Report No: 140815007GZU-002
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	:	Air conditioner
FCC ID	:	2ADAP-CS532K
Model No.	:	Refer to page 3.
Electrical Rating	:	AC 208-230V/60Hz
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

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Approved By:

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

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CONTENT

1. General Description

1.1 Product Description

The equipment under test (EUT) is a transceiver in air conditioner with RF at 2.425GHz, 2.450GHz and 2.475GHz. The EUT is powered by 230V~ 60Hz. It sends the status of air conditioner function to remote controller, when the remote controller is pressed the air conditioner will receive control command.

Model Lists:
GWH09UC-D3DNA4A/I, GWH09UC-D3DNA4C/I, CROWN09HP230V1AH, 40GRQB09B--3, 40GRQB09H--3, 619FEQ009BBGA, 619FEQ009HBGA;
GWH12UC-D3DNA4A/I, GWH12UC-D3DNA4C/I, CROWN12HP230V1AH, 40GRQB12B--3, 40GRQB12H--3, 619FEQ012BBGA, 619FEQ012HBGA;
GWH18UC-D3DNA4A/I, GWH18UC-D3DNA4C/I, CROWN18HP230V1AH, 40GRQB18B--3, 40GRQB18H--3, 619FEQ018BBGA, 619FEQ018HBGA

Antenna Type: PCB antenna.

All models are identical except the capacity rating, model name and brand name, so full tests were performed on model GWH18UC-D3DNA4A/I.

We tested the air conditioner, model: GWH18UC-D3DNA4A/I, 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-SAA1FB1F.

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.

Conducted emission test was performed according to ANSI C63.10: 2009. The EUT was set to achieve the maximum emission level. The mains terminal disturbance voltage was measured with the EUT in a shielded room. The EUT was connected to AC power source through an Artificial Mains Network which provides a 50Ω linear impedance Artificial hand is used if appropriate (for handheld apparatus). The load/control terminal disturbance voltage was measured with passive voltage probe if appropriate.

The vertical conducting plane or wall of a screened room shall be located 40 cm to the rear of the EUT. All other surfaces of tabletop EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs The table-top EUT was placed on a 0.8m high non-metallic table above earthed ground plane(Ground Reference Plane).And for floor standing EUT, was placed on a 0.1m high non-metallic supported on GRP. The Artificial Mains Network is situated at a distance of 0.8m from the EUT.

During the test, mains lead of EUT excess 0.8m was folded back and forth parallel to the lead so as to form a horizontal bundle with a length between 0.3m and 0.4m.

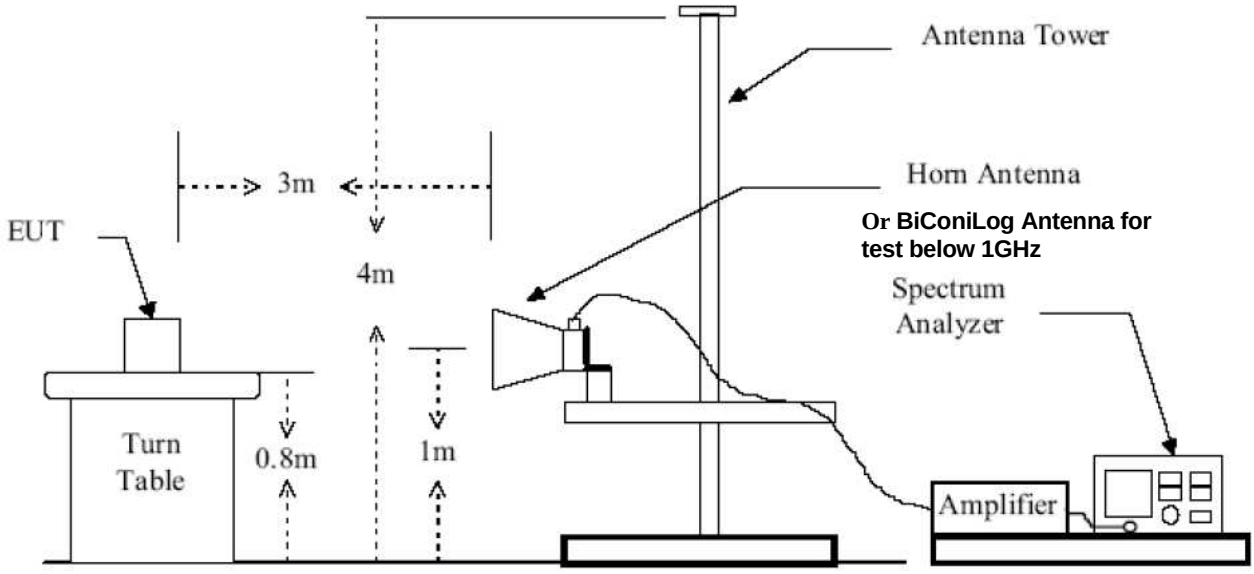
The bandwidth of test receiver was set at 9 kHz. The frequency range from 150 kHz to 30MHz was checked.

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 230V/60Hz in the testing.

Type of modulation: 2-FSK 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.

Switch is installed for changing the frequency for measurement.

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	Pass
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

3.2.1 Conducted Emission Limits

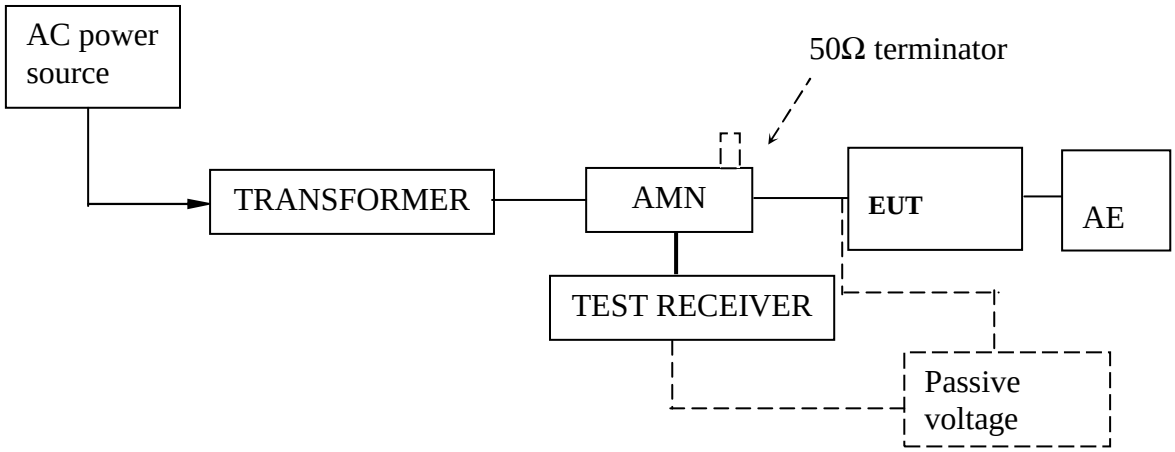
According to FCC 15.207, for an intentional radiator that is designed to be connected to the public utility(AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150kHz to 30MHz, shall not exceed the limits in the following table:

Frequency of emission(MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Pre-test in the three channels: 2425MHz, 2450MHz and 2475MHz and found the conducted emission on 2425MHz is the worst case, so below test data is for 2425MHz.

3.2.2 Block Diagram of Test Setup



3.2.3 Conducted Emission Test Data

Tested Wire: Live **Operation Mode: EUT transmitting on 2425MHz**

Frequency	Quasi-Peak		Average	
[MHz]	Disturbance level [dB(μV)]	Permitted limit [dB(μV)]	Disturbance level [dB(μV)]	Permitted limit [dB(μV)]
0.160	<55	65.5	<48	58.3
0.240	<52	62.1	<43	53.9
0.550	<46	56.0	<36	46.0
1.000	<46	56.0	<36	46.0
1.400	<46	56.0	<36	46.0
2.000	<46	56.0	<36	46.0
6.000	<50	60.0	<40	50.0
10.000	<50	60.0	<40	50.0
22.000	<50	60.0	<40	50.0
30.000	<50	60.0	<40	50.0

Tested Wire: Neutral **Operation Mode: EUT transmitting on 2425MHz**

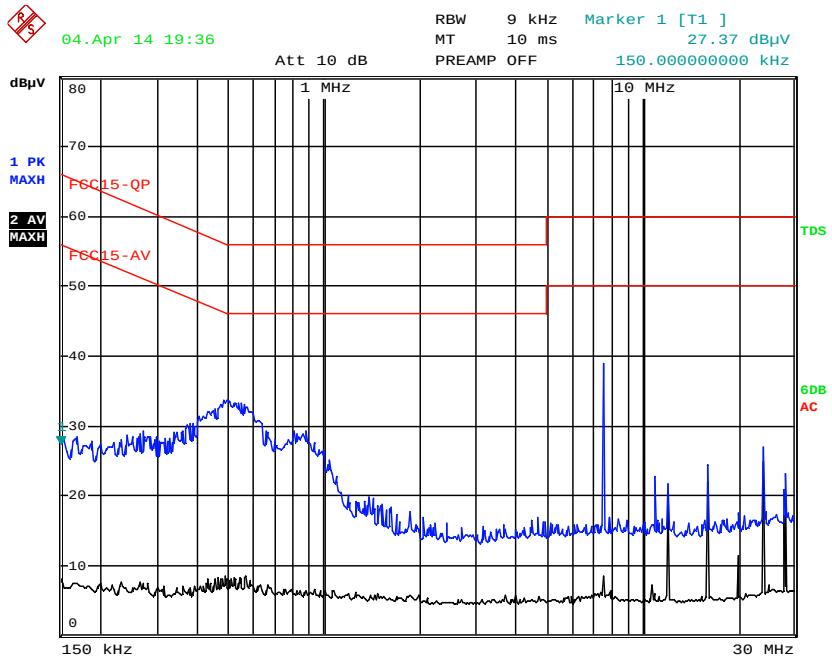
Frequency	Quasi-Peak		Average	
[MHz]	Disturbance level [dB(μV)]	Permitted limit [dB(μV)]	Disturbance level [dB(μV)]	Permitted limit [dB(μV)]
0.160	<55	65.5	<48	58.3
0.240	<52	62.1	<43	53.9
0.550	<46	56.0	<36	46.0
1.000	<46	56.0	<36	46.0
1.400	<46	56.0	<36	46.0
2.000	<46	56.0	<36	46.0
6.000	<50	60.0	<40	50.0
10.000	<50	60.0	<40	50.0
22.000	<50	60.0	<40	50.0
30.000	<50	60.0	<40	50.0

3.2.4 Emission Curve

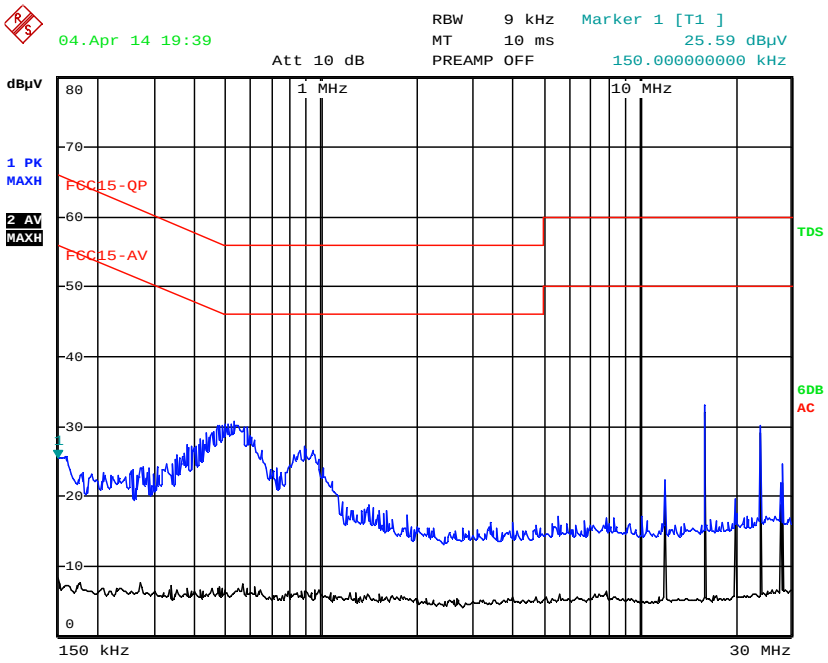
At mains terminal:

Operation Mode: EUT transmitting on 2425MHz

Tested Wire: Live



Tested Wire: Neutral



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. § 15.35(c), 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	134.040	22.20	43.5
Horizontal	208.000	38.90	43.5
Horizontal	260.000	32.70	46.0
Vertical	101.880	20.80	43.5
Vertical	111.000	20.10	43.5
Vertical	208.000	29.40	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	208.000	37.40	43.5
Horizontal	260.000	31.20	46.0
Horizontal	312.040	30.40	46.0
Vertical	38.080	20.40	40.0
Vertical	108.480	20.40	43.5
Vertical	208.000	26.50	43.5

Operation mode: Transmitting Operation Frequency: 2475MHz

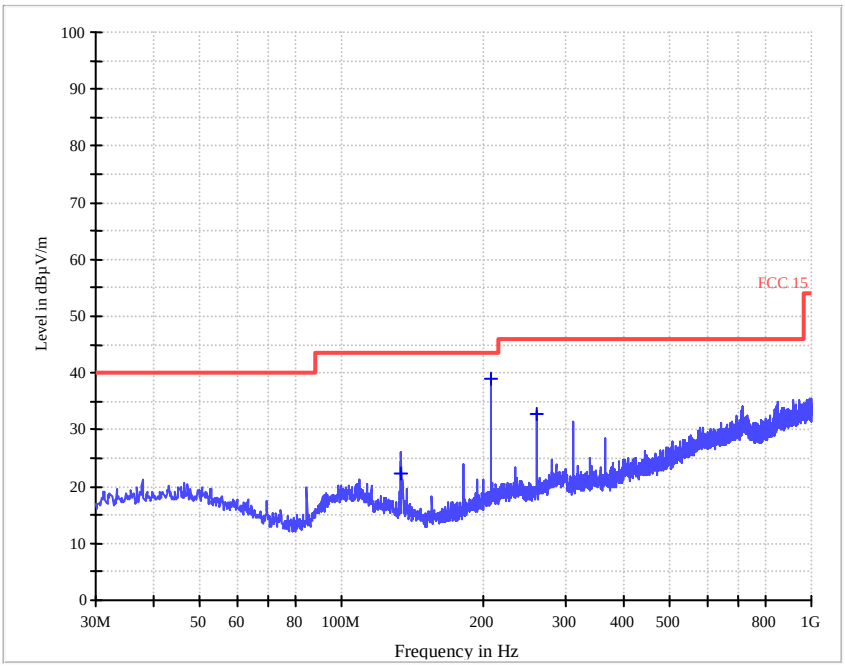
Pursuant to FCC 15.209: Emissions Requirement (30MHz-1GHz)

Antenna Polarization	Frequency [MHz]	Measured Net at 3m [dB(µV/m)]	Limit at 3m [dB(µV/m)]
Horizontal	208.000	36.80	43.5
Horizontal	260.000	30.60	46.0
Horizontal	312.040	29.00	46.0
Vertical	32..64	20.70	54.0
Vertical	102.000	20.60	43.5
Vertical	208.000	25.00	43.5

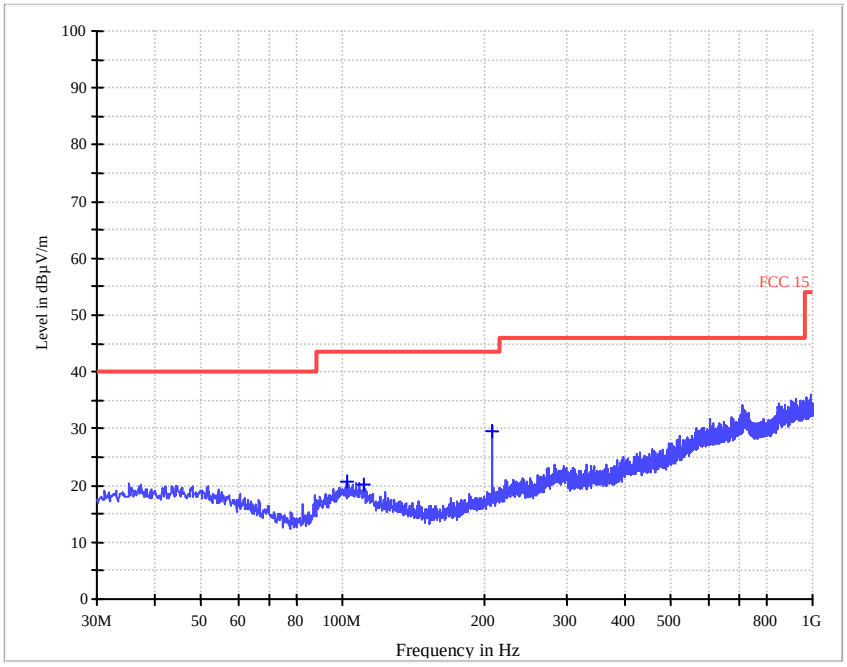
3.3.5 Test Curve

Operation mode: Transmitting Operation Frequency: 2425MHz

Horizontal:

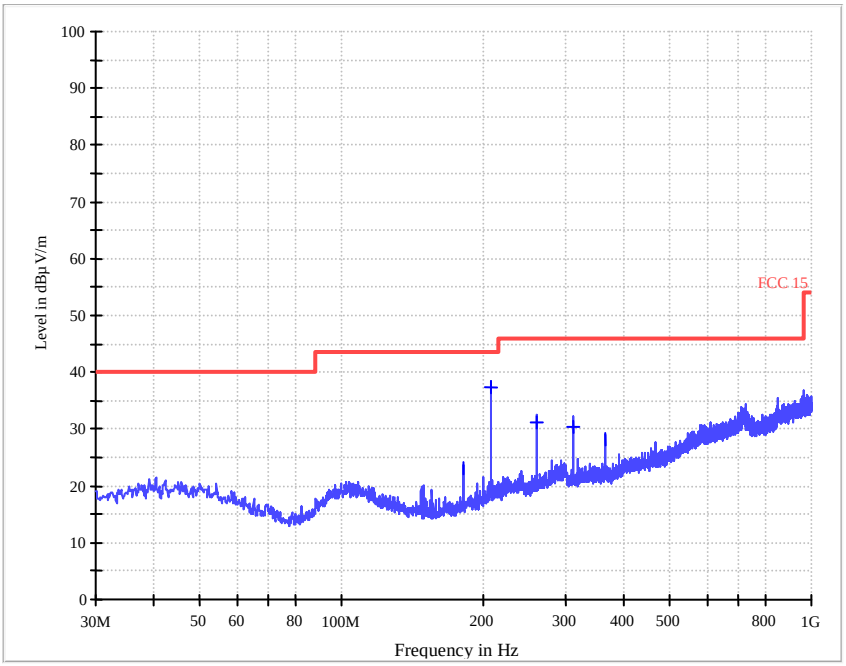


Vertical:

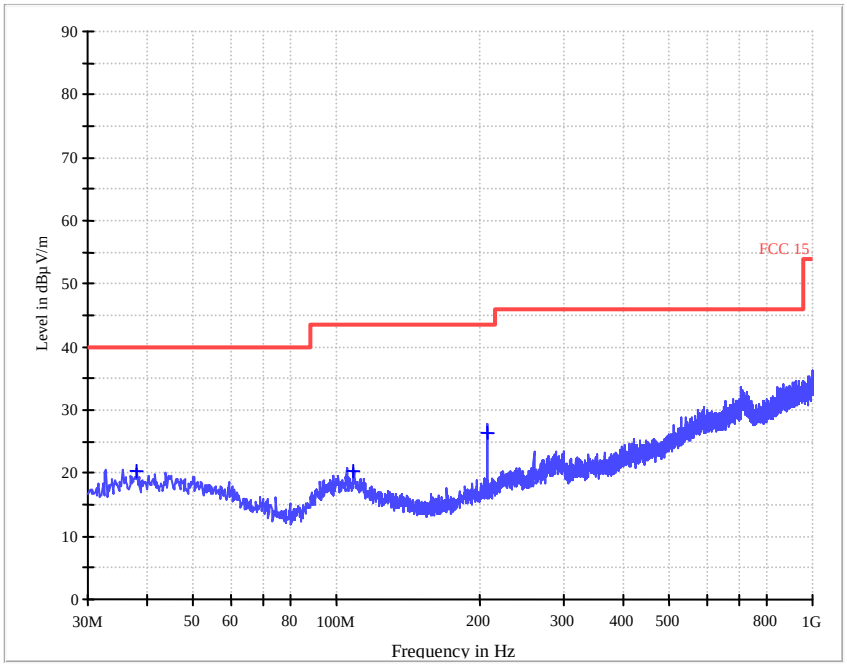


Operation mode: Transmitting Operation Frequency: 2450MHz

Horizontal:

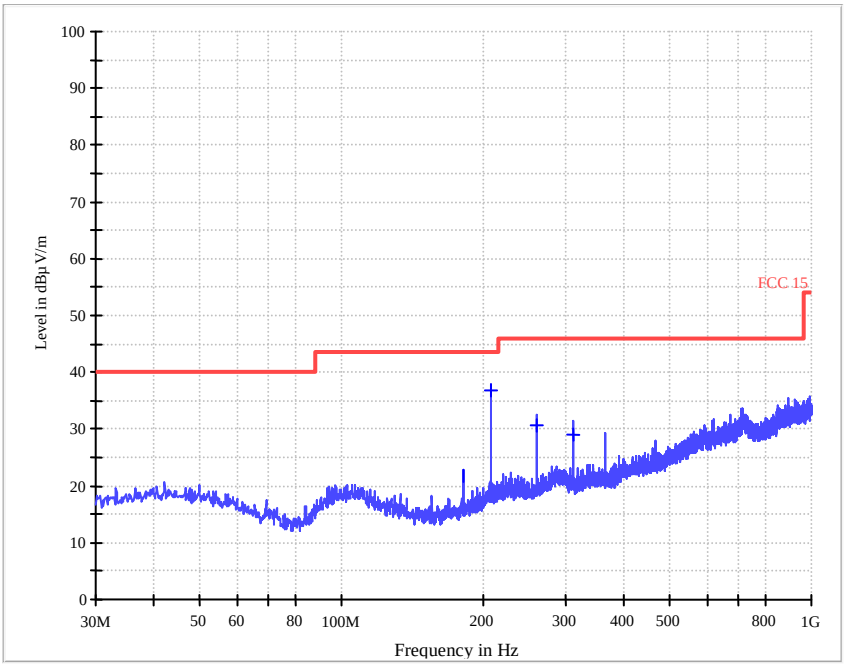


Vertical:

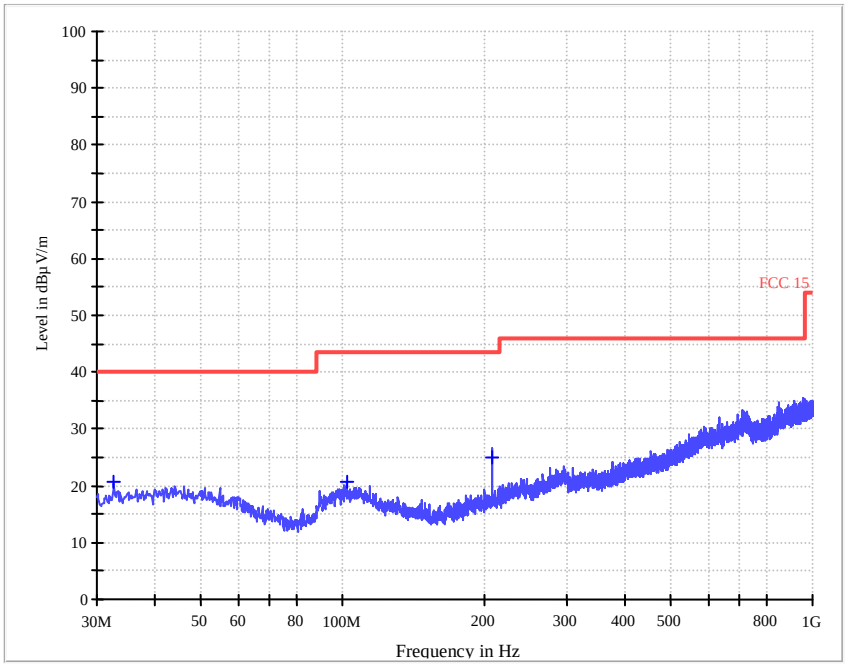


Operation mode: Transmitting Operation Frequency: 2475MHz

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	89.6	-7.7	81.9	94.0	-12.1
Horizontal	4850.500	44.3	-0.7	43.6	54.0	-10.4
Horizontal	7270.875	35.0	7.4	42.4	54.0	-11.6
Vertical	2423.750	94.8	-7.7	87.1	94.0	-6.9
Vertical	4848.375	54.1	-0.7	53.4	54.0	-0.6
Vertical	7277.250	35.9	7.4	43.3	54.0	-10.7

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	90.3	-7.7	82.6	94.0	-11.4
Horizontal	4899.375	45.7	-0.7	45.0	54.0	-9.0
Horizontal	7279.375	34.6	7.4	42.0	54.0	-12.0
Vertical	2449.250	96.4	-7.7	88.7	94.0	-5.3
Vertical	4899.375	54.6	-0.7	53.9	54.0	-0.1
Vertical	7351.625	34.9	7.4	42.3	54.0	-11.7

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	90.2	-7.7	82.5	94.0	-11.5
Horizontal	4950.375	45.6	-0.7	44.9	54.0	-9.1
Horizontal	7426.000	35.9	7.4	43.3	54.0	-10.7
Vertical	2474.750	92.1	-7.7	84.4	94.0	-9.6
Vertical	4950.375	50.0	-0.7	49.3	54.0	-4.7
Vertical	7426.000	36.0	7.4	43.4	54.0	-10.6

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.

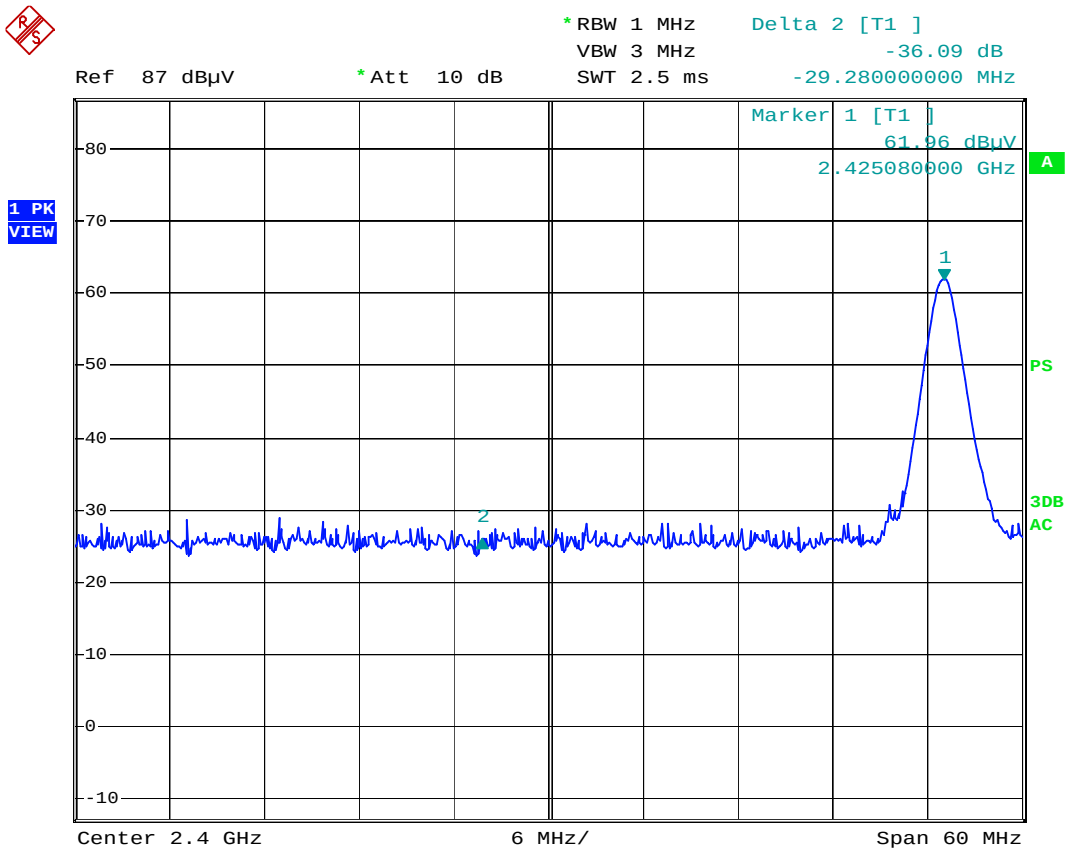
Sec15.215:
(c) Intentional radiators operating under the alternative provisions to the general emission limites, as contained in § §15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20dB bandwidth may otherwise be specified in the specific rule section under which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

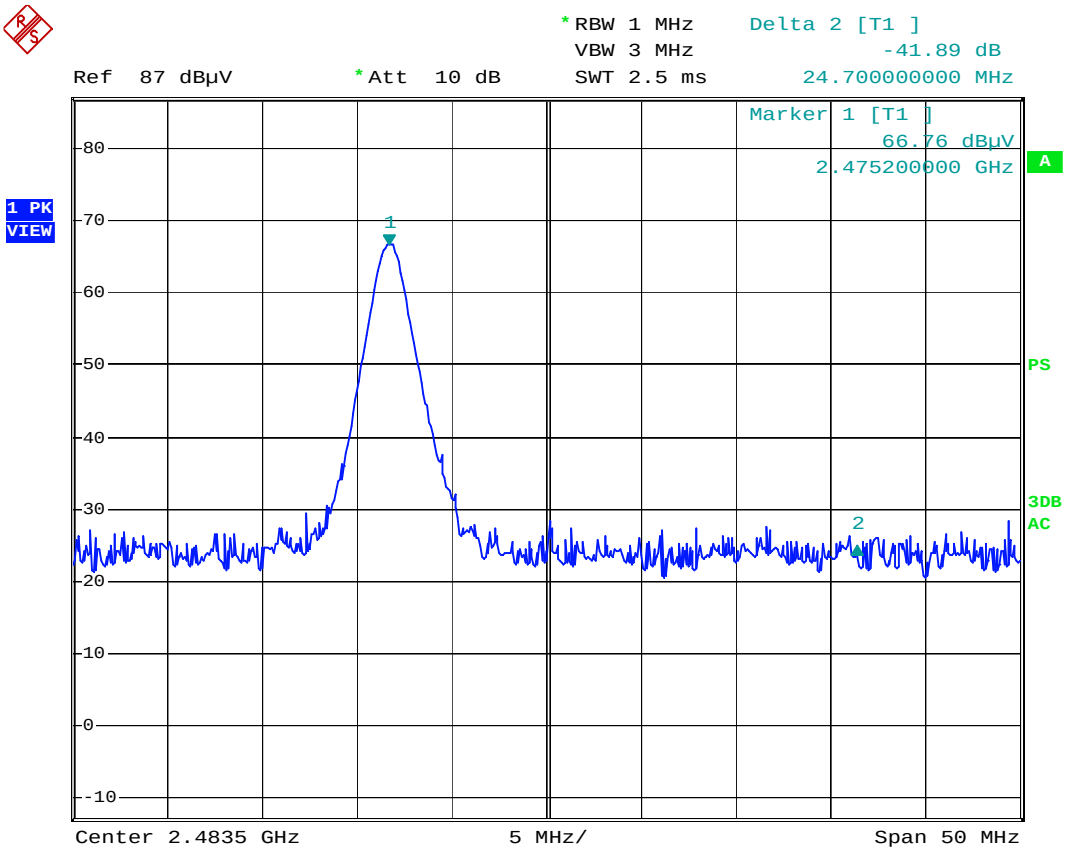
3.4.2 Test Setup

Refer to 1.4

3.4.3 Test Plot

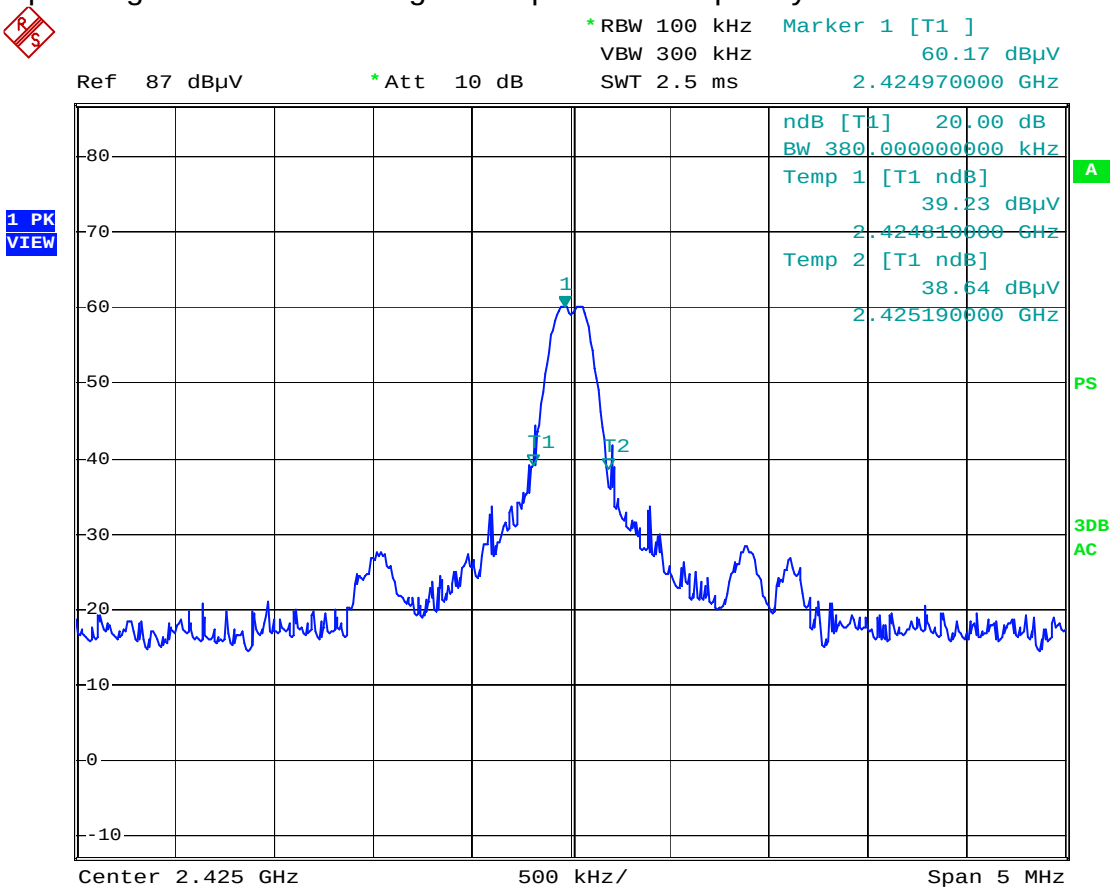
Frequency Bands
Operating mode: Transmitting



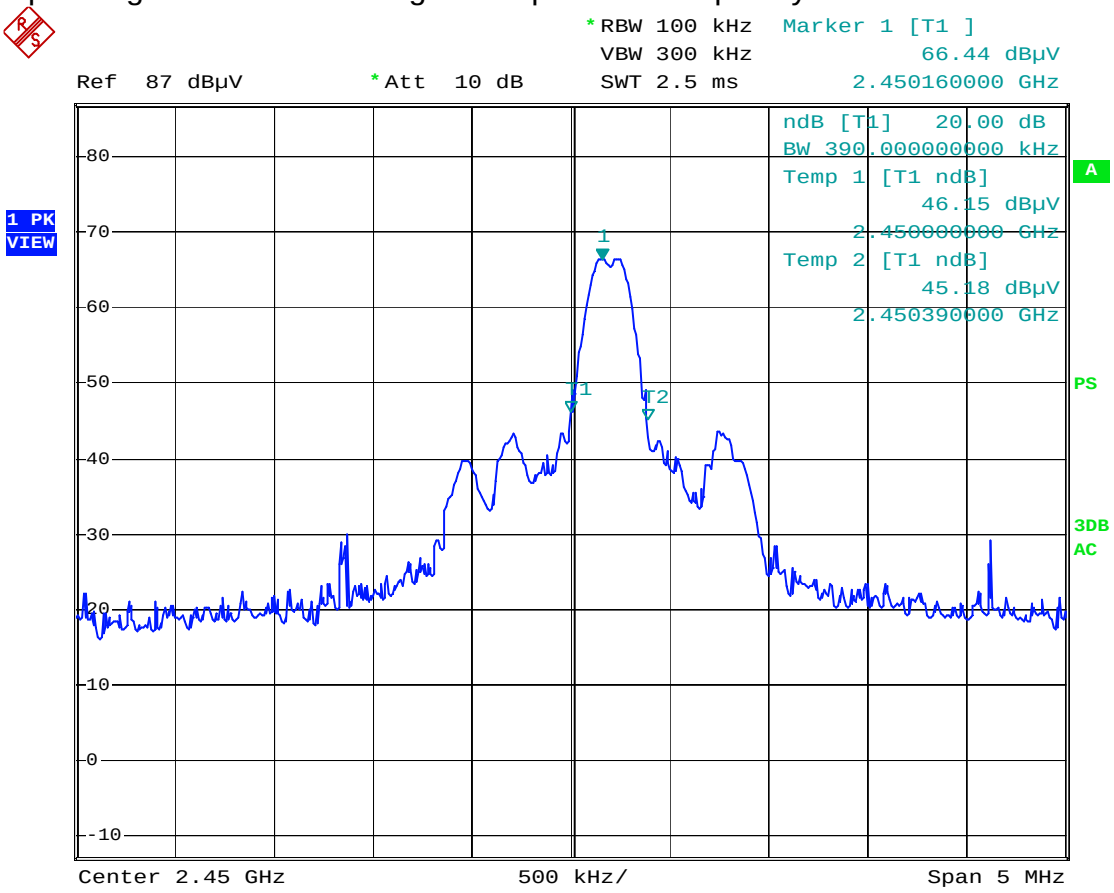

*RBW 1 MHz
VBW 3 MHz
SWT 2.5 ms
Delta 2 [T1]
-41.89 dB
24.700000000 MHz
Ref 87 dBµV
*Att 10 dB
Marker 1 [T1]
66.76 dBµV
2.475200000 GHz
1 PK
VIEW
A
PS
3DB
AC
80
70
60
50
40
30
20
10
0
-10
Center 2.4835 GHz
5 MHz/
Span 50 MHz

Modulation Bandwidth

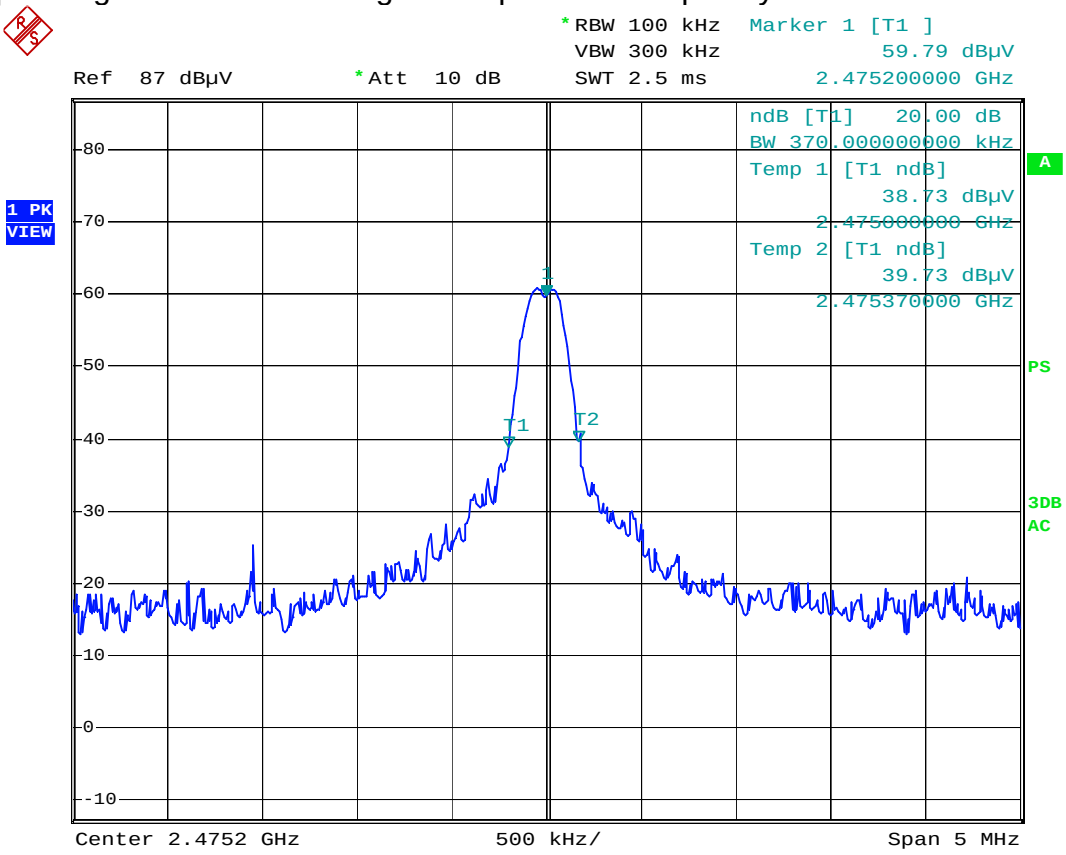
Operating mode: Transmitting Operation Frequency: 2425MHz



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

= 87.1dBµv/m – 36.09dB
= 51.01dBµv/m

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

= 84.4dBµv/m – 41.89dB
= 42.51dBµv/m

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

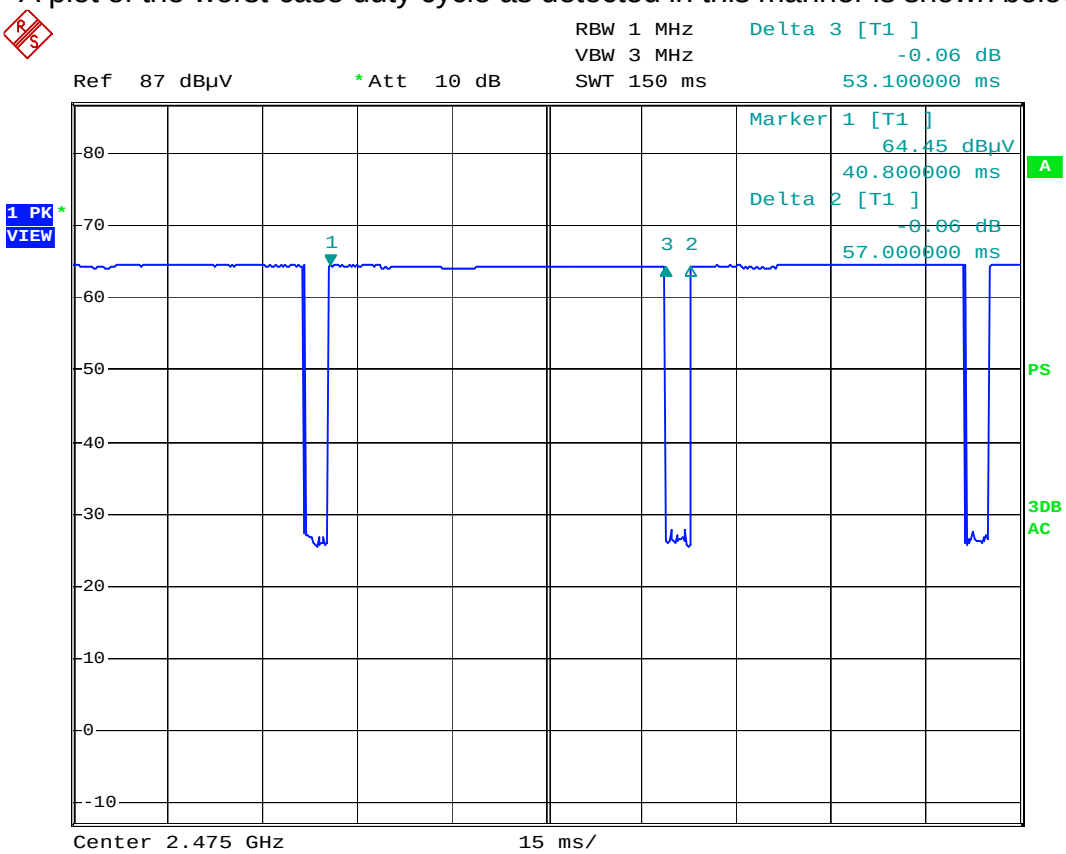
3.4.5 Transmitter Duty Cycle Calculation FCC Rule 15.35(b, c)

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 = 57.000ms
Effective period of the cycle = 53.100ms

DC =43.500/47.700=0.93158 or 93.158%

Therefore, the averaging factor is found by 20lg0.93158=-0.62dB

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 ----------