BID SPECIFICATION FOR RADAR SENSOR

GENERIC SPECIFICATION FOR A MULTI-LANE MULTI-OBJECT TRACKING RADAR

TRUGRD (UMRR-12 Type 48) radar sensor product

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1 CONTENT

2 GENERAL

This specification shall provide the necessary product details equivalent to the smartmicro TRUGRD (UMRR-12 Type 48) radar sensor for intersection control.

This specification shall govern the purchase and installation of an aboveground Microwave Vehicle Detection System (MVDS) stop bar and advance radar detector for the detection of vehicles using a forward-fire radar sensor.

For intersection applications, detected vehicles, that can include pedestrians and bicycles, will be communicated to a traffic signal controller or other applications, as deemed necessary.

2.1 SENSOR EQUIPMENT COMPONENTS

The main components of the MVDS radar sensor system shall include but not limited to the following:

1. One or more forward fire MVDS radar sensors comprising of a fully contained and IP67 sealed unit with black radome cover with sealed rear bullet connector.
2. Each MVDS radar sensor shall have a small Junction Box (J-Box), being IP67 protected when directly attached to the rear of the radar sensor to facilitate simple connection of the branch cable back to the traffic signal controller cabinet. The J-Box shall provide surge and lightning protection for the sensor. No separate J-Box shall be allowed or splicing of cables from cabinet to sensor assembly.
3. Each MVDS sensor shall be mounted to a pole or mast arm using a stainless-steel multi-angle bracket that includes etched markings to facilitate accurate sensor horizontal and elevation angles.
4. Each branch cable shall connect to a dedicated port on a cabinet interface board (the Cabinet Interface Option, CIO) that will provide both power to the sensors and surge and lightning protection to the cabinet.
5. Sensor connection to the traffic signal controller can be achieved by one of the following:
    a. A Cabinet Relay Option (CRO) DIN Rail mounted circuit board assembly providing direct wiring of the sensor to the detector rack or input file for TS-1, 170, or 33X or other type of traffic signal cabinet configurations.
    b. A Traffic Management Interface Board (TMIB) that shall be capable of communicating to TS-1 or TS2-2 type traffic signal controller via open collector outputs and TMIB-C 4-port expansion cards, or a Traffic Management Interface Board (TMIB) that shall be capable of communicating to TS2-1 type traffic signal controller via an SDLC Bus interface.
6. Configuration software to enable setup and commissioning of the MVDS radar sensor system.
7. Configuration of the above components will require a laptop or personal computer capable of supporting either serial RS485 or Ethernet communications.

3 SENSOR DESIGN AND OPERATIONAL CHARACTERISTICS

The MVDS radar sensor shall operate in the 24GHz frequency range as permitted by local rules and regulations. The radar sensor system shall have the required FCC Part 15, NEMA, or EU/EN certifications, as applicable for use in a commercial/traffic cabinet environment. The manufacturer shall provide all relevant certificates and test reports for inspection and validation of sensor/cabinet equipment.

3.1 ANTENNA DESIGN

The main components of the MVDS radar antenna design sensor shall include but not be limited to the following:

1 Shall consist of 2 x TX and 8 x RX channels operating simultaneously and not in a rotating sequence. The frequency range within the 24GHz band should be no more than 250MHz and the average EIRP transmit power shall be no more than 20dBm under normal configuration.

2 Shall allow for forward-fire operation for detecting of both approaching and receding traffic simultaneously. Up to 10 lanes should be possible.

3 Shall allow for both stop bar and advance detection simultaneously with an advance detection range up to 300m (1,000ft) line of sight. All detection shall be on a lane by lane and/or by vehicle classification basis.

3.2 RADAR SENSOR DESIGN

The main components of the MVDS radar sensor design shall include but not be limited to the following:

1 Shall be a Doppler-based radar sensor that measures range, radial speed, horizontal angle, reflectivity and additional parameters of multiple stationary and moving reflectors (targets) simultaneously. Shall detect up to 512 moving and stationary targets.

2 Shall be able to track objects with x and y position, absolute velocity, heading range, length and be individually assigned an object identifier.

3 Shall operate on a Linux-based operating system using an 8-core Processor.

4 Shall detect moving objects with direct unambiguous measurement in one single measurement cycle up to at least -216…+216km/h (-134…+134mph), optionally extendable to -320…+320km/h (-199…+199mph).

5 Shall track up to 256 objects within the radar's beams field of view simultaneously.

6 Shall be able to detect passenger vehicles up to 260m (853ft) from radar location.

7 Shall be able to classify 7 classes: Pedestrian, Bicycle, Motorbike, Passenger Car, Transporter, Truck/Bus, Long Truck.

8 Shall be capable to detect stationary objects.

9 Shall track objects lane by lane over the length of the radar beam.

10 Shall track and refresh all detected objects every 100ms, optionally 50ms.

11 Shall have an attitude sensor on board that can directly measure pitch and roll angle of the sensor when mounted on a pole or gantry.

3.3 SENSOR DETECTION ZONES AND OUTPUTS

The radar sensor system should exhibit the following user operational characteristics:

1 The sensor should be able to support a minimum of 32 detection zones.

2 The sensor shall be able to support up to 64 output channels per sensor.

3 The sensor shall have a configurable Event Trigger mechanism for each zone for:

a. Presence detection
b. Speed detection
c. Estimated Time of Arrival (ETA)
d. Vehicle class
e. Wrong way driving
f. Queue Length Estimation (QLE)
g. Custom trigger – combination of above events.

4 The sensor shall be able to map detection zones to output channels in any type of configuration (one to one or one to many).

5 The sensor shall be able to support the configuration of lanes lines to follow the curvature of the actual road to optimize lane by lane detection.

6 The sensor shall be able to define channel output extend, delay, and pulse functionality.

7 The sensor shall be able to minimize or mitigate adjacent lane or cross traffic detection through the placement of polygons or areas of no interest to be excluded from detection movement.

8 The sensor shall have fail-safe capabilities that can detect RF interference, pitch and roll misalignment, rain or snow, and other sensor blind conditions that would otherwise impact the radar sensor's performance. Upon detection of one or more of the preceding conditions, the sensor shall provide configurable outputs to the controller to signal that the controller should fall back to fixed-timed programming, on a sensor by sensor basis.

4 SENSOR PHYSICAL PROPERTIES AND ENVIRONMENTAL CHARACTERISTICS

The MVDS radar sensor shall be designed to operate as a maintenance free device requiring no adjustment or cleaning during normal use.

4.1 PHYSICAL PROPERTIES

1 The sensor itself shall not exceed 212.6mm x 154.6mm x 40mm (8.37in x 6.08in x 1.57 in) in its physical dimensions.
2 The sensor shall not exceed 1,290g (45.5oz) in weight.
3 The sensor shall have a black radome cover and sealed to IP67.
4 The sensor shall operate between -40°C and +80°C (-40°F and +176°F) ambient temperature.
5 The housing shall be anodized aluminum to minimize effects of corrosion and increase surface durability.
6 The sensor shall have a 12-pin plug Hirose LF10WBRB or similar bayonet-type connector on the rear backplate.
7 The sensor shall display all relevant and valid FCC regulatory information including serial number, hardware/antenna assembly revision information on a label mounted on the sensor rear.
8 It shall be possible to mount a protective shield over the sensor radome to minimize influence of raindrops, snow, or ice build-up.

4.2 ELECTRICAL PROPERTIES

1 The sensor shall operate with an input voltage range between +7…+32VDC.
2 The sensor shall not consume more than 12W power during normal operation.
3 The J-Box or rear cable connection assembly shall have surge protection circuitry.
4 The sensor shall have both serial RS485 and Ethernet communications.

5 CONFIGURATION PROPERTIES

The MVDS radar sensor shall be configured using a separate software program product issued by the manufacturer that further enhances the operation of the sensor through definition of event triggers and traffic statistics gathering. Additionally, the sensor should have the ability to be tested for transmission compliance easily and safely.

5.1 CONFIGURATION SOFTWARE

1 The sensor system shall include a graphical user interface software program that displays all configurable attributes of the sensor beam pattern, lane lines, zones, and assigned outputs.

2 The software shall guide the user during the setup in a “guided alignment” process which includes the pitch and roll angles measured directly by the sensor and reported to the user.

3 The software shall display a 2D representation of a 3D field of view of the sensor, i.e. the pattern of the detection beam intersecting the road surface. The field of view display shall be separate for the detection range of different object classes (like pedestrians, passenger cars or trucks) to allow a comprehensive visualization of the effective field of view for a certain class of object.

4 The software shall allow the user to download scalable and optimized Google maps for the purpose of configuring the lanes and zones and sensor placement accurately to a minimum of one-foot resolution.

5 The software shall be capable of importing a scaled diagram or file depicting the intersection or target detection area via a PDF or other graphical image.

6 The software shall be capable of drawing lanes that follow the curvature of the road and allow for the placement of up to 32 zones per sensor.

7 The software shall be capable of allowing the user to map zones to outputs and assign vehicle classes independently for each zone/output.

8 The software shall have the capability of pre-defining all sensor configuration attributes without the need for the actual sensor to be present or connected. The configuration file shall be able to be saved and downloaded to the sensor later.

9 The software shall be capable of downloading firmware updates and retrieving configuration data from the sensor.

10 The software shall be capable of retrieving, displaying, and capturing statistical data from the sensor.

5.2 ALIGNMENT/COMPLIANCE TOOLS

1 The sensor system shall have an optional manufacturer-supplied Electronic K-Band Target Simulator Doppler Generator battery powered handheld device.

2 This unit shall simulate a moving target in distances of up to 100m (328ft) that can verify installation, alignment, calibration, or functional testing of the radar sensor in the field or workshop.

6 INSTALLATION, TRAINING, AND WARRANTY

6.1 INSTALLATION

1 The supplier of the radar sensor system may supervise the installation and testing of the complete system and may configure the radar sensors using the software program.

2 Upon completion of installation, adequate documentation shall be provided to the user that covers technical installation and operation guides.

6.2 TRAINING

1 The supplier of the radar sensor system shall provide adequate training to the user of the sensor system that will include installation, setup, maintenance, and operation of the radar sensor system.

2 The supplier shall provide training that should include troubleshooting techniques and regular online webinars and refresher courses of the product to include product updates and best practices.

6.3 WARRANTY

1 The supplier of the radar sensor shall provide a limited warranty (free from manufacturing defects and workmanship) for two years from the date of shipment.

2 Firmware updates shall be free of charge for the life of the sensor system that could be attributed to firmware fixes or general product updates for improved performance and functionality.

3 The manufacturer of the radar system shall operate under ISO 9001 quality control procedures. This certificate shall be available upon written request.

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