# CE EMC
# TEST REPORT

for

**AC /DC Power Modules**

**Model : TMM24 SERIES**

**Brand Name:** TRACO POWER

Test Report Number:

**T161215N19-E1**

Issued for

**TRACO ELECTRONIC AG**

SIHLBRUGGSTRASSE 111 CH-6340 BAAR, SWITZERLAND

Issued By:

**Compliance Certification Services Inc.**

**Tainan Lab.**

No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

TEL: 886-6-580-2201

FAX: 886-6-580-2202

**Issued Date : January 23, 2017**

ilac-MRA TAF Testing Laboratory 1109

# REVISION HISTORY

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
|---|---|---|---|---|
| 00 | January 23, 2017 | Initial Issue | ALL | Eva Lin |
| 01 | | | | |
| | | | | |

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# 1 TEST CERTIFICATION

| | |
|---|---|
| **Product:** | AC /DC Power Modules |
| **Model:** | TMM24 SERIES |
| **Brand:** | TRACO POWER |
| **Applicant:** | **TRACO ELECTRONIC AG**<br>SIHLBRUGGSTRASSE 111 CH-6340 BAAR, SWITZERLAND |
| **Tested:** | October 07, 2013<br>July 5, 2016 ~ July 13, 2016 |
| **Applicable Standards:** | **EN 55011: 2009+A1: 2010, Class B**<br>EN 61000-3-2: 2014<br>EN 61000-3-3: 2013<br>**EN 60601-1-2: 2015**<br>IEC 61000-4-2: 2008, IEC 61000-4-3: 2010,<br>IEC 61000-4-4: 2012, IEC 61000-4-5: 2014,<br>IEC 61000-4-6: 2013, IEC 61000-4-8: 2009,<br>IEC 61000-4-11: 2004 |

| Deviation from Applicable Standard |
|---|
| None |

The above equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirements set forth in the Directive 93/42/EEC concerning medical devices and technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

***Approved by:***

**Jeter Wu**
Assistant Manager

***Reviewed by:***

**Eric Huang**
Assistant Section Manager

## 2 TEST RESULT SUMMARY

| EMISSION | | | |
|---|---|---|---|
| **Standard** | **Item** | **Result** | **Remarks** |
| **EN 55011: 2009+A1:2010** | Conducted | PASS | Meet Class B limit |
| | Radiated | PASS | Meet Class B limit |
| EN 61000-3-2: 2014 | Harmonic current emissions | PASS | Meet the requirement |
| EN 61000-3-3: 2013 | Voltage fluctuations & flicker | PASS | Meet the requirement |

| IMMUNITY【 EN 60601-1-2: 2015 】 | | | |
|---|---|---|---|
| **Standard** | **Item** | **Result** | **Remarks** |
| IEC 61000-4-2: 2008 | ESD | PASS | Meets the requirements of Performance Criterion A |
| IEC 61000-4-3: 2010 | RS | PASS | Meets the requirements of Performance Criterion A |
| IEC 61000-4-4: 2012 | EFT | PASS | Meets the requirements of Performance Criterion A |
| IEC 61000-4-5: 2014 | Surge | PASS | Meets the requirements of Performance Criterion A |
| IEC 61000-4-6: 2013 | CS | PASS | Meets the requirements of Performance Criterion A |
| IEC 61000-4-8: 2009 | PFMF | PASS | Meets the requirements of Performance Criterion A |
| IEC 61000-4-11: 2004 | Voltage dips & voltage variations | PASS | Voltage Dips:<br>i) 100% reduction for 0.5 cycle at 50Hz, 100% reduction for 1 cycle at 50Hz Performance Criterion A<br>ii) 30% reduction for 25/30 cycles at 50/60Hz Performance Criterion A<br>Voltage Interruptions:<br>100% reduction for 250/300 cycles at 50/60Hz Performance Criterion B. |

**NOTE:** 1. The statements of test result on the above are decided by the request of test standard only; the measurement uncertainties are not factored into this compliance determination.
2. The information of measurement uncertainty is available upon the customer's request.

# 3 EUT DESCRIPTION

| | |
|---|---|
| **Product** | AC /DC Power Modules |
| **Model** | TMM24 SERIES |
| **Brand Name** | TRACO POWER |
| **Applicant** | TRACO ELECTRONIC AG |
| **Housing material** | Plastics |
| **Identify Number** | T161215N19 |
| **Received Date** | October 07, 2013 |
| **E.U.T. Power Rating** | See Below |
| **E.U.T. Size (L* W * H)** | 7.5 * 5.5 * 2 cm |

**I/O PORT**

| I/O PORT TYPES | Q'TY | TESTED WITH |
|---|---|---|
| 1. AC Power | 1 | AC Source |
| 2. DC Power | 1 | Load |

**Note:**

1. Client consigns only eight model samples to test (Model Number: **TMM24105; TMM24109; TMM24112; TMM24115; TMM24124; TMM24212; TMM24215; TMM24105C**). Therefore, the testing Lab. just guarantees the unit, which has been tested.
2. For more details, please refer to the User's manual of the EUT.

**The different of the each model is shown as below:**

| Model Number PCB Mounting (For model with Chassis Mounting, add suffix C) | AC Input Voltage (Range) | Output Voltage | Output Current |
|---|---|---|---|
| | | | Max. |
| | VAC | VDC | mA |
| TMM24105<br>TMM24105C | 85~264 | 5 | 3000 |
| TMM24109<br>TMM24109C | | 9 | 2666 |
| TMM24112<br>TMM24112C | | 12 | 2000 |
| TMM24115<br>TMM24115C | | 15 | 1600 |
| TMM24124<br>TMM24124C | | 24 | 1000 |
| TMM24212<br>TMM24212C | | ±12 | ±1000 |
| TMM24215<br>TMM24215C | | ±15 | ±800 |

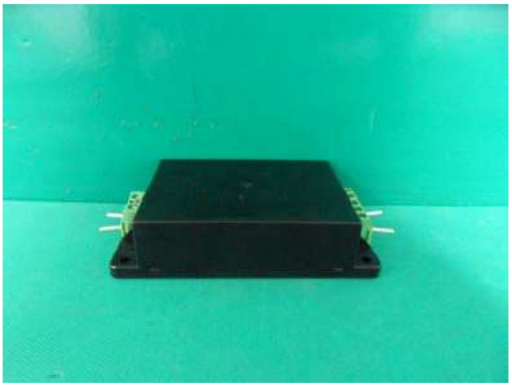
Notes:

1. "#": For each output

2. To order the module with chassis mount package, please add a suffix C (e.g. TMM24105C)

External(1) : TMM24105

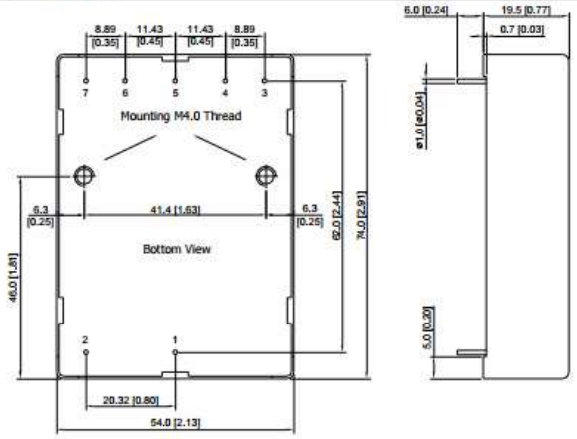
External(2) : TMM24105C



## Package Specifications：

**Package Specifications PCB Mounting**

Mechanical Dimensions

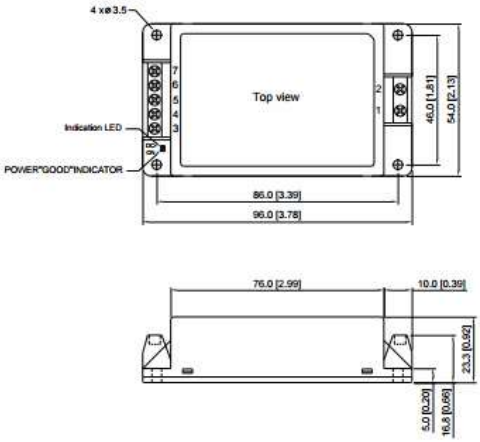



| Pin Connections | | |
|---|---|---|
| Pin | Single Output | Dual Output |
| 1 | AC (N) | AC (N) |
| 2 | AC (L) | AC (L) |
| 3 | No Pin | No Pin |
| 4 | -Vout | -Vout |
| 5 | No Pin | Common |
| 6 | +Vout | +Vout |
| 7 | No Pin | No Pin |

- All dimensions in mm (inches)
- Tolerance: ±0.5 (±0.02)
- Pin diameter ⌀ 1.0 ±0.1 (0.04±0.004)

**Package Specifications Chassis Mounting** (order code suffix C)

Mechanical Dimensions



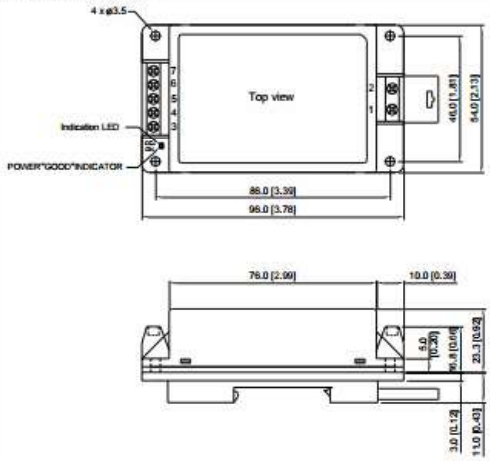

| Connections | | |
|---|---|---|
| Pin | Single Output | Dual Output |
| 1 | AC (N) | AC (N) |
| 2 | AC (L) | AC (L) |
| 3 | NC | NC |
| 4 | -Vout | -Vout |
| 5 | NC | Common |
| 6 | +Vout | +Vout |
| 7 | NC | NC |

NC: No Connection

- All dimensions in mm (inches)
- Tolerance: ±0.5 (±0.02)

**Package Specifications with DIN Rail Mounting Bracket**

Mechanical Dimensions



# 4 TEST METHODOLOGY

## 4.1. DECISION OF FINAL TEST MODE

The EUT was tested together with the above additional components, and a configuration, which produced the worst emission levels, was selected and recorded in this report.

The test configuration/ mode is as the following:

### EMI Test Mode:

**Conduction (Power port) Modes: (Full Load)**

| | | | |
|---|---|---|---|
| **1.** | **TMM24105** | **5.** | **TMM24124** |
| **2.** | **TMM24109** | **6.** | **TMM24212** |
| **3.** | **TMM24112** | **7.** | **TMM24215** |
| **4.** | **TMM24115** | | |

**Radiation Modes: (Full Load)**

| | | | |
|---|---|---|---|
| **1.** | **TMM24105** | **5.** | **TMM24124** |
| **2.** | **TMM24109** | **6.** | **TMM24212** |
| **3.** | **TMM24112** | **7.** | **TMM24215** |
| **4.** | **TMM24115** | | |

### EMS Test Mode:

| | |
|---|---|
| **1.** | **TMM24105** |

## 4.2. EUT SYSTEM OPERATION

1. Setup a whole system for test as shown on setup diagram.
2. Turn on power and check function.
3. Start to test.

# 5 SETUP OF EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

**Peripherals Devices:**

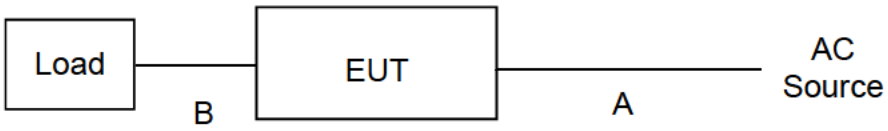
| No. | Product | Manufacturer | Model No. | Certify No. | Signal cable |
|---|---|---|---|---|---|
| 1 | N/A | --- | --- | --- | --- |

| No. | Signal cable description | |
|---|---|---|
| A | AC Power Cable | Unshielded, 1m, 1pcs. with 3 cores |
| B | DC Power cable | Unshielded, 0.15m, 1pcs. |

**Note:**

1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

## 5.2. CONFIGURATION OF SYSTEM UNDER TEST



# 6 FACILITIES AND ACCREDITATIONS

## 6.1. FACILITIES

All measurement facilities used to collect the measurement data are located at CCS Taiwan Tainan Laboratory at

☒ No.8, Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

☒ No.163-1, Jhongsheng Rd., Sindian Dist, New Taipei City 23151, Taiwan (R.O.C.).

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. All receiving equipment conforms to CISPR 16-1-1, CISPR 16-1-2, CISPR 16-1-3, CISPR 16-1-4 and CISPR 16-1-5.

## 6.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

| | |
|---|---|
| **Taiwan** | TAF |

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

| | |
|---|---|
| **Canada** | Industry Canada |
| **Germany** | TUV NORD |
| **Taiwan** | BSMI |
| **USA** | FCC |

Copies of granted accreditation certificates are available for downloading from our web site, http://www.ccsrf.com

## 6.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement | | Frequency | Uncertainty |
|---|---|---|---|
| Power Line Conducted Emission | | 9kHz~30MHz | ±1.39dB |
| Conduction Emission | ISN | 150kHz~30MHz | ±2.56dB |
| | T-ISN | 150kHz~30MHz | ±2.56dB |
| Radiated Emission (10m) | Test Site : OATS-5 | 30 MHz ~200 MHz | ±3.55dB |
| | | 200 MHz ~1000 MHz | ±3.10dB |
| | Test Site : OATS-6 | 30 MHz ~200 MHz | ±3.58dB |
| | | 200 MHz ~1000 MHz | ±3.22dB |
| | Test Site : OATS-7 | 30 MHz ~200 MHz | ±3.74dB |
| | | 200 MHz ~1000 MHz | ±3.82dB |
| Radiated Emission (3m) | Test Site : OATS-5 | 30 MHz ~200 MHz | ±3.36dB |
| | | 200 MHz ~1000 MHz | ±2.48dB |
| | Test Site : OATS-6 | 30 MHz ~200 MHz | ±3.21dB |
| | | 200 MHz ~1000 MHz | ±3.09dB |
| | Test Site : OATS-7 | 30 MHz ~200 MHz | ±3.55dB |
| | | 200 MHz ~1000 MHz | ±3.56dB |

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

# 7 EMISSION TEST

## 7.1. CONDUCTED EMISSION MEASUREMENT

### 7.1.1. LIMITS

**CLASS A**

| FREQUENCY (MHz) | Group 1 | | Group 2 | | Group 2* | |
|---|---|---|---|---|---|---|
| | Quasi-peak (dBuV) | Average (dBuV) | Quasi-peak (dBuV) | Average (dBuV) | Quasi-peak (dBuV) | Average (dBuV) |
| 0.15 - 0.5 | 79 | 66 | 100 | 90 | 130 | 120 |
| 0.50 - 5.0 | 73 | 60 | 86 | 76 | 125 | 115 |
| 5.0 - 30.0 | 73 | 60 | 90-70 | 80-60 | 115 | 105 |
| | | | Decreasing linearly with logarithm of frequency | | | |

* Mains supply currents in excess of 100 A per phase when using the CISPR voltage probe or a suitable V-network (LISN or AMN).

**Note:** 1. The lower limit shall apply at the transition frequency.
2. Care should be taken to comply with leakage current requirements.

**CLASS B**

| FREQUENCY (MHz) | Group 1 & 2 | |
|---|---|---|
| | Quasi-peak (dBuV) | Average (dBuV) |
| 0.15 - 0.5 | 66-56 Decreasing linearly with logarithm of frequency | 56-46 Decreasing linearly with logarithm of frequency |
| 0.50 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

**Note:** 1. The lower limit shall apply at the transition frequency
2. Care should be taken to comply with leakage current requirements.

### 7.1.2. TEST INSTRUMENTS

| Conducted Emission room #1 | | | | |
|---|---|---|---|---|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| BNC Coaxial Cable | CCS | BNC50 | 11 | 12/04/2016 |
| EMI Test Receiver | R&S | ESCS 30 | 100348 | 12/03/2016 |
| LISN | SCHWARZBECK | NNLK8130 | 8130124 | 10/27/2016 |
| LISN | Schwarzbeck | NSLK 8127 | 8127526 | 08/23/2016 |
| Pulse Limiter | R&S | ESH3-Z2 | 100116 | 12/04/2016 |
| Test S/W | e-3 (5.04211j) | | | |

**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

## 7.1.3. TEST PROCEDURES

### Procedure of Preliminary Test

The EUT and Support equipment, if needed, was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per EN 55011(see Test Facility for the dimensions of the ground plane used). When the EUT is a floor standing equipment, it is placed on the ground plane, which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.

All I/O cables were positioned to simulate typical actual usage as per EN 55011.

The test equipment EUT installed received main power, through a Line Impedance Stabilization Network (LISN), which supplied power source and was grounded to the ground plane.

All support equipment power received from a second LISN.

The EUT test program was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.

The Receiver scanned from 150kHz to 30MHz for emissions in each of the test modes.

During the above scans, the emissions were maximized by cable manipulation.

The test mode(s) described in Item 4.1 were scanned during the preliminary test.

After the preliminary scan, we found the test mode described in Item 4.1 producing the highest emission level.

The EUT configuration and cable configuration of the above highest emission levels were recorded for reference of the final test.

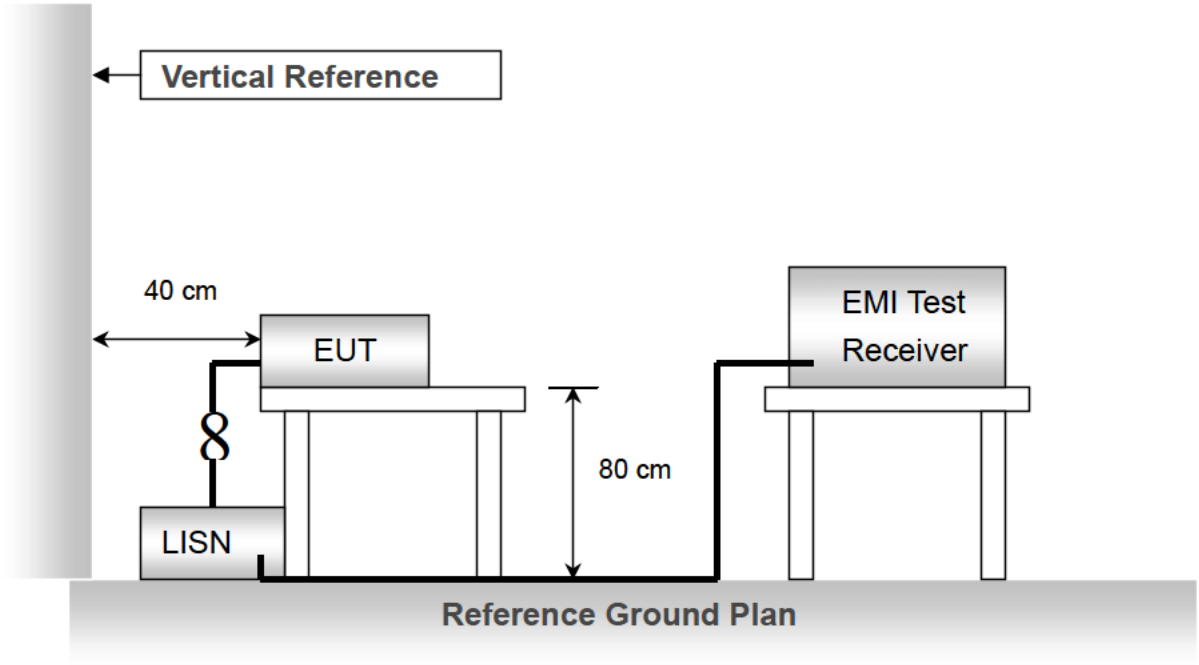
### Procedure of Final Test

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.

A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.

The test data of the worst-case condition(s) was recorded.

### 7.1.4. TEST SETUP




For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 7.1.5. DATA SAMPLE

| Freq. (MHz) | LISN Factor (dB) | Cable Loss (dB) | Meter Reading (dBuV) | Measured Level (dBuV) | Limits (dBuV) | Over Limits (dBuV) | Detector |
|---|---|---|---|---|---|---|---|
| x.xx | 9.6 | 0.1 | 15.7 | 25.4 | 46 | -20.6 | QP |

Freq = Emission frequency in MHz
LISN Factor = Insertion loss of LISN and Pulse Limiter
Cable Loss = Insertion loss of Cable (LISN to EMI Tester Receiver)
Meter Reading = Uncorrected Analyzer/Receiver reading
Measured Level = Read Level + Factor
Limit = Limit stated in standard
Over Limit = Reading in reference to limit
Peak = Peak Reading
QP = Quasi-peak Reading

AV = Average Reading

**Calculation Formula**

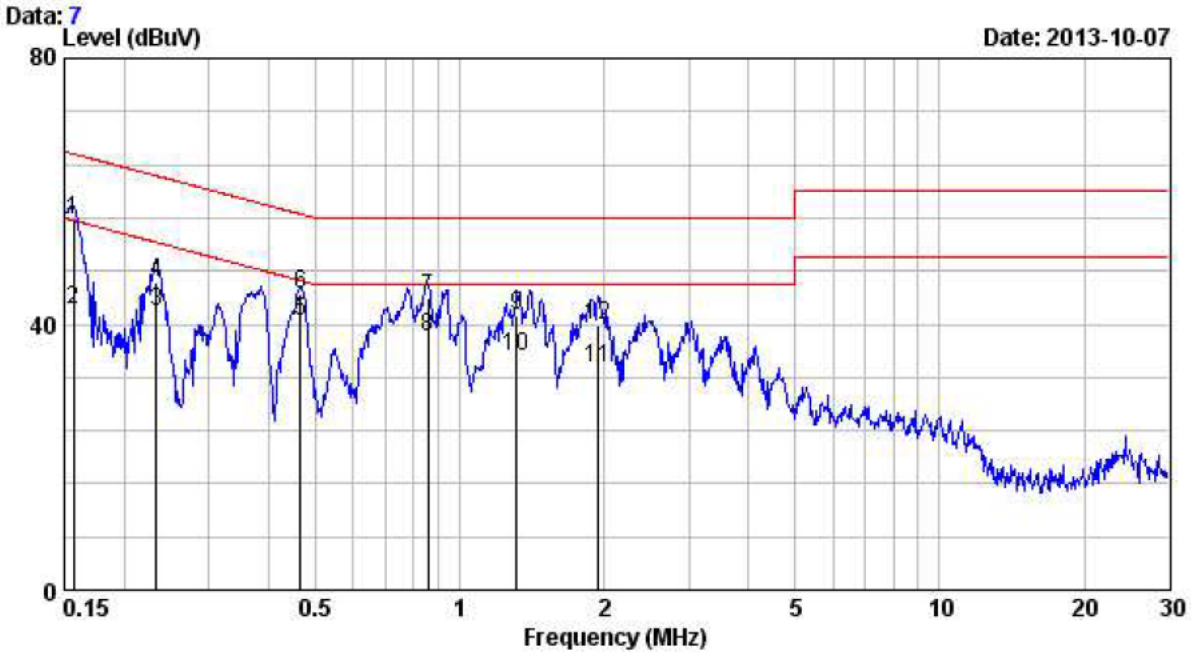
1. Measured Level (dBuV) = LISN Factor (dB) + Cable Loss (dB)+ Meter Reading (dBuV)
2. Over Limit (dBuV) = Measured Level (dBuV) – Limits (dBuV)

## 7.1.6. TEST RESULTS

| Model No. | TMM24105 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full Load |
| Tested by | Shiang Su | | |

**LINE**

(The chart below shows the highest readings taken from the final data.)



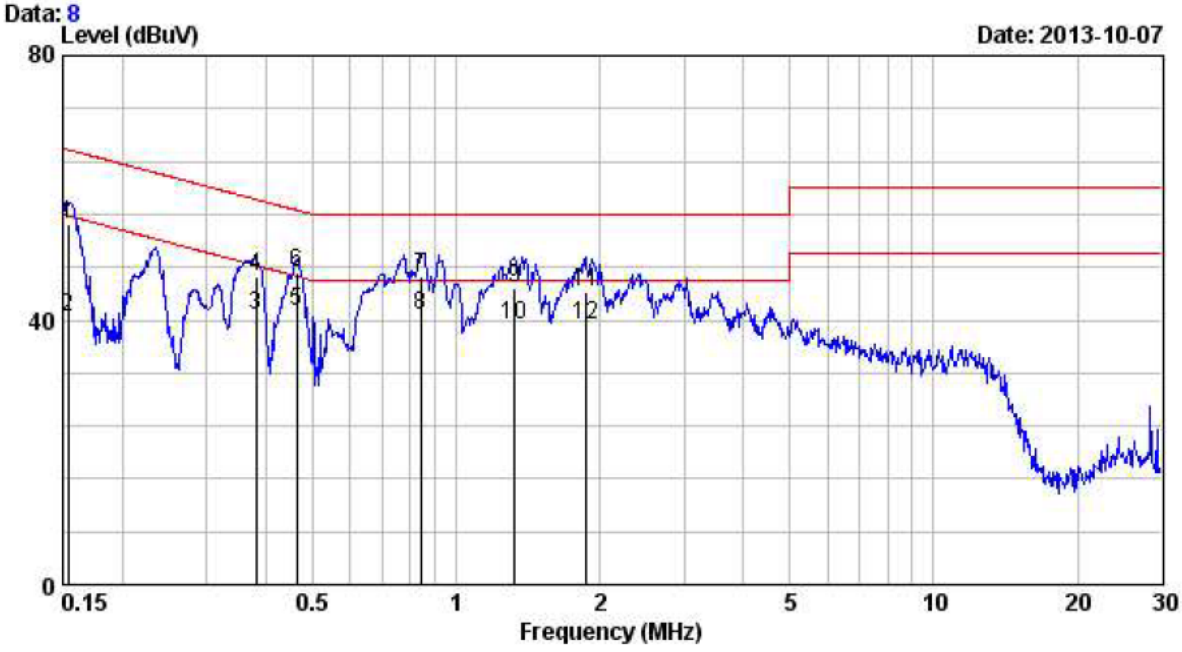

| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.16 | 8.87 | 0.05 | 46.65 | 55.57 | 65.65 | -10.08 | QP |
| 0.16 | 8.87 | 0.05 | 33.23 | 42.15 | 55.65 | -13.50 | AVERAGE |
| 0.23 | 8.88 | 0.05 | 32.95 | 41.88 | 52.35 | -10.46 | AVERAGE |
| 0.23 | 8.88 | 0.05 | 37.43 | 46.36 | 62.35 | -15.98 | QP |
| 0.47 | 8.92 | 0.07 | 31.37 | 40.36 | 46.58 | -6.22 | AVERAGE |
| 0.47 | 8.92 | 0.07 | 35.55 | 44.54 | 56.58 | -12.04 | QP |
| 0.86 | 8.96 | 0.05 | 34.90 | 43.91 | 56.00 | -12.09 | QP |
| 0.86 | 8.96 | 0.05 | 29.17 | 38.18 | 46.00 | -7.82 | AVERAGE |
| 1.32 | 8.99 | 0.06 | 32.23 | 41.27 | 56.00 | -14.73 | QP |
| 1.32 | 8.99 | 0.06 | 26.12 | 35.16 | 46.00 | -10.84 | AVERAGE |
| 1.95 | 9.01 | 0.07 | 24.29 | 33.37 | 46.00 | -12.63 | AVERAGE |
| 1.95 | 9.01 | 0.07 | 30.85 | 39.93 | 56.00 | -16.07 | QP |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24105 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full Load |
| Tested by | Shiang Su | | |

**NEUTRAL**

(The chart below shows the highest readings taken from the final data.)

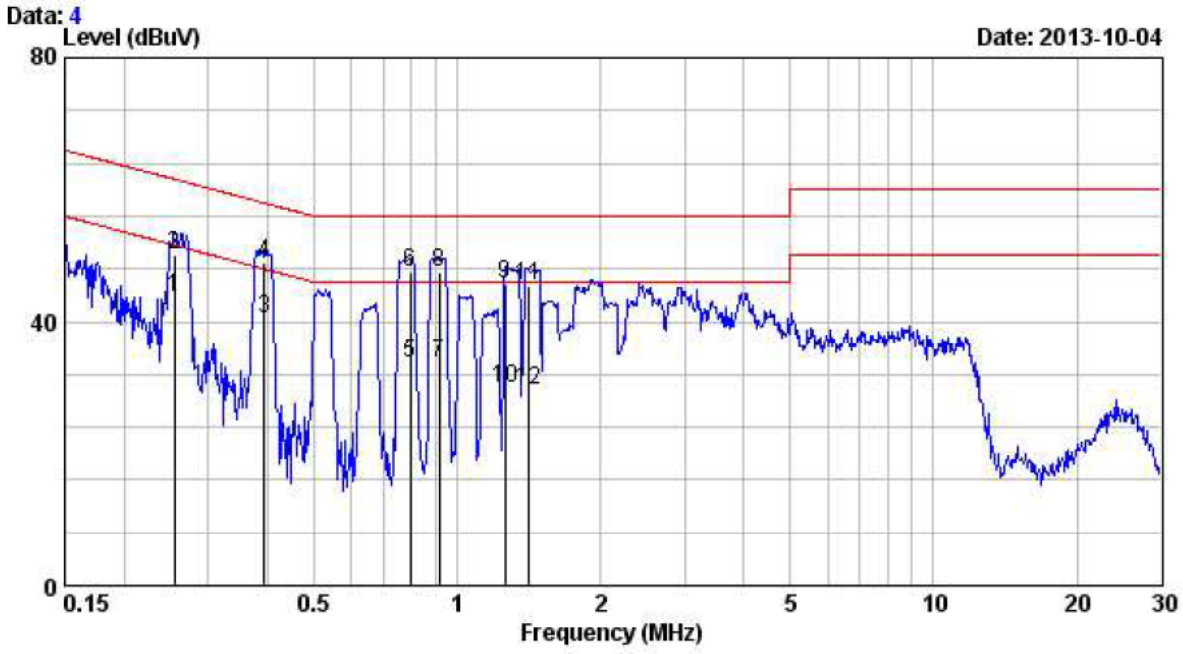



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.15 | 8.85 | 0.05 | 45.72 | 54.62 | 65.78 | -11.16 | QP |
| 0.15 | 8.85 | 0.05 | 31.59 | 40.49 | 55.78 | -15.29 | AVERAGE |
| 0.38 | 8.89 | 0.06 | 31.74 | 40.69 | 48.25 | -7.57 | AVERAGE |
| 0.38 | 8.89 | 0.06 | 37.63 | 46.58 | 58.25 | -11.68 | QP |
| 0.46 | 8.88 | 0.07 | 32.39 | 41.34 | 46.63 | -5.29 | AVERAGE |
| 0.46 | 8.88 | 0.07 | 38.33 | 47.28 | 56.63 | -9.35 | QP |
| 0.84 | 8.90 | 0.05 | 37.58 | 46.53 | 56.00 | -9.47 | QP |
| 0.84 | 8.90 | 0.05 | 31.73 | 40.68 | 46.00 | -5.32 | AVERAGE |
| 1.32 | 8.90 | 0.06 | 35.96 | 44.92 | 56.00 | -11.08 | QP |
| 1.32 | 8.90 | 0.06 | 30.40 | 39.36 | 46.00 | -6.64 | AVERAGE |
| 1.87 | 8.90 | 0.07 | 35.32 | 44.29 | 56.00 | -11.71 | QP |
| 1.87 | 8.90 | 0.07 | 30.31 | 39.28 | 46.00 | -6.72 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24109 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by | Shiang Su | | |

**LINE**

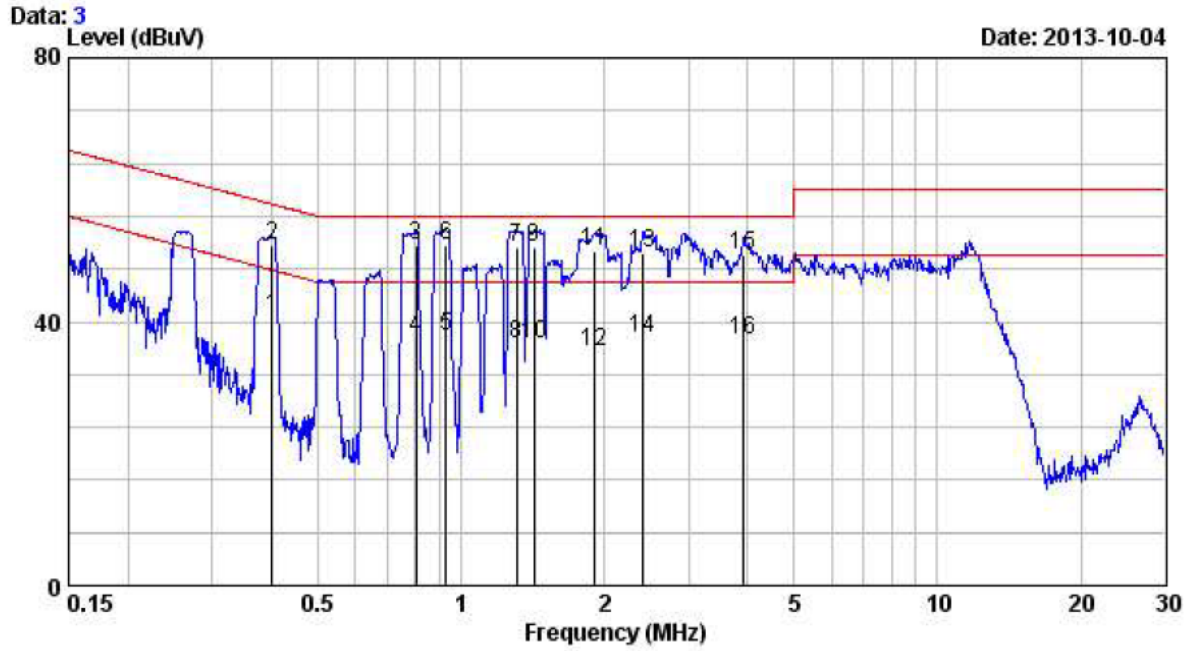



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.25 | 8.89 | 0.05 | 34.65 | 43.59 | 51.60 | -8.01 | AVERAGE |
| 0.25 | 8.89 | 0.05 | 41.29 | 50.23 | 61.60 | -11.37 | QP |
| 0.39 | 8.93 | 0.06 | 31.48 | 40.47 | 47.99 | -7.52 | AVERAGE |
| 0.39 | 8.93 | 0.06 | 39.98 | 48.97 | 57.99 | -9.02 | QP |
| 0.80 | 8.95 | 0.06 | 24.65 | 33.66 | 46.00 | -12.34 | AVERAGE |
| 0.80 | 8.95 | 0.06 | 38.37 | 47.38 | 56.00 | -8.62 | QP |
| 0.92 | 8.96 | 0.05 | 24.57 | 33.59 | 46.00 | -12.41 | AVERAGE |
| 0.92 | 8.96 | 0.05 | 38.54 | 47.56 | 56.00 | -8.44 | QP |
| 1.26 | 8.98 | 0.06 | 36.81 | 45.85 | 56.00 | -10.15 | QP |
| 1.26 | 8.98 | 0.06 | 20.99 | 30.03 | 46.00 | -15.97 | AVERAGE |
| 1.41 | 8.99 | 0.06 | 36.48 | 45.53 | 56.00 | -10.47 | QP |
| 1.41 | 8.99 | 0.06 | 20.65 | 29.70 | 46.00 | -16.30 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24109 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by: | Shiang Su | | |

**NEUTRAL**

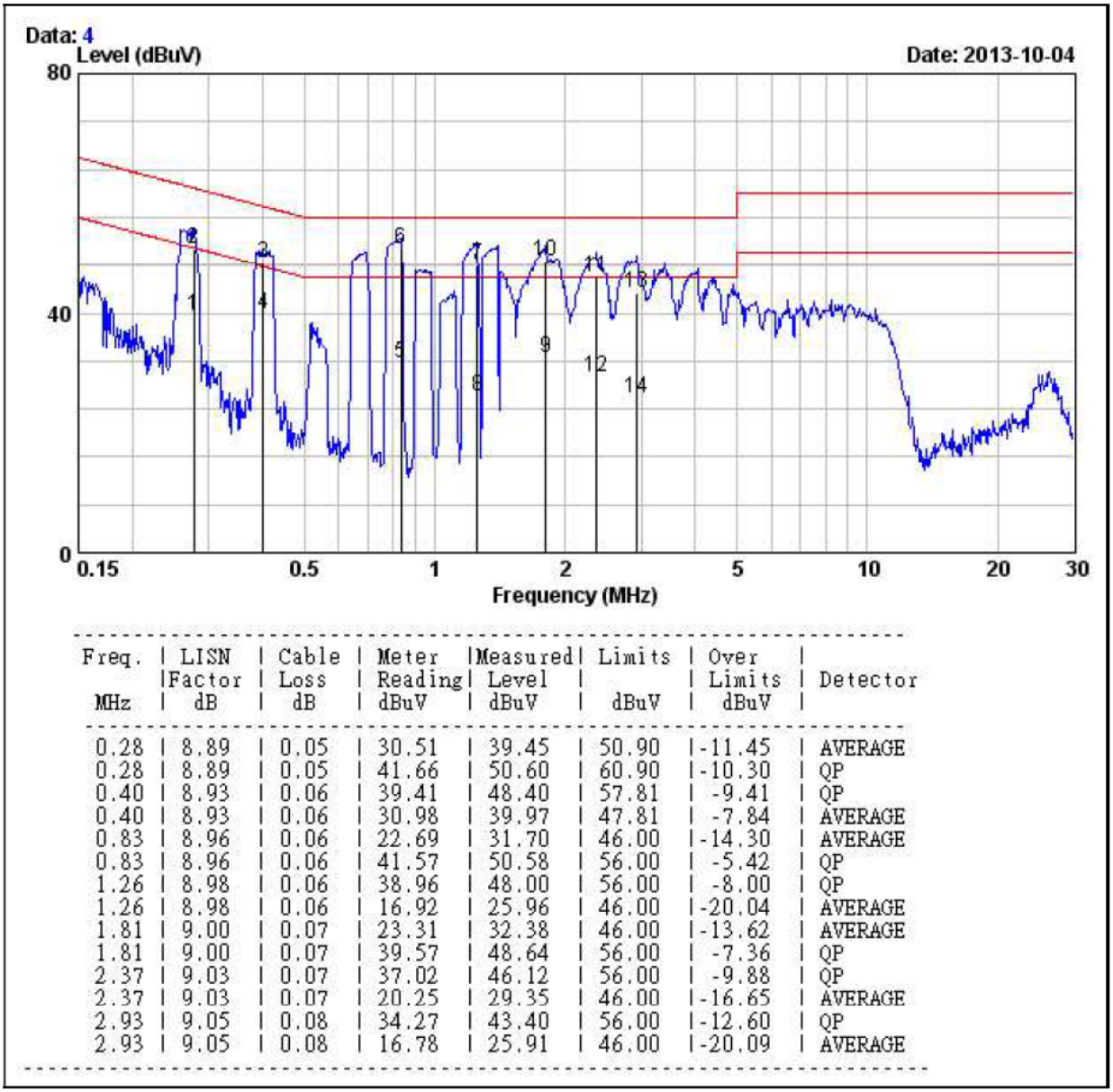



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.40 | 8.89 | 0.06 | 31.81 | 40.76 | 47.81 | -7.05 | AVERAGE |
| 0.40 | 8.89 | 0.06 | 42.64 | 51.59 | 57.81 | -6.22 | QP |
| 0.80 | 8.89 | 0.06 | 42.67 | 51.62 | 56.00 | -4.38 | QP |
| 0.80 | 8.89 | 0.06 | 28.44 | 37.39 | 46.00 | -8.61 | AVERAGE |
| 0.93 | 8.90 | 0.05 | 28.79 | 37.74 | 46.00 | -8.26 | AVERAGE |
| 0.93 | 8.90 | 0.05 | 42.77 | 51.72 | 56.00 | -4.28 | QP |
| 1.31 | 8.90 | 0.06 | 42.29 | 51.25 | 56.00 | -4.75 | QP |
| 1.31 | 8.90 | 0.06 | 27.53 | 36.49 | 46.00 | -9.51 | AVERAGE |
| 1.43 | 8.90 | 0.06 | 42.42 | 51.38 | 56.00 | -4.62 | QP |
| 1.43 | 8.90 | 0.06 | 27.54 | 36.50 | 46.00 | -9.50 | AVERAGE |
| 1.90 | 8.90 | 0.07 | 41.87 | 50.84 | 56.00 | -5.16 | QP |
| 1.90 | 8.90 | 0.07 | 26.39 | 35.36 | 46.00 | -10.64 | AVERAGE |
| 2.40 | 8.92 | 0.07 | 41.30 | 50.29 | 56.00 | -5.71 | QP |
| 2.40 | 8.92 | 0.07 | 28.42 | 37.41 | 46.00 | -8.59 | AVERAGE |
| 3.90 | 8.96 | 0.09 | 41.07 | 50.12 | 56.00 | -5.88 | QP |
| 3.90 | 8.96 | 0.09 | 28.13 | 37.18 | 46.00 | -8.82 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24112 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by | Shiang Su | | |

**LINE**

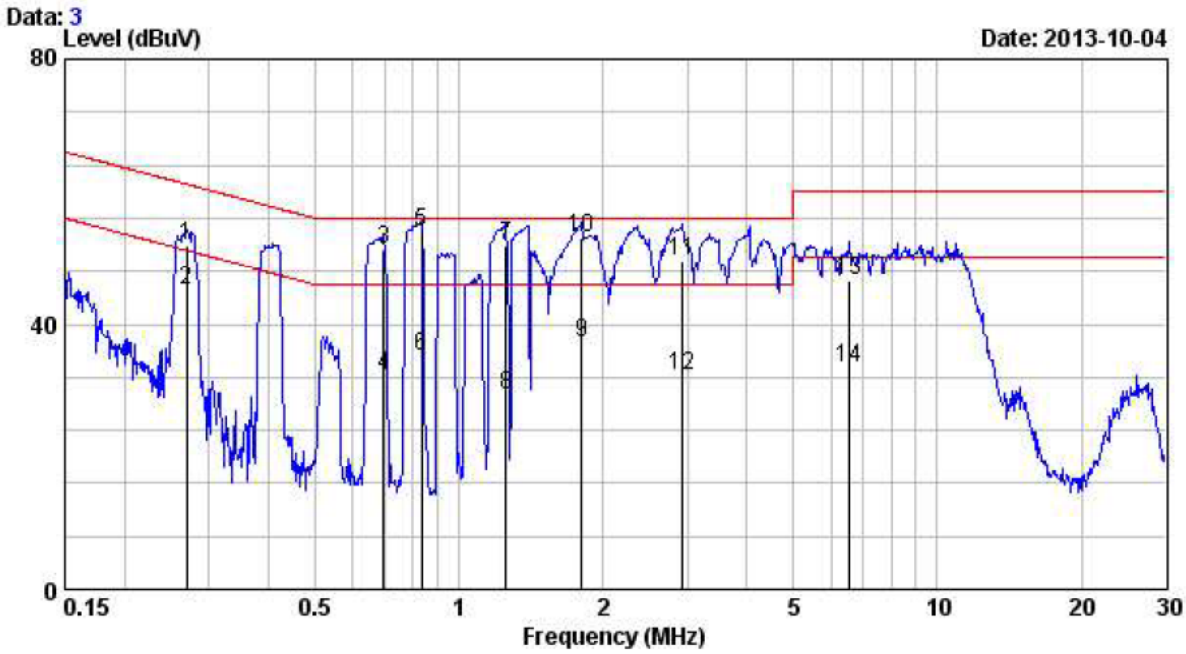



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.28 | 8.89 | 0.05 | 30.51 | 39.45 | 50.90 | -11.45 | AVERAGE |
| 0.28 | 8.89 | 0.05 | 41.66 | 50.60 | 60.90 | -10.30 | QP |
| 0.40 | 8.93 | 0.06 | 39.41 | 48.40 | 57.81 | -9.41 | QP |
| 0.40 | 8.93 | 0.06 | 30.98 | 39.97 | 47.81 | -7.84 | AVERAGE |
| 0.83 | 8.96 | 0.06 | 22.69 | 31.70 | 46.00 | -14.30 | AVERAGE |
| 0.83 | 8.96 | 0.06 | 41.57 | 50.58 | 56.00 | -5.42 | QP |
| 1.26 | 8.98 | 0.06 | 38.96 | 48.00 | 56.00 | -8.00 | QP |
| 1.26 | 8.98 | 0.06 | 16.92 | 25.96 | 46.00 | -20.04 | AVERAGE |
| 1.81 | 9.00 | 0.07 | 23.31 | 32.38 | 46.00 | -13.62 | AVERAGE |
| 1.81 | 9.00 | 0.07 | 39.57 | 48.64 | 56.00 | -7.36 | QP |
| 2.37 | 9.03 | 0.07 | 37.02 | 46.12 | 56.00 | -9.88 | QP |
| 2.37 | 9.03 | 0.07 | 20.25 | 29.35 | 46.00 | -16.65 | AVERAGE |
| 2.93 | 9.05 | 0.08 | 34.27 | 43.40 | 56.00 | -12.60 | QP |
| 2.93 | 9.05 | 0.08 | 16.78 | 25.91 | 46.00 | -20.09 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24112 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by: | Shiang Su | | |

**NEUTRAL**

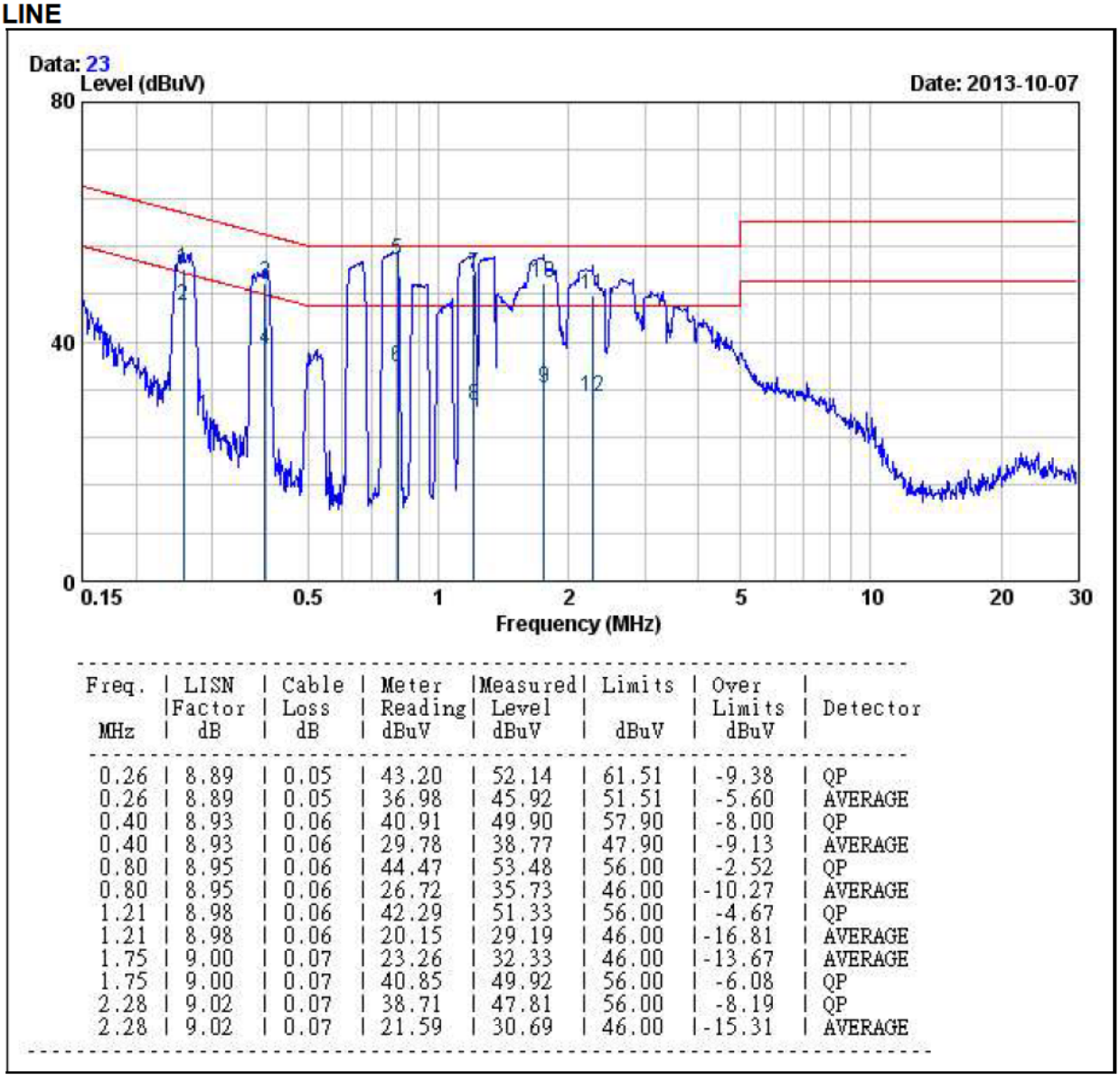



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.27 | 8.87 | 0.05 | 42.96 | 51.88 | 61.12 | -9.24 | QP |
| 0.27 | 8.87 | 0.05 | 36.33 | 45.25 | 51.12 | -5.87 | AVERAGE |
| 0.70 | 8.89 | 0.06 | 42.29 | 51.24 | 56.00 | -4.76 | QP |
| 0.70 | 8.89 | 0.06 | 23.34 | 32.29 | 46.00 | -13.71 | AVERAGE |
| 0.83 | 8.89 | 0.06 | 44.90 | 53.85 | 56.00 | -2.15 | QP |
| 0.83 | 8.89 | 0.06 | 26.16 | 35.11 | 46.00 | -10.89 | AVERAGE |
| 1.26 | 8.90 | 0.06 | 43.05 | 52.01 | 56.00 | -3.99 | QP |
| 1.26 | 8.90 | 0.06 | 20.42 | 29.38 | 46.00 | -16.62 | AVERAGE |
| 1.81 | 8.90 | 0.07 | 28.33 | 37.30 | 46.00 | -8.70 | AVERAGE |
| 1.81 | 8.90 | 0.07 | 44.21 | 53.18 | 56.00 | -2.82 | QP |
| 2.93 | 8.94 | 0.08 | 40.42 | 49.44 | 56.00 | -6.56 | QP |
| 2.93 | 8.94 | 0.08 | 23.34 | 32.36 | 46.00 | -13.64 | AVERAGE |
| 6.56 | 9.01 | 0.10 | 37.39 | 46.50 | 60.00 | -13.50 | QP |
| 6.56 | 9.01 | 0.10 | 24.27 | 33.38 | 50.00 | -16.62 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24115 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by | Shiang Su | | |

**LINE**

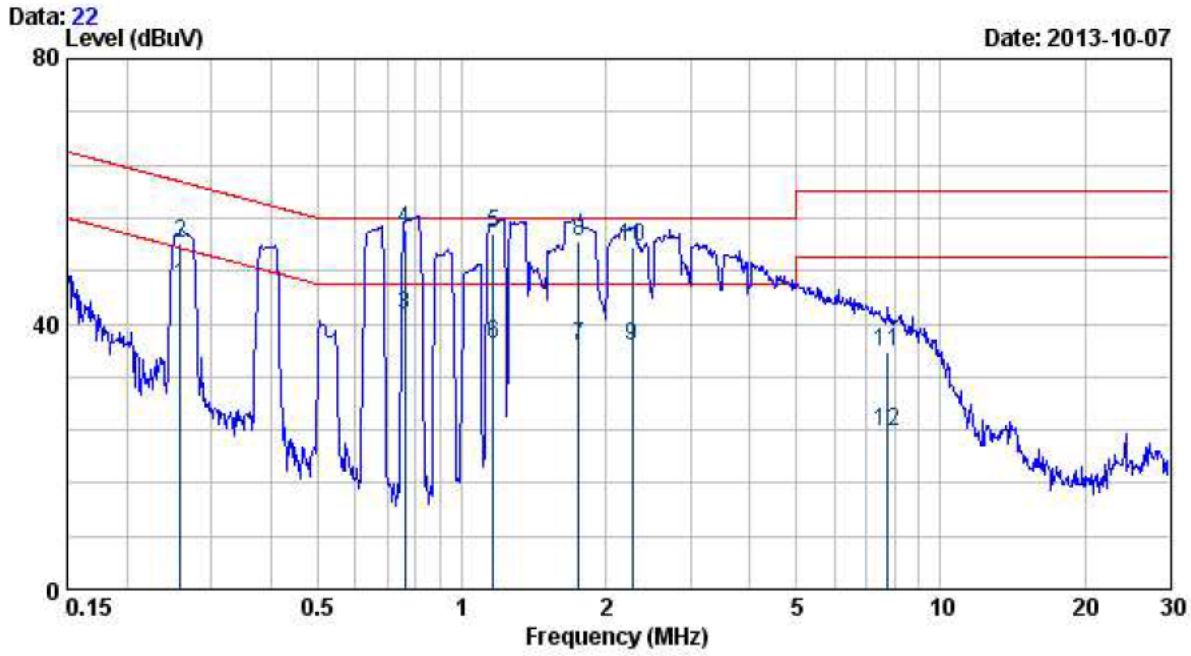



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.26 | 8.89 | 0.05 | 43.20 | 52.14 | 61.51 | -9.38 | QP |
| 0.26 | 8.89 | 0.05 | 36.98 | 45.92 | 51.51 | -5.60 | AVERAGE |
| 0.40 | 8.93 | 0.06 | 40.91 | 49.90 | 57.90 | -8.00 | QP |
| 0.40 | 8.93 | 0.06 | 29.78 | 38.77 | 47.90 | -9.13 | AVERAGE |
| 0.80 | 8.95 | 0.06 | 44.47 | 53.48 | 56.00 | -2.52 | QP |
| 0.80 | 8.95 | 0.06 | 26.72 | 35.73 | 46.00 | -10.27 | AVERAGE |
| 1.21 | 8.98 | 0.06 | 42.29 | 51.33 | 56.00 | -4.67 | QP |
| 1.21 | 8.98 | 0.06 | 20.15 | 29.19 | 46.00 | -16.81 | AVERAGE |
| 1.75 | 9.00 | 0.07 | 23.26 | 32.33 | 46.00 | -13.67 | AVERAGE |
| 1.75 | 9.00 | 0.07 | 40.85 | 49.92 | 56.00 | -6.08 | QP |
| 2.28 | 9.02 | 0.07 | 38.71 | 47.81 | 56.00 | -8.19 | QP |
| 2.28 | 9.02 | 0.07 | 21.59 | 30.69 | 46.00 | -15.31 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24115 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by: | Shiang Su | | |

**NEUTRAL**

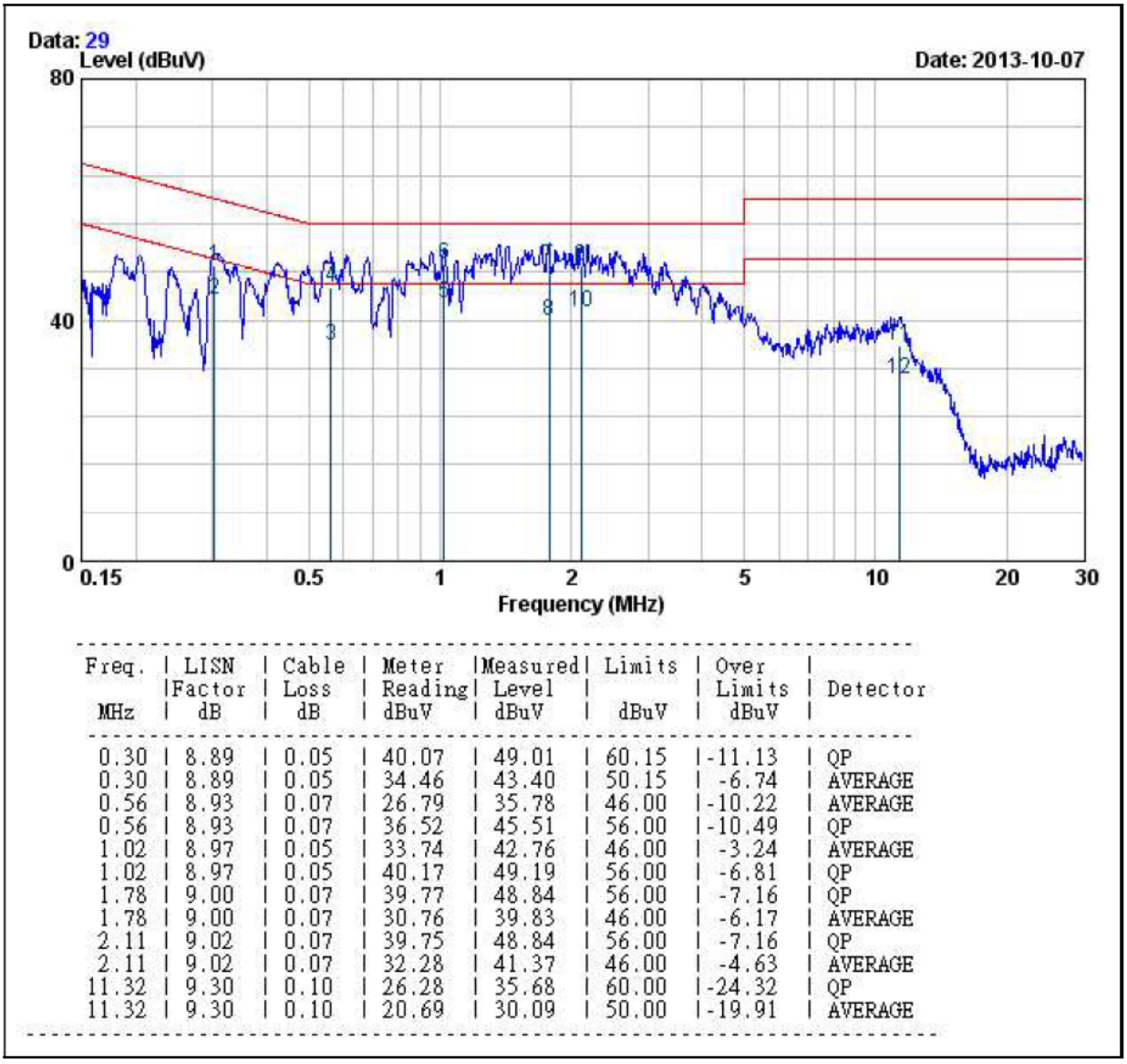



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.26 | 8.87 | 0.05 | 36.92 | 45.84 | 51.47 | -5.63 | AVERAGE |
| 0.26 | 8.87 | 0.05 | 43.28 | 52.20 | 61.47 | -9.27 | QP |
| 0.76 | 8.89 | 0.06 | 32.26 | 41.21 | 46.00 | -4.79 | AVERAGE |
| 0.76 | 8.89 | 0.06 | 45.16 | 54.11 | 56.00 | -1.89 | QP |
| 1.16 | 8.90 | 0.05 | 44.69 | 53.64 | 56.00 | -2.36 | QP |
| 1.16 | 8.90 | 0.05 | 27.92 | 36.87 | 46.00 | -9.13 | AVERAGE |
| 1.76 | 8.90 | 0.07 | 27.77 | 36.74 | 46.00 | -9.26 | AVERAGE |
| 1.76 | 8.90 | 0.07 | 43.35 | 52.32 | 56.00 | -3.68 | QP |
| 2.27 | 8.91 | 0.07 | 27.61 | 36.60 | 46.00 | -9.40 | AVERAGE |
| 2.27 | 8.91 | 0.07 | 42.60 | 51.59 | 56.00 | -4.41 | QP |
| 7.77 | 9.04 | 0.09 | 26.60 | 35.74 | 60.00 | -24.26 | QP |
| 7.77 | 9.04 | 0.09 | 14.69 | 23.83 | 50.00 | -26.17 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24124 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by | Shiang Su | | |

**LINE**

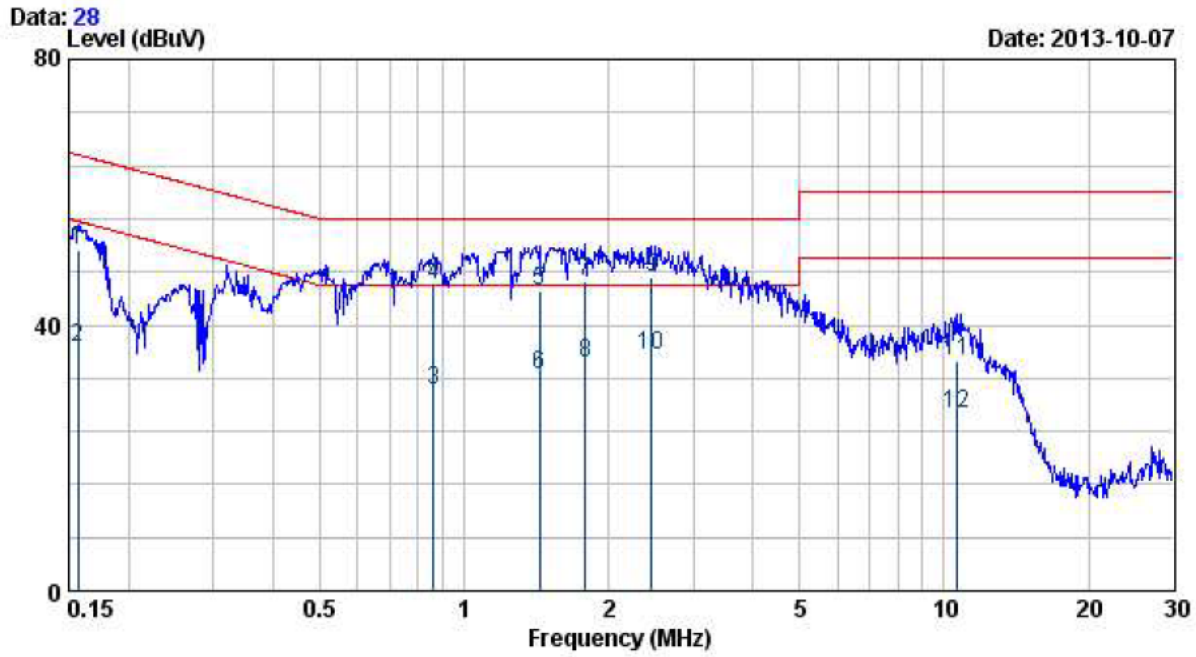



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.30 | 8.89 | 0.05 | 40.07 | 49.01 | 60.15 | -11.13 | QP |
| 0.30 | 8.89 | 0.05 | 34.46 | 43.40 | 50.15 | -6.74 | AVERAGE |
| 0.56 | 8.93 | 0.07 | 26.79 | 35.78 | 46.00 | -10.22 | AVERAGE |
| 0.56 | 8.93 | 0.07 | 36.52 | 45.51 | 56.00 | -10.49 | QP |
| 1.02 | 8.97 | 0.05 | 33.74 | 42.76 | 46.00 | -3.24 | AVERAGE |
| 1.02 | 8.97 | 0.05 | 40.17 | 49.19 | 56.00 | -6.81 | QP |
| 1.78 | 9.00 | 0.07 | 39.77 | 48.84 | 56.00 | -7.16 | QP |
| 1.78 | 9.00 | 0.07 | 30.76 | 39.83 | 46.00 | -6.17 | AVERAGE |
| 2.11 | 9.02 | 0.07 | 39.75 | 48.84 | 56.00 | -7.16 | QP |
| 2.11 | 9.02 | 0.07 | 32.28 | 41.37 | 46.00 | -4.63 | AVERAGE |
| 11.32 | 9.30 | 0.10 | 26.28 | 35.68 | 60.00 | -24.32 | QP |
| 11.32 | 9.30 | 0.10 | 20.69 | 30.09 | 50.00 | -19.91 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24124 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by: | Shiang Su | | |

**NEUTRAL**

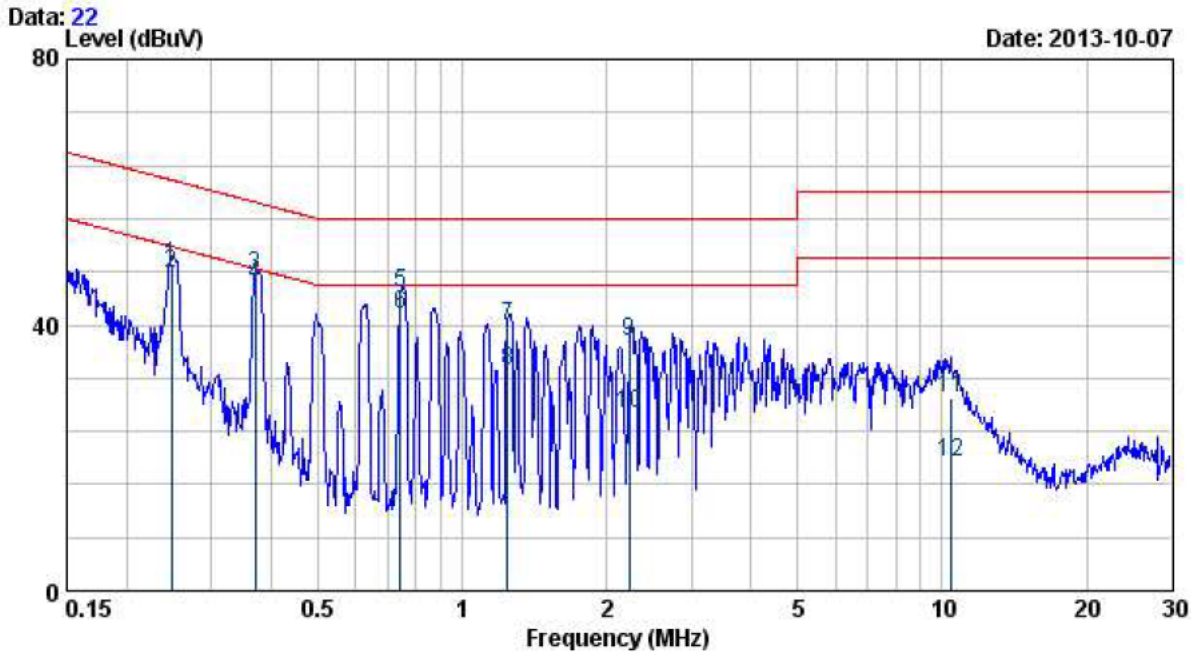



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.16 | 8.85 | 0.05 | 42.44 | 51.34 | 65.65 | -14.31 | QP |
| 0.16 | 8.85 | 0.05 | 27.64 | 36.54 | 55.65 | -19.11 | AVERAGE |
| 0.86 | 8.90 | 0.05 | 21.13 | 30.08 | 46.00 | -15.92 | AVERAGE |
| 0.86 | 8.90 | 0.05 | 37.08 | 46.03 | 56.00 | -9.97 | QP |
| 1.43 | 8.90 | 0.06 | 36.03 | 44.99 | 56.00 | -11.01 | QP |
| 1.43 | 8.90 | 0.06 | 23.50 | 32.46 | 46.00 | -13.54 | AVERAGE |
| 1.79 | 8.90 | 0.07 | 37.50 | 46.47 | 56.00 | -9.53 | QP |
| 1.79 | 8.90 | 0.07 | 25.36 | 34.33 | 46.00 | -11.67 | AVERAGE |
| 2.46 | 8.92 | 0.08 | 38.10 | 47.10 | 56.00 | -8.90 | QP |
| 2.46 | 8.92 | 0.08 | 26.34 | 35.34 | 46.00 | -10.66 | AVERAGE |
| 10.62 | 9.11 | 0.09 | 25.38 | 34.58 | 60.00 | -25.42 | QP |
| 10.62 | 9.11 | 0.09 | 17.36 | 26.56 | 50.00 | -23.44 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24212 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by | Shiang Su | | |

**LINE**

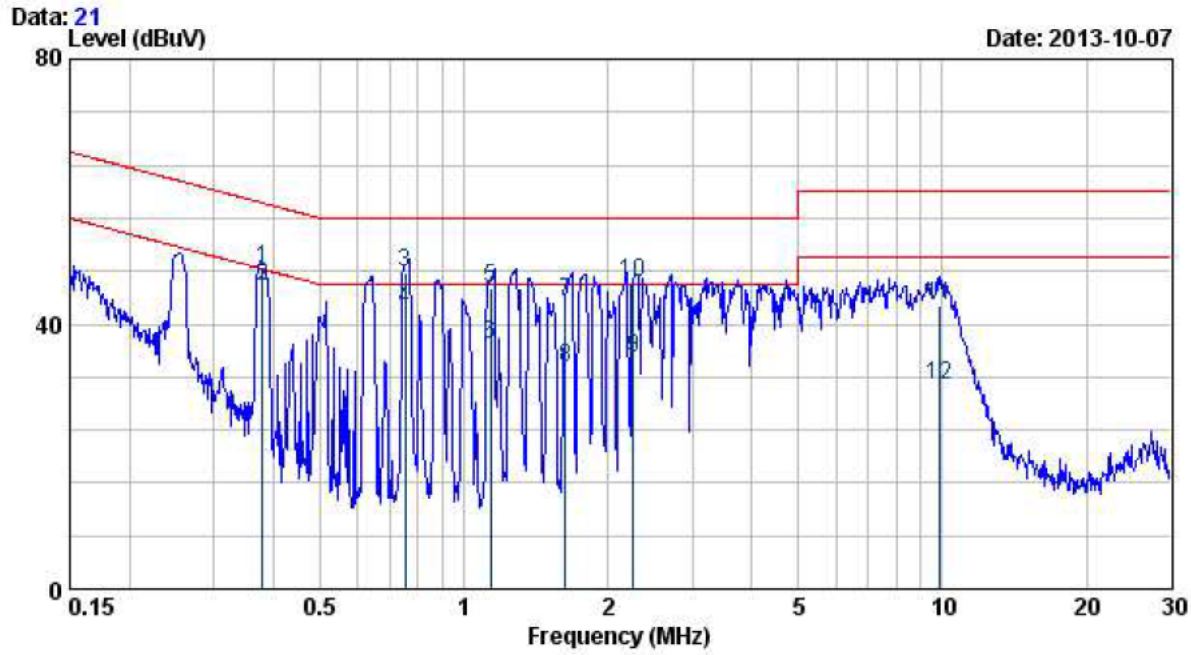



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.25 | 8.89 | 0.05 | 39.91 | 48.85 | 61.82 | -12.97 | QP |
| 0.25 | 8.89 | 0.05 | 38.89 | 47.83 | 51.82 | -3.99 | AVERAGE |
| 0.37 | 8.92 | 0.06 | 38.39 | 47.37 | 58.48 | -11.11 | QP |
| 0.37 | 8.92 | 0.06 | 36.93 | 45.91 | 48.48 | -2.57 | AVERAGE |
| 0.74 | 8.95 | 0.06 | 35.70 | 44.71 | 56.00 | -11.29 | QP |
| 0.74 | 8.95 | 0.06 | 32.53 | 41.54 | 46.00 | -4.46 | AVERAGE |
| 1.24 | 8.98 | 0.06 | 30.94 | 39.98 | 56.00 | -16.02 | QP |
| 1.24 | 8.98 | 0.06 | 24.01 | 33.05 | 46.00 | -12.95 | AVERAGE |
| 2.23 | 9.02 | 0.07 | 28.29 | 37.38 | 56.00 | -18.62 | QP |
| 2.23 | 9.02 | 0.07 | 17.61 | 26.70 | 46.00 | -19.30 | AVERAGE |
| 10.40 | 9.26 | 0.09 | 19.54 | 28.90 | 60.00 | -31.10 | QP |
| 10.40 | 9.26 | 0.09 | 10.03 | 19.39 | 50.00 | -30.61 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24212 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by: | Shiang Su | | |

**NEUTRAL**

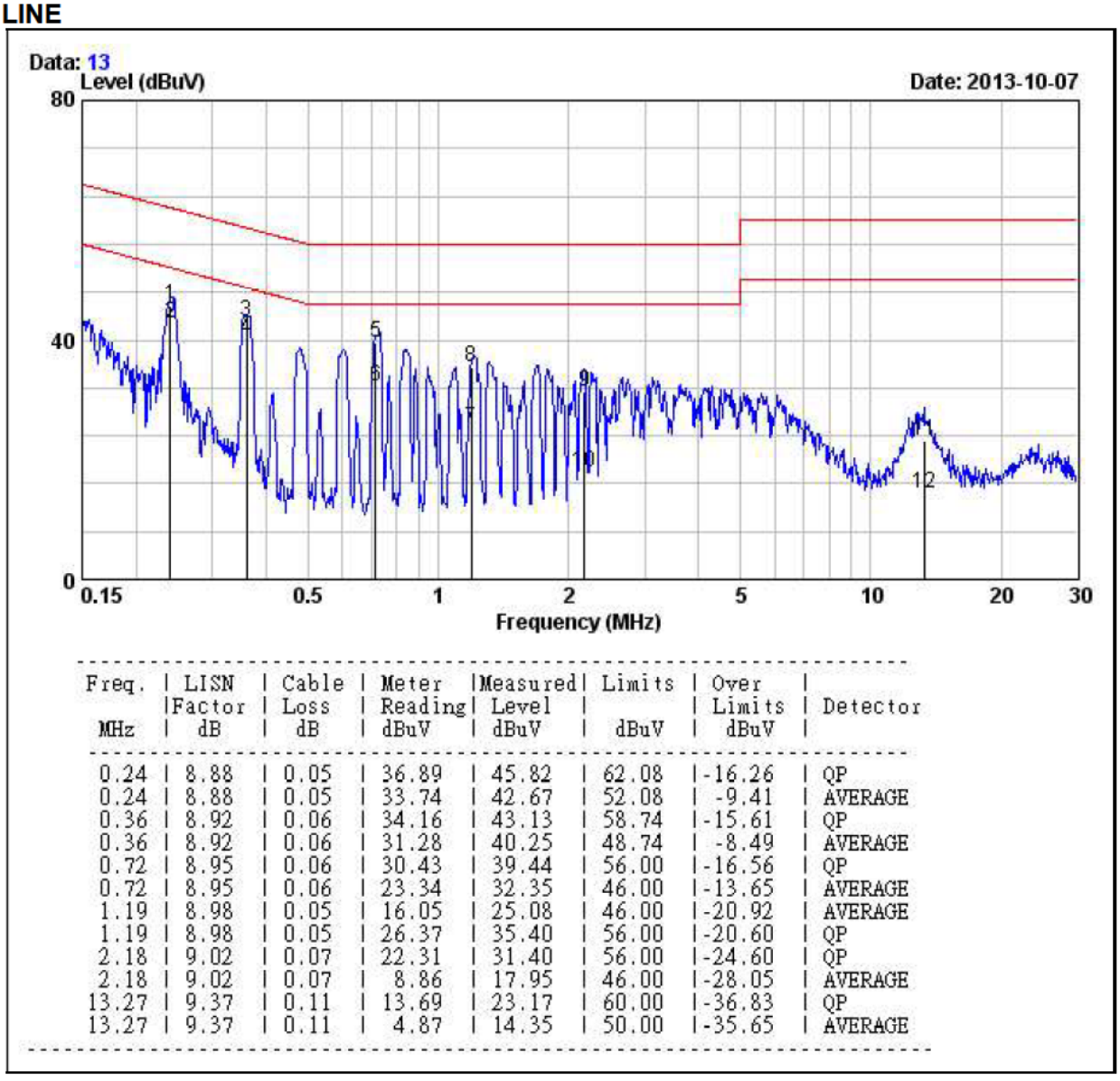



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.38 | 8.89 | 0.06 | 39.46 | 48.40 | 58.30 | -9.89 | QP |
| 0.38 | 8.89 | 0.06 | 36.74 | 45.68 | 48.30 | -2.61 | AVERAGE |
| 0.75 | 8.89 | 0.06 | 38.67 | 47.62 | 56.00 | -8.38 | QP |
| 0.75 | 8.89 | 0.06 | 33.34 | 42.29 | 46.00 | -3.71 | AVERAGE |
| 1.13 | 8.90 | 0.05 | 36.44 | 45.39 | 56.00 | -10.61 | QP |
| 1.13 | 8.90 | 0.05 | 27.86 | 36.81 | 46.00 | -9.19 | AVERAGE |
| 1.63 | 8.90 | 0.06 | 34.38 | 43.34 | 56.00 | -12.66 | QP |
| 1.63 | 8.90 | 0.06 | 24.49 | 33.45 | 46.00 | -12.55 | AVERAGE |
| 2.26 | 8.91 | 0.07 | 25.78 | 34.77 | 46.00 | -11.24 | AVERAGE |
| 2.26 | 8.91 | 0.07 | 37.42 | 46.41 | 56.00 | -9.60 | QP |
| 9.86 | 9.09 | 0.09 | 33.57 | 42.75 | 60.00 | -17.25 | QP |
| 9.86 | 9.09 | 0.09 | 21.69 | 30.87 | 50.00 | -19.13 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24215 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by | Shiang Su | | |

**LINE**

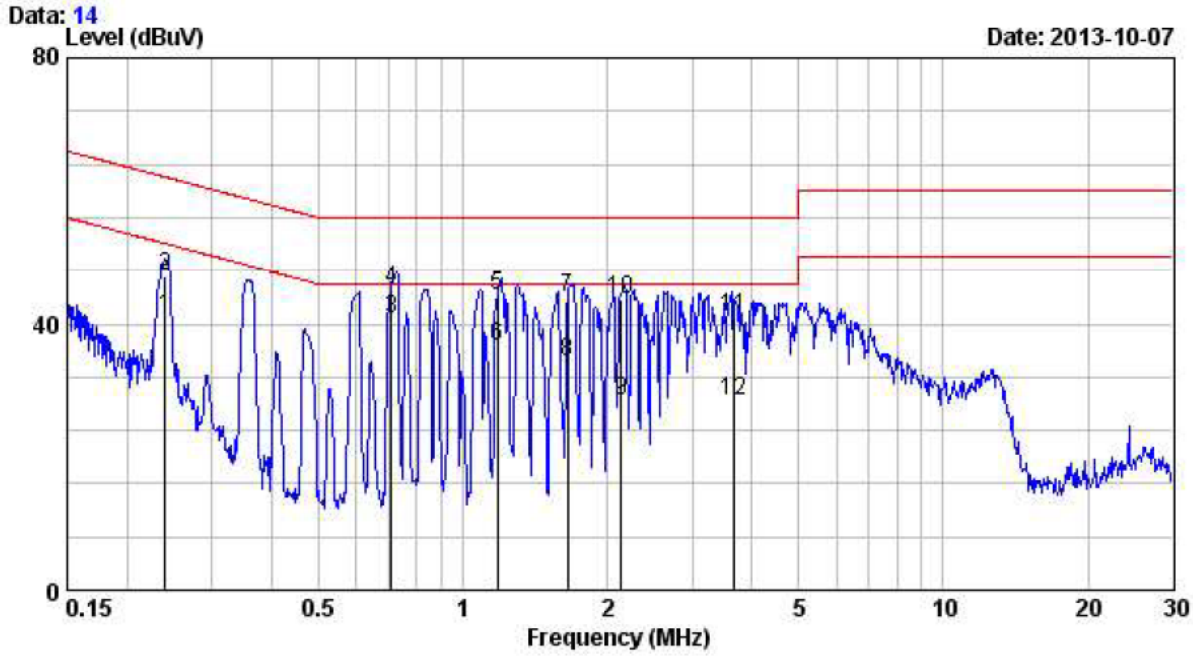



| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.24 | 8.88 | 0.05 | 36.89 | 45.82 | 62.08 | -16.26 | QP |
| 0.24 | 8.88 | 0.05 | 33.74 | 42.67 | 52.08 | -9.41 | AVERAGE |
| 0.36 | 8.92 | 0.06 | 34.16 | 43.13 | 58.74 | -15.61 | QP |
| 0.36 | 8.92 | 0.06 | 31.28 | 40.25 | 48.74 | -8.49 | AVERAGE |
| 0.72 | 8.95 | 0.06 | 30.43 | 39.44 | 56.00 | -16.56 | QP |
| 0.72 | 8.95 | 0.06 | 23.34 | 32.35 | 46.00 | -13.65 | AVERAGE |
| 1.19 | 8.98 | 0.05 | 16.05 | 25.08 | 46.00 | -20.92 | AVERAGE |
| 1.19 | 8.98 | 0.05 | 26.37 | 35.40 | 56.00 | -20.60 | QP |
| 2.18 | 9.02 | 0.07 | 22.31 | 31.40 | 56.00 | -24.60 | QP |
| 2.18 | 9.02 | 0.07 | 8.86 | 17.95 | 46.00 | -28.05 | AVERAGE |
| 13.27 | 9.37 | 0.11 | 13.69 | 23.17 | 60.00 | -36.83 | QP |
| 13.27 | 9.37 | 0.11 | 4.87 | 14.35 | 50.00 | -35.65 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

| Model No. | TMM24215 | Resolution Bandwidth | 9 kHz |
|---|---|---|---|
| Environmental Conditions | 22℃, 60% RH | Test Mode | Full load |
| Tested by: | Shiang Su | | |

**NEUTRAL**




| Freq. MHz | LISN Factor dB | Cable Loss dB | Meter Reading dBuV | Measured Level dBuV | Limits dBuV | Over Limits dBuV | Detector |
|---|---|---|---|---|---|---|---|
| 0.24 | 8.86 | 0.05 | 32.15 | 41.06 | 52.08 | -11.02 | AVERAGE |
| 0.24 | 8.86 | 0.05 | 38.41 | 47.32 | 62.08 | -14.76 | QP |
| 0.71 | 8.89 | 0.06 | 31.84 | 40.79 | 46.00 | -5.21 | AVERAGE |
| 0.71 | 8.89 | 0.06 | 36.19 | 45.14 | 56.00 | -10.86 | QP |
| 1.18 | 8.90 | 0.05 | 35.38 | 44.33 | 56.00 | -11.67 | QP |
| 1.18 | 8.90 | 0.05 | 27.79 | 36.74 | 46.00 | -9.26 | AVERAGE |
| 1.65 | 8.90 | 0.06 | 35.04 | 44.00 | 56.00 | -12.00 | QP |
| 1.65 | 8.90 | 0.06 | 25.21 | 34.17 | 46.00 | -11.83 | AVERAGE |
| 2.14 | 8.91 | 0.07 | 19.45 | 28.43 | 46.00 | -17.57 | AVERAGE |
| 2.14 | 8.91 | 0.07 | 34.81 | 43.79 | 56.00 | -12.21 | QP |
| 3.67 | 8.95 | 0.09 | 32.12 | 41.16 | 56.00 | -14.84 | QP |
| 3.67 | 8.95 | 0.09 | 19.43 | 28.47 | 46.00 | -17.53 | AVERAGE |

Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)

## 7.2. RADIATED EMISSION MEASUREMENT

### 7.2.1. LIMITS

| Frequency band (MHz) | Measured on a test site | | Measured in situation |
|---|---|---|---|
| | Group 1, class A 10m measurement distance dB(μV) | Group 1, class B 10m measurement distance dB(μV) | Group 1, class A Limits with measuring distance 30m from exterior wall outside the building in which the equipment is situated dB(μV/m) |
| 0.15-30 | Under consideration | Under consideration | Under consideration |
| 30—230 | 40 | 30 | 30 |
| 230—1000 | 47 | 37 | 37 |

**NOTE**: (1) The lower limit shall apply at the transition frequencies.
(2) Emission level (dBuV/m) = 20 log Emission level (uV/m).

### 7.2.2. TEST INSTRUMENTS

| Open Area Test Site # 7 | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| Bi-Log Antenna | Sunol | JB1 | A013105-1 | 08/09/2016 |
| EMI Test Receiver | R&S | ESCI | 101336 | 03/21/2017 |
| Type N coxical cable | Suhner | RG_214_U/2X | 7 | 12/02/2016 |
| Test Software | e3 (5.04211j) | | | |

**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

## 7.2.3. TEST PROCEDURE

### Procedure of Preliminary Test

The equipment was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden turntable with a height of 0.8 meters is used which is placed on the ground plane. When the EUT is a floor standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.

Support equipment, if needed, was placed as per EN 55011.

All I/O cables were positioned to simulate typical usage as per EN 55011.

The EUT received AC power source from the outlet socket under the turntable. All support equipment power received from another socket under the turntable.

Mains cables, telephone lines or other connections to auxiliary equipment located outside the test are shall drape to the floor, be fitted with ferrite clamps or ferrite tubes placed on the floor at the point where the cable reaches the floor and then routed to the place where they leave the turntable. No extension cords shall be used to mains receptacle.

The antenna was placed at 10 meter away from the EUT as stated in EN 55022. The antenna connected to the Spectrum Analyzer via a cable and at times a pre-amplifier would be used.

The Analyzer / Receiver quickly scanned from 30MHz to 1000MHz. The EUT test program was started. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

The test mode(s) described in Item 4.1 were scanned during the preliminary test:

After the preliminary scan, we found the test mode described in Item 4.1 producing the highest emission level.

The EUT and cable configuration, antenna position, polarization and turntable position of the above highest emission level were recorded for the final test.

### Procedure of Final Test

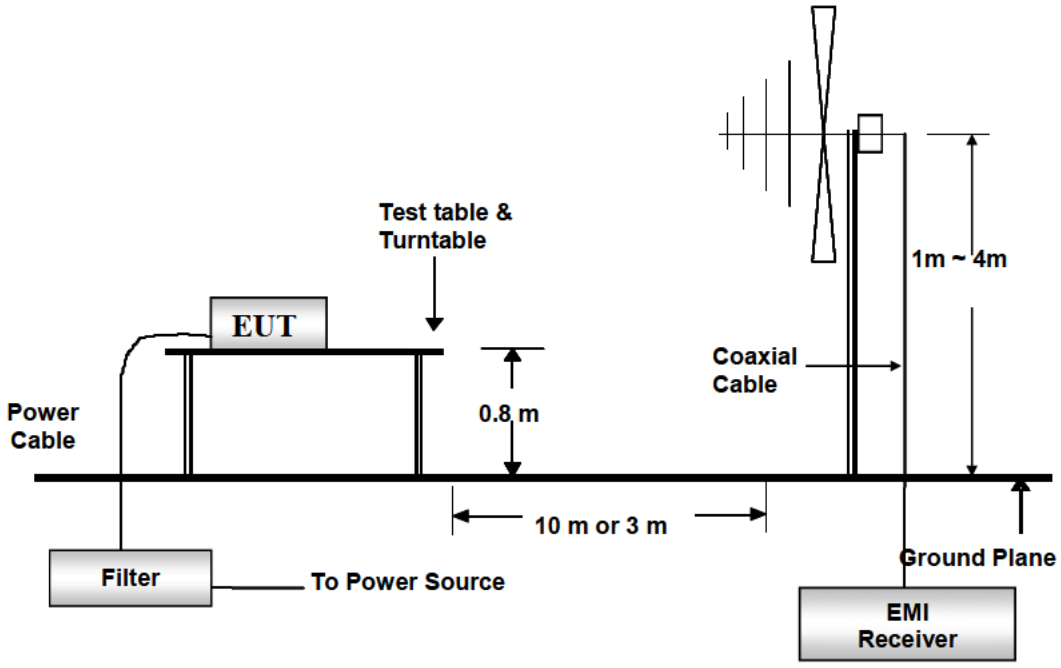
EUT and support equipment were set up on the turntable as per the configuration with highest emission level in the preliminary test.

The Analyzer / Receiver scanned from 30MHz to 1000MHz. Emissions were scanned and measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

Recorded at least the six highest emissions. Emission frequency, amplitude, antenna position, polarization and turntable position were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit and only Q.P. reading is presented.

The test data of the worst-case condition(s) was recorded.

## 7.2.4. TEST SETUP




For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

## 7.2.5. DATA SAMPLE

| Freq. (MHz) | Reading dBuV/m | Antenna Factor dB | Cable loss dB | Measure level dBuV/m | Limit dBu/m | Over limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| x.xx | 24.48 | 7.33 | 1.50 | 33.31 | 40 | -6.69 | QP |

Freq. = Emission frequency in MHz
Reading = Uncorrected Analyzer/Receiver reading
Antenna Factor = Antenna Factor
Cable loss = Insertion loss of cable
Measure level = Reading + Factor
Limit = Limit stated in standard
Over limit = Measure level – Limit
Peak = Peak Reading
QP = Quasi-peak Reading
AV = Average Reading

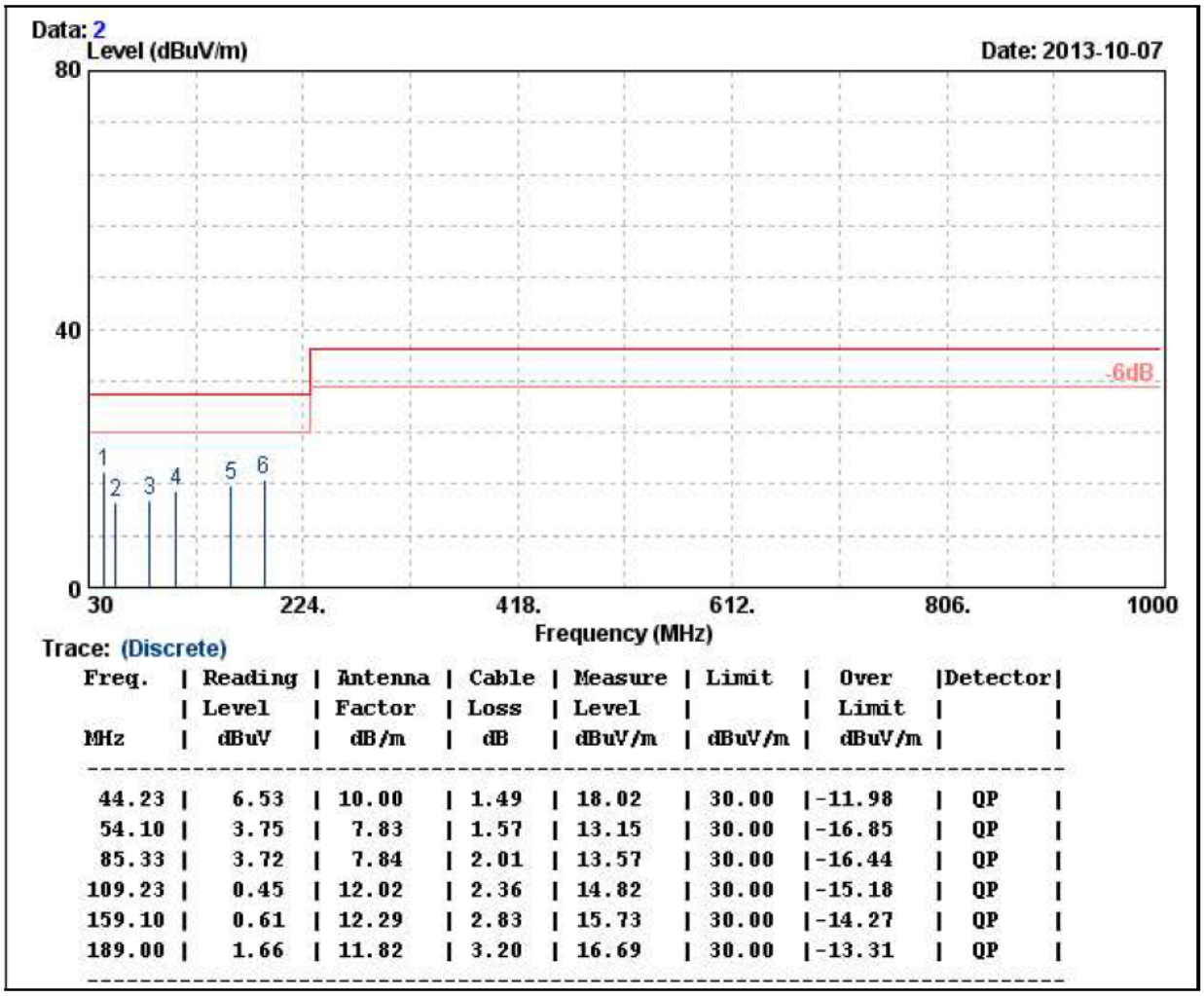
**Calculation Formula**

Over limit (dBuV/m) = Result (dBuV/m) – Limit (dBuV/m)

## 7.2.6. TEST RESULTS

| Model No. | TMM24105 | Test Mode | Full Load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | 6dB Bandwidth | 120 kHz |
| Antenna Pole | Vertical | Antenna Distance | 10m |
| Detector Function | Quasi-peak. | Tested by | Ted Huang |

(The chart below shows the highest readings taken from the final data.)



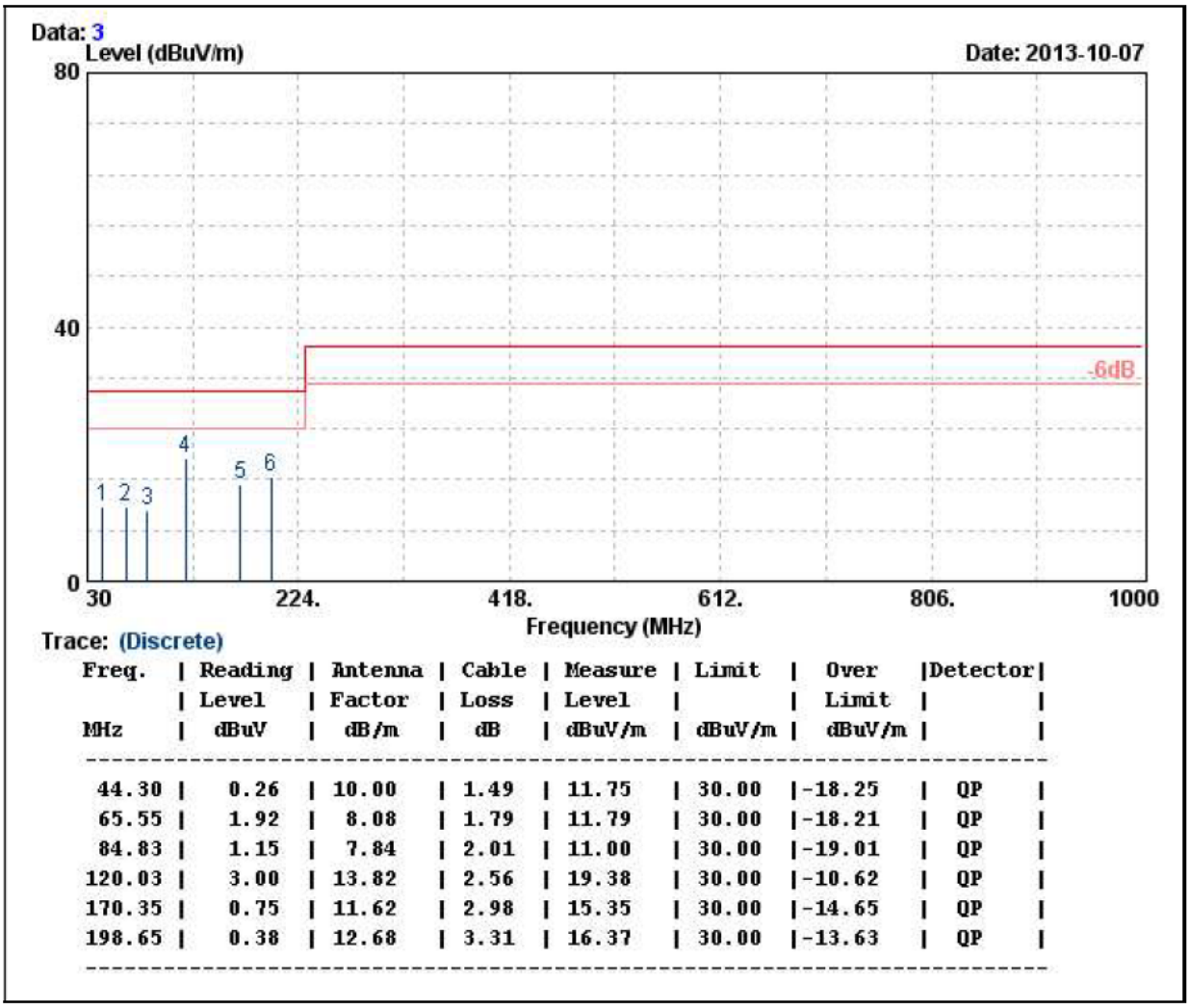

Trace: (Discrete)

| Freq. MHz | Reading Level dBuV | Antenna Factor dB/m | Cable Loss dB | Measure Level dBuV/m | Limit dBuV/m | Over Limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| 44.23 | 6.53 | 10.00 | 1.49 | 18.02 | 30.00 | -11.98 | QP |
| 54.10 | 3.75 | 7.83 | 1.57 | 13.15 | 30.00 | -16.85 | QP |
| 85.33 | 3.72 | 7.84 | 2.01 | 13.57 | 30.00 | -16.44 | QP |
| 109.23 | 0.45 | 12.02 | 2.36 | 14.82 | 30.00 | -15.18 | QP |
| 159.10 | 0.61 | 12.29 | 2.83 | 15.73 | 30.00 | -14.27 | QP |
| 189.00 | 1.66 | 11.82 | 3.20 | 16.69 | 30.00 | -13.31 | QP |

Note:
1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit.

| Model No. | TMM24105 | Test Mode | Full Load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | 6dB Bandwidth | 120 kHz |
| Antenna Pole | Horizontal | Antenna Distance | 10m |
| Detector Function | Quasi-peak. | Tested by | Ted Huang |

(The chart below shows the highest readings taken from the final data.)



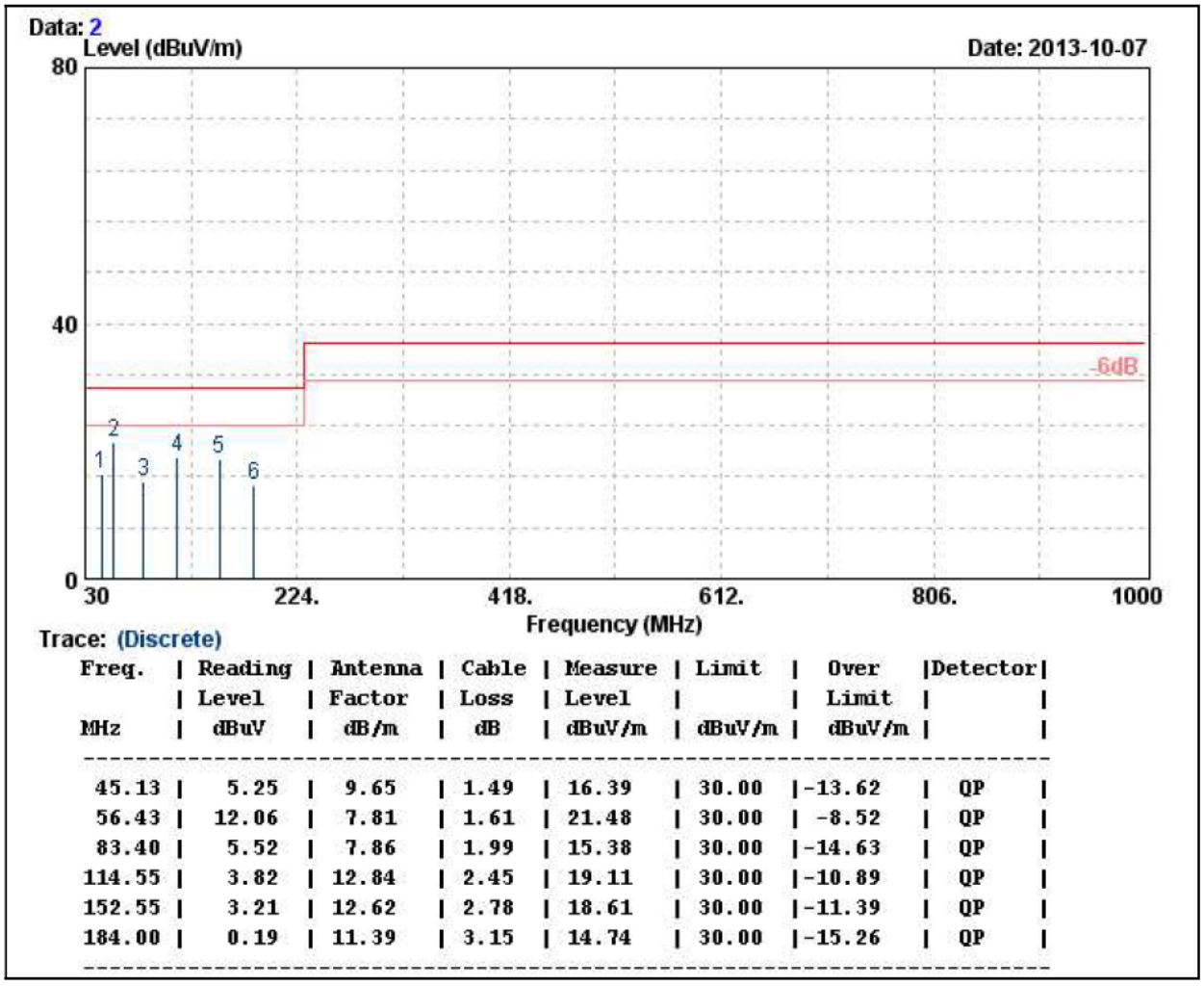

Trace: (Discrete)

| Freq. MHz | Reading Level dBuV | Antenna Factor dB/m | Cable Loss dB | Measure Level dBuV/m | Limit dBuV/m | Over Limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| 44.30 | 0.26 | 10.00 | 1.49 | 11.75 | 30.00 | -18.25 | QP |
| 65.55 | 1.92 | 8.08 | 1.79 | 11.79 | 30.00 | -18.21 | QP |
| 84.83 | 1.15 | 7.84 | 2.01 | 11.00 | 30.00 | -19.01 | QP |
| 120.03 | 3.00 | 13.82 | 2.56 | 19.38 | 30.00 | -10.62 | QP |
| 170.35 | 0.75 | 11.62 | 2.98 | 15.35 | 30.00 | -14.65 | QP |
| 198.65 | 0.38 | 12.68 | 3.31 | 16.37 | 30.00 | -13.63 | QP |

Note:

1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit.

| Model No. | TMM24109 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Vertical | Antenna Distance | 10m |
| Detector Function: | Quasi-peak. | Tested By | Ted Huang |

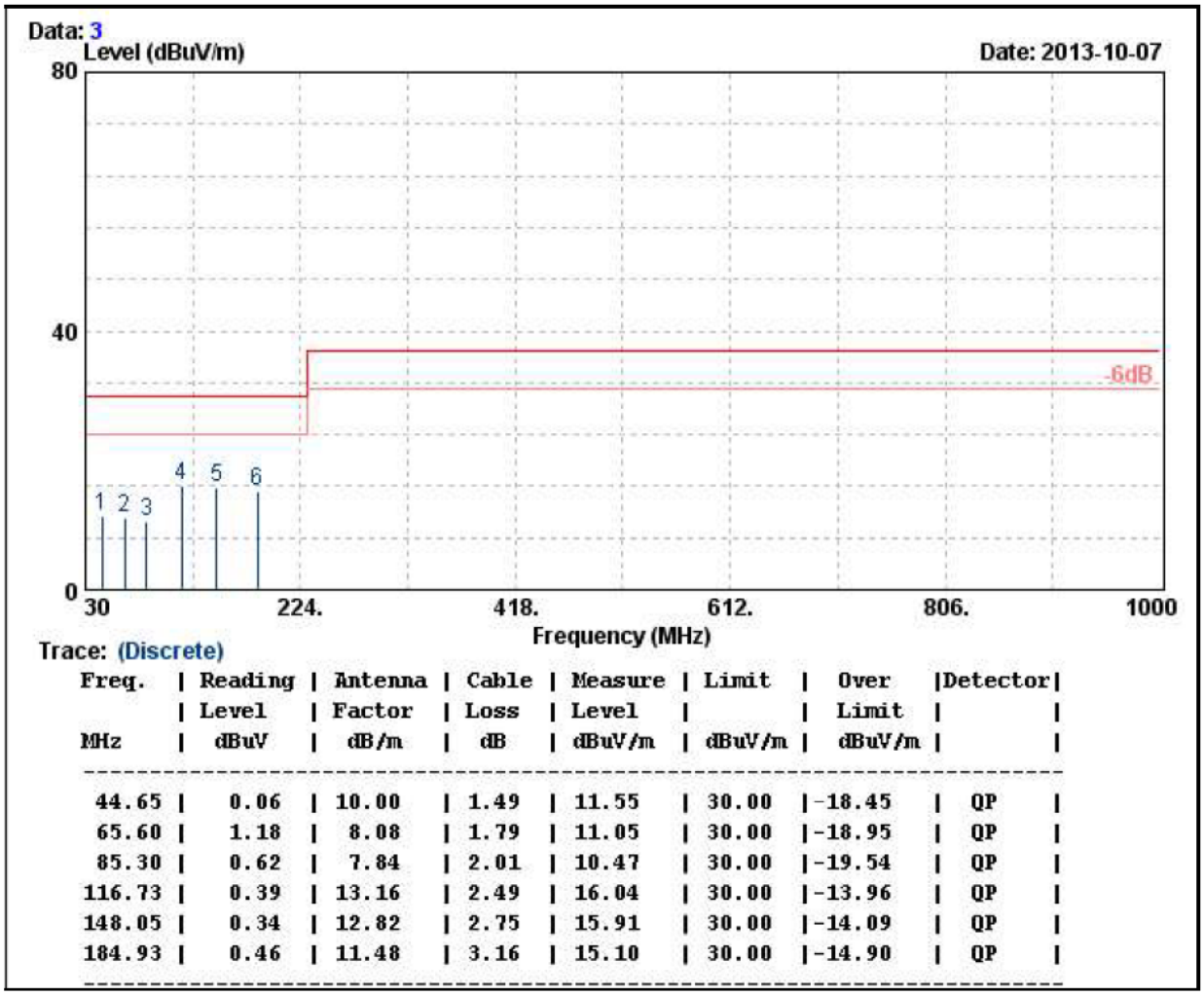



Trace: (Discrete)

| Freq. MHz | Reading Level dBuV | Antenna Factor dB/m | Cable Loss dB | Measure Level dBuV/m | Limit dBuV/m | Over Limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| 45.13 | 5.25 | 9.65 | 1.49 | 16.39 | 30.00 | -13.62 | QP |
| 56.43 | 12.06 | 7.81 | 1.61 | 21.48 | 30.00 | -8.52 | QP |
| 83.40 | 5.52 | 7.86 | 1.99 | 15.38 | 30.00 | -14.63 | QP |
| 114.55 | 3.82 | 12.84 | 2.45 | 19.11 | 30.00 | -10.89 | QP |
| 152.55 | 3.21 | 12.62 | 2.78 | 18.61 | 30.00 | -11.39 | QP |
| 184.00 | 0.19 | 11.39 | 3.15 | 14.74 | 30.00 | -15.26 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

| Model No. | TMM24109 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Horizontal | Antenna Distance | 10m |
| Detector Function | Quasi-peak. | Tested By | Ted Huang |

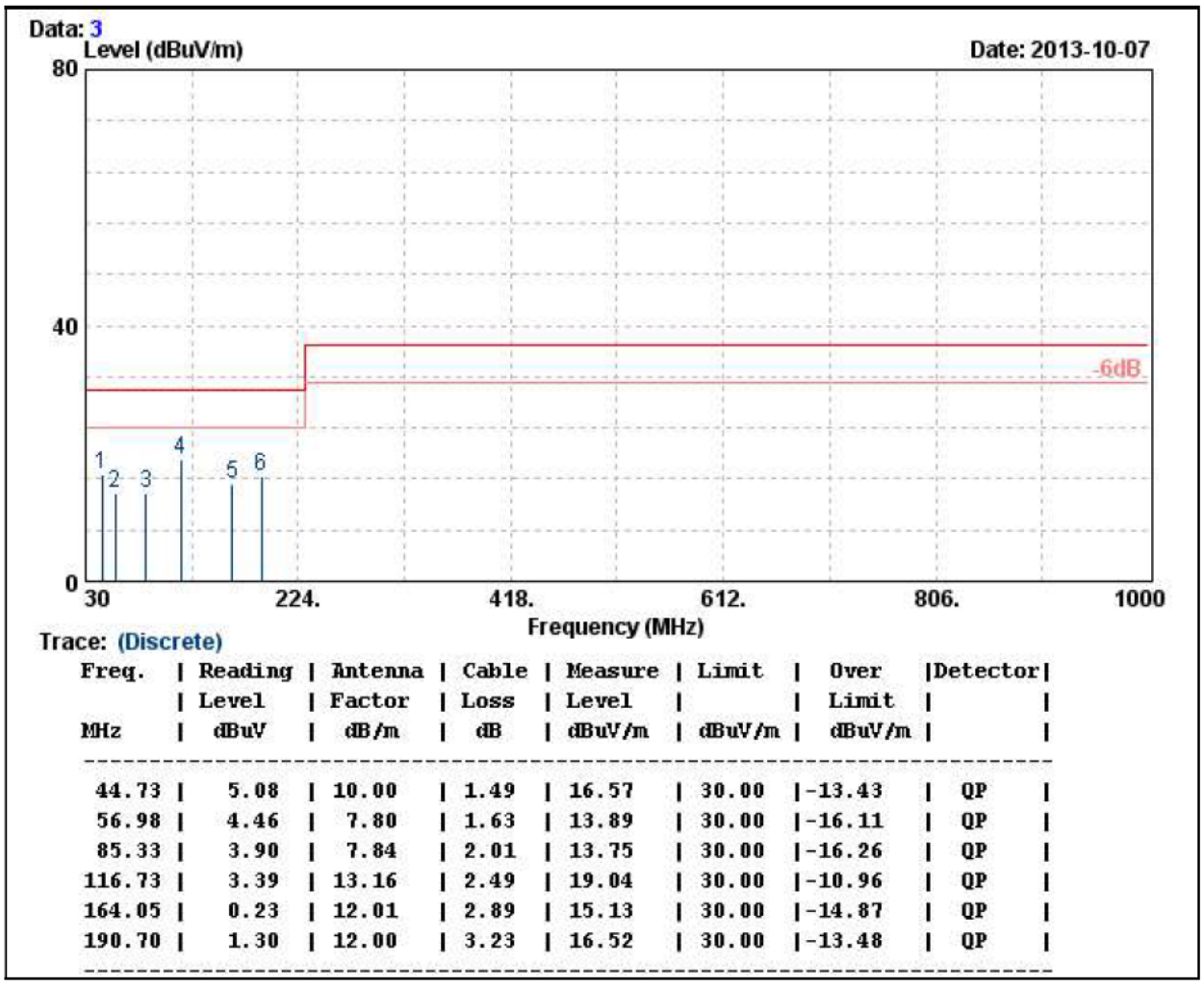



Trace: (Discrete)

| Freq. | Reading Level | Antenna Factor | Cable Loss | Measure Level | Limit | Over Limit | Detector |
|---|---|---|---|---|---|---|---|
| MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dBuV/m | |
| 44.65 | 0.06 | 10.00 | 1.49 | 11.55 | 30.00 | -18.45 | QP |
| 65.60 | 1.18 | 8.08 | 1.79 | 11.05 | 30.00 | -18.95 | QP |
| 85.30 | 0.62 | 7.84 | 2.01 | 10.47 | 30.00 | -19.54 | QP |
| 116.73 | 0.39 | 13.16 | 2.49 | 16.04 | 30.00 | -13.96 | QP |
| 148.05 | 0.34 | 12.82 | 2.75 | 15.91 | 30.00 | -14.09 | QP |
| 184.93 | 0.46 | 11.48 | 3.16 | 15.10 | 30.00 | -14.90 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

| Model No. | TMM24112 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Vertical | Antenna Distance | 10m |
| Detector Function: | Quasi-peak. | Tested By | Ted Huang |

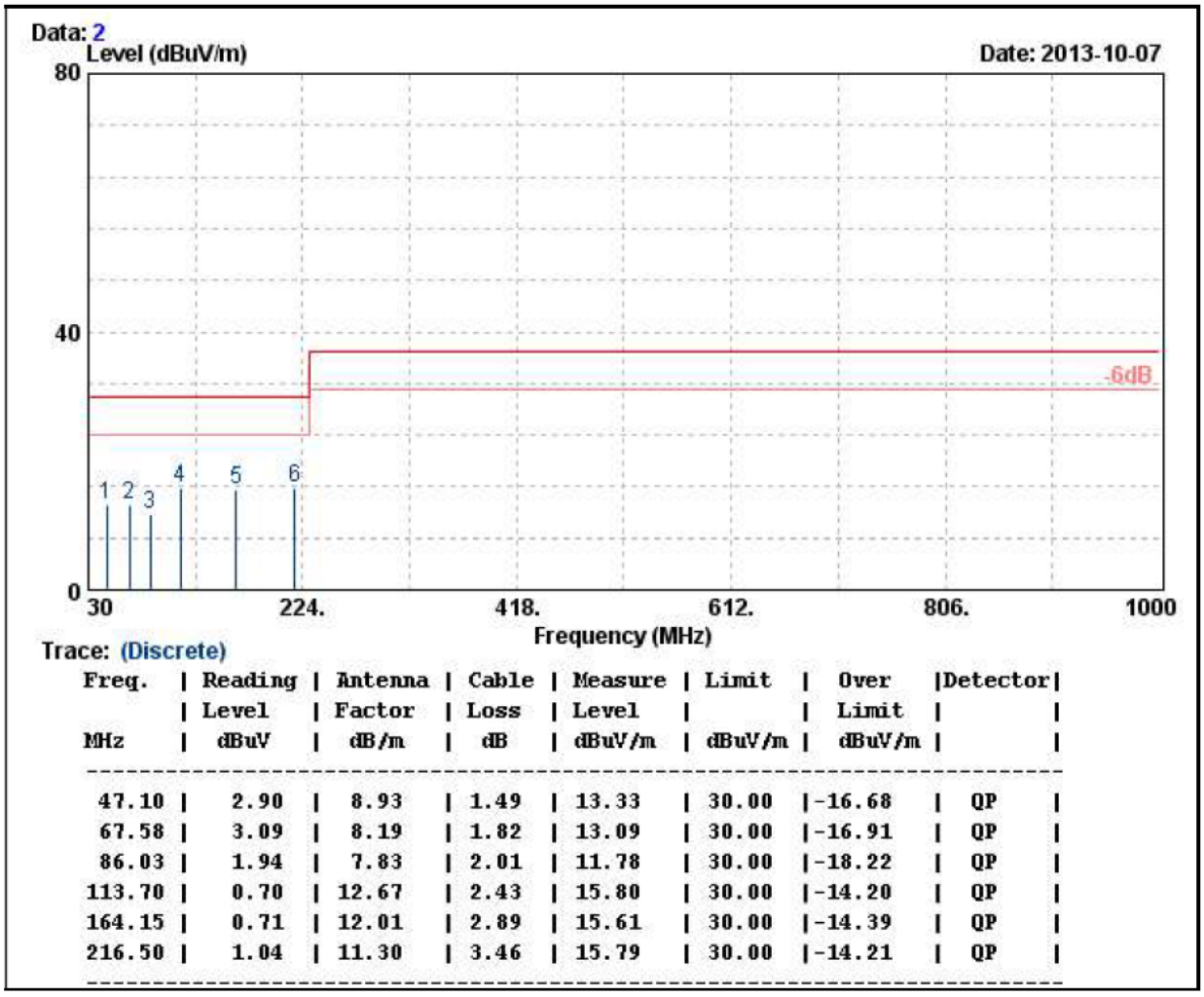



Trace: (Discrete)

| Freq. MHz | Reading Level dBuV | Antenna Factor dB/m | Cable Loss dB | Measure Level dBuV/m | Limit dBuV/m | Over Limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| 44.73 | 5.08 | 10.00 | 1.49 | 16.57 | 30.00 | -13.43 | QP |
| 56.98 | 4.46 | 7.80 | 1.63 | 13.89 | 30.00 | -16.11 | QP |
| 85.33 | 3.90 | 7.84 | 2.01 | 13.75 | 30.00 | -16.26 | QP |
| 116.73 | 3.39 | 13.16 | 2.49 | 19.04 | 30.00 | -10.96 | QP |
| 164.05 | 0.23 | 12.01 | 2.89 | 15.13 | 30.00 | -14.87 | QP |
| 190.70 | 1.30 | 12.00 | 3.23 | 16.52 | 30.00 | -13.48 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

| Model No. | TMM24112 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Horizontal | Antenna Distance | 10m |
| Detector Function | Quasi-peak. | Tested By | Ted Huang |

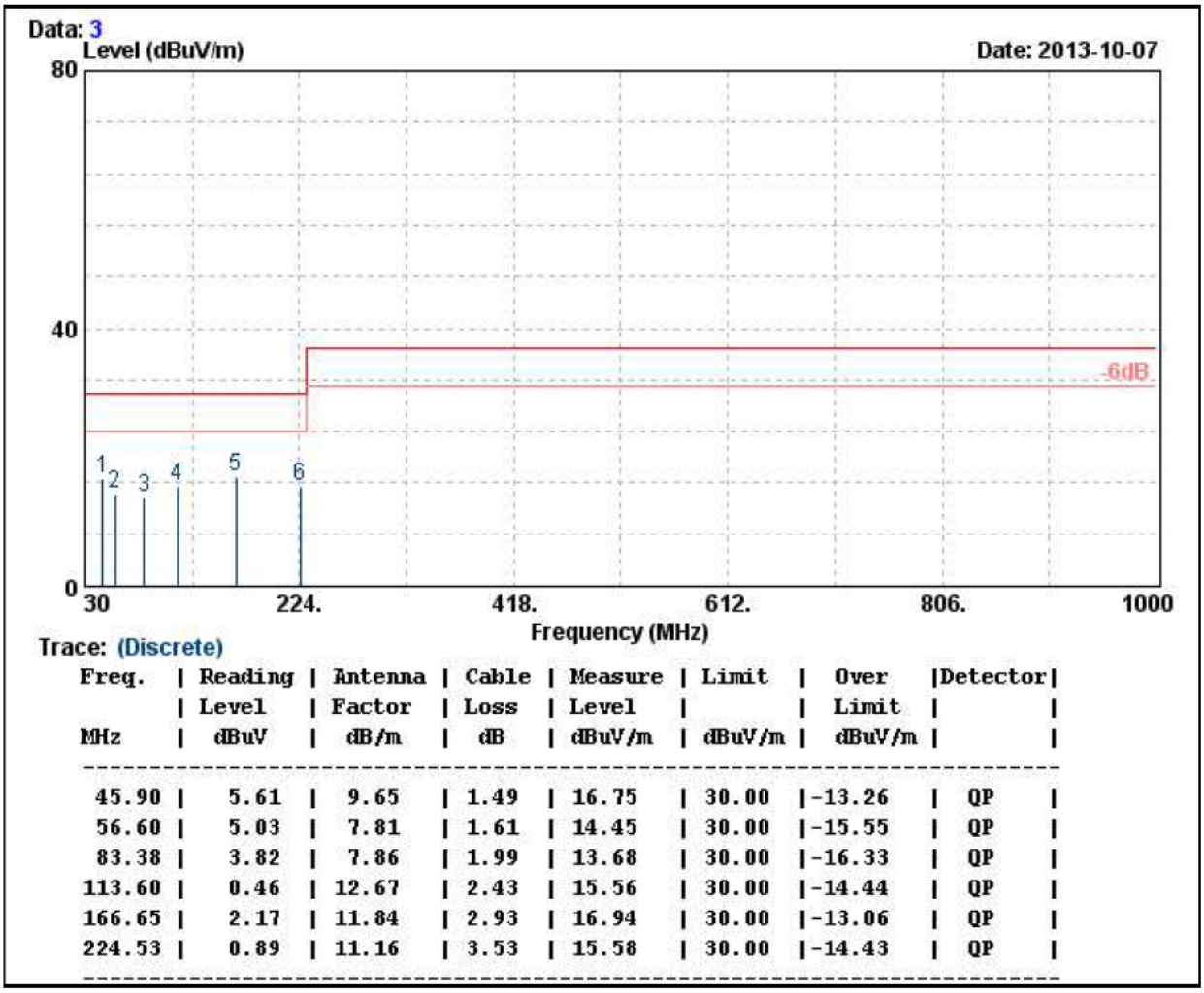



Trace: (Discrete)

| Freq. | Reading Level | Antenna Factor | Cable Loss | Measure Level | Limit | Over Limit | Detector |
|---|---|---|---|---|---|---|---|
| MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dBuV/m | |
| 47.10 | 2.90 | 8.93 | 1.49 | 13.33 | 30.00 | -16.68 | QP |
| 67.58 | 3.09 | 8.19 | 1.82 | 13.09 | 30.00 | -16.91 | QP |
| 86.03 | 1.94 | 7.83 | 2.01 | 11.78 | 30.00 | -18.22 | QP |
| 113.70 | 0.70 | 12.67 | 2.43 | 15.80 | 30.00 | -14.20 | QP |
| 164.15 | 0.71 | 12.01 | 2.89 | 15.61 | 30.00 | -14.39 | QP |
| 216.50 | 1.04 | 11.30 | 3.46 | 15.79 | 30.00 | -14.21 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

| Model No. | TMM24115 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Vertical | Antenna Distance | 10m |
| Detector Function: | Quasi-peak. | Tested By | Ted Huang |

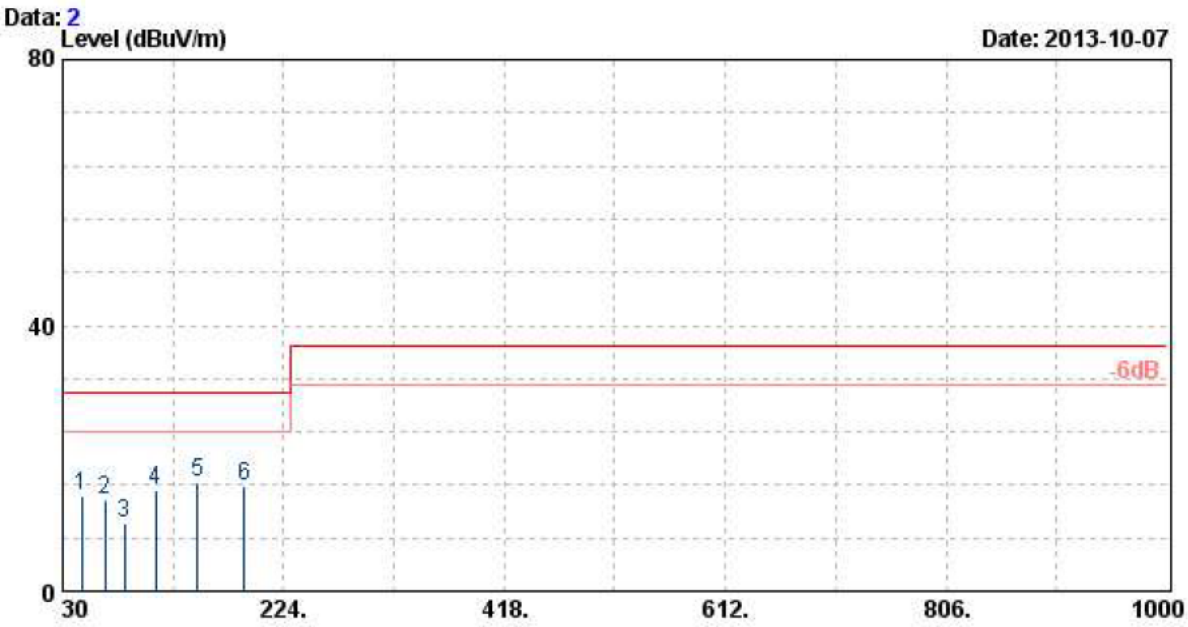



Trace: (Discrete)

| Freq. MHz | Reading Level dBuV | Antenna Factor dB/m | Cable Loss dB | Measure Level dBuV/m | Limit dBuV/m | Over Limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| 45.90 | 5.61 | 9.65 | 1.49 | 16.75 | 30.00 | -13.26 | QP |
| 56.60 | 5.03 | 7.81 | 1.61 | 14.45 | 30.00 | -15.55 | QP |
| 83.38 | 3.82 | 7.86 | 1.99 | 13.68 | 30.00 | -16.33 | QP |
| 113.60 | 0.46 | 12.67 | 2.43 | 15.56 | 30.00 | -14.44 | QP |
| 166.65 | 2.17 | 11.84 | 2.93 | 16.94 | 30.00 | -13.06 | QP |
| 224.53 | 0.89 | 11.16 | 3.53 | 15.58 | 30.00 | -14.43 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

| Model No. | TMM24115 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Horizontal | Antenna Distance | 10m |
| Detector Function | Quasi-peak. | Tested By | Ted Huang |

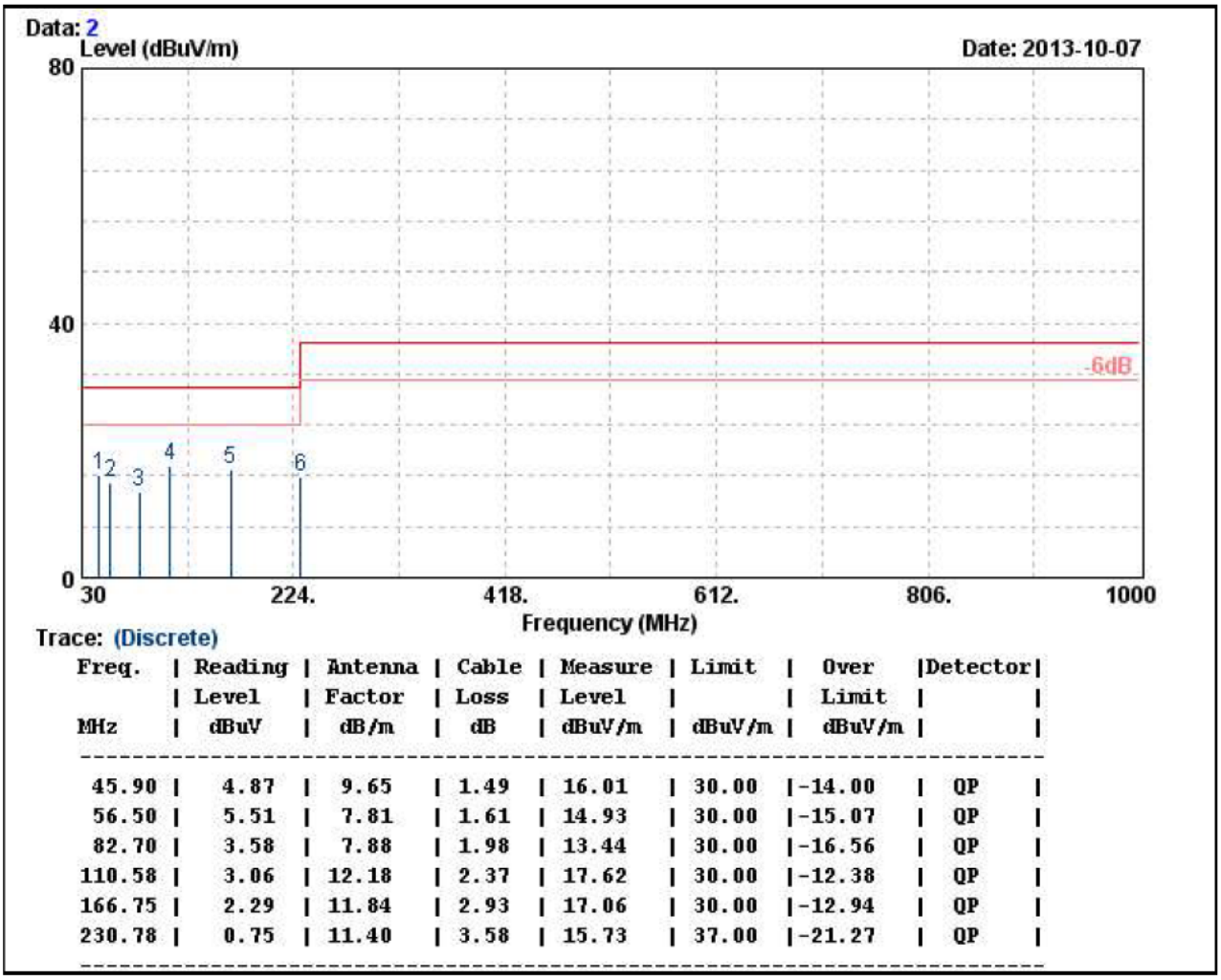



Trace: (Discrete)

| Freq. | Reading Level | Antenna Factor | Cable Loss | Measure Level | Limit | Over Limit | Detector |
|---|---|---|---|---|---|---|---|
| MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dBuV/m | |
| 46.45 | 3.53 | 9.29 | 1.49 | 14.31 | 30.00 | -15.69 | QP |
| 67.58 | 3.65 | 8.19 | 1.82 | 13.65 | 30.00 | -16.35 | QP |
| 84.25 | 0.44 | 7.85 | 2.00 | 10.29 | 30.00 | -19.71 | QP |
| 111.95 | 0.37 | 12.35 | 2.39 | 15.11 | 30.00 | -14.89 | QP |
| 148.28 | 0.70 | 12.82 | 2.75 | 16.27 | 30.00 | -13.73 | QP |
| 189.63 | 0.56 | 11.91 | 3.22 | 15.69 | 30.00 | -14.32 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

| Model No. | TMM24124 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Vertical | Antenna Distance | 10m |
| Detector Function: | Quasi-peak. | Tested By | Ted Huang |

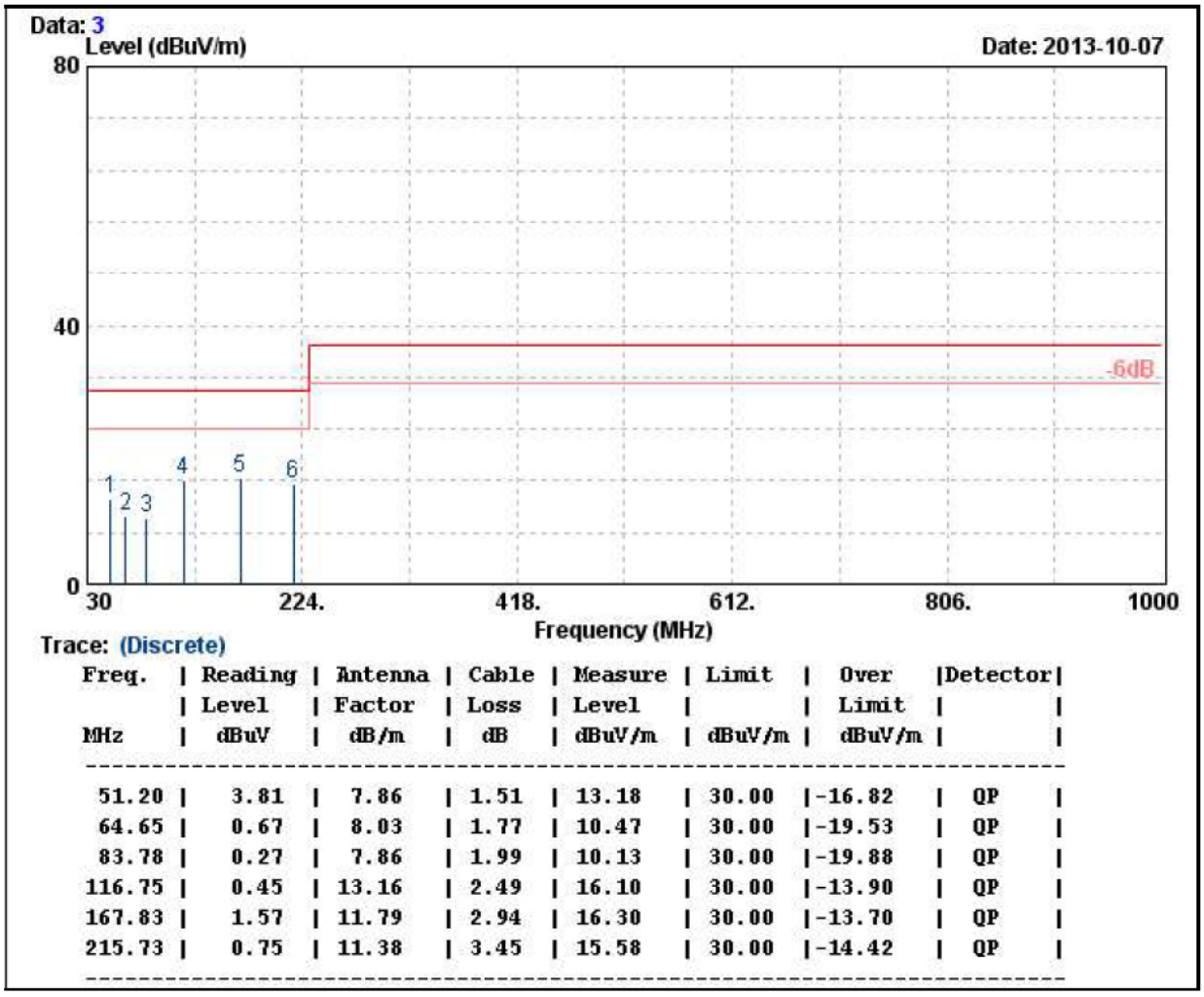



Trace: (Discrete)

| Freq. MHz | Reading Level dBuV | Antenna Factor dB/m | Cable Loss dB | Measure Level dBuV/m | Limit dBuV/m | Over Limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| 45.90 | 4.87 | 9.65 | 1.49 | 16.01 | 30.00 | -14.00 | QP |
| 56.50 | 5.51 | 7.81 | 1.61 | 14.93 | 30.00 | -15.07 | QP |
| 82.70 | 3.58 | 7.88 | 1.98 | 13.44 | 30.00 | -16.56 | QP |
| 110.58 | 3.06 | 12.18 | 2.37 | 17.62 | 30.00 | -12.38 | QP |
| 166.75 | 2.29 | 11.84 | 2.93 | 17.06 | 30.00 | -12.94 | QP |
| 230.78 | 0.75 | 11.40 | 3.58 | 15.73 | 37.00 | -21.27 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

| Model No. | TMM24124 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Horizontal | Antenna Distance | 10m |
| Detector Function | Quasi-peak. | Tested By | Ted Huang |

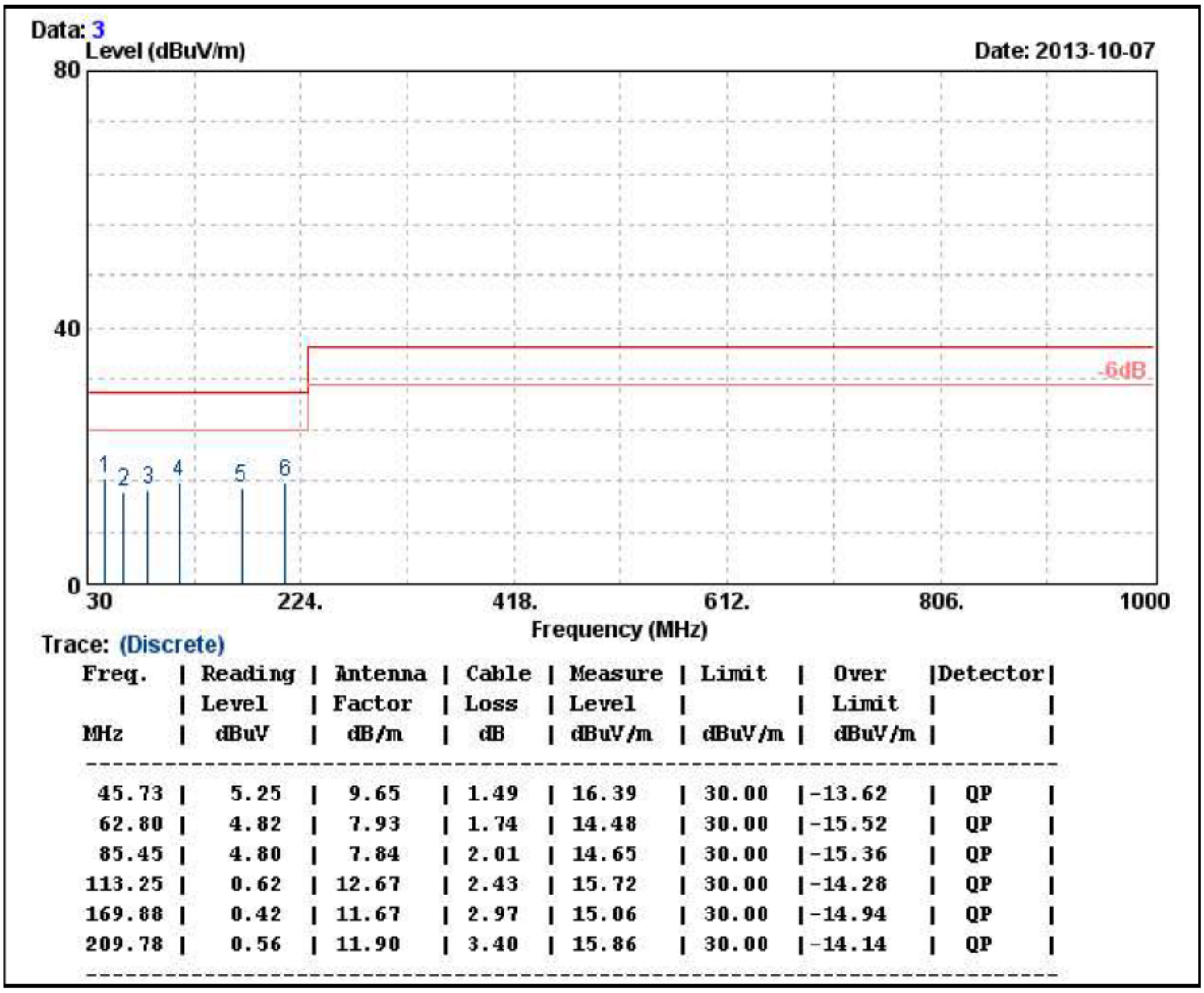



Trace: (Discrete)

| Freq. MHz | Reading Level dBuV | Antenna Factor dB/m | Cable Loss dB | Measure Level dBuV/m | Limit dBuV/m | Over Limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| 51.20 | 3.81 | 7.86 | 1.51 | 13.18 | 30.00 | -16.82 | QP |
| 64.65 | 0.67 | 8.03 | 1.77 | 10.47 | 30.00 | -19.53 | QP |
| 83.78 | 0.27 | 7.86 | 1.99 | 10.13 | 30.00 | -19.88 | QP |
| 116.75 | 0.45 | 13.16 | 2.49 | 16.10 | 30.00 | -13.90 | QP |
| 167.83 | 1.57 | 11.79 | 2.94 | 16.30 | 30.00 | -13.70 | QP |
| 215.73 | 0.75 | 11.38 | 3.45 | 15.58 | 30.00 | -14.42 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

| Model No. | TMM24212 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Vertical | Antenna Distance | 10m |
| Detector Function: | Quasi-peak. | Tested By | Ted Huang |

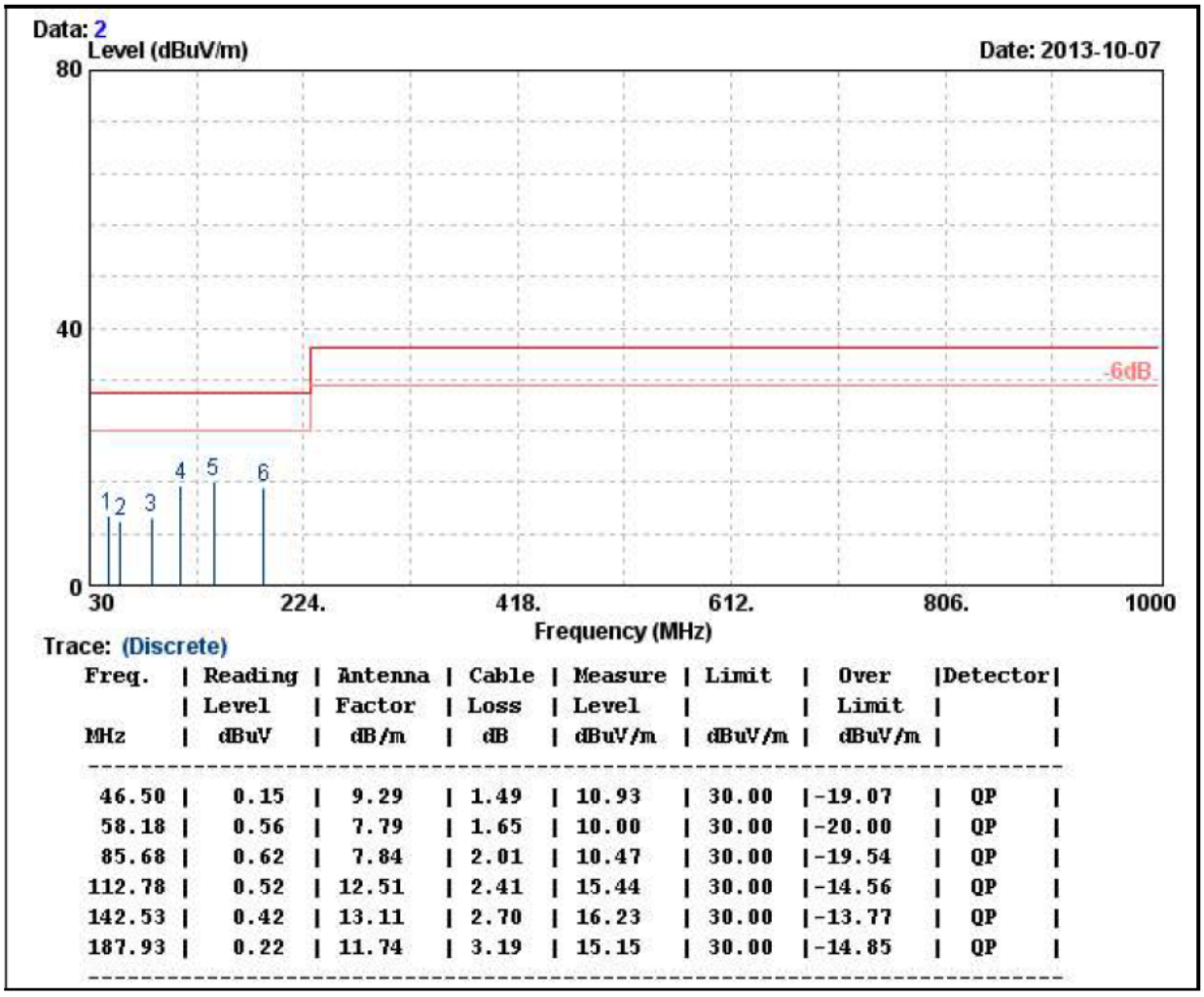



Trace: (Discrete)

| Freq. MHz | Reading Level dBuV | Antenna Factor dB/m | Cable Loss dB | Measure Level dBuV/m | Limit dBuV/m | Over Limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| 45.73 | 5.25 | 9.65 | 1.49 | 16.39 | 30.00 | -13.62 | QP |
| 62.80 | 4.82 | 7.93 | 1.74 | 14.48 | 30.00 | -15.52 | QP |
| 85.45 | 4.80 | 7.84 | 2.01 | 14.65 | 30.00 | -15.36 | QP |
| 113.25 | 0.62 | 12.67 | 2.43 | 15.72 | 30.00 | -14.28 | QP |
| 169.88 | 0.42 | 11.67 | 2.97 | 15.06 | 30.00 | -14.94 | QP |
| 209.78 | 0.56 | 11.90 | 3.40 | 15.86 | 30.00 | -14.14 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

| Model No. | TMM24212 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Horizontal | Antenna Distance | 10m |
| Detector Function | Quasi-peak. | Tested By | Ted Huang |

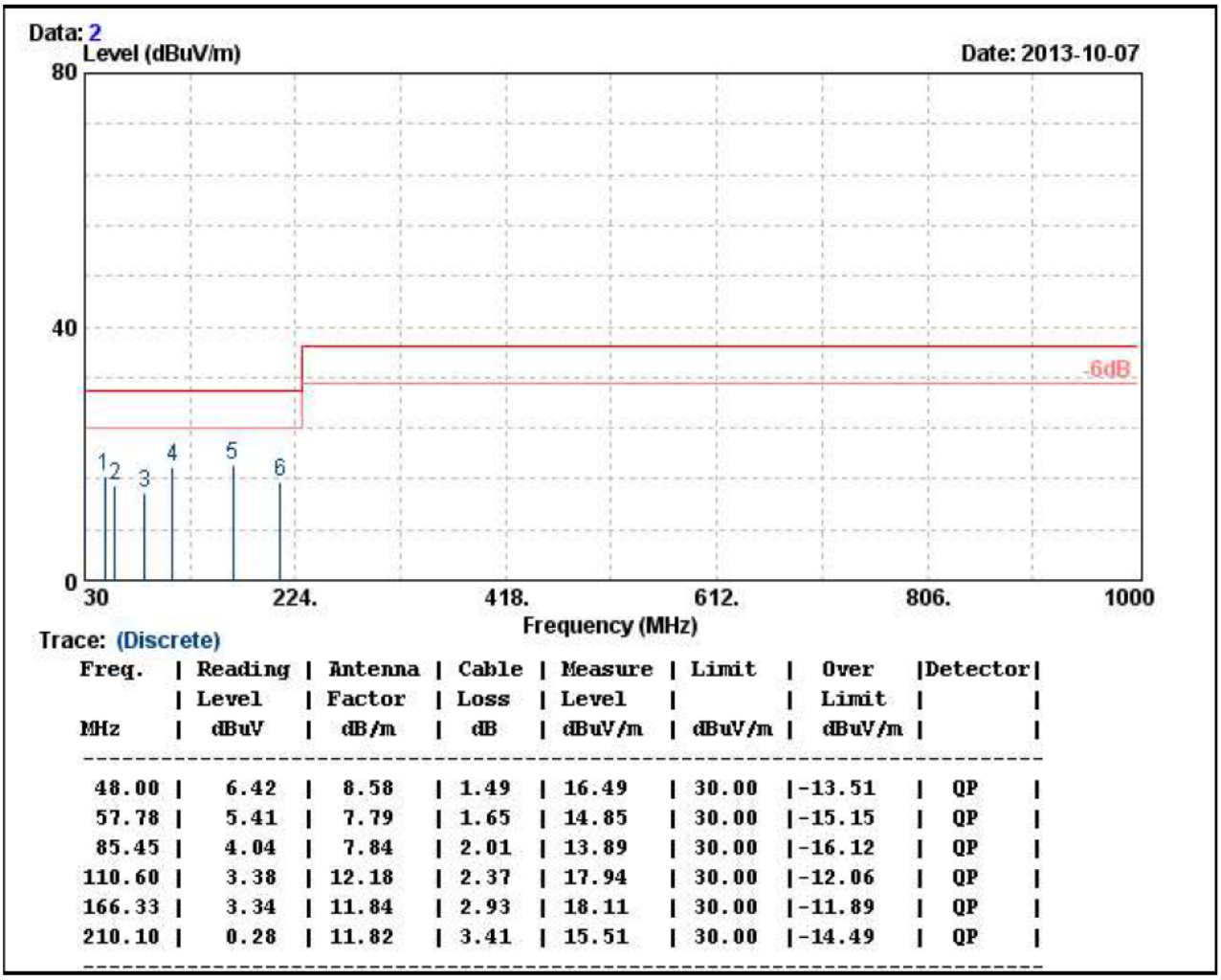



Trace: (Discrete)

| Freq. | Reading Level | Antenna Factor | Cable Loss | Measure Level | Limit | Over Limit | Detector |
|---|---|---|---|---|---|---|---|
| MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dBuV/m | |
| 46.50 | 0.15 | 9.29 | 1.49 | 10.93 | 30.00 | -19.07 | QP |
| 58.18 | 0.56 | 7.79 | 1.65 | 10.00 | 30.00 | -20.00 | QP |
| 85.68 | 0.62 | 7.84 | 2.01 | 10.47 | 30.00 | -19.54 | QP |
| 112.78 | 0.52 | 12.51 | 2.41 | 15.44 | 30.00 | -14.56 | QP |
| 142.53 | 0.42 | 13.11 | 2.70 | 16.23 | 30.00 | -13.77 | QP |
| 187.93 | 0.22 | 11.74 | 3.19 | 15.15 | 30.00 | -14.85 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

| Model No. | TMM24215 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Vertical | Antenna Distance | 10m |
| Detector Function: | Quasi-peak. | Tested By | Ted Huang |

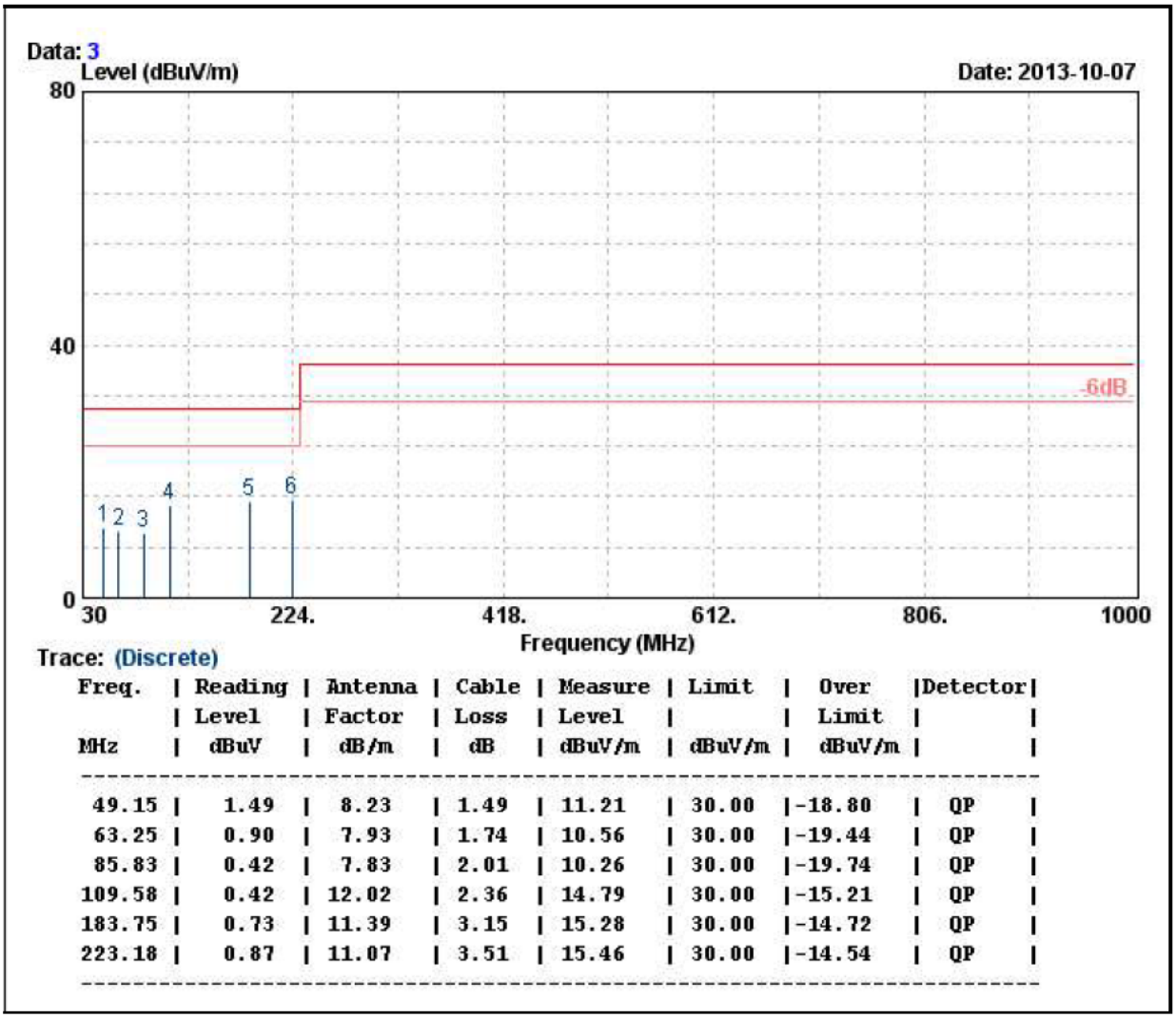



Trace: (Discrete)

| Freq. MHz | Reading Level dBuV | Antenna Factor dB/m | Cable Loss dB | Measure Level dBuV/m | Limit dBuV/m | Over Limit dBuV/m | Detector |
|---|---|---|---|---|---|---|---|
| 48.00 | 6.42 | 8.58 | 1.49 | 16.49 | 30.00 | -13.51 | QP |
| 57.78 | 5.41 | 7.79 | 1.65 | 14.85 | 30.00 | -15.15 | QP |
| 85.45 | 4.04 | 7.84 | 2.01 | 13.89 | 30.00 | -16.12 | QP |
| 110.60 | 3.38 | 12.18 | 2.37 | 17.94 | 30.00 | -12.06 | QP |
| 166.33 | 3.34 | 11.84 | 2.93 | 18.11 | 30.00 | -11.89 | QP |
| 210.10 | 0.28 | 11.82 | 3.41 | 15.51 | 30.00 | -14.49 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

| Model No. | TMM24215 | Test Mode | Full load |
|---|---|---|---|
| Environmental Conditions | 26, 45% RH | Resolution Bandwidth | 120 kHz |
| Antenna Pole | Horizontal | Antenna Distance | 10m |
| Detector Function | Quasi-peak. | Tested By | Ted Huang |




Trace: (Discrete)

| Freq. | Reading Level | Antenna Factor | Cable Loss | Measure Level | Limit | Over Limit | Detector |
|---|---|---|---|---|---|---|---|
| MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dBuV/m | |
| 49.15 | 1.49 | 8.23 | 1.49 | 11.21 | 30.00 | -18.80 | QP |
| 63.25 | 0.90 | 7.93 | 1.74 | 10.56 | 30.00 | -19.44 | QP |
| 85.83 | 0.42 | 7.83 | 2.01 | 10.26 | 30.00 | -19.74 | QP |
| 109.58 | 0.42 | 12.02 | 2.36 | 14.79 | 30.00 | -15.21 | QP |
| 183.75 | 0.73 | 11.39 | 3.15 | 15.28 | 30.00 | -14.72 | QP |
| 223.18 | 0.87 | 11.07 | 3.51 | 15.46 | 30.00 | -14.54 | QP |

Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)
2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)

## 7.3. HARMONICS CURRENT MEASUREMENT

### 7.3.1. LIMITS OF HARMONICS CURRENT MEASUREMENT

| Limits for Class A equipment | |
|---|---|
| Harmonics Order n | Max. permissible harmonics current A |
| Odd harmonics | |
| 3 | 2.30 |
| 5 | 1.14 |
| 7 | 0.77 |
| 9 | 0.40 |
| 11 | 0.33 |
| 13 | 0.21 |
| 15<=n<=39 | 0.15x15/n |
| Even harmonics | |
| 2 | 1.08 |
| 4 | 0.43 |
| 6 | 0.30 |
| 8<=n<=40 | 0.23x8/n |

| Limits for Class D equipment | | |
|---|---|---|
| Harmonics Order n | Max. permissible harmonics current per watt mA/W | Max. permissible harmonics current A |
| Odd Harmonics only | | |
| 3 | 3.4 | 2.30 |
| 5 | 1.9 | 1.14 |
| 7 | 1.0 | 0.77 |
| 9 | 0.5 | 0.40 |
| 11 | 0.35 | 0.33 |
| 13 | 0.30 | 0.21 |
| 15<=n<=39 | 3.85/n | 0.15x15/n |
| | | |
| | | |
| | | |
| | | |
| | | |

**Note:**

1. Class A and Class D are classified according to item 7.4.3.
2. According to section 7 of EN 61000-3-2, the above limits for all equipment except for lighting equipment having an active input power > 75 W and no limits apply for equipment with an active input power up to and including 75 W.

### 7.3.2. TEST INSTRUMENTS

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Harmonics Analyzer | TTI | HA1600 | 198202 | MAY. 12, 2014 |
| Test S/W | H/F HA 1600 PC LINK<br>Field Probe | | | |

**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 7.3.3. TEST PROCEDURE

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

The classification of EUT is according to section 5 of EN 61000-3-2.

The EUT is classified as follows:

Class A: Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.

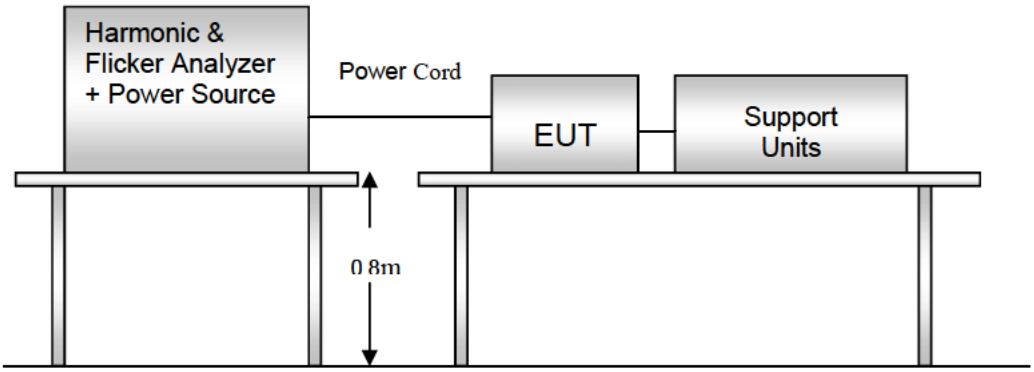
Class B: Portable tools; Arc welding equipment which is not professional equipment.

Class C: Lighting equipment.

Class D: Equipment having a specified power less than or equal to 600 W of the following types: Personal computers and personal computer monitors and television receivers.

The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.

### 7.3.4. TEST SETUP




For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 7.3.5. TEST RESULTS

| | | | |
|---|---|---|---|
| **Power Consumption** | N/A | **Test Mode** | N/A |
| **Environmental Conditions** | N/A | **Tested by** | N/A |

**Note:**

1. Limits classified according to item 7.4.3.
2. According to clause 7 of EN 61000-3-2: 2006, equipment with a rated power of 75W or less, no limits apply. The test result is only for reference.

## Test result of EN 61000-3-2

**※ For the equipment with a rated power of 75 W or less, limits are not specified in this standard.**

## 7.4. VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

### 7.4.1. LIMITS OF VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

| Test item | Limit | Remark |
|---|---|---|
| $P_{st}$ | 1.0 | $P_{st}$ means short-term flicker indicator. |
| $P_{lt}$ | 0.65 | $P_{lt}$ means long-term flicker indicator. |
| $T_{dt}$ (ms) | 500 | $T_{dt}$ means maximum time that dt exceeds 3 %. |
| $d_{max}$ (%) | 4% | $d_{max}$ means maximum relative voltage change. |
| dc (%) | 3.3% | dc means relative steady-state voltage change |

### 7.4.2. TEST INSTRUMENTS

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Harmonic Test System | Teseq | Profline 2105(NSG 1007/CCN 1000-1) | 1504A02655 | 03/02/2017 |
| Test S/W | H/F HA 1600 PC LINK<br>Field Probe | | | |

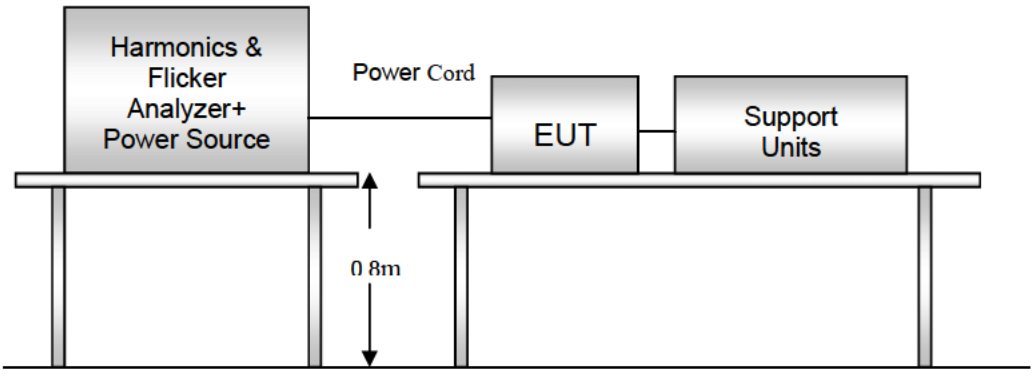
**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 7.4.3. TEST PROCEDURE

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.

During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

### 7.4.4. TEST SETUP




For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

## 7.4.5. TEST RESULTS

**For Model: TMM24105**

| | | | |
|---|---|---|---|
| **Observation Period (Tp)** | 120 min | **Test Mode** | Full Load |
| **Environmental Conditions** | 25°C, 48% RH, 1028mbar | **Tested by** | Taiyu Cyu |

### Flicker Test Summary per EN/IEC61000-3-3 (Run time)

**EUT: Equipment under test** **Tested by:Taiyu**

**Test category: All parameters (European limits)** **Test Margin: 100**

**Test date: 2016/7/5** **Start time: AM 09:39:59** **End time: AM 11:42:10**

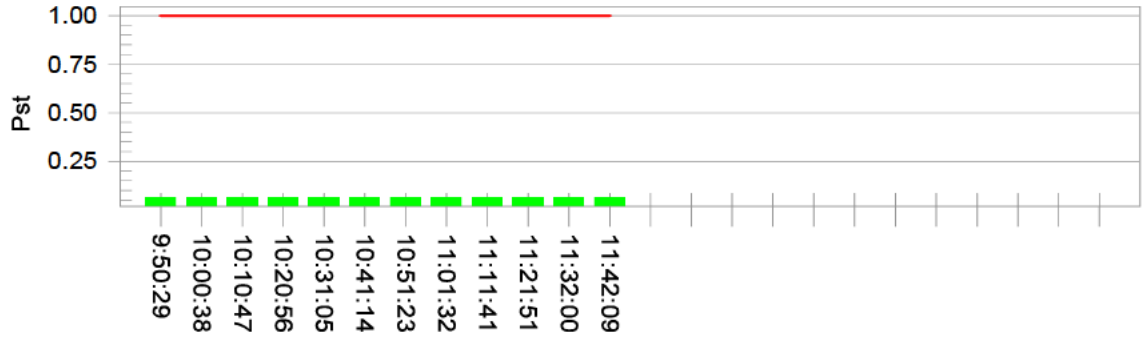
**Test duration (min): 120** **Data file name: F-000432.cts_data**

**Equipment Under Test: AC/DC POWER MODULES**

**Model:TMM24105**

**Test Result: Pass** **Status: Test Completed**

**$Pst_i$ and limit line** **European Limits**




**Plt and limit line**


**Parameter values recorded during the test:**

| | | | | |
|---|---|---|---|---|
| **Vrms at the end of test (Volt):** | **230.54** | | | |
| **Highest dt (%):** | **0.00** | **Test limit (%):** | **N/A** | **N/A** |
| **T-max (mS):** | **0** | **Test limit (mS):** | **500.0** | **Pass** |
| **Highest dc (%):** | **0.00** | **Test limit (%):** | **3.30** | **Pass** |
| **Highest dmax (%):** | **0.08** | **Test limit (%):** | **4.00** | **Pass** |
| **Highest Pst (10 min. period):** | **0.064** | **Test limit:** | **1.000** | **Pass** |
| **Highest Plt (2 hr. period):** | **0.064** | **Test limit:** | **0.650** | **Pass** |

# 8 IMMUNITY TEST

## 8.1. GENERAL DESCRIPTION

| Product Standard | EN 60601-1-2: 2015 | |
|---|---|---|
| | Test Type | Minimum Requirement |
| Basic Standard, Specification, and Performance Criterion required | IEC 61000-4-2 | Electrostatic Discharge – ESD:<br>15kV air discharge, 8kV Contact discharge<br>Performance Criterion A |
| | IEC 61000-4-3 | Radio-Frequency Electromagnetic Field Susceptibility Test – RS:<br>80 ~2700 MHz, 3V/m, 80% AM, 1kHz,<br>385 MHz, 27V/m, 50% Duty Cycle, 18Hz,<br>450 MHz, 28V/m, 50% Duty Cycle FM (± 5kHz deviation), 1kHz,<br>710, 745, 780MHz, 9V/m, 50% Duty Cycle, 217Hz,<br>810, 870, 930MHz, 28V/m, 50% Duty Cycle, 18Hz,<br>1720, 1845, 1970MHz, 28V/m, 50% Duty Cycle, 217Hz,<br>2450 MHz, 28V/m, 50% Duty Cycle, 217Hz,<br>5240, 5500, 5785MHz, 9V/m, 50% Duty Cycle, 217Hz<br>Performance Criterion A |
| | IEC 61000-4-4 | Electrical Fast Transient/Burst - EFT,<br>Power Port: 2kV<br>Signal cable greater than 3 meters: 1kV<br>Performance Criterion A |
| | IEC 61000-4-5 | Surge Immunity Test:<br>1.2/50 µs Open Circuit Voltage,<br>8/20 µs Short Circuit Current,<br>AC Power Port ~ line to line: 0.5; 1kV, line to ground: 0.5; 1; 2kV<br>Performance Criterion A |
| | IEC 61000-4-6 | Conducted Radio Frequency Disturbances Test –CS:<br>AC Power Port; DC Power Port;<br>Signal Ports and Telecommunication Ports:<br>0.15 ~ 80 MHz, 3Vrms, 80% AM, 1kHz,<br>0.15 ~ 80 MHz, 3Vrms, 80% AM, 2Hz,<br>To control, monitor or measure a physiological parameter: 2Hz modulated<br>All Other: 1kHz modulated<br>The ISM (Industrial, scientific and medical) broadcast frequency bands are listed as below:<br>6,765 MHz to 6,795 MHz, 13,553 MHz to 13,567 MHz, 26,957 MHz to 27,283 MHz, and 40,66 MHz to 40,70 MHz, 6Vrms, before modulation is applied,<br>The amateur radio bands between 0,15 MHz and 80 MHz are 1,8 MHz to 2,0 MHz, 3,5 MHz to 4,0 MHz, 5,3 MHz to 5,4 MHz, 7 MHz to 7,3 MHz,<br>10,1 MHz to 10,15 MHz, 14 MHz to 14,2 MHz, 18,07 MHz to 18,17 MHz, 21,0 MHz to 21,4 MHz, 24,89 MHz to 24,99 MHz, 28,0 MHz to 29,7 MHz, and 50,0 MHz to 54,0 MHz, 6Vrms, before modulation is applied<br>Performance Criterion A |

| | | |
|---|---|---|
| | IEC 61000-4-8 | Power frequency magnetic field immunity test<br>50Hz or 60Hz, 30A/m<br>Performance Criterion A |
| | IEC 61000-4-11 | Voltage Dips:<br>i) 0% reduction for 0.5 cycle at 50Hz,<br>0% reduction for 1 cycle at 50Hz<br>Performance Criterion B<br>ii)70% reduction for 25/30 cycles at 50/60Hz<br>Performance Criterion C<br>Voltage Interruptions:<br>0% reduction for 250/300 cycles at 50/60Hz<br>Performance Criterion C |

## 8.2. GENERAL PERFORMANCE CRITERIA DESCRIPTION

| | |
|---|---|
| **Criteria A:** | The apparatus shell continues 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 apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the manufacturer does not specify the minimum performance level or the permissible performance loss, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended. |
| **Criteria B:** | After test, the apparatus shell continues to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomenon below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance.<br>During the test, degradation of performance is however allowed. However, no change of operating state if stored data is allowed to persist after the test. If the manufacturer does not specify the minimum performance level or the permissible performance loss, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended. |
| **Criteria C:** | Temporary loss of function is allowed, provided the functions is self-recoverable or can be restored by the operation of controls by the user in accordance with the manufacturer instructions.<br>Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost. |

## 8.3. ELECTROSTATIC DISCHARGE (ESD)

### 8.3.1. TEST SPECIFICATION

| | |
|---|---|
| **Basic Standard:** | IEC 61000-4-2 |
| **Discharge Impedance:** | 330 ohm / 150 pF |
| **Discharge Voltage:** | Air Discharge: 2, 4, 8, 12, 15 kV (Direct)<br>Contact Discharge: 8 kV (Direct/Indirect) |
| **Polarity:** | Positive & Negative |
| **Number of Discharge:** | Air Discharge: min. 10 times at each test point for each polarity<br>Contact Discharge: min. 200 times in total |
| **Discharge Mode:** | Single Discharge<br>1 second minimum |

### 8.3.2. TEST INSTRUMENT

| IMMUNITY SHIELDED ROOM (IEC 61000-4-2) | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| ESD Simulator | NoiseKen | TC-815R | ESS1366835 | 08/24/2016 |
| ESD Simulator | NoiseKen | ESS-2002 | ESS04Z3762 | 08/14/2016 |

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 8.3.3. TEST PROCEDURE

The discharges shall be applied in two ways:

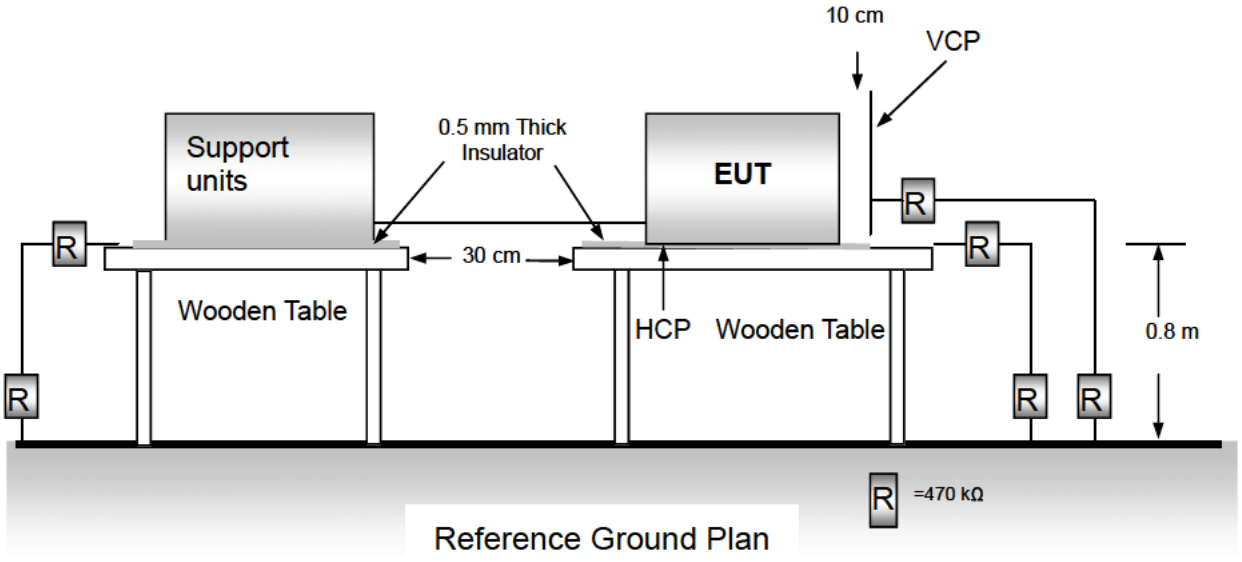
a) Contact discharges to the conductive surfaces and coupling planes:
   The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the **H**orizontal **C**oupling **P**lane (**HCP**). The remaining three test points shall each receive at least 50 direct contact discharges. If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.

b) Air discharges at slots and apertures and insulating surfaces:
   On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area normally handled by the user. A minimum of 10 single air discharges shall be applied to the selected test point for each such area.

The basic test procedure was in accordance with IEC 61000-4-2:

a) The EUT was located 0.1 m minimum from all side of the **HCP** (dimensions 1.6m x 0.8m).
b) The support units were located another table 30 cm away from the EUT, but direct support unit was/were located at same location as EUT on the HCP and keep at a distance of 10 cm with EUT.
c) The time interval between two successive single discharges was at least 1 second.
d) Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
e) Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.
f) At least ten single discharges (in the most sensitive polarity) were applied at the front edge of each **HCP** opposite the center point of each unit of the EUT and 0.1 meters from the front of the EUT. The long axis of the discharge electrode was in the plane of the **HCP** and perpendicular to its front edge during the discharge.
g) At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **V**ertical **C**oupling **P**lane (**VCP**) in sufficiently different positions that the four faces of the EUT were completely illuminated. The **VCP** (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.

## 8.3.4. TEST SETUP




For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

**NOTE:**

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **G**round **R**eference **P**lane. The **GRP** consisted of a sheet of aluminum at least 0.25 mm thick, and 2.5 meters square connected to the protective grounding system. A **H**orizontal **C**oupling **P**lane (1.6 m x 0.8 m) was placed on the table and attached to the **GRP** by means of a cable with 940kΩ total impedance. The equipment under test, was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were placed on the **HCP** and isolated by an insulating support of 0.5 mm thickness. A distance of 1meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1 meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25 mm thick, and 2.5 meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

### 8.3.5. TEST RESULTS

**Model: TMM24105**

| Temperature | 23°C | Humidity | 41% RH |
|---|---|---|---|
| Pressure | 1028mbar | Tested By | Taiyu Cyu |
| Required Passing Performance | | Criterion A | |

| Air Discharge | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test Points | Test Levels | | | | | Results | | | |
| | ± 2 kV | ± 4 kV | ± 8 kV | ± 12 kV | ± 15 kV | Pass | Fail | Performance Criterion | Observation |
| Front | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |
| Back | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |
| Left | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |
| Right | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |
| Top | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |
| Bottom | ☒ | ☒ | ☒ | ☒ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |

| Contact Discharge | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test Points | Test Levels | | | | | Results | | | |
| | ± 2 kV | ± 4 kV | ± 6 kV | ± 8 kV | ± 12 kV | Pass | Fail | Performance Criterion | Observation |
| Front | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐A☐B☐C☐D | |
| Back | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐A☐B☐C☐D | |
| Left | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐A☐B☐C☐D | |
| Right | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐A☐B☐C☐D | |
| Top | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐A☐B☐C☐D | |
| Bottom | ☐ | ☐ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒A☐B☐C☐D | |

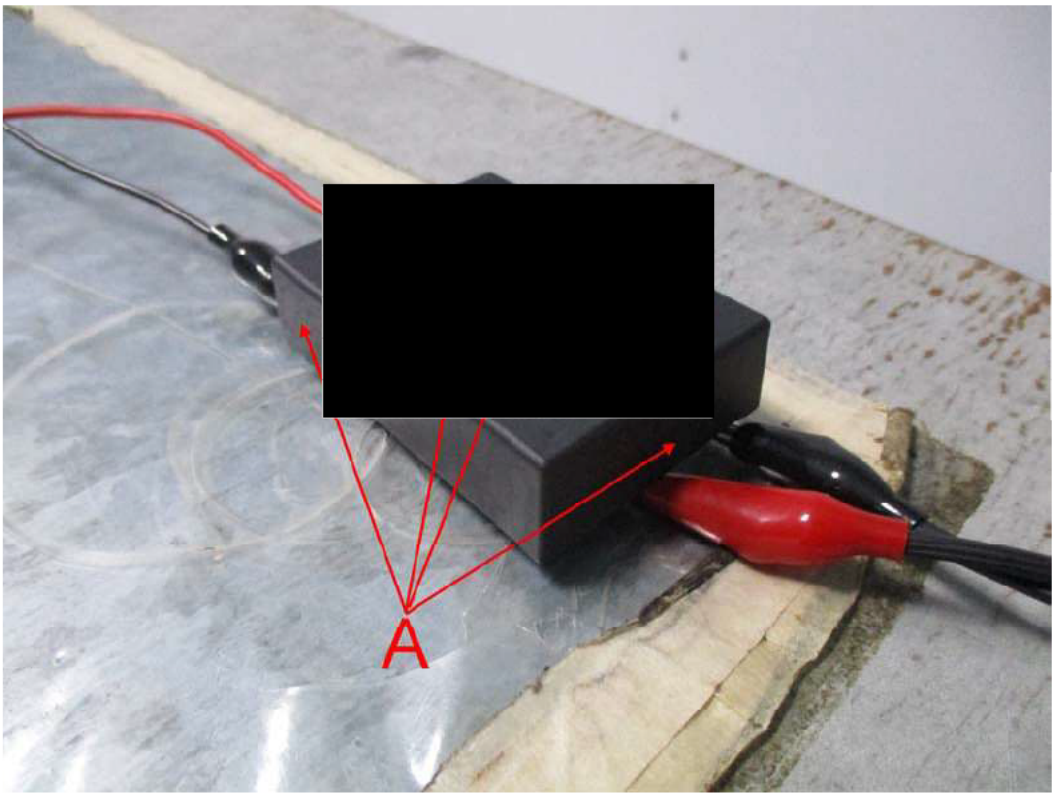
| Discharge To Horizontal Coupling Plane | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Side of EUT | Test Levels | | | | Results | | | |
| | ± 2 kV | ± 4 kV | ± 6 kV | ± 8 kV | Pass | Fail | Performance Criterion | Observation |
| Front | ☐ | ☐ | ☐ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |
| Back | ☐ | ☐ | ☐ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |
| Left | ☐ | ☐ | ☐ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |
| Right | ☐ | ☐ | ☐ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |

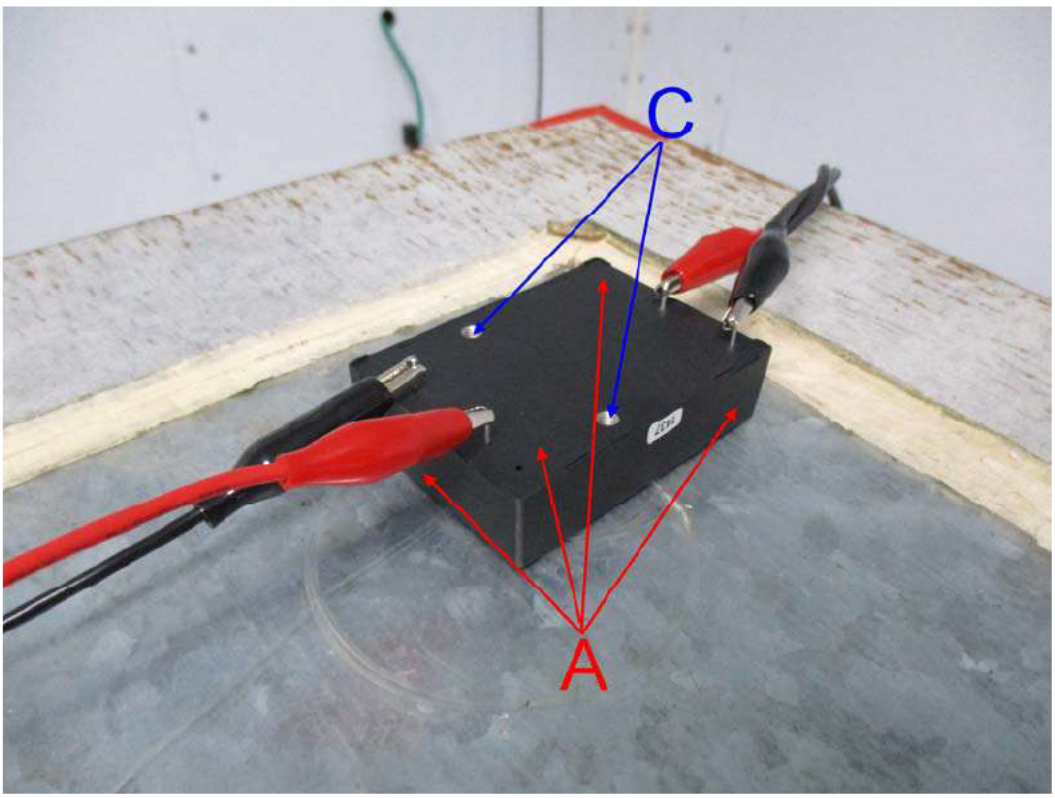
| Discharge To Vertical Coupling Plane | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Side of EUT | Test Levels | | | | Results | | | |
| | ± 2 kV | ± 4 kV | ± 6 kV | ± 8 kV | Pass | Fail | Performance Criterion | Observation |
| Front | ☐ | ☐ | ☐ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |
| Back | ☐ | ☐ | ☐ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |
| Left | ☐ | ☐ | ☐ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |
| Right | ☐ | ☐ | ☐ | ☒ | ☒ | ☐ | ☒A☐B☐C☐D | |

Remark: When EUT connects to iPod , ESD interference will effect iPod. Therefore EUT disconnect to iPod during ESD test. Connect to iPod and verify EUT function after ESD test.

## The Photo for Discharge Points of EUT

**Test Model: TMM24105**




'A' Mark — Air Discharged ;

## 8.4. RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD (RS)

### 8.4.1. TEST SPECIFICATION

| | |
|---|---|
| **Basic Standard:** | IEC 61000-4-3 |
| **Frequency Range:** | 1) 80 MHz ~ 2700 MHz<br>2) 385 MHz<br>3) 450 MHz<br>4) 710, 745, 780MHz<br>5) 810, 870, 930MHz<br>6) 1720, 1845, 1970MHz<br>7) 2450 MHz<br>8) 5240, 5500, 5785MHz |
| **Field Strength:** | 1) 10 V/m<br>2) 27 V/m<br>3) 28 V/m<br>4) 9 V/m<br>5) 28 V/m<br>6) 28 V/m<br>7) 28 V/m<br>8) 9 V/m |
| **Modulation:** | 1) 1kHz, 80% AM Modulation<br>2) 18Hz, 50% Duty cycle Pulse Modulation<br>3) 1kHz, 50% Duty cycle FM (± 5kHz deviation) Modulation<br>4) 217Hz, 50% Duty cycle Pulse Modulation<br>5) 18Hz, 50% Duty cycle Pulse Modulation<br>6) 217Hz, 50% Duty cycle Pulse Modulation<br>7) 217Hz, 50% Duty cycle Pulse Modulation<br>8) 217Hz, 50% Duty cycle Pulse Modulation |
| **Frequency Step:** | 1 % of preceding frequency value |
| **Polarity of Antenna:** | Horizontal and Vertical |
| **Test Distance:** | 3 m |
| **Antenna Height:** | 1.5m |

### 8.4.2. TEST INSTRUMENT

**For Sindian Lab.**

| 844 Chamber#RS (EN 61000-4-3)_80-1000MHz | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| Electric Field Probe | AR | FL7006 | 0338955 | 05/30/2017 |
| Field of Calibration | CCS | Chamber#RS | 80-1000MHz | 04/04/2017 |
| Power Sensor | Boonton | 51013-4E | 35812 | 03/09/2017 |
| Power Sensor | Boonton | 51013-4E | 35811 | 03/09/2017 |
| RF Power Meter | Boonton | 4242-01-02 | 14357 | 03/09/2017 |
| Signal Generator | Agilent | N5181A | MY47421336 | 12/10/2016 |
| Thermo-Hygro Meter | TFA | N/A | NO.6 | 10/25/2016 |
| Broadband Antenna | AR | AT1080 | 311819 | N.C.R |
| Direction Coupler | AR | DC6180A | 312189 | N.C.R |
| Power Amplifier | AR | 500W1000A | 320994 | N.C.R |
| Software | SW1005 Release 1.4.exe | | | |

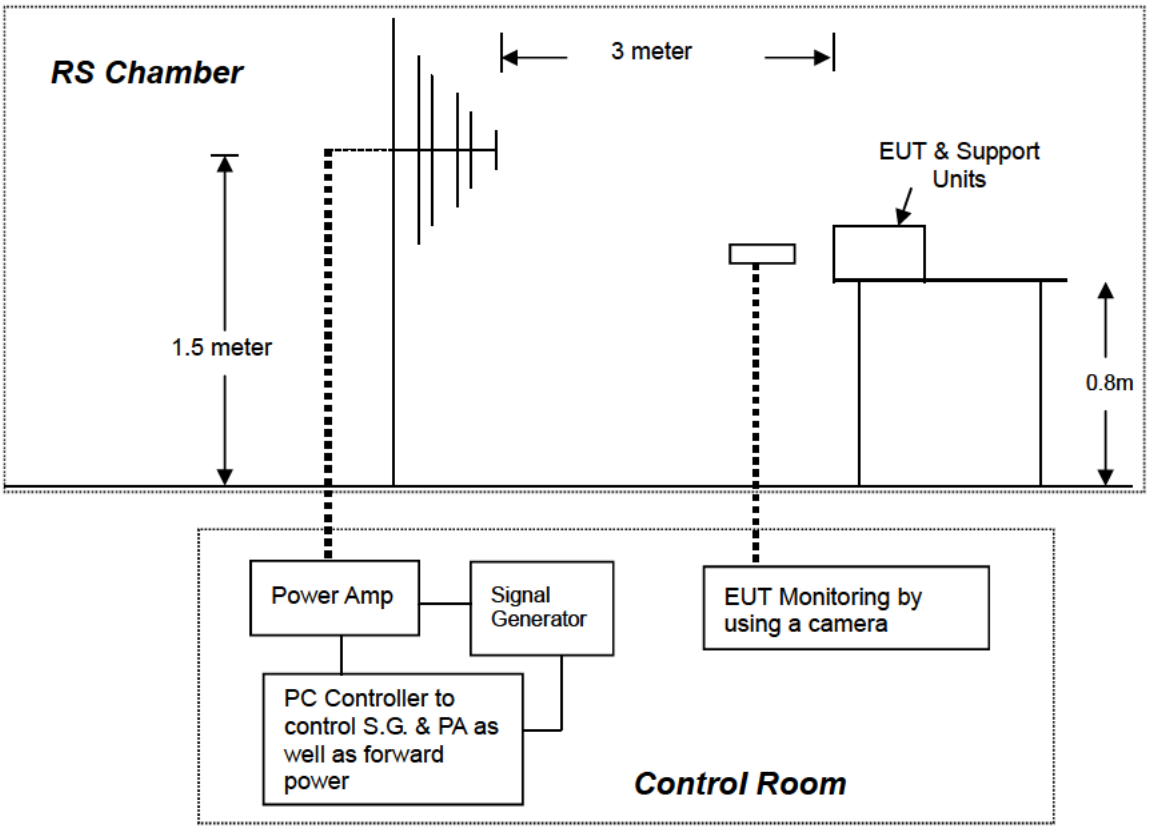
| 844 Chamber#RS (EN 61000-4-3)_1-6GHz | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| Field of Calibration | CCS | Chamber#RS | 1-3GHz | 04/07/2017 |
| Direction Coupler | AR | DC7200 | 0343647 | N.C.R |
| Horn Antenna | EMCO | 3115 | 5761 | N.C.R |
| Power Amplifier | AR | 50S1G6M1 | 0343693 | N.C.R |
| Power Amplifier | AR | 60S1G3 | 302728 | N.C.R |
| Software | SW1005 Release 1.4.exe | | | |

### 8.4.3. TEST PROCEDURE

The test procedure was in accordance with IEC 61000-4-3

a) The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.
b) The frequency range is swept from 80 MHz to 2.5 GHz, with the signal 80% amplitude modulated with a 1kHz sine-wave. The rate of sweep did not exceed 1.5 x $10^{-3}$ decade/s, where the frequency range is swept incrementally, the step size was 1% of preceding frequency value.
c) The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
e) The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

### 8.4.4. TEST SETUP




For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

**NOTE:**

TABLETOP EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

FLOOR STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

### 8.4.5. TEST RESULTS

**For Sindian Lab.**

**Model: TMM24105**

| | | | |
|---|---|---|---|
| **Temperature** | 19°C | **Humidity** | 55% RH |
| **Pressure** | 1028mbar | **Dwell Time** | 3 sec. |
| **Tested By** | PIPO | **Required Passing Performance** | **Criterion A** |

| Frequency (MHz) | Polarity | Azimuth | Field Strength (V/m) | Performance Criterion | Result | Observation |
|---|---|---|---|---|---|---|
| 80 ~ 1000 | V&H | 0 | 10 | ☒A ☐B ☐C ☐D | PASS | |
| 80 ~ 1000 | V&H | 90 | 10 | ☒A ☐B ☐C ☐D | PASS | |
| 80 ~ 1000 | V&H | 180 | 10 | ☒A ☐B ☐C ☐D | PASS | |
| 80 ~ 1000 | V&H | 270 | 10 | ☒A ☐B ☐C ☐D | PASS | |

| | | | |
|---|---|---|---|
| **Temperature** | 19°C | **Humidity** | 55% RH |
| **Pressure** | 1003mbar | **Dwell Time** | 3 sec. |
| **Tested By** | PIPO | **Required Passing Performance** | **Criterion A** |

| Frequency (MHz) | Polarity | Azimuth | Field Strength (V/m) | Performance Criterion | Result | Observation |
|---|---|---|---|---|---|---|
| 1000 ~ 2700 | V&H | 0 | 10 | ☒A ☐B ☐C ☐D | PASS | |
| 1000 ~ 2700 | V&H | 90 | 10 | ☒A ☐B ☐C ☐D | PASS | |
| 1000 ~ 2700 | V&H | 180 | 10 | ☒A ☐B ☐C ☐D | PASS | |
| 1000 ~ 2700 | V&H | 270 | 10 | ☒A ☐B ☐C ☐D | PASS | |

| Temperature | 19°C | Humidity | 55% RH |
|---|---|---|---|
| Pressure | 1008mbar | Dwell Time | 3 sec. |
| Tested By | PIPO | Test Distance: | 1m |
| Input Voltage | 230VAC / 50Hz | | |
| Required Passing Performance | **Criterion A** | | |

| Frequency (MHz) | Polarity | Azimuth | Field Strength (V/m) | Result | Observation |
|---|---|---|---|---|---|
| 385 | V&H | 0 | 27 | PASS | |
| 385 | V&H | 90 | 27 | PASS | |
| 385 | V&H | 180 | 27 | PASS | |
| 385 | V&H | 270 | 27 | PASS | |
| 450 | V&H | 0 | 28 | PASS | |
| 450 | V&H | 90 | 28 | PASS | |
| 450 | V&H | 180 | 28 | PASS | |
| 450 | V&H | 270 | 28 | PASS | |
| 710, 745, 780 | V&H | 0 | 9 | PASS | |
| 710, 745, 780 | V&H | 90 | 9 | PASS | |
| 710, 745, 780 | V&H | 180 | 9 | PASS | |
| 710, 745, 780 | V&H | 270 | 9 | PASS | |
| 810, 870, 930 | V&H | 0 | 28 | PASS | |
| 810, 870, 930 | V&H | 90 | 28 | PASS | |
| 810, 870, 930 | V&H | 180 | 28 | PASS | |
| 810, 870, 930 | V&H | 270 | 28 | PASS | |
| 1720, 1845, 1970 | V&H | 0 | 28 | PASS | |
| 1720, 1845, 1970 | V&H | 90 | 28 | PASS | |
| 1720, 1845, 1970 | V&H | 180 | 28 | PASS | |
| 1720, 1845, 1970 | V&H | 270 | 28 | PASS | |
| 2450 | V&H | 0 | 28 | PASS | |
| 2450 | V&H | 90 | 28 | PASS | |
| 2450 | V&H | 180 | 28 | PASS | |
| 2450 | V&H | 270 | 28 | PASS | |
| 5240, 5500, 5785 | V&H | 0 | 9 | PASS | |
| 5240, 5500, 5785 | V&H | 90 | 9 | PASS | |
| 5240, 5500, 5785 | V&H | 180 | 9 | PASS | |
| 5240, 5500, 5785 | V&H | 270 | 9 | PASS | |

## 8.5. ELECTRICAL FAST TRANSIENT (EFT)

### 8.5.1. TEST SPECIFICATION

| | |
|---|---|
| **Basic Standard:** | IEC 61000-4-4 |
| **Test Voltage:** | Power Line: 2 kV |
| **Polarity:** | Positive & Negative |
| **Impulse Frequency:** | 100 kHz |
| **Impulse Wave-shape:** | 5/50 ns |
| **Burst Duration:** | 0.75 ms |
| **Burst Period:** | 300 ms |
| **Test Duration:** | Not less than 1 min |

### 8.5.2. TEST INSTRUMENT

| Fast Transients/Burst Test Site (IEC 61000-4-4) | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| Capacitor Clamp | KeyTek | CCL-4 | 9306412 | 01/17/2017 |
| EMS Test System | KeyTek | EMCpro | 0312231 | 11/19/2016 |
| Test S/W | CE Ware 3.00b | | | |

**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R.= No Calibration Required.

### 8.5.3. TEST PROCEDURE

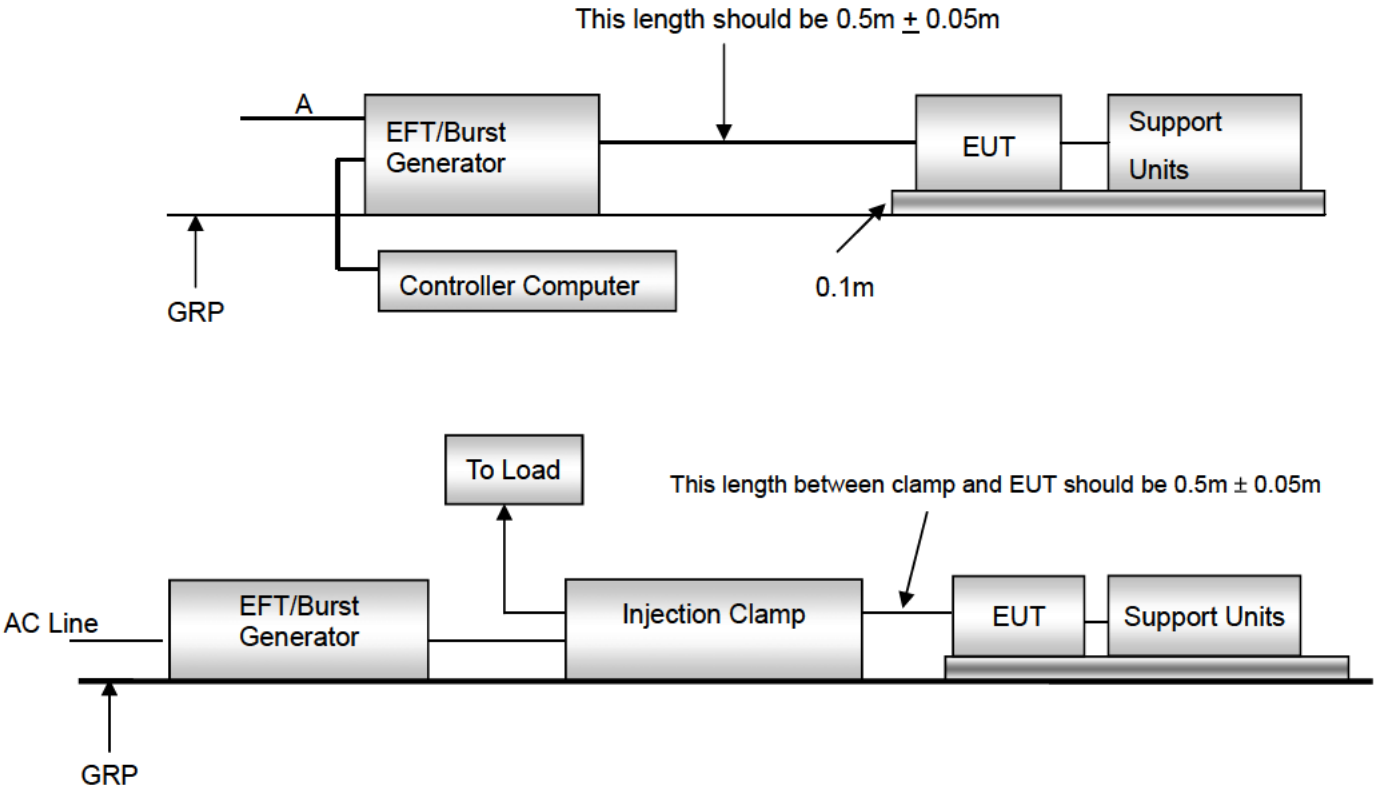
a) Both positive and negative polarity discharges were applied.

b) The length of the “hot wire” from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1 meter.

c) The duration time of each test sequential was 1 minute.

d) The transient/burst waveform was in accordance with IEC 61000-4-4, 5/50ns.

## 8.5.4. TEST SETUP




For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

**NOTE:**

TABLETOP EQUIPMENT

The configuration consisted of a wooden table (0.8 m high) standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum (at least 0.25 mm thick and 2.5 m square) connected to the protective grounding system. A minimum distance of 0.5m was provided between the EUT and the walls of the laboratory or any other metallic structure.

FLOOR STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC 61000-4-4 and its cables, were isolated from the Ground Reference Plane by an insulating support that is 0.1 meter thick. The GRP consisted of a sheet of aluminum (at least 0.25 mm thick and 2.5 m square) connected to the protective grounding system.

### 8.5.5. TEST RESULTS

**Model: TMM24105**

| | | | |
|---|---|---|---|
| **Temperature** | 24 °C | **Humidity** | 46 % RH |
| **Pressure** | 1028 mbar | **Tested By** | Taiyu Cyu |
| **Required Performance** | **Criteria A** | **Voltage** | 230Vac, 50Hz |

POWER

| Test Point | Polarity | Test Level (kV) | Performance Criterion | Result | Observation |
|---|---|---|---|---|---|
| L | +/- | 2kV | ☒A ☐B ☐C | PASS | |
| N | +/- | 2kV | ☒A ☐B ☐C | PASS | |
| L + N | +/- | 2kV | ☒A ☐B ☐C | PASS | |

Characteristics of the fast transient/burst generator

| Burst duration | Burst Period | Repetition Rate | Rise time | Duration |
|---|---|---|---|---|
| 0.75 ms $^{+}_{-}$20% | 300 ms $^{+}_{-}$20% | 100 kHz | 5 ns $^{+}_{-}$30% | 50 ns $^{+}_{-}$30% |

## 8.6. SURGE IMMUNITY TEST

### 8.6.1. TEST SPECIFICATION

| | |
|---|---|
| **Basic Standard:** | IEC 61000-4-5 |
| **Wave-Shape:** | Combination Wave<br>1.2/50 µs Open Circuit Voltage<br>8/20 µs Short Circuit Current |
| **Test Voltage:** | AC Power Port~ line to line: 0.5, 1kV, line to ground: ---kV<br>DC Power Port~ line to earth: ---kV<br>Signal and Telecommunication Ports ~ line to ground: ---kV |
| **Surge Input/Output:** | DC Power Line: L1-L2 |
| **Generator Source Impedance:** | 2 ohm between networks<br>12 ohm between network and ground |
| **Polarity:** | Positive/Negative |
| **Phase Angle:** | 0° / 90° / 180° / 270° |
| **Pulse Repetition Rate:** | 1 time / min. (maximum) |
| **Number of Tests:** | 5 positive and 5 negative at selected points |

### 8.6.2. TEST INSTRUMENT

| Surge Immunity Test Site (IEC 61000-4-5) | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| CDN | EMC-PAPTNER | CDN-UTP8 | CDN-UTP8-1504 | 11/26/2016 |
| EMS Test System | KeyTek | EMCpro | 0312231 | 11/19/2016 |
| Test S/W | CE Ware 3.00b | | | |

**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R. = No Calibration Required.

### 8.6.3. TEST PROCEDURE

a) For EUT power supply:

The surge is applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

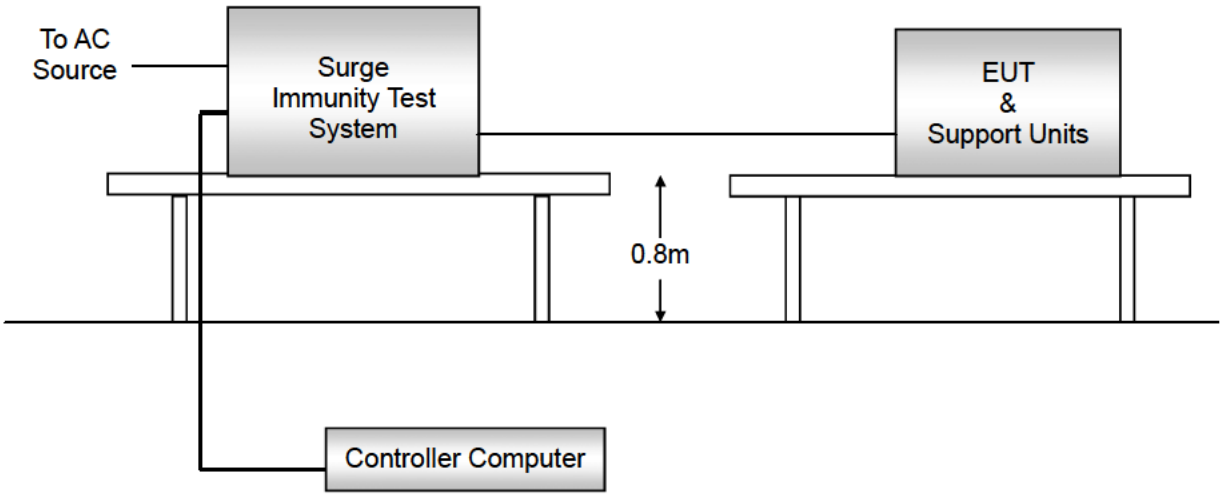
b) For test applied to unshielded un-symmetrically operated interconnection lines of EUT:

The surge was applied to the lines via the capacitive coupling. The coupling / decoupling networks didn't influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

c) For test applied to unshielded symmetrically operated interconnection / telecommunication lines of EUT:

The surge was applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor were not specified. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

### 8.6.4. TEST SETUP




For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 8.6.5. TEST RESULTS

**Model: TMM24105**

| | | | |
|---|---|---|---|
| **Temperature** | 24 °C | **Humidity** | 46 % RH |
| **Pressure** | 1028 mbar | **Tested By** | Taiyu Cyu |
| **Required Performance** | **Criteria A** | **Voltage** | 230Vac, 50Hz |

POWER

| Test Point | Polarity | Test Level (kV) | Performance Criterion | Result | Observation |
|---|---|---|---|---|---|
| L - N | +/- | 0.5; 1kV | ☒A ☐B ☐C | PASS | |

| Phase shifting | Repetition Rate | Waveform parameter | Coupling Rate |
|---|---|---|---|
| 0° 、90° 、180° 、270° | 30 sec | Combine Wave 1.2μs/50μs 8μs /20μs | 5 times |
| | | Impedance 12 Ω / 2 Ω | Each Angel and Polarity |

## 8.7. CONDUCTED RADIO FREQUENCY DISTURBANCES (CS)

### 8.7.1. TEST SPECIFICATION

| | |
|---|---|
| **Basic Standard:** | IEC 61000-4-6 |
| **Frequency Range:** | 0.15 ~ 80MHz: 3 Vrms<br>ISM Frequency: 6 Vrms |
| **Field Strength:** | 1) 3 Vrms<br>2) 6 Vrms |
| **Modulation:** | 1) 1kHz Wave, 80%, AM Modulation<br>2) Before modulation is applied |
| **Frequency Step:** | 1 % of preceding frequency value |
| **Coupling device:** | CDN-M2 (2 wires) /<br>CDN-M3 (3 wires) |
| **Remark:** | Except for the ISM (Industrial, scientific and medical) broadcast frequency bands:<br>6,765 MHz to 6,795 MHz, 13,553 MHz to 13,567 MHz, 26,957 MHz to 27,283 MHz, and 40,66 MHz to 40,70 MHz<br>The amateur radio bands between 0,15 MHz and 80 MHz are 1,8 MHz to 2,0 MHz, 3,5 MHz to 4,0 MHz, 5,3 MHz to 5,4 MHz, 7 MHz to 7,3 MHz, 10,1 MHz to 10,15 MHz, 14 MHz to 14,2 MHz, 18,07 MHz to 18,17 MHz, 21,0 MHz to 21,4 MHz, 24,89 MHz to 24,99 MHz, 28,0 MHz to 29,7 MHz, and 50,0 MHz to 54,0 MHz |

### 8.7.2. TEST INSTRUMENT

| CS Test Site (IEC 61000-4-6) | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| CDN | Frankonia | CDN M2+M3 | A3011095 | 12/06/2016 |
| Conduction Immunity | Frankonia | CIT-10/75 | 102C3220 | 04/26/2017 |
| Couplihd/Decoupling Networks | FRANKONIA | CDN-RJ45 | A3100030/2013 | 04/27/2017 |
| EM Injection Clamp | FCC | F-203I-23MM | 449 | 05/03/2017 |
| 6dB Attenuator | BIRD | 75-A-FFN-06 | 0346 | N.C.R |
| Test S/W | CS-EN61000-4-6 | | | |

**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R.= No Calibration Required.

### 8.7.3. TEST PROCEDURE

The EUT shall be tested within its intended operating and climatic conditions.

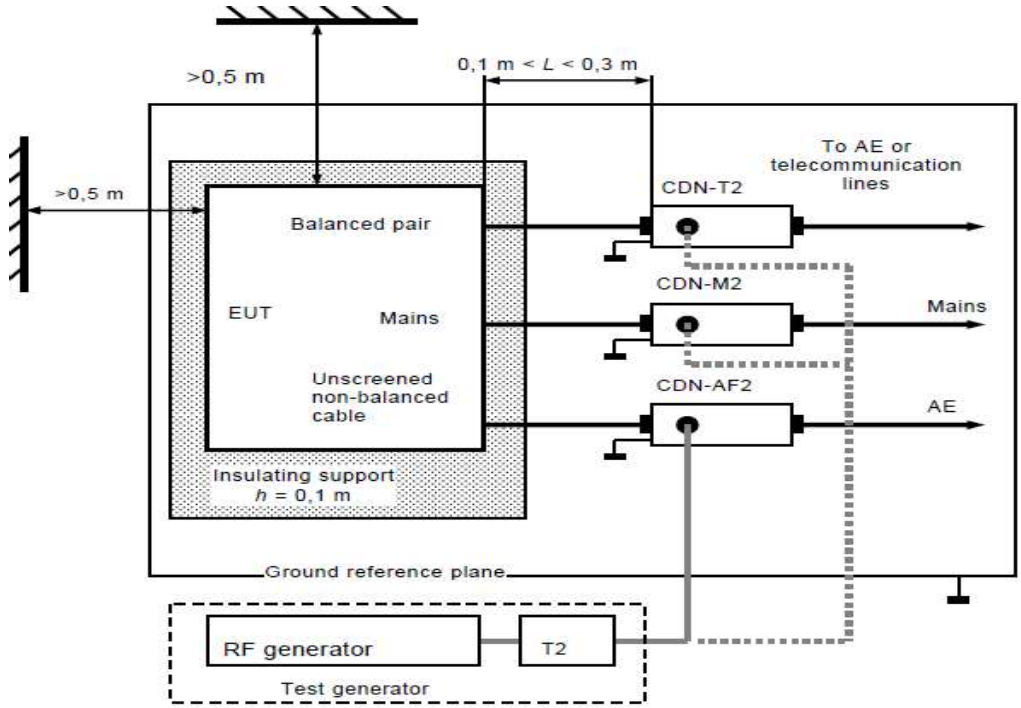
The test shell performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.

The frequency range was swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal was modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. The sweep rate was 1.5 x $10^{-3}$ decades/s. Where the frequency range is swept incrementally, the step size was 1 % of preceding frequency value from 150 kHz to 80 MHz.

The dwell time at each frequency was less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequency(ies) and harmonics or frequencies of dominant interest, was analyzed separately.

Attempts was made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.

### 8.7.4. TEST SETUP




**Dote:**

1. The EUT is setup 0.1m above Ground Reference Plane
2. The CDNs and / or EM clamp used for real test depends on ports and cables configuration of EUT.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

**NOTE:**

TABLE-TOP AND FLOOR-STANDING EQUIPMENT

The equipment to be tested is placed on an insulating support of 0.1 meters height above a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.

### 8.7.5. TEST RESULTS

**Model: TMM24105**

| | | | |
|---|---|---|---|
| **Temperature** | 24 °C | **Humidity** | 44 % RH |
| **Pressure** | 1028 mbar | **Tested By** | Taiyu Cyu |
| **Required Performance** | **Criteria A** | | |

POWER

| Frequency Band (MHz) | Field Strength (Vrms) | Cable | Injection Method | Performance Criterion | Result | Observation |
|---|---|---|---|---|---|---|
| 0.15 ~ 80 | 3 | AC Power | CDN-☒M2 ☐M3 | ☒A☐B☐C | PASS | |

| Frequency Band (MHz) | Field Strength (Vrms) | Cable | Injection Method | Performance Criterion | Result | Observation |
|---|---|---|---|---|---|---|
| ISM & amateur radio Bands | 6 | AC Power | CDN-☒M2 ☐M3 | ☒A☐B☐C | PASS | |

## 8.8. POWER FREQUENCY MAGNETIC FIELD

### 8.8.1. TEST SPECIFICATION

| | |
|---|---|
| **Basic Standard:** | IEC 61000-4-8 |
| **Frequency Range:** | 50Hz |
| **Field Strength:** | 30 A/m |
| **Observation Time:** | 1 minute |
| **Inductance Coil:** | Rectangular type, 1mx1m |

### 8.8.2. TEST INSTRUMENT

| Power Frequency Magnetic Field Immunity Test (IEC/EN 61000-4-8) | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| AC/DC CLAMP METER | PROVA | 2003 | 2190104 | 01/27/2017 |
| Magnetic generator | Schaffner | MFO 6501 | 154 | N.C.R |
| Magnetic loops | Schaffner | INA 702 | 158 | N.C.R |

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R. = No Calibration Required.

### 8.8.3. TEST PROCEDURE

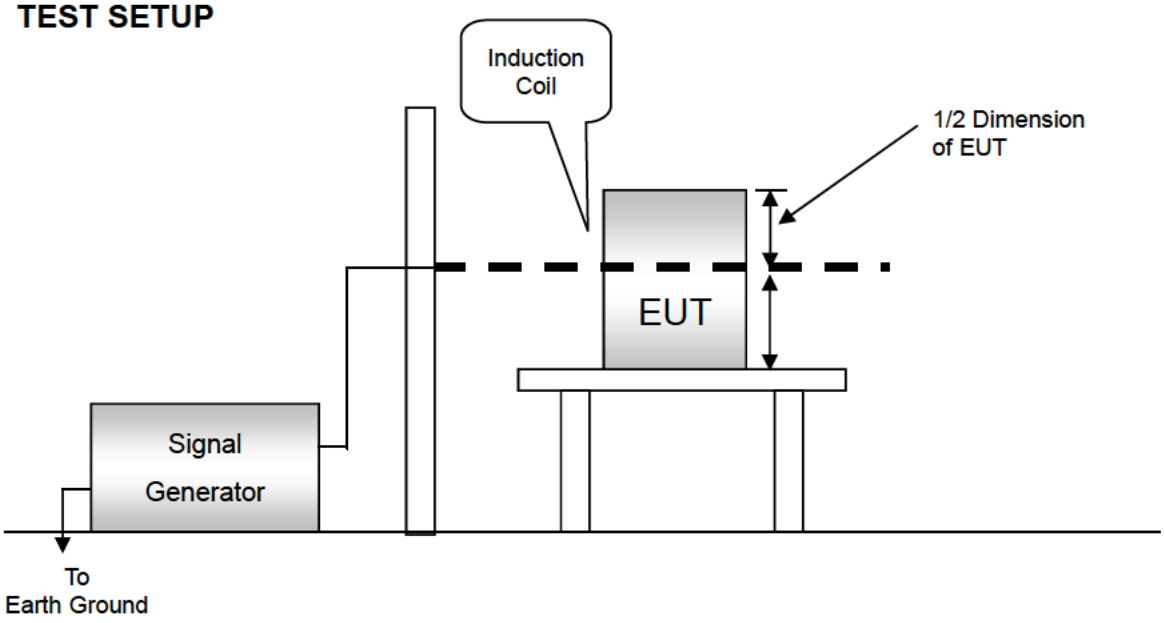
a) The equipment is configured and connected to satisfy its functional requirements. It shall be placed on the GRP with the interposition of a 0.1m-thick insulating support.

b) The equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.

c) The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.

d) The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.

## 8.8.4. TEST SETUP




For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

**NOTE:**

TABLETOP EQUIPMENT

The equipment shall be subjected to the test magnetic field by using the induction coil of standard dimension (1 m x 1 m). The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

FLOOR-STANDING EQUIPMENT

The equipment shall be subjected to the test magnetic field by using induction coils of suitable dimensions. The test shall be repeated by moving and shifting the induction coils, in order to test the whole volume of the EUT for each orthogonal direction. The test shall be repeated with the coil shifted to different positions along the side of the EUT, in steps corresponding to 50 % of the shortest side of the coil. The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

### 8.8.5. TEST RESULTS

**Model: TMM24105**

| | | | |
|---|---|---|---|
| **Temperature** | 24 °C | **Humidity** | 44 % RH |
| **Pressure** | 1028 mbar | **Tested By** | Taiyu Cyu |
| **Required Performance** | **Criteria A** | | |

| DIRECTION | Field Strength (A/m) | Performance Criterion | Result | Observation |
|---|---|---|---|---|
| X | 30 | ☒A ☐B ☐C ☐D | PASS | |
| Y | 30 | ☒A ☐B ☐C ☐D | PASS | |
| Z | 30 | ☒A ☐B ☐C ☐D | PASS | |

## 8.9. VOLTAGE DIP & VOLTAGE INTERRUPTIONS

### 8.9.1. TEST SPECIFICATION

| | |
|---|---|
| **Basic Standard:** | IEC 61000-4-11 |
| **Test duration time:** | Minimum three test events in sequence |
| **Interval between event:** | Minimum 10 seconds |
| **Phase Angle:** | $0^o$ / $45^o$ / $90^o$ / $135^o$ / $180^o$ / $225^o$ / $270^o$ / $315^o$ / $360^o$ |
| **Test cycle:** | 3 times |

### 8.9.2. TEST INSTRUMENT

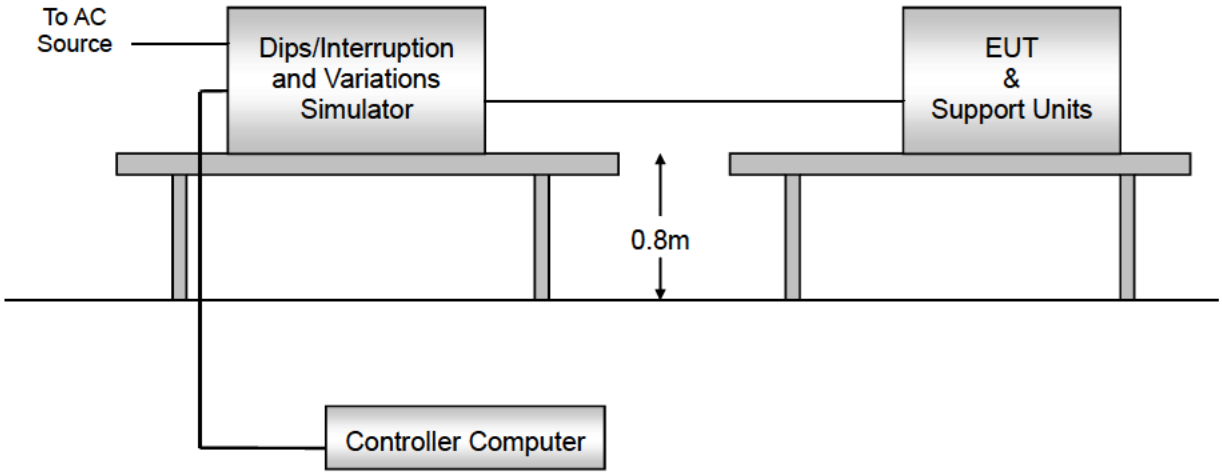
| Voltage Dips/Short Interruption and Voltage Variation Immunity Test Site (IEC/EN 61000-4-11) | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| Computer | IBM | M/T 8183 - ICV | 99BG137 | N.C.R. |
| VGA Monitor | Acer | 1555 | 917160230584200572P5C431 | N.C.R. |
| Keyboard | HP | KB - 0133 | B69360MGAPEOK5 | N.C.R. |
| EMS Test System | KeyTek | EMCpro | 0312231 | 11/19/2016 |
| Test S/W | CE Ware 3.00b | | | |

**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R. = No Calibration Required.

### 8.9.3. TEST PROCEDURE

a) The EUT and support units were located on a wooden table, 0.8 m away from ground floor.
b) Setting the parameter of tests and then perform the test software of test simulator.
c) Conditions changes to occur at 0 degree crossover point of the voltage waveform.
d) Recording the test result in test record form.

### 8.9.4. TEST SETUP




For the actual test configuration, please refer to the related item – Photographs of the Test Configuration

## 8.9.5. TEST RESULTS

**Model: TMM24105**

| | | | |
|---|---|---|---|
| **Temperature** | 24°C | **Humidity** | 46% RH |
| **Pressure** | 1028mbar | **Tested by** | Taiyu Cyu |
| **Test Mode** | Full Load | **Input Voltage** | 230V/50Hz |
| **Required Passing Performance** | Voltage Dips:<br>i) 0% reduction for 0.5 cycle at 50Hz,<br>0% reduction for 1 cycle at 50Hz, Performance Criterion A<br>ii) 70% reduction for 25/30 cycles at 50/60Hz, Performance Criterion C<br>Voltage Interruptions:<br>iii) 0% reduction for 250/300 cycles at 50/60Hz, Performance Criterion C | | |

| Item | Angle | Reduction (%) | Test Duration (P) | | Performance Criterion | Test Result |
|---|---|---|---|---|---|---|
| Voltage Dips | 0 | 100 | 0.5 | | ☒ A ☐ B ☐ C | Pass |
| | 45 | | | | ☒ A ☐ B ☐ C | Pass |
| | 90 | | | | ☒ A ☐ B ☐ C | Pass |
| | 135 | | | | ☒ A ☐ B ☐ C | Pass |
| | 180 | | | | ☒ A ☐ B ☐ C | Pass |
| | 225 | | | | ☒ A ☐ B ☐ C | Pass |
| | 270 | | | | ☒ A ☐ B ☐ C | Pass |
| | 315 | | | | ☒ A ☐ B ☐ C | Pass |
| | 0 | 100 | 1 | | ☒ A ☐ B ☐ C | Pass |
| | 0 | 30 | AT 50 Hz | AT 60 Hz | ☒ A ☐ B ☐ C | Pass |
| | | | 25 | 30 | | Pass |
| Voltage Interruption | 0 | 100 | AT 50 Hz | AT 60 Hz | ☐ A ☒ B ☐ C | Pass |
| | 45 | | 250 | 300 | ☐ A ☒ B ☐ C | Pass |
| | 90 | | | | ☐ A ☒ B ☐ C | Pass |
| | 135 | | | | ☐ A ☒ B ☐ C | Pass |
| | 180 | | | | ☐ A ☒ B ☐ C | Pass |
| | 225 | | | | ☐ A ☒ B ☐ C | Pass |
| | 270 | | | | ☐ A ☒ B ☐ C | Pass |
| | 315 | | | | ☐ A ☒ B ☐ C | Pass |

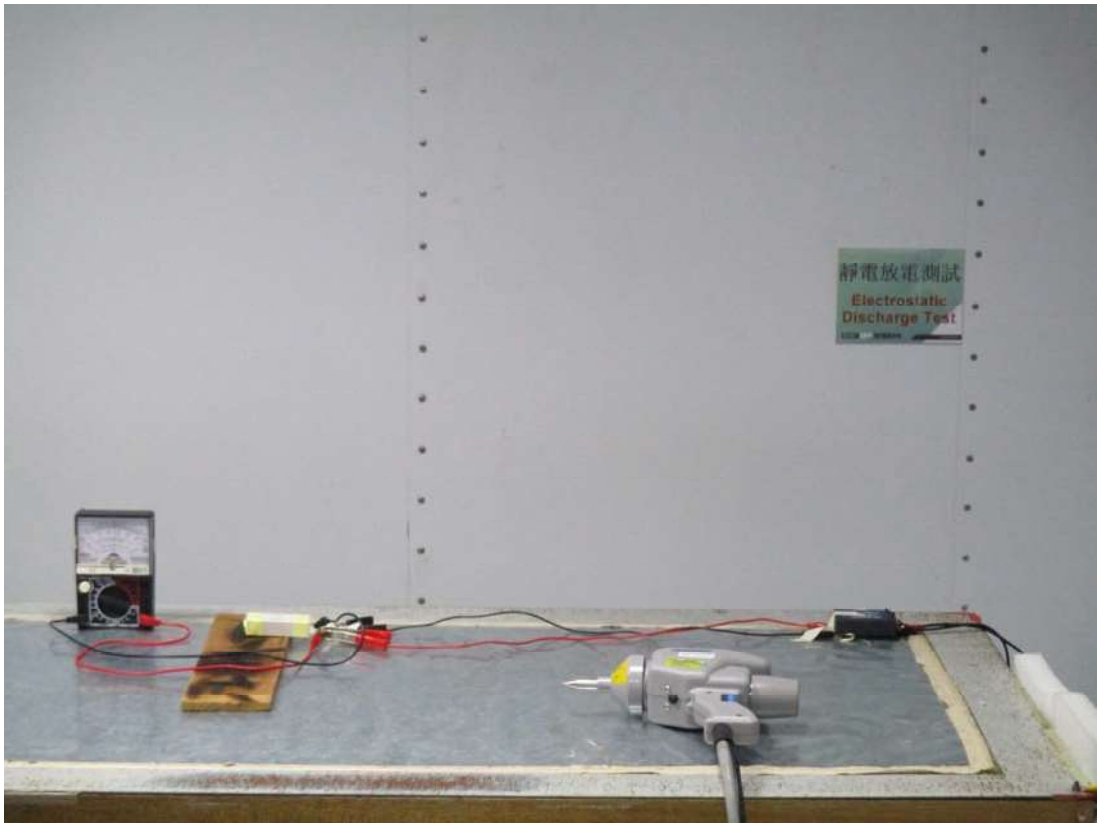
# 9 PHOTOGRAPHS OF THE TEST CONFIGURATION

## CONDUCTED EMISSION TEST

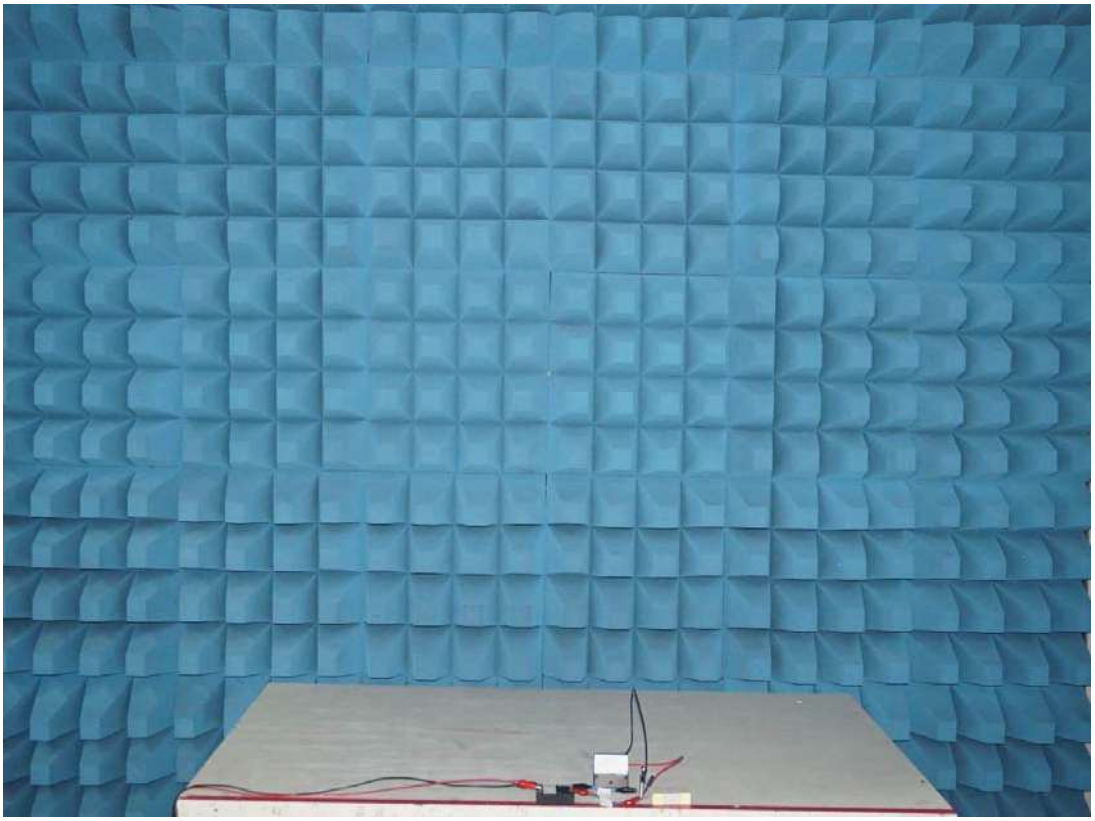
## RADIATED EMISSION TEST

## FLICKER TEST

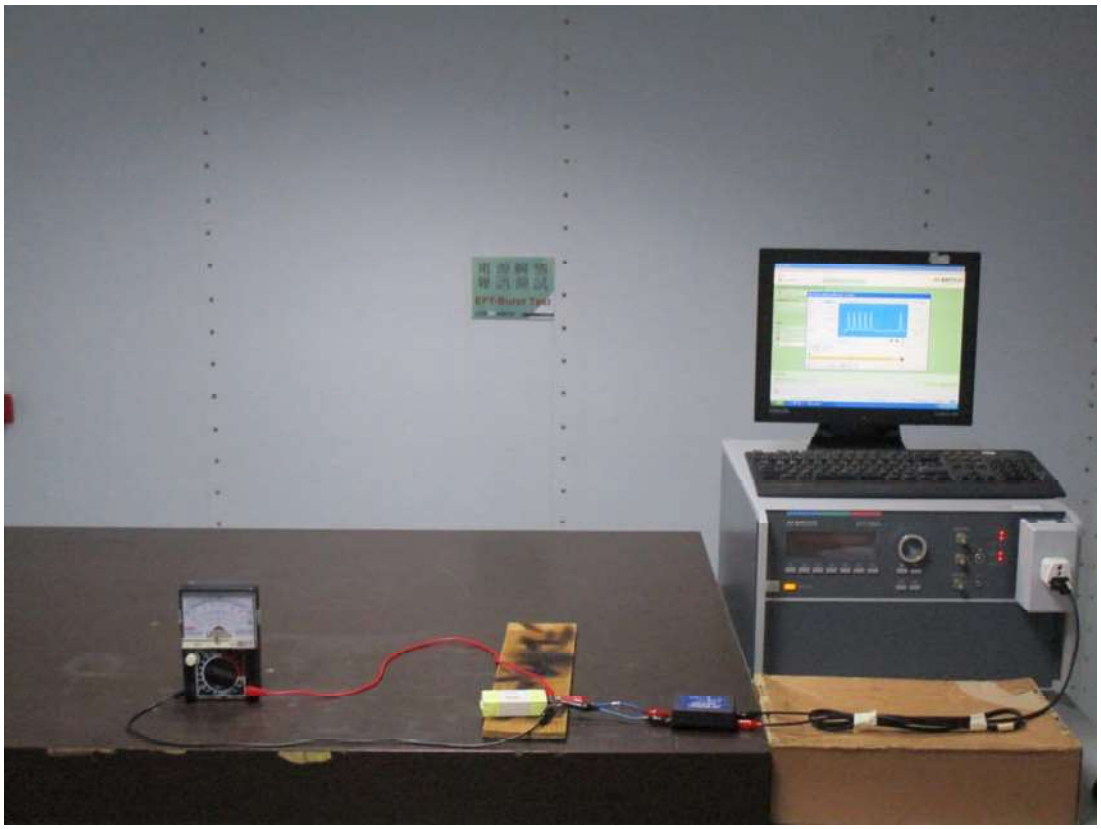
## ESD TEST (Model: TMM24105)



## RS TEST



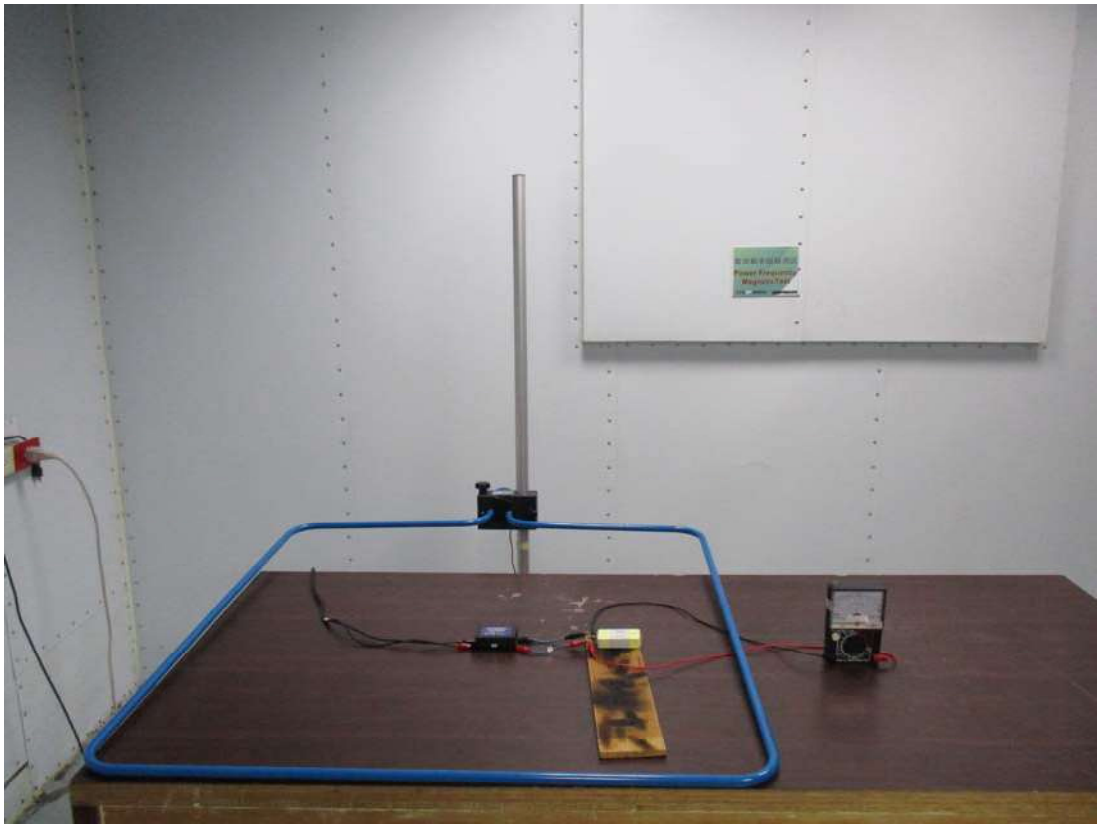
## EFT TEST



## SURGE TEST

## CS TEST

## PFMF TEST



## VOLTAGE DIPS / INTERRUPTIONS TEST