



FCC PART 15B, CLASS B
MEASUREMENT AND TEST REPORT

For

Shenzhen Rakwireless Technology Co., Ltd.

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Model: RAK5005-O

Report Type: Original Report	Product Type: Wisblock
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Report Number: RSZ201124006-EM-00	
Report Date: 2020-12-08 Joson Xiao	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Wisblock
Tested Model	RAK5005-O
Voltage Range	DC 5V
Highest operating frequency	1800kHz
Date of Test	2020-12-07
Sample number	RSZ201124006-EM-S1(Assigned by BACL, Shenzhen)
Received date	2020-11-24
Sample/EUT Status	Good condition

Objective

This test report is in accordance with Part 2-Subpart J, Part 15B Subparts A and B of the Federal Communication Commissions rules.

The objective of the manufacturer is to determine the compliance of the EUT with FCC Part 15B.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expanded combined standard uncertainty of test at Bay Area Compliance Laboratories Corp. (Shenzhen) is shown as below. And the uncertainty will be taken into consideration for the test data recorded in the report

Parameter		uncertainty
Conducted Emissions		±1.95dB
Emissions, radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0023.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in worst case condition.

EUT exercise software

No exercise software was used.

Equipment Modifications

No modification was made to the EUT tested.

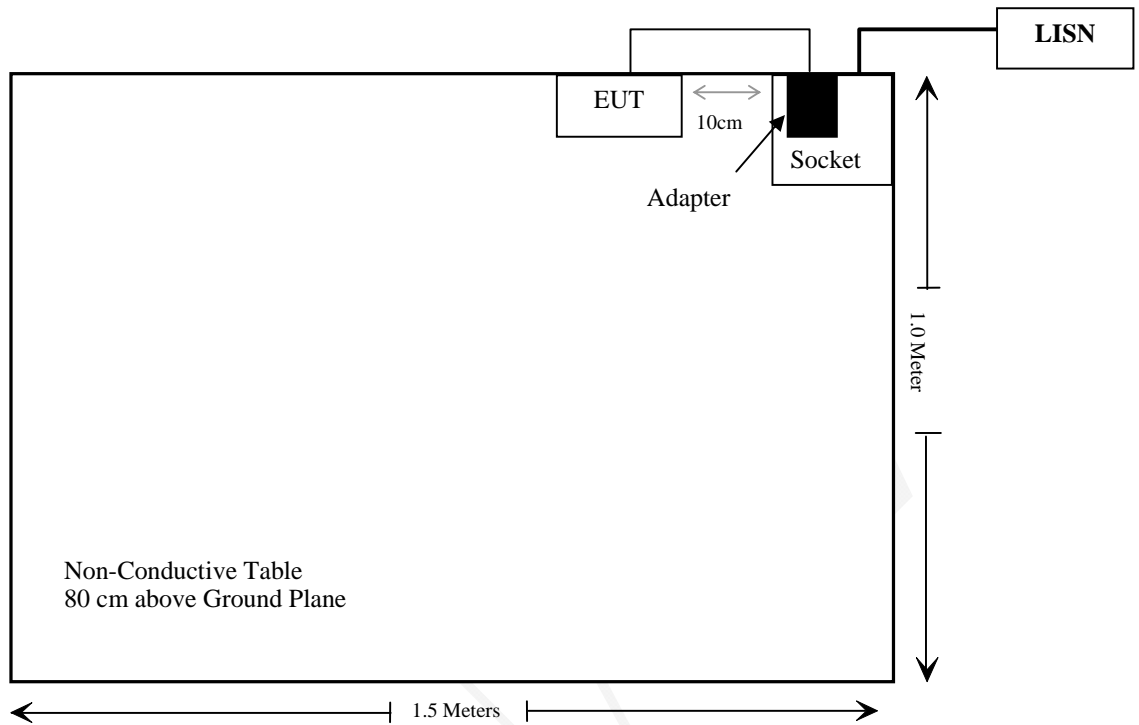
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
BULL	Socket	GN-212	A37209315081183
ZTE	Adapter	STC-A51A	E1346861

External I/O Cable

Cable Description	Length (m)	From/Port	To
Unshielded Un-detachable AC cable	1.0	Socket	LISN
Unshielded Detachable DC cable	1.0	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

Description	Results
AC Power Line Conducted Emissions	Compliance
Radiated Emissions	Compliance

FINAL

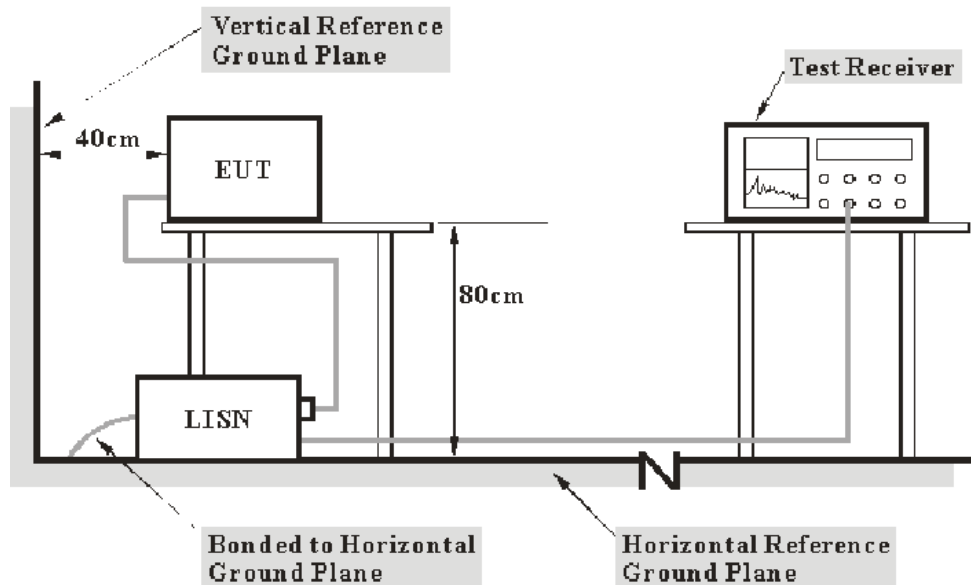
TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2020/08/04	2021/08/03
Rohde & Schwarz	LISN	ENV216	101613	2020/08/04	2021/08/03
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2020/11/29	2021/11/28
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2020/11/29	2021/11/28
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2020/08/04	2021/08/03
Sonoma instrument	Pre-amplifier	310 N	186238	2020/08/04	2021/08/03
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017/12/22	2020/12/21
Unknown	Cable 2	RF Cable 2	F-03-EM197	2020/11/29	2021/11/28
Unknown	Cable	Chamber Cable 4	EC-007	2020/11/29	2021/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Yijia	Temperature & Humidity Meter	TA218B	E0938	2020/10/14	2021/10/13

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

AC LINE CONDUCTED EMISSIONS

EUT Setup



- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with ANSI C63.4-2014. The related limit was specified in FCC Part 15.107.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Factor} = \text{LISN/ISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Data

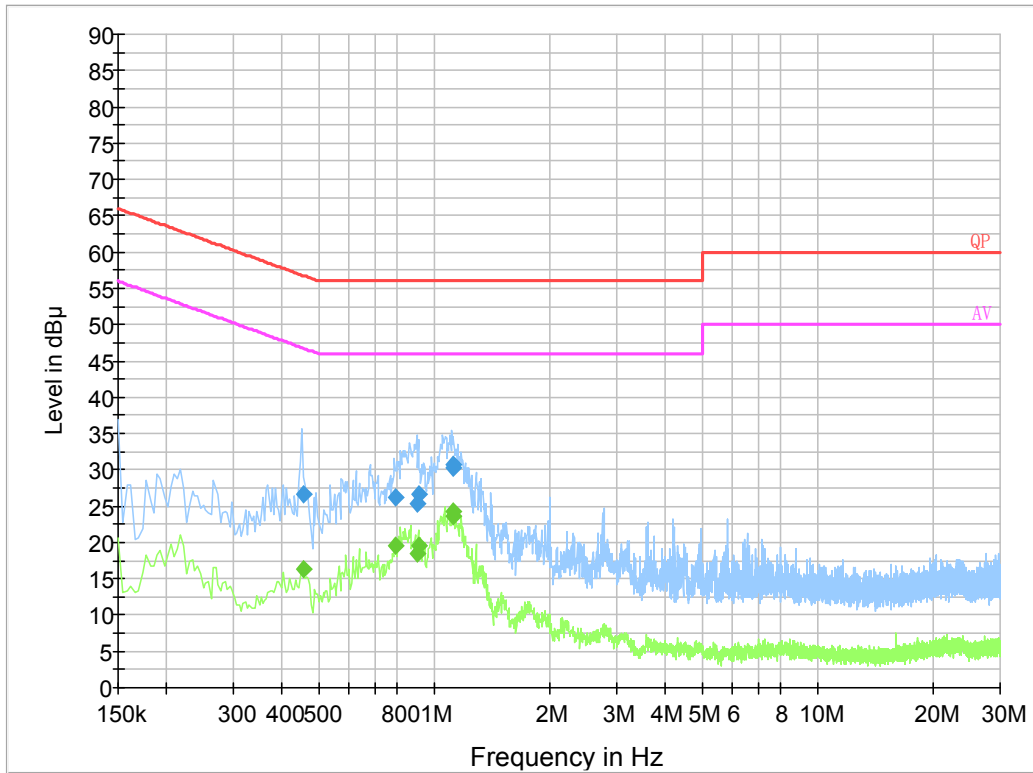
Environmental Conditions

Temperature:	25 °C
Relative Humidity:	65 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li on 2020-12-07.

EUT Operation Mode: Charging & Working

AC 120V/60 Hz, Line



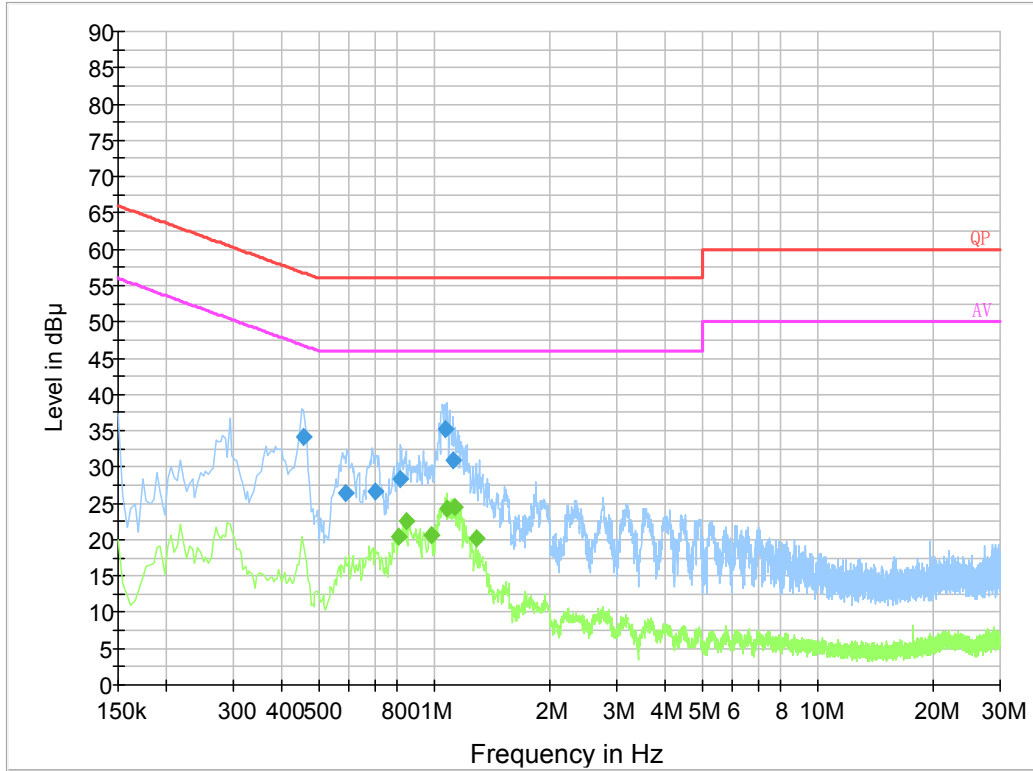
Final Result 1

Frequency (MHz)	QuasiPeak (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.455190	26.7	9.000	L1	19.8	30.1	56.8
0.794150	26.1	9.000	L1	19.8	29.9	56.0
0.904470	25.4	9.000	L1	19.8	30.6	56.0
0.916350	26.6	9.000	L1	19.8	29.4	56.0
1.125110	30.4	9.000	L1	19.8	25.6	56.0
1.125290	30.8	9.000	L1	19.8	25.2	56.0

Final Result 2

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.455190	16.3	9.000	L1	19.8	30.5	46.8
0.794150	19.6	9.000	L1	19.8	26.4	46.0
0.904470	18.5	9.000	L1	19.8	27.5	46.0
0.916350	19.5	9.000	L1	19.8	26.5	46.0
1.125110	23.7	9.000	L1	19.8	22.3	46.0
1.125290	24.3	9.000	L1	19.8	21.7	46.0

AC 120V/60 Hz, Neutral



Final Result 1

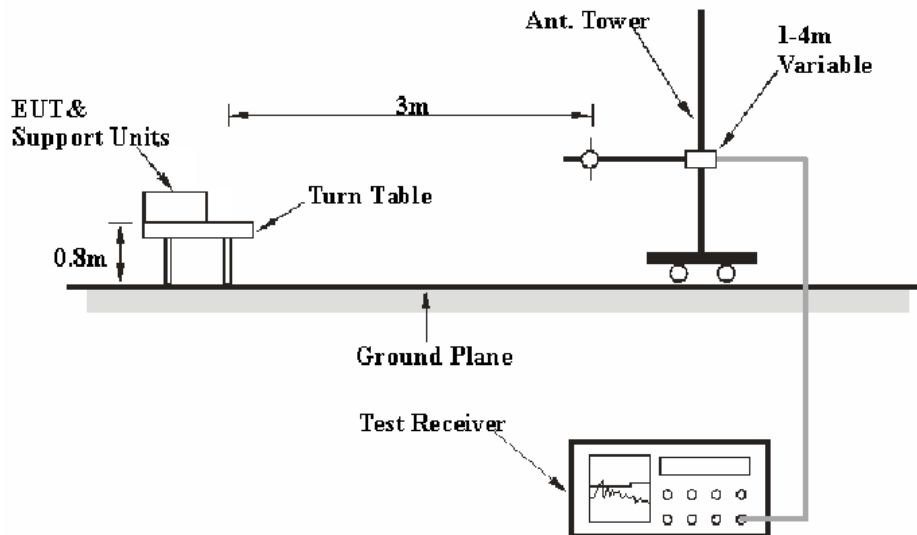
Frequency (MHz)	QuasiPeak (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.455190	34.2	9.000	N	19.8	22.6	56.8
0.589090	26.5	9.000	N	19.8	29.5	56.0
0.699650	26.7	9.000	N	19.8	29.3	56.0
0.817730	28.4	9.000	N	19.8	27.6	56.0
1.069710	35.2	9.000	N	19.8	20.8	56.0
1.124990	31.0	9.000	N	19.8	25.0	56.0

Final Result 2

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.810000	20.5	9.000	N	19.8	25.5	46.0
0.846000	22.6	9.000	N	19.8	23.4	46.0
0.986000	20.6	9.000	N	19.8	25.4	46.0
1.086000	24.3	9.000	N	19.8	21.7	46.0
1.138000	24.4	9.000	N	19.8	21.6	46.0
1.286000	20.2	9.000	N	19.8	25.8	46.0

RADIATED EMISSIONS

EUT Setup



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.4-2014. The related limit was specified in FCC Part 15B.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

FUNNIAL

Test Data

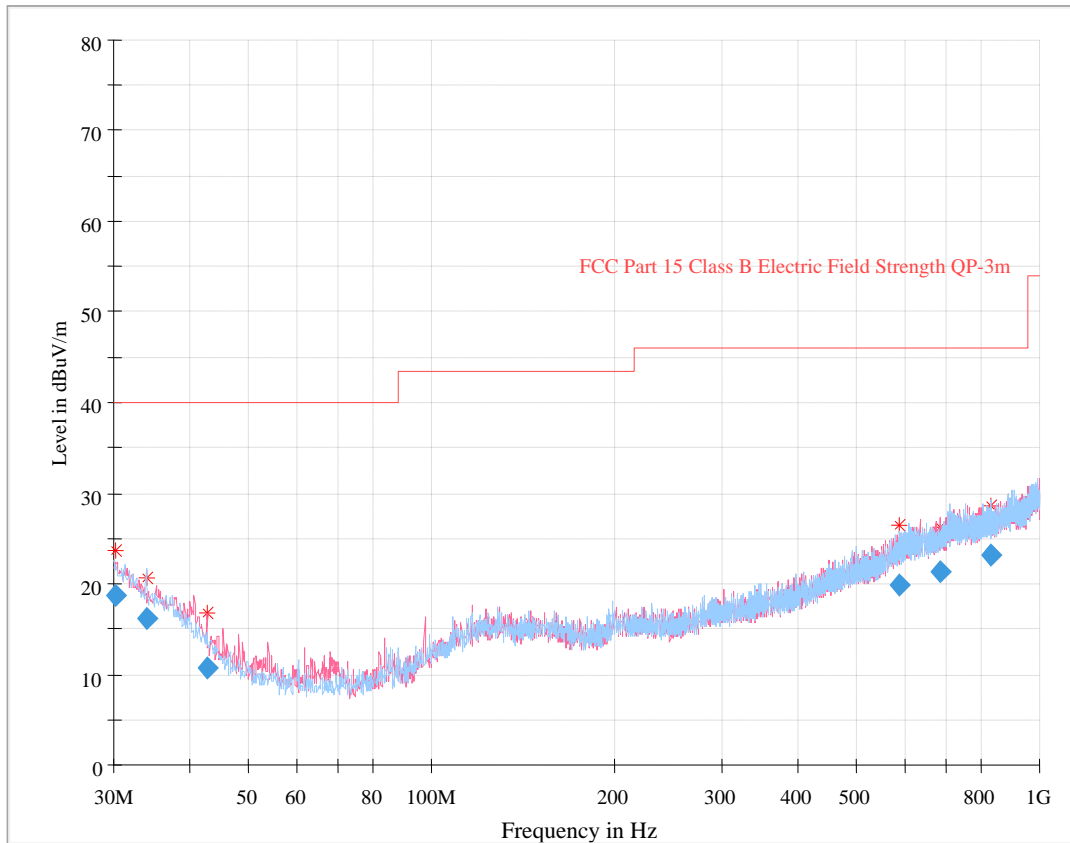
Environmental Conditions

Temperature:	27 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Harris He on 2020-12-07.

EUT Operation Mode: Charging&Working

30 MHz~1 GHz



Final Result

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.290812	18.15	40.00	21.85	400.0	H	146.0	-4.6
33.963750	15.62	40.00	24.38	265.0	H	323.0	-6.8
42.722000	10.59	40.00	29.41	111.0	V	237.0	-12.5
589.287500	19.77	46.00	26.23	323.0	H	89.0	-2.5
684.867500	21.82	46.00	24.18	272.0	V	355.0	-1.5
832.424375	23.87	46.00	22.13	157.0	H	232.0	0.3

EXHIBIT A - EUT PHOTOGRAPHS

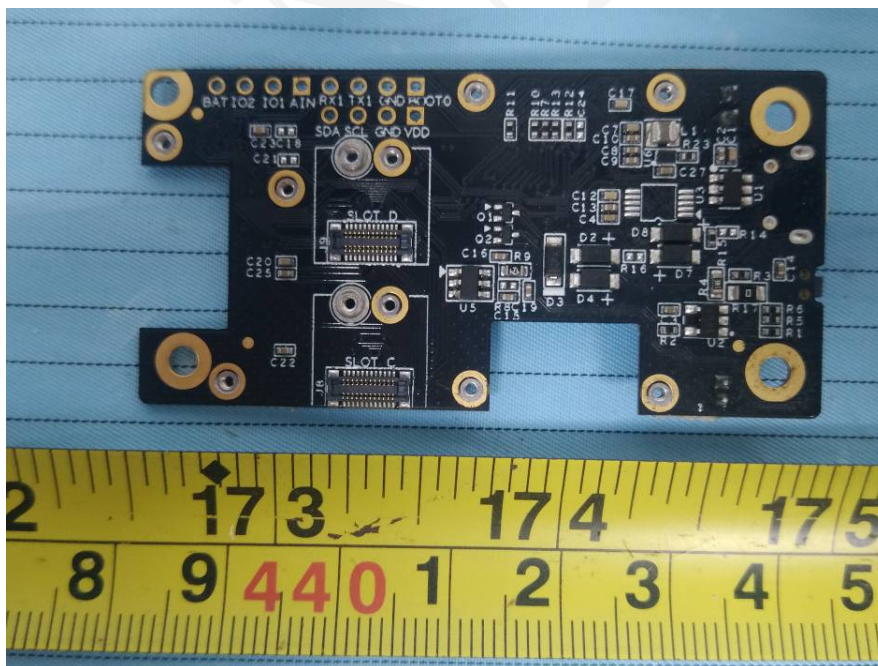
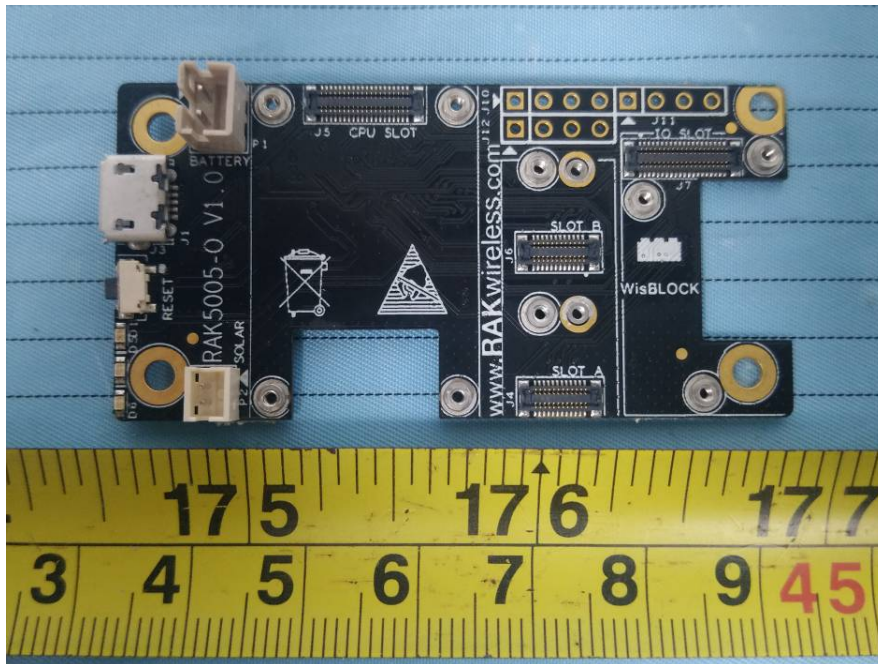
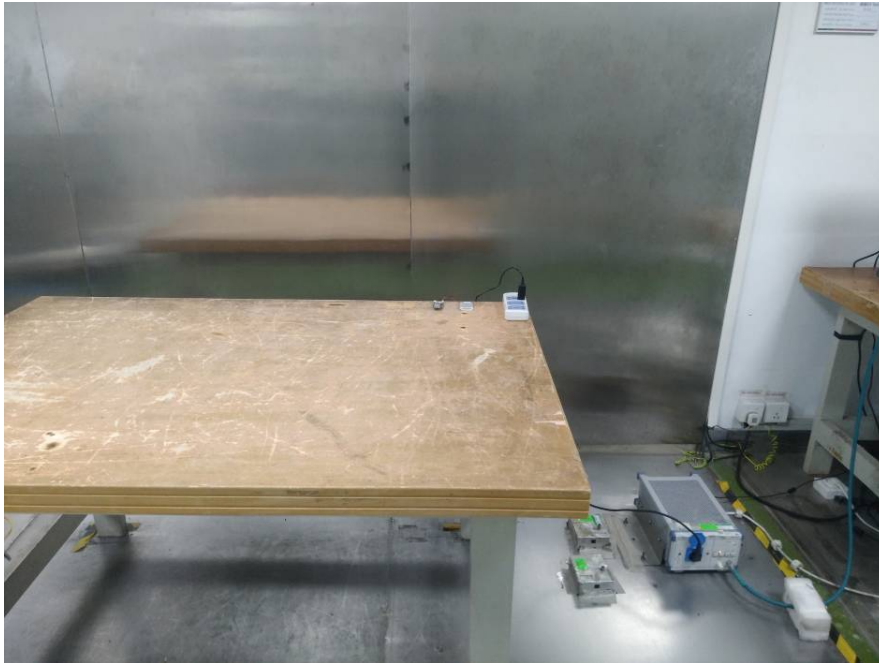


EXHIBIT B - TEST SETUP PHOTOGRAPHS

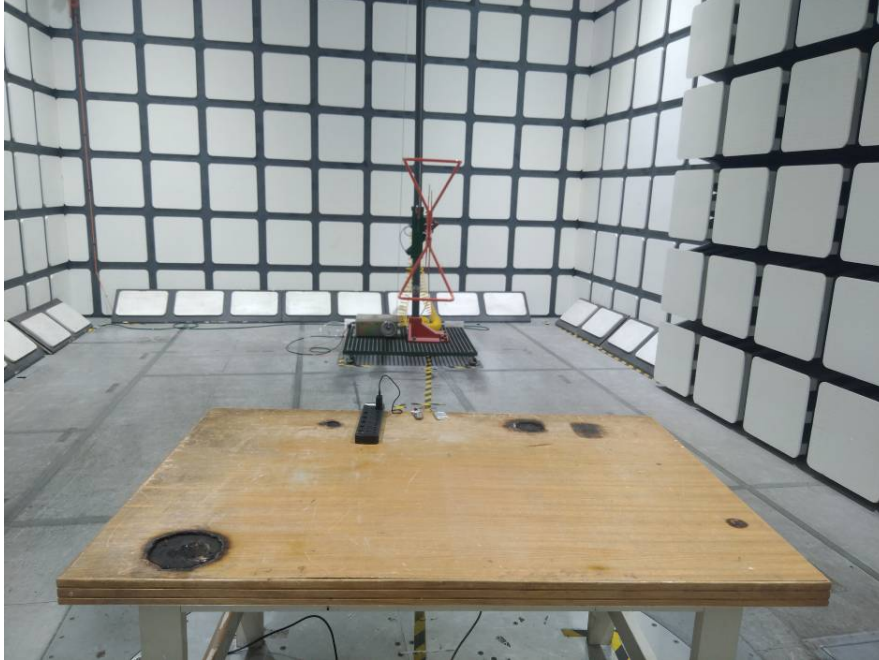
Conducted Emissions - Front View



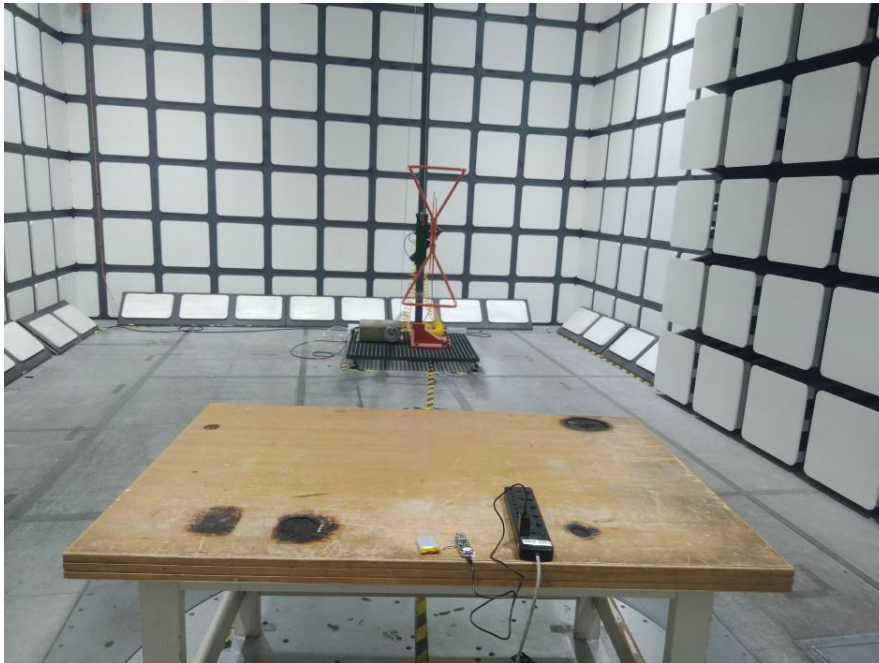
Conducted Emissions - Side View



Radiated Emissions – Front View



Radiated Emissions – Rear View



******* END OF REPORT *******