



Functional Description
of
TIS-09
Wheel Unit

Type

ASK/FSK 433.92 MHz

Tire Pressure Generation

1. SYSTEM OVERVIEW

The tire pressure monitoring system (referred as TG for Tire Guard) consists of the following units:

- Tire guard wheel unit type TIS-09 which includes an integrated pressure, temperature and acceleration sensor and a RF transmitter.
- LF receiver unit which includes a LF receiver (not described in this document)

The TG monitors a vehicle's tire pressure whilst driving or stationary. An electronic unit (wheel unit) inside each tire, mounted to the valve stem, periodically measures the actual tire pressure. By means of RF communication, this pressure information is transmitted to the RF receiver.

2. TECHNICAL DESCRIPTION

Carrier frequency:	433.92 MHz
Number of channels:	1
Type of modulation:	Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK)
Baud rate:	9600bps
Rated Output Power:	< 10mW
Antenna:	Internal
Voltage supply range:	2.1 up to 3.2V

3. TYPICAL USAGE PATTERN

3.1 AVERAGE FACTOR CALCULATION (Standard 47 CFR Part 15C (periodic intentional transmitter))

Maximum transmitting duration in whatever 100ms windows: 10.31ms

$$\Rightarrow \text{Averaging factor} = 20 \times \log(10.31/100) = \underline{\underline{-19.73\text{dB}}}$$

Baudrate := 9600bps ToleranceBaudrate := 1%

Framebyte := 12byte + 2bit

Framebits := Framebyte

Framebits = 98

$$t_{\text{bit}} := \frac{1}{\text{Baudrate} \cdot (1 - \text{ToleranceBaudrate})}$$

$$t_{\text{bit}} = 0.10522\text{ms}$$

tFramebits := tbit · Framebits

tFramebits = 10.31145ms

tFrameFSKbits := tFramebits · 1 due to FSK 100%

$$\text{AveragingFactor}_{\text{tFrame}} := \left| 20 \log \left(\frac{t_{\text{FrameFSKbits}}}{100\text{ms}} \right) \right|$$

$$\text{Averaging Factor}_{\text{tFrame}} = \underline{\underline{-19.8\text{dB}}}$$



ASK WUP: 320 bits
Baudrate= 9600bps/s (+/-1%)
ASK: 50% duty cycle

Max WUP duration = 16.83ms

$$\text{AveragingFactor_tWUP} := \left\lceil 20 \log \left(\frac{\text{tWUPFrameASKbit}}{100\text{ms}} \right) \right\rceil$$

Averaging Factor_tWUP = -15.5dB

Note: The time between inter frames is always higher than the 100ms FCC window.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

"依據低功率電波輻射性電機管理辦法：

•第十二條

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

•第十四條

低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信法規定作業之無線電通信。

低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。"

"NCC Warning Statement

Article 12

Without permission, any company, firm or user shall not alter the frequency, increase the power, or change the characteristics and functions of the original design of the certified lower power frequency electric machinery.

Article 14

The application of low power frequency electric machineries shall not affect the navigation safety nor interfere a legal communication, if an interference is found, the service will be suspended until improvement is made and the interference no longer exists."