



MEASUREMENT REPORT

FCC Part 15B

FCC ID: SFK-WF610
APPLICANT: CIG Shanghai Co., Ltd.

Application Type: Certification
Product: WF-610 2x2 dual band 802.11ac Outdoor AP
Model No.: WF-610
FCC Classification: FCC Class B Digital Device (JBP)
FCC Rule Part(s): FCC Part 15 Subpart B
Test Procedure(s): ANSI C63.4: 2014
Test Date: August 01 ~ 12, 2015

Reviewed By : Robin Wu
(Robin Wu)

Approved By : Marlin Chen
(Marlin Chen)



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2014. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date
1506RSU01303	Rev. 01	Initial report	08-19-2015

CONTENTS

Description	Page
§2.1033 General Information	4
1. INTRODUCTION	5
1.1. Scope	5
1.2. MRT Test Location	5
2. PRODUCT INFORMATION	6
2.1. Equipment Description.....	6
2.2. Description of Available Antennas	7
2.3. Device Capabilities	7
2.4. Test Configuration	8
2.5. Test Software	8
2.6. EMI Suppression Device(s)/Modifications	8
2.7. Labeling Requirements.....	9
3. DESCRIPTION OF TEST	10
3.1. Evaluation Procedure	10
3.2. AC Line Conducted Emissions	10
3.3. Radiated Emissions.....	11
4. TEST EQUIPMENT CALIBRATION DATE	12
5. MEASUREMENT UNCERTAINTY.....	13
6. TEST RESULT	14
6.1. Summary	14
6.2. Conducted Emission Measurement	15
6.2.1. Test Limit	15
6.2.2. Test Setup.....	15
6.2.3. Test Result of Conducted Emissions.....	16
6.3. Radiated Emission Measurement	18
6.3.1. Test Limit	18
6.3.2. Test Setup.....	18
6.3.3. Test Result of Radiated Emissions.....	20
7. CONCLUSION.....	24

§2.1033 General Information

Applicant:	CIG Shanghai Co., Ltd.
Applicant Address:	F/5, 8 Building No.2388 Chenhang Road, Minhang District, Shanghai
Manufacturer:	CIG Shanghai Co., Ltd.
Manufacturer Address:	F/5, 8 Building No.2388 Chenhang Road, Minhang District, Shanghai
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
MRT FCC Registration No.:	809388
Model No.:	WF-610
FCC ID:	SFK-WF610
Test Device Serial No.:	N/A <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering
FCC Classification:	FCC Class B Digital Device (JBP)

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Reg. No. 809388) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-4179, G-814, C-4664, T-2206) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, EU and TELEC Rules.



1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name	WF-610 2x2 dual band 802.11ac Outdoor AP
Model No.	WF-610
Frequency Range	<u>For 2.4GHz Band:</u> 802.11b/g/n: 2412 ~ 2462 MHz <u>For 5.0GHz Band:</u> For 802.11a/n-HT20/ac-VHT20: 5180~5240MHz, 5745~5825MHz For 802.11n-HT40/ac-VHT40: 5190~5230MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 5775MHz
Type of Modulation	802.11b: DSSS 802.11g/a/n/ac: OFDM

2.2. Description of Available Antennas

Antenna Type	Frequency Band (GHz)	Tx Paths	Max Peak Gain (dBi)	Beam Forming Directional Gain (dBi)	CDD Directional Gain (dBi)	
					For Power	For PSD
PCB Antenna	2.4	2	8	11	8	11
	5	2	18	21	18	21

Note:

1. Transmit at 2.4GHz & 5GHz support two antennas.
2. The EUT supports Beam Forming technology & CDD technology.

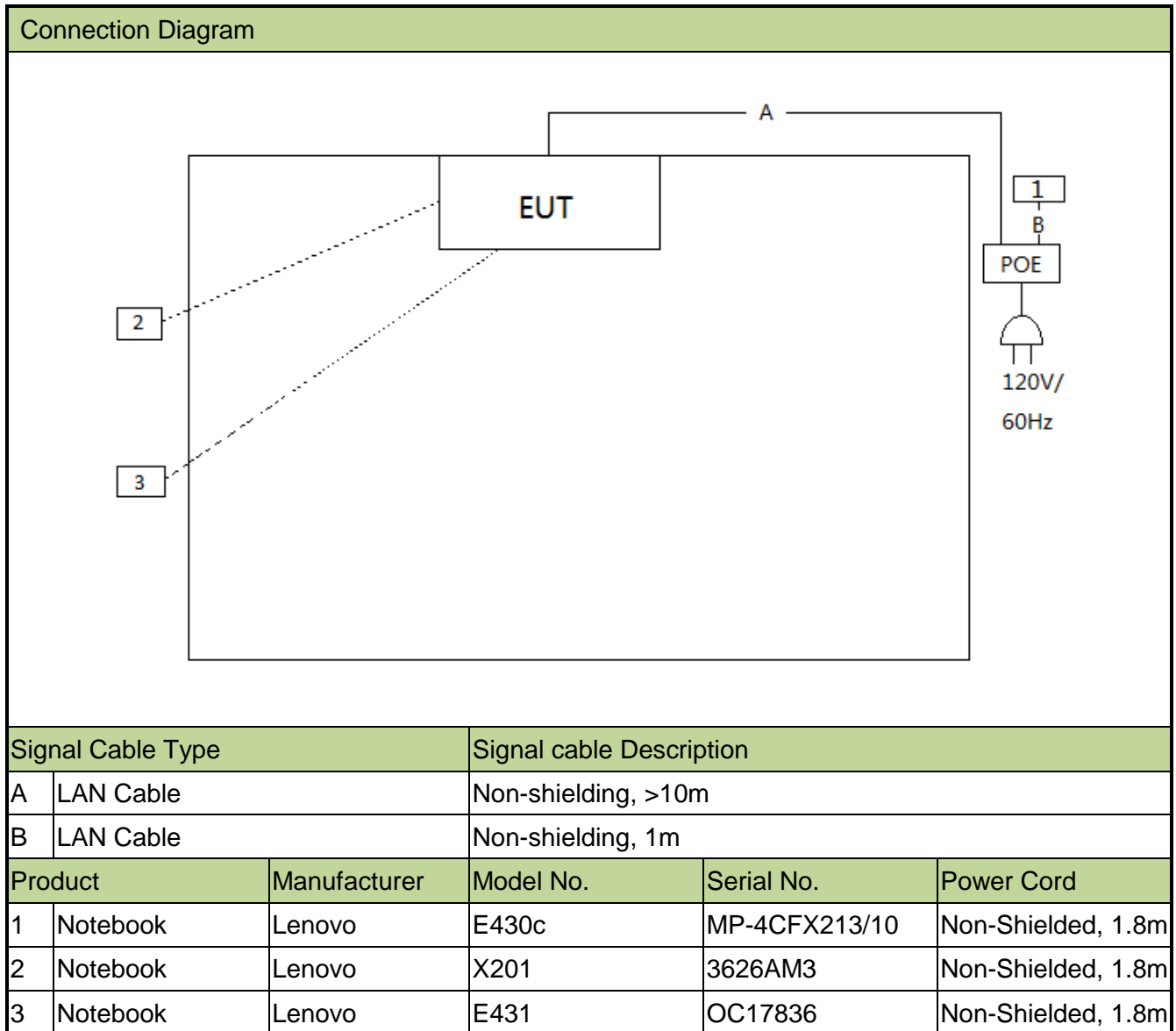
2.3. Device Capabilities

This device contains the following capabilities:

2.4GHz & 5GHz Wi-Fi Device (DTS/UNII)

2.4. Test Configuration

The WF-610 2x2 dual band 802.11ac Outdoor AP FCC ID: SFK-WF610 was tested per the guidance FCC Part 15 Subpart B: 2013 and ANSI C63.4: 2014 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.



2.5. Test Software

Not applicable.

2.6. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.7. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase.

However, when the device is so small wherein placement of the label with specified statement is not practical, only the trade name and FCC ID must be displayed on the device per Section 15.19(a)(5).

Please see attachment for FCC ID label and label location.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2014) was used in the measurement of the **WF-610 2x2 dual band 802.11ac Outdoor AP FCC ID: SFK-WF610.**

Deviation from measurement procedure.....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150 kHz to 30 MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or resolution, clock or data exchange speed, scrolling H pattern to the EUT and/or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. Line conducted emissions test results are shown in Section 6.2.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. An MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30 MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30 MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 0.8 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB beam-width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2015/11/07
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2015/11/07
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2015/11/07
Temperature/Humidity Meter	Ouleinuo	N/A	MRTSUE06114	1 year	2015/11/20

Radiated Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	E4447A	MRTSUE06028	1 year	2015/10/09
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2015/11/07
Preamplifier	Agilent	83017A	MRTSUE06020	1 year	2015/12/13
Preamplifier	Schwarzbeck	BBV9721	MRTSUE06121	1 year	2016/04/15
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2015/11/08
TRILOG Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2015/11/08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06023	1 year	2015/11/08
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2016/01/05
Temperature/Humidity Meter	Ouleinuo	N/A	MRTSUE06115	1 year	2015/11/20

Software	Version	Function
e3	V8.3.5	EMI Test Software

5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

AC Conducted Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 150kHz~30MHz: 3.5dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): Horizontal: 30MHz~1GHz: 4.07dB 1GHz~18GHz: 4.16 dB Vertical: 30MHz~1GHz: 4.18 dB 1GHz~18GHz: 4.76 dB

6. TEST RESULT

6.1. Summary

Product Name: WF-610 2x2 dual band 802.11ac Outdoor AP
FCC ID: SFK-WF610
FCC Classification: FCC Class B Digital Device (JBP)
Test Mode: Communication with Notebook

FCC Part Section(s)	Test Description	Test Result
15.107	Conducted Emissions	Pass
15.109	Radiated Emissions	Pass

6.2. Conducted Emission Measurement

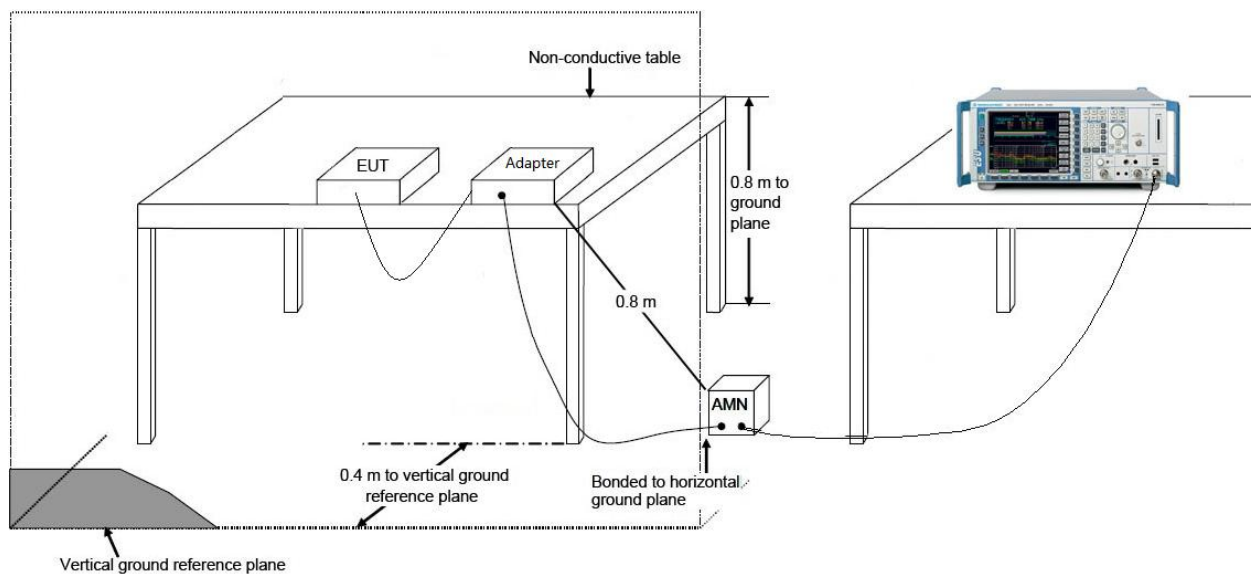
6.2.1. Test Limit

FCC Part 15.107 Limits		
Frequency (MHz)	QP (dB μ V)	AV (dB μ V)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

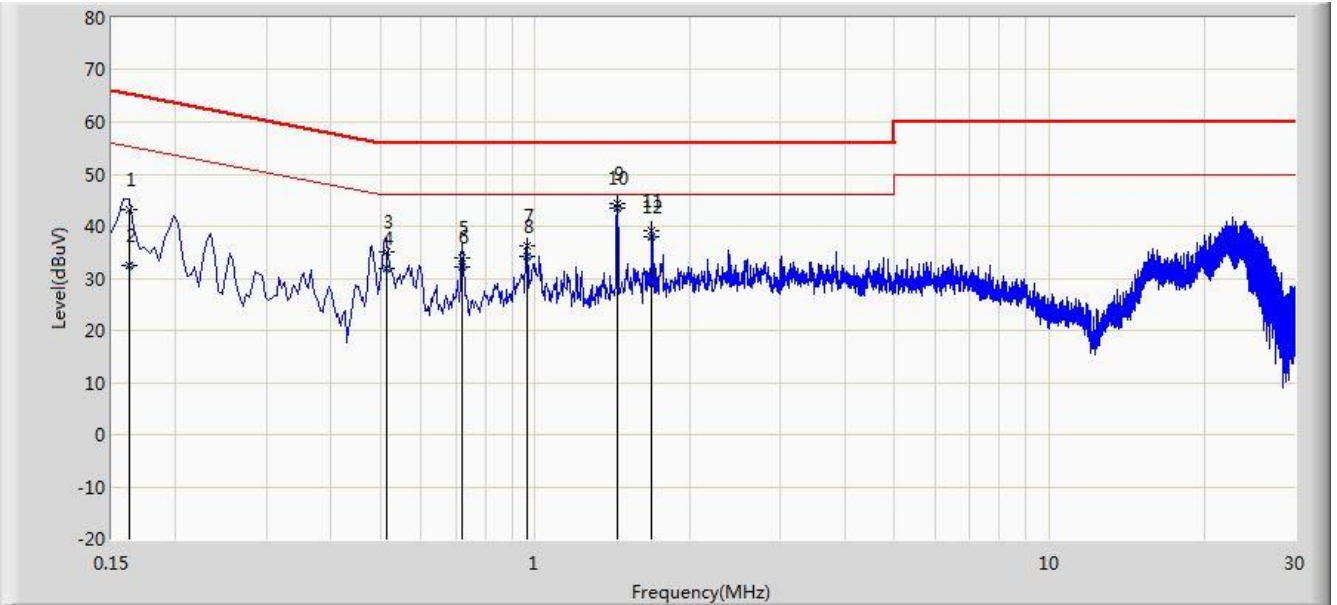
Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

6.2.2. Test Setup



6.2.3. Test Result of Conducted Emissions

Site: SR2	Time: 2015/08/12 - 10:11
Limit: FCC_Part15.107_CE_ClassB	Engineer: Roy Cheng
Probe: ENV216_101683_Filter On	Polarity: Line
EUT: WF-610 2x2 dual band 802.11ac Outdoor AP	Power: AC 120V/60Hz
Test Mode: Communication with Notebook	

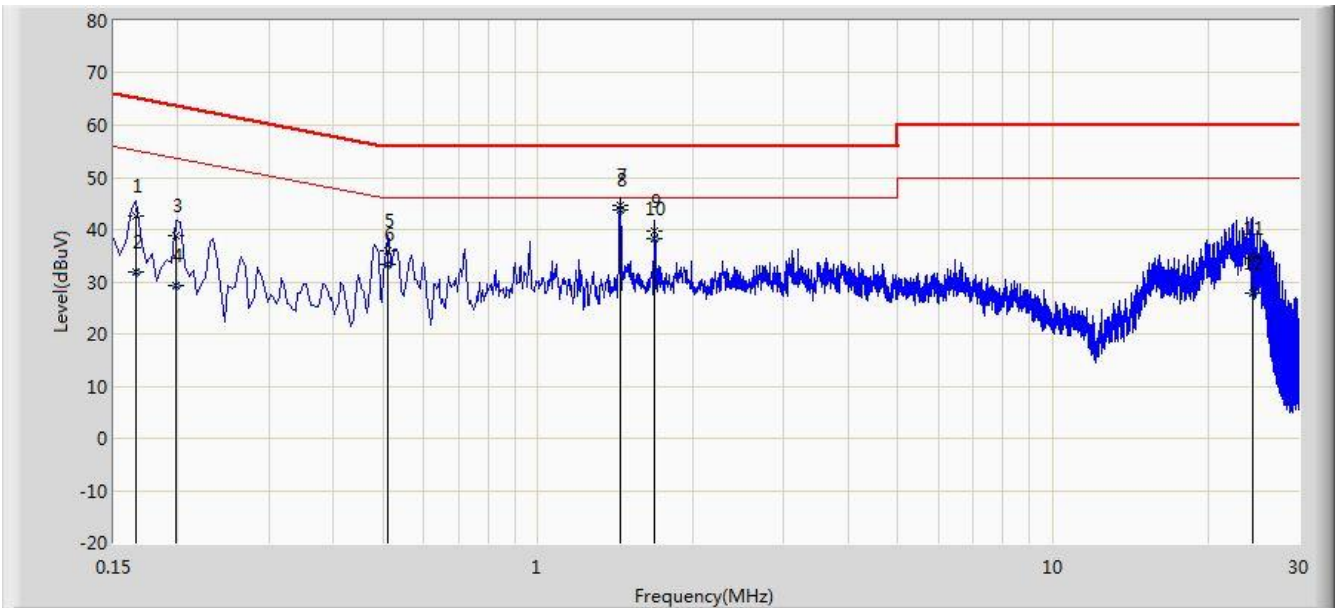


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.162	43.177	33.079	-22.184	65.361	10.097	QP
2			0.162	32.521	22.424	-22.840	55.361	10.097	AV
3			0.514	35.111	24.955	-20.889	56.000	10.156	QP
4			0.514	32.003	21.846	-13.997	46.000	10.156	AV
5			0.722	33.849	23.797	-22.151	56.000	10.052	QP
6			0.722	32.198	22.146	-13.802	46.000	10.052	AV
7			0.962	36.106	26.178	-19.894	56.000	9.928	QP
8			0.962	34.291	24.363	-11.709	46.000	9.928	AV
9			1.442	44.298	34.407	-11.702	56.000	9.891	QP
10		*	1.442	43.374	33.483	-2.626	46.000	9.891	AV
11			1.686	39.197	29.314	-16.803	56.000	9.882	QP
12			1.686	37.876	27.993	-8.124	46.000	9.882	AV

Note: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

Site: SR2	Time: 2015/08/12 - 10:16
Limit: FCC_Part15.107_CE_ClassB	Engineer: Roy Cheng
Probe: ENV216_101683_Filter On	Polarity: Neutral
EUT: WF-610 2x2 dual band 802.11ac Outdoor AP	Power: AC 120V/60Hz
Test Mode: Communication with Notebook	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.166	42.648	32.577	-22.510	65.158	10.071	QP
2			0.166	31.938	21.867	-23.220	55.158	10.071	AV
3			0.198	38.913	28.898	-24.781	63.694	10.015	QP
4			0.198	29.149	19.135	-24.545	53.694	10.015	AV
5			0.510	35.983	25.807	-20.017	56.000	10.176	QP
6			0.510	33.208	23.032	-12.792	46.000	10.176	AV
7			1.442	44.775	34.882	-11.225	56.000	9.892	QP
8		*	1.442	43.761	33.869	-2.239	46.000	9.892	AV
9			1.686	39.586	29.702	-16.414	56.000	9.883	QP
10			1.686	38.287	28.404	-7.713	46.000	9.883	AV
11			24.486	34.360	24.070	-25.640	60.000	10.291	QP
12			24.486	27.815	17.525	-22.185	50.000	10.291	AV

Note: Measure Level (dBuV) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

6.3. Radiated Emission Measurement

6.3.1. Test Limit

FCC Part 15.109 Limits		
Frequency (MHz)	Distance (m)	Level (dB μ V/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

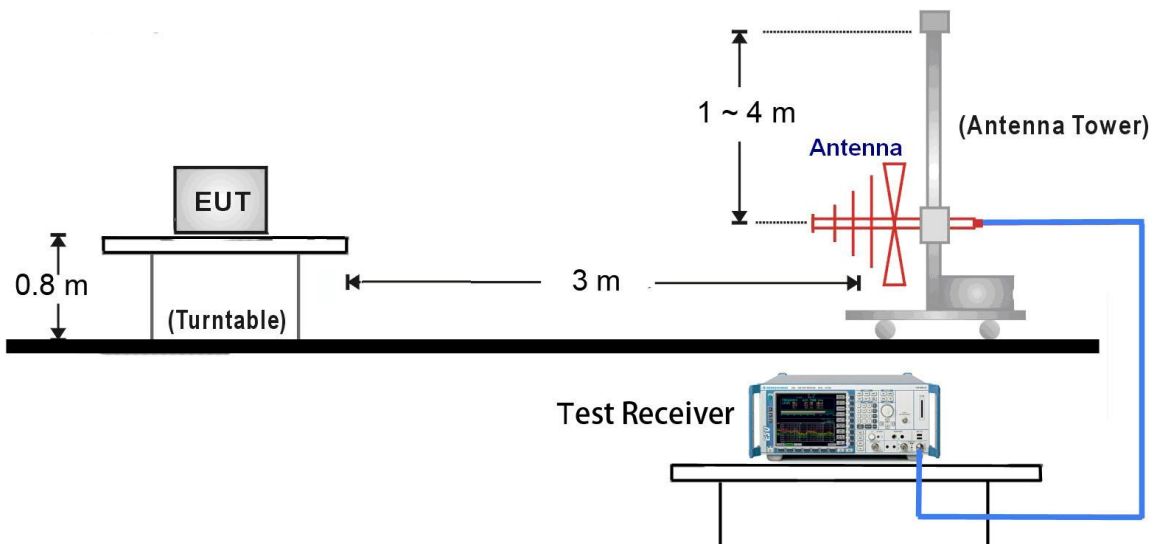
Note 1: The lower limit shall apply at the transition frequency.

Note 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.

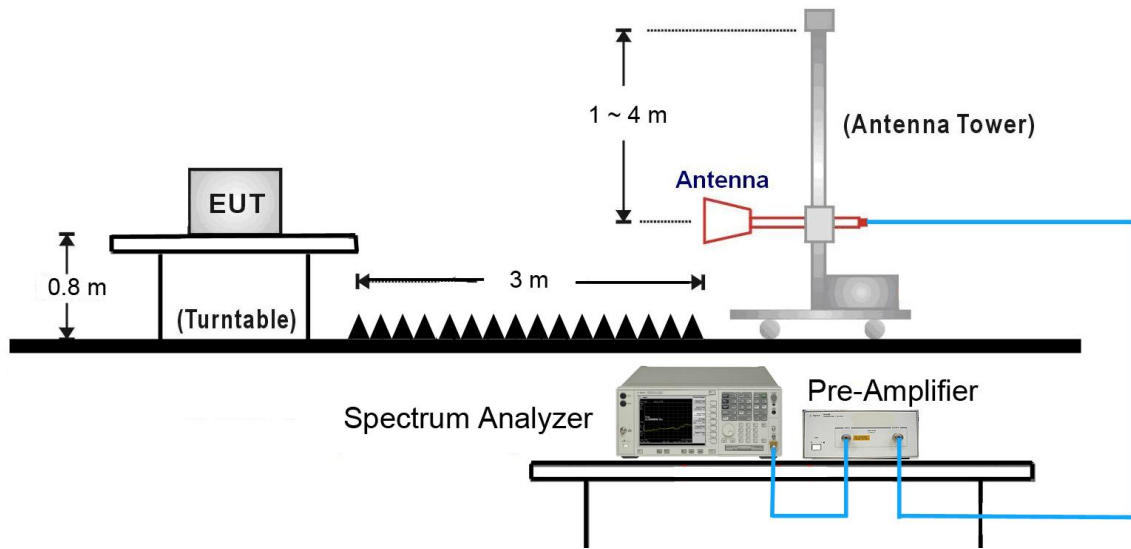
Note 3: E field strength (dB μ V/m) = 20 log E field strength (uV/m)

6.3.2. Test Setup

30MHz ~ 1GHz Test Setup:

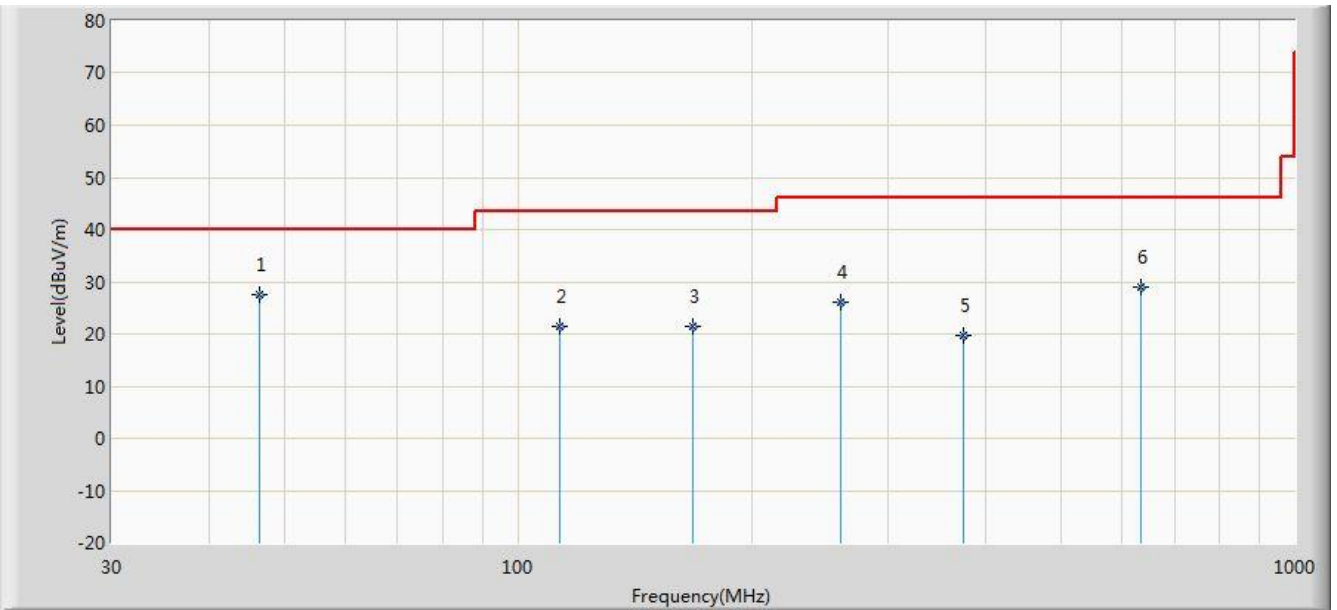


1GHz ~18GHz Test Setup:



6.3.3. Test Result of Radiated Emissions

Site: AC1	Time: 2015/08/12 - 11:36
Limit: FCC_Part15.109_RE(3m)_Class B	Engineer: Milo Li
Probe: VULB9162_0.03-8GHz	Polarity: Horizontal
EUT: WF-610 2x2 dual band 802.11ac Outdoor AP	Power: AC 120V/60Hz
Test Mode: Communication with Notebook	

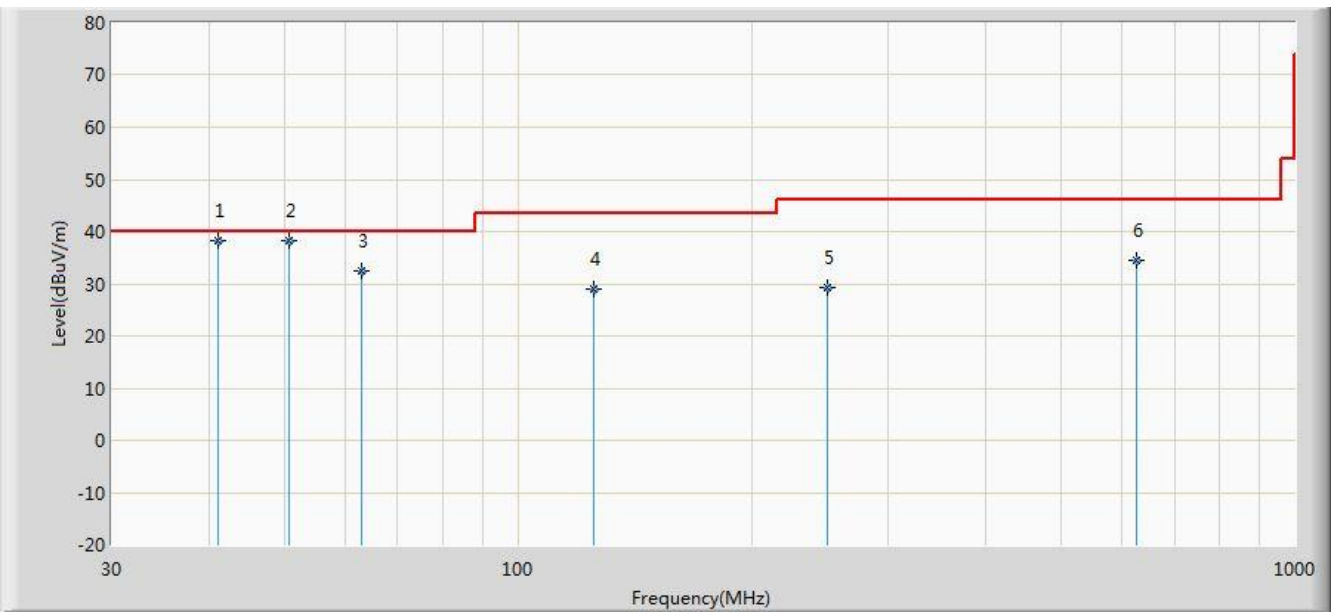


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	46.490	27.615	12.653	-12.385	40.000	14.962	QP
2			113.420	21.312	8.998	-22.188	43.500	12.314	QP
3			167.740	21.491	11.369	-22.009	43.500	10.122	QP
4			259.890	26.214	12.379	-19.786	46.000	13.835	QP
5			375.320	19.663	3.506	-26.337	46.000	16.157	QP
6			634.795	28.965	8.606	-17.035	46.000	20.359	QP

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2015/08/12 - 11:36
Limit: FCC_Part15.109_RE(3m)_Class B	Engineer: Milo Li
Probe: VULB9162_0.03-8GHz	Polarity: Vertical
EUT: WF-610 2x2 dual band 802.11ac Outdoor AP	Power: AC 120V/60Hz
Test Mode: Communication with Notebook	

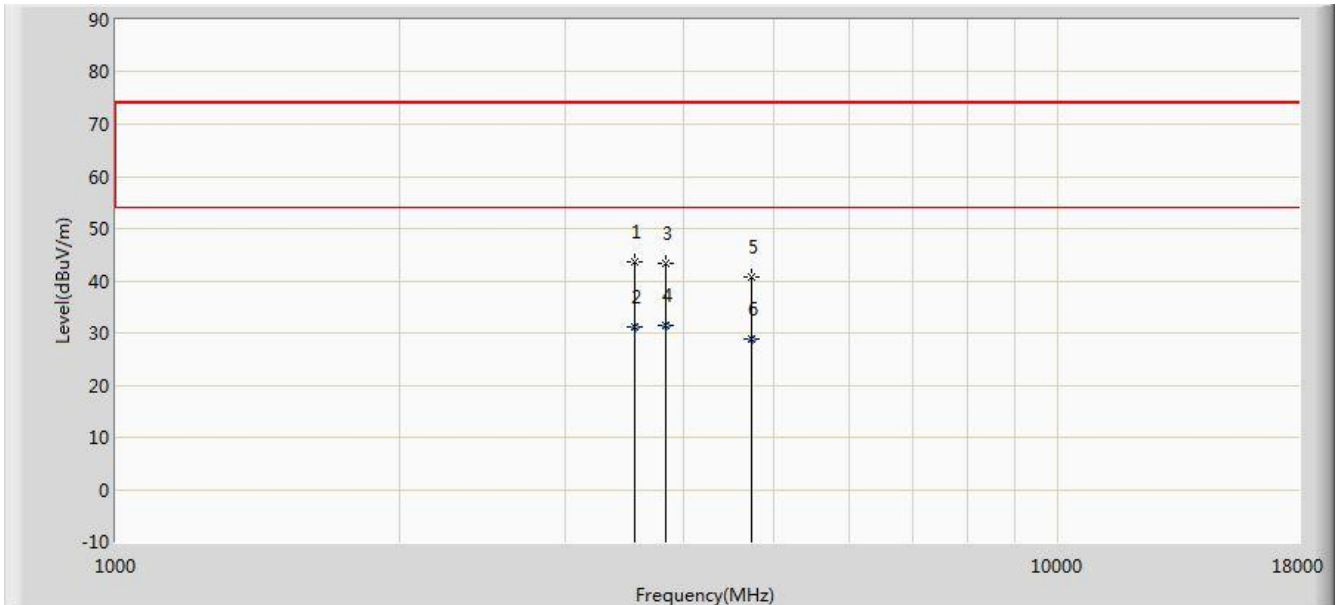


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			41.155	38.298	24.235	-1.702	40.000	14.063	QP
2		*	50.855	38.367	23.475	-1.633	40.000	14.892	QP
3			62.980	32.417	19.233	-7.583	40.000	13.184	QP
4			125.060	29.019	18.522	-14.481	43.500	10.497	QP
5			250.190	29.363	15.731	-16.637	46.000	13.632	QP
6			625.095	34.546	14.284	-11.454	46.000	20.262	QP

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2015/08/12 - 17:07
Limit: FCC_Part15.109_RE(3m)_Class B	Engineer: Milo Li
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: WF-610 2x2 dual band 802.11ac Outdoor AP	Power: AC 120V/60Hz
Test Mode: Communication with Notebook	

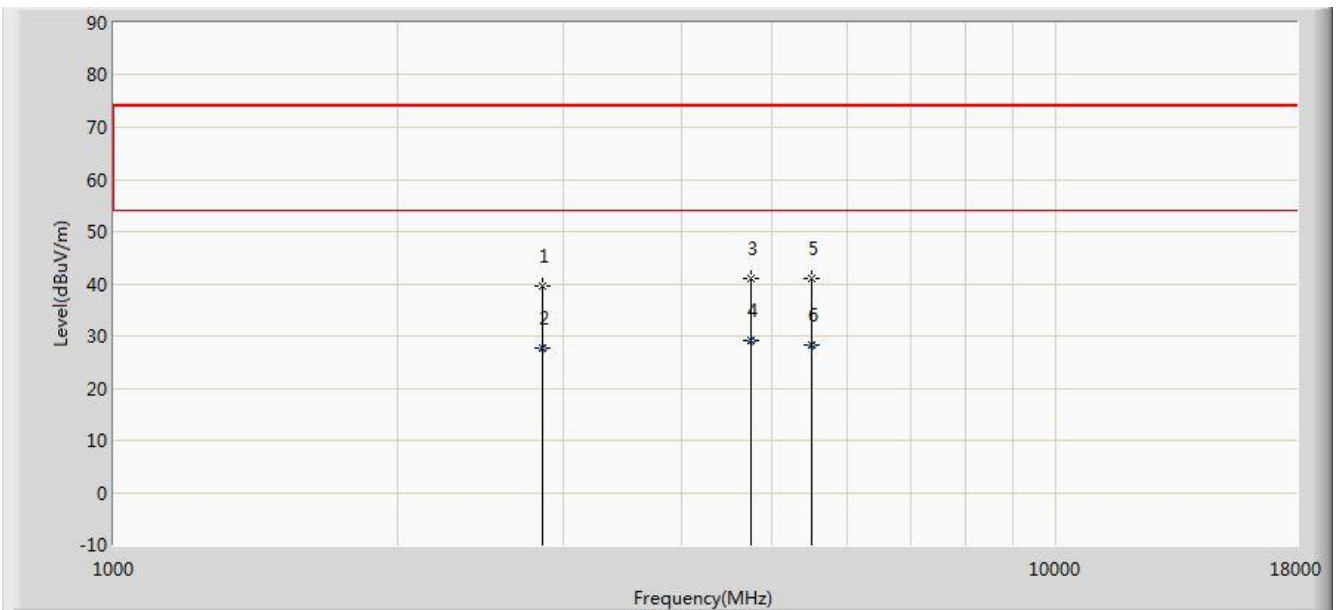


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			3550.000	43.624	44.509	-30.376	74.000	-0.885	PK
2			3550.012	31.260	32.145	-22.740	54.000	-0.885	AV
3			3830.500	43.470	43.528	-30.530	74.000	-0.058	PK
4		*	3830.503	31.417	31.475	-22.583	54.000	-0.058	AV
5			4723.000	40.660	38.223	-33.340	74.000	2.437	PK
6			4723.154	28.916	26.478	-25.084	54.000	2.438	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

Site: AC1	Time: 2015/08/12 - 17:07
Limit: FCC_Part15.109_RE(3m)_Class B	Engineer: Milo Li
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: WF-610 2x2 dual band 802.11ac Outdoor AP	Power: AC 120V/60Hz
Test Mode: Communication with Notebook	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2853.000	39.439	41.837	-34.561	74.000	-2.398	PK
2			2853.120	27.726	30.124	-26.274	54.000	-2.398	AV
3			4748.500	41.128	38.584	-32.872	74.000	2.544	PK
4		*	4748.514	29.019	26.475	-24.981	54.000	2.545	AV
5			5505.000	40.941	37.420	-33.059	74.000	3.521	PK
6			5505.102	28.366	24.845	-25.634	54.000	3.521	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

7. CONCLUSION

The data collected relate only the item(s) tested and show that the **WF-610 2x2 dual band 802.11ac Outdoor AP FCC ID: SFK-WF610** has been tested to comply with the requirements specified in §15.107 and §15.109 of the FCC Rules.

_____ The End _____