

FCC & IC TEST REPORT (433MHz)
No. 160801355SHA-002

Applicant : NINGBO DOOYA MECHANIC & ELECTRONIC
TECHNOLOGY CO., LTD.
No.168 Shengguang Road, Luotuo, Zhenhai, Ningbo,
ZHEJIANG, China

Manufacturer : NINGBO DOOYA MECHANIC & ELECTRONIC
TECHNOLOGY CO., LTD.
No.168 Shengguang Road, Luotuo, Zhenhai, Ningbo,
ZHEJIANG, China

Product Name : Wifi BOX

Type/Model : DD7001

TEST RESULT : PASS

SUMMARY

The equipment complies with the requirements according to the following standard(s):

47CFR Part 15 (2018): Radio Frequency Devices (Subpart C)

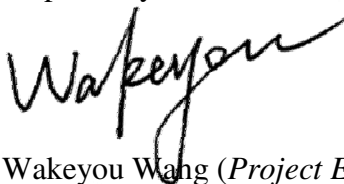
ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of
Unlicensed Wireless Devices

RSS-210 Issue 9 (August 2016): Licence-Exempt Radio Apparatus: Category I Equipment

RSS-Gen Issue 5 (April 2018): General Requirements for Compliance of Radio Apparatus

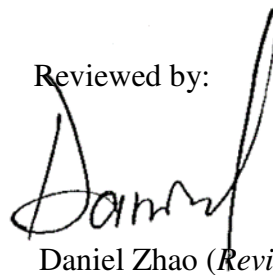
Date of issue: May 15, 2019

Prepared by:



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Description of Test Facility

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IC Assigned Code: 2042B-1

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1. General Information

1.1 Applicant Information

Applicant:	NINGBO DOOYA MECHANIC & ELECTRONIC TECHNOLOGY CO., LTD. No.168 Shengguang Road, Luotuo, Zhenhai, Ningbo, ZHEJIANG, China
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Manufacturer:	NINGBO DOOYA MECHANIC & ELECTRONIC TECHNOLOGY CO., LTD. No.168 Shengguang Road, Luotuo, Zhenhai, Ningbo, ZHEJIANG, China
Sample received date:	Sep 20, 2016
Sample Identification No:	/
Date of test:	Sep 20, 2016 ~ May 10, 2019

1.2 Identification of the EUT

Equipment:	Wifi BOX
Type/model for FCC:	DD7001
FCC ID:	VYYDD7001
IC:	21396-DD7001

1.3 Technical specification

Frequency Range:	2400 – 2483.5 MHz, 433.925MHz
Modulation:	DBPSK, DQPSK, CCK, BPSK QPSK, 16-QAM, 64-QAM; GFSK
Gain of Antenna:	2.0dBi; 1.2dBi
Rating:	DC 5V powered by USB port
Description of EUT:	There is one model only. The device supports both wi-fi and 433MHz SRD. Among this report, only 433MHz SRD function was tested.
Channel Description:	2.4GHz band: Channel spacing 5MHz 11 channels for 2412~2462MHz; 7 channels for 2422~2452MHz for 11n HT40; 433.925MHz band: 1 channel only.

2. Test Specification

2.1 Test Standard

47CFR Part 15 (2018): Radio Frequency Devices (Subpart C)

ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

RSS-210 Issue 9 (August 2016): Licence-Exempt Radio Apparatus: Category I Equipment

RSS-Gen Issue 5 (April 2018): General Requirements for Compliance of Radio Apparatus

2.2 Mode of operation during the test

Within this test report, EUT was tested with modulation and tested under its rating voltage and frequency.

The EUT is a fixed installed device and therefore it was setup as its normal use.

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Peripherals	Brand	Model No.	Serial No.	Description of Data Cable
USB adaptor	PHIHONG	PSAI10R-050Q	N/A	USB shielded × 1 (1m)
RS485 to RS232 adapter	UTEK	UT-2201	N/A	RJ-21 unshielded × 1 (6m)
Notebook PC	DELL	Latitude D610	1YWZK1S	NA

2.5 Instrument list

PXA Signal Analyzer	Keysight	N9030A	EC 5338	2020-03-04
Power sensor	Agilent	U2021XA	EC 5338-1	2020-03-04
Vector Signal Generator	Agilent	N5182B	EC 5175	2020-03-04
Universal Radio Communication Tester	R&S	CMW500	EC5944	2019-12-22
MXG Analog Signal Generator	Agilent	N5181A	EC 5338-2	2020-03-04
Test Receiver	R&S	ESCI 7	EC 4501	2019-09-12
Climate chamber	GWS	MT3065	EC 6021	2019-07-03
Spectrum Analyzer	Keysight	N9030A	EC 6078	2020-06-11
Semi-anechoic chamber	Albatross project	-	EC 3048	2019-07-31
Test Receiver	R&S	ESIB 26	EC 3045	2019-09-12
Bilog Antenna	TESEQ	CBL 6112D	EC 4206	2019-12-10
Pre-amplifier	R&S	AFS42-00101800-25-S-42	EC5262	2020-06-11
Test Receiver	R&S	ESCS 30	EC 2107	2019-07-15
A.M.N.	R&S	ESH2-Z5	EC 3119	2019-11-29

2.6 Test Summary

This report applies to tested sample only. The test results have been compared directly with the limits, and the measurement uncertainty is recorded. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	FCC REFERENCE	IC REFERENCE	RESULT
Fundamental & spurious emission	15.231(b)	RSS-210 Issue 9 Annex A1.2	Pass
Restrict band radiated emission	15.205	RSS-210 Issue 9 Clause 4.1	Pass
Power line conducted emission	15.207	RSS-Gen Issue 4 Clause 8.8	Pass
Emission bandwidth	15.231(c)	RSS-210 Issue 9 Annex A1.3	Pass
Deactivating time	15.231(a)(1)	RSS-210 Issue 9 Annex A1.1	Pass
Occupied bandwidth	-	RSS-Gen Issue 4 Clause 6.6	Tested

2.7 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT

Item No.	Test Items	Expanded Uncertainty (k=2) (±)
1	Radio frequency	0.84×10^{-7}
2	RF power, conducted	0.74 dB
3	RF power, radiated	5.92 dB
5	Power Spectral Density, conducted	2.99 dB
6	Occupied Channel Bandwidth	0.88 %
7	Conducted emission at mains ports	3.19 dB
8	Radiated Emissions up to 1 GHz	4.90 dB
9	Radiated Emissions 1-6GHz	5.02 dB
19	Radiated Emissions 6-18GHz	5.28 dB

3. Fundamental & Spurious Emission & Restrict band radiated emission

Test result: PASS

3.1 Test limit

3.1.1 The emission shall test through the 10th harmonic or to 40GHz, whichever is lower. It must comply with the limits below:

Fundamental Frequency (MHz)	Fundamental limit (uV/m)	Spurious limit (uV/m)
<input type="checkbox"/> 40.66 – 40.70	2250	225
<input type="checkbox"/> 70 – 130	1250	125
<input type="checkbox"/> 130 - 174	1250 to 3750	125 to 375
<input type="checkbox"/> 174 - 260	3750	375
<input checked="" type="checkbox"/> 260 – 470	3750 to 12500	375 to 1250
<input type="checkbox"/> Above 470	12500	1250

The formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(Frequency) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(Frequency) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

For that the EUT use fundamental frequency of 433.92MHz, after calculation, the limit is:

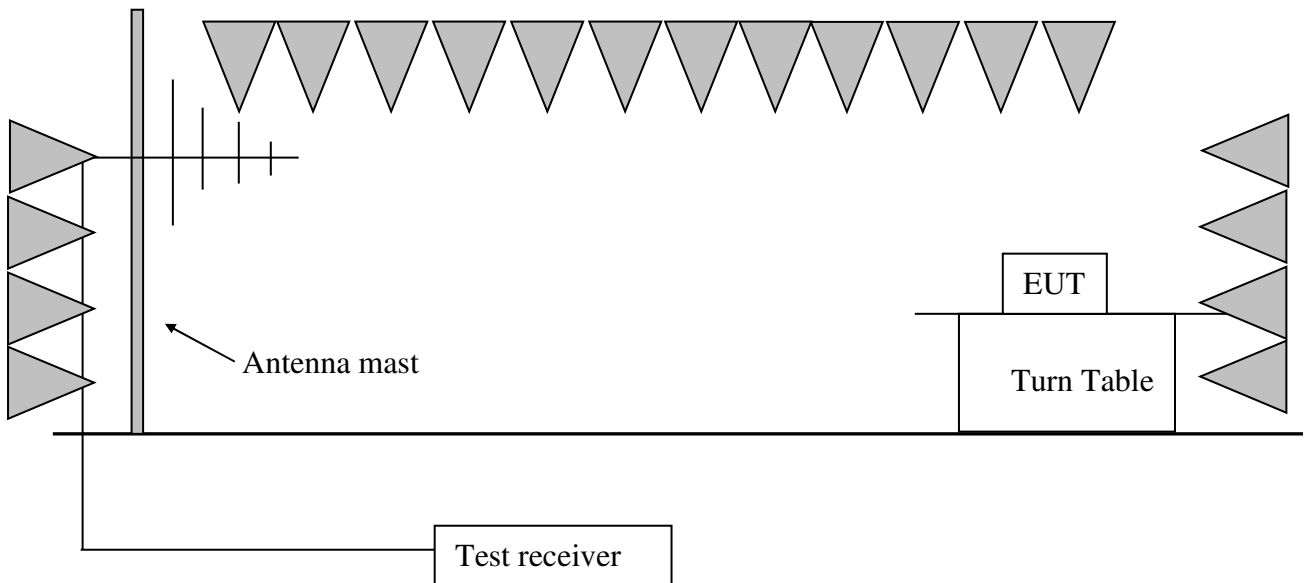
Fundamental limit = $41.6667 * 433.92 - 7083.3333 = 10996.68 \text{ uV/m} = 80.80 \text{ dBuV/m}$
 Spurious limit = $81 - 20 = 60.80 \text{ dBuV/m}$

////////////////////////////////////

3.1.2 The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

3.2 Test Configuration



3.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m.

The turntable rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

RBW = 300 Hz, VBW = 1 kHz (9 kHz~150 kHz);
RBW = 10 kHz, VBW = 30 kHz (150 kHz~30MHz);
RBW = 100 kHz, VBW = 300 kHz (30MHz~1GHz for PK)
RBW = 1MHz, VBW = 3MHz (>1GHz for PK);
RBW = 1MHz, VBW = 10Hz (>1GHz for AV);

Remark:

1. Factor= Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Measured level= Original Receiver Reading + Factor
3. Margin = Limit – Measured level
4. If the PK measured level is lower than AV limit, the AV test can be elided.

Example:

Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.
Then Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Measured level = 10dBuV + 0.20dB/m = 10.20dBuV/m
Assuming limit = 54dBuV/m,
Measured level = 10.20dBuV/m, then Margin = 54 - 10.20 = 43.80dBuV/m.

3.4 Test protocol

Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Emission Type	Limit (dBuV/m)	Margin	Detector
V	433.92	19.10	76.30	Fundamental	100.80	24.50	PK
V	346.85	17.10	32.40	Spurious	46.00	13.60	PK
H	410.00	19.10	30.70	Restrict	46.00	15.30	PK
V	867.98	24.00	47.70	Harmonics	80.80	33.10	PK
H	1296.59	-12.20	50.20	Harmonics	80.80	30.60	PK
H	1729.45	-11.40	49.70	Harmonics	80.80	31.10	PK
V	2170.34	-10.80	50.30	Harmonics	80.80	30.50	PK
H	3036.07	-5.00	50.80	Harmonics	80.80	30.00	PK

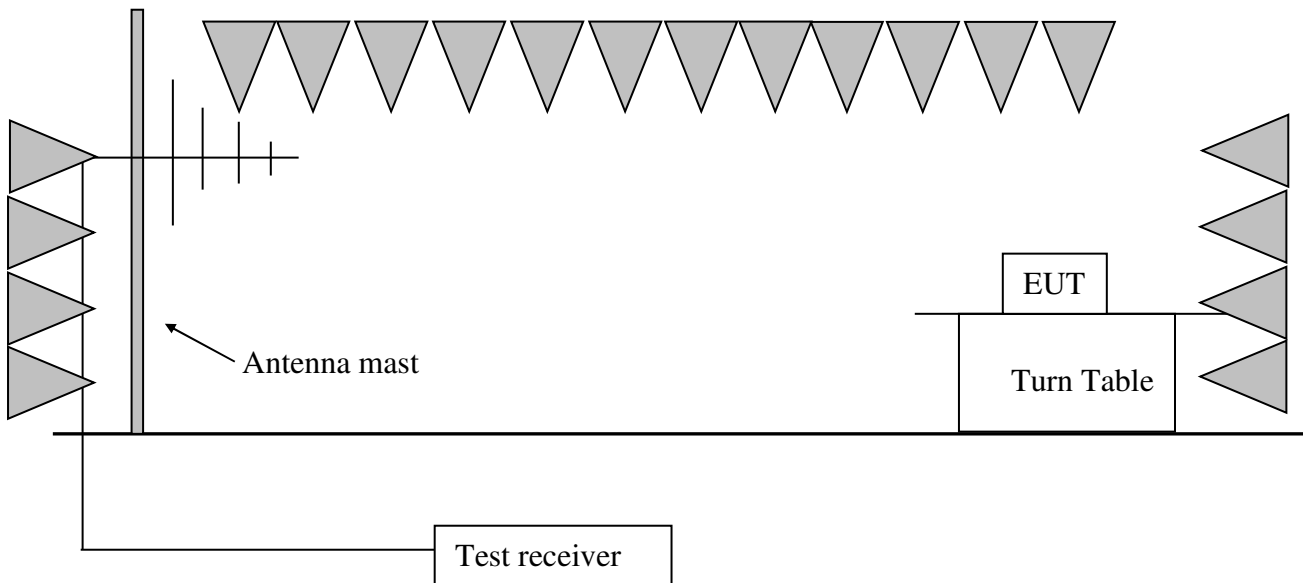
4. Deactivating time

Test result: PASS

4.1 Test limit

- ☒ (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- ☐ (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- ☐ (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.
- ☐ (4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.
- ☐ (5) Transmission of set-up information for security systems may exceed the transmission duration limits in (1) and (2) above, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

4.2 Test Configuration



4.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber.

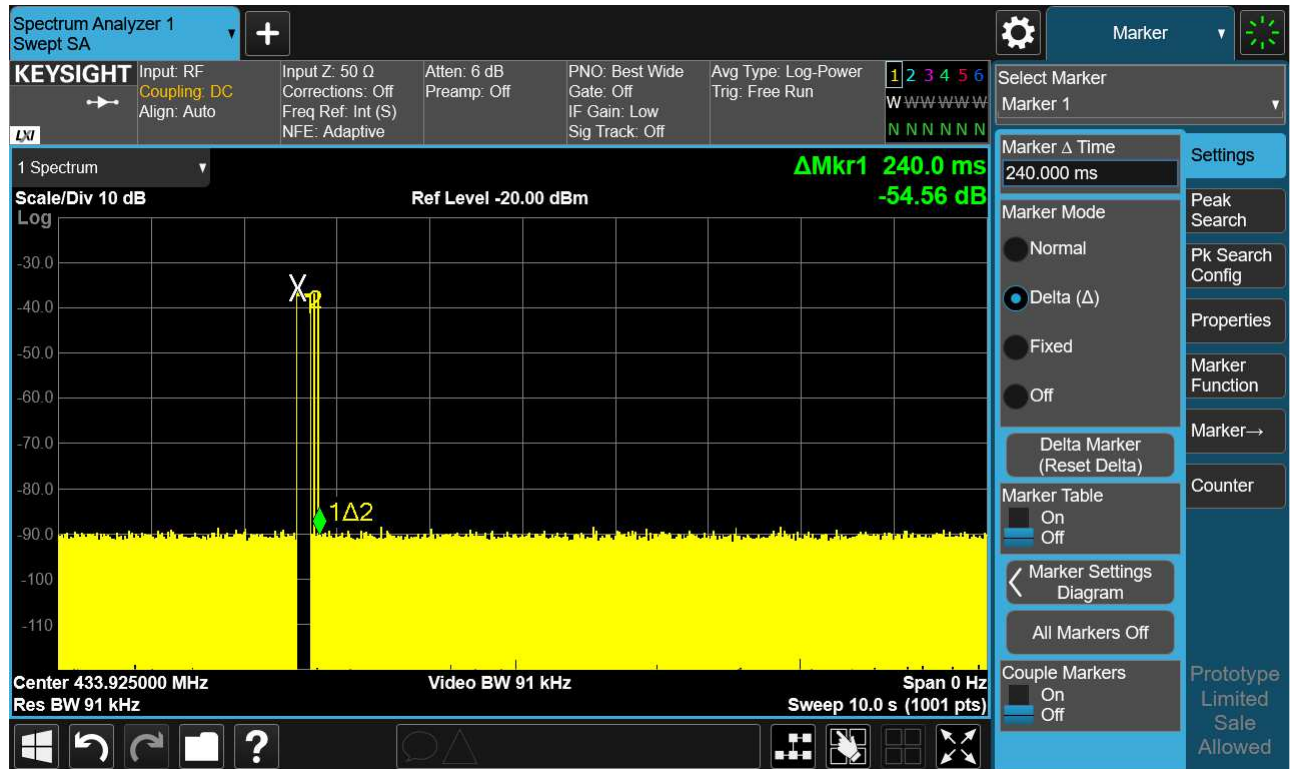
The central frequency of test receiver was set as the operating frequency of EUT and the Span was set as 0.

The EUT was switched once. The test receiver recorded the whole time from the triggered moment to the time of stopping radiating. For manual switching, to avoid uncertainty, the operating above would be repeated five times and the worst data is recorded.

4.4 Test protocol

Whole time from the triggered moment to the time of stopping radiating: 0.24s.

As a result, the EUT complies with the limit of 5s' deactivating time.



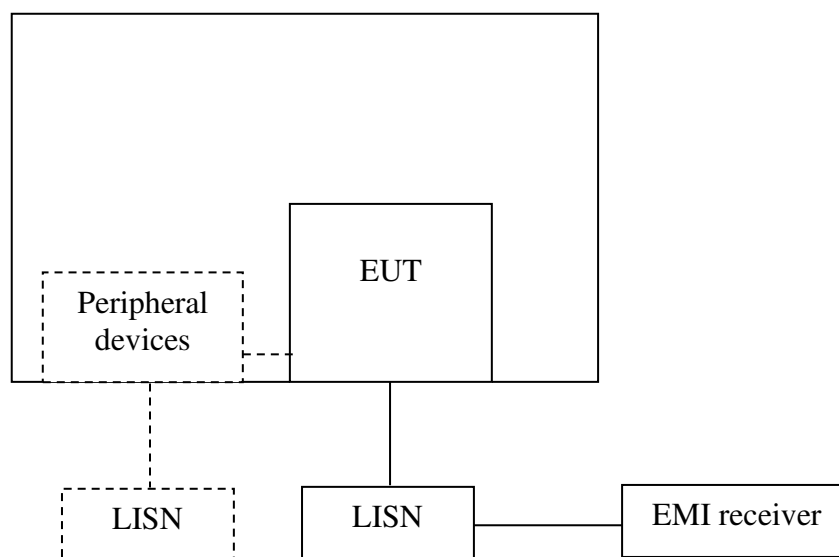
5. Power line conducted emission

Test result: **Pass**

5.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
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.		

5.2 Test configuration



☒ For table top equipment, wooden support is 0.8m height table

☐ For floor standing equipment, wooden support is 0.1m height rack.

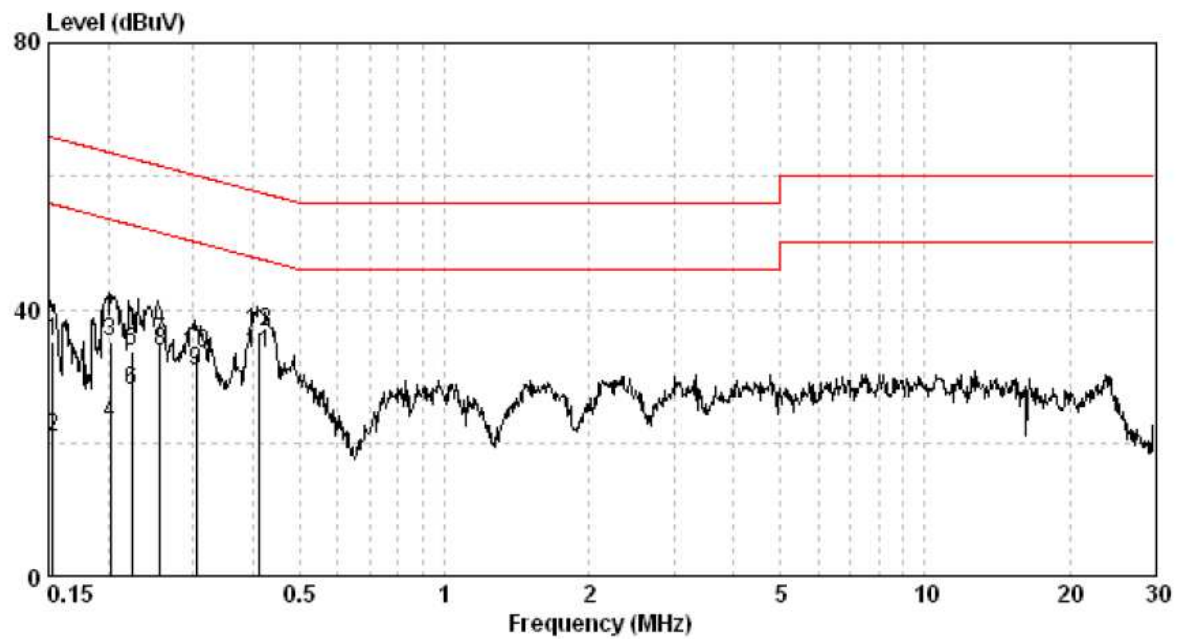
5.3 Test procedure and test set up

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a $50\Omega/50\mu\text{H}$ coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a $50\Omega/50\mu\text{H}$ coupling impedance with 50Ω termination.

Both sides (Line and Neutral) of AC 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 C63.4 on conducted measurement. The bandwidth of the test receiver is set at 9 kHz.

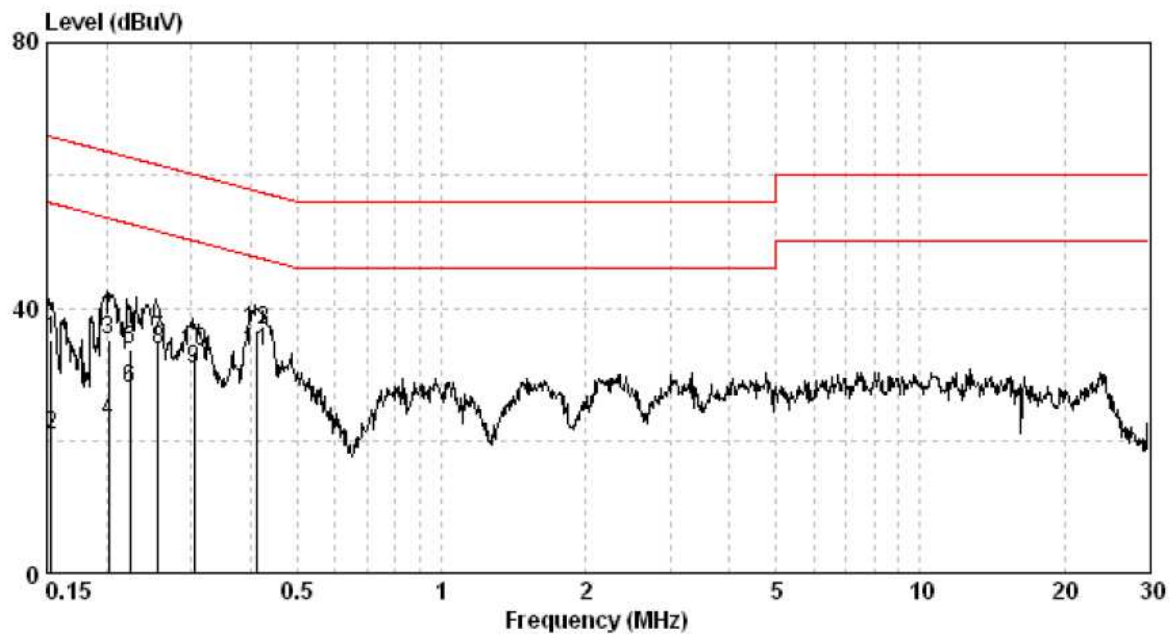
5.4 Test protocol

Line L



Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB)	
						Qp	Av
0.153	9.74	35.05	65.82	20.79	55.82	-30.77	-35.03
0.202	9.74	35.27	63.54	22.75	53.54	-28.27	-30.79
0.223	9.74	33.82	62.70	27.92	52.70	-28.87	-24.77
0.256	9.75	35.23	61.56	33.59	51.56	-26.33	-17.97
0.305	9.76	33.43	60.10	30.64	50.10	-26.68	-19.47
0.413	9.77	36.59	57.59	33.45	47.59	-21.01	-14.15

Line N



Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level Av (dBuV)	Limit Av (dBuV)	Margin (dB)	
						Qp	Av
0.156	9.74	36.58	65.65	29.99	55.65	-29.07	-25.66
0.182	9.74	37.83	64.42	30.99	54.42	-26.59	-23.43
0.207	9.74	29.44	63.32	25.96	53.32	-33.87	-27.35
0.246	9.75	27.76	61.91	23.27	51.91	-34.15	-28.64
0.410	9.77	33.44	57.64	27.16	47.64	-24.20	-20.48
1.338	9.87	29.08	56.00	24.39	46.00	-26.92	-21.61

Remark:

1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)

6. Emission Bandwidth

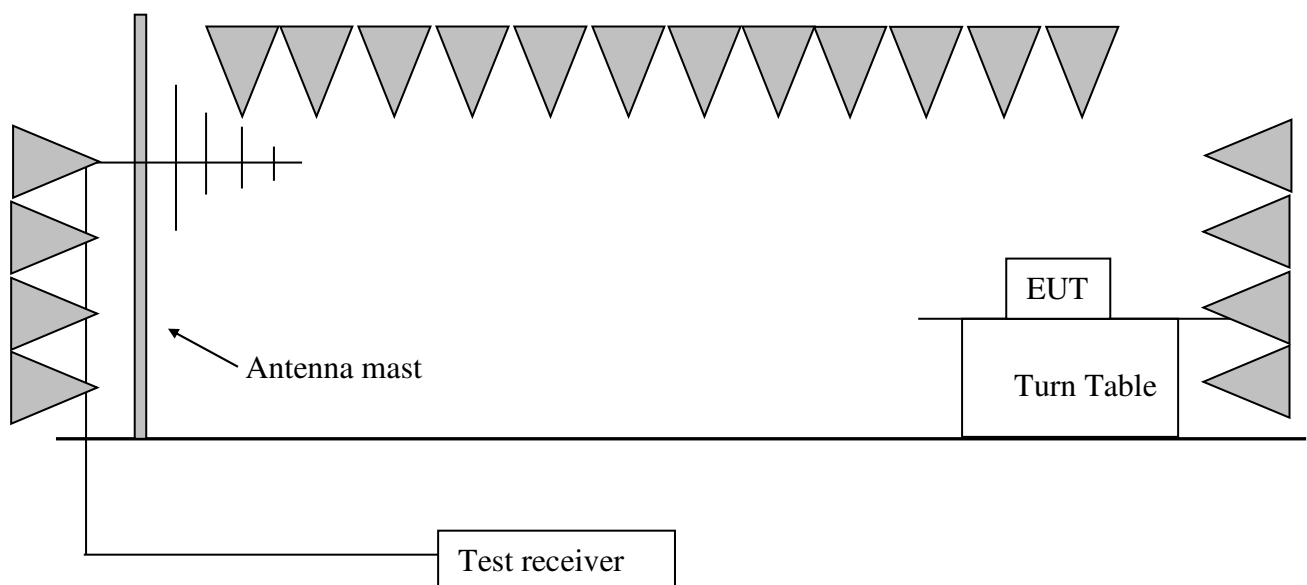
Test Status: Pass

6.1 Test limit

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

The limit for the EUT = $0.25\% * 433.92\text{MHz} = 1085\text{kHz}$

6.2 Test Configuration



6.3 Test procedure and test setup

The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1 meter to 4 meters to find out the maximum emission level.

The central frequency of test receiver was set near the operating frequency of EUT.

The test was conducted using the Spectrum Analyzer with the resolutions bandwidth set at 10kHz, the video bandwidth set at 30kHz.

6.4 Test protocol

Temperature : 22 °C
Relative Humidity : 53 %

Channel	Emission Bandwidth (kHz)	Limit (kHz)
1	83.14	1085



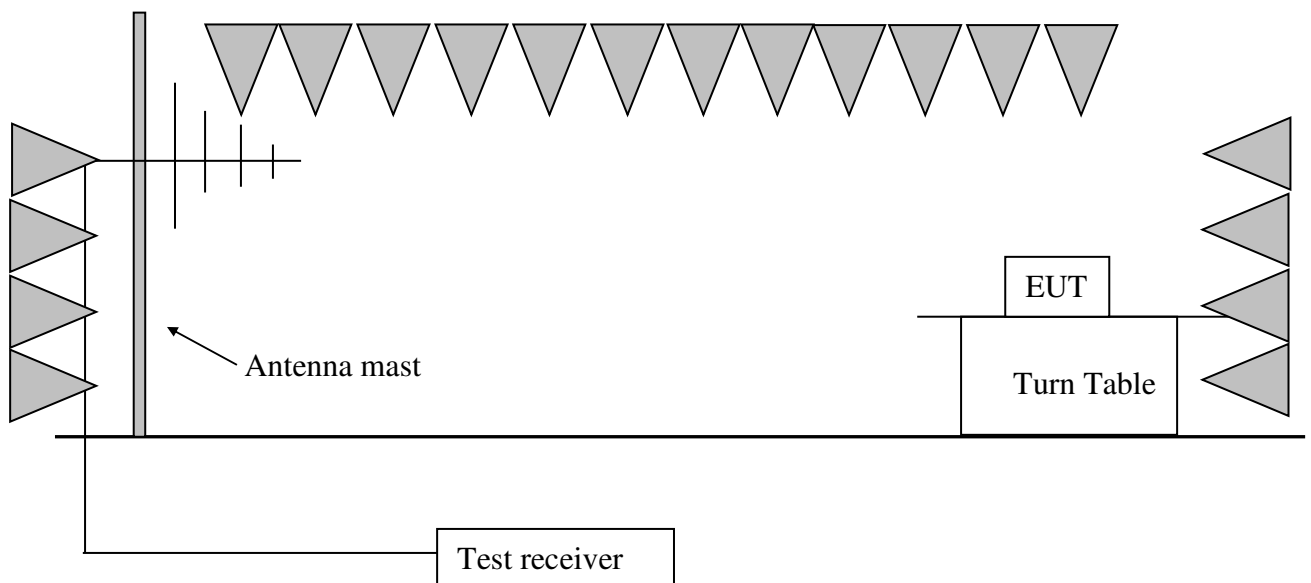
7. Occupied Bandwidth

Test Status: Tested

7.1 Test limit

None

7.2 Test Configuration



7.3 Test procedure and test setup

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

7.4 Test protocol

Temperature : 25 °C
Relative Humidity : 55 %

Channel	Occupied Bandwidth (kHz)
1	78.61

