

April 5, 2013

*Automotive Electronics
24175 Research Dr.
Farmington Hills, MI 48335-2642
Tel 248.478.7210
Fax 248.699.4241*

Model #: 225816-122, 225816-131

GENERAL DESCRIPTION

This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. The transmitter device also transmits rotation position and time information that is used by an RF receiver in determining the location of the transmitter on a vehicle. In addition, this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to the simultaneous transmission. The transmitter device also has a Low Frequency (LF) receiver. This receiver supports Low Frequency (LF) magnetic field communications allowing the changing of measurement/monitoring states of the transmitter by commands sent via the TPM diagnostic tool. The RF signal operates at 433.92MHz and uses FSK Manchester code modulation and crystal based PLL circuit for oscillation. 225816-122 and 225816-131 transmits 8 RF packets every 60 seconds in normal operation.

PRINCIPLES OF CIRCUIT OPERATION

The sensor incorporates an ASIC to measure the parameters within the tire. The ASIC sends the measured data in digital pulses. The digital data is frequency modulated. The transmitted signal uses Frequency Shift Keying (FSK). The worst case frequency shift of the carrier is 433.85 MHz for the low frequency and 434.000 Hz for the high frequency shift. The receiver bandwidth must be wide enough to pass the transmitter worst case frequency shifts.

Description of Operations

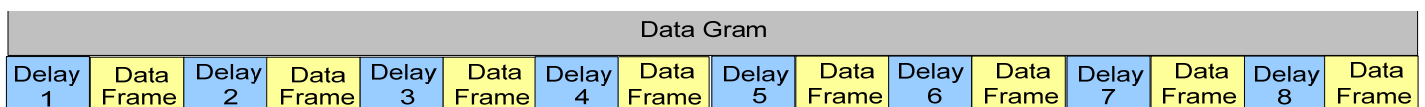
Mode of Operation	Explanation	Frequency of Transmission
Storage Mode	No transmission. Measures temperature & pressure.	4 words when activation occurs with TPM diagnostic tool
Sleep State	Measures temperature, pressure, and motion. Enters this mode/state when <ol style="list-style-type: none"> 1. Pressure goes above pressure threshold in Storage Mode or 2. No motion is detected for 15 minutes in Normal Mode/Rest State. 	4 words when activation occurs with TPM diagnostic tool
Localization	Measures temperature, pressure, and motion. Transmits periodically. Enters this state when motion is detected in Sleep State.	<ul style="list-style-type: none"> • 8 Local Z words every 12-16 seconds, with wheel rotation data. • 4 words when activation occurs with TPM diagnostic tool
Normal State	Measures temperature, pressure, & motion. Transmits periodically. Enters this state when: <ol style="list-style-type: none"> 1. Localization is complete or 	<ul style="list-style-type: none"> • 8 pressure/temperature data / words every 60 seconds • 4 words when activation occurs with TPM diagnostic tool
Rest State	Measures temperature, pressure, & motion. Enters this state after no motion is detected in Normal Mode/Normal State.	4 words when activation occurs with TPM diagnostic tool
Alert Mode	Transmits periodically. Enters this mode when: <ol style="list-style-type: none"> 1. Significant pressure delta detected 	<ul style="list-style-type: none"> • 8 pressure/temperature data/words every 4 seconds for 1 minute • 4 words when activation occurs with TPM diagnostic tool

Data Frame/Delays

A data gram is composed of one or more identical data frames separated by random and or fixed delays. The number of frames, and delay times will depend on if the Datagram is periodic, or is in response to an LF request.

The Normal, Local Z and Alert Data Gram shall be composed of 8 identical data frames separated by pseudo random delays as shown in the table below. The pattern transmitted is randomly selected.

For RF transmissions that are responding to an LF command, pattern 1-4 is randomly selected and only the first 4 frames are transmitted.



Frame time 7.6 ms								
Frame #	1	2	3	4	5	6	7	8
	delay	delay	delay	delay	delay	delay	delay	delay
Pattern 1	0	12	84	18	100	1	100	6
Pattern 2	0	1	100	18	84	6	84	12
Pattern 3	0	18	84	6	84	6	100	1
Pattern 4	0	6	100	1	100	12	84	18

Environmental Conditions

Operating Temperature Range: -40° to 120°C
Humidity: 0 to 100%

Transmission / RF Characteristics

Parameter	Units	Low	Nom	High	Conditions
Modulation Type			FSK		
Centre Frequency	MHz		433.92		-40° to 120°C
FSK Deviation	kHz		60		
Frequency	MHz	433.85		434.000	-40° to 120°C
Output Power (Continuous Wave)	mW (ERP)		5		25°C

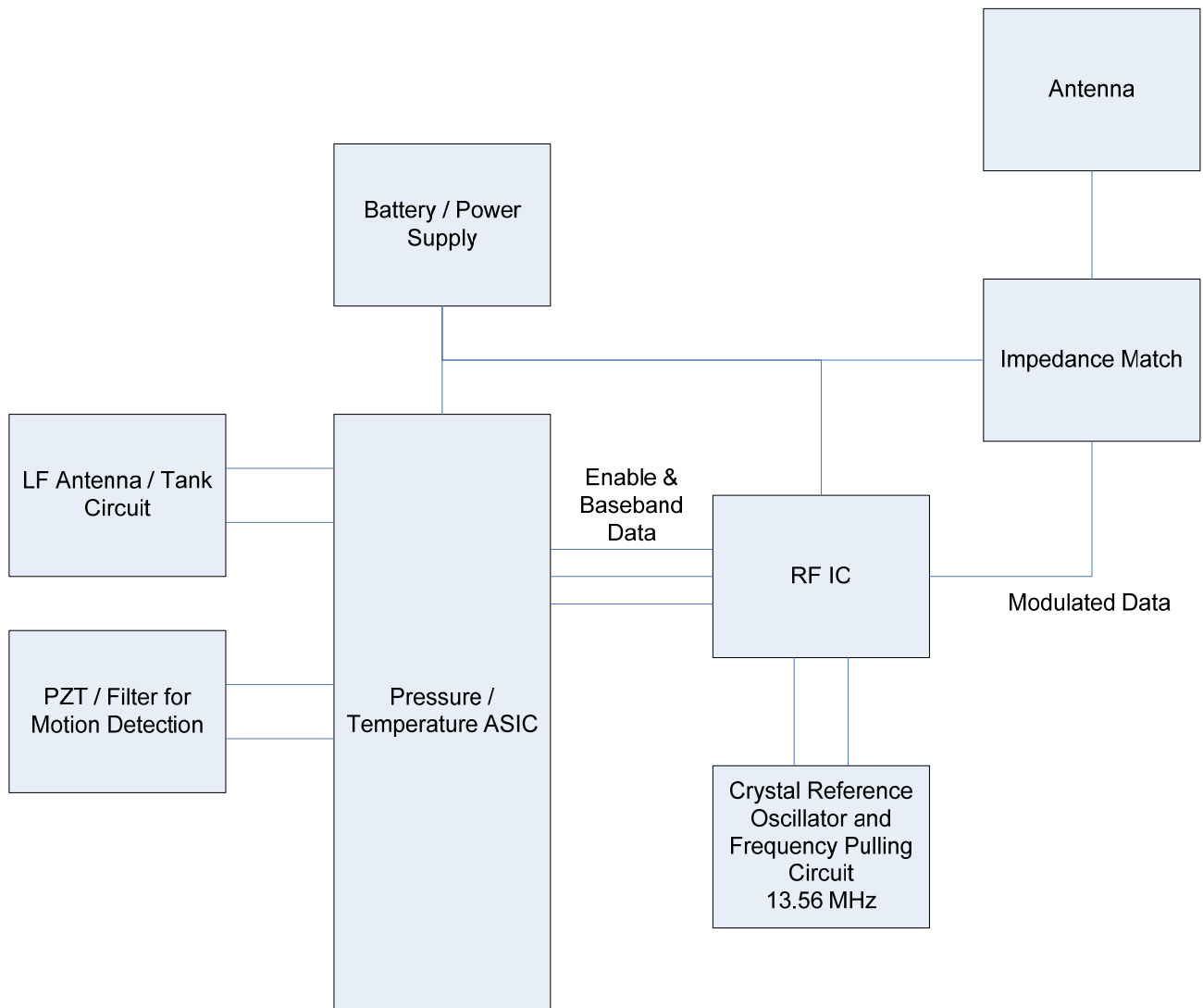
Antenna Specification

Antenna gain: =-20.66dBi

PRINCIPLES OF CIRCUIT OPERATION

The sensor incorporates an ASIC to measure the parameters within the tire. The ASIC outputs the measured data in digital pulses. The digital data is frequency modulated. The transmitted signal uses Frequency Shift Keying (FSK). The carrier frequency of the sensor is 434MHz typically. The worst case frequency shift of the carrier is 433.92MHz for the low frequency and 434MHz for the high frequency shift. The receiver bandwidth must be wide enough to pass the transmitter worst case frequency shifts. Reference Block Diagram below.

Block Diagram



COMPLIANCE STATEMENT

The TPM Transmitter is sold only as part of a vehicle by the retail automobile dealers and as such has no separate manual.

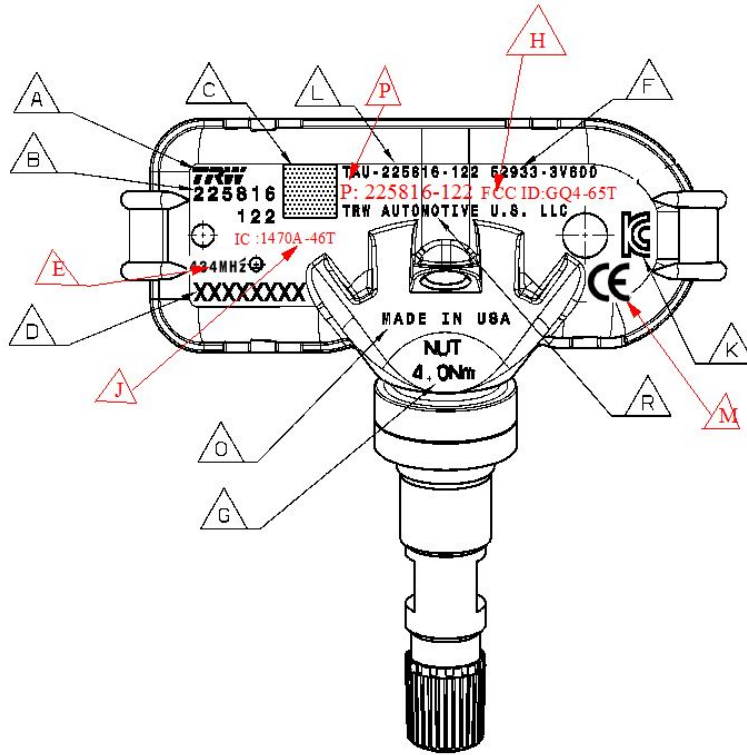
The compliance statement for the TPM Transmitter will be integrated by the OEM into the vehicle owner's manual. It will read:

This device complies with KCC 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.

WARNING: Changes or modifications not expressly approved by TRW Automotive U.S. LLC could void the user's authority to operator the equipment.

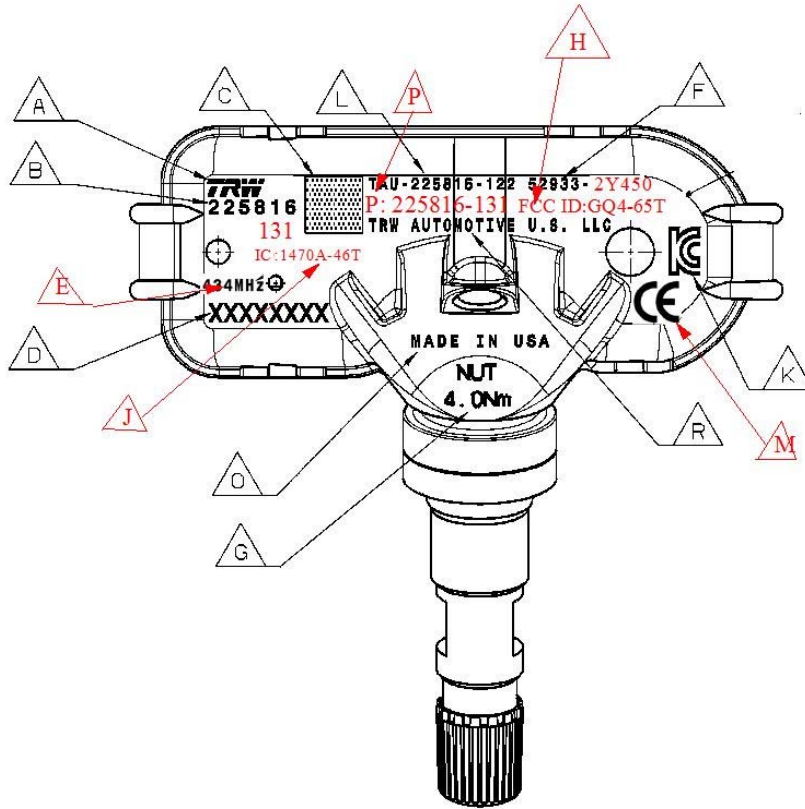


225816-122

Laser Marking

ITEMS TO BE LASER MARKED		
A	TRW LOGO	TRW
B	TRW PART NUMBER	225816-122
C	2D BAR CODE	(6X6)
D	TRANSMITTER SERIAL ID	XXXXXXXXXX
E	FREQUENCY	434MHZ
F	CUSTOMER PART NUMBER	52933-3V600
G	NUT TIGHTENING TORQUE	NUT 4.0Nm
J	INDUSTRY OF CANADA CERTIFICATION NUMBER	IC :1470A-46T
K	KC LOGO	KC
L	KC ID	TAU-225816-122
M	CE LOGO	CE
O	MANUFACTURING NATION	MADE IN USA
P	SUPPLIER P/N FOR CANADIAN CERTIFICATION	225816-122
R	MANUFACTURERS ID	TRW AUTOMOTIVE U.S. LLC

Laser Marking Chart 225816-122



225816-131

ITEMS TO BE LASER MARKED		
A	TRW LOGO	TRW
B	TRW PART NUMBER	225816-131
C	2D BAR CODE	(6X6)
D	TRANSMITTER SERIAL ID	XXXXXXXXXX
E	FREQUENCY	434MHZ
F	CUSTOMER PART NUMBER	52933-2Y450
G	NUT TIGHTENING TORQUE	NUT 4.0Nm
J	INDUSTRY OF CANADA CERTIFICATION NUMBER	IC :1470A-46T
K	KC LOGO	KC
L	KC ID	TAU-225816-122
M	CE LOGO	CE
O	MANUFACTURING NATION	MADE IN USA
P	SUPPLIER P/N FOR CANADIAN CERTIFICATION	225816-131
R	MANUFACTURERS ID	TRW AUTOMOTIVE U.S. LLC

Laser Marking Chart 225816-131