



## Test Report

Prepared for: Quantum Instruments, Inc

Model: Qflash Co-Pilot QF91

Description: A Wireless Radio Commander Unit for Digital Cameras to Control Remote Flashes

To

FCC Part 15.231

Date of Issue: March 2, 2012

On the behalf of the applicant: Quantum Instruments, Inc.  
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Project Test Engineer

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### Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	March 2, 2012	Greg Corbin	Original Document
2.0	March 29, 2012	Greg Corbin	Added Limit calculations, revised Occupied BW data



## Table of Contents

<b><u>Description</u></b>	<b><u>Page</u></b>
Standard Test Conditions Engineering Practices .....	6
Test Results Summary.....	8
Fundamental Field Strength.....	9
Radiated Spurious Emissions .....	10
Occupied Bandwidth .....	12
Test Equipment Utilized .....	14



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The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

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Testing Certificate Number: **2152.01**



**FCC OATS Reg, #933597**

**IC Reg. #2044A-1**

**Non-accredited tests contained in this report:**

**N/A**



**The applicant has been cautioned as to the following**

15.21: Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a): Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator the responsible part may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.



## Standard Test Conditions Engineering Practices

Environmental Conditions		
Temperature (Deg C)	Humidity (%)	Pressure (mbar)
22.1 – 25.1	18.8 – 26.2	972.7 – 974.1

### **EUT Description**

**Model:** Qflash Co-Pilot QF91

**Description:** A Wireless Radio Commander Unit for Digital Cameras to Control Remote Flashes

**Firmware:** N/A

**Software:** N/A

**S/N:** EMI test sample #2

### **Additional Information:**

The EUT is a transmitter only.

The EUT transmits a ASK (Amplitude Shift Keying) modulated signal to remote flash units.

### **EUT Operation during Tests**

The EUT was configured to operate with the transmitter on in a continuous mode for test purposes only. The EUT can be configured to operate on its own or with a flash attached via a control cable. The EUT was tested in both configurations with the worst case results reported in the test report.



**Accessories:**

Qty	Desc	Mfg	Model	S/N
1	Camera	Canon	T90	1144424
1	Flash Unit	Quantum	T5d-R	QG6129
1	Flash Power Pack	Quantum	Turbo SC	S009
1	Lightstand (Tripod)	Giottos	LC 210	N/A

**Cables:**

Qty	Desc	Length (M)	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
1	Mutli-pin control cable – from transmitter to flash	0.5	N	N	N
1	Mutli-pin control cable – from flash to flash power pack	1	N	N	N

**Modifications: None**

**15.203: Antenna Requirement:**

- The antenna is permanently attached to the EUT
- The antenna uses a unique coupling
- The EUT must be professionally installed
- The antenna requirement does not apply



### Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.231(b) RSS – 210(A1.1.2)	Fundamental Field Strength	Pass	
15.231(b) RSS-210(A1.1.2)	Out of Band Spurious Emissions	Pass	
15.231(c) RSS-210(A1.1.3)	99% Occupied Bandwidth	Pass	





**Fundamental Field Strength**

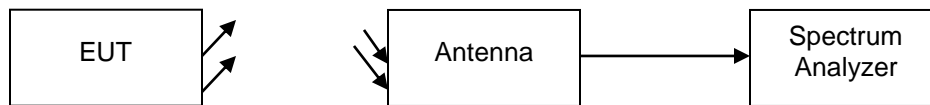
**Name of Test:** Fundamental Field Strength  
**Test Equipment Utilized:** i00267, i00379

**Engineer:** Greg Corbin  
**Test Date:** 3/1/2012

**Test Procedure**

The EUT was tested on an Open Area Test Site (OATS) at a distance of 3 meters from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Fundamental Field Strength. The antenna correction and distance correction factors were summed with the quasi-peak measurement to ensure accurate readings were obtained. The following table indicates the highest emission in each of the indicated bands.

**Test Setup**



**Spectrum Analyzer Settings**

Detector Settings	RBW	VBW	Span
Quasi – Peak	120 kHz	300 kHz	As Necessary

Correction Factors include Antenna and cable insertion loss correction factors.  
Measured Level includes correction factors that were input to the spectrum analyzer before recording test data.

Limit Calculation Formula:

$$\text{Limit} = L1 + [(Fo-F1)(L2-L1)/(F2-F1)]$$

L1 and L2 = limits from table in 15.231(b)

F1 and F2 = Start and stop frequency from table in 15.231(b)

Fo = test frequency

$$L1 = 3750 \text{ uV/m}$$

$$L2 = 12500 \text{ uV/m}$$

$$Fo = 433.9 \text{ MHz}$$

$$F1 = 260 \text{ MHz}$$

$$F2 = 470 \text{ MHz}$$

$$\text{Limit uV/m} = 3750 + [((433.9 - 260)(12500 - 3750)/(470 - 260))] = 10995.83 \text{ uV/m}$$

$$\text{Limit dBuV/m} = 20\log(V) + 120$$

$$\text{Limit dBuV/m} = 20\log(10995.83) + 120 = 80.82 \text{ dBuV/m}$$

**Fundamental Field Strength**

Tuned Freq (MHz)	Quasi-Peak Measured Level (dBuV/m)	Quasi-Peak Limit (dBuV/m)	Result
433.9	69.2	80.82	Pass



**Radiated Spurious Emissions**

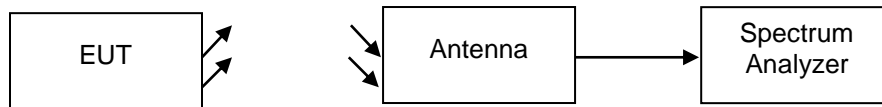
**Name of Test:** Radiated Spurious Emissions  
**Test Equipment Utilized:** i00103, i00267, i00379

**Engineer:** Greg Corbin  
**Test Date:** 3/1/2012

**Test Procedure**

The EUT was tested on an Open Area Test Site (OATS) at a distance of 3 meters from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions. The spectrum for each tuned frequency was examined to the 10<sup>th</sup> harmonic.

**Test Setup**



**Analyzer Settings**

Detector Settings	RBW	VBW	Span
Peak	1 MHz	3 MHz	As Necessary
Average	1 MHz	3 MHz	As Necessary

**Sample Calculations:**

Correction Factors include Antenna and cable insertion loss correction factors.

Measured Level includes correction factors that were input to the spectrum analyzer before recording test data.

Limit calculations: The limit is the greater of the limit listed in 15.209 and the limit listed in the table in 15.231(b).

**15.209 Limit:**

From 216 – 960 MHz, Limit = 200 uV/m

$$\text{dBuV} = 20\log(V) + 120$$

$$\text{Limit dBuV} = 20\log(0.0002) + 120 = 46.02 \text{ dBuV}$$

**Limit from 15.231(b):**

Limit Calculation Formula:

$$\text{Limit} = L1 + [(Fo-F1)(L2-L1)/(F2-F1)]$$

L1 and L2 = limits from table in 15.231(b)

F1 and F2 = Start and stop frequency from table in 15.231(b)

Fo = test frequency

$$L1 = 375 \text{ uV/m}$$

$$L2 = 1250 \text{ uV/m}$$

$$Fo = 433.9 \text{ MHz}$$

$$F1 = 260 \text{ MHz}$$

$$F2 = 470 \text{ MHz}$$

$$\text{Limit uV/m} = 375 + [((433.9 - 260)(1250 - 375)/(470 - 260))] = 724.583 \text{ uV/m}$$

$$\text{Limit dBuV/m} = 20\log(V) + 120$$

$$\text{Limit dBuV/m} = 20\log(.000724583) + 120 = 57.20 \text{ dBuV/m}$$



Per 15.231(b)(3) – The spurious emissions limit is the higher of the 15.209 limit and the table in 15.231(b). The limit listed in 15.231(b) was the higher limit and is used for the Average spurious emission limit. Per section 15.35, the peak limit is 20 dB higher than the average limit.

### Radiated Spurious Emissions

Tuned Freq (MHz)	Emission Freq (MHz)	Peak Measured Level (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
433.9	867.8	30.6	77.2	-46.6
433.9	1301.7	48.1	77.2	-29.1
433.9	1735.6	47.3	77.2	-29.9
433.9	2169.5	41.4	77.2	-35.8

Tuned Freq (MHz)	Emission Freq (MHz)	Avg Measured Level (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)
433.9	867.8	28.6	57.2	-28.6
433.9	1301.7	43.8	57.2	-13.4
433.9	1735.6	37.9	57.2	-19.3
433.9	2169.5	50.1	57.2	-7.1

No other emissions were detectable. All other emissions were greater than -20 dBc.



**Occupied Bandwidth**

**Name of Test:** Occupied Bandwidth  
**Test Equipment Utilized:** i00267, i00379

**Engineer:** Greg Corbin  
**Test Date:** 3/1/2012

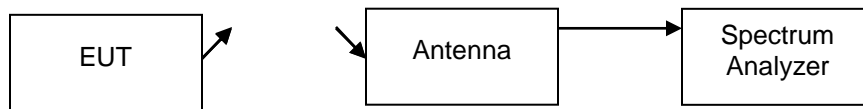
**Test Procedure**

The EUT was tested on an Open Area Test Site (OATS) at a distance of 3 meter from the receiving antenna. The Span was set wide enough to capture the entire transmit spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold and for Industry Canada the 99% Occupied Bandwidth (-26 dB BW) was measured. For the FCC the -20 dB BW was measured.

The OCC BW limit is calculated as .25% of the center frequency.  
OCC BW Limit = 433.9 MHz x 0.25% = 1.08475 MHz

RBW = 30 KHz (no less than 1% of span), VBW = 120 KHz (3 x RBW)

**Test Setup**



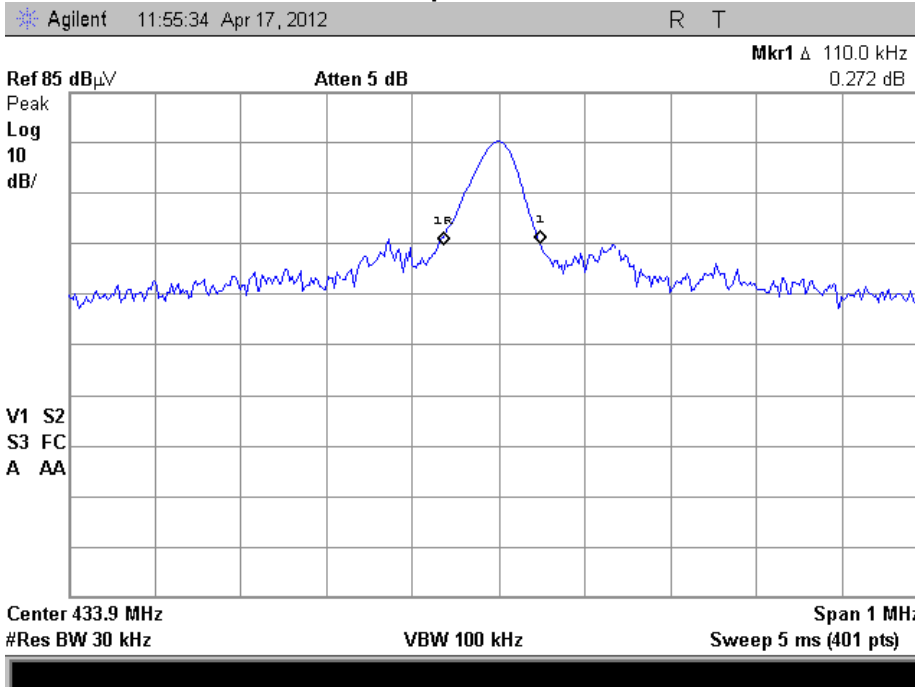
**Occupied Bandwidth Summary**

	Frequency (MHz)	Recorded Measurement	Limit	Result
FCC	433.9	110 kHz	1.08475 MHz	Pass
IC	433.9	137.5 kHz	1.08475 MHz	Pass

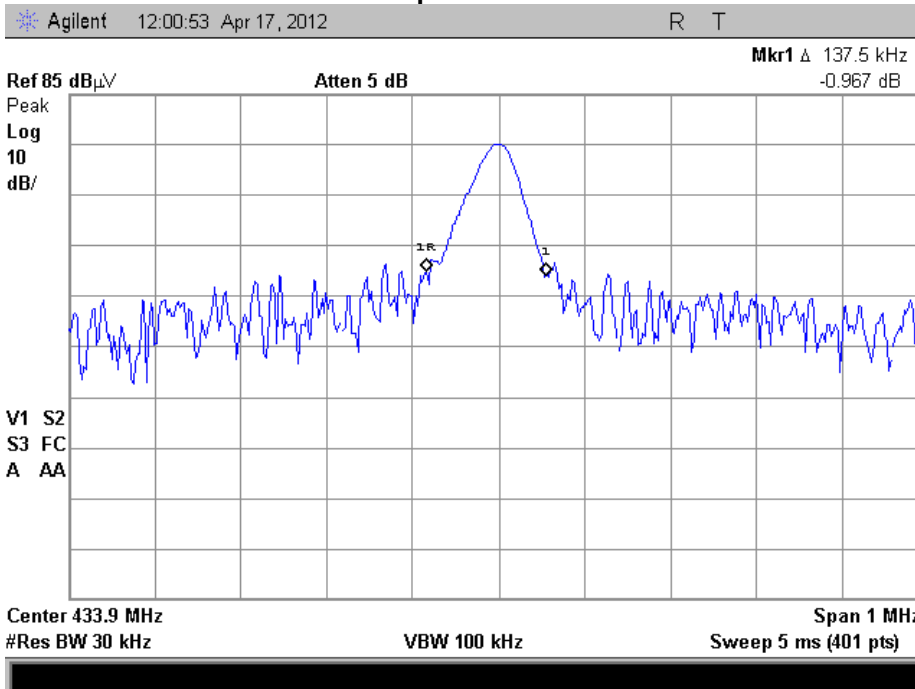


### Occupied Bandwidth Plot

#### FCC Occupied Bandwidth



#### IC Occupied Bandwidth





**Test Equipment Utilized**

Description	Manufacturer	Model Number	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	EMCO	3115	i00103	11/5/10	11/5/12
Bi-Log Antenna	Schaffner	CBL611C	i00267	12/19/2011	12/19/2013
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	11/5/11	11/5/12
Humidity / Temp Meter	Control Company	4189CC	i00355	1/11/12	1/11/13
Spectrum Analyzer	Agilent	E7405A	i00379	12/14/2011	12/14/2012

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT