

EMC Test Report

For

Purism, SPC

Test Standards:	ETSI EN 301 489 -1 V2.2.3(2019-11) ETSI EN 301 489 -3 V2.1.1(2019-03) <u>Draft ETSI EN 301 489 -17 V3.2.2(2019-12)</u>
Product Description:	Librem Mini
Tested Model:	LMv1-01
Report No.:	<u>EC2005029RE01</u>
Tested Date:	<u>2020-05-29 to 2020-06-15</u>
Issued Date:	<u>2020-06-15</u>
Tested/ Prepared By:	<u></u> Jerry Wang / Engineer
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Note: The test results in this report apply exclusively to the tested model / sample. Without written approval of Hunan Ecloud Testing Technology Co., Ltd., the test report shall not be reproduced except in full.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	2020.06.15	Valid	Original Report

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SUMMARY OF TEST RESULT

CLAUSE (EN301489-1)	TEST ITEMS	TEST STANDARD	RESULT (PASS/FAIL)	REMARK
EMC Emission Measurements				
8.2	Radiated Emission	EN 55032 : 2015 Class B	PASS	Under limit 6.58 dB at 890.39 MHz for Quasi-Peak
8.3 / 8.4 / 8.7	Conducted Emission	EN 55032 : 2015 Class B	PASS	Under limit 1.65 dB at 8.062 MHz for Quasi-Peak
8.5	Harmonic Current Emissions	EN 61000-3-2:2014 Class A	Not Required	-
8.6	Voltage Fluctuations and Flicker	EN 61000-3-3:2013	Not Required	-
EMC Immunity Tests				
9.2	RF Electromagnetic Field	EN 61000-4-3:2006+A1:2 008+A2:2010	PASS	-
9.3	Electrostatic Discharge	EN 61000-4-2:2009	PASS	-
9.4	Fast Transients, Common Mode	EN 61000-4-4:2012	PASS	-
9.5	Radio frequency, Common Mode	EN 61000-4-6:2014	PASS	-
9.6	Transients and Surges in the vehicular environment	ISO 7637-2:2004	Not Required	-
9.7	Voltage Dips and Interruptions	EN 61000-4-11:2004	PASS	-
9.8	Surges	EN 61000-4-5:2014	PASS	-
Note: Not required means after assessing, test items are not necessary to carry out.				

1 General Information

1.1 Applicant

Purism, SPC

One Market Street, 36th Floor, San Francisco, CA 94105, USA

1.2 Manufacturer

Purism, SPC

One Market Street, 36th Floor, San Francisco, CA 94105, USA

1.3 General Description of EUT

Product	Librem Mini	
Model NO.	LMv1-01	
Additional NO.	N/A	
Difference Description	N/A	
Nominal Voltage	AC230V/50Hz for adapter	
Extreme Temperature	0℃ and 45℃	
Modulation Type	WLAN	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
	RLAN	256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM
	Bluetooth	GFSK, $\pi/4$ -DQPSK, 8DPSK
Operating Frequency	WLAN	2412-2472MHz for 11b/g/n(HT20) 2422-2462MHz for 11n(HT40)
	RLAN	5725-5850MHz for ac80(VHT80)
	Bluetooth	2402MHz~2480MHz
Geo-location capability	Not Supported	
Antenna Type / Gain	Bluetooth : FPC Antenna / 3 dBi WLAN: FPC Antenna / 3 dBi RLAN: FPC Antenna / 5 dBi	
HW Version	N/A	
SW Version	N/A	
I/O Ports	Refer to user's manual	
Accessory Devices	Refer to note as below	

NOTE:

1. The above EUT information is declared by manufacturer and for more detailed feature description, please refer to the manufacturer's specifications or user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

3. The EUT was powered by the following adapters:

MODEL:	ADS-40SI-19-3 19040E
INPUT:	100-240V~50/60Hz 1.0A MAX
OUTPUT:	19V DC 2.1A
DC LINE:	2.5 m

1.4 Support equipment List

Manufacturer	Description	Model	Serial Number	Certificate
Dell	Flat Panel Monitor	P2317H	CN-02J06R-7426 1-6CI-0RWS-AOO	DOC
Lenovo	PC	Xiaoxinchao5000	PF0QPQMH	DOC
NETGEAR	WLAN AP	X4S R7800	N/A	DOC

1.5 Support USB cable and Earphone

I/O Port Description	Trade Name	Model Name	Comment
Micro USB	SanDisk	A1	N/A
Earphone	Apple	EarPods	N/A

1.6 Modification of EUT

No modifications are made to the EUT during all test items.

1.7 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of **ETSI EN301 489-1 V2.2.3 (2019-11)** , **ETSI EN 301 489-3 V2.1.1 (2019-03)** and **Draft ETSI EN 301 489 -17 V3.2.2(2019-12)**

2 Test Configuration of Equipment under Test

2.1 Details of EUT Test Modes

Details of Test line Items	
Radiated Emission (Refer to EN301 489-1 Section 8.2)	
Mode 1	: Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 2	: Bluetooth Idle + WLAN(2.4G) Idle + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 3	: Bluetooth Link + WLAN(2.4G) Idle + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 4	: Bluetooth Idle + WLAN(2.4G) Link + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Conducted Emission (Refer to EN301 489-1 Section 8.4)	
AC Port & Wired Network Port	
Mode 1	: Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 2	: Bluetooth Idle + WLAN(2.4G) Idle + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 3	: Bluetooth Link + WLAN(2.4G) Idle + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 4	: Bluetooth Idle + WLAN(2.4G) Link + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Radio Frequency Electromagnetic Field (Refer to EN301 489-1 Section 9.2)	
Mode 1	: Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 2	: Bluetooth Idle + WLAN(2.4G) Idle + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 3	: Bluetooth Link + WLAN(2.4G) Idle + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 4	: Bluetooth Idle + WLAN(2.4G) Link + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Electrostatic Discharge (Refer to EN301 489-1 Section 9.3)	
Mode 1	: Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 2	: Bluetooth Idle + WLAN(2.4G) Idle + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 3	: Bluetooth Link + WLAN(2.4G) Idle + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 4	: Bluetooth Idle + WLAN(2.4G) Link + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 5	: Adapter <Fig.2>
Voltage Dips and Interruptions (Refer to EN301 489-1 Section 9.7)	
AC Port	
Mode 1	: Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 2	: Bluetooth Idle + WLAN(2.4G) Idle + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>

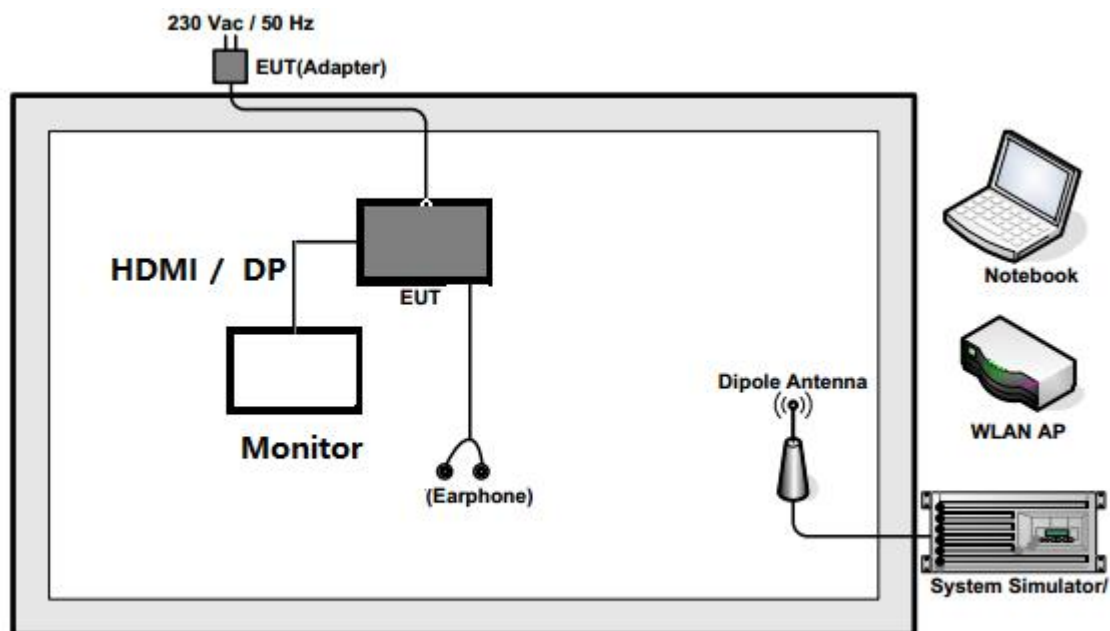
Mode 3	: Bluetooth Link + WLAN(2.4G) Idle + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 4	: Bluetooth Idle + WLAN(2.4G) Link + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Fast Transient, Common Mode (Refer to EN301 489-1 Section 9.4)	
Surges (Refer to EN301 489-1 Section 9.8)	
AC Port & Wired Network Port	
Mode 1	: Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 2	: Bluetooth Idle + WLAN(2.4G) Idle + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 3	: Bluetooth Link + WLAN(2.4G) Idle + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 4	: Bluetooth Idle + WLAN(2.4G) Link + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Radio Frequency, Common Mode (Refer to EN301 489-1 Section 9.5)	
Mode 1	: Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 2	: Bluetooth Idle + WLAN(2.4G) Idle + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 3	: Bluetooth Link + WLAN(2.4G) Idle + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Mode 4	: Bluetooth Idle + WLAN(2.4G) Link + RLAN(5G) Link + HDMI + Burnin test + Ping + Earphone + Adapter <Fig.1>
Remark:	
Data Linking with Notebook means data application transferred mode between EUT and Notebook HDMI, DP and Type C interfaces have been tested and only show the test results of the worst mode	

Worst mode of all test items listed in section 2.1

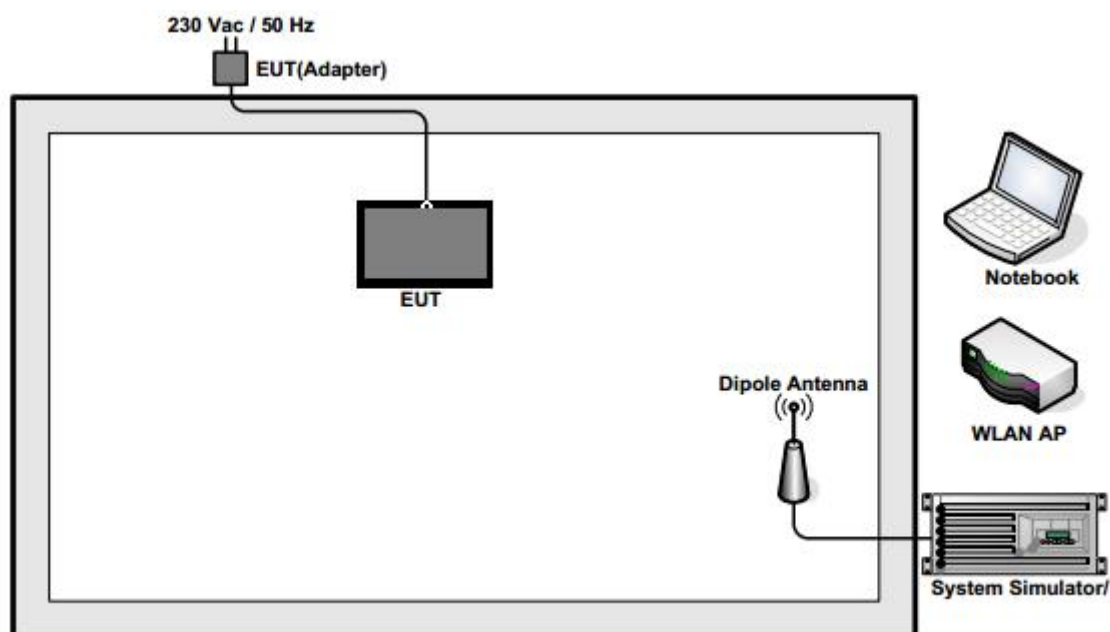
Test items	Worst mode
Radiated Emission	1
Conducted Emission	1
Radio Frequency Electromagnetic Field	All
Electrostatic Discharge	All
Fast Transient, Common Mode	All
Radio Frequency, Common Mode	All
Voltage Dips and Interruptions	All
Surges	All

Remark: Only data of worst mode (if test item has) was reported in test result.

2.2 Connection of System Under Test



<Fig.1>



<Fig.2>

2.3 EUT Operation Test Setup

The EUT was set in below conditions during EMI and EMS testing

Read/Write and Storage of Data

1. Let EUT be connected with notebook.
2. Execute the program for files transferring between EUT and storage device.
3. Monitor the data transmission by checking whether there some error or abnormal action occurred.

WLAN

1. Enable WLAN function of the EUT.
2. The EUT links with supported units
3. Execute "PING IP" function under the " cmd " of Window system to transfer packet bi-directionally between the EUT and supported units.
4. Monitor the packet loss and WLAN radio performance.

Bluetooth (include Bluetooth Data Link and Bluetooth Headset)

1. Link with supported unit via Bluetooth radio function.
2. Monitor the status of connection by checking the Bluetooth link performance without radio link drop.

3 Test Conditions of 301489 Series Standards

3.1 Special Conditions of Applied Standards for EUT

Below each section is special condition applied for each application of EUT.

3.1.1 Emission

EN301 489-3

No special conditions shall apply to UE in the scope of the present document.

EN301 489-17

No special conditions shall apply to UE in the scope of the present document.

3.1.2 Immunity

EN301 489-3

As per section 7.2 of ETSI EN 301 489-3 V2.1.1 (2019-03)

Reference to clauses in EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions in EN 301 489-1 [1], clause 9
9.2.2: Test method; Radiofrequency electromagnetic field	The test shall be performed over the range 80 MHz to 2700 MHz with the exception of the exclusion bands defined in clause 4.6. Where the EUT is subject to EMC Immunity testing under a Harmonised Standard of a Directive other than the Directive 2014/53/EU then the modulating signal frequency specified in the that Harmonised Standard may be used. If this alternative modulating frequency is used, then the applicable Directive, Harmonised Standard & modulating frequency shall be noted in the test report.
9.5.2: Test method; Radiofrequency, common mode	Where the EUT is subject to EMC Immunity testing under a Harmonised Standard of a Directive other than the Directive 2014/53/EU then the modulating signal frequency specified in the that Harmonised Standard may be used. If this alternative modulating frequency is used, then the applicable Directive, Harmonised Standard & modulating frequency shall be noted in the test report.

EN301 489-17

No special conditions are relevant for products covered in the present document.

3.2 RF Exclusion Band of Radio Equipment

As per section 4.3 of ETSI EN 301 489-1 V2.2.3 (2019-11)

As per section 4.6 of ETSI EN 301 489-3 V2.1.1 (2019-03)

As per section 4.3 of Draft ETSI EN 301 489-17 V3.2.2 (2019-12)

4 Emission Measurements

4.1 Radiated Emission Test

4.1.1 Limits for Radiated Emission Test

<Class B limit>

Table A.4—Requirements for radiated emissions at frequencies up to 1GHz for Class B equipment

Table Clause	Frequency Range (MHz)	Measurement		Class B limits dB (μV/m)
		Distance (m)	Detector Type/ Bandwidth	OATS/SAC
A4.1	30 ~ 230	10	Quasi Peak / 120 kHz	30
	230 ~ 1000			37
A4.2	30 ~ 230	3		40
	230 ~ 1000			47

Table A.5—Requirements for radiated emissions at frequencies above 1GHz for Class B equipment

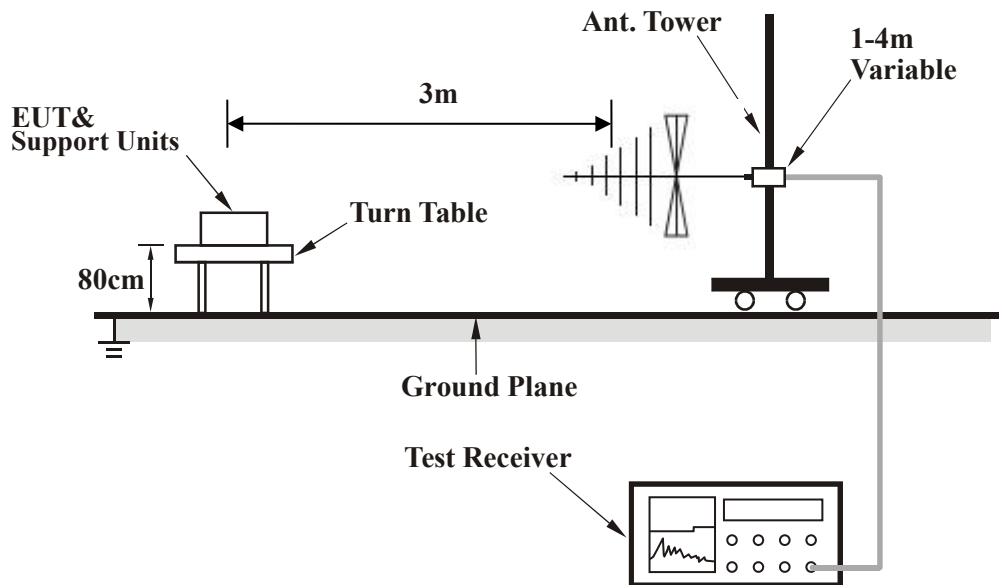
Table Clause	Frequency Range (MHz)	Measurement		Class B limits dB(μV/m)
		Distance (m)	Detector Type/ Bandwidth	FSOATS
A5.1	1000 ~ 3000	3	Average / 1 MHz	50
	3000 ~ 6000			54
A5.2	1000 ~ 3000		Peak / 1 MHz	70
	3000 ~ 6000			74

Conditional testing frequency:

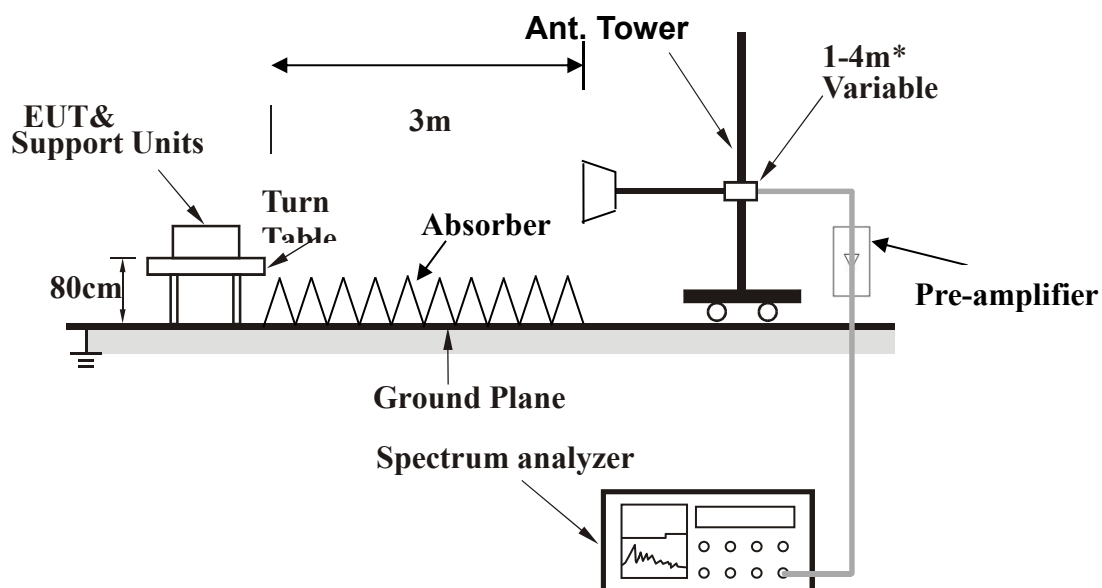
Highest measured frequency	Highest measured frequency
$F_x \leq 108 \text{ MHz}$	1 GHz
$108 \text{ MHz} \leq F_x \leq 500 \text{ MHz}$	2 GHz
$500 \text{ MHz} \leq F_x \leq 1 \text{ GHz}$	5 GHz
$F_x \geq 108 \text{ MHz}$	5 x F_x up to a maximum of 6 GHz
NOTE: For FM and TV broadcast receivers, F_x is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.	

4.1.2 Test Setup

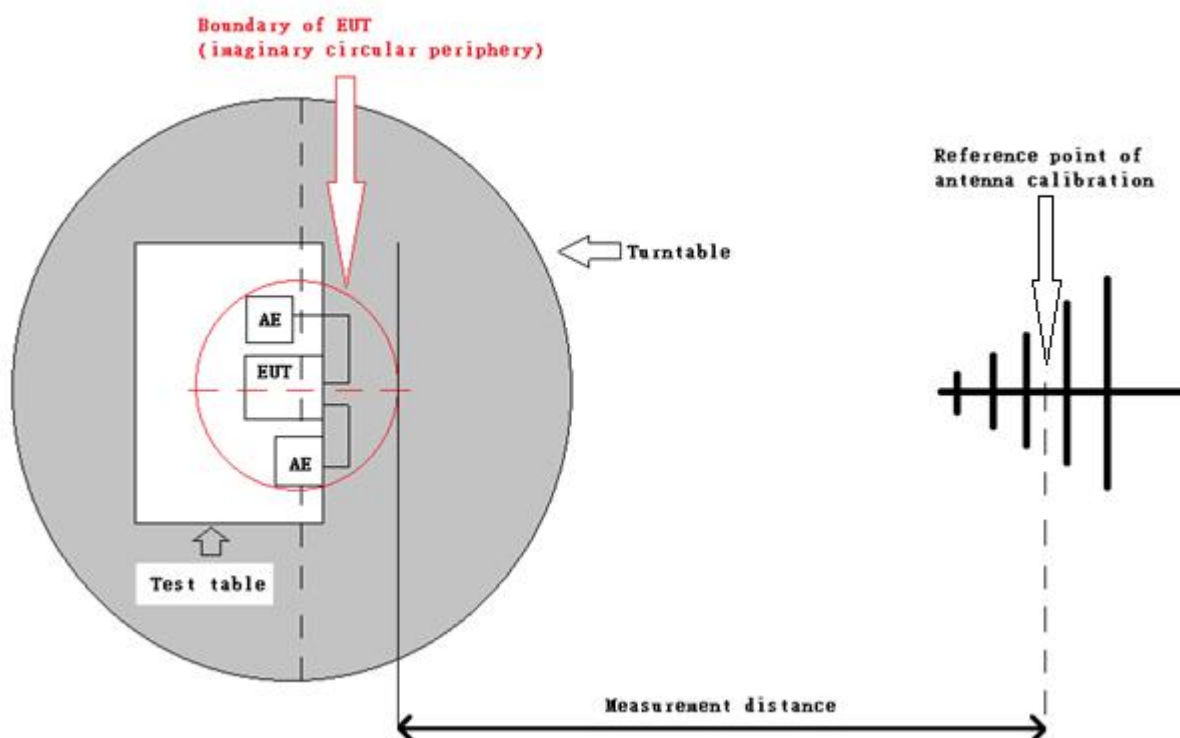
< Frequency Range below 1GHz >



< Frequency Range above 1GHz >



<Radiated Emissions Setup Configuration>



4.1.3 Test Procedures

Frequency range 30MHz~1GHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1GHz.

Frequency range above 1GHz

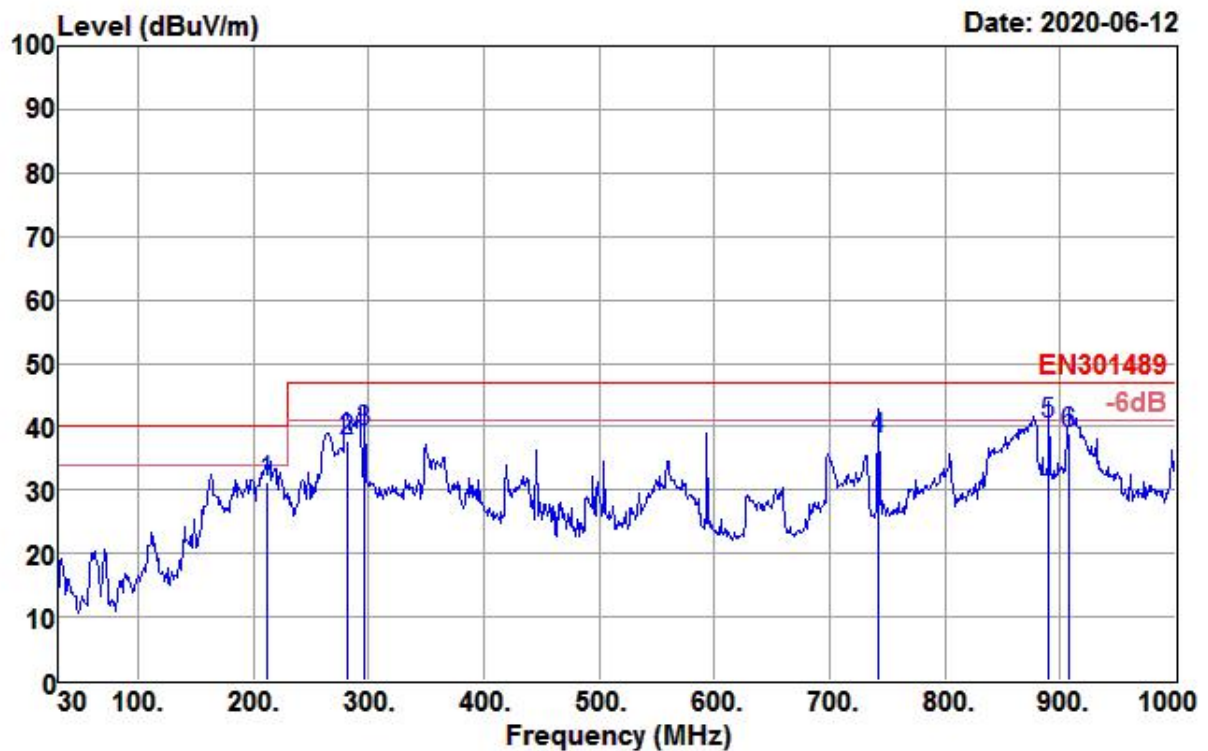
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna can be varied from 1 meter to 4 meters, the height of adjustment depends on the EUT height and the antenna 3dB beamwidth both, to detect the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test receiver/spectrum was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.

4.1.4 Test Result

Test Mode :	Mode1	Temperature :	23°C
Test Engineer :	Jack Liu	Relative Humidity :	60%
Test Distance :	3m	Polarization :	Horizontal
Function Type :	Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter		

- Emission level (dBμV/m) = 20 log Emission level (μV/m)
- Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
- The test that passed at the minimum margin was marked by the frame in the following test record

Data: 7

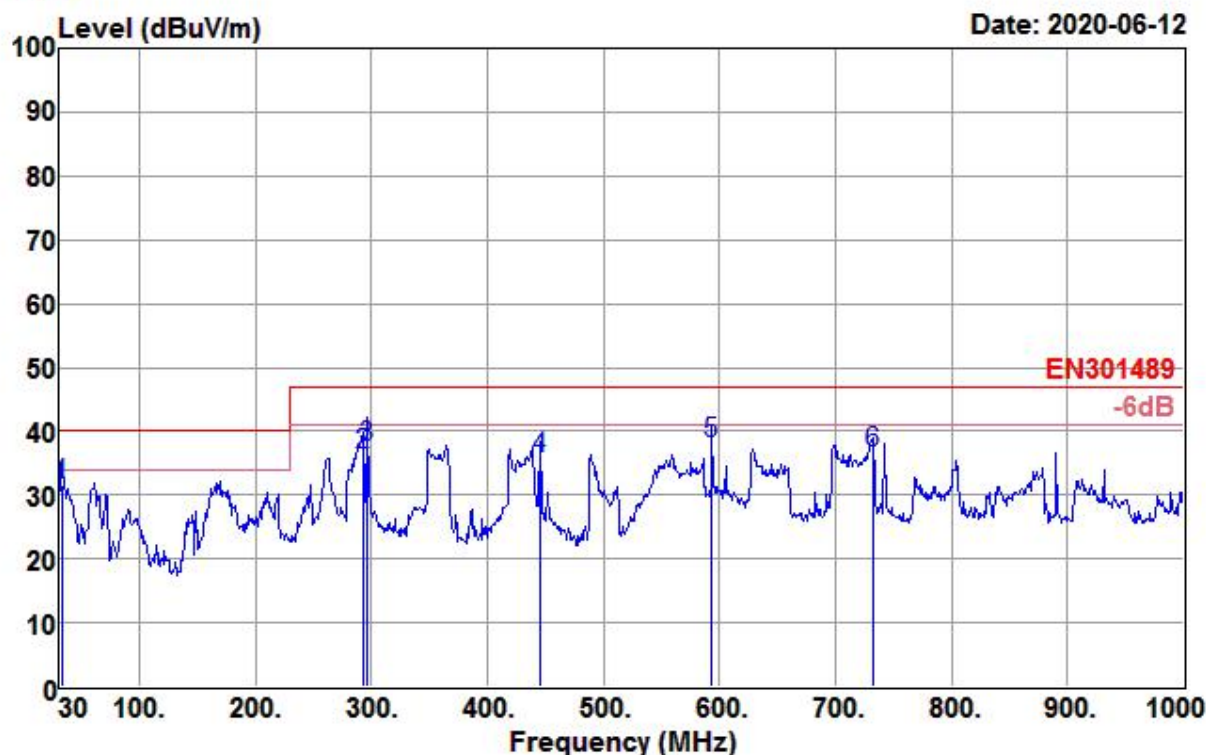


Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
211.390	49.82	11.17	2.81	32.47	31.33	40.00	-8.67	QP
281.230	53.26	13.79	3.28	32.49	37.84	47.00	-9.16	QP
296.750	54.36	14.13	3.38	32.49	39.38	47.00	-7.62	QP
741.980	42.93	22.04	5.52	32.50	37.99	47.00	-9.01	QP
890.390	43.18	23.37	6.07	32.20	40.42	47.00	-6.58	QP
907.850	41.27	23.64	6.12	32.18	38.85	47.00	-8.15	QP

Test Mode :	Mode 1	Temperature :	23°C
Test Engineer :	Jack Liu	Relative Humidity :	60%
Test Distance :	3m	Polarization :	Vertical
Function Type :	Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter		

- Emission level (dBμV/m) = 20 log Emission level (μV/m)
- Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
- The test that passed at the minimum margin was marked by the frame in the following test record

Data: 8

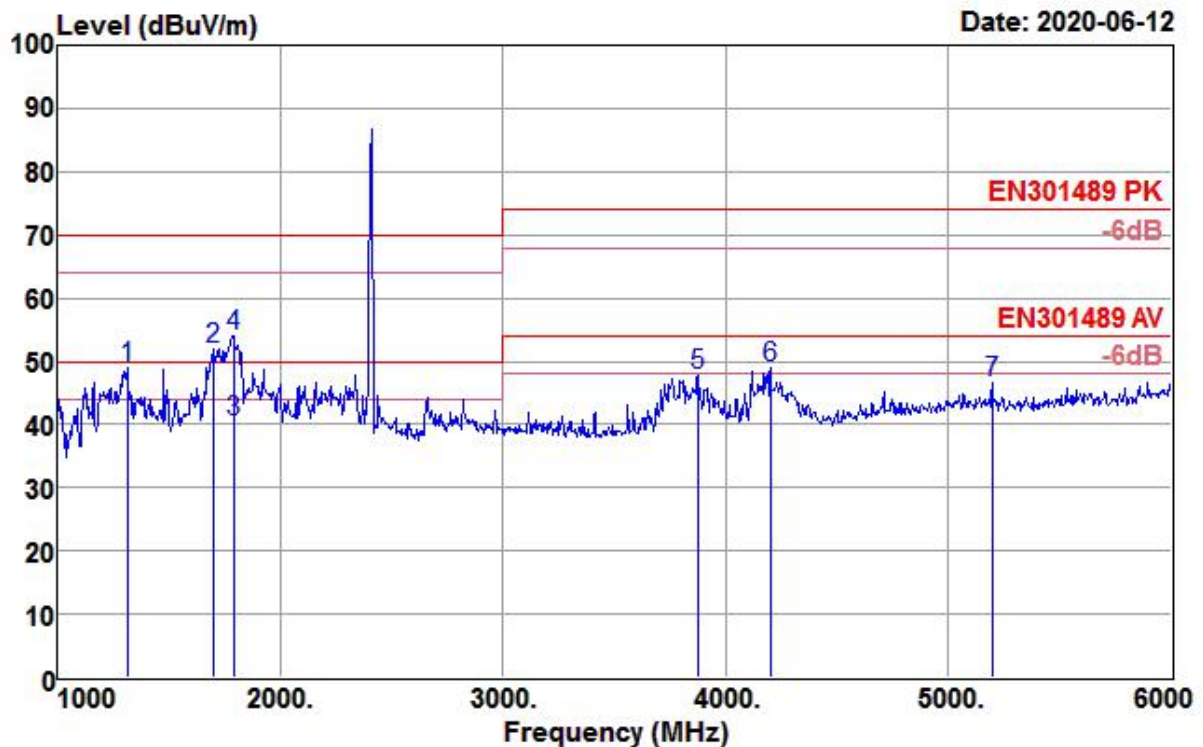


Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
32.910	51.06	11.78	1.11	32.45	31.50	40.00	-8.50	QP
291.900	51.36	14.02	3.35	32.49	36.24	47.00	-10.76	QP
296.750	52.39	14.13	3.38	32.49	37.41	47.00	-9.59	QP
445.160	46.84	17.15	4.19	32.59	35.59	47.00	-11.41	QP
593.570	45.98	19.88	4.85	32.69	38.02	47.00	-8.98	QP
732.280	41.85	21.85	5.45	32.53	36.62	47.00	-10.38	QP

Test Mode :	Mode 1	Temperature :	23°C
Test Engineer :	Jack Liu	Relative Humidity :	60%
Test Distance :	3m	Polarization :	Horizontal
Function Type :	Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter		

- Emission level (dBμV/m) = 20 log Emission level (μV/m)
- Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
- The test that passed at the minimum margin was marked by the frame in the following test record
- For Linking mode, a notch filter was used for fundamental signal review.

Data: 6

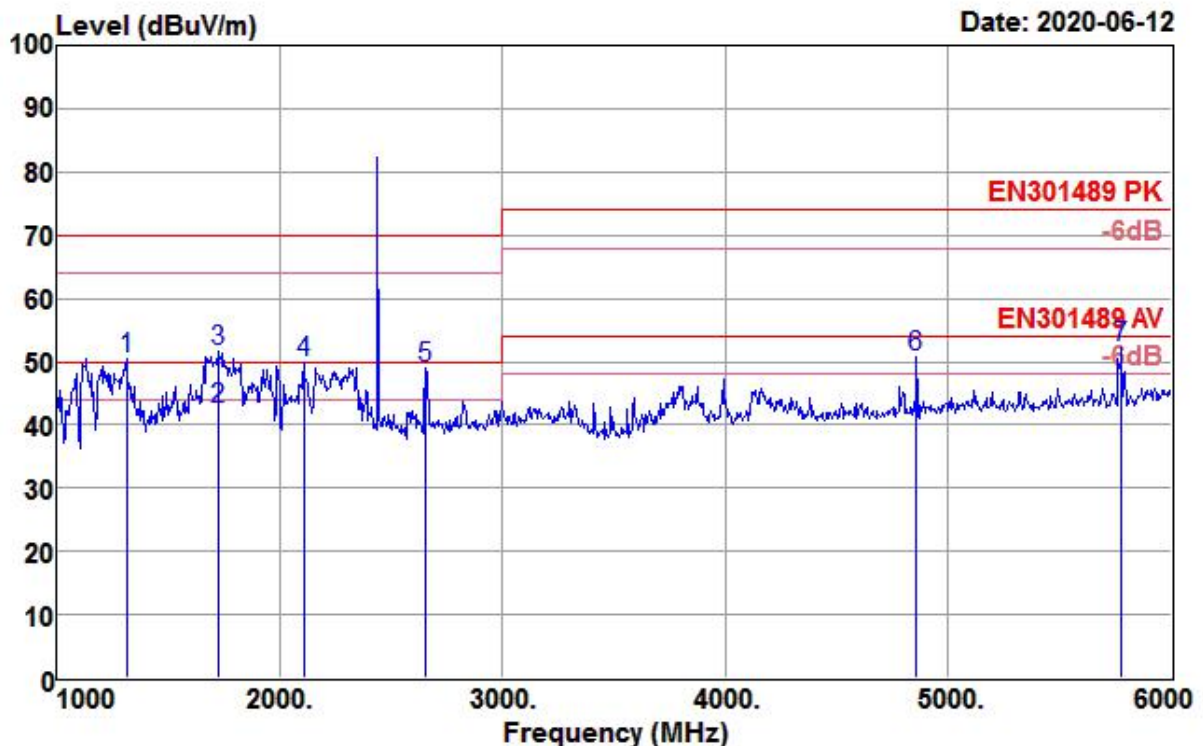


Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
1315.000	56.53	24.53	3.07	35.16	48.97	70.00	-21.03	Peak
1705.000	58.04	25.64	3.23	35.01	51.90	70.00	-18.10	Peak
1790.000	46.22	25.94	3.38	34.98	40.56	50.00	-9.44	Average
1790.000	59.80	25.94	3.38	34.98	54.14	70.00	-15.86	Peak
3875.000	49.35	29.47	5.65	36.60	47.87	74.00	-26.13	Peak
4200.000	49.81	30.08	5.46	36.40	48.95	74.00	-25.05	Peak
5195.000	44.18	31.36	6.64	35.64	46.54	74.00	-27.46	Peak

Test Mode :	Mode 1	Temperature :	23°C
Test Engineer :	Jack Liu	Relative Humidity :	60%
Test Distance :	3m	Polarization :	Vertical
Function Type :	Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter		

- Emission level (dBμV/m) = 20 log Emission level (μV/m)
- Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
- The test that passed at the minimum margin was marked by the frame in the following test record
- For Linking mode, a notch filter was used for fundamental signal review.

Data: 5



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
1315.000	57.96	24.53	3.07	35.16	50.40	70.00	-19.60	Peak
1730.000	48.62	25.73	3.27	35.00	42.62	50.00	-7.38	Average
1730.000	57.75	25.73	3.27	35.00	51.75	70.00	-18.25	Peak
2110.000	54.12	26.94	3.82	35.15	49.73	70.00	-20.27	Peak
2655.000	53.02	27.92	4.35	36.39	48.90	70.00	-21.10	Peak
4855.000	49.59	31.00	6.08	36.00	50.67	74.00	-23.33	Peak
5775.000	48.70	32.04	6.30	34.84	52.20	74.00	-21.80	Peak

4.1.5 Setup Photographs

Frequency: 30 MHz to 1000 MHz



Frequency: 1000 MHz to 6000 MHz



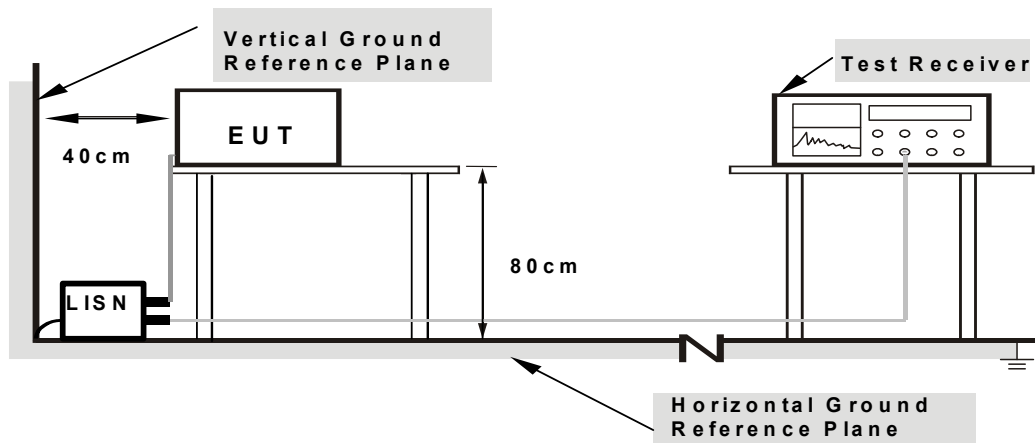
4.2 Conducted Emission Test

4.2.1 Limits for Conducted Emissions

Applicable to AC mains power ports			
Frequency Range (MHz)	Coupling Device	Detector Type / Bandwidth	Class B limits dB(μ V)
0.15~0.5	AMN	Quasi Peak / 9 kHz	66~56
0.5~5			56
5~30			60
0.15~0.5	AMN	Average / 9 kHz	56~46
0.5~5			46
5~30			50

The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.

4.2.2 Test Setup



Note: 1.Support units were connected to second LISN.

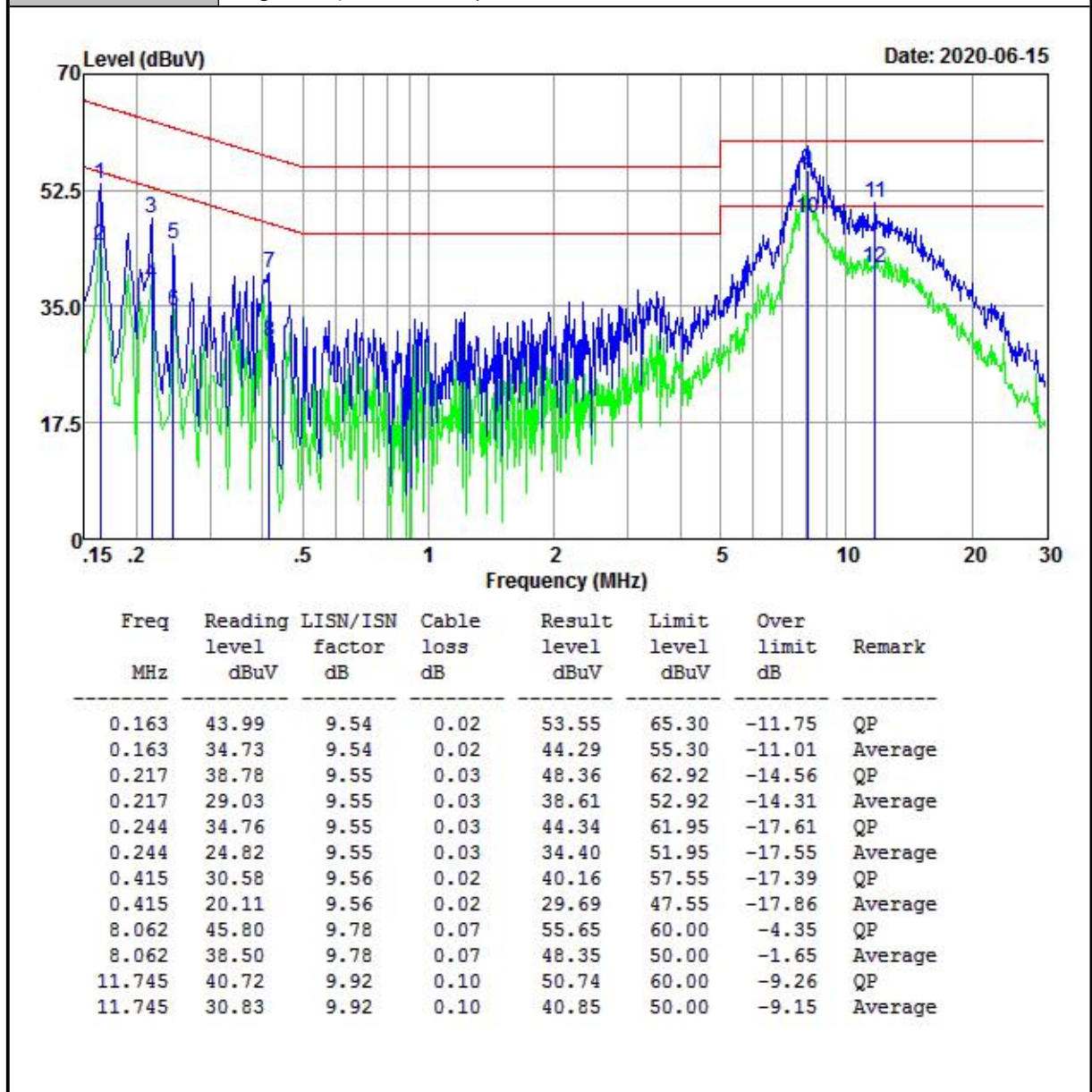
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

4.2.3 Test Procedure

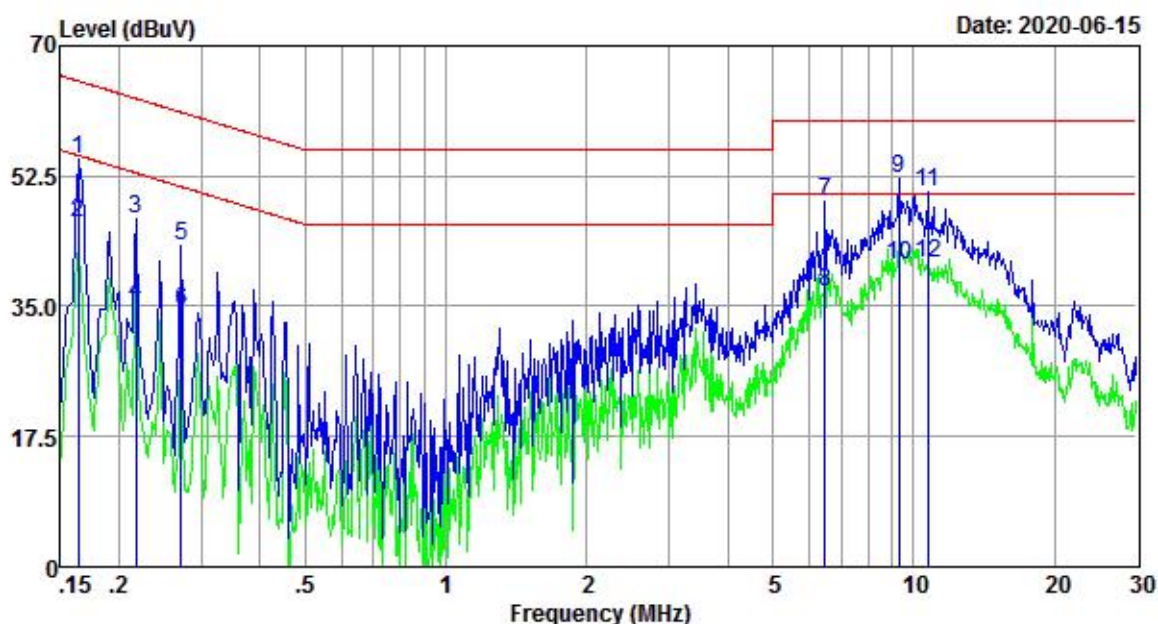
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels under Limit - 20dB was not recorded.

4.2.4 Test Results

Test Mode :	Mode 1	Temperature :	21~23°C
Test Engineer :	Jerry Liu	Relative Humidity :	41~42%
Test Voltage :	230Vac / 50Hz	Phase :	Line
Function Type :	Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter		

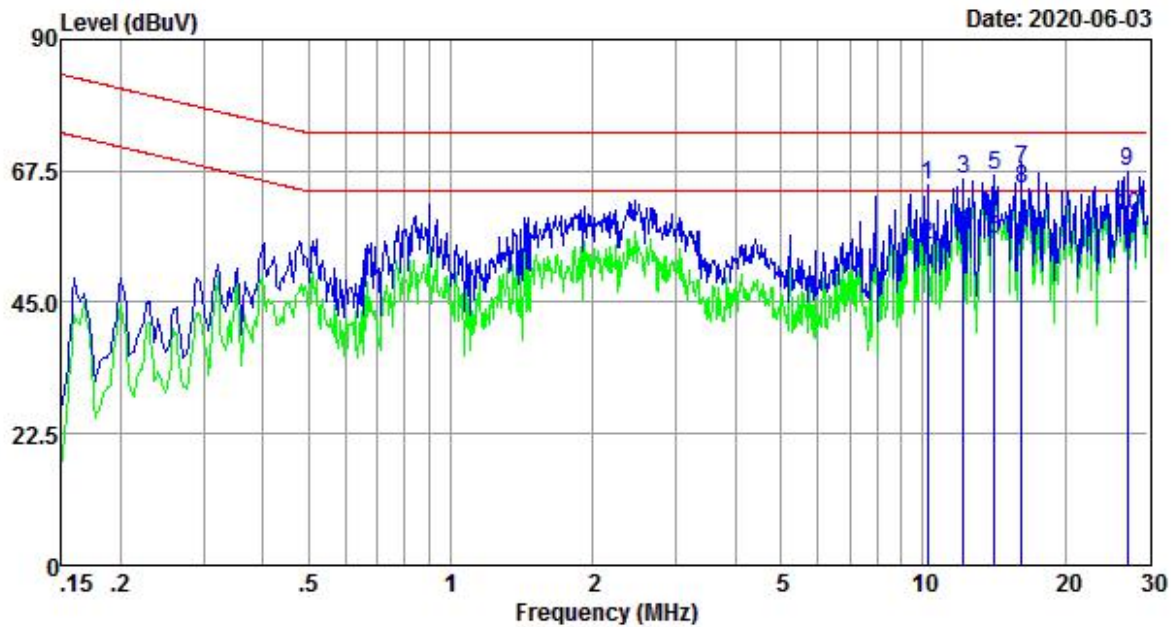


Test Mode :	Mode 1	Temperature :	21~23°C
Test Engineer :	Jerry Liu	Relative Humidity :	41~42%
Test Voltage :	230Vac / 50Hz	Phase :	Neutral
Function Type :	Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter		



Freq MHz	Reading level dBuV	LISN/ISN factor dB	Cable loss dB	Result level dBuV	Limit level dBuV	Over limit dB	Remark
0.163	45.08	9.54	0.02	54.64	65.30	-10.66	QP
0.163	36.74	9.54	0.02	46.30	55.30	-9.00	Average
0.217	37.15	9.55	0.03	46.73	62.92	-16.19	QP
0.217	25.80	9.55	0.03	35.38	52.92	-17.54	Average
0.272	33.60	9.55	0.03	43.18	61.07	-17.89	QP
0.272	24.76	9.55	0.03	34.34	51.07	-16.73	Average
6.454	39.22	9.72	0.06	49.00	60.00	-11.00	QP
6.454	27.07	9.72	0.06	36.85	50.00	-13.15	Average
9.302	42.17	9.83	0.08	52.08	60.00	-7.92	QP
9.302	30.66	9.83	0.08	40.57	50.00	-9.43	Average
10.733	40.27	9.89	0.09	50.25	60.00	-9.75	QP
10.733	30.75	9.89	0.09	40.73	50.00	-9.27	Average

Test Mode :	Mode 1	Temperature :	21~23°C
Test Engineer :	Jerry Liu	Relative Humidity :	41~42%
Test Voltage :	230Vac / 50Hz	Phase :	100M
Function Type :	Bluetooth Link + WLAN(2.4G) Link + RLAN(5G) Idle + HDMI + Burnin test + Ping + Earphone + Adapter		



Freq MHz	Reading level dBuV	LISN/ISN factor dB	Cable loss dB	Result level dBuV	Limit level dBuV	Over limit dB	Remark
10.233	55.53	0.00	0.09	65.22	74.00	-8.78	QP
10.233	45.01	0.00	0.09	54.70	74.00	-19.30	Average
12.188	56.47	0.00	0.10	66.17	74.00	-7.83	QP
12.188	47.13	0.00	0.10	56.83	74.00	-17.17	Average
14.213	57.20	0.00	0.10	66.89	74.00	-7.11	QP
14.213	46.24	0.00	0.10	55.93	74.00	-18.07	Average
16.226	57.90	0.00	0.14	67.63	74.00	-6.37	QP
16.226	54.60	0.00	0.14	64.33	74.00	-9.67	Average
27.127	57.50	0.00	0.13	67.28	74.00	-6.72	QP
27.127	50.12	0.00	0.13	59.90	74.00	-14.10	Average

4.2.5 Setup Photographs

AC Port



Wired Network Port



5 Immunity Tests

5.1 Requirements of Limit and EUT Performance Criteria for all Immunity Test Items

Test limit including test level, test frequency range, pulse type, test duration...etc. requirements.

This section is intended to integrate requirements of limit, and required performance criteria for all immunity test Items.

In subsection 5.1.1, includes two parts:

- a. Subsection 5.1.1.1 : Support ports list of EUT, accessory, and cable record, where EUT intended to use in. These information will be used for decide test items and test limit
 - i. Supported ports list of EUT: Because test limit are based on supported ports of EUT, this is necessary information.
 - ii. Accessory : include adapter type and remark EUT has battery or not.
 - iii. Cable record : includes cable type, cable length, indoor/outdoor. These parameters will decide tests shall be carrying out or not.
- b. Subsection 5.1.1.2 : tables of immunity test level specified in EN301489 series standards and immunity test level specified by manufacturer.

If immunity test level specified by manufacturer are higher/stronger than level specified in EN301489 series standards, they will be also record in this table. Therefore anyone could distinguish requirements specified by standard or manufacturer from these tables.

In subsection 5.1.2, required performance criteria of EUT per EN301489 series standards.

Integrated required performance criteria of EN301489 series standards, they are used for all immunity test of this report.

5.1.1 Test Limit

5.1.1.1 Information of supported ports of EUT, accessory, cable record where EUT intended to use in.

1. Supported ports of EUT are listed as below (symbol ☒ means supported port):

☒	Enclosure Port
☒	Input AC power port
☐	Input DC power port
☒	Telecommunication port

2. Accessory (symbol ☒ means have used with EUT during test)

☒	☒ AC Adapter ☐ DC Adapter ☐ Car charger ☐ PoE adapter	Pins : ☐ 2pins ☒ 3pins Cable Length : ☐ >3m ☒ <3m
☐	Battery	

As per above information, corresponded test limit (including test level, test frequency range, pulse type, test duration...etc. requirements) specified in below table 1~4 have been selected to carry out test in this report.

5.1.1.2 Tables of Immunity Test Level Specified in EN301489 series standards and Immunity Test Level Specified by Manufacturer

When immunity test level specified by manufacturer are higher (stronger) than level specified in EN301489 series standards, they will be also record in this table. But if manufacturer doesn't specify immunity test level, "N/A" is filling in table and test level of all immunity test items are following requirements of EN301489 series standards.

Table 1 - Enclosure Port

Test item	Immunity test level specified in EN301489-1	Immunity test level specified by manufacturer
Electrostatic discharge (ESD)	± 2 kV, ± 4 kV contact	N/A
	± 2 kV, ± 4 kV, ± 8 kV air	N/A
Radio frequency electromagnetic field (RS)	3 V/m	N/A
	Frequency range : 80 MHz – 6 GHz	N/A
	Modulation: 80 % AM at 1 kHz	N/A

Table 2 – Input AC Power Port

Test Item	Immunity test level specified in EN301489-1	Immunity Test level specified by manufacturer
Fast transients, common mode (EFT)	± 1 kV 5 kHz repetition frequency	N/A
Surges Line-to-line	$\pm 0,5$ kV, ± 1 kV	N/A
Surges Line-to-ground	$\pm 0,5$ kV, ± 1 kV, ± 2 kV	N/A
Radio frequency, common mode (CS)	3 Vrms	N/A
	Frequency range: 0,15 MHz – 80 MHz	N/A
	Modulation: 80 % AM at 1 kHz	N/A
Voltage dips	0 % residual; 0,5 cycle , 50Hz Phase At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°	N/A
	0 % residual; 1 cycle , 50Hz Phase At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°	
	70 % residual; 25 cycles , 50Hz Phase At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°	
Voltage interruptions	0 % residual; 250cycle , 50Hz	N/A

Table 3 – Input DC Power Port (not necessary performed on EUT of this report)

Test Item	Immunity test level specified in EN301489-1	Immunity Test level specified by manufacturer
Fast transients, common mode (EFT)	± 0.5 kV 5 kHz repetition frequency When cable length >3m	N/A
Radio frequency, common mode (CS)	3 Vrms When cable length >3m	N/A
	Frequency range: 0,15 MHz – 80 MHz	N/A
	Modulation: 80 % AM at 1 kHz	N/A
Transients and surges in the vehicular environment	As specified in ISO 7637-2 : Pulse type : 1, 2a, 2b, 3a, 3b, 4 Level : III	N/A

Table 4 –Telecommunication Port (not necessary performed on EUT of this report)

Test Item	Immunity test level specified in EN301489-1	Immunity Test level specified by manufacturer
Fast transients, common mode (EFT)	± 0.5 kV 5 kHz repetition frequency When cable length >3m	N/A
Surges Line-to-ground	± 0.5 kV for indoor cable When cable length >10m	N/A
	± 1 kV for outdoor cable	N/A
Radio frequency, common mode (CS)	3 Vrms When cable length >3m	N/A
	Frequency range: 0,15 MHz – 80 MHz	N/A
	Modulation: 80 % AM at 1 kHz	N/A

5.1.2 Required Performance Criteria of EUT per EN301489 series standards

Criteria	Performance criteria
CT/CR	During the test, the equipment shall: • continue to operate as intended; • not unintentionally transmit; • not unintentionally change its operating state; • not unintentionally change critical stored data. • GSM The EUT (transmitter) uplink speech and (receiver) downlink output level shall be at least 35dB less than the previously recorded reference. • The EUT (receiver) shall show the RXQUAL of the GSM downlink does not exceed the value of three. • WCDMA: The BER of the WCDMA shall be no greater than 0.1%, and measure during each individual exposure in the test sequence. • LTE: The Throughput of the LTE shall be ≥ 95 % of the maximum throughput of the reference measurement channel, and measure during each individual exposure in the test sequence.

TT/TR	For all ports and transient phenomena with the exception described below, the following applies: • 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. • After application of the transient phenomena, the equipment shall operate as intended. For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies: • 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. • 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.
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*Performance requirements table of 301489-3

CLAUSE 6.2 of EN301489-3		
Criteria	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 be 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.

*Performance requirements table of 301489-17

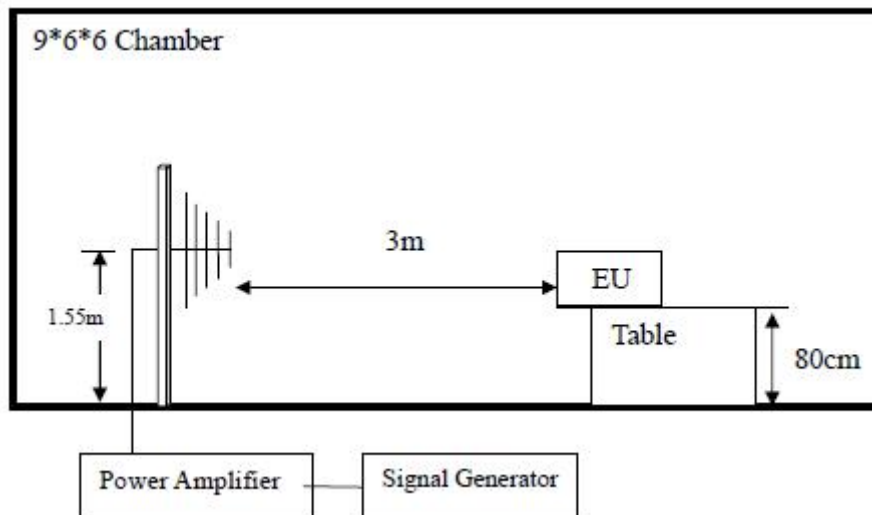
CLAUSE 6.2 of EN301489-17		
Criteria	During test	After test
A	Shall operate as intended. (see note). Shall be no loss of function. Shall be no unintentional transmissions	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of critical stored 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 1: Operate as intended during the test allows a level of degradation in accordance with clause NOTE 2. NOTE 2: 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.	

CLAUSE 6.3 to 6.6 of EN301489-17	
Criteria	Performance criteria
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.
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.
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.
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.

5.2 Radio frequency electromagnetic field (RS) Test

5.2.1 Test Setup



5.2.2 Test Instrument Setting

Frequency Step Size	1% increment
Modulation	80% AM (1kHz)
Dwell Time	3 seconds
Tested Antenna Height	1.55m

5.2.3 Test Procedures

The antenna is placed 3m away from the equipment. The required field strength is pre-calibrated and complies with the uniform field area requirement lay down in the IEC/EN 61000-4-3.

5.2.4 Test Result

Test Standard	EN 61000-4-3:2006+A1:2008+A2:2010
Product Standard	EN 301 489-1, EN 301 489-3, EN 301 489-17
Test Frequency Range	80 MHz ~ 6 GHz
Test Level	3 V/m
Polarity	Horizontal and Vertical
Azimuth	0°, 90°, 180°, 270°
Required Performance Criteria	CT/CR
Performance Criteria of EUT	CT/CR
Ambient Temperature	23°C
Relative Humidity	55%
Test Date	Jun. 12, 2020
Test Engineer	Jack Liu
Test Result	PASS

5.2.5 Setup Photographs

Position 0°
LF

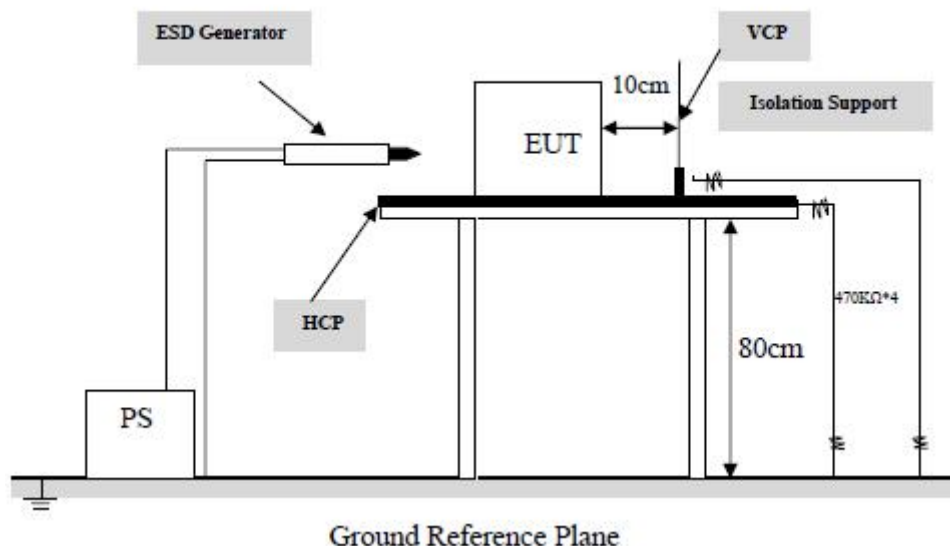


HF



5.3 Electrostatic Discharge (ESD) Test (Refer to EN301 489-1 Section 9.3)

5.3.1 Test Setup



A distance of 1m minimum was provided between the EUT and the wall or any other metallic structure. In cases where this length exceeds the length necessary to apply the discharges to the selected points, the excess length shall, where possible, be placed non-inductively off the ground reference plane and shall not be less than 0.2m to other conductive parts in the test setup.

The coupling plane is placed parallel to, and positioned at a distance of 0,1 m from the EUT.

5.3.2 Test Instrument Setting

Tested number of air discharge is at least 10 discharges (in the most sensitive polarity). For contact discharge, tested number is at least 10 discharges.

For the time interval between successive single discharges an initial value of 1 s is recommended.

Sweeping of the EUT with a grounded carbon fibre brush with bleeder resistors (for example, 2*470 kΩ) in the grounding cable.

Ensure parameters of current waveform of an ESD generator is within specifications before test.

5.3.3 Test Procedure

EUT and auxiliary instrument necessary to perform DIRECT and INDIRECT application of discharges to the EUT, in the following manner:

· CONTACT DISCHARGE to the conductive surfaces and to the coupling plane;

· AIR DISCHARGE at insulating surfaces.

a. Contact Discharges to the conductive surfaces and to coupling planes

In the case of contact discharges, the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

In the case of painted surface covering a conducting substrate, the following procedure shall be adopted :

- If the coating is not declared to be an insulating coating by the equipment manufacturer, then the pointed tip of the generator shall penetrate the coating so as to make contact with the conducting substrate.

- Coating declared as insulating by the manufacturer shall only be submitted to the air discharge.

- The contact discharge test shall not be applied to such surfaces.

b. Air Discharge to apertures and insulation surfaces:

In the case of air discharges, the round discharge tip of the discharge electrode shall be approached as fast as possible (without causing mechanical damage) to touch the EUT.

After each discharge, the ESD generator (discharge electrode) shall be removed from the EUT. The generator is then retriggered for a new single discharge. This procedure shall be repeated until the discharges are completed. In the case of an air discharge test, the discharge switch, which is used for contact discharge, shall be closed.

c. Ensure that the applied charge on the EUT has been dis-charged before next ESD pulse

5.3.4 Test Result

Test Standard	EN 61000-4-2:2009
Product Standard	EN 301 489-1, EN 301 489-3, EN 301 489-17
EUT operated voltage during test	230Vac / 50Hz
Tested Level	$\pm 2 / \pm 4 / \pm 8$ kV for air discharge
	$\pm 2 / \pm 4$ kV for contact discharge
Required Performance Criteria	TT/TR
Performance Criteria of EUT	CT/CR
Ambient Temperature	24°C
Relative Humidity	57%
Atmospheric Pressure	101kPa
Test Date	Jun. 12 ,2020
Test Engineer	Jack Liu
Test Result	PASS

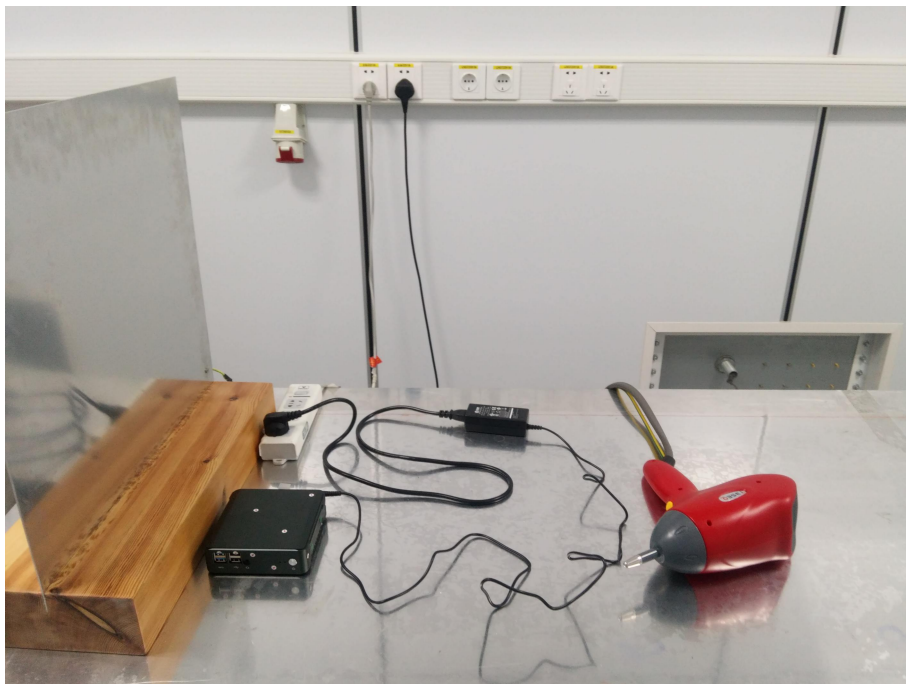
5.3.5 Photos for Identification of ESD Test Points

Remark: Air Discharge refer to the green arrow on the photo, Contact Discharge refer to the red arrow on the photo

<EUT>

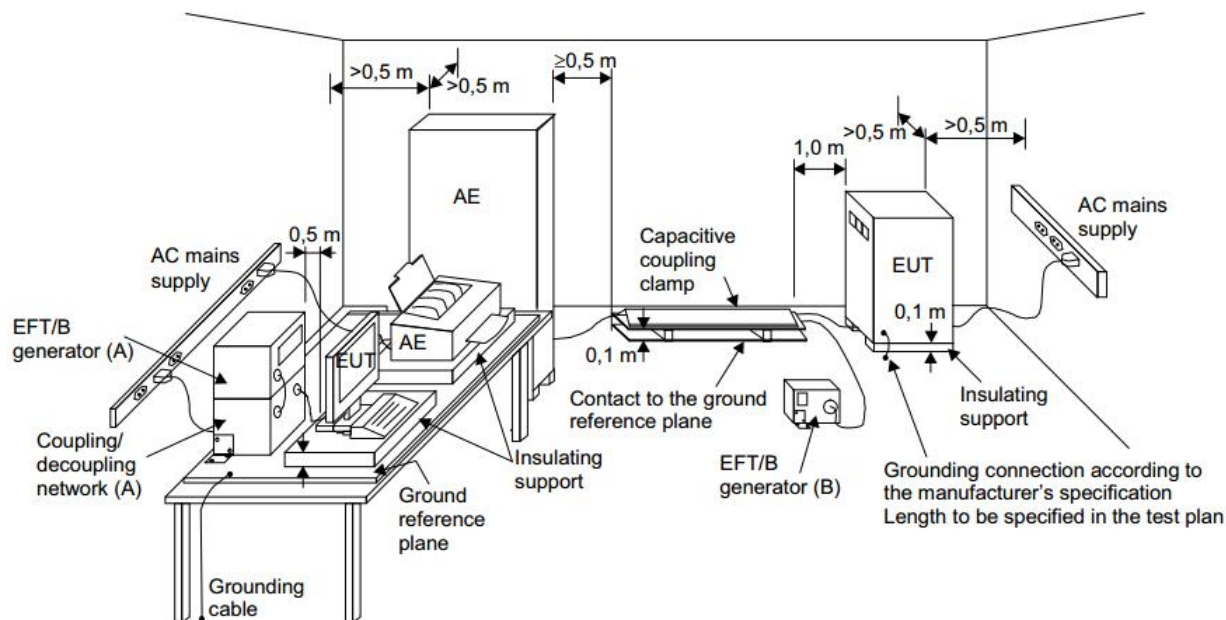


5.3.6 Setup Photographs



5.4 Fast Transients, Common Mode (EFT/BURST) Test

5.4.1 Test Setup



The EUT was placed on a ground reference plane and was insulated from it by an insulating support about 0.1m thick. If the EUT is table-top equipment, it was located approximately 0.8m above the GRP. The GRP was a metallic sheet (copper or aluminum) of 0.25 mm, minimum thickness; other metallic may be used but they shall have at least 0.65 mm thickness.

5.4.2 Test Instrument Setting

Pulse repetition rate	Burst duration/ Burst period	Duration of test per port
5kHz	15 ms / 300 ms	1 minute

5.4.3 Test Procedure

- a. Both positive and negative polarity discharges were applied.
- b. The distance between any coupling devices and the EUT should be $(0.5 - 0/+0.1)$ m for table-top equipment testing, and (1.0 ± 0.1) m for floor standing equipment.
- c. The duration time of each test sequential was 1 minute.
- d. Testing on signal input/output parts port is followed below requirements:
 - i. The coupling clamp is composed of a clamp unit for cable length more than 3 m, and it was placed on the GRP.
 - ii. Telecommunication port whose maximum cable length is less than 3 m in length are excluded Electrical Fast Transients / BURST test

5.4.4 Test Result

Test Standard	EN 61000-4-4:2012
Product Standard	EN 301 489-1, EN 301 489-3, EN 301 489-17
EUT operated voltage during test	230Vac / 50Hz
Test Level	on AC Power Port : ± 1 kV Telecommunication port ± 0.5 kV
Required Performance Criteria	TT/TR
EUT Performance	CT/CR
Ambient Temperature	22~23°C
Relative Humidity	43~45%
Test Date	Jun. 12 ,2020
Test Engineer	Jack Liu
Test Result	PASS

5.4.5 Setup Photographs

AC Port



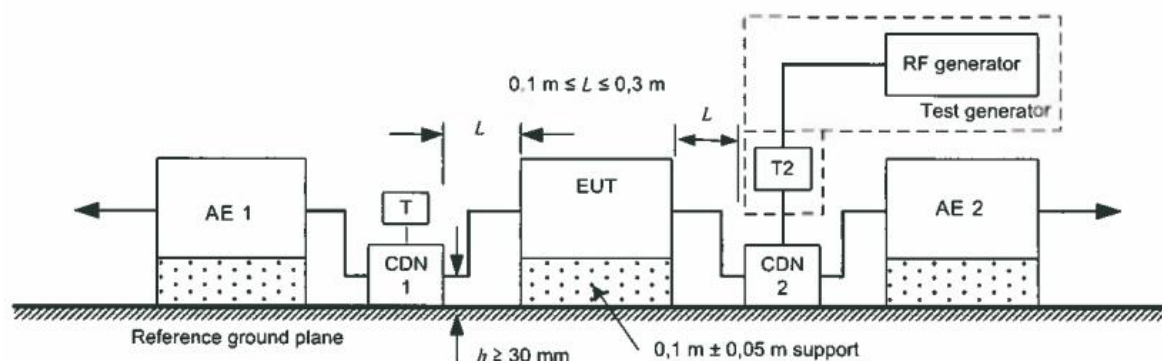
Wired Network Port



5.5 Radio frequency, Common mode (CS) Test

5.5.2 Test Setup

<CDN>



5.5.3 Test Instrument Setting

Frequency Step Size	1% increment
Modulation	80% AM (1kHz)
Dwell Time	3 seconds

5.5.4 Test Procedures

- The EUT shall be tested within its intended operating and climatic conditions.
- An artificial hand was placed on the hand-held accessory and connected to the ground reference plane.
- One of the CDNs not used for injection was terminated with 50Ω, providing only one return path. All other CDNs were coupled as decoupling networks.
- The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. Where the frequency is swept incrementally, the step size shall not exceed 1% of the preceding frequency value.
- The dwell time of the amplitude modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0.5 s. The sensitive frequencies (e.g. clock frequencies) shall be analyzed separately.
- Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.

5.5.5 Test Result

Test Standard	EN 61000-4-6:2014
Product Standard	EN 301 489-1, EN 301 489-3, EN 301 489-17
EUT operated voltage during test	230Vac / 50Hz
Test Frequency Range	0.15 MHz ~ 80 MHz
Test Level	3 V rms
Test Method	CDN for Power port and Telecommunication port
Required Performance Criteria	CT/CR
Performance Criteria of EUT	CT/CR
Ambient Temperature	26~27℃
Relative Humidity	48~49%
Test Date	Jun. 12 ,2020
Test Engineer	Jack Liu
Test Result	PASS

5.5.6 Setup Photographs

AC Port

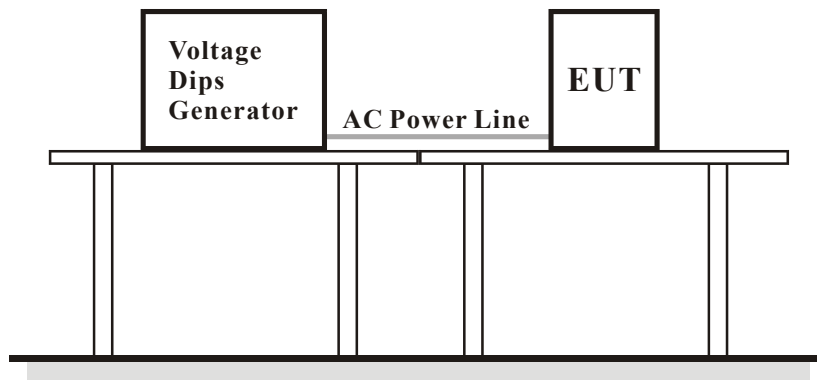


Wired Network Port



5.6 Voltage Dips and Interruptions

5.6.2 Test Setup



5.6.3 Test Instrument Setting

Test of interval	10 sec
Waveform Rise (and Fall) Time	1 ~ 5 μ s.
Duration	Sequence of 3 dips/interrupts.

5.6.4 Test Procedures

The EUT was tested for each selected combination of test levels and duration with a sequence of three dips/interruptions with intervals of 10s minimum (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at zero crossings of the voltage waveform.

5.6.5 Test Result

Test Standard	EN 61000-4-11:2004
Product Standard	EN 301 489-1, EN 301 489-3, EN 301 489-17
EUT input voltage	230Vac, 50Hz
Requirements among Phase, Residual and Duration	As following table
Required Performance Criteria	TT/TR for Voltage Interruption TT/TR for Voltage Dips
Performance Criteria of EUT	CT/CR for Voltage Interruption CT/CR for Voltage Dips
Ambient Temperature	22~23℃
Relative Humidity	43~45%
Test Date	Jun. 12 ,2020
Test Engineer	Jack Liu
Test Result	PASS

Test	Phase Angle	Residual (%)	Duration (ms)
Voltage Dips	0 °, 45 °, 90 °, 135 °, 180 °, 225 °, 270 °, 315 °	0%	10
		0%	20
		70%	500
Voltage Interruption	0 °	0%	5000

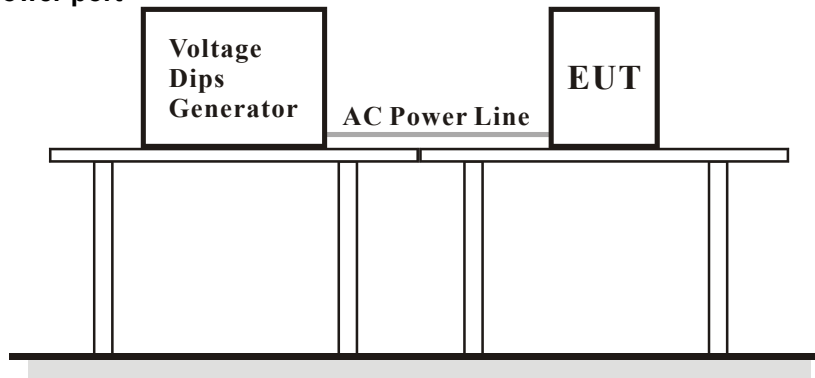
5.6.6 Setup Photographs



5.7 Surges Test

5.7.1 Test Setup

<Testing for power port >



5.7.2 Test Instrument Setting

Surge wave form (Tr/Th)	1,2/50 μ s, for power port (if EUT supported) 10/700 μ s, for signal port (if EUT supported)
Number of impulses	For d.c. power ports and interconnection lines five positive and five negative surge impulses
	For a.c. power ports five positive and five negative impulses each at 0°, 90°, 180° and 270°
Time between successive impulses	1 minute

5.7.3 Test Procedure

a. For EUT power supply:

The surge is applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

b. For test applied to unshielded unsymmetrically operated interconnection lines of EUT:

The surge was applied to the lines via the capacitive coupling. The coupling / decoupling networks didn't influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

c. For test applied to unshielded symmetrically operated interconnection / telecommunication lines of EUT:

The surge was applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor was not specified. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

5.7.4 Test Result

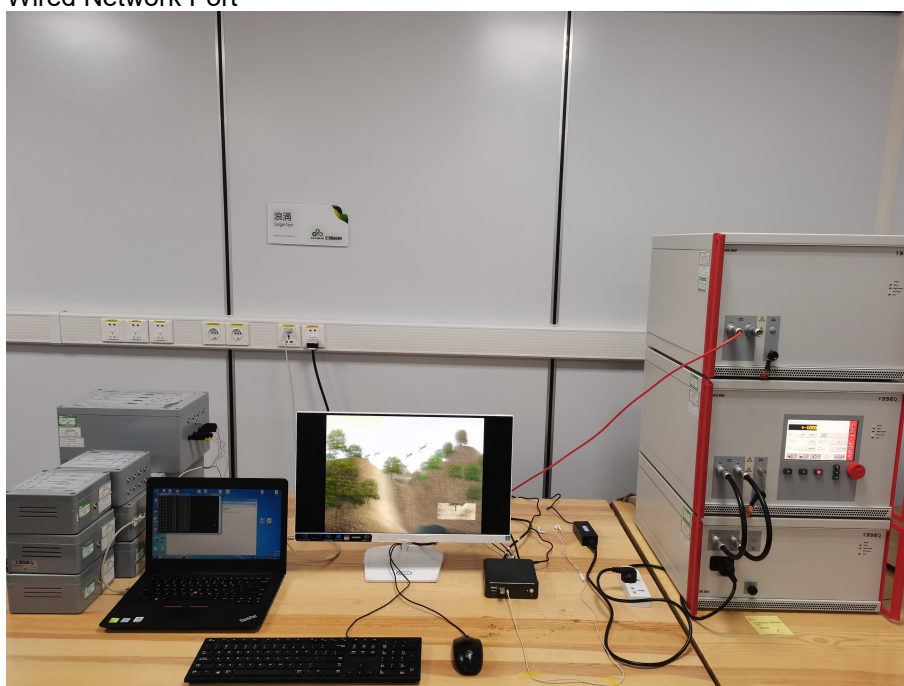
Test Standard	EN 61000-4-5:2014
Product Standard	EN 301 489-1, EN 301 489-3, EN 301 489-17
EUT operated voltage during test	230 Vac, 50Hz
Test Level	on AC Power Port ± 0.5 kV, ± 1 kV, Telecommunication port ± 0.5 kV
Required Performance Criteria	TT/TR for Power Port
Performance Criteria of EUT	CT/CR for Power Port
Ambient Temperature	22~23°C
Relative Humidity	43~45%
Test Date	Jun. 12 ,2020
Test Engineer	Jack Liu
Test Result	PASS

5.7.5 Setup Photographs

AC Port



Wired Network Port



6 Measurement Uncertainty

Uncertainty of Conducted Emission Measurement (150 KHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)	2.42dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 200 MHz Polarity: Horizontal)

Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)	3.70dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 200 MHz Polarity: Vertical)

Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)	3.84dB
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Uncertainty of Radiated Emission Measurement (200 MHz ~ 1000 MHz Polarity: Horizontal)

Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)	4.05dB
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Uncertainty of Radiated Emission Measurement (200 MHz ~ 1000 MHz Polarity: Vertical)

Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)	5.28dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)	4.89dB
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Uncertainty of Radiated Susceptibility Measurement (80 MHz ~ 6 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)	2.19dB
--	--------

Uncertainty of Electrostatic Discharge Measurement

	Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$) %
Electrostatic Discharge ~ Rise Time	15.0%
Electrostatic Discharge ~ Peak Current	6.3%
Electrostatic Discharge ~ 30ns Current	6.3%
Electrostatic Discharge ~ 60ns Current	6.3%

Uncertainty of Conducted Susceptibility Measurement (150kHz ~ 80 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)	1.36dB
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For Surge test

Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)- Surge open-circuit voltage front time (TfV)	0.16 μ s
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Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)- Surge open-circuit voltage peak value (VP)	0.33kV
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Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)- surge open-circuit voltage duration (Td)	0.3 μ s
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For Electrical Fast Transients / BURST test

Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)- budget for voltage rise time (tr)	0.33ns
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Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)- EFT/B peak voltage value (VP)	0.32kV
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Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$)- EFT/B voltage pulse width (tw)	3.0ns
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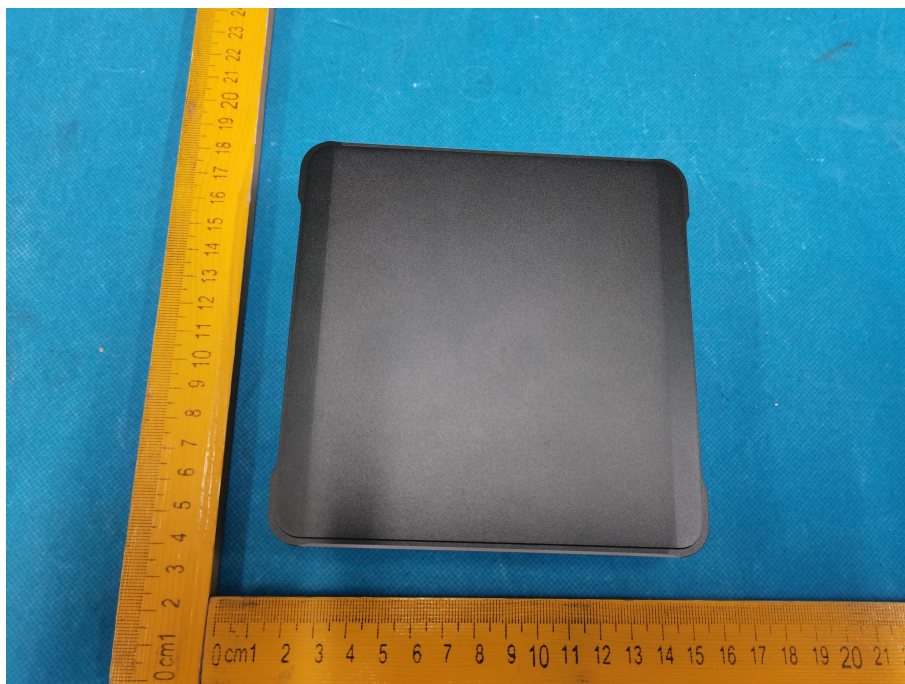
7 List of Measuring Equipment

Test Equipment for Conducted Emission					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
LISN	R&S	ENV216	102125	2020-01-08	2021-01-07
LISN	R&S	ENV432	101327	2020-01-08	2021-01-07
ISN	Schwarzbeck	NTFM 8158	0127	2020-02-12	2021-02-11
EMI Test Receiver	R&S	ESR3	102143	2020-01-16	2021-01-15
EMI Test Software	Audix	E3	N/A	N/A	N/A
Test Equipment for Radiated Emission					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
EMI Test Receiver	R&S	ESR-3	102144	2020-01-16	2021-01-15
Amplifier	Sonoma	310	363917	2020-01-15	2021-01-14
Amplifier	Schwarzbeck	BBV 9718	327	2020-01-15	2021-01-14
Broadband Antenna	Schwarz beck	VULB9168	9168-757	2018-08-31	2021-08-30
Horn Antenna	Schwarzbeck	BBHA 9120 D	1677	2020-02-14	2023-02-13
EMI Test Software	Audix	E3	N/A	N/A	N/A
Test Equipment for ESD					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
ESD Generator	Teseq	NSG 437	1121	2020-02-10	2021-02-09
Test Equipment for EFT/SURGE/DIPS					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Surge Generator	Teseq	NSG 3060-MF	4040	2020-01-09	2021-01-08
CDN	Teseq	CDN 3061-S16	3003	2020-01-09	2021-01-08
EFT/DIPS Generator	Teseq	NSG 3040-MF	6033	2020-01-15	2021-01-14
Transformer	Teseq	INA6501	1002	2020-01-15	2021-01-14
Capacitive Coupling Clamp	Teseq	CDN 3425	3041	2019-07-05	2020-07-04
CDN	Teseq	CDN 118	43182	2020-01-09	2021-01-08
CDN	Teseq	CDN 118	44682	2020-01-09	2021-01-08
CDN	Teseq	INA 185	44056	2020-01-09	2021-01-08
CDN	Teseq	INA 185	44059	2020-01-09	2021-01-08
Test Equipment for CS					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
CS Generator	Teseq	NSG 4070B-80	45341	2020-01-15	2021-01-14
6dB Attenuator	Teseq	ATN 6075	32154	2020-01-08	2021-01-07
CDN	Teseq	CDN M016	45065	2020-01-08	2021-01-07
CDN	Teseq	CDN T800	42821	2020-01-08	2021-01-07
Test Equipment for RS					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Signal generator	R&S	SMB100A	113825	2020-01-08	2021-01-07
Power Meter	R&S	NRP2	105581	2020-01-08	2021-01-07
Power Sensor	R&S	NRP-Z91	103778	2020-01-08	2021-01-07
Power Sensor	R&S	NRP-Z91	103779	2020-01-08	2021-01-07
Power Amplifier	R&S	BBA150	102377	2020-01-08	2021-01-07
Power Amplifier	R&S	BBA150	102376	2020-01-08	2021-01-07
Power Amplifier	R&S	BBA150	103014	2020-01-08	2021-01-07
Antenna	R&S	HL046E	100230	N/A	N/A
Antenna	Schwarzbeck	STLP 9149	9149-459	N/A	N/A
RS Test Software	Fala	EZ-RS	N/A	N/A	N/A

N/A: No Calibration Required

Appendix A. Photographs of EUT

External Photos

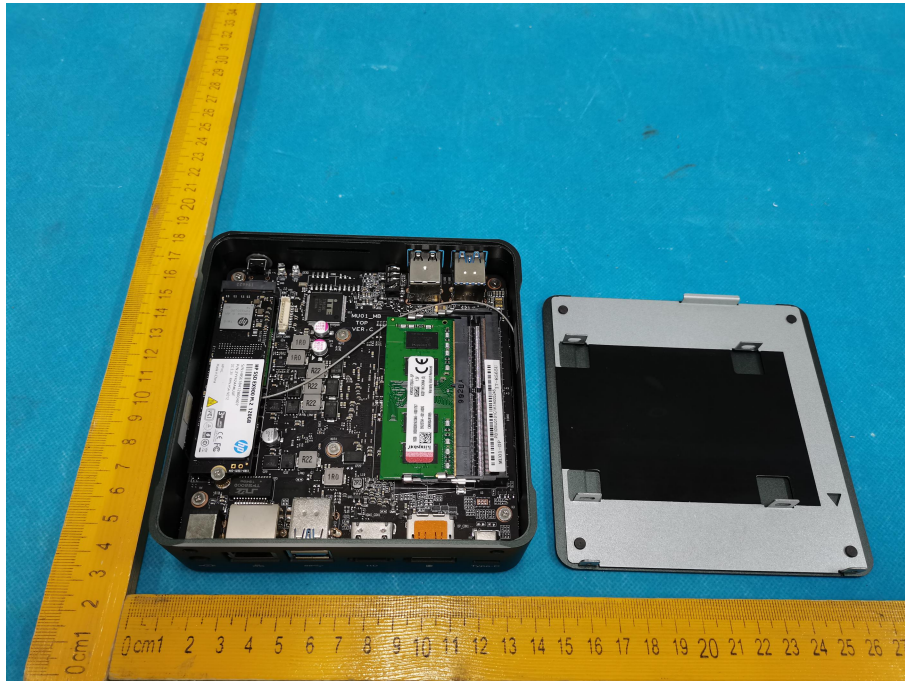


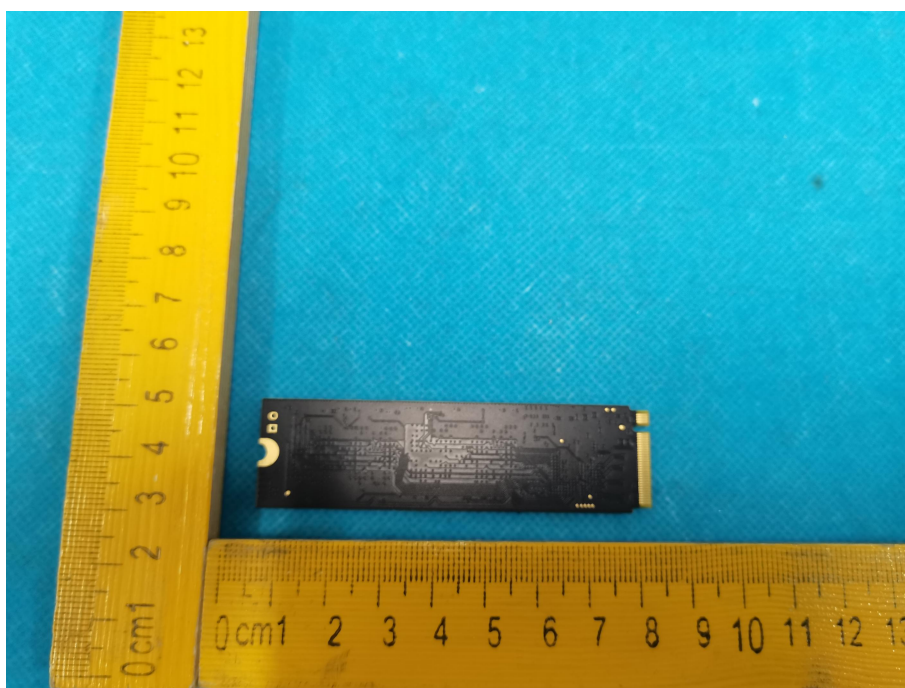
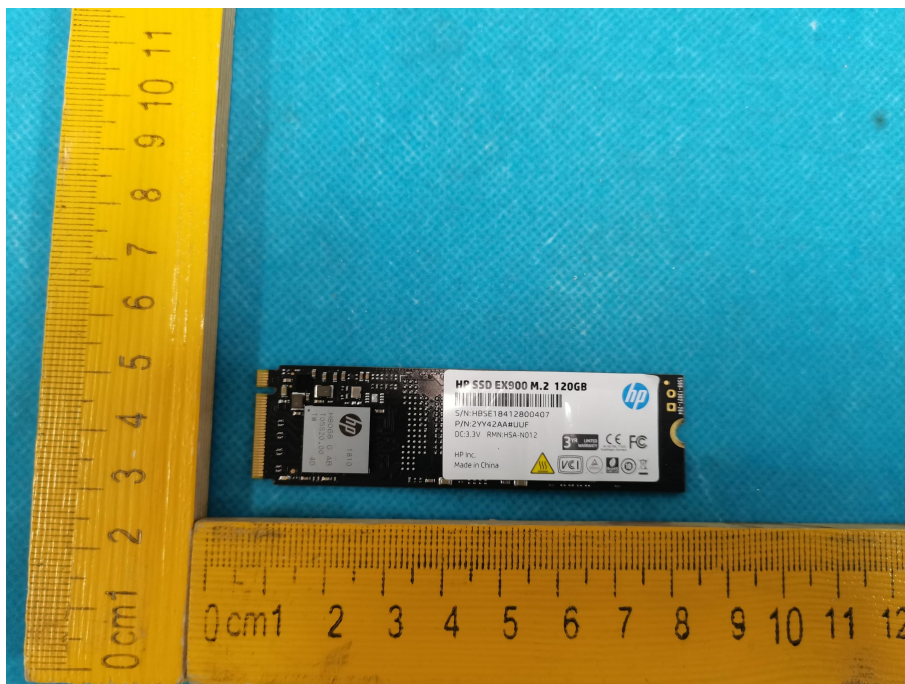


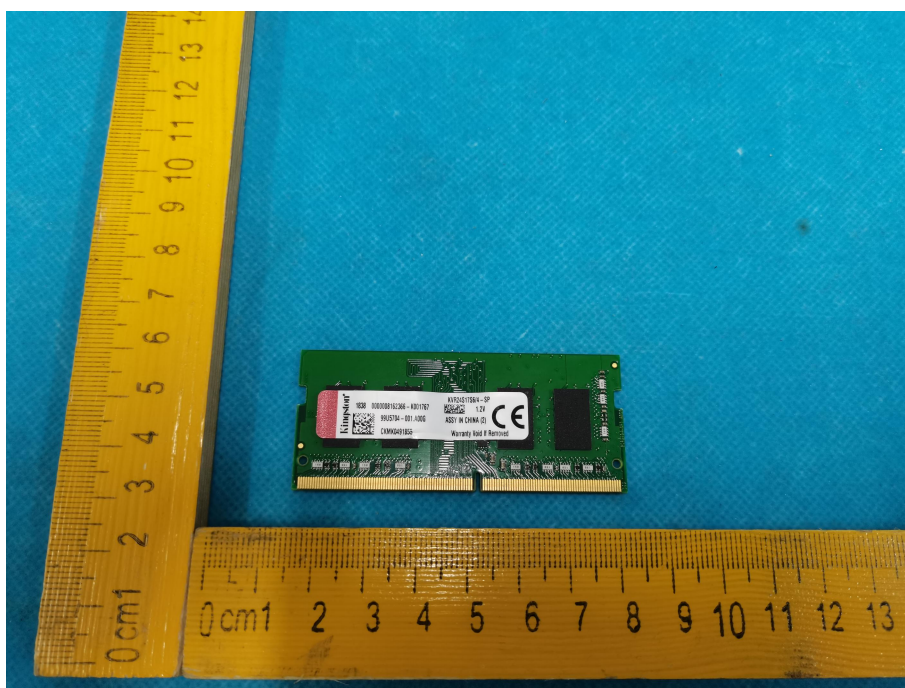
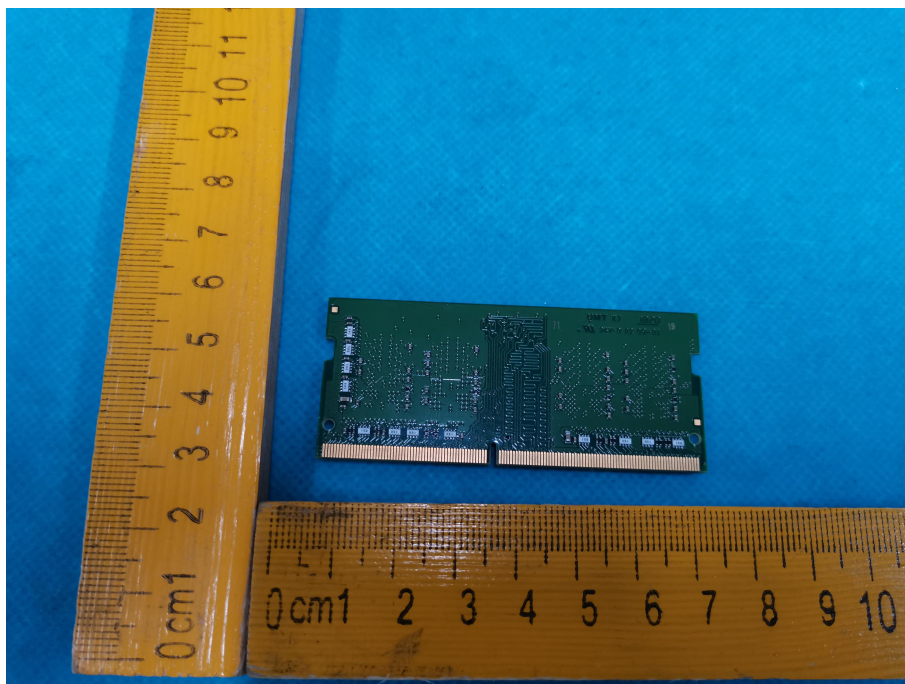


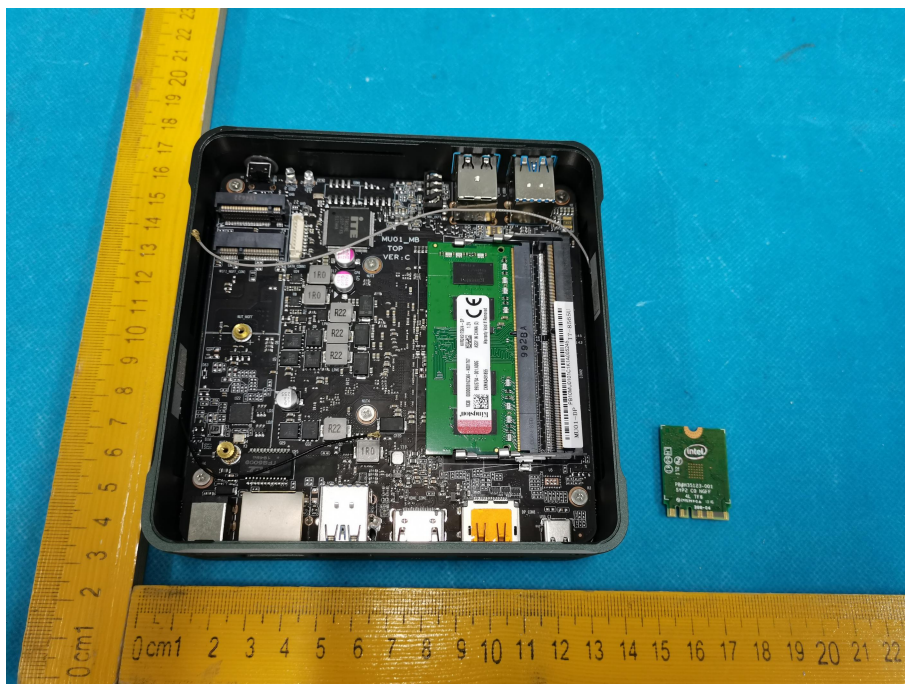


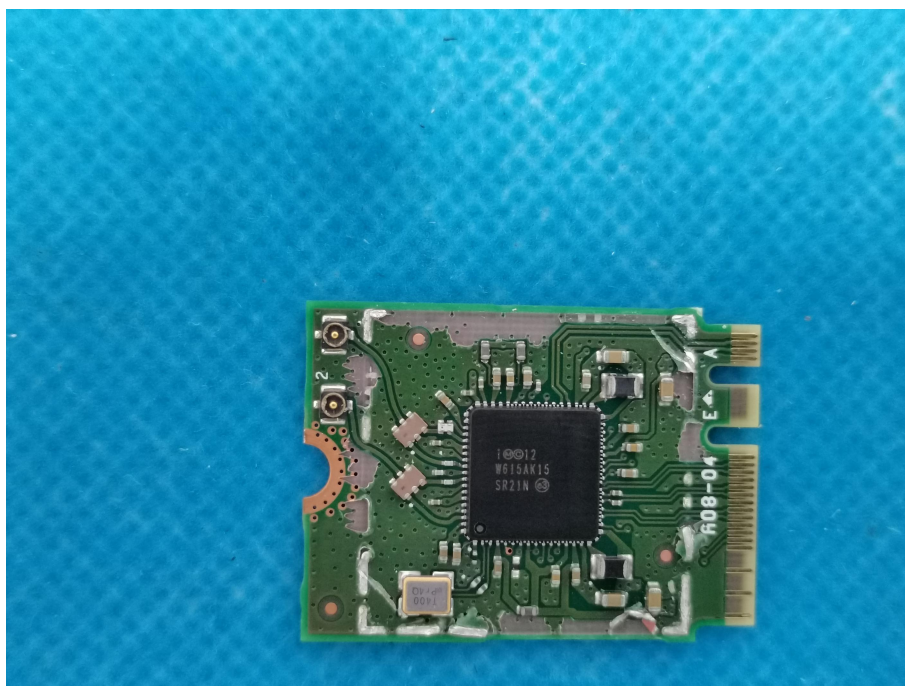
Internal Photos

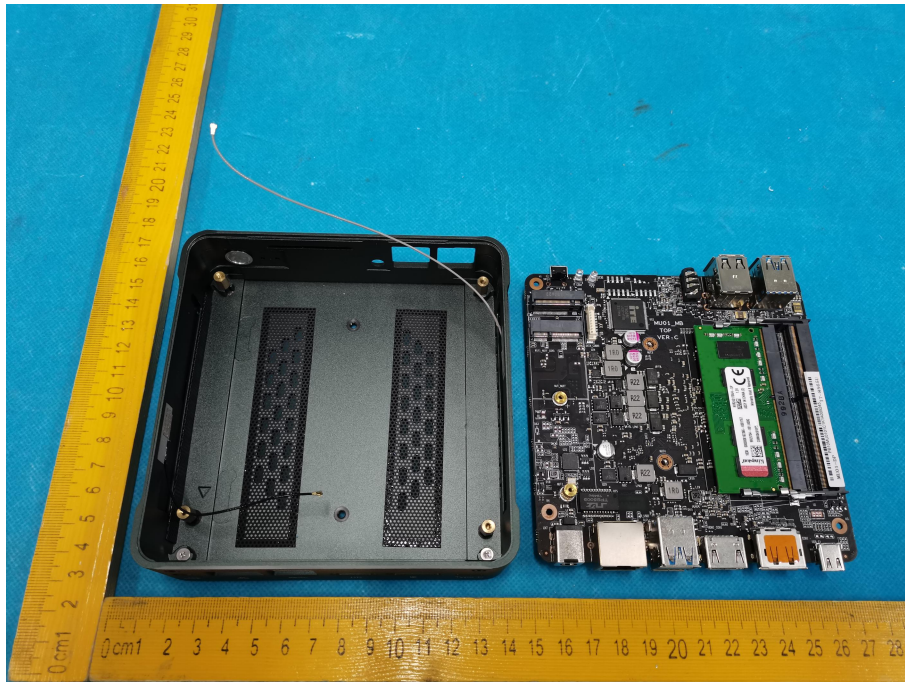


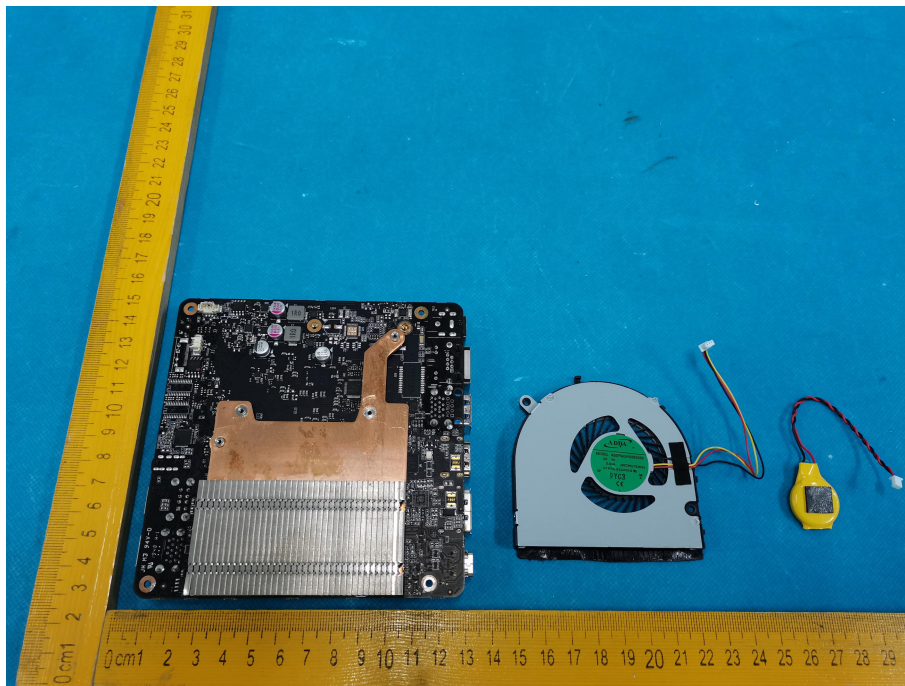
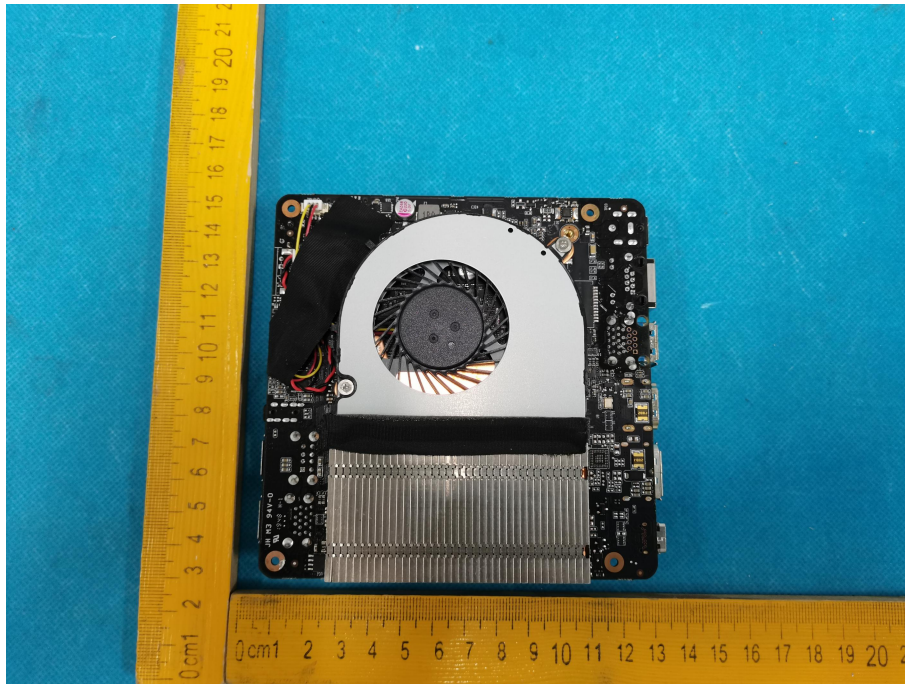


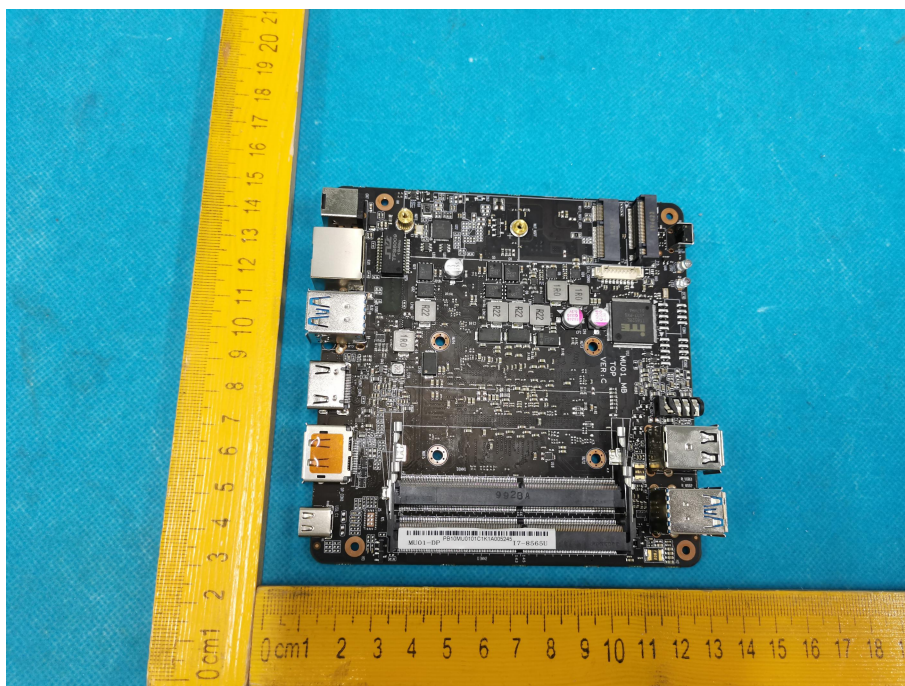
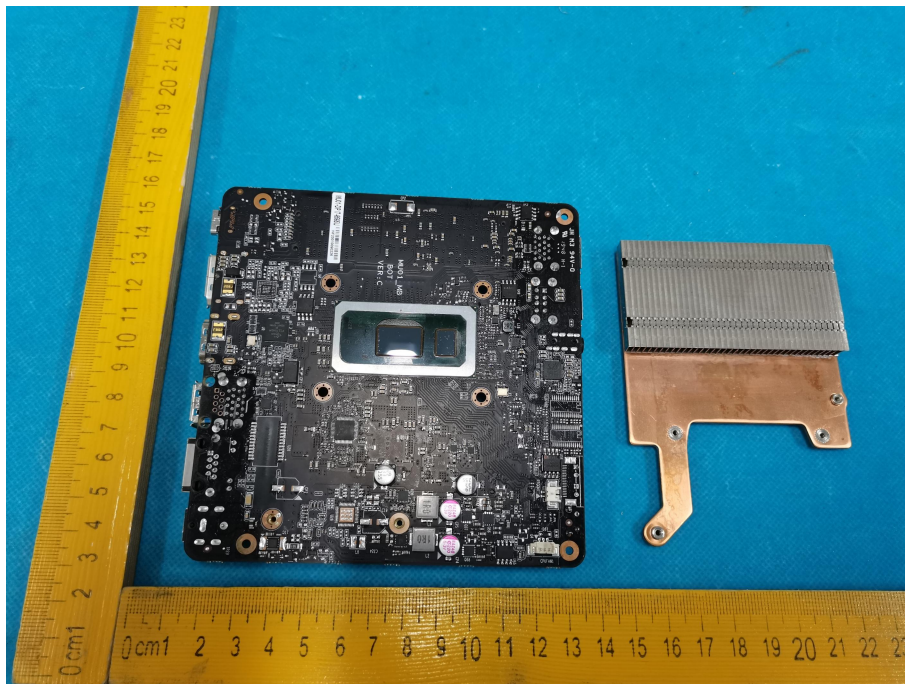


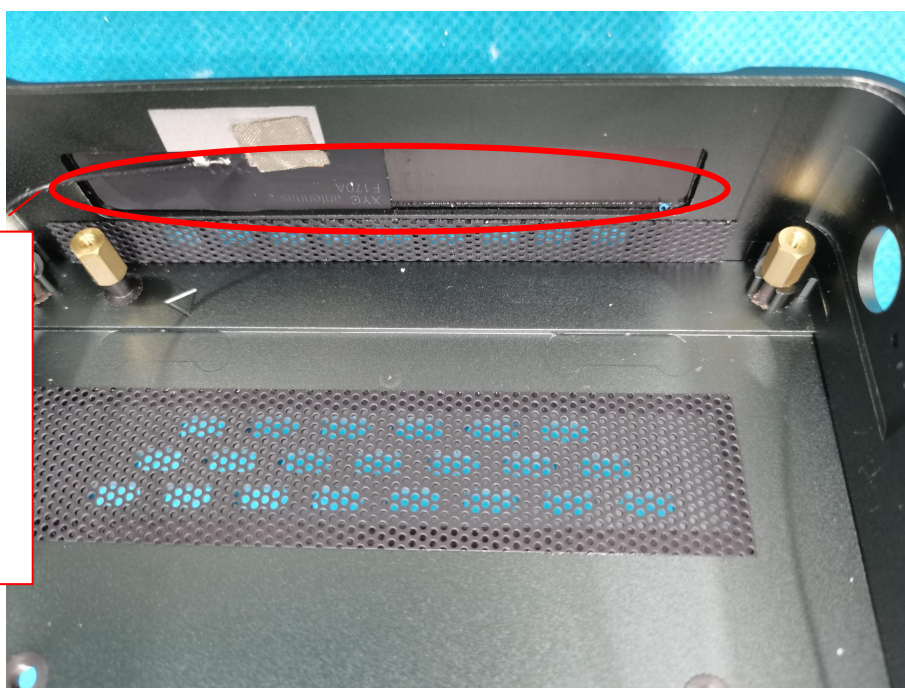
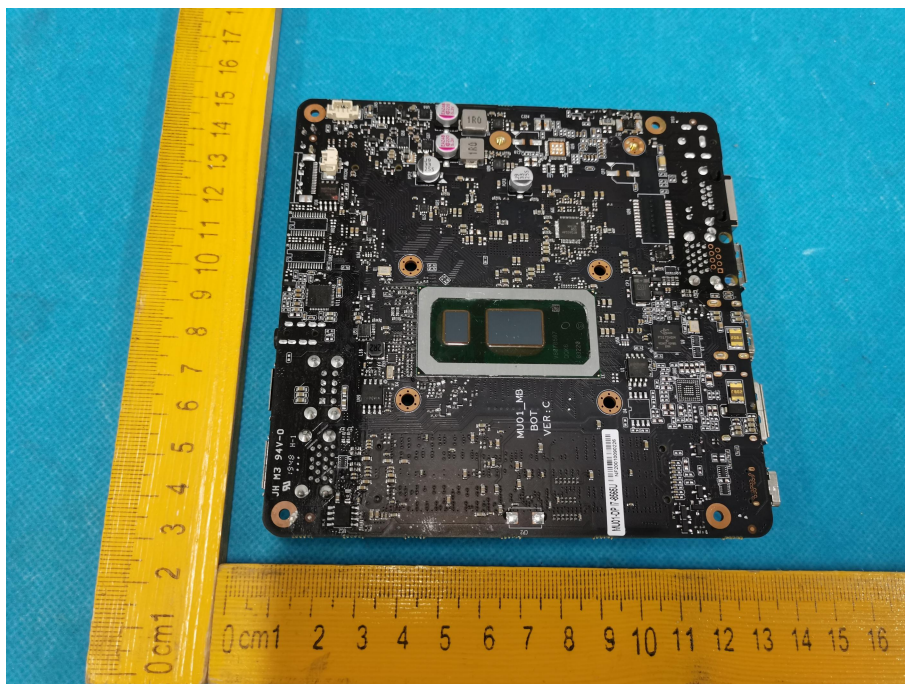




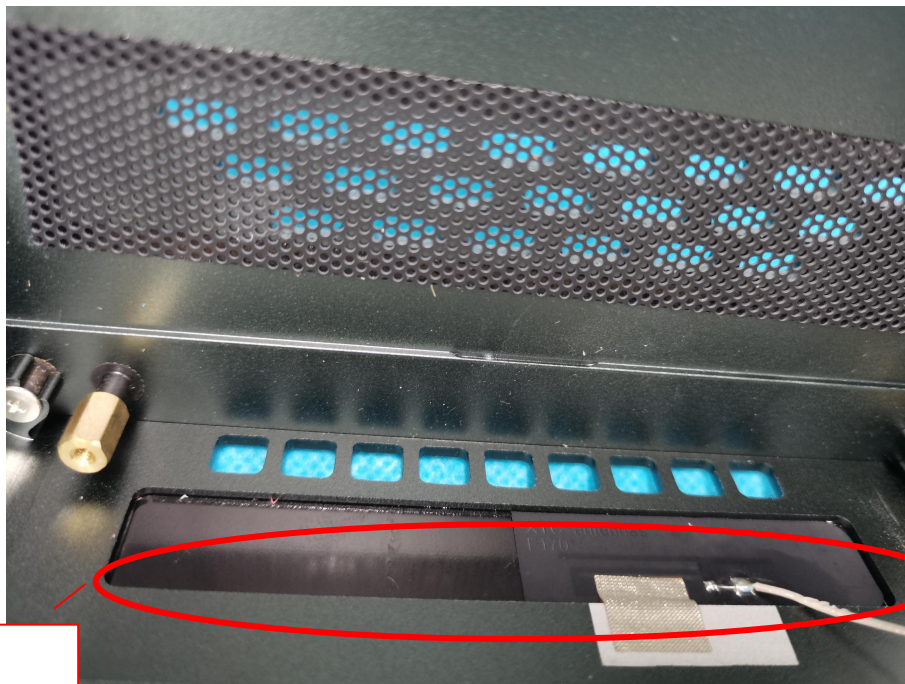








5G WIFI
Antenna



BT /
2.4G WIFI
Antenna

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