TPMS technical specification

(Wuling automobile G105 model)

Version 1

Warning

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 this device must accept any interference received, including interference that may cause undesired operation.

Caution: Changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

Catalogue

1. System introduction

1.1 General survey

This document is used to define the design scheme of TPMS project applicable to Wuling Automobile G105 model according to the relevant technical agreement and preparation requirements of Wuling Automobile Research Institute on Tire Pressure monitoring system (TPMS). The document specifies the structure, function, performance, installation position and other characteristics of the developed product.

1.2 Part number

Part number	Vehicle Part number	Function Description

1.3 Reference codes and regulations

No.	Standard no.	Standard name	Standard type
1	ISO 20653-2006	Road vehicles - Degrees of protection (IP-Code) - Protection of electrical equipment against foreign objects, water and access	International standard
2	ISO 16750-2006	Road vehicles – Environmental conditions and testing for electrical and electronic equipment	International standard
3	GB 14023	Vehicles, boats and internal combustion engine – Radio disturbance characteristics – Limits and methods of measurement for the	International standard

		protection of off-board receivers	
4	GB 18655-2002	Limits and methos of measurement of radio disturbance characteristics for the protection of receivers used on board vehicles	International standard
5	GB/T 17619-1998	Limits and methods of testing for immunity of electrical/electronic subassemblies in vehicles to electromagnetic radiation	International standard
6	GB/T 19951-2006	Experimental method of electromagnetic disturbance generated by electrostatic discharge in road vehicles	International standard
7	GB/T 21437.2-2008	Electrical disturbance of road vehicles due to conduction and coupling - Part 2	International standard
8	GB/T 2423.17-1993	Basic environmental test procedure for electrical and electronic products-Test Ka: salt spray test method	International standard
9	GB/T 26149-2010	Automobile tire pressure detection system	International standard
10	QC/T 413-2002	Basic technical conditions of automotive electrical equipment	Occupation standard

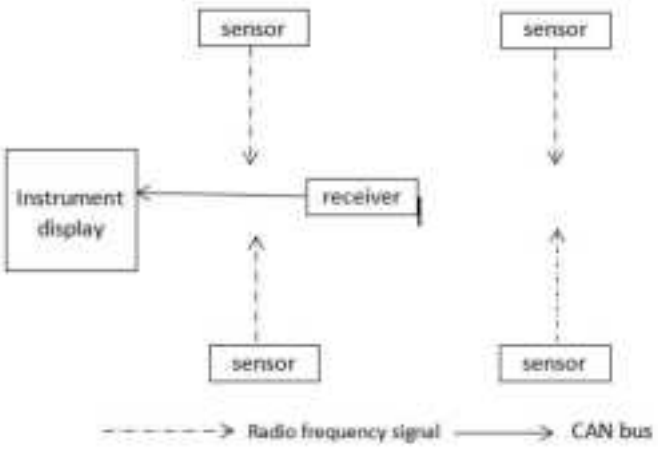
1.4 Term interpretation or noun definition

Term/definition/abbreviation	Descriptions
Tire pressure monitoring system （TPMS）	The device for real-time monitoring of tire pressure, temperature and other information of the vehicle can provide a communication interface as a subsystem of the vehicle information system according to user requirements。

sensor	A device that transmits information such as the detected pressure and temperature of automobile tires through radio frequency.
receiver	Receiving and processing radio frequency signal emitted by tire pressure sensor, TPMS monitoring device with alarm and display function.
pressure	Unless otherwise specified, the pressure described in this standard is relative pressure, that is, absolute pressure minus 101kPa.

2. System

2.1 System block diagram



2.2 System description

The TPMS system is composed of a sensor and a receiver. The sensor is installed in the tire to directly measure the pressure and temperature of the tire, and the tire information detected is sent to the receiver through radio frequency signal. The receiver is installed in the car, and the tire information received wirelessly is transmitted to the vehicle instrument through CAN bus. Allows the driver to check tire pressure and temperature.

2.3 System interface

2.3.1 Communication protocol with the body

The receiver supports the communication between the CAN bus and the automobile instrument. The CAN communication protocol is as follows：

信号名称	信号描述	发送节点	周期(ms)	CAN ID	起始字节	起始位	长度	信号使用说明
TPMSTransducerLocation	传感器位于轮子位置上	TPMS	50	0x390	0	4	3	0x0: Front-Left Transucer (FL) 0x1: Front-Right Transucer (FR) 0x2: Rear-Right Transucer (RR) 0x3: Rear-Left Transucer (RL) 0x4: Reserved 0x5: Reserved
TyrePressure	轮胎压力	TPMS	50	0x390	1	8	8	Resolution：3.1373。 Offset：0。 Unit：kpa For example： Byte1=0x51， Pressure=0x51(Hex) * 3.1373 = 81(Dec) * 3.1373=254kpa
TyreTemperature	轮胎温度	TPMS	50	0x390	2	16	8	Resolution：1。 Offset：-50。 Unit：℃ For example：Byte2=0x51， Temperature=0x51(Hex) - 50 = 81(Dec) - 50=31℃
TyreMsgValid	接收有效标志	TPMS	50	0x390	3	24	1	0x0: Non Learning Status 0x1: Learning Status
TransducerSelfTestStu	传感器自检	TPMS	50	0x390	3	25	1	0x0: No Alarm 0x1: Alarm now
TyreLeakOutAlarmStu	轮胎漏气警告	TPMS	50	0x390	3	26	1	0x0: No Alarm 0x1: Alarm now
LostTransducerAlarmStu	传感器丢失警告	TPMS	50	0x390	3	27	1	0x0: No Alarm 0x1: Alarm now
BatteryVoltageLowAlarmStu	传感器电池电压低警告	TPMS	50	0x390	3	28	1	0x0: No Alarm 0x1: Alarm now
HighTemperatureAlarmStu	高温警告	TPMS	50	0x390	3	29	1	0x0: No Alarm 0x1: Alarm now
LowPressureAlarmStu	低压警告	TPMS	50	0x390	3	30	1	0x0: No Alarm 0x1: Alarm now
HighPressureAlarmStu	高压警告	TPMS	50	0x390	3	31	1	0x0: No Alarm 0x1: Alarm now
LearningValid	传感器学习请求	IC	1000	0x620	4	32	1	0x0: No request to learn 0x1: Request to learn

2.4 System mode and status

2.4.1 Power on

The ignition switch is from OFF to ON, the TPMS receiver is turned on and started, and the tire information is displayed through the CAN bus control instrument. The tire information is the last data recorded in the previous ignition cycle (pressure, temperature, alarm information, etc.) until the sensor sends a wireless signal to update

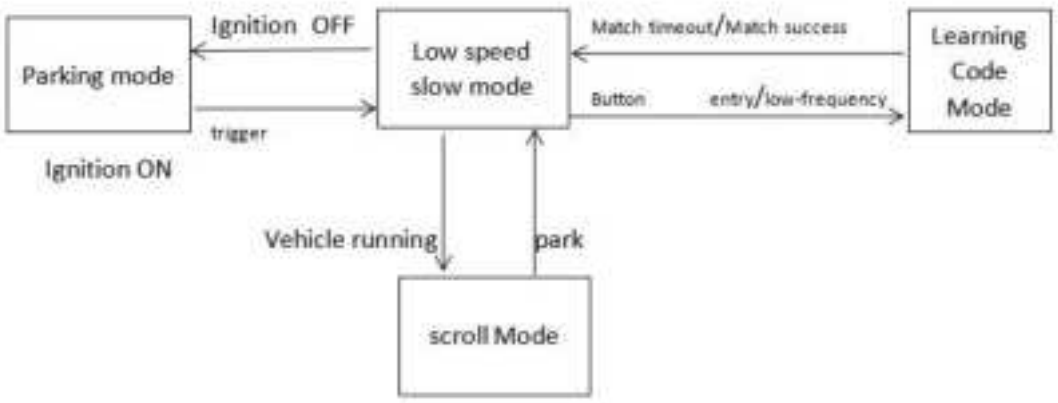
the tire information.

2.4.2 System operating mode

The working mode of the system can be divided into four types: parking mode, traffic light mode, driving mode and learning code mode.

Working mode	Condition	Function description
Parking mode	IGN_OFF	The receiver module is closed without power consumption; The sensor only detects whether it has entered the driving state;
Low speed slow mode	IGN_ON Stationary vehicle	The receiver module is in normal operation; The sensor is in parking mode or slow driving mode (see sensor working mode);
Driving mode	IGN_ON Vehicle running	The receiver module is in normal operation; The sensor is in driving mode;
learning code mode	IGN_ON	Receiver button operation to enter the code mode; The sensor sends the ID information to the receiver according to the command issued by the trigger tool

2.4.3 System state logic diagram



2.5 system performance parameters

2.5.1 Electrical characteristics

Operating voltage and current characteristics

The working voltage and current are shown in the table below：

product name	Lower limit working voltage	rated voltage	Upper limit working voltage	Power supply mode
sensor	2.3V	3V	3.6V	lithium battery
receiver	9V	12V	16V	IGN

product name	Sampling current	Emission Current	quiescent current
sensor	1~2.5mA	9~13mA	<0.7uA

product name	Working current
receiver	≤100mA

Working environment conditions

The ambient temperature applicable to each component of the TPMS varies depending on its function and installation environment. The working and storage temperatures of each component are shown in the table below：

product name	Lower operating temperature（° C）	Lower storage temperature（° C）	Upper operating temperature（° C）	Upper storage temperature（° C）
sensor	-40	-40	105	125
receiver	-40	-40	85	95

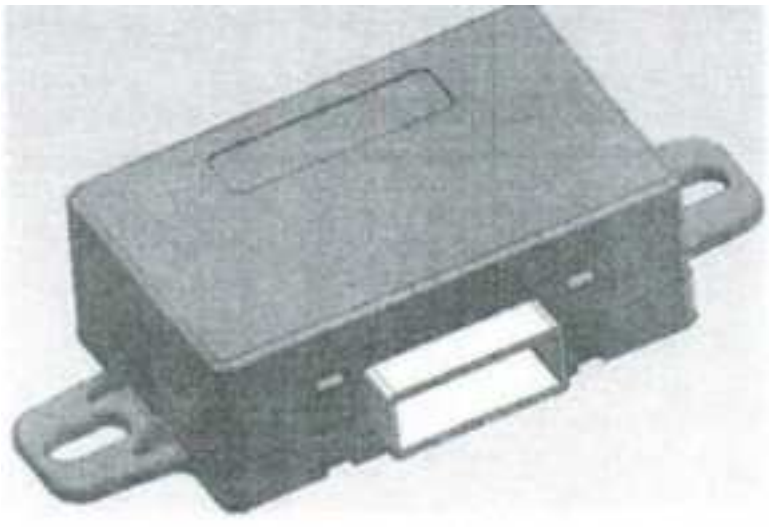
3. TPMS receiver

3.1 TPMS Receiver performance parameters

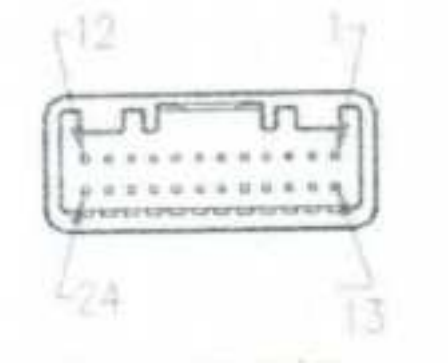
Receiver	
Receiving frequency	433.92±0.1MHZ
Receiving sensitivity	≤-104dBm
modulation	FSK
Data Baud	9600bps±96bps
Communication Interface	CAN BUS
CAN BUS Baud rate	500Kbps

3.2 TPMS Receiver structure diagram

The following figure shows the exterior view of the TPMS receiver



The appearance of the connector on the TPMS receiver is shown in the figure. The connector model is TE: 1318853-2, and the detailed pin definition is shown in the table. The corresponding connector model is TE: 1318917-1



Pin definition of tire pressure monitoring control module assembly in the above figure

Serial Number	name	describe	notes
2	GND	grounding	
4	CAN_H	CAN_H	
5	CAN_L	CAN_L	
13	KL15	Power supply when the ignition switch is in the ON position	
Note: The remaining feet are empty			

3.3 Installation location of TPMS receiver

Due to the need for the TPMS receiver to receive wireless radio frequency signals from tire pressure sensors, the periphery of the receiver cannot be wrapped in a large area of metal. The TPMS receiver is fixed on a metal frame and supports installation under the driver's seat near the armrest. As shown in the following figure:

Installation position of receiver and bracket on actual vehicle

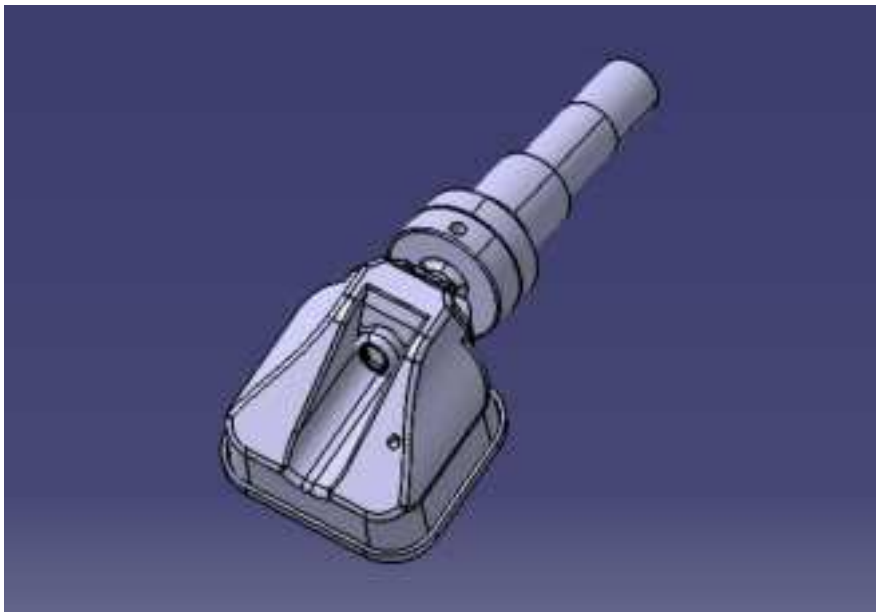
4. TPMS sensor

4.1 TPMS Sensor performance parameters

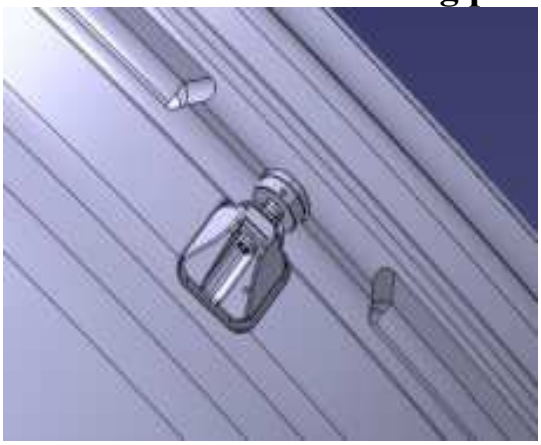
sensor	
Transmission frequency	433.92±0.07MHZ
Low frequency reception frequency	125±5KHZ
Transmitting power	4~6dbm
Pressure measuring range	100~900Kpa(Absolute pressure)
pressure error (100~500Kpa) (V=2.1~3.6V)	±7Kpa(0~50℃)
	±9Kpa(50~70℃)
	±17.5Kpa(-40~0℃/70~125℃)
pressure error (501~900Kpa)	±14Kpa(0~50℃)
	±18Kpa(50~70℃)
	±35Kpa(-40~0℃/70~125℃)
Temperature measurement range	-40~125℃
temperature error (V=2.1~3.6V)	±5℃(-40~20℃)
	±3℃(-20~70℃)
	±5℃(70~125℃)
Quick air leakage alarm	When the vehicle is in driving mode, 4S detects the primary pressure, when the secondary pressure changes to 8.25Kpa compared with the last time
Battery life	≥5 years or 100k km

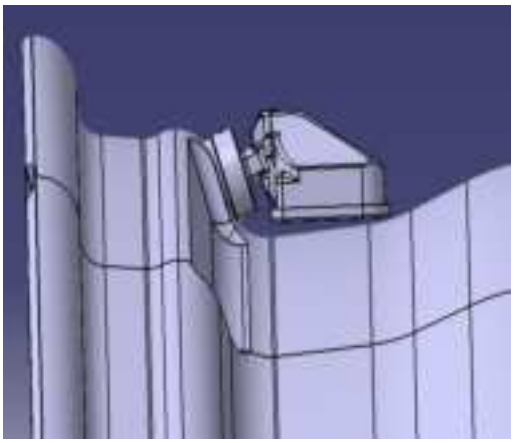
* Battery life will be affected by the use of the environment, this life calculation is estimated to be based on the control process and working mode, and normal temperature daily driving 4 hours。

4.2 TPMS Sensor structure diagram



4.3 TPMS Sensor mounting position





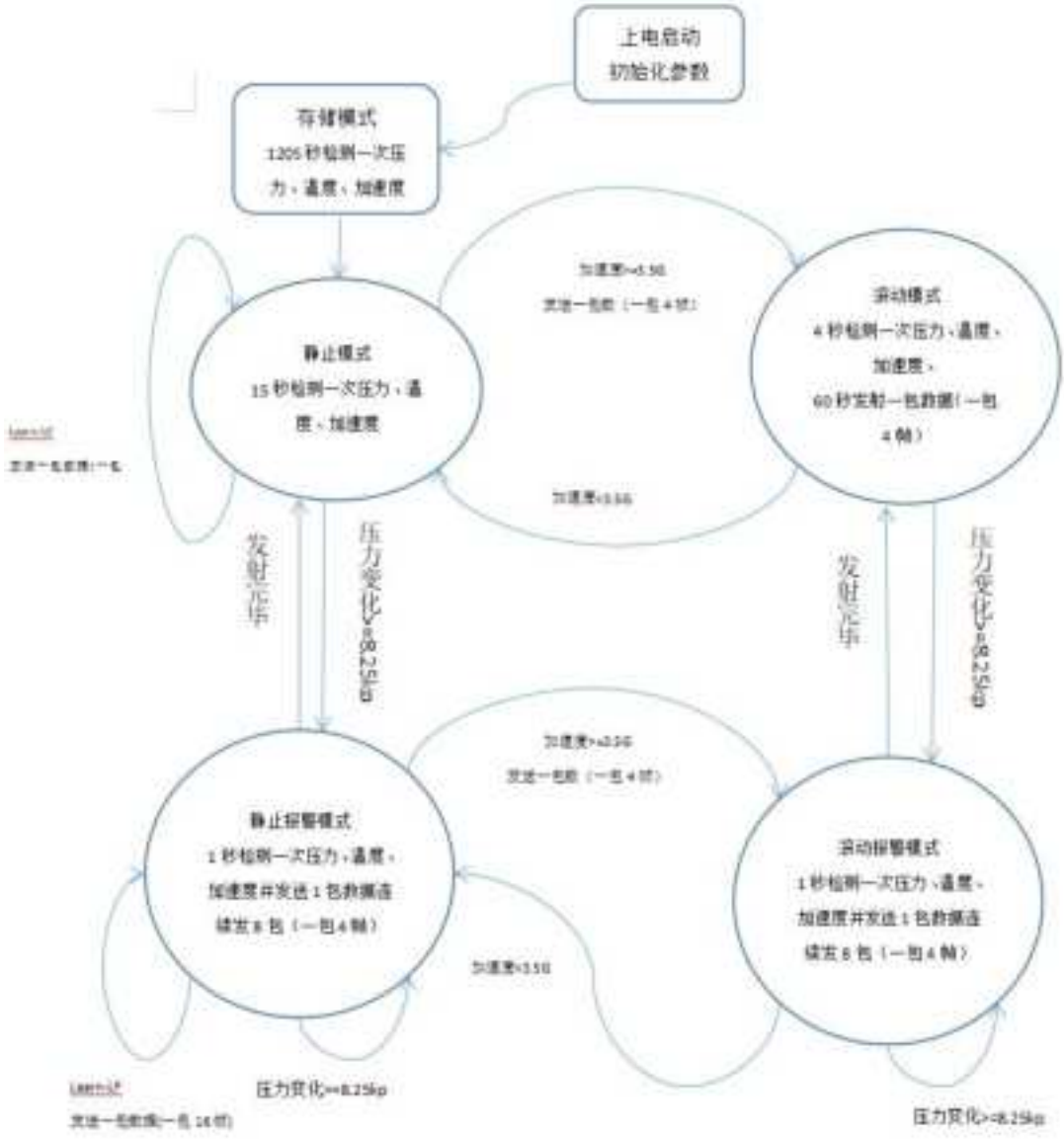
4.4 TPMS Sensor operating mode

- The sensor has 24-hour uninterrupted monitoring function, which is mainly divided into parking mode, driving mode, parking alarm mode, driving alarm mode, and learning code mode.
- Parking mode: After the sensor is powered on, it initializes the action and then enters this mode, in which the vehicle is at rest.
- Driving mode: When the vehicle acceleration is greater than 3.5G, the vehicle is in driving mode.

- Parking alarm mode: When the sensor is in parking mode, the sensor pressure change is greater than or equal to 8.25KP, entering the parking alarm mode.
- Driving alarm mode: When the sensor is in driving mode, the sensor pressure change is greater than or equal to 8.25KP, entering the driving alarm mode.
- Code learning mode: Use the code learning trigger to trigger the sensor, so that the receiving module can learn or collect the sensor information status.

	Storage mode	Parking mode	Parking alarm mode	driving mode	Driving alarm mode	Learning Code Mode
Launch interval	X	X	Measure acceleration, pressure, and temperature every second, and transmit a packet of data (1 packet of 4 frames) every second, continuously sending 8 times.	60S	Measure acceleration, pressure, and temperature every second, transmit a packet of data (1 packet of 4 frames) every second, and continuously send 8 times。	When the trigger is triggered, the sensor emits a packet of data (1 packet of 16 frames)
Number of transmitted frames	0	0		4		
Pressure measurement interval	120S	15S		4S		
Temperature measurement interval	120S	15S		4S		
Acceleration measurement interval	120S	15S		4S		

4.5 TPMS sensor logic state diagram



5. TPMS Learning code matching function

5.1 TPMS Learning code tools

The TPMS code learning device is mainly used for sensor code matching during vehicle assembly of TPMS and tire maintenance. It uses low-frequency technology to trigger sensors inside the tire, and records the ID code and corresponding position sent by the sensor. The recorded ID and corresponding tire position are sent to the TPMS receiver through transmission buttons.


Front left
左前
Rear left
左后
Trigger the signal light
触发信号灯
Trigger signal button 触
发信号按键
Tire position toggle key
轮胎位置切换键
Power button
开关键
Front right
右前
Rear right
右后
Trigger a success semaphore
触发成功信号灯
Trigger the failure semaphore
触发失败信号灯
Send keystrokes
发送按键

5.2 TPMS Learn the code operation process

When the coder is within 10cm of the tire position, we can switch to the corresponding tire position through the tire position switch button. After we press the trigger signal button, the trigger signal light will continue to flash.

After the sensor receives the low-frequency trigger signal, it continuously sends several frames of RF signals containing the sensor ID and tire pressure. The code learner receives the RF signal sent by the sensor, and after receiving the RF signal successfully, the trigger success signal light will turn on. The information is stored in the coder, and the tire position displays tire pressure information.

Repeat the above steps to complete the ID and tire pressure collection of the four sensors in turn, and the tire pressure information will be displayed in the four positions of the tire。

The instrument sends TPMS learning request to the receiver. The receiver receives the request sent by the meter, that enters the learning mode and is ready to accept tire information, while the receiver restores the meter status to the initial state, and the meter shows the TPMS learning code status indication according to the CAN data.

The code learner is close to the receiver installation position and press the OK button of the code learner, that transmit the ID, wheel number, and tire pressure of the four sensors to the receiver through RF in turn. The receiver receives the tire information and updates the instrument display content through the CAN bus, then the code learning is successful. If all four tires are successfully learned, the receiver exits the code-learning mode, and the meter cancels the TPMS code-learning status indication.If the four tires did not learn the code successfully more than 2min, the receiver exited the code learning mode, and the instrument canceled the TPMS code learning indication state

6. Revise resume

Version	Date (YY/MM/DD)	Author	approve	description
01	2022/10/17	Tang Yuan		Publication and distribution

Federal Communications Commission (FCC) Statement. This device complies with part 15 of the FCC Rules. Operation is subject to the following twoconditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received,

including interference that may cause undesired operation. Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide Reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one ormore of the following measures:

•Reorient or relocate the receiving antenna.

•Increase the separation between the equipment and receiver.

•Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

•Consult the dealer or an experienced radio/TV technician for help.

Warning: Changes or modifications made to this device not expressly approved by **Indigo Technologies, Inc.** may void the FCC authorization to operate this device.Note: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

RF exposure statement:

This device complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The device is installed and operated without restriction.