



中国认可
国际互认
检测
TESTING
CNAS L6478



TEST REPORT

Reference No...... : WTF24F08196279W003
Applicant..... : Mid Ocean Brands B.V.
Address..... : 7/F., Kings Tower, 111 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong
Manufacturer : 118966
Address..... : ---
Product Name..... : TWS earbuds in bamboo case
Model No...... : MO2303
Test specification..... : ETSI EN 301 489-1 V2.2.3 (2019-11)
ETSI EN 301 489-17 V3.2.4 (2020-09)
Date of Receipt sample : 2024-10-11
Date of Test : 2024-10-11 to 2024-10-15
Date of Issue..... : 2024-10-30
Test Report Form No. : WEW-301489A-01B
Test Result..... : Pass

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of approver.

Prepared By:

Waltek Testing Group (Foshan) Co., Ltd.

Address: 1/F., Building 19, Sunlink Machinery City, Xingye 4 Road,
Guanglong Industrial Park, Chihua Neighborhood Committee, Chencun Town,
Shunde District, Foshan, Guangdong, China

Tel:+86-757-23811398 Fax:+86-757-23811381 E-mail:info@waltek.com.cn

Tested by:

Approved by:

Roy Hong

Danny Zhou



1 Test Summary

Emission				
Test	Test Requirement	Test Method	Class / Severity	Result
Conducted Emissions	ETSI EN 301 489-17 V3.2.4	ETSI EN 301 489-1 V2.2.3 EN 55032	Table A.10 of EN 55032	N/A
Radiation Emission	ETSI EN 301 489-17 V3.2.4	ETSI EN 301 489-1 V2.2.3 EN 55032	Table A.4 and Table A.5 of EN 55032	Pass
Harmonic Current Emissions	ETSI EN 301 489-17 V3.2.4	ETSI EN 301 489-1 V2.2.3 EN 61000-3-2	Clause 7 of EN 61000-3-2	N/A
Voltage Fluctuations and Flicker	ETSI EN 301 489-17 V3.2.4	ETSI EN 301 489-1 V2.2.3 EN 61000-3-3	Clause 5 of EN 61000-3-3	N/A
Immunity				
Test	Test Requirement	Test Method	Class / Severity	Result
Electrostatic Discharge (ESD)	ETSI EN 301 489-17 V3.2.4	ETSI EN 301 489-1 V2.2.3 EN 61000-4-2	$\pm 2/\pm 4$ kV Contact $\pm 2/\pm 4/\pm 8$ kV Air	Pass
Radio frequency electromagnetic field (80 MHz to 6 000MHz)	ETSI EN 301 489-17 V3.2.4	ETSI EN 301 489-1 V2.2.3 EN 61000-4-3	3V/m, 80%, 1kHz, Amp. Mod.	Pass
Fast Transients Common Mode (EFT)	ETSI EN 301 489-17 V3.2.4	ETSI EN 301 489-1 V2.2.3 EN 61000-4-4	AC $\pm 0.5/1.0$ kV	N/A
Surge	ETSI EN 301 489-17 V3.2.4	ETSI EN 301 489-1 V2.2.3 EN 61000-4-5	± 1 kV D.M. $\dagger$ ± 2 kV C.M. $\ddagger$	N/A
RF common mode 0,15 MHz to 80 MHz (CS)	ETSI EN 301 489-17 V3.2.4	ETSI EN 301 489-1 V2.2.3 EN 61000-4-6	3Vrms(emf), 80%, 1kHz Amp. Mod.	N/A
Voltage Dips and Interruptions	ETSI EN 301 489-17 V3.2.4	ETSI EN 301 489-1 V2.2.3 EN 61000-4-11	0 % UT* for 0.5per 0 % UT* for 1per 70 % UT* for 25per 0 % UT* for 250per	N/A

Remark:

- Pass Test item meets the requirement
- Fail Test item does not meet the requirement
- N/A Test case does not apply to the test object
- A.M Amplitude Modulation
- $\dagger$ Differential Mode
- $\ddagger$ Common Mode
- * U_T is the nominal supply voltage



2 Contents

	Page
1 TEST SUMMARY	2
2 CONTENTS	3
3 GENERAL INFORMATION	4
3.1 GENERAL DESCRIPTION OF E.U.T.	4
3.2 DETAILS OF E.U.T.	4
3.3 DESCRIPTION OF SUPPORT UNITS	4
3.4 STANDARDS APPLICABLE FOR TESTING	4
3.5 TEST FACILITY	5
3.6 SUBCONTRACTED	5
3.7 ABNORMALITIES FROM STANDARD CONDITIONS	5
4 EQUIPMENT USED DURING TEST	6
4.1 EQUIPMENT LIST	6
4.2 SOFTWARE LIST	8
4.3 MEASUREMENT UNCERTAINTY	8
4.4 SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	9
4.5 DECISION RULE	9
5 EMC REQUIREMENTS FOR EMISSIONS	10
5.1 RADIATED EMISSION	10
6 EMC REQUIREMENT FOR IMMUNITY	16
6.1 PERFORMANCE CRITERIA	16
6.2 ELECTROSTATIC DISCHARGE(ESD)	17
6.3 RF ELECTROMAGNETIC FIELD (80MHZ TO 6 000MHZ) (RS)	19
7 PHOTOGRAPHS - TEST SETUP	21
7.1 PHOTOGRAPH - RADIATED EMISSIONS TEST SETUP	21
7.2 PHOTOGRAPH - RF ELECTROMAGNETIC FIELD TEST SETUP	22
7.3 PHOTOGRAPH - ESD TEST SETUP	22
8 PHOTOGRAPHS – EUT CONSTRUCTIONAL DETAILS	23



3 General Information

3.1 General Description of E.U.T.

Product Name : TWS earbuds in bamboo case

Model No. : MO2303

Remark : ---

3.2 Details of E.U.T.

Technical Data : Type-C Input: DC 5V, 1A
Type-C Output: DC 5V, 0.5A
USB output: DC 5V, 0.5A
Earbud battery: 3.7V, 30mAh
Charging case battery: 3.7V, 1200mAh

3.3 Description of Support Units

The EUT has been tested as an independent unit. MO2303 is the test sample. The full tests were performed in the condition of battery 3.7V input.

3.4 Standards Applicable for Testing

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



3.5 Test Facility

The test facility has a test site registered with the following organizations:

- **ISED – Registration No.: 21895**

Waltek Testing Group (Foshan) Co., Ltd. has been registered and fully described in a report filed with the Innovation, Science and Economic Development Canada (ISED). The acceptance letter from the ISED is maintained in our files. Registration ISED number: 21895, March 12, 2019

- **FCC – Registration No.: 820106**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 820106, August 16, 2018

- **NVLAP – Lab Code: 600191-0**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 600191-0.

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

3.6 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test items: ---

Lab information: ---

3.7 Abnormalities from Standard Conditions

None.



4 Equipment Used during Test

4.1 Equipment List

☐ Mains Terminal Disturbance Voltage 1#(Conducted Emission)						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	EMI Test Receiver	R&S	ESR3	102423	2024-01-05	2025-01-04
2.	LISN	R&S	ENV216	101343	2024-01-05	2025-01-04
3.	Cable	HUBER+SUHNER	CBL2-NN-6M	223NN624	2024-01-04	2025-01-03
4.	Switch	CD	RSU-A4 18G	RSUA4008	2024-01-04	2025-01-03
☐ Mains Terminal Disturbance Voltage 2#(Conducted Emission)						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	EMI Test Receiver	R&S	ESCI	101178	2024-01-06	2025-01-05
2.	LISN	R&S	ENV216	101215	2024-01-05	2025-01-04
3.	Cable	HUBER+SUHNER	CBL2-NN-6M	6102701	2024-01-04	2025-01-03
4.	Switch	ESE	RSU/M2	---	2024-01-04	2025-01-03
☐ Mains Terminal Disturbance Voltage 3#(Conducted Emission)						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	EMI Test Receiver	R&S	ESR3	102842	2024-01-05	2025-01-04
2.	LISN	R&S	ENV216	101542	2024-01-05	2025-01-04
3.	Cable	YIHENG	LMR195UF-NMNM-2.5	---	2024-01-04	2025-01-03
4.	Manual RF Switch	YIHENG	SW-2	RSU0402	2024-01-04	2025-01-03
☒ Radiated Emission (30MHz to 1GHz) 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	3m Semi-anechoic Chamber	CHANGCHUANG	9m×6m×6m	-	2024-01-06	2025-01-05
2.	EMI Test Receiver	R&S	ESR7	101566	2024-01-06	2025-01-05
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB 9162	9162-117	2024-01-06	2025-01-05
4.	Coaxial Cable (below 1GHz)	H+S	CBL3-NN-12+3m	214NN320	2024-01-06	2025-01-05
☐ Radiated Emission (30MHz to 1GHz) 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	3m Semi-anechoic Chamber	YIHENG	9m×6m×6m	YH2021071801	2024-01-06	2025-01-05
2.	EMI Test Receiver	R&S	ESR7	102454	2024-01-06	2025-01-05
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB 9163	01418	2024-02-22	2025-02-21
4.	Coaxial Cable (below 1GHz)	Times-Microwave Systems	LMR240UF-NMSM-7.5	-	2024-01-06	2025-01-05



☒ Radiated Emission (1GHz to 6GHz) 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	3m Semi-anechoic Chamber	CHANGCHUANG	9m×6m×6m	-	2024-01-05	2025-01-04
2.	EMI Test Receiver	R&S	ESR7	101566	2024-01-06	2025-01-05
3.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2024-01-05	2025-01-04
4.	Coaxial Cable (above 1GHz)	Times-Microwave	CBL5-NN	-	2024-01-04	2025-01-03
5.	Preamplifier	Lunar E M	LNA1G18-40	20160501002	2024-01-04	2025-01-03
☐ Radiated Emission (1GHz to 6GHz) 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	3m Semi-anechoic Chamber	YIHENG	9m×6m×6m	YH2021071801	2024-01-06	2025-01-05
2.	EMI Test Receiver	R&S	ESR7	102454	2024-01-06	2025-01-05
3.	Broad-band Horn Antenna	SCHWARZBECK	BBHA9120D	02465	2024-01-05	2025-01-04
4.	Coaxial Cable (above 1GHz)	Times-Microwave Systems	SFT205-NMSM-7	-	2024-01-06	2025-01-05
5.	Preamplifier	Tonscend	TAP0118045	AP21J806168	2024-01-05	2025-01-04
☐ Harmonics and Flicker Measuring System						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	Harmonics and Flicker Measuring System	YUANFANG	HFM-3000	V200	2024-02-28	2025-02-27
☒ ESD						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	ESD Simulator	TESEQ	NSG437	521	2024-01-03	2025-01-02
☐ EFT & Voltage Dips and Interruptions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	EMS test system	TESEQ	NSG3040	1858	2024-01-06	2025-01-05
☐ Surge						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	Surge Simulator	TESEQ	NSG3060	1395	2024-01-05	2025-01-04
☐ Injected Currents						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	Conducted Immunity test system	TESEQ	NSG4070	45345	2024-01-05	2025-01-04
2.	CDN	TESEQ	CDN M016	31586	2024-01-05	2025-01-04
3.	6dB Attenuator	TESEQ	ATN6075	32122	2024-01-05	2025-01-04
☒ Radio-frequency electromagnetic fields						
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1.	RF Power Amplifier	OPHIR	5225R	1051/1712	2024-01-05	2025-01-04



2.	RF Power Amplifier	OPHIR	5293RE	1051/171	2024-01-05	2025-01-04
3.	Stacked double logarithmic periodic antenna	SCHWARZBECK	STLP9128E-SPECIAL	142	2024-01-05	2025-01-04
4.	Stacked double logarithmic periodic antenna	SCHWARZBECK	STLP 9149	476	2024-01-05	2025-01-04
5.	Analog signal generator	RS	SMB100A	105566	2024-01-04	2025-01-03
6.	Power meter	RS	NRP6A	101133	2024-01-05	2025-01-04
7.	Power meter	RS	NRP6A	101134	2024-01-05	2025-01-04

☐: Not Used

☒: Used

4.2 Software List

Description	Manufacturer	Model	Version
EMI Test Software (Conducted Emission 1#)	FARATRONIC	EZ-EMC	EMEC-3A1
EMI Test Software (Conducted Emission 2#)	FARATRONIC	EZ-CON	FARAD-3A1.1+
EMI Test Software (Conducted Emission 3#)	FARATRONIC	EZ-EMC	EMC-CON 3A1.1+
EMI Test Software (Radiated Emission 1#)	FARATRONIC	EZ-EMC	RA-03A1-2
EMI Test Software (Radiated Emission 2#)	FARATRONIC	EZ-EMC	RA-03A1-2
Harmonics and Flicker Test Software	YUANFANG	HFM-3000	V2.00.120
Radiated Immunity Test Software	Chinese EMC	EMS	V1.0.0.0

4.3 Measurement Uncertainty

Test Item	Frequency Range	Uncertainty	Note
Conducted Emission	150kHz~30MHz	±2.6dB	(1)
Radiated Emission	30MHz~1GHz	±4.5dB	(1)
Radiated Emission	1GHz~6GHz	±4.5dB	(1)

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



4.4 Special Accessories and Auxiliary Equipment

Item	Equipment	Technical Data	Manufacturer	Model No.	Serial No.
1.	/	/	/	/	/

4.5 Decision Rule

Compliance or non-compliance with a disturbance limit shall be determined in the following manner.

If U_{LAB} is less than or equal to U_{cispr} , then

- Compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{LAB} is greater than U_{cispr} , then

- Compliance is deemed to occur if no measured disturbance level, increased by $(U_{LAB} - U_{cispr})$, exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{LAB} - U_{cispr})$, exceeds the disturbance limit.

WALTEK



5 EMC Requirements for Emissions

5.1 Radiated Emission

Test Requirement	ETSI EN 301 489-17
Test Method	ETSI EN 301 489-1, EN 55032, Class B
Frequency Range	30MHz to 1GHz, 1GHz to 6GHz
Class/Severity	Class B/ Table A.4 and A.5 of EN 55032
Detector	Peak for pre-scan (120kHz Resolution Bandwidth Below 1GHz; 1MHz Resolution Bandwidth Above 1GHz)

5.1.1 EUT Operation:

Operating Environment:

Temperature	23.3°C
Humidity	51.6%RH
Atmospheric Pressure	101.2kPa

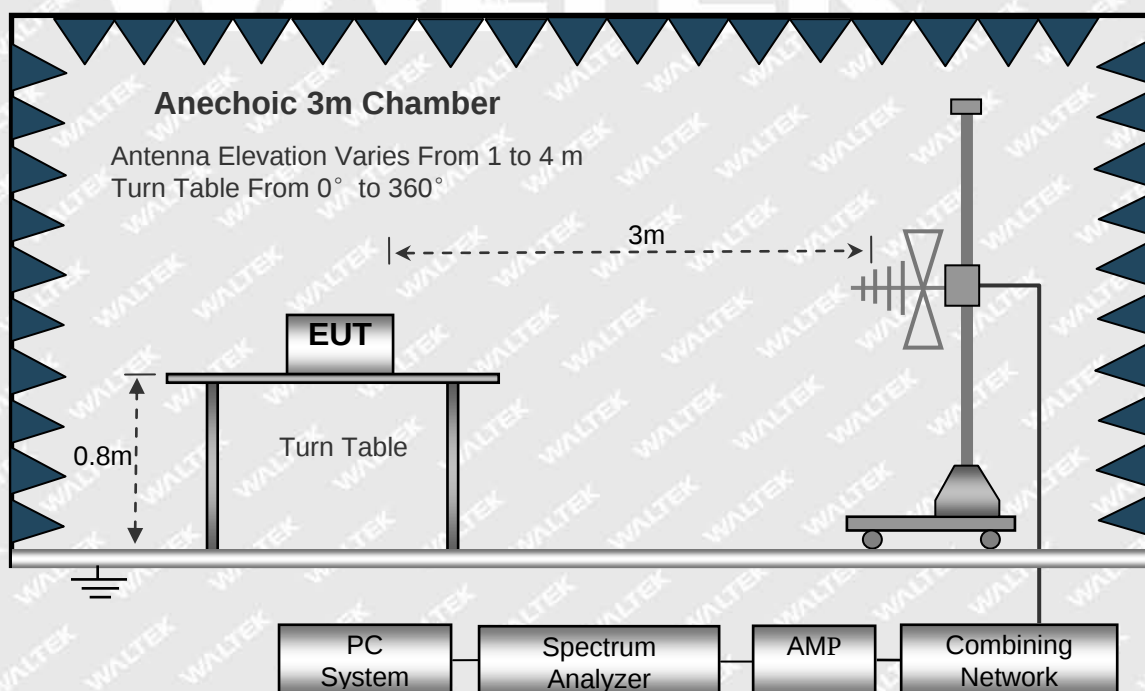
EUT Operation:

Input Voltage	AC 240V/50Hz
Operating Mode	BT link mode

5.1.2 Test Setup

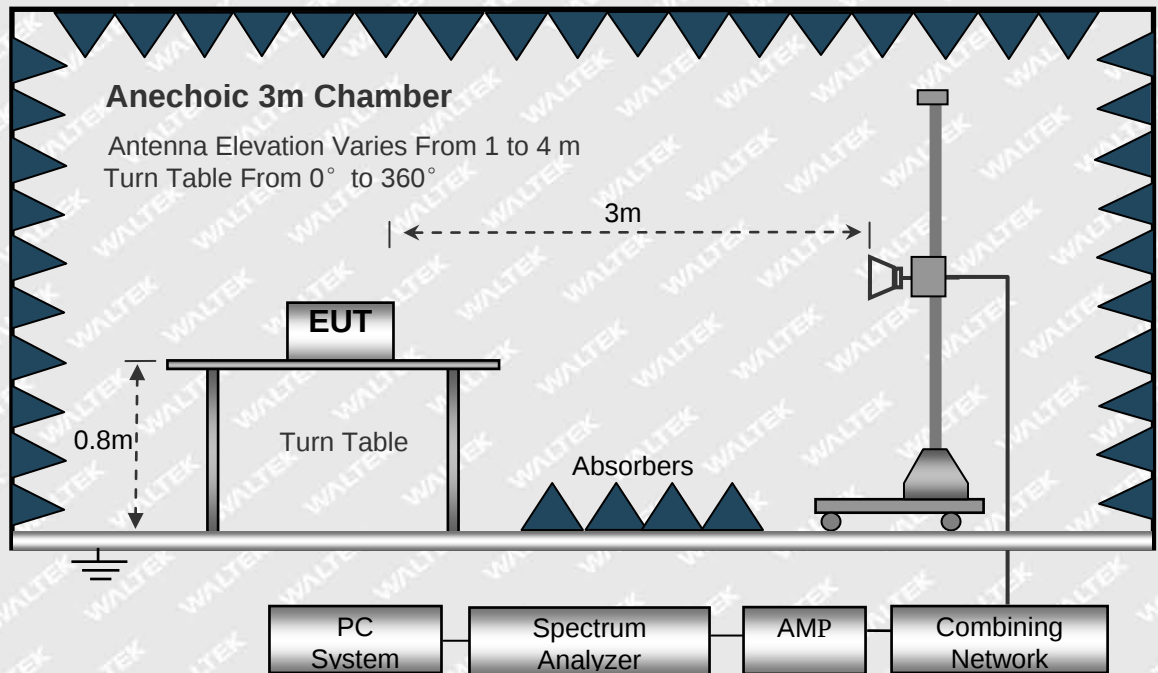
The radiated emission tests were performed using the setup accordance with the EN 55032.

Frequency Range: Below 1 GHz





Frequency Range: Above 1 GHz



5.1.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Corr. Factor}$$

$$\text{Corr. Factor} = \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit.

The equation for margin calculation is as follows:

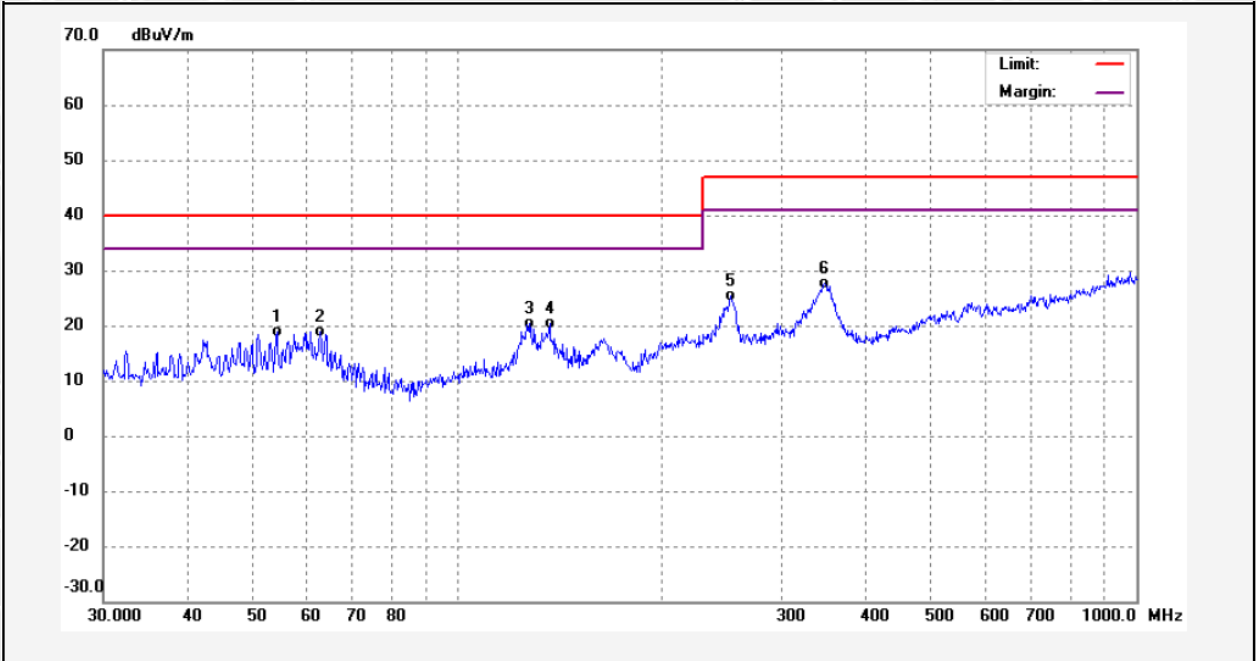
$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$



5.1.4 Test Result

Frequency Range: 30MHz ~ 1000MHz

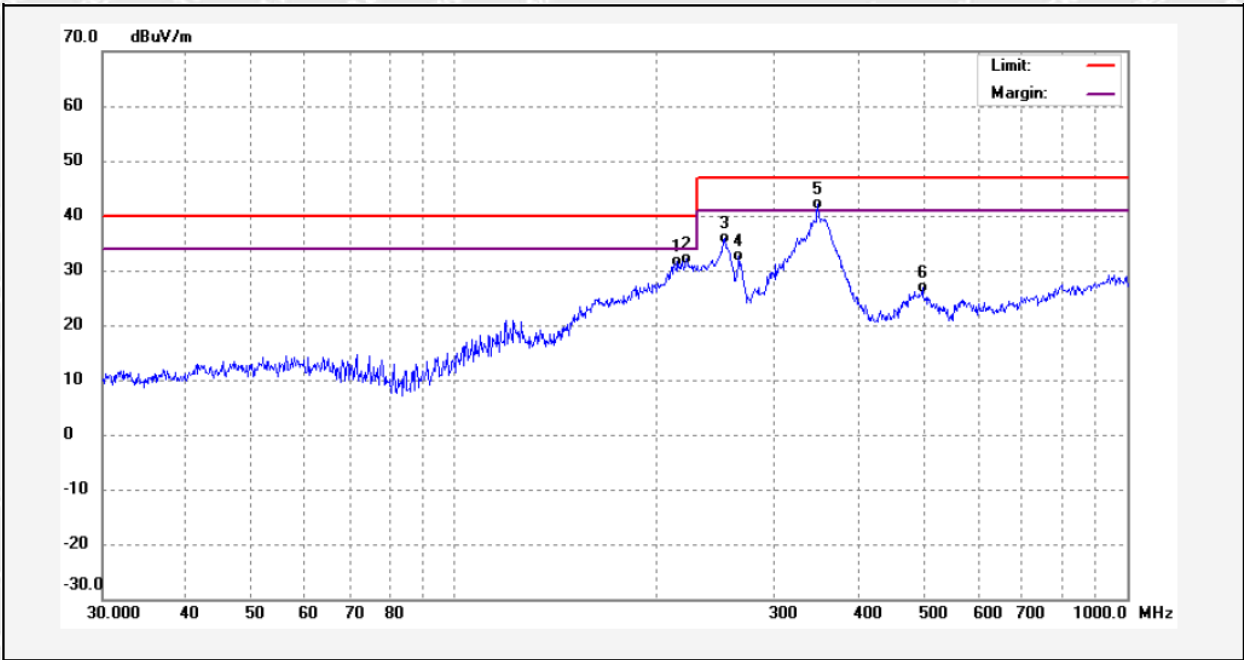
Antenna Polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	54.1470	4.56	14.30	18.86	40.00	-21.14	QP	
2	62.7386	5.27	13.56	18.83	40.00	-21.17	QP	
3	127.8437	10.18	10.21	20.39	40.00	-19.61	QP	
4	136.6514	10.55	9.71	20.26	40.00	-19.74	QP	
5	252.5051	10.81	14.55	25.36	47.00	-21.64	QP	
6	346.8092	10.55	17.03	27.58	47.00	-19.42	QP	



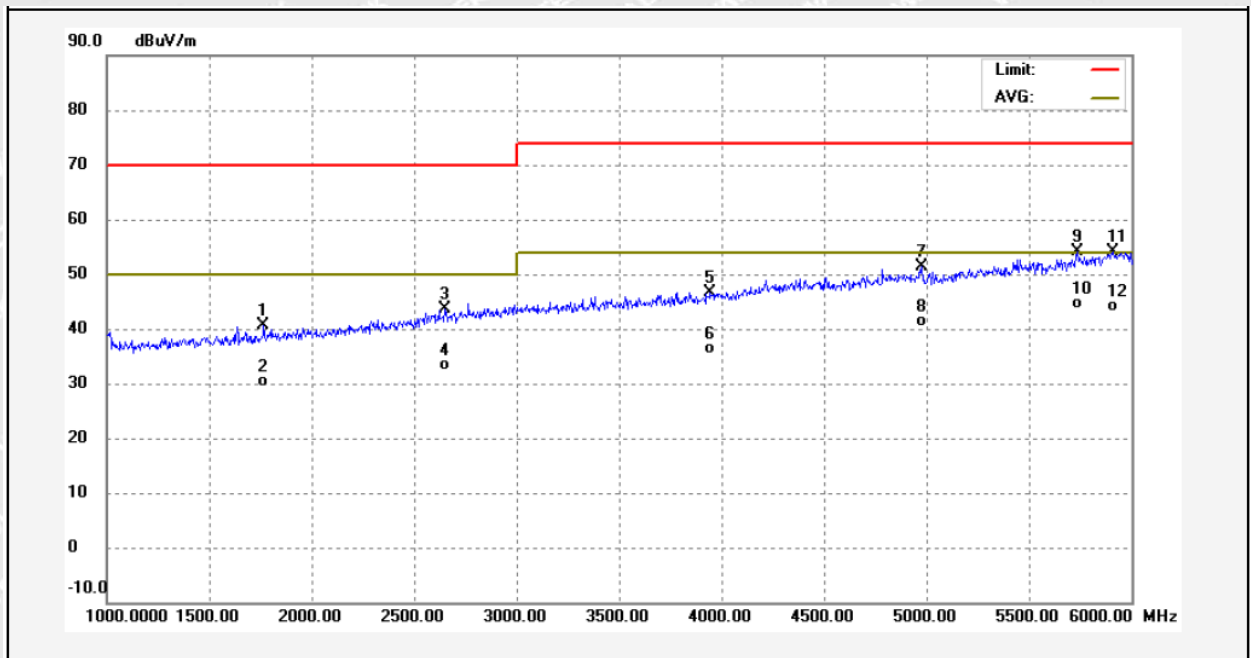
Antenna Polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	215.1923	17.35	14.16	31.51	40.00	-8.49	QP	
2	221.9362	17.70	14.32	32.02	40.00	-7.98	QP	
3	252.8595	21.46	14.54	36.00	47.00	-11.00	QP	
4	265.6757	17.86	14.65	32.51	47.00	-14.49	QP	
5	347.5396	25.01	17.06	42.07	47.00	-4.93	QP	
6	496.2823	6.33	20.46	26.79	47.00	-20.21	QP	

**Frequency Range: 1000MHz ~ 6000MHz**

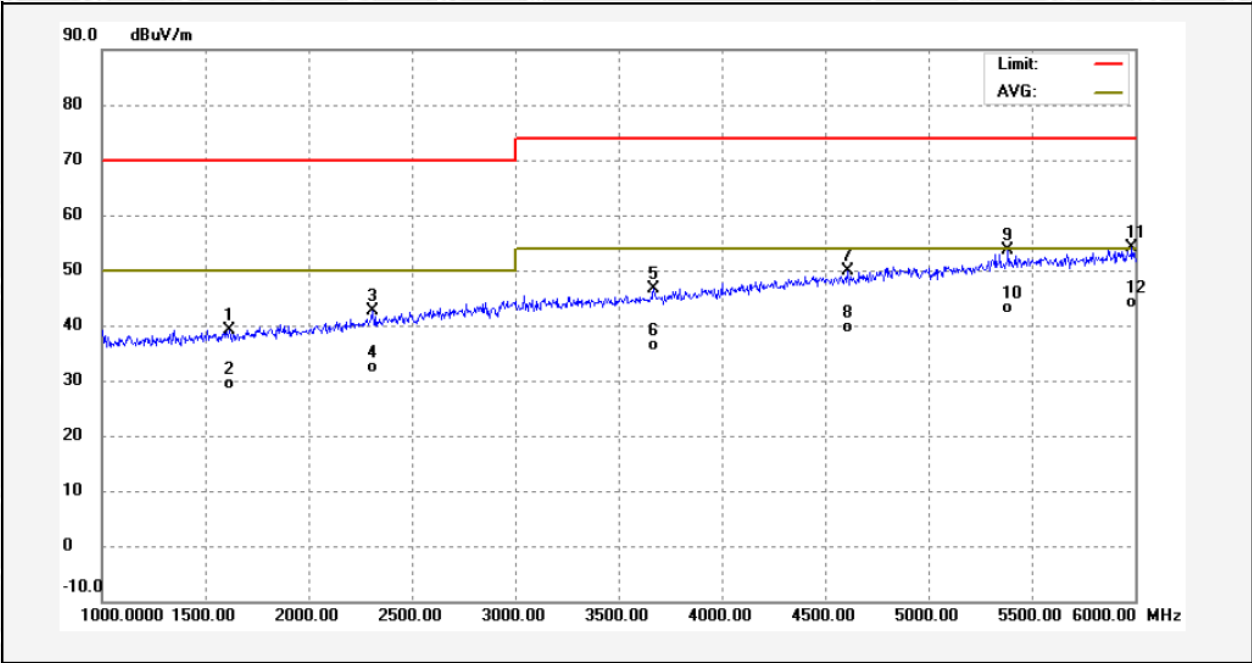
Antenna Polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1768.500	10.39	30.25	40.64	70.00	-29.36	peak	
2	1768.500	0.01	30.25	30.26	50.00	-19.74	AVG	
3	2653.000	10.56	33.06	43.62	70.00	-26.38	peak	
4	2653.000	0.22	33.06	33.28	50.00	-16.72	AVG	
5	3948.500	10.93	35.81	46.74	74.00	-27.26	peak	
6	3948.500	0.61	35.81	36.42	54.00	-17.58	AVG	
7	4978.000	12.69	38.73	51.42	74.00	-22.58	peak	
8	4978.000	2.56	38.73	41.29	54.00	-12.71	AVG	
9	5739.500	13.77	40.24	54.01	74.00	-19.99	peak	
10	5739.500	4.34	40.24	44.58	54.00	-9.42	AVG	
11	5911.000	13.48	40.69	54.17	74.00	-19.83	peak	
12	5911.000	3.37	40.69	44.06	54.00	-9.94	AVG	



Antenna Polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1618.000	9.05	30.02	39.07	70.00	-30.93	peak	
2	1618.000	-0.73	30.02	29.29	50.00	-20.71	AVG	
3	2310.500	10.77	31.90	42.67	70.00	-27.33	peak	
4	2310.500	0.46	31.90	32.36	50.00	-17.64	AVG	
5	3673.500	11.43	35.14	46.57	74.00	-27.43	peak	
6	3673.500	1.27	35.14	36.41	54.00	-17.59	AVG	
7	4613.000	12.22	37.76	49.98	74.00	-24.02	peak	
8	4613.000	1.76	37.76	39.52	54.00	-14.48	AVG	
9	5388.500	14.09	39.42	53.51	74.00	-20.49	peak	
10	5388.500	3.83	39.42	43.25	54.00	-10.75	AVG	
11	5985.000	13.30	40.89	54.19	74.00	-19.81	peak	
12	5985.000	3.19	40.89	44.08	54.00	-9.92	AVG	



6 EMC Requirement for Immunity

6.1 Performance Criteria

6.1.1 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.

6.1.2 Performance table

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.

WALTEK



6.2 Electrostatic Discharge(ESD)

Test Requirement	ETSI EN 301 489-17
Test Method	ETSI EN 301 489-1, EN 61000-4-2
Discharge Impedance	330 Ω / 150 pF
Discharge Voltage	Air Discharge: +/-2,4,8 KV Contact Discharge: +/-2,4 kV HCP & VCP: +/-2,4 kV
Polarity	Positive & Negative
Discharge Repeat Times	At Least 20 times at each test point
Discharge Mode	Single Discharge
Discharge Period	1 second minimum

6.2.1 E.U.T. Operation

Operating Environment:

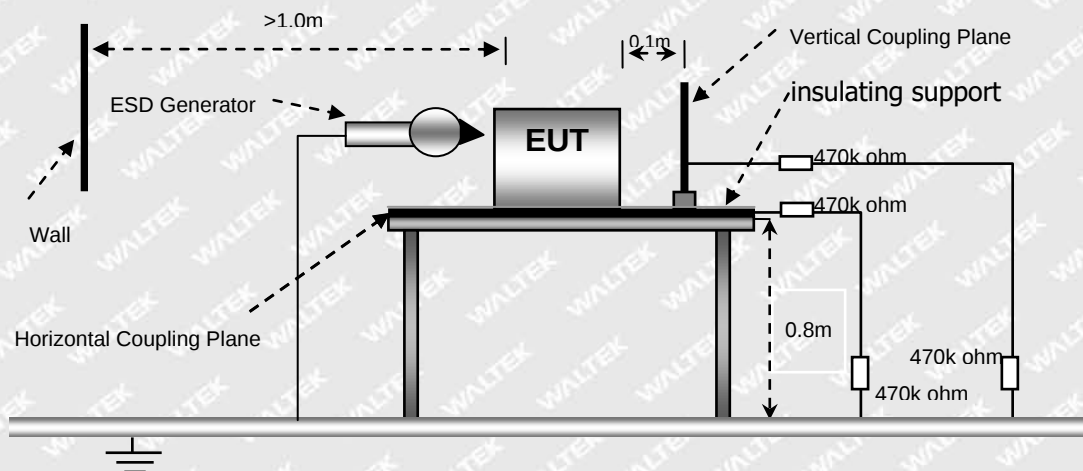
Temperature	21.4°C
Humidity	52.1%RH
Atmospheric Pressure	100.2kPa

EUT Operation:

Input Voltage	AC 230V/50Hz
Operating Mode	BT link mode

6.2.2 Block Diagram of Setup

The ESD test was performed in accordance with the EN 61000-4-2.





6.2.3 Test Result

Direct Discharge			Performance Criteria	
Discharge Level (kV)	Performance Criterion	Test Point	Contact Discharge	Air Discharge
$\pm 2 / \pm 4 / \pm 8$	B	1	N/A	Pass*
$\pm 2 / \pm 4$	B	2	Pass*	N/A

Remark:

Test points 1. All Exposed Surface & Seams; 2. All metallic part
* During the test no deviation was detected to the selected operation mode(s)

Indirect Discharge			Performance Criteria	
Discharge Level (kV)	Performance Criterion	Test Point	Horizontal Coupling	Vertical Coupling
$\pm 2 / \pm 4$	B	1	Pass*	Pass*

Remark:

Test points 1. All sides
* During the test no deviation was detected to the selected operation mode(s)

WALTEK



6.3 RF Electromagnetic Field (80MHz to 6 000MHz) (RS)

Test Requirement : ETSI EN 301 489-17
Test Method : ETSI EN 301 489-1, EN 61000-4-3
Face of EUT : Front, Back, Left, Right
Frequency Range : 80MHz to 6 000MHz
Test Level : 3V/m
Modulation : 80%, 1kHz Amplitude Modulation.
Antenna polarisation : Horizontal& Vertical

6.3.1 E.U.T. Operation

Operating Environment:

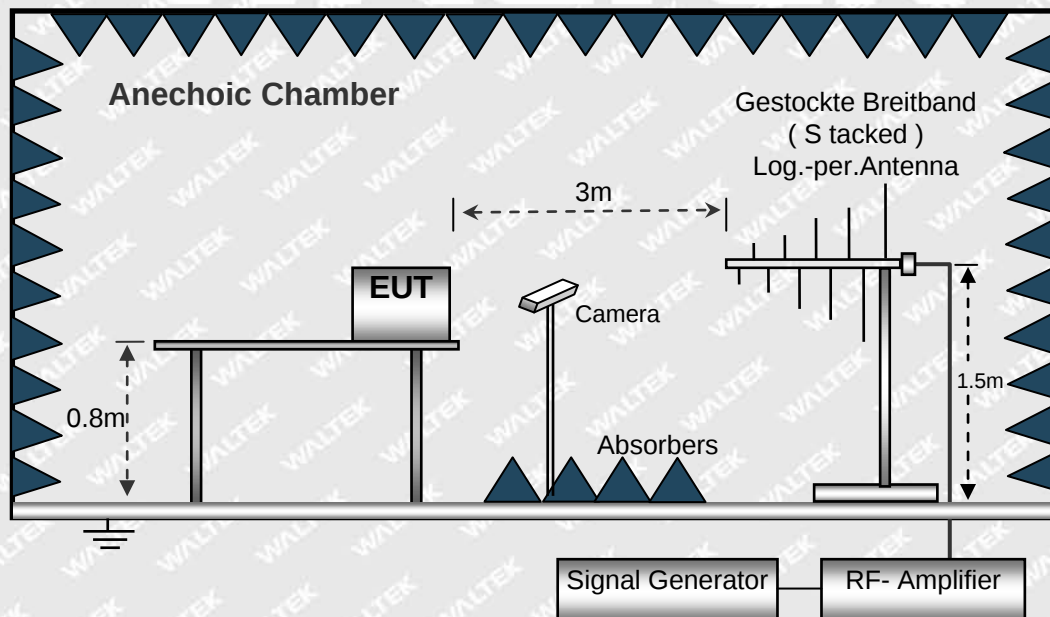
Temperature : 21.4°C
Humidity : 51.9%RH
Atmospheric Pressure : 100.1kPa

EUT Operation:

Input Voltage : AC 230V/50Hz
Operating Mode : BT link mode

6.3.2 Block Diagram of Setup

The Radiated Immunity test was performed in accordance with the EN 61000-4-3.





6.3.3 Test Result

Frequency	Face of EUT	Antenna polarisation	Test Level	Step Size	Dwell Time	Performance Criterion	Result
80MHz to 1000MHz	Front, Back, Left, Right	Horizontal	3V/m	1%	1s	A	Pass*
80MHz to 1000MHz	Front, Back, Left, Right	Vertical	3V/m	1%	1s	A	Pass*
1000MHz to 6000MHz	Front, Back, Left, Right	Horizontal	3V/m	1%	1s	A	Pass*
1000MHz to 6000MHz	Front, Back, Left, Right	Vertical	3V/m	1%	1s	A	Pass*

Remark:

* During the test no deviation was detected to the selected operation mode(s)

WALTEK



7 Photographs - Test Setup

7.1 Photograph - Radiated Emissions Test Setup

Below 1000MHz



Above 1000MHz

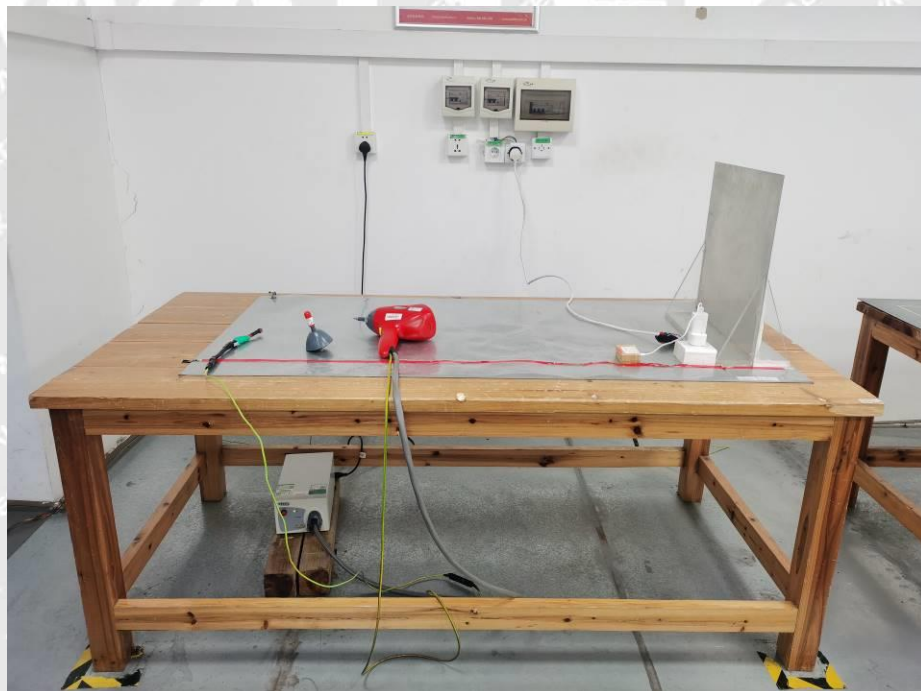




7.2 Photograph - RF Electromagnetic Field Test Setup



7.3 Photograph - ESD Test Setup





8 Photographs – EUT Constructional Details

Please refer to “ANNEX”.

=====End of Report=====

WALTEK



中国认可
国际互认
检测
TESTING
CNAS L6478



TEST REPORT

Reference No. : WTF24F08196280W
Applicant : Mid Ocean Brands B.V.
Address : 7/F., Kings Tower, 111 King Lam Street, Cheung Sha Wan, Kowloon,
Hong Kong
Manufacturer : 118966
Address : ---
Product Name : TWS earbuds in bamboo case
Model No. : MO2303
Test specification : EN 55032:2015+A11:2020+A1:2020
EN 55035:2017+A11:2020
Date of Receipt sample : 2024-10-11
Date of Test : 2024-10-11 to 2024-10-15
Date of Issue : 2024-10-30
Test Report Form No. : WEI-55032A-04B
Test Result : Pass

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of approver.

Prepared By:

Waltek Testing Group (Foshan) Co., Ltd.

Address: 1/F., Building 19, Sunlink Machinery City, Xingye 4 Road,
Guanglong Industrial Park, Chihua Neighborhood Committee, Chencun Town,
Shunde District, Foshan, Guangdong, China

Tel: +86-757-23811398

Fax: +86-757-23811381

E-mail: info@waltek.com.cn

Tested by:

Roy Hong

Approved by:

Danny Zhou



1 Test Summary

EMISSION				
Test Item	Test Standard		Class / Severity	Result
Mains Terminal Disturbance Voltage, 150kHz to 30MHz	EN 55032:2015+A11:2020+A1:2020		Table A.10	Pass
Radiated Emission, 30MHz to 1000MHz	EN 55032:2015+A11:2020+A1:2020		Table A.4	Pass
Radiation Emission, 1GHz to 6GHz	EN 55032:2015+A11:2020+A1:2020		Table A.5	Pass
IMMUNITY (EN 55035:2017+A11:2020)				
Test Item	Test Method	Class / Severity	Performance Criteria	Result
Electrostatic Discharge(ESD)	IEC 61000-4-2:2008	±4 Kv Contact ±8 Kv Air	B	Pass
Continuous RF Electromagnetic Field Disturbances	IEC 61000-4-3: 2006+A1+A2	3V/m, 80%, 1kHz, Amp. Mod.	A	Pass
Electrical Fast Transients (EFT)	IEC 61000-4-4:2012	AC ±1.0Kv DC ±0.5Kv	B	Pass
Surge	IEC 61000-4-5:2005	±1Kv D.M.† ±2Kv C.M.‡	B	Pass
Continuous Induced RF Disturbances, 0.15MHz to 10MHz	IEC 61000-4-6:2008	3Vr.m.s.(emf), 80%, 1kHz Amp. Mod.	A	Pass
Continuous Induced RF Disturbances, 10MHz to 30MHz		3 to 1Vr.m.s.(emf), 80%, 1kHz Amp. Mod	A	
Continuous Induced RF Disturbances, 30MHz to 80MHz		1Vr.m.s.(emf), 80%, 1kHz Amp. Mod	A	
Power-Frequency Magnetic Field	IEC 61000-4-8:2009	1A/m	A	N/A
Voltage Dips	IEC 61000-4-11:2004	< 5 % U _T * for 0.5per	B	Pass
		70 % U _T * for 25/30per	C	
Voltage Interruptions		< 5 % U _T * for 250/300per	C	

Remark:

- Pass Test item meets the requirement
- Fail Test item does not meet the requirement
- N/A Test case does not apply to the test object
- A.M Amplitude Modulation
- † Differential Mode
- ‡ Common Mode
- * U_T is the nominal supply voltage



2 Contents

	Page
COVER PAGE	1
1 TEST SUMMARY	2
2 CONTENTS	3
3 GENERAL INFORMATION.....	5
3.1 GENERAL DESCRIPTION OF E.U.T.	5
3.2 DETAILS OF E.U.T.	5
3.3 DESCRIPTION OF SUPPORT UNITS	5
3.4 STANDARDS APPLICABLE FOR TESTING	5
3.5 TEST FACILITY.....	6
3.6 SUBCONTRACTED.....	6
3.7 ABNORMALITIES FROM STANDARD CONDITIONS	6
4 EQUIPMENT USED DURING TEST	7
4.1 SOFTWARE LIST	9
4.2 MEASUREMENT UNCERTAINTY	9
4.3 SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT.....	10
4.4 DECISION RULE.....	10
5 EMISSION TEST RESULTS.....	11
5.1 MAINS TERMINALS DISTURBANCE VOLTAGE, 150 KHZ TO 30MHZ.....	11
5.1.1 E.U.T. Operation	11
5.1.2 Block Diagram of Test Setup	11
5.1.3 Measurement Data	11
5.1.4 Corrected Amplitude & Margin Calculation	12
5.1.5 Mains Terminals Disturbance Voltage Test Data.....	12
5.2 RADIATED EMISSION, 30MHZ TO 1GHZ	14
5.2.1 E.U.T. Operation	14
5.2.2 Block Diagram of Test Setup	14
5.2.3 Measurement Data	14
5.2.4 Corrected Amplitude & Margin Calculation	15
5.2.5 Radiated Emission Test Data.....	15
5.3 RADIATED EMISSION, 1GHZ TO 6GHZ.....	19
5.3.1 E.U.T. Operation	19
5.3.2 Block Diagram of Test Setup	19
5.3.3 Measurement Data	19
5.3.4 Corrected Amplitude & Margin Calculation	20
5.3.5 Radiated Emission Test Data	20
6 IMMUNITY TEST RESULTS.....	24
6.1 PERFORMANCE CRITERIA	24
6.2 ELECTROSTATIC DISCHARGE (ESD).....	25
6.2.1 E.U.T. Operation	25
6.2.2 Block Diagram of Setup	25
6.2.3 Direct Discharge Test Results	26
6.2.4 Indirect Discharge Test Results.....	26
6.3 CONTINUOUS RF ELECTROMAGNETIC FIELD DISTURBANCES	27
6.3.1 E.U.T. Operation	27
6.3.2 Block Diagram of Setup	27
6.3.3 Test Results.....	28
6.4 ELECTRICAL FAST TRANSIENTS (EFT).....	29
6.4.1 E.U.T. Operation	29
6.4.2 Block Diagram of Setup	30



6.4.3	Test Results.....	30
6.5	SURGE.....	31
6.5.1	E.U.T. Operation.....	31
6.5.2	Block Diagram of Setup.....	31
6.5.3	Test Result.....	32
6.6	CONTINUOUS INDUCED RF DISTURBANCE.....	33
6.6.1	E.U.T. Operation.....	33
6.6.2	Block Diagram of Setup.....	33
6.6.3	Test Results.....	34
6.7	VOLTAGE DIPS AND INTERRUPTIONS.....	35
6.7.1	E.U.T. Operation.....	35
6.7.2	Block Diagram of Setup.....	35
6.7.3	Test Results.....	36
7	PHOTOGRAPHS – TEST SETUP	37
7.1	PHOTOGRAPH – MAINS TERMINAL DISTURBANCE VOLTAGE TEST SETUP	37
7.2	PHOTOGRAPH – RADIATED EMISSION TEST SETUP, 30MHZ TO 1GHZ.....	37
7.3	PHOTOGRAPH – RADIATED EMISSION TEST SETUP, 1GHZ TO 6GHZ	38
7.4	PHOTOGRAPH – ESD IMMUNITY TEST SETUP	38
7.5	PHOTOGRAPH – CONTINUOUS RF ELECTROMAGNETIC FIELD DISTURBANCES TEST SETUP	39
7.6	PHOTOGRAPH – EFT IMMUNITY TEST SETUP.....	39
7.7	PHOTOGRAPH – SURGE IMMUNITY TEST SETUP.....	40
7.8	PHOTOGRAPH – CONTINUOUS INDUCED RF DISTURBANCE TEST SETUP	40
7.9	PHOTOGRAPH – VOLTAGE DIPS AND INTERRUPTIONS IMMUNITY TEST SETUP	41
8	PHOTOGRAPHS – CONSTRUCTIONAL DETAILS	42
8.1	EUT – EXTERNAL PHOTOS.....	42
8.2	EUT – INTERNAL PHOTOS.....	43

WALTEK



3 General Information

3.1 General Description of E.U.T.

Product Name : TWS earbuds in bamboo case

Model No. : MO2303

Remark : ---

3.2 Details of E.U.T.

Technical Data : Type-C Input: DC 5V, 1A
Type-C Output: DC 5V, 0.5A
USB output: DC 5V, 0.5A
Earbud battery: 3.7V, 30mAh
Charging case battery: 3.7V, 1200mAh

3.3 Description of Support Units

The EUT has been tested as an independent unit. MO2303 is the test sample. The DV and RE tests were performed in the condition of AC 240V/50Hz input. The other tests were performed in the condition of AC 230V/50Hz input. The full tests were performed with the AC adapter specified by the laboratory. The RE, ESD and RS tests were performed in the additional condition of battery 3.7V input.

3.4 Standards Applicable for Testing

The tests were performed according to following standards:

EN 55032:2015+A11:2020 +A1:2020 Electromagnetic compatibility of multimedia equipment - Emission Requirements

EN 55035:2017+A11:2020 Electromagnetic compatibility of multimedia equipment - Immunity requirements



3.5 Test Facility

The test facility has a test site registered with the following organizations:

- **ISED – Registration No.: 21895**

Waltek Testing Group (Foshan) Co., Ltd. has been registered and fully described in a report filed with the Innovation, Science and Economic Development Canada (ISED). The acceptance letter from the ISED is maintained in our files. Registration ISED number: 21895, March 12, 2019

- **FCC – Registration No.: 820106**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 820106, August 16, 2018

- **NVLAP – Lab Code: 600191-0**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 600191-0.

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

3.6 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test items: ---

Lab information: ---

3.7 Abnormalities from Standard Conditions

None.



4 Equipment Used during Test

☒ Mains Terminal Disturbance Voltage (Conducted Emission) 1#					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	EMI Test Receiver	R&S	ESR3	102423	Valid
2.	LISN	R&S	ENV216	101343	Valid
3.	Cable	HUBER+SUHNER	CBL2-NN-6M	223NN624	Valid
4.	Switch	CD	RSU-A4 18G	RSUA4008	Valid
☐ Mains Terminal Disturbance Voltage (Conducted Emission) 2#					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	EMI Test Receiver	R&S	ESCI	101178	Valid
2.	LISN	R&S	ENV216	101215	Valid
3.	Cable	HUBER+SUHNER	CBL2-NN-6M	6102701	Valid
4.	Switch	ESE	RSU/M2	---	Valid
☐ Mains Terminal Disturbance Voltage (Conducted Emission) 3#					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	EMI Test Receiver	R&S	ESR3	102842	Valid
2.	LISN	R&S	ENV216	101542	Valid
3.	Cable	YIHENG	LMR195UF-NMNM-2.5	---	Valid
4.	Manual RF Switch	YIHENG	SW-2	RSU0402	Valid
☒ Radiated Emission (30MHz to 1GHz) 1#					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	3m Semi-anechoic Chamber	CHANGCHUANG	9m×6m×6m	-	Valid
2.	EMI Test Receiver	R&S	ESR7	101566	Valid
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB 9162	9162-117	Valid
4.	Coaxial Cable (below 1GHz)	H+S	CBL3-NN-12+3 m	214NN320	Valid
☐ Radiated Emission (30MHz to 1GHz) 2#					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	3m Semi-anechoic Chamber	YIHENG	9m×6m×6m	YH2021071801	Valid
2.	EMI Test Receiver	R&S	ESR7	102454	Valid
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB 9163	01418	Valid
4.	Coaxial Cable (below 1GHz)	Times-Microwave Systems	LMR240UF-NMSM-7.5	-	Valid



☒ Radiated Emission (1GHz to 6GHz) 1#					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	3m Semi-anechoic Chamber	CHANGCHUANG	9m×6m×6m	-	Valid
2.	EMI Test Receiver	R&S	ESR7	101566	Valid
3.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	Valid
4.	Coaxial Cable (above 1GHz)	Times-Microwave	CBL5-NN	-	Valid
5.	Preamplifier	Lunar E M	LNA1G18-40	20160501002	Valid
☐ Radiated Emission (1GHz to 6GHz) 2#					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	3m Semi-anechoic Chamber	YIHENG	9m×6m×6m	YH2021071801	Valid
2.	EMI Test Receiver	R&S	ESR7	102454	Valid
3.	Broad-band Horn Antenna	SCHWARZBECK	BBHA9120D	02465	Valid
4.	Coaxial Cable (above 1GHz)	Times-Microwave Systems	SFT205-NMSM-7	-	Valid
5.	Preamplifier	Tonscend	TAP0118045	AP21J806168	Valid
☒ ESD					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	ESD Simulator	TESEQ	NSG437	521	Valid
☒ EFT & Voltage Dips and Interruptions					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	EMS test system	TESEQ	NSG3040	1858	Valid
☒ Surge					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	Surge Simulator	TESEQ	NSG3060	1395	Valid
☒ Injected Currents					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	Conducted Immunity test system	TESEQ	NSG4070	45345	Valid
2.	CDN	TESEQ	CDN M016	31586	Valid
3.	6dB Attenuator	TESEQ	ATN6075	32122	Valid



☒ Radio-frequency Electromagnetic Fields					
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Status
1.	RF Power Amplifier	OPHIR	5225R	1051/1712	Valid
2.	RF Power Amplifier	OPHIR	5293RE	1051/171	Valid
3.	Stacked double logarithmic periodic antenna	SCHWARZBECK	STLP9128E-SPECIAL	142	Valid
4.	Stacked double logarithmic periodic antenna	SCHWARZBECK	STLP 9149	476	Valid
5.	Analog signal generator	RS	SMB100A	105566	Valid
6.	Power meter	RS	NRP6A	101133	Valid
7.	Power meter	RS	NRP6A	101134	Valid

☐: Not Used

☒: Used

4.1 Software List

Description	Manufacturer	Model	Version
EMI Test Software (Conducted Emission 1#)	FARATRONIC	EZ-EMC	EMEC-3A1
EMI Test Software (Conducted Emission 2#)	FARATRONIC	EZ-EMC	FARAD-3A1.1+
EMI Test Software (Conducted Emission 3#)	FARATRONIC	EZ-EMC	EMC-CON 3A1.1+
EMI Test Software (Radiated Emission 1#)	FARATRONIC	EZ-EMC	RA-03A1-2
EMI Test Software (Radiated Emission 2#)	FARATRONIC	EZ-EMC	RA-03A1-2
Radiated Immunity Test Software	Chinese EMC	EMS	V1.0.0.0

4.2 Measurement Uncertainty

Test Item	Frequency Range	Uncertainty	Note
Conducted Emission	150kHz~30MHz	±2.6dB	(1)
Radiated Emission	30MHz~1GHz	±4.5dB	(1)
Radiated Emission	1GHz~6GHz	±4.5dB	(1)

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



4.3 Special Accessories and Auxiliary Equipment

Item	Equipment	Technical Data	Manufacturer	Model No.
1.	AC Adapter	Input: AC 100-240V~, 50/60Hz, 0.5A Output: DC 5V, 2A or DC 9V, 2A	HUAWEI	HW-090200CH0

4.4 Decision Rule

Compliance or non-compliance with a disturbance limit shall be determined in the following manner.

If U_{LAB} is less than or equal to U_{cispr} , then

- Compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{LAB} is greater than U_{cispr} , then

- Compliance is deemed to occur if no measured disturbance level, increased by $(U_{LAB} - U_{cispr})$, exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{LAB} - U_{cispr})$, exceeds the disturbance limit.

WALTEK



5 Emission Test Results

5.1 Mains Terminals Disturbance Voltage, 150 kHz to 30MHz

Test Requirement	: EN 55032 Annex A.3
Test Method	: EN 55032 Annex A.3
Limit	: Table A.10 of EN 55032
Test Result	: Pass
Frequency Range	: 150kHz to 30MHz
Class	: Class B

5.1.1 E.U.T. Operation

Operating Environment:

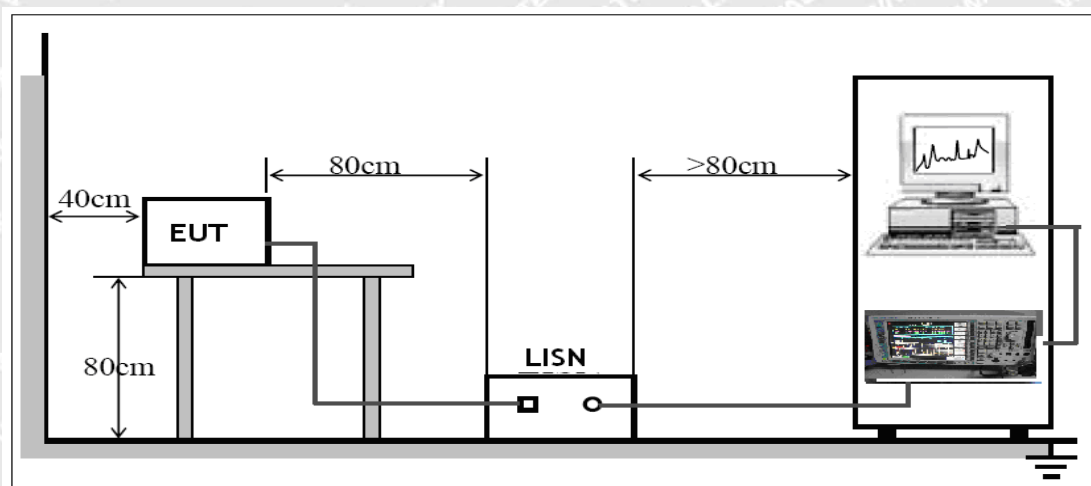
Temperature	: 26°C
Humidity	: 60%RH
Atmospheric Pressure	: 101.2kPa

EUT Operation:

Input Voltage	: AC 240V/50Hz
Operating Mode	: Charging mode

5.1.2 Block Diagram of Test Setup

The Mains Terminals Disturbance Voltage tests were performed in accordance with the CISPR 16-1-2.



5.1.3 Measurement Data

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.



5.1.4 Corrected Amplitude & Margin Calculation

The Corrected factor is calculated by adding LISN VDF(Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Measurement} = \text{Reading Level} + \text{Correct Factor}$$

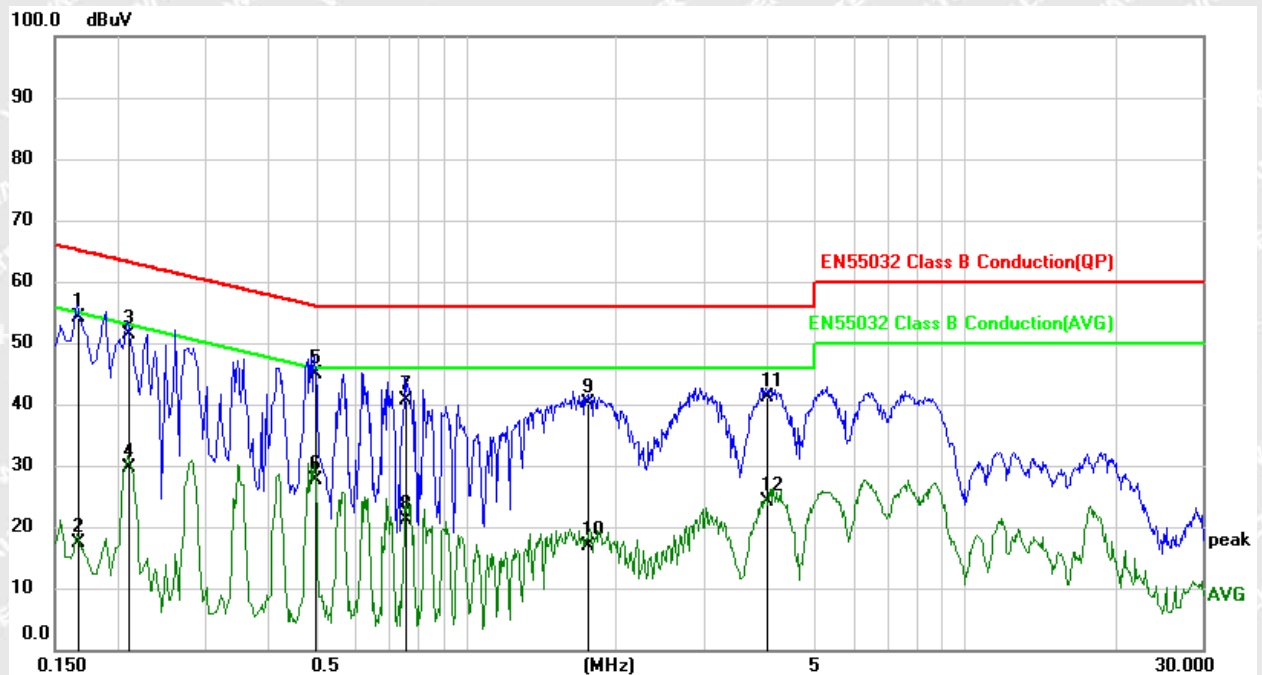
$$\text{Correct Factor} = \text{LISN VDF} + \text{Cable Loss}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Measurement} - \text{Limit}$$

5.1.5 Mains Terminals Disturbance Voltage Test Data

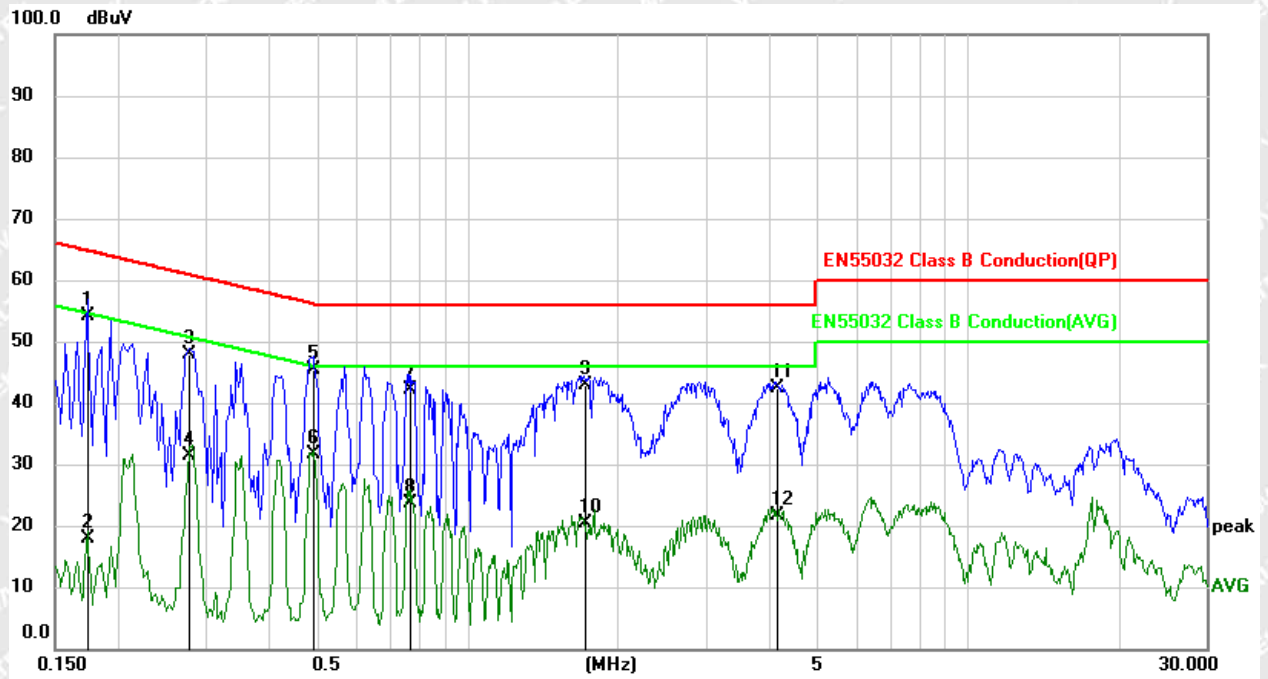
Live Line



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1660	44.48	9.63	54.11	65.16	-11.05	QP	
2		0.1660	7.84	9.63	17.47	55.16	-37.69	AVG	
3		0.2100	41.72	9.64	51.36	63.21	-11.85	QP	
4		0.2100	20.05	9.64	29.69	53.21	-23.52	AVG	
5		0.4980	35.13	9.68	44.81	56.03	-11.22	QP	
6		0.4980	18.00	9.68	27.68	46.03	-18.35	AVG	
7		0.7580	31.00	9.69	40.69	56.00	-15.31	QP	
8		0.7580	11.39	9.69	21.08	46.00	-24.92	AVG	
9		1.7620	30.48	9.71	40.19	56.00	-15.81	QP	
10		1.7620	7.14	9.71	16.85	46.00	-29.15	AVG	
11		3.9900	31.38	9.75	41.13	56.00	-14.87	QP	
12		3.9900	14.34	9.75	24.09	46.00	-21.91	AVG	



Neutral Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector Comment
1	*	0.1740	44.58	9.63	54.21	64.77	-10.56	QP
2		0.1740	8.23	9.63	17.86	54.77	-36.91	AVG
3		0.2779	38.30	9.66	47.96	60.88	-12.92	QP
4		0.2779	21.72	9.66	31.38	50.88	-19.50	AVG
5		0.4940	35.70	9.68	45.38	56.10	-10.72	QP
6		0.4940	21.93	9.68	31.61	46.10	-14.49	AVG
7		0.7660	32.48	9.69	42.17	56.00	-13.83	QP
8		0.7660	13.95	9.69	23.64	46.00	-22.36	AVG
9		1.7100	33.28	9.70	42.98	56.00	-13.02	QP
10		1.7100	10.77	9.70	20.47	46.00	-25.53	AVG
11		4.1420	32.53	9.75	42.28	56.00	-13.72	QP
12		4.1420	11.80	9.75	21.55	46.00	-24.45	AVG



5.2 Radiated Emission, 30MHz to 1GHz

Test Requirement	: EN 55032 Annex A.2
Test Method	: EN 55032 Annex A.2
Test Limit.....	: Table A.4 of EN 55032
Test Result	: Pass
Frequency Range	: 30MHz to 1000MHz
Class	: Class B

5.2.1 E.U.T. Operation

Operating Environment:

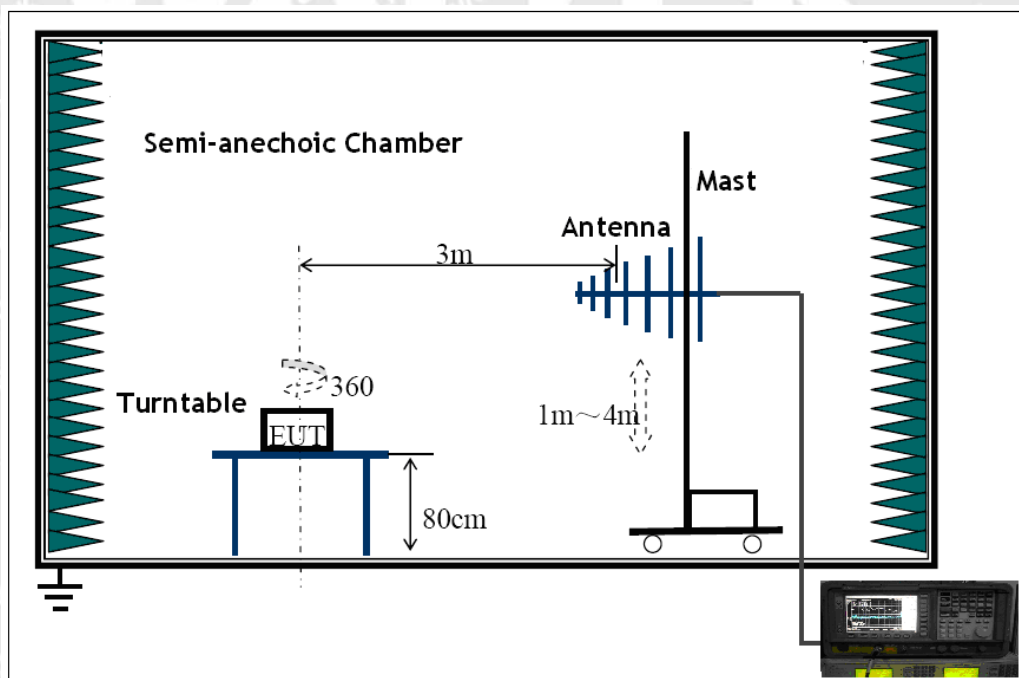
Temperature.....	: 23.3°C
Humidity	: 51.6%RH
Atmospheric Pressure	: 101.2kPa

EUT Operation:

Input Voltage.....	: AC 240V/50Hz for mode 1; Battery 3.7V for mode 2
Operating Mode	: Mode 1: Charging mode Mode 2: BT link mode

5.2.2 Block Diagram of Test Setup

The Radiated Emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the CISPR 16-2-3.



5.2.3 Measurement Data

The maximised peak emissions from the EUT was scanned and measured for EUT 0°-360°.Quasi-peak measurements were performed if peak emissions were within 6dB of the limit line.



5.2.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Corr. Factor}$$

$$\text{Corr. Factor} = \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

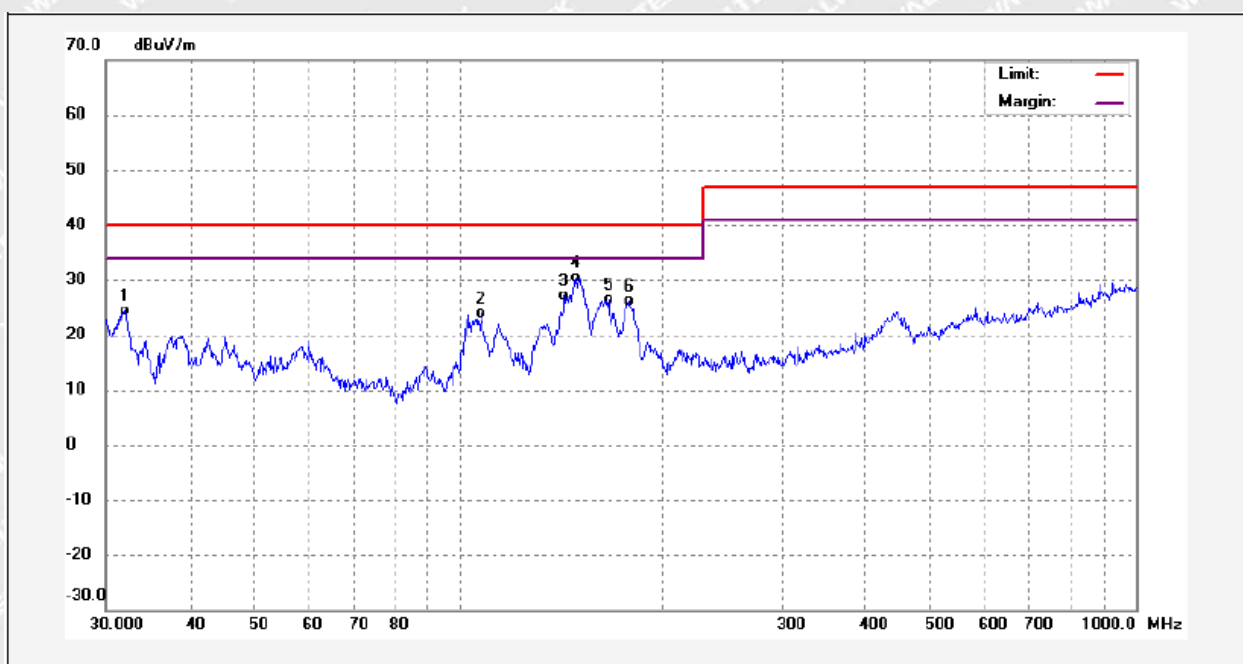
The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

5.2.5 Radiated Emission Test Data

Charging mode

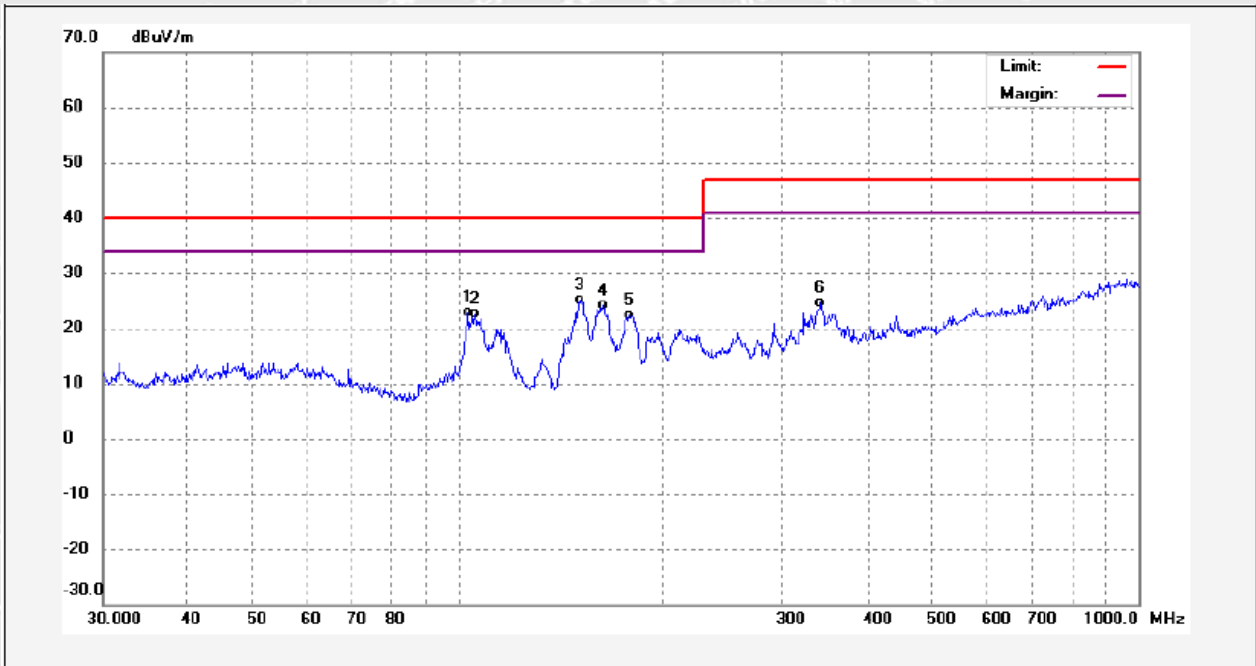
Vertical Polarization



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	32.1456	12.17	12.24	24.41	40.00	-15.59	QP	
2	108.0391	11.01	12.87	23.88	40.00	-16.12	QP	
3	143.0750	18.02	9.12	27.14	40.00	-12.86	QP	
4	148.7537	21.09	9.23	30.32	40.00	-9.68	QP	
5	166.1846	15.82	10.54	26.36	40.00	-13.64	QP	
6	178.3827	14.92	11.12	26.04	40.00	-13.96	QP	



Horizontal Polarization

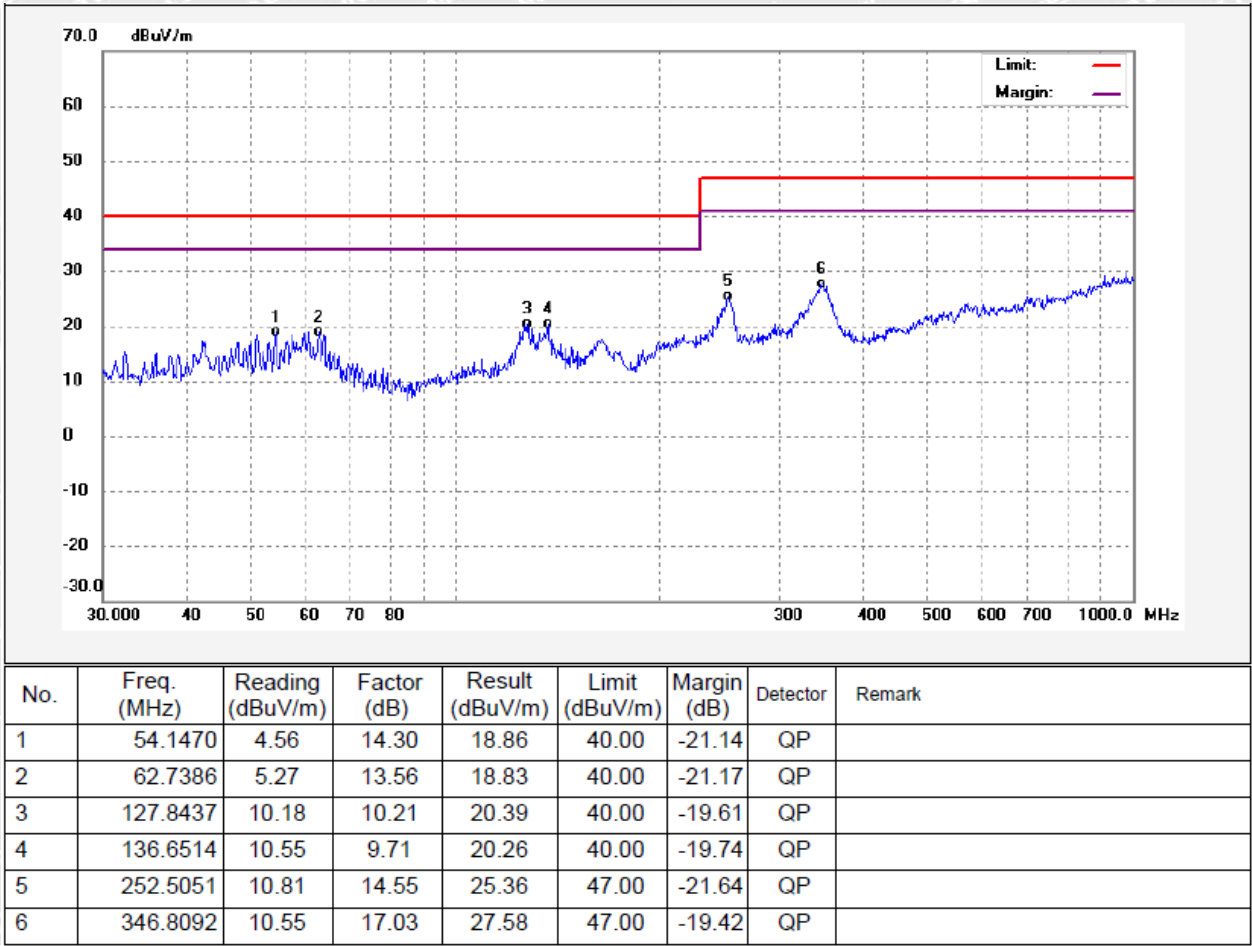


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	103.5509	9.94	12.86	22.80	40.00	-17.20	QP	
2	105.9012	9.54	13.03	22.57	40.00	-17.43	QP	
3	151.1195	15.77	9.40	25.17	40.00	-14.83	QP	
4	163.6976	13.65	10.46	24.11	40.00	-15.89	QP	
5	179.0721	11.26	11.11	22.37	40.00	-17.63	QP	
6	341.0207	7.79	16.78	24.57	47.00	-22.43	QP	



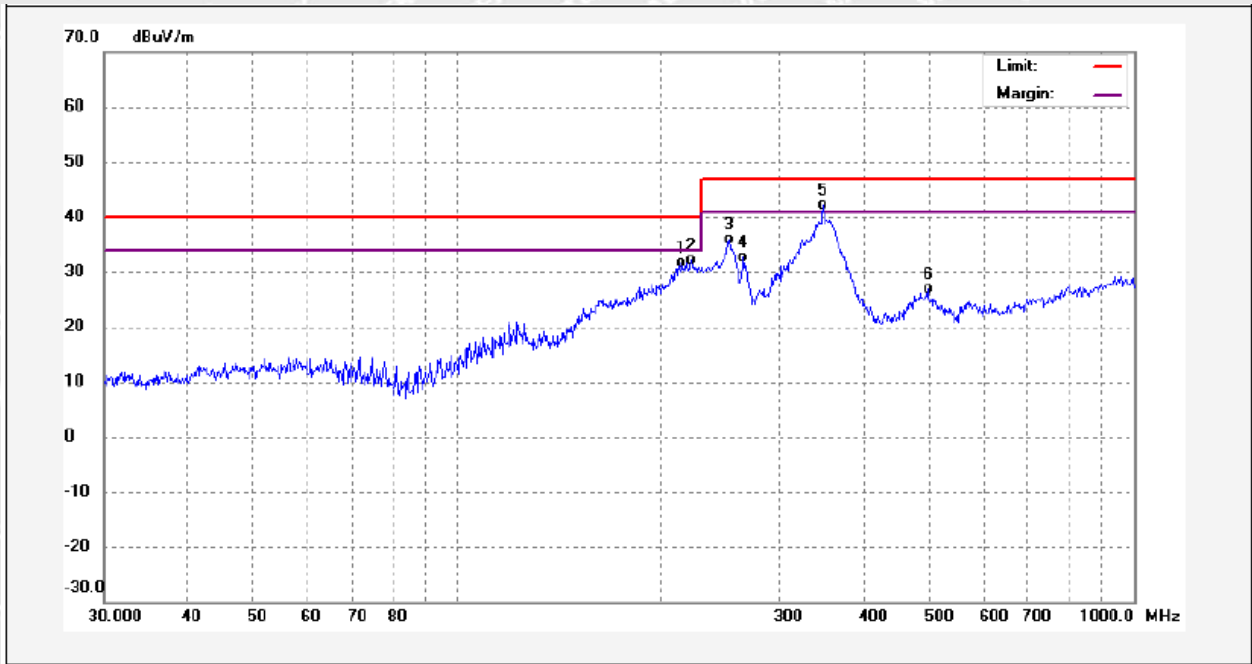
BT link mode

Vertical Polarization





Horizontal Polarization



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	215.1923	17.35	14.16	31.51	40.00	-8.49	QP	
2	221.9362	17.70	14.32	32.02	40.00	-7.98	QP	
3	252.8595	21.46	14.54	36.00	47.00	-11.00	QP	
4	265.6757	17.86	14.65	32.51	47.00	-14.49	QP	
5	347.5396	25.01	17.06	42.07	47.00	-4.93	QP	
6	496.2823	6.33	20.46	26.79	47.00	-20.21	QP	



5.3 Radiated Emission, 1GHz to 6GHz

Test Requirement	: EN 55032 Annex A.2
Test Method	: EN 55032 Annex A.2
Test Limit.....	: Table A.5 of EN 55032
Test Result	: Pass
Frequency Range	: 1GHz to 6GHz
Class.....	: Class B

5.3.1 E.U.T. Operation

Operating Environment:

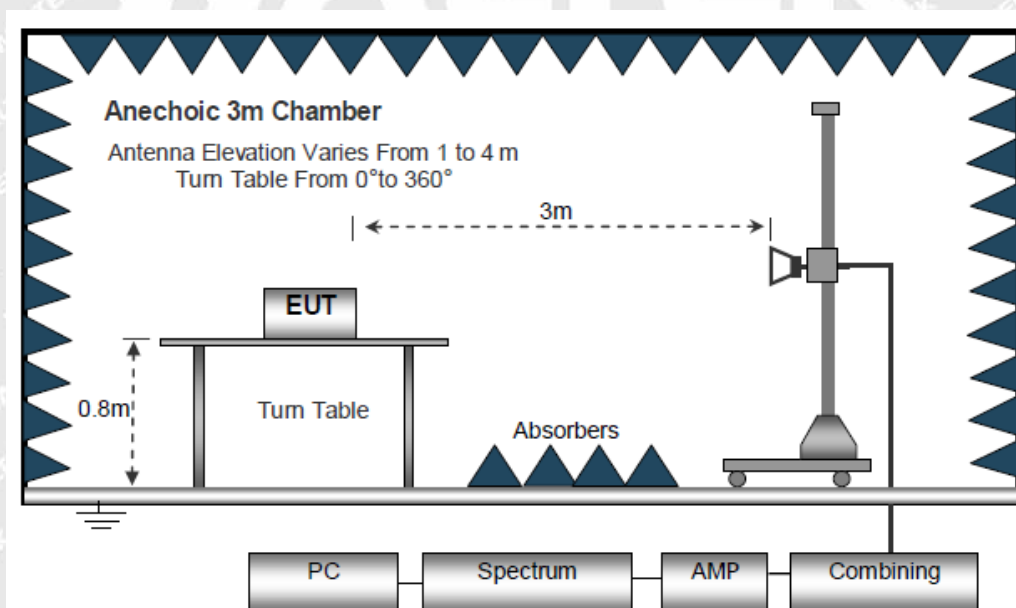
Temperature.....	: 23.3°C
Humidity	: 51.6%RH
Atmospheric Pressure	: 101.2kPa

EUT Operation:

Input Voltage.....	: AC 240V/50Hz for mode 1; Battery 3.7V for mode 2
Operating Mode	: Mode 1: Charging mode Mode 2: BT link mode

5.3.2 Block Diagram of Test Setup

The Radiated Emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the CISPR 16-2-3.



5.3.3 Measurement Data

The maximised peak emissions from the EUT was scanned and measured for EUT 0°-360°. Quasi-peak measurements were performed if peak emissions were within 6dB of the limit line.



5.3.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Corr. Factor}$$

$$\text{Corr. Factor} = \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

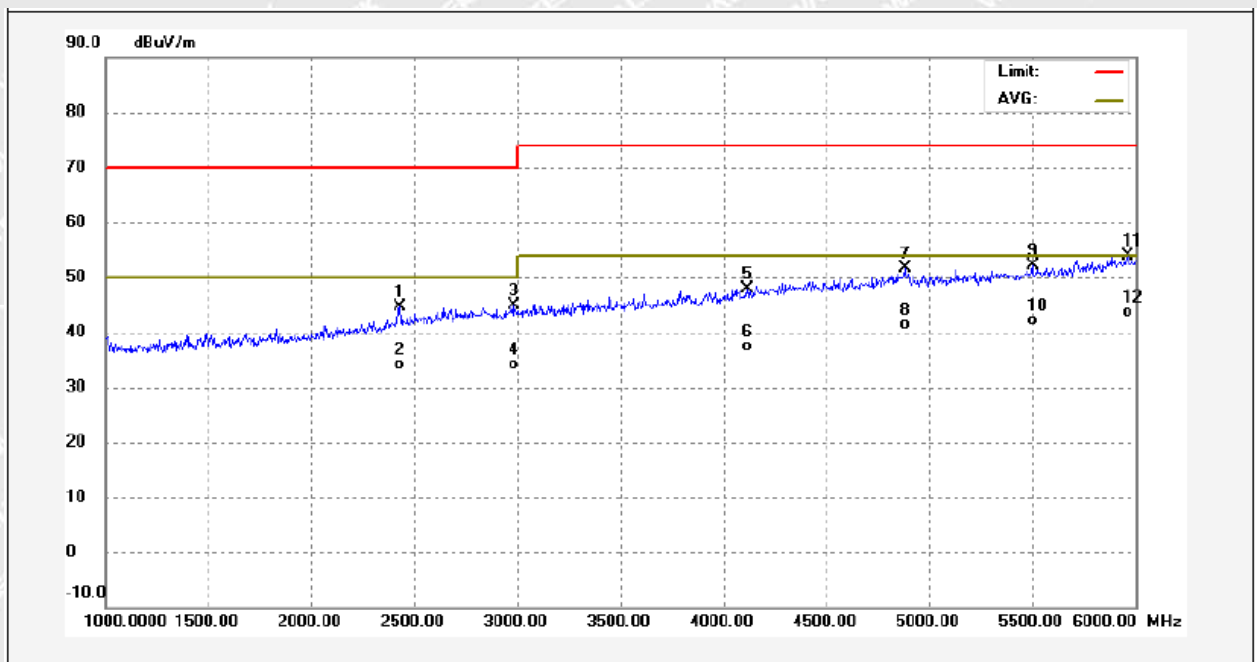
The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

5.3.5 Radiated Emission Test Data

Charging mode

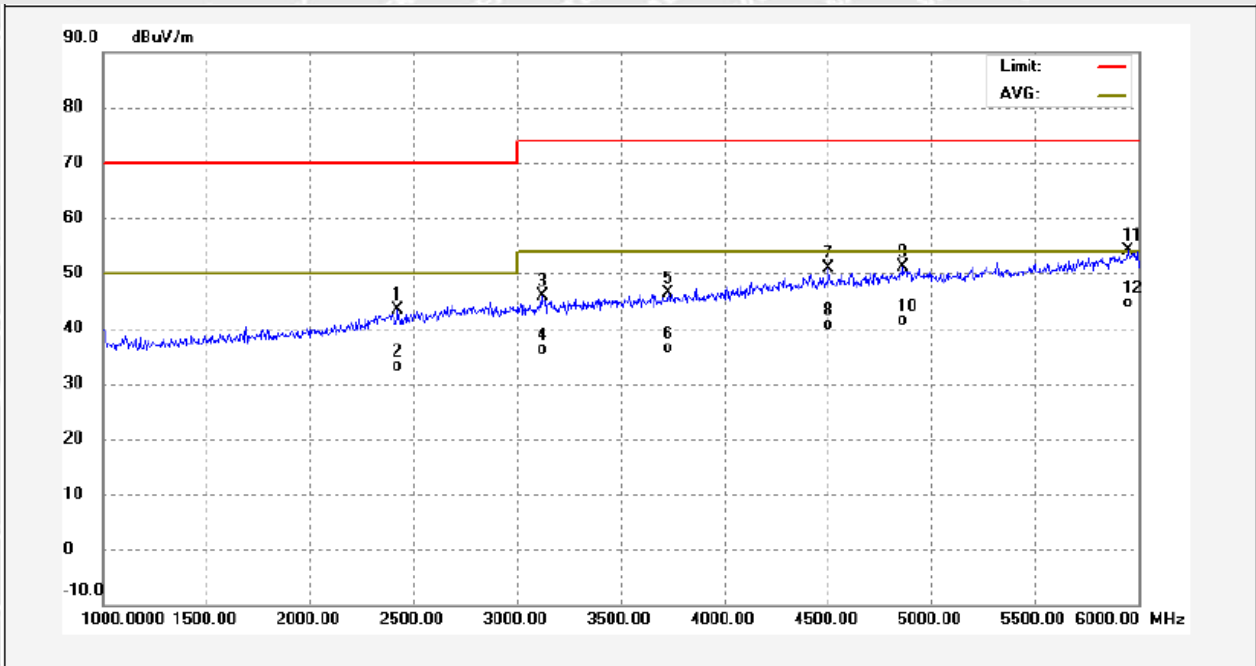
Vertical Polarization



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2430.500	12.24	32.41	44.65	70.00	-25.35	peak	
2	2430.500	1.84	32.41	34.25	50.00	-15.75	AVG	
3	2983.000	11.07	33.86	44.93	70.00	-25.07	peak	
4	2983.000	0.24	33.86	34.10	50.00	-15.90	AVG	
5	4115.000	11.54	36.28	47.82	74.00	-26.18	peak	
6	4115.000	1.14	36.28	37.42	54.00	-16.58	AVG	
7	4884.500	13.03	38.48	51.51	74.00	-22.49	peak	
8	4884.500	2.81	38.48	41.29	54.00	-12.71	AVG	
9	5500.500	12.46	39.60	52.06	74.00	-21.94	peak	
10	5500.500	2.58	39.60	42.18	54.00	-11.82	AVG	
11	5963.500	13.14	40.83	53.97	74.00	-20.03	peak	
12	5963.500	2.86	40.83	43.69	54.00	-10.31	AVG	



Horizontal Polarization

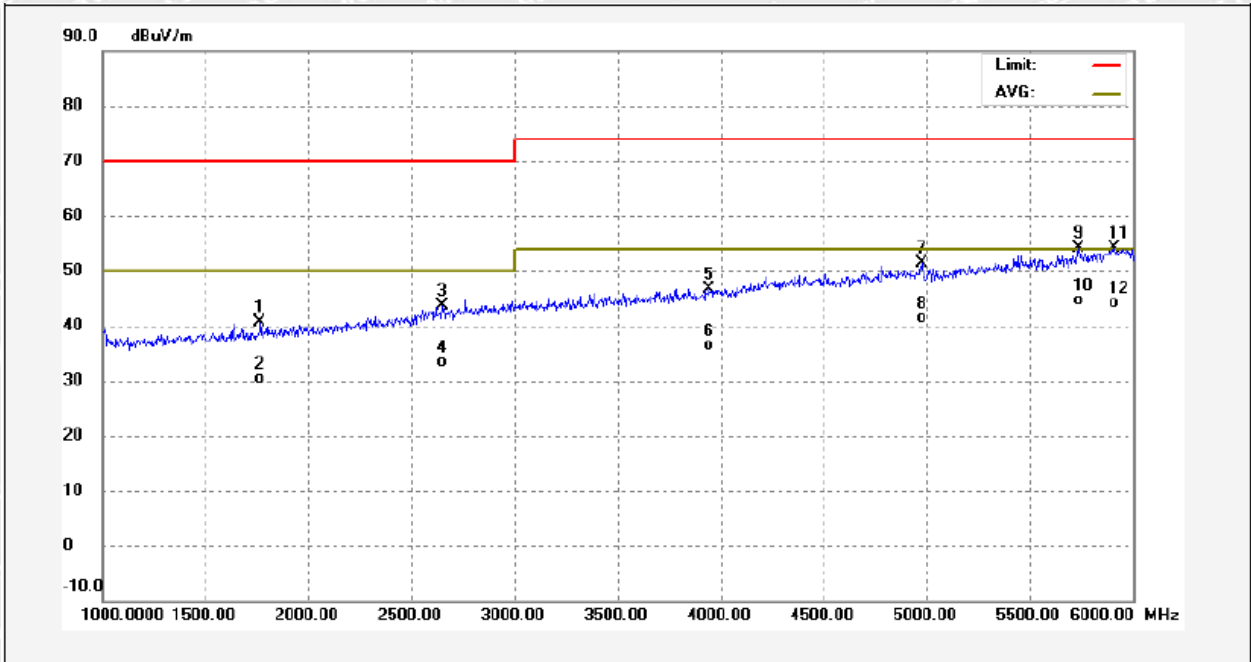


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2429.500	10.91	32.41	43.32	70.00	-26.68	peak	
2	2429.500	0.80	32.41	33.21	50.00	-16.79	AVG	
3	3124.500	11.90	34.10	46.00	74.00	-28.00	peak	
4	3124.500	2.14	34.10	36.24	54.00	-17.76	AVG	
5	3731.000	11.00	35.28	46.28	74.00	-27.72	peak	
6	3731.000	1.01	35.28	36.29	54.00	-17.71	AVG	
7	4508.000	13.35	37.49	50.84	74.00	-23.16	peak	
8	4508.000	3.02	37.49	40.51	54.00	-13.49	AVG	
9	4868.000	12.77	38.44	51.21	74.00	-22.79	peak	
10	4868.000	2.98	38.44	41.42	54.00	-12.58	AVG	
11	5954.500	13.23	40.81	54.04	74.00	-19.96	peak	
12	5954.500	3.83	40.81	44.64	54.00	-9.36	AVG	



BT link mode

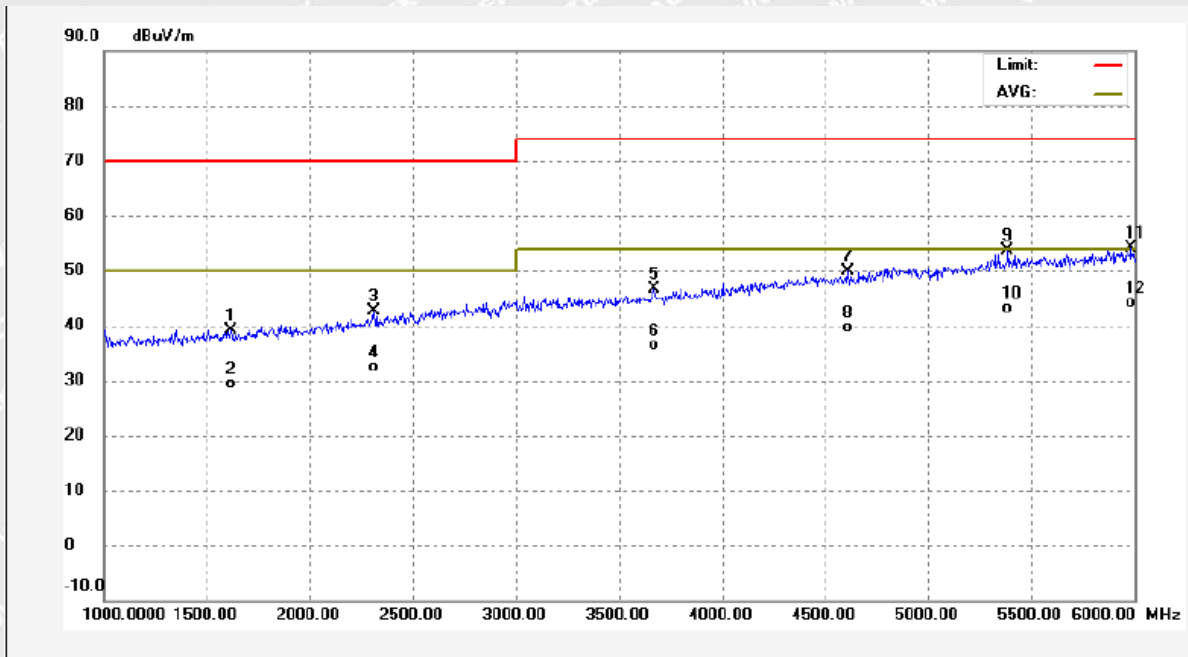
Vertical Polarization



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1768.500	10.39	30.25	40.64	70.00	-29.36	peak	
2	1768.500	0.01	30.25	30.26	50.00	-19.74	AVG	
3	2653.000	10.56	33.06	43.62	70.00	-26.38	peak	
4	2653.000	0.22	33.06	33.28	50.00	-16.72	AVG	
5	3948.500	10.93	35.81	46.74	74.00	-27.26	peak	
6	3948.500	0.61	35.81	36.42	54.00	-17.58	AVG	
7	4978.000	12.69	38.73	51.42	74.00	-22.58	peak	
8	4978.000	2.56	38.73	41.29	54.00	-12.71	AVG	
9	5739.500	13.77	40.24	54.01	74.00	-19.99	peak	
10	5739.500	4.34	40.24	44.58	54.00	-9.42	AVG	
11	5911.000	13.48	40.69	54.17	74.00	-19.83	peak	
12	5911.000	3.37	40.69	44.06	54.00	-9.94	AVG	



Horizontal Polarization



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1618.000	9.05	30.02	39.07	70.00	-30.93	peak	
2	1618.000	-0.73	30.02	29.29	50.00	-20.71	AVG	
3	2310.500	10.77	31.90	42.67	70.00	-27.33	peak	
4	2310.500	0.46	31.90	32.36	50.00	-17.64	AVG	
5	3673.500	11.43	35.14	46.57	74.00	-27.43	peak	
6	3673.500	1.27	35.14	36.41	54.00	-17.59	AVG	
7	4613.000	12.22	37.76	49.98	74.00	-24.02	peak	
8	4613.000	1.76	37.76	39.52	54.00	-14.48	AVG	
9	5388.500	14.09	39.42	53.51	74.00	-20.49	peak	
10	5388.500	3.83	39.42	43.25	54.00	-10.75	AVG	
11	5985.000	13.30	40.89	54.19	74.00	-19.81	peak	
12	5985.000	3.19	40.89	44.08	54.00	-9.92	AVG	



6 Immunity Test Results

6.1 Performance Criteria

Performance criterion A: The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended.

Performance criterion B: After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test

Performance criterion C: 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. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

WALTEK



6.2 Electrostatic Discharge (ESD)

Test Requirement	: EN 55035
Test Method	: IEC 61000-4-2
Test Result	: Pass
Discharge Impedance	: 330Ω / 150pF
Discharge Voltage	Air Discharge: ±8kV Contact Discharge: ±4kV HCP & VCP: ±4kV
Polarity	: Positive & Negative
Number of Discharge	: Minimum 10 times at each test point
Discharge Mode	: Single Discharge
Discharge Period	: 1 second minimum

6.2.1 E.U.T. Operation

Operating Environment:

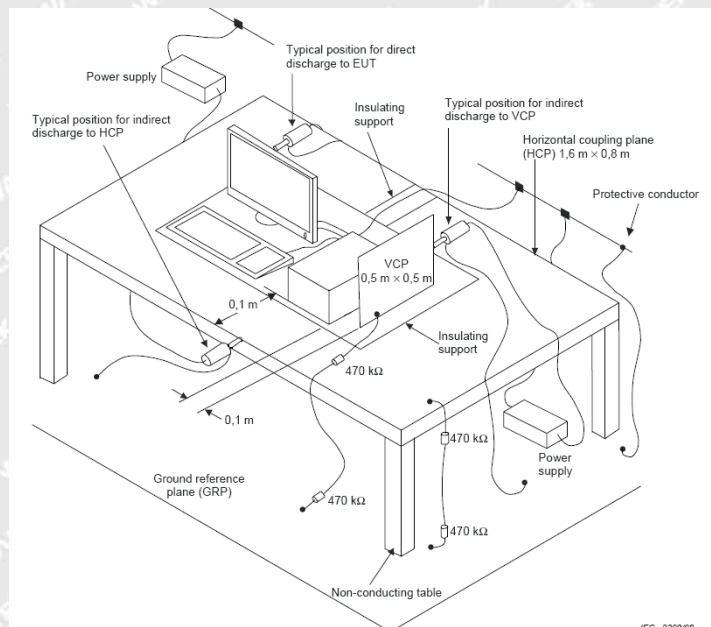
Temperature	: 21.2°C
Humidity	: 51.9%RH
Barometric Pressure	: 100.9kPa

EUT Operation:

Input Voltage	: AC 230V/50Hz for mode 1; Battery 3.7V for mode 2
Operating Mode	: Mode 1: Charging mode Mode 2: BT link mode

6.2.2 Block Diagram of Setup

The ESD test was performed in accordance with the IEC 61000-4-2.





6.2.3 Direct Discharge Test Results

Observations:

Test points:

1. All Exposed Surface & Seams;
2. All metallic part

Direct Discharge			Test Results	
Applied Voltage (kV)	Performance Criterion	Test Point	Contact Discharge	Air Discharge
±8	B	1	N/A	Pass*
±4	B	2	Pass*	N/A

Remark:

- * During the test no deviation was detected to the selected operation mode(s)

6.2.4 Indirect Discharge Test Results

Observations:

Test points:

1. All sides.

Indirect Discharge			Test Results	
Applied Voltage (kV)	Performance Criterion	Test Point	Horizontal Coupling	Vertical Coupling
±4	B	1	Pass*	Pass*

Remark:

- * During the test no deviation was detected to the selected operation mode(s)



6.3 Continuous RF Electromagnetic Field Disturbances

Test Requirement	: EN 55035
Test Method	: IEC 61000-4-3
Test Result	: Pass
Frequency Range	: 80MHz to 1000MHz, 1800MHz, 2600MHz, 3500MHz, 5000MHz
Test level	: 3V/m
Modulation	: 80%, 1kHz Amplitude Modulation.
Face of EUT	: Front, Back, Left, Right
Antenna polarisation.....	: Horizontal & Vertical
Test Distance	: 3m

6.3.1E.U.T. Operation

Operating Environment:

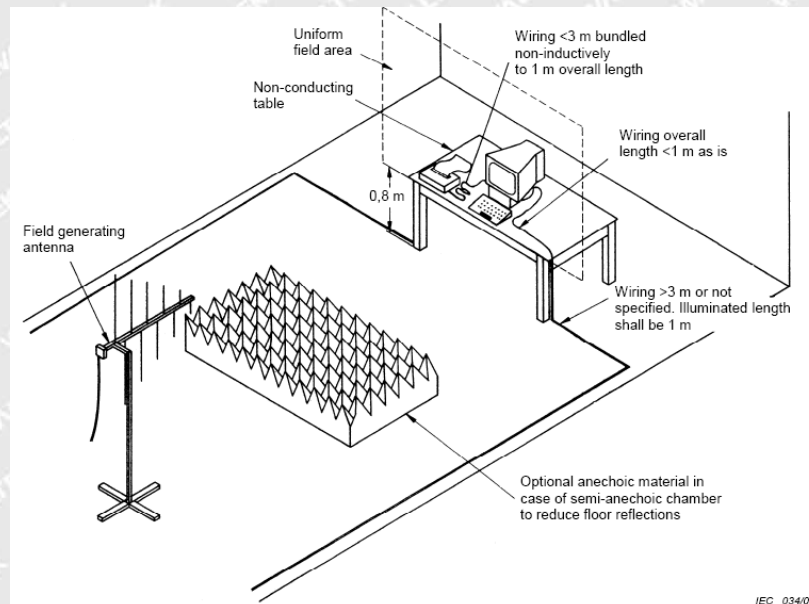
Temperature.....	: 21.1°C
Humidity	: 51.7%RH
Barometric Pressure	: 100.9kPa

EUT Operation:

Input Voltage.....	: AC 230V/50Hz for mode 1; Battery 3.7V for mode 2
Operating Mode	: Mode 1: Charging mode Mode 2: BT link mode

6.3.2 Block Diagram of Setup

The Radio-frequency electromagnetic fields Immunity test was performed in accordance with the IEC 61000-4-3.





6.3.3 Test Results

Frequency	Face of EUT	Antenna polarisation	Test Level	Step Size	Dwell Time	Performance Criterion	Result
80 to 1000MHz	Front, Back, Left, Right	Horizontal	3V/m	1%	1s	A	Pass*
80 to 1000MHz	Front, Back, Left, Right	Vertical	3V/m	1%	1s	A	Pass*
1800MHz	Front, Back, Left, Right	Horizontal	3V/m	1%	1s	A	Pass*
1800MHz	Front, Back, Left, Right	Vertical	3V/m	1%	1s	A	Pass*
2600MHz	Front, Back, Left, Right	Horizontal	3V/m	1%	1s	A	Pass*
2600MHz	Front, Back, Left, Right	Vertical	3V/m	1%	1s	A	Pass*
3500MHz	Front, Back, Left, Right	Horizontal	3V/m	1%	1s	A	Pass*
3500MHz	Front, Back, Left, Right	Vertical	3V/m	1%	1s	A	Pass*
5000MHz	Front, Back, Left, Right	Horizontal	3V/m	1%	1s	A	Pass*
5000MHz	Front, Back, Left, Right	Vertical	3V/m	1%	1s	A	Pass*

Remark:

- * During the test no deviation was detected to the selected operation mode(s)



6.4 Electrical Fast Transients (EFT)

Test Requirement	: EN 55035
Test Method	: IEC 61000-4-4
Test Result	: Pass
Test Level	: 1.0kV on AC Mains
Polarity	: Positive & Negative
Repetition Frequency....	: 5kHz
Burst Duration	: 5/50ns
Test Duration	: 2 minutes per level & polarity

6.4.1E.U.T. Operation

Operating Environment:

Temperature.....	: 21.4°C
Humidity	: 52.3%RH
Barometric Pressure	: 100.9kPa

EUT Operation:

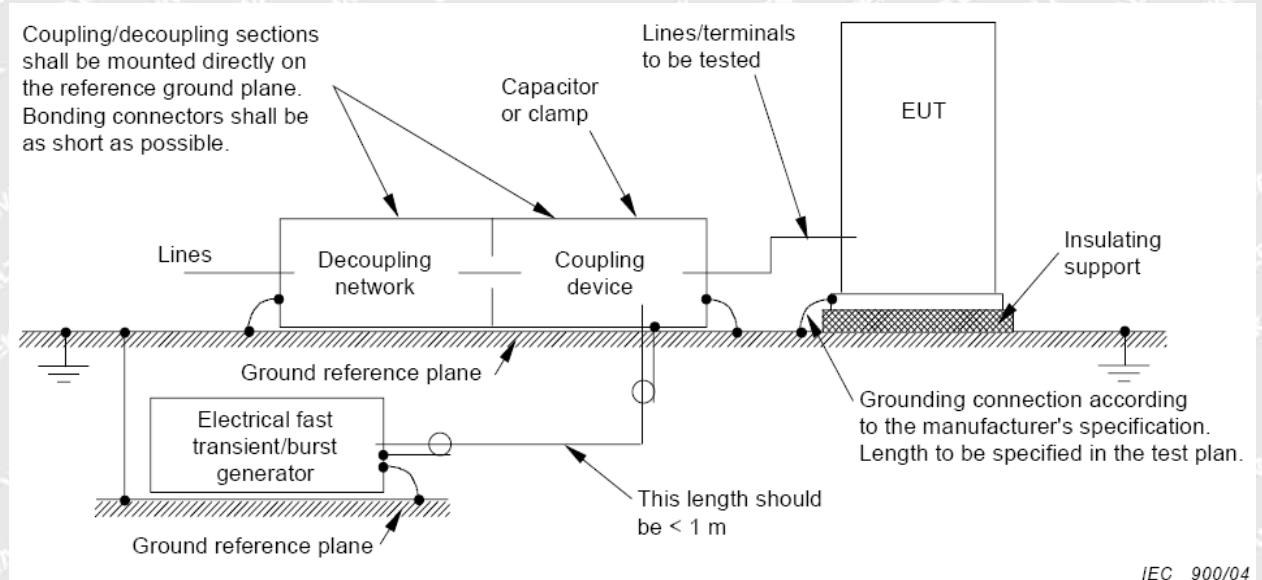
Input Voltage.....	: AC 230V/50Hz
Operating Mode	: Charging mode

WALTEK



6.4.2 Block Diagram of Setup

The Electrical Fast Transients Immunity test was performed in accordance with the IEC 61000-4-4.



6.4.3 Test Results

Test Port	Test Level(kV)	Performance Criterion	Result
Line-Neutral	± 1.0	B	Pass*

Remark:

- * During the test no deviation was detected to the selected operation mode(s)



6.5 Surge

Test Requirement : EN 55035

Test Method : IEC 61000-4-5

Test Result : Pass

Test level : $\pm 1\text{kV}$ Live to Neutral, $\pm 2\text{kV}$ Live to PE and Neutral to PE

Interval : 60s between each surge

No. of surges : five positive and five negative pulses each at 0° , 90° , 180° and at 270°

6.5.1E.U.T. Operation

Operating Environment:

Temperature : 21.4°C

Humidity : 51.7%RH

Barometric Pressure : 100.9kPa

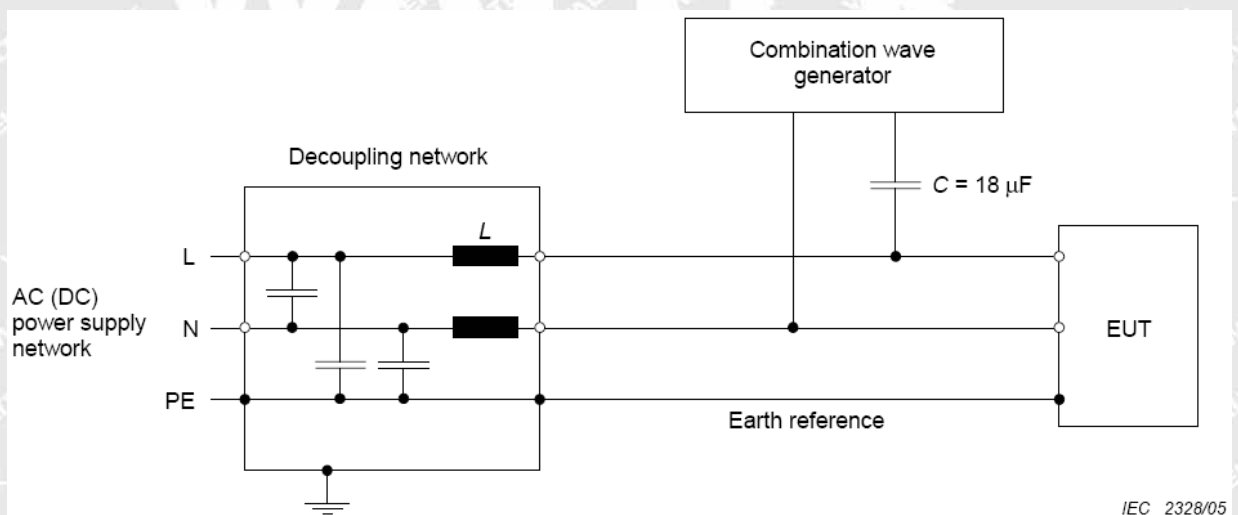
EUT Operation:

Input Voltage : AC 230V/50Hz

Operating Mode : Charging mode

6.5.2Block Diagram of Setup

The Surge Immunity test was performed in accordance with the IEC 61000-4-5.





6.5.3 Test Result

Test Port	Applied Voltage (kV)	Performance criterion	Result
Between Phase And Phase	± 1	B	N/A
Between Live And Neutral	± 1	B	Pass*
Between Live And Earth	± 2	B	N/A
Between Neutral And Earth	± 2	B	N/A

Remark:

* During the test no deviation was detected to the selected operation mode(s)

WALTEK



6.6 Continuous Induced RF Disturbance

Test Requirement : EN 55035

Test Method : IEC 61000-4-6

Test Result : Pass

Frequency Range : 0.15 to 10MHz, 10 to 30MHz, 30 to 80MHz

Test level : 3V r.m.s. /3~1V r.m.s. / 1V r.m.s. (unmodulated emf into 150 Ω)

Modulation : 80%, 1kHz Amplitude Modulation.

6.6.1E.U.T. Operation

Operating Environment:

Temperature..... : 21.3°C

Humidity : 52.1%RH

Barometric Pressure : 100.9kPa

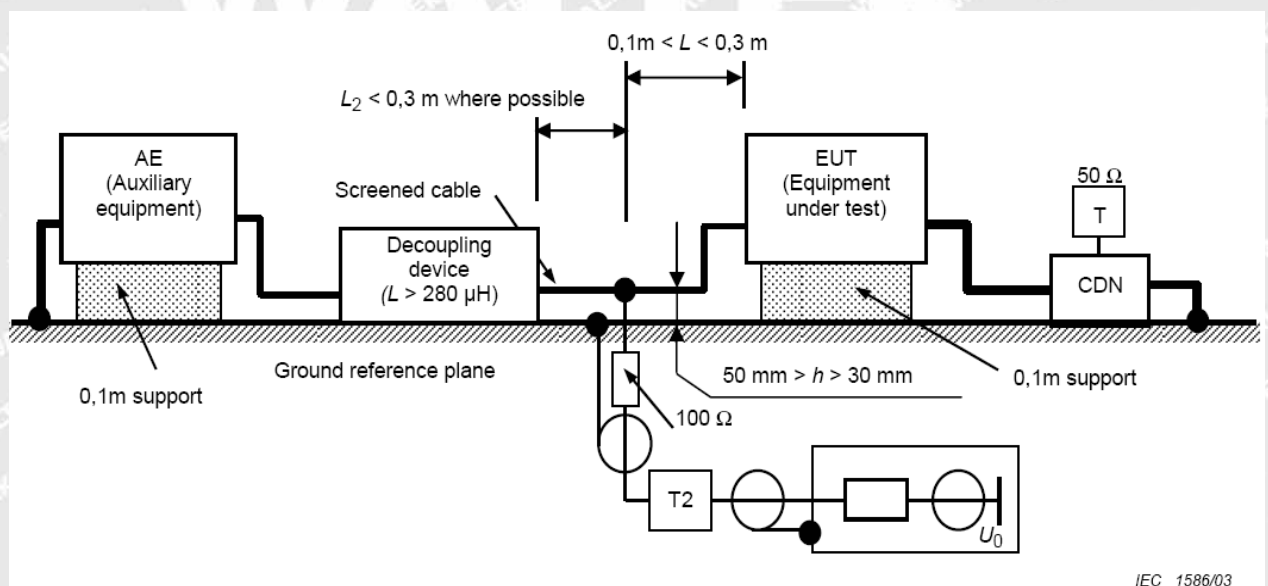
EUT Operation:

Input Voltage..... : AC 230V/50Hz

Operating Mode : Charging mode

6.6.2 Block Diagram of Setup

The Injected Currents Immunity test was performed in accordance with the IEC 61000-4-6.





6.6.3Test Results

Frequency	Line	Test Level	Modulation	Step Size	Dwell Time	Performance Criterion	Result
0.15MHz to 10MHz	2 Wire AC Supply Cables	3Vr.m.s.	80%, 1kHz Amp. Mod.	1%	1s	A	Pass*
10MHz to 30MHz	2 Wire AC Supply Cables	3 to 1 Vr.m.s.	80%, 1kHz Amp. Mod.	1%	1s	A	Pass*
30MHz to 80MHz	2 Wire AC Supply Cables	1Vr.m.s.	80%, 1kHz Amp. Mod.	1%	1s	A	Pass*

Remark:

* During the test no deviation was detected to the selected operation mode(s)

WALTEK



6.7 Voltage Dips and Interruptions

Test Requirement : EN 55035
Test Method : IEC 61000-4-11
Test Result : Pass
Test Level(Voltage reduction) : >90% & 30 % of Induction
No. of Dips / Interruptions : 1 per Level at 20ms intervals

6.7.1E.U.T. Operation

Operating Environment:

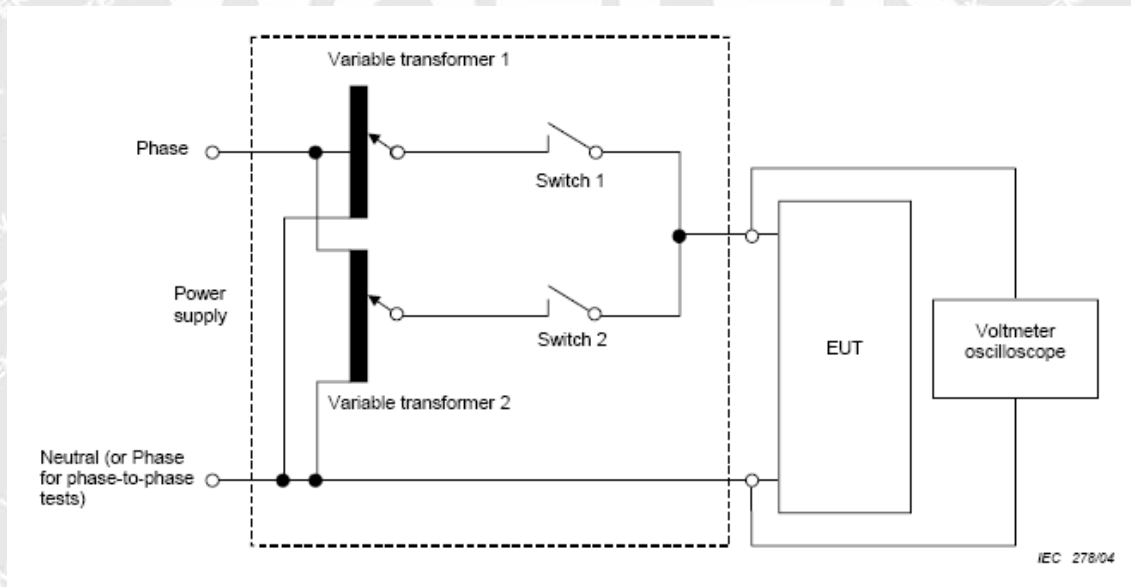
Temperature : 21.6°C
Humidity : 51.4%RH
Barometric Pressure : 100.9kPa

EUT Operation:

Input Voltage : AC 230V/50Hz
Operating Mode : Charging mode

6.7.2 Block Diagram of Setup

The Voltage Dips and Interruptions Immunity test was performed in accordance with the IEC 61000-4-11.





6.7.3Test Results

Test Item	Test Level in %U _T	Performance criterion	50Hz		60Hz	
			Duration	Result	Duration	Result
Voltage Dips	< 5	B	0.5	Pass*	0.5	Pass*
	70	C	25	Pass*	30	Pass*
Voltage Interruptions	< 5	C	250	Pass*	300	Pass*

Remark:

* During the test no deviation was detected to the selected operation mode(s)

WALTEK



7 Photographs – Test Setup

7.1 Photograph – Mains Terminal Disturbance Voltage Test Setup



7.2 Photograph – Radiated Emission Test Setup, 30MHz to 1GHz

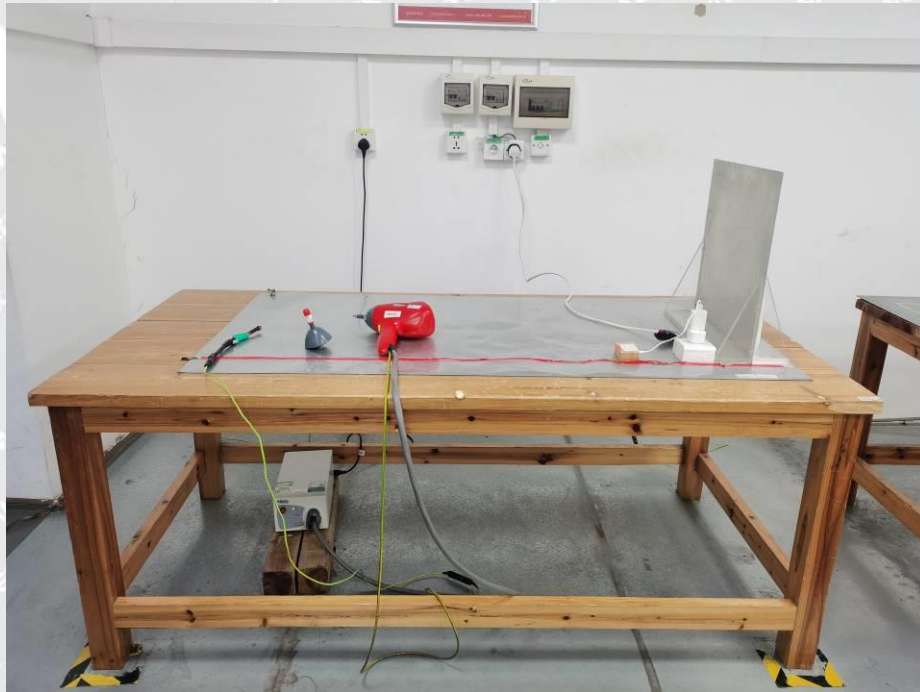




7.3 Photograph – Radiated Emission Test Setup, 1GHz to 6GHz



7.4 Photograph – ESD Immunity Test Setup





7.5 Photograph – Continuous RF Electromagnetic Field Disturbances Test Setup



7.6 Photograph – EFT Immunity Test Setup

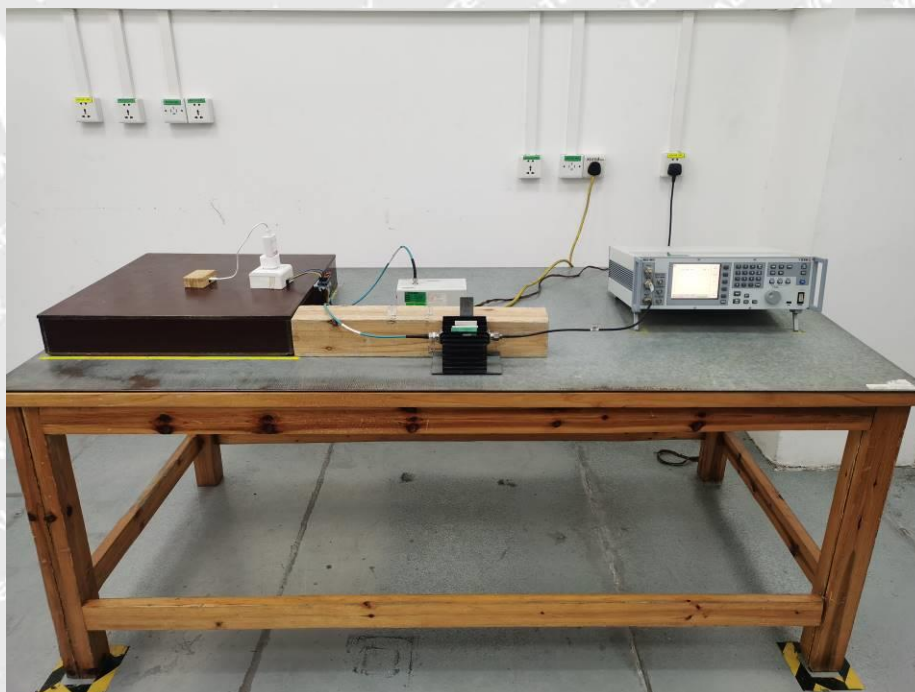




7.7 Photograph – Surge Immunity Test Setup

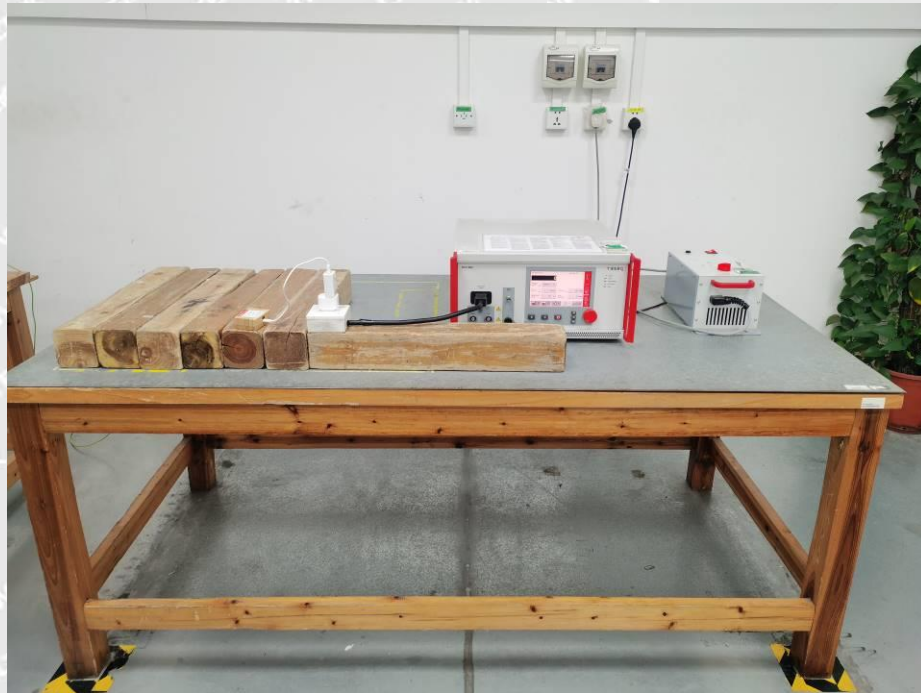


7.8 Photograph – Continuous Induced RF Disturbance Test Setup





7.9 Photograph – Voltage Dips and Interruptions Immunity Test Setup



WALTEK



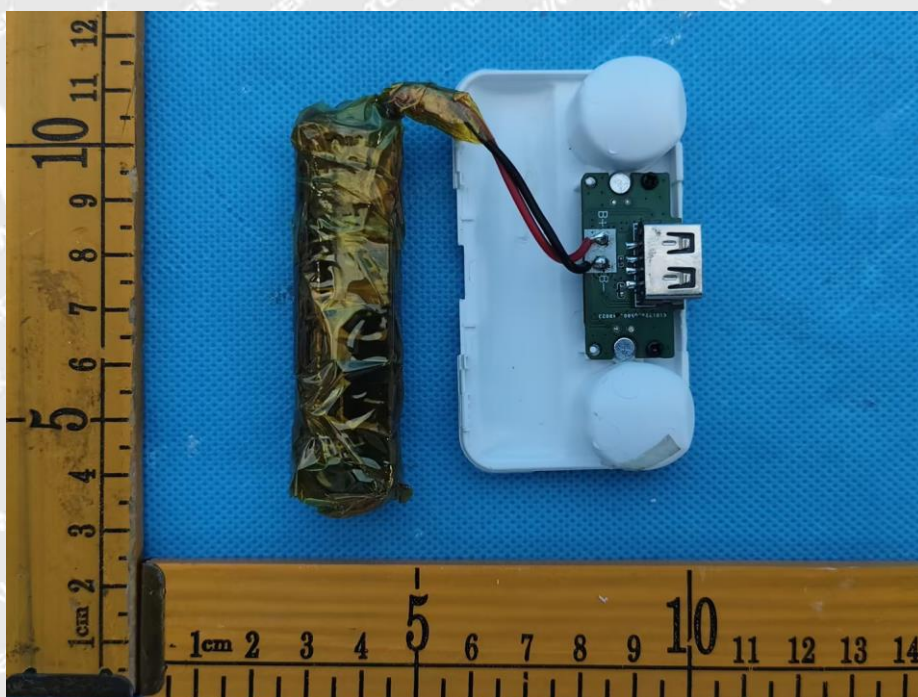
8 Photographs – Constructional Details

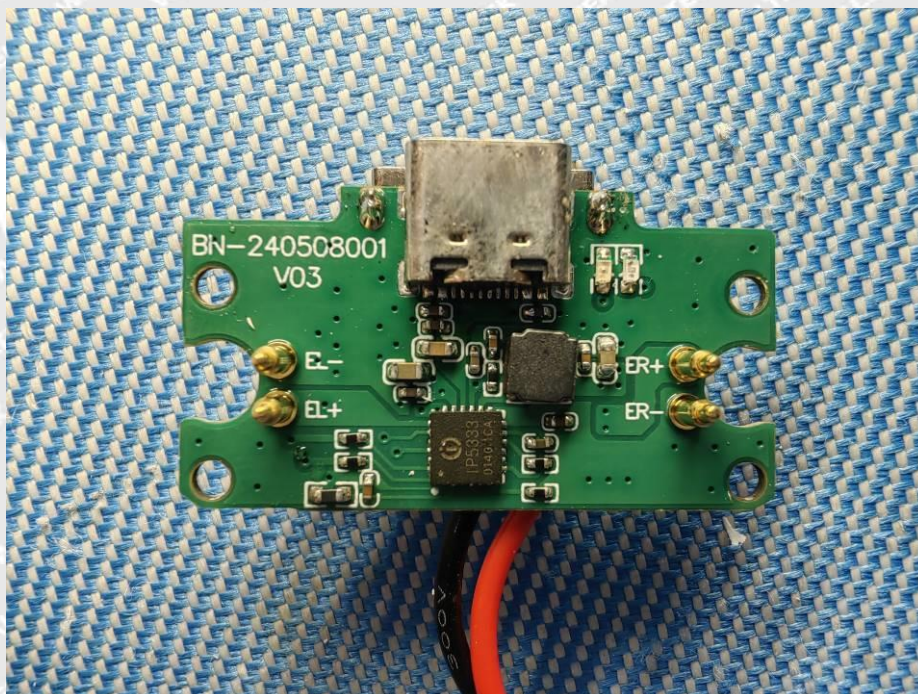
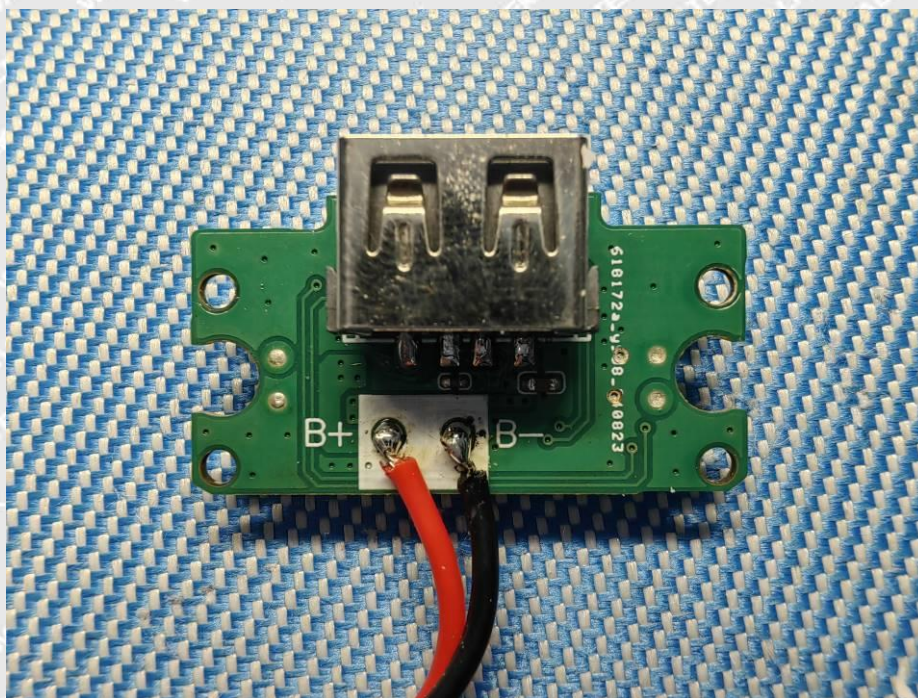
8.1 EUT – External Photos

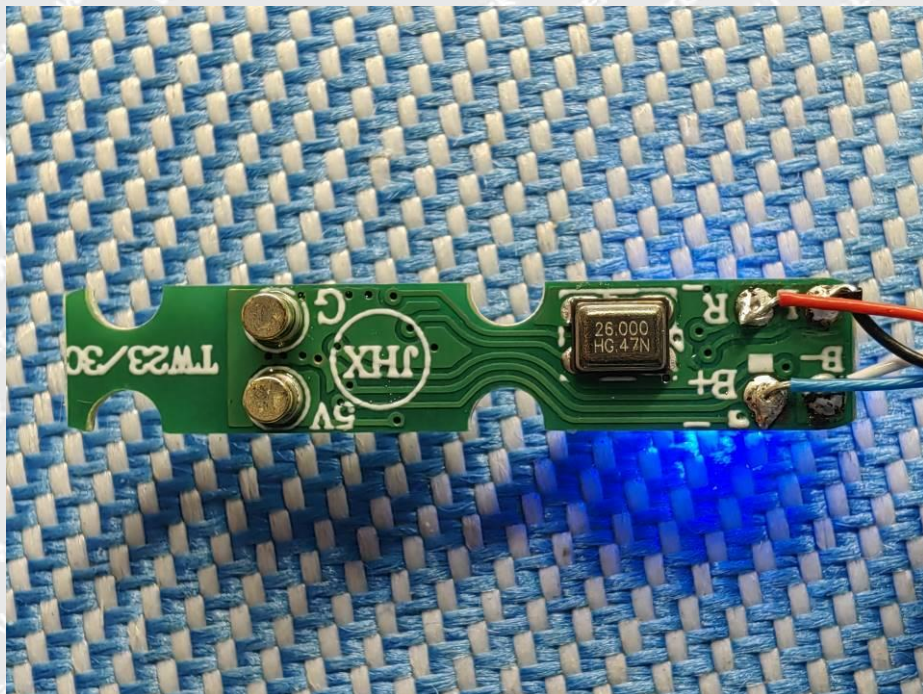
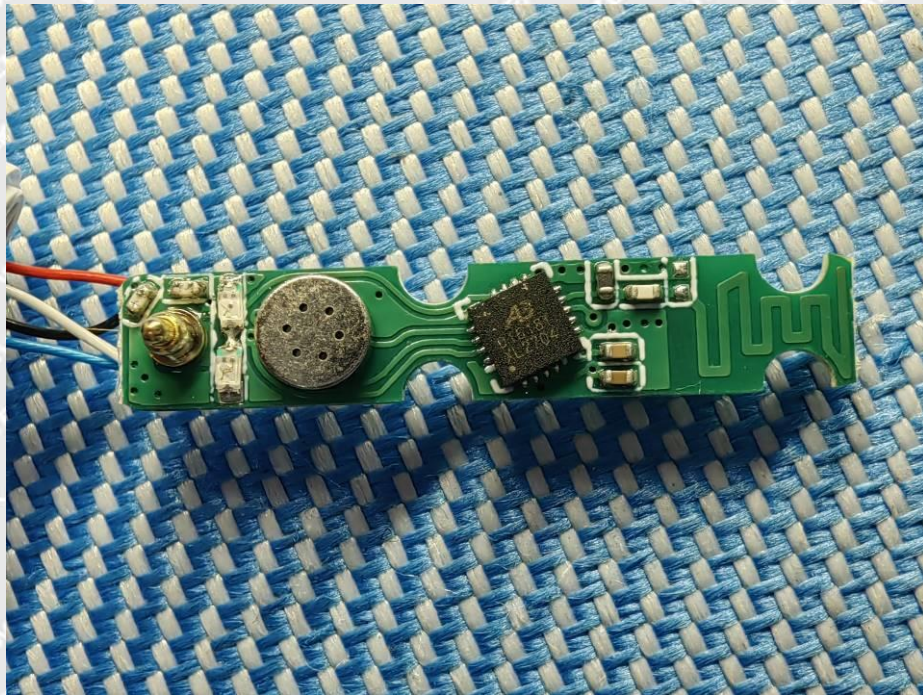


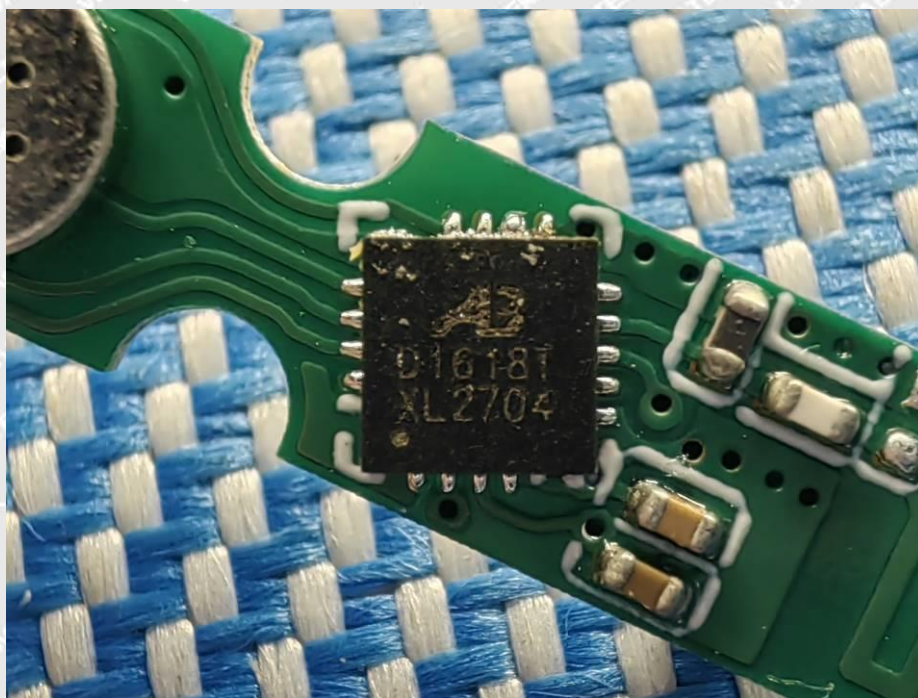


8.2 EUT – Internal Photos









===== End of Report =====

WALTEK