



CERT NO: 2088-01

TEST REPORT #190110D

STANDARD: FCC PART 15

SUBPART C--INTENTIONAL RADIATORS

**SECTION 15. 231 PERIODIC OPERATION IN THE BAND
40.66 – 40.70 MHZ AND ABOVE 70 MHZ**

EQUIPMENT TESTED:

**ELECTRONIC CONTROLLED SYSTEMS, INC.
dba
KING CONTROLS, INC.**

FCC ID: UUM433A

MODEL: VQ1

TEST DATE: 19 JANUARY, 2010

1100 Falcon Avenue
Glencoe, MN 55336



***INTERNATIONAL
CERTIFICATION SERVICES, INC.***

Tele: 320-864-4444
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Prepared for: Electronic Controlled Systems, Inc. dba King Controls, Inc.
11200 Hampshire Avenue South
Bloomington, MN 55438

Test agent: International Certification Services, Inc.
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Test location: International Certification Services, Inc.
1100 Falcon Avenue
Glencoe, MN 55336
Tele: 320-864-4444
Fax: 320-864-6611

Prepared by: International Certification Services, Inc.
1100 Falcon Avenue
Glencoe, MN 55336

International Certification Services represents to the client that testing is done in accordance with standard procedures applicable and that reported test results are accurate within generally accepted commercial ranges of accuracy.

• This report only applies to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. International Certification Services shall have no liability for any deductions, inferences or generalizations drawn by the client or others from this report.

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1.0 TEST SUMMARY

TEST REPORT: #190110D

COMPANY: Electronic Controlled Systems, Inc. dba King Controls, Inc.

AGENT: International Certification Services, Inc.

PHONE: 320-864-4444

TEST DATE: 19 January, 2010

EQUIPMENT UNDER TEST: Mobile Satellite TV Antenna Model: VQ1

GENERAL TEST SUMMARY: The testing was performed at International Certification Services, Inc. at 1100 Falcon Ave, Glencoe, MN 55336

VERIFICATION / CERTIFICATION STATUS: The Electronic Controlled Systems, Inc. dba King Controls, Inc. Mobile Satellite TV Antenna Model:VQ1 was found to be in compliance with the FCC Part 15 Subpart C, Section 15.231 requirements.

MODIFICATIONS NECESSARY: None

TESTED BY

Steve Wendlandt



WRITTEN BY

Duane R. Bagdons



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Applicable Standards

47 CFR Ch.1 (10-01-09 Edition)

FCC Part 15 Radio Frequency Devices

Subpart C Intentional Radiators

Section 15.231 Periodic Operation in the band 40.66 – 40.70 Mhz,
and above 70 Mhz.

2.1 Referenced Standards

ANSI C63.4-2003 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 Ghz.

2.2 Equipment Units Tested

The equipment tested was a 433 Mhz transmitter that is part of the Electronic Controlled Systems, Inc. Mobile Satellite TV Antenna Model: VQ1. There are two members of this VQ1 family: 1) VQ1000 (with handle) and 2) V10 (with NO handle). The Model: VQ1 contains a wireless device that is operated in the 433 Mhz frequency spectrum. There is no external antenna for the wireless feature of this model. The VQ1 (Base Station) gets its DC power from a HOST device such as a satellite receiver. There is no connection to any public mains circuitry on the device itself.

2.3 Equipment and Cable Configuration

See photo of the EUT test configuration setup in Attachment A

2.4 List of Test Equipment

<u>Test Equipment</u>	<u>Model</u>	<u>S/N</u>	<u>Calibration Date</u>
Spectrum Analyzer	Hewlett-Packard 8566B	2747A05211	08/12/09
Preamp	P0012	1726A00666	11/16/09
Preamp	P0013 Nextec	378	05/27/09
Log Periodic Antenna (200-1000 MHz)	EMCO 3146	9111-3280	06/22/09
Horn Antenna (1-18 Ghz)	EMCO 3115	2334	06/23/09

Measurement cable losses, and antenna correction factors are included in the data sheets. The Resolution BW was set at 1 Mhz and the Video BW was set at 1 Hz with a Span of 0 Hz to perform the correct average detected measurements over 1000 Mhz.

2.5 Units of Measurement.

All measurements were taken in dBuV/m with the antenna located at 3 meters distance from the EUT. Frequency measurements are recorded in Mhz

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2.6 Location of Test Site

The open area test site (OATS) measurement facility used to collect the data was International Certification Services, Inc. at 1100 Falcon Ave in Glencoe, MN 55336. This site has been certified to be in spec of the normalized site attenuation per ANSI C63.4-2003.

2.7 Measurement Procedures

The antenna was placed at a distance of 3 meters from the EUT. The EUT was set on an insulating table in the OATS site and **rotated through 360 degrees** to determine the worst case EUT orientation. The **antenna was then positioned vertical and horizontal** to determine which antenna polarity orientation was worst case. Then certification data was recorded at all the transmitter frequencies from the fundamental to the 10th harmonic at an **antenna height variation of from 1-4 meters**.

The worst case orientation was found to be at 270 degrees with the antenna in Vertical Polarity and at a height of 1 meter.

2.8 Reporting Measurement Data

See data sheets and plots in Attachment B.

2.9 Radiated Emissions Data

The frequency and amplitude of the tuned frequency of the EUT along with the frequencies and amplitudes of the harmonics up to the 10th harmonic are reported in the data sheets in Attachment B. This information is plotted against the limit of section 15.231 of FCC Part 15 subpart C. Both Horizontal and Vertical antenna polarities as well as antenna heights of 1 to 4 meters were observed but all maximum signal strengths occurred in the Horizontal antenna polarity and at 1 meter antenna height.

EUT Orientation Degrees	Amplitude (dBuV/m)	Ant Pol
0	96	V
90	97.5	V
180	98.3	V
270	102	V
0	86.9	H
90	88.4	H
180	88.7	H
270	80.2	H

Worst case EUT orientation is 270 degrees and vertical antenna Polarization

The Final Level, expressed in dBuV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBuV) and adding the antenna correction factor and cable loss factor (Factor dB) and subtracting the preamp gain. This result then has the FCC limit subtracted

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from it to provide the margin which gives the tabular data as shown in the data sheets in Attachment B.

Example:

<u>Frequency</u> <u>(MHz)</u>	<u>Level</u> <u>(dBuV)</u>	+	<u>Factor</u> <u>(dB)</u>	=	<u>Corr Data</u> <u>(dBuV/m)</u>	-	<u>FCC Limit</u> <u>(dBuV/m)</u>	=	<u>Margin</u> <u>(dB)</u>
100.0	20.6	+	11.0	=	31.6	-	43.5	=	-11.9

2.10 Operating Frequency Data for Intentional Radiators

All operating frequencies and harmonic frequencies and ambient temperature at which all data was taken was recorded in the data sheets in Attachment B.

2.11 Occupied Bandwidth Data for Intentional Radiators

The occupied BW data for the EUT is listed in the data sheets in Attachment B.

2.12 Summary of Results

The EUT passed the requirements of FCC Part 15 Subpart C, Section 15.231. FCC section 15.35 was implemented since this device is a pulse modulated device. The transmitted burst only occupies 16 mS of ON time during a 100 mS period (i.e. 16 %). Hence the calculated Average output amplitude $= 89.83 - [20 \cdot \log(.16)]$ dBuV/m = 73.91 dBuV/m against a FCC 15.231 Limit of 80.801 dBuV/m.

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ATTACHMENT A

RADIATED MEASUREMENT

TEST SET UP

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**Electronic Controlled Systems, Inc.
Model: VQ1
FCC 15.231 Radiated Emissions
Base Unit Test Configuration**



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ATTACHMENT B

DETAILED TEST DATA SHEETS

Each radiated emissions plot indicates the receiving antenna measurement distance in meters and the emission amplitudes with respect to their applicable limits. The associated tabulation for each radiated plot lists the emission frequency, the final emission level, and the margin from the limit.

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Electronic Controlled Systems, Inc.
Models: VQ1
Temperature: 66 Deg F.
Humidity: 38 % R.H.

Test Technician: Steve Wendlandt

Center Frequency: 433.197 Mhz

The equipment tested was the VQ1 Mobile Satellite receiver system RF transmitter. This unit transmits at a frequency of 433.197 Mhz. The Transmitter uses a PC board Foil antenna. There is no external antenna or connection to any Public Mains for this unit. The Base Unit is powered from the antenna cable that plugs into the HOST satellite receiver and gets its power from the satellite receiver. The output RF signal is actuated by a push button switch on the Remote Hand Held unit which in turn gets a transmitted response from the Base Unit. An automatic response transmission takes place with this EUT. The Base Unit responds with a 16 mS burst of data spaced at 494 mS apart. As soon as the Base Unit is finished responding to the Remote Hand Held unit, the firmware in the Base Unit turns the Transmit Mode OFF automatically on the Base Unit. **Once the maximum orientation from either of the EUT's was determined then tests were performed at this test configuration and then this signal was maximized to 0-360 degrees orientation and antenna height of 1-4 meters.**

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.

Not Applicable

15.231 (a) (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

The firmware in the Base Unit automatically responds to the Remote Hand Held signal by transmitting a signal out. As soon as the transmitted signal is transmitted, the Base Unit Firmware turns the transmitter OFF automatically. This is well within the 5 seconds time allowed. It is shortly (mS) after the 16 mS transmitted burst is sent out

The EUT PASSES this requirement

15.231 (a) (3) Periodic transmissions at regular predetermined intervals are not permitted....There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

Not Applicable, there are no periodic regular predetermined intervals in this transmission scheme.

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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.

Not Applicable

15.231 (a) (5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(4) 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.

Not Applicable this unit is used for setting up information for security systems.

15.231 (b) In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Freq (Mhz)	Field Strength of Fundamental (uV/m)	Field Strength of Fundamental (dBuV/m)	Field Strength of Spurious Emissions (uV/m)	Field Strength of Spurious Emissions (dBuV/m)
40.66-40.70	2250		225	
70-130	1250		125	
130-174	1250 to 3750		125 to 375	
174-260	3750		375	
260-470	3750 to 12,500**	71.48 to 81.938	375 to 1250**	51.48 to 61.938
Above 470	12,500		1250	61.938

****Linear interpolations**

The maximum permitted fundamental field strengths are as follows:...for the band 260-470 Mhz, uV/m at 3 meters = 41.6667 (F) – 7083.3333. The maximum permitted unwanted emissions level is 20 dB below the maximum permitted fundamental level.

LIMIT:

Fundamental Freq (Mhz)	Field Strength of Fundamental (uV/m)	Field Strength of Fundamental (dBuV/m)	Field Strength of Spurious Emissions (uV/m) (above 470 Mhz)	Field Strength of Spurious Emissions (dBuV/m)
433.197	10,966.56	80.80	1250	61.938

15.231 (b)(1) The field strength limits are specified at a distance of 3 meters.

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15.231 (b)(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 emissions 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.

15.35 (b) ...Unless otherwise specified, e.g., see 5.250, 15.252, 15.255, and 15.509-15519 of this part, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test....

Worst case orientation data is shown in the table below:

EUT Orientation Degrees	Amplitude (dBuV/m)	Ant Pol
0	96	V
90	97.5	V
180	98.3	V
270	102	V
0	86.9	H
90	88.4	H
180	88.7	H
270	80.2	H

Freq (Mhz)	dBuV	Corr Fac (dB)	Corr Data (dBuV)	FCC 15.35 Duty Cycle Average (dB)	Final Corr Data Average (dBuV/m)	FCC & IC AVG Limit (dBuV/m)	Ant Pol
433.188	104.5	-14.66	89.83	-15.92	73.91	80.8	V

The 15.231 AVERAGE limit = 80.8 dB

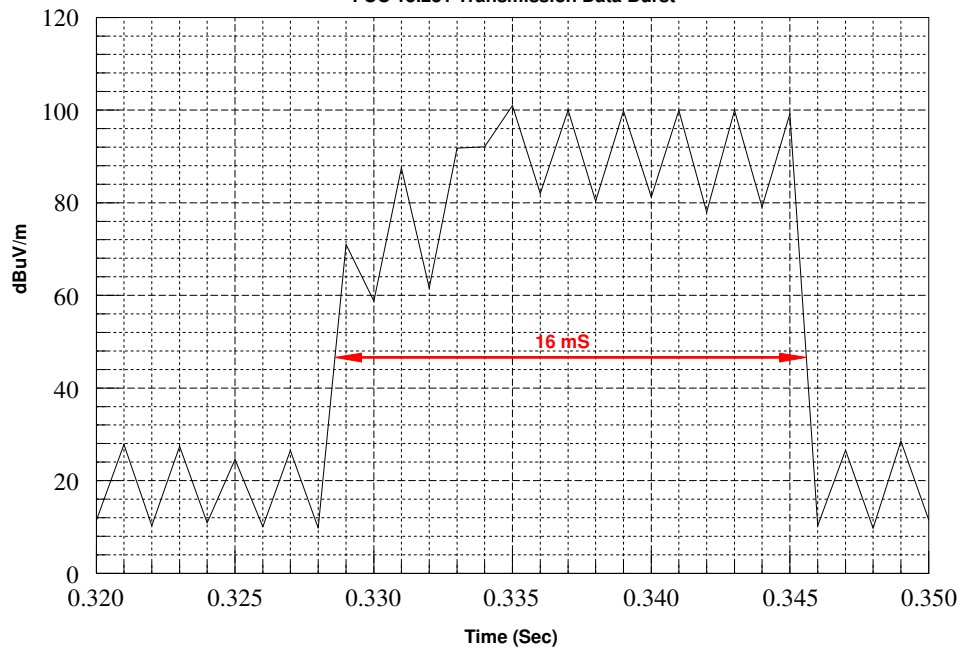
This EUT PASSES this requirement.

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Electronic Controlled Systems, Inc.
Model: VQ1
FCC 15.231 Transmission Data Burst



International Certification Services, Inc.

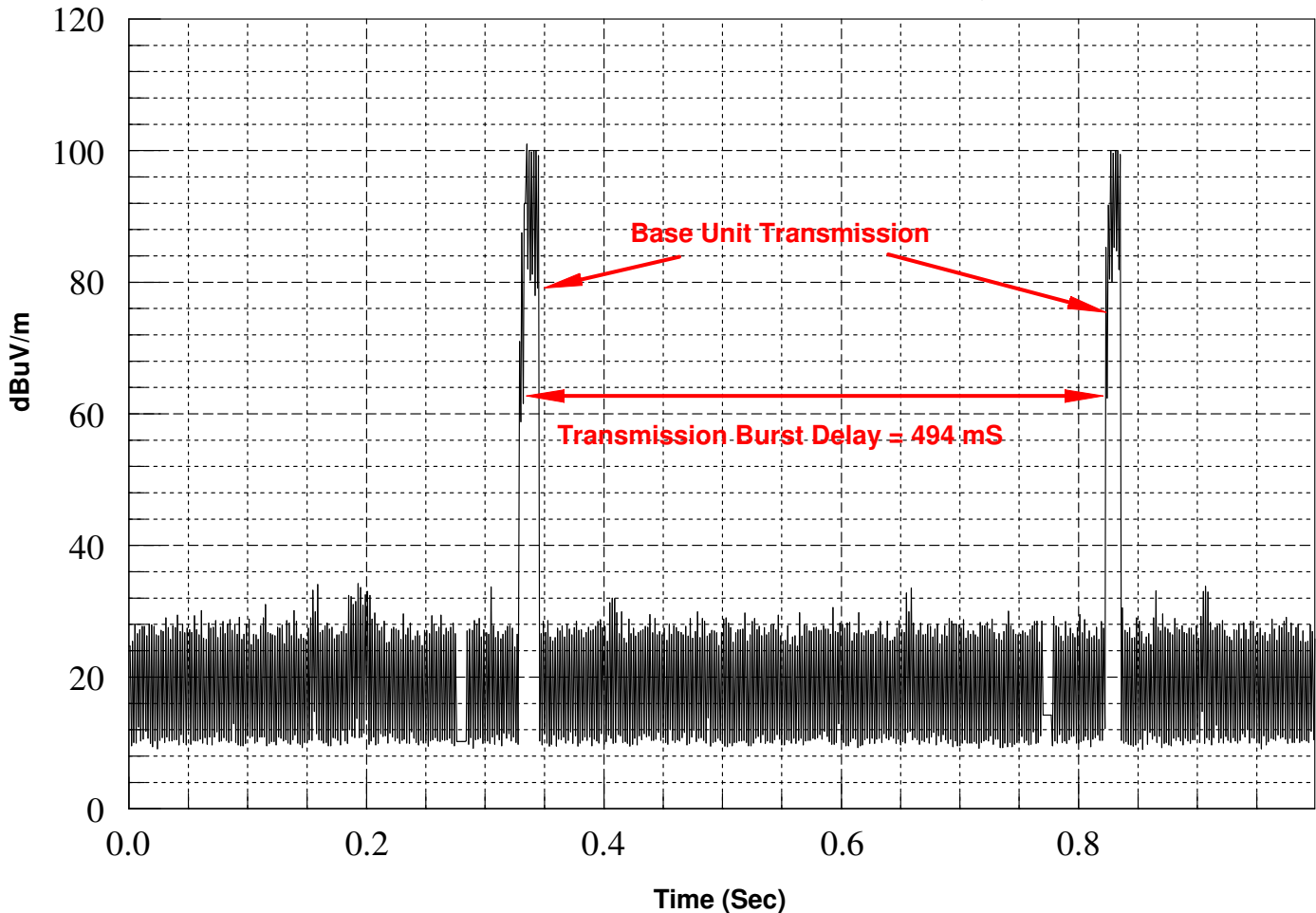
April 14, 2010

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Electronic Controlled Systems, Inc.
Model: VQ1
FCC 15.231 Transmission Data Burst Delay



International Certification Services, Inc.

April 14, 2010

The above graphs show that this device is pulse modulated and falls under section 15.35 for effective amplitude reduction. The calculation method for this amplitude reduction is as follows:

The transmitted burst only occupies 16 mS of ON time during a 100 mS period (i.e. 0.16 or 16 %). Hence the calculated Average output amplitude is:

$0.16 \% = \text{ABS Val } (20 \times \text{LOG}_{10} (.16)) = \text{ABS VAL } (-15.92) = 15.92 \text{ dB}$
 $89.83 \text{ dBuV/m} - 15.92 \text{ dB} = 73.91 \text{ uV/m}$ against a FCC 15.231 Limit of 80.801 dBuV/m.

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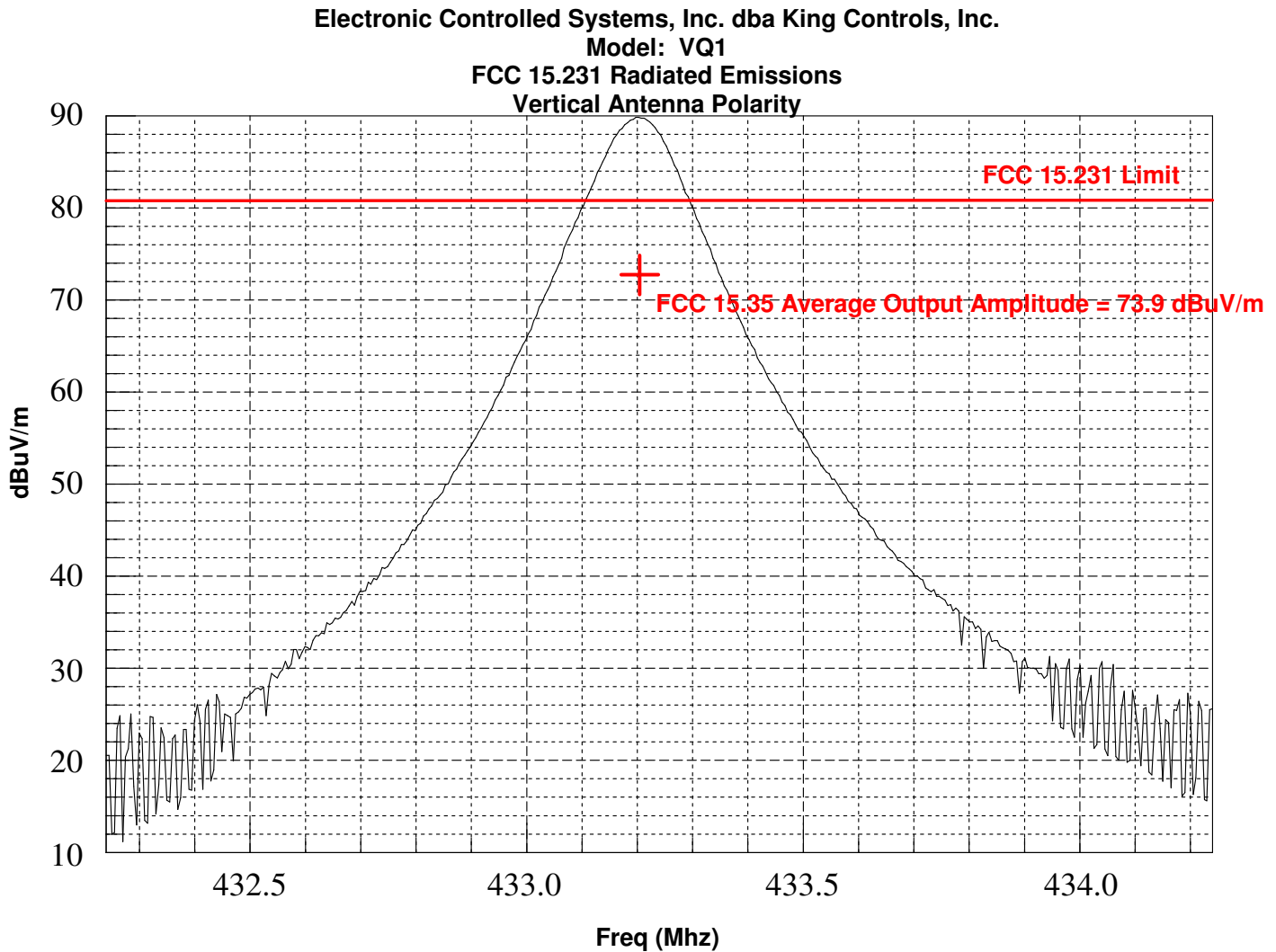
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Hence for a 100 mS period the Average Output level:

433.197 Mhz	73.91 dBuV/m Average output level
867.88 Mhz	52.53 dBuV/m – 15.92 = 36.61 dBuV/m
1301.82 Mhz	55.2 dBuV/m – 15.92 = 39.28 dBuV/m

Fundamental Average Limit = 80.801 dBuV/m

Harmonic Average Limit = 61.938 dBuV/m



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January 18, 2010

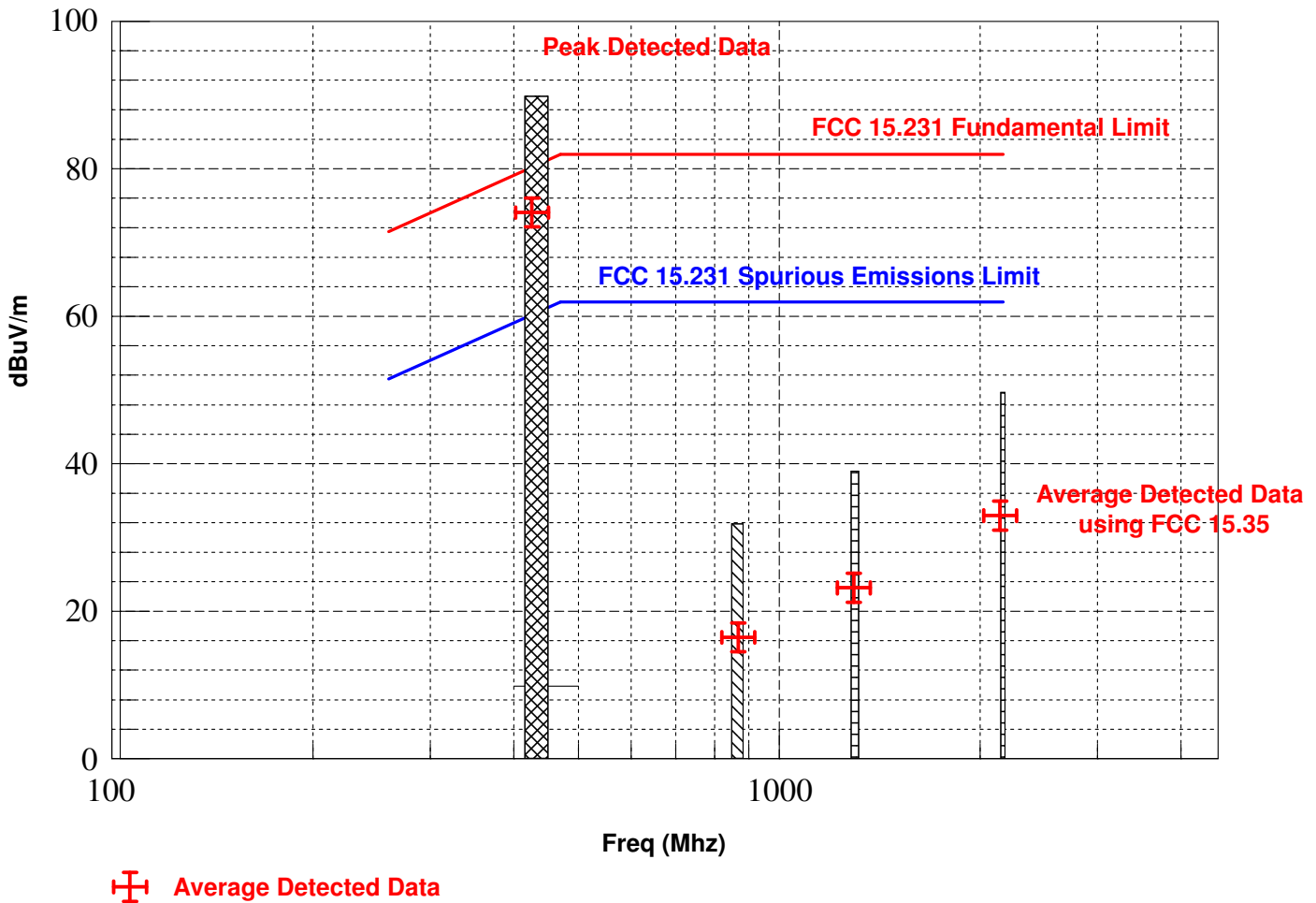
RBW=100 Khz, VBW=300 Khz

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King Controls
Model: VQ1
FCC 15.231 Harmonic Emissions
Vertical Antenna Polarity



International Certification Services, Inc.

January 19, 2010

Using the calculation method from section 15.35, I have shown the actual average pulse modulated levels for both the fundamental frequency as well as the harmonics are below the allowed limit of FCC 15.231.

The EUT PASSES this requirement

15.231 (b)(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.

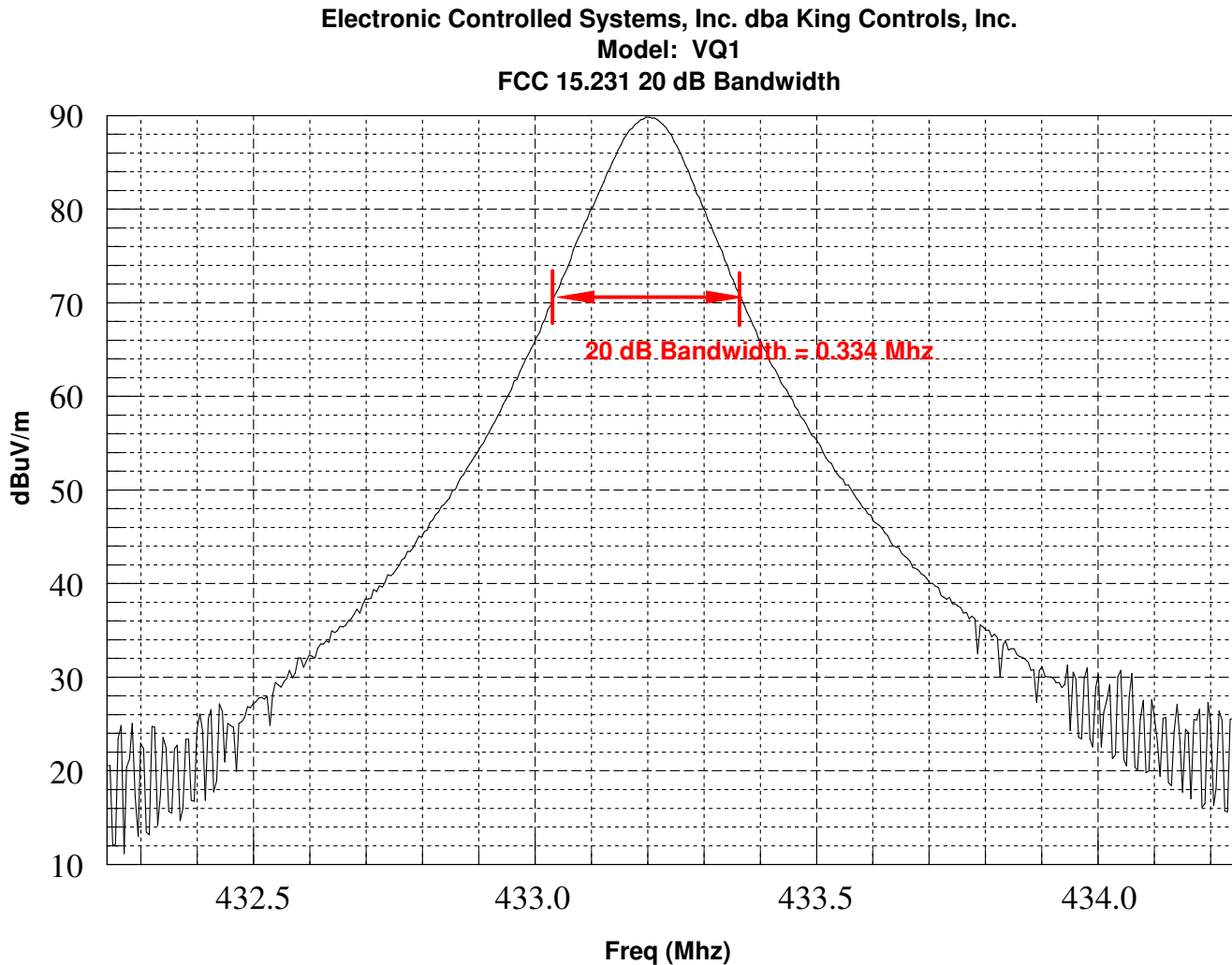
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NOTE: No other signals from the EUT were observed. This satisfies 15.205.

15.231 (c) 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 emissions shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.



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January 18, 2010

FCC Required Bandwidth
 $433.197 \times 0.0025 = 1.08299 \text{ Mhz}$

Measured Bandwidth = 0.334 Mhz
(RBW=100 Khz, VBW = 300 Khz)

This EUT PASSES this requirement

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15.231 (d) For devices operating within the frequency band 40.66 to 40.70 Mhz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be +/- 0.01%. This frequency tolerance shall be maintained for a temperature variation of -20 degrees to +50 Degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Not Applicable

15.231 (e) Intentional Radiators may operate at a periodic rate exceeding that specified in paragraph (a) and may be employed for any type of operation, including operation prohibited in paragraph (a), provided the intentional radiator complies with the provision of paragraphs (b) through (d) of this Section, except the field strength table in paragraph (b) is replaced by the following:

Fundamental Frequency (Mhz)	Field Strength of Fundamental (uV/m)	Field Strength of Fundamental (dBuV/m)	Field Strength of Spurious Emission (uV/m)	Field Strength of Spurious Emission (dBuV/m)
40.66-40.70	1000	60	100	40
70-130	500	53.979	50	33.979
130-174	500 to 1500**		50 to 150**	
174-260	1500	63.52	150	43.52
260-470	1500 to 5000**		150 to 500**	
Above 470	5000	73.979	500	53.979

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Not Applicable, this device operates within the criteria of 15.231 (a)

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ATTACHMENT C

**PRODUCT DATA SHEET OR PRODUCT INFORMATION FORM AS SUPPLIED
BY THE CUSTOMER**

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COMPANY NAME: Electronic Controlled Systems, Inc. dba King Controls

CUSTOMER REPRESENTATIVE: International Certification Services, Inc.

EQUIPMENT DESCRIPTION: Mobile Satellite TV Antenna.

MODEL NUMBER: VQ1

SERIAL NUMBER: N/A

TYPE OF TEST: ☐ Development
☒ Initial Design Verification
☐ Design Change (Please describe exact changes below)
☐ Production Sample (Audit Test)

OSCILLATOR FREQUENCIES:

16 Mhz

POWERLINE INTERFACE:

Frequency: DC

Voltage: 13-18 VDC

POWER SUPPLY: None

POWER CABLE: None

POWER LINE FILTER: None

CABINET SHIELDING PROVISION:

Plastic Enclosure

SOFTWARE AND / OR OPERATING MODES:

Rev: CE

INTERFACING EQUIPMENT OR SIMULATORS:

Description	P/N
Satellite Receiver (PACE)	Model: BSKYB2400; S/N: EABACRF949540227

I/O CABLES:

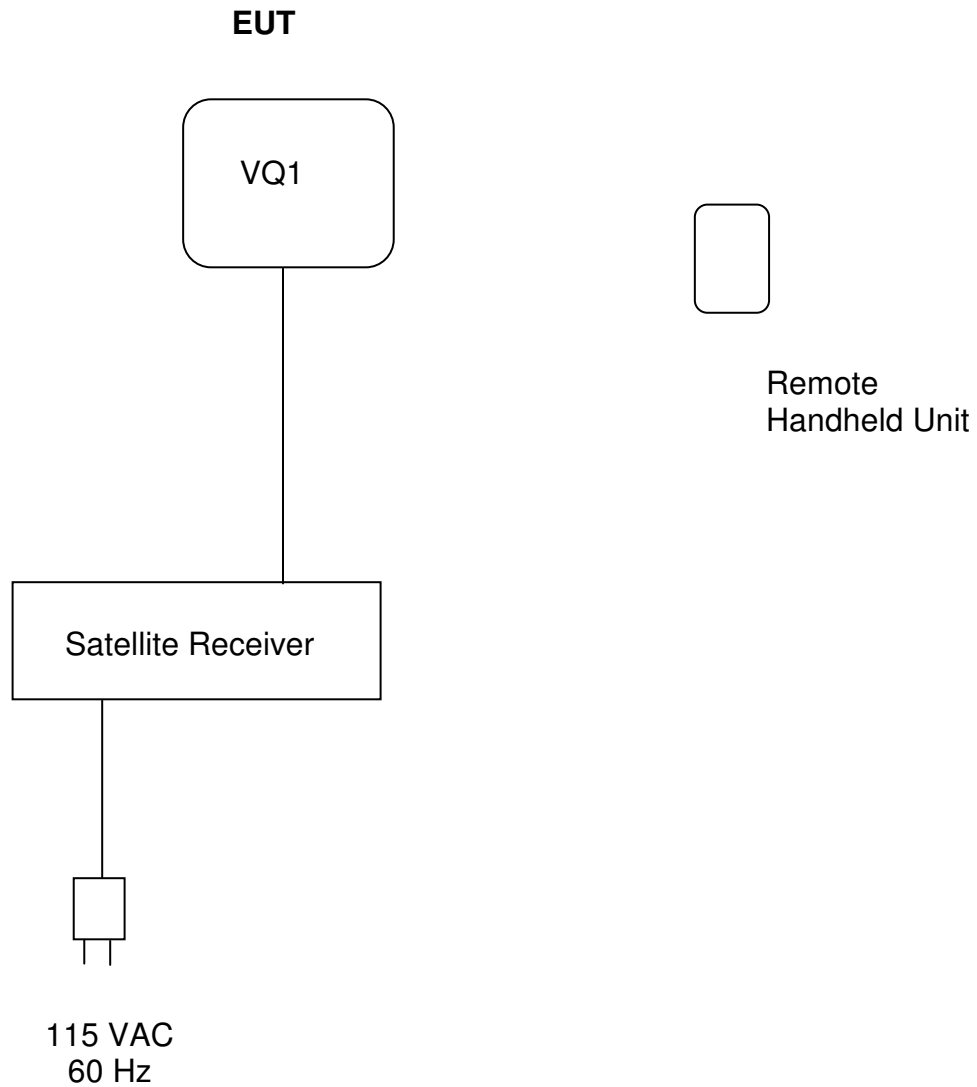
FUNCTION	LENGTH	CONNECTOR TYPE	SHIELD TERMINATION
RG 6 signal/power cable	15.2 meters	F type	Shield connected to connector back shell

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Electronic Controlled Systems, Inc. dba King Controls
Model: VQ1
Test Configuration



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