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Automotive millimeter-wave radar performance requirements and test methods

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Foreword

This document is drafted in accordance with the provisions of GB/T 1.1—2020 Standardization Work Guidelines - Part 1: Rules for the Structure and Drafting of Standardization Documents.

Attention is drawn to the fact that certain content of this standard may involve patents. The issuing body of this standard shall not be liable for identifying such patents.

This document is proposed and under the jurisdiction of the National Technical Committee of Standardization for Automobiles (SAC/TC 114).

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Bus service door emergency control

1 Scope

This document specifies the performance requirements and test methods for vehicle-mounted millimeter wave radar.

This document applies to the millimeter wave radar for external target detection on vehicles (hereinafter referred to as radar) operating in the frequency ranges of 76~77 GHz and 76~79 GHz.

2 Normative References

The contents of the following documents form an integral part of this document through normative reference in the text. For dated reference documents, only the version corresponding to the specified date shall apply to this document; for undated reference documents, the latest version (including all amendment sheets) shall apply to this document.

GB/T 1865—2009 Paints and Varnishes - Artificial Weathering and Artificial Radiation Exposure - Filtered Xenon Arc Radiation

GB/T 2828.1 Sampling Procedures for Inspection by Attributes - Part 1: Single Sampling Plans for Lot-by-Lot Inspection Retrieved by Acceptance Quality Limit (AQL)

GB/T 18655—2018 Road Vehicles, Ships and Internal Combustion Engines - Radio Disturbance Characteristics - Limits and Measurement Methods for the Protection of On-Vehicle Receivers

GB/T 18838.2 Surface Preparation of Steel Substrates Before Coating Application - Technical Requirements for Metal Abrasives for Blasting - Part 2: Chilled Iron Grit

GB/T 19951—2019 Road Vehicles - Test Methods for Electrostatic Discharge (ESD) Immunity of Electrical/Electronic Components

GB/T 21437.2—2021 Road Vehicles - Test Methods for Electromagnetic Immunity of Electrical/Electronic Components Caused by Conduction and Coupling - Part 2: Electromagnetic Conducted Emission and Immunity Along Power Supply Lines

GB/T 21437.3—2021 Road Vehicles - Test Methods for Electromagnetic Immunity of Electrical/Electronic Components Caused by Conduction and Coupling - Part 3: Immunity to Electromagnetic Signals Coupled to Non-Power Supply Lines

GB/T 28046.2—2019 Road Vehicles - Environmental Conditions and Testing for Electrical and Electronic Equipment - Part 2: Electrical Loads

GB/T 28046.3—2011 Road Vehicles - Environmental Conditions and Testing for Electrical and Electronic Equipment - Part 3: Mechanical Loads

GB/T 28046.4—2011 Road Vehicles - Environmental Conditions and Testing for Electrical and Electronic Equipment - Part 4: Climatic Loads

GB/T 28046.5—2013 Road Vehicles - Environmental Conditions and Testing for Electrical and Electronic Equipment - Part 5: Chemical Loads

GB/T 30038—2013 Road Vehicles - Degrees of Protection (IP Code) for Electrical and Electronic Equipment

GB 34660—2017 Road Vehicles - Electromagnetic Compatibility (EMC) Requirements and Test Methods

GB/T 38186—2019 Commercial Vehicles - Advanced Emergency Braking System (AEB) - Performance Requirements and Test Methods

GB/T 39265—2020 Road Vehicles - Blind Spot Detection System (BSD) - Performance Requirements and Test Methods

GB/T 39323—2020 Passenger Cars - Lane Keeping Assist System (LKA) - Performance Requirements and Test Methods

GB/T 39901—2021 Passenger Cars - Advanced Emergency Braking System (AEB) - Performance Requirements and Test Methods

GB/T 41796—2022 Commercial Vehicles - Lane Keeping Assist System - Performance Requirements and Test Methods

GB/T 44156—2024 Passenger Cars - Rear Cross Traffic Alert System - Performance Requirements and Test Methods

GB/T XXXXX—XXXX Passenger Cars - Door Open Warning System - Performance Requirements and Test Methods

ISO 20567-1:2017 Paints and varnishes - Determination of stone-chip resistance of coatings - Part 1: Multi-impact testing

3 Terms and Definitions

3.1 radar

A device that discovers targets and acquires target information by means of electromagnetic waves. It transmits electromagnetic signals, receives the echo signals of targets within its coverage range, and acquires the target position and other relevant information from the echo signals.

3.2 frequency modulation continuous wave radar (FMCW radar)

A continuous wave radar whose transmitted signal frequency is modulated in a predetermined pattern.

3.3 radar operating center frequency

The electromagnetic wave frequency at which a radar operates, also referred to as the carrier frequency of the radar's transmitted signal.

Note: A radar may operate at one or more operating center frequencies.

3.4 radar operating bandwidth

The frequency band width within which a radar can perform normal operation.

3.5 frequency linearity deviation

The degree to which the modulated frequency of a frequency modulation continuous wave radar deviates from the ideal value.

3.6 effective frequency modulation bandwidth

The frequency modulation bandwidth corresponding to the actual effective sampling time within the radar operating bandwidth.

3.7 frequency modulation deviation

The deviation between the actual modulated frequency and the ideal frequency modulation frequency.

3.8 power flatness

The difference between the maximum and minimum power values of a radar within its effective frequency modulation bandwidth.

3.9 far field

A region of an antenna's radiated field where the angular distribution of the radiated field is essentially independent of the distance to the antenna.

Note: In free space, if the maximum overall dimension D of an antenna is large relative to the wavelength λ, the far field region is generally considered to exist at a distance greater than $2D^2/\lambda$ from the antenna. The far field pattern of certain antennas (e.g., multi-beam reflector antennas) is sensitive to phase variations across the aperture, for which $2D^2/\lambda$ may be insufficient.

3.10 near field

The space between an antenna and its far field region, which can be further divided into the inductive near field region and the radiating near field region. The inductive near field region refers to the part of the near field region immediately adjacent to the antenna, where the inductive field dominates; the radiating near field region refers to the part of the near field region between the antenna's far field region and inductive near field region, where the angular distribution of the field is dependent on the distance to the antenna. For antennas focused at infinity, the radiating near field region is sometimes also called the Fresnel zone by analogy with optical terminology.

Note: For an extremely short dipole or an equivalent radiator, only the inductive near field region is generally considered to exist, whose outer boundary is at a distance of λ from the antenna surface.

3.11 equivalent isotropically radiated power (EIRP)

The product of the power delivered to the antenna and the antenna gain relative to an isotropic antenna in a specified direction.

3.12 detection range

The spatial range within which a radar can detect a target and measure the target coordinates under specified conditions.

3.13 detection coverage

The maximum detection range of a radar at all spatial angles.

3.14 radar cross section (RCS)

A quantity that measures the reflection intensity of a radar target.

3.15 anti-interference capability

The ability of a radar to eliminate or suppress interference when operating in an interference environment.