

FCC TEST REPORT

For

Willis Electric Co., Ltd.

Control box

Model No.: WL605-A-2

Prepared for : Willis Electric Co., Ltd.
Address : No.504-1, Chung-Hua Road, Sec.4, Hsin Chu, Taiwan

Prepared by : Shenzhen LCS Compliance Testing Laboratory Ltd.
Address : 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China

Date of receipt of test sample : June 05, 2013
Number of tested samples : 1
Serial number : Prototype
Date of Test : June 05, 2013 - June 20, 2013
Date of Report : June 20, 2013

FCC TEST REPORT
FCC CFR 47 PART 15 Subpart B: 2012

Report Reference No. : LCS130605117TF

Date Of Issue..... : June 20, 2013

Testing Laboratory Name : Shenzhen LCS Compliance Testing Laboratory Ltd.

Address : 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China

Testing Location/ Procedure : Full application of Harmonised standards [checked]
Partial application of Harmonised standards []
Other standard testing method []

Applicant's Name..... : Willis Electric Co., Ltd.

Address : No.504-1, Chung-Hua Road, Sec.4, Hsin Chu, Taiwan

Test Specification

Standard : FCC CFR 47 PART 15 Subpart B:2012, ANSI C63.4-2009

Test Report Form No. : LCSEMC-1.0

TRF Originator..... : Shenzhen LCS Compliance Testing Laboratory Ltd.

Master TRF : Dated 2011-03

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Test Item Description. : Control box

Trade Mark..... : N/A

Model/ Type Reference..... : WL605-A-2

Ratings : AC 90~130V, 60Hz, 1.8A

Result : Positive

Compiled by:

[Signature of Yoyo Wang]

Supervised by:

[Signature of Fox Zhang]

Approved by:

[Signature of Gavin Liang]

Yoyo Wang/ File administrators

Fox Zhang/ Technique principal

Gavin Liang/ Manager

FCC TEST REPORT

Test Report No. : LCS130605117TF	<u>June 20, 2013</u> Date of issue
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Type/ Model..... : WL605-A-2
EUT..... : Control box
Applicant..... : Willis Electric Co., Ltd. Address..... : No.504-1, Chung-Hua Road, Sec.4, Hsin Chu, Taiwan Telephone..... : / Fax..... : /
Manufacturer..... : Kupoint (Dongguan) Electric Co., Ltd. Address..... : Huaide Village, Humen, Dongguan, Guangdong, China Telephone..... : / Fax..... : /
Factory..... : Kupoint (Dongguan) Electric Co., Ltd. Address..... : Huaide Village, Humen, Dongguan, Guangdong, China Telephone..... : / Fax..... : /

Test Result	Positive
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The test report merely corresponds to the test sample.
 It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1. SUMMARY OF STANDARDS AND RESULTS

The EUT have been tested according to the applicable standards as referenced below.

EMISSION			
Description of Test Item	Standard	Limits	Results
Conducted disturbance at mains terminals	FCC CFR 47 PART 15 Subpart B: 2012	Class B	PASS
Radiated disturbance	FCC CFR 47 PART 15 Subpart B: 2012	Class B	PASS

N/A is an abbreviation for Not Applicable.

2. GENERAL INFORMATION

2.1. Description of Device (EUT)

EUT	:	Control box
Model Number	:	WL605-A-2
Power Supply	:	AC 90~130V, 60Hz, 1.8A
EUT Clock	:	≤108MHz
Receiving Frequency	:	433.92MHz
Receiving Antenna	:	PCB Antenna, 0dBi

2.2. Support Equipment List

Manufacturer	Description	Model	Serial Number	Certificate
N/A	N/A	N/A	N/A	N/A

2.3. External I/O Port

I/O Port Description	Quantity	Cable
N/A	N/A	N/A

2.4. Description of Test Facility

Site Description

EMC Lab.	:	Accredited by CNAS, June 04, 2010 The Certificate Registration Number. is L4595. Accredited by FCC, July 14, 2011 The Certificate Registration Number. is 899208. Accredited by Industry Canada, May. 02, 2011 The Certificate Registration Number. is 9642A-1 Accredited by VCCI, Japan January 30, 2012 The Certificate Registration Number. is C-4260 and R-380
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2.5.Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

2.6.Measurement Uncertainty

Test Item	Frequency Range	Uncertainty	Note
Radiation Uncertainty :	30MHz~200MHz	±2.96dB	(1)
	200MHz~1000MHz	±3.10dB	(1)
	1GHz~26.5GHz	±3.80dB	(1)
Conduction Uncertainty :	150kHz~30MHz	±1.63dB	(1)
Power disturbance :	30MHz~300MHz	±1.60dB	(1)

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

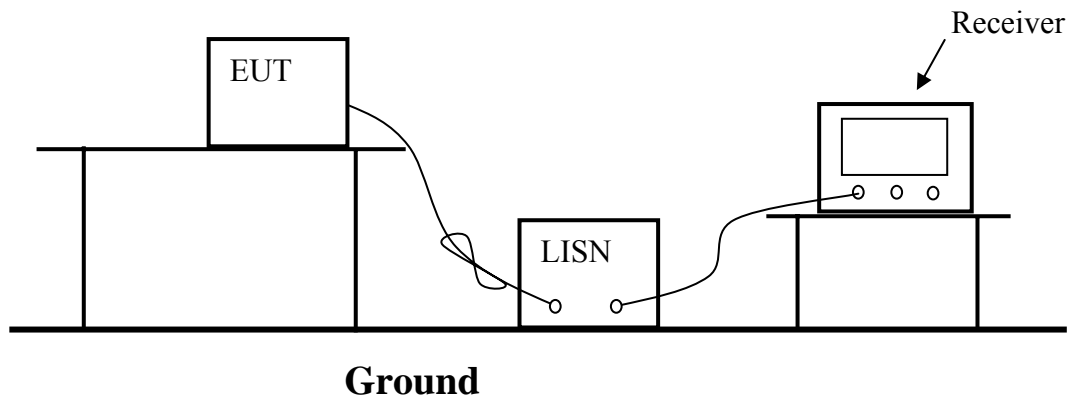
3. POWER LINE CONDUCTED MEASUREMENT

3.1. Test Equipment

The following test equipments are used during the power line conducted measurement:

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
1	EMC Receiver	R&S	ESCS30	100174	2013/06/18	2014/06/17
2	L.I.S.N	Mess Tec	NNB-2/16Z	99079	2013/06/18	2014/06/17
3	50Ω Coaxial Switch	R&S	MP59B	M20531	2013/06/18	2014/06/17
4	Pulse Limiter	Anritsu	ESH3-Z2	100006	2013/06/18	2014/06/17
5	Voltage Probe	Rohde & Schwarz	TK9416	N/A	2013/06/18	2014/06/17

3.2. Block Diagram of Test Setup



3.3. Power Line Conducted Emission Measurement Limits (Class B)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 ~ 0.50	66 to 56*	56 to 46*
0.50 ~ 5.00	56	46
5.00 ~ 30.00	60	50

- Notes: 1. *Decreasing linearly with logarithm of frequency.
 2. The lower limit shall apply at the transition frequencies.

3.4. Configuration of EUT on Measurement

The following equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner, which tends to maximize its emission characteristics in a normal application.

3.5. Operating Condition of EUT

- (1) Setup the EUT and simulator as shown as Section 3.2.
- (2) Turn on the power of all equipment.
- (3) Let the EUT work in test mode (ON) and measure it.

3.6. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC/ANSI C63.4-2009 on Conducted Emission Measurement.

The bandwidth of test receiver is set at 9kHz.

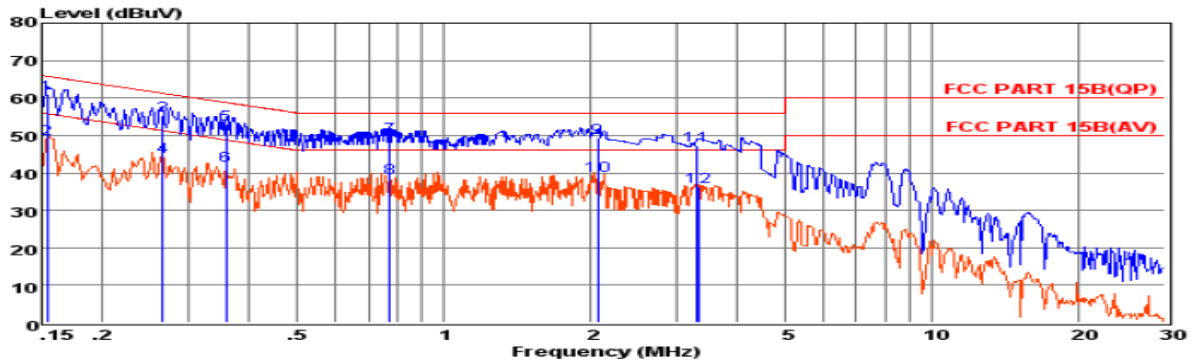
The frequency range from 150kHz to 30MHz is checked.

3.7. Test Results

PASS.

The test data please refer to following page.

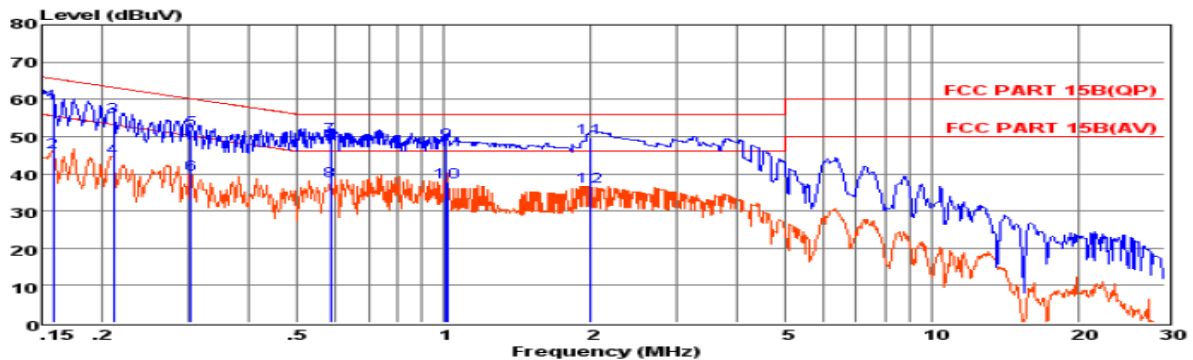
Temperature	25°C	Humidity	60%
EUT	Control box	Model Name	WL605-A-2



Env. Ins: 24*/56%
 Power Rating: AC 120V/60Hz
 Test Mode: On
 Operator: Tree
 Memo:
 Pol: LINE

	Freq	Reading	LisnFac	CabLos	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.15	51.33	9.58	0.02	60.93	65.78	-4.85	QP
2	0.15	39.37	9.58	0.02	48.97	55.77	-6.80	Average
3	0.27	45.67	9.63	0.03	55.33	61.25	-5.92	QP
4	0.27	34.65	9.63	0.03	44.31	51.24	-6.93	Average
5	0.36	43.28	9.62	0.03	52.93	58.78	-5.85	QP
6	0.36	32.27	9.62	0.03	41.92	48.78	-6.86	Average
7	0.78	40.05	9.64	0.04	49.73	56.00	-6.27	QP
8	0.78	29.10	9.64	0.04	38.78	46.00	-7.22	Average
9	2.07	39.78	9.64	0.05	49.47	56.00	-6.53	QP
10	2.07	29.71	9.64	0.05	39.40	46.00	-6.60	Average
11	3.31	37.50	9.65	0.06	47.21	56.00	-8.79	QP
12	3.31	26.58	9.65	0.06	36.29	46.00	-9.71	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss.
 2. The emission levels that are 20dB below the official limit are not reported.



Env. Ins: 24*/56%
 Power Rating: AC 120V/60Hz
 Test Mode: On
 Operator: Tree
 Memo:
 Pol: NEUTRAL

	Freq	Reading	LisnFac	CabLos	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.16	49.28	9.68	0.02	58.98	65.56	-6.58	QP
2	0.16	36.24	9.68	0.02	45.94	55.55	-9.61	Average
3	0.21	45.78	9.59	0.03	55.40	63.18	-7.78	QP
4	0.21	34.79	9.59	0.03	44.41	53.18	-8.77	Average
5	0.30	42.02	9.60	0.03	51.65	60.15	-8.50	QP
6	0.30	30.10	9.60	0.03	39.73	50.14	-10.41	Average
7	0.59	40.35	9.62	0.04	50.01	56.00	-5.99	QP
8	0.59	28.40	9.62	0.04	38.06	46.00	-7.94	Average
9	1.01	38.94	9.63	0.05	48.62	56.00	-7.38	QP
10	1.01	27.94	9.63	0.05	37.62	46.00	-8.38	Average
11	1.99	39.85	9.63	0.05	49.53	56.00	-6.47	QP
12	2.00	26.80	9.63	0.05	36.48	46.00	-9.52	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss.
 2. The emission levels that are 20dB below the official limit are not reported.

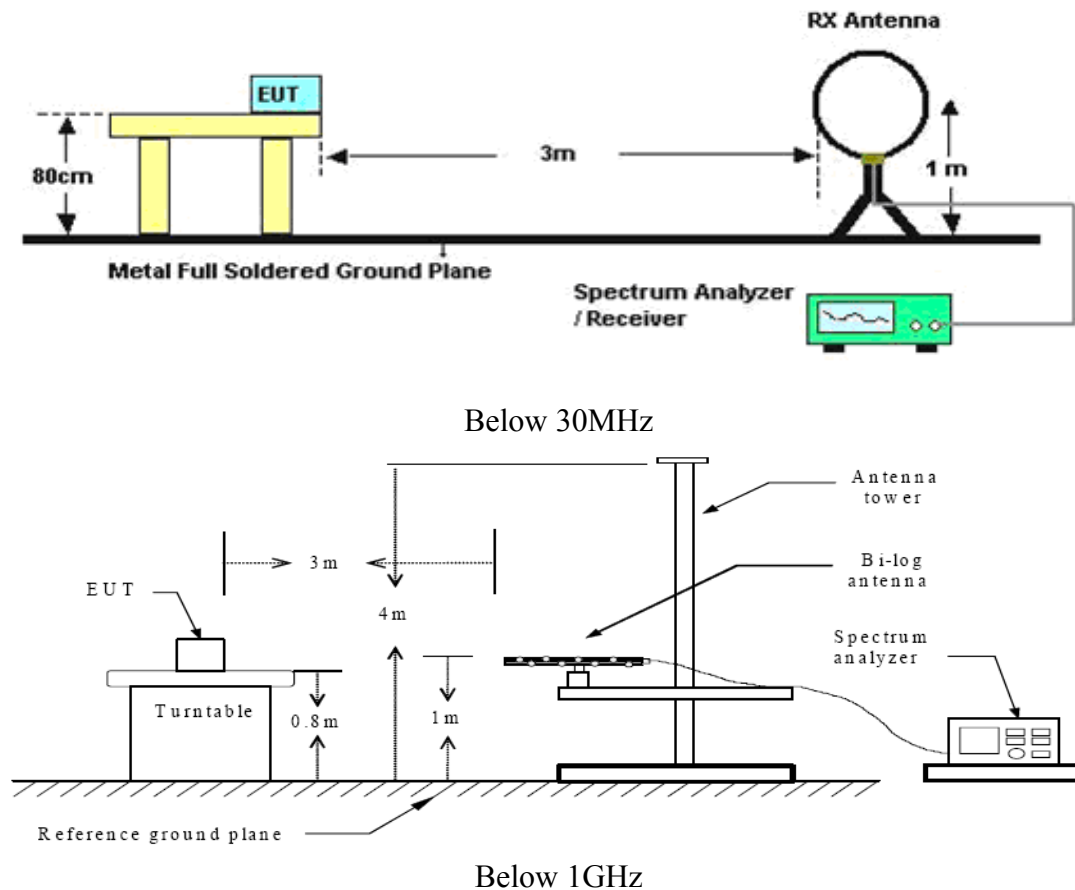
4. RADIATED EMISSION MEASUREMENT

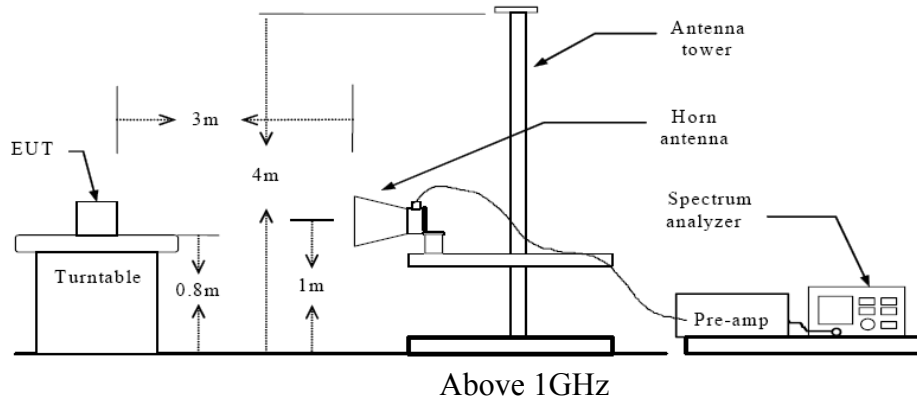
4.1. Test Equipment

The following test equipments are used during the radiated emission measurement:

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2013-06-18	2014-06-17
2	Amplifier	SCHAFFNER	COA9231A	18667	2013-06-18	2014-06-17
3	Amplifier	Agilent	8449B	3008A02120	2013-06-16	2014-06-15
4	Amplifier	MITEQ	AMF-6F-260400	9121372	2013-06-16	2014-06-15
5	Spectrum Analyzer	Agilent	E4407B	MY41440292	2013-06-16	2014-06-15
6	Signal analyzer	Agilent	E4448A(External mixers to 40GHz)	US44300469	2013-06-16	2014-06-15
7	Loop Antenna	R&S	HFH2-Z2	860004/001	2013-06-18	2014-06-17
8	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2013-06-10	2014-06-09
9	Horn Antenna	EMCO	3115	6741	2013-06-10	2014-06-09
10	Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	2013-06-10	2014-06-09
11	RF Cable-R03m	Jye Bao	RG142	CB021	2013-06-18	2014-06-17
12	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2013-06-18	2014-06-17

4.2. Block Diagram of Test Setup





4.3. Radiated Emission Limit (Class B)

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		$\mu\text{V}/\text{m}$	$\text{dB}(\mu\text{V})/\text{m}$
30~88	3	100	40.0
88~216	3	150	43.5
216~960	3	200	46.0
960~1000	3	500	54.0

- Remark: (1) Emission level $(\text{dB})\mu\text{V} = 20 \log$ Emission level $\mu\text{V}/\text{m}$
 (2) The smaller limit shall apply at the cross point between two frequency bands.
 (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system

Limits for radiated disturbance Above 1GHz			
FREQUENCY (MHz)	DISTANCE (Meters)	FIELD STRENGTHS LIMIT	
		Average Limit ($\text{dB}\mu\text{V}/\text{m}$)	Peak Limit ($\text{dB}\mu\text{V}/\text{m}$)
1000-10 Harmonics	3	54	74

Note: The lower limit applies at the transition frequency.

4.4. EUT Configuration on Measurement

The following equipment are installed on Radiated Emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

4.5. Operating Condition of EUT

- (1) Setup the EUT as shown in Section 4.2.
- (2) Let the EUT work in test mode (on) and measure it.

4.6. Test Procedure

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four

meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.

4. For each suspected emissions, the antenna tower was scan (from 1 m to 4 m) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading

5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.

6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.

7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.

9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated by-log antenna) is used as receiving antenna. Both horizontal and vertical polarization of the antenna is set on measurement. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.4-2009 on radiated emission measurement.

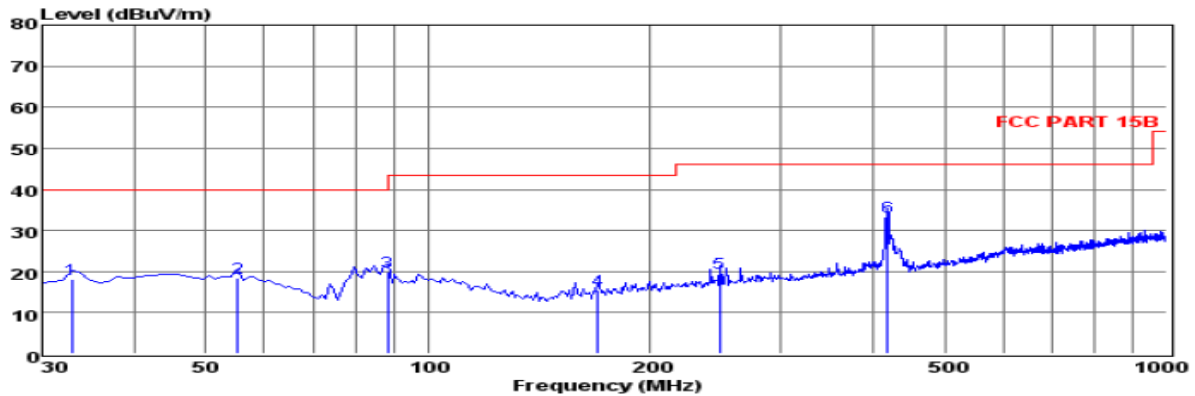
4.7. Test Results

PASS.

The test data please refer to following page.

Temperature	25°C	Humidity	60%
EUT	Control box	Model Name	WL605-A-2

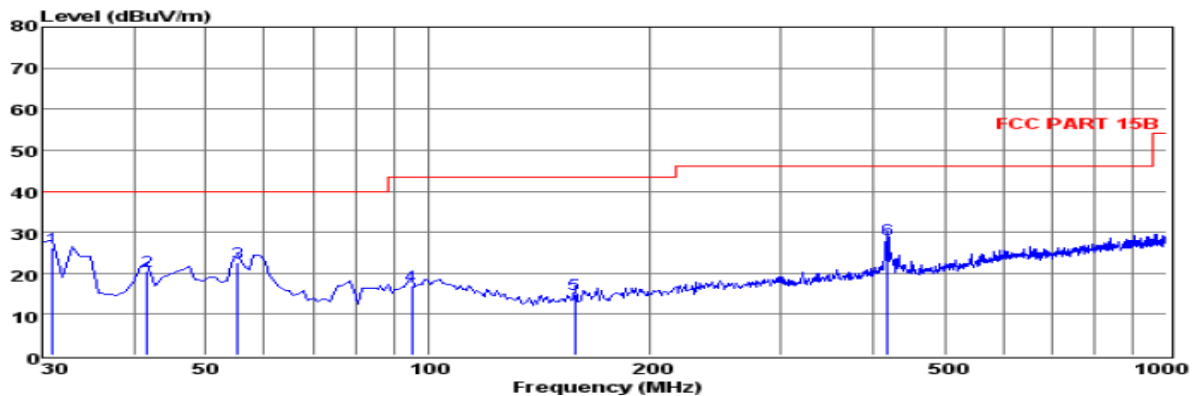
Below 1GHz:



Env. /Ins: 24°C /56%
 Power Rating: AC 120V/60Hz
 Test Mode: On
 Operator: Tree
 Memo:
 pol: HORIZONTAL

	Freq	Reading	CabLos	AntFac	PreFac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	32.91	5.49	0.37	12.31	0.00	18.17	40.00	-21.83	QP
2	55.22	5.03	0.46	13.01	0.00	18.50	40.00	-21.50	QP
3	88.20	7.82	0.68	11.33	0.00	19.83	43.50	-23.67	QP
4	169.68	5.60	0.80	8.96	0.00	15.36	43.50	-28.14	QP
5	248.25	6.51	0.97	12.07	0.00	19.55	46.00	-26.45	QP
6	418.97	16.54	1.32	15.45	0.00	33.31	46.00	-12.69	QP

Note: 1. All readings are Quasi-peak values.
 2. Measured = Reading + Antenna Factor + Cable Loss - Amp Factor.
 3. The emission levels that are 20dB below the official limit are not reported.

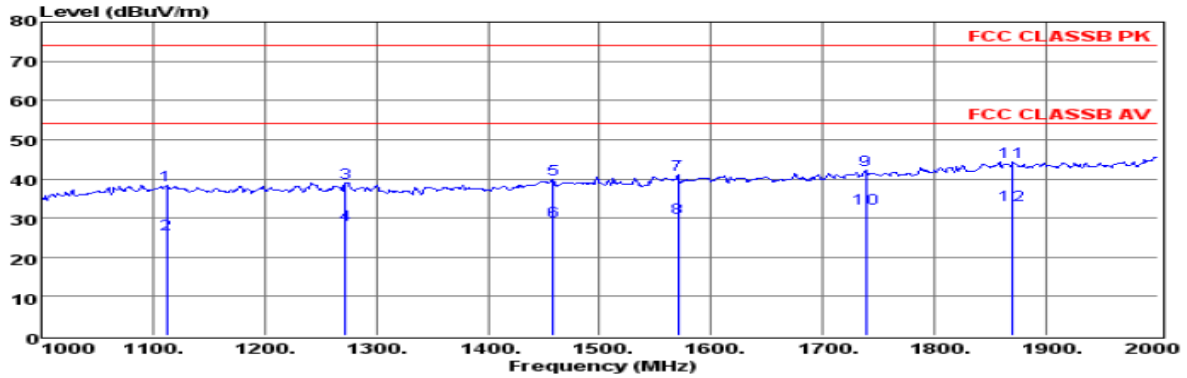


Env. /Ins: 24°C /56%
 Power Rating: AC 120V/60Hz
 Test Mode: On
 Operator: Tree
 Memo:
 pol: VERTICAL

	Freq	Reading	CabLos	AntFac	PreFac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	30.97	13.53	0.39	12.32	0.00	26.24	40.00	-13.76	QP
2	41.64	6.40	0.50	13.57	0.00	20.47	40.00	-19.53	QP
3	55.22	9.23	0.46	13.01	0.00	22.70	40.00	-17.30	QP
4	94.99	3.53	0.58	12.84	0.00	16.95	43.50	-26.55	QP
5	158.04	5.39	0.83	8.59	0.00	14.81	43.50	-28.69	QP
6	418.97	11.43	1.32	15.45	0.00	28.20	46.00	-17.80	QP

Note: 1. All readings are Quasi-peak values.
 2. Measured = Reading + Antenna Factor + Cable Loss - Amp Factor.
 3. The emission levels that are 20dB below the official limit are not reported.

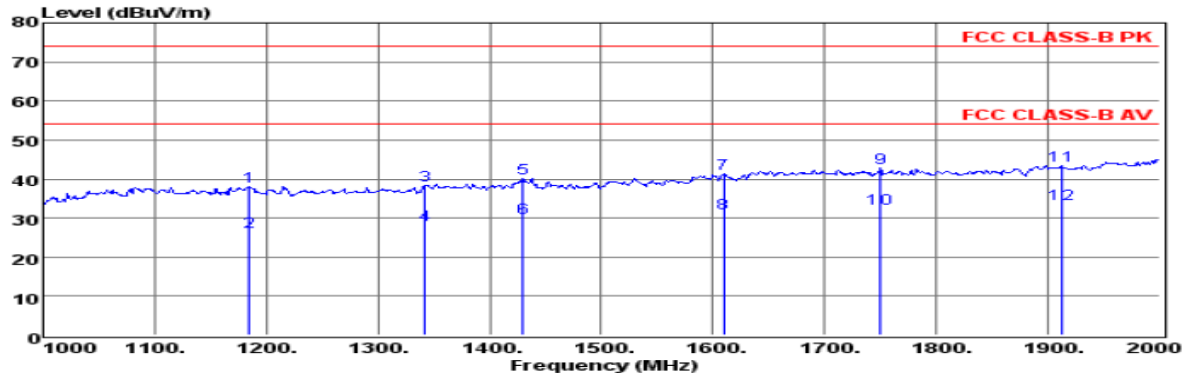
Above 1GHz:



Env. /Ins: 24 °C /56%
 Power Rating: AC 120V/60Hz
 Test Mode: On
 Operator: Tree
 Memo:
 pol: HORIZONTAL

	Freq	Reading	CabLos	AntFac	PreFac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	1112.00	45.15	4.32	25.57	36.67	38.37	74.00	-35.63	Peak
2	1112.00	32.79	4.32	25.57	36.67	26.01	54.00	-27.99	Average
3	1272.00	45.27	4.35	26.11	36.76	38.97	74.00	-35.03	Peak
4	1272.00	34.63	4.35	26.11	36.76	28.33	54.00	-25.67	Average
5	1458.00	46.19	4.39	26.28	36.87	39.99	74.00	-34.01	Peak
6	1458.00	35.35	4.39	26.28	36.87	29.15	54.00	-24.85	Average
7	1570.00	47.12	4.41	26.34	36.93	40.94	74.00	-33.06	Peak
8	1570.01	36.33	4.41	26.34	36.93	30.15	54.00	-23.85	Average
9	1738.00	48.24	4.45	26.42	37.01	42.10	74.00	-31.90	Peak
10	1738.00	38.66	4.45	26.42	37.01	32.52	54.00	-21.48	Average
11	1870.00	50.41	4.47	26.49	37.03	44.34	74.00	-29.66	Peak
12	1870.00	39.37	4.47	26.49	37.03	33.30	54.00	-20.70	Average

Note: 1. All readings are Quasi-peak values.
 2. Measured = Reading + Antenna Factor + Cable Loss - Amp Factor.
 3. The emission levels that are 20dB below the official limit are not reported.



Env. /Ins: 24 °C /56%
 Power Rating: AC 120V/60Hz
 Test Mode: On
 Operator: Tree
 Memo:
 pol: VERTICAL

	Freq	Reading	CabLos	AntFac	PreFac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	1185.00	44.51	4.34	25.82	36.71	37.96	74.00	-36.04	Peak
2	1185.01	32.88	4.34	25.82	36.71	26.33	54.00	-27.67	Average
3	1342.00	44.68	4.37	26.22	36.80	38.47	74.00	-35.53	Peak
4	1342.00	34.55	4.37	26.22	36.80	28.34	54.00	-25.66	Average
5	1430.00	46.33	4.39	26.27	36.85	40.14	74.00	-33.86	Peak
6	1430.00	36.15	4.39	26.27	36.85	29.96	54.00	-24.04	Average
7	1610.00	47.46	4.42	26.35	36.95	41.28	74.00	-32.72	Peak
8	1610.00	37.32	4.42	26.36	36.95	31.15	54.00	-22.85	Average
9	1750.00	48.87	4.45	26.42	37.01	42.73	74.00	-31.27	Peak
10	1750.00	38.48	4.45	26.43	37.01	32.35	54.00	-21.65	Average
11	1912.00	49.06	4.48	26.81	37.04	43.31	74.00	-30.69	Peak
12	1912.00	39.28	4.48	26.81	37.04	33.53	54.00	-20.47	Average

Note: 1. All readings are Quasi-peak values.
 2. Measured = Reading + Antenna Factor + Cable Loss - Amp Factor.
 3. The emission levels that are 20dB below the official limit are not reported.

5. MANUFACTURER/ APPROVAL HOLDER DECLARATION

The following Series model(s):

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Belong to the tested device:

Product description : Control box

Model name : WL605-A-2

Remark: No additional models were tested.

-----THE END OF REPORT-----