# EMC TEST REPORT

| | |
|---|---|
| **Applicant:** | Dragino Technology Co., Limited |
| **Address of Applicant:** | Room 202, Block B, BCT Incubation Bases (BaoChengTai), No.8 CaiYunRoadLongCheng Street, LongGang District ; Shenzhen 518116,China |
| **Manufacturer/Factory:** | Dragino Technology Co., Limited |
| **Address of Manufacturer/Factory:** | Room 202, Block B, BCT Incubation Bases (BaoChengTai), No.8 CaiYunRoadLongCheng Street, LongGang District ; Shenzhen 518116,China |
| **Equipment Under Test (EUT)** | |
| Product Name: | LoRaWAN Gateway |
| Model No.: | LPS8 |
| Trade Mark: | Dragino |
| **Applicable standards:** | ETSI EN 301 489-1 V2.2.3 (2019-11)<br>ETSI EN 301 489-3 V2.1.1 (2019-03)<br>Draft ETSI EN 301 489-17 V3.2.0 (2017-03)<br>EN 55032:2015/AC:2016<br>EN 55035:2017<br>EN 61000-3-3:2013 |
| **Date of sample receipt:** | Nov. 29, 2019 |
| **Date of Test:** | Dec. 02- Dec. 09, 2019 |
| **Date of report issue:** | Dec. 11, 2019 |
| **Test Result :** | PASS * |

* In the configuration tested, the EUT complied with the standards specified above.

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The protection requirements with respect to electromagnetic compatibility contained in Directive 2014/53/EU are considered.

**Laboratory Manager**

# 2 Version

| Version No. | Date | Description |
|---|---|---|
| *00* | *Dec. 11, 2019* | *Original* |
| | | |
| | | |
| | | |
| | | |

***Prepared By:***  ***Date:*** *Dec. 11, 2019*

***Project Engineer***

***Check By:***  ***Date:*** *Dec. 11, 2019*

***Reviewer***

# 3 Contents

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# 4 Test Summary

| EMI Test | | | | |
|---|---|---|---|---|
| Test Item | Test Requirement | Test Method | Application | Result |
| Radiated Emission | ETSI EN 301 489-3<br>ETSI EN 301 489-17<br>EN 55032 | ETSI EN301 489-1<br>EN 55032 | Enclosure | Pass |
| Conducted Emission | ETSI EN 301 489-3<br>ETSI EN 301 489-17<br>EN 55032 | ETSI EN301 489-1<br>EN 55032 | AC port/<br>Signal port | Pass |
| Harmonic Current Emissions | ETSI EN 301 489-3<br>ETSI EN 301 489-17<br>EN 55032 | ETSI EN301 489-1<br>EN 55032 | AC port | N/A |
| Voltage Fluctuations and Flicker | ETSI EN 301 489-3<br>ETSI EN 301 489-17<br>EN 55032 | ETSI EN301 489-1<br>EN 55032 | AC port | Pass |
| **EMS Test** | | | | |
| ESD (Electrostatic Discharge) | ETSI EN 301 489-3<br>ETSI EN 301 489-17<br>EN 55035 | EN 61000-4-2<br>EN 55035 | Enclosure | Pass |
| Radio frequency electromagnetic field (80 MHz to 6 000 MHz) | ETSI EN 301 489-3<br>ETSI EN 301 489-17<br>EN 55035 | EN 61000-4-3<br>EN 55035 | Enclosure | Pass |
| EFT (Electrical Fast Transients) | ETSI EN 301 489-3<br>ETSI EN 301 489-17<br>EN 55035 | EN 61000-4-4<br>EN 55035 | AC port/<br>Signal port | Pass |
| Surge Immunity | ETSI EN 301 489-3<br>ETSI EN 301 489-17<br>EN 55035 | EN 61000-4-5<br>EN 55035 | AC port/<br>Signal port | Pass |
| Radio frequency, common mode | ETSI EN 301 489-3<br>ETSI EN 301 489-17<br>EN 55035 | EN 61000-4-6<br>EN 55035 | AC port/<br>Signal port | Pass |
| Voltage Dips and Interruptions | ETSI EN 301 489-3<br>ETSI EN 301 489-17<br>EN 55035 | EN 61000-4-11<br>EN 55035 | AC port | Pass |

*Remark:*
*Pass: The EUT complies with the essential requirements in the standard.*
*N/A: Not applicable*

# 5 General Information

## 5.1 General Description of EUT

| | |
|---|---|
| Product Name: | LoRaWAN Gateway |
| Model No.: | LPS8 |
| Power Supply: | DC 5.0V From Adapter |
| **Lora** | |
| Operation Frequency: | 863MHz-870MHz |
| Channel Numbers: | 35 |
| Channel Separation: | 200KHz |
| Modulation Type: | FSK |
| Antenna Type: | External antenna |
| Antenna Gain: | 2.69dBi |
| **WIFI** | |
| Operation Frequency: | 2412MHz~2472MHz 802.11b/802.11g/802.11n(HT20)<br>2422MHz~2462MHz 802.11n(H40) |
| Channel Separation: | 5MHz |
| Modulation Technology: | 802.11b: DSSS<br>802.11n(HT20)/802.11n(HT40) |
| Antenna Type: | Integral Antenna |
| Antenna gain: | 3.30dBi |

## 5.2 Operating Modes

| Operating mode | Detail description |
|---|---|
| Lora mode | Keep the EUT works at Lora link communication status. |
| WiFi mode | Keep the EUT works at play internet information by wifi network status. |
| LAN mode | Keep the EUT works at ping with PC status. |

## 5.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

● **FCC —Registration No.: 381383**

Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 381383.

● **IC —Registration No.: 9079A**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0

## 5.4 Description of Support Units

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| Apple | PC | A1278 | C1MN99ERDTY3 |

## 5.5 Test Location

| RI test was performed at: |
|---|
| SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch,<br>No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057. |
| All other tests were performed at: |
| Global United Technology Services Co., Ltd.<br>Address: No. 123- 128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102<br>Tel: 0755-27798480<br>Fax: 0755-27798960 |

## 5.6 Deviation from Standards

None.

## 5.7 Abnormalities from Standard Conditions

None.

## 5.8 Other Information Requested by the Customer

None.

## 5.9 Monitoring of EUT for All Immunity Test

| | |
|---|---|
| Visual: | Monitored the work status of the EUT |
| Audio: | None |

# 6 Equipment Used during Test

| Radiated Emission: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | 3m Semi- Anechoic Chamber | ZhongYu Electron | 9.2(L)*6.2(W)* 6.4(H) | GTS250 | July. 03 2015 | July. 02 2020 |
| 2 | Control Room | ZhongYu Electron | 6.2(L)*2.5(W)* 2.4(H) | GTS251 | N/A | N/A |
| 3 | EMI Test Receiver | Rohde & Schwarz | ESU26 | GTS203 | June. 27 2019 | June. 26 2020 |
| 4 | BiConiLog Antenna | SCHWARZBECK MESS-ELEKTRONIK | VULB9163 | GTS214 | June. 27 2019 | June. 26 2020 |
| 5 | Double -ridged waveguide horn | SCHWARZBECK MESS-ELEKTRONIK | BBHA 9120 D | GTS208 | June. 27 2019 | June. 26 2020 |
| 6 | Horn Antenna | ETS-LINDGREN | 3160 | GTS217 | June. 27 2019 | June. 26 2020 |
| 7 | EMI Test Software | AUDIX | E3 | N/A | N/A | N/A |
| 8 | Coaxial Cable | GTS | N/A | GTS213 | June. 27 2019 | June. 26 2020 |
| 9 | Coaxial Cable | GTS | N/A | GTS211 | June. 27 2019 | June. 26 2020 |
| 10 | Coaxial cable | GTS | N/A | GTS210 | June. 27 2019 | June. 26 2020 |
| 11 | Coaxial Cable | GTS | N/A | GTS212 | June. 27 2019 | June. 26 2020 |
| 12 | Amplifier(100kHz-3GHz) | HP | 8347A | GTS204 | June. 27 2019 | June. 26 2020 |
| 13 | Amplifier(2GHz-20GHz) | HP | 84722A | GTS206 | June. 27 2019 | June. 26 2020 |
| 14 | Amplifier (18-26GHz) | Rohde & Schwarz | AFS33-18002 650-30-8P-44 | GTS218 | June. 27 2019 | June. 26 2020 |
| 15 | Band filter | Amindeon | 82346 | GTS219 | June. 27 2019 | June. 26 2020 |
| 16 | Power Meter | Anritsu | ML2495A | GTS540 | June. 27 2019 | June. 26 2020 |
| 17 | Power Sensor | Anritsu | MA2411B | GTS541 | June. 27 2019 | June. 26 2020 |
| 18 | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500 | GTS575 | June. 27 2019 | June. 26 2020 |
| 19 | Splitter | Agilent | 11636B | GTS237 | June. 27 2019 | June. 26 2020 |
| 20 | Loop Antenna | ZHINAN | ZN30900A | GTS534 | June. 27 2019 | June. 26 2020 |
| 21 | Breitband hornantenne | SCHWARZBECK | BBHA 9170 | GTS579 | Oct. 20 2019 | Oct. 19 2020 |
| 22 | Amplifier | TDK | PA-02-02 | GTS574 | Oct. 20 2019 | Oct. 19 2020 |
| 23 | Amplifier | TDK | PA-02-03 | GTS576 | Oct. 20 2019 | Oct. 19 2020 |
| 24 | PSA Series Spectrum Analyzer | Rohde & Schwarz | FSP | GTS578 | June. 27 2019 | June. 26 2020 |

| Conducted Emission | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | Shielding Room | ZhongYu Electron | 7.3(L)x3.1(W)x2.9(H) | GTS252 | May.15 2019 | May.14 2022 |
| 2 | EMI Test Receiver | R&S | ESCI 7 | GTS552 | June. 27 2019 | June. 26 2020 |
| 3 | Coaxial Switch | ANRITSU CORP | MP59B | GTS225 | June. 27 2019 | June. 26 2020 |
| 4 | Artificial Mains Network | SCHWARZBECK MESS | NSLK8127 | GTS226 | June. 27 2019 | June. 26 2020 |
| 5 | Coaxial Cable | GTS | N/A | GTS227 | N/A | N/A |
| 6 | EMI Test Software | AUDIX | E3 | N/A | N/A | N/A |
| 7 | Thermo meter | KTJ | TA328 | GTS233 | June. 27 2019 | June. 26 2020 |
| 8 | Absorbing clamp | Elektronik-Feinmechanik | MDS21 | GTS229 | June. 27 2019 | June. 26 2020 |

| ESD | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | ESD Simulator | KIKUSUI | KES4021A | GTS242 | June. 27 2019 | June. 26 2020 |
| 2 | Thermo meter | KTJ | TA328 | GTS243 | June. 27 2019 | June. 26 2020 |

| Conducted Immunity | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | Signal Generator | ROHDE & SCHWARZ | SMB 100A | GTS553 | June. 27 2019 | June. 26 2020 |
| 2 | CDN | LionCEL | CDN-M3-16 | GTS554 | June. 27 2019 | June. 26 2020 |
| 3 | CDN | CYBERTEK | EM 5070 | GTS559 | June. 27 2019 | June. 26 2020 |
| 4 | Power amplifier | rflight | NTWPA-00010475 | GTS555 | June. 27 2019 | June. 26 2020 |
| 5 | ATT | SUNWAVE | SJ-50-06DB | GTS556 | June. 27 2019 | June. 26 2020 |
| 6 | Clamp | SCHAFFNER | KEMZ 801 | GTS558 | June. 27 2019 | June. 26 2020 |

| Harmonic/ Flicker | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | Power Analyzer H/F | EMTEST | DPA500 | GTS235 | June. 27 2019 | June. 26 2020 |
| 2 | AC POWER SUPPLY | EMTEST | ACS500 | GTS236 | June. 27 2019 | June. 26 2020 |
| 3 | Thermo meter | KTJ | TA328 | GTS256 | June. 27 2019 | June. 26 2020 |

| EFT, Surge, Voltage dips and Interruption | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | EMTEST system | EMTEST | UCS500N | GTS239 | June. 27 2019 | June. 26 2020 |
| 2 | Clamp | EMTEST | HFK | GTS557 | June. 27 2019 | June. 26 2020 |
| 3 | Thermo meter | KTJ | TA328 | GTS238 | June. 27 2019 | June. 26 2020 |

| Radiated Immunity | | | | | |
|---|---|---|---|---|---|
| **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal. Date (yyyy-mm-dd)** | **Cal. Due date (yyyy-mm-dd)** |
| Fully-Anechoic Chamber 2 | Chang Zhou Zhong Shuo | 854 | SEM001-05 | 2017-05-10 | 2020-05-09 |
| Power Sensor | Rohde & Schwarz | NRP-Z91 | SEM009-09 | 2019-04-01 | 2020-03-31 |
| Stacked Log.-Per.-Broadband Antenna (70MHz-10GHz) | Schwarzbeck | STLP 9129 | SEM003-25 | N/A | N/A |
| Signal Generator (9kHz-6GHz) | Rohde & Schwarz | SMB100A | SEM006-11 | 2019-04-01 | 2020-03-31 |
| Broadband Amplifier (80MHz-1GHz) | Rohde & Schwarz | BBA150-BC250 | SEM005-12 | 2019-09-25 | 2020-09-24 |
| Broadband Amplifier (800MHz-3GHz) | Rohde & Schwarz | BBA150-D110 | SEM005-13 | 2019-04-01 | 2020-03-31 |
| Broadband Amplifier (2.5GHz-6GHz) | Rohde & Schwarz | BBA150-E60 | SEM005-16 | 2019-04-12 | 2020-04-11 |
| Measurement Software | Rohde & Schwarz | EMC32 V9.25.00 | N/A | N/A | N/A |

| General used equipment: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | Humidity/ Temperature Indicator | KTJ | TA328 | GTS243 | June. 27 2019 | June. 26 2020 |
| 2 | Barometer | ChangChun | DYM3 | GTS255 | June. 27 2019 | June. 26 2020 |

# 7 EMC Requirements Specification in ETSI EN 301 489-3/-17

## 7.1 EMI (Emission)

### 7.1.1 Radiated Emission

| | |
|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55032 |
| Test Method: | ETSI EN 301 489-1 and EN 55032 |
| Test Frequency Range: | 30MHz to 6GHz |
| Test site: | Measurement Distance: 3m |

Receiver setup:

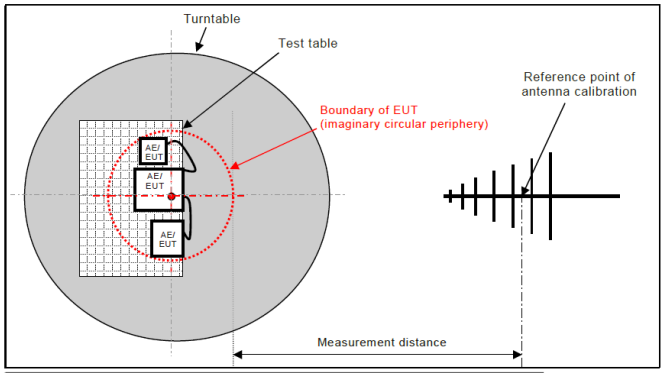
| Frequency | Detector | RBW | VBW | Remark |
|---|---|---|---|---|
| 30MHz-1GHz | Quasi-peak | 100kHz | 300kHz | Quasi-peak Value |
| Above 1GHz | Peak | 1MHz | 3MHz | Peak Value |
| | AV | 1MHz | 3MHz | Average Value |

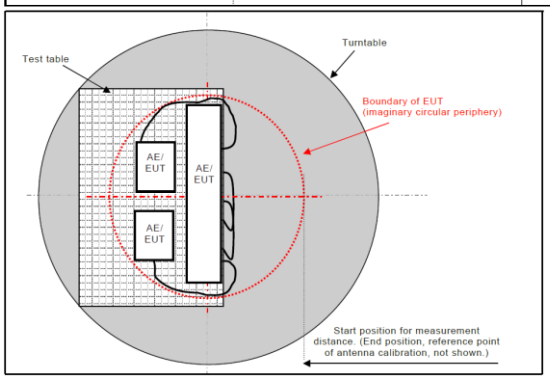
Limit:

| Frequency | Limit (dBuV/m @3m) | Remark |
|---|---|---|
| 30MHz-230MHz | 40.00 | Quasi-peak Value |
| 230MHz-1GHz | 47.00 | Quasi-peak Value |
| 1GHz-3GHz | 50.00 | Average Value |
| | 70.00 | Peak Value |
| 3GHz-6GHz | 54.00 | Average Value |
| | 74.00 | Peak Value |

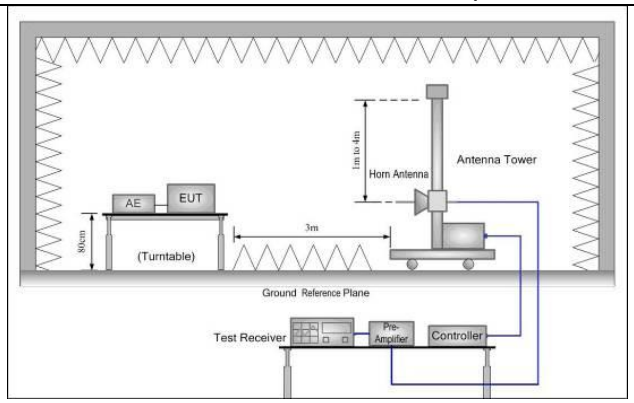
Test setup:

Below 1GHz




Above 1GHz

<table>
<tr><td></td><td colspan="5"> 
</td></tr>
<tr><td>Test Procedure:</td><td colspan="5">■ From 30MHz to 1GHz:<br>1. The radiated emissions test was conducted in a semi-anechoic chamber.<br>2. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.<br>3. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emissions spectrum plots of the EUT.<br>4. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization.<br>■ Above 1GHz:<br>1. The radiated emissions test was conducted in a fully-anechoic chamber.<br>2. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.<br>3. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emission spectrum plots of the EUT.<br>4. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization.</td></tr>
<tr><td>Test environment:</td><td>Temp.:</td><td>25 °C</td><td>Humid.:</td><td>50%</td><td>Press.:</td><td>1 010mbar</td></tr>
<tr><td>Measurement Record:</td><td colspan="5">Uncertainty: ± 4.64dB（30-1000MHz）<br>±3.68dB（1GHz-18GHz）</td></tr>
</table>

| | |
|---|---|
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

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

**Measurement Data**

Worst Case at LAN Mode

30MHz to 1GHz

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarity |
|---|---|---|---|---|---|---|---|---|
| 31.96 | 58.95 | 0.00 | 0.57 | 32.06 | 27.46 | 40.00 | -12.54 | Vertical |
| 49.88 | 54.77 | 0.00 | 0.77 | 31.96 | 23.58 | 40.00 | -16.42 | Vertical |
| 90.22 | 56.46 | 0.00 | 1.11 | 31.72 | 25.85 | 40.00 | -14.15 | Vertical |
| 153.20 | 56.76 | 0.00 | 1.59 | 31.99 | 26.36 | 40.00 | -13.64 | Vertical |
| 232.53 | 66.83 | 0.00 | 2.03 | 32.16 | 36.70 | 47.00 | -10.30 | Vertical |
| 893.86 | 65.82 | 0.00 | 4.83 | 31.19 | 39.46 | 47.00 | -7.54 | Vertical |
| 35.62 | 50.86 | 0.00 | 0.62 | 32.06 | 19.42 | 40.00 | -20.58 | Horizontal |
| 55.22 | 49.90 | 0.00 | 0.82 | 31.95 | 18.77 | 40.00 | -21.23 | Horizontal |
| 87.11 | 54.28 | 0.00 | 1.09 | 31.73 | 23.64 | 40.00 | -16.36 | Horizontal |
| 144.34 | 59.53 | 0.00 | 1.53 | 31.96 | 29.10 | 40.00 | -10.90 | Horizontal |
| 232.53 | 67.83 | 0.00 | 2.03 | 32.16 | 37.70 | 47.00 | -9.30 | Horizontal |
| 297.22 | 64.67 | 0.00 | 2.35 | 32.18 | 34.84 | 47.00 | -12.16 | Horizontal |

**Above 1GHz**

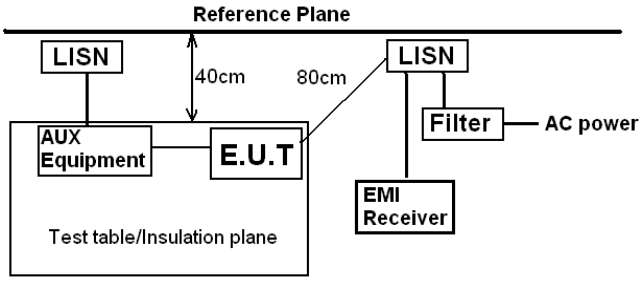
Peak measurement

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarity |
|---|---|---|---|---|---|---|---|---|
| 1045.00 | 44.35 | 24.61 | 4.33 | 32.84 | 40.45 | 70.00 | -29.55 | Vertical |
| 1970.00 | 43.69 | 25.99 | 4.95 | 34.40 | 40.23 | 70.00 | -29.77 | Vertical |
| 3035.00 | 38.97 | 28.56 | 6.00 | 33.28 | 40.25 | 74.00 | -33.75 | Vertical |
| 3955.00 | 34.85 | 29.60 | 7.79 | 32.23 | 40.01 | 74.00 | -33.99 | Vertical |
| 5000.00 | 34.66 | 31.96 | 8.76 | 32.18 | 43.20 | 74.00 | -30.80 | Vertical |
| 5950.00 | 31.37 | 32.82 | 10.13 | 32.16 | 42.16 | 74.00 | -31.84 | Vertical |
| 1225.00 | 43.82 | 25.45 | 4.49 | 33.13 | 40.63 | 70.00 | -29.37 | Horizontal |
| 1860.00 | 43.61 | 25.56 | 4.89 | 34.23 | 39.83 | 70.00 | -30.17 | Horizontal |
| 2820.00 | 39.41 | 28.41 | 5.78 | 33.53 | 40.07 | 70.00 | -29.93 | Horizontal |
| 3745.00 | 36.10 | 29.30 | 7.42 | 32.48 | 40.34 | 74.00 | -33.66 | Horizontal |
| 4860.00 | 32.37 | 31.83 | 8.64 | 32.11 | 40.73 | 74.00 | -33.27 | Horizontal |
| 5770.00 | 31.94 | 32.61 | 9.88 | 32.26 | 42.17 | 74.00 | -31.83 | Horizontal |

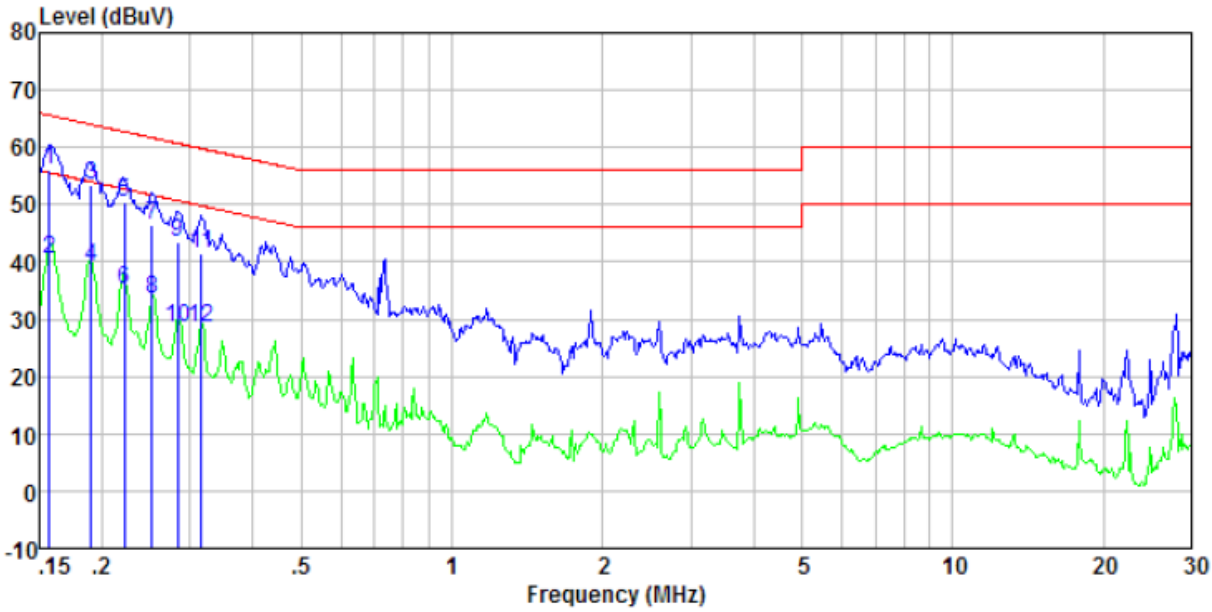
Remark:

1. The EUT was test at 3m in field chamber.
2. If the average limit is met when using a Peak detector, the EUT shall be deemed to meet both peak and average limits. And measurement with the average detector is unnecessary.

### 7.1.2 Conducted Emission (AC Port)

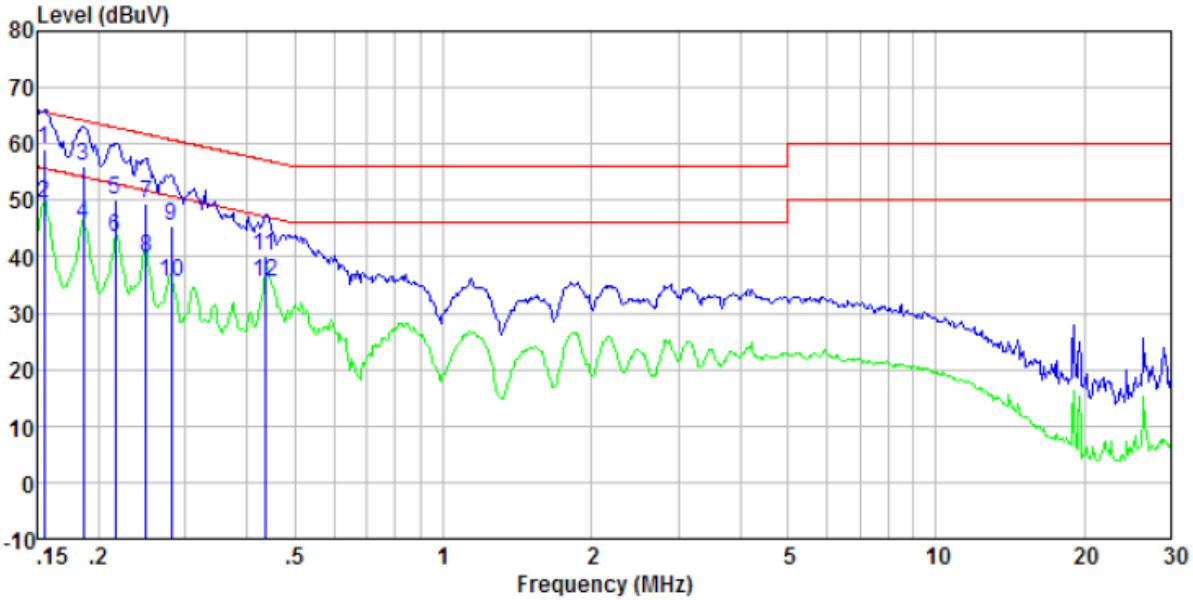
| | |
|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55032 |
| Test Method: | ETSI EN 301 489-1 and EN 55032 |
| Test Frequency Range: | 150kHz to 30MHz |
| Class / Severity: | Class B |
| Receiver setup: | RBW=9kHz, VBW=30kHz |
| Limit: | Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average<br>0.15-0.5: 66 to 56* / 56 to 46*<br>0.5-5: 56 / 46<br>5-30: 60 / 50<br>* Decreases with the logarithm of the frequency. |
| Test setup: |  <br>*Remark:*<br>*E.U.T: Equipment Under Test*<br>*LISN: Line Impedence Stabilization Network*<br>*Test table height=0.8m* |
| Test procedure | 1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network(L.I.S.N.). The provide a 50ohm/50uH coupling impedance for the measuring equipment.<br>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs).<br>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to EN55032 Class B on conducted measurement. |
| Test Instruments: | Temp.: 24 °C \| Humid.: 51% \| Press.: 1 010mbar |
| Measurement Record: | Uncertainty: 3.44dB |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

Worst Case at LAN Mode
Line:




| Freq MHz | Reading level dBuV | lISN/ISN factor dB | Cable loss dB | level dBuV | Limit level dBuV | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|
| 0.157 | 55.46 | 0.42 | 0.12 | 56.00 | 65.60 | -9.60 | QP |
| 0.157 | 39.82 | 0.42 | 0.12 | 40.36 | 55.60 | -15.24 | Average |
| 0.190 | 52.81 | 0.42 | 0.13 | 53.36 | 64.02 | -10.66 | QP |
| 0.190 | 38.70 | 0.42 | 0.13 | 39.25 | 54.02 | -14.77 | Average |
| 0.222 | 49.97 | 0.43 | 0.12 | 50.52 | 62.74 | -12.22 | QP |
| 0.222 | 34.74 | 0.43 | 0.12 | 35.29 | 52.74 | -17.45 | Average |
| 0.252 | 45.76 | 0.44 | 0.11 | 46.31 | 61.69 | -15.38 | QP |
| 0.252 | 33.12 | 0.44 | 0.11 | 33.67 | 51.69 | -18.02 | Average |
| 0.283 | 42.78 | 0.44 | 0.10 | 43.32 | 60.72 | -17.40 | QP |
| 0.283 | 28.12 | 0.44 | 0.10 | 28.66 | 50.72 | -22.06 | Average |
| 0.317 | 40.84 | 0.44 | 0.10 | 41.38 | 59.80 | -18.42 | QP |
| 0.317 | 28.11 | 0.44 | 0.10 | 28.65 | 49.80 | -21.15 | Average |

Neutral:

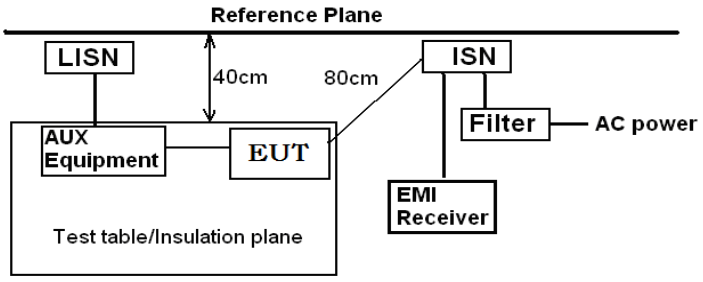



| Freq MHz | Reading level dBuV | lISN/ISN factor dB | Cable loss dB | level dBuV | Limit level dBuV | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|
| 0.155 | 58.44 | 0.41 | 0.12 | 58.97 | 65.74 | -6.77 | QP |
| 0.155 | 48.98 | 0.41 | 0.12 | 49.51 | 55.74 | -6.23 | Average |
| 0.186 | 55.41 | 0.41 | 0.13 | 55.95 | 64.20 | -8.25 | QP |
| 0.186 | 45.21 | 0.41 | 0.13 | 45.75 | 54.20 | -8.45 | Average |
| 0.216 | 49.66 | 0.42 | 0.13 | 50.21 | 62.96 | -12.75 | QP |
| 0.216 | 42.95 | 0.42 | 0.13 | 43.50 | 52.96 | -9.46 | Average |
| 0.249 | 48.96 | 0.42 | 0.11 | 49.49 | 61.78 | -12.29 | QP |
| 0.249 | 39.42 | 0.42 | 0.11 | 39.95 | 51.78 | -11.83 | Average |
| 0.280 | 45.02 | 0.42 | 0.10 | 45.54 | 60.81 | -15.27 | QP |
| 0.280 | 34.98 | 0.42 | 0.10 | 35.50 | 50.81 | -15.31 | Average |
| 0.435 | 39.76 | 0.38 | 0.11 | 40.25 | 57.15 | -16.90 | QP |
| 0.435 | 35.02 | 0.38 | 0.11 | 35.51 | 47.15 | -11.64 | Average |

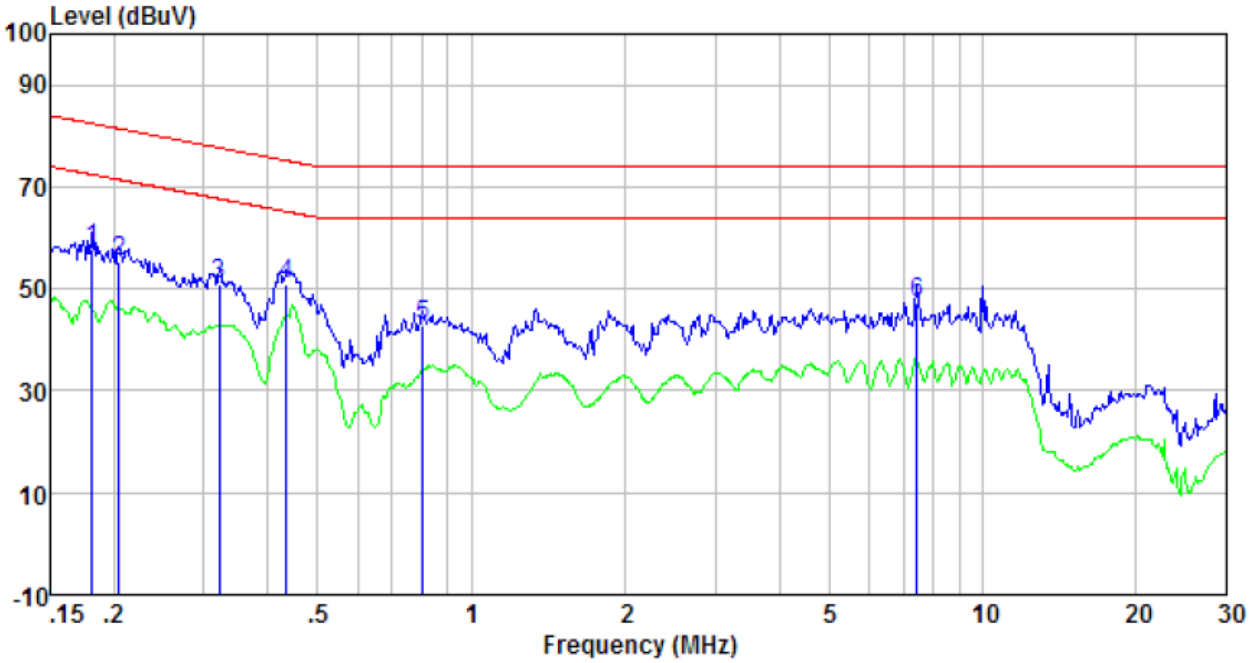
*Notes:*

1. *An initial pre-scan was performed on the live and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Cable Loss*
4. *If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.*

### 7.1.3 Conducted Emission (Telecommunication Port)

| | |
|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55032 |
| Test Method: | ETSI EN 301 489-1 and EN 55032 |
| Test Frequency Range: | 150kHz to 30MHz |
| Class / Severity: | Class B |
| Receiver setup: | RBW=9kHz, VBW=30kHz |
| Limit: | Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average<br>0.15-0.5: 84 to 74* / 74 to 64*<br>0.5-30: 74 / 64<br>* Decreases with the logarithm of the frequency. |
| Test setup: |  <br>*Remark:*<br>*E.U.T: Equipment Under Test*<br>*ISN: Impedence Stabilization Network*<br>*Test table height=0.8m* |
| Test procedure | 1. The E.U.T and simulators are connected to the main power through a impedance stabilization network( ISN). The provide a 50ohm/50uH coupling impedance for the measuring equipment.<br>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs).<br>3. Wired network line is checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to EN55032 Class B on conducted measurement. |
| Test Instruments: | Temp.: 24 °C \| Humid.: 51% \| Press.: 1 010mbar |
| Measurement Record: | Uncertainty: 3.44dB |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

LAN Mode：




| Freq | Reading level | lISN/ISN factor | Cable loss | level | Limit level | Over limit | Remark |
|---|---|---|---|---|---|---|---|
| MHz | dBuV | dB | dB | dBuV | dBuV | dB | |
| 0.182 | 48.17 | 9.57 | 0.13 | 57.87 | 82.42 | -24.55 | QP |
| 0.204 | 45.72 | 9.53 | 0.13 | 55.38 | 81.45 | -26.07 | QP |
| 0.322 | 41.45 | 9.40 | 0.10 | 50.95 | 77.66 | -26.71 | QP |
| 0.435 | 41.29 | 9.37 | 0.11 | 50.77 | 75.15 | -24.38 | QP |
| 0.804 | 33.35 | 9.22 | 0.13 | 42.70 | 74.00 | -31.30 | QP |
| 7.446 | 38.11 | 9.00 | 0.18 | 47.29 | 74.00 | -26.71 | QP |

### 7.1.4 Harmonics Test Results

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

### 7.1.5 Flicker Test Results

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 61000-3-3 | | | | | |
| Test Method: | EN 61000-3-3 | | | | | |
| Class/Severity: | Clause 5 of EN 61000-3-3 | | | | | |
| Measurement Time: | 10 min | | | | | |
| Detector: | As per EN 61000-3-3 | | | | | |
| Test Instruments: | Temp.: | 24 °C | Humid.: | 51% | Press.: | 1 010mbar |
| Test Instruments: | Refer to section 6.0 for details | | | | | |
| Test mode: | Refer to section 5.2 for details. | | | | | |
| Test results: | Pass | | | | | |

**Measurement Data**

| | EUT values | Limit | Result |
|---|---|---|---|
| Pst | 0.028 | 1.00 | PASS |
| dc [%] | 0.006 | 3.30 | PASS |
| dmax [%] | 0.060 | 4.00 | PASS |
| dt [s] | 0.000 | 0.50 | PASS |

## 7.2 Immunity

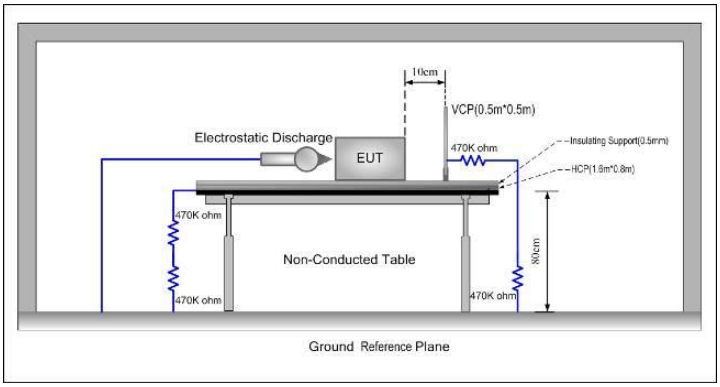
| Performance Criteria of ETSI EN 301 489-1, clause 6 | |
|---|---|
| **6.1 Performance criteria for continuous phenomena applied to transmitters and receivers** | If no further details are given in the relevant part of ETSI EN 301 489 series [i.13] dealing with the particular type of radio equipment, the following general performance criteria for continuous phenomena shall apply.<br>During and after the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.<br>During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data.<br>If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended. |
| **6.2 Performance criteria for transient phenomena applied to transmitters and receivers** | For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:<br>• For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the<br>user in accordance with the manufacturer's instructions. A SW reboot is not allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.<br>• For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. A SW reboot is not allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.<br>For all other ports the following applies:<br>• After the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.<br>• During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed.<br>• If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended. |

| | |
|---|---|
| **6.3 Performance criteria for equipment which does not provide a continuous communication link** | For radio equipment which does not provide a continuous communication link, the performance criteria described in clauses 6.1 and 6.2 are not appropriate, in these cases the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation. The related specifications set out in clause 5.3 have also to be taken into account.<br>The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in clauses 6.1 and 6.2. |
| **6.4 Performance criteria for ancillary equipment tested on a stand alone basis** | If ancillary equipment is intended to be tested on a stand alone basis, the performance criteria described in clauses 6.1 and 6.2 are not appropriate, in these cases the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation. The related specifications set out in clause 5.3 have also to be taken into account.<br>The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in clauses 6.1 and 6.2. |

| **Performance Criteria of ETSI EN 301 489-3, clause 6** | | |
|---|---|---|
| Criteria | During Test | After Test |
| A | Operate as intended<br>No loss of function<br>No unintentional responses | Operate as intended<br>No loss of function<br>No degradation of performance<br>No loss of stored data or user programmable functions |
| B | May show loss of function<br>No unintentional responses | Operate as intended<br>Lost function(s) shall be self-recoverable<br>No degradation of performance<br>No loss of stored data or user programmable functions |

| Performance Criteria of ETSI EN 301 489-17, clause 6 | | |
|---|---|---|
| Criteria | During Test | After Test |
| **A** | Shall operate as intended. (see note 1).<br>Shall be no loss of function.<br>Shall be no unintentional transmissions. | Shall operate as intended.<br>Shall be no degradation of performance (see note 3).<br>Shall be no loss of function.<br>Shall be no loss of stored data or user programmable functions. |
| **B** | May show loss of function (one or more).<br>May show degradation of performance (see note 2).<br>Shall be no unintentional transmissions. | Functions shall be self-recoverable.<br>Shall operate as intended after recovering.<br>Shall be no degradation of performance (see note 3).<br>Shall be no loss of stored data or user programmable functions. |
| **C** | May be loss of function (one or more). | Functions shall be recoverable by the operator.<br>Shall operate as intended after recovering.<br>Shall be no degradation of performance (see note 3). |
| **Note 1:** | Operate as intended during the test allows a level of degradation not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended. | |
| **Note 2:** | Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance.<br>If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended. | |
| **Note 3:** | No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed.<br>If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended. | |

### 7.2.1 Electrostatic Discharge

| | |
|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55035 |
| Test Method: | EN 61000-4-2 |
| Discharge Voltage: | Contact Discharge: ±4kV<br>Air Discharge: ±2kV, ±4kV, ±8kV<br>HCP/VCP: ±4kV |
| Polarity: | Positive & Negative |
| Number of Discharge: | Contact Discharge: Minimum 10 times at each test point,<br>Air Discharge: Minimum 10 times at each test point. |
| Discharge Mode: | Single Discharge |
| Discharge Period: | 1 second minimum |
| Limit: | Criteria B |
| Test setup: |  |
| Test Procedure: | **Air discharge:**<br>1. The test was applied on non-conductive surfaces of EUT.<br>2. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT.<br>3. After each discharge, the discharge electrode was removed from the EUT.<br>4. The generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point.<br>5. This procedure was repeated until all the air discharge completed<br>**Contact Discharge:**<br>1. The test was applied on conductive surfaces of EUT.<br>2. the generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point.<br>3. the tip of the discharge electrode was touch the EUT before the discharge switch was operated.<br>**Indirect discharge for horizontal coupling plane**<br>1. At least 10 single discharges shall be applied at the front edge of each HCP opposite the centre point of each unit of the EUT and 0.1m from the front of the EUT.<br>2. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge.<br>3. Consideration should be given to exposing all sides of the EUT. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Indirect discharge for vertical coupling plane**<br>1. At least 10 single discharges were applied to the center of one vertical edge of the coupling plane.<br>2. The coupling plane, of dimensions 0.5m X 0.5m, was placed parallel to, and positioned at a distance of 0.1m from the EUT.<br>3. Discharges were applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated. | | | | | |
| Test environment: | Temp.: | 24 °C | Humid.: | 51% | Press.: | 1 010mbar |
| Test Instruments: | Refer to section 6.0 for details | | | | | |
| Test mode: | Refer to section 5.2 for details | | | | | |
| Test results: | Pass | | | | | |

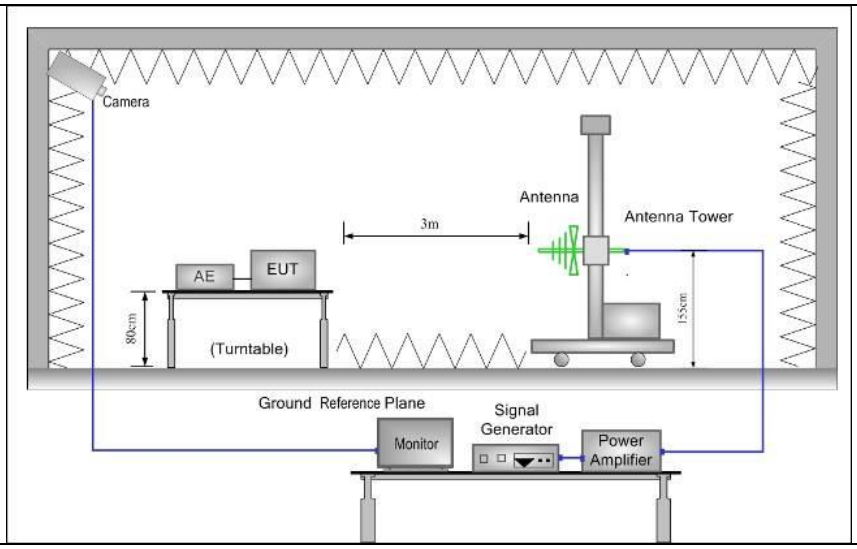
**Measurement Record:**

| | | | | |
|---|---|---|---|---|
| Test points: | I: LAN port, USB port, | | | |
| | II: Seams, LED indicator lamp, Holes | | | |
| **Direct discharge** | | | | |
| **Discharge Voltage (KV)** | **Type of discharge** | **Test points** | **Observations Performance** | **Result** |
| ± 4 | Contact | I | A | Pass |
| ± 2, ± 4,± 8 | Air | II | A | Pass |
| **Indirect discharge** | | | | |
| **Discharge Voltage (KV)** | **Type of discharge** | **Test points** | **Observation Performance** | **Result** |
| ± 4 | HCP-Bottom/Top/ Front/Back/Left/Right | Edge of the HCP | A | Pass |
| ± 4 | VCP-Front/Back /Left/Right | Center of the VCP | A | Pass |

Remark:

A: Normal performance within the specification limits.

### 7.2.2 Radiated Immunity

| | |
|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55035 |
| Test Method: | EN 61000-4-3 |
| Frequency range: | 80MHz to 6GHz |
| Test Level: | 3V/m |
| Modulation: | 80%, 1kHz Amplitude Modulation |
| Performance Criterion: | Criteria A |
| Test setup: |  |
| Test Procedure: | 1. For table-top equipment, the EUT was placed in the chamber on a non-conductive table 0.8m high. For arrangement of floor-standing equipment, the EUT was mounted on a non-conductive support 0.1m above the supporting plane. For human body-mounted equipment, the EUT may be tested in the same manner as table top items.<br>2. If possible, a minimum of 1 m of cable is exposed to the electromagnetic field. Excess length of cables interconnecting units of the EUT shall be bundled low-inductively in the approximate center of the cable to form a bundle 30 cm to 40 cm in length.<br>3. The EUT was initially placed with one face coincident with the calibration plane. The EUT face being illuminated was contained within the UFA (Uniform Field Area).<br>4. The frequency ranges to be considered were swept with the signal modulated and pausing to adjust the RF signal level or to switch oscillators and antennas as necessary.Where the frequency range was swept incrementally, the step size was not exceed 1 % of the preceding frequency value.<br>5. The dwell time of the amplitude modulated carrier at each frequency was not be less than the time necessary for the EUT to be exercised and to respond, and was not less than 0,5 s.<br>6. The test normally was performed with the generating antenna facing each side of the EUT.<br>7. The polarization of the field generated by each antenna necessitates testing each selected side twice, once with the antenna positioned |

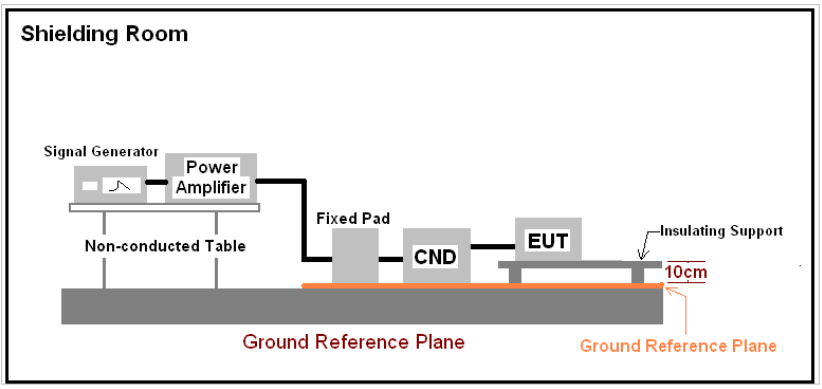
| | | | | | | |
|---|---|---|---|---|---|---|
| | vertically and again with the antenna positioned horizontally.<br>8. The EUT was performed in a configuration to actual installation conditions, a video camera and/or a audio monitor were used to monitor the performance of the EUT. | | | | | |
| Test environment: | Temp.: | 25 °C | Humid.: | 52% | Press.: | 1 010mbar |
| Test Instruments: | Refer to section 6.0 for details | | | | | |
| Test results: | Pass | | | | | |

**Measurement Record:**

| Frequency | Level | Modulation | Operating Mode | Antenna Polarization | EUT Face | Observations (Performance Criterion) |
|---|---|---|---|---|---|---|
| 80 MHz-6 GHz | 3 V/m | 1 kHz, 80 % Amp. Mod, 1 % increment, dwell time=3seconds | All mode | V | Front | A |
| | | | | H | | A |
| | | | | V | Rear | A |
| | | | | H | | A |
| | | | | V | Left | A |
| | | | | H | | A |
| | | | | V | Right | A |
| | | | | H | | A |
| | | | | V | Top | A |
| | | | | H | | A |
| | | | | V | Bottom | A |
| | | | | H | | A |

Remarks:
A: normal performance within the specification limits

### 7.2.3 Radio frequency common mode (AC Port)

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55035 | | | | | |
| Test Method: | EN 61000-4-6 | | | | | |
| Frequency range: | 0.15MHz to 80MHz | | | | | |
| Test Level: | 3V rms on AC Ports (unmodulated emf into 150 Ω) | | | | | |
| Modulation: | 80%, 1kHz Amplitude Modulation | | | | | |
| Performance Criterion: | Criteria A | | | | | |
| Test setup: |  | | | | | |
| Test Procedure: | 1. Let the EUT work in test mode and test it.<br>2. The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).<br>3. The disturbance signal described below is injected to EUT through CDN.<br>4. The EUT operates within its operational mode(s) under intended climatic conditions after power on.<br>5. The frequency range is swept from 0.150MHz to 80MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave.The rate of sweep shall not exceed $1.5*10^{-3}$decades/s. Where the frequency is swept incrementally; the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.<br>6. Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion. | | | | | |
| Test environment: | Temp.: | 24 °C | Humid.: | 51% | Press.: | 1 010mbar |
| Test Instruments: | Refer to section 6.0 for details | | | | | |
| Test results: | Pass | | | | | |

**Measurement Record:**

Lora mode and WiFi mode

| Frequency | Injected Position | Test Level | Modulation | Step Size | Dwell Time | Observations (Performance Criterion) |
|---|---|---|---|---|---|---|
| 150kHz to 80MHz | AC Main | 3Vrms | 80%, 1kHz Amp. Mod. | 1% | 2s | A |

Remark:

A: Normal performance within the specification limits.

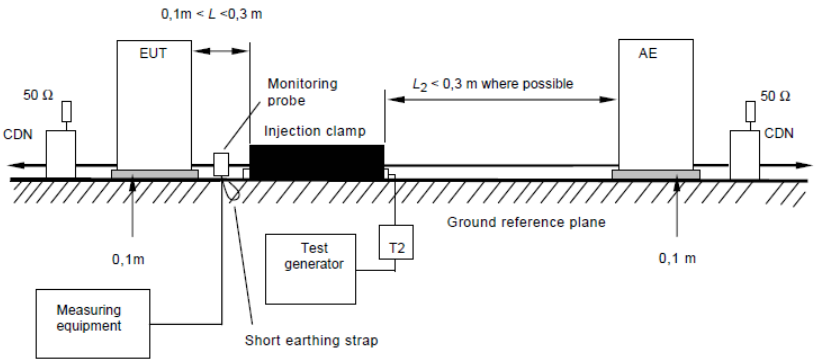
LAN mode

| Frequency | Injected Position | Test Level | Modulation | Step Size | Dwell Time | Observations (Performance Criterion) |
|---|---|---|---|---|---|---|
| 150kHz to 10MHz | AC Main | 3Vrms | 80%, 1kHz Amp. Mod. | 1% | 2s | A |
| 10MHz to 30MHz | AC Main | 3 to 1 Vrms | 80%, 1kHz Amp. Mod. | 1% | 2s | A |
| 30MHz to 80MHz | AC Main | 1Vrms | 80%, 1kHz Amp. Mod. | 1% | 2s | A |

Remark:

A: Normal performance within the specification limits.

### 7.2.4 Radio frequency common mode (Telecommunication Port)

| | |
|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55035 |
| Test Method: | EN 61000-4-6 |
| Frequency range: | 0.15MHz to 80MHz |
| Test Level: | 3V rms on AC Ports (unmodulated emf into 150 Ω) |
| Modulation: | 80%, 1kHz Amplitude Modulation |
| Performance Criterion: | Criteria A |
| Test setup: |  |
| Test Procedure: | 1. Let the EUT work in test mode and test it.<br>2. The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).<br>3. The disturbance signal described below is injected to EUT through CDN.<br>4. The EUT operates within its operational mode(s) under intended climatic conditions after power on.<br>5. The frequency range is swept from 0.150MHz to 80MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave.The rate of sweep shall not exceed $1.5*10^{-3}$decades/s. Where the frequency is swept incrementally; the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.<br>6. Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Test environment: | Temp.: | 24 °C | Humid.: | 51% | Press.: | 1 010mbar |
| Test Instruments: | Refer to section 6.0 for details | | | | | |
| Test results: | Pass | | | | | |

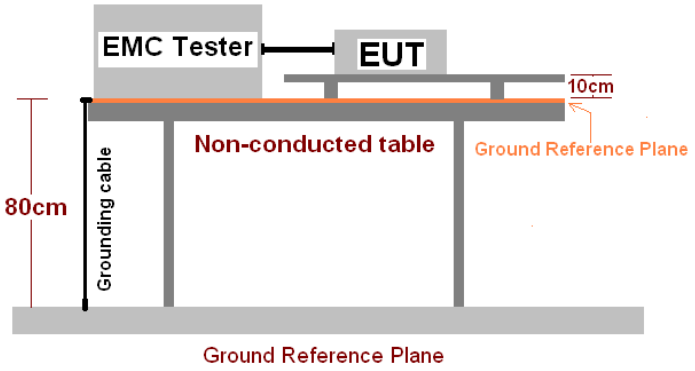
**Measurement Record:**

| Frequency | Injected Position | Test Level | Modulation | Step Size | Dwell Time | Observations (Performance Criterion) |
|---|---|---|---|---|---|---|
| 150kHz to 80MHz | Clamp | 3Vrms | 80%, 1kHz Amp. Mod. | 1% | 2s | A |

Remark:

A: Normal performance within the specification limits.

### 7.2.5 Electrical Fast Transients (AC Port)

| | |
|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55035 |
| Test Method: | EN 61000-4-4 |
| Test Level: | 1.0kV on AC port |
| Polarity: | Positive & Negative |
| Repetition Frequency: | 5kHz |
| Burst Duration: | 15ms |
| Burst Period: | 300ms |
| Test Duration: | 2 minute per level & polarity |
| Performance Criterion: | B |
| Test setup: |  |
| Test Procedure: | 1. The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1m + 0.01m thick. The ground reference plane was 1m*1m metallic sheet with 0.65mm minimum thickness.<br>2. This reference ground plane was project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane was more than 0.5m.<br>3. All cables to the EUT was placed on the wood support, cables not subject to EFT/B was routed as far as possible from the cable under test to minimize the coupling between the cables.<br>4. The length of the signal and power lines between the coupling device and the EUT is 0.5m<br>**Test on Signal Ports, Telecommunication Ports and Control Ports:**<br>The EFT interference signal is through a coupling clamp device couples to the signal and control lines of the EUT with burst noise for 2 minutes.<br>**Test on power supply ports:**<br>1. The EUT is connected to the power mains through a coupling device that directly couples the EFT/B interference signal.<br>2. Each of the Line and Neutral conductors is impressed with burst noise for 2 minutes. |
| Test environment: | Temp.: 26 °C ¦ Humid.: 54% ¦ Press.: 1 010mbar |
| Test Instruments: | Refer to section 6.0 for details |

| | |
|---|---|
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

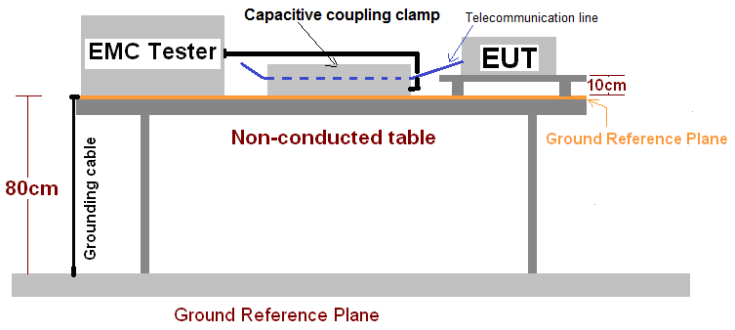
**Measurement Record:**

| Lead under Test | Level (±kV) | Coupling Direct/Clamp | Observations (Performance Criterion) | Result |
|---|---|---|---|---|
| L | ± 1.0 | Direct | A | Pass |
| N | ± 1.0 | Direct | A | Pass |
| L-N | ± 1.0 | Direct | A | Pass |

Remark:

A: Normal performance within the specification limits

### 7.2.6 Electrical Fast Transients (Telecommunication Port)

| | |
|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55035 |
| Test Method: | EN 61000-4-4 |
| Test Level: | 0.5kV on Telecommunication port |
| Polarity: | Positive & Negative |
| Repetition Frequency: | 5kHz |
| Burst Duration: | 15ms |
| Burst Period: | 300ms |
| Test Duration: | 2 minute per level & polarity |
| Performance Criterion: | B |
| Test setup: |  |
| Test Procedure: | 5. The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1m + 0.01m thick. The ground reference plane was 1m*1m metallic sheet with 0.65mm minimum thickness.<br>6. This reference ground plane was project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane was more than 0.5m.<br>7. All cables to the EUT was placed on the wood support, cables not subject to EFT/B was routed as far as possible from the cable under test to minimize the coupling between the cables.<br>8. The length of the signal and power lines between the coupling device and the EUT is 0.5m<br>**Test on Signal Ports, Telecommunication Ports and Control Ports:**<br>The EFT interference signal is through a coupling clamp device couples to the signal and control lines of the EUT with burst noise for 2 minutes.<br>**Test on power supply ports:**<br>3. The EUT is connected to the power mains through a coupling device that directly couples the EFT/B interference signal.<br>4. Each of the Line and Neutral conductors is impressed with burst noise for 2 minutes. |
| Test environment: | Temp.: 26 °C \| Humid.: 54% \| Press.: 1 010mbar |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |

| Test results: | Pass |
|---|---|

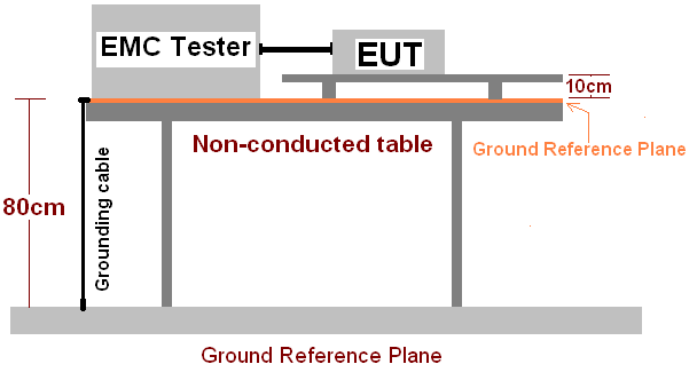
**Measurement Record:**

| Lead under Test | Level (kV) | Coupling Direct/Clamp | Observations (Performance Criterion) | Result |
|---|---|---|---|---|
| Signal line | ±0.5 | Clamp | A | Pass |

Remark:

A: Normal performance within the specification limits

### 7.2.7 Surge (AC Port)

| | |
|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55035 |
| Test Method: | ETSI EN 61000-4-5 |
| Test Level: | 1kV line to line: Differential mode<br>2kV line to earth: Common mode |
| Polarity: | Positive & Negative |
| Test Interval: | 60s between each surge |
| No. of surges: | 5 positive, 5 negative at 0°, 90°, 180°, 270°. |
| Performance Criterion: | B |
| Test setup: |  |
| Test Procedure: | 1. For line-to-line coupling mode, provide a 1kV 1.2/50us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points, and for active line / neutral lines to ground are same except test level is 2kV.<br>2. At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test.<br>3. Different phase angles are done individually.<br>4. Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test. |
| Test environment: | Temp.: 26 °C \| Humid.: 53% \| Press.: 1 010mbar |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

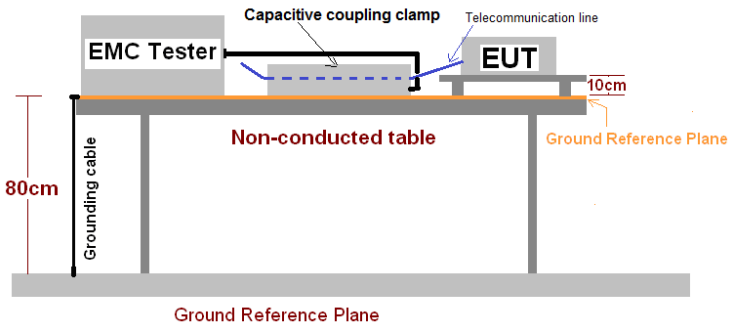
**Measurement Record:**

| Location | Level(kV) | Pulse No | Surge Interval | Phase(deg) | Observations (Performance Criterion) |
|---|---|---|---|---|---|
| L-N | ± 1 | 5 | 60s | 0° | A |
| | | | | 90° | A |
| | | | | 180° | A |
| | | | | 270° | A |

Remark:

A. Normal performance within the specification limits

### 7.2.8 Surge (Telecommunication Port)

| | |
|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55035 |
| Test Method: | ETSI EN 61000-4-5 |
| Test Level: | 0.5kV line to line: Differential mode<br>1kV line to earth: Common mode |
| Polarity: | Positive & Negative |
| Test Interval: | 60s between each surge |
| No. of surges: | 5 positive, 5 negative at 0°, 90°, 180°, 270°. |
| Performance Criterion: | B |
| Test setup: |  |
| Test Procedure: | 1. or applied line to ground, or shield to ground), provide a 0.5kV 1.2/50us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points.<br>2. At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test.<br>3. Different phase angles are done individually.<br>4. Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test. |
| Test environment: | Temp.: 26 °C \| Humid.: 53% \| Press.: 1 010mbar |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

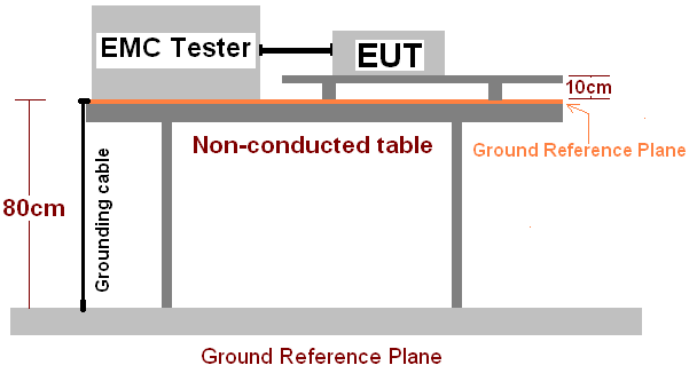
**Measurement Record:**

| Lead under Test | Level(kV) | Pulse No | Surge Interval | Phase(deg.) | Observations (Performance Criterion) |
|---|---|---|---|---|---|
| Signal port | ± 0.5 | 5 | 60s | 0° | A |
| | | | | 90° | A |
| | | | | 180° | A |
| | | | | 270° | A |

Remark:

A. Normal performance within the specification limits

### 7.2.9 Voltage Dip and Voltage Interruptions

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Requirement: | ETSI EN 301 489-3/-17, EN 55035 | | | | | |
| Test Method: | EN 61000-4-11 | | | | | |
| Test Level: | 0% of VT(Supply Voltage) for 0.5 period<br>0% of VT(Supply Voltage) for 1.0 period<br>70% of VT(Supply Voltage) for 25 period<br>0% of VT(Supply Voltage) for 250 period | | | | | |
| No. of Dips / Interruptions: | 3 per Level | | | | | |
| Performance Criterion: | 0% VD, 0.5 period----Performance criterion: B<br>0% VD, 1 period----Performance criterion: B<br>70% VD, 25 period----Performance criterion: C<br>0% VI, 250 period----Performance criterion: C | | | | | |
| Test setup: |  | | | | | |
| Test Procedure: | 1>.The EUT and test generator were setup as shown on above setup photo.<br>2>.The interruptions are introduced at selected phase angles with specified duration.<br>3>.Record any degradation of performance. | | | | | |
| Test environment: | Temp.: | 26 °C | Humid.: | 53% | Press.: | 1 010mbar |
| Test Instruments: | Refer to section 6.0 for details | | | | | |
| Test mode: | Refer to section 5.2 for details | | | | | |
| Test results: | Pass | | | | | |

**Measurement Record:**

| Test Level $U_T$ | Duration (Periods) | Phase angle | No of dropout | Time between dropout | Observations (Performance Criterion) |
|---|---|---|---|---|---|
| 0% | 0.5 | 0°, 90°, 180°, 270° | 3 | 10s | A |
| 0% | 1.0 | 0°, 90°, 180°, 270° | 3 | 10s | A |
| 70% | 25 | 0°, 90°, 180°, 270° | 3 | 10s | A |
| 0% | 250 | 0°, 90°, 180°, 270° | 3 | 10s | B |

Remark:

A. Normal performance within the specification limits.

B: During the test, the adapter stops work, but after the test, it can automatically return to normal.

# 8 Test Setup Photo

Reference to the **appendix I** for details.

# 9 EUT Constructional Details

Reference to the **appendix II** for details.

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------End------