EMC TEST REPORT

For

Shenzhen DOOGEE Hengtong Technology CO., LTD

3G/4G Smart Phone

Test Model: X96Pro

Additional Model No.: X96

Prepared for	:	Shenzhen DOOGEE Hengtong Technology CO., LTD
Address	:	B, 2/F, Building A4, Silicon Valley Power Digital Industrial Park, No. 22, Dafu Industrial Zone, Guanlan Aobei Community, Guanlan Street, Longhua New District, Shenzhen, China.
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	Room 101, 201, Building A and Room 301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Street, Bao'an District, Shenzhen, Guangdong, China
Tel	:	(+86)755-82591330
Fax	:	(+86)755-82591332
Web	:	www.LCS-cert.com
Mail	:	webmaster@LCS-cert.com
Date of receipt of test sample	:	February 22, 2021
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	February 22, 2021 ~ March 05, 2021
Date of Report	:	March 08, 2021

CE

EMC TEST REPORT

ETSI EN 301 489-17 V3.2.4 (2020-09) & ETSI EN 301 489-19 V2.1.1 (2019-04) & Draft ETSI EN 301 489-52 V1.1.2 (2020-12)

Report Reference No.	:	**LCS210222023AEA**
Date Of Issue	:	March 08, 2021
Testing Laboratory Name	:	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	:	Room 101, 201, Building A and Room 301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Street, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure	:	Full application of Harmonised standards■ Partial application of Harmonised standards□ Other standard testing method□
Applicant's Name	:	**Shenzhen DOOGEE Hengtong Technology CO., LTD**
Address	:	B, 2/F, Building A4, Silicon Valley Power Digital Industrial Park, No. 22, Dafu Industrial Zone, Guanlan Aobei Community, Guanlan Street, Longhua New District, Shenzhen, China.
Test Specification		
Standard	:	ETSI EN 301 489-1 V2.2.3 (2019-11) ETSI EN 301 489-17 V3.2.4 (2020-09) ETSI EN 301 489-19 V2.1.1 (2019-04) Draft ETSI EN 301 489-52 V1.1.2 (2020-12) EN 55032:2015/A1:2020 EN 55035:2017/A11:2020
Test Report Form No.	:	LCSEMC-1.0
TRF Originator	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	:	Dated 2017-06

Test Item Description	:	**3G/4G Smart Phone**
Trade Mark	:	DOOGEE
Test Model	:	X96Pro
Ratings	:	DC 3.85V by Rechargeable Li-ion Battery(5400mAh) Recharged by 5.0V⎓2.0A Adapter
Result	:	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Linda He / Administrators	Jin Wang/ Technique principal	Gavin Liang/ Manager

EMC -- TEST REPORT

Test Report No. : LCS210222023AEA	March 08, 2021 Date of issue

Test Model.....	: X96Pro
EUT.....	: 3G/4G Smart Phone
Applicant.....	**: Shenzhen DOOGEE Hengtong Technology CO., LTD**
Address.....	: B, 2/F, Building A4, Silicon Valley Power Digital Industrial Park, No. 22, Dafu Industrial Zone, Guanlan Aobei Community, Guanlan Street, Longhua New District, Shenzhen, China.
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: Shenzhen DOOGEE Hengtong Technology CO., LTD**
Address.....	: B, 2/F, Building A4, Silicon Valley Power Digital Industrial Park, No. 22, Dafu Industrial Zone, Guanlan Aobei Community, Guanlan Street, Longhua New District, Shenzhen, China.
Telephone.....	: /
Fax.....	: /
Factory.....	**: /**
Address.....	: /
Telephone.....	: /
Fax.....	: /

Test Result	**Positive**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Report Version	Issue Date	Revisions	Revised By
000	March 08, 2021	Initial Issue	Gavin Liang

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. Product Description for Equipment Under Test (EUT)

EUT	:	3G/4G Smart Phone
Test Model	:	X96Pro
Additional Model No.	:	X96
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Power Supply	:	DC 3.85V by Rechargeable Li-ion Battery(5400mAh) Recharged by 5.0V⎓2.0A Adapter
Hardware Version	:	V1.0
Software Version	:	DOOGEE-X96Pro-Android11-20210129
2G	:	
Support Band	:	☒GSM 900 (EU-Band) ☒DCS 1800 (EU-Band) ☒GSM 850 (U.S.-Band) ☒PCS 1900 (U.S.-Band)
Release Version	:	R99
GPRS Class	:	Class 12
EGPRS Class	:	Class 12
Uplink	:	GSM 900: 880MHz ~ 915MHz DCS 1800: 1710MHz ~ 1785MHz
Downlink	:	GSM 900: 925MHz ~ 960MHz DCS 1800: 1805MHz ~ 1880MHz
Type Of Modulation	:	GMSK for GSM/GPRS; 8PSK for EGPRS
Antenna Description	:	PIFA Antenna; 2.0dBi (max.)
Power Class	:	GSM 900: Level 5, DCS 1800: Level 0
3G	:	
Support Band	:	☒WCDMA Band II (U.S.-Band) ☒WCDMA Band V (U.S.-Band) ☐WCDMA Band IV (U.S.-Band) ☒WCDMA Band I (EU-Band) ☒WCDMA Band VIII (EU-Band)
Release Version	:	R8
Uplink	:	WCDMA Band I: 1920MHz ~ 1980MHz WCDMA Band VIII: 880MHz~915MHz
Downlink	:	WCDMA Band I: 2110MHz ~ 2170MHz WCDMA Band VIII: 925MHz~960MHz
Type Of Modulation	:	WCDMA: BPSK; HSDPA/HSUPA: BPSK
Antenna Description	:	PIFA Antenna; 2.0dBi (max.)
Power Class	:	Level 3
LTE	:	
Support Band	:	☒E-UTRA Band 1(EU-Band) ☒E-UTRA Band 3(EU-Band) ☒E-UTRA Band 5(Non EU-Band)

		☒E-UTRA Band 7(EU-Band) ☒E-UTRA Band 8(EU-Band) ☒E-UTRA Band 20(EU-Band) ☒E-UTRA Band 40(EU-Band) ☒E-UTRA Band 41(Non EU-Band)
LTE Release Version	:	R9
FDD Band	:	Uplink: E-UTRA Band 1: 1920MHz ~ 1980MHz E-UTRA Band 3: 1710MHz~1785MHz E-UTRA Band 7: 2500MHz ~ 2570MHz E-UTRA Band 8: 880MHz ~ 915MHz E-UTRA Band 20: 832MHz ~ 862MHz Downlink: E-UTRA Band 1: 2110MHz ~ 2170MHz E-UTRA Band 3: 1805MHz~1880MHz E-UTRA Band 7: 2620MHz ~ 2690MHz E-UTRA Band 8: 925MHz ~ 960MHz E-UTRA Band 20: 791MHz ~ 821MHz
TDD Band	:	E-UTRA Band 40: 2300MHz ~ 2400MHz
Type Of Modulation	:	QPSK/16QAM
Antenna Description	:	PIFA Antenna; 2.0dBi (max.)
Power Class	:	Class 3
Bluetooth	:	
Frequency Range	:	2402MHz ~ 2480MHz
Channel Number	:	79 channels for Bluetooth V4.2 (BDR/EDR) 40 channels for Bluetooth V4.2 (BT LE)
Channel Spacing	:	1MHz for Bluetooth V4.2 (BDR/EDR) 2MHz for Bluetooth V4.2 (BT LE)
Modulation Type	:	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth V4.2 (BDR/EDR) GFSK for Bluetooth V4.2 (BT LE)
Bluetooth Version	:	V4.2
WIFI(2.4G Band)	:	
Frequency Range	:	2412MHz ~ 2472MHz
Channel Spacing	:	5MHz
Channel Number	:	13 Channel for 20MHz bandwidth(2412~2472MHz) 9 channels for 40MHz bandwidth(2422~2462MHz)
Modulation Type	:	802.11b: DSSS; 802.11g/n: OFDM
GPS Receiver	:	
Receive Frequency	:	1575.42MHz
Channel Number	:	1
Antenna Description	:	PIFA Antenna, 2.0dBi(Max.) The BT, WIFI and GPS shares the same antenna.
FM	:	
Frequency Range	:	87.5MHz ~ 108MHz
Modulation Type	:	FM

Antenna Description : External Antenna (Earphone)

1.2. Objective

ETSI EN 301 489-1	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility
ETSI EN 301 489-17	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard for ElectroMagnetic Compatibility
ETSI EN 301 489-19	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 19: Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1,5 GHz band providing data communications and GNSS receivers operating in the RNSS band (ROGNSS) providing positioning, navigation, and timing data; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
ETSI EN 301 489-52	Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 52: Specific conditions for Cellular Communication Mobile and portable (UE) radio and ancillary equipment
EN 55032	Electromagnetic compatibility of multimedia equipment - Emission requirements
EN 55035	Electromagnetic compatibility of multimedia equipment - Immunity requirements

The objective is to determine compliance with ETSI EN 301 489-1 V2.2.3 (2019-11), ETSI EN 301 489-17 V3.2.4 (2020-09), ETSI EN 301 489-19 V2.1.1 (2019-04), Draft ETSI EN 301 489-52 V1.1.2 (2020-12), EN 55032:2015/A1:2020 and EN 55035:2017/A11:2020.

1.3. Related Submittal(s)/Grant(s)

No Related Submittals.

1.4. Test Methodology

All measurements contained in this report were conducted with ETSI EN 301 489-1 V2.2.3 (2019-11), ETSI EN 301 489-17 V3.2.4 (2020-09), ETSI EN 301 489-19 V2.1.1 (2019-04), Draft ETSI EN 301 489-52 V1.1.2 (2020-12), EN 55032:2015/A1:2020 and EN 55035:2017/A11:2020.

1.5. Description of Test Facility

NVLAP Accreditation Code is 600167-0.
FCC Designation Number is CN5024.
CAB identifier is CN0071.
CNAS Registration Number is L4595.

1.6. Support Equipment List

Manufacturer	Description	Model	Serial Number	Certificate
SHENZHEN EAST SUN ELECTRONIC CO., LTD	Adapter	ES518-U050200 XYE	---	CE

1.7. External I/O

I/O Port Description	Quantity	Cable
USB Port(Type C)	1	1.0m, unshielded
Earphone Jack	1	N/A

1.8. Measurement Uncertainty

Item	MU	Remark
Uncertainty for Power point Conducted Emissions Test	2.42dB	
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.54dB	Polarize: V
	4.1dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	2.08dB	Polarize: H
	2.56dB	Polarize: V
Uncertainty for radio frequency	0.01ppm	
Uncertainty for conducted RF Power	0.65dB	
Uncertainty for temperature	0.2℃	
Uncertainty for humidity	1%	
Uncertainty for DC and low frequency voltages	0.06%	

1.9. Description of Test Modes

There was 27 test Modes. TM1 to TM 27 were shown below:

TM1 : Operate in traffic mode GSM 900;
TM2 : Operate in traffic mode GPRS 900;
TM3 : Operate in traffic mode EGPRS 900;
TM4 : Operate in traffic mode DCS 1800;
TM5 : Operate in traffic mode GPRS 1800;
TM6 : Operate in traffic mode EGPRS 1800;
TM7 : Operate in traffic mode WCDMA For band I;
TM8 : Operate in traffic mode HSUPA For band I;
TM9 : Operate in traffic mode HSDPA For band I;
TM10 : Operate in traffic mode WCDMA For band VIII;
TM11 : Operate in traffic mode HSUPA For band VIII;
TM12 : Operate in traffic mode HSDPA For band VIII;
TM13 : Operate in traffic mode For E-UTRA Band 1;
TM14 : Operate in traffic mode For E-UTRA Band 3;
TM15 : Operate in traffic mode For E-UTRA Band 7;
TM16 : Operate in traffic mode For E-UTRA Band 8;
TM17 : Operate in traffic mode For E-UTRA Band 20;
TM18 : Operate in traffic mode For E-UTRA Band 40;
TM19 : Operate in 2.4G WIFI Link mode;
TM20 : Operate in Bluetooth mode;
TM21 : Operate in GPS(RX) mode;
TM22 : Operate in FM(RX) mode;
TM23 : Playing music mode;
TM24 : Camera mode;
TM25 : Exchange data with PC;
TM26 : Operate in charging mode;
TM27 : Idle mode

***Note:
1. The EUT has two SIM card slots(SIM1&SIM2). The result for GSM/WCDMA/LTE card slot(SIM1) is the worst case which was only recorded.
2. All test modes were tested, but we only recorded the worst case in this report.

2. SUMMARY OF TEST RESULTS

Rule	Description of Test Items	Result
§7.1	Reference to clause 8.4 of ETSI EN 301 489-1 Conducted Emission (AC mains input/output port)	Compliant
§7.1	Reference to clause 8.3 of ETSI EN 301 489-1 Conducted Emission (DC power input/output port)	N/A*
§7.1	Reference to clause 8.7 of ETSI EN 301 489-1 Conducted Emission (Wired network port)	N/A*
§7.1	Reference to clause 8.2 of ETSI EN 301 489-1 Radiated Emission (Enclosure of ancillary equipment)	Compliant
§7.1	Reference to clause 8.5 of ETSI EN 301 489-1 Harmonic current emissions (AC mains input port)	Compliant
§7.1	Reference to clause 8.6 of ETSI EN 301 489-1 Voltage fluctuations and flicker (AC mains input port)	Compliant
§7.2	Reference to clause 9.3 of ETSI EN 301 489-1 Electrostatic discharge (Enclosure port) (EN 61000-4-2)	Compliant
§7.2	Reference to clause 9.2 of ETSI EN 301 489-1 RF electromagnetic field (80MHz to 6000MHz) (Enclosure port) (EN 61000-4-3)	Compliant
§7.2	Reference to clause 9.4 of ETSI EN 301 489-1 Fast transients common mode (signal, wired network and control ports, DC and AC power ports) (EN 61000-4-4)	Compliant
§7.2	Reference to clause 9.8 of ETSI EN 301 489-1 Surges, line to line and line to ground (AC mains power input ports, wired network ports) (EN 61000-4-5)	Compliant
§7.2	Reference to clause 9.5 of ETSI EN 301 489-1 RF common mode 0.15MHz to 80MHz (signal, wired network and control ports, DC and AC power ports) (EN 61000-4-6)	Compliant
§7.2	Reference to clause 9.6 of ETSI EN 301 489-1 Transients and surges in the vehicular environment (ISO 7637-2)	N/A*
§7.2	Reference to clause 9.7 of ETSI EN 301 489-1 Voltage dips and interruptions (AC mains power input ports) (EN 61000-4-11)	Compliant

3. TEST RESULTS

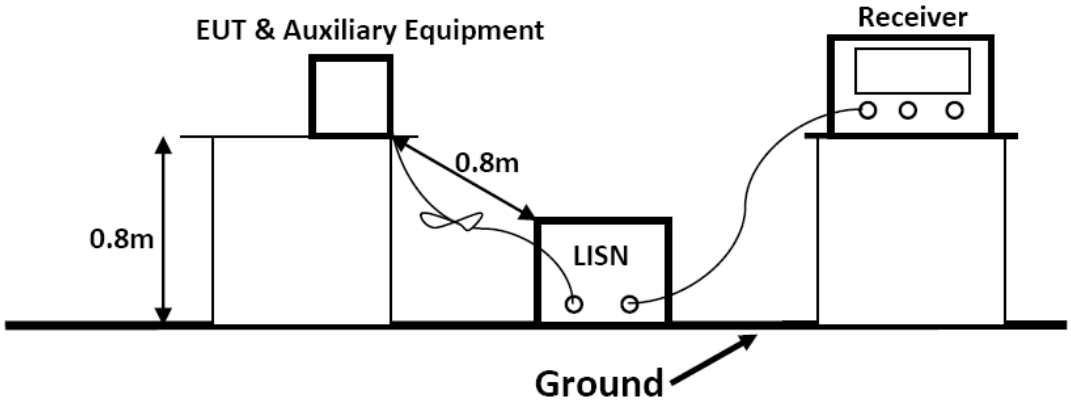
3.1. Line Conducted Emission

3.1.1 Conducted Emission Limit

Relevant Standard(s): ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 55032:2015/A1:2020 Class B

Limits for Line Conducted Emission		
Frequency (MHz)	Limit (dBμV)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66.0 ~ 56.0 *	56.0 ~ 46.0 *
0.50 ~ 5.00	56.0	46.0
5.00 ~ 30.00	60.0	50.0
NOTE1-The lower limit shall apply at the transition frequencies. NOTE2-The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.		

3.1.2 Test Configuration



The setup of EUT is according with per ETSI EN 301 489-1 measurement procedure. The specification used was with the ETSI EN 301 489-1 limits.

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.

The EUT received charging power from the charger which received power through a LISN supplying power of AC 230V/50Hz.

3.1.3 EMI Test Receiver Setup

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

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	150KHz ~ 30MHz
(IF)RBW	9kHz

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

3.1.4 Test Procedure

Power on the EUT, the EUT begins to work. Make sure the EUT operates normally during the test.

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

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

3.1.5 Test Results

PASS

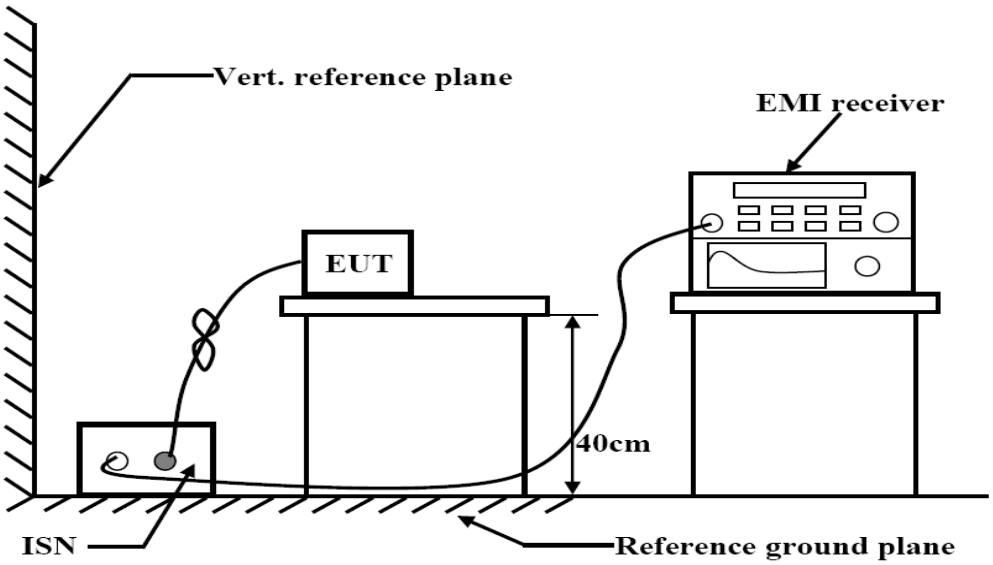
Please refer to Appendix A.1 for Emission and Immunity test results.

3.2. Conducted Emission (Wired Network Port)

3.2.1 Conducted Emission Limit(Wired Network Port)

Limits for asymmetric mode conducted emissions				
Frequency (MHz)	Class B voltage limits (dBμV)		Class B current limits (dBμA)	
	Quasi-peak Level	Average Level	Quasi-peak Level	Average Level
0.15 ~ 0.50	84.0~74.0	74.0~64.0	40.0~30.0	30.0~20.0
0.50 ~ 30.00	74.0	64.0	30.0	20.0
NOTE 1-The limits decrease linearly with the logarithm of the frequency in the range 0,15 MHz to 0,5 MHz. NOTE 2-The current and voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which presents a common mode (asymmetric mode) impedance of 150Ω to the telecommunication port under test (conversion factor is 20 log10 150 / l = 44 dB).				

3.2.2 Test Configuration



3.2.3 EMI Test Receiver Setup

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

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	150KHz ~ 30MHz
(IF)RBW	9kHz

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

3.2.4 Test Procedure

Please refer to ETSI EN 301 489-1 Clause 8.7.2 and EN 55032 Clause 6 for the measurement methods.

3.2.5 Test Results

Not applicable.

3.3. Radiated Disturbance

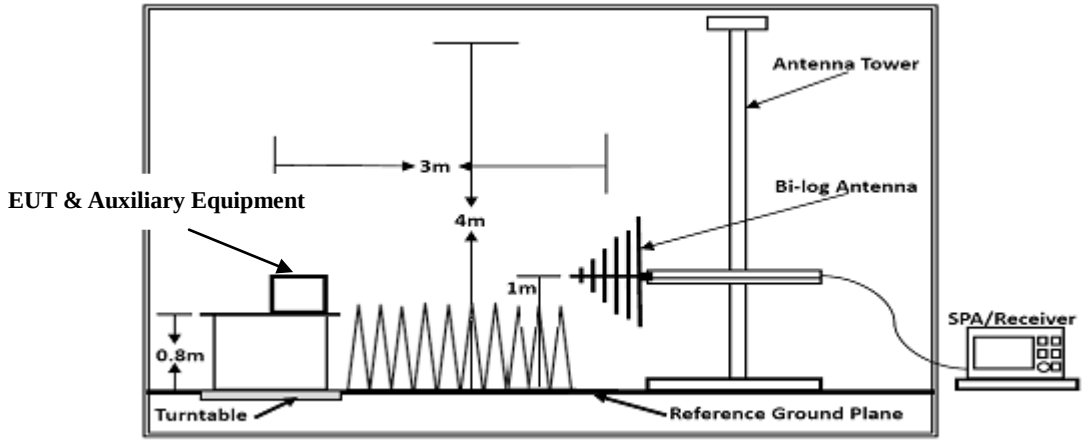
3.3.1 Radiated Emission Limit

Relevant Standard(s): ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 55032:2015/A1:2020 Class B

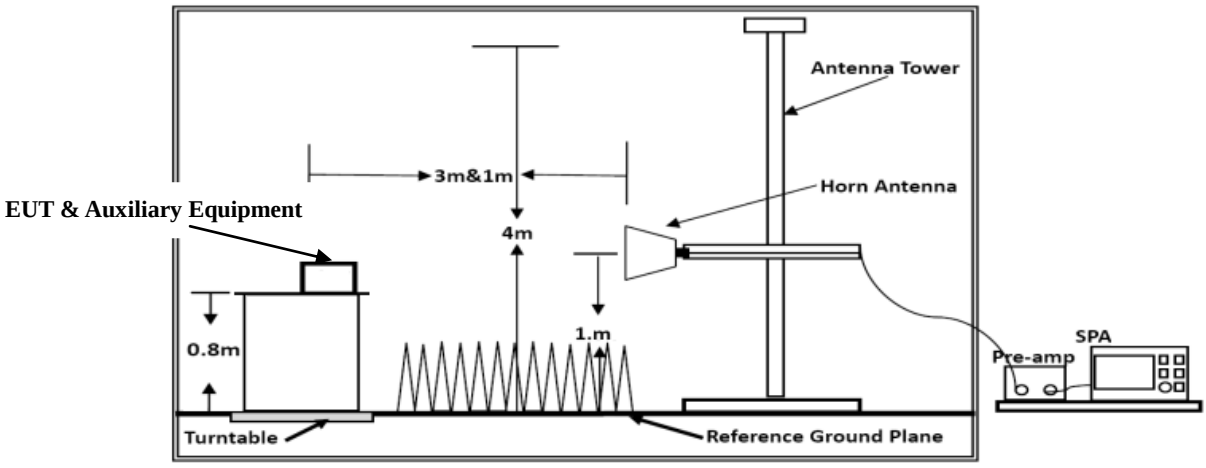
Limits for Radiated Disturbance Below 1GHz			
Frequency (MHz)	Facility	Distance (Meters)	Field Strengths Limit (dBμV/m)
30 ~ 230	FAR	3	42-35
230 ~ 1000	FAR	3	42
***Note: (1) The smaller limit shall apply at the combination point between two frequency bands. (2) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the EUT.			
Limits for Radiated Disturbance Above 1GHz			
Frequency (MHz)	Distance (Meters)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)
1000 ~ 3000	3	70	50
3000 ~ 6000	3	74	54
***Note: The lower limit applies at the transition frequency.			

Limits for Radiated Disturbance Below 1GHz (For FM Receivers)			
Frequency (MHz)	Distance (Meters)	Class B Limit (dBμV/m)	
		Fundamental	Harmonics
30 ~ 230	3	60	52
230 ~ 300	3		52
300 ~ 1000	3		56
***Note: These relaxed limits apply only to emissions at the fundamental and harmonic frequencies of the LO. Signals at all other frequencies shall be compliant with the limits given in above Table.			
Limits for Radiated Disturbance Above 1GHz (For FM Receivers)			
1000 ~ 3000	3	70	50
3000 ~ 6000	3	74	54
***Note: The lower limit applies at the transition frequency.			

3.3.2 Test Configuration



Below 1GHz



Above 1GHz

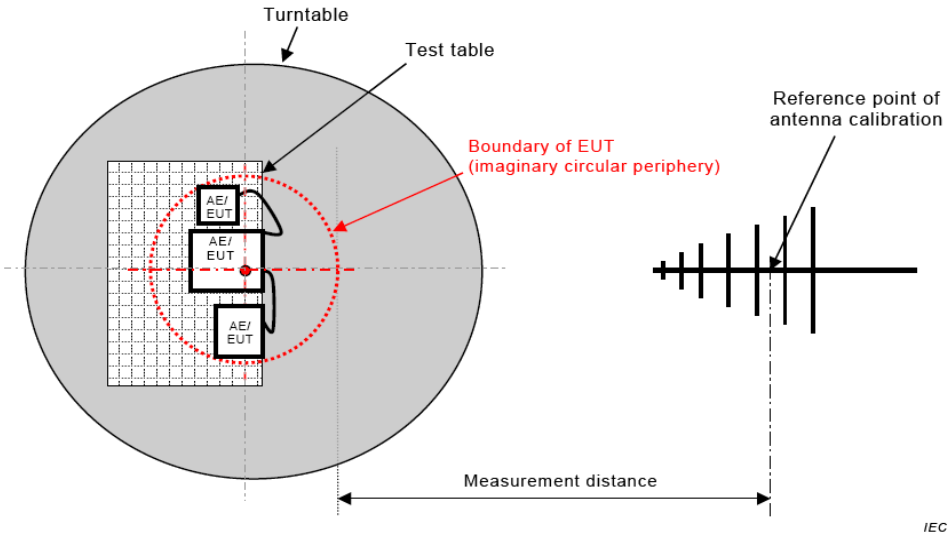


Figure C.1 – Measurement distance

Test Setup for FM Receiver

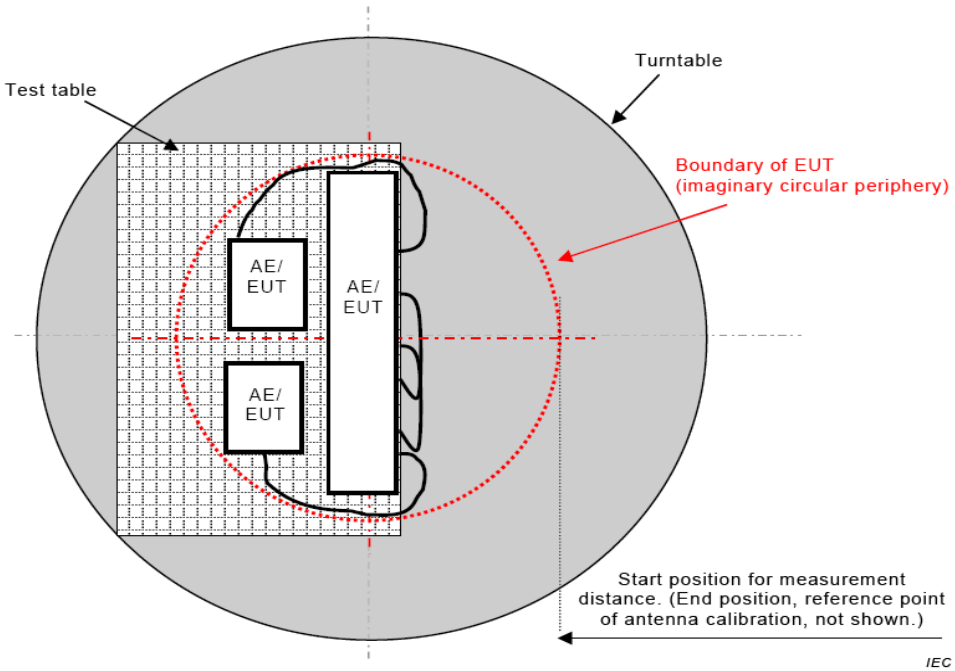


Figure C.2 – Boundary of EUT, Local AE and associated cabling

Test Setup for FM Receiver

3.3.3 Test Procedure

1) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
--- Auxiliary equipment and cables were positioned to simulate normal operation conditions
--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
--- The measurement distance is 3 meter.
--- The EUT was set into operation.

Pre-measurement:

--- The turntable rotates from 0 °to 315 °using 45 °steps.
--- The antenna is polarized vertical and horizontal.
--- The antenna height changes from 1 to 4 meter.
--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.
--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (±45 °) and antenna movement between 1 and 4 meter.
--- The final measurement will be done with QP detector with an EMI receiver.
--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre-measurement with marked maximum final measurements and the limit will be stored.

2) Sequence of testing 1 GHz to 6 GHz

Setup:
--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
--- Auxiliary equipment and cables were positioned to simulate normal operation conditions
--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
--- The measurement distance is 3 meter.
--- The EUT was set into operation.
Pre-measurement:
--- The turntable rotates from 0 °to 315 °using 45 °steps.
--- The antenna is polarized vertical and horizontal.
--- The antenna height scan range is 1 meter to 4 meter.
--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.
Final measurement:
--- The final measurement will be performed with minimum the six highest peaks.
--- According to the maximum antenna and turntable positions of pre-measurement the software maximize the peaks by changing turntable position (±45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre-measurement with marked maximum final measurements and the limit will be stored.

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	30MHz~1000MHz / RBW 100kHz for QP

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	6000 MHz
RBW / VBW	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average

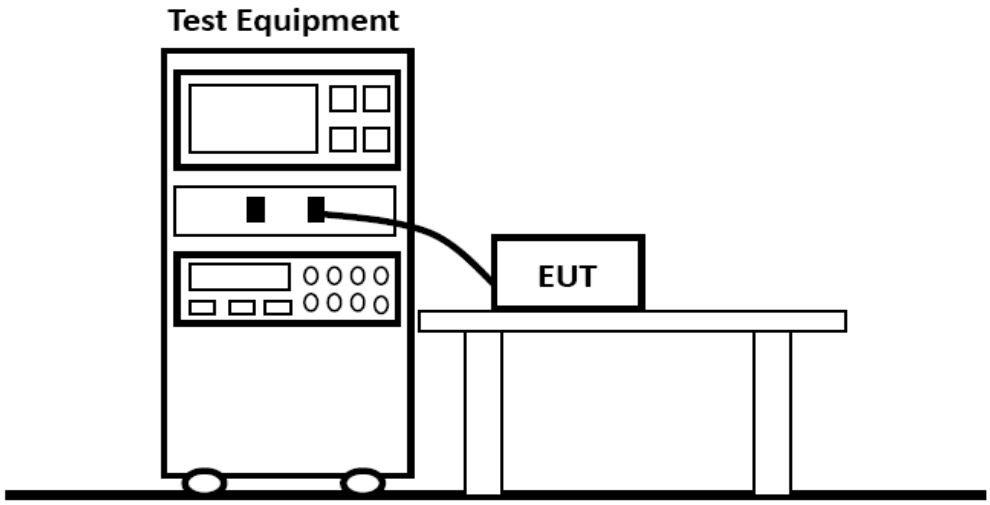
3.3.4 Test Results

PASS

The worst test mode of the EUT was TM1, and its test data please refer to Appendix A.3 for Emission and Immunity test results.

3.4. Harmonic Current Emissions

3.4.1 Test Configuration



3.4.2 Test Standard

According to ETSI EN 301 489-1 V2.2.3 (2019-11) & EN 61000-3-2: 2014

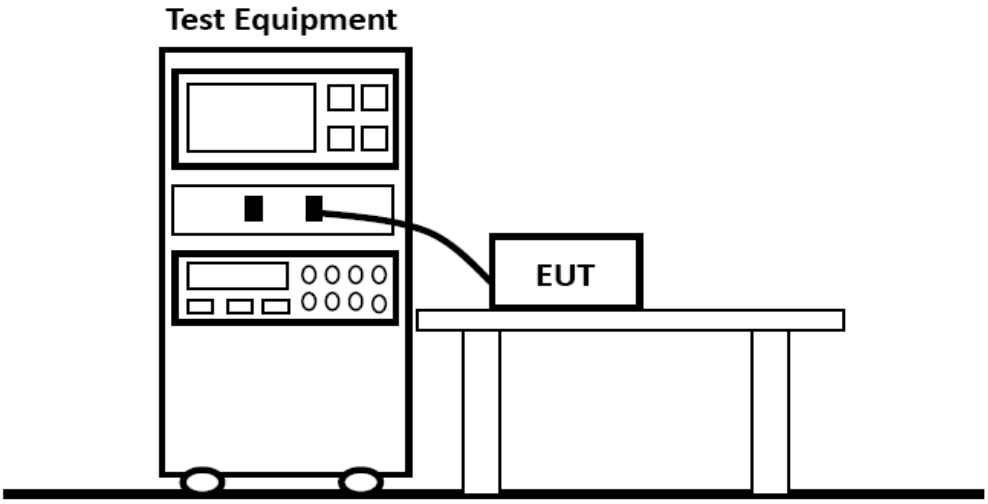
3.4.3 Test Results

PASS

Please refer to Appendix A.4 for Emission and Immunity test results.

3.5. Voltage Fluctuation and Flicker

3.5.1 Test Configuration



3.5.2 Test Standard

According to ETSI EN 301 489-1 V2.2.3 (2019-11) & EN 61000-3-3: 2013

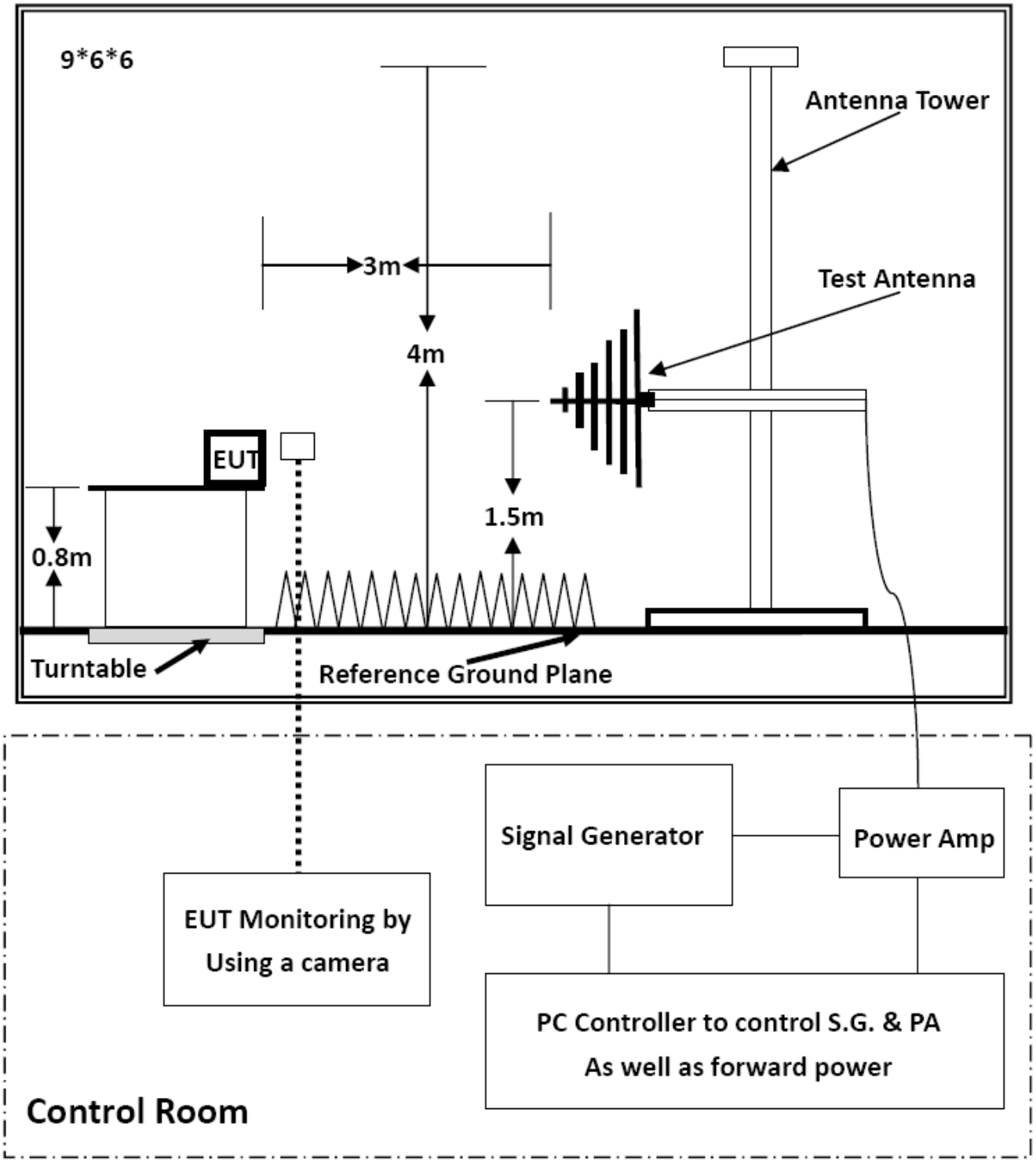
3.5.3 Test Results

PASS

Please refer to Appendix A.5 for Emission and Immunity test results.

3.6. RF Electromagnetic Field (80 MHz - 6000 MHz)

3.6.1 Test Configuration



3.6.2 Test Standard

ETSI EN 301 489-1, ETSI EN 301 489-3, ETSI EN 301 489-17, ETSI EN 301489-19 & ETSI EN 301 489-52 / (EN 61000-4-3: 2006+A2: 2010)

Test level 2 at 3V/m.

3.6.3 Severity Level

Level	Field Strength (V/m)
1	1
2	3
3	10
X	Special
Performance Criterion: **A**	

3.6.4 Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. EUT is set 3 meter away from the transmitting antenna which is mounted on an antenna tower. Both horizontal and vertical polarization of the antenna are set on test. Each of the four sides of EUT must be faced this transmitting antenna and measured individually. In order to judge the EUT performance, a CCD camera is used to monitor EUT screen. All the scanning conditions are as follows:

Condition of Test	Remark
Fielded Strength	3 V/m (Severity Level 2)
Radiated Signal	Unmodulated
Scanning Frequency	80-6000MHz
Dwell time of radiated	0.0015 decade/s
Waiting Time	3 Sec.

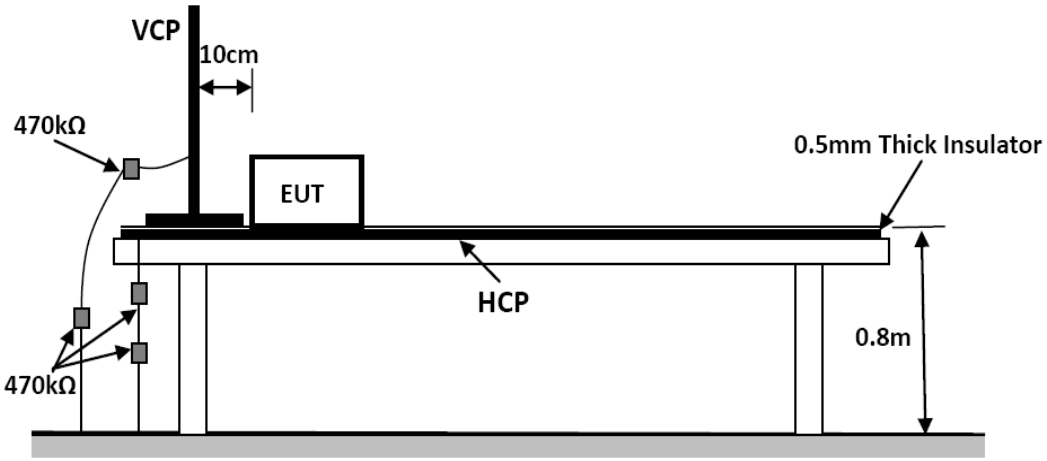
3.6.5 Test Results

PASS

Please refer to Appendix A.6 for Emission and Immunity test results.

3.7. Electrostatic Discharge

3.7.1 Test Configuration



EN 61000-4-2 specifies that a tabletop EUT shall be placed on a non-conducting table which is 80 centimeters above a ground reference plane and that floor mounted equipment shall be placed on a insulating support approximately 10 centimeters above a ground plane. During the tests, the EUT is positioned over a ground reference plane in conformance with this requirement.

For tabletop equipment, a 1.5 by 1.0-meter metal sheet (HCP) is placed on the table and connected to the ground plane via a metal strap with two 470 k Ohms resistors in series. The EUT and attached cables are isolated from this metal sheet by 0.5-millimeter thick insulating material. A Vertical Coupling Plane (VCP) grounded on the ground plane through the same configuration as in the HCP is used.

3.7.2 Test Procedure

ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 61000-4-2: 2009
Test level 3 for Air Discharge at ±8 kV
Test level 2 for Contact Discharge at ±4 kV

3.7.2.1 Air Discharge

This test is done on a non-conductive surface. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

3.7.2.2 Contact Discharge

All the procedure shall be same as Section 3.7.2.1. except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

3.7.2.3 Indirect Discharge For Horizontal Coupling Plane

At least 10 single discharges (in the most sensitive polarity) shall be applied at the front edge of each HCP opposite the center point of each unit (if applicable) 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.

3.7.2.4 Indirect Discharge For Vertical Coupling Plane

At least 10 single discharges (in the most sensitive polarity) shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

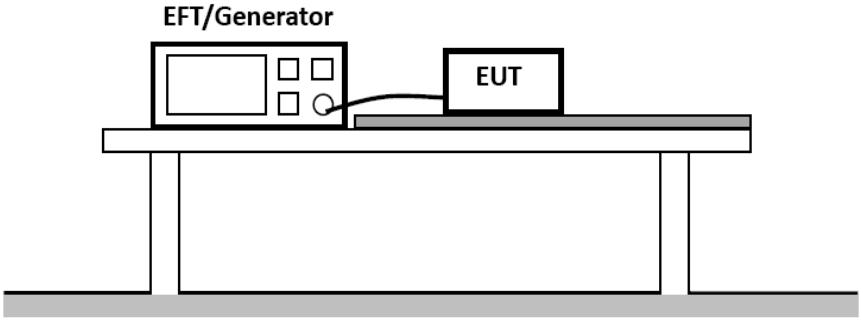
3.7.3 Test Results

PASS

Please refer to Appendix A.7 for Emission and Immunity test results.

3.8. Electrical Fast Transient Immunity

3.8.1 Test Configuration



3.8.2 Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11)/ EN61000-4-4: 2012
Test level 2 at 1 kV

Test Level		
Open Circuit Output Test Voltage ±10%		
Level	On Power Supply Lines	On I/O (Input/Output) Signal data and control lines
1	0.5 kV	0.25 kV
2	1 kV	0.5 kV
3	2 kV	1 kV
4	4 kV	2 kV
X	Special	Special
Performance Criterion: B		

3.8.3 Test Procedure

The EUT is put on the table, which is 0.8 meter high above the ground. This reference ground plane shall 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 beneath the EUT, shall be more than 0.5m.

3.8.3.1 For input and output AC power ports:
The EUT is connected to the power mains by using a coupling device, which couples the EFT interference signal to AC power lines. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 minutes.

3.8.3.2 For signal lines and control lines ports: No I/O ports. It's unnecessary to test.

3.8.3.3 For DC output line ports: It's unnecessary to test.

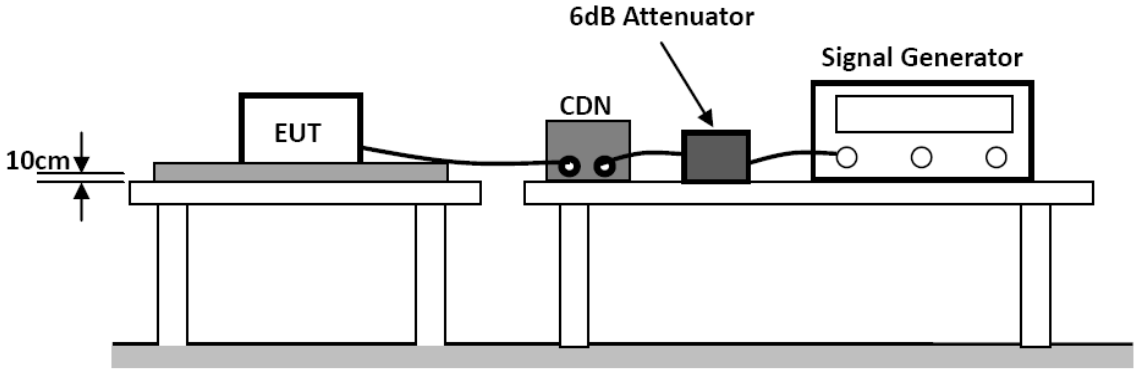
3.8.4 Test Results

PASS

Please refer to Appendix A.8 for Emission and Immunity test results.

3.9. RF Common Mode

3.9.1 Test Configuration



3.9.2 Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11)/ EN 61000-4-6: 2014
Test level: 3V (r.m.s.) for 0.15MHz ~ 10MHz; 3V (r.m.s.) to 1V (r.m.s.) for 10MHz ~ 30MHz; 1V (r.m.s.) for 30MHz ~ 80MHz
Modulation type: AM
Modulation depth: 80%
Modulation signal: 1 kHz

Test Level	
Level	Voltage Level (r.m.s..) (V)
1	1
2	3
3	10
X	Special
Performance Criterion: A	

3.9.3 Test Procedure

3.9.3.1 Let the EUT work in test mode and test it.

3.9.3.2 The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50mm (where possible).

3.9.3.3 The disturbance signal described below is injected to EUT through CDN.

3.9.3.4 The EUT operates within its operational mode(s) under intended climatic conditions after power on.

3.9.3.5 The frequency range is swept from 150kHz to 10MHz using 3V signal level, 10MHz to 30MHz using 3V to 1V signal level, 30MHz to 80MHz using 1V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave.

3.9.3.6 The rate of sweep shall not exceed 1.5*10-3 decades/s. Where the frequency is swept incrementally, the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.

3.9.3.7 Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

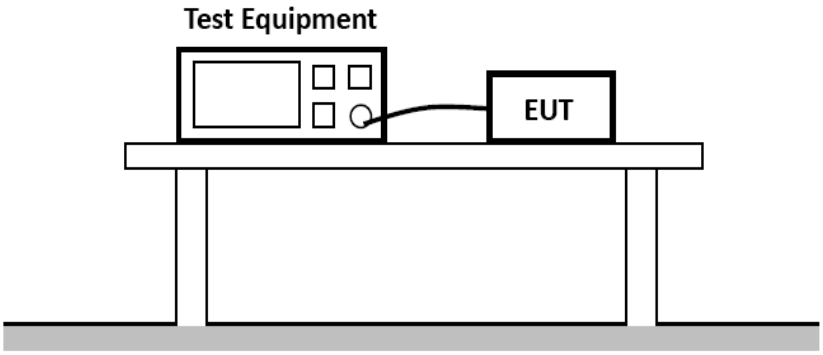
3.9.4 Test Results

PASS

Please refer to Appendix A.9 for Emission and Immunity test results.

3.10. Surges, Line to Line and Line to Ground

3.10.1 Test Configuration



3.10.2 Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 61000-4-5: 2014
L-N: Test level 2 at 1 kV
L-PE, N-PE Test Level 3 at 2kV

Test Level		
Open Circuit Output Test Voltage ±10%		
Level	On Power Supply Lines	On I/O (Input/Output) Signal data and control lines
1	0.5 kV	0.25 kV
2	1 kV	0.5 kV
3	2 kV	1 kV
4	4 kV	2 kV
X	Special	Special
Performance Criterion: B		

3.10.3 Test Procedure

3.10.3.1 For line to line coupling mode, provide a 0.5 kV 1.2/50us voltage surge (at open-circuit condition).
3.10.3.2 At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are conducted during test.
3.10.3.3 Different phase angles are done individually.
3.10.3.4 Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

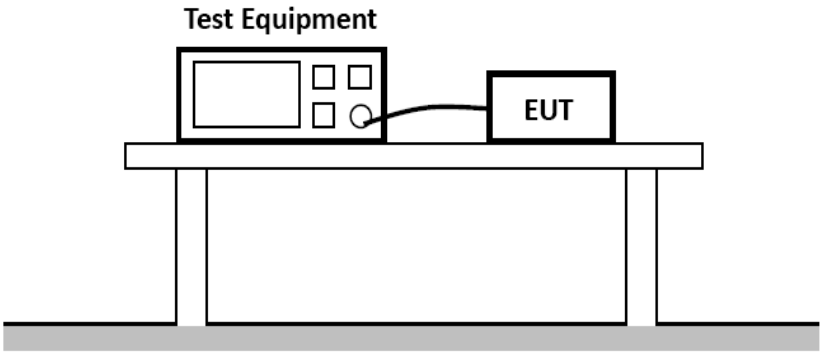
3.10.4 Test Results

PASS

Please refer to Appendix A.10 for Emission and Immunity test results.

3.11. Voltage Dips/Interruptions Immunity Test

3.11.1 Test Configuration



3.11.2 Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11)/ EN 61000-4-11: 2004+A1:2017
Test levels and Performance Criterion

Test Level		
Voltage Reduction $\%U_T$	Voltage Dips $\%U_T$	Duration (in Period)
100	0	0.5
100	0	1
30	70	5
Voltage Reduction $\%U_T$	Voltage Dips $\%U_T$	Duration (in Period)
100	0	250
Performance Criterion: B&C		

3.11.3 Test Procedure

3.11.3.1 The interruption is introduced at selected phase angles with specified duration.

3.11.3.2 Record any degradation of performance.

3.11.4 Test Results

PASS

Please refer to Appendix A.11 for Emission and Immunity test results.

4. GENERAL PERFORMANCE CRITERIA FOR IMMUNITY TEST

4.1. Performance criteria for Continuous phenomena applied to Transmitter (CT)

For equipment of type II or type III that requires a communication link that is maintained during the test, it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained during each individual exposure in the test sequence.
Where the EUT is a transmitter, tests shall be repeated with the EUT in standby mode to ensure that any unintentional transmission does not occur.

4.2. Performance criteria for Transient phenomena applied to Transmitter (TT)

For equipment of type II or type III that requires a communication link that is maintained during the test, this shall be verified by appropriate means supplied by the manufacturer during each individual exposure in the test sequence. Where the EUT is a transmitter, tests shall be repeated with the EUT in standby mode to ensure that any unintentional transmission does not occur.

4.3. Performance criteria for Continuous phenomena applied to Receiver (CR)

For equipment of type II or III that requires a communication link that is maintained during the test, it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained during each individual exposure in the test sequence. Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

4.4. Performance criteria for Transient phenomena applied to Receiver (TR)

For equipment of type II or type III that requires a communication link that is maintained during the test, this shall be verified by appropriate means supplied by the manufacturer during each individual exposure in the test sequence. Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

Performance criteria for ETSI EN 301 489-17 V3.2.4 (2020-09)

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.		

Performance criteria for ETSI EN 301 489-19 V2.1.1 (2019-04)

1) General performance criteria

If the EUT is of a non specialized nature or the EUT is combined with an ancillary equipment, the test modulation, test arrangements, etc. as required in clause 4 shall apply. The EUT, for all immunity tests according to the present document, except the spot frequency test of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2), shall be assessed for:

• the storage of messages in the memory of the EUT at the start of the test;
• unintentional responses of the EUT during the test;
• the maintenance of the EUT memory assessed at the conclusion of the test;
• the ability to receive and store messages at the conclusion of the test.

For the spot frequency test 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.

2) Performance criteria for Continuous phenomena applied to ROMES and ROGNSS receivers (CR)

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):

• the general performance criteria set out in clause 6.1;
• during the test no false calls shall occur;
• 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.

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

3) Performance criteria for Transient phenomena applied to ROMES and ROGNSS receivers (TR)

For the EUT:

• the general performance criteria set out in clause 6.1;
• during the test no false calls shall occur;
• 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.

4) Performance criteria for equipment which does not provide a continuous communication link

The provision of ETSI EN 301 489-1 [1], clause 6.3 shall apply with the following modifications.

For EUTs of a specialized nature and/or ancillary equipment tested on a stand alone basis the manufacturer shall define the method of test to determine the acceptable level of performance or degradation of performance during and/or after the test. Under these circumstances the manufacturer will also provide the following information:

• the primary functions of the equipment to be tested during and after EMC stress;
• the intended functions of the EUT which shall be in accordance with the documentation accompanying the equipment;
• the pass/failure criteria for the equipment;
• the method of observing a degradation of performance of the equipment.

The assessment of the performance or the degradation of performance which shall be carried out during and/or at the conclusion of the tests, shall be simple, but at the same time give adequate proof that the primary functions of the equipment are operational.

Performance criteria for Draft ETSI EN 301 489-52 V1.1.2 (2020-12)

1) Performance criteria for Continuous phenomena applied to Transmitters (CT)

During the test, the uplink speech output level shall be at least 35 dB (±3 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).

NOTE: When there is a high-level background noise present, the filter bandwidth can be reduced down to a minimum of 40 Hz.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical 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.

2) Performance criteria for Continuous phenomena applied to Receivers (CR)

During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence.

During the test, the downlink speech output level shall be at least 35 dB (±3 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).

NOTE: When there is a high-level background noise present, the filter bandwidth can be reduced down to a minimum of 40 Hz.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical stored data, and the communication link shall have been maintained.

5. LIST OF MEASURING EQUIPMENT

LINE CONDUCTED EMISSION

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	EMI Test Software	Farad	EZ	/	N/A	N/A
2	EMI Test Receiver	R&S	ESPI	101840	2020-06-22	2021-06-21
3	Artificial Mains	R&S	ENV216	101288	2020-06-22	2021-06-21
4	10dB Attenuator	SCHWARZBECK	MTS-IMP-136	261115-001-0032	2020-06-22	2021-06-21
5	Impedance Stabilization Network	TESEQ	ISN T800	45130	2020-11-17	2021-11-16
6	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2020-06-22	2021-06-21

RADIATED DISTURBANCE

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	EMI Test Software	Farad	EZ	/	N/A	N/A
2	3m Full Anechoic Chamber	MRDIANZI	FAC-3M	MR009	2020-09-26	2021-09-25
3	Positioning Controller	MF	MF7082	MF78020803	2020-06-22	2021-06-21
4	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2018-07-26	2021-07-25
5	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2018-07-02	2021-07-01
6	EMI Test Receiver	R&S	ESR 7	101181	2020-06-22	2021-06-21
7	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2020-11-17	2021-11-16
8	Broadband Preamplifier	/	BP-01M18G	P190501	2020-06-22	2021-06-21
9	RF Cable-R03m	Jye Bao	RG142	CB021	2020-06-22	2021-06-21
10	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2020-06-22	2021-06-21
11	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2020-06-22	2021-06-21

VOLTAGE FLUCTUATION AND FLICKER/HARMONIC CURRENT EMISSIONS

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Power Analyzer Test System	Voltech	PM6000	200006700523	2020-06-22	2021-06-21
2	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2020-06-22	2021-06-21

RF ELECTROMAGNETIC FIELD

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	RS Test Software	Tonscend	/	/	N/A	N/A
2	ESG Vector Signal Generator	Agilent	E4438C	MY42081396	2020-11-17	2021-11-16
3	3m Full Anechoic Chamber	MRDIANZI	FAC-3M	MR009	2020-09-26	2021-09-25
4	RF POWER AMPLIFIER	OPHIR	5225R	1052	NCR	NCR
5	RF POWER AMPLIFIER	OPHIR	5273F	1019	NCR	NCR
6	RF POWER AMPLIFIER	SKET	HAP_0306G-50W	/	NCR	NCR
7	Stacked Broadband Log Periodic Antenna	SCHWARZBECK	STLP 9128	9128ES-145	NCR	NCR
8	Stacked Mikrowellen Log.-Per Antenna	SCHWARZBECK	STLP 9149	9149-484	NCR	NCR
9	Electric field probe	Narda S.TS./PMM	EP601	611WX80208	2020-03-26	2021-03-25
10	Sound Level meter	BK Precision	735	73500873100100 20	2020-06-22	2021-06-21
11	Audio Analyzer	R&S	UPV	1146.2003K02-1 01721-UW	2020-11-17	2021-11-16
12	Mouse Simulation	Bruel & Kjaer	4227	A0304216	2020-06-22	2021-06-21
13	Ear Simulation and supply	Bruel & Kjaer	2669.4182.5935	A0305284	2020-06-22	2021-06-21
14	Acoustical Calibrators	Bruel & Kjaer	4231	A0304215	2020-06-22	2021-06-21
15	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2020-06-22	2021-06-21

ELECTROSTATIC DISCHARGE

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	ESD Simulator	SCHLODER	SESD 230	604035	2020-07-21	2021-07-20
2	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2020-06-22	2021-06-21

ELECTRICAL FAST TRANSIENT IMMUNITY

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Immunity Simulative Generator	EM TEST	UCS500-M4	0101-34	2020-06-22	2021-06-21
2	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2020-06-22	2021-06-21

RF COMMON MODE

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Simulator	FRANKONIA	CIT-10/75	A126A1195	2020-06-22	2021-06-21
2	CDN	FRANKONIA	CDN-M2+M3	A2210177	2020-06-22	2021-06-21
3	6dB Attenuator	FRANKONIA	DAM25W	1172040	2020-06-22	2021-06-21
4	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2020-06-22	2021-06-21
5	Sound Level meter	BK Precision	735	7350087310010020	2020-06-22	2021-06-21
6	Audio Analyzer	R&S	UPV	1146.2003K02-101 721-UW	2020-11-17	2021-11-16
7	Mouse Simulation	Bruel & Kjaer	4227	A0304216	2020-06-22	2021-06-21
8	Ear Simulation and supply	Bruel & Kjaer	2669.4182.5935	A0305284	2020-06-22	2021-06-21
9	Acoustical Calibrators	Bruel & Kjaer	4231	A0304215	2020-06-22	2021-06-21

SURGES, LINE TO LINE AND LINE TO GROUND

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Immunity Simulative Generator	EM TEST	UCS500-M4	0101-34	2020-06-22	2021-06-21
2	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2020-06-22	2021-06-21

VOLTAGE DIPS/INTERRUPTIONS IMMUNITY TEST

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Voltage dips and up generator	3CTEST	VDG-1105G	EC0171014	2020-06-22	2021-06-21
2	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2020-06-22	2021-06-21

Note: NCR --- No calibration requirement.

6. PHOTOGRAPHS OF TEST SETUP

Please refer to separated files Appendix B for Photographs of Test Setup_EMC

7. PHOTOGRAPHS OF THE EUT

Please refer to separated files Appendix C for Photographs of The EUT.

----------THE END OF REPORT----------