



Wireless Connectivity eBook

Wireless LAN and Bluetooth® Technologies Permeate Our Lives





Wireless LAN and *Bluetooth*® Technology Use Case Issues and Solutions

Electronic devices around us adopt various wireless communication standards depending on the purpose of use. The technologies differ in communication distance, transmission speed, and power saving capability among other characteristics. These include 5G and 4G for cellular networks and NB-IoT, LTE-Cat M1, LoRa, and Sigfox for low-power wide area networks (LPWAN), as well as RedCap, wireless LAN (WLAN), and Bluetooth technology.

WLAN and Bluetooth technology are characterized by high-speed data transmission or low power consumption in short-range communication. They also provide easy connectivity to multiple devices. Furthermore, because of their low cost of use, these technologies are employed in a vast range of products, including cell phones, IoT devices, automobiles, audio equipment, and medical equipment, thus supporting people's lives.

While WLAN and Bluetooth technology are used in all kinds of situations, there are some issues to address for enabling comfortable communication. This document describes those use case issues and solutions.

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1. Wireless Connectivity Use Cases and the Points to Note

Smartphone/Tablet



Besides cellular communication, mobile devices such as a smartphone feature other wireless functions as well. WLAN is used for video streaming and cloud access over high-speed Internet connections, and Bluetooth technology is used for short-range communication in conjunction with wireless earphones and speakers. Both technologies make mobile terminals more useful.

However, the WLAN and Bluetooth technologies face the same problem as other wireless communication standards – a drop in communication speed in locations with poor signal reception and in a congested network. Moreover, mobile terminals featuring multiple wireless functions may experience interference among radio waves with different wireless standards. In that case, the issue is to secure the quality of communication.

AR/VR

Head Mounted Display (HMD) for augmented reality (AR) and virtual reality (VR), which are used for medical and industrial applications, gaming, and so forth, have evolved in many ways, including increased display resolution, improved tracking technology, and enhanced sensor accuracy. Therefore, enabling the streaming of high-quality AR/VR contents requires advanced wireless communication specifications, such as Wi-Fi 7 and 5G, for network connectivity.

Wireless connectivity under these advanced specifications has the following issues.

- High-speed wireless communication requires broad bandwidth.
- The quality of communication degrades due to wireless network congestion or signal blockage.
- Quality degradation of communication destabilizes the network condition, causing data communication delays.

Related Links : [Extended Reality \(XR\)](#)



Healthcare/Wearable



Featuring low power consumption and short-range communication, Bluetooth technology offers portability and ease of connection, leading to its widespread use in wearable devices. For example, healthcare devices and smart watches actively are utilized to monitor and gather health condition data such as heart rates and sleep patterns.

Many wearable terminals support a communication range of not more than 10 meters to achieve low power consumption. These devices may not be able to deliver required performance as the communication is blocked by an obstacle such as a wall or depending on the part of the body the user wears it on. It is therefore necessary to check in advance that the required the quality of communication is secured in the intended usage environment.

Medical

Medical institutions use digital data for treatment by storing and managing treatment data, gathering examination data, monitoring inpatients' physical condition data, and so forth. Recently, AI-powered diagnosis systems have come into use for diagnostic assistance. WLAN is increasingly used for the data transmission from such digital medical devices, taking into consideration Internet connectivity and portability.

Communication may be interrupted, however, because the radio waves do not reach the access point (AP) due to the distance to the AP, an obstacle in the communication path, or the like or because of wireless interference from an external source. Ensuring the quality of communication with medical devices be secured is important so as to prevent any adverse effect on diagnosis.

Related Links : [Internet of Medical Things \(IoMT\)](#)



Automotive – Infotainment



Advances in connected car technology have turned a vehicle into a moving living room. During a long drive, passengers can enjoy watching streaming video, as well as participate in an online meeting or do some work over a cloud connection, by using an in-vehicle WLAN. Connecting Bluetooth technology to an in-vehicle system allows passengers to speak on the phone and operate the navigation system, among other things, as they wish.

On the other hand, since radio waves of multiple wireless communication standards coexist, problems such as wireless interference and noise can arise. There is also a concern that the communication quality may degrade as radio waves are blocked by or reflected on a metallic part of the car body.

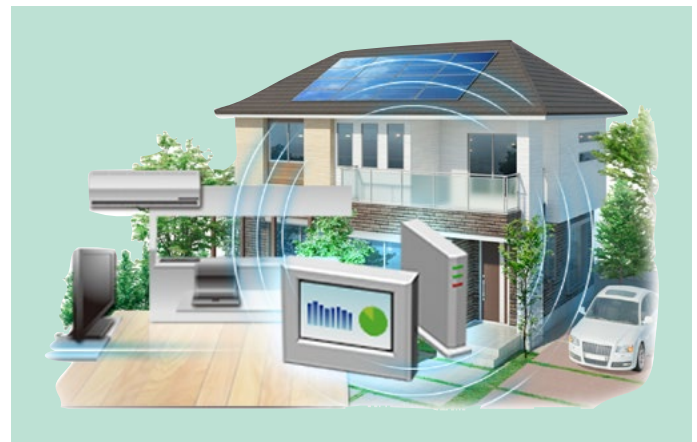
Related Links : [Infotainment](#)

Smart Home

A smart home enables various convenient functions via a network of electronic devices that feature WLAN or Bluetooth technology. Users can operate home appliances remotely using a smartphone or tablet, as well as control the lighting and temperature of the house with the aid of a voice assistant. Operating home appliances from outside the house is also possible via a mobile network.

There are issues, however, regarding connection instability in locations with poor signal reception or due to wireless interference, security, etc. Care needs to be exercised about stable wireless quality of electronic devices, unauthorized access from external sources, and so on.

Related Links : [Smart Office/Smart Home](#)



As stated above, WLAN and Bluetooth technologies are used for a wide range of purposes.

The beauty of these two technologies is that they support wireless communication, eliminating the constraints of cabling, providing high portability, and allowing multiple devices to be connected easily. However, some issues exist in terms of connection stability. They include interference with other radio equipment, network congestion caused by limited communication bandwidth, and a drop in connection due to constraints of the communication range. To solve these issues, it is necessary to secure wireless quality. This requires understanding the relevant wireless communication standards and conducting necessary tests.

2. Frequency Bands and Challenges in WLAN and Bluetooth Technologies

The Coexistence of Diverse Radio Waves in the ISM Bands

WLAN and Bluetooth technologies mainly use the 2.4 GHz and 5 GHz frequency bands (Bluetooth technology only uses 2.4 GHz band). These frequency bands are known as ISM (Industrial, Scientific, and Medical) bands and allocated for general use in industrial, scientific, and medical fields by the International Telecommunication Union (ITU). While the use of radio waves typically requires a radio operator license and notification, most devices that utilize the ISM bands can be used without a license. Therefore, a vast variety of devices share these bands, becoming widespread in the markets.

However, wireless communication devices utilizing the ISM bands may experience the problem of interference with surrounding electronic appliances and wireless communication instruments. The 2.4 GHz and 5 GHz band in particular is extremely congested, with a host of devices using the same frequency, which potentially leads to signal interference or an adverse effect on communication stability. This may result in connection instability or reduced communication speed.

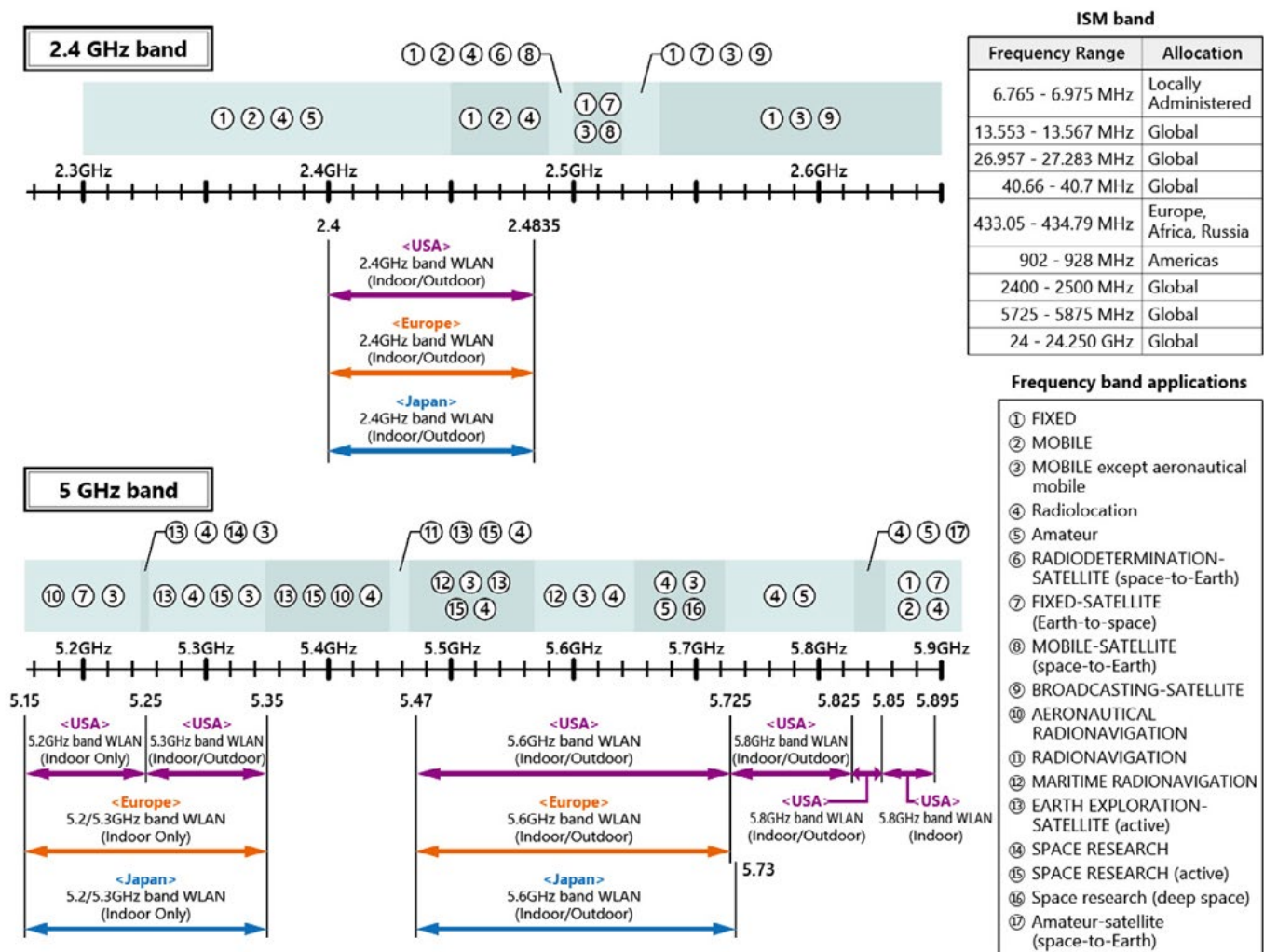


Figure 1 WLAN 2.4 GHz/5 GHz Bands and ISM Frequency Band Usage

To Sell in the Global Market

When exporting wireless devices abroad, compliance with the laws and regulations is required in the destination country or region, as well as the relevant international rules. Each country or region has its unique laws and regulations regarding the use of radio frequency. To ensure compliance, it is vital to check the laws and regulations of the destination country or region for specifics.

The standards and certification processes for WLAN and Bluetooth technologies have been established by the Institute of Electrical and Electronics Engineers (IEEE) and other industrial organizations. Wireless devices must comply with the pertinent standards and acquire pertinent certification as appropriate for the use of the product.

Regulatory Certification

There are various regulations that require certification from different perspectives, as shown below.

The frequency range of radio waves that can be used for communication, broadcasting, etc. is limited. In addition, once emitted to the air, radio waves continue to propagate while attenuating. This causes radio waves to interfere with each other when they are used in the same space at the same time. Since such interference can occur across countries, the International Telecommunication Union Radiocommunication Sector (ITU-R) controls the frequencies internationally and each country or region regulates the use of radio waves in accordance with the laws that are based on the rules set by the ITU-R.

- (1) Use of radio waves
- (2) EMC (Electro Magnetic Compatibility)
- (3) Safety

Table 1 Examples of regulatory bodies in different countries and regions

Region	Approval Standards
Europe	European Telecommunications Standards Institute (ETSI)
USA	Federal Communications Commission (FCC)
China	Ministry of Industry and Information Technology (MIIT)
Southeast Korea	Korea Communication Commission (KCC)
Taiwan	National Communications Commission (NCC)
Japan	Ministry of Internal Affairs and Communications (MIC)

IEEE 802.11 Standard

This standard specifies the performance and functional requirements for WLAN devices. For WLAN devices to communicate with each other, each of those devices needs to comply with the IEEE 802.11 standard. However, there are no certification tests intended to check whether a WLAN device implementation is compliant with the IEEE 802.11 standard. Since no certification scheme based on the IEEE 802.11 standard exists, there has been a problem in the past where connection cannot be established between WLAN devices from different vendors.

Wi-Fi Alliance Certification

The Wi-Fi Alliance is a non-profit organization working to spread WLAN technology and to promote interoperability. It tests devices based on the IEEE 802.11 standard and grants Wi-Fi marks to certified products. This test does not check compliance with the IEEE standard using a simulator or other testing instrument; rather, it is mainly intended to check whether the DUT* establishes a connection and functions normally with a WLAN device selected as a reference. Acquiring Wi-Fi certification guarantees interconnectivity with other Wi-Fi certified devices. Certification tests can be conducted only by those test labs approved by the Wi-Fi Alliance. The acquisition of Wi-Fi certification is optional and not required by law.

* DUT: Device Under Test

Bluetooth SIG Certification

The Bluetooth SIG is a non-profit organization established to develop and spread Bluetooth technology. It creates specifications and standards on Bluetooth technology and facilitates the operation of a certification system to ensure interoperability among products. Once certified by the Bluetooth SIG, a product is allowed to carry the Bluetooth logo and registered as a certified device on the Bluetooth SIG website. This also guarantees interconnectivity with other Bluetooth products. Products need to be tested by a certification authority to check that they meet the performance requirements set forth in the Bluetooth Test Specification.

3. WLAN (Wi-Fi) Standards and Appropriate Test Solutions

Table 2 lists the major WLAN standards and technical specifications. One of these WLAN standards is selected based on the usage conditions of the product equipped with WLAN capability (installation location and method and purpose of use).

Table 2 Major WLAN standards and technical specifications

IEEE 802.11		11b	11a	11g	11n	11ac	11ax	11be*1
Transmission Vector Format		Non-HT (Non-High Throughput)	Non-HT (Non-High Throughput)	Non-HT (Non-High Throughput)	HT (High Throughput)	VHT (Very High Throughput)	HE (High Efficiency)	EHT (Extreme High Throughput)
Freq.	2.4 GHz	✓	n/a	✓	✓	n/a	✓	✓
	5 GHz	n/a	✓	n/a	✓	✓	✓	✓
	6 GHz	n/a	n/a	n/a	n/a	n/a	✓	✓
Bandwidth [MHz]		20	20	20	20/40	20/40/80/ 160/80 + 80	20/40/80/ 160/80 + 80	20/40/80/ 160/320
Maximum Throughput Rate [bps]		11M	54M	54M	540M	6.9G	9.6G	30G or more*2
Modulation Scheme		DBPSK DQPSK	BPSK QPSK 16QAM 64QAM	BPSK QPSK 16QAM 64QAM	BPSK QPSK 16QAM 64QAM	BPSK QPSK 16QAM 64QAM 256QAM	BPSK QPSK 16QAM 64QAM 256QAM 1024QAM	BPSK QPSK 16QAM 64QAM 256QAM 1024QAM 4096QAM
Stream		—	—	—	4 streams	8 streams	8 streams OFDMA	16 streams OFDMA

*1: Information of the March 2019 Project Authorization Request

*2: Effective value

Frequency Bands Used for WLAN

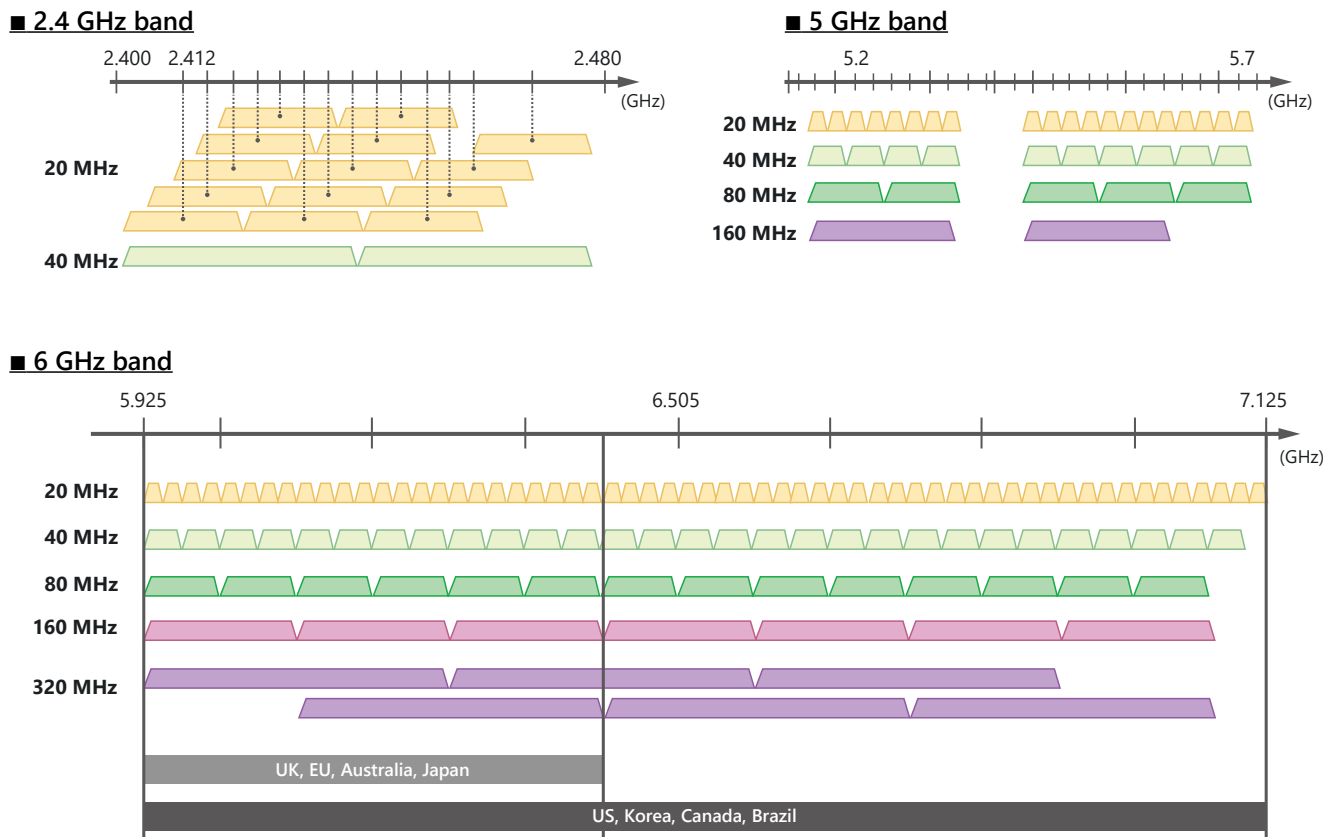


Figure 2 Frequency bands used for WLAN

IEEE 802.11 Standard in the OSI Reference Model

The IEEE 802.11 standard covers the Physical Layer (PHY) and Data Link Layer of the OSI reference model. IEEE 802.11 defines the Data Link Layer as two separate sublayers: Logic Link Control and Medium Access Control (MAC).

Table 3 Scope of application of the IEEE 802.11 standard in the OSI reference model

Layer	OSI Reference Model	802.11 Standard
7	Application	Out of scope
6	Presentation	Out of scope
5	Session	Out of scope
4	Transport	Out of scope
3	Network	Out of scope
2	Data Link	Out of scope (Logic Link Control)
		Medium Access Control (MAC)
1	Physical	Physical (PHY)

Physical Layer (PHY): The IEEE 802.11 standard covers the Physical Layer, which includes frequency bands used for wireless transmission, signal transmission system, channel width, etc. Various versions of the standard, such as 802.11g, 802.11n, 802.11ac, 802.11ax, and 802.11be, define different frequency bands and maximum data rates, respectively.

Data Link Layer: The IEEE 802.11 standard defines the WLAN frame structure and media access control (MAC) protocol in the Data Link Layer. This includes the frame format, data transmission and reception methods, data error detection, and retransmission control.

Test Solutions Optimal for Signal Quality Evaluation of WLAN Products

With an electronic device that adopts WLAN for its communication system, it is possible to simply check the communication status of the device by using a commercially available AP. It is not possible, however, to accurately grasp quantitative numerical data that may affect the communication performance, such as transmit power and receiver sensitivity. As a result, if the communication performance is lower than expected, the device may become unable to maintain stable communication as the usage environment changes. To ensure stable communication despite the impact of the usage environment requires monitoring the wireless communication performance quantitatively. The basic evaluation methods include the follows.

- Transmission signal quality testing, transmission power, which measures the strength of the radio waves emitted when electronic equipment transmits data, and modulation accuracy, which evaluates whether the signal modulation is in the expected format
- Receiver sensitivity test to calculate the packet error rate (PER) by counting the acknowledge (ACK) frames that an electronic device returns in response to test packets transmitted

RF Transmit and Receiver Measuring Instrument for WLAN-equipped Devices

The wireless connectivity test set MT8862A, Anritsu's RF transmit and receiver characteristic evaluation solution, is useful when designing WLAN-equipped devices and evaluating the quality of those devices. The most remarkable feature of the MT8862A is that it supports the "network mode" in which the DUT (Device Under Test) can be measured in an actual operating condition with the DUT connected to a commercial AP (STA) because it implements the standard WLAN protocol messaging (WLAN signaling). The direct mode is also supported, which allows a single MT8862A unit to test a WLAN-equipped device from multiple aspects.

Supports the Latest Standard

In addition to IEEE 802.11a, b, g, n, ac, and ax, the MT8862A is compliant with the latest WLAN standard, IEEE 802.11be, supporting the unlicensed 6 GHz band that is increasingly used around the world. The MT8862A can evaluate the diversifying RF transmit and receiver characteristics of various WLAN-equipped devices, such as transmit power, modulation accuracy, and receiver sensitivity.

Simple Setup for an Efficient Measurement Environment

The MT8862A simulates an access point (AP) or station (STA) and sets up a network connection with the DUT by using the standard WLAN protocol messaging compliant with IEEE 802.11a, b, g, n, ac, ax, or be. It also supports the WEP, WPA-Personal, WPA2-Personal, and WPA3-Personal security schemes and, by combining these versions, the TKIP or AES encryption method can be selected. Once a connection is set up, RF measurements can be made using the general WLAN communication protocol without the need for any special tool or control. No special measurement environment needs to be set up.

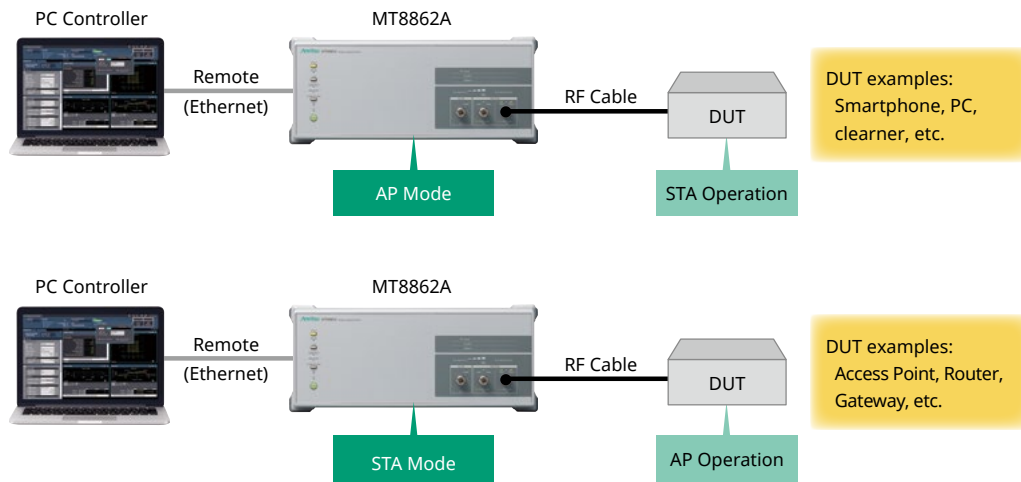


Figure 3 Examples of the measurement system connection

Network Mode Suitable for OTA (Over The Air) Tests

The transmit and receiver performance of a wireless communication terminal is affected by the terminal shape and antenna characteristics among other things. In an OTA test, radio waves are actually emitted to evaluate the overall transmit and receiver performance of a wireless communication terminal. In connection with OTA tests for WLAN, test standards on TRP (Total Radiated Power), TIS (Total Isotropic Sensitivity), and so on are specified in the RF performance measurement plans of the CTIA* and the CWG (Converged Wireless Group) of the Wi-Fi Alliance. System integrators provide various test solutions that use the MT8862A.

*: Cellular Telecommunications & Internet Association. international non-profit organization consisting of wireless communication carriers, manufacturers, service providers, etc.

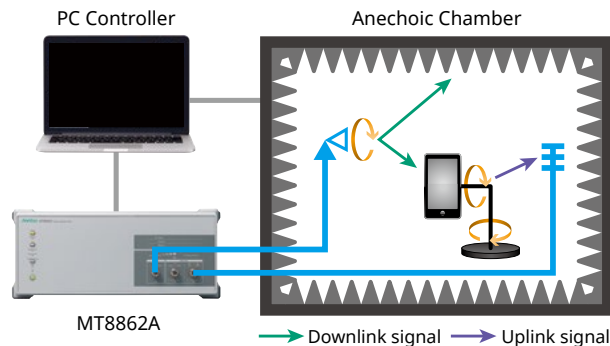


Figure 4 Example of the OTA measurement system connection

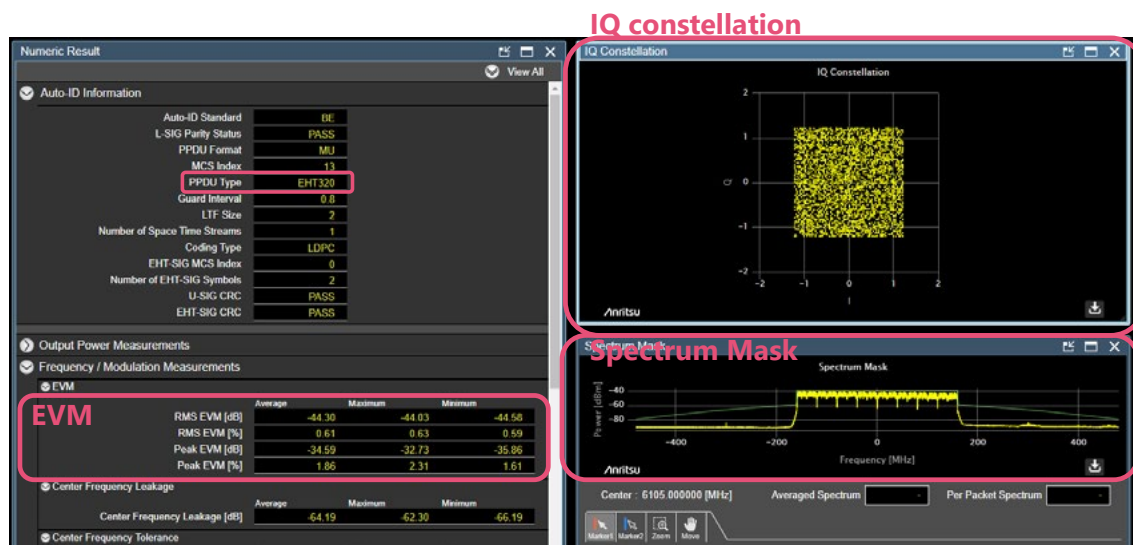


Figure 5 MT8862A measurement GUI

4. Bluetooth Standards and Appropriate Test Solutions

Advances in Bluetooth Technology

The Bluetooth v3.0 standard supports a high data rate, and Bluetooth v4.0 adopts Bluetooth Low Energy (LE) technology to include low power consumption in its specifications. In Bluetooth v5.0 and later, new functions such as Long-Range Communication and High-Precision Indoor Positioning are added.

Table 4 Advances in Bluetooth technology

	v1.0	v1.1	v1.2	v2.0+EDR	v2.1+EDR	v3.0 HS	v4.0	v4.2	v5	v5.1	v5.2	v5.3	v5.4
Frequency Band	2.4 GHz ISM Band (2402 MHz - 2480 MHz)												
Channel Spacing	1 MHz						2 MHz						
Range	1 to 100 m						1 to >1000 m						
Modulation	GFSK			GFSK PSK ($\pi/4$ -DPQSK and 8DPSK)		AMP	GFSK						
Gross Data Rate	1 Mbps			2 or 3 Mbps		24 Mbps	1 Mbps		1 Mbps, 2 Mbps, 500 kbps, 125 kbps				
Power Consumption	High			Medium			Low						
Key Feature	First spec	First working spec	AFH	EDR		HS	Low Energy	IP conn Security	AE 2 Mbps Coded PHY	AoA/ AoD GATT Cache	LE Audio Power Control EATT	Enh. Connect Chan. Class. Remove AMP	PAwR (Periodic Advertising with Responses)
								DLE					
Security	Less secure				More secure			Less secure	More secure				

Bluetooth RF Specifications

The RF specifications of Bluetooth technology are defined as follows.

BR/EDR transmission power (Max)	Class1: +20 dBm, Class2: +4 dBm, Class3: 0 dBm
LE transmission power (Max)	Class1: +20 dBm, Class1.5: +10 dBm, Class2: +4 dBm, Class3: 0 dBm
Receiver sensitivity	-70 dBm
Frequency band	2.4 GHz ISM band
Channels	79 BR/EDR, 40 LE
Channel bandwidth	1 MHz BR/EDR, 2 MHz LE
Modulation	GFSK for BR and LE, $\pi/4$ -DQPSK and 8DPSK for EDR
Gross data rate (symbol rate)	1 Mbps BR and LE v4.x, 2 and 3 Mbps in EDR 2 Mbps, 500 kbps and 125 kbps for LE v5.x
Robustness	CRC - 16 bit BR/EDR, 24 bit LE

Protocol Stack of Bluetooth Technology

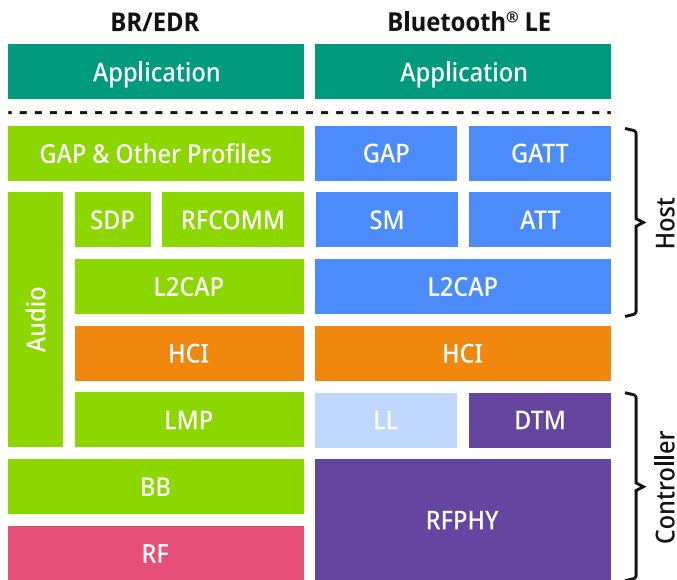
The Bluetooth Protocol stack includes a variety of protocols.

The core protocol includes the Bluetooth radio, baseband, Link Manager Protocol (LMP), Logical Link Control and Adaptation Protocol (L2CAP) and Service Discovery Protocol (SDP).

The Cable Replacement Protocol includes the Radio Frequency Communication (RFCOMM) protocol, which is a simple set of transport protocols, on top of the L2CAP protocol, and it provides up to 60 simultaneously emulated RS-232C serial ports to a single Bluetooth device. This protocol is not only used directly in many telephony-related profiles as an AT command carrier but also as the transport layer for Object Exchange (OBEX) on a Bluetooth connection.

The attribute protocol (ATT) and generic attribute profile, which were introduced in Bluetooth v4.0, are expected to be used by all low energy devices. Note, however, that they can also be used for BR/EDR.

GAP stands for Generic Access Profile. This profile controls a Bluetooth connection between devices and determines how to permit advertising using Bluetooth communication and interaction between paired devices. Advertising is used to broadcast data by means of Bluetooth technology to enable connections and transmit data to multiple devices (for example, in the case of Bluetooth beacons).



ATT	Attribute Protocol
BB	Baseband
DTM	Direct Test Mode
GAP	Generic Access Profile
GATT	Generic Attribute Profile
HCI	Host Controller Interface
L2CAP	Logical Link Control and Adaptation Protocol
LL	Link Layer
LMP	Link Manager Protocol
RF	Radio Frequency
RFPHY	Radio Frequency Physical Layer
RFCOMM	Radio Frequency Communication
SDP	Service Discovery Protocol
SM	Security Manager Protocol

Bluetooth technology is a packet-based protocol with a central-peripheral structure and a piconet or scatternet architecture. The central connects a device to the network and handles the hopping sequence and multiplexing. The Bluetooth profile defines the type of data to be transmitted by the device and the service to be used. Standard profiles differ depending on the purpose, such as smartphones, PC peripherals, audio equipment, and wearable terminals.

Any manufacturer wishing to sell a Bluetooth product is required to prove that the product meets the Bluetooth specifications. Tests must be conducted at a certified lab and include:

- RF/RFPHY conformance test
- Protocol/profile conformance test
- Profile interoperability test

The Bluetooth specifications are backward compatible with the older versions, and the latest version defines two wireless communication technologies.

- Basic Rate (BR)/ Enhanced Data Rate (EDR)
- Bluetooth Low Energy (LE)

BR/EDR and Bluetooth LE have different structures and characteristics. When designing a product, one or both these technologies can be supported depending on the application requirements.

Appropriate Test Solutions for Bluetooth Product Evaluation

Module or device manufacturers need to maintain the quality and reliability of their products. Therefore, introducing the latest testing technology is necessary for adopting an ever-evolving technology like Bluetooth. Anritsu's Bluetooth test set MT8852B provides test functions that meet the diverse needs in the development process. It enables vendors to evaluate the module or device performance accurately and to ensure that high performance and high reliability can be achieved.

Moreover, in the testing process of the production line, the MT8852B allows a test to be conducted quickly with one button test. This reduces the cycle time and boosts yield, helping to cut test costs.

Compliance with the RF Test Procedure Defined by Bluetooth SIG

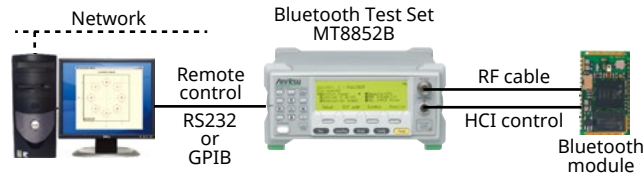
The MT8852B can quickly and easily test the Basic Rate, EDR, and Bluetooth low energy power, frequency, modulation, receiver sensitivity, etc. required in the Bluetooth RF test specifications.

- Measurement performed in Bluetooth test mode
- Support of loopback and Tx modes.
- The MT8852B can connect to the HCI (Host Control Interface) of a device and switch the device to test mode. Support the UART, USB, or USB adapter interface.
- Support the Bluetooth low energy 2-wire interface as a standard feature.
- Support of a receiver sensitivity test using a dirty signal.

Bluetooth Module Testing

The MT8852B offers sufficient performance and functionality to meet the test needs of Bluetooth module manufacturers.

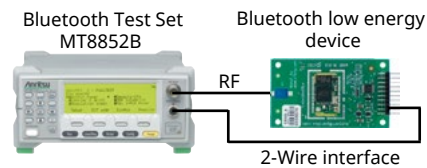
If the address of the DUT is unknown, the MT8852B conducts the test by automatically reading or inquiring the address via the module HCI (RS-232C or USB). Its built-in CW frequency counter can be used for crystal trimming. When testing the DUT, the MT8852B can be connected either directly to RF or to the module HCI interface.



Bluetooth BR/EDR/Low Energy Device Testing

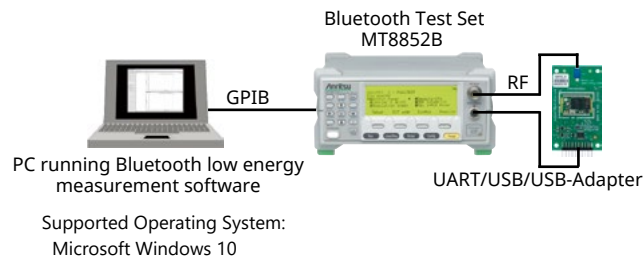
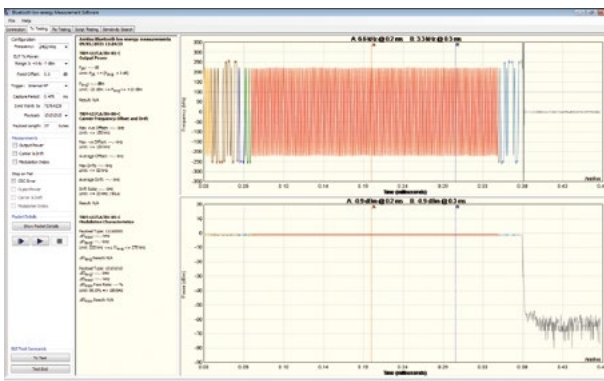
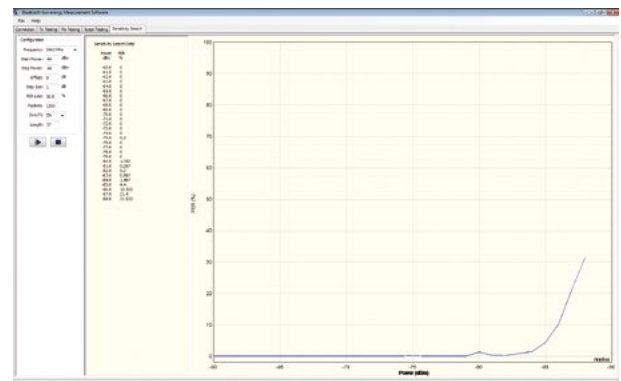
There are two types of Bluetooth device. One is a dual mode device integrating the Basic Rate, EDR, and Bluetooth low energy functions into a single chip, and the other is a single mode device that supports only Bluetooth low energy.

Unlike the Basic Rate and EDR tests, the Bluetooth low energy specifications do not define any test mode (loopback mode) based on the signaling to the DUT. The DUT needs to be controlled either by a test control command transmitted via the HCI interface or, if the DUT does not support the HCI interface, via the 2-wire interface.



A Bluetooth low energy device can be tested by controlling a PC remotely using Bluetooth low energy measurement software. The Bluetooth low energy measurement software is installed in the PC, and the PC and MT8852B are connected using a GPIB cable. The Bluetooth low energy DUT and MT8852B are connected using an RF cable.

The reference packets transmitted from the DUT are analyzed and displayed on the PC, and the MT8852B is used for setting and controlling the packets. The receiver sensitivity of the DUT can be tested by transmitting these reference packets.



Related Links : [Bluetooth Testing Solutions](#)

5. Evolving Electronic Devices and Increasingly Diverse and Sophisticated Production Lines

Test Solutions Optimal for Evaluating Devices against Diverse Wireless Standards

Electronic devices including smartphones, IoT terminals, consumer appliances, and automotive parts, are provided as complex applications, each putting together diverse wireless communication standards such as WLAN and Bluetooth technology.

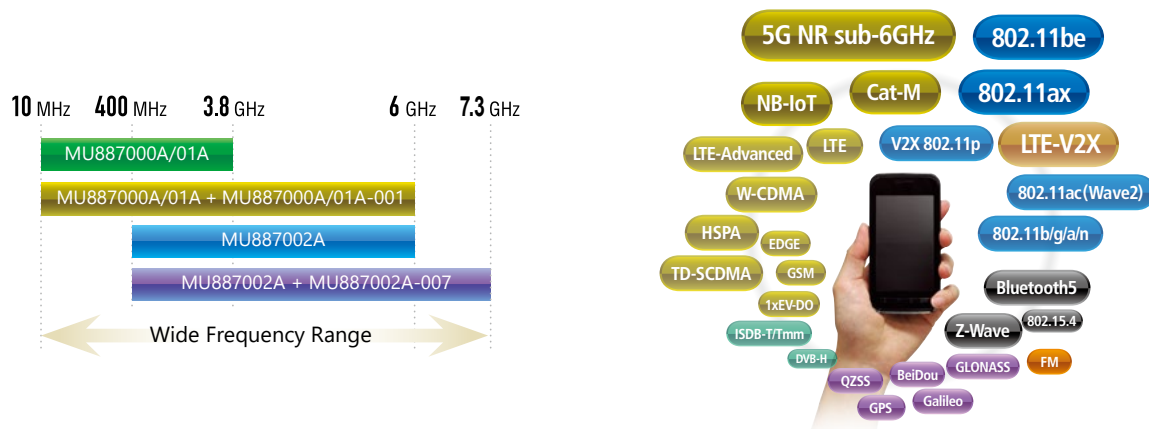
In the mass-production lines of such increasingly sophisticated electronic devices, the tests in the manufacturing process are becoming more complex and there is a growing need for test solutions that allow manufacturers to enhance productivity while flexibly responding to diverse communication standards.

The universal wireless test set MT8870A supports a variety of wireless communication standards including 5G NR sub-6 GHz, LTE, LTE-V2X, WLAN, and Bluetooth technology. It can house up to four modular test units and control each of them independently. This enables tests to be conducted efficiently while addressing different communication standards.

A single test unit supporting various wireless communication standards

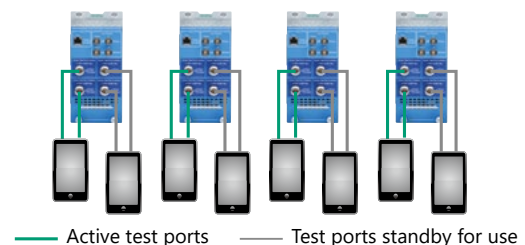
A single MU88700xA test unit can support multiple wireless communication standards. Support of each individual communication standard is achieved by adding measurement software and waveform files. This enables the sharing of transmit and receiver test units.

A wide frequency range can be supported by selecting different test units. Unlike a dedicated measuring instrument that supports only a specific frequency, the MU88700xA makes it possible to flexibly respond to new wireless communication standards, enabling manufacturers to address various communication standards quickly and efficiently.



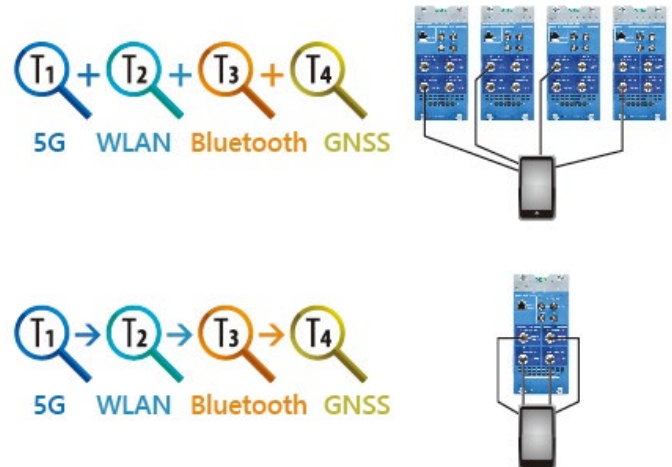
Connecting 8 test communication terminals simultaneously – Ping-pong measurement

The ping-pong measurement method allows two test communication terminals to be connected to a test unit and measured alternately on a continual basis. Since the MT8870A can house up to four test units, the two communication terminals connected to each test unit can be tested alternately at the same time. A single MU887000A/01A test unit has four RF test ports, and up to two communication terminal antennas can be connected. A single MU887002A test unit has two transmission and reception functions, each equipped with 12 RF test ports. This allows up to eight communication terminals and up to six antennas to be connected. Using these functions can improve manufacturing efficiency.



Simultaneous testing of 4 different standards

Smartphones feature not only cellular communication but multiple other wireless communication systems as well such as Bluetooth technology and WLAN. Testing a device against multiple wireless communication standards simultaneously can reduce the test time per standard.



Testing multiple wireless communication standards continuously with a single test unit

MT8870A can perform multiple wireless communication tests in succession by installing measurement software and waveform licenses for the target wireless communication standard on a single test device. This makes it possible to test a device against different wireless communication standards efficiently on a continual basis.

Universal Wireless Test Set MT8870A/MT8872A

PC applications

CombiView

CombiView is a PC application used to control the MT8870A/MT8872A and display graphical and numerical test results.

It has the following functions:

Key Features

- Windows interface displays graphs of Tx measurement results, and controls signal generator for Rx test
- Remote control of MT8870A/MT8872A (MU88700xA) via Ethernet and GPIB (option)
- Setting of MT8870A/MT8872A (MU88700xA)



6. Wireless Connectivity Test Product

Anritsu provides three types of measuring instruments designed for wireless quality evaluations for WLAN and Bluetooth technology. These products can be used as appropriate for the purpose ranging from development and manufacturing to maintenance.

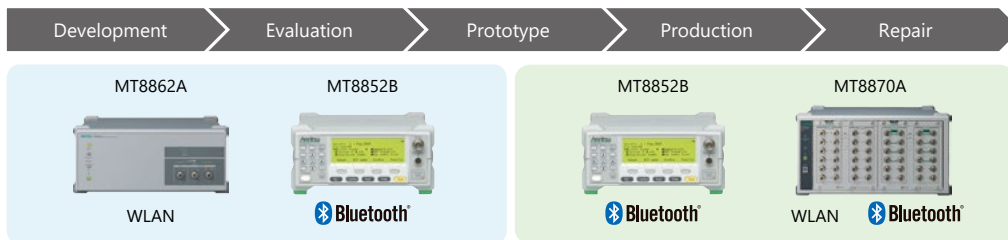
Test solutions with signaling functions ideal for the development process:

- Wireless Connectivity Test Set MT8862A
- Bluetooth Test Set MT8852B

* MT8862A can also be connected in non-signaling or direct mode. It is possible to test devices without signaling functionality in the early development stage.

Non-signaling test solution ideal for the production line:

- Universal Wireless Test Set MT8870A/MT8872A
- Bluetooth Test Set MT8852B



Evaluate the radio quality by connecting the DUT and the instrument in one of the following modes.

Select the connection mode according to the state of the DUT and the purpose of evaluation.

Signaling/network mode:

This method establishes a connection by executing procedures and protocols for communication through signaling operation. By reproducing and testing actual communication protocols, product quality and performance can be evaluated under actual operating conditions. Since it does not require a dedicated test mode, it also has the advantage of reducing development costs. By measuring under conditions close to actual communication, it is easier to identify the cause of any defects that may occur.

Non-signaling/direct mode:

This method establishes a connection by signal input/output to the measured device without any signaling procedure. Since no specific communication protocol is required, testing can be performed without a completed protocol stack. In addition, direct control of signal transmission and reception enables fast and efficient measurements.

Wireless Connectivity Test Set (WLAN Tester) MT8862A



- Network Mode: Connection establishment with WLAN devices using WLAN protocol messaging (WLAN Signalling) makes measurement available.
- IEEE 802.11a/b/g/n/ac/ax/be including 6 GHz band and 320 MHz BW support
- 2x2 MIMO Rx sensitivity and Tx power measurement functions
- Supports secure WEP, WPA-Personal, WPA2-Personal and WPA3-Personal encrypted connections.
- Tx measurements (Tx power, modulation accuracy, etc.) using ICMP echo request.
- PER (packet error rate) measurement using ACK count for Bathtub curve generation as Rx measurements
- Remote control and display of measurement results from Web browser using built-in Web server
- Connection troubleshooting by capturing and analyzing WLAN protocol message
- Sending/receiving IP data to/from external server using built-in IP interface

Related Links : [Wireless Connectivity Test Set \(WLAN Tester\) MT8862A](#)

Bluetooth Test Set MT8852B



- Qualified by Bluetooth SIG for measurements
- Compliant with Bluetooth Core Specification v.5.4 RF test suite
- Basic Rate and EDR measurement performed in Bluetooth test mode – Loopback or Tx mode supported
- Signal generator and transmitter analyzer modes for protocol free applications
- “Quick Test” script validates Basic Rate, EDR and Bluetooth low energy test performance in under 15 seconds
- “Full Test” script performs full Bluetooth SIG compliant testing from single key press
- For design proving and production test
- Full implementation of Basic Rate, EDR and Bluetooth low energy dirty transmitter for Bluetooth SIG RF test specification compliant measurements
- Audio test capability, 3 SCO channels with CVSD, μ -Law and A-Law air interface
- Adaptive Frequency Hopping (AFH) measurements (MT8852B-015)
- Easy operation – one-touch testing with “Run” key
- BlueSuite Pro3 PC software displays; FSK modulation, power burst profile, PSK constellation diagrams and sensitivity searches graphically
- CombiTest software automates tests with test script generator and results data base
- GPIB and RS232 remote programming interfaces
- Initialization and control of test devices through USB, RS232 and USB-Adapter HCI control port
- Built-in support for Bluetooth low energy 2-Wire control interface
- Small size (half rack) and low weight (≤ 3.8 kg)

Related Links : [Bluetooth Test Set MT8852B](#)

Universal Wireless Test Set MT8870A/72A



- The measurement functions for up to four TRX test modules are mounted in a single chassis. Realizes a high-density measurement system
- Signal generator and Analyzer pair is installed in one slot
- Replaceable TRX test module to reduce manufacturing downtime
- Supports multiple wireless standards
5G NR, LTE/LTE-V2X, W-CDMA/HSPA, TD-SCDMA, GSM/EDGE, CDMA2000/1xEV-DO, IEEE 802.11be/ax/ac/n/a/g/b/p (V2X), Bluetooth, Zigbee, Z-Wave, GPS/GLONASS/BeiDou/Galileo/QZSS, DVB-H, ISDB-T
- Supports simultaneous signal output of 0 dBm (Max.) from all 12 RF connectors per slot (MU887002A)
- Supports FM measurement by Built-in audio analyzer and audio generator (MU887001A)

Related Links : [Universal Wireless Test Set MT8870A](#)