

# Conformance Test

**6103 AMR AIME** - AMR Layer 1 & Protocol Analysis

**6103 AIME AMR/CT** - AMR Conformance Test Solution

**AEROFLEX**  
A passion for performance.



- Protocol analyzer, Layer 1 tester and conformance tester for GSM AMR terminals
- Modular and expandable from R&D use to full Conformance Test System
- Accredited GCF and PTCRB test platform
- Simple to use script driven test environment
- Supports Half Rate, Full Rate & Enhanced Full Rate speech
- Supports all AMR Coding Schemes
- Supports RATSCCH and DTX frames and signalling
- Voice Quality Assessment tool
- Layer 3 Message Encoder option

The introduction of AMR (Adaptive Multi-Rate) speech frames presents a new challenge for the GSM mobile terminal developers. Not only must half rate, full rate and enhanced full rate speech frames be created, encoded and decoded, but support must also be provided for eight new full rate coding schemes and six new half rate coding schemes. Additionally, the adaptive nature of AMR must be accommodated. With each AMR speech frame (50 per second) a set of in-band control bits are sent. These allow the current coding rate to be signaled, in addition to requests for changes in the rate of the remote sender.

Also, it should be noted that AMR is asymmetric - uplink and downlink coding rates can be changed independently. Additionally, the in-band signaling allows only a selection of four rates from the possible six or eight to be in use at any one time.

These four rates are referred to as the active codec set. AMR allows for the uplink and downlink active codec sets to be different. AMR also introduces a new set of DTX frames, complicating the whole DTX procedure.

Racal Instruments Wireless Solutions (RIWS) ProCLAIME range of protocol analyzers increases with the addition of the 6103 AMR AIME and 6103 AIME AMR/CT. Capable of emulating an AMR network and all the complex coding schemes and protocol introduced to support AMR.

The 6103 AMR AIME is designed to meet the early R&D challenges such as RF, DSP and protocol stack development. To protect customer investments in test systems, RIWS offers the ability to upgrade to the 6103 AIME AMR/CT a fully compliant AMR conformance tester capable of running both the AMR RF and Protocol tests required to prove compliance against 3GPP TS51.010.

The 6103 AIME AMR/CT is listed at the GCF and the PTCRB as Test Platform 10 and was the first test platform to support AMR TS51.010 test cases.

Due to its ability to run both RF and Protocol tests the 6103 AIME AMR/CT has more AMR test cases approved by either the GCF or the PTCRB than any other AMR supported platform.

\*Illustration of customer configured system in Layer 1 & Protocol Configuration using 6103 AIME AMR/CT and other equipment manufacturers' products.

## RESEARCH & DEVELOPMENT APPLICATIONS

The 6103 AMR AIME is suitable for use by developers of AMR capable mobile terminals and has been designed to address the demanding test requirements posed by the introduction of AMR technology. The modular concept allows the user to configure the system to his particular requirements.

For Research and Development applications, the 6103 AMR AIME is capable of the following functionality:

- Verification of correct AMR coding schemes
- Confirmation of coding of frames and parity
- Verification of correct coding of DTX and RATSCCH frames
- Verification of correct implementation of RATSCCH messaging
- Verification of correct demodulation and decoding
- Confirmation and subjective testing of the adaptive nature of AMR speech frames
- Easy Identification of bad CRC and invalid in-band signaling combinations

## 6103 AMR AIME FEATURES

The MMI is designed to be easy to use and provides a number of features designed to support fast easy testing:

- Real time Layer 2-3 logging
- Decoding of detailed protocol signaling messages between the mobile and the network as per 24.008/44.018
- Filtering capability at Layers 2 and 3 to hide unwanted protocol messages from the MMI displays
- Generation of log files to allow off-line protocol analysis
- Color coding of information to improve readability
- Ability to synchronise Traffic, Layer 2 and Layer 3 frames
- COM based API allowing scripts to be written in any COM based language
- Built-in SAX Basic script environment with coloured code types and auto-code complete facility

Logging all messaging as a function of its OSI layer enables quick and easy detection of interoperability issues.

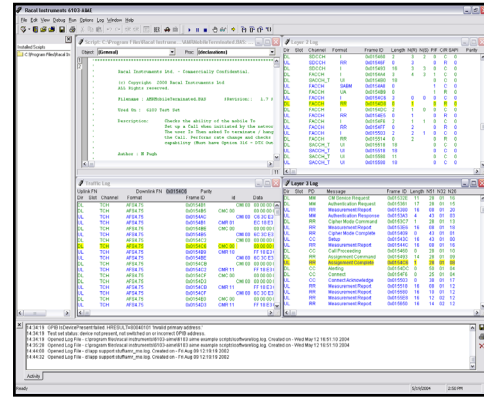


FIGURE 1: MMI WITH WINDOW SHOWING SCRIPT AND 3 LOGGING WINDOWS FOR LAYERS 1, 2 & 3

Double clicking the logged messages in the layer 2 or layer 3 window displays a detailed decode of the message on a bit by bit level as per 24.008 and 44.018 (Mobile radio interface layer 3 specification). This enables the terminal developer to quickly assess if the protocol stack is compliant and if not where the interoperability has occurred

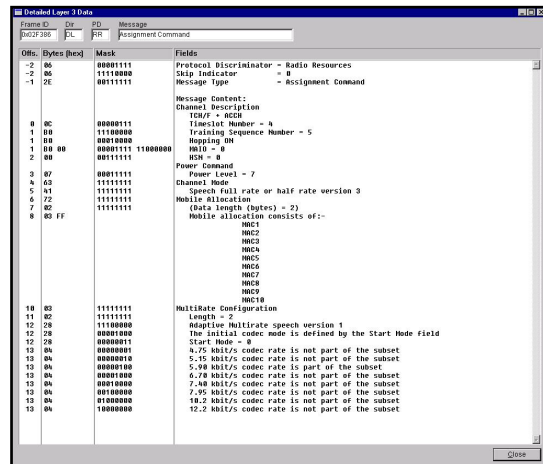


FIGURE 2: DETAILED LAYER 3 WINDOW SHOWING DECODED LAYER 3 MESSAGE

## APPLICATION PROGRAMMING INTERFACE

The 6103 AMR AIME MMI program uses an Encoder API module that is implemented as an In-Process COM OLE Automation Server, which makes available a set of methods (functions) that are language independent. They can be called from a script written in any programming language that is capable of Automation control. This includes the programming languages Visual Basic and Visual C++.

The RIWS 6103 AIME MMI program uses an embedded scripting language and host environment called Sax Basic. This provides an editing and debugging environment and a language that is very similar to Visual Basic.

With built in extras that enable data entry windows to be constructed visually, the user is able to quickly and easily build intuitive pop up boxes facilitating drop down menu's or tick boxes to customise how a specific script runs.

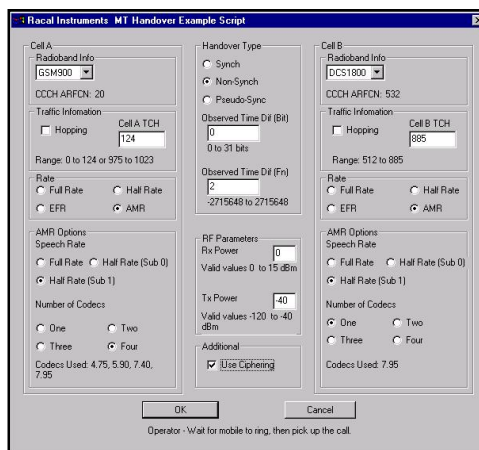


FIGURE 3: EXAMPLE SCRIPT DATA ENTRY WINDOW

## SYSTEM COMPONENTS

The RIWS 6103 is capable of supporting all 4 GSM RF bands 850/900/1800/1900 MHz on one test set. The 6103 test sets are connected via GPIB to the PC which acts as the test controller, running the RIWS MMI providing an environment for script creation and execution as well as logging all the messaging.

The system comprises:

- 6103 - Digital Radio Test Set
- Option 94 - Desktop PC with GPIB card and Windows 2000 Operating System
- Option 300 - GSM Mobile Air Interface Protocol Monitor/Emulator
- Option 315 - AMR AIME for 6103, including DTX functionality and CRC Inversion

Additional functionality may be included with the following options:

- Option 317 - AMR VQA
- Option 333 - Enhanced BER Measurement
- Option 501 - GSM+SMS Encoder option
- Option 502 - AMR Encoder option

OPTION 94 A PC workstation and LCD flat screen monitor equipped with a GPIB card and cabling required to interface to the 6103 hardware, see PC spec on last page of data sheet.

OPTION 300 Provides the GSM AIME functionality and is common to all the GSM ProCLAIME Family. Providing the logging and debug environment within the MMI and the embedded software capable of generating the required sequences.

OPTION 315 Supplies the extra functionality required to support all the AMR codecs, AMR specific channels and AMR specific messaging such as DTX and RATSCCH. Also provides CRC inversion for testing receiver DSP algorithms.

OPTION 317 Also known as VQA (Voice Quality Assessment) provides the user with the ability to assess the voice quality (aurally) of GSM coded speech frames including half rate, full rate, EFR and all AMR Codecs.

OPTION 333 Provides additional Layer 1 testing of the speech frames. The BER/FER test is enhanced to allow full classification of bits, both by class and frame type. In addition, these metrics are made available to the script API, thus a full pass/fail determination is possible from within the script itself.

OPTIONS 501 & 502 Comprise a Layer 3 Encoder API with associated libraries for standard GSM and AMR messaging. These options provide a set of keywords and constants for quickly and easily encoding radio resource management, mobility management and circuit switched call control messages specified in the GSM signalling specs.

## CONFORMANCE TEST APPLICATIONS

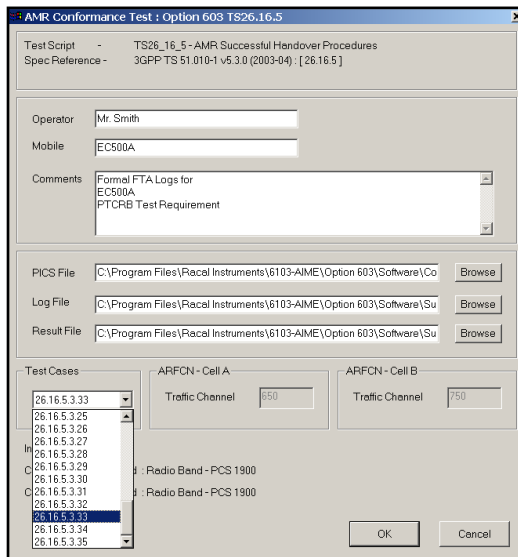
The 6103 AIME AMR/CT breaks the existing model of one conformance platform for RF and another for protocol testing as it is a fully compliant AMR conformance test platform, capable of running all the RF and protocol test cases listed in 3GPP TS51.010.

Backward compatible to the 6103 AMR AIME mode and retaining all the generic features such as real time logging, decoding of messages and the ability to filter out unwanted or repetitive messaging, the conformance test AMR/CT upgrade is designed for the latter stage of AMR development such as:

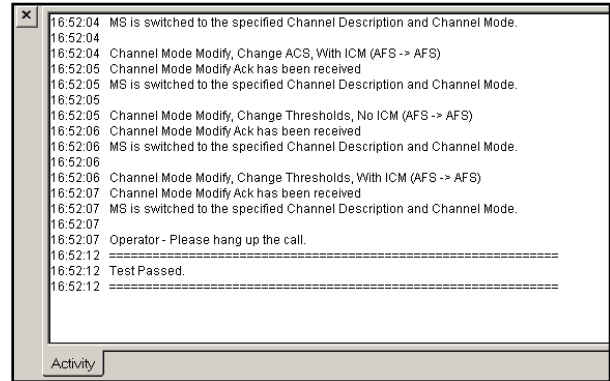
- RF performance analysis
- Protocol stack integration
- Interoperability analysis/problem diagnosis
- Pre-validation confidence testing
- Mobile station validation for accreditation
- Writing customers' own specific protocol conformance style test cases to go beyond the minimum level of testing defined in 51.010
- Post-deployment network testing

When executing a test case a message box is presented displaying paths and filenames to the below three files enabling the user to utilise different PICS files or store results in the appropriate folder on the controlling PC or a corporate network:

- PICS file to be used
- Log file containing all the protocol logging
- Results file containing summary of the tests in a textual format



During the execution of each test case not only is the full logging recorded in the MMI protocol windows but the activity window also records each major test case milestone that has been completed. After running each test case a clear indication is given in the activity window stating if the test has passed or failed.



## SYSTEM COMPONENTS

Upgrading from a 6103 AMR AIME to 6103 AIME AMR/CT is as easy as an extra 6103 digital radio test set, a software option and test case packages.

6103 - Digital Radio Test Sets

Option 301/315 - AMR Software for 2nd test set

Option 333 - Enhanced BER Measurement

Option 601, 603 & 604 - AMR Protocol TS51.010 Test Cases

Layer 1 test functionality may require the following additional options:

Option 23 - RF IN/OUT for Fading Simulator

Option 602, 605 & 607 - AMR Layer 1 TS51.010 Test Cases

Option 606 - Cingular Network Acceptance Test Cases

OPTION 301 Instead of having to purchase another option 300 and 315 to enable the second test set to perform AMR, Option 301 can be purchased. This offers a significant price reduction. However, in this case, it will not be possible to use the second 6103 as a separate stand-alone 6103 AMR AIME development system.

Please note that the frequency band options must be identical for both the 6103 test sets.

OPTIONS 601 TO 607 Are all AMR test case packages. These packages are all compliant to 3GPP 51.010-1 (excluding 606). Options 601, 603 and 604 are Protocol test case packages. Options 602, 605 and 607 address the Layer 1.

Option 606 is a package of test cases written in conjunction with Cingular Wireless for network acceptance.

	OPTION 601	602	603	604	605	606	607
Layer 1		*			*	*	*
Config including 23R							
Protocol only	*		*	*			
Config							

The above table is a matrix showing what test case packages are Layer 1, requiring option 23R hardware or protocol test cases.

## SYSTEM CONFIGURATIONS

### PROTOCOL ONLY CONFIGURATION

RIWS 6103 test sets are connected to a PC through a single GPIB connection. The PC acts as the test controller running the validated TS51.010 test cases, providing an environment to log all of the messaging and provide detailed analysis.

### LAYER 1 & PROTOCOL CONFIGURATION

Connection is similar to the protocol only config, however to measure the AMR RF characteristics the system also requires the following additional equipment:

- Sofimation Sofi 05 Fading Simulator:  
2x10DIGIF127A,DFAGC2
- Rohde and Schwarz FSP 7 Spectrum Analyzer
- Aeroflex 2025 Signal Generator with Option 3 - High Power RF Output
- RIWS option 23R (Rear of 6103 digital test set SMA Connections)

### TEST CASE DEVELOPMENT AND SUBMISSION

RIWS delivers fully compliant 3GPP TS51.010 AMR test cases approved by the Global Certification Forum (GCF) and the PCS Type Certification Review Board (PTCRB).

RIWS supplies the test case source code and exposes the API to enable its customers to edit and create their own test cases to go beyond the minimum test criteria, providing a mechanism for the

end user to build up a vast array of variations and manufacturer defined test cases to establish the limits of the mobile stations' performance.

RIWS invests heavily in the test case development process. The integrity of the test cases is ensured through a rigorous process of testing in-house and working with selected leaders in the mobile RF and protocol development arena. Test cases are chosen for validation based on in-house and partner recommendation and GCF/PTCRB Priorities. Those test cases are then delivered to accredited test labs for validation. Upon successful validation the test cases are submitted for certification at the GCF and the PTCRB/PVG.

RIWS is very active within GERAN WG3 defining the AMR test specs and presenting CR's to help speed up the test times required for AMR tests, particularly the RF tests which require large numbers of samples to make the necessary calculations

RIWS and Cingular Wireless, both contributors to GERAN WG3 on AMR, decided to partner on developing network acceptance test cases designed primarily to focus on real network issues of the RF that test the mobiles ability to be using the correct codecs, active sets or implement DTX in noisy and more true to life network conditions. These test have now become the standard tests required to obtain Cingular handset acceptance for AMR functionality.

## SUPPORT

Support of the system hardware is an essential element in maximizing efficiency and return on investment of the equipment. RIWS offers several comprehensive hardware support packages, which are tailored to typical usage profiles.

The 6103 AMR AIME and 6103 AIME AMR/CT is delivered with a comprehensive worldwide hardware, software and test case support package. Three tiers of support packages are offered to the user: Standard, Silver and Gold. Regardless of the level of support chosen, users have access to a helpdesk facility where any faults or issues can be logged and will receive a response from RIWS typically within the next working day.

The support also covers issues such as specification tracking and any changes in the 3GPP versions of the standard. To fulfill specific support needs, the user is able to customize any of the support packages.

Further details about support can be found in the support section on the Aeroflex website.

### 3GPPTS51.010 AMR TEST CASE PACKAGES

Below is a list of the AMR test case package options that can be purchased to execute on the 6103 AIME AMR/CT. All validated test cases are validated to the latest version of 3GPP TS51.010.

For current certification status please refer to the GCF CC Database or the latest version of NAPRD03 + PVG 5 day rule submissions. The 6103 AIME

AMR/CT is listed in the GCF CC Database and in the PTCRB NAPRD03.doc as Test Platform 10.

Please note that the list and number of available test cases is constantly changing due to the 3GPP standards constantly evolving. Please consult your local RIWS office for the latest available information.

3GPPTS51.010 AMR TEST CASES		
Option	51.010-1 Test Case Section and description	
601	26.16.2 26.16.3 26.16.4 26.16.6 26.16.7 26.16.8	In-band Signaling, Uplink Codec Adaptation Structured procedures / MS terminated call / early assignment / no initial codec mode Structured procedures / MS originated call / late assignment / specified initial codec mode Structured procedures / emergency call AMR Signaling / Directed Retry / Mobile Originated Call AMR Signaling / Directed Retry / Mobile Terminated Call
602	14.2.10 14.2.18 14.4.8 14.4.16 14.5.1.2 14.5.1.3	Reference sensitivity - TCH/AFS Reference sensitivity - TCH/AHS Co-channel rejection - TCH/AFS Co-channel rejection - TCH/AHS Adjacent channel rejection - TCH/AFS Adjacent channel rejection - TCH/AHS
603	26.16.3a 26.16.4a 26.16.5 26.16.10 26.16.10.2 26.16.11	Structured procedures / MS terminated call / early assignment / specified initial codec mode Structured procedures / MS originated call / late assignment / no initial codec mode AMR signaling / Handover / active call / successful case AMR signaling/ test of the channel mode modify procedure/ full rate AMR signaling/ test of the channel mode modify procedure/ half rate Handover / layer 1 failure
604	26.16.9.1 26.16.9.2 26.16.9.3 26.16.9.4 26.16.9.5 26.16.9.6 26.16.9.7 26.16.9.8 26.16.9.9 26.16.9.10 26.16.9.11	AMR Configuration Change (normal) AMR Configuration Change (abnormal) Codec Mode Phase Change (normal) Codec Mode Phase Change (abnormal) Threshold Change (normal) Threshold Change (abnormal) Unknown RATSCCH REQ Message Ignore subsequent REQ prior to expiry of REQ_Activation counter Initialization of Transaction with ACK_OK, ACK_ERR or ACK_UNKNOWN Inversion of the Phase of the CMR/CMI Change of Active Codec Set
605	14.2.19 14.2.20 14.4.17 14.4.18 14.10.1 14.10.2	Structured procedures / MS terminated call / early assignment / specified initial codec mode Structured procedures / MS originated call / late assignment / no initial codec mode AMR signaling / Handover / active call / successful case AMR signaling/ test of the channel mode modify procedure/ full rate AMR signaling/ test of the channel mode modify procedure/ half rate Handover / layer 1 failure
607	14.1.5 14.1.6 21.3.3 21.3.4 21.4.2 21.4.3	Bad Frame Indication - TCH/AFS Bad Frame Indication - TCH/AHS Signal quality under static conditions - TCH/AFS Signal quality under static conditions - TCH/AHS Signal quality under TUhigh propagation conditions - TCH/AFS Signal quality under TUhigh propagation conditions - TCH/AHS

## AMR NETWORK ACCEPTANCE TEST CASES

AMR Network acceptance test cases, defined by Cingular Wireless and Racal Instruments Wireless Solutions are tests that go beyond TS51.010 and are more focused to real network situations.

## AMR NETWORK ACCEPTANCE TEST CASES

Option	Network	Test Case Name and description
606	C1	1900 TU1.5 Ideal TCH/AFS5.9
	C2	1900 TU50 Ideal TCH/AFS5.9
	C3	1900 TU1.5 No FH TCH/AFS5.9
	C4	900 TU50 No FH TCH/AFS5.9
	C5	1900 TU1.5 Ideal TCH/AFS12.2
	C6	1900 TU50 Ideal TCH/AFS12.2
	C7	1900 TU1.5 No FH TCH/AFS12.2
	C8	1900 TU50 No FH TCH/AFS12.2
	C9	1900 TU1.5 Ideal TCH/AHS5.9
	C10	1900 TU50 Ideal TCH/AHS5.9
	C11	1900 TU1.5 No FH TCH/AHS5.9
	C12	1900 TU50 No FH TCH/AHS5.9
	C13	1900 TU1.5 Ideal TCH/AFS-INB
	C14	1900 TU50 Ideal TCH/AFS-INB
	C15	1900 TU1.5 No FH TCH/AFS-INB
	C16	1900 TU50 No FH TCH/AFS-INB
	C17	1900 TU1.5 Ideal TCH/AHS-INB
	C18	1900 TU50 Ideal TCH/AHS-INB
	C19	1900 TU1.5 No FH TCH/AHS-INB
	C20	1900 TU50 No FH TCH/AHS-INB
	C21	850 TU3 Ideal TCH/AFS5.9
	C22	850 TU50 Ideal TCH/AFS5.9
	C23	850 TU3 No FH TCH/AFS5.9
	C24	850 TU50 No FH TCH/AFS5.9
	C25	850 TU3 Ideal TCH/AFS12.2
	C26	850 TU50 Ideal TCH/AFS12.2
	C27	850 TU3 No FH TCH/AFS12.2
	C28	850 TU50 No FH TCH/AFS12.2
	C29	850 TU3 Ideal TCH/AHS5.9
	C30	850 TU50 Ideal TCH/AHS5.9
	C31	850 TU3 No FH TCH/AHS5.9
	C32	850 TU50 No FH TCH/AHS5.9
	C33	850 TU3 Ideal TCH/AFS-INB
	C34	850 TU50 Ideal TCH/AFS-INB
	C35	850 TU3 No FH TCH/AFS-INB
	C36	850 TU50 No FH TCH/AFS-INB
	C37	850 TU3 Ideal TCH/AHS-INB
	C38	850 TU50 Ideal TCH/AHS-INB
	C39	850 TU3 No FH TCH/AHS-INB
	C40	850 TU50 No FH TCH/AHS-INB

## SPECIFICATION

### ENVIRONMENTAL AND SAFETY (6103 TEST SET)

#### Voltage Range

85 to 130 V and 180 to 264 V AC

#### Frequency Range

47 to 66 Hz

#### Operating Temperature:

10°C to 35°C

#### Humidity

Complies with IEC60068

#### Calibration:

1 year

#### EMC

Complies with EN61326-1 :1997+A1 : 1998 , Class A (emissions) , EN61326-1 :1997+A1 : 1998 Table 1 (immunity)

#### Safety

Complies with EN61010-1: 1993+A2: 1995

### CONTROL PC RECOMMENDED SPECIFICATION

#### (OPTION 94)

#### CPU

Intel® P4 Processor 2.8GHz

#### RAM

256 MB Dual Channel (2x128 PC333 Non ECC) DDR Memory

#### HDD

40GB ATA-100 IDE primary HDD

#### I/O interface

100 Mbps Ethernet

#### CD

20/48x CD-ROM

#### PCI

Minitower with 3 industry-standard PCI slots

#### O/S

Microsoft Windows 2000 Professional (service pack 4) with media using NTFS

#### Monitor

Dell UltraSharp™ 1703FP flat panel (17.0 viewable)

#### Support

Client Gold Technical Support - 3 Yrs

### FREQUENCY BAND CONFIGURATIONS

- 1 = 900 MHz only
- 2 = 1800 MHz only
- 3 = 1900 MHz only
- 6 = 900/1800/1900 MHz - Tri Band
- 8 = 850 MHz only
- 9 = 850/900/1800/1900 MHz - Quad Band

Note for 6103 AIME AMR/CT both 6103 digital radio test sets need to be optioned to support identical RF bands.

## VERSIONS AND ACCESSORIES

### ORDERING INFORMATION

#### 6103 AMR AIME MOBILE PROTOCOL ANALYSER

##### Hardware

6103	Digital Radio Test set
6103-04F	Very High Stability Frequency Standard
6103-10R	Encryption retrofit kit
Band Config	See bottom left frequency band configuration chart

##### Control PC

6103-94	Controlling PC Workstation
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##### Software Environment

6103-300	GSM AIME Software
6103-315	AMR AIME Software
6103-333	Enhanced BER Measurement

#### 6103 AIME AMR/CT MOBILE CONFORMANCE TESTER

##### Hardware

2 * 6103	Digital Radio Test set
2 * 6103-04F	Very High Stability Frequency Standard
2 * 6103-10R	Encryption retrofit kit
2 * 6103-23R	RF IN/OUT for Fading Simulator
2 * Band Config	See bottom left frequency band configuration chart

##### Control PC

6103-94	Controlling PC Workstation
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##### Software Environment

6103-300	GSM AIME Software
6103-301	Slave AMR Software
6103-315	AMR AIME Software
6103-333	Enhanced BER Measurement

#### 3GPP TS51.010 Conformance Test Cases

6103- 601- 607 AMR 3GPP TS51.010 and Network Acceptance Test cases

Note. Please refer to separate Test Case product information for further details within this datasheet.

#### 6103 AIME AMR/CT UPGRADE FROM 6103 AMR AIME

6103	Digital Radio Test set
6103-04F	Very High Stability Frequency Standard
6103-10R	Encryption retrofit kit
Band Config	See bottom left frequency band configuration chart
2 * 6103-23R	RF IN/OUT for Fading Simulator

##### Operational Software

6103-301	Slave AMR Software
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#### 3GPP TS51.010 Conformance Test Cases

6103- 601- 607 AMR 3GPP TS51.010 and Network Acceptance Test cases

Note. Please refer to separate Test Case product information for further details within this datasheet.

##### CHINA Beijing

Tel: [+86] (10) 6467 2761 2716  
Fax: [+86] (10) 6467 2821

##### CHINA Shanghai

Tel: [+86] (21) 6282 8001  
Fax: [+86] (21) 62828 8002

##### FINLAND

Tel: [+358] (9) 2709 5541  
Fax: [+358] (9) 804 2441

##### FRANCE

Tel: [+33] 1 60 79 96 00  
Fax: [+33] 1 60 77 69 22

##### GERMANY

Tel: [+49] 8131 2926-0  
Fax: [+49] 8131 2926-130

##### HONG KONG

Tel: [+852] 2832 7988  
Fax: [+852] 2834 5364

##### INDIA

Tel: [+91] 80 5115 4501  
Fax: [+91] 80 5115 4502

##### KOREA

Tel: [+82] (2) 3424 2719  
Fax: [+82] (2) 3424 8620

##### SCANDINAVIA

Tel: [+45] 9614 0045  
Fax: [+45] 9614 0047

##### SPAIN

Tel: [+34] (91) 640 11 34  
Fax: [+34] (91) 640 06 40

##### UK Burnham

Tel: [+44] (0) 1628 604455  
Fax: [+44] (0) 1628 662017

##### UK Stevenage

Tel: [+44] (0) 1438 742200  
Fax: [+44] (0) 1438 727601  
Freephone: 0800 282388

##### USA

Tel: [+1] (316) 522 4981  
Fax: [+1] (316) 522 1360  
Toll Free: 800 835 2352

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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.