# TEST REPORT

**Report Number: 3102753MIN-001**
**Project Number: 3102753**

**Application**
**For Class II Permissive Changes**
**SmarTire TPMT**
**FCC ID: RP3-3833**

**to**
**FCC Part 2**
**FCC Part 15, Subpart C, Section 15.209**

**For**
**SPX Corporation**

| Test Performed by: | Test Authorized by: |
|---|---|
| Intertek Testing Services, Inc. | SPX Corporation |
| 7250 Hudson Blvd. Suite 100 | 2300 Park Drive |
| Oakdale, MN 55128 | Owatonna, MN 55060 |

Prepared by: _____ Date: December 9, 2006
Norman Shpilsher

Reviewed by: _____ Date: December 9, 2006
Uri Spector

# CONTENTS

# 1.0 GENERAL DESCRIPTION

## 1.1 Related Submittals Grants

This is a class II Permissive Change application of the SPX *SmarTire TPMT Transmitter* for Certification under FCC Part 15, Subpart C.
There are no other simultaneous applications.

## 1.2 Product Description

*SmarTire TPMT Transmitter* is a RF remote control transmitter operating in 126kHz. The intended use of the *SmarTire TPMT Transmitter* is to generate and transmit a RF signal to verify tire sensor functionality. The *SmarTire TPMT Transmitter* is powered at 4.5VDC with three "C" cell Alkaline Batteries.

Antenna Description:

Integrated antenna

| | |
|---|---|
| Sample Submitted: | November 22, 2006 |
| Test Work Started: | November 27, 2006 |
| Test Work Completed: | December 1, 2006 |

## 1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-2003. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in Appendices D and E were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 and 10 meters, unless stated otherwise in the "**Justification Section**" of this Application.

## 1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been fully described in a report dated on December 2005 submitted to FCC. Please reference the site registration number: 90706, dated December 6, 2005.

## 2.0 SYSTEM TEST CONFIGURATION

### 2.1 Justification

The manufacturer on the *SmarTire TPMT* made the following changes from the initial application:

1. The new receiver board is used for the device.

Based on modifications made by the *SmarTire TPMT* manufacturer the following measurements and calculations were made during Class II Permissive Change Certification:

1. Verification of the field strength level at fundamental
2. Transmitter Spurious Radiated Emissions
3. Verification of the Radiated Emissions in receiving/standby mode.

### 2.2 EUT Setup

For simplicity of testing, the transmitter was run in test mode to transmit continuously.

### 2.3 EUT Exercising Software

N/A

### 2.4 Special Accessories

There are no special accessories necessary for compliance of these products.

### 2.5 Equipment Modification

No modifications were installed during the testing.

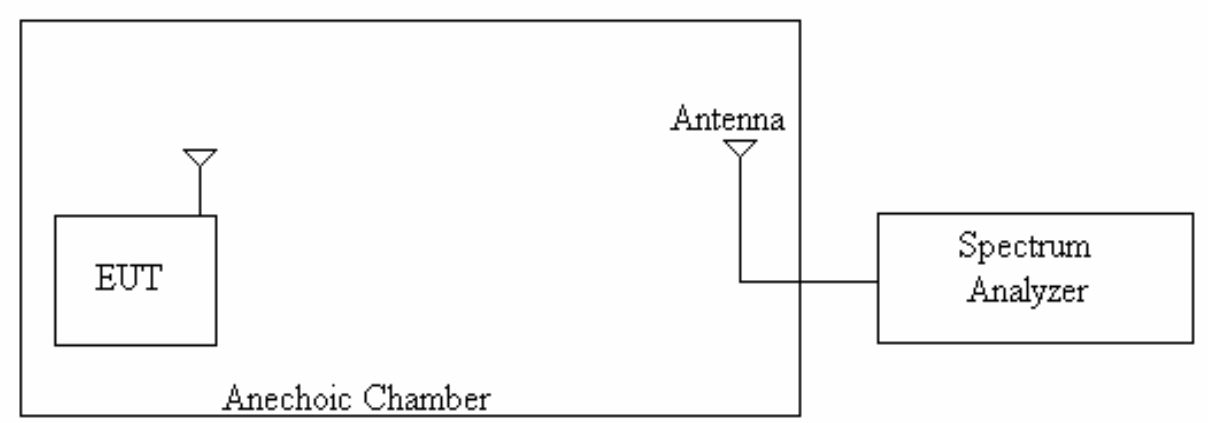
### 2.6 Support Equipment List and Description

N/A

## 2.7 Test Configuration Block Diagrams

The EUT was setup as tabletop equipment.
Measurements below 30MHz were performed at 10-m measurement distance with Loop Antenna.
Measurements from 30MHz to 1GHz were performed at 3-m measurement distance with Bicono-Log Antenna.
The EUT was powered at 4.5VDC from new alkaline batteries.

Field Strength Measurements



## 3.0 TEST RESULTS

Data is included for the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and graphical representations of the emissions are included.

The EUT is intended for operation under the requirements of Part 15 Subpart C. Specific test requirements include the following:

| | |
|---|---|
| 47 CFR 15.209 | Field Strength of Fundamental |
| 47 CFR 15.209 | Field Strength of Spurious Emissions |
| 47 CFR 15.109 | Radiated Emissions |

## 3.1 Field Strength of Fundamental, FCC 15.209

Field Strength of Fundamental and Spurious Emissions measurements were made at Fundamental frequency of 127 KHz.

The Table 3-1-1 shows the Field Strength of Fundamental for the *SmarTire TPMT* Transmitter. Graph 3.2.1 shows emissions below 30MHz including emissions at fundamental frequency.

The maximum emissions were measured with margin 13.3dB below limits.

**Radiated Emissions from at Fundamental** **Date:** 11-27-2006

| | |
|---|---|
| **Company:** | SPX Corp. |
| **Model:** | SmarTireSmarTire TPMT |
| **Test Engineer:** | Norman Shpilsher |
| **Special Info:** | Continuous transmission |
| **Standard:** | FCC Part15, Subpart C, 15.209 |
| **Note:** | Measurement distance 10m with Loop antenna SAS 200/562B<br>Distance Factor 40dB per decade below 30MHz<br>The table shows the worst case radiated emissions.<br>Measurements were taken with RBW 200Hz and VBW 300Hz |

**Table # 3-1-1**

| Frequency MHz | Reading dBµV | E Ant. Factor dB/m | Pre-Amp Gain (dB) | Net at 10m dBµV/m | Distance Factor dB | 15.209 Limit dBµV/m | Margin dB | Antenna pos. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 0.12780 | 43.0 | 57.0 | 28.7 | 71.3 | 59.1 | 25.5 | -13.3 | Front |
| 0.12780 | 33.9 | 57.0 | 28.8 | 62.1 | 59.1 | 25.5 | -22.5 | Side |
| | | | | | | | | |

## 3.2 Field Strength Spurious Radiated Emissions, FCC 15.209

Field Strength of Spurious Radiated Emissions measurements were made in frequency range from 9kHz to 1GHz.

The maximum emissions were measured with margin 4.8dB below limits.

The Tables 3-2-1 and 3-2-2 and Graphs 3-2-1 and 3-2-2 show the Field Strength of Spurious Radiated Emissions.

**Radiated Emissions from 9kHz to 30MHz** **Date:** 11-27-2006

**Company:** SPX Corp.
**Model:** SmarTireSmarTire TPMT
**Test Engineer:** Norman Shpilsher
**Special Info:** Continuous transmission
**Standard:** FCC Part15, Subpart C, 15.209
**Note:** Measurement distance 10m with Loop antenna SAS 200/562B
Distance Factor 40dB per decade below 30MHz
The table shows the worst case radiated emissions.
Measurements below 150kHz were taken with RBW 200Hz and VBW 300Hz
Measurements above 150kHz were taken with RBW 9kHz and VBW 30kHz

**Table # 3-2-1**

| Frequency MHz | Reading dBµV | E Ant. Factor dB/m | Pre-Amp Gain (dB) | Net at 10m dBµV/m | Distance Factor dB | 15.209 Limit dBµV/m | Margin dB | Antenna pos. |
|---|---|---|---|---|---|---|---|---|
| 0.0185 | 10.9 | 73.4 | 28.6 | 55.7 | 59.1 | 42.3 | -45.6 | Front |
| 0.0235 | 16.8 | 71.3 | 28.7 | 59.4 | 59.1 | 40.2 | -39.8 | Front |
| 0.0235 | 16.3 | 71.3 | 28.8 | 58.8 | 59.1 | 40.2 | -40.4 | Side |
| 0.0262 | 12.6 | 70.5 | 28.8 | 54.3 | 59.1 | 39.2 | -44.1 | Side |
| 0.0379 | 14.0 | 67.5 | 28.8 | 52.7 | 59.1 | 36.0 | -42.4 | Front |
| 0.0379 | 12.6 | 67.5 | 28.8 | 51.3 | 59.1 | 36.0 | -43.8 | Side |
| 0.0436 | 12.8 | 66.3 | 28.8 | 50.3 | 59.1 | 34.8 | -43.6 | Side |
| 0.068 | 13.6 | 62.3 | 28.8 | 47.1 | 59.1 | 31.0 | -43.0 | Front |
| 0.153 | 16.6 | 55.5 | 28.7 | 43.4 | 59.1 | 23.9 | -39.6 | Front |
| 0.172 | 17.3 | 54.3 | 28.7 | 42.9 | 59.1 | 22.9 | -39.1 | Side |
| 0.225 | 12.8 | 51.7 | 28.7 | 35.8 | 59.1 | 20.6 | -43.8 | Front |
| 0.239 | 12.3 | 51.2 | 28.7 | 34.8 | 59.1 | 20.1 | -44.3 | Side |

**Radiated Emissions from 30MHz to 1GHz** **Date:** 11-27-2006

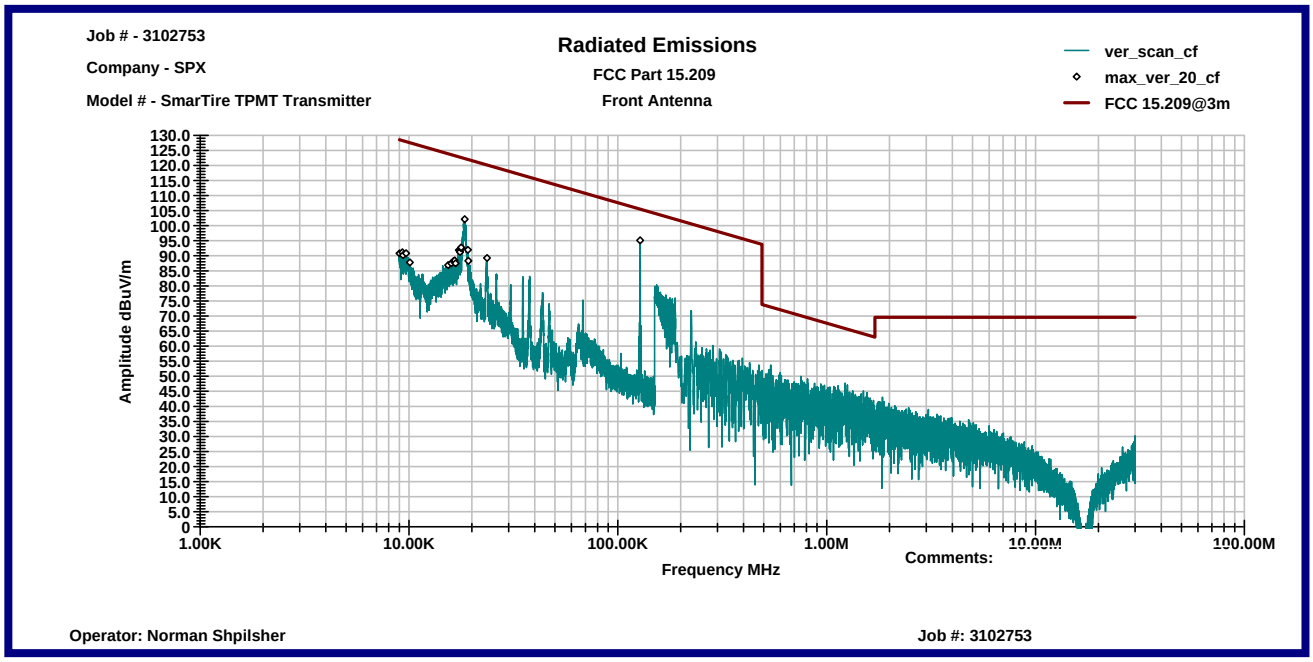
**Company:** SPX Corp.
**Model:** SmarTireSmarTire TPMT
**Test Engineer:** Norman Shpilsher
**Special Info:**
**Standard:** FCC Part 15.209
**Test Site:** 3m Anechoic Chamber, 3m measurement distance
**Note:** The table shows the worst case radiated emissions
All measurements were taken using a Peak detector

**Table # 3-2-2**

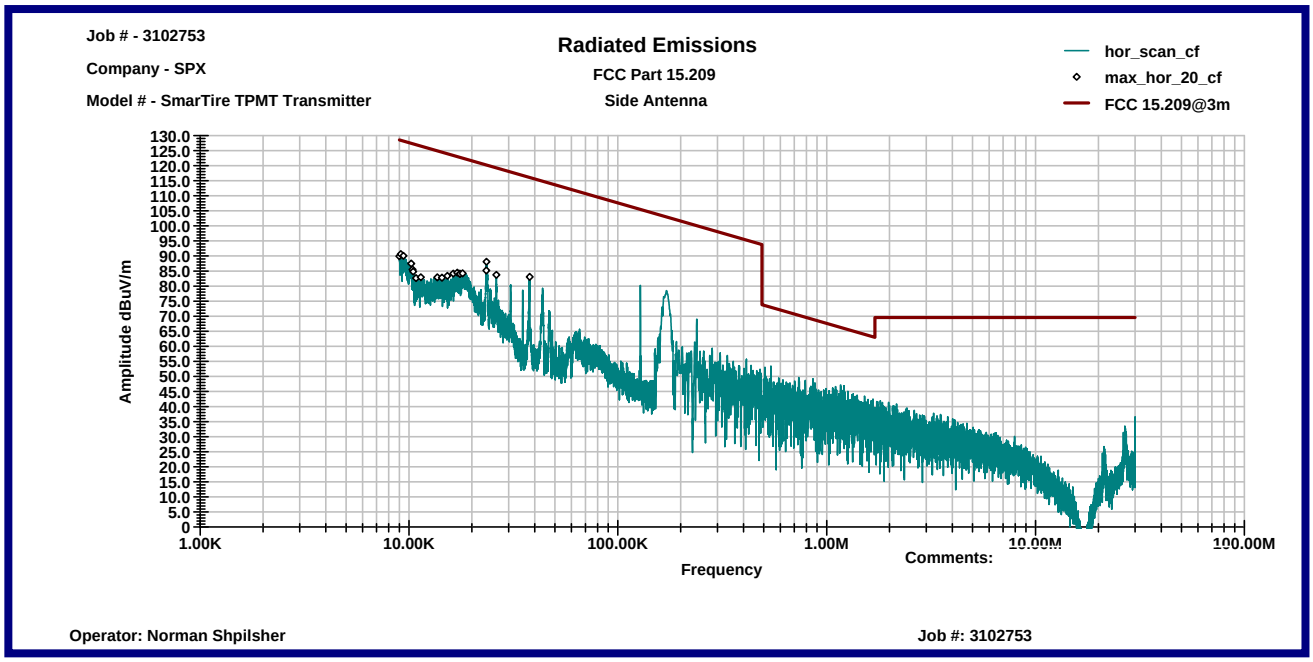
| Frequency | Ant. Polarity | Peak Reading dBµV | Ant. Factor dB1/m | Total at 3m dBµV/m | QP Limit dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 30.139 MHz | V | 13.6 | 18.9 | 32.5 | 40.0 | -7.5 |
| 132.53 MHz | V | 20.5 | 13.3 | 33.7 | 43.5 | -9.8 |
| 950.49 MHz | V | 15.6 | 25.6 | 41.3 | 46.0 | -4.8 |
| | | | | | | |
| 30.069 MHz | H | 13.7 | 19.0 | 32.7 | 40.0 | -7.3 |
| 131.94 MHz | H | 18.1 | 13.3 | 31.4 | 43.5 | -12.2 |
| 934.22 MHz | H | 15.5 | 25.5 | 41.0 | 46.0 | -5.1 |

# Graph # 3-2-1
## Radiated Emissions from 9kHz to 30MHz

### Vertical Antenna Polarization

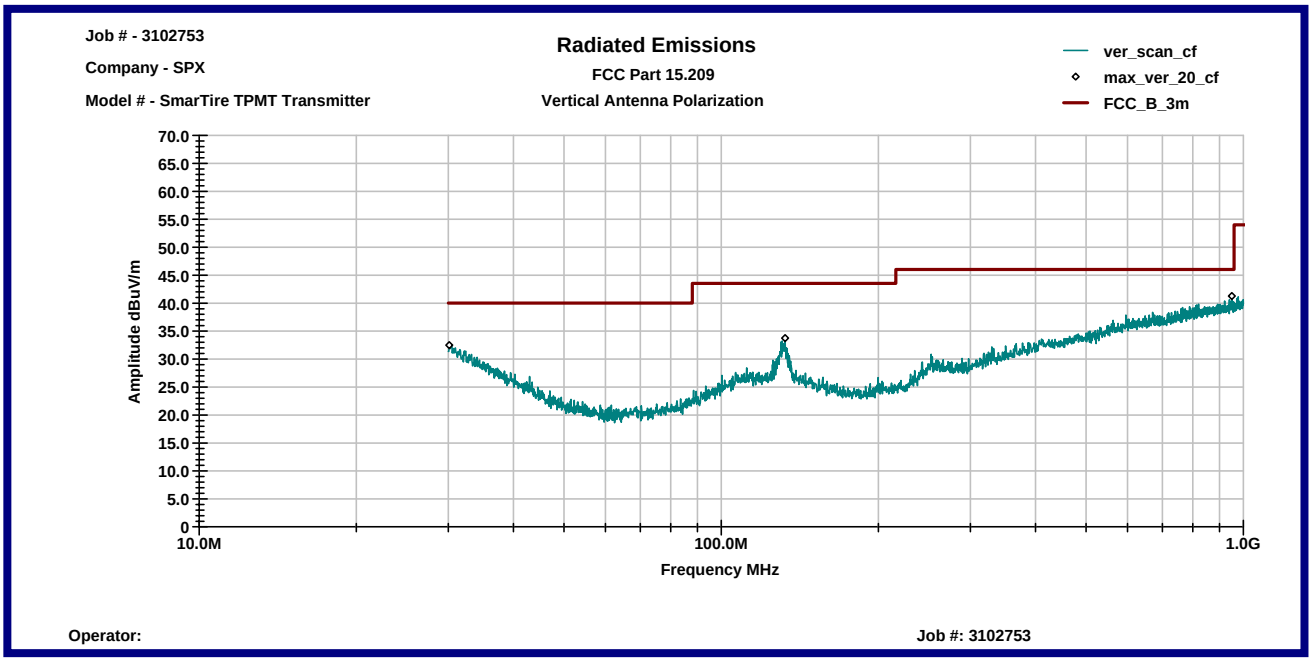



### Horizontal Antenna Polarization

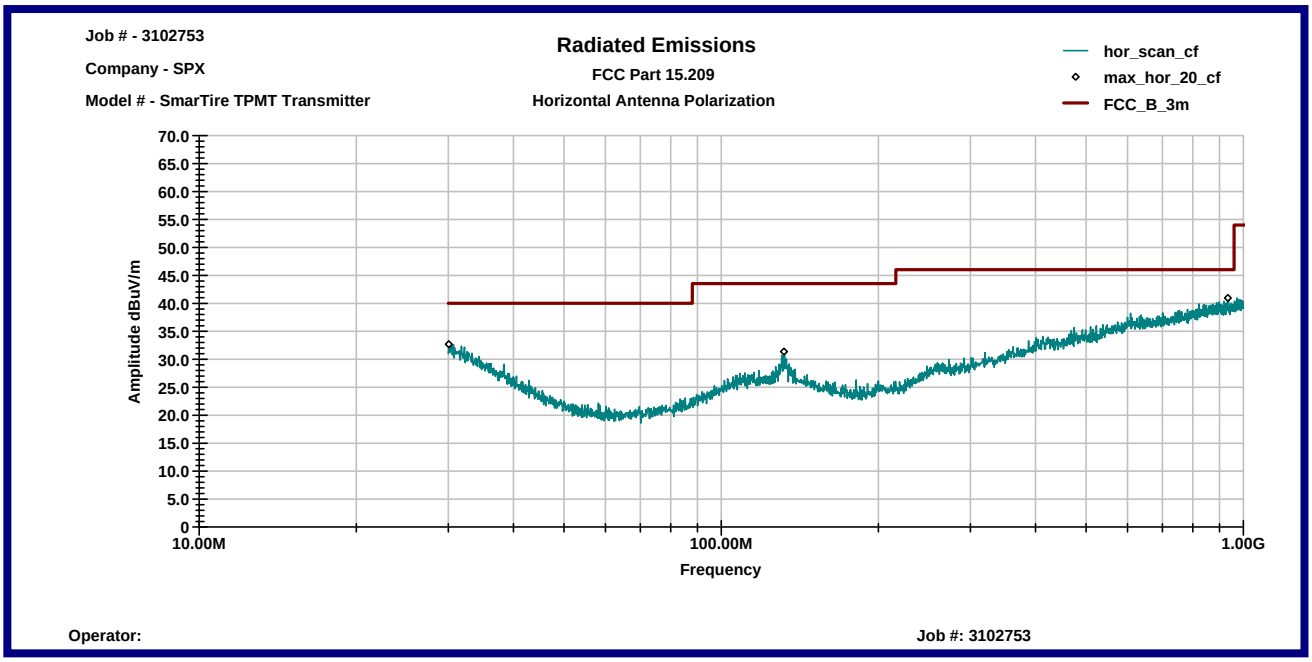


# Graph # 3-2-2
## Radiated Emissions from 30MHz to 1GHz

### Vertical Antenna Polarization




### Horizontal Antenna Polarization



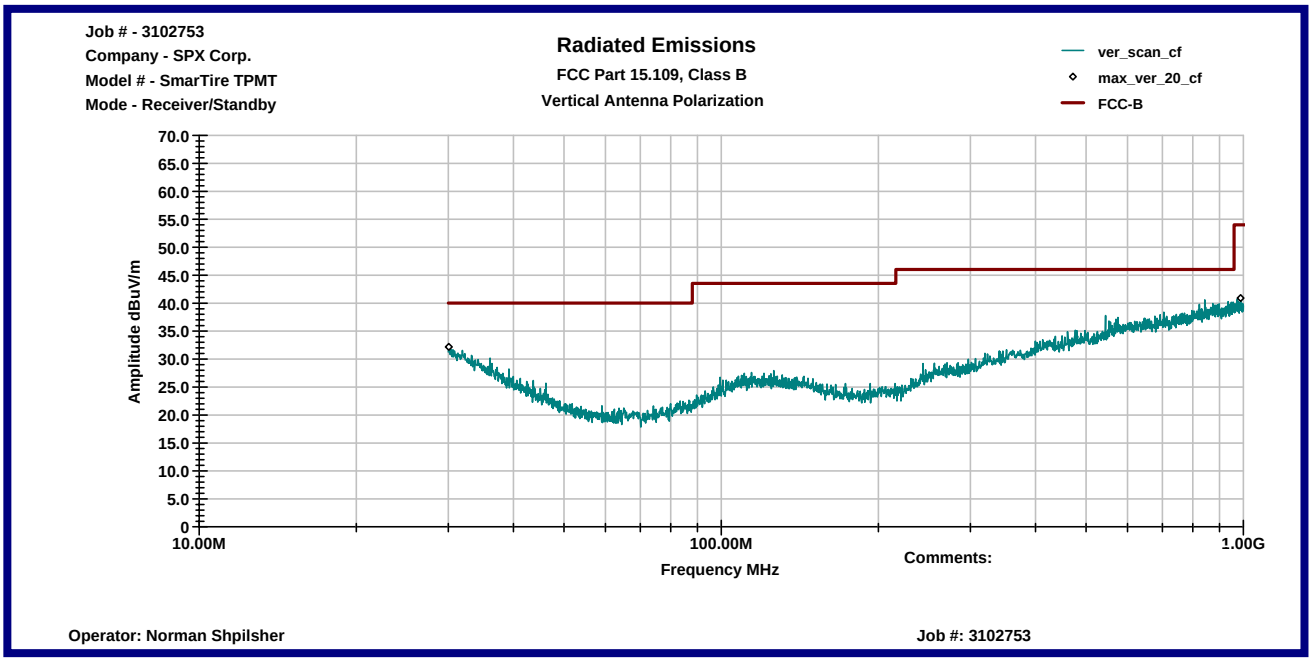
### 3.3 Radiated Emissions, FCC 15.109, Class B

The *SmarTire TPMT* was tested according to FCC Part 15.109, Class B in frequency range from 30MHz to 1GHz in standby/receiver mode.

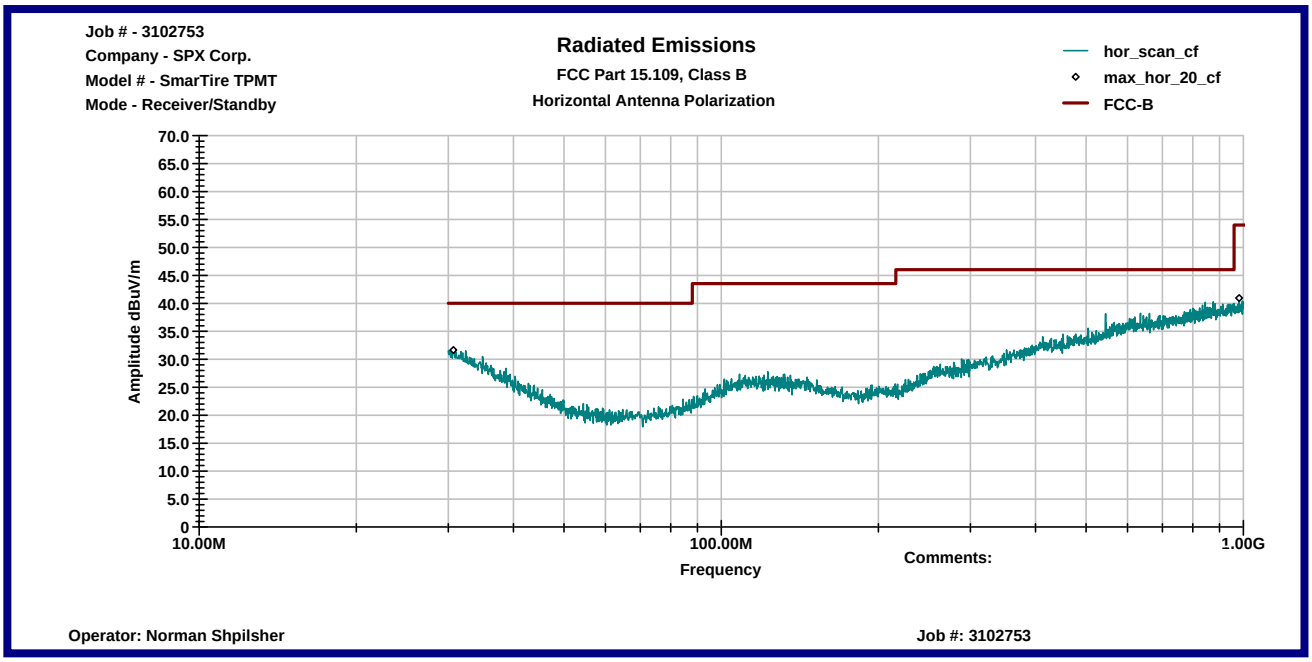
Graph 3-3-1 demonstrates compliance with the FCC Part 15.109, Class B limits.

# Graph # 3-3-1
## Radiated Emissions from 30MHz to 1GHz

### Vertical Antenna Polarization




### Horizontal Antenna Polarization



## 3.4 Test Procedure

Field Strength Measurements

For emissions greater than 30 MHz; the EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anechoic Chamber. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at 3m distance. The Bicono-Log antenna was used in frequency range from 30MHz to 1GHz. The radiated emissions were maximized by configuring the EUT through its placement in three orthogonal axes, by rotating the EUT, by changing antenna polarization, and by changing antenna height from 1 to 4m. Method of the direct Field Strength Calculation is shown in Section 3.6.

For emissions below 30 MHz measurements were performed with a loop antenna at a 10 meter distance at both antenna polarities (front antenna oriented to the EUT and side antenna oriented to the EUT) at an antenna height of 1 meter.

### 3.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:
FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB($m^{-1}$)
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(µV) is obtained. The antenna factor of 7.4 dB($m^{-1}$) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(µV/m).

RA = 48.1 dB(µV)
AF = 7.4 dB($m^{-1}$)
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(µV/m)

In the tables the Cable correction factors are included to the Antenna Factors.

### 3.6 Measurement Uncertainty

The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be:
±4 dB at 10m ±5.4 dB at 3m

The expanded uncertainty (k = 2) for emissions from 150 kHz to 30 MHz has been determined to be:
±2.6 dB

Tested by:

Norman Shpilsher
EMC Staff Engineer
Intertek ETL SEMKO

Signature

December 9, 2006

## 4.0 TEST EQUIPMENT

**Receivers/Spectrum Analyzers and Test Software**

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|---|---|---|---|
| HP85462A Receiver RF Section | 3325A00106 | 04/06 | 04/07 | |
| HP85460A RF Filter Section | 3330A00109 | 04/06 | 04/07 | |
| HP85462A Receiver RF Section | 3549A00306 | 02/06 | 02/07 | X |
| HP85460A RF Filter Section | 3448A00276 | 02/06 | 02/07 | X |
| Rohde & Schwarz FSP 40 Spectrum Analyzer | 100024 | 07/06 | 07/07 | |
| Rohde & Schwarz ESCI Spectrum Analyzer | 100358 | 04/06 | 04/07 | X |
| Advantest R3271A Spectrum Analyzer | 55050084 | 10/06 | 10/07 | |
| Agilent E7402A Spectrum Analyzer | MY44212200 | 10/06 | 10/07 | |
| TILE! Instrument Control System | Ver. 3.4 K.15 | N/A | N/A | X |

**Antennas**

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|---|---|---|---|
| Schaffner-Chase Bicono-Log Antenna | 2468 | 01/06 | 01/07 | X |
| Schaffner-Chase Bicono-Log Antenna | 2630 | 08/06 | 08/07 | |
| EMCO Horn Antenna 3115 | 9507-4513 | 01/06 | 01/07 | |
| A.H. System Loop Antenna SAS-200/562 | 215 | 05/06 | 05/07 | X |
| MITEQ AMF-5D Pre-Amplifier | 1122951 | 02/06 | 02/07 | |
| HP 8447F Pre-Amplifier | 3113A04974 | 02/06 | 02/07 | X |