

FCC Part 15C Measurement and Test Report

For

DewertOkin GmbH

Weststr. 1, 32278 Kirchlingern, Germany

FCC ID: O3YRF151A

FCC Rule(s):	<u>FCC Part 15.249</u>
Product Description:	<u>REMOTE CONTROL ECO</u>
Tested Model:	<u>RF151A</u>
Report No.:	<u>STR14078150I</u>
Tested Date:	<u>2014-08-06 to 2014-08-11</u>
Issued Date:	<u>2014-08-12</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: DewertOkin GmbH
Address of applicant: Weststr. 1, 32278 Kirchlengern, Germany

Manufacturer: Shenzhen C&D Electronics Co., Ltd
Address of manufacturer: Building 2, XiaYouSong Mountaintop Industrial District, YouSong Village, Longhua Town, BaoAn District, Shenzhen, Guangdong, China

General Description of EUT	
Product Name:	REMOTE CONTROL ECO
Trade Name:	
Model No.:	RF151A
Adding Model(s):	/
Rated Voltage:	DC 30V
Power Adapter Model:	/
<i>Note: The test data is gathered from a production sample, provided by the manufacturer.</i>	

Technical Characteristics of EUT	
Frequency Range:	2403-2480MHz
Max. Field Strength:	80.67dBuV/m
Data Rate:	1Mbps
Modulation:	GFSK
Quantity of Channels:	78
Channel Separation:	1MHz
Antenna Type:	PCB Antenna
Antenna Gain:	0dBi
Lowest Internal Frequency of EUT:	16MHz

1.2 Test Standards

The following report is prepared on behalf of the DewertOkin GmbH in accordance with FCC Part 15, Subpart B, Subpart C, and section 15.107, 15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.107, 15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

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

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, 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.

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 engineering mode to fix the Tx frequency 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	Low Channel	2403MHz
TM2	Middle Channel	2440MHz
TM3	High Channel	2480MHz
TM4	Operating	Simulate the normal operating condition

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

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
AC/DC Power Supply	C&D	CU258-2-75135	Z13100193461300456
Simulation control panel	C&D	PCB-A	/

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	Compliant
§ 15.209(a)(f)	Radiated Spurious Emissions	Compliant
§15.249(a)	Field Strength of Emissions	Compliant
§15.249(d)	Out of Band Emission	Compliant
§15.215 (c)	Emission Bandwidth	Compliant

3. Antenna Requirements

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 an integral 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 §15.249(a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field strength of fundamental (milli-volts/meter)	Field strength of Harmonics (micro-volts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

4.3 Test Equipment List and Details

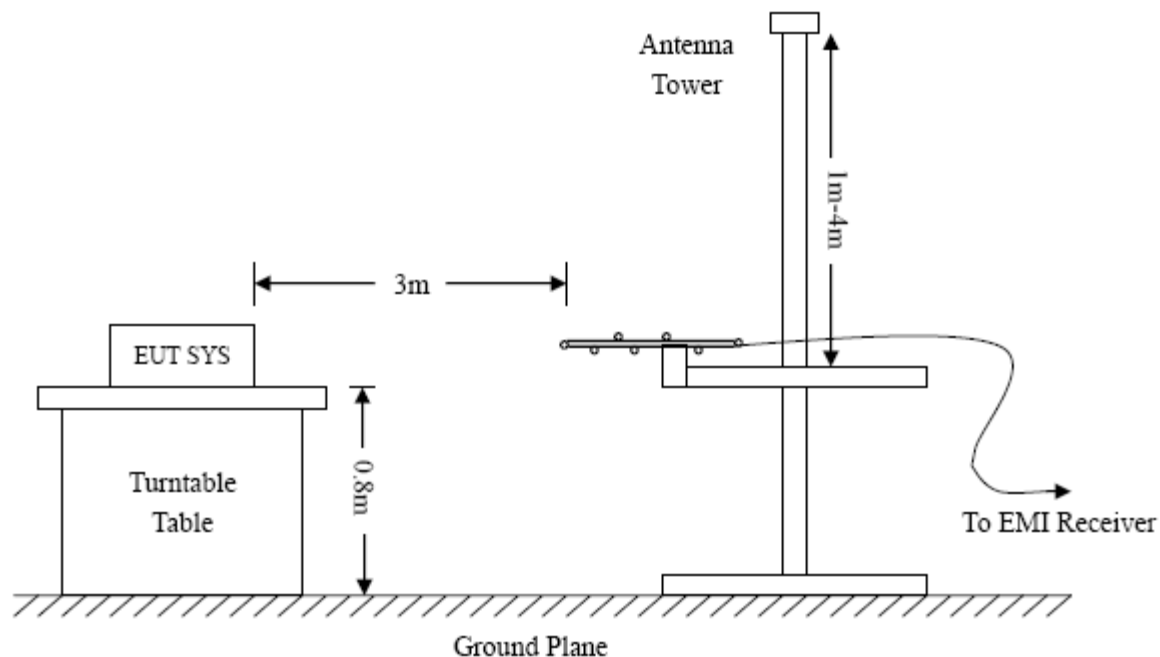
Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2014-05-28	2015-05-27
EMI Test Receiver	R&S	ESVB	825471/005	2014-05-28	2015-05-27
Pre-amplifier	Agilent	8447F	3113A06717	2014-05-28	2015-05-27
Pre-amplifier	Compliance Direction	PAP-0118	24002	2014-05-28	2015-05-27
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2014-05-24	2015-05-23
Horn Antenna	ETS	3117	00086197	2014-05-24	2015-05-23
Loop Antenna	SCHWARZECK	HFRA 5165	9365	2014-05-24	2015-05-23

4.4 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.205 15.249(a) 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.



Frequency :9kHz-30MHz

RBW=10KHz,

VBW =30KHz

Sweep time= Auto

Trace = max hold

Detector function = peak

Frequency :30MHz-1GHz

RBW=120KHz,

VBW=300KHz

Sweep time= Auto

Trace = max hold

Detector function = peak, QP

Frequency :Above 1GHz

RBW=1MHz,

VBW=3MHz(Peak), 10Hz(AV)

Sweep time= Auto

Trace = max hold

Detector function = peak, AV

4.5 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

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

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

4.6 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	60 %
ATM Pressure:	1012 mbar

4.7 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.249 standards, and had the worst margin of:

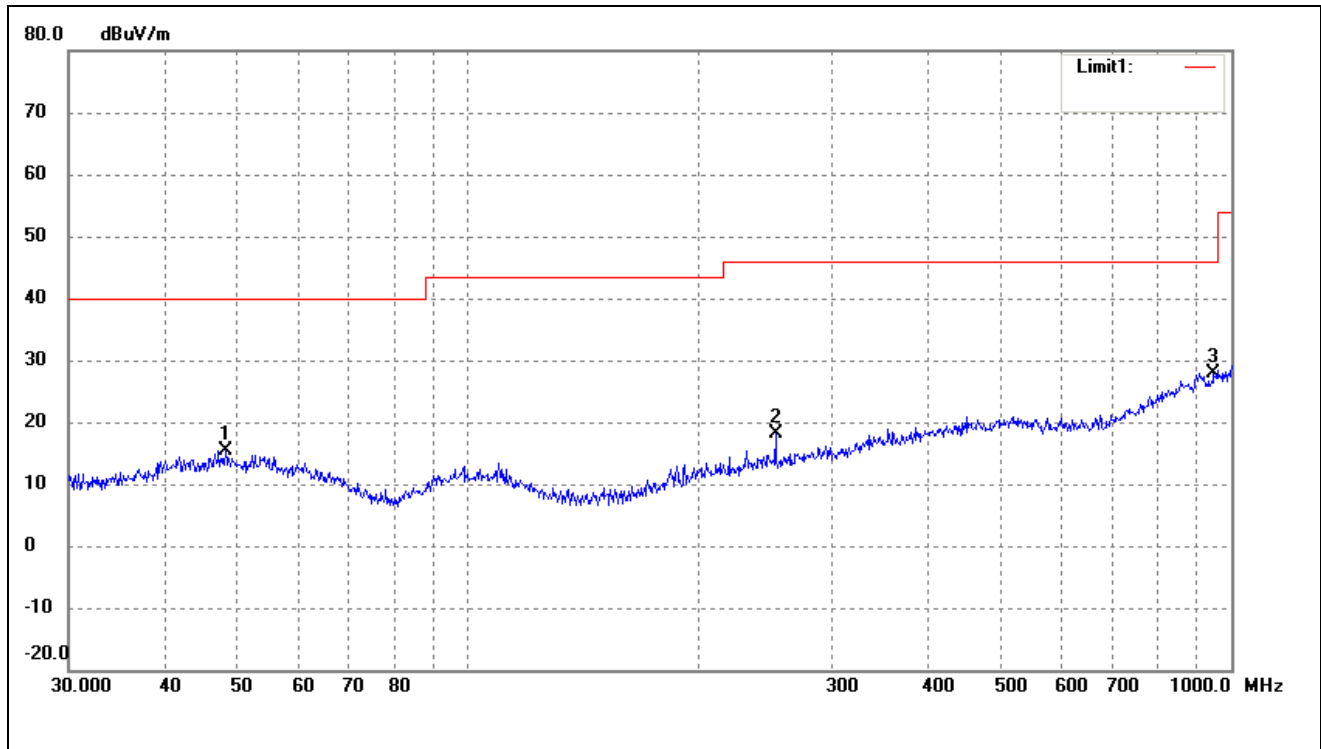
**-16.96 dB at 912.8620 MHz in the Horizontal polarization, Middle Channel of Antenna, 9 kHz to 25 GHz,
3Meters**

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

Plot of Radiated Emissions Test Data (30MHz to 1GHz)

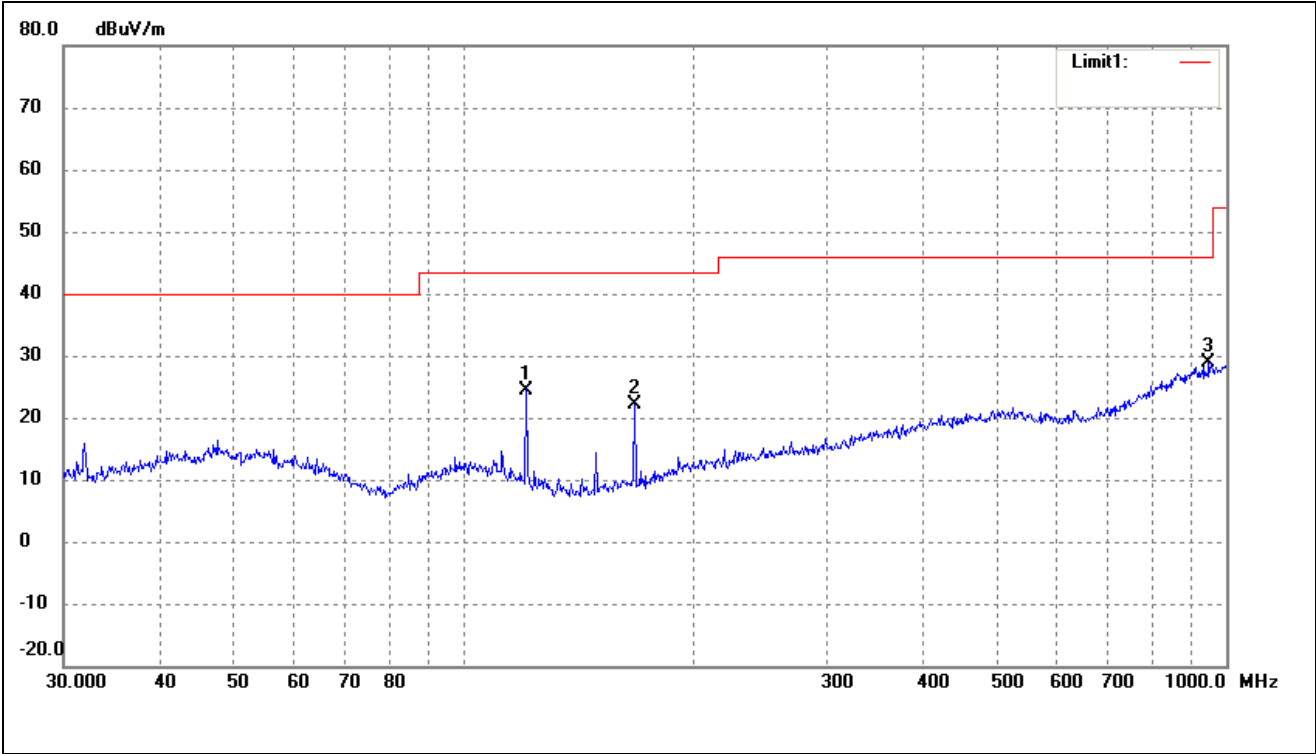
EUT: REMOTE CONTROL ECO
 Tested Model: RF151A
 Operating Condition: Transmitting Low Channel (2403MHz)
 Comment: DC 30V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (°)	Height (cm)	Remark
1	48.1626	22.85	-7.46	15.39	40.00	-24.61	200	100	peak
2	252.9482	25.44	-7.40	18.04	46.00	-27.96	120	200	peak
3	948.7610	21.99	5.92	27.91	46.00	-18.09	0	100	peak

Test Specification: Vertical

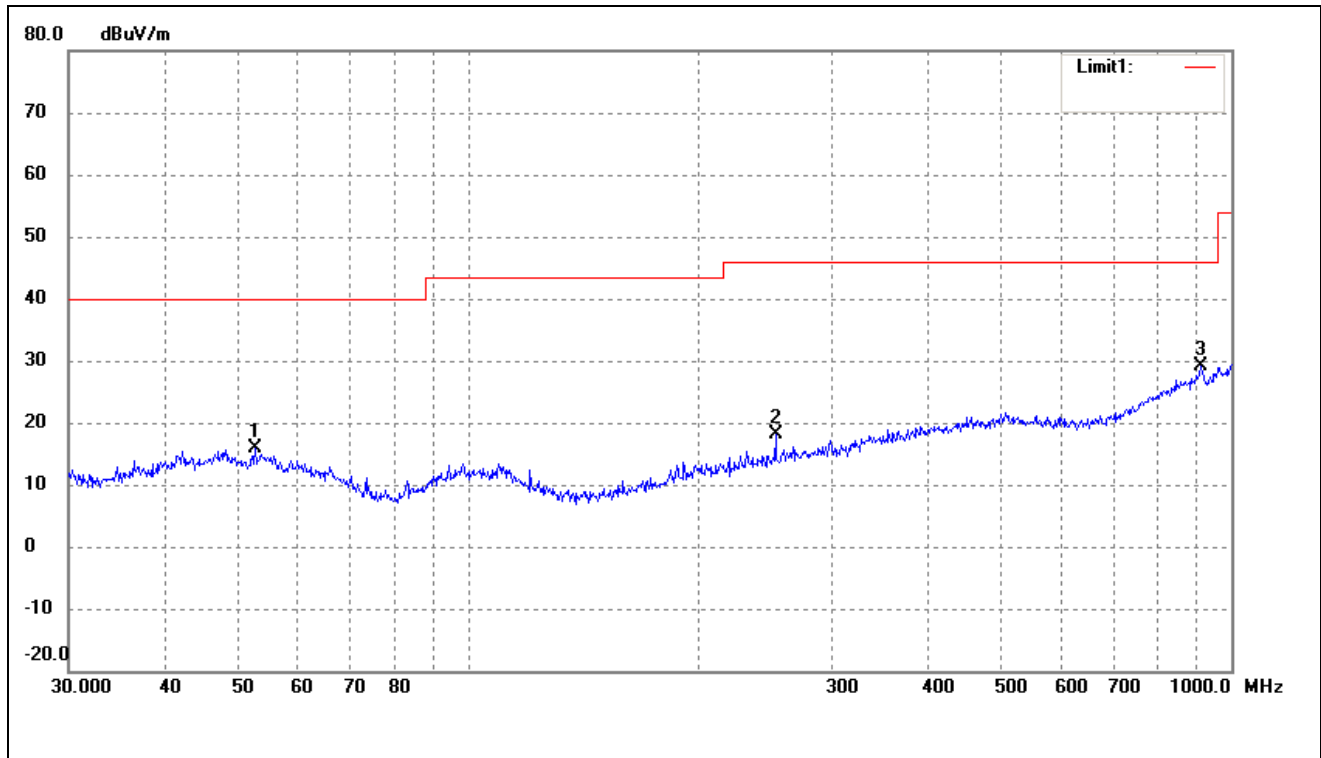


No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(°)	(cm)	
1	121.1231	35.93	-11.43	24.50	43.50	-19.00	240	100	peak
2	167.8243	34.03	-11.95	22.08	43.50	-21.42	180	100	peak
3	948.7610	22.99	5.92	28.91	46.00	-17.09	110	100	peak

Operating Condition: Transmitting Middle Channel (2440MHz)

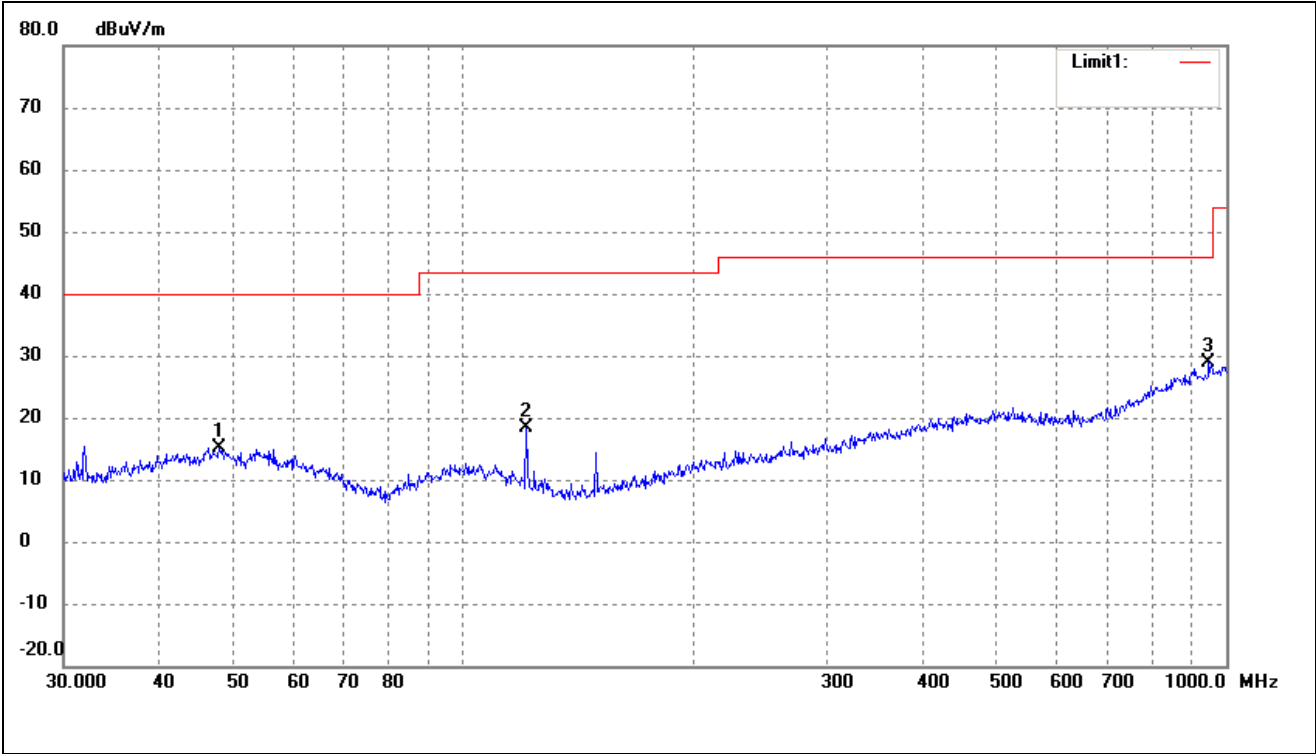
Comment: DC 30V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (°)	Height (cm)	Remark
1	52.5753	23.52	-7.71	15.81	40.00	-24.19	360	100	peak
2	252.9482	25.44	-7.40	18.04	46.00	-27.96	200	100	peak
3	912.8620	23.51	5.53	29.04	46.00	-16.96	0	100	peak

Test Specification: Vertical

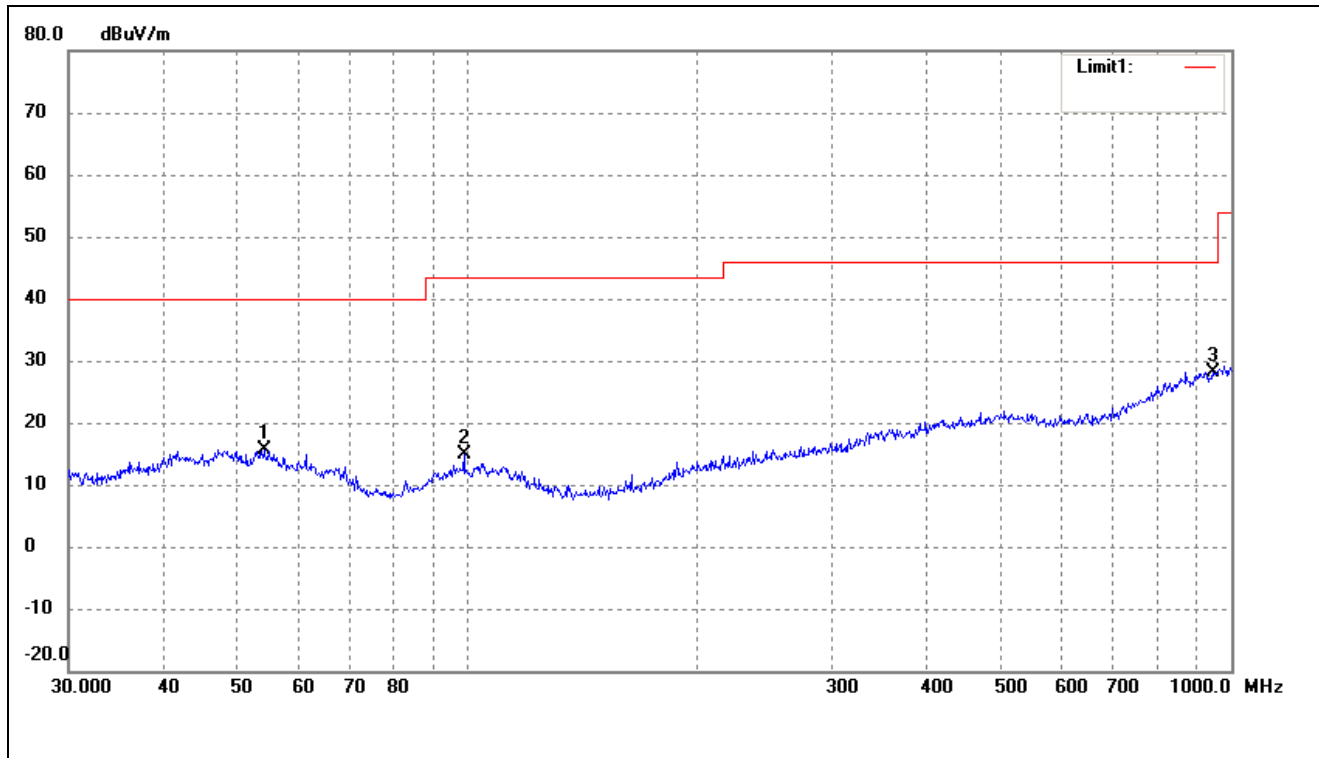


No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(°)	(cm)	
1	47.9940	22.66	-7.46	15.20	40.00	-24.80	240	100	peak
2	121.1231	29.89	-11.43	18.46	43.50	-25.04	187	100	peak
3	948.7610	22.99	5.92	28.91	46.00	-17.09	220	100	peak

Operating Condition: Transmitting High Channel (2480MHz)

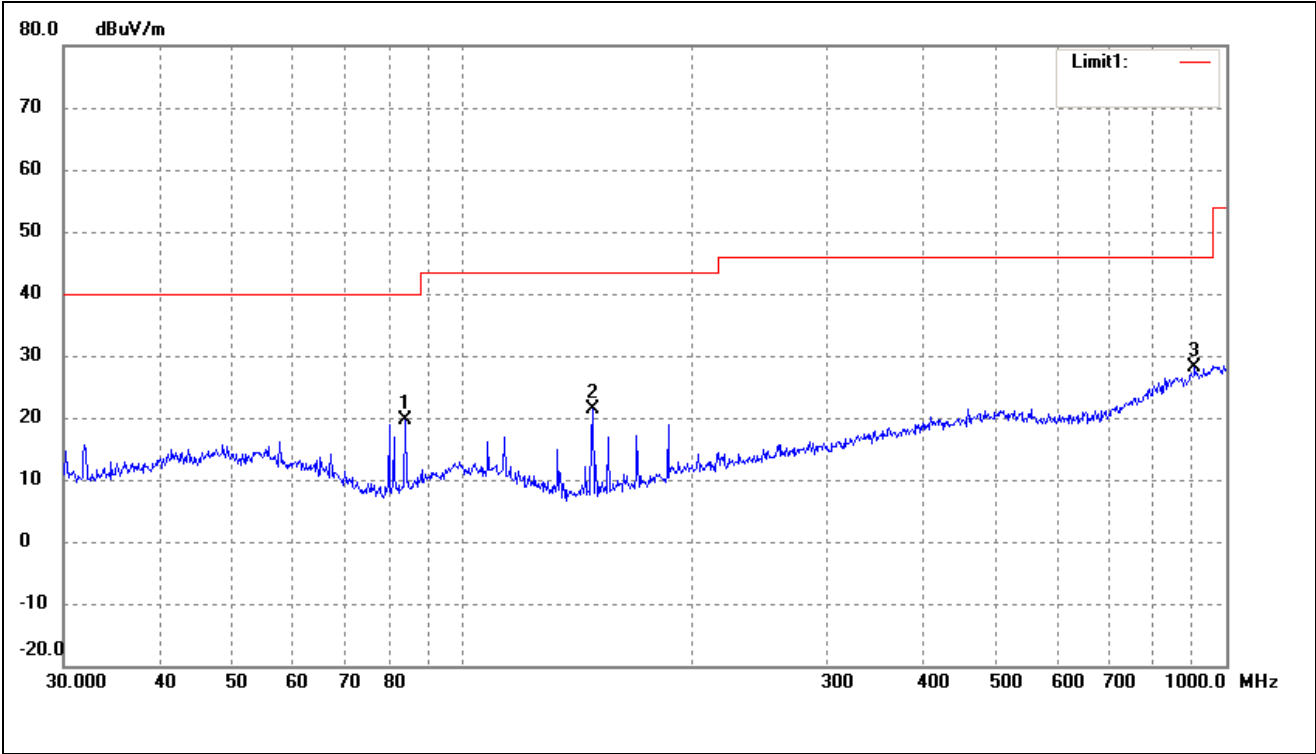
Comment: DC 30V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (°)	Height (cm)	Remark
1	54.0711	23.50	-7.85	15.65	40.00	-24.35	162	100	peak
2	98.8326	24.65	-9.70	14.95	43.50	-28.55	200	100	peak
3	945.4399	22.37	5.88	28.25	46.00	-17.75	0	100	peak

Test Specification: Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(°)	(cm)	
1	84.1100	32.30	-12.68	19.62	40.00	-20.38	240	100	peak
2	147.9214	34.40	-12.99	21.41	43.50	-22.09	180	100	peak
3	909.6667	22.62	5.49	28.11	46.00	-17.89	20	100	peak

Spurious Emissions Above 1GHz

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2403MHz							
2403.000	84.04	-3.51	80.53	114	-33.47	H	PK
2403.000	74.45	-3.51	70.94	94	-23.06	H	AV
4806.000	44.06	0.54	44.60	74	-29.40	H	PK
4806.000	32.36	0.54	32.90	54	-21.10	H	AV
7209.000	35.33	3.67	39.00	74	-35.00	H	PK
7209.000	23.50	3.67	27.17	54	-26.83	H	AV
2403.000	84.04	-3.51	80.53	114	-33.47	V	PK
2403.000	76.90	-3.51	73.39	94	-20.61	V	AV
4806.000	46.14	0.54	46.68	74	-27.32	V	PK
4806.000	31.74	0.54	32.28	54	-21.72	V	AV
7209.000	34.43	3.67	38.10	74	-35.90	V	PK
7209.000	23.06	3.67	26.73	54	-27.27	V	AV
Middle Channel-2440MHz							
2440.000	84.03	-3.43	80.60	114	-33.4	H	PK
2440.000	73.71	-3.43	70.28	94	-23.72	H	AV
4880.000	45.68	0.65	46.33	74	-27.67	H	PK
4880.000	31.60	0.65	32.25	54	-21.75	H	AV
7320.000	38.46	3.75	42.21	74	-31.79	H	PK
7320.000	25.75	3.75	29.50	54	-24.50	H	AV
2440.000	84.03	-3.43	80.60	114	-33.4	V	PK
2440.000	76.33	-3.43	72.90	94	-21.1	V	AV
4880.000	47.12	0.65	47.77	74	-26.23	V	PK
4880.000	31.77	0.65	32.42	54	-21.58	V	AV
7320.000	38.29	3.75	42.04	74	-31.96	V	PK
7320.000	25.83	3.75	29.58	54	-24.42	V	AV

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2480MHz							
2480.000	84.00	-3.33	80.67	114	-33.33	H	PK
2480.000	73.78	-3.33	70.45	94	-23.55	H	AV
4960.000	42.79	0.77	43.56	74	-30.44	H	PK
4960.000	31.01	0.77	31.78	54	-22.22	H	AV
7440.000	37.15	3.85	41.00	74	-33.00	H	PK
7440.000	26.35	3.85	30.20	54	-23.80	H	AV
2480.000	84.00	-3.33	80.67	114	-33.33	V	PK
2480.000	75.99	-3.33	72.66	94	-21.34	V	AV
4960.000	42.67	0.77	43.44	74	-30.56	V	PK
4960.000	31.14	0.77	31.91	54	-22.09	V	AV
7440.000	36.78	3.85	40.63	74	-33.37	V	PK
7440.000	26.24	3.85	30.09	54	-23.91	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The measurements greater than 20dB below the limit from 9kHz to 30MHz..

5. Out of Band Emissions

5.1 Standard Applicable

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

5.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2014-05-28	2015-05-27
EMI Test Receiver	R&S	ESVB	825471/005	2014-05-28	2015-05-27
Pre-amplifier	Agilent	8447F	3113A06717	2014-05-28	2015-05-27
Pre-amplifier	Compliance Direction	PAP-0118	24002	2014-05-28	2015-05-27
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2014-05-24	2015-05-23
Horn Antenna	ETS	3117	00086197	2014-05-24	2015-05-23

5.3 Test Procedure

As the radiation test, set the Lowest and Highest Transmitting Channel, observed the outside band of 2400MHz to 2483.5MHz, than mark the higher-level emission for comparing with the FCC rules.

5.4 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	60 %
ATM Pressure:	1012 mbar

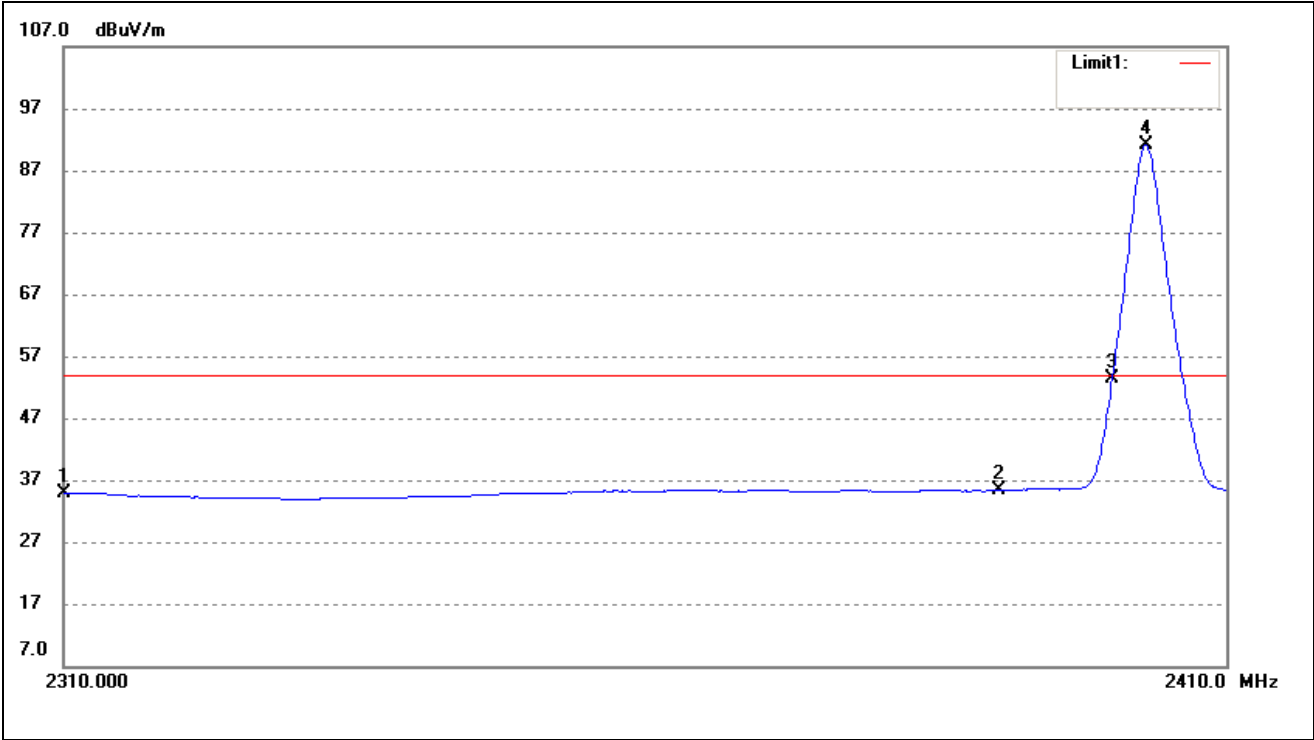
5.5 Summary of Test Results/Plots

Test mode	Frequency	Limit	Result
	MHz	dBuV / dBc	
Lowest	2310.00	<54 dBuV	Pass
	2390.00	<54 dBuV	Pass
	2400.00	<54 dBuV	Pass
Highest	2483.50	<54 dBuV	Pass
	2500.00	<54 dBuV	Pass

The edge emissions are below the FCC 15.209 Limits or complies with the 15.249 requirements.

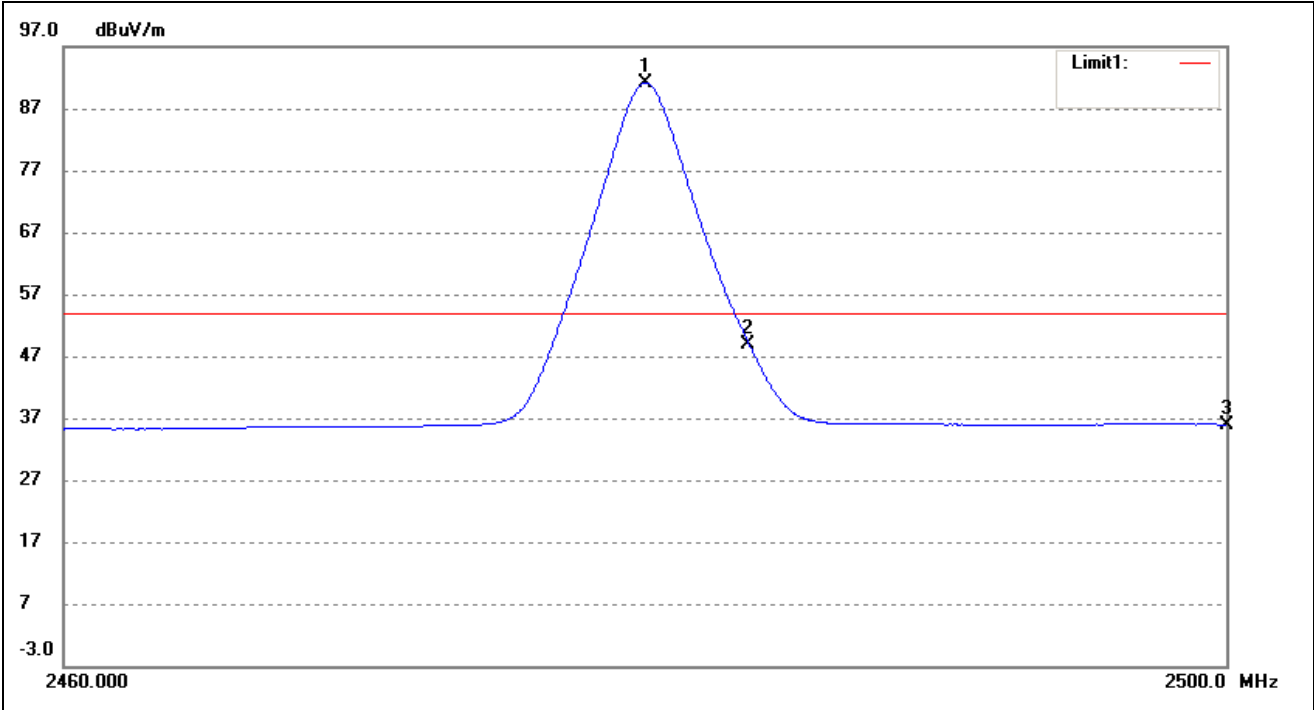
Please refer to the test plots as below.

The worst case (Horizontal)
Lowest Bandedge



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	18.57	16.34	34.91	54.00	-19.09	Ave Detector
	2310.000	31.57	16.34	47.91	74.00	-26.09	Peak Detector
2	2390.000	18.27	17.03	35.30	54.00	-18.70	Ave Detector
	2390.000	30.72	17.03	47.75	74.00	-26.25	Peak Detector
3	2400.000	36.39	17.11	53.50	54.00	-0.50	Ave Detector
	2400.000	39.31	17.11	56.42	74.00	-17.58	Peak Detector

The worst case (Horizontal)
Highest Bandedge



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2	2483.500	31.15	17.73	48.88	54.00	-5.12	Ave Detector
	2483.500	35.20	17.73	52.93	74.00	-21.07	Peak Detector
3	2500.000	18.15	17.85	36.00	54.00	-18.00	Ave Detector
	2500.000	30.52	17.86	48.38	74.00	-25.62	Peak Detector

6. Emission Bandwidth

6.1 Standard Applicable

According to 15.215 (c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

6.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2014-05-28	2015-05-27
Attenuator	ATTEN	ATS100-4-20	/	2014-05-28	2015-05-27

6.3 Test Procedure

According to the ANSI 63.4-2003, the emission bandwidth test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Set span = 1MHz, centered on a transmitting channel

RBW $\geq$ 1% 20dB Bandwidth, VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down and 99% bandwidth of the emission.

6.4 Environmental Conditions

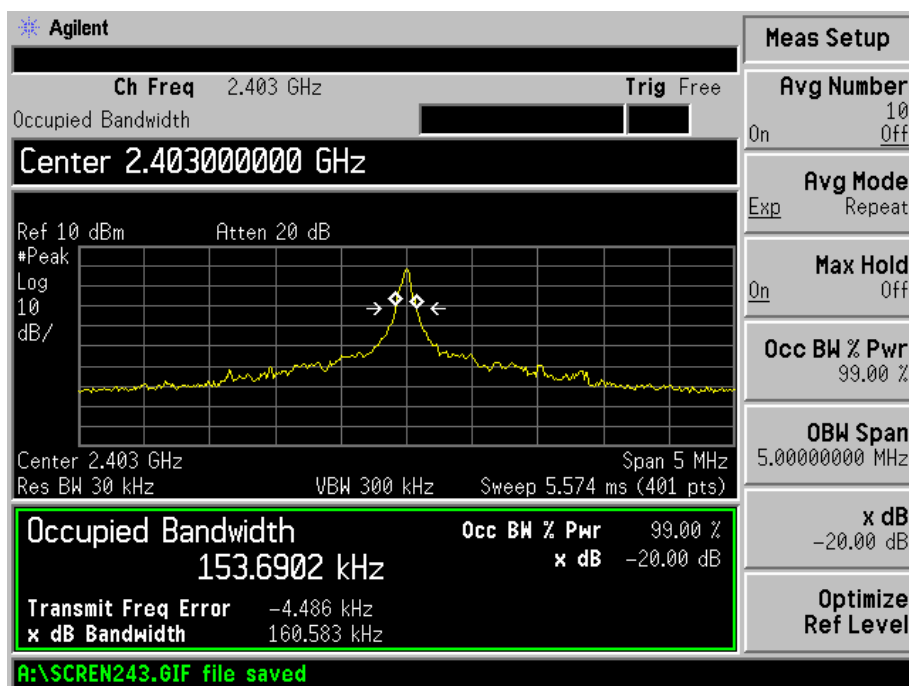
Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.5 Summary of Test Results/Plots

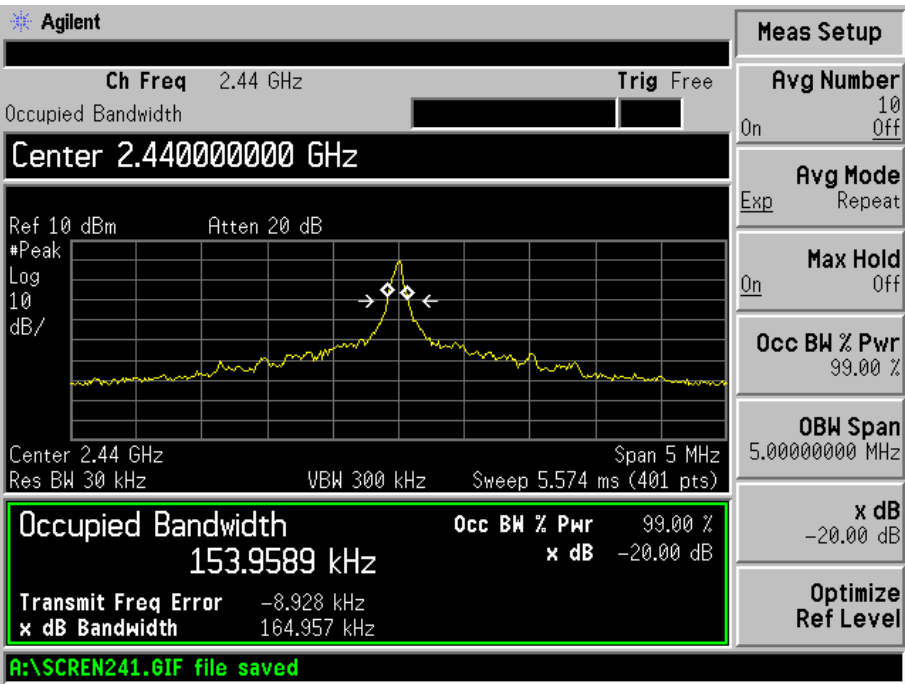
Channel	Frequency MHz	20dB Bandwidth kHz	99% Bandwidth kHz
Low Channel	2403	160.583	153.6902
Middle Channel	2440	164.957	153.9589
High Channel	2479	177.731	163.5885

Please refer to the following test plots

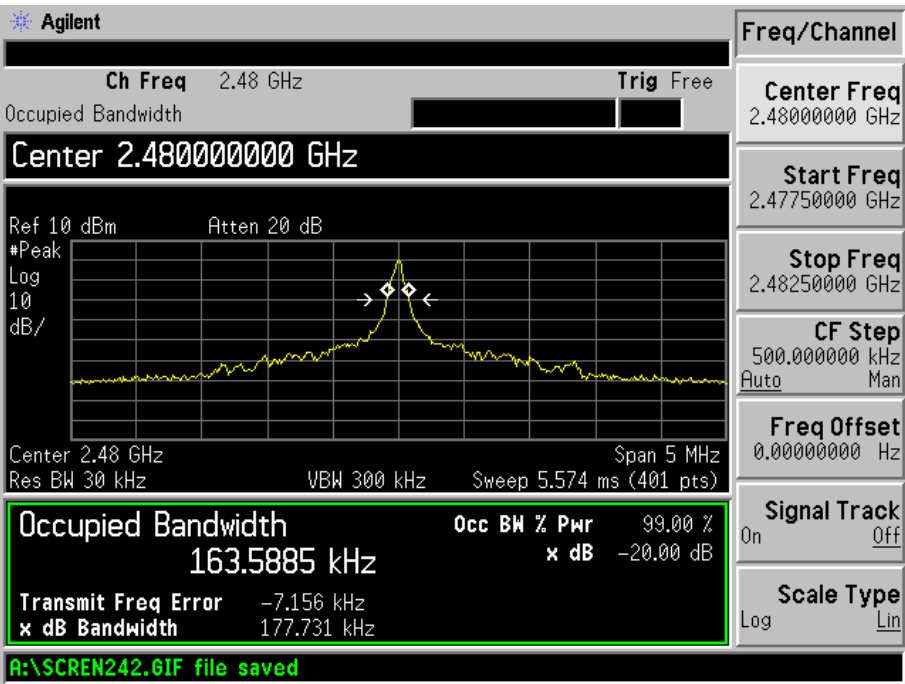
Low Channel:



Middle Channel:



High Channel:



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 Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2014-05-28	2015-05-27
L.I.S.N	Schwarz beck	NSLK8126	8126-224	2014-05-28	2015-05-27
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2014-05-28	2015-05-27

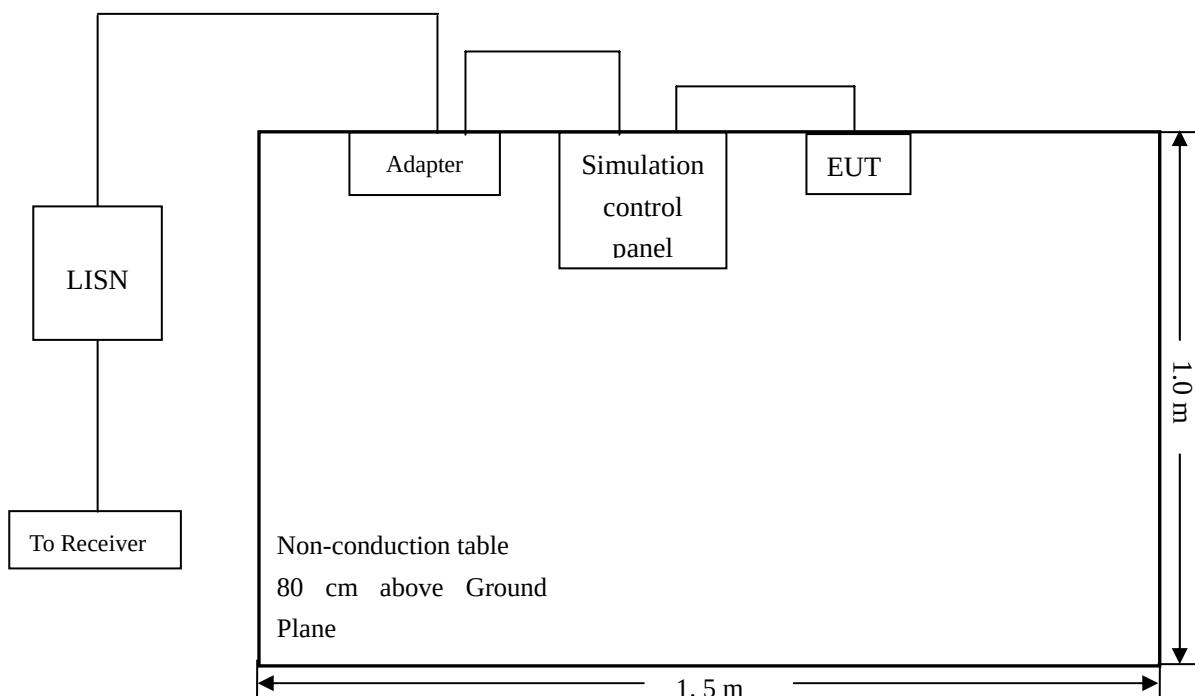
7.3 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 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.

7.4 Basic Test Setup Block Diagram



7.5 Environmental Conditions

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

7.6 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

7.7 Summary of Test Results/Plots

According to the data in section 12.8, the EUT complied with the FCC Part 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

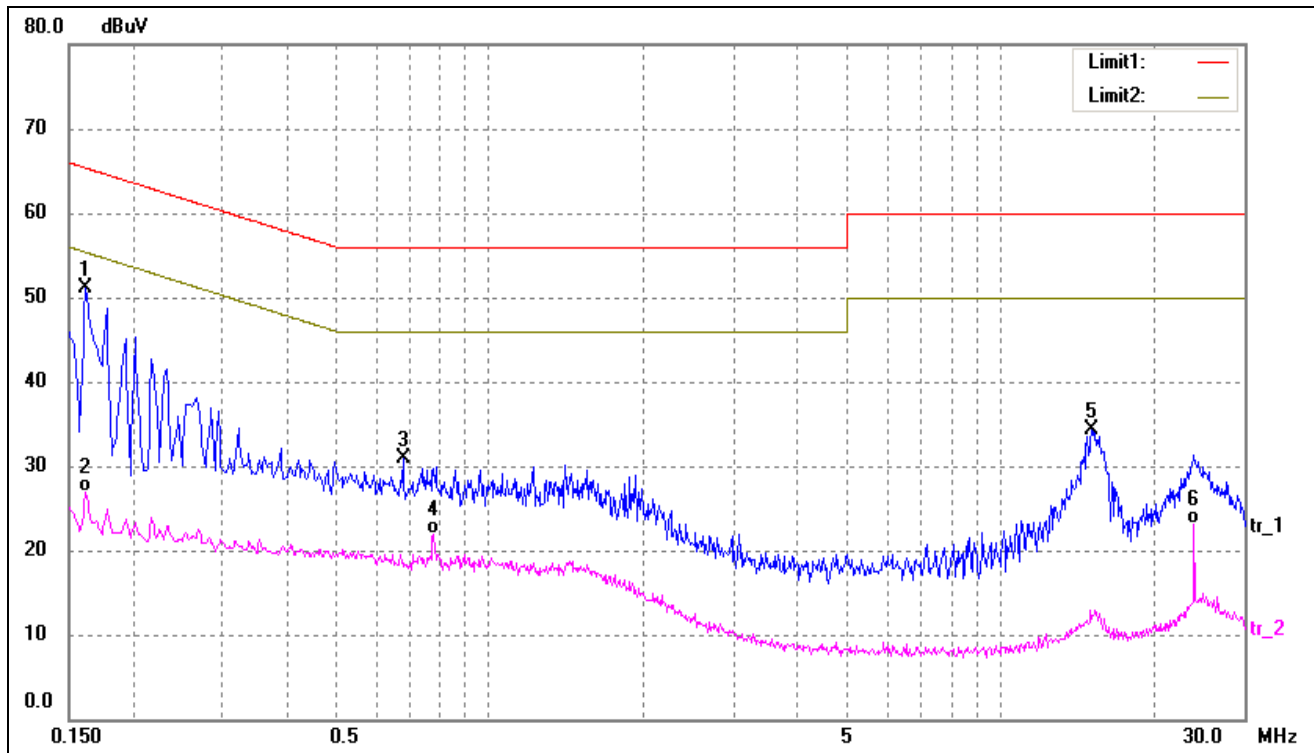
-14.25 dB at 0.1620 MHz in the Neutral mode, peak detector, 0.15-30MHz

7.8 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

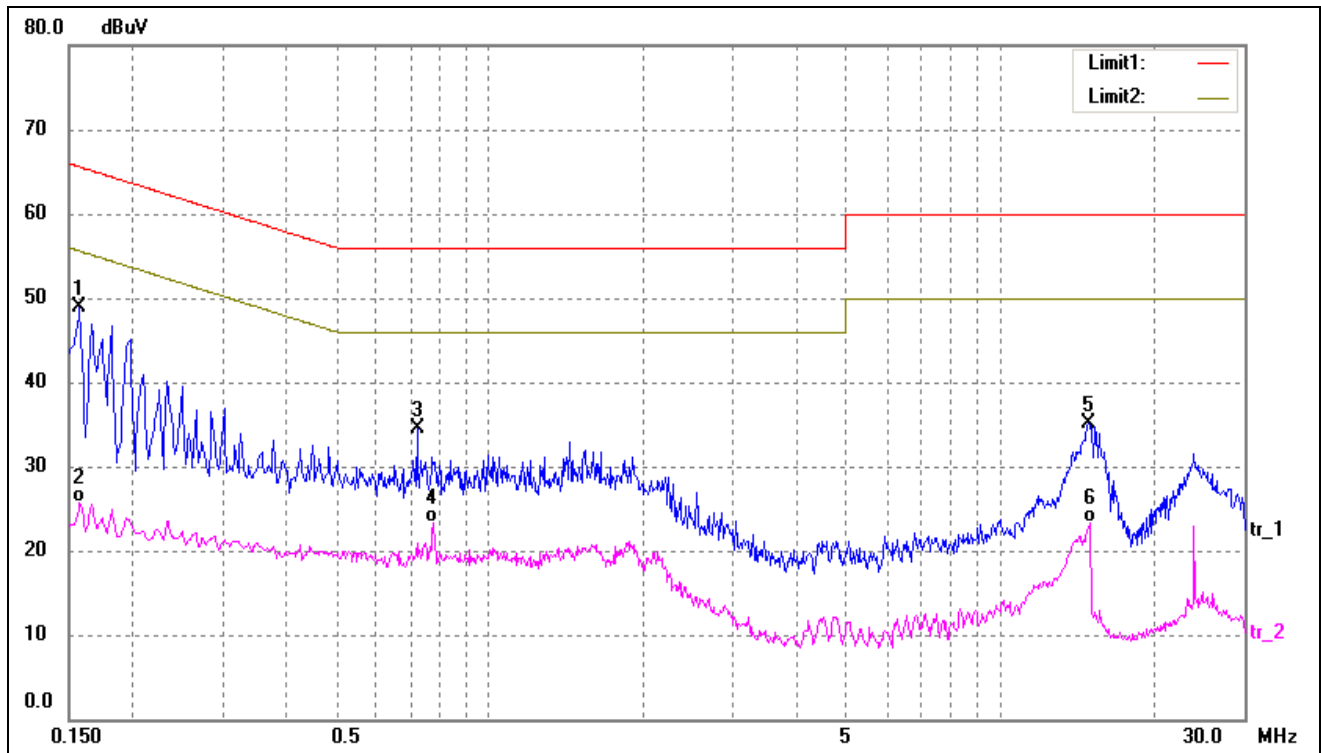
EUT: REMOTE CONTROL ECO
 Tested Model: RF151A
 Operating Condition: TM4
 Comment: AC 120V/60Hz; DC Power supply DC 30V

Test Specification: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1620	41.61	9.50	51.11	65.36	-14.25	peak
2	0.1620	17.35	9.50	26.85	55.36	-28.51	AVG
3	0.6780	21.15	9.68	30.83	56.00	-25.17	peak
4	0.7780	12.22	9.78	22.00	46.00	-24.00	AVG
5	15.1420	23.18	11.03	34.21	60.00	-25.79	peak
6	24.0020	10.49	12.67	23.16	50.00	-26.84	AVG

Test Specification: Line



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1580	39.35	9.50	48.85	65.57	-16.72	peak
2	0.1580	16.18	9.50	25.68	55.57	-29.89	AVG
3	0.7220	24.85	9.72	34.57	56.00	-21.43	peak
4	0.7780	13.44	9.78	23.22	46.00	-22.78	AVG
5	14.8900	24.03	10.98	35.01	60.00	-24.99	peak
6	15.0460	12.34	11.01	23.35	50.00	-26.65	AVG

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