Report No: 140815007GZU-001
Issued: 2014-09-22

TEST REPORT

Applicant Name & Address	:	Gree Electric Appliances, Inc. of Zhuhai Jinji West Road, Qianshan, Zhuhai, Guangdong 519070, P. R. China
Sample Description		
Product	:	Remote Controller
FCC ID	:	2ADAP-SAA1FB1F
Model No.	:	SAA1FB1F
Electrical Rating	:	DC 3V
Frequency	:	2.425GHz, 2.450GHz and 2.475GHz Transceiver
Date Received	:	15 Aug., 2014
Date Test Conducted	:	15 Aug., 2014 – 21 Sept., 2014
Test standards	:	**FCC Part 15: 2013**
Test Result	:	Pass
Conclusion	:	The submitted samples complied with the above rules/standards.
Remark	:	None.

**********End of Page**********

Prepared and Checked By:

Endy Ye
Endy Ye
Engineer
Intertek Guangzhou

Approved By:

Helen Ma *Signature*
Helen Ma
Sr. Project Engineer
Intertek Guangzhou
22 Sept., 2014 *Date*

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program. The test report only allows to be revised within three years from its original issued date unless further standard or the requirement was noticed.

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD Guangzhou, China
Tel / Fax: 86-20-8213 9688/86-20-3205 7538

CONTENT

1. General Description

1.1 Product Description

The equipment under test (EUT) is a transceiver remote controller of air conditioner at 2.425GHz, 2.450GHz and 2.475GHz. The EUT is powered by 2*1.5V/AAA battery. It sends the command of air conditioner function to the air conditioner.

Antenna Type: PCB antenna.
We tested the remote controller, model: SAA1FB1F, to determine if it was in compliance with the relevant FCC standards. We found that the unit met the requirements of FCC part 15.249 when tested as received. The worst case's test data was presented in this test report.

1.2 Related Submittal (s) / Grants

The FCC ID of corresponding transceiver for this transceiver is 2ADAP-CS532K.

1.3 Test Methodology

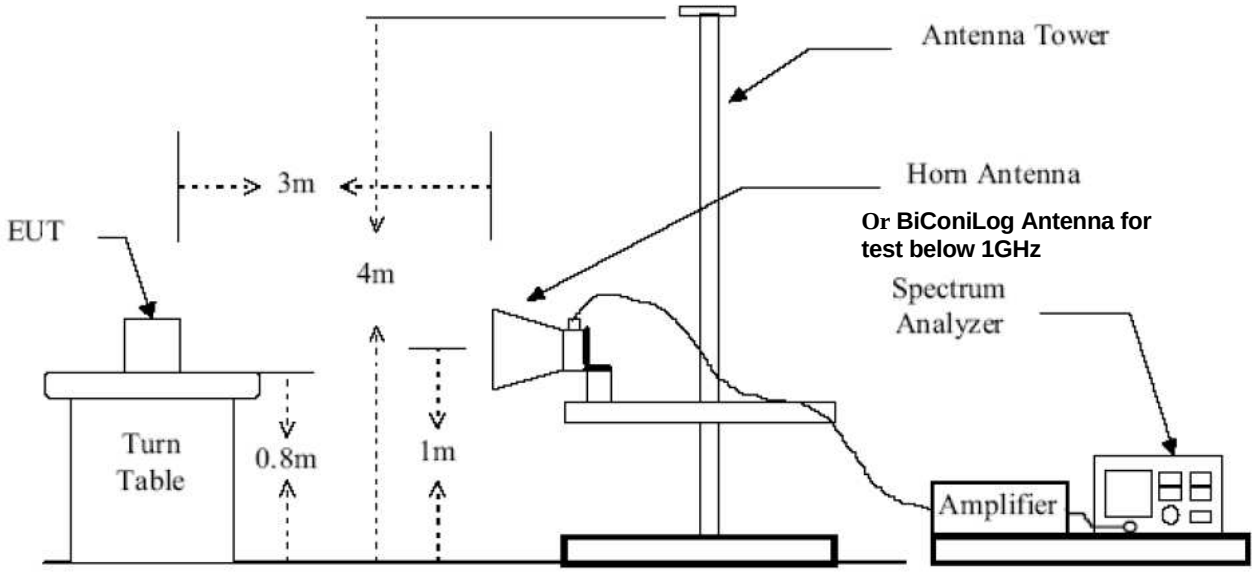
Radiated emission measurements were performed according to the procedures in ANSI C63.10:2009. Radiated emission measurement was performed in semi-anechoic chamber room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

All of the tests are performed at:
Intertek Testing Services Shenzhen Ltd. Guangzhou Branch.
Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD Guangzhou, China 510663.

This test facility and site measurement data have been fully placed on file with the FCC, test firm registration number is 549654.

Test setup figure



Test setup figure

1.5 Measurement Uncertainty

Radiated Emission: 3.79dB in the frequency range of 30MHz-200MHz, 3.62dB in the frequency range of 200MHz-1000MHz, 5.04dB in the frequency above 1GHz at a level of confidence of 95%. When determining the test conclusion, the Measurement Uncertainty of test has been considered.

2. System Test Configuration

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10:2009

The EUT was powered by 2*1.5V/AAA battery in the testing.

Type of modulation: GFSK modulation, and only the worst data was reported in this report.

The unit was operated standalone and placed in the center of the turntable.

For maximizing emissions, the unit was placed in the center of the turntable, and the turntable was rotated through 360°, the antenna hei ght was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Chapter 3.

2.2 EUT Exercising Software

There was no special software to exercise the device.

2.3 Special Accessories

No special accessories used.

2.4 Equipment Modification

Any modifications installed previous to testing by Gree Electric Appliances, Inc. of Zhuhai will be incorporated in each production model sold/leased in the United States. No modifications were installed by Intertek Testing Services Shenzhen Ltd. Guangzhou Branch.

2.5 Support Equipment List and Description

N/A

3. Summary of Test Results

FCC Rules	Description of Test	Result
15.203	Antenna Requirement	Pass
15.207	Disturbance Voltage at the Mains Terminals	N/A
15.249	Radiated Emission	Pass
15.249	Band Edges Measurement	Pass

Remark: When determining the test results, measurement uncertainty of tests has been considered.

3.1 Antenna Requirement

The EUT Antenna Type: PCB antenna.

3.2 Conducted Emission

The EUT is battery operating device, the conducted emission is unnecessary.

3.3 Radiated Emission

Data is included worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

3.3.1 Radiated Emission Limits

According to FCC 15.249, operating within the bands 2400-2483.5 MHz, the field strength of emissions from intentional radiators operated within this frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
2400 - 2483.5	50	500

3.3.2 Test Setup

Reference 1.4

3.3.3 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD
→ FS = RA + Correct Factor

Where FS = Peak Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
Correct Factor = AF + CF – AG + PD

Unless otherwise specified, e.g. § 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the average value of field strength shall be determined by:

Average value = Peak value + Average factor

3.3.4 Radiated Emission Test Data

Radiated Emissions (Below 1GHz)

Operation mode: Transmitting Operation Frequency: 2425MHz

Pursuant to FCC 15.209: Emissions Requirement (30MHz-1GHz)

Antenna Polarization	Frequency [MHz]	Measured Net at 3m [dB(μV/m)]	Limit at 3m [dB(μV/m)]
Horizontal	36.761	20.77	40.0
Horizontal	42.933	21.01	40.0
Horizontal	97.312	20.81	43.5
Vertical	36.173	20.01	40.0
Vertical	48.518	19.81	40.0
Vertical	109.217	22.02	43.5

Operation mode: Transmitting Operation Frequency: 2450MHz

Pursuant to FCC 15.209: Emissions Requirement (30MHz-1GHz)

Antenna Polarization	Frequency [MHz]	Measured Net at 3m [dB(μV/m)]	Limit at 3m [dB(μV/m)]
Horizontal	34.115	19.40	40.0
Horizontal	49.988	19.88	40.0
Horizontal	100.252	19.98	43.5
Vertical	39.112	20.50	40.0
Vertical	46.902	20.42	40.0
Vertical	106.130	21.86	43.5

Operation mode: Transmitting Operation Frequency: 2475MHz

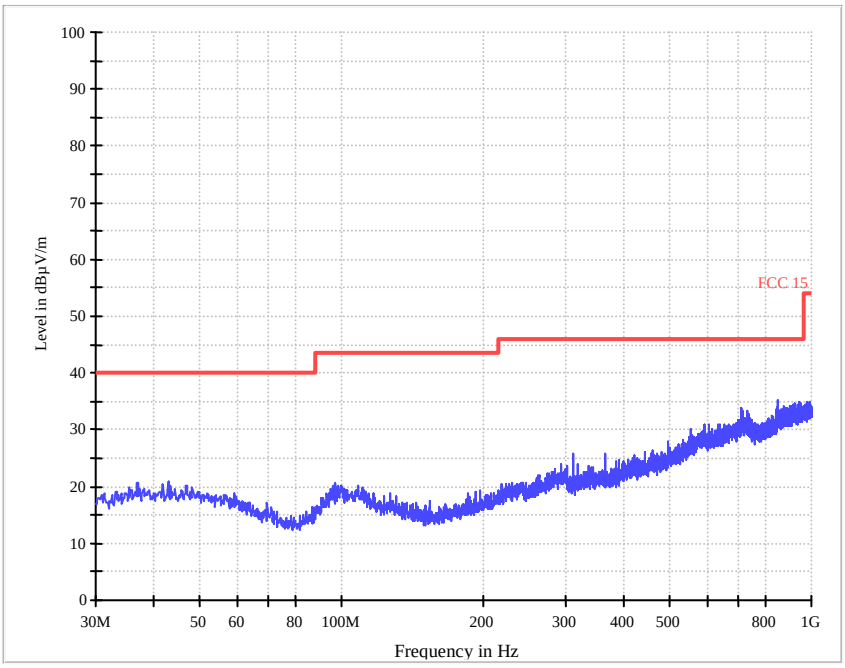
Pursuant to FCC 15.209: Emissions Requirement (30MHz-1GHz)

Antenna Polarization	Frequency [MHz]	Measured Net at 3m [dB(µV/m)]	Limit at 3m [dB(µV/m)]
Horizontal	42.786	19.43	40.0
Horizontal	59.247	19.03	40.0
Horizontal	101.868	20.37	43.5
Vertical	38.524	19.53	40.0
Vertical	48.371	19.89	40.0
Vertical	101.280	20.16	43.5

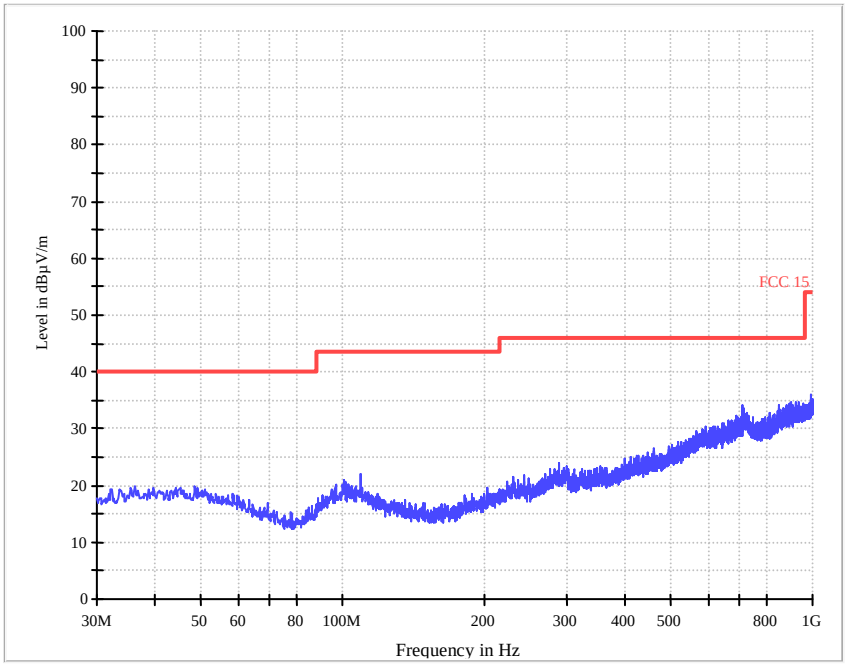
3.3.5 Test Curve

Operation mode: Transmitting Operation Frequency: 2425MHz

Horizontal:

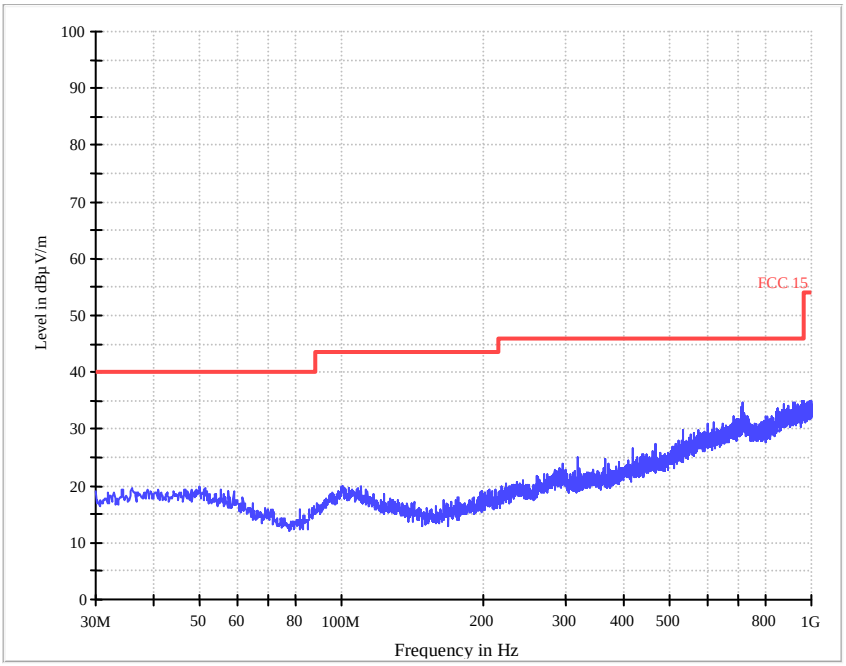


Vertical:

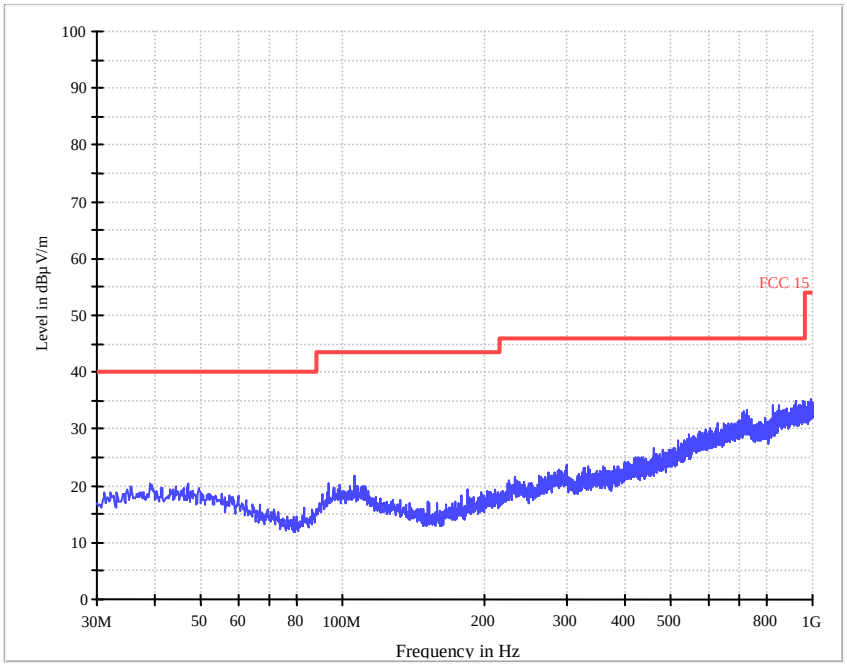


Operation mode: Transmitting Operation Frequency: 2450MHz

Horizontal:

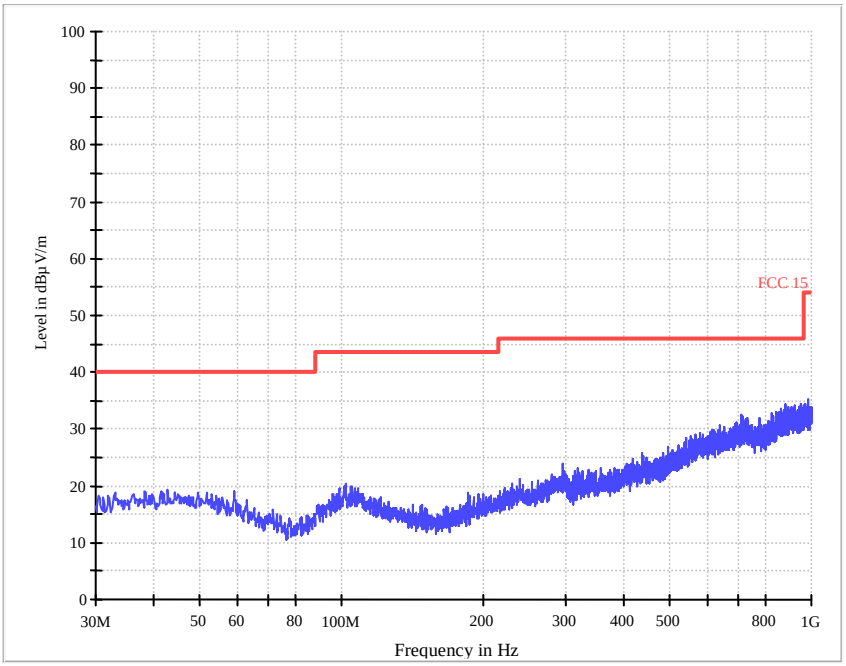


Vertical:

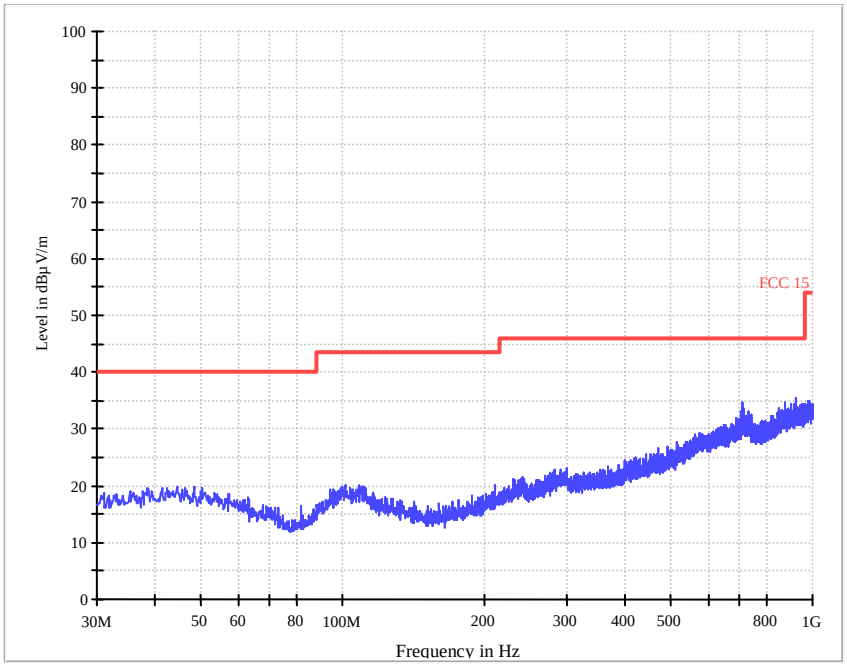


Operation mode: Transmitting Operation Frequency: 2475MHz

Horizontal:



Vertical:



Radiated Emissions (Above 1GHz)

Operation Frequency: 2425MHz

Pursuant to FCC 15.249: Emissions Requirement(1GHz-25GHz)

Polarization	Frequency (MHz)	PK Reading (dBµV)	Correction Factor (dB)	PK Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2423.750	72.4	-7.7	64.7	94.0	-29.3
Horizontal	4847.500	42.5	-0.7	41.8	54.0	-12.2
Horizontal	7271.250	35.4	7.4	42.8	54.0	-11.2
Vertical	2423.750	73.2	-7.7	65.5	94.0	-28.5
Vertical	4850.500	44.2	-0.7	43.5	54.0	-10.5
Vertical	7275.125	40.1	7.4	47.5	54.0	-6.5

Operation Frequency: 2450MHz

Pursuant to FCC 15.249: Emissions Requirement(1GHz-25GHz)

Polarization	Frequency (MHz)	PK Reading (dBµV)	Correction Factor (dB)	PK Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2449.250	71.3	-7.7	63.6	94.0	-30.4
Horizontal	4899.375	43.5	-0.7	42.8	54.0	-11.2
Horizontal	7336.750	37.5	7.4	44.9	54.0	-9.1
Vertical	2449.250	76.5	-7.7	68.8	94.0	-25.2
Vertical	4899.375	45.2	-0.7	44.5	54.0	-9.5
Vertical	7349.500	39.1	7.4	46.5	54.0	-7.5

Operation Frequency: 2475MHz

Pursuant to FCC 15.249: Emissions Requirement(1GHz-25GHz)

Polarization	Frequency (MHz)	PK Reading (dBµV)	Correction Factor (dB)	PK Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2474.750	70.6	-7.7	62.9	94.0	-31.1
Horizontal	4950.375	43.2	-0.7	42.5	54.0	-11.5
Horizontal	7421.750	37.2	7.4	44.6	54.0	-9.4
Vertical	2474.750	71.2	-7.7	63.5	94.0	-30.5
Vertical	4950.375	42.3	-0.7	41.6	54.0	-12.4
Vertical	7426.000	39.7	7.4	47.1	54.0	-6.9

Notes: 1. AT frequencies equal to or less than 1000MHz, quasi-peak detector was used, above 1000MHz, Peak detector was used.

2. All measurements were made at 3 meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna is used for the emission over 1000MHz.

3.4 Bandedges Measurement

3.4.1 Limited of the bandedges measurement

Sec15.249:
(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 Section 15.209, whichever is the lesser attenuation.

(e) As shown in Section 15.35(b), for frequencies above 1000 MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

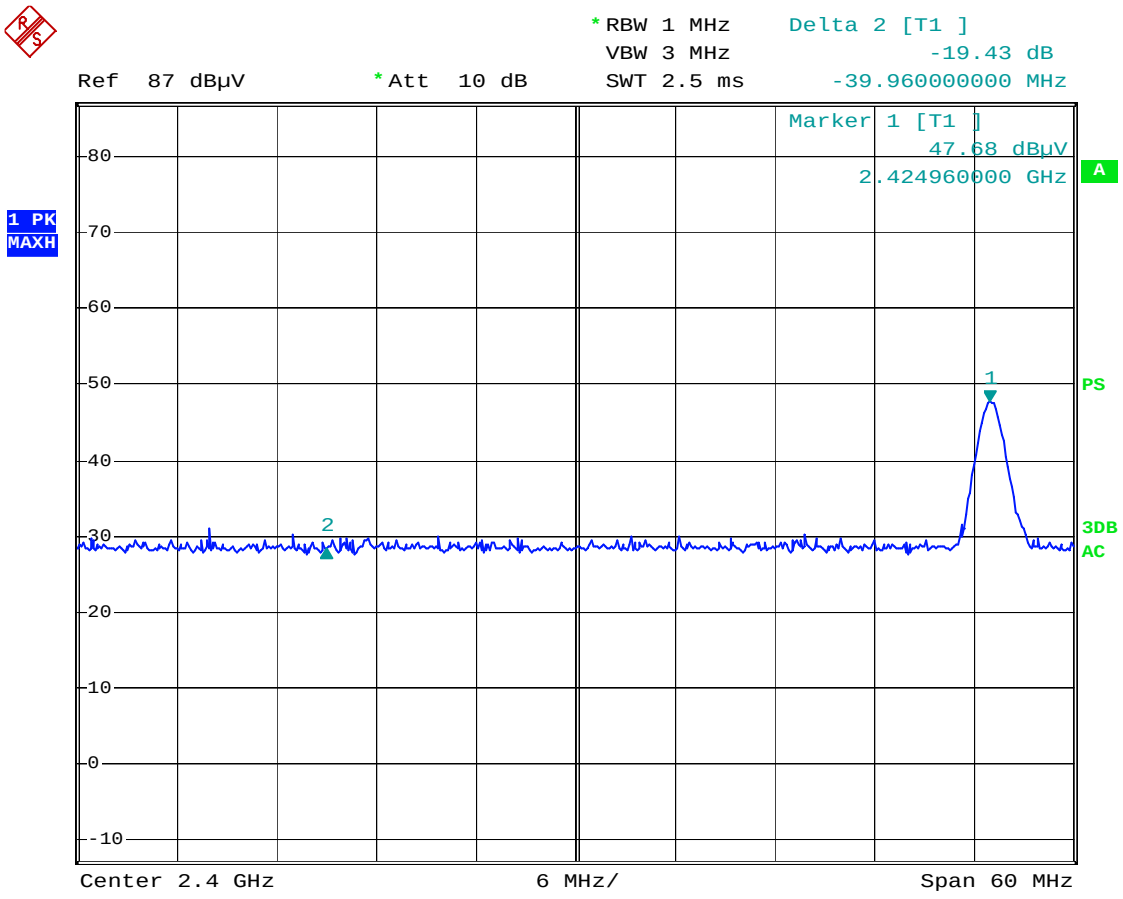
Sec15.215:
(c) Intentional radiators operating under the alternative provisions to the general emission limites, as contained in § §15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20dB bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

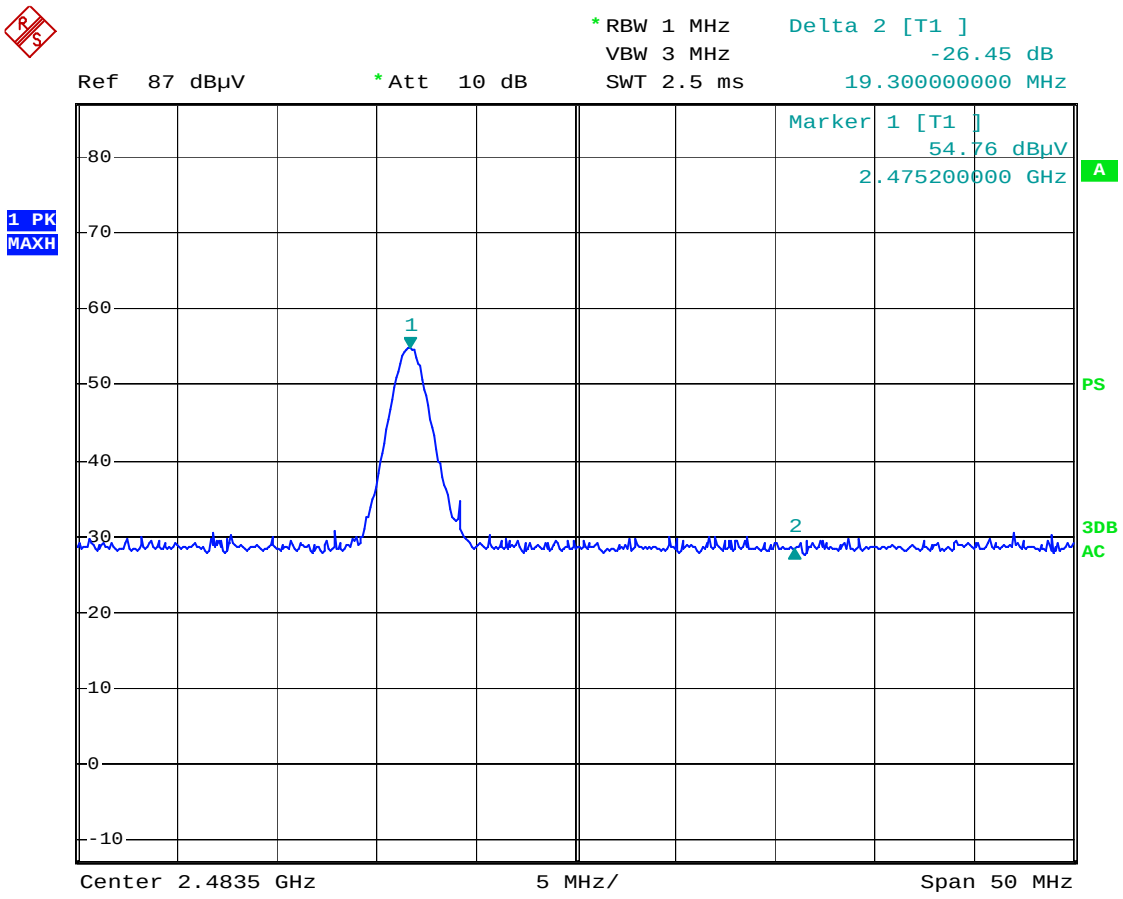
3.4.2 Test Setup

Refer to 1.4

3.4.3 Test Plot

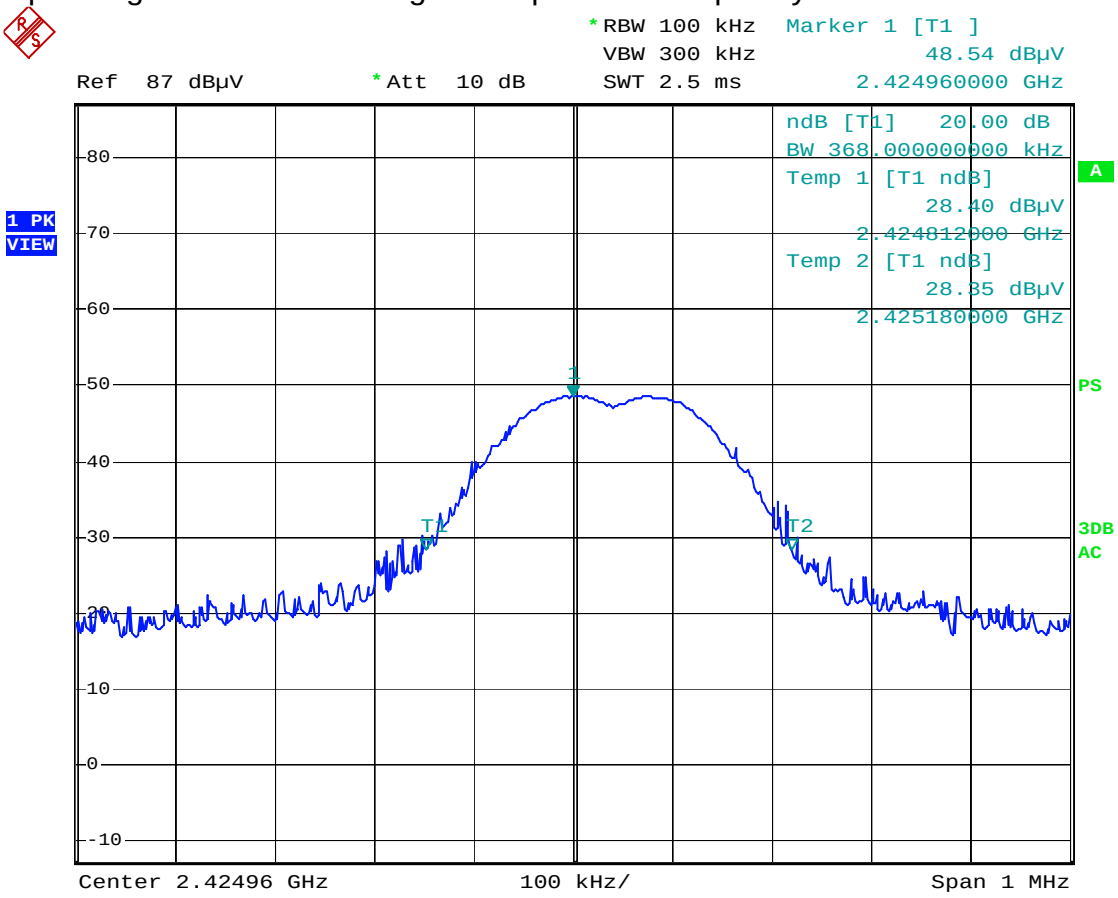
Frequency Bands
Operating mode: Transmitting



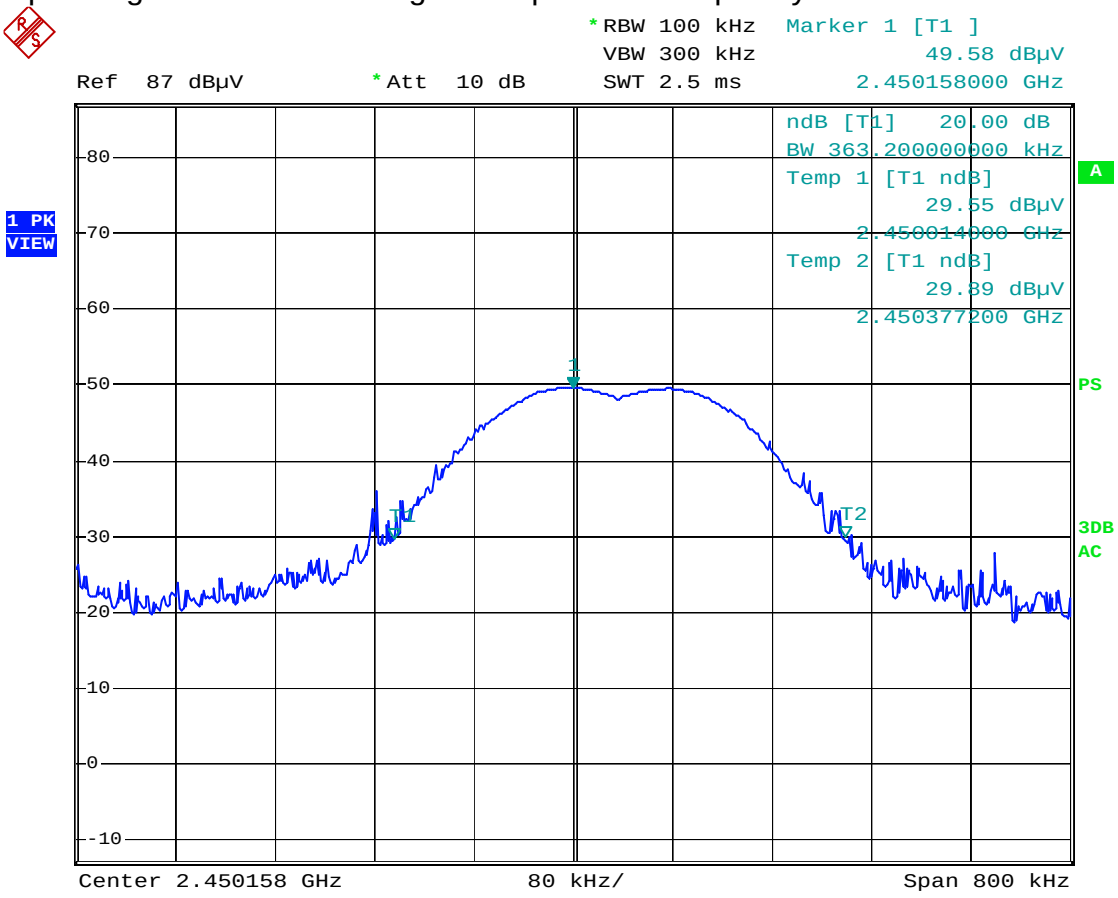

*RBW 1 MHz
VBW 3 MHz
SWT 2.5 ms
Delta 2 [T1]
-26.45 dB
19.300000000 MHz
Ref 87 dBµV
*Att 10 dB
Marker 1 [T1]
54.76 dBµV
2.475200000 GHz
1 PK
MAXH
A
PS
3DB
AC
80
70
60
50
40
30
20
10
0
-10
Center 2.4835 GHz
5 MHz/
Span 50 MHz

Modulation Bandwidth

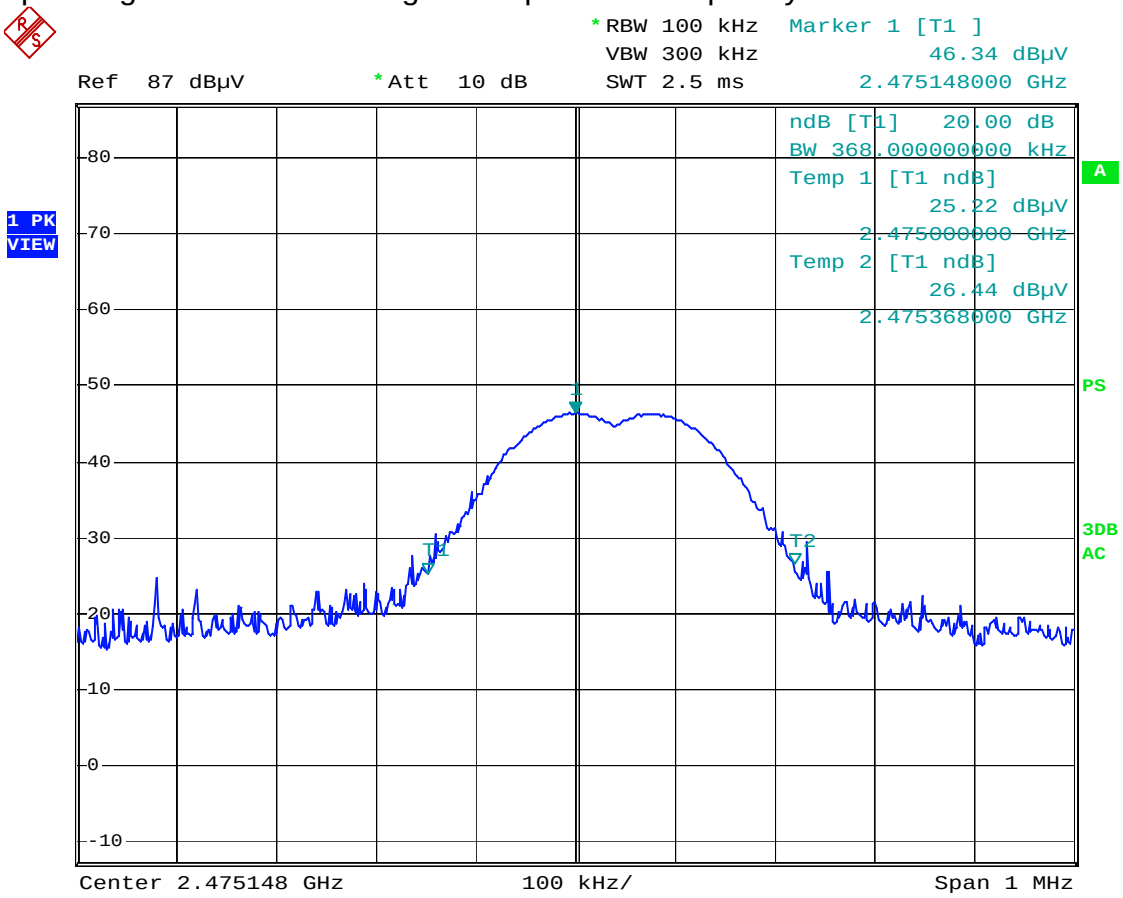
Operating mode: Transmitting Operation Frequency: 2425MHz



Operating mode: Transmitting Operation Frequency: 2450MHz



Operating mode: Transmitting Operation Frequency: 2475MHz



3.4.4 Test Result

From the plot, the field strength of any emissions outside of the specified frequency band are attenuated to the general radiated emission limits in section 15.209. It fulfils the requirement of 15.249(d).

Peak Measurement

Bandedge compliance is determined by applying marker-delta method, i.e (Bandedge Plot).

(i) Lower bandedge:

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

= 65.50dBµv/m – 19.43dB
= 46.07dBµv/m

(ii) Upper bandedge:

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

= 63.50dBµv/m – 26.45dB
= 37.05dBµv/m

The Peak resultant field strength meets the general radiated emission AV limit in section 15.209, so it complies with the requirement.

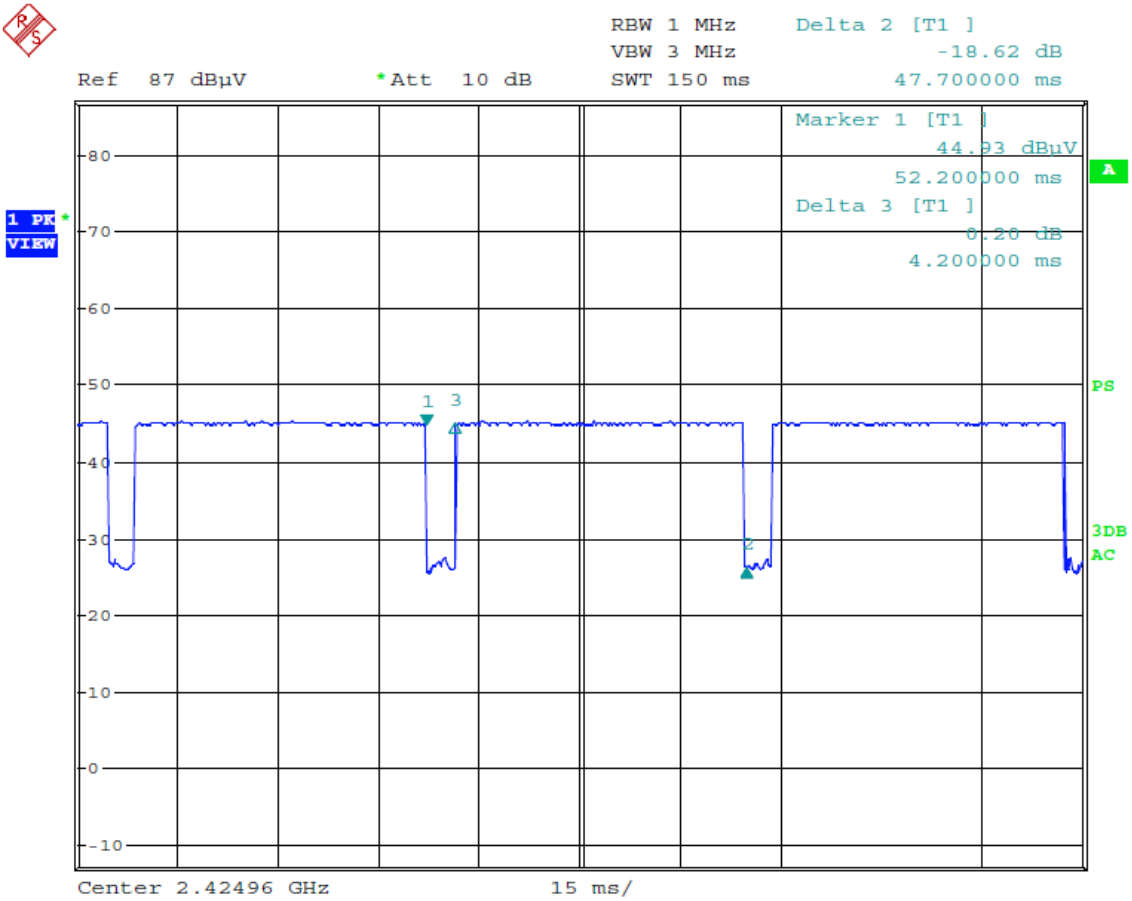
3.4.5 Transmitter Duty Cycle Calculation FCC Rule 15.35(b, c)

Averaging factor in dB = 20 log (duty cycle)

The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured is 100 milliseconds, or the repetition cycle, whichever is a shorter time frame. The worst case (highest percentage on) duty cycle is used for the calculation. The duty cycle is measured by placing the spectrum analyzer in zero scan (receiver mode) and linear mode at maximum bandwidth (1 MHz at 3 dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

A plot of the worst-case duty cycle as detected in this manner is shown below.



The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 47.700ms
Effective period of the cycle = 43.500ms

DC =43.500/47.700=0.91195 or 91.195%

Therefore, the averaging factor is found by 20lg0.91195=-0.80dB

4. Equipment List

Equipment No.	Equipment	Model	Manufacturer	Cal. Due date (YYYY-MM-DD)	Calibration Interval
EM030-01	3m Semi-Anechoic Chamber	9×6×6 m^3	ETS•LINDGREN	2015-04-02	1Y
EM030-02	Control room for 3m Semi-Anechoic Chamber	4×4×3 m^3	ETS•LINDGREN		
EM031-02	EMI Test Receiver (9 kHz~7 GHz)	R&S ESR7	R&S	2015-06-03	1Y
EM031-03	Signal and Spectrum Analyzer (10 Hz~40 GHz)	R&S FSV40	R&S	2015-06-03	1Y
EM011-04	Loop antenna (9 kHz-30 MHz)	HFH2-Z2	R&S	2015-05-25	1Y
EM061-03	TRILOG Super Broadband test Antenna (30 MHz-1.5 GHz）	VULB 9161	SCHWARZBECK	2015-05-25	1Y
EM033-02	Bouble-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)	R&S HF907	R&S	2015-05-25	1Y
EM031-02-01	Coaxial cable	/	R&S	2015-06-03	1Y
EM080-05	EMI Test Receiver	ESCI	R&S	2014-08-04	1Y

---------- End of Report ----------