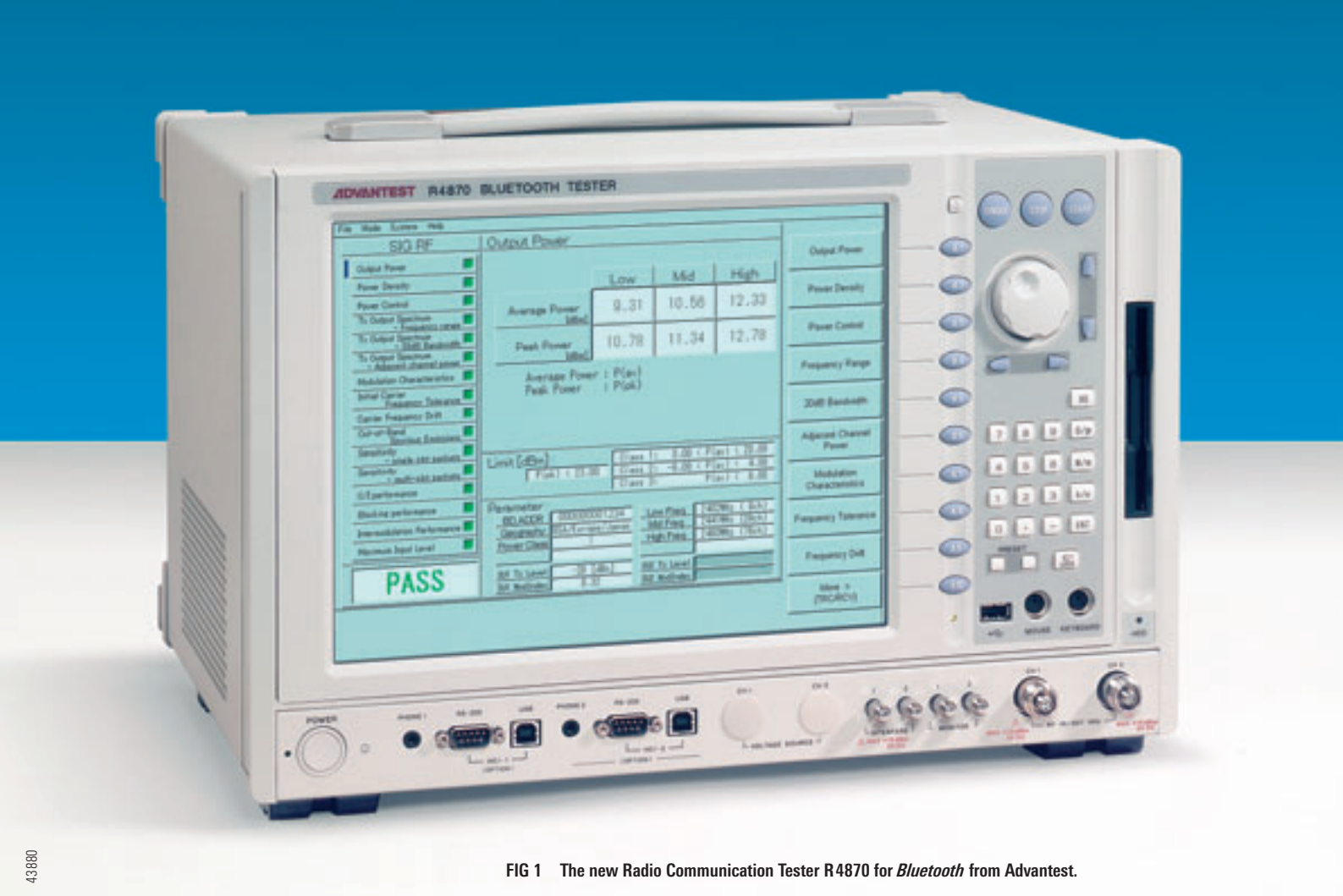


43880

FIG 1 The new Radio Communication Tester R 4870 for *Bluetooth* from Advantest.

Bluetooth™

Radio Communication Tester R 4870 (*Bluetooth*) from Advantest

RF and communication tests according to the *Bluetooth* SIG standard

The growth forecasts for the *Bluetooth* market are promising, and the demand for automated and high-speed measurement instruments is growing. Advantest is taking this into account with its new Tester R 4870, which makes it possible to perform both RF measurements and communication tests according to the SIG standard.

Bluetooth is booming

The *Bluetooth* market promises enormous growth: In 2006, the number of supplied *Bluetooth* modules is expected to surpass the one-billion mark. The high pressure on prices for chips and modules is increasing the need for fast, automated test solutions in production and integration, for example. Advantest aims to fulfil this need with its new Radio Communication Tester R 4870 (FIG 1), which enables both RF measurements and communication tests (known as Blue Unit test cases) according to the SIG standard.

RF measurements

The R 4870 can be used to implement various RF test cases as described in the SIG standard, version 1.1 [1], including the test of the output power or the modulation characteristics of the *Bluetooth* signal (FIG 2). For this purpose, the R 4870 first puts the DUT into the transmitter test mode via the *HCI* interface supported by the tester, for example. The parameters described in the standard for each test case are already stored as defaults, so the user need only select the test cases to be measured and start the measurement. The results are displayed both numerically and as a

PASS/FAIL statement. In the lower central part of the screen, the R4870 indicates important parameters, such as the *BD* address, the type of data packet (*DH1*, *DH3, DH5*), the output power, the frequency channels to be measured, etc (FIG 3).

In addition, the R4870 supports receiver RF test cases such as sensitivity measurements. For this purpose, it generates a "dirty transmitter" signal, as is defined in the standard (box at the bottom of page 19). Using this signal, the bit error rate can be measured under realistic conditions.

Measurements on the R4870 are normally made at the press of a button using the defaults; however, it is of course also possible to change the test parameters, in order to configure test routines flexibly and simulate extreme situations. The instrument's user interface is based on Windows™ NT. Its touch screen makes operation easier, and it has ports for a mouse and keyboard.

SIG standard number	Test cases	Basic unit R4870	Test system
TRM/CA/01/C	Output Power	✓	✓
TRM/CA/02/C	Power Density	–	✓
TRM/CA/03/C	Power Control	–	✓
TRM/CA/04/C	TX Output Spectrum (Frequency Range)	–	✓
TRM/CA/05/C	TX Output Spectrum (20 dB Bandwidth)	–	✓
TRM/CA/06/C	TX Output Spectrum (Adjacent Channel Power)	–	✓
TRM/CA/07/C	Modulation Characteristics	✓	✓
TRM/CA/08/C	Initial Carrier Frequency Tolerance	✓	✓
TRM/CA/09/C	Carrier Frequency Drift	✓	✓
TRC/CA/01/C	Out-of-Band Spurious Emissions	–	✓
RCV/CA/01/C	Sensitivity (single-slot packets)	✓	✓
RCV/CA/02/C	Sensitivity (multislot packets)	✓	✓
RCV/CA/03/C	C/I Performance	–	✓
RCV/CA/04/C	Blocking Performance	–	✓
RCV/CA/05/C	Intermodulation Performance	–	✓
RCV/CA/06/C	Maximum Input Level	✓	✓
	Signalling	✓	✓

FIG 2 Test cases to the SIG standard version 1.1.

All test cases listed in FIG 2 cannot be covered by an RF tester alone. Measuring the out-of-band spurious emissions (TRC/CA/01/C) requires a spectrum analyzer that covers the frequency range up to 12.5 GHz, and measuring the intermodulation characteristics (RCV/CA/05/C) requires two additional signal generators. In the near future, it will therefore be possible to link the R4870 to other instruments to form a prequalification test system that can cover all the RF test cases specified by the standard. Manufacturers of

FIG 3 Result of an output power measurement in the lower, center and upper frequency channel.

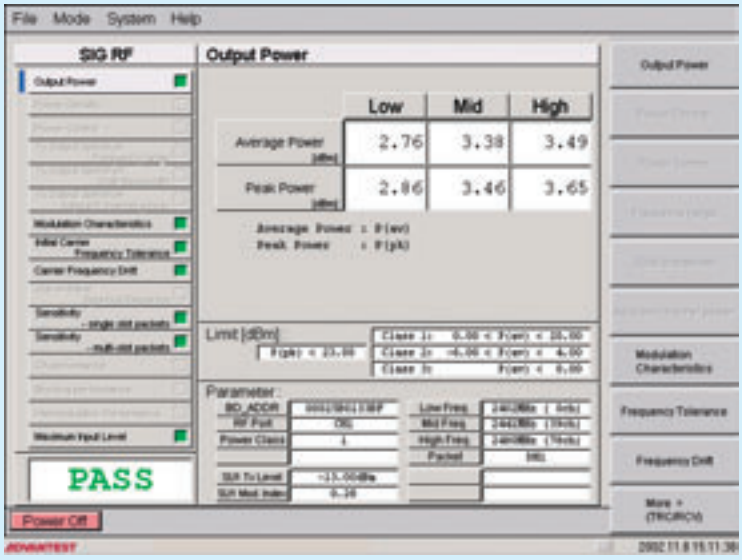
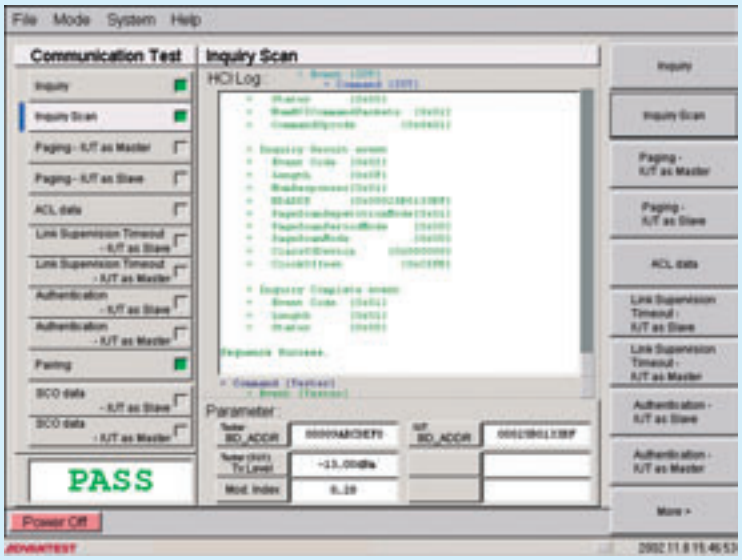


FIG 4 Result of an inquiry scan measurement.



Bluetooth modules can then perform prequalifying measurements during the development phase in order to later obtain the qualification of their modules from an independent test house without having to make costly and time-consuming changes.

Communication measurements

The Blue Unit test cases describe tests for checking the interoperability between *Bluetooth* modules. They monitor communication via the HCI interface and can also be used as a quick alternative to RF measurements, i.e. as a type of Go/NoGo test to ensure minimal interoperability between two modules.

The R 4870 covers all Blue Unit test cases described in the standard [2]. For this purpose, the tester contains a Blue Unit, which can act both as master and slave. The radio communication tester is connected with the DUT via the *HCI* interface; the results are available as PASS/FAIL statements or as records in the form of *HCI* commands (FIG 4).

Summary

Due to the steadily declining prices of *Bluetooth* chips, it is necessary to perform high-speed tests providing results in the form of a PASS/FAIL statement in the production of *Bluetooth* modules or their integration into headsets, mobile telephones, PCs or modems. The R 4870 from Advantest makes it possible to measure the RF test cases described in the SIG standard at the press of a button. The tester can also be used to perform Blue Unit test cases, which are a quick means of obtaining information about a module's communication capacity. Users can choose between either test method or perform both, of course. If, for example, one of the Blue Unit tests ends with FAIL, the cause can be determined by means of RF measurements.

Furthermore, in the future it will be possible to optionally expand the R 4870 into a small test system that covers all RF test cases and that can be used for making all prequalifying measurements.

Patricio Dueñas

More information and data sheet at www.rohde-schwarz.com (search term: R 4870)

REFERENCES

[1] Test Specification RF 1.1, Revision 0.91, Bluetooth Test & Interoperability Working Group

[2] Test Specification Blue Unit Test Cases (Draft), Revision 1.1, Hans Andersson (Ericsson Technology Licensing AB)

Abbreviations

SIG	Special Interest Group
BD address	Bluetooth device address
DH1, DH3, DH5	Data packets having a length of 1, 3 or 5 slots
HCI	Host controller interface

Parameter set	Carrier frequency offset (kHz)	Modulation index
1	75	0.28
2	14	0.30
3	–2	0.29
4	1	0.32
5	39	0.33
6	0	0.34
7	–42	0.29
8	74	0.31
9	–19	0.28
10	75	0.35

FIG 5 Parameter sets of the "dirty transmitter" signal.

Dirty transmitter

The *Bluetooth* RF standard [1] describes two variants of sensitivity measurements under RCV/CA/01/C (with *DH1* packets) and RCV/CA/02/C (with *DH5* or *DH3* packets). In both cases the DUT is put into the test mode. The radio communication tester sends a signal to the DUT, and then the received signal is sent back to the DUT at maximum power (loopback test mode). The radio communication tester subsequently measures the bit error rate. For this purpose, however, a "dirty transmitter" signal should be used instead of an ideal transmit signal. The configuration of this signal is defined in the standard, in a table listing the various parameter sets (FIG 5). Each set specifies a particular shift of the carrier frequency and a different modulation index of the signal. In the first 20 ms the signal is transmitted using the parameters of set 1, in the next 20 ms using the parameters of set 2, etc. After parameter set 10, transmission continues with set 1 again.