



1601 North A.W. Grimes Blvd., Suite B
Round Rock, TX 78665
e-mail: info@ptitest.com
(512) 244-3371 Fax: (512) 244-1846

April 4, 2014

Tim Fiebrich
Naztec
522 Gillingham Dr
Sugar Land, TX 77478

Dear Tim:

Enclosed is the Wireless Test Report for the Naztec VDS-POD-S. This report can be used to demonstrate compliance with FCC requirements for wireless devices in the United States.

If you have any questions, please contact me.

Sincerely,

Jeffrey A. Lenk
President

Enclosure

Project 15311-15

**Naztec
VDS-POD-S
FCC ID: MD5-SM02**

Wireless Certification Report

Prepared for:

Naztec
522 Gillingham Dr.
Sugar Land, TX 77478

By

Professional Testing (EMI), Inc.
1601 N. A.W. Grimes Blvd., Suite B
Round Rock, Texas 78665

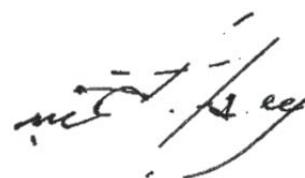
April 4, 2014

Reviewed by



Larry Finn

Written by



Eric Lifsey

Product Development Engineer

Test Engineer

Table of Contents

Title Page.....	1
Table of Contents.....	3
Revision History	5
1.0 Introduction.....	7
1.1 Scope.....	7
1.2 EUT Description	7
1.3 EUT Operation.....	7
1.4 Modifications	7
1.5 Test Site	7
2.0 Applicable Documents and Clauses.....	8
3.0 Transmitter Duty Cycle.....	9
3.2 Test Procedure	9
3.3 Test Criteria	9
3.4 Test Results.....	9
4.0 Occupied Bandwidth.....	10
4.1 Test Procedure	11
4.2 Test Criteria	11
4.3 Test Results.....	11
5.0 Band Edge Spurious Emissions	14
5.1 Test Procedure	14
5.2 Test Criteria	14
5.3 Test Results.....	14
6.0 Out of Band Spurious Emissions	19
6.1 Test Procedure	19
6.2 Test Criteria	19
6.3 Test Results.....	20
7.0 Frequency Hopping Parameter Measurements	29
7.1 Test Procedure	29
7.2 Test Criteria	29
7.3 Test Results.....	30
8.0 Peak Output Power	33
8.1 Test Procedure	33
8.2 Test Criteria	33
8.3 Test Results.....	33
9.0 Antenna Construction Requirements	34
9.2 Test Procedure	34
9.3 Test Criteria	34
9.4 Test Results.....	34
10.0 Equipment Lists	35
10.1 Equipment for Spurious Radiated Emissions Below 1 GHz; Power and Band Edge.....	35
10.2 Equipment for Bandwidth, Hopping Parameters, and Duty Cycle Measurements.....	36
Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty	37
End of Report.....	39

NOTICE: This Report must not be used to claim product endorsement, by NVLAP, NIST, the FCC or any other Agency. This report also does not warrant certification by NVLAP or NIST. This report shall not be reproduced except in full, without the written approval of Professional Testing (EMI), Inc. The significance of this report is dependent on the representative character of the test sample submitted for evaluation and the results apply only in reference to the sample tested. The manufacturer must continuously implement the changes shown herein to attain and maintain the required degree of compliance.

Revision History

Revision Number	Description	Date
04	Revised per TUV comments	April 4, 2014



Applicant: Naztec
 Applicant's Address: 522 Gillingham Dr.
 Sugar Land, TX 77478

FCC ID: MD5-SM02
 Model: VDS-POD-S
 Project Number: 15311-15

The **VDS-POD-S** by **Naztec** was tested utilizing the following documents and found to be in compliance with the required criteria on the indicated test date.

47 CFR (USA)		
Section Reference	Parameter	Date
15.247(a)	Hopping Frequency Separation, Number of Hopping Channels, Channel Occupancy Time	2013-02-25
15.247(a)	Occupied Bandwidth,	2014-02-19
15.247(b)	Peak Output Power (conducted)	2014-02-12
15.209 + 15.205	Harmonic & Spurious Emissions + Band Edge	2014-02-12
15.203	Antenna Requirements	2014-02-25
2.1091	Maximum Permissible Exposure	2014-02-21

I, Eric Lifsey, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

Eric Lifsey
 EMC Engineer

This report has been reviewed and accepted by **Naztec**. The undersigned is responsible for ensuring that this device will continue to comply with the FCC rules.

 Representative of **Naztec**

1.0 Introduction

1.1 Scope

This report describes the extent of the equipment under test (EUT) conformance to the intentional radiator requirements of the United States.

1.2 EUT Description

The **VDS-POD-S** by **Naztec** is a sensor module installed a few cm below the roadway to detect and report traffic flow. It communicates wirelessly on 902-928 MHz to a network radio module(s) located on poles or structures above the traffic. It operates on battery power for up to 10 years and uses an integral antenna.

Table 1.2.1: Equipment Under Test	
Manufacturer	Naztec, Inc. (dba Trafficware)
Model Number	VDS-POD-S
FCC ID	MD5-SM02
Frequency (MHz)	902-928 MHz
Description of Change	The new antenna is .032" thick instead of .016" thick and it is copper plated.

1.3 EUT Operation

EUT was operated in a manner consistent with normal operation. The EUT is designed to be buried below the road surface. Measurements in this report were done entirely above ground.

1.4 Modifications

No modifications were made to the EUT during the performance of the test program.

1.5 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. This site is registered with the FCC under Section 2.948 and Industry Canada per RSS-Gen, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas, 78758, while the main office is located at 1601 N. A.W. Grimes Blvd., Suite B, Round Rock, Texas, 78665.

Professional Testing (EMI), Inc., (PTI) follows the guidelines of National Institute of Standards and Technology (NIST) for all uncertainty calculations, estimates, and expressions thereof for electromagnetic compatibility testing. The procedure of ANSI C63.4: 2009 were utilized for making all emissions measurements.

2.0 Applicable Documents and Clauses

Table 2.0.1: Applicable Documents

Document	Title	Release
ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment	2009
47 CFR	Part 15 – Radio Frequency Devices Subpart C -Intentional Radiators	

Table 2.0.2: Applicable Clauses

Clause Subject	Section References	Required?	Result
Radiated Output Power	15.247	Yes	Pass
Occupied Bandwidth, 20 dB	2.1049, 15.247(a)	Yes	Pass
Field Strength of Radiated Spurious/Harmonic Emissions (30 MHz to 25 GHz)	15.205, 15.247, 15.209	Yes	Pass
Antenna Construction	15.203	Yes	Pass
Maximum Permissible Exposure*	2.1091, FCC OET Bulletin 65	Yes	Pass

*Reported separately.

3.0 Transmitter Duty Cycle

Measurements of transmitter on time and intervals between transmissions were made to determine the duty cycle factor.

3.2 Test Procedure

The EUT was loaded with firmware that simulated the maximum possible real world transmission rate and payload. Transmissions are triggered by vehicles passing over the sensor. The test command for hopping transmission was modified to produce this effect.

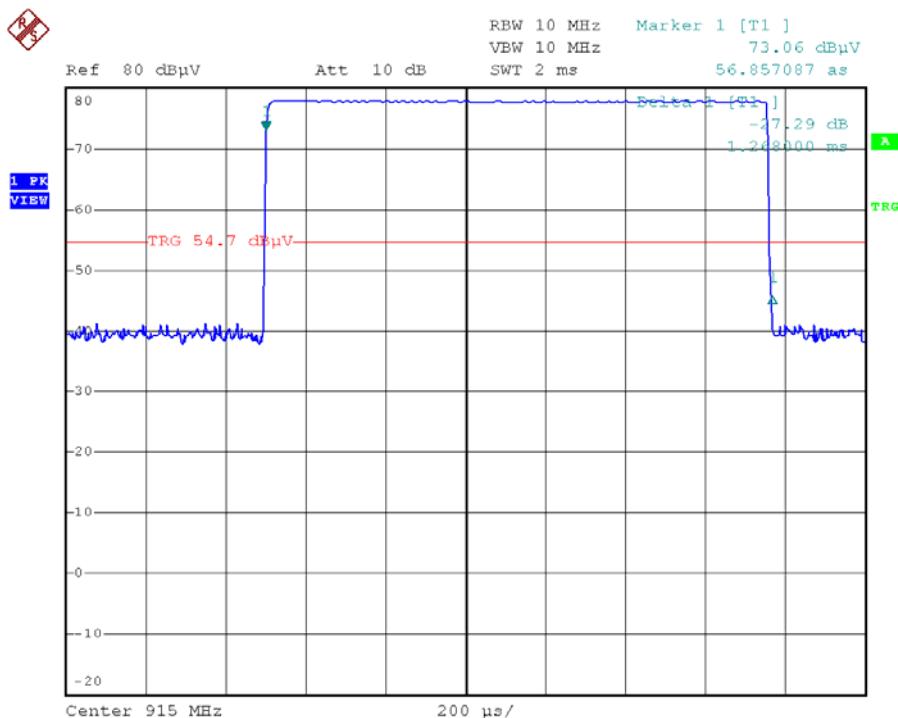
3.3 Test Criteria

Measurement is based on intervals not to exceed 100 msec. Maximum transmitter on time is divided by the lesser of 100 msec or the actual measured minimum transmitter interval time. The result is converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power. This is not a pass/fail measurement.

3.4 Test Results

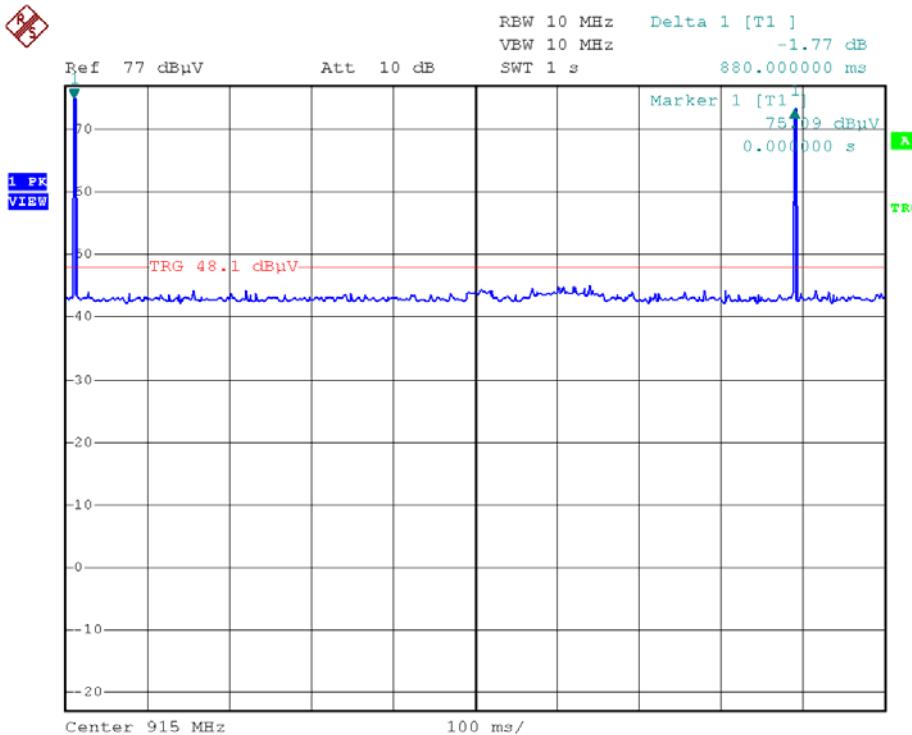
Measurements were performed on March 4, 2013 with the following results.

Plot 3.3.1 Transmit On Time



Measured maximum transmit time: 1.268 msec

Plot 3.3.2 Transmit Interval Time



Measured minimum transmit interval time: 880 msec (Allowed 100 msec.)

Table 3.3.1 Duty Cycle Factor Result

Measured On Time (msec)	Measured Time Interval (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
1.268	880 msec (100 msec allowed)	= 20 * Log ₁₀ (1.268 msec / 100 msec)	-37.9	-20

4.0 Occupied Bandwidth

Occupied bandwidth measurement was made on the EUT.

4.1 Test Procedure

The EUT is configured for best signal/power and the bandwidth then is measured. A recording of the results is included.

4.2 Test Criteria

Section Reference	Parameter	Date
2.1049, 15.247(a)	Bandwidth, 20 dB	2014-02-19

4.3 Test Results

The EUT is a frequency hopper with 60 channels and bandwidth under 250 kHz.

The EUT was found to be in compliance with applicable requirements.

Channel	Measured BW (kHz)
L	171.0
M	171.0
H	169.0

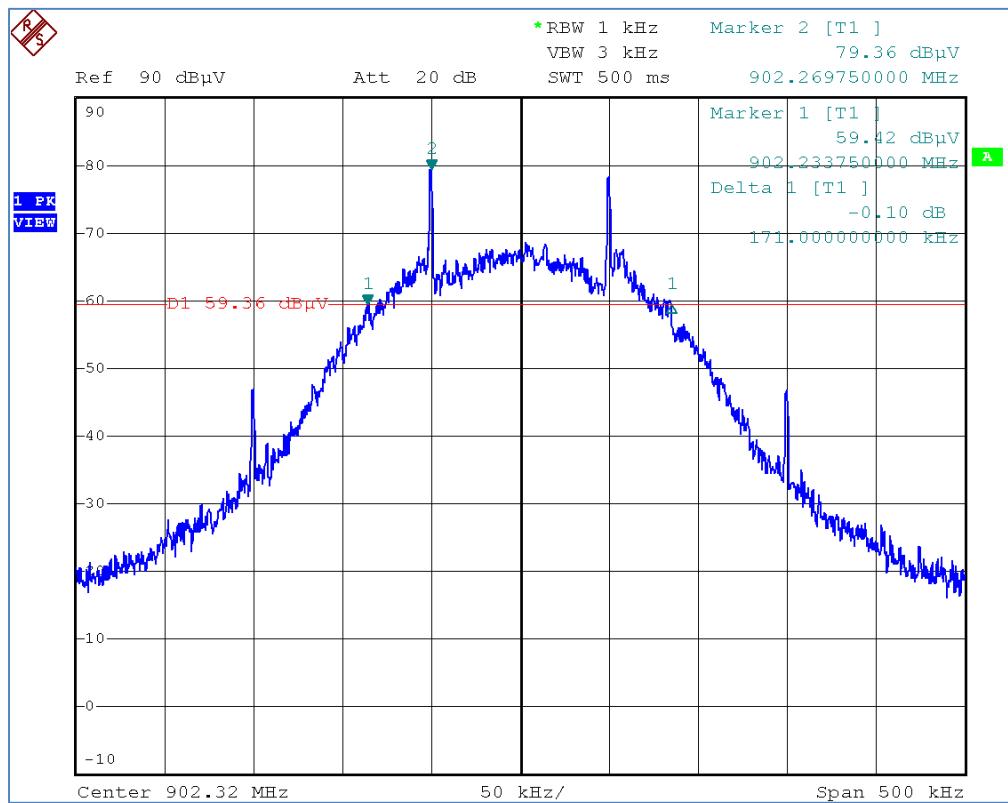


Figure 4.3.1: Measured BW (Channel L)

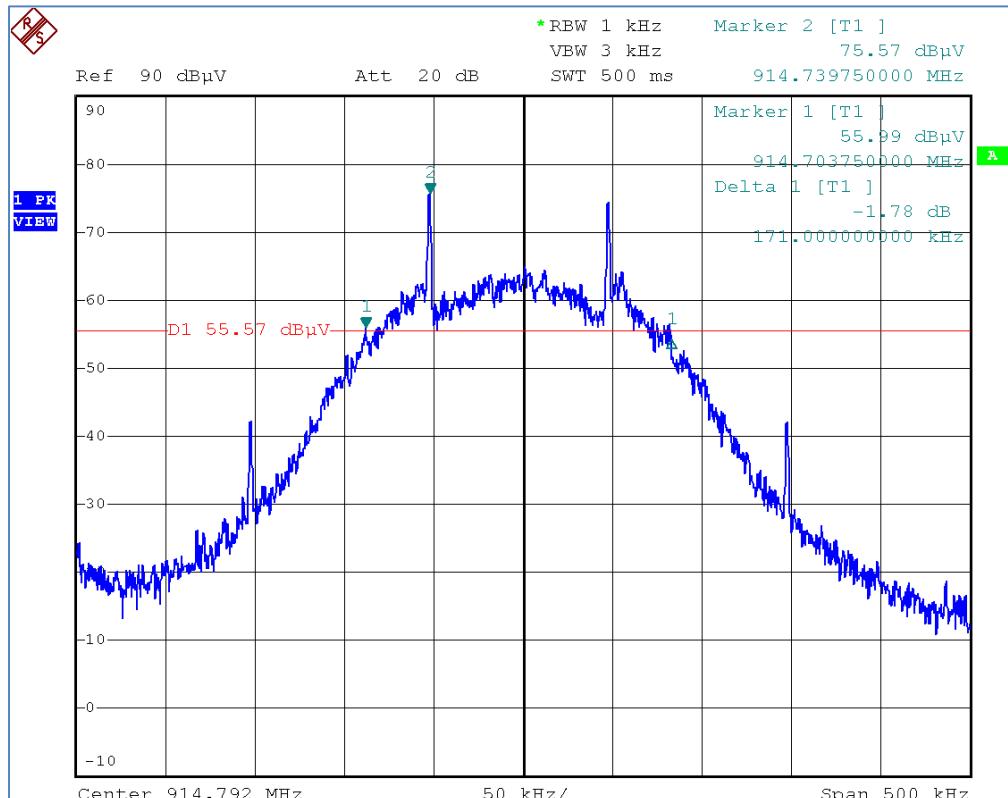


Figure 4.3.2: Measured BW (Channel M)

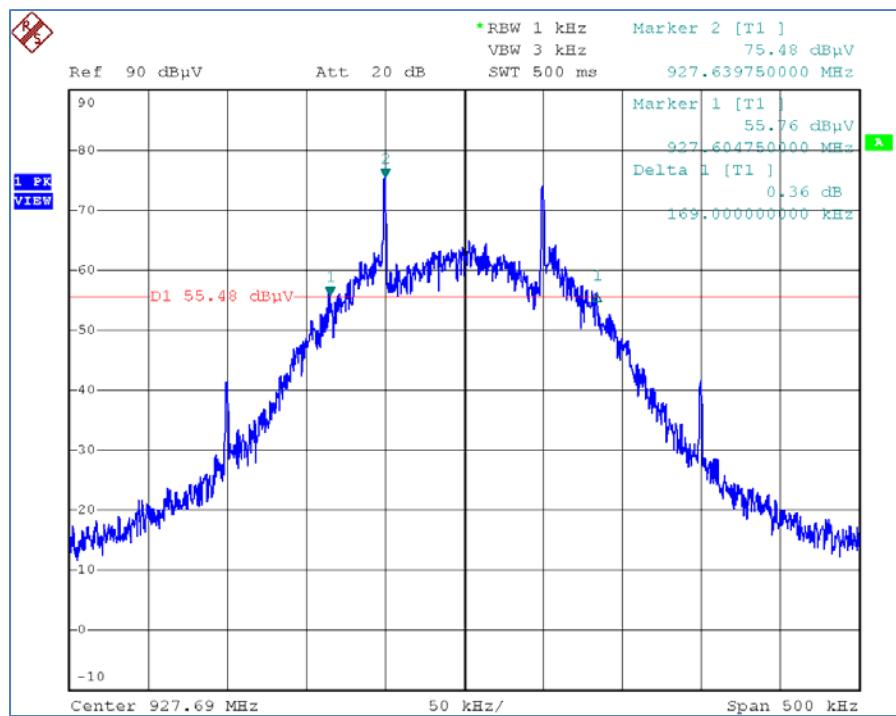


Figure 4.3.3: Measured BW (Channel H)

5.0 Band Edge Spurious Emissions

Band edge spurious emissions measurements were performed on the EUT to determine compliance to FCC 15.247(d) and RSS-210 A8.5.

5.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable, which allows 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 1 meter as measured from the closest point of the EUT. Rotating the EUT maximized the emissions.

The spectrum analyzer was set for peak detection using a 120 kHz resolution bandwidth. The span is set wide enough to show the band edge and the fundamental emission on the plot. A vertical line is placed on the plot to denote the band edge frequency.

5.2 Test Criteria

Clause Subject	Section Number	Date
Out of Band Emissions, Band Edge	15.205, 15.247(d)	2014-02-12

5.3 Test Results

EUT was found to be in compliance with applicable requirements.

The fundamental emission outside the band edge is attenuated by an excess of 40 dB. There are no restricted bands adjacent to the 902-928 MHz band. Emissions were investigated up to 10 GHz which includes the 10th harmonic.

Plotted measurements appear below.

Table 5.3.1: Band Edge, Channel High, Vertical Polarity

Professional Testing, EMI, Inc.					
Test Method:	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" (incorporated by reference, see §15.38).				
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits				
Section:	15.209				
Test Date(s):	2/12/2014	EUT Serial #:	1324601000010000		
Customer:	Naztec	EUT Part #:	None		
Project Number:	15311-15	Test Technician:	Bob Redoutey / Eric Lifsey		
Purchase Order #:	NP00005714	Supervisor:	Rob McCollough		
Equip. Under Test:	SM101 Sensor	Witness' Name:	None		
Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	3.6 VDC	EUT Power Frequency:	- N/A		
Antenna Orientation:	Vertical	Frequency Range:	30MHz to 1GHz		
EUT Mode of Operation:		Band Edge Transmitting High Channel			
<p>Professional Testing, EMI, Inc Radiated Emissions, 10m Distance 30MHz - 1GHz Vertical Polarity Measured Emissions</p> <p>Operator: Bob Redoutey / Eric Lifsey 15311'GHZ'BE'HighChan'2013RE020414.til 01:18:41 PM, Wednesday, February 12, 2014</p> <p>EUT Mode: Transmit, High Freq EUT Power: 3.6V Battery</p> <p>Frequency</p> <p>Field Strength (dBµV/m)</p> <p>927.5M 927.6M 927.7M 927.8M 927.9M 928.0M 928.1M 928.2M 928.3M 928.4M 928.5M</p> <p>110 100 90 80 70 60 50 40 30 20 10 0</p> <p>Quasi-peak Limit Level Corrected Quasi-peak Reading Peak Limit Level Corrected Peak Value MarkHighBE</p> <p>PROFESSIONAL TESTING</p> <p>EUT: SM101 Sensor Project Number: 15311-15 Client: Naztec-Trafficware</p>					
≤ 1GHz Vertical Antenna Polarity Measured Emissions					

Table 5.3.2: Band Edge, Channel High, Horizontal Polarity

Professional Testing, EMI, Inc.					
Test Method:	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" (incorporated by reference, see §15.38).				
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits				
Section:	15.209				
Test Date(s):	2/12/2014	EUT Serial #:	1324601000010000		
Customer:	Naztec	EUT Part #:	None		
Project Number:	15311-15	Test Technician:	Bob Redoutey / Eric Lifsey		
Purchase Order #:	NP00005714	Supervisor:	Rob McCollough		
Equip. Under Test:	SM101 Sensor	Witness' Name:	None		
Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	3.6 VDC	EUT Power Frequency:	- N/A		
Antenna Orientation:	Horizontal	Frequency Range:	30MHz to 1GHz		
EUT Mode of Operation:		Band Edge Transmitting High Channel			
<p>Professional Testing, EMI, Inc Radiated Emissions, 10m Distance 30MHz - 1GHz Horizontal Polarity Measured Emissions</p> <p>Field Strength (dBμV/m)</p> <p>Frequency</p> <p>927.5M 927.6M 927.7M 927.8M 927.9M 928.0M 928.1M 928.2M 928.3M 928.4M 928.5M</p> <p>Operator: Bob Redoutey / Eric Lifsey 15311'GHZ'BE'HighChan'2013RE020414.til 01:18:40 PM, Wednesday, February 12, 2014</p> <p>EUT Mode: Transmit, High Freq EUT Power: 3.6V Battery</p> <p>EUT: SM101 Sensor Project Number: 15311-15 Client: Naztec-Trafficware</p>					
\leq 1GHz Horizontal Antenna Polarity Measured Emissions					

Table 5.3.3: Band Edge, Channel Low, Vertical Polarity

Professional Testing, EMI, Inc.					
Test Method:	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" (incorporated by reference, see §15.38).				
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits				
Section:	15.209				
Test Date(s):	2/12/2014	EUT Serial #:	1324601000010000		
Customer:	Naztec	EUT Part #:	None		
Project Number:	15311-15	Test Technician:	Bob Redoutey / Eric Lifsey		
Purchase Order #:	NP00005714	Supervisor:	Rob McCollough		
Equip. Under Test:	SM101 Sensor	Witness' Name:	None		
Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	3.6 VDC	EUT Power Frequency:	- N/A		
Antenna Orientation:	Vertical	Frequency Range:	30MHz to 1GHz		
EUT Mode of Operation:		Band Edge Transmitting Low Channel			
<p>Professional Testing, EMI, Inc Radiated Emissions, 10m Distance 30MHz - 1GHz Vertical Polarity Measured Emissions</p>					
≤ 1GHz Vertical Antenna Polarity Measured Emissions					

Table 5.3.4: Band Edge, Channel Low, Horizontal Polarity
Professional Testing, EMI, Inc.

Test Method:	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" (incorporated by reference, see §15.38).				
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits				
Section:	15.209				
Test Date(s):	2/12/2014	EUT Serial #:	1324601000010000		
Customer:	Naztec	EUT Part #:	None		
Project Number:	15311-15	Test Technician:	Bob Redoutey / Eric Lifsey		
Purchase Order #:	NP00005714	Supervisor:	Rob McCollough		
Equip. Under Test:	SM101 Sensor	Witness' Name:	None		
Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	3.6	VDC	EUT Power Frequency: - N/A		
Antenna Orientation:	Horizontal		Frequency Range: 30MHz to 1GHz		
EUT Mode of Operation:		Band Edge Transmitting Low Channel			
<p>Professional Testing, EMI, Inc Radiated Emissions, 10m Distance 30MHz - 1GHz Horizontal Polarity Measured Emissions</p> <p>Field Strength (dBμV/m)</p> <p>Frequency</p> <p>Operator: Bob Redoutey / Eric Lifsey 15311'GHZ'BE'LowChan'2013RE020414.til 02:36:05 PM, Wednesday, February 12, 2014</p> <p>EUT Mode: Transmit, Low Freq EUT Power: 3.6V Battery</p> <p>EUT: SM1 Sensor Project Number: 15311-15 Client: Naztec-Trafficware</p>					
≤ 1GHz Horizontal Antenna Polarity Measured Emissions					

6.0 Out of Band Spurious Emissions

Out of band spurious/harmonic emissions measurements were performed on the EUT to determine compliance to 47 CFR, Part 15.

6.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 10 meters from the measurement antenna for below 1 GHz. Above 1 GHz the measurement antenna distance is 3 meters.

Emissions below 1 GHz were measured with peak detection with a resolution bandwidth of 120 kHz and measured at a distance of 10 meters. Quasi-peak detection was used to determine compliance of the EUT if the peak did not meet the peak limit.

Harmonic emissions above 1 GHz were measured with peak detection, a resolution bandwidth of 1 MHz, and at a distance of 3 meters. If peak measurements exceeded average limits, the peak limit was applicable and duty cycle factor was then applied for average level calculation. Emissions were investigated up to the 10th harmonic of the transmitter fundamental.

Non-harmonic spurious emissions must satisfy the average limit and the peak limit (20 dB above average). A diagram showing the test setup is given as Figure 5.1.1.

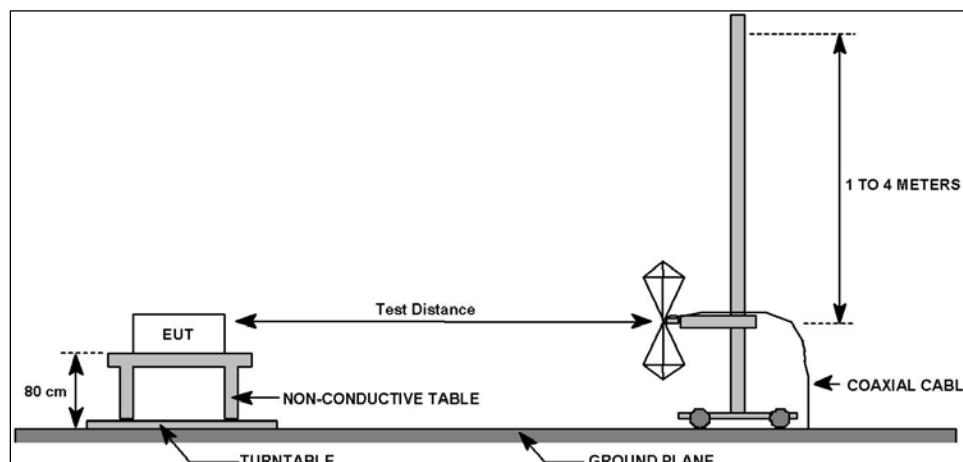


Figure 5.1.1: Field Strength of Spurious Emissions Test Setup

6.2 Test Criteria

Clause Subject	Section Number	Date
Field Strength of Radiated Spurious/Harmonic Emissions	15.205, 15.209, RSS-210 A2.9(a) and (b)	2014-02-12

6.3 Test Results

For harmonic emissions only the peak detection levels were recorded. For harmonics of the fundamental the average is determined by applying the duty cycle factor, which for this device is 20 dB. Therefore a passing peak detection signal also passes the average limit.

Plotted results appear below.

Table 6.4.1: Radiated Spurious Emissions, Below 1 GHz, Vertical Polarity

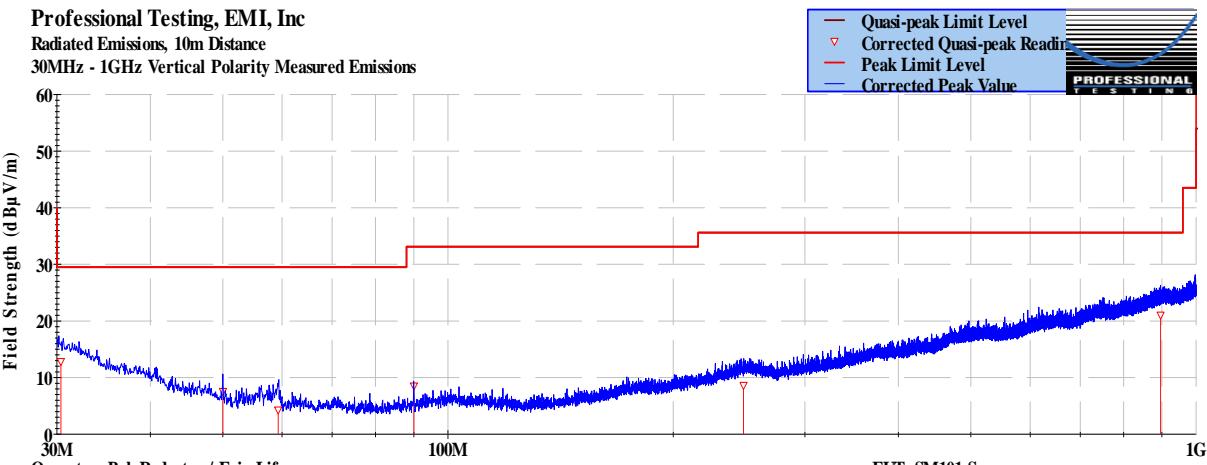
Professional Testing, EMI, Inc.									
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).								
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits								
Section:	15.209								
Test Date(s):	2/12/2014			EUT Serial #:	1324601000010000				
Customer:	Naztec			EUT Part #:	None				
Project Number:	15311-15			Test Technician:	Bob Redoutey / Eric Lifsey				
Purchase Order #:	NP00005714			Supervisor:	Rob McCollough				
Equip. Under Test:	SM101 Sensor			Witness' Name:	None				
Radiated Emissions Test Results Data Sheet								Page:	1 of 1
EUT Line Voltage:	3.6	VDC	EUT Power Frequency: -			N/A			
Antenna Orientation:	Vertical			Frequency Range: 30MHz to 1GHz					
EUT Mode of Operation:					Transmit Freq Hopping				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dB μ V)	Corrected Level (dB μ V/m)	Limit Level (dB μ V/m)	Margin (dB)	Test Results
30.373	10	63	2.9	Quasi-peak	24.1	12.833	29.5	-16.7	Pass
50.0184	10	176	1.17	Quasi-peak	27.8	7.53	29.5	-22.0	Pass
59.2947	10	213	1.34	Quasi-peak	25.5	4.26	29.5	-25.2	Pass
90.0365	10	57	1.75	Quasi-peak	29.5	8.508	33.1	-24.6	Pass
248.316	10	33	1.77	Quasi-peak	22.1	8.609	35.6	-27.0	Pass
896.479	10	119	3.26	Quasi-peak	21.3	21.026	35.6	-14.6	Pass
Professional Testing, EMI, Inc Radiated Emissions, 10m Distance 30MHz - 1GHz Vertical Polarity Measured Emissions									
 <p>Graph showing Field Strength (dBμV/m) versus Frequency (MHz). The x-axis ranges from 30M to 1G, and the y-axis ranges from 0 to 60. A blue line represents the measured data, which shows a sharp increase in field strength between 1GHz and 1.5GHz. Red lines represent the Quasi-peak Limit Level and Peak Limit Level. A blue line represents the Corrected Peak Value. A legend in the top right corner identifies the lines: Quasi-peak Limit Level (red), Corrected Quasi-peak Reading (blue), Peak Limit Level (red), and Corrected Peak Value (blue). The graph is titled "30MHz - 1GHz Vertical Polarity Measured Emissions" and includes the "PROFESSIONAL TESTING" logo.</p>									
Operator: Bob Redoutey / Eric Lifsey 15311_2013 Rad Emissions_ClassB_020414.til 10:09:26 AM, Wednesday, February 12, 2014									
Frequency EUT Mode: Transmit, Freq Hopping EUT Power: 5V Battery EUT: SM101 Sensor Project Number: 15311-15 Client: Naztec									
≤ 1GHz Vertical Antenna Polarity Measured Emissions									

Table 6.4.2: Radiated Spurious Emissions, Below 1 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.									
Test Method:	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" (incorporated by reference, see §15.38).								
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits								
Section:	15.209								
Test Date(s):	2/12/2014			EUT Serial #:	1324601000010000				
Customer:	Naztec			EUT Part #:	None				
Project Number:	15311-15			Test Technician:	Bob Redoutey / Eric Lifsey				
Purchase Order #:	NP00005714			Supervisor:	Rob McCollough				
Equip. Under Test:	SM101 Sensor			Witness' Name:	None				
Radiated Emissions Test Results Data Sheet								Page:	1 of 1
EUT Line Voltage:	3.6	VDC		EUT Power Frequency:	-	N/A			
Antenna Orientation:	Horizontal			Frequency Range:	30MHz to 1GHz				
EUT Mode of Operation:					Transmit Freq Hopping				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dB μ V)	Corrected Level (dB μ V/m)	Limit Level (dB μ V/m)	Margin (dB)	Test Results
31.5321	10	122	3.87	Quasi-peak	24.1	12.263	29.5	-17.2	Pass
68.8935	10	237	1.08	Quasi-peak	23.3	1.841	29.5	-27.7	Pass
202.364	10	10	2.5	Quasi-peak	22.5	5.788	33.1	-27.3	Pass
484.726	10	274	2.51	Quasi-peak	22.3	13.996	35.6	-21.6	Pass
642.678	10	185	1.72	Quasi-peak	22	16.805	35.6	-18.8	Pass
882.507	10	352	3.21	Quasi-peak	21.4	20.68	35.6	-14.9	Pass
<p>Professional Testing, EMI, Inc Radiated Emissions, 10m Distance 30MHz - 1GHz Horizontal Polarity Measured Emissions</p> <p>Field Strength (dBμV/m)</p> <p>Frequency (MHz)</p> <p>Operator: Bob Redoutey / Eric Lifsey 15311_2013 Rad Emissions_ClassB_020414.til 10:09:26 AM, Wednesday, February 12, 2014</p> <p>EUT: SM101 Sensor Project Number: 15311-15 Client: Naztec</p>									
≤ 1GHz Horizontal Antenna Polarity Measured Emissions									

Table 6.4.3: Radiated Spurious Emissions, Above 1 GHz, Low Channel, Vertical Polarity

Professional Testing, EMI, Inc.												
Test Method:	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" (incorporated by reference, see §15.38).											
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits											
Section:	15.209											
Test Date(s):	2/12/2014		EUT Serial #:	1324601000010000								
Customer:	Naztec		EUT Part #:	None								
Project Number:	15311-15		Test Technician:	Bob Redoutey / Eric Lifsey								
Purchase Order #:	NP00005714		Supervisor:	Rob McCollough								
Equip. Under Test:	SM101 Sensor		Witness' Name:	None								
Radiated Emissions Test Results Data Sheet				Page:	1 of 1							
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	-	N/A							
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz								
EUT Mode of Operation:			Transmitting Low Channel									
<p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-10GHz Vertical Polarity Measured Emissions</p> <p>Field Strength (dBμV/m)</p> <p>Frequency (GHz)</p> <p>1G 10G</p> <p>Operator: Bob Redoutey / Eric Lifsey 15311_GHZ_Low_2013 Rad Emissions_ClassB_020414.ti 11:10:53 AM, Wednesday, February 12, 2014</p> <p>EUT: SM101 Sensor Project Number: 15311-15 Client: Naztec</p>												
> 1GHz Vertical Antenna Polarity Measured Emissions												

Table 6.4.4: Radiated Spurious Emissions, Above 1 GHz, Low Channel, Horizontal Polarity

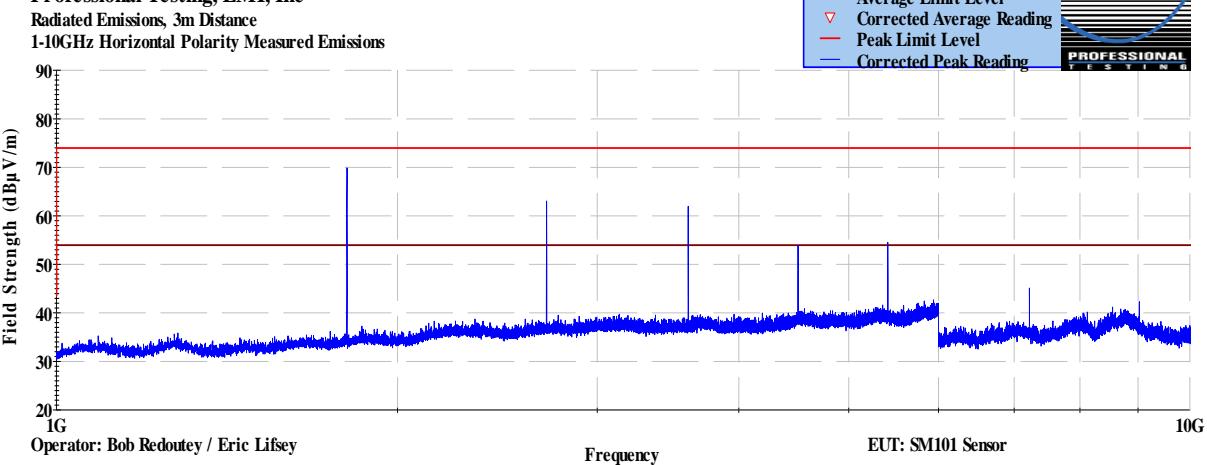
Professional Testing, EMI, Inc.												
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).											
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits											
Section:	15.209											
Test Date(s):	2/12/2014		EUT Serial #:	1324601000010000								
Customer:	Naztec		EUT Part #:	None								
Project Number:	15311-15		Test Technician:	Bob Redoutey / Eric Lifsey								
Purchase Order #:	NP00005714		Supervisor:	Rob McCollough								
Equip. Under Test:	SM101 Sensor		Witness' Name:	None								
Radiated Emissions Test Results Data Sheet				Page:	1 of 1							
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	-	N/A							
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz								
EUT Mode of Operation:			Transmitting Low Channel									
<p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-10GHz Horizontal Polarity Measured Emissions</p>  <p>Field Strength (dBμV/m)</p> <p>1G 10G</p> <p>Operator: Bob Redoutey / Eric Lifsey 15311_GHZ_Low_2013 Rad Emissions_ClassB_020414.t EUT Mode: Transmit, Low Freq, CW 11:10:51 AM, Wednesday, February 12, 2014</p> <p>Frequency</p> <p>EUT: SM101 Sensor Project Number: 15311-15 Client: Naztec</p>												
> 1GHz Horizontal Antenna Polarity Measured Emissions												

Table 6.4.5: Radiated Spurious Emissions, Above 1 GHz, Middle Channel, Vertical Polarity

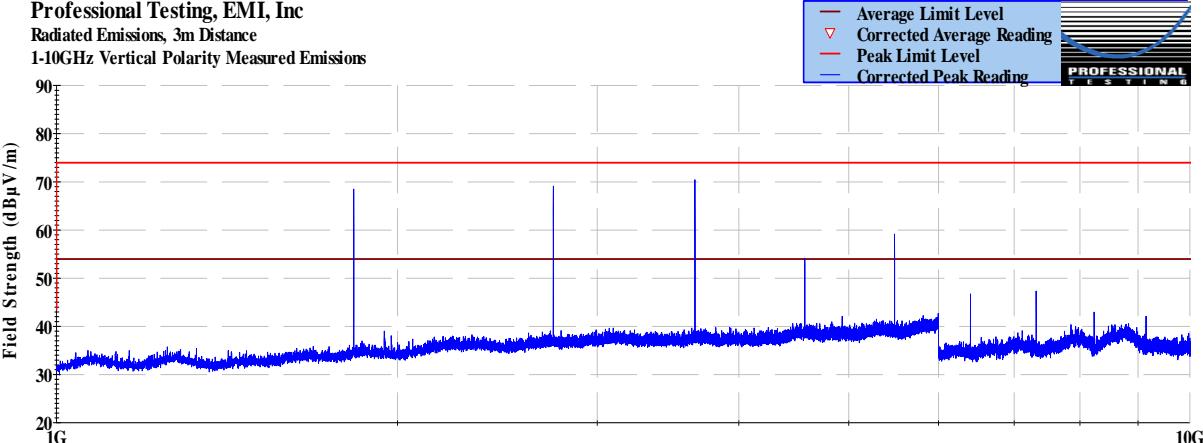
Professional Testing, EMI, Inc.					
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).				
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits				
Section:	15.209				
Test Date(s):	2/12/2014		EUT Serial #:	1324601000010000	
Customer:	Naztec		EUT Part #:	None	
Project Number:	15311-15		Test Technician:	Bob Redoutey / Eric Lifsey	
Purchase Order #:	NP00005714		Supervisor:	Rob McCollough	
Equip. Under Test:	SM101 Sensor		Witness' Name:	None	
Radiated Emissions Test Results Data Sheet				Page: 1 of 1	
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	-	N/A
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz	
EUT Mode of Operation:	Transmitting Middle Channel				
<p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-10GHz Vertical Polarity Measured Emissions</p>  <p>Field Strength (dBμV/m)</p> <p>1G 10G</p> <p>Operator: Bob Redoutey / Eric Lifsey 15311_GHZ_Mid_2013 Rad Emissions_ClassB_020414.ti 11:38:50 AM, Wednesday, February 12, 2014</p> <p>Frequency EUT: SM101 Sensor Project Number: 15311-15 Client: Naztec</p>					
> 1GHz Vertical Antenna Polarity Measured Emissions					

Table 6.4.6: Radiated Spurious Emissions, Above 1 GHz, Middle Channel, Horizontal Polarity

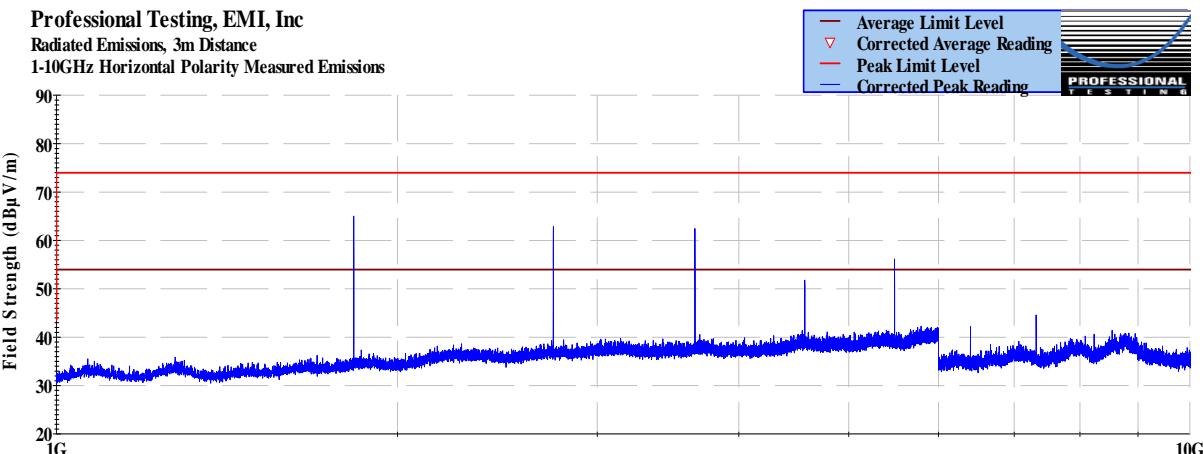
Professional Testing, EMI, Inc.					
Test Method:			ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:			FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:			15.209		
Test Date(s):	2/12/2014	EUT Serial #:	1324601000010000		
Customer:	Naztec	EUT Part #:	None		
Project Number:	15311-15	Test Technician:	Bob Redoutey / Eric Lifsey		
Purchase Order #:	NP00005714	Supervisor:	Rob McCollough		
Equip. Under Test:	SM101 Sensor	Witness' Name:	None		
Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	3.6 VDC	EUT Power Frequency:	- N/A		
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz		
EUT Mode of Operation:		Transmitting Middle Channel			
<p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-10GHz Horizontal Polarity Measured Emissions</p>  <p>Field Strength (dBμV/m)</p> <p>Frequency (GHz)</p> <p>1G 10G</p> <p>Operator: Bob Redoutey / Eric Lifsey 15311_GHZ_Mid_2013 Rad Emissions_ClassB_020414.ti 11:38:47 AM, Wednesday, February 12, 2014</p> <p>EUT: SM101 Sensor Project Number: 15311-15 Client: Naztec</p>					
> 1GHz Horizontal Antenna Polarity Measured Emissions					

Table 6.4.7: Radiated Spurious Emissions, Above 1 GHz, High Channel, Vertical Polarity

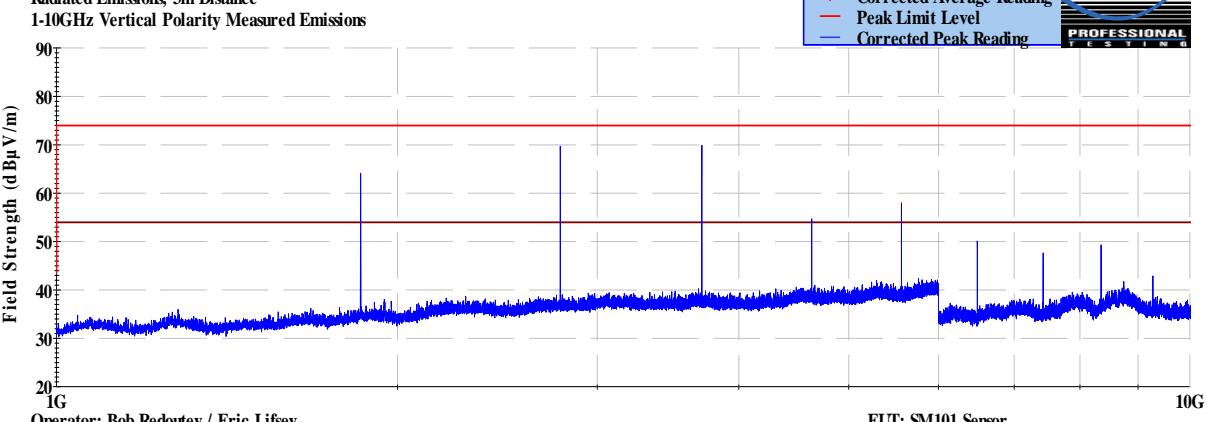
Professional Testing, EMI, Inc.												
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).											
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits											
Section:	15.209											
Test Date(s):	2/12/2014		EUT Serial #:	1324601000010000								
Customer:	Naztec		EUT Part #:	None								
Project Number:	15311-15		Test Technician:	Bob Redoutey / Eric Lifsey								
Purchase Order #:	NP00005714		Supervisor:	Rob McCollough								
Equip. Under Test:	SM101 Sensor		Witness' Name:	None								
Radiated Emissions Test Results Data Sheet				Page:	1 of 1							
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	-	N/A							
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz								
EUT Mode of Operation:	Transmitting High Channel											
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-10GHz Vertical Polarity Measured Emissions												
 <p>Field Strength (dB_uV/m)</p> <p>1G 10G</p> <p>— Average Limit Level ▼ Corrected Average Reading — Peak Limit Level — Corrected Peak Reading</p> <p>PROFESSIONAL TESTING</p> <p>Operator: Bob Redoutey / Eric Lifsey 15311_GHZ_High_2013 Rad Emissions_ClassB_020414.tHUT Mode: Transmit, High Freq, CW 12:09:16 PM, Wednesday, February 12, 2014</p> <p>Frequency EUT: SM101 Sensor Project Number: 15311-15 Client: Naztec</p>												
> 1GHz Vertical Antenna Polarity Measured Emissions												

Table 6.4.8: Radiated Spurious Emissions, Above 1 GHz, High Channel, Horizontal Polarity

Professional Testing, EMI, Inc.												
Test Method:	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" (incorporated by reference, see §15.38).											
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits											
Section:	15.209											
Test Date(s):	2/12/2014		EUT Serial #:	1324601000010000								
Customer:	Naztec		EUT Part #:	None								
Project Number:	15311-15		Test Technician:	Bob Redoutey / Eric Lifsey								
Purchase Order #:	NP00005714		Supervisor:	Rob McCollough								
Equip. Under Test:	SM101 Sensor		Witness' Name:	None								
Radiated Emissions Test Results Data Sheet				Page:	1 of 1							
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	-	N/A							
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz								
EUT Mode of Operation:	Transmitting High Channel											
<p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-10GHz Horizontal Polarity Measured Emissions</p> <p>Legend: Average Limit Level (Red line), Corrected Average Reading (Red triangle), Peak Limit Level (Red line), Corrected Peak Reading (Blue line)</p> <p>1G 10G</p> <p>Field Strength (dB_uV/m)</p> <p>Frequency (GHz)</p> <p>Operator: Bob Redoutey / Eric Lifsey 15311_GHZ_High_2013 Rad Emissions_ClassB_020414.tBUT Mode: Transmit, High Freq, CW 12:09:13 PM, Wednesday, February 12, 2014</p> <p>EUT: SM101 Sensor Project Number: 15311-15 Client: Naztec</p>												
> 1GHz Horizontal Antenna Polarity Measured Emissions												

7.0 Frequency Hopping Parameter Measurements

Frequency Hopping measurements were performed on the EUT to determine compliance to FCC 15.247(a). FCC Public Notice DA 00-705 is referenced for this procedure.

7.1 Test Procedure

The EUT is configured for best signal/power then the frequency hopping parameters are measured.

Carrier Frequency Separation. This is measured with EUT in hopping mode. The spectrum analyzer is set to a span wide enough to observe at least 2 channels. Resolution bandwidth is set to at least 1% of span. The EUT is then set to hopping mode and max hold acquisition continues until a stable curve is obtained. Markers are used to measure center to center frequency separation.

Number of Hopping Frequencies. This is determined by allowing the EUT to operate in hopping mode while the spectrum analyzer collects the entire band, with some margin, in max-hold mode until a stable result was obtained with clearly discernible channels. The peaks for each hopping channel are then counted. The channel count will be used to determine other criteria.

Time of Occupancy (Dwell Time). This is measured with the spectrum analyzer centered on a hopping channel. The spectrum analyzer is set to 1 MHz resolution bandwidth and put in time domain (zero-span) mode. The transmit events are then observed in max-hold mode and the dwell time measured by placing markers. In addition, a video trigger is employed with a small negative offset to guarantee capture of the leading edge and thus the entire transmit signal.

7.2 Test Criteria

Section Reference	Parameter	Date
15.247(a)	Hopping Frequency Separation, Number of Hopping Channels*, Channel Occupancy Time	2013-02-21

*For 902-928 MHz band: Minimum 25 hopping channels. Under 50 channels limits power to 0.25 W, over 50 channels limits power to 1 W.

7.3 Test Results

Measured Carrier Frequency Separation	Measured Number of Hopping Frequencies	Measured Time of Occupancy (Dwell Time)
428 kHz	60 channels	1.496 msec

Measured time of occupancy (dwell time) for one total transmission =	1496 μ s
Time Frame = 0.4 s * 60 hopping channels =	24000 ms
Measured time to return to one channel =	3763 ms
Total transmit events for one channel in the Time Frame, 24000 ms / 3763 ms =	6.378 events
Total time that one channel transmits within the 24 s Time Frame = 6.378 * 1496 μ s =	9.542 ms

EUT was found to be in compliance with applicable requirements with 60 hopping channels in use. Recorded data is presented below.

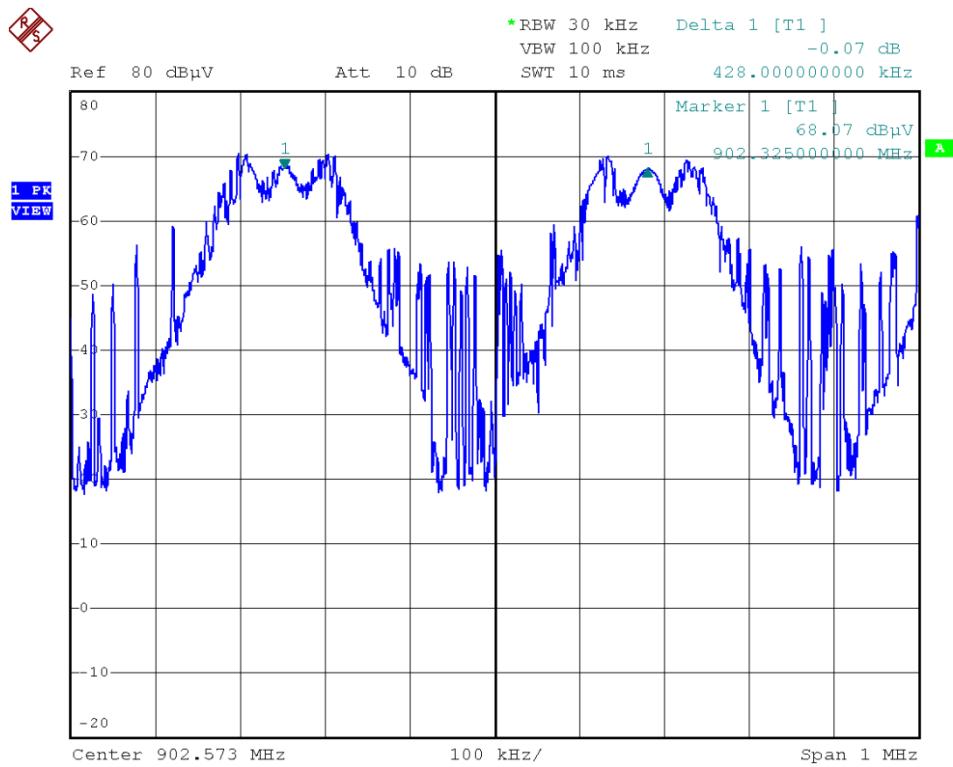


Figure 7.4.1: Carrier Frequency Separation

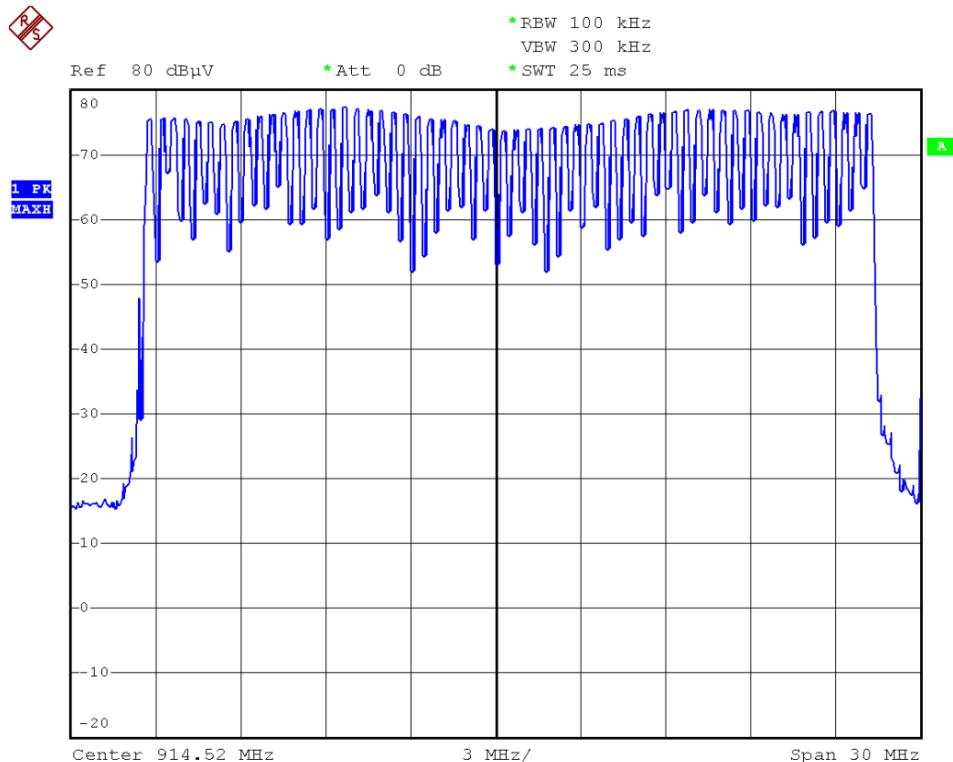


Figure 7.4.2: Number of Hopping Frequencies

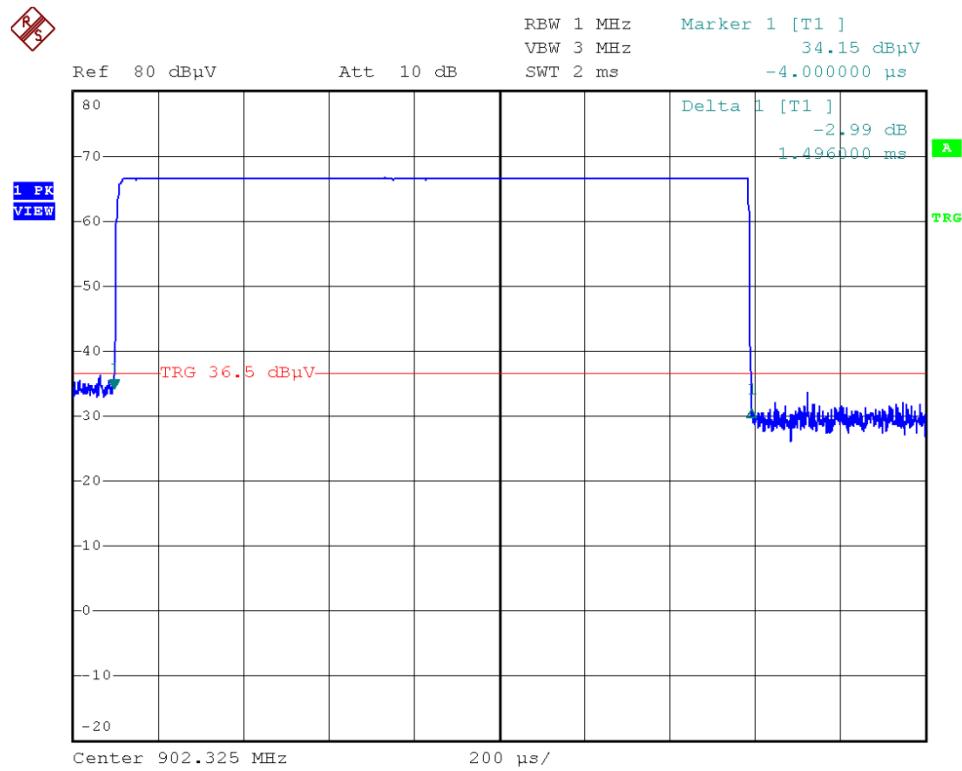


Figure 7.4.3: Time of Occupancy (Dwell Time)

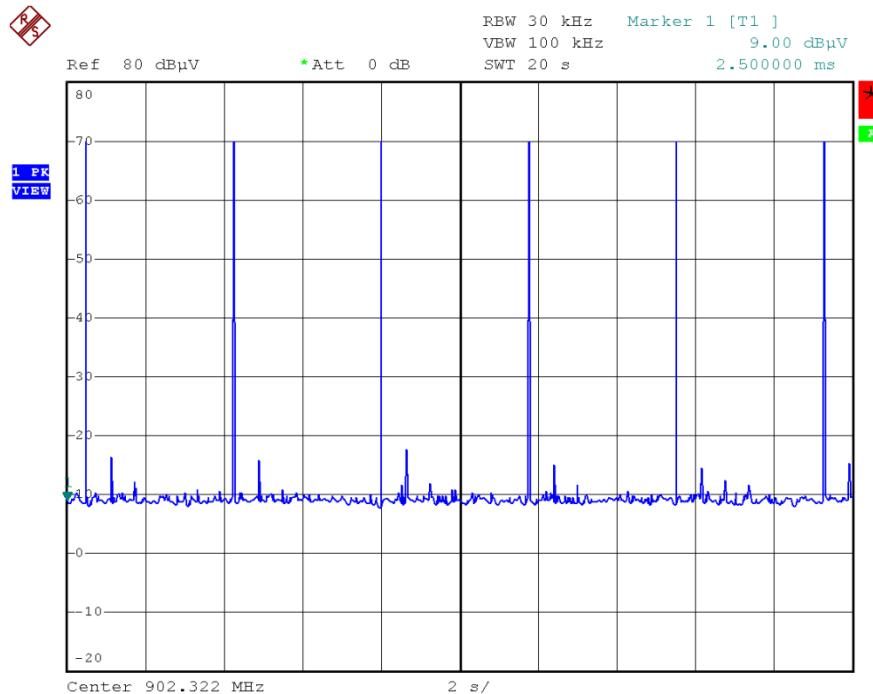


Figure 7.4.4: Hop Timing (Intervals)
3763 ms

8.0 Peak Output Power

8.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 10 meters from the measurement antenna.

Three operating channels were measured, the lowest, middle, and highest. The maximum recorded power for each channel is reported.

8.2 Test Criteria

Section Reference	Parameter	Date
15.247	Peak Fundamental Power Limit 1 Watt Conducted*	2014-02-12

*The maximum output power is 1 W for devices operating in the frequency range 902-928 MHz MHz according to FCC 15.247 and when using at least 50 hopping channels. The EUT employs 60 hopping channels.

8.3 Test Results

The measurement was performed as field strength and converted to EIRP. The highest recorded power was on the middle channel. The relevant peak output power criteria were selected based on measured channel count of 60. Measurement bandwidth was 300 kHz RBW, 1 MHz VBW.

Channel / Frequency (MHz)	Measured Corrected Power in Log Terms (dB μ V/m)	Radiated Measurement Distance (m)	EIRP Calculated (W)	Peak Output Power Allowed (W)
Low / 902.32	99.8	10	0.0318	1
Mid / 914.79	101.9	10	0.0516	1
High / 927.70	99.3	10	0.0284	1

Antenna polarity of maximum emission is horizontal in each case.

EUT was found to be in compliance with applicable requirements.

9.0 Antenna Construction Requirements

The design was investigated for meeting the antenna construction requirements of the applicable rules.

9.2 Test Procedure

A direct examination of the antenna construction is performed and compared to a criterion that prevents wireless device antennas from being modified by end users in ways that would void their authorization to use the device.

9.3 Test Criteria

Clause Subject	Section Number	Date
Antenna Construction	15.203	2014-02-25

9.4 Test Results

The antenna is internal only to the device.

The antenna is a metal loop antenna designed by the manufacturer.

The antenna is connected via soldering only.

There is no antenna connector.

The design meets the requirements of the rules.

10.0 Equipment Lists

10.1 Equipment for Spurious Radiated Emissions, Power and Band Edge

Professional Testing, EMI, Inc.								
Test Method:	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" (incorporated by reference,							
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators,							
Section:	Radiated Emissions Limits							
Test Date(s):	2/12/2014	EUT Serial #:	1324601000010000					
Customer:	Naztec	EUT Part #:	None					
Project Number:	15311-15	Test Technician:	Bob Redoutey / Eric Lifsey					
Purchase Order #:	NP00005714	Supervisor:	Rob McCollough					
Equip. Under Test:	SM101 Sensor	Witness' Name:	None					
Radiated Emissions Test Equipment List								
Test! Software Version: 4.2.A, May 23, 2010, 08:38:52 AM								
Test Profile: Radiated Emissions_Profile Version October 12, 2011								
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date			
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	7/29/2014			
1890	HP	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	1/22/2015			
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY44303298	12/2/2015			
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	00135454	7/29/2014			
C027	N/A	RG214	Cable Coax, N-N, 25m	none	9/26/2014			
1327	EMCO	1050	Controller, Antenna Mast	none	N/A			
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A			
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A			
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A			
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	7/16/2014			
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	11/19/2014			
C030	N/A	0	Cable Coax, N-N, 30m	none	9/26/2014			
Loaner-ETS	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	135203	1/14/2015			

10.2 Equipment for Bandwidth, Hopping Parameters, and Duty Cycle Measurements

Asset #	Manufacturer	Model #	Description	Calibration Due
0582	EMCO	3115	Ridge Guide Antenna	Not Required
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer	2015-01-29

Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11: 2007, all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

1. Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacturer's statements or specifications of the calibration tolerances, or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting stated uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a priori, or u-shaped) will be stated for each Type B evaluation.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements is shown as Table 1. These are the worst-case uncertainties considering all operative influence factors.

Table 1: Summary of Measurement Uncertainties for Site 45

Type of Measurement	Frequency Range	Meas. Dist.	Expanded Uncertainty U, dB (k=2)
Mains Conducted Emissions	150 kHz to 30 MHz	N/A	2.9
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	2.8
Radiated Emissions	30 to 1,000 MHz	10 m	4.8
	1 to 18 GHz	3 m	5.7

End of Report

(This page intentionally left blank.)