

FCC Part 15C

Measurement and Test Report

For

Guangzhou Andea Electronics Technology Co., Ltd

401, Building H, No.1, Jingye 3rd Street, Yushu Industry Park, Luogang

District, Guangzhou, China.

FCC ID: 2AFI8-RD543

FCC Rule(s):	<u>FCC Part 15.225</u>
Product Description:	<u>HF Reader</u>
Tested Model:	<u>RD543</u>
Report No.:	<u>STR15078100I-1</u>
Tested Date:	<u>2015-07-07 to 2015-07-20</u>
Issued Date:	<u>2015-07-20</u>
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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM.Test Technology Co., Ltd.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Guangzhou Andea Electronics Technology Co., Ltd
Address of applicant: 401, Building H, No.1, Jingye 3rd Street, Yushu Industry Park, Luogang District, Guangzhou, China.
Manufacturer: Guangzhou Andea Electronics Technology Co., Ltd
Address of manufacturer: 401, Building H, No.1, Jingye 3rd Street, Yushu Industry Park, Luogang District, Guangzhou, China.

General Description of EUT	
Product Name:	HF Reader
Trade Name:	/
Model No.:	RD543
Adding Model(s):	RD503
Rated Voltage:	DC 12V
Power Adapter Model:	F150603-B I/P: AC 100-240V~1.8A 50-60Hz O/P: 12-16A-max. 5.0A(60W)
<p><i>Note: The test data is gathered from a production sample, provided by the manufacturer.</i></p> <p>1. Only the antenna quantity of other model listed in the report is different from main-test model RD543, but the circuit and the electronic construction do not change, RD503 only has one antenna, RD543 has four antennas, but there is only one antenna transmitting when operation, declared by the manufacturer.</p> <p>2. All test modes are performed, but only the worst case is recorded in this report.</p>	

Technical Characteristics of EUT	
Support Standards:	RFID
Frequency Range:	13.56MHz
Max. Field Strength:	74.20dBuV/m
Antenna Type:	SMA-reverse Loop Antenna
Device Category:	Fixed device
Lowest Internal Frequency of EUT:	8MHz

1.2 Test Standards

The following report is prepared on behalf of the Guangzhou Andea Electronics Technology Co., Ltd in accordance with FCC Part 15, Subpart C, and section 15.203,15.205,15.209 and 15.225 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203,15.205,15.209 and 15.225 rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2009, 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.

The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

1.4 Test Facility

FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

CNAS Registration No.: L4062

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101).

1.5 EUT Setup and Test Mode

The EUT was operated in the continuous transmitting mode that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Transmitting	13.56MHz

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
Reticle	1.2	Unshielded	Without Ferrite

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Notebook	Lenovo	E10	/

1.6 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Spectrum Analyzer	Agilent	E4407B	MY41440400	2015-06-17	2016-06-16
Spectrum Analyzer	Rohde & Schwarz	FSP	836079/035	2015-06-17	2016-06-16
EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2015-06-17	2016-06-16
Amplifier	Agilent	8447F	3113A06717	2015-06-17	2016-06-16
Amplifier	C&D	PAP-1G18	2002	2015-06-17	2016-06-16
Broadband Antenna	Schwarz beck	VULB9163	9163-333	2015-06-17	2016-06-16
Horn Antenna	ETS	3117	00086197	2015-06-17	2016-06-16
Loop Antenna	Schwarz beck	FMZB 1516	9773	2015-06-17	2016-06-16
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2015-06-17	2016-06-16
L.I.S.N	Schwarz beck	NSLK8126	8126-224	2015-06-17	2016-06-16
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2015-06-17	2016-06-16

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§15.209	Radiated Emission Limit	Compliant
§15.225(a)	Field Strength	Compliant
§15.225(b)(c)	Out of Band Emission	Compliant
§15.225(e)	Frequency Stability	Compliant

N/A: not applicable

3. Antenna Requirement

3.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

3.2 Test Result

This product has a SMA-reverse Loop Antenna, fulfill the requirement of this section.

4. Radiated Emissions

4.1 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ± 5.10 dB.

4.2 Standard Applicable

According to §15.225(a), The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

According to §15.225(d) The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in §15.209.

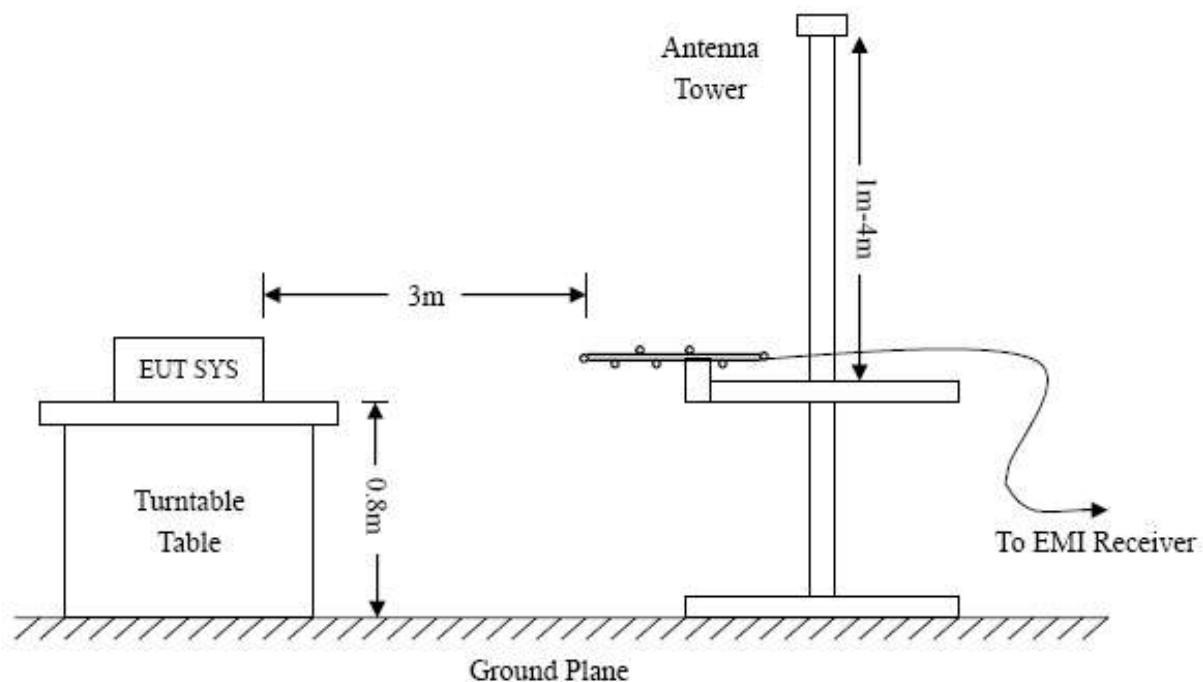
Note: Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

4.3 Test Procedure

The setup of EUT is according with per ANSI C63.4-2009 measurement procedure. The specification used was with the FCC Part 15.205 15.225(d) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.



4.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} - \text{Corr. Factor}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

4.5 Environmental Conditions

Temperature:	26° C
Relative Humidity:	52%
ATM Pressure:	1022 mbar

4.6 Summary of Test Results/Plots

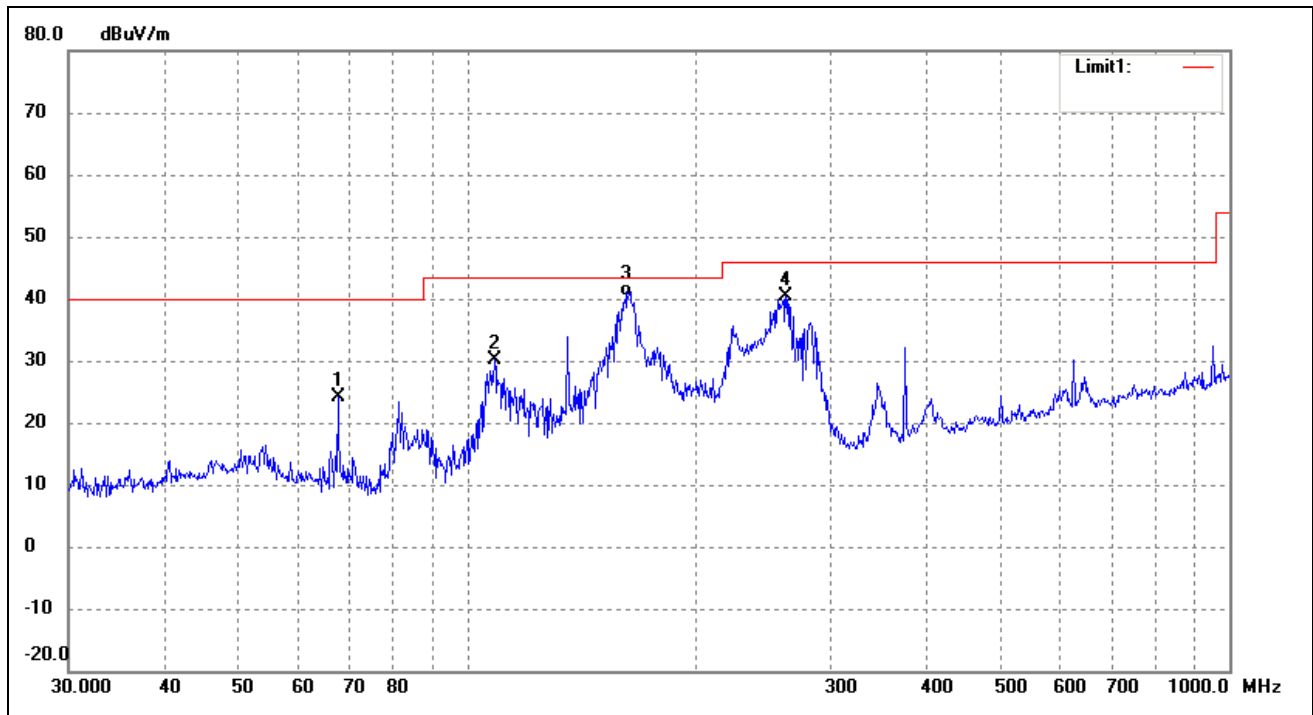
According to the data below, the FCC Part 15.205, 15.209 and 15.225 standards, and had the worst margin of:

-3.34 dB at 27.1542 MHz in the Horizontal polarization, 9 kHz to 1 GHz, 3Meters

***Note:** this EUT was tested in 3 orthogonal positions and the worst case position data was reported.*

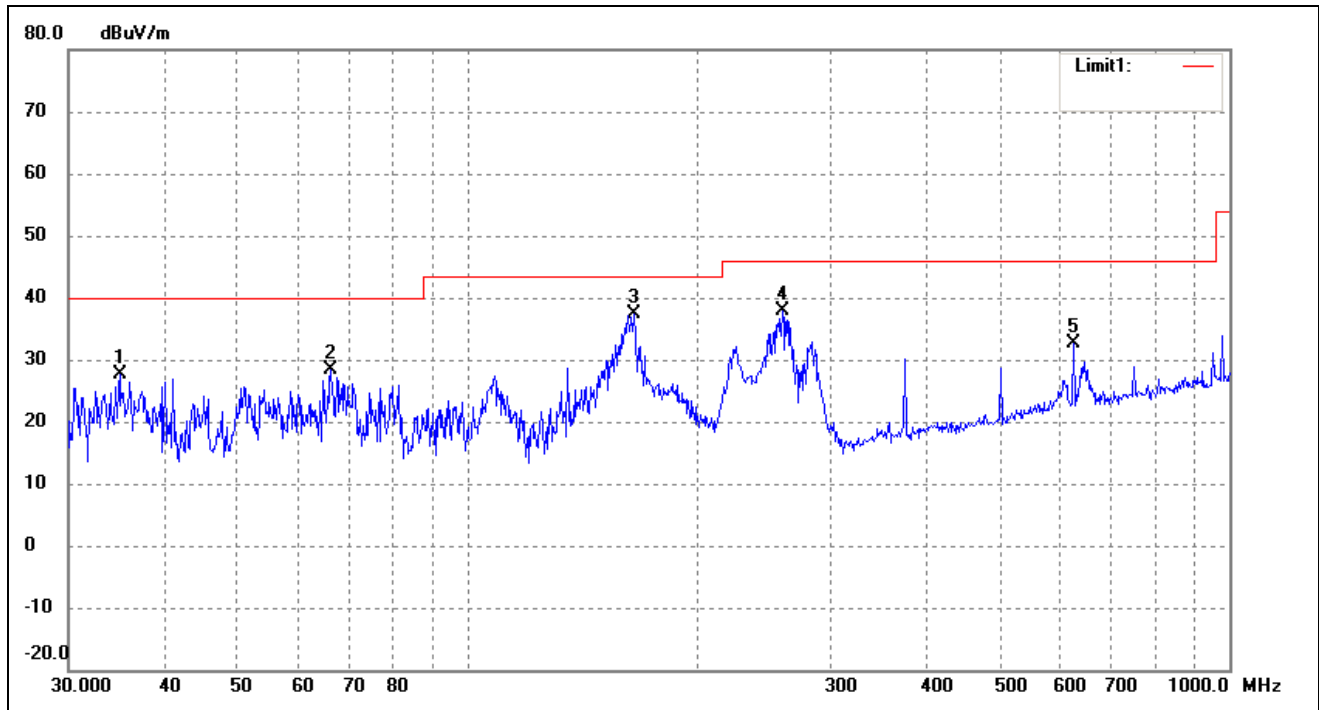
All test modes are performed, but only the worst case is recorded in this report.

Frequency	Reading	Correction Factor	Result	Limit	Margin	Polar	Detector
MHz	dBuV/m	dB/m	dBuV/m	dBuV/m	dB	H/V	
13.5600	57.42	16.78	74.20	104.0	-29.80	H	Peak
27.1200	50.31	-3.65	46.66	69.5	-52.85	H	Peak
13.5600	53.36	16.78	70.14	104.0	-33.86	V	Peak
27.1200	48.22	-3.65	44.57	69.5	-33.18	V	Peak

Plot of Radiated Emissions Test Data*EUT: HF Reader**Tested Model: RD543**Operating Condition: Transmitting**Comment: 120V/60Hz; Adapter DC 12V**Test Specification: Horizontal*

No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(°)	(cm)	
1	67.6751	36.12	-12.05	24.07	40.00	-15.93	102	100	peak
2	108.6470	40.74	-10.56	30.18	43.50	-13.32	149	100	peak
3	162.0414	50.90	-10.46	40.44	43.50	-3.06	166	100	QP
4	261.9753	46.42	-6.09	40.33	46.00	-5.67	187	100	peak

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (°)	Height (cm)	Remark
1	35.0048	38.17	-10.58	27.59	40.00	-12.41	102	100	peak
2	66.2662	40.16	-11.75	28.41	40.00	-11.59	149	100	peak
3	165.4867	47.56	-10.29	37.27	43.50	-6.23	166	100	peak
4	259.2338	44.05	-6.10	37.95	46.00	-8.05	187	100	peak
5	625.0780	30.86	1.88	32.74	46.00	-13.26	201	100	peak

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics. The measurements greater than 20dB below the limit from 9kHz to 30MHz.

5. OUT OF BAND EMISSIONS

5.1 Standard Applicable

According to FCC 15.225 (b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. (c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

5.2 Test Procedure

As the radiation test, set the RBW=10kHz VBW=30kHz, observed the outside band of 13.11MHz to 14.01MHz, than mark the higher-level emission for comparing with the FCC rules.

5.3 Environmental Conditions

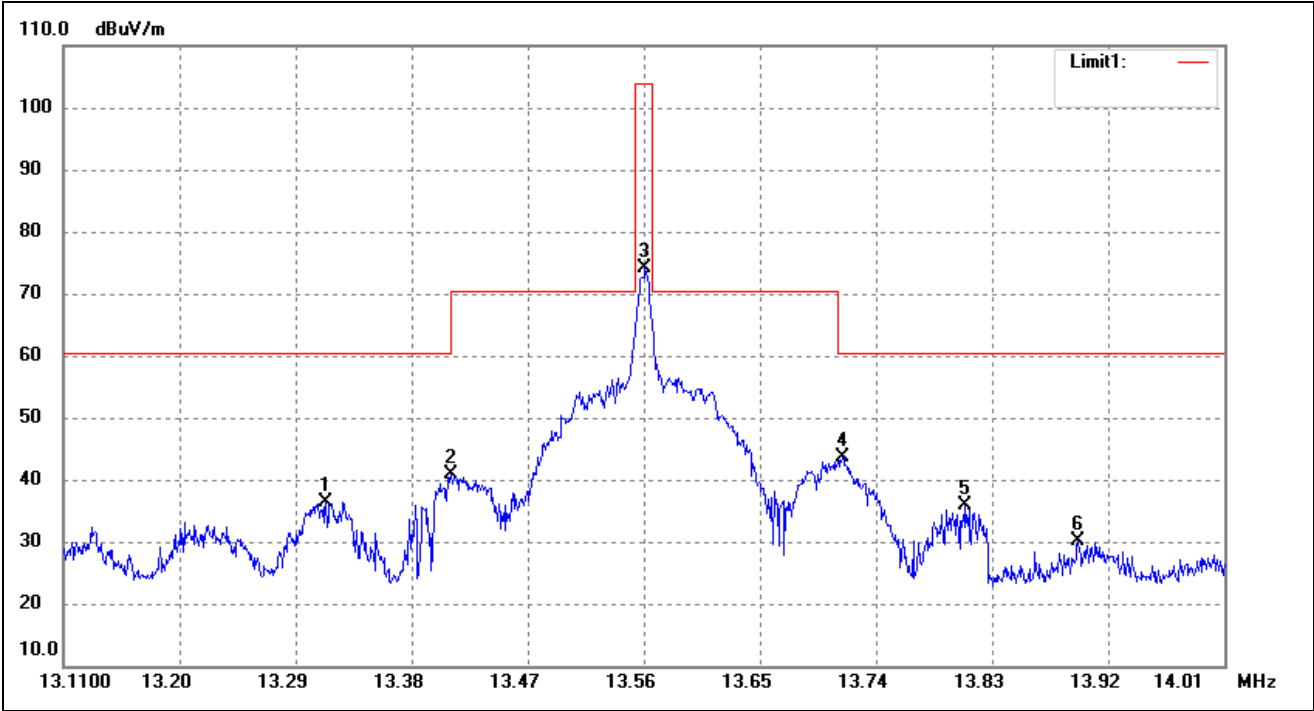
Temperature:	26° C
Relative Humidity:	57%
ATM Pressure:	1022 mbar

5.4 Summary of Test Results/Plots

All test modes are performed, but only the worst case is recorded in this report.

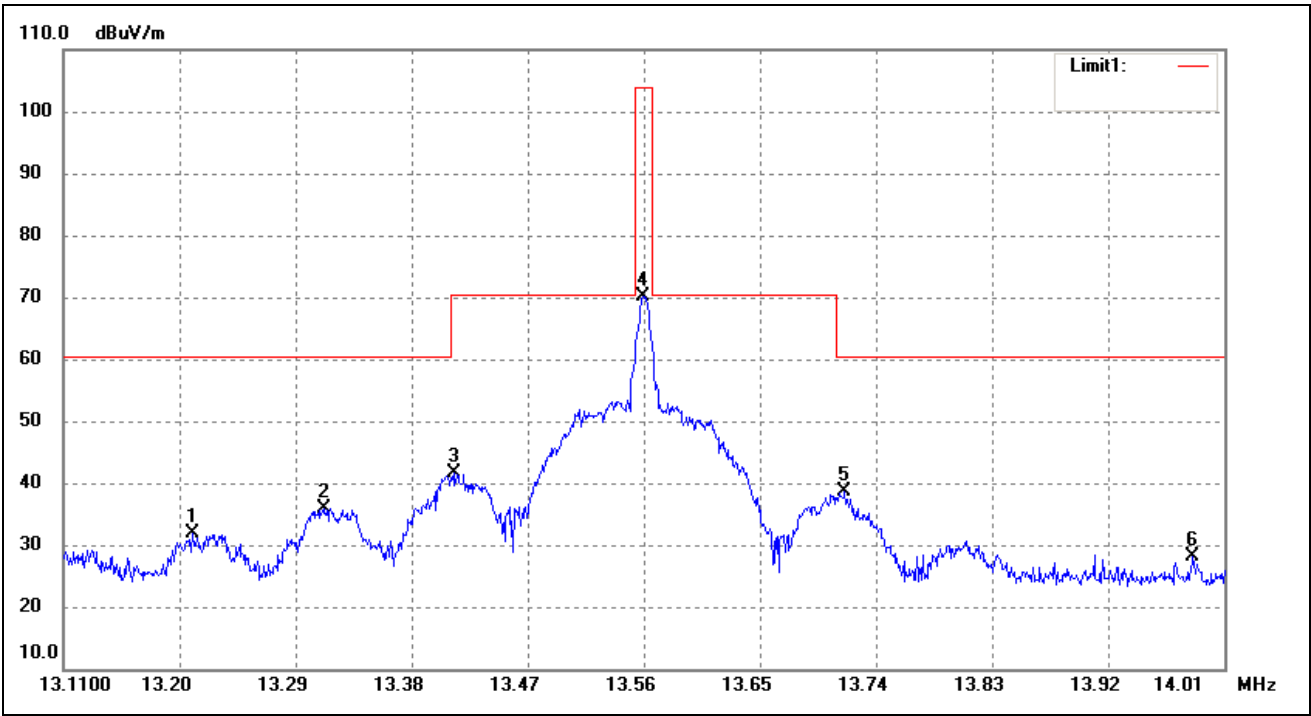
Out of band emission

Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	()	(cm)	
1	13.3134	19.73	16.70	36.43	60.50	-24.07	124	100	peak
2	13.4106	24.14	16.73	40.87	70.50	-29.63	159	100	peak
3	13.5609	57.42	16.78	74.20	104.00	-29.80	168	100	peak
4	13.7139	26.81	16.84	43.65	60.50	-16.85	184	100	peak
5	13.8093	19.11	16.87	35.98	60.50	-24.52	222	100	peak
6	13.8966	13.31	16.90	30.21	60.50	-30.29	264	100	peak

Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	()	(cm)	
1	13.2099	15.12	16.67	31.79	60.50	-28.71	114	100	peak
2	13.3125	19.08	16.70	35.78	60.50	-24.72	126	100	peak
3	13.4124	24.96	16.73	41.69	70.50	-28.81	137	100	peak
4	13.5591	53.36	16.78	70.14	104.00	-33.86	155	100	peak
5	13.7157	21.74	16.84	38.58	60.50	-21.92	184	100	peak
6	13.9857	11.24	16.93	28.17	60.50	-32.33	263	100	peak

6. Frequency Stability

6.1 Standard Applicable

According to 15.225(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

6.2 Test Procedure

The setup of EUT is according with per ANSI C63.4-2009 measurement procedure.

6.3 Environmental Conditions

Relative Humidity:	55%
ATM Pressure:	1015 mbar

6.4 Summary of Test Results/Plots

Reference Frequency: 13.56MHz, Limit: 100ppm			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Error	
		Error (Hz)	Error (ppm)
50	120	167	12.32
40	120	140	10.32
30	120	125	9.22
20	120	102	7.52
10	120	90	6.64
0	120	76	5.60
-10	120	50	3.69
-20	120	24	1.77

Reference Frequency: 13.56MHz, Limit: 100ppm			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Error	
		Error (Hz)	Error (ppm)
20	102	105	7.74
	7.4	102	7.52
	138	101	7.45

7. Conducted Emissions

7.1 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is ± 2.88 dB.

7.2 Test Procedure

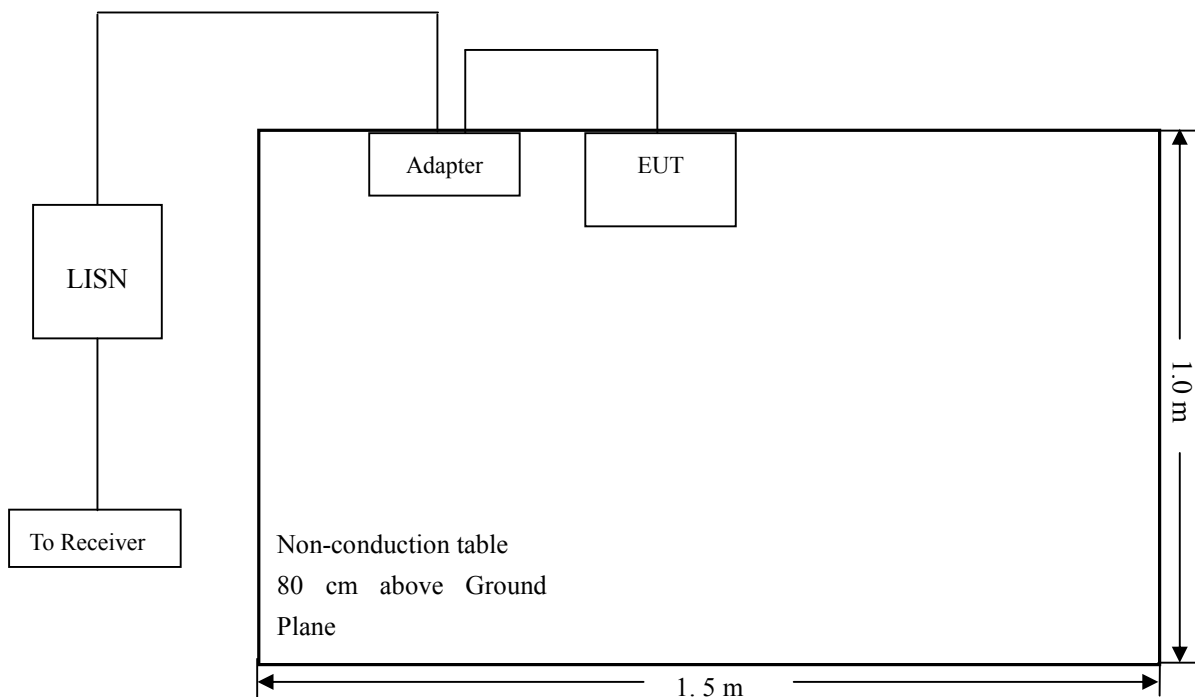
The setup of EUT is according with per ANSI C63.4-2009 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

Note: Base on the calibrated result, for the impedance characteristic and insertion loss, the effect shall be ignored from the placed multiple outlet power strip between the device and LISN.

7.3 Basic Test Setup Block Diagram



7.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

7.5 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency 150 kHz
Stop Frequency..... 30 MHz
Sweep Speed Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth 9 kHz
Quasi-Peak Adapter Mode Normal

7.6 Summary of Test Results/Plots

According to the data in section 7.7, the EUT complied with the FCC Part 15.207 Conducted margin for this device, with the *worst* margin reading of:

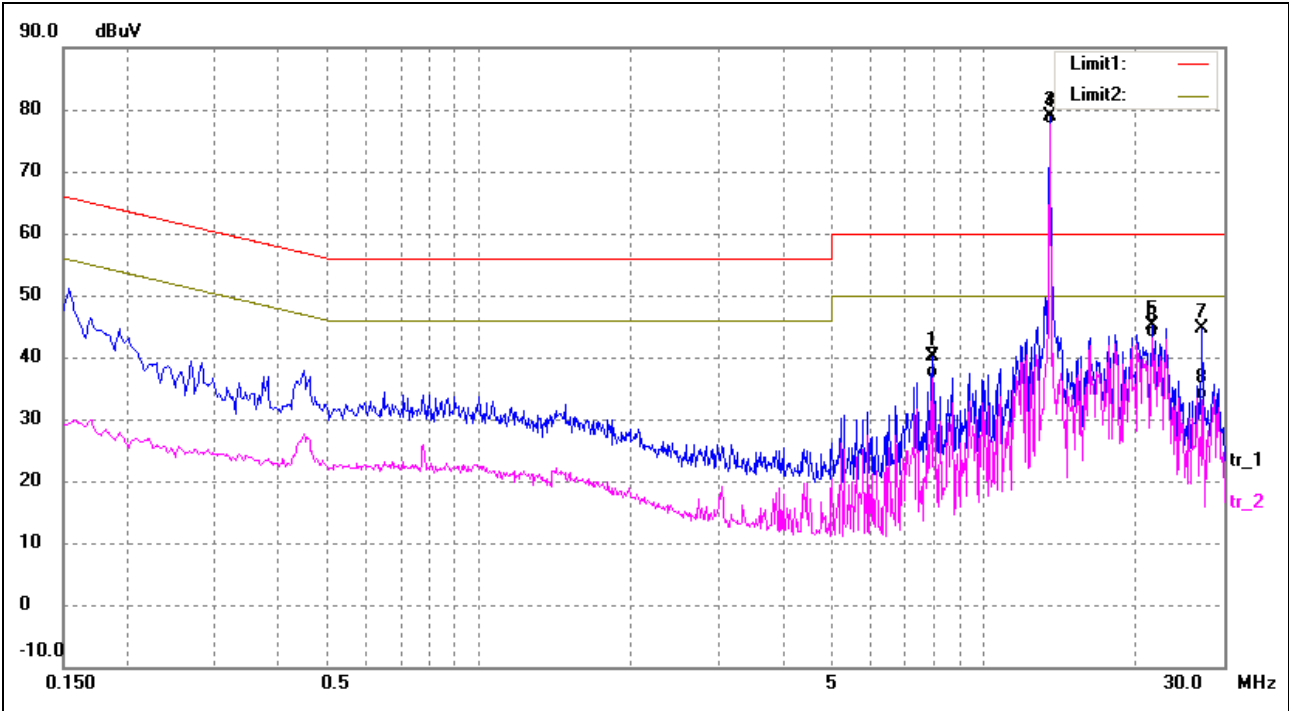
-6.84 dB at 21.6620 MHz in the Neutral mode, peak detector, 0.15-30MHz

7.7 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

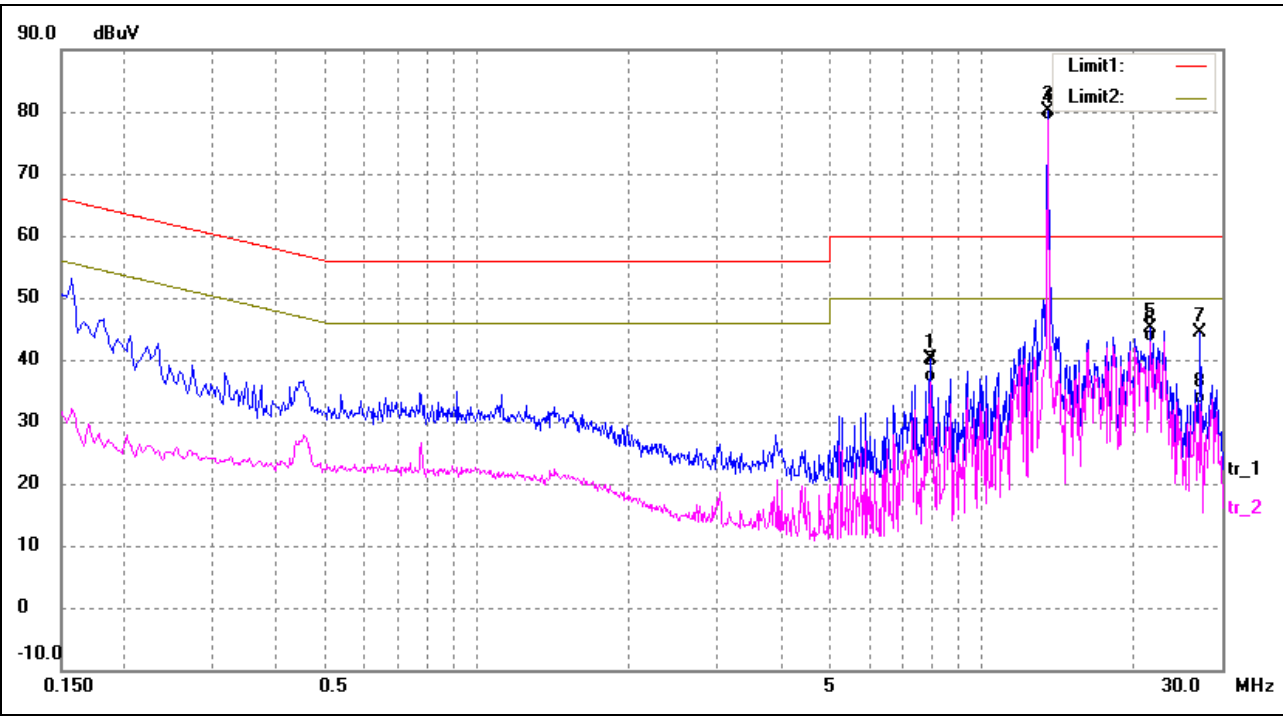
EUT: HF Reader
Tested Model: RD543
Operating Condition: 13.56MHz Transmitting
Comment: 120V/60Hz; Adapter DC 5V

Test Specification: Neutral



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	7.9220	28.30	11.83	40.13	60.00	-19.87	peak
2	7.9220	24.85	11.83	36.68	50.00	-13.32	AVG
3X	13.5580	67.97	11.00	78.97	Fundamental		peak
4*	13.5580	66.66	11.00	77.66			AVG
5	21.6620	33.17	12.00	45.17	60.00	-14.83	peak
6	21.6620	31.16	12.00	43.16	50.00	-6.84	AVG
7	27.1580	31.62	13.00	44.62	60.00	-15.38	peak
8	27.1580	20.19	13.00	33.19	50.00	-16.81	AVG

Test Specification: Line



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	7.9220	28.33	11.83	40.16	60.00	-19.84	peak
2	7.9220	24.51	11.83	36.34	50.00	-13.66	AVG
3X	13.5620	69.10	11.00	80.10	Fundamental		peak
4*	13.5620	67.54	11.00	78.54			AVG
5	21.6620	33.07	12.00	45.07	60.00	-14.93	peak
6	21.6620	30.92	12.00	42.92	50.00	-7.08	AVG
7	27.1580	31.35	13.00	44.35	60.00	-15.65	peak
8	27.1580	19.94	13.00	32.94	50.00	-17.06	AVG

***** END OF REPORT *****