FCC EMC Test Report

Applicant:	Aratek Biometrics Co., Ltd.
Address of Applicant:	2F, T2-A Building, ShenZhen Software Park South Area, Hi-Tech Park
Equipment Under Test (EUT)	
Product Name:	Fingerprint Smart Terminal
Model No.:	BM5510, BM5500, BM5520, Marshall 5
Trade Mark:	ARATEK
FCC ID:	2AGUJBM5510S
Applicable Standards:	FCC CFR Title 47 Part 15B
Date of Sample Receipt:	01 Nov., 2022
Date of Test:	02 Nov., 2022 to 10 Jan., 2023
Date of report Issued:	11 Jan., 2023
Test Result:	PASS

Tested by:	Janet Wei ***Test Engineer***	***Date:***	*11 Jan., 2023*
Reviewed by:	Winner Zhang ***Project Engineer***	***Date:***	*11 Jan., 2023*
Approved by:	Marc Zhang ***Manager***	***Date:***	*11 Jan., 2023*

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.

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1 Version

Version No.	Date	Description
00	*11 Jan., 2023*	*Original*

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3 General Information

3.1 Client Information

Applicant:	Aratek Biometrics Co., Ltd.
Address:	2F, T2-A Building, ShenZhen Software Park South Area, Hi-Tech Park
Manufacturer/ Factory:	Aratek Biometrics Co., Ltd.
Address:	2F, T2-A Building, ShenZhen Software Park South Area, Hi-Tech Park

3.2 General Description of E.U.T.

Product Name:	Fingerprint Smart Terminal
Model No.:	BM5510, BM5500, BM5520, Marshall 5
Power Supply:	Rechargeable Li-ion Battery DC3.7V, 10000mAh
AC Adapter:	Model: ES019C-U120150XYF Input: AC100-240V, 50/60Hz, 0.6A Output: DC 5.0V, 3.0A, DC 9.0V, 2.0A, DC 12.0V, 1.5A
Remark:	Model No.: BM5510, BM5500, BM5520, Marshall 5 were identical inside, the electrical circuit design, layout, components used and internal wiring, with only difference being different name.
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

3.3 Test Mode

Operating Mode	Detail Description
PC mode	Keep the EUT in Downloading mode(Worst case)
Charging+Recording mode	Keep the EUT in Charging+Recording mode
Charging+Playing mode	Keep the EUT in Charging+Playing mode
GPS mode	Keep the EUT in GPS receiver mode
The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

3.4 Description of Test Auxiliary Equipment

Manufacturer	Description	Model	S/N	FCC ID/DoC
Lenovo	Laptop	ThinkPad T14 Gen 1	SL10Z47277	DoC

3.5 Description of Cable Used

Cable Type	Description	Length	From	To
Detached USB Cable	Shielding	1.02m	EUT	PC/Adapter

3.6 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Conducted Emission for LISN (9kHz ~ 10MHz)	1.9 dB
Conducted Emission for LISN (10MHz ~ 30MHz)	2.6 dB
Radiated Emission (1GHz ~ 18GHz) (3m SAC)	3.6 dB
Radiated Emission (30MHz ~ 1GHz) (10m SAC)	3.7 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.*

3.7 Additions to, Deviations, or Exclusions from the Method

No

3.8 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

3.9 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

3.10 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	04-13-2024
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	03-08-2022	03-07-2023
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	03-08-2022	03-07-2023
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXJ001-2	01-20-2022	01-19-2023
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXJ001-3	01-20-2022	01-19-2023
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	03-05-2022	03-04-2023
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	01-20-2022	01-19-2023
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	01-20-2022	01-19-2023
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG001-5	01-20-2022	01-19-2023
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	TS+	Version: 3.0.0.1		

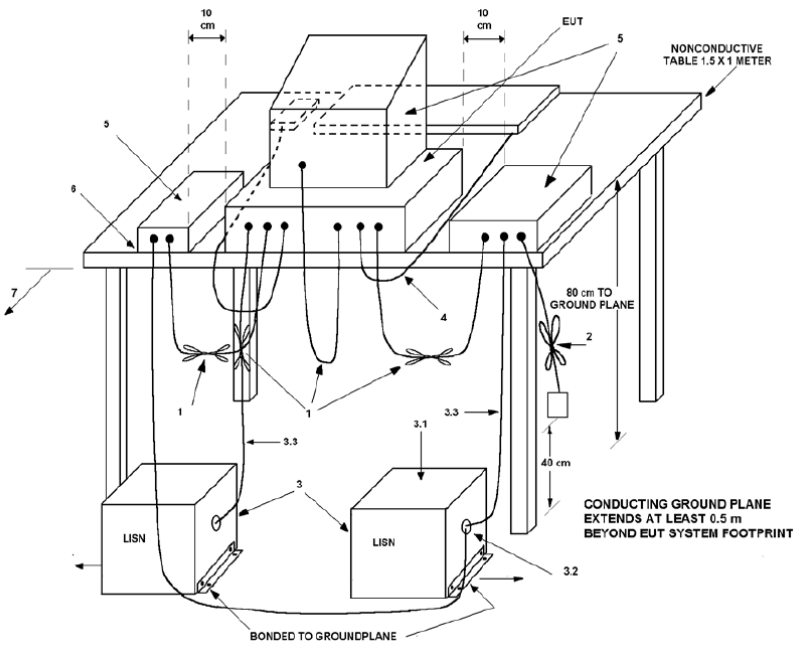
Radiated Emission(10m SAC):					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
10m SAC	ETS	RFSD-100-F/A	WXJ090	04-28-2021	04-27-2024
BiConiLog Antenna	SCHWARZBECK	VULB 9168	WXJ090-1	04-01-2022	03-31-2023
BiConiLog Antenna	SCHWARZBECK	VULB 9168	WXJ090-2	03-31-2022	03-30-2023
EMI Test Receiver	R&S	ESR 3	WXJ090-3	03-30-2022	03-29-2023
EMI Test Receiver	R&S	ESR 3	WXJ090-4	03-30-2022	03-29-2023
Low Pre-amplifier	Bost	LNA 0920N	WXJ090-6	01-20-2022	01-19-2023
Low Pre-amplifier	Bost	LNA 0920N	WXJ090-7	01-20-2022	01-19-2023
Cable	Bost	JYT10M-1G-NN-10M	WXG002-7	01-20-2022	01-19-2023
Cable	Bost	JYT10M-1G-NN-10M	WXG002-8	01-20-2022	01-19-2023
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	07-12-2022	07-11-2023
LISN	Schwarzbeck	NSLK 8127	QCJ001-13	02-24-2022	02-23-2023
LISN	Rohde & Schwarz	ESH3-Z5	WXJ005-1	03-30-2022	03-29-2023
LISN Coaxial Cable (9kHz ~ 30MHz)	JYTSZ	JYTCE-1G-NN-2M	WXG003-1	02-24-2022	02-23-2023
RF Switch	TOP PRECISION	RSU0301	WXG003	N/A	
Test Software	AUDIX	E3	Version: 6.110919b		

4 Measurement Setup and Procedure

4.1 Test Setup

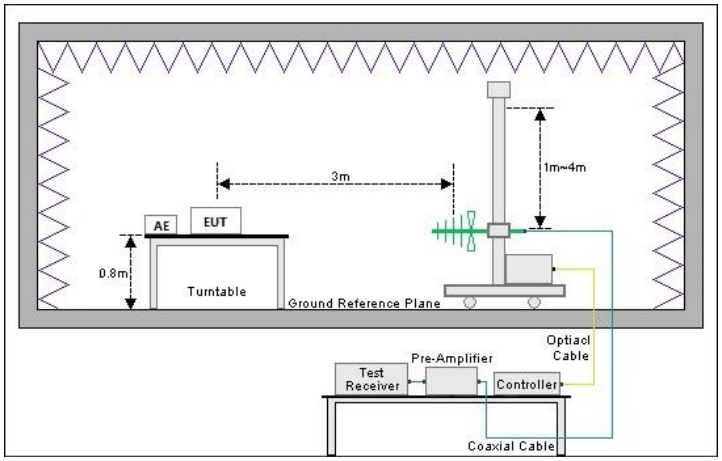
1) Conducted emission measurement:



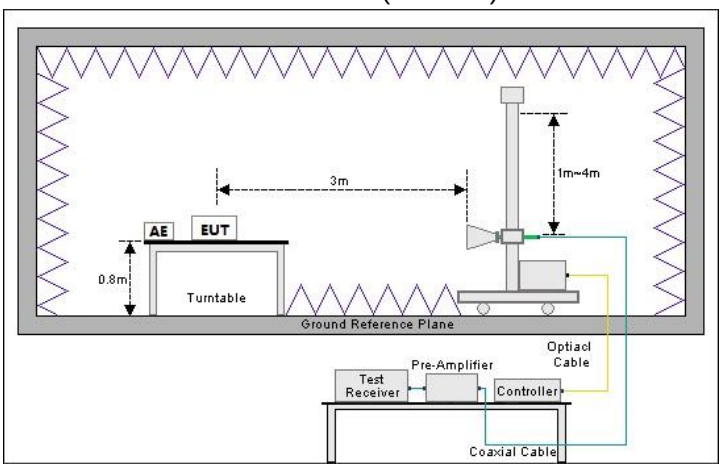
Note: The detailed descriptions please refer to Figure 8 of ANSI C63.4:2014.

2) Radiated emission measurement:

Below 1GHz (10m SAC)



Above 1GHz (3m SAC)



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 C63.4 on conducted measurement.
Radiated emission	**For below 1GHz:** 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. **For above 1GHz:** 1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m fully anechoic room. The measurement distance from the EUT to the receiving antenna is 3 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.

5 Test Results

5.1 Summary

5.1.1 Clause and data summary

Test items	Standard clause	Test data	Result
Conducted Emission	Part 15.107	See Section 5.2	Pass
Radiated Emission	Part 15.109	See Section 5.3	Pass

Remark:

1. *The EUT is a **Class B** digital device.*
2. *Pass: The EUT complies with the essential requirements in the standard.*
3. *N/A: Not Applicable.*

Test Method:	*ANSI C63.4:2014*

5.1.2 Test Limit

Test items	Limit
Conducted Emission	
Radiated Emission	

Frequency (MHz)	Class A Limit (dBμV)		Class B Limit (dBμV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15 – 0.5	79	66	66 to 56 Note 1	56 to 46 Note 1
0.5 – 5	73	60	56	46
5 – 30	73	60	60	50

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)	Class A Limit (dBμV/m)		Class B Limit (dBμV/m)	
	Quasi-Peak @ 3m	Quasi-Peak @ 10m	Quasi-Peak @ 3m	Quasi-Peak @ 10m
30 – 88	49.0	39.0	40.0	30.0
88 – 216	53.5	43.5	43.5	33.5
216 – 960	56.0	46.0	46.0	36.0
960 – 1000	60.0	50.0	54.0	44.0

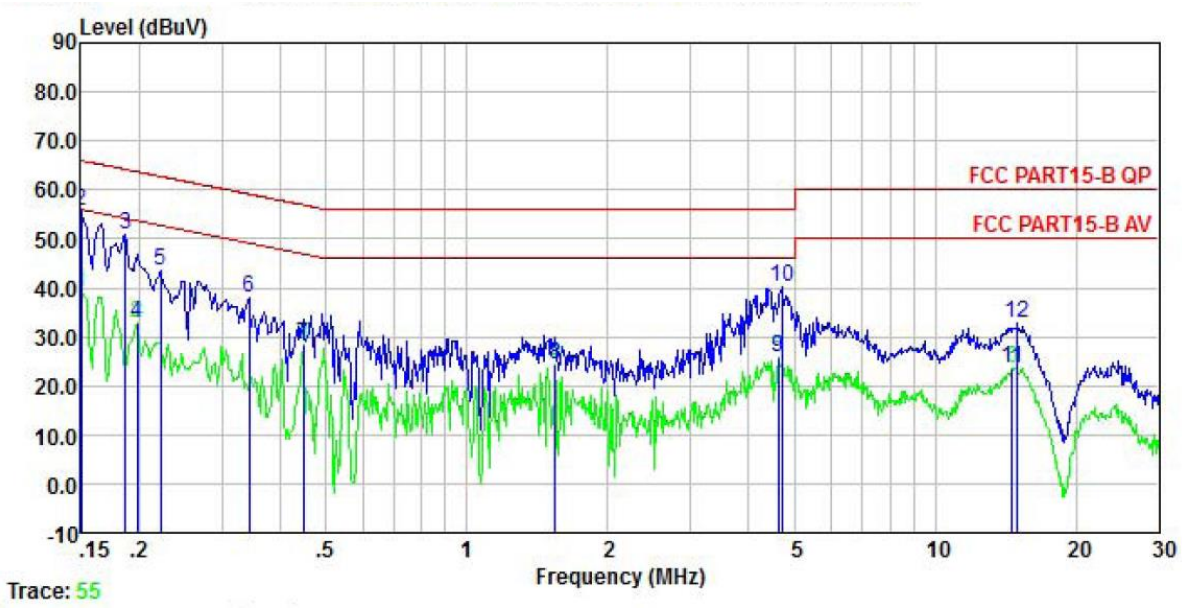
Note: The more stringent limit applies at transition frequencies.

Frequency	Class A Limit (dBμV/m) @ 3m		Class B Limit (dBμV/m) @ 3m	
	Average	Peake	Average	Peake
Above 1 GHz	60.0	80.0	54.0	74.0

Note: The measurement bandwidth shall be 1 MHz or greater.

5.2 Conducted Emission

Product name:	Fingerprint Smart Terminal	**Product model:**	BM5510
Test by:	Mike	**Test mode:**	PC mode
Test frequency:	150 kHz ~ 30 MHz	**Phase:**	Line
Test voltage:	AC 120 V/60 Hz		

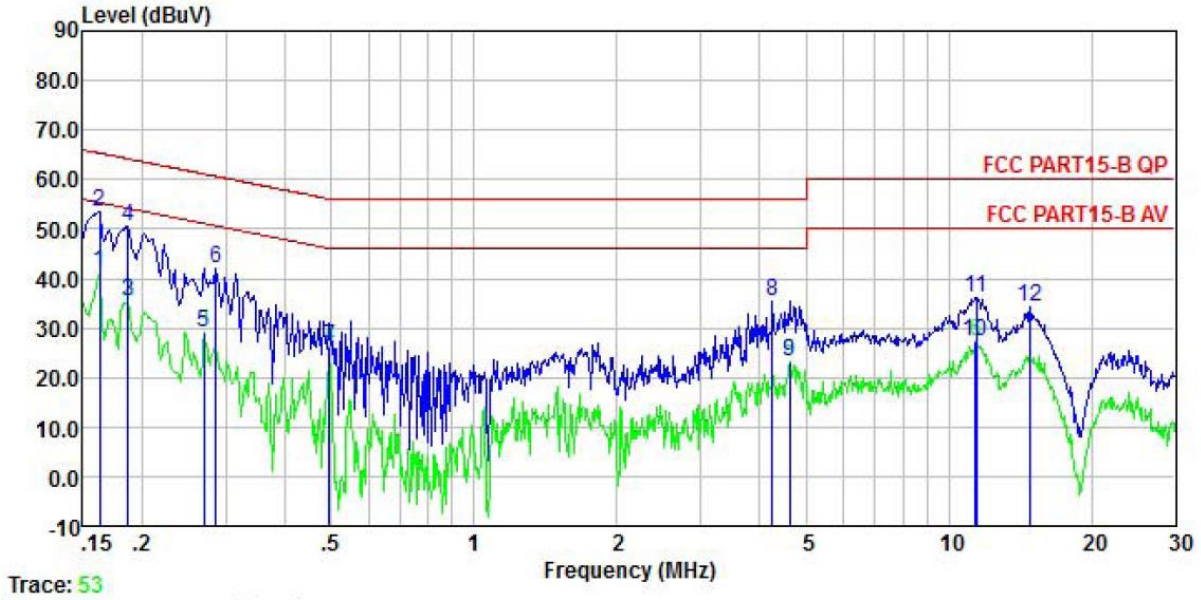


	Freq	Read Level	LISN Factor	Aux2 Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.150	28.63	0.04	10.50	0.01	39.18	56.00	-16.82	Average
2	0.150	45.07	0.04	10.50	0.01	55.62	66.00	-10.38	QP
3	0.186	40.36	0.05	10.50	0.02	50.93	64.20	-13.27	QP
4	0.198	22.39	0.05	10.50	0.04	32.98	53.71	-20.73	Average
5	0.222	32.77	0.05	10.50	0.03	43.35	62.74	-19.39	QP
6	0.343	27.26	0.06	10.50	0.02	37.84	59.13	-21.29	QP
7	0.447	17.77	0.05	10.50	0.03	28.35	46.93	-18.58	Average
8	1.544	13.75	0.08	10.50	0.15	24.48	46.00	-21.52	Average
9	4.622	14.92	0.12	10.50	0.09	25.63	46.00	-20.37	Average
10	4.696	29.34	0.12	10.50	0.09	40.05	56.00	-15.95	QP
11	14.594	12.85	0.28	10.50	0.13	23.76	50.00	-26.24	Average
12	14.986	22.04	0.29	10.50	0.14	32.97	60.00	-27.03	QP

Remark:

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

Product name:	Fingerprint Smart Terminal	**Product model:**	BM5510
Test by:	Mike	**Test mode:**	PC mode
Test frequency:	150 kHz ~ 30 MHz	**Phase:**	Neutral
Test voltage:	AC 120 V/60 Hz		



	Freq	Read Level	LISN Factor	Aux2 Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.162	30.67	0.06	10.50	0.01	41.24	55.34	-14.10	Average
2	0.162	42.89	0.06	10.50	0.01	53.46	65.34	-11.88	QP
3	0.186	24.74	0.05	10.50	0.02	35.31	54.20	-18.89	Average
4	0.186	40.07	0.05	10.50	0.02	50.64	64.20	-13.56	QP
5	0.270	18.39	0.05	10.50	0.02	28.96	51.12	-22.16	Average
6	0.286	31.54	0.05	10.50	0.03	42.12	60.63	-18.51	QP
7	0.497	15.42	0.04	10.50	0.03	25.99	46.05	-20.06	Average
8	4.247	24.57	0.10	10.50	0.08	35.25	56.00	-20.75	QP
9	4.622	12.43	0.11	10.50	0.09	23.13	46.00	-22.87	Average
10	11.377	16.60	0.23	10.50	0.11	27.44	50.00	-22.56	Average
11	11.438	25.40	0.23	10.50	0.11	36.24	60.00	-23.76	QP
12	14.828	23.45	0.27	10.50	0.14	34.36	60.00	-25.64	QP

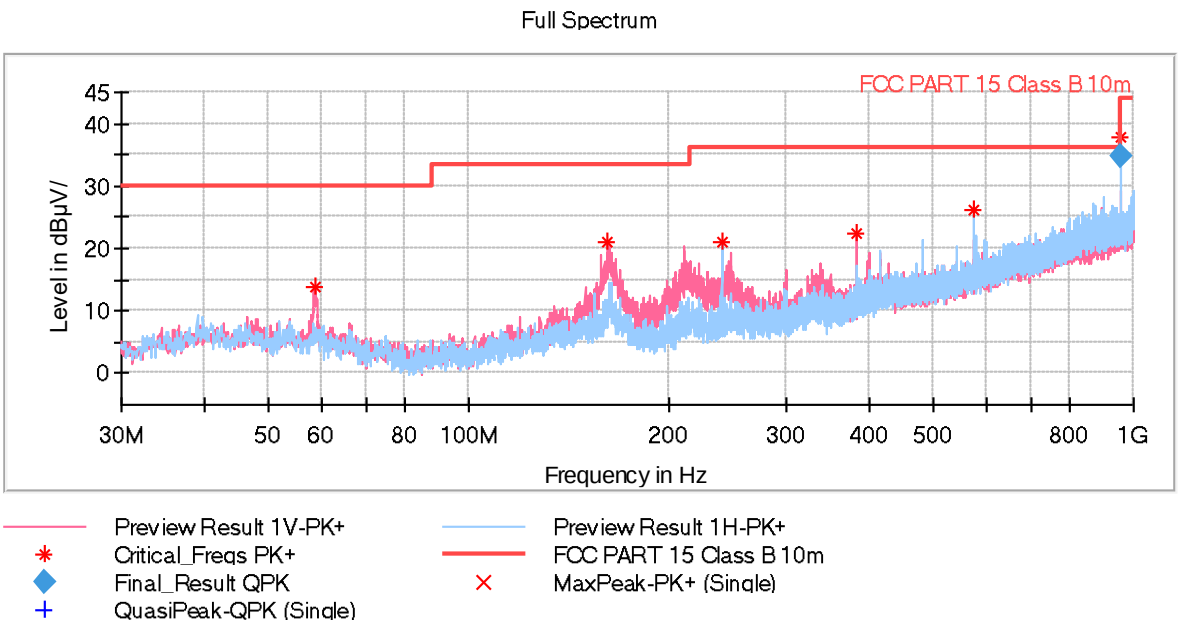
Remark:

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

5.3 Radiated Emission

Below 1GHz:

Product Name:	Fingerprint Smart Terminal	**Product Model:**	BM5510
Test By:	Mike	**Test mode:**	PC mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Vertical & Horizontal
Test Voltage:	AC 120V/60Hz		



Frequency (MHz)	MaxPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
58.518000	13.92	30.00	16.08	100.0	V	77.0	-16.8
162.065500	21.07	33.50	12.43	100.0	V	156.0	-15.0
239.956500	20.97	36.00	15.03	100.0	H	205.0	-17.1
384.001500	22.28	36.00	13.72	100.0	V	290.0	-12.4
576.013000	26.25	36.00	9.75	100.0	H	152.0	-7.7
959.987500	37.88	36.00	-1.88	100.0	H	133.0	-0.4

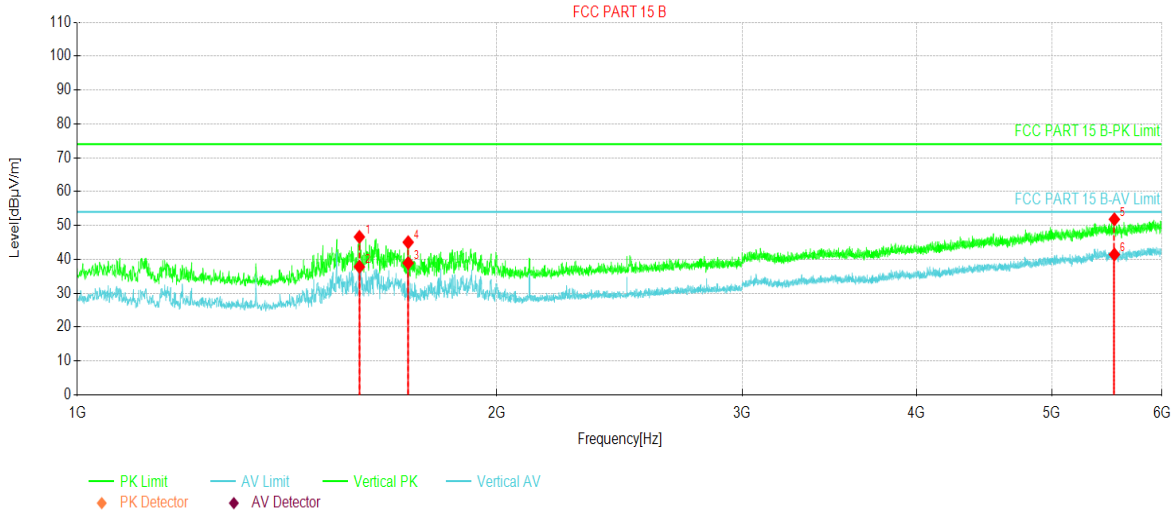
Frequency (MHz)	QuasiPeak (dB µ V/m)	Limit (dB µ	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
959.987500	34.74	36.00	1.26	104.0	H	142.0	-0.4

Remark:

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

Above 1GHz:

Product Name:	Fingerprint Smart Terminal	**Product Model:**	BM5510
Test By:	Mike	**Test mode:**	PC mode
Test Frequency:	1000 MHz ~ 6000 MHz	**Polarization:**	Vertical
Test Voltage:	AC 120V/60Hz		

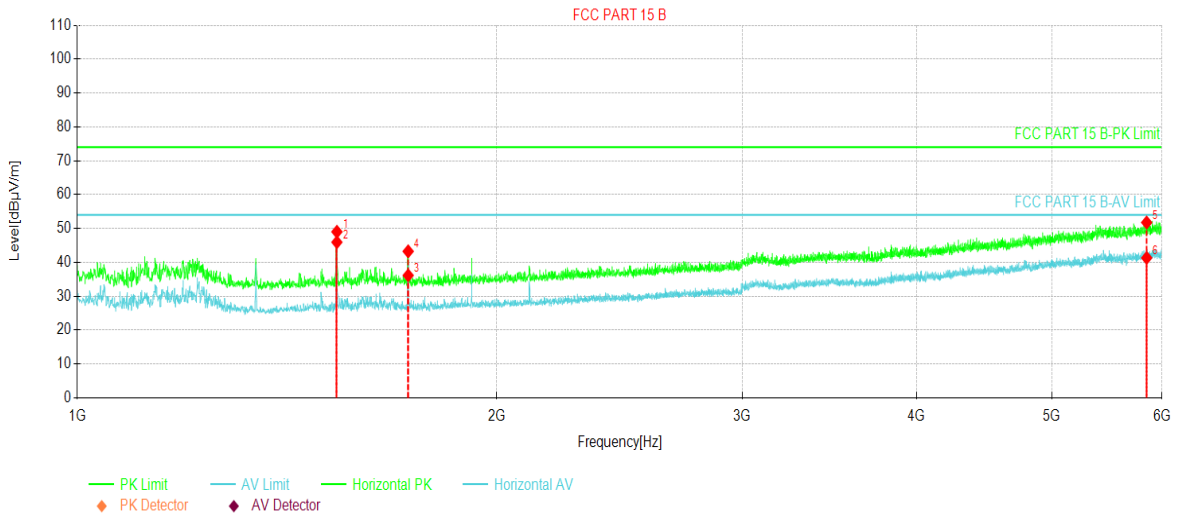


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1593.75	69.07	-22.45	46.62	74.00	27.38	PK	Vertical
2	1593.75	60.27	-22.45	37.82	54.00	16.18	AV	Vertical
3	1727.50	61.03	-22.09	38.94	54.00	15.06	AV	Vertical
4	1727.50	67.15	-22.09	45.06	74.00	28.94	PK	Vertical
5	5546.25	57.92	-6.10	51.82	74.00	22.18	PK	Vertical
6	5546.25	47.55	-6.10	41.45	54.00	12.55	AV	Vertical

Remark:

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

Product Name:	Fingerprint Smart Terminal	**Product Model:**	BM5510
Test By:	Mike	**Test mode:**	PC mode
Test Frequency:	1000 MHz ~ 6000 MHz	**Polarization:**	Horizontal
Test Voltage:	AC 120V/60Hz		



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	1535.62	71.45	-22.42	49.03	74.00	24.97	PK	Horizontal
2	1535.62	68.38	-22.42	45.96	54.00	8.04	AV	Horizontal
3	1727.50	58.24	-22.09	36.15	54.00	17.85	AV	Horizontal
4	1727.50	65.34	-22.09	43.25	74.00	30.75	PK	Horizontal
5	5850.00	56.31	-4.54	51.77	74.00	22.23	PK	Horizontal
6	5850.00	45.87	-4.54	41.33	54.00	12.67	AV	Horizontal

Remark:

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

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