Nemko USA, Inc.
2210 Faraday Ave, Suite 150
Carlsbad, CA 92008
Phone (760) 444-3500 Fax (760) 444-3005

Certification Test Report

In Accordance With:	FCC Part 15 Subpart C, 15.231& 15.231(e)
Applicant:	Advanced Sensor Technology 840 First Ave, Suite 300 King of Prussia, PA 19406
Equipment Under Test (EUT): Model:	Moisture sensor Cypress systems
FCC ID: IC:	YVAUG400S 10216A-UG400S
Tested By:	Nemko USA Inc. 2210 Faraday Avenue, Suite 150 Carlsbad, CA 92008
Test Report Number: Date: Project Number NEX Number	2013 08226596 FCC September 3, 2013 43834 149167
Total Number of Pages:	29

Applicant Affirmation

Kathy Sohrabi, PhD representing Advanced Sensor Technology hereby affirms:

a) That he/she has reviewed and concurs that the test shown in this report are reflective of the operational characteristics of the device for which certification is sought;

b) That the device in this test report will be representative of production units;

c) That all changes (in hardware and software/firmware) to the subject device will be reviewed.

d) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving (certifying) the subject equipment.

Kathy Sohrabi, PhD	
Printed name of official	Signature of official
840 First Ave, Suite 300 King of Prussia, PA 19406	August 26, 2013 Date
+1 484.524.3468 Telephone number	ksohrabi@ugmo.com Email address of official

NOTE—This affirmation must be signed by the responsible party before it is submitted to a regulatory body for approval.

Section 1. Summary of Test Results

1.1 General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C. Radiated tests were conducted is accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC and Industry Canada.

The assessment summary is as follows:

Apparatus Assessed:	Moisture sensor
Model:	Cypress systems
Specification:	FCC Part 15 Subpart C, 15.231
Date Received in Laboratory:	August 26, 2013
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None

1.2 Report Release History

REVISION	DATE	COMMENTS
-	January 13, 2010	Prepared By: Kevin Marquess
-	January 13, 2010	Initial Release: Alan Laudani

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

Nemko USA Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko USA Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Kevin Marquess, Senior RF/EMC Engineer

Alan Laudani, Senior RF/EMC Engineer

TABLE OF CONTENTS

Section 1. Summary of Test Results 2

1.1 General 3
1.2 Report Release History 4

Section 2: Equipment Under Test 6

2.1 EUT description 6
2.2 Technical Specifications of the EUT 6

Section 3: Test Conditions 7

3.1 Specifications 7
3.2 Deviations From Laboratory Test Procedures 7
3.3 Test Environment 7
3.3 Test Equipment 7

Section 4: Observations 8

4.1 Modifications Performed During Assessment 8
4.2 Record Of Technical Judgements 8
4.3 EUT Parameters Affecting Compliance 8
4.4 Tests Deleted 8
4.5 Additional Observations 8

Section 5: Results Summary 9

5.1 Test Results 9

Appendix A: Test Results 1

Conducted Emissions 1
Occupied Bandwidth 2
Frequency Stability 5
Types of Momentary Signals 6
Spurious Emissions and Field Strength 9
Conducted Emissions Test Data—Receive Mode 15
Radiated Emissions Test Data—Receive Mode 16

APPENDIX B 1

B. Radiated Emissions Measurement Uncertainties 1

APPENDIX C 1

C. Nemko USA, Inc. Test Equipment & Facilities Calibration Program 1

Section 2: Equipment Under Test

2.1 EUT description

The Cypress systems is a Moisture sensor. Its function is to detect moisture and report. The EUT was exercised by a continuously running burn-in program and pinging. If the program and/or pinging are disrupted as seen, or there is loss of functionality, may be considered a failure.

The EUT's performance during test was evaluated against the performance criterion specified by applicable test standards. Performance results are detailed in the test results section of this report.

2.2 Technical Specifications of the EUT

Manufacturer:	Advanced Sensor Technology
Operating Frequency:	107.9 MHz 434 MHz
Measured Power:	107.9 MHz: 36.7 dBuV/m @ 3m 434.0 MHz: 94.8 dBuV/m @ 3m 434.0 MHz: 92.7 dBuV/m @ 3m
Modulation:	107.9 MHz: none 434.0 MHz: GFSK
Antenna Data:	107.9 MHz: circuit traces 434.0 MHz: coil antenna
Antenna Connector:	NONE
Power Source:	3.3 V Battery

Section 3: Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.231 & 15.231(e)
Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

RSS-210 Issue 8 December 2010
Annex 1 - Momentarily Operated Devices and Remote Control

3.2 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	14 – 22 ºC
Humidity range	:	32--76 %
Pressure range	:	102.0 kPa
Power supply range	:	+/- 5% of rated voltages

3.3 Test Equipment

Nemko ID	Device	Mfr.	Model	Serial Number	Cal Date	Cal Due Date
111	Antenna, LPA	EMCO	3146	1382	1/9/2013	1/9/2014
1046	Antenna, Bicon	A.H. Systems	SAS-540	736	4/22/2013	4/22/2014
901	Preamplifier	Sonoma	310N	130607	10/15/2012	10/15/2013
877	Antenna, DRG Horn, .7-18GHz	AH Systems	SAS-571	688	9/13/2012	9/13/2014
911	Spectrum Analyzer	Agilent	E4440A	US41421266	10/15/2012	10/15/2013
835	Spectrum Analyzer	Rohde & Schwarz	FSEK	829058/005	9/6/2012	9/6/2013

Registrations of the Anechoic Chamber are on file with the Federal Communications Commission and with Industry Canada under Site Number 2040B-3.

Section 4: Observations

4.1 Modifications Performed During Assessment

No modifications were performed during assessment.

4.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

4.4 Tests Deleted

No Tests were deleted from this assessment.

4.5 Additional Observations

There were no additional observations made during this assessment.

Section 5: Results Summary

This section contains the following:

FCC Part 15 Subpart C: Test Results.
RSS-210 Issue 7 June 2007

The column headed “Required” indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N No: not applicable / not relevant
Y Yes: Mandatory i.e. the apparatus shall conform to these tests.
N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

5.1 Test Results

Part 15	RSS	Test Description	Required	Result
15.231 (b)	A1.1.2	Field Strengths and Frequency Bands	Y	Pass
15.231 (e)	A1.1.5	Reduced Field Strengths	Y	Pass
15.215(c) 15.231(c)	A1.1.3	Occupied Bandwidth/ 99% Bandwidth	Y	Pass
15.231 (a)	A1.1 Table A RSS-Gen 7.2.2	Types of Momentary Signals	Y	Pass
15.231 (d)	A1.1.4	Frequency Stability	N	NA**
15.231 (b)	A1.1.2	Spurious Emissions	Y	Pass
15.231 (e)	A1.1.5	Spurious Emissions (reduced field strengths)	Y	Pass
15.207 (a)	RSS-Gen 7.2.4	Power line Conducted Emissions	N	NA*
15.107 (a)	RSS-Gen 7.2.4	Receiver Spurious Conducted Emissions	N	NA*
15.109 (a)	RSS-Gen 6.1	Receiver Spurious Radiated Emissions	Y	Pass

* Battery Powered
** Not transmitting in band requiring Frequency Stability

Appendix A: Test Results

Conducted Emissions

Client	Advanced Sensor Technology	Temperature	21	°C
Pan #	226596	Relative Humidity	65	%
EUT Name	Moisture sensor	Barometric Pressure	100.5	kPa
EUT Model	Cypress systems	Test Location	San Diego	
Governing Doc	CFR 47, Part 15B	Test Engineer	Kevin Marquess	
Basic Standard	Sec. 15.207 Class "B" Transmit	Date of test	8/26/2013	
Test Parameters	Peak RBW: 100kHz VBW: 100kHz Quasi-Peak: RBW 9kHz, VBW 30 kHz Average: RBW 9kHz, VBW 30 kHz Quasi-Peak Limit Blue Line, Average Limit Green Line			

Not applicable as EUT is battery powered.

Occupied Bandwidth

A1.1. The 99% bandwidth shall be no wider than 0.25% of the centre frequency for devices operating between 70-900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the centre frequency.

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 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.

15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Sec. Sec. 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. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Conditions:

Client	Advanced Sensor Technology	Temperature	21	°C
Pan #	226596	Relative Humidity	65	%
EUT Name	Moisture sensor	Barometric Pressure	100.5	kPa
EUT Model	Cypress systems	Test Location	San Diego	
Governing Doc	CFR 47, Part 15C	Test Engineer	Kevin Marquess	
Basic Standard	Sec. 15.231 Transmit	Date of test	8/26/2013	

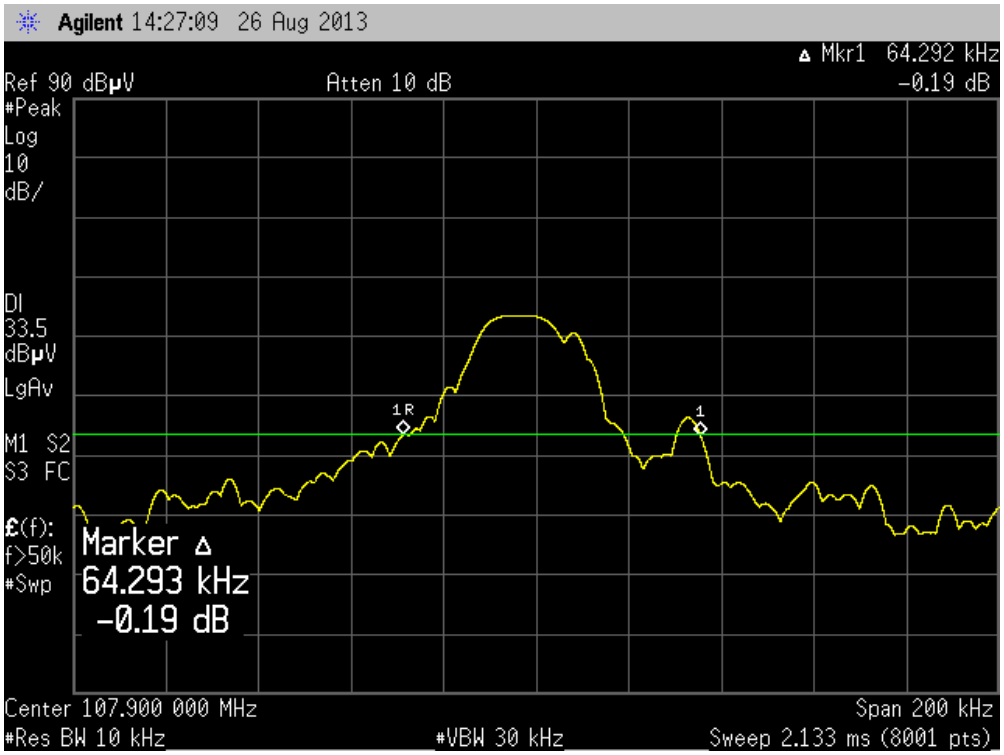
Test Results:

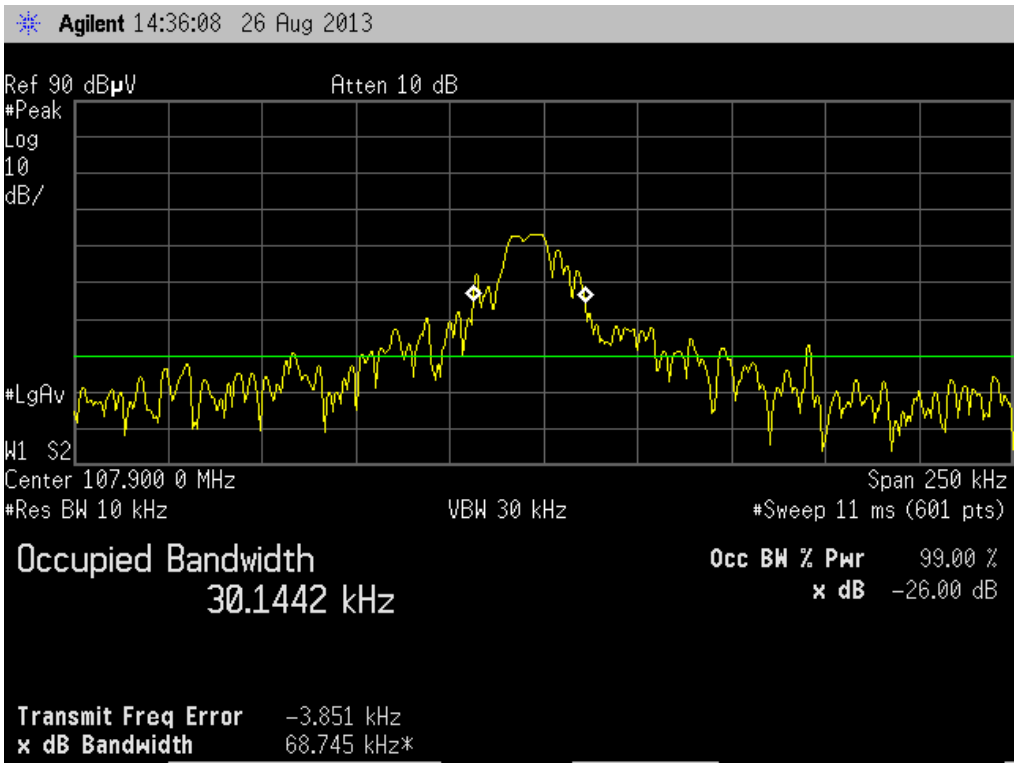
107.9 MHz

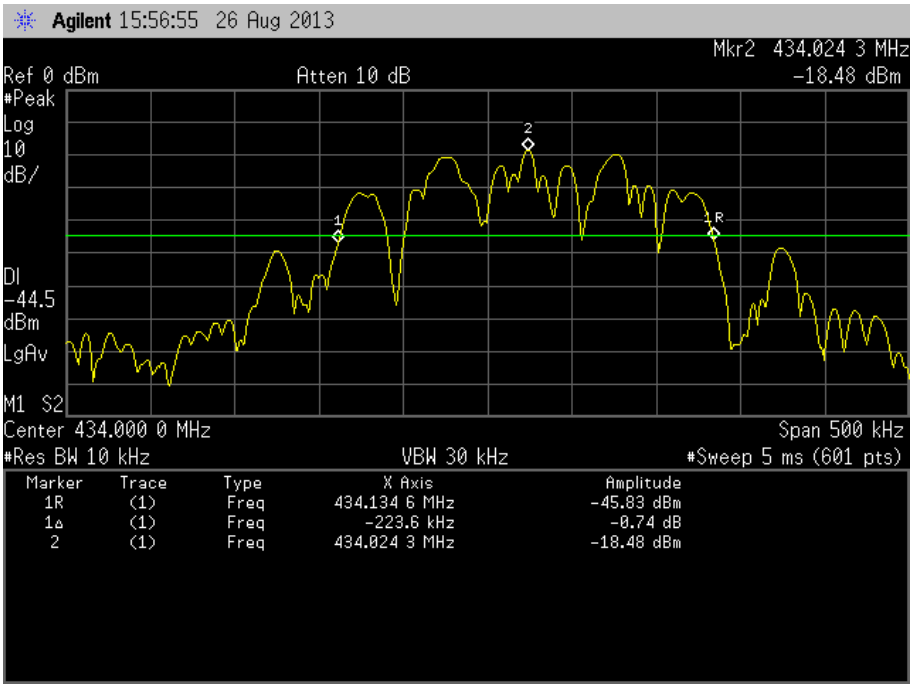
Measured Occupied Bandwidth: 64 kHz
Measured 99% Bandwidth = 30 kHz

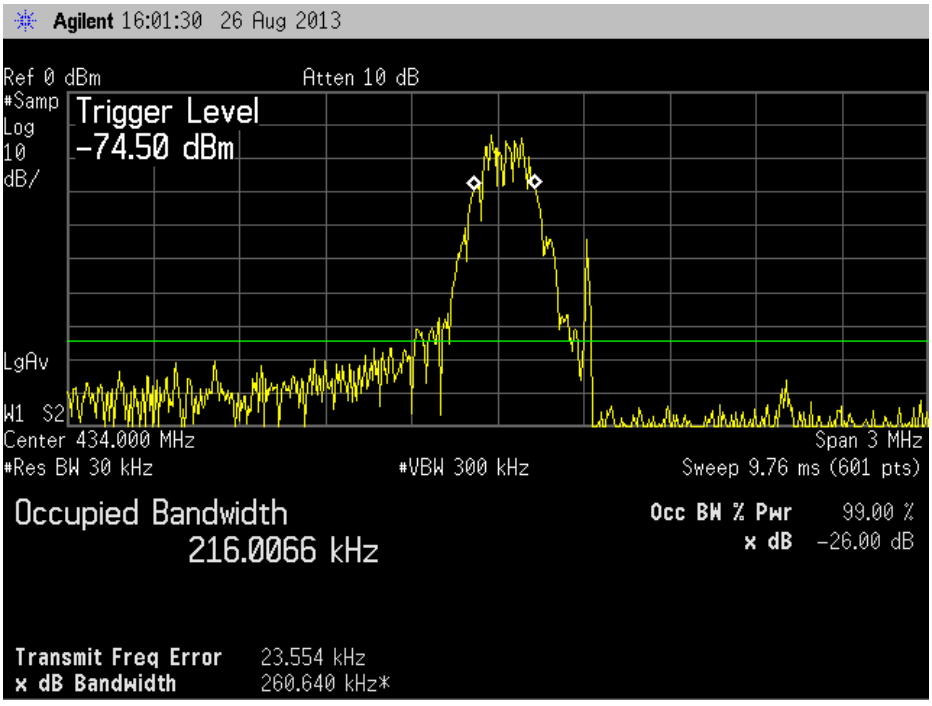
434.0 MHz

Measured Occupied Bandwidth: 224 kHz
Measured 99% Bandwidth = 216 kHz









Frequency Stability

A1.1.4 Carrier frequency stability of devices momentarily operated in the band 40.66-40.70 MHz shall be maintained to ±0.01% (±100 ppm).

15.231(d) For devices operating within the frequency band 40.66–40.70 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 voltages at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Conditions:

Client	Advanced Sensor Technology	Temperature		°C
Pan #	226596	Relative Humidity		%
EUT Name	Moisture sensor	Barometric Pressure		kPa
EUT Model	Cypress systems	Test Location	San Diego	
Governing Doc	CFR 47, Part 15C	Test Engineer	Kevin Marquess	
Basic Standard	Sec. 15.231 Transmit	Date of test		

Test Results:

The EUT does not transmit within the 40.66—40.70 MHz band, therefore this test is not applicable.

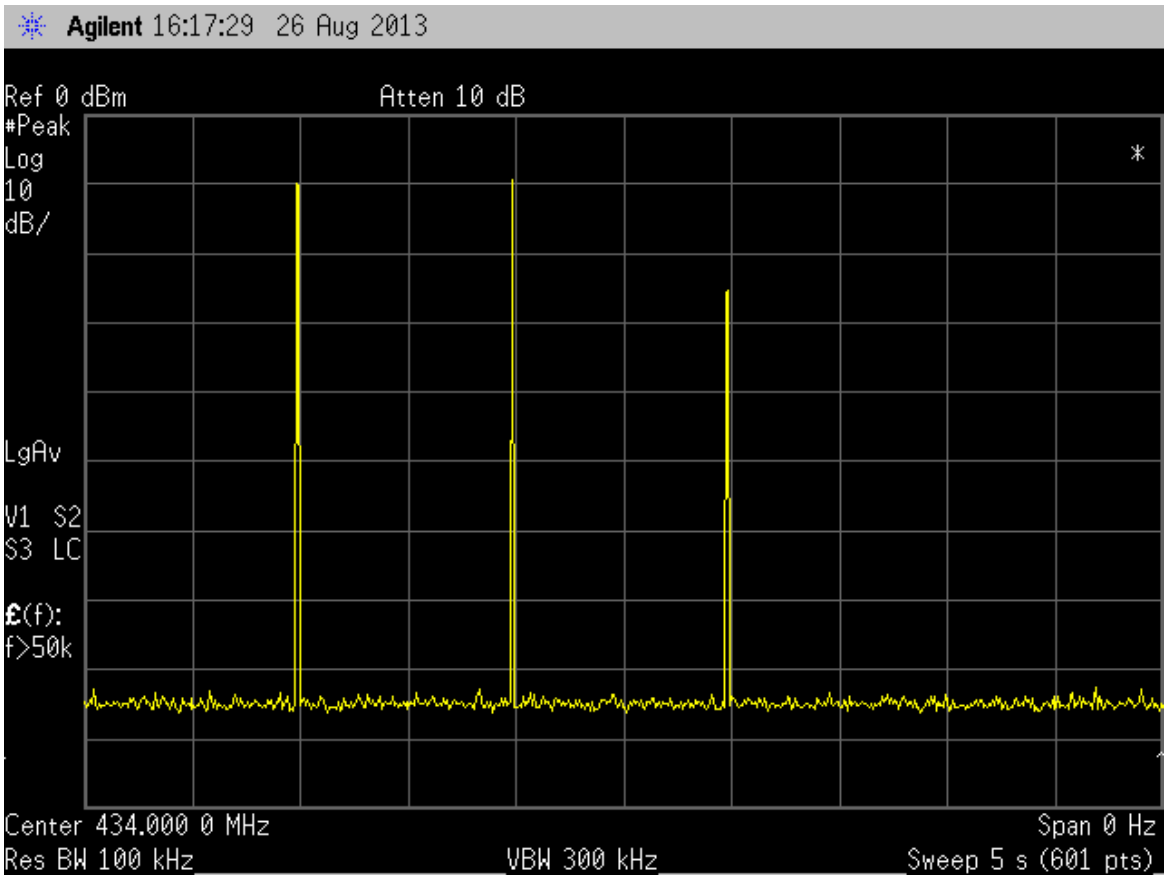
Types of Momentary Signals

RSS A1.1.1(c) Periodic transmissions at regular predetermined intervals are not permitted, except as provided in A.1.1.5. However, polling or supervision transmissions, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmission does not exceed 2 seconds per hour for each transmitter.

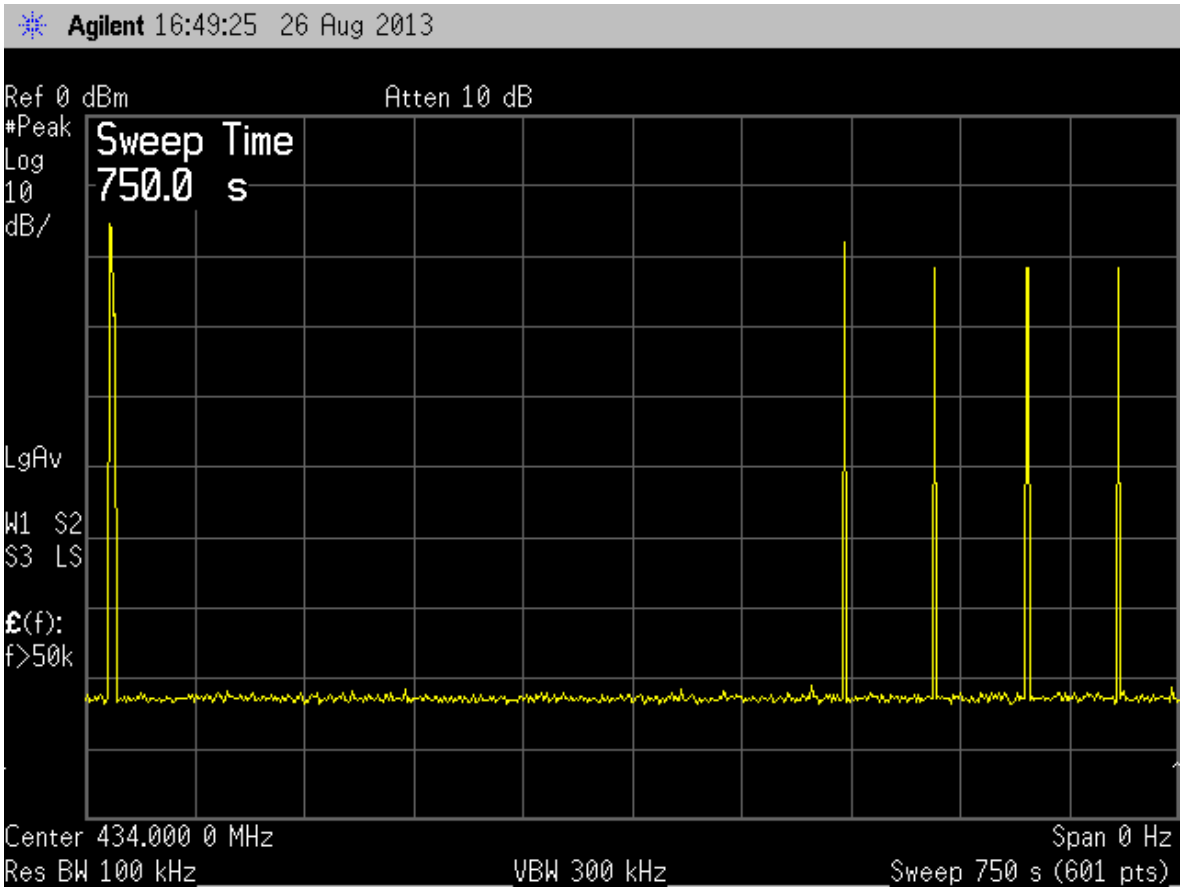
15.231(a)(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation

Client	Advanced Sensor Technology	Temperature	21	°C
Pan #	226596	Relative Humidity	65	%
EUT Name	Moisture sensor	Barometric Pressure	100.5	kPa
EUT Model	Cypress systems	Test Location	San Diego	
Governing Doc	CFR 47, Part 15C	Test Engineer	Kevin Marquess	
Basic Standard	Sec. 15.231 Transmit	Date of test	8/26/2013	

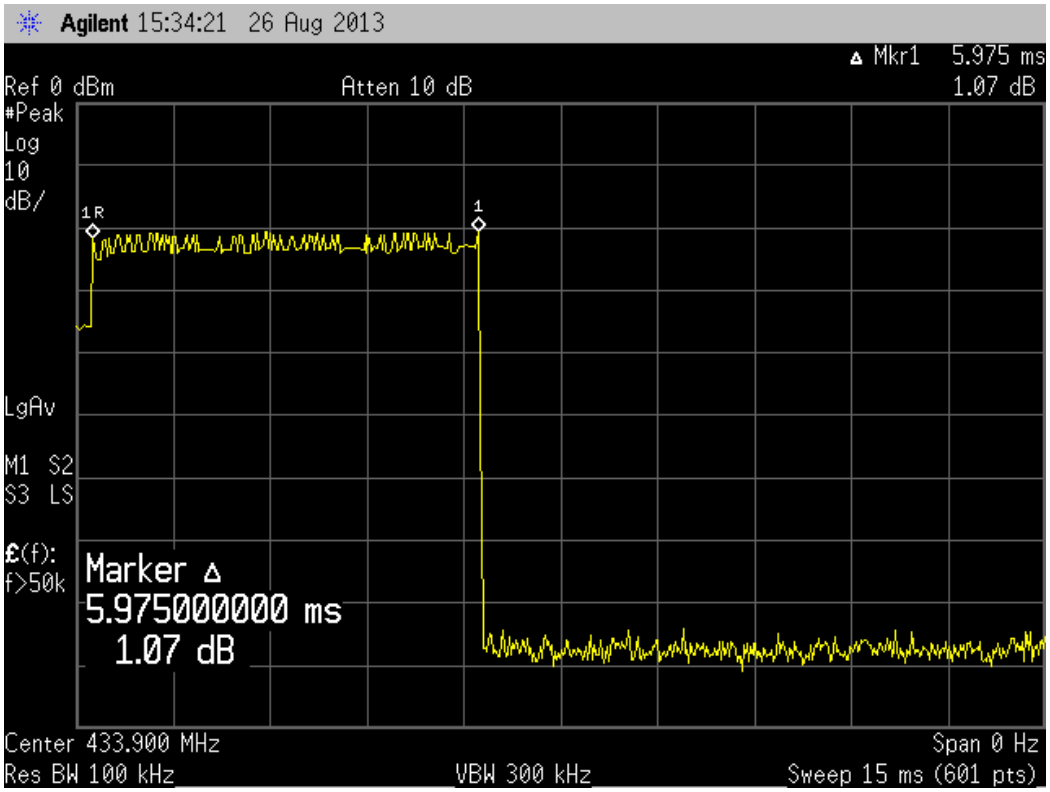
This plot shows the transmitter stops within 5 seconds of operation



Under normal operating mode, the sensor is in a dormant state most of the time. The sensor wakes up every ten minutes and checks the soil condition by performing a sensing operation and a signal transmission. The Sensor is 'turned on and off' by means of a turn switch. When the sensor is turned on, it will transmit once per second, not to exceed 5 seconds. It will then wait for one minute. After that it will sense its environment. It will then transmit about once per minute for the next 100 minutes (Interim Mode), then about once per 10 minutes (Normal Mode). The interval durations are somewhat randomized. The Sensor measures the conditions of the environment surrounding its tine a few milliseconds prior to each potential transmission, which allows it to determine that it is 'in air' or 'in soil'. (Plot below shows >10 minute condition)



In normal mode:
Duty cycle factor = 20 x log(on /100 ms) = 20 x log(6ms/100ms) = -24.4 dB



Spurious Emissions and Field Strength

RSS210 Annex 1
A1.1.2 (1) The field strength of emissions from momentarily operated intentional radiators shall not exceed the limits in Table 4.

Fundamental Frequency (MHz), excluding restricted band frequencies of Table 1	Field Strength of Fundamental (Note 1) microvolts/m at 3 metres, (watts, e.i.r.p.)	Field Strength of Unwanted Emissions (Note 1) microvolts/m at 3 metres
40.66-40.70	See Section A2.7	
70-130	1,250 (470 nW)	125
130-174	1,250 to 3,750*	125 to 375
174-260 (Note 2)	3,750 (4.2 µW)	375
260-470 (Note 2)	3,750 to 12,500*	375 to 1,250
Above 470	12,500 (47 µW)	1,250

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

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]1,250 to 3,750	[1]125 to 375
174–260	3,750	375
260–470	[1]3,750 to 12,500	[1]375 to 1,250
Above 470	12,500	1,250

[1]Linear interpolations.

At 434 MHz this interpolates to 11000 microVolts/m or 80.8 dBuV/m at 3m
Unwanted emissions 60.8 or FCC15.209/RSS Table 2, whatever is higher.

Client	Advanced Sensor Technology	Temperature	21	°C
Pan #	226596	Relative Humidity	65	%
EUT Name	Moisture sensor	Barometric Pressure	100.5	kPa
EUT Model	Cypress systems	Test Location	San Diego	
Governing Doc	CFR 47, Part 15C	Test Engineer	Kevin Marquess	
Basic Standard	Sec. 15.231 Transmit	Date of test	8/26/2013	

Test Results:

See Table. EUT complies for fundamental power and spurious emissions.

Additional Observations:

The Spectrum was searched from 30MHz to the 10th Harmonic (4350 MHz).

These results apply to emissions that may be found in the restricted bands defined in FCC Part 15 Subpart C, 15.205.

The EUT was investigated with a fresh battery. The emissions were measured with a test mode to repeat the emission so measurements could be maximized for the rotation of the sample and height and polarity of the measurement antenna.

All Measurements below 1GHz were performed at 3m employing a CISPR quasi-peak detector, except for the radio's fundamental. Peak measurements above 1GHz were done utilizing RBW of 1MHz and VBW of 3MHz. Average measurements above 1GHz were done utilizing RBW of 1MHz and VBW of 10Hz as the duty cycle was 100%.

Measurements made at the 3 meter Outside Area Test Site, all measurements max hold after peaking for EUT rotation and antenna height from 1 to 4 meters.

Fundamental power was measured at 1 MHz RBW, 3 MHz VBW to ensure capture of entire emissions envelope. Average reading of Fundamental power therefore was peak + duty cycle factor.

No other emissions found within 20 dB of the limits.

Emissions were measured on a 80cm (height) table and in a bucket of dirt on top of the 80cm table.

Since the EUT is to be orientated horizontally when installed, it was not defined as a hand held device.

Radiated Emissions Data

Job # :	Q10247408	Date :	8/26/2013	Page 1 of 1	
NEX#:	240975	Time :	am		
		Staff :	KDM		
Client Name :	Advanced Sensor Tech (UGMO)			EUT Voltage :	3V batt
EUT Name :	Cypress Sensor			EUT Frequency :	NA
EUT Model # :				Phase:	NA
EUT Serial # :	99000001				
EUT Config. :	Buried in soil 3in from surface				
	37% moisture content in soil			Distance < 1000 MHz:	3 m
				Distance > 1000 MHz:	3 m
Specification :	CFR47 Part 15, Subpart C 15.209				
Loop Ant. #:	NA				
Bicon Ant.#:	E1046	Temp. (°C) :	22		
Log Ant.#:	111_3m	Humidity (%) :	54		
DRG Ant. #	529	Spec Analyzer #:	911		
Cable LF#:	SAC_10m	Analyzer Display #:	911		
Cable HF#:	NA	Quasi-Peak Detector #:	911		
Preamp LF#:	902	Duty Cycle (%):	10.00		
Preamp HF#	NA				

Quasi-Peak	RBW: 120 kHz
	Video Bandwidth 300 kHz
Peak	RBW: 1 MHz
	Video Bandwidth 3 MHz
Average = Peak + Duty Cycle Factor	
DCF = 20 x log(duty cyle)	

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.
Measurements above 1 GHz are Average values, unless otherwise stated.

Meas. Freq. (MHz)	Meter Reading **Vertical**	Meter Reading **Horizontal**	Det.	EUT Side DEG	Ant. Height cm	Max. Reading (dBµV)	Corrected Reading (dBµV)	Spec. limit (dBµV)	CR/SL Diff. (dB)	Pass Fail	Comment
107.9	57.0	55.4	P	250.0	100.0	57.0	36.7	43.5	-6.8	Pass	
215.8	28.0		P			28.0	10.7	43.5	-32.8	Pass	
323.7			P				-13.0	46.0	-59.1	Pass	none seen above 2nd
431.6			P				-11.3	46.0	-57.3	Pass	
539.5			P				-9.0	46.0	-55.0	Pass	

Mode: in air, meeting Limits of 15.231(a), table in (b)

Special test mode to broadcast once per second.

Normal operation stops transmitting within 5 seconds.

Radiated Emissions Data

Job # :	10234705	Date :	12/13/12	Page	1 of 1
NEX #:	226596	Time :	11am		
		Staff :	AG		
Client Name :	Ugmo Technologies			EUT Voltage :	3V batt
EUT Name :	Underground soil moisture sensor			EUT Frequency :	N/A
EUT Model # :				Phase:	N/A
EUT Serial # :	99000000				
EUT Config. :	Transmit every second				
	in air			Distance < 1000 MHz:	3 m
				Distance > 1000 MHz:	3 m
Specification :	FCC Part 15.231 a (in air)				
Loop Ant. #:	NA				
Bicon Ant.#:	128_3m	Temp. (°C) :	22		
Log Ant.#:	110_3m	Humidity (%) :	53		
DRG Ant. #	529	Spec Analyzer #:	911		
Cable LF#:	SAC_10m	Analyzer Display #:	911		
Cable HF#:	WCC	Quasi-Peak Detector #:	911		
Preamp LF#:	901	**Duty Cycle (%):**	7.00		
Preamp HF#	317				

Quasi-Peak	RBW: 120 kHz
	Video Bandwidth 300 kHz
Peak	RBW: 1 MHz
	Video Bandwidth 3 MHz
Average = Peak + Duty Cycle Factor	
	DCF = 20 x log(duty cyle)

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.
Measurements above 1 GHz are Average values, unless otherwise stated.

Meas. Freq. (MHz)	Meter Reading **Vertical**	Meter Reading **Horizontal**	Det.	EUT Side DEG	Ant. Height cm	Max. Reading (dBµV)	Corrected Reading (dBµV)	Spec. limit (dBµV)	CR/SL Diff. (dB)	Pass Fail	Comment
433.9	74.1	64.3	P	274	114	74.1	94.8	100.8	-6.0	Pass	in air
433.9	74.1	64.3	A	274	114	74.1	71.7	80.8	-9.1	Pass	in air
868.1	71.0	76.3	P	236	101	76.3	72.8	80.8	-8.0	Pass	
868.1	71.0	76.3	A	236	101	76.3	49.8	60.8	-11.0	Pass	
472.1		42.9	Q	105	100	42.9	32.1	46.0	-13.9	Pass	
488.3		46.9	Q	101	199	46.9	36.2	46.0	-9.8	Pass	
524.1		51.1	Q	250	173	51.1	42.0	46.0	-4.0	Pass	
647.4		49.9	Q	99	138	49.9	42.5	46.0	-3.5	Pass	
971.0		53.1	Q	287	152	53.1	51.0	54.0	-3.0	Pass	

Note: Corrected Reading Computations
Average = Peak Maximum Meter Reading + Antenna Factor + Path Loss + DUTY CYCLE FACTOR
66.8 = 71.0 + 16.6 + 3.0 –23.8

EUT passes
Limit paragraph 231(e) = 4400 uV/m
Corrected Average Reading = 66.8 dBuV/m
$10^{(66.8/20)}$ = 2188 uV/m
"Sensor" was the model number when the datasheet was secured. UGMO has changed it to Cypress systems
Peak limit = 20 dB above the average limit.
The emissions at 107.9 MHz are from energizing the tine to sense soil moisture and meet the limit of 15.209(a).

In Soil Mode: Limits of 15.231(e). Special test mode TX once per second.

Radiated Emissions Data

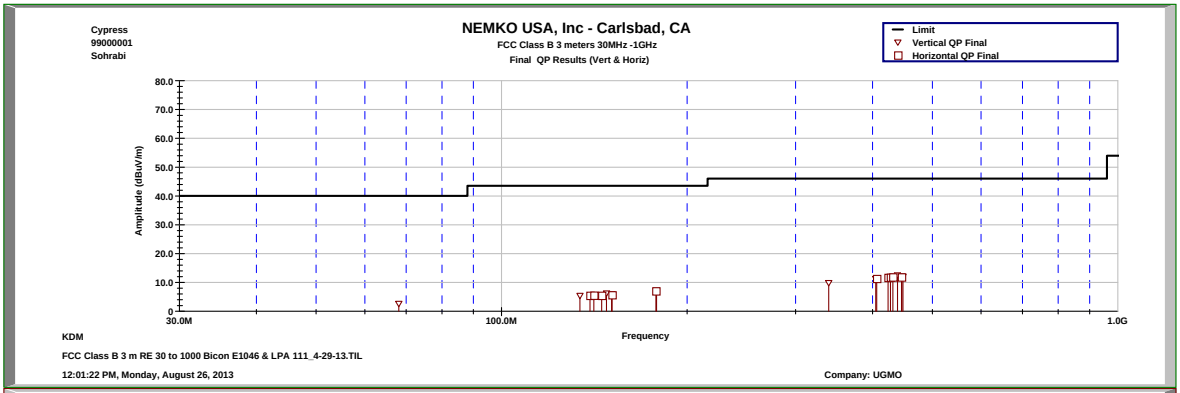
Job # :	10234705	Date :	12/12/12	Page	1 of 1
NEX #:	226596	Time :	12pm		
		Staff :	AG		
Client Name :	Ugmo Technologies			EUT Voltage :	3V batt
EUT Name :	Underground soil moisture sensor			EUT Frequency :	N/A
EUT Model # :				Phase:	N/A
EUT Serial # :	99000000				
EUT Config. :	Transmit every second				
	soil: heavily compacted, moisture level: 46.8 %			Distance < 1000 MHz:	3 m
				Distance > 1000 MHz:	3 m
Specification :	FCC Part 15.231 e (in soil)				
Loop Ant. #:	NA				
Bicon Ant.#:	128_3m	Temp. (°C) :	21		
Log Ant.#:	110_3m	Humidity (%) :	47		
DRG Ant. #	529	Spec Analyzer #:	911		
Cable LF#:	SAC_10m	Analyzer Display #:	911		
Cable HF#:	WCC	Quasi-Peak Detector #:	911		
Preamp LF#:	901	**Duty Cycle (%):**	7.00		
Preamp HF#	317				

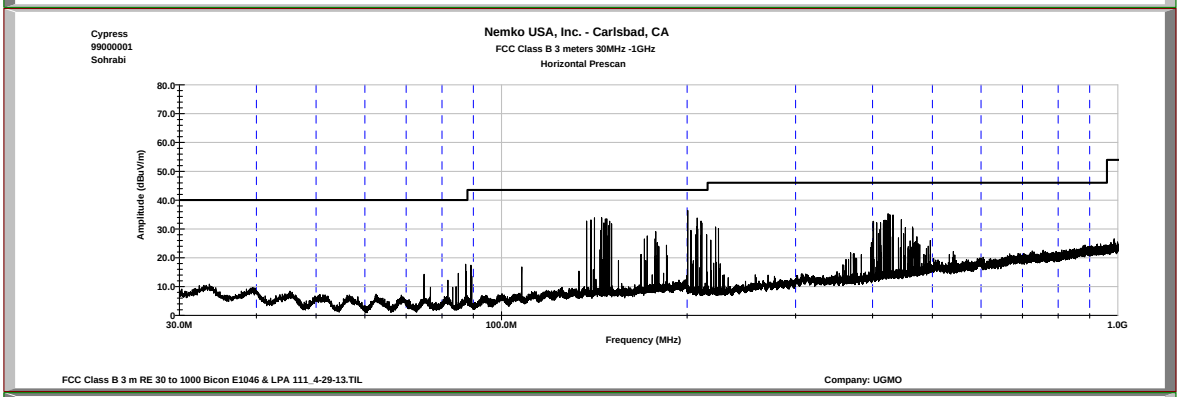
Quasi-Peak	RBW: 120 kHz
	Video Bandwidth 300 kHz
Peak	RBW: 1 MHz
	Video Bandwidth 3 MHz
Average = Peak + Duty Cycle Factor	
DCF = 20 x log(duty cyle)	

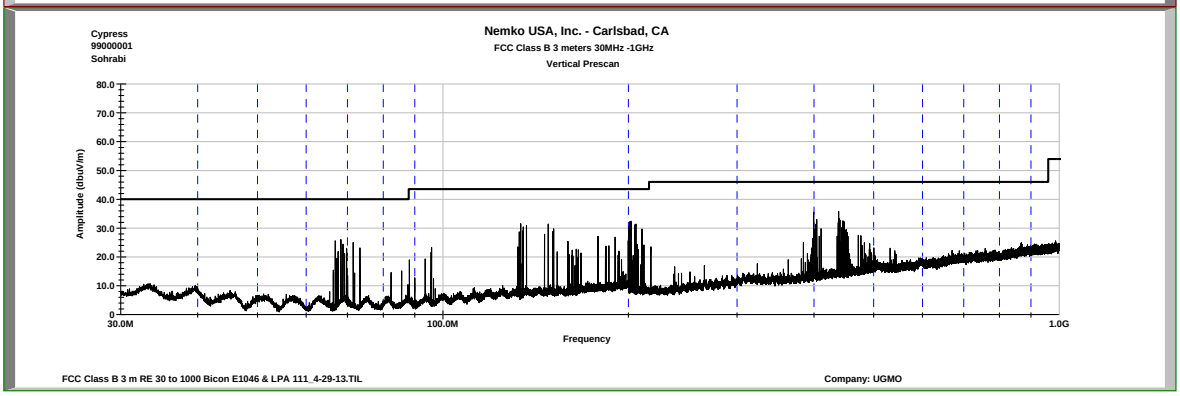
Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.
Measurements above 1 GHz are Average values, unless otherwise stated.

Meas. Freq. (MHz)	Meter Reading **Vertical**	Meter Reading **Horizontal**	Det.	EUT Side DEG	Ant. Height cm	Max. Reading (dBµV)	Corrected Reading (dBµV)	Spec. limit (dBµV)	CR/SL Diff. (dB)	Pass Fail	Comment
433.9	68.8	72.0	P	31.0	174.0	72	92.7	92.9	-0.2	Pass	In soil
433.9	68.8	72.0	A	31.0	174.0	72	69.6	72.9	-3.3	Pass	In soil
215.8	46.4	50.4	Q	82.0	132.0	50.4	32.9	43.5	-10.6	Pass	
323.8	49.5	51.6	Q	261.0	100.0	51.6	37.5	46.0	-8.5	Pass	
539.5	37.3	42.2	Q	72.0	136.0	42.2	32.8	46.0	-13.2	Pass	
868.1	55.3	61.8	P	44.0	167.0	61.8	58.3	72.9	-14.6	Pass	
868.1	55.3	61.8	A	44.0	167.0	61.8	35.3	52.9	-17.6	Pass	
1736.0	48.3	44.6	P	51.0	118.0	48.3	50.5	72.9	-22.4	Pass	
1736.0	48.3	44.6	A	51.0	118.0	48.3	27.4	52.9	-25.5	Pass	

30 to 1000 MH scans at 3m







Conducted Emissions Test Data—Receive Mode

Part 15.207(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

7.2.2 The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network. Except when the requirements applicable to a given device state otherwise, for any license-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown below. The tighter limit applies at the frequency range boundaries. The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network Frequency Range

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Client	Advanced Sensor Technology	Temperature	16	°C
Pan #	226596	Relative Humidity	74	%
EUT Name	Moisture sensor			
EUT Model	Sensor	Test Location		
Governing Doc	CFR 47, Part 15B	Test Engineer		
Basic Standard	Sec. 15.107 Class “B”	Date of test		
Test Parameters	Peak RBW: 100kHz VBW: 100kHz Quasi-Peak: RBW 9kHz, VBW 30 kHz Average: RBW 9kHz, VBW 30 kHz Quasi-Peak Limit Blue Line, Average Limit Green Line			
EUT does not have need for AC power as it is battery powered.				

Radiated Emissions Test Data—Receive Mode

The following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1.

Table 1 - Spurious Emission Limits for Receivers

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

Client	Advanced Sensor Technology	Temperature		°C
Pan #	226596	Relative Humidity		%
EUT Name	Moisture sensor			
EUT Model	Sensor	Test Location		
Governing Doc	CFR 47, Part 15B	Test Engineer		
Basic Standard	Sec. 15.207 Class "B"	Date of test		

EUT does not have a receive mode.
No emissions evident while in standby mode

APPENDIX B

B. Radiated Emissions Measurement Uncertainties

1. Introduction

ISO/IEC 17025:2005 and ANSI/NCSL Z540.3: 2006 require that all measurements contained in a test report be “traceable”. “Traceability” is defined in the *International Vocabulary of Basic and General Terms in Metrology* (ISO: 1993) as: “the property of the result of a measurement... whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons, *all having stated uncertainties*”.

The purposes of this Appendix are to “state the *Measurement Uncertainties*” of the conducted emissions and radiated emissions measurements contained in Section 5 of this Test Report, and to provide a practical explanation of the meaning of these measurement uncertainties.

2. Statement of the Worst-Case Measurement Uncertainties for the Conducted and Radiated Emissions Measurements Contained in This Test Report

Table 1: Worst-Case Expanded Uncertainty "U" of Measurement for a k=2 Coverage Factor

Radiated Emissions Measurement Detection Systems	Applicable Frequency Range	"U” for a k=2 Coverage Factor
Spectrum Analyzer with QPA & Preamplifier	30 MHz - 200 MHz	+3.9 dB, -4.0 dB
Spectrum Analyzer with QPA & Preamplifier	200 MHz-1000 MHz	+/- 3.5 dB
Spectrum Analyzer with Preamplifier	1 GHz - 18 GHz	+2.5 dB, -2.6 dB
Spectrum Analyzer with Preamplifier	18 GHz - 40 GHz	+/- 3.4 dB

NOTES:
1. Applies to 3 and 10 meter measurement distances
2. Applies to all valid combinations of Transducers (i.e. LISNs, Line Voltage Probes, and Antennas, as appropriate)
3. Excludes the Repeatability of the EUT

3. Practical Explanation of the Meaning of Radiated Emissions Measurement Uncertainties

In general, a "Statement of Measurement Uncertainty" means that with a certain (specified) confidence level, the "true" value of a measurand will be between a (stated) upper bound and a (stated) lower bound.

In the specific case of EMC Measurements in this test report, the measurement uncertainties of the conducted emissions measurements and the radiated emissions measurements have been calculated in accordance with the method detailed in the following documents:

- *ANSI Z540.2 (2002) Guide to the Expression of Uncertainty in Measurement*
- NIS 81:1994, *The Treatment of Uncertainty in EMC Measurements* (NAMAS, 1994)
- NIST Technical Note 1297(1994), *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results* (NIST, 1994)

The calculation method used in these documents requires that the stated uncertainty of the measurements be expressed as *an "expanded uncertainty", U, with a k=2 coverage factor*. The practical interpretation of this method of expressing measurement uncertainty is shown in the following example:

EXAMPLE: Assume that at 39.51 MHz, the (measured) radiated emissions level was equal to +26.5 dBuV/m, and that the +/- 2 standard deviations (i.e. 95% confidence level) measurement uncertainty was +/- 3.4 dB.

APPENDIX C

C. Nemko USA, Inc. Test Equipment & Facilities Calibration Program

Nemko USA, Inc. operates a comprehensive Periodic Calibration Program in order to ensure the validity of all test data. Nemko USA's Periodic Calibration Program is fully compliant to the requirements of NVLAP Policy Guide PG-1-1988, ANSI/NCSL Z540.3: 2006, ISO 10012:2003, ISO/IEC 17025:2005, and ISO-9000: 2000. Nemko USA, Inc.'s calibrations program therefore meets or exceeds the US national commercial and military requirements [N.B. ANSI/NCSL Z540.1-1994 replaced MIL-STD-45662A].

Specifically, all of Nemko USA's *primary reference standard devices* (e.g. vector voltmeters, multimeters, attenuators and terminations, RF power meters and their detector heads, oscilloscope mainframes and plug-ins, spectrum analyzers, RF preselectors, quasi-peak adapters, interference analyzers, impulse generators, signal generators and pulse/function generators, field-strength meters and their detector heads, etc.) and certain *secondary standard devices* (e.g. RF Preamplifiers used in CISPR 11/22 and FCC Part 15/18 tests) are periodically recalibrated by:

- A Nemko USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Guide 25-accredited as a calibration laboratories by NIST; or,
- A Nemko USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Guide 25-accredited as a calibration laboratory by another accreditation body (such as A2LA) that is mutually recognized by NIST; or,
- A manufacturer of Measurement and Test Equipment (M&TE), if the manufacturer uses NIST-traceable standards and is ISO Guide 25-accredited as calibration laboratory either by NIST or by another accreditation body (such as A2LA) that is mutually recognized by NIST; or
- A manufacturer of M&TE (or by a Nemko USA-approved independent third party metrology laboratory) that is not ISO Guide 25-accredited. (In these cases, Nemko USA conducts an annual audit of the manufacturer or metrology laboratory for the purposes of proving traceabilty to NIST, ensuring that adequate and repeatable calibration procedures are being applied, and verifying conformity with the other requirements of ISO Guide 25).

In all cases, the entity performing the Calibration is required to furnish Nemko USA with a calibration test report and/or certificate of calibration, and a "calibration sticker" on each item of M&TE that is successfully calibrated.

Calibration intervals are normally one year, except when the manufacture advises a shorter interval or if US Government directives or client requirements demand a shorter interval. Items of instrumentation/related equipment which fail during routine use, or which suffer visible mechanical damage (during use or while in transit), are sidelined pending repair and recalibration. (Repairs are carried out either in-house [if minor] or by a Nemko USA-approved independent [third party] metrology laboratory, or by the manufacturer of the item of M&TE).

Each antenna used for CISPR 11 and CISPR 22 and FCC Part 15 and Part 18 radiated emissions testing (and for testing to the equivalent European Norms) is calibrated annually by either a NIST (or A2LA) ISO Standard 17025-Accredited third-party Antenna Calibration Laboratory or by the antenna's OEM if the OEM is NIST or A2LA ISO Standard 17025-accredited as an antenna calibration laboratory. The antenna calibrations are performed using the methods specified in Annex G.5 of CISPR 16-1(2003) or ANSI C63.5-2004, including the "Three-Antenna Method". Certain other kinds of antennas (e.g. magnetic-shielded loop antennas) are calibrated annually by either a NIST (or A2LA) ISO Standard 17025-accredited third-party antenna calibration laboratory, or by the antenna's OEM if the OEM is NIST or A2LA ISO Standard 17025-accredited as an antenna calibration laboratory using the procedures specified in the latest version of SAE ARP-958.

In accordance with FCC and other regulations, Nemko USA recalibrates its suite of antennas used for radiated emissions tests on an annual basis. These calibrations are performed as a precursor to the FCC-required annual revalidation of the Normalized Site Attenuation properties of Nemko USA's Open Area Test Site. Nemko USA, Inc. uses the procedures given in both Sub clause 16.6 and Annex G.2 of CISPR 16-1 (2003), and, ANSI C63.4-2003 when performing the normalized site attenuation measurements.