PRODUCT INFORMATION

6103 Digital Radio Test Set

- Easy to use, fully integrated Test Set optimized for maintenance and servicing of GSM 850, 900, 1800 and 1900
- Dual-Band Handover
- Modulation Analyzer for alignment and diagnostics
- Complete set of facilities for battery life evaluation
- Enhanced Full Rate speech and 3 digit MNC for North America
- Fax and Bi-directional Data tests, complete with diagnostics
- Cell Broadcast and point to point Short Message Service testing
- "No button start" for ultimate simplicity of operation

RACAL INSTRUMENTS

www.racalinstruments.com

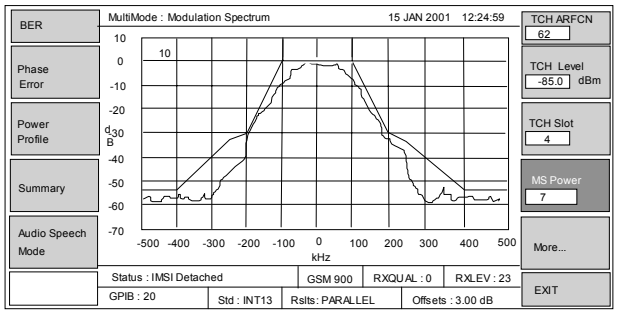
GENERAL DESCRIPTION

Since its introduction, the Racal Instruments Digital Radio Test Set, 6103, has set new industry standards in cellular radio testing. It is a high performance, portable, fully integrated instrument designed for the production and maintenance of modern digital mobile telephones. Aimed at GSM 850, 900, 1800 and 1900 the 6103 has been selected by most of the world's mobile manufacturers for field service operations. Building on this success Racal Instruments will be introducing further system options to address new and emerging markets.

The user controls have been carefully designed to allow operators of any skill level to successfully test and fault find mobile phones. A 'no button start' feature allows them to be tested rapidly without even touching the instrument. Another mode provides all key measurements to be viewed simultaneously with any reading out of limits being highlighted, making adjustment simplicity itself. In all, the 6103 offers five testing modes to suit any user and application.

- Single Tests
- Automatic Sequences
- Multimode
- Unsynchronized Mode
- Remote Operation

The use of a large LCD display coupled with intuitive, streamlined soft keys, ensures that the user can select the required operation, change parameter values and read test results, quickly and clearly without the need for an external PC or monitor. The use of soft keys and a spinwheel also allows the user to move quickly and logically through the menu structure and select the desired operation without any ambiguity.

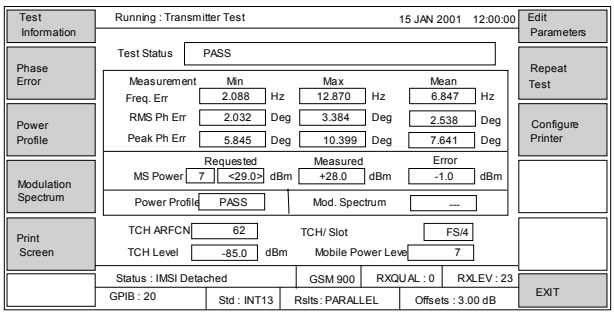


Real time displays for simple adjustments with superimposed limit mask

SPEED

With the decreasing cost of modern mobile phones and the ever growing numbers of subscribers, rapid test times are essential. To achieve this, the 6103 offers an integrated testing approach. For example, a single transmitter test can take the 5 key measurements of power, frequency, power profile, time alignment and modulation error in under 2 seconds. At the same time a full suite of graphs is available to view proper profile, phase trajectory and modulation spectrum. This integrated philosophy is also repeated for receiver testing ensuring maximum test throughput.

THE FUTURE

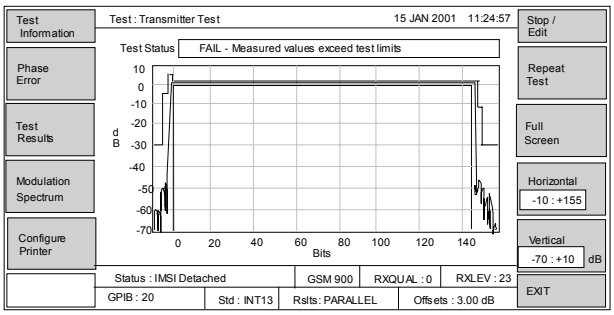


Combined transmitter test for rapid measurements of all key transmitter parameters

Digital radio markets are undergoing significant changes as the standards mature and new facilities are added to meet higher customer expectations. For this reason the 6103 already includes facilities not currently implemented on many networks, such as Cell Broadcast, Point to Point SMS, Data channel coding and half rate speech. Recent additions include, Enhanced Full Rate speech (EFR), binary encoding of SMS messages and decoding of 3 digit MNC's in readiness for use in North America.

The 6103 is an integral part of the GSM Phase 2 type approval system developed by Anite Systems. Other developments allow manufacturers and network operators to realistically evaluate and compare the battery life of any GSM mobile, including 850, 900, 1800, 1900 and dual mode variants.

The story does not end there however, Racal Instruments has a policy of on-going product enhancement. As a result, the instrument firmware is periodically updated to reflect changes in standards and new market requirements. A software support scheme enables customers units to be automatically updated as soon as the new facilities are available.



Graphic displays for fast recognition of failure modes

MEMORY CARDS

The memory cards provide the user with the ability to store and recall a number of instrument set-ups and test sequences, for carrying out various tests on differing mobile types. New test sequences can be generated from the front panel using a special learning facility and then stored on the memory card. In this way test can be selected, limits and parameters changed, and printing controlled, guaranteeing total control and repeatability of testing.

Other forms of files can also be stored on the memory cards. These include speech phrases and test results. The PCMCIA version 2 industry standard card and DOS formatting allows direct transfer of files to a suitable PC. Two sockets are provided so that files are easily duplicated and test sequence files can be conveniently separated from results and parameter files.

COMPREHENSIVE SIGNALING PROTOCOL

All signaling between the Test Set and the mobile-under-test is completely automatic so that the user does not need to have detailed knowledge of signaling standards. The 6103 even knows when to use phase 2 protocol. Individual signaling procedures can be invoked including:

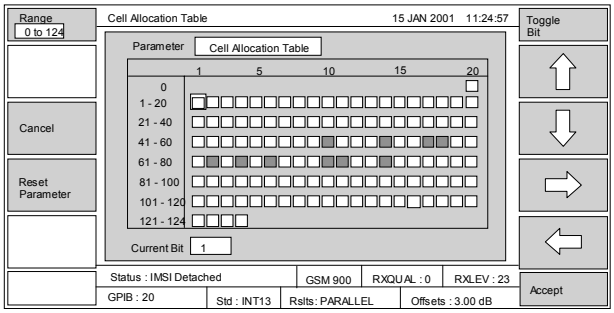
- Location Updating
- Call Set-up, MO & MT
- Call Termination, MO & MT
- Call Lost
- Handover (inc Dual-Band)
- Emergency Calls
- Frequency Hopping
- Encryption (A5/1 & A5/2)
- Timing Advance
- Cell Broadcast Messages
- Point to Point SMS, MO & MT
- Calling Party Identity
- Fax Call, MO & MT
- Bi-directional Data Cell, MO & MT

ADDITIONAL FACILITIES

- Synchronization Output – A programmable synchronization output allows external equipment such as a spectrum analyzer or a logic analyzer to be triggered at any point in the GSM frame. Using this port, spurious signals can be reviewed either out-of-band or during the unused slots.

- Auxiliary RF Port – An auxiliary RF port is also provided eliminating the need for external couplers and loads when used with other test equipment. It also allows short range monitoring of signals off-air.

- Dual-Band Handover – With the introduction of dual-band mobiles and with networks operating on several bands, it is essential that phones can Camp-on to the correct BCCH and be handed over from one band to another. The 6103 can simulate a BCCH on either band while handing over TCH in either direction.



Parameters are easily modified to suit the application

SUPPORT

Not only is the 6103 good value for money, but it has also been designed to be simple and economic to repair. The pre-calibrated modules and self diagnostic capabilities mean that repair times and costs are minimized. This is further backed up by a world-wide network of service centers offering a full range of repair, calibration and support facilities.

Racal Instruments has a growing library of pre-written test sequences and software modules available free to 6103 customers. Library sequences are a good way to see what is possible and a good point to start programming from.

OPTIONS

The 6103 in its basic form is a complete integrated test set capable of performing the full range of measurements on a GSM mobile. To complement this, Racal Instruments can supply a range of options and accessories which significantly enhance the applications of the 6103. A full list is provided on the back page along with ordering information.

FREQUENCY STANDARDS

Under normal circumstances the supplied frequency standard is more than adequate, however in a laboratory or production situation higher performance may be required. The optional internal standards can achieve stabilities of up to 0.03 ppcm per year.

	Supplied	Option O4E	Option O4F
Frequency:	13 MHz	10 MHz	10 MHz
Stability*	$\pm 1 \times 10^{-6}$ /year	$\pm 1 \times 10^{-7}$ /year	$\pm 3 \times 10^{-8}$ /year
0 to 50°C:	$< \pm 3 \times 10^{-7}$	$< \pm 6 \times 10^{-9}$	$< \pm 4 \times 10^{-9}$
Warm up time:	5 minutes	30 minutes	30 minutes

* aging after 30 days continuous operation

TEST SIM, OPTION 70

The 6103 can be used with virtually any test SIM, however option 70 has been programmed to match the instrument's default settings, making testing very simple. The SIM is supplied as a full size SIM with 'break outs' to convert it into a miniature SIM. A full size adapter is also provided.

PIN:	0000 0000
PUK1/2:	1111 1111 2222 2222
Ki:	5E4AB358 91375D2A EE812E67 C309A629
IMSI:	001 01 012 345 6789
Admin Field:	Set to 80 (Type Approval)

Racal Instruments has a policy of continuous improvement which means that specifications may change. For details of the latest enhancements and options, contact your local Racal Instruments office.

SINGLE TESTS

For trouble shooting and development work, individual tests can be selected where any signaling necessary to perform the test is automatically generated. Prior to starting the test, the user can modify any associated parameters. On completion, the user is presented with the numeric results and a pass/fail indicator. If appropriate, any graphic information can also be viewed.

AUTOMATIC AND GO/NO GO TESTING

The 6103 is ideal for both step by step fault or for fully automatic, GO/NO-GO testing. The automatic capability offers a choice of running one of the instrument's built-in programs or a sequence created by the user. In this way it is possible to select virtually any combination of tests with complete freedom of channel numbers, parameters and test limits. Test sequences can be automatically entered to start by a location update or a call set up. Using this facility it is possible to carry out any series of tests without even touching the instrument. This is particularly attractive for high throughput, screening applications.

Test sequences are easily produced from the front panel through a special learning mode or via a PC running a text editor. The instrument employs a form of instrument BASIC making programming very straightforward. New commands allow data entry, string handling, results processing, external device control and virtually any format of printout to be created. User variables and looping functions mean that a large number of test scenarios can be covered with very few lines of code.

MULTIMODE

As well as test sequences and single tests, the 6103 supports a special 'Multimode'. This provides continuously updated numeric and graphic displays of all the major transmitter and receiver measurements. The graphs and graduated bar-charts aid fault diagnosis and adjustment by giving

the user recognizable 'pictures' of the performance of the mobile under test, as it happens.

As a further aid to the operator, the normal GSM test limits are marked on the bargraphs. If a reading exceeds these limits, the bar itself turns solid black making a potential fault easily recognized.

While in Multimode, most parameters are easily changed such as channel, slot number, mobile power and RF level. The rotary control can now be used to continuously update the RF level for manual sensitivity testing. Any protocol necessary to perform the changes is automatically generated making the 6103 very intuitive to operate.

UNSYNCHRONIZED MODE

Another mode similar to the Multimode is the unsynchronized mode. This provides the user with all the diagnostic facilities for testing RF modules and partially functioning phones. It also ensures that the instrument can be used with the manufacturer's specific test modes where the transmitter or receiver can be enabled without a SIM or any network signaling.

For transmitter testing, the instrument will automatically find any signal in the GSM 850, 900, 1800 or 1900 bands and then continuously display all key measurements, including power profile and modulation spectrum graphs. A special IQ mode filter can be used for optimizing a mobile's modulator settings.

For receiver testing, the 6103 can generate a range of test signals including a valid control channel, a bursting traffic channel or an unmodulated carrier.

The unsynchronized mode is particularly suitable for making adjustments to a mobile's free running frequency standard or to its transmitter power steps.

REMOTE OPERATION

For production test systems where speed and control are paramount, the 6103 offers full 1EEE488 remote control of all tests and readings, including graph data. Remote control of the multimode means that transmitter and receiver measurements can be performed concurrently and parameters and settings are quickly changed with simple commands. For

mobile adjustment or for mobile 'local' control, the unsynchronized mode can be used. This has the benefit that no time is wasted waiting for the protocol to synchronize and set up a call.

TECHNICAL SPECIFICATION

TEST CAPABILITY

Functional Tests:	Call Set up – MO & MT Call Termination – MO, MT & Call lost Synchronized Handover
Transmitter Tests:	Tx Test – Power, Phase & Frequency Error, Power Profile, Modulation Spectrum, Burst Timing Power Levels/Steps Timing Advance
Receiver Tests:	Rx Test – CII & CIb BER, FER, RXQUAL, RXLEV Sensitivity (Absolute)
Speech & Data Tests:	Voice Loopback Send speech Receive speech SMS point to point MO & MT (transfer in call or idle mode) Fax MO & MT Bi-directional Data MO & MT

SIGNALING & PROTOCOL FEATURES

Control Channel:	Combined format, FCCH+SCH+CCCH+SDCCH (4)+SACCH/4 with CBCH when cell broadcast active
Traffic Channel:	Full and half rate speech, TCH/FS+SACCH/TF and TCH/HS+SACCH/TH Data at 9.6, 4.8 & 2.4 kbs TCH/F9.6, TCH/F4.8 & TCH/F2.4±SACCH/TF Frequency Hopping Encryption (with option10) Doppler shift
Supplementary Services:	Calling Line Identity

SIGNAL SOURCE

Modulation:	GMSK & CW
Frequency	
Frequency Bands:	869 to 894 (GSM 850) 925 to 960 MHz (E-GSM) 1.805 to 1.880 GHz (GSM1800) 1.930 to 1.990 GHz (GSM1900)
Resolution:	1 Hz

Main RF Input/Output Level	
Range:	-40 dBm to -120 dBM
Accuracy: Absolute (Typical)	GSM 850, 900 ± 1.5 dB [1.2] (±0.6 dB) [4.5] DCS 1800 ± 2.0 dB [1.2] (±0.7 dB) [4.5] GSM 1900 ± 2.0 dB [1.2] (±0.8 dB) [4.5]
Resolution:	0.1 dB
Auxiliary RF Input/Output Level Range:	-2.5 dBm to -105 dBm

MEASURING RECEIVER

Frequency Bands:	824 to 849 MHz 880 to 915 MHz 1.710 to 1.785 GHz 1.850 to 1.910 GHz
Main RF Input/Output	
Impedance:	50 Ω, nominal
VSWR:	≤1.3:1
Connector:	N Type female
Input Level Range:	+46 dBm to -1 dBm PEP
Max Power:	80 W PEP; 10 W continuous

Auxiliary RF Input/output

Connector type:	TNC female
Input level Range:	+ 31 dBm to -16 dBm PEP
Max power:	2.5W PEP; 0.3W continuous

MEASUREMENTS

Phase Error	
Range:	10° RMS, ±30° peak
Accuracy RMS:	<±0.3° at 5°
Accuracy:	<±7.2°
Frequency Error	
Range:	±2.5 kHZ
Accuracy:	±6.5 Hz + freq Std [3]
Power Level	
Range:	+46 dBm to –1 dBm PEP
Absolute Accuracy:	<±1.0 dB (GSM 850, 900)[2] <±1.3 dB, (GSM 1800 and 1900)[2]
Relative Accuracy:	<±0.4 dB
Pulse Profile	
Dynamic Range:	>48 dB
Time of Arrival	
Accuracy:	0.05 bits
Modulation Spectrum	
Dynamic Range:	>52 dB[3]
Frequency Span:	1 MHz, (5 channels)

INTERFACES	
Memory Card:	2 sockets, PCMCIA V2.0
Card Size:	Type 1, 2 or 3
Card types supported:	SRAM, ATA flash EEPROM and hard disk
Synchronization Output:	For synchronizing external equipment such as a spectrum analyzer
GPIB:	ANSI/IEEE 488.2 – 1987
Compatibility Subset:	SH1, AH1, T5, L4, SR1, RL1, PPO, DC1, DTO, CO, E1
RS232 Interfaces:	2 configurable ports for printing and control 9 way male D-Type
Parallel Printer:	25 way female D-Type
GENERAL	
Voltage ranges:	85 to 130V and 180 to 264V AC
Frequency range:	45 to 66 Hz
Power consumption:	170 VA maximum
Frequency Standard	
Internal:	$\pm 1 \times 10^{-6}$
(all sources of error)	$\pm 1.2 \times 10^{-7}$ (option O4E) $\pm 3.5 \times 10^{-8}$ (option 04F)
External frequencies:	10 MHz ± 2.5 ppm (13 MHz, option O4E/0EF) -2 dBm to + 19 dBm into 50 Ω
Output:	10 MHz or 13 MHz
(option 04E/04F)	+9 dBm nominal into 50 Ω
Dimensions and Environmental	
Height:	210 mm
Width:	350 mm
Depth:	420 mm
Weight:	12 kg approx
Operating Temperature:	0 to 50°C
Calibration Period:	1 year
EMC:	Complies with BS EN50081-1 (emissions) BS EN50082-1 (immunity)
Safety:	Complies with BS EN61010-1

Notes:
1. For signals > -110 dBm
2. Valid for 15°C to 35°C
3. 10 bursts averaged, non hopping, options 04E or 04F
4. For signals >89.9 dBm into 50 Ω
5. Valid from 15°C to 31°C

Supplemental characteristics provide additional information useful in applying the instrument, giving typical, but not warranted performance

ORDERING INFORMATION

6103	**Digital Radio Test Set**
6103	Digital Radio Test Set GSM 900
6103 E	Digital Radio Test Set with Encryption comprising 6103 and option 10
Radio Systems	
Option 01	GSM 900 operation (supplied as standard on 6103)
Option 02	GSM 1800 operation (Includes Dual Band Handover functionality)*
Option 03	GSM 1900 operation*
Option 06	GSM 900, 1800 and 1900
Frequency Standards	
Option 04E	High Stability Frequency Standard, 0.1 ppm/year
Option 04F	High Stability Frequency Standard, 0.03 ppm/year
Encryption	
Option 10R	Encryption, factory fit (forms part of 6103E)
Software Options	
Option 300	6103 AIME Software – Air Interface Monitor/Emulator Software
Option 320	Enhances Short Message Service and Cell Broadcast Software
Option 330	14.4 kbs Data Functionality
Accessories	
Option 61	Soft padded carrying case with shoulder strap and accessory pocket.
Option 62	Rigid transit case for heavy duty use (exceeds ATA 300 Category 1)
Option 64	Front Panel Protection Cover
Option 70	Test SIM E-GSM/DCS1800/GSM1900 (supplied and miniature SIM and full size adapter)
Option 76	256k byte SRAM memory card
Option 77	2M byte SRAM memory card
Option 90	Test Set/PC RS232 download cable, (9 way D-type)
Option 91	Test Set/Printer RS232 cable (25 way D-type)
Option 92	Test Set/Printer parallel cable
Support Options	
Option S1	One year Software Support
Option S2	Two year Software Support
Option S3	Three year Software Support
Option C1	One annual calibration
Option C2	Two annual calibrations
Option E2	One year extended warranty
Option E3	Two year extended warranty
Option W2	One year extended warranty with calibration
Option W3	Two year extended warranty with calibrations

* Only one of these options may be fitted at the same time

RACAL INSTRUMENTS

www.racalinstruments.com

Racal Instruments Inc. 4 Goodyear Street, Irvine CA 92618, USA. Tel: +1 949 859 8999 Fax: +1 949 859 7139
Racal Instruments Ltd. 480 Bath Road, Slough, Berkshire SL1 6BE, United Kingdom. Tel: +44 (0) 1628 604455 Fax: +44 (0) 1628 662017
Racal Systems Electronique S.A. 18 Avenue Dutartre, 78150 Le Chesnay, France. Tel: +33 (1) 39 23 22 22 Fax: +33 (1) 39 23 22 25
Racal Systems Elettronica srl Strada 2 - Palazzo C4, 20090 Milanofiori Assago MI, Italy. Tel: + 39 (2) 5750 1796 Fax: + 39 (2) 5750 1828
Racal Instruments GmbH TechnologiePark Bergisch Gladbach, Friedrich-Ebert-Strasse, 51429 Bergisch Gladbach, Germany. Tel: + 49 2204 844200
Fax: + 49 2204 844219
Racal Instruments Korea, 36-1, Hannam-1Dong, Yongsan-Ku, Seoul, Korea Tel: + 82 2 790 7233 Fax: + 82 2 790 3371
Racal Instruments Ltd., Unit 4508, 45/F, Tower Two, Metroplaza, No.223 Hing Fong Road, Kwai Chung, Hong Kong, PRC Tel: + 852 2405 5500
Fax: + 852 2416 4335
Racal Instruments, Unit 1300, Beijing Sunflower Tower, No 37 Maizidian Street, Chaoyang District, Beijing 100026, China Tel: + 86 10 6500 3392 Fax: + 86 10 8527 5201
Racal Instruments, Room D2, 13/F, Block C, Electronic Science & Technology Building, No 2070A Shennan Zhong Road, Shenzhen 518031, China Tel: + 86 755 3296 327
Fax: + 86 755 3296 329
Racal Instruments, 1001, 'B' Wing, 10th Floor, Mittal Towers, M.G. Road, Bangalore, 560 001, India Tel: + 91 80 506 5041 Fax: + 91 80 558 5518

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E-mail: sales@racalinst.com