SIGNAL LIGHT VEST
Product Specification

1. EXECUTIVE SUMMARY

This document contains the product specifications of the new innovation of SIGZEEN ™ 1600 series Signal Light Vest hereinafter called "Signal Light Vest". The Signal Light Vest is patented in USA and Patent Pending in all other countries. In addition Industrial Design Patent has also been filed.

The Signal Light Vest is developed and designed for bicycle riders, in-line skaters, skate boarders and other non enclosed vehicle riders, to be visible from all direction during night time riding.

Signal Light Vest is inserted with electronic components which has four LED lamps hereinafter called "LEDYS", two in front and two in back, capable of performing pre programmed sequence of light signals. The LEDYS system is controlled by a wireless Remote Controller operating in the 314MHz radio frequency band. Further, there are two Manual Switch panels provide same operating performance as the Remote controller. This is specially designed; at any time the remote is malfunction wearer is able to operate the signals manually. The LEDYS system is powered by 1 x 3.7V 1800mAh Li-ion environmental friendly rechargeable battery.

This LEDYS system is designed to indicate the Left Turn Signal, Right Turn Signal, Yield Signal and Hazard Signal. In addition there are other Control Modes that control the LED lamps flashing and Steady On functions. These Control Modes allows changing the indicating lighting system according to requirements of each state or country. For Example: some countries flashing red lights are not allowed except emergency vehicles. If this situation the Control mode can be set the red light to be keep Steady On position.

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2. INTRODUCTION

The Signal Light Vest is a very effective gear for non enclosed vehicle riders on the road. It is important to note that this system is designed and developed with the lighting system that allows riders to be seen from all directions. This would help other vehicle drivers to recognize the presence of the riders, and approach with extreme caution.

The purpose of this report is to provide the product specifications for to obtain FCC15 and RSS210 radio frequency license and certification for the use of 314Mz radio frequency control system to operate signal lamps in the Vest.

The Product Report is comprised of two sections.

(1) Description of the product.

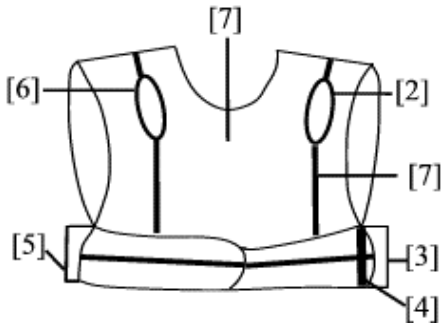
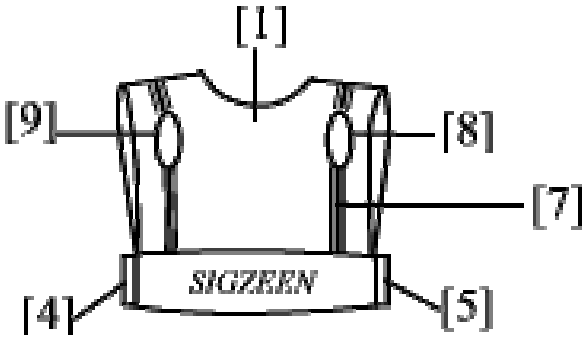
(2) Drawings and other information

3. COMPONENTS AND BASIC OPERATING SYSTEM

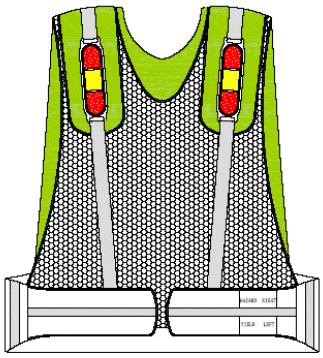
3.1 Major Components:

The Signal Light Vest consists of four major elements

- Clothing Vest
- Main Operating System (LEDYS)
- RF Remote Controller
- Battery Power

FRONT VIEW	BACK VIEW
	
1. Signal Light Vest 2. Right Front Lamp 3. Main Controller 4. Manual Switch Panel	5. Battery Holder 6. Left Front Lamp 7. Reflector 8. Right Back Lamp 9. Left Back Lamp

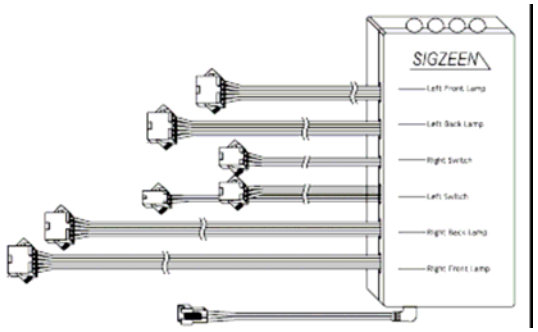
3.2 VEST



The Vest is made in two different sizes large and medium that fit men and women, for children the sizes are available in large and medium as well. The Vest is inserted with the following components:

- 1 Main Controller
- 4 Signal Lamps
- 1 Manual Switch Panel (4 switch buttons)
- 1 Battery Box (Li-lion battery pack)
- Speaker
- Ribbon Cables and Connectors

3.3 MAIN CONTROLLER



The Main Controller receives signals from Manual Switches or the 314Mz RF Remote Controller and sends said signals to the Main Controller which has a 16345F microcontroller, and

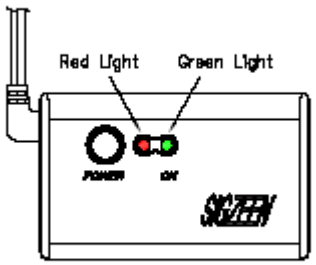
The microcontroller processes data received from the manual switches or the Remote Controller and sends said signals to the signal lamps and to the speaker.

The four Signal Lamps, Main Controller, Manual Switches, Speaker and Battery Box are inserted into the Vest. The Battery Box is inserted to Vest such way that the Battery Box is easily be removed for recharged.

3.4 RF REMOTE CONTROLLER

The Remote Control device is attached to the bicycle handle bar or on the wrist of the wearer (In-Line Skaters, Skate Borders etc.). The receiver is incorporated into the PCB in the Main Controller.

3.5 BATTERY POWER



The LEDYS system is designed with a 1 x 3.7 low Voltage Li-lion battery power system that is able to run the Main Controller, Manual Switches, RF Remote Controller and operates the four signal lamps in the Vest at least continues of 6 hours.

4. RELATED DOCUMENTS

4.1 SECTION 1 – Software design – Vest and the components

This section includes the following:

- Software design
- Design of the Vest
- Design of the Signal Lamps, Main Controller, Manual Switches, Remote Controller, Speaker, Battery Box, Battery Pack, Battery Charger.

4.2 SECTION 2 – Other than the section 1

This section includes:

- Wiring diagrams of the Vest.
- Schematics of all the components.
- Block Diagrams.

- Parts List
- Owners Manual.
- Product Internal Pictures

4.3 SOFTWARE DESIGN

The microcontroller is programmed to run under a 4.912MHz crystal oscillator, all timing has been calculated accordingly. A description of the function prototypes and main is all that is needed to understand the operation of the micro controller software.

4.4 SOURCE CODE

The new source code is specially designed for the Signal Light Vest LEDYS to perform a number of functions. The source code has been designed taking into consideration that the rules of the flashing light system could be changed according to the requirements of any state or country

4.4.1 Void Get_pulses(void);

This function is the core timing function behind the flashing of the LEDs at different speeds in correct phase. It toggles several global flags allowing all functions and/or events to synchronise correctly.

4.4.2 Void reset_all(void);

This function sets all outputs to low (ground), effectively disabling all LEDs and the speaker.

4.4.3 Void Speaker_buzz(void);

This function is used to generate the buzzing sound effect associated with braking mode.

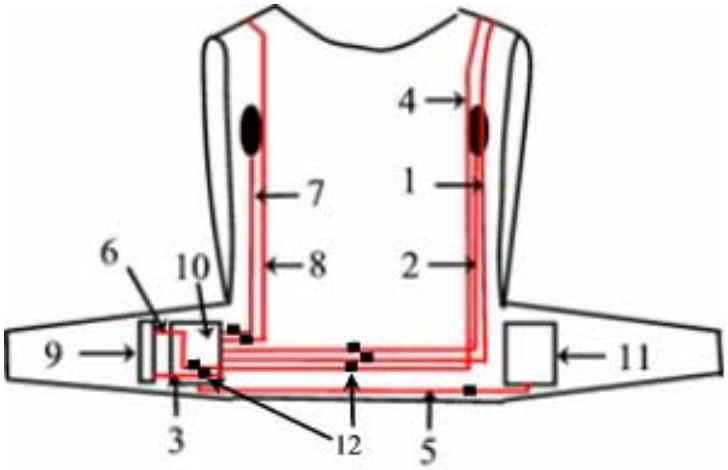
4.4.4 VoidCheck_modes(Void);

This function checks what mode the wearer is in and which of the timer flags have been enabled, and sets LED and Speaker outputs accordingly. The function also checks for some Control inputs specifically no SFX mode and European mode.

4.4.5 Void main (void);

Every iteration through main a global register called timer is incremented. Get_pulses function is called and depending on the value of the timer register sets or resets the global timing flags. Main then checks the most common inputs and determines what mode the wearer is now in. If the mode has changed, reset all function is called prior to the Check_modes function.

4.5 SIGNAL LIGHT VEST



1. Right Front Lamp wire
2. Right Back Lamp wire
3. Right/Hazard Switch wire
4. Speaker wire
5. Power Connection wire
6. Left/Yield Switch wire
7. Left Back Lamp wire
8. Left Back Lamp wire
9. Manual Switch Panel
10. Main Controller
11. Battery Box
12. Connectors

The Signal Light Vest consists of four signal lamps; front left and right, back left and right that are connected to the Main Controller by number of ribbon

cables. In addition there are four switch controllers and a speaker connected to the main controller. The system is comprised as described below:

- The Signal Light Vest is made with a mesh fabric and waterproof waistband. The colors and fabric is specially selected to provide more visibility for safety and breatherbility that would provide comfort to the wearer.
- The waistband is made with waterproof fabric to protect the Main Controller and maintain the specific temperature inside the Main Controller.
- Inner side of the Vest consists of two long panels that runs the specific ribbon cable through to the Signal Lamps.
- The waistband consists of a pocket with a Velcro element that would house the Main Controller.
- The waistband also consists of a removable pocket that house the Battery Box which can be detachable for the purpose of recharging the batteries.

4.6 LEDYS SYSTEM OVERVIEW

The LEDYS system consists of six main modules, which can be further broken down into different subsystems. The six main modules are:

- Main Controller
- Lamps (printed circuit boards with several different color LEDs positioned in clusters.
- Manuel Switches
- RF Remote Controller
- Battery Pack and the Charger

4.6.1 MAIN CONTROLLER

The subsystems that make up the Main Controller are:

- Micro Controller (Pic16F872)
- Speaker Amplifier
- Input/Output Connectors
- Specialized Input Switches
- Remote RF Receiver and its components

The Main controller performs several essential tasks:

- Sends appropriate signals to the lamp units and speaker via the main ribbon cable.
- Monitors the specialized input switches (large push-button switches) in real time for any change.
- Allows for different modes via configuration switches.

Main controller was designed to be flexible, allowing for any future additions or modifications to be easily integrated.

4.7 SIGNAL LAMPS

There are four signal lamp modules inserted to the Vest;

- Front left and right
- Back left and right

4.8 SIGNAL LAMP CONNECTIONS:

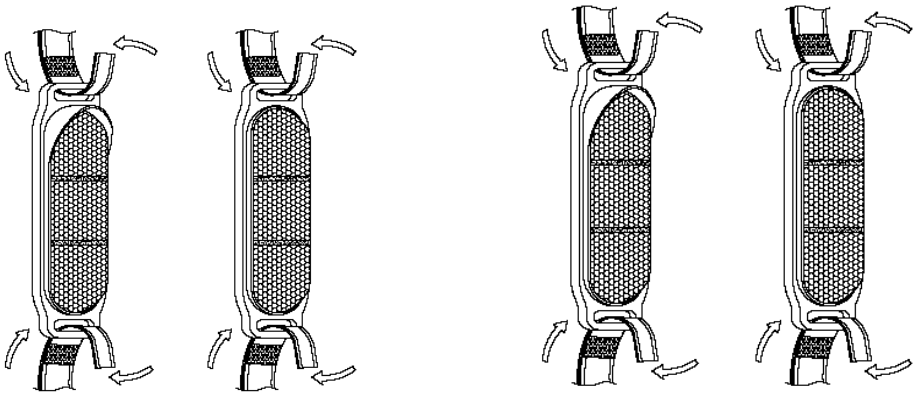
Each lamp module is directly connected to the Main Controller by ribbon cables. These cables individually run through the binding for the following reasons:

- To protect wires getting bent and damaged.
- For better interior appearance of the Vest..

4.9 LAMP COMPONENTS

- The lamp modules are cluster of LEDs controlled by surface mount transistors acting as switches. All biasing resistors and current limiting resistors are onboard the lamp modules. Each lamp is connected to the main controller by ribbon cables, which is able to be removed for replacement.
- The lamp modules are divided into two different sub systems, (1) Front Lamp modules, and (2) Back Lamp modules.

FRONT LAMPS **BACK LAMPS**



Each Front Lamp module consists of:

- 2 White LEDs – 4000mcd each
- 4 Yellow LEDs – 3000mcd each
- 2 White LEDs - 8000mcd each

Each Back Lamp module consists of:

- 4 Red LEDs – 1800mcd each
- 4 Yellow LEDs – 3000mcd each
- 4 Red LEDs – 1800mcd each

4.10 LAMP COLORS

- The Signal Lamps consists of different colors: (1) Front lamps are White, Yellow, White (2) Back lamps are Red, Yellow and Red.
- It is important to note that these light colors are not permanently fixed colors. They are changeable according requirements of any relevant standard and regulation of any state, country or purpose. This has been specifically described in the Patent applications. For example; for the police force, the one of the white and one of the red light would be changed to a blue light.

5. THEORY OF OPERATION

The Main Controller Module controls all the Lamp modules and the signals sent to the speaker. It also monitors in real time the specialized Input switches and Control switches. The push button switches are the specialized input switches, the push button switches in the Main Controller holder are the Control Switches. The LEDs user controls which "mode" he/she is in either by pressing one of the specialized input switches on the side of the vest or by pressing one of the control switches located on the Main Controller. The different modes determine what sound effects will be played on the speaker, and which LEDs are going to be switched on/off and how often.

It is important to note that toggie switches in the Main Controller and software in the system are designed that the LEDs are able to change the flashing system either by intermittent manner or Steady On. This would provide an opportunity to program the software according to specific needs of each state or countries regulations, since some countries would not allow flashing lights.

5.1 Primary Modes

5.1.1 *Yield Mode*

The default mode. This mode is designed to make the wearer more visible, while using as little power as possible. There are no sound

effects associated with this mode. This mode will use when rider is moving.

Flashing system: Front top white and bottom white LEDs

Back top red and bottom red LEDs

5.1.2 *Right Turn Mode*

This mode clearly signals that the wearer intends to turn right. The turning sound effect is activated when in this mode.

Flashing system: Front right yellow LEDs.

Back right yellow and red LEDs.

Back left red LEDs Steady On.

Front white LED steady On.

5.1.3 *Left Turn Mode:*

This mode clearly signals that the wearer intends to turn left. The turning sound effect is activated when in this mode.

Important to note that the left turn sound effect is different from the right turn sound effect.

Flashing system: Front left yellow LEDs.

Back left yellow and red LEDs.

Back right red LEDs Steady On

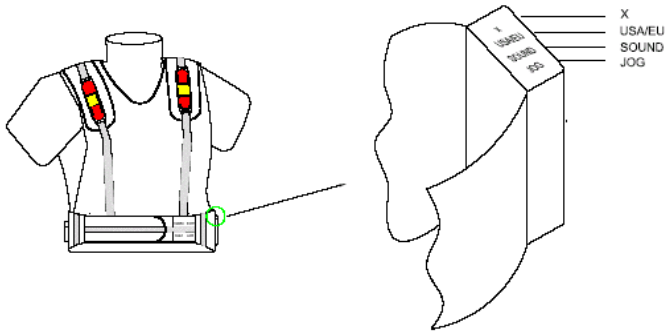
Front Yellow LED Steady On

5.1.4 *Hazard Mode:*

This mode signals the use in heavy traffic or emergency situations. The hazard sound effect is activated when in this mode. However, the sound effect is able to be switched off from the " SFX" mode in the main controller control switch if necessary.

Flashing system: Front white and yellow LEDs Back red and yellow LED.

5.2 Secondary Modes



5.2.1 "X' Mode

All white and red lights remains Steady On.

5.2.2 "USA/EU" mode

EU mode stops the red LEDs from flashing and would be Steady On when the system is in Yield mode. When the USA mode is activated, the top white, red and white lights flash in an intermittent manner. These modes are activated only by the Control Switches. In certain states in USA and certain countries the flashing red lights are only permitted to indicate emergencies.

5.2.3 - "SFX mode"

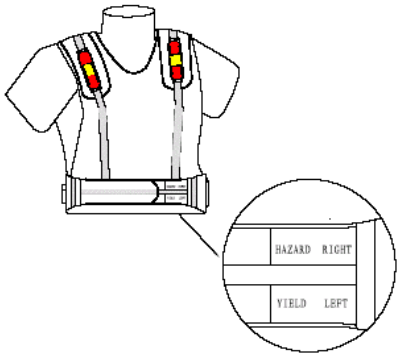
This disables all sound effects in all modes, conserving power, this mode can only be activated by the Control Switch.

5.2.4 "Jogging Mode"

This mode is specially designed for joggers.

It is important to note that the LEDYS system is designed that at any time the flashing system is able to be re-programmed according to the requirement of any state or country.

5.3 MANUAL SWITCHES



The manual switches are located near the Main Controller pocket on the waistband of the Vest. This provides access to the same signaling function as the Remote Controller. The system is specially designed for non-bicycle riders, and taking into consideration that if at any time the Remote Controller malfunctions the rider is able to switch back to the Manual Switches for safety reasons.

Manual switches are one of the specialized input switches that will immediately put the micro controller into the switch target mode. If the micro controller is already in the switches target mode, it will stay in the current mode. The user will have to press a different mode specialized input switch to return to a specific mode.

6. REMOTE CONTROL

The Remote Control hereinafter called RC is designed in a manner that the RC is able to be removed from the bicycle and worn on the wrist of the user. This would provide flexibility for non bicycle riders such as In-Line skaters, skate boarders to wear the system and operate the system with the Remote Controller as well.

The Remote Control system covers the minimum performance requirement for low power radio frequency operating band 315 MHz. The specifications are as follows:

Working Frequency: 314MHz

Transmit Power: >10mW

Modulating Mode: ASK

Received Sensitive Degree: > 100uV

Availableln: > 2m

Main Controller

Voltage: 3.0V-4.2V

Battery Discharge Time: >10hours

Working Temperature Range: -40℃- +55℃

6.1 Theory of operation Remote Controller

- "Y" button - Yield Signal
- "H" button - Hazard Signal
- "R" button - Right Turn Signal
- "L" button - Left Turn Signal

7. SPEAKER AMPLIFIER SUBSYSTEM

The micro controller produces a logic output used to control a surface mount NPN transistor which effectively amplifies the signal. This amplified signal is fed through the speaker to create sound.

The resistor should be placed in series with the speaker to allow volume control and power consumption limiting. The value of this resistor can only be determined upon selection of speaker and volume required from speaker. With no resistor, the circuit operates at maximum volume but is quite inefficient.

8. BATTERY HOLDER AND BATTERY PACK

The subsystems that make up the Battery Holder and Battery Pack are:

- Battery Holder for 3.7 V 1800 mAh Li battery.
- Battery charger.

8.1 Battery Holder

The battery holder is single module that provides a reusable safe and effective power supply designed specially for the LEDYS system. The battery holder consists of a circuit and two indicating lights Red and Green that would indicate low battery power, also charging signals.

8.2 Low Battery Power

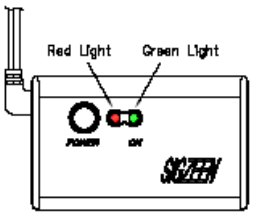
The system is designed giving the wearer the ability to recognize the low battery power prior to the LED lights being completely shut off.

- The Green light indicates batteries are fully charged.
- The Steady Red light indicates the batteries are in low power.
- The flashing Red light indicates batteries to be recharged immediately.

In addition following effects would be seen in the system when the battery power is low:

- All the LED lamps illuminate on the Vest and remain Steady ON.
- The user will not be able to operate any signal functions. However, illumination of all the lamps provides safety and visibility for the rider.

9 SIGZEEN LI BATTERY PACK



The battery pack is designed with one Li battery (each 3.7V 1800 mAh) held in one sealed plastic wrap that shall be recharged while the batteries are in the battery box holder.

10. BATTERY CHARGER

The Li battery charger is a single module that provides a safe and effective power supply designed specially for the LEDYS system. This module was designed to be easily connected to the battery holder jack. The battery recharging circuit uses a high efficiency switching current source to charge one Li batteries held in one sealed plastic enclosure. The batteries will take approximately 5-6 hours to recharge.

11. MANUFACTURER'S EXPERIENCE

The LEDYS system is being manufactured in China. Since the Signal Light Vest consists of three different components, different manufacturers who are experts in each field have been selected. However, one single leading manufacturer who are experts in electronic components of the LEDYS system has been selected to complete the Vest, packing and delivering the product. Following are the manufacturer's experience.

- Electronic Component and the Remote Controller
- Battery and Battery Charger
- The Vest

12. LEDYS SYSTEM

The single main manufacturer who are manufacturing the electronic component have worked with this Signal Light Vest project from the development stage for the past 2 years and have a good understanding of past and existing issues. It is important to note that this manufacturer has experience of the product quality required by the Western and European markets. Following are some of the existing customers.

13. LABELING

The signal Light Vest shall be provided with clear indication labels.

- Fabric contains label
- Washing instructions
- Warning label
- Remote Control label

Note: Warning label is permanently sewn on to the inner phase of the waistband indicating that the person using the Signal Light Vest must use existing legalized hand signals. If at any time the user is not aware of the signals, they must obtain information from the local transportation branch. This is specially stated to give priority to existing legalized hand signals. In addition two wrist bands are provided for more visibility to other drivers when the rider is using the hand signal.