From
BEG-SC/EAS2

Our Reference
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Abstatt
06 September 2017

Report

Issue

Topic **Bosch Engineering MRRe14HBW user information**

Description

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2 User information

2.1 Features and mechanical design

The MRRe14HBW is a bi-static multimodal radar with four independent receive channels and digital beam forming (DBF). These technologies allow the MRRe14HBW to be configured with independent antennae for different directions, which improves the angular measurement accuracy and means that the radar's field of view can be adjusted depending on the situation.

The high level of integration of the sensor and control unit functionalities, along with the compact design and space-saving planar antennae, mean that the system can be easily integrated into vehicles.

Thanks to the robust sensor design, which does not have any mechanical moving parts and features a high tolerance for vibration, the MRRe14HBW can be used across all ground-based vehicle segments. Radome heating is available for the MRRe14HBW — guaranteeing high sensor availability, even in poor weather conditions, such as snow and ice. A mirror is available for optical sensor orientation.

The MRRe14HBW uses the frequency band of 76 – 77 GHz, which accepted for radar applications for ground-based vehicles. Thanks to its triple carrier frequency, a 77 GHz sensor requires only a third of the antenna surface of an existing 24 GHz model in order to cover the same field of view at the same resolution. This means that the sensor is significantly smaller, making it well suited to installation in compact applications. The triple frequency also supports the system when measuring speed based on the Doppler effect, producing results that are three times more accurate than measurements from a 24 GHz version.

2.2 Areas of application

Based on the hardware of the Mid-Range-Radar in the automotive industry, the MRRe14HBW has been further optimized for Off-Highway and rail applications.
Objects located in field of view of the radar sensor cause multiple radar reflections depending on the object's material, size, and shape. These reflections are evaluated internally and then transmitted as 'targets.' The sensor allows target detection in rough conditions originating from weather, view and environment.

The MRRe14HBW features the possibility to switch between two antenna configurations, a far and a near range antenna. By focusing the far range antenna on a narrow main lobe with an opening angle of ±6.0 degrees, an excellent detection range of dead-ahead objects of up to 160 m is realized.

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The use of the near range antenna results in a wide detection angle of ±42.6 degrees. The MRRe14HBW can be installed at the front, side, or rear of a machine. Therefore, with multiple sensors a large field of view around the vehicle is possible. The robust automotive sensor design with no moving parts has high vibration resistance allowing for application in the Off-Highway and rail sector.

The MRRe14HBW uses worldwide approved frequency bands for automotive applications. Therefore, Bosch Engineering is able to offer three modulation band widths of 200, 400 and 740 MHz.

- The frequency modulation of 740 MHz enables an excellent object separation capability and distance measurement accuracy.
- The 200 MHz modulation offers a higher detection range to support applications involving high vehicle speeds.

Our flexibility by switching between far and near range antennas as well as using different modulations is a tremendous benefit.

The sensor can be easily integrated into machine systems with customer-configurable CAN-IDs and baud rates. Furthermore, private and public CAN buses are available, meaning that the data output can be comfortably integrated and used in all circumstances.

Due to its benefits radar technology is fundamental for sensor fusion projects. Fusing different sensor technologies not only helps the operator, it is also a first step towards autonomous driving in the Off-Highway business.

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3 Intended use

The intended use of the MRRe14HBW is being mounted on ground based vehicles. These include but are not limited to construction equipment (excavators, dump trucks, bulldozers etc.), agriculture equipment (tractors, combine harvesters etc.), material handling equipment (forklifters, mobile industrial robots, etc.), mobile work platforms, trains, trams, light rail vehicles, boats and ships operated within territorial waters and automotive vehicles (passenger cars, trucks, busses, motorcycles, motorbikes).

4 Mounting conditions

4.1 Installation instructions for the MRRe14HBW

The MRRe14HBW is installed at the desired location of the machine. The sensor's radome normal points in the direction to be covered by the radar and the connector downwards. The outline dimensions of the sensor (without connector) are approx. 70 x 60 x 30 mm^3 (L× W× H, Category II), further details can be taken out of offer drawings.

The radome design of the MRRe14HBW is chosen to minimize detrimental absorption effects on the sensor's performance due to water droplets or film on the radome surface.

The MRRe14HBW is not released for installation behind covers.

4.2 Radar Cone

The area in front of the radar sensor must be free from any parts, except in case of integration behind a cover like radome or bumper. This area is described by the radar cone. In this area no metal parts are allowed, especially not in front of the sensor.

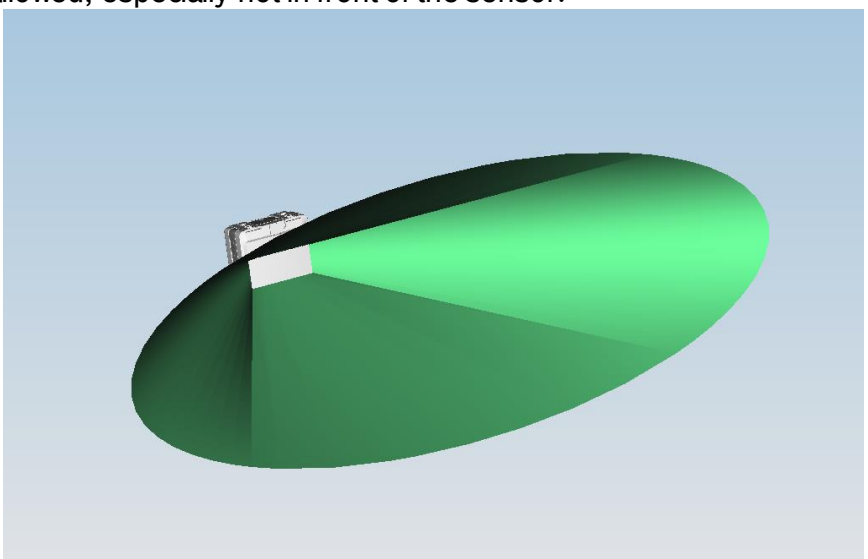

Figure 2.1 Radar Cone of the MRRe14HBW

Radar cone shape:

- Foot print on radar PCB: 23.3 mm x 49.6 mm (Category II)
- Opening angle: (Category II): +/-20° vertical and +/-45° horizontal

The radar-cones describe a “safe-area” where no detailed investigations have to be done regarding distorting interaction of machine-environment and antenna diagram (information in the following chapters has to be considered). Nevertheless, in such cases where materials locally protrude into the defined radar cones, it does not mean that the mounting position is unacceptable. In that case, further detailed investigations have to be done to verify the mounting location (investigations can be offered on request).

The MRRe14HBW is not released for mounting positions not fulfilling these requirements.

Mounting condition guidelines	
Clearance in front of the sensor of any parts, in particular metallic parts but except cover, emblem or bumper designed as an radome for covered sensor integration as described by radar cone specification	Radar cone as specified above
Recommended clearance to other machine parts: (Sensor-movement during adjustment: ± 3° vertical and horizontal is considered). The customer is responsible to avoid any mechanical stress at the MRRe14HBW assembly w.r.t. contact with surrounding parts. No vibration sources (e.g. a horn) are allowed on the same mounting structure of the MRRe14HBW .	10 mm on each side

4.3 Mounting instructions with regard to parts outside the radar cone

At parts in front of the sensor but outside the radar cone reflections occur which may cause interference signals influencing the sensor performance.

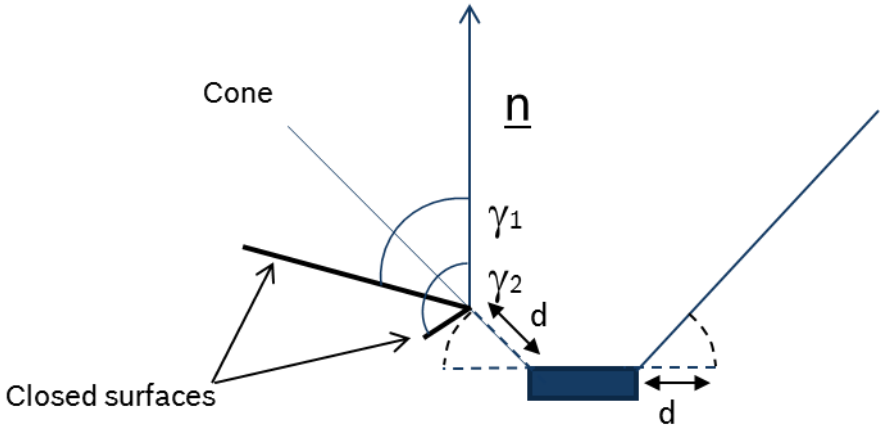

Figure 2.2 Closed surfaces (masks)

For closed surfaces (masks) in azimuth, the angle between mask surface and the normal vector n of the sensor must be in the range [55… 160] ° for parts outside the radar cone. The minimum distance d between sensor and parts outside the radar cone such as masks is recommended to be at least 10 mm.

4.4 Alignment

The sensor has to be mounted on the machine in such a way that its field of view coincides with the area desired to be monitored. For best performance, the radar can be aligned precisely with a light collecting box as used for aligning car headlights. Therefore, the mirror on the sensor subcarrier is used to measure the deviation of the mirror axis and a defined external light source and detector.

4.5 Orientation of sensor

The sensors can be mounted on a machine oriented along arbitrary directions. It should, however, be noted that the sensor's performance is superior in the radial direction than in the azimuthal direction (directions see Figure 9.1). I.e., a distance measurement is of better performance than an angle measurement.

5 Handling Instructions

5.1 General handling instructions

The MRRe14HBW is an integrated unit consisting of a radar sensor for the measurement of distance and relative velocity and a control unit for signal processing.

The MRRe14HBW can be treated similar to other ECUs.

No modifications are allowed before mounting the MRRe14HBW to the machine, e.g. pre-adjustment or removal of the alignment screws or removal of the retaining springs. In addition, the MRRe14HBW should be only carefully disassembled from the bracket and such disassemblies should be kept to an absolute minimum.

MRRe14HBW which dropped to the ground are not allowed to be mounted to machines and must be scrapped.

To avoid problems during the alignment process, any contamination of the alignment mirror (located at the radome) must be avoided.

The SCU is equipped with a pressure equalization membrane located under the type label. Damage can affect the water tightness of the MRRe14HBW. Therefore, damaged parts must be scrapped.

Although the radome is not sensitive to slight contamination such as dust, fingerprints, or small scratches, gloves should be used during the handling to avoid customer complaints due to optical defects.

The use of aggressive cleaning agents is prohibited. The use of glass cleaner is recommended, e.g., to wipe of fingerprints.

5.2 Handling instructions regarding the wiring harness connector

The connector pins are not allowed to be touched to avoid ESD related issues.

It is recommended to plug the wiring harness connector with no voltage applied in order to avoid the generation of error entries.

The proper sealing of the wiring harness connector must be assured in order to avoid the intrusion of water or humidity in the connector area.

It is not allowed to use improper tools to mount the wiring harness connector, e.g., screwdrivers.

The proper engagement of the wiring harness connector must be checked. Special attention must be paid during all mounting processes to avoid mechanical loads on the MRRe14HBW which can lead to damage.

The wiring harness has to be fixed at a maximum distance of 20 cm from the bracket.

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5.3 Handling instructions for maintenance, repair, and decommissioning

It has to be ensured that the sensor is off before maintenance, repair and disassembly.

6 Mandatory Country Specific User Manual Statements

The below mentioned countries have requirements regarding specific phrases that have to be reproduced in the vehicle user's manual.

The specific phrases and labels result from the radio type approval requirements of those countries.

The phrases have to be included in a conspicuous location in the vehicle user manual and accurately reprinted as indicated in the following sub-chapters:

6.1 USA

User manual statement according to §15.19:

NOTICE:

This device complies with Part 15 of the FCC Rules
Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

User manual statement according to §15.21:

Changes or modifications made to this equipment not expressly approved by Bosch Engineering GmbH may void the FCC authorization to operate this equipment.

User manual statements according to §15.105:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

RF Exposure Information according 2.1091 / 2.1093 / KDB 447498 / OET bulletin 65:

Radiofrequency radiation exposure Information:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

6.2 Canada

User manual statement according to RSS-GEN

NOTICE:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device must not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RF Exposure Information according to RSS-102

Radiofrequency radiation exposure Information:

This equipment complies with FCC and IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.
Ce transmetteur ne doit pas etre place au meme endroit ou utilise simultanement avec un autre transmetteur ou antenne.