**Purchase Specification**

**for a**

**15” Radar Speed Sign**

1. **Overview**

Each 15” radar speed sign shall consist of a display enclosure that houses the LED boards, controller, radar, Bluetooth, and shall be available in DC or AC power options. Each 15” radar speed sign shall include a static sign mounted to the display enclosure. The 15” radar speed sign shall be pre-wired to the maximum extent possible. The 15” radar speed sign shall conform to all MUTCD provisions contained in Chapter 2L Changeable Message Signs for color, dimensions, and layout and Chapter 2B.13 for speed limit regulatory signs.

1. **Mechanical Specifications**

The display enclosure and static sign shall be constructed from .09” (2.3mm) aluminum. All batteries and electronics shall be mounted in the display enclosure.

Display enclosure shall be a non-sealed, ventilated NEMA 3R type design. Internal components shall be easily accessible with removal of four or fewer external fasteners.

Display enclosure shall be comprised of modular components that are field-replaceable without removal of the sign from the mounting post. The static sign, display window, radar unit, controller board, fuse block(s) and fuse(s), LED display boards, AC power supply, and battery shall also be field-replaceable.

Display enclosure shall not exceed 26.5” (67.3cm) in width and 19.5” (49.5cm) in height. The depth of the display enclosure shall not exceed 7” (17.8cm).

Display enclosure shall be constructed to absorb impacts from thrown objects or vandalism attempts. Display window and LED boards shall deflect inwards up to 2” (5.1cm) without damaging internal components. The LEDs shall be protected by the polycarbonate window upon deflection.

Display window shall be made of ¼” (6.35mm) minimum thickness shatter-resistant UV-protected polycarbonate.

15” radar speed sign shall be designed with LED safety masking to reduce driver distractions introduced by the radar speed display. The display view shall be limited to the forward viewing angle approximately 30° from the roadside.

15” radar speed sign shall have optional integrated strobe(s) which shall be powered and triggered from the display’s controller at a speed threshold from 5 to 99 mph (8 to 99 km).

The display enclosure and AC power box fasteners shall be NCHRP 350 crash test approved with the use of AASHTO or FHWA approved break-away base.

Display controller shall be reverse polarity protected.

Static sign shall adhere to MUTCD requirements of 6” increments and shall be 30” (76.2cm) wide by 42” (106.7cm) high with 15” (38.1cm) display digits. An optional 30” (76.2cm) wide by 30” (76.2cm) wide shall also be available.

Static sign and display shall not exceed 37 lbs. (16.8 kg) with internal AC power supply.

Static sign letters, “YOUR SPEED” or other regulatory text, shall be printed in two lines using approximately 6” high letters. The sign background surface shall be fluorescent yellow-green, yellow, orange, or white high intensity sheeting or equivalent.

An optional “SLOW DOWN” message shall include LED characters approximately 6” high, and shall be available in either yellow or red LEDs.

Display alignment shall be easily adjusted, without exchanging internal parts, to work on the center median, left, or right side of the roadway.

Display shall be a seven-segment design for maximum digit recognition. A full matrix or 13-segment design is not acceptable.

Each display segment shall consist of 16 discrete LEDs of approximately 15° to 17° viewing angle. LEDs shall be individually aimed to within +/- 2° of each other to concentrate light distribution within the drivers viewing area and to provide consistent cut-off of the display at the edge of the viewing cone.

Display design shall have a 1” black border around the LED sections, and shall have very high contrast between LEDs and their immediate background, to maximize visibility in direct sunlight, fog and night time conditions.

Display window shall have clear LED windows and a black surround matrix of less than or equal to 25% reflectance in accordance with the MUTCD, to maximize viewing contrast in all lighting conditions.

Display must not use anti-glare sheeting that would reduce the display’s visibility and contrast.

Non-illuminated portions of the seven segments display must not have visible “88” ghosting when a mix of on and off segments is displayed or in direct sunlight.

1. **Mounting**

Mounting hardware for the 15” radar speed sign shall be available for the following configurations:

* 2.5” – 3.5” OD Side of pole
* 4” – 6” OD Side of pole
* 6” (and greater) OD Side of pole
* Flat surface

Various mounting configurations shall not require specialized tools for installation.

1. **Configuration**

15” radar speed sign programming software shall maintain settings and schedules indefinitely. The software shall have the capability of data collection for speed, date, and vehicle count.

An optional traffic analysis software shall access the data collection and report on the date, speed and time of the vehicle, the number of daily vehicles, average daily volume, posted speed, average speed, vehicles within user-specified percentiles (typically 50th and 85th percentiles), and percent compliance. The software is also capable of filtering and windowing data for analysis.

Display shall have the following speed threshold programming capabilities: minimum displayed speed, flashing digits in excess of pre-set speed limit, flash rate increase with speeds over the set threshold, and high-speed blank-out threshold. Display digits shall flash at a rate from 120 – 150 FPM, increasing as speed increases.

Optional “SLOW DOWN” message shall display at a preset speed threshold. The display shall alternate between the driver’s speed and “SLOW DOWN” until the high-speed blanking threshold is met, and then only “SLOW DOWN” is displayed.

Data collection function shall have the capacity to record over 200,000 individual data points which include date, time and speed.

Data shall be formatted as a .csv file that can be imported into other traffic analysis tools.

15” radar speed sign software shall allow programming, data downloads and diagnostics to be accessible via Bluetooth wireless link to a Windows-compatible computer, and shall have the following display diagnostics:

* Test the real-time connection to the sign
* Run a test sequence that initiates a display digit roll-up test to verify the sign is operating properly.
* System voltage check, to validate the DC power source
* Validate real-time vehicle count to determine if data is being collected and radar is operational
* Ability to verify and update to new firmware version

The sign shall be capable of displaying numbers from 1 to 99 with optional display in miles or kilometers per hour if requested.

The sign shall be capable of displaying the numeric readout value within one second of detection of a vehicle and shall hold the detected speed for approximately one second after the vehicle passes outside the detection area and return to standby mode with a blank display when no vehicles are present.

The maximum display brightness shall be factory-selectable to allow for special local lighting conditions.

The display shall have the option to trigger up to two external 12-volt devices at different speed thresholds or be controlled by time of day to support integration of external flashers or other devices.

The 15” radar speed sign shall have the capability to integrate with third-party hardware and web-based applications for remote settings control, scheduling, and monitoring of solar panel voltage, battery voltage, median detected speed, communication events and errors.

1. **Solar Panel System**

The 15” radar speed sign shall be offered with one 50-watt, 80 watt, or 170-watt 18-volt solar panel supplied with mounting hardware and bypass diode. Nominal voltage shall be 12 volts.

The solar charge controller must provide 4-stage battery charging via pulse width modulation (PWM) and shall have the following features:

* Temperature compensation
* Low-voltage-disconnect (LVD) – to prevent complete battery discharge
* Battery, state-of-charge and battery fault LED indications
* Reverse polarity, short circuit, and over-voltage protection

The charge controller must also be impervious to water and dust ingress and have an operating temperature range from -40°C to 60°C (-40°F to 140°F).

The controller shall meet all requirements of Underwriters Laboratories UL 1741 and must be Class B Part 15 FCC certified.

The solar controller shall be connected to the solar panels and batteries inside a weather proof (NEMA 3R or better) enclosure in natural aluminum or light color paint to reflect sunlight for increased battery life.

1. **Battery System**

The battery cabinet shall house one 35 Ah, 55 Ah or 100 Ah sealed 12-volt valve-regulated AGM lead-acid maintenance-free battery. The battery shall be equipped with a fast-acting 7-amp cartridge fuse on the positive lead.

The battery, in conjunction with recommended 15” radar speed sign performance, shall be designed for a demonstrable service life of 5 years.

The operating temperature range of the battery shall be -40 to 161˚ F (-40 to 72˚ C)

Batteries shall be readily available from multiple suppliers and non-proprietary.

1. **AC Power**

 AC powered signs shall be capable of operation from 100-240 volts/47-63 Hz power.

At maximum power draw, display shall not exceed 20 watts if operated on AC.

Fluctuations in line voltage within normal limits shall not affect luminous intensity of the display.

**8.0 Operational Specifications**

Radar device shall meet specifications for an FCC part 15 Low Power Device - 24.150 GHz (K-band) and shall not require an operating license.

The radar shall have a reporting accuracy of ±1MPH and shall be set to detect approaching vehicles only.

Radar shall operate on voltages from 10.5VDC to 16.8VDC and shall consume less than 1/3 amp at 12VDC, typically <1/10 amp.

Sign display at maximum brightness shall consume less than 6.5 watts maximum of DC power; with a typical power requirement of 3.5 watts and shall consume less than 1.75 watts in stealth mode (collecting data but no display); shall consume less than 0.95 watts in standby.

The system shall use an ambient brightness sensor for nighttime dimming and apply any optionally-enabled intensity adjustments.

1. **Solar Simulations**

Detailed solar simulations shall be provided as evidence that the 15” radar speed sign is capable of meeting the performance requirements at a specific location. Solar Simulations shall be composed of three calculations: Energy Balance, Array-to-Load Ratio (ALR), and Autonomy. The manufacturer or bidder shall provide a detailed analysis of these three calculations in an” Energy Balance Report.”

Monthly average sunlight (insolation), night length and temperature data for a specific, declared location shall be from recognized public sources such as the NASA Atmospheric Sciences Data Center. All sources shall be cited exactly and accessible online without cost to allow verification of the data.

**Energy Balance**

During a normal 24-hour cycle of operation, a solar-powered 15” radar speed sign will take energy in from the sun and consume energy through the flashing of the display, general quiescent power draw and optional strobes, beacons or other devices. Energy Balance refers to the evaluation of these energy values to determine overall system sustainability and resistance to variances in sunlight and activation load.

Energy Balance compares Energy-In and Energy-Out. Calculations shall be performed for the “Worst Month” of the year where worst month is determined by the lowest value of Energy-In divided by Energy-Out.

**Energy-In**

Energy-In is the total amount of sunlight energy in watt-hours *available* to the 15” radar speed sign over a 24-hour period. Energy-In is available to operate the 15” radar speed sign, charge the batteries, or both. Energy-In shall be determined as follows:

Insolation X Panel Wattage X Shading X charging efficiency X Battery charge acceptance

* The energy from the solar panel shall be based on available solar radiation at the installation location for the panel’s inclination angle. The solar radiation (insolation) values used shall be for the worst-case month of the calendar year.
* Shading from nearby trees, buildings or other structures unique to a particular location are to be factored-in and the calculations shall clearly show and justify the de-rating of the solar panel energy input. A photograph showing the sun’s path and obstructions it encounters shall be included.
* Batteries shall be returned to full charge by sunset at the end of each day.

**Energy-Out**

Energy-Out is the total amount of energy in watt-hours consumed by the 15” radar speed sign in a 24-hour period of normal operation.

Energy-Out is the sum of quiescent and operating loads, measured in watt-hours, in all circuitry over 24 hours, including:

* Solar charge controller quiescent draw
* Radar “detection mode” and idle quiescent draw
* System controller quiescent draw when no vehicles are being detected
* System “active” load when vehicles are being detected and display is active – in both day and night modes.
* The simulations shall clearly detail both the number of sign display activations due to vehicle volume, and beacon or third-party device load variations based on scheduling.

**ALR (Array-to-Load Ratio)**

System Array-to-Load (ALR) ratio shall be calculated as: Daily Available Energy-In divided by Daily Energy-Out as defined above.

15” radar speed sign solar simulations shall be calculated demonstrating a minimum Array-to-Load (ALR) ratio of 1.2:1 (1.2)

**Autonomy**

Autonomy is the number of days that the 15” radar speed sign can continue to operate normally in the absence of any solar charging. Autonomy shall be calculated as follows:

(Nominal Battery Capacity de-rated for Temperature minus battery capacity unavailable due to Low Voltage Disconnect) divided by (Daily total energy consumption at specified ADT or as otherwise specified)

15” radar speed sign autonomy shall be a minimum of 5 days.

1. **Environmental**

The 15” radar speed sign display enclosure and optional battery cabinet shall be rated to a minimum of NEMA 3R.

The sign shall be 150 mph (241 km/h) wind load rated when installed as specified by the manufacturer.

The 15” radar speed sign display enclosure shall meet a system operating temperature between -40 to 167° F (-40 to 75° C).

1. **Qualifications**

The 15” radar speed sign shall be FCC certified to comply with all 47 CFR FCC Part 15 Subpart B Emission requirements.

The 15” radar speed sign shall be manufactured in the USA and shall be Buy America compliant.

Manufacturer shall provide a 3-Year Limited Warranty.

The Manufacturer shall be ISO 9001 certified.

The unit shall be manufactured by Carmanah Technologies.

Manufacturer: Carmanah Technologies Inc.

Model: SpeedCheck-15 radar speed sign

Toll-Free: 1-877-722-8877

www.carmanah.com