SNUPI Technologies

TEST REPORT FOR

Water Sensor
Model: 900-00002

Tested To The Following Standards:

FCC Part 15 Subpart C Sections 15.225

Report No.: 95285-6

Date of issue: January 23, 2014

ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

Testing the Future
CKC LABORATORIES, INC.

TABLE OF CONTENTS

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

SNUPI Technologies
4512 University Way NE
Seattle, WA 98105

REPRESENTATIVE: Patrick Vilbrandt
Customer Reference Number: 1125

REPORT PREPARED BY:

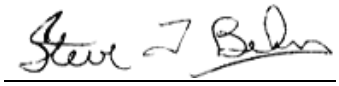
Morgan Tramontin
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 95285

DATE OF EQUIPMENT RECEIPT: January 8, 2014
DATE(S) OF TESTING: January 8-9, 2014

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
22116 23rd Drive S.E., Suite A
Bothell, WA 98021-4413

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.00.14
Immunity	5.00.07

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Bothell	US0081	SL2-IN-E-1145R	3082C-1	318736	A-0148

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C

Test Procedure/Method	Description	Results
15.207 / ANSI C63.4	Conducted Emissions	NA
15.215(c)	-20dBc Occupied Bandwidth	Pass
15.225(a,b,c) / FHSS-DA00705 / DTS-KDB 558074 / ANSI C63.4	Field Strength Emissions Within Specified Bands	Pass
15.225(d) / FHSS-DA00705 / DTS-KDB 558074 / ANSI C63.4	Field Strength Emissions Outside of Specified Bands	Pass
15.225(e) / FHSS-DA00705 / DTS-KDB 558074 / ANSI C63.4	Frequency Tolerance	Pass

Conditions During Testing

This list is a summary of the conditions noted for or modifications made to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

EQUIPMENT UNDER TEST

Water Sensor
Manuf: SNUPI Technologies
Model: 900-00002
Serial: 90-7A-F1-FF-FF-24

PERIPHERAL DEVICES

The EUT was not tested with peripheral devices.

FCC PART 15 SUBPART C

This report contains EMC emissions test results under United States Federal Communications Commission (FCC) 47 CFR 15C requirements for Unlicensed Radio Frequency Devices, Subpart C - Intentional Radiators.

15.207 AC Conducted Emissions

Test Engineer:	Steven Pittsford	**Test Procedure:**	15.207
Test Level:	NA		
Declarations: The manufacturer declares that the EUT is battery operated.			

15.215(c) -20dBc Occupied Bandwidth

Test Equipment					
Asset #	**Description**	**Model**	**Manufacturer**	**Cal Date**	**Cal Due**
02871	Spectrum Analyzer	E4440A	Agilent	7/19/2013	7/19/2015
P06505	Cable	32026-29080-29080-84	Astrolab	10/18/2013	10/18/2015
P05547	Cable	Heliax	Andrews	9/7/2012	9/7/2014
00052	Loop Antenna	6502	EMCO	5/16/2012	5/16/2014

Test Conditions / Setup

FCC 15.215(c) 20dB BW.

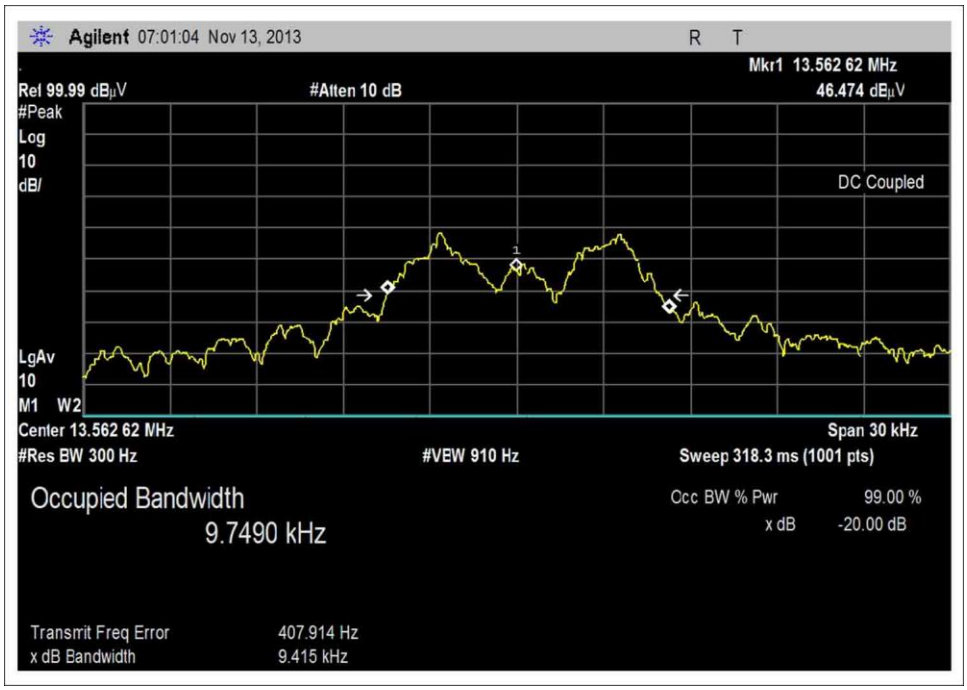
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

Temp: 22°C
Humidity: 31%
Pressure: 101.9kPa

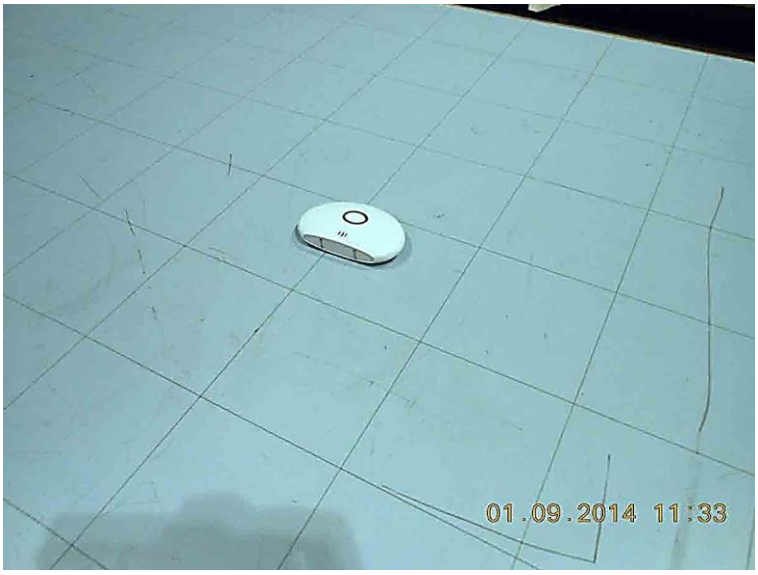
EUT is located on the test. Antenna is located at 3m from the EUT. Measurement performed at ambient temperature. TX frequency is 13.56MHz.

Freq	20dB OBW	99% OBW
13.56MHz	9.415kHz	9.749kHz

Test Plot


Agilent 07:01:04 Nov 13, 2013
R T
Mkr1 13.562 62 MHz
Ref 99.99 dBµV
#Atten 10 dB
46.474 dBµV
#Peak
Log
10
dB/
DC Coupled
LgAv
10
M1 W2
Center 13.562 62 MHz
Span 30 kHz
#Res BW 300 Hz
#VEW 910 Hz
Sweep 318.3 ms (1001 pts)
Occupied Bandwidth
9.7490 kHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error 407.914 Hz
x dB Bandwidth 9.415 kHz

Test Setup Photos



15.225(a,b,c) Field Strength Emissions Within Specified Bands

Test Equipment					
Asset #	**Description**	**Model**	**Manufacturer**	**Cal Date**	**Cal Due**
02871	Spectrum Analyzer	E4440A	Agilent	7/19/2013	7/19/2015
P06505	Cable	32026-29080-29080-84	Astrolab	10/18/2013	10/18/2015
P05547	Cable	Heliax	Andrews	9/7/2012	9/7/2014
00052	Loop Antenna	6502	EMCO	5/16/2012	5/16/2014
02871	Spectrum Analyzer	E4440A	Agilent	7/19/2013	7/19/2015

Test Conditions / Setup

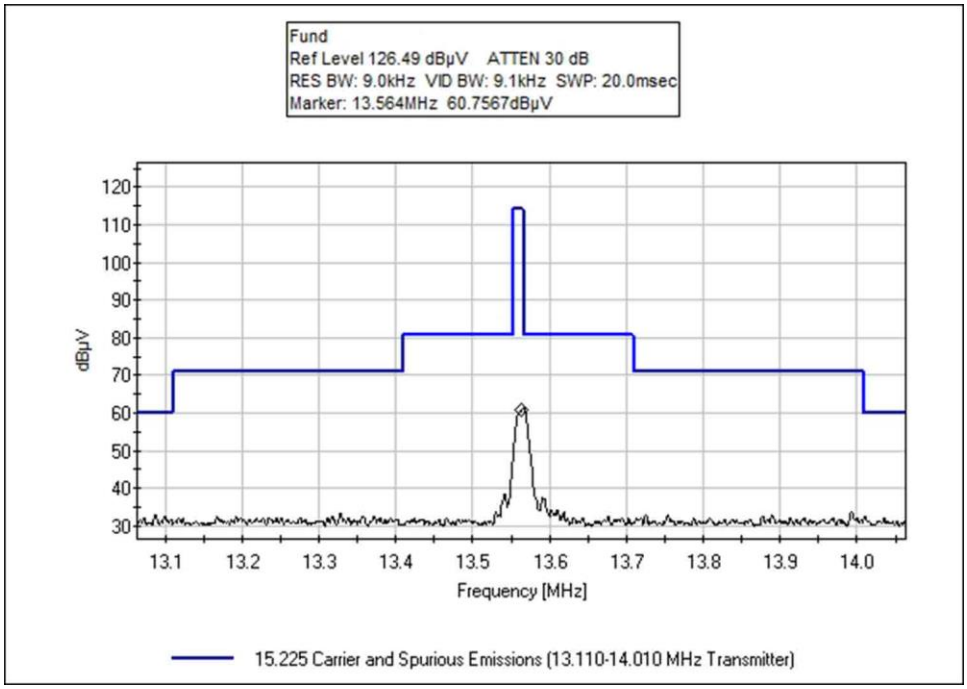
FCC 15.225(a,b,c).

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

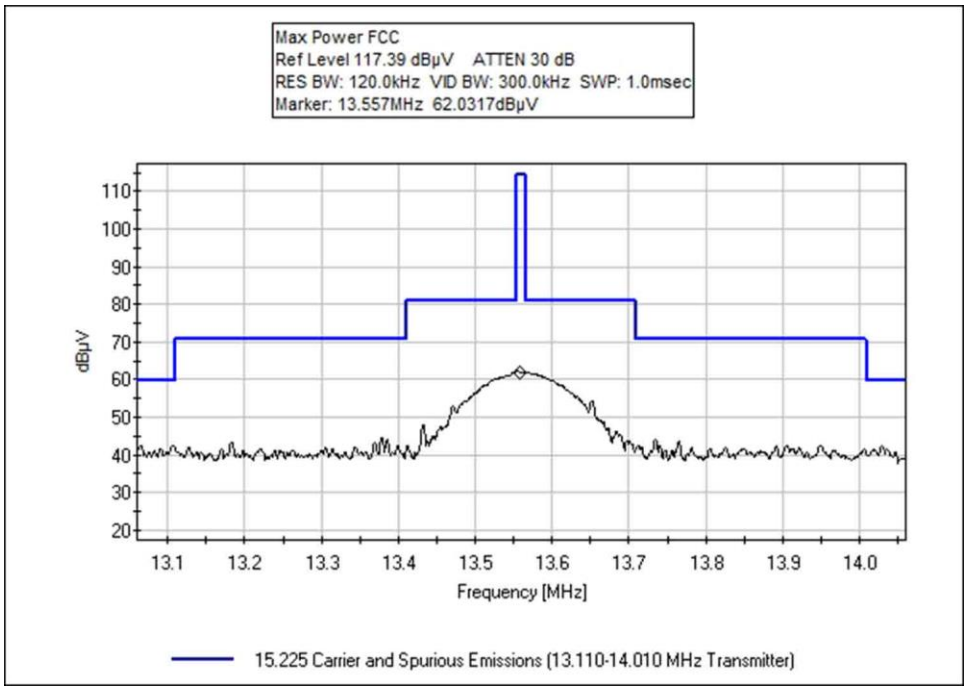
Temp: 22°C
Humidity: 31%
Pressure: 101.9kPa

EUT is located on the test. Antenna is located at 3m from the EUT. Measurement performed at ambient temperature. TX frequency is 13.56MHz. EUT was tested both in standing and lying orientations. Emissions were maximized with only the worst being reported.

Test Plots



Mask



Max Power

Test Setup Photos

15.225(d) Field Strength Emission Outside Specified Bands

Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **SNUPI Technologies**
Specification: **15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter)**
Work Order #: **95285** Date: 1/9/2014
Test Type: **Radiated Scan** Time: 10:52:41 AM
Equipment: **Water Sensor** Sequence#: 30
Manufacturer: SNUPI Technologies Tested By: Steven Pittsford
Model: 900-00002
S/N: 90-7A-F1-FF-FF-24

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02308	Preamp	8447D	4/3/2012	4/3/2014
T2	AN01996	Biconilog Antenna	CBL6111C	3/2/2012	3/2/2014
T3	ANP05360	Cable	RG214	12/3/2012	12/3/2014
T4	ANP05541	Cable	Heliax	4/11/2012	4/11/2014
T5	ANP06505	Cable	32026-29080-29080-84	10/18/2013	10/18/2015
	AN02871	Spectrum Analyzer	E4440A	4/11/2013	4/11/2015

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Water Sensor*	SNUPI Technologies	900-00002	90-7A-F1-FF-FF-24

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

Temperature: 24°C
Pressure: 101.2kPa
Humidity: 31%
Frequency: 30-1000MHz

Mode: Transmitting 2 packets per second

EUT tested standing on side and lying down. Vertical and Horizontal Antenna polarities investigated. Only worst case emissions reported.

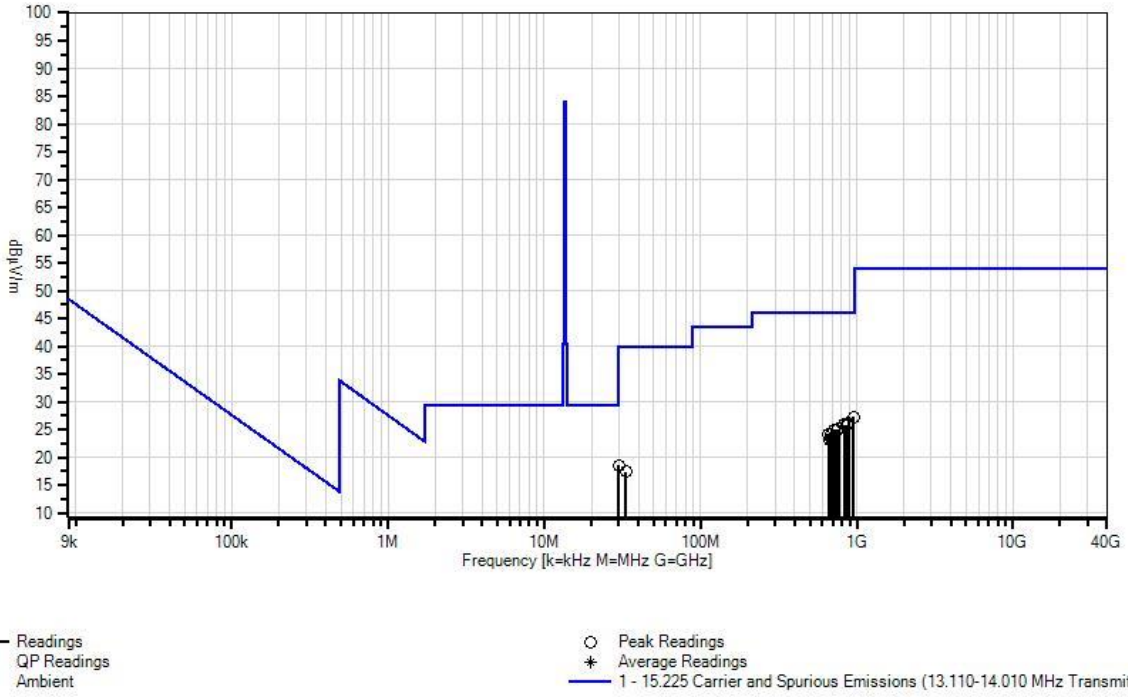
CISPR Bandwidth used
15.31 EUT has fresh battery installed.

Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	953.294M	27.0	-27.3 +0.9	+23.4	+2.1	+1.1	+0.0 360	27.2	46.0	-18.8	V & H 124
2	888.490M	27.3	-27.4 +0.9	+22.4	+2.0	+1.1	+0.0 360	26.3	46.0	-19.7	V & H 124
3	882.068M	27.2	-27.5 +0.9	+22.3	+2.0	+1.1	+0.0 360	26.0	46.0	-20.0	V & H 124
4	833.611M	27.6	-27.7 +0.8	+22.1	+2.0	+1.1	+0.0 360	25.9	46.0	-20.1	V & H 124
5	877.981M	27.1	-27.5 +0.9	+22.3	+2.0	+1.1	+0.0 360	25.9	46.0	-20.1	V & H 124
6	855.212M	27.2	-27.6 +0.9	+22.2	+2.0	+1.1	+0.0 360	25.8	46.0	-20.2	V & H 124
7	761.801M	27.9	-28.0 +0.8	+21.5	+1.9	+1.0	+0.0 360	25.1	46.0	-20.9	V & H 124
8	737.281M	28.2	-28.0 +0.8	+21.2	+1.8	+1.0	+0.0 360	25.0	46.0	-21.0	V & H 124
9	720.934M	28.4	-28.1 +0.8	+21.0	+1.8	+1.0	+0.0 360	24.9	46.0	-21.1	V & H 124
10	30.000M	27.2	-28.0 +0.2	+18.7	+0.3	+0.2	+0.0 360	18.6	40.0	-21.4	V & H 124
11	658.465M	28.5	-28.3 +0.8	+20.4	+1.7	+1.0	+0.0 360	24.1	46.0	-21.9	V & H 124
12	687.072M	28.2	-28.2 +0.8	+20.6	+1.7	+1.0	+0.0 360	24.1	46.0	-21.9	V & H 124
13	33.325M	28.0	-28.0 +0.2	+16.7	+0.3	+0.2	+0.0 360	17.4	40.0	-22.6	V & H 124
14	684.737M	27.4	-28.2 +0.8	+20.6	+1.7	+1.0	+0.0 360	23.3	46.0	-22.7	V & H 124
15	672.477M	27.3	-28.3 +0.8	+20.5	+1.7	+1.0	+0.0 360	23.0	46.0	-23.0	V & H 124

CKC Laboratories, Inc. Date: 1/9/2014 Time: 10:52:41 AM SNUPI Technologies WO#: 95285
Test Distance: 3 Meters Sequence#: 30 V & H
SNUPI Technologies Water Sensor P/N: 900-00002



Readings
QP Readings
Ambient
Peak Readings
Average Readings
1 - 15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter)

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **SNUPI Technologies**
Specification: **15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter)**
Work Order #: **95285** Date: 1/9/2014
Test Type: **Radiated Scan** Time: 10:36:52
Equipment: **Water Sensor** Sequence#: 28
Manufacturer: SNUPI Technologies Tested By: Steven Pittsford
Model: 900-00002
S/N: 90-7A-F1-FF-FF-24

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05547	Cable	Heliax	9/7/2012	9/7/2014
T2	ANP06505	Cable	32026-29080-29080-84	10/18/2013	10/18/2015
	AN02871	Spectrum Analyzer	E4440A	4/11/2013	4/11/2015
T3	AN00052	Loop Antenna	6502	5/16/2012	5/16/2014

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Water Sensor*	SNUPI Technologies	900-00002	90-7A-F1-FF-FF-24

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

Temperature: 24°C
Pressure: 101.2kPa
Humidity: 31%
Frequency: 9k-30MHz

Mode: Transmitting 2 packets per second
EUT tested standing on side and laying down, Parallel and perpendicular ant polarizations investigated. Only worst case emissions reported.

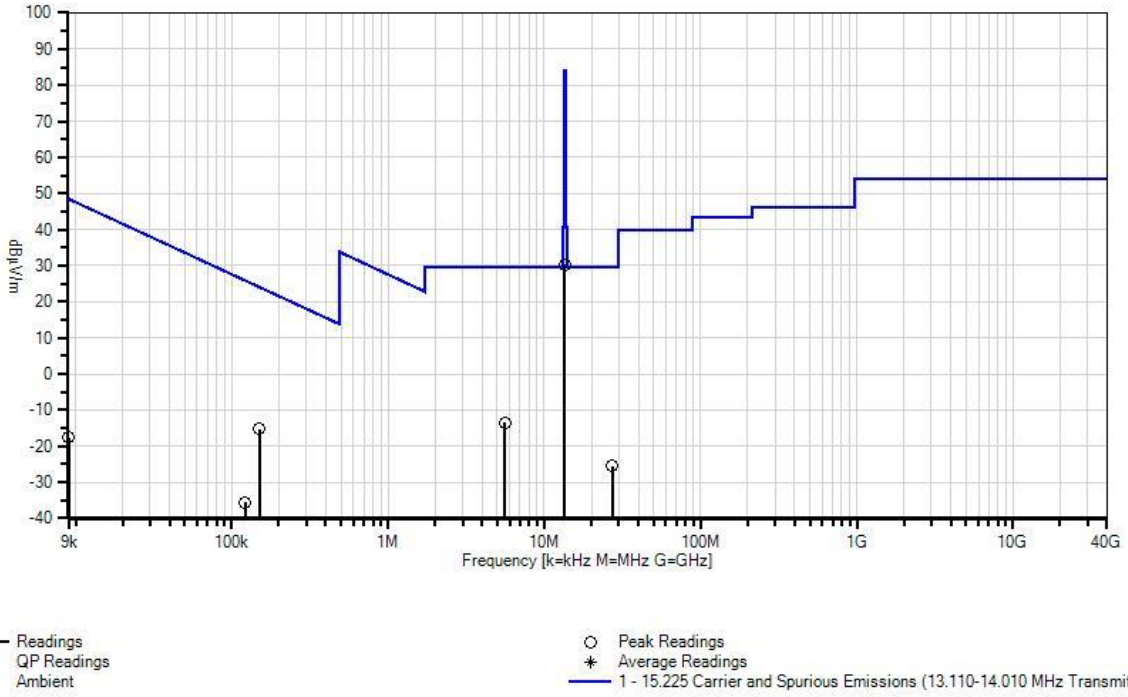
CISPR Bandwidth used
15.31 EUT has fresh battery installed.

Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	150.000k	55.2	+0.0	+0.0	+9.5		-80.0	-15.3	24.1	-39.4	Paral 112
2	5.583M	16.6	+0.1	+0.1	+9.7		-40.0	-13.5	29.5	-43.0	Paral 112
3	13.564M	60.8	+0.1	+0.1	+9.4		-40.0 360	30.4	84.0	-53.6	Paral 112
4	27.127M	9.0	+0.1	+0.2	+5.2		-40.0 343	-25.5	29.5	-55.0	Paral 112
5	122.254k	34.9	+0.0	+0.0	+9.6		-80.0 360	-35.5	25.9	-61.4	Paral 112
6	9.027k	46.8	+0.0	+0.0	+15.5		-80.0 312	-17.7	48.5	-66.2	Paral 112

CKC Laboratories, Inc. Date: 1/9/2014 Time: 10:36:52 SNUPI Technologies WO#: 95285
Test Distance: 3 Meters Sequence#: 28 Parallel
SNUPI Technologies Water Sensor P/N: 900-00002



Readings
QP Readings
Ambient
Peak Readings
Average Readings
1 - 15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter)

Test Setup Photos

15.225(e) Frequency Tolerance

Test Equipment					
Asset #	**Description**	**Model**	**Manufacturer**	**Cal Date**	**Cal Due**
02757	Temperature Chamber	F100/350-8	Bemco	1/22/2013	1/22/2015
03029	Thermometer, Digital Infrared	566	Fluke	2/1/2013	2/1/2015
02871	Spectrum Analyzer	E4440A	Agilent	7/19/2013	7/19/2015

Test Conditions / Setup

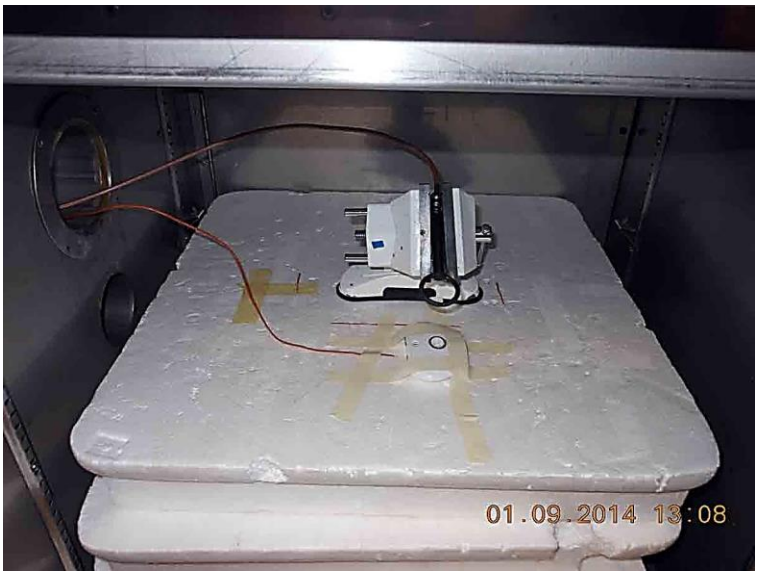
FCC 15.225(e) Frequency Tolerance & Voltage Variation.

*The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C. F*or battery operated equipment, the equipment tests shall be performed using a new battery.

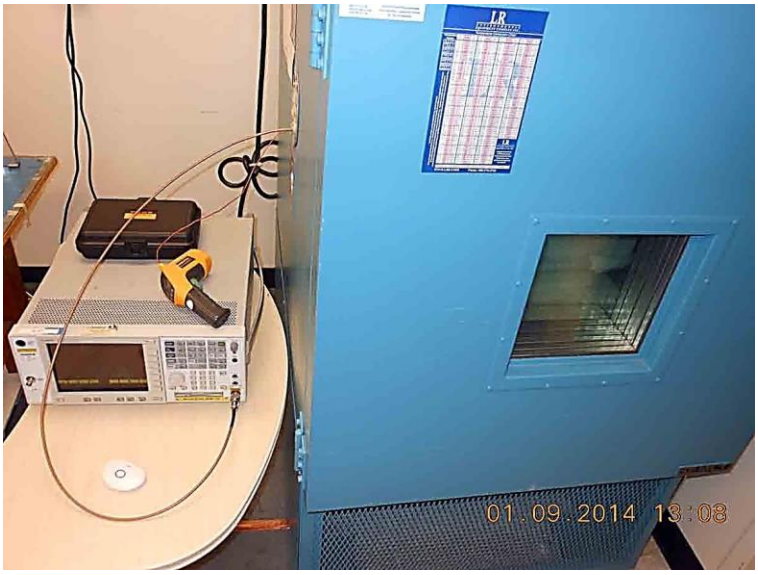
EUT is located inside the temperature chamber. The temperature will change from -20°C to +50°C in 10° increments. An infrared thermometer with a thermocouple attachment is being used to monitor the actual temperature on the EUT. After the EUT has reached thermal stabilization the measurements are performed. Frequency variation cannot be higher than ±0.01% or ±1.356kHz .

Temp	Freq (MHz)
-20°C	13.56290
-10°C	13.56285
0°C	13.56295
10°C	13.56290
20°C	13.56293
30°C	13.56293
40°C	13.56295
50°C	13.56288

Test Setup Photos



Inside



Outside

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

The reported measurement uncertainties are calculated based on the worst case of all laboratory environments from CKC Laboratories, Inc. test sites. Only those parameters which require estimation of measurement uncertainty are reported. The reported worst case measurement uncertainty is less than the maximum values derived in CISPR 16-4-2. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or carrot ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.