FCC 47 CFR PART 15 SUBPART B AND ANSI C63.4:2014
IC ICES-003 Issue 6
TEST REPORT

For

8port Gigabit Web Smart PoE Switch

Model: VigorSwitch P1100

Trade Name: DrayTek

Issued for

DrayTek Corporation

No. 26, Fushing Rd., Hukou, Hsinchu Industrial Park, Hsinchu, 303, Taiwan

Issued by

Compliance Certification Services Inc.
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Testing Laboratory
0240

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	08/17/2016	Initial Issue	All Page 22	Vera Hsu

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1. TEST REPORT CERTIFICATION

Applicant	：	DrayTek Corporation
Address	：	No. 26, Fushing Rd., Hukou, Hsinchu Industrial Park, Hsinchu, 303, Taiwan
Equipment Under Test	：	8port Gigabit Web Smart PoE Switch
Model	：	VigorSwitch P1100
Trade Name	：	DrayTek
Tested Date	：	March 24 ~ May 04, 2016

APPLICABLE STANDARD		
Standard	**Item**	**Test Result**
FCC Part 15 Subpart B, CLASS A, ANSI C63.4:2014 AND IC ICES-003 Issue 6	Radiated Emission	PASS
	Conducted Emission	PASS

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

Approved by:

Sb. Lu
Sr. Engineer

Reviewed by:

Gundam Lin
Sr. Engineer

2. EUT DESCRIPTION

Product Name	8port Gigabit Web Smart PoE Switch
Model Number	VigorSwitch P1100
Identify Number	T160804S01
Received Date	March 24, 2016
Power Rating	100-240Vac, 50/60 Hz, 2A MAX
Test Voltage	120Vac/60Hz
AC Power Cable Type	Non-shielded cable, 1.7m × 1 (Detachable)
I/O Port	RJ-45 Port × 8, AC Power Port × 1, Fiber Port × 2

Remark: *1. For more details, please refer to the User's manual of the EUT.*
2. This report is transferred fromT16080302-D.

3. DESCRIPTION OF TEST MODES

1. The following test modes were scanned during the preliminary test:

No.	Pre-Test Mode
1	Normal Operating

2. After the preliminary scan, the following test mode was found to produce the highest emission level.

Final Test Mode		
Emission	Radiated Emission	Mode 1
	Conducted Emission	Mode 1

Remark: *Then, the above highest emission mode of the configuration of the EUT and cable was chosen for all final test items.*

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4:2014 and FCC CFR 47 Part 15 Subpart B, IC ICES-003 Issue 6.

5. FACILITIES AND ACCREDITATION

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No.989-1, Wenshan Rd., Shangshan Village,
Qionglin Township, Hsinchu County 30741, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.4:2014 and CISPR 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.

5.2 ACCREDITATIONS

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

Taiwan	TAF

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

Canada	INDUSTRY CANADA
Japan	VCCI
Taiwan	BSMI
USA	FCC MRA

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

5.3 MEASUREMENT UNCERTAINTY

The following table is for the measurement uncertainty, which is calculated as per the document CISPR 16-4-2.

PARAMETER	UNCERTAINTY
Open Area Test Site (OATS No.3) / Radiated Emission, 30 to 1000 MHz	+/- 4.21
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 30 to 1000 MHz	+/- 3.97
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 1 to 18GHz	+/- 3.58
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 18 to 26 GHz	+/- 3.59
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 26 to 40 GHz	+/- 3.81
Conducted Emission (Mains Terminals), 9kHz to 30MHz	+/- 2.48

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, clause 11, Measurement Uncertainty) determining compliance with the limits shall be base on the results of the compliance measurement. Consequently the measure emissions being less than the maximum allowed emission result in this be a compliant test or passing test.
The acceptable measurement uncertainty value without requiring revision of the compliance statement is base 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.

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

No.	Product	Manufacturer	Model No.	Serial No.
1	Notebook PC	TOSHIBA	1E101235H	PT345T-007002
2	Notebook PC	TOSHIBA	M840	9C104267C
3	Optical Transceivers	Finisar	FTLF8519P2BCL	PKS38NS
4	Optical Transceivers	Finisar	FTLF8519P2BCL	PKS3JLX

No.	Power & Signal Cable Description
1	Non-shielded RJ-45 cable, 1.5m × 6
2	Non-shielded RJ-45 cable, 10m × 2
3	Non-shielded Fiber cable, 5 m × 2

SETUP DIAGRAM FOR TESTS

EUT & peripherals setup diagram is shown in appendix setup photos.

EUT OPERATING CONDITION

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

1. EUT & peripherals setup diagram is shown in appendix setup photos.
2. Turn on the power of all equipments.
3. RJ-45 Port 1 link to Notebook PC 1 ; RJ-45 port 8 link to Notebook PC 2. Setup Notebook PC1 and Notebook PC2 IP 192.168.1.X.
4. Notebook PC 1 ping to Notebook PC 2.
5. RJ-45 port 2~7 / fiber port connect to load.
6. All of the functions are under run.
7. Start test.

7. EMISSION TEST

7.1 RADIATED EMISSION

LIMITS

(1) For Frequency Below 1GHz

☒ 47 CFR Part 15 Subpart B Section 15.109 (a) (b)

Frequency (MHz)	Class A			Class B		
	Field Strength (μV/m)	Field Strength (dBμV/m)	Distance (meters)	Field Strength (μV/m)	Field Strength (dBμV/m)	Distance (meters)
30 - 88	90	39.0	10	100	40.0	3
88 - 216	150	43.5	10	150	43.5	3
216 - 960	210	46.4	10	200	46.0	3
Above 960	300	49.5	10	500	54.0	3

☐ CISPR 22 (According to 47 CFR Part 15 Subpart B Section 15.109 (g))

Frequency (MHz)	Field Strengths (dBμV/m)		Distance (meters)
	Class A	Class B	
30 - 230	40	30	10
230 - 1000	47	37	10

(2) For Frequency Above 1GHz (According to 47 CFR Part 15 Subpart B Section 15.109)

Frequency (GHz)	Field Strength (dBμV/m)				Distance (meters)
	Class A		Class B		
	Peak	Average	Peak	Average	
Above 1GHz	80	60	74	54	3

(3) Frequency Range of Radiated Measurement (For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5^{th} harmonic of the highest frequency or 40GHz, whichever is lower

TEST EQUIPMENT

Radiated Emission below 1GHz / OATS3

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Bi-log Antenna	TESEQ	CBL 6112D	36996	08/03/2016
EMI Test Receiver	Rohde & Schwarz	ESCI	101131	03/15/2017
Pre-Amplifier	EMCI	EMC330H	980140	04/28/2017
Test S/W	N/A			

Remark: *Each piece of equipment is scheduled for calibration once a year.*

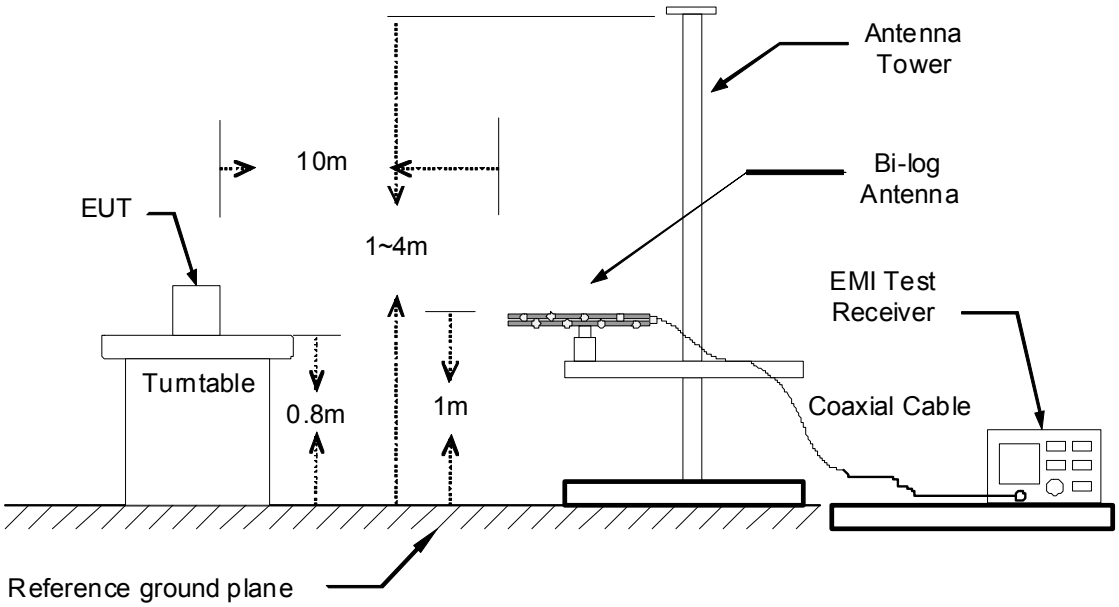
Radiated Emission above 1GHz / 966Chamber_B

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY46180323	04/12/2017
EMI Test Receiver	Rohde & Schwarz	ESCI	100221	04/26/2017
Bi-log Antenna	TESEQ	CBL 6112D	35403	08/04/2016
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-778	08/09/2016
Pre-Amplifier	Agilent	8447D	2944A10052	07/14/2016
Pre-Amplifier	Agilent	8449B	3008A01916	07/14/2016
Test S/W	E3.815206a			

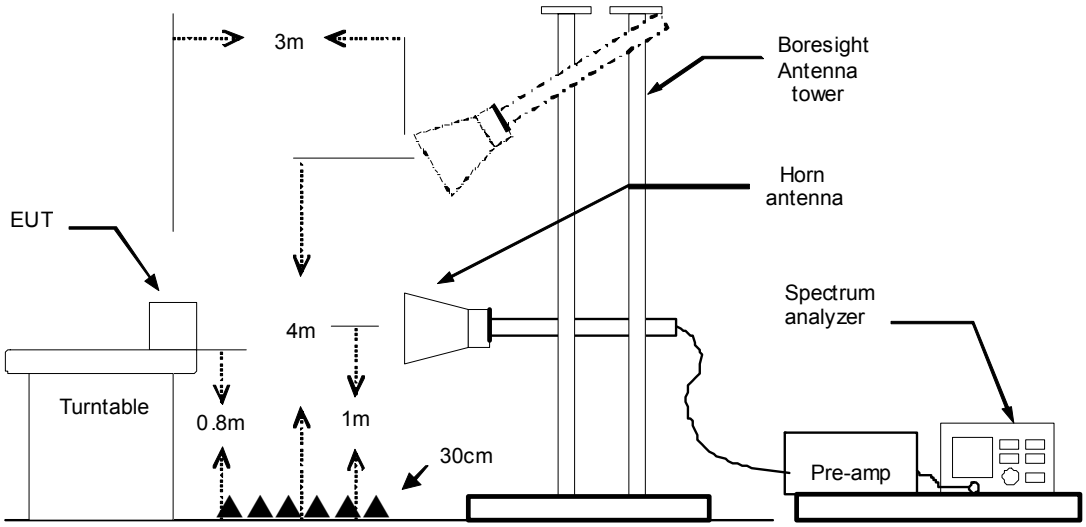
Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

The diagram below shows the test setup that is utilized to make the measurements for emission below 1GHz.



The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.



TEST PROCEDURE

The basic test procedure was in accordance with ANSI C63.4:2014.
The devices under test were placed on a rotatable table top 0.8 meter above ground. The table was rotated 360 degrees to determine the position of the highest radiation. EUT is set 3 or 10m meters from the interference receiving antenna which is mounted on the top of a variable height mast. The antenna height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.

Note：

1. The bandwidth setting on the E.M.I. meter (EMI TEST RECEIVER) is 120 KHz. The levels are Quasi-Peak value readings. The frequency spectrum from 30MHz to 1000MHz was investigated.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.

TEST RESULTS

Below 1 GHz

Product Name	8port Gigabit Web Smart PoE Switch	Test By	Kenneth Huang
Test Model	VigorSwitch P1100	Test Date	2016/05/03
Test Mode	Mode 1	Temp. & Humidity	28°C, 55%

OATS3 at 10Meter / Horizontal								
Frequency (MHz)	Corr. Factor (dB/m)	Meter Reading (dBμV)	Limits (dBμV/m)	Emission Level (dBμV/m)	Margin Limit (dB)	Azimuth (°)	Height (cm)	Remark
125.06	-18.63	46.88	43.50	28.25	-15.25	51	256	QP
250.19	-16.66	47.23	46.40	30.57	-15.83	302	123	QP
290.93	-15.89	49.65	46.40	33.76	-12.64	316	145	QP
375.32	-13.13	40.78	46.40	27.65	-18.75	238	168	QP
500.45	-9.79	45.46	46.40	35.67	-10.73	299	192	QP
750.71	-4.96	39.98	46.40	35.02	-11.38	135	278	QP

OATS3 at 10Meter / Vertical								
Frequency (MHz)	Corr. Factor (dB/m)	Meter Reading (dBμV)	Limits (dBμV/m)	Emission Level (dBμV/m)	Margin Limit (dB)	Azimuth (°)	Height (cm)	Remark
32.91	-14.04	42.87	39.00	28.83	-10.17	101	145	QP
52.31	-23.46	52.98	39.00	29.52	-9.48	10	165	QP
70.74	-24.05	44.32	39.00	20.27	-18.73	201	258	QP
125.06	-18.63	47.77	43.50	29.14	-14.36	31	159	QP
250.19	-16.66	39.67	46.40	23.01	-23.39	348	235	QP
500.45	-9.79	43.85	46.40	34.06	-12.34	106	147	QP

Remark:

1. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit.*
2. *Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) – PreAmp.Gain (dB)*
3. *Emission Level (dBuV/m) = Correction Factor (dB/m) + Meter Reading (dBμV)*
4. *Margin (dB) = Emission Level (dBuV/m) - Quasi-peak limit (dBuV/m)*

Above 1GHz

Product Name	8port Gigabit Web Smart PoE Switch	Test By	Kenneth Huang
Test Model	VigorSwitch P1100	Test Date	2016/03/28
Test Mode	Mode 1	Temp. & Humidity	20°C, 50%

966Chamber_B at 3Meter / Horizontal

Freq. MHz	Reading dBuV	C.F. dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Azimuth deg	Height cm	Remark
1440.00	45.28	-6.16	39.12	80.00	-40.88	20	100	Peak
1815.00	44.07	-4.55	39.52	80.00	-40.48	1	150	Peak
1940.00	42.94	-4.04	38.90	80.00	-41.10	335	100	Peak
2765.00	40.94	-1.06	39.88	80.00	-40.12	175	150	Peak
4105.00	40.56	3.24	43.80	80.00	-36.20	10	300	Peak
5500.00	39.03	7.14	46.17	80.00	-33.83	36	200	Peak

966Chamber_B at 3Meter / Vertical

Freq. MHz	Reading dBuV	C.F. dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Azimuth deg	Height cm	Remark
1815.00	43.69	-4.55	39.14	80.00	-40.86	360	100	Peak
1940.00	44.42	-4.04	40.38	80.00	-39.62	39	100	Peak
2560.00	41.13	-1.67	39.46	80.00	-40.54	295	150	Peak
3840.00	41.37	2.12	43.49	80.00	-36.51	158	400	Peak
4700.00	41.12	5.08	46.20	80.00	-33.80	119	200	Peak
5285.00	39.34	6.66	46.00	80.00	-34.00	97	100	Peak

Remark:

1. *Average test would be performed if the peak result were greater than the average limit.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
3. *Result = Reading + Correction Factor*
   Margin = Result – Limit
   Remark Peak = Result(PK) – Limit(PK)
   Remark AVG = Result(AV) – Limit(AV)

7.2 CONDUCTED EMISSION

LIMITS

Frequency Range (MHz)	Voltage Limits (dBμV)			
	Class A		Class B	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.50	79	66	66 - 56*	56 - 46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

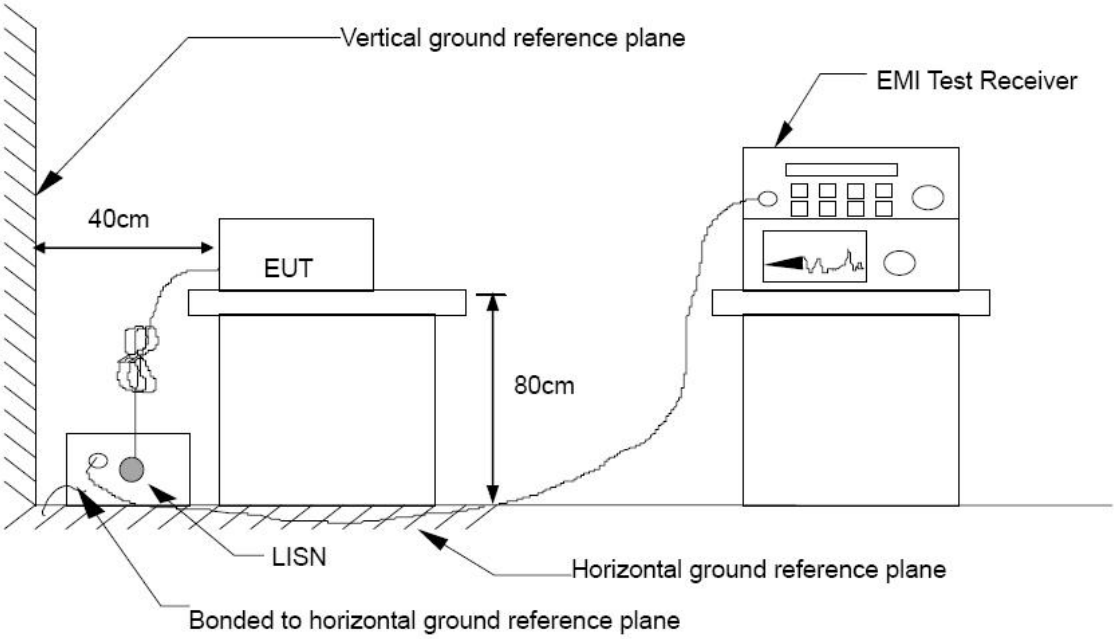
Remark: *(1) The limit decreases linearly with logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.*
(2) The lower limit shall apply at the transition frequency.
*(3) * Decreasing linearly with the logarithm of the frequency.*

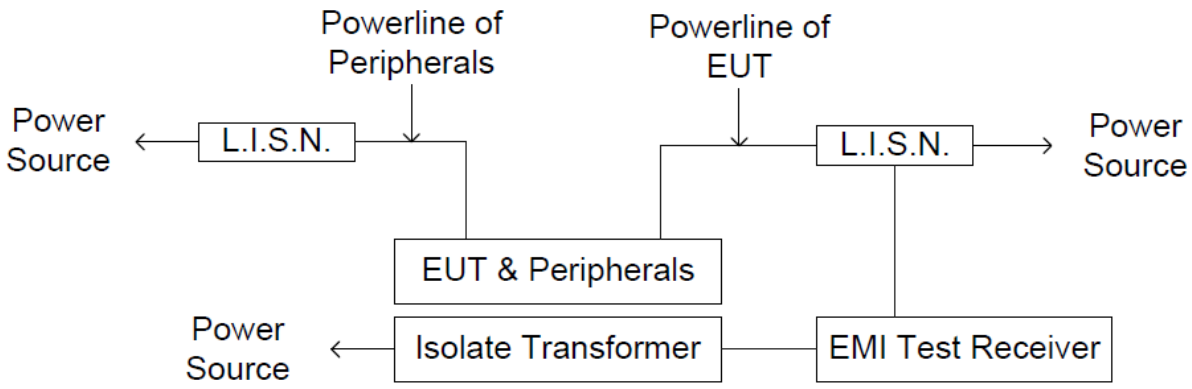
TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
L.I.S.N	Schwarzbeck	NSLK 8127	8127 465	08/05/2016
L.I.S.N	Schwarzbeck	NSLK 8127	8127 473	03/10/2017
EMI Test Receiver	Rohde & Schwarz	ESHS 30	838550/003	10/31/2016
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100111	06/28/2016
Test S/W	E3.815206a			

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP





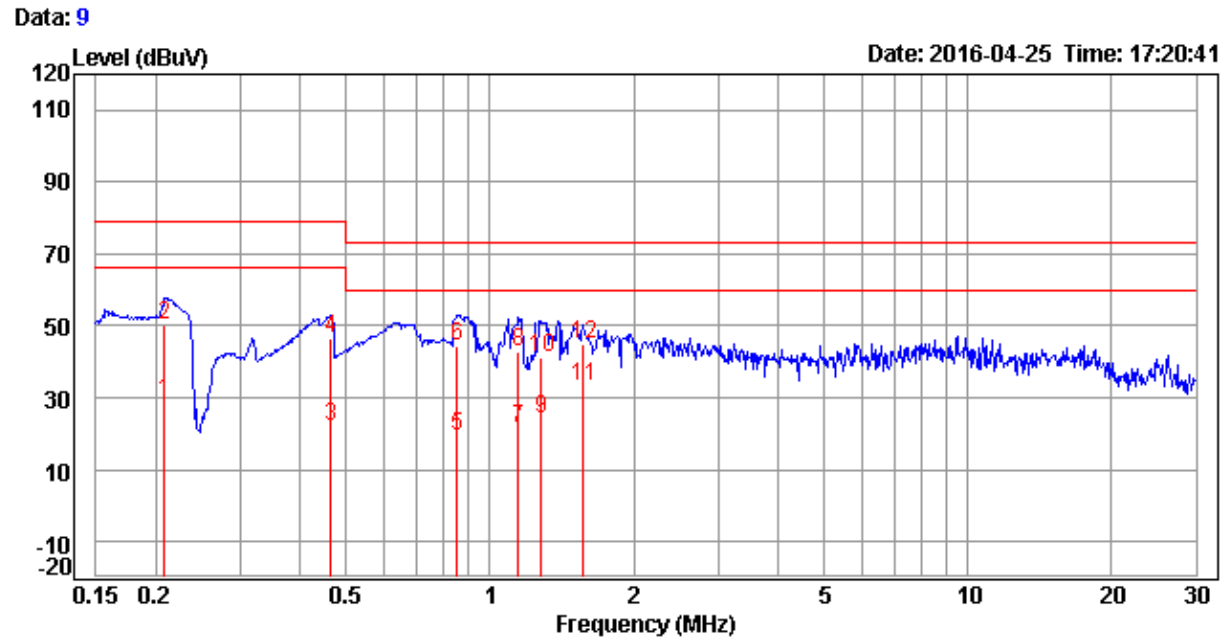
TEST PROCEDURE

The basic test procedure was in accordance with ANSI C63.4:2014.
The test procedure is performed in a 4m × 3m × 2.4m (L×W×H) shielded room.
The EUT along with its peripherals were placed on a 1.0m (W) × 1.5m (L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
The EUT was located so that the distance between the boundary of the EUT and the closest surface of the LISN is 0.8 m. Where a mains flexible cord was provided by the manufacturer shall be 1 m long, or if in excess of 1 m, the excess cable was folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

TEST RESULTS

Product Name	8port Gigabit Web Smart PoE Switch	Test By	Gill Yeh
Test Model	VigorSwitch P1100	Test Date	2016/04/25
Test Mode	Mode 1	Temp. & Humidity	19.9°C, 52%

LINE



Trace:

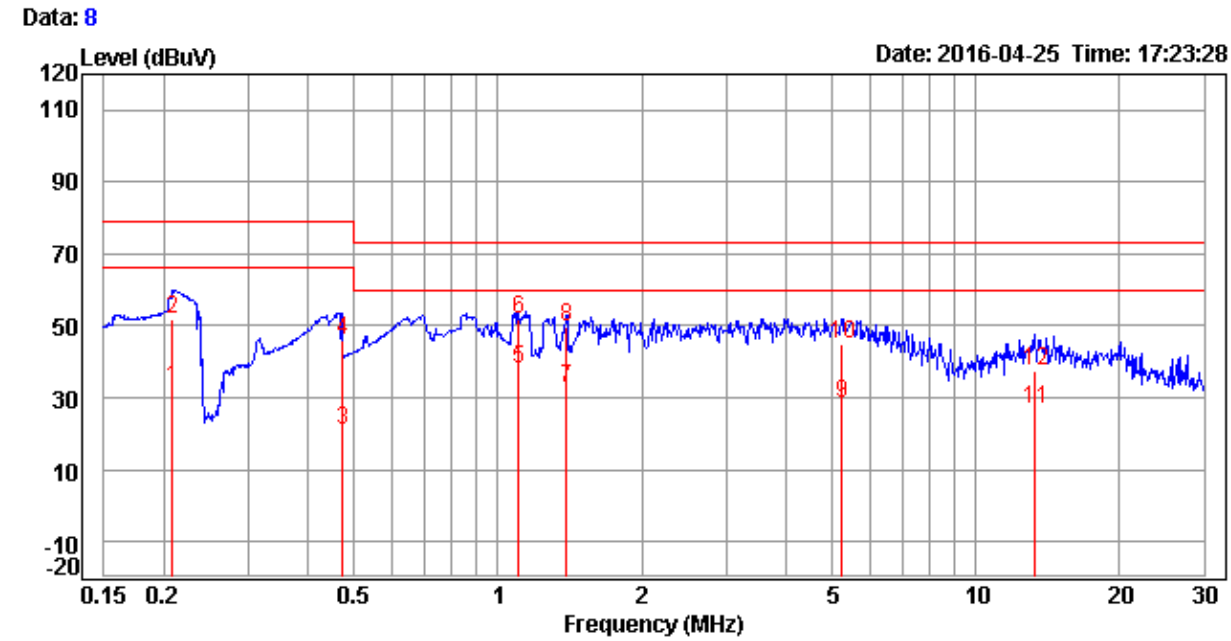
Freq. MHz	Reading dBuV Q.P.	Reading dBuV AV.	C.F. dB	Result dBuV Q.P.	Result dBuV AV.	Limit dBuV Q.P.	Limit dBuV AV.	Margin dB Q.P.	Margin dB AV.
0.208	40.38	18.94	10.04	50.42	28.98	79.00	66.00	-28.58	-37.02
0.464	36.59	11.92	10.07	46.66	21.99	79.00	66.00	-32.34	-44.01
0.853	34.53	9.48	10.07	44.60	19.55	73.00	60.00	-28.40	-40.45
1.147	32.67	11.46	10.08	42.75	21.54	73.00	60.00	-30.25	-38.46
1.276	31.09	14.09	10.09	41.18	24.18	73.00	60.00	-31.82	-35.82
1.568	34.80	22.93	10.11	44.91	33.04	73.00	60.00	-28.09	-26.96

Remark:

1. *Correction Factor = Insertion loss + Cable loss*
2. *Result level = Reading Value + Correction factor*
3. *Margin value = Result level – Limit value*

Product Name	8port Gigabit Web Smart PoE Switch	Test By	Gill Yeh
Test Model	VigorSwitch P1100	Test Date	2016/04/25
Test Mode	Mode 1	Temp. & Humidity	19.9°C, 52%

NEUTRAL



Trace:

Freq. MHz	Reading dBuV Q.P.	Reading dBuV AV.	C.F. dB	Result dBuV Q.P.	Result dBuV AV.	Limit dBuV Q.P.	Limit dBuV AV.	Margin dB Q.P.	Margin dB AV.
0.208	41.85	22.74	10.07	51.92	32.81	79.00	66.00	-27.08	-33.19
0.471	35.95	10.92	10.05	46.00	20.97	79.00	66.00	-33.00	-45.03
1.100	41.87	28.07	10.09	51.96	38.16	73.00	60.00	-21.04	-21.84
1.388	39.66	22.41	10.10	49.76	32.51	73.00	60.00	-23.24	-27.49
5.249	34.52	18.25	10.22	44.74	28.47	73.00	60.00	-28.26	-31.53
13.267	26.77	16.13	10.46	37.23	26.59	73.00	60.00	-35.77	-33.41

Remark:

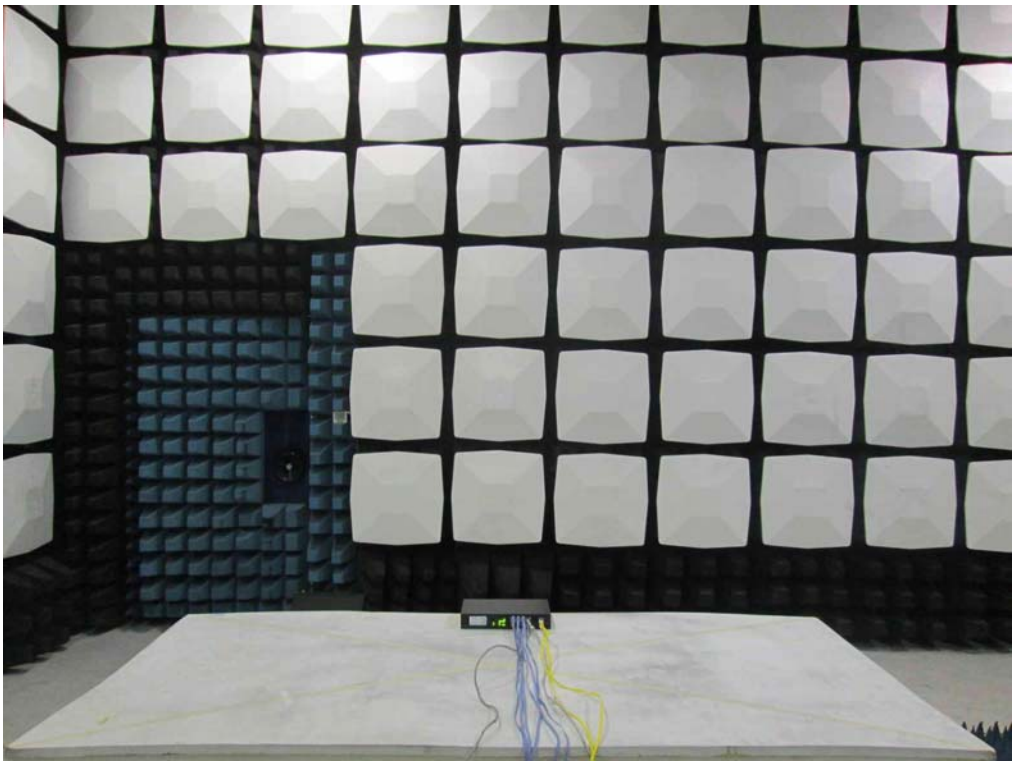
1. *Correction Factor = Insertion loss + Cable loss*
2. *Result level = Reading Value + Correction factor*
3. *Margin value = Result level – Limit value*

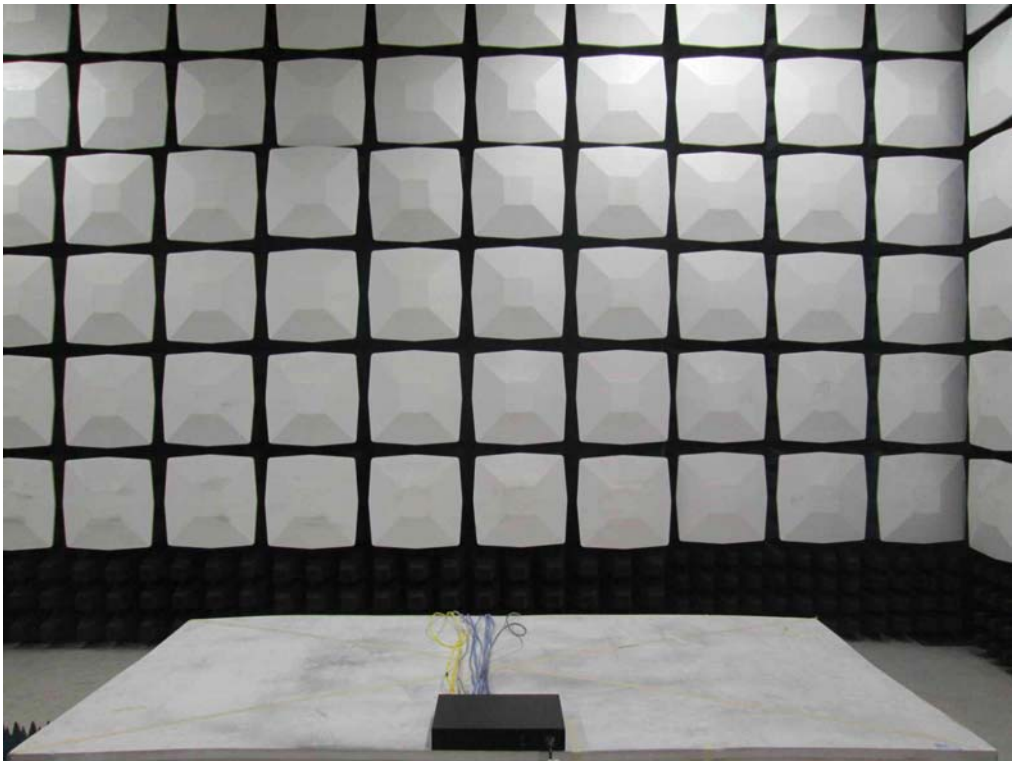
8. APPENDIX SETUP PHOTOS

RADIATED EMISSION SETUP

Below 1GHz

Above 1GHz





CONDUCTED EMISSION SETUP