Report No: GZ12060119-1

TEST REPORT

Applicant Name & Address	:	Universal Electronics Inc. 6101 Gateway Drive, Cypress, California, USA, 90630-4841
Sample Description		
Product	:	Remote controller unit
FCC ID	:	MG3-2035
Model No.	:	UES HW DC750 RF4CE 1 CHIP
Electrical Rating	:	3V DC
Frequency	:	2.4GHz Transmitter
Date Received	:	04 June 2012
Date Test Conducted	:	12 June 2012 – 21 June 2012
Test standards	:	**FCC Part 15: 2011**
Test Result	:	Pass
Conclusion	:	The submitted samples complied with the above rules/standards.
Remark	:	None.

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

Prepared and Checked By:

Helen Ma

Helen Ma
Project Engineer
Intertek Guangzhou

Approved By:

Signature

Carrie Chen
Technical Supervisor
Intertek Guangzhou
14 March 2013 Date

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CONTENT

1. General Description

1.1 Product Description

The Equipment Under Test (EUT) is a transmitter, model: UES HW DC750 RF4CE 1 CHIP, it's powered by 3V DC. The main function of EUT is working as a TV controller.

Antenna Type: internal, PCB antenna.

We found that the unit met the requirements of FCC part 15.249. The worst case's test data was presented in this test report.

1.2 Related Submittal (s) / Grants

The FCC ID of corresponding transmitter for this transmitter is MG3-2035.

1.3 Test Methodology

Radiated emission measurements were performed in semi-anechoic chamber room according to the procedures in ANSI C63.4 :2009.For radiated emission measurement, three orthogonal axes of device were tested, only the worst case data was shown in the report. 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

The Radiated Emission test is performed at:
Compliance Certification Services (Shenzhen) Inc. located at No.10-1Mingkeda Logistics Park, No.18Huanguan South RD. Guanlan Town, Baoan District Shenzhen China. This test facility and site measurement data have been fully placed on file with the FCC, test firm registration number is 441872.

Test Equipment List

Serial No.	Equipment	Manufacturer	Model No.	Cal. Date	Due Date
100783	Receiver	R&S	ESCI	19-Mar-12	19-Mar-13
D286	Horn Antenna	SCHWARZBECK	BBHA9120D	19-Mar-12	19-Mar-13
US44300399	PSA Series Spectrum Analyzer	Agilent	E4446A	19-Mar-12	19-Mar-13
5082	Bilog Antenna	SCHAFFNER	CBL6143	03-Jun-12	03-Jun-13
1411843	Amplifier	MITEQ	AM-1604-3000	18-Mar-12	18-Mar-13

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 C63.4 :2009.

The EUT was powered by 3V DC in the testing.

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

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 Universal Electronics Inc 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
15.249	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: internal integrated antenna.

3.2 Conducted Emission

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

3.3 Radiated Emission

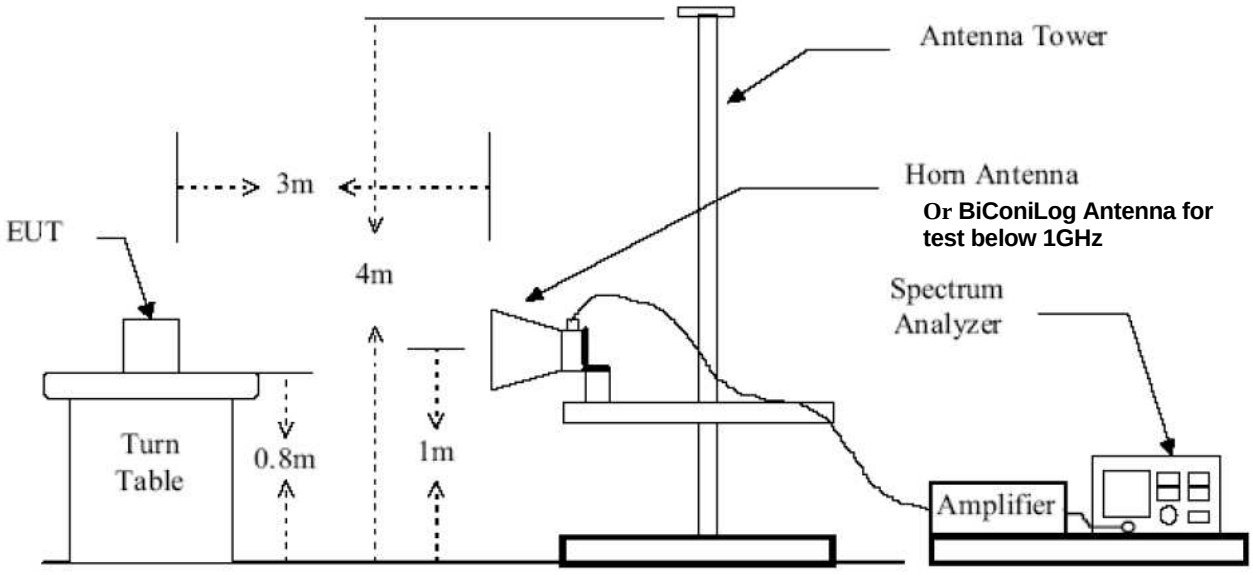
Data is included worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

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



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 + AV
→ FS = RA + Correct Factor + AV

Where FS = 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
AV = Average Factor in –dB
Correct Factor = AF + CF – AG + PD

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

Assume a receiver reading of 62.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 62.0 dBµV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB
AV = -10 dB

Correct Factor = 7.4 + 1.6 – 29.0 + 0 = -20 dB

FS = 62 + (-20) + (-10) = 32 dBµV/m

Level in µV/m = Common Antilogarithm [(32 dBµV/m)/20] = 39.8 µV/m

3.3.4 Radiated Emission Test Data

Operation: EUT on transmitting operation

Radiated Emissions
Pursuant to FCC 15.249: Emissions Requirement

2425MHz

Polarization	Frequency (MHz)	Reading (dBµV)	Correction Factor (dB)	Net at 3m (dBµV/m)	QP Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	557.033	33.3	-13.8	19.5	46.0	-26.5
Horizontal	700.917	32.9	-10.4	22.5	46.0	-23.5
Horizontal	859.350	32.9	-9.3	23.6	46.0	-22.4
Vertical	421.233	32.8	-15.2	17.6	46.0	-28.4
Vertical	616.850	32.4	-12.5	19.9	46.0	-26.1
Vertical	856.117	33.4	-9.5	23.9	46.0	-22.1

2425MHz

Polarization	Frequency (MHz)	Reading (dBµV)	Correction Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2425.000	103.1	-5.6	97.5	114.0	-16.5
Horizontal	3865.000	46.4	-1.3	45.1	74.0	-28.9
Horizontal	4855.000	52.1	2.0	54.1	74.0	-19.9
Vertical	2425.000	94.0	-5.6	88.4	114.0	-25.6
Vertical	3985.000	47.7	-1.0	46.7	74.0	-27.3
Vertical	4855.000	46.7	2.0	48.7	74.0	-25.3

Polarization	Frequency (MHz)	Reading (dBµV)	Correction Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2425.000	103.1	-5.6	-23.1	74.4	94.0	-19.6
Horizontal	3865.000	46.4	-1.3	-23.1	22.0	54.0	-32.0
Horizontal	4855.000	52.1	2.0	-23.1	31.0	54.0	-23.0
Vertical	2425.000	94.0	-5.6	-23.1	65.3	94.0	-28.7
Vertical	3985.000	47.7	-1.0	-23.1	23.6	54.0	-30.4
Vertical	4855.000	46.7	2.0	-23.1	25.6	54.0	-28.4

Notes:
1. Peak detector data was used for both above and below 1GHz.
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.

Operation: EUT on transmitting operation

Radiated Emissions
Pursuant to FCC 15.249: Emissions Requirement

2450MHz

Polarization	Frequency (MHz)	Reading (dBµV)	Correction Factor (dB)	Net at 3m (dBµV/m)	QP Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	387.283	34.5	-16.5	18.0	46.0	-28.0
Horizontal	584.517	32.3	-12.8	19.5	46.0	-26.5
Horizontal	702.533	33.2	-10.5	22.7	46.0	-23.3
Vertical	472.967	33.1	-14.7	18.4	46.0	-27.6
Vertical	612.000	32.8	-12.3	20.5	46.0	-25.5
Vertical	721.933	32.6	-10.8	21.8	46.0	-24.2

Polarization	Frequency (MHz)	Reading (dBµV)	Correction Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2455.000	98.9	-5.5	93.4	114.0	-20.6
Horizontal	4045.000	46.9	-0.8	46.1	74.0	-27.9
Horizontal	4900.000	49.7	2.2	51.9	74.0	-22.1
Vertical	2455.000	100.4	-5.5	94.9	114.0	-19.1
Vertical	4330.000	46.1	0.2	46.3	74.0	-27.7
Vertical	4900.000	47.3	2.2	49.5	74.0	-24.5

Polarization	Frequency (MHz)	Reading (dBµV)	Correction Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2455.000	98.9	-5.5	-22.4	71.0	94.0	-23.0
Horizontal	4045.000	46.9	-0.8	-22.4	23.7	54.0	-30.3
Horizontal	4900.000	49.7	2.2	-22.4	29.5	54.0	-24.5
Vertical	2455.000	100.4	-5.5	-22.4	72.5	94.0	-21.5
Vertical	4330.000	46.1	0.2	-22.4	23.9	54.0	-30.1
Vertical	4900.000	47.3	2.2	-22.4	27.1	54.0	-26.9

Notes:
1. Peak detector data was used for both above and below 1GHz.
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

Operation: EUT on transmitting operation

Radiated Emissions
Pursuant to FCC 15.249: Emissions Requirement

2475MHz

Polarization	Frequency (MHz)	Reading (dBµV)	Correction Factor (dB)	Net at 3m (dBµV/m)	QP Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	453.567	33.4	-15.3	18.1	46.0	-27.9
Horizontal	573.200	32.7	-13.6	19.1	46.0	-26.9
Horizontal	762.350	33.9	-11.1	22.7	46.0	-23.3
Vertical	421.233	34.0	-15.2	18.8	46.0	-27.2
Vertical	615.233	33.7	-12.5	21.2	46.0	-24.8
Vertical	856.117	34.5	-9.5	25.0	46.0	-21.0

Polarization	Frequency (MHz)	Reading (dBµV)	Correction Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2470.000	103.7	-5.4	98.3	114.0	-15.7
Horizontal	3940.000	47.1	-1.1	46.0	74.0	-28.0
Horizontal	4945.000	51.1	2.4	53.5	74.0	-20.5
Vertical	2470.000	92.1	-5.4	86.7	114.0	-27.3
Vertical	3850.000	46.7	-1.3	45.4	74.0	-28.6
Vertical	4945.000	46.7	2.4	49.1	74.0	-24.9

Polarization	Frequency (MHz)	Reading (dBµV)	Correction Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2470.000	103.7	-5.4	-22.6	75.7	94.0	-18.3
Horizontal	3940.000	47.1	-1.1	-22.6	23.4	54.0	-30.6
Horizontal	4945.000	51.1	2.4	-22.6	30.9	54.0	-23.1
Vertical	2470.000	92.1	-5.4	-22.6	64.1	94.0	-29.9
Vertical	3850.000	46.7	-1.3	-22.6	22.8	54.0	-31.2
Vertical	4945.000	46.7	2.4	-22.6	26.5	54.0	-27.5

Notes:
1. Peak detector data was used for both above and below 1GHz.
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

3.3.5 Test Result

The data on the above test result table lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

According 15.249, the worst case radiated emission at 2470.000 MHz
Judgement: Passed by 15.7dB

3.4 Band Edges Measurement

3.4.1 Limited of the band edges 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.

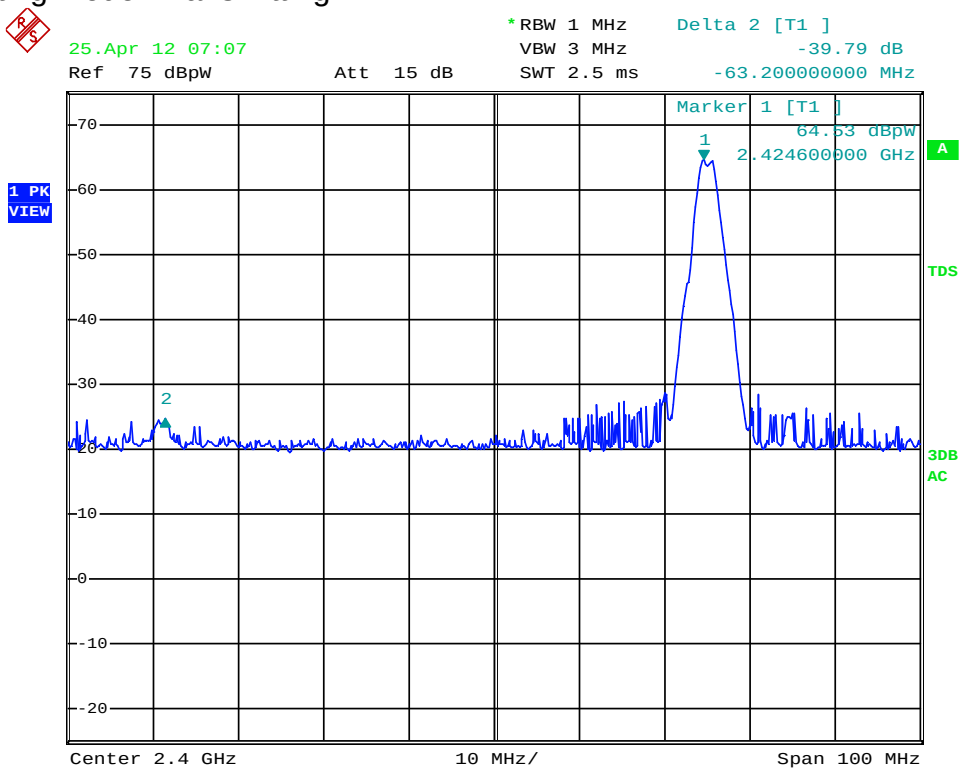
3.4.2 Test Setup

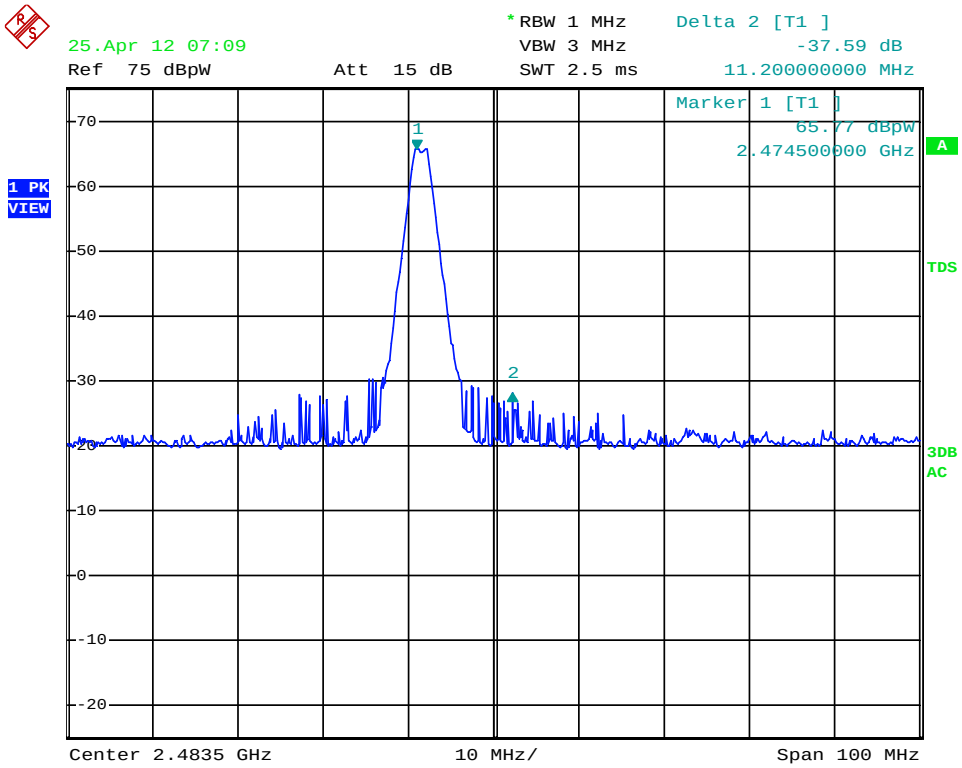
Refer to 3.3.2

3.4.3 Test Plot

band edges

Operating mode: Transmitting





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 fulfil 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

= 97.5dBµv/m – 39.79dB
= 57.71dBµv/m

Average Resultant field strength = Fundamental emissions (peak value) – average factor

= 57.71dBµv/m – 23.1dB
= 34.61dBµv/m

(ii) Upper bandedge:

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

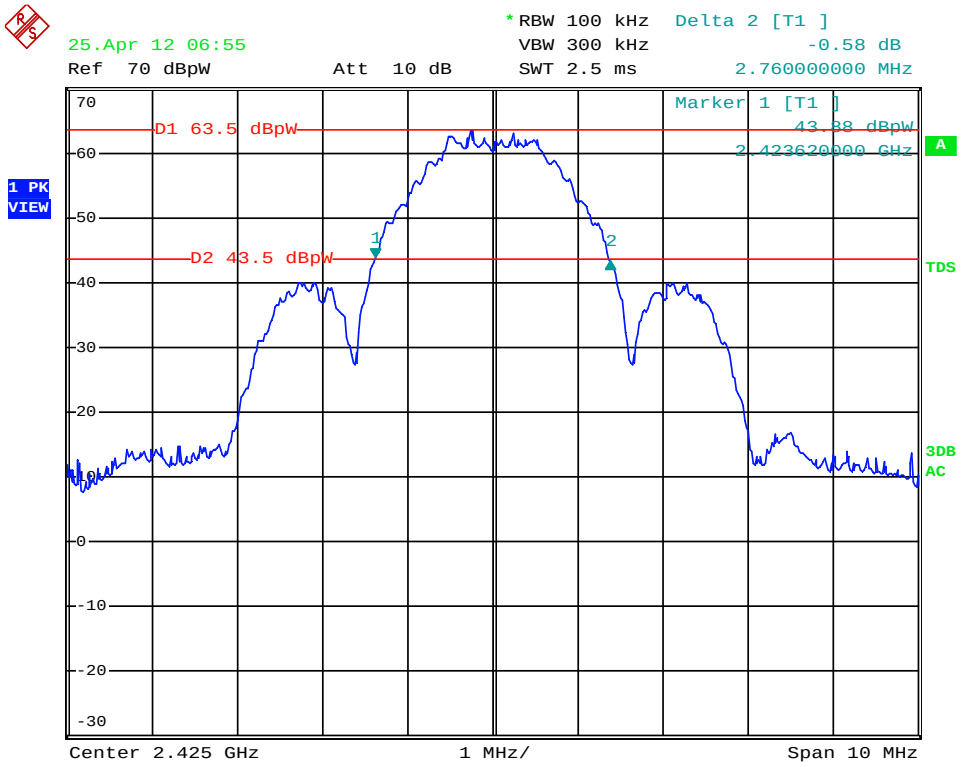
= 98.3dBµv/m – 37.59dB
= 60.71dBµv/m

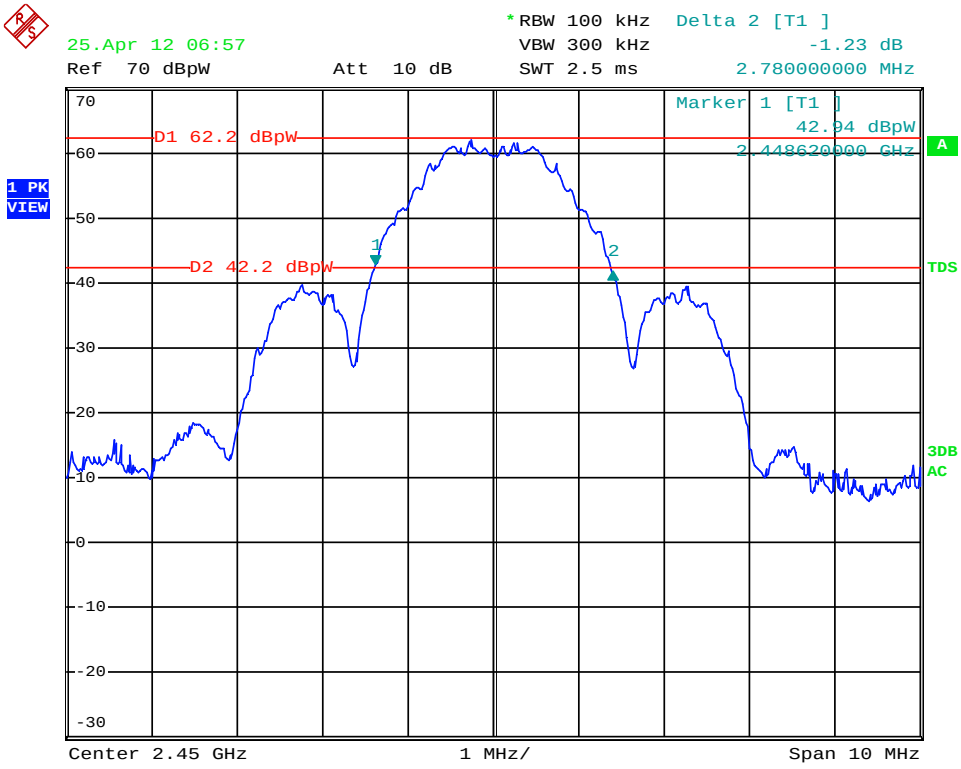
Average Resultant field strength = Fundamental emissions (peak value) –average factor

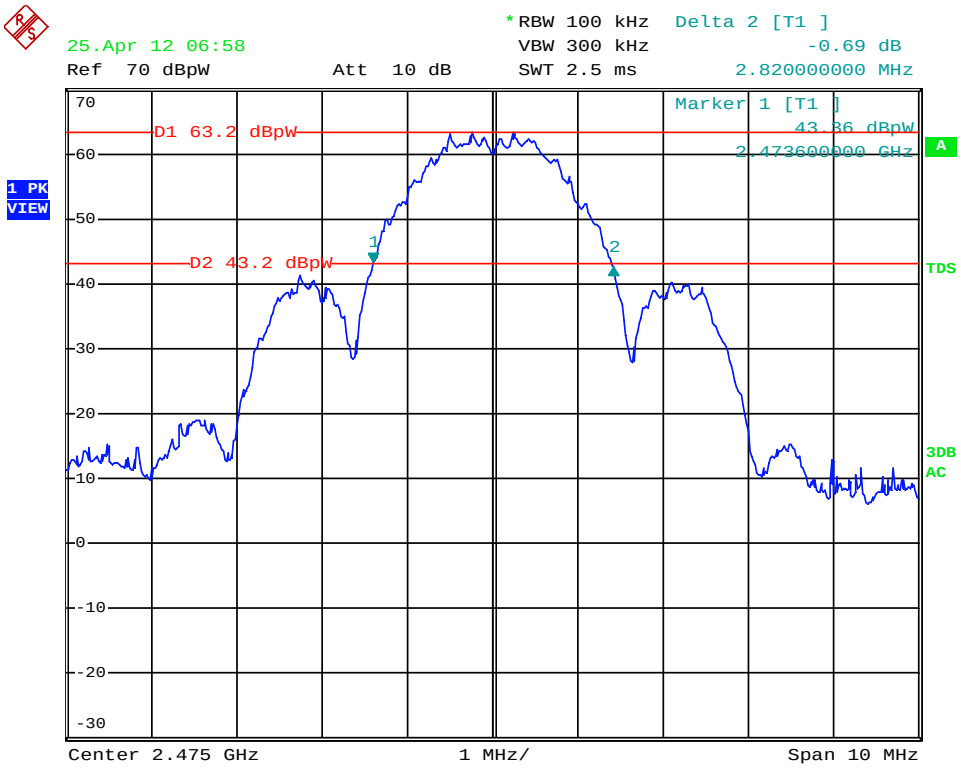
= 60.71dBµv/m – 22.6dB
= 38.11dBµv/m

The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 74 dBµv/m (Peak Limit) and 54dBµv/m (Average Limit).

Modulation Bandwidth
Operating mode: Transmitting




25.Apr 12 06:57
*RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Delta 2 [T1]
-1.23 dB
2.780000000 MHz
Ref 70 dBpW
Att 10 dB
Marker 1 [T1]
42.94 dBpW
2.448620000 GHz
D1 62.2 dBpW
D2 42.2 dBpW
1 PK
VIEW
A
TDS
3DB
AC
Center 2.45 GHz
1 MHz/
Span 10 MHz


25.Apr 12 06:58
*RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Delta 2 [T1]
-0.69 dB
2.820000000 MHz
Ref 70 dBpW
Att 10 dB
Marker 1 [T1]
43.86 dBpW
2.473600000 GHz
D1 63.2 dBpW
D2 43.2 dBpW
1 PK
VIEW
A
TDS
3DB
AC
Center 2.475 GHz
1 MHz/
Span 10 MHz

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

Averaging factor in dB = 20 log (duty cycle)

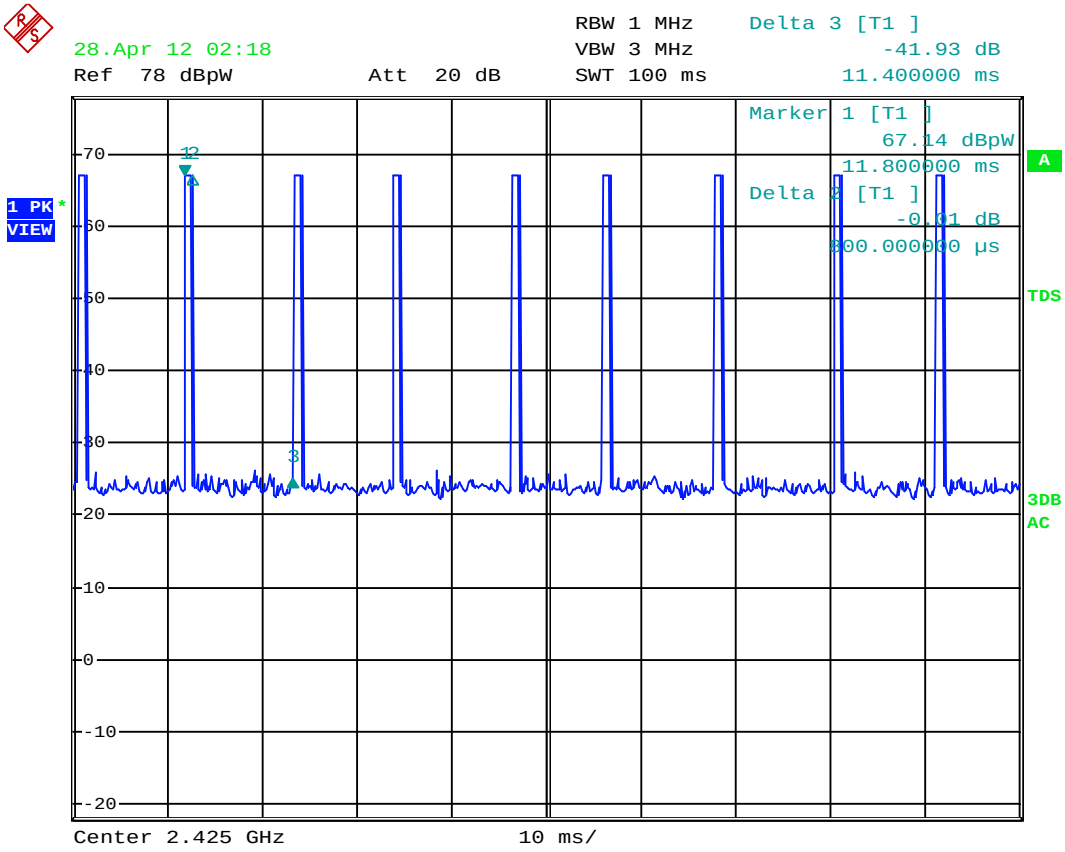
The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the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

2425MHz:

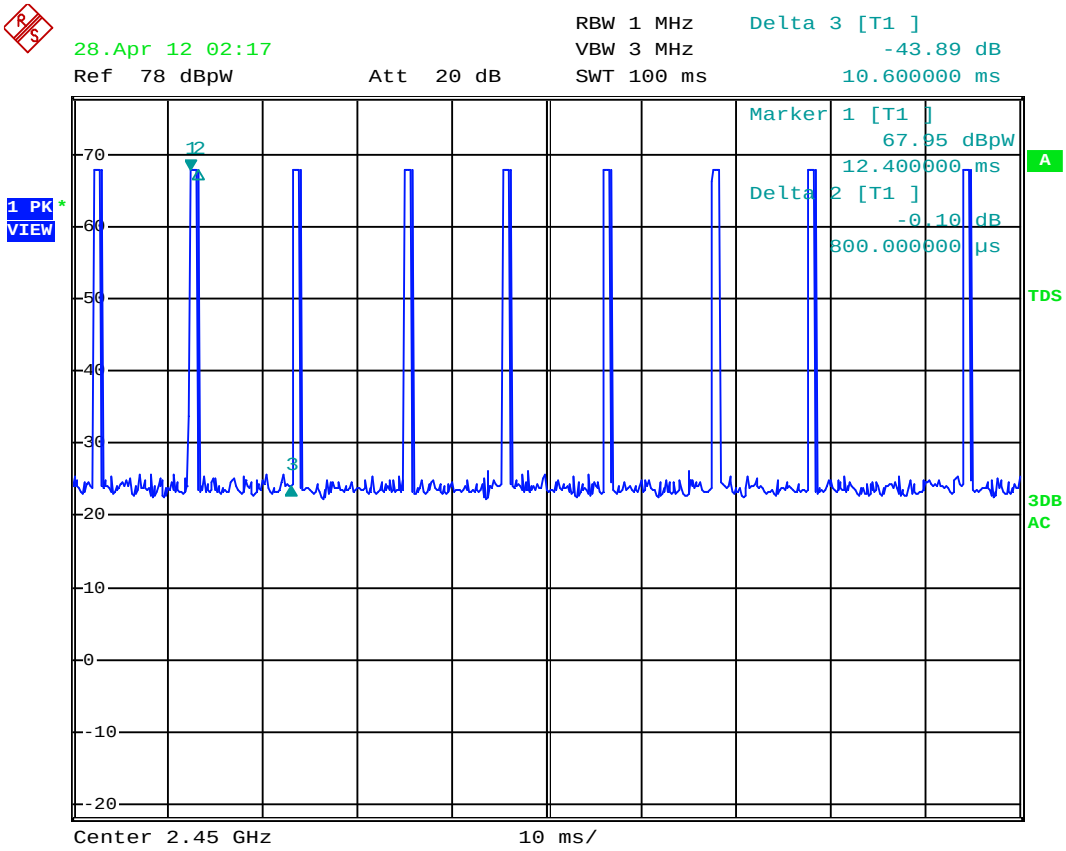


The duration of one cycle = 11.4ms
Effective period of the cycle = 0.8ms

DC =0.8/11.4=0.0701 or 7.01%

therefore, the averaging factor is found by 20lg0.0701=-23.1dB

2450MHz:

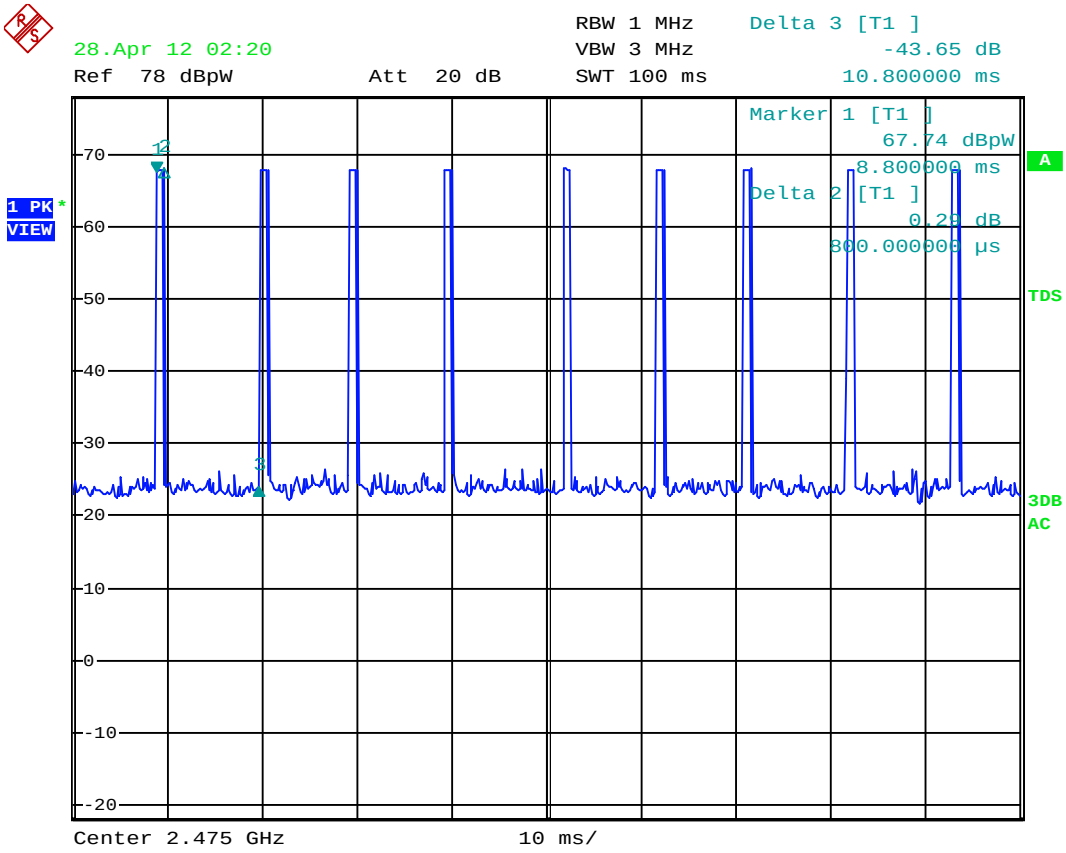


The duration of one cycle = 10.6ms
Effective period of the cycle = 0.8ms

DC =0.8/10.6=0.0755 or 7.55%

therefore, the averaging factor is found by 20lg0.0755=-22.4dB

2475MHz:



The duration of one cycle = 10.8ms
Effective period of the cycle = 0.8ms

DC =0.8/10.8=0.0741 or 7.41%

therefore, the averaging factor is found by 20lg0.0741=-22.6dB

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