EMC TEST REPORT

No. 130501648SHA-001

Applicant	:	NINGBO KML ELECTRICAL CO., LTD. No.707 Xiufeng Road, Gaoqiao Industry Park, Gaoqiao Town, Yinzhou District, Ningbo, Zhejiang 315173, P.R.China
Manufacturer	:	NINGBO KML ELECTRICAL CO., LTD. No.707 Xiufeng Road, Gaoqiao Industry Park, Gaoqiao Town, Yinzhou District, Ningbo, Zhejiang 315173, P.R.China
Equipment	:	Plug-in Wireless Motion Activated Control
Type/Model	:	KUL01TX-01

SUMMARY

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

47CFR Part 15 (2012): Radio Frequency Devices

ANSI C63.4 (2003): American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Date of issue: July 08, 2013

Prepared by:	Reviewed by:
Nemo Li	
Nemo Li (*Project Engineer*)	Jonny Jing (*Reviewer*)

Description of Test Facility

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Content

1. General Information

1.1 Applicant Information

Applicant:	NINGBO KML ELECTRICAL CO., LTD. No.707 Xiufeng Road, Gaoqiao Industry Park, Gaoqiao Town, Yinzhou District, Ningbo, Zhejiang 315173, P.R.China
Manufacturer:	NINGBO KML ELECTRICAL CO., LTD. No.707 Xiufeng Road, Gaoqiao Industry Park, Gaoqiao Town, Yinzhou District, Ningbo, Zhejiang 315173, P.R.China
Sample received date:	May 22, 2013
Sample Identification No :	0130522-20-008
Date of test :	May 22~ July 8, 2013

1.2 Identification of the EUT

Equipment:	Plug-in Wireless Motion Activated Control
Type/model:	KUL01TX-01
FCC ID:	2AAFT-KUL01TX-01

1.3 Technical specification

Operation Frequency Band:	315MHz
Modulation:	ASK
Antenna Designation:	Integral antenna, non-user removable.
Rating:	Battery: DC 3V Working frequency: 315MHz
Description of EUT:	There is one model only. The EUT transmits RF signal to control the working condition of the corresponding receiver.
Channel Description:	There is one channel only, namely 315MHz.

1.4 Mode of operation during the test / Test peripherals used

Within this test report, EUT was tested with modulation and tested under its rating voltage and frequency.
The EUT is a fix-installed device, so it was set up as its normal use condition.

2. Test Specification

2.1 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESIB 26	R&S	EC 3045	2012-10-21	2013-10-20
Semi-anechoic chamber	-	Albatross project	EC 3048	2013-5-21	2014-5-20
Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2013-5-16	2015-5-15
Horn antenna	HF 906	R&S	EC 3049	2013-5-13	2015-5-12
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2013-4-12	2014-4-11
Test Receiver	ESCS 30	R&S	EC 2107	2012-10-21	2013-10-20
A.M.N.	ESH2-Z5	R&S	EC 3119	2013-1-9	2014-1-8
A.M.N.	ESH3-Z5	R&S	EC 2109	2013-1-10	2014-1-9
High Pass Filter	WHKX 1.0/15G-10SS	Wainwright	EC4297-1	2013-2-8	2014-2-7
High Pass Filter	WHKX 2.8/18G-12SS	Wainwright	EC4297-2	2013-2-8	2014-2-7
High Pass Filter	WHKX 7.0/1.8G-8SS	Wainwright	EC4297-3	2013-2-8	2014-2-7
Band Reject Filter	WRCGV 2400/2483-2390/2493-35/10SS	Wainwright	EC4297-4	2013-2-8	2014-2-7
Test Receiver	FSV40	R&S	/	2012-10-21	2013-10-20
Power Splitter/Combiner	ZN2PD2-63	Mini-Circuits	815	2012-12-3	2013-12-2

2.2 Test Standard

47CFR Part 15 (2012): Radio Frequency Devices

ANSI C63.4 (2003): American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

2.3 Test Summary

This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	FCC REFERANCE	RESULT
Fundamental & spurious emission	15.231(b)	Pass
Restrict band radiated emission	15.205	Pass
Power line conducted emission	15.207	NA
Emission bandwidth	15.231(c)	Pass
Deactivating time	15.231(a)(1)	Pass

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)
☐ 40.66 – 40.70	2250	225
☐ 70 – 130	1250	125
☐ 130 - 174	1250 to 3750	125 to 375
☐ 174 - 260	3750	375
☒ 260 – 470	3750 to 12500	375 to 1250
☐ 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 315MHz, after calculation, the limit is:

Fundamental limit = 41.6667 * 315 - 7083.3333 = 6041.68 uV/m = 75.60dBuV/m
Spurious limit = 75.60 – 20 = 55.60dBuV/m

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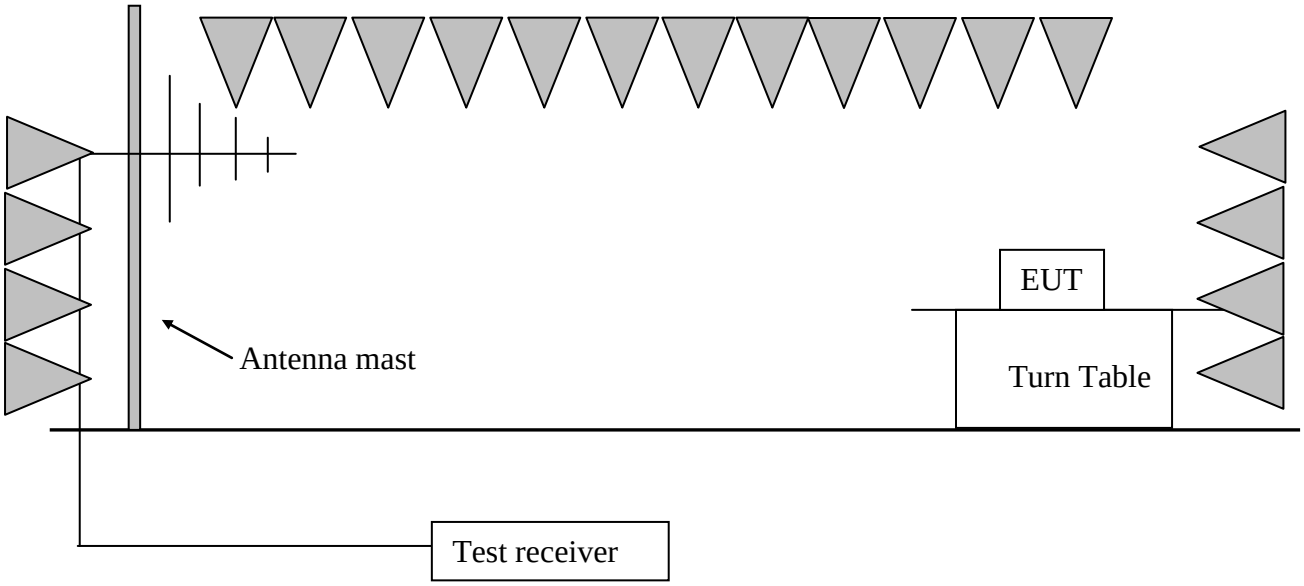
3.1.2 The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

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, the pre-amplifier and high pass filter is equipped just at the output terminal of the antenna.
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 1meter to 4 meters to find out the maximum emission level.
Both horizontal and vertical polarities of the receiving antenna were assessed and the higher reading was listed in this report.
The radiated emission was measured using the test receiver with the resolutions bandwidth set as:

RBW = 100kHz, VBW = 300kHz (30MHz~1GHz)
RBW = 1MHz, VBW = 3MHz (>1GHz for PK)

3.4 Test protocol

Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Emission Type	Limit (dBuV/m)	Margin	Detector
H	315.751503	15.8	55.90	Fundamental	95.60	39.70	PK
H	630.661323	21.6	43.10	Spurious	75.60	32.50	PK
H	788.116232	23.4	34.40	Restrict	75.50	41.10	PK
H	945.571142	24.5	48.20	Spurious	75.60	27.40	PK
H	1260.521042	-11.6	36.30	Spurious	75.60	39.30	PK
H	*1576.152305	-11.1	38.70	Restrict	74.00	35.30	PK
H	1891.783567	-9.1	43.70	Spurious	75.60	31.90	PK
H	*2207.414830	-8.0	43.00	Restrict	74.00	31.00	PK
H	2523.046092	-7.3	47.80	Spurious	75.60	27.80	PK
H	*2838.677355	-6.8	47.60	Restrict	74.00	26.40	PK
H	3469.939880	-4.6	43.30	Spurious	75.60	32.30	PK
V	315.751503	15.8	61.90	Fundamental	95.60	33.70	PK
V	630.661323	21.6	57.60	Spurious	75.60	18.00	PK
V	945.571142	24.5	47.40	Spurious	75.60	28.20	PK
V	*1100.200401	-12.0	40.80	Restrict	74.00	33.20	PK
V	1260.521042	-11.6	40.70	Spurious	75.60	34.90	PK
V	*1576.152305	-11.1	46.80	Restrict	74.00	27.20	PK
V	1891.783567	-9.1	48.50	Spurious	75.60	27.10	PK
V	*2207.414830	-8.0	48.20	Restrict	74.00	25.80	PK
V	2523.046092	-7.3	51.10	Spurious	75.60	24.50	PK
V	*2838.677355	-6.8	46.00	Restrict	74.00	28.00	PK
V	3469.939880	-4.6	46.90	Spurious	75.60	28.70	PK

Note : * means the frequency is located in restricted band defined in section 15.205

Remark: 1.Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz)
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit - Corrected Reading
4. If PK reading is less 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 = 10.00dBuV, limit = 40.00dBuV/m.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m; Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m; Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

Calculating the AV value according to the duty cycle

Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Duty Cycle Factor (dB)	Corrected AV Reading (dBuV/m)	Limit (dBuV/m)	Margin
H	315.751503	55.90	-10.28	45.62	75.60	29.98
H	630.661323	43.10	-10.28	32.82	55.60	22.78
H	788.116232	34.40	-10.28	24.12	55.60	31.48
H	945.571142	48.20	-10.28	37.92	55.60	17.68
H	1260.521042	36.30	-10.28	26.02	55.60	29.58
H	*1576.152305	38.70	-10.28	28.42	54.00	25.58
H	1891.783567	43.70	-10.28	33.42	55.60	22.18
H	*2207.414830	43.00	-10.28	32.72	54.00	21.28
H	2523.046092	47.80	-10.28	37.52	55.60	18.08
H	*2838.677355	47.60	-10.28	37.32	54.00	16.68
H	3469.939880	43.30	-10.28	33.02	55.60	22.58
V	315.751503	61.90	-10.28	51.62	75.60	23.98
V	630.661323	57.60	-10.28	47.32	55.60	8.28
V	945.571142	47.40	-10.28	37.12	55.60	18.48
V	*1100.200401	40.80	-10.28	30.52	54.00	23.48
V	1260.521042	40.70	-10.28	30.42	55.60	25.18
V	*1576.152305	46.80	-10.28	36.52	54.00	17.48
V	1891.783567	48.50	-10.28	38.22	55.60	17.38
V	*2207.414830	48.20	-10.28	37.92	54.00	16.08
V	2523.046092	51.10	-10.28	40.82	55.60	14.78
V	*2838.677355	46.00	-10.28	35.72	54.00	18.28
V	3469.939880	46.90	-10.28	36.62	55.60	18.98

Note : * means the frequency is located in restricted band defined in section 15.205

Note : '*' means the frequency is located in restricted band defined in section 15.205

Remark: 1.Duty Cycle Factor = 20lg (duty cycle) = 20lg (0.3061) = -10.28dB
2. Corrected AV Reading = Corrected PK Reading + Duty Cycle Factor
3. Margin = limit – Corrected AV Reading

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.

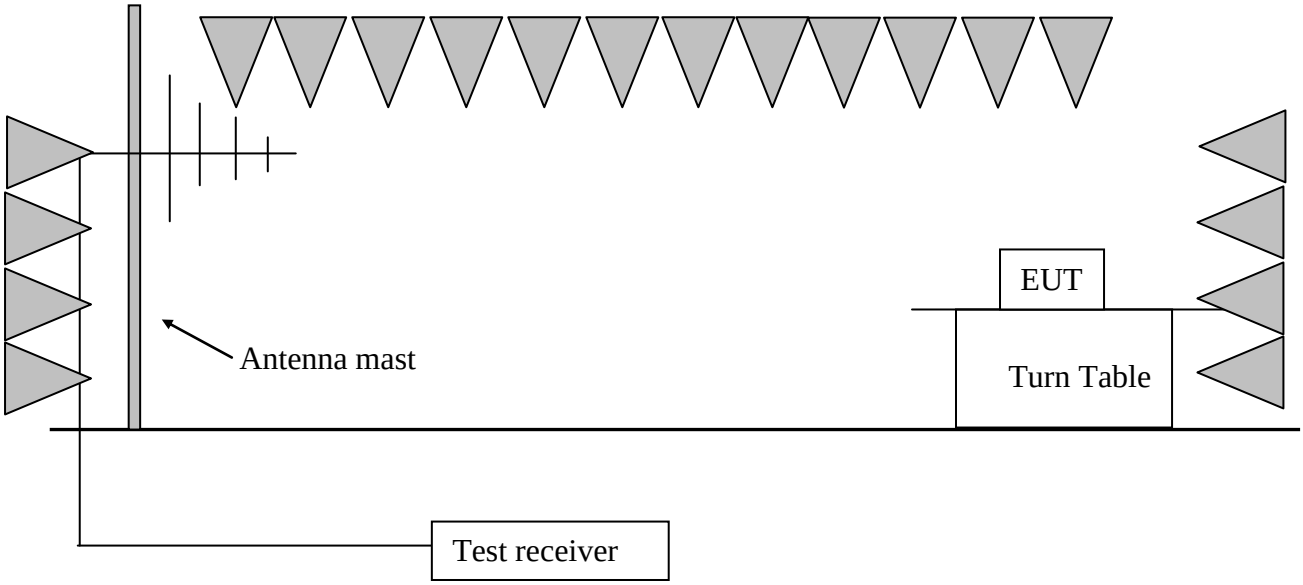
☐ (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

☐ (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: 180ms.
As a result, the EUT complies with the limit of 5s' deactivating time.

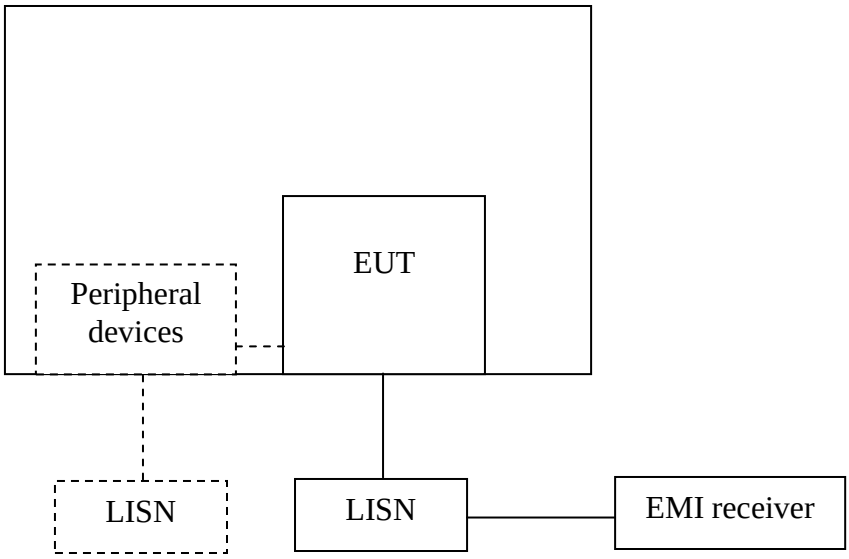
5. Power line conducted emission

Test result: **NA**

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 50Ω/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50Ω/50uH 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

Power line: L

Frequency	Correct Factor (dB)	Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB).
2. Margin (dB) = Limit - Corrected Reading.
3. If the margin higher than 20dB, it would be marked as *.

Power line: N

Frequency	Correct Factor (dB)	Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB).
2. Margin (dB) = Limit - Corrected Reading.
3. If the margin higher than 20dB, it would be marked as *.

6. Emission Bandwidth

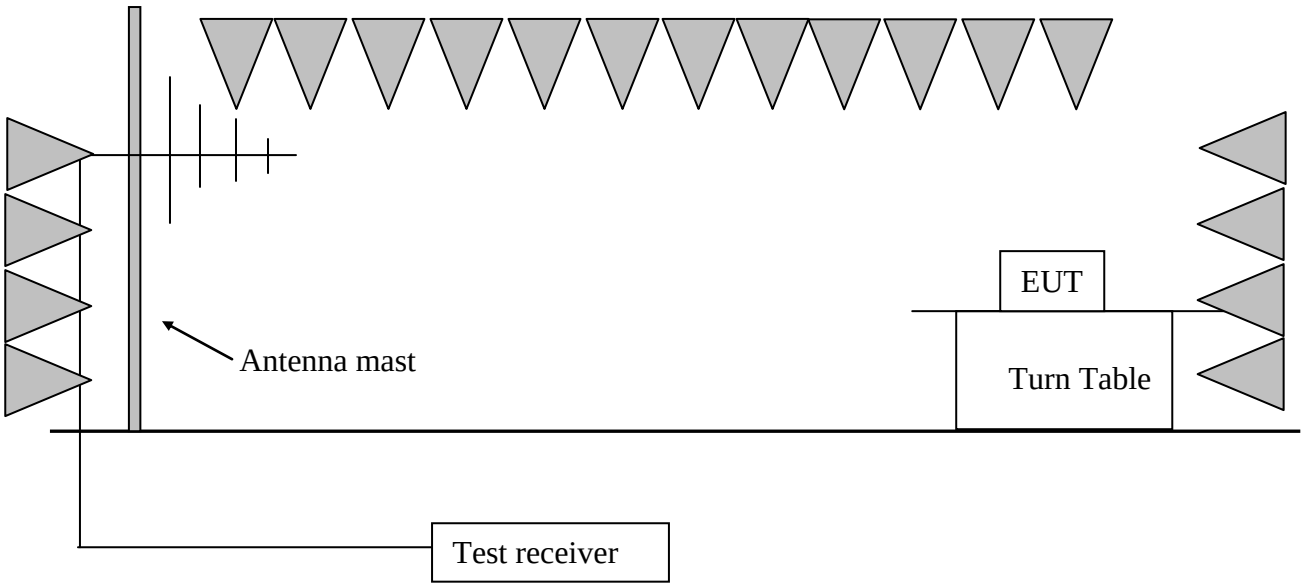
Test Status: Pass

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% * 315MHz = 787.5kHz

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 1meter 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 : 25 °C

Relative Humidity : 55 %

Channel	Emission Bandwidth (kHz)	Limit (kHz)
1	50.40	787.5