MEASUREMENT REPORT

FCC Part 15 Subpart B

FCC ID:	FHO-F1730
Applicant:	IKEA of Sweden AB
Application Type:	Certification
Product:	FREKVENS Subwoofer
Model No.:	F1730
Brand Name:	IKEA
FCC Rule Part(s):	FCC Part 15 Subpart B: 2018 Class B
Test Procedure(s):	ANSI C63.4: 2014
Result:	Complies
Test Date:	March 08 ~ March 14, 2019

Reviewed By: (Kevin Guo)

Approved By: (Robin Wu)

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

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.

Revision History

Report No.	Version	Description	Issue Date	Note
1809WSU002-U1	Rev. 01	Initial report	05-21-2019	Invalid
1809WSU002-U1	Rev. 02	Remove Bluetooth description	07-01-2019	Valid

CONTENTS

§2.1033 General Information

Applicant:	IKEA of Sweden AB
Applicant Address:	SE-343 81, Älmhult, Sweden
Manufacturer:	IKEA of Sweden AB
Manufacturer Address:	SE-343 81, Älmhult, Sweden
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
FCC Registration No.:	893164
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering

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. 893164) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.**
- **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-20025, G-20034, C-20020, T-20020) 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, Radio and SAR testing.**


Accredited Laboratory

MRT TECHNOLOGY (SUZHOU) CO., LTD.

Suzhou, Jiangsu, People's Republic of China

Electrical Testing

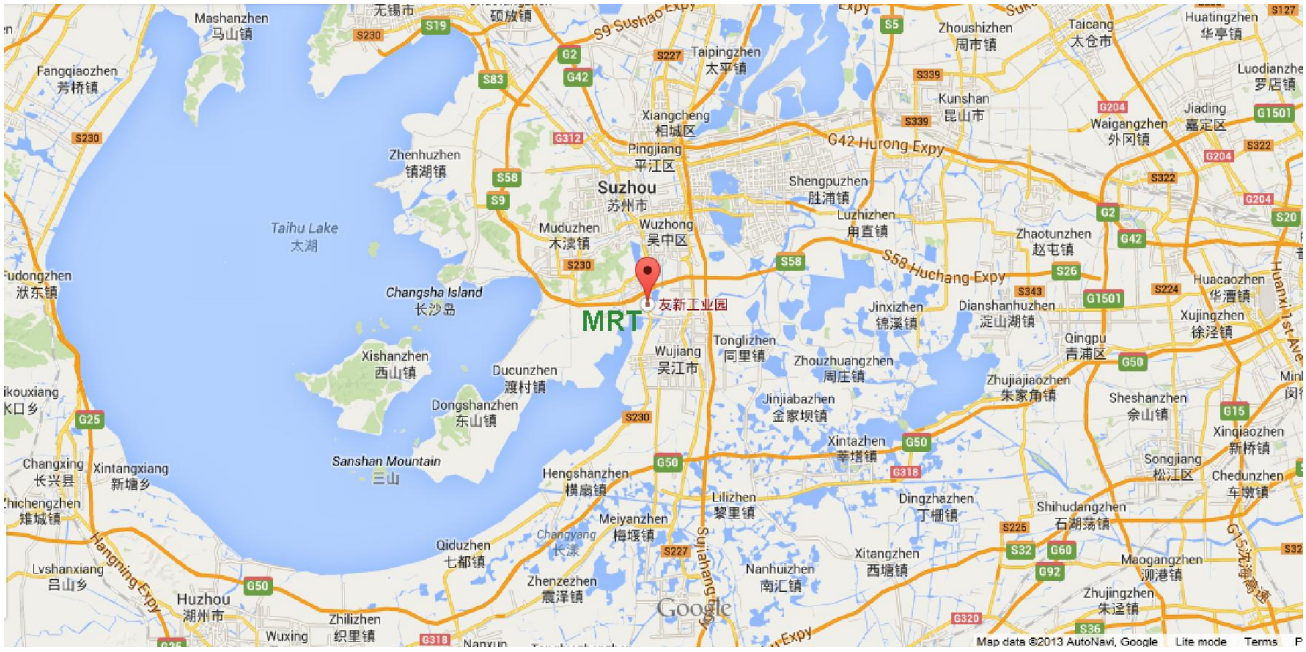
1. INTRODUCTION

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, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	FREKVENS Subwoofer
Model No.:	F1730
Brand Name:	IKEA
Working Voltage:	AC120V/60Hz
Accessory	
Battery:	Model: ICBL14.4-36-A1 Capacity: 2600mAh, 16.8V, 37.4WH Input: DC16.8V/2.0A max Output: 14.4V DC/3.1A max

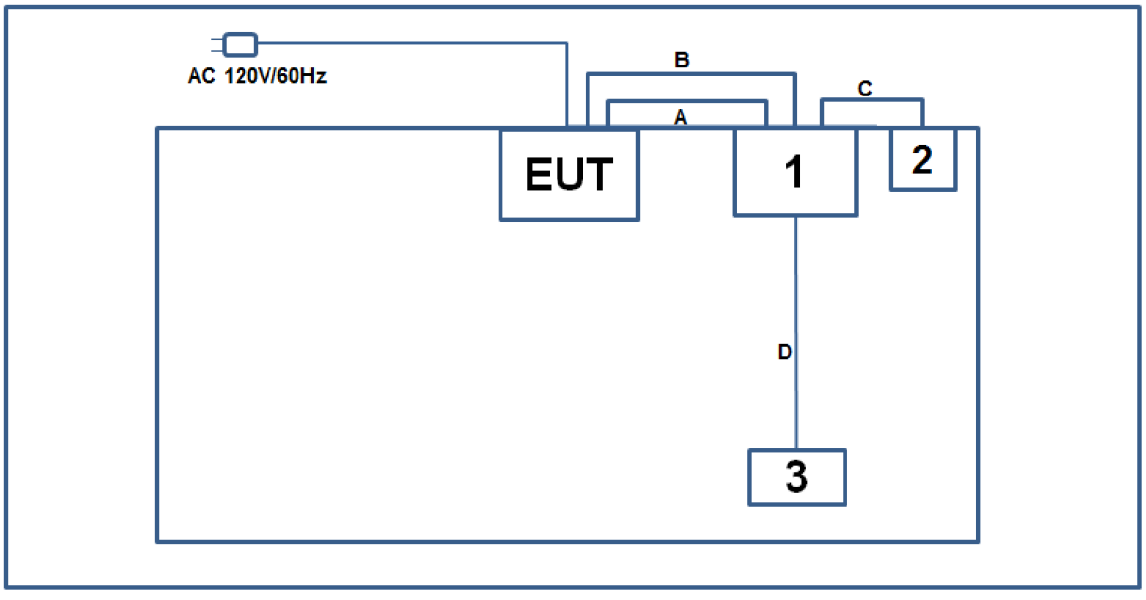
2.2. Test Mode

EMI Mode	Mode 1: Power on & Connect to Bluetooth Speaker through Audio cable and play music

2.3. Configuration of Tested System

The **FREKVENS Subwoofer** was tested per the guidance FCC Part 15 Subpart B: 2018 Class B and ANSI C63.4: 2014 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

Connection Diagram (Mode 1)



Signal Cable Type	Signal Cable Description

A	Power Cable	Non-Shielding, 0.5m
B	Audio Cable	Shielding, 0.6m
C	Audio Cable	Shielding, 0.6m
D	Audio Cable	Shielding, 0.6m

2.4. Test System Details

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

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	FREKVENS Speaker	IKEA	F1720	N/A	N/A
2	Speaker	BOSH	Soundlink Mini	N/A	N/A
3	Mobilephone	OPPO	X9009	N/A	N/A

2.5. Test Procedure

1	Setup the EUT and simulators as shown on above.
2	Configure the EUT according to test mode of section 2.2 and testing.
3	Begin to test.

2.6. EMI Suppression Device(s)/Modifications

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

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 18GHz (ANSI C63.4-2014) was used in the measurement of the device.

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.

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 - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2019/04/20
Two-Line V-Network	R&S	ENV 216	MRTSUE06002	1 year	2019/06/15
Two-Line V-Network	R&S	ENV 216	MRTSUE06003	1 year	2019/06/15
Thermohygrometer	Testo	608-H1	MRTSUE06404	1 year	2019/08/15
Shielding Anechoic Chamber	Mikebang	Chamber-SR2	MRTSUE06214	N/A	N/A

Radiated Emissions - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2019/08/14
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2019/09/14
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2019/11/20
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2019/04/12
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2019/10/20
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2019/12/17
Broadband Coaxial Preamplifier	Agilent	83017A	MRTSUE06076	1 year	2019/11/16
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2019/06/12
Digitial Thermometer & Hygrometer	Testo	608-H1	MRTSUE06403	1 year	2019/08/15
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06213	1 year	2019/05/02

Radiated Emissions - AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2019/08/14
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2019/11/09
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2019/10/20
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2019/11/09
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2019/12/17
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2019/11/16
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2019/06/13
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2019/12/13
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2019/05/02

Software	Version	Function
e3	V 8.3.5	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 - SR2
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 150kHz~30MHz: 3.46dB
Radiated Emission Measurement - AC1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz ~ 1GHz: 4.18dB 1GHz ~ 25GHz: 4.76dB
Radiated Emission Measurement - AC2
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz ~ 1GHz: 3.86dB 1GHz ~ 25GHz: 4.33dB

6. TEST RESULT

6.1. Summary

Product Name: **FREKVENS Subwoofer**

FCC ID: **FHO-F1730**

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

6.2. Conducted Emission Measurement

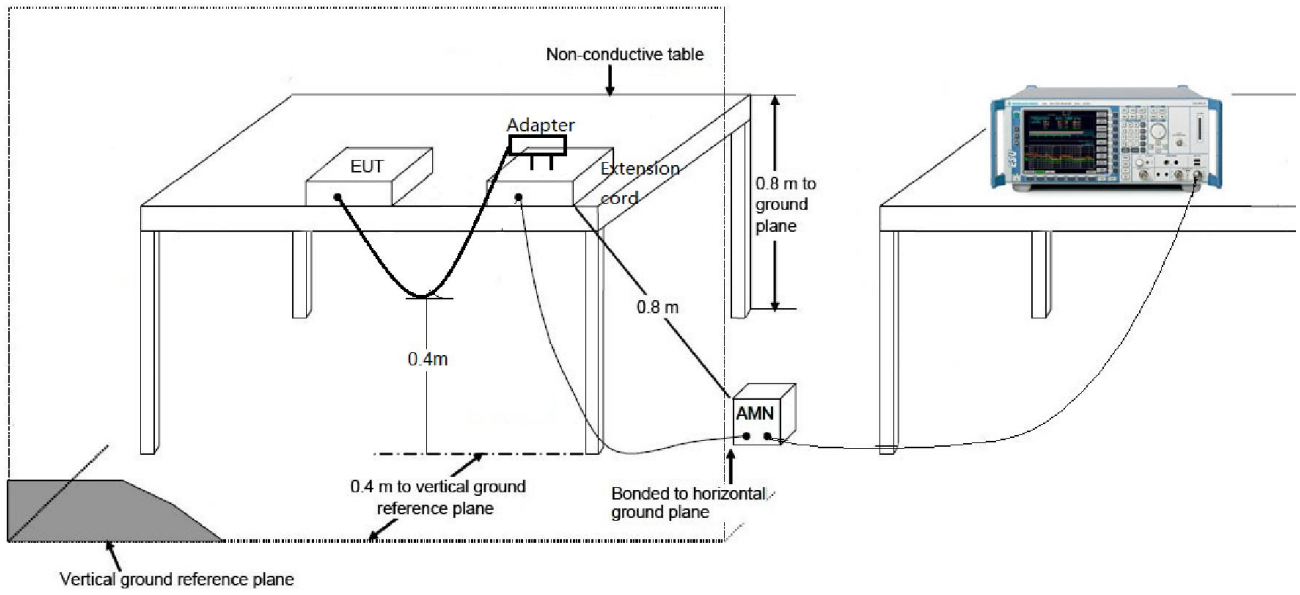
6.2.1.Test Limit

FCC Part 15.107 Limits		
Frequency (MHz)	QP (dBμV)	AV (dBμV)
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.

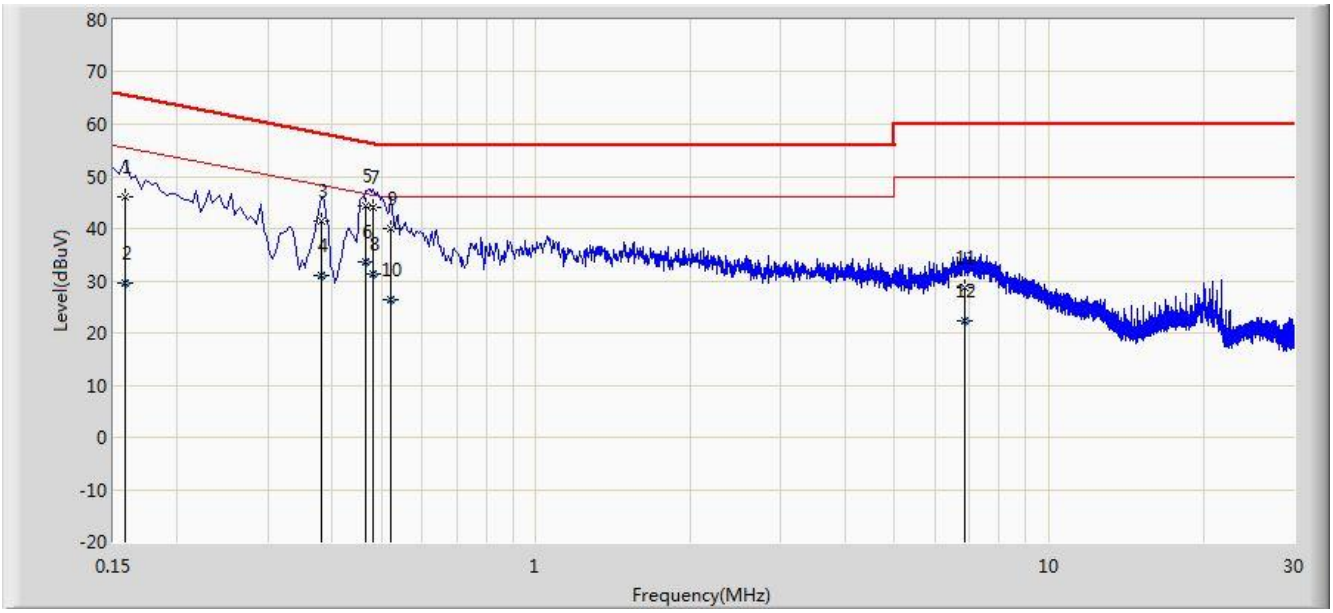
Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

6.2.2.Test Setup



6.2.3.Test Result

Site: SR2	Time: 2019/03/08 - 18:05
Limit: FCC_Part15.107_CE_AC Power_ Class B	Engineer: Lia Yuan
Probe: ENV216_101683_Filter On	Polarity: Line
EUT: FREKVENS Subwoofer	Power: AC 120V/60Hz
Test Mode 1	

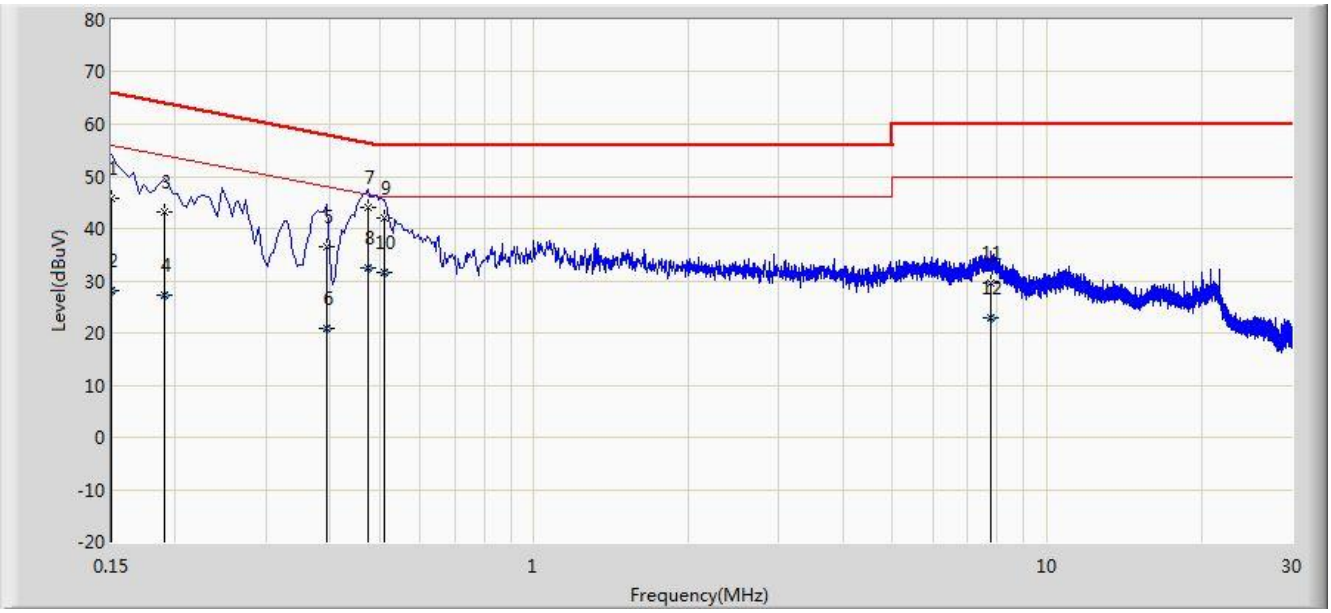


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.158	46.192	35.835	-19.399	65.591	10.356	QP
2			0.158	29.483	19.127	-26.107	55.591	10.356	AV
3			0.382	41.548	31.477	-16.688	58.236	10.071	QP
4			0.382	31.136	21.065	-17.100	48.236	10.071	AV
5		*	0.464	44.337	34.200	-12.283	56.621	10.137	QP
6			0.464	33.537	23.400	-13.083	46.621	10.137	AV
7			0.482	43.973	33.821	-12.331	56.305	10.152	QP
8			0.482	31.324	21.173	-14.980	46.305	10.152	AV
9			0.522	39.881	29.726	-16.119	56.000	10.155	QP
10			0.522	26.442	16.287	-19.558	46.000	10.155	AV
11			6.850	28.808	18.656	-31.192	60.000	10.152	QP
12			6.850	22.413	12.261	-27.587	50.000	10.152	AV

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

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

Site: SR2	Time: 2019/03/08 - 18:11
Limit: FCC_Part15.107_CE_AC Power_ Class B	Engineer: Lia Yuan
Probe: ENV216_101683_Filter On	Polarity: Neutral
EUT: FREKVENS Subwoofer	Power: AC 120V/60Hz
Test Mode 1	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.150	45.819	34.677	-20.181	66.000	11.142	QP
2			0.150	28.198	17.056	-27.802	56.000	11.142	AV
3			0.190	43.224	33.196	-20.813	64.037	10.028	QP
4			0.190	27.177	17.149	-26.859	54.037	10.028	AV
5			0.394	36.648	26.541	-21.330	57.979	10.108	QP
6			0.394	20.976	10.869	-27.003	47.979	10.108	AV
7		*	0.474	44.101	33.933	-12.343	56.444	10.167	QP
8			0.474	32.404	22.237	-14.039	46.444	10.167	AV
9			0.510	42.109	31.933	-13.891	56.000	10.176	QP
10			0.510	31.508	21.332	-14.492	46.000	10.176	AV
11			7.758	29.466	19.279	-30.534	60.000	10.187	QP
12			7.758	23.042	12.855	-26.958	50.000	10.187	AV

Note: Measure Level (dBμV) = Reading Level (dBμV) + 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 (dBμV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

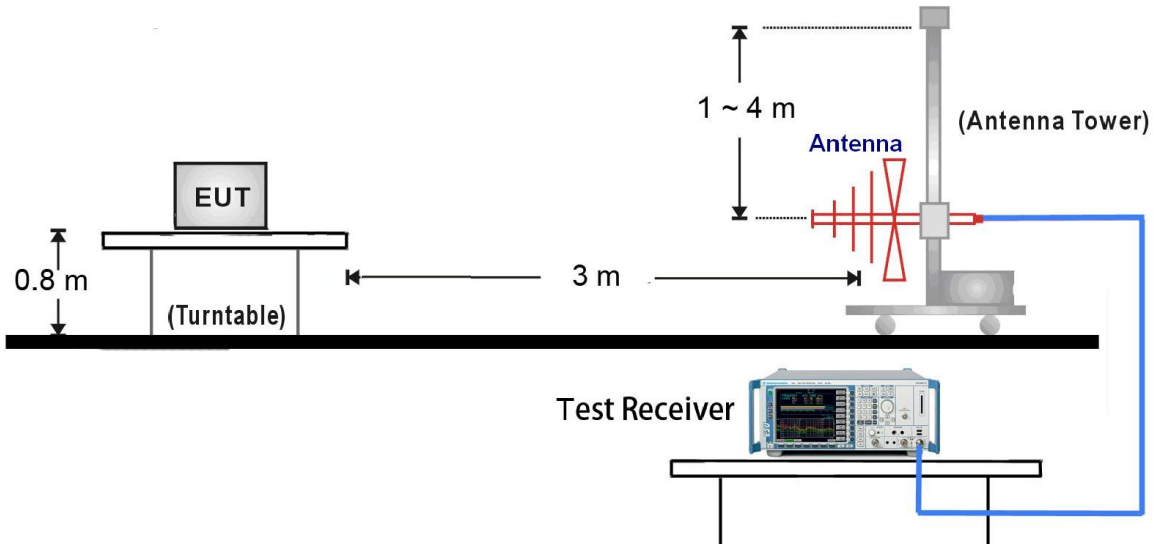
Note 1: The lower limit shall apply at the transition frequency.

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.

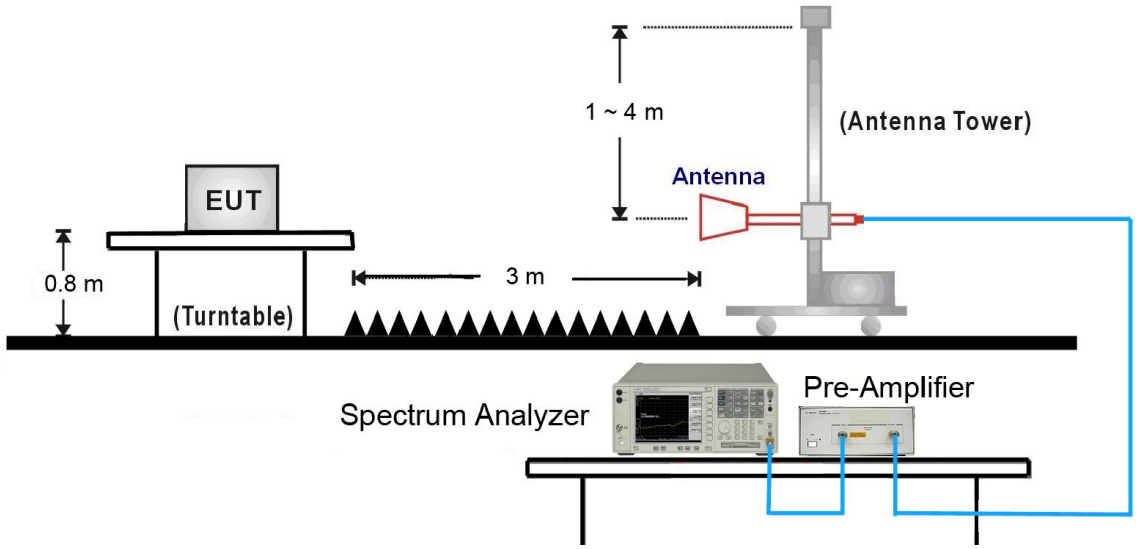
Note 3: E field strength (dBμV/m) = 20 log E field strength (uV/m)

6.3.2.Test Setup

30MHz ~ 1GHz Test Setup:

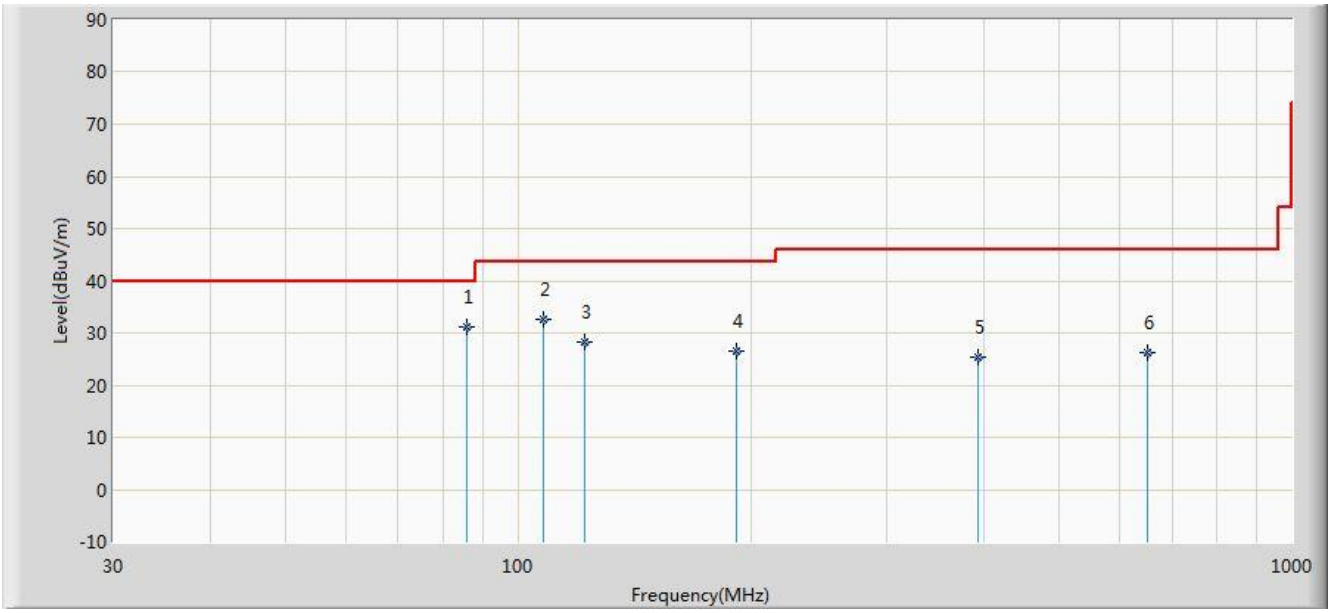


1GHz ~18GHz Test Setup:



6.3.3.Test Result

Site: AC1	Time: 2019/03/14 - 07:31
Limit: FCC_Part15.109_RE(3m)_ Class B	Engineer: David Lv
Probe: VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: FREKVENS Subwoofer	Power: AC 120V/60Hz
Test Mode 1	

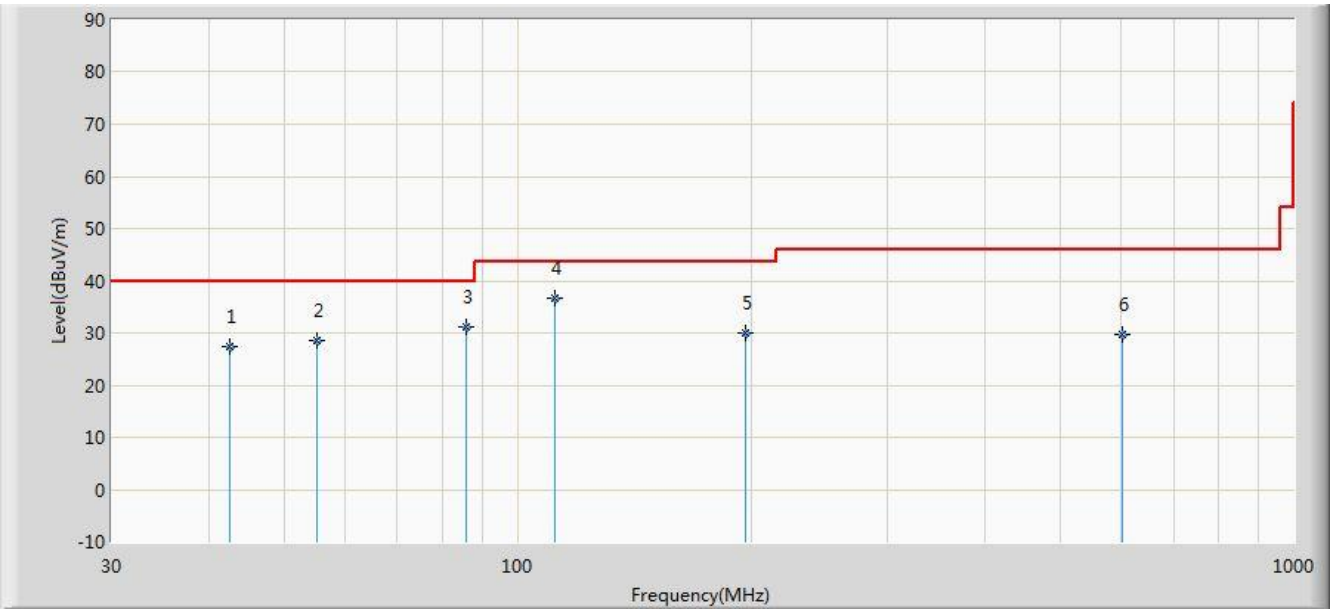


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	85.775	31.108	20.875	-8.892	40.000	10.234	QP
2			107.904	32.575	20.700	-10.925	43.500	11.875	QP
3			122.150	28.150	14.780	-15.350	43.500	13.369	QP
4			191.990	26.459	14.835	-17.041	43.500	11.624	QP
5			393.265	25.492	9.040	-20.508	46.000	16.452	QP
6			651.770	26.266	4.787	-19.734	46.000	21.479	QP

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

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

Site: AC1	Time: 2019/03/14 - 07:31
Limit: FCC_Part15.109_RE(3m)_ Class B	Engineer: David Lv
Probe: VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: FREKVENS Subwoofer	Power: AC 120V/60Hz
Test Mode 1	

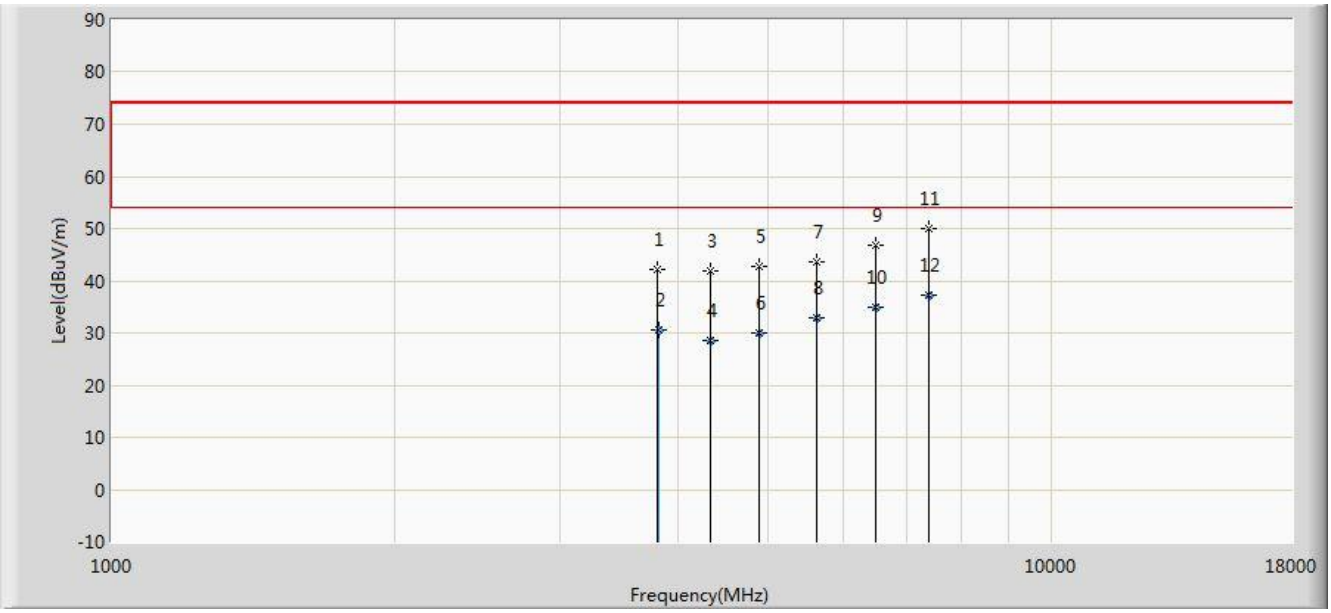


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			42.610	27.247	12.794	-12.753	40.000	14.452	QP
2			55.220	28.640	14.830	-11.360	40.000	13.810	QP
3			85.775	31.163	20.930	-8.837	40.000	10.234	QP
4		*	111.739	36.794	24.500	-6.706	43.500	12.294	QP
5			196.355	30.086	18.694	-13.414	43.500	11.392	QP
6			602.300	29.827	9.195	-16.173	46.000	20.631	QP

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

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

Site: AC1	Time: 2019/03/14 - 07:32
Limit: FCC_Part15.109_RE(3m)_ Class B	Engineer: David Lv
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: FREKVENS Subwoofer	Power: AC 120V/60Hz
Test Mode 1	

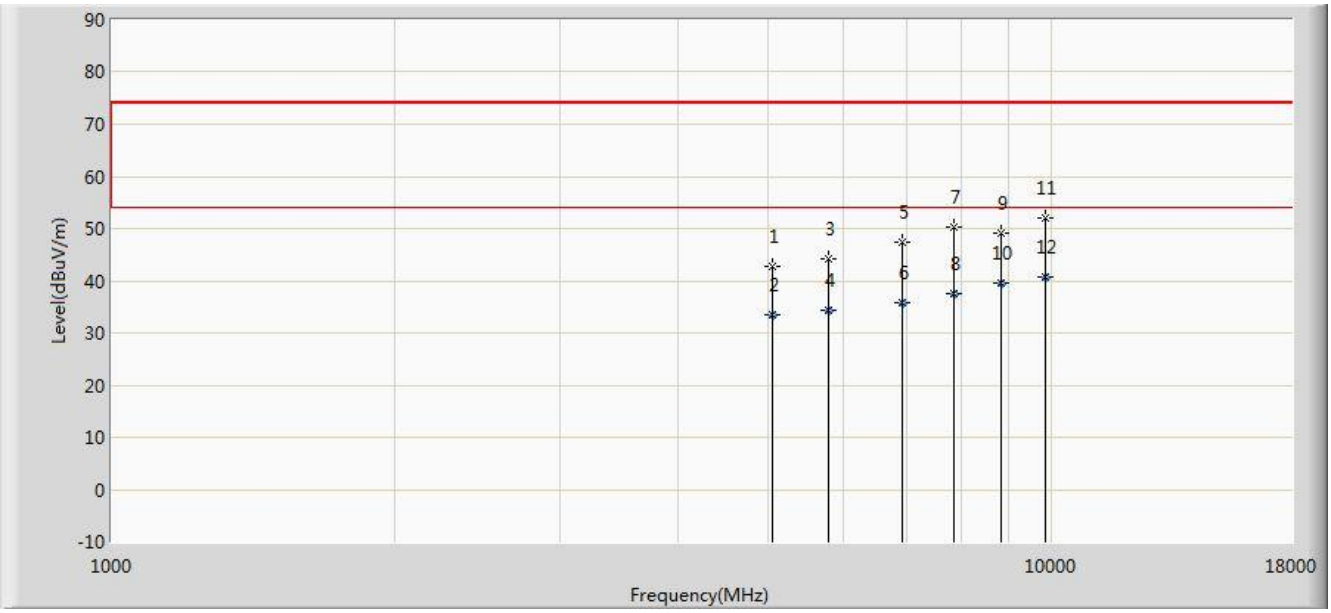


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			3813.500	42.051	39.237	-31.949	74.000	2.814	PK
2			3814.250	30.605	27.790	-23.395	54.000	2.815	AV
3			4332.000	41.844	37.446	-32.156	74.000	4.398	PK
4			4333.025	28.421	24.030	-25.579	54.000	4.391	AV
5			4884.500	42.836	36.862	-31.164	74.000	5.974	PK
6			4885.030	29.964	23.990	-24.036	54.000	5.974	AV
7			5615.500	43.667	36.671	-30.333	74.000	6.995	PK
8			5615.750	32.873	25.877	-21.127	54.000	6.996	AV
9			6508.000	46.787	36.891	-27.213	74.000	9.896	PK
10			6509.250	35.036	25.133	-18.964	54.000	9.903	AV
11			7400.500	49.948	37.336	-24.052	74.000	12.612	PK
12		*	7401.250	37.240	24.630	-16.760	54.000	12.610	AV

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

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

Site: AC1	Time: 2019/03/14 - 07:32
Limit: FCC_Part15.109_RE(3m)_ Class B	Engineer: David Lv
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: FREKVENS Subwoofer	Power: AC 120V/60Hz
Test Mode 1	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			5037.500	42.884	36.433	-31.116	74.000	6.450	PK
2			5037.500	33.361	26.910	-20.639	54.000	6.450	AV
3			5794.000	44.235	36.698	-29.765	74.000	7.537	PK
4			5794.000	34.447	26.910	-19.553	54.000	7.537	AV
5			6941.500	47.382	36.259	-26.618	74.000	11.122	PK
6			6941.500	35.883	24.760	-18.117	54.000	11.122	AV
7			7876.500	50.203	36.857	-23.797	74.000	13.347	PK
8			7876.500	37.496	24.150	-16.504	54.000	13.347	AV
9			8820.000	48.992	35.657	-25.008	74.000	13.335	PK
10			8820.000	39.515	26.180	-14.485	54.000	13.335	AV
11			9857.000	52.027	35.358	-21.973	74.000	16.669	PK
12		*	9857.000	40.629	23.960	-13.371	54.000	16.669	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + 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 **FREKVENS Subwoofer** has been tested to comply with the requirements specified in Part 15B of the FCC Rules.

The End

Appendix A – Test Setup Photograph

Refer to “1809WSU018-UT” file.

Appendix B – EUT Photograph

Refer to “1809WSU018-UE” file.