

EMC TEST REPORT

No. SH09110844-001

Applicant : Motolux (Shanghai) Pty. Ltd.
Unit2, 333 Lianying Road, Chedun Town, Songjiang,
Shanghai, 201611, China

Manufacturer : Motolux (Shanghai) Pty. Ltd.
Unit2, 333 Lianying Road, Chedun Town, Songjiang,
Shanghai, 201611, China

Equipment : Remote control transmitter

Type/Model : MRT02-01, MRT02-11

SUMMARY

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

47CFR Part 15 (2009): Radio Frequency Devices

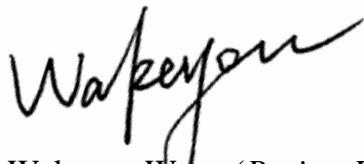
ANSI C63.4 (2003): American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

RSS-210 Issue 7 (June 2007): Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

RSS-Gen Issue 2 (June 2007): General Requirements and Information for the Certification of Radiocommunication Equipment

Date of issue: Sep 19, 2010

Prepared by:



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Content

SUMMARY	1
DESCRIPTION OF TEST FACILITY.....	2
1. GENERAL INFORMATION.....	4
1.1 Applicant Information	4
1.2 Identification of the EUT	4
1.3 Technical specification.....	5
1.4 Mode of operation during the test / Test peripherals used	5
2. TEST SPECIFICATION.....	6
2.1 Instrument list.....	6
2.2 Test Standard.....	6
3. FUNDAMENTAL & SPURIOUS EMISSION & RESTRICT BAND RADIATED EMISSION.....	8
3.1 Test limit.....	8
3.2 Test Configuration	9
3.3 Test procedure and test setup	9
3.4 Test protocol.....	10
4. DEACTIVATING TIME	11
4.1 Test limit.....	11
4.2 Test Configuration	12
4.3 Test procedure and test setup	12
4.4 Test protocol.....	12
5. POWER LINE CONDUCTED EMISSION	13
5.1 Limit	13
5.2 Test configuration	13
5.3 Test procedure and test set up	14
5.4 Test protocol.....	15
6. EMISSION BANDWIDTH.....	16
6.1 Test limit.....	16
6.2 Test Configuration	16
6.3 Test procedure and test setup	16
6.4 Test protocol.....	17
7. OCCUPIED BANDWIDTH.....	18
7.1 Test limit.....	18
7.2 Test Configuration	18
7.3 Test procedure and test setup	18
7.4 Test protocol.....	19

1. General Information

1.1 Applicant Information

Applicant: Motolux (Shanghai) Pty. Ltd.
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Sample received date : Dec 3, 2009
Sample Identification No : *0091203-08-001*
Date of test : Dec 3, 2009 ~ Sep 1, 2010

1.2 Identification of the EUT

Equipment: Remote control transmitter
Type/model: MRT02-01, MRT02-11
FCC ID: YPB-MRT002
IC: Not applied

1.3 Technical specification

Operation Frequency Band:	433.92MHz
Modulation:	ASK
Antenna Designation:	PCB antenna, non-user removable.
Gain of Antenna:	1.2dBd
Rating:	Built-in Battery: DC 12V Working frequency: 433.92MHz
Description of EUT:	There are two models. They are electrically identical except for different model names. Therefore, one of them was chosen in random to perform test as representative. The EUT is a transmitter to transmit wireless signal so as to control the working condition of a motor. There are five keys on the front of the EUT corresponding to “up”, “down”, “left”, “right” and “stop” function. All of them were assessed and the worst data is listed in the report.
Channel Description:	There are 11 channels designed among the EUT. Nevertheless, all the 11 channels are working at the central frequency of 433.92MHz and the only difference of them is the coding method. Therefore, all the channels were assessed and the one with maximum duty cycle was chosen to perform all tests.

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 portable device, so three axes were observed while the test receiver worked as “max hold” continuously and the highest reading among the whole test procedure was recorded.

2. Test Specification

2.1 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESIB 26	R&S	EC 3045	2010-6-1	2011-5-31
Semi-anechoic chamber	-	Albatross project	EC 3048	2010-6-1	2011-5-31
A.M.N.	ESH2-Z5	R&S	EC 3119	2010-1-23	2011-1-22
A.M.N.	ENV 216	R&S	EC 3394	2009-10-19	2010-10-18
Test Receiver	ESCS 30	R&S	EC 2107	2010-1-23	2011-1-22
Ultra-broadband Antenna	CBL 6112D	TESEQ	EC 4206	2010-5-30	2011-6-1
Horn Antenna	HF 906	R&S	EC 3049	2010-6-30	2011-6-29
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2010-6-30	2011-6-29
Power meter	PM2002	AR	EC3043-7	2010-1-23	2011-1-22
Power sensor	PH2000	AR	EC3043-8	2010-1-23	2011-1-22
Signal generator	SMR 20	R&S	EC 3044-1	2009-8-21	2010-8-20
Spectrum Analyzer	E7402A	Agilent	EC2254	2009-9-17	2010-9-16
High Pass Filter	WHKX 1.0/15G-10SS	Wainwright	EC4297-1	2010-2-8	2011-2-7
High Pass Filter	WHKX 2.8/18G-12SS	Wainwright	EC4297-2	2010-2-8	2011-2-7
High Pass Filter	WHKX 7.0/1.8G-8SS	Wainwright	EC4297-3	2010-2-8	2011-2-7
Band Reject Filter	WRCGV 2400/2483-2390/2493-35/10SS	Wainwright	EC4297-4	2010-2-8	2011-2-7

2.2 Test Standard

47CFR Part 15 (2009)
ANSI C63.4: 2003
RSS-210 Issue 7 (June 2007)
RSS-Gen Issue 2 (June 2007)

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	IC REFERANCE	RESULT
Fundamental & spurious emission	15.231(b)	RSS-210 Issue 7 Annex A1.1.2	Pass
Restrict band radiated emission	15.205	RSS-210 Issue 7 Clause 2	Pass
Power line conducted emission	15.207	RSS-Gen Issue 2 Clause 7.2.2	NA
Emission bandwidth	15.231(c)	RSS-Gen Issue 2 Annex A1.1.3	Pass
Deactivating time	15.231(a)(1)	RSS-210 Issue 7 Annex A1.1.1	Pass
Occupied bandwidth	-	RSS-Gen Issue 2 Clause 4.6.1	Tested

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 = $56.81818(\text{Frequency}) - 6136.3636$; for the band 260-470 MHz, uV/m at 3 meters = $41.6667(\text{Frequency}) - 7083.3333$. 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:

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

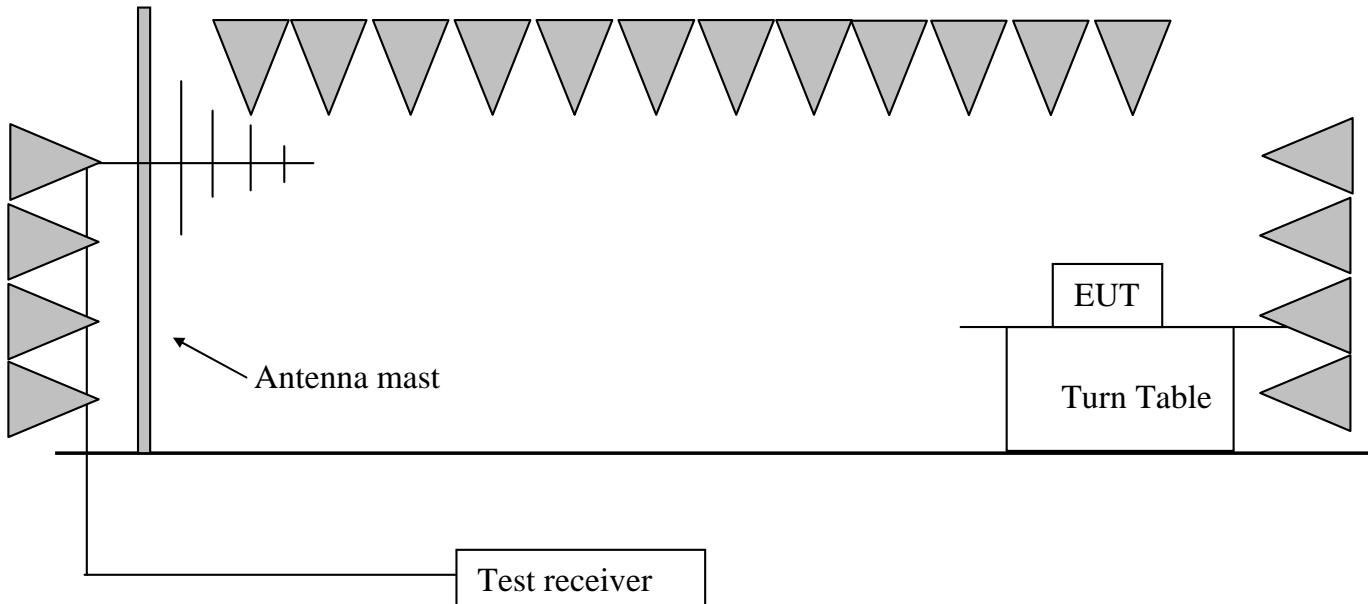
$$\text{Spurious limit} = 81 - 20 = 61 \text{ dBuV/m}$$

//////////

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, 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.

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	433.92	18.00	86.30	Fundamental	101.00	14.70	PK
H	867.82	23.10	66.30	Harmonics	81.00	14.70	PK
H	1296.59	-9.60	47.10	Harmonics	61.00 (AV limit)	13.90	PK
V	1737.47	-7.40	47.30	Harmonics	61.00 (AV limit)	13.70	PK
H	400.43	17.70	33.10	Restrict	46.00	12.90	PK
H	406.65	17.70	33.30	Restrict	46.00	12.70	PK
H	408.74	17.70	33.70	Restrict	46.00	12.30	PK

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 = $30.20 + 2.00 - 32.00 = 0.20$ dB/m; Corrected Reading = $10\text{dBuV} + 0.20\text{dB/m} = 10.20\text{dBuV/m}$; Margin = $40.00\text{dBuV/m} - 10.20\text{dBuV/m} = 29.80\text{dB}$.

Calculating the AV value according to the duty cycle

Antenna	Frequency (MHz)	PK Reading (dBuV/m)	Correct Factor (dB)	AV Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	433.92	86.30	-13.00	73.30	81.00	7.70
H	867.82	66.30	-13.00	53.30	61.00	7.70

Remark: 1. Correct Factor = $20\lg(\text{duty cycle}) = 20\lg(0.225) = -13.00$

2. AV Reading = PK Reading + Correct Factor

3. Margin = limit - AV Reading

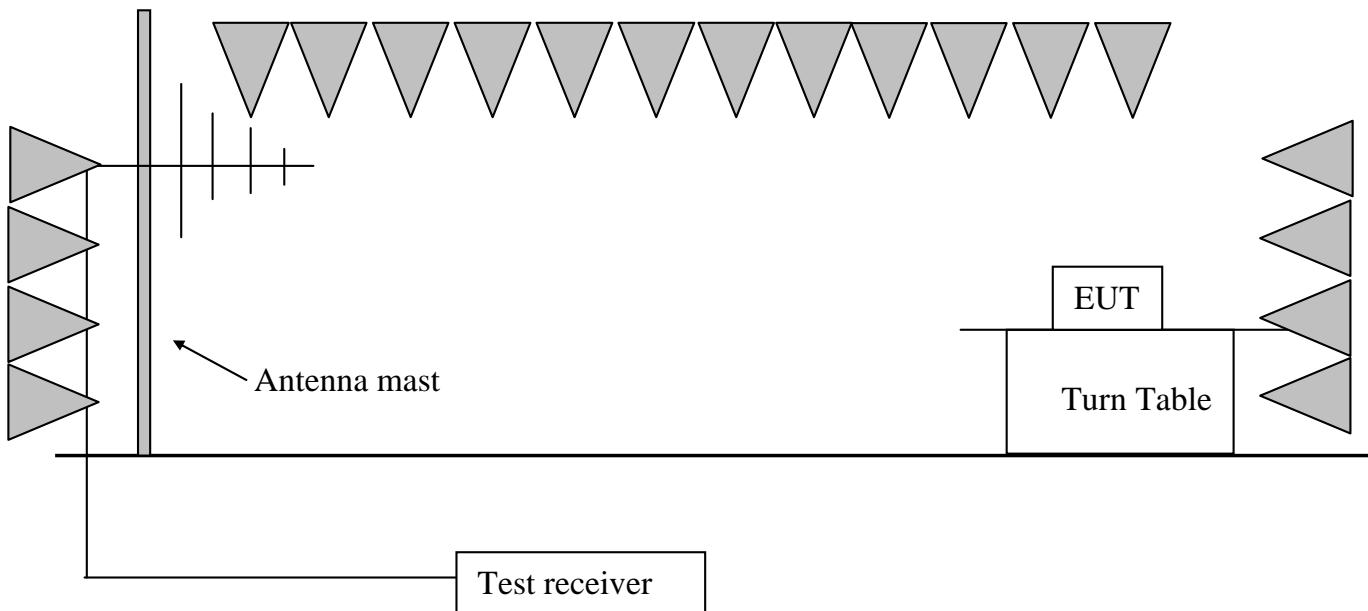
4. Deactivating time

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: 339ms.

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

5. Power line conducted emission

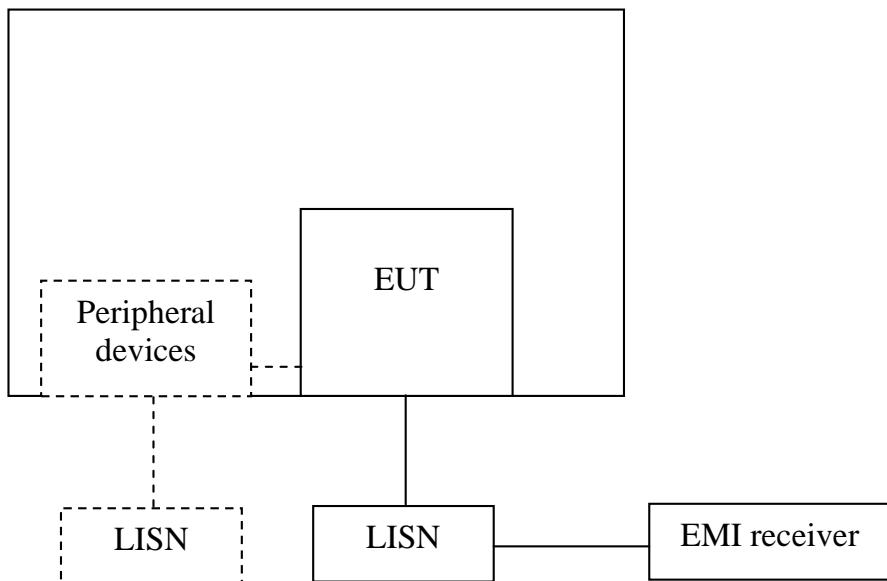
Test result: NA

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 $50\Omega/50\mu\text{H}$ 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

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

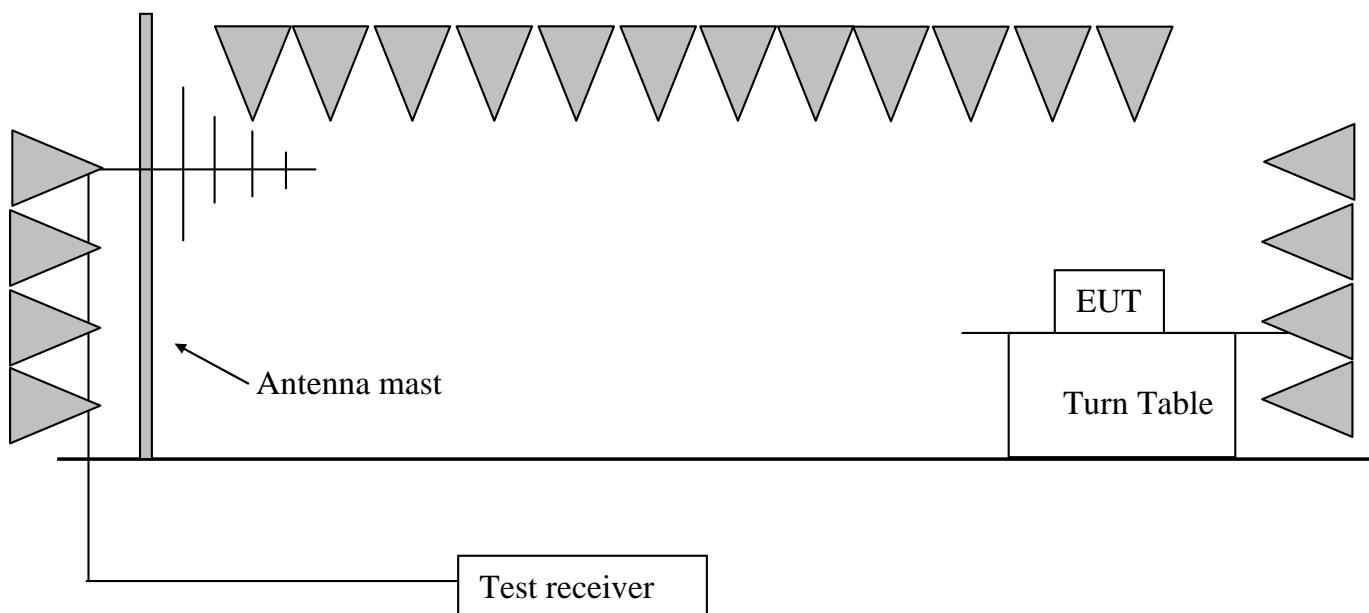
Test Status: Pass

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 = $0.25\% * 433.92\text{MHz} = 1085\text{kHz}$

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 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 : 22 °C
Relative Humidity : 43 %

Channel	Emission Bandwidth (kHz)	Limit (kHz)
1	56	1085

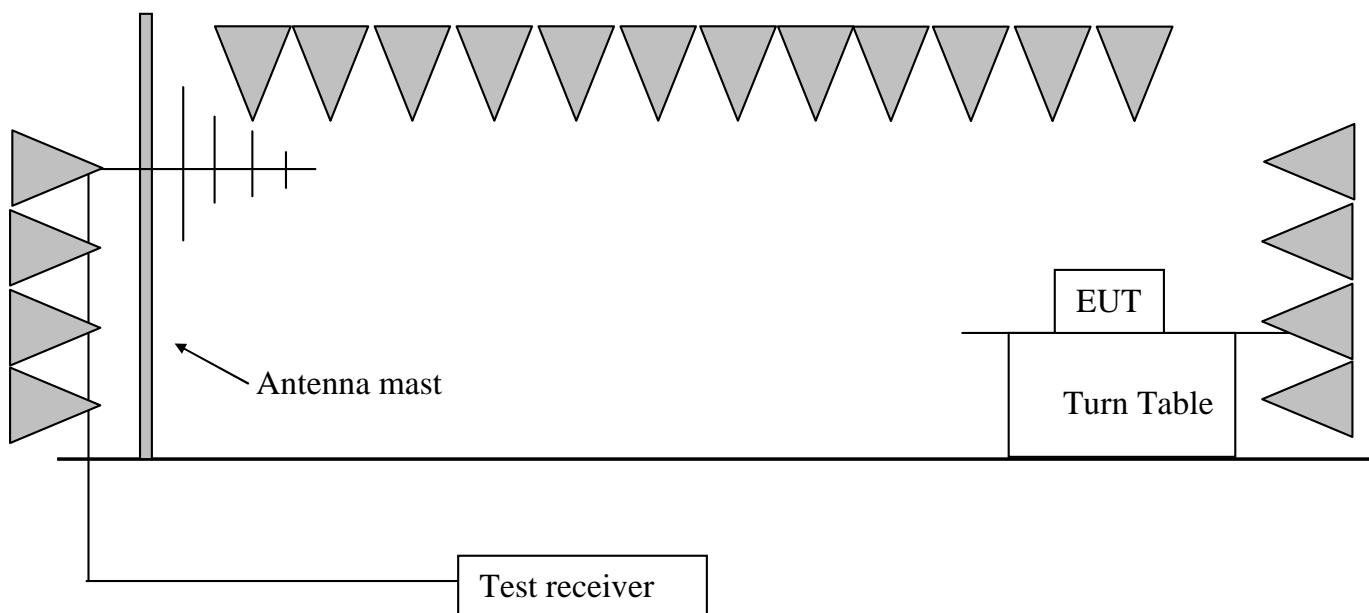
7. Occupied Bandwidth

Test Status: Tested

7.1 Test limit

None

7.2 Test Configuration



7.3 Test procedure and test setup

The occupied bandwidth per RSS-Gen Issue 2 Clause 4.6.1 was measured using the Spectrum Analyzer with the resolutions bandwidth set at 10kHz, the video bandwidth set at 30kHz.

7.4 Test protocol

Temperature : 22 °C

Relative Humidity : 43 %

Channel	Occupied Bandwidth (kHz)	Max. Value (kHz)
1	113.63	113.63

Remark: “Max. Value” is the maximum test result of all the measured occupied bandwidth.