



# **CE EMC TEST REPORT**

for

**DC /DC Power Converter**

**MODEL:**

**TMDC 20-2412; TMDC 20-2415; TMDC 20-2418; TMDC 20-2411;  
TMDC 20-4812; TMDC 20-4815; TMDC 20-4818; TMDC 20-4811**

**Brand:** 

Test Report Number:  
**T141224N03-E**

Issued to:

**TRACO ELECTRONIC AG**

SIHLBRUGGSTRASSE 111 CH-6340 BAAR, SWITZERLAND

Issued by:

**Compliance Certification Services Inc.  
Tainan Laboratory**

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**Issued Date: December 30, 2014**



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**Revision History**

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		December 30, 2014		Initial Issue	ALL	Eva Lin



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## 1 TEST CERTIFICATION

**Product:** DC /DC Power Converter

**Model:** TMDC 20-2412; TMDC 20-2415; TMDC 20-2418; TMDC 20-2411;  
TMDC 20-4812; TMDC 20-4815; TMDC 20-4818; TMDC 20-4811

**Brand:**



**Applicant:** TRACO ELECTRONIC AG  
SIHLBRUGGSTRASSE 111 CH-6340 BAAR, SWITZERLAND

**Tested:** March 28, 2014 – April 1, 2014  
December 25, 2014

**Applicable Standards:** EN 61000-6-4: 2007+A1:2011

**EN 61000-6-2: 2005, including**  
IEC 61000-4-2: 2008  
IEC 61000-4-3: 2010  
IEC 61000-4-4: 2012  
IEC 61000-4-5: 2005  
IEC 61000-4-6: 2008  
IEC 61000-4-8: 2009

Deviation from Applicable Standard
None

The above equipment was tested by Compliance Certification Services Inc. for compliance with the the requirements of technical standards specified above under the Directive 93/42/EEC concerning medical devices. 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:**

**Reviewed by:**

**Jeter Wu**  
Assistant Manager

**Eric Huang**  
Assistant Section Manager



## 2 TEST RESULT SUMMARY


EMISSION			
Standard	Item	Result	Remarks
EN 61000-6-4: 2007+A1:2011	Conducted (Power Port)	PASS	Meet EN 61000-6-4 limit
	Conducted (Telecom port)	N/A	No requirement
	Radiated	PASS	Meet EN 61000-6-4 limit
EN 61000-3-2: 2006+ A2:2009	Harmonic current emissions	N/A	No requirement
EN 61000-3-3: 2008	Voltage fluctuations & flicker	N/A	No requirement

IMMUNITY [ EN 61000-6-2: 2005 ]			
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: 2005	Surge	PASS	Meets the requirements of Performance Criterion A
IEC 61000-4-6: 2008	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	N/A	Voltage Dips: i) 100% reduction for 1 Cycle, Performance Criterion N/A ii) 60 % reduction for 10/12 Cycle at 50/60Hz, Performance Criterion N/A iii) 30% reduction for 25/30 Cycle at 50/60Hz, Performance Criterion N/A Voltage Interruptions: 100% reduction for 250/300 Cycle at 50/60Hz Performance Criterion N/A

**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

<b>Product</b>	DC /DC Power Converter
<b>Model</b>	TMDC 20-2412; TMDC 20-2415; TMDC 20-2418; TMDC 20-2411; TMDC 20-4812; TMDC 20-4815; TMDC 20-4818; TMDC 20-4811
<b>Brand</b>	
<b>Applicant</b>	TRACO ELECTRONIC AG
<b>Housing material</b>	Plastics
<b>Identify Number</b>	T141224N03-E
<b>Received Date</b>	March 31, 2014
<b>EUT Power Rating</b>	See Below

#### I/O PORT

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

#### Note:

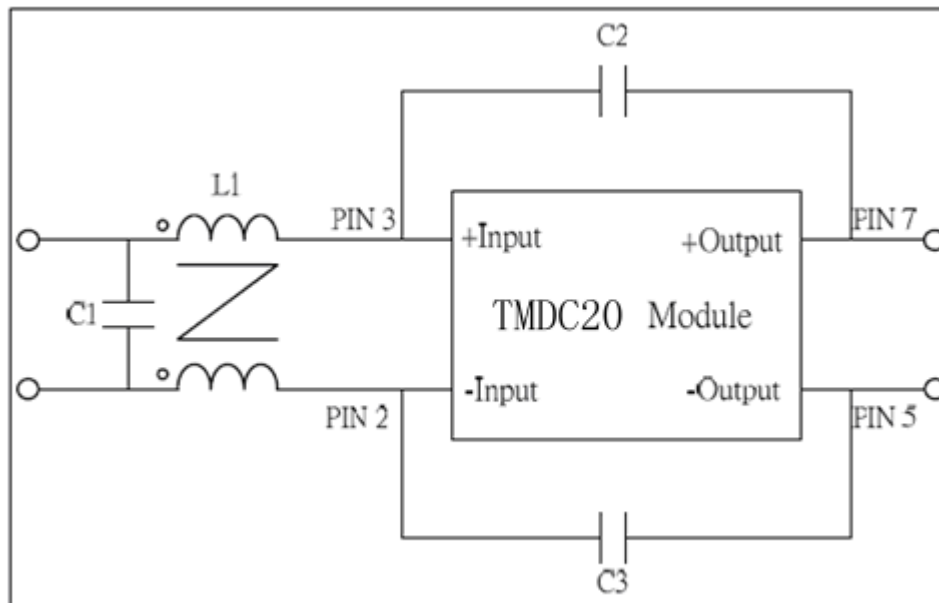
- Client consigns only eight model samples to test (Model Number: **TMDC 20-2412; TMDC 20-2415; TMDC 20-2418; TMDC 20-2411; TMDC 20-4812; TMDC 20-4815; TMDC 20-4818; TMDC 20-4811**). Therefore, the testing Lab. just guarantees the unit, which has been tested.
- For more details, please refer to the User's manual of the EUT.
- The new PCB board is all the same of the original PCB board, except for different layout and circuit are just for the marketing purpose.
- Type A: With a external capacitor for test. Type B: Without a external capacitor for test.
- The different of the each model is shown as below:

#### The different of the each model:

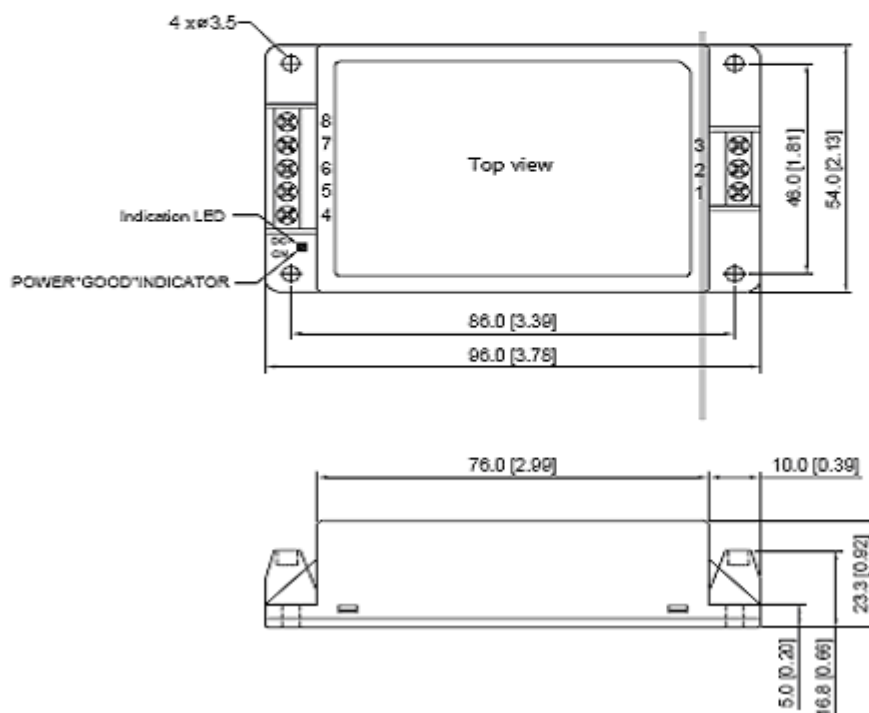
Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Max. capacitive Load	Efficiency (typ.)
	VDC	VDC	Max. mA(typ.)	@ Max. Load mA(typ.)	@No Load mA(typ.)		@Max. Load %
TMDC 20-2411	24 (9~36)	5.1	4000	944	70	6800	90
TMDC 20-2412		12	1670	918	70	1160	91
TMDC 20-2415		24	835	918	70	300	91
TMDC 20-2418		48	420	944	70	75	89
TMDC 20-4811	48 (18~75)	5.1	4000	472	35	6800	90
TMDC 20-4812		12	1670	459	35	1160	91
TMDC 20-4815		24	835	459	35	300	91
TMDC 20-4818		48	420	472	35	75	89



1) Radiation Solution:



	L1	C1	C2	C3
TMDC20-24SXXC	120uH/120uH	4.7uF 50V	None	220pF
TMDC20-48SXXC		3.3uF 100V	220pF	220pF



Connections	
Pin	Function
2	-Vin
3	+Vin
5	-Vout
7	+Vout



## 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:

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

1.	TMDC 20-2412	5.	TMDC 20-4812
2.	TMDC 20-2415	6.	TMDC 20-4815
3.	TMDC 20-2418	7.	TMDC 20-4818
4.	TMDC 20-2411	8.	TMDC 20-4811

#### Conduction (Telecom port) Modes

1.	Non
----	-----

#### Radiation Modes: (Full Load)

1.	TMDC 20-2412	5.	TMDC 20-4812
2.	TMDC 20-2415	6.	TMDC 20-4815
3.	TMDC 20-2418	7.	TMDC 20-4818
4.	TMDC 20-2411	8.	TMDC 20-4811

#### EMS Modes: (Full Load)\_Type A: With a external capacitor for test.

1.	TMDC 20-2411
----	--------------

#### EMS Modes: (Full Load)\_Type B: Without a external capacitor for test.

1.	TMDC 20-2411
----	--------------

### 4.2. EUT SYSTEM OPERATION

1. Setup whole system for test as shown on setup diagram.
2. Turn on power and check EUT 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	DC Power Supply	GW	GPR-3036D	DoC	Power cable, unshd, 1.6m

No.	Signal cable description	
A	DC Power cable	Unshielded, 1.0m, 1pcs.
B	DC Power cable	Unshielded, 0.1m, 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 Lab. at

☒ No.8, Jiucengling, Xinhua Dist., Tainan City 712, 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.

<b>Taiwan</b>	TAF
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The measuring facility of laboratories has been authorized or registered by the following approval agencies.

<b>Canada</b>	Industry Canada
<b>Germany</b>	TUV NORD
<b>Taiwan</b>	BSMI
<b>USA</b>	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	±1.48dB
Conduction Emission	ISN	150kHz~30MHz	±2.61dB
	T-ISN	150kHz~30MHz	±2.61dB
	Clamp	30MHz ~ 300MHz	±2.0736dB
Radiated Emission (10m)	Test Site : OATS-5	30 MHz ~200 MHz	±3.6721dB
		200 MHz ~1000 MHz	±2.9511dB
	Test Site : OATS-6	30 MHz ~200 MHz	±3.7451dB
		200 MHz ~1000 MHz	±3.2195dB
	Test Site : OATS-7	30 MHz ~200 MHz	±3.8729dB
		200 MHz ~1000 MHz	±3.8996dB
Radiated Emission (3m)	Test Site : OATS-5	30 MHz ~200 MHz	±3.6303dB
		200 MHz ~1000 MHz	±2.3764dB
	Test Site : OATS-6	30 MHz ~200 MHz	±3.4896dB
		200 MHz ~1000 MHz	±2.7196dB
	Test Site : OATS-7	30 MHz ~200 MHz	±3.6570dB
		200 MHz ~1000 MHz	±2.9825dB

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

Consistent with industry standard (e.g. CISPR 22: 2009+A1: 2010, clause 11, Measurement Uncertainty) determining compliance with the limits shall be based on the results of the compliance measurement. Consequently the measured emissions being less than the maximum allowed emission result in this being a compliant test or passing test.

The acceptable measurement uncertainty value without requiring revision of the compliance statement is based on conducted and radiated emissions being less than  $U_{CISPR}$  which is 3.6dB and 5.2dB respectively. CCS values (called  $U_{Lab}$  in CISPR 16-4-2) is less than  $U_{CISPR}$  as shown in the table above. Therefore, MU need not be considered for compliance.



## 7 EMISSION TEST

### 7.1. CONDUCTED EMISSION MEASUREMENT

#### 7.1.1. LIMITS

**TEST STANDARD: EN 61000-6-4**

FREQUENCY (MHz)	Quasi-peak	Average
0.15 - 0.5	79	66
0.50 - 5.0	73	60
5.0 - 30.0	73	60

**NOTE:** 1. The lower limit shall apply at the transition frequencies.  
2. All emanations from digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

#### 7.1.2. TEST INSTRUMENTS

Conducted Emission room # 1				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
L.I.S.N.	SCHWARZBECK	NNLK 8130	8130124	AUG. 12, 2014
	Rohde & Schwarz	ESH 3-Z5	840062/021	SEP. 09, 2014
TEST RECEIVER	Rohde & Schwarz	ESCS 30	100348	AUG. 09, 2014
BNC COAXIAL CABLE	CCS	BNC50	11	NOV. 19, 2014
Test S/W	e-3 (5.04211c) R&S (2.27)			

**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 Request.



### **7.1.3. TEST PROCEDURES**

#### **Procedure of Preliminary Test for EN55011**

The EUT 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 CISPR 11 (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 15 cm non-conductive covering to insulate the EUT from the ground plane.

Support equipment, if needed, was placed as per CISPR 11.

All I/O cables were positioned to simulate typical actual usage as per CISPR 11.

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

All support equipment received power 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 worst configuration of EUT and cable of the above highest emission level 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. If EUT emission level was less -2dB to the Average limit in Q.P. mode, then the emission signal was re-checked using an Average detector.

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



### **Procedure of Preliminary Test for EN61000-6-4**

The EUT 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 CISPR 16-2-1, 7.4.1 (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 15 cm non-conductive covering to insulate the EUT from the ground plane.

Support equipment, if needed, was placed as per CISPR 16-2-1, 7.4.1.

All I/O cables were positioned to simulate typical actual usage as per CISPR 16-2-1, 7.4.1.

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

All support equipment received power 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 level were recorded for reference of the final test.

### **Procedure of Final Test**

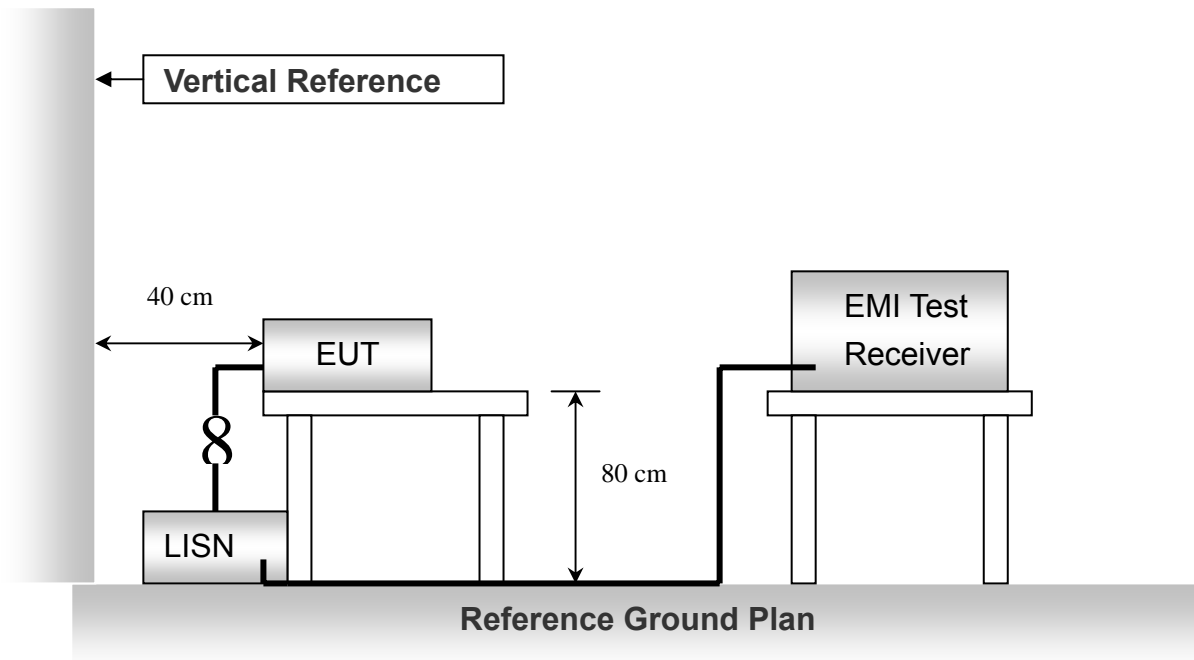
EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.

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

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

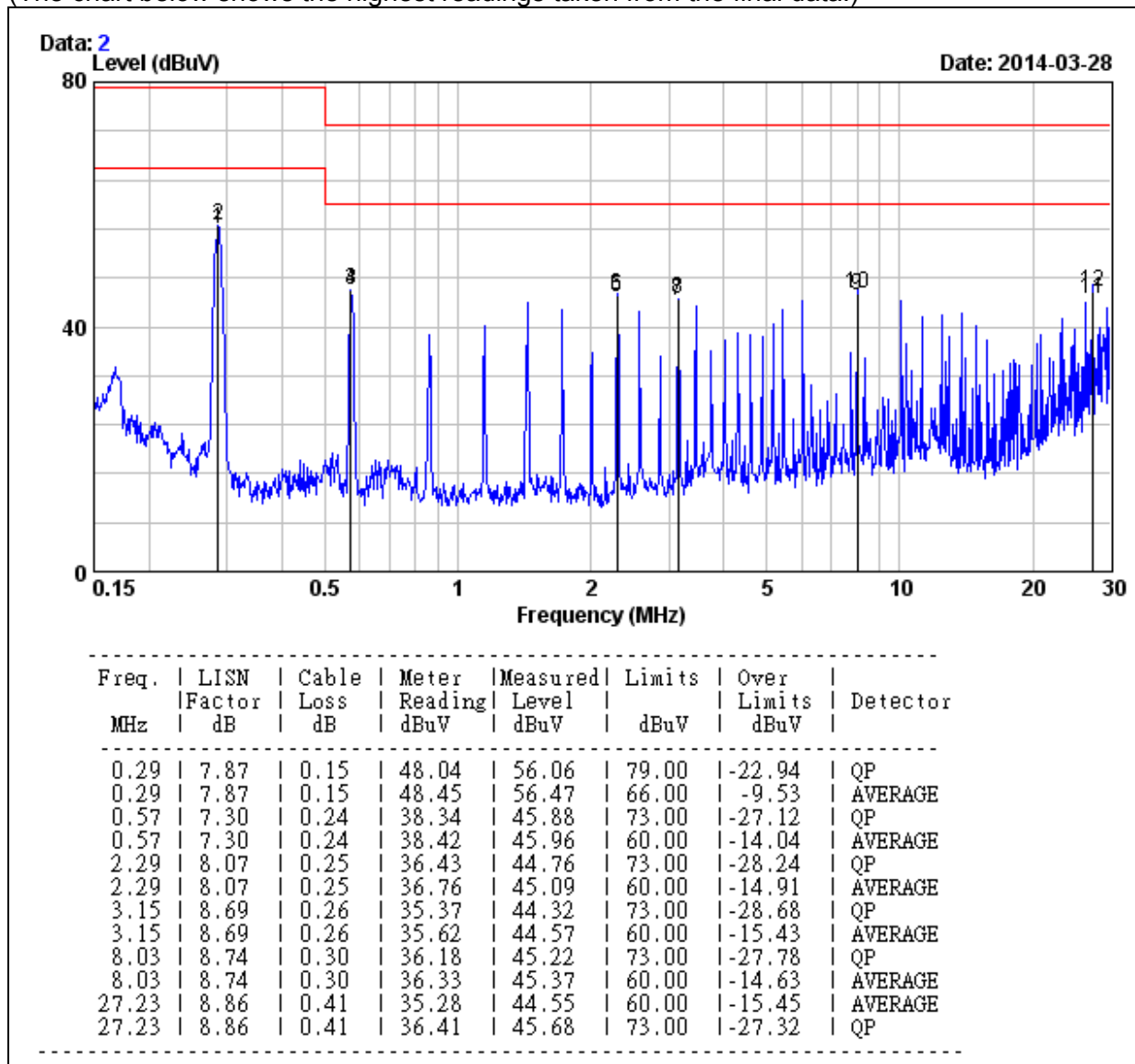


### 7.1.6. TEST RESULTS

Model No.	TMDC 20-2412	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full Load
Tested by	Sam Shen		

#### LINE

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



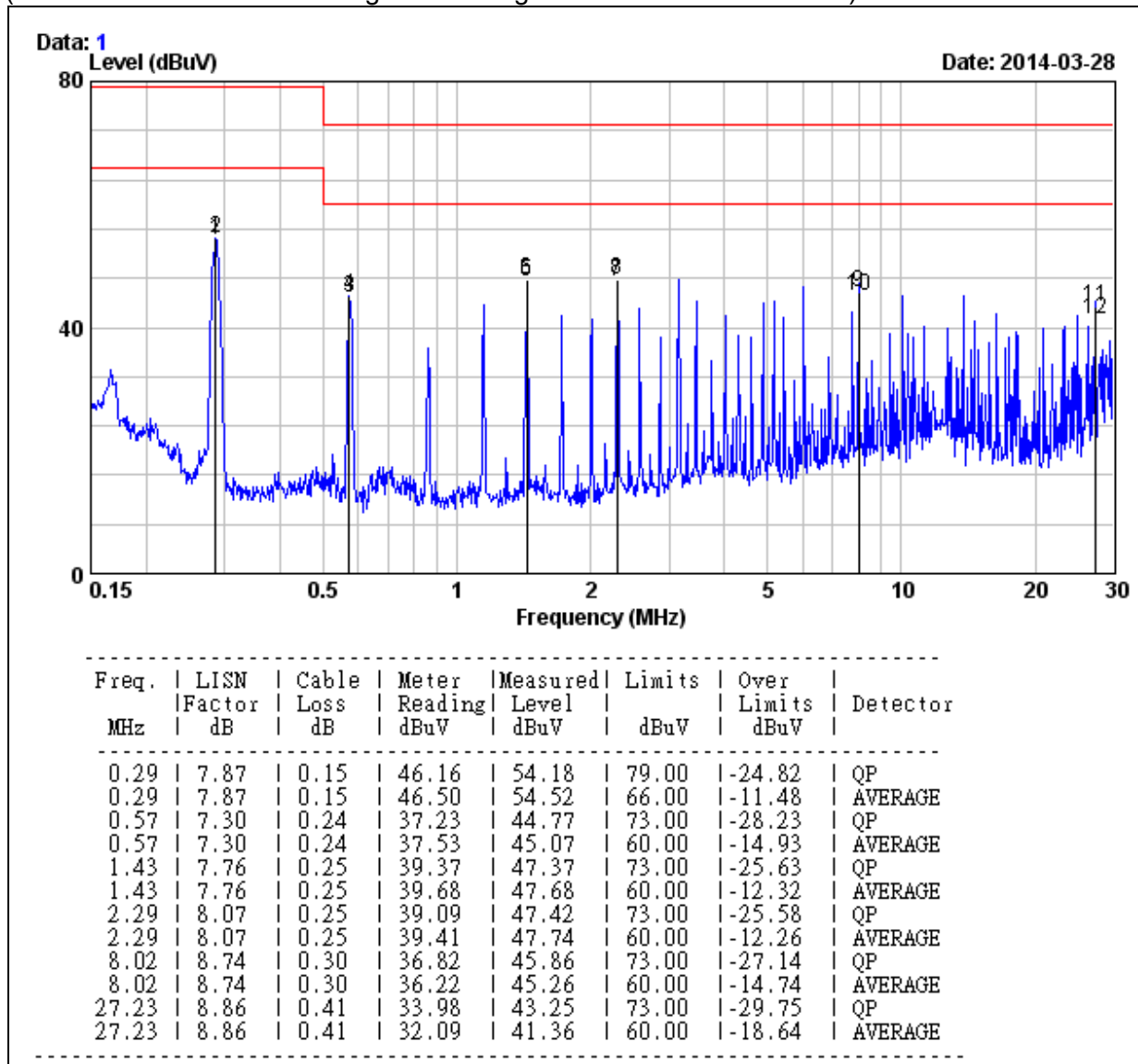
Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)  
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-2412	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full Load
Tested by	Sam Shen		

## NEUTRAL

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

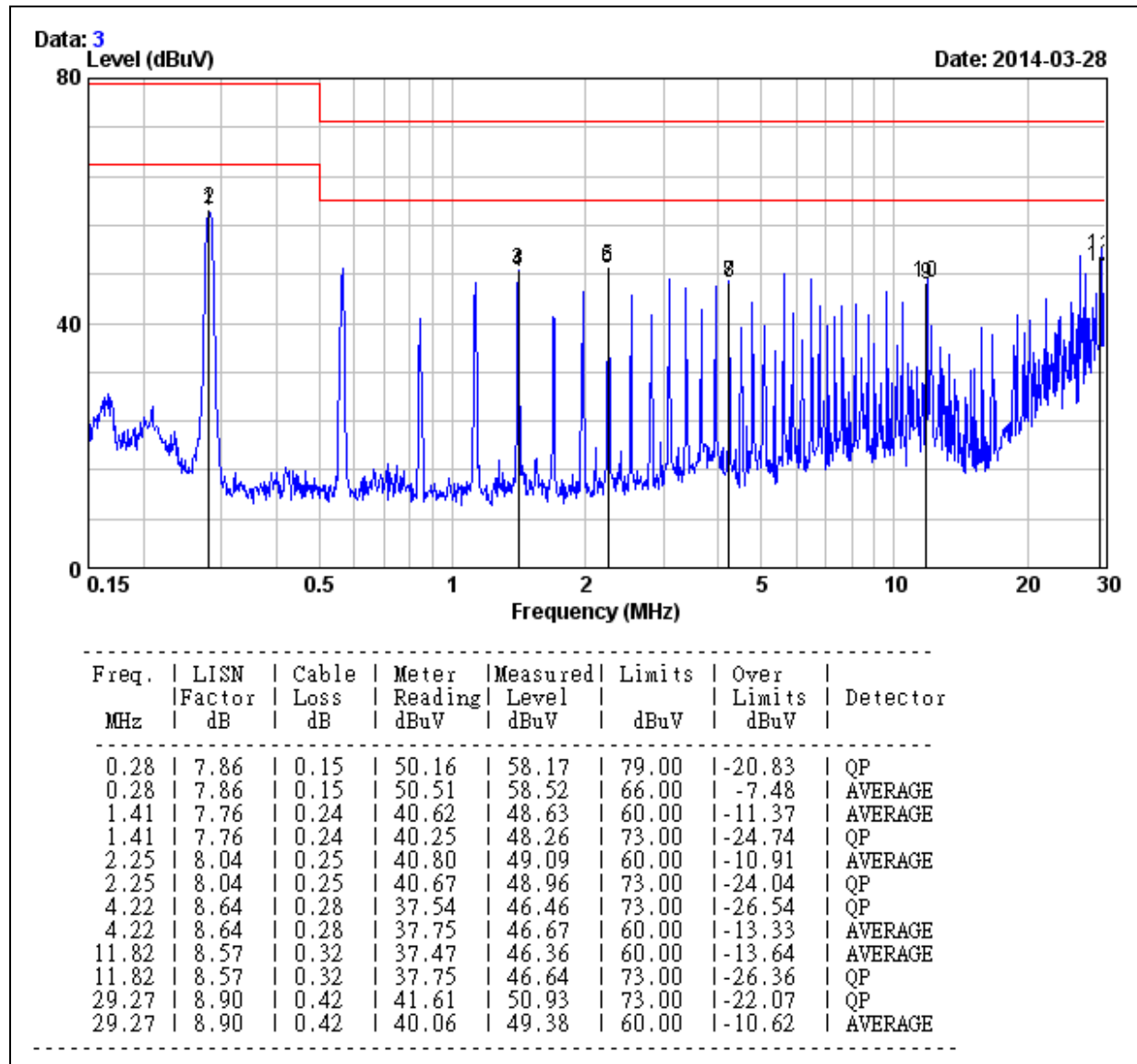


- Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)  
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-2415	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by	Sam Shen		

LINE



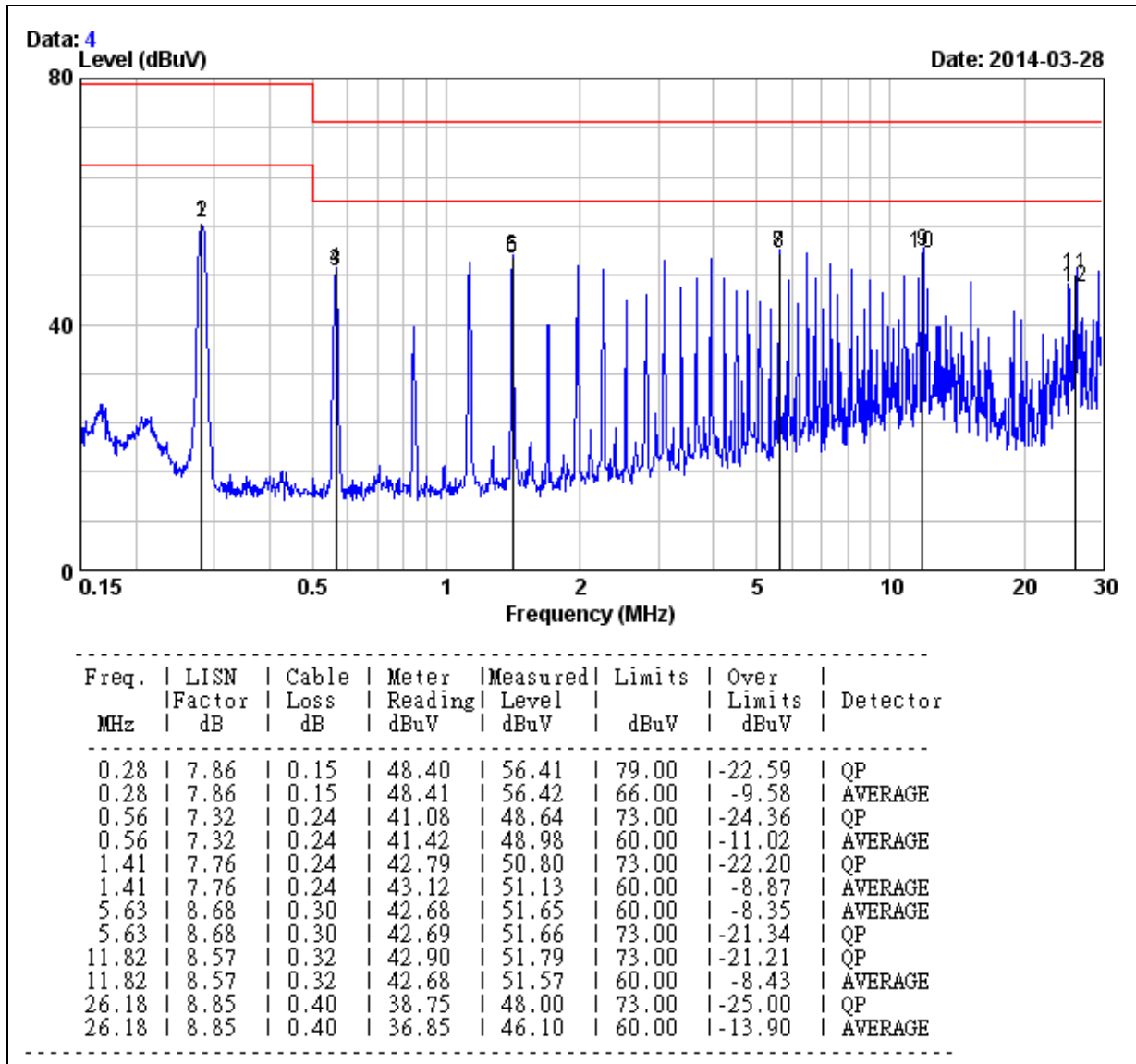
Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)

2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-2415	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by:	Sam Shen		

NEUTRAL

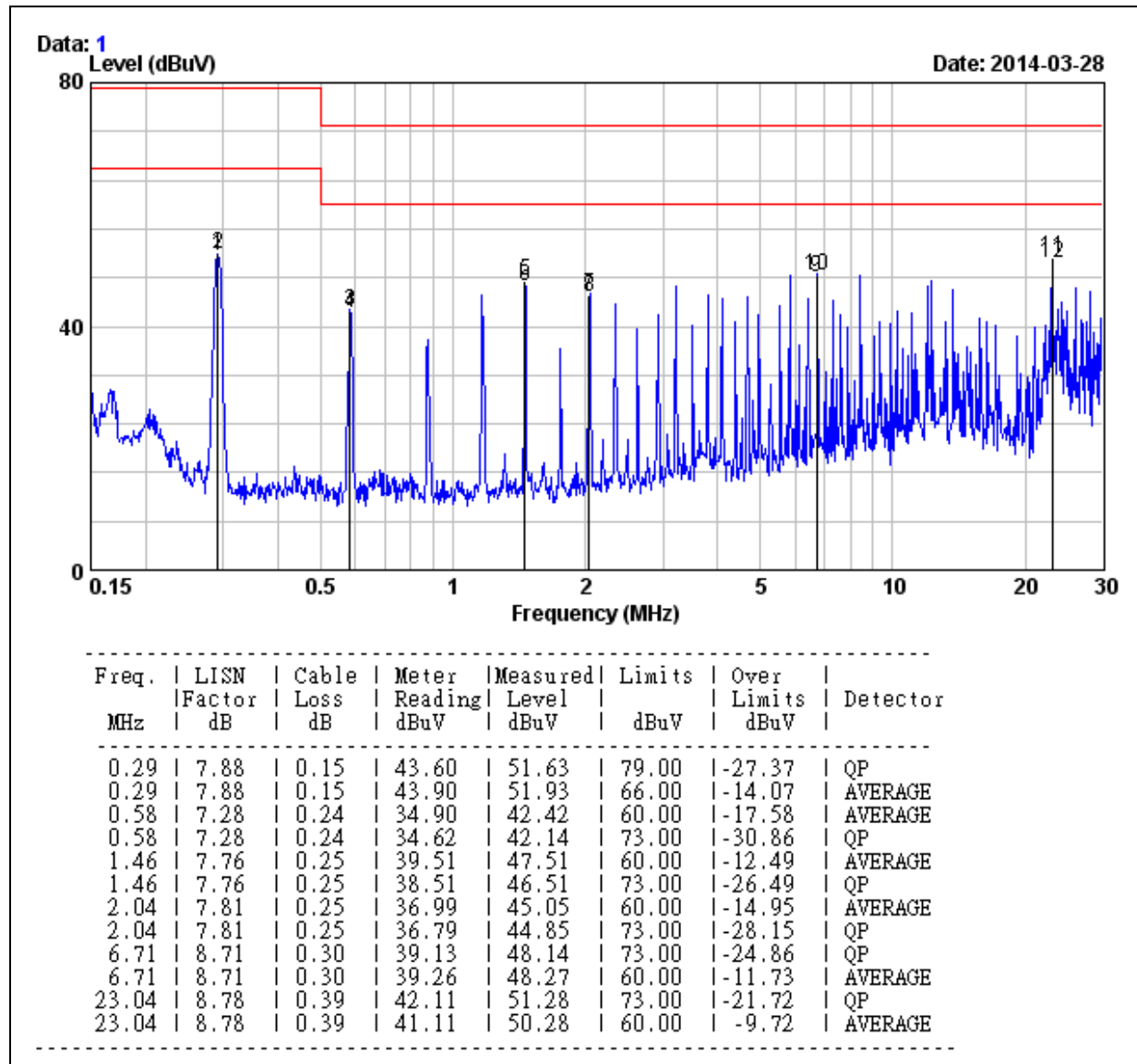


- Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)  
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-2418	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by	Sam Shen		

LINE

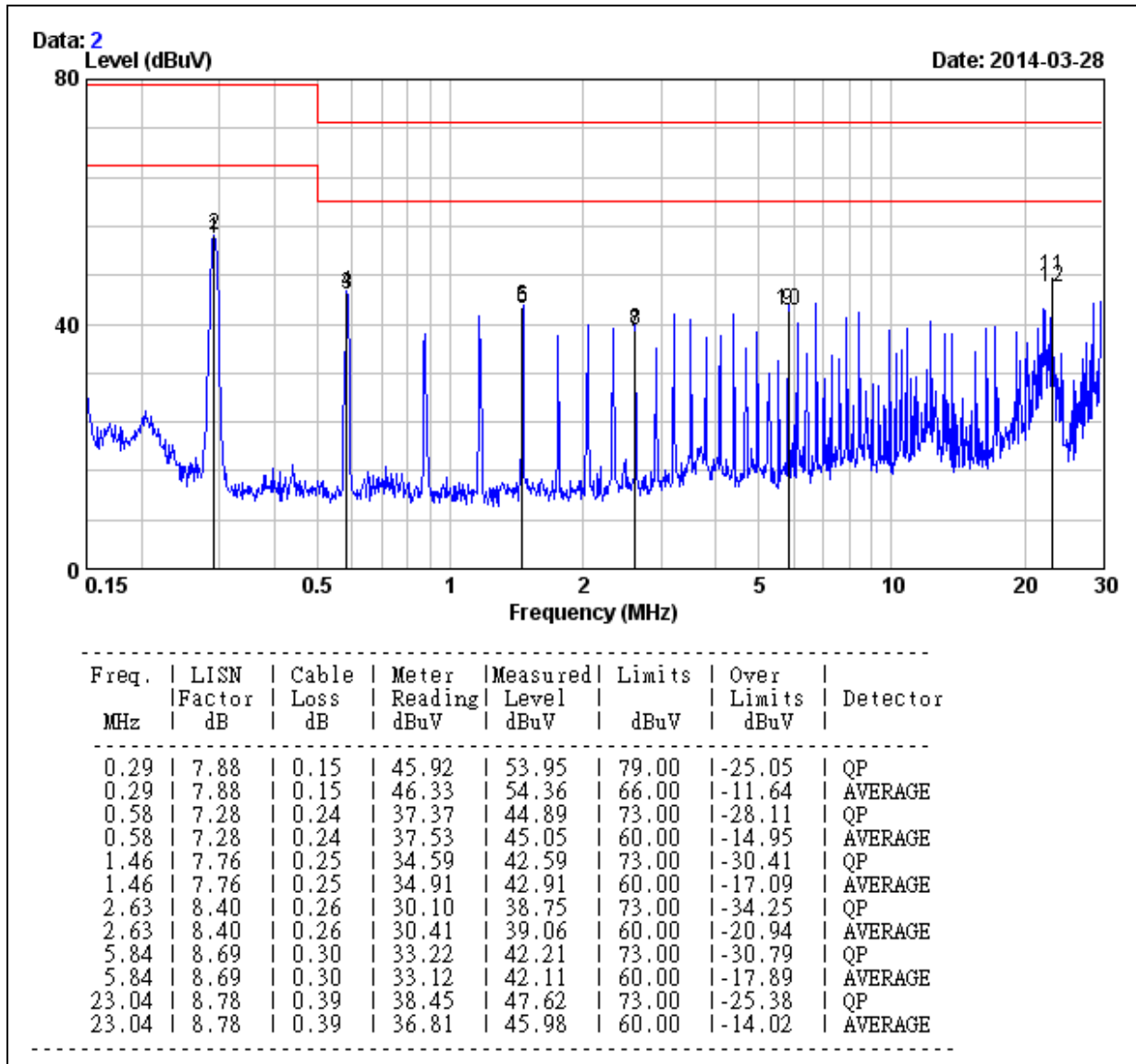


- Note:
1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
  2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-2418	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by:	Sam Shen		

NEUTRAL

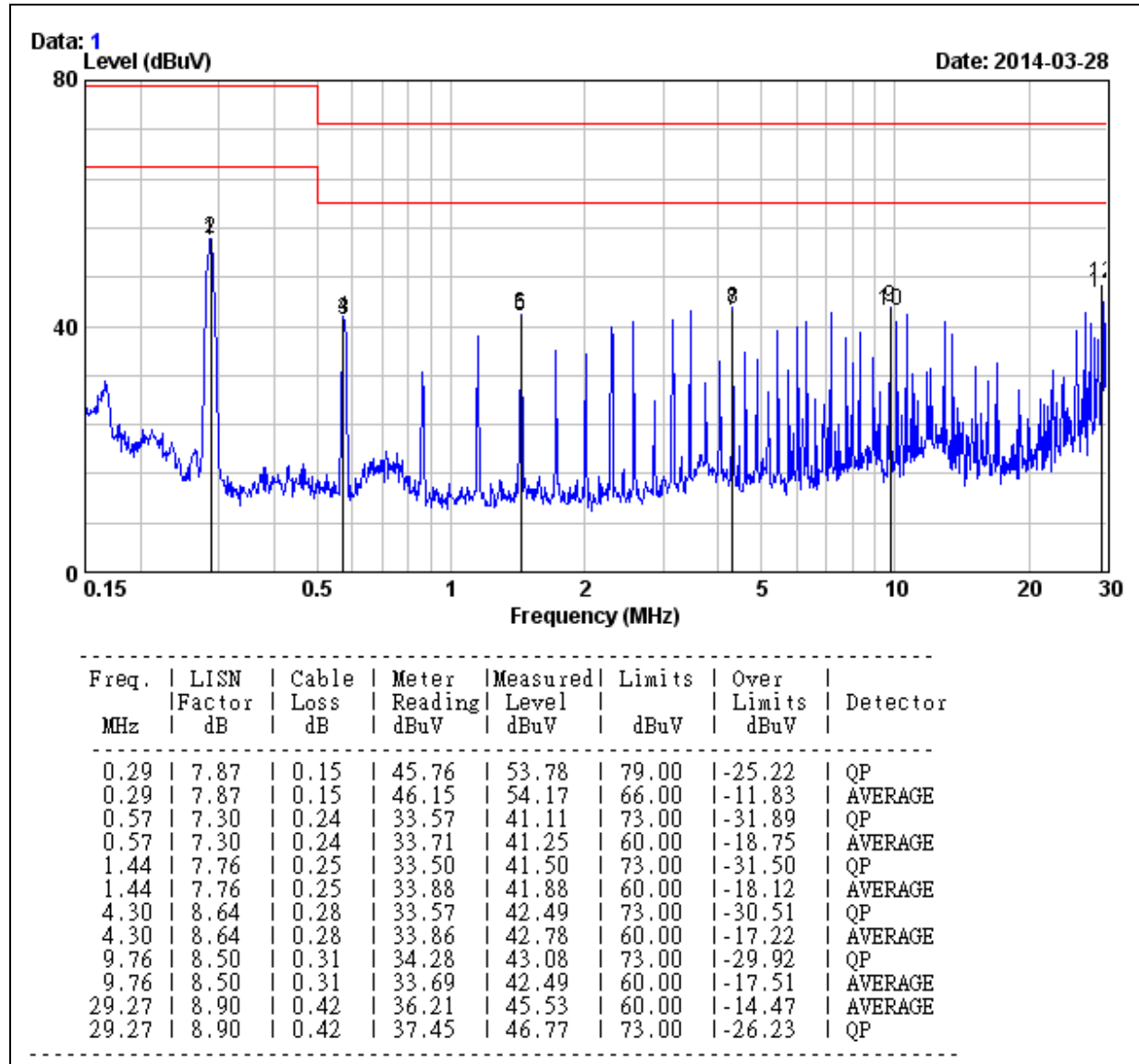


- Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)  
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-2411	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by	Sam Shen		

LINE



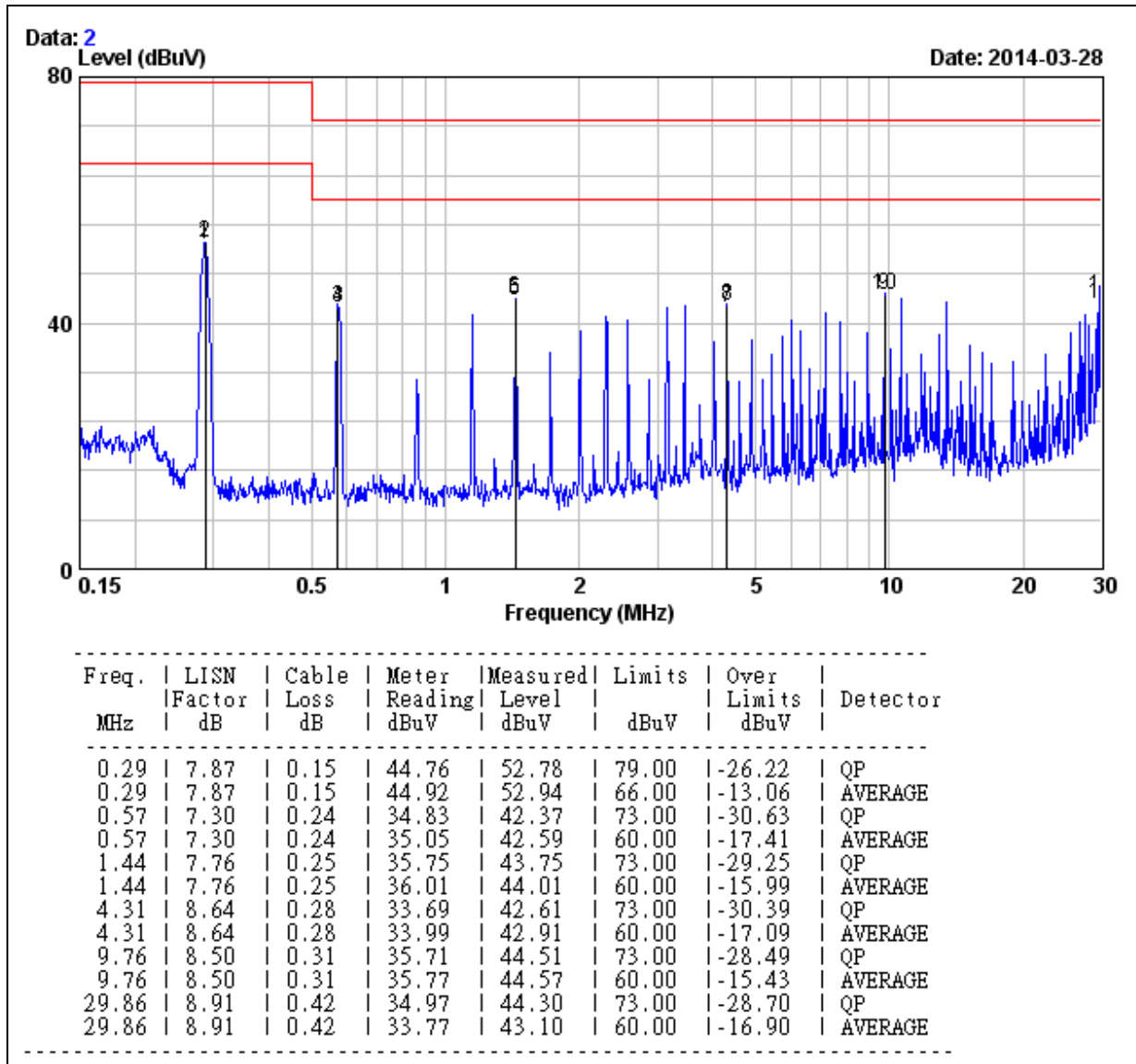
Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)

2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-2411	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by:	Sam Shen		

NEUTRAL

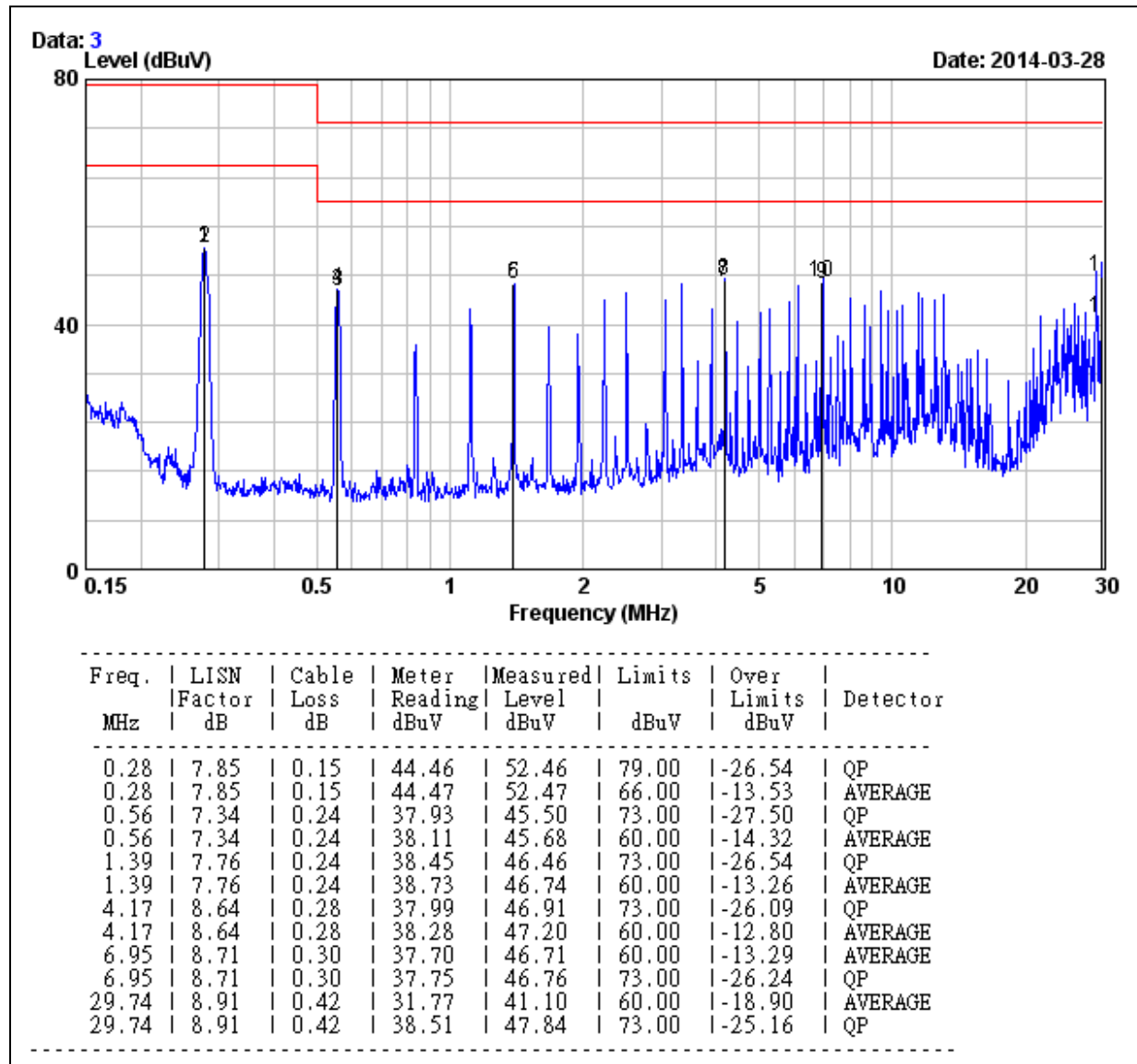


- Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)  
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-4812	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by	Sam Shen		

LINE

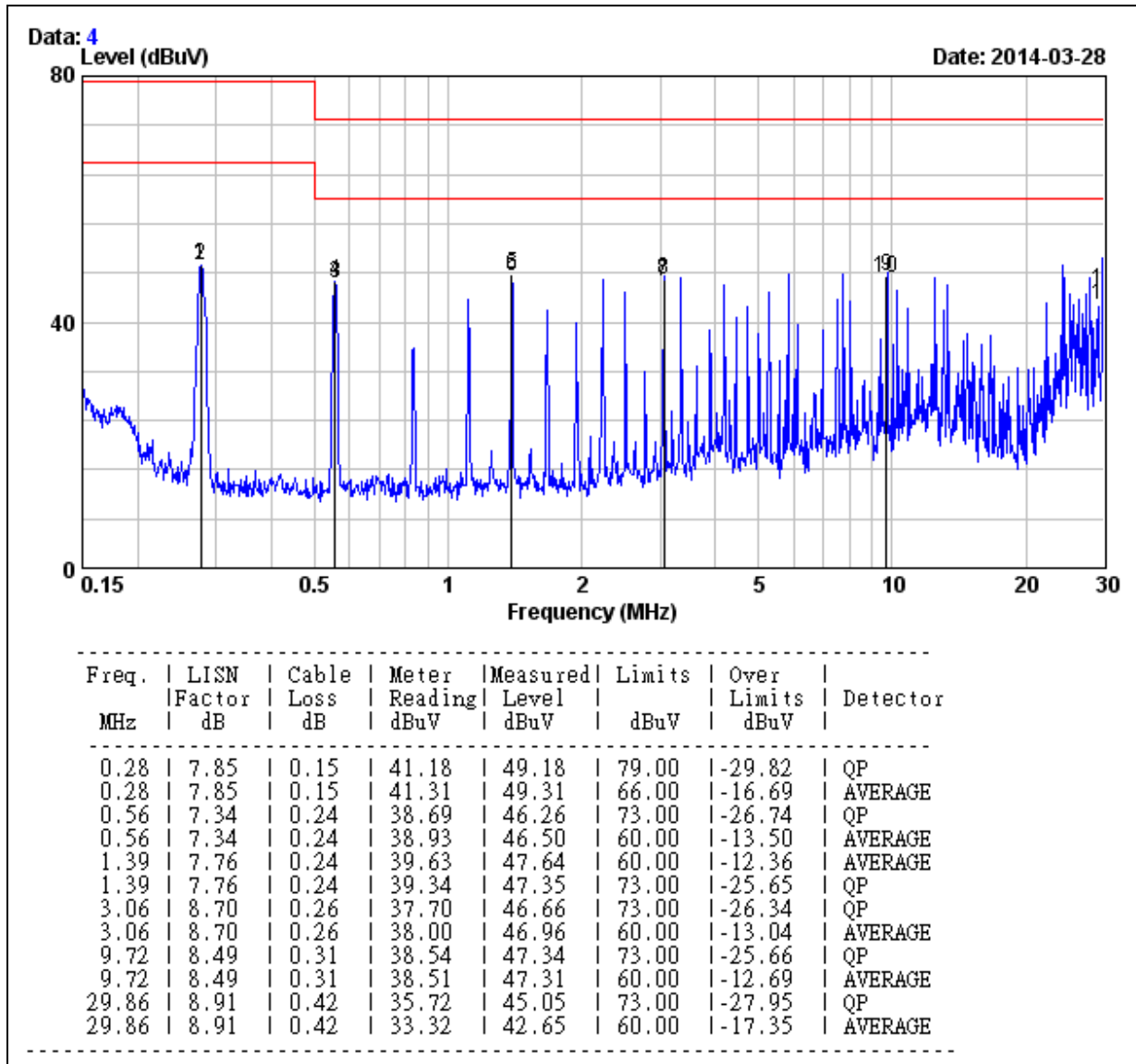


Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)  
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-4812	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by:	Sam Shen		

NEUTRAL

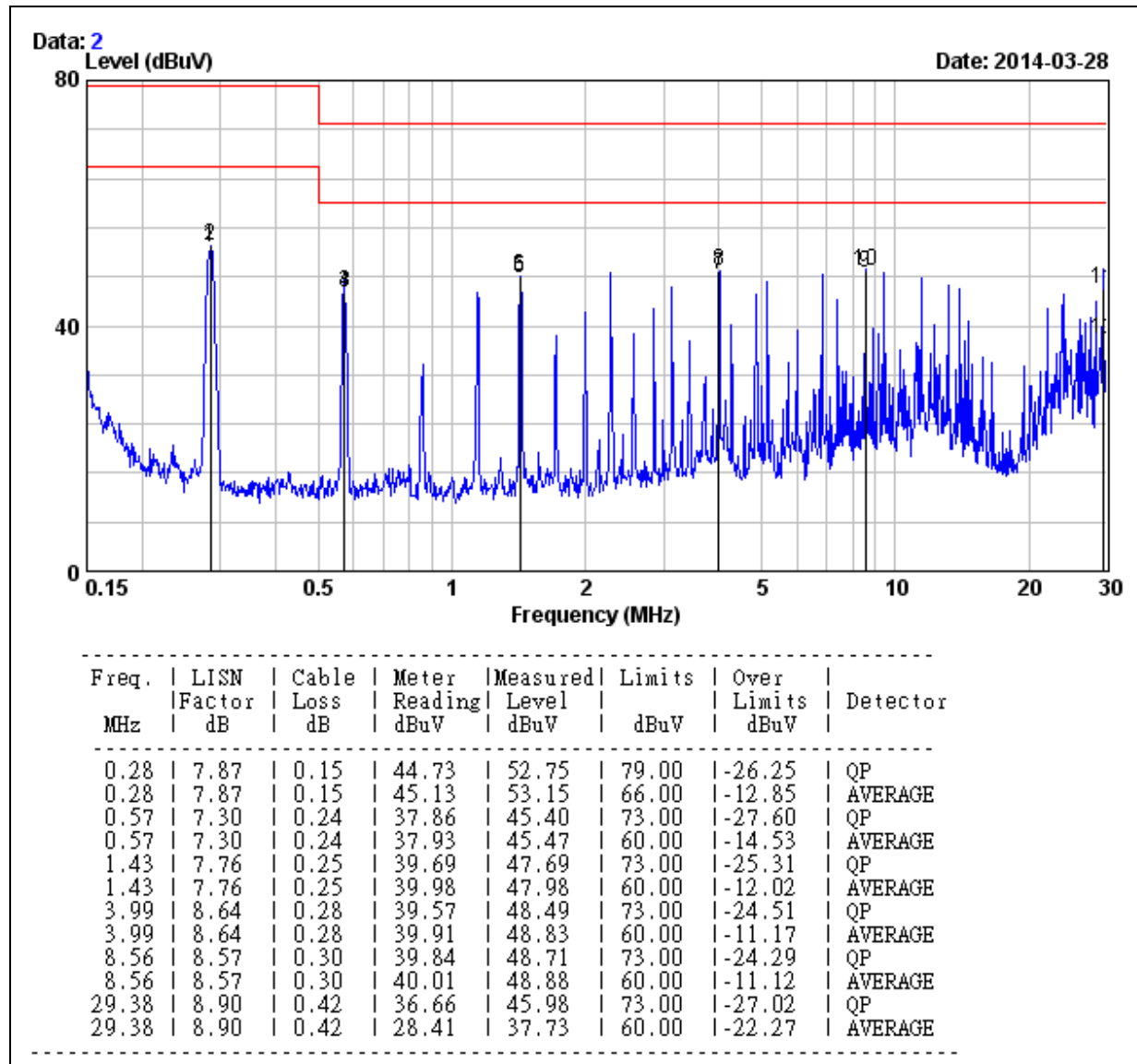


- Note:
1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
  2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-4815	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by	Sam Shen		

LINE

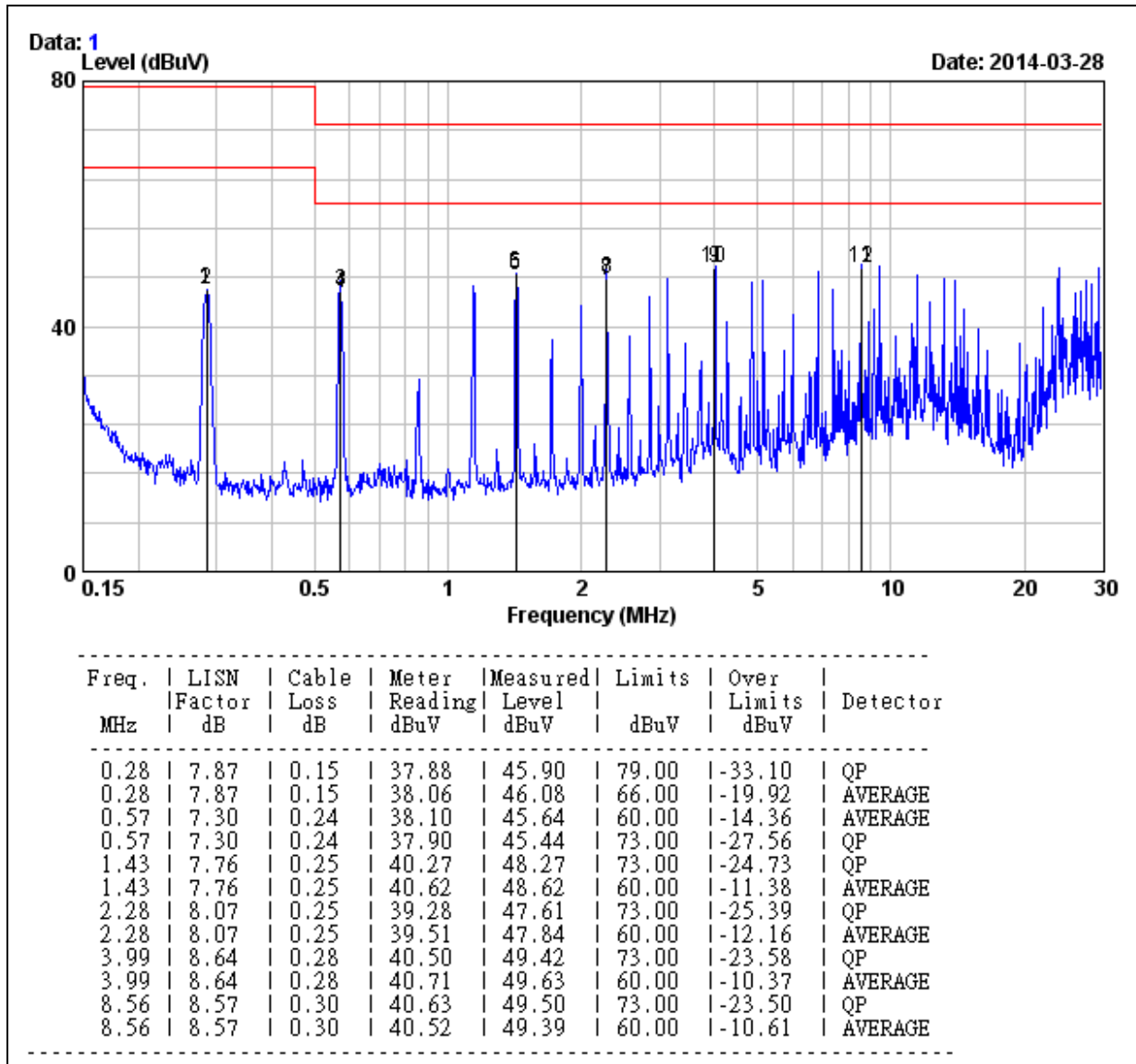


- Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)  
2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-4815	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by:	Sam Shen		

NEUTRAL



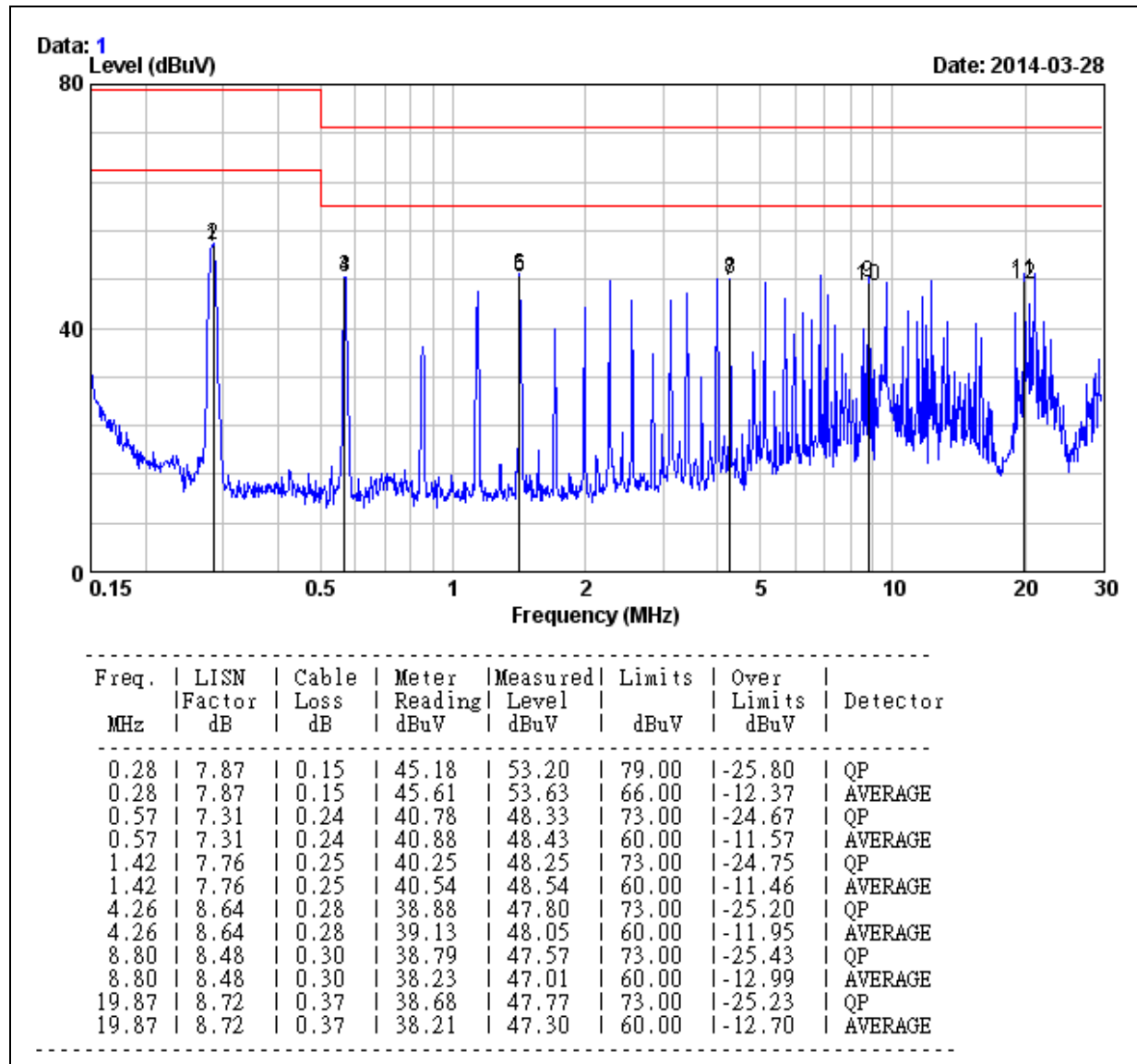
Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)

2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-4818	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by	Sam Shen		

LINE



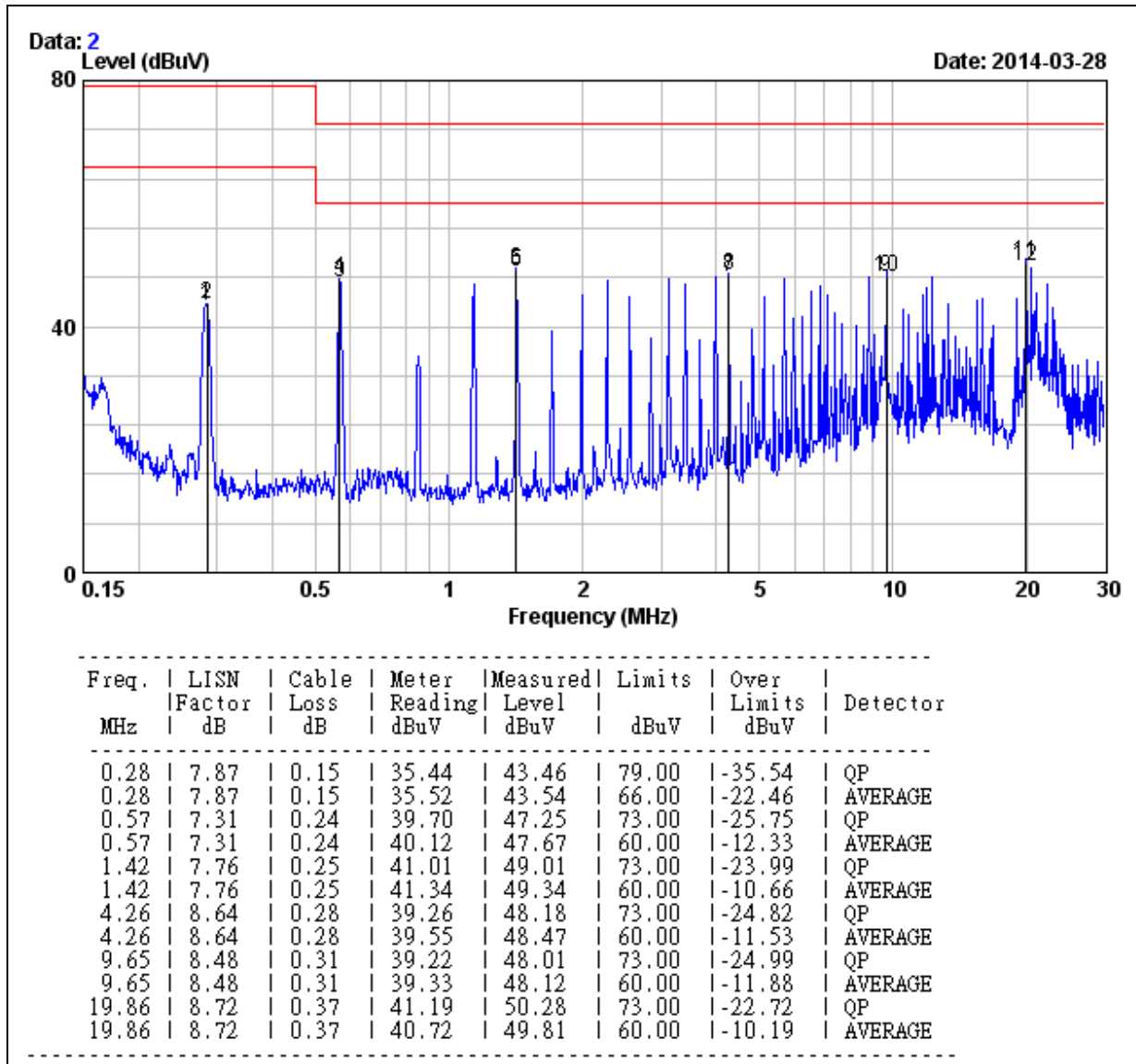
Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)

2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-4818	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by:	Sam Shen		

NEUTRAL



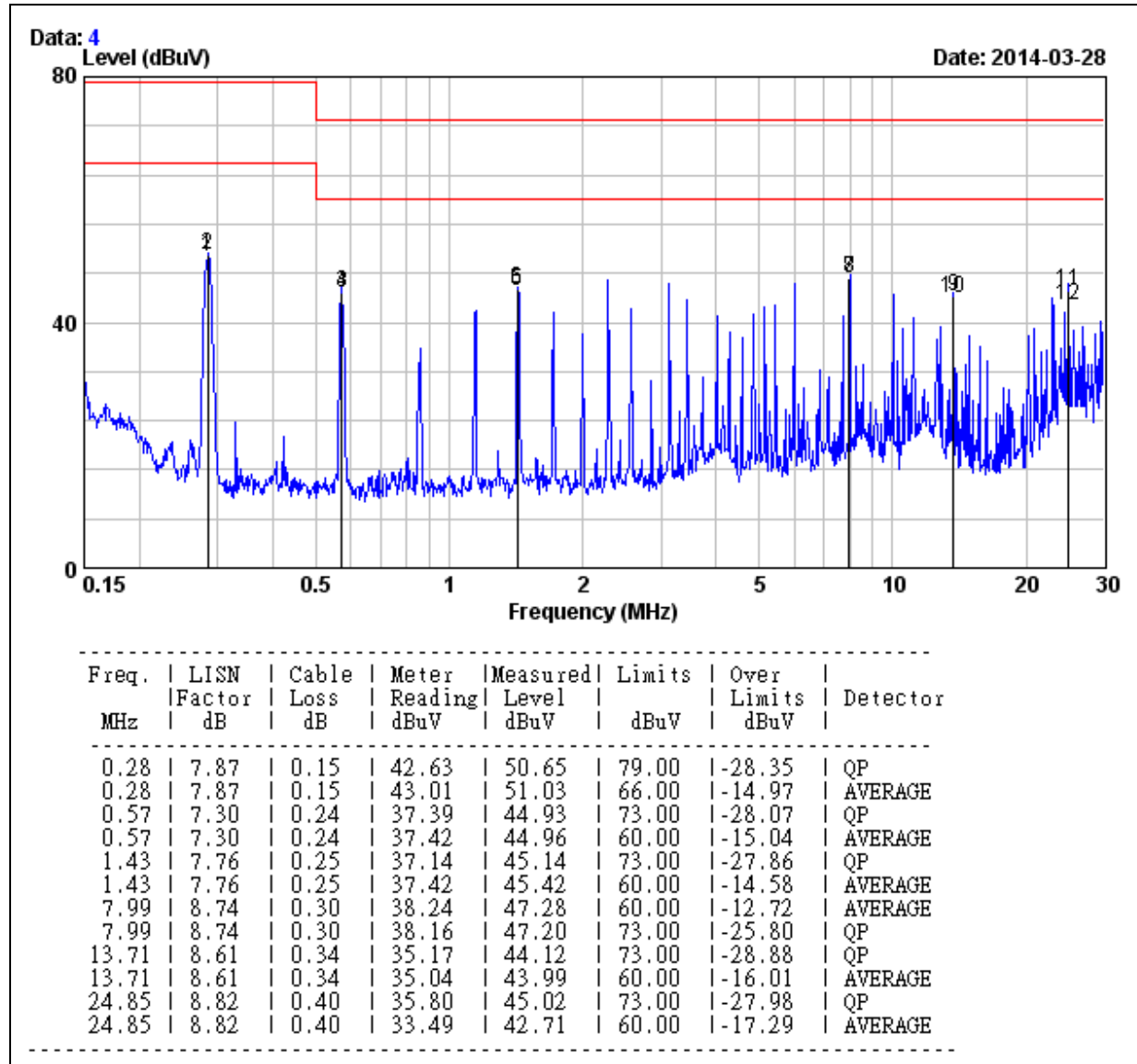
Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)

2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-4811	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by	Sam Shen		

LINE



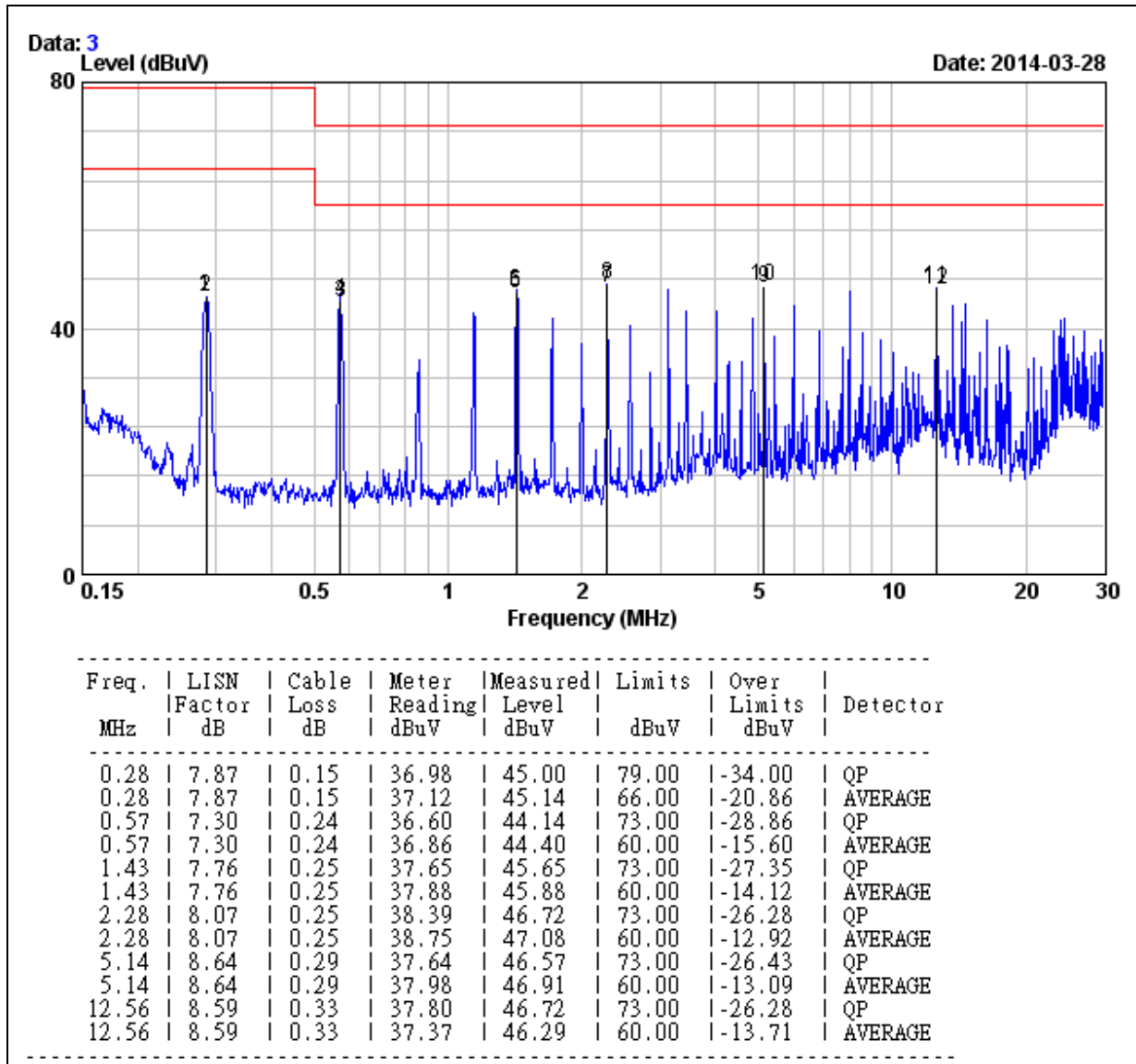
Note: 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)

2. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Model No.	TMDC 20-4811	Resolution Bandwidth	9 kHz
Environmental Conditions	23.1°C, 60% RH	Test Mode	Full load
Tested by:	Sam Shen		

NEUTRAL



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. CONDUCTED EMISSION MEASUREMENT AT TELECOMMUNICATION PORTS

### 7.2.1. LIMITS

#### TEST STANDARD: EN 61000-6-4

FREQUENCY (MHz)	Voltage Limit (dBuV)		Current Limit (dBuA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.5	97 ~ 87	84 ~ 74	53 ~ 43	40 ~ 30
0.5 ~ 30.0	87	74	43	30

**NOTE:** 1. At transitional frequencies the lower limit applies.  
2. The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.  
3. The current and voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which presents a common mode (asymmetric mode) impedance of 150Ω to the telecommunication port under test (conversion factor is  $20 \log_{10} 150 / 1 = 44$  dB).

### 7.2.2. TEST INSTRUMENTS

Conducted Emission room				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
L.I.S.N.	SCHWARZBECK	NNLK 8130	8130124	AUG. 12, 2014
TEST RECEIVER	Rohde & Schwarz	ESCS 30	100348	SEP. 09, 2014
BNC COAXIAL CABLE	CCS	BNC50	11	AUG. 09, 2014
T-ISN	SCHAFFNER	ISN PLC-25-30	23391	NOV. 19, 2014
ISN	FCC	F-071115-1057-1-09	111130	SEP. 10, 2014
Test S/W	e-3 (5.04211c) R&S (2.27)			

**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 Request.



### 7.2.3. TEST PROCEDURE

Selecting ISN for unscreened cable or a current probe for screened cable to take measurement.

The port of the EUT was connected to the remote side support equipment through the ISN/Current Probe and communication in normal condition.

Making a overall range scan by using the test receiver controlled by controller and record at least six highest emissions for showing in the test report.

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.

In case of measuring on the screened cable, the current limit shall be applied; otherwise the voltage limit should be applied.

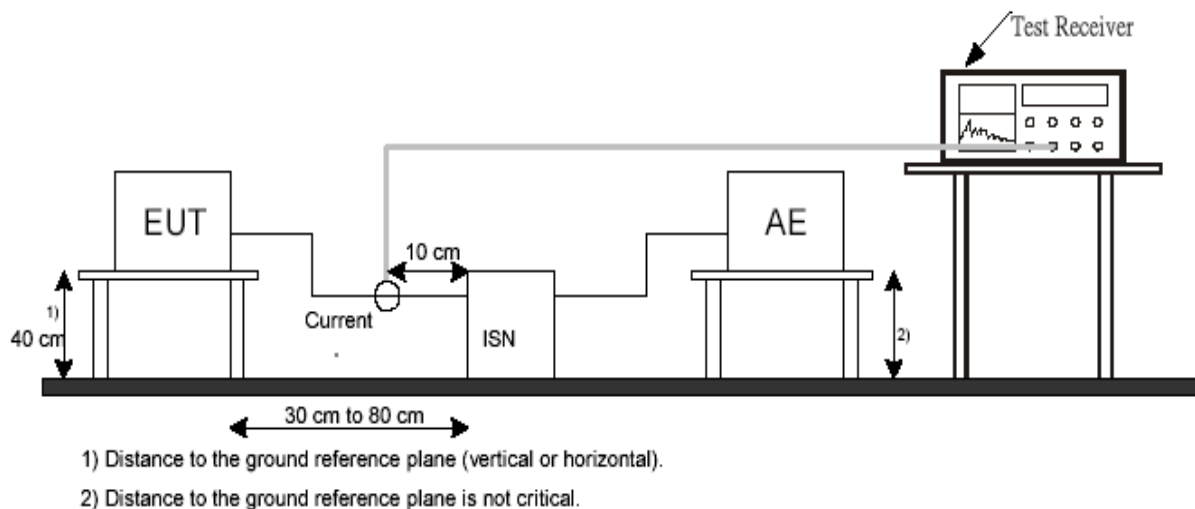
The following test modes was scanned during the preliminary test:

**N/A**

After the preliminary scan, we found the following test mode(s) producing the highest emission level and test data of the worst case was recorded.

**N/A**

### 7.2.4. TEST SETUP

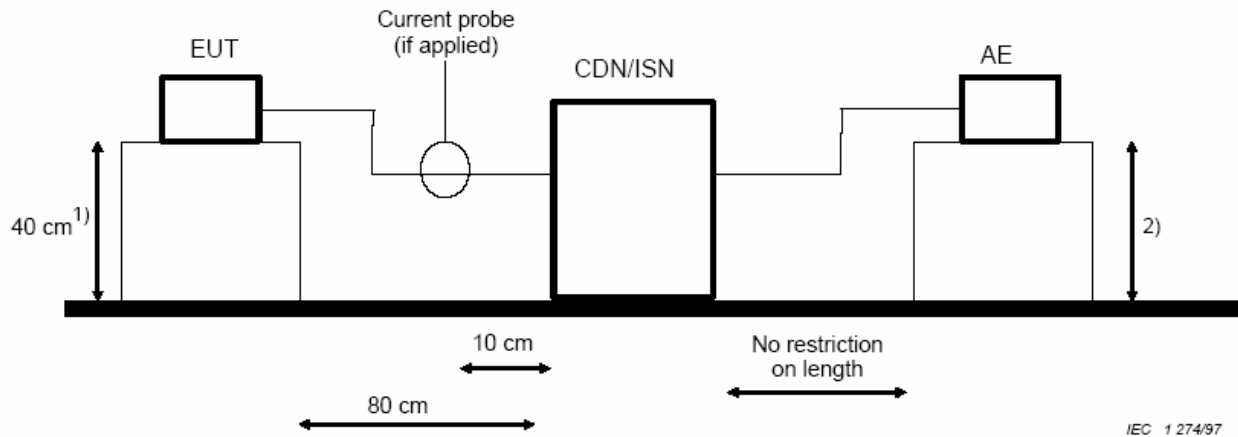


For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.



## TEST SETUP

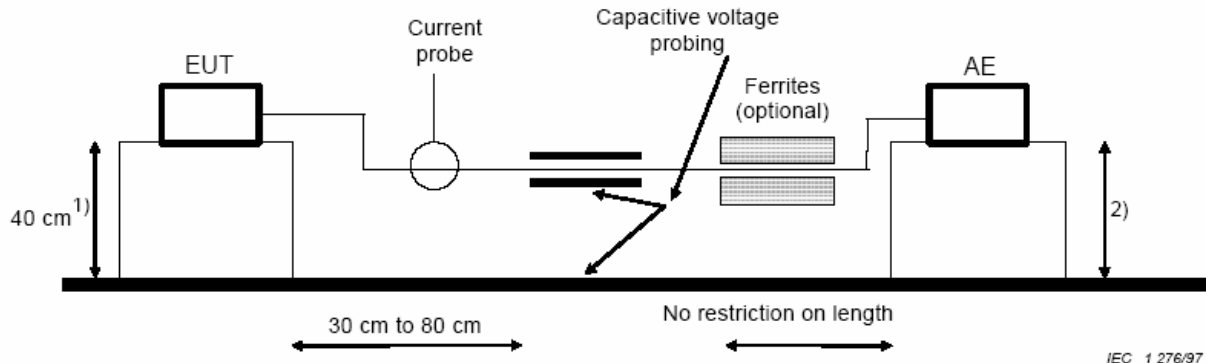
### For ISN & Current Probe:



AE = Associated equipment  
EUT = Equipment under test

- 1) Distance to the reference groundplane (vertical or horizontal).  
2) Distance to the reference groundplane is not critical.

### For Voltage & Current Probe:



AE = Associated equipment  
EUT = Equipment under test

- 1) Distance to the reference groundplane (vertical or horizontal).  
2) Distance to the reference groundplane is not critical.

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

**7.2.5. DATA SAMPLE**

Freq. (MHz)	LISN Factor dB	Cable Loss dB	Meter Reading dBuV	Measured Level dBuV	Limits dBuV	Over Limits dBuV	Detector
x.xx	9.71	0.02	37.17	46.9	66	-19.10	QP

Freq. = Emission frequency in MHz  
LISN Factor = Insertion loss of ISN and Pulse Limiter  
Cable loss = Insertion loss of Cable (ISN 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**

Over Limit (dB) = Level (dBuV) – Limit (dBuV)

**7.2.6. TEST RESULTS**

<b>Model No.</b>	N/A	<b>6dB Bandwidth</b>	N/A
<b>Environmental Conditions</b>	N/A	<b>Test Mode</b>	N/A
<b>Tested by</b>	N/A		

※ No applicable, the EUT doesn't have LAN Port or Modem port.



### 7.3. RADIATED EMISSION MEASUREMENT

#### 7.3.1. LIMITS

**TEST STANDARD: EN 61000-6-4**

FREQUENCY (MHz)	dBuV/m (At 10m)
30 ~ 230	40
230 ~ 1000	47

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

#### 7.3.2. TEST INSTRUMENTS

Open Area Test Site # 5				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
TEST RECEIVER	Rohde & Schwarz	ESCS 30	100294	JUN. 24, 2014
TYPE N COAXIAL CABLE	SUHNER	RG_214_U/2X	5	NOV. 18, 2014
BILOG ANTENNA	Sunol sciences	JB1	A070506-1	SEP. 11, 2014
Test Software	EMI e-3 / AUDIX (5.04211c)			

Open Area Test Site # 7				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
TEST RECEIVER	Rohde & Schwarz	ESCS 30	100343	FEB. 26, 2015
EMI Test Receiver	Rohde & Schwarz	ESCI3	101336	JAN. 17, 2015
TYPE N COAXIAL CABLE	SUHNER	RG_214_U/2X	7	NOV. 18, 2014
BILOG ANTENNA	Sunol sciences	JB1	A013105-1	SEP. 11, 2014
Test Software	EMI e-3 / AUDIX (5.04211c)			

**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 Request.



### **7.3.3. 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 15 cm non-conductive covering to insulate the EUT from the ground plane.

Support equipment, if needed, was placed as per CISPR 16-2-3.

All I/O cables were positioned to simulate typical usage as per CISPR 16-2-3.

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

The antenna was placed at 10 meter away from the EUT as stated in CISPR 16-2-3. 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.

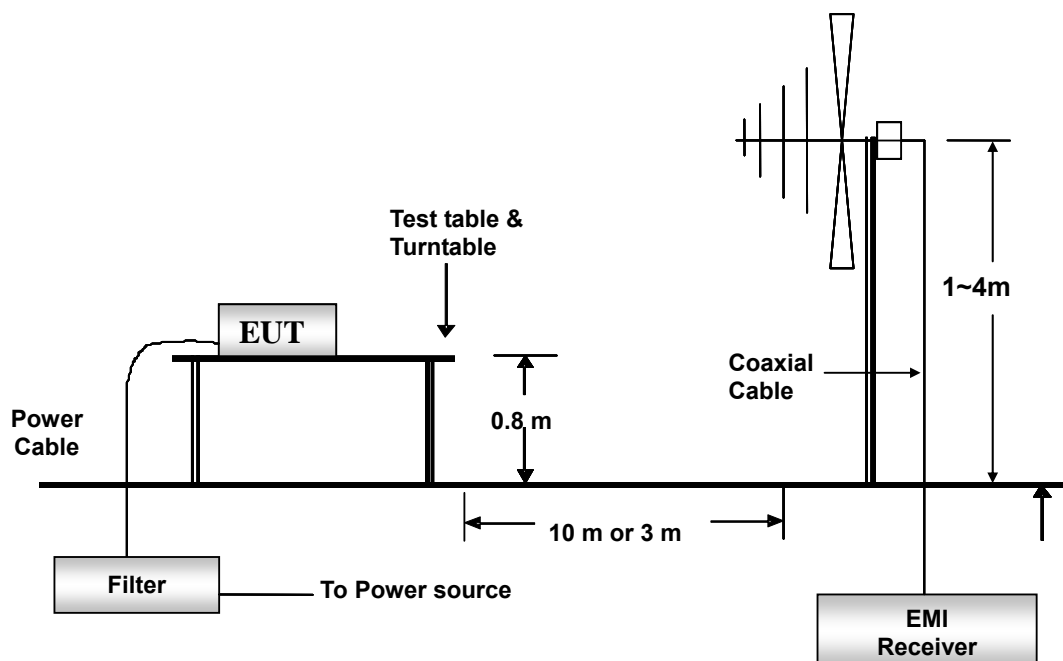
The Analyzer / Receiver scanned from 30MHz to 1000MHz. Emissions were scanned and measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading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



#### 7.3.4. TEST SETUP



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

#### 7.3.5. 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 - Amplifier Gain
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

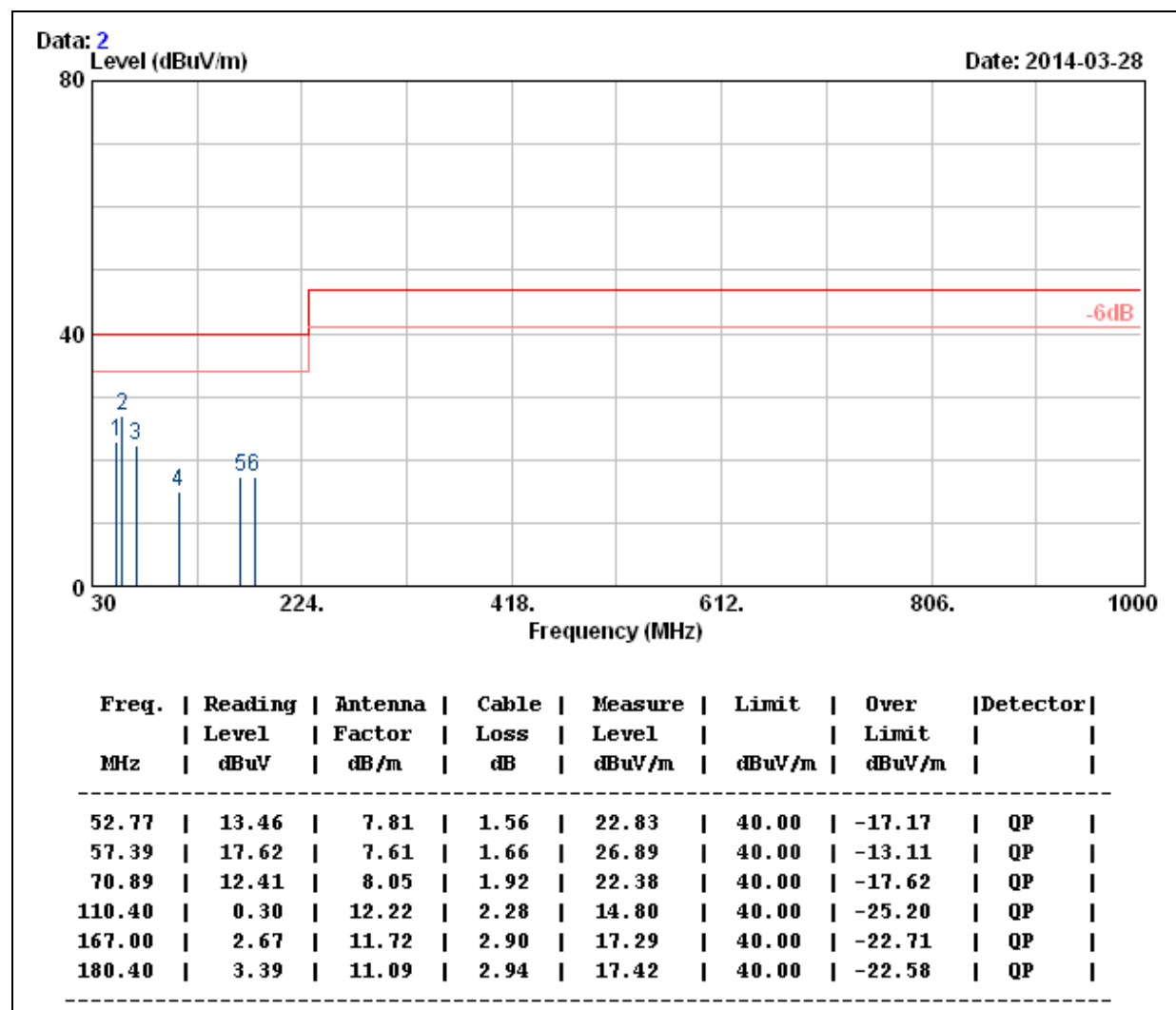
Over limit (dBuV/m) = Result (dBuV/m) – Limit (dBuV/m)



### 7.3.6. TEST RESULTS

Model No.	TMDC 20-2412	Test Mode	Full Load
Environmental Conditions	25.9 deg, 57% RH	6dB Bandwidth	120 kHz
Antenna Pole	Vertical	Antenna Distance	10m
Detector Function	Quasi-peak.	Tested by	Weici Lo

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



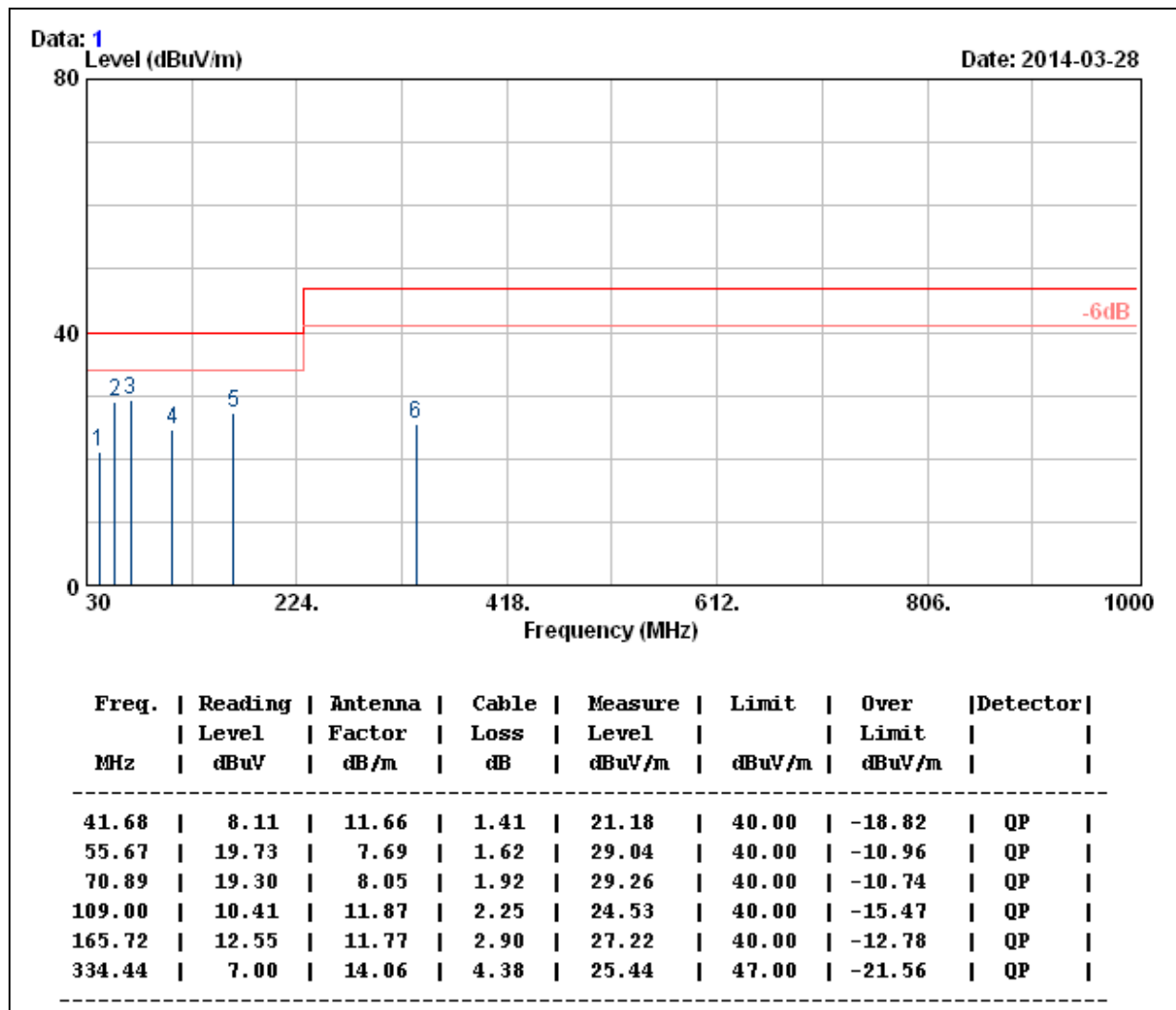
Note:

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



Model No.	TMDC 20-2412	Test Mode	Full Load
Environmental Conditions	25.9 deg, 57% RH	6dB Bandwidth	120 kHz
Antenna Pole	Horizontal	Antenna Distance	10m
Detector Function	Quasi-peak.	Tested by	Weici Lo

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

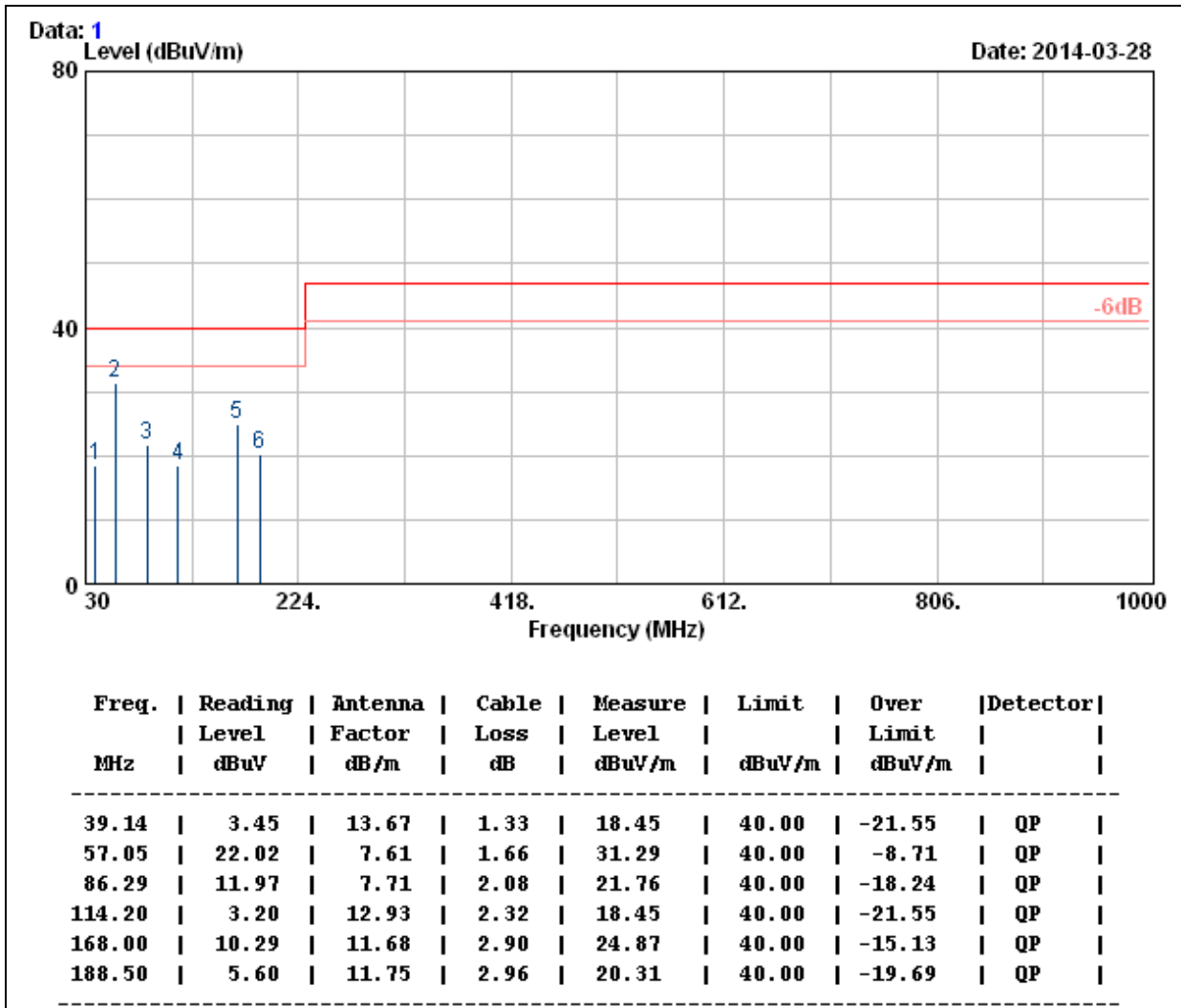


Note:

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



Model No.	TMDC 20-2415	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Vertical	Antenna Distance	10m
Detector Function:	Quasi-peak.	Tested By	Weici Lo

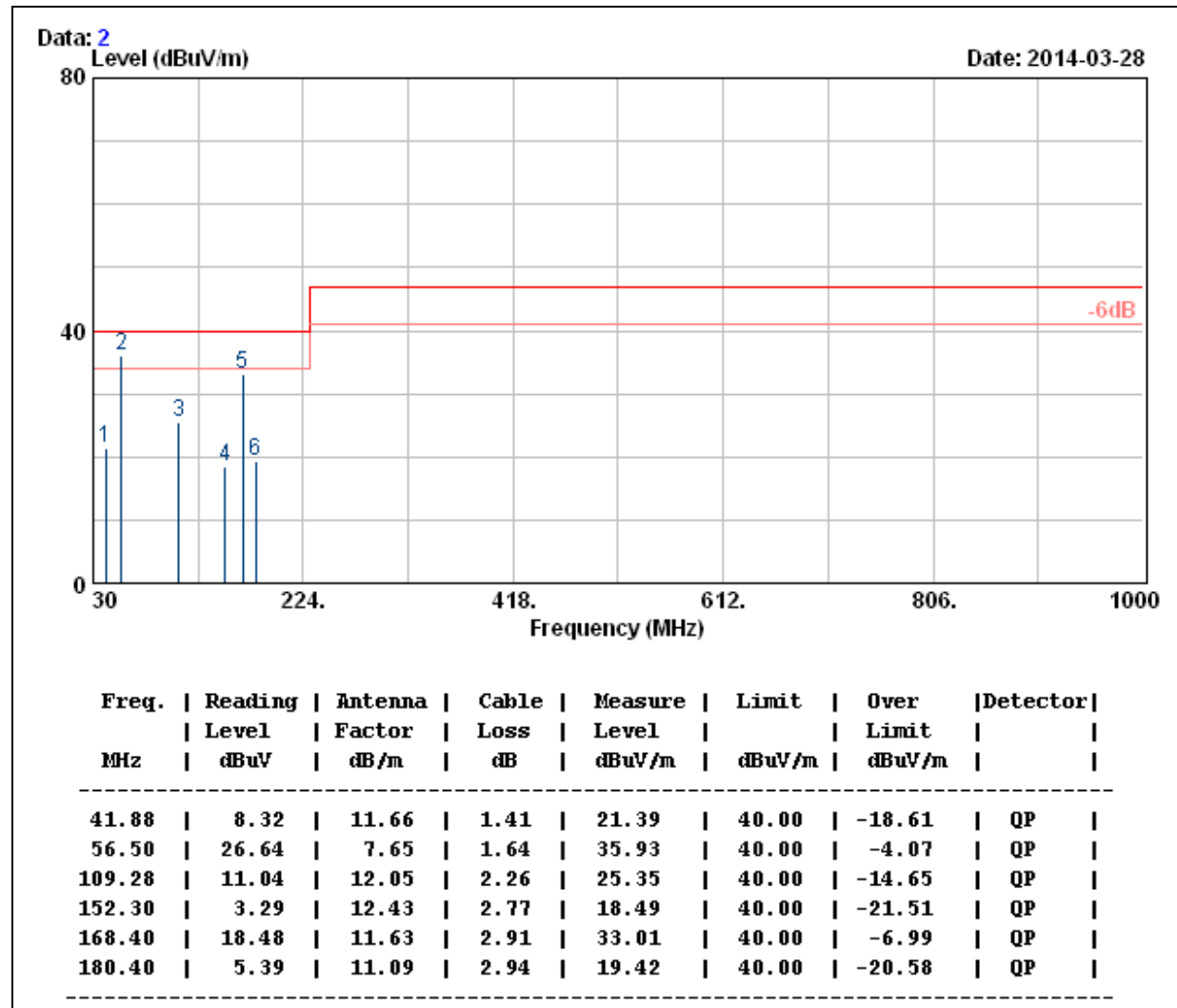


Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)

2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)



Model No.	TMDC 20-2415	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Horizontal	Antenna Distance	10m
Detector Function	Quasi-peak.	Tested By	Weici Lo

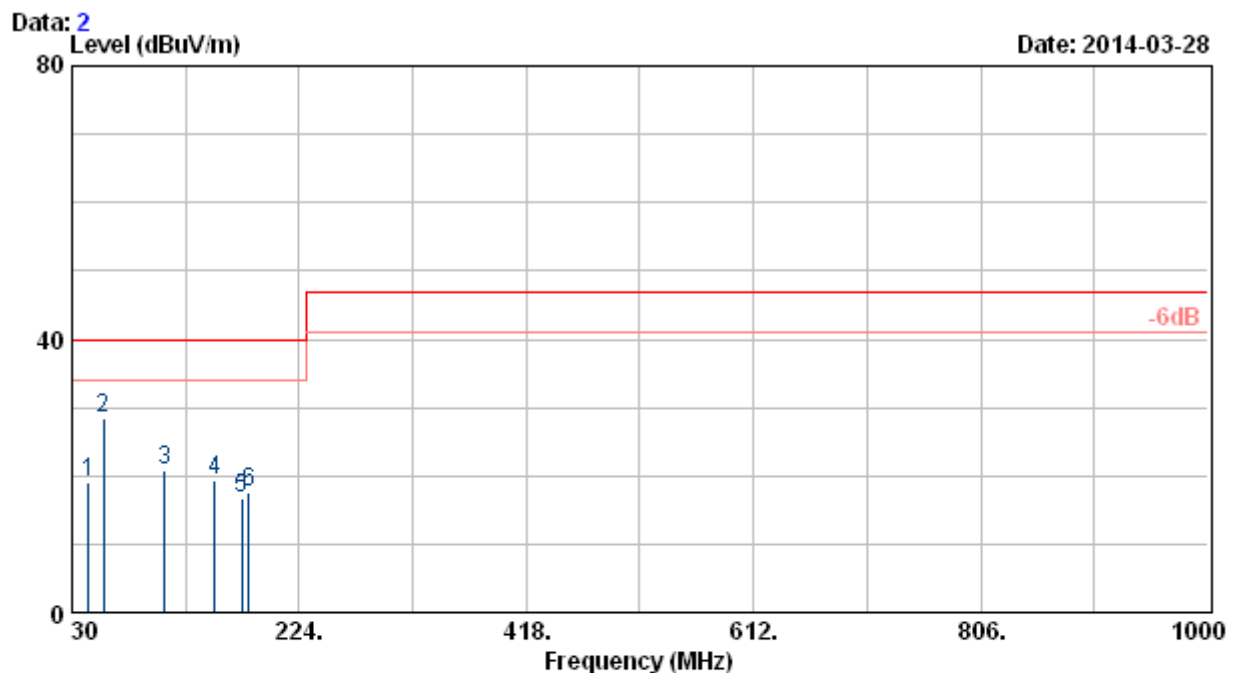


Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)

2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)



Model No.	TMDC 20-2418	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Vertical	Antenna Distance	10m
Detector Function:	Quasi-peak.	Tested By	Weici Lo



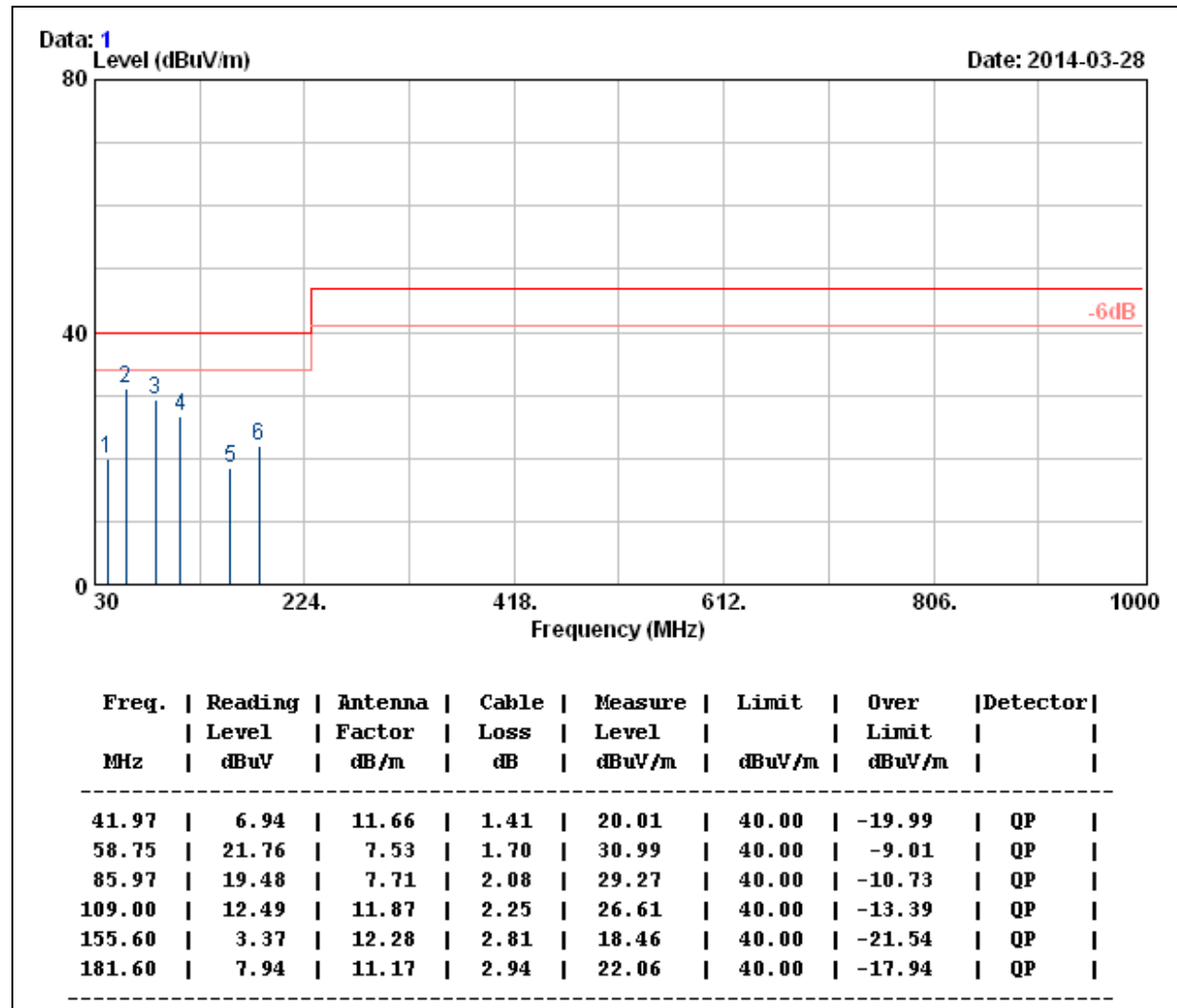
Freq.	Reading	Antenna	Cable	Measure	Limit	Over	Detector
MHz	Level	Factor	Loss	Level	dBuV/m	Limit	
	dBuV	dB/m	dB	dBuV/m		dBuV/m	
44.20	7.67	9.75	1.49	18.91	40.00	-21.09	QP
57.30	19.30	7.61	1.66	28.57	40.00	-11.43	QP
109.40	6.47	12.05	2.26	20.78	40.00	-19.22	QP
152.30	4.23	12.43	2.77	19.43	40.00	-20.57	QP
175.20	2.41	11.32	2.93	16.66	40.00	-23.34	QP
180.90	3.37	11.17	2.94	17.49	40.00	-22.51	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.	TMDC 20-2418	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Horizontal	Antenna Distance	10m
Detector Function	Quasi-peak.	Tested By	Weici Lo

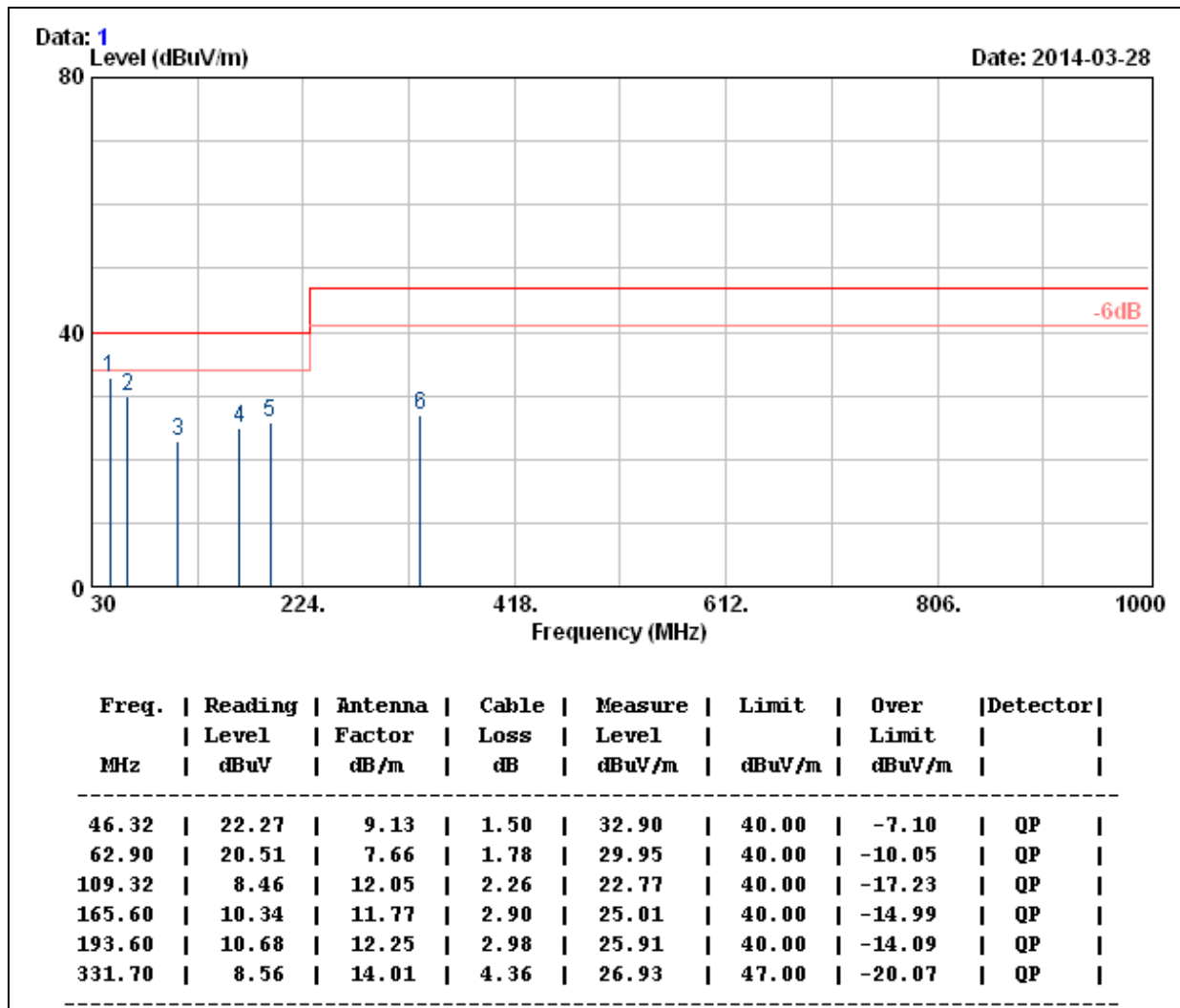


Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)

2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)



Model No.	TMDC 20-2411	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Vertical	Antenna Distance	10m
Detector Function:	Quasi-peak.	Tested By	Weici Lo

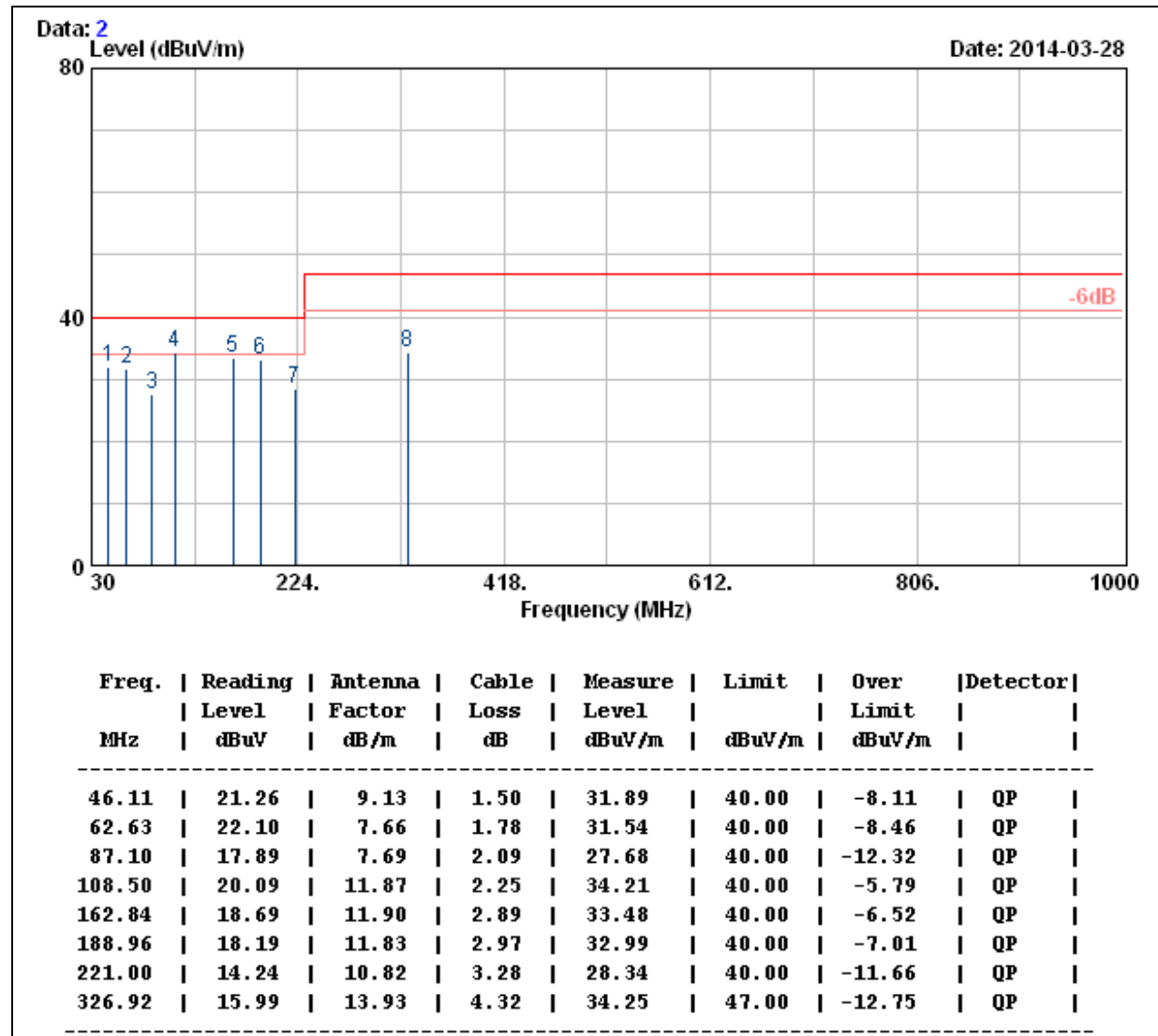


Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)

2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)



Model No.	TMDC 20-2411	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Horizontal	Antenna Distance	10m
Detector Function	Quasi-peak.	Tested By	Weici Lo

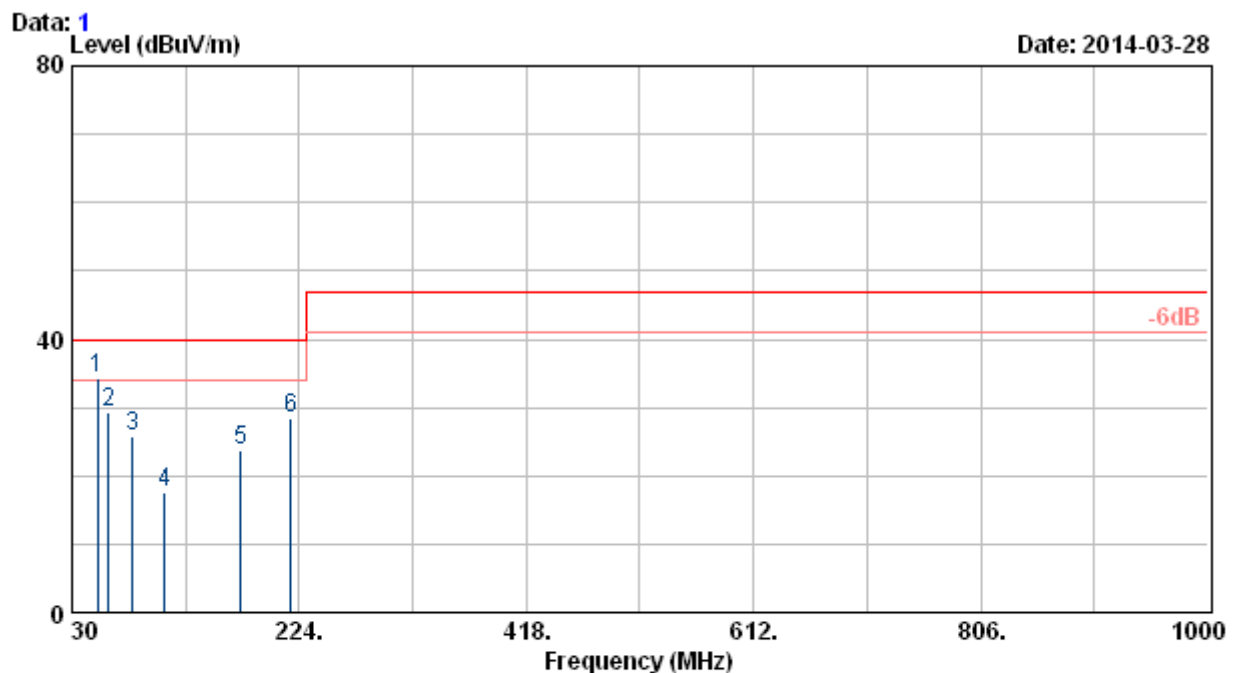


Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)

2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)



Model No.	TMDC 20-4812	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Vertical	Antenna Distance	10m
Detector Function:	Quasi-peak.	Tested By	Weici Lo



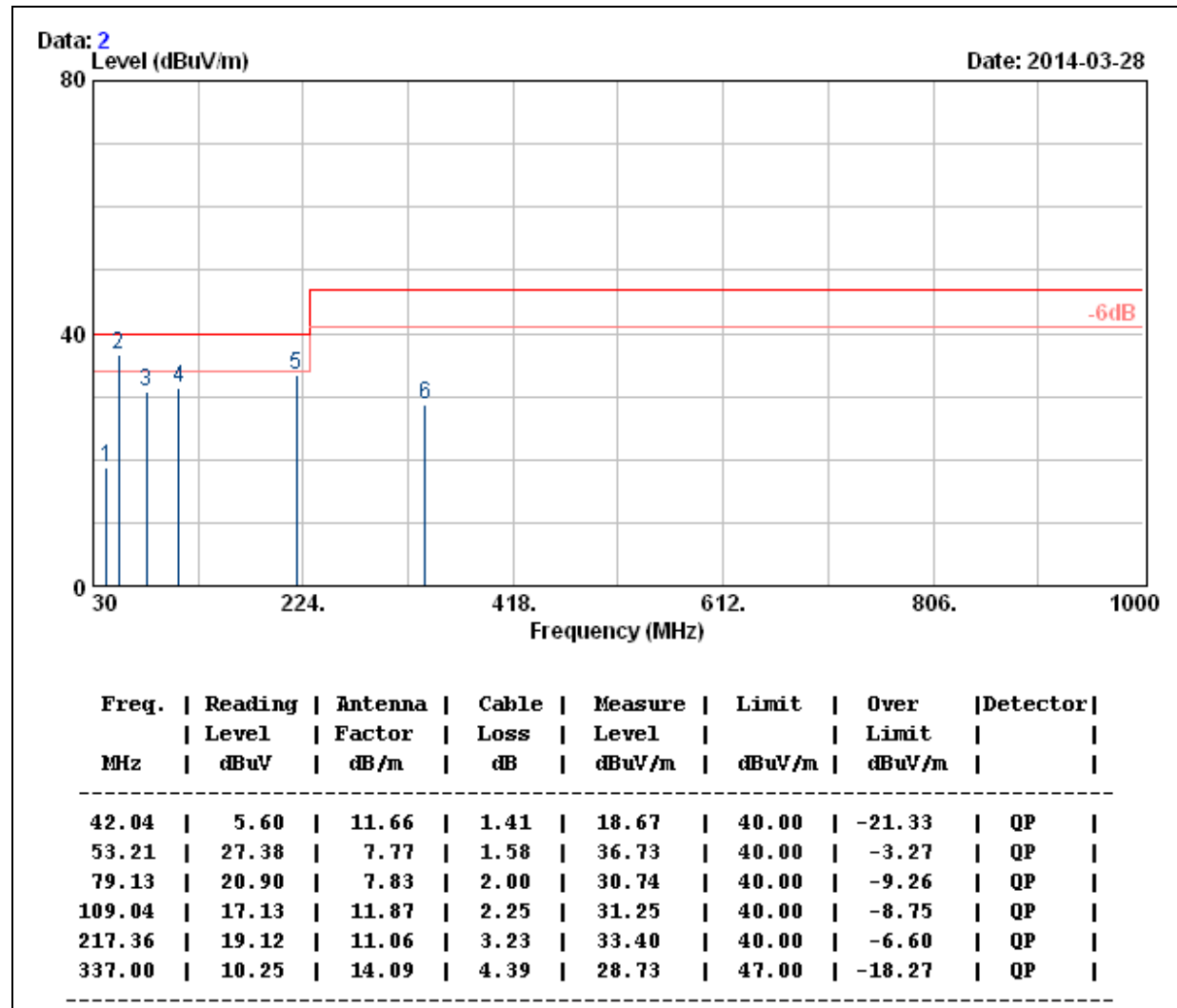
Freq.	Reading	Antenna	Cable	Measure	Limit	Over	Detector
MHz	Level	Factor	Loss	Level		Limit	
	dBuV	dB/m	dB	dBuV/m	dBuV/m	dBuV/m	
51.57	24.97	7.85	1.54	34.36	40.00	-5.64	QP
61.48	19.92	7.55	1.74	29.20	40.00	-10.80	QP
81.47	15.91	7.79	2.02	25.73	40.00	-14.27	QP
109.00	3.57	11.87	2.25	17.69	40.00	-22.31	QP
174.19	9.51	11.36	2.92	23.79	40.00	-16.21	QP
216.47	14.07	11.15	3.22	28.44	40.00	-11.56	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.	TMDC 20-4812	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Horizontal	Antenna Distance	10m
Detector Function	Quasi-peak.	Tested By	Weici Lo

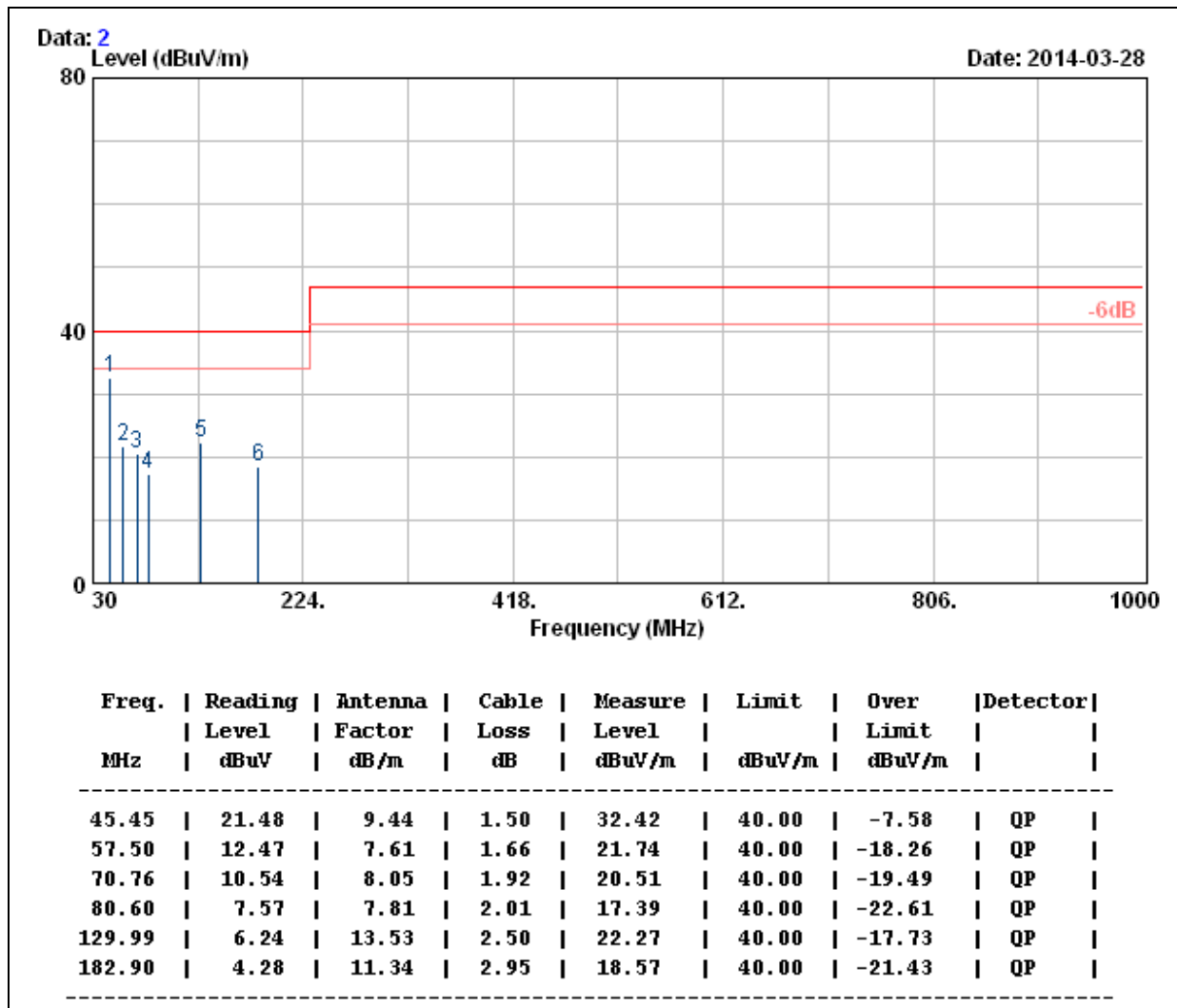


Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)

2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)



Model No.	TMDC 20-4815	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Vertical	Antenna Distance	10m
Detector Function:	Quasi-peak.	Tested By	Weici Lo

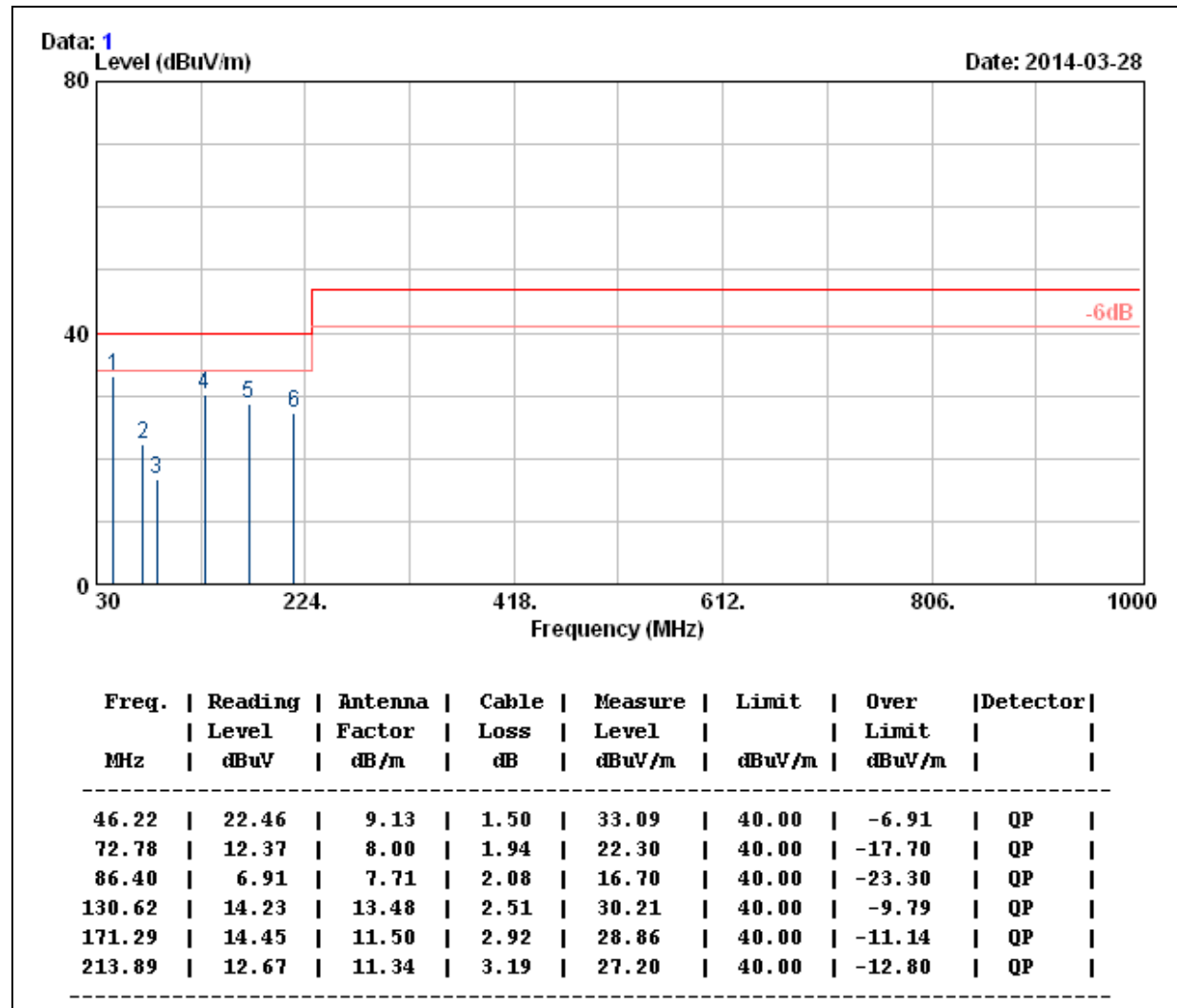


Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)

2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)



Model No.	TMDC 20-4815	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Horizontal	Antenna Distance	10m
Detector Function	Quasi-peak.	Tested By	Weici Lo

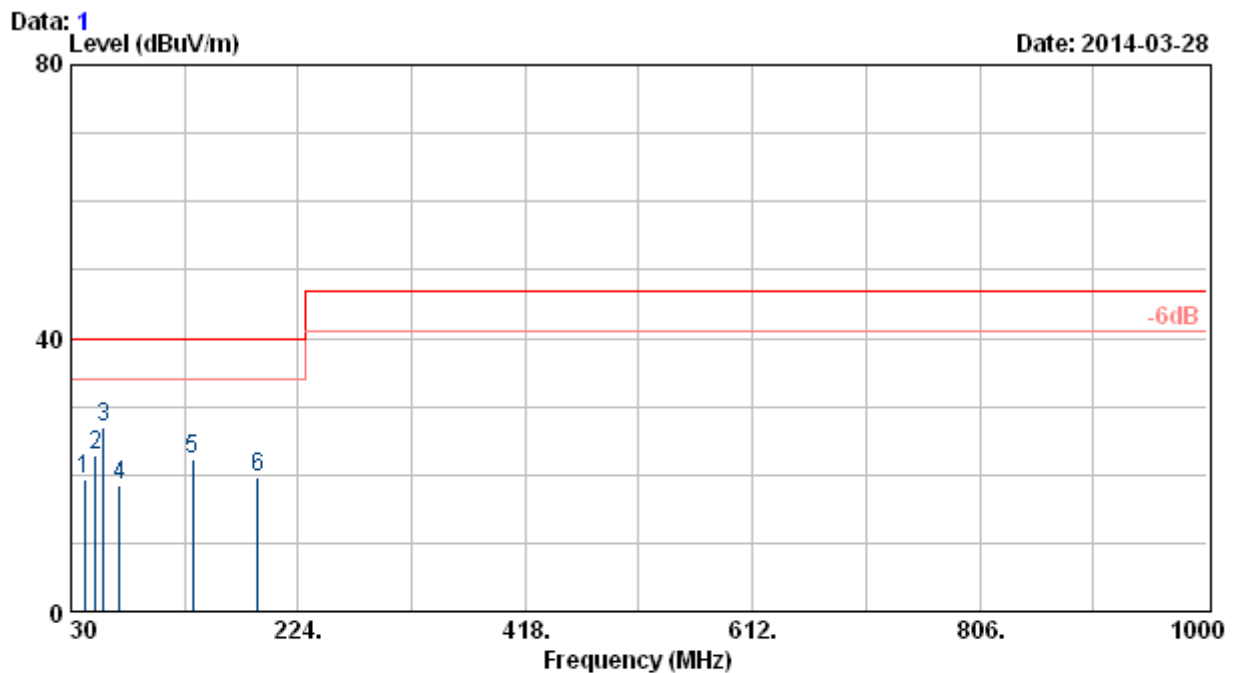


Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)

2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)



Model No.	TMDC 20-4818	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Vertical	Antenna Distance	10m
Detector Function:	Quasi-peak.	Tested By	Weici Lo



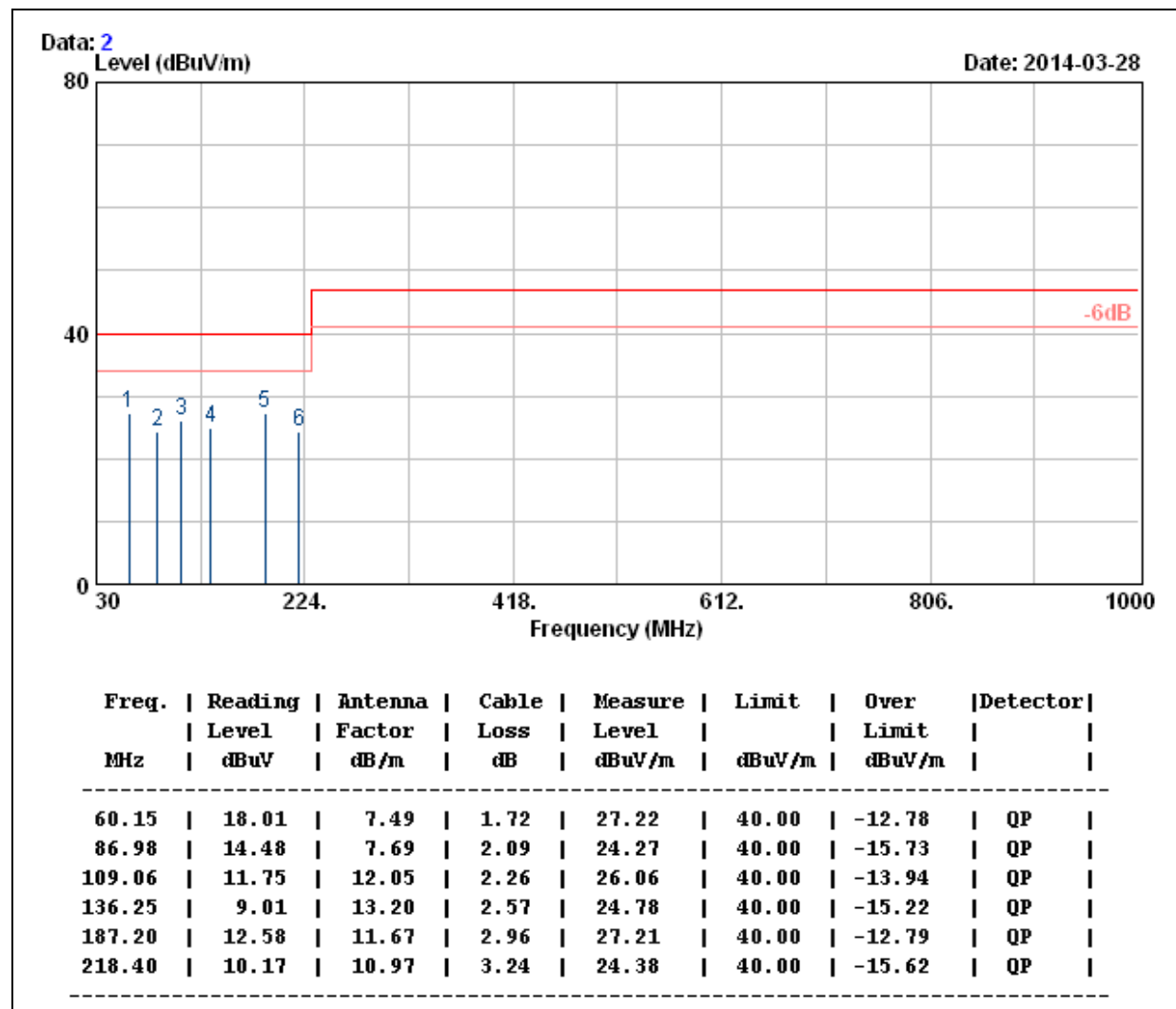
Freq.	Reading	Antenna	Cable	Measure	Limit	Over	Detector
MHz	Level	Factor	Loss	Level	dBuV/m	Limit	
	dBuV	dB/m	dB	dBuV/m		dBuV/m	
41.17	6.39	11.66	1.41	19.46	40.00	-20.54	QP
50.59	13.45	7.89	1.52	22.86	40.00	-17.14	QP
57.50	17.80	7.61	1.66	27.07	40.00	-12.93	QP
71.60	8.43	8.02	1.93	18.38	40.00	-21.62	QP
133.71	6.42	13.34	2.54	22.30	40.00	-17.70	QP
189.22	4.92	11.83	2.97	19.72	40.00	-20.28	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.	TMDC 20-4818	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Horizontal	Antenna Distance	10m
Detector Function	Quasi-peak.	Tested By	Weici Lo

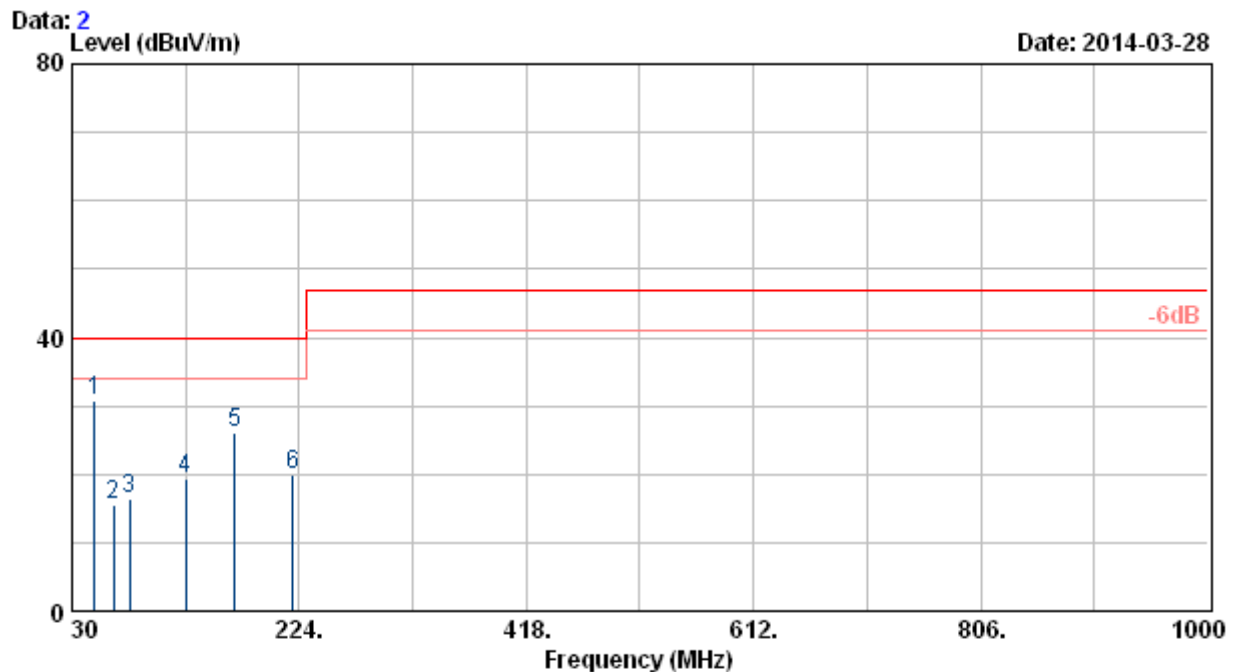


Note: 1.Level (dBuV/m) = Read Level (dBuV) + Antenna Factor (dB/m) + Cable loss (dB)

2.Over Limit value (dB) = Level (dBuV/m)-Limit Line(dBuV/m)



Model No.	TMDC 20-4811	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Vertical	Antenna Distance	10m
Detector Function:	Quasi-peak.	Tested By	Weici Lo



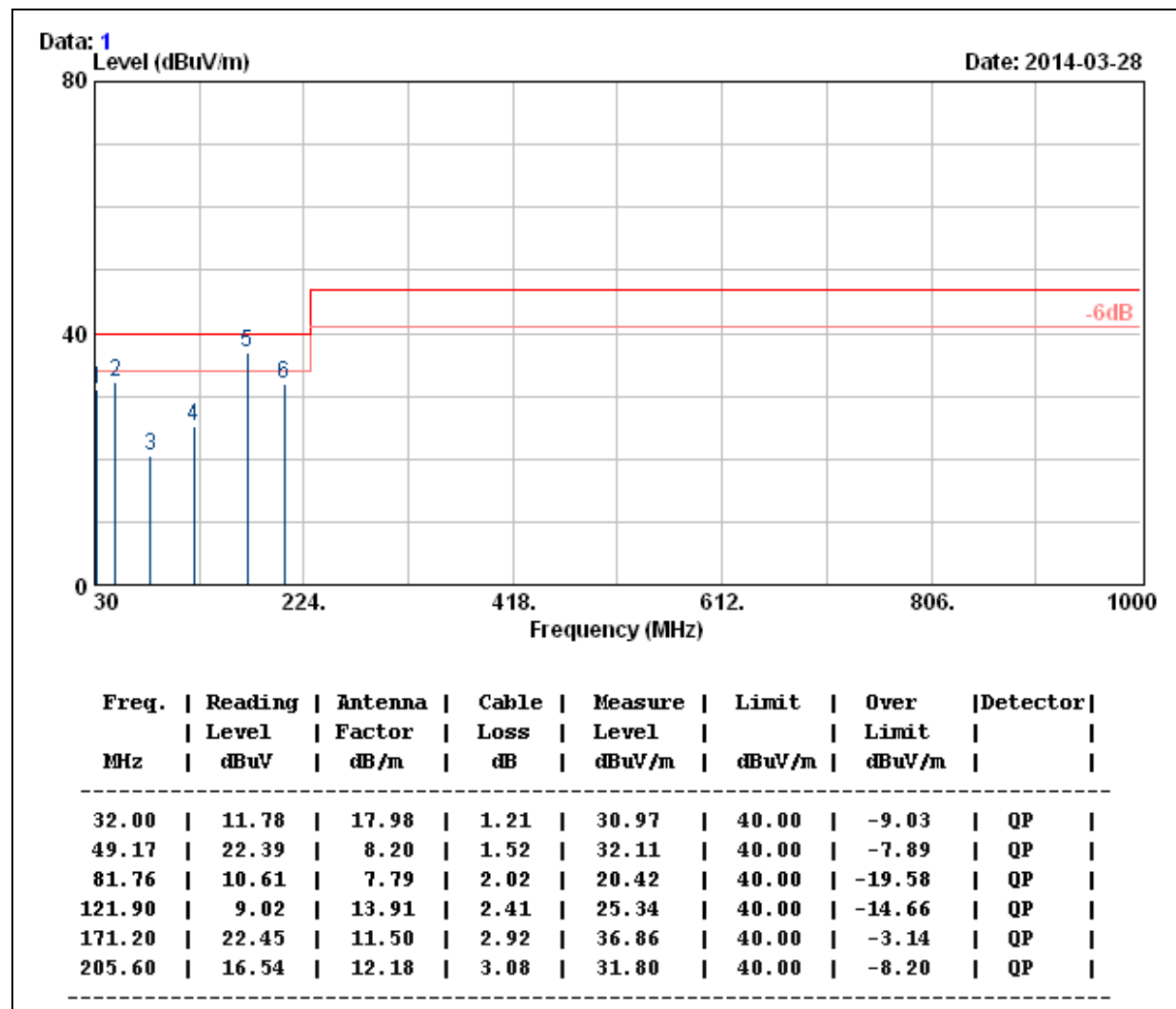
Freq.	Reading	Antenna	Cable	Measure	Limit	Over	Detector
MHz	Level	Factor	Loss	Level	dBuV/m	Limit	
	dBuV	dB/m	dB	dBuV/m	dBuV/m	dBuV/m	
49.00	21.20	8.20	1.52	30.91	40.00	-9.09	QP
65.09	5.89	7.78	1.82	15.49	40.00	-24.51	QP
79.16	6.62	7.83	2.00	16.45	40.00	-23.55	QP
127.00	3.22	13.67	2.46	19.35	40.00	-20.65	QP
169.10	11.53	11.63	2.91	26.07	40.00	-13.93	QP
218.70	5.93	10.87	3.25	20.06	40.00	-19.94	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.	TMDC 20-4811	Test Mode	Full load
Environmental Conditions	25.9 deg, 57% RH	Resolution Bandwidth	120 kHz
Antenna Pole	Horizontal	Antenna Distance	10m
Detector Function	Quasi-peak.	Tested By	Weici Lo



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)



## 7.4. HARMONICS CURRENT MEASUREMENT

### 7.4.1. LIMITS OF HARMONICS CURRENT MEASUREMENT

Limits for Class A equipment		Limits for Class D equipment		
Harmonics Order n	Max. permissible harmonics current A	Harmonics Order n	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd harmonics		Odd Harmonics only		
3	2.30	3	3.4	2.30
5	1.14	5	1.9	1.14
7	0.77	7	1.0	0.77
9	0.40	9	0.5	0.40
11	0.33	11	0.35	0.33
13	0.21	13	0.30	0.21
15<=n<=39	0.15x15/n	15<=n<=39	3.85/n	0.15x15/n
Even harmonics				
2	1.08			
4	0.43			
6	0.30			
8<=n<=40	0.23x8/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.

### 7.4.2. TEST INSTRUMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Harmonics Analyzer	TTI	HA1600	198202	MAY. 12, 2014
Software	H/F HA 1600 PC LINK 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 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.

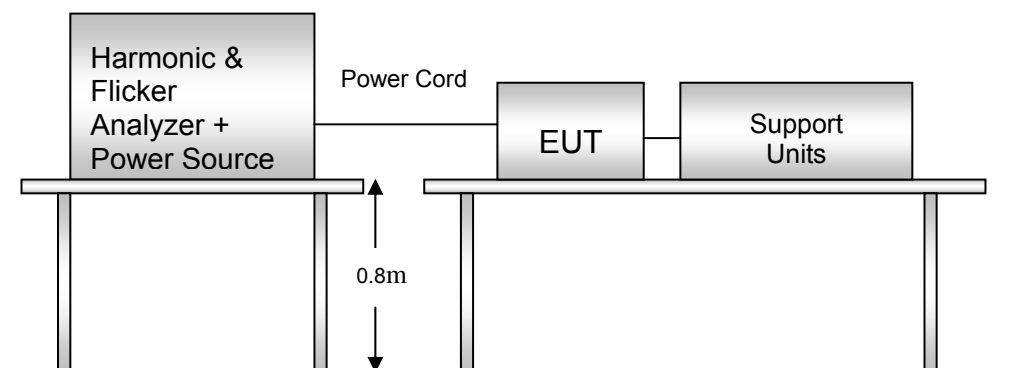
Class B: Portable tools; Arc welding equipment which is not professional equipment.

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.

### 7.4.4. TEST SETUP



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

### 7.4.5. TEST RESULTS

Power Consumption	--- W	Test Mode	---
Environmental Conditions	-°C, -% RH	Tested by	---

### Test Result

※ This EUT do not connect to AC Source directly. Not applicability for this test.



## 7.5. VOLTAGE FLUCTUATION AND FLICKER MEASUREMENT

### 7.5.1. LIMITS OF VOLTAGE FLUCTUATION AND FLICKER 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

### 7.5.2. TEST INSTRUMENTS

**N**

IMMUNITY SHIELDED ROOM				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Harmonics Analyzer	TTI	HA1600	198202	MAY. 12, 2014
Software	H/F HA 1600 PC LINK Field Probe			

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

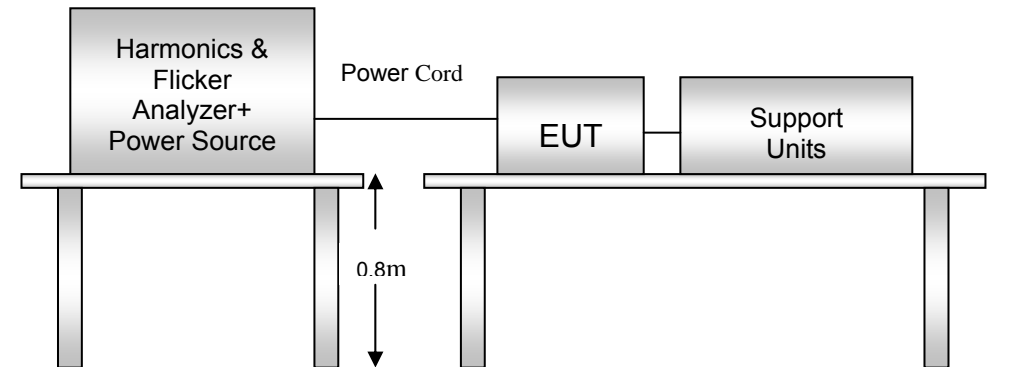
### 7.5.3. TEST PROCEDURE

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.



#### 7.5.4. TEST SETUP



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

#### 7.5.5. TEST RESULTS

Observation Period (Tp)	--- Seconds	Test Mode	---
Environmental Conditions	--- deg.C, ---% RH, --- mbar	Tested by	---

#### Test Result

※ This EUT do not connect to AC Source directly. Not applicability for this test.



## 8 IMMUNITY TEST

### 8.1. GENERAL DESCRIPTION

Product Standard	EN 61000-6-2: 2005	
	Test Type	Minimum Requirement
Basic Standard, Specification, and Performance Criterion required	IEC 61000-4-2	Electrostatic Discharge – ESD: 8kV air discharge, 4kV Contact discharge, Performance Criterion B
	IEC 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80 ~1000 MHz, 10V/m, 80% AM(1kHz), 1400 ~2000 MHz, 3V/m, 80% AM(1kHz), 2000 ~2700 MHz, 1V/m, 80% AM(1kHz), Performance Criterion A
	IEC 61000-4-4	Electrical Fast Transient/Burst - EFT, AC / DC Power line: 2kV, Signal/Control line: 2kV, Performance Criterion B
	IEC 61000-4-5	Surge Immunity Test: 1.2/50 us Open Circuit Voltage, 8 /20 us Short Circuit Current, AC Power Port ~ Line to line: 1kV, Line to ground: 2kV DC Power Port ~ Line to line and Line to ground: 0.5kV Signal Port ~ Lines to ground: 1kV Performance Criterion B
	IEC 61000-4-6	Conducted Radio Frequency Disturbances Test –CS: 0.15 ~ 80 MHz, 10Vrms, 80% AM, 1kHz, Performance Criterion A
	IEC 61000-4-8	Power frequency magnetic field immunity test 50Hz/60Hz, 30A/m Performance Criterion A
	IEC 61000-4-11	<b>Voltage Dips:</b> i) 95reduction for 1 Cycle, Performance Criterion B ii) 60 % reduction for 10/12 Cycle at 50/60Hz, Performance Criterion C iii) 30% reduction for 25/30 Cycle at 50/60Hz, Performance Criterion C <b>Voltage Interruptions:</b> 95reduction for 250/300 Cycle at 50/60Hz Performance Criterion C



## 8.2. GENERAL PERFORMANCE CRITERIA DESCRIPTION

<b>Criteria A:</b>	The apparatus shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the 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.
<b>Criteria B:</b>	<p>After test, the apparatus shall continue 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.</p> <p>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.</p>
<b>Criteria C:</b>	<p>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.</p> <p>Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.</p>



### 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; 8kV (Direct)  
Contact Discharge: 4 kV (Direct/Indirect)

**Polarity:** Positive & Negative

**Number of Discharge:** Minimum 10 times at each test point

**Discharge Mode:** Single Discharge  
1 second minimum

#### 8.3.2. TEST INSTRUMENT

IMMUNITY SHIELDED ROOM				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
ESD Simulator	NoiseKen	ESS-2002	ESS04Z3762	MAR. 16, 2015

**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 **Horizontal Coupling Plane (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:

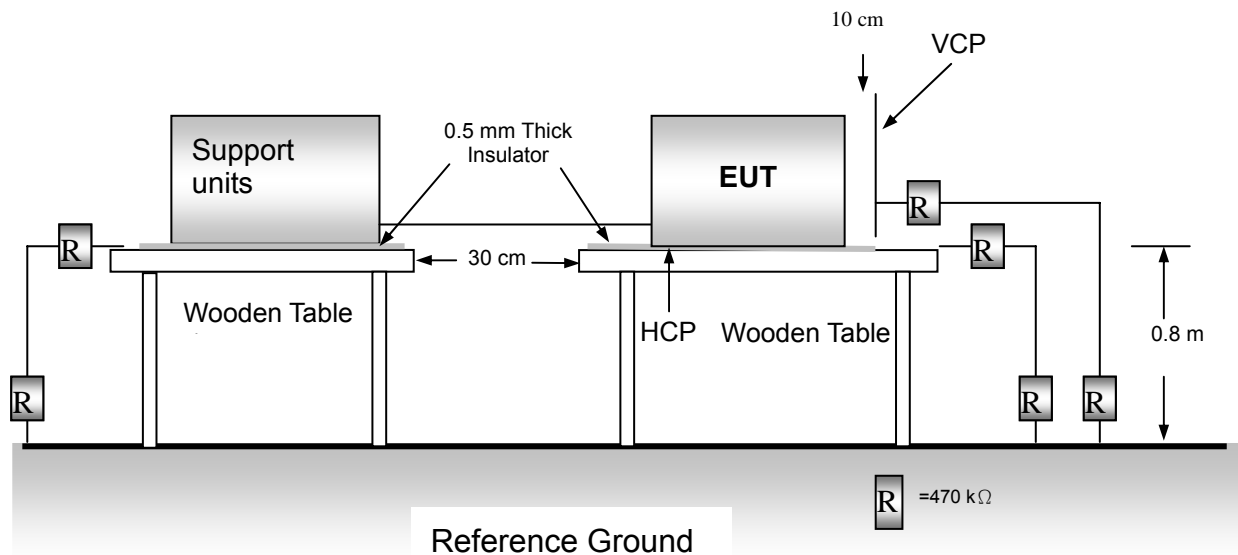
On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area normally 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 **Vertical Coupling Plane (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 **Ground Reference Plane**. The **GRP** consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A **Horizontal Coupling Plane** (1.6m x 0.8m) 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 0.5mm thickness. A distance of 1-meter 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 0.25mm 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

#### Type A

Temperature	24°C	Humidity	43% RH
Pressure	1028mbar	Tested By	Rock Guo
Required Passing Performance		Criterion B	

Air Discharge									
Test Points	Test Levels					Results			
	± 2 kV	± 4 kV	± 8 kV	± 12 kV	± 15 kV	Pass	Fail	Performance Criterion	Observation
Front	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Back	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Left	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Right	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Top	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Bottom	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	

Contact Discharge									
Test Points	Test Levels					Results			
	± 2 kV	± 4 kV	± 6 kV	± 8 kV	± 12 kV	Pass	Fail	Performance Criterion	Observation
Front	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Back	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Left	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Right	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Top	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Bottom	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	

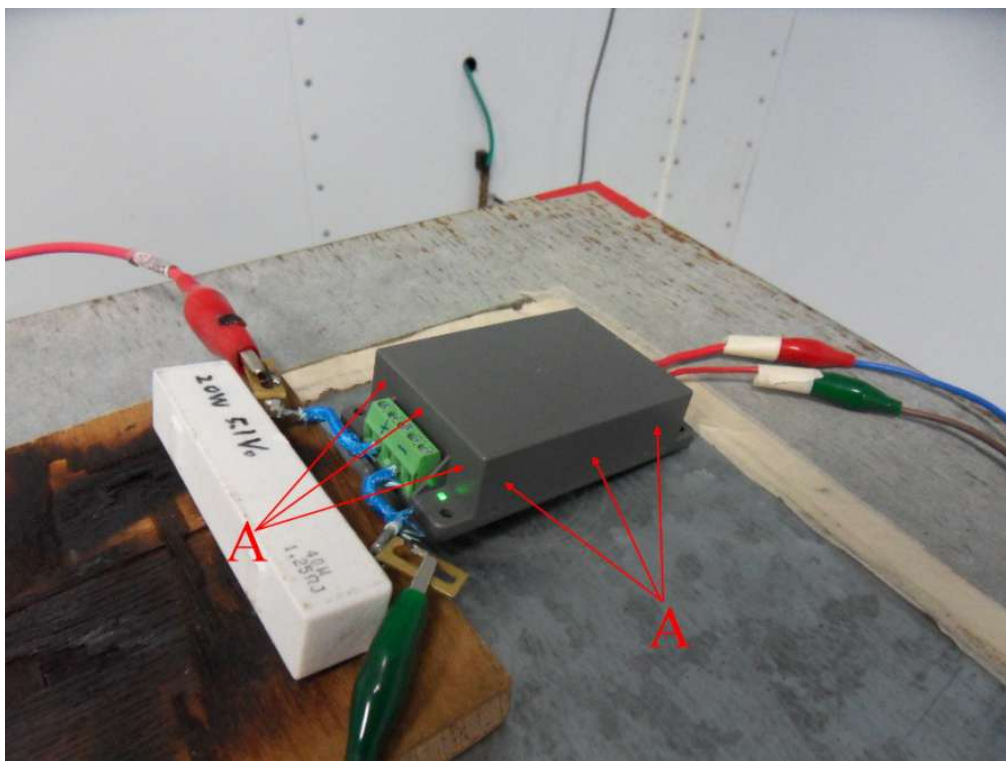
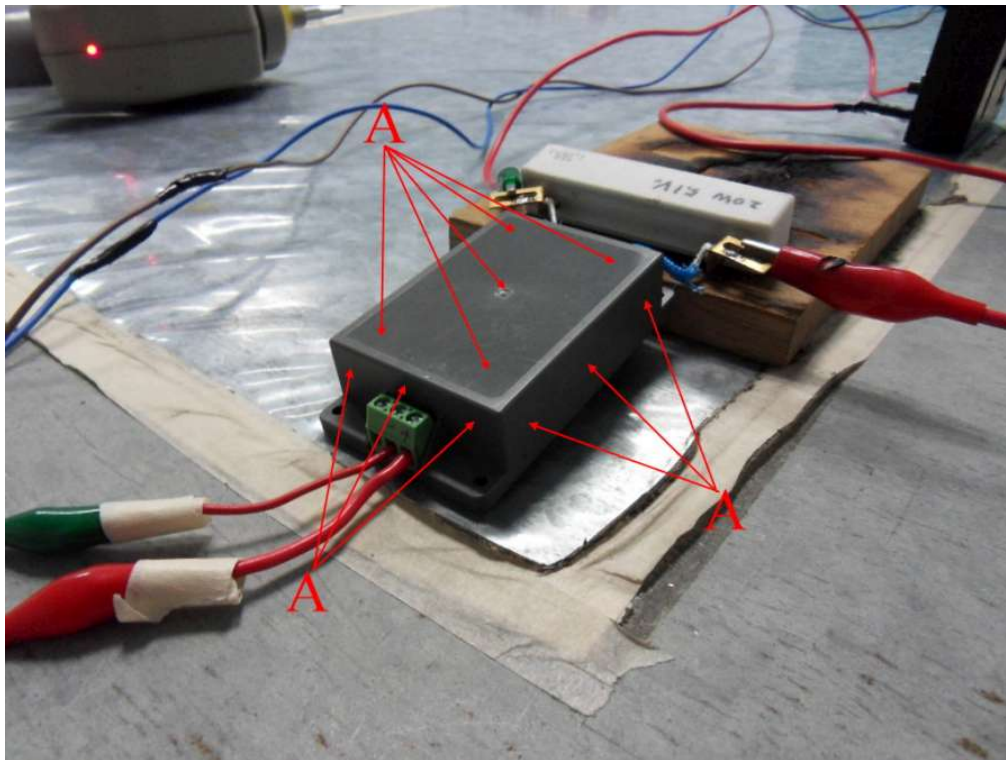
Please refer to ESD test photo on next page for detail discharge point

Discharge To Horizontal Coupling Plane								
Side of EUT	Test Levels				Results			
	± 2 kV	± 4 kV	± 6kV	± 8 kV	Pass	Fail	Performance Criterion	Observation
Front	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Back	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Left	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Right	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	

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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Back	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Left	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Right	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	



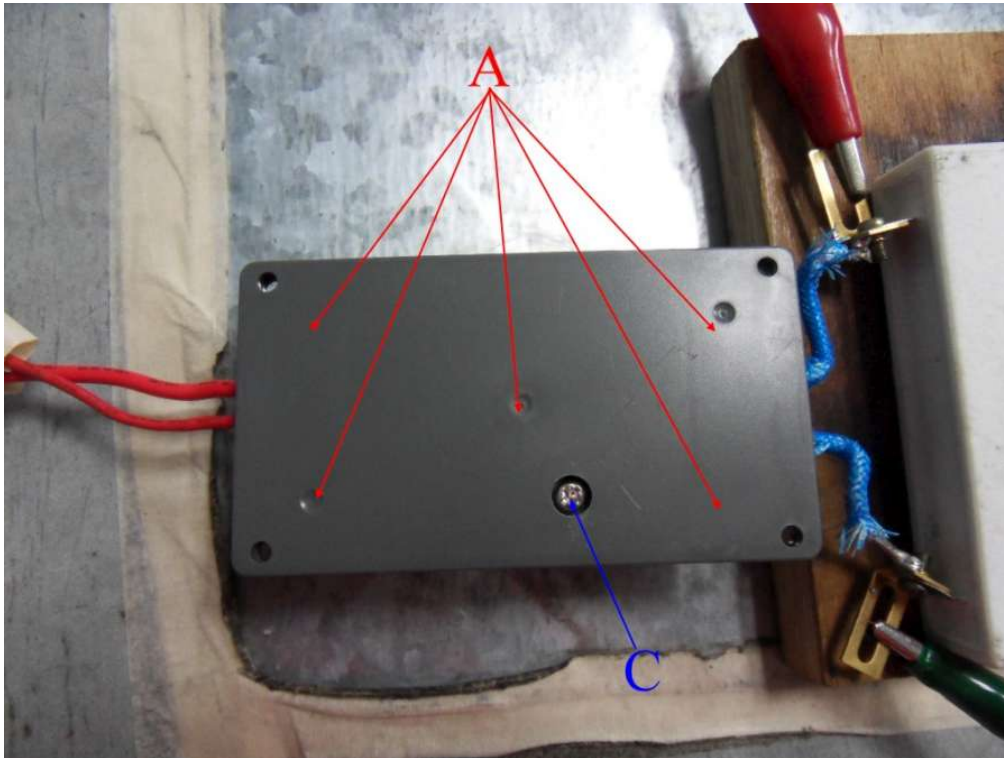
The Photo for Discharge Points of EUT



'A' Mark — Air Discharged ;



**The Photo for Discharge Points of EUT**



'A' Mark — Air Discharged ;  
'C' Mark —Contact Discharged



Type B

Temperature	19°C	Humidity	45% RH
Pressure	1028mbar	Tested By	Sam Shen
Required Passing Performance		Criterion B	

Air Discharge									
Test Points	Test Levels					Results			
	± 2 kV	± 4 kV	± 8 kV	± 12 kV	± 15 kV	Pass	Fail	Performance Criterion	Observation
Front	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Back	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Left	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Right	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Top	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Bottom	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	

Contact Discharge									
Test Points	Test Levels					Results			
	± 2 kV	± 4 kV	± 6 kV	± 8 kV	± 12 kV	Pass	Fail	Performance Criterion	Observation
Front	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Back	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Left	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Right	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Top	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Bottom	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	

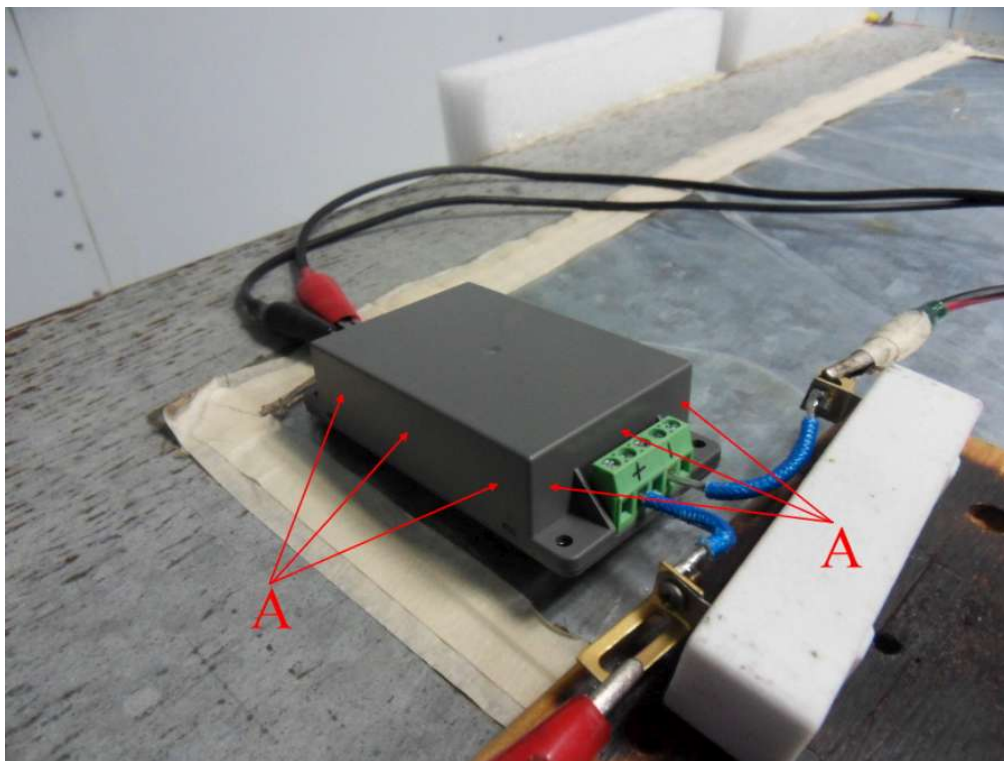
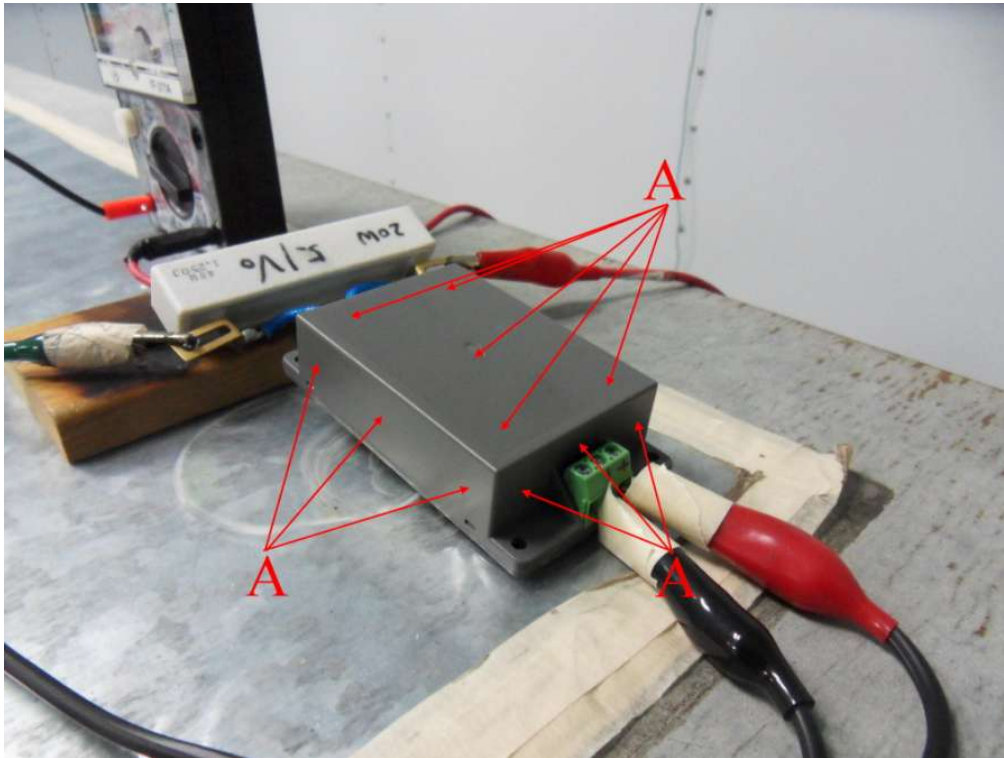
Please refer to ESD test photo on next page for detail discharge point

Discharge To Horizontal Coupling Plane								
Side of EUT	Test Levels				Results			
	± 2 kV	± 4 kV	± 6kV	± 8 kV	Pass	Fail	Performance Criterion	Observation
Front	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Back	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Left	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Right	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	

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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Back	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Left	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	
Right	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	



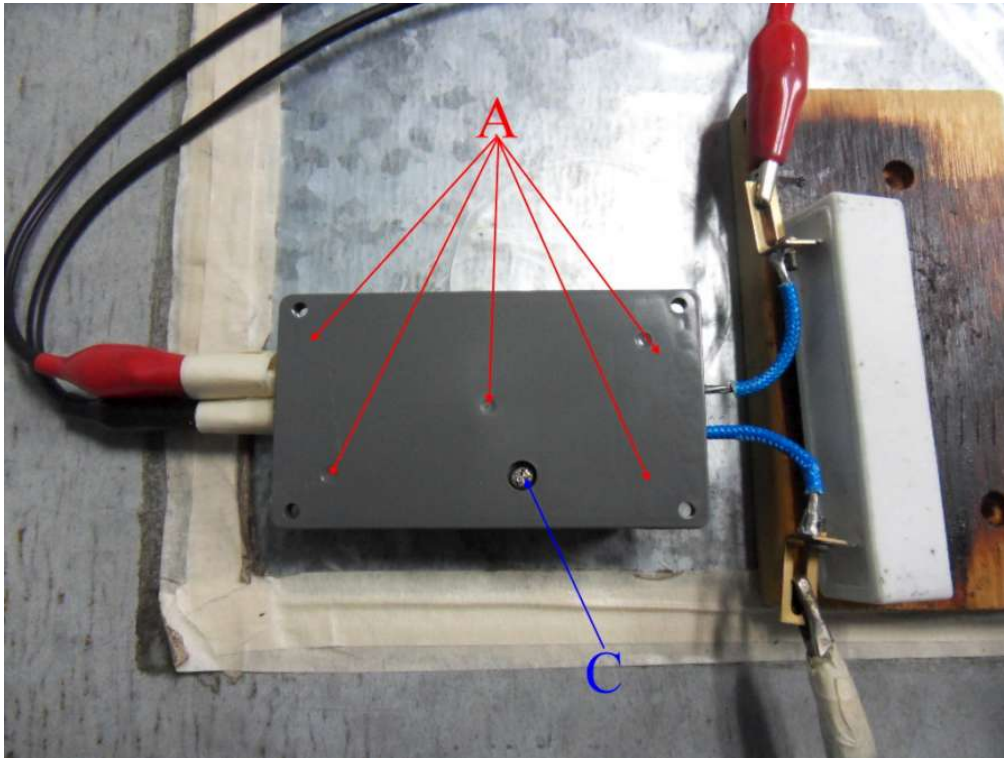
**The Photo for Discharge Points of EUT**



'A' Mark — Air Discharged ;



**The Photo for Discharge Points of EUT**



'A' Mark — Air Discharged ;  
'C' Mark —Contact Discharged



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

### 8.4.1. TEST SPECIFICATION

**Basic Standard:** IEC 61000-4-3

**Frequency Range:** 80 ~ 1000 MHz, 1400 ~ 2000 MHz, 2000 ~ 2700 MHz

**Field Strength:** 10 V/m, 3 V/m, 1 V/m

**Modulation:** 1kHz Sine Wave, 80%, AM Modulation

**Frequency Step:** 1 % of preceding frequency value

**Polarity of Antenna:** Horizontal and Vertical

**Test Distance:** 3 m (Below 1GHz) & 1 m (Above 1GHz)

**Antenna Height:** 1.5 m

### 8.4.2. TEST INSTRUMENT

966 RS Chamber				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Computer	SYNNEX	BTO -LMIW300 - GB	A41202-0031	N.C.R.
LCD Monitor	Acer	AL1715sm	ETL130719944302366R H01	N.C.R.
Keyboard	SYNNEX	5211A	G4430091266	N.C.R.
Amplifier Freq. Range :80MHz ~ 1GHz	AR	150W1000M3	310037	N.C.R.
Amplifier Freq. Range :0.8MHz ~ 3GHz	AR	60S1G3M3	310102	N.C.R.
Digital SIGNAL GENERATOR	HP	ESG-D3000A	US36260655	JUN. 08, 2015
RF Power Meter	BOONTON	4232A-01-02	122202	MAY. 27, 2015
Log – Periodic Antenna	AR	AT5080	309817	N.C.R.
Software	RS SW1005 R1_4			

**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

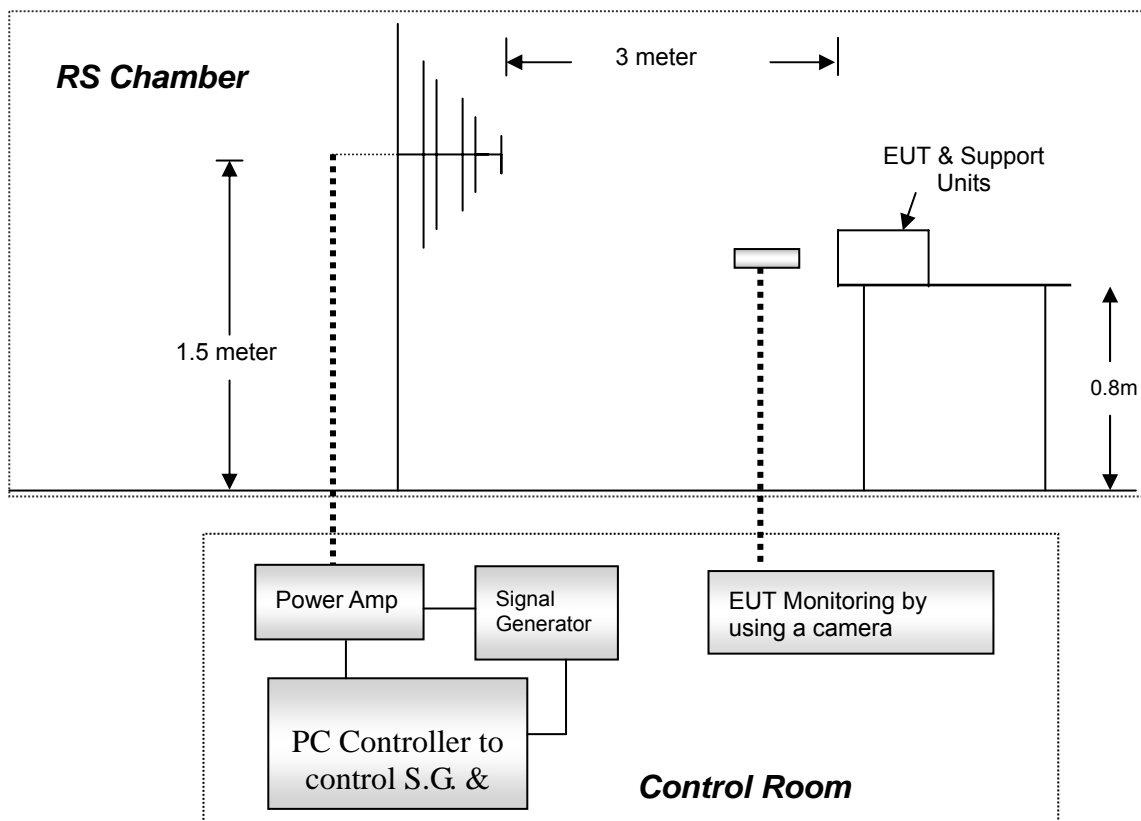


### 8.4.3. TEST PROCEDURE

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

- The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 (below 1GHz) or 1 (above 1GHz) from the EUT.
- The frequency range is swept from 80 MHz to 2700 MHz, with the signal 80% amplitude modulated with a 1kHz sine-wave. The rate of sweep did not exceed  $1.5 \times 10^{-3}$  decade/s, where the frequency range is swept incrementally, the step size was 1% of preceding frequency value.
- The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- 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****Type A**

<b>Temperature</b>	26°C	<b>Humidity</b>	51% RH
<b>Pressure</b>	1028mbar	<b>Dwell Time</b>	3 sec.
<b>Tested By</b>	Rock Guo	<b>Required Passing Performance</b>	<b>Criterion A</b>

<b>Frequency (MHz)</b>	<b>Polarity</b>	<b>Azimuth</b>	<b>Field Strength (V/m)</b>	<b>Result</b>	<b>Observation</b>
80 ~ 1000	V&H	0	10	PASS	
80 ~ 1000	V&H	90	10	PASS	
80 ~ 1000	V&H	180	10	PASS	
80 ~ 1000	V&H	270	10	PASS	
1400 ~ 2000	V&H	0	3	PASS	
1400 ~ 2000	V&H	90	3	PASS	
1400 ~ 2000	V&H	180	3	PASS	
1400 ~ 2000	V&H	270	3	PASS	
2000 ~ 2700	V&H	0	1	PASS	
2000 ~ 2700	V&H	90	1	PASS	
2000 ~ 2700	V&H	180	1	PASS	
2000 ~ 2700	V&H	270	1	PASS	

**Type B**

<b>Temperature</b>	23°C	<b>Humidity</b>	49% RH
<b>Pressure</b>	1028mbar	<b>Dwell Time</b>	2.86 sec.
<b>Tested By</b>	Sam Shen	<b>Required Passing Performance</b>	<b>Criterion A</b>

Frequency (MHz)	Polarity	Azimuth	Field Strength (V/m)	Result	Observation
80 ~ 1000	V&H	0	10	PASS	
80 ~ 1000	V&H	90	10	PASS	
80 ~ 1000	V&H	180	10	PASS	
80 ~ 1000	V&H	270	10	PASS	
1400 ~ 2000	V&H	0	3	PASS	
1400 ~ 2000	V&H	90	3	PASS	
1400 ~ 2000	V&H	180	3	PASS	
1400 ~ 2000	V&H	270	3	PASS	
2000 ~ 2700	V&H	0	1	PASS	
2000 ~ 2700	V&H	90	1	PASS	
2000 ~ 2700	V&H	180	1	PASS	
2000 ~ 2700	V&H	270	1	PASS	

**NOTE:** There was no change compared with the initial operation during the test.



## 8.5. ELECTRICAL FAST TRANSIENT (EFT)

### 8.5.1. TEST SPECIFICATION

<b>Basic Standard:</b>	IEC 61000-4-4
<b>Test Voltage:</b>	DC Power Line: 2 kV Signal/Control Line: 2 kV
<b>Polarity:</b>	Positive & Negative
<b>Impulse Frequency:</b>	5 kHz
<b>Impulse Wave-shape:</b>	5/50 ns
<b>Burst Duration:</b>	15 ms
<b>Burst Period:</b>	300 ms
<b>Test Duration:</b>	Not less than 1 min.

### 8.5.2. TEST INSTRUMENT

Immunity Shield Room				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Computer	IBM	M/T 8183 – ICV	99BG137	N.C.R.
VGA Monitor	Acer	1555	917160230584200572 P5C431	N.C.R.
Keyboard	HP	KB – 0133	B69360MGAPEOK5	N.C.R.
EMC Pro IMMUNITY TEST SYSTEM	KeyTek	EMCpro	0312231	APR. 07, 2015
Software	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.

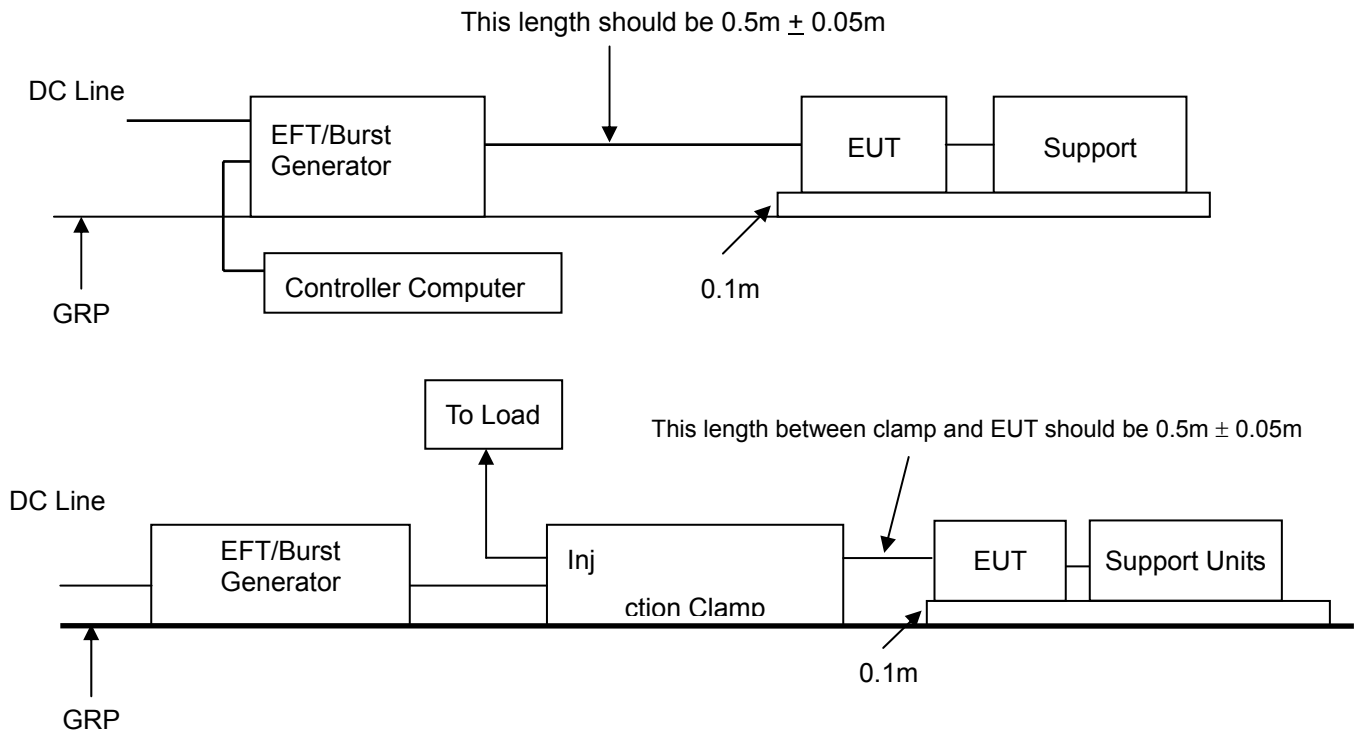
2. N.C.R.= No Calibration required

### 8.5.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-024)

- Both positive and negative polarity discharges were applied.
- The length of the “hot wire” from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 0.5 meter.
- The duration time of each test sequential was 1 minute.
- 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 (0.1m high) standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m 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 0.25mm thick and 2.5m square) connected to the protective grounding system.

**8.5.5. TEST RESULTS****Type A**

<b>Temperature</b>	25°C	<b>Humidity</b>	48% RH
<b>Pressure</b>	1028mbar	<b>Tested By</b>	Rock Guo
<b>Required Passing Performance</b>		<b>Criterion B</b>	

Test Point	Polarity	Test Level (kV)	Performance Criterion	Result	Observation
L	+/-	2	<input checked="" type="checkbox"/> A <input type="checkbox"/> B	PASS	
N	+/-	2	<input checked="" type="checkbox"/> A <input type="checkbox"/> B	PASS	
L + N	+/-	2	<input checked="" type="checkbox"/> A <input type="checkbox"/> B	PASS	

**Type B**

<b>Temperature</b>	20°C	<b>Humidity</b>	47% RH
<b>Pressure</b>	1028mbar	<b>Tested By</b>	Sam Shen
<b>Required Passing Performance</b>		<b>Criterion B</b>	

Test Point	Polarity	Test Level (kV)	Performance Criterion	Result	Observation
L1	+/-	2	<input checked="" type="checkbox"/> A <input type="checkbox"/> B	PASS	
L2	+/-	2	<input checked="" type="checkbox"/> A <input type="checkbox"/> B	PASS	
L1 + L2	+/-	2	<input checked="" type="checkbox"/> A <input type="checkbox"/> B	PASS	

**NOTE:** 1. There was no change compared with initial operation during the test.



## 8.6. SURGE IMMUNITY TEST

### 8.6.1. TEST SPECIFICATION

<b>Basic Standard:</b>	IEC 61000-4-5
<b>Wave-Shape:</b>	Combination Wave 1.2/50 us Open Circuit Voltage 8/20 us Short Circuit Current
<b>Test Voltage:</b>	DC Power: Power Line ~ Line to Line: 0.5 kV
<b>Surge Input/Output:</b>	Power Line: L-N; L-PE; N-PE
<b>Generator Source Impedance:</b>	2 ohm between networks 12 ohm between network and ground
<b>Polarity:</b>	Positive/Negative
<b>Phase Angle:</b>	DC Power: 0°
<b>Pulse Repetition Rate:</b>	1 time / min. (maximum)
<b>Number of Tests:</b>	5 positive and 5 negative at selected points

### 8.6.2. TEST INSTRUMENT

Immunity Shield Room				
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.
EMC Pro IMMUNITY TEST SYSTEM	KeyTek	EMCpro	0312231	APR. 07, 2015
Switzerland	CDN	CDN-UTP8	See headline	MAR. 06, 2015
Software	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** (please refer to measurement standard or CCS SOP PA-025)

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.

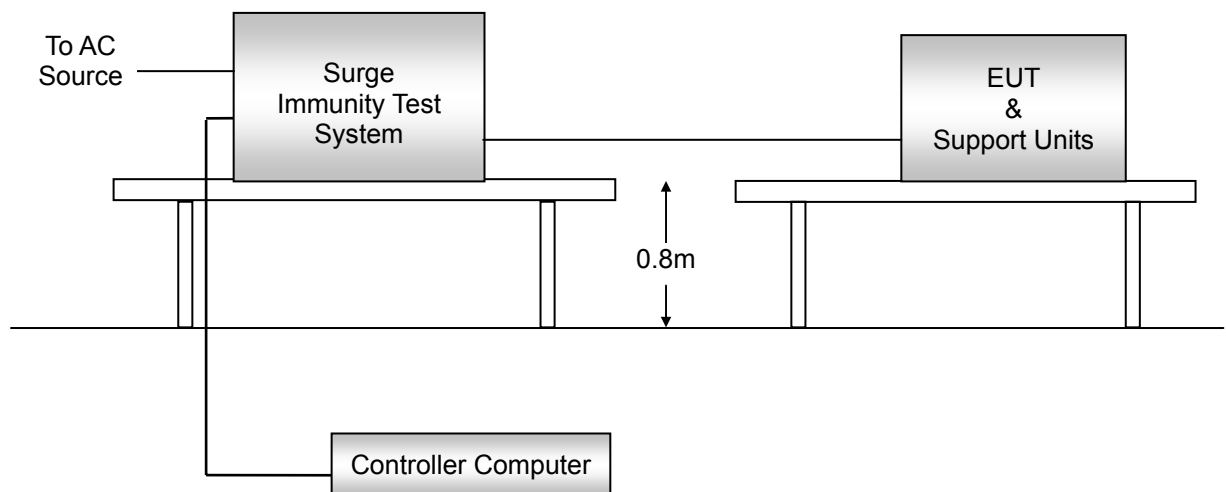
b) For test applied to unshielded un-symmetrically operated interconnection lines of EUT:

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****Type A**

<b>Temperature</b>	25°C	<b>Humidity</b>	48% RH
<b>Pressure</b>	1028mbar	<b>Tested By</b>	Rock Guo
<b>Required Passing Performance</b>		<b>Criterion B</b>	

Test Point	Polarity	Test Level (kV)	Performance Criterion	Result	Observation
L – N	+/-	0.5	<input checked="" type="checkbox"/> A <input type="checkbox"/> B	PASS	

**Type B**

<b>Temperature</b>	20°C	<b>Humidity</b>	47% RH
<b>Pressure</b>	1028mbar	<b>Tested By</b>	Sam Shen
<b>Required Passing Performance</b>		<b>Criterion B</b>	

Test Point	Polarity	Test Level (kV)	Performance Criterion	Result	Observation
L1 – L2	+/-	2	<input checked="" type="checkbox"/> A <input type="checkbox"/> B	PASS	

**NOTE:** 1. (a) There was no change compared with initial operation during the test.

(b) Where normal functioning of LAN can't be achieved because of the impact of CDN on the EUT, no test be required.



## 8.7. CONDUCTED RADIO FREQUENCY DISTURBANCES (CS)

### 8.7.1. TEST SPECIFICATION

<b>Basic Standard:</b>	IEC 61000-4-6
<b>Frequency Range:</b>	0.15 MHz ~ 80 MHz
<b>Field Strength:</b>	10 Vrms
<b>Modulation:</b>	1kHz Sine Wave, 80%, AM Modulation
<b>Frequency Step:</b>	1 % of preceding frequency value
<b>Coupling device:</b>	CDN-M2 (2 wires)

### 8.7.2. TEST INSTRUMENT

CS Room				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Computer	HP	d330 uT	SGH3480LTH	N.C.R.
VGA Monitor	NEC	JC-1572VMA	6600645RA	N.C.R.
Keyboard	IBM	KB - 8923	1021424	N.C.R.
CS Frankonia EMVMess-System GmbH	FRANKONIA	CIT-10/75	102C3220	JUN. 10, 2015
FCC Coupling Decoupling Network Freq. range : 150KHz~230MHz	FRANKONIA	CDN M2+M3	A3011095	JUN. 09, 2015
FCC EM Injection Clamp	-----	F-203I-23mm	449	NOV. 17, 2015
Software	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 (please refer to measurement standard or CCS SOP PA-026)

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

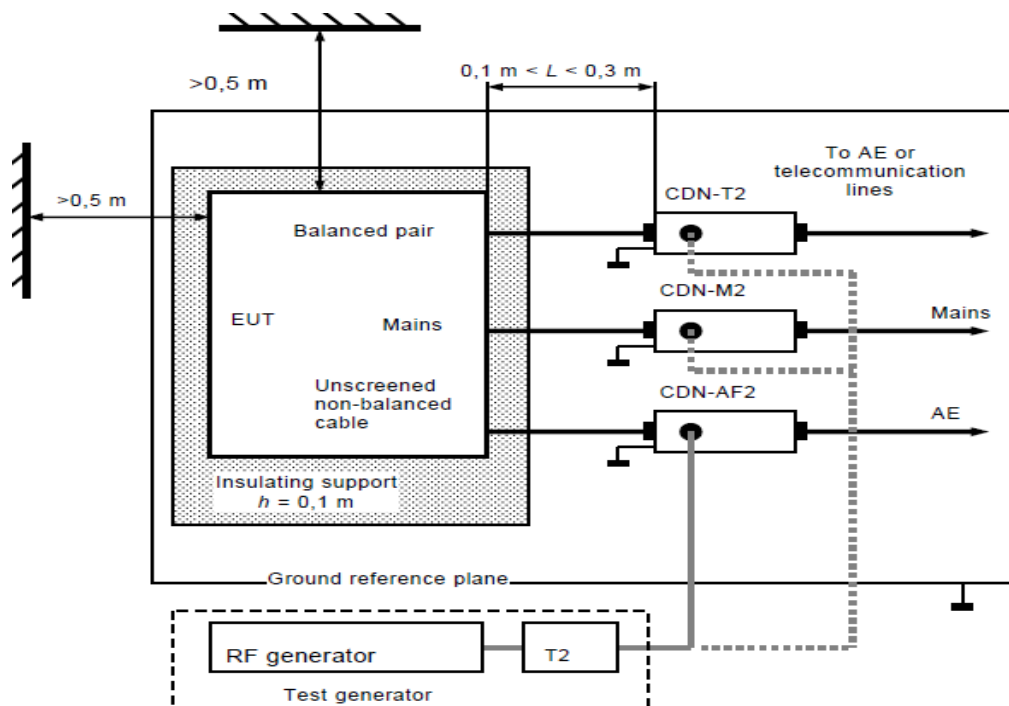
The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.

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  $1.5 \times 10^{-3}$  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 were made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.

### 8.7.4. TEST SETUP



- Note:** 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****Type A**

<b>Temperature</b>	25°C	<b>Humidity</b>	46% RH
<b>Pressure</b>	1028mbar	<b>Tested By</b>	Rock Guo
<b>Required Passing Performance</b>		<b>Criterion A</b>	

Frequency Band (MHz)	Field Strength (Vrms)	Cable	Injection Method	Performance Criterion	Result	Observation
0.15 ~ 80	10	DC Power	CDN-M2	<input checked="" type="checkbox"/> A <input type="checkbox"/> B	PASS	

**Type B**

<b>Temperature</b>	19°C	<b>Humidity</b>	48% RH
<b>Pressure</b>	1028mbar	<b>Tested By</b>	Sam Shen
<b>Required Passing Performance</b>		<b>Criterion A</b>	

Frequency Band (MHz)	Field Strength (Vrms)	Cable	Injection Method	Performance Criterion	Result	Observation
0.15 ~ 80	10	DC Power	CDN-M2	<input checked="" type="checkbox"/> A <input type="checkbox"/> B	PASS	

**NOTE:** 1. There was no change compared with initial operation during the test.



## 8.8. POWER FREQUENCY MAGNETIC FIELD

### 8.8.1. TEST SPECIFICATION

<b>Basic Standard:</b>	IEC 61000-4-8
<b>Frequency Range:</b>	50Hz/60Hz
<b>Field Strength:</b>	30 A/m
<b>Observation Time:</b>	1 minute
<b>Inductance Coil:</b>	Rectangular type, 1mx1m

### 8.8.2. TEST INSTRUMENT

Immunity Shield Room				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Magnetic field generator	Schaffner	MFO 6501	154	MAR. 24, 2015

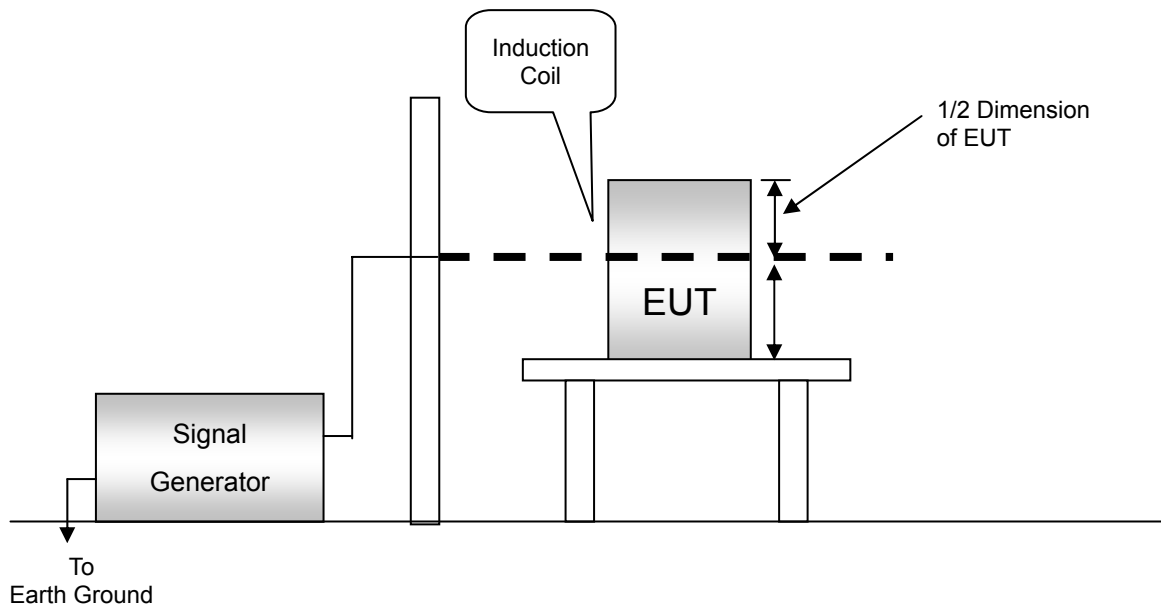
**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
2. N.C.R. = No Calibration required

### 8.8.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-027)

- 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.
- The equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.
- The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.
- 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****Type A**

<b>Temperature</b>	25°C	<b>Humidity</b>	46% RH
<b>Pressure</b>	1028mbar	<b>Tested By</b>	Rock Guo
<b>Required Passing Performance</b>		<b>Criterion A</b>	

<b>DIRECTION</b>	<b>Field Strength (A/m)</b>	<b>Performance Criterion</b>	<b>Result</b>	<b>Observation</b>
X	30	A	PASS	
Y	30	A	PASS	
Z	30	A	PASS	

**Type B**

<b>Temperature</b>	19°C	<b>Humidity</b>	48% RH
<b>Pressure</b>	1028mbar	<b>Tested By</b>	Sam Shen
<b>Required Passing Performance</b>		<b>Criterion A</b>	

<b>DIRECTION</b>	<b>Field Strength (A/m)</b>	<b>Performance Criterion</b>	<b>Result</b>	<b>Observation</b>
X	30	A	PASS	
Y	30	A	PASS	
Z	30	A	PASS	

**NOTE:** There was no change compared with initial operation during the test.



## 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° / 45° / 90° / 135° / 180° / 225° / 270° / 315° / 360°

**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.
EMC Pro IMMUNITY TEST SYSTEM	KeyTek	EMCpro	0312231	APR. 07, 2015
Test S/W	CE Ware 3.00b			

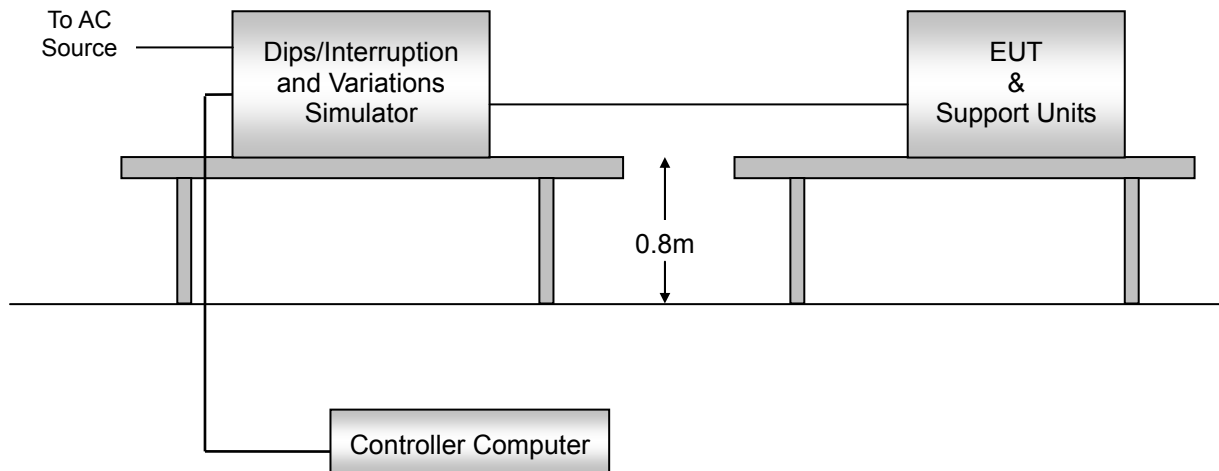
**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
2. N.C.R.= No Calibration required

### 8.9.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-028)

1. The EUT and support units were located on a wooden table, 0.8 m away from ground floor.
2. Setting the parameter of tests and then perform the test software of test simulator.
3. Conditions changes to occur at 0 degree crossover point of the voltage waveform.
4. 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

Temperature	--- °C	Humidity	--- % RH
Pressure	---mbar	Tested By	---
Required Passing Performance	Criterion B: >95% reduction 1 period Criterion C: 60% reduction/50Hz 10 period & 60% reduction/60Hz 12 period 30% reduction/50Hz 25 period & 60% reduction/60Hz 30 period >95% reduction/50Hz 250 period & >95% reduction/60Hz 300 period		

Test Power: 230Vac, 50Hz				
Voltage (% Reduction)	Duration (Period)	Performance Criterion	Test Result	Observation
>95	---	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	---	

Test Power: 230Vac, 50/60Hz				
Voltage (% Reduction)	Duration (Period)	Performance Criterion	Test Result	Observation
60	---	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	---	
60	---	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	---	

Test Power: 230Vac, 50/60Hz				
Voltage (% Reduction)	Duration (Period)	Performance Criterion	Test Result	Observation
30	---	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	---	
30	---	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	---	

Test Power: 230Vac, 50/60Hz				
Voltage (% Reduction)	Duration (Period)	Performance Criterion	Test Result	Observation
>95	---	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	---	
>95	---	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	---	

※ This EUT do not connect to AC Source directly. Not applicability for this test.



## 9 PHOTOGRAPHS OF THE TEST CONFIGURATION

### CONDUCTED EMISSION TEST



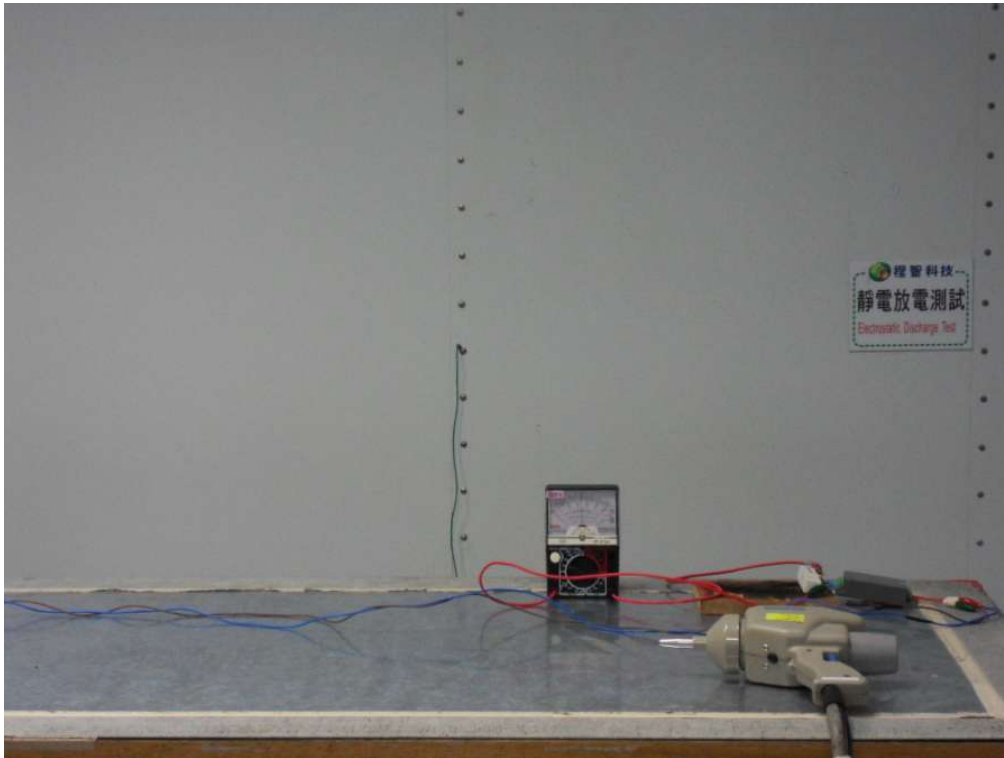


## **RADIATED EMISSION TEST**





### ESD Test (Type A)



### RS Test (Type A)





### EFT Test (Type A)

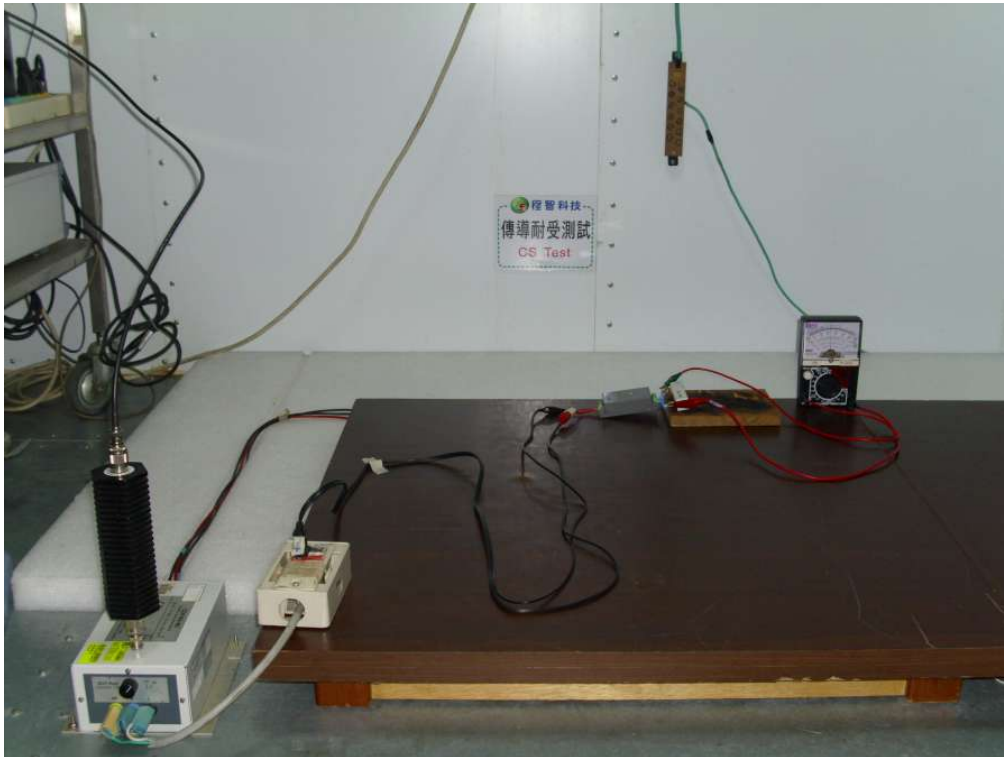


### Surge Test (Type A)

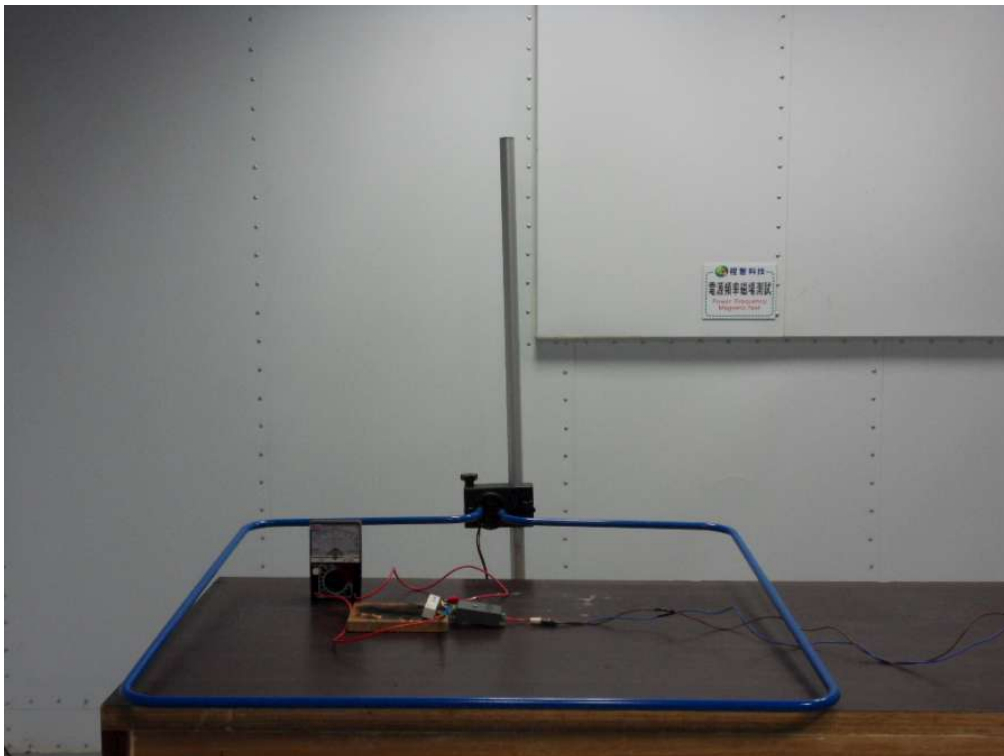




### CS Test (Type A)



### PFMF Test (Type A)





### ESD Test (Type B)



### RS Test (Type B)





### EFT Test (Type B)

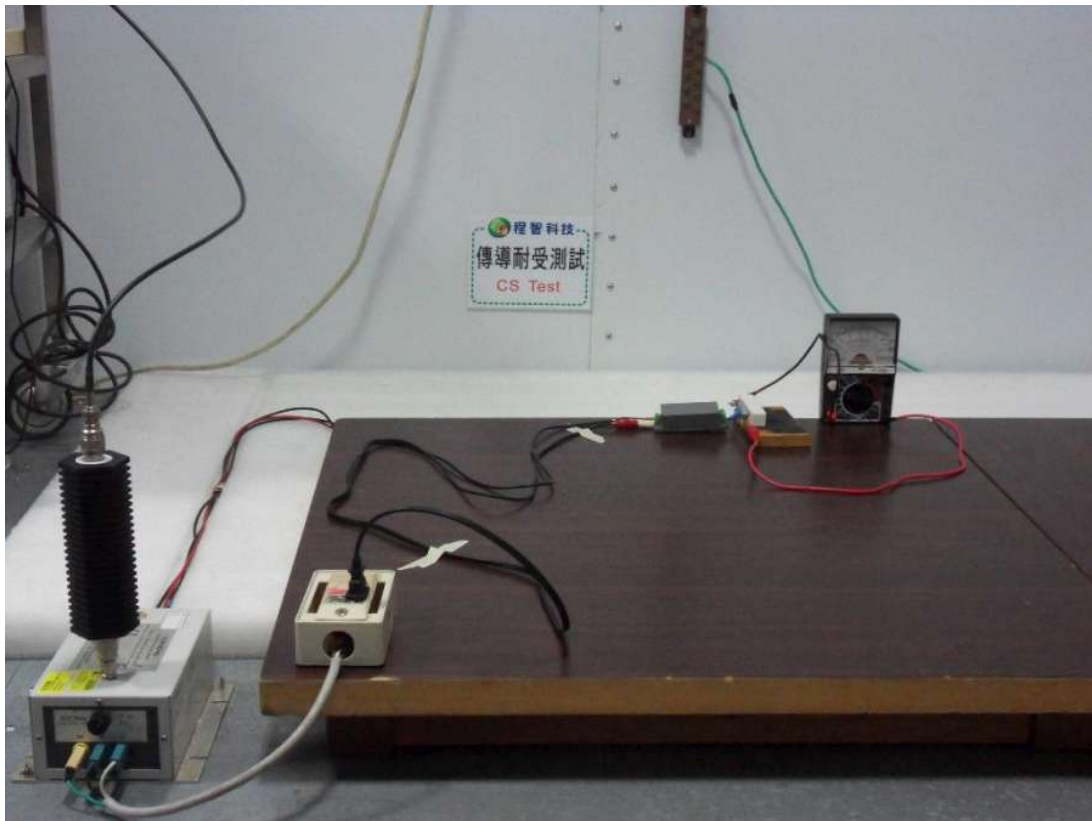


### Surge Test (Type B)





### CS Test (Type B)



### PFMF Test (Type B)

