



中国认可  
国际互认  
检测  
TESTING  
CNAS L6478



# TEST REPORT

**Reference No.**..... : WTF25F05116761W003  
**Applicant**..... : Mid Ocean Brands B.V.  
**Address**..... : Unit 711-716, 7/F., Tower A, 83 King Lam Street, Cheung Sha Wan,  
Kowloon, Hong Kong.  
**Manufacturer** ..... : 106613  
**Address**..... : ---  
**Product Name**..... : Recycled PU wireless speaker  
**Model No.**..... : MO2173  
**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** .... : 2025-06-09  
**Date of Test** ..... : 2025-06-16 to 2025-06-17  
**Date of Issue**..... : 2025-06-23  
**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,  
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                                                    | Pass               |
| 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 IEC 61000-3-2 | Clause 7 of EN IEC 61000-3-2                                              | Pass <sup>a)</sup> |
| 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                                                  | Pass <sup>b)</sup> |
| 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     | ±2/±4 kV Contact<br>±2/±4/±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±0.5/1.0kV                                                              | Pass               |
| Surge                                                      | ETSI EN 301 489-17 V3.2.4 | ETSI EN 301 489-1 V2.2.3 EN 61000-4-5     | ±1kV D.M.†<br>±2kV C.M.‡                                                  | Pass               |
| 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.                                           | Pass               |
| 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 | Pass               |

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

a) According to the electrical characteristics and usage of the equipment, the EUT will not produce harmonics which might exceed the limits specified by the relevant standard. Therefore the requirements deem to be fulfilled without further testing.

b) According to the electrical characteristics and usage of the equipment, it is unlikely to produce significant voltage fluctuation or flicker. EUT is deemed to fulfil the requirement without testing.



## 2 Contents

|                                                                     | Page      |
|---------------------------------------------------------------------|-----------|
| <b>1 TEST SUMMARY</b>                                               | <b>2</b>  |
| <b>2 CONTENTS</b>                                                   | <b>3</b>  |
| <b>3 GENERAL INFORMATION</b>                                        | <b>4</b>  |
| 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                                                   | 4         |
| 3.6 SUBCONTRACTED                                                   | 5         |
| 3.7 ABNORMALITIES FROM STANDARD CONDITIONS                          | 5         |
| <b>4 EQUIPMENT USED DURING TEST</b>                                 | <b>6</b>  |
| 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         |
| <b>5 EMC REQUIREMENTS FOR EMISSIONS</b>                             | <b>10</b> |
| 5.1 CONDUCTED EMISSION                                              | 10        |
| 5.2 RADIATED EMISSION                                               | 13        |
| <b>6 EMC REQUIREMENT FOR IMMUNITY</b>                               | <b>23</b> |
| 6.1 PERFORMANCE CRITERIA                                            | 23        |
| 6.2 ELECTROSTATIC DISCHARGE(ESD)                                    | 24        |
| 6.3 RF ELECTROMAGNETIC FIELD (80MHZ TO 6 000MHZ) (RS)               | 26        |
| 6.4 FAST TRANSIENTS COMMON MODE (EFT)                               | 28        |
| 6.5 SURGES                                                          | 30        |
| 6.6 RF COMMON MODE 0,15 MHZ TO 80MHZ (CS)                           | 32        |
| 6.7 VOLTAGE DIPS AND INTERRUPTIONS                                  | 34        |
| <b>7 PHOTOGRAPHS - TEST SETUP</b>                                   | <b>35</b> |
| 7.1 PHOTOGRAPH - RADIATED EMISSIONS TEST SETUP                      | 35        |
| 7.2 PHOTOGRAPH - CONDUCTED EMISSIONS TEST SETUP                     | 36        |
| 7.3 PHOTOGRAPH - RF ELECTROMAGNETIC FIELD TEST SETUP                | 36        |
| 7.4 PHOTOGRAPH - ESD TEST SETUP                                     | 37        |
| 7.5 PHOTOGRAPH - EFT IMMUNITY TEST SETUP                            | 37        |
| 7.6 PHOTOGRAPH - SURGE IMMUNITY TEST SETUP                          | 38        |
| 7.7 PHOTOGRAPH - RADIO-FREQUENCY COMMON MODE TEST SETUP             | 38        |
| 7.8 PHOTOGRAPH - VOLTAGE DIPS AND INTERRUPTIONS IMMUNITY TEST SETUP | 39        |
| <b>8 PHOTOGRAPHS – EUT CONSTRUCTIONAL DETAILS</b>                   | <b>40</b> |



### 3 General Information

#### 3.1 General Description of E.U.T.

**Product Name** ..... : Recycled PU wireless speaker

**Model No.** ..... : MO2173

**Remark** ..... : ---

#### 3.2 Details of E.U.T.

**Technical Data** ..... : Input: DC 5V, 0.5A  
Battery: 3.7V, 300mAh, 1.11Wh

#### 3.3 Description of Support Units

The EUT has been tested as an independent unit. MO2173 is the test sample. The full tests were performed in the condition of AC 230V/50Hz input 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:

|                                       |                                                                                                                                                                                   |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ETSI EN 301 489-1<br>V2.2.3 (2019-11) | ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;<br>Part 1: Common technical requirements; Harmonised Standard for<br>ElectroMagnetic Compatibility |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                        |                                                                                                                                                                                                                  |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ETSI EN 301 489-17<br>V3.2.4 (2020-09) | ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;<br>Part 17: Specific conditions for Broadband Data Transmission Systems;<br>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.

# WALTEK



## 4 Equipment Used during Test

### 4.1 Equipment List

| <input type="checkbox"/> 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       | 2025-01-06 | 2026-01-05 |
| 2.                                                                                            | LISN                     | R&S                     | ENV216              | 101343       | 2025-01-06 | 2026-01-05 |
| 3.                                                                                            | Cable                    | HUBER+SUHNER            | CBL2-NN-6M          | 223NN624     | 2025-01-06 | 2026-01-05 |
| 4.                                                                                            | Switch                   | CD                      | RSU-A4              | RSUA4008     | 2025-01-06 | 2026-01-05 |
| <input checked="" type="checkbox"/> 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       | 2025-01-06 | 2026-01-05 |
| 2.                                                                                            | LISN                     | R&S                     | ENV216              | 101215       | 2025-01-07 | 2026-01-06 |
| 3.                                                                                            | Cable 22                 | Times Microwave Systems | LMR195UF-BMNM-5.00M | ---          | 2025-01-08 | 2026-01-07 |
| 4.                                                                                            | Switch                   | ESE                     | RSU/M2              | ---          | 2025-01-06 | 2026-01-05 |
| <input type="checkbox"/> 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       | 2025-01-06 | 2026-01-05 |
| 2.                                                                                            | LISN                     | R&S                     | ENV216              | 101542       | 2025-01-06 | 2026-01-05 |
| 3.                                                                                            | Cable 12                 | YIHENG                  | LMR195UF-NMNM-2.5   | ---          | 2025-01-06 | 2026-01-05 |
| 4.                                                                                            | Manual RF Switch         | Top Precision           | SW-2                | RSU0402      | 2025-01-06 | 2026-01-05 |
| <input checked="" type="checkbox"/> 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            | ---          | 2024-01-05 | 2027-01-04 |
| 2.                                                                                            | EMI Test Receiver        | R&S                     | ESR7                | 101566       | 2025-01-06 | 2026-01-05 |
| 3.                                                                                            | Trilog Broadband Antenna | SCHWARZBECK             | VULB 9162           | 9162-117     | 2025-01-12 | 2026-01-11 |
| 4.                                                                                            | Cable 20                 | Times Microwave Systems | RG223-NMNM-10M      | ---          | 2025-01-06 | 2026-01-05 |
| 5.                                                                                            | Cable 21                 | Times Microwave Systems | RG223-NMNM-3M       | ---          | 2025-01-06 | 2026-01-05 |
| <input type="checkbox"/> 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 | 2027-01-05 |
| 2.                                                                                            | EMI Test Receiver        | R&S                     | ESR7                | 102454       | 2025-01-06 | 2026-01-05 |
| 3.                                                                                            | Trilog Broadband Antenna | SCHWARZBECK             | VULB 9163           | 01418        | 2025-02-08 | 2026-02-07 |
| 4.                                                                                            | Cable 14                 | YIHENG                  | LMR240UF-NMSM-7.5   | ---          | 2025-01-06 | 2026-01-05 |



| <input checked="" type="checkbox"/> <b>Radiated Emission (1GHz to 6GHz) 1#</b>      |                                        |                         |               |              |            |            |
|-------------------------------------------------------------------------------------|----------------------------------------|-------------------------|---------------|--------------|------------|------------|
| Item                                                                                | Equipment                              | Manufacturer            | Model No.     | Serial No.   | Cal Date   | Due Date   |
| 1.                                                                                  | 3m Semi-anechoic Chamber               | CHANGCHUANG             | 9m×6m×6m      | -            | 2024-01-05 | 2027-01-04 |
| 2.                                                                                  | EMI Test Receiver                      | R&S                     | ESR7          | 101566       | 2025-01-06 | 2026-01-05 |
| 3.                                                                                  | Broad-band Horn Antenna                | SCHWARZBECK             | BBHA 9120 D   | 01561        | 2025-01-13 | 2026-01-12 |
| 4.                                                                                  | Coaxial Cable (above 1GHz)             | Times-Microwave         | CBL5-NN       | -            | 2025-01-06 | 2026-01-05 |
| 5.                                                                                  | Preamplifier                           | Lunar E M               | LNA1G18-40    | 20160501002  | 2025-01-06 | 2026-01-05 |
| <input type="checkbox"/> <b>Radiated Emission (1GHz to 6GHz) 2#</b>                 |                                        |                         |               |              |            |            |
| Item                                                                                | Equipment                              | Manufacturer            | Model No.     | Serial No.   | Cal Date   | Due Date   |
| 1.                                                                                  | 3m Semi-anechoic Chamber               | YIHENG                  | 9m×6m×6m      | YH2021071801 | 2024-01-06 | 2027-01-05 |
| 2.                                                                                  | EMI Test Receiver                      | R&S                     | ESR7          | 102454       | 2025-01-06 | 2026-01-05 |
| 3.                                                                                  | Broad-band Horn Antenna                | SCHWARZBECK             | BBHA9120D     | 02465        | 2025-01-13 | 2026-01-12 |
| 4.                                                                                  | Coaxial Cable (above 1GHz)             | Times-Microwave Systems | SFT205-NMSM-7 | -            | 2025-01-06 | 2026-01-05 |
| 5.                                                                                  | Preamplifier                           | Tonscend                | TAP0118045    | AP21J806168  | 2025-01-06 | 2026-01-05 |
| <input type="checkbox"/> <b>Harmonics and Flicker Measuring System</b>              |                                        |                         |               |              |            |            |
| Item                                                                                | Equipment                              | Manufacturer            | Model No.     | Serial No.   | Cal Date   | Due Date   |
| 1.                                                                                  | Harmonics and Flicker Measuring System | YUANFANG                | HFM-3000      | V200         | 2025-01-07 | 2026-01-06 |
| <input checked="" type="checkbox"/> <b>ESD</b>                                      |                                        |                         |               |              |            |            |
| Item                                                                                | Equipment                              | Manufacturer            | Model No.     | Serial No.   | Cal Date   | Due Date   |
| 1.                                                                                  | ESD Simulator                          | TESEQ                   | NSG437        | 521          | 2025-01-06 | 2026-01-05 |
| <input checked="" type="checkbox"/> <b>EFT &amp; Voltage Dips and Interruptions</b> |                                        |                         |               |              |            |            |
| Item                                                                                | Equipment                              | Manufacturer            | Model No.     | Serial No.   | Cal Date   | Due Date   |
| 1.                                                                                  | EMS test system                        | TESEQ                   | NSG3040       | 1858         | 2025-01-06 | 2026-01-05 |
| 2.                                                                                  | Step transformer                       | TESEQ                   | INA6501       | 206          | 2025-01-06 | 2026-01-05 |
| 3.                                                                                  | Coupling clamp                         | TESEQ                   | CDN8014       | 31405        | 2025-01-07 | 2026-01-06 |
| <input checked="" type="checkbox"/> <b>Surge</b>                                    |                                        |                         |               |              |            |            |
| Item                                                                                | Equipment                              | Manufacturer            | Model No.     | Serial No.   | Cal Date   | Due Date   |
| 1.                                                                                  | Surge Simulator                        | TESEQ                   | NSG3060       | 1395         | 2025-01-06 | 2026-01-05 |
| <input checked="" type="checkbox"/> <b>Injected Currents</b>                        |                                        |                         |               |              |            |            |
| Item                                                                                | Equipment                              | Manufacturer            | Model No.     | Serial No.   | Cal Date   | Due Date   |
| 1.                                                                                  | Conducted Immunity test system         | TESEQ                   | NSG4070       | 45345        | 2025-01-06 | 2026-01-05 |
| 2.                                                                                  | CDN                                    | TESEQ                   | CDN M016      | 31586        | 2025-01-07 | 2026-01-06 |
| 3.                                                                                  | EM Clamp                               | TESEQ                   | KEMZ801       | 32362        | 2025-01-06 | 2026-01-05 |
| 4.                                                                                  | 6dB Attenuator                         | TESEQ                   | ATN6075       | 32122        | 2025-01-07 | 2026-01-06 |



| <input checked="" type="checkbox"/> Radio-frequency electromagnetic fields |                                             |              |                   |            |            |            |
|----------------------------------------------------------------------------|---------------------------------------------|--------------|-------------------|------------|------------|------------|
| Item                                                                       | Equipment                                   | Manufacturer | Model No.         | Serial No. | Cal Date   | Due Date   |
| 1.                                                                         | RF Power Amplifier                          | MICOTOP      | MPA-80-1000-250   | MPA2405139 | 2025-01-06 | 2026-01-05 |
| 2.                                                                         | RF Power Amplifier                          | MICOTOP      | MPA-1000-6000-100 | MPA2405140 | 2025-01-06 | 2026-01-05 |
| 3.                                                                         | Stacked double logarithmic periodic antenna | SCHWARZBECK  | STLP9128E-SPECIAL | 142        | 2025-01-15 | 2026-01-14 |
| 4.                                                                         | Stacked double logarithmic periodic antenna | SCHWARZBECK  | STLP 9149         | 476        | 2025-01-13 | 2026-01-12 |
| 5.                                                                         | Analog signal generator                     | RS           | SMB100A           | 105566     | 2025-01-06 | 2026-01-05 |
| 6.                                                                         | Power meter                                 | RS           | NRP6A             | 101133     | 2025-01-06 | 2026-01-05 |
| 7.                                                                         | Power meter                                 | RS           | NRP6A             | 101134     | 2025-01-06 | 2026-01-05 |

☐: 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 | V2.00.147      |
| 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 Conducted Emission

|                        |                                               |
|------------------------|-----------------------------------------------|
| Test Requirement ..... | ETSI EN 301 489-17                            |
| Test Method .....      | ETSI EN 301 489-1, EN 55032 Class B           |
| Frequency Range .....  | 150kHz to 30MHz                               |
| Class/Severity .....   | Class B/ Table A.10 of EN 55032               |
| Ports .....            | AC Mains                                      |
| Detector .....         | Peak for pre-scan (9kHz Resolution Bandwidth) |

#### 5.1.1 E.U.T. Operation

##### Operating Environment:

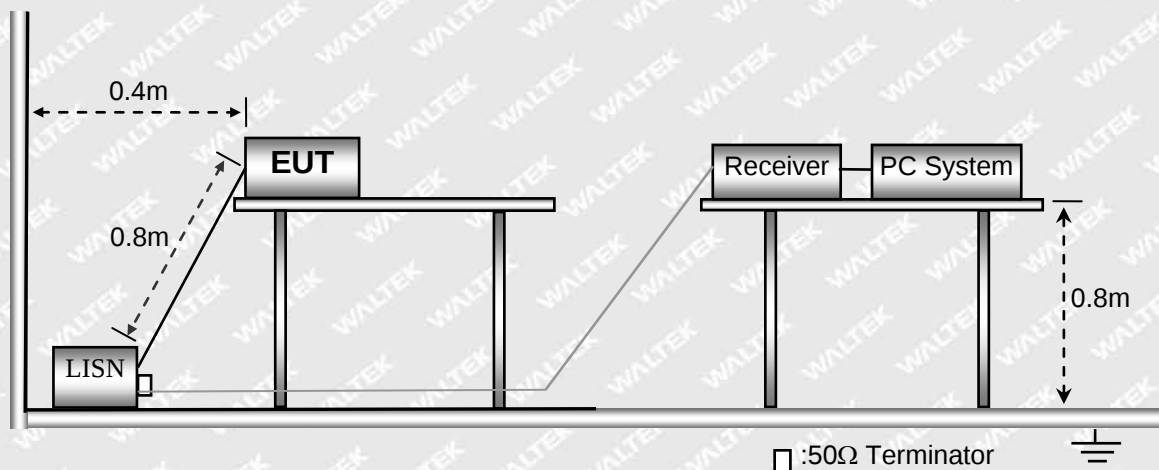
|                            |          |
|----------------------------|----------|
| Temperature .....          | 20.8°C   |
| Humidity .....             | 49.3%RH  |
| Atmospheric Pressure ..... | 101.2kPa |

##### EUT Operation:

|                      |                                 |
|----------------------|---------------------------------|
| Input Voltage .....  | AC 230V/50Hz                    |
| Operating Mode ..... | BT connected mode with AC input |

#### 5.1.2 Test Setup

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





### 5.1.3 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:

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

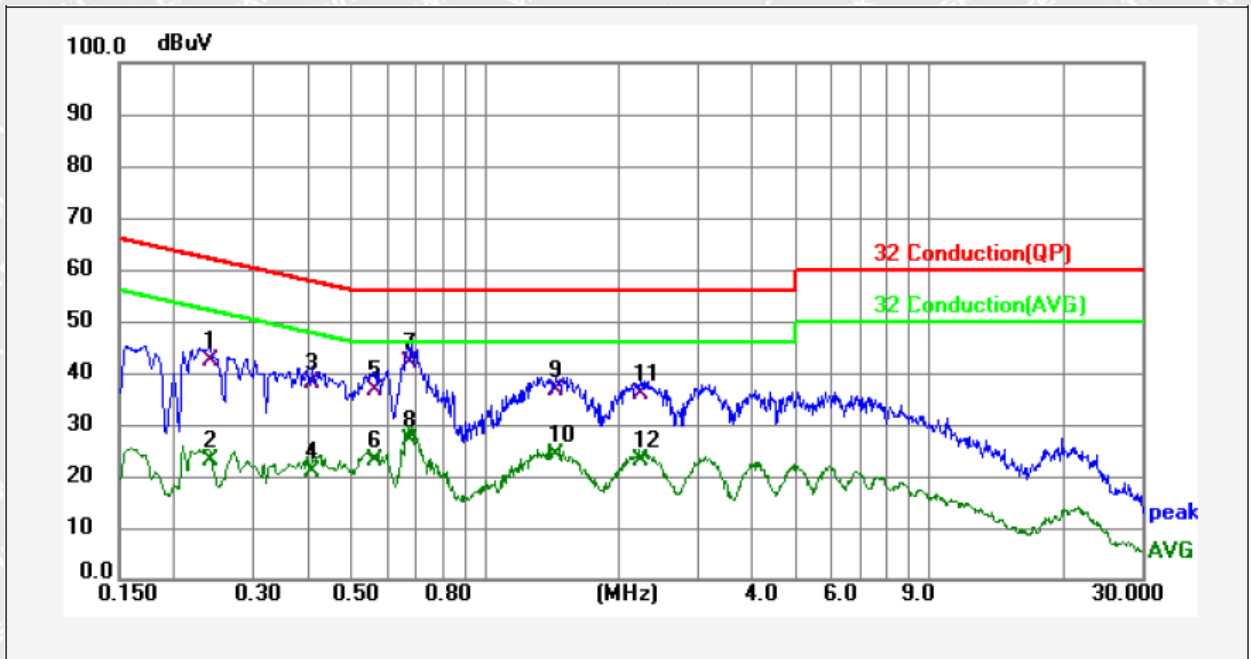
$$\text{Correct Factor} = \text{LISN VDF} + \text{Cable Loss}$$

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:

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

### 5.1.4 Test Result

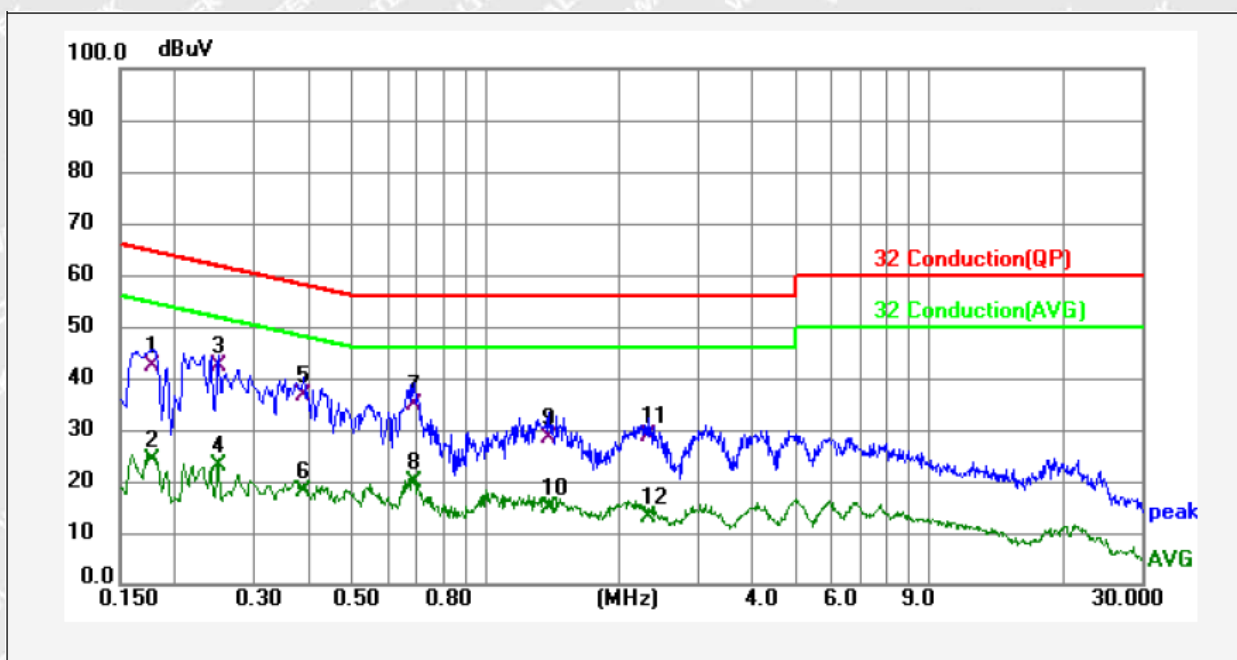
#### Live Line



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|--------------|-------------|----------|--------|
| 1   | 0.240       | 32.64          | 9.61        | 42.25         | 62.10        | -19.85      | QP       |        |
| 2   | 0.240       | 13.39          | 9.61        | 23.00         | 52.10        | -29.10      | AVG      |        |
| 3   | 0.406       | 28.52          | 9.63        | 38.15         | 57.73        | -19.58      | QP       |        |
| 4   | 0.406       | 11.37          | 9.63        | 21.00         | 47.73        | -26.73      | AVG      |        |
| 5   | 0.564       | 27.04          | 9.65        | 36.69         | 56.00        | -19.31      | QP       |        |
| 6   | 0.564       | 13.35          | 9.65        | 23.00         | 46.00        | -23.00      | AVG      |        |
| 7   | 0.681       | 32.35          | 9.65        | 42.00         | 56.00        | -14.00      | QP       |        |
| 8   | 0.681       | 17.35          | 9.65        | 27.00         | 46.00        | -19.00      | AVG      |        |
| 9   | 1.446       | 26.85          | 9.71        | 36.56         | 56.00        | -19.44      | QP       |        |
| 10  | 1.446       | 14.29          | 9.71        | 24.00         | 46.00        | -22.00      | AVG      |        |
| 11  | 2.247       | 26.24          | 9.76        | 36.00         | 56.00        | -20.00      | QP       |        |
| 12  | 2.247       | 13.24          | 9.76        | 23.00         | 46.00        | -23.00      | AVG      |        |



## Neutral Line



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|--------------|-------------|----------|--------|
| 1   | 0.177       | 32.82          | 9.53        | 42.35         | 64.63        | -22.28      | QP       |        |
| 2   | 0.177       | 14.49          | 9.53        | 24.02         | 54.63        | -30.61      | AVG      |        |
| 3   | 0.249       | 32.82          | 9.54        | 42.36         | 61.79        | -19.43      | QP       |        |
| 4   | 0.249       | 13.48          | 9.54        | 23.02         | 51.79        | -28.77      | AVG      |        |
| 5   | 0.389       | 27.00          | 9.56        | 36.56         | 58.09        | -21.53      | QP       |        |
| 6   | 0.389       | 8.44           | 9.56        | 18.00         | 48.09        | -30.09      | AVG      |        |
| 7   | 0.690       | 25.42          | 9.58        | 35.00         | 56.00        | -21.00      | QP       |        |
| 8   | 0.690       | 10.42          | 9.58        | 20.00         | 46.00        | -26.00      | AVG      |        |
| 9   | 1.383       | 18.83          | 9.63        | 28.46         | 56.00        | -27.54      | QP       |        |
| 10  | 1.383       | 5.37           | 9.63        | 15.00         | 46.00        | -31.00      | AVG      |        |
| 11  | 2.324       | 19.01          | 9.68        | 28.69         | 56.00        | -27.31      | QP       |        |
| 12  | 2.324       | 3.52           | 9.68        | 13.20         | 46.00        | -32.80      | AVG      |        |



## 5.2 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;<br>1MHz Resolution Bandwidth Above 1GHz) |

### 5.2.1 EUT Operation:

#### Operating Environment:

|                            |          |
|----------------------------|----------|
| Temperature .....          | 22.4°C   |
| Humidity .....             | 52.6%RH  |
| Atmospheric Pressure ..... | 101.2kPa |

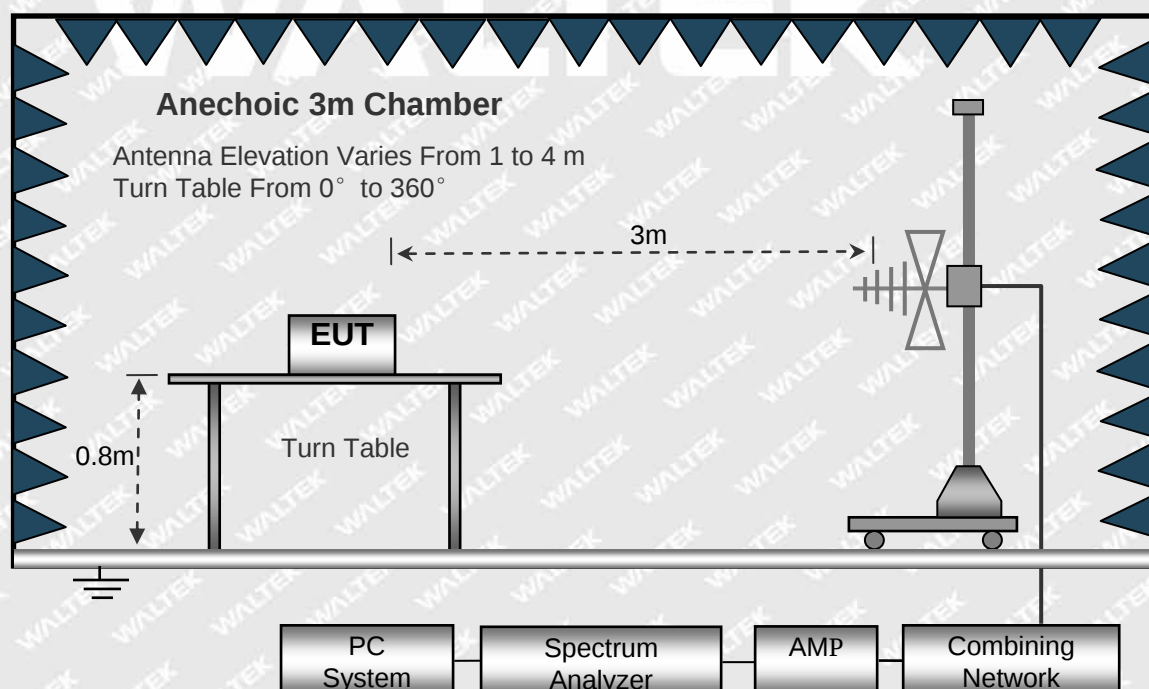
#### EUT Operation:

|                      |                                                                                            |
|----------------------|--------------------------------------------------------------------------------------------|
| Input Voltage .....  | AC 230V/50Hz for mode 1; Battery 3.7V for mode 2                                           |
| Operating Mode ..... | Mode 1: BT connected mode with AC input<br>Mode 2: BT connected mode with battery operated |

### 5.2.2 Test Setup

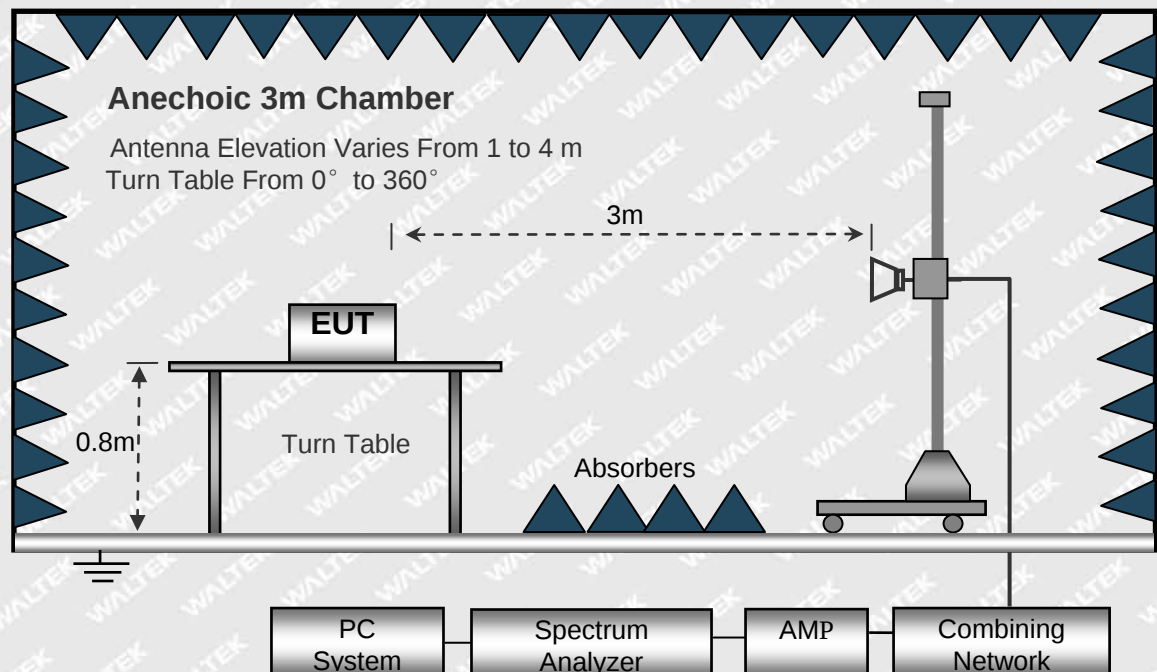
The radiated emission tests were performed using the setup accordance with the EN 55032.

Frequency Range: Below 1 GHz





Frequency Range: Above 1 GHz



### 5.2.3 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:

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

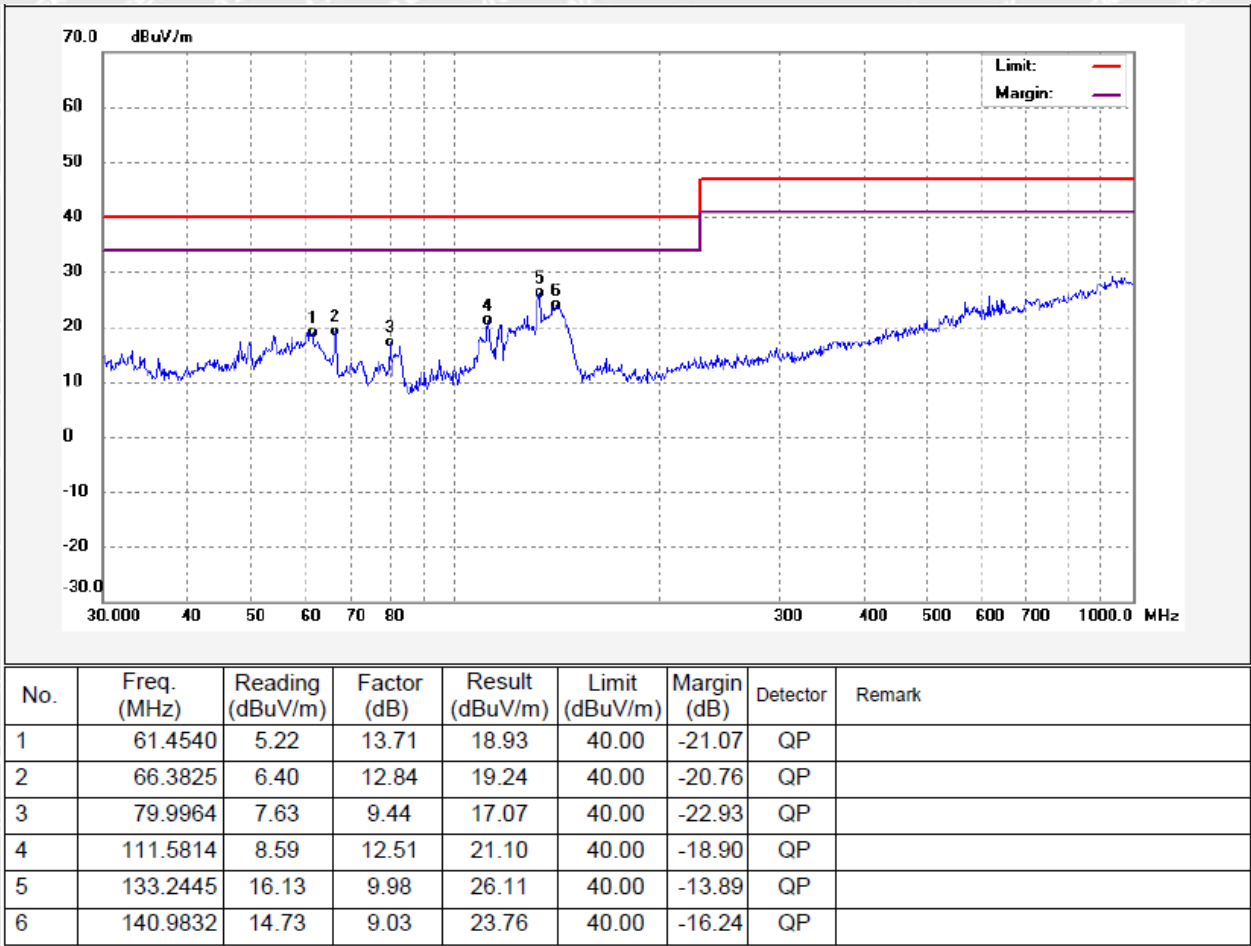


5.2.4 Test Result

BT connected mode with AC input

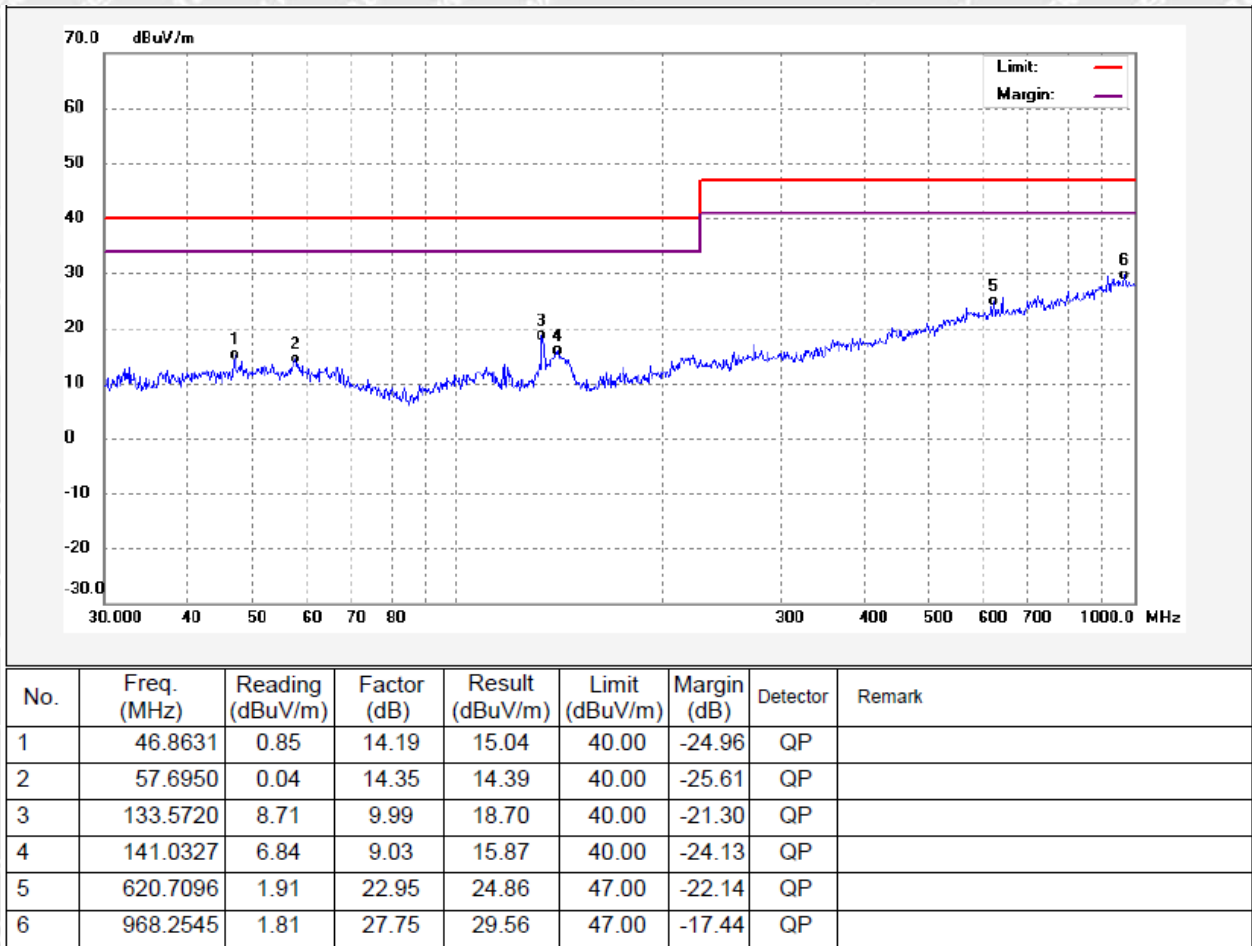
Frequency Range: 30MHz ~ 1000MHz

Antenna Polarization: Vertical



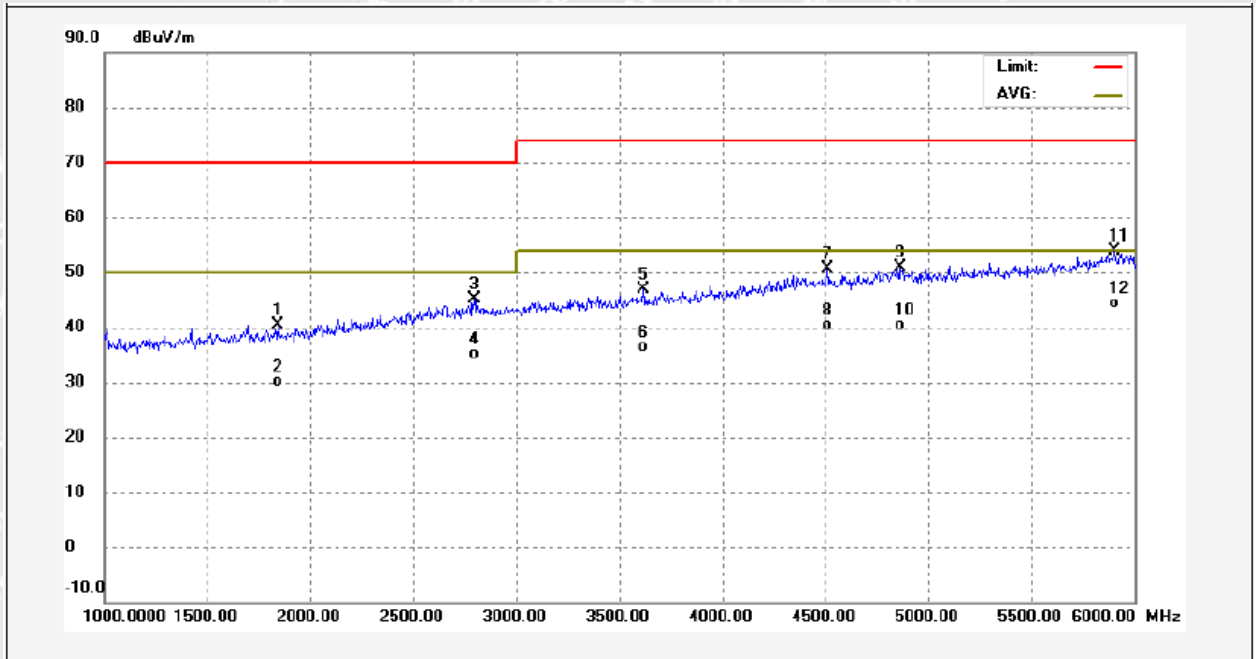


Antenna Polarization: Horizontal



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

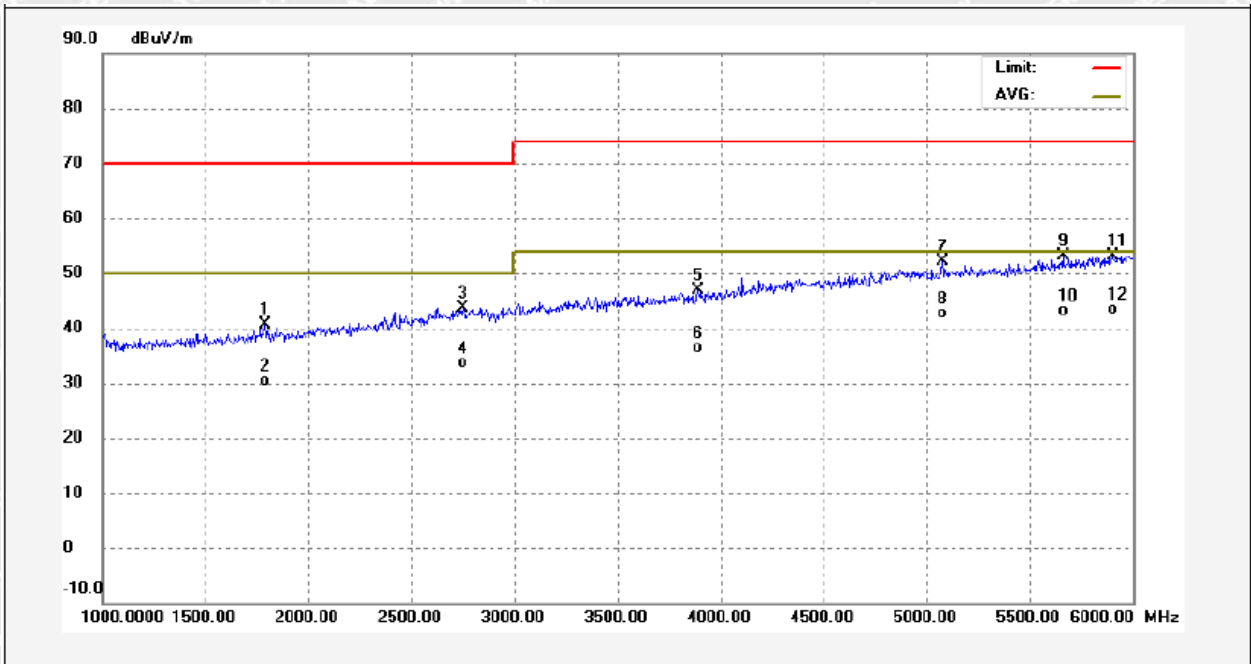
Antenna Polarization: Vertical



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 1842.000    | 9.95             | 30.36       | 40.31           | 70.00          | -29.69      | peak     |        |
| 2   | 1842.000    | -0.11            | 30.36       | 30.25           | 50.00          | -19.75      | AVG      |        |
| 3   | 2798.500    | 11.69            | 33.42       | 45.11           | 70.00          | -24.89      | peak     |        |
| 4   | 2798.500    | 1.60             | 33.42       | 35.02           | 50.00          | -14.98      | AVG      |        |
| 5   | 3616.500    | 11.78            | 35.01       | 46.79           | 74.00          | -27.21      | peak     |        |
| 6   | 3616.500    | 1.49             | 35.01       | 36.50           | 54.00          | -17.50      | AVG      |        |
| 7   | 4514.500    | 13.03            | 37.51       | 50.54           | 74.00          | -23.46      | peak     |        |
| 8   | 4514.500    | 2.75             | 37.51       | 40.26           | 54.00          | -13.74      | AVG      |        |
| 9   | 4869.000    | 12.46            | 38.44       | 50.90           | 74.00          | -23.10      | peak     |        |
| 10  | 4869.000    | 1.84             | 38.44       | 40.28           | 54.00          | -13.72      | AVG      |        |
| 11  | 5905.000    | 13.32            | 40.68       | 54.00           | 74.00          | -20.00      | peak     |        |
| 12  | 5905.000    | 3.66             | 40.68       | 44.34           | 54.00          | -9.66       | AVG      |        |



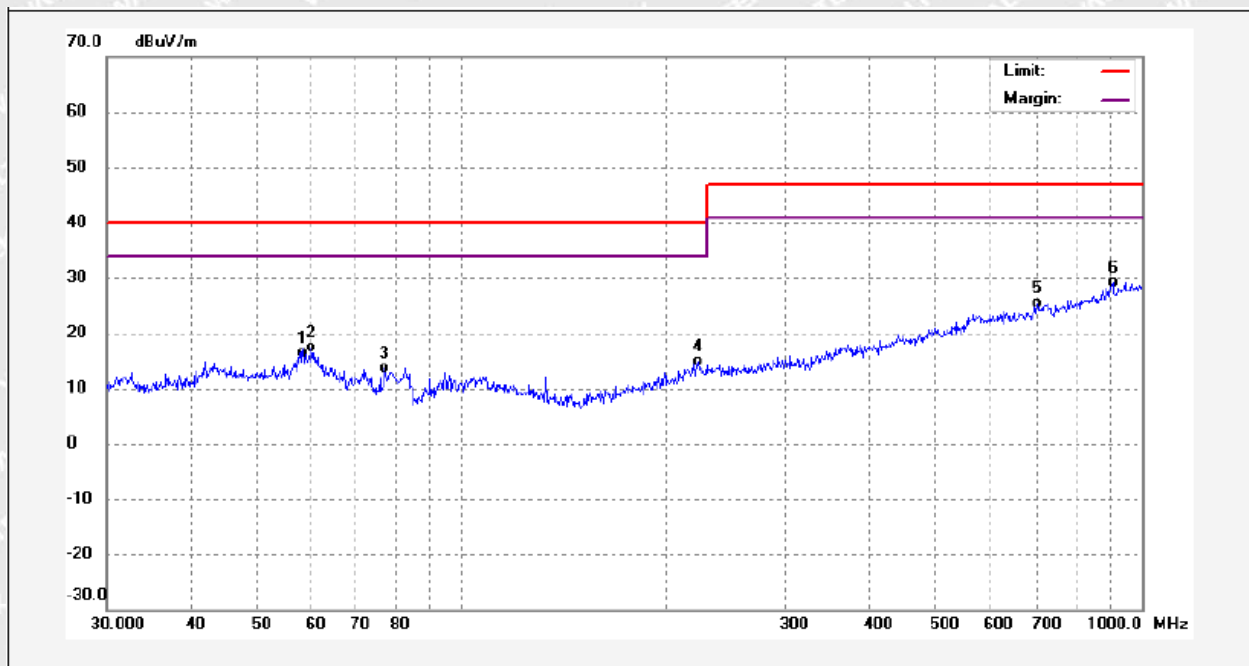
Antenna Polarization: Horizontal



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 1794.500    | 10.27            | 30.29       | 40.56           | 70.00          | -29.44      | peak     |        |
| 2   | 1794.500    | -0.03            | 30.29       | 30.26           | 50.00          | -19.74      | AVG      |        |
| 3   | 2752.500    | 10.42            | 33.30       | 43.72           | 70.00          | -26.28      | peak     |        |
| 4   | 2752.500    | 0.22             | 33.30       | 33.52           | 50.00          | -16.48      | AVG      |        |
| 5   | 3894.000    | 11.11            | 35.67       | 46.78           | 74.00          | -27.22      | peak     |        |
| 6   | 3894.000    | 0.80             | 35.67       | 36.47           | 54.00          | -17.53      | AVG      |        |
| 7   | 5078.000    | 13.27            | 38.91       | 52.18           | 74.00          | -21.82      | peak     |        |
| 8   | 5078.000    | 3.71             | 38.91       | 42.62           | 54.00          | -11.38      | AVG      |        |
| 9   | 5660.000    | 13.06            | 40.03       | 53.09           | 74.00          | -20.91      | peak     |        |
| 10  | 5660.000    | 3.22             | 40.03       | 43.25           | 54.00          | -10.75      | AVG      |        |
| 11  | 5900.500    | 12.57            | 40.66       | 53.23           | 74.00          | -20.77      | peak     |        |
| 12  | 5900.500    | 2.67             | 40.66       | 43.33           | 54.00          | -10.67      | AVG      |        |

**BT connected mode with battery operated****Frequency Range: 30MHz ~ 1000MHz**

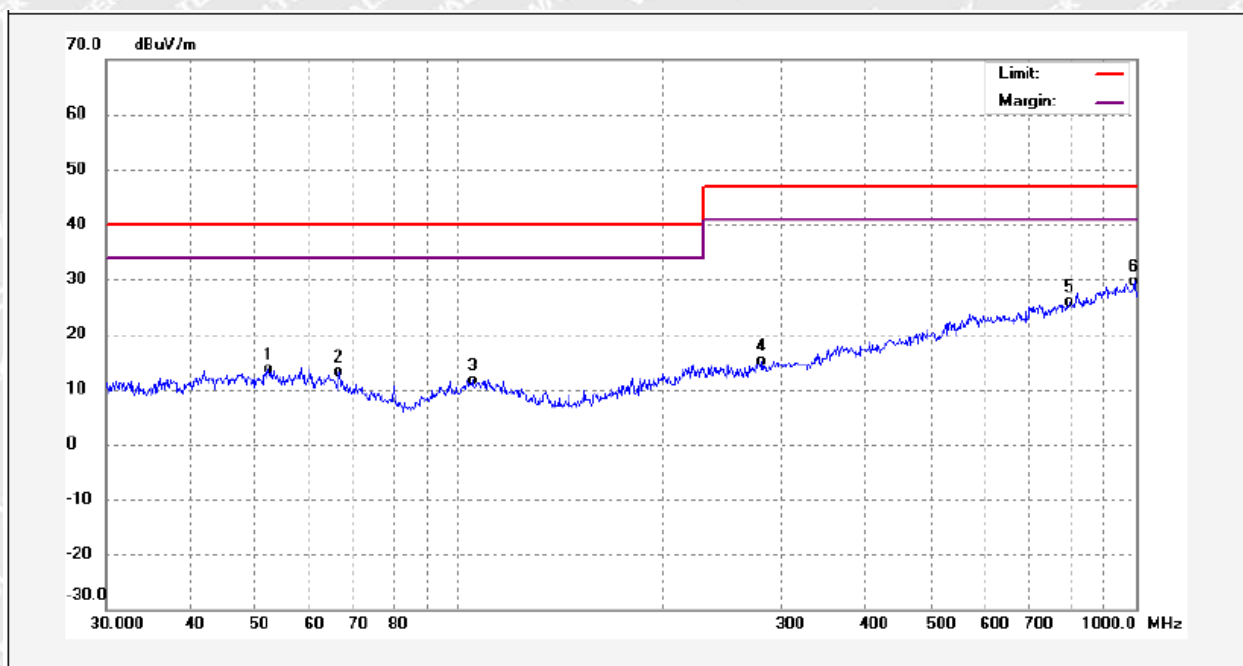
Antenna Polarization: Vertical



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 58.3870     | 2.21             | 14.23       | 16.44           | 40.00          | -23.56      | QP       |        |
| 2   | 60.2590     | 3.48             | 13.83       | 17.31           | 40.00          | -22.69      | QP       |        |
| 3   | 77.1856     | 3.54             | 10.05       | 13.59           | 40.00          | -26.41      | QP       |        |
| 4   | 222.6377    | 0.46             | 14.33       | 14.79           | 40.00          | -25.21      | QP       |        |
| 5   | 702.4996    | 1.10             | 24.27       | 25.37           | 47.00          | -21.63      | QP       |        |
| 6   | 908.0731    | 2.36             | 26.73       | 29.09           | 47.00          | -17.91      | QP       |        |



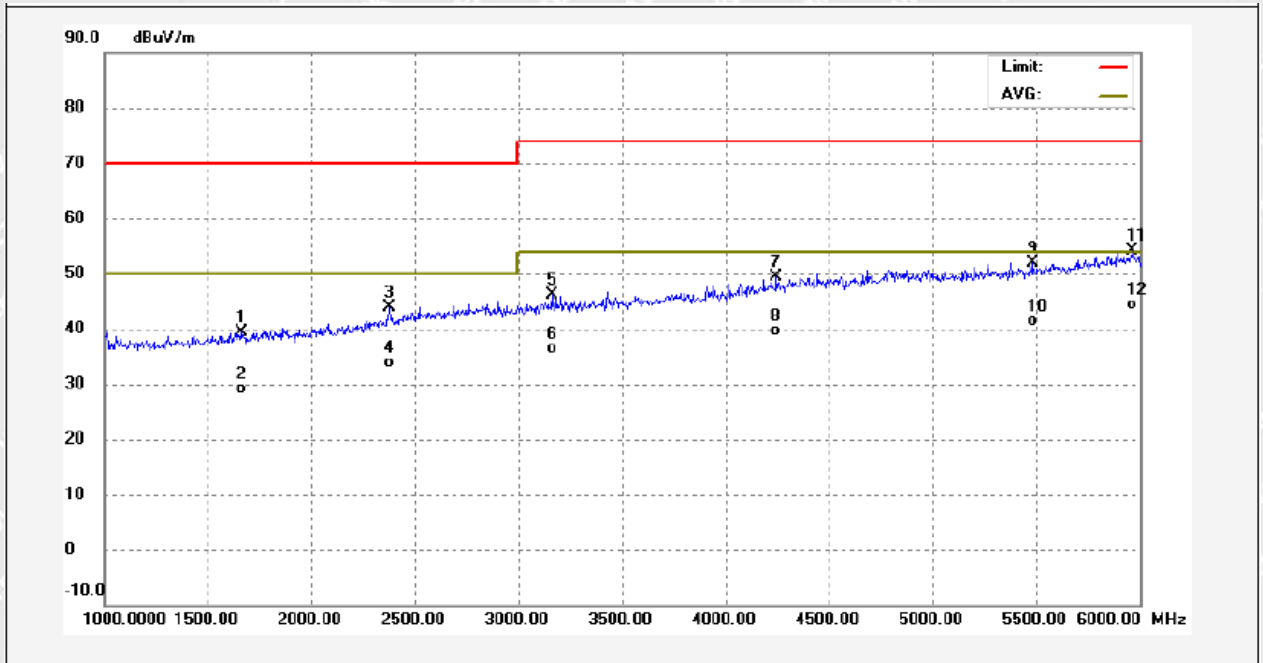
Antenna Polarization: Horizontal



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 52.2995     | -0.79            | 14.35       | 13.56           | 40.00          | -26.44      | QP       |        |
| 2   | 66.3592     | 0.33             | 12.85       | 13.18           | 40.00          | -26.82      | QP       |        |
| 3   | 104.5727    | -1.31            | 13.03       | 11.72           | 40.00          | -28.28      | QP       |        |
| 4   | 280.6136    | -0.27            | 15.41       | 15.14           | 47.00          | -31.86      | QP       |        |
| 5   | 798.4195    | 0.47             | 25.44       | 25.91           | 47.00          | -21.09      | QP       |        |
| 6   | 997.8983    | 1.81             | 27.92       | 29.73           | 47.00          | -17.27      | QP       |        |

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

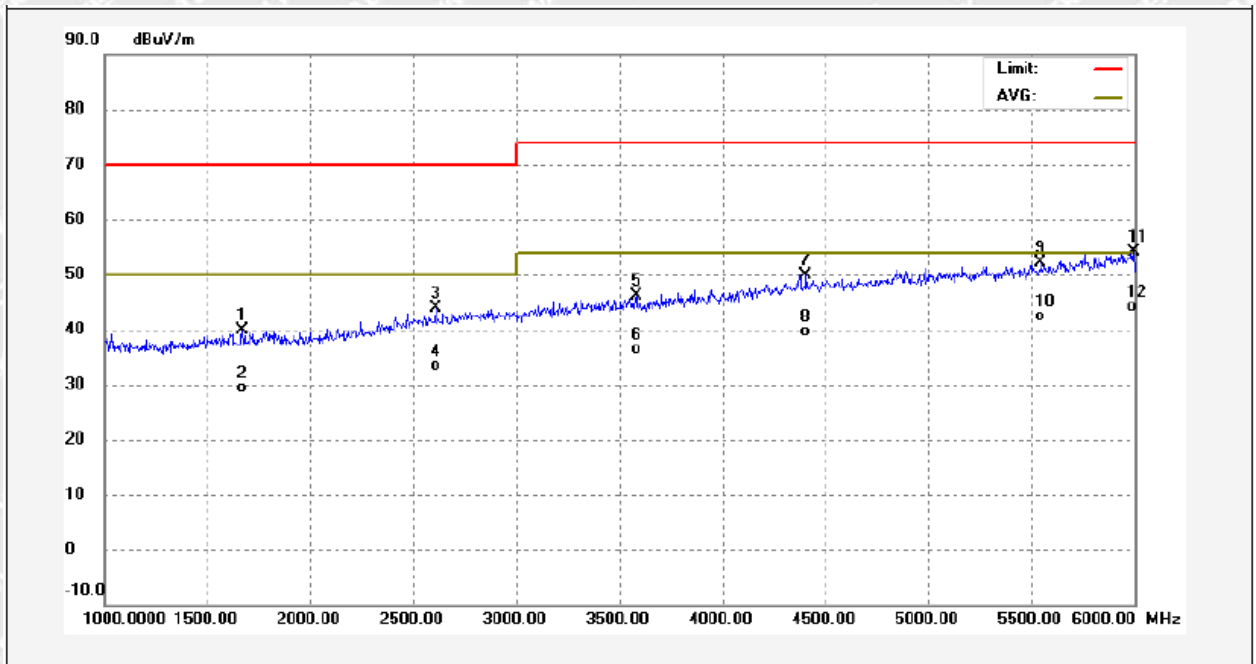
Antenna Polarization: Vertical



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 1663.000    | 9.27             | 30.09       | 39.36           | 70.00          | -30.64      | peak     |        |
| 2   | 1663.000    | -1.04            | 30.09       | 29.05           | 50.00          | -20.95      | AVG      |        |
| 3   | 2377.500    | 11.74            | 32.18       | 43.92           | 70.00          | -26.08      | peak     |        |
| 4   | 2377.500    | 1.65             | 32.18       | 33.83           | 50.00          | -16.17      | AVG      |        |
| 5   | 3162.000    | 12.05            | 34.17       | 46.22           | 74.00          | -27.78      | peak     |        |
| 6   | 3162.000    | 2.23             | 34.17       | 36.40           | 54.00          | -17.60      | AVG      |        |
| 7   | 4249.000    | 12.58            | 36.70       | 49.28           | 74.00          | -24.72      | peak     |        |
| 8   | 4249.000    | 2.82             | 36.70       | 39.52           | 54.00          | -14.48      | AVG      |        |
| 9   | 5489.500    | 12.40            | 39.58       | 51.98           | 74.00          | -22.02      | peak     |        |
| 10  | 5489.500    | 1.79             | 39.58       | 41.37           | 54.00          | -12.63      | AVG      |        |
| 11  | 5968.500    | 13.24            | 40.84       | 54.08           | 74.00          | -19.92      | peak     |        |
| 12  | 5968.500    | 3.54             | 40.84       | 44.38           | 54.00          | -9.62       | AVG      |        |



Antenna Polarization: Horizontal



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 1672.000    | 9.77             | 30.10       | 39.87           | 70.00          | -30.13      | peak     |        |
| 2   | 1672.000    | -0.69            | 30.10       | 29.41           | 50.00          | -20.59      | AVG      |        |
| 3   | 2614.500    | 10.84            | 32.97       | 43.81           | 70.00          | -26.19      | peak     |        |
| 4   | 2614.500    | 0.29             | 32.97       | 33.26           | 50.00          | -16.74      | AVG      |        |
| 5   | 3581.500    | 11.30            | 34.92       | 46.22           | 74.00          | -27.78      | peak     |        |
| 6   | 3581.500    | 1.49             | 34.92       | 36.41           | 54.00          | -17.59      | AVG      |        |
| 7   | 4405.000    | 12.76            | 37.18       | 49.94           | 74.00          | -24.06      | peak     |        |
| 8   | 4405.000    | 2.34             | 37.18       | 39.52           | 54.00          | -14.48      | AVG      |        |
| 9   | 5545.500    | 12.51            | 39.72       | 52.23           | 74.00          | -21.77      | peak     |        |
| 10  | 5545.500    | 2.78             | 39.72       | 42.50           | 54.00          | -11.50      | AVG      |        |
| 11  | 5998.500    | 13.11            | 40.93       | 54.04           | 74.00          | -19.96      | peak     |        |
| 12  | 5998.500    | 3.08             | 40.93       | 44.01           | 54.00          | -9.99       | 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.<br>(See note).<br>Shall be no loss of function.<br>Shall be no unintentional transmissions. | Shall operate as intended.<br>Shall be no degradation of performance.<br>Shall be no loss of function.<br>Shall be no loss of critical stored data. |
| B        | May be loss of function.                                                                                               | Functions shall be self-recoverable.<br>Shall operate as intended after recovering.<br>Shall be no loss of critical stored data.                    |
| C        | May be loss of function.                                                                                               | Functions shall be recoverable by the operator.<br>Shall operate as intended after recovering.<br>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  $\Omega$  / 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**..... : 23.9°C

Humidity ..... : 51.2%RH

**Atmospheric Pressure** ..... : 101.7kPa

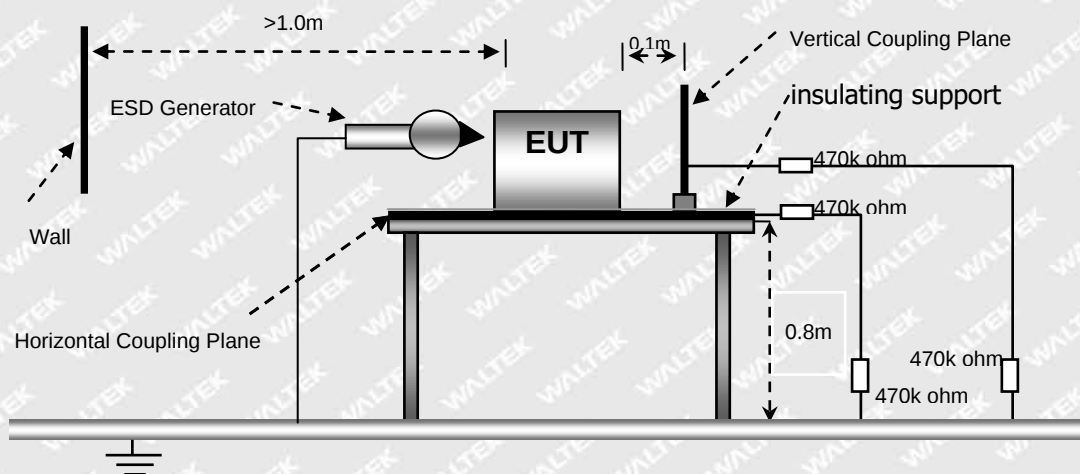
### EUT Operation:

**Input Voltage**..... : AC 230V/50Hz for mode 1; Battery 3.7V for mode 2

**Operating Mode** ..... : Mode 1: BT connected mode with AC input  
Mode 2: BT connected mode with battery operated

### 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:

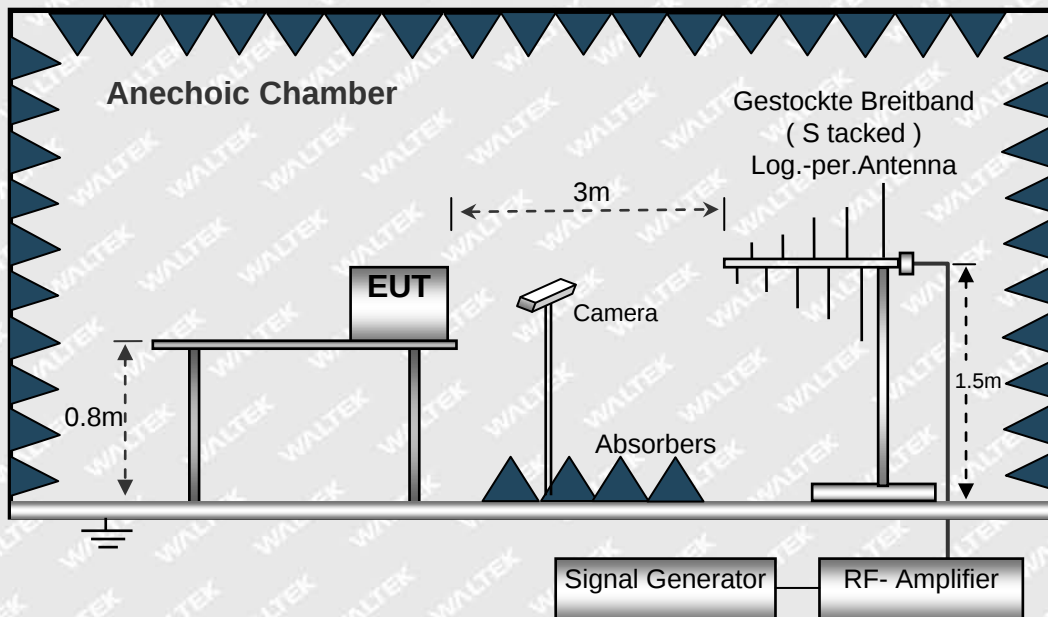
**Temperature** ..... : 23.3°C  
**Humidity** ..... : 51.4%RH  
**Atmospheric Pressure** ..... : 101.2kPa

##### EUT Operation:

**Input Voltage** ..... : AC 230V/50Hz for mode 1; Battery 3.7V for mode 2  
**Operating Mode** ..... : Mode 1: BT connected mode with AC input  
Mode 2: BT connected mode with battery operated

#### 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



## 6.4 Fast Transients Common Mode (EFT)

|                           |                                   |
|---------------------------|-----------------------------------|
| Test Requirement .....    | : ETSI EN 301 489-17              |
| Test Method .....         | : ETSI EN 301 489-1, EN 61000-4-4 |
| Polarity .....            | : Positive & Negative             |
| Repetition Frequency..... | : 5kHz                            |
| Burst Duration .....      | : 300ms                           |
| Test Duration .....       | : 2 minutes per level & polarity  |

### 6.4.1 E.U.T. Operation

#### Operating Environment:

|                            |            |
|----------------------------|------------|
| Temperature.....           | : 23.7°C   |
| Humidity .....             | : 51.4%RH  |
| Atmospheric Pressure ..... | : 101.7kPa |

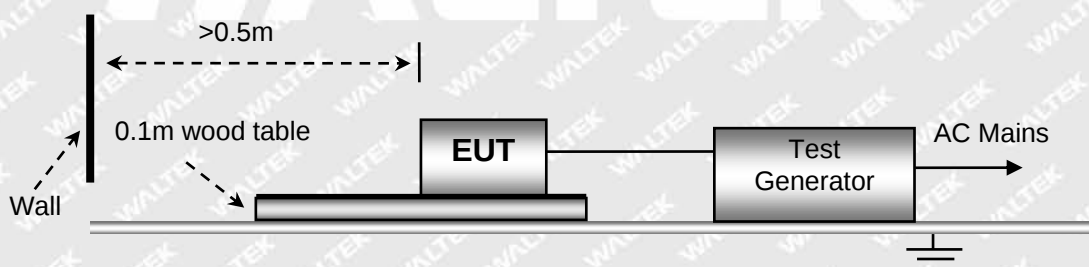
#### EUT Operation:

|                      |                                   |
|----------------------|-----------------------------------|
| Input Voltage.....   | : AC 230V/50Hz                    |
| Operating Mode ..... | : BT connected mode with AC input |

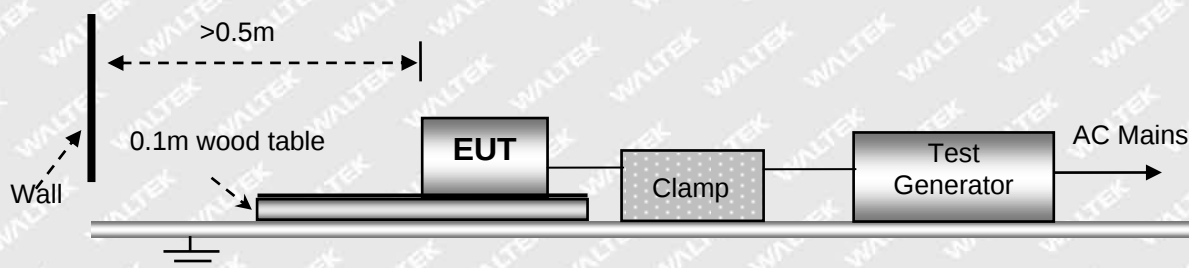
### 6.4.2 Block Diagram of Test Setup

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

For AC Mains or DC Ports:



For Signal, Wired network or Control Ports:





6.4.3 Test Result

| Test Port           | Test Level(kV) | Performance Criterion | Result |
|---------------------|----------------|-----------------------|--------|
| AC mains power port | ±1.0           | B                     | Pass*  |
| DC power port       | ±0.5           | B                     | N/A    |
| Signal port         | ±0.5           | B                     | N/A    |
| Control port        | ±0.5           | B                     | N/A    |
| Wired network port  | ±0.5           | B                     | N/A    |

Remark:

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

WALTEK



## 6.5 Surges

**Test Requirement** ..... : ETSI EN 301 489-17

**Test Method** ..... : ETSI EN 301 489-1, EN 61000-4-5

**Interval** ..... : 60s between each surge

**No. of surges** ..... : 5 positive, 5 negative at 0°, 90°, 180°, 270°.

### 6.5.1 E.U.T. Operation

#### Operating Environment:

**Temperature** ..... : 23.5°C

**Humidity** ..... : 51.6%RH

**Atmospheric Pressure** ..... : 101.7kPa

#### EUT Operation:

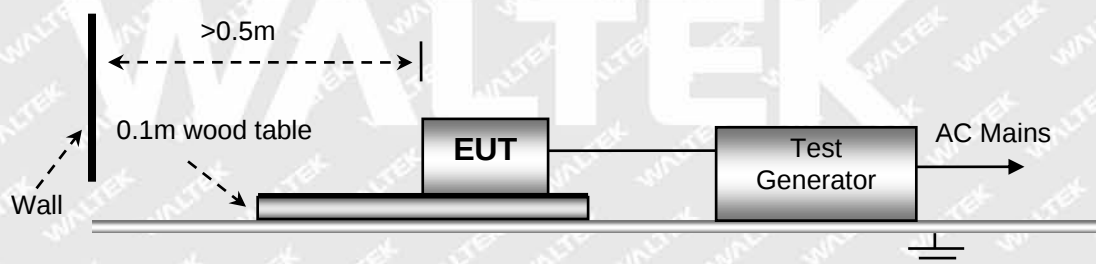
**Input Voltage** ..... : AC 230V/50Hz

**Operating Mode** ..... : BT connected mode with AC input

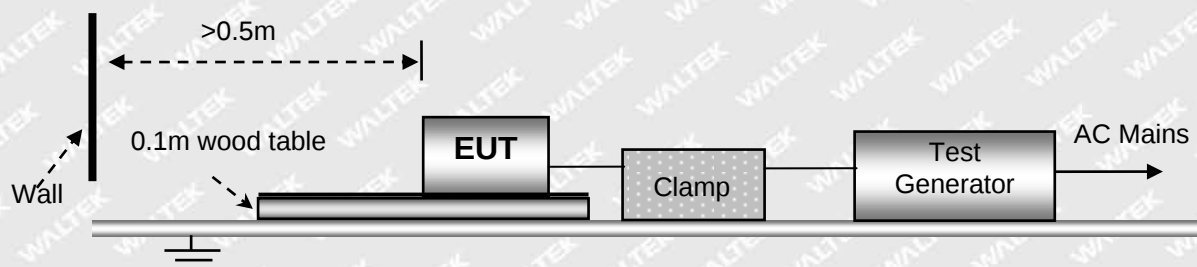
### 6.5.2 Block Diagram of Test Setup

The Surges Immunity test was performed in accordance with the EN 61000-4-5.

For AC Mains or DC Ports:



For Wired network port:





6.5.3 Test Result

| Coupling point | Test Port                 | Applied Voltage (kV) | Performance criterion | Result |
|----------------|---------------------------|----------------------|-----------------------|--------|
| AC power port  | 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 RF Common Mode 0,15 MHz to 80MHz (CS)

**Test Requirement** ..... : ETSI EN 301 489-17

**Test Method** ..... : ETSI EN 301 489-1, EN 61000-4-6

**Frequency Range** ..... : 150kHz to 80MHz

**Test level** ..... : 3V rms (unmodulated emf into 150  $\Omega$ )

**Modulation** ..... : 80%, 1kHz Amplitude Modulation.

### 6.6.1 E.U.T. Operation

**Operating Environment:**

**Temperature** ..... : 23.3°C

**Humidity** ..... : 51.8%RH

**Atmospheric Pressure** ..... : 101.7kPa

**EUT Operation:**

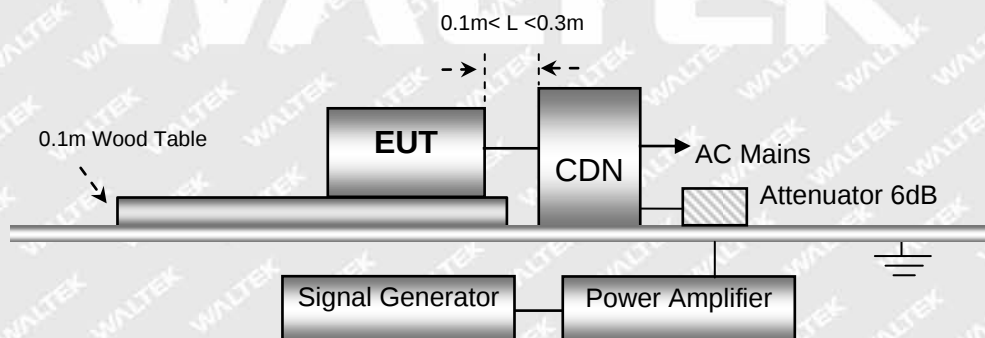
**Input Voltage** ..... : AC 230V/50Hz

**Operating Mode** ..... : BT connected mode with AC input

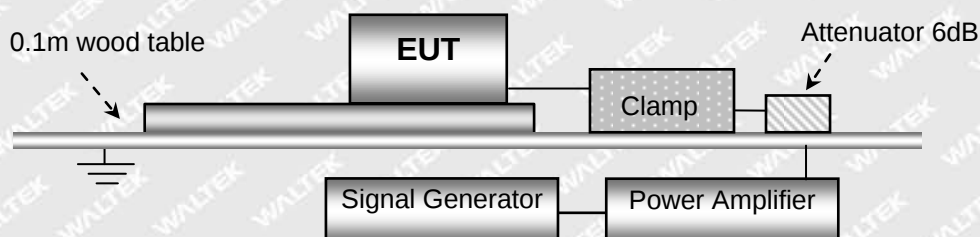
### 6.6.2 Block Diagram of Test Setup

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

For AC Mains or DC Ports:



For Signal, Wired network or Control Ports:





6.6.3 Test Result

| Line                | Voltage Level | Modulation          | Step Size | Dwell Time | Performance Criteria | Test Result |
|---------------------|---------------|---------------------|-----------|------------|----------------------|-------------|
| AC mains power port | 3Vr.m.s       | 80%, 1kHz Amp. Mod. | 1%        | 1s         | A                    | Pass*       |
| DC power port       | 3Vr.m.s       | 80%, 1kHz Amp. Mod. | 1%        | 1s         | A                    | N/A         |
| Signal port         | 3Vr.m.s       | 80%, 1kHz Amp. Mod. | 1%        | 1s         | A                    | N/A         |
| Wired network port  | 3Vr.m.s       | 80%, 1kHz Amp. Mod. | 1%        | 1s         | A                    | N/A         |
| Control port        | 3Vr.m.s       | 80%, 1kHz Amp. Mod. | 1%        | 1s         | A                    | N/A         |

Remark:

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

WALTEK



## 6.7 Voltage Dips and Interruptions

**Test Requirement** ..... : ETSI EN 301 489-17  
**Test Method** ..... : ETSI EN 301 489-1, EN 61000-4-11  
**No. of Dips / Interruptions** ..... : 3 per Level at 10ms intervals  
**Test Level(Voltage reduction)** : 0%&70 % of  $U_T$  (Supply Voltage)

### 6.7.1 E.U.T. Operation

#### Operating Environment:

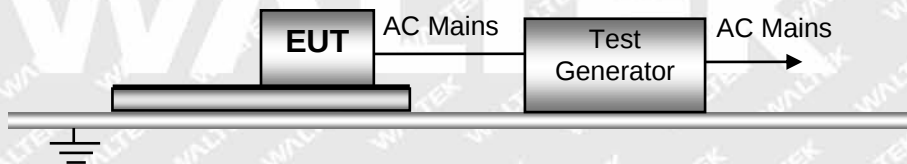
**Temperature**..... : 23.1°C  
**Humidity** ..... : 52.2%RH  
**Atmospheric Pressure** ..... : 101.7kPa

#### EUT Operation:

**Input Voltage**..... : AC 230V/50Hz  
**Operating Mode** ..... : BT connected mode with AC input

### 6.7.2 Block Diagram of Setup

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



### 6.7.3 Test Result

| Type                 | Test Level in % $U_T$ | Phase     | Duration | Performance criterion | Result |
|----------------------|-----------------------|-----------|----------|-----------------------|--------|
| Voltage Dips         | 0                     | 0° & 180° | 0.5      | B                     | Pass*  |
|                      | 0                     | 0° & 180° | 1        | B                     | Pass*  |
|                      | 70                    | 0° & 180° | 25       | B                     | Pass*  |
| Voltage Interruption | 0                     | 0° & 180° | 250      | B                     | Pass*  |

Remark:

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



## 7 Photographs - Test Setup

### 7.1 Photograph - Radiated Emissions Test Setup

Below 1000MHz



Above 1000MHz





## 7.2 Photograph - Conducted Emissions Test Setup

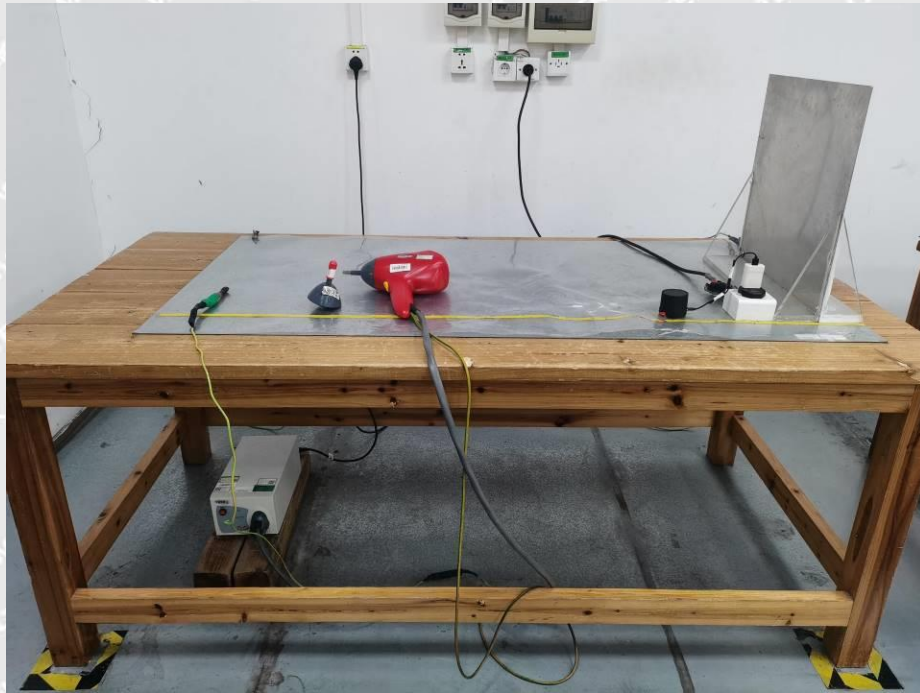


## 7.3 Photograph - RF Electromagnetic Field Test Setup





#### 7.4 Photograph - ESD Test Setup



#### 7.5 Photograph - EFT Immunity Test Setup





## 7.6 Photograph - Surge Immunity Test Setup



## 7.7 Photograph - Radio-frequency Common Mode Test Setup





## 7.8 Photograph - Voltage Dips and Interruptions Immunity Test Setup



# WALTEK



## 8 Photographs – EUT Constructional Details

Please refer to “ANNEX” (Reference No. WTF25F05116761W).

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

# WALTEK



中国认可  
国际互认  
检测  
TESTING  
CNAS L6478



# TEST REPORT

**Reference No.**..... : WTF25F05116762W  
**Applicant**..... : Mid Ocean Brands B.V.  
**Address**..... : Unit 711-716, 7/F., Tower A, 83 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong.  
**Manufacturer** ..... : 106613  
**Address**..... : ---  
**Product Name**..... : Recycled PU wireless speaker  
**Model No.**..... : MO2173  
**Test specification**..... : EN 55032:2015+A11:2020+A1:2020  
EN 55035:2017+A11:2020  
**Date of Receipt sample** .... : 2025-06-09  
**Date of Test** ..... : 2025-06-16 to 2025-06-17  
**Date of Issue**..... : 2025-06-23  
**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,  
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<br>±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<br>DC ±0.5Kv                 | B                    | Pass   |
| Surge                                                | IEC 61000-4-5:2005             | ±1Kv D.M.†<br>±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 <sub>T</sub> * for 0.5per      | B                    | Pass   |
|                                                      |                                | 70 % U <sub>T</sub> * for 25/30per     | C                    |        |
| Voltage Interruptions                                |                                | < 5 % U <sub>T</sub> * 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<sub>T</sub> is the nominal supply voltage



## 2 Contents

|                                                                | Page      |
|----------------------------------------------------------------|-----------|
| <b>COVER PAGE .....</b>                                        | <b>1</b>  |
| <b>1 TEST SUMMARY .....</b>                                    | <b>2</b>  |
| <b>2 CONTENTS .....</b>                                        | <b>3</b>  |
| <b>3 GENERAL INFORMATION.....</b>                              | <b>5</b>  |
| 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.....                                         | 5         |
| 3.6 SUBCONTRACTED.....                                         | 6         |
| 3.7 ABNORMALITIES FROM STANDARD CONDITIONS .....               | 6         |
| <b>4 EQUIPMENT USED DURING TEST .....</b>                      | <b>7</b>  |
| 4.1 SOFTWARE LIST .....                                        | 9         |
| 4.2 MEASUREMENT UNCERTAINTY .....                              | 9         |
| 4.3 SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT.....           | 10        |
| 4.4 DECISION RULE.....                                         | 10        |
| <b>5 EMISSION TEST RESULTS.....</b>                            | <b>11</b> |
| 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        |
| <b>6 IMMUNITY TEST RESULTS.....</b>                            | <b>24</b> |
| 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     | <b>PHOTOGRAPHS – TEST SETUP .....</b>                                          | <b>37</b> |
| 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     | <b>PHOTOGRAPHS – CONSTRUCTIONAL DETAILS .....</b>                              | <b>42</b> |
| 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 ..... : Recycled PU wireless speaker  
Model No. .... : MO2173  
Remark ..... : ---

#### 3.2 Details of E.U.T.

Technical Data ..... : Input: DC 5V, 0.5A  
Battery: 3.7V, 300mAh, 1.11Wh

#### 3.3 Description of Support Units

The EUT has been tested as an independent unit. MO2173 is the test sample. The full tests were performed in the condition of AC 230V/50Hz input 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<br>+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.

# WALTEK



#### 4 Equipment Used during Test

| <input type="checkbox"/> 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              | RSUA4008     | Valid              |
| <input checked="" type="checkbox"/> 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 22                 | Times Microwave Systems | LMR195UF-BMNM-5.00M | ---          | Valid              |
| 4.                                                                                             | Switch                   | ESE                     | RSU/M2              | ---          | Valid              |
| <input type="checkbox"/> 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 12                 | YIHENG                  | LMR195UF-NMNM-2.5   | ---          | Valid              |
| 4.                                                                                             | Manual RF Switch         | Top Precision           | SW-2                | RSU0402      | Valid              |
| <input checked="" type="checkbox"/> 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.                                                                                             | Cable 20                 | Times Microwave Systems | RG223-NMNM-10M      | ---          | Valid              |
| 5.                                                                                             | Cable 21                 | Times Microwave Systems | RG223-NMNM-3M       | ---          | Valid              |
| <input type="checkbox"/> 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.                                                                                             | Cable 14                 | YIHENG                  | LMR240UF-NMSM-7.5   | ---          | Valid              |



| <input checked="" type="checkbox"/> 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              |
| <input type="checkbox"/> Radiated Emission (1GHz to 6GHz) 2#             |                                |                 |             |             |                    |
| 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              |
| <input checked="" type="checkbox"/> ESD                                  |                                |                 |             |             |                    |
| Item                                                                     | Equipment                      | Manufacturer    | Model No.   | Serial No.  | Calibration Status |
| 1.                                                                       | ESD Simulator                  | TESEQ           | NSG437      | 521         | Valid              |
| <input checked="" type="checkbox"/> EFT & Voltage Dips and Interruptions |                                |                 |             |             |                    |
| Item                                                                     | Equipment                      | Manufacturer    | Model No.   | Serial No.  | Calibration Status |
| 1.                                                                       | EMS test system                | TESEQ           | NSG3040     | 1858        | Valid              |
| 2.                                                                       | Step transformer               | TESEQ           | INA6501     | 206         | Valid              |
| 3.                                                                       | Coupling clamp                 | TESEQ           | CDN8014     | 31405       | Valid              |
| <input checked="" type="checkbox"/> Surge                                |                                |                 |             |             |                    |
| Item                                                                     | Equipment                      | Manufacturer    | Model No.   | Serial No.  | Calibration Status |
| 1.                                                                       | Surge Simulator                | TESEQ           | NSG3060     | 1395        | Valid              |
| <input checked="" type="checkbox"/> 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.                                                                       | EM Clamp                       | TESEQ           | KEMZ801     | 32362       | Valid              |
| 4.                                                                       | 6dB Attenuator                 | TESEQ           | ATN6075     | 32122       | Valid              |



| <input checked="" type="checkbox"/> Radio-frequency Electromagnetic Fields |                                             |              |                   |            |                    |
|----------------------------------------------------------------------------|---------------------------------------------|--------------|-------------------|------------|--------------------|
| Item                                                                       | Equipment                                   | Manufacturer | Model No.         | Serial No. | Calibration Status |
| 1.                                                                         | RF Power Amplifier                          | MICOTOP      | MPA-80-1000-250   | MPA2405139 | Valid              |
| 2.                                                                         | RF Power Amplifier                          | MICOTOP      | MPA-1000-6000-100 | MPA2405140 | 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-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      |
| 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<br>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:

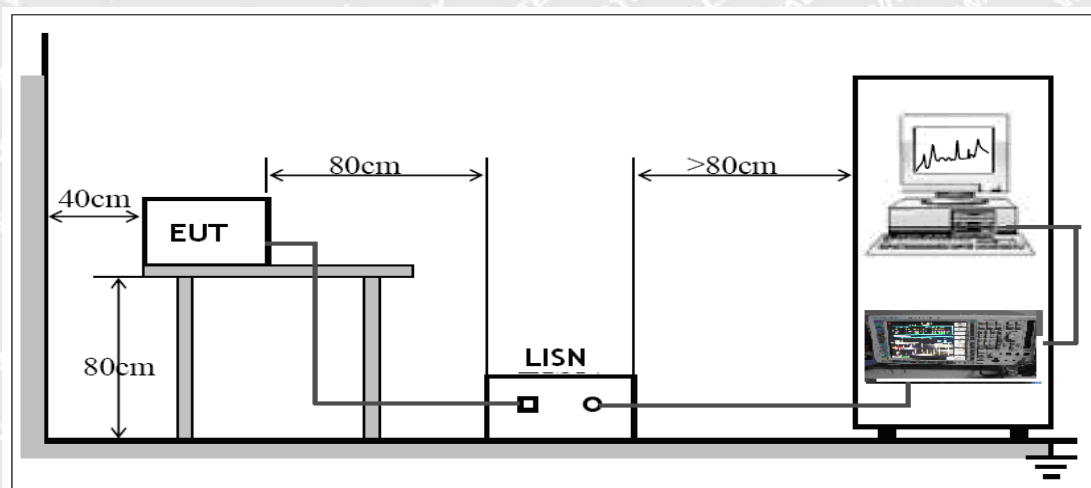
|                            |            |
|----------------------------|------------|
| Temperature .....          | : 20.8°C   |
| Humidity .....             | : 49.3%RH  |
| Atmospheric Pressure ..... | : 101.2kPa |

##### EUT Operation:

|                      |                                   |
|----------------------|-----------------------------------|
| Input Voltage .....  | : AC 230V/50Hz                    |
| Operating Mode ..... | : BT connected mode with AC input |

#### 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:

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

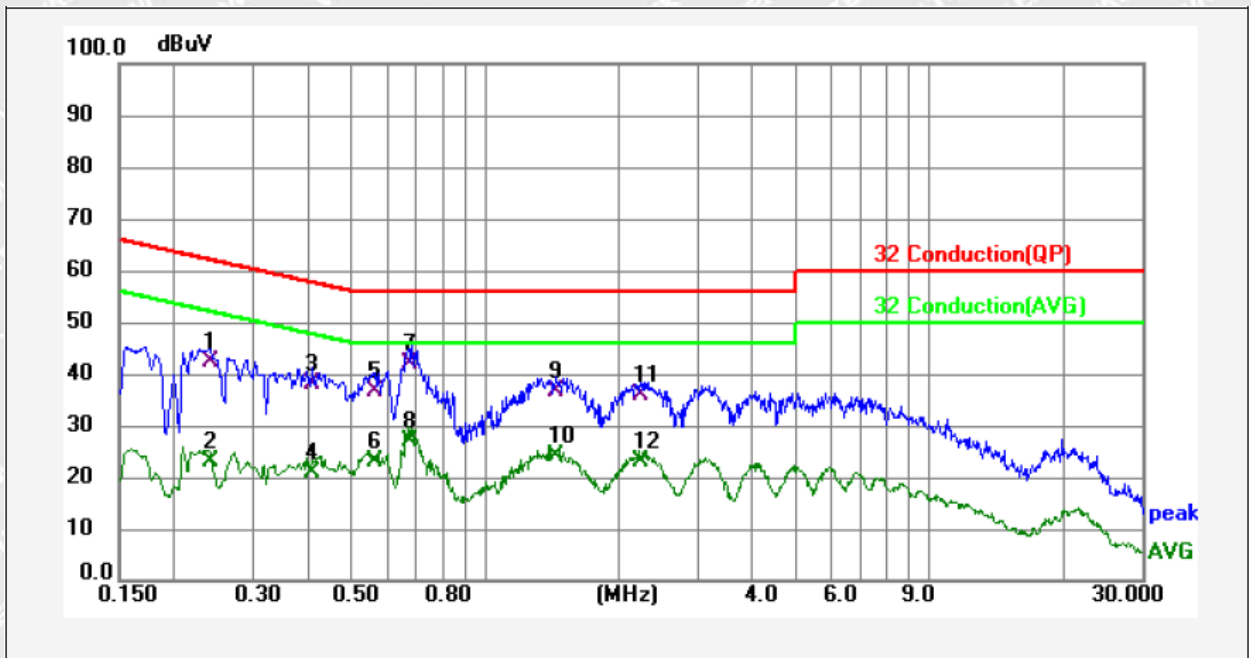
$$\text{Correct Factor} = \text{LISN VDF} + \text{Cable Loss}$$

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

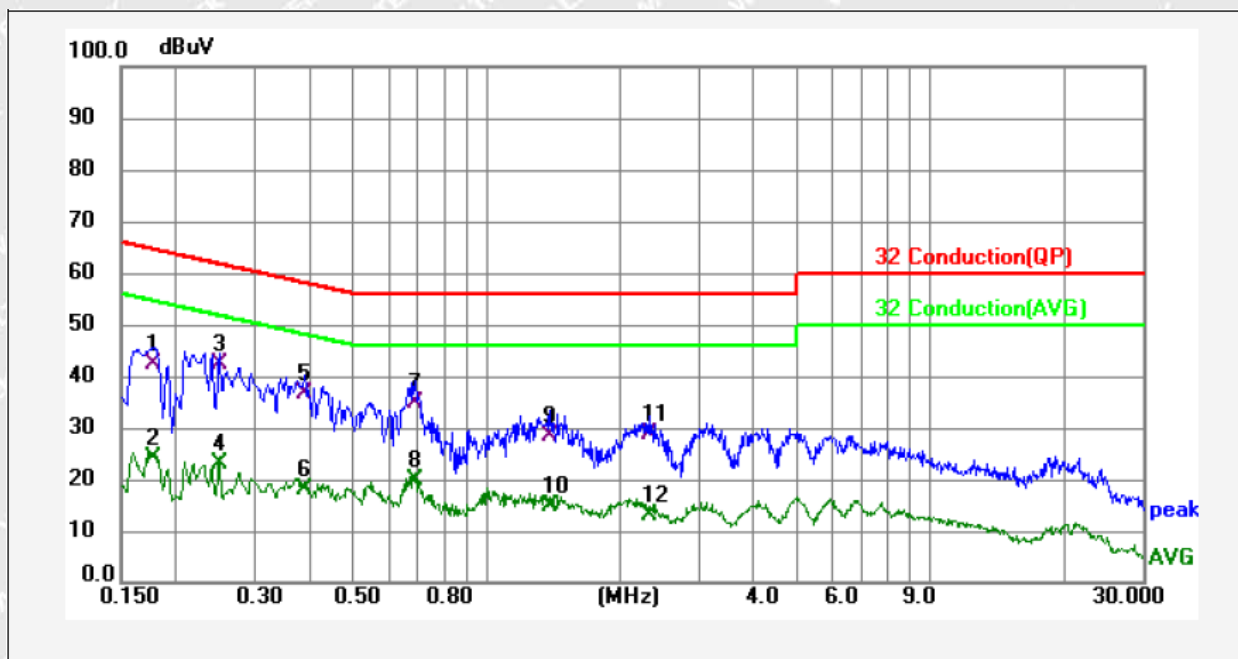
##### Live Line



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|--------------|-------------|----------|--------|
| 1   | 0.240       | 32.64          | 9.61        | 42.25         | 62.10        | -19.85      | QP       |        |
| 2   | 0.240       | 13.39          | 9.61        | 23.00         | 52.10        | -29.10      | AVG      |        |
| 3   | 0.406       | 28.52          | 9.63        | 38.15         | 57.73        | -19.58      | QP       |        |
| 4   | 0.406       | 11.37          | 9.63        | 21.00         | 47.73        | -26.73      | AVG      |        |
| 5   | 0.564       | 27.04          | 9.65        | 36.69         | 56.00        | -19.31      | QP       |        |
| 6   | 0.564       | 13.35          | 9.65        | 23.00         | 46.00        | -23.00      | AVG      |        |
| 7   | 0.681       | 32.35          | 9.65        | 42.00         | 56.00        | -14.00      | QP       |        |
| 8   | 0.681       | 17.35          | 9.65        | 27.00         | 46.00        | -19.00      | AVG      |        |
| 9   | 1.446       | 26.85          | 9.71        | 36.56         | 56.00        | -19.44      | QP       |        |
| 10  | 1.446       | 14.29          | 9.71        | 24.00         | 46.00        | -22.00      | AVG      |        |
| 11  | 2.247       | 26.24          | 9.76        | 36.00         | 56.00        | -20.00      | QP       |        |
| 12  | 2.247       | 13.24          | 9.76        | 23.00         | 46.00        | -23.00      | AVG      |        |



## Neutral Line



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|--------------|-------------|----------|--------|
| 1   | 0.177       | 32.82          | 9.53        | 42.35         | 64.63        | -22.28      | QP       |        |
| 2   | 0.177       | 14.49          | 9.53        | 24.02         | 54.63        | -30.61      | AVG      |        |
| 3   | 0.249       | 32.82          | 9.54        | 42.36         | 61.79        | -19.43      | QP       |        |
| 4   | 0.249       | 13.48          | 9.54        | 23.02         | 51.79        | -28.77      | AVG      |        |
| 5   | 0.389       | 27.00          | 9.56        | 36.56         | 58.09        | -21.53      | QP       |        |
| 6   | 0.389       | 8.44           | 9.56        | 18.00         | 48.09        | -30.09      | AVG      |        |
| 7   | 0.690       | 25.42          | 9.58        | 35.00         | 56.00        | -21.00      | QP       |        |
| 8   | 0.690       | 10.42          | 9.58        | 20.00         | 46.00        | -26.00      | AVG      |        |
| 9   | 1.383       | 18.83          | 9.63        | 28.46         | 56.00        | -27.54      | QP       |        |
| 10  | 1.383       | 5.37           | 9.63        | 15.00         | 46.00        | -31.00      | AVG      |        |
| 11  | 2.324       | 19.01          | 9.68        | 28.69         | 56.00        | -27.31      | QP       |        |
| 12  | 2.324       | 3.52           | 9.68        | 13.20         | 46.00        | -32.80      | 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:

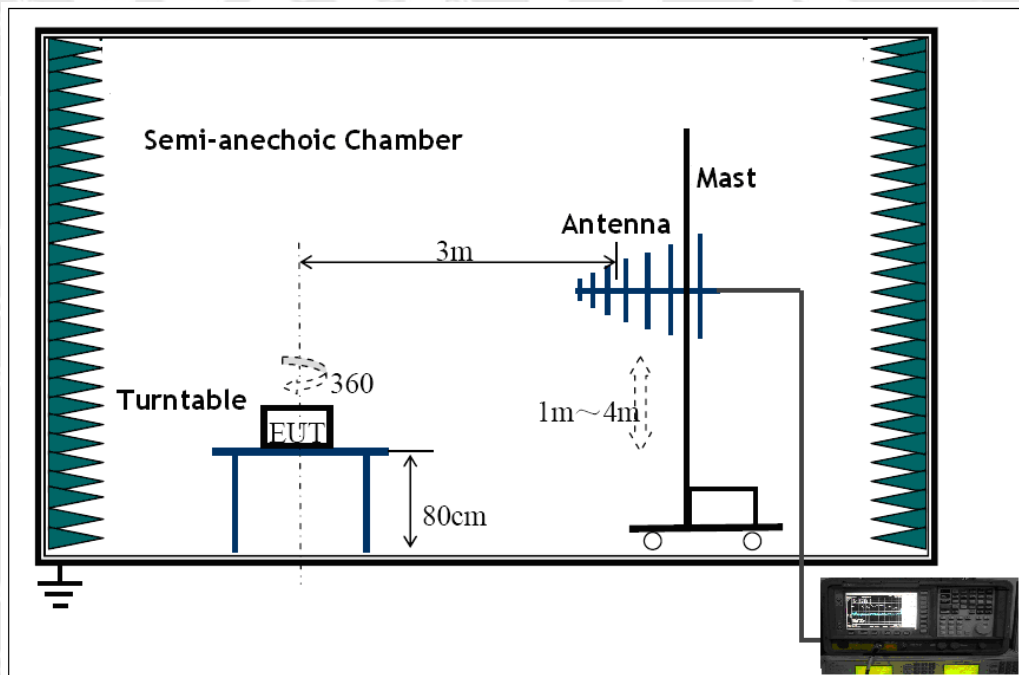
|                            |            |
|----------------------------|------------|
| Temperature.....           | : 22.4°C   |
| Humidity .....             | : 52.6%RH  |
| Atmospheric Pressure ..... | : 101.2kPa |

#### EUT Operation:

|                      |                                                                                              |
|----------------------|----------------------------------------------------------------------------------------------|
| Input Voltage.....   | : AC 230V/50Hz for mode 1; Battery 3.7V for mode 2                                           |
| Operating Mode ..... | : Mode 1: BT connected mode with AC input<br>Mode 2: BT connected mode with battery operated |

### 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:

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

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

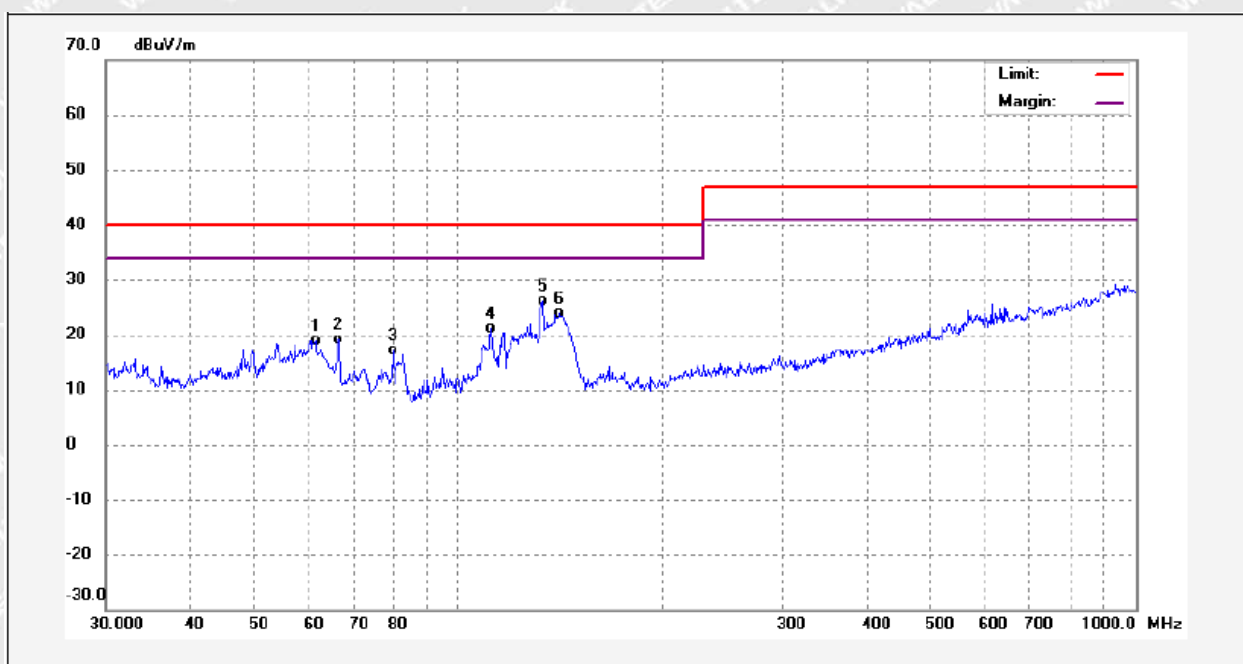
The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

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

## 5.2.5 Radiated Emission Test Data

BT connected mode with AC input

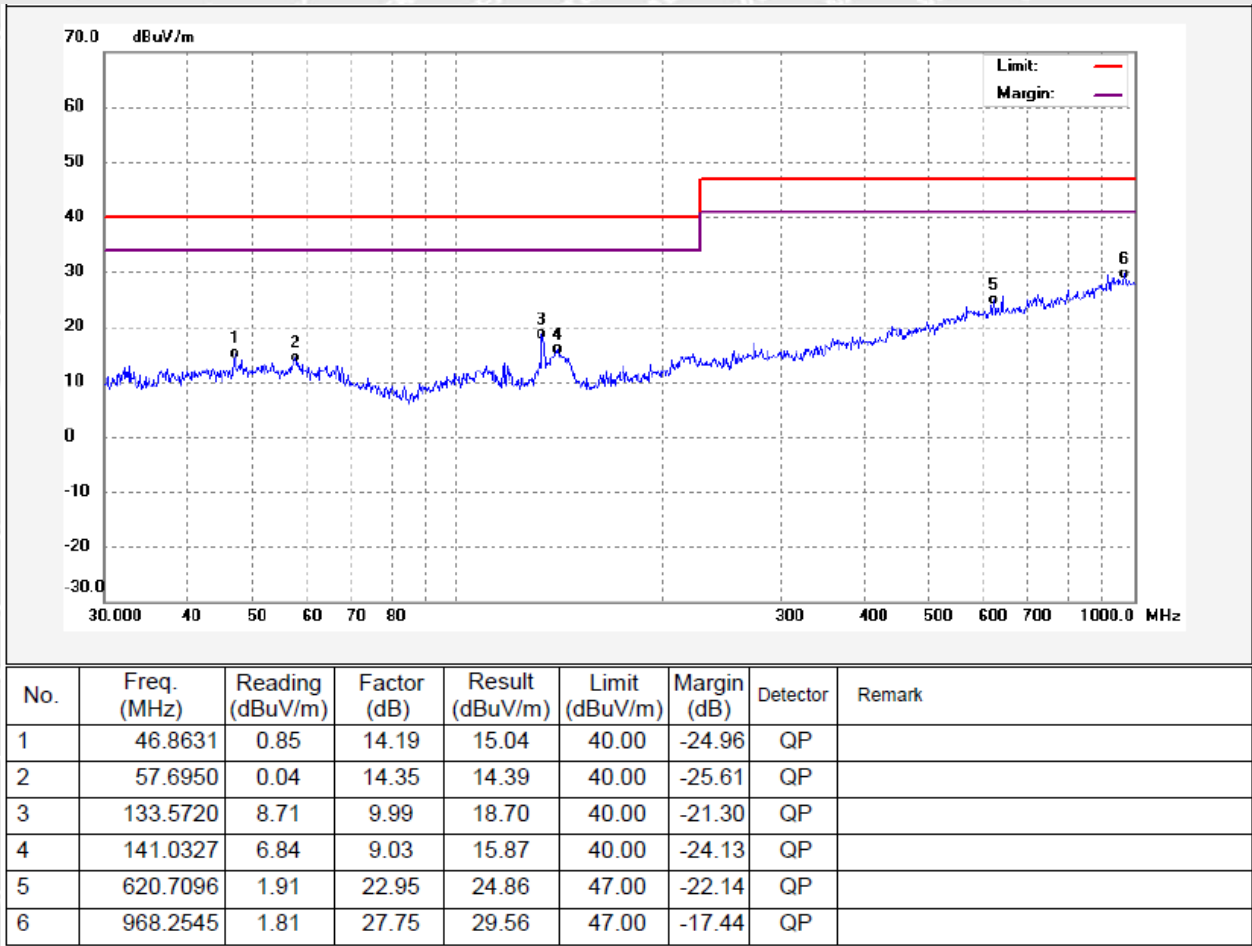
Vertical Polarization



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 61.4540     | 5.22             | 13.71       | 18.93           | 40.00          | -21.07      | QP       |        |
| 2   | 66.3825     | 6.40             | 12.84       | 19.24           | 40.00          | -20.76      | QP       |        |
| 3   | 79.9964     | 7.63             | 9.44        | 17.07           | 40.00          | -22.93      | QP       |        |
| 4   | 111.5814    | 8.59             | 12.51       | 21.10           | 40.00          | -18.90      | QP       |        |
| 5   | 133.2445    | 16.13            | 9.98        | 26.11           | 40.00          | -13.89      | QP       |        |
| 6   | 140.9832    | 14.73            | 9.03        | 23.76           | 40.00          | -16.24      | QP       |        |



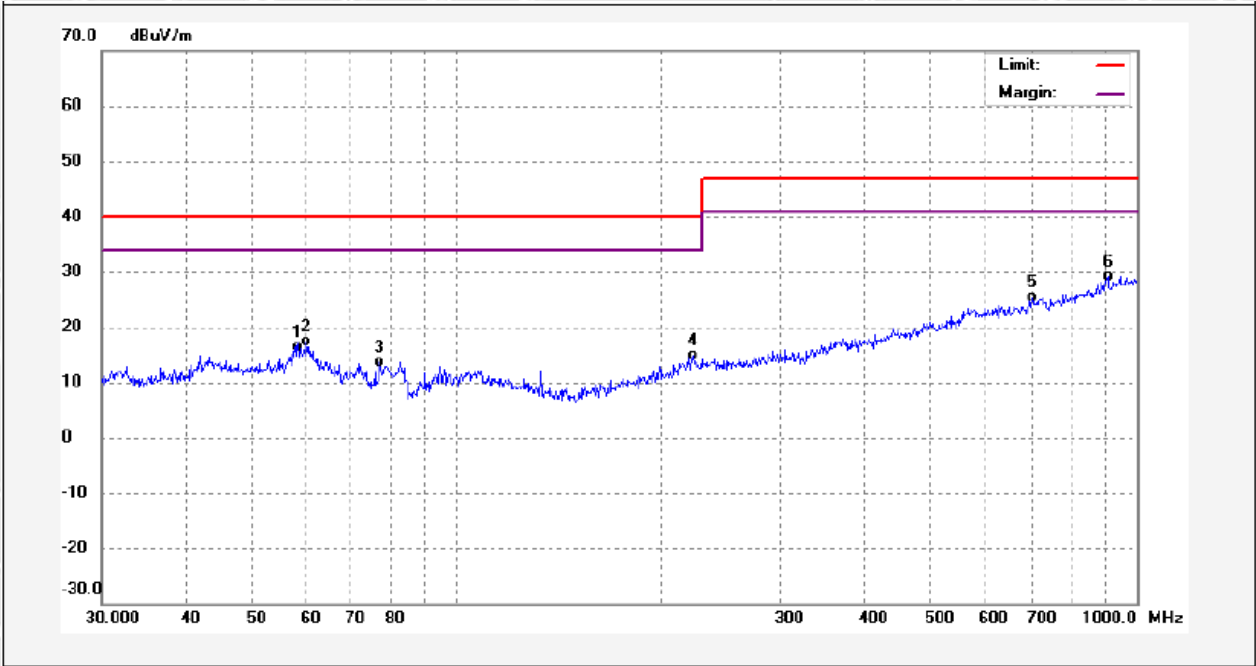
Horizontal Polarization





BT connected mode with battery operated

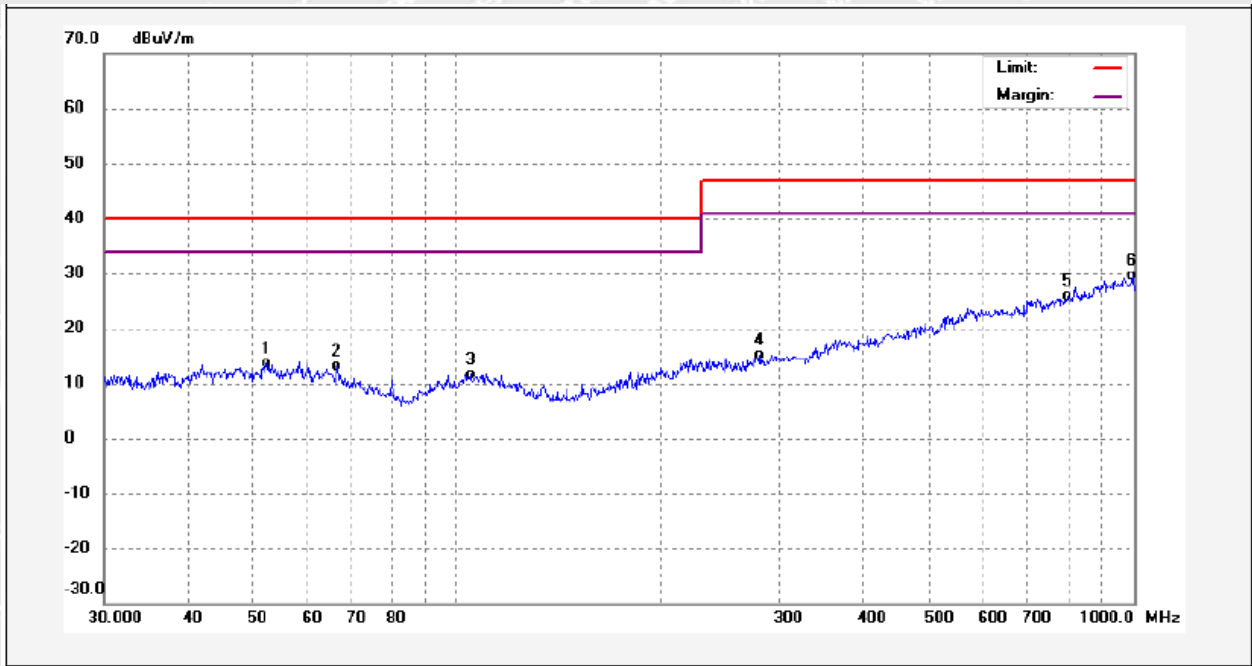
Vertical Polarization



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 58.3870     | 2.21             | 14.23       | 16.44           | 40.00          | -23.56      | QP       |        |
| 2   | 60.2590     | 3.48             | 13.83       | 17.31           | 40.00          | -22.69      | QP       |        |
| 3   | 77.1856     | 3.54             | 10.05       | 13.59           | 40.00          | -26.41      | QP       |        |
| 4   | 222.6377    | 0.46             | 14.33       | 14.79           | 40.00          | -25.21      | QP       |        |
| 5   | 702.4996    | 1.10             | 24.27       | 25.37           | 47.00          | -21.63      | QP       |        |
| 6   | 908.0731    | 2.36             | 26.73       | 29.09           | 47.00          | -17.91      | QP       |        |



Horizontal Polarization



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 52.2995     | -0.79            | 14.35       | 13.56           | 40.00          | -26.44      | QP       |        |
| 2   | 66.3592     | 0.33             | 12.85       | 13.18           | 40.00          | -26.82      | QP       |        |
| 3   | 104.5727    | -1.31            | 13.03       | 11.72           | 40.00          | -28.28      | QP       |        |
| 4   | 280.6136    | -0.27            | 15.41       | 15.14           | 47.00          | -31.86      | QP       |        |
| 5   | 798.4195    | 0.47             | 25.44       | 25.91           | 47.00          | -21.09      | QP       |        |
| 6   | 997.8983    | 1.81             | 27.92       | 29.73           | 47.00          | -17.27      | 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:

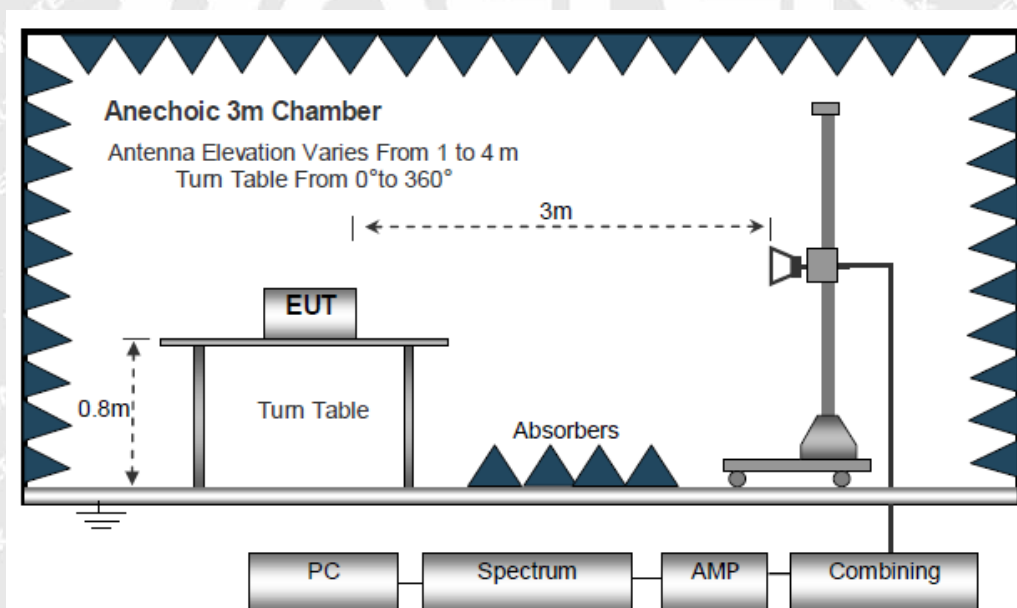
|                            |            |
|----------------------------|------------|
| Temperature.....           | : 22.4°C   |
| Humidity .....             | : 52.6%RH  |
| Atmospheric Pressure ..... | : 101.2kPa |

##### EUT Operation:

|                      |                                                                                              |
|----------------------|----------------------------------------------------------------------------------------------|
| Input Voltage.....   | : AC 230V/50Hz for mode 1; Battery 3.7V for mode 2                                           |
| Operating Mode ..... | : Mode 1: BT connected mode with AC input<br>Mode 2: BT connected mode with battery operated |

#### 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:

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

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

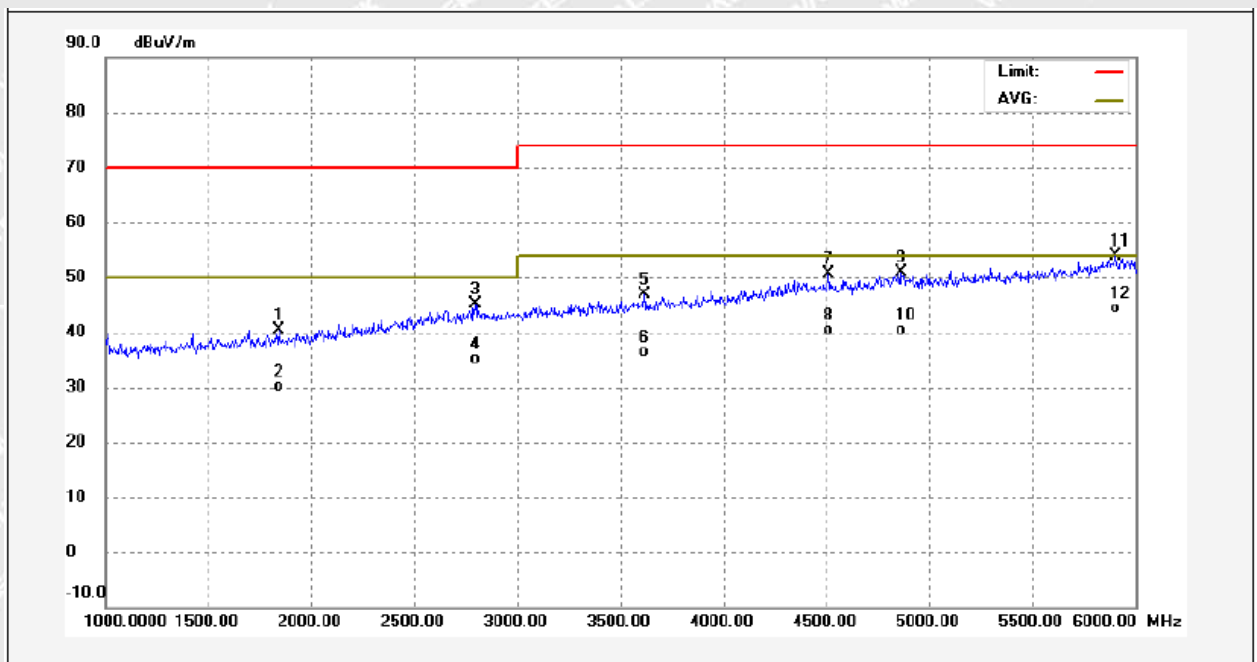
The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

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

### 5.3.5 Radiated Emission Test Data

BT connected mode with AC input

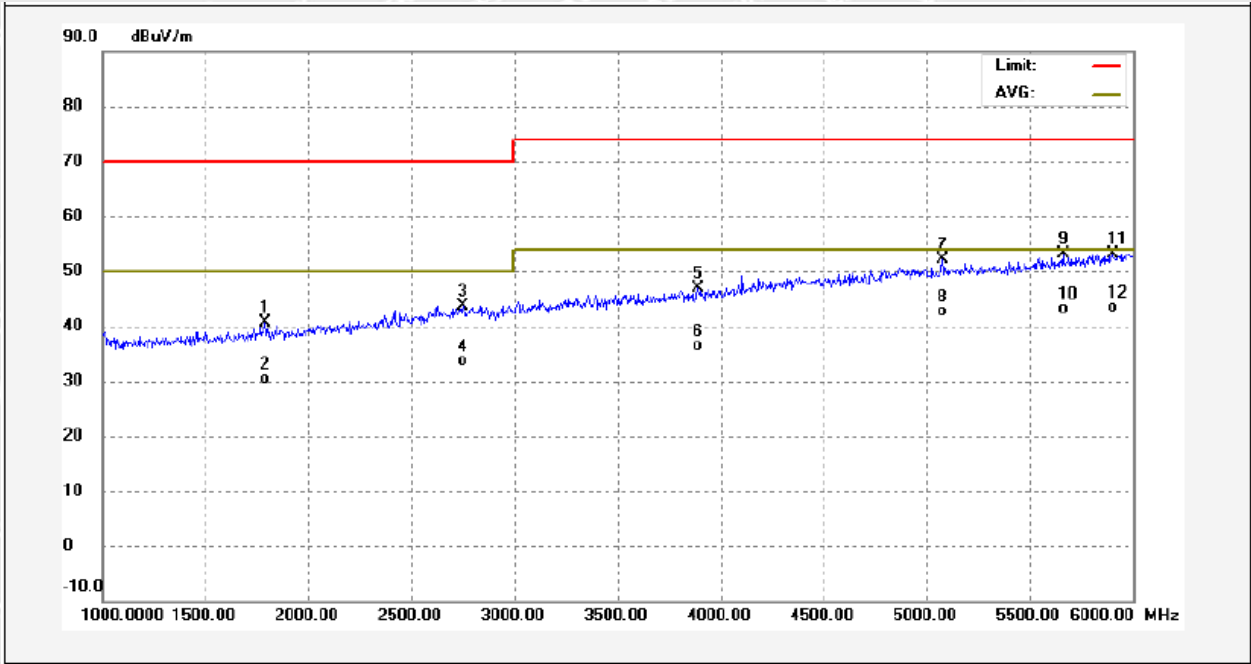
#### Vertical Polarization



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 1842.000    | 9.95             | 30.36       | 40.31           | 70.00          | -29.69      | peak     |        |
| 2   | 1842.000    | -0.11            | 30.36       | 30.25           | 50.00          | -19.75      | AVG      |        |
| 3   | 2798.500    | 11.69            | 33.42       | 45.11           | 70.00          | -24.89      | peak     |        |
| 4   | 2798.500    | 1.60             | 33.42       | 35.02           | 50.00          | -14.98      | AVG      |        |
| 5   | 3616.500    | 11.78            | 35.01       | 46.79           | 74.00          | -27.21      | peak     |        |
| 6   | 3616.500    | 1.49             | 35.01       | 36.50           | 54.00          | -17.50      | AVG      |        |
| 7   | 4514.500    | 13.03            | 37.51       | 50.54           | 74.00          | -23.46      | peak     |        |
| 8   | 4514.500    | 2.75             | 37.51       | 40.26           | 54.00          | -13.74      | AVG      |        |
| 9   | 4869.000    | 12.46            | 38.44       | 50.90           | 74.00          | -23.10      | peak     |        |
| 10  | 4869.000    | 1.84             | 38.44       | 40.28           | 54.00          | -13.72      | AVG      |        |
| 11  | 5905.000    | 13.32            | 40.68       | 54.00           | 74.00          | -20.00      | peak     |        |
| 12  | 5905.000    | 3.66             | 40.68       | 44.34           | 54.00          | -9.66       | AVG      |        |



Horizontal Polarization

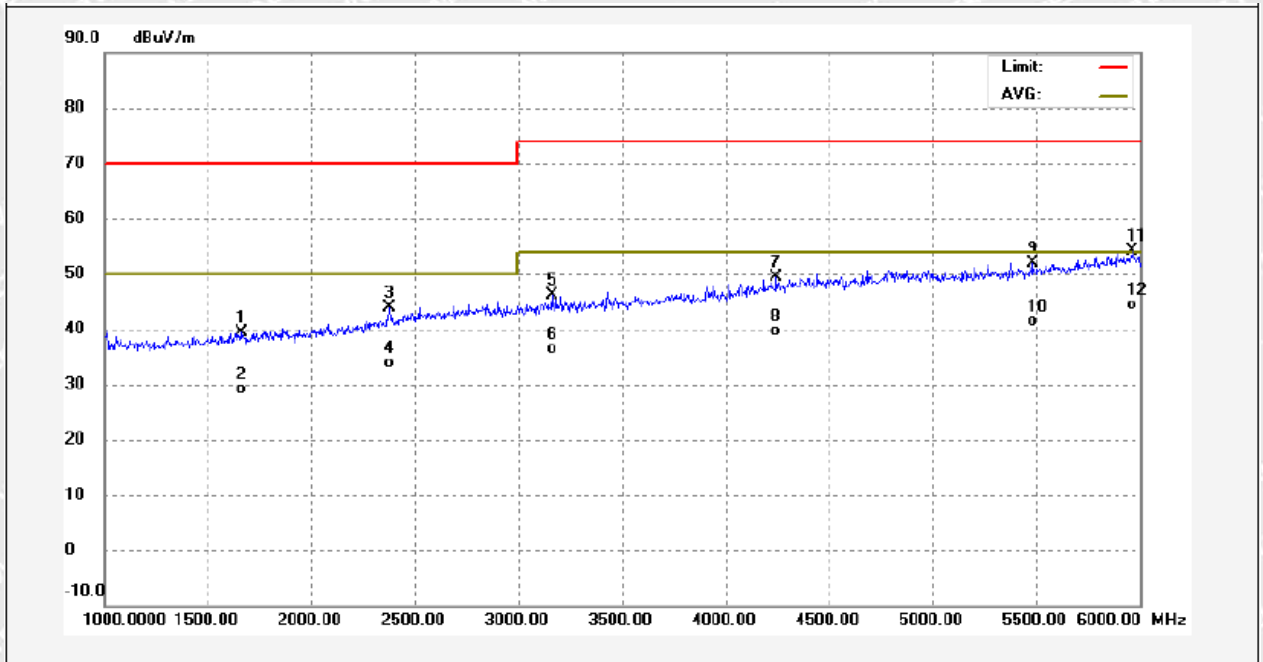


| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 1794.500    | 10.27            | 30.29       | 40.56           | 70.00          | -29.44      | peak     |        |
| 2   | 1794.500    | -0.03            | 30.29       | 30.26           | 50.00          | -19.74      | AVG      |        |
| 3   | 2752.500    | 10.42            | 33.30       | 43.72           | 70.00          | -26.28      | peak     |        |
| 4   | 2752.500    | 0.22             | 33.30       | 33.52           | 50.00          | -16.48      | AVG      |        |
| 5   | 3894.000    | 11.11            | 35.67       | 46.78           | 74.00          | -27.22      | peak     |        |
| 6   | 3894.000    | 0.80             | 35.67       | 36.47           | 54.00          | -17.53      | AVG      |        |
| 7   | 5078.000    | 13.27            | 38.91       | 52.18           | 74.00          | -21.82      | peak     |        |
| 8   | 5078.000    | 3.71             | 38.91       | 42.62           | 54.00          | -11.38      | AVG      |        |
| 9   | 5660.000    | 13.06            | 40.03       | 53.09           | 74.00          | -20.91      | peak     |        |
| 10  | 5660.000    | 3.22             | 40.03       | 43.25           | 54.00          | -10.75      | AVG      |        |
| 11  | 5900.500    | 12.57            | 40.66       | 53.23           | 74.00          | -20.77      | peak     |        |
| 12  | 5900.500    | 2.67             | 40.66       | 43.33           | 54.00          | -10.67      | AVG      |        |



## BT connected mode with battery operated

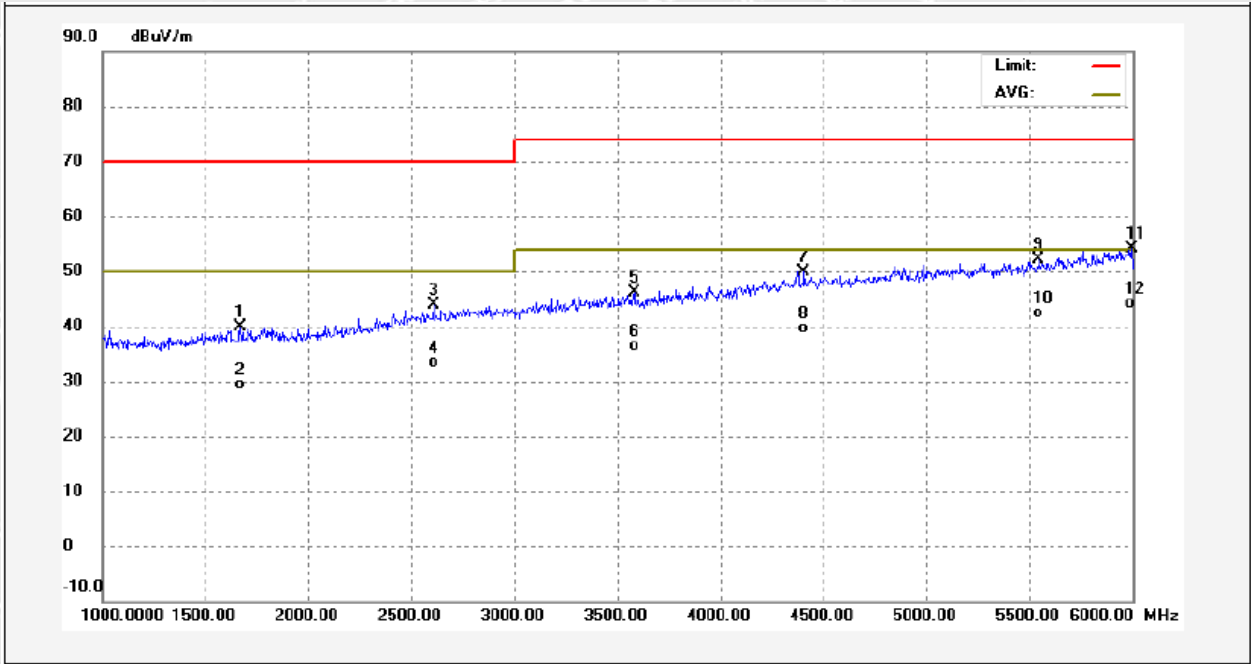
### Vertical Polarization



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 1663.000    | 9.27             | 30.09       | 39.36           | 70.00          | -30.64      | peak     |        |
| 2   | 1663.000    | -1.04            | 30.09       | 29.05           | 50.00          | -20.95      | AVG      |        |
| 3   | 2377.500    | 11.74            | 32.18       | 43.92           | 70.00          | -26.08      | peak     |        |
| 4   | 2377.500    | 1.65             | 32.18       | 33.83           | 50.00          | -16.17      | AVG      |        |
| 5   | 3162.000    | 12.05            | 34.17       | 46.22           | 74.00          | -27.78      | peak     |        |
| 6   | 3162.000    | 2.23             | 34.17       | 36.40           | 54.00          | -17.60      | AVG      |        |
| 7   | 4249.000    | 12.58            | 36.70       | 49.28           | 74.00          | -24.72      | peak     |        |
| 8   | 4249.000    | 2.82             | 36.70       | 39.52           | 54.00          | -14.48      | AVG      |        |
| 9   | 5489.500    | 12.40            | 39.58       | 51.98           | 74.00          | -22.02      | peak     |        |
| 10  | 5489.500    | 1.79             | 39.58       | 41.37           | 54.00          | -12.63      | AVG      |        |
| 11  | 5968.500    | 13.24            | 40.84       | 54.08           | 74.00          | -19.92      | peak     |        |
| 12  | 5968.500    | 3.54             | 40.84       | 44.38           | 54.00          | -9.62       | AVG      |        |



Horizontal Polarization



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-------------|------------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1   | 1672.000    | 9.77             | 30.10       | 39.87           | 70.00          | -30.13      | peak     |        |
| 2   | 1672.000    | -0.69            | 30.10       | 29.41           | 50.00          | -20.59      | AVG      |        |
| 3   | 2614.500    | 10.84            | 32.97       | 43.81           | 70.00          | -26.19      | peak     |        |
| 4   | 2614.500    | 0.29             | 32.97       | 33.26           | 50.00          | -16.74      | AVG      |        |
| 5   | 3581.500    | 11.30            | 34.92       | 46.22           | 74.00          | -27.78      | peak     |        |
| 6   | 3581.500    | 1.49             | 34.92       | 36.41           | 54.00          | -17.59      | AVG      |        |
| 7   | 4405.000    | 12.76            | 37.18       | 49.94           | 74.00          | -24.06      | peak     |        |
| 8   | 4405.000    | 2.34             | 37.18       | 39.52           | 54.00          | -14.48      | AVG      |        |
| 9   | 5545.500    | 12.51            | 39.72       | 52.23           | 74.00          | -21.77      | peak     |        |
| 10  | 5545.500    | 2.78             | 39.72       | 42.50           | 54.00          | -11.50      | AVG      |        |
| 11  | 5998.500    | 13.11            | 40.93       | 54.04           | 74.00          | -19.96      | peak     |        |
| 12  | 5998.500    | 3.08             | 40.93       | 44.01           | 54.00          | -9.99       | 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<br>Contact Discharge: ±4kV<br>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:

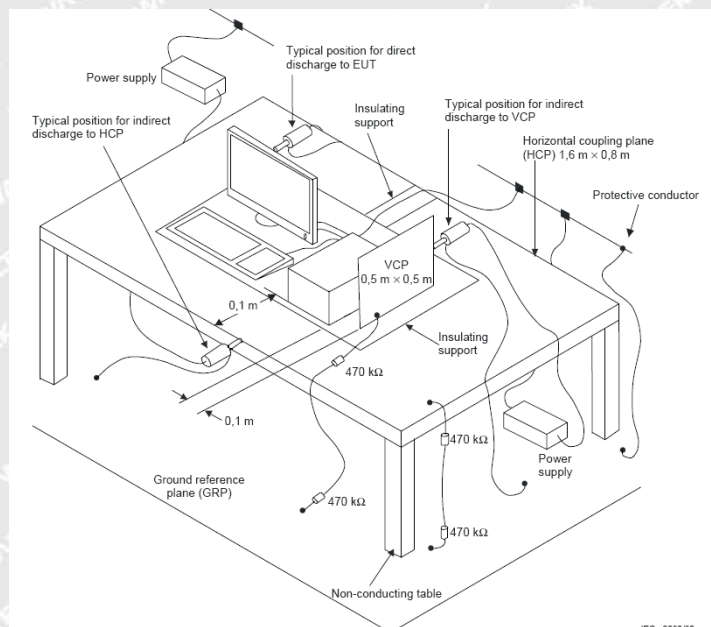
|                           |            |
|---------------------------|------------|
| Temperature .....         | : 23.9°C   |
| Humidity .....            | : 51.2%RH  |
| Barometric Pressure ..... | : 101.7kPa |

#### EUT Operation:

|                      |                                                                                              |
|----------------------|----------------------------------------------------------------------------------------------|
| Input Voltage .....  | : AC 230V/50Hz for mode 1; Battery 3.7V for mode 2                                           |
| Operating Mode ..... | : Mode 1: BT connected mode with AC input<br>Mode 2: BT connected mode with battery operated |

### 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                                                   |

#### 6.3.1 E.U.T. Operation

##### Operating Environment:

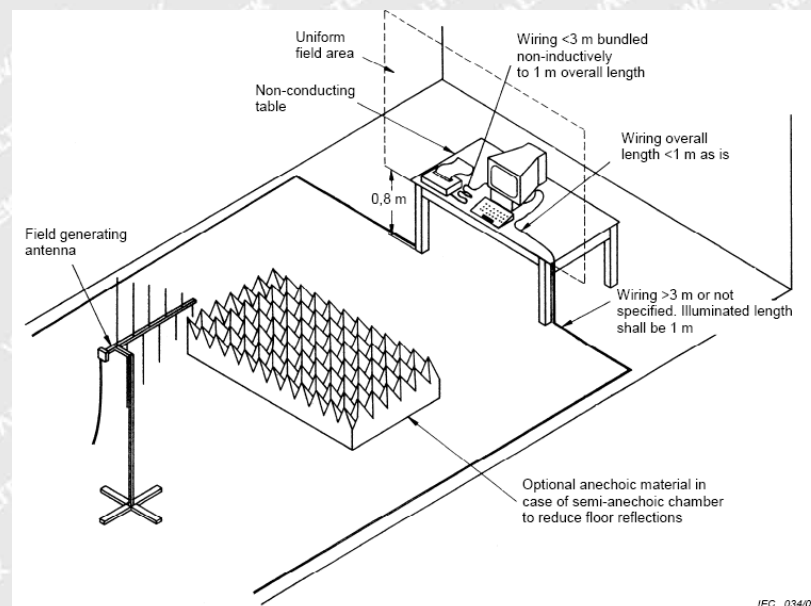
|                           |            |
|---------------------------|------------|
| Temperature .....         | : 23.3°C   |
| Humidity .....            | : 51.4%RH  |
| Barometric Pressure ..... | : 101.2kPa |

##### EUT Operation:

|                      |                                                                                              |
|----------------------|----------------------------------------------------------------------------------------------|
| Input Voltage .....  | : AC 230V/50Hz for mode 1; Battery 3.7V for mode 2                                           |
| Operating Mode ..... | : Mode 1: BT connected mode with AC input<br>Mode 2: BT connected mode with battery operated |

#### 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** ..... : 23.7°C  
**Humidity** ..... : 51.4%RH  
**Barometric Pressure** ..... : 101.7kPa

#### EUT Operation:

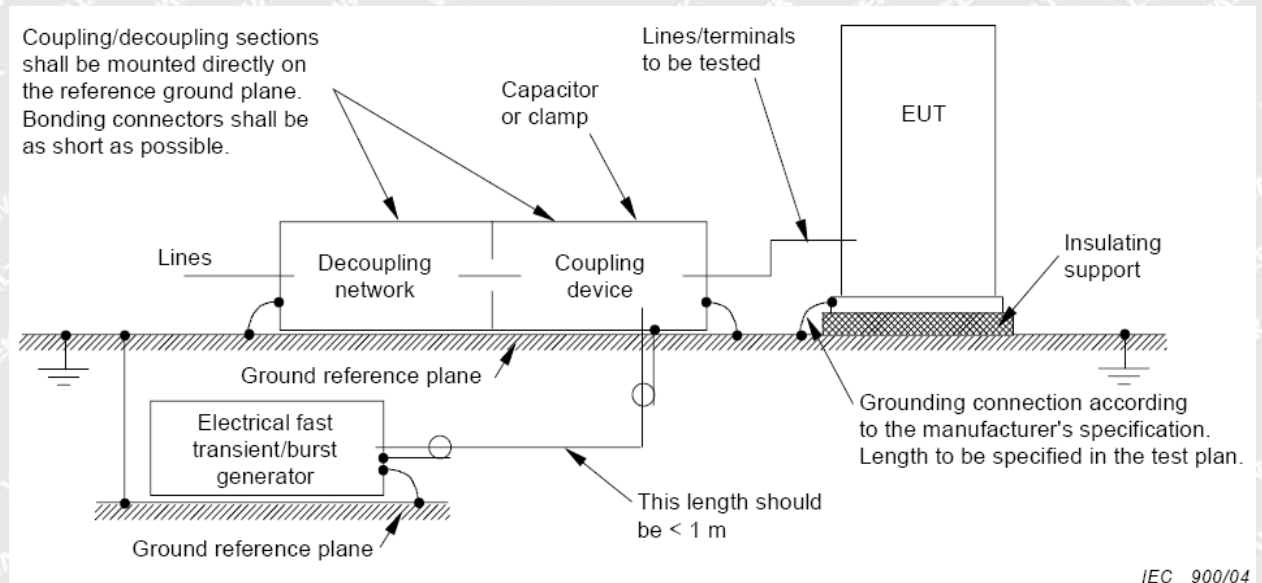
**Input Voltage** ..... : AC 230V/50Hz  
**Operating Mode** ..... : BT connected mode with AC input

# 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 | $\pm 1.0$      | 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  $0^\circ$ ,  $90^\circ$ ,  $180^\circ$  and at  $270^\circ$

### 6.5.1E.U.T. Operation

#### Operating Environment:

**Temperature** ..... :  $23.5^\circ\text{C}$

**Humidity** ..... : 51.6%RH

**Barometric Pressure** ..... : 101.7kPa

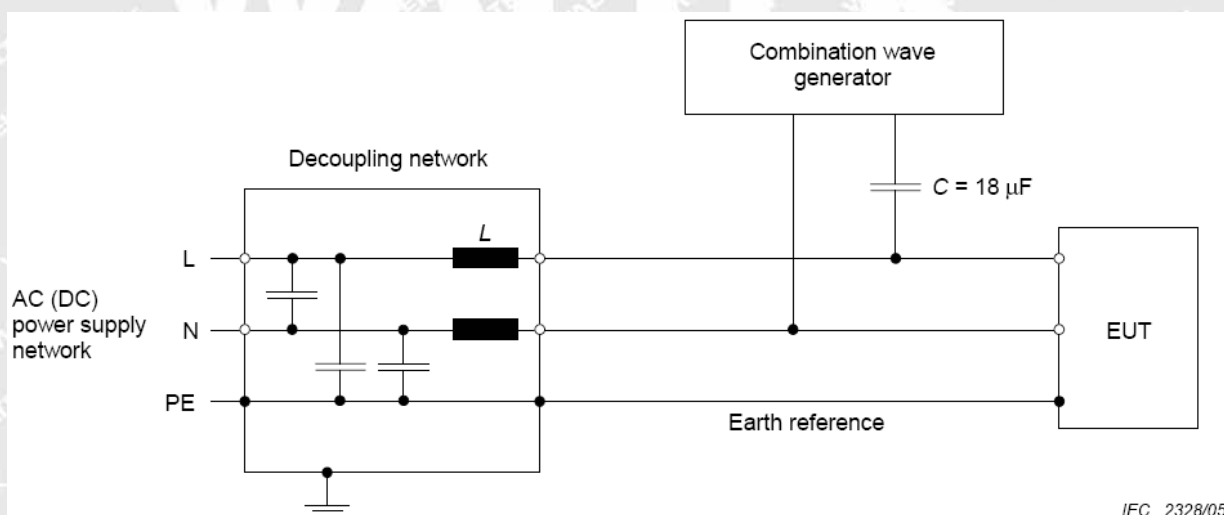
#### EUT Operation:

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

**Operating Mode** ..... : BT connected mode with AC input

### 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   | $\pm 1$              | B                     | N/A    |
| Between Live And Neutral  | $\pm 1$              | B                     | Pass*  |
| Between Live And Earth    | $\pm 2$              | B                     | N/A    |
| Between Neutral And Earth | $\pm 2$              | 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  $\Omega$ )

**Modulation** ..... : 80%, 1kHz Amplitude Modulation.

### 6.6.1E.U.T. Operation

**Operating Environment:**

**Temperature** ..... : 23.3°C

**Humidity** ..... : 51.8%RH

**Barometric Pressure** ..... : 101.7kPa

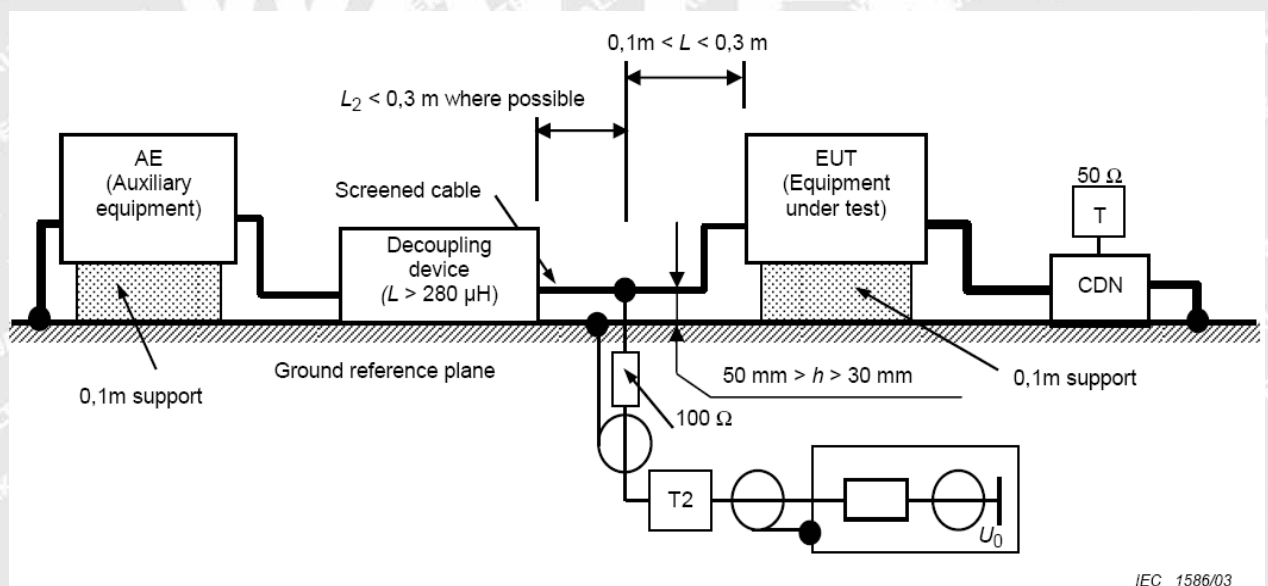
**EUT Operation:**

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

**Operating Mode** ..... : BT connected mode with AC input

### 6.6.2 Block Diagram of Setup

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





6.6.3 Test 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:

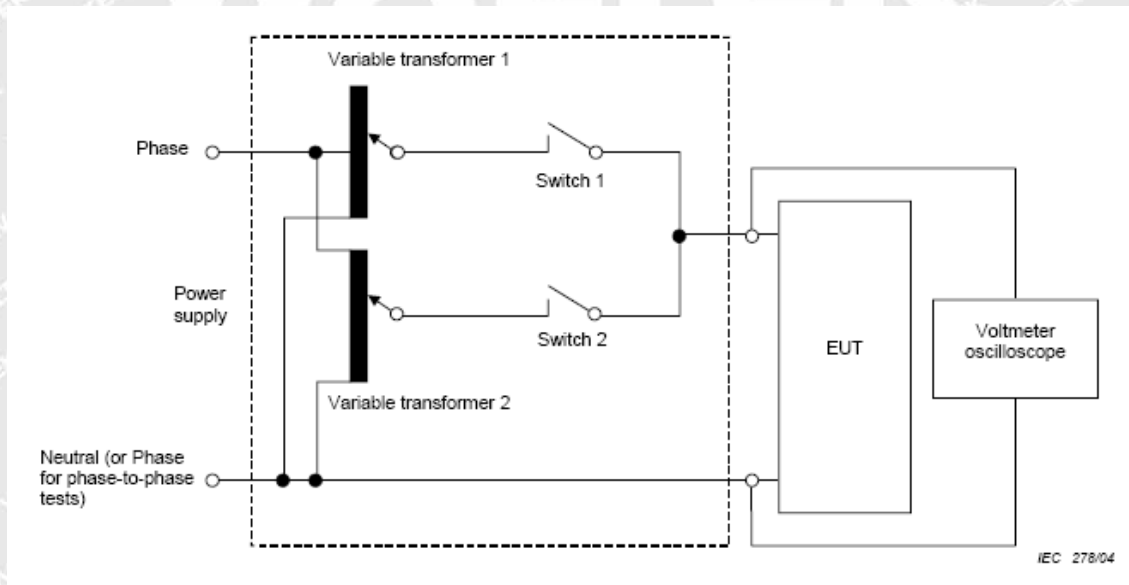
**Temperature** ..... : 23.1°C  
**Humidity** ..... : 52.2%RH  
**Barometric Pressure** ..... : 101.7kPa

#### EUT Operation:

**Input Voltage** ..... : AC 230V/50Hz  
**Operating Mode** ..... : BT connected mode with AC input

### 6.7.2 Block Diagram of Setup

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





6.7.3 Test Results

| Test Item             | Test Level<br>in %U <sub>T</sub> | Performance<br>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

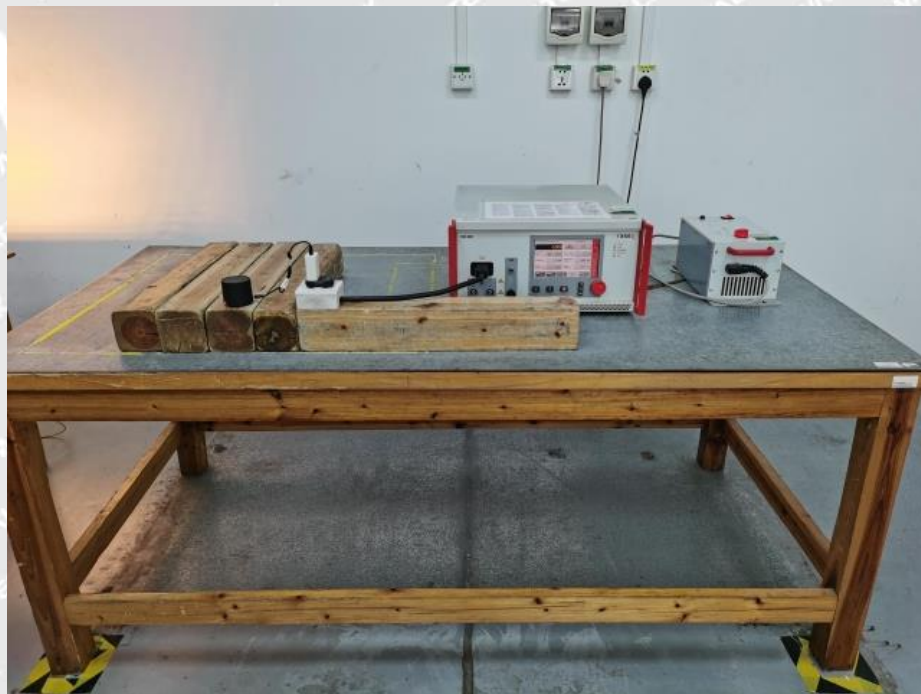




## 7.5 Photograph – Continuous RF Electromagnetic Field Disturbances Test Setup



## 7.6 Photograph – EFT Immunity Test Setup





## 7.7 Photograph – Surge Immunity Test Setup

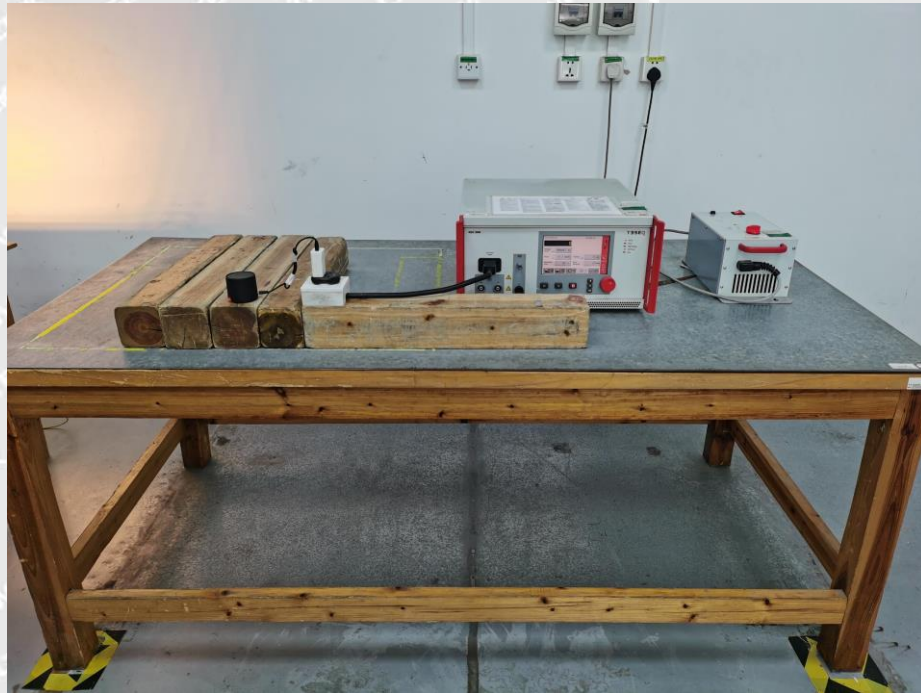


## 7.8 Photograph – Continuous Induced RF Disturbance Test Setup





## 7.9 Photograph – Voltage Dips and Interruptions Immunity Test Setup



# WALTEK



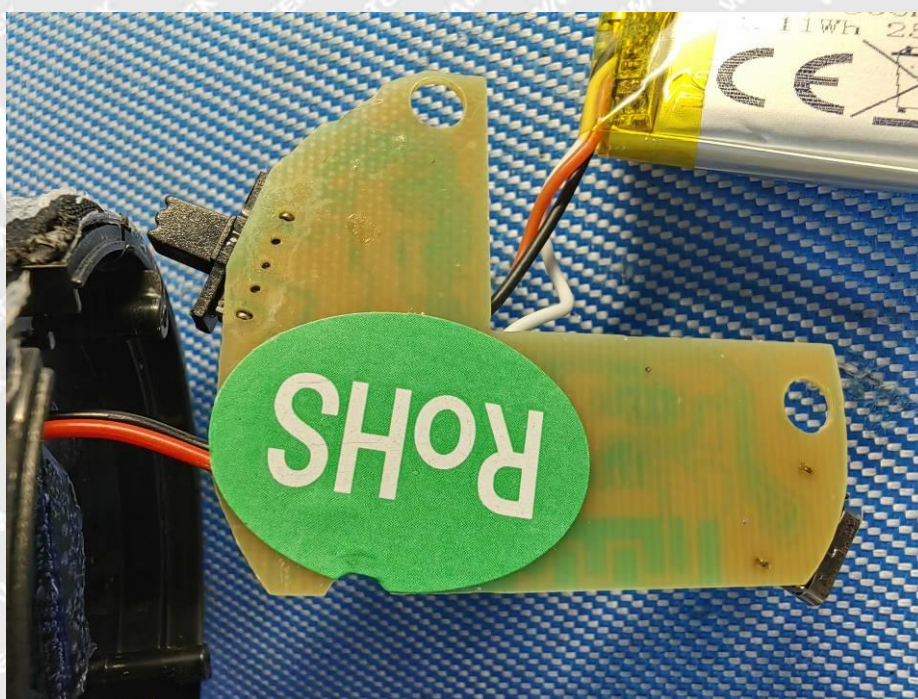
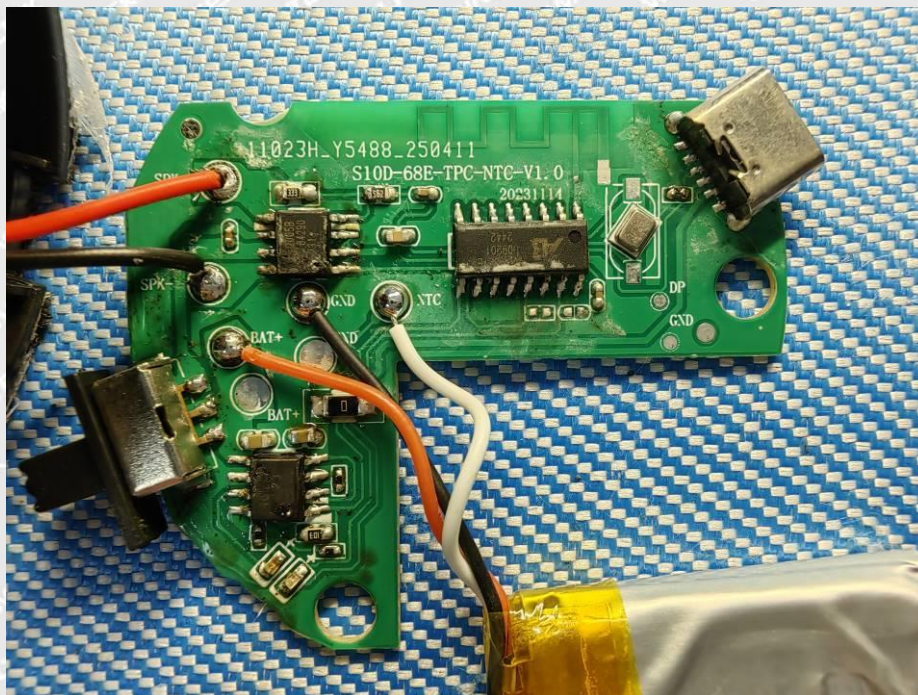
## 8 Photographs – Constructional Details

### 8.1 EUT – External Photos





## 8.2 EUT – Internal Photos





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

# WALTEK