

TEST REPORT

Product Name : Small speakers
Trade mark : N/A
Model No. : P329.24X
Report Number : BLA-EMC-201910-A15-01
Date of sample receipt : October 12, 2019
Date of Test : October 12, 2019–October 22, 2019
Date of Issue : October 24, 2019
Test standard : Draft ETSI EN 301 489-1 V2.2.1 (2019-03)
Draft ETSI EN 301 489-17 V3.2.0 (2017-03)
Test result : PASS

Prepared for:

Prepared by:

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Date: October 24, 2019



2 Version

Version No.	Date	Description
00	October 24, 2019	Original

BlueAsia

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4 Test Summary

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

5 General Information

5.1 Client Information

Applicant:	
Address:	
Manufacturer:	
Address:	
Factory:	
Adress:	

5.2 General Description of E.U.T.

Product Name:	Small speakers
Model No.:	P329.24X
Test Model No.:	P329.24X
Tx Frequency:	Bluetooth: 2402MHz~2480MHz
Rx Frequency	Bluetooth: 2402MHz~2480MHz
Hardware version:	EPOT-M1
Software version:	5.0
Modulation technology:	Bluetooth BDR: GFSK, Bluetooth EDR: $\pi/4$ -DQPSK, 8DPSK
Antenna Type:	PCB antenna
Antenna Gain:	BT: -0.58dBi
Power supply:	Rechargeable Li-ion polymer Battery DC3.7V, 320mAh

5.3 Test mode

TM 1:	Bluetooth link + Adapter
TM 2:	Multimedia function on + Adapter
Remark:	The highlight part means the worst case modes which were shown in report.

5.4 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
UGREEN	Adapter	CD112	20358	N/A

5.5 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	± 4.34 dB	(1)

Radiated Emission	30MHz ~ 1000MHz	$\pm 4.24\text{dB}$	(1)
Radiated Emission	1GHz ~ 26.5GHz	$\pm 4.68\text{dB}$	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	$\pm 3.45\text{dB}$	(1)

Note (1): The measurement uncertainty is for coverage factor of $k=2$ and a level of confidence of 95%.

5.6 Description of Cable Used

CableType	Description	Length	From	To
USB Cable	Detachable, Shielded	0.8m	EUT	Adapter

5.7 Laboratory Location

All tests were performed at:
BlueAsia of Technical Services(Shenzhen) Co., Ltd.
IOT Test Centre of BlueAsia
No. 448 Bulong Road, Bantian Street, Longgang District, Shenzhen, China
Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673
No tests were sub-contracted.

5.8 Monitoring of EUT for the Immunity Test

Sound:	Monitored the sound of EUT
LED	Monitored the LED of EUT
Other:	Monitored the data link of EUT

5.9 Test Instruments list

Radiated Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	SKET	9m*6 m*6m	966	06-10-2018	06-09-2023
Broadband Antenna	SCHWARZBECK	VULB9168	00836 P:00227	07-14-2019	07-13-2020
Horn Antenna	SCHWARZBECK	9120D	01892 P:00331	07-14-2019	07-13-2020
EMI Test Software	EZ	EZ	N/A	N/A	N/A
Pre-amplifier	SKET	N/A	N/A	07-19-2019	07-18-2020
Spectrum analyzer	Rohde & Schwarz	FSP40	100817	05-24-2019	05-23-2020
EMI Test Receiver	Rohde & Schwarz	ESR7	101199	03-21-2019	03-20-2020
Controller	SKET	N/A	N/A	N/A	N/A
Vector Signal Generator	Agilent	E4438C	MY45092582	05-24-2019	05-23-2020
Signal Generator	Agilent	E8257D	MY44320250	05-24-2019	05-23-2020

Conducted Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESPI3	101082	06-10-2019	06-09-2020
LISN	CHASE	MN2050D	1447	12-18-2018	12-17-2019
LISN	Rohde & Schwarz	ENV216	3560.6550.15	07-19-2019	07-18-2020
EMI Test Software	EZ	EZ	N/A	N/A	N/A
Temperature Humidity Chamber	Mingle	TH101B	N/A	07-19-2019	07-18-2020

ESD:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
ESD Generator	Noiseken	ESS-2002	ESS03X2235	05-10-2019	05-09-2020

Surge:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Surge Generator	Lioncel	LSE-545CB	0180101	06-20-2019	06-19-2020

EFT:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EFT Generator	Lioncel	LSE-545CB	0180101	06-20-2019	06-19-2020
Coupling clamp	Lioncel	N/A	N/A	06-20-2019	06-19-2020

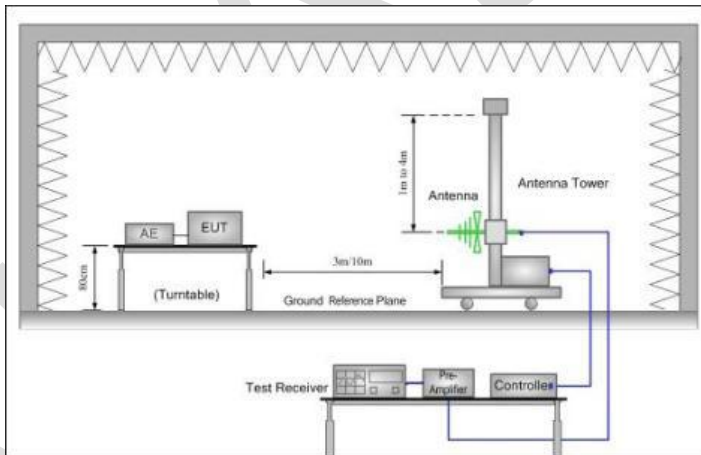
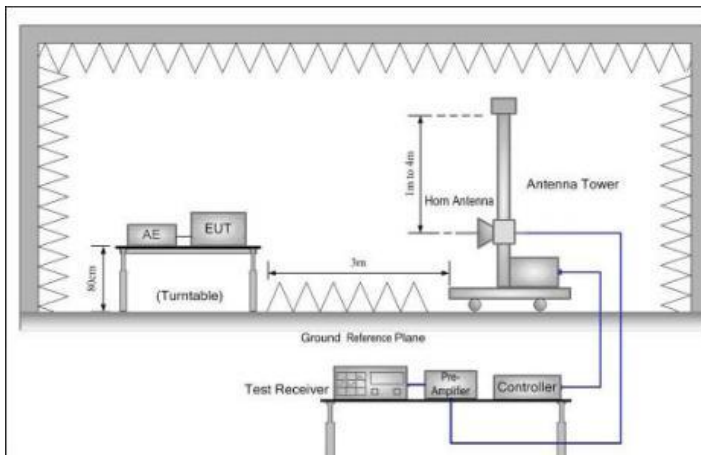
Voltage dips and Interruption:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Voltage dips	Lioncel	VDS-1102	0180502	06-20-2019	06-19-2020
Adjustable power	Lioncel	RGL-220	0171104	06-20-2019	06-19-2020
Adjustable power	Lioncel	RGL-220	0171103	06-20-2019	06-19-2020

Conducted Immunity:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Conducted Disturbance Test system	Lioncel	RIS-6091	0180501	06-20-2019	06-19-2020
Decoupling network	Lioncel	CDN-M3-16	0171103	06-20-2019	06-19-2020
Decoupling network	Lioncel	CDN-M2-16	0180502	06-20-2019	06-19-2020

6 EMC Requirements Specification in ETSI EN 301489

6.1 EMI (Emission)

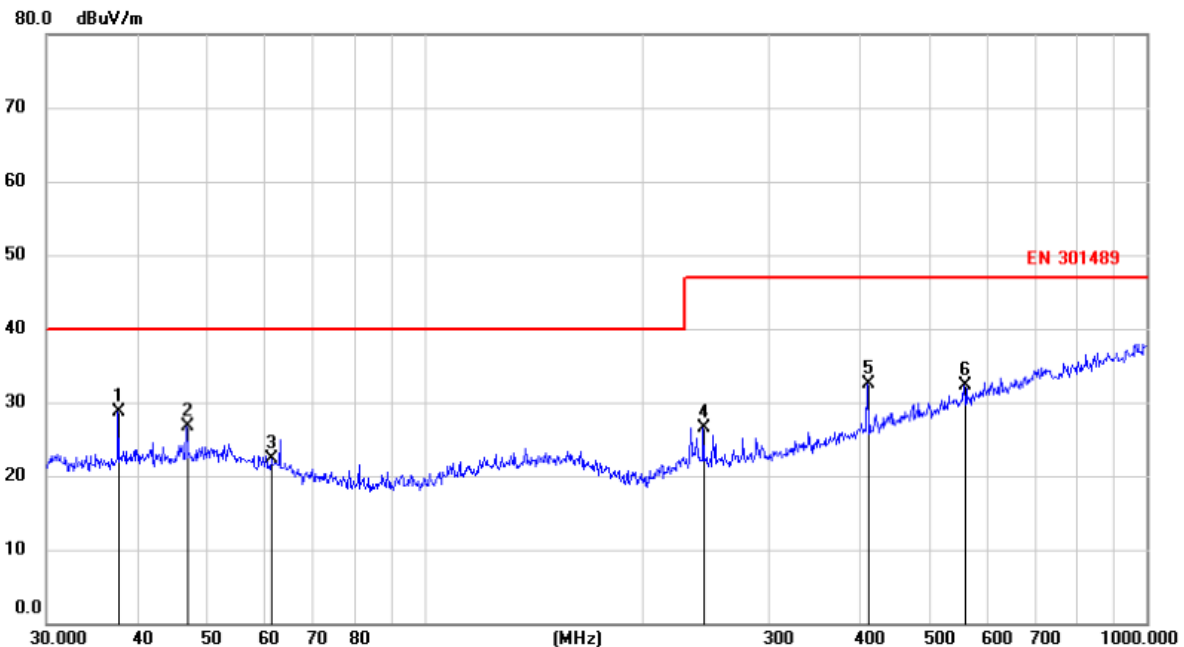
6.1.1 Radiated Emission

Test Requirement:	ETSI EN 301 489 -1				
Test Method:	EN55032				
Test Frequency Range:	30MHz to 6GHz				
Test Distance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	100kHz	300kHz	QP Value
	Above 1GHz	Peak	1MHz	3MHz	PK Value
		Average	1MHz	3MHz	AV Value
Limit:	Frequency		Limit (dBuV/m @3m)		Remark
	30MHz-230MHz		40.0		QP Value
	230MHz-1GHz		47.0		QP Value
	1GHz-3GHz		50.0		AV Value
			70.0		PK Value
	3GHz-6GHz		54.0		AV Value
74.0			PK Value		
Test setup:	Below 1GHz				
					
Test setup:	Above 1GHz				
					
Test Procedure:	30MHz to 1GHz: - The radiated emissions test was conducted in a semi-anechoic chamber. - The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the				

	EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation. - Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emissions spectrum plots of the EUT. - The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization. Above 1GHz: - The radiated emissions test was conducted in a fully-anechoic chamber. - The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation. - Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emission spectrum plots of the EUT. - The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization.
Test environment:	Temp.: 25.5°C Humid.: 55% Press.: 101kPa
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

EUT:	Small speakers	Model:	P329.24X
Test By:	Lucas	Test mode:	TM1
Power Source:	AC230V/50Hz	Temp./Hum.(%H):	25.5°C/55%RH
Test Frequency:	30 MHz - 1 GHz	Polarization:	Vertical

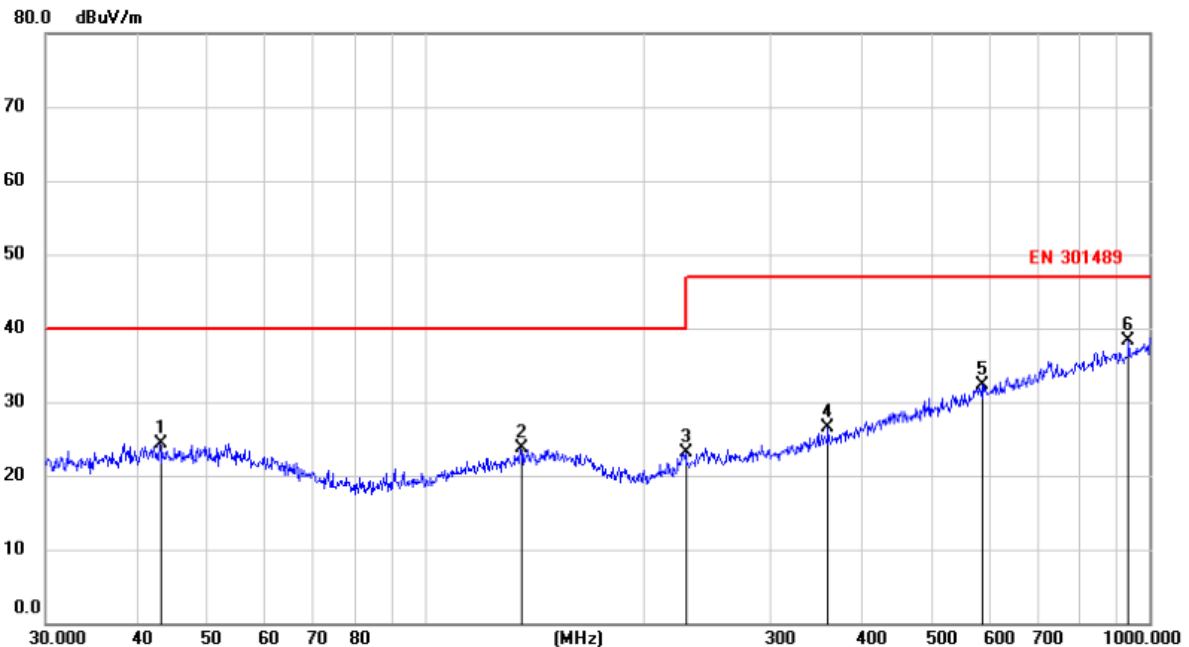


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1	*	37.6798	15.49	13.20	28.69	40.00	-11.31	QP
2		46.8303	12.74	13.89	26.63	40.00	-13.37	QP
3		61.3463	9.72	12.64	22.36	40.00	-17.64	QP
4		243.3772	13.80	12.71	26.51	47.00	-20.49	QP
5		410.3825	15.80	16.75	32.55	47.00	-14.45	QP
6		558.7302	12.17	20.12	32.29	47.00	-14.71	QP

Remark:

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

EUT:	Small speakers	Model:	P329.24X
Test By:	Lucas	Test mode:	TM1
Power Source:	AC230V/50Hz	Temp./Hum.(%H):	25.5°C/55%RH
Test Frequency:	30 MHz - 1 GHz	Polarization:	Horizontal

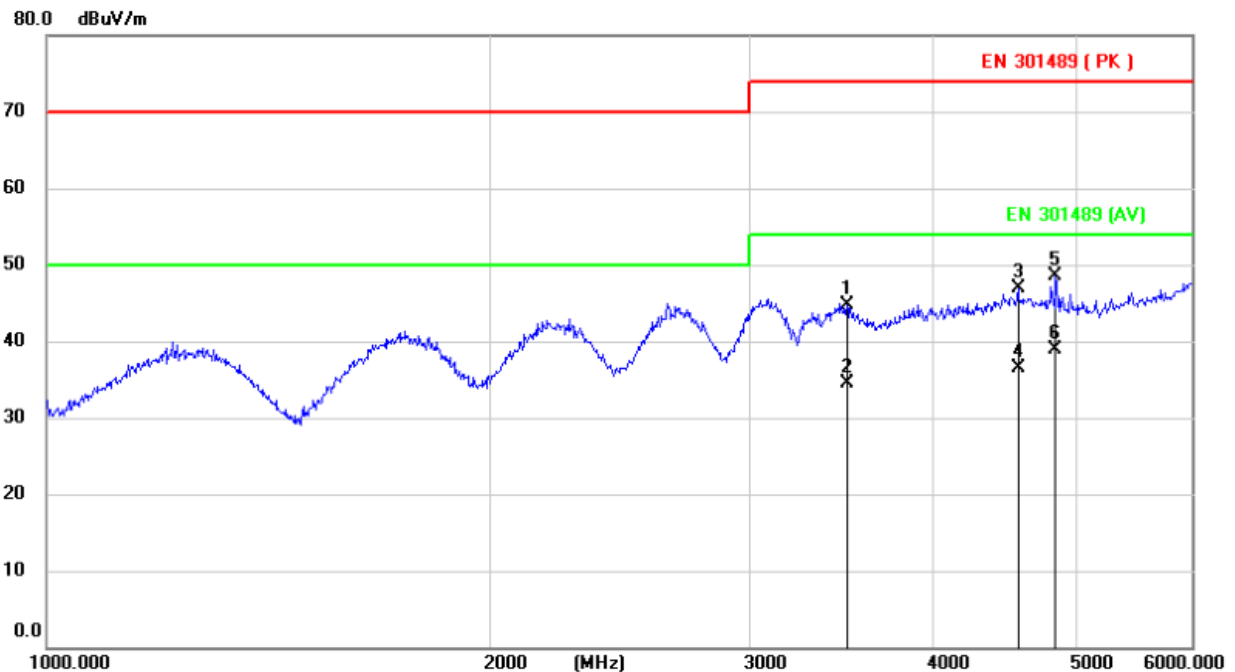


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		43.0505	10.46	13.79	24.25	40.00	-15.75	QP
2		135.5062	10.74	12.90	23.64	40.00	-16.36	QP
3		229.2931	11.06	11.95	23.01	40.00	-16.99	QP
4		360.4476	11.24	15.31	26.55	47.00	-20.45	QP
5		586.8437	11.66	20.67	32.33	47.00	-14.67	QP
6	*	935.5463	12.70	25.51	38.21	47.00	-8.79	QP

Remark:

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

EUT:	Small speakers	Model:	P329.24X
Test By:	Lucas	Test mode:	TM1
Power Source:	AC230V/50Hz	Temp./Hum.(%H):	25.5°C/55%RH
Test Frequency:	1 GHz - 6 GHz	Polarization:	Vertical

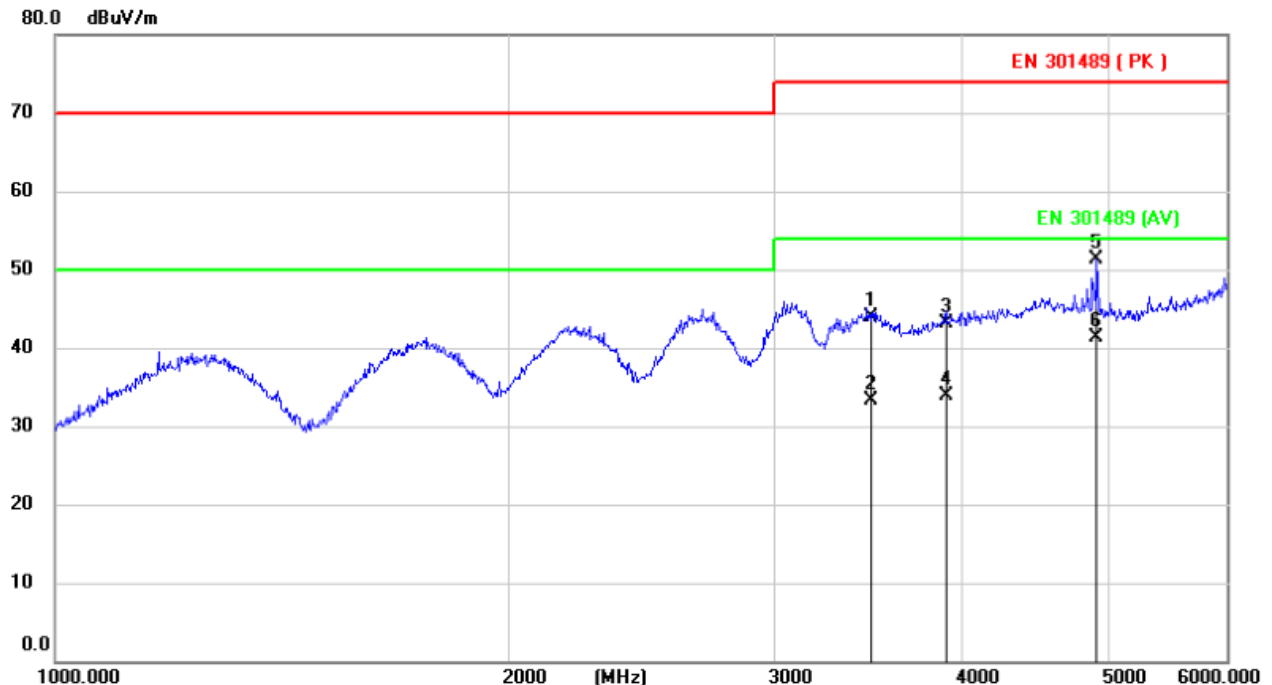


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		3498.869	54.64	-9.85	44.79	74.00	-29.21	peak
2		3498.869	44.41	-9.85	34.56	54.00	-19.44	AVG
3		4569.538	53.65	-6.75	46.90	74.00	-27.10	peak
4		4569.538	43.29	-6.75	36.54	54.00	-17.46	AVG
5		4847.873	55.56	-7.14	48.42	74.00	-25.58	peak
6	*	4847.873	46.03	-7.14	38.89	54.00	-15.11	AVG

Remark:

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

EUT:	Small speakers	Model:	P329.24X
Test By:	Lucas	Test mode:	TM1
Power Source:	AC230V/50Hz	Temp./Hum.(%H):	25.5°C/55%RH
Test Frequency:	1 GHz - 6 GHz	Polarization:	Horizontal

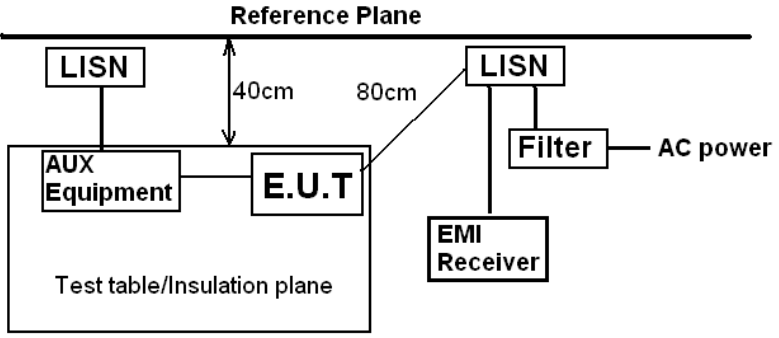


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		3473.883	53.82	-9.99	43.83	74.00	-30.17	peak
2		3473.883	43.22	-9.99	33.23	54.00	-20.77	AVG
3		3909.967	52.71	-9.57	43.14	74.00	-30.86	peak
4		3909.967	43.46	-9.57	33.89	54.00	-20.11	AVG
5		4917.863	58.54	-7.31	51.23	74.00	-22.77	peak
6	*	4917.863	48.67	-7.31	41.36	54.00	-12.64	AVG

Remark:

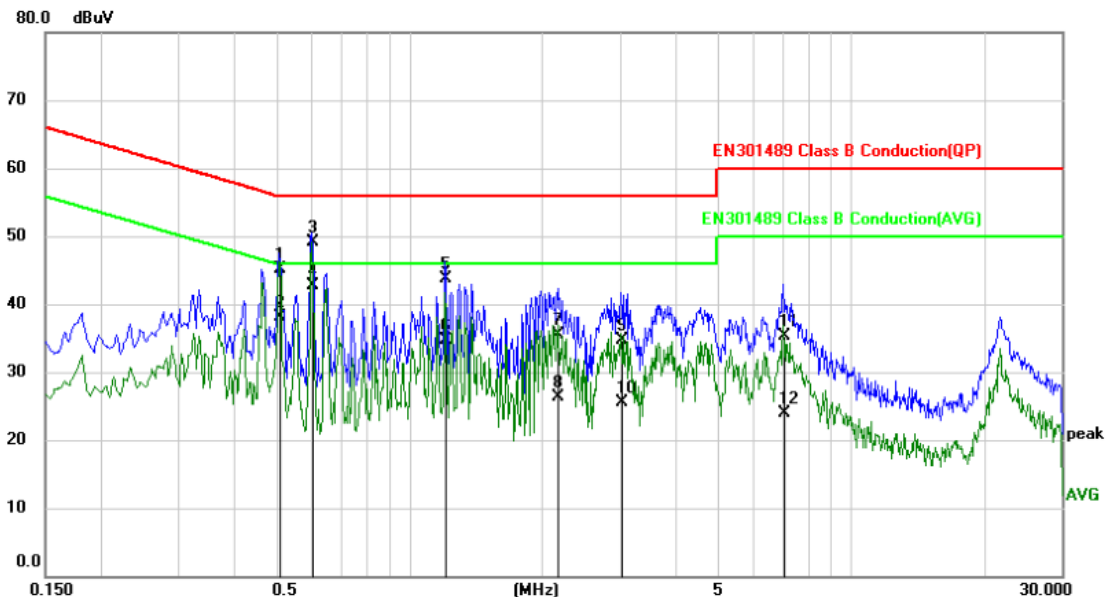
1. Final Level = Receiver Read level + Correct Factor
2. Correct Factor = Antenna Factor + Cable Loss – Preamplifier Factor.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

6.1.2 Conducted Emissions

Test Requirement:	ETSI EN 301 489 -1		
Test Method:	EN 55032		
Test Frequency Range:	150kHz to 30MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9kHz, VBW=30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
* Decreases with the logarithm of the frequency.			
Test setup:	 Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m		
Test procedure	The E.U.T and simulators are connected to the main power through a line impedance stabilization network(L.I.S.N.). Which provide a 50ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to EN55032 Class B on conducted measurement.		
Test environment:	Temp.:	23°C	Humid.: 56% Press.: 101kPa
Test Instruments:	Refer to section 5.9 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Passed		

Measurement Data:

EUT:	Small speakers	Model:	P329.24X
Test By:	Lucas	Test mode:	TM1
Power Source:	AC230V/50Hz	Temp./Hum.(%H):	23°C/56%RH
Test Frequency:	150kHz to 30MHz	Phase:	Line

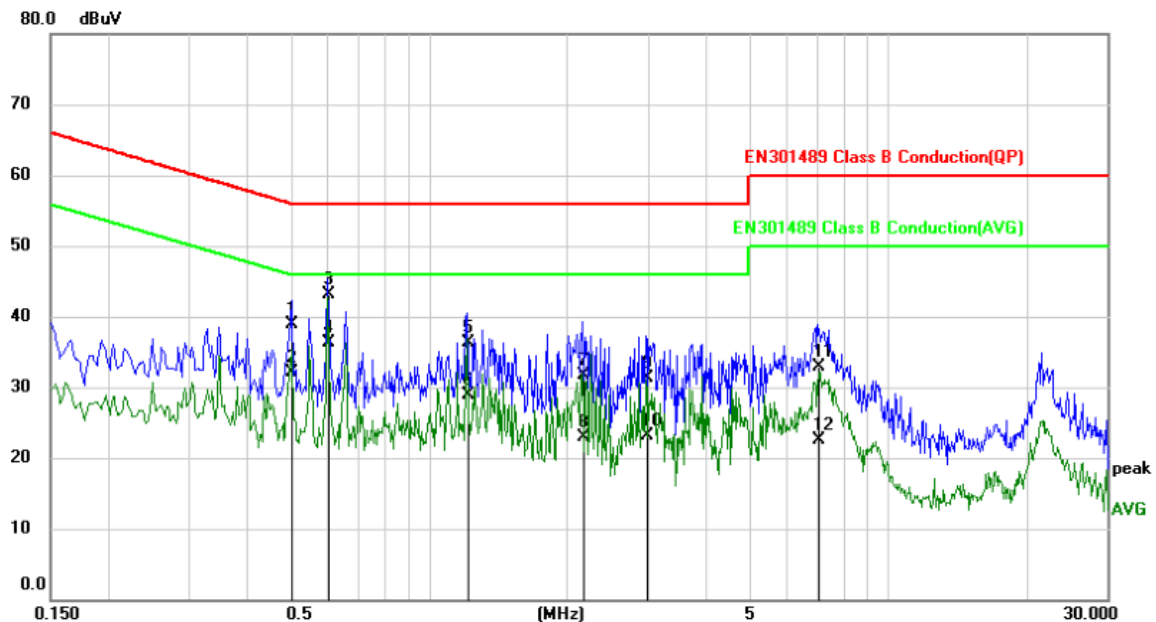


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.5100	35.31	9.73	45.04	56.00	-10.96	QP
2		0.5100	28.47	9.73	38.20	46.00	-7.80	AVG
3		0.6020	39.30	9.74	49.04	56.00	-6.96	QP
4	*	0.6020	33.03	9.74	42.77	46.00	-3.23	AVG
5		1.2059	33.83	9.81	43.64	56.00	-12.36	QP
6		1.2059	24.88	9.81	34.69	46.00	-11.31	AVG
7		2.1700	25.72	9.82	35.54	56.00	-20.46	QP
8		2.1700	16.56	9.82	26.38	46.00	-19.62	AVG
9		3.0220	24.81	9.87	34.68	56.00	-21.32	QP
10		3.0220	15.58	9.87	25.45	46.00	-20.55	AVG
11		7.0540	25.41	9.86	35.27	60.00	-24.73	QP
12		7.0540	14.05	9.86	23.91	50.00	-26.09	AVG

Notes:

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

EUT:	Small speakers	Model:	P329.24X
Test By:	Lucas	Test mode:	TM1
Power Source:	AC230V/50Hz	Temp./Hum.(%H):	23°C/56%RH
Test Frequency:	150kHz to 30MHz	Phase:	Neutral



No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1	0.5020	29.17	9.72	38.89	56.00	-17.11	QP
2	0.5020	22.33	9.72	32.05	46.00	-13.95	AVG
3	0.6020	33.46	9.74	43.20	56.00	-12.80	QP
4 *	0.6020	26.66	9.74	36.40	46.00	-9.60	AVG
5	1.2100	26.45	9.83	36.28	56.00	-19.72	QP
6	1.2100	19.00	9.83	28.83	46.00	-17.17	AVG
7	2.1580	21.78	9.86	31.64	56.00	-24.36	QP
8	2.1580	13.11	9.86	22.97	46.00	-23.03	AVG
9	2.9700	21.36	9.89	31.25	56.00	-24.75	QP
10	2.9700	13.25	9.89	23.14	46.00	-22.86	AVG
11	7.0420	23.11	9.84	32.95	60.00	-27.05	QP
12	7.0420	12.57	9.84	22.41	50.00	-27.59	AVG

Notes:

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

6.1.3 Harmonics Test Results

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

6.1.4 Flicker Test Results

Test Requirement:	ETSI EN 301 489-1/17: EN61000-3-3
Test Method:	N/A: See Remark Below
Remark:	The appropriate requirements of EN 61000-3-3 [9] for voltage fluctuations and flicker apply for equipment covered by the scope of the present document with an input current up to and including 16A per phase. For equipment with an input current of greater than 16A per phase EN 61000-3-11 [12] applies.

6.2 EMS (Immunity)

Performance Criteria of ETSI EN 301 489-1/17, sub clause 6

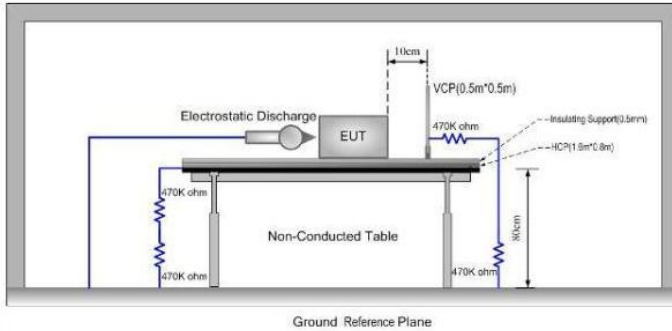
Criteria	Performance Criteria of EN 301 489-1 clause 6
CT/CR	During and after the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.
TT/TR	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 restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A SW reboot is not allowed. 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. A SW reboot is not allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost. For all other ports the following applies: • After the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. • During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed. • If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

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

Table 1: Performance criteria

Criteria	During test	After test
A	Shall operate as intended. (see note 1). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance (see note 3). Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance (see note 2). Shall be no unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3). Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3).
NOTE 1: Operate as intended during the test allows a level of degradation not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended. NOTE 2: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended. NOTE 3: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.		

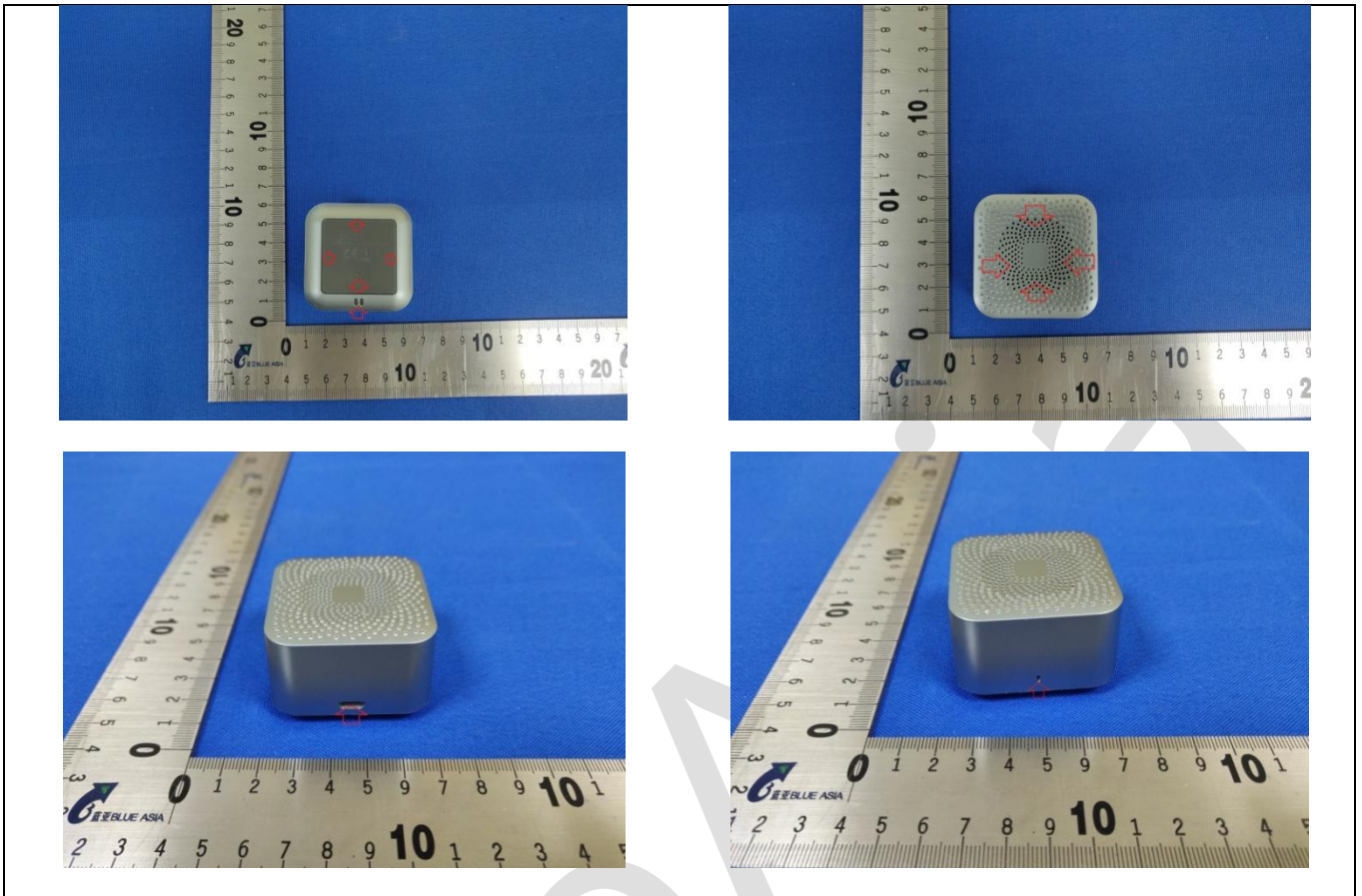
6.2.1 Electrostatic Discharge

Test Requirement:	ETSI EN 301 489-1
Test Method:	EN 61000-4-2
Discharge Voltage:	Contact Discharge, HCP and VCP: $\pm 2\text{kV}$, $\pm 4\text{kV}$, Air Discharge: $\pm 2\text{kV}$, $\pm 4\text{kV}$, $\pm 8\text{kV}$
Polarity:	Positive & Negative
Number of Discharge:	Contact Discharge: Minimum 25 times at each test point, Air Discharge: Minimum 10 times at each test point.
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum
Testsetup:	
Test Procedure:	1) Air discharge: The test was applied on non-conductive surfaces of EUT. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. After each discharge, the discharge electrode was removed from the EUT. The generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure was repeated until all the air discharge completed 2) Contact discharge: The test was applied on conductive surfaces of EUT. the generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. the tip of the discharge electrode was touch the EUT before the discharge switch was operated. 3) Indirect discharge for horizontal coupling plane At least 10 single discharges shall be applied at the front edge of each HCP opposite the centre point of each unit of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge. Consideration should be given to exposing all sides of the EUT. 4) Indirect discharge for vertical coupling plane At least 10 single discharges were applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, was placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges were applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.
Test environment:	Temp.: 26°C Humid.: 54% Press.: 101kPa
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

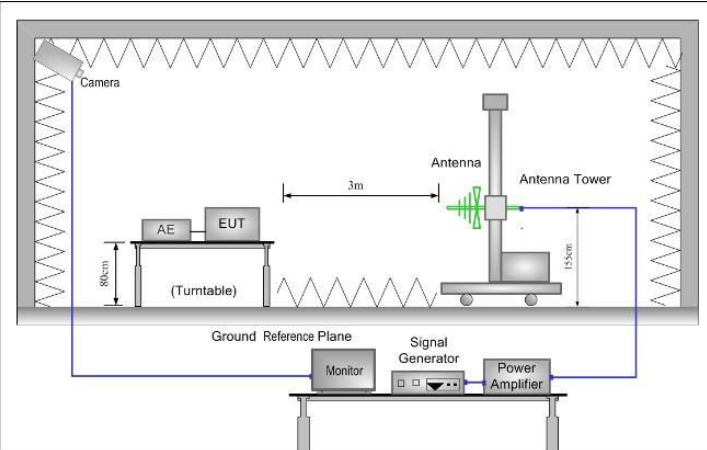
Measurement Record:

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

ESD Test points as below:



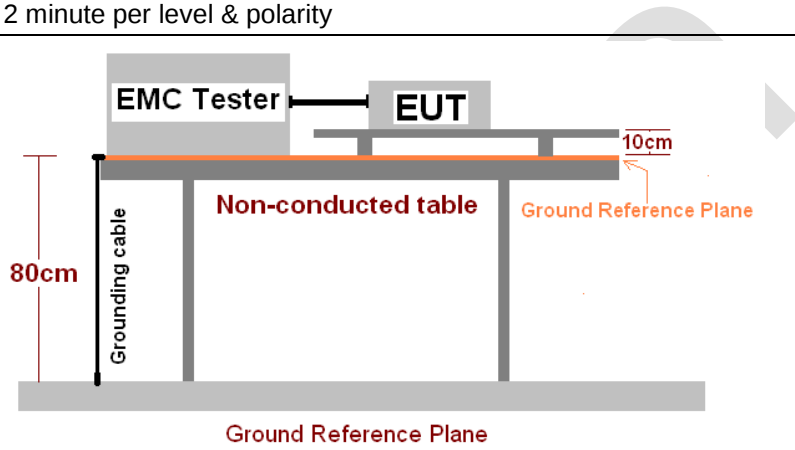
6.2.2 Radiated Immunity

Test Requirement:	ETSI EN 301 489 -1
Test Method:	EN 61000-4-3
Frequency range:	80MHz to 6GHz
Test Level:	3V/m
Modulation:	80%, 1kHz Amplitude Modulation
Testsetup:	
Test Procedure:	1. For table-top equipment, the EUT was placed in the chamber on a non-conductive table 0.8m high. For arrangement of floor-standing equipment, the EUT was mounted on a non-conductive support 0.1m above the supporting plane. For human body-mounted equipment, the EUT may be tested in the same manner as table top items. 2. If possible, a minimum of 1 m of cable is exposed to the electromagnetic field. Excess length of cables interconnecting units of the EUT shall be bundled low-inductively in the approximate center of the cable to form a bundle 30 cm to 40 cm in length. 3. The EUT was initially placed with one face coincident with the calibration plane. The EUT face being illuminated was contained within the UFA (Uniform Field Area). 4. The frequency ranges to be considered were swept with the signal modulated and pausing to adjust the RF signal level or to switch oscillators and antennas as necessary. Where the frequency range was swept incrementally, the step size was not exceed 1 % of the preceding frequency value. 5. The dwell time of the amplitude modulated carrier at each frequency was not be less than the time necessary for the EUT to be exercised and to respond, and was not less than 0,5 s. 6. The test normally was performed with the generating antenna facing each side of the EUT. 7. The polarization of the field generated by each antenna necessitates testing each selected side twice, once with the antenna positioned vertically and again with the antenna positioned horizontally. 8. The EUT was performed in a configuration to actual installation conditions, a video camera and/or a audio monitor were used to monitor the performance of the EUT.
Test environment:	Temp.: 26°C Humid.: 54% Press.: 101kPa
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Record:

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

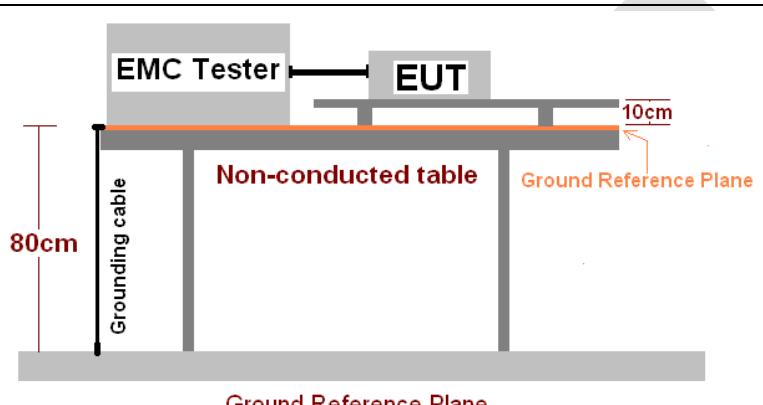
6.2.3 Electrical Fast Transients

Test Requirement:	ETSI EN 301 489 -1
Test Method:	EN 61000-4-4
Test Level:	$\pm 1.0\text{kV}$ on AC port
Polarity:	Positive & Negative
Repetition Frequency:	5kHz
Burst Duration:	15ms
Burst Period:	300ms
Test Duration:	2 minute per level & polarity
Test setup:	 The diagram illustrates the test setup. An EMC Tester and the Equipment Under Test (EUT) are positioned on a non-conducted table. The table is supported by a wood support that is 0.1m + 0.01m thick. The table is 80cm high. A grounding cable is connected to the table. A ground reference plane is shown at the base of the table, with a 10cm clearance between the table and the plane.
Test Procedure:	The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1m + 0.01m thick. The ground reference plane was 1m*1m metallic sheet with 0.65mm minimum thickness. This reference groundplane was project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane was more than 0.5m. All cables to the EUT was placed on the wood support, cables not subject to EFT/B was routed as far as possible from the cable under test to minimize the coupling between the cables. Test on Signal Ports, Telecommunication Ports and Control Ports: The EFT interference signal is through a coupling clamp device couples to the signal and control lines of the EUT with burst noise for 2 minutes. Test on power supply ports: The EUT is connected to the power mains through a coupling device that directly couples the EFT/B interference signal. Each of the Line and Neutral conductors is impressed with burst noise for 2 minutes. The length of the signal and power lines between the coupling device and the EUT is 0.5m
Test environment:	Temp.: 26°C Humid.: 54% Press.: 101kPa
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Record:

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

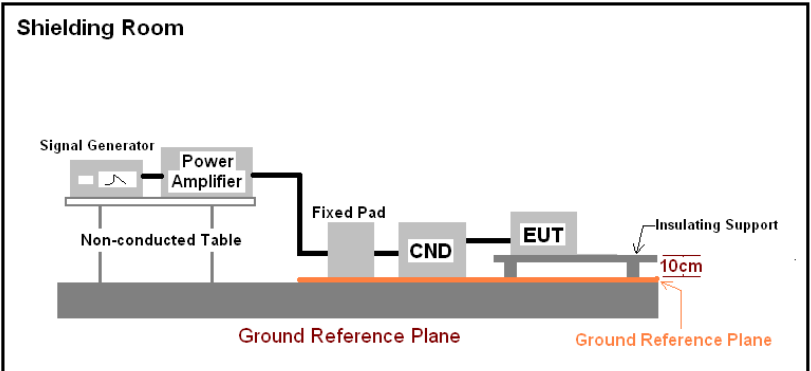
6.2.4 Surge

Test Requirement:	ETSI EN 301 489 -1
Test Method:	EN 61000-4-5
Test Level:	±1kV Live to Neutral: Differential mode ±2kV Live to Earth or Neutral to Earth: Common mode
Polarity:	Positive & Negative
Test Interval:	60s between each surge
No. of surges:	5 positive, 5 negative at 0°, 90°, 180°, 270°.
Performance Criterion:	B
Test setup:	 The diagram illustrates the test setup. An EMC Tester is connected to an EUT (Equipment Under Test) via a cable. The EUT is placed on a non-conducted table. A grounding cable is connected to the table, which is 80cm high. A ground reference plane is indicated at 10cm from the table surface.
Test Procedure:	- For line-to-line coupling mode, provide a 1kV 1.2/50 us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points, and for active line / neutral lines to ground are same except test level is 2kV. - At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test. - Different phase angles are done individually. - Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.
Test environment:	Temp.: 26°C Humid.: 53% Press.: 101kPa
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Record:

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

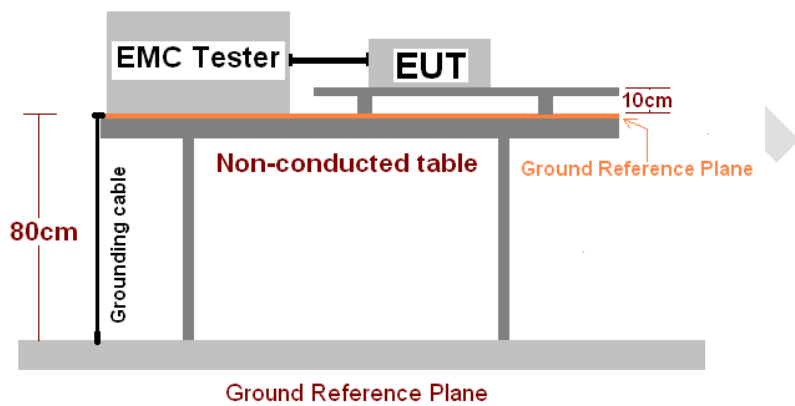
6.2.5 Injected Currents susceptibility Test

Test Requirement:	ETSI EN 301 489 -1					
Test Method:	EN 61000-4-6					
Frequency range:	0.15MHz to 80MHz					
Test Level:	3V rms on AC Ports (unmodulated emf into 150 Ω)					
Modulation:	80%, 1kHz Amplitude Modulation					
Test setup:						
Test Procedure:	- Let the EUT work in test mode and test it. - 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 50 mm (where possible). - The disturbance signal described below is injected to EUT through CDN. - The EUT operates within its operational mode(s) under intended climatic conditions after power on. - The frequency range is swept from 0.150MHz to 80MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sinewave. - 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 there after 1% of the preceding frequency value. - Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.					
Test environment:	Temp.:	26°C	Humid.:	53%	Press.:	101kPa
Test Instruments:	Refer to section 5.9 for details					
Test mode:	Refer to section 5.3 for details					
Test results:	Passed					

Measurement Record:

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

6.2.6 Voltage Dip and Voltage Interruptions

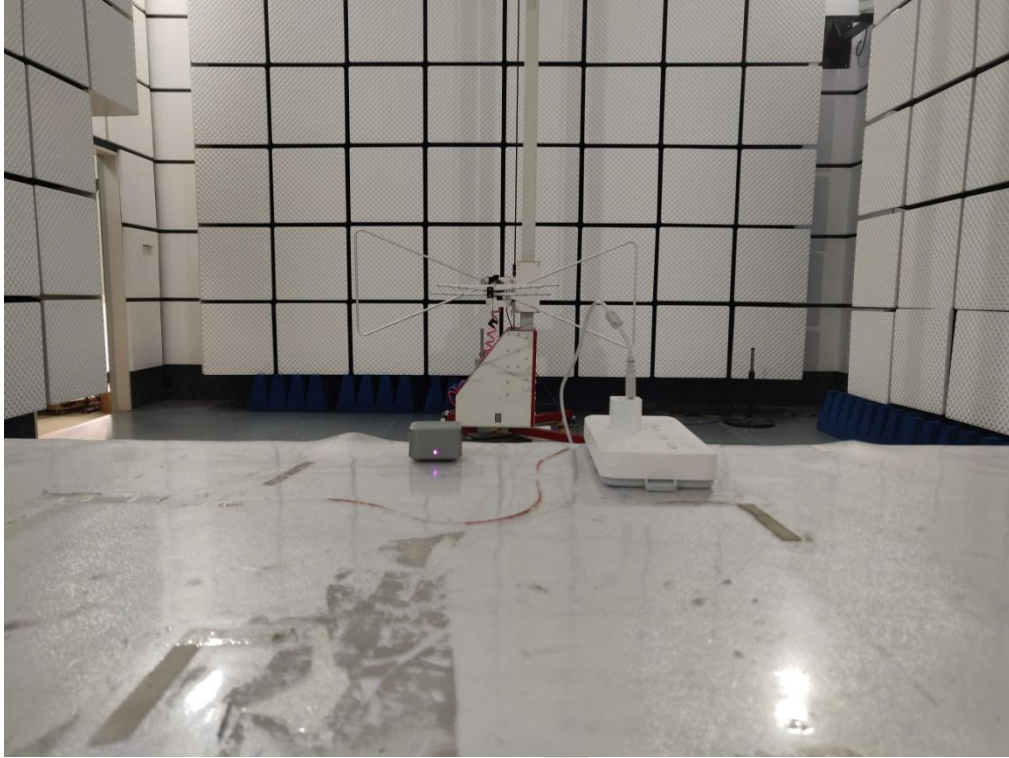
Test Requirement:	ETSI EN 301 489 -1
Test Method:	EN 61000-4-11
Test Level:	0% of VT(Supply Voltage) for 0.5 period 0% of VT(Supply Voltage) for 1.0 period 70% of VT(Supply Voltage) for 25 period 0% of VT(Supply Voltage) for 250 period
No. of Dips / Interruptions:	3 per Level
Test setup:	 The diagram illustrates the test setup. An EMC Tester and the Equipment Under Test (EUT) are positioned on a non-conducted table. A grounding cable connects the table to the ground reference plane. The vertical distance from the table top to the ground reference plane is 80cm. The vertical distance from the EUT to the ground reference plane is 10cm.
Test Procedure:	1. The EUT and test generator were setup as shown on above setup photo. 2. The interruptions are introduced at selected phase angles with specified duration. 3. Record any degradation of performance.
Test environment:	Temp.: 26°C Humid.: 53% Press.: 101kPa
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Record:

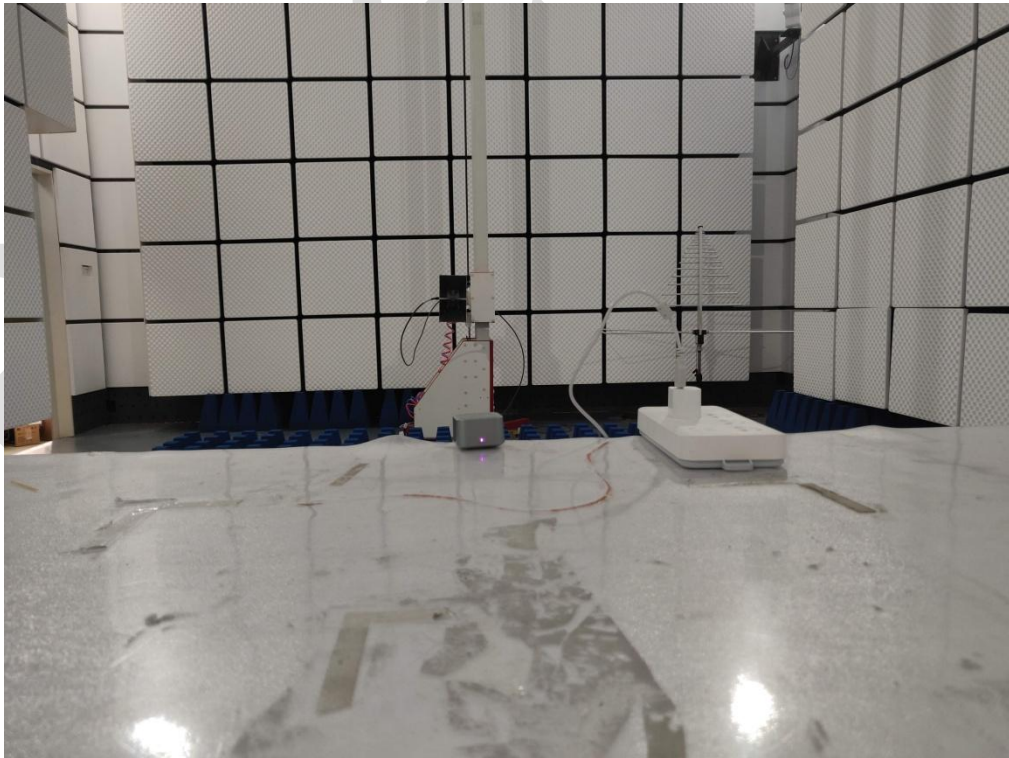
Test Level % U_T	Duration (Periods)	Phase angle	No of dropout	Time between dropout	Observations (Performance Criterion)	Result
0	0.5	0°, 90°, 180°, 270°	3	10s	TT/TR	Pass
0	1	0°, 90°, 180°, 270°	3	10s		
70	25	0°, 90°, 180°, 270°	3	10s		
0	250	0°, 90°, 180°, 270°	3	10s		

7 Test Setup Photo

Radiated Emission Below1GHz



Radiated Emission Above1GHz



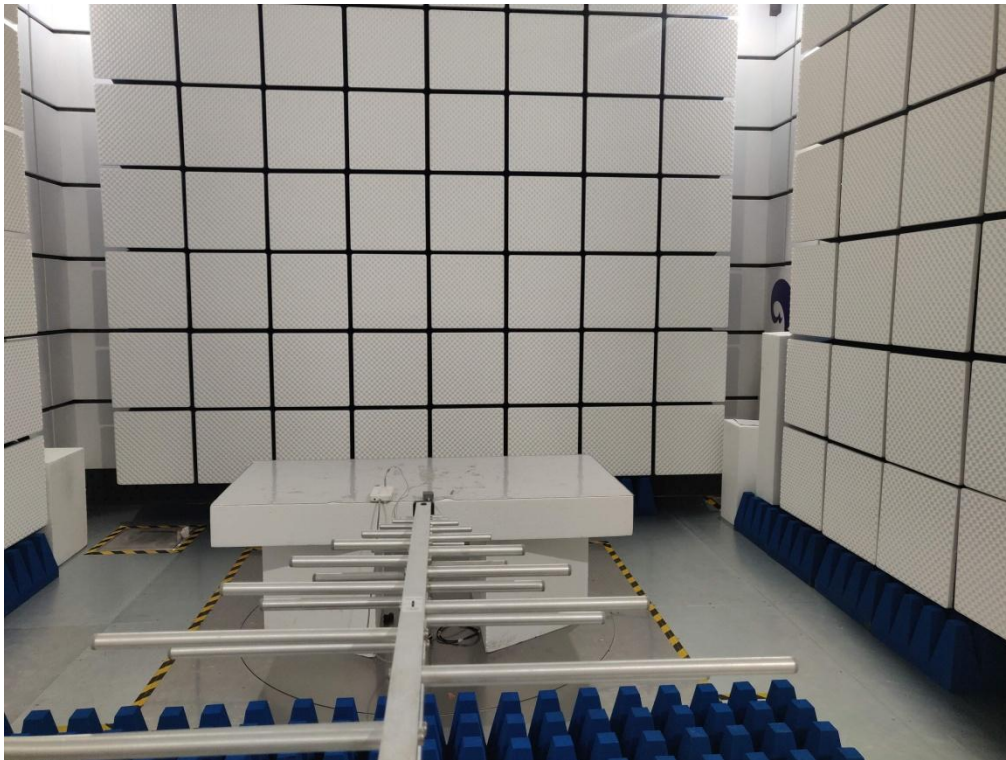
Conducted Emission



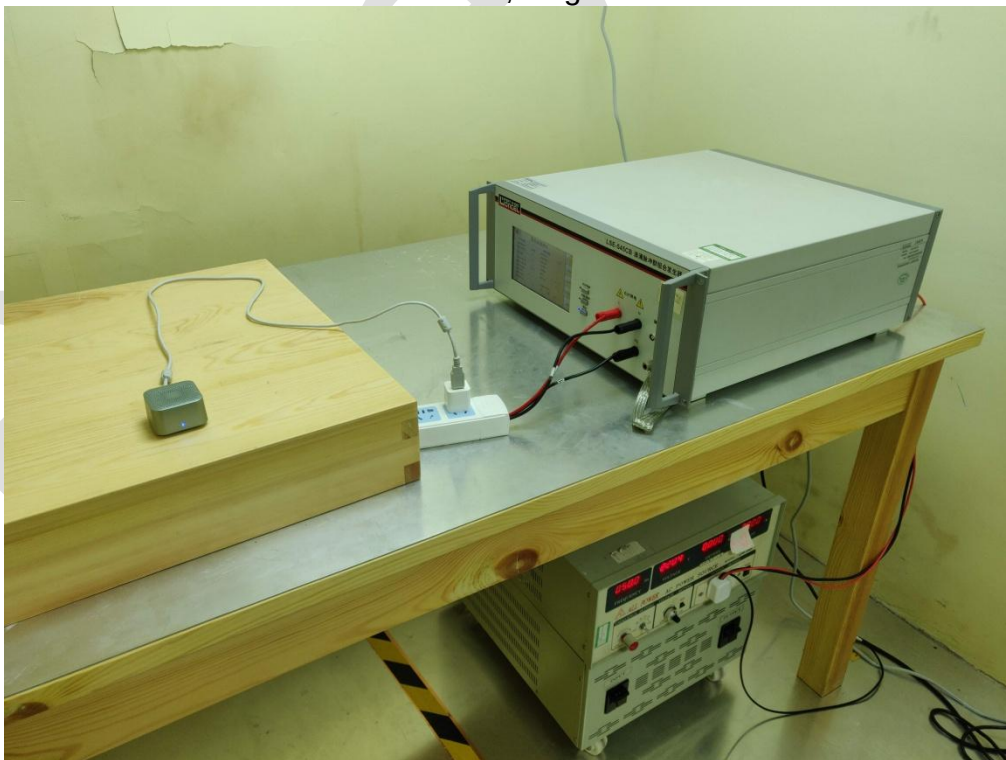
ESD



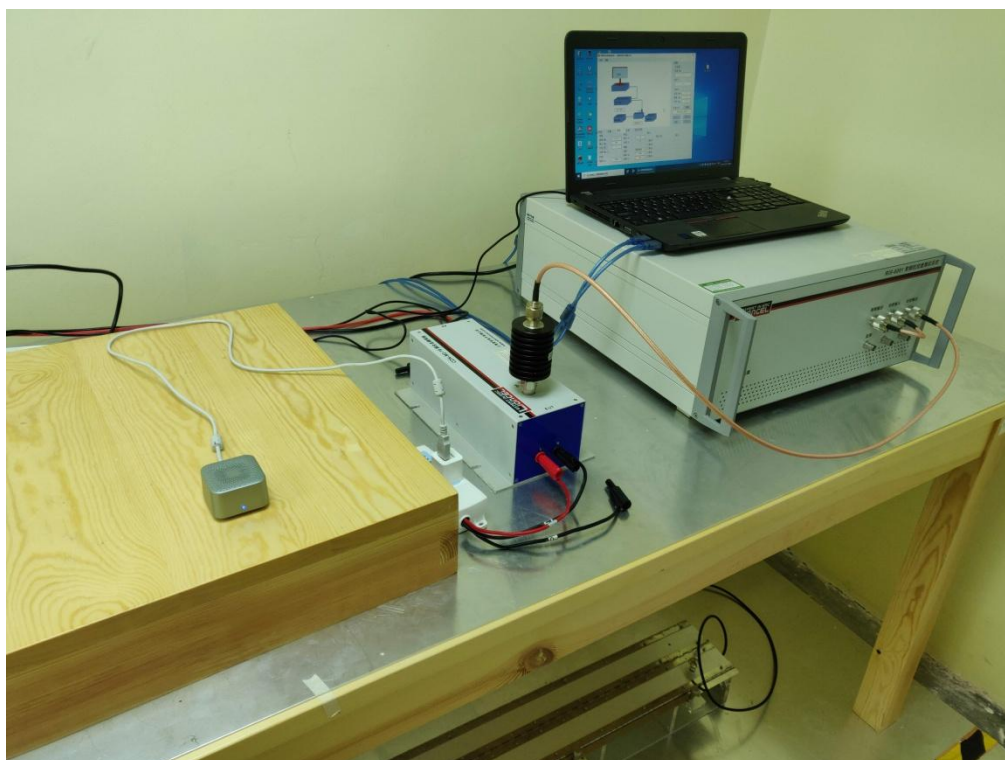
R/S



EFT/B, Surge



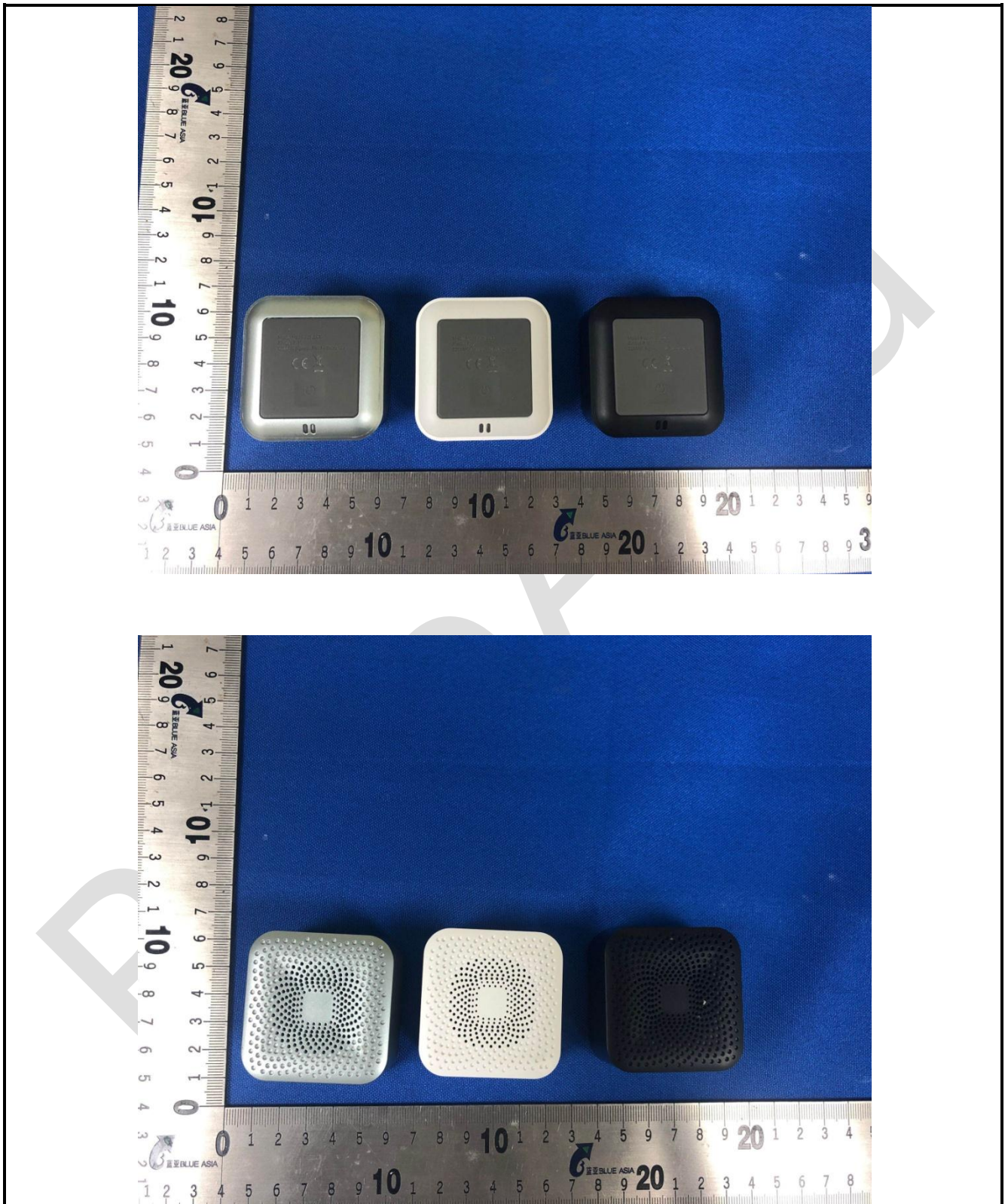
C/S

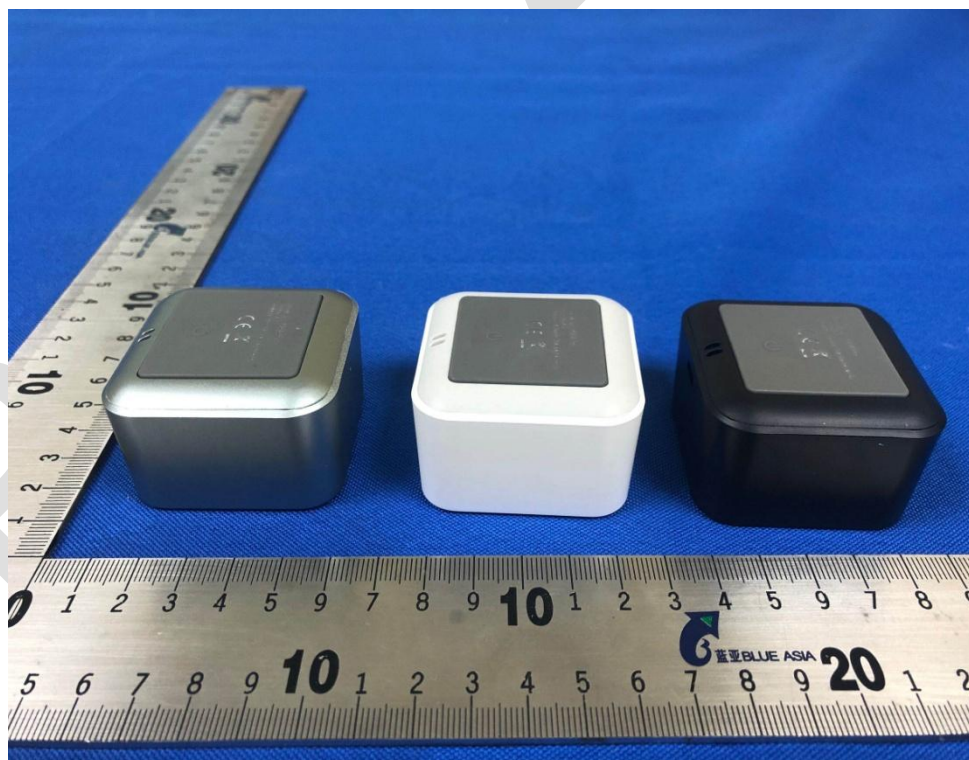


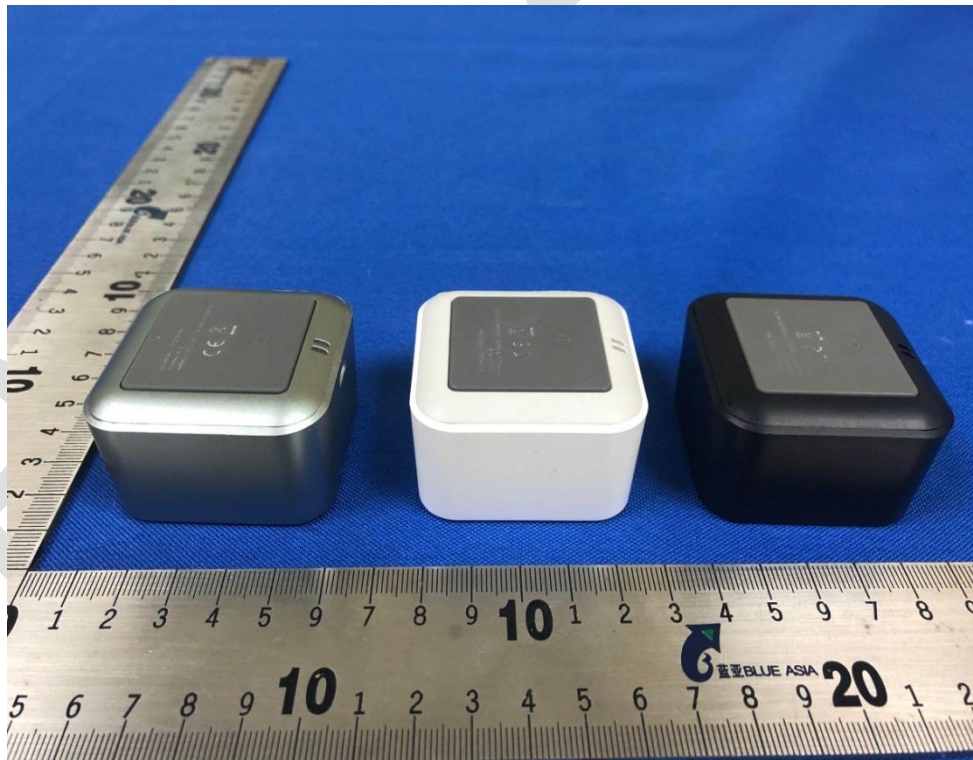
V-dips

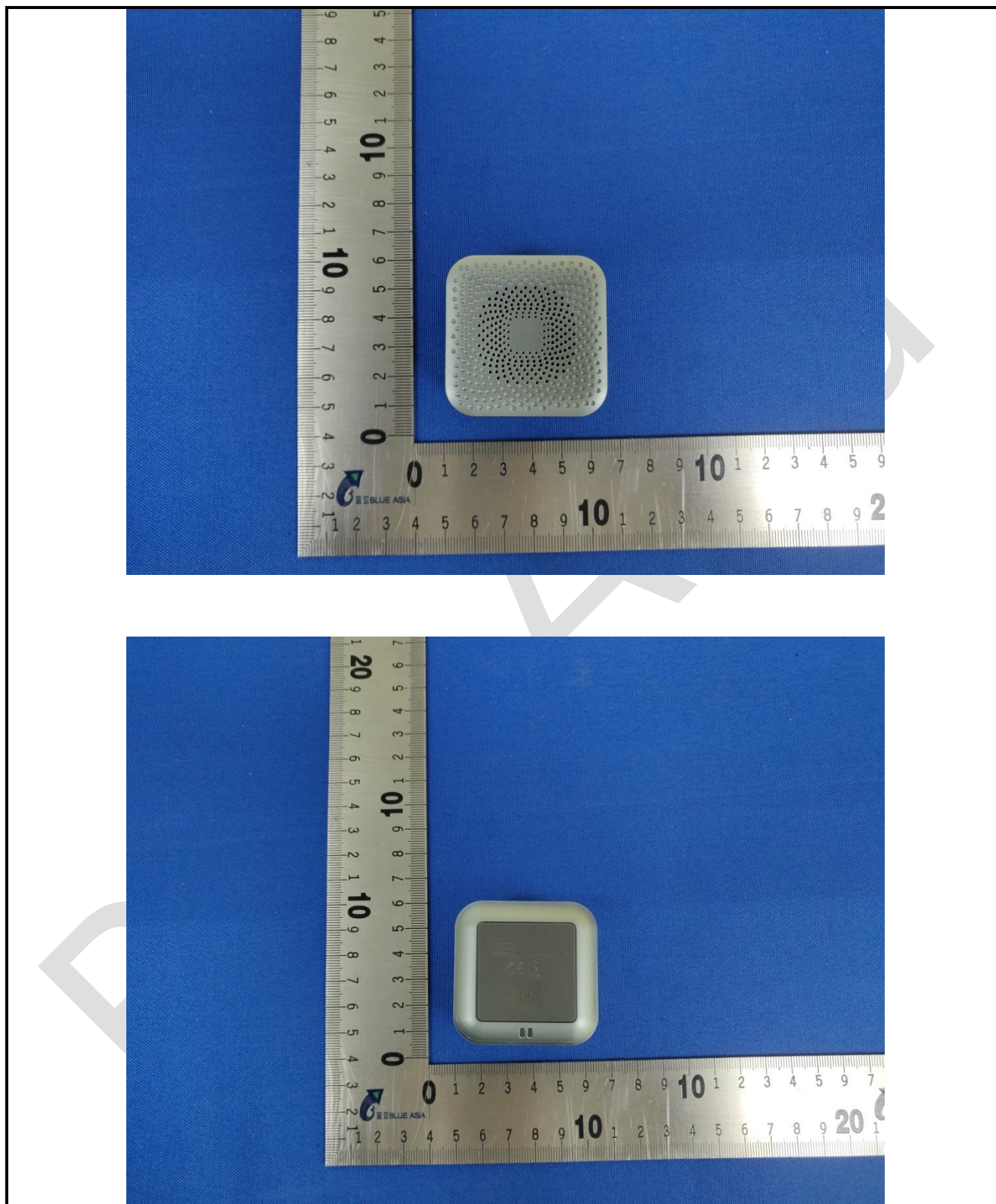


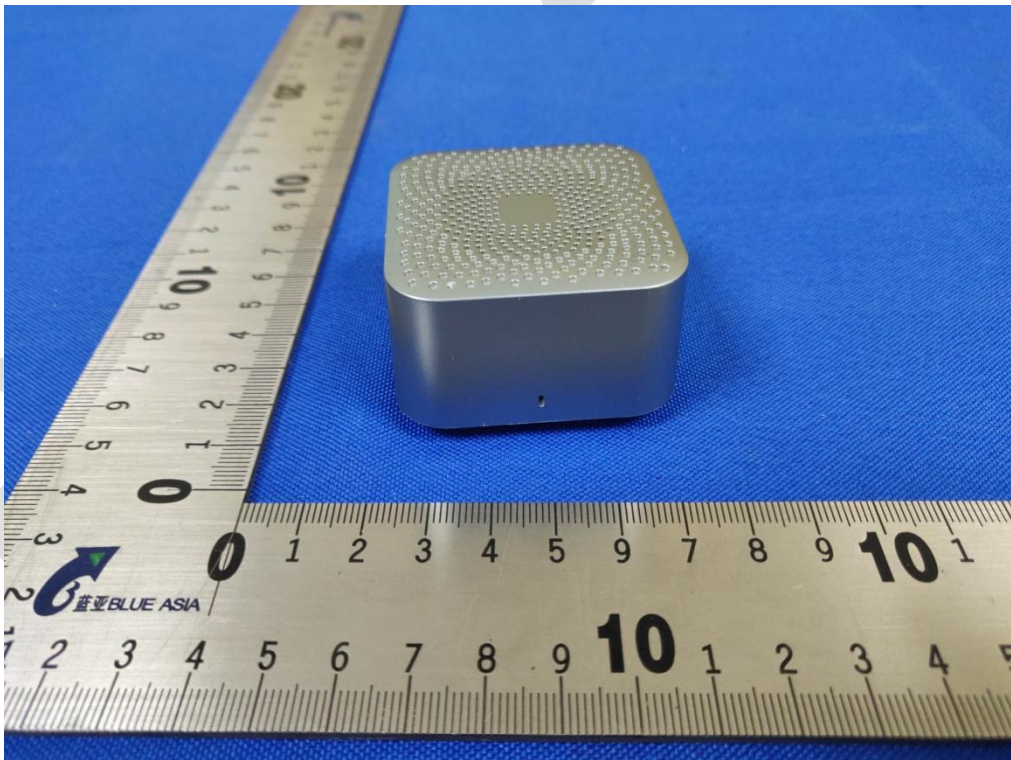
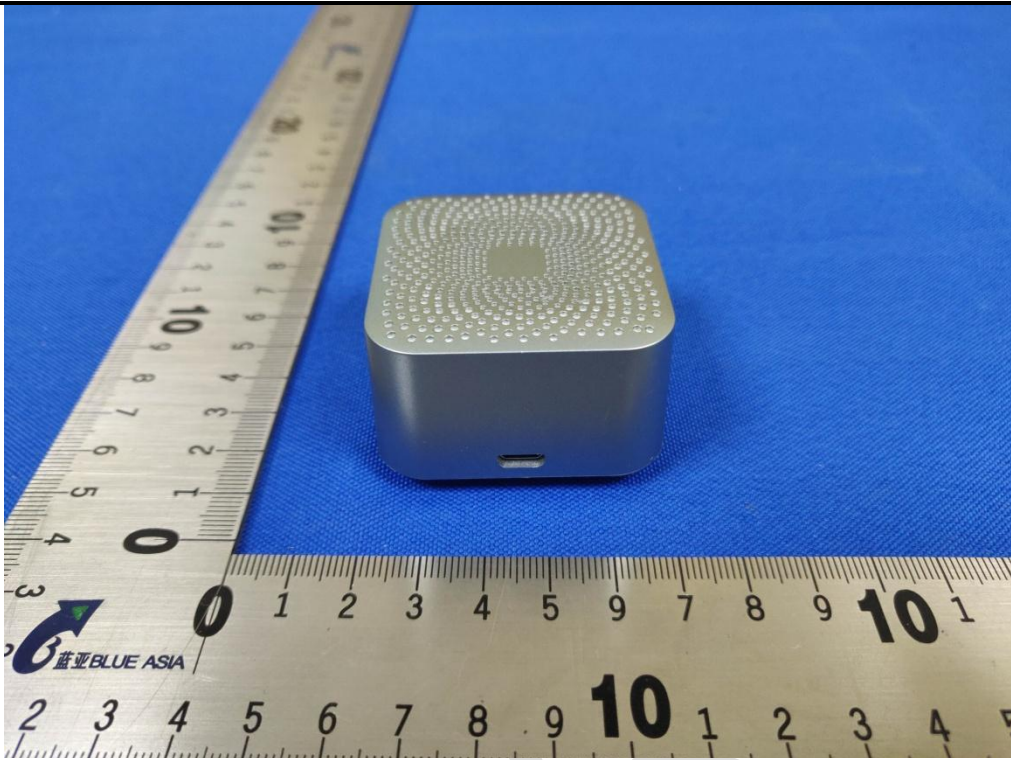
8 EUT Constructional Details

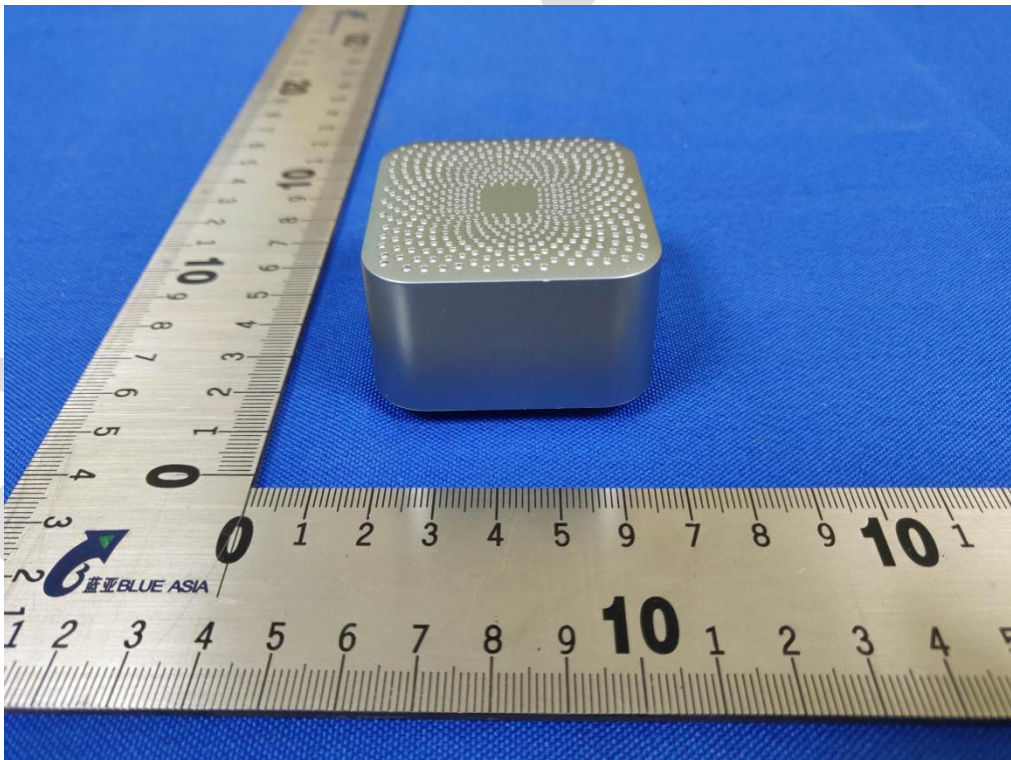
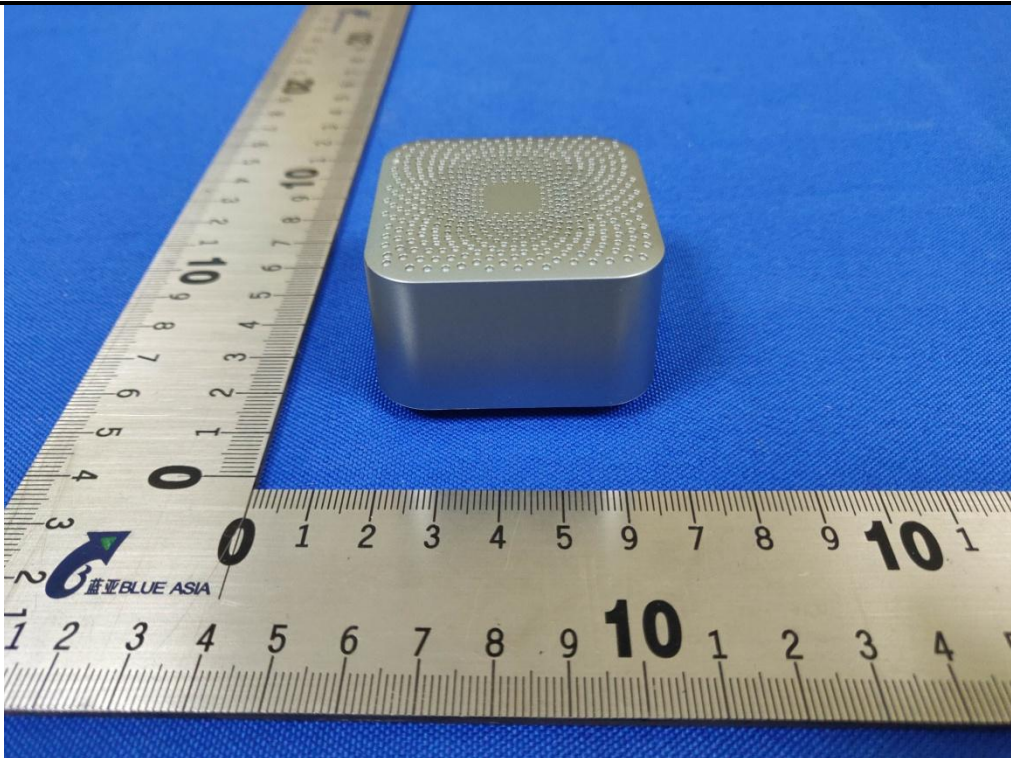


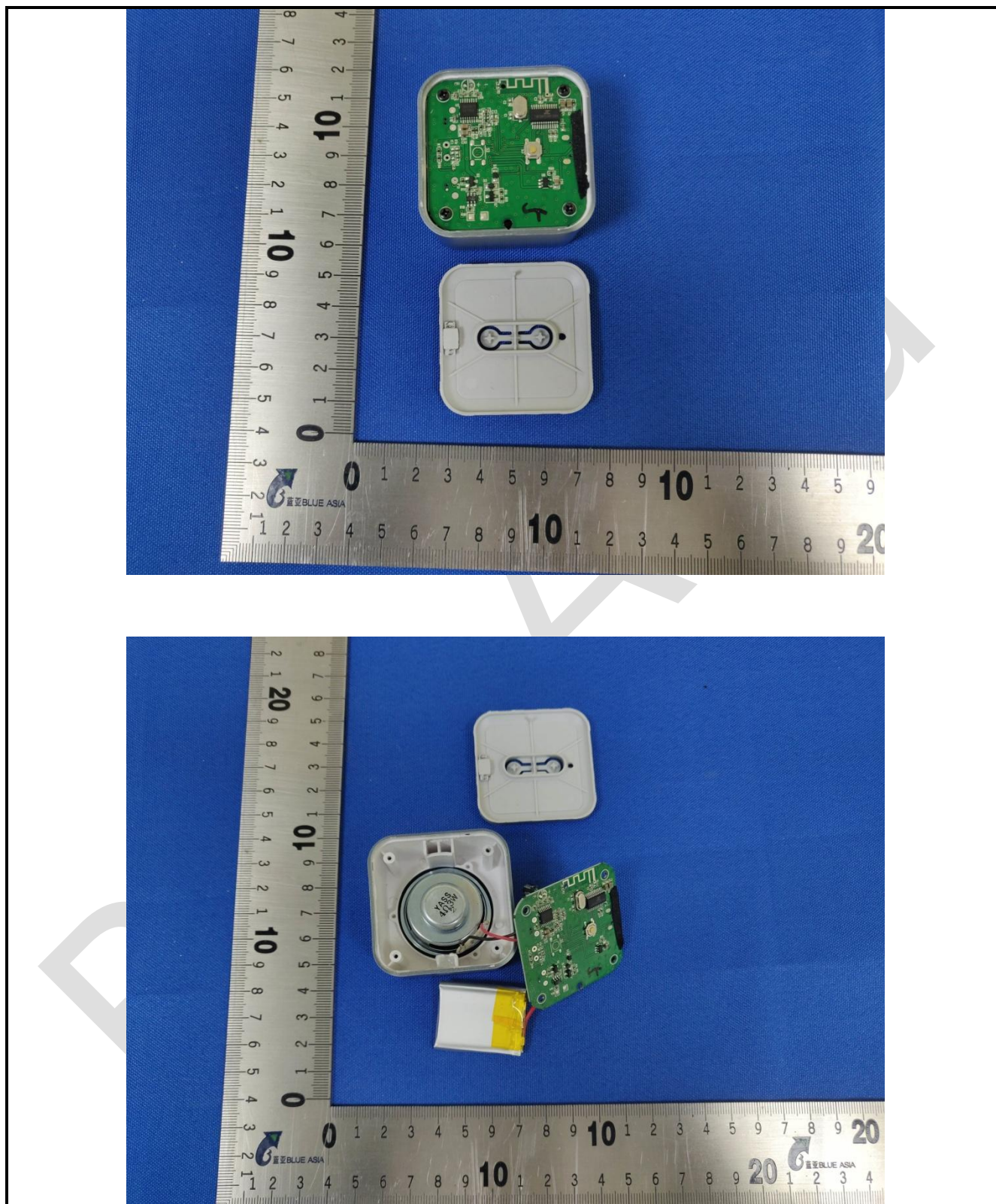


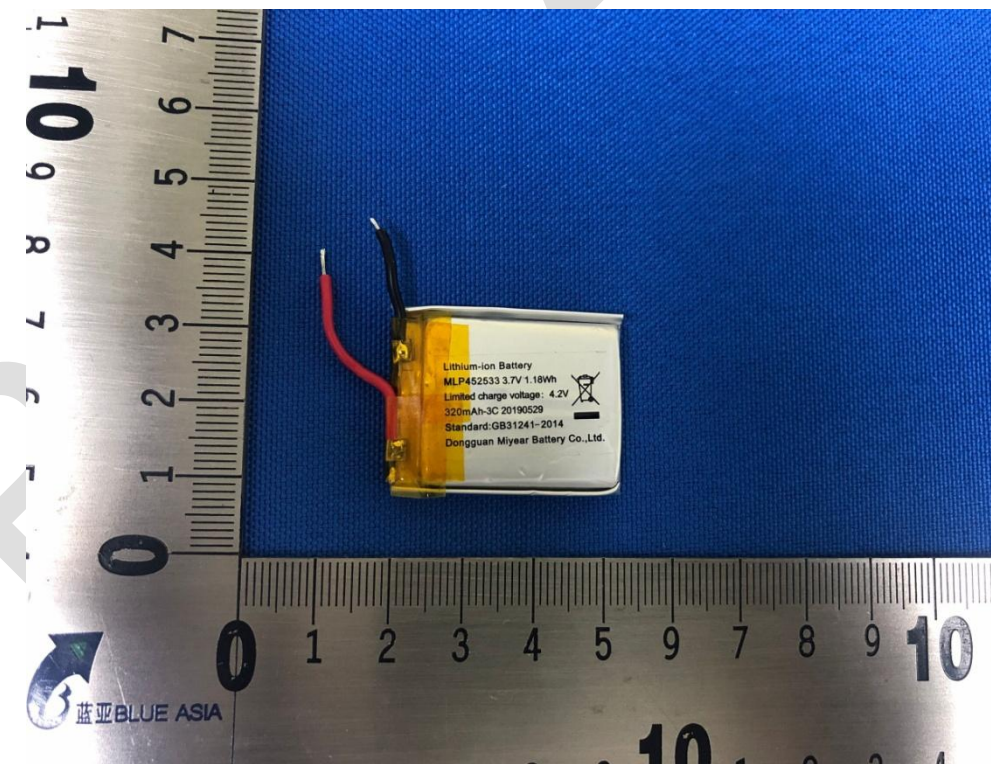
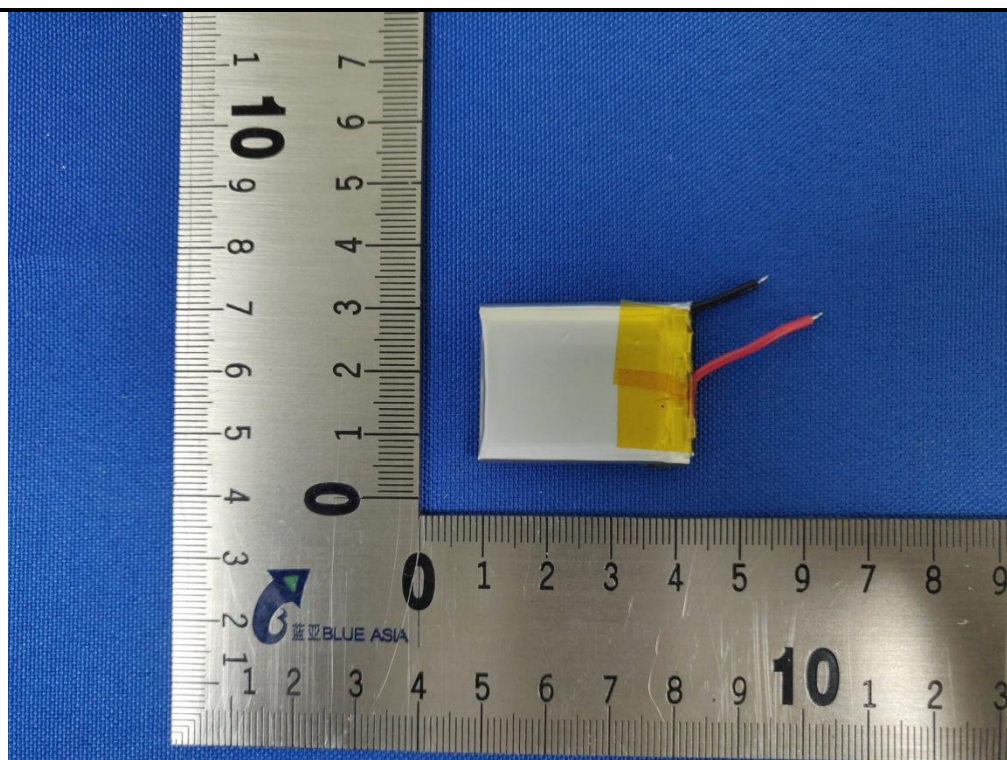


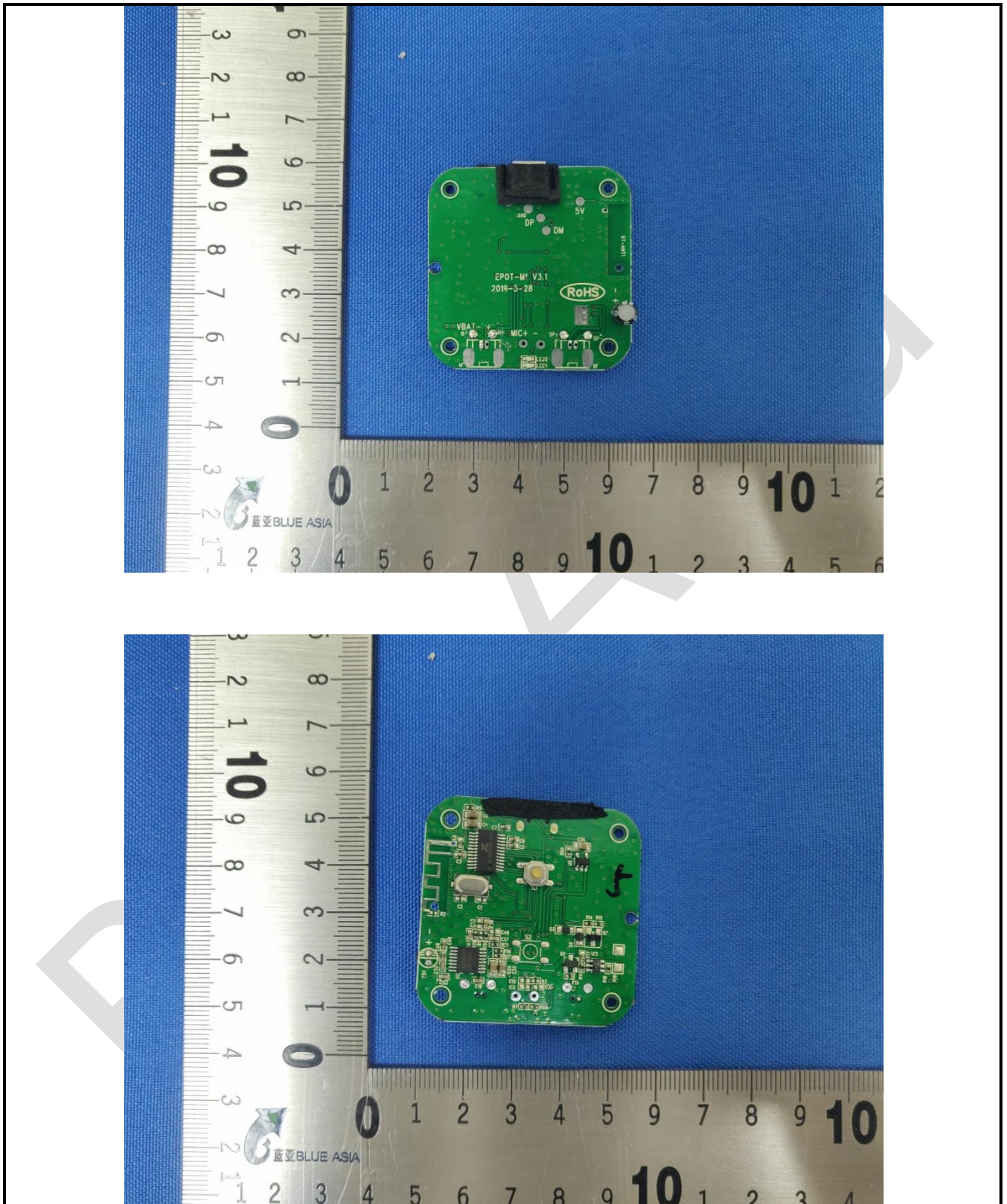


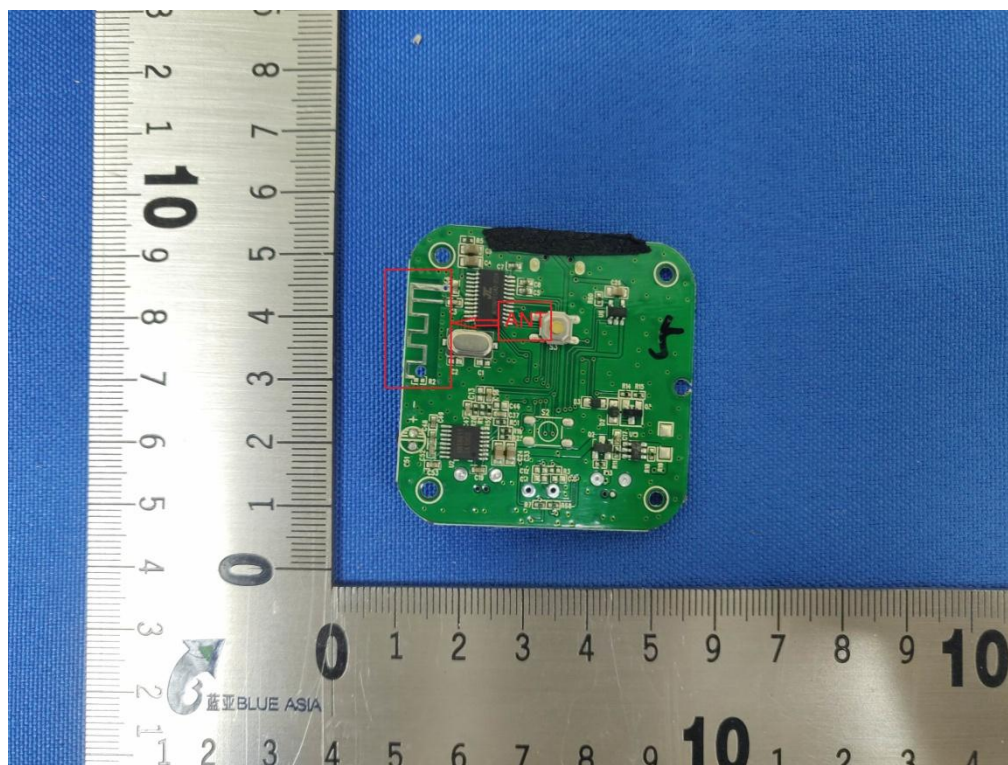












*** End of Report ***

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