ATTACHMENT H.

- Hardware Manual -

■ An outline of Transmitter(HSN-1A)

1. How to use HSN-1A

- HSN-1A is Tire Pressure Monitoring System(wireless)
- This unit consist of Transmitter(HSN-1A) and Receiver

2. Introduction of Transmitter(HSN-1A)

- HSN-1A is periodically measure and transfer to ECU the pressure and temperature inside of tire.
- It also monitors and transfers the condition of Battery and Sensor.
- Following is the major functionalities.
  - ► Measure and transfer the tire pressure
  - ► Measure and transfer inside temperature of tire.
  - ► Measure and transfer tire rotating condition by acceleration value.
  - ► Measure and transfer voltage of mounted battery
  - ► Measure and transfer abnormal condition of sensor (pressure and accelerometer)
  - ► Decide existence and nonexistence of abnormal pressure change occurs inside of tire.

■ Description of Transmitter(HSN-1A)

1. Introduction

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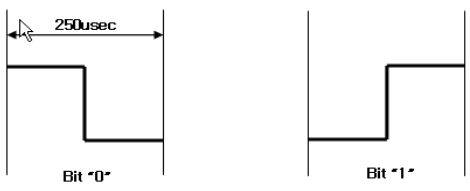
2. ELECTRICAL CHARACTERISTICS

	Transmitter
Model Name	HSN-1A
Supply Voltage	DC 3V
Operating Voltage	DC 2.2 ~ 3V
Consumption current	TBD Max 12mA
Operating Frequency	315MHz(±30kHz)
Operating temperature	-40 ~ +120℃
Modulation	FSK(Manchester Code)
Bit Rate	4 Kbps

3. DESCRIPTION MODE

1) Bit Format



2) Frame Data Format

WU transferred data is composed of total 92bits and following is the structure of the data.

► Preamble (28bits)

Composed of 0xFFFFEA9. Upper 20bit 0xFFFFE is the signal for bit check of ECU RF IC. 0xA9 is the signal for program Sync.

► ID (32bits)

Unique 32bit-identification that is assigned during production

► Pressure (8bits)

Sensor measured pressure in the tire

► Temperature (8bits)

Sensor measured temperature in the tire

► Status (8bits)

Indication of current sensor condition

► CRC 8 (8bits)

Data failure check

Preamble (0xFFFFEA9) 28bits	WU ID 32bits	Pressure 8bits	Temperature 8bits	WU Status 8bits	CRC8 8bits

7	6	5	4	4	2	1	0
Sensor Condition	Motion Detection	Battery Condition	LF Response	Current State			
0 : OK 1 : Failure	0 : Stationary 1: Rolling (Detection Level 5G)	0 : OK 1 : Low Voltage	0 : NO 1 : Response	0x00	Off State		
				0x01	Normal Stationary		
				0x02	Auto Learning State		
				0x03	Normal Rolling State		
				0x04	Alert State		
				0x05	T-Shutdown State		
				0x06	Factory State		
				0x07	Fast State		
				0x08 ~ 0xFF	Reserved		

3) Characteristics for each WU conditions

- WU operates within 8 different conditions. Each condition has own unique function to change the condition depends on tire rotation/non-rotation, LF protocol, and change in pressure.

WU State	Measurement Time				RF Transmission Interval	LF Response	
	P	T	ACC	LF		LF Command	Next State
OFF	*	*	*	4s	*	Factory LF	Factory
						Test LF	OFF
						Normal LF	Normal Stationary
Normal Stationary	20s	20s	20s	4s	200s	Off LF	OFF
						Test LF	Normal Stationary
						Factory LF	Fast
Normal Rolling	20s	20s	20s	4s	200s	Test LF	Normal Rolling
						Factory LF	Fast
Auto Learning	20s	20s	20s	4s	60s	Test LF	Auto Learning
						Factory LF	Fast
Alert	4s	*	*	*	20s	*	*
Shutdown	4s	*	*	*	20s	*	*
Factory	*	*	*	*	Continuance Carrier	Off LF	OFF
Fast	20s	20s	20s	4s	20s	Normal LF	Previous State

P(Pressure) T(Temperature) ACC(Accelation) LF(Low Frequency)

► OFF

Only monitors LF signal and make no motion. Condition for transportation after production,

► Normal Stationary

Condition of ACC < 9.5g, normally represents vehicle in stop mode

► Normal Rolling

Condition of ACC ≥ 9.5g, normally represents vehicle in motion

► Auto Learning

Condition of ACC ≥ 9.5g after WU places in NSS more than 10 minutes.

This condition is for faster auto learning of the ECU.

► Alert

Condition of when the tire pressure change about 20kPa(3psi) or tire interior temperature exceed 110℃. WU transmit message five times within four seconds period in order to send fast warning.

► Shutdown

When the measured tire interior temperature is above 120℃, WU enters into sleep condition after sending message three times within four second period in order to protect itself.

► Factory

Transmit unchanged signal due to characteristic check in production.

► Fast

Condition for fast receiving rate test and product characteristics check during production.

CAUTION: Changes and modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.