REVISION HISTORY			
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002	Certification Documentation		

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SENSOR MODULE, AUTOMOTIVE RADAR, SRR, NB

FCC ID/MODEL Number: WU8NB24G1V2

ATTENTION
USER OF THIS DOCUMENT IS RESPONSIBLE FOR DETERMINING CURRENT REVISION LEVEL BEFORE USING DOCUMENT.

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1.0 PRODUCT OVERVIEW

This system is designed to provide the Blind Spot Detection, Lane Change Assist and Rear Cross Traffic warning features as defined by the ISO17387. It relies on two standalone 24GHz narrow band radar sensors located in the rear corners of the vehicle. This radar complies with the low power 24 GHz narrow band regulations (also known as low power non-specific short range or “ISM”) of most countries such as European CEPT community, USA, Canada, China, Brazil and Japan.

The sensor has two modes of operations: It operates in a Blind Spot Detection & Lane Change Assist mode when the vehicle is in forward gear or standstill and switches to a Rear Cross Traffic Alert mode when the vehicle is operating in reverse. The sensor generates three different waveforms. Blind Spot Detection is optimized for very near range detection (sub 10m), Lane Change Assist is optimized for mid-range up (70m) and Rear Cross Traffic Alert is optimized for short range detection (40m).

2.0 MOUNTING ORIENTATION

2.1. Vehicle Orientation

The sensor is mounted behind a plastic fascia squinted 50deg towards the rear.

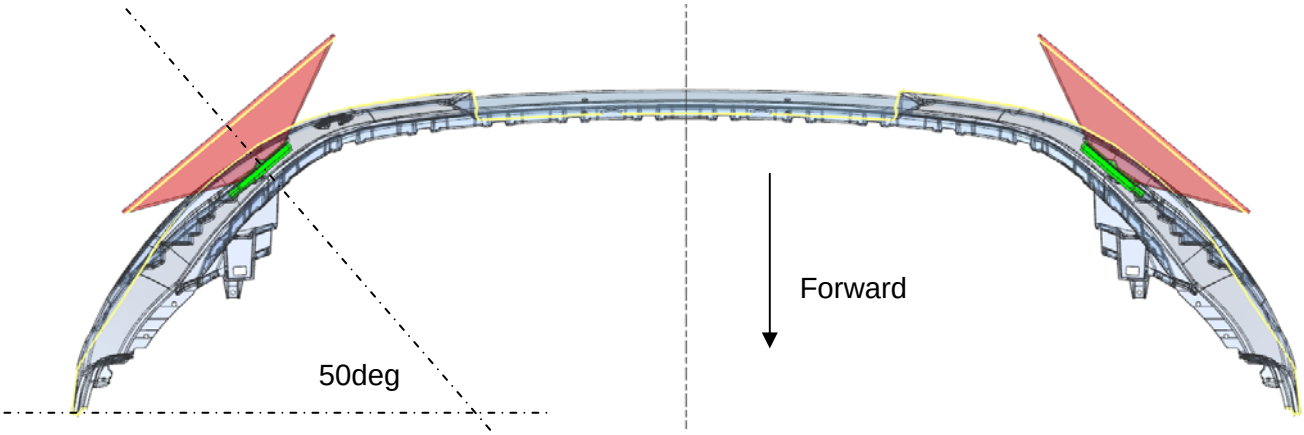

Figure 1. Vehicle Orientation

2.2. Sensor Orientation

The connector must be facing towards the rear of the vehicle and the sensor boresight is facing the fascia outwards.

Figure 2 : Radar Orientation

3.0 SPECIFICATION

3.1. Sensor characteristics

	Limits	Comments
External interface		
Operating Temperature	-40C to +85C	External Ambient temperature
Input Voltage, operating	6.0-16.0 VDC	
Input current (/power)	0.350 A max	I*V ~ constant @ <4 W
Operating Life	15 yrs.	Automotive standard
Vehicle network interface	CAN 2.0B	Automotive standard
Digital		
DSP Processor Clock(s)	30.0 MHz +/-100ppm	Internal PLL to 150MHz
Host Processor	30.0 MHz +/-100ppm	Internal PLL to 60Mhz
CAN baud rate	25 kbps to 1Mbps	Com baud rate is SW configurable
LED Drive current	40-60 mA	Short-circuit current limited (<120mA)
RF in BSD mode		
Occupied Bandwidth	24.150 - 24.250GHz (ISM)	See Type Approval Radio test report
Power Output, Transmit	+13 dBm peak	in any direction
Tx patterns – elevation	+/-11 deg	At -6 dB points
-azimuth	> -40 to +40 degrees	
Search range	0.5 m – 14 m	
Range Accuracy	+/- 20 cm	
Angle Accuracy	+/- 5 deg	Within +/- 40 deg FOV
Speed Accuracy	+/- 5 km/hr	
RF in LCA mode		
Occupied Bandwidth	24.050 - 24.250GHz (ISM)	See Type Approval Radio test report
Power Output, Transmit	+15 dBm peak pulse	in any direction
Tx patterns – elevation	+/-11 deg	At -6 dB points
- azimuth	> -40 to +40 degrees	
Search range	4 m – 80 m	
Range Accuracy	+/- 50cm	
Angle Accuracy	+/- 2 deg	
Speed Accuracy	+/- 2 km/hr	
RF in RCTA mode		
Occupied Bandwidth	24.050 - 24.250GHz (ISM)	See Type Approval Radio test report
Power Output, Transmit	+15 dBm peak pulse	in any direction
Tx patterns – elevation	+/-10 deg	At -6 dB points
- azimuth	> -40 to +40 degrees	
Search range	2 m – 60m	
Range Accuracy	+/- 50 cm	
Angle Accuracy	+/- 5 deg	
Speed Accuracy	+/- 2 km/h	
Antenna Polarization	Linear Vertical	
RF Oscillator	60 MHz +/- 100 ppm	

Table 1, Performance Characteristics

5.0 MECHANICAL

5.1. Envelope dimensions, weight and connector pin-out

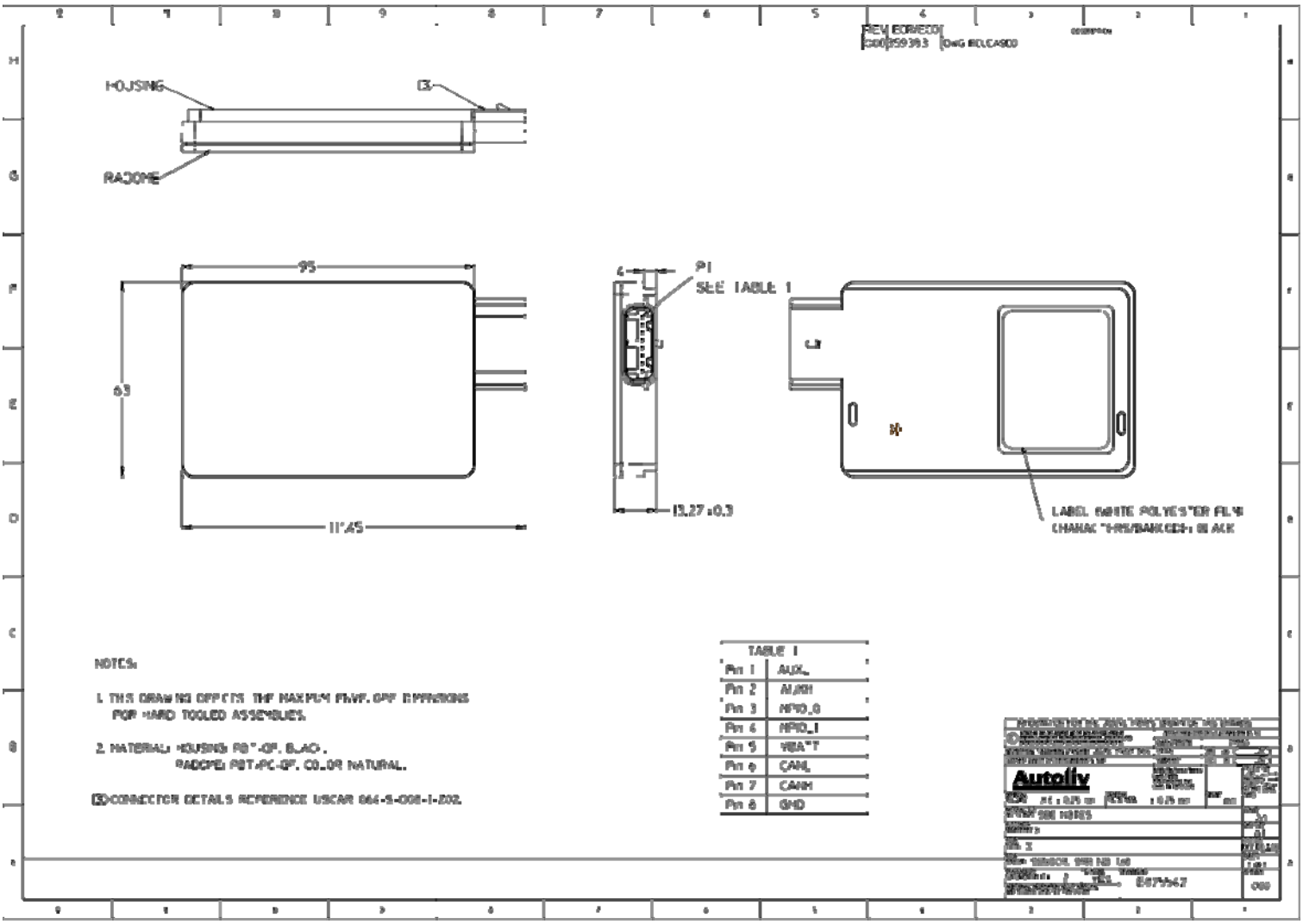

Figure 4 : Envelope Drawing

Sensor Weight: 90 grams approx.

5.2. Security protection – Tamper proof features

Sensor is sealed by LASER Welding the cover with the plastic housing during manufacturing and cannot be disassembled without permanent and visible damages to the structure. The sensor has no serviceable parts and therefore is not repairable.

5.3. Label

Find below the drawing of the label for part traceability and type approval markings. The label is attached to the back of the sensor per the drawing in Figure 5. Dimensions are in mm.

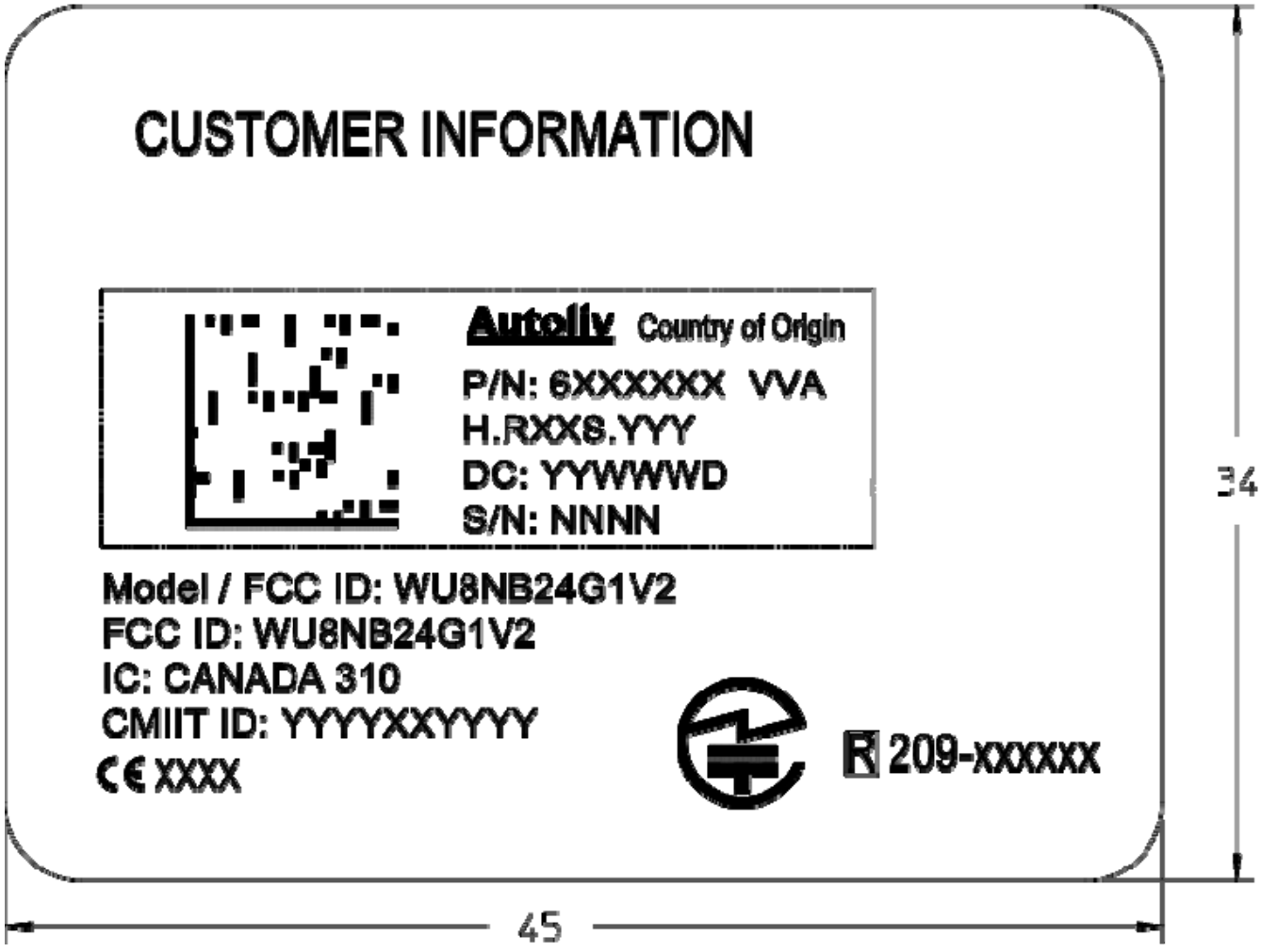

Figure 5 : Label Drawing

6.0 INTEGRATION AND MOUNTING GUIDELINES

This chapter describes the characteristics relevant to the installation of NB-SRR sensors in the bumper. In addition general specifications are mentioned, which have to be followed for each position to enable sufficient sensor performance. Therefore the following guidelines are to be observed carefully.

6.1. Attachment to the vehicle

The sensor slides in a plastic bracket. The bracket is attached either to the vehicle chassis structure or directly to the plastic fascia of the vehicle. The connector must face towards the rear of the vehicle to ensure the performance characteristics listed in Table 1.

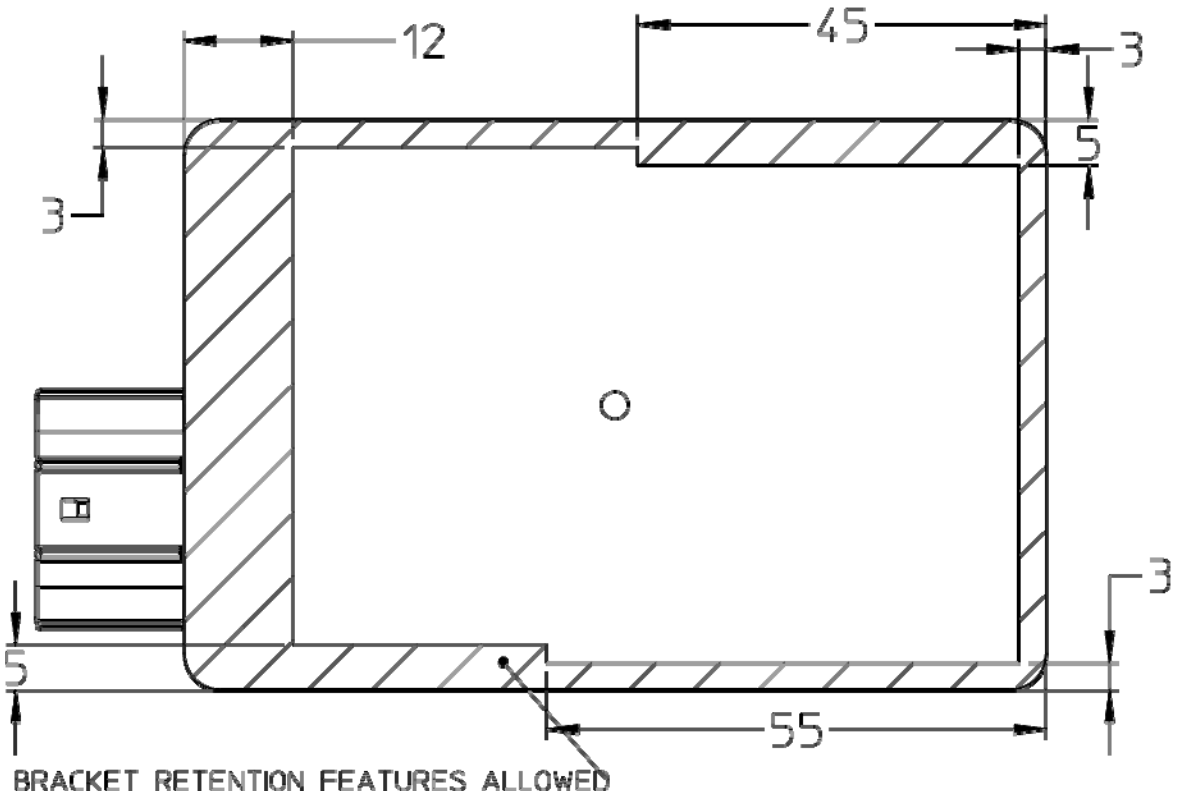

Figure 6 : Bracket Retention Features

6.2. Detection Range / Azimuth Angle Measurement Range

Figure 8 displays the detection area of the NB-SRR sensor. One should differentiate between the detection area of the sensor and the angle measurement area. The angle measurement area is reduced to ±50° around bore sight whereas the detection area is as wide as ±65° in azimuth. Within the detection area of the antennas there must not be metal parts like screws, mounting brackets, license plate etc. The impact reducing foam material, clips or fascia laminations has to be avoided in that area. The azimuth keep out zone is shown in Figure 9. If the azimuth keep out zone is not followed, then the performance of the sensor will be degraded. Consult Autoliv for guidance if the azimuth keep out zone is violated.

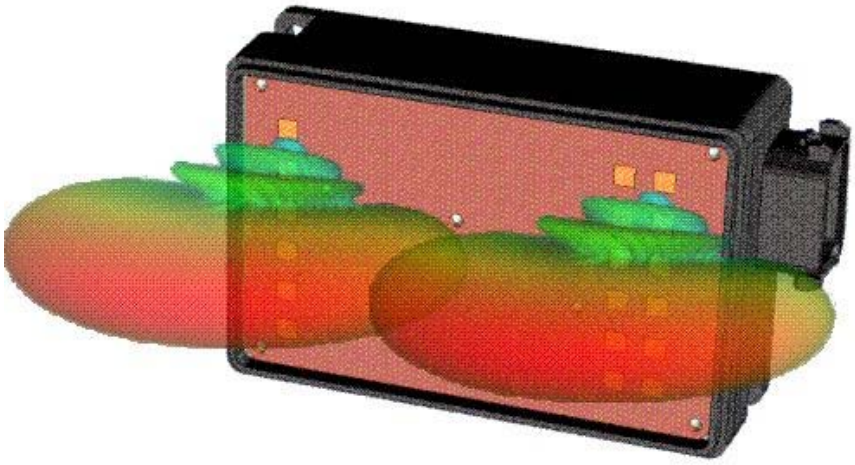

Figure 7 : Azimuth Detection zone

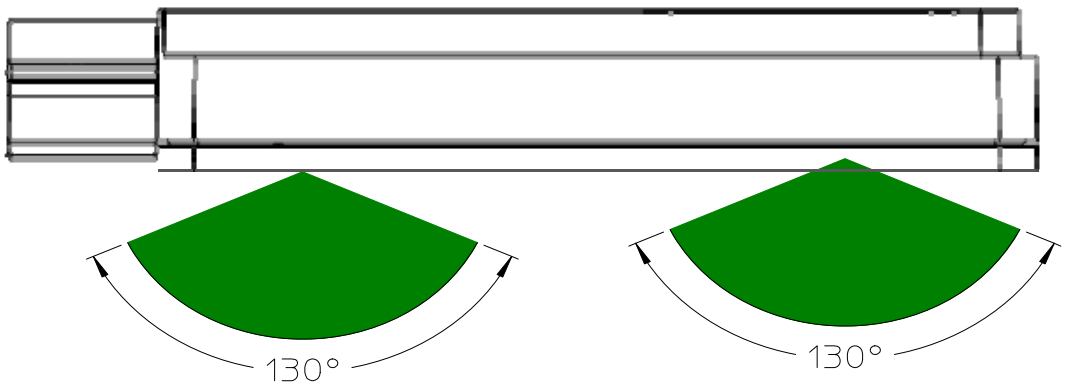

Figure 8 : Azimuth keep out zone

6.3. Detection Angle Elevation

The detection angle of ±10° is related to the 3dB points of the elevation transmit pattern; this means the area where the signal amplitude is reduced by 3dB compared to bore sight direction. To avoid close range false objects there must not be metal parts like screws, mounting brackets, license plate, etc. in an angle of ±30° (see figure 10). Impact reducing foam material, clips or fascia laminations must be avoided in this area.

Figure 11 shows details of objects keep out zone for both azimuth and elevation.

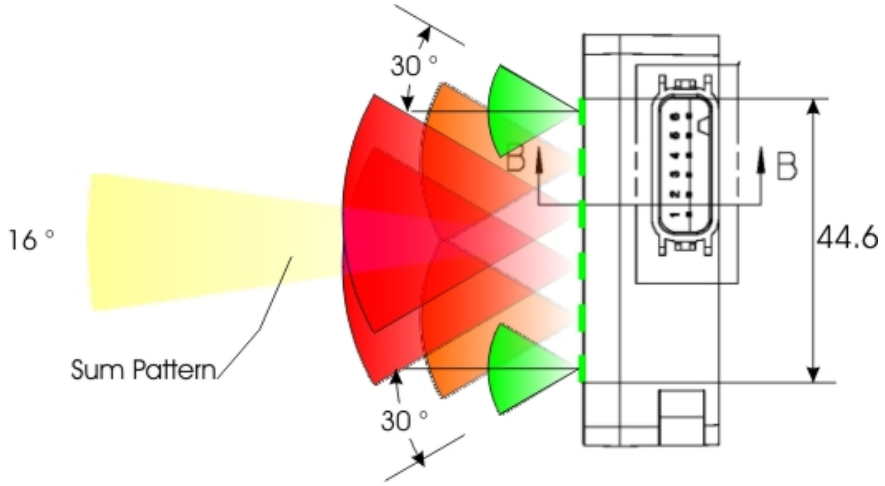

Figure 9 : Elevation keep out zone

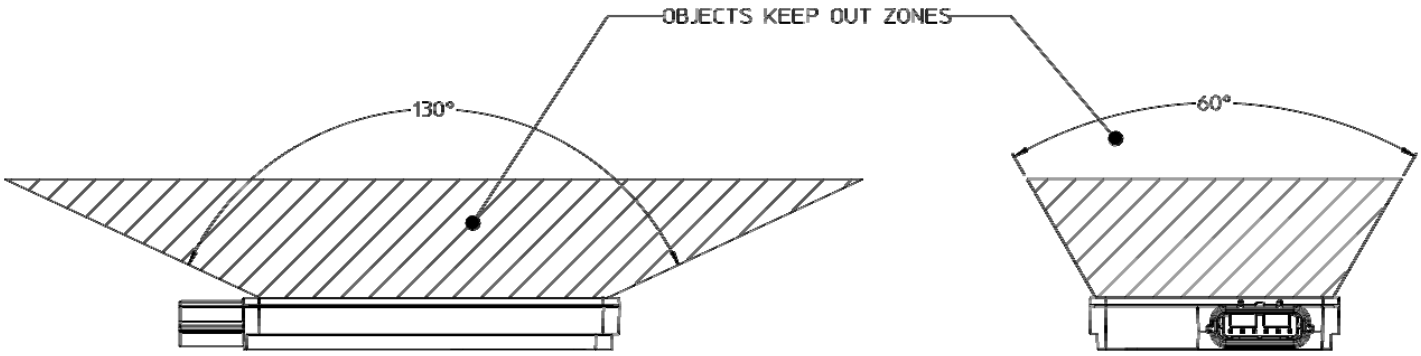

Figure 10 : Azimuth and Elevation Keep out zones

6.4. Installation Guidelines For Individual Sensors

6.4.1 Distance to bumper fascia

The distance of the NB-SRR sensor to the bumper shall be between 5 and 20 mm in front of the antennas.

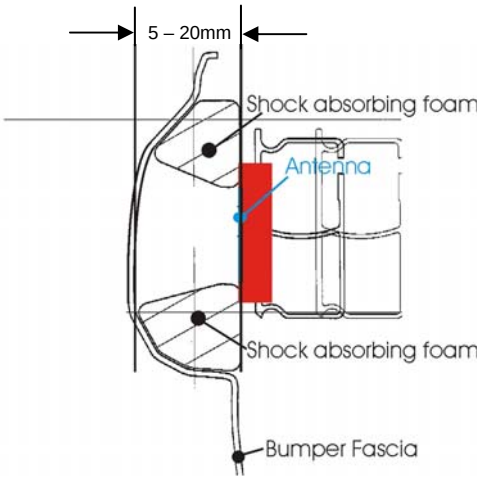

Figure 11 : Distance to bumper fascia

6.4.2 Effect Of Type- And Thickness Of Fascia Material

Autoliv has examined various fascia material samples with a thickness of 2.5 – 4 mm. For those samples, the radar signal is attenuated by 0.5 – 2 dB (corresponds to reduction of the range of coverage of 2 – 11%). Impact reducing material (foam) causes additional attenuation, especially when water is absorbed. Therefore, there shall be no impact reducing material in the antenna areas as described in 6.2 – 6.3. There shall also be no metallic parts, snap-on contacts, clips or double wall laminations in the antenna areas as described in 6.2 – 6.3.

Fascia loss effects can be minimized by proper control of the material thickness and dielectric constant. Autoliv recommends the analysis of sample materials to determine the dielectric constant and proper thickness for optimal performance. Thickness and dielectric constant must be controlled to a tolerance of ±10% max to ensure optimal performance. Please consult Autoliv with prospective fascia configurations to assess potential performance impacts.

6.4.3 Effect of the paint

Depending upon the type of paint, number of coatings, base coats used, etc., the attenuation of the radar signal due to the paint varies roughly between 2 and 5 dB (corresponds to reduction of coverage between 11 and 25%). Because attenuation has significant impact on performance, prior inspection of the material and paint samples are suggested.

Autoliv recommends the characterization of painted fascia samples to determine the radar signal loss effects. Autoliv sensor specifications assume a maximum signal loss (2-way) of 4 dB due to fascia effects. Materials and paints that exhibit greater than 4 dB loss will degrade the specified performance. As noted in 6.4.2 performance can be optimized by proper control of the fascia material thickness and dielectric constant.

New fascia, paint material or process by the OEM should be submitted to Autoliv for characterization.

6.4.4 Smoothness of Fascia in Front of Antenna

Avoid sharp vertical or horizontal character lines in front of sensor antenna. Horizontal character lines have less of an effect on sensor performance.

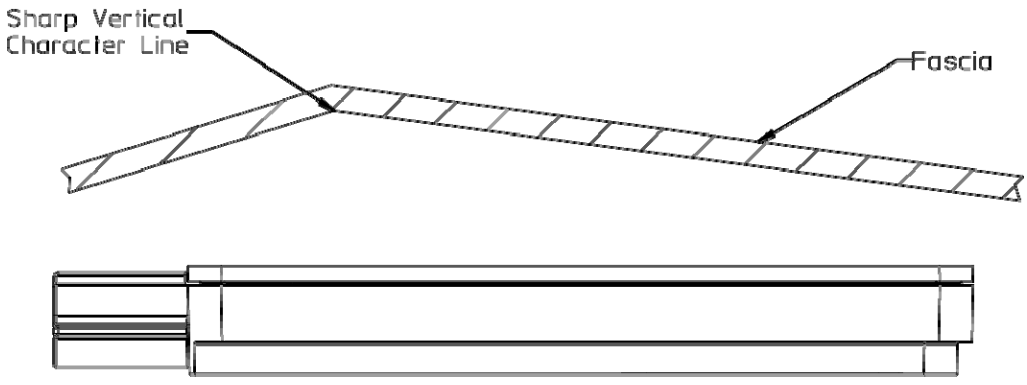

Figure 12 : Character lines

6.5. Feature installation guidelines

The sensors should be located in the optimal location for best overall coverage and range performance. The optimal locations will be dependent upon the specific application and the bumper characteristics.

6.5.1 Sensor Connector Orientation

The Sensor connector orientation must be oriented rearward.

6.5.2 Vehicle Coordinate System

Figure 8 shows the coordinate system used for identifying sensor position in a multi-sensor application. The arrows indicate positive values. The most forward location on the front bumper was selected as reference point. The Z-axis is the vertical axis. Z-values are indicated from the ground surface.

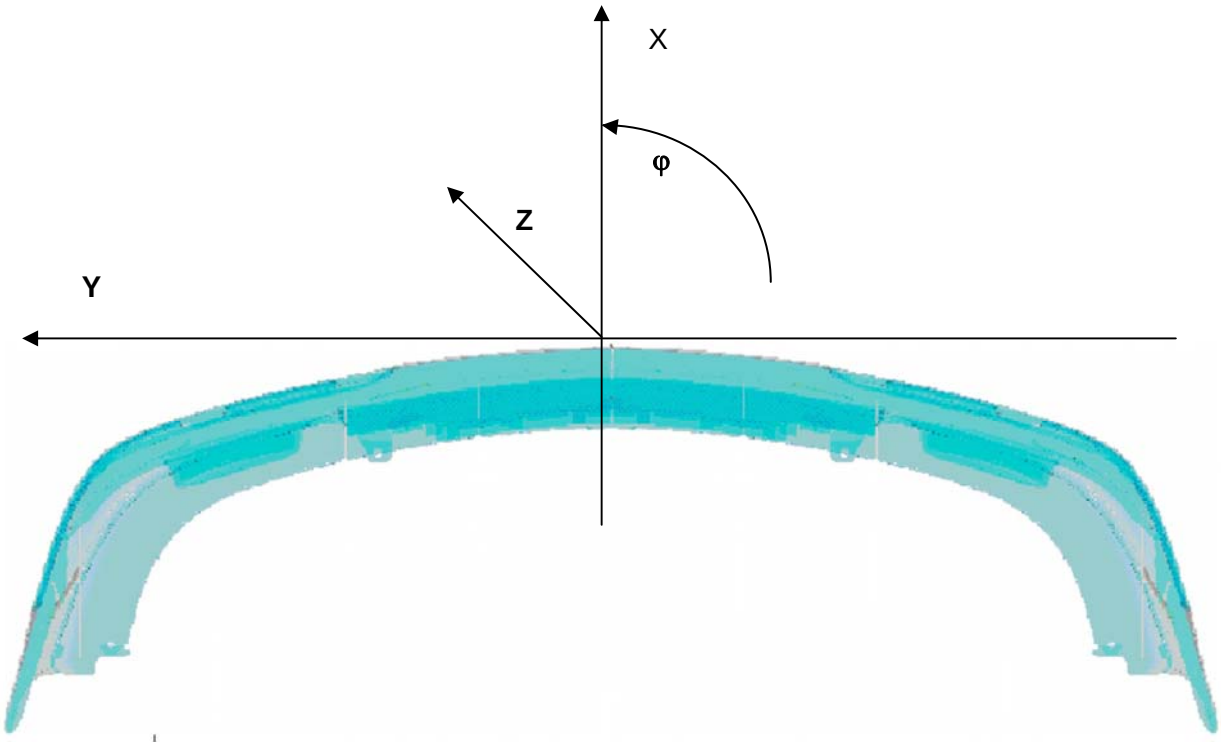

Figure 13 : Vehicle coordinate system

6.5.3 Identifying the Sensor Position

Figure 16 represents typical positions for REAR mounted Sensors on a vehicle bumper. The left and right sensors are inter-changeable and the sensors have an addressable pin in the vehicle connector that is used to logically identify the sensors position to the system. A GROUND or OPEN connection from the vehicle harness to this particular contact pin dictates the Sensor's position on the vehicle to the system. The address pin of the right sensor must be grounded while the address pin of the left sensor must remain unconnected.

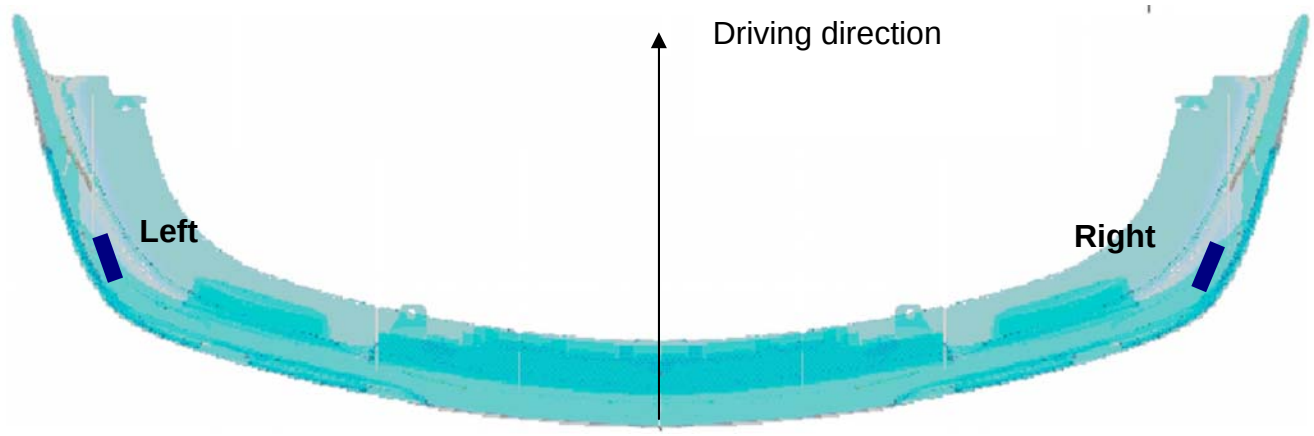

Figure 14 : Sensor position

6.5.4 Y-direction recommendation

The Y location of the sensors will determine the extent of the rear side Blind zone coverage. The location selections are highly dependent on the desired application and bumper dimensions. Bumper features (chrome trim, badges, etc.) may not allow this while maintaining the guidelines of section 5. In this case the locations should be as close to the ideal locations as possible while meeting the requirements of section 5. A measurement check is required to verify the actual installation implementation.

6.5.5 X-direction recommendation

In general, the X locations will be dictated by the contour of the bumper and the installation guidelines of section 5. However, each sensor should be located as far rearward as possible while maintaining other packaging requirements (radome to fascia B-side, angle, etc.).

6.5.1 Sensor Azimuth Angle (X-Y Plane)

Each sensor shall be angled 50° +/-1deg rearward.

6.5.2 Elevation Angle recommendation

Preferably, the elevation angle of the sensors shall be 0 deg [+1° / -1°] with respect to the ground (sensor white cover surface perpendicular (90°) to the ground).

6.5.1 Sensor Height and Elevation Angle Settings

Please follow the following table for setting the elevation angle of the Side Blind Spot / Lane change Assist sensor. The sensor shall not be placed below 500mm or above 600mm without review and approval by Autoliv.

Sensor Height from Ground	Elevation Angle	Manufacturing Tolerance
550 – 650 mm	0°	+1° / -1°

7.0 User information and Conformity to regulation

7.1. Required notice to the user in the USA for Part 15 Devices per FCC

This device complies with part 15 of the FCC Rules and is identified as **WU8NB24G1V2**.

Operation is subject to the following conditions:
1. This device must not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes and Modifications not expressly approved by **AUTOLIV** can void your authority to operate this equipment under Federal Communications Commission's rules.

RADIO AND TELEVISION INTERFERENCE

NOTE: 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.

7.2. Required notice to user in Canada per RSS-gen issue 3

This device complies with Industry Canada license-exempt RSS standard(s) and is identified with the marking IC **CANADA 310**.

Operation is subject to the following two conditions: (1) this device may 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.

7.3. Required notices to user in Japan

This device has been granted a designation number by the Ministry of Internal Affairs and Communications according to the Ordinance concerning the Technical Regulations

Conformity Certification etc. of Specified Radio Equipment (特定無線設備の技術基準適合証明等に関する規則) Article 2 clause 1 item 8 Approval n°: **202-SMAO32**

This device shall not be modified otherwise the granted designation number will become invalid.