EMC TEST REPORT

Applicant	Nokia Shanghai Bell CO., Ltd.
FCC ID	2ADZRA020WA
Product	WIFI Mesh
Brand	Nokia
Model	HA-020W-A, A-020W-A
Report No.	R1806B0067-E1
Issue Date	June 28, 2018

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC Code CFR47 Part15B (2017)/ ANSI C63.4 (2014)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Wei Liu

Performed by: Wei Liu/ Manager

Guangchang Fan

Approved by: Guangchang Fan/ Director

TA Technology (Shanghai) Co., Ltd.

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Summary of measurement results

Number	Test Case	Clause in FCC Rules	Conclusion
1	Radiated Emission	15.109, ANSI C63.4-2014	PASS
2	Conducted Emission	15.107, ANSI C63.4-2014	PASS
Test Date: February 2, 2018~ February 5, 2018			

1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein .Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2 Test facility

CNAS (accreditation number: L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3 Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China
City:	Shanghai
Post code:	201201
Country:	P. R. China
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Fax:	+86-021-50791141/2/3-8000
Website:	http://www.ta-shanghai.com
E-mail:	xukai@ta-shanghai.com

2 General Description of Equipment under Test

2.1 Client Information

Applicant	Nokia Shanghai Bell CO., Ltd.
Applicant address	388#, Ningqiao Road, China (Shanghai) Pilot Free Trade Zone, Shanghai 201206, China
Manufacturer	Nokia Shanghai Bell CO., Ltd.
Manufacturer address	388#, Ningqiao Road, China (Shanghai) Pilot Free Trade Zone, Shanghai 201206, China

2.2 General information

EUT Description	
Device Type:	Portable Device
Product Name:	WIFI Mesh
Model Number:	HA-020W-A, A-020W-A
IMEI:	/
HW Version:	PEM4
SW Version:	3FE473360.00
Antenna Type:	Internal Antenna
Test Mode:	Transfer Data Mode
EUT Accessory	
Adapter 1	Manufacturer: Shenzhen Ruide Electronical Industrial CO., LTD Model: RD1201000- C55-26MG
Adapter 2	Manufacturer: Dongguan Shilong Fuhua Electronic CO., LTD Model: UES12W8-120100SPAU
Note: The information of the EUT is declared by the manufacturer. 2. There are more than one Adapters, each one should be applied throughout the compliance test respectively, however, only the worst case (Adapter 1) will be recorded in this report.	

Item	HA-020W-A	A-020W-A
Software	The same	The same
Hardware	The same	The same
Mechanical Shell	Black	White
Mechanical push button	Plastic handle reduced 2mm	Plastic handle increase 2mm
Other	The same	The same
Note: Customer declaration, two models is the same, except for Mechanical. There are more than one model, each one should be applied throughout the compliance test respectively, however, only the worst case (HA-020W-A) will be recorded in this report.		

2.3 Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards
FCC Code CFR47 Part15B (2017)
ANSI C63.4 (2014)

2.4 Test Mode

Test Mode	
Mode 1:	EUT+ADAPTER+PC+Traffic
Mode 2:	EUT+ADAPTER+PC+IDLE

During the test, the preliminary test was performed in all modes, mode 1 with adapter 1 selected as the worst condition. The test data of the worst-case condition was recorded in this report.

3 Test Case Results

3.1 Radiated Emission

Ambient condition

Temperature	Relative humidity	Pressure
24°C~26°C	45%~50%	102.5kPa

Methods of Measurement

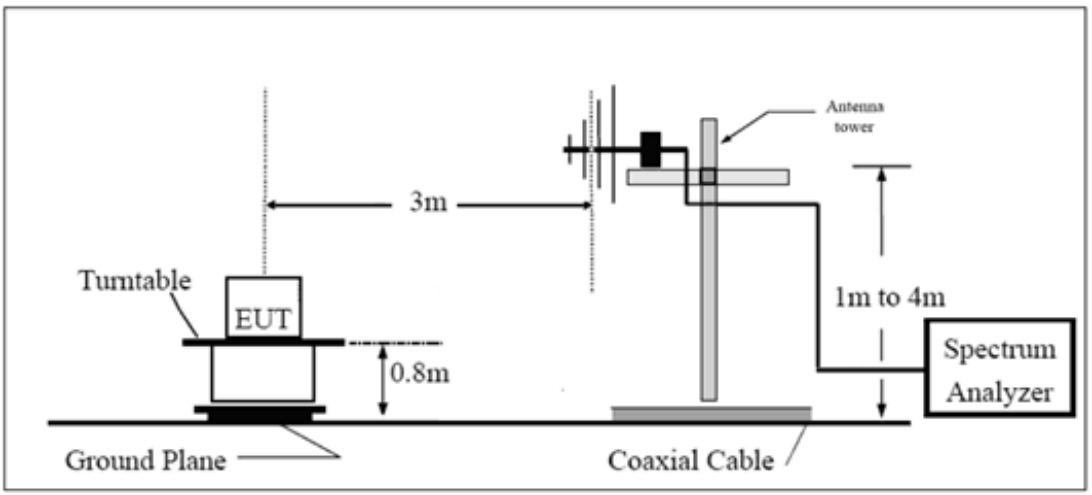
The EUT is placed on a non-metallic table 0.8m above the horizontal metal reference ground plane. The distance between EUT and receive antenna should be 3 meters. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.4-2014. Sweep the whole frequency band through the range from 30MHz to the 5th harmonic of the carrier. During the test, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees for detecting the maximum of radiated signal level.
The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. During the test, the EUT is worked at maximum output power.
Set the spectrum analyzer in the following:
Below 1GHz:
RBW=100 kHz / VBW=300 kHz / Sweep=AUTO
Above 1GHz:
(a) PEAK: RBW=1MHz / VBW=3MHz/ Sweep=AUTO
(b) AVERAGE: RBW=1MHz / VBW=3MHz / Sweep=AUTO

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

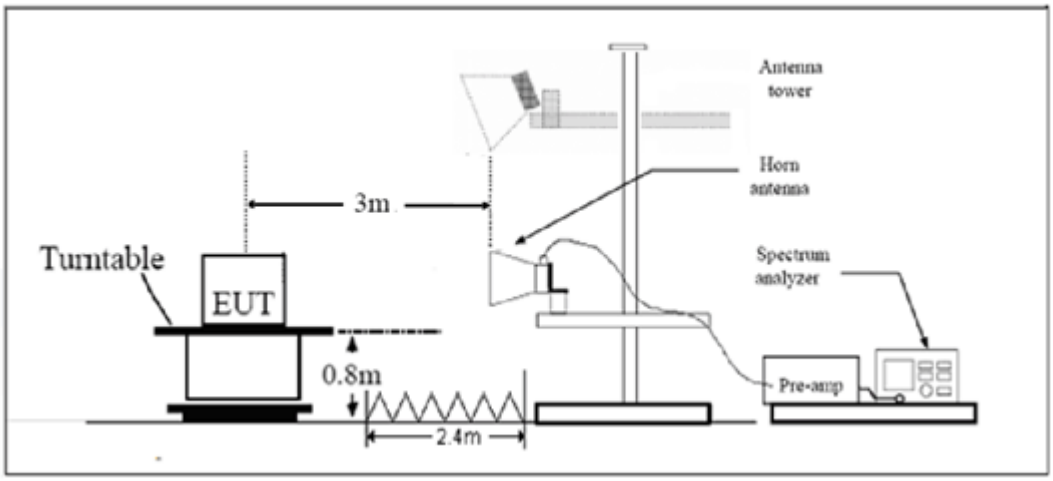
During the test, EUT is connected to adapter in the case of wifi function on mode.

Test Setup

Below 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Antenna Tower meets ANSI C63.4 requirements for measurements above 1 GHz by keeping the antenna aimed at the EUT during the antenna's ascent/ descent along the antenna mast.

Limits

Frequency (MHz)	Field Strength (dBμV/m)	Detector
30 -88	40.0	Quasi-peak
88-216	43.5	Quasi-peak
216 – 960	46.0	Quasi-peak
960-1000	54.0	Quasi-peak
1000-5th harmonic of the highest frequency or 40GHz,which is lower	54 74	Average Peak

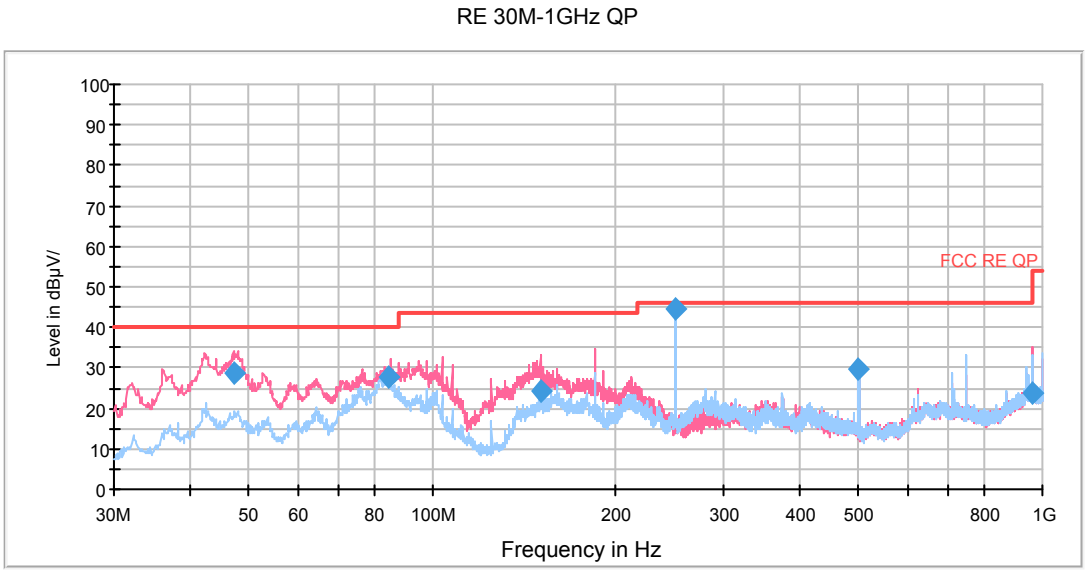
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 1.96. U= 3.704 dB.

Test Results

The following graphs display the maximum values of horizontal and vertical by software.
For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.

Adapter 1



Radiated Emission from 30MHz to 1GHz

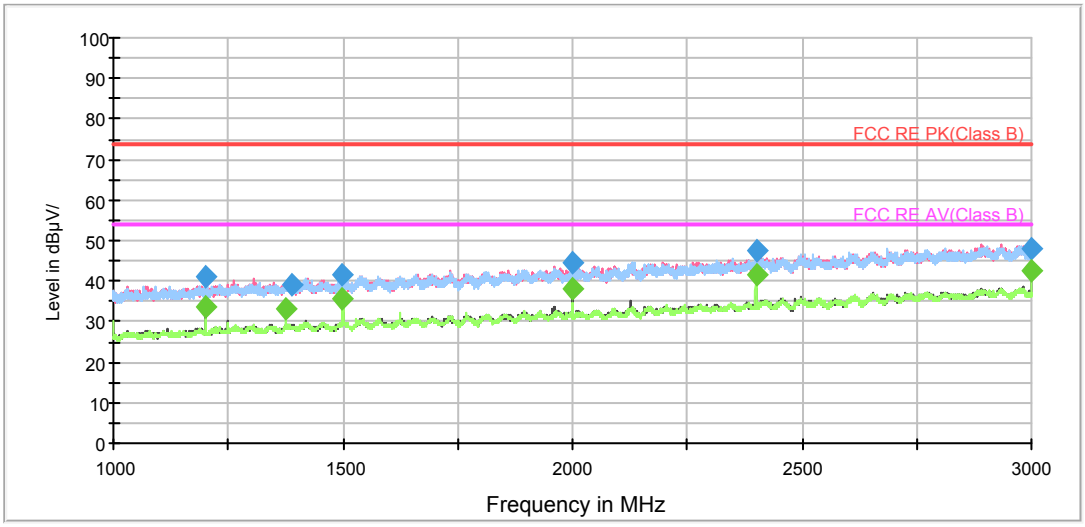
Frequency (MHz)	Quasi-Peak (dBuV/m)	Reading value (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
47.178510	28.9	46.8	100.0	V	67.0	-17.9	11.1	40.0
84.955828	27.7	52.5	125.0	V	94.0	-24.8	12.3	40.0
150.023353	24.5	53.0	100.0	V	0.0	-28.5	19.0	43.5
250.002500	44.4	69.4	125.0	H	271.0	-25.0	1.6	46.0
499.995000	29.9	50.5	175.0	H	251.0	-20.6	16.1	46.0
959.666750	23.6	34.3	100.0	V	15.0	-10.7	22.4	46.0

Remark: 1. Quasi-Peak = Reading value + Correction factor

2. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)

3. Margin = Limit – Quasi-Peak

RE 1G-3GHz PK+AV

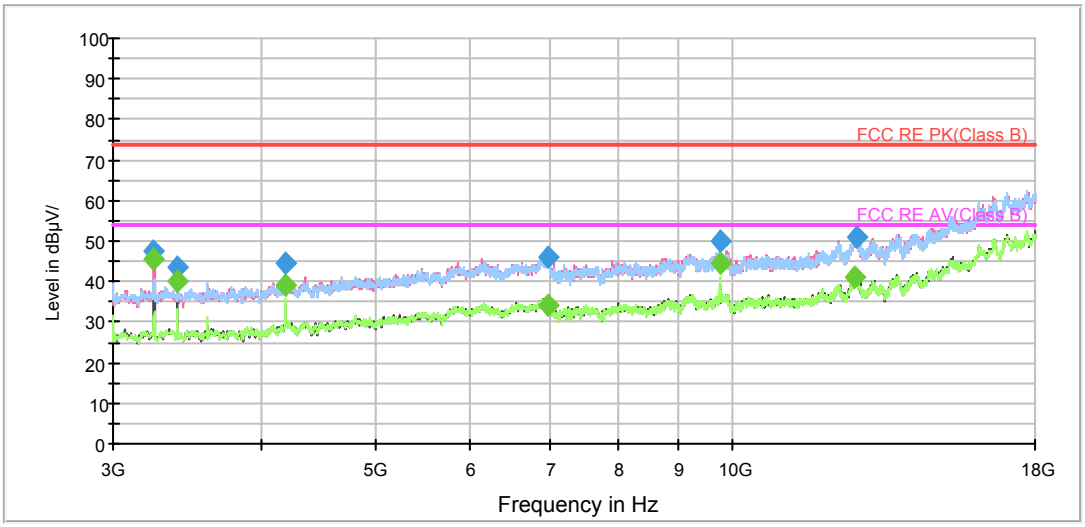


Radiated Emission from 1GHz to 3GHz

Frequency (MHz)	Peak (dBuV/m)	Reading value (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1199.831250	41.0	49.2	100.0	V	137.0	-8.2	33.0	74
1390.290000	39.2	46.2	100.0	V	243.0	-7.0	34.8	74
1499.936250	41.6	48.3	100.0	H	338.0	-6.7	32.4	74
1999.856250	44.6	48.0	100.0	V	110.0	-3.4	29.4	74
2400.005000	47.3	48.5	100.0	H	0.0	-1.2	26.7	74
2999.947750	47.8	45.5	100.0	V	64.0	2.3	26.2	74

Frequency (MHz)	Average (dBuV/m)	Reading value (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1200.233750	33.4	41.6	100.0	V	146.0	-8.2	20.6	54.0
1375.131250	33.0	40.1	100.0	H	239.0	-7.1	21.0	54.0
1499.883750	35.8	42.5	100.0	H	230.0	-6.7	18.2	54.0
1999.965000	37.9	41.3	100.0	V	110.0	-3.4	16.1	54.0
2400.115000	41.8	43.0	100.0	H	8.0	-1.2	12.2	54.0
2999.983750	42.5	40.2	100.0	V	321.0	2.3	11.5	54.0

RE 3-18GHz PK+AV



Radiated Emission from 3GHz to 18GHz

Frequency (MHz)	Peak (dBuV/m)	Reading value (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
3249.368750	47.6	50.1	200.0	V	274.0	-2.5	26.4	74.0
3395.958750	43.7	46.3	200.0	V	293.0	-2.6	30.3	74.0
4200.052500	44.3	43.9	100.0	H	99.0	0.4	29.7	74.0
6975.761250	46.3	40.0	300.0	V	0.0	6.3	27.7	74.0
9748.073750	49.9	40.1	100.0	H	179.0	9.8	24.1	74.0
12737.666250	51.2	37.1	300.0	H	309.0	14.1	22.8	74.0

Frequency (MHz)	Average (dBuV/m)	Reading value (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
3249.290000	45.3	47.8	200.0	V	274.0	-2.5	8.7	54.0
3396.080000	40.1	42.7	200.0	V	293.0	-2.6	13.9	54.0
4200.011250	39.2	38.8	100.0	H	99.0	0.4	14.8	54.0
6991.568750	34.1	27.6	200.0	V	238.0	6.5	19.9	54.0
9748.013750	44.7	34.9	100.0	H	179.0	9.8	9.3	54.0
12685.462500	41.3	27.1	100.0	V	271.0	14.2	12.7	54.0

3.2 Conducted Emission

Ambient condition

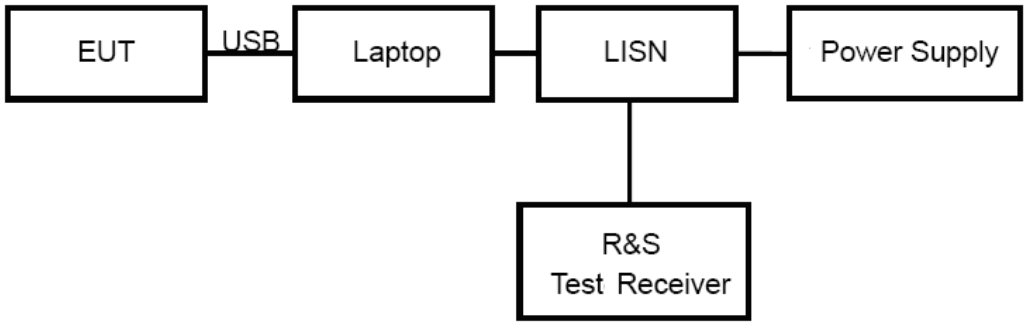
Temperature	Relative humidity	Pressure
24°C ~26°C	50%~55%	102.5kPa

Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.4-2014. Connect the AC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. RBW is set to 9 kHz, VBW is set to 30kHz. The measurement result should include both L line and N line.

During the test, EUT is connected to adapter in the case of wifi function on mode.

Test Setup



Note: Power Supply is AC Power source and it is used to change the voltage 120V/60Hz.

Limits

Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46 *
0.5 - 5	56	46
5 - 30	60	50
*: Decreases with the logarithm of the frequency.		

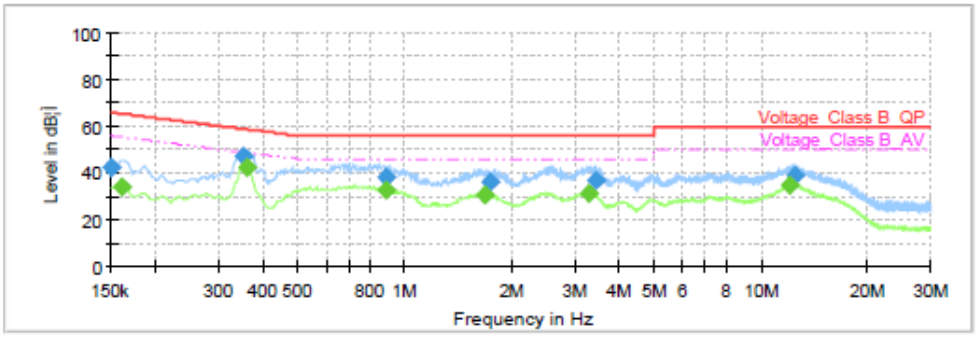
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 1.96. U= 2.57 dB.

Test Results

Following plots, Blue trace uses the peak detection; Green trace uses the average detection.

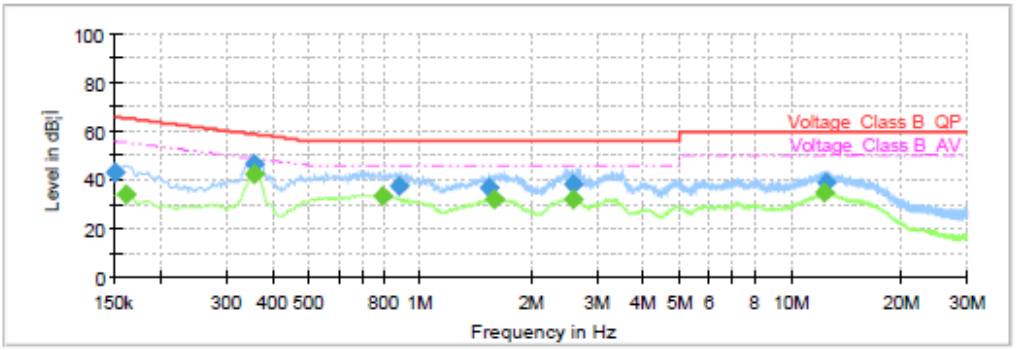
Adapter 1



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	42.49	---	66.00	23.51	1000.0	9.000	L1	ON	19.6
0.161250	---	33.96	55.40	21.44	1000.0	9.000	L1	ON	19.6
0.352500	46.89	---	58.90	12.01	1000.0	9.000	L1	ON	19.6
0.359250	---	42.25	48.75	6.50	1000.0	9.000	L1	ON	19.6
0.883500	38.22	---	56.00	17.78	1000.0	9.000	L1	ON	19.6
0.885750	---	32.41	46.00	13.59	1000.0	9.000	L1	ON	19.6
1.689000	---	30.23	46.00	15.77	1000.0	9.000	L1	ON	19.6
1.743000	35.91	---	56.00	20.09	1000.0	9.000	L1	ON	19.6
3.288750	---	31.47	46.00	14.53	1000.0	9.000	L1	ON	19.6
3.441750	36.67	---	56.00	19.33	1000.0	9.000	L1	ON	19.6
12.097500	---	34.43	50.00	15.57	1000.0	9.000	L1	ON	19.9
12.486750	38.97	---	60.00	21.03	1000.0	9.000	L1	ON	19.9

L line

Conducted Emission from 150 KHz to 30 MHz



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	43.40	---	66.00	22.60	1000.0	9.000	N	ON	19.7
0.161250	---	34.20	55.40	21.20	1000.0	9.000	N	ON	19.7
0.354750	---	42.03	48.85	6.82	1000.0	9.000	N	ON	19.6
0.354750	46.73	---	58.85	12.12	1000.0	9.000	N	ON	19.6
0.791250	---	33.18	46.00	12.82	1000.0	9.000	N	ON	19.6
0.874500	37.50	---	56.00	18.50	1000.0	9.000	N	ON	19.6
1.531500	36.75	---	56.00	19.25	1000.0	9.000	N	ON	19.6
1.587750	---	31.72	46.00	14.28	1000.0	9.000	N	ON	19.6
2.580000	38.19	---	56.00	17.81	1000.0	9.000	N	ON	19.6
2.595750	---	31.67	46.00	14.33	1000.0	9.000	N	ON	19.6
12.322500	---	34.39	50.00	15.61	1000.0	9.000	N	ON	19.9
12.453000	38.97	---	60.00	21.03	1000.0	9.000	N	ON	19.9

N line

Conducted Emission from 150 KHz to 30 MHz

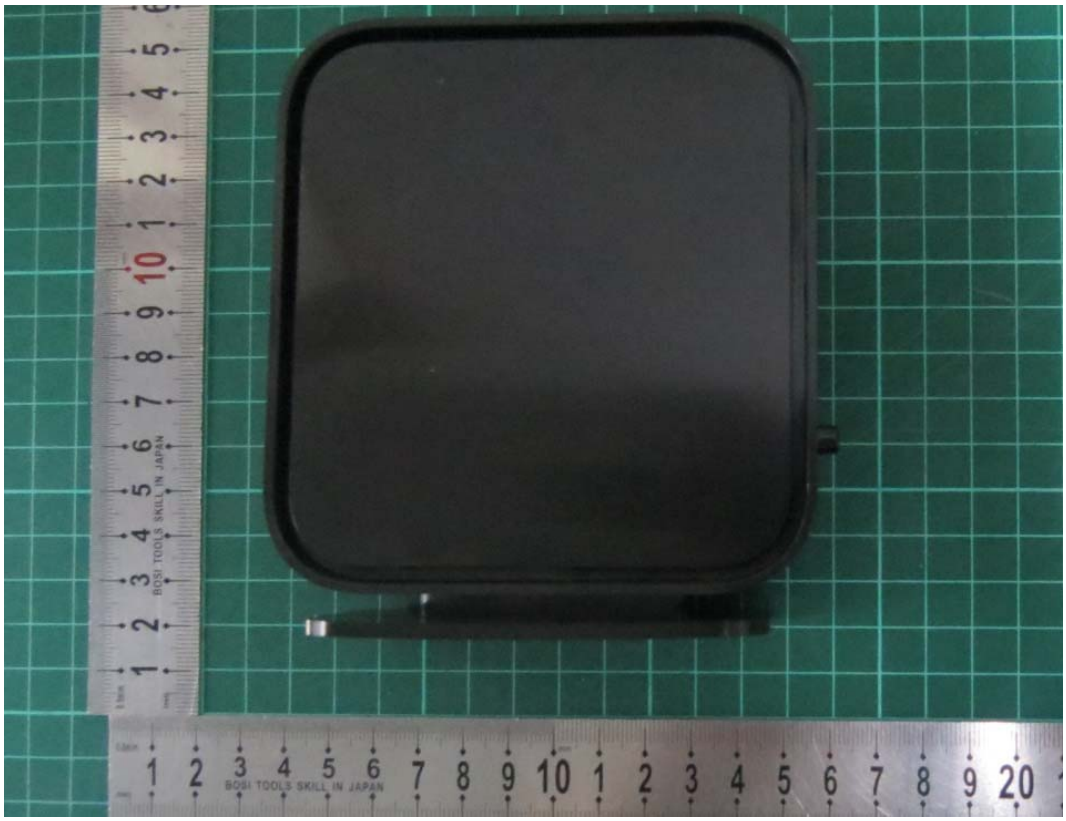
4 Main Test Instrument

Name	Manufacturer	Type	Serial Number	Last Cal.	Cal. Due Date
Signal Analyzer	R&S	FSV30	100815	2017-12-17	2018-12-16
EMI Test Receiver	R&S	ESCI	100948	2017-05-20	2018-05-19
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2017-02-18	2019-02-17
Trilog Antenna	SCHWARZBECK	VULB 9163	9163-201	2017-11-18	2020-11-17
Horn Antenna	R&S	HF907	100126	2014-12-06	2019-12-05
Horn Antenna	ETS-Lindgren	3160-09	00102643	2015-01-30	2020-01-29
EMI Test Receiver	R&S	ESR	101667	2017-09-06	2018-09-05
LISN	R&S	ENV216	101171	2016-12-16	2019-12-15
Bore Sight Antenna mast	ETS	2171B	00058752	NA	NA
Test software	EMC32	R&S	V9.26.0	NA	NA

*******END OF REPORT *******

ANNEX A： The EUT Appearance and Test Configuration

A.1 EUT Appearance

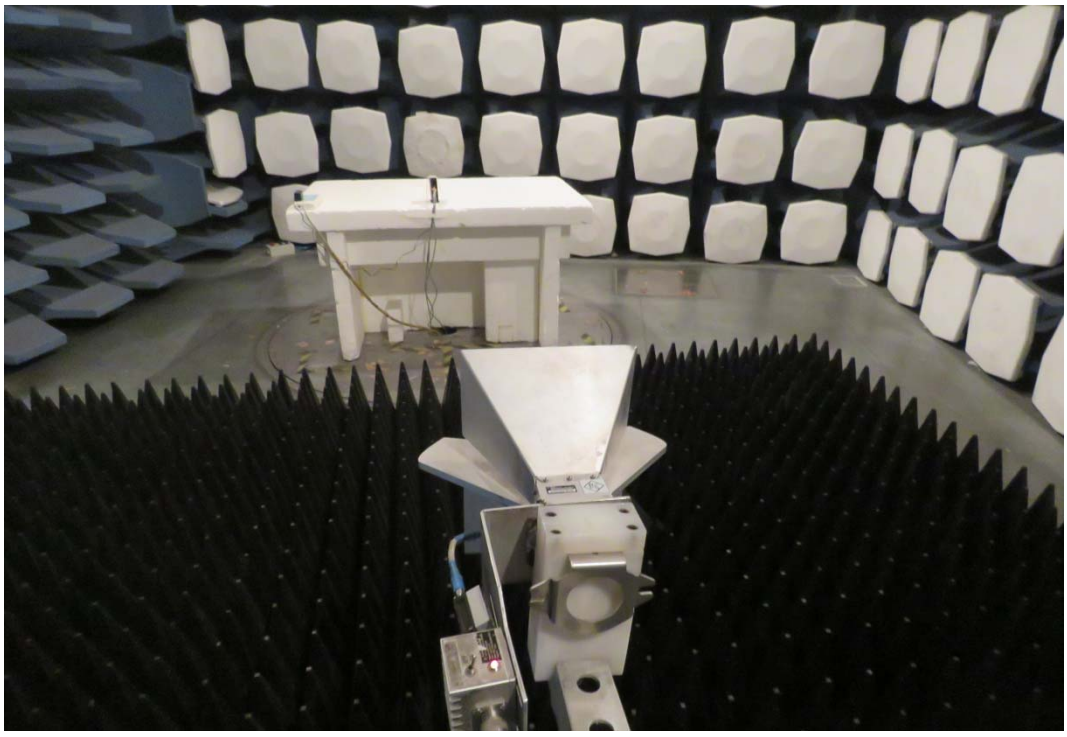


HA-020W-A

A-020W-A
Picture 1 EUT

A.2 Test Setup

a: Below 1GHz



b: Above 1GHz

Picture 2 Radiated Emission Test Setup

Adapter 1

Picture 3 Conducted Emission Test Setup