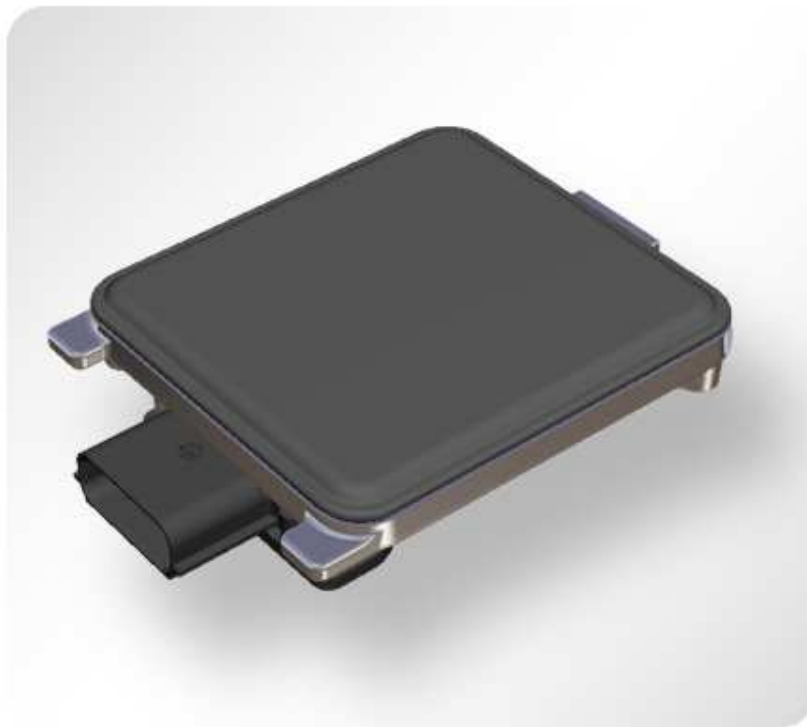


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RS 5.4 – User's Guide



The RS 5.4 is an advanced driver assistant system, to warn the driver of the ego vehicle against potential collisions with other road users to the side, to the rear and to the front of the ego vehicle.

This system is not meant to encourage aggressive driving. The absence of a warning will not guarantee the absence of other road users. Responsibility for the safe operation of the vehicle remains with the driver.

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1 Functions

The sensor is capable to detect moving object. With this recognition capability it covers the following functionality:

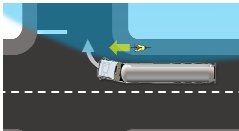
1.1 LCW



LCW (Lane Change Warning) is the feature used for recognition of target vehicles in the blind spot zone or in further distance in order to inform the driver of the ego vehicle about the safety level of a lane change. In case that a target vehicle approaches the ego vehicle in that way, that the lane change is no longer safe, a warning lamp is activated. If the driver of the ego vehicle decides to change the lane in such a dangerous situation, a warning can be given by setting the warning LED to blink.

Other HELLA terms are BSD = Blind Spot Detection and LCA = Lane Change Assistant

1.2 CTA



The City Turn Assist is the function supporting the truck driver during turning maneuvers and to keep an overview of blind spot zone of the truck.

In HELLA terminology there is a risk of mixing the abbreviation "CTA" with the Cross Traffic Alert-function, which is referring to rear cross traffic warnings. Therefore the City Turn Assist is often abbreviated as "TA".

1.3 FTA



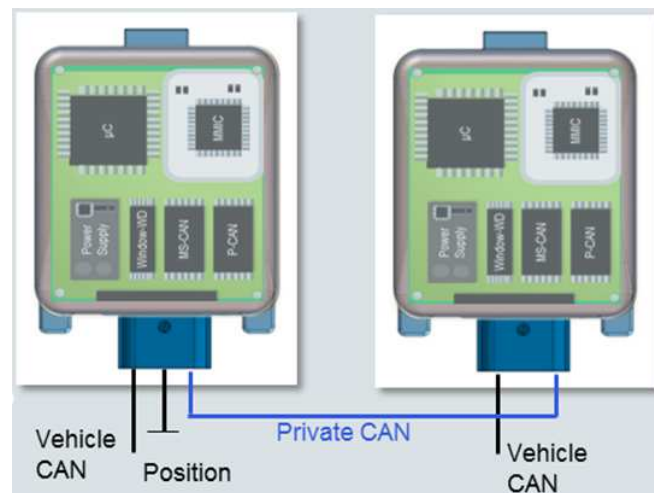
The Front Traffic Alert (also known as Front Cross Traffic Alert (FCTA)) supports the driver on traffic in front of the vehicle, which is especially helpful on the driver diverted side.

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2 System Architecture

The system consists of two or more radar sensor units which are mounted in the front or rear corners of a vehicle or on the left and right sides of a vehicle so that the respective peripheral sectors of the vehicle can be observed.

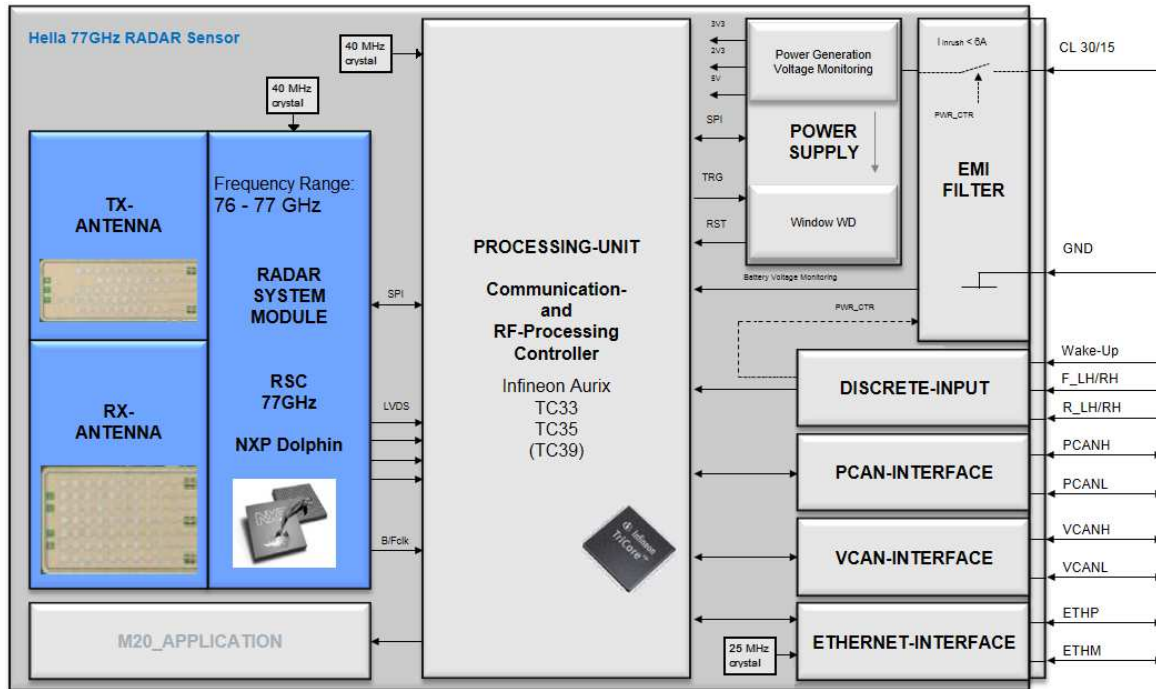
The units interchange data between each other and the vehicle via the sensor CAN-bus. All units incorporate an RF part and a microcontroller to perform the radar signal processing.



Block diagram of example system architecture.

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Block diagram of one radar sensor unit shows RF part and microcontroller part.

Each unit contains the following RF parts:

- one VCO,
- two transmitters (consisting of power amplifier and antenna)
- four receivers (each consisting of antenna, mixer, BPF and base-band amplifier).

The transmit signal is generated by the VCO. The VCO frequency is controlled by a PLL. Each transmit antenna is a microstrip patch antenna array with 1x6 elements. It is designed to illuminate a broad field of view and is thus a medium gain antenna.

The receive antennas are also microstrip patch antennas with a medium gain (each 1x6 elements). The receivers down-convert the receive signals directly to zero-IF by using the VCO signal. The base-band receive signals are finally digitized by ADCs.

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Technical Data

Supply voltage	+9 V ... +32 V
Power consumption	Typ. 4 W
Operating frequency range	76000 MHz ... 77000 MHz
Modulation bandwidth	< 1000 MHz
Modulation	FMCW (fast chirps)
Antenna feed power	< 10 dBmW average
Antenna type	Microstrip patch array
Transmit antenna gain	14 dBi
Operating temperature range	-40°C ... +85°C

Abbreviations

ADC	Analog-to-digital converter
BPF	Band pass filter
FMCW	Frequency modulated continuous wave
IF	Intermediate frequency
PCAN	Private controller area network
RF	Radio frequency
Rx	Receive
Tx	Transmit
VCAN	Vehicle controller area network
VCO	Voltage controlled oscillator
WD	Watch dog

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3 Vehicle Integration

Due to the fact that RADAR waves can penetrate plastics, the sensor integration is possible behind the bumper fascia and thus invisible from the exterior. However, the plastic and other materials which surround the sensor may cause bending, refraction and reflection of the RADAR waves. Distances, clearances, selected radii and other constructive elements in their arrangement can lead to constructive or destructive interference of the RADAR waves. In case of an unfavourable configuration of all parameters towards each other, the sensor properties can be influenced disadvantageously. For these reasons, a generally valid positioning guideline covering all possible configurations and degrees of freedom and guaranteeing undisturbed sensor properties cannot be given.

The sensors should be positioned in the vehicle at a height of 400 to 700 mm above the road surface. If the sensor is positioned too close above the road surface, increased road reflections may appear. Thus, an installation height as high as possible must be aimed for.

If the height specification cannot be fulfilled, then the planned installation height must be evaluated and agreed upon with Hella GmbH. & Co. KGaA. The amount of road reflections can for example be reduced by inserting a special additional shield below the radar sensor.

Spatial orientation of the sensors

The RS5.4 sensors can be mounted in the front, lateral and/or rear area of a vehicle under defined angles.

Examples for typical integration:

Lateral/ side integration: 85...95 deg



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Rear side integration: 45 deg (depending on required field of view)



Front side integration: 45 deg (depending on required field of view)



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4 Legal text requirements

Note: This User's Guide is not intended for the end user. The RS5.4 Advanced Driver Assistance System is not sold separately from the vehicle. All the full legal texts must be provided by the OEM in the User's Manual of the vehicle.

USA:

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

Radio frequency 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.

Canada (both English and French language required):

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (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.

This equipment complies with ISSED 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 ISSED 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 être placé au même endroit ou utilisé simultanément avec un autre transmetteur ou antenne.