Project Documentation | UMRR-96 Type 153 User Manual

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2 Abbreviations

ADC	Analog-to-digital converter
CAN	Controller area network
DSP	Digital signal processing; digital signal processor
FMCW	Frequency modulated continuous wave
MMIC	Monolithic microwave integrated circuit
UMRR	Universal medium-range radar

3 Introduction

This document is a short documentation of the general purpose **u**niversal **m**edium **r**ange **r**adar (UMRR) UMRR-96 Type 153 radar sensor with type 153 antenna.

4 General description

4.1 Sensor description

The main task of the UMRR is the detection of any reflectors in the field of view, to measure the distance, the relative speed and the angle to the shortest reflector (and to other reflectors), to detect motion and to track (filter) the results over time.

For this **general purpose measurement application**, range and relative radial speed and the angle value of each reflector inside the antenna beam are measured and the results are reported via the communication links cycle by cycle.

4.2 Transmit Signal

The UMRR transmit frequency is in the band from 77 GHz to 81 GHz, the used bandwidth is smaller than 4 GHz. The maximum transmit power is 31 dBm.

The device uses different FMCW transmit signal waveforms for distance and speed measurement.

4.3 General Performance Data

After power on or reset, the sensor readings are within specified performance within <2 seconds. In Table 4-1 the general performance data of UMRR-96 Type 153 are given.

Table 4-1: General performance data

Environmental		
Ambient Temperature	-40 ... +85	degree C
Shock	100	g_{rms}
Vibration	14	g_{rms}
IP	67	
Pressure / Transport Altitude	0…10.000	m
Mechanical		
Weight	≤153	g
Dimensions	See 5.2	
Housing Identification	0B	
Antenna Identification	99	
DSP Board Identification	96	
General		
Power Supply	8 ... 24 [I] <5	V DC W
Frequency Band	77.0…81.0	GHz
Bandwidth	< 4	GHz
Max. Transmit Power (EIRP)	31.0	dBm
Interfaces	Primary CAN V2.0b (passive) 2-wire Automotive Ethernet 100Mbit (optional by software)	
Connector	8 Pin plug ACES / TE Connectivity	CAN, Power, RS485, Eth.

[I] measured at connector

5 Hardware

5.1 UMRR sensor

An example picture of a UMRR-96 Type 153 sensor is shown in the figures below, see Figure 5-1 and Figure 5-2.

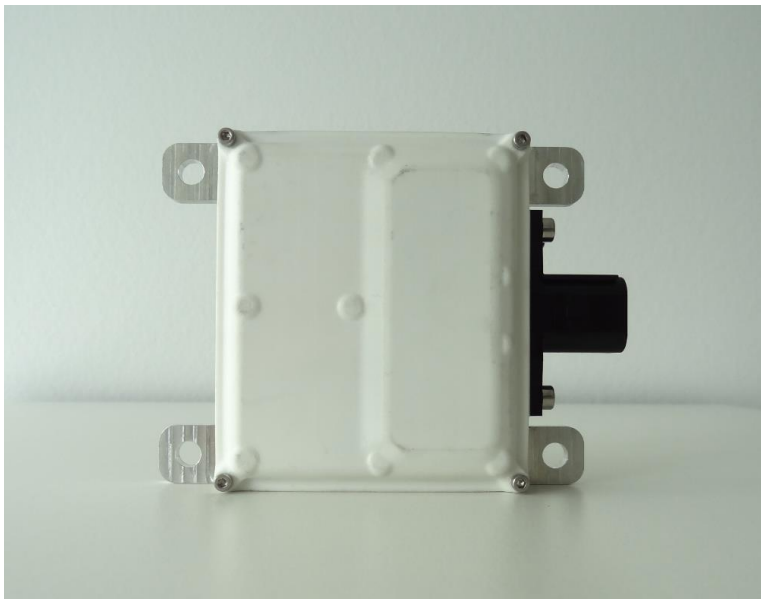

Figure 5-1: Front view of UMRR-96 Type 153

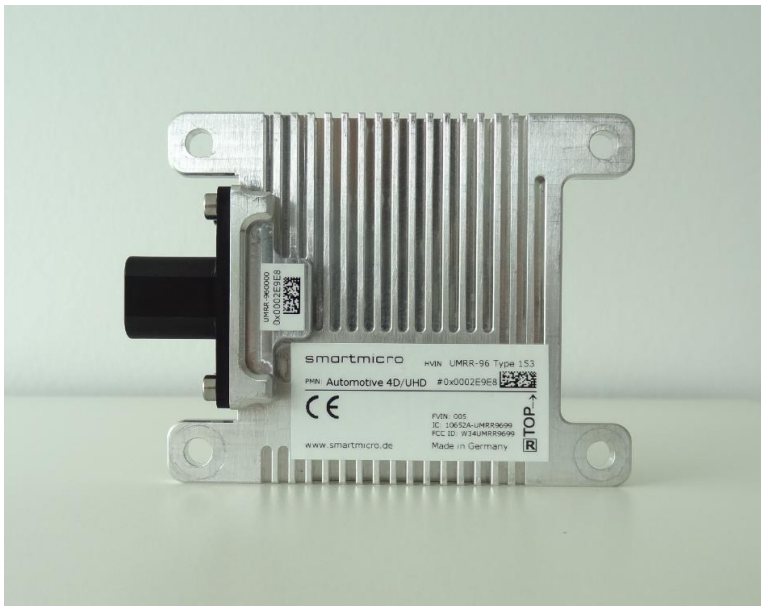

Figure 5-2: Rear View of UMRR-96 Type 153

5.2 Sensor Dimensions

The dimensions of UMRR-96 Type 153 are given in mm, see Figure 5-3.

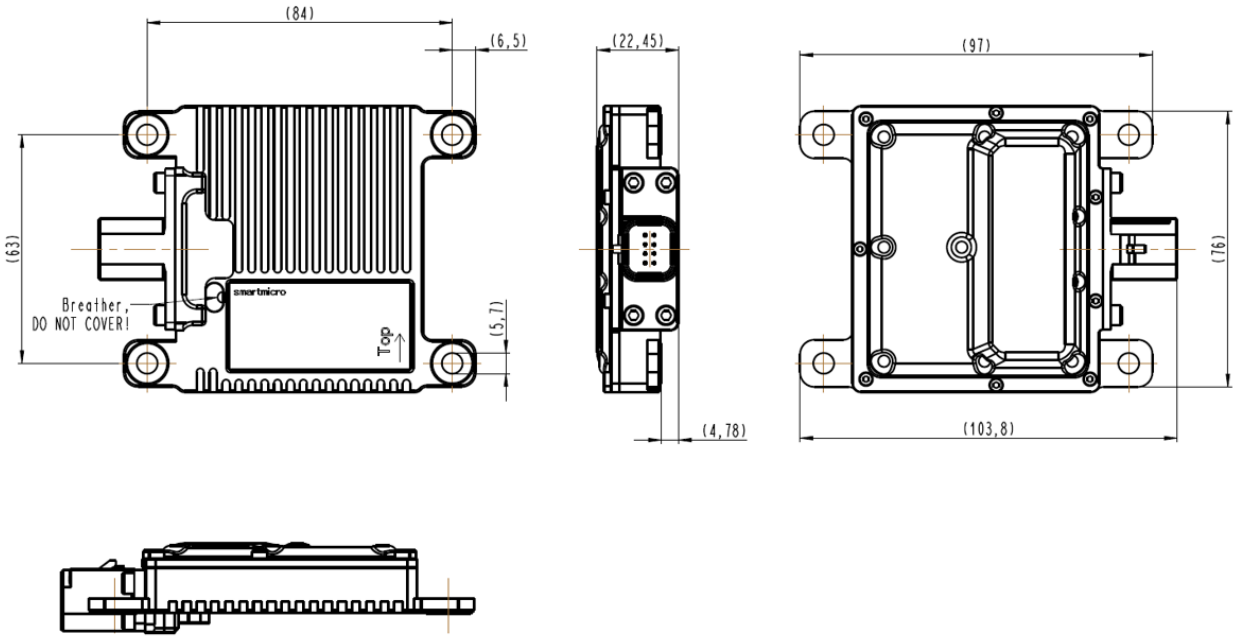

Figure 5-3: Dimensions of sensor UMRR-96 Type 153

6 Cables and connectors

6.1 Sensor connector

The sensor connector mates with an 8-pin female connector for automotive interconnections (TE 1411001-1: water proof IP67, manufacturer TE). The pin numbering of the female connector is shown in Figure 6-1 and Figure 6-2. The pin-out of the connector is shown in Table 6-1.

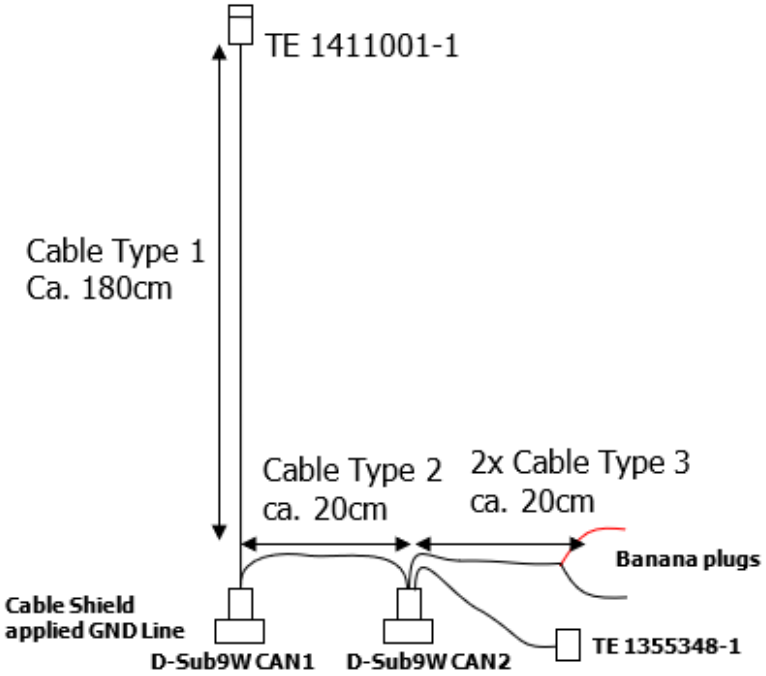

Figure 6-1: The pin out of the connector

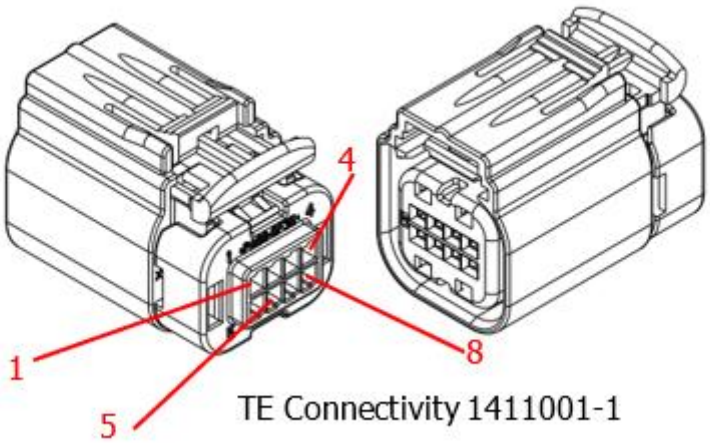

Figure 6-2: Diagram of cable-FF0025 and rear view of female counterpart

Table 6-1: Sensor connector pin-out

TE 1411001-1	Pair	Label	DSUB-9-w CAN1	DSUB-9-w CAN2	Banana plug	TE 1355348-1
1	**1**	**GND**	**3**	**3**	**Black**	
2	**2**	**BroadR_P**				**9**
3	**3**	**CAN2_H**		**7**		
4	**3**	**CAN2_L**		**2**		
5	**1**	**V+**			**Red**	
6	**2**	**BroadR_N**				**8**
7	**4**	**CAN1_H**	**7**			
8	**4**	**CAN1_L**	**2**			
	-	**SHIELD**	**3**			

Please note that in the standard configuration the sensor has 120 Ohms resistor on board (CAN bus termination between CAN_L and CAN_H). A number of cable sets for initial operation and test purposes are offered by Smartmicro, to deliver a fast set-up of a sensor system.

7 Data interfaces

7.1 CAN data interface

This specification gives a detailed description of the CAN data communication used in the UMRR based systems on the sensor CAN. The UMRR is compliant with CAN 2.0B standard.

CAN is a very robust full duplex bidirectional interface.

7.2 CAN-Settings

Baud Rate:	500kBit/s or lower	
T_{seg1}:	8	
T_{seg2}:	7	
T_{sjw}:	2	(SJW: synchronization jump width)

Above values for CAN bit timing are illustrated in Figure 7-1 used in the UMRR radar sensor (note: the CAN module is integrated in the DSP). For comparison purposes, in Figure 7-2 the CAN bit timing as defined by the CAN protocol is shown.

The CAN bit timing parts as defined by the CAN protocol (Figure 7-2) can be described as follows:

- **Sync**: This part of bit time is used to synchronize the various nodes on the bus. An edge is expected to lie within this segment. For the UMRR sensor, this segment is always 1 TIME QUANTUM (TQ).
- **Prop**: This part of the bit time is used to compensate for the physical delay times within the network. It is twice the sum of the signal's propagation time on the bus line, the input comparator delay, and the output driver delay. For the UMRR sensor, this segment is programmable from 1 to 8 TIME QUANTA (TQ).
- **Phase 1**: This phase is used to compensate for positive edge phase error. For the UMRR sensor, this segment is programmable from 1 to 8 TIME QUANTA (TQ) and can be lengthened by resynchronization.
- **Phase 2**: This phase is used to compensate for negative edge phase error. For the UMRR sensor, this segment is programmable from 2 to 8 TIME QUANTA (TQ) and can be shortened by resynchronization.

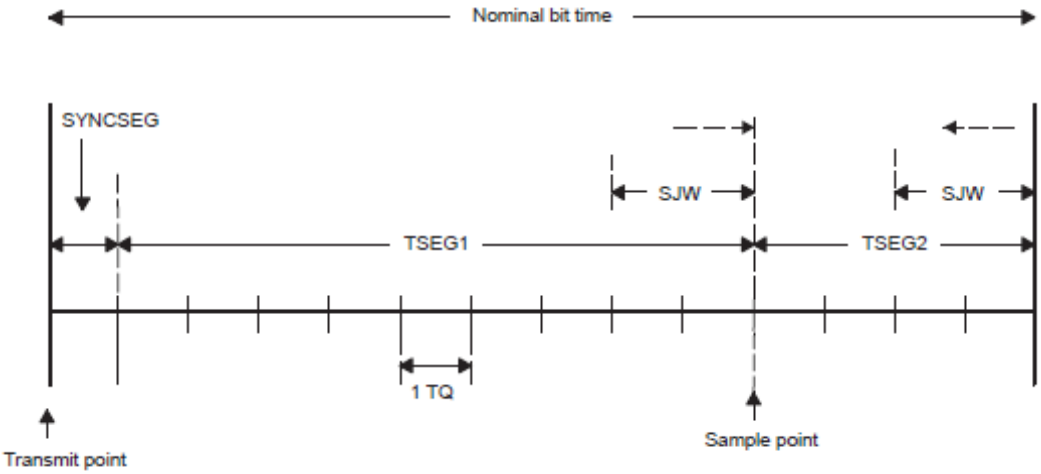

Figure 7-1: CAN bit timing for UMRR sensor

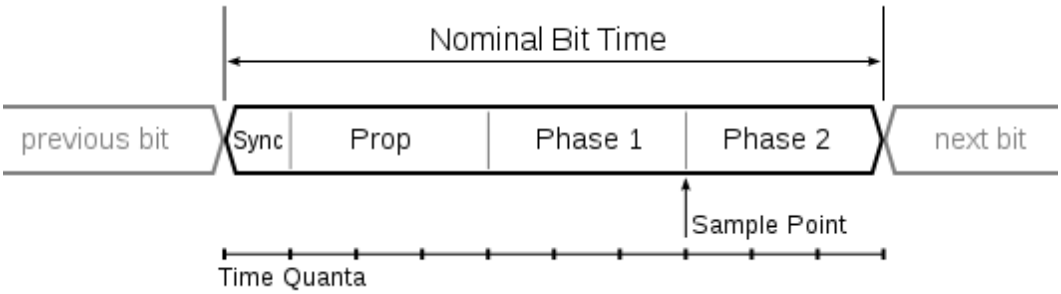

Figure 7-2: CAN bit timing as defined by the CAN protocol

8 Applications

The sensor is very versatile and can be used for all kind of 360 degree short- and medium range applications.

The sensor is especially well suited for all kind of blind spot detection (**BSD**) and lane change assist (**LCA**) applications. It can be applied for short- and medium range collision warning (**CW**) applications for **autonomous driving**.

One or multiple sensors are specifically integrated into vehicle models of automotive OEMs. Usually there is a certain OEM-specific engineering effort required for the adaptation to specific vehicle models and the test and qualification procedures to be applied. Customer specific connectors, CAN(FD)/Ethernet interfaces, tracking algorithms, warning algorithms or other custom software packages can be included.

Examples:
- Blind Spot Detection (**BSD**).
- Lane Change Assist (**LCA**)
- Rear and front Cross Traffic Alert (**RCTA/FCTA**).
- Warning to open door if object approaches from behind.
- Rear and side **Pre-Crash**/**Pre-Safe** applications.
- **Parking** assistance
- Front, rear and side Collision Warning (**CW**), 360degree collision warning
- **Autonomous driving**

Functional Safety:
This sensor can optionally be compliant to ASIL Level B in customer specific projects (requirements and safety concept to be agreed between OEM and smartmicro).

AUTOSAR:
This sensor can optionally be offered with AUTOSAR compliant software in customer specific projects (specification to be agreed between OEM and smartmicro).

9 Declaration of Conformity

9.1 Declaration of Conformity for USA

This device has been tested and found to comply with the requirements set forth in 47 CFR Part 95, Subpart M for both fundamental emissions and unwanted emissions. These limits are designed to provide reasonable protection against any harmful interference when the device is operated in a commercial environment.

Changes or modifications made to this equipment not expressly approved by s.m.s, smart microwave sensors GmbH may void the FCC authorization to operate this equipment.

In that event, your right to use the device may be limited by FCC regulations, and you may be required to correct any interference to radio or television communications at your own expense.

This device complies with the requirements set forth in 47 CFR Section 95.3385 addressing RF exposure from radio frequency devices. To maintain compliance, the minimum separation distance from the antenna to general bystander is 20 cm.

9.1.1 FCC Label

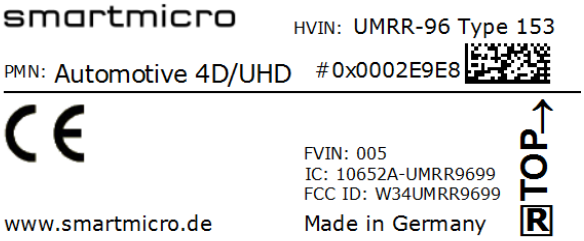

Figure 9-1: Sample of FCC Label

9.2 Declaration of Conformity for Canada

9.2.1 Declaration of Conformity in English

This device complies with Part 15 of the FCC Rules and with Industry Canada licence-exempt RSS standard(s).
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.

IC Radiation Exposure Statement:
This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with the minimum distance 20cm between the radiator & your body.

9.2.2 Déclaration de conformité en francais

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'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

DÉCLARATION D'EXPOSITION AUX RADIATIONS

Cet equipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cetéquipement doit être installé et utilisé avec un minimum de 20cm de distance entre la source de rayonnement et votre corps.

9.2.3 Industry Canada (IC) Label

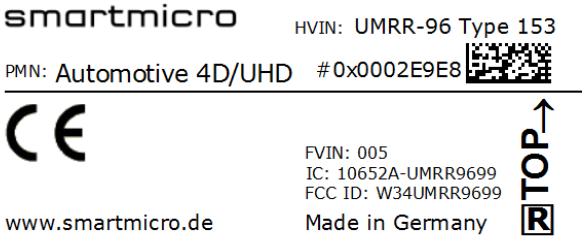

Figure 9-2: Sample of IC label