Product Name:

The DUT is named **ESR**, which stands for Electronically Scanning Radar.

Users Manual / Operational Description:

The Device Under Test (DUT) is a 76.5 GHz vehicular radar. The device employs a dynamic chirp modulated transmit array. Multiple transmit elements are employed for long range operation and a subset of these same elements are used for medium range operation. Multiple receive antennas are used to determine target angular resolution through digital beam forming. When installed on a vehicle, the device will operate when the vehicle is running, and the long range operation will be disabled when the vehicle is at rest. The nominal operating voltage is 12.0 VDC.

The DUT is capable of two primary modes of operation, long range and medium range. Long range transmission employs a greater number of array elements, resulting in a higher total EIRP. Long range modulation employs a chirp rate with a frequency span of 100 MHz. Mid-range modulation employs a chirp traversing 200 MHz.

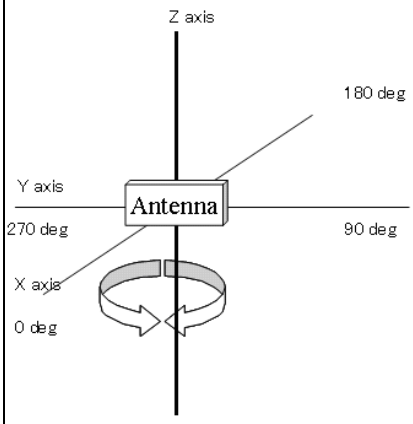
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

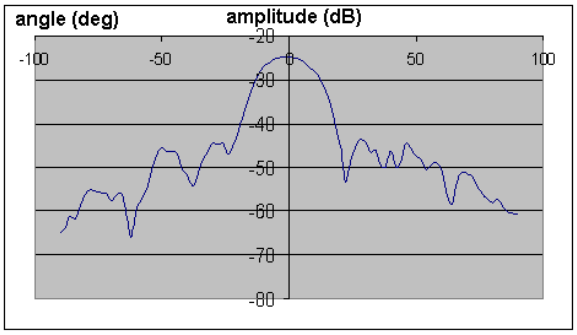
Antenna Operation

Item		**Specification**
Frequency Band (GHz)		76.5 +/- 0.5
VSWR		=< 1.9
Polarization (deg)		45 deg
Average Gain (dBi)		Long range transmit = 21 Long range receive = 20 Medium range transmit = 16 Medium range receive = 16
Beamwidth	Azimuth (deg)	30
	Elevation (deg)	4.2 to 4.75
Operating Temperature (degC)		from -40C to +85C

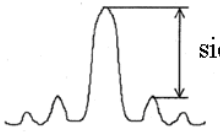
Antenna Beam Pattern

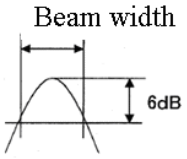
Azimuth





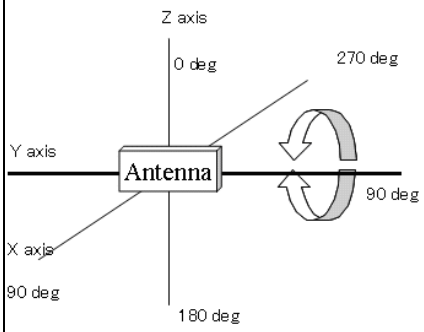
Measurement item	Data	
Beam width (Azimuth)	26	deg
Side lobe ratio (Azimuth)	19	dB

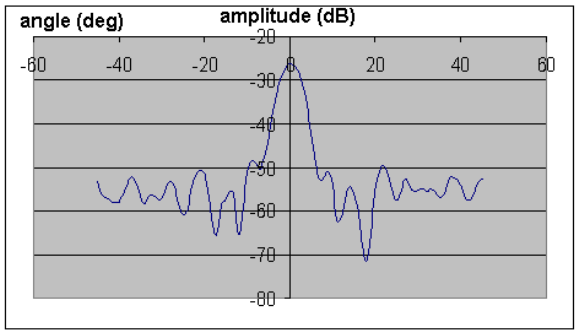




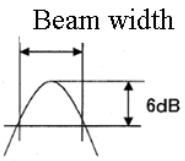
Antenna Beam Pattern

Vertical



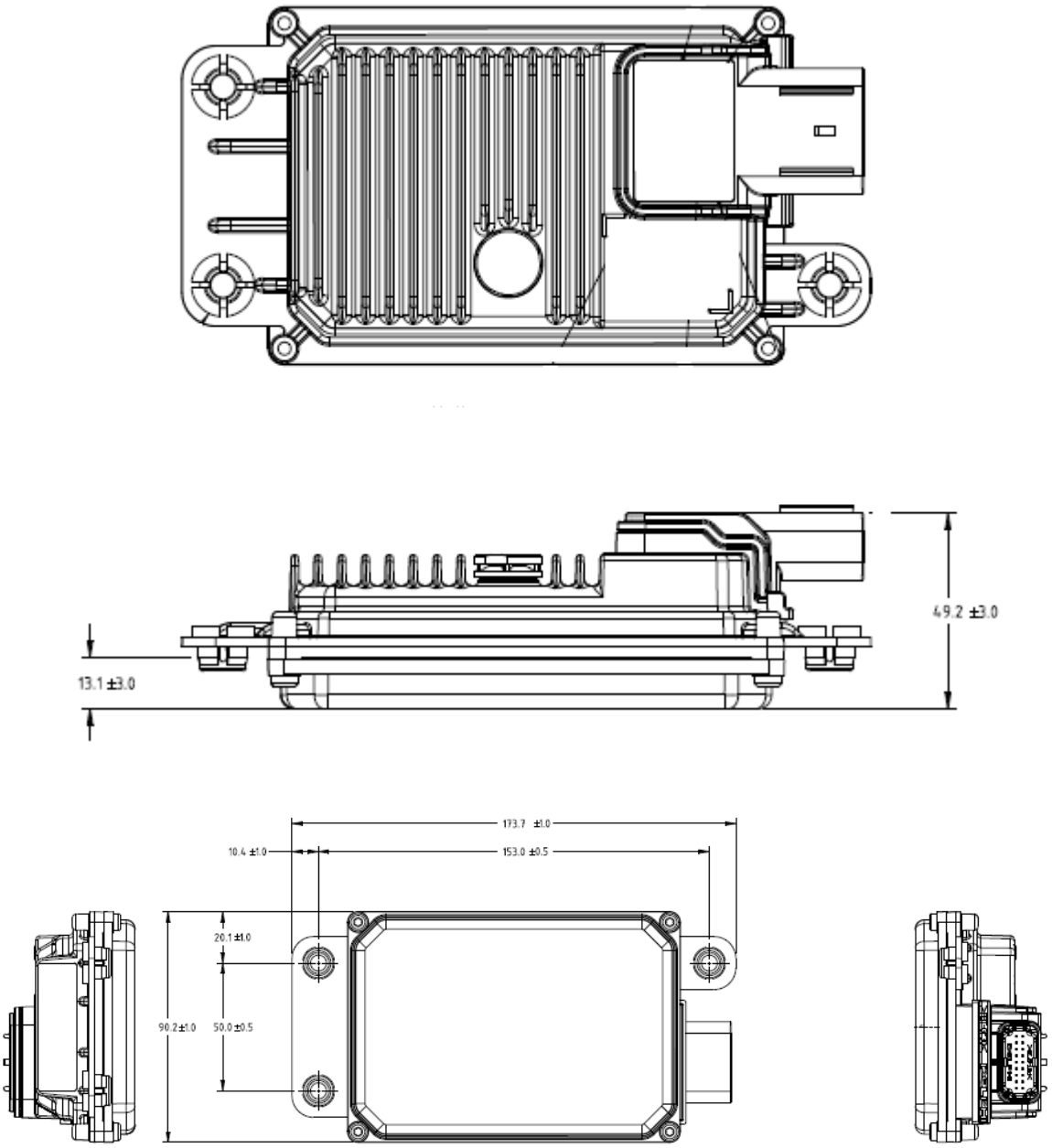


Measurement item	Data	
Beam width (Vertical)	6	deg
Side lobe ratio (Vertical)	22	dB



Mechanical Interface

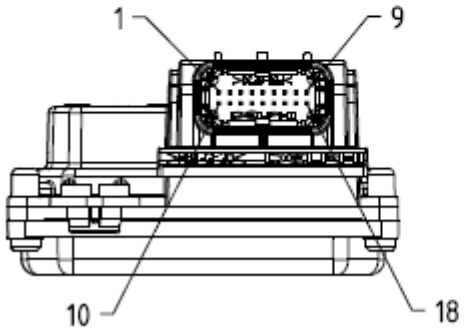
The Radar mechanical interface is the following:
(dimensions are in mm)



Electrical Interface

The Radar electrical interface is the following:

Pin #	Signal	Nominal Voltage / Current
1	Battery	+12VDC / 900mA
3	Ground	+0VDC / 900mA
9	CANL	n/a
10	Ignition	+12VDC / 3mA
18	CANH	n/a



CONNECTOR PIN ASSIGNMENT	
PIN NO.	DESCRIPTION
1	BATT
2	NC
3	GND
4	NC
5	NC
6	NC
7	NC
8	NC
9	PCANL
10	IGN
11	NC
12	NC
13	NC
14	NC
15	NC
16	NC
17	NC
18	PCANH

Communications Interface

The Radar has an industry-standard Controller Area Network (CAN) interface compliant to Bosch CAN 2.0B standard. The speed of the interface is 500 Kbps.

The Radar software is located in Flash memory and can be reprogrammed with custom tools provided by Delphi.

For the functional interface, the primary CAN signals are as below:

Received Signals from CAN	Transmitted Signals from CAN
Vehicle Speed (0x600 frame)	Scanning Index (0x601 frame)
Yaw Rate (0x600 frame)	Software Version (0x601 frame)
Scanning Command (0x600 frame)	Scanning Acknowledge (0x601 frame)
Radiating Command (0x600 frame)	Radiating Acknowledge (0x601 frame)
	Diagnostic Fault Flag (0x601 frame)
	Blockage Detected Flag (0x601 frame)
	Vehicle Speed Acknowledge (0x601 frame)

	Yaw Rate Acknowledge (0x601 frame)
	Radar Track Data: ID, Range, Range Rate, Angle, Amplitude (0x603 and 0x604 frames)

System Requirements

The Radar is part of an automotive adaptive cruise control (ACC) system. The vehicle control functions are performed by a separate Controller supplied by Delphi. The Radar is responsible for the sensing functions only. The Radar measures the following parameters and provides these to the Controller:

Parameter	Operational Range
Range	1 meters to 175 meters (long range operation) 1 to 100m (medium range operation)
Range Rate	-100 meters/sec to +40meters/sec
Angle	+/-10 degrees (long range operation) +/-45 degrees (medium range operation)
Data Update Rate	20 Hz

Environmental Requirements

This Radar is validated for automotive environmental requirements and is intended to be mounted near the front bumper of the vehicle.

2006 LR Range Rover Sport

Due to this location, the radar is subjected to standard automotive environmental Validation tests:

- Low temperature testing to -40C
- High temperature testing to +85C
- Thermal shock and cycling testing between -40C and +85C
- Humidity testing up to 100% humidity
- Salt mist testing
- Water immersion testing
- High pressure water spray testing
- Chemical compatibility with multiple fluids
- Dust testing
- Drop testing
- Mechanical shock and vibration testing
- Connector testing
- Audible noise testing
- Gravel bombardment testing
- Electromagnetic compatibility (EMC) testing