REVISION HISTORY

Rev	Description	Date	Apprv'd
000	Initial Release per ECO 127519	Ref.	PLM
001	Update after customer review	Ref.	PLM
002	Update 5.3.1, add 5.3.8	Ref.	PLM
003	Update 5.3.1 RX Distance	Ref.	PLM

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

1.0 PURPOSE/SCOPE

This document describes the specifications for installation of type C6 Radar Sensors.

2.0 MATERIALS/EQUIPMENT

N/A

3.0 APPLICABLE DOCUMENTS

Outline see Fig 1.
DIN 40050-9 IP6K9K

IEC 68-2-6 Fc	IEC 68-2-7	IEC68-2-10	IEC68-2-11 Ka
IEC 668-2-14Nb	IEC 68-2-27	IEC 68-2-29	IEC68-2-30
IEC68-2-32	IEC68-2-38	IEC68-2-50	IEC68-2-51
IEC68-2-52	IEC68-2-56	IEC68-2-64Fh	IEC529, 13.4
SAE J1211	SAE J1812	SAE J1879	

4.0 DEFINITIONS

N/A

5.0 SPECIFICATIONS

5.1. Preface

This chapter describes the specifications to install C6 radar sensors into vehicles. These specifications shall be complied with to enable the specified characteristics of the sensors as well as the complete system. Due to the various installation situations and applications, a measurement check is required to verify the actual installation implementation.

5.2. C6 Sensors

This chapter describes the characteristics relevant to the installation of C6 sensors in vehicles. Note that there are three types of C6 sensors, each supporting various applications as follows:

C6 Mid Range Radar (24 GHz MRR)
Model # 6208428
– used for medium range applications such as Forward collision Warning.
C6 Short Range Radar (24 GHz SRR)
Model # 6221569
– used for short range applications such as ACC Stop and Go, Blind Spot Monitoring.
C6 Multi Mode sensor (24 GHz MMR)
Model # 6234448
– combined SRR and MRR functionality.

Unless otherwise stated the specifications contained in this document apply to all C6 sensor types.

5.2.1. Dimensions and Weight of the C6 Sensor

Figure 1 shows the dimensions of the C6 sensor and details the mounting of the sensor.

Please refer to Fig. 1 for the detailed drawing.

Sensor weight: 150 grams max.

5.0 SPECIFICATIONS

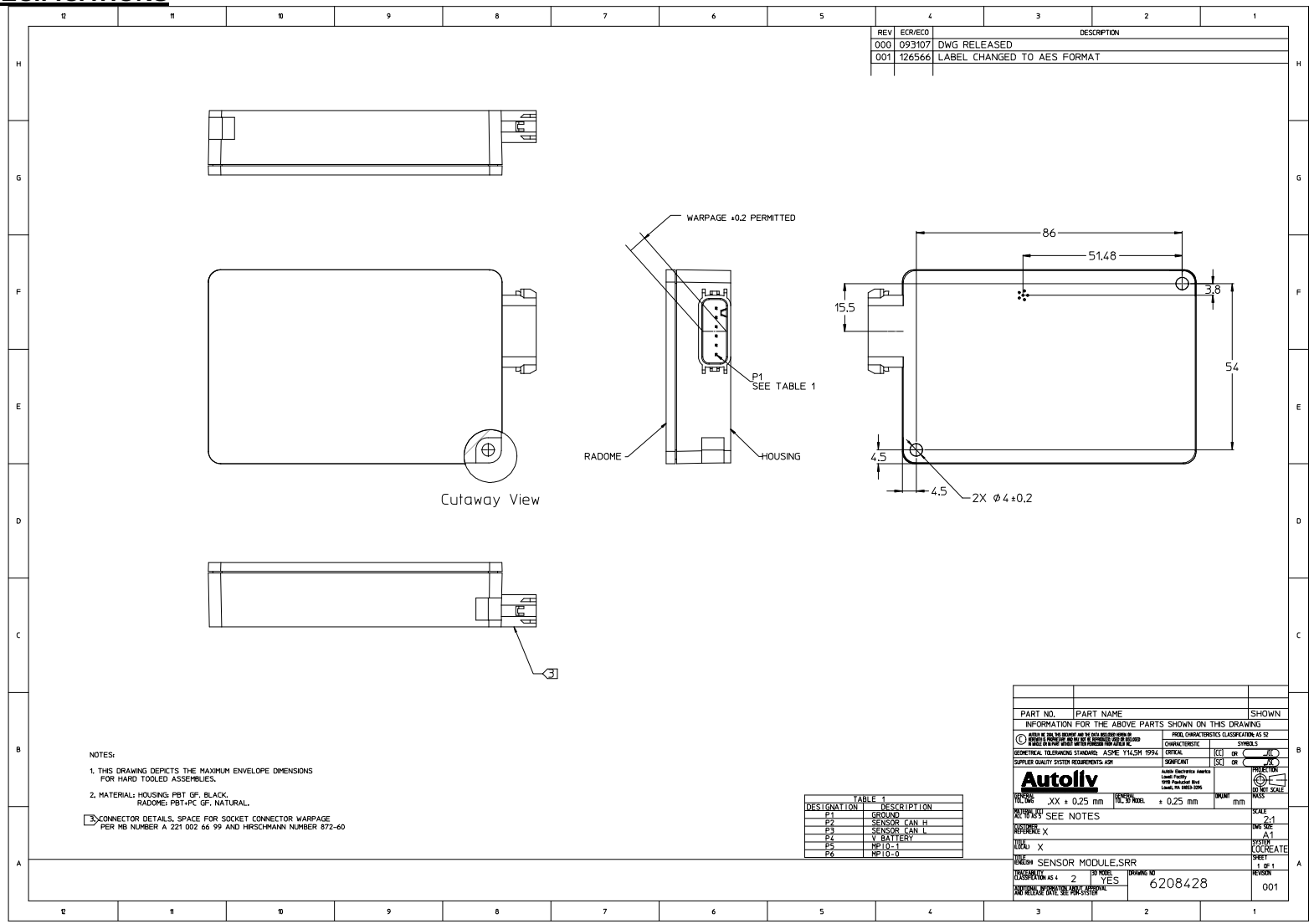

Figure 1

IMPORTANT NOTE: The two mounting holes are not specified for mounting the complete sensor. They do not provide the mechanical properties to keep the sensor in place. They shall be used to fix the sensor in a mounting bracket. Mounting tabs are to be fastened tight to mounting bracket using appropriate fastener. Maximum strength per tab is 270 N.

5.0 SPECIFICATIONS

5.2 C6 Sensor (cont'd)

5.2.2 Keep-Out Zone / Azimuth Angle Measurement Range

Figure 2 displays the keep out area of the C6 sensor.

Within the detection area of the antennas there must not be objects like screws, mounting brackets, license plates etc. The impact reducing foam material, clips or fascia laminations has to be avoided in that area.

Within the keep out zone of the antennas there must be no vertical character lines present in the fascia (see 5.3.5). Mounting bracket material shall not enter the keep out zone. Bracket retention features which interface with the surface of the sensor radome shall not enter the keep out zone noted in **Section 5.2.5**

The keep out zone in the azimuth direction is ±65°. The angle is established 7mm from the edge of the sensor.

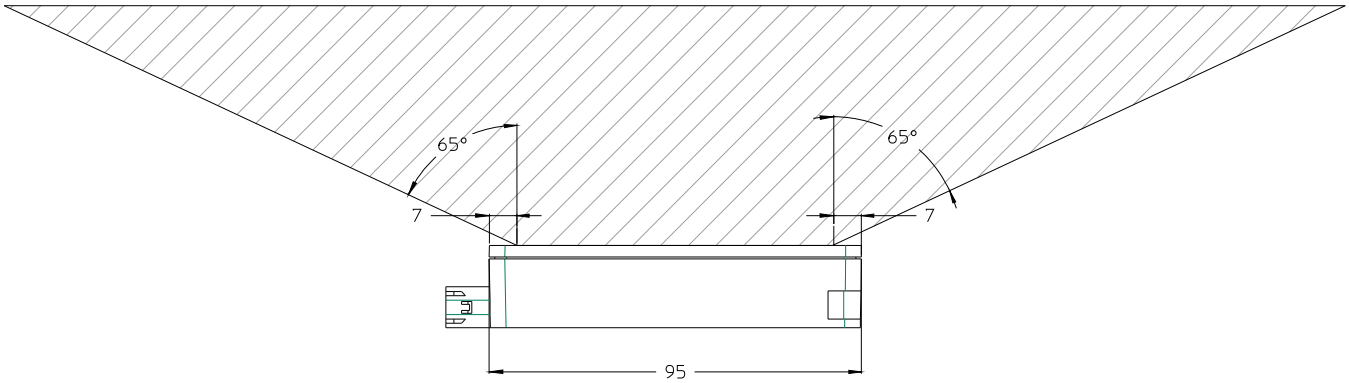

Figure 2

5.0 SPECIFICATIONS

5.2 C6 Sensor (cont'd)

5.2.3 Keep-out zone, Angle Elevation

Within the elevation keep out zone 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.

Within the keep out zone of the antennas there must be no vertical character lines present in the fascia (see 5.3.5). Mounting bracket material shall not enter the keep out zone. Bracket retention features which interface with the surface of the sensor radome shall not enter the keep out zone noted in **Section 5.2.5**

The elevation material keep out zone in elevation is ±30°. This angle is established 7mm from the edge of the sensor.

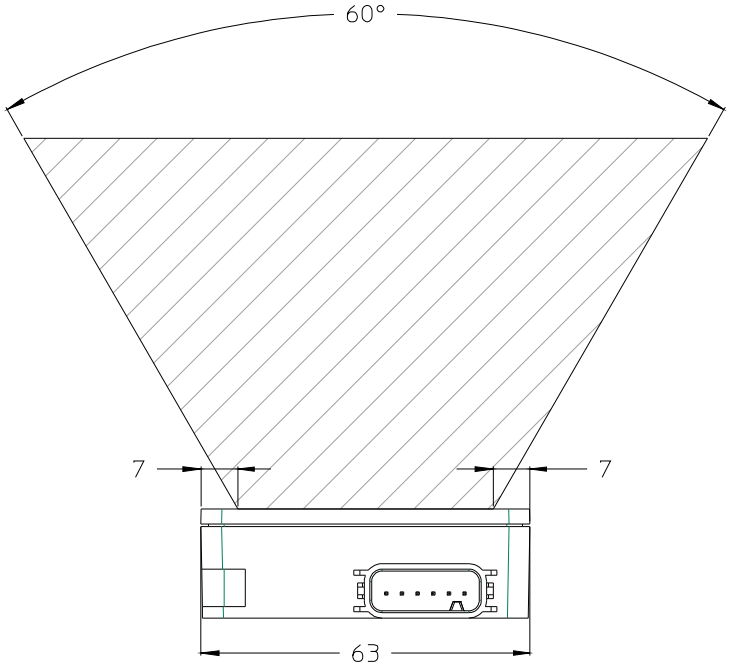

Figure 3

5.2 C6 Sensor (cont'd)

5.2.4 Section deleted

5.2.5 Bracket to sensor retention features keep out zone

Bracket retention features which are used to hold the sensor into the bracket, shall be made of non-conductive material, and protrude into the face of the sensor radome with enough overlap to overcome any variability in the bracket (ie. bracket to sensor gap, material distortion). A general guideline is to create a retention feature with overlap which is positioned in the allowable shaded area outlined below (Figure 3b).

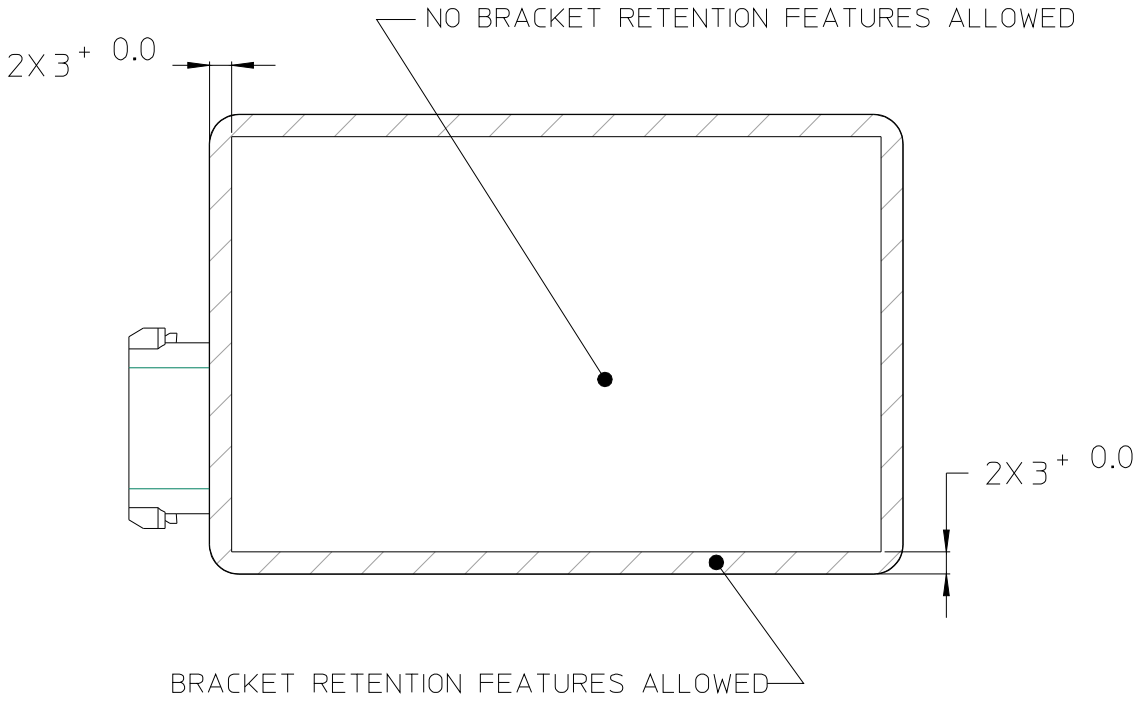

Figure 3b

5.3 Installation Specifications for Individual Sensors

5.3.1 Distance to the Bumper Material

The distance of the C6 Sensor to the bumper shall be as shown below. An installation with the sensor parallel to fascia is preferred. If this is not possible any combination of TX and RX distance within the table below are allowed.

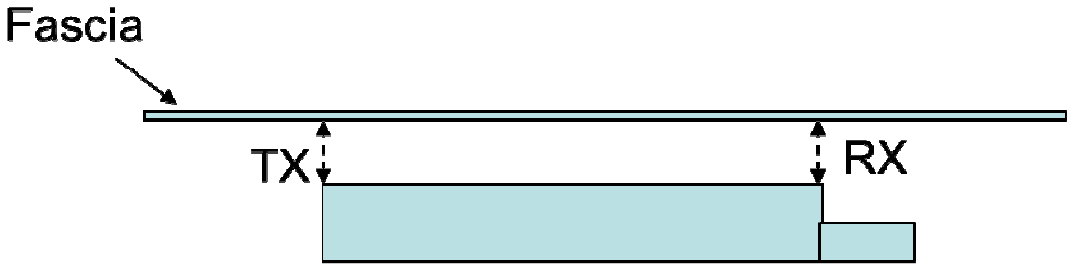

Figure 4

Sensor Model#	Sensor Type	RX Distance	TX Distance
6208428	Mid Range Radar	5mm-25mm	5mm-25mm
6221569	Short Range Radar	5mm-25mm	5mm-25mm
6234448	Multimode Sensor	5mm-25mm	5mm-25mm

5.3.2 Section Deleted

5.0 SPECIFICATIONS

5.3 Installation Specifications for Individual Sensors (cont'd)

5.3.3 Effect of Type- and Thickness of Fascia Material

Autoliv has examined various fascia material samples with a thickness of 2.5 – 4 mm. Fascia loss effects can be optimized by proper control of the material thickness and dielectric constant. Thickness should be uniform in front of the radar sensor.

Thickness and dielectric constant must be controlled to a tolerance of ±10% max to ensure optimal performance.

New fascia material shall be evaluated by Autoliv for its characteristics at RF antenna frequency.

5.3.4 Effect of the Paint

Effect of paint is detailed in Appendix A. New paint material shall be evaluated by Autoliv.

5.3.5 Smoothness of Fascia in Front of Antenna

Avoid sharp vertical or near vertical character lines in front of sensor antenna. Horizontal character lines seem to have little effect on sensor performance.

Fascias with textured surfaces shall be evaluated by Autoliv to characterize the effects on sensor performance.

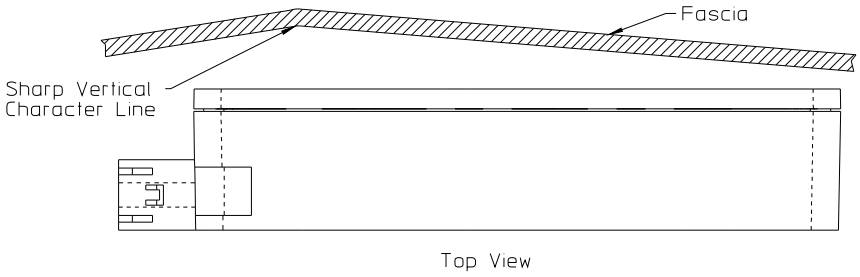

Figure 6

5.0 SPECIFICATIONS

5.3 Installation Specifications For Individual Sensors (cont'd)

5.3.6 Protection from Mud and Dirt Buildup

There will be performance degradation if excessive buildup occurs on the antenna areas and especially for wet mud. Therefore Autoliv strongly recommends the sensor mounting include provisions to protect the antenna face from dirt and mud accumulation. The mounting concept should completely protect the face of the antenna to prevent mud and dirt from entering the free space between the sensor radome and the fascia, yet a small weep hole at the bottom of the bracket is required to allow condensation to dissipate.

5.3.7 Sensor Mounting Thermal Considerations

The sensor is specified to operate in a –40° to +85℃ ambient, still air environment. Natural convection and venting from the front and backside surfaces of the sensor to the ambient air is assumed. Therefore the mounting concept shall leave both the front radome and backside area of the sensor exposed to the ambient air. Minimum area to be left for the backside exposed is as shown below. Bracket reinforced structure such as cross bars are allowed if approximately 80% of backside area remains exposed to ambient air for heat dissipation. Maximum surface temperature in this region is +115℃ at a maximum ambient of +85℃.

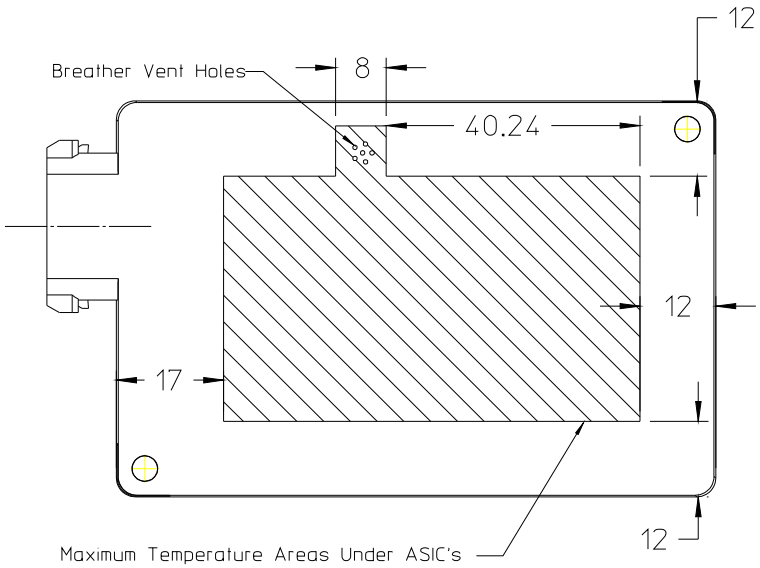

Figure 7

5.3.8 Mounting Bracket Design and Vehicle Mounting

In addition to the mounting bracket design being consistent with the keep out zones described in this document the bracket must also provide the following:

- The mounting bracket shall prevent sensor movement or vibration in x, y, or z direction with respect to the bracket.
- The bracket shall be mounted to vehicle in manner to prevent sensor movement or vibration in x, y, or z direction with respect to the fascia surface that is in the sensor field view (sensor keep out zone). To achieve this it is preferred that the bracket be firmly attached to the inner surface of the fascia.
- For cases where a chassis mounted bracket is only option there shall be design considerations in place to prevent movement or vibration in x, y, or z direction with respect to the fascia surface that is in the sensor field view (sensor keep out zone).

6.0 C6 SENSOR SYSTEM

The following observations refer to the combination of several C6 Sensors into one sensor system. Many applications require several sensors networked together to achieve the desired function. The sensors should be placed in the best possible location for optimal coverage and range performance relative to the specific applications. The optimal locations will be highly dependent on the desired applications and the bumper dimensions. Autoliv can perform analysis and characterization to determine sensor locations to best achieve a desired performance. Attention should be paid that the installation specifications for individual sensors from chapter 5 are maintained. Due to the various installation situations and applications, a measurement check is required to verify the actual installation implementation.

APPENDIX A

EFFECT OF PAINT

Depending upon the type of paint, number of coatings, base coats used, etc. the attenuation of the radar signal was measured 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 can characterize 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 5.3.3 performance can be optimized by proper control of the fascia material thickness and dielectric constant.