EMC TEST REPORT
No. SH08030701-001

Applicant	:	Shanghai Nine Eagles Electronic Technology Co., Ltd. Room 1104, Huaxiang Building, No. 80 Moling Road, Shanghai, 200070, China
Manufacturer	:	Shanghai Nine Eagles Electronic Technology Co., Ltd. No. 28 Yulu road, Malu, Jiading District, Shanghai, China
Equipment	:	Radio Control Helicopter
Type/Model	:	NE-024G

SUMMARY

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

47CFR Part 15 (2007): Radio Frequency Devices

ANSIC63.4 (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: May 22, 2008

Tested by:

Wakeyou Wang (*Project Engineer*)

Reviewed by:

Daniel Zhao (*Reviewer*)

Description of Test Facility

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Content

1. General Information

1.1 Applicant Information

Applicant:		Shanghai Nine Eagles Electronic Technology Co., Ltd. Room 1104, Huaxiang Building, No. 80 Moling Road, Shanghai, 200070, China
Name of contact:		Mr. Huang Guochuan
Tel: Fax:		86 21 69152688 86 21 69152687
Manufacturer:		Shanghai Nine Eagles Electronic Technology Co., Ltd. No. 28 Yulu road, Malu, Jiading District, Shanghai, China
Sample received date	:	March 21, 2008
Date of test	:	March 21, 2008 ~ May 21, 2008

1.2 Identification of the EUT

Equipment:	Radio Control Helicopter
Type/model:	NE-024G
FCC ID:	U45-2400008001
IC:	Not applied

1.3 Technical specification

Operation Frequency Band:	2400-2483.5MHz
Modulation:	BPSK
Antenna Designation:	Internal antenna, non-user removable. Although there is a component with antenna- like shape at the top of EUT, it is an adorning in fact and independent of electrical parts.
Gain of Antenna:	1.20dBi max.
Rating:	Built-in Battery: DC 4*1.5V Working frequency: 2410MHz
Description of EUT:	There is one model only. The EUT is a transmitter to transmit wireless signal so as to control the flight of Helicopter. There are two joy sticks on the panel: one control forward & back; the other control left & right.
Channel Description:	There is one channel only and working at the central frequency of 2410MHz.

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 two joy sticks were operated in turn and the worst test result was recorded.
While for radiated test, as a portable device, 3 orthogonal axes of the EUT were observed and the worst data were recorded.

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2. Test Specification

2.1 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESIB 26	R&S	EC 3045	2007-6-1	2008-5-31
Semi-anechoic chamber	-	Albatross project	EC 3048	2007-6-1	2008-5-31
A.M.N.	ESH2-Z5	R&S	EC 3119	2008-1-23	2009-1-22
Test Receiver	ESCS 30	R&S	EC 2107	2008-1-23	2009-1-22
Ultra-broadband antenna	HL 562	R&S	EC 3046-1	2007-6-30	2008-6-29
Horn antenna	HF 906	R&S	EC 3049	2007-6-30	2008-6-29
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2007-6-30	2008-6-29
Pre-amplifier	Pre-amp 40	Beijing Radio 2	-	2008-3-4	2009-3-3
Horn antenna	K638A	Beijing Radio 2	-	2008-3-4	2009-3-3
Power meter	PM2002	AR	EC3043-7	2008-1-23	2009-1-22
Power sensor	PH2000	AR	EC3043-8	2008-1-23	2009-1-22
Signal generator	SMR 20	R&S	EC 3044-1	2007-8-21	2008-8-20
Spectrum Analyzer	E7402A	Agilent	EC2254	2007-9-17	2008-9-16

2.2 Test Standard

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

2.3 Radiated test description

Test site: Semi-anechoic chamber

Test distance: 3m

Antenna: Ultra-broadband antenna (30MHz ~ 1GHz);
Horn antenna (1GHz ~ 18GHz & 18Gz ~ 40GHz)

Typical Gain of Preamplifiers: 30dB (for 1GHz ~ 18GHz); 37dB (for 18Gz ~ 40GHz)

Test Receiver set: RBW = 100kHz, VBW = 300kHz, internal amplifier: ON; (30MHz~1GHz)
RBW = 1MHz, VBW = 3MHz, internal amplifier: OFF; (>1GHz for PK);
RBW = 1MHz, VBW = 10Hz, internal amplifier: OFF; (>1GHz for AV);

Floor noise reading of the radiated test system (consisting of test site, antenna, preamplifier and receiver):

1GHz ~ 18GHz

Antenna	Frequency (MHz)	Uncorrected Reading (dBuV)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Detector
H	1000	33.80	-0.60	33.20	PK
H	8650	34.30	5.10	39.40	PK
H	15000	34.80	5.50	40.30	PK
V	1000	33.80	-0.60	33.20	PK
V	8650	34.20	5.10	39.30	PK
V	15000	34.70	5.50	40.20	PK
H	1000	17.10	-0.60	16.50	AV
H	8650	17.30	5.10	22.40	AV
H	15000	18.80	5.50	24.30	AV
V	1000	17.00	-0.60	16.40	AV
V	8650	17.10	5.10	22.20	AV
V	15000	18.60	5.50	24.10	AV

Remark: 1.Correct Factor = Antenna Factor + Cable Loss - Gain of Preamplifier.
Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB, Gain of Preamplifier = 32.00dB, then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m

2. Corrected Reading = Uncorrected Reading + Correct Factor
Example: Assuming Uncorrected Reading = 35.00dBuV, Correct Factor = 0.20dB/m, then Corrected Reading =35.00+0.20 = 35.20dBuV/m

18GHz ~ 25GHz

Antenna	Frequency (MHz)	Uncorrected Reading (dBuV)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Detector
H	18000	35.30	5.70	41.00	PK
H	20000	36.20	5.10	41.30	PK
H	25000	37.20	6.60	43.80	PK
V	18000	35.20	5.70	40.90	PK
V	20000	36.20	5.10	41.30	PK
V	25000	37.20	6.60	43.80	PK
H	18000	18.50	5.70	24.20	AV
H	20000	20.20	5.10	25.30	AV
H	25000	20.80	6.60	27.40	AV
V	18000	18.50	5.70	24.20	AV
V	20000	20.20	5.10	25.30	AV
V	25000	20.80	6.60	27.40	AV

Remark: 1.Correct Factor = Antenna Factor + Cable Loss - Gain of Preamplifier.
Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB, Gain of Preamplifier = 32.00dB, then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m

2. Corrected Reading = Uncorrected Reading + Correct Factor
Example: Assuming Uncorrected Reading = 35.00dBuV, Correct Factor = 0.20dB/m, then Corrected Reading =35.00+0.20 = 35.20dBuV/m

2.4 Test Summary

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TEST ITEM	FCC REFERANCE	IC REFERANCE	RESULT
Fundamental & Harmonic emission	15.249(a)	RSS-210 Issue 7 Annex A2.9(a)	Pass
Spurious emission other than harmonics	15.249(d)	RSS-210 Issue 7 Annex A2.9(b)	Pass
Restrict band & adjacent band radiated emission	15.205 & 15.249(d)	RSS-210 Issue 7 Clause 2 & RSS-210 Issue 7 Annex A2.9(b)	Pass
Assigned bandwidth (20dB bandwidth)	15.215(c)	-	Pass
Power line conducted emission	15.207	RSS-Gen Issue 2 Clause 7.2.2	NA
Occupied bandwidth	-	RSS-Gen Issue 2 Clause 4.6.1	NA
Spurious emission for receiver	-	RSS-210 Issue 7 Clause 2.3	NA

3. Fundamental & Harmonic Emission

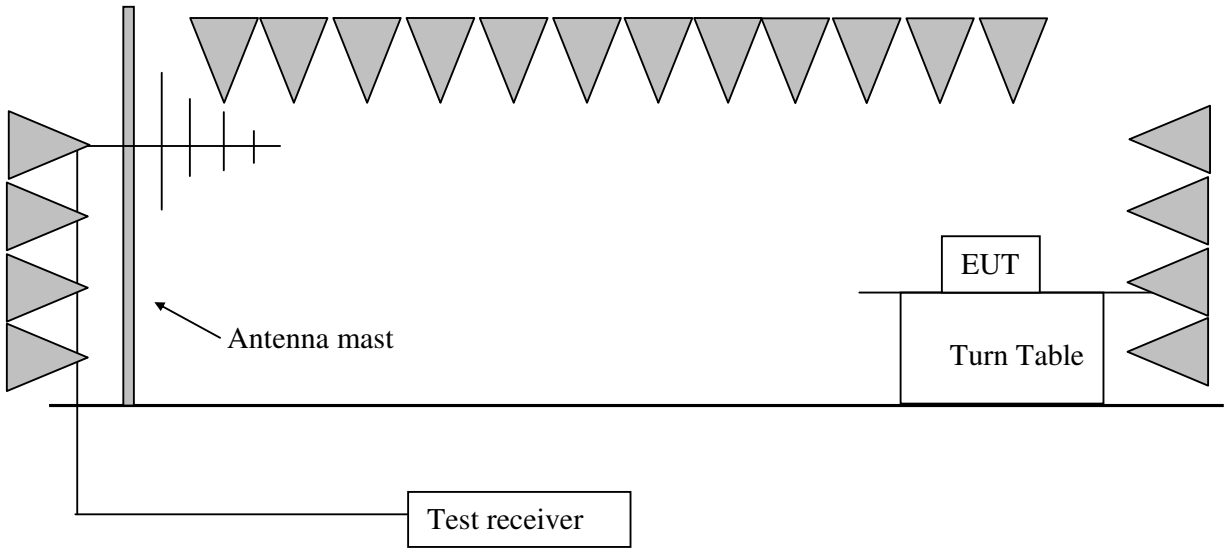
Test result: **PASS**

3.1 Test limit

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 (dBuV/m)	Harmonic limit (dBuV/m)
☐902 - 928	94	54
☒2400 - 2483.5	94	54
☐5725 - 5875	94	54
☐24000 - 24250	108	68

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 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.

3.4 Test protocol

Channel	Antenna	Frequency (MHz)	Uncorrected Reading (dBuV)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Detector
1	H	2410.12	81.22	2.20	83.42	114.00	PK
1	H	4820.35	51.03	4.80	55.83	74.00	PK
1	V	2410.12	81.97	2.20	84.17	114.00	PK
1	V	4820.35	51.19	4.80	55.99	74.00	PK
1	H	2410.10	27.76	2.20	29.96	94.00	AV
1	H	4820.35	*	4.80	*	54.00	AV
1	V	2410.10	28.34	2.20	30.54	94.00	AV
1	V	4820.35	*	4.80	*	54.00	AV

Remark: 1.Correct Factor = Antenna Factor + Cable Loss - Gain of Preamplifier
2. Uncorrected Reading is the original data which can be referred from “test data”.
3. Corrected Reading = Uncorrected Reading + Correct Factor
4. The shaded data is the fundamental reading.
5. If the reading is submerged in the floor noise, it would be marked as *.

3.5 Measurement uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.
Measurement uncertainty of radiated emission is: ± 5.31dB
The measurement uncertainty is given with a confidence of 95%, k=2.
The measurement uncertainty is traceable to internal procedure TI-036.

4. Spurious Emission Other than Harmonics

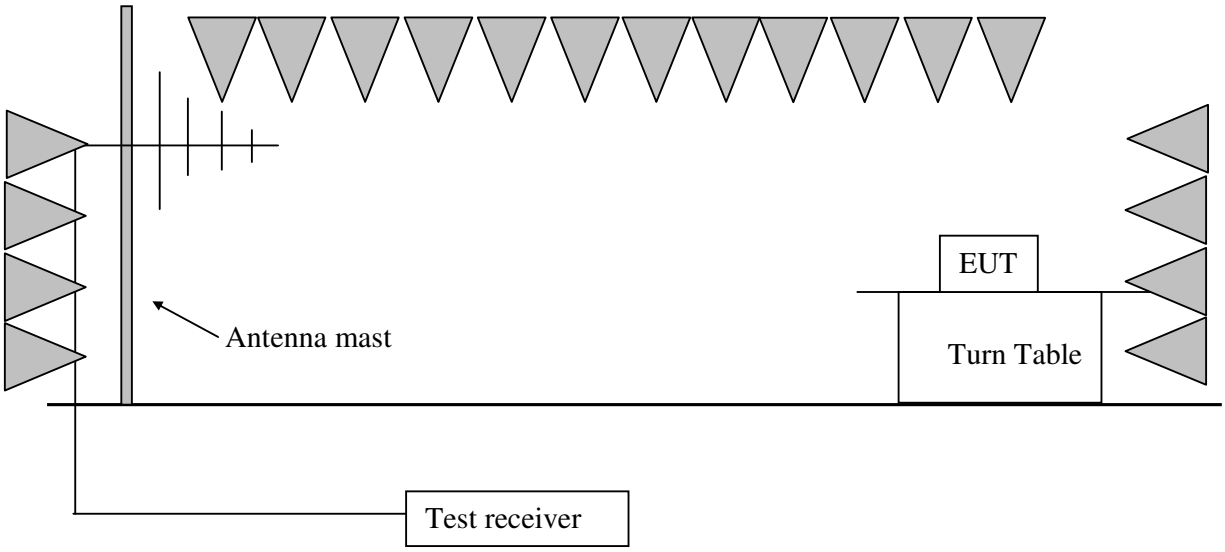
Test result: **PASS**

4.1 Test limit

The spurious emission shall test through the 10th harmonic or to 40GHz, whichever is lower. It must comply with the less stringent limits listed below:
☐50 dB below the level of the fundamental;
☒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

4.2 Test Configuration



4.3 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 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.

4.4 Test protocol

Spurious emission for test below 1GHz, highest reading related to the limit

Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	148.58	*	*	*	*	QP
H	296.31	*	*	*	*	QP
H	372.12	*	*	*	*	QP
H	519.86	*	*	*	*	QP
H	593.73	*	*	*	*	QP
H	891.14	*	*	*	*	QP
V	41.66	*	*	*	*	QP
V	74.71	*	*	*	*	QP
V	148.58	*	*	*	*	QP
V	372.12	*	*	*	*	QP
V	519.86	*	*	*	*	QP
V	675.37	*	*	*	*	QP

Remark: 1.Correct Factor = Antenna Factor + Cable Loss
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit - Corrected Reading
4. If the reading is submerged in the floor noise, it would be marked as *.
5. For more details, please refer to the test data.

Spurious emissions above 1GHz other than harmonics: all is submerged in the floor noise.

4.5 Measurement uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.
Measurement uncertainty of radiated emission is: ± 5.31dB
The measurement uncertainty is given with a confidence of 95%, k=2.
The measurement uncertainty is traceable to internal procedure TI-036.

5. Restrict band & adjacent band radiated emission

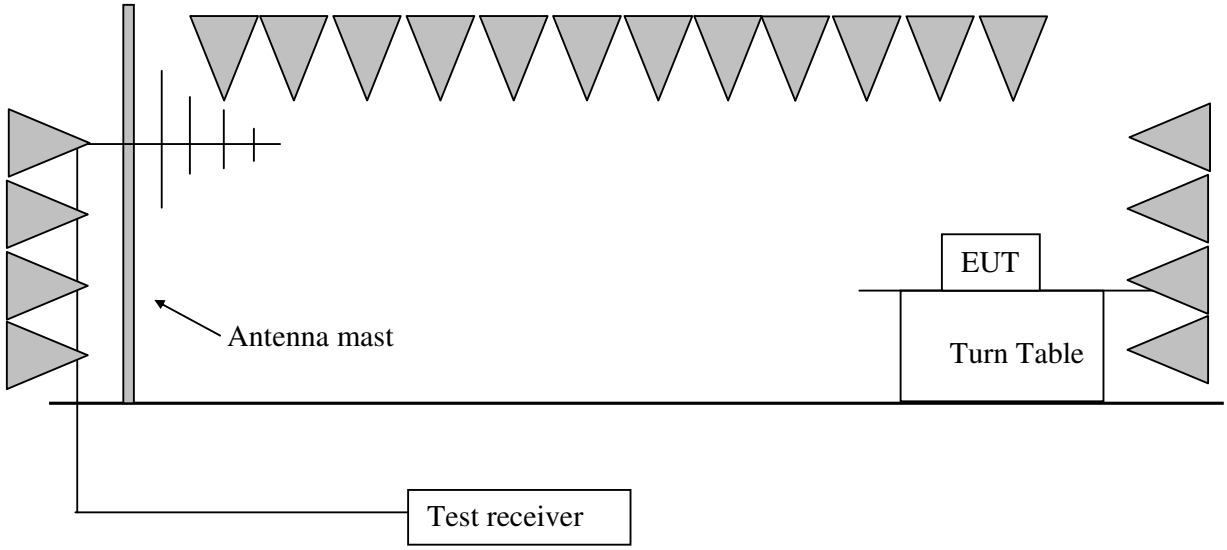
Test result: PASS

5.1 Test limit

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

5.2 Test Configuration



5.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for restrict band emission higher than 1GHz, the pre-amplifier 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.

5.4 Test protocol

Highest reading on restrict band 2310MHz ~ 2390MHz

Detector	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)
PK	2310 ~ 2390	2.20	<44.30	74
AV	2310 ~ 2390	2.20	Not performed	54

Note: Because the PK reading is less than the AV limit, AV test is elided.

Highest reading on restrict band 2483.5MHz ~ 2500MHz

Detector	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)
PK	2483.5~ 2500	2.20	<43.28	74
AV	2483.5~ 2500	2.20	Not performed	54

Note: Because the PK reading is less than the AV limit, AV test is elided.

Highest reading on adjacent band 2390MHz ~ 2400MHz

Detector	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)
PK	2399.83	2.20	52.21	74
AV	2399.83	2.20	Not performed	54

Note: Because the PK reading is less than the AV limit, AV test is elided.

5.5 Measurement uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.
Measurement uncertainty of radiated emission is: ± 5.31dB
The measurement uncertainty is given with a confidence of 95%, k=2.
The measurement uncertainty is traceable to internal procedure TI-036.

6. Assigned bandwidth (20dB bandwidth)

Test result: **Pass**

6.1 Test Limit

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emission is contained within the allocated frequency band as clause 3.1 shows.

6.2 Test configuration

See clause 3.2.

6.3 Test protocol

20dB bandwidth (MHz)	Allocated frequency band (MHz)
2406.98 ~ 2413.24	2400 ~ 2483.5

Conclusion: The 20dB bandwidth is completely contained within the limit.

6.4 Measurement Uncertainty

The measurement uncertainty is ±100Hz.

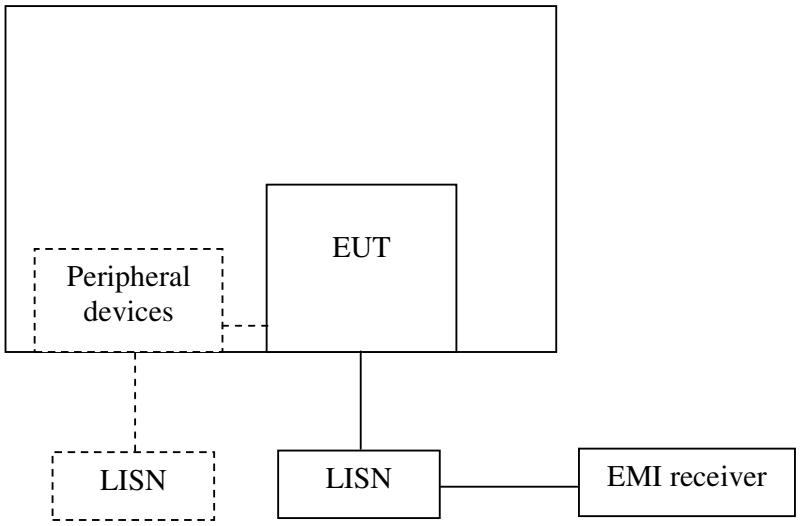
7. Power line conducted emission

Test result: **NA**

7.1 Test 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.		

7.2 Test configuration



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

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

7.3 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.

7.4 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 *.

7.5 Measurement Uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.
Measurement uncertainty at mains terminal: ± 1.99dB
The measurement uncertainty is given with a confidence of 95%, k=2.
The measurement uncertainty is traceable to internal procedure TI-036.

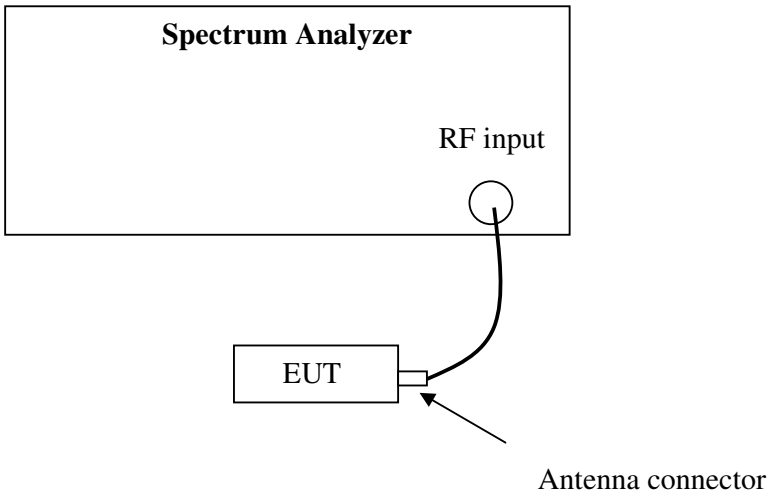
8. Occupied Bandwidth

Test Status: NA

8.1 Test limit

None

8.2 Test Configuration



8.3 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 1MHz, the video bandwidth set at 3MHz. The test was performed at 3 channels (lowest, middle and highest channel).

8.4 Test protocol

Temperature : °C

Relative Humidity : %

Channel	Occupied Bandwidth (MHz)	Max. Value (MHz)
1	-	-
2	-	
3	-	

Remark: "Max. Value" is the maximum test result of the three measured occupied bandwidth.

8.5 Measurement uncertainty

The measurement uncertainty is ±100Hz.

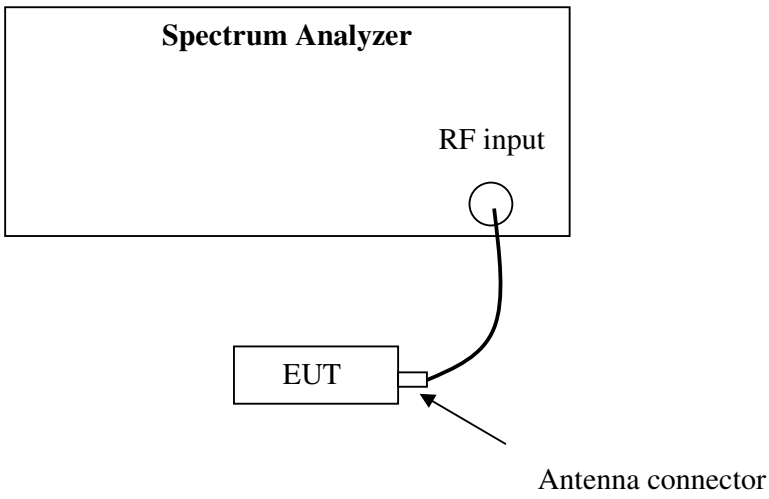
9. Spurious emission for receiver

Test result: **NA**

9.1 Test limit

The spurious emission shall test through 3 times tuneable or local oscillator frequency whichever is the higher, without exceeding 40 GHz. If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2nW per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5nW above 1 GHz.

9.2 Test Configuration



9.3 Test procedure and test setup

The receiver spurious emission per RSS-210 Issue 7 Clause 2.3 is measured using the Spectrum Analyzer with the resolution bandwidth / video bandwidth set at 5kHz for 30MHz ~ 1GHz and with the resolution bandwidth / video bandwidth set at 1MHz for higher than 1GHz.

9.4 Test protocol

Highest reading related to the limit

Detector	Frequency (MHz)	Correct Factor (dB)	Corrected Receiver Reading (dBm)	Limit (dBm)
PK	≤1GHz	-	-	-
PK	>1GHz	-	-	-

Note: For frequency higher than 1GHz, the PK detector is employed while the limit is AV limit.

9.5 Measurement uncertainty

The measurement uncertainty is ±1dB.