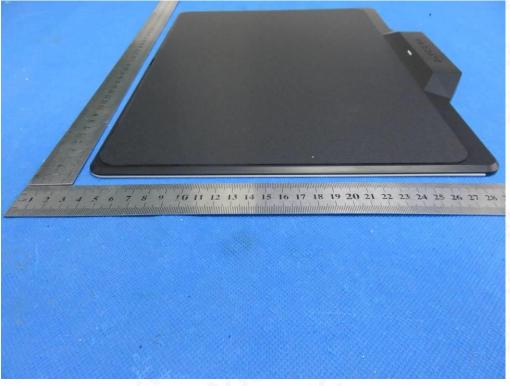


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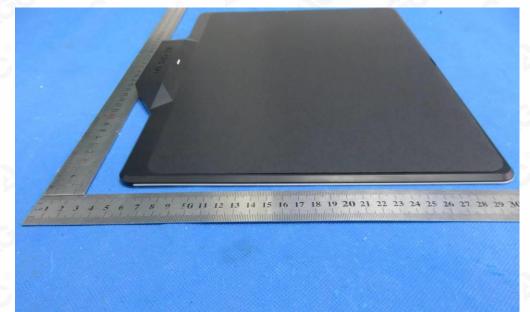


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LEFT VIEW OF EUT



**RIGHT VIEW OF EUT** 



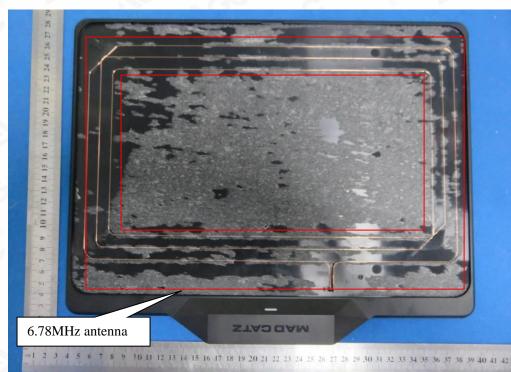


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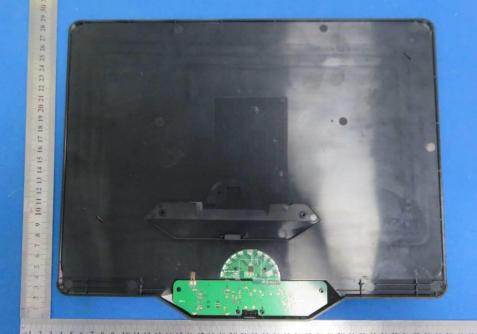


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OPEN VIEW OF EUT-1



**OPEN VIEW OF EUT-2** 



=1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43



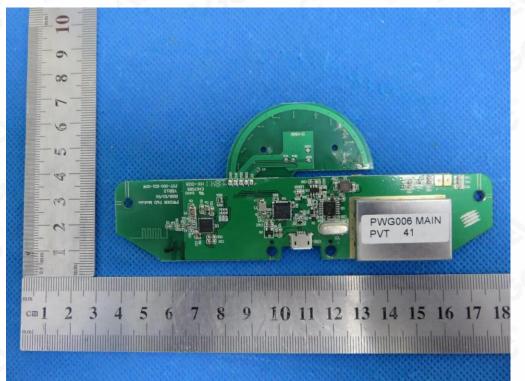
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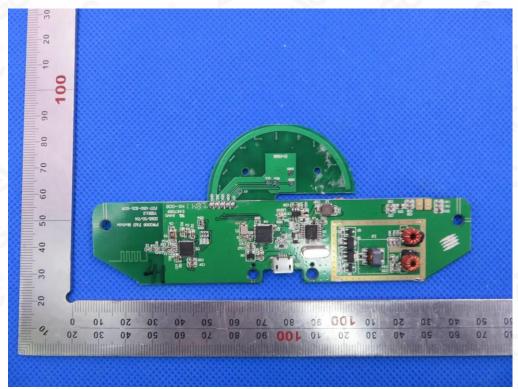


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**INTERNAL VIEW OF EUT-2** 





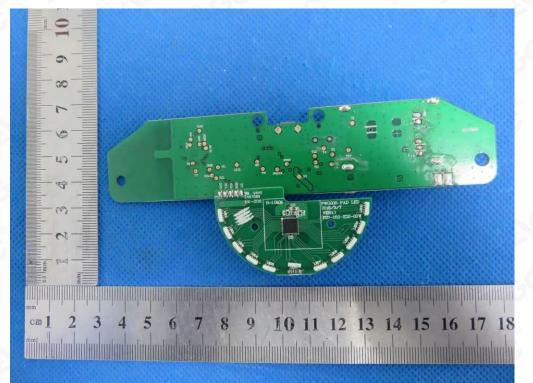
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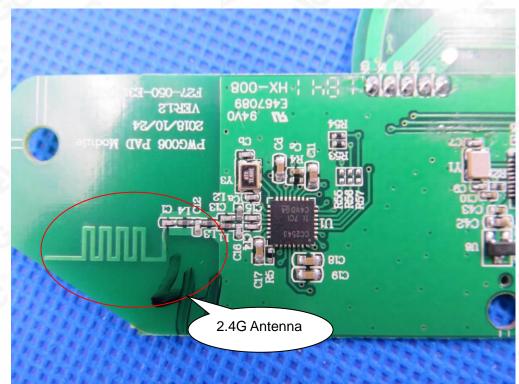


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# **INTERNAL VIEW OF EUT-3**



**INTERNAL VIEW OF EUT-4** 





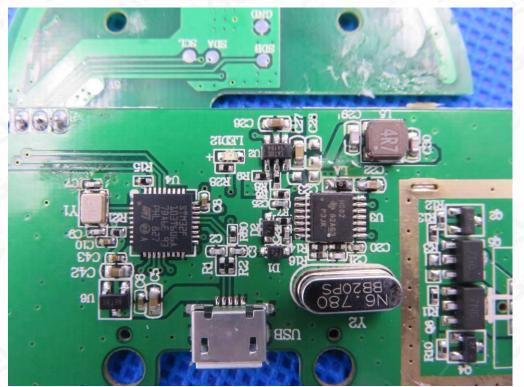
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## **INTERNAL VIEW OF EUT-5**



----END OF REPORT----



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