

# EMC REPORT

**Applicant:** Shenzhen Huafurui Technology Co., Ltd.

**Address of Applicant:** Unit 1401 &1402, 14/F, Jinqi zhigu mansion (No. 4 building of Chongwen Garden), Crossing of the Liuxian street and Tangling road, Taoyuan street, Nanshan district, Shenzhen, P.R. China

**Equipment Under Test (EUT)**

Product Name: Smartphone

Model No.: C20

Trade mark: CUBOT

**Applicable standards:** ETSI EN 301 489-1 V2.2.3 (2019-11)  
ETSI EN 301 489-3 V2.1.1 (2019-03)  
Final draft ETSI EN 301 489-17 V3.2.3 (2020-07)  
ETSI EN 301 489-19 V2.1.1 (2019-04)  
Draft ETSI EN 301 489-52 V1.1.0 (2016-11)

**Date of sample receipt:** 17 Aug., 2020

**Date of Test:** 17 Aug., to 22 Sep., 2020

**Date of report issue:** 23 Sep., 2020

**Test Result:** PASS\*

\*In the configuration tested, the EUT complied with the standards specified above.

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The protection requirements with respect to electromagnetic compatibility contained in Directive 2014/53/EU are considered.



Bruce Zhang  
Laboratory Manager



This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

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## 2 Version

Version No.	Date	Description
00	23 Sep., 2020	Original

Tested by: Mike Ou  
Test Engineer

Date: 23 Sep., 2020

Reviewed by: Winner Zhang  
Project Engineer

Date: 23 Sep., 2020

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## 4 Test Summary

Test Item	Test Requirement	Test Method	Application	Result
<b>EMI Test Items</b>				
Radiated Emission	ETSI EN301 489-1	EN 55032	Enclosure	PASS
Conducted Emission	ETSI EN301 489-1	EN 55032	AC port	PASS
Harmonic Current Emissions	ETSI EN301 489-1	EN 61000-3-2	AC port	Not Required
Voltage Fluctuations and Flicker	ETSI EN301 489-1	EN 61000-3-3	AC port	Not Required
<b>EMS Test Items</b>				
ESD (Electrostatic Discharge)	ETSI EN301 489-1	EN 61000-4-2	Enclosure	PASS
Radiated Immunity	ETSI EN301 489-1	EN 61000-4-3	Enclosure	PASS
EFT (Electrical Fast Transients)	ETSI EN301 489-1	EN 61000-4-4	AC port	PASS
Surge Immunity	ETSI EN301 489-1	EN 61000-4-5	AC port	PASS
Injected Currents	ETSI EN301 489-1	EN 61000-4-6	AC port	PASS
Voltage Dips and Interruptions	ETSI EN301 489-1	EN 61000-4-11	AC port	PASS
<b>Remark:</b> 1. Pass: Meet the requirement. 2. N/A: Not Applicable.				

## 5 General Information

### 5.1 Client Information

Applicant:	Shenzhen Huafurui Technology Co., Ltd.
Address:	Unit 1401 &1402, 14/F, Jinqi zhigu mansion (No. 4 building of Chongwen Garden), Crossing of the Liuxian street and Tangling road, Taoyuan street, Nanshan district, Shenzhen, P.R. China
Manufacturer/ Factory:	Shenzhen Huafurui Technology Co., Ltd.
Address:	Unit 1401 &1402, 14/F, Jinqi zhigu mansion (No. 4 building of Chongwen Garden), Crossing of the Liuxian street and Tangling road, Taoyuan street, Nanshan district, Shenzhen, P.R. China

### 5.2 General Description of E.U.T.

Product Name:	Smartphone																	
Model No.:	C20																	
Tx Frequency:	GSM 900: 880MHz~915MHz, GSM 1800: 1710MHz~1785MHz WCDMA 900: 880MHz~915MHz, WCDMA 2100: 1920MHz~1980MHz LTE FDD Band 1: 1920MHz~1980MHz LTE FDD Band 3: 1710MHz~1785MHz LTE FDD Band 7: 2500MHz~2570MHz LTE FDD Band 8: 880MHz~915MHz LTE FDD Band 20: 832MHz~862MHz Wi-Fi: 2412MHz~2472MHz Bluetooth/ BLE: 2402MHz~2480MHz																	
Rx Frequency	GSM 900: 925MHz~960MHz, GSM 1800: 1805MHz~1880MHz WCDMA 900: 925MHz~960MHz, WCDMA 2100: 2110MHz~2170MHz LTE FDD Band 1: 2110MHz~2170MHz LTE FDD Band 3: 1805MHz~1880MHz LTE FDD Band 7: 2620MHz~2690MHz LTE FDD Band 8: 925MHz~960MHz LTE FDD Band 20: 791MHz~821MHz Wi-Fi: 2412MHz~2472MHz Bluetooth/ BLE: 2402MHz~2480MHz GPS: 1575.42MHz																	
Hardware version:	V956_MB_V2.0_20200427																	
Software version:	CUBOT_C20_A025C_V01_20200731																	
Modulation technology:	GSM: <input checked="" type="checkbox"/> Voice(GMSK) <input checked="" type="checkbox"/> GPRS(GMSK) <input checked="" type="checkbox"/> EGPRS(GMSK, 8PSK) WCDMA: <input checked="" type="checkbox"/> RCM(QPSK) <input checked="" type="checkbox"/> HSDPA(QPSK,16QAM) <input checked="" type="checkbox"/> HSUPA(QPSK) LTE: <input checked="" type="checkbox"/> QPSK <input checked="" type="checkbox"/> 16QAM Wi-Fi: <input checked="" type="checkbox"/> 802.11b(DSSS) <input checked="" type="checkbox"/> 802.11g/n (OFDM) Bluetooth: <input checked="" type="checkbox"/> BDR(GFSK) <input checked="" type="checkbox"/> EDR( $\pi$ /4-DQPSK, 8DPSK) <input checked="" type="checkbox"/> LE(GFSK)																	
Antenna Type:	Internal Antenna																	
Antenna Gain:	<table><tr><td>2G:</td><td>GSM900: 1.33dBi</td><td>DCS1800: 0.86dBi</td></tr><tr><td>3G:</td><td>WCDMA 2100: 1.01dBi</td><td>WCDMA 900: 1.25dBi</td></tr><tr><td>4G:</td><td>Band 1: 1.09dBi</td><td>Band 3: 0.89dBi                      Band 7: 1.24dBi</td></tr><tr><td></td><td>Band 8: 1.16dB</td><td>Band 20: 0.84dBi</td></tr><tr><td></td><td>BT/BLE: 1.06dBi</td><td>Wi-Fi:1.11dBi                      GPS:1.25dBi</td></tr></table>			2G:	GSM900: 1.33dBi	DCS1800: 0.86dBi	3G:	WCDMA 2100: 1.01dBi	WCDMA 900: 1.25dBi	4G:	Band 1: 1.09dBi	Band 3: 0.89dBi                      Band 7: 1.24dBi		Band 8: 1.16dB	Band 20: 0.84dBi		BT/BLE: 1.06dBi	Wi-Fi:1.11dBi                      GPS:1.25dBi
2G:	GSM900: 1.33dBi	DCS1800: 0.86dBi																
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	Band 8: 1.16dB	Band 20: 0.84dBi																
	BT/BLE: 1.06dBi	Wi-Fi:1.11dBi                      GPS:1.25dBi																

Power supply:	Rechargeable Li-ion Battery DC3.85V/4200mAh
AC adapter:	Model No.:HJ-0502000W2-EU Input: AC100-240V, 50/60Hz 0.3A Output: DC 5.0V, 2.0A

### 5.3 Test mode

Radiated emission
TM 1: GSM 900 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 2: GSM 900 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 3: GSM 1800 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 4: GSM 1800 idle + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 5: WCDMA 2100 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link+ GPS link + NFC link + Earphone + Adapter
TM 6: WCDMA 2100 idle + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 7: WCDMA 900 link + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link+ GPS link + NFC link + Earphone + Adapter
TM 8: WCDMA 900 idle + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link+ GPS link + NFC link + Earphone + Adapter
TM 9: LTE FDD Band 1 link + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 10: LTE FDD Band 1 idle + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link + Earphone+ Adapter
TM 11: LTE FDD Band 3 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone+ Adapter
TM 12: LTE FDD Band 3 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone+ Adapter
TM 13: LTE FDD Band 7 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone+ Adapter
TM 14: LTE FDD Band 7 idle + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone+ Adapter
TM 15: LTE FDD Band 8 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone+ Adapter
TM 16: LTE FDD Band 8 idle + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone+ Adapter
TM 17: LTE FDD Band 20 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone+ Adapter
TM 18: LTE FDD Band 20 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + + NFC link Earphone+ Adapter
TM 19: GSM 900 idle + Wi-Fi link + Bluetooth link +GPS link + NFC link + USB cable(link with PC)
TM 20: Multimedia function on + Earphone+ Adapter
TM 21: Camera + Earphone+ Adapter
Conducted emission
TM 1: GSM 900 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 2: GSM 1800 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 3: WCDMA 2100 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 4: WCDMA 900 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 5: LTE FDD Band 1 link + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 6: LTE FDD Band 3 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 7: LTE FDD Band 7 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 8: LTE FDD Band 8 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 9: LTE FDD Band 20 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 10: Multimedia function on + Earphone + Adapter
TM 11: Camera+ Earphone + Adapter
RS
TM 1: GSM 900 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Adapter
TM 2: GSM 900 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 3: GSM 1800 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Adapter
TM 4: GSM 1800 idle + Wi-Fi link(2.4G Wi-Fi ) +Bluetooth link + GPS link + NFC link + Earphone + Adapter
TM 5: WCDMA 2100 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Adapter

TM 6: WCDMA 2100 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 7: WCDMA 900 link + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link +Adapter  
 TM 8: WCDMA 900 idle + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 9: LTE FDD Band 1 link + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 10: LTE FDD Band 1idle + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 11: LTE FDD Band 3 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 12: LTE FDD Band 3 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 13: LTE FDD Band 7 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 14: LTE FDD Band 7 idle + Wi-Fi link(2.4G Wi-Fi ) +Bluetooth link + GPS link + NFC link + Earphone + Adapter  
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 TM 16: LTE FDD Band 8 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 17: LTE FDD Band 20 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 18: LTE FDD Band 20 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 19: GSM 900 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + USB cable(link with PC)  
 TM 20: Multimedia function on + Earphone + Adapter  
 TM 21: Camera+ Earphone + Adapter

**CS**

TM 1: GSM 900 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Adapter  
 TM 2: GSM 900 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 3: GSM 1800 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Adapter  
 TM 4: GSM 1800 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 5: WCDMA 2100 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Adapter  
 TM 6: WCDMA 2100 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 7: WCDMA 900 link + Wi-Fi link(2.4G Wi-Fi ) +Bluetooth link + GPS link + NFC link + Adapter  
 TM 8: WCDMA 900 idle + Wi-Fi link(2.4G Wi-Fi ) +Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 9: LTE FDD Band 1 link + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 10: LTE FDD Band 1 idle + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 11: LTE FDD Band 3 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 12: LTE FDD Band 3 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 13: LTE FDD Band 7 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 14: LTE FDD Band 7 idle + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 15: LTE FDD Band 8 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 16: LTE FDD Band 8 idle + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 17: LTE FDD Band 20 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 18: LTE FDD Band 20 idle + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 19: Multimedia function on + Earphone + Adapter  
 TM 20: Camera+ Earphone + Adapter

**ESD**

TM 1: GSM 900 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 2: GSM 1800 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 3: WCDMA 2100 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 4: WCDMA 900 link + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link+ GPS link + NFC link + Earphone + Adapter  
 TM 5: LTE FDD Band 1 link + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 6: LTE FDD Band 3 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 7: LTE FDD Band 7 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 M 8: LTE FDD Band 8 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter



TM 9: LTE FDD Band 20 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 10: GSM 900 idle + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link +GPS link + NFC link + USB cable(link with PC)  
 TM 11: Multimedia function on + Earphone + Adapter  
 TM 12: Camera + Earphone + Adapter

**EFT/Surge/Dips**

TM 1: GSM 900 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 2: GSM 1800 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 3: WCDMA 2100 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 4: WCDMA 900 link + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 5: LTE FDD Band 1 link + Wi-Fi link(2.4G Wi-Fi ) + Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 6: LTE FDD Band 3 link + Wi-Fi link(2.4G Wi-Fi )+Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 7: LTE FDD Band 7 link + Wi-Fi link(2.4G Wi-Fi ) +Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 8: LTE FDD Band 8 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 9: LTE FDD Band 20 link + Wi-Fi link(2.4G Wi-Fi )+ Bluetooth link + GPS link + NFC link + Earphone + Adapter  
 TM 10: Multimedia function on + Earphone + Adapter  
 TM 11: Camera + Earphone + Adapter

Remark: The report only reflects the test data of worst mode.

**5.4 Description of Support Units**

Manufacturer	Description	Model	S/N	FCC ID/DoC
MERCURY	Wireless router	MW150R	12922104015	FCC ID
NAKAMICHI	Bluetooth earphone	T8	N/A	FCC ID
DELL	PC	OPTIPLEX7070	2J8XSZ2	DoC
DELL	MONITOR	SE2018HR	3M7QPY2	DoC
DELL	KEYBOARD	KB216d	N/A	DoC
DELL	MOUSE	MS116t1	N/A	DoC
HP	Printer	HP LaserJet P1007	VNFP409729	DoC
Anritsu	Simulated Station	MT8820C	6201026545	N/A
Simulated Station	Rohde& Schwarz	CMU200	122477	N/A

**5.5 Measurement Uncertainty**

Parameter	Expanded Uncertainty (Confidence of 95%)
Conducted Emission (9kHz ~ 30MHz)	±1.60 dB
Radiated Emission (9kHz ~ 30MHz)	±3.12 dB
Radiated Emission (30MHz ~ 1000MHz)	±4.32 dB
Radiated Emission (1GHz ~ 18GHz)	±5.16 dB
Radiated Emission (18GHz ~ 26.5GHz)	±3.20 dB

**5.6 Description of Cable Used**

CableType	Description	Length	From	To
DetachedUSB Cable	Shielded	1.0m	EUT	PC/Adapter



## 5.7 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC- Designation No.: CN1211**

Shenzhen ZhongjianNanfang Testing 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 of Shenzhen ZhongjianNanfang Testing Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 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>

## 5.8 Laboratory Location

Shenzhen ZhongjianNanfang Testing Co., Ltd.

Address: No.110~116, Building B, Jinyuan Business Building, Xixiang Road, Bao'an District, Shenzhen, Guangdong, China

Tel: +86-755-23118282, Fax: +86-755-23116366

Email: info@ccis-cb.com, Website: <http://www.ccis-cb.com>

## 5.9 Monitoring of EUT for the Immunity Test

Visual:	Monitored the display of EUT
Sound:	Monitored the sound of EUT
Other:	Monitored the data link of EUT

## 5.10 Test Instruments list

Radiated Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
3m SAC	SAEMC	9m*6m*6m	966	07-22-2020	07-21-2021
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-07-2020	03-06-2021
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-07-2020	03-06-2021
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-07-2020	03-06-2021
Pre-amplifier	CD	PAP-1G18	11804	03-07-2020	03-06-2021
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-05-2020	03-04-2021
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-05-2020	03-04-2021
Simulated Station	Anritsu	MT8820C	6201026545	03-05-2020	03-04-2021
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-07-2020	03-06-2021
Cable	MICRO-COAX	MFR64639	K10742-5	03-07-2020	03-06-2021
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-07-2020	03-06-2021

Conducted Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESCI	101189	03-05-2020	03-04-2021
Pulse Limiter	SCHWARZBECK	OSRAM 2306	9731	03-05-2020	03-04-2021
LISN	CHASE	MN2050D	1447	03-05-2020	03-04-2021
LISN	Rohde & Schwarz	ESH3-Z5	8438621/010	07-21-2020	07-20-2021
ISN	Schwarzbeck	CAT3 8158	#96	03-05-2020	03-04-2021
ISN	Schwarzbeck	CAT5 8158	#166	03-05-2020	03-04-2021
ISN	Schwarzbeck	NTFM 8158	#126	03-05-2020	03-04-2021
Cable	HP	10503A	N/A	03-05-2020	03-04-2021
EMI Test Software	AUDIX	E3	Version: 6.110919b		

ESD:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
ESD Simulator	Haefely	ONYX30	183900	03-17-2020	03-16-2021

Surge:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
Surge test system	Prima	SUG61005BG	PR160951341	11-18-2019	11-17-2020
Surge test system	Prima	SUG10/700G	PR161151381	11-18-2019	11-17-2020

EFT:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
EFT test system	Prima	EFT61004AG	PR16084621	11-18-2019	11-17-2020
Coupling clamp	Prima	/	CCIS0189	11-18-2019	11-17-2020

Voltage dips and Interruption:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
Voltage dips and Interruption test system	Prima	DRP61011AG	PR16076343	11-18-2019	11-17-2020

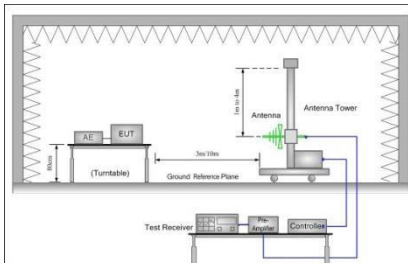
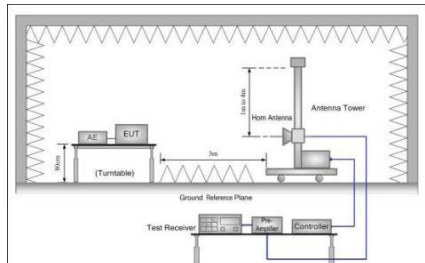
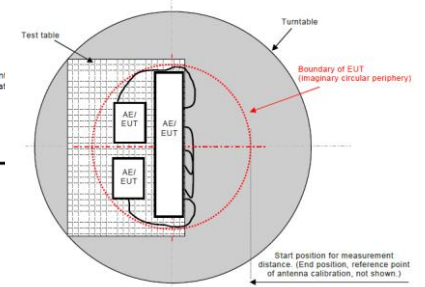
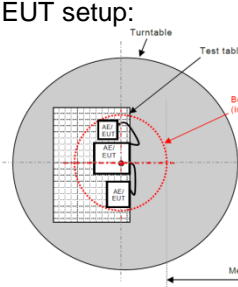
Conducted Immunity:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Conducted Disturbance Test system	SCHLODER	CDG6000	126B1445/2016	03-05-2020	03-04-2021
Coupling/Decoupling Network	SCHLODER	CDN-M2+3	A2210417/2016	03-05-2020	03-04-2021
EM Clamp	SCHLODER	EMCL-20	132A1281/2016	03-05-2020	03-04-2021
Nexus Conduituining Amplifier	B&K	2690-0S2	3003552	N/A	N/A
MUTH Simulator	B&K	4227	N/A	N/A	N/A
Sound Level Calibrator	B&K	4231	N/A	N/A	N/A
Audio Analyzer	Rohde & Schwarz	UPL 16	100150	03-05-2020	03-04-2021

Radiated Immunity:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Signal Generator	Rohde & Schwarz	SMR20	1104.002.20	03-05-2020	03-04-2021
RF Amplifier 80M-1GHz	Amplifier Research	AR 150W1000	115243	03-05-2020	03-04-2021
RF Amplifier 1GHz-4.2GHz	Amplifier Research	AR 25S1G4AM1	145863	03-05-2020	03-04-2021
RF Amplifier 4GHz-6GHz	Amplifier Research	35S4G8A	247443	03-05-2020	03-04-2021
Power Meter	Rohde & Schwarz	NRVS	1020.1809.02	03-05-2020	03-04-2021
Software EMC32	Rohde & Schwarz	EMC32-S	N/A	N/A	N/A
Log-periodic Antenna	Amplifier Research	AT1080	3654	03-05-2020	03-04-2021
Antenna Tripod	Amplifier Research	TP1000A	7412	N/A	N/A
High Gain Horn Antenna	Amplifier Research	AT4002A	6987	03-05-2020	03-04-2021
Nexus Conduituining Amplifier	B&K	2690	3003552	N/A	N/A
MUTH Simulator	B&K	4227	N/A	N/A	N/A
Sound Level Calibrator	B&K	4231	N/A	N/A	N/A
Audio Analyzer	Rohde & Schwarz	UPL 16	100150	03-05-2020	03-04-2021

## 6 EMC Requirements Specification in ETSI EN 301489

### 6.1 EMI (Emission)

#### 6.1.1 Radiated Emission

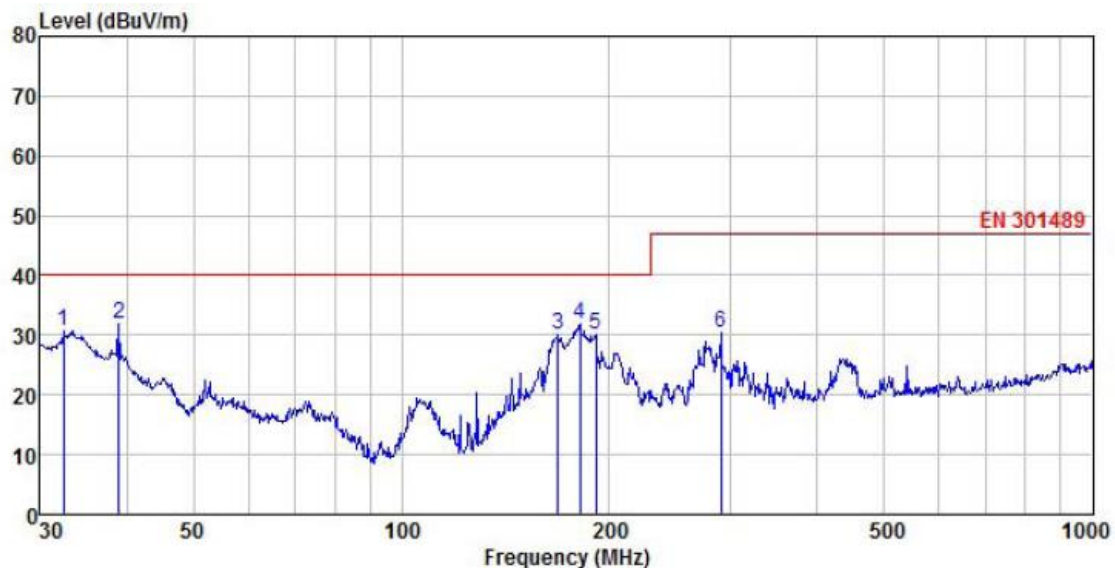
Test Requirement:	ETSI EN301 489-1				
Test Method:	EN55032				
TestFrequencyRange:	30MHz to 6GHz				
TestDistance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	100kHz	300kHz	QP Value
	Above 1GHz	Peak	1MHz	3MHz	PK Value
		Average	1MHz	3MHz	AV Value
Limit:	Frequency	Limit (dBuV/m @3m)			Remark
	30MHz-230MHz	40.0			QP Value
	230MHz-1GHz	47.0			QP Value
	1GHz-3GHz	50.0			AV Value
		70.0			PK Value
	3GHz-6GHz	54.0			AV Value
74.0			PK Value		
Test setup:	Below 1GHz:		Above 1GHz:		
					
	<div>EUT setup:</div> <div></div>				
Test Procedure:	<div>30MHz to 1GHz:</div> <div><div>1.</div><div>The radiated emissions test was conducted in a semi-anechoic chamber.</div></div> <div><div>2.</div><div>The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.</div></div> <div><div>3.</div><div>Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emissions spectrum plots of the EUT.</div></div> <div><div>4.</div><div>The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization.</div></div>				

	<p><b>Above 1GHz:</b></p> <ol style="list-style-type: none"><li>1. The radiated emissions test was conducted in a fully-anechoic chamber.</li><li>2. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.</li><li>3. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emission spectrum plots of the EUT.</li><li>4. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization.</li></ol>
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

## Measurement Data:

## Below 1GHz:

Product Name:	Smartphone	Product Model:	C20
Test By:	Mike	Test mode:	TM 1
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical
Test Voltage:	AC 230/50Hz	Environment:	Temp: 24℃ Humi: 57%

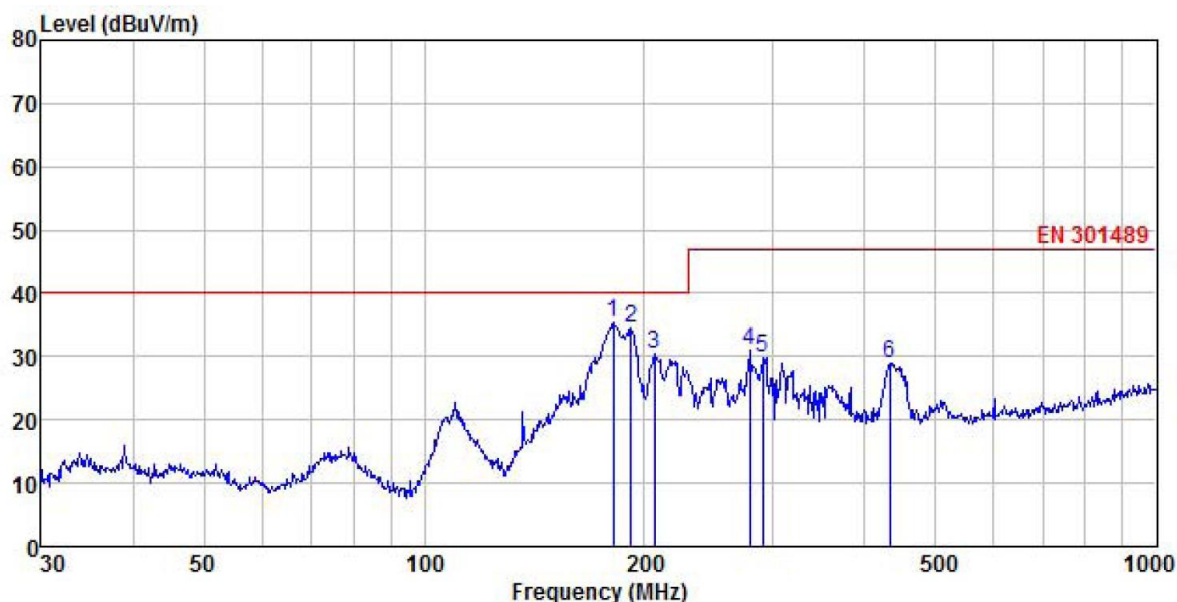


	Freq	Read Level	Antenna Factor	Cable Loss	Aux Factor	Preamp Factor	Level	Limit	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB	
1	32.406	48.08	12.20	0.37	0.00	29.97	30.68	40.00	-9.32	QP
2	39.024	48.67	12.76	0.35	0.00	29.91	31.87	40.00	-8.13	QP
3	168.414	42.37	16.20	0.65	0.00	29.06	30.16	40.00	-9.84	QP
4	181.283	43.19	16.98	0.68	0.00	28.96	31.89	40.00	-8.11	QP
5	191.074	40.86	17.50	0.70	0.00	28.89	30.17	40.00	-9.83	QP
6	290.017	39.41	18.66	0.85	0.00	28.47	30.45	47.00	-16.55	QP

## Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.
3. The Aux Factor is a notch filter switch box loss, this item is not used.

Product Name:	Smartphone	Product Model:	C20
Test By:	Mike	Test mode:	TM 1
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	AC 230/50Hz	Environment:	Temp: 24℃ Humi: 57%



	Freq	Read	Antenna	Cable	Aux	Preamp	Level	Limit	Over	Remark
	MHz	Level	Factor	Loss	Factor	Factor	Level	Line	Limit	
		dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB	
1	181.283	46.58	16.98	0.68	0.00	28.96	35.28	40.00	-4.72	QP
2	191.745	45.27	17.55	0.70	0.00	28.89	34.63	40.00	-5.37	QP
3	206.398	40.08	18.33	0.73	0.00	28.79	30.35	40.00	-9.65	QP
4	278.067	39.93	18.62	0.84	0.00	28.49	30.90	47.00	-16.10	QP
5	290.017	38.85	18.66	0.85	0.00	28.47	29.89	47.00	-17.11	QP
6	432.546	37.59	19.17	1.03	0.00	28.84	28.95	47.00	-18.05	QP

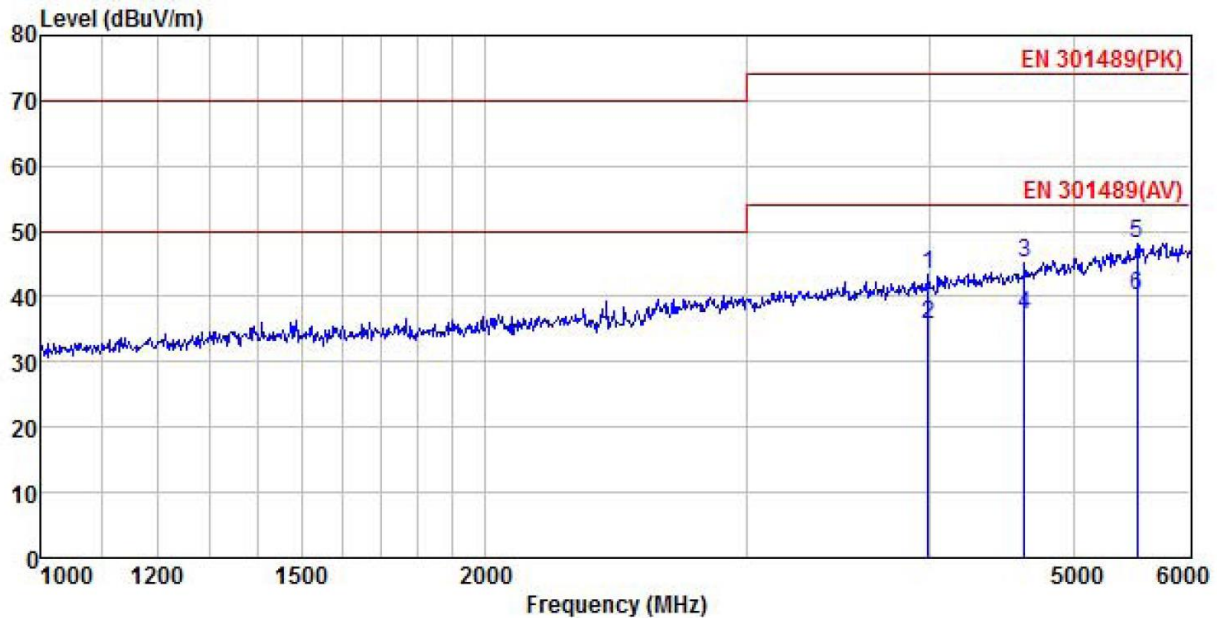
**Remark:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.
3. The Aux Factor is a notch filter switch box loss, this item is not used.



**Above 1GHz:**

<b>Product Name:</b>	Smartphone	<b>Product Model:</b>	C20
<b>Test By:</b>	Mike	<b>Test mode:</b>	TM 1
<b>Test Frequency:</b>	1 GHz ~ 6 GHz	<b>Polarization:</b>	Vertical
<b>Test Voltage:</b>	AC 230/50Hz	<b>Environment:</b>	Temp: 24℃ Humi: 57%

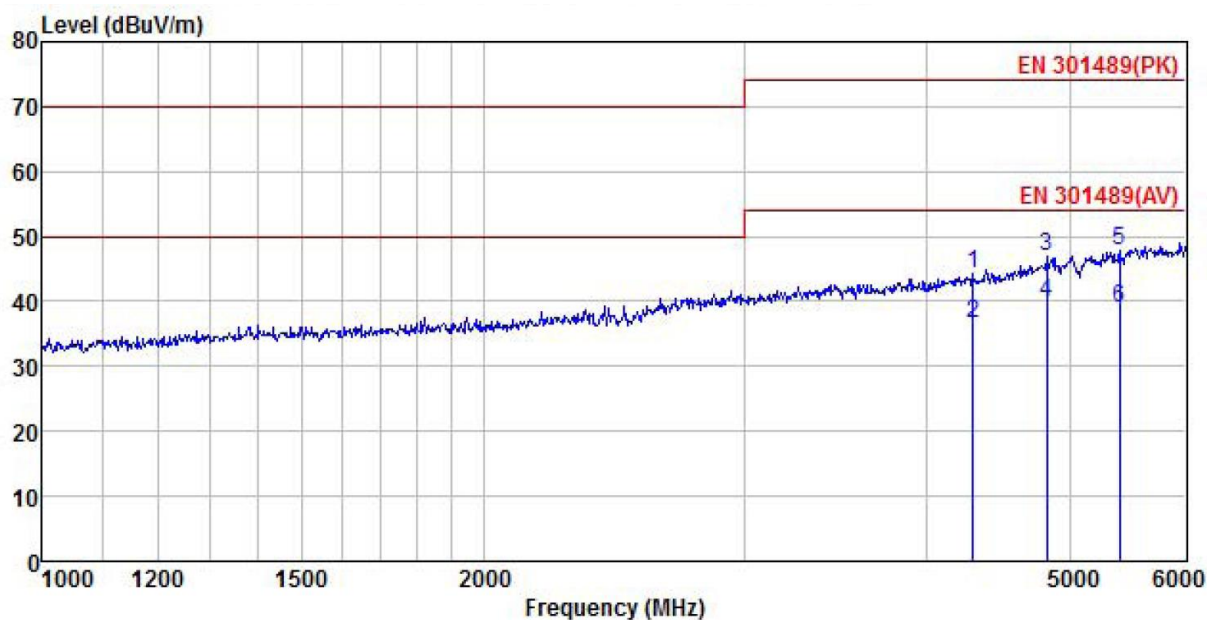


	Freq	ReadAntenna	Cable	Aux	Preamp	Level	Limit	Over	
	MHz	Level	Factor	Loss	Factor	Factor	Line	Limit	Remark
		dBuV	dB/m	dB	dB	dB	dBuV/m	dB	
1	3987.794	48.03	29.29	5.76	2.20	41.81	43.47	74.00	-30.53 Peak
2	3987.794	40.29	29.29	5.76	2.20	41.81	35.73	54.00	-18.27 Average
3	4635.509	48.12	30.43	6.26	2.40	42.07	45.14	74.00	-28.86 Peak
4	4635.509	40.07	30.43	6.26	2.40	42.07	37.09	54.00	-16.91 Average
5	5525.306	47.93	32.31	7.01	2.66	41.82	48.09	74.00	-25.91 Peak
6	5525.306	39.99	32.31	7.01	2.66	41.82	40.15	54.00	-13.85 Average

**Remark:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	Smartphone	Product Model:	C20
Test By:	Mike	Test mode:	TM 1
Test Frequency:	1 GHz ~ 6 GHz	Polarization:	Horizontal
Test Voltage:	AC 230/50Hz	Environment:	Temp: 24℃ Humi: 57%

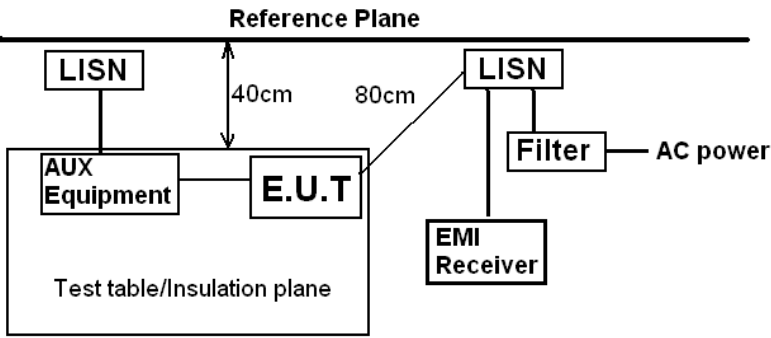


	ReadAntenna	Cable	Aux	Preamp		Limit	Over	
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
-----MHz-----	-----dBuV-----	-----dB/m-----	-----dB-----	-----dB-----	-----dB-----	-----dBuV/m-----	-----dBuV/m-----	-----dB-----
1	4299.472	48.01	29.80	5.99	2.30	41.89	44.21	74.00 -29.79 Peak
2	4299.472	40.33	29.80	5.99	2.30	41.89	36.53	54.00 -17.47 Average
3	4821.884	49.08	30.81	6.41	2.44	41.82	46.92	74.00 -27.08 Peak
4	4821.884	42.01	30.81	6.41	2.44	41.82	39.85	54.00 -14.15 Average
5	5407.773	47.93	32.10	6.92	2.62	41.86	47.71	74.00 -26.29 Peak
6	5407.773	39.32	32.10	6.92	2.62	41.86	39.10	54.00 -14.90 Average

## Remark:

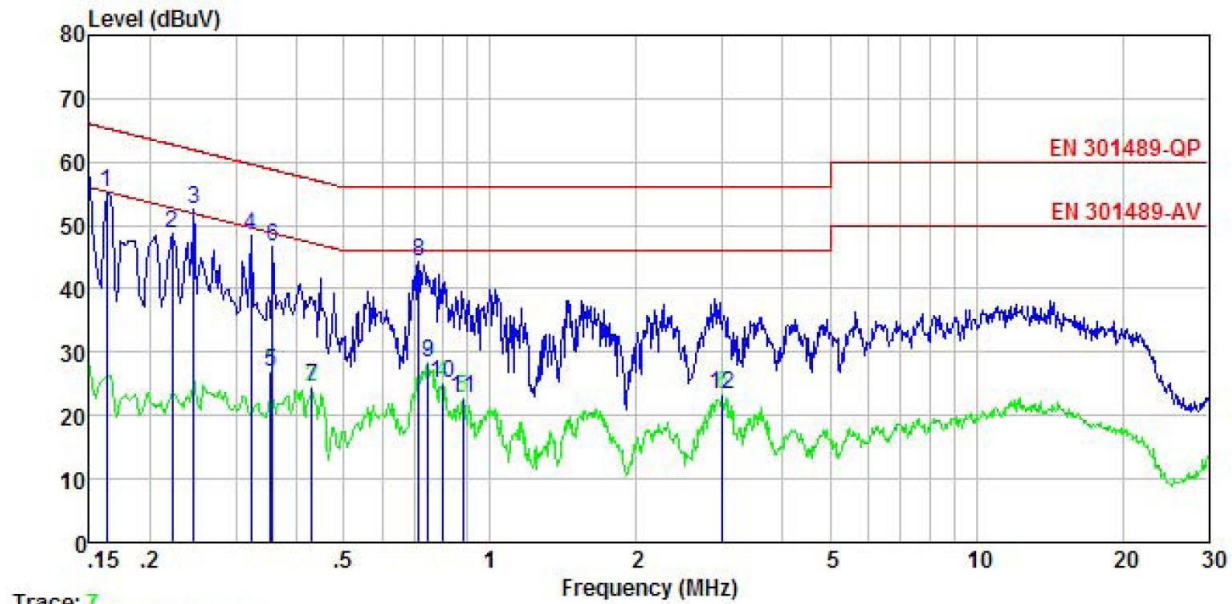
1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

## 6.1.2 Conducted Emissions

Test Requirement:	ETSI EN301 489-1		
Test Method:	EN 55032		
TestFrequencyRange:	150kHz to 30MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9kHz, VBW=30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
* Decreases with the logarithm of the frequency.			
Test setup:	 <p><i>Remark:</i>  E.U.T: Equipment Under Test  LISN: Line Impedance Stabilization Network  Test table height=0.8m</p>		
Test procedure	<p>The E.U.T and simulators are connected to the main power through a line impedance stabilization network(L.I.S.N.). Which provide a 50ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). 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 EN55032 Class B on conducted measurement.</p>		
Test Instruments:	Refer to section 5.10 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Passed		

## Measurement Data:

Product name:	Smartphone	Product model:	C20
Test by:	Mike	Test mode:	TM 1
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 230 V/50 Hz	Environment:	Temp: 22.5℃ Humi: 55%



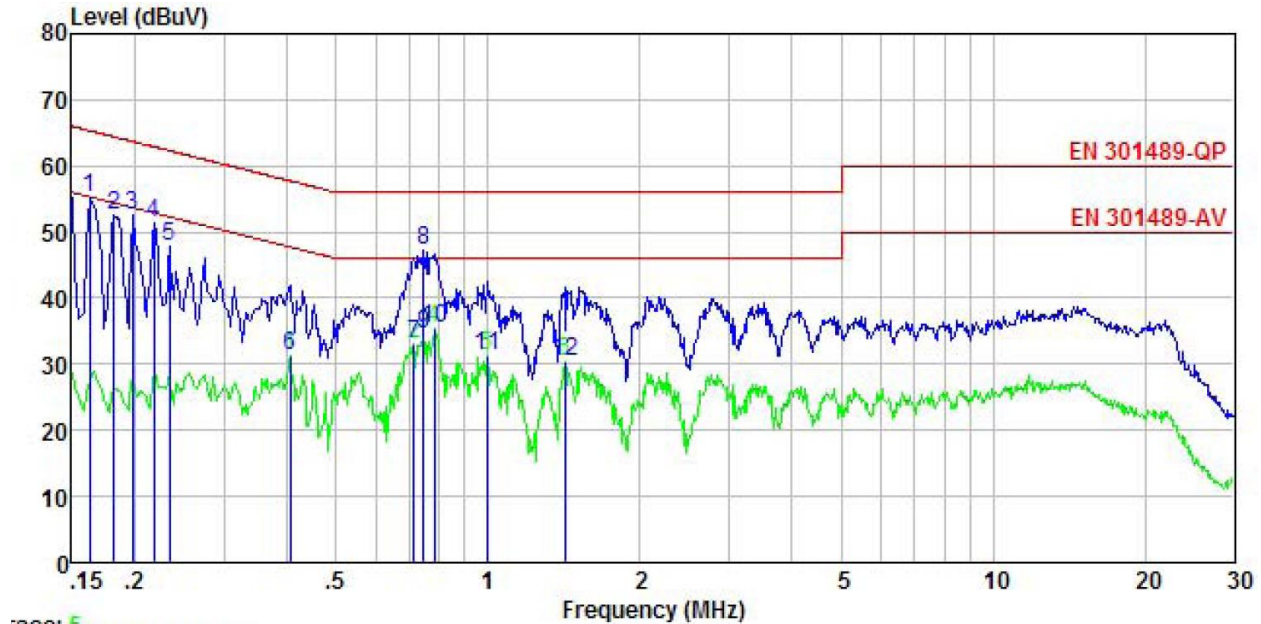
	Freq	Read Level	LISN Factor	Cable Loss	Aux Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.162	45.06	-0.58	10.77	-0.08	55.17	65.34	-10.17	QP
2	0.222	38.74	-0.58	10.76	-0.19	48.73	62.74	-14.01	QP
3	0.246	42.58	-0.57	10.75	-0.21	52.55	61.91	-9.36	QP
4	0.322	38.34	-0.53	10.74	-0.09	48.46	59.66	-11.20	QP
5	0.354	16.40	-0.51	10.73	0.14	26.76	48.87	-22.11	Average
6	0.358	36.28	-0.51	10.73	0.16	46.66	58.78	-12.12	QP
7	0.431	14.07	-0.46	10.73	0.16	24.50	47.24	-22.74	Average
8	0.712	34.25	-0.53	10.78	-0.36	44.14	56.00	-11.86	QP
9	0.747	18.39	-0.55	10.79	-0.24	28.39	46.00	-17.61	Average
10	0.796	14.86	-0.56	10.81	-0.09	25.02	46.00	-20.98	Average
11	0.880	12.40	-0.59	10.83	0.15	22.79	46.00	-23.21	Average
12	3.009	13.06	-0.43	10.92	-0.21	23.34	46.00	-22.66	Average

## Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss + Aux Factor.



Product name:	Smartphone	Product model:	C20
Test by:	Mike	Test mode:	TM 1
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 230 V/50 Hz	Environment:	Temp: 22.5℃ Humi: 55%



	Freq	Read Level	LISN Factor	Cable Loss	Aux Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.162	45.02	-0.68	10.77	0.01	55.12	65.34	-10.22	QP
2	0.182	42.35	-0.68	10.77	0.00	52.44	64.42	-11.98	QP
3	0.198	42.32	-0.67	10.76	0.00	52.41	63.71	-11.30	QP
4	0.219	41.14	-0.67	10.76	0.00	51.23	62.88	-11.65	QP
5	0.234	37.81	-0.67	10.75	0.00	47.89	62.30	-14.41	QP
6	0.406	21.14	-0.63	10.72	-0.05	31.18	47.73	-16.55	Average
7	0.712	22.97	-0.64	10.78	0.04	33.15	46.00	-12.85	Average
8	0.747	37.14	-0.65	10.79	0.05	47.33	56.00	-8.67	QP
9	0.747	24.43	-0.65	10.79	0.05	34.62	46.00	-11.38	Average
10	0.783	25.16	-0.65	10.81	0.05	35.37	46.00	-10.63	Average
11	0.994	20.99	-0.68	10.87	0.08	31.26	46.00	-14.74	Average
12	1.418	20.05	-0.70	10.92	0.13	30.40	46.00	-15.60	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss + Aux Factor.

### 6.1.3 Harmonics Test Results

<b>Test Requirement:</b>	ETSI EN 301 489-1/3/17/19/52: EN61000-3-2
<b>Test Method:</b>	N/A: See Remark Below
<b>Remark:</b>	<p>There is no need for Harmonics test to be performed on this product (rated power is less than 75W) in accordance with EN 61000-3-2.</p> <p>For further details, please refer to Clause 7, Note 1 of EN 61000-3-2 which states:</p> <p>“For the following categories of equipment limits are not specified in this edition of the standard.</p> <p>Note 1: Equipment with a rated power of 75W or less, other than lighting equipment.”</p>

### 6.1.4 Flicker Test Results

<b>Test Requirement:</b>	ETSI EN 301 489-1/3/17/19/52: EN61000-3-3
<b>Test Method:</b>	N/A: See Remark Below
<b>Remark:</b>	<ol style="list-style-type: none"><li>1. The appropriate requirements of EN 61000-3-3 [9] for voltage fluctuations and flicker apply for equipment covered by the scope of the present document with an input current up to and including 16A per phase. For equipment with an input current of greater than 16A per phase EN 61000-3-11 [12] applies.</li><li>2. As the section 6.1 of EN 61000-3-3, “Devices and Equipment that do (with the utmost probability) not generate relevant voltage fluctuations or flicker need not to be tested”.</li></ol>

## 6.2 EMS (Immunity)

### Performance Criteria of ETSI EN 301 489-1/3/17/19/52, sub clause 6

Criteria	Performance Criteria of EN 301 489-1 clause 6	
CT/CR	During the test, the equipment shall: <ul style="list-style-type: none"><li>• continue to operate as intended;</li><li>• not unintentionally transmit;</li><li>• not unintentionally change its operating state;</li><li>• not unintentionally change critical stored data.</li></ul>	
TT/TR	For all ports and transient phenomena with the exception described below, the following applies: <ul style="list-style-type: none"><li>• The application of the transient phenomena shall not result in a change of the mode of operation (e.g. unintended transmission) or the loss of critical stored data.</li><li>• After application of the transient phenomena, the equipment shall operate as intended.</li></ul> For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies: <ul style="list-style-type: none"><li>• For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be otherwise restored. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.</li><li>• For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.</li></ul>	
Performance Criteria of EN 301 489-3 clause 6		
In the table below: <ul style="list-style-type: none"><li>• performance criterion A applies for immunity tests with phenomena of a continuous nature;</li><li>• performance criterion B applies for immunity tests with phenomena of a transient nature.</li></ul> NOTE: Whether a phenomenon is considered transient, continuous or otherwise is indicated in the test proceduresfor the phenomenon in ETSI EN 301 489-1 [1], clause 9.		
Table 2: Performance Requirements		
Criterion	During test	After test
A	Operate as intended No loss of function No unintentional responses	Operate as intended No loss of function No degradation of performance No loss of stored data or user programmable functions
B	May show loss of function No unintentional responses	Operate as intended Lost function(s) shall be self-recoverable No degradation of performance No loss of stored data or user programmable functions



Criteria	Performance Criteria of EN 301 489-17 clause 6
CT	The performance criteria A shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an ACKnowledgement (ACK) or Not ACKnowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
TT	The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
CR	The performance criteria A shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
TR	The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

**Table 1: Performance criteria**

Criteria	During test	After test (i.e. as a result of the application of the test)
A	Shall operate as intended. (see note). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of critical stored data.
B	May be loss of function.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no loss of critical stored data.
C	May be loss of function.	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no loss of critical stored data.

NOTE: Operate as intended during the test allows a level of degradation in accordance with clause 6.2.2.

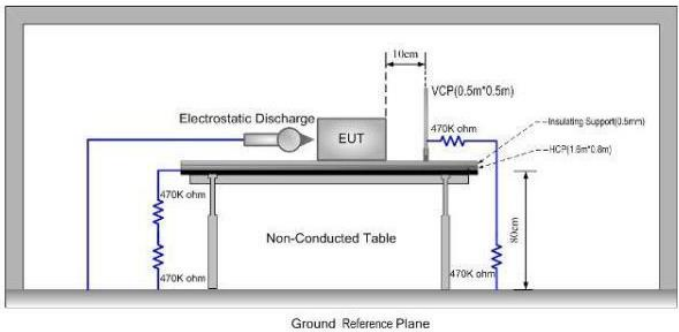
## 6.2.2 Minimum performance level

For equipment that supports a PER or FER, the minimum performance level shall be a PER or FER less than or equal to 10 %.

For equipment that does not support a PER or a FER, the minimum performance level shall be no loss of the wireless transmission function needed for the intended use of the equipment.

Criteria	Performance Criteria of EN 301 489-19 clause 6
CR	<p>For the EUT, excluding spot frequency tests as part of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2):</p> <ul style="list-style-type: none"> <li>• the general performance criteria set out in clause 6.1;</li> <li>• during the test no false calls shall occur;</li> <li>• at the conclusion of the test comprising the series of individual exposures the EUT shall operate as intended with no loss of functions or stored data (messages), as declared by the manufacturer.</li> </ul> <p>For the spot frequency test as part of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2) the EUT shall be assessed by monitoring the accuracy of the call received alert signal.</p>
TR	<p>For the EUT:</p> <ul style="list-style-type: none"> <li>• the general performance criteria set out in clause 6.1;</li> <li>• during the test no false calls shall occur;</li> <li>• at the conclusion of the test comprising the series of individual exposures, the EUT shall operate as intended with no loss of function and/or stored data (messages), as declared by the manufacturer.</li> </ul>
Criteria	Performance Criteria of EN 301 489-52 clause 6
CT	<p>A communication link shall be established at the start of the test, and maintained during the test, see clauses 4.2.3 and 4.2.4.</p> <p>During the test, the uplink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).</p> <p>NOTE: When there is a high level background noise present the filter bandwidth can be reduced down to a minimum of 40 Hz.</p> <p>At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.</p>
TT	<p>A communications link shall be established at the start of the test, see appropriate clauses 4.2 to 4.2.4.</p> <p>At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link.</p> <p>At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained.</p> <p>In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.</p>
CR	<p>A communications link shall be established at the start of the test, see appropriate clauses 4.2 to 4.2.6.</p> <p>During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence.</p> <p>During the test, the downlink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).</p> <p>NOTE: When there is a high level background noise present the filter bandwidth can be reduced down to a minimum of 40 Hz.</p> <p>At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained.</p>
TR	<p>A communications link shall be established at the start of the test, see appropriate clauses 4.2 to 4.2.6.</p> <p>At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link.</p> <p>At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained.</p>

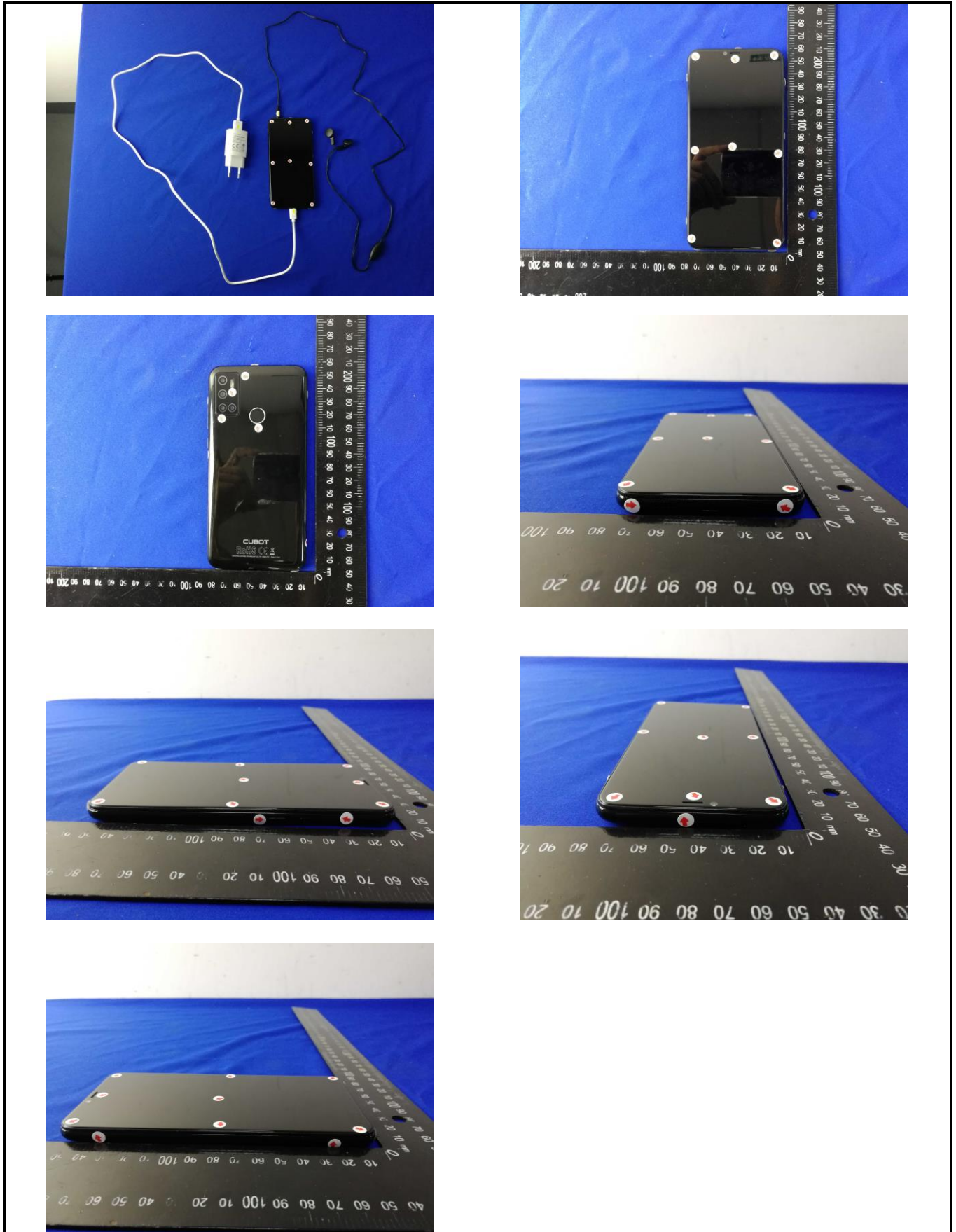
## 6.2.1 Electrostatic Discharge

Test Requirement:	ETSI EN301489-1					
Test Method:	EN61000-4-2					
Discharge Voltage:	Contact Discharge, HCP and VCP: $\pm 2\text{kV}$ , $\pm 4\text{kV}$ , Air Discharge: $\pm 2\text{kV}$ , $\pm 4\text{kV}$ , $\pm 8\text{kV}$					
Polarity:	Positive & Negative					
Number of Discharge:	Contact Discharge: Minimum 25 times at each test point, Air Discharge: Minimum 10 times at each test point.					
Discharge Mode:	Single Discharge					
Discharge Period:	1 second minimum					
Testsetup:						
Test Procedure:	<p><b>1) Air discharge:</b> The test was applied on non-conductive surfaces of EUT. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. After each discharge, the discharge electrode was removed from the EUT. The generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure was repeated until all the air discharge completed</p> <p><b>2) Contact discharge:</b> The test was applied on conductive surfaces of EUT. the generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. the tip of the discharge electrode was touch the EUT before the discharge switch was operated.</p> <p><b>3) Indirect discharge for horizontal coupling plane</b> At least 10 single discharges shall be applied at the front edge of each HCP opposite the centre point of each unit of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge. Consideration should be given to exposing all sides of the EUT.</p> <p><b>4) Indirect discharge for vertical coupling plane</b> At least 10 single discharges were applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, was placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges were applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.</p>					
Testenvironment:	Temp.:	26°C	Humid.:	54%	Press.:	101kPa
Test Instruments:	Refer to section 5.10 for details					
Test mode:	Refer to section 5.3 for details					
Test results:	Passed					

**Measurement Record:**

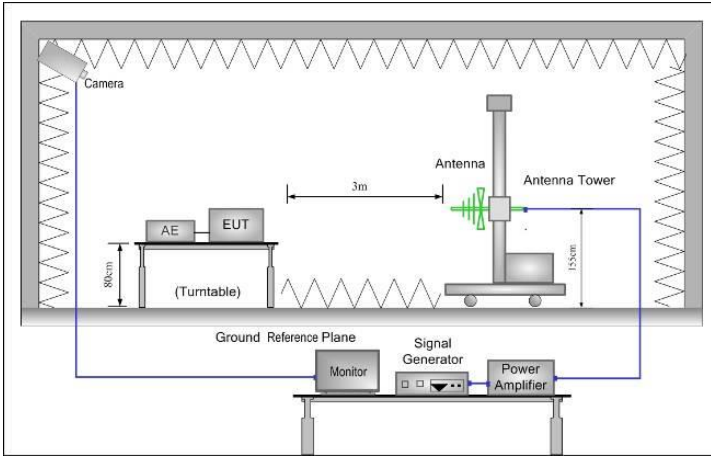
Test mode:	TM 1			
Test points:	I: Please refer to red arrows as below plots			
	II: Please refer to yellow arrows as below plots			
<b>Direct discharge</b>				
<b>Discharge Voltage (KV)</b>	<b>Type of discharge</b>	<b>Test points</b>	<b>Observations (Performance Criterion)</b>	<b>Result</b>
$\pm 2, \pm 4$	Contact	II	TT/TR	Pass
$\pm 2, \pm 4, \pm 8$	Air	I	TT/TR	Pass
<b>Indirect discharge</b>				
<b>Discharge Voltage (KV)</b>	<b>Type of discharge</b>	<b>Test points</b>	<b>Observation Performance</b>	<b>Result</b>
$\pm 2, \pm 4$	HCP-Bottom/Top/ Front/Back/Left/Right	Edge of the HCP	TT/TR	Pass
$\pm 2, \pm 4$	VCP-Front/Back /Left/Right	Center of the VCP	TT/TR	Pass
<b>Remark:</b> Red arrow: air discharge test points. Yellow arrow: contact discharge test points.				

ESD Test points as below:





## 6.2.2 Radiated Immunity

Test Requirement:	ETSI EN 301 489-1
Test Method:	EN61000-4-3
Frequency range:	80MHz to 6GHz
Test Level:	3V/m
Modulation:	80%, 1kHz Amplitude Modulation
Testsetup:	
Test Procedure:	<ol style="list-style-type: none"> <li>1. For table-top equipment, the EUT was placed in the chamber on a non-conductive table 0.8m high. For arrangement of floor-standing equipment, the EUT was mounted on a non-conductive support 0.1m above the supporting plane. For human body-mounted equipment, the EUT may be tested in the same manner as table top items.</li> <li>2. If possible, a minimum of 1 m of cable is exposed to the electromagnetic field. Excess length of cables interconnecting units of the EUT shall be bundled low-inductively in the approximate center of the cable to form a bundle 30 cm to 40 cm in length.</li> <li>3. The EUT was initially placed with one face coincident with the calibration plane. The EUT face being illuminated was contained within the UFA (Uniform Field Area).</li> <li>4. The frequency ranges to be considered were swept with the signal modulated and pausing to adjust the RF signal level or to switch oscillators and antennas as necessary. Where the frequency range was swept incrementally, the step size was not exceed 1 % of the preceding frequency value.</li> <li>5. The dwell time of the amplitude modulated carrier at each frequency was not be less than the time necessary for the EUT to be exercised and to respond, and was not less than 0.5 s.</li> <li>6. The test normally was performed with the generating antenna facing each side of the EUT.</li> <li>7. The polarization of the field generated by each antenna necessitates testing each selected side twice, once with the antenna positioned vertically and again with the antenna positioned horizontally.</li> <li>8. The EUT was performed in a configuration to actual installation conditions, a video camera and/or audio monitor were used to monitor the performance of the EUT.</li> </ol>
Test environment:	Temp.: 26°C    Humid.: 54%    Press.: 101kPa
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

**Measurement Record:**

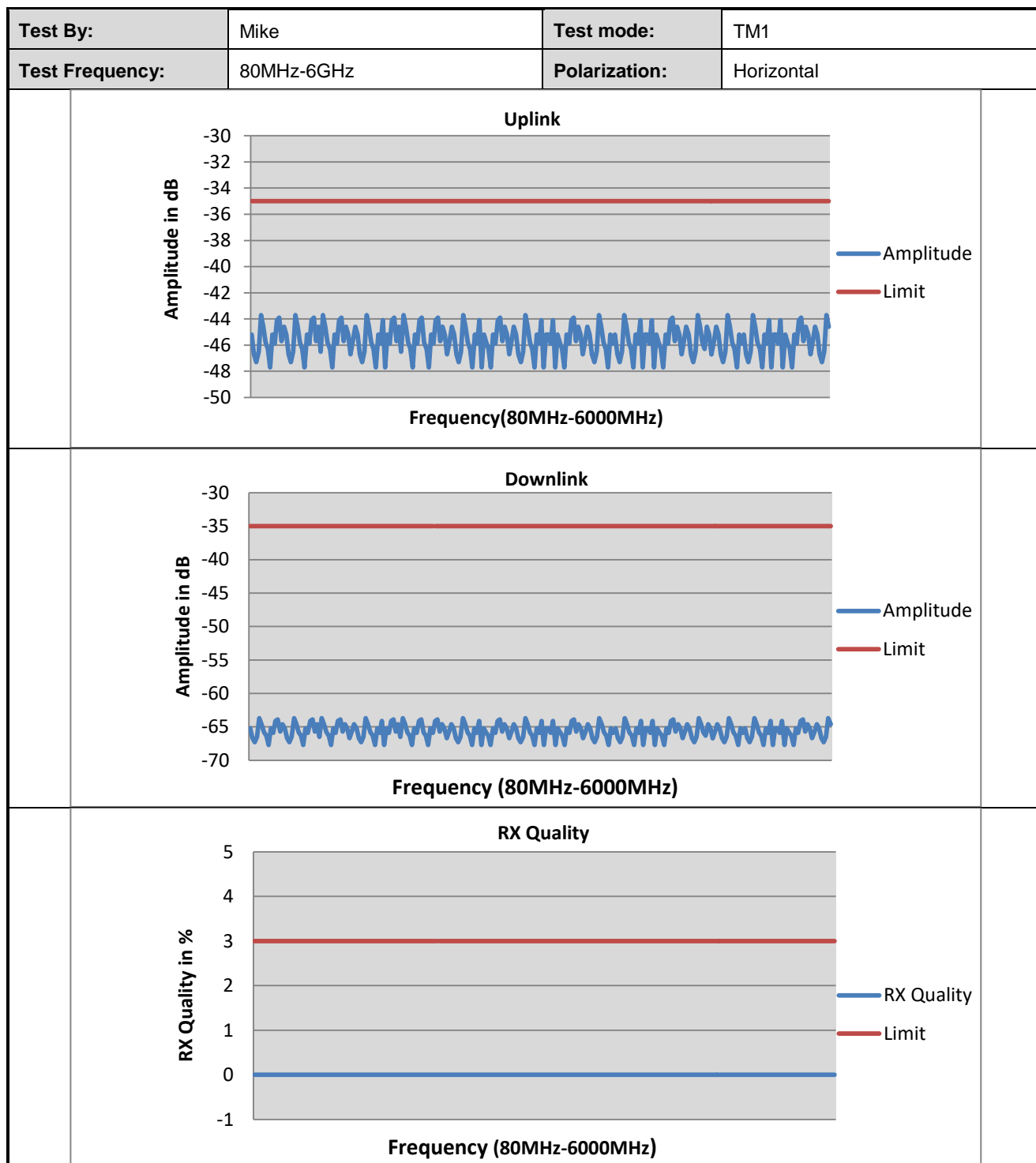
Test mode: TM 1

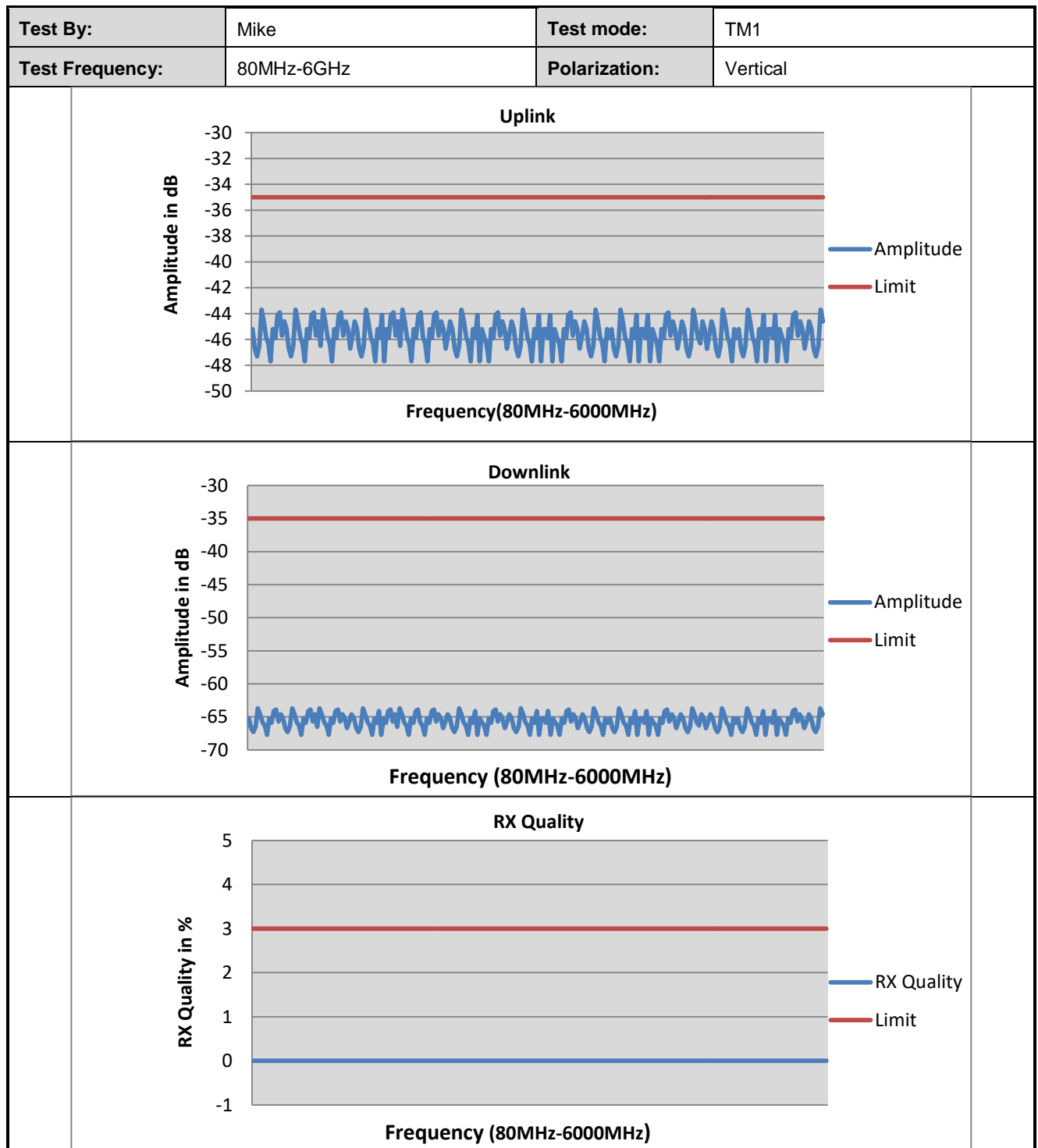
Frequency	Level	Modulation	Antenna Polarization	EUT Face	Observations (Performance Criterion)	Result
80MHz-6GHz	3V/m	1kHz, 80% Amp. Mod, 1% increment, dwell time=3seconds	V	Front	CT/CR	Pass
			H			
			V	Rear		
			H			
			V	Left		
			H			
			V	Right		
			H			
			V	Top		
			H			
			V	Bottom		
			H			
Remark:	<div>1. Pre-test all EUT face, and just the worst case face (Rear) was shown in report.</div> <div>2. Transmitter exclusion band: The exclusion band for transmitters and transmitter sections of transceivers is the band of frequencies over which noimmunity tests with radiated RF are made. The exclusion band for transmitters extends three times the channel separation (3 × 200 kHz = 600 kHz) centred on thenominal operating frequency of the transmitter.</div> <div>3. Receiver and receivers of duplex transceivers exclusion band: The exclusion band for receivers and receiver sections of transceivers is the band of frequencies over which no immunity tests with radiated RF are made. The lower frequency of the exclusion band is the lower frequency of the receive band of the EUT minus 6 % of that frequency. The upper frequency of the exclusion band is the upper frequency of the receive band of the EUT plus 5 % of that frequency.</div>					

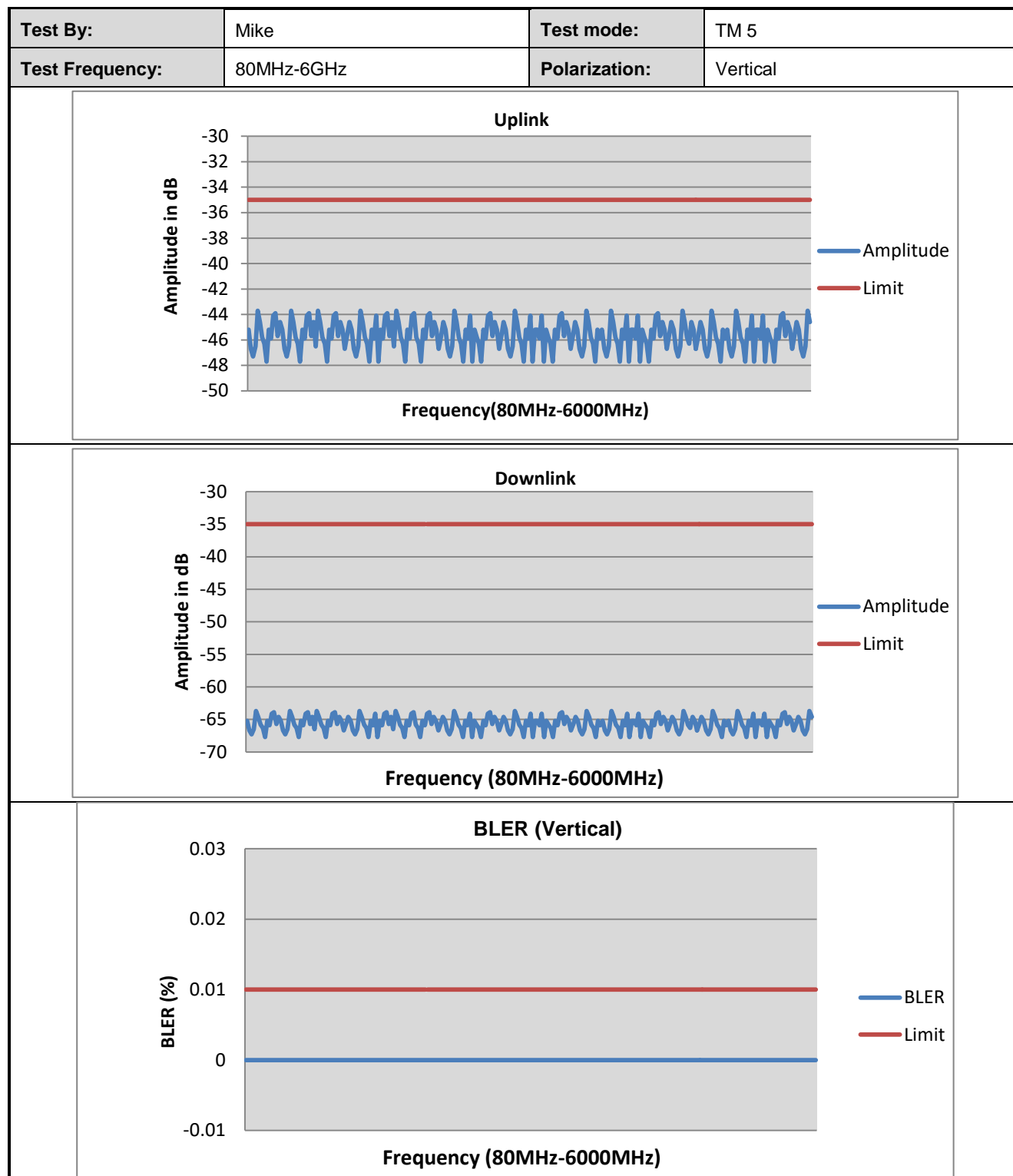


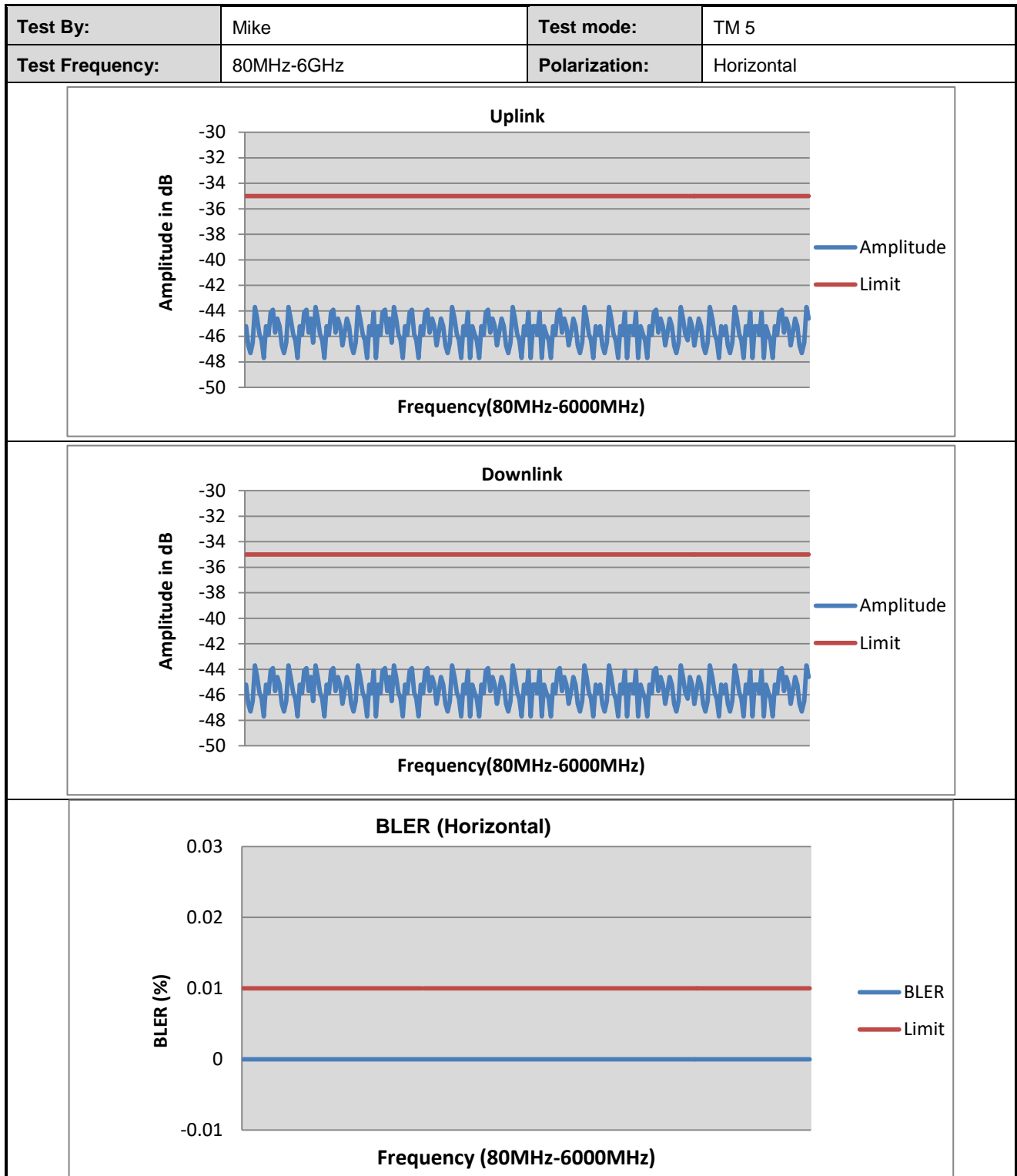
## Special conditions of ETSI EN 301 489-19 V2.1.1 (2019-04)

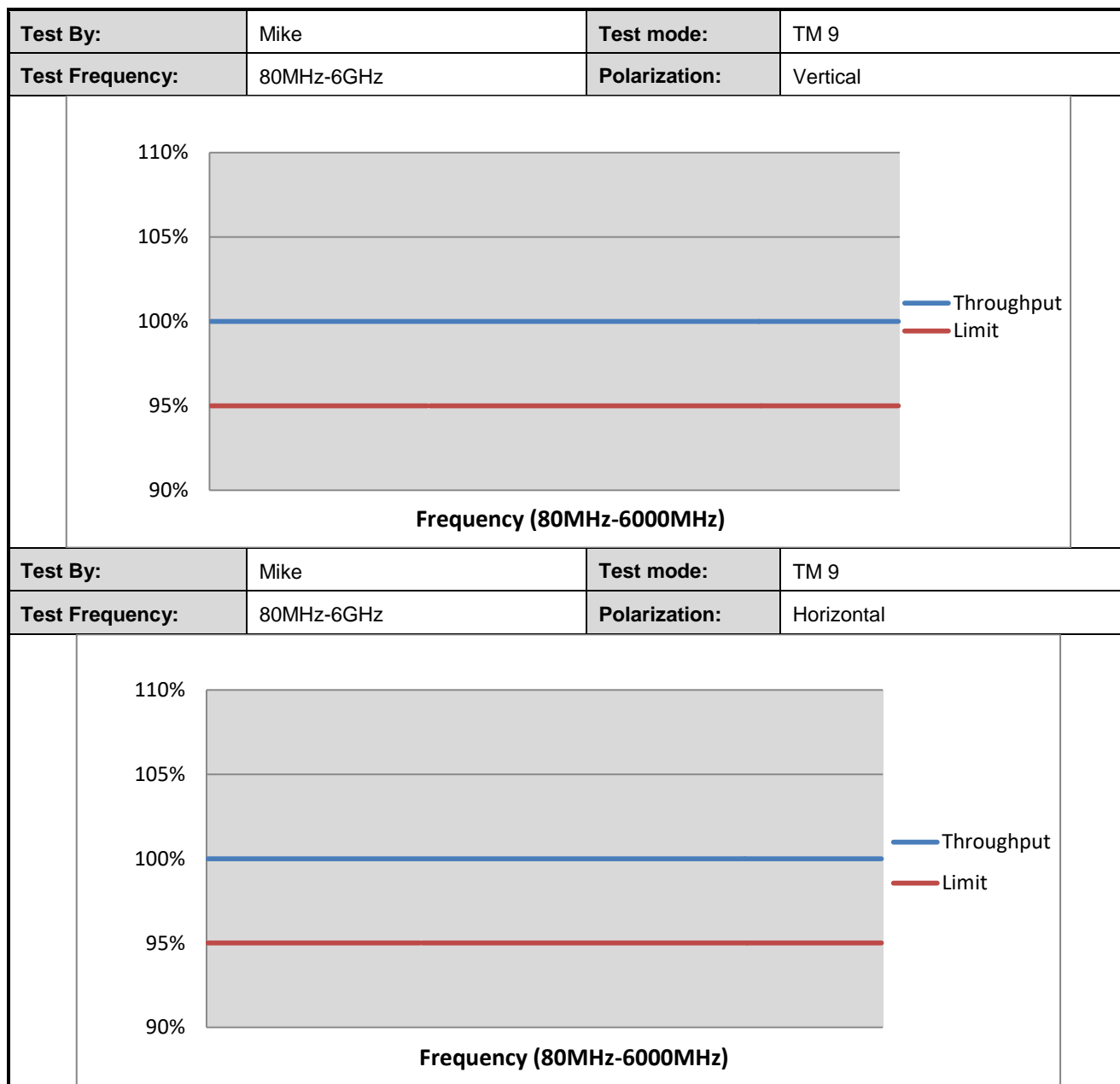
Frequency	Level	Modulation	Antenna Polarization	EUT Face	Observations (Performance Criterion)	Result
80 MHz; 104 MHz; 136 MHz; 165 MHz; 200 MHz; 260 MHz; 330 MHz; 430 MHz; 560 MHz; 715 MHz ± 1 MHz; 920 MHz ± 1 MHz.	3V/m	(measured unmodulated) 100 % modulated by 200 Hz pulses of equal mark to space ratio	V	Front	CT/CR	Pass
			H			
			V	Rear		
			H			
			V	Left		
			H			
			V	Right		
			H			
			V	Top		
			H			
			V	Bottom		
			H			



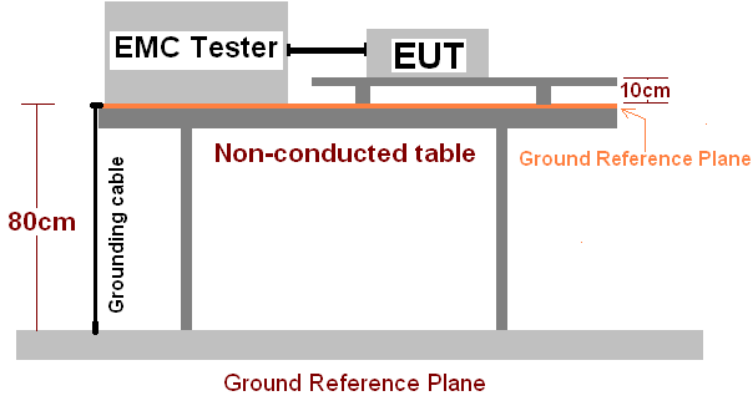








### 6.2.3 Electrical Fast Transients

Test Requirement:	ETSI EN 301 489-1
Test Method:	EN 61000-4-4
Test Level:	$\pm 1.0\text{kV}$ on AC port
Polarity:	Positive & Negative
Repetition Frequency:	5kHz
Burst Duration:	15ms
Burst Period:	300ms
Test Duration:	2 minute per level & polarity
Testsetup:	 <p>The diagram illustrates the test setup. An EMC Tester is connected to an EUT (Equipment Under Test) via a cable. Both are placed on a non-conducted table. A grounding cable is connected to the table, which is 80cm high. A ground reference plane is shown at the base of the table, and another is shown at the top of the table, 10cm from the EUT. The EUT is 10cm high.</p>
Test Procedure:	<p>The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1m + 0.01m thick. The ground reference plane was 1m*1m metallic sheet with 0.65mm minimum thickness. This reference ground plane was project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane was more than 0.5m. All cables to the EUT was placed on the wood support, cables not subject to EFT/B was routed as far as possible from the cable under test to minimize the coupling between the cables.</p> <p>Test on Signal Ports, Telecommunication Ports and Control Ports: The EFT interference signal is through a coupling clamp device couples to the signal and control lines of the EUT with burst noise for 2 minutes.</p> <p>Test on power supply ports: The EUT is connected to the power mains through a coupling device that directly couples the EFT/B interference signal. Each of the Line and Neutral conductors is impressed with burst noise for 2 minutes. The length of the signal and power lines between the coupling device and the EUT is 0.5m</p>
Test environment:	Temp.: 26°C    Humid.: 54%    Press.: 101kPa
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

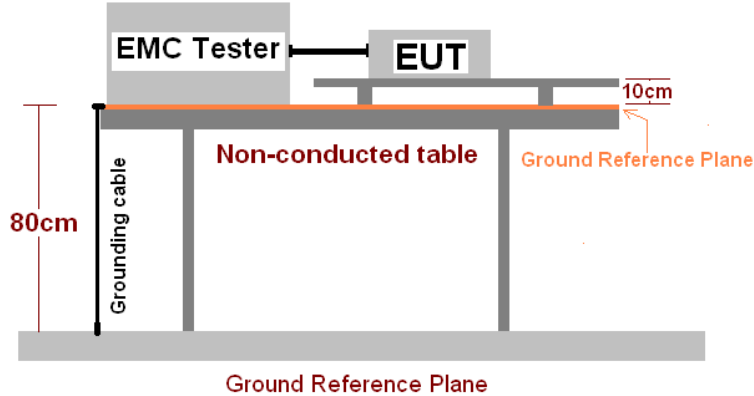


**Measurement Record:**

Test mode: TM 1

Lead under Test	Level(kV)	Coupling Direct/Clamp	Observations (Performance Criterion)	Result
L	$\pm 1.0$	Direct	TT/TR	Pass
N	$\pm 1.0$	Direct	TT/TR	Pass
L-N	$\pm 1.0$	Direct	TT/TR	Pass

## 6.2.4 Surge

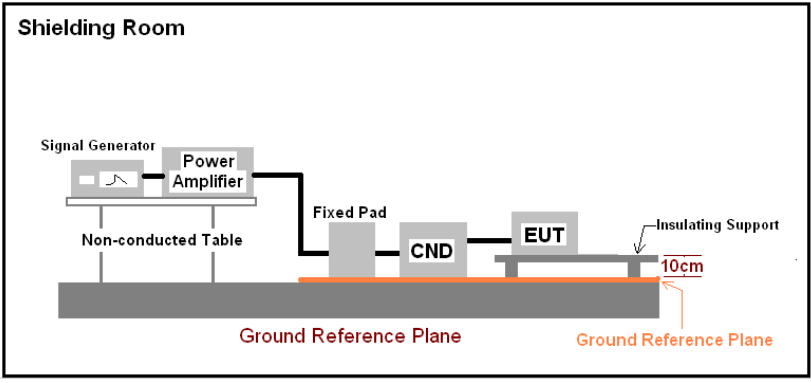
Test Requirement:	ETSI EN 301 489-1
Test Method:	EN61000-4-5
Test Level:	$\pm 1\text{kV}$ Live to Neutral: Differential mode $\pm 2\text{kV}$ Live to Earth or Neutral to Earth: Common mode
Polarity:	Positive & Negative
Test Interval:	60s between each surge
No. of surges:	5 positive, 5 negative at $0^\circ$ , $90^\circ$ , $180^\circ$ , $270^\circ$ .
Performance Criterion:	B
Testsetup:	 <p>The diagram illustrates the test setup. An EMC Tester and an EUT are connected by a cable and placed on a non-conducted table. A grounding cable is connected to the table, which is 80cm high. A ground reference plane is indicated at 10cm from the table surface.</p>
Test Procedure:	<ol style="list-style-type: none"> <li>For line-to-line coupling mode, provide a <math>1\text{kV}</math> <math>1.2/50\mu\text{s}</math> voltage surge (at open-circuit condition) and <math>8/20\mu\text{s}</math> current surge to EUT selected points, and for active line / neutral lines to ground are same except test level is <math>2\text{kV}</math>.</li> <li>At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test.</li> <li>Different phase angles are done individually.</li> <li>Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.</li> </ol>
Test environment:	Temp.: $26^\circ\text{C}$ Humid.: 53% Press.: $101\text{kPa}$
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

## Measurement Record:

Test mode: TM 1

Location	Level(kV)	Pulse No	Surge Interval	Phase(deg)	Observations (Performance Criterion)	Result
L-N	$\pm 1$	5	60s	$0^\circ$	TT/TR	Pass
				$90^\circ$		
				$180^\circ$		
				$270^\circ$		

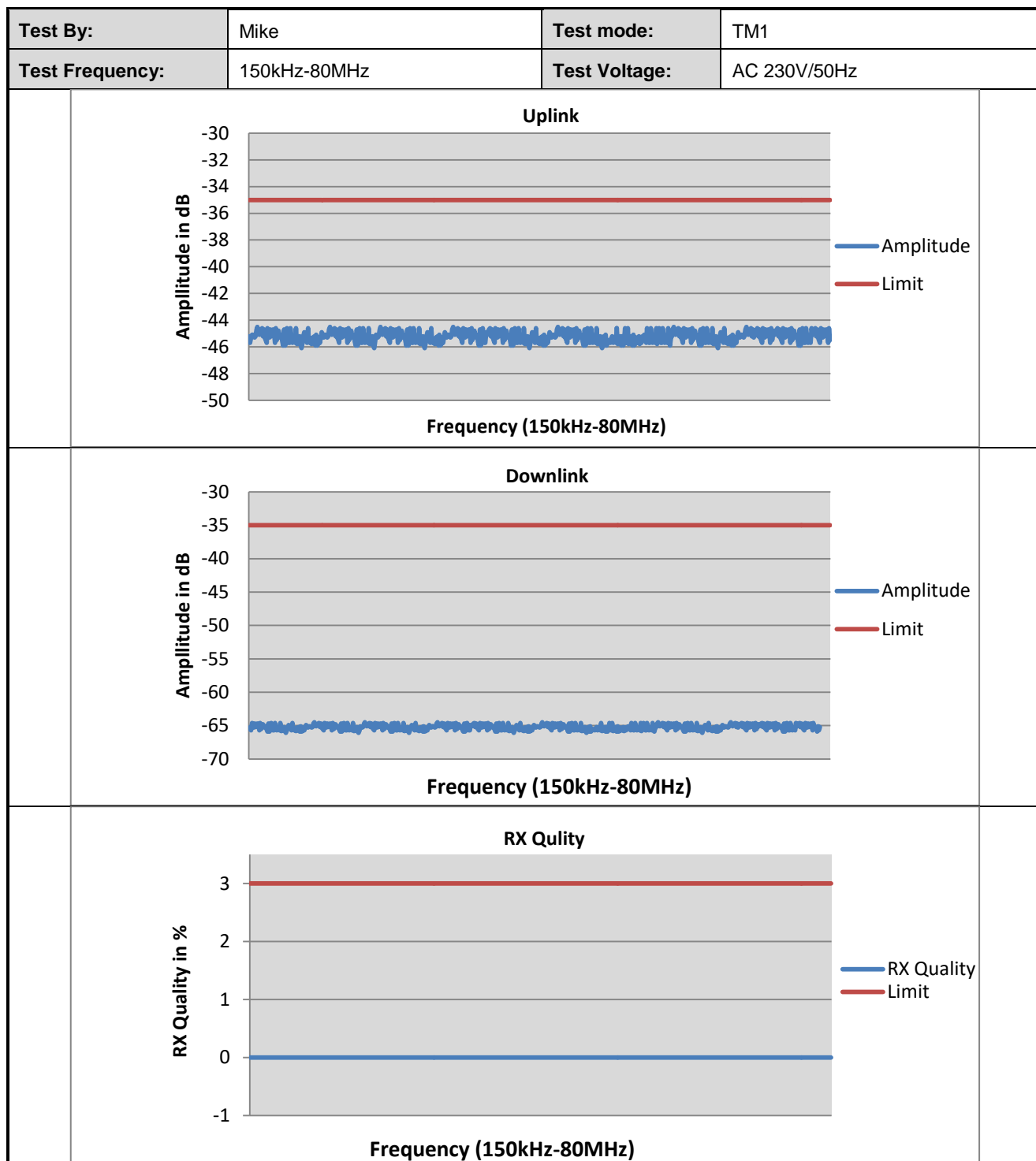
### 6.2.5 Injected Currents susceptibility Test

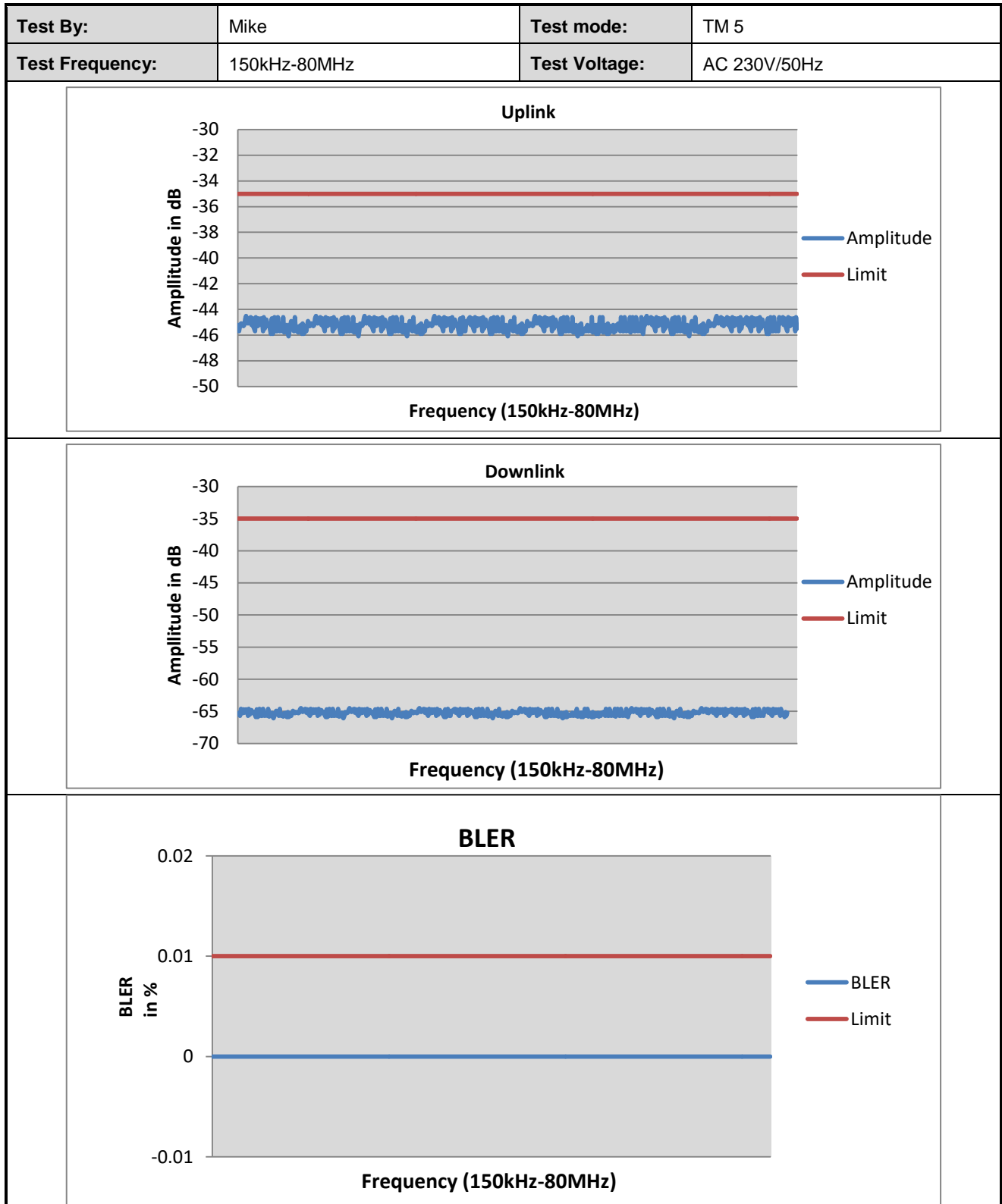
Test Requirement:	ETSI EN301489-1				
Test Method:	EN61000-4-6				
Frequency range:	0.15MHz to 80MHz				
Test Level:	3V rms on AC Ports (unmodulated emf into 150 $\Omega$ )				
Modulation:	80%, 1kHz Amplitude Modulation				
Testsetup:					
Test Procedure:	<ol style="list-style-type: none"> <li>Let the EUT work in test mode and test it.</li> <li>The EUT are placed on an insulating support 0.1m high above a groundreference plane. CDN (coupling and decoupling device) is placed on theground plane about 0.3m from EUT. Cables between CDN and EUT are asshort as possible, and their height above the ground reference plane shall bebetween 30 and 50 mm (where possible).</li> <li>The disturbance signal described below is injected to EUT through CDN.</li> <li>The EUT operates within its operational mode(s) under intended climaticconditions after power on.</li> <li>The frequency range is swept from 0.150MHz to 80MHz using 3V signal level,and with the disturbance signal 80% amplitude modulated with a 1kHz sinewave.</li> <li>The rate of sweep shall not exceed <math>1.5 \times 10^{-3}</math> decades/s. Where the frequency isswept incrementally; the step size shall not exceed 1% of the start andthereafter 1% of the preceding frequency value.</li> <li>Recording the EUT operating situation during compliance testing and decidethe EUT immunity criterion.</li> </ol>				
Testenvironment:	Temp.:	26°C	Humid.:	53%	Press.: 101kPa
Test Instruments:	Refer to section 5.10 for details				
Test mode:	Refer to section 5.3 for details				
Test results:	Passed				

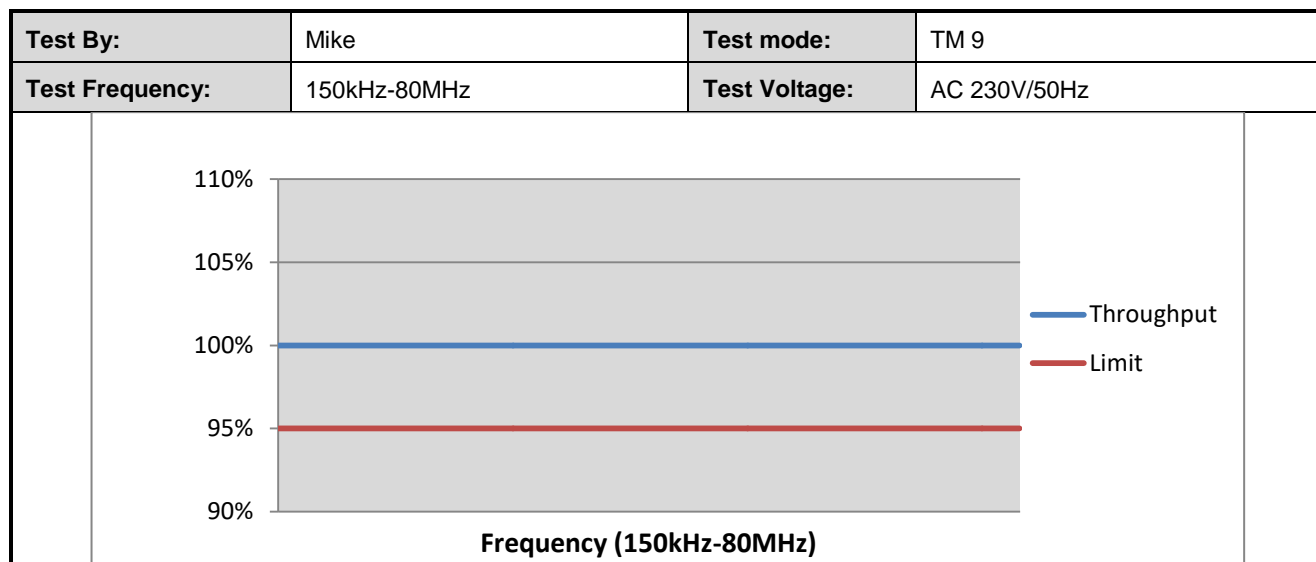
#### Measurement Record:

Test mode: TM 1

Frequency	Injected Position	Test Level	Modulation	Step Size	Dwell Time	Observations (Performance Criterion)	Result
150kHz to 80MHz	AC Mains	3Vrms	80%, 1kHz Amp. Mod.	1%	2s	CT/CR	Pass

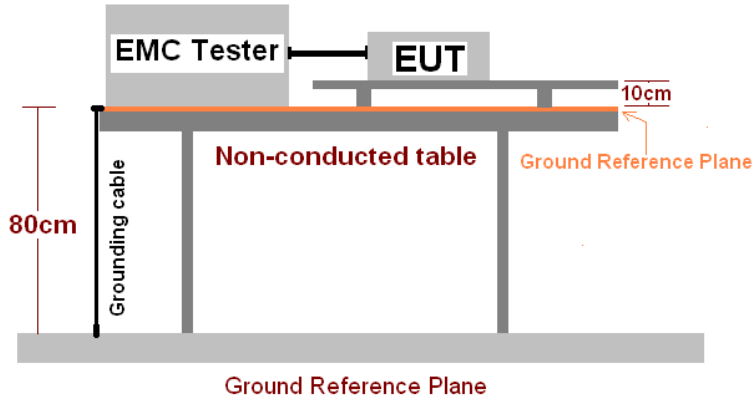








### 6.2.6 Voltage Dip and Voltage Interruptions

Test Requirement:	ETSI EN301489-1
Test Method:	EN61000-4-11
Test Level:	0% of VT(Supply Voltage) for 0.5 period 0% of VT(Supply Voltage) for 1.0 period 70% of VT(Supply Voltage) for 25 period 0% of VT(Supply Voltage) for 250 period
No. of Dips / Interruptions:	3 per Level
Testsetup:	 <p>The diagram shows the test setup. An EMC Tester and EUT are placed on a non-conducted table. A grounding cable is connected to the table, and a ground reference plane is indicated at 10cm height. The table is 80cm high.</p>
Test Procedure:	<ol style="list-style-type: none"> <li>1. The EUT and test generator were setup as shown on above setup photo.</li> <li>2. The interruptions are introduced at selected phase angles with specified duration.</li> <li>3. Record any degradation of performance.</li> </ol>
Testenvironment:	Temp.: 26°C Humid.: 53% Press.: 101kPa
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

#### Measurement Record:

Test mode: TM 1

Test Level % U <sub>T</sub>	Duration (Periods)	Phase angle	No of dropout	Time between dropout	Observations (Performance Criterion)	Result
0	0.5	0°, 90°, 180°, 270°	3	10s	TT/TR	Pass
0	1	0°, 90°, 180°, 270°	3	10s		
70	25	0°, 90°, 180°, 270°	3	10s		
0	250	0°, 90°, 180°, 270°	3	10s		

## 7 Test Setup Photo

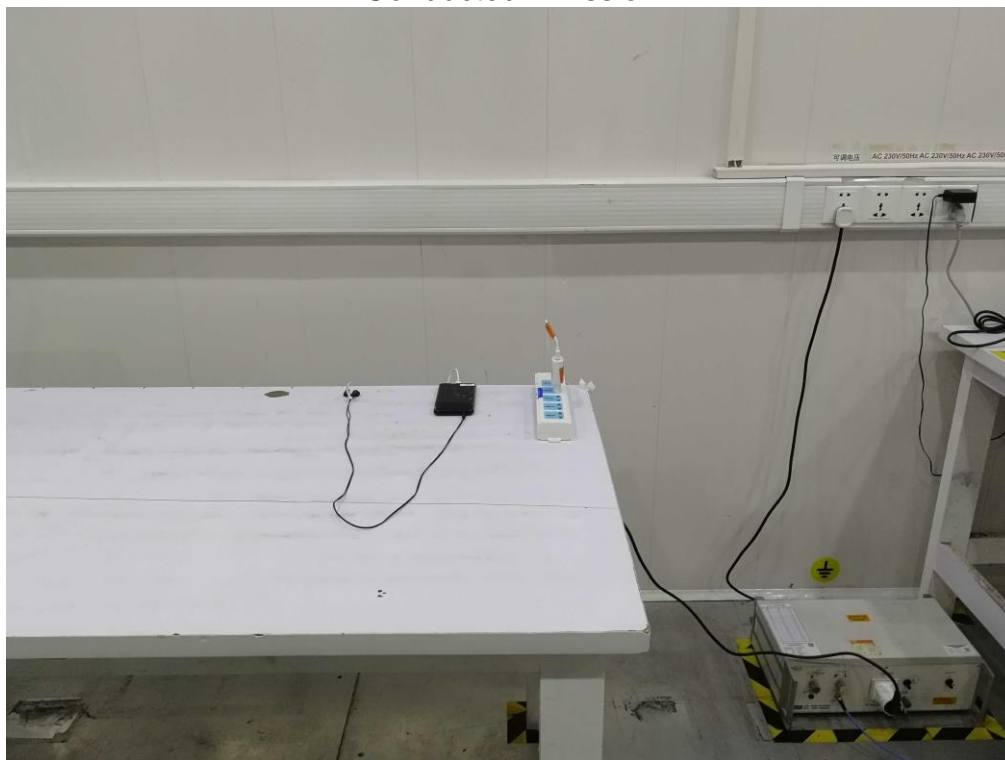
Radiated Emission Below 1GHz



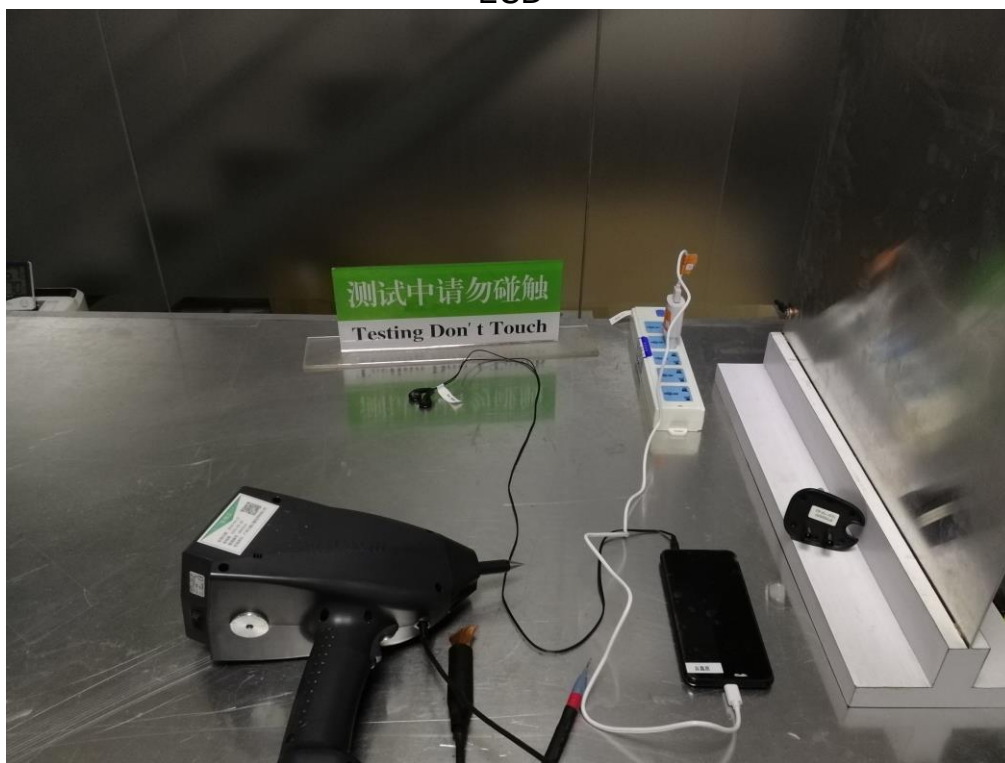
Radiated Emission Above 1GHz



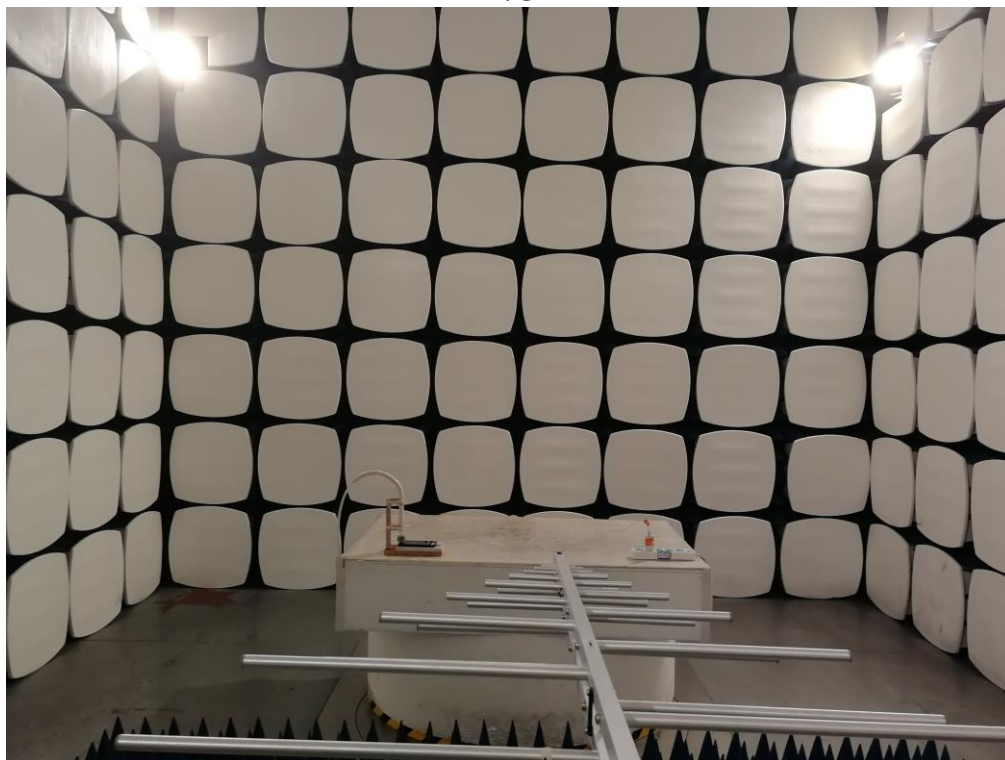
## Conducted Emission



## ESD



R/S

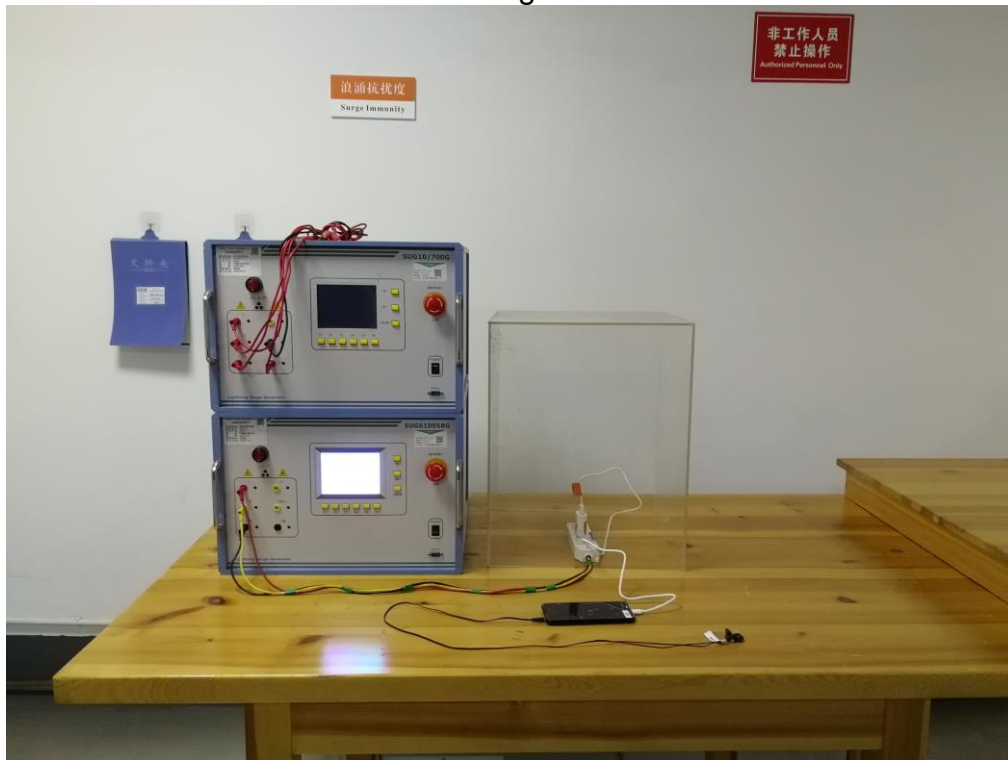


EFT/B

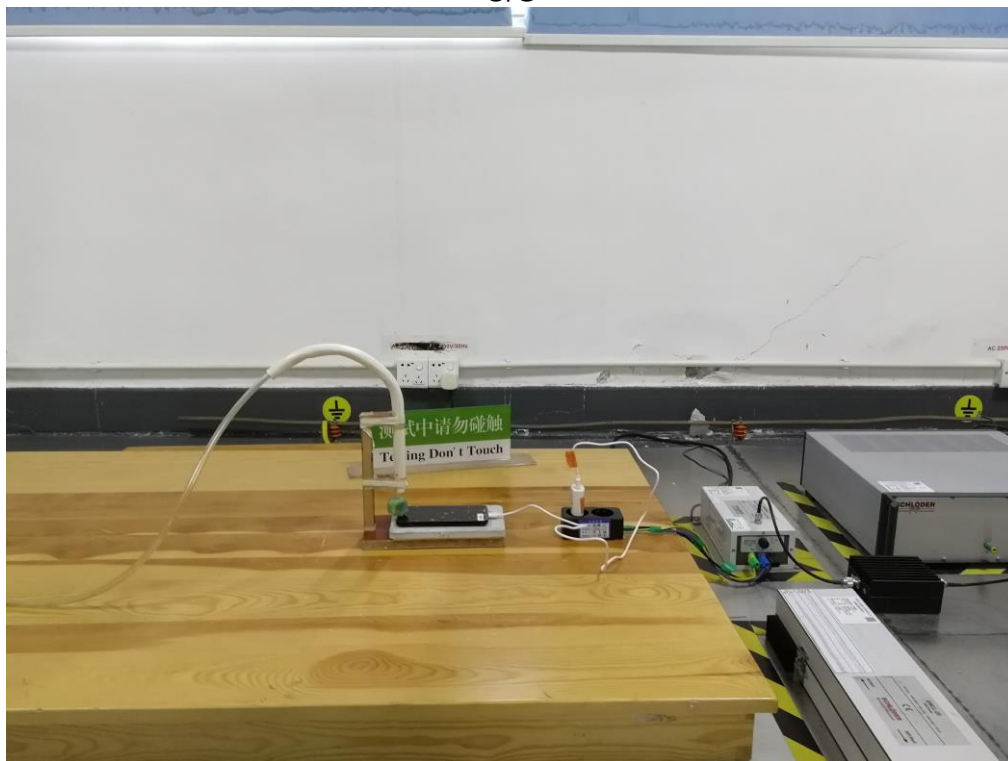




Surge



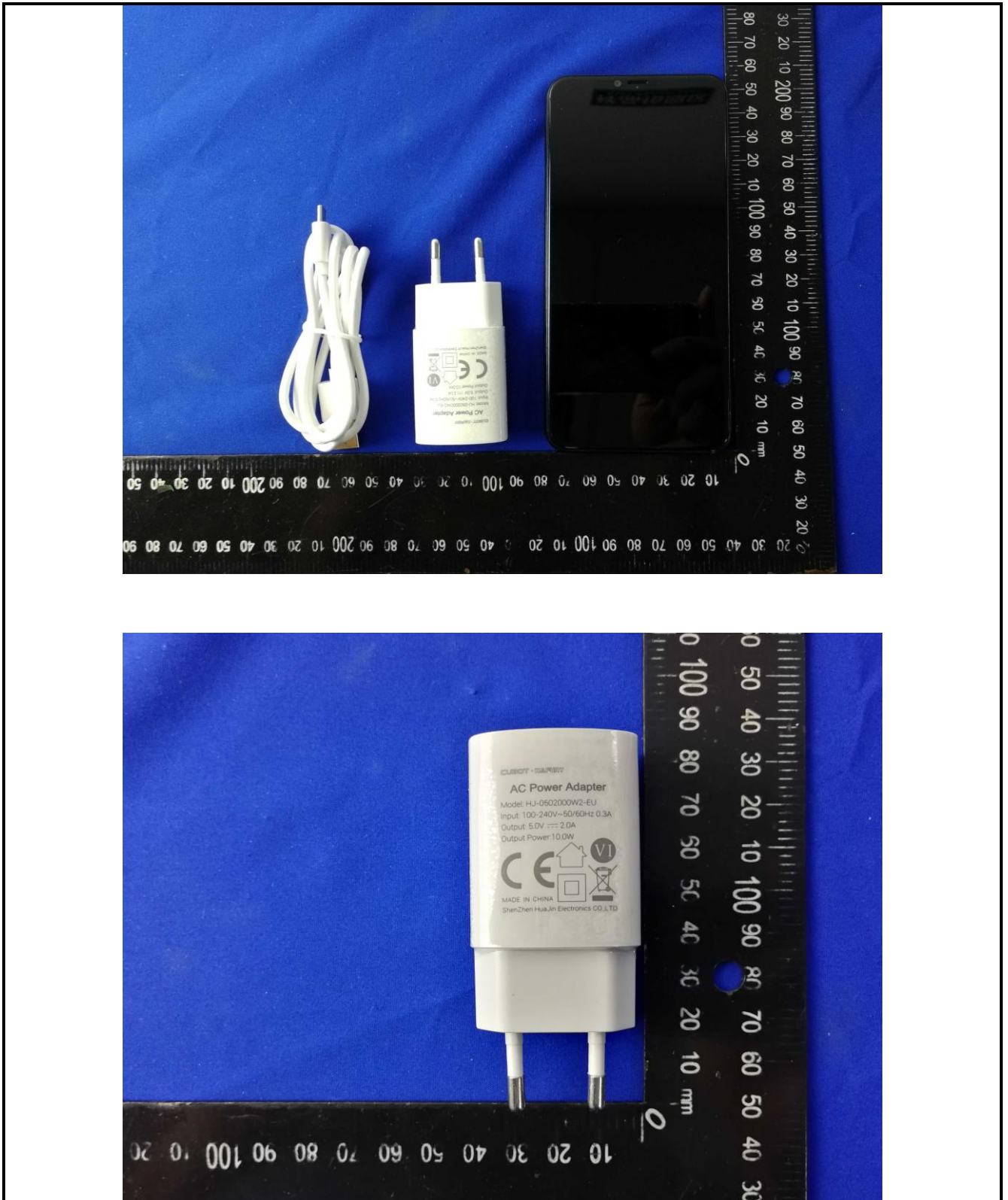
C/S



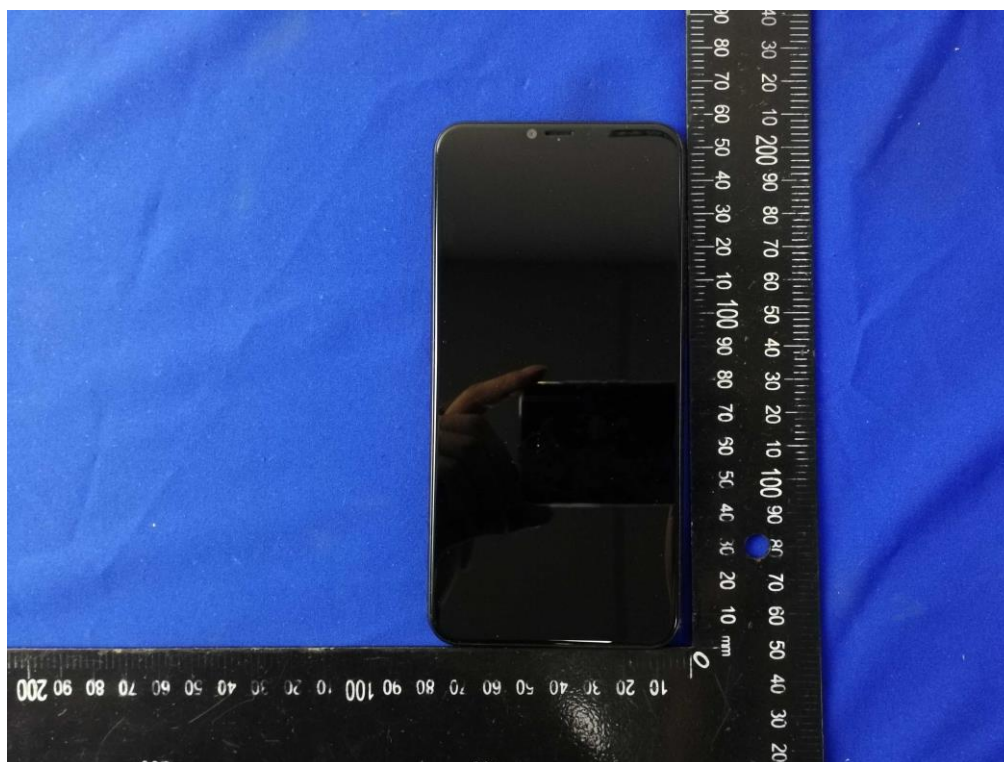
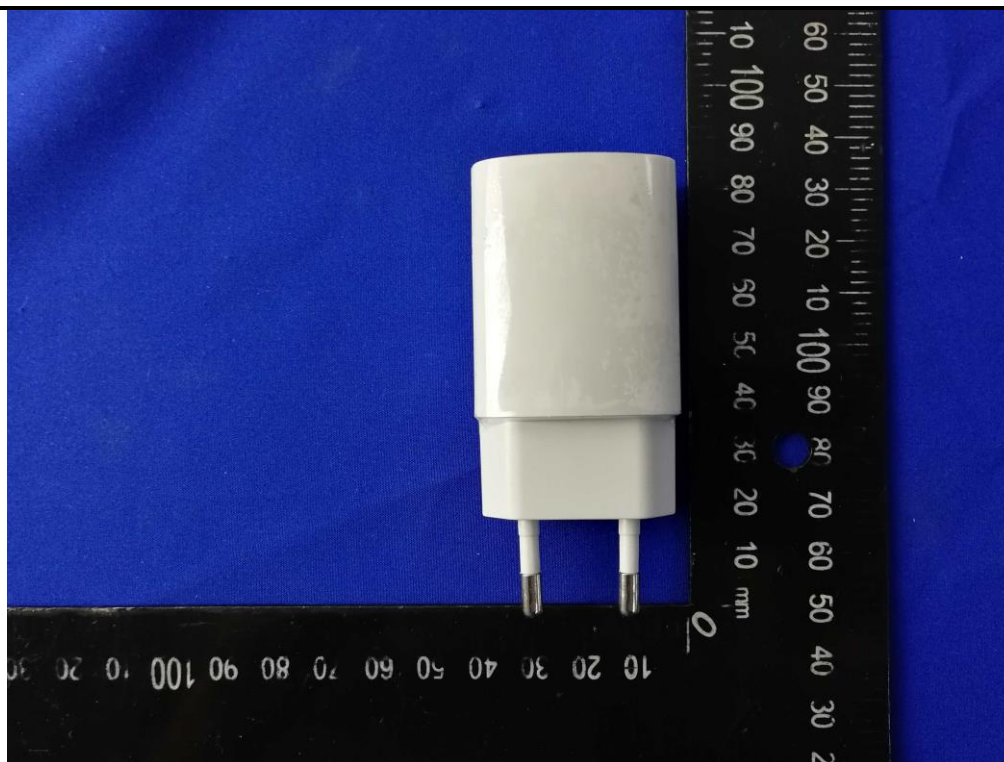
V-dips



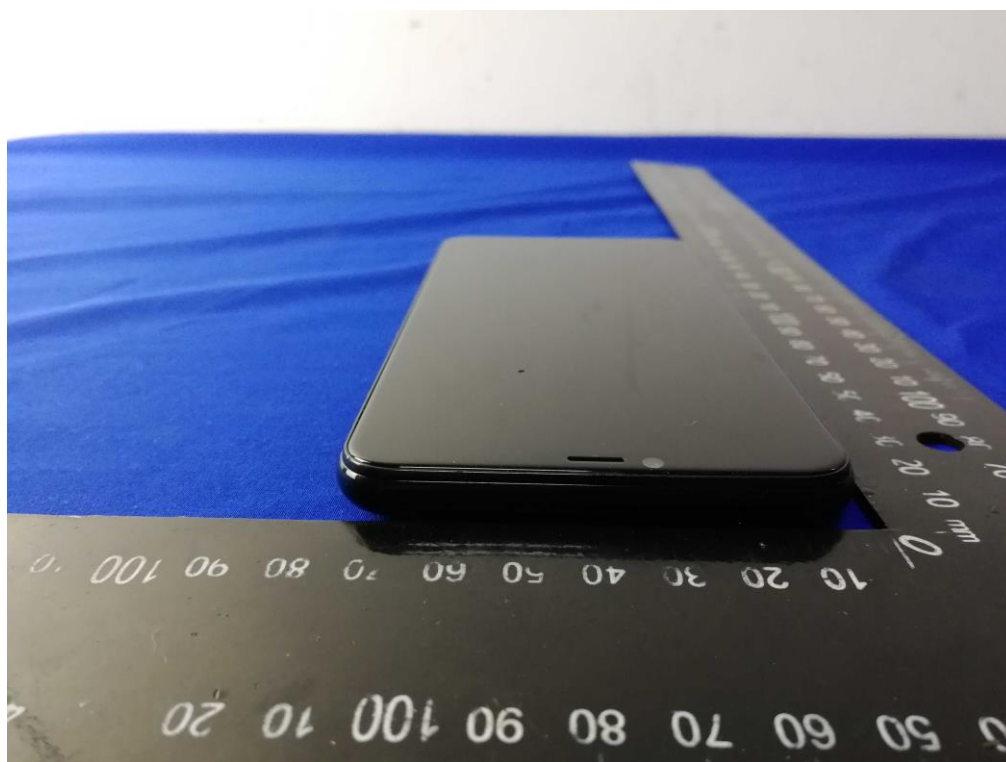
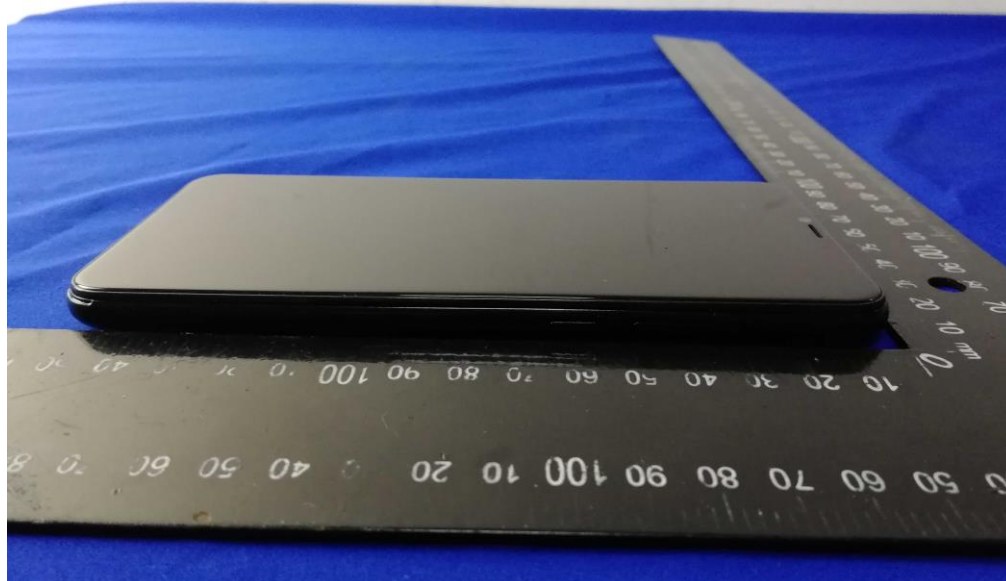
## 8 EUT Constructional Details



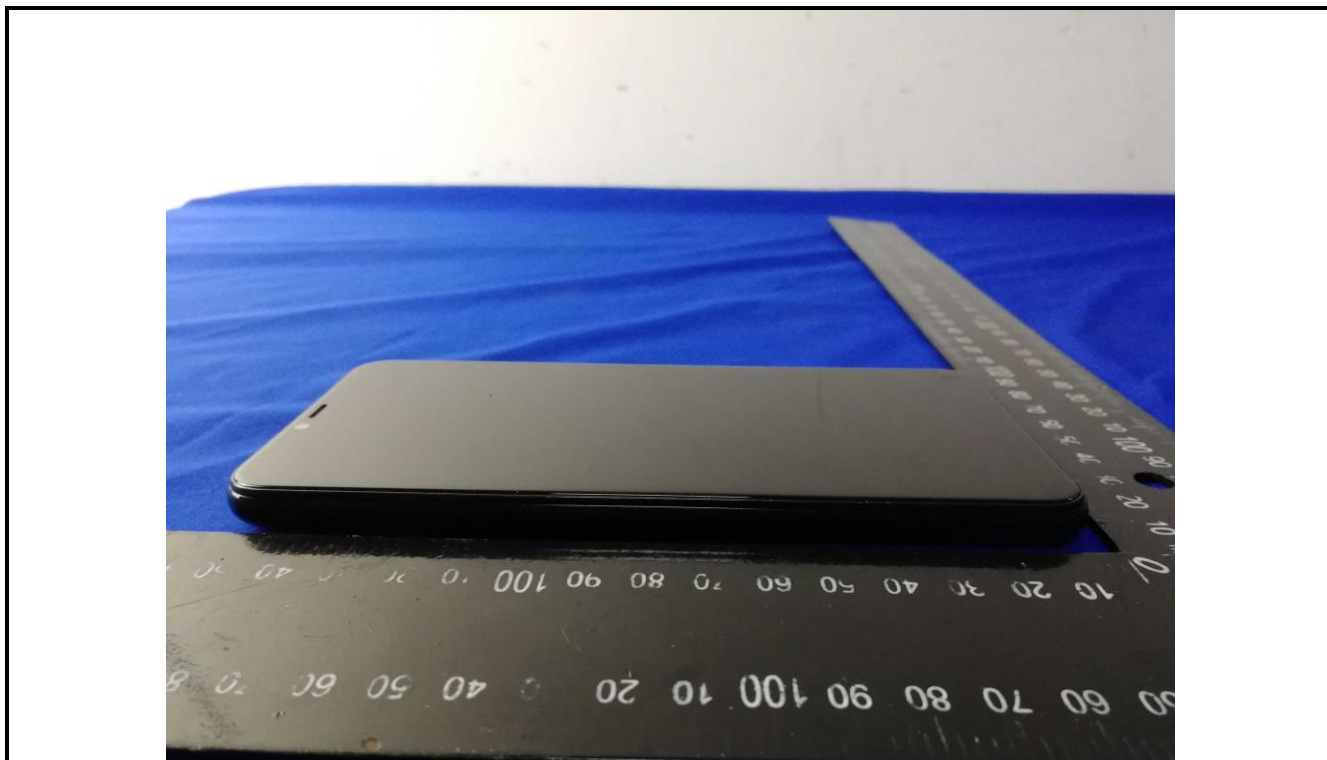




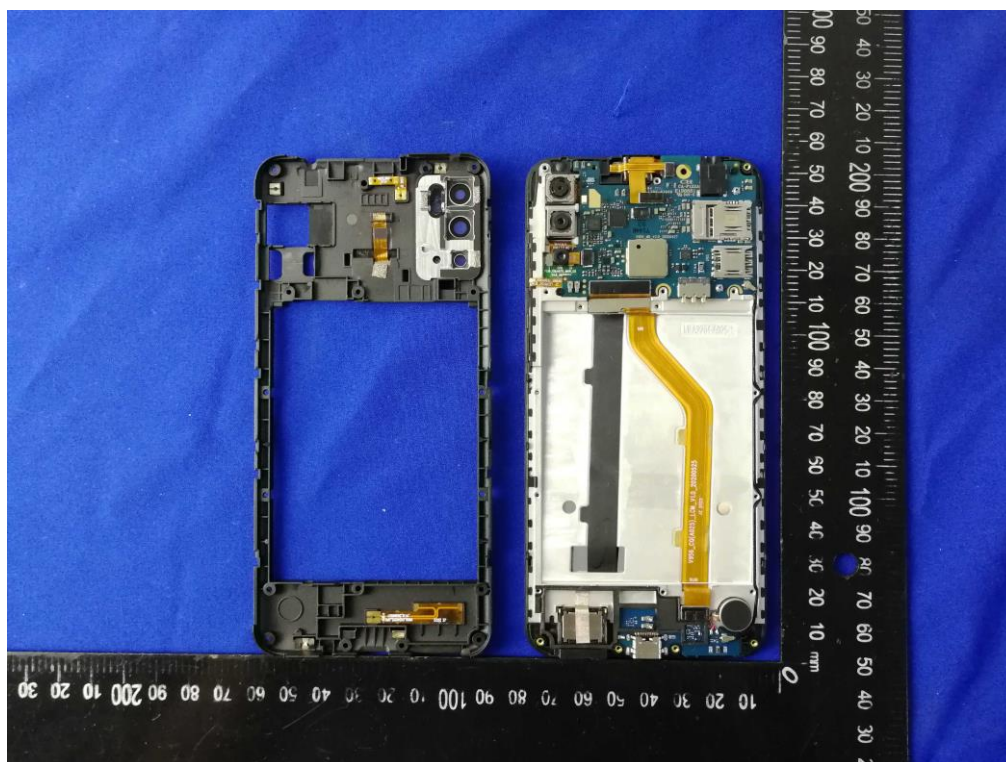
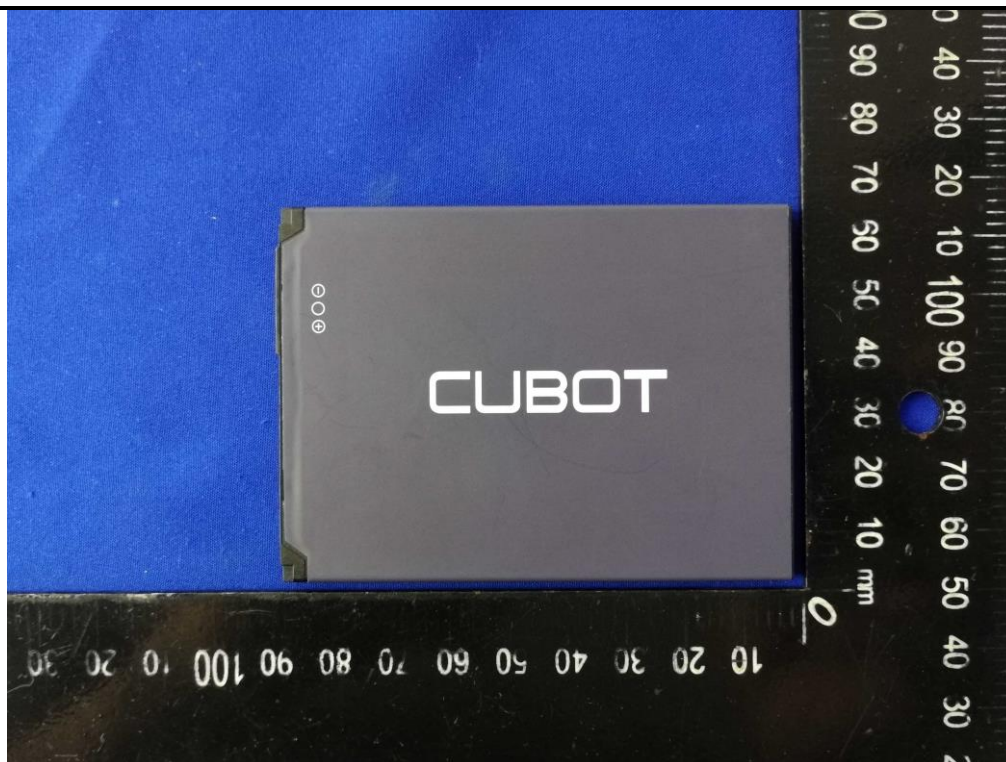




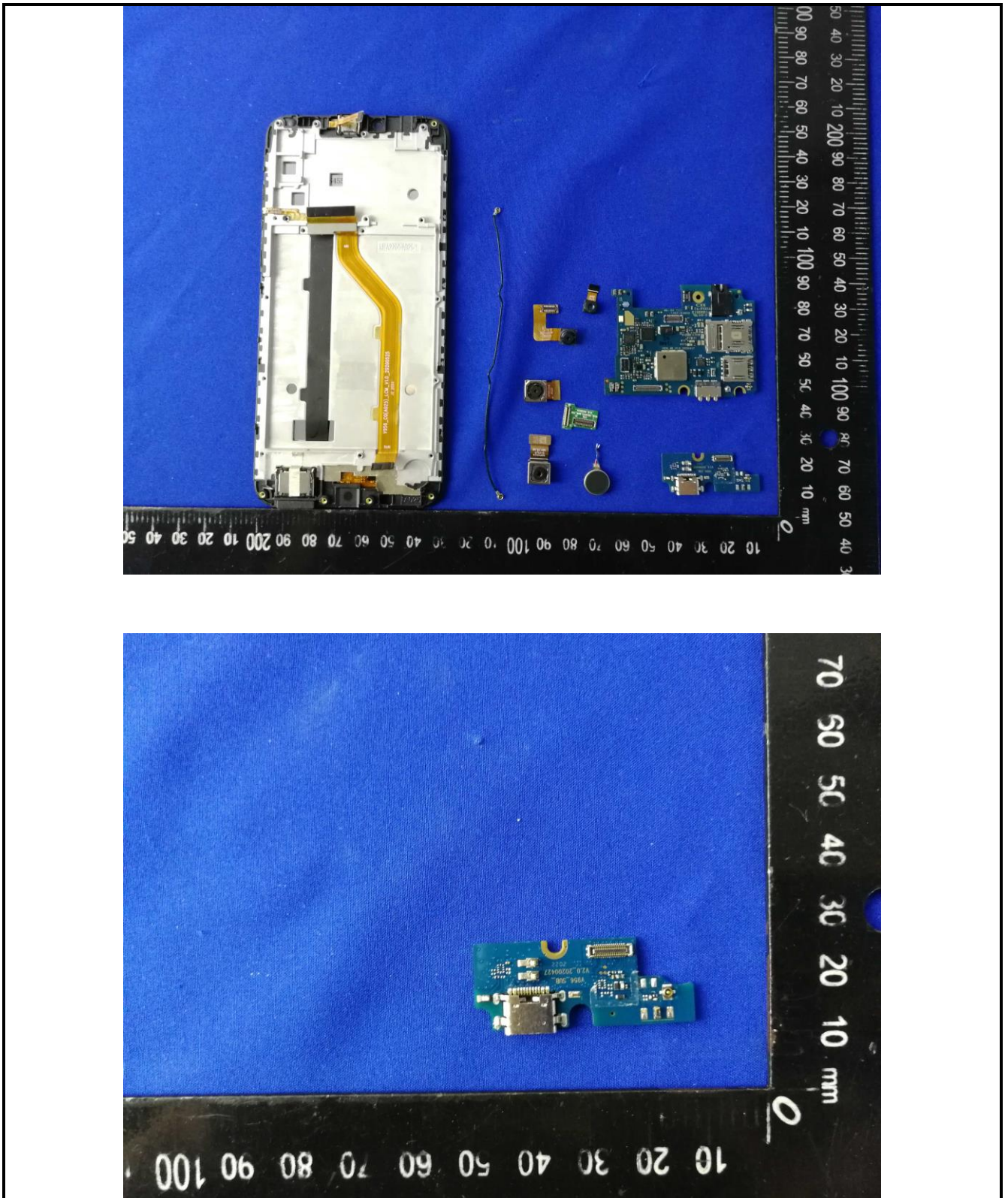




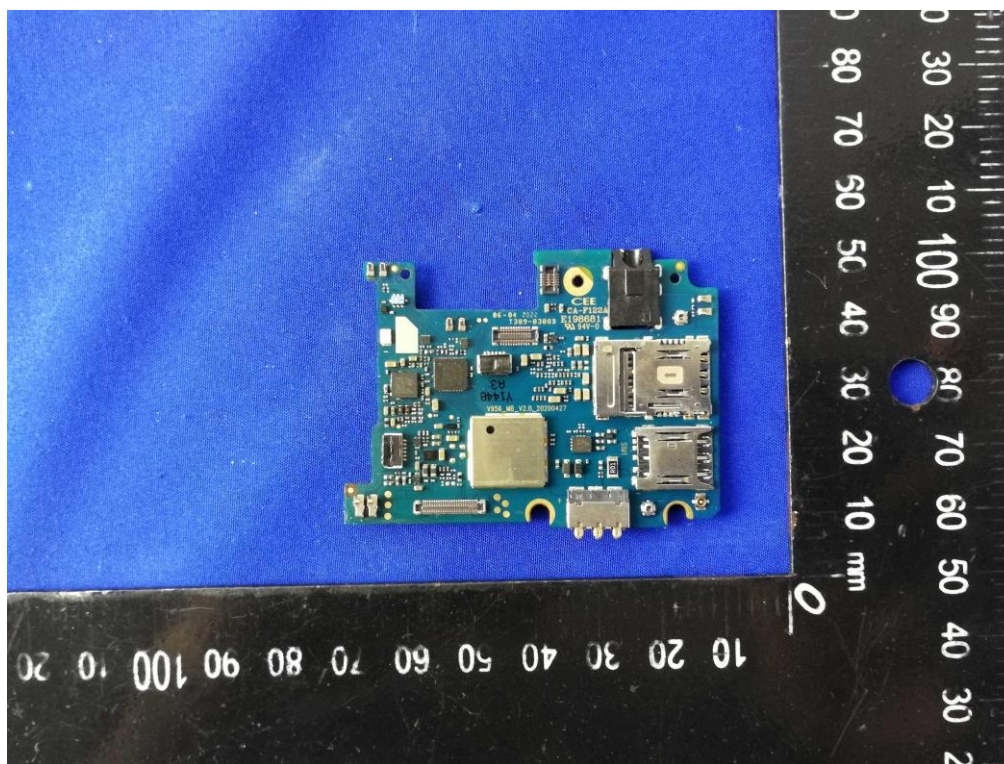
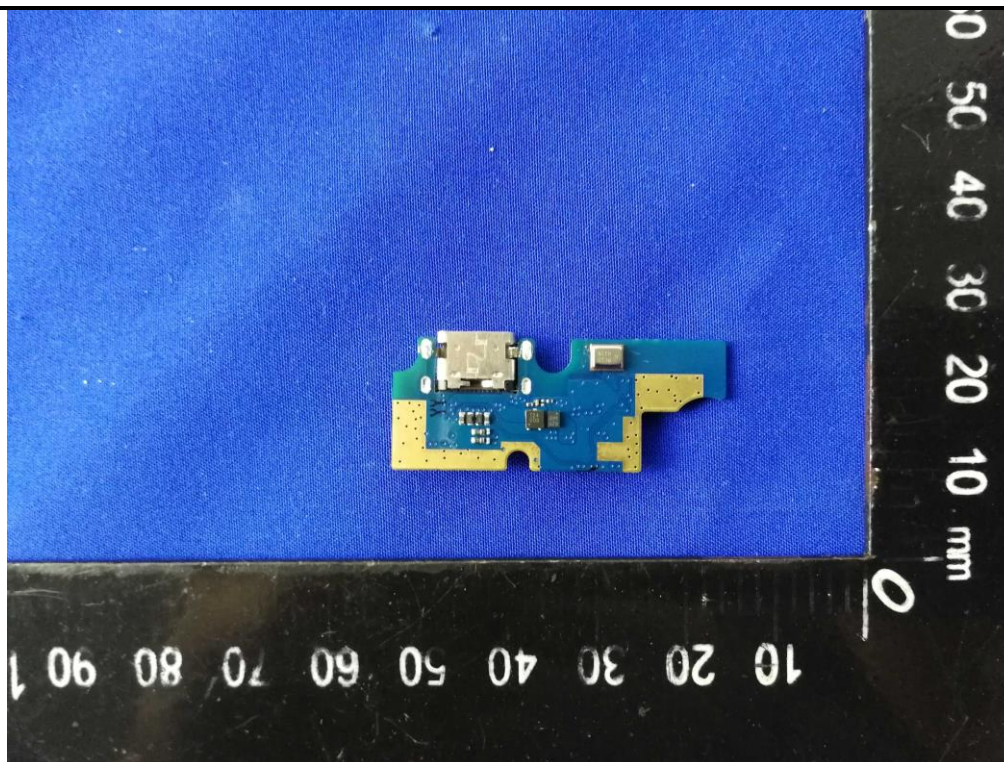




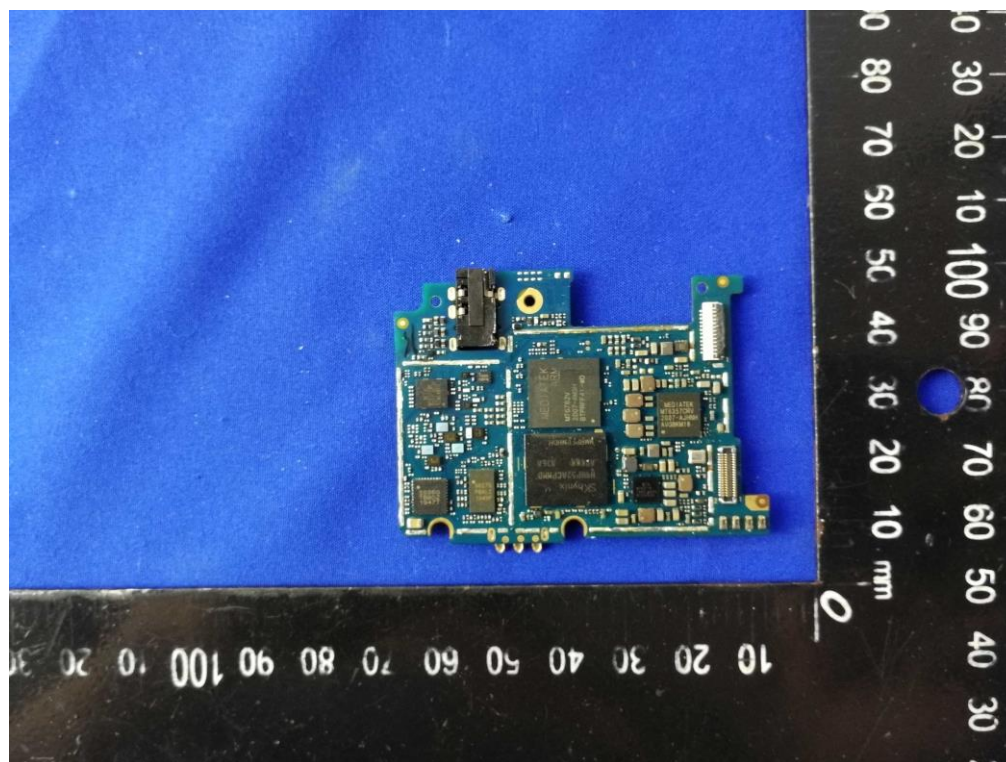
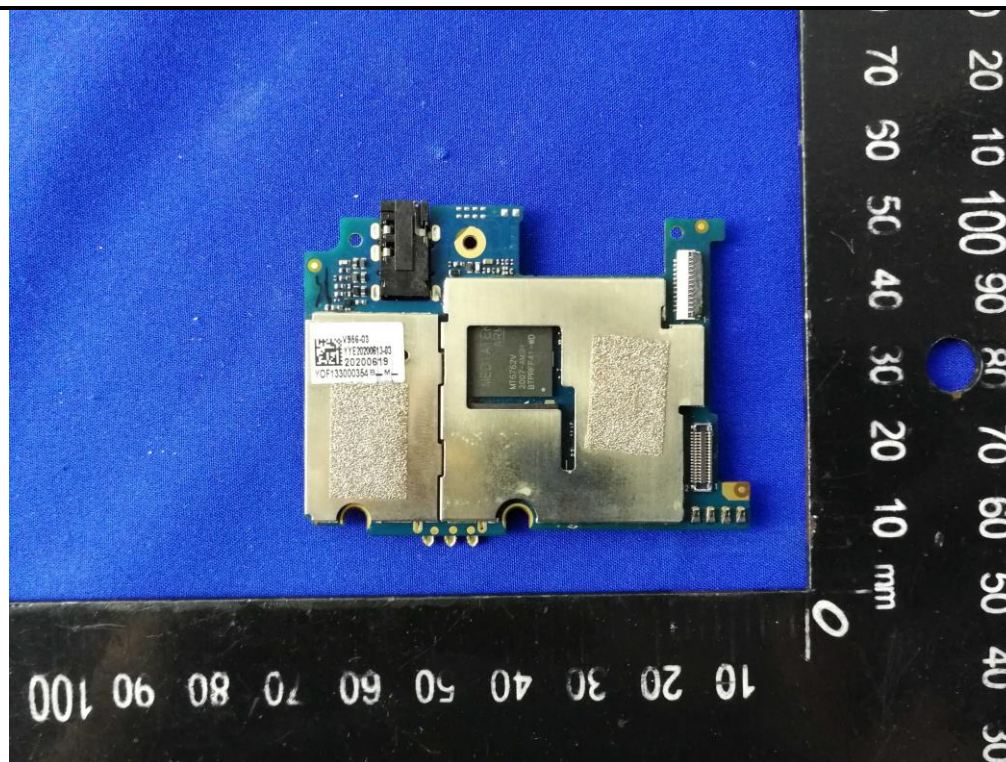




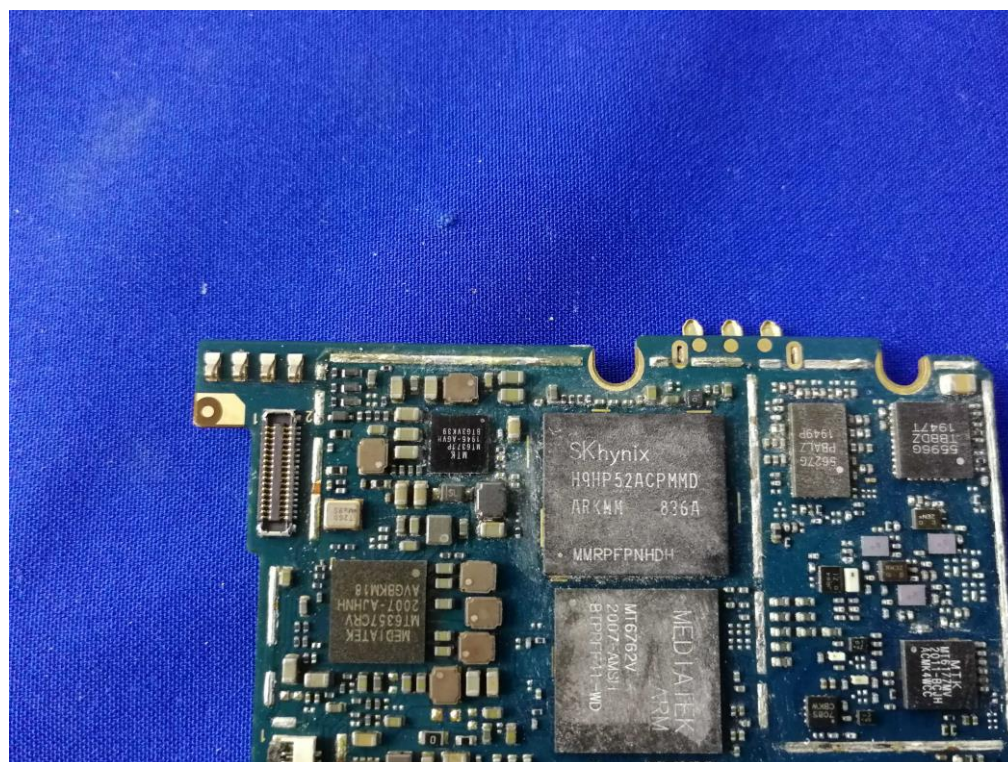
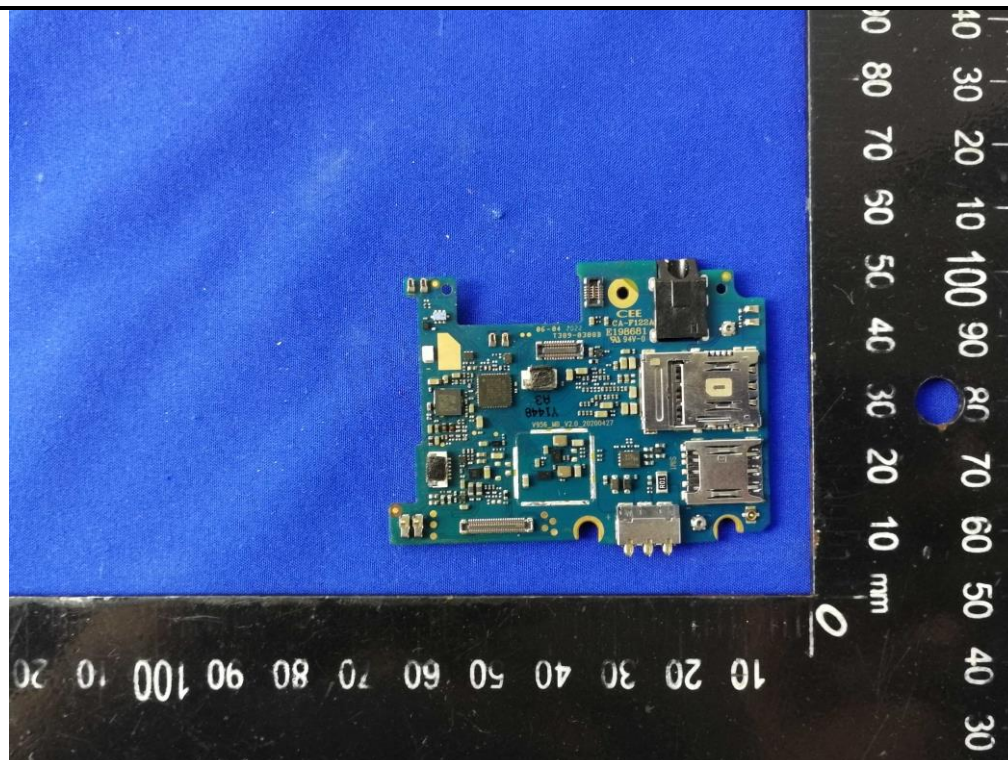




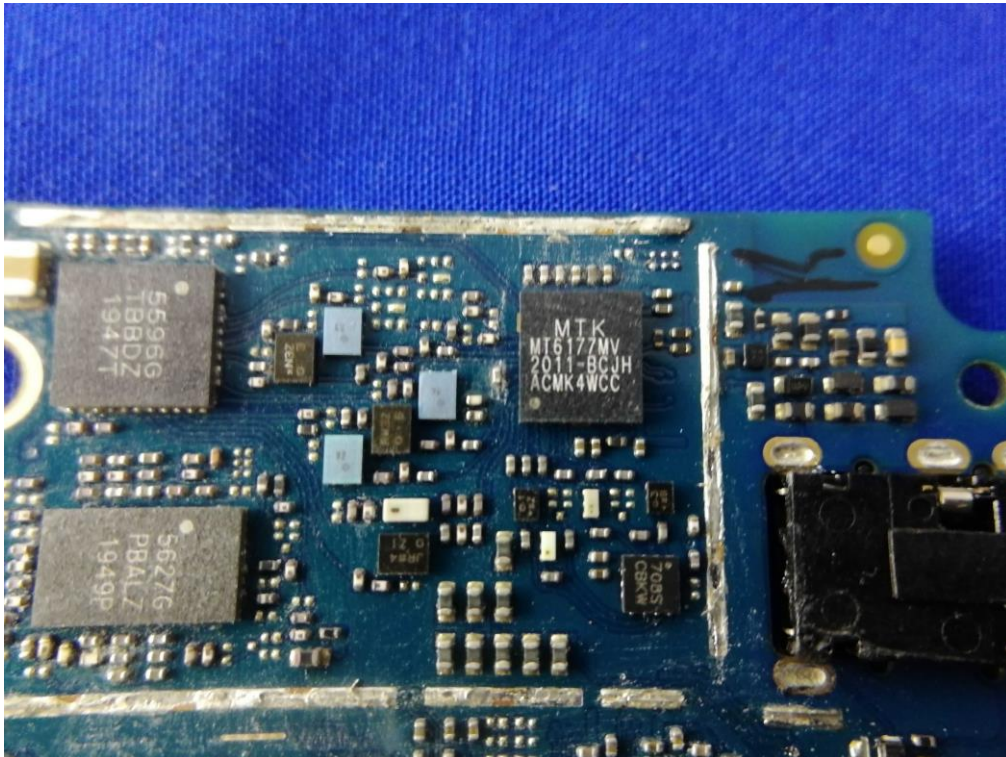
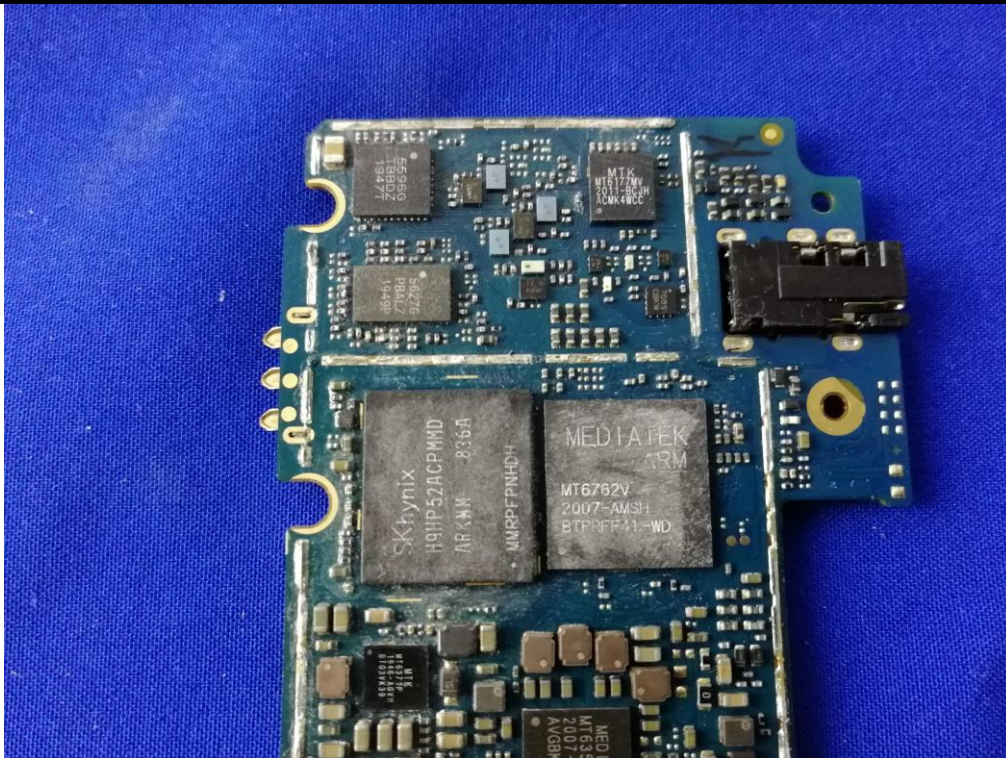




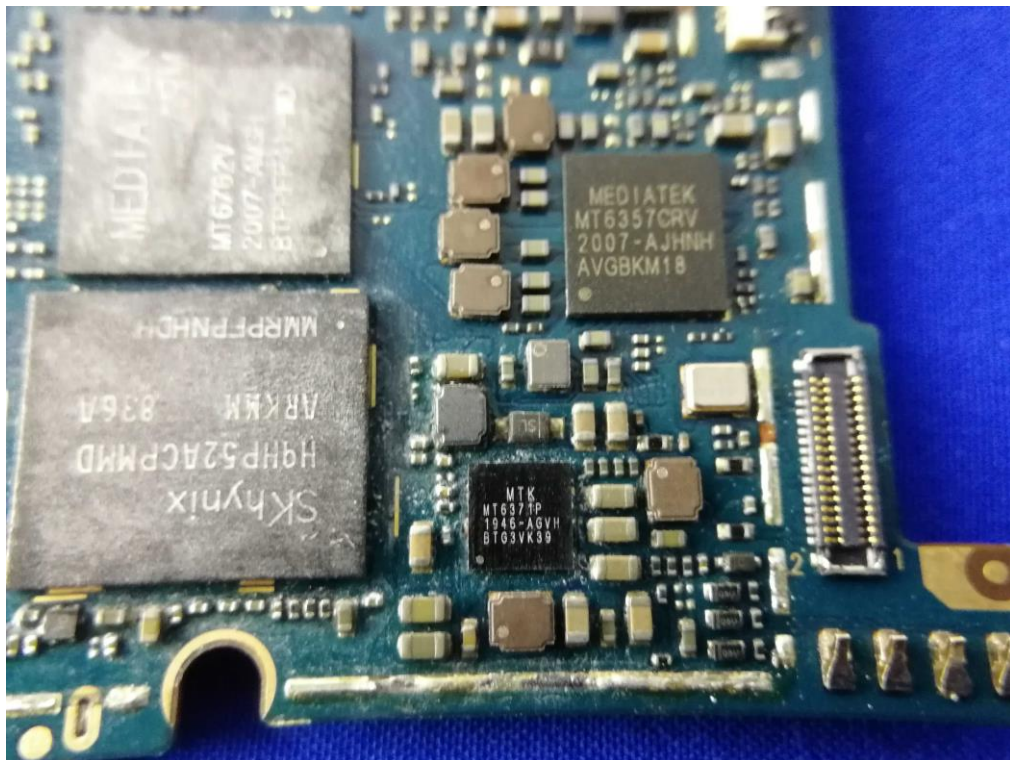
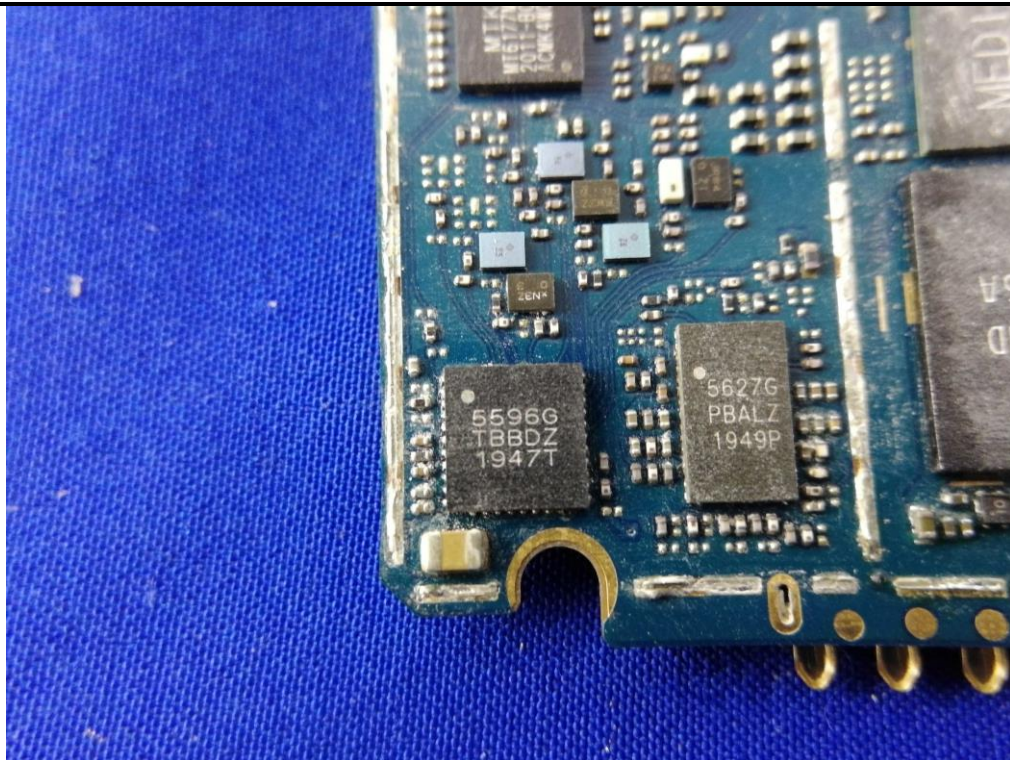




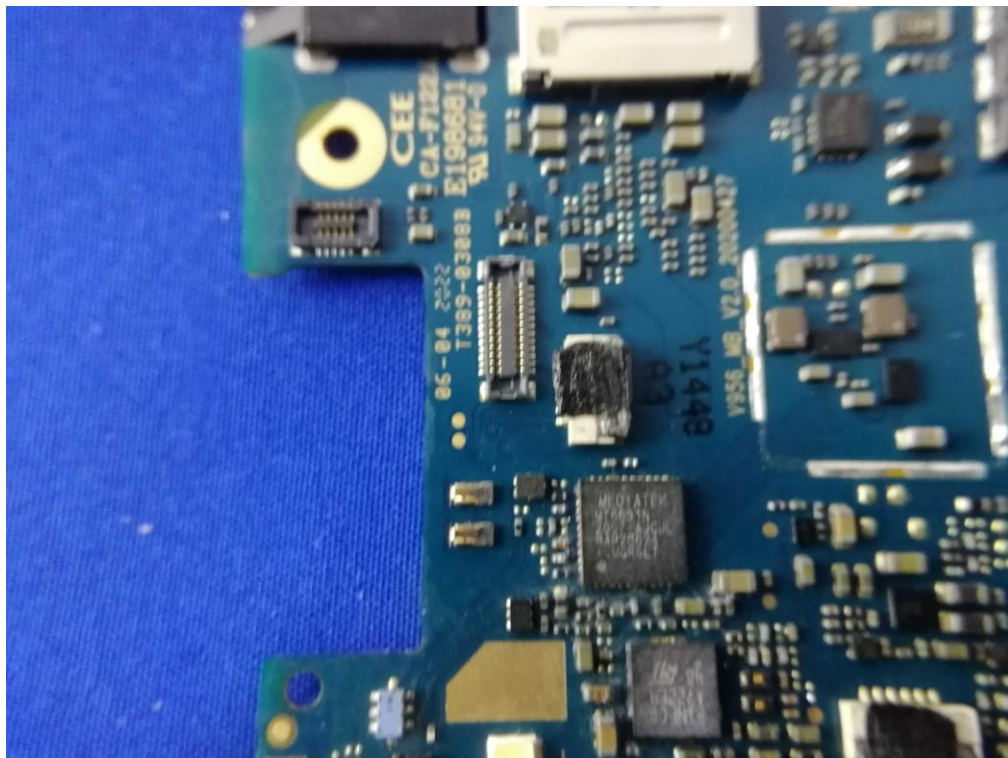
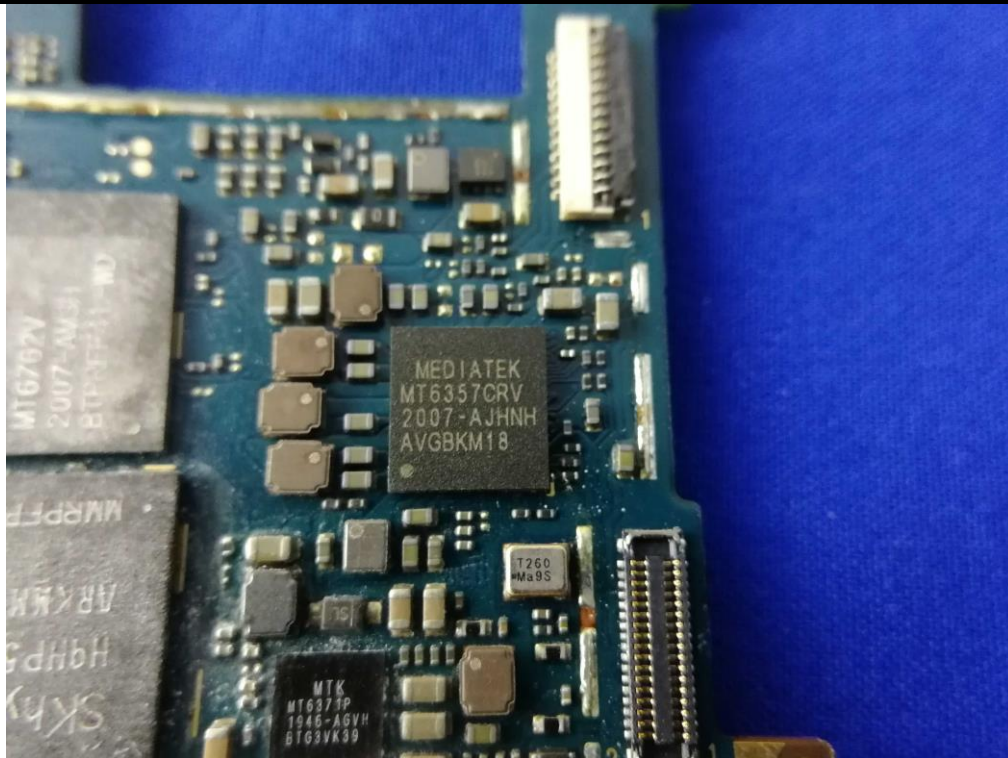


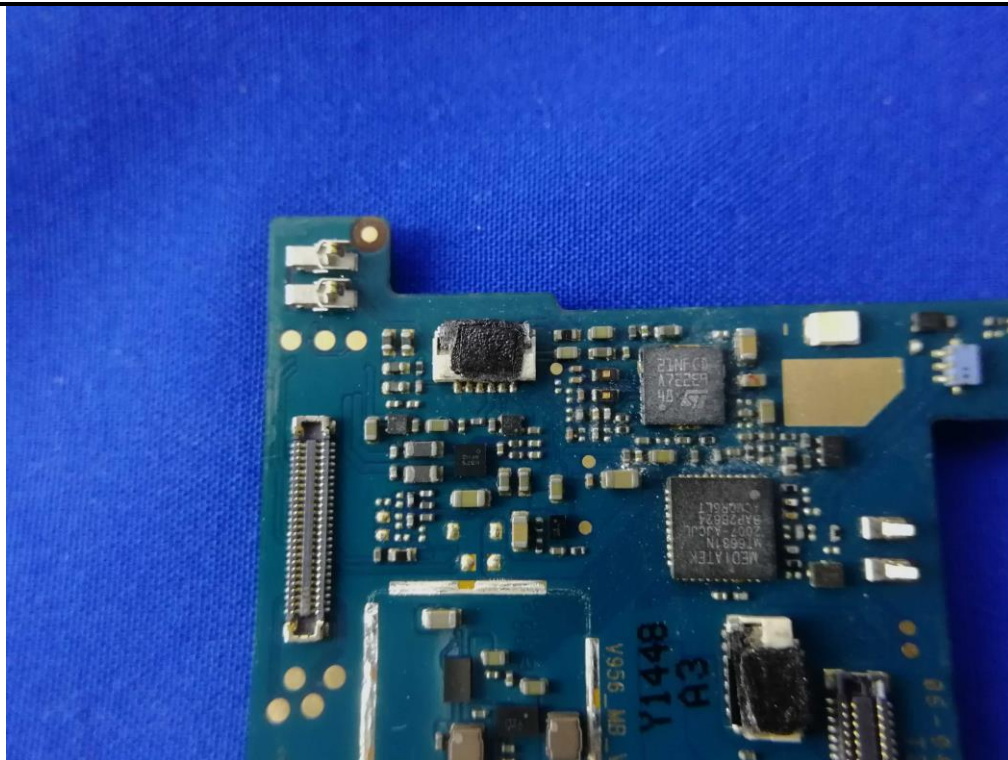




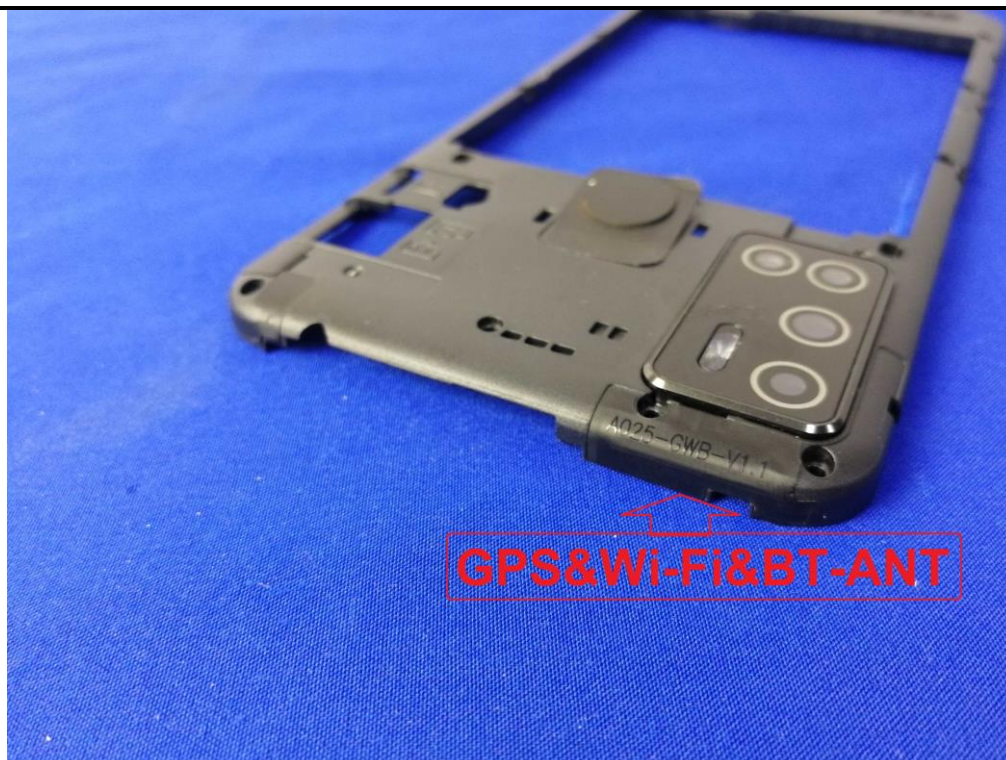














-----End of report-----