

FCC RF Test Report

(NFC)

Report No.: JYTSZ-R12-2400871

Applicant: Aratek Biometrics Co., Ltd.

Address of Applicant: 1F, T2-B building, Shenzhen Hi-tech Industrial Park, 518057, Shenzhen, China

Equipment Under Test (EUT)

Product Name: Marshall 8 Plus

Model No.: Marshall 8 Plus

Trade Mark: ARATEK

FCC ID: 2AGUJM8PLUS

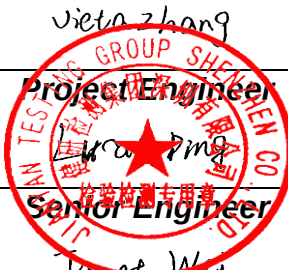
Applicable Standards: FCC CFR Title 47 Part 15C (§15.225)

Date of Sample Receipt: 09 May, 2024

Date of Test: 10 May, to 19 Aug., 2024

Date of Report Issue: 20 Aug., 2024

Test Result: PASS

Tested by:	 <u>Vieta Zhang</u>	Date:	<u>20 Aug., 2024</u>
Reviewed by:	<u>Li Wang</u>	Date:	<u>20 Aug., 2024</u>
Approved by:	<u>James Wei</u> Manager	Date:	<u>20 Aug., 2024</u>

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in above the application standard version. Test results reported herein relate only to the item(s) tested.

This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. 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.

1 Version

Version No.	Date	Description
00	20 Aug., 2024	Original

2 Contents

Page

Cover Page	1
1 Version	2
2 Contents	3
3 General Information	4
3.1 Client Information	4
3.2 General Description of E.U.T.	4
3.3 Test Mode and Environment	5
3.4 Description of Test Auxiliary Equipment	5
3.5 Measurement Uncertainty	5
3.6 Additions to, Deviations, or Exclusions From the Method	5
3.7 Laboratory Facility	5
3.8 Laboratory Location	6
3.9 Test Instruments List	6
4 Measurement Setup and Procedure	8
4.1 Test Setup	8
4.2 Test Procedure	10
5 Test Results	11
5.1 Summary	11
5.1.1 Clause and Data Summary	11
5.1.2 Test Limit	12
5.2 Antenna Requirement	13
5.3 AC Power Line Conducted Emission	14
5.4 20dB Bandwidth	16
5.5 Field Strength of Fundamental	17
5.6 Field Strength of Spurious Emissions	19
5.7 Frequency Tolerance	22

3 General Information

3.1 Client Information

Applicant:	Aratek Biometrics Co., Ltd.
Address:	1F, T2-B building, Shenzhen Hi-tech Industrial Park, 518057, Shenzhen, China
Manufacturer:	Aratek Biometrics Co., Ltd.
Address:	1F, T2-B building, Shenzhen Hi-tech Industrial Park, 518057, Shenzhen, China

3.2 General Description of E.U.T.

Product Name:	Marshall 8 Plus
Model No.:	Marshall 8 Plus
Operation Frequency:	13.56MHz
Channel Numbers:	1
Modulation Type:	ASK
Antenna Type:	Induction Coil Antenna
Power Supply:	Rechargeable Li-ion Polymer Battery DC3.7V, 10000mAh
AC Adapter:	Model: ES015C-U120150XYE Input: AC100-240V, 50/60Hz, 0.6A Output: DC 5.0V, 3.0A 15.0W or 9.0V, 2.0A 18.0W or 12.0V, 1.5A 18.0W
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

3.3 Test Mode and Environment

Test Mode:	
Transmitting mode:	Keep the EUT in transmitting mode with modulation
Remark: Pre-scan The EUT was placed on three different polar directions tested: i.e. X axis, Y axis, Z axis, and found Y axis was worse case, so the report only reflects the worse axis tested data.	
Operating Environment:	
Temperature:	Normal: 15°C ~ 35°C
Humidity:	20 % ~ 75 % RH
Atmospheric Pressure:	1008 mbar
Voltage:	Nominal: 3.70 Vdc, Extreme: Low 3.50 Vdc, High 4.25 Vdc
Test Engineer:	Logan Li (Conducted measurement) Robin Gu (Radiated measurement)

3.4 Description of Test Auxiliary Equipment

Manufacturer	Description	Model	Serial Number	FCC ID/DoC
N/A	N/A	N/A	N/A	N/A

3.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Conducted Emission for LISN (9kHz ~ 150kHz)	3.57 dB
Conducted Emission for LISN (150kHz ~ 30MHz)	3.14 dB
Radiated Emission (9kHz ~ 30MHz) (3m SAC)	3.3 dB
Radiated Emission (30MHz ~ 200MHz) (3m SAC)	4.6 dB
Radiated Emission (200MHz ~ 1000MHz) (3m SAC)	5.8 dB
Radiated Emission (1GHz ~ 6GHz) (3m SAC)	4.5 dB
Radiated Emission (6GHz ~ 18GHz) (3m SAC)	4.7 dB

Note: All the measurement uncertainty value were shown with a coverage k=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

3.6 Additions to, Deviations, or Exclusions From the Method

No

3.7 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations: ● FCC - Designation No.: CN1211 JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551. ● ISED – CAB identifier.: CN0021 The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1. ● CNAS - Registration No.: CNAS L15527 JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527. ● A2LA - Registration No.: 4346.01 This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf
--

3.8 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.
Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info-JYTee@lets.com, Website: <http://jyt.lets.com>

3.9 Test Instruments List

Radiated Emission(3m SAC):					
Test Equipment	Manufacturer	Model No.	Manage No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	ETS	9m*6m*6m	WXJ001-1	04-14-2021	04-13-2026
Loop Antenna	Schwarzbeck	FMZB 1519 B	WXJ002-4	01-05-2024	01-04-2025
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	01-09-2024	01-08-2025
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXJ001-2	12-27-2023	12-26-2024
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	12-27-2023	12-26-2024
Coaxial Cable (9kHz ~ 30MHz)	JYT	JYT3M-1G-BB-5M	WXG001-6	01-17-2024	01-16-2025
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	01-17-2024	01-16-2025
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	TS+	Version: 3.0.0.1		
EMI Test Software	AUDIX	E3	Version: 6.110919b		

Radiated Emission(10m SAC):					
Test Equipment	Manufacturer	Model No.	Manage No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
10m SAC	ETS	RFSD-100-F/A	WXJ090	04-28-2021	04-27-2026
BiConiLog Antenna	SCHWARZBECK	VULB 9168	WXJ090-1	01-05-2024	01-04-2025
BiConiLog Antenna	SCHWARZBECK	VULB 9168	WXJ090-2	12-28-2023	12-27-2024
EMI Test Receiver	R&S	ESR 3	WXJ090-3	12-27-2023	12-26-2024
EMI Test Receiver	R&S	ESR 3	WXJ090-4	12-27-2023	12-26-2024
Low Pre-amplifier	Bost	LNA 0920N	WXJ090-6	12-27-2023	12-26-2024
Low Pre-amplifier	Bost	LNA 0920N	WXJ090-7	12-27-2023	12-26-2024
Cable	Bost	JYT10M-1G-NN-10M	WXG002-7	01-17-2024	01-16-2025
Cable	Bost	JYT10M-1G-NN-10M	WXG002-8	01-17-2024	01-16-2025
Test Software	R&S	EMC32	Version: 10.50.40		

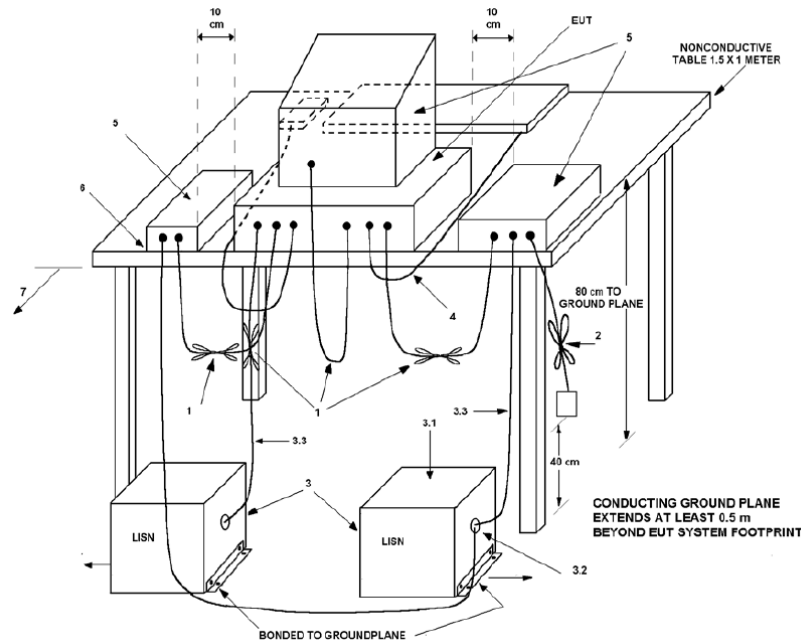
Conducted Emission:					
Test Equipment	Manufacturer	Model No.	Manage No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESR3	WXJ003-2	07-05-2023	07-04-2024
				06-11-2024	06-10-2025
LISN	Schwarzbeck	NSLK 8127	QCJ001-13	12-27-2023	12-26-2024
LISN	Rohde & Schwarz	ESH3-Z5	WXJ005-1	12-27-2023	12-26-2024
LISN Coaxial Cable (9kHz ~ 30MHz)	JYTSZ	JYTCE-1G-NN-2M	WXG003-1	01-17-2024	01-16-2025
RF Switch	TOP PRECISION	RSU0301	WXG003	N/A	
Test Software	AUDIX	E3	Version: 6.110919b		

Conducted Method:					
Test Equipment	Manufacturer	Model No.	Manage No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Spectrum Analyzer	Keysight	N9020B	WXJ081-1	06-13-2023	06-12-2024
				06-11-2024	06-10-2025

4 Measurement Setup and Procedure

4.1 Test Setup

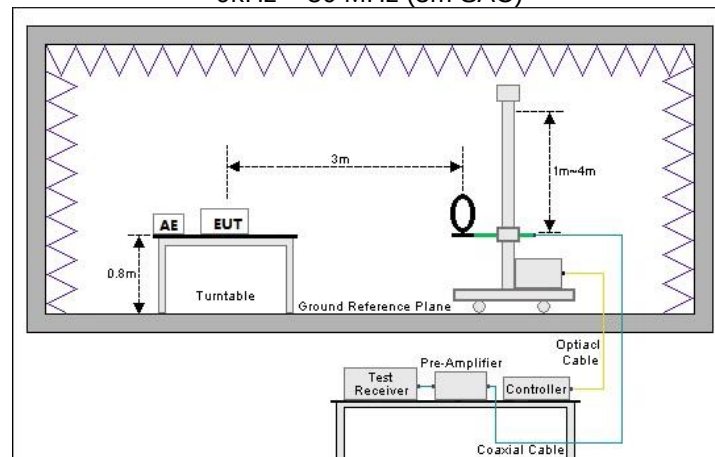
1) Conducted emission measurement:

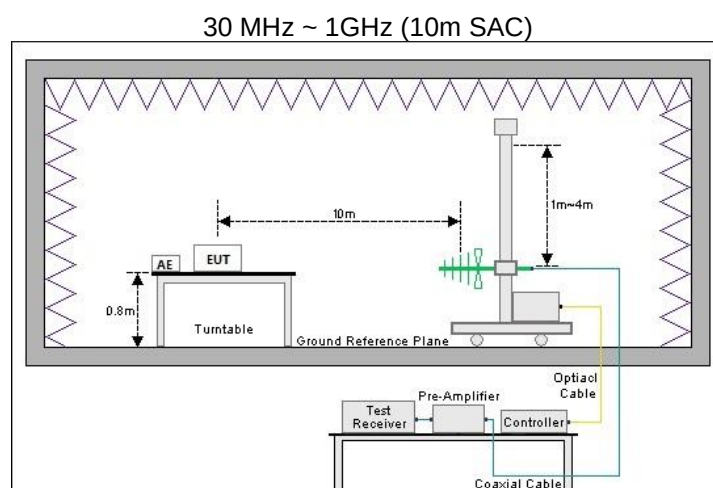


Note: The detailed descriptions please refer to Figure 8 of ANSI C63.4:2014.

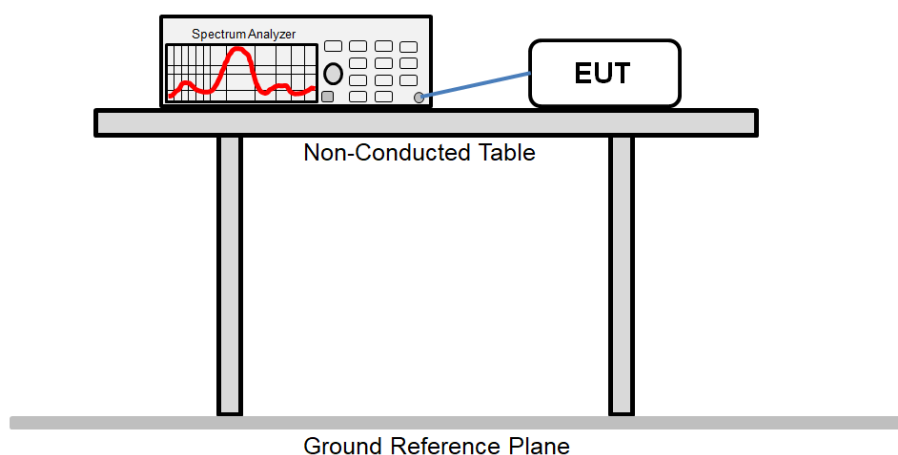
2) Radiated emission measurement:

9kHz ~ 30 MHz (3m SAC)





Conducted test method:



4.2 Test Procedure

Test method	Test step
Conducted emission	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.
Radiated emission	1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 10 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 10 m. 2. EUT works in each mode of operation that needs to be tested, and having the EUT continuously working, respectively on 3 axis (X, Y & Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
Conducted test method	1. The antenna port of EUT was connected to the RF port of the spectrum analyzer through an RF cable. 2. The EUT is keeping in continuous transmission mode and tested in all modulation modes. 3. The test data is saved by the screenshot function of the spectrum analyzer.

5 Test Results

5.1 Summary

5.1.1 Clause and Data Summary

Test items	Standard clause	Test data	Result
Antenna Requirement	15.203	See Section 5.2	Pass
AC Power Line Conducted Emission	15.207	See Section 5.3	Pass
20dB Bandwidth	15.215(c)	See Section 5.4	Pass
Field Strength of Fundamental	15.225 (a)(b)(c)	See Section 5.5	Pass
Field Strength of Spurious Emissions	15.209 15.225 (d)	See Section 5.6	Pass
Frequency Tolerance	15.225 (e)	See Section 5.7	Pass
Remark: 1. Pass: The EUT complies with the essential requirements in the standard. 2. N/A: Not Applicable.			
Test Method:	ANSI C63.4-2014 ANSI C63.10-2013		

5.1.2 Test Limit

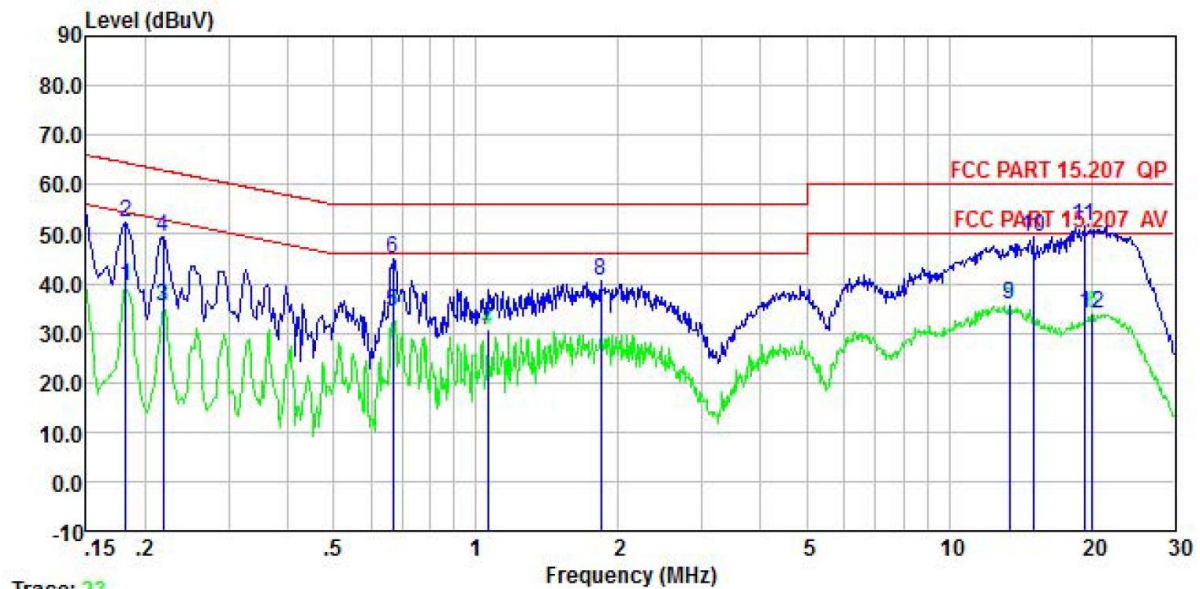
Items	Limit																								
AC Power Line Conducted Emission	<table><tr><th rowspan="2">Frequency (MHz)</th><th colspan="2">Limit (dBµV)</th></tr><tr><th>Quasi-Peak</th><th>Average</th></tr><tr><td>0.15 – 0.5</td><td>66 to 56 ^{Note 1}</td><td>56 to 46 ^{Note 1}</td></tr><tr><td>0.5 – 5</td><td>56</td><td>46</td></tr><tr><td>5 – 30</td><td>60</td><td>50</td></tr></table> Note 1: The limit level in dBµV decreases linearly with the logarithm of frequency. Note 2: The more stringent limit applies at transition frequencies.	Frequency (MHz)	Limit (dBµV)		Quasi-Peak	Average	0.15 – 0.5	66 to 56 ^{Note 1}	56 to 46 ^{Note 1}	0.5 – 5	56	46	5 – 30	60	50										
Frequency (MHz)	Limit (dBµV)																								
	Quasi-Peak	Average																							
0.15 – 0.5	66 to 56 ^{Note 1}	56 to 46 ^{Note 1}																							
0.5 – 5	56	46																							
5 – 30	60	50																							
20dB Bandwidth	N/A																								
Field Strength of Fundamental	(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. (b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. (c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters. (d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.																								
Field Strength of Spurious Emissions	<table><tr><th>Frequency (MHz)</th><th>Field strength (microvolts/meter)</th><th>Measurement distance (meters)</th></tr><tr><td>0.009 – 0.490</td><td>2400/F (kHz)</td><td>300</td></tr><tr><td>0.490 – 1.705</td><td>24000/F (kHz)</td><td>30</td></tr><tr><td>1.705 – 30.0</td><td>30</td><td>30</td></tr><tr><td>30 – 88</td><td>100**</td><td>3</td></tr><tr><td>88 – 216</td><td>150**</td><td>3</td></tr><tr><td>216 – 960</td><td>200**</td><td>3</td></tr><tr><td>Above 960</td><td>500</td><td>3</td></tr></table> ** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.	Frequency (MHz)	Field strength (microvolts/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
Frequency (MHz)	Field strength (microvolts/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																							
Frequency Tolerance	The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of ?20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.																								

5.2 Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203
15.203 requirement:	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.
E.U.T Antenna:	The EUT make use of an induction coil antenna.

5.3 AC Power Line Conducted Emission

Product name:	Marshall 8 Plus	Product model:	Marshall 8 Plus
Test by:	Asher Zhang	Test mode:	NFC mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz		



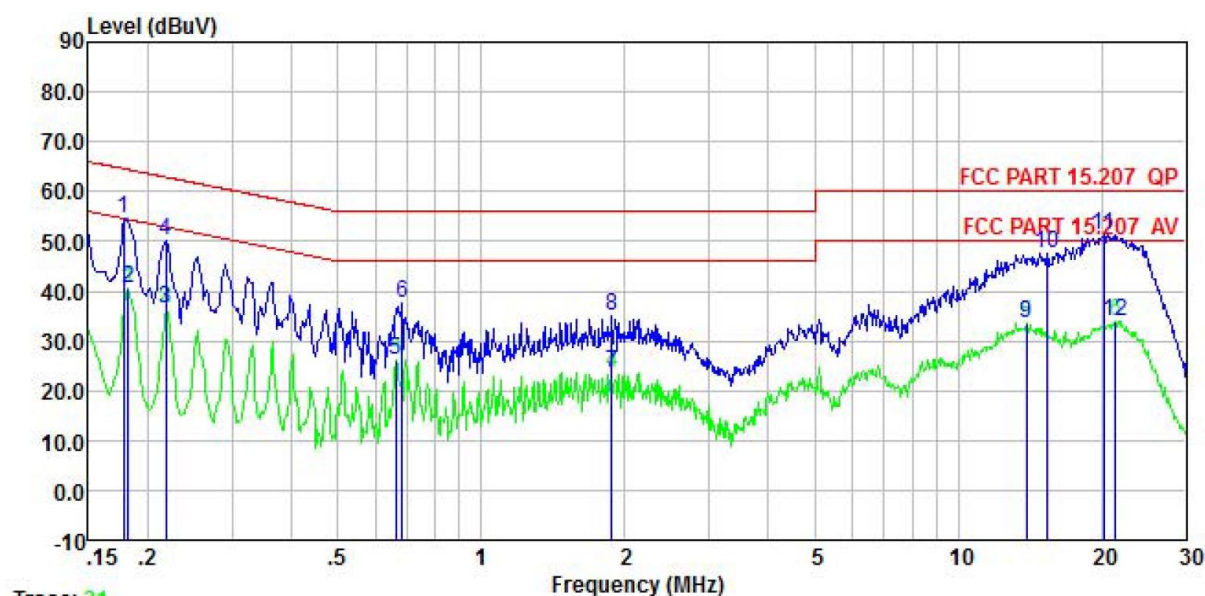
Trace: 23

	Freq	Read Level	LISN Factor	Aux Factor	Aux2 Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB	
1	0.182	29.18	0.20	0.00	9.88	0.01	39.27	54.42	-15.15	Average
2	0.182	42.40	0.20	0.00	9.88	0.01	52.49	64.42	-11.93	QP
3	0.219	25.18	0.20	0.00	9.88	0.03	35.29	52.88	-17.59	Average
4	0.219	39.32	0.20	0.00	9.88	0.03	49.43	62.88	-13.45	QP
5	0.668	24.28	0.20	0.00	9.88	0.03	34.39	46.00	-11.61	Average
6	0.668	35.04	0.20	0.00	9.88	0.03	45.15	56.00	-10.85	QP
7	1.060	20.55	0.20	0.00	9.88	0.06	30.69	46.00	-15.31	Average
8	1.839	30.27	0.20	0.00	9.88	0.19	40.54	56.00	-15.46	QP
9	13.408	25.41	0.27	0.00	9.92	0.11	35.71	50.00	-14.29	Average
10	15.066	38.90	0.30	0.00	9.93	0.14	49.27	60.00	-10.73	QP
11	19.326	41.11	0.39	0.00	9.96	0.15	51.61	60.00	-8.39	QP
12	20.056	23.45	0.40	0.00	9.96	0.19	34.00	50.00	-16.00	Average

Remark:

1. Level = Read level + LISN Factor + Cable Loss.

Product name:	Marshall 8 Plus	Product model:	Marshall 8 Plus
Test by:	Asher Zhang	Test mode:	NFC mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz		



	Read	LISN	Aux	Aux2	Cable		Limit	Over	
Freq	Level	Factor	Factor	Factor	Loss	Level	Line	Limit	Remark
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB	
1	0.178	44.36	0.20	0.00	9.88	0.01	54.45	64.59	-10.14 QP
2	0.182	30.29	0.20	0.00	9.88	0.01	40.38	54.42	-14.04 Average
3	0.219	26.21	0.20	0.00	9.88	0.03	36.32	52.88	-16.56 Average
4	0.219	40.22	0.20	0.00	9.88	0.03	50.33	62.88	-12.55 QP
5	0.661	15.94	0.20	0.00	9.88	0.03	26.05	46.00	-19.95 Average
6	0.683	27.36	0.20	0.00	9.88	0.03	37.47	56.00	-18.53 QP
7	1.878	13.35	0.29	0.00	9.88	0.19	23.71	46.00	-22.29 Average
8	1.878	24.69	0.29	0.00	9.88	0.19	35.05	56.00	-20.95 QP
9	13.915	23.02	0.40	0.00	9.93	0.12	33.47	50.00	-16.53 Average
10	15.307	37.08	0.40	0.00	9.93	0.15	47.56	60.00	-12.44 QP
11	20.162	40.88	0.40	0.00	9.96	0.19	51.43	60.00	-8.57 QP
12	21.373	23.41	0.40	0.00	9.97	0.17	33.95	50.00	-16.05 Average

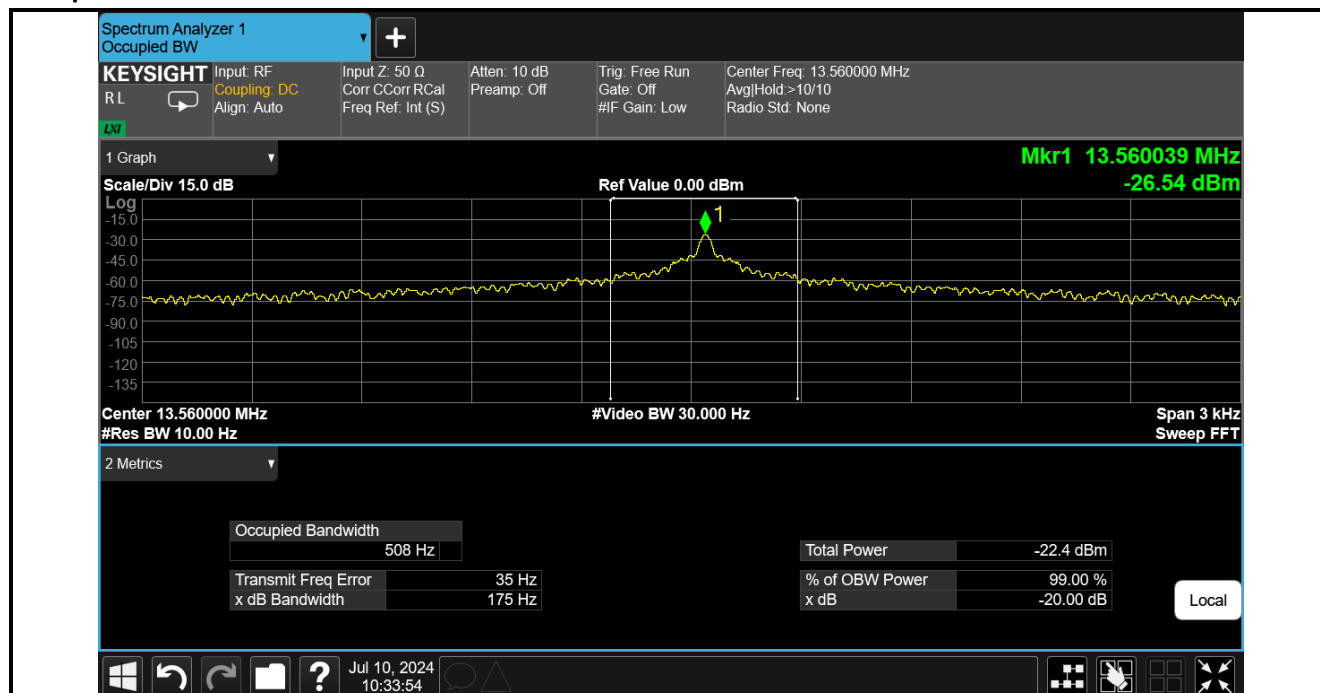
Remark:

1. Level = Read level + LISN Factor + Cable Loss.

5.4 20dB Bandwidth

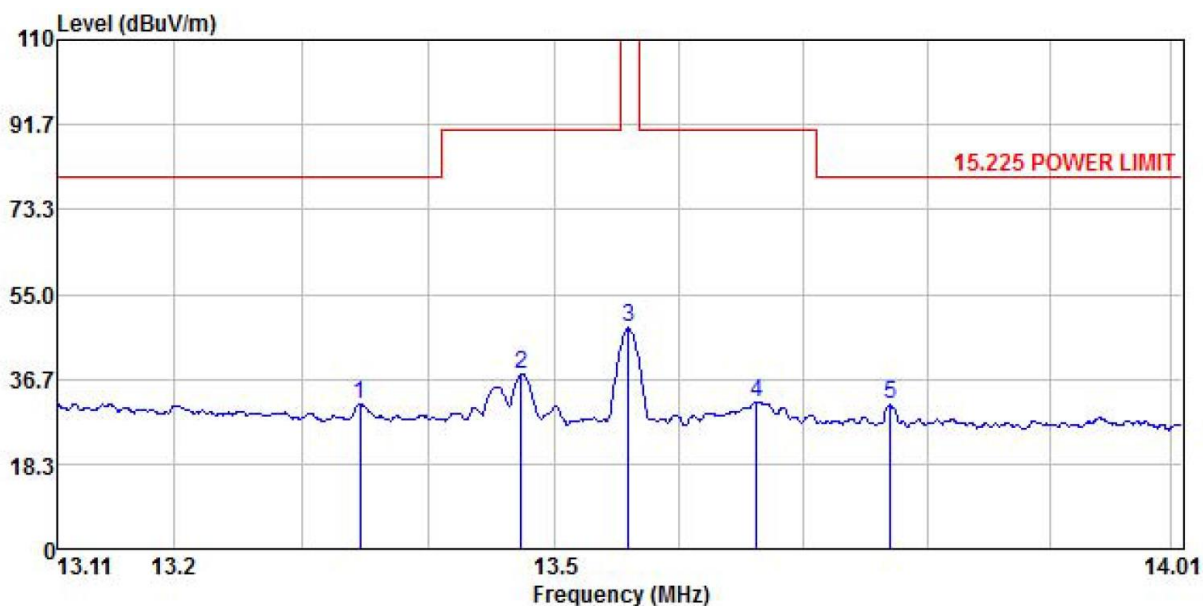
20dB bandwidth (kHz)	Limit (kHz)	Results
0.175	11.2	Passed
Note: For 13.56MHz, permitted Band is 14 kHz, so the Limit is 11.2 kHz.		

Test plot as follows:



5.5 Field Strength of Fundamental

Product Name:	Marshall 8 Plus	Product Model:	Marshall 8 Plus
Test By:	Robin Gu	Test mode:	NFC Tx mode
Test Voltage:	DC 3.7V	Polarization:	Coxial

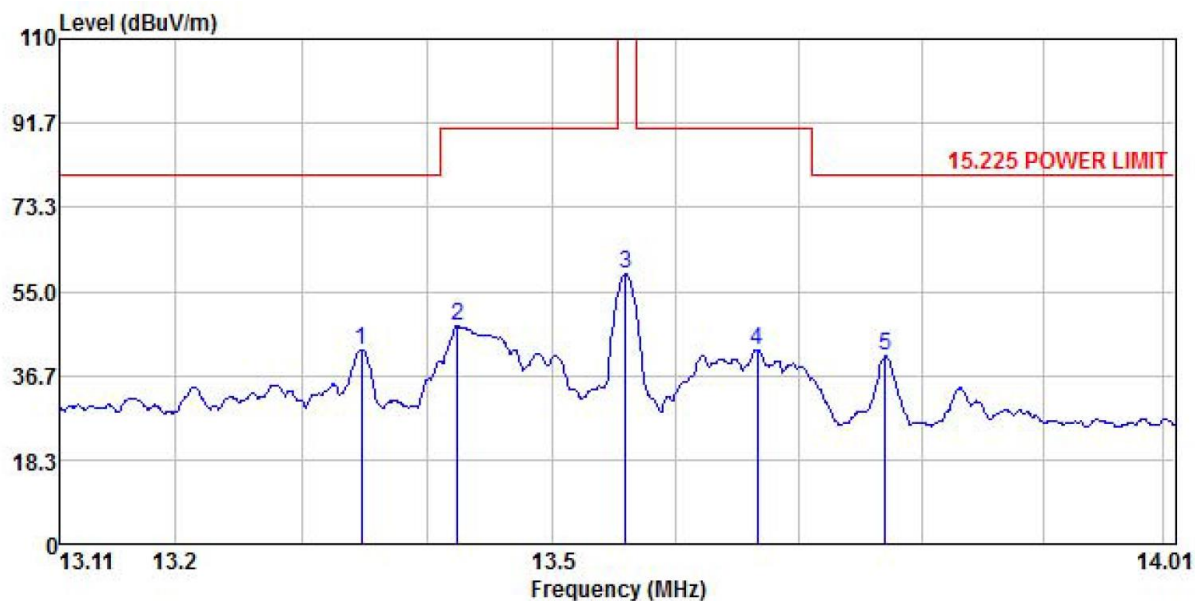


	Freq	Read	Antenna	Cable	Preamp	Level	Limit	Over	
	MHz	Level	Factor	Loss	Factor	dBuV/m	dBuV/m	Limit	Remark
		dBuV	dB/m	dB	dB			dB	
1	13.345	11.31	19.63	0.40	0.00	31.34	80.50	-49.16	Peak
2	13.474	17.77	19.61	0.41	0.00	37.79	90.50	-52.71	Peak
3	13.559	27.77	19.59	0.41	0.00	47.77	124.00	-76.23	Peak
4	13.662	11.68	19.57	0.42	0.00	31.67	90.50	-58.83	Peak
5	13.770	11.15	19.54	0.43	0.00	31.12	80.50	-49.38	Peak

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

Product Name:	Marshall 8 Plus	Product Model:	Marshall 8 Plus
Test By:	Robin Gu	Test mode:	NFC Tx mode
Test Voltage:	DC 3.7V	Polarization:	Coplanar



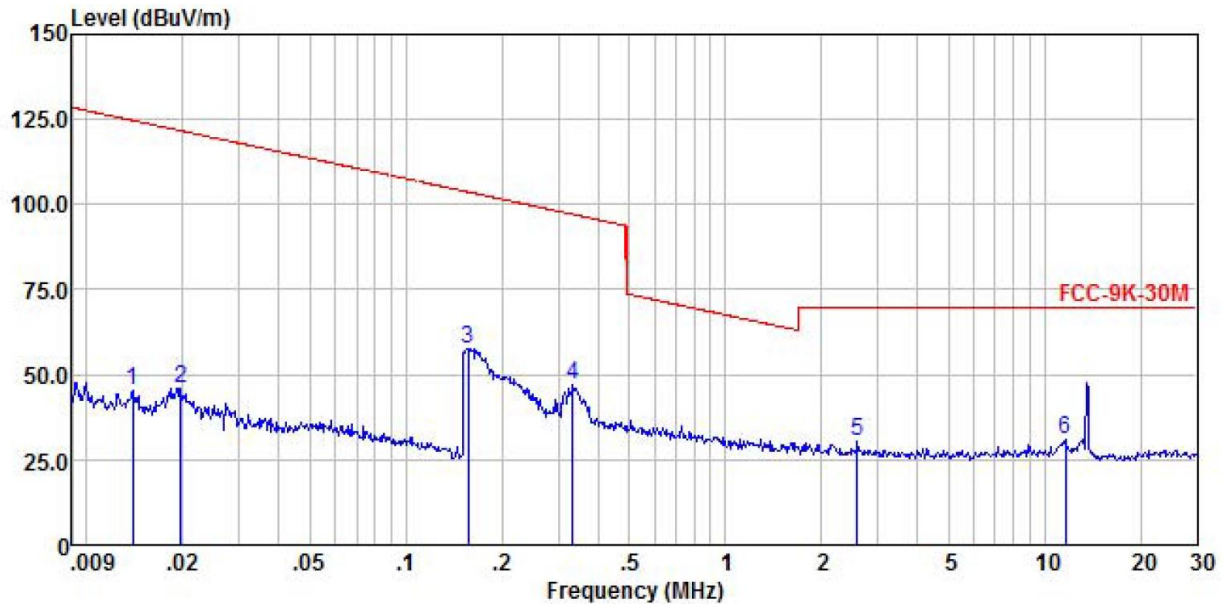
	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Level	Limit	Over	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	13.347	22.32	19.63	0.40	0.00	42.35	80.50	-38.15	Peak
2	13.424	27.53	19.61	0.41	0.00	47.55	90.50	-42.95	Peak
3	13.559	38.93	19.59	0.41	0.00	58.93	124.00	-65.07	Peak
4	13.665	22.38	19.57	0.42	0.00	42.37	90.50	-48.13	Peak
5	13.770	21.01	19.54	0.43	0.00	40.98	80.50	-39.52	Peak

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

5.6 Field Strength of Spurious Emissions

Product Name:	Marshall 8 Plus	Product Model:	Marshall 8 Plus
Test By:	Robin Gu	Test mode:	NFC Tx mode
Test Frequency:	150 kHz – 30 MHz	Polarization:	Coxial
Test Voltage:	DC 3.7V		

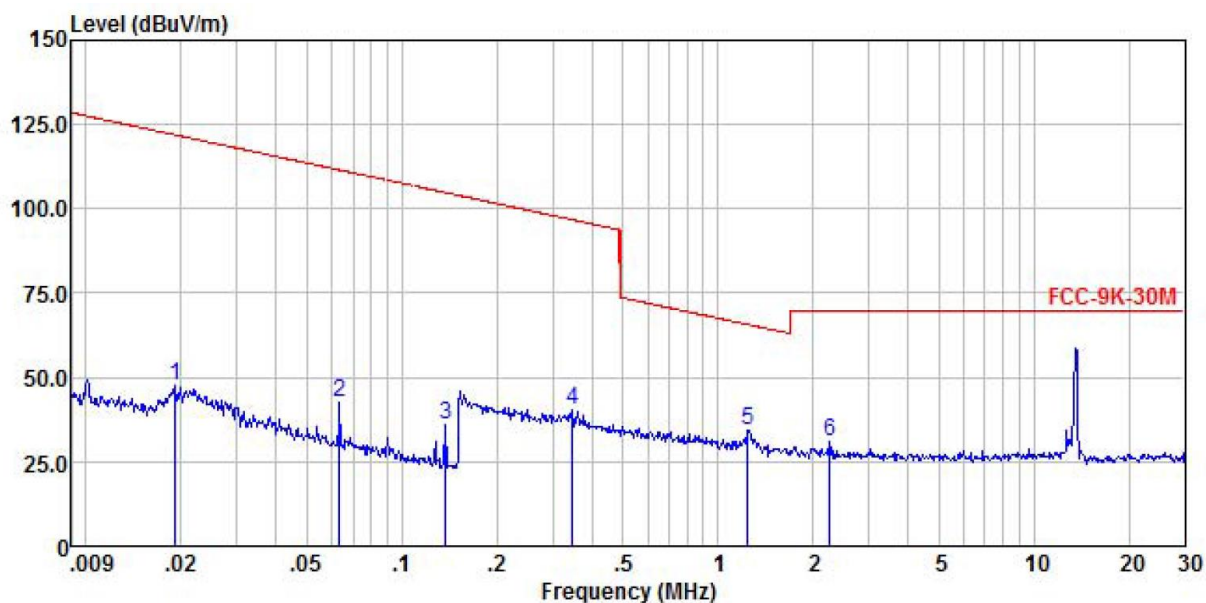


	Freq	ReadAntenna	Cable Preamp	Limit	Over				
		Level	Factor	Loss	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	0.014	24.83	20.41	0.01	0.00	45.25	124.70	-79.45	Peak
2	0.020	25.54	20.31	0.01	0.00	45.86	121.67	-75.81	Peak
3	0.156	37.49	20.22	0.03	0.00	57.74	103.74	-46.00	Peak
4	0.333	26.25	20.60	0.06	0.00	46.91	97.17	-50.26	Peak
5	2.589	9.87	20.41	0.21	0.00	30.49	69.50	-39.01	Peak
6	11.613	10.37	20.03	0.41	0.00	30.81	69.50	-38.69	Peak

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of 9 kHz~150 kHz are background noise and very lower than the limit, so not show in test report.

Product Name:	Marshall 8 Plus	Product Model:	Marshall 8 Plus
Test By:	Robin Gu	Test mode:	NFC Tx mode
Test Frequency:	150 kHz – 30 MHz	Polarization:	Coplanar
Test Voltage:	DC 3.7V		



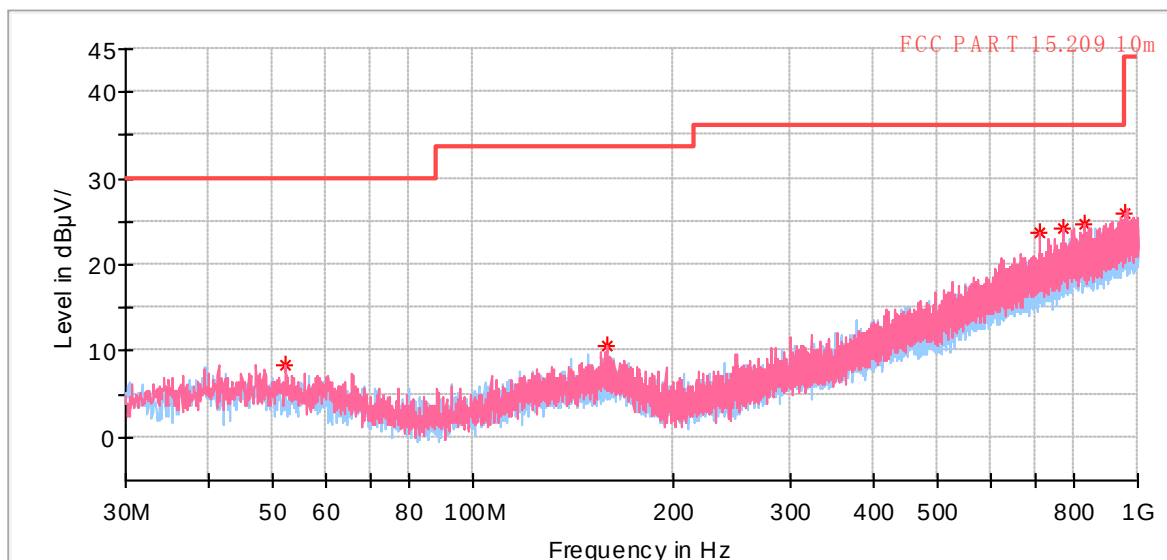
	Freq	ReadLevel	AntennaFactor	CableLoss	PreampFactor	Level	LimitLine	OverLimit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	0.019	27.48	20.32	0.01	0.00	47.81	121.95	-74.14	Peak
2	0.064	21.90	20.53	0.02	0.00	42.45	111.52	-69.07	Peak
3	0.137	16.06	20.02	0.03	0.00	36.11	104.87	-68.76	Peak
4	0.346	19.96	20.62	0.06	0.00	40.64	96.82	-56.18	Peak
5	1.248	13.82	20.48	0.17	0.00	34.47	65.70	-31.23	Peak
6	2.256	10.47	20.43	0.19	0.00	31.09	69.50	-38.41	Peak

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of 9 kHz~150 kHz are background noise and very lower than the limit, so not show in test report.

Product Name:	Marshall 8 Plus	Product Model:	Marshall 8 Plus
Test By:	Kiran Zeng	Test mode:	NFC Tx mode
Test Frequency:	30 MHz – 1000 MHz	Polarization:	Vertical & Horizontal
Test Voltage:	DC 3.7V		

Full Spectrum



Critical_Freqs

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
52.310000	8.34	30.00	21.66	100.0	V	9.0	-16.5	14:53:25 - 2024/8/12
159.543500	10.53	33.50	22.97	100.0	V	108.0	-15.4	14:53:21 - 2024/8/12
712.492000	23.77	36.00	12.23	100.0	V	147.0	-4.0	14:53:27 - 2024/8/12
772.341000	24.30	36.00	11.70	100.0	V	180.0	-2.9	14:53:16 - 2024/8/12
830.201500	24.60	36.00	11.40	100.0	V	346.0	-2.2	14:53:46 - 2024/8/12
959.842000	25.93	36.00	10.07	100.0	V	9.0	-0.1	14:52:37 - 2024/8/12

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

5.7 Frequency Tolerance

Frequency Stability V.S. Temperature Measurement:

Voltage (Vdc)	Temperature (°C)	Frequency Tolerance (kHz)	Frequency Error (%)	Limit (%)	Results
3.70	-20	-0.023	-0.0002	±0.01	Pass
	-10	-0.032	-0.0002	±0.01	Pass
	0	0.011	0.0001	±0.01	Pass
	+10	0.023	0.0002	±0.01	Pass
	+20	-0.035	-0.0003	±0.01	Pass
	+30	-0.013	-0.0001	±0.01	Pass
	+40	-0.025	-0.0002	±0.01	Pass
	+50	-0.027	-0.0002	±0.01	Pass

Frequency Stability V.S. Voltage Measurement:

Temperature (°C)	Voltage (Vdc)	Frequency Tolerance (kHz)	Frequency Error (%)	Limit (%)	Results
25.0	3.70	-0.027	-0.0002	±0.01	Pass
	3.50	0.025	0.0002	±0.01	Pass
	4.25	-0.022	-0.0002	±0.01	Pass

-----End of report-----