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Replacing GB/T 20851.5-2007

**Electronic toll collection - Dedicated short range
communication - Part 5: Test methods of the main parameters in
physical layer**

电子收费 专用短程通信 第5部分：物理层主要参数测试方法

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Foreword

GB/T 20851.5-2019 was issued on 10 May 2019 by the State Administration for Market Regulation and the Standardization Administration of the People's Republic of China, and came into force on 1 December 2019. It is classified under ICS 35.100.10 and Chinese Standard Classification code L 79. It replaces GB/T 20851.5-2007.

GB/T 20851, Electronic toll collection - Dedicated short range communication, is divided

into five parts: Part 1: Physical layer; Part 2: Data link layer; Part 3: Application layer; Part 4: Equipment application; Part 5: Test methods of the main parameters in physical layer. This document is Part 5 of GB/T 20851.

This part was drafted in accordance with the rules given in GB/T 1.1-2009.

This part replaces GB/T 20851.5-2007, Electronic toll collection - Dedicated short range communication - Part 5: Test methods of the main parameters in physical layer. Apart from editorial changes, the main technical changes with respect to GB/T 20851.5-2007 are as follows: the requirements for the test signals have been revised and extended (see 5.2, and 5.2 of the 2007 edition); a subclause on the required test state of the equipment under test has been added (see 5.3); the way the test methods are expressed has been revised (see 6.2, 6.3 and 6.4, and 6.2, 6.3, 6.4, 6.5, 6.6, 6.7 and 6.8 of the 2007 edition); test methods have been added for the receive sensitivity, receive bandwidth, highest input signal power, co-channel interference rejection ratio, adjacent-channel interference rejection ratio and blocking interference rejection ratio of the roadside unit (see 6.2); test methods have been added for the wake-up sensitivity, wake-up time, receive sensitivity, receive bandwidth, highest input signal power, co-channel interference rejection ratio, adjacent-channel interference rejection ratio and blocking interference rejection ratio of the on-board unit (see 6.3); and the test method for the on-board unit initialisation equipment has been revised and extended (see 6.4, and 6.4 of the 2007 edition).

This part was proposed by and is under the jurisdiction of the National Technical Committee on Intelligent Transport Systems of Standardization Administration of China (SAC/TC 268).

The drafting organisations of this part are: Research Institute of Highway of the Ministry of Transport; Zhongguancun Zhongjiao Guotong Intelligent Transportation Industry Alliance; Beijing Zhongjiao Guotong Intelligent Transportation System Technology Co., Ltd.; Beijing Juli Technology Co., Ltd.; Shanghai Changjiang Intelligent Data Technology Co., Ltd.; and Beijing Sutong Technology Co., Ltd.

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The previous editions of the standard replaced by this part are: GB/T 20851.5-2007.

1 Scope

Free-flow tolling stands or falls on a radio exchange that lasts a fraction of a second. A vehicle crosses the gantry at highway speed, the roadside unit wakes the transponder behind the windscreen, and the two must complete a transaction before the antenna pattern runs out. Everything that governs whether that happens - the transmitted power, the carrier frequency tolerance, the receive sensitivity, the wake-up sensitivity and wake-up time, the receive bandwidth, the highest tolerable input power, and how well the receiver

rejects a co-channel, adjacent-channel or blocking interferer - lives in the physical layer. Two devices that both claim to meet the physical layer specification will still fail against each other if each manufacturer measures those quantities its own way, with its own chamber, its own antenna and its own signal. This part of GB/T 20851 removes that freedom. It fixes the recommended characteristics of the instruments, the test site and system configuration, the test signals and the state the equipment under test must be held in, and then the step-by-step measurement procedure for each physical layer parameter of both roadside and on-board units.

This part of GB/T 20851 specifies the recommended characteristics of the main test equipment and accessories, the test conditions and the test methods for the main parameters of the physical layer of dedicated short range communication for electronic toll collection.

This part applies to electronic toll collection systems for highways and urban roads. It may also be used for reference in the fields of automatic vehicle identification, vehicle access management and similar applications.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including all amendments) applies.

GB/T 9254, Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.

GB/T 12190-2006, Measurement method for the shielding effectiveness of electromagnetic shielding enclosures.

GB/T 20851.1-2019, Electronic toll collection - Dedicated short range communication - Part 1: Physical layer.

3.1 Symbols

The following symbols apply to this document.

D is the maximum diameter of the antenna; d is the distance between the equipment under test and the test antenna; dBc denotes the ratio of a power to the power of the carrier signal; dBm denotes the ratio of a power to 1 mW; e.i.r.p.con is the spurious equivalent isotropically radiated power; e.i.r.p.max is the maximum equivalent isotropically radiated power.

f_1 is the lower limit frequency of the receive bandwidth; f_2 is the upper limit frequency of the receive bandwidth; f_c is the centre frequency of the signal transmitted by the signal source; f_{Tx} is the nominal carrier frequency; f_{Tx} is the actual carrier frequency; Δf is the

frequency tolerance; λ is the wavelength.

GRx is the gain of the receiving antenna of the equipment under test; GT is the gain of the test antenna; GTx is the gain of the transmitting antenna of the equipment under test; h is the height above ground of the equipment under test and of the test antenna.

PA is the power of the adjacent-channel interference test signal; PB is the power of the blocking interference test signal; PC is the power of the co-channel interference test signal; Pcon is the spurious emission power; Pcw is the single-frequency signal power of the equipment under test; Pcwo is the single-frequency signal power of the signal source and test antenna; $P_{i,max}$ is the highest input signal power; P0 is the output power of the signal source; PR is the power of the signal received by the test antenna in place of the equipment under test.

RA is the adjacent-channel interference rejection ratio; RB is the blocking interference rejection ratio; RC is the co-channel interference rejection ratio; SRx is the receive sensitivity; SW is the wake-up sensitivity; T0 is the start time of transmission of the test wake-up signal; TR is the start time of transmission of the response signal; TW is the wake-up time.

3.2 Abbreviations

The following abbreviations apply to this document.

OBU: On Board Unit. RBW: Resolution Bandwidth. RSU: Roadside Unit. VSWR: Voltage Standing-Wave Ratio.

4.1 Power meter

The recommended characteristics of the power meter shall meet the following requirements: power measurement range from -60 dBm to +20 dBm; frequency range from 10 MHz to 18 GHz; power measurement error within plus or minus 3 per cent.

4.2 Frequency counter

The recommended characteristics of the frequency counter shall meet the following requirements: frequency range from 10 Hz to 20 GHz; frequency measurement error within plus or minus 10×10^{-9} .

4.3 Microwave signal source

The recommended characteristics of the microwave signal source shall meet the following requirements: frequency range from 250 kHz to 20 GHz; frequency accuracy $f_c \times 100 \times 10^{-9}$; phase noise less than -98 dBc/Hz at 10 GHz with a 1 kHz offset.