



# EMC TEST REPORT

(Certification of Compliance)

## CFR 47 Part 15 Subpart C

Test Report File No.	12-IST-0417	<input checked="" type="checkbox"/> Basic	<input type="checkbox"/> Alternate
Date of Receipt	June 14, 2012	Begin of test date	June 20, 2012
Date of Issue	June 30, 2012	End of test date	June 21, 2012

Kind of Product	Robot Cleaner
Basic Model(s)	RYDIS MR6550
Buyer Model(s)	-

Applicant / Manufacturer	MONEUAL INC.
Address	1501, 15 <sup>th</sup> FL. Partners Tower I, 83, Gasandigital1-ro, Geumcheon-gu, Seoul, Korea

Standard	Section 15.207, Section 15.209 [Class B Equipment]
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**Test Result**

☒ **Positive**

☐ **Negative**

Tested By

Reviewed By

J.H. CHOI

S.J. CHO

### Comment(s)

- Investigations requested : Measurement to the relevant clauses of FCC rules and regulations Part 15 Subpart C - Intentional Radiators, Class B.
- The test report with appendix consists of 28 pages.
- The test result only responds to the tested sample.
- It is not allowed to copy this report even partly without the allowance of IST EMC Laboratory.
- This equipment as for has been shown to be capable of continued compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4 2003.





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### ■ Test Conditions and Data - Emissions

◆ Conducted Emissions	0.15 MHz - 30 MHz	Applicable
Test Conditions / Data and Plots		10-14
◆ Radiated Emissions(Limits Below 1 GHz)	30 MHz - 6 GHz	Applicable
Test Conditions / Data and Plots		15-20

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Note:



IST Co., Ltd.  
TEST REPORT NO. : 12-IST-0417

## INFORMATIONS OF TEST LABORATORY

IST Co., Ltd.

400-19, Singal-dong, Giheung-gu, Yongin-si,

Kyonggi-Do, 446-599, Korea

TEL : +82 31 326 6700

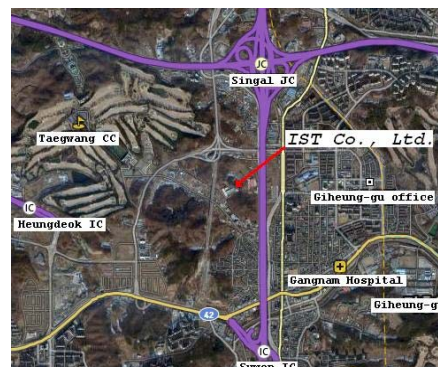
FAX : +82 31 326 6797

KOLAS Testing No. : 118

RRA & FCC(DoC) Designation No. : KR0018

FCC Registration No. : 400603

VCCI Member No. : 1739



## POWER SUPPLY SYSTEM USED

Power supply system

AC 120 V, 60 Hz

(Refer to the product information)

## Measurement Uncertainty

Conducted Emissions	$U = 2.98$ [dB] (Confidence level approximately 95 %, $k = 2$ )
Radiated Emissions (Antenna - Horizontal)	$U = 3.83$ [dB] (Confidence level approximately 95 %, $k = 2$ )
Radiated Emissions (Antenna - Vertical)	$U = 4.50$ [dB] (Confidence level approximately 95 %, $k = 2$ )

## PRODUCT INFORMATION

Battery	LiFePO4
Battery capacity	standard battery : 1400 mAh High-capacity battery : 2800 mAh
Power consumption	Maximum 20W (2800mA Battery, Maximum 25W)
maximum current	20 W
Operating time	Typical suction power: Normal: 60 min. and turbo: 40min. (2800mA Battery, Normal: 100 min. and turbo: 70 min)
Adapter	Input Voltage : (100~240) Vac, 50/60 Hz, 1.7 A Output Voltage : 18 Vdc, 2.78 A
CLK Frequency	Internal clock frequency : 72 Mhz Remote Control frequency : 2.5 GHz

- EMC suppression device is not used during the test.
- Please refer to user's manual.



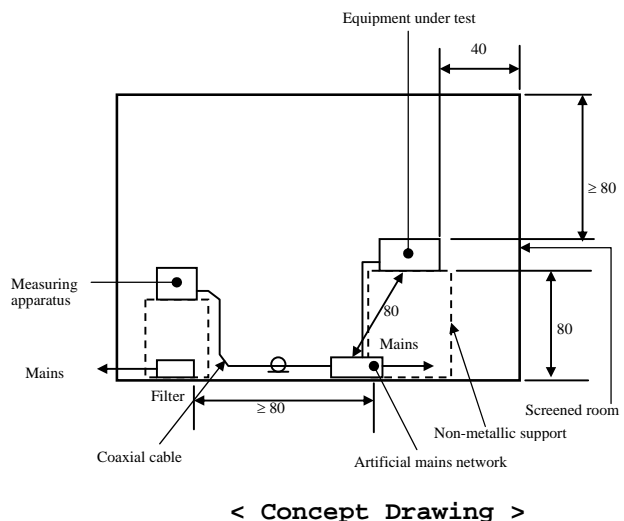
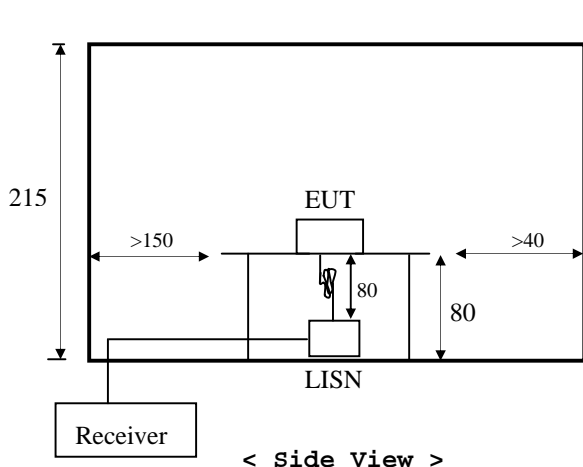
## DESCRIPTIONS OF TEST

### Conducted Emissions:

The measurement were performed over the frequency range of 0.15 MHz to 30 MHz using a  $50\ \Omega/50\mu\text{H}$  LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10KHz or for "quasi-peak" & "Average" within a bandwidth of 9 KHz.

#### -Procedure of Test

The line-conducted facility is located inside a shielded room No.1. A 1 m X 1.5 m wooden table 80 cm height is placed 40 cm away from the vertical wall and 1.5 m away from the other wall of the shielded room. The R/S ESH3-Z5 and Hyup-Rip KNW-407 LISN are bonded to bottom of the shielded room. The EUT is located on the wooden table with distance more than 80 cm from the LISN and powered from the Hyup-Rip LISN. The peripheral equipment is powered from the other LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner  $\phi$  1.2 cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the Hyup-Rip LISN. All interconnected cables more than 1 m were shortened by non-inductive bundling to a 1 m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating conditions. The RF output of the LISN was connected to the R/S receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using Quasi-Peak mode by manual measurement, after scanned by automatic Peak mode for frequency range from 0.15 to 30 MHz. The bandwidth of the receiver was set to 10 kHz. The EUT, peripheral equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.





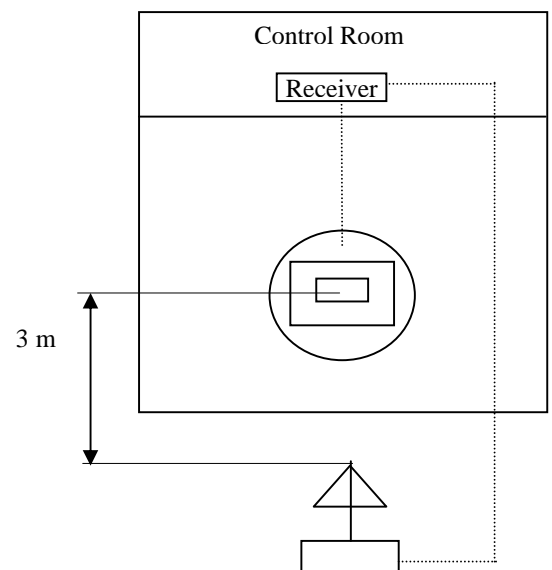
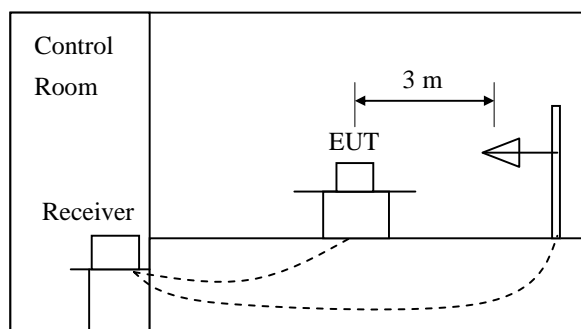
## DESCRIPTION OF TEST

### Radiated Emissions:

The measurement was performed over the frequency range of 30 MHz to 1 GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurement was made with the detector set for "quasi-peak" within a bandwidth of 120 KHz.

#### -Procedure of Test

Preliminary measurements were made at 3 meter using bi-log antennas, and spectrum analyzer to determine the frequency producing the max. emission in anechoic chamber. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turn-table azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 MHz to 1000 MHz using S/B bi-log antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used. Final measurements were made at open site with 3-meters test distance using S/B bi-log antenna. The OATS have been verified in regular for its normalized site attenuation. The test equipment was placed on a wooden table. Sufficient time for the EUT, peripheral equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency of type of signal. The EUT, peripheral equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, peripheral equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation to the EUT and/or peripheral equipment and changing the polarity of the antenna, whichever determined the worst-case emission.





## Equipment Under Test

### EUT Type :

- ☒ Table-Top. ☐ Floor-Standing.  
☐ Table-Top and Floor-Standing(Combination).

### Operation - mode of the E.U.T. :

The equipment under test was operated during the measurement under following conditions :

- ☐ Standby Mode  
☒ Operational Condition : Charge mode, Operation mode

### Configuration of the equipment under test :

Following peripheral devices and interface cables were connected during the measurement :

Equipment	Type	Brand	Serial No.
Robot Cleaner	RYDIS MR6550	MONEUAL INC.	N/A
Adapter	KPA-050J	CHANNEL WELL TECHNOLOGY.	N/A

### Connecting Interface Cables :

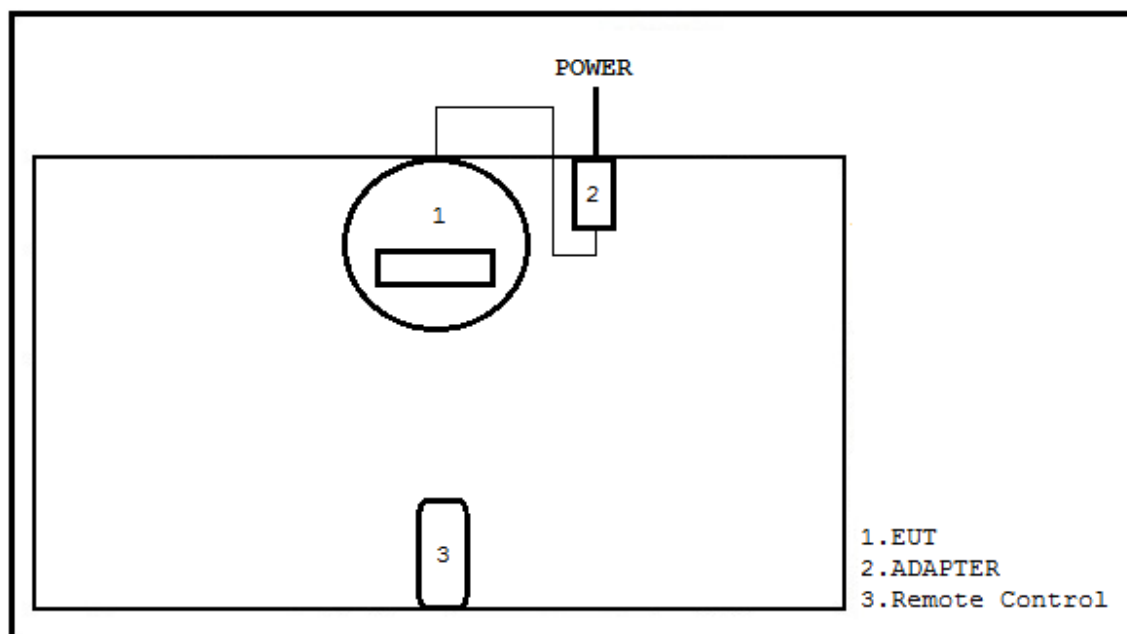
- Unshielded AC Power Cable : 1.8 m

-

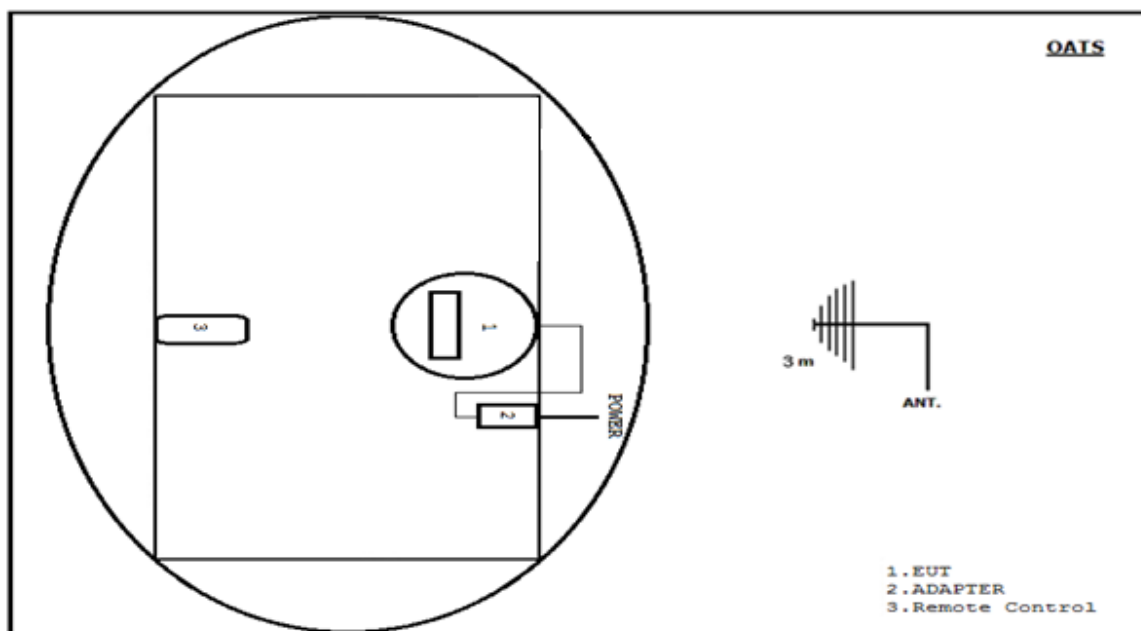
Note :



## Test Set-Up



## Conducted Emissions



## Radiated Emissions



## SUMMARY

### Emissions

#### ■ Conducted Emission

The requirements are ☒ MET ☐ Not MET  
Minimum limit margin 7.05 dB at 0.158 MHz  
Maximum limit exceeding  
**Remarks : Limits are kept with more than 3 dB margin.**

#### ■ Radiated Emission

The requirements are ☒ MET ☐ Not MET  
Minimum limit margin 4.46 dB at 213.330 MHz  
Maximum limit exceeding  
**Remarks : Limits are kept with more than 3 dB margin.**



## Sample Calculation

### Conducted Emission

#### Sample Signal Strength Calculation

$$S(\text{Result}) = \text{Measurement} + \text{IL} + \text{CL}$$

$$\text{Margin} = \text{Limit} - S(\text{Result})$$

$$S(\text{Result}) = \text{Signal Strength}$$

$$\text{Measurement} = \text{Voltage at the Receiver}$$

$$\text{IL} = \text{LISN Insertion Loss}$$

$$\text{CL} = \text{Cable Loss}$$

For example at 15.402 MHz if the measured voltage is 45.35 dBuV, the Cable loss is 0.15 dB, the insertion loss is 0.74 dB, the signal strength would be calculated:

$$S(\text{Result}) = 45.35 + 0.15 + 0.74 = 46.24 \text{ dBuV}$$

$$\text{Margin} = 60 \text{ dBuV} - 46.24 \text{ dBuV} = 13.76 \text{ dB}$$

### Radiated Emission

#### Sample Field Strength Calculation

$$FS(\text{Result}) = \text{Reading} + \text{AF} + \text{CL}$$

$$\text{Margin} = \text{Limit} - FS(\text{Result})$$

$$FS(\text{Result}) = \text{Field Strength}$$

$$\text{Reading} = \text{Measured Voltage at the Receiver}$$

$$\text{AF} = \text{Antenna Factor}$$

$$\text{CL} = \text{Cable Loss}$$

For example at 240.000 MHz if the measured voltage is 21.70 dBuV with an antenna Distance of 3 meters, the field intensity would be calculated:

$$\text{Limit}[\text{dBuV/m}] = 200[\text{uV/m}] = 20\log(200) = 46.00 \text{ dBuV/m}$$

$$FS(\text{Result}) = 21.70 + 10.71 + 2.28 = 34.69 \text{ dBuV/m}$$

$$\text{Margin} = 46.00 \text{ dBuV/m} - 34.69 \text{ dBuV/m} = 11.31 \text{ dB}$$



## TEST CONDITIONS AND DATA

### Conducted Emissions

[Applicable]

#### ◆ Test Equipment Used

Model Name	Description	Manufacture	Due Calibration	Serial No.
ESCI	Test Receiver	Rohde & Schwarz	May 10, 2013	100374
ESH2-Z5	LISN	Rohde & Schwarz	May 10, 2013	842966/007
ESH3-Z2	Pulse Limiter	Rohde & Schwarz	May 10, 2013	357.8810.52

#### ◆ Test Accessories Used

Type	Manufacturer
Aneroid Barometer	Sato
Hygrometer	Sato

#### ◆ Environmental Conditions

Temperature	(21.7 ± 0.2) °C
Humidity	(41.3 ± 0.2) % R.H.
Atmosphere pressure	1 002 hPa

◆ Test Program                      See the operation mode on page 6

◆ Test Area                              Conducted Room #2

◆ Test Date                              June 20, 2012

Note :

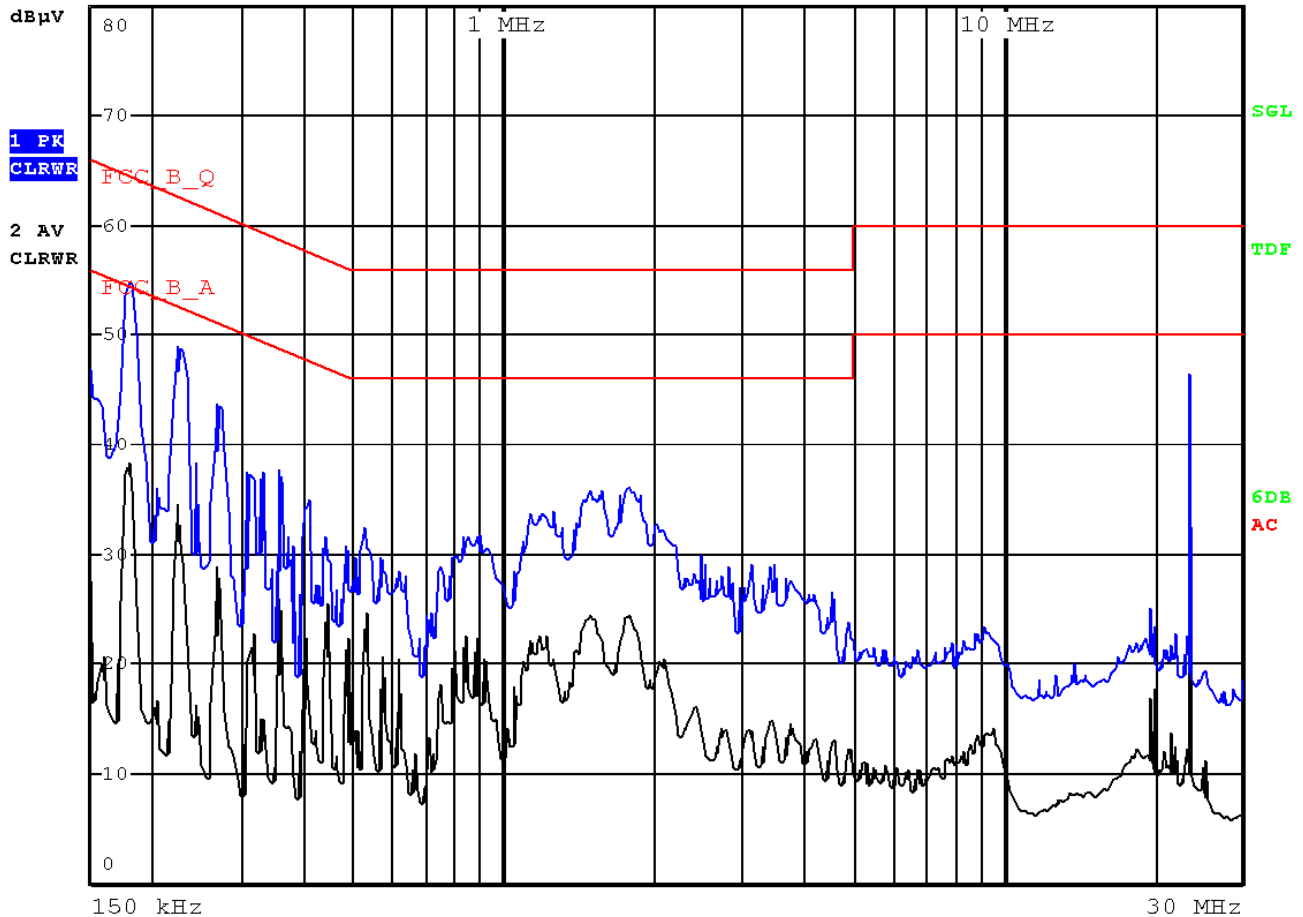


## Conducted Emissions



RBW 9 kHz  
MT 160 ms  
PREAMP OFF

Att 10 dB



Model Name : RYDIS 6550 120 Vac, 60 Hz Phase : Live  
Mode : Charge Mode Battery Capacity : 1400 mAh

Freq. [MHz]	Measurement [dB $\mu$ V]		Limit [dB $\mu$ V]		Insertion Loss	Cable Loss	Result [dB $\mu$ V]		Margin [dB]	
	Q-peak	Average	Q-peak	Average			Q-peak	Average	Q-peak	Average
0.187	38.31	16.74	64.17	54.17	0.16	0.01	38.48	16.91	25.69	37.26
0.220	34.42	14.96	62.82	52.82	0.16	0.01	34.59	15.13	28.23	37.69
0.266	28.16	12.03	61.24	51.24	0.16	0.02	28.34	12.21	32.91	39.04
0.354	23.37	13.90	58.87	48.87	0.16	0.02	23.55	14.08	35.32	34.79
1.762	22.16	12.54	56.00	46.00	0.22	0.05	22.43	12.81	33.57	33.19
23.462	45.82	41.32	60.00	50.00	0.06	0.19	46.08	41.58	13.92	8.42

Note : Battery Capacity 1400 mAh, Charge Mode.

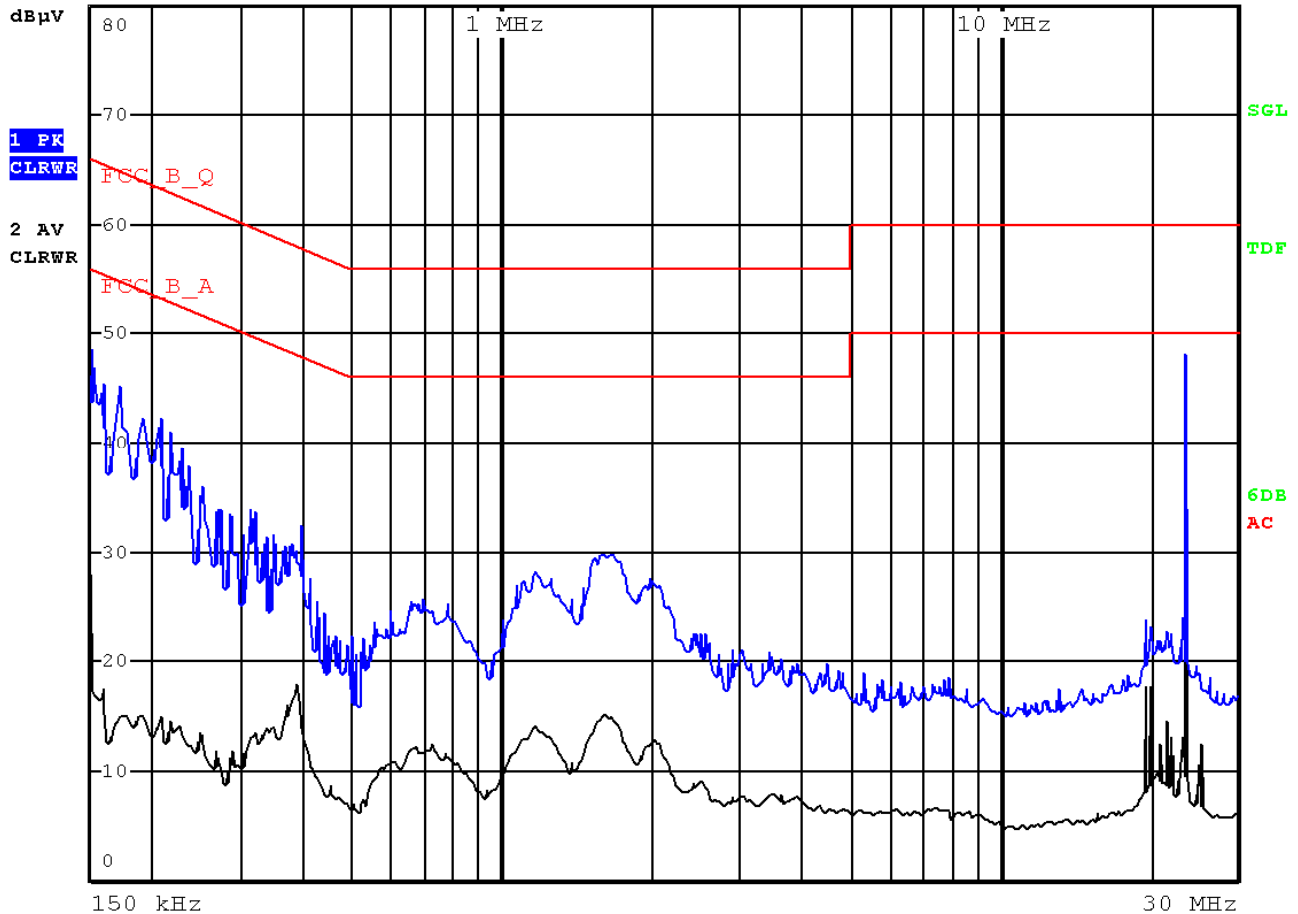


## Conducted Emissions



RBW 9 kHz  
MT 160 ms  
PREAMP OFF

Att 10 dB



Model Name : RYDIS 6550 120 Vac, 60 Hz Phase : Neutral  
Mode : Charge Mode Battery Capacity : 1400 mAh

Freq. [MHz]	Measurement [dB $\mu$ V]		Limit [dB $\mu$ V]		Insertion Loss [dB]	Cable Loss [dB]	Result [dB $\mu$ V]		Margin [dB]	
	Q-peak	Average	Q-peak	Average			Q-peak	Average	Q-peak	Average
0.150	41.34	16.55	66.00	56.00	0.12	0.01	41.47	16.68	24.53	39.32
0.214	33.65	12.49	63.05	53.05	0.12	0.01	33.78	12.62	29.27	40.43
0.318	25.89	11.94	59.76	49.76	0.13	0.02	26.04	12.09	33.72	37.67
1.622	24.94	13.50	56.00	46.00	0.18	0.05	25.17	13.73	30.83	32.27
19.554	25.80	22.54	60.00	50.00	0.12	0.18	26.09	22.83	33.91	27.17
23.450	46.29	36.41	60.00	50.00	0.14	0.19	46.62	36.74	13.38	13.26

**Note** : Battery Capacity 1400 mAh, Charge Mode.

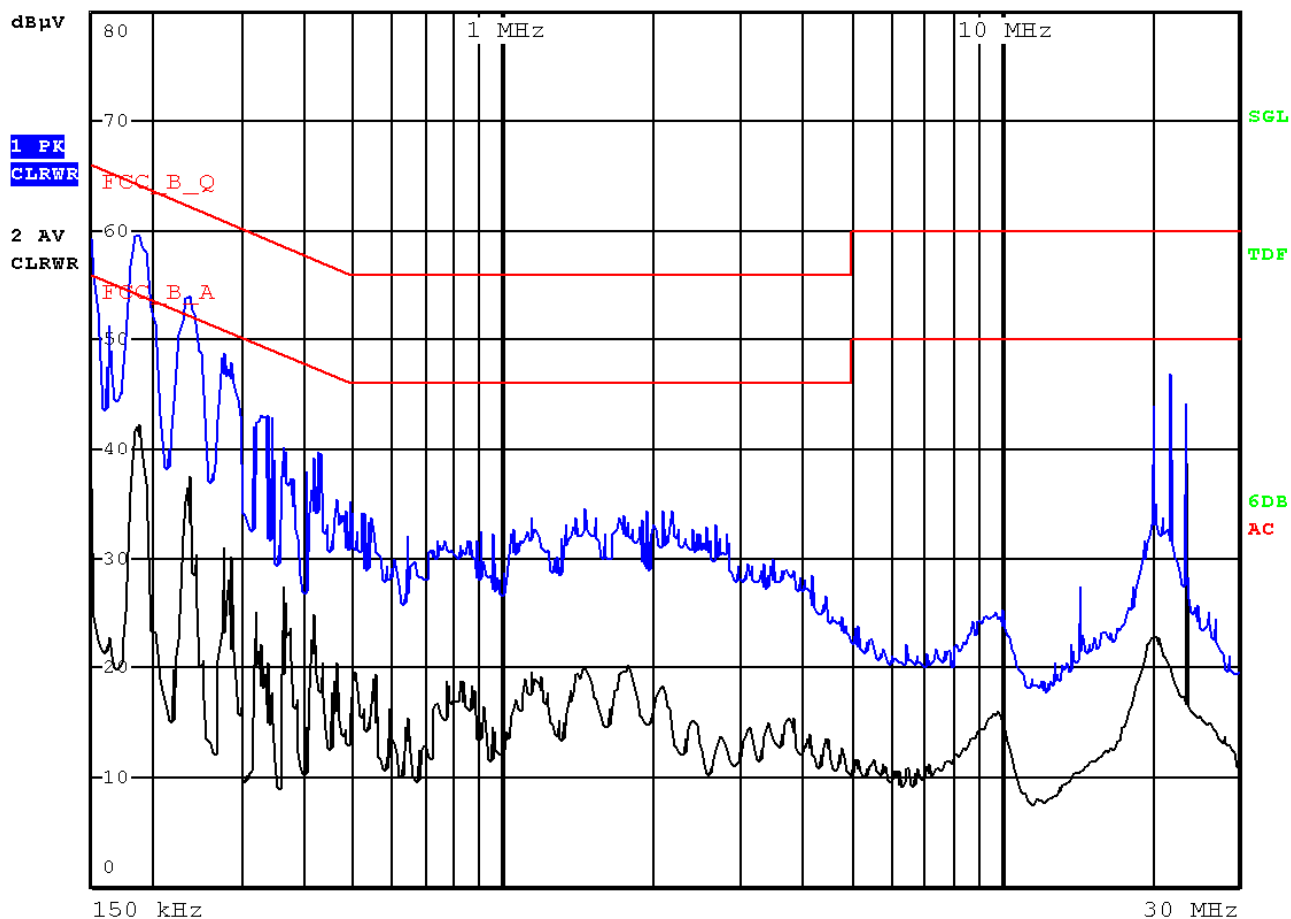


## Conducted Emissions



RBW 9 kHz  
MT 160 ms  
PREAMP OFF

Att 10 dB



Model Name : RYDIS 6550 120 Vac, 60 Hz Phase : Live  
Mode : Charge Mode Battery Capacity : 2800 mAh

Freq. [MHz]	Measurement [dB $\mu$ V]		Limit [dB $\mu$ V]		Insertion Loss	Cable Loss	Result [dB $\mu$ V]		Margin [dB]	
	Q-peak	Average	Q-peak	Average			Q-peak	Average	Q-peak	Average
0.150	53.93	42.55	66.00	56.00	0.15	0.01	54.09	42.71	11.91	13.29
0.186	37.25	21.83	64.21	54.21	0.16	0.01	37.42	22.00	26.80	32.22
0.234	38.01	15.53	62.31	52.31	0.16	0.01	38.18	15.70	24.12	36.60
1.466	30.08	19.92	56.00	46.00	0.21	0.05	30.33	20.17	25.67	25.83
20.342	28.71	23.00	60.00	50.00	0.05	0.18	28.94	23.23	31.06	26.77
21.890	24.69	18.75	60.00	50.00	0.06	0.19	24.94	19.00	35.07	31.01

**Note** : Battery Capacity 2800 mAh, Charge Mode.

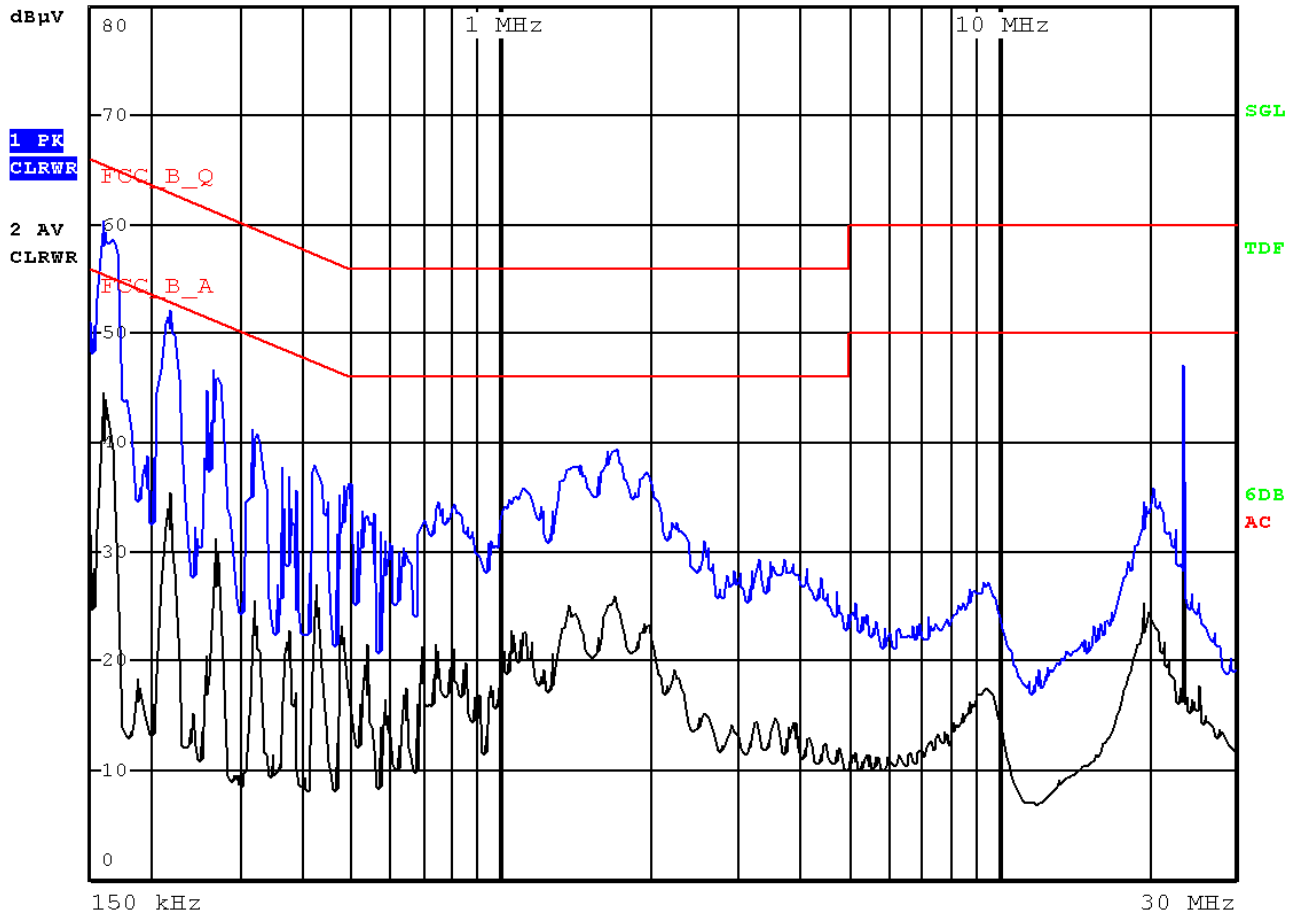


### Conducted Emissions



RBW 9 kHz  
MT 160 ms  
PREAMP OFF

Att 10 dB



Model Name : RYDIS 6550 120 Vac, 60 Hz Phase : Neutral  
Mode : Charge Mode Battery Capacity : 2800 mAh

Freq. [MHz]	Measurement [dB $\mu$ V]		Limit [dB $\mu$ V]		Insertion Loss	Cable Loss	Result [dB $\mu$ V]		Margin [dB]	
	Q-peak	Average	Q-peak	Average			Q-peak	Average	Q-peak	Average
0.158	58.39	43.55	65.57	55.57	0.12	0.01	58.52	43.68	7.05	11.89
0.214	49.44	33.66	63.05	53.05	0.12	0.01	49.57	33.79	13.48	19.26
0.262	44.20	29.76	61.37	51.37	0.12	0.02	44.34	29.90	17.03	21.47
1.714	36.08	24.51	56.00	46.00	0.19	0.05	36.32	24.75	19.69	21.26
20.554	27.62	22.37	60.00	50.00	0.11	0.18	27.91	22.66	32.09	27.34
23.458	46.43	37.68	60.00	50.00	0.14	0.19	46.76	38.01	13.24	11.99

Note : Battery Capacity 2800 mAh, Charge Mode.



## TEST CONDITIONS AND DATA

### Radiated Emission

[Applicable]

#### ◆ Test Equipment Used

Model Name	Description	Manufacture	Due Calibration	Serial No.
ESCS30	Test Receiver	Rohde & Schwarz	May 10, 2013	100171
VULB 9160	Antenna	Schwarzbeck	July 19, 2013	3071
ESCI7	Test Receiver	Rohde & Schwarz	Jul. 25, 2012	100872
8449B OPT H02	Pre Amplifier	HP	Oct. 11, 2012	3008A0530
3115	Horn Ant.	EMCO	Nov. 21, 2013	9012-3602

#### ◆ Test Accessories Used

Type	Manufacturer
Aneroid Barometer	Sato
Hygrometer	Sato

#### ◆ Environmental Conditions

Temperature	(21.3 ± 0.3) °C
Humidity	(41.8 ± 0.2) % R.H.
Atmosphere pressure	1 001 hPa

◆ Test Program                      See the operational condition page 6..

◆ Test Area                            Open Area Test Site #2(3 m)  
   Full-Anechoic Room (3 m)

◆ Test Date                            June 21, 2012

Note :



### Radiated Emissions

[Applicable]

Freq. [MHz]	Reading [dBuV]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Limit [dBuV/m]	Result [dBuV/ m]	Margin [dB]
119.240	21.00	11.09	1.79	V	43.50	33.88	9.62
140.580	24.10	12.24	1.95	H	43.50	38.29	5.21
188.110	17.80	10.05	2.25	H	43.50	30.10	13.40
288.020	19.50	12.48	2.48	H	46.00	34.46	11.54
600.358	9.20	19.53	4.11	H	46.00	32.84	13.16

[Charge Mode \_ 1400 mAh]

Freq. [MHz]	Reading [dBuV]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Limit [dBuV/m]	Result [dBuV/ m]	Margin [dB]
119.240	24.00	11.09	1.79	V	43.50	36.88	6.62
139.610	23.90	12.18	1.94	H	43.50	38.02	5.48
288.020	16.90	12.48	2.48	H	46.00	31.86	14.14
528.580	11.80	18.43	3.90	H	46.00	34.13	11.87
741.974	12.00	20.95	4.56	H	46.00	37.51	8.49

[Charge Mode \_ 2800 mAh]

Freq. [MHz]	Reading [dBuV]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Limit [dBuV/m]	Result [dBuV/ m]	Margin [dB]
41.640	14.00	11.50	1.10	V	40.00	26.60	13.40
133.790	21.40	11.88	1.90	H	43.50	35.18	8.32
195.870	25.50	9.43	2.30	H	43.50	37.23	6.27
213.330	27.00	9.63	2.41	H	43.50	39.04	4.46
406.360	20.00	15.39	3.37	H	46.00	38.76	7.24

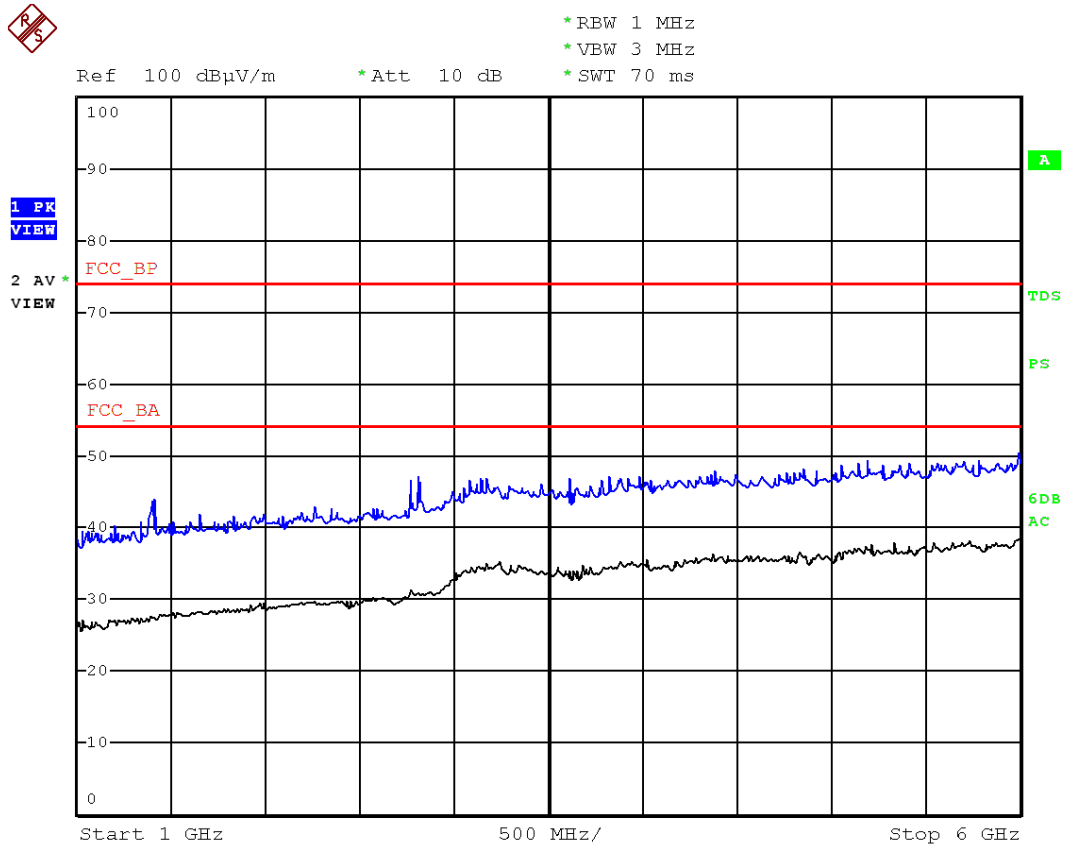
[Operation Mode]

Note : Limits Below 1 GHz (3 m method)



**Radiated Emissions**  
(Disturbance Radiation)

Horizontal



Model Name : RYDIS MR6550    120 Vac, 50 Hz    Phase : Hor.  
Mode : Charge Mode    Battery Capacity : 1400 mAh

Freq. [GHz]	Reading[dBuV]		Ant. Height [cm]	Polar. [H/V]	Limit[dBuV/m]		Margin [dB]	
	Peak	Average			Peak	Average	Peak	Average
1.410	38.99	28.50	100	H	74.00	54.00	35.01	25.50
2.810	43.74	30.76	100	H	74.00	54.00	30.26	23.24
4.380	48.16	36.08	100	H	74.00	54.00	25.84	17.92
5.190	48.91	36.57	100	H	74.00	54.00	25.09	17.43

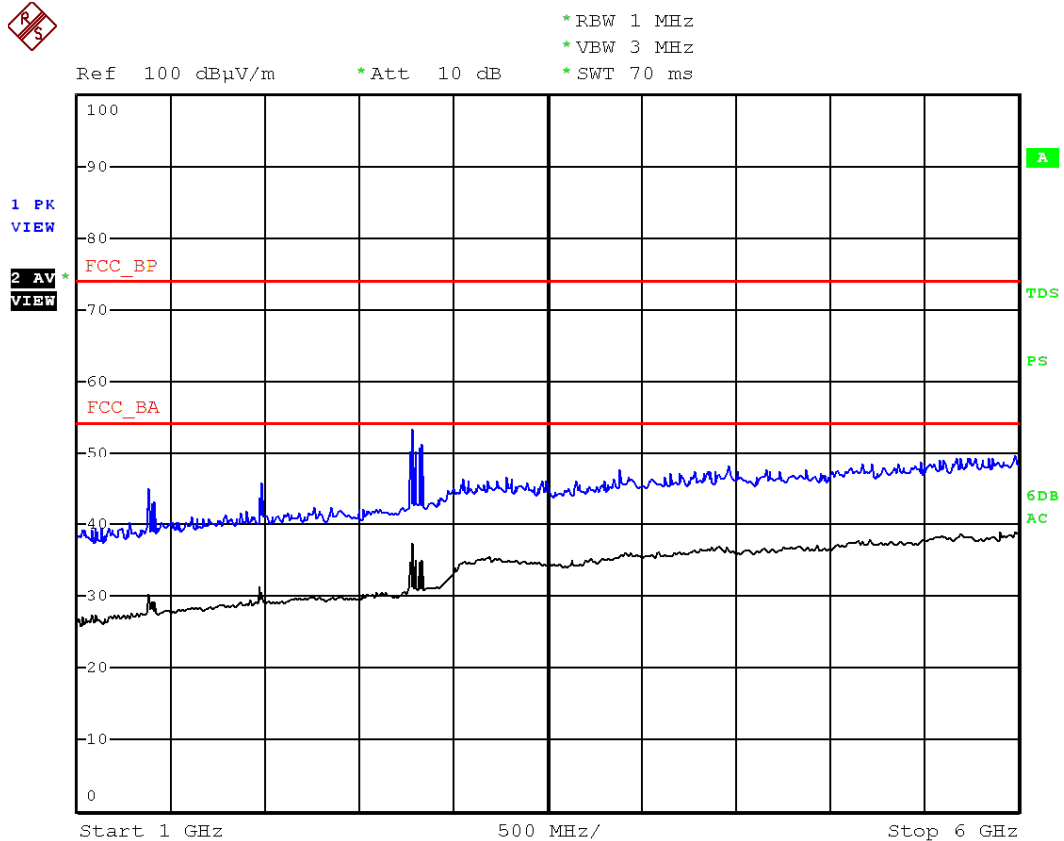
Note : Limits above 1 GHz(3 m method)

Charge Mode \_ 1400 mAh



**Radiated Emissions**  
(Disturbance Radiation)

Vertical



Model Name : RYDIS MR6550 120 Vac, 50 Hz Phase : Ver.  
Mode : Charge Mode Battery Capacity : 1400 mAh

Freq. [GHz]	Reading[dBuV]		Ant. Height [cm]	Polar. [H/V]	Limit[dBuV/m]		Margin [dB]	
	Peak	Average			Peak	Average	Peak	Average
1.380	39.85	26.80	100	V	74.00	54.00	34.15	27.20
1.980	40.59	28.58	100	V	74.00	54.00	33.41	25.42
2.781	42.79	30.66	100	V	74.00	54.00	31.21	23.34
3.885	47.97	35.06	100	V	74.00	54.00	26.03	18.94

Note : Limits above 1 GHz(3 m method)

Charge Mode \_ 1400 mAh



**Radiated Emissions**  
(Disturbance Radiation)

Horizontal



\*RBW 1 MHz

\*VBW 3 MHz

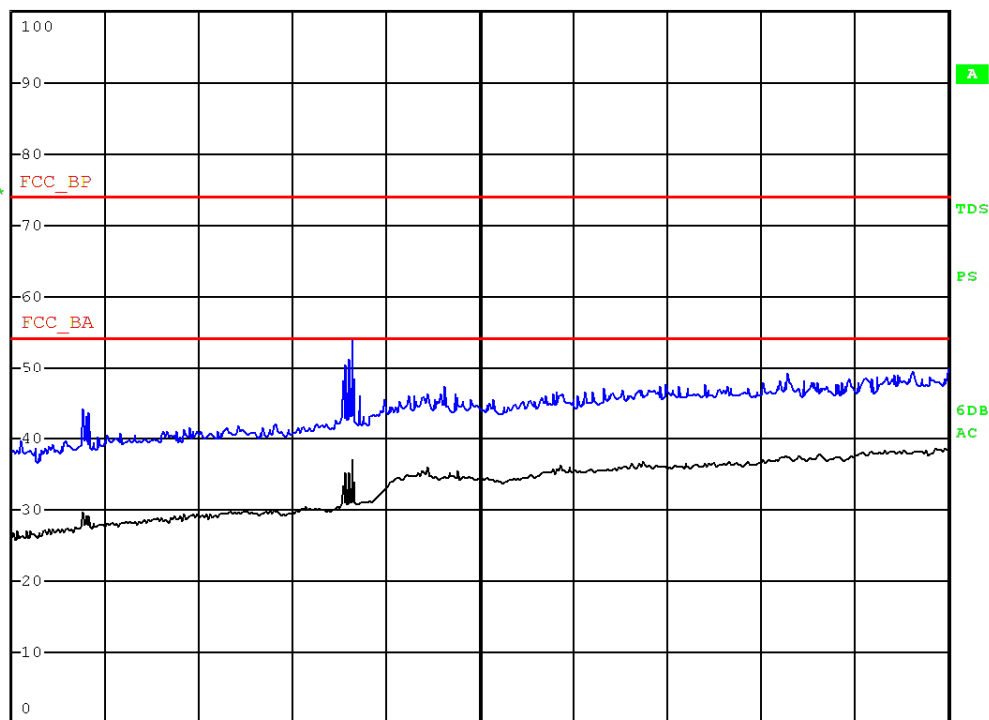
\*SWT 70 ms

Ref 100 dBuV/m

\*Att 10 dB

1 PK  
VIEW

2 AV  
VIEW



Start 1 GHz

500 MHz/

Stop 6 GHz

Model Name : RYDIS MR6550 120 Vac, 50 Hz Phase : Hor.

Mode : Charge Mode Battery Capacity : 2800 mAh

Freq. [GHz]	Reading[dBuV]		Ant. Height [cm]	Polar. [H/V]	Limit[dBuV/m]		Margin [dB]	
	Peak	Average			Peak	Average	Peak	Average
1.381	39.11	26.75	100	H	74.00	54.00	34.89	27.25
1.960	42.85	28.49	100	H	74.00	54.00	31.15	25.51
2.771	48.21	30.14	100	H	74.00	54.00	25.79	23.86
5.350	48.91	36.53	100	H	74.00	54.00	25.09	17.47

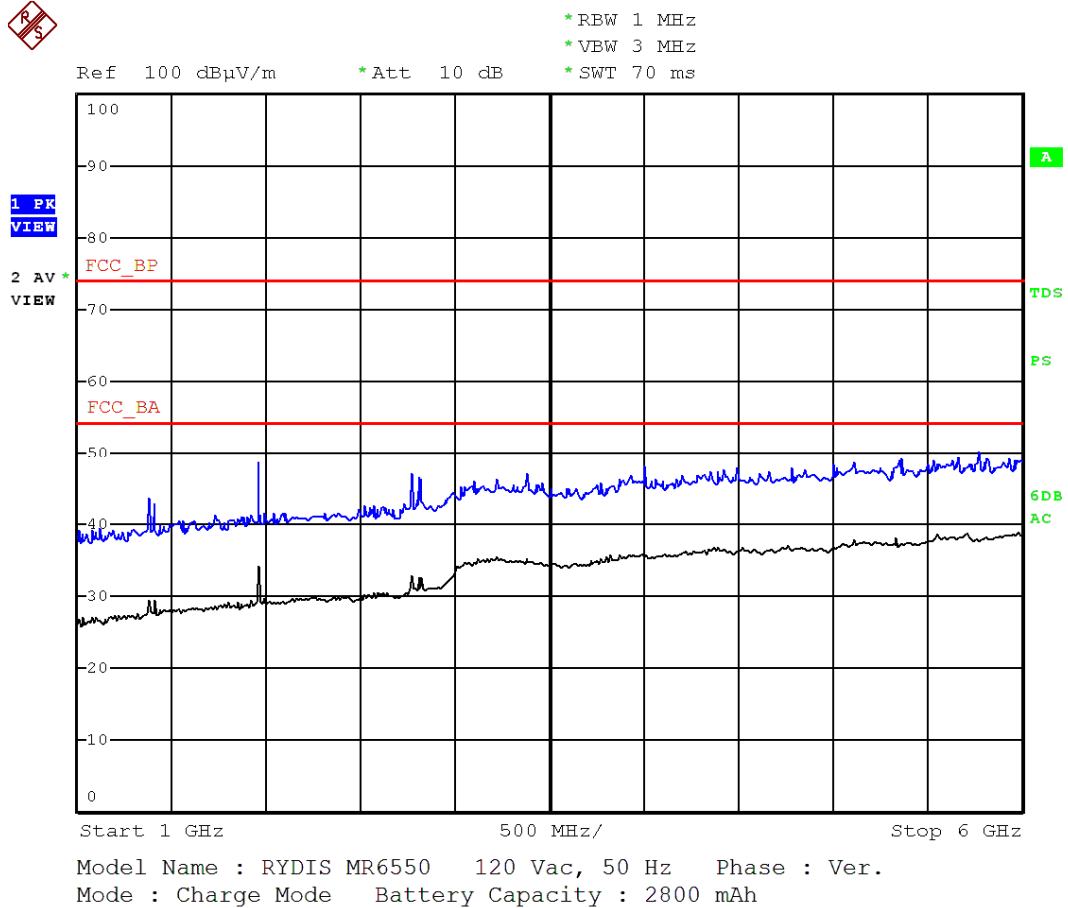
Note : Limits above 1 GHz(3 m method)

Charge Mode \_ 2800 mAh



**Radiated Emissions**  
(Disturbance Radiation)

Vertical



Freq. [GHz]	Reading[dBuV]		Ant. Height [cm]	Polar. [H/V]	Limit[dBuV/m]		Margin [dB]	
	Peak	Average			Peak	Average	Peak	Average
1.380	39.88	26.79	100	V	74.00	54.00	34.12	27.21
2.824	49.86	30.40	100	V	74.00	54.00	24.14	23.60
3.310	47.49	34.25	100	V	74.00	54.00	26.51	19.75
5.144	49.36	36.67	100	V	74.00	54.00	24.64	17.33

Note : Limits above 1 GHz(3 m method)

Charge Mode \_ 2800 mAh



IST Co., Ltd.

TEST REPORT NO. : 12-IST-0417

Appendix A. The Photos of Test Setup



Conducted Emissions - Front View



Conducted Emissions - Rear View



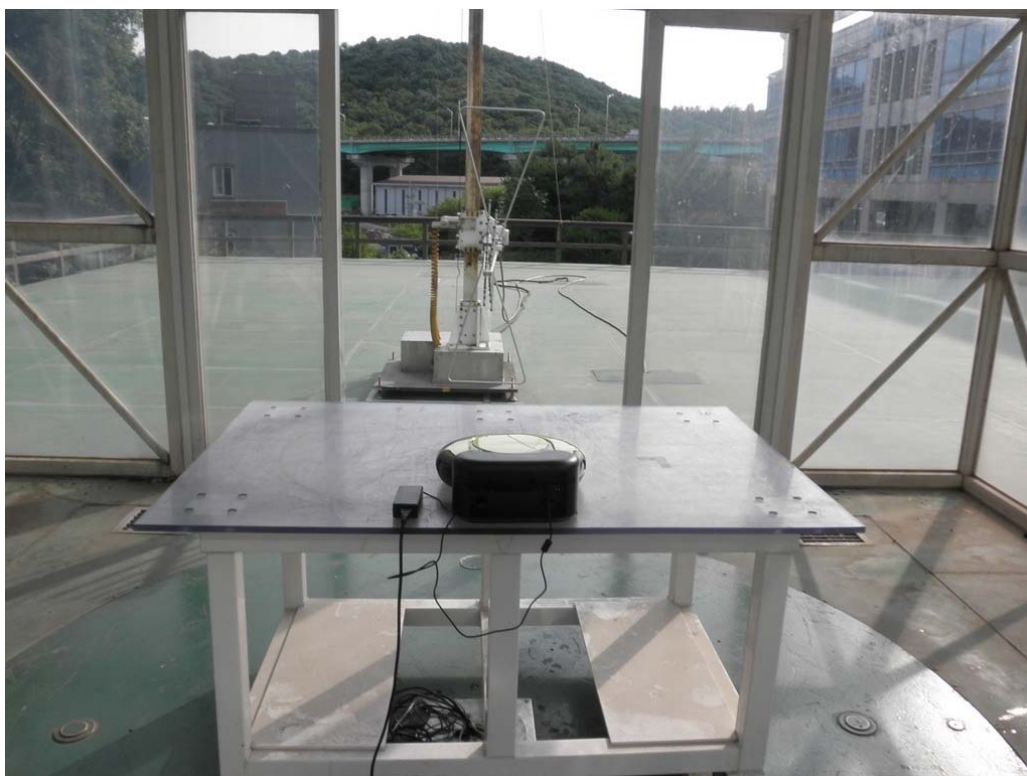
IST Co., Ltd.

TEST REPORT NO. : 12-IST-0417

Appendix A. The Photos of Test Setup



Radiated Emissions below 1 GHz- Front View



Radiated Emissions below 1 GHz - Rear View



IST Co., Ltd.

TEST REPORT NO. : 12-IST-0417

Appendix A. The Photos of Test Setup



Radiated Emissions above 1 GHz- Front View



Radiated Emissions above 1 GHz - Rear View



Appendix B. The Photos of Equipment Under Test



Front View



Rear View



## Appendix B. The Photos of Equipment Under Test



Inner View



Appendix B. The Photos of Equipment Under Test



Adapter View



Adapter label View



Appendix B. The Photos of Equipment Under Test



Remote Control View



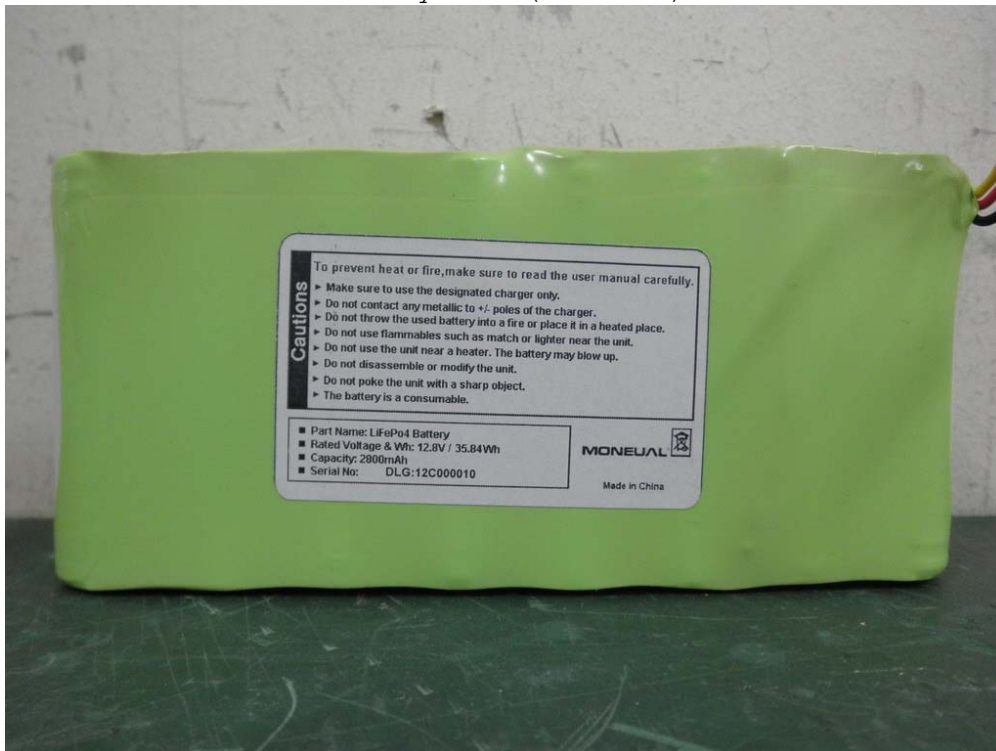
Remote Control View



## Appendix B. The Photos of Equipment Under Test



Battery View (1400 mAh)



Battery View (2800 mAh)