Certified translation from Polish
9 pages of the original document

[Document submitted for translation in a form of a pdf.]

Appendix no. 1

to the ITC report reg. no. 8642

[Underneath two logos, and the following address data:]

INSTYTUT ENERGETYKI
(the Institute of Power Engineering)
Instytut Badawczy
(Research Institute)
ODDZIAŁ TECHNIKI CIEPLNEJ „ITC"
("ITC" Thermal Technology Branch) in Łódź
93-208 Łódź, ul. Dąbrowskiego 113 www.itc.edu.pl, e-mail: itc@itc.edu.pl

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TEST REPORT no. 15/2016

HUSH PHONE

telephone cabin acoustic test

Place of the test:	OTC laboratory
Date of providing access to the object of the test:	16 November 2016
Date of the test:	17 November 2016
Date of issuance of the test report:	5 December 2016

no. of pages: 9 no. of pictures: 3 no. of charts *[no entry]* no. of tables: 3

Name and address of the Ordering Party: **Instytut Energetyki OTC „ITC" in Łódź**
93-208 Łódź
ul. Dąbrowskiego 113

[On the top of pages 2-9:]

ITC NW	**TEST REPORT no. 15/2016** HUSH PHONE telephone cabin acoustic tests	*[Page numbering and number of pages]*

THE ORDERING PARTY

Fabryka Mebli Biurowych MIKOMAX Sp. z o.o.
93-231 Łódź
ul. Dostawcza 4

1. THE TESTED OBJECT

TECHNICAL DATA:

NAME	Hush Phone HUS-BX-005
[A picture with dimensions.] **Description**	Construction based on cellular board connected with joints made of the aluminium alloy. The sides and the panels are made of a 38 mm cellular board covered with 2 mm PVC in laser technology. The central post designed as a box-type structure and the Edge banding made of 18 mm melamine board covered with 2 mm PVC in laser technology. Lacobel glass back panel made in bonding technology, i.e. safe glass. The front glass panel made of 8 mm toughened glass. The upholstered elements made of a 3.2 mm HDF board with the use of 40 mm upholstering foam covered with fabric.

Technical data of the casing	
dimensions in mm	1000 x 900 x 2400
external volume in m^3	2.16
internal volume in m^3	1.48
total weight in kg	231
surface of cabin openings in m^2	0.058
gross surface of cabin walls in m^2	8.97
leak indicator in Θ	0.0065
internal surface	two upholstered walls, carpet flooring, the back of the cabin consists of two glued glass windows and a post made of melamine board, the cabin front is made of an 8 mm toughened glass window
cabin assembly	assembled with the use of bolted connections of particular construction elements
equipment	electrification with two modules, active ventilation system, a lacquered table, a folding table in wood veneer, upholstered pillows
comments	cabin assembly in the room is carried out by the manufacturer
Manufacturer	Fabryka Mebli Biurowych MIKOMAX Sp. z o.o.

2. TEST METHOD AND THE MEASURING EQUIPMENT

Test method: the acoustic measurements were carried out in accordance with the following standard: PN-EN ISO 3741:2011 *Acoustics - Determination of sound power levels and of noise source energy levels on the basis of sound pressure level measurements. Precision methods for reverberation rooms.* PN-EN ISO 11957:2000: *Acoustics - Determination of sound insulation performance of cabins - laboratory and in situ measurements.* PN-EN ISO 354: 2005 *Acoustics - Measurement of sound absorption in a reverberation room.* PN-EN ISO 3382-3:2012 *Acoustics. Measurement of room acoustic parameters. Part 3.*

Method of sound pressure level determination: two measurement series with the average period used 30 s were carried out:

- measurement series inside the cabin for two locations of sound source in the reverberation room
- measurement series source in the reverberation room for the same locations and working conditions of the sound source.

Background measurements: determined after cessation of the sound source.

3. Measuring equipment

Measuring device					Validity of the Calibration / control certificate
Name		Type	Manufacturer	Serial no.	No.
Measuring set 2144 B channel	meter	2144	Brüel & Kjær	1765615	February 2018
	condenser microphone	4942	Brüel & Kjær	2647435	
	preamplifier	2669	Brüel & Kjær	1936057	
Calibrator		4231	Brüel & Kjær	2686649	August 2017
Sound power source		4205	Brüel & Kjær	1775038	January 2017
Rotating microphone boom		3923	Brüel & Kjær	02307038	-
Barometer		HD 9908T	Delta OHM	11002854	February 2018
Thermohygrometer		HD 2717T.D0	Delta OHM	11032846	February 2018
Measuring tape		30m	Richter	2134	September 2019

Calibration of the measurement chain the measuring set was calibrated before the measurement and after its completion with a sound calibrator (in accordance with the calibration certificate L_{pref} =(94.01±0.09) dB in the reference conditions, i.e. at the 23°C for the pressure of 1013.25 hPa, relative humidity of 50%).

Date of the measurement	Measuring set	Before the measurement	After the measurement
8 November 2016[1]	2144	- 0.08 dB	- 0.08 dB
17 November 2016	2144	- 0.07 dB	- 0.08 dB

The measurement results take into account the calibration correction applied as of the time of carrying out the test.

4. Ambient conditions during the measurement:

			Before the measurement	After the measurement
8 November 2016	temperature	°C	10.2	10.3
	humidity	%	57.7	57.6
	barometric pressure	hPa	985	984
17 November 2016	temperature	°C	8.4	8.4
	humidity	%	75.3	74.5
	barometric pressure	hPa	985	984

REVERBERATION ROOM			
Volume V	m^3		237
Total surface of partitions S	m^2		231.5
Planes limiting the room		All non-parallel planes	
Diffusing elements		Diffuser	

The reverberation time (T) of the room

f_{av}, Hz	100	125	160	200	250	315	400	500	630	800	1000
T, s	4.49	4.36	4.27	4.85	5.33	5.51	5.60	5.49	5.29	5.08	4.88
U_{A95}	0.30	0.23	0.22	0.22	0.20	0.17	0.15	0.11	0.07	0.05	0.04
f_{av}, Hz	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	
T, s	4.43	3.92	3.86	3.57	3.16	2.62	2.10	1.64	1.23	0.88	
U_{A95}	0.04	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.02	0.02	

[1] refers to *the measurement of the reverberation time of the cabin*

The following symbols have been used in the above table:

T – specified reverberation time of the room of the ITC Aeroacoustics Laboratory – closed technological openings,

$U_{A,95}$ – expanded uncertainty of A type measurement, determined using the Student's T table for the $T_{95\%}$ factor = 2.201, v_{eff} effective degrees of freedom p=95% confidence level.

For the entire measurement range, the **T** reverberation time is compliant[2] with the standard PN-EN ISO 3741:2011.

5. Description of the test background

Description of the place/conditions of the measurements	The tests were carried out in the left reverberation room fulfilling the conditions required in the applied measurement method.
Position of the tested object	In the middle of the room so that the walls of the object were not parallel to the room's walls.
Sound source positions	- 2 m from the tested object in two locations shifted by 180 ° - inside the tested object, at the location of the operator's head
Microphone positions	- in the reverberation room - two positions of the rotating microphone boom and three positions of the microphone within 120 ° on a 10 m circle and not parallel to the floor of the room - in the tested object – inside a sphere with a radius of 0.3 m at the height of 1.55 m over the floor and in three points placed symmetrically on the surface of the sphere.

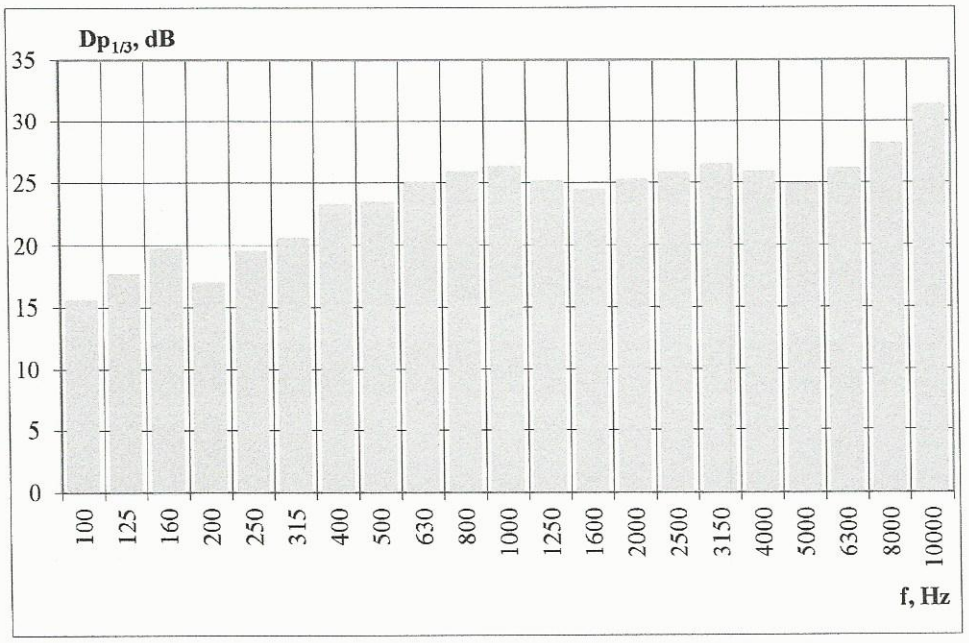
[2] *Excluding the 10,000 Hz frequency*

6. The acoustic characteristics of the cabin

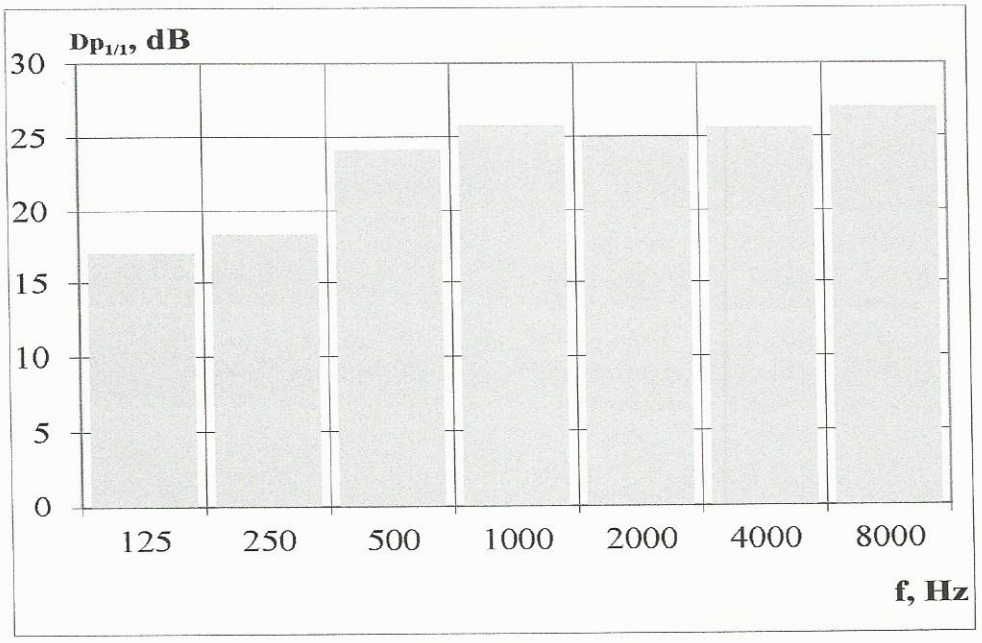
6.1 Sound reduction of the telephone cabin D_p.

Table 1

f	Reverberation room		Telephone cabin		Sound reduction	
	Background $L_{p(B)}$	L_p	Background $L_{p(B)}$	L_p	$D_{p(1/3)}$	$D_{p(1/1)}$
Hz	**dB**					
100	11.3	70.2	2.8	54.8	**15.4**	*[No entry]*
125	5.9	69.0	0	51.4	**17.5**	**17.0**
160	2.6	69.1	0	49.5	**19.6**	*[No entry]*
200	1.1	69.3	0	52.5	**16.8**	*[No entry]*
250	1.1	68.4	0	49.0	**19.4**	**18.3**
315	3.0	66.8	0	46.4	**20.4**	*[No entry]*
400	2.4	68.9	0	45.7	**23.2**	*[No entry]*
500	1.0	70.4	0	47.1	**23.4**	**24.1**
630	1.7	73.3	0	48.4	**24.9**	*[No entry]*
800	0.8	76.1	0	50.3	**25.8**	*[No entry]*
1000	0.8	77.4	0.4	51.2	**26.2**	**25.8**
1250	1.5	74.2	1.2	49.2	**25.0**	*[No entry]*
1600	2.0	71.9	1.9	47.6	**24.4**	*[No entry]*
2000	2.5	72.0	2.4	46.8	**25.1**	**24.9**
2500	3.4	68.9	3.4	43.3	**25.7**	*[No entry]*
3150	4.0	66.2	4.0	39.9	**26.3**	*[No entry]*
4000	4.6	66.2	4.6	40.4	**25.8**	**25.6**
5000	5.1	65.4	5.1	40.6	**24.8**	*[No entry]*
6300	5.3	63.5	5.3	37.5	**26.0**	*[No entry]*
8000	5.1	60.5	5.1	32.5	**28.0**	**26.9**
10000	4.5	56.5	4.5	25.3	**31.1**	*[No entry]*



Pic. 1 Sound reduction spectrum of a telephone cabin in one third octave bands.



Pic. 2 Sound reduction spectrum of a telephone cabin in octave bands.

6.2 Weighted sound reduction index of a cabin D_{pw}.

Weighted sound reduction index of a telephone cabin D_{pw} (for frequency range 100 Hz - 3150 Hz) has been determined in accordance with point 8 of the PN-EN ISO 11957 :2000 standard, comparing the values of specific sound reduction D_p to the reference curve given in PN-EN ISO 717-1 standard.

Weighted sound reduction index of a cabin	D_{pw}	25.0 dB

6.3 Internal noise level L_{pA}.

Mechanical ventilation constituting an integral part of the telephone cabin is the source of the noise inside it. The noise level has been determined in the cabin inside a sphere with a radius of 0.3 m at the height of 1.55 m over the floor and in three points placed symmetrically on the surface of the sphere.

Internal noise level	L_{pA}	26.9 dB

6.4 Speech attenuation index D_S

Normalized acoustic power spectrum of normal speech was applied for the determined sound reduction value of the cabin that is the difference between sound source acoustic power inside the cabin and outside the cabin in accordance with the ISO 3382-3: 2012 standard.
The table below presents the values of the acoustic power determined in the tests and the normalized spectrum $L_{W,S}$.

Table 2

f	$L_{W,1}$	$L_{W,2}$	ΔL_W	$L_{W,S}$	$L_{W,S} - \Delta L_W$	A	$L_{W,S} + A$	$L_{W,S} - \Delta L_W + A$
Hz	dB							
125	78.8	65	13.8	60.9	47.1	-16.1	44.8	31.0
250	76.4	55.2	21.2	65.3	44.1	-8.6	56.7	35.5
500	78.7	56	22.7	69	46.3	-3.2	65.8	43.1
1000	83.9	60.8	23.1	63	39.9	0.0	63.0	39.9
2000	80	57.4	22.6	55.8	33.2	1.2	57.0	34.4
4000	76.5	53.4	23.1	49.8	26.7	1.0	50.8	27.7
8000	74.6	50.1	24.5	44.5	20.0	-1.1	43.4	18.9
Σ							68.4	45.8

Speech attenuation index $D_S = 22.6$ dB

where:

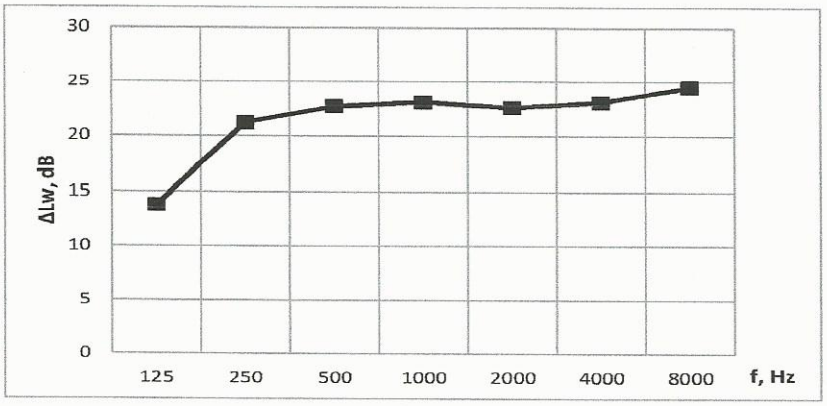
$L_{W,1}$ - acoustic power level outside the cabin

$L_{W,2}$ - acoustic power level inside the cabin

ΔL_W - power reduction by the cabin

$L_{W,S}$ - normalized acoustic power spectrum of speech

A - the frequency characteristics



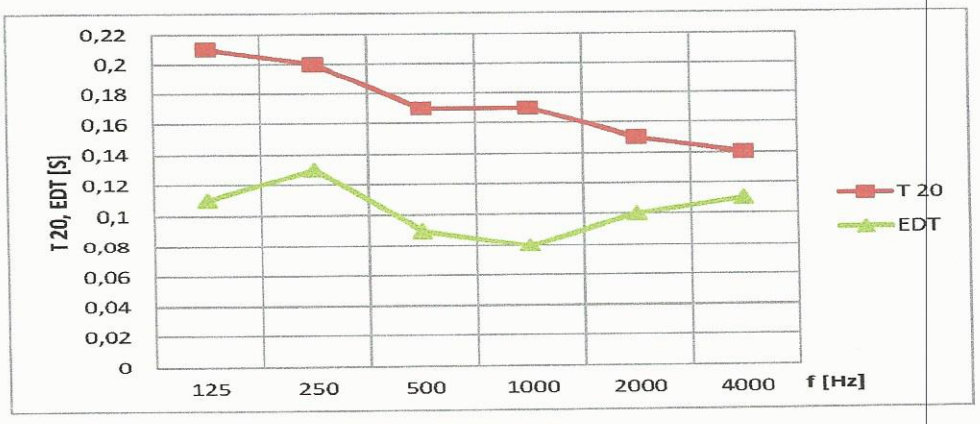
Pic. 3 Octave spectrum of power reduction ΔL_W.

6.5 Determination of T_{20} reverberation time and the early decay time (EDT)

In accordance with the PN-EN ISO 354:2005 standard, sound decay curves were obtained with the use of the interrupted noise method, on the basis of which the T_{20} reverberation time (range from 5 to 25dB) and the early decay time (EDT) were determined. The results have been shown in the table below.

Table 3

f	T_{20}	EDT
Hz	s	
125	0.21	0.11
250	0.2	0.13
500	0.17	0.09
1000	0.17	0.08
2000	0.15	0.1
4000	0.14	0.11



Pic. 3 Determined T20 and EDT time for the octave band centre frequencies.

Tests performed by:

J.R. Jaworski P. Gaj

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[Place for signatures]

The laboratory declares that the above results of the tests refer exclusively to the tested Hush Phone HUS-BX-005 cabin provided by the Ordering Party. This report must not be copied otherwise than in its entirety without written consent of the Laboratory.

I, the undersigned Magdalena Rosińska, M.A., listed as a sworn translator of English by the Minister of Justice under the number TP/56/12, hereby certify that this is a true and faithful translation of the original document presented to me.

Rep. No. 7/2017

Łódź, 18 January 2017

MAGDALENA ROSIŃSKA TŁUMACZ PRZYSIĘGŁY JĘZYKA ANGIELSKIEGO NR TP/56/12

Magdalena Rosińska