

FCC Test Report

Project No. : 1705C116C
Equipment : PoE Smart Lite Giga Switch
Test Model : VigorSwitch P1092
Applicant : DrayTek Corp.
Address : 303 No. 26, Fu Shing Rd., HuKou County, Hsin-Chu
Industrial Park, Hsin-Chu, Taiwan R.O.C

Date of Receipt : May 11, 2017
Date of Test : May 11, 2017 ~ May 24, 2017
Issued Date : Sep. 13, 2017
Tested by : BTL Inc.

Testing Engineer : Simon Ling
(Simon Ling)

Technical Manager : Bill Zhang
(Bill Zhang)

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B T L I N C .

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Declaration

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Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

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REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FCCE-1-1705C116	Original Report.	May 25, 2017
BTL-FCCE-1-1705C116C	Compared with the previous report (BTL-FCCE-1-1705C116), product, brand, model name and applicant information are changed which does not affect the test results, the rest are kept the same.	Sep. 13, 2017

1. VERIFICATION

Equipment : PoE Smart Lite Giga Switch
Brand Name : DrayTek
Test Model : VigorSwitch P1092
Applicant : DrayTek Corp.
Manufacturer : DrayTek Corp.
Address : 303 No. 26, Fu Shing Rd., HuKou County, Hsin-Chu Industrial Park,
Hsin-Chu, Taiwan R.O.C
Factory : DrayTek Corp.
Address : 303 No. 26, Fu Shing Rd., HuKou County, Hsin-Chu Industrial Park,
Hsin-Chu, Taiwan R.O.C
Date of Test : Jan. 18, 2017 ~ May. 24, 2017
Test Sample : Engineering Sample
Standard(s) : FCC Part 15, Subpart B
ANSI C63.4-2014

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCCE-1-1705C116C) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

EMC Emission				
Standard(s)	Test Item	Limit	Judgment	Remark
FCC Part15, Subpart B ANSI C63.4-2014	Conducted Emission	Class A	PASS	
	Radiated emission Below 1 GHz	Class A	PASS	
	Radiated emission Above 1 GHz	Class A	N/A	NOTE(1) NOTE(2)

NOTE:

- (1) " N/A" denotes test is not applicable to this device.
- (2) The EUT's max operating frequency is 25MHz which does not exceed 108 MHz, so the test will not be performed.

2.1 TEST FACILITY

The test facilities used to collect the test data in this report at the location of No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China.

2.2 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. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{CISPR} requirement.

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95%**.

A. Conducted Measurement :

Test Site	Method	Measurement Frequency Range	U, (dB)
DG-C01	CISPR	150 kHz ~ 30MHz	3.16

B. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)
DG-CB08 (10m)	CISPR	30MHz ~ 200MHz	V	4.66
		30MHz ~ 200MHz	H	4.64
		200MHz ~ 1,000MHz	V	4.88
		200MHz ~ 1,000MHz	H	4.86

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	PoE Smart Lite Giga Switch
Brand Name	DrayTek
Test Model	VigorSwitch P1092
Model Difference	N/A
Power Source	AC Mains.
Power Rating	AC 100V-240V,50/60Hz,2.6A

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

3.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	FULL SYSTEM

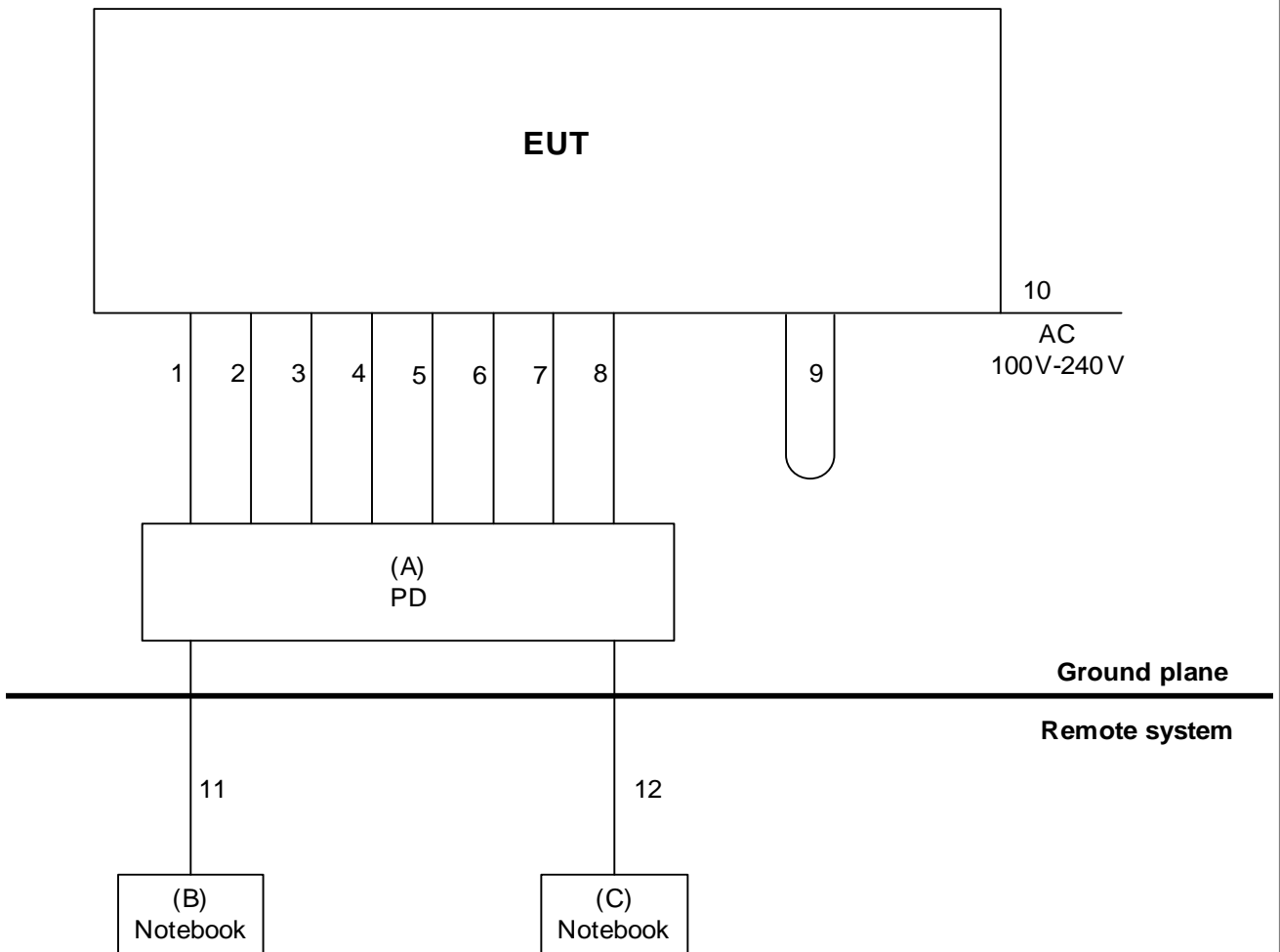
For Conducted Test	
Final Test Mode	Description
Mode 1	FULL SYSTEM

For Radiated Test	
Final Test Mode	Description
Mode 1	FULL SYSTEM

3.3 EUT OPERATING CONDITIONS

The EUT exercise program used during radiated and/or conducted emission measurement was designed to exercise the various system components in a manner similar to a typical use.

3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



3.5 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.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.
A	PD	N/A	N/A	N/A	N/A
B	Notebook	Dell	E5510	DOC	OJYNHR
C	Notebook	HP	8460P	DOC	CNU1301BJ3

Item	Shielded Type	Ferrite Core	Length	Note
1	NO	NO	2.0m	RJ45 Cable
2	NO	NO	2.0m	RJ45 Cable
3	NO	NO	2.0m	RJ45 Cable
4	NO	NO	2.0m	RJ45 Cable
5	NO	NO	2.0m	RJ45 Cable
6	NO	NO	2.0m	RJ45 Cable
7	NO	NO	2.0m	RJ45 Cable
8	NO	NO	2.0m	RJ45 Cable
9	NO	NO	0.5m	Fiber Cable
10	NO	NO	1.8m	AC Cable
11	NO	NO	10m	RJ45 Cable
12	NO	NO	10m	RJ45 Cable

4. EMC EMISSION TEST

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 POWER LINE CONDUCTED EMISSION (FREQUENCY RANGE 150KHZ-30MHZ)

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	60.00	50.00

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
- (3) The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)
 Margin Level = Measurement Value - Limit Value

4.1.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Measurement Software	Farad	EZ-EMC Ver.NB-03A 1-01	N/A	N/A
2	50Ω Terminator	SHX	TF2-3G-A	08122901	Mar. 26, 2018
3	TWO-LINE V-NETWORK	R&S	ENV216	100526	Mar. 26, 2018
4	EMI Test Receiver	R&S	ESR3	101862	Sep. 04, 2017
5	Artificial-Mains Network	SCHWARZBECK	NSLK 8127	8127685	Sep. 04, 2017
6	Cable	N/A	RG400 12m	N/A	Mar. 07, 2018

Remark: "N/A" denotes no model name, serial no. or calibration specified.
 All calibration period of equipment list is one year.

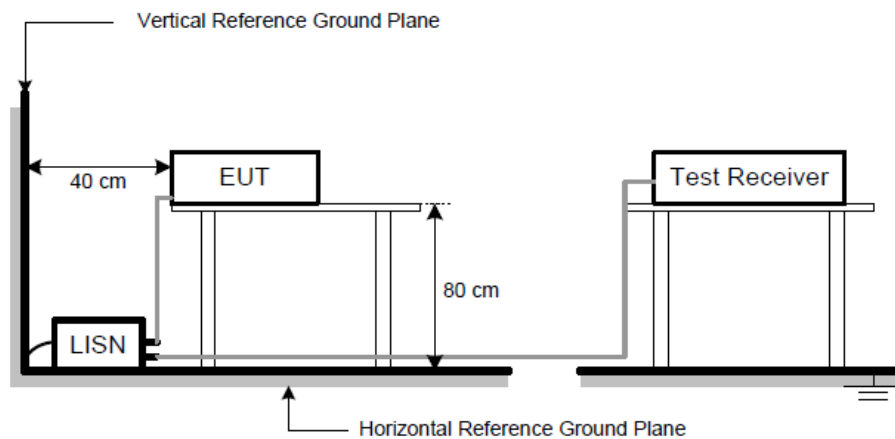
4.1.3 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.
- f. First the whole spectrum of emission caused by equipment under test(EUT) is recorded with Detector set to peak. Peak value recorded in table if the margin from QP Limit is larger than 2dB, otherwise, QP value is recorded, Measuring frequency range from 150KHz to 30MHz.

4.1.4 DEVIATION FROM TEST STANDARD

No deviation

4.1.5 TEST SETUP

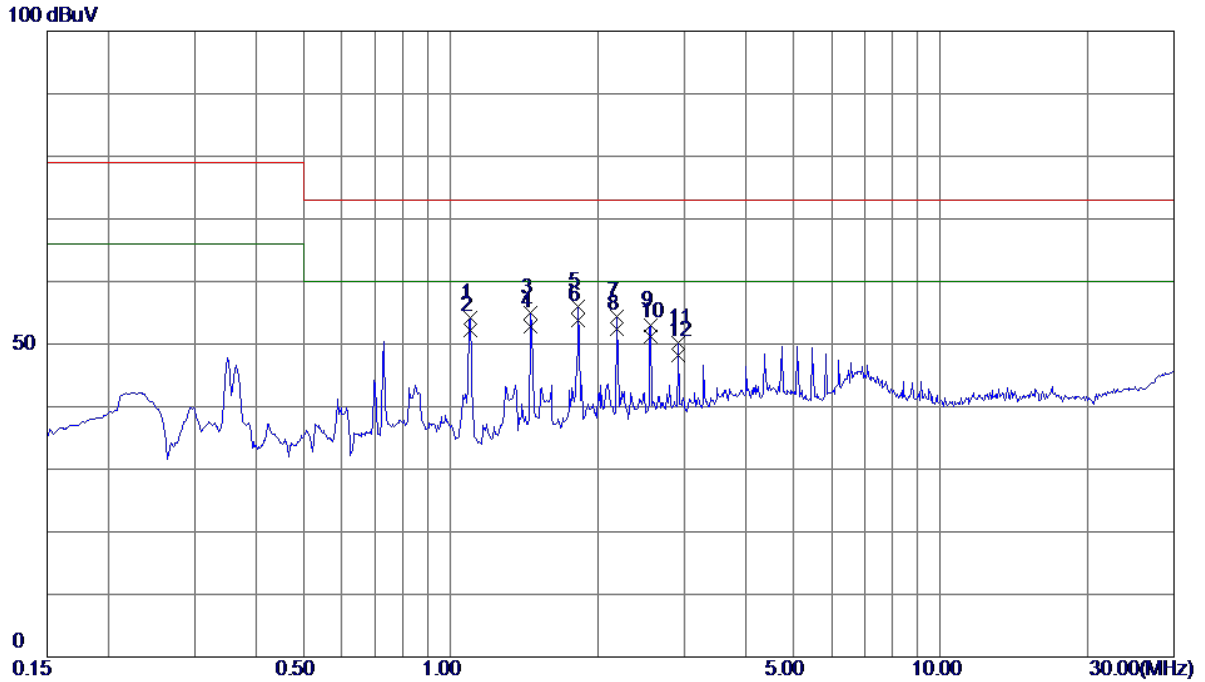


4.1.6 TEST RESULTS

Remark

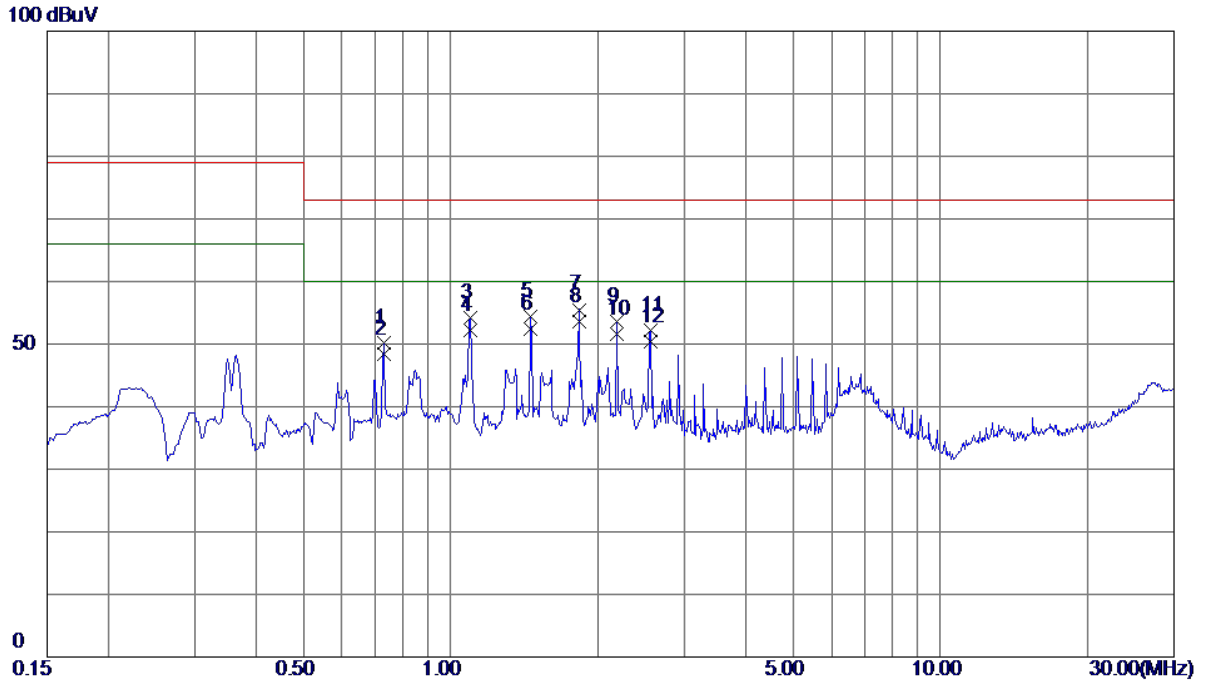
- (1) Reading in which marked as QP means measurements by using are Quasi-Peak Mode with Detector BW=9KHz; SPA setting in RBW=10KHz,VBW =10KHz, Swp. Time = 0.3 sec./MHz. Reading in which marked as AV means measurements by using are Average Mode with instrument setting in RBW=10KHz,VBW=10KHz, Swp. Time =0.3 sec./MHz.
- (2) All readings are QP Mode value unless otherwise stated AVG in column of 『Note』. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform. In this case, a “ * ” marked in AVG Mode column of Interference Voltage Measured.

EUT	PoE Smart Lite Giga Switch	Model Name	VigorSwitch P1092
Temperature	25°C	Relative Humidity	53%
Test Voltage	AC 120V/60Hz	Phase	Line
Test Mode	FULL SYSTEM		
Test Engineer	Simon Ling		



No.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measurement dBuV	Limit dBuV	Margin dB	Detector
1	1.0950	44.18	9.99	54.17	73.00	-18.83	QP
2	1.0950	42.21	9.99	52.20	60.00	-7.80	AVG
3	1.4595	44.94	9.99	54.93	73.00	-18.07	QP
4	1.4595	42.89	9.99	52.88	60.00	-7.12	AVG
5	1.8240	45.98	9.93	55.91	73.00	-17.09	QP
6 *	1.8240	43.91	9.93	53.84	60.00	-6.16	AVG
7	2.1885	44.41	9.92	54.33	73.00	-18.67	QP
8	2.1885	42.50	9.92	52.42	60.00	-7.58	AVG
9	2.5553	43.03	9.92	52.95	73.00	-20.05	QP
10	2.5553	41.21	9.92	51.13	60.00	-8.87	AVG
11	2.9198	40.39	9.87	50.26	73.00	-22.74	QP
12	2.9198	38.40	9.87	48.27	60.00	-11.73	AVG

EUT	PoE Smart Lite Giga Switch	Model Name	VigorSwitch P1092
Temperature	25°C	Relative Humidity	53%
Test Voltage	AC 120V/60Hz	Phase	Neutral
Test Mode	FULL SYSTEM		
Test Engineer	Simon Ling		



No.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measurement dBuV	Limit dBuV	Margin dB	Detector
1	0.7304	40.54	9.72	50.26	73.00	-22.74	QP
2	0.7304	38.60	9.72	48.32	60.00	-11.68	AVG
3	1.0950	44.47	9.75	54.22	73.00	-18.78	QP
4	1.0950	42.50	9.75	52.25	60.00	-7.75	AVG
5	1.4595	44.45	9.86	54.31	73.00	-18.69	QP
6	1.4595	42.60	9.86	52.46	60.00	-7.54	AVG
7	1.8263	45.60	9.90	55.50	73.00	-17.50	QP
8 *	1.8263	43.70	9.90	53.60	60.00	-6.40	AVG
9	2.1908	43.65	9.92	53.57	73.00	-19.43	QP
10	2.1908	41.70	9.92	51.62	60.00	-8.38	AVG
11	2.5553	42.31	9.92	52.23	73.00	-20.77	QP
12	2.5553	40.41	9.92	50.33	60.00	-9.67	AVG

4.2 RADIATED EMISSION MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Below 1 GHz

Measurement Method and Applied Limits:

ANSI C63.4:

Frequency (MHz)	Class A (at 10m)		Class B (at 3m)	
	(uV/m) Field strength	(dBuV/m) Field strength	(uV/m) Field strength	(dBuV/m) Field strength
30 - 88	90	39	100	40
88 - 216	150	43.5	150	43.5
216 - 960	210	46.4	200	46
Above 960	300	49.5	500	54

NOTE:

- (1) The limit for radiated test was performed according to as following:
FCC Part 15, Subpart B
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m) = 20log Emission level (uV/m).
3m Emission level = 10m Emission level + 20log(10m/3m).
- (4) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use)
Margin Level = Measurement Value - Limit Value

4.2.2 MEASUREMENT INSTRUMENTS LIST

Up to 1GHz:

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Pre-Amplifier	Mini-Circuits	EMC 9135	980284	Mar. 26, 2018
2	Pre-Amplifier	Mini-Circuits	EMC 9135	980283	Mar. 26, 2018
3	Trilog-Broadband Antenna	Schwarzbeck	VULB9168	586	Mar. 26, 2018
4	Trilog-Broadband Antenna	Schwarzbeck	VULB9168	587	Mar. 26, 2018
5	Cable	emci	LMR-400(5m+1 1m+15m)	N/A	Dec. 27, 2017
6	Cable	emci	LMR-400(5m+8 m+15m)	N/A	Dec. 27, 2017
7	Measurement Software	Farad	EZ-EMC Ver.BTL-2ANT-1	N/A	N/A
8	Multi-Device Controller	ETS-Lindgren	2090	N/A	N/A
9	Attenuator	N/A	SA18N-06	6dB	Apr. 14, 2018
10	Attenuator	N/A	SA18N-06	6dB	Apr. 14, 2018
11	Receiver	Keysight	N9038A	MY54450004	Sep. 04, 2017
12	MXE EMI Receiver	Agilent	N9038A	MY53220133	Jun. 23, 2017

Remark: "N/A" denotes no model name, serial no. or calibration specified.

All calibration period of equipment list is one year.

4.2.3 TEST PROCEDURE

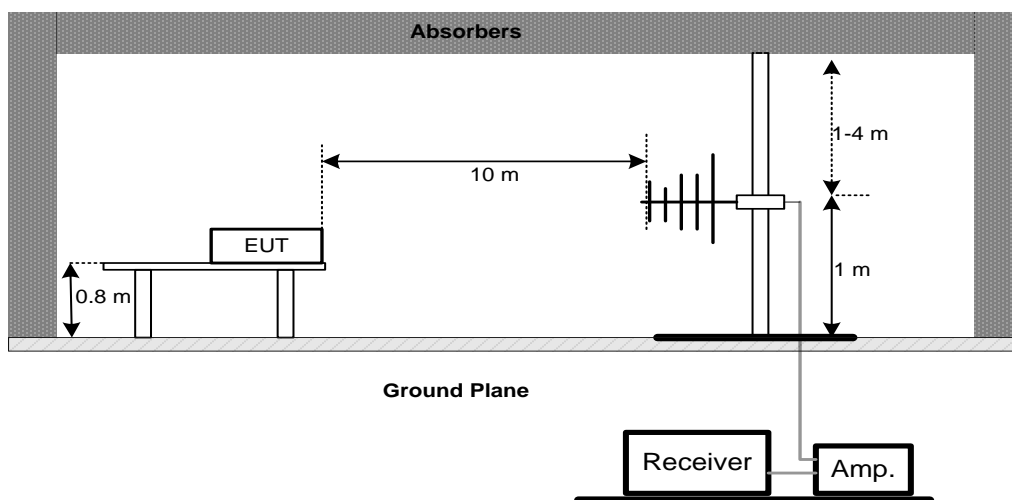
- a. The measuring distance of 10 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- b. The height of the equipment or of the substitution antenna shall be 0.8 m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- c. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- d. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1GHz)
- e. For the actual test configuration, please refer to the related Item - Block Diagram of system tested (please refer to 3.3).

4.2.4 DEVIATION FROM TEST STANDARD

No deviation

4.2.5 TEST SETUP

(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



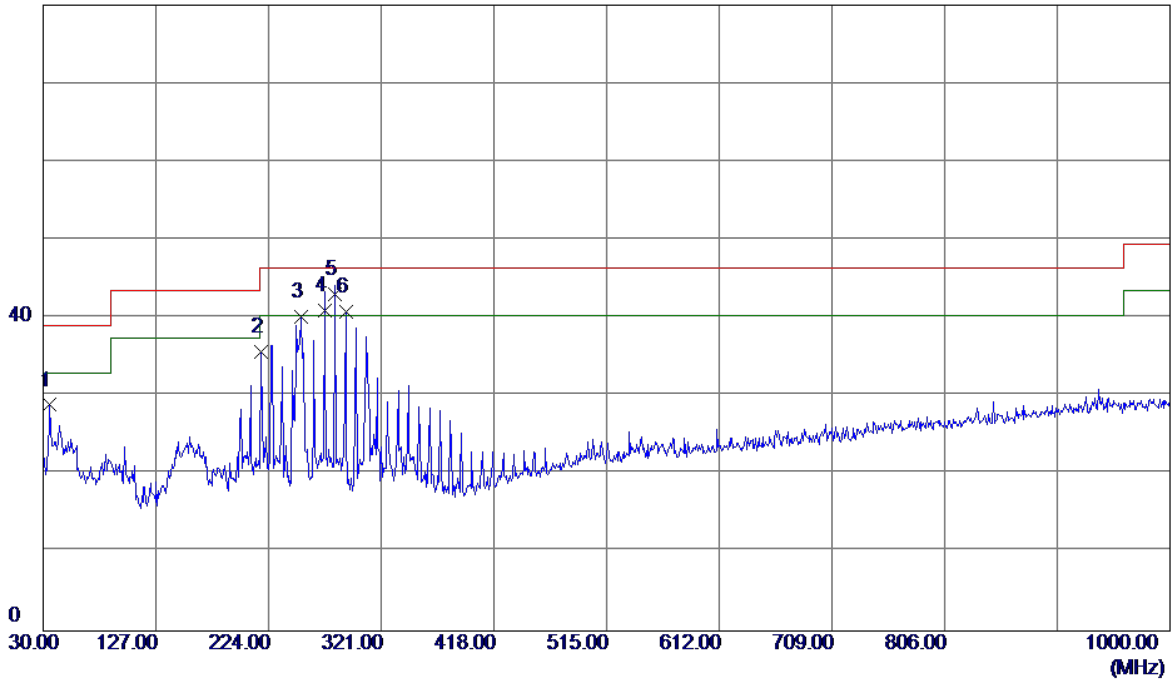
4.2.6 TEST RESULTS-BELOW 1GHZ

Remark :

- (1) All readings are Peak unless otherwise stated QP in column of 『Note』 . Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform ◦
- (2) Measuring frequency range from 30MHz to 1000MHz ◦
- (3) If the peak scan value lower limit more than 20dB, then this signal data does not show in table ◦

EUT	PoE Smart Lite Giga Switch	Model Name	VigorSwitch P1092
Temperature	25°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz	Polarization	Vertical
Test Mode	FULL SYSTEM		
Test Engineer	Simon Ling		

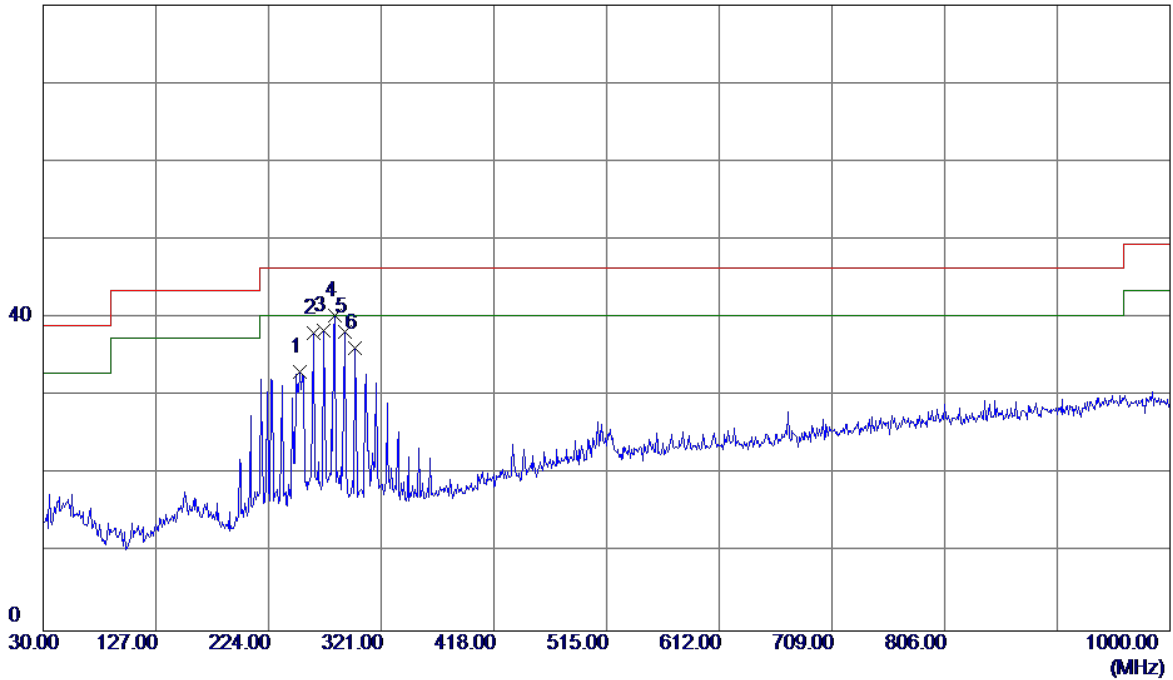
80 dBuV/m



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measurement dBuV/m	Limit dBuV/m	Margin dB	Detector
1	35.8200	52.64	-23.76	28.88	39.00	-10.12	QP
2	217.6950	59.43	-23.81	35.62	46.40	-10.78	QP
3	251.6450	61.97	-21.74	40.23	46.40	-6.17	QP
4	272.0150	61.81	-20.78	41.03	46.40	-5.37	QP
5 *	281.2300	63.36	-20.37	42.99	46.40	-3.41	QP
6	290.4450	60.96	-20.13	40.83	46.40	-5.57	QP

EUT	PoE Smart Lite Giga Switch	Model Name	VigorSwitch P1092
Temperature	25°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz	Polarization	Horizontal
Test Mode	FULL SYSTEM		
Test Engineer	Simon Ling		

80 dBuV/m



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector
1	251.1600	54.50	-21.38	33.12	46.40	-13.28	QP
2	262.8000	59.02	-20.90	38.12	46.40	-8.28	QP
3	271.5300	58.77	-20.41	38.36	46.40	-8.04	QP
4 *	281.2300	60.29	-19.98	40.31	46.40	-6.09	QP
5	289.9600	58.00	-19.75	38.25	46.40	-8.15	QP
6	298.6900	55.63	-19.51	36.12	46.40	-10.28	QP

5. EUT TEST PHOTO

Conducted Emission



Radiated emission below 1 GHz

