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6113.qxd 07/Jun/2005 13:10 Page 1

Cellular Parametric Test

Racal Instruments Wireless Solutions 6113

Digital Radio Test Set

AEROFLEX
A passion for performance.



- Easy to use, fully integrated, soft key driven BTS test set
- Support for GSM850, GSM900, GSM1800 and GSM1900
- Comprehensive test of transmitter and receiver
- Options to control all major BTS types
- Manual and fully automatic testing
- Test sequences for full customization
- Optimized for installation and commissioning, routine maintenance, fault diagnosis and production testing
- A-bis interface for full BTS control and bit error ratio (BER) measurements
- Two PC Card slots for data storage, field upgrades and software enhancements

The Racal Instruments Wireless Solutions (RIWS) 6113 Digital Radio Test Set provides a wide range of test and measurement functions to enable fast manual or automatic testing of GSM850, GSM900, GSM1800 or GSM1900 Base Transceiver Stations (BTSs). Applications includes installation and commissioning, routine maintenance, fault diagnosis and final unit product testing.

The Base Station On-Air Service System (BOSS) allows live RF network traffic monitoring and analyzing. It can set up calls for receiver testing. A sensitive measuring receiver option permits operation remote from the antenna.

A-BIS INTERFACE

In order to perform comprehensive, "real environment", stand-alone testing of a base station, the test set must be capable of controlling the BTS. The 6113 is unique in its ability to measure RF transmissions as well as connecting to the BTS via the A-bis interface. Through the use of the specific BTS manufacturers' Operation & Maintenance (O&M) commands, the 6113 is able to emulate the Base Station Controller (BSC) and take complete control of the BTS. This is accomplished automatically without the need for user intervention. The A-bis interface also allows the user to make Bit Error Ratio (BER) measurements on both the receiver and transmitter, as specified in GSM rec 11-20/11-21. The 6113 A-bis interface also permits a wide variety of other test functions to be performed that could not otherwise be done.

The A-bis interface of the 6113 supports a bi-directional communications and control link at either 2.048 Mbit/s (CEPT standard) or 1.544 Mbit/s (US T1) standard. With one traffic channel and two signaling channels of either 16 or 64 kbit/s, the 6113 accommodates the fact that the mapping of traffic and signaling channels are manufacturer specific.



For the very latest specifications visit **www.aeroflex.com**

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6113.qxd 07/Jun/2005 13:11 Page 2

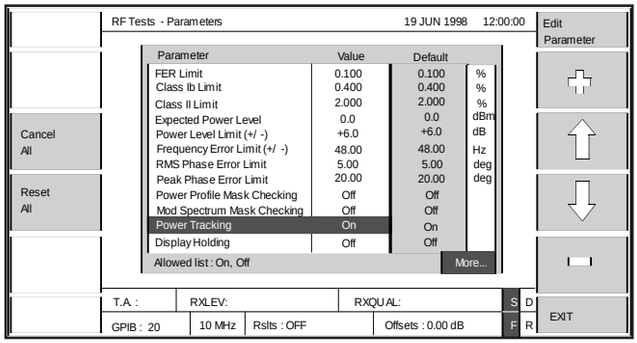
CODE DOWNLOAD

Code download of the manufacturer specific application files to the BTS is another important feature of the 6113. This allows a BTS that may not already be connected to a BSC to be tested with the same code that will be used during normal operation, i.e. "real environment" testing.

CONFIGURATION

Configuration of the BTS can be performed by the 6113 allowing the user to place the BTS in a state ready for testing. During testing, the 6113 can control the important parameters of the BTS including; channel number, timeslot, output power of the transmitter, receiver diversity and the transceiver unit under test.

In addition, the 6113 extracts the BTS measurement reports (RX LEV, RX QUAL) for the channel under test, from the A-bis interface and reports them to the user continuously throughout the testing process. The 6113 also displays error or fault reports that the BTS produces on the A-bis interface.



Simple and comprehensive parameter menus

RF INTERFACE

The 6113 can be configured to support GSM850, GSM900, GSM1800 or GSM1900. The 6113 has two separate RF ports for simplex connection to the BTS Receiver and Transmitter. In addition to this the RF IN port can be configured to operate as a duplex connection, thus allowing the testing of micro base stations.

All the necessary protocols for signaling and control of the BTS are provided in the 6113. Encryption (ciphering) is also available, export license requirements permitting. Both A5/1 and A5/2 algorithms are supported.

TEST MODES

A variety of test modes is available. The single test and test sequence modes allow controlled, repeatable testing for production and field use, with user definable pass/fail limits. The multi-mode feature allows all measurements to be performed simultaneously in real time, which aids fault diagnosis and isolation of intermittent problems. Whichever mode is used, the 6113 provides the user with a comprehensive range of tests to measure the performance and functionality of the complete BTS. Wherever possible all of the tests performed are in line with the requirements of the GSM rec. 05-05 and 11-20/11-21.

The 6113 has been designed for operation by both very experienced and semi-skilled users alike. The experienced user has a great degree of flexibility in setting up and testing BTSs. The less experienced user can use the test sequences for quick set up of the 6113 and repeatable, error free testing.

Ease of use is further facilitated by the use of the soft keys, a spin wheel and a numeric keypad along with a simple, logical menu structure.

PARAMETER SETTINGS

Parameter settings for all the necessary testing variants are accessible for the experienced user. For the less experienced user a suggested default value, based on GSM recommendations, is available. The 6113 has a further ability to store all of the set-up variables in a "parameter file" which can be used to recall settings before testing begins.

SINGLE TEST MODE

Single Test mode allows the user to individually select from a wide range of tests. A full range of settings is available for the user to specify including overall PASS/FAIL criteria. The test is then run with a full set of results returned including the PASS/FAIL indication.

TEST SEQUENCE MODE

Test Sequence mode allows the user to run a complete sequence of single tests using only one or two keystrokes, allowing controlled and repeatable testing.



6113 Digital Radio Test Set

New test sequences can also be generated very quickly from the front panel using a special learning facility and stored on the memory card. Full control over which tests are selected is left to the programmer. Further editing of the test sequences can be accomplished on a PC using a text editor.

MULTIMODE OPERATION

Mulitmode operation is an ideal tool for fault finding and isolation of intermittent faults. It provides continuously updated numeric and graphic displays of all the key 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 BTS under test as it happens.

As an aid to the operator, the normal GSM test limits are marked on the bar-graphs. If a reading exceeds

these limits, the bar itself turns solid black making a potential fault easily recognized.

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6113.qxd 07/Jun/2005 13:11 Page 3

While in Multimode, most parameters such as channel, slot number, BTS power and RF level are easily changed. Any control commands necessary to perform the change are automatically generated making the 6113 very intuitive to operate.

ADDITIONAL FACILITIES

INSTRUMENT CONTROL

The instrument is capable of being controlled either from the front panel keyboard or remotely via IEEE488 GPIB interface. This allows the test set to be included as part of a larger automatic test system. Whichever control method is used, particular attention has been paid to ease and speed of use.

MEMORY CARDS

The PC memory cards and hard disks provide the user with the ability to store and recall a number of instrument set-ups, test sequences and configuration files for carrying out various tests on differing BTS 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 tests can be selected, limits and parameters changed, and printing controlled, guaranteeing total control and repeatability of testing.



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 beconveniently separated from results and parameter files.

SYNCHRONIZATION OUTPUT

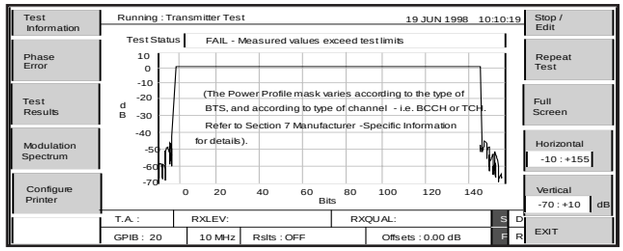
A programmable synchronization output allows external equipment such as a spectrum analyzer or a logic analyzer to be triggered at any point in the GSM frame. Using this trigger signal, spurious signals can be monitored either out-of-band or during the unused slots.

OPTIONS

The 6113 in its basic form is a complete integrated test set capable of performing the full range of measurements on a GSM Base Station. To complement this, RIWS can supply a range of options and accessories, which significantly enhance the applications of the 6113. 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, a higher performance may be required. The optional internal standard can achieve a stability of 0.03 ppm per year.



6113 Digital Radio Test Set can be easily carried to remote sites

	Supplied	***Option 04F***
Frequency	10 MHz	10 MHz
Stability*:	±1 x 10-7/year	± 3 x 10-8/year
0° to 50°C:	<±1.7 x 10 -8	<±1 x 10 -8
Warm up time:	30 minutes	30 minutes

*Ageing after 30 days of continuous operation

LIVE TESTING (OPTIONS 54 AND 310)

The RIWS 6113 Live Testing option addresses the growing demand by network operators to be able to evaluate the performance of BTSs without first taking them out of service and losing call revenue.

By emulating the mobile protocol it is possible to set up a call and measure the transmitter and receiver performance without affecting other users of the network. A special SIM card reader ensures that the instrument is properly authenticated and can perform encryption.

The Live Testing options add two further modes of operation to the 6113's normal A-bis control and auto sequence modes. A-bis control provides the most detailed measurements and diagnostics on a BTS but requires it to be taken out of service. All of the Live Testing modes are aimed at in-service testing and do not affect normal call traffic.

- Live Testing allows network operators to perform periodic performance assessments of their BTSs, without taking them out of service and impacting revenue.
- Live Testing permits intermittent fault isolation. Loose cables, temperature sensitive transceiver units, dead time slots, and many other BTS problems that may not be reported by the base station controller are easily identified.
- Live Testing enables users to monitor and make parametric measurements on BTSs while normal call traffic is in progress. The 6113's call set-up facilities provide a system for evaluating the performance of both the BTS's transmitter and receiver.

TRANSMITTER MONITORING

This allows a user, independent of BTS type or manufacturer, to passively monitor the RF characteristics of any Transmitter (Tx) active in the base station. This is accomplished by using the monitor ports on the BTS to gain access to the wanted signal and the base station's broadcast control channel (BCCH). In this mode the user has the option of either entering the channel number, where known, or using

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6113.qxd 07/Jun/2005 13:11 Page 4

the 6113's unique scanning feature to locate the CCH and any associated traffic channels. Once located, the 6113 will automatically lock on and decode it. The 6113 will then non-intrusively monitor all of the following parameters on any selected channel and time slot.

· Transmitter power and power profile

· RMS phase error

· Peak phase error

· Frequency error (Relative to the 6113 time base)

· Modulation spectrum

The measurements are displayed as precise numerical readings along with easy to read bar graphs. Exceeding the recommended limits causes the bar to change color, quickly high-lighting a possible fault condition.

FULL CALL SET UP, RECEIVER SENSITIVITY

Measurement Once the performance of the transmitters has been verified, the next logical step is to check the operation of the receivers. As with any digital receiver testing, this is accomplished with a bit error ratio (BER) measurement.

Using the call set-up facilities of the 6113 a call is established using a normal network SIM. Once a traffic channel has been assigned, the instrument can then inject a variety of test patterns. Using the high impedance A-bis input, the entire receiver traffic is monitored and the test pattern automatically located. Once synchronized, a continuous BER reading is available. The signal level seen

by the receiver can then be varied manually or automatically to determine the sensitivity.

For more detailed information there is also available a separate menu displaying the FER, Class Ib and Class II Minimum, Maximum and Mean BER readings.

LIVE TESTING OPTIONS

Two Live Testing options are offered for the 6113. The first (Option 310) provides just the software associated with call setup and Live Testing, this is useful where individual transceivers can be isolated such as when testing microcells and where a low loss RF connection can be made to the base station.

A second option (Option 54) adds a sensitive and selective receiver unit, which then allows the instruments to discriminate the wanted signal from nearby unwanted signals, and additional gain compensates for a significant path loss. It is also available as a retrofit option for existing 6113 users. (Note: Option 310 is always included with option 54).

CELL INTEGRITY (OPTION 311)

The Cell Integrity Test Suite provides important new functionality for the RIWS 6113 GSM digital radio BTS test set. This new software allows the user to assess the total integrity of a complete cell site, and will normally form part of the complete commissioning and integration procedure.

Whilst the 6113 when in A-bis Control Mode allows the user to check the performance of the complete BTS, the new Cell Integrity Test Suite allows the user to assess the performance of the site as a whole, including the antennas, masthead amplifiers, interconnecting cables, etc.

It is also possible to monitor the performance of the site from any point within the cell coverage area using the Cell Integrity Test Suite automated functions. The 6113 emulates all the network functionality required to make these tests, thus obviating the necessity for an A-bis connection to the network BSC.

The only additional equipment required to carry out these cell performance checks are a standard GSM mobile handset (supplied), a valid network SIM card and a RIWS CIT SIM card (supplied).

MAIN FEATURES

The user may check the following aspects of a GSM based cell site:

· Integrity and correct connection of all cell antennas, masthead amplifiers and cabling.

· Quality of speech using a standard mobile terminal.

· Automated sequential call placement utilizing all timeslots* and all carriers.

· Combined uplink and downlink BER measurements.

· Comparison of uplink and downlink losses over the air.

· Equalization of uplink and downlink losses - cell or antenna balancing. (Worldwide patents pending)

*with the exception of timeslot 0

BRIEF TEST SUMMARY

The following tests are available within the RIWS Cell Integrity Test Suite for the 6113.

· 6113 Originated Call with Mobile Audio Loopback (using Racal Instruments test SIM)

· 6113 Originated Call with Audio Loopback.

· 6113 Originated Call with Audio Loopback AND Mobile Audio Loopback (using Racal Instruments test SIM)

· Mobile Originated Call with Mobile Audio Loopback (using Racal Instruments test SIM)

· Mobile Originated Call with Audio Loopback

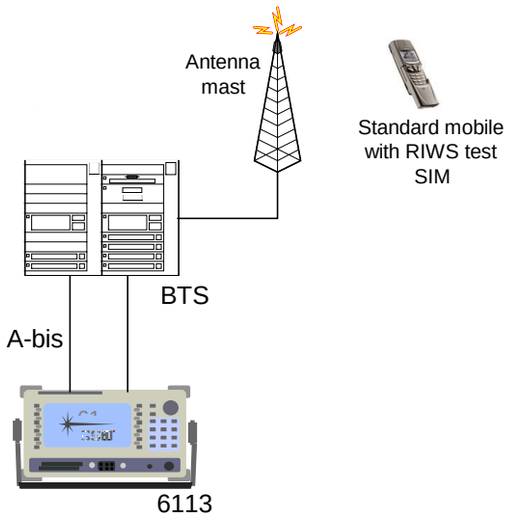
· Mobile Originated Call with Audio Loopback AND Mobile Audio Loopback (using Racal Instruments test SIM)

· Antenna Balancing

DETAILED TEST DESCRIPTIONS

Please refer to the diagram below for details of test equipment connections. It can be seen that the 6113 acts as a BSC or network simulator that has full control of the BTS. No RF connections are made to the 6113. All antennas and external equipment are connected to the BTS as normal.

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6113 ORIGINATED CALL WITH MOBILE AUDIO LOOPBACK (USING RIWS TEST SIM)

The 6113 instructs the BTS to generate a combined BCCH on the ARFCN selected by the user and at a user defined power level.The system information for the control channel is derived from the information in the 6113's GSM parameter settings. The user is prompted to switch on the mobile handset, which then registers to the '6113 network', provided that its IMSI and IMEI have been correctly entered in the 6113 test parameters menu. The cell is barred to all users except those defined by the user in the test parameters for this function.

Following registration, the mobile is paged and a call is assigned to the selected timeslot, or timeslot 1 if automatic testing on all timeslots has been previously selected as a test parameter.

The mobile is instructed to loop back the traffic frames and a BER test is performed for the specified duration, during which the interim BER

measurements are displayed together with the uplink RXLEV reports, the uplink RXQUAL reports, the downlink RXLEV reports and the downlink RXQUAL reports. Upon completion of the test, the call is terminated. If all timeslots have been selected for testing, subsequent calls are made automatically, checking each timeslot in turn.

This test may be fully automated if the mobile handset is configured for auto-answer mode.

6113 ORIGINATED CALL WITH AUDIO LOOPBACK.

This test allows the user to assess the voice quality of the air interface link between the BTS and the mobile handset. Registration and call set up are performed in an identical manner to the test detailed above. Once the call is in progress, the 6113 will loop back the traffic frames to the mobile, after a defined period of delay, thus allowing the user to assess the quality of the link. If all timeslots have been previously selected for testing, the caller will be paged on the next untested timeslot each time a call is terminated until all timeslots have been tested.

6113 ORIGINATED CALL WITH AUDIO LOOPBACK AND MOBILE AUDIO LOOPBACK (USING RIWS TEST SIM)

Registration and call set up are completed in the manner described above. This test is a concatenation of the previous two tests. During the first stage, a BER test is run with audio loopback activated within the mobile handset. When this is complete, loopback is removed from the mobile and applied to the 6113, allowing voice quality assessment to be made. Sequential testing of all timeslots is performed in a manner similar to that described above.

MOBILE ORIGINATED CALL WITH MOBILE AUDIO LOOPBACK (USING RIWS TEST SIM)

Registration is performed in the manner described above. The 6113 now waits for a mobile originated call. A simple coding system allows the user to select from the mobile keypad the timeslot number to be assigned by the 6113 for the call. A BER test is then performed for the duration specified by the user.

MOBILE ORIGINATED CALL WITH AUDIO LOOPBACK

Registration is performed in the manner described above. The 6113 now waits for a mobile originated call. A simple coding system allows the user to select from the mobile keypad the timeslot number to be assigned by the 6113 for the call. The 6113 will loop back traffic frames such that the user may assess the quality of the speech received at the mobile terminal.

MOBILE ORIGINATED CALL WITH AUDIO LOOPBACK AND MOBILE AUDIO LOOPBACK (USING RIWS TEST SIM)

Registration and call set up are completed in the manner described above. This test is a concatenation of the previous two tests. During the first stage, a BER test is run with audio loopback activated within the mobile handset. When this is complete, loopback is removed from the mobile and applied to the 6113, allowing voice quality assessment to be made. Sequential testing of all timeslots is performed in a similar manner to that described above.

EDGE (OPTION 440)

Option 440 adds the ability to test EDGE enabled base stations.

In addition to the current GSM channel types, the following (E)GPRS channel types are also supported:

· CS-1 to CS-4 (GMSK)

· MCS-1 to MCS-4 (GMSK)

· MCS-5 to MCS-9 (8PSK)

For full details, please refer to the separate 6113 EDGE product information.

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6113.qxd 07/Jun/2005 13:11 Page 6

SPECIFICATION

TEST CAPABILITY

Transmitter Tests

Cell Control Channel

Generation

Bit Error Ratio

Phase/Frequency Error

Power Level/Steps

Power Profile

Modulation Spectrum

Receiver Tests

Traffic Channel Bit Error Ratio

Traffic Channel Absolute

Sensitivity

RACH Frame Erasure Rate

RX Level

RX Quality

A-bis Function Test

Link Test

SIGNAL SOURCE

FREQUENCY

Range

890 to 915 MHz (GSM900)

1710 to 1785 MHz (GSM1800)

Resolution

1850 to 1910 MHz (GSM1900)

1 Hz

LEVEL

Range

-40 dBm to -120 dBm into 50 Ω (Simplex mode)

-47dBm to -120 dBm into 50 Ω (Duplex mode)

Resolution

0.1 dB

Accuracy

±1.5 dB GSM900(>-110 dBm) (Simplex)

±1.8 dB GSM1800 (>110 dBm)

±1.8 dB GSM1900 (>-110 dBm)

Accuracy

±1.5 dB GSM900(>-110 dBm)[1] (Duplex)

±1.8 dB GSM1800 (>-110 dBm)[1]

±1.8 dB GSM1900 (<-110 dBm)[1]

RF OUT CONNECTOR

Impedance

50 Ω Nominal

VSWR

≤ 1.2:1

Connector

TNC female

RF IN/DUPLEX CONNECTOR

Impedance

50 Ω Nominal

VSWR

≤ 1.2:1

Connector

N Type female

MEASURING RECEIVER

Frequency Range

935 to 960 MHz (GSM900)

1805 to 1880 MHz (GSM1800)[2]

1930 to 1990 MHz (GSM 1900)

Level Range

+46 dBM to -1 dBm

Max Power

50 Ω (+47 dBm) continuous

A-BIS INTERFACE

Format

2.048 Mbit/s or 1.544 Mbit/ssupporting
32 or 24 x 64 kbit/s time slots

Connectors

Switchable BNC unbalanced and 4 mm Banana balanced

Traffic

Single 16 kbit/s bi-directional Channel

Signaling

Two 16 or 64 kbit/s bi-directional Links

Impedance

E1 (option 52) either 75 Ω BNC or 120

Ω 4 mm banana T1 (option 51) 100 Ω BNC or 4 mm banana

MEASUREMENTS

PHASE ERROR

Range

10° RMS, ±30° peak

Accuracy RMS

<0.3° at 5° phase error

Accuracy Peak

±7.2°

FREQUENCY ERROR

Range

±2.5 kHz

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6113.qxd 07/Jun/2005 13:11 Page 7

Accuracy

4.5 Hz + freq. std[3].

POWER LEVEL

Range

±46 dBm to -1 dBm

Absolute Accuracy

±1.0 dB (GSM900)

±1.0 dB (GSM1800, =20W)

±1.2 dB (GSM1900, =20W)

Relative Accuracy

<±0/.4 dB

POWER PROFILE

Dynamic Range

>48 dB[2]

MODULATION SPECTRUM

Dynamic Range

>52 dB[3]

Frequency Span

1 MHz

FREQUENCY STANDARD

Internal

±1.2 x 10^{-7} (standard)[4]

(1 Year, all sources of error) ±3.5 x 10^{-8} (Option 04F)[4]

External frequencies:

10 MHz or 13 MHz ± 2.5 ppm-2 dBm to +19 dBm into 50 Ω

Reference Output:

10 MHz or 13 MHz +9 dBm nominal into 50 Ω

INTERFACES

Memory Card

2 Sockets, PCMCIA V2.0

Card Size

Type1, 2 or 3

Card Types supported

SRAM, ATA Flash EEPROM And hard discs

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 PP0, DC1, DT0, C0, E1

RS232 Interfaces

2 configurable ports for printing and Control 9 way male D-Type

Parallel Printer

25 way female D-Type

BTS MANUFACTURERS SUPPORTED

Alcatel

Ericsson

Interwave

Italtel

Motorola

Nokia

Nortel

PKI

Siemens

GENERAL

Voltage ranges

85 to 13V and 180 to 264V AC

Frequency range

45 to 66 Hz

Power consumption

170 VA maximum

DIMENSIONS AND ENVIRONMENT

Height

210 mm

Width

350 mm

Depth

420 mm

Weight

14 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

UPDATE PROGRAMS

Aeroflex offers a comprehensive software maintenance and enhancement program. This means that as new BTS software versions are released the test capability of the 6113 can be updated in line with any changes. Adding new BTS software versions or updating existing software features of the 6113 can be performed quickly and easily in the field via memory card, IEEE488 or RS232 interface.

Aeroflex has a policy of continuous improvements which means that specifications will change. For full details of 6113 capabilities and BTS support options, contact your local Aeroflex office.

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6113.qxd 07/Jun/2005 13:11 Page 8

VERSIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

ORDERING INFORMATION

Model 6113	BTS Test Set
Model 6113E	BTS Test Set with encryption, option 10R
Option 01	GSM900 operation*
Option 02	GSM1800 operation*
Option 03	GSM1900 operation*
Option 04F	Very High Stability Frequency Standard
Option 08	GSM 850 Operation
Option 10R	Encryption retrofit kit
Option 51	T1 A-bis Interface†
Option 52	E1 A-bis Interface†
Option 60	Rack Mounting
Option 61	Padded Carrying Bag
Option 62	Rigid Transit Case
Option 64	Front Panel Protection Cover
Option 70	GSM/DCS1800/PCS1800 test SIM for test set
Option 71	Miniature SIM adaptor for test set
Option 76	Memory Card, 256 kbyte
Option 77	Memory Card, 2 Mbyte
Option 78	Flash Memory Card, 10M byte
Option 79	Removable Hard Disk Drive 1 Gb
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

**A least one of the option 01,02,03 must be ordered with the basic model and options 02 and 03 cannot be installed together.*

†At least one of option 51 or 52 must be ordered with the basic model

MANUFACTURER SPECIFIC SOFTWARE

Option 220	Ericsson Software
Option 230	Italtel Software
Option 235	Siemens Software
Option 250	Nortel Software
Option 255	Motorola Software
Option 270	Nokia Software
Option 275	Alcatel Software
Option 280	Lucent Software
Option 285	Interwave Software
Option 300	AIME Software - Air Interface Monitor and Emulator Software
Option 310	LIVE Testing
Option 311	Cell Integrity Testing Software

SUPPORT OPTIONS

A number of support options are available that ensure equipment is kept up to date and calibrated. Software support ensures that the latest software is provided. This is important where base station software is revised by the base station manufacturer, and where new features and enhancements are made available.

Extended warranty and calibration is also available. Request Product Support Information data for full details.

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

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Part No. 46891/192, Issue 1, 04/05

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