



TEST REPORT

**ETSI EN 301 489-1 V2.2.3 (2019-11)/
ETSI EN 301 489-17 V3.2.4 (2020-09)/
EN55032:2015+A11:2020/ EN55035:2017+A11:2020/
EN IEC 61000-3-2:2019/ EN61000-3-3:2013+A1:2019**

Report Reference No......: **TZ231004983-RE**

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Approved by

(position+printed name+signature)...: Manager Andy Zhang

Date of issue.....: 2023/10/23



Testing Laboratory Name.....: Shenzhen Tongzhou Testing Co.,Ltd

Address.....: 1th Floor, Building 1, Haomai High-tech Park, Huating Road 387,
Dalang Street, Longhua, Shenzhen, China

Applicant's name.....: **Mid Ocean Brands B.V.**

Address.....: Wellensiekstraat 2, 6718 XZ Ede The Netherlands

Test specification:

Standard: **ETSI EN 301 489-1 V2.2.3 (2019-11)/
ETSI EN 301 489-17 V3.2.4 (2020-09)/
EN55032:2015+A11:2020/ EN55035:2017+A11:2020/
EN IEC 61000-3-2:2019/ EN61000-3-3:2013+A1:2019**

TRF Originator.....: Shenzhen Tongzhou Testing Co.,Ltd

Master TRF.....: Dated 2020-10

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Test item description: TWS earbuds

Trade Mark: N/A

Model/Type reference.....: MO2176

Listed Models: N/A

Hardware Version.....: TW26-0107A

Software Version: V1.0

Rating: DC 3.7V by battery

USB Input: DC5V

Result.....: **Pass**

**TEST REPORT**

Test Report No. :	TZ231004983-RE	2023/10/23 Date of issue
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Equipment under Test : TWS earbuds

Model /Type : MO2176

Listed Models : N/A

Applicant : Mid Ocean Brands B.V.

Address : Wellensiekstraat 2, 6718 XZ Ede The Netherlands

Manufacturer :

Address :

Test Result according to the standards on page 5:	Pass
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.



**** Modified History ****

Revision	Description	Issued Data	Remark
Revision 1.0	Initial Test Report Release	2023/10/23	Andy Zhang



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1. TEST STANDARDS

The tests were performed according to following standards:

[ETSI EN 301 489-1 V2.2.3 \(2019-11\)](#)

ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;
Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility

[ETSI EN 301 489-17 V3.2.4 \(2020-09\)](#)

ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;
Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard for ElectroMagnetic Compatibility

[EN55032:2015+A11:2020](#) Electromagnetic compatibility of multimedia equipment - Emission Requirements

[EN55035:2017+A11:2020](#) Electromagnetic compatibility of multimedia equipment - Immunity requirements

[EN IEC 61000-3-2:2019](#) Electromagnetic compatibility (EMC) -- Part 3-2: Limits - Limits for harmonic current emissions (equipment input current up to and including 16 A per phase)

[EN61000-3-3:2013+A1:2019](#) Electromagnetic compatibility (EMC) -- Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection



2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	2023/6/7
Testing commenced on	:	2023/6/7
Testing concluded on	:	2023/6/12

2.2. Product Description

Name of EUT	TWS earbuds
Model(s) Number	MO2176
List Models	N/A
Difference description	N/A
Hardware version	TW26-0107A
Software version	V1.0
Antenna Type	Integral

Wireless Type	Working Frequency	Modulation Type	Version
Bluetooth	2402MHz-2480MHz	GFSK, π /4DQPSK	V5.3



2.3. Equipment under Test

Power supply system utilised

Power supply voltage	:	<input type="radio"/>	120V / 60 Hz	<input type="radio"/>	115V / 60Hz
		<input type="radio"/>	12 V DC	<input type="radio"/>	24 V DC
		<input checked="" type="radio"/>	Other (specified in blank below)		

DC 3.7V by battery

2.4. Short description of the Equipment under Test (EUT)

For details, refer to the user's manual of EUT.

Serial number: Prototype



2.5. EUT operation mode

The equipment under test was operated during the measurement under the following conditions:

Test Item	
EMI	
Mode 1	Charging Mode
Mode 2	Bluetooth Link(TX)
EMS	
Mode 1	Charging Mode
Mode 2	Bluetooth Link(TX)

Note:Pre-scan above all test mode, found Mode 1 which was worse case mode. Test results reported represents the worst case simultaneous transmission condition.



2.6. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - Supplied by the lab

● AC Adapter	MODEL:	GKYPG0200050EU2
	INPUT:	AC 100-240V~50/60Hz 0.5A
	OUTPUT:	DC 5V,2A

2.7. Performance level

For ETSI EN 301 489-1 V2.2.3 (2019-11)

Refer to clause 6 Performance criteria as following:

6.0 Introduction

The performance criteria are used to take a decision on whether a radio equipment passes or fails immunity tests.

For the purpose of the present document two categories of performance criteria apply:

- Performance criteria for continuous phenomena.
- Performance criteria for transient phenomena.

NOTE: Normally, the performance criteria depends upon the type of radio equipment and/or its intended application. Thus, the present document only contains general performance criteria commonly used for the assessment of radio equipment.

6.1 Performance criteria for continuous phenomena applied to transmitters and receivers

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.

6.2 Performance criteria for transient phenomena applied to transmitters and receivers

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.

**For ETSI EN 301 489-17 V3.2.4 (2020-09)****Refer to clause 6 Performance criteria as following:****6.1 General performance criteria**

The performance criteria are:

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria C for immunity tests with power interruptions exceeding a certain time.

The equipment shall meet the minimum performance criteria as specified in the following clauses.

6.2 Performance table**Table 2: Performance criteria**

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

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

6.2.2 Minimum performance level

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

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

6.3 Performance criteria for Continuous phenomena

The performance criteria A shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur during the test.

Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur during the test.

6.4 Performance criteria for Transient phenomena

The performance criteria B shall apply, except for voltage dips greater than or equal to 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur as a result of the application of the test.

Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur as a result of the application of the test.



2.8. Modifications

No modifications were implemented to meet testing criteria.

2.9. NOTE

Function	Test Standards	Reference Report
EMF	EN 62479:2010 EN 50663:2017	TZ231004983-EMF
Bluetooth BDR+EDR	ETSI EN 300 328 V2.2.2 (2019-07)	TZ231004983-EDR
EMC	ETSI EN 301 489-1 V2.2.3 (2019-11) ETSI EN 301 489-17 V3.2.4 (2020-09) EN55032:2015+A11:2020 EN55035:2017+A11:2020 EN IEC 61000-3-2:2019 EN61000-3-3:2013+A1:2019	TZ231004983-RE



3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Tongzhou Testing Co.,Ltd
1th Floor, Building 1, Haomai High-tech Park, Huating Road 387, Dalang Street, Longhua, Shenzhen,
China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2014) and CISPR Publication 22.

3.2. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 950-1050mbar

3.3. Configuration of Tested System

Fig. 2-1 Configuration of Tested System

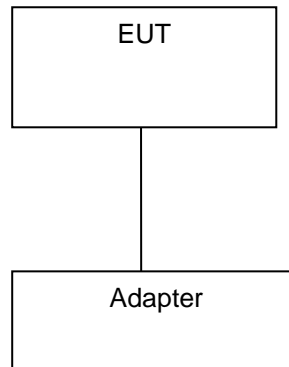


Table 2-1 Equipment Used in Tested System

No.	Product	Manufacturer	Model No.	FCC ID



3.4. Test Description

ETSI EN 301 489-1/-17 requirements		
Radiated Emission	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.1 EN55032:2015+A11:2020 Annex A.2	PASS
Conducted Emission(AC Mains)	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.1 EN55032:2015+A11:2020 Annex A.3	PASS
Conducted Emission(Telecommunication Ports)	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.1 EN55032:2015+A11:2020 Annex A.3	N/A
Harmonic Current Emissions	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.1 EN IEC 61000-3-2:2019	N/A
Voltage Fluctuations and Flicker	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.1 EN61000-3-3:2013+A1:2019	PASS
Electrostatic Discharge	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.2	PASS
RF Electromagnetic Field	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.2	PASS
Fast Transients Common Mode	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.2	PASS
RF Common Mode 0,15 MHz to 80 MHz	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.2	PASS
Transients and Surges	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.2	N/A
Voltage Dips and Interruptions	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.2	PASS
Surges, Line to Line and Line to Ground	ETSI EN 301 489-1 V2.2.3 (2019-11) Clause 7.2	PASS

Remark: The measurement uncertainty is not included in the test result.

3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Tongzhou Testing Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Tongzhou Testing Co.,Ltd is reported:

Test Item	Frequency Range	Uncertainty	Note
Radiation Uncertainty	9KHz~30MHz	±3.08dB	(1)
	30MHz~1000MHz	±3.92dB	(1)
	1GHz~40GHz	±4.28dB	(1)
Conduction Uncertainty	150kHz~30MHz	±2.71dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



3.6. Equipments Used during the Test

Conducted emission						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due
1	EMI Test Receiver	ROHDE & SCHWARZ	ESCI-7	100849/003	2022/12/28	2023/12/27
2	Artificial Mains	ROHDE & SCHWARZ	ENV 216	101333-IP	2022/12/28	2023/12/27
3	EMI Test Software	ROHDE & SCHWARZ	ESK1	V1.71	N/A	N/A
4	Wideband Radio Communication Tester	R&S	CMW500	101855	2022/12/28	2023/12/27

Radiated emission						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due
1	Test Receiver	R&S	ESCI-7	100849/003	2022/12/28	2023/12/27
2	wideband Antenna	Schwarzbeck	VULB 9163	958	2022/11/13	2025/11/12
3	Horn Antenna	Schwarzbeck	BBHA 9120D	01989	2022/11/13	2025/11/12
4	Amplifier	Schwarzbeck	BBV 9743	209	2022/12/28	2023/12/27
5	Amplifier	Tonscend	TSAMP-0518SE	--	2022/12/28	2023/12/27
6	Postional Controller	MF	MF7802	--	--	--
7	RE test software	Tonscend	JS32-RE	V2.0.2.0	--	--
8	Wideband Radio Communication Tester	R&S	CMW500	101855	2022/12/28	2023/12/27
9	Band Reject Filter Box	Tonscend	JS0806-F	TZRFA009	2022/12/28	2023/12/27

Voltage Fluctuation and Flicker						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due
1	Harmonic & Flicker Tester	SCHAFFNER	CCN1000-1	72046	2022/6/15	2023/6/14
2	Power Source	SCHAFFNER	NSG1007-3-240	HK54238	2022/6/15	2023/6/14
3	software	AMETEK	CTS 4	V 4.6.2		
4	Wideband Radio Communication Tester	R&S	CMW500	101855	2022/12/28	2023/12/27

Electrostatic Discharge						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due
1	ESD Simulator	TESEQ	NSG 437	976	2022/12/29	2023/12/28
2	Wideband Radio Communication Tester	R&S	CMW500	101855	2022/12/28	2023/12/27



RF Electromagnetic Field						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due
1	Horn Antenna	COMMW	ZAB-1-18G-50	20171109	2022/7/4	2023/7/3
2	Bilog Antenna	Sunol Sciences	JB3	N/A	2022/7/3	2025/7/2
3	Power Amplifier	Micotop	MPA-80-1000-250	MPA1808208	2022/6/18	2023/6/17
4	Power Amplifier	Micotop	MPA-1000-6000-100	MPA1808210	2022/6/18	2023/6/17
5	Signal Switch	Micotop	MSW-80-6000-PA	MPA1808211	2022/6/18	2023/6/17
6	Signal generator	Agilent	N5181A	MY49060403	2022/6/18	2023/6/17
7	Power Meter	Agilent	E4419B	US392155053	2022/6/18	2023/6/17
8	Power Sensor	Agilent	E9301H	MY41495659	2022/6/18	2023/6/17
9	RS test software	Farad	EMC-RS	V:2.0.1.3	--	--
10	Wideband Radio Communication Tester	R&S	CMW500	101855	2022/12/28	2023/12/27
11	Audio Analyzer	R&S	UPP200	120175	2022/12/28	2023/12/27

Fast transients common mode						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due
1	Ultra Compact Simulator	HTEC	HCOMPACT 7	162904	2022/12/28	2023/12/27
2	Coupling Clamp	H3C	HTEC	162908	2023/1/12	2024/1/11
3	Wideband Radio Communication Tester	R&S	CMW500	101855	2022/12/28	2023/12/27

Surges, line to line and line to ground						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due
1	Ultra Compact Simulator	HTEC	HCOMPACT 7	162904	2022/12/28	2023/12/27
2	Wideband Radio Communication Tester	R&S	CMW500	101855	2022/12/28	2023/12/27

PFMF						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due
1	PFMF test system	HTEC	HPFMF 100	TZE067	2022/10/30	2023/10/29
2	Wideband Radio Communication Tester	R&S	CMW500	101855	2022/12/28	2023/12/27



RF common mode 0,15 MHz to 80 MHz						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due
1	COUPLING AND DECOUPLING NETWORK	Luthi	CDN801-M3	202304/060	2022/6/18	2023/6/17
2	COUPLING AND DECOUPLING NETWORK	TESEQ	CDN T8	37213	2022/6/18	2023/6/17
3	Signal generator	R&S	SML01	102286	2022/6/18	2023/6/17
4	Power Amplifier	AR	50A220	0010230A	2022/6/18	2023/6/17
5	Attenuator	Luthi	50W3G	335625	2022/6/18	2023/6/17
6	CS Test software	Farad	CS-35	V:2.0.1.3	--	--
7	Integrating Sound Level	TES	TES-1353S	170502155	2022/6/18	2023/6/17
8	Audio Analyzer	R&S	UPP200	120175	2023/1/2	2024/1/1

Voltage Dips and Interruptions						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due
1	Ultra Compact Simulator	HTEC	HCOMPACT 7	162904	2022/12/28	2023/12/27
2	Voltage Dips and interruption Simulator	HTEC	HV1P16T	162907	2022/12/28	2023/12/27
3	Wideband Radio Communication Tester	R&S	CMW500	101855	2022/12/28	2023/12/27

4. TEST CONDITIONS AND RESULTS

4.1. REQUIREMENTS

4.1.1. Radiated Emission

LIMIT

Please refer to ETSI EN 301 489-1 Clause 8.2.3

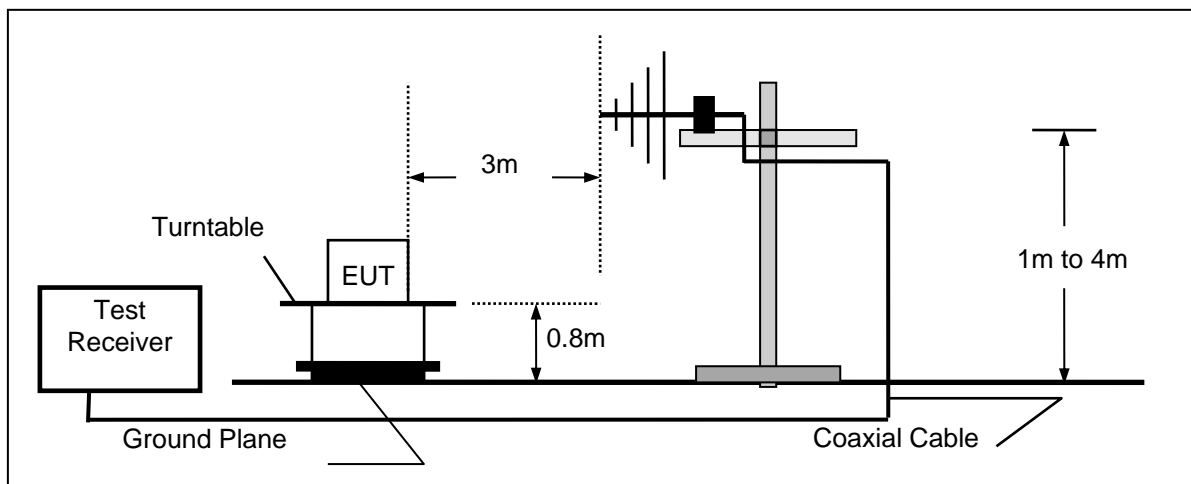
The ancillary equipment shall meet the class B limits given in CENELEC EN 55032 [1], annex A tables A.4 and A.5.

Alternatively, for ancillary equipment intended to be used exclusively in an industrial environment or telecommunication centres, the class A limits given in CENELEC EN 55032 [1], annex A tables A.2 and A.3 may be used.

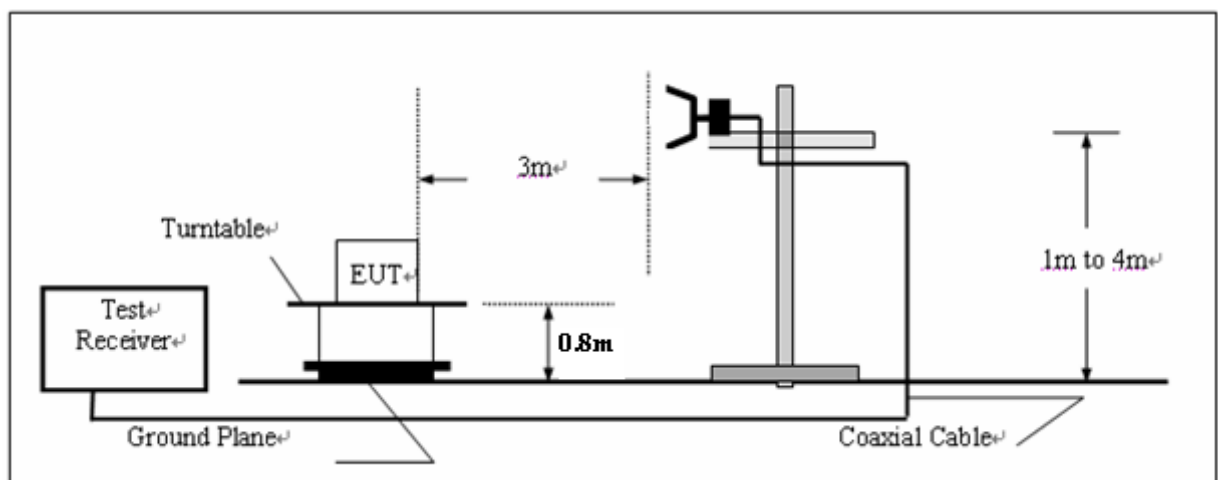
If EUT is also a FM Receiver, it shall meet CENELEC EN 55032 [3], annex A tables A.6

TEST CONFIGURATION

(a) Radiated Emission Test Set-Up, Frequency below 1000MHz



(b) Radiated Emission Test Set-Up, Frequency above 1000MHz



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 8.2.2 and The test method shall be in accordance with CENELEC



EN 55032 [1], annex A.2. for the measurement methods.

Climatic conditions

- ambient temperature : 25 °C
- relative humidity: 55%
- atmospheric pressure: 960 mbar

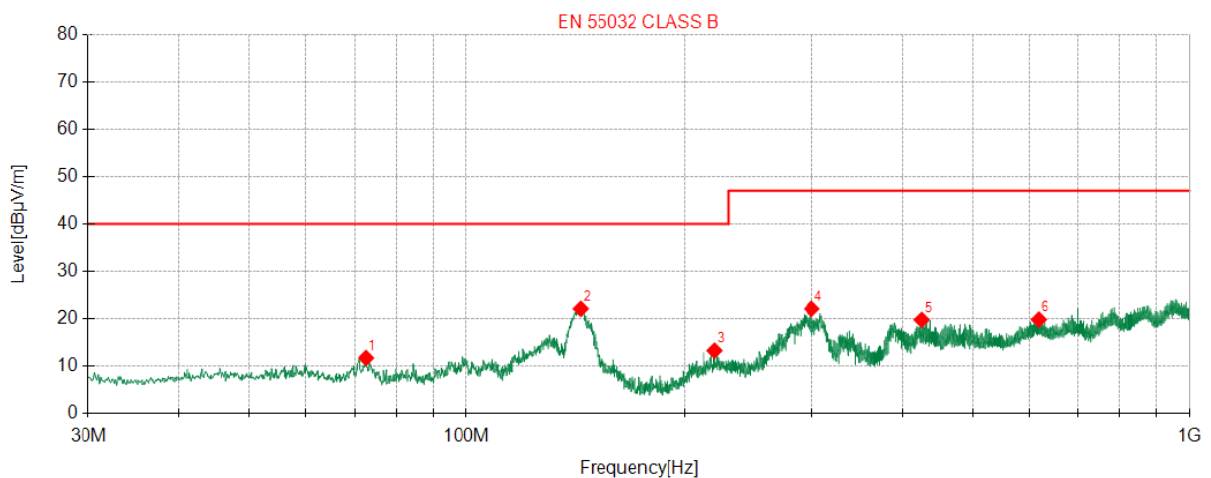
TEST RESULTS

Pass

Note 1: All Modes has been tested only list the worst case(Mode 1) in this report.

Note 2: While performing the testing, the Band Reject Filter Box is used to filter the fundamental emission for avoiding test instrument overload.

Below 1000MHz



◆ QP Detector

Suspected Data List

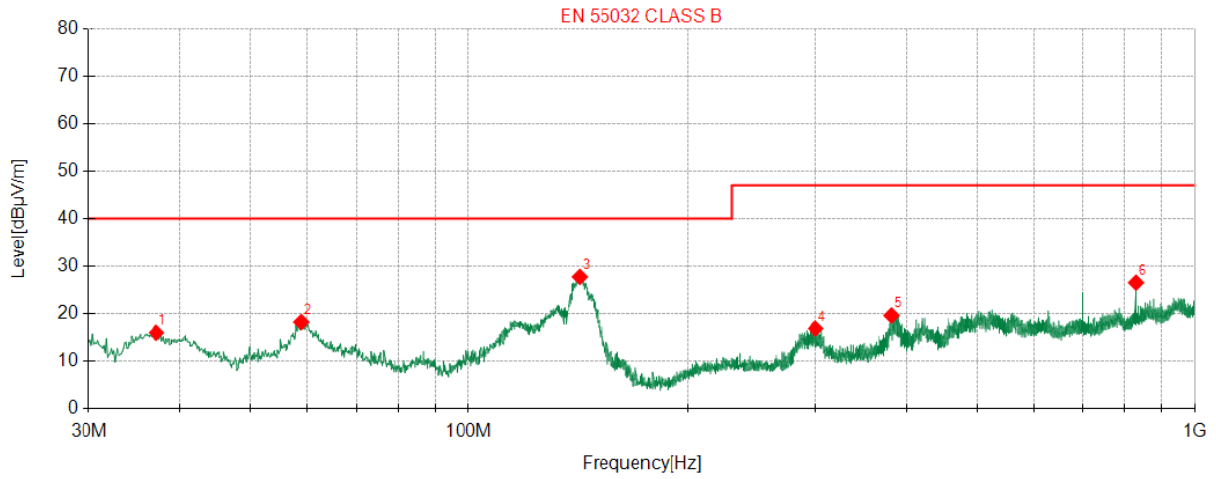
NO.	Freq. [MHz]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	72.68	-18.71	11.76	40.00	28.24	300	338	Horizontal
2	143.85	-19.35	22.14	40.00	17.86	300	317	Horizontal
3	220.24	-14.80	13.31	40.00	26.69	100	359	Horizontal
4	299.90	-12.81	22.13	47.00	24.87	100	246	Horizontal
5	425.88	-9.53	19.80	47.00	27.20	100	251	Horizontal
6	617.45	-5.37	19.86	47.00	27.14	300	153	Horizontal

Note:

1. Level [dBµV/m] = Reading [dBµV] + Factor [dB/m]

2. Margin [dB] = Limit [dBµV/m] - Level [dBµV/m]

3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.



◆ QP Detector

Suspected Data List								
NO.	Freq. [MHz]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	37.153	-15.00	16.02	40.00	23.98	100	250	Vertical
2	58.857	-14.91	18.27	40.00	21.73	100	105	Vertical
3	142.27	-18.15	27.77	40.00	12.23	100	213	Vertical
4	300.02	-12.11	16.91	47.00	30.09	200	294	Vertical
5	381.98	-10.60	19.65	47.00	27.35	100	182	Vertical
6	828.79	-2.76	26.56	47.00	20.44	200	26	Vertical

Note:

1. Level [dBµV/m] = Reading [dBµV] + Factor [dB/m]
2. Margin [dB] = Limit [dBµV/m] - Level [dBµV/m]
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

Above 1000MHz

Frequency (MHz)	MaxPeak (dBuV/m)	Average (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Pol	Azimuth (deg)
1481.07	42.86	---	70	27.14	100	1000	100	V	268
1073.10	41.02	---	70	28.98	100	1000	100	V	279
2452.39	47.13	---	70	22.87	100	1000	100	H	154
2674.12	46.33	---	70	23.67	100	1000	100	H	272
2760.36	47.12	---	70	22.88	100	1000	100	V	198
2971.61	49.56	---	70	20.44	100	1000	100	H	329

4.1.2. Conducted Emission (AC Mains)

LIMIT

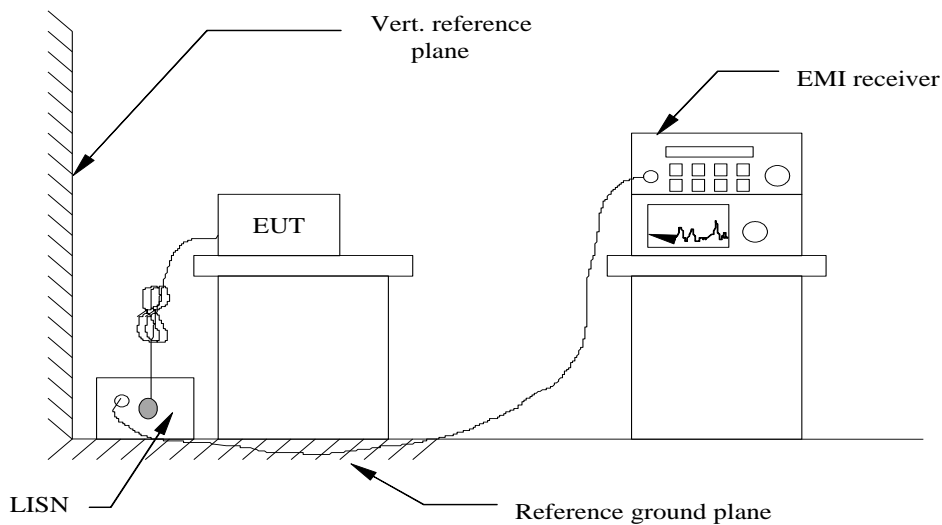
Please refer to ETSI EN 301 489-1 Clause 8.4.3

The equipment shall meet the class B limits given in CENELEC EN 55032 [1], annex A table A.10.

Alternatively, for equipment intended to be used in an industrial environment or a telecommunication centre, the class A limits given in CENELEC EN 55032 [1], annex A table A.9 can be used.

If EUT is also a FM Receiver, it shall meet CENELEC EN 55032 [3], annex A tables A.13

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 8.4.2 for the measurement methods.

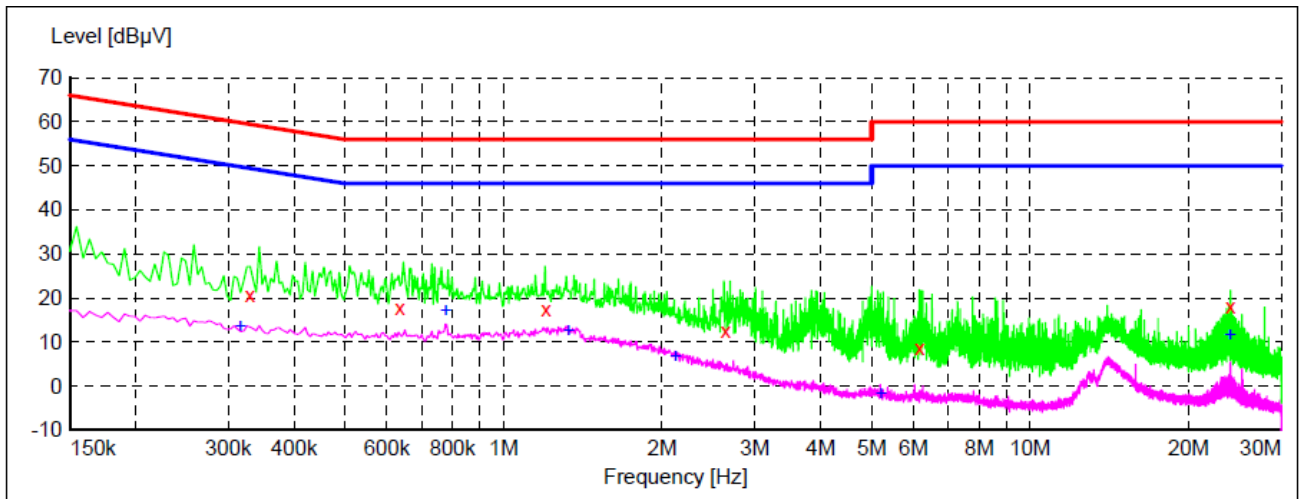
Climatic conditions

- ambient temperature : 25 °C
- relative humidity: 55%
- atmospheric pressure: 960 mbar

TEST RESULTS

Pass

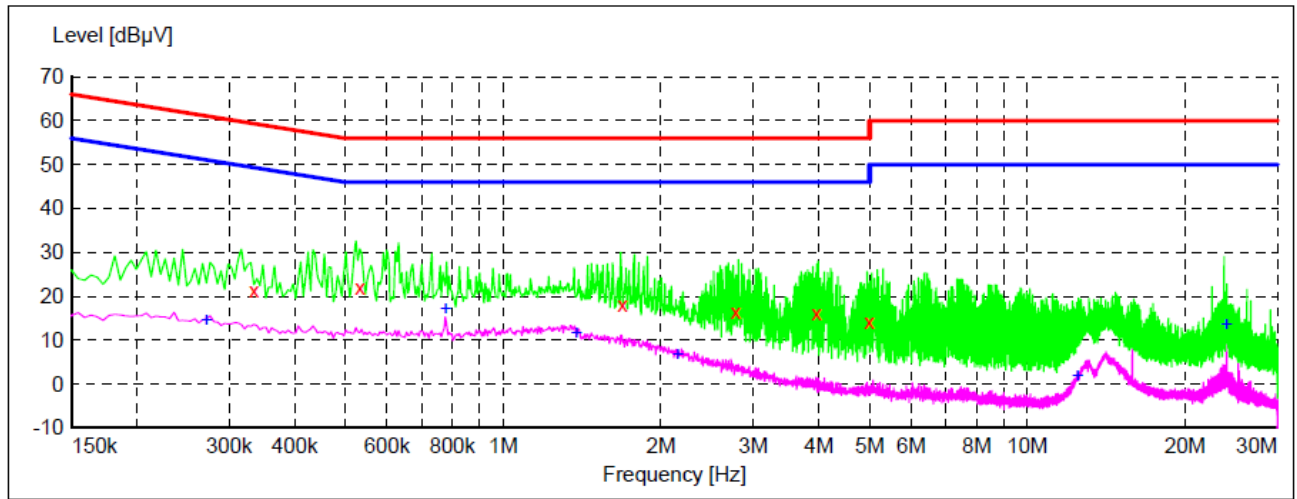
Note: All Modes has been tested only list the worst case(Mode 1) in this report.



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.330000	20.60	10.1	60	38.9	QP	N	GND
0.636000	17.90	9.9	56	38.1	QP	N	GND
1.203000	17.50	9.8	56	38.5	QP	N	GND
2.643000	12.40	9.7	56	43.6	QP	N	GND
6.162000	8.80	9.8	60	51.2	QP	N	GND
24.031500	18.20	10.1	60	41.8	QP	N	GND
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.316500	13.60	10.2	50	36.2	AV	N	GND
0.775500	17.10	9.8	46	28.9	AV	N	GND
1.329000	12.50	9.8	46	33.5	AV	N	GND
2.121000	6.80	9.7	46	39.2	AV	N	GND
5.208000	-1.70	9.8	50	51.7	AV	N	GND
24.027000	11.50	10.1	50	38.5	AV	N	GND

Note:

1. $\text{Margin(dB)} = \text{Limit(dB}\mu\text{V)} - \text{Level(dB}\mu\text{V)}$
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz), Step size: 4 kHz, Scan time: auto.



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.334500	21.20	10.1	59	38.1	QP	L1	GND
0.532500	22.10	9.9	56	33.9	QP	L1	GND
1.689000	18.00	9.7	56	38.0	QP	L1	GND
2.773500	16.50	9.7	56	39.5	QP	L1	GND
3.957000	16.10	9.7	56	39.9	QP	L1	GND
4.987500	14.30	9.8	56	41.7	QP	L1	GND
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.271500	14.60	10.3	51	36.5	AV	L1	GND
0.775500	17.00	9.8	46	29.0	AV	L1	GND
1.378500	11.40	9.7	46	34.6	AV	L1	GND
2.152500	6.80	9.7	46	39.2	AV	L1	GND
12.466500	1.70	9.8	50	48.3	AV	L1	GND
24.022500	13.50	10.1	50	36.5	AV	L1	GND

Note:

1. $\text{Margin(dB)} = \text{Limit(dB}\mu\text{V)} - \text{Level(dB}\mu\text{V)}$
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz), Step size: 4 kHz, Scan time: auto.

4.1.3. Conducted Emission (Telecommunication Ports)

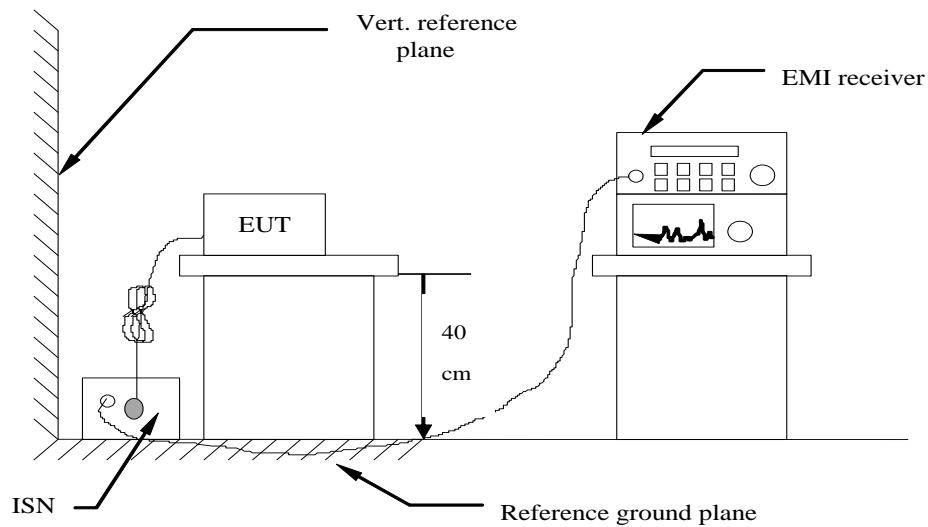
LIMIT

Please refer to ETSI EN 301 489-1 Clause 8.7.3

The wired network ports shall meet the class B limits given in CENELEC EN 55032 [1], annex A table A.12.

Alternatively, for equipment intended to be used exclusively in an industrial environment or a telecommunication centre, the class A limits given in CENELEC EN 55032 [1] annex A table A.11 can be used.

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 8.7.2 and The test method shall be in accordance with CENELEC EN 55032 [1], annex A.3. for the measurement methods.

Climatic conditions

- ambient temperature : 25 °C
- relative humidity: 55%
- atmospheric pressure: 960 mbar

TEST RESULTS

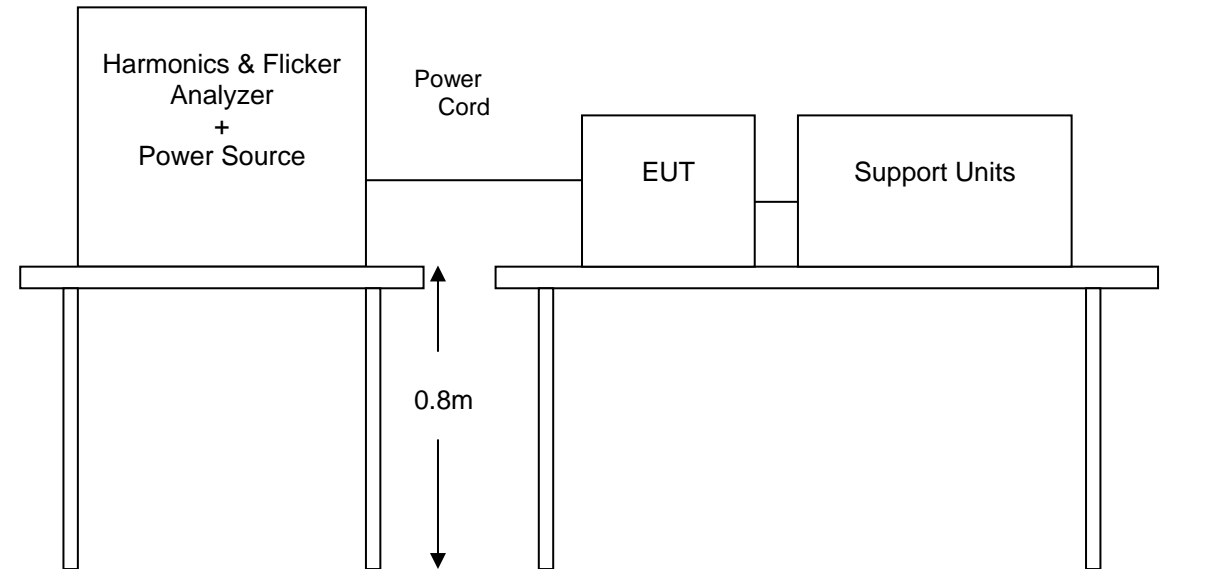
Not applicable

4.1.4. Harmonic Current Emission

LIMIT

Please refer to EN 61000-3-2

TEST CONFIGURATION



TEST PROCEDURE

Please refer to EN 61000-3-2 for the measurement methods.

Climatic conditions

- ambient temperature : 25 °C
- relative humidity: 55%
- atmospheric pressure: 960 mbar

TEST RESULTS

Not applicable (<75W)



4.1.5. Voltage Fluctuation and Flicker

LIMIT

Please refer to EN 61000-3-3

TEST CONFIGURATION

Same as the configuration of the Harmonic Current Emission.

TEST PROCEDURE

Please refer to EN 61000-3-3 for the measurement methods.

Climatic conditions

- ambient temperature : 25 °C
- relative humidity: 55%
- atmospheric pressure: 960 mbar

TEST RESULTS

Standard used:	EN/IEC 61000-3-3 Flicker
Short time (Pst):	10 min
Observation time:	120 min (12 Flicker measurements)
Customer:	Mid Ocean Brands B.V.
Mains supply voltage:	AC 230V/50Hz
E. U. T.:	TWS earbuds M/N: MO2176
Date of test:	2023/6/7
Tester:	Tony Luo

Test Result	PASS
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Maximum Flicker results

	EUT values	Limit	Result
Pst	0.028	1.00	PASS
Plt	0.028	0.65	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.127	4.00	PASS
dt [s]	0.000	0.50	PASS

Detail Flicker data

Flicker measurement 1	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.127	4.00	PASS
dt [s]	0.000	0.50	PASS



Flicker measurement 2	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.093	4.00	PASS
dt [s]	0.000	0.50	PASS

Flicker measurement 3	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.093	4.00	PASS
dt [s]	0.000	0.50	PASS

Flicker measurement 4	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.091	4.00	PASS
dt [s]	0.000	0.50	PASS

Flicker measurement 5	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.092	4.00	PASS
dt [s]	0.000	0.50	PASS

Flicker measurement 6	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.095	4.00	PASS
dt [s]	0.000	0.50	PASS

Flicker measurement 7	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.091	4.00	PASS
dt [s]	0.000	0.50	PASS



Flicker measurement 8	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.094	4.00	PASS
dt [s]	0.000	0.50	PASS

Flicker measurement 9	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.093	4.00	PASS
dt [s]	0.000	0.50	PASS

Flicker measurement 10	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.094	4.00	PASS
dt [s]	0.000	0.50	PASS

Flicker measurement 11	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.095	4.00	PASS
dt [s]	0.000	0.50	PASS

Flicker measurement 12	EUT values	Limit	Result
Pst	0.028	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.093	4.00	PASS
dt [s]	0.000	0.50	PASS

4.1.6. Electrostatic Discharge

LIMIT

Please refer to EN 61000-4-2

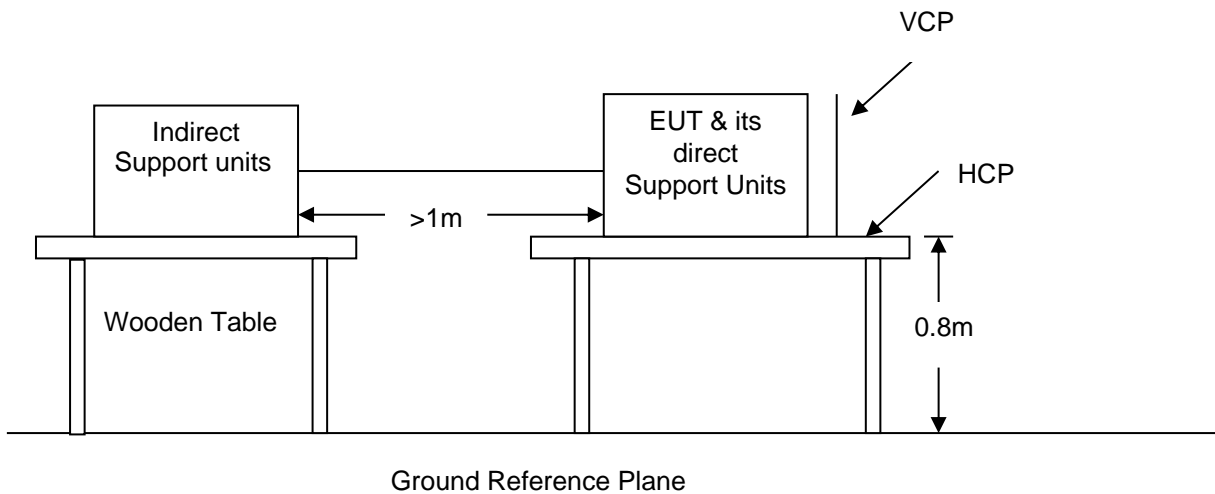
SEVERITY LEVELS OF ELECTROSTATIC DISCHARGE

Test level: Contact Discharge at $\pm 2KV, \pm 4KV$ Air Discharge at $\pm 2KV, \pm 4KV, \pm 8KV$

Level	Test Voltage Contact Discharge (KV)	Test Voltage Air Discharge (KV)
1	2	2
2	4	4
3	6	8
4	8	15
X	Special	Special

Performance criterion: **B**

Test Configuration



Test procedure

Please refer to ETSI EN 301 489-1 Clause 9.3.2 and EN 61000-4-2 for the measurement methods.

Test results

Contact Discharge:

The ESD generator is held perpendicular to the surface to which the discharge is applied and the tip of the discharge electrode touch the surface of EUT. Then turn the discharge switch. The generator is then re-triggered for a new single discharge and repeated at least 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed

Air Discharge:

Air discharge is used where contact discharge can't be applied. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated at least 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

**Indirect discharge for horizontal coupling plane:**

At least 10 single discharges shall be applied to the horizontal coupling plane, at points on each side of the EUT.

Indirect discharge for vertical coupling plane:

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

Climatic conditions

- ambient temperature : 25 °C
- relative humidity: 55%
- atmospheric pressure: 960 mbar

Description of the Electrostatic Discharges (ESD)

Point of Discharge	Applied Voltage (KV)	Total No. of Discharge (Each Point)	Results	Criteria Level	Remark
Air Test Point	±2	20	Pass	B	-
	±4	20	Pass	B	-
	±8	20	Pass	B	-
Contact Discharge Test Points	±2	20	Pass	B	
	±4	20	Pass	B	
VCP (4 sides)	±2	20	Pass	B	-
	±4	20	Pass	B	-
HCP (4 sides)	±2	20	Pass	B	-
	±4	20	Pass	B	-

The requirements are **Fulfilled**

Performance Criterion: **B**

Remarks: The ancillary equipment's specification for an acceptable level of performance or degradation of performance during and/or after the ESD tests.

Description of Discharge Point

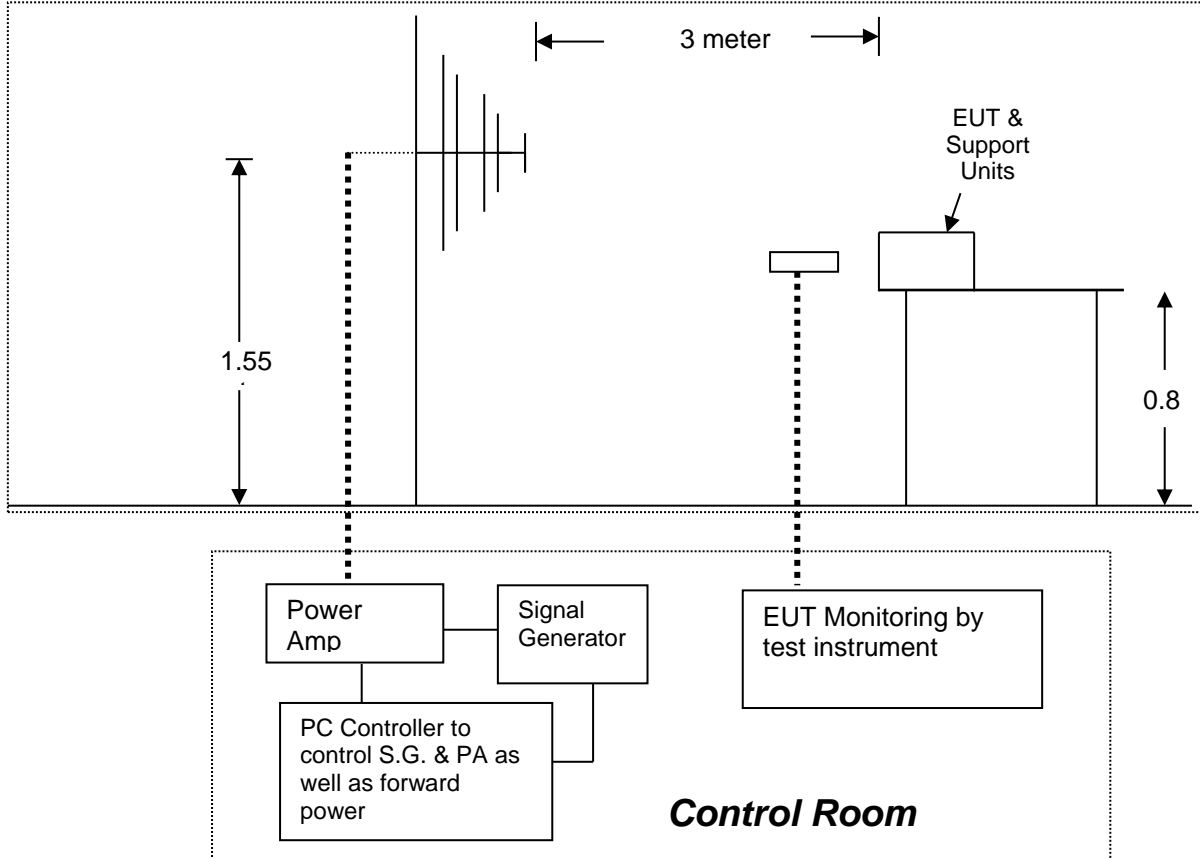
Contact Discharge		Air Discharge	
○	Metallic Screws	○	Plastic Screws
○	Metallic Case	●	Plastic Case(gap)
●	Metallic Connect ports	○	Plastic Connect Ports
○	Metallic Junctions	●	Plastic Junctions
○	Others (Antenna Port)	○	Others

4.1.7. RF Electromagnetic Field

LIMIT

Please refer to EN 61000-4-3

Test Configuration



Test Levels of RF Electromagnetic Field

Test level: RF Field Strength: 3V/m

Level	RF Field Strength(V/m)
1	1
2	3
3	10
X	Special

Performance criterion: **A**

TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.2.2 and EN 61000-4-3 for the measurement methods.

**Climatic conditions**

- ambient temperature : 25 °C
- relative humidity: 55%
- atmospheric pressure: 960 mbar

TEST RESULTS **Result of Final Tests (Operating Mode & Standby (Receiving) Mode)**

	Freq. Range (MHz)	Field	Modulation	Polarity	Position	Mode	Result (Pass/Fail)
1	80-1000	3V/m	Yes	H / V	Front	Normal Operating	Pass
	1000-6000	3V/m	Yes	H / V	Front		Pass
2	80-1000	3V/m	Yes	H / V	Right	Normal Operating	Pass
	1000-6000	3V/m	Yes	H / V	Right		Pass
3	80-1000	3V/m	Yes	H / V	Back	Normal Operating	Pass
	1000-6000	3V/m	Yes	H / V	Back		Pass
4	80-1000	3V/m	Yes	H / V	Left	Normal Operating	Pass
	1000-6000	3V/m	Yes	H / V	Left		Pass

 Result of Final Tests(EN 55035) **Swept Test**

Freq. Range (MHz)	Field	Modulation	Polarity	Position	Mode	Result (Pass/Fail)
80-1000	3V/m	Yes	H / V	Front	Normal Operating	PASS
80-1000	3V/m	Yes	H / V	Right	Normal Operating	PASS
80-1000	3V/m	Yes	H / V	Back	Normal Operating	PASS
80-1000	3V/m	Yes	H / V	Left	Normal Operating	PASS

 Spot Test

Freq. Range (MHz)	Field	Modulation	Polarity	Position	Mode	Result (Pass/Fail)
1800, 2600, 3500, 5000	3V/m	Yes	H / V	Front	Normal Operating	PASS
1800, 2600, 3500, 5000	3V/m	Yes	H / V	Right	Normal Operating	PASS
1800, 2600, 3500, 5000	3V/m	Yes	H / V	Back	Normal Operating	PASS
1800, 2600, 3500, 5000	3V/m	Yes	H / V	Left	Normal Operating	PASS

PERFORMANCE CRITERIA

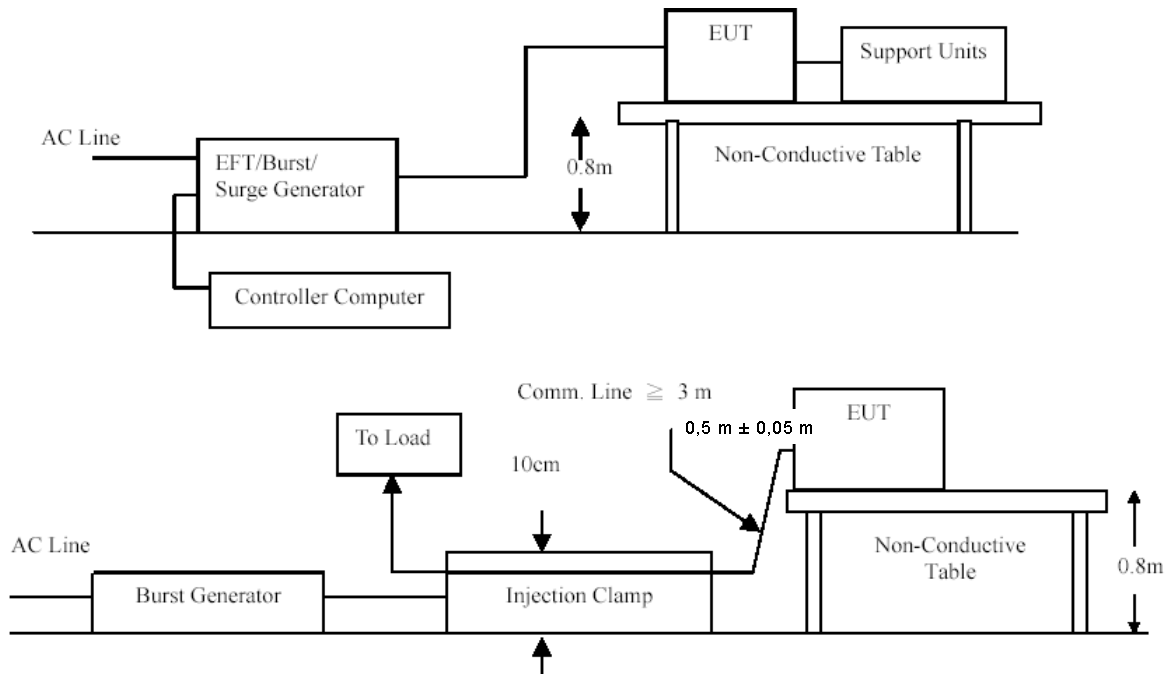
Criteria requested	<input checked="" type="checkbox"/> A / <input type="checkbox"/> B / <input type="checkbox"/> C
Criteria meet	<input checked="" type="checkbox"/> A / <input type="checkbox"/> B / <input type="checkbox"/> C

4.1.8. Fast Transients Common Mode

LIMIT

Please refer to EN 61000-4-4

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.4.2 and EN 61000-4-4 for the measurement methods.

Climatic conditions

- ambient temperature : 25 °C
- relative humidity: 55%
- atmospheric pressure: 960 mbar

TEST RESULTS

Results of Final Tests (Operating Mode)

Impulse Frequency: 5 kHz

Tr/Th: 5/50ns

Burst Duration: 15ms

Burst Period: 300ms

Test duration: 120s



Injection Line	Voltage (kV)	Injected Method	Result (Pass / Fail)
<input checked="" type="checkbox"/> Line	±1	Direct	Pass
<input checked="" type="checkbox"/> Neutral	±1	Direct	Pass
<input type="checkbox"/> PE	± 1	Direct	Pass
<input checked="" type="checkbox"/> Line + Neutral	±1	Direct	Pass
<input type="checkbox"/> L + PE	± 1	Direct	Pass
<input type="checkbox"/> N + PE	± 1	Direct	Pass
<input type="checkbox"/> L + N + PE	± 1	Direct	Pass
<input type="checkbox"/> RJ45 port (LAN cable)	±0.5	Clamp	Pass
<input type="checkbox"/> RJ11 port (Line cable)	±0.5	Clamp	Pass

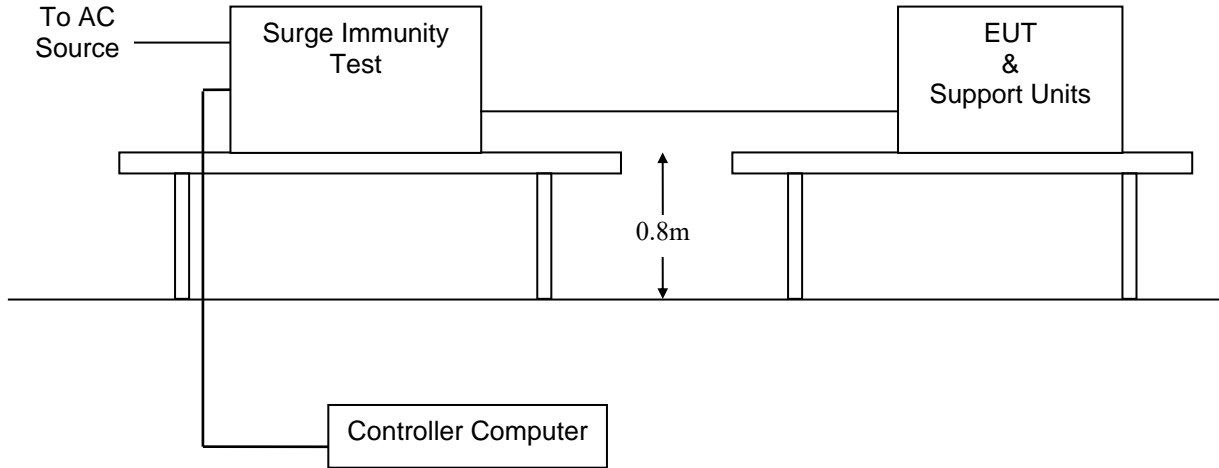
PERFORMANCE CRITERIA	
Criteria requested	<input type="checkbox"/> A / <input checked="" type="checkbox"/> B / <input type="checkbox"/> C
Criteria meet	<input type="checkbox"/> A / <input checked="" type="checkbox"/> B / <input type="checkbox"/> C

4.1.9. Surges, Line to Line and Line to Ground

LIMIT

Please refer to EN 61000-4-5

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.8.2 and EN 61000-4-5 for the measurement methods.

Climatic conditions

- ambient temperature : 25 °C
- relative humidity: 55%
- atmospheric pressure: 960 mbar

TEST RESULTS

Results of Final Tests (Operating Mode)

Voltage Waveform: 1.2/50 us

Current Waveform: 8/20 us

Polarity: Positive/Negative

Phase angle: 0°, 90°, 180°, 270°

Coupling Line	Voltage (kV)	Polarity	Coupling Method	Result (Pass/Fail)
<input checked="" type="checkbox"/> Line + Neutral	1	Pos./ Neg.	Capacitive	Pass
<input type="checkbox"/> L + PE	2	Pos./ Neg.	Capacitive	Pass
<input type="checkbox"/> N + PE	2	Pos./ Neg.	Capacitive	Pass
<input type="checkbox"/> T, R-Ground	0.5	Pos./ Neg.	Capacitive	Pass
<input type="checkbox"/> RJ45 port (LAN)	0.5	Pos./ Neg.	Capacitive	Pass
<input type="checkbox"/> RJ11 port (Line cable)	0.5	Pos./ Neg.	Capacitive	Pass

PERFORMANCE CRITERIA

Criteria requested A / B / C

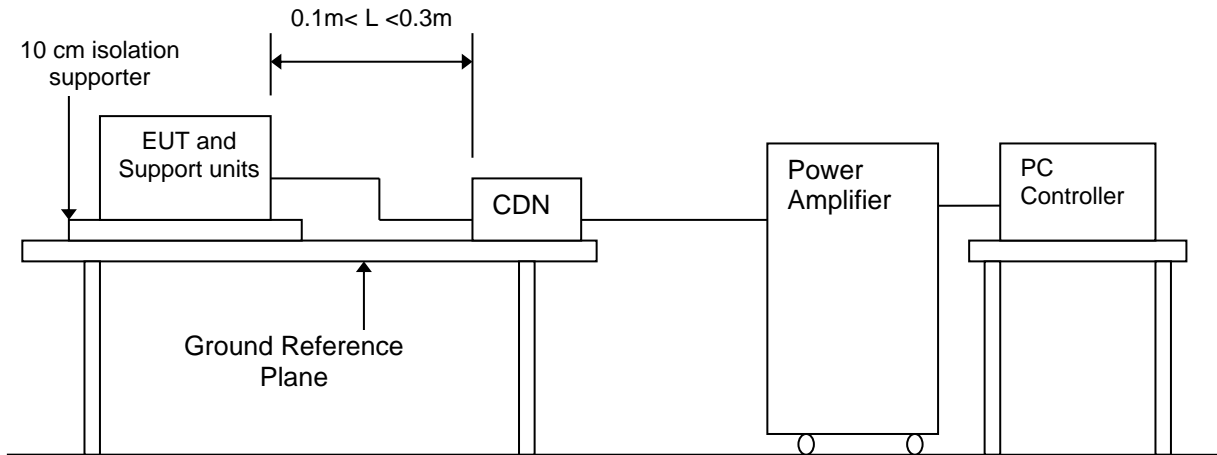
Criteria meet A / B / C

4.1.10. RF- Common Mode 0.15MHz to 80MHz

LIMIT

Please refer to EN 61000-4-6

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.5.2 and EN 61000-4-6 for the measurement methods.

Climatic conditions

- ambient temperature : 25 °C
- relative humidity: 55%
- atmospheric pressure: 960 mbar

TEST RESULTS

Test conditions

Results of Final Tests (Operating Mode)

Frequency Range: 0.15MHz~80MHz
 Frequency Step: 1% of fundamental
 Dwell time: 1 Sec.

- 80% A.M., 1 kHz Sine wave (Field Strength: 3 V/m)**
- Coupling type:** **CDN** / **RF Current Probe** / **EM CLAMP (LÜTHI)**

Range (MHz)	Field	Modulation	Injected Position	Result (Pass/Fail)
0.15-80	3V	Yes	AC Main	Pass

 **Results of Final Tests (EN 55035)**

Range (MHz)	Field	Modulation	Injected Position	Result (Pass/Fail)
0.15-10	3V	Yes	AC Main	Pass
10-30	3V – 1V	Yes	AC Main	Pass
30-80	1V	Yes	AC Main	Pass

PERFORMANCE CRITERIA

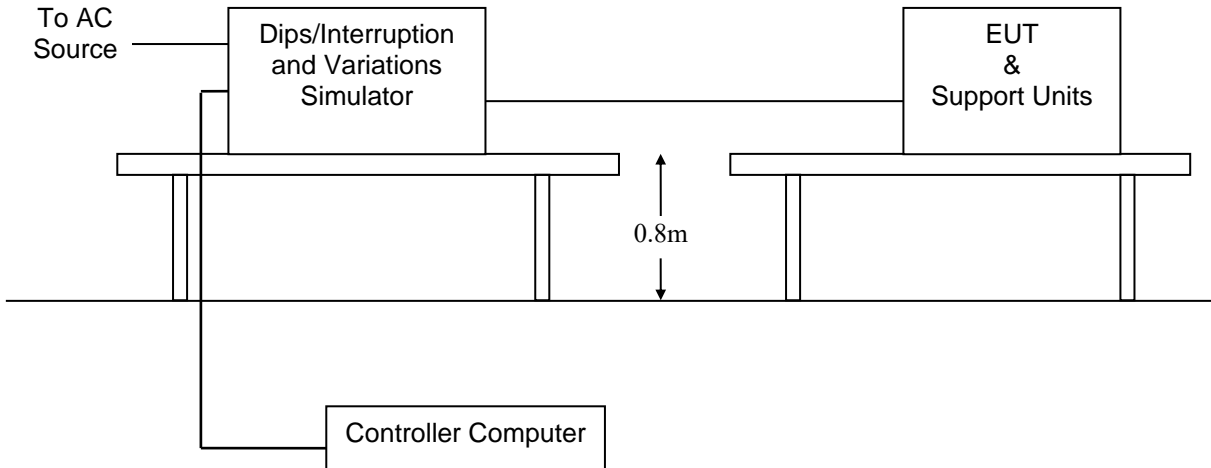
Criteria requested	<input checked="" type="checkbox"/> A / <input type="checkbox"/> B / <input type="checkbox"/> C
Criteria meet	<input checked="" type="checkbox"/> A / <input type="checkbox"/> B / <input type="checkbox"/> C

4.1.11. Voltage Dips and Interruptions

LIMIT

Please refer to EN 61000-4-11

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.7.2 and EN 61000-4-11 for the measurement methods

Climatic conditions

- ambient temperature : 25 °C
- relative humidity: 55%
- atmospheric pressure: 960 mbar

TEST RESULTS

Test conditions

Interruption at phase angles of 0, 45, 90, 135, 180, 225, 270 and 315 degree in a 10 sec-interval.

	Test Level (% UT)	Reduction (%)	Duration		Criterion
			Peiod	ms	
Voltage Dips	0	100%	0.5	10	B
	0	100%	1	20	B
	70	30%	25	500	B
Voltage Interruption	0	100%	250	5000	C

Note: The duration with a sequence of three dips/interruptions with a minimum interval of 10 s between each test event. The test level is $U_T=100V$ and $U_T=240V$.

 **Results of Final Tests (Operating Mode)****U_T=100V** *Voltage Dips*

Test Level (% UT)	Reduction (%)	Duration		Observation	Criterion
		Peiod	ms		
0	100%	0.5	10	Normal	A
0	100%	1	20	Normal	A
70	30%	25	500	Normal	B

 Interruptions

Test Level (% UT)	Reduction (%)	Duration		Observation	Criterion
		Peiod	ms		
0	100%	250	5000	Normal	C

U_T=240V *Voltage Dips*

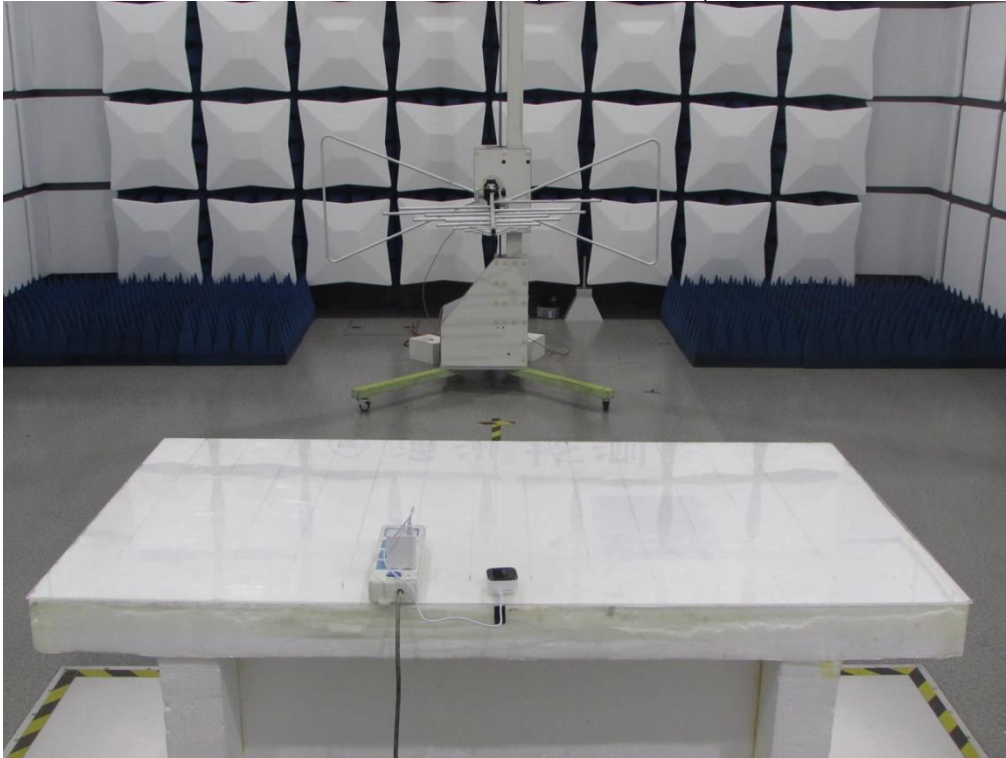
Test Level (% UT)	Reduction (%)	Duration		Observation	Criterion
		Peiod	ms		
0	100%	0.5	10	Normal	A
0	100%	1	20	Normal	A
70	30%	25	500	Normal	A

 Interruptions

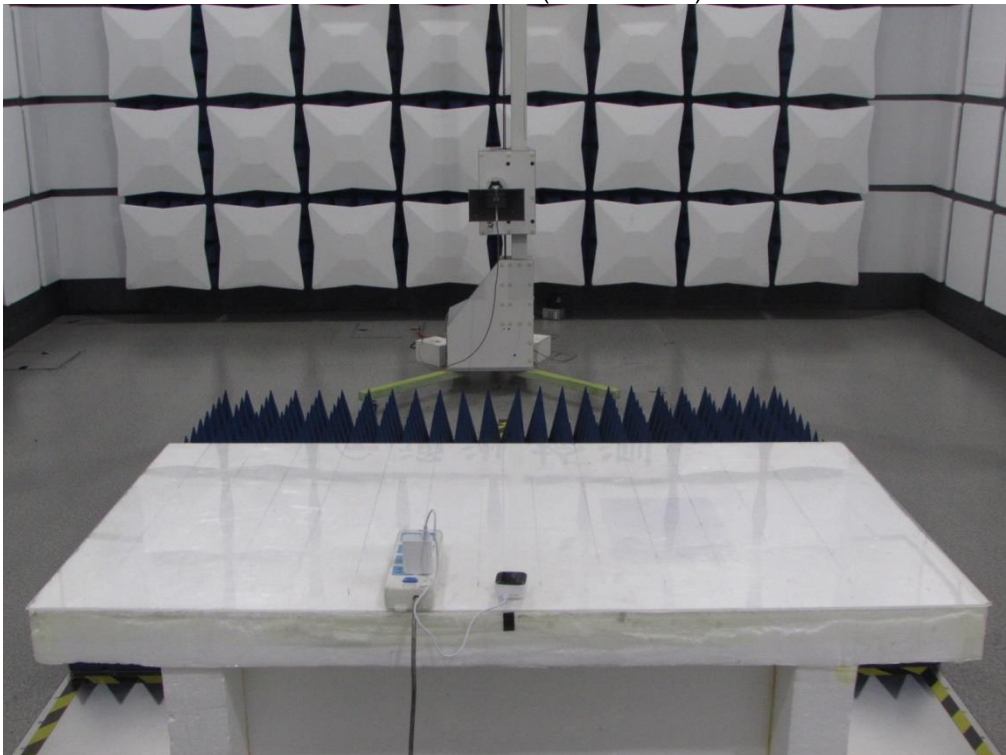
Test Level (% UT)	Reduction (%)	Duration		Observation	Criterion
		Peiod	ms		
0	100%	250	5000	Normal	C

5. Test Set-up Photos of the EUT

Radiated Emission (30MHz-1GHz)



Radiated Emission (1GHz-6GHz)

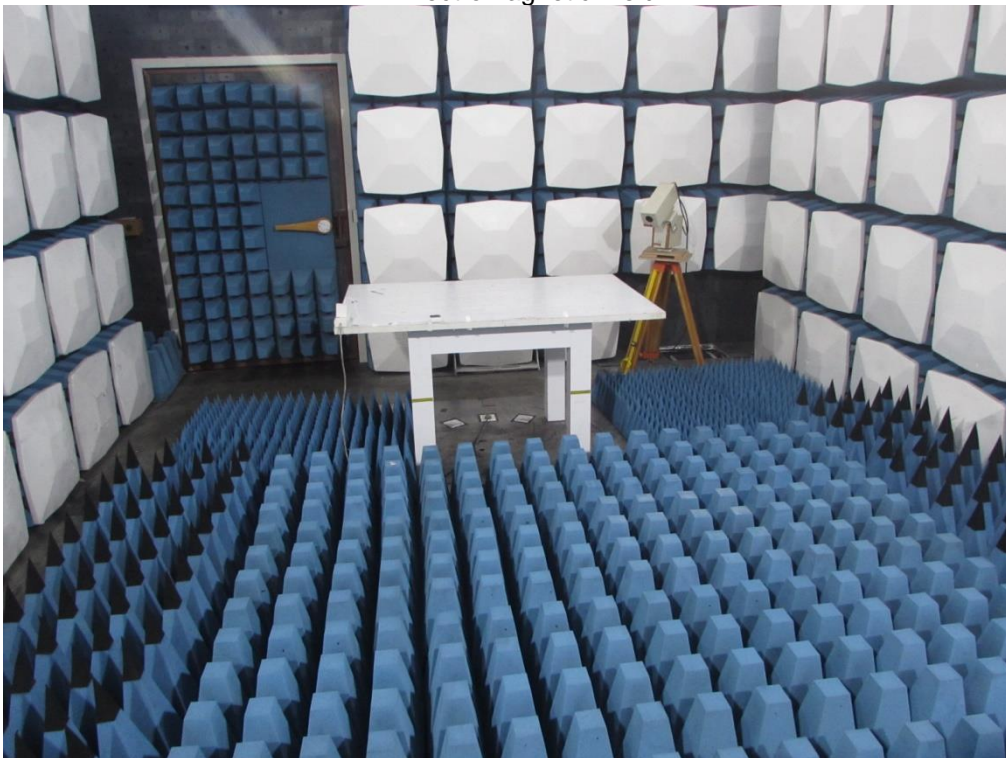




Conducted Emission (AC Mains)



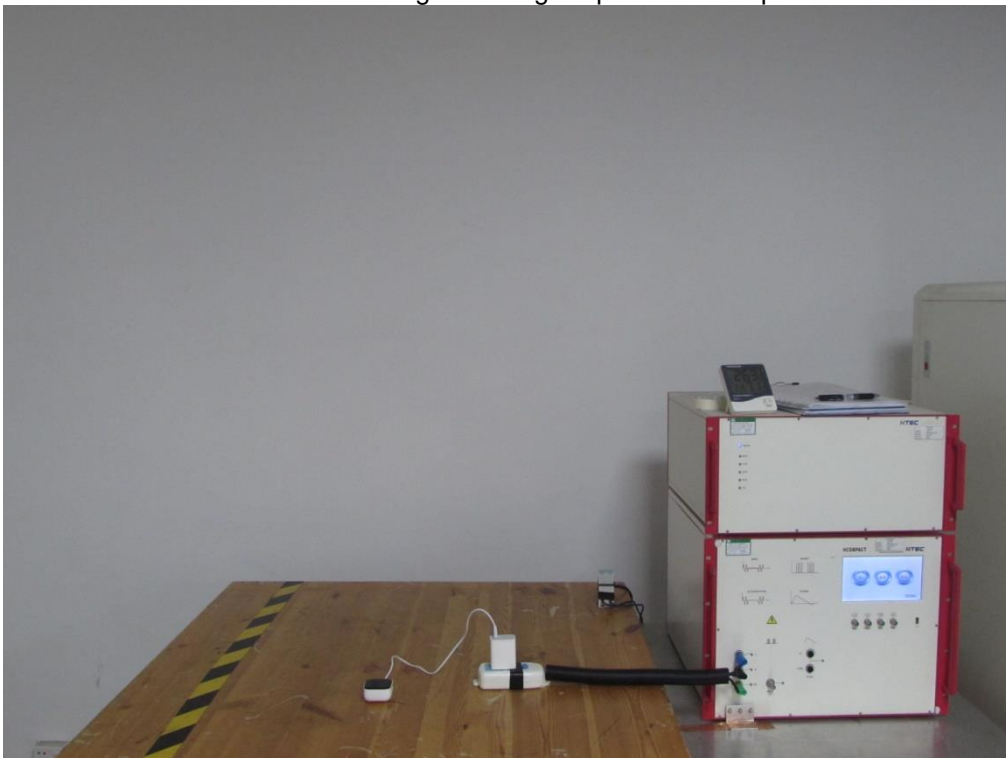
RF Electromagnetic Field



Electrostatic Discharge



Fast Transients/Surges/ Voltage Dips and Interruptions



6. PHOTOS OF THE EUT

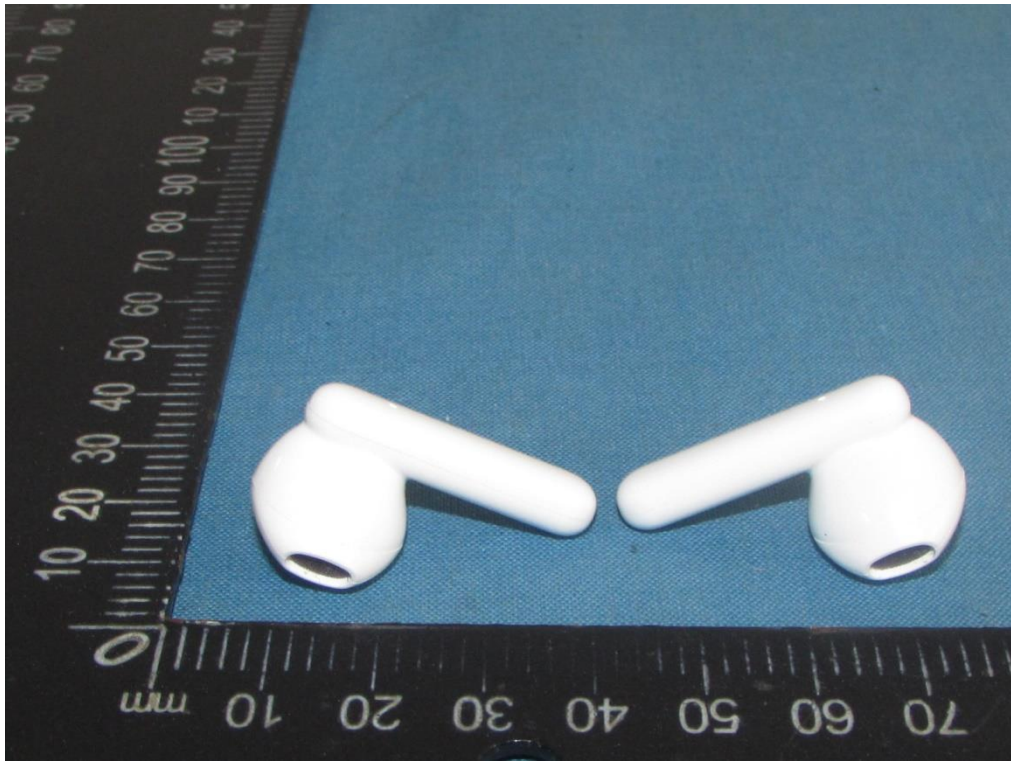
External photos





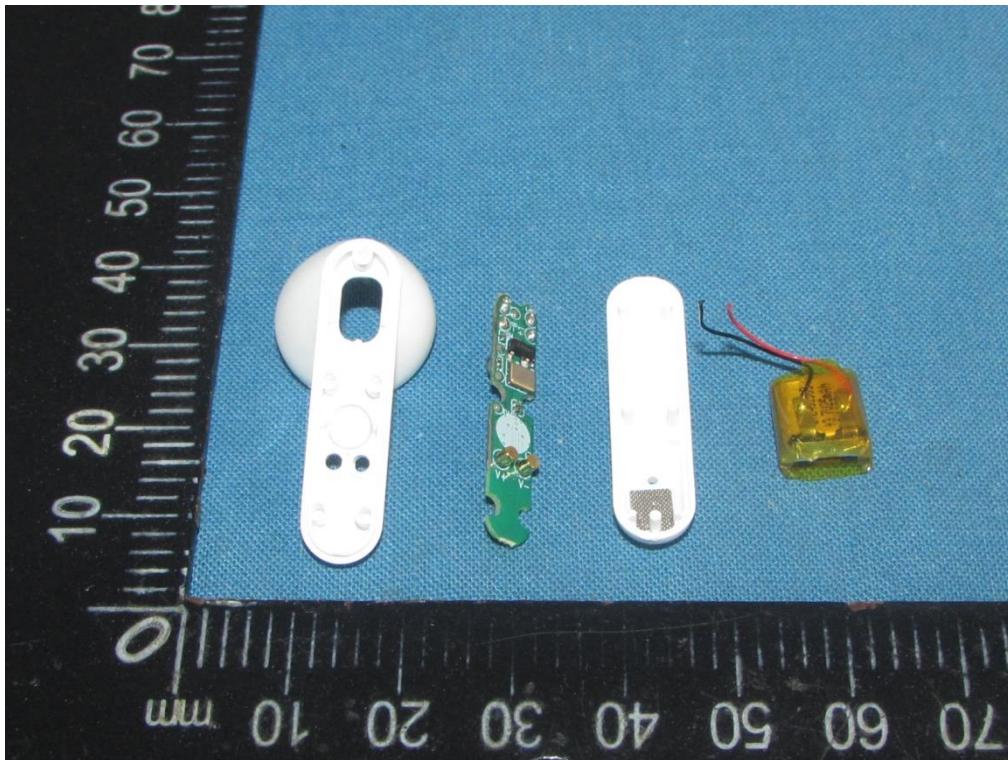
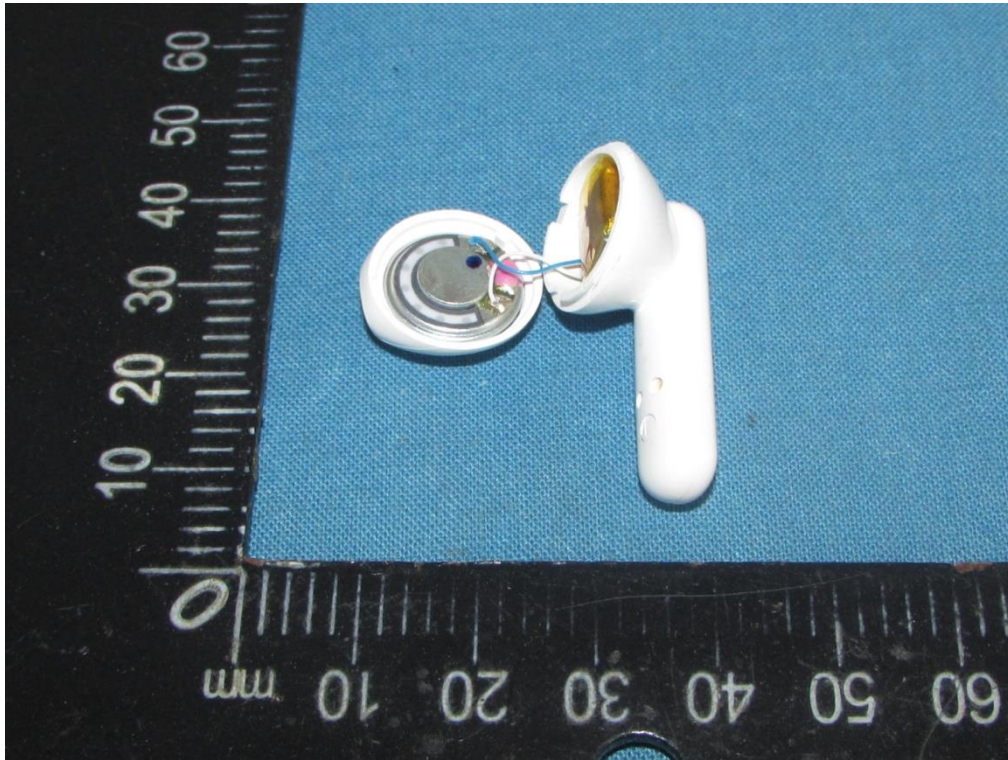






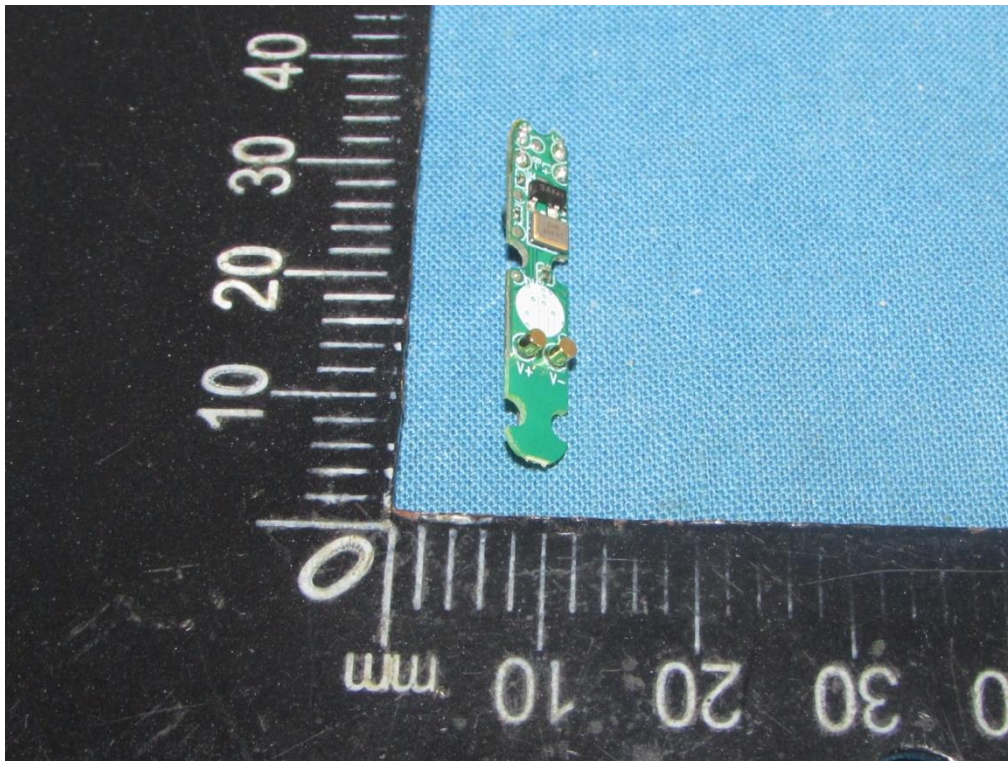
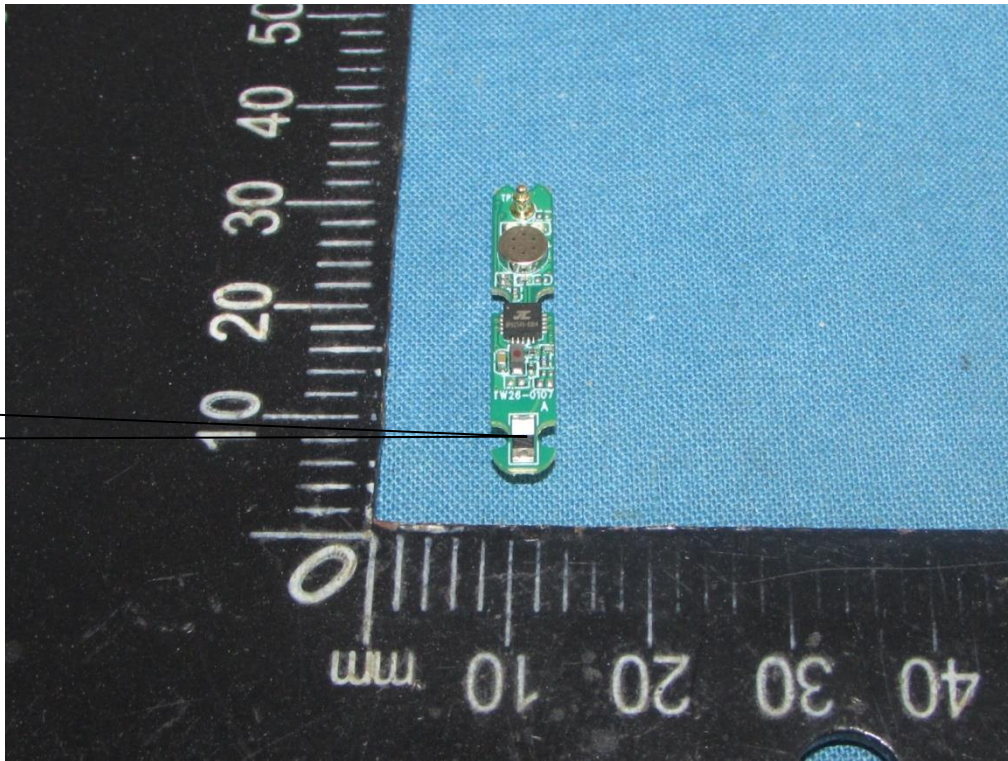


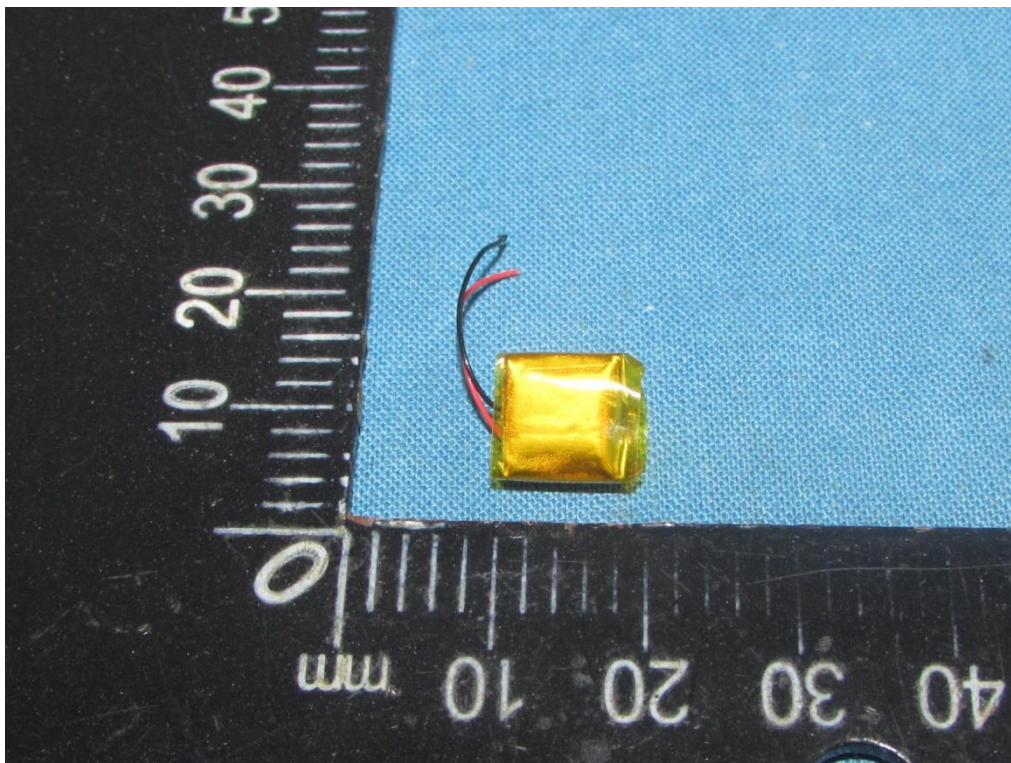
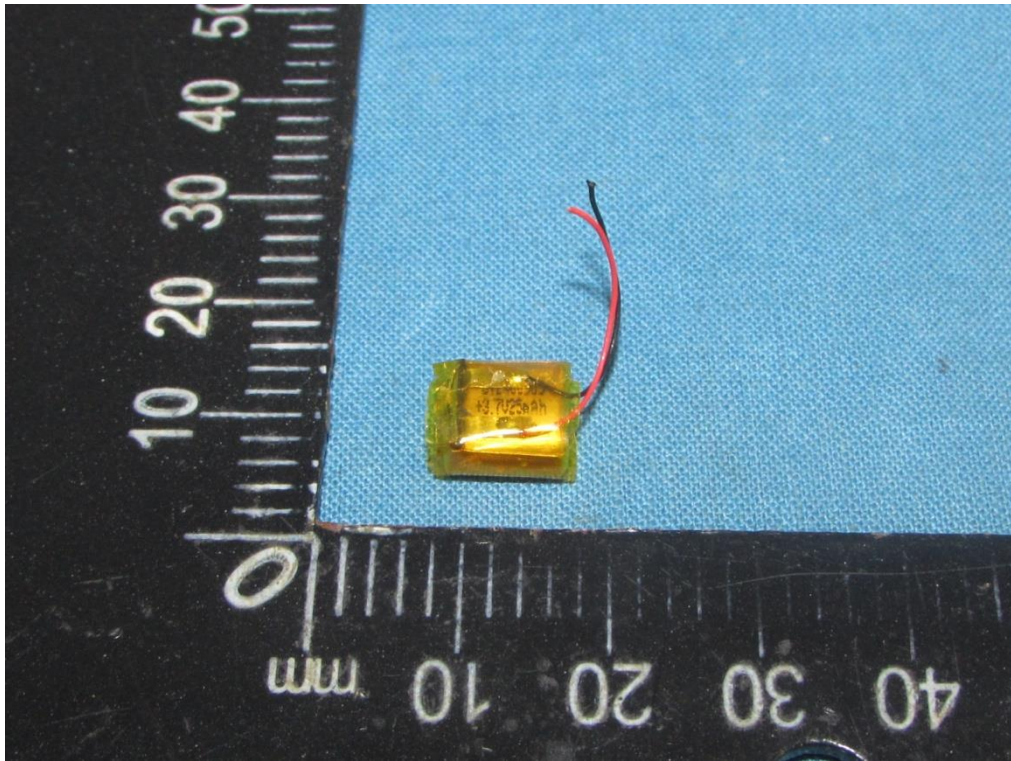
Internal Photos





Bluetooth
Antenna





.....End of Report.....