

# PRODUCT INFORMATION

## 6113 Digital Radio Test Set



- ❑ 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

**RACAL INSTRUMENTS**

[www.racalstruments.com](http://www.racalstruments.com)

## OVERVIEW

The Racal Instruments 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, either 16 or 64 kbit/s, the 6113 accommodates the fact that the mapping of traffic and signaling channels are manufacturer specific.

## 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, ie “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.

Test Information	Multimode : Summary	19 JUN 1998 14:17:52	Channel No. 90
BER	RX Class II BER <input type="text" value="0"/> 4 <input type="text" value=""/> %		Rx Level -104.0 dBm
	TX Class II BER <input type="text" value="0"/> 4 <input type="text" value=""/> %		
Phase Error	BTS TX Power <input type="text" value="37"/> 52 <input type="text" value=""/> dBm		Timeslot 4
	RMS Phase Error <input type="text" value="0"/> 10 <input type="text" value=""/> Deg		BTS Power Max
Power Profile	Peak Phase Error <input type="text" value="0"/> 40 <input type="text" value=""/> Deg		
Modulation Spectrum	Frequency Error <input type="text" value="-200"/> 200 <input type="text" value=""/> Hz		More...
	Power Profile <input type="text" value="---"/> Modulation Spectrum <input type="text" value="---"/>		
	T.A. : GPIB : 20	RXLEV : 10 MHz	RXQUAL : Rslts : OFF
			Offsets : 0.00 dB
			S D F R Abort

## 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.

RF Tests - Parameters		19 JUN 1998 12:00:00		Edit
Parameter	Value	Default		Parameter
FER Limit	0.100	0.100	%	+ ↑ ↓ -
Class 1b Limit	0.400	0.400	%	
Class II Limit	2.000	2.000	%	
Expected Power Level	0.0	0.0	dBm	
Power Level Limit (+/-)	+6.0	+6.0	dB	
Frequency Error Limit (+/-)	48.00	48.00	Hz	
RMS Phase Error Limit	5.00	5.00	deg	
Peak Phase Error Limit	20.00	20.00	deg	
Power Profile Mask Checking	Off	Off		
Mod Spectrum Mask Checking	Off	Off		
Power Tracking	On	On		
Display Holding	Off	Off		
Allowed list: On, Off			More...	
T.A :	RXLEV:	RXQUAL:	S D	EXIT
GPB : 20	10 MHz	Rsts : OFF	Offsets : 0.00 dB	

Simple and comprehensive parameter menus

### 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.



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### 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.

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 with most DOS text editors.

### Multimode Operation

Multimode 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.

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.

# TECHNICAL SPECIFICATION (PROVISIONAL DATA)

## 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 Link Test
A-bis Function Test:	

## SIGNAL SOURCE

### Frequency

Range:	890 to 915 MHz (GSM900) 1710 to 1785 MHz (GSM1800) 1850 to 1910 MHz (GSM1900)
Resolution:	1 Hz

### Level

Range:	-40 dBm to -120 dBm into 50 $\Omega$ (Simplex mode) -47dBm to -120 dBm into 50 $\Omega$ (Duplex mode)
Resolution:	0.1 dB
Accuracy: (Simplex)	$\pm 1.5$ dB GSM900 (>-110 dBm) $\pm 1.8$ dB GSM1800 (>-110 dBm) $\pm 1.8$ dB GSM1900 (>-110 dBm) <sup>1</sup>
Accuracy (Duplex)	$\pm 1.5$ dB GSM900 (>-110 dBm) <sup>1</sup> $\pm 1.8$ dB GSM1800 (>-110 dBm) <sup>1</sup> $\pm 1.8$ dB GSM1900 (<-110 dBm) <sup>1</sup>

## RF OUT Connector

Impedance:	50 $\Omega$ Nominal
VSWR:	$\leq 1.2:1$
Connector	TNC female

## RF IN/Duplex Connector

Impedance:	50 $\Omega$ Nominal
VSWR:	$\leq 1.2:1$
Connector:	N Type female

## MEASURING RECEIVER

Frequency Range:	935 to 960 MHz (GSM900) 1805 to 1880 MHz (GSM1800) <sup>2</sup> 1930 to 1990 MHz (GSM 1900)
Level Range:	+46 dBm to -1 dBm
Max Power:	50W (+47 dBm) continuous

## A-bis INTERFACE

Format:	2.048 Mbit/s or 1.544 Mbit/s supporting 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 $\Omega$ BNC or 120 $\Omega$ 4 mm banana T1 (option 51) 100 $\Omega$ BNC or 4 mm banana

## MEASUREMENTS

### Phase Error

Range:	10° RMS, $\pm 30^\circ$ peak
Accuracy RMS:	<0.3° at 5° phase error
Accuracy Peak:	$\pm 7.2^\circ$

### Frequency Error

Range:	$\pm 2.5$ kHz
Accuracy:	4.5 Hz + freq. std <sup>3</sup> .

### Power Level

Range:	$\pm 46$ dBm to -1 dBm
Absolute Accuracy:	$\pm 1.0$ dB (GSM900) $\pm 1.0$ dB (GSM1800, $\leq 20$ W) $\pm 1.2$ dB (GSM1900, $\leq 20$ W)
Relative Accuracy:	$\leq \pm 0.4$ dB

### Power Profile

Dynamic Range	>48 dB <sup>2</sup>
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### Modulation Spectrum

Dynamic Range	>52 dB <sup>3</sup>
Frequency Span:	1 MHz

## Frequency Standard

Internal (1 Year, all sources of error)	$\pm 1.2 \times 10^{-7}$ (standard) <sup>4</sup> $\pm 3.5 \times 10^{-8}$ (Option 04F) <sup>4</sup>
External frequencies:	10 MHz or 13 MHz $\pm 2.5$ ppm -2 dBm to +19 dBm into 50 $\Omega$
Reference Output:	10 MHz or 13 MHz +9 dBm nominal into 50 $\Omega$

## 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 25 way female 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 66Hz
Power consumption	170 VA maximum
<b>Dimensions and Environment</b>	
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

Racal Instruments 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.

Racal Instruments 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 Racal Instruments office.

## Notes

1. Input power  $\leq 5$ W ( $\pm 37$ dBm)
2. For 1 dB overshoot
3. 10 Bursts averaged, non-hopping
4. After 20 days continuous operation



## 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 be conveniently separated from results and parameter files.

### Synchronization Output

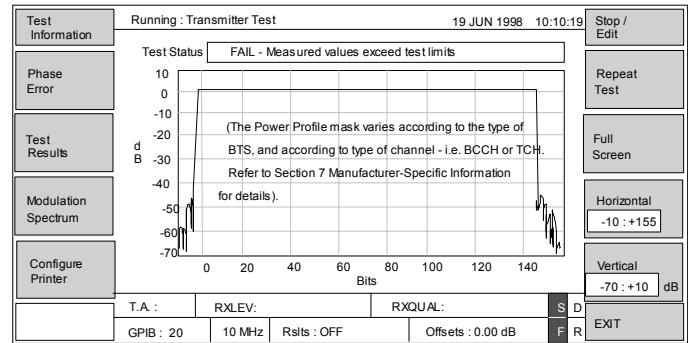
A programmable synchronization output allows external equipment such as a spectrum analyzer or a logic analyzer to be triggered at any point in the GSM frame. Using this trigger signal, spurious signals can be monitored either out-of-band or during the unused slots.



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

## 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, Racal Instruments 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.



A zoom mode allows more detailed examination

### 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 0.03ppm per year.

	Supplied	Option 04F
Frequency	10 MHz	10 MHz
Stability*:	$\pm 1 \times 10^{-7}$ /year	$\pm 3 \times 10^{-8}$ /year
0° to 50°C:	$< \pm 1.7 \times 10^{-8}$	$< \pm 1 \times 10^{-8}$
Warm up time:	30 minutes	30 minutes

\*Ageing after 30 days of continuous operation

## 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 61	Padded Carrying Bag
Option 62	Rigid Transit Case
Option 64	Front Panel Protection Cover
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 170M byte
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

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

# RACAL INSTRUMENTS

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 The Racal policy is one of continuous improvement and consequently the equipment may vary in detail from the description and specification in this publication