ADVANTEST®

R4870
Radio Communication Tester

RF tests conforming to Bluetooth™ SIG standards and connection tests with Blue Unit Test Cases can be achieved with a single unit

R4870

From Development and Pre-qualification Testing to Manufacturing Inspection of Bluetooth Modules and Incorporated Devices

Bluetooth, the specifications for the technology related to short-range communications between electronic devices, has received considerable attention in every field. The achievement of seamless communications between different types of electronic devices requires identification of the related RF characteristics and communication protocols.

The R4870 Radio Communication Tester is designed exclusively for Bluetooth. Its compact body incorporates every function required for evaluating the performance of Bluetooth modules.

The design of a Bluetooth module requires verification of items of interoperability such as RF characteristics. The R4870 provides RF and communication test functions. The RF test can evaluate power, frequency, modulation index, and receiving sensitivity that conform to Bluetooth SIG standards by control through a wireless interface. In addition, the R4870 implements the Blue Unit Test Cases, which are included in the Bluetooth SIG standards, so that the communication test can evaluate interoperability by executing the connection test with the R4870.

The Bluetooth qualification test consists of complicated series of test items and requires a considerable amount of labor for pre-qualification. The R4870 controls the spectrum analyzer and signal generator for interference and optionally provides a function to test all specification items regarding wireless devices automatically. It also facilitates configuration of an ideal system for comprehensive evaluation.

- Bluetooth SIG tests major items with loopback testing.
- Including the HCI command for controlling test modes.
- A Dirty Transmitter Signal is supported for the receiving sensitivity (BER) test.
- The Blue Unit Test Cases testing protocol is embedded.
- The control commands of the spectrum analyzer and signal generator for interference are incorporated to facilitate total test system configuration (Option*).
- Includes a 12-inch TFT LCD.
- Features a user-friendly touch panel for control.
- Compact, light weight design

* Schedules for delivery in the fourth quarter of 2002 (from October to December)

Test items conforming to SIG Ver. 1.1

	SIG Standard No.		Test item	R4870	The total test system containing the R4870*
Sending test	5.1.3	TRM/CA/01/C	Output Power	●	●
	5.1.4	TRM/CA/02/C	Power Density	–	●
	5.1.5	TRM/CA/03/C	Power Control	–	●
	5.1.6	TRM/CA/04/C	TX Output Spectrum (Frequency range)	–	●
	5.1.7	TRM/CA/05/C	TX Output Spectrum (20dB Bandwidth)	–	●
	5.1.8	TRM/CA/06/C	TX Output Spectrum (Adjacent channel power)	–	●
	5.1.9	TRM/CA/07/C	Modulation Characteristics	●	●
	5.1.10	TRM/CA/08/C	Initial Carrier Frequency Tolerance	●	●
	5.1.11	TRM/CA/09/C	Carrier Frequency Drift	●	●
	5.1.12	TRC/CA/01/C	Out-of-band Spurious Emissions	–	●
Receiving test	5.1.13	RCV/CA/01/C	Sensitivity (single slot packets)	●	●
	5.1.14	RCV/CA/02/C	Sensitivity (multi-slot packets)	●	●
	5.1.15	RCV/CA/03/C	C/I Performance	–	●
	5.1.16	RCV/CA/04/C	Blocking Performance	–	●
	5.1.17	RCV/CA/05/C	Intermodulation Performance	–	●
	5.1.18	RCV/CA/06/C	Maximum Input Level	●	●
			Signaling	●	●

* The total test system containing the R4870 will be delivered in the fourth quarter of 2002 (from October to December)

User-friendly Panel Design

Touch screen with user-friendly design
12-inch TFT LCD panel

Function selection and execution keys from software menu

Test execution key
- START ––– Starting sequential tests
- SINGLE –– Starting an individual test
- STOP –––– Terminating the test

Floppy disk drive
Settings and test results can be stored on disk

Mouse and keyboard connector

Power-off switch (software switch)
This switch must be used to turn off the power

Power-on switch (hardware switch)

External spectrum analyzer/signal generator/power meter RF connection port

RF input-output port (high sensitivity)

RF input-output port (normal)

CONTROLLER (OPTION)

RS232 (for controlling HCI)

LAN   VIDEO

Rear panel

10 MHz REF. IN/OUT   **TRIG. OUT**

Embedded HCI Command Enabling Loopback Test

Embedded HCI command

The Bluetooth module must be set to test mode before a loopback test can be executed. The R4870 houses an HCI interface, and can set the module to the test mode wait state. Then, the test mode can be activated by an RF signal to automatically start the loopback test.

If a device contains a Bluetooth module but does not contain an HCI interface, the test can still be executed by turning off the HCI control of the R4870.
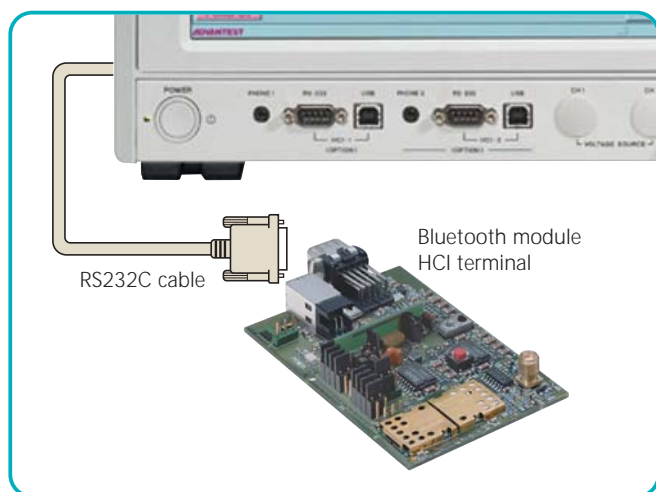
Test execution

The R4870 provides its own independent automatic test environment. It executes the specified test items sequentially, displays the test data along with an indication of PASS or FAIL which appear with different colors, and delivers an overall evaluation. In addition, it can select an individual item to be retested. The test data can be stored in the built-in large-capacity hard disk.

RS232C cable

Bluetooth module
HCI terminal
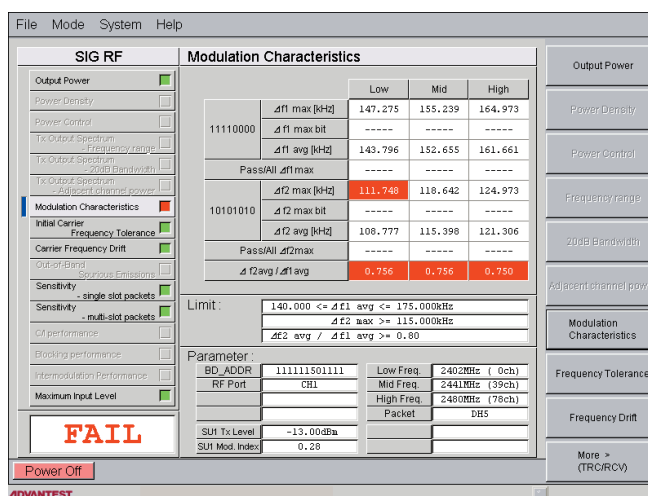
Easy modification of test items

Items for automatic testing can easily be specified in the Setup window. Simply touching the name of a listed test item inverts the check in the box, immediately modifying the test item status. In a similar way, the test channel for each test item can be specified. Accordingly, an optimum test environment can quickly be set up by modifying the system corresponding to the items varying with changes in requirements.
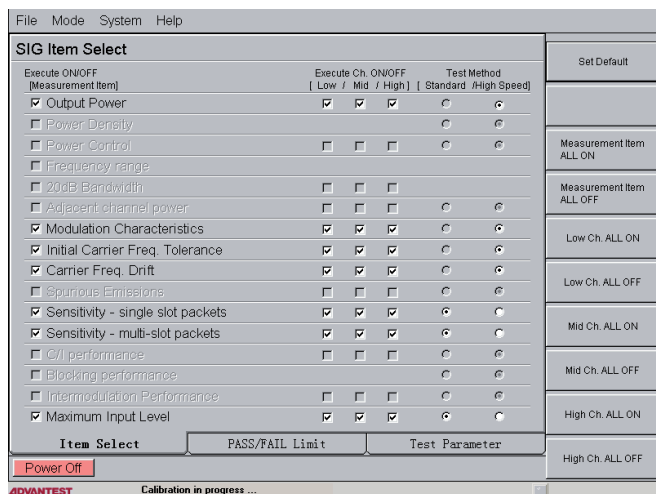
Changing criteria for determining PASS or FAIL

The criteria for determining PASS or FAIL of the test items can be changed. Although the default value is set to the standard value, it is useful to be able to control the tolerance of Bluetooth devices.
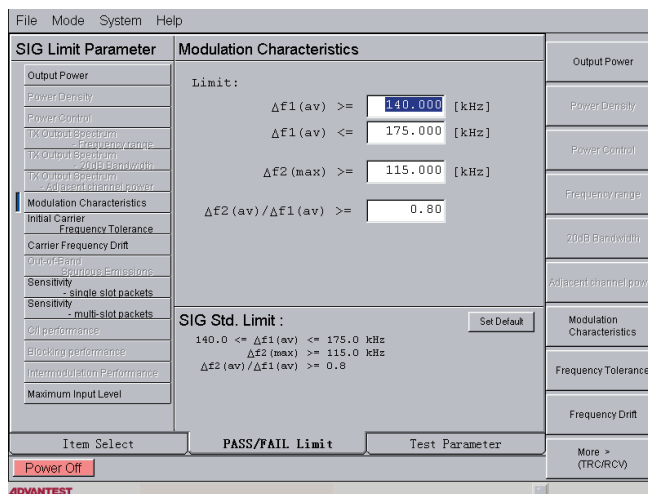
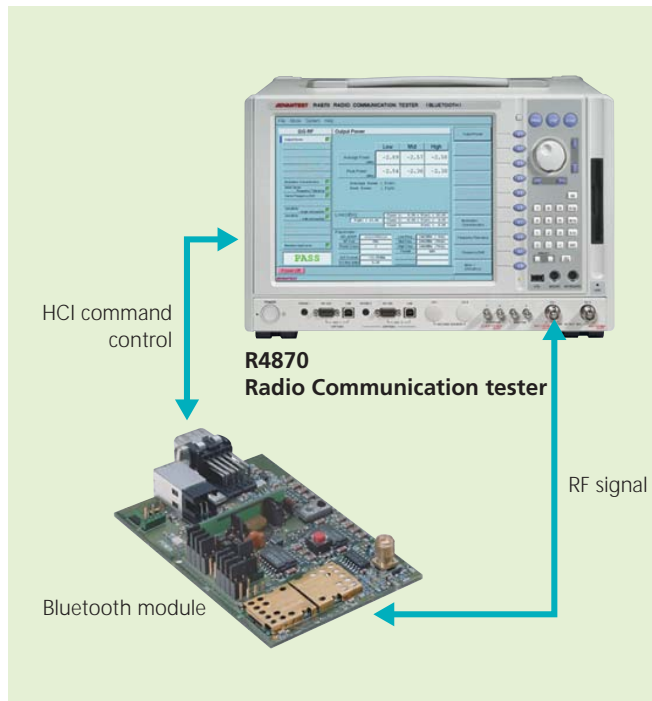## Test items the R4870 provides independently

Transmitter characteristics

- Peak power
- Average power
- FM deviation
- Carrier frequency
- Frequency drift
- Frequency drift rate

Receiver characteristics

- Receiving sensitivity (single-slot packets)
- Receiving sensitivity (multislot packets)
- Maximum input level

A Dirty Transmitter Signal is supported for the receiving sensitivity test.
The test setting can be switched to test with a normal signal.

HCI command control

R4870
Radio Communication tester

RF signal

Bluetooth module

Example of modulation characteristics test

Example of carrier frequency test

Example of frequency drift test

Example of receiving sensitivity test

Radio Communication Tester

Connection Test Based on Bluetooth SIG Standard Blue Unit Test Cases

Communication test

Operation adaptability test of RF, BB, and LM is specified in the Blue Unit Test Cases to maintain a minimum level of interoperability of Bluetooth modules. The R4870 contains 12 test cases, which are listed below. Therefore, an interoperability evaluation that is equivalent to the connection test with the current Blue Unit is available. The built-in test cases are executed sequentially, and either PASS or FAIL is indicated with different colors as the test result for each item. An individual test item can be executed separately. The center of the window displays the HCI command that is transmitted between the R4870 and the Bluetooth modules and HCI event in different colors.
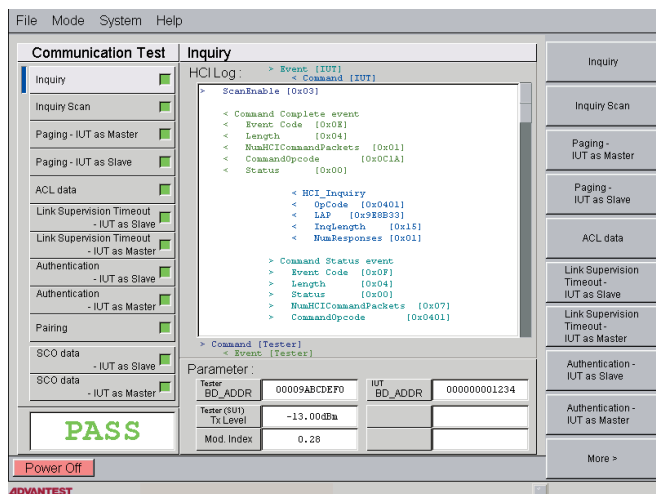

Supported Blue Unit Test Cases

- Inquiry
- Inquiry Scan
- Paging (IUT as Master)
- Paging (IUT as Slave)
- ACL Packet Types
- Link Supervision Time out (IUT as Slave)
- Link Supervision Time out (IUT as Master)
- Authentication (IUT as Slave)
- Authentication (IUT as Master)
- Pairing
- SCO data (IUT as Slave)
- SCO data (IUT as Master)

Configuring the system for pre-qualification testing (Option*)

Evaluation testing at the Bluetooth Qualification Test Facility (BQTF) is complicated and time-consuming. In addition, failing the test leads to unnecessary excessive expenses and/or loss of business opportunities. A test system configuration consisting of the R4870 and spectrum analyzer, signal generator enables automatic RF testing that conforms to Bluetooth SIG standards.

An external tester required for a specific test item can be controlled by the R4870 using GPIB, and the user does not have to create new system control software for the test. In addition, an RF signal can be transmitted between the Bluetooth module and each external tester via the R4870. The loss of signal level of the RF path can be corrected by adjusting the initial settings of the R4870. The test can be started immediately without measuring and entering corrective data.

The system that has successfully passed the comprehensive test will be delivered in the fourth quarter of 2002 (from October to December)
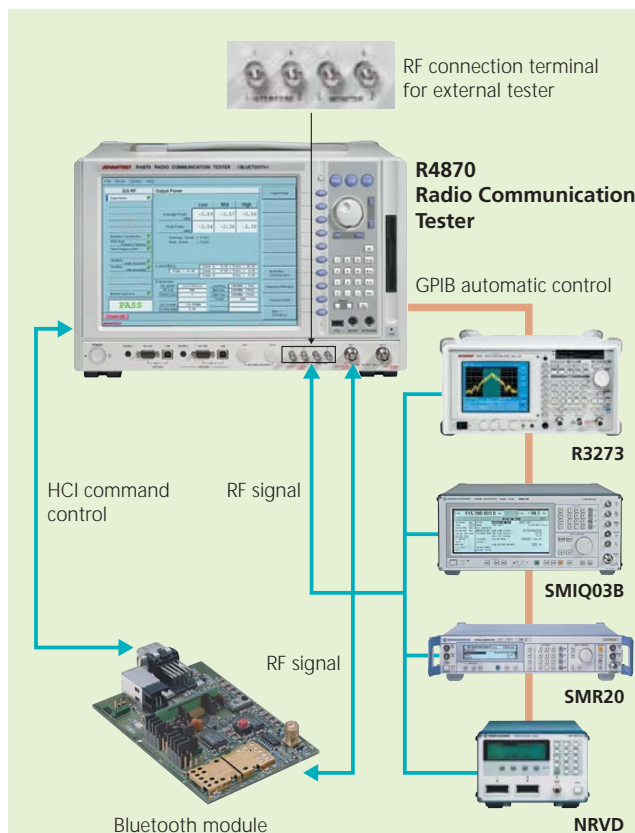
Externally-connected devices

- **R3273:** Spectrum analyzer (to 26.5 GHz)
  - OPT.01: Digital modulation analysis option
  - OPT.66: Bluetooth modulation analysis option (required)
- **SMIQ03B:** Digital modulation signal generator (to 3 GHz)
  - SMIQ-B20: Digital modulation coder
- **SMR20:** CW signal generator (to 20 GHz)
  - SMR-B11: 0.01 to 1 GHz extended frequency
- **NRVD:** Dual channel power meter (for system calibration)
  - NRV-Z52: Power sensor x 2 (required)

Specifications

Transmitter test

Frequency and modulation analysis measurement
Input frequency range:	2402 to 2480 MHz
Measurement resolution:	1 Hz
Accuracy:	±5 kHz; -200 to +200 kHz
	±7 kHz; -300 to +300 kHz
Analysis range[*1]:	-300 to +300 kHz

Output power measurement
Input frequency range:	2402 to 2480 MHz
Input level range	
CH1:	-15 to +23 dBm
CH2:	-30 to +5 dBm
Measurement resolution:	0.01 dB
Accuracy	
CH1:	±1.2 dB; -10 to +23 dBm
CH2:	±2.2 dB; -20 to +5 dBm

*[*1]: Frequency error + Frequency deviation = ±300 kHz or less*

Receiver test

Frequency
Output frequency:	2402 to 2480 MHz
Resolution:	1 MHz[*2]

Carrier frequency
Accuracy:	5 kHz or less
	(for the specified channel frequency)

Level
Output level range	
CH1:	-85 to -13 dBm
CH2:	-65 to 0 dBm
Resolution:	1 dB
Accuracy	
CH1:	±1.2 dB; -75 to -15 dBm
CH2:	±2.5 dB; -55 to 0 dBm

Modulation
Modulation index range:	0.20 to 0.40
Accuracy:	4 kHz
	(for a modulation index from 0.28 to 0.34)
Resolution:	0.01
BT product:	0.5
	(20 dB with a bandwidth of 1 MHz or less)
Transmission rate:	1 Mbps

Signal purity
±2 MHz leakage power:	-30 dB or less
±3 MHz leakage power:	-35 dB or less

Receive sensitivity
Test bit length:	Standard measurement range;
	1600000 to 9999999 bits[*3]
	High speed measurement range;
	1 to 1600000 bits[*3]
Error rate:	0 to 100%
Resolution:	0.0001%

*[*2]: 1 kHz for the Dirty Transmitter test*
*[*3]: Minimum number of packets for measuring the above number of bits*

Communication text

Measurement items:	Inquiry, Inquiry Scan, Paging-IUT as Master, Paging-IUT as Slave, ACL Data, Link Supervision Timeout-IUT as Slave, Link Supervision Timeout-IUT as Master, Authentication-IUT as Slave, Authentication-IUT as Master, Pairing, SCO data-IUT as Slave, SCO data-IUT as Master The above test items conform to the Bluetooth Test Specification, Blue Unit Test Cases Revision 1.1.

Reference OSC

Frequency:	10 MHz
Change over time:	3×10^{-8}/day
	3×10^{-7}/year
Temperature stability:	1×10^{-7} (+5 to +40°C)

I/O

Front Panel
Interface Port 1
Frequency:	30 MHz to 12.75 GHz
Inter-RF-CH1 loss:	Approx. -15 dB

Interface Port 2
Frequency:	2.4 to 2.5 GHz
Inter-RF-CH1 loss:	Approx. -18 dB

Monitor Port 1
Frequency:	2 to 3 GHz
Loss from RF CH1:	Approx. -17 dB

Monitor Port 2
Frequency:	2.4 to 2.5 GHz
Distribution ratio with the reference signal:	Approx. -6 dB

Audio Input/Output
Input impedance:	High impedance
Output impedance:	Approx. 1.2 kΩ
Terminal shape:	Stereo mini jack
Keyboard:	P/S 101/106 keyboard
Mouse:	P/S mouse

Rear panel
HCI (Host Control Interface)
Baud Rate:	115.200 k, 57.60 k, 38.4 k, 19.2 k, 14.4 k, 9.6 k, 4.8 k, 2.4 k, 1.2 kbps
Data bit:	Fixed to 8 bits
Parity bit:	0, 1, none
Stop bit:	1, 1.5, 2.0
External display signal:	15 pin D-SUB connector (VGA)
LAN port:	10Base-T
External reference frequency input:	Input impedance; 50Ω
	Input level; 0 dBm or more
External reference frequency output:	Output impedance; 50Ω
	Output level; 0 dBm or more
External trigger output:	Output level; TTL

General Specifications

Operating environmental factors:	Temperature; +5 to +40°C
	Relative humidity; 80% or less
Storage environmental factors:	Temperature; -20 to +60°C
	Relative humidity; 80% or less
AC power input:	Automatic switching between 100 VAC and 220 VAC
	Operation at 100 VAC; 100 to 120 V, 50/60Hz
	Operation at 200 VAC; 200 to 240 V, 50/60Hz
Power consumption:	200 VA or less
External dimension:	424 (W) x 266 (H) x 270 (D) mm
Mass:	15 kg or less

Bluetooth™ is a trademark owned by Bluetooth SIG, Inc., U. S. A.

Please be sure to read the product manual thoroughly before using the products. Specifications may change without notification.

ADVANTEST