

# FCC Test Report

Product Name	In wall Switch
Model No.	PAN04-2
FCC ID.	RHHPAN04

Applicant	Philio Technology Corporation
Address	8F., No.653-2, Zhongzheng Rd., Xinzhuang Dist., New Taipei City 24257, Taiwan(R.O.C)

Date of Receipt	June 20, 2013
Issued Date	July 05, 2013
Report No.	136340R-RFUSP25V01
Report Version	V1.0



The Test Results relate only to the samples tested.

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# Test Report Certification

Issued Date: July 05, 2013

Report No. : 136340R-RFUSP25V01



Product Name	In wall Switch
Applicant	Philio Technology Corporation
Address	8F., No.653-2, Zhongzheng Rd., Xinzhuang Dist., New Taipei City 24257, Taiwan(R.O.C)
Manufacturer	Philio Technology Corporation
Model No.	PAN04-2
FCC ID.	RHHPAN04
EUT Rated Voltage	AC 90~240V, 47~63Hz
EUT Test Voltage	AC 120V/60Hz
Trade Name	
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2012 ANSI C63.4: 2003, ANSI C63.10: 2009
Test Result	Complied


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( Engineer / Vincent Chu )


Approved By :   
( Manager / Vincent Lin )

# TABLE OF CONTENTS

Description	Page
<b>1. GENERAL INFORMATION.....</b>	<b>4</b>
1.1. EUT Description .....	4
1.2. Operation Description .....	5
1.3. Tested System Details .....	6
1.4. Configuration of Test System.....	6
1.5. EUT Exercise Software.....	6
1.6. Test Facility .....	7
<b>2. Conducted Emission .....</b>	<b>8</b>
2.1. Test Equipment .....	8
2.2. Test Setup.....	8
2.3. Limits .....	9
2.4. Test Procedure .....	9
2.5. Uncertainty.....	9
2.6. Test Result of Conducted Emission .....	10
<b>3. Radiated Emission .....</b>	<b>12</b>
3.1. Test Equipment .....	12
3.2. Test Setup.....	13
3.3. Limits .....	14
3.4. Test Procedure.....	15
3.5. Uncertainty.....	15
3.6. Test Result of Radiated Emission .....	16
<b>4. Band Edge.....</b>	<b>22</b>
4.1. Test Equipment .....	22
4.2. Test Setup.....	23
4.3. Limit.....	23
4.4. Test Procedure.....	24
4.5. Uncertainty.....	24
4.6. Test Result of Band Edge.....	25
<b>5. EMI Reduction Method During Compliance Testing .....</b>	<b>27</b>

## 1. GENERAL INFORMATION

### 1.1. EUT Description

Product Name	In wall Switch
Trade Name	
FCC ID.	RHHPAN04
Model No.	PAN04-2
Frequency Range	908.42MHz
Type of Modulation	FSK
Number of Channels	1
Channel Control	Auto
Antenna Type	Monopole Antenna

Center Frequency of Each Channel:

Channel	Frequency
Channel 1:	908.42MHz

Note:

1. The EUT is an In wall Switch with a built-in 908.42MHz Z-Wave transceiver.
2. These tests are conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.249.
3. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

Test Mode	Mode 1: Transmit
-----------	------------------

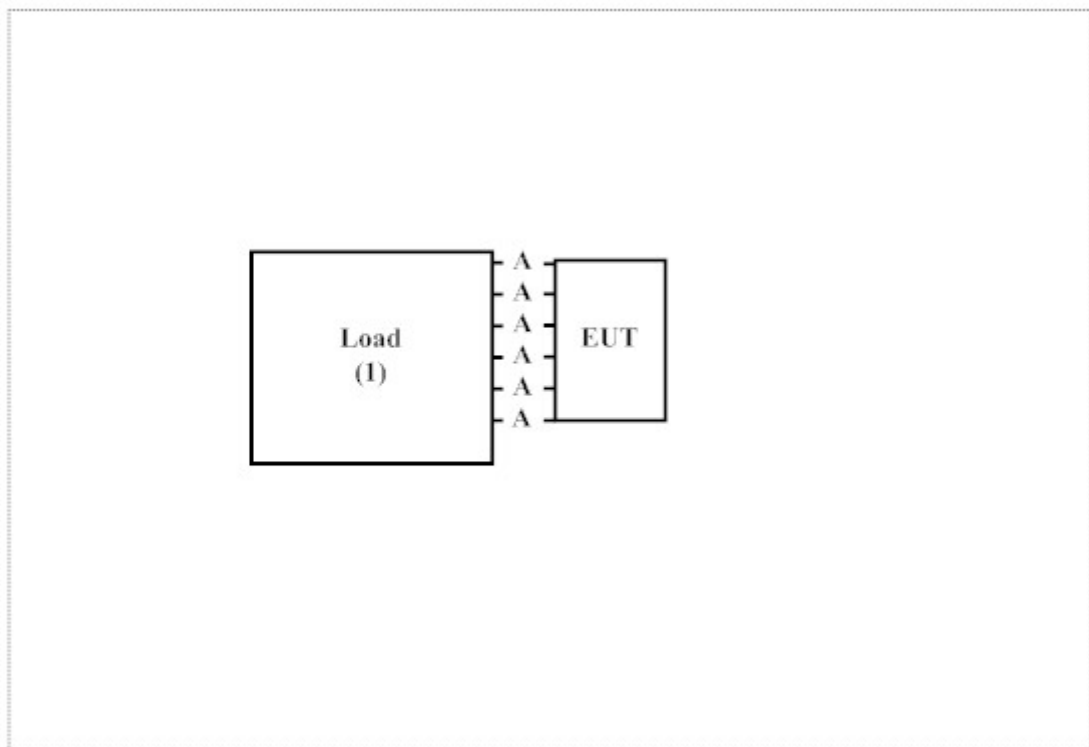
### 1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1. Load (400W)	Pioneer	N/A	N/A	N/A

Signal Cable Type	Signal cable Description
A. Power Line Cable	Non-shielded, 0.2m, six PCS.

### 1.4. Configuration of Test System



### 1.5. EUT Exercise Software

- (1) Setup the EUT as shown in section 1.4.
- (2) Provide the AC Power Source.
- (3) Starts the continuous transmit.
- (4) Verify that the EUT works correctly.

## 1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from Quietek Corporation's Web Site : <http://tw.quietek.com/modules/myalbum/>  
The address and introduction of Quietek Corporation's laboratories can be founded in our Web site : <http://www.quietek.com/>

Site Description: File on  
Federal Communications Commission  
FCC Engineering Laboratory  
7435 Oakland Mills Road  
Columbia, MD 21046  
Registration Number: 92195

Site Name: Quietek Corporation  
Site Address: No.5-22, Ruishukeng Linkou Dist., New Taipei City  
24451, Taiwan, R.O.C.  
TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789  
E-Mail : [service@quietek.com](mailto:service@quietek.com)

FCC Accreditation Number: TW1014

## 2. Conducted Emission

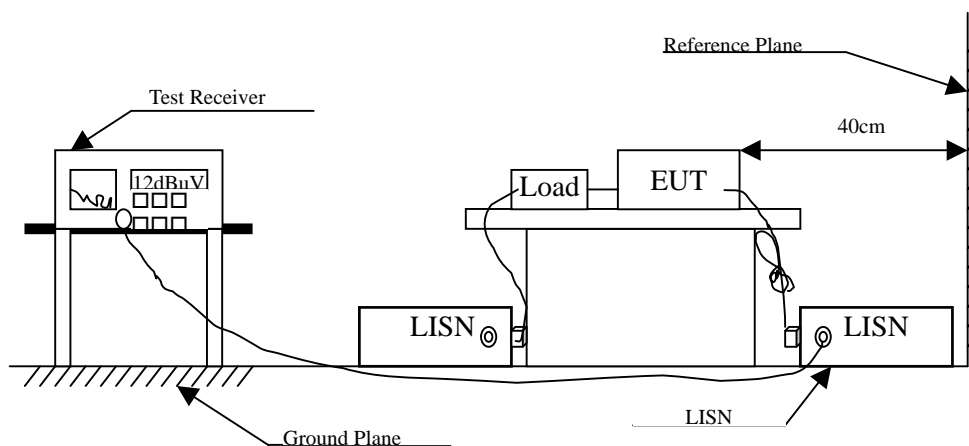
### 2.1. Test Equipment

	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
X	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2012	
X	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2013	Peripherals
X	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2013	EUT
	DC LISN	Schwarzbeck	8226 / 176	Mar, 2013	EUT
X	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2013	
	No.8 Shielded Room				

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked by "X" are used to measure the final test results.

### 2.2. Test Setup



### 2.3. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

### 2.4. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2009 on conducted measurement.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

### 2.5. Uncertainty

$\pm 2.26$  dB



## 2.6. Test Result of Conducted Emission

Product : In wall Switch  
 Test Item : Conducted Emission Test  
 Power Line : Line 1  
 Test Mode : Mode 1: Transmit

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV	dB	dBuV
<b>Line 1</b>					
<b>Quasi-Peak</b>					
0.166	9.790	49.550	59.340	-6.203	65.543
0.212	9.790	47.840	57.630	-6.599	64.229
0.244	9.790	45.410	55.200	-8.114	63.314
0.373	9.790	41.360	51.150	-8.479	59.629
0.545	9.790	32.870	42.660	-13.340	56.000
0.892	9.790	29.670	39.460	-16.540	56.000
<b>Average</b>					
0.166	9.790	27.730	37.520	-18.023	55.543
0.212	9.790	38.650	48.440	-5.789	54.229
0.244	9.790	28.110	37.900	-15.414	53.314
0.373	9.790	32.520	42.310	-7.319	49.629
0.545	9.790	16.040	25.830	-20.170	46.000
0.892	9.790	19.830	29.620	-16.380	46.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : In wall Switch  
 Test Item : Conducted Emission Test  
 Power Line : Line 2  
 Test Mode : Mode 1: Transmit

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV	dB	dBuV
<b>Line 2</b>					
<b>Quasi-Peak</b>					
0.193	9.770	48.670	58.440	-6.331	64.771
0.224	9.770	46.970	56.740	-7.146	63.886
0.275	9.770	45.500	55.270	-7.159	62.429
0.408	9.770	40.360	50.130	-8.499	58.629
1.017	9.780	29.610	39.390	-16.610	56.000
1.670	9.790	25.070	34.860	-21.140	56.000
<b>Average</b>					
0.193	9.770	31.650	41.420	-13.351	54.771
0.224	9.770	30.270	40.040	-13.846	53.886
0.275	9.770	29.500	39.270	-13.159	52.429
0.408	9.770	26.250	36.020	-12.609	48.629
1.017	9.780	17.790	27.570	-18.430	46.000
1.670	9.790	20.360	30.150	-15.850	46.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

### 3. Radiated Emission

#### 3.1. Test Equipment

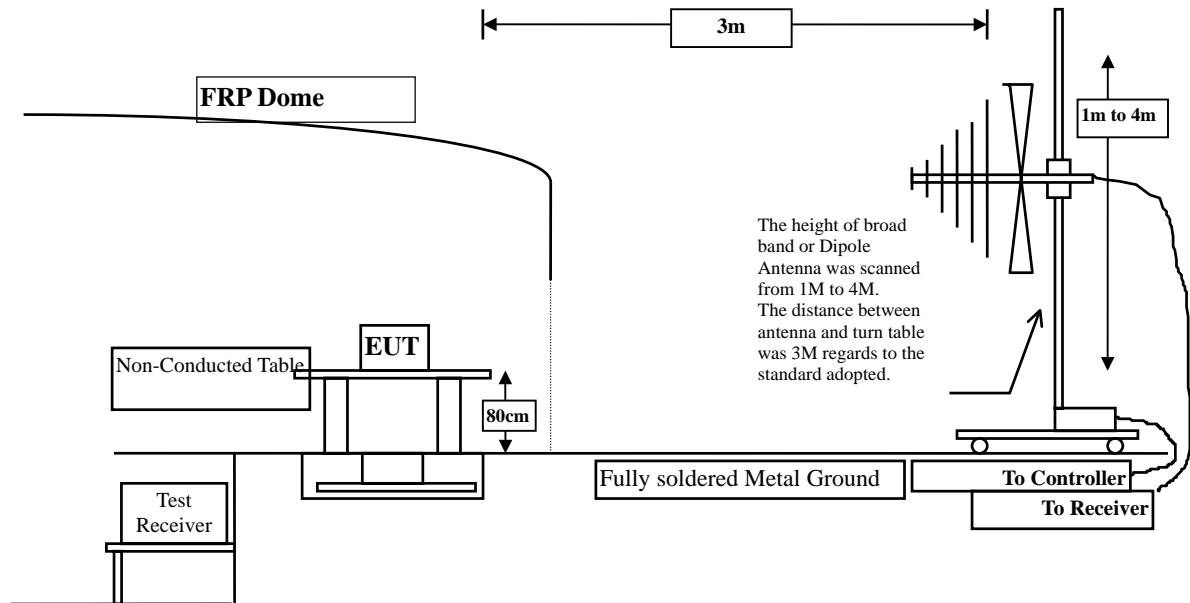
The following test equipment are used during the radiated emission test:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
<input checked="" type="checkbox"/> Site # 3	X Loop Antenna	Teseq	HLA6120 / 26739	Jul., 2013
	X Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2012
	X Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2012
	X Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2013
	X Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2013
	X Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2012
	X Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2013
	X Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2013
	X Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2012
	X Coaxial Cable	QuieTek	QTK-CABLE/ CAB5	Feb., 2013
	X Controller	QuieTek	QTK-CONTROLLER/ CTRL3	N/A
	X Coaxial Switch	Anritsu	MP59B/6200265729	N/A

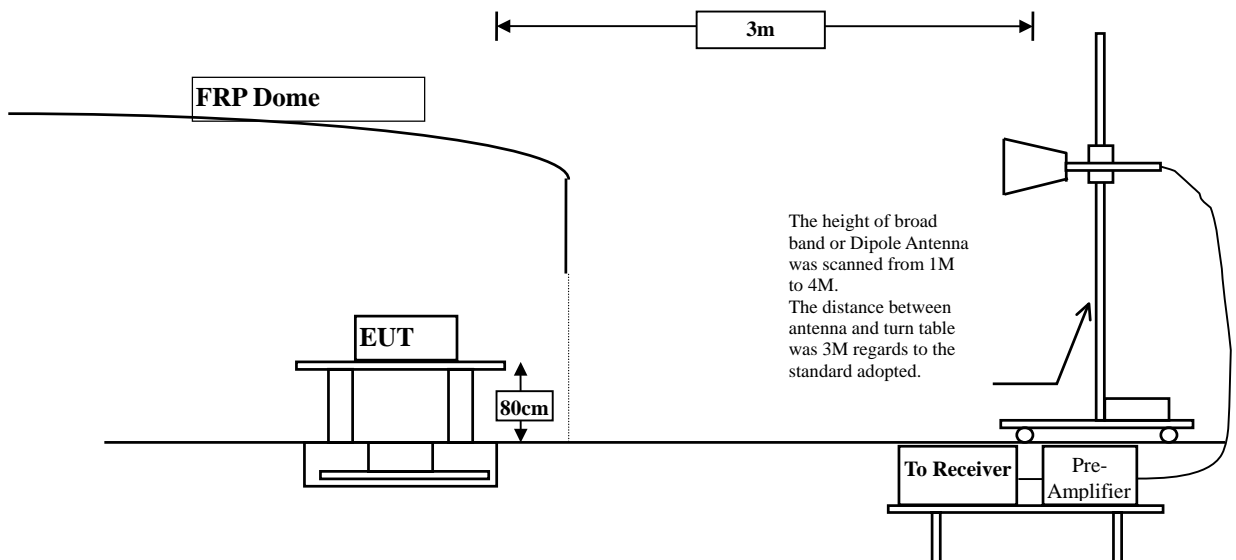
- Note:
1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
  2. The test instruments marked with "X" are used to measure the final test results.

### 3.2. Test Setup

Below 1GHz



Above 1GHz



### 3.3. Limits

#### ➤ Fundamental and Harmonics Emission Limits

FCC Part 15 Subpart C Paragraph 15.249 Limits				
Frequency MHz	Field Strength of Fundamental		Field Strength of Harmonics	
	(mV/m @3m)	(dBuV/m @3m)	(uV/m @3m)	(dBuV/m @3m)
902-928	50	94	500	54
2400-2483.5	50	94	500	54
5725-5875	50	94	500	54

- Remarks :
1. RF Voltage (dBuV/m) = 20 log RF Voltage (uV/m)
  2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

#### ➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

- Remarks :
1. RF Voltage (dBuV/m) = 20 log RF Voltage (uV/m)
  2. In the Above Table, the tighter limit applies at the band edges.
  3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

### 3.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2009 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The worst radiated emission is measured on the Final Measurement.

The measurement frequency range from 9KHz - 10th Harmonic of fundamental was investigated.

### 3.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

### 3.6. Test Result of Radiated Emission

Product : In wall Switch  
 Test Item : Fundamental Radiated Emission  
 Test Site : No.3OATS  
 Test Mode : Mode 1: Transmit (X-asix )

<b>Peak Detector</b>					
Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Horizontal</b>					
908.420	27.562	64.644	92.206	-1.794	94.000
--					
<b>Vertical</b>					
908.420	24.073	67.983	92.056	-1.944	94.000
--					

Note:

1. All Readings below 1GHz are peak detector, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna Factor + Cable Loss – PreAMP.

Product : In wall Switch  
 Test Item : Fundamental Radiated Emission  
 Test Site : No.3OATS  
 Test Mode : Mode 1: Transmit (Y-asix )

#### Peak Detector

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Horizontal</b>					
908.420	27.562	65.194	92.756	-1.244	94.000
--					
<b>Vertical</b>					
908.420	24.073	65.953	90.026	-3.974	94.000
--					

#### Note:

1. All Readings below 1GHz are peak detector, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna Factor + Cable Loss – PreAMP.



Product : In wall Switch  
 Test Item : Fundamental Radiated Emission  
 Test Site : No.3OATS  
 Test Mode : Mode 1: Transmit (Z-asix )

<b>Peak Detector</b>					
Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Horizontal</b>					
908.420	27.562	64.464	92.026	-1.974	94.000
--					
<b>Vertical</b>					
908.420	24.073	65.863	89.936	-4.064	94.000
--					

Note:

1. All Readings below 1GHz are peak detector, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna Factor + Cable Loss – PreAMP.

Product : In wall Switch  
Test Item : Harmonic Radiated Emission Data  
Test Site : No.3 OATS  
Test Mode : Mode 1: Transmit

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
1810.000	-4.423	45.538	41.114	-32.886	74.000
2728.000	-1.058	46.794	45.736	-28.264	74.000
3633.680	-0.395	38.927	38.532	-35.468	74.000
4542.100	1.901	39.248	41.150	-32.850	74.000
5450.520	4.228	35.763	39.991	-34.009	74.000
6358.940	6.502	36.802	43.304	-30.696	74.000
7267.360	11.106	36.035	47.141	-26.859	74.000
8182.000	15.025	38.595	53.620	-20.380	74.000
9084.200	13.021	34.191	47.212	-26.788	74.000

#### Average Detector:

--

#### Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : In wall Switch  
 Test Item : Harmonic Radiated Emission Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Vertical</b>					
<b>Peak Detector:</b>					
1816.840	-2.613	39.399	36.786	-37.214	74.000
2728.000	-1.212	50.335	49.123	-24.877	74.000
3633.680	0.379	39.847	40.226	-33.774	74.000
4546.000	5.438	45.439	50.877	-23.123	74.000
5450.520	5.976	36.136	42.111	-31.889	74.000
6358.940	7.975	35.422	43.398	-30.602	74.000
7267.360	11.925	34.429	46.354	-27.646	74.000
8182.000	15.667	39.318	54.984	-19.016	74.000
9084.200	13.142	34.101	47.243	-26.757	74.000
<b>Average Detector:</b>					
8182.000	15.667	34.260	49.926	-4.074	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : In wall Switch  
 Test Item : General Radiated Emission Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Horizontal</b>					
99.952	-15.301	38.476	23.175	-20.325	43.500
224.311	-20.048	46.984	26.936	-19.064	46.000
390.641	-12.022	39.335	27.313	-18.687	46.000
622.260	-6.336	39.503	33.167	-12.833	46.000
780.817	-5.979	39.405	33.426	-12.574	46.000
973.574	-5.452	42.452	37.000	-17.000	54.000
<b>Vertical</b>					
45.030	-19.902	49.700	29.798	-10.202	40.000
224.311	-12.743	42.686	29.943	-16.057	46.000
378.205	-13.722	38.990	25.268	-20.732	46.000
546.090	-10.848	38.584	27.736	-18.264	46.000
687.548	-8.961	38.886	29.925	-16.075	46.000
847.660	-6.322	37.847	31.525	-14.475	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

#### 4. Band Edge

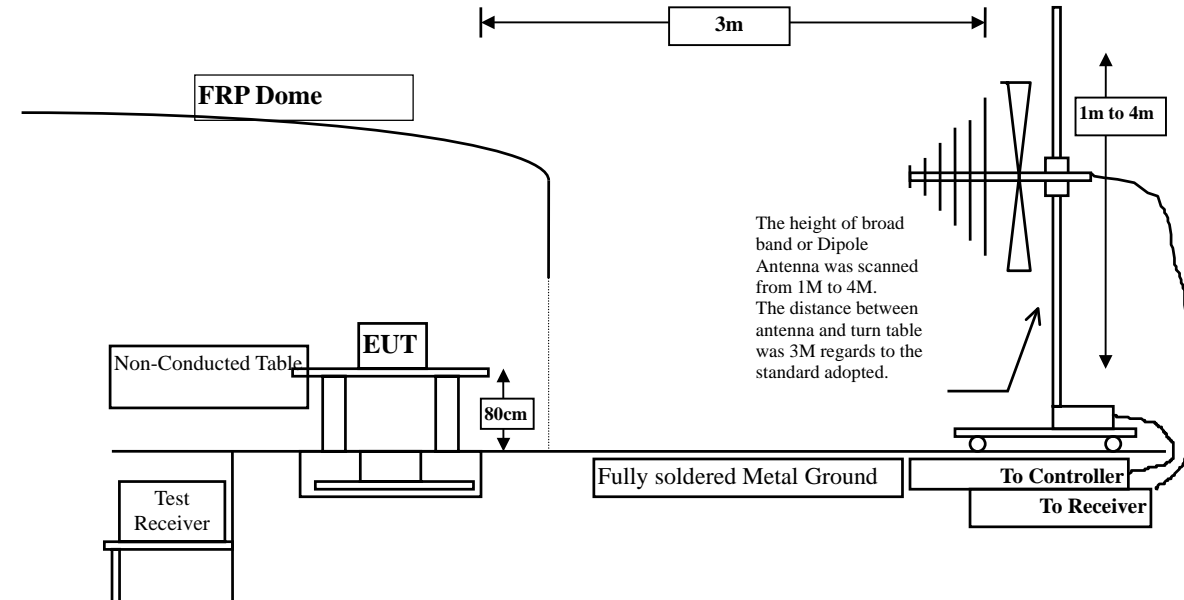
##### 4.1. Test Equipment

The following test equipments are used during the band edge tests:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
<input checked="" type="checkbox"/> Site # 3	X Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2012
	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2012
	Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2013
	X Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2013
	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2012
	Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2013
	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2013
	X Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2012
	X Coaxial Cable	QuieTek	QTK-CABLE/ CAB5	Feb., 2013
	X Controller	QuieTek	QTK-CONTROLLER/ CTRL3	N/A
	X Coaxial Switch	Anritsu	MP59B/6200265729	N/A

- Note:
1. All equipments are calibrated every one year.
  2. The test equipments marked by "X" are used to measure the final test results.

## 4.2. Test Setup



## 4.3. Limit

Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

#### **4.4. Test Procedure**

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10:2009 on radiated measurement.

The bandwidth below 1GHz setting on the field strength meter (R&S Test Receiver ESCS 30 )is 120 kHz, above 1GHz are 1 MHz.

#### **4.5. Uncertainty**

Radiated is  $\pm 3.9$  dB.

#### 4.6. Test Result of Band Edge

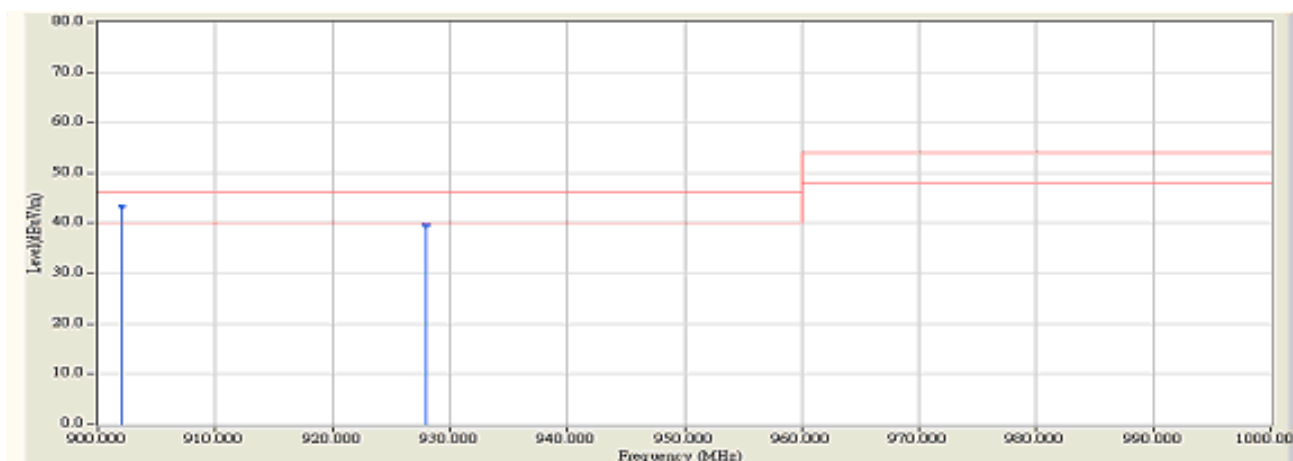
Product : In wall Switch  
 Test Item : Band Edge Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit

##### RF Radiated Measurement (Horizontal):

No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Quasi-Peak Limit (dBuV/m)	Result
01(Quasi-Peak)	902.000	-6.100	49.700	43.599	46.020	Pass
02(Quasi-Peak)	928.000	-5.878	45.600	39.722	46.020	Pass

Figure Channel 01:

Horizontal (Quasi-Peak)



Note:

1. Quasi-Peak measurements: RBW=100kHz,VBW=1MHz,Sweep: Auto.
2. “ \* ”, means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

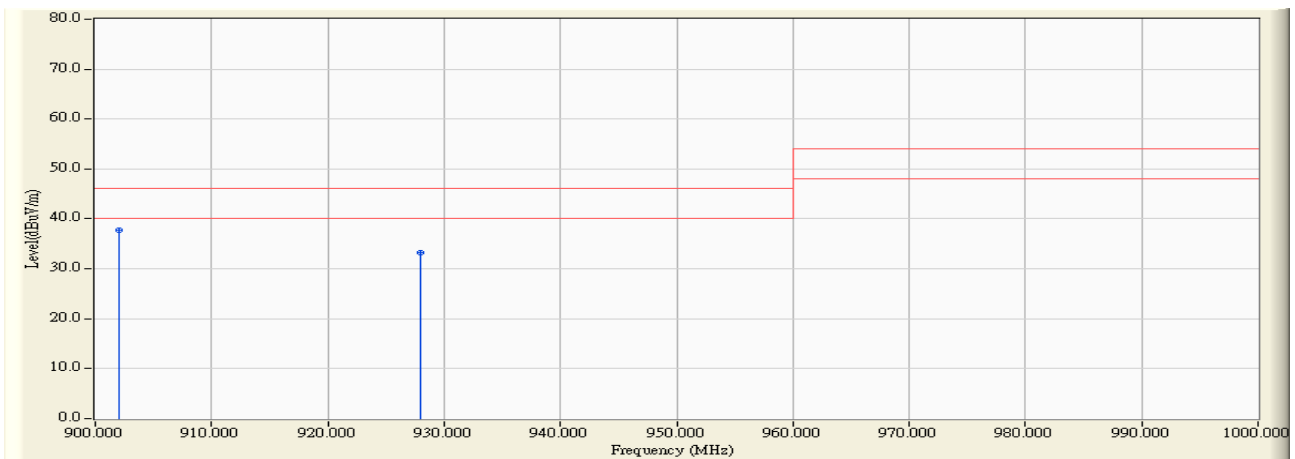


Product : In wall Switch  
 Test Item : Band Edge Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit

**RF Radiated Measurement (Vertical):**

No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Quasi-Peak Limit (dBuV/m)	Result
01(Quasi-Peak)	902.000	-4.950	42.800	37.850	46.020	Pass
02(Quasi-Peak)	928.000	-4.898	38.200	33.302	46.020	Pass

**Figure Channel 01: Vertical (Quasi-Peak)**



Note:

1. Quasi-Peak measurements: RBW=100kHz,VBW=1MHz,Sweep: Auto.
2. “ \* ”, means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

## **5. EMI Reduction Method During Compliance Testing**

No modification was made during testing.