DOEWE
TEST SOLUTION EXPERT

COMPANY PROFILE

Doewe Technologies, headquartered in Beijing, has been operating for a decade and currently has branches including the Beijing R&D Center, Chengdu R&D Center, Doewe Shanghai, Doewe Shenzhen, and Doewe Hong Kong. The company is fully committed to building its independent brand "Doewe," with its business covering two main categories: Advanced Sensing Measurement and Control (ASMC) and Professional Test and Measurement Solutions (PTMS).

The ASMC product line provides innovative high-precision sensing acquisition and data analytics solutions. PTMS focuses on industry-specific test and measurement solutions for audio, video, and RF applications. It has established the 5XC product system, serving sectors such as transportation, broadcasting, automotive electronics, consumer electronics, and university research institutes.

Through relentless effort, several of the company's products have become benchmark test instruments in their respective industries. Doewe Technologies also holds multiple core patents and software copyrights, participates in relevant industry standards working groups, and contributes to the formulation of national and industry standards. Building on past achievements, Doewe continues to increase its R&D investment. We have never forgotten our original aspiration, firmly believing that only profound technological accumulation creates value. We persistently pursue innovation in test and measurement technology, dedicated to technology development, application software services, and research in test and measurement solutions.

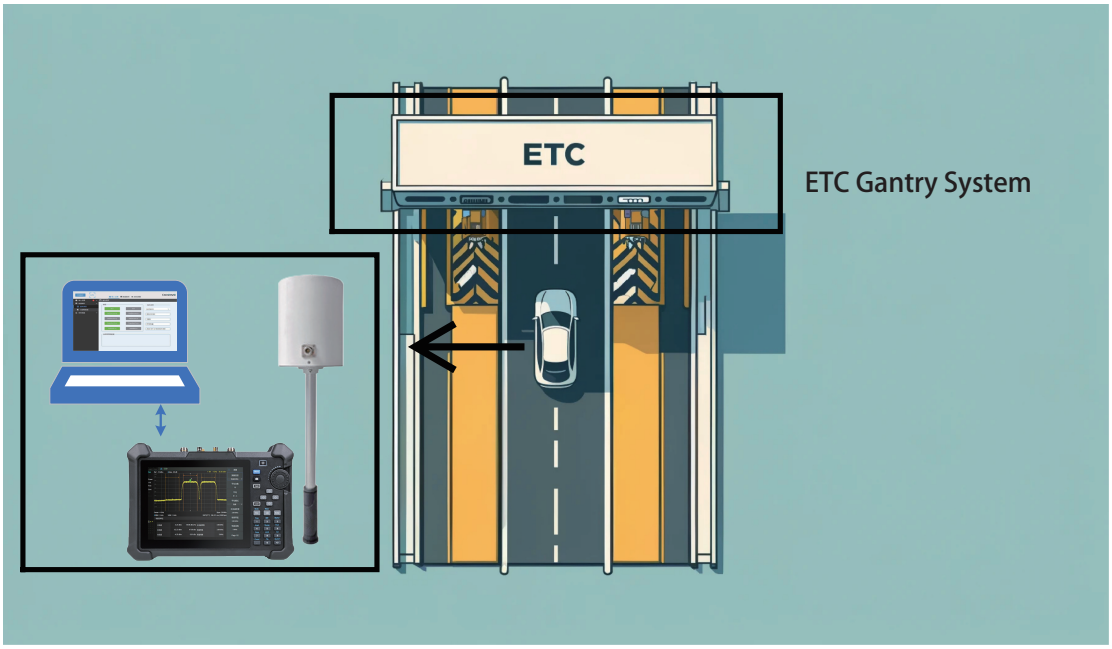
Leveraging its Beijing headquarters, related technical centers, and subsidiaries, Doewe Technologies has gradually established a nationwide pre-sales and after-sales service network, providing customers with professional technical consultation. Guided by the principles of "Rigorous, Efficient, Professional, Innovative," Doewe Technologies will continue steadfastly on this path, living up to the trust of every customer.

The journey ahead is long and challenging. We will accompany you on this path of growth to create a new future of technology together.

Overview

Solution Overview

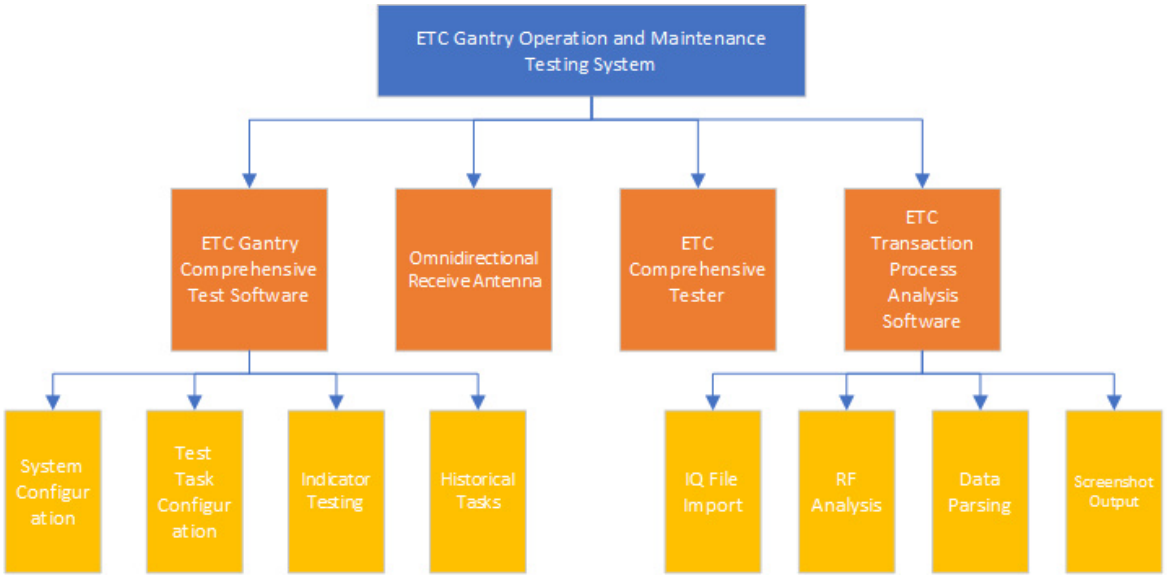
The ETC Gantry Operation and Maintenance Testing Solution is primarily designed to troubleshoot and resolve issues such as unsuccessful charging/billing or low charging/billing success rates during the actual use of the ETC gantry system's RSU antennas. It employs professional RF testing equipment to reliably test core critical indicators of the ETC gantry system, including RSU communication area, RSU operating signal strength, RSU operating frequency, RSU preamble, and RSU communication process. This is used to diagnose issues causing unsuccessful charging/billing in the ETC gantry system.



The ETC gantry system testing system is divided into an objective index testing module and a transaction process analysis module. The objective index testing module is composed of the core acquisition equipment ETC comprehensive tester and an omnidirectional antenna. In the actual test, the omnidirectional antenna is used to receive the RF signal output by the RSU, and the ETC comprehensive tester is used to test the key index parameters such as power, frequency, bandwidth, and preamble. When testing the transaction process analysis module, a vehicle installed with a normally tradable OBU is required, and the ETC comprehensive tester, omnidirectional antenna, and transaction process analysis software are loaded on the vehicle. During the test, the vehicle needs to be driven through the ETC gantry, and the testing system will record and analyze the actual transaction signals.

Features

System Framework

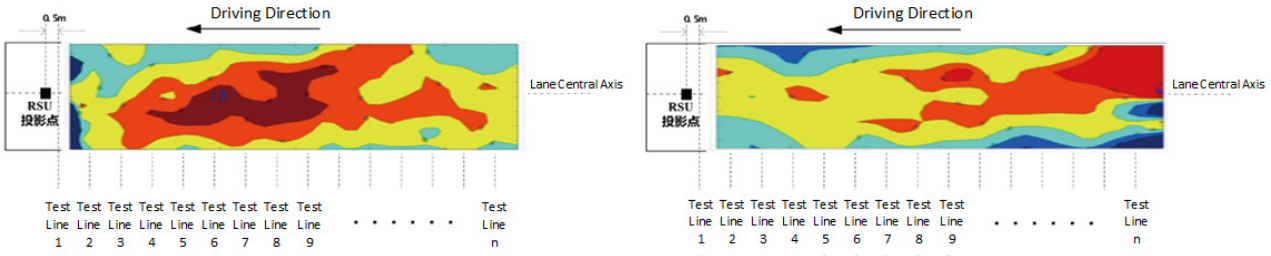


Solution Features

- Utilizes professional-grade testing equipment; data can be archived and traced; abandons primitive OBU-based detection methods.
- Possesses comprehensive ETC gantry signal detection capabilities, including RF power/frequency, data frame structure, and transaction process integrity.
- High-standard compliance: Testing methods adhere to national standards and transportation industry standards, including《GB/T 20851-2019 Dedicated Short Range Communication for Electronic Toll Collection》series standards、《JTG 2182-2020: Standard for Quality Inspection and Assessment of Highway Engineering - Section 2: Electromechanical Engineering》and《JTG/T 3520-2021: Testing Regulations for Highway Electromechanical Engineering》etc.;
- Supports automated testing: Core control software enables automated one-click testing, improving testing efficiency and reducing operator requirements and training costs.
- Visualizes test processes and data analysis results; supports displaying lane field strength coverage maps, facilitating result analysis, demonstration, and learning.
- Supports one-click test report generation; customizable test report templates aid reporting and archiving.
- Features high compatibility: Supports interfacing with third-party data display systems; all collected and analyzed data can be uploaded for display on large screens.
- Features high scalability: Supports future upgrades and extensions of testing applications.
- Includes professional ETC Transaction Process Analysis Software; supports retrieval and judgment of key interaction sentences, including: Preamble, BST, VST, SetM-MLrq, SetMMLrs, and concatenated statements.
- Core hardware devices feature portable design and support battery power; core devices and software support Chinese language, facilitating testing operations.
- System testing framework is clear; processes are reasonable; easy for test management.

Indicator Testing Examples

RSU Communication Area Test (Field Strength Coverage Effectiveness Test)



The RSU Communication Area Test function primarily tests whether the RF electromagnetic signals radiated by the RSU antenna achieve the intended electromagnetic field strength pre-coverage effect within the corresponding lane area. When visualized with dedicated software, the field strength coverage of the RSU communication area under test can be viewed intuitively. The figure above shows test result renderings for non-compliant (top left) and compliant (top right) communication area radiation field strength.

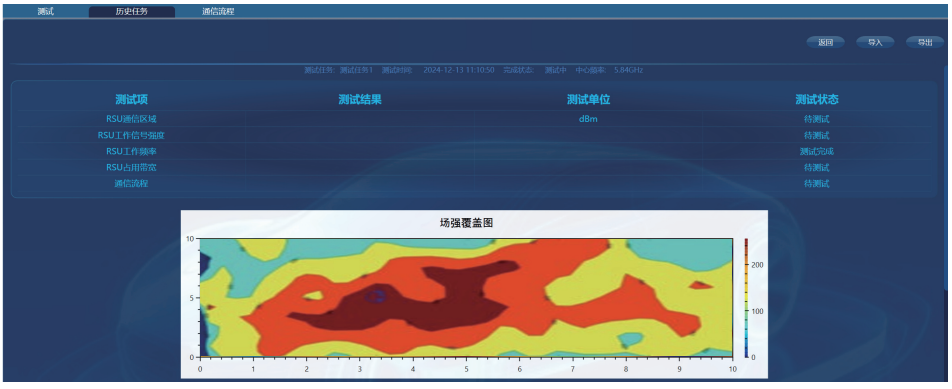
Communication Process Test

Use the ETC Comprehensive Tester connected to a receive antenna to record the interaction process between the OBU and RSU. Analyze the recorded signal using the ETC Transaction Process Analysis Software ProEye to obtain the relevant information contained within the signal.

Feature Software Interfaces

Test Task Configuration Interface: Allows setting up test equipment, test items, and lane-related settings.

Test Status Display Interface: Provides information on the current test progress.



Intuitively displays field strength coverage at different positions within the lane using different colors.

Core Equipment Introduction

ETC Comprehensive Tester

- Spectrum Analysis Mode, frequency range from 9 kHz to 7.5 GHz;
- Reference Level Setting Range: -200dBm to +30dBm, step 1dB;
- Level Measurement Range:
  DANL to +10 dBm, 100 KHz~1 MHz, Preamp Off;
  DANL to +20 dBm , 1 MHz~7.5 GHz, Preamp Off;
- Minimum Resolution Bandwidth (RBW): 1 Hz;
- Full Amplitude Accuracy: ±0.7dB;
- Maximum Continuous Wave RF Power:
  +33dBm, fc≥1 0 MHz, 3 min,
  Input Attenuation>20 dB;
- Trace Detection Modes:
  Positive Peak, Negative Peak, Sample, Normal, Average (Voltage/RMS/Video);
- Spectrum Analysis Trigger Modes Supported: Free Run, Video, External.

Omnidirectional Receive Antenna

Item	Specification
Operating Frequency	1.0GHz - 8.0GHz
Polarization	Vertical
VSWR	2.0 (TYP)
Antenna Gain	0dBi ~ 3.5dBi
Input Impedance	50Ω
Connector Type	N-type Female
Dimensions	Φ130×170mm
Weight	Antenna Body: ~1.3kg, Handheld Handle: ~0.35kg

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