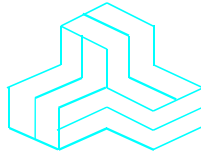


# ENGINEERING TEST REPORT



## Quik-Kee Transmitter

**Model No.: QK-1, QK-1P, QK-2, QK-2P, QK-4 and QK-4P**

**FCC ID: LW3-QK**

*Applicant:*

### Active Control Technology Inc

1800 Appleby Line, Suite 4  
Burlington, Ontario  
Canada L7L 6A1

**In Accordance With  
Federal Communications Commission (FCC)  
Part 15, Subpart C, Section 15.231 Periodic Operation**

**UltraTech's File No.: ACCT-052F15C231**

This Test report is Issued under the Authority of  
Tri M. Luu, Professional Engineer,  
Vice President of Engineering  
UltraTech Group of Labs

Date: May 4, 2010



Report Prepared by: Dan Huynh

Tested by: Wayne Wu, EMC/RFI Technician

Issued Date: May 4, 2010

Test Dates: April 15 & 27, 2010

- The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.
- This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.

## UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4

Tel.: (905) 829-1570 Fax.: (905) 829-8050

Website: [www.ultratech-labs.com](http://www.ultratech-labs.com), Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Email: [tri@ultratech-labs.com](mailto:tri@ultratech-labs.com)



91038



1309



46390-2049



NvLap Lab Code  
200093-0



SL2-IN-E-1119R



Korea KCC-RRL

CA2049

## TABLE OF CONTENTS

<b>EXHIBIT 1.</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1.	SCOPE .....	1
1.2.	RELATED SUBMITTAL(S)/GRANT(S).....	1
1.3.	NORMATIVE REFERENCES .....	1
<b>EXHIBIT 2.</b>	<b>PERFORMANCE ASSESSMENT.....</b>	<b>2</b>
2.1.	CLIENT INFORMATION .....	2
2.2.	EQUIPMENT UNDER TEST (EUT) INFORMATION .....	2
2.3.	EUT'S TECHNICAL SPECIFICATIONS .....	3
2.4.	LIST OF EUT'S PORTS .....	3
2.5.	ANCILLARY EQUIPMENT .....	3
2.6.	TEST SETUP BLOCK DIAGRAM.....	3
<b>EXHIBIT 3.</b>	<b>EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS.....</b>	<b>4</b>
3.1.	CLIMATE TEST CONDITIONS .....	4
3.2.	OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS .....	4
<b>EXHIBIT 4.</b>	<b>SUMMARY OF TEST RESULTS.....</b>	<b>5</b>
4.1.	LOCATION OF TESTS.....	5
4.2.	APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS.....	5
4.3.	MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES .....	5
<b>EXHIBIT 5.</b>	<b>MEASUREMENTS, EXAMINATIONS &amp; TEST DATA FOR EMC EMISSIONS.....</b>	<b>6</b>
5.1.	TEST PROCEDURES.....	6
5.2.	MEASUREMENT UNCERTAINTIES.....	6
5.3.	MEASUREMENT EQUIPMENT USED .....	6
5.4.	ANTENNA REQUIREMENTS [47 CFR § 15.203].....	6
5.5.	PROVISIONS FOR PERIODIC TRANSMITTERS [47 CFR 15.231(A)].....	7
5.6.	TRANSMITTER RADIATED EMISSIONS [47 CFR §§ 15.231(B), 15.209 & 15.205] .....	8
5.7.	20 dB BANDWIDTH [47 CFR 15.231(c)] .....	15
<b>EXHIBIT 6.</b>	<b>TEST EQUIPMENT LIST.....</b>	<b>17</b>
<b>EXHIBIT 7.</b>	<b>MEASUREMENT UNCERTAINTY.....</b>	<b>18</b>
7.1.	LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY .....	18
7.2.	RADIATED EMISSION MEASUREMENT UNCERTAINTY .....	19

**EXHIBIT 1. INTRODUCTION****1.1. SCOPE**

<b>Reference:</b>	FCC Part 15, Subpart C, Section 15.231
<b>Title:</b>	Code of Federal Regulations (CFR), Title 47, Telecommunication - Part 15
<b>Purpose of Test:</b>	To gain FCC Equipment Certification for section 15.231, Periodic Operation.
<b>Test Procedures:</b>	American National Standards Institute ANSI C63.10 - American National Standard for Testing Unlicensed Wireless Devices
<b>Environmental Classification:</b>	[ x ] Commercial, industrial or business environment [ x ] Residential

**1.2. RELATED SUBMITTAL(S)/GRANT(S)**

None.

**1.3. NORMATIVE REFERENCES**

<b>Publication</b>	<b>Year</b>	<b>Title</b>
FCC 47 CFR 15	2009	Code of Federal Regulations – Telecommunication
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
CISPR 22 EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances

**EXHIBIT 2. PERFORMANCE ASSESSMENT****2.1. CLIENT INFORMATION**

<b>APPLICANT</b>	
<b>Name:</b>	Active Control Technology Inc.
<b>Address:</b>	1800 Appleby Line, Suite 4 Burlington, Ontario Canada L7L 6A1
<b>Contact Person:</b>	Peter Gimon Phone #: 905-670-5500 Fax #: 905-592-9691 Email Address: pgimon@activecontrol.com

<b>MANUFACTURER</b>	
<b>Name:</b>	Active Control Technology Inc.
<b>Address:</b>	1800 Appleby Line, Suite 4 Burlington, Ontario Canada L7L 6A1
<b>Contact Person:</b>	Peter Gimon Phone #: 905-670-5500 Fax #: 905-592-9691 Email Address: pgimon@activecontrol.com

**2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION**

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

<b>Brand Name:</b>	Active Control Technology Inc
<b>Product Name:</b>	Quik-Kee Transmitter
<b>Model Name or Number:</b>	QK-1, QK-1P, QK-2, QK-2P, QK-4 and QK-4P
<b>Serial Number:</b>	Test sample
<b>Type of Equipment:</b>	Periodic operated device (Security/Remote Control Transmitter)
<b>Input Power Supply Type:</b>	3V lithium battery
<b>Primary User Functions of EUT:</b>	Key FOB

**2.3. EUT'S TECHNICAL SPECIFICATIONS**

<b>TRANSMITTER</b>	
<b>Equipment Type:</b>	Portable
<b>Intended Operating Environment:</b>	Commercial, industrial or business environment Residential
<b>Power Supply Requirement:</b>	3V lithium battery
<b>RF Output Power Rating:</b>	76.26 dBμV/m at 3m distance
<b>Operating Frequency Range:</b>	433.92 MHz
<b>Duty Cycle:</b>	32.2 %
<b>20 dB Bandwidth:</b>	8.72 kHz
<b>Modulation Type:</b>	ASK
<b>Oscillator Frequencies:</b>	13.56 MHz
<b>Antenna Connector Type:</b>	Integral
<b>Antenna Description:</b>	Manufacturer: Active Control Type: Integral, PCB trace Model: N/A Frequency Range: 433.92 MHz Gain: N/A

**2.4. LIST OF EUT'S PORTS**

<b>Port Number</b>	<b>EUT's Port Description</b>	<b>Number of Identical Ports</b>	<b>Connector Type</b>	<b>Cable Type (Shielded/Non-shielded)</b>
No interface port				

**2.5. ANCILLARY EQUIPMENT**

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

No ancillary equipment.

**2.6. TEST SETUP BLOCK DIAGRAM**

Stand-alone Device



## EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

### 3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	3V lithium battery

### 3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

<b>Operating Modes:</b>	The EUT was configured for continuous transmission for the duration of testing.
<b>Special Test Software:</b>	N/A
<b>Special Hardware Used:</b>	N/A
<b>Transmitter Test Antenna:</b>	The EUT was tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

<b>Transmitter Test Signals</b>	
<b>Frequency Band(s):</b>	433.92 MHz
<b>Test Frequency(ies):</b>	433.92 MHz
<b>RF Power Output:</b>	76.26 dBµV/m at 3m distance
<b>Normal Test Modulation:</b>	ASK
<b>Modulating Signal Source:</b>	Internal

## EXHIBIT 4. SUMMARY OF TEST RESULTS

### 4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2011-05-01.

### 4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna Requirement	Yes
15.231(a)	Provisions of FCC 15.231	Yes
15.231(b) 15.109 15.209	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious Emissions	Yes
15.231(c)	20 dB Bandwidth	Yes
15.231(d)	Frequency Tolerance for Devices Operating within the Frequency Band 40.66-40.70 MHz	Not applicable
15.207(a)	AC Power-Line Conducted Emissions	Not applicable for battery operated device.

### 4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

## **EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS**

### **5.1. TEST PROCEDURES**

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.10 and Ultratech's test procedures ULTR-P001-2004.

### **5.2. MEASUREMENT UNCERTAINTIES**

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document LAB 34 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

### **5.3. MEASUREMENT EQUIPMENT USED**

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.10 and CISPR 16-1-1.

### **5.4. ANTENNA REQUIREMENTS [47 CFR § 15.203]**

#### **5.4.1. Requirements**

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.

**Notes:** This requirement does not apply to carrier current devices operated under the provisions of @ 15.211, 15.213, 15.217, 17.219 or 15.221.

#### **5.4.2. Engineering Analysis**

The antenna is an integral part of the EUT; it is a trace antenna on the printed circuit board.



**5.5. PROVISIONS FOR PERIODIC TRANSMITTERS [47 CFR 15.231(a)]****5.5.1. Engineering Analysis**

<b>FCC Rules</b>	<b>FCC Provisions</b>	<b>Analysis on Compliance</b>
15.231(a)	The intentional radiator restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal.	Only control signals are sent. Control signals are only sent after a pushbutton is activated.
15.231(a)(1)	A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.	Transmitter is deactivated 1 second after button is pressed.
15.231(a)(2)	A transmitter activated automatically shall cease transmission within 5 seconds after activation.	N/A – no automatic operation.
15.231(a)(3)	Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.	N/A – Signals are only transmitted after a pushbutton is activated.
15.231(a)(4)	Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.	N/A
15.231(a)(5)	Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.	N/A

**5.6. TRANSMITTER RADIATED EMISSIONS [47 CFR §§ 15.231(b), 15.209 & 15.205]****5.6.1. Limit(s)****47 CFR 15.231(b) Field Strength Limits**

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70.	2,250	225
70-130	1,250	125
130-174	1,250 to 3,750 <sup>1</sup>	125 to 375 <sup>1</sup>
174-260	3,750	375
260-470	3,750 to 12,500 <sup>1</sup>	375 to 1,250 <sup>1</sup>
Above 470	12,500	1,250

<sup>1</sup> Linear interpolations with frequency F in MHz:

For 130-174 MHz: FS (microvolts/m) = (56.82 x F) - 6136

For 260-470 MHz: FS (microvolts/m) = (41.67 x F) - 7083.

- (1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.
- (2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

**47 CFR 15.205(a) Restricted bands of operation**

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
<sup>1</sup> 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	( <sup>2</sup> )
13.36-13.41.			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.<sup>2</sup> Above 38.6

- (3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

**47 CFR 15.209(a) General Field Strength Limits**

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76– 88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.		

### 5.6.2. Method of Measurements

Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.10 for measurement methods.

## 5.6.3. Test Data

**Remarks:**

- The measuring receiver shall be tuned over the frequency range 30 MHz to 4.5 GHz.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- For portable transmitter, EUT was placed in three different orthogonal positions for searching maximum field strength level.
- In the restricted band per FCC 15.205: § 15.209 (a) limits applied
- Outside the restricted band per FCC 15.205: § 15.231 (b) limits or § 15.209 (a) applied, whichever allows higher field strength emission.
- Section 15.231(b) field strength limit of the fundamental at 433.92 MHz =  $20 \log [(41.67 \times 433.92) - 7083] = 80.8 \text{ dB}\mu\text{V/m}$
- Spurious emissions limit is 20 dB below fundamental limit.
- Duty cycle correction factor (see plots 5.6.3.1(i), (ii), (iii) & (iv) for detail).

Computation of duty-cycle correction factor:

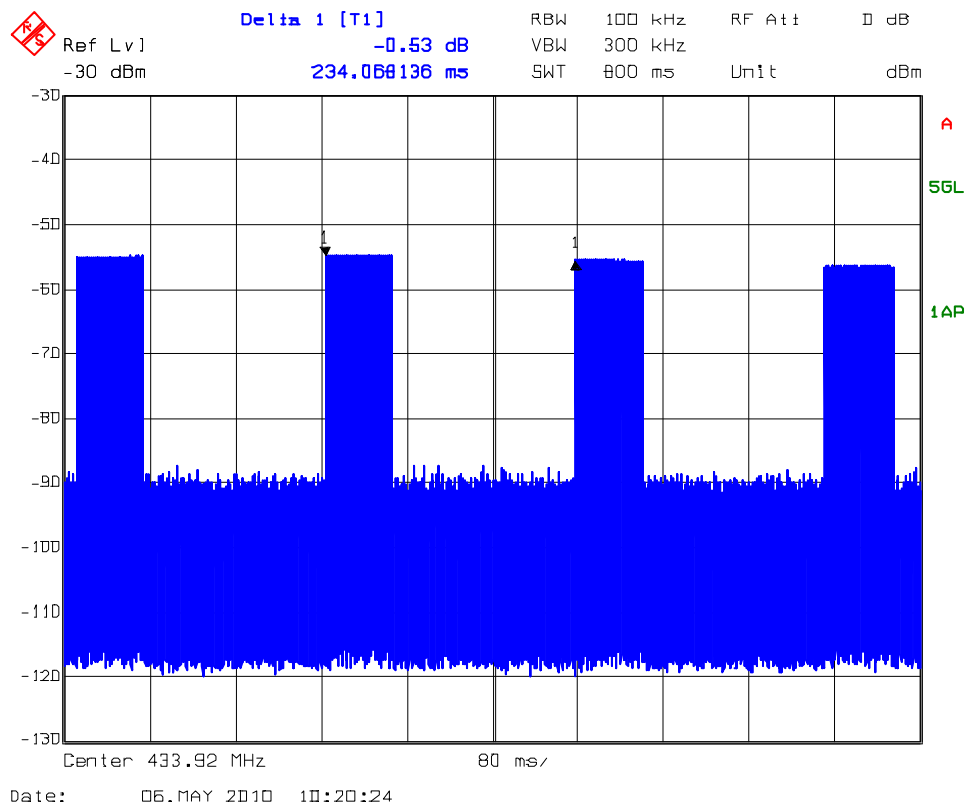
Sub-Pulse	Duration (ms)	Number of pulses	Sub-Pulse "On Time" (ms)
1	0.405	36	14.57
2	0.802	22	17.64
Total on time:			32.21

$$\text{Duty cycle correction factor} = 20 \log (T_{\text{ON}}/100 \text{ ms}) = 20 \log (32.21 \text{ ms}/100 \text{ ms}) = -9.84 \text{ dB}$$

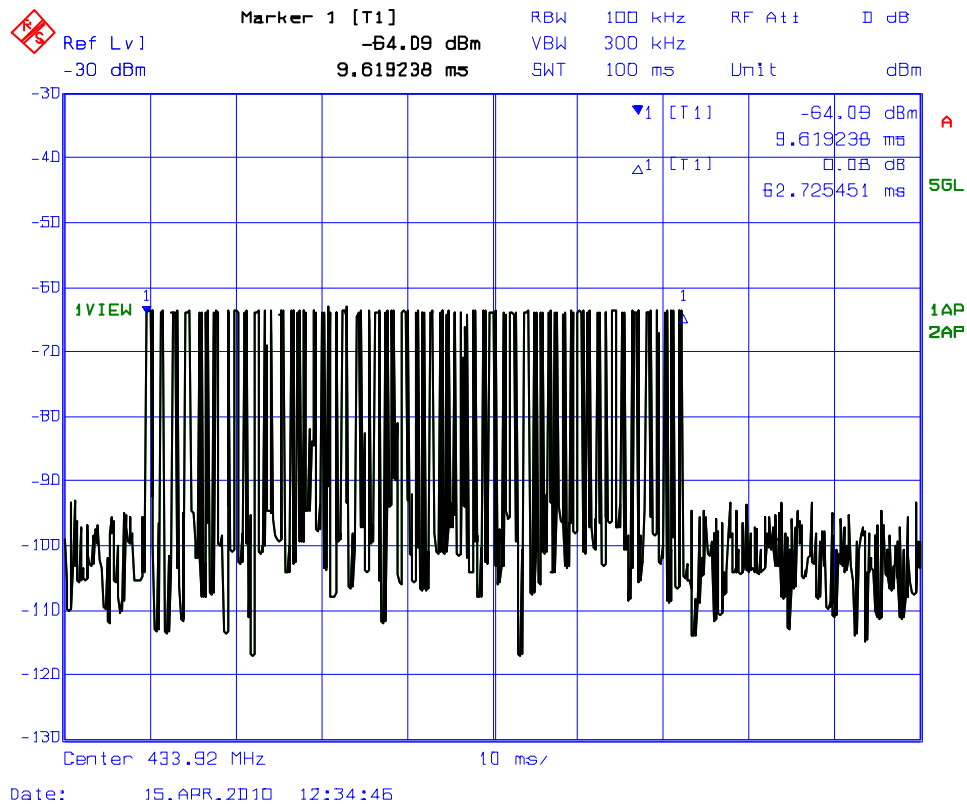
Frequency (MHz)	Peak E-Field @ 3m (dBµV/m)	Average E-Field @ 3m (dBµV/m)	Antenna Plane (H/V)	Limits @ 3m (dBµV/m)		Margin (dB)
				§ 15.231 (b)	§ 15.209 (a)	
Field Strength of Fundamental						
433.92	84.09	74.25	V	80.8	--	-6.6
433.92	86.10	76.26	H	80.8	--	-4.6
Field Strength of Spurious Emissions						
1301.76*	57.71	47.87	V	60.8	54.0	-6.1
1301.76*	58.65	48.81	H	60.8	54.0	-5.2
1735.68	51.03	41.19	V	60.8	54.0	-19.6
1735.68	52.17	42.33	H	60.8	54.0	-18.5

\* Emissions within the restricted bands.

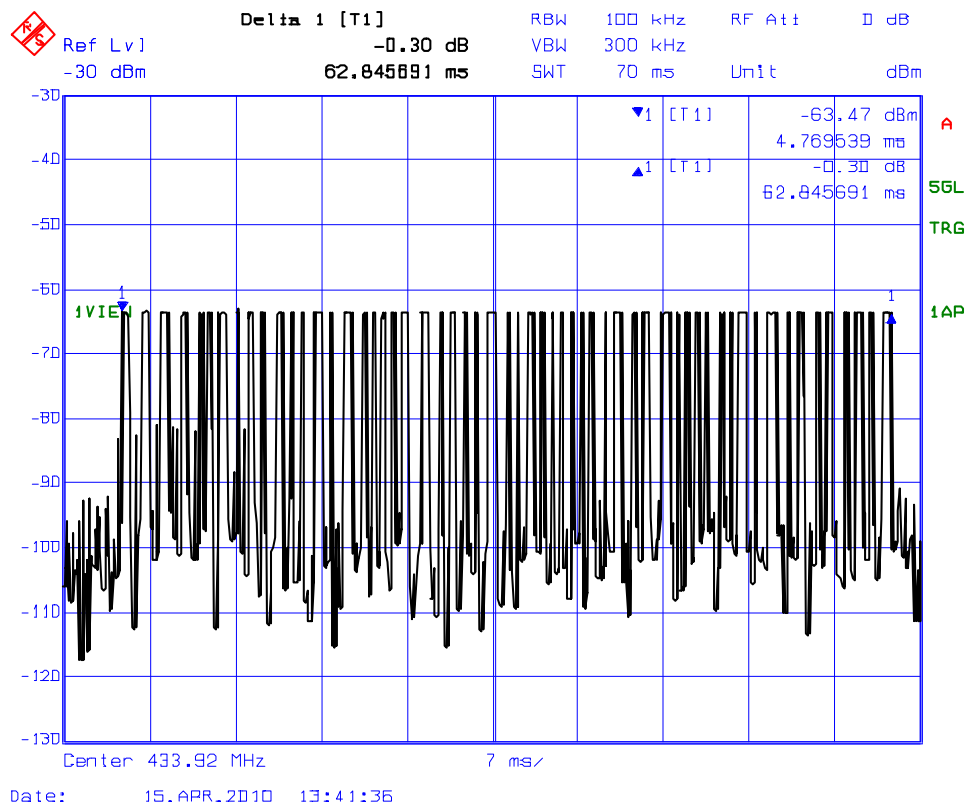
Plot 5.6.3.1(i) Duty Cycle (pulse train)



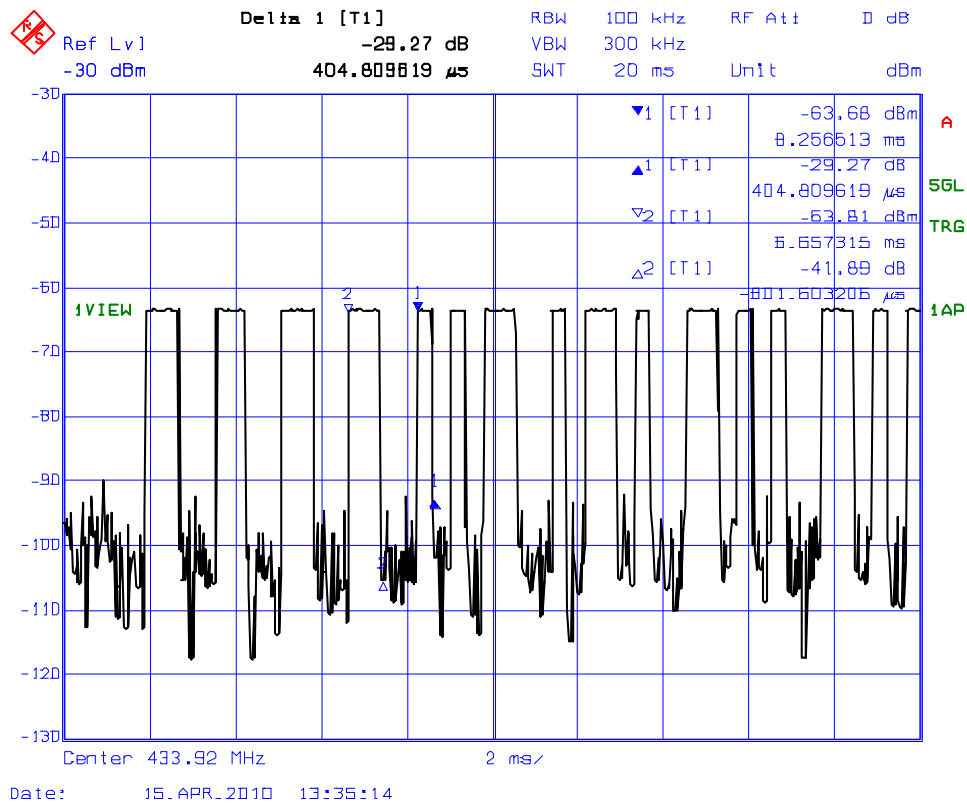
Plot 5.6.3.1(ii) Duty Cycle in 100 ms



**Plot 5.6.3.1(iii) Duty Cycle (Number of Pulses)**  
**Number of Sub-Pulse 1: 36; Number of Sub-Pulse 2: 22**



**Plot 5.6.3.1(iv) Duty Cycle (Duration)**  
**Sub-pulse 1: 405  $\mu$ S; Sub-pulse 2: 802  $\mu$ S**





## 5.7. 20 dB BANDWIDTH [47 CFR 15.231(c)]

### 5.7.1. Limit(s)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

### 5.7.2. Method of Measurements

The measurements were performed in accordance with Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.10:.

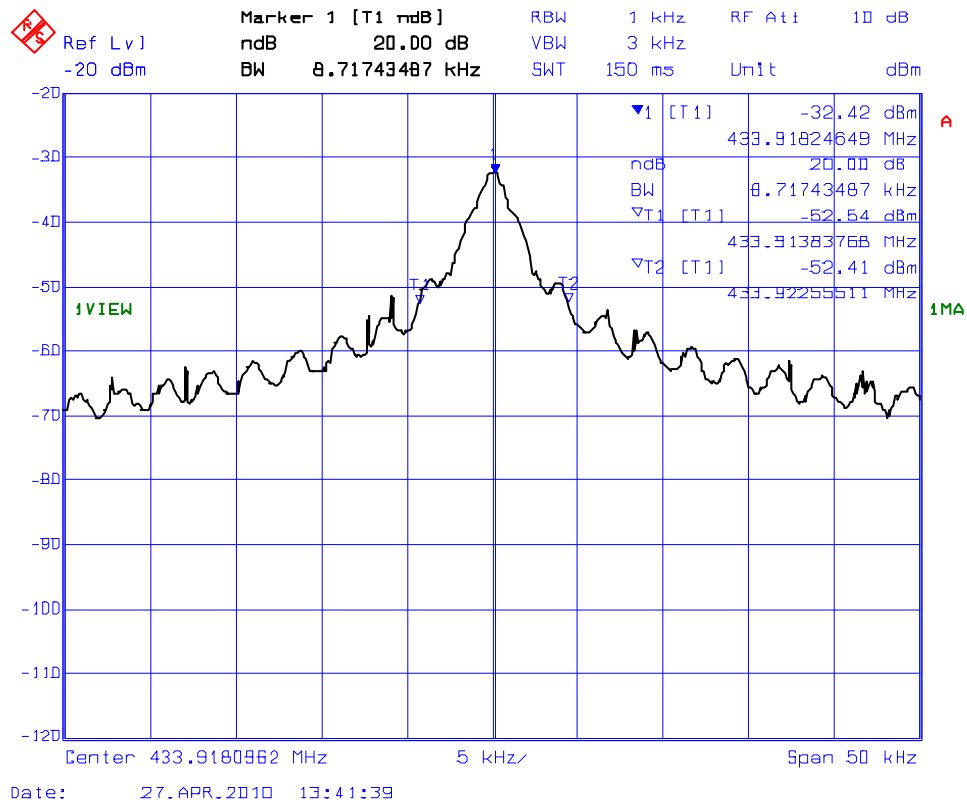
The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna. The bandwidth of the fundamental frequency was measured with the spectrum analyzer, with the resolution BW set to 1% to 3 % of the approximate emission width and video BW set to 3 times the resolution BW.

### 5.7.3. Test Data

Frequency (MHz)	20 dB Bandwidth (kHz)	Maximum Bandwidth Limit (kHz)
433.92	8.72	1084.8

See the following plots for details.

Plot 5.7.3.1: 20 dB Bandwidth  
Fc: 433.92 MHz



**EXHIBIT 6. TEST EQUIPMENT LIST**

<b>Test Instruments</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Operating Range</b>
EMI-Test Receiver	Rohde & Schwarz	ESU40	100037	20 Hz- 40 GHz, build in amplifier
Spectrum Analyzer	Rohde & Schwarz	FSEK	834157/005	9 kHz- 40 GHz
Biconilog Anenna	Emco	3142C	26873	26 – 3000 MHz
Biconilog Anenna	Emco	3142B	1575	26 – 2000 MHz
Horn Antenna	Emco	3115	6570	1 – 18 GHz
Horn Antenna	Emco	3115	5955	1 – 18 GHz
Loop Antenna	Emco	6502	2611	10 kHz – 30 MHz
RF Amplifier	Com-Power	PA-103A	161243	10 MHz – 1000 MHz
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz
High Pass Filter	Mini Circuit	SHP-600	--	Cut off at 560 MHz

**ULTRATECH GROUP OF LABS**

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: ACCT-052F15C231

May 4, 2010

*All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

**EXHIBIT 7. MEASUREMENT UNCERTAINTY**

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and LAB 34

**7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY**

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	$\pm 1.5$	$\pm 1.5$
LISN coupling specification	Rectangular	$\pm 1.5$	$\pm 1.5$
Cable and Input Transient Limiter calibration	Normal (k=2)	$\pm 0.3$	$\pm 0.5$
Mismatch: Receiver VRC $\Gamma_1 = 0.03$ LISN VRC $\Gamma_R = 0.8(9 \text{ kHz}) 0.2(30 \text{ MHz})$ Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	$\pm 0.2$	$\pm 0.3$
System repeatability	Std. deviation	$\pm 0.2$	$\pm 0.05$
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	$\pm 1.25$	$\pm 1.30$
Expanded uncertainty U	Normal (k=2)	$\pm 2.50$	$\pm 2.60$

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30 \text{ dB}$$

$$U = 2u_c(y) = \pm 2.6 \text{ dB}$$

**7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY**

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY ( $\pm$ dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	$\pm 1.0$	$\pm 1.0$
Cable Loss Calibration	Normal (k=2)	$\pm 0.3$	$\pm 0.5$
EMI Receiver specification	Rectangular	$\pm 1.5$	$\pm 1.5$
Antenna Directivity	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	$\pm 2.0$	$\pm 0.5$
Antenna phase center variation	Rectangular	0.0	$\pm 0.2$
Antenna factor frequency interpolation	Rectangular	$\pm 0.25$	$\pm 0.25$
Measurement distance variation	Rectangular	$\pm 0.6$	$\pm 0.4$
Site imperfections	Rectangular	$\pm 2.0$	$\pm 2.0$
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67(\text{Bi}) 0.3 (\text{Lp})$ Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	+1.1 -1.25	$\pm 0.5$
System repeatability	Std. Deviation	$\pm 0.5$	$\pm 0.5$
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k = 2 is used:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$