



RF TEST REPORT

Test Report No. : TK-FR11027
Standards : Part 15 Subpart B&C 15.249
FCC ID : ZBTRYDISR750
Description of Product : Rotot Cleaner
Applicant : Moneual Inc.
Manufacturer : Moneual Inc.
Model Name : RYDIS R750
Date of test(s) : 2011.03.28 ~ 2011.03.30
Date of issue : 2011.05.23

The test results relate only to the items tested.

Test and Report Completed by :	Report Approval by :
	
Jeff Do Test Engineer	Gyu-cheol Shin Technical Manager

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Revision history

Revision	Date of issue	Test report No.	Description
-			Initial

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1.0 General product description

Equipment model name : RYDIS R750
Serial number : Prototype
EUT condition : Pre-production, not damaged
Antenna type & gain : PCB antenna / Gain -2.43 dBi
Frequency Range : 2403 ~ 2479 MHz
Number of channels : 11
Type of Modulation : GFSK
Power Source : DC 12.80 V

1.1 Test frequency

	Low channel	Middle channel	High channel
Frequency (MHz)	2403	2441	2479

1.2 Model differences

Not applicable

1.3 Device modifications

The following modifications were necessary for compliance: Not applicable manufacturer

1.4 Peripheral devices




Device	Manufacturer	Model No.	Serial No.
N/A			

1.5 Test facility

The measurement facility is located at 477-6, Hageo-ri, Yeoju-eup, Yeoju-gun, Gyeonggi-do, 469-803, Korea. Tel: +82-31-883-5092/Fax: +82-31-883-5169.

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.6 Laboratory accreditations and listings

Country	Agency	Scope of accreditation	Logo
USA	FCC	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	 343818
KOREA	KCC	EMI (10 meter Open Area Test Site and two conducted sites) Radio (3 & 10 meter Open Area Test Sites and one conducted site)	 KR100
Canada	IC	3 & 10 meter Open Area Test Sites and one conducted site	 4769B-1

2.0 Summary of tests

Section in FCC Part 15	Parameter	Status
15.209(a) 15.249(a) 15.249(d) 15.205	Fundamental, spurious emission and band edge radiated emission	C
15.207	AC conducted emission	C
Note 1: C=Complies NC=Not complies NT=Not tested NA=Not applicable		
Note 2: The data in this test report are traceable to the national or international standards.		
Note 3: The sample was tested according to the following specification: FCC Part 15.249, ANSI C63.4-2003		

2.1 Technical characteristic test

2.1.1 Fundamental, spurious emission and band edge radiated emission

Test location

Testing was performed at a test distance of 3 meter Open Area Test Site

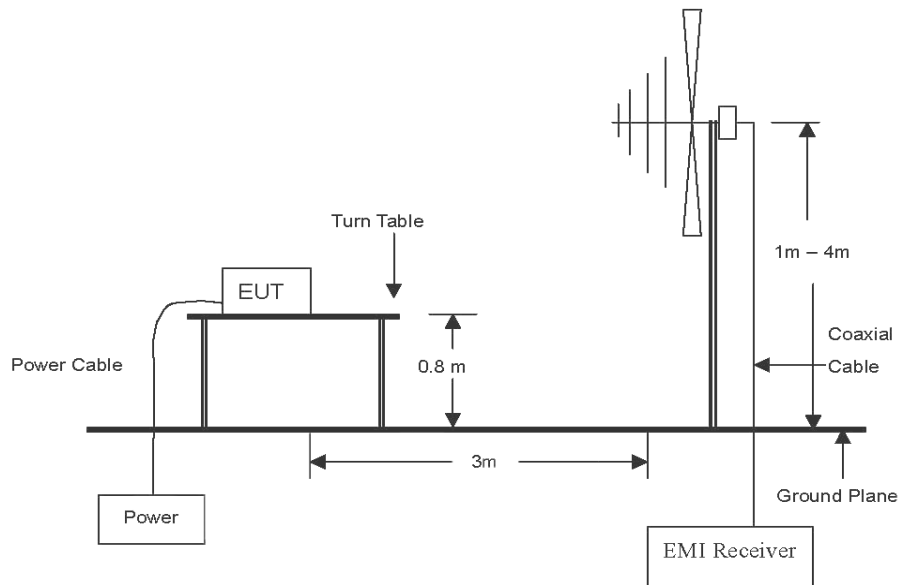
Test procedures

The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity. The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

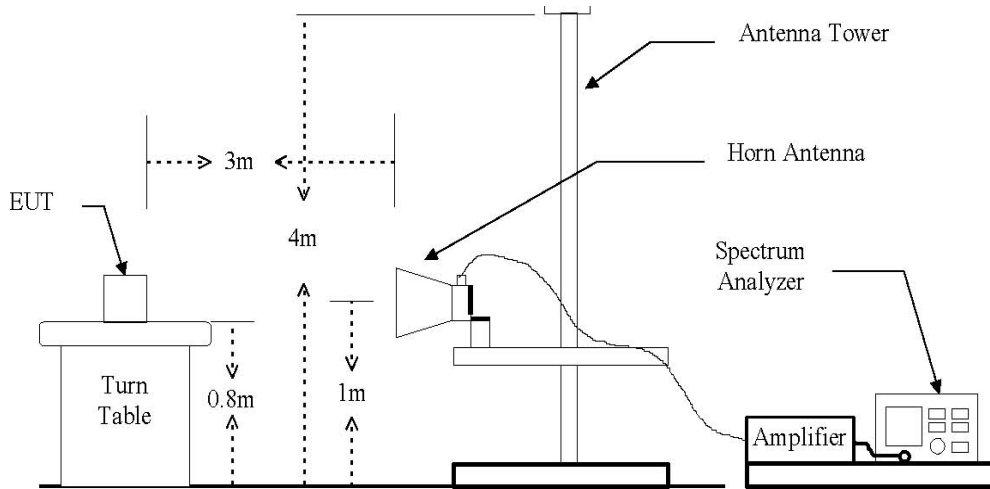
The spectrum analyzer is set to:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 120 kHz for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1 GHz.

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 24 GHz emissions.



Limit

In the section 15.249(a) :

Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (mV/m)	Field strength of harmonics (μV/m)
902 ~ 928 MHz	50	500
2 400 ~ 2 483.5 MHz	50	500
5 725 ~ 5 875 MHz	50	500
24.0 ~ 24.25 GHz	250	2500

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Fundamental frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
30 ~ 88	100*	3
88 ~ 216	150*	3
216 ~ 960	200*	3
Above 960	500	3

※ Remark

Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 - 72 MHz, 76 - 88 MHz, 174 - 216 MHz or 470 - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

In the above emission table, the tighter limit applies at the band edges.

Fundamental frequency (MHz)	Field strength ($\mu\text{V}/\text{m}$ at 3 meter)	Field strength (dB$\mu\text{V}/\text{m}$ at 3 meter)
30 ~ 88	100	40
88 ~ 216	150	43.5
216 ~ 960	200	46
Above 960	500	54

Test results (Below 1000 MHz)

The frequency spectrum from 30 MHz to 1000 MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB.

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
31.9	19.34	V	13.28	0.25	32.87	40.00	7.13
117.0	25.96	H	11.91	0.66	38.53	43.50	4.97
117.2	23.16	V	11.93	0.66	35.75	43.50	7.75
279.3	18.23	H	12.35	1.31	31.89	46.00	14.11
288.1	24.37	H	12.54	1.34	38.25	46.00	7.75
297.2	18.10	H	12.74	1.37	32.21	46.00	13.79
366.8	14.88	V	14.16	1.61	30.65	46.00	15.35
415.4	12.52	V	15.13	1.73	29.38	46.00	16.62
432.3	16.35	H	15.55	1.77	33.67	46.00	12.33
600.4	9.62	V	18.33	2.07	30.02	46.00	15.98
775.6	8.34	V	20.54	2.37	31.25	46.00	14.75
800.3	8.44	V	20.70	2.42	31.56	46.00	14.44
869.9	7.55	V	21.26	2.52	31.33	46.00	14.67
883.7	9.30	H	21.43	2.55	33.28	46.00	12.72
944.0	9.19	V	22.10	2.64	33.93	46.00	12.07
978.5	8.53	H	22.21	2.70	33.44	54.00	20.56
989.4	8.50	H	22.22	2.71	33.43	54.00	20.57
997.9	7.55	H	22.23	2.73	32.51	54.00	21.49

※ Remark

1. All spurious emission at channels are almost the same below 1 GHz, so that middle channel was chosen at representative in final test.
2. Actual = Reading + Ant. factor + Amp + CL (Cable loss)
3. Detector mode: Quasi peak
4. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

Test results (Above 1000 MHz)

A. Low channel (2403 MHz)

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual dB μ V/m	Limit (dB μ V/m)	Margin (dB)
2403	89.23	P	H	28.34	-27.93	89.64	114.00	24.36
2403	72.99	A	H	28.34	-27.93	73.40	94.00	20.60
2403	83.33	P	V	28.34	-27.93	83.74	114.00	30.26
2403	63.78	A	V	28.34	-27.93	64.19	94.00	29.81
2390*	56.18	P	H	28.31	-27.94	56.55	74.00	17.45
2390*	32.44	A	H	28.31	-27.94	32.81	54.00	21.19
2390*	52.22	P	V	28.31	-27.94	52.59	74.00	21.41
2390*	32.45	A	V	28.31	-27.94	32.82	54.00	21.18
4806*	31.72	P	H	33.91	-22.28	43.35	74.00	30.65
4806*	31.43	P	V	33.91	-22.28	43.06	74.00	30.94

B. Middle channel (2453 MHz)

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual dB μ V/m	Limit (dB μ V/m)	Margin (dB)
2441	89.20	P	H	28.42	-27.89	89.73	114.00	24.27
2441	72.87	A	H	28.42	-27.89	73.40	94.00	20.60
2441	85.71	P	V	28.42	-27.89	86.24	114.00	27.76
2441	70.43	A	V	28.42	-27.89	70.96	94.00	23.04
4882*	30.91	P	H	34.16	-22.05	43.02	74.00	30.98
4882*	30.84	P	V	34.16	-22.05	42.95	74.00	31.05

C. High channel (2478 MHz)

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2479	88.27	P	H	28.49	-27.85	88.91	114.00	25.09
2479	72.77	A	H	28.49	-27.85	73.41	94.00	20.59
2479	84.88	P	V	28.49	-27.85	85.52	114.00	28.48
2479	69.04	A	V	28.49	-27.85	69.68	94.00	24.32
2483.5*	54.09	P	H	28.50	-27.85	54.74	74.00	19.26
2483.5*	32.93	A	H	28.50	-27.85	33.58	54.00	20.42
2483.5*	58.31	P	V	28.50	-27.85	58.96	74.00	15.04
2483.5*	32.86	A	V	28.50	-27.85	33.51	54.00	20.49
4958*	31.34	P	H	34.41	-21.81	43.94	74.00	30.06
4958*	31.64	P	V	34.41	-21.81	44.24	74.00	29.76

※ Remark

1. “*” means the restricted band.
2. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using peak/average detector mode.
4. Average test would be performed if the peak result were greater than the average limit.
5. Actual = Reading + Ant. factor + Amp + CL (Cable loss)
6. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

2.1.2 AC conducted emissions

Frequency range of measurement

150 kHz to 30 MHz

Instrument settings

IF Band Width: 9 kHz

Test procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m. Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

According to 15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted limit (dB μ V/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

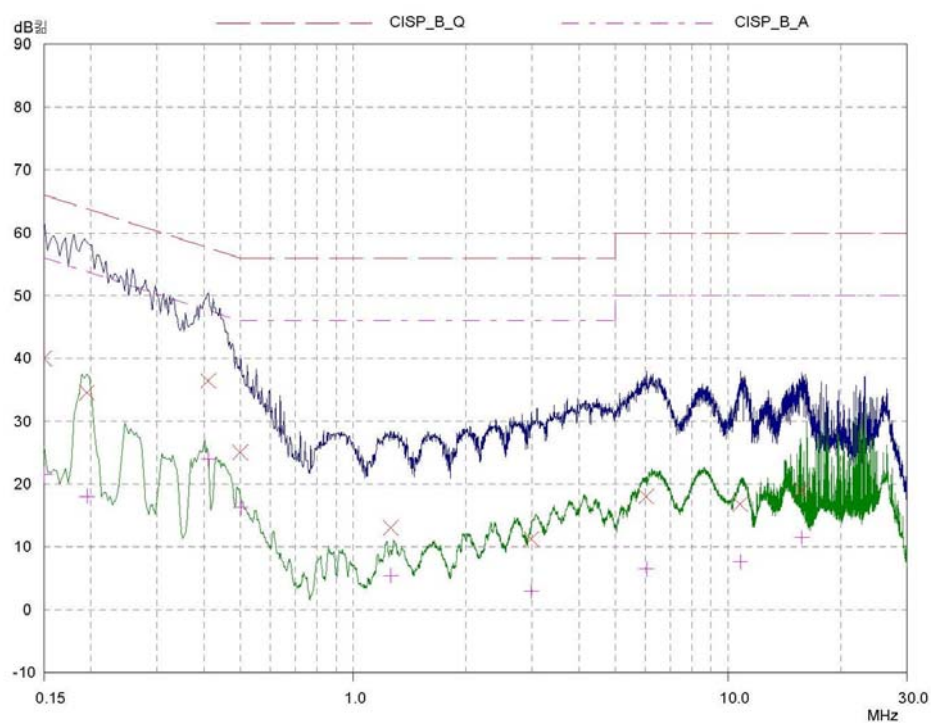
※ Remark

Decreases with the logarithm of the frequency.

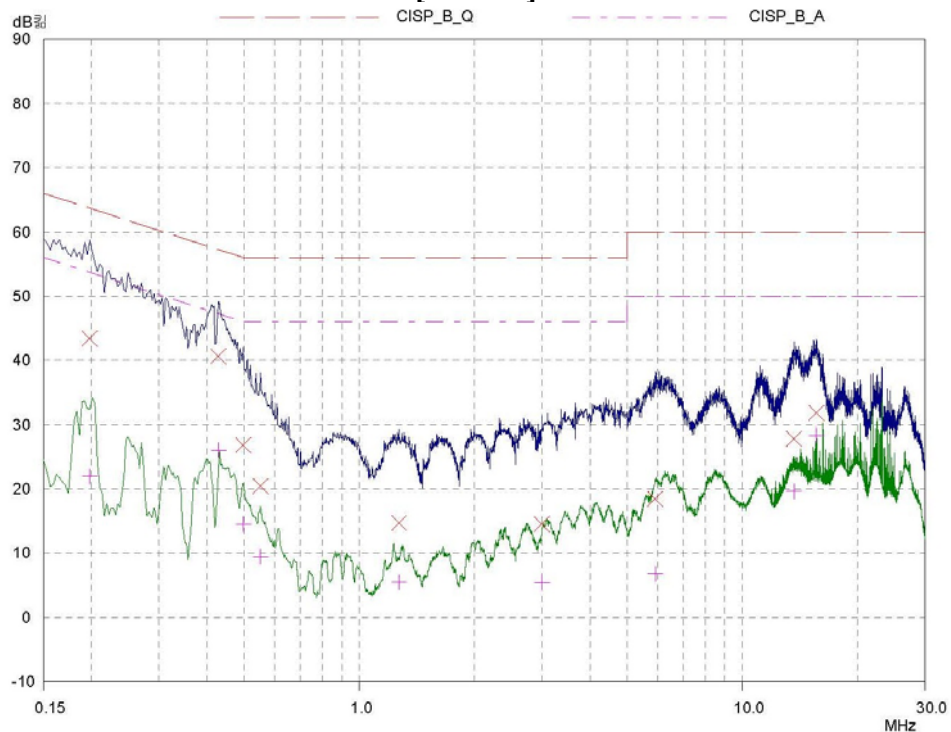
Test results

Frequency (MHz)	Correction		Phase Hot/ Neutral	Quasi peak			Average		
	LISN	Cable Loss		Reading	Result	Limit	Reading	Result	Limit
0.150	0.080	0.100	H	39.980	40.160	66	21.520	21.700	56
0.195	0.053	0.100	H	34.530	34.683	64	18.030	18.183	54
0.198	0.091	0.100	N	43.430	43.621	64	21.960	22.151	54
0.411	0.050	0.100	H	36.420	36.570	58	23.930	24.080	48
0.429	0.057	0.100	N	40.620	40.777	57	26.030	26.187	47
0.498	0.050	0.100	N	26.760	26.910	56	14.490	14.640	46
0.501	0.050	0.100	H	25.030	25.180	56	16.300	16.450	46
0.552	0.050	0.100	N	20.440	20.590	56	9.410	9.560	46
1.260	0.060	0.151	H	13.060	13.271	56	5.450	5.661	46
1.269	0.063	0.152	N	14.680	14.895	56	5.490	5.705	46
2.988	0.080	0.101	H	11.240	11.420	56	2.950	3.130	46
2.997	0.080	0.100	N	14.550	14.730	56	5.430	5.610	46
5.925	0.157	0.104	N	18.440	18.701	60	6.800	7.061	50
6.051	0.151	0.100	H	18.050	18.301	60	6.470	6.721	50
10.785	0.332	0.100	H	16.810	17.242	60	7.570	8.002	50
13.629	0.468	0.179	N	27.820	28.467	60	19.650	20.297	50
15.618	0.560	0.121	N	31.820	32.501	60	28.340	29.021	50
15.753	0.520	0.113	H	19.020	19.653	60	11.480	12.113	50

[Hot]



[Neutral]



Appendix A – Test equipment used for test

Equipment	Manufacturer	Model	Calibration due.
Spectrum Analyzer	R&S	FSV30	2012-01-07
EMI Test Receiver	LIG NEX1	ISA-80	2011-07-26
High Pass Filter	Wainwright Instrument	WHJS3000-10TT	2012-01-07
Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	2013-04-28
Horn Antenna	A.H. Systems	SAS-571	2013-03-22
Preamplifier	HP	8449B	2011-07-27
EMI Test Receiver	R&S	ESHS10	2012-05-09
LISN	R&S	ENV216	2012-02-16

Test setup photo and configuration

Radiated field emissions



AC conducted emission

