PRODUCT DATA

Voice Testing System for Mobile Phones — Type 6712

Voice Testing System Type 6712 for mobile phones provides a new approach to voice testing of mobile phones in a fast, reliable and efficient way. By using noise excitation, the speech codec can be included in the measurement path. This means that the antenna is used as the access point. Accordingly, the full receive and transmit signal paths are measured, giving realistic measurements of phone performance.

Type 6712 is a powerful tool in the development and production process of mobile phones. Besides being a solid foundation for Type 6712 applications, the PULSE™ platform also provides a wide range of analysis capabilities for the verification of the acoustic design during development, and is a versatile platform for objective as well as subjective evaluation of specific components such as noise suppressors, echo chancellors, etc.

6712

Brüel & Kjær

|	
USES	Voice testing of mobile phones according to specific standards
	Measurement of the complete transmit and receive signal path using the air interface
	Measurement of the raw acoustical design of the mobile phone using the Digital Audio Interface
	Research and development of mobile phones with focus on voice testing using advanced test signals
	Quality assurance and sample testing of mobile phones
	Inspection and validation of mobile phones
FEATURES	Pre-programmed test suites according to commonly used standards and recommendations for mobile phone testing
	Test suites that allow individual or complete sequences of tests with minimum operator interaction
	Flexible user-interface enabling high-level users to modify parameters and tolerances in the individual test cases
	Adaptive test methods for sine excitation ensure highly accurate results – even in noisy environments
	Advanced noise-excitation test methods including artificial speech signal ITU-T P.50 and continuous pink noise
	Sound level measurements (IEC 651) for noise and speech signal analyses and real-time filters (IEC 225)
	Supports the use of Type 1, Type 3.2 and Type 3.3 (HATS) ear simulators
	Digital equalization of mouth simulators and diffuse fields
	Digital equalization of audio paths
	Automatic report generation

Introduction

Voice Testing System Type 6712 for mobile phones is a comprehensive system for testing the acoustical transmission performance of mobile phones according to different standards. Furthermore, the system is designed to accommodate the needs for quality assurance testing, sample testing, incoming inspection and validation of mobile telephones. The tests performed by the system can be executed using the codec or both the codec and the Digital Audio Interface (DAI) – whichever is required by the standard.

The test system is based on software-controlled instruments that allow measurements to be made consistently and with a minimum of operator interaction. Test suites delivered with the system allow tests to be run individually or as a sequence constituting the different standards. Higher-level users can use the PULSE platform software interactively to develop their own tests and measurements to determine audio parameters not covered by standard test cases. This makes it easy to perform tests for research and development purposes.

All Type 6712's control, measurement and report functions are software-based. The software is optimised to run under Windows®, its familiar interface making the system intuitive and efficient for inexperienced and experienced operators alike. Furthermore, extensive on-line help is always available to provide guidance if a question arises during test execution. The system is delivered with licensed copies of Microsoft® Office as well as Telephone Test Software BZ 5137.
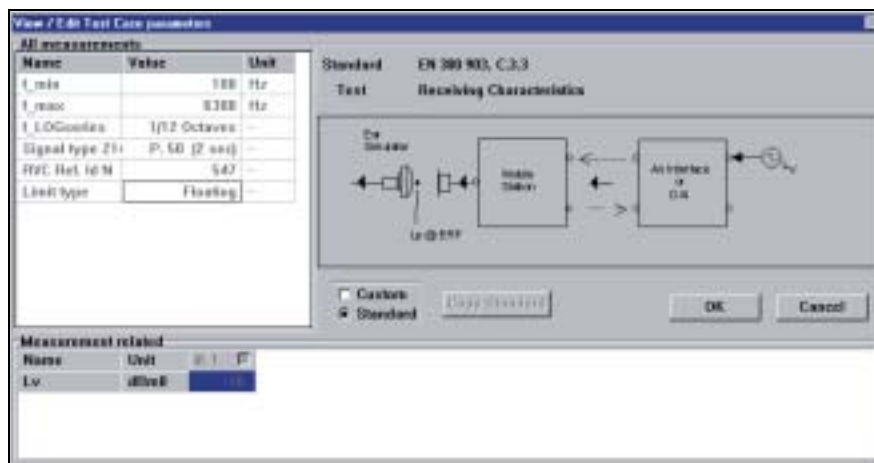
Performing Measurements
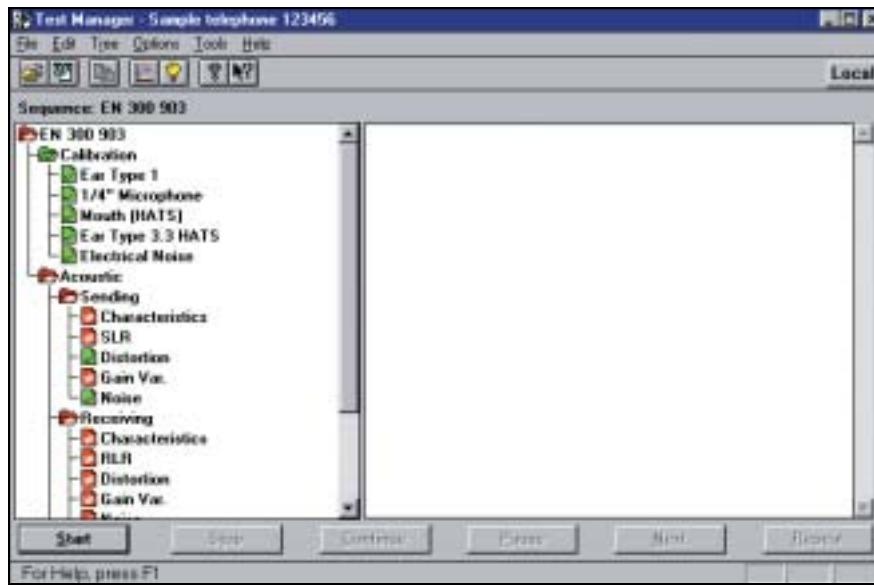
To control the actual measurements, the Test Manager (see Fig. 1) is used to start, pause and stop the testing of a specific telephone. The testing is performed in accordance with the selected session profile corresponding to a specific test suite or standard. When a session has been selected, the operator is presented with a hierarchical tree showing all the tests included in the session. By selecting the root of the tree, all tests are performed consecutively. It is also possible to select individual branches of the tree to do a limited range of tests, for example only sending characteristics. Test results are clearly indicated on the screen, making pass/fail judgements immediately obvious. Each test within a session can be performed according to the standard set down by the issuing authority. Alternatively, the operator can select different parameters and tolerances within the range of the hardware and software, allowing research and development testing to be conducted (see Fig. 2). As each test is performed, an information window shows the current state of the system and the results of the test in numeric form. Using the Data Browser, it is also possible to see the results of tests graphically during or after a test is performed.

3

Viewing, Storing and Retrieving Measurements

The Data Browser (see Fig. 3) is a versatile display for viewing measurements. Combined, the Data Browser and the Test Manager constitute a tool for instantly displaying the results of the current test or for viewing the previous tests. Several Data Browser windows can be opened at once, allowing direct comparisons to be made on-screen. Using the Windows® cut-and-paste facility, results can be copied to word-processing packages or spreadsheets.

Fig. 3
Speed and versatility are the main features of the Data Browser. The Data Browser dispalys the measurement results in graphical or tabular format
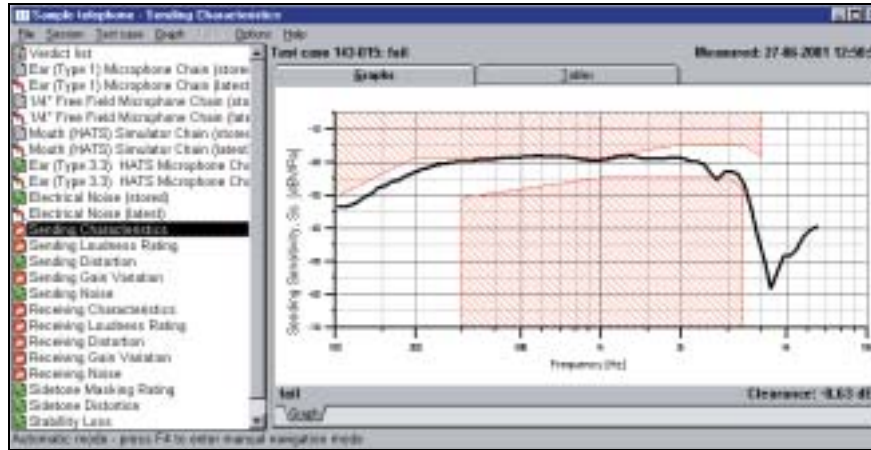
Using the Session Manager (see Fig. 4), the operator can gain access to the different sessions that hold the measurements. A session is a set of tests conducted on a telephone according to a specific standard and related measurement data produced during the test of the telephone. The Session Manager supports facilities to quickly find previous sessions and simple procedures to create new sessions. Commonly used sessions containing recurrent information, for example, the name of the test house or telephone manufacturer, are easily copied into new sessions, considerably reducing the time needed for test of similar telephones. Measurement results of stored sessions can be examined using the Data Browser and reports of stored sessions are easily produced with the report generator.

Fig. 4
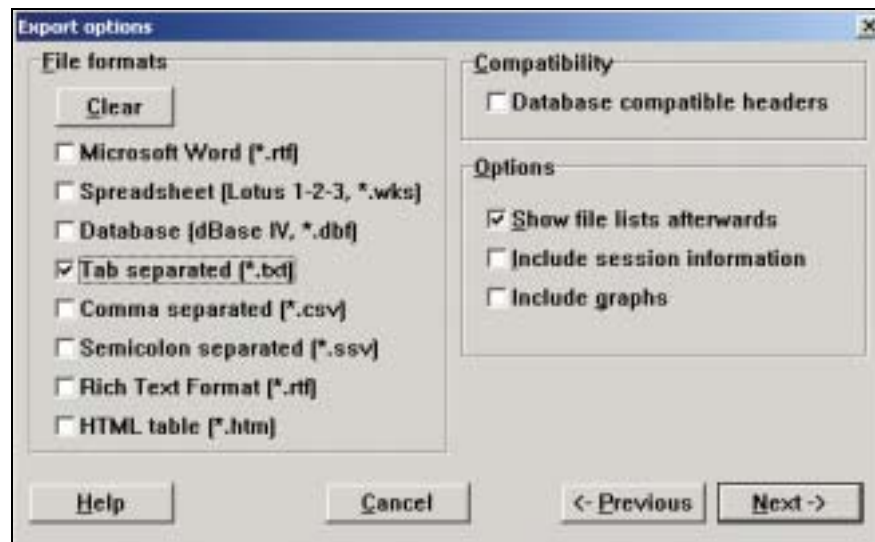*The Session Manager supports viewing, storing and retrieving measurements*

Documenting the Measurements

The Report Generator takes measurement data files, either singly, when selected from the Data Browser, or collectively when selected from the Session Manager or the Test Manager, and rapidly converts the stored results into pre-formatted Microsoft® Word documents. Each test can be presented in short form, showing only a graph and a table of the most important results, or in standard form, where parameters, tolerances and detailed measurement data are given. Once in Microsoft® Word format, the report can be printed, or the page layout modified to suit individual corporate standards.

For customised documentation of measurements, the actual measurement data, etc., can be exported in different file formats. This powerful export facility takes the measurement data and formats them into files that can be imported into a wide variety of standard data-processing programs (see Fig. 5). Measurement data can even be dynamically linked to enable automatic referencing and updating. The file formats currently supported are: ASCII (tab, comma, or semicolon separated), spreadsheet (support for Microsoft® Lotus, 1-2-3, Borland Quattro Pro, and Excel), Rich Text Format (general and Microsoft® Word optimised), HTML table, and database format (Microsoft® Access and dBase IV®).

Preparing for Measurements

Before making the actual measurements, the test system must be calibrated and the radio link between the air interface and the mobile phone established. The software supports both these tasks.

The system needs to be calibrated at least once a day. During the calibration procedure, the ear simulator, mouth simulator and the electrical signal paths are measured, ensuring that any deviation can be digitally compensated for during the actual measurements. Calibration is valid for one day, i.e., 24 hours.

The radio link between the air interface and the mobile phone can be controlled manually or remotely. In remote mode, the air interface is controlled by the software via the IEEE–488 interface. The air interfaces that can be controlled remotely are HP-8922, CMD-55 and CMU-200. When controlled manually, the radio link is established from the

front panel of the air interface. In manual mode, the operator must enter the send and receive gains at 1 kHz. Manual mode allows the use of air interfaces not supported by the control software. The manual mode also allows testing of other telephone technologies than the ones currently available for Type 6712.
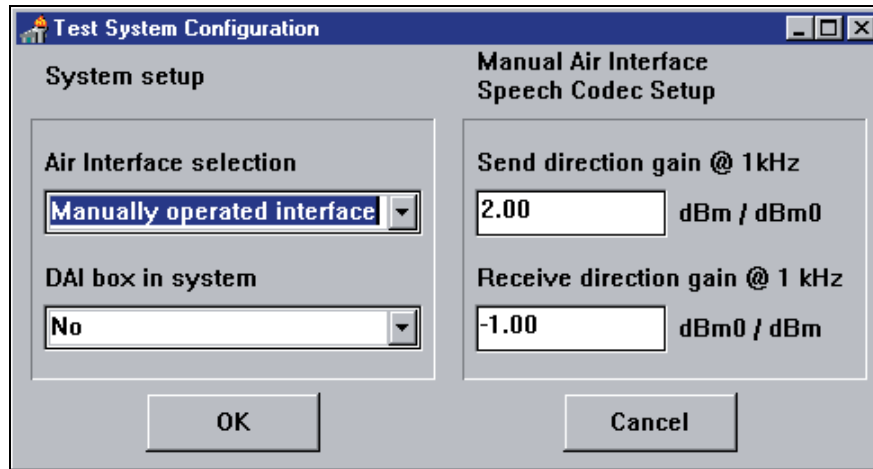
System Configurations

Voice Testing System Type 6712 is a modular system. However, its overall structure is very simple and straightforward. The system consists of an Acoustic Interface, an Acquisition and Analysis System, one or more Software Licenses and optional accessories.

Acoustic Interface

To establish a standardised and suitable acoustical coupling between the mobile phone and the Acquisition and Analysis System, Telephone Test Head Type 4602 B or Head and Torso Simulator (HATS) Type 4128 D should be used. Both Type 4602 B and Type 4128 D are especially suitable for the correct placement of mobile handsets, since both accommodate small handsets, handsets with antennae and non-symmetrical handsets. Type 4602 B incorporates Mouth Simulator Type 4227 and Ear Simulator Type 4185 or Wideband Ear Simulator Type 4195 allowing tests to be performed in a standardised position according to ITU-T recommendations. Type 4128 C with Handset Positioner Type 4606 is a very realistic test setup for handset testing, using either standardised position according to ITU-T recommendations or user-defined positions.

Acquisition and Analysis System

Type 3560 C PULSE Front-end is the heart of Type 6712 and is used for all tests performed by it. Type 3560 C generates the excitation signal such as the P.50 Artificial Speech Signal and the Pink Noise Signal. Furthermore, it includes CPB (Constant Percentage Bandwidth), FFT (Fast Fourier Transform) or SSR (Steady State Response Analyzer) signal analysis. CPB and FFT are used for all response measurements that require a broadband excitation signal such as artificial speech signal or pink noise signal. SSR is used for all response measurements that require a sinusoidal excitation signal and is used for determining the frequency

response. The SSR analyzer incorporates an adaptive sweep algorithm to ensure highly accurate results, even in noisy environments.

Fig. 7 *Items available for system configurations*
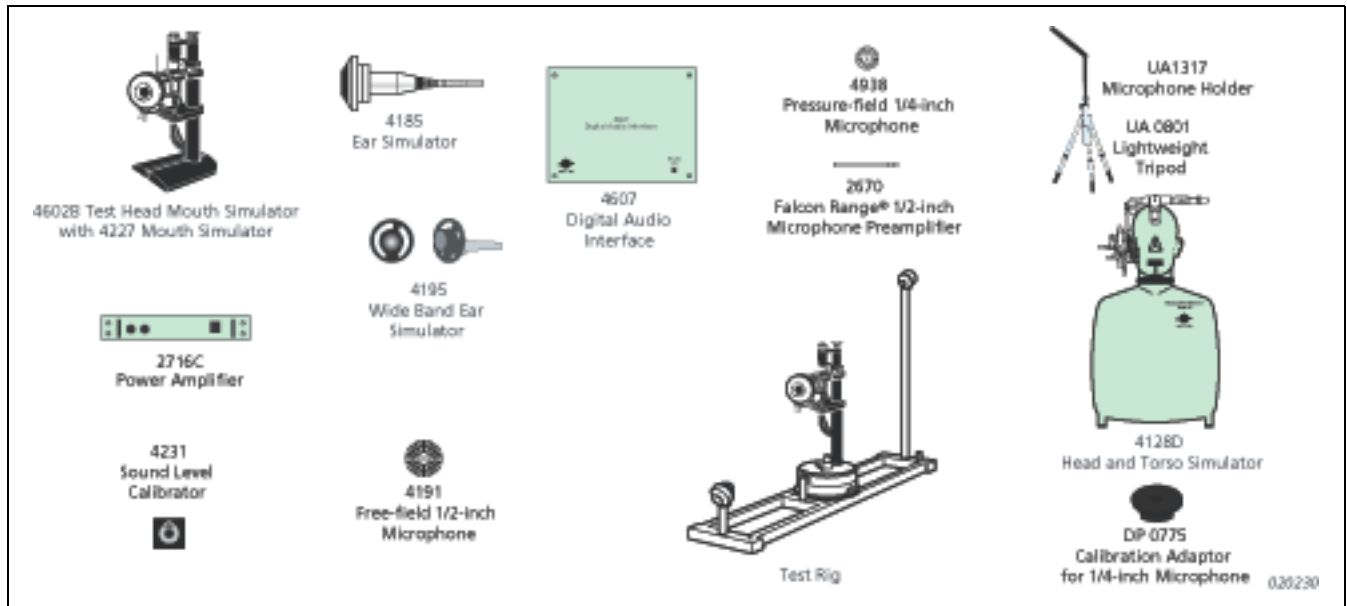
Software Licenses

Software licenses fall into two groups – those that support testing of mobile phones according to specific standards, and those that add analysis capability and features to the PULSE software platform. For more information see Fig. above.

Optional licenses for standards that allow testing according to specific standards:
BZ 5137–017 EN 300 903 (GSM 03.50) for GSM phones
BZ 5137–020 3GPP TS 26.132 for GSM and UMTS phones
BZ 5137–027 3GPP TS. 51.010 (GSM 11.10) for GSM phones
BZ 5137–025 CTIA test plan for dual mode AMPS/CDMA phones
BZ 5137–023 Hands-free based on ITU.T Rec. 340
BZ 5137–029 LSTR and ANR based on GSM and 3GPP specifications

Optional PULSE licenses that add analysis capability to PULSE:
Type 7772 Steady State Response Analysis
Type 7701 Data Recorder
Type 7705 Time Capture
Type 7698 Sound Quality Software
BZ 5265 Zwicker Loudness option for Type 7698
BZ 5301 Psychoacoustic Test Bench option for Type 7698

Optional Accessories

The following optional accessories are available for use with software licenses that support testing of mobile phones according to specific standards – accessories for remote control of Air Interface via IEEE–488, accessories for measurements via the Digital Audio Interface (DAI), accessories for Stability, LSTR and ANR measurements, and accessories for measurements on the Alerting Module (Ringer Test)

For easy configuration of a complete system, a number of standard system configurations are available from Brüel & Kjær. However, the standard configurations have all been put together by selecting from the full configuration overview shown above. For specific information regarding standard system configurations, please see the ordering information.

Using PULSE as a General Research and Development Tool

PULSE provides access to analyzers, post-processing functions and display facilities for many applications within the area of electroacoustic testing. Using the FFT Analyzer, CPB (1/nth octave) Analyzer, Overall Level Analyzer and Signal Generators included with Type 6712, PULSE can be set up to accommodate the vast amount of different measurements typically required for R&D of new electroacoustic devices. Furthermore, PULSE contains a task-oriented user interface that allows the tasks involved in the complete measurement process to be implemented in PULSE as individual tasks that can be performed one after another. This could typically include many different types of analysis that can easily be managed and documented. All the tasks can be stored together with the actual measurements, and reports can be stored as a PULSE project that can be restored in PULSE at a later stage. For displaying the measurements, PULSE has a large variety of different functions such as 3D waterfall display and contour display. For documenting the measurements PULSE supports the use of either dynamic or static links to Word or Excel displays.

Fig. 8
PULSE software showing task-oriented user interface
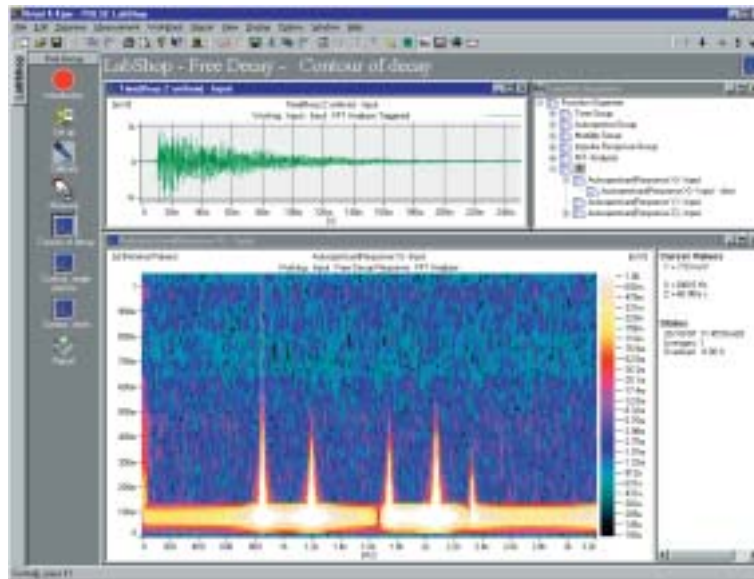
Fig. 9
Waterfalls showing FFT and 1/3-octave acoustic response from multi-analysis using FFT and Real-time Digital Filter (CPB) analyzers
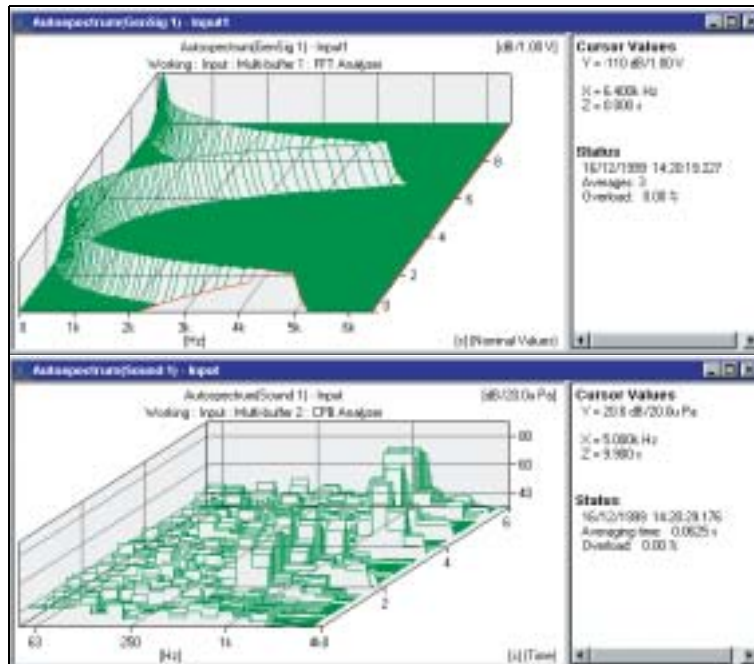
Additional software that enhances the analysis capability of PULSE and that could be useful during the development of new electroacoustic devices are:

Type 7772 Steady State Response Analysis for component testing
Type 7701 Data Recorder or Type 7705 Time Capture for recording of acoustical or electrical signals – recording that can be exported from PULSE as a wave file and then be loaded into the generator and replayed

For more information on PULSE software and hardware please refer to System Data Sheets BU 0229 (PULSE Software) and BU 0228 (PULSE Hardware).

# Using Sound Quality for Product Sound Evaluation

Using the Brüel & Kjær Sound Quality solution during the development of specific electroacoustic components enables useful sound quality parameters such as loudness, sharpness, fluctuation strength, roughness and related parameters to be determined.

The main features of the sound quality software allow recording, editing and replay of sounds using binaural techniques. It also supports Subjective Listening Tests or jury testing such as Semantic Differential and Paired Comparison. The actual way in which the tests are set up and presented to the person listening can be designed using the Sound Quality software.

Besides the subjective test, the Sound Quality software also supports a wide range of Objective measurements. Objective measurements using Zwicker Loudness analysis allows the calculation of metrics for both stationary and non-stationary sounds revealing:

Total Loudness vs. Time
Specific Loudness
Instantaneous Loudness vs. Time
Statistical Instantaneous Loudness
Sharpness vs. Time
Specific Roughness
Specific Fluctuation Strength

Fig. 10
Recording with
PULSE

9
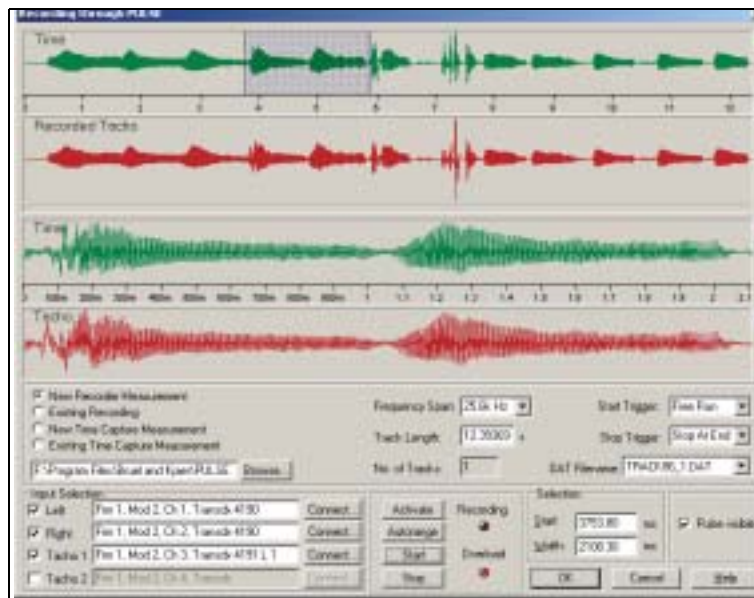
The Sound Quality Software available for PULSE are:

PULSE Sound Quality Software Type 7698
BZ 5265 Zwicker Loudness Option for Type 7698
BZ 5301 Psychoacoustic Test Bench Option for Type 7698

For more information on PULSE Sound Quality software and hardware please refer to the Product Data for PULSE Sound Quality Software (BP 1589).

Handset Testing of GSM and UMTS Mobile Phones

The table below shows which test cases from the three GSM testing standards – GSM 03.50 EN 300 903, GSM 11.10 3GPP TS 51.010, and 3GPP TS 26.132 – are supported by Type 6712. The numbers stated in the table refer to the sections in the relevant standard. N/A means that, although the test case is not applicable for the specific standard, it is still supported in the software.

Test Case Title	GSM 03.50 EN 300 903	GSM 11.10 3GPP TS 51.010	3GPP TS 26.132
Sending Response	3.8.1.1	30.1	7.4.1
SLR	3.1.1	30.2	7.2.2.1
Sending Distortion	3.9.1	30.7.1	7.8.1
Sending Gain Variation of Input	3.9.1	N/A	N/A
Discrimination on Out-of-band Signals	3.11.1.1	30.9.1	N/A
Sending Noise	3.6.1	30.10.1	7.3.1
Receiving Response	3.8.1.2	30.3	7.4.2
RLR	3.1.1	30.4	7.2.2.2
Receiving Distortion	3.9.2	30.7.2	7.8.2
Receiving Gain Variation of Input	3.9.2	N/A	N/A
Spurious Out-of-band Signals	3.11.2.1	30.9.2	N/A
Receiving Noise	3.6.2	30.10.2	7.3.2
Talker Sidetone (STMR)	3.10.1	30.5.1	7.5.1
Sidetone Distortion	3.10.2	30.8	N/A
Listener Sidetone (LSTR)	3.10.1	30.5.2	N/A
Ambient Noise Rejection SFDelSm	3.14	30.11	7.9
Acoustic Echo Loss	3.4.3.2	30.6.1	7.7.3
Stability Loss	3.2	30.6.2	7.6

For specific information on software licenses and hardware configurations please see the ordering information.

Handset Testing of Dual Mode AMPS and CDMA Mobile Phones

The table below shows which test cases from the TIA and CTIA test plan that are supported by Type 6712. The numbers stated in the table refer to the sections in the relevant standard. N/A means that, although the test case is not applicable for the specific standard, it is still supported in the software.

Test Case Title	AMPS mode	CDMA mode
Sending Response	P.3.3.1.2.5	P.3.3.2.2.2
SLR/TOLR	P.3.3.1.2.6	P.3.3.2.2.3
Sending Distortion	N/A	N/A
Sending Gain Variation of Input	N/A	N/A
Discrimination on Out-of-band Signals	N/A	N/A
Sending Noise	N/A	N/A
Receiving Response	P.2.2.2.6	P.2.2.4.2
RLR/ROLR	P.2.2.2.7	P.2.2.4.3
Receiving Distortion	N/A	N/A
Receiving Gain Variation of Input	N/A	N/A
Spurious Out-of-band Signals	N/A	N/A
Receiving Noise	N/A	N/A
Talker Sidetone (STMR/SOLR)	N/A	N/A
Sidetone Distortion	N/A	N/A
Acoustic Echo Loss	P.3.5	P.3.5
Stability Loss	N/A	N/A
Loudness Contrast	P.3.3.3	P.3.3.3
Ear Protection (Acoustic Shock)	P.7.3	P.7.3
Ear Protection from Alerting Signal	P.?	P.?
Alerting Loudness	P. Alerting	P. Alerting

For specific information on software licenses and hardware configurations please see the ordering information.

Ordering Information

STANDARD SYSTEM CONFIGURATIONS USING TEST HEAD TYPE 4602 B
Type 6712 A – S01 System for Testing using Test Head

STANDARD SYSTEM CONFIGURATIONS USING HATS TYPE 4128
Type 6712 A – S02 System for Testing using HATS

STANDARD SYSTEM CONFIGURATIONS USING TEST RIG
Type 6712 A – S03 System for Testing using Test Rig

The following items are included in all standard system configurations:

Type 3560 C	Portable PULSE Acquisition Front-end
Type 2827 C	Power Supply
Type 7533	LAN interface Module
Type 3109	Generator, 4/2-ch. Input/Output Module
Type 7700 -N2	Noise & Vibration Analysis, 2-channel Licence
Type 7700 –MS1	Maintenance and Upgrade Agreement for Type 7700
Type 2716 C	Audio Amplifier
Type 4231	Sound Level Calibrator
UL 0208 – GB	Microsoft® Office
UL 0216 – GB	PC
UL 0217 – GB	Monitor
BZ 5137	Telephone Test Software
AO 0389	BNC-BNC cable 0.1 m

ITEMS INCLUDED IN THE STANDARD SYSTEM CONFIGURATION USING TEST HEAD:
Type 4602B, Type 4227

ITEMS INCLUDED IN THE STANDARD SYSTEM CONFIGURATION USING HATS:
Type 4182D, Type 4938–A–011

ITEMS INCLUDED IN THE STANDARD SYSTEM CONFIGURATION USING TEST RIG:
Accessories for Remote Control of Air Interface
Accessories for Stability, LSTR and ANR measurements

REQUIRED ACCESSORIES FOR STANDARD CONFIGURATION USING TEST HEAD
Selection of Type 1 Ear Simulator or Type 3.2 Ear Simulator is required for standard system configurations 6712 A – S01 and 6712 A – S03

Type 4185	Ear Simulator for Telephonometry
or	
Type 4195	Wideband Ear Simulator
Type 4191	½″ Free-field Microphone

OPTIONAL ACCESSORIES FOR STANDARD CONFIGURATIONS
Accessories for Remote Control of Air Interface

WQ 1270	IEEE 488 Interface Card – PCI-GPIB
AO 0265	IEEE 488 Cable (2m)
WL 1368	Antenna Cable-BNC to open-end
AO 0530	Air Interface Cable for R&S CMD-55 codec
WL 3162	Air Interface Cable for R&S CMU-200 codec
2 × AO 0087	Air Interface Cable for HP-8922 codec

The accessories for Remote Control of Air Interface are available for all standard system configurations. Please note that Type 6712 supports Remote Control of Air Interface HP-8922, CMD-55 and CMU-200

Accessories for DAI Measurements

Type 4607	Digital Audio Interface
AO 0512	Cable for Analogue IO on DAI
AO 0446	IEEE – 488 Cable (1m)
4 × JJ 0076	Connector BNC-BNC F-F

The accessories for DAI measurements are available for all standard system configurations

Accessories for Stability, LSTR and ANR Measurements

2 × Type 4227	Mouth Simulator
3 × AO 0447	2 × Banana to 2 × Banana (15 m)
Type 9640	Turntable System
AO 0446	IEEE – 488 Cable (1 m)
EA 8002	Test Rig for Stability, LSTR and ANR
2 × AO 0028	Microphone Extension Cable (10 m)
BZ 5137 – 029	Software for LSTR and ANR measurements

The accessories for Stability, LSTR and ANR measurements are available for standard system configuration: 6712 A – S01

Accessories for Alerting Module or Ringer Measurements

UA 0801	Lightweight Tripod
UA 1317	Microphone Preamplifier Holder

The accessories for Alerting Module or Ringer measurements are available for standard system configuration: 6712 A – S01

Optional licenses for standards that allow testing according to specific standards
BZ 5137 – 017 EN 300 903 (GSM 03.50) for GSM phones
BZ 5137 – 020 3GPP TS 26.132 for GSM and UMTS phones
BZ 5137 – 027 3GPP TS. 51.010 (GSM 11.10) for GSM phones
BZ 5137 – 025 CTIA test plan for dual mode AMPS/CDMA phones
BZ 5137 – 023 Hands-free based on ITU.T Rec. 340
BZ 5137 – 029 LSTR and ANR based on GSM and 3GPP specifications

Optional PULSE licenses that add analysis capability to PULSE
Type 7772 Steady State Response Analysis
Type 7701 Data Recorder
Type 7705 Time Capture
Type 7698 Sound Quality Software
BZ 5265 Zwicker Loudness option for Type 7698
BZ 5301 Psychoacoustic Test Bench option for Type 7698

Brüel & Kjær reserves the right to change specifications and accessories without notice

Brüel & Kjær