INSTALLATION GUIDE – MOVING PLATFORM

KEYWORD(S):
UMRR-11 Type 132, UMRR-96 Type 153, Installation, Moving Platform

DATE:
17. NOVEMBER 2020

STATUS:
RELEASED

s.m.s, smart microwave sensors GmbH
In den Waashainen 1
38108 Braunschweig
Germany

Phone: +49 531 39023-0
Fax: +49 531 39023-599
info@smartmicro.de
www.smartmicro.com

CONTENT

1 Mounting Positions 3
1.1 Front or Rear Mounting 3
1.2 Corner Mounting 4
1.3 Coordinate System 5
2 General Installation Guidelines 6
2.1 Material Recommendation 9
2.2 Clearances 10
2.3 Unwanted Effects 10
2.3.1 Electromagnetic RF Considerations 11
2.3.2 Indirect Reflection Paths or Vibrations 11
2.3.3 Electrical Considerations 11
2.3.4 Other Considerations 11
3 LEGAL DISCLAIMER NOTICE 12

1 MOUNTING POSITIONS

There are almost no restrictions on the type of car to be used, except that it should allow for the sensor to be mounted at a height of 0.5m to 0.8m (1.6ft to 26.3ft) above the ground for best performance. However, it is possible to install the sensor on a maximum height of 2m (6.6ft), like in a "bar" on the roof of the vehicle.

The sensor can be mounted on a vehicle as follows:

- On the front
- Behind the bumper
- On the hood
- On the top with up to 2m (6.6ft) mounting height
- Behind the windshield

Please make sure to mount the sensor the right way around. The label on the back of the sensor indicates, which side of the sensor is the top side.

1.1 FRONT OR REAR MOUNTING

The sensor should be mounted in the front on the centerline of the car as illustrated below. The azimuth (horizontal) mounting angle should be 0° and the elevation (vertical) mounting angle should be 1.5° (facing up), if the sensor height is below 0.5m (1.6ft). If the sensor height is above 0.5m (1.6ft), the elevation (horizontal) angle should be 0°.

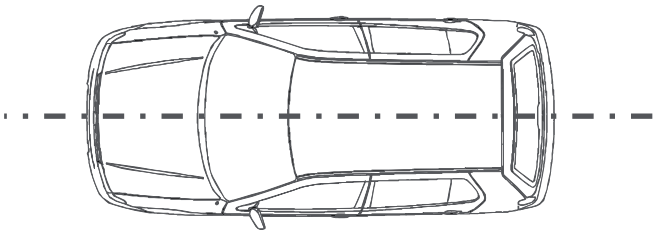


Figure 1: Centre line of the vehicle

Sensor mounting examples:

Figure 2: Behind the bumper

Figure 3: In front of air intake

Figure 4: On top of the roof

1.2 CORNER MOUNTING

The sensors can be mounted close to the corners of the vehicle.

The azimuth angle of the sensor for a corner-based application (e.g. BSD/RCTA) is usually set to 40° from the vehicle's longitudinal centreline.

Based on experience, smaller installation tolerances can be achieved, if the sensor is mounted to the bumper rather than to the chassis.

The typical sensor installation position of a corner-based application is illustrated below. The connectors of the sensors are aimed inwards compared to the longitudinal centreline of the vehicle. For smartmicro sensors, the connector outlet usually points towards the centre of the vehicle.

The mounting position (x-position, y-position, azimuth and elevation angle) is selected in the corner of the bumper in a way that the required warning area of the corner-based applications and other functions are covered.

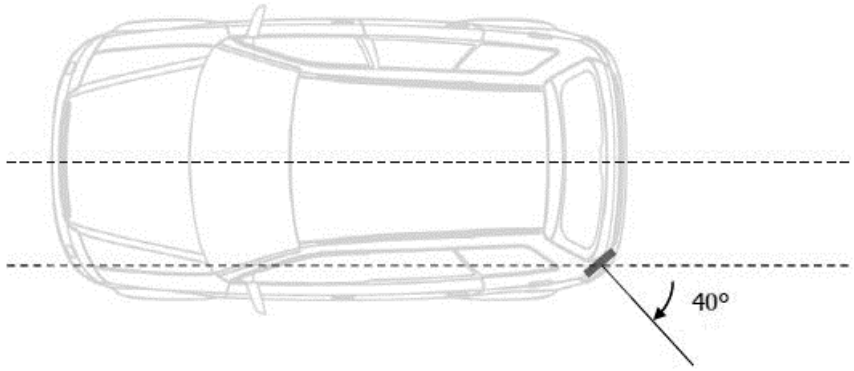


Figure 5: Typical mounting position - azimuth angle

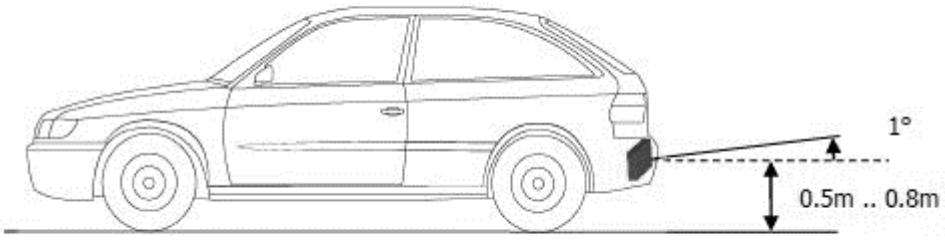


Figure 6: Typical mounting position - elevation angle

1.3 COORDINATE SYSTEM

Below, the coordinate system of the radar sensor is illustrated. The data are reported in polar coordinates. The origin of the coordinate system is the middle of the RX antenna array of each sensor (zero axis). The azimuth angle refers to the horizontal axis, whereas the elevation angle refers to the vertical axis as indicated below. All the values are provided relative to the mounting position.

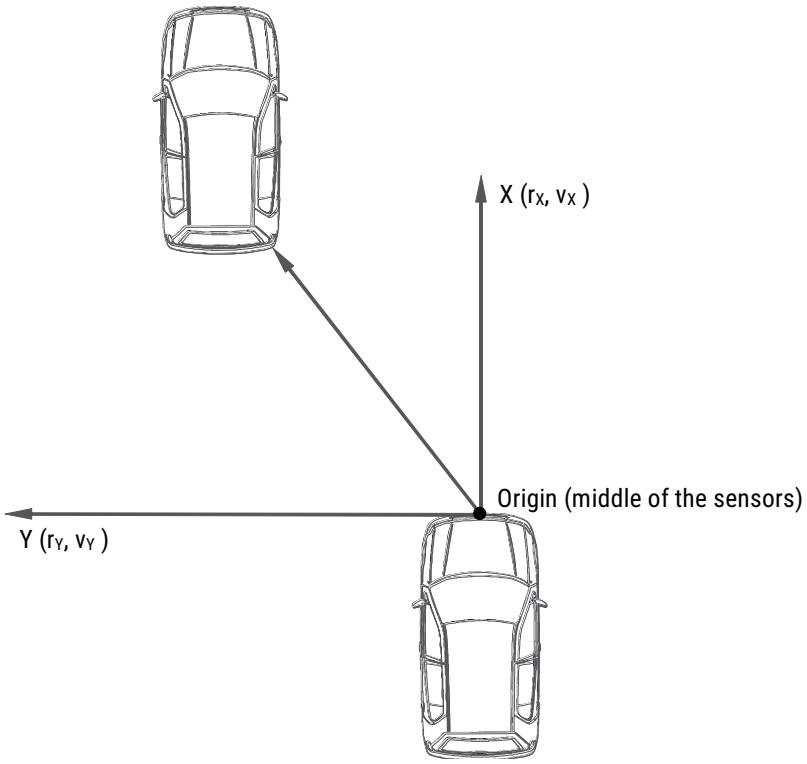


Figure 7: Sensor coordinate system

Figure 8: UMRR-11 Type 132 coordinate system
(view from the rear side in the positive x-axis direction)

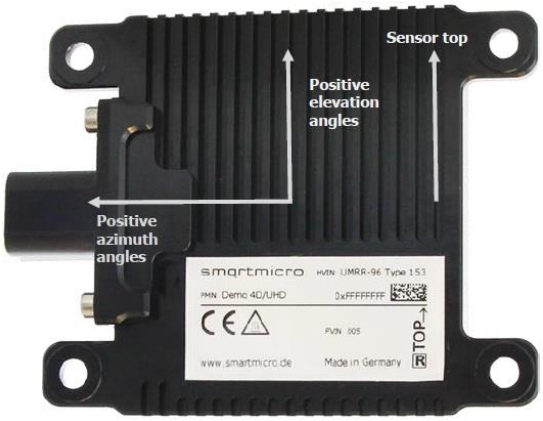


Figure 9: UMRR-96 Type 153 coordinate system
(view from the rear side in the positive x-axis direction)

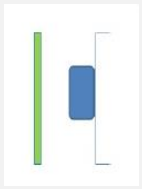
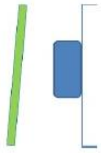
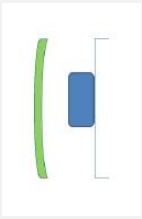
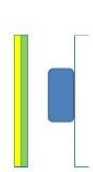
2 GENERAL INSTALLATION GUIDELINES

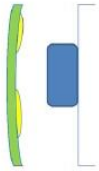
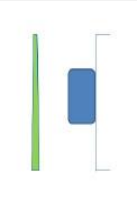
Some of the general guidelines for the sensor positions are given below:

- The bumper in front of the sensor should be as straight as possible, since each curve has an influence on the performance of the sensor.
- There should be only one layer of plastic (i.e. the bumper skin) in front of the sensor, but no second plastic part (inlay or the like).
- The bumper should consist of standard plastic material to avoid influences on the performance. The thickness of the material itself has an influence on the performance as well, so it should be as constant as possible. The material thickness of the bumper should not exceed the current state-of-art single layer bumper designs.

- The azimuth installation angle of the sensor should be as close as possible to the defined value to avoid influences on the performance.
- The elevation angle of the sensor should be as close as possible to the defined value to avoid influences on the performance and unnecessary ground reflections.

For a better overview, please note the following installation instructions:

Situation	Valuation	Description
	Ideal	A flat bumper parallel to the radome
	Good	A flat bumper and small angle between bumper and radome
	Fair	Bumper shape with large radius
	Not recommended	A double layer bumper should be avoided
	Not recommended	Decoration elements should be avoided

	Not recommended	The bumper surface facing the sensor should be smooth (e. g. rack fastening elements should be avoided)
	Not recommended	Bumper material with changing thickness should be avoided
	Not recommended	The part of the bumper facing the sensor should not be composed of two or more different materials. Also, a junction of different bumper parts should not be in front of the sensor (even if the material is the same)
	Not recommended	The part of the bumper facing the sensor should not overlap with one or more additional layers (even if the material is the same)
	Not recommended	The part of the bumper facing the sensor should have a smooth shape. It should not be shaped with bent lines

2.1 MATERIAL RECOMMENDATION

Since the material in front of the sensor can have an influence on the sensor performance, a few recommendations can be useful:

- Please make sure that no metal resides in front of the plastic radome surface
- Tested materials are:
    - Clear makrolon material of 10mm (0.4in) thickness can be placed in front of the sensor radome
    - PP materials can be placed in front of the sensor, but they are not as protective as other materials
- It is possible to paint the sensor radome but the paint needs to be chosen carefully depending on the ingredients
    - Red color, for example, may contain iron which deteriorated the sensor performance

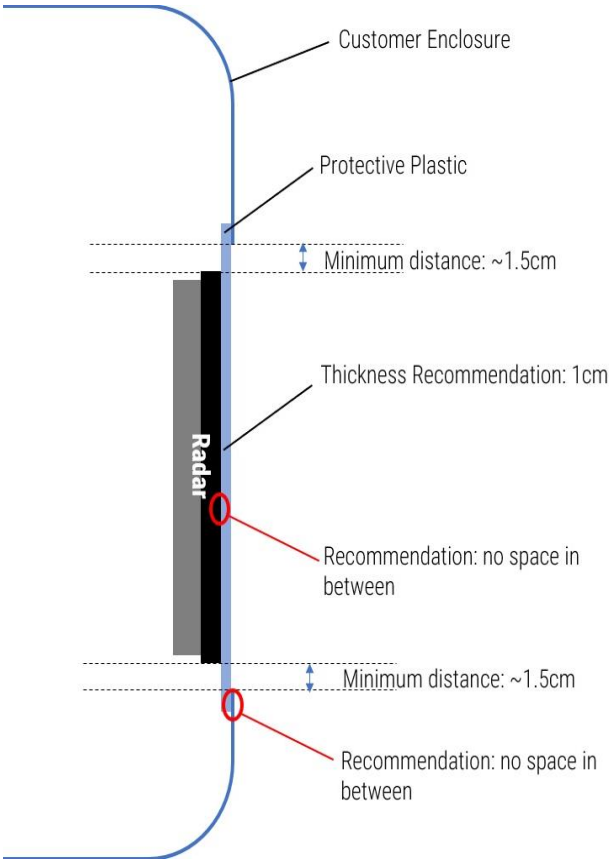


Figure 10: Material recommendation and placement overview

2.2 CLEARANCES

The space between the sensor and the bumper should be empty. Please make sure that no additional parts of the vehicle like other sensors or cables are placed in front of the sensor. The space directly around the sensor should be left empty for at least 10cm (3.9in).

Additionally, the sensor requires a free field of view of -70° to +70° in azimuth (horizontal) and at least - 45° to +45°in elevation (vertical) direction.

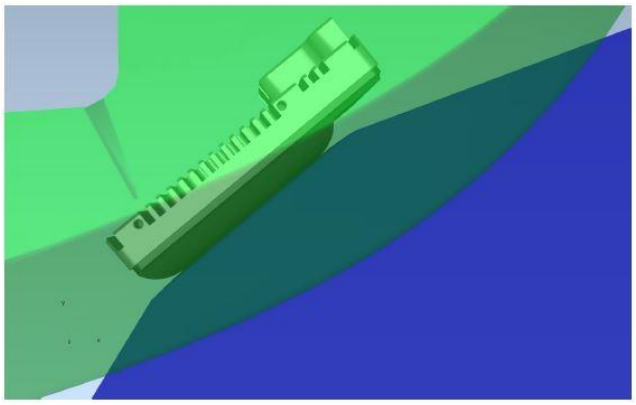


Figure 11: Example mounting position behind a bumper showing azimuth clearance (connector pointing to the center of the vehicle)

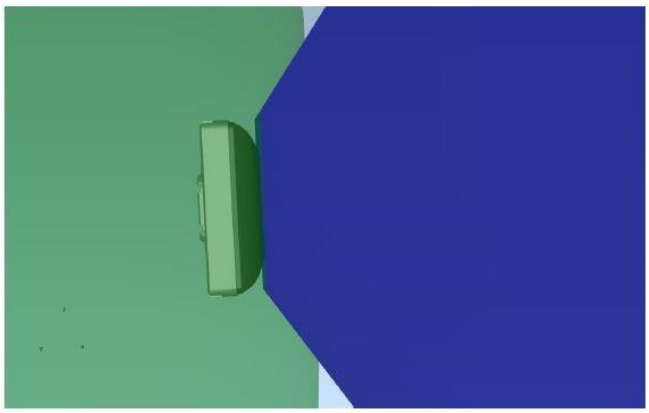


Figure 12: Example mounting position behind a bumper showing elevation clearance

2.3 UNWANTED EFFECTS

While the position of the sensor is crucial for the field of view, the sensor performance may also strongly depend upon the surroundings of the sensor. Unwanted effects due to the surroundings of the sensor and the bumper itself need to be minimized. Various influences can be distinguished as described in the following.

2.3.1 ELECTROMAGNETIC RF CONSIDERATIONS

Using EM (Electromagnetic) simulations, smartmicro analyses the effects of:

- Bumper material
- Bumper shape
- Bumper decoration

And minimizes their influence by selecting the ideal mounting position.

The paint coating of the bumper usually has a smaller influence on the sensor performance than the mounting position. As a rule, it can be said that:

- The paint should have only one layer (or one set of layers), considered a standard for vehicles.
- A second layer (or second set of layers) of paint should be avoided, as it increases attenuation and, therefore, decreases the sensor performance.
- The paint should not include an excessive amount of metal particles to avoid an influence on the sensor performance.

2.3.2 INDIRECT REFLECTION PATHS OR VIBRATIONS

The radar waves may be reflected inside the bumper multiple times like in a waveguide. Due to such reflections, moving parts inside the bumper could have an influence on the radar performance or may cause false alarms. These reflections can be blocked using “blinds” with or without RAM (Radar Absorbing Materials) attached. Changing the sensor position can be an alternative solution.

2.3.3 ELECTRICAL CONSIDERATIONS

The customer system should be designed in a way that an incorrect installation, for example accidentally swapping sensors meant for different locations, is not be possible.

Beside the necessary electrical connections (system harness) for the sensors, no other electrical components like communication bus systems, other antenna systems, live wires, etc. should be placed close to the sensor to avoid electrical crosstalk.

2.3.4 OTHER CONSIDERATIONS

Please make sure to avoid excessive temperatures, for example, the installation position of the sensor should not be close to the exhaust system of the vehicle.

Any conductive layer inside or outside of the bumper surface will reduce the sensor range and performance. Usually, conductive layers on the outside cannot be avoided, but mechanical design measures should be taken to avoid such layers on the inner surface. Modern bumper designs are (almost) closed in such a way that water, ice, snow, or other layers are not building up inside.

3 LEGAL DISCLAIMER NOTICE

This document is subject to change without notice.

The installation procedure/field test or other procedure described herein ("manual") is a mere recommendation or proposal by smartmicro for installing and/or implementing and/or otherwise using the product in generic/general applications. The recommendations and proposals contained herein are believed to be accurate as of the stated date.

smartmicro disclaims any and all liability for any errors, inaccuracies or incompleteness contained in this manual or in any other disclosure relating to the manual. In particular, the manual was designed for generic/general applications and has not been adapted to a particular/specific purpose of use of the products.

Since the installation procedure/field test or other procedure may vary due to the specific applications and surroundings, smartmicro makes no representations or warranties in relation to this manual or the information and test procedures provided herein.

The manual is provided solely for informational purposes. It is the customer's/user's own responsibility to validate that the application of the product is suitable for the customer's/user's particular/specific purpose. The installation procedure/field test or other procedure for the products may deviate from the statements made herein due to specific applications and due to specific surroundings. It is important that the customer/user invents and certifies its own installation, test or other procedures to validate the performance of the products in the particular/specific application before commercialization. Although products are well optimized to be used for the intended applications stated herein, it must also be understood by the customer/user that the detection probability may not be 100 % and the false alarm rate may not be zero. In case of uncertainties with the installation, test or other procedures, the customer/user shall consult smartmicro, a certified distributor, subsidiary or appropriate professional.

To the extent permitted by applicable law, smartmicro disclaims (i) any and all liability arising out of the application or use of the manual or product (ii) any and all liability of damages exceeding direct damages, including - without limitation - indirect, consequential or incidental damages.

Please note that the application of the product may be subject to standards or other regulations that may vary from country to country. We do not guarantee that the use of products in the applications described herein will comply with such regulations in any country. It is the customer's/user's responsibility to ensure that the use and installation of products complies with the regulatory requirements of their markets.

If any provision of this disclaimer is, or is found to be, void or unenforceable under applicable law, that will not affect the validity or enforceability of the other provisions of this disclaimer.