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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

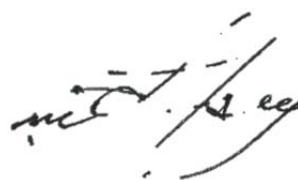
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Reviewed by



Larry Finn

Written by



Eric Lifsey

Product Development Engineer

Test Engineer

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**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	
<b>Manufacturer</b>	Naztec, Inc. (dba Trafficware)
<b>Model Number</b>	VDS-POD-S
<b>FCC ID</b>	MD5-SM02
<b>Frequency (MHz)</b>	902-928 MHz
<b>Description of Change</b>	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.

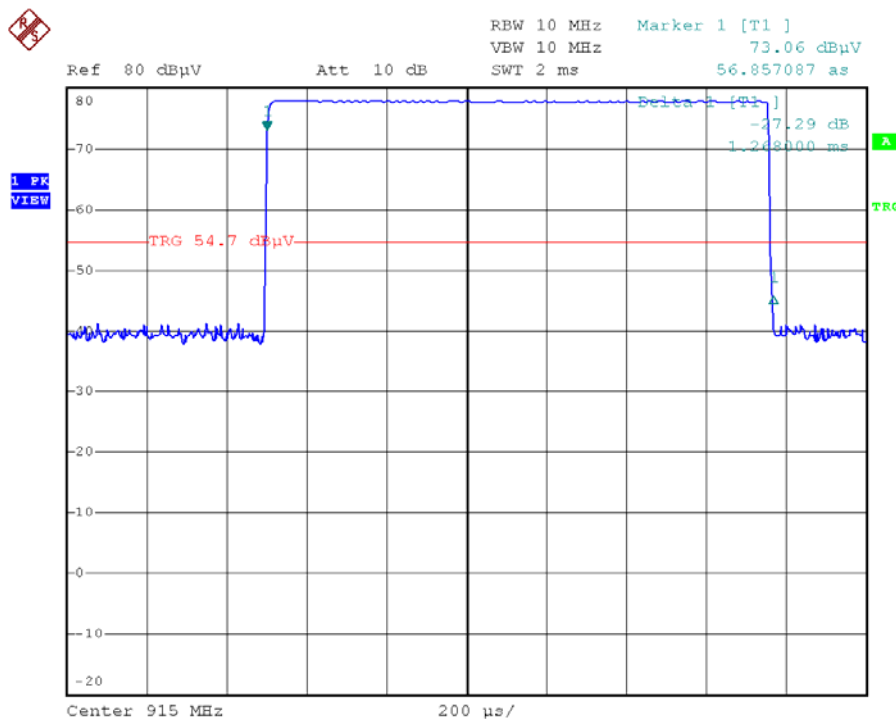
### 3.3 Test Criteria

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.

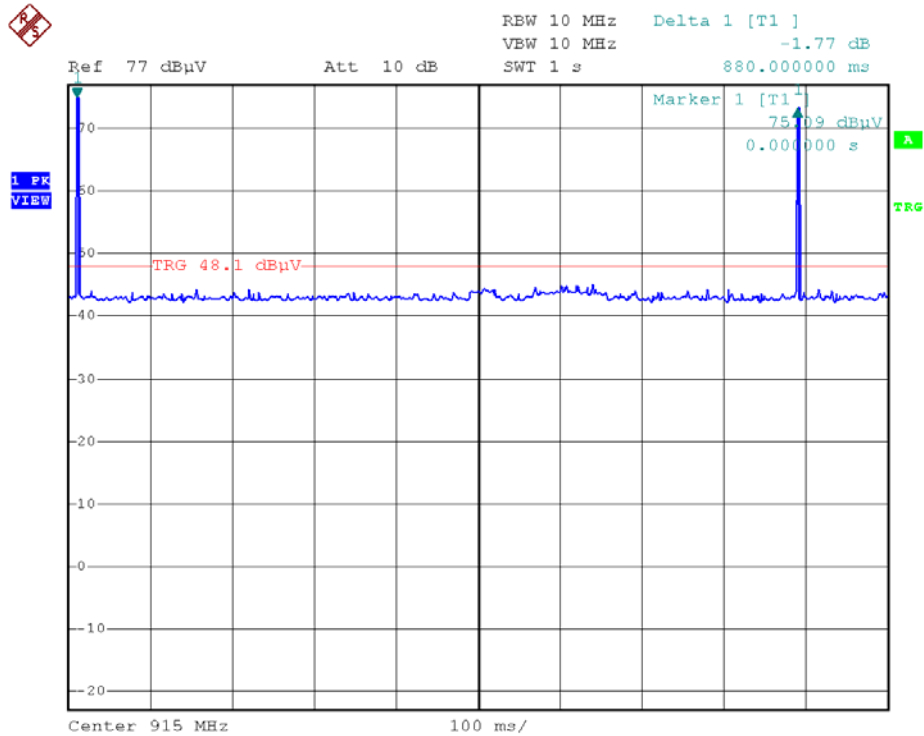
### 3.4 Test Results

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)	$= 20 * \log_{10} ( 1.268 \text{ msec} / 100 \text{ msec} )$	-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

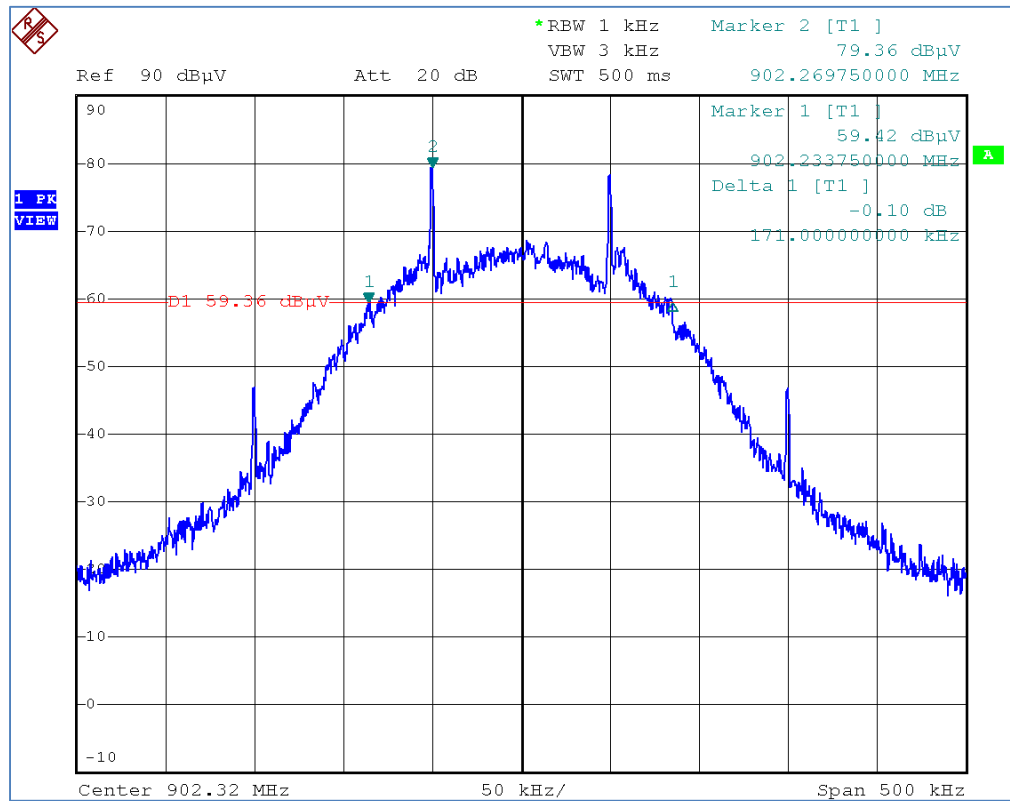


Figure 4.3.1: Measured BW (Channel L)

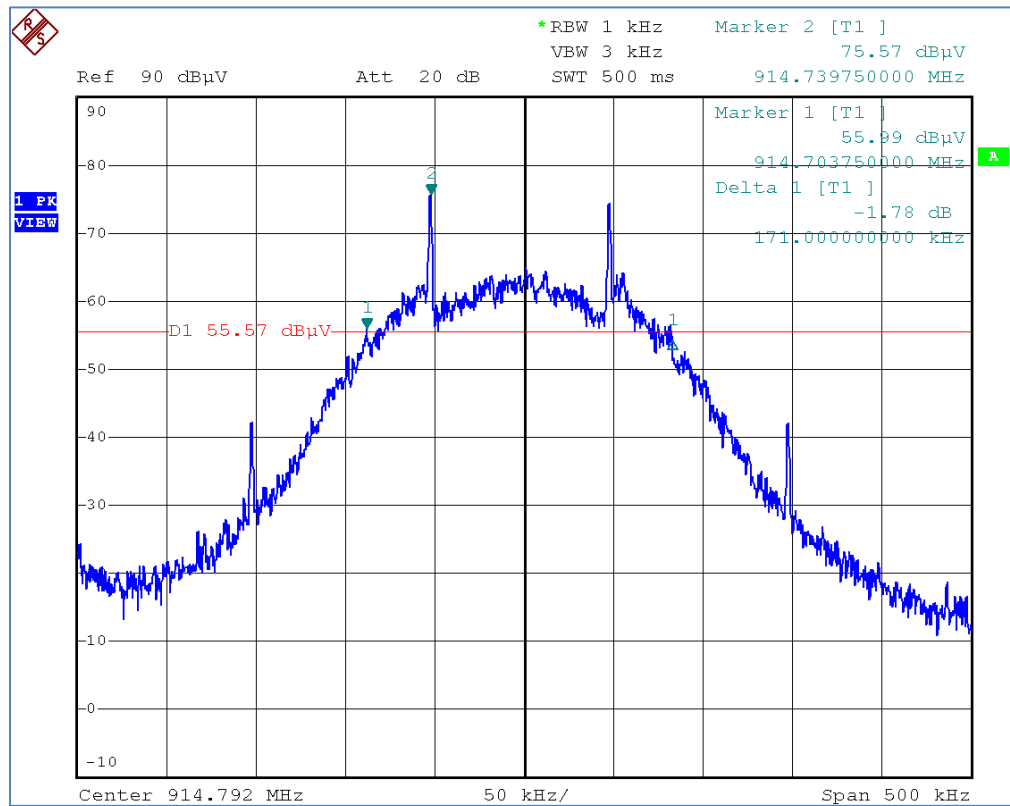
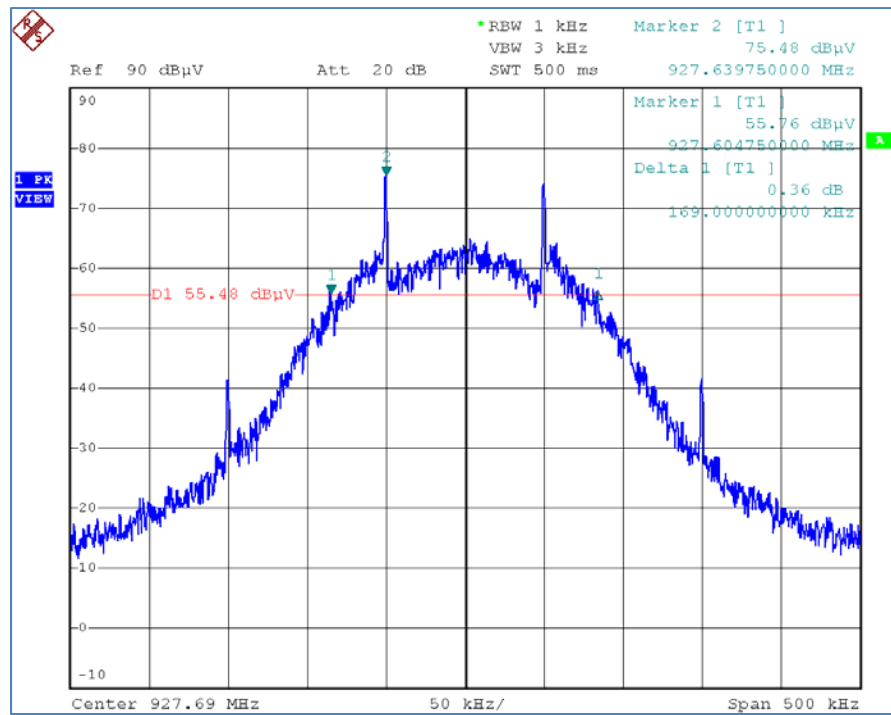


Figure 4.3.2: Measured BW (Channel M)



**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 10<sup>th</sup> harmonic.

Plotted measurements appear below.

Table 5.3.1: Band Edge, Channel High, Vertical Polarity


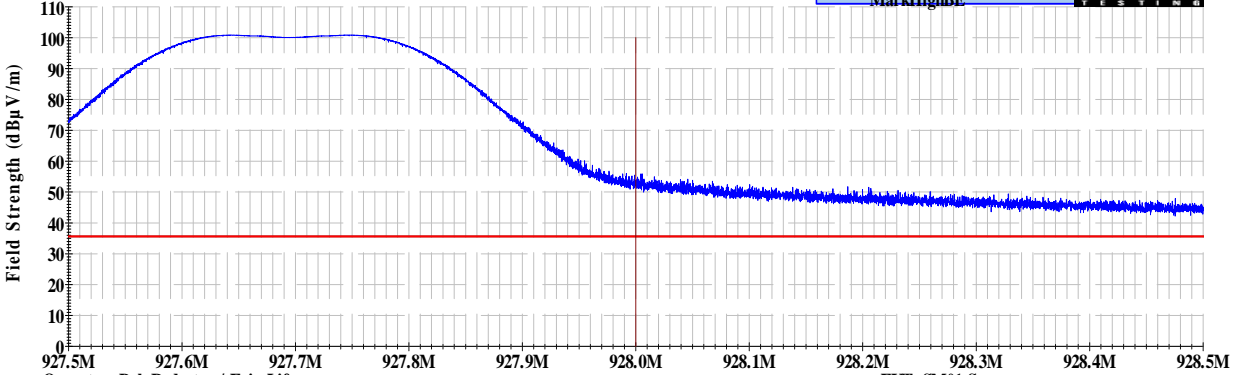
Professional Testing, EMI, Inc.			
<b>Test Method:</b>	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
<b>In accordance with:</b>	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
<b>Section:</b>	15.209		
<b>Test Date(s):</b>	2/12/2014	<b>EUT Serial #:</b>	1324601000010000
<b>Customer:</b>	Naztec	<b>EUT Part #:</b>	None
<b>Project Number:</b>	15311-15	<b>Test Technician:</b>	Bob Redoutey / Eric Lifsey
<b>Purchase Order #:</b>	NP00005714	<b>Supervisor:</b>	Rob McCollough
<b>Equip. Under Test:</b>	SM101 Sensor	<b>Witness' Name:</b>	None
Radiated Emissions Test Results Data Sheet		Page: 1 of 1	
<b>EUT Line Voltage:</b>	3.6 VDC	<b>EUT Power Frequency:</b>	- N/A
<b>Antenna Orientation:</b>	Vertical	<b>Frequency Range:</b>	30MHz to 1GHz
<b>EUT Mode of Operation:</b>		<b>Band Edge Transmitting High Channel</b>	
<div> <div> Professional Testing, EMI, Inc  Radiated Emissions, 10m Distance  30MHz - 1GHz Vertical Polarity Measured Emissions </div> <div> <div> Quasi-peak Limit Level  Corrected Quasi-peak Reading  Peak Limit Level  Corrected Peak Value  MarkHighBE </div>  </div> </div>  <div> Operator: Bob Redoutey / Eric Lifsey  15311'GHZ'BE'HighChan'2013RE020414.ttl  01:18:41 PM, Wednesday, February 12, 2014 </div> <div> EUT Mode: Transmit, High Freq  EUT Power: 3.6V Battery </div> <div> EUT: SM01 Sensor  Project Number: 15311-15  Client: Naztec-Trafficware </div>			
≤ 1GHz Vertical Antenna Polarity Measured Emissions			

Table 5.3.2: Band Edge, Channel High, Horizontal Polarity

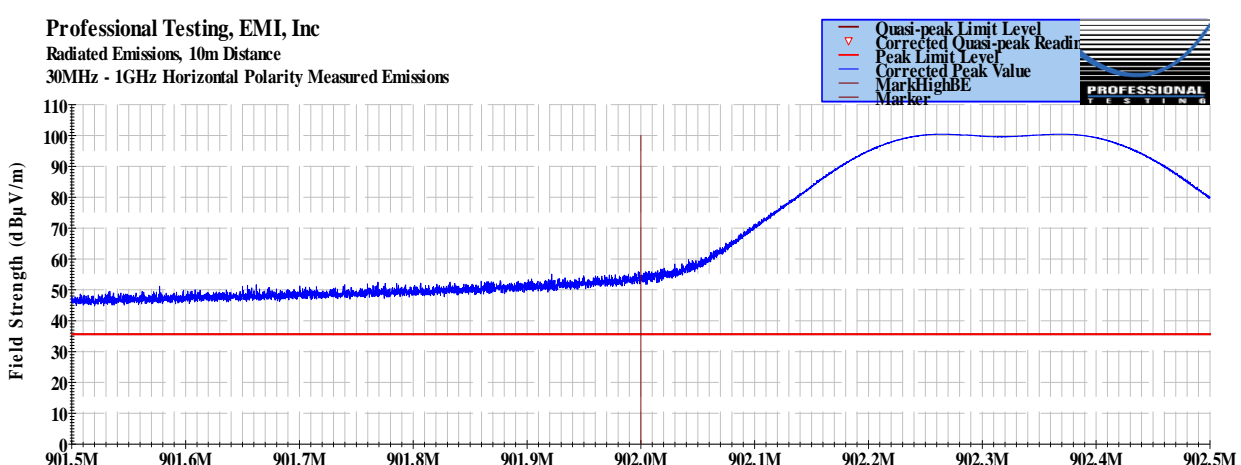
Professional Testing, EMI, Inc.			
<b>Test Method:</b>	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
<b>In accordance with:</b>	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
<b>Section:</b>	15.209		
<b>Test Date(s):</b>	2/12/2014	<b>EUT Serial #:</b>	1324601000010000
<b>Customer:</b>	Naztec	<b>EUT Part #:</b>	None
<b>Project Number:</b>	15311-15	<b>Test Technician:</b>	Bob Redoutey / Eric Lifsey
<b>Purchase Order #:</b>	NP00005714	<b>Supervisor:</b>	Rob McCollough
<b>Equip. Under Test:</b>	SM101 Sensor	<b>Witness' Name:</b>	None
Radiated Emissions Test Results Data Sheet		Page: 1 of 1	
<b>EUT Line Voltage:</b>	3.6 VDC	<b>EUT Power Frequency:</b>	- N/A
<b>Antenna Orientation:</b>	Horizontal	<b>Frequency Range:</b>	30MHz to 1GHz
<b>EUT Mode of Operation:</b>		<b>Band Edge Transmitting High Channel</b>	
<div> Professional Testing, EMI, Inc  Radiated Emissions, 10m Distance  30MHz - 1GHz Horizontal Polarity Measured Emissions </div> <div> Operator: Bob Redoutey / Eric Lifsey  15311'GHZ'BE'HighChan'2013RE020414.til  01:18:40 PM, Wednesday, February 12, 2014 </div> <div> EUT Mode: Transmit, High Freq  EUT Power: 3.6V Battery </div> <div> EUT: SM101 Sensor  Project Number: 15311-15  Client: Naztec-Trafficware </div>			
≤ 1GHz Horizontal Antenna Polarity Measured Emissions			



Table 5.3.3: Band Edge, Channel Low, Vertical Polarity

Professional Testing, EMI, Inc.			
<b>Test Method:</b>	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).		
<b>In accordance with:</b>	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
<b>Section:</b>	15.209		
<b>Test Date(s):</b>	2/12/2014	<b>EUT Serial #:</b>	1324601000010000
<b>Customer:</b>	Naztec	<b>EUT Part #:</b>	None
<b>Project Number:</b>	15311-15	<b>Test Technician:</b>	Bob Redoutey / Eric Lifsey
<b>Purchase Order #:</b>	NP00005714	<b>Supervisor:</b>	Rob McCollough
<b>Equip. Under Test:</b>	SM101 Sensor	<b>Witness' Name:</b>	None
Radiated Emissions Test Results Data Sheet		Page: 1 of 1	
<b>EUT Line Voltage:</b>	3.6	<b>VDC</b>	
<b>EUT Power Frequency:</b>	-	<b>N/A</b>	
<b>Antenna Orientation:</b>	Vertical		<b>Frequency Range:</b> 30MHz to 1GHz
<b>EUT Mode of Operation:</b>		Band Edge Transmitting Low Channel	
<div> <div> Professional Testing, EMI, Inc  Radiated Emissions, 10m Distance  30MHz - 1GHz Vertical Polarity Measured Emissions </div> <div> <div> Quasi-peak Limit Level  Corrected Quasi-peak Reading  Peak Limit Level  Corrected Peak Value  Mark HighBE  Marker </div> </div> </div> <div> Operator: Bob Redoutey / Eric Lifsey  15311'GHZ'BE'LowChan'2013RE020414.til  02:36:05 PM, Wednesday, February 12, 2014 </div> <div> EUT Mode: Transmit, Low Freq  EUT Power: 3.6V Battery </div> <div> EUT: SM101 Sensor  Project Number: 15311-15  Client: Naztec-Trafficware </div>			
≤ 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		
<div>Professional Testing, EMI, Inc Radiated Emissions, 10m Distance 30MHz - 1GHz Horizontal Polarity Measured Emissions</div> <div><div><div>Field Strength (dBµV/m)</div><div></div><div><div>901.5M901.6M901.7M901.8M901.9M902.0M902.1M902.2M902.3M902.4M902.5M</div><div>Operator: Bob Redoutey / Eric Lifsey 15311'GHZ'BE'LowChan'2013RE020414.tif 02:36:05 PM, Wednesday, February 12, 2014</div></div><div><div>EUT Mode: Transmit, Low Freq EUT Power: 3.6V Battery</div><div>EUT: SM101 Sensor Project Number: 15311-15 Client: Naztec-Trafficware</div></div></div></div> <div>≤ 1GHz Horizontal Antenna Polarity Measured Emissions</div>				

## 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.

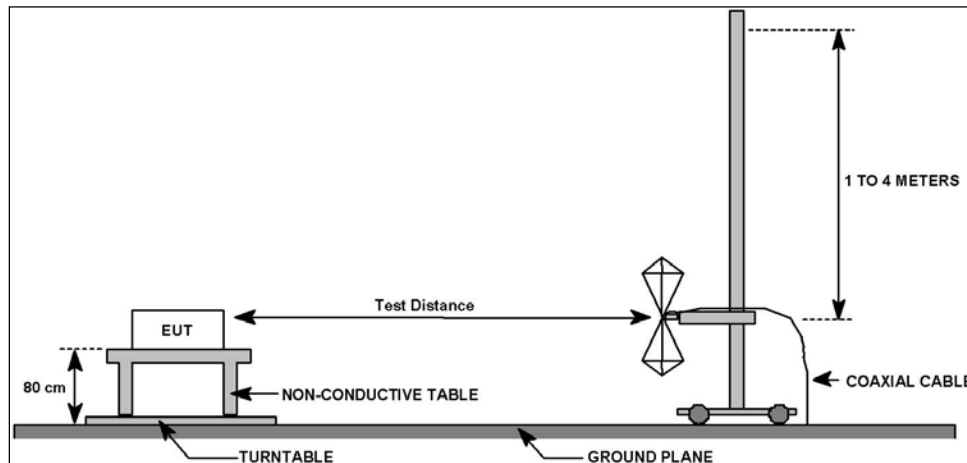


Figure 5.1.1: Field Strength of Spurious Emissions Test Setup

### 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 (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/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

— Quasi-peak Limit Level

▽ Corrected Quasi-peak Reading

— Peak Limit Level

— Corrected Peak Value

PROFESSIONAL TESTING

Operator: Bob Redoutey / Eric Lifsey

15311\_2013 Rad Emissions\_ClassB\_020414.ttl

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

≤ 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 (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/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	

Professional Testing, EMI, Inc

Radiated Emissions, 10m Distance

30MHz - 1GHz Horizontal Polarity Measured Emissions

Field Strength (dBμV/m)

60

50

40

30

20

10

0

30M

100M

1G

Operator: Bob Redoutey / Eric Lifsey

15311\_2013 Rad Emissions\_ClassB\_020414.ttl

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

— Quasi-peak Limit Level

▽ Corrected Quasi-peak Reading

— Peak Limit Level

— Corrected Peak Value

PROFESSIONAL TESTING

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

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

Professional Testing, EMI, Inc.			
<b>Test Method:</b>	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).		
<b>In accordance with:</b>	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
<b>Section:</b>	15.209		
<b>Test Date(s):</b>	2/12/2014	<b>EUT Serial #:</b>	1324601000010000
<b>Customer:</b>	Naztec	<b>EUT Part #:</b>	None
<b>Project Number:</b>	15311-15	<b>Test Technician:</b>	Bob Redoutey / Eric Lifsey
<b>Purchase Order #:</b>	NP00005714	<b>Supervisor:</b>	Rob McCollough
<b>Equip. Under Test:</b>	SM101 Sensor	<b>Witness' Name:</b>	None
Radiated Emissions Test Results Data Sheet			Page: 1 of 1
<b>EUT Line Voltage:</b>	3.6	<b>VDC</b>	<b>EUT Power Frequency:</b> - N/A
<b>Antenna Orientation:</b>	Vertical		<b>Frequency Range:</b> Above 1GHz
<b>EUT Mode of Operation:</b>		Transmitting Low Channel	
<div> <div> Professional Testing, EMI, Inc  Radiated Emissions, 3m Distance  1-10GHz Vertical Polarity Measured Emissions </div> <div> <div> Average Limit Level  Corrected Average Reading  Peak Limit Level  Corrected Peak Reading </div> </div> </div> <div> <div> Operator: Bob Redoutey / Eric Lifsey  15311_GHZ_Low_2013 Rad Emissions_ClassB_020414.tti  11:10:53 AM, Wednesday, February 12, 2014 </div> <div> Frequency  EUT Mode: Transmit, Low Freq, CW  EUT Power: 3.6V Battery </div> <div> EUT: SM101 Sensor  Project Number: 15311-15  Client: Naztec </div> </div>			
<b>&gt; 1GHz Vertical Antenna Polarity Measured Emissions</b>			

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


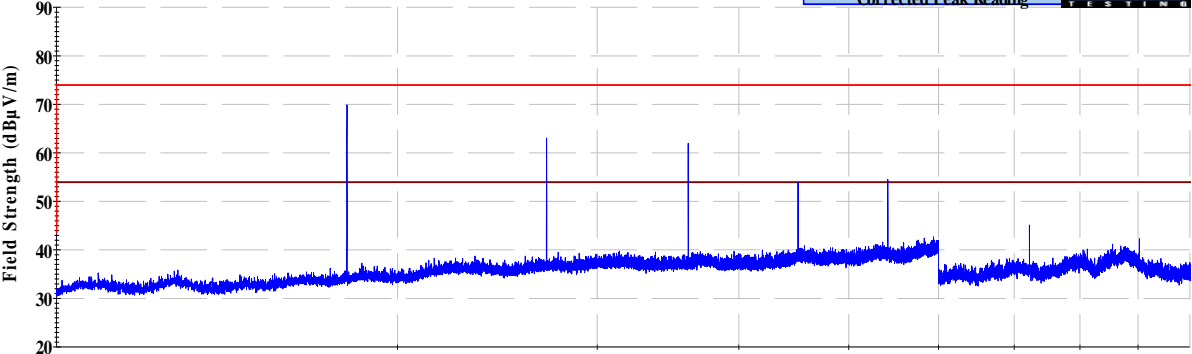
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations 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	
<div> <div> Professional Testing, EMI, Inc  Radiated Emissions, 3m Distance  1-10GHz Horizontal Polarity Measured Emissions </div> <div> <div> Average Limit Level  Corrected Average Reading  Peak Limit Level  Corrected Peak Reading </div>  </div> </div>  <div> Operator: Bob Redoutey / Eric Lifsey  15311_GHZ_Low_2013 Rad Emissions_ClassB_020414.tti  11:10:51 AM, Wednesday, February 12, 2014 </div> <div> Frequency  EUT Mode: Transmit, Low Freq, CW  EUT Power: 3.6V Battery </div> <div> EUT: SM101 Sensor  Project Number: 15311-15  Client: Naztec </div>			
> 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	
<div> <div> Professional Testing, EMI, Inc  Radiated Emissions, 3m Distance  1-10GHz Vertical Polarity Measured Emissions </div> <div> <div> Average Limit Level  Corrected Average Reading  Peak Limit Level  Corrected Peak Reading </div> </div> </div> <div> <div> Operator: Bob Redoutey / Eric Lifsey  15311_GHZ_Mid_2013 Rad Emissions_ClassB_020414.tti  11:38:50 AM, Wednesday, February 12, 2014 </div> <div> EUT Mode: Transmit, Middle Freq, CW  EUT Power: 3.6V Battery </div> <div> EUT: SM101 Sensor  Project Number: 15311-15  Client: Naztec </div> </div>			
> 1GHz Vertical Antenna Polarity Measured Emissions			

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

Professional Testing, EMI, Inc.			
<b>Test Method:</b>	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).		
<b>In accordance with:</b>	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
<b>Section:</b>	15.209		
<b>Test Date(s):</b>	2/12/2014	<b>EUT Serial #:</b>	1324601000010000
<b>Customer:</b>	Naztec	<b>EUT Part #:</b>	None
<b>Project Number:</b>	15311-15	<b>Test Technician:</b>	Bob Redoutey / Eric Lifsey
<b>Purchase Order #:</b>	NP00005714	<b>Supervisor:</b>	Rob McCollough
<b>Equip. Under Test:</b>	SM101 Sensor	<b>Witness' Name:</b>	None
Radiated Emissions Test Results Data Sheet			Page: 1 of 1
<b>EUT Line Voltage:</b>	3.6 VDC	<b>EUT Power Frequency:</b>	- N/A
<b>Antenna Orientation:</b>	Horizontal	<b>Frequency Range:</b>	Above 1GHz
<b>EUT Mode of Operation:</b>		Transmitting Middle Channel	
<div> <div> Professional Testing, EMI, Inc  Radiated Emissions, 3m Distance  1-10GHz Horizontal Polarity Measured Emissions </div> <div> <div> Average Limit Level  Corrected Average Reading  Peak Limit Level  Corrected Peak Reading </div> </div> </div> <div> <div> Operator: Bob Redoutey / Eric Lifsey  15311_GHZ_Mid_2013 Rad Emissions_ClassB_020414.tti  11:38:47 AM, Wednesday, February 12, 2014 </div> <div> EUT Mode: Transmit, Middle Freq, CW  EUT Power: 3.6V Battery </div> <div> EUT: SM101 Sensor  Project Number: 15311-15  Client: Naztec </div> </div>			
<b>&gt; 1GHz Horizontal Antenna Polarity Measured Emissions</b>			

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

Professional Testing, EMI, Inc.			
<b>Test Method:</b>	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).		
<b>In accordance with:</b>	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
<b>Section:</b>	15.209		
<b>Test Date(s):</b>	2/12/2014	<b>EUT Serial #:</b>	1324601000010000
<b>Customer:</b>	Naztec	<b>EUT Part #:</b>	None
<b>Project Number:</b>	15311-15	<b>Test Technician:</b>	Bob Redoutey / Eric Lifsey
<b>Purchase Order #:</b>	NP00005714	<b>Supervisor:</b>	Rob McCollough
<b>Equip. Under Test:</b>	SM101 Sensor	<b>Witness' Name:</b>	None
Radiated Emissions Test Results Data Sheet		Page: 1 of 1	
<b>EUT Line Voltage:</b>	3.6 VDC	<b>EUT Power Frequency:</b>	- N/A
<b>Antenna Orientation:</b>	Vertical	<b>Frequency Range:</b>	Above 1GHz
<b>EUT Mode of Operation:</b>		Transmitting High Channel	
<div> <div> Professional Testing, EMI, Inc  Radiated Emissions, 3m Distance  1-10GHz Vertical Polarity Measured Emissions </div> <div> <div> Average Limit Level  Corrected Average Reading  Peak Limit Level  Corrected Peak Reading </div> </div> </div> <div> <div> Operator: Bob Redoutey / Eric Lifsey  15311_GHZ_High_2013 Rad Emissions_ClassB_020414.tft  12:09:16 PM, Wednesday, February 12, 2014 </div> <div> Frequency  EUT Mode: Transmit, High Freq, CW  EUT Power: 3.6V Battery </div> <div> EUT: SM101 Sensor  Project Number: 15311-15  Client: Naztec </div> </div>			
<b>&gt; 1GHz Vertical Antenna Polarity Measured Emissions</b>			

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	
<div> Professional Testing, EMI, Inc  Radiated Emissions, 3m Distance  1-10GHz Horizontal Polarity Measured Emissions </div> <div> Operator: Bob Redoutey / Eric Lifsey  15311_GHZ_High_2013 Rad Emissions_ClassB_020414.tft  12:09:13 PM, Wednesday, February 12, 2014 </div> <div> Frequency  EUT Mode: Transmit, High Freq. CW  EUT Power: 3.6V Battery </div> <div> EUT: SM101 Sensor  Project Number: 15311-15  Client: Naztec </div>			
> 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

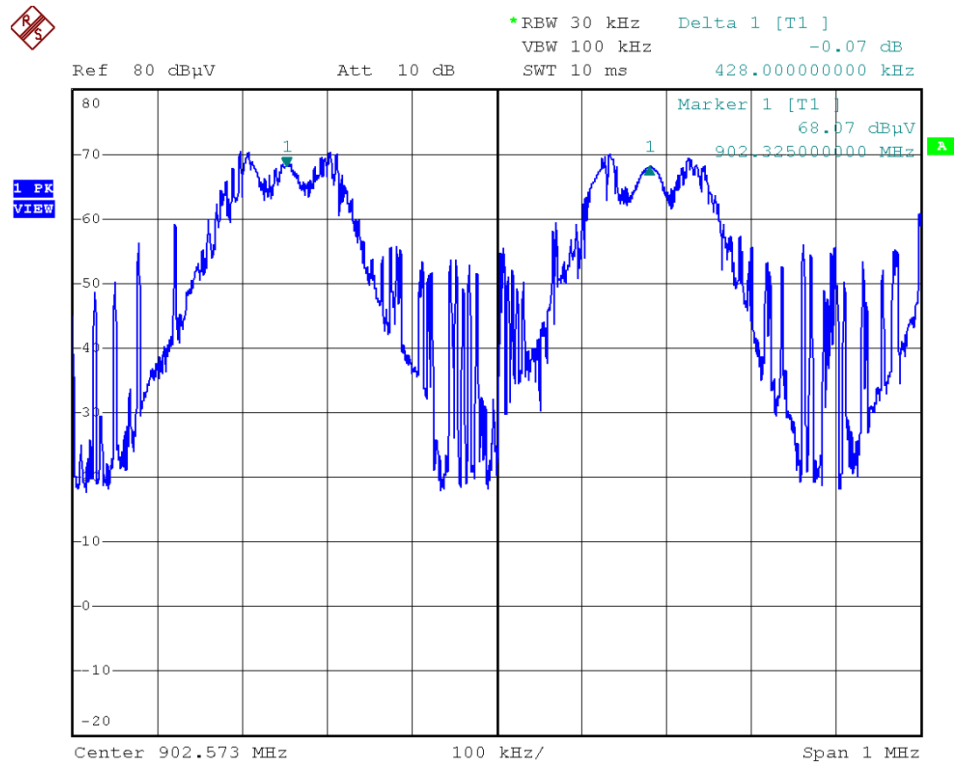
\*For 902-928 MHz band: Minimum 25 hopping channels. Under 50 channels limits power to 0.25 W, over 50 channels limits power to 1 W.

### 7.3 Test Results

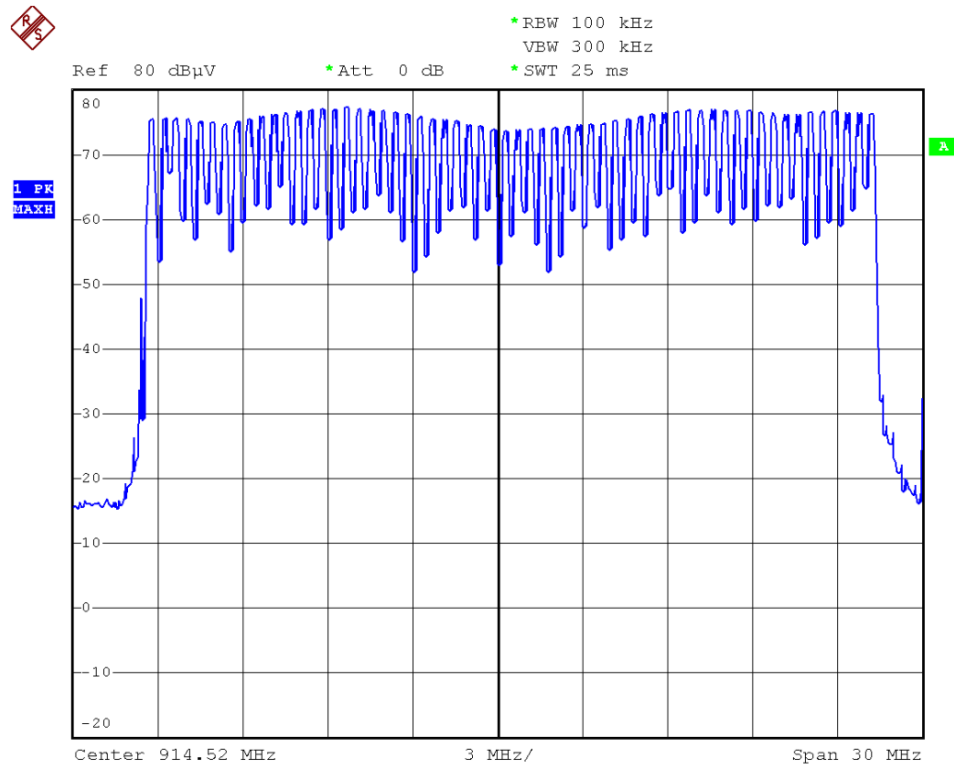
Measured Carrier Frequency Separation	Measured Number of Hopping Frequencies	Measured Time of Occupancy (Dwell Time)
428 kHz	60 channels	1.496 msec

Measured time of occupancy (dwell time) for one total transmission =	1496 $\mu$ 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 $\mu$ s =	<b>9.542 ms</b>

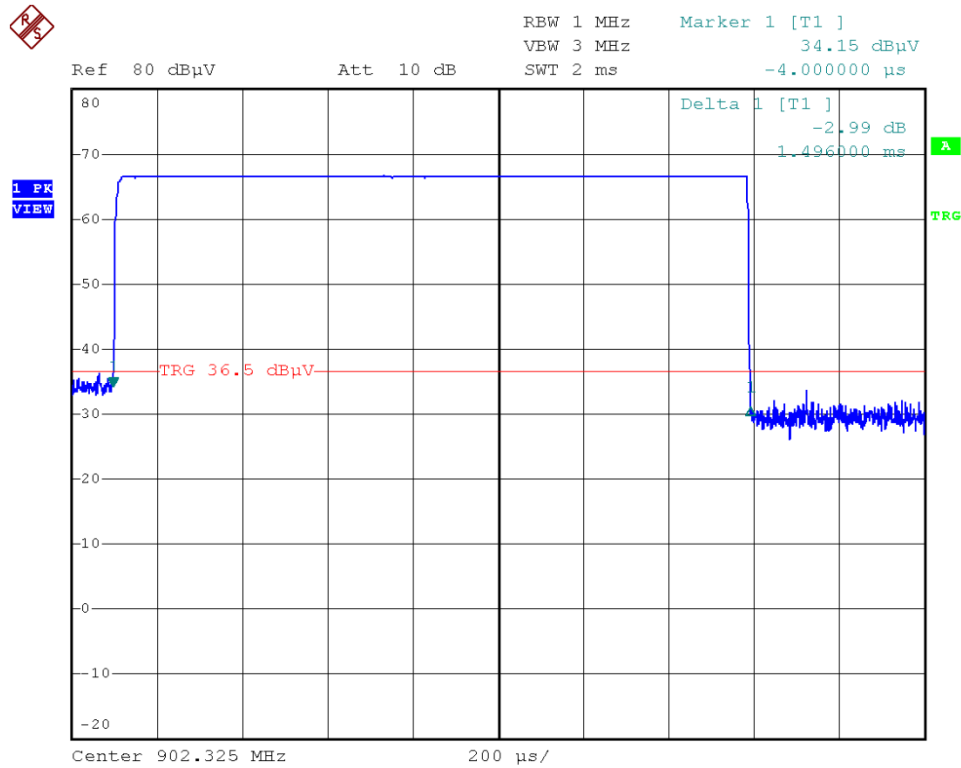
EUT was found to be in compliance with applicable requirements with 60 hopping channels in use. Recorded data is presented below.



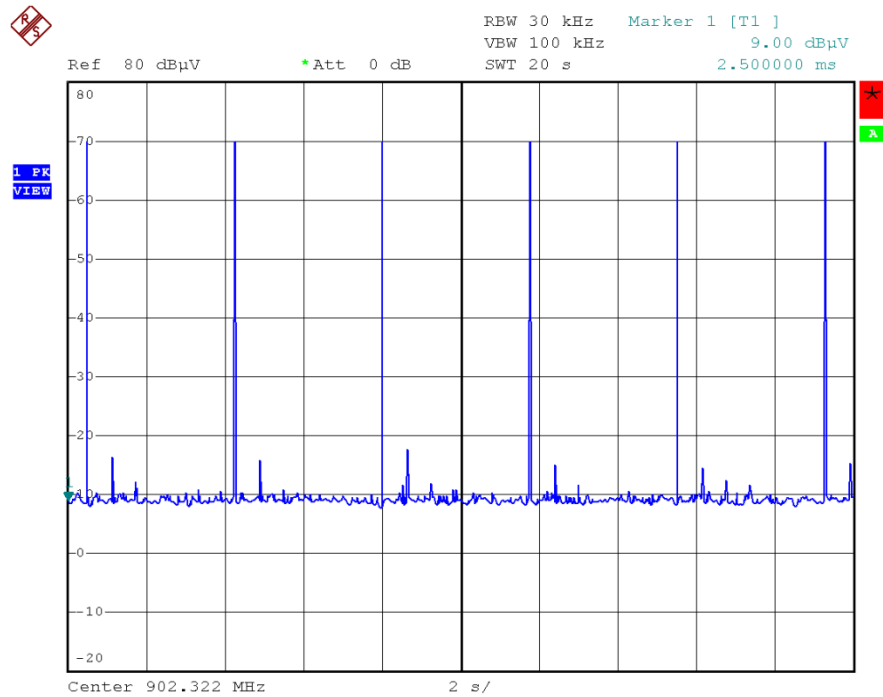
**Figure 7.4.1: Carrier Frequency Separation**



**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 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 $\mu$ 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, 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 Equipment List					
Tile! 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**

<b>Asset #</b>	<b>Manufacturer</b>	<b>Model #</b>	<b>Description</b>	<b>Calibration Due</b>
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**

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