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.

Scheme Overview and Core Advantages

Scheme Overview

Wi-Fi6/BT/WIFI Product R&D and Testing Solutions (hereinafter referred to as "BWTS")This solution currently includes three models: Single-port (Wi-Fi)、Dual-port (Wi-Fi + BT)、Triple-port (Wi-Fi6/6e + BT + TXQ). All models feature leading WLAN signaling wireless radio frequency (RF) testing capabilities, which can realistically simulate Wi-Fi network calling functions. Through automatic wireless signal connection via AP-STA communication protocols, they test various wireless RF performance indicators of the Device Under Test (DUT), providing a reliable and efficient RF testing solution for Wi-Fi6 and 6e products.

It boasts leading performance among solutions of the same type and can be used to test the wireless performance indicators of smartphones, computers, smart speakers, TWS earphones and other products with Bluetooth functions. Its indicators such as dynamic range, testing speed, weak power level and trace noise are all superior to those of mainstream products in the market. Its high calibration consistency and reliability ensure accurate measurement results during long-term operation.

Core Advantages

- **Max Number of Supported Concurrent Users on AP Test**
  - It can accurately measure the maximum number of STAs that an AP can access under given bandwidth/rate conditions;
  - It can accurately measure the resources that each user can occupy under the condition of a given number of users.

- **With an ultra-large power measurement dynamic range**
  - It can accurately detect weak wireless signals as low as -75 dBm without additional amplifiers.
- **Extremely High Cost-performance Ratio**
  - The test result data can be directly benchmarked against similar competitive products of industry giants (with a difference of less than 1dBm). The tested performance is superior, and the price is far lower than the pricing of competitive products, saving customers' R&D and production costs.
- **High - performance Wi - Fi 6、6e Validation Testing**
  - It supports the signaling test of IEEE 802.11ax and is backward compatible with all protocols of 802.11a/b/g/n/ac.

Runtime Environment

The BWTS needs to be used with the WTE Run client software. The host computer client software can be version - adapted according to different models of instruments, and present various test results on the software interface.

- **Hardware Requirements**
  - Software control platform, including PC or laptop: Computers meeting the following requirements are needed: equipped with a Pentium II or higher processor, a minimum of 256MB of memory, a minimum of 20GB of hard disk, a display (with a minimum resolution of 1024*768), a mouse, and a keyboard.
  - It is used in conjunction with our company's WTE series WLAN signaling testers. The software control platform with this software connects and communicates with the instruments via Ethernet.
- **Software Requirements**
  - Supports Windows 7/8/10 and is compatible with 32-bit/64-bit systems.
  - It supports Linux operating systems such as Ubuntu, RedHat and Fedora (adaptation in progress).

Performance Indicators

BWTS(Wi-Fi+BT)	
Project	Wi-Fi parameters
Impedance	50Ω nominal
Freq. Range	2.4 GHz(2412 MHz ~ 2472 MHz) 5.0 GHZ(5180 MHz ~ 5825 MHz) 6.0 GHz (5955 MHz ~ 7115 MHz)
Max. Input Power	30 dBm peak or 25 dBm average
Input Power Range	20 to -80 dBm
Input Power Accuracy	±0.25 dB(+15 to -60 dBm)
Output Power Range	5 to -90 dBm(2.4G frequency band) 0 to -92 dBm(5.8G frequency band)
Output Power Resolution	0.25 dB
Output Power Accuracy	±0.5 dB
The output power range of CW	-17dBm~-90dBm
Min. Testable Signal	-80 dBm
Input Voltage and Frequency	100-240VAC，50/60Hz
Rated Power	72 W
Operating Temperature	5°C to 40°C
Operating Humidity	20% to 75%
Weight/Volume	15 Kg 495mm(W)× 465mm(D)× 113mm(H)

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Performance Indicators

Project	BTparameters
Impedance	50Ω nominal
Freq. Range	2402 MHz ~ 2480 MHz
Bandwidth	1MHz(BR/EDR) 1MHz、2MHz(BLE)
rate	1Mbps(BR) 2Mbps、3Mbps(EDR) 1Mbps、2Mbps(BLE)
Freq. Resolution	300Hz
Max. Input Power	20dBm
Input Power Range	15 to -40 dBm
Input Power Resolution	0.1 dB
Input Power Accuracy	±0.5 dB (+15 to -30 dBm)
Output Power Range	-17 to -95 dBm(BR/EDR) -10 to -90 dBm(BLE)
Output Power Resolution	0.1 dB
Output Power Accuracy	±0.5 dB(-17 to -80 dBm)
The output power range of CW	-17dBm ~ -90dBm
Input Voltage and Freq.	100-240 VAC，50/60Hz
Rated Power	72W
Operating Temperature	5°C to 40°C
Operating Humidity	20% to 75%
Weight	8Kg
Volume	425mm(W) X 350mm(D) X 100mm(H)
Protocol Version	Classic Bluetooth(BR/EDR)Protocol Bluetooth Low Energy(BLE)4.2/5.0/5.1/5.2/5.3

Test Item Display

The test objects of this scheme are wireless devices with Wi-Fi modules, such as mobile phones, tablets, wireless network cards, laptops, etc.

Project Presentation	Wi-Fi Test Item Name
Transmit Power	Transmit(TX) Power
Receiving Sensitivity	Receiver(RX) Sensitivity
Packet Loss Rate	PER
The comparison range of packet loss rate	PER VS Range
MAC layer throughput	MAC Throughput
IP layer throughput	Iperf Throughput
The comprehensive index of transmission power and MAC layer throughput	TxPower & Throughput
Multi-layer Protocol Analysis	3D Protocol Measurement (RF、PHY、MAC)
Four - layer Protocol Analysis	4D Protocol Measurement (RF、PHY、MAC、Transport)
RVR Throughput	RVR (Throughput Range VS. Pathloss Range)
AP Wi-Fi Load	Network(Wi-Fi Load)
Error Vector Magnitude	EVM
Spectrum Template	Spectrum Mask
Spectral Flatness	Spectrum Flatness
IQ Constellation Diagram	IQ Constellation

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Test Item Presentation

Project Presentation	Classic Bluetooth(BR)Test Item Name
RF/TRM/CA/BV-01-C	Output Power
RF/TRM/CA/BV-03-C	Power Control
RF/TRM/CA/BV-07-C	Moduation Characteristics
RF/TRM/CA/BV-08-C	Initial Carrier Freq. Tolerance
RF/TRM/CA/BV-09-C	Carrier Freq. Drift
RF/TRM/CA/BV-01-C	Single Sensitivity
RF/TRM/CA/BV-02-C	Multi Sensitivity
RF/TRM/CA/BV-06-C	Max. Input Level
——	Throughput
Project Presentation	**Classic Bluetooth(EDR)Test Item Name**
RF/TRM/CA/BV-10-C	EDR relative transmit power
RF/TRM/CA/BV-11-C	EDR carrier freq. stability and modulation accuracy
RF/TRM/CA/BV-12-C	EDR differential phase encoding
RF/TRM/CA/BV-07-C	EDR sensitivity
RF/TRM/CA/BV-10-C	EDR max. input level
——	Throughput

Test Item Presentation

Project Presentation	Bluetooth Low Energy(BLE4.2/5.0/5.1/5.2)Test Item Name
TRM-LE/CA/01/C	Output Power
TRM-LE/CA/05/C	Moduation Characteristics
TRM-LE/CA/06/C	Carrier Freq. offset & Drift
RCV-LE/CA/01/C	Receiver Sensitivity
RCV-LE/CA/06/C	Max. Input Signal Level
——	Throughput

- **Analysis of Characteristic Four-Layer Protocol**

  Through the visualization of test data for the four-layer protocols (RF/PHY/MAC/Transport) and the real-time linkage of test data across layers, customers can quickly and accurately locate product issues.

- **WI-FI6 OFDMA Test Plan**

  The BWTS is configured with four sets of Vector Signal Analyzers (VSAs) for simultaneous signal analysis and four sets of Vector Signal Generators (VSGs) for simultaneous signal transmission. It supports the testing of uplink and downlink multi - user OFDMA scenarios, RU resource configuration testing, etc.

- **Over-The-Air (OTA) Testing System Solution**

  The system can support professional customized shielded enclosures, which feature an alloy box body and a solid and reliable design. Using the latest shielding materials, it has strong wave - absorbing capabilities, can effectively attenuate electromagnetic wave signals, has good shielding tightness, and a firm structure. It is currently the most economical and practical shielding test box, and its low price can reduce unnecessary expenses for enterprises. Equipped with a highly reliable sealed door, it makes the shielding effect better.

- **Interference Test System Scheme**

  Test Items: Performance testing of each layer under mutual interference of TRP/TIS/EIRP/EIS/Throughput (WiFi & BT), analysis and detection of the Adaptive-CCA mechanism; supporting protocols: 802.11 a/b/g/n/ac/ax; BT: BDR/EDR/BLE.

- **A high-throughput testing scheme supporting 1-to-N mode**

  It can perform over-the-air testing on multiple terminals simultaneously. The powerful network simulation allows IoT/M2M system integrators to conduct functional testing, module integration, and custom IP application programs. It supports high-throughput signaling testing and can open the interface according to user needs.

- **TXQ Test**

  Including multiple functional tests such as EVM (Error Vector Magnitude), Spectrum Mask, Spectrum Flatness, and IQ Constellation.

- **Module Testing**

  Here are the requirements for Bluetooth module manufacturers: Test time must be minimized as much as possible, while performance must be guaranteed. BWTS can establish a connection with the module under test and perform a set of basic receiver and transmitter measurements within 10 seconds. Module testing requires a test fixture, ideally in a shielded box, to connect the Bluetooth module to BWTS. The test fixture should provide a direct RF connection and, if necessary, an HCI connection with the module.

Introduction to Solutions

- **Consumer Product Testing**

  According to incomplete statistics, billions of electronic products are produced every year, and Bluetooth technology has become one of the standard configurations for many consumer products, including but not limited to WTS headphones, smart wearable bracelets, gaming phones, laptops, car Bluetooth, etc. For many manufacturers, this will be the first time to carry out radio frequency measurements in their production environment.BWTS is a highly directional solution, with all testing procedures designed in a simple and easy-to-operate software. Simply connecting the instrument to the host computer enables various quick solutions, which can be rapidly integrated into existing production facilities. By using the WTERun automatic testing software, BWTS can be quickly integrated into the production process, and all test results are automatically archived into CSV files for convenient access by customers.

- **Production Line Testing**

  In production line testing, the commonly concerned issue is how to ensure the accuracy of test results while also improving test efficiency as much as possible. BWTS supports dual - channel parallel testing, which can increase the test efficiency by 1.5 to 1.8 times and has a greater price advantage. The company currently has a group of senior FAE (Field Application Engineers) who are specialized in providing high - quality, customized and automated pre - sales and after - sales services (including FAE on - site support services) for customer companies.

- **Mobile Phone Testing**

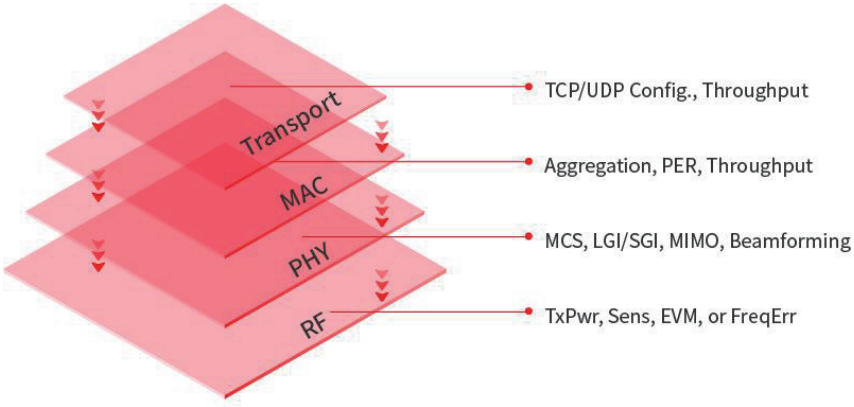
  Mobile phones are the largest mass-produced products that benefit from Bluetooth technology. Smartphone manufacturers also need to demonstrate the performance of Bluetooth technology. For mobile phones without radio frequency test connectors, BWTS can perform all measurements through over-the-air testing. It can measure various radio frequency indicators of the device under test, such as power, frequency, modulation and demodulation, receive sensitivity, and throughput, without the need to enter the DTM mode.

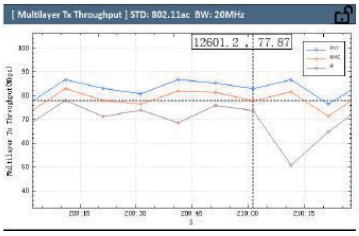
Four-Layer Protocol Solution

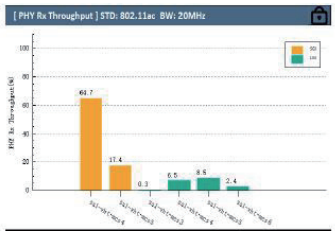
Pain point problem: When customers use products from different instrument manufacturers to carry out test and measurement processes, since instrument manufacturers typically provide testing services using different hierarchical protocols and do not attach importance to the development and application of the MAC layer in the four-layer protocol system, the data between layers cannot be connected due to the fault of the MAC layer. It may even lead to problems such as inability to capture multi-layer data, difficult data synchronization, or no relevance of test result data.

Brand manufacturers often face a dilemma: when selecting products from different chip manufacturers, simple RF performance tests show that the indicators of each chip manufacturer are nearly identical with low distinguishability. However, the actual customer experience varies significantly. Brand manufacturers themselves cannot distinguish the advantages and disadvantages of chip suppliers solely based on RF indicators; different chip suppliers can use various excuses to evade problems with their products, while brand manufacturers are unable to judge the authenticity of these claims.

The visualization of data testing for the four-layer protocol (RF/PHY/MAC/Transport) and real-time linkage of test data across layers can help brand manufacturers quickly and accurately locate product issues. No matter which layer the problem occurs in, it can identify the root cause of significant differences in actual customer experience, preventing chip suppliers from shirking product-related problems and enhancing the brand manufacturers' capability as the client. Each layer is independent yet interconnected: independent in that issues in one layer do not affect the operation of other layers, and interconnected in that upper-layer protocols rely on services provided by lower-layer protocols.



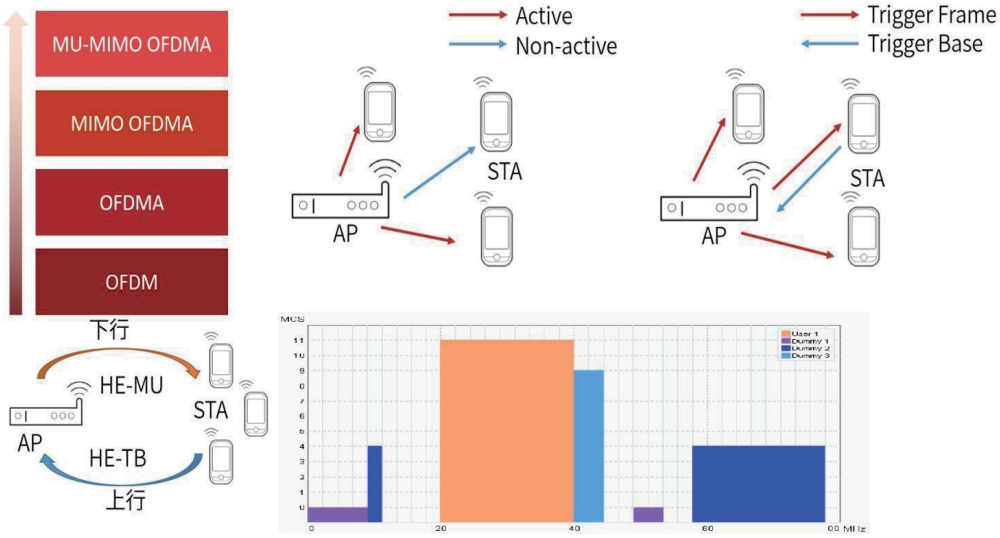




WI-FI6 OFDMA Test Plan

Traditional non-signaling testing for OFDMA faces numerous challenges. Different from conventional test items such as power and EVM, non-signaling OFDMA testing requires reconstructing test interfaces and software, adapting to proprietary instruction sets of different DUTs, and necessitates collaboration and support from original manufacturers. The long cycle from development to test application poses significant difficulties for SMEs in conducting OFDMA testing.

BWTS is configured with multiple sets of Vector Signal Analyzers (VSA) and Vector Signal Generators (VSG) to simultaneously analyze and transmit signals, supporting testing for uplink/downlink multi-user OFDMA scenarios and RU resource configuration testing.



Test Item Display

-- Support MU-MIMO Over-The-Air (OTA) Testing;

-- Signaling Testing for Ultra-High Throughput Protocols;

-- Support RF testing for Wi-Fi 6/6E products and be compatible with all previous protocols (a/b/g/n/ac);

-- Support SISO radiation power, sensitivity, diversity gain and multi-antenna throughput tests;

-- With an ultra-large power measurement dynamic range, it can accurately detect weak wireless signals as low as -80dBm without additional amplifiers, making it more suitable for 5GHz Wi-Fi OTA testing.

OTA Performance Testing Plan

BWTS, combined with the WTS-8000 OTA testing system, is a manually operated shielded box customized by our company in collaboration with professional shielded room and shielded box manufacturers. With a compact working size, it is suitable for RF shielding tests, EMI/EMC tests, and detection of relatively large wireless communication devices such as routers, AP products, tablets, navigators, cordless telephones, vehicle-mounted navigation products, and netbooks. The shielded box is made of die-cast alloy materials, integrated with absorbing materials, featuring excellent shielding tightness and a robust structure.

Advantages and characteristics

1、System simplicity: No external power amplifier unit is required (the radio frequency path is more robust);

2、Data accuracy: The uncertainty for testing small ITC-class products, when compared with large systems, is < 0.5dB, eliminating the need for a reference spectrum analyzer;

3、Cost-effective: With an aperture distance of 180*180cm, it features a reduced volume, faster testing speed, and a construction cost that is only 1/2 of mainstream testing systems.

Test Project

-- RVR Test

-- Total Isotropic Sensitivity (TIS)

-- Equivalent Isotropic Sensitivity (EIS)

-- Total Radiated Power(TRP)

-- Effective Isotropic Radiated Power(EIRP)

-- PHY/MAC/IP throughput (Throughput)

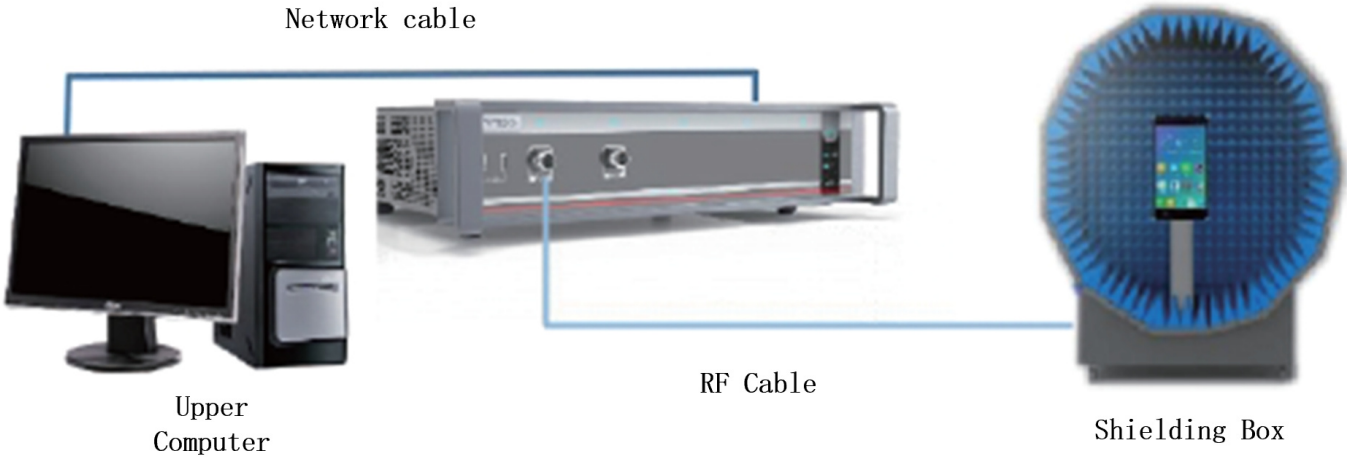
-- 2D/3D radiation pattern (Radiation Pattern)

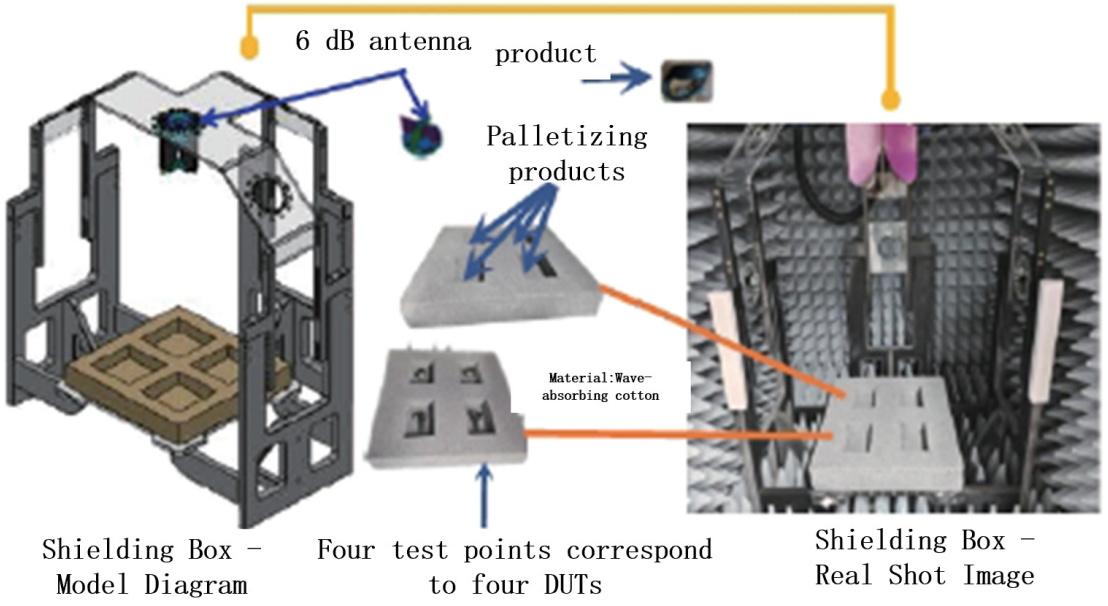
-- It can achieve fast signaling Association connection (<0.5s)

-- It can accurately measure weak wireless signals as low as -80 dBm

One-to-Four Testing Scheme

For manufacturers, traditional testing solutions mostly adopt the method of using ping-pong + multiple shielded boxes, which increases testing costs and floor space. Once there are a large number of products, manual rotation of the DUTs (Devices Under Test) for sequential testing each time will undoubtedly consume a lot of time costs. BWTS supports multi-panel testing in a 1-to-many mode (up to 4 terminals can be tested simultaneously, i.e., the 1-to-4 solution). The testing system can perform over-the-air testing on multiple terminals at the same time. Even if four DUTs are tested synchronously, there will be no mutual interference. This not only greatly saves testing time costs but also ensures that the data of the four DUTs are basically consistent with the data measured individually. It is suitable for large-scale mass production testing in production lines, helping enterprises improve industry testing efficiency, save time costs, and provide great convenience for R&D testing.

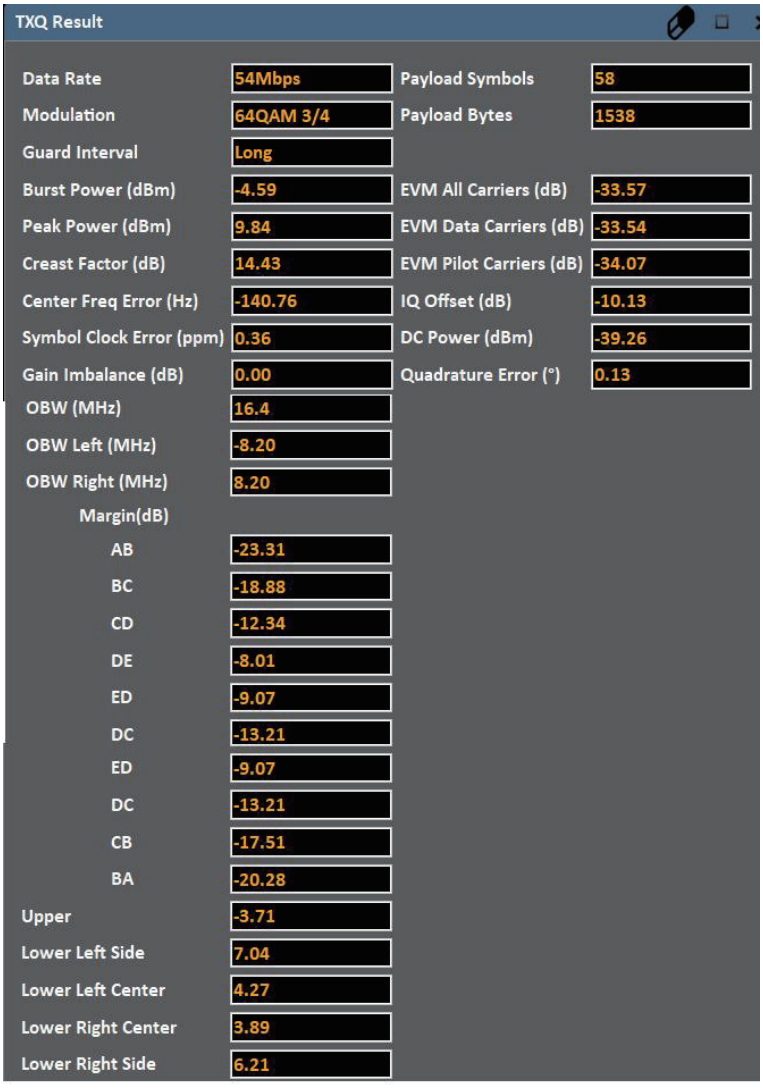




TXQ Test

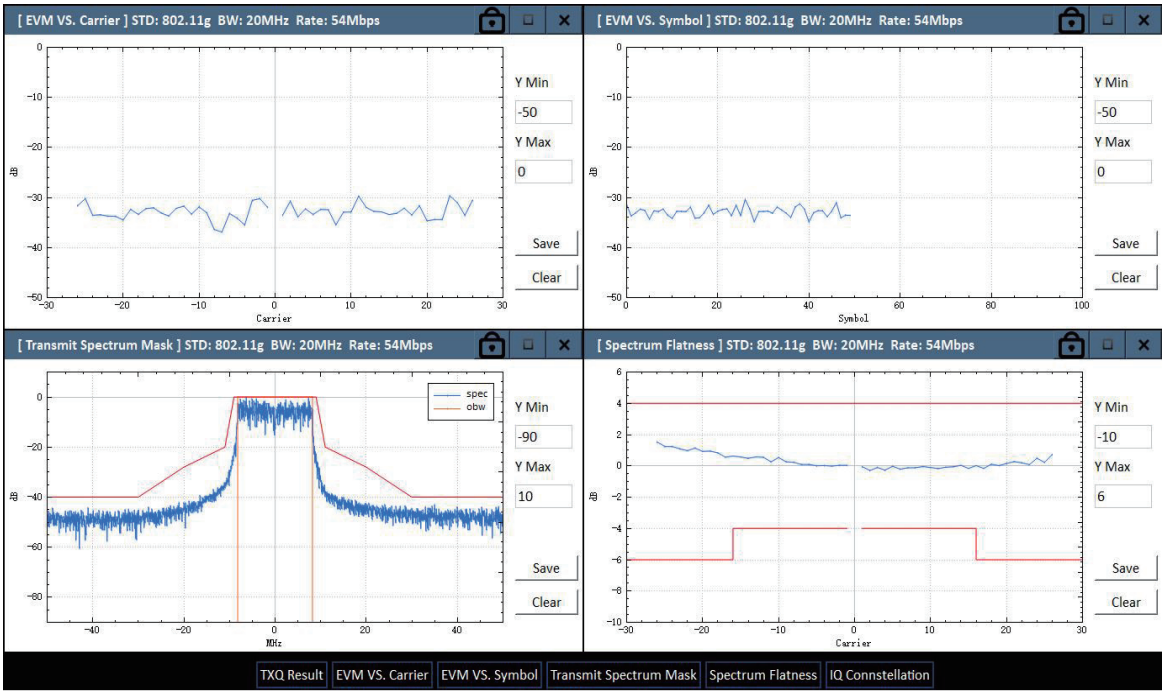
The TXQ test under signaling mode is supported (including EVM, Spectrum Mask, Spectrum Flatness, and IQ Constellation).

The results are shown in the figure: it indicates the comprehensive indicators (such as Power, EVM, etc.) for testing TXQ.

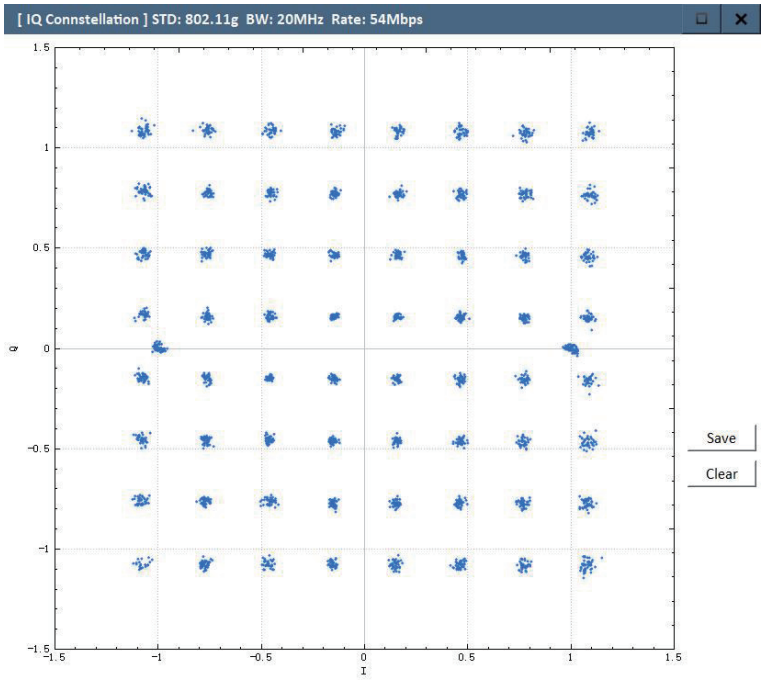


Specialty Testing Projects

As shown in the figure below: The EVM VS. Carrier and EVM VS. Symbol windows can show the variation of EVM with Carrier and Symbol. The Transmit Spectrum Mask window printout can show the spectrum template data, and the Spectrum Flatness window printout can show the spectrum flatness.



As shown in the figure: The IQ Constellation window can display the situation of the IQ constellation diagram.



Bluetooth Throughput Test

Pain point problem: For manufacturers, conventional Bluetooth general testing can only test product indicators such as power, frequency offset, modulation characteristics, and receiving sensitivity. However, it cannot solve the audio dropout issue that most Bluetooth audio products encounter during music playback. Therefore, there is an urgent need for instruments and testing solutions that can perform throughput testing on Bluetooth products to address this problem.

BWTS is one of the representative solutions for Bluetooth protocol testing systems in the industry that can support throughput testing functions. It can not only test indicators of Bluetooth products such as power, frequency offset, modulation, and receiving sensitivity, but also perform throughput testing on Bluetooth products, helping manufacturers solve the audio dropout problem that occurs when most Bluetooth products play music.

Competitor Analysis for Pairing Mode

With the continuous development of Bluetooth technology and the gradual popularization of various Bluetooth products in daily life, how to enhance the actual user experience has become a major focus of attention for major Bluetooth manufacturers.

At present, the factory testing of most products on the market is carried out in engineering mode. Moreover, to obtain the method for a product to enter engineering mode, technical support from the chip original manufacturer is usually required. However, for competitive product analysis, it is generally impossible to obtain the corresponding commands of competitors. Therefore, having an instrument that can perform connection testing in the pairing mode of products is of great significance for R&D and competitive product analysis.

BWTS features a Pairing mode competitive product analysis function, enabling quick testing of various RF indicators without the DUT needing to enter DUT mode. This significantly improves testing frequency, while the test data results are closer to the product's actual usage status. It supports real-time saving of test data, facilitating customers' comparative analysis of test results and practically implementing the customer-first principle.

BLE Signaling Test

In traditional DTM testing, specifically BLE DTM, the test instrument sends RF test commands to the Bluetooth Controller layer of the DUT (Device Under Test) via the UART interface using HCI or 2-wire protocols. It then captures the DUT's RF signals and calculates corresponding RF metrics. This process necessitates a wired connection to control the DUT.BWTS supports the BLE signaling test method. Without requiring the DUT (Device Under Test) to enter DTM mode, it can measure basic RF indicators of the DUT, including power, frequency offset, modulation/demodulation, receiving sensitivity, and throughput. This approach eliminates the need for a serial port, excluding the influence of common-mode interference, and the test results are closer to the DUT's real-world operational data. It effectively solves the problem of traditional DTM testing, where frequent plugging and unplugging of data cables reduces testing efficiency, and enables normal testing even without an external serial port.The proprietary BLE signaling test feature of BWTS enables you to effectively reduce reliance on traditional DTM testing. Particularly in production line testing, it minimizes wear and tear on USB cables, genuinely enhancing testing efficiency, lowering testing complexity, and saving both time and material costs. This makes the testing process more convenient and productive.

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