TYPE OF EXHIBIT:	TEST REPORT
FCC PART:	15.231 per 2.1033 (b)(6)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODELS:	RQA-1B, RQA-4B
TYPE OF UNIT:	433.92 MHz Call Button Transmitter
FCC ID:	AIERIT35-433
DATE:	October 22, 2013

The following is a list of attached exhibits required by the Federal Communications Commission for the application to and grant of FCC Part 15 Certification. All tests are per ANSI C63.4-2003 where applicable.

Table of Content

EXHIBIT:	GENERAL INFORMATION
FCC PART:	15 Subpart C
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODELS:	RQA-1B, RQA-4B
TYPE OF UNIT:	433.92 MHz Call Button Transmitter
FCC ID:	AIERIT35-433
DATE:	October 22, 2013

1.1 Purpose

The purpose of this test report is to confirm compliance with Chapter 47 Part 15 Subpart C of the FCC's Code of Federal Regulations.

1.2 Product Description

The Ritron models RQA-1B and RQA-4B are wireless call buttons to be used in conjunction with Ritron Part 15 model receiver RQT-433-RCVR (FCC ID: AIERIT32-433-RCVR).

Frequency:	433.920 MHz
Operating Channels:	1
Modulation:	ASK (OOK)
Operating Voltage:	Single CR123A 3V Lithium primary battery

1.3 Test Methodology

The RQA-1B/4B was tested for radiated emissions in both a vertical and horizontal orientation per FCC requirements, but the product is intended for operation in a vertical orientation only.

1.4 Testing Summary

All tests were conducted on the RQA-1B/4B for the purpose of demonstrating compliance with Part 15.231. All tests were conducted using measurement procedure from ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz as appropriate.

Test Name	Test Method/Standard	Result	Comments
Unintentional Radiated Emissions	15.109	N/A	
Antenna requirement	15.203	Pass	RQA-1B/4B antenna is a Helix Monopole, attached permanently to the PCB.
External radio frequency power amplifiers and antenna modifications	15.204	N/A	External power amp, alternative antenna and antenna modification are not available.
A/C Power Line Conducted Emissions	15.207(a)	N/A	RQA-1B/4B uses a single CR123A 3V Lithium primary battery only.
Occupied Bandwidth	15.231(c)	Pass	
Deactivation Time	15.231(a)(1)	Pass	
Duty Cycle	15.231	Pass	
Radiated & Spurious Emissions	15.231(b),15.209(a), 15.205,15.35(C)	Pass	

TYPE OF EXHIBIT:	DESCRIPTION OF TEST FACILITY
FCC PART:	2.948(a)(2)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODELS:	RQA-1B, RQA-4B
TYPE OF UNIT:	433.92 MHz Call Button Transmitter
FCC ID:	AIERIT35-433
DATE:	October 22, 2013

2.1 The emission measurements filed with this application were made on a site certified by RITRON, Inc. Data pertaining to this site is on file with the FCC and Industry Canada.

Firm Registration Number:	536261
Firm FRN:	0004-3348-76
FCC Reference:	ANSI STD C63.4-2003
Industry Canada Radio Standard:	Procedure 212

This site is used on a continuing basis exclusively by RITRON, Inc. and is utilized only for RF field strength measurements of equipment designed and manufactured by RITRON, Inc. It is not used for measurements by, or for, any other party on a contract basis or otherwise.

All other measurements are taken at RITRON's engineering laboratory in Carmel, IN.

Signed: Michael A. Pickard

Michael A. Pickard - Project Engineer

Ritron Test Site

TYPE OF EXHIBIT:	TEST EQUIPMENT LIST
FCC PART:	2.947(d)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODELS:	RQA-1B, RQA-4B
TYPE OF UNIT:	433.92 MHz Call Button Transmitter
FCC ID:	AIERIT35-433
DATE:	October 22, 2013

3.1 The measured data in this report was obtained using one or more of the following pieces of equipment. The particular equipment used in any one test is detailed in the procedure for that test.

ITEM	MANUFACTURER	MODEL NO.	SERIAL NO.	Last Cal	EXP Cal
Spectrum Analyzer	Advantest	R3265A	75060189	02 OCT 2013	02 OCT 2014
Log Periodic Antenna	Electro-Metrics	LPA-25	8-102	17 MAY 2011	17 MAY 2014
Gain horn	EMCO	3105	2034	22 OCT 2013	22 OCT 2015

Support equipment:

ITEM	MANUFACTURER	MODEL NO.	SERIAL NO.
Digital Multimeter	Fluke	179	82800086

Signed: Michael A. Pickard

Michael A. Pickard - Project Engineer

EXHIBIT:	TEST RESULTS
FCC PART:	15.231
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODELS:	RQA-1B, RQA-4B
TYPE OF UNIT:	433.92 MHz Call Button Transmitter
FCC ID:	AIERIT35-433
DATE:	October 22, 2013

4.1 Overview

This document describes the test setups, test methods, required test equipment, and the test limits used to perform compliance testing of the RQA-1B/4B Call Button Transmitter per FCC Part 15 Rules. All tests described in this document were performed to demonstrate compliance of the RQA-1B/4B to FCC Part 15 requirements.

Model(s) Tested:	RQA-1B/4B
FCC ID:	AIERIT35-433
Emission Designator:	N/A
Supply Voltage:	3 VDC, single CR123A Lithium primary battery only
Frequency:	433.92 MHz
Type(s) of Modulation:	OOK
Operation Power:	10,998 microvolts/meter at 3 meters (Radiated)
Test Item:	Pre-Production
Type of Equipment:	Wireless Call Button
Type of Antenna:	Helix Monopole, permanently attached to PCB
Modification to the EUT:	None

4.2 Antenna Requirement – FCC: CFR 47 Part 15.203

The RQA-1B and RQA-4B antenna is a helix monopole, attached permanently to the PCB. There are no provisions for alternative antenna installation. All tests included in this report were conducted with the standard helix monopole antenna attached.

4.3 External radio frequency power amplifiers and antenna modifications – FCC: CFR 47 Part 15.204

An external power amp, alternative antenna and antenna modification are not available for the RQA-1B and RQA-4B. Therefore, FCC Part 15.204 does not apply.

4.4 A/C Power Line Conducted Emissions – FCC: CFR 47 Part 15.207(a)

The RQA-1B and RQA-4B use a single CR123A 3V Lithium primary battery only. All tests included in this report were conducted with a fresh CR123A 3V Lithium primary battery installed. Therefore, FCC Part 15.207(a) does not apply.

Signed: Michael A. Pickard

Michael A. Pickard - Project Engineer

4.5 Periodic Operation - FCC: CFR 47 Part 15.231(a)(1)

Deactivation Time - Test Requirement(s): CFR 47 Part 15.231(a)(1)

Test Procedure:
As required by CFR 47 Part 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.

The RQA-1B/4B transmitter is not activated until the button is released. At that time the RQA-1B and RQA-4B will transmit a modulated signal for 2 S. This satisfies the FCC requirement to deactivate the transmitter no more than 5 seconds after the button has been released.

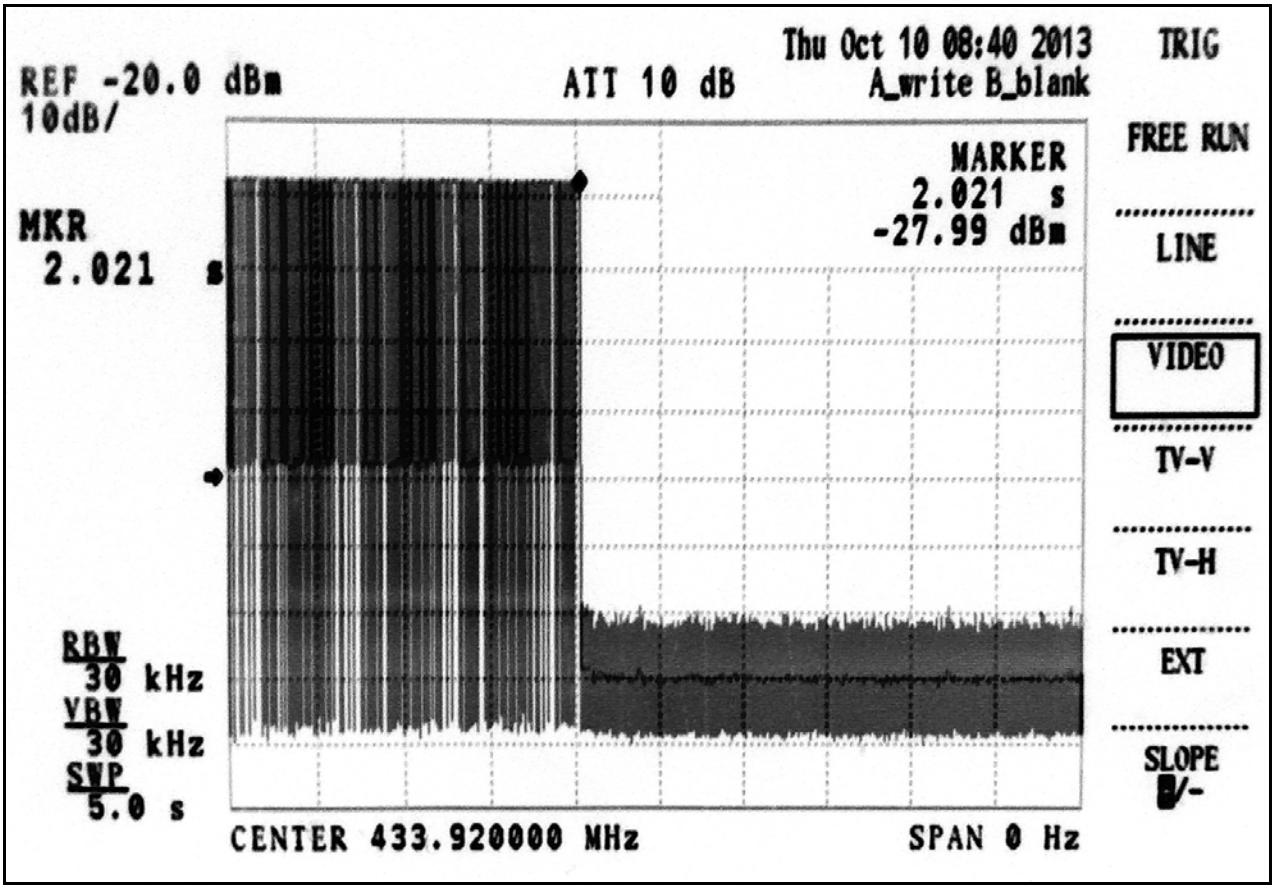
The RQA-1B/4B antenna was attached and the waveform was received by the test antenna which was connected to the Advantest R3265A spectrum analyzer. The device was operated and the transmission time was measured with the spectrum analyzer set to zero span at the fundamental frequency

Detector Setting	Resolution Bandwidth	Video Bandwidth	Span
Video Peak	30 kHz	30 kHz	Zero

Table 1 – Analyzer settings for Deactivation Time Test

Frequency (MHz)	Transmission Time (Sec)	Specification Limit (Sec)
433.920	2.021	5 seconds or less

Table 2 - Deactivation Time Test Results



Plot 1 - Deactivation Time

Signed: Michael A. Pickard

Michael A. Pickard - Project Engineer

4.6 Occupied Bandwidth - FCC: CFR 47 Part 15.231(c)(1)

Test Procedure:

Per 47 CFR 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

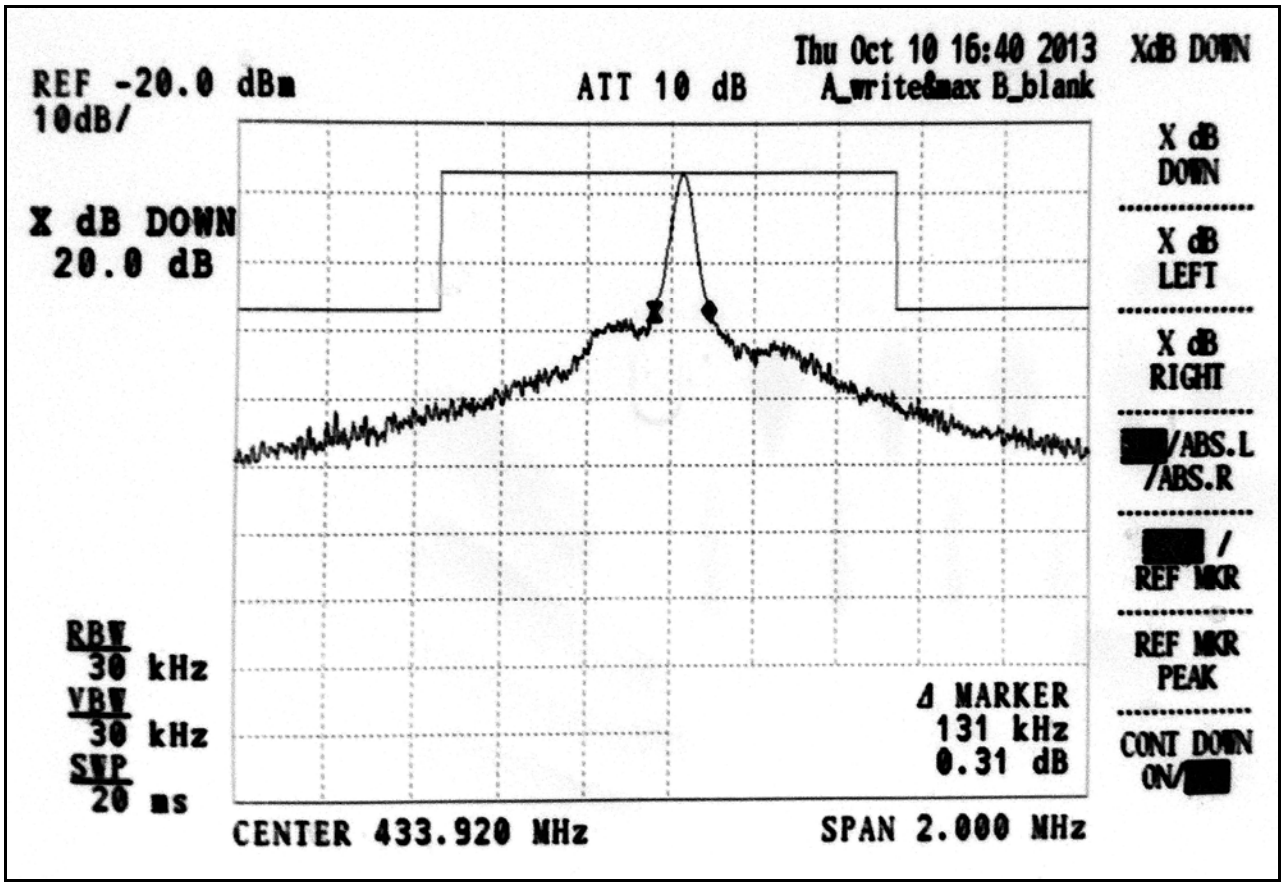
The RQA-1B/4B was placed in test mode for continuous RF modulation. The RQA-1B/4B antenna was attached and the waveform was received by the test antenna which was connected to the Advantest R3265A spectrum analyzer. The measured highest peak power was used as a reference. The RBW of the Spectrum Analyzer was set to 30 kHz and VBW=RBW.

Frequency (MHz)	Bandwidth	Specification Limit
433.920	120 kHz	1.085 MHz

Table 3 – Occupied Bandwidth Test Results

Note: Limit = 0.25%*Center Frequency = 0.25% * 433.920 MHz = 1.085 MHz

Following is the Occupied Bandwidth plot with limit line.



Plot 2 – Occupied Bandwidth with limit line

Signed: Michael A. Pickard

Michael A. Pickard - Project Engineer

4.7 Duty Cycle for Calculating Average Correction Factor

Test Procedure:

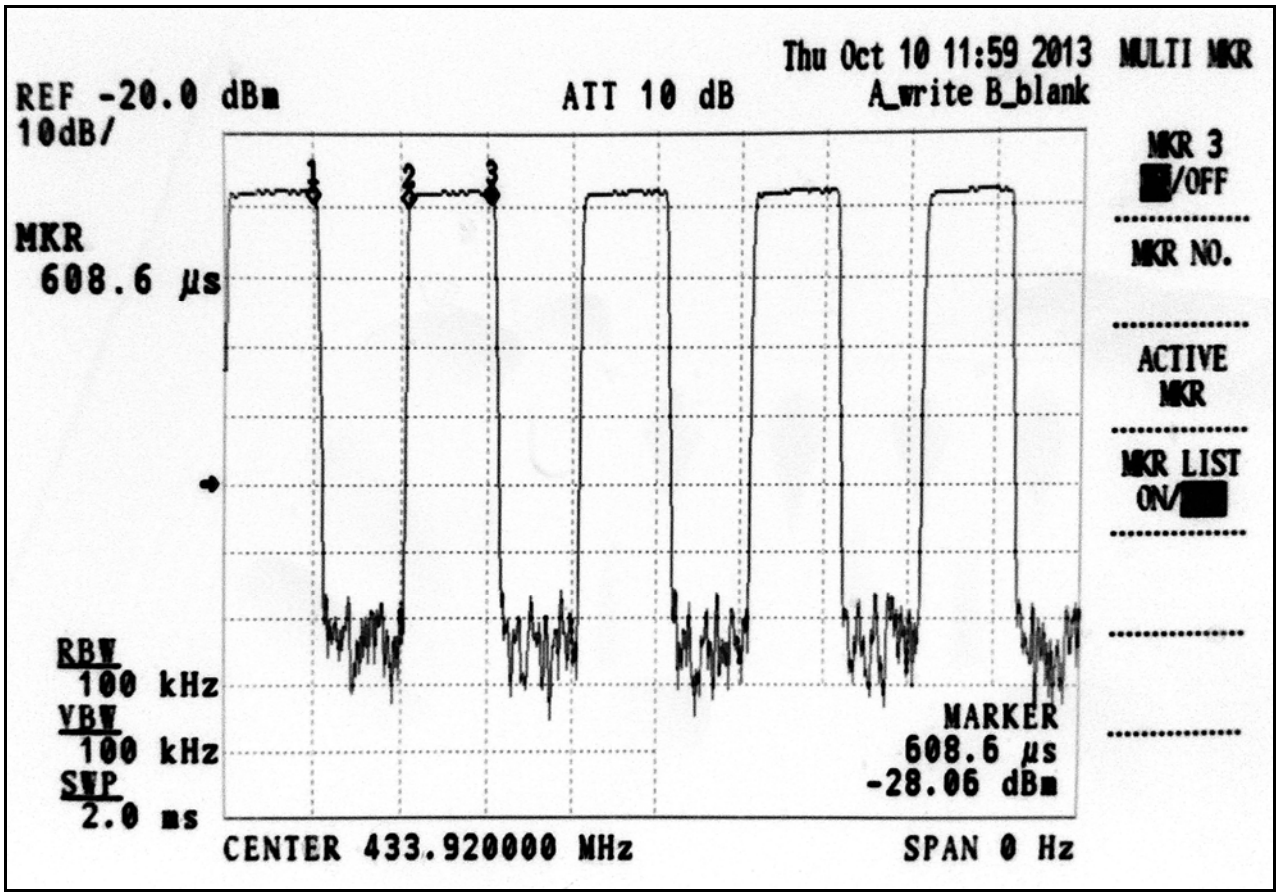
There are no limits for this test. The data from this test is used to calculate the average correction factor applied to measured peak radiated emission results.

The RQA-1B/4B is placed in a test mode where the modulated transmitter is set to run continuously, otherwise the unit is operating in a normal condition with primary lithium battery and PCB mounted antenna. The waveform is received by a test antenna connected to the Advantest R3265A spectrum analyzer. The duty cycle is measured with the spectrum analyzer set to zero span at the operating frequency of 433.92 MHz. The resulting analyzer wave form is shown below along with the duty cycle calculation.

Marker 1: 200.0 µS
Marker 2: 417.1 µS
Marker 3: 608.6 µS

Pulse Width: Marker 3 – Marker 2 = 191.5 µS
Period: Marker 3 – Marker 1 = 408.6 µS

Average Correction Factor (dB) = 20 log(Pulse Width/Period) = -6.58 dB



Plot 3 – Duty Cycle

Signed: Michael A. Pickard

Michael A. Pickard - Project Engineer

4.8 Radiated Emissions - FCC: CFR 47 Part 15.231(b)

Test Procedure:

The RQA-1B, RQA-4B is a fixed tuned, 433.92 MHz Call Button Transmitter. There are no provisions to operate at any other frequency.

1. Field strength of the radiated emissions of the RQA-1B, RQA-4B was measured per ANSI C63.4-2003 Part 8.3 at the RITRON, Inc. 3-meter test site, details of which are on file with the FCC.
2. The RQA-1B, RQA-4B was powered by a new CR123A, 3V lithium primary battery with the non-removable, 433 MHz, helical wound antenna permanently installed in the product.
4. All field strength measurements were made with the Advantest R3265A Spectrum Analyzer connected to the Electro-Metrics LPA-25 log periodic antenna for frequencies 200-1000 MHz, and to the EMCO 3105 horn antenna for frequencies 1000 MHz to the 10^{th} harmonic of 4339.2 MHz.
5. For each emission, the height and polarization of the field strength measuring antenna and orientation of the RQA-1B, RQA-4B was varied to find maximum field strength.
6. The spectrum was searched from 433 MHz – 4.3392 GHz (433.92 MHz x 10) per FCC Part 15.33(a)(1).
7. Analyzer readings in dBµV were converted to field strength in dBµV/m as follows:

   E(dBµV/m) = RA (dBµV) + AF(dB) + CF(dB)

   where: RA is the measured amplitude in dBµV at 3 meters
   AF is the calibrated antenna factor in dB
   CF is the measured cable loss and amplifier gain
   DC is the duty cycle correction factor

   For the Average field strength the Duty Cycle Factor of -6.58 dB was added as follows.

   E(dBµV/m) = RA (dBµV) + AF(dB) + CF(dB) + DC(dB)
8. The results were compared to the FCC limits per Part 15.231(b), or to the FCC limits per Part 15.209(a) for frequencies within a restricted band specified in Part 15.205(a).

   If desired, results can be converted to µV/m: E(µV/m) = 10^(E(dBµV/m) / 20)

Frequency (MHz)	Measured Level (dBuV)	Antenna Factor (dB)	Correction Factor (dB)	Duty Cycle (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)		Antenna Polarity
					pk	Avg	pk	Avg	pk	Avg	(H/V)
433.92	62.91	20.9	0.9	-6.58	84.67	78.09	100.8	80.8	16.1	2.7	V
433.92	58.88	20.9	0.9	-6.58	80.64	74.06	100.8	80.8	20.2	6.7	H
1735.68	9.88	24.2	1.7	-6.58	35.77	29.19	80.8	60.8	45.0	31.6	V
1735.68	10.19	24.2	1.7	-6.58	36.08	29.50	80.8	60.8	44.7	31.3	H
2169.60	20.69	25.1	1.7	-6.58	47.54	40.96	80.8	60.8	33.3	19.8	V
2169.60	10.84	25.1	1.7	-6.58	37.69	31.11	80.8	60.8	43.1	29.7	H
2603.52	5.63	25.6	2.9	-6.58	34.18	27.60	80.8	60.8	46.6	33.2	V
2603.52	6.16	25.6	2.9	-6.58	34.71	28.13	80.8	60.8	46.1	32.7	H
3037.44	7.34	28.4	4.5	-6.58	40.25	33.67	80.8	60.8	40.5	27.1	V
3037.44	5.81	28.4	4.5	-6.58	38.72	32.14	80.8	60.8	42.1	28.7	H
3471.36	3.47	28.1	4.5	-6.58	36.09	29.51	80.8	60.8	44.7	31.3	H

Table 4 – Radiated Emissions Test Results

NOTE: From 3 meters, if a spurious radiation was detected at any height, polarization, or orientation that was more than 30 dB below the FCC limit it was not listed in this report.

Signed: Michael A. Pickard

Michael A. Pickard - Project Engineer

TYPE OF TEST: RADIATED SPURIOUS EMISSIONS

FCC PART: 15.31(a)(3), 15.33(b)(3), 15.109(a)

MODELS: RQA-1B, RQA-4B

TYPE OF UNIT: 433.92 MHz Call Button Transmitter

FCC ID: AIERIT35-433

RQA-1B, RQA-4B Radiated Spurious Emissions Test Setup Photos