BSD+RCTA System Specification

Project: RT05

2016/11/15
WNC
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FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this 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.

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1 History

Version#	Reviser	Date	Description of the revision	Reviewer
0.1	Nancy	2016.11.15	First release	

2 Scope

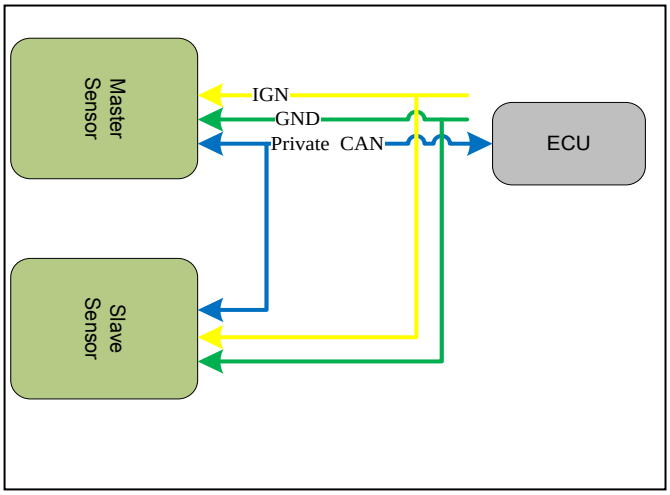
This document describes system introduce, technical requirement, function requirement, mechanism, installation, connecter interface, CAN communication and environment requirement.

3 System description

3.1 System Introduce

Two 24 GHz narrow band sensors compose this system. Two major functions are included which are BSD (Blind spot detection)and RCTA (Rear cross traffic Alert).

3.2 System Diagram



ECU is built by customer. The communication interface between 2 sensors is CAN (Private CAN or sensor CAN). The information on this CAN is vehicle data, sensor position setup data, warning parameter setup data and normal warning data output.

3.3 Sub- system description

2 sub-systems are included which is BSD and RCTA

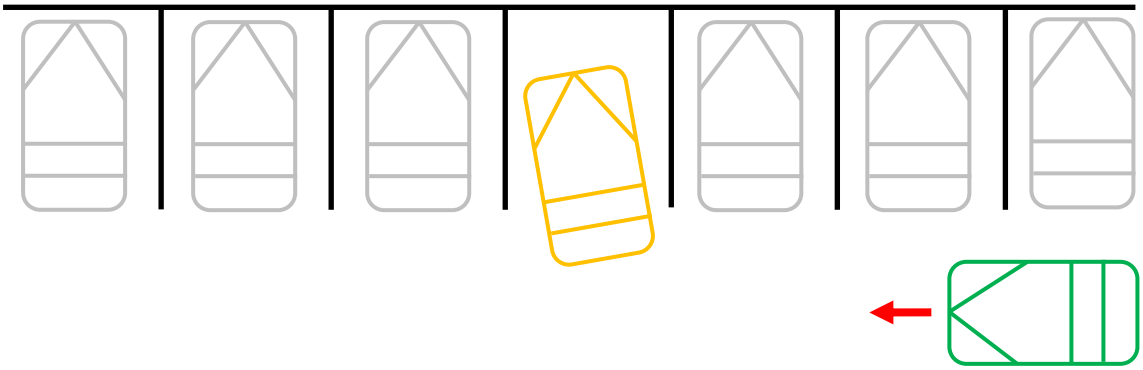
3.3.1 BSD function

Blind Spot Detection (BSD) Radar sensor is designed for **short range detection**, the field of view is selected to cover the **full blind spot warning zone**, which is defined in the related ISO norms **(ISO- 17387)** corresponding to this application.

3.3.2 RCTA (Rear Cross Traffic Alert)

The **Rear Cross Traffic Alert** (**RCTA**) system uses the same radar infrastructure used for detecting vehicles in the blind spot (Blind Spot Detection, BSD).

Some serious accidents are happen when driver are reversing out of parking space (Refer to follow picture). The usual reason of these accidents is because drivers either fail to see a vehicle or cyclist approaching from the side or they see them too late. RCTA system provides assistance to the driver to prevent this. It is activating when the reverse gear is selected.



4 Technical requirement

4.1 Basic parameter

- Operation voltage range：9~16V
- Typical operation voltage: 12V
- Operation temperature：-30℃~+85℃
- Maximum power consumption ：7W
- Operation frequency: 24GHZ (NB)
- Water proof: IP67

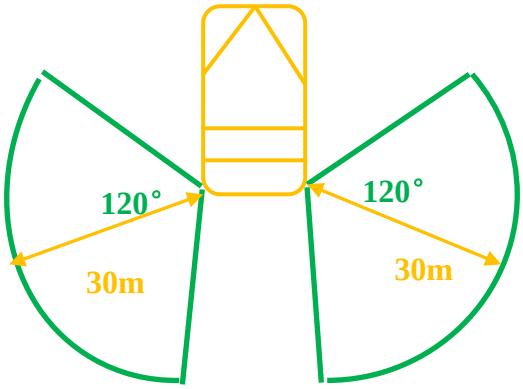
4.2 Radar performance

- Frequency : 24.075 – 24.225GHz (Left side)
  24.065 – 24.215GHz (Right side)
- FOV : 120 degree
- range accuracy: 0.25m
- range resolution:1m
- velocity accuracy: 0.08 m/s
- Velocity resolution: 0.31 m/s
- Angular accuracy):+- 1degree
- Maximum objects detection : 32
- Cycle Time: 20.48ms

5 Function requirement

5.1 Detection

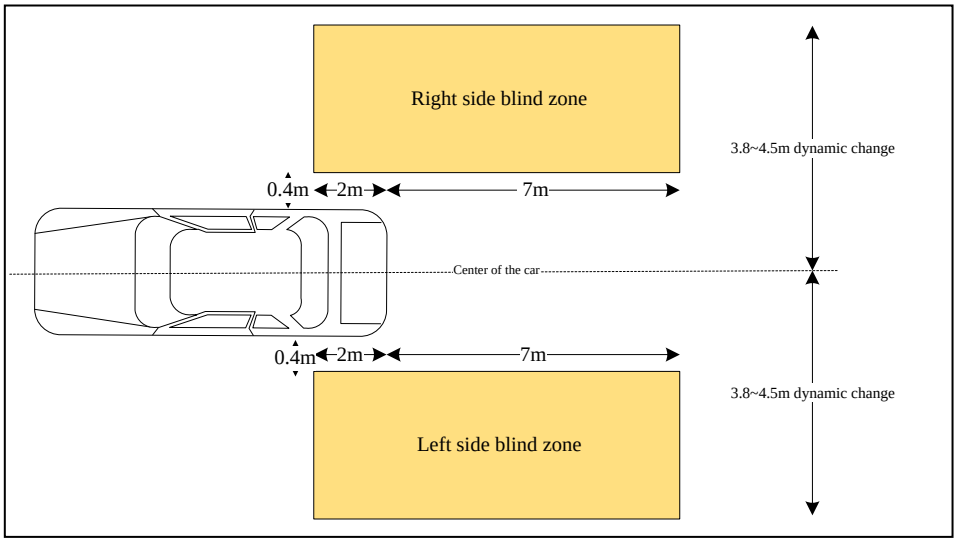
FOV is 120 degree.



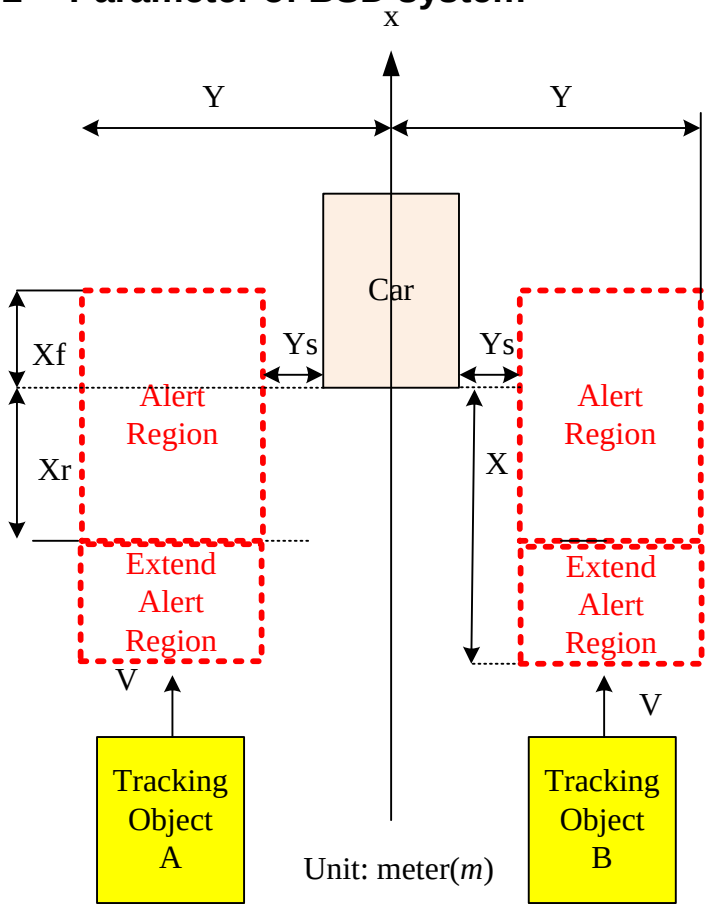
5.2 Warning

5.2.1 Blind zone define of BSD system

The warning zone definition is as follow, and it can be adjusted if needed.



5.2.2 Parameter of BSD system



Parameter	Description	Default value
Xf	Forward length of Alert region	2m
Xr	Backward length of Alert region	7m
Ys	Alert ignore area	0.4m
Thold_ToS	Warning hold time when target overtaking subject	0.5sec
Thold_SoT	Warning hold time when subject overtaking target	0.5sec
Vy_dynamic_alarm_min	The velocity minimum gate for dynamic y distance	18m/s
Vy_dynamic_alarm_max	The velocity maximum gate for dynamic y distance	38.75m/s
y_dynamic_alarm_min	Minimum gate of dynamic y distance	3.8m
y_dynamic_alarm_max	Maximum gate of dynamic y distance	4.5m
Y	Alert width	Variable
X	Alert length after rear bumper	Variable

- For Y:
  - If relative speed of object ≦ **Vy_dynamic_alarm_min** then Y= **y_dynamic_alarm_min**
  - If relative speed of object ≧ **Vy_dynamic_alarm_max** then Y= **y_dynamic_alarm_max**
  - If **Vy_dynamic_alarm_min** <relative speed of object< **Vy_dynamic_alarm_max** then Y is linear interpolation between **y_dynamic_alarm_min** and **y_dynamic_alarm_max.**

■ For X:

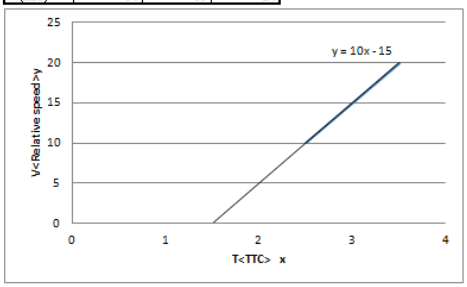
We have one linear formula as follow which is calculate from ISO 17387 Chapter 4

Table 3

Table 3 — Closing vehicle warning time to collision by target vehicle closing speed classification

Type	Maximum target vehicle closing speed for full performance m/s	Time to collision s
A	10	2,5
B	15	3,0
C	20	3,5

T(sec)	2.5	3	3.5
V(m/s)	10	15	20



T=0.1V +1.5 (where T is TTC and V is relative speed)

That means different relative speed, we have different TTC.

X=V*T

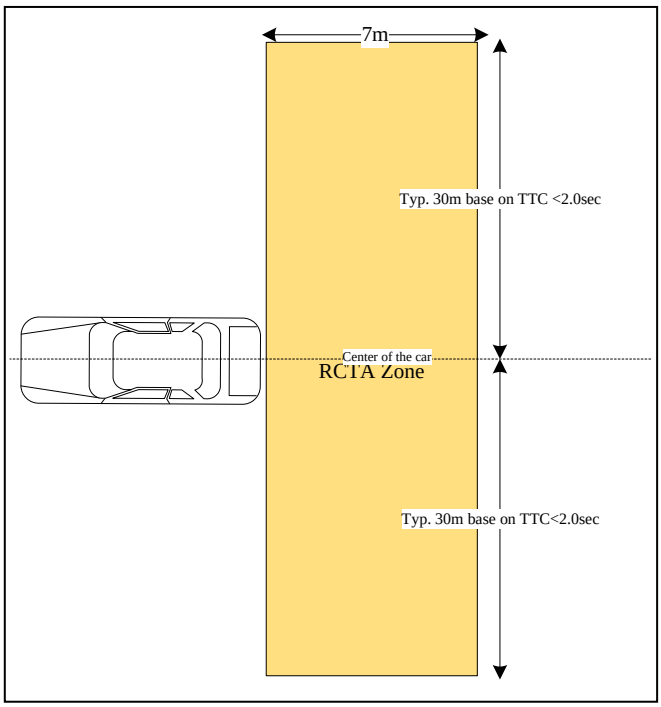
- If VT≦Xr then X=Xr (fix)
- If VT>Xr then X=VT (Dynamic)

5.2.3 RCTA zone of RCTA system

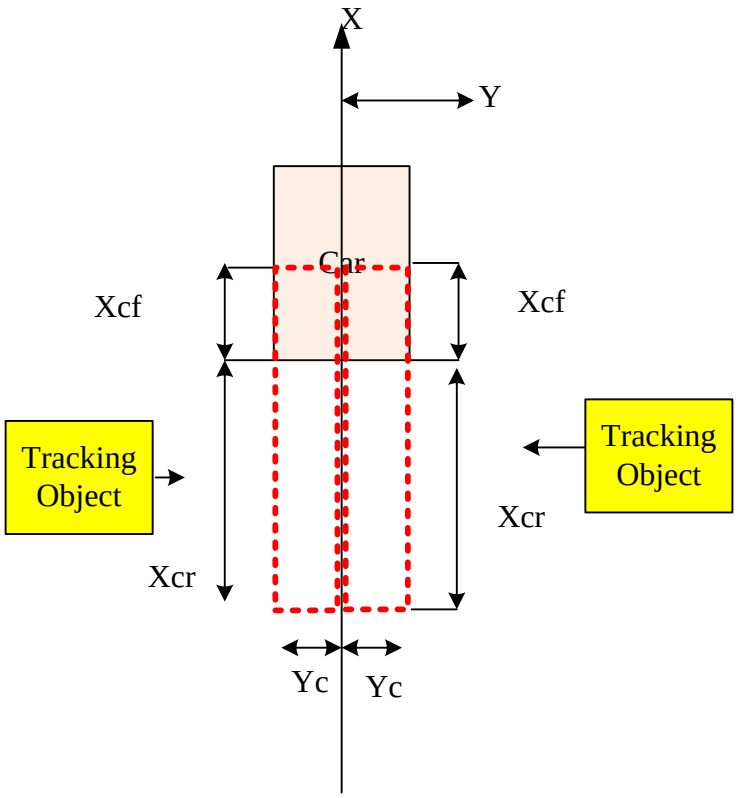
The RCTA zone definition is as follow, and it can be adjusted if needed.

The moving target which is with Speed between**2.5m/sec~15m/sec** and enter left or right RCTA ZONE and have Potential collision **TTC<2.0sec**

The maximum subject car speed is not over **15km/hr**.



5.2.4 Parameter of RCTA system



Position of Tracking Object will fall into the potential collision Region (length is Xcf+Xcr, Width is Yc for each side) with TTC within 2sec

Parameter	Description	Default value
Xcf	Forward length of potential collision area	3m
Xcr	Backward length of potential collision area	5m
Yc	Width of each side (right or left)	0.8m
TTC_RCTA	Alert TTC setting	2sec

5.3 Self diagnostic

System will do self diagnostic during the boot up and operation.

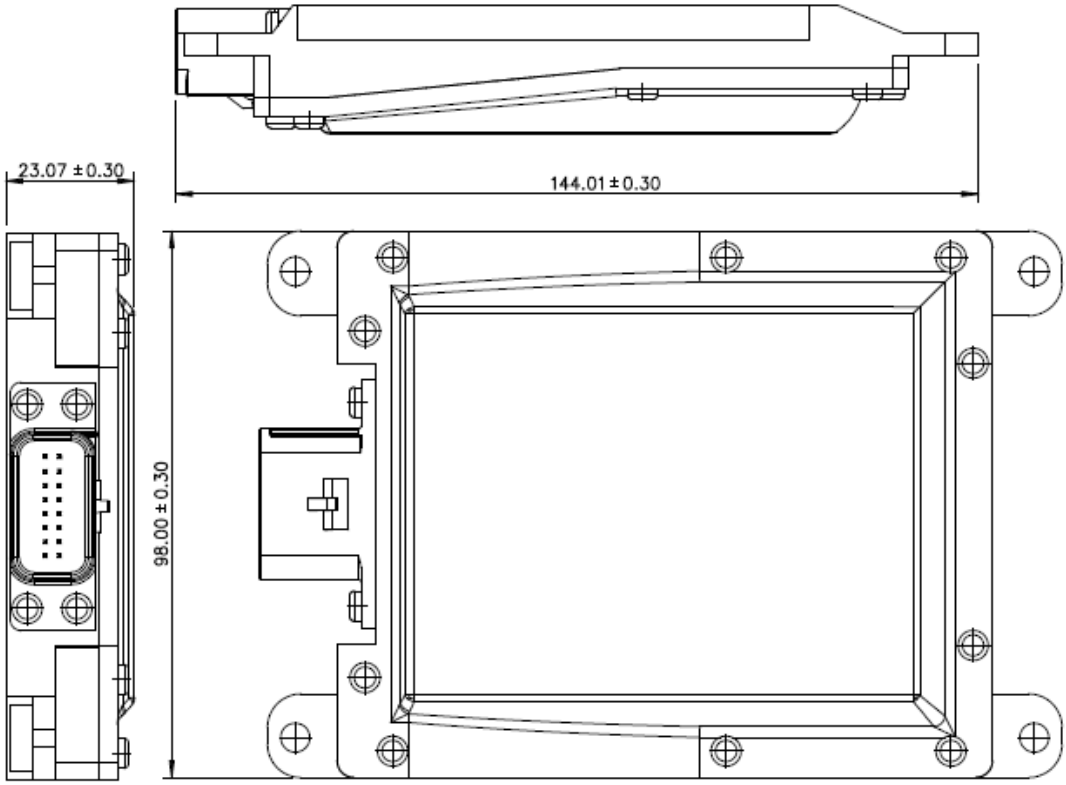
6 Mechanical Requirement

6.1 Weight

Weight of Signal sensor is 285g

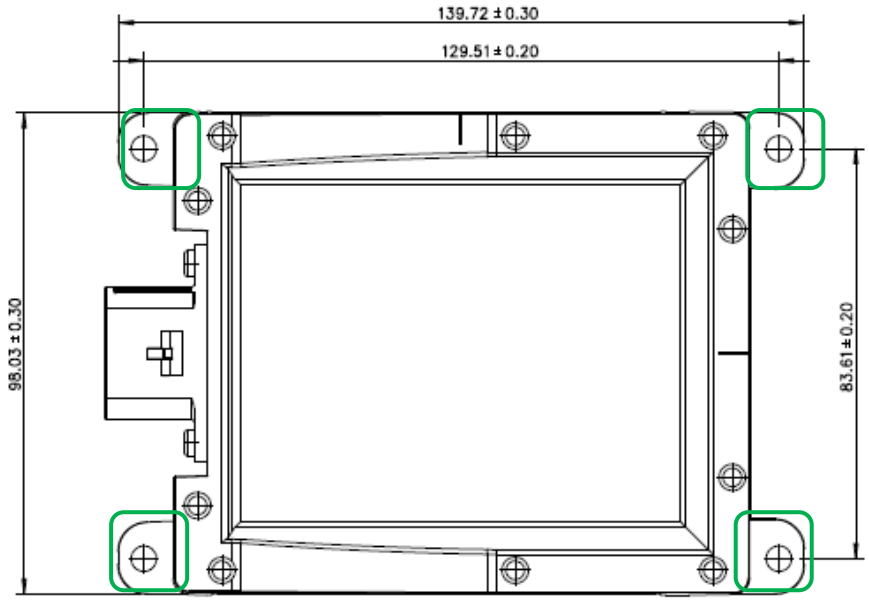
6.2 The size of sensor

- 144*98*23±0.3 mm (L*W*H)
- Outline is as follow:



6.3 Installation

- There are 4 fix locations, please refer to follow:



- The master sensor is installed inside the rear bumper of left, and the connecter is down.
- The slave sensor is installed inside the rear bumper of right, and the connecter is down。 Please refer to follow

- Azimuth angle is 57 degree
- Elevation angle is 1~4 degree
- The height of sensor is 30~80 cm

7 Connecter interface

7.1 Connecter

- I/O connecter [16pin]: **ACES: 50992-0161L-001**
- Wire connecter: ***Tyco 1438031-1***

7.2 Pin define

8.2.1. Master sensor

NO	Signal Name	I/O/P	Description	Note
1	LED_L	P	HMI LED for left side	HMI
2	LED_R	P	HMI LED for right side	HMI
3	TURN_R	IO	Indicator signal for right side	Vehicle data
4	TURN_L	IO	Indicator signal for left side	Vehicle data
5	SPD	IO	Vehicle speed physical line	Vehicle data
6	VEHICLE_CAN_H	IO	Vehicle CAN bus	Vehicle data
7	**GND**	P	Power Ground	Ground
8	**V_IN**	P	Power Input	Power
9	**---**	IO	---	---
10	**---**	IO	---	---
11	BUZZER	P	HMI Buzzer	HMI
12	**S_PRIVATE_CAN_L**	IO	Sensor private CAN	To slave sensor
13	**S_PRIVATE_CAN_H**	IO	Sensor private CAN	To slave sensor
14	VEHICLE_CAN_L	IO	Vehicle CAN bus	Vehicle data
15	**GND**	P	Power Ground	Ground
16	**V_IN**	P	Power Input	Power

8.2.2. Slave sensor

NO	Signal Name	I/O/P	Description	Note
1	---	IO	---	---
2	---	IO	---	---
3	---	IO	---	---
4	---	IO	---	---
5	---	IO	---	---
6	---	IO	---	---
7	GND	P	Power Ground	Ground
8	V_IN	P	Power Input	Power
9	---	IO	---	---
10	---	IO	---	---
11	---	IO	---	---
12	S_PRIVATE_CAN_L	IO	Sensor private CAN	To Sensor
13	S_PRIVATE_CAN_H	IO	Sensor private CAN	To Sensor
14	---	IO	---	---
15	---	IO	---	---
16	---	IO	---	---