PRODUCT DATA

Wideband Ear Simulator Type 4987 Family

High precision ear simulators for production line testing

The Wideband Ear Simulator Type 4987 family includes a range of ear simulators designed for realistic and comparable quality control (QC) testing of earphones, ear buds, telephone handsets and headsets on high-volume production lines.

There are three models:

- Type 4987 (photo left)
- Type 4987-A (photo centre)
- Type 4987-B (photo right)



Uses and Features

Uses

- Compliance testing on production lines
- Testing during R&D
- Quality assurance testing

Features

- Design based on ITU-T Rec. P.57 Type 2 ear simulator
- Includes high-precision ½" microphone and constant current line drive (CCLD) preamplifier with TEDS and SMB connector
- Easy calibration and verification
- Fast and easy swap between different designs on the production line
- Calibration data including acoustic transfer impedance, microphone response and sensitivity
- Allows easy mounting of leakage adapters

Description

The Type 4987 family has been developed for production line quality control of insert, intra-concha (ear buds), supra-aural (on-ear), supra-concha (in-ear) and circum-aural (over-ear) earphone devices. Mating to the device under test (DUT) is done by means of standardized or customized adapters that are screwed onto the coupler. This innovative concept allows full measurement compatibility between the production line and the laboratory or verification department.

The design of the ear simulator in Type 4987 is based on ITU-T Rec. P.57 Type 2 ear simulator. It consists of a main housing with built-in annular air volumes connected to the main volume by air passages. The acoustic input impedance simulates the average acoustic load of the inner part of the ear canal. This ensures proper acoustical performance and accurate absolute measurements of the DUT. A $\frac{1}{2}$ " high-precision prepolarized pressure-field microphone is mounted in the housing of the ear simulator, terminating the main ear canal volume. The microphone is connected to a CCLD microphone preamplifier, with TEDS, making it suitable for connection to a wide variety of conditioning equipment supplying CCLD power.

The ear simulator is supplied with full calibration data, including: microphone response; sensitivity; transfer impedance and equivalent volume.



Type 4987 Structure

Type 4987 can be fitted with different types of simplified pinna simulators, supporting high-leak or low-leak performance, as well as with standard or customized adapters to make a perfect fit for the DUT.

The product type number (4987-X-nnn) is structured in the following way:

- 4987: specifies the occluded ear simulator coupler with a ½" microphone and CCLD preamplifier
- -X: specifies different types of simplified pinna/concha simulators, as follows: --: No pinna/concha simulator

A: High-leak pinna simulator with flange for telephone receivers

- B: High-leak concha base simulator for earphones
- -nnn: specifies different types of standard and customized adapters, as follows: --: No DUT adapter
 - -001: Circular-shaped for 'A' version
 - -002: Semi-circular for 'A' version
 - -005: Micro-speaker adapter for 'B' version



Configuration Selection

Table 1 Selecting the configuration for your application

Application	Туре 4987-А-001	Туре 4987-А-002	Туре 4987-В-005
Classic handset testing	\checkmark		
Smartphone testing		\checkmark	
Micro-speaker testing			\checkmark
Earbud testing			\checkmark

Fig. 1 *Components for the*

of Type 4987-X-nnn

Calibration and Verification

During manufacture, the ear simulator is calibrated according to ITU-T Rec. P.57. A comprehensive individual calibration data set is supplied, allowing easy frequency response correction for optimal performance.

Supplied individual calibration data includes:

- Microphone frequency response re 250 Hz
- Acoustic transfer impedance
- Sensitivity of the ear simulator at 250 Hz

Fig. 2 Typical frequency response of the included pressure field microphone re. 250 Hz (dB)



Acoustic Transfer Impedance

The acoustic transfer impedance is measured as the worst-case transfer impedance using a sound transmitter with an ultra-high impedance.

Fig. 3 Type 4987 – Typical acoustic transfer impedance × f dB re. 500 Hz



Fig. 4 Type 4987 – Typical low frequency response of Type 4969 microphone when mounted in Type 4987 re. 250 Hz (dB)



Fig. 5 Type 4987-B-x - Typical acoustic transfer impedance \times f dB re. 500 Hz



Fig. 6 Typical acoustic transfer impedance of Type 4987-A-x × f dB re. 500 Hz



Sensitivity Calibration Using Calibration Adapter DP-1079

Fig. 7 Performing a sensitivity check on a Type 4987-A-001 using Sound Calibrator Type 4231 with Calibration Adapter DP-1079



The absolute sensitivity is verified by means of Sound Calibrator Type 4231 mounted with Calibration Adapter DP-1079, Fig. 7.

Using Calibration Adapter DP-1079 allows you to fit the ear simulator to Sound Calibrator Type 4231 without removing the adapter ring.

DP-1079 has a correction factor of +6.0 dB when used in combination with Type 4231 in order to obtain the sensitivity at 250 Hz.

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Table 2 Types of calibration adapter

Type 4987 Variant	Calibration Adapter	Accuracy
4987	·····*/ - · · · · · · · · · · · · · · · · · ·	±0.5 dB
4987-A-001	UA-1546 (+3.1 dB') or ±0. DP-1079 (+6.0 dB [†])	
4987-A-002		
4987-B-005		

* When disassembled.

+ Correction factor (when used in combination with Type 4231 to obtain sensitivity at 250 Hz.

Positioning Recommendations for Types 4987-A

To obtain correct measurements, the centre of the DUT sound port must be in the centre of Type 4987-A, where the ERP is positioned, as shown in the example with Type 4987-A-001 in Fig. 8. To ensure correct sealing between the adapter and the DUT, a vertical force between 10 and 15 newtons is recommended.

Fig. 8

Positioning of Semi-circular Adapter Ring will seal correctly with just 1 mm flat surface between speaker port and edge of phone. Positioning tolerance onto handset: ±0.2 mm Vertical force: 10 - 15 N



Compliance with Standards

(€ & ⊚ ≟	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China WEEE mark indicates compliance with the EU WEEE Directive
Safety	EN/IEC 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use. ANSI/UL 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use
EMC Emission	EN/IEC 61000–6–3: Generic emission standard for residential, commercial and light industrial environments. EN/IEC 61000–6–4: Generic emission standard for industrial environments. CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device.
EMC Immunity	EN/IEC 61000–6–1: Generic standards – Immunity for residential, commercial and light industrial environments. EN/IEC 61000–6–2: Generic standards – Immunity for industrial environments. EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements. Note: The above is only guaranteed using accessories listed in this Product Data
Temperature	IEC 60068–2–1 & IEC 60068–2–2: Environmental Testing. Cold and Dry Heat. Operating Temperature: –10 to +50 °C (14 to 122 °F). Storage Temperature: –25 to +70 °C (–13 to +158 °F)
Humidity	IEC 60068–2–78: Damp Heat: 90% RH (non-condensing at 40 °C (104 °F))
Mechanical	Non-operating: IEC 60068-2-6: Vibration: 0.3 mm, 20 m/s ² , 10 - 500 Hz IEC 60068-2-27: Shock: 1000 m/s ² IEC 60068-2-29: Bump: 1000 bumps at 250 m/s ²
Enclosure	IEC 60529: Protection provided by enclosures: IP 20

Specifications – Type 4987

Specification [*]	Туре 4987	Туре 4987-А-х/Туре 4987-В-х
Sensitivity	– 38.2 dB ± 2 dB re 1 V/Pa	
Effective Coupler Volume	$1.26 \text{ cm}^3 \pm 0.04 \text{ cm}^3$	Variant dependant
First Resonant Frequency (Typical)	12.5 kHz	Type 4987-A-x : 1.7 kHz Type 4987-B-005 : 1.6 kHz
Frequency Range	20 Hz – 20 kHz	
Upper Limit of Dynamic Range	137 dB SPL (peak) below 500 Hz, 134 dB SPL (peak) up to 20 kHz	
Inherent Noise	21 dB SPL (A-weighted)	
Influence of Humidity	less than – 0.1 dB in absence of condensation	
Pressure Coefficient	0.005 dB/kPa	
Temperature Coefficient	+ 0.003 dB/K (–10 to +50 °C, 14 to 122 °F)	
Preamplifier Connector	SMB	
Leakage [†]	None	High
Adapter Mounting Thread	M22 × 1	
Coupler Dimensions	See Fig. 9	

 $^*~$ All values are typical at 23 °C (73 °F), 101.3 kPa and 50% RH unless otherwise specified $^+$ 'Low Leakage' or 'No Leakage' available on request

Fig. 9 Coupler Dimensions – a) Type 4987, b) Type 4987-B-x, c) Type 4987-A-x



Type 4987

Wideband Ear Simulator

(½" Microphone and CCLD Preamplifier)

Consisting of:

- IEC 60318-4 (formerly IEC 60711) compliant coupler
- ½" High Precision Pressure Field Microphone, prepolarized
- ½" CCLD Microphone Preamplifier with TEDS
- 5 × Dust protectors (DS-0535)
- Calibration chart

TYPE 4987 CONFIGURATIONS

Configuration Overview			
Item	Description	Pinna Simulator	DUT Adapter
Туре 4987	Wideband Ear Simulator (½" Microphone and CCLD Preamplifier)	No pinna simulator	No DUT adapter
Туре 4987-А-х	Wideband Ear Simulator (½" Microphone and CCLD Preamplifier)	High-leak flange	For modern smartphone receivers: x: 001 - circular x: 002 - semi-circular Customized variants also available
Туре 4987-В-х	Wideband Ear Simulator (½" Microphone and CCLD Preamplifier)	High-leak	For micro-speaker testing: x: 005 - circular \varnothing 11 Customized variants also available
Available Configu	rations		
Туре 4987-А-001	Wideband Ear Simulator (½" Microphone and CCLD Preamplifier)	High-leak	Circular
Туре 4987-А-002	Wideband Ear Simulator (½" Microphone and CCLD Preamplifier)	High-leak	Semi-circular
Туре 4987-В-005	Wideband Ear Simulator (½" Microphone and CCLD Preamplifier)	High-leak	Circular Ø11

OPTIONAL ACCESSORIES^{*}

Type 4231	Sound Calibrator, Class 1
AO-0564-D-xxx [†]	Single-screen Coaxial Cable, SMB right angle (F) to
	BNC (M)
AO-0587-D-xxx [†]	Single-screen Coaxial Cable, SMB (F) to BNC (M)

DS-0535	Dust Protector, 8.0×1.5 mm diameter
UA-1546	Calibration Adapter
	(Correction factor for Type 4231: 3.1 dB ± 0.5 dB)
DP-1079	Calibration Adapter

Standard ear mould adapters for Type 4157 will also fit on Type 4987

+ xxx = length in decimetres

SERVICES

Type 4987-CFF Standard factory calibration Type 4987-REF Repair and standard factory calibration

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