Technical Documentation

Telephone Test Head
Type 4602B
And Upgrade Kit UA 1403

Brüel & Kjær

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Type 4602 B
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Telephone Test Head Type 4602 B
User Manual

BE 1273 – 12

Contents

Chapter 1

Introduction

1.1 Introduction

Telephone Test Head Type 4602 (B) is a test jig which allows accurate positioning of telephone handsets, mobile telephones and cordless telephones relative to the Mouth Simulator and the Artificial Ear, enabling standardized measurements to be performed.

The lower main plate of the Test Head supports the Mouth Simulator Type 4227. This is accurately mounted on a suspended bushing to prevent transmission of vibrations from the Mouth Simulator to the handset and the Artificial Ear. Changing between the standardized speaking positions is simply a matter of selecting one of the associated and clearly marked mounting jigs.

The upper main plate holds the artificial ear assembly and the handset. The Artificial Ear is mounted in a spring-loaded mechanism which gives a well-defined force against the earcap, to prevent acoustical leakage. The force is indicated on a scale for easy adjustment.

1.1.1 Positioning Handsets

The handset is accurately held in position by a handset stop, two sets of adjustable rods and a holder arm. Alternatively, for QC (quality control) purposes a custom-built jig (see section 2.5) can be fitted to the upper main plate to hold the handset.

A coupler hole ring is positioned above the Artificial Ear assembly to define the ear reference plane. It has a scale for positioning the handset in the longitudinal direction with the adjustable handset stop. The centre of the handset earcap is easily established with the Handset Gauge. Two different coupler hole rings are provided to increase possibilities for optimum fitting of handsets. The coupler hole ring with the larger hole allows the artificial ear assembly to be moved further up to allow for handsets with a larger concavity.

1.1.2 Updated Test Head

Test Head Type 4602B provides more space and adjustment range than the previous Type 4602, to allow for the new generation of slim handsets as well as the thick mobile telephones fitted with high capacity battery packs.

The adjustable handset stop can be angled in different positions so that handsets with antennas in various positions can be mounted.

1.1.3 Alignment Rods and Gauge

For symmetrical handsets the adjustable self-centring alignment rods offer quick and accurate positioning in the latitudinal direction. A pair of handset alignment

rods with offset adjustment are provided with the test head to allow positioning of the increasing number of handsets with asymmetrically positioned transducers. A handset gauge for non-symmetrical handsets (Fig. 2.4) is also provided.

A rubber pad on the holder arm holds the handset and distributes the pressure. The holder arm can be rotated for easy access and has a calibrated scale for adjusting the force.

The solid base has vibration-damping rubber feet and a slot to arrange the cables and eliminate cable vibrations.

1.1.4 Updating Test Head Type 4602 to a Type 4602 B (Upgrade Kit UA 1403)

Previous Telephone Test Head Type 4602 can be updated to the functionality of the 4602B version to allow positioning of mobile handsets with antennas, by using Upgrade Kit UA 1403.

1.1.5 Ear Simulators Type 4195 and 4185

Wideband Ear Simulator for Telephonometry Type 4195 can be used for testing both high- and low-impedance telephone handsets. It provides a very realistic acoustic load to the telephone under test and therefore exposes the acoustical differences between telephone handsets as they appear in real use. This is accomplished by a built-in leakage which can be selected as high or low grade. The Wideband Ear Simulator conforms to ITU–T Rec. P.57, Type 3.2.

Ear Simulator for Telephonometry Type 4185 is an IEC 318 coupler for testing high impedance handsets under well defined sealed conditions. It fulfils ITU–T Rec. P.57 Type 1 and relevant IEEE and BS recommendations.

1.2 How to Use this Manual

This manual describes how to set up and how to use the Telephone Test Head with various ear simulators and telephone handsets. It also contains an appendix about updating an old Type 4227 Mouth Simulator for use with the Test Head, and for updating the previous Telephone Test Head Type 4602 to a Type 4602 B using Upgrade Kit UA 1403.

Chapter 2 describes how to assemble the Telephone Test Head with a Mouth Simulator and an Ear Simulator and how to fit a telephone handset.

Chapter 3 gives an example of a test set-up and shows typical measurements of Send, Receive and Sidetone responses.

Chapter 4 describes the major positioning standards in detail. It also includes an accurate vector description of the positions.

Chapter 5 provides an overview of literature references that may be useful.

Chapter 6 contains the specifications.

Chapter 7 is a glossary and a list of abbreviations that are commonly used in association with telecommunication measurements.

Chapter 8 is about service and repair.

Chapter 9 is an appendix that gives an overview of the accessories used with the Test Head and shows the positioning of the parts that constitute the Test Head. It also describes how to update an old Type 4227 Mouth Simulator for use with the Test Head, and how to update the previous Telephone Test Head Type 4602 to a Type 4602 B using Upgrade Kit UA 1403.

Chapter 2

Setting Up the Telephone Test Head

2.1 Assembling the Telephone Test Head

On delivery, the Telephone Test Head is not completely assembled. The two handset alignment rods, the positioning jig and mounting bushing for the Mouth Simulator and the coupler hole ring have not been fitted. Fitting these parts is described in the following.

Throughout Chapter 2 it will be useful to refer to Fig.9.4 in the Appendix to identify the various parts of the Test Head.

2.2 Fitting the Mouth Simulator

The Mouth Simulator Type 4227 is the sound source used with the Test Head for measurements on the microphones (transmitter capsules) of telephone handsets and Sidetone measurements. The Mouth Simulator is positioned on the lower main plate of the Test Head.

Different positioning jigs are used to obtain the standardized LRGP, REF, AEN and the HATS speaking positions. The jigs are clearly marked with the speaking positions, so they can be easily distinguished. The Mouth Simulator is mounted on one of the positioning jigs with a suspended bushing to prevent transmission of vibrations from the Mouth Simulator to the telephone handset and the Ear Simulator. If you change speaking positions frequently, you can avoid moving the bushing by obtaining the required number of bushings and leaving them on the relevant jigs.

To change between the speaking positions, fit the Mouth Simulator as follows:

1. Select the proper jig for the desired speaking position.

2. The bushing for the Mouth Simulator has two asymmetrically positioned locating pins underneath to ensure correct positioning on the jig. Fit the bushing on the side of the jig with the imprinted text, using the two M5 Allen screws.

3. The lower main plate has a recess and two locating pins for correct positioning of the jig. It is important that the jig is positioned with the imprinted text facing upwards. Fit the jig with the single M5 Allen screw which is positioned under the main plate.

4. Mount the Mouth Simulator on top of the bushing, and secure it with the finger screw (see Fig.9.4). A thinner pair of locating pins on top of the bushing ensure that the Mouth Simulator is correctly positioned.

When using the Mouth Simulator in the LRGP position, very little room is left for the electrical connection. For this particular use, a pair of short banana plugs is provided (JP 0189).

Note: The 4602 B Test Head holds the handset relative to the Mouth Simulator and the Ear Simulator in a position that corresponds to a person holding a handset against his right ear. Handsets that are asymmetrical around the longitudinal axis may give different measurement results depending on whether a left or right ear position is used.

2.2.1 Mouth Simulator Calibration

Before being used in measurements, the Mouth Simulator Type 4227 should be calibrated. An acoustical output calibration is used to establish the level of the electrical signal which must be applied to the mouth in order to produce the desired sound pressure at the mouth reference point (MRP) in the absence of any obstruction due to the handset under test. The MRP is defined as a point on the mouth simulator axis at a distance of 25 mm from the lip ring. Fig.2.1 shows the calibration arrangement recommended by the ITU–T (Rec. P 51).

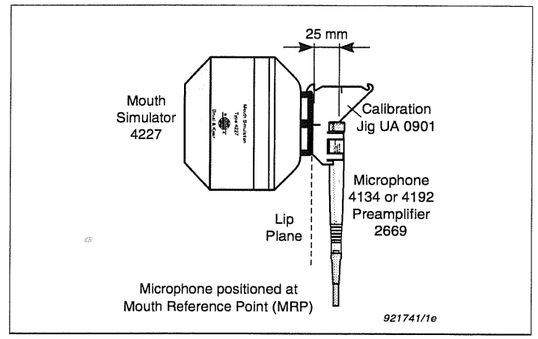


Fig.2.1 MRP according to ITU–T

The calibration is made with a $^1/_2$″ microphone and the calibration jig supplied with Type 4227. The procedure is described in the User Manual for Type 4227. Alternatively, for OREM A test procedures, a 1″ microphone and a SFERT baffle are used.

2.3 The Ear Simulator

For tests on the receiver of a telephone handset, the Test Head must be fitted with an Ear Simulator assembly. An Ear Simulator consists of a coupler combined with a microphone assembly. The different possibilities for Ear Simulator assemblies are illustrated in Fig.2.2 along with the SFERT baffle used to calibrate the Mouth Simulator for OREM A tests using a 1″ pressure Microphone Type 4144. The 1″ Microphone Type 4144 fits the NBS 9A coupler and the SFERT baffle.

The assembly and fitting of the Ear Simulator assemblies are described in the following sections.

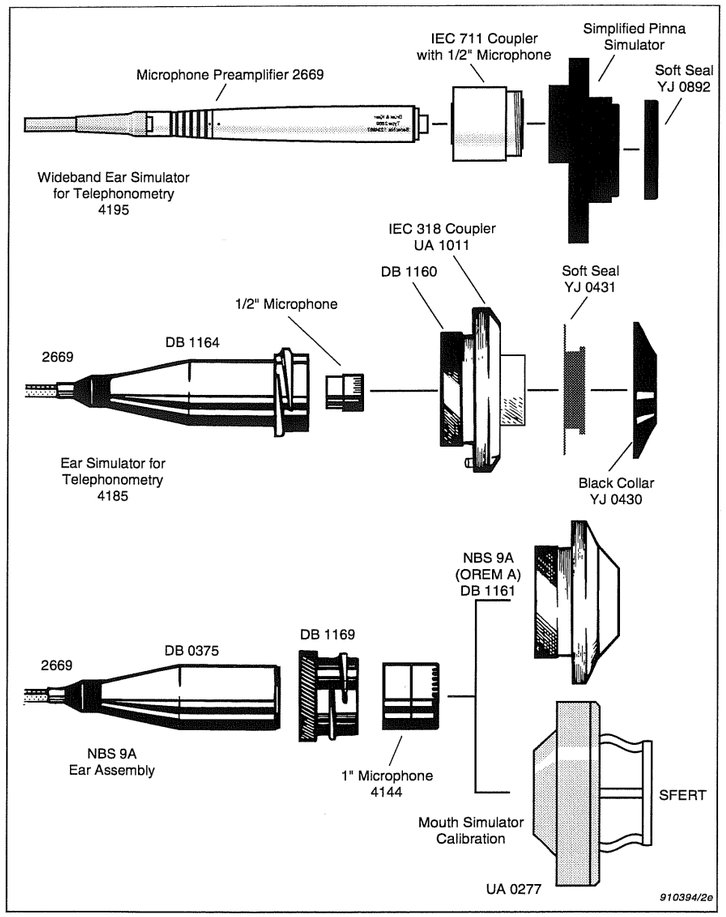


Fig.2.2 Parts for the assembly of Ear Simulators Types 4195, 4185 and the OREM A coupler

2.3.1 Calibration of Ear Simulators

Wideband Ear Simulator Type 4195 is calibrated using a Sound Level Calibrator Type 4231 and the supplied Adaptor DB 0894.

Before assembly of Ear Simulator Type 4185, the microphone to be used should be calibrated using a Sound Level Calibrator Type 4231. The procedure is described in the Type 4231 instruction manual. Pistonphone Type 4228 can also be used for calibrating Ear Simulator Type 4185 and the NBS 9A Ear Assembly.

2.3.2 Wideband Ear Simulator (ITU–T Type 3.2)

The Wideband Ear Simulator for Telephonometry Type 4195 conforms to ITU–T Rec. P.57, Type 3.2. It can be used for testing both high- and low-impedance telephone handsets. It provides a very realistic acoustic load to the telephone under test and therefore exposes the acoustical differences between telephone handsets as they appear in real use. This is accomplished by using the Simplified Pinna Simulator which adds a cavity to the IEC 711 Coupler, increasing the ear canal extension, and carefully controlling leakage. It is supplied with two different Simplified Pinna Simulators, so that you can select high or low grades of leakage. Assemble the ear simulator as follows (see Fig.2.2):

1. Attach the Soft Seal (YJ 0892) to the Simplified Pinna Simulator (high or low leak version).

2. Screw the IEC 711 Coupler into the Simplified Pinna Simulator.

3. Screw the ear assembly onto Preamplifier Type 2669

2.3.3 IEC 318 (ITU–T Type 1) Ear Assembly

Ear Simulator for Telephonometry Type 4185 is supplied with the Coupler UA 1011 and Adaptor DB 1160. These do not need to be separated for use with the Test Head. If the two parts are separate, they must be screwed together. Fit the microphone and preamplifier as follows (see Fig.2.2):

1. Insert Preamplifier Type 2669 into the Adaptor DB 1164 at the opposite end to the coarse thread.

2. Screw the $^1/_2$″ Microphone onto the preamplifier body so that the adaptor face is clamped between the microphone and the preamplifier.

3. Screw the complete assembly onto the IEC (UA 1011) coupler using the coarse thread in its adaptor.

Coupler UA 1011 consists of a metal body, a Soft Seal YJ 0431 and a Black Collar YJ 0430. The soft seal ensures a good seal even in the case of handsets which have an irregular shape or a textured surface.

Type 4185 is supplied with four soft seals and a built-in miniature sound source for performing a seal-check

2.3.4 NBS 9A Ear Assembly

Assemble the NBS 9A ear as follows (see Fig.2.2):

1. Insert Microphone Cartridge Type 4144 into the Adaptor DB 1169 at the end away from the knurled ring.

2. Insert the $^1/_2$″ to 1″ Adaptor DB 0375 into the knurled ring end and screw it onto the microphone.

3. Screw this assembly onto Preamplifier Type 2669.

4. Finally, screw the completed assembly into the NBS 9A (DB 1161) coupler or the SFERT baffle.

2.3.5 Fitting the Ear Simulator into the Test Head

The Ear Simulator assembly is mounted in the upper main plate (see Fig. 9.4). The ear assembly is mounted in a spring-loaded mechanism which gives a well-defined and adjustable force against the earcap. This design, together with the soft seal on Types 4195 and 4185 is optimized to prevent acoustical leakage between the earcap and the Ear Simulator. If an acoustical leakage is present it will affect the frequency response.

Fit the Ear Simulator assembly as follows:

1. Lift the handset stop by turning it and lift the handset alignment rods sufficiently to allow you to lift up the coupler hole ring. Remove the coupler hole ring from the upper main plate.

2. Pass the microphone cable through the holes in the upper and lower main plates.

3. If you want to use the built-in seal-check facility of Type 4185, the micro-dot cable must be fitted on the coupler and the cable passed through the holes along with the microphone cable.

4. Insert the complete Ear Simulator assembly into the spring-loaded mechanism. If Type 4185 is used, make sure that the micro-dot connector locates in the notch in the spring-loaded ring.

5. Re-insert the proper coupler hole ring (see section 2.4.1).

6. Pass the cables from the Ear Simulator, the seal-check facility (Type 4185) and the Mouth Simulator through the slot in the base to eliminate cable vibrations and make a neat installation. Make sure that the cables do not interfere with the function of the spring-loaded mechanism.

When the Test Head is not being used, the Ear Simulator should be protected against dust that could otherwise block the small holes in the coupler and the microphone and affect the performance. For this purpose you can use the handset gauge (for symmetrical handsets) by simply placing it on the coupler hole ring so it closes the opening.

2.4 Fitting a Handset in the Test Head

The handset under test is held with its earcap resting on one of the two coupler hole rings (reference planes), (see Fig. 9.4). The speaking positions for the handset are solely determined by the positioning jigs used with the Mouth Simulator. A summary of the requirements for the major handset measurement standards is given in Table 2.1.

Speaking Position	Ear Simulator	Mouth Simulator	Mouth Calibration	Standards and Recommendations
LRGP	IEC 318 (4185) ITU–T Type 1 ITU–T Type 3.2	4227	4134, 4192 in UA 0901 (perpendicular mounting)	ITU–T Rec. P.57, P.76 B.S. 6317 IEEE 269, 661 EIA - RS 470
AEN	IEC 318 (4185) ITU–T Type 1	4227	4134, 4192 in UA 0901 (coaxial mounting)	ITU–T Rec. P.76
REF	NBS 9A	4227 with Mouthpiece UA 0899 (4219 equivalent)	4144 in SFERT baffle (UA 0277)	OREM A
HATS	IEC 711 ITU–T Type 3.2	4227	4134, 4192 in UA 0901 (perpendicular mounting)	ITU–T Rec. P.57, P.58

Table 2.1 Combinations of handset positions and ear assemblies required for the major telephone handset measurement standards

The origin for all positioning is the ear reference point (ERP), which is located in the plane of the earcap. Fig. 4.3 (section 4.1) indicates the position of the ERP. The ERP is normally fairly easy to establish, e.g., as the centre hole in the earcap. However, if the openings to the receiver capsule are oblong or are positioned asymmetrically, it is not always obvious where the ERP is. In certain cases it may be necessary to obtain exact information from the manufacturer.

2.4.1 Positioning Symmetrical Handsets

The handset gauge for symmetrical handsets is used to establish the centre of the handset earcap, i.e. the position of the centre opening, in the longitudinal direction. Place the gauge over the earcap so that the upper end of the handset rests against the stop, see Fig. 2.3. Read the distance to the centre of the earcap and adjust the handset stop on the Test Head accordingly, using the built-in scale or the engraved scale on the coupler hole ring (see Fig. 9.4).

The handset is automatically centred sideways when using the self-centring handset alignment rods and is held in position by the holder arm, as described below.

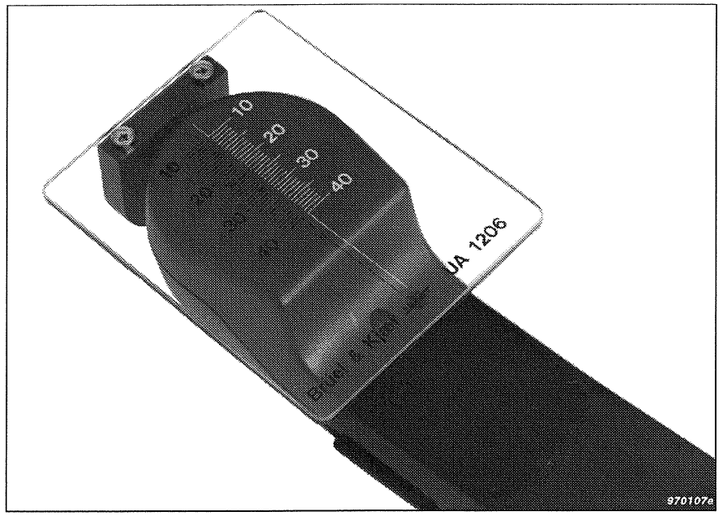


Fig. 2.3 Using the handset gauge for symmetrical handsets to find the centre of the handset earcap

2.4.2 Positioning Non-symmetrical Handsets

A special gauge and alignment rods are provided for accurate positioning of non-symmetrical handsets. Refer to section 2.4.6 for information about fitting the special handset alignment rods with offset adjustment.

Since the non-symmetrical handset gauge is used for finding the correct position in both the longitudinal and lateral directions, the procedure is slightly more involved than for symmetrical handsets:

1. Start by loosening all the positioning pins on the gauge.

2. Position the centre cross on the gauge over the acoustical centre of the handset (ERP).

3. While keeping the handset in position, adjust and tighten the two centre positioning pins so that they secure the handset in the lateral direction.

4. Adjust and tighten the top positioning pin to establish the longitudinal position of the handset. The gauge has three different slots for the top pin, this may be useful for various handset shapes.

5. Finally adjust and tighten the remaining two lower positioning pins so that the handset is flush with the gauge. Some fine adjustment of the other positioning pins may be required.

6. Read off the values from the scales for each of the positioning pins, and adjust the alignment rods and the handset stop to the same values for each of the respective positions.

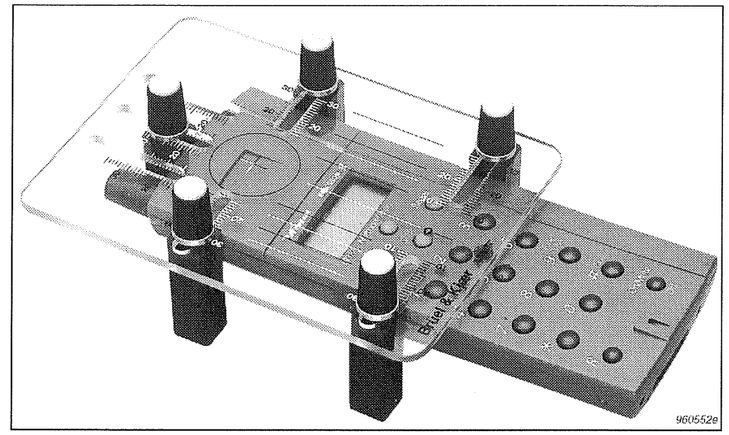


Fig. 2.4 Handset gauge for accurate positioning of non-symmetrical handsets

Notice: The performance of certain handsets may be affected by gravitation, making them sensitive to the angular position when in use. An obvious example is a handset with a mercury contact that disconnects the transmitter capsule when the handset is held horizontally as is the case when using the Test Head. The position of the diaphragm in the receiver capsule may also be slightly changed when using the handset in a horizontal position which can cause small differences in the measured response. In these special cases it may be necessary to tilt the complete Test Head until a satisfactory position is found. If it is found that the responses vary with orientation, preference should be given to the positions described in Chapter 4 for a horizontal mouth axis. However, when tilting the Test Head (see section 2.5) it may be necessary to increase the ear force to avoid leakage (see section 2.4.7) and compensate for the unequal load of the spring-loaded mechanism that holds the Ear Simulator.

2.4.3 Selection of Coupler Hole Ring

The coupler hole ring forms the reference plane for the earcap. Two coupler hole rings with different sized holes are provided to increase possibilities for optimum fitting of handsets. The coupler hole ring with the larger hole ring allows the Ear Simulator assembly to be moved further up to allow for handsets with a larger concavity. The 40 mm coupler hole ring can be used with earcaps with concavity from 0 to 3.9 mm (measured at the edge of the ITU–T Type 1 (IEC 318) ear) and the 50 mm coupler hole ring from 0 to 7.0 mm. Small earcaps may not be supported

by the larger coupler hole ring. Fig.2.5 illustrates when the small or the large coupler hole ring should be used.

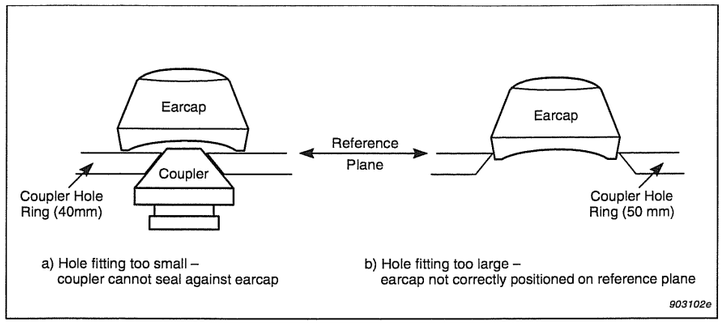


Fig.2.5 The 40 mm coupler hole ring will support most handsets. However, the 50 mm coupler hole ring allows the Ear Simulator assembly to be moved further up to allow for handsets with a larger concavity

2.4.4 Adjusting the Holder Arm Pressure

The holder arm (see Fig.9.4) pushes on the back of the receiver earcap and keeps the handset firmly in position against the ear reference plane.

The holder arm can be rotated for easy access. A click-stop indicates when the arm is accurately centred over the handset. The smaller knob (release knob) lowers the retaining pad when rotated clockwise and raises it when rotated counter-clockwise.

The handset retaining force can be adjusted with the larger knob. The holder arm has a calibrated scale (10 to 28 N) to indicate the actual retaining force. A high handset retaining force ensures that the handset rests firmly on the reference plane, however, too high a retaining force may deform the handset. A rubber pad is used to hold the handset, distributing the pressure and giving a firm grip. The rubber pad can be replaced by an alternative holder pad, for example for quality control purposes. The rubber pad can be lifted off by using your fingers. Underneath it an M5 thread is provided for an alternative holder pad. The retaining force can be adjusted to a higher force than indicated on the scale, but doing so temporarily disables the lifting mechanism.

Note: When you place the handset in the Test Head, it is important that you place it so that the upper end of the handset (the edge farthest away from the transmitter capsule) touches the reference plane, see Fig.2.6. When engaging the holder arm the friction of the rubber pad then tends to pull the handset towards the handset stop. If there is a gap between the earcap and the reference plane at the opposite edge of the earcap, see Fig.2.6, engaging the holder arm tends to move the handset away from the handset stop.

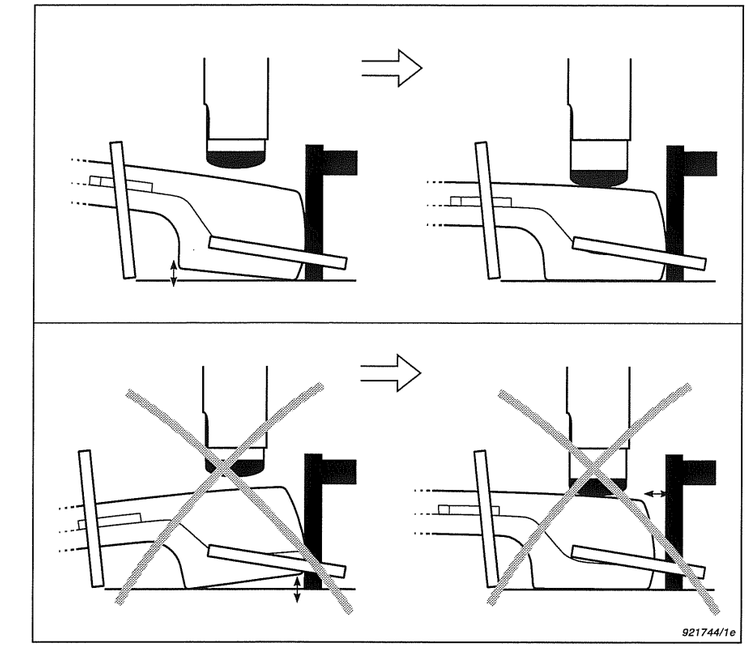


Fig.2.6 Correct positioning of a handset. Observe that the handset is not pushed away from the handset stop

2.4.5 Fitting and Adjusting the Self-centring Handset Alignment Rods

Symmetrical handsets should be positioned by using the self-centring handset alignment rods. They ensure that the lateral plane of symmetry is aligned correctly in relation to the Mouth Simulator.

Each pair of alignment rods is held by a clamp with a finger screw (see Fig.9.4). Fit the self-centring alignment rods as follows:

1. Lift the handset stop by turning it.

2. Position the alignment rods in the notches at the front end of the main plate and at the top of the main plate, respectively. The alignment rods can be mounted in two different ways, giving different adjustment directions, i.e., when adjusting the distance between the rods. We recommend that they are both mounted so that turning the adjustment screws clockwise (the ones on the side of the Test Head with imprinted text) makes the rods move together.

3. Fit the clamps and tighten the finger screws. The rods can be tilted without loosening the clamps.

The self-centring handset alignment rods are factory adjusted. However, the symmetry of the alignment rods can be easily checked by using the edges of the hole in the coupler hole ring as a gauge. Mount the pair of alignment rods to be checked in the position closest to the column. Tilt the rods so that they touch the coupler hole ring. Adjust the rods with the finger screw so that they are aligned with the edge of the hole. If they are correctly aligned, they should both line up with the edge. If they are not aligned correctly, they can be adjusted as follows:

1. Remove the green plastic caps at the end of the adjustment screws.

2. Use a 6 mm socket wrench to loosen the two nuts holding the adjustment screws. Remove the adjustment screws.

3. The two rods can now be moved in parallel to either side. Using the edges of the hole in the coupler hole ring as a gauge, as described above, adjust the rods by tightening the metal shaft, using your fingers only. The rods should just touch the column without any play.

4. Fit the two adjustment screws. You should allow a very small gap between the adjustment screws and the body of the alignment rods, otherwise there will be too much friction when turning the adjustment screws. It is important to keep the gap to an absolute minimum, as it affects the precision of the alignment rods. Hold the adjustment screws steady while tightening the nuts, in order not to upset the position of the rods. Check that the rods are still correctly aligned, and that there is not too much play when using the adjustment screws.

5. Refit the green plastic caps. The cap has a slot which must be positioned correctly relative to the tab.

Position the handset with its earcap on the reference plane and engage the holder arm (or hold it down manually). Make sure that the earcap touches the handset stop, see Fig. 2.6, and tilt the alignment rods to support the handset at suitable positions. Adjust the rods by tightening the finger screws. The rods should only be tightened enough to position the handset correctly and you should be able to remove the handset easily.

Note that the orientation and distance of a handset mouthpiece from the Mouth Simulator is dependent only on the handset design and the standard speaking position chosen. The standards define the position of the mouth in relation to the ear reference point (and hence in relation to the earcap) but do not directly define the mouthpiece position. Thus different handset designs will lead to different mouthpiece-Mouth Simulator distances when the handsets are mounted in the Test Head (as is also the case in normal use). A description of positioning standards is given in Chapter 4.

The positioning arrangement of the Test Head works very well for testing and quality control of test samples or smaller production batches. However, if a large number of handsets of a given design is tested, it is recommended that the handset is positioned in the Test Head by making a custom-built jig for that particular

handset type (see section 2.5). The upper main plate has four M5 threads for holding a custom-built jig. If this solution is selected, the two pairs of alignment rods must normally be dismounted.

2.4.6 Fitting the Handset Alignment Rods with Offset Adjustment

Non-symmetrical handsets can be aligned using the handset alignment rods with offset adjustment.

Each of the four identical alignment rods have a scale for adjustment. They are held by the finger screw clamps (see Fig. 9.4), similar to the self-centring alignment rods:

1. Position the alignment rods in the notches at the front end of the main plate and at the top of the main plate, respectively, by inserting them from the outside, until they are stopped by the recess.

2. Fit the clamps in the proper position and tighten the finger screws. The rods can be tilted without loosening the clamps.

2.4.7 Adjusting the Ear Simulator Force

The spring-loaded mechanism that holds the Ear Simulator can be raised or lowered with a large adjustment screw (ear force adjustment screw), to increase or decrease the force that the ear exerts against the earcap. The force (0 to 10 N) is indicated on a small scale under the spring-loaded mechanism (see Fig. 9.4). The lower graduation equals 0 N the middle one 5 N and the upper one 10 N.

It is important that the earcap rests firmly on the coupler hole ring which forms the reference plane. The force from the Ear Simulator assembly must be adjusted according to the force from the holder arm. Obviously the force should not exceed the handset retaining force, and if the ear force is too high the handset may be lifted from the reference plane. Lower the Ear Simulator assembly before the handset is mounted and adjust the ear force after the holder arm has been engaged. For repeated measurements on the same handset design the above procedure need not be repeated.

Type 4185:

When using Ear Simulator Type 4185 that requires sealed conditions, it is essential for the measured response that there is no leakage between the handset earcap and the ear coupler. This can be checked in four ways:

- With the receiver energized (low frequency), adjust the Ear Simulator force until audible sound is at a minimum.
- With the measurement equipment set up, and using a low test frequency (for example 200 Hz), adjust the Ear Simulator force until maximum output from the microphone in the Ear Simulator is detected.

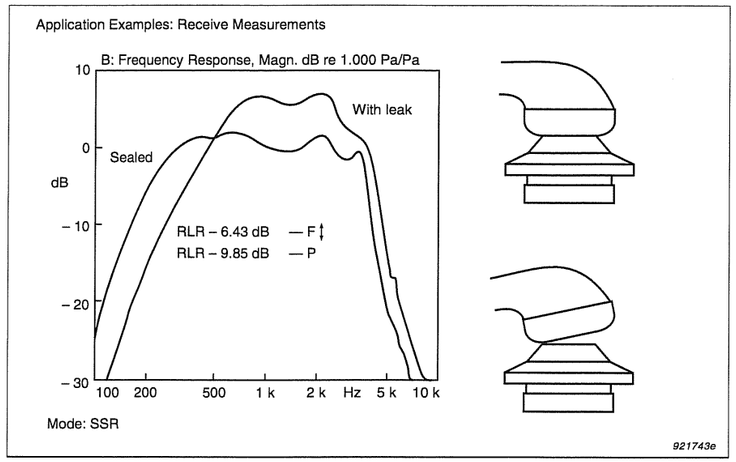


Fig.2.7 Use of the frequency response curve to assist in obtaining a good acoustic seal between the handset earcap and the coupler

- With the measurement equipment set up, measure the frequency response repeatedly and adjust the Ear Simulator force for maximum low frequency response (see Fig.2.5).
- With the built-in seal-check facility of Type 4185. This procedure is very similar to using a low test frequency as explained above, but the built-in sound source of Type 4185 has the advantage of delivering a constant volume velocity, so that the resulting SPL in the Ear Simulator is independent of the receiver sensitivity.

For Ear Simulator for Telephonometry Type 4185 (ITU–T Type 1 (IEC 318), the ITU–T Recommendation P.57 section 4.1 recommends an application force between 8 N and 10 N for placing earcaps against the Ear Simulator. An application force higher than 10 N will affect the performance of the IEC 318 coupler.

Type 4195:

Although it is important to obtain correct sealing between the handset earcap and the coupler, Wideband Ear Simulator for Telephonometry Type 4195 (ITU–T Type 3.2) has a built-in leakage, and the frequency response will therefore not be affected as noticeable as for Type 4185, if a small leakage occurs. The ITU–T Recommendation P.57, Type 3.2, recommends to use an application force between 5 N and 10 N for placing hard earcaps against the Type 3.2 Artificial Ear.

If a leak is detected and increasing the ear force does not remedy the fault, you should check the following items:

- That the correct coupler hole ring has been selected (see section 2.4.3).

- That the coupler and microphone assembly are screwed properly together (see sections 2.3.2, 2.3.3 and 2.3.4).
- That the cables do not interfere with the spring-loaded mechanism.
- That the Test Head is in a horizontal position.

2.4.8 Checking the Standardized Positions with the Test Templates

The Test Head Type 4602 B is very stable, and has long-lasting mechanical parts. This means that the tolerances of the Test Head are normally within the specified limits. However, if you want to check the standardized positions for very critical use, Brüel & Kjær can supply a set of templates (WA 0614) for checking the AEN and LRGP speaking positions. WA 0614 consists of two templates to simulate the mouth and the handset respectively. Fig.2.8 shows the templates and how they are assembled. To check the standardized positions, proceed as follows:

1. Assemble the templates as shown in Fig.2.8. Notice that the stepped disk that simulates the earcap on the handset template, can be turned upside down, so it can be used with both the 40 mm and the 50 mm coupler hole rings.

2. Fit the LRGP or AEN positioning jig.

3. Fit the mouth template in the positioning jig. The two locating pins ensure that the template is fitted in the correct position, as illustrated in Fig.2.9. Secure the template by tightening the finger screw.

4. Fit the handset template in the same way as described for fitting a handset. Make sure that the stepped disk is positioned correctly in the coupler hole ring. Only the outer set of alignment rods (self-centring rods) are needed to position the template (ensure that the alignment rods are correctly aligned, refer to 2.4.5). Secure the handset template with the holder arm.

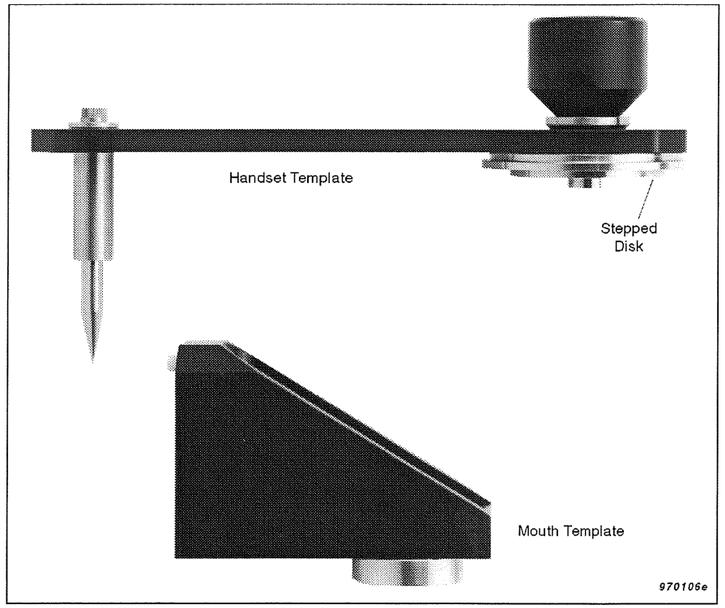


Fig. 2.8 Optional templates (WA 0614) for checking the speaking positions

The nominal test position for the needle point on the handset template is the MRP (mouth reference point). The MRP is 1 mm in front of the centre of the white plastic cylinder on the mouth template (see Fig. 2.9). Check that the distance between the needle point on the handset template and the white plastic cylinder is within 1 mm ±1 mm in the mouth axis direction. In the direction perpendicular to this (i.e. radially with respect to the mouth) the needle point must be within the area of the white plastic cylinder, i.e. within 2 mm of the nominal position.

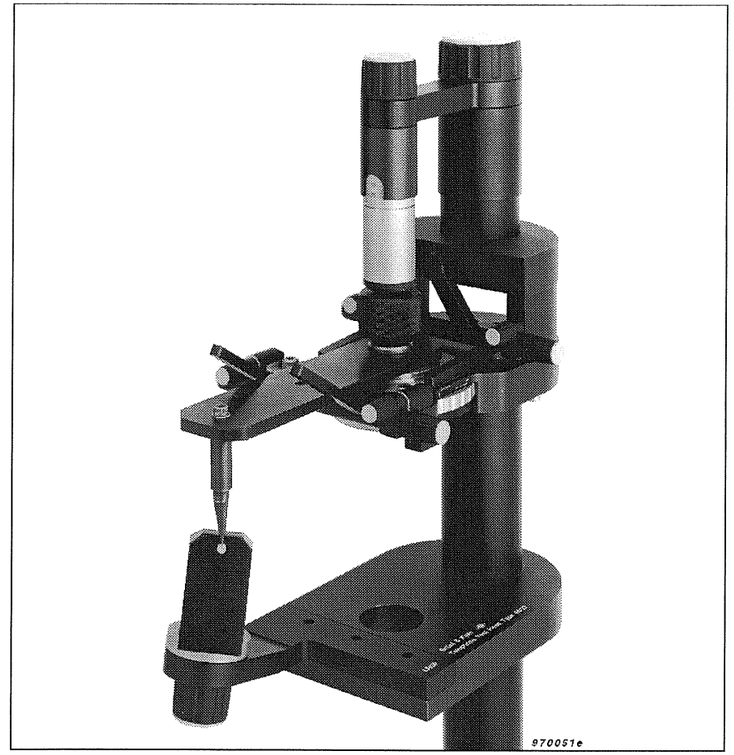


Fig. 2.9 Telephone Test Head fitted with test templates for checking the LRGP and AEN speaking positions

2.5 Setting Up the Test Head for Quality Control Purposes

The Test Head can be adapted for quality control use. The central part of the Test Head can be disengaged from the main column and base and can be mounted in a test set-up on a production line. The upper main plate has provision for fitting a custom-built jig to hold the handset.

To Dismantle the Test Head

Unscrew the M 12 Allen screw underneath the base (see Fig. 9.4). This screw holds together the base, the lower part of the vertical column, the lower main plate and the upper part of the Test Head. Fit the lower main plate to the upper part of the test head in its original position with the two location pins. Use the short M 12 Allen screw provided (YQ 0538) to assemble these parts. The M 12 thread can also be used for mounting the Test Head in a tripod or a custom-built base that allows the Test Head to be tilted.

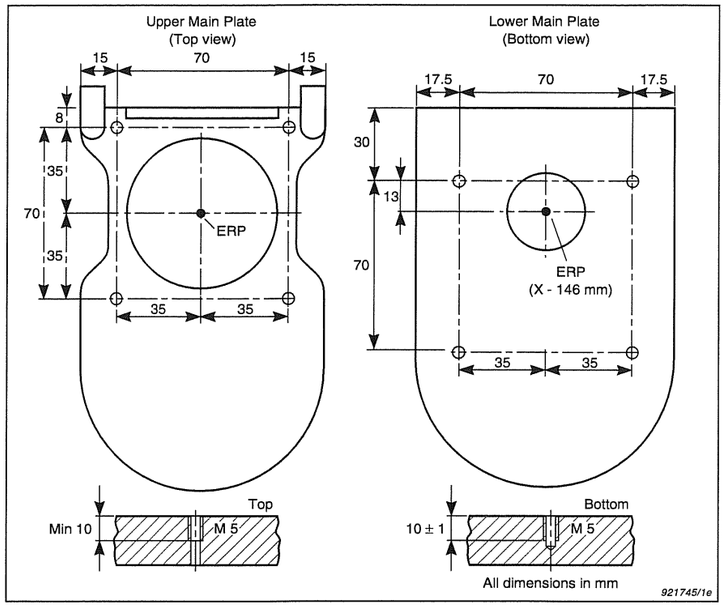


Fig. 2.10 Position of M5 threads for mounting a custom-built jig (upper main plate) and for mounting the Test Head in a QC set-up (lower main plate)

The lower main plate has four M 5 threads for mounting the Test Head in a QC (quality control) set-up. The position of the threads is shown in Fig. 2.10.

Using a Custom-built Handset Jig

The upper main plate has four M 5 threads for mounting a custom-built handset jig. The position of the threads and the ERP are shown in Fig. 2.10. The jig can be milled from a piece of aluminium, plastic or another appropriate material, or can be moulded. Fig. 2.11 indicates the position and shape of such a jig. If a handset jig is used, the alignment rods must be removed.

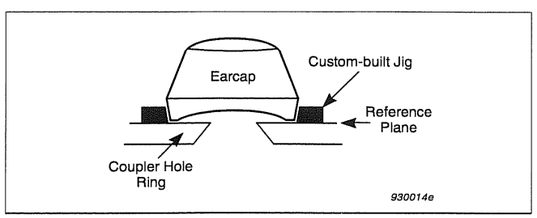


Fig. 2.11Position of a custom- built jig

The holder arm has an M 5 thread for mounting an alternative holder pad or extension piece. The thread is normally used for holding the extension piece (DB 3565). The rubber pad can be lifted off by using your fingers. Alternatively, the holder arm can be replaced by, for example, an external pneumatic device.

2.6 Acoustical Reflections in the Region of the Mouth Simulator

The acoustical design of the Test Head minimizes diffraction and reflections. This has been achieved by reducing the number of surfaces and edges, and by rounding the critical edges. Also, the orifice of the Mouth Simulator extends beyond the test head framework, and points away from the largest possible reflecting surfaces, i.e. the lower and upper main plates. This construction reduces, but does not completely remove, reflections from the Test Head. Cables from the Mouth Simulator and Ear Simulator can be passed through the lower main plate and the base to prevent them from interfering with the sound field.

Improvements can also be obtained by standing the Test Head on sound-absorbing material and using similar material to shield any nearby objects. To be effective, a porous absorbing material should have a thickness of $^1/_4$ wavelength or more at the lowest test frequency to be used.

When judging the likelihood of reflective objects affecting results, it should be remembered that rods, wires and the like are acoustically "transparent", while plane surfaces and sharp edges are more obtrusive. The size of objects should be judged in relation to the wavelength at the actual test frequency.

Measurements on telephone transmitters can be seriously affected by acoustical reflections from objects around the handset and Mouth Simulator. If the bench top is large enough to allow dispersal of peripheral equipment away from the region of the Test Head, then the main reflecting surfaces are the bench top and the Test Head itself. If a large surface is suspected of causing disturbing reflections, it may be possible to reorientate it so that the sound is not reflected back to the mouthpiece.

Notice:

- Send and Sidetone measurements are near-field measurements, where these effects can only occur if an obvious mistake has been made, i.e., an object, surface or person is in the near proximity of the Mouth Simulator during the measurement.

2.7 Recommendations for Handset Designers

In order to enable easy sample testing, production control testing or type approval of handset telephones, it is worth remembering the following points:

- Ideally the surface of the earcap should constitute part of a sphere or at least be rotationally symmetric, and the earcap holes should be positioned such that they can be enclosed by the sealing edges of the couplers.
- The handset should be basically symmetrical (i.e. it should be possible to define a plane of symmetry of the handset).
- All four standardized test positions may be used, so it should be ensured that the handset can be mounted in the relevant positions.
- Telephones without the above characteristics are not necessarily of inferior electro acoustical performance when used under real conditions, but the measurements required to comply with various national standards may be more difficult to perform.

Chapter 3

Examples of Using the Telephone Test Head

3.1 Test Set-up

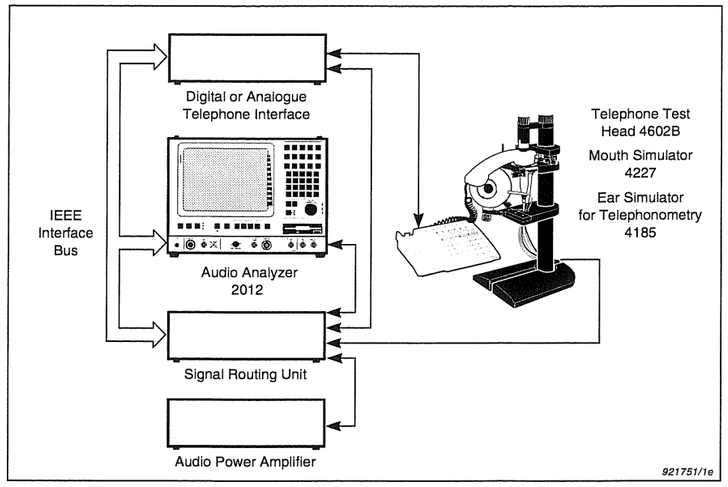


Fig. 3.1 The measurement set-up used for making the Send, Receive and Sidetone measurements described in this Chapter

The basic elements of a measurement set-up for measuring Send, Receive and Sidetone measurements is illustrated in Fig. 3.1. Fig. 3.2 shows a practical implementation of the above, based on the Audio Analyzer Type 2012 and the Telephone Interface Type 4604. The Telephone Interface contains all the necessary switching arrangements, feeding bridge/power supply and artificial lines for the telephone under test. It also contains a power amplifier for driving the Mouth Simulator. The following measurements were made with this set-up.

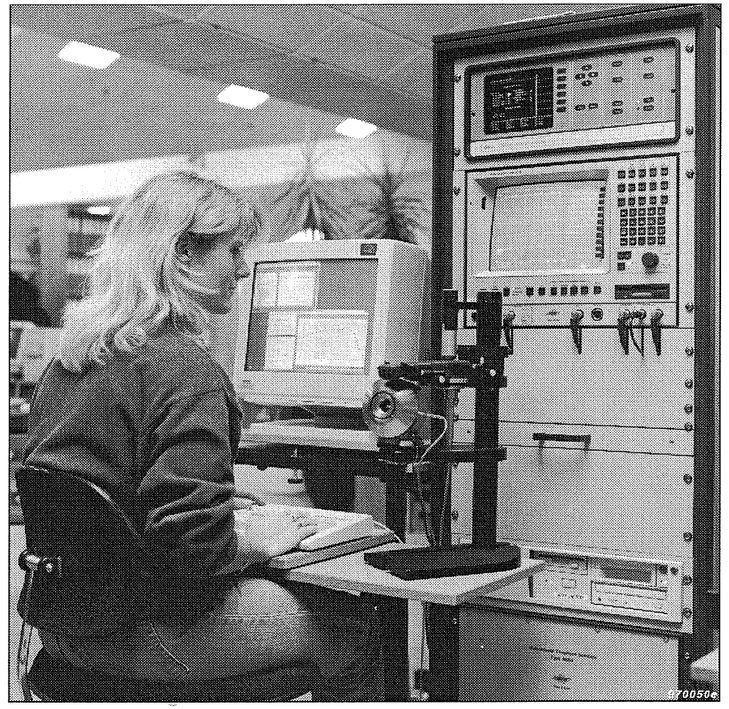


Fig. 3.2 Complete test set-up with Test Head Type 4602 B, Mouth Simulator Type 4227, Ear Simulator Type 4185 and handset mounted in the LRGP position

3.1 Measuring, Send, Receive and Sidetone Response

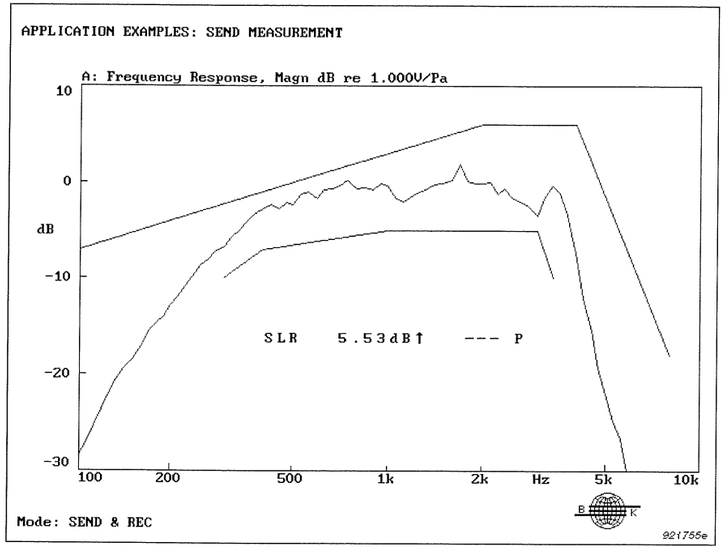


Fig.3.3 Typical Send response

The Send response illustrated in Fig.3.3 has a fairly smooth appearance due to the acoustical design of the Test Head which minimizes diffraction and reflection.

The Sidetone response in Fig.3.5 illustrates the low mechanical interference from the Mouth Simulator, due to the high damping of the Test Head.

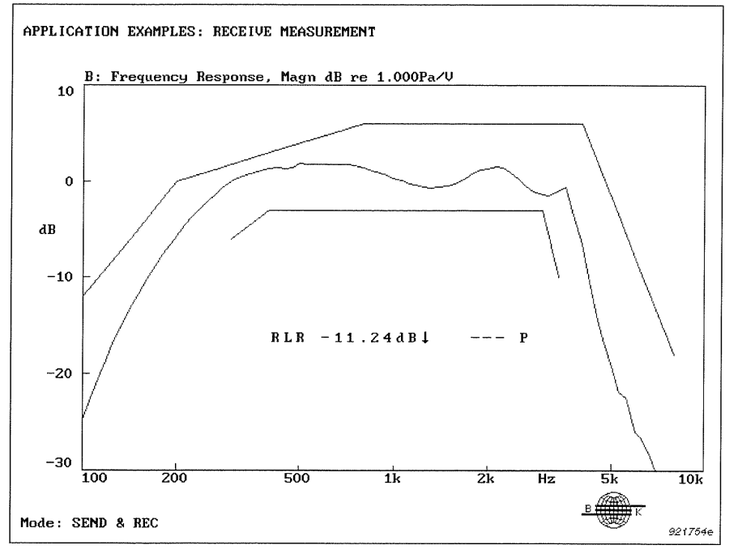


Fig.3.4 Typical Receive response

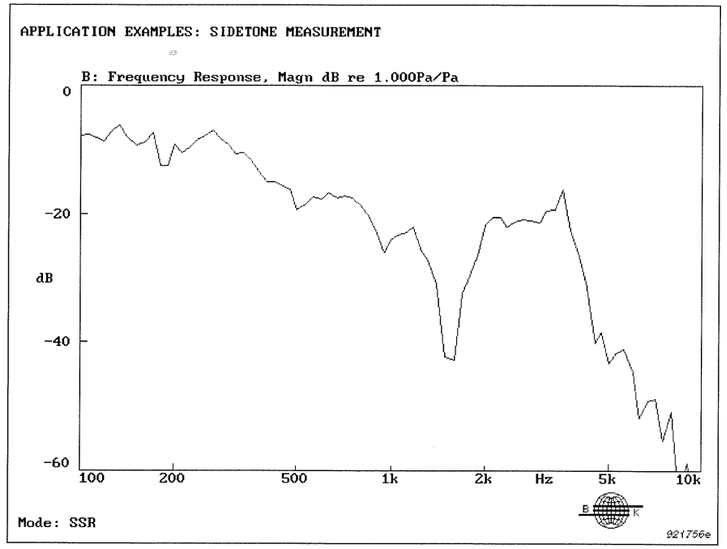


Fig.3.5 Typical Sidetone response

Chapter 4

Description of Positioning Standards

4.1 Description of Positioning Standards

There are currently three major standards governing the position in which a handset should be held for tests, all of which begin from the same reference point. By international agreement the ear reference plane is that which lies across the top surface of the telephone earcap, with the handset orientated as shown in Fig.4.3. The ear reference point (ERP) is the intersection of this plane with a line perpendicular to it and passing through the centre of the earcap. The reference plane in Test Head Type 4602B is the machined surface (with the engraved scale) of the coupler hole ring. The three standards govern the distances and angles between the ear reference plane, the ear reference point, and the lip ring of the Mouth Simulator. They are derived from many measurements of human heads and attempt to reproduce the relationship between the human ear and a plane which just brushes the lips (the lip plane).

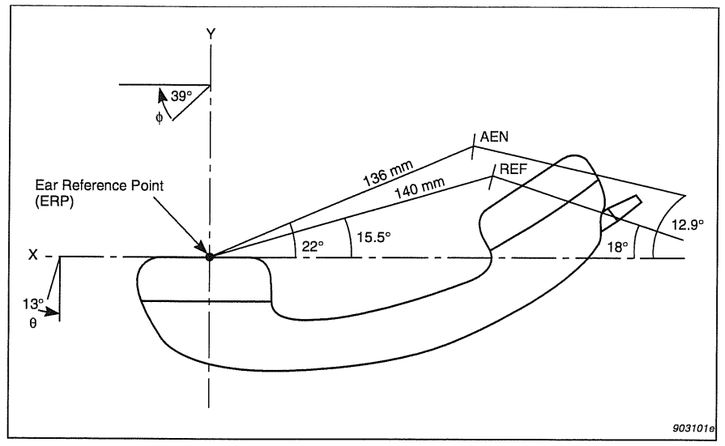


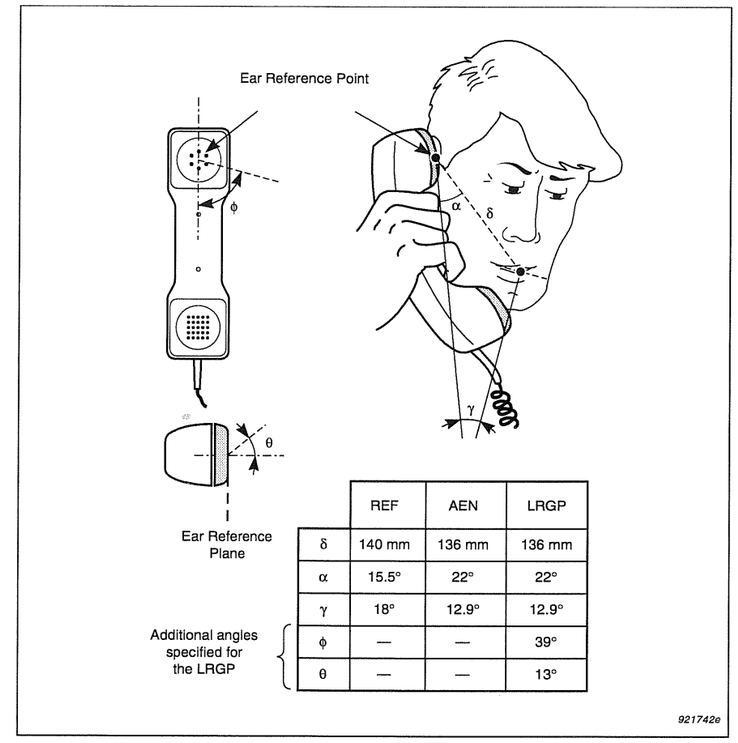
Fig.4.1 The AEN and REF lip ring positions for a typical handset, and the angles of rotation required to go from the AEN position to the LRGP position

The REF speaking position places the lip plane further from the ear (and therefore closer to the telephone transmitter) as well as unrealistically defining the ear and mouth to lie in the same horizontal plane, than the more modern AEN and LRGP speaking positions. For some modern handsets the REF lip plane actually passes through the transmitter cap making it impossible for these telephones to be measured using the REF standard. If this difficulty is met when using Test Head Type 4602B, it may be necessary to remove the lip ring. Alternatively the extra lip ring supplied with the Mouth Simulator can be adapted by trimming off the part which runs against the handset.

A less satisfactory solution is to shift the Mouth Simulator to the AEN position, this fact being stated clearly when reporting results. A specific correction factor for

changes between REF, AEN and LRGP measuring positions cannot be given since this will depend largely on the characteristics of the particular telephone handset and transmitter. In general, however, measurements in the AEN and LRGP positions will result in a lower measured sensitivity, as the mouthpiece is placed further away from the Mouth Simulator compared to the REF position.

The reference positions are shown in Fig.4.3 and Fig.4.2. These are self-explanatory as far as the REF and AEN positions are concerned, but the LRGP requires further explanation due to the two extra angles involved.



	REF	AEN	LRGP
δ	140 mm	136 mm	136 mm
α	15.5°	22°	22°
γ	18°	12.9°	12.9°
ϕ	—	—	39°
θ	—	—	13°

Additional angles specified for the LRGP

Fig.4.2 The relation between a telephone handset and the standard human head

The LRGP is obtained by first putting the handset in the AEN position with the handset symmetry plane horizontal (see Fig.4.3). Then it should be rotated downwards by 39° about an axis through the centre of the earcap (Y in the figure), and finally rotated through 13° about the longitudinal axis of the handset (X in the figure) so that the transmitter faces slightly upwards. It is essential that the movements are done in this order. During these rotations the Mouth Simulator is also rotated. However the mouth axis should eventually be rotated back to horizontal

about an axis lying in the symmetry plane of the handset and passing through the centre of the lip ring. When using the Test Head, all relative positioning is automatically set up by the geometry of the test head. Note that absolute LRGP, as specified in ITU-T Rec. P.64 (COM XII-R 28-E, March 1992) also requires that "the mouth should be horizontal". If necessary, this can easily be obtained by simply tilting the Test Head.

In addition to the three standards described above, Test Head Type 4602 B allows handsets to be positioned in the HATS (Head And Torso Simulator) position (ITU-T Rec. P.58). This position is described in the following section.

4.2 Vector Description of Positioning Standards

The appearance of more representative and hence more complex speaking positions, has also meant that the description of them has become increasingly complex (e.g., LRGP and HATS). It is therefore advantageous to use a vector analysis method to describe the speaking positions.

The axes with the origin at the ERP (Ear Reference Point – 0,0,0) are defined as follows:

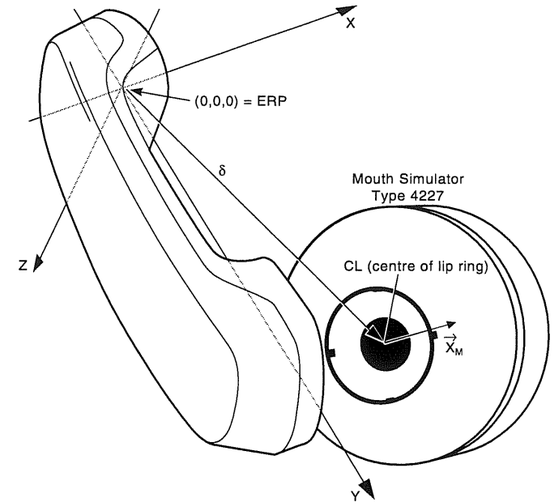
X-axis: This is the axis of the ear-cap with positive direction away from the transmitter capsule.

Y-axis: This is the line of intersection of the plane of symmetry of the handset with the earcap plane, with positive direction towards the microphone.

Z-axis: This is the normal to the plane of symmetry of the handset with positive direction obliquely downwards for a right ear (as used in Type 4602 B), and obliquely upwards for a left ear.

The Reference Axis is the line perpendicular to the lip plane containing the centre of the lip ring, with positive direction into the mouth.

The positions in Fig. 4.3 are valid for a right ear. The HATS position corresponds to the position of Head and Torso Simulator Type 4128 when using a ITU-T Type 3.3 Artificial Ear.



Speaking positions	$\vec{X}_M$ (Reference axis)	X_e, Y_e, Z_e (ERP → CL)	δ
AEN	$\begin{pmatrix} 0.2233 \\ -0.9748 \\ 0 \end{pmatrix}$	$\begin{pmatrix} 50.95 \\ 126.10 \\ 0 \end{pmatrix}$	136.0 mm
REF	$\begin{pmatrix} 0.3090 \\ -0.9511 \\ 0 \end{pmatrix}$	$\begin{pmatrix} 37.46 \\ 134.88 \\ 0 \end{pmatrix}$	140.0 mm
LRGP	$\begin{pmatrix} 0.1441 \\ -0.7444 \\ 0.6519^* \end{pmatrix}$	$\begin{pmatrix} 50.95 \\ 126.10 \\ 0 \end{pmatrix}$	136.0 mm
HATS	$\begin{pmatrix} 0.1934 \\ -0.9094 \\ 0.3683^* \end{pmatrix}$	$\begin{pmatrix} 50.03 \\ 131.64 \\ 0 \end{pmatrix}$	140.8 mm

*Multiply by –1 for left ear

921767e

Fig. 4.3 Vector description of the speaking positions used with the Telephone Test Head. The positions are valid for a right ear

Chapter 5

Literature References

Brüel & Kjær Instruction Manual for Pistonphone Type 4228 (BE 1094)

Brüel & Kjær Instruction Manual for Sound Level Calibrator Type 4231 (BB 0910)

ITU–T P.51: Artificial Voices, Artificial Mouths, Artificial Ears[1]

ITU–T P.75 and P.76[1]

ITU–T Rec. P.57: Artificial Ears[1]

ITU–T Rec. P.58: Head and Torso Simulator for Telephonometry[1]

IEEE 269: Method for Measuring Transmission Performance of Telephone Handsets[2]

IEEE 661: Standard Methods of Determining Objective Loudness Rating of Telephone Connections[2]

[1]Available from: Expèdition Publicitaire, Place des Nations, CH–1211 Genève 20 Suisse, Phone +4122730.52.43, Tèlèfax +4122740.10.13, Telex 421000 UIT CH

[2]Available from: The Institute of Electrical and Electronics Engineering, Inc 345 East 47th Street, New York, NY 10017

Chapter 6

Specifications

Specifications

SPEAKING POSITIONS:
LRGP position (ITU-T Rec. P.76)
HATS position (ITU-T P.58)
REF position (OREM A)
AEN position (ITU-T Rec. P.76)

PRECISION OF SPEAKING POSITIONS:
The position of the mouth reference point is within 1 mm of the nominal position in the mouth axis direction, and within 2 mm of the nominal position perpendicular to this (i.e., mouth radially)

HANDSET GAUGE FOR SYMMETRICAL HANDSETS:
Has a 10 to 40 mm scale with 1 mm graduations for reading the distance from the centre of the earcap to the top of the handset

HANDSET GAUGE FOR NON-SYMMETRICAL HANDSETS:
The maximum lateral offset adjustment range of the handset is ±18 mm with respect to the Ear Reference Point.
Note: The adjustment range is reduced as the handset approaches the maximum allowable handset width (65 mm).
In the longitudinal direction the adjustment range is 22 mm with respect to the Ear Reference Point

HANDSET STOP:
Can be adjusted from 13 to 38 mm relative to the centre of the coupler hole ring. Maximum length of handsets from the centre of the earcap to the top of the handset is 47 mm without the stop screw, and 59 mm without the rear alignment rods

MAXIMUM HANDSET THICKNESS
The Telephone Test Head allows positioning of handset with a maximum thickness of 55 mm (2.2″). The clearance under the "bridge" is 33 mm (1.3″)

HANDSET ALIGNMENT RODS:
Two adjustable self-centring rods for positioning handsets. Maximum allowable width of handsets is 65 mm

HANDSET ALIGNMENT RODS WITH OFFSET ADJUSTMENT:
Two sets of adjustable rods for positioning handsets. The rods are individually adjustable to accommodate asymmetrical handsets. Adjustment range from 10 to 33 mm

COUPLER HOLE RING (40mm hole):
For earcaps with concavity from 0 to 3.9 mm (measured at edge of IEC ear). Has a 0 to 20 mm scale (1 mm graduations) along the periphery, and a 20 to 36 mm scale under the stop screw

COUPLER HOLE RING (50mm hole):
For earcaps with concavity from 0 to 7.0 mm (measured at edge of IEC ear). Has a 0 to 25 mm scale (1 mm graduations) along the periphery, and a 25 to 36 mm scale under the stop screw

HOLDER ARM:
Has a calibrated scale for adjusting the force on the handset from 10 to 28 N (2 N graduations). Accommodates handsets up to 55 mm height

EAR FORCE:
The force that the Artificial Ear exerts against an earcap can be adjusted from 0 to 10 N

MOUNTING OF TEST HEAD FOR QUALITY CONTROL:
The upper main plate (for holding the handset) has four 5 mm threads for mounting a custom-built handset jig.

The lower main plate (for holding the Mouth Simulator) has four 5 mm threads for mounting the Test Head in a quality control setup.

The holder arm has a 5 mm thread for mounting an alternative holder pad

DIMENSIONS:
Height: 462 – 490 mm (18.2 – 19.3″)
Width: 170 mm (6.7″)
Depth: 260 mm (10.2″)
Weight: 5.4 kg (11.9 lb.)
Weight: 7.4 kg (16.3 lb.) with Mouth Simulator

Chapter 7

Glossary and Abbreviations

Artificial voice – A complex test signal used to simulate human speech having characteristics corresponding to the average human voice (see ITU-T Rec. P.50).

BSI – British Standards Institution.

Capsule – Term used to refer either to the transmitter microphone or earphone transducer when separated from a handset.

ITU-T – Abbreviation for *International Telecommunication Union – Telecommunication Standardization Sector*. A committee of the ITU that publishes recommendations regarding all aspects of telecommunication.

dB – Abbreviation for decibel, used to express a logarithmic power ratio between two quantities. X (in dB) = 10 $\log_{10}$ (P/P_0) where P_0 is the reference value.

DIN – Abbreviation for *Deutsches Institut für Normung*.

Ear simulator – A device consisting of a precision acoustic coupler and an integral calibrated microphone that accurately simulates the acoustic impedance of the average human ear, according to ITU-T Rec. P.57. A Type 1 ear is used for sealed earphone measurements on high impedance handsets. A Type 2 ear is required for measurements of headsets and insert-type earphones. A Type 3 ear is used for realistic measurements on both high and low impedance handsets.

ERP – Ear Reference Point. The point at the entrance of the listener's ear occupied by the centre of a telephone earcap. This point is used as the origin in handset positioning specifications.

Handset – A rigid assembly for holding both the microphone and earphone simultaneously to the mouth and ear, respectively.

HATS – Head And Torso Simulator. A measurement manikin including ear and mouth simulators that provides the correct representation of the acoustic effects around a human head and torso according to ITU-T Rec. P.58.

IEC – International Electrotechnical Commission.

IEEE – Institute of Electrical and Electronics Engineers.

LR – Loudness Rating. A single number, expressed in dB, determined either subjectively or objectively, representing the loss in a telephone system.

LRGP – Loudness Rating Guard-ring Position. The handset position for Loudness Rating measurements specified by most standards.

Mouth simulator – A device consisting of a loudspeaker mounted in an enclosure designed to have acoustic characteristics similar to the average human mouth, according to ITU-T Rec. P.51.

Chapter 7 — Glossary and Abbreviations

MRP – Mouth Reference Point. A point 25 mm in front of the lips of a talker or mouth simulator, as defined by the ITU-T.

OREM – Objective Reference Equivalent Measurement. The first system developed for objective measurement of telephone transmission performance. A single figure representing the loss is indicated on a special meter.

Receive – In a telephone system, the transmission path from the telephone line to the earphone.

REF – Reference position. The handset position used for OREM.

Send – In a telephone system, the transmission path from the transmitter microphone to the telephone line.

SFERT – Abbreviation for *le Système Fondamental Européen de Référence pour la Transmission téléphonique*. Previously, the master system for subjective measurements in Europe. It is also used to refer to an adaptor for calibration of the mouth simulator and a corresponding filter used in OREM.

Sidetone – In a telephone system, the transmission path from a speaker's mouth to his/her own ear.

STMR – Sidetone Masking Rating. A single figure measure of telephone sidetone path loss calculated as a Loudness Rating from a sidetone measurement.

Transmit – *See* send.

Chapter 8

Service and Repair

Telephone Test Head Type 4602 B is designed and constructed to provide the user with many years of reliable operation. However, if the test head is damaged in any way, contact your local Brüel & Kjær representative for repair.

Chapter 9

Appendix

9.1 Updating a Test Head Type 4602 to a Type 4602 B (Upgrade Kit UA 1403)

An Upgrade Kit UA 1403 is available for updating a Telephone Test Head Type 4602 to the most recent 4602 B version. Except for a few small details, an upgraded Type 4602 is similar to the improved 4602 B version. The procedure for updating the Test Head consists of two parts: disassembling the old Test Head and fitting Upgrade Kit UA 1403, as described in the following sections:

9.1.1 Disassembling a Test Head Type 4602

1. Remove the Mouth Simulator and the Ear Simulator, if fitted.
2. Remove the stop screw.
3. Remove both handset alignment rods and the clamps and finger screws.
4. Remove the green plastic cap from the large knob that is used for adjusting the handset retaining force. Carefully use a small screwdriver to lift it off.
5. Loosen the screw at the top (only one revolution is required), and lift off the plastic knob.
6. Use a 30 mm spanner to loosen the large nut at the top. Remove the nut.
7. The holder arm can now be removed.
8. Remove the long bolt at the top, by turning it counter-clockwise with your fingers.
9. Lift off the black top piece cover.
10. Use the supplied 4 mm Allen Key (QA 0121) to remove the four M5 screws that hold the upper part of the Test Head. Finally remove the upper part.

The Test Head is now stripped down to the upper main plate and is ready for fitting the new parts in Upgrade Kit UA 1403, as described below.

9.1.2 Fitting Upgrade Kit UA 1403

Upgrade Kit UA 1403 contains the parts shown in Fig. 9.1.

1. Fit the black plastic cover (UA 1420) at the rear of the upper main plate.
2. Position the "bridge" (DK 1284) at the top of the upper main plate and secure it with the two M4 Allen screws (YQ 9103). Tighten the screws with the 3 mm Allen Key (QA 0122).
3. Fit the two finger screw-fittings (DC 0588 and DC 0589) at the front of the upper main plate, using the two M4 Allen screws (YQ 0095). The screws are inserted from below. Tighten them securely with the 3 mm Allen Key (QA 0122).

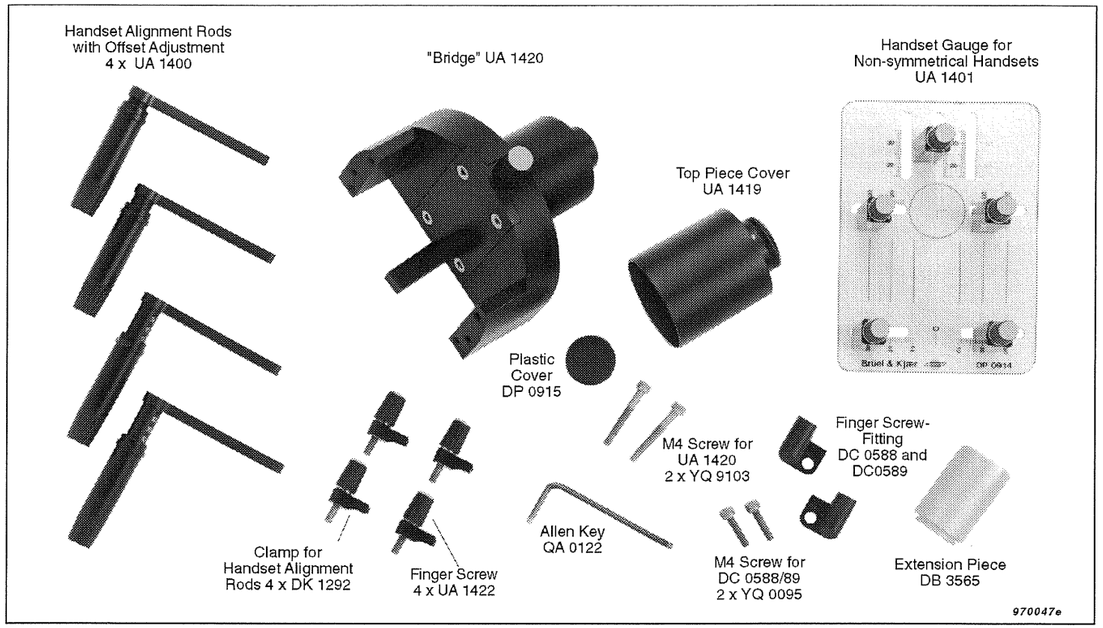


Fig. 9.1 Parts supplied with Upgrade Kit UA 1403

4. Fit the self-centring handset alignment rods or the alignment rods with offset adjustment as required (see also sections 2.4.1 and 2.4.2). Use the four finger screws (UA 1422) and four clamps (DK 1292) supplied in the Upgrade Kit.
5. Fit the new top piece cover (UA 1419) onto the top of the "bridge". The small plastic tap must be facing towards the handset stop, so that the top piece cover can be pushed all the way down.
6. Screw in the long bolt, that was removed at disassembling, at the top. Only tighten the bolt with your fingers.
7. Fit the holder arm in the correct position.
8. Fit the large nut that holds the holder arm. Use a 30 mm spanner to tighten it.
9. Fit the black plastic knob at the top. Tighten the screw.
10. Fit the green plastic cover on top of the knob, make sure that the recess matches the small plastic tap.
11. Lift off the rubber pad from the holder arm using your fingers.
12. Screw the extension piece (DB 3565) onto the holder arm.
13. Fit the rubber pad onto the holder arm extension.

The assembling procedure is complete and the Test Head has essentially been updated to a Telephone Test Head Type 4602 B. However, there are a few minor differences. The front edge of the upper main plate on a Type 4602 B Test Head has been chamfered in order to minimize the risk of scratching handsets. The two finger screw-fittings at the front of the upper main plate are an integral part of the Type 4602 B Test Head and cannot be removed. With an updated Test Head they can be removed, allowing any existing custom-built handset jigs to be fitted (see section 2.5).

9.2 Modifying an Old Type 4227 Mouth Simulator

If you have a Mouth Simulator Type 4227 with a serial number less than 1658020, and you want to use it in the 4602 B Test Head with a compressor microphone, a small modification is needed. When fitting the compressor microphone in the original type, the microphone will interfere with the handset. The position of the compressor microphone, however, can be changed by removing a small locating pin inside the Mouth Simulator and turning the front part. If you feel uncertain about making this operation, you can get your local Brüel & Kjær agent to do the job for a charge. Otherwise follow the instructions below.

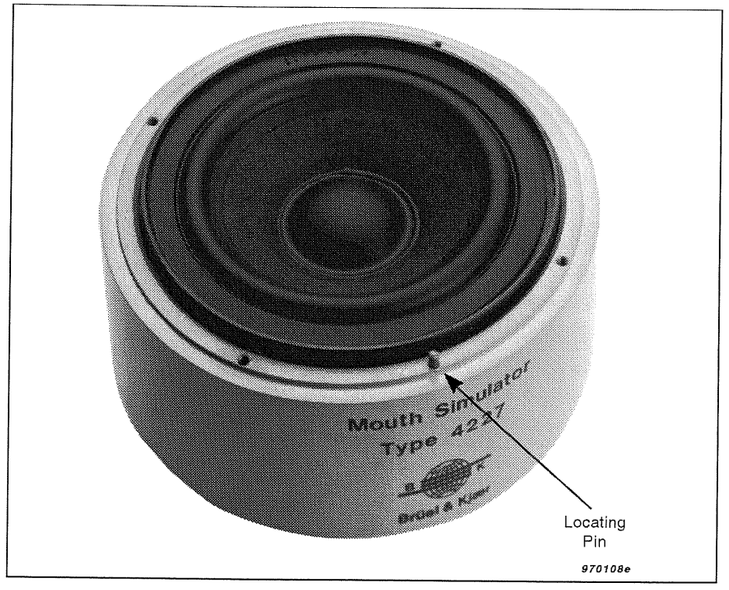


Fig. 9.2 Position of the locating pin in the Mouth Simulator

1. Unscrew the mouthpiece.

2. Loosen the four pozi-drive screws that hold the front part of the Mouth Simulator. Remove the front part.
3. With a suitable pair of strong pliers pull out the locating pin positioned at the outer edge of the bottom piece (see Fig. 9.2), taking care not to damage the edge of the Mouth Simulator or the drive unit. The pin is a tight fit and can be difficult to pull out.
4. Replace the front part and turn it 90° clockwise relative to the original position. Replace the four screws.
5. Fit the 1/4" Microphone and Preamplifier or plastic dummy microphone (DA 0150) into the slot provided and replace the mouthpiece.

9.3 Accessories

The Telephone Test Head Type 4602 B is provided with the accessories shown in Fig. 9.3.

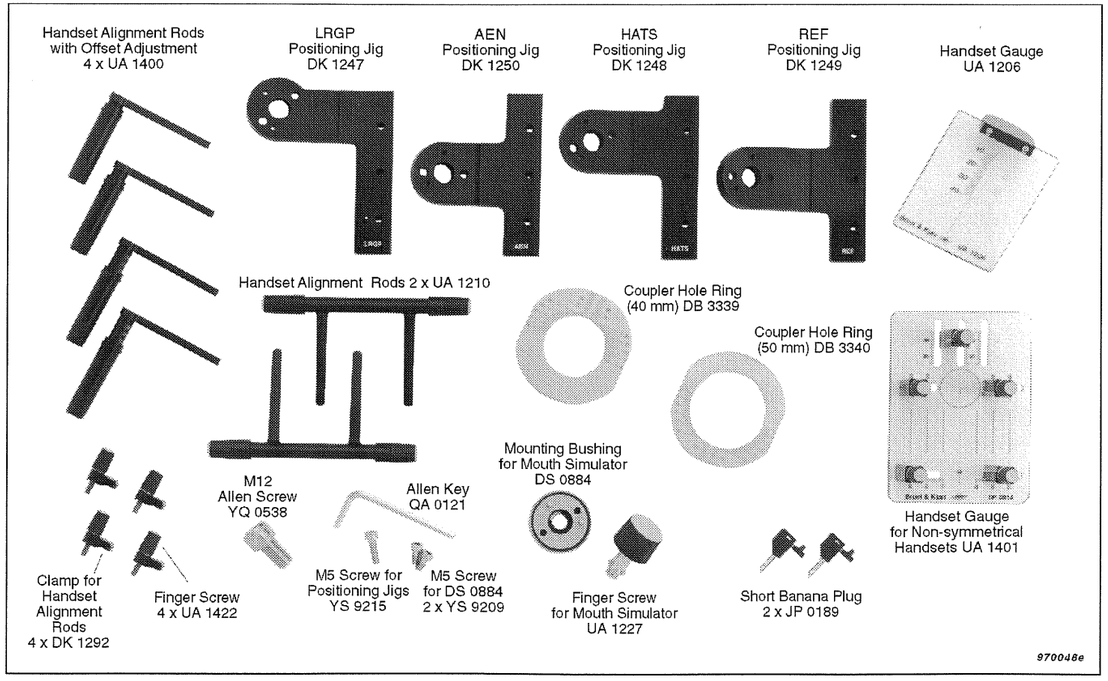


Fig. 9.3 Accessories provided with Telephone Test Head Type 4602 B

9.4 Assembly

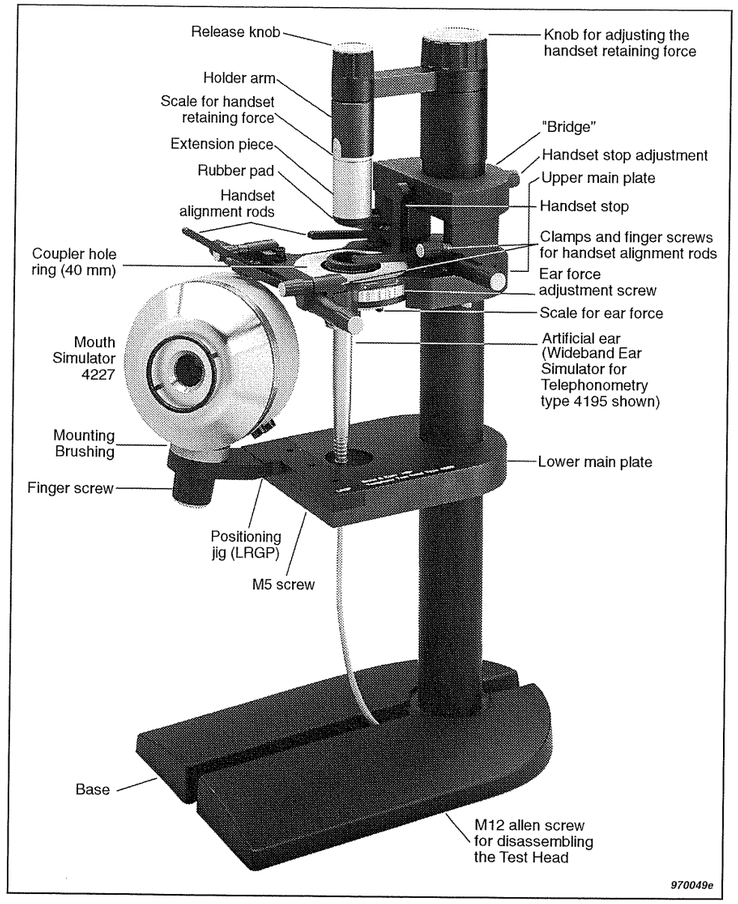


Fig. 9.4 *The Telephone Test Head Type 4602 B with Mouth Simulator Type 4227 and Wideband Ear Simulator for Telephonometry Type 4195 fitted. The Mouth Simulator is fitted to the Test Head with the LRGP positioning jig for making measurements in the Loudness Rating Guard-ring Position*