

11x15x3.5 MM SPEAKER

The 11 x 15 x 3.5 mm rectangular speaker is a high end miniature speaker specifically designed for portable devices, music phones and smartphones where high quality sound is required.

It delivers pure , uncolored sound reproduction in applications with small space.

Suitable for mono and stereo applications.



Features:

- Flat, wide frequency response
- Low resonance frequency (800Hz) in 1cm³ closed back cavity
- Compound membrane with additional stiffening plate for inner damping and low THD
- Extremely robust spring connector
- 100% in-line measurement of all specified acoustical and electrical parameters

2403-260-00001

Contents

1. Theory of operation.....	3
2. Mechanical Layout and Dimensions.....	4
2.1. Main Dimensions.....	4
2.2. Spring Force.....	4
2.3. Pad layout.....	5
2.4. Force layout.....	5
2.5. Material list.....	6
2.6. Part marking.....	6
3. Electrical and Acoustical Specifications.....	7
3.1. Frequency response	7
3.2. Excursion	8
3.3. Electro-acoustic characteristics acc. IEC 268-5	9
3.4. Measurement setup	10
3.5. Measurement adapter 1 cm ³	11
3.6. Measured Parameters.....	12
4. Environmental Conditions.....	13
4.1. Storage.....	13
4.2. Transportation.....	13
4.3. Functionality.....	13
5. Environmental tests	14
5.1. Qualification tests.....	14
5.2. Reliability tests	14
5.3. Sample Size, Sequence	14
5.4. Period of Shelf-Life	14
5.5. Testing Procedures.....	14
6. Related Documents	18
7. Change History	19
8. Disclaimer	19



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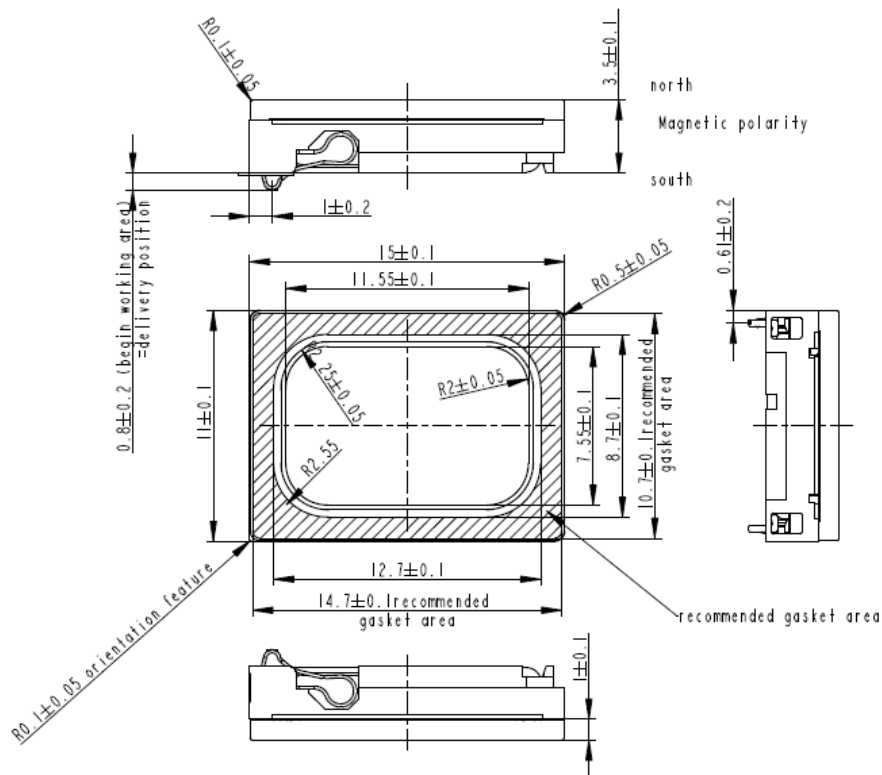
1. Theory of operation

The 11x15x3.5 rectangular speaker is an electro dynamic transducer, designed to translate electrical analog signals into sound. The input signal is fed into a coil in a magnetic field, which is attached to a membrane. Through the principle of the electromagnetic force, the membrane is moved according to the contents of the input signal.

2403-260-00001

2. Mechanical Layout and Dimensions

2.1. Main Dimensions

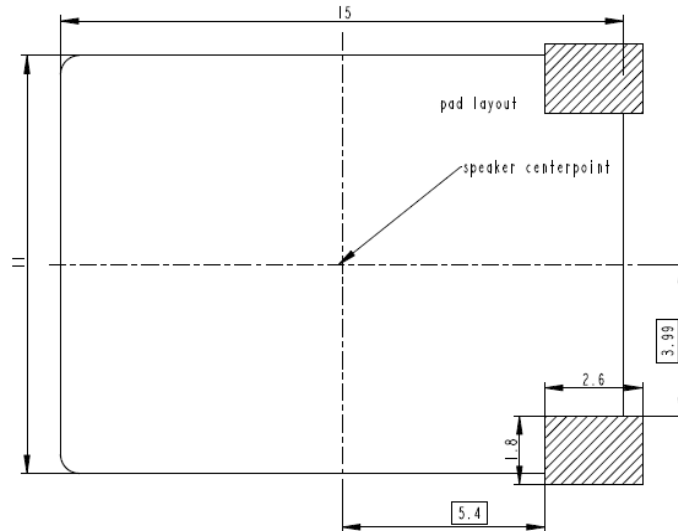


2.2. Spring Force

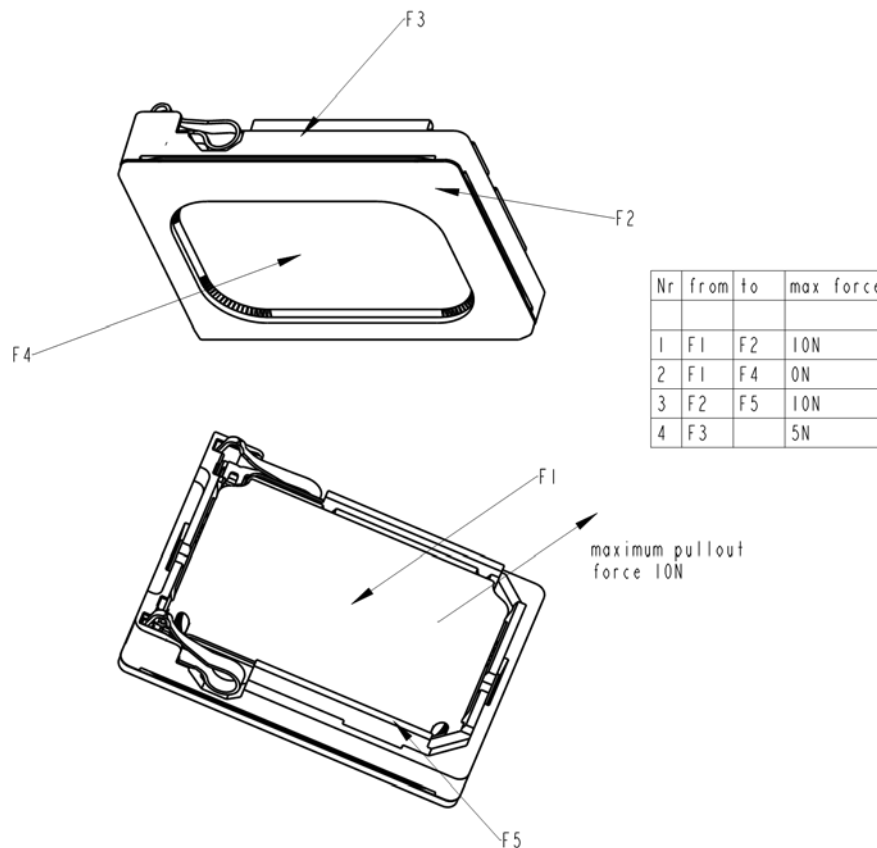


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2.3. Pad layout



2.4. Force layout

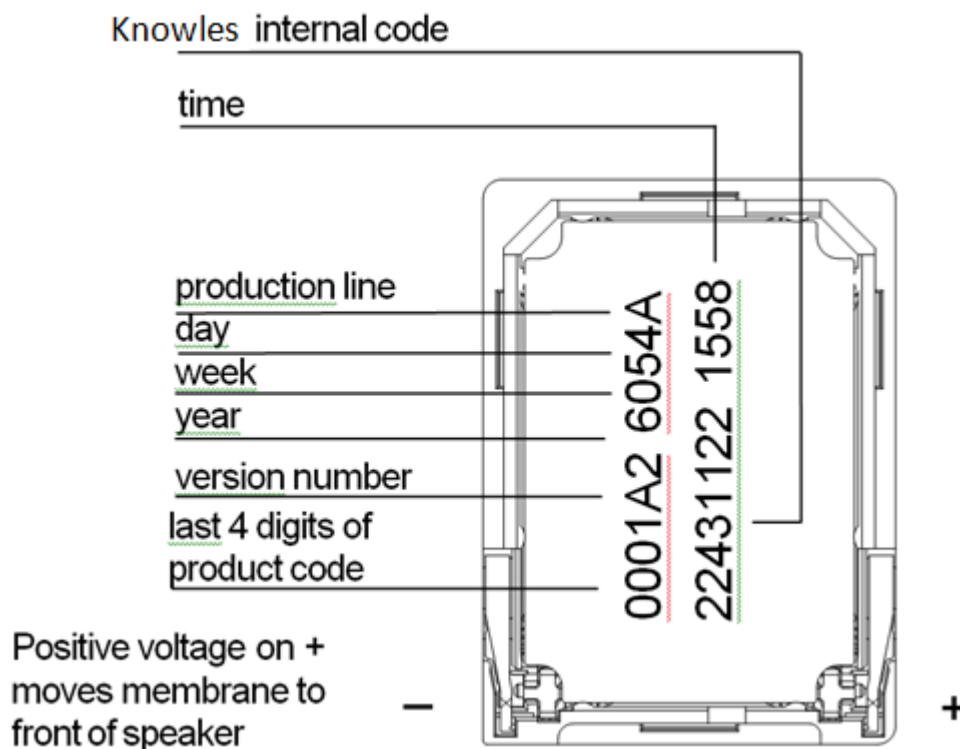


2403-260-00001

2.5. Material list

1. MATERIAL of BASKET: Polycarbonate
2. MATERIAL of MEMBRANE: Polyarylate-Compound
3. MATERIAL of POT: soft magnetic Iron
4. MATERIAL of MAGNET: Nd Fe B /N42
5. MATERIAL of CONTACT CrNi-Steel, gold plated
6. MATERIAL of COVER: Polycarbonate
7. DIMENSION: 15x11x3.5mm
8. MASS: 1.6g

2.6. Part marking

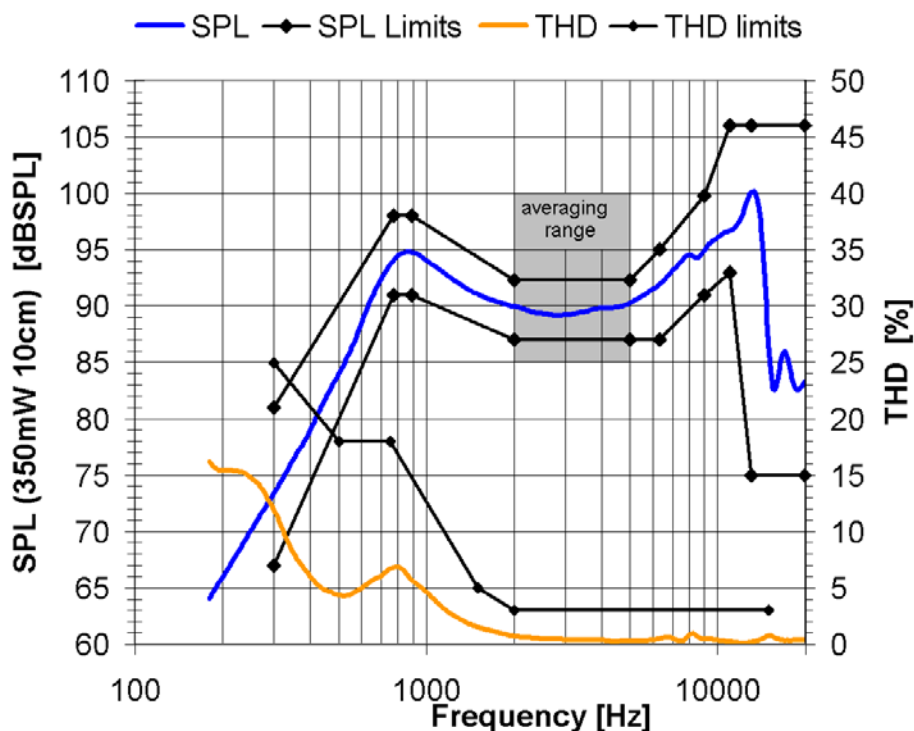


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3. Electrical and Acoustical Specifications

3.1. Frequency response

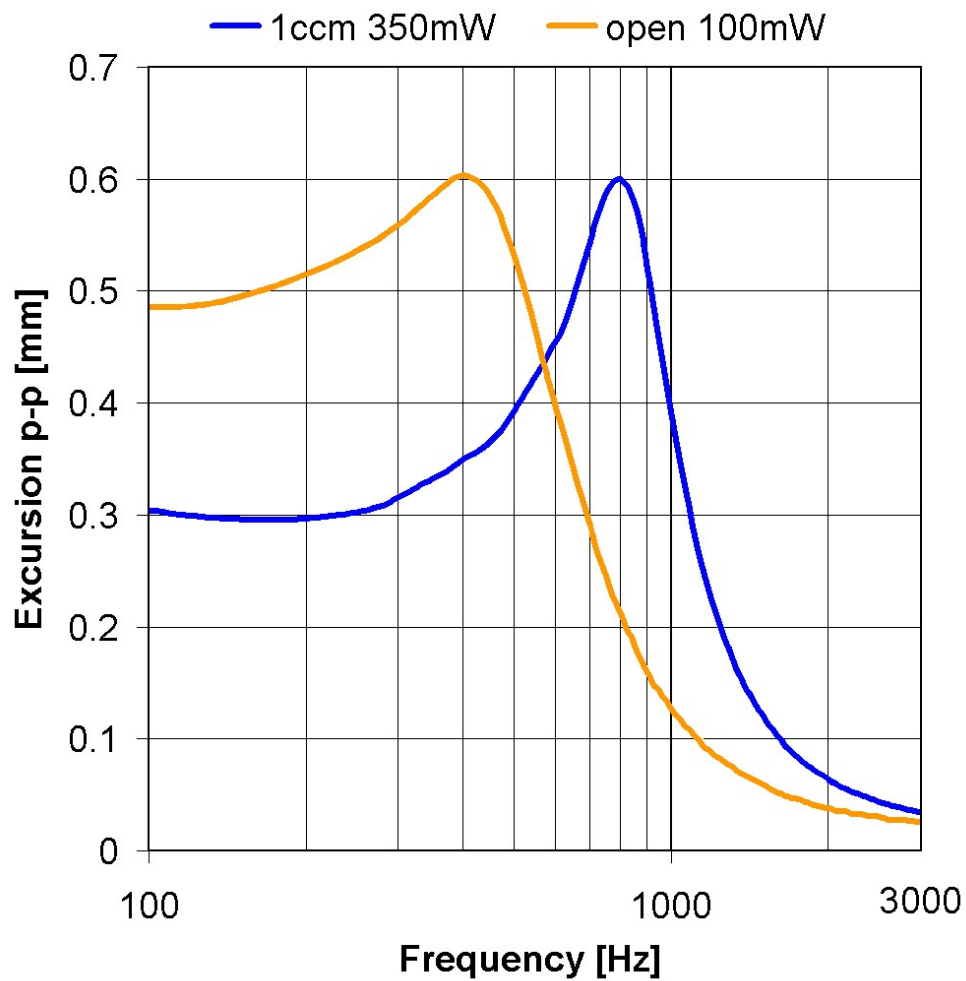
TYPICAL FREQUENCY RESPONSE measured in Baffle according to 3.4
(distance $d = 10\text{cm}$, with back cavity 1cm^3 at 350mW)



Tolerance window				
f [Hz]	lower limit [SPL floating]	upper limit [SPL floating]	f [Hz]	upper limit [%THD]
300	67	81	300	25
770	91	98	500	18
890	91	98	750	18
2000	87	92,5	1500	5
5000	87	92,5	2000	3
6300	87	95	15000	3
9000	91	100		
11000	93	106		
13000	75	106		
20000	75	106		

2403-260-00001

3.2. Excursion



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3.3. Electro-acoustic characteristics acc. IEC 268-5**3.3.1. LOUDSPEAKER IN 1cm³ MEASUREMENT ADAPTER ACC. TO 3.4**

1. RATED IMPEDANCE	Z:	8Ω
2. VOICE COIL RESISTANCE	R:	7.4Ω ± 10%
3. RESONANCE FREQUENCY	f ₀ :	800Hz ± 7.5%
4. MAXIMUM LINEAR EXCURSION	Xmax:	+/- 0.30mm
5. CHARACT. SENSITIVITY (1W in 1m) average from 2kHz to 5kHz		73 ± 2dB
6. THD		according to Sheet 190 - 3
7. RUB & BUZZ at 350mW		no audible rub & buzz

3.3.2. LOUDSPEAKER IN BAFFLE WITHOUT BACK CAVITY

1. TYPICAL RESONANCE FREQUENCY	f ₀ :	450Hz
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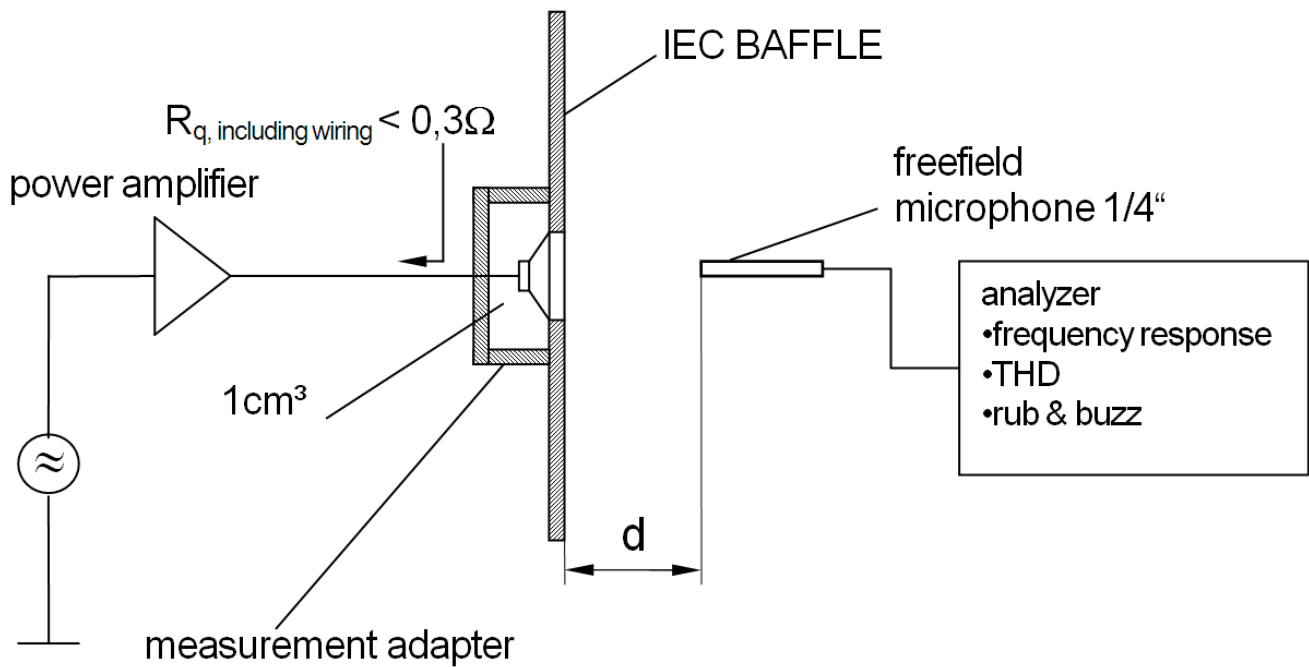
3.3.3. Loudspeaker mounted in Lifetime test device (closed Box 2ccm, open front)

Signal IEC268-1 with high-pass 12dB/Oct. at 800Hz, crest factor 2, used for all operating lifetime tests

1. MAX.SHORT TERM POWER	1sec ON, 1min. OFF, 60 cycles	1000mW
Ambient temperature 70°C		
2. MAX LONG TERM POWER	1min ON, 2min. OFF, 10 cycles	600mW
Ambient temperature 70°C		
3. MAX. NOISE POWER	(PHC continuous) 500h	500mW
Ambient temperature 70°C		

2403-260-00001

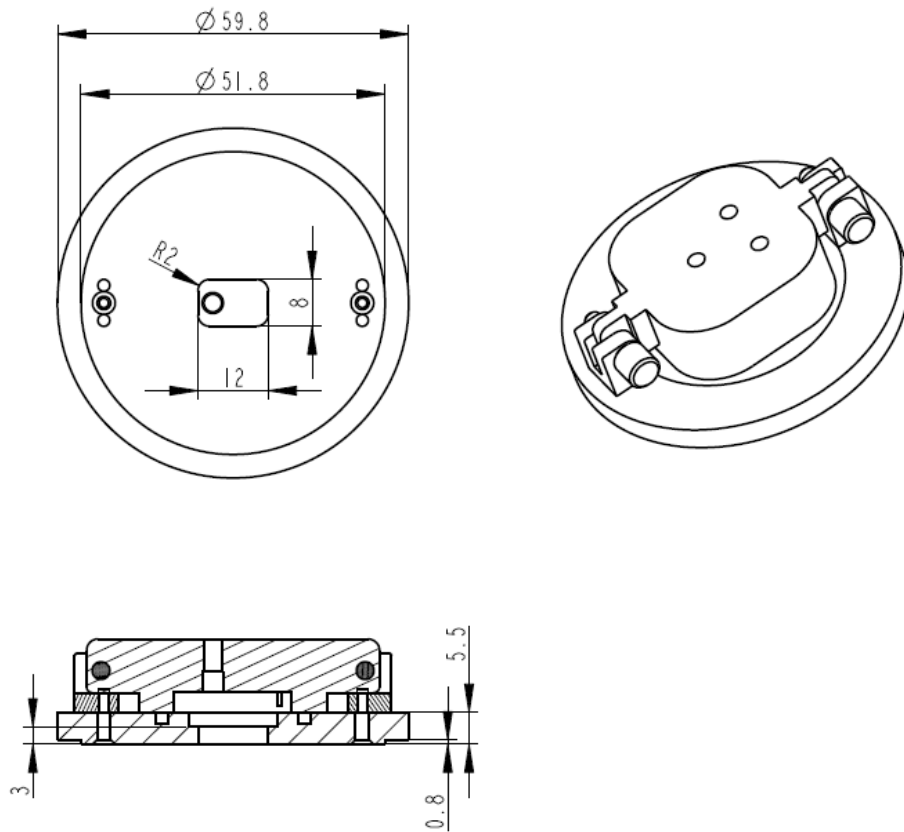
3.4. Measurement setup



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3.5. Measurement adapter 1 cm³





2403-260-00001

3.6. Measured Parameters

3.6.1. Sensitivity

SPL is expressed in dB rel 20 μ Pa, computed according to IEC 268-5.

Measurement set up and parameters according chapter 3.4.

This test is performed for 100% of products in the production line.

3.6.2. Frequency response

Frequency response is measured according test set up in chapter 3.4 data sheet and checked against the tolerance window defined in chapter 3.1. This Test is performed for 100% of products in the production line.

3.6.3. Total harmonic distortion (THD)

Is measured according IEC 268-5 (2nd to 5th harmonics) and test set up in chapter 3.4. This test is performed for 100% of products in the production line.

3.6.4. Rub& Buzz

Rub & Buzz will be measured in the Inline-measuring device with a sinusoidal sweep. Rub & Buzz is defined as the maximum level of no harmonic energy, expressed as signal to non-harmonic content ratio, in a certain frequency-range. Signal and evaluation criteria are according to chapter 3.3. This test is performed for 100% of products in the production line.

2403-260-00001

4. Environmental Conditions

4.1. Storage

The transducer fulfills the specified data after treatment according to the conditions of

ETS 300 019-2-1	Specification of environmental test: Storage Test spec. T 1.2: Weather protected, not temperature controlled storage locations.
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4.2. Transportation

The transducer fulfills the specified data after treatment according to the conditions of

ETS 300 019-2-2	Specification of environmental test: Transportation Test Spec. T 2.3: Public Transportation
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4.3. Functionality

The transducer fulfills the specified data after treatment according to the conditions of

ETS 300 019-2-5	Specification of environmental test: Ground vehicle installations Test spec. T 5.1: Protected installation
ETS 300 019-2-7	Specification of environmental test: Portable and non-stationary use Test spec. T 7.3E: Partly weather protected and non-weather protected locations.

2403-260-00001

5. Environmental tests

5.1. Qualification tests

According to our milestone plan (Product Creation Process), a complete qualification test will be done at design validation of products manufactured under serial conditions.

1x per year and product family a requalification takes place. The qualification process covers all tests described under 5.5 and a complete inspection.

5.2. Reliability tests

1x per month and product family samples are taken and submitted to tests described under 5.5.2

5.3. Sample Size, Sequence

Unless otherwise stated 20 arbitrary new samples will be used to perform each test for both, qualification and requalification test as described under 5.1 and 5.2.

5.4. Period of Shelf-Life

The period of shelf-life is 2 years.

5.5. Testing Procedures

5.5.1. Storage Tests

5.5.1.1. Cold Storage Test

Parameter	Test Method and Conditions	Duration	Evaluation Standard
Low Temperature Storage (Ref. EN 60068-2-1)	-40°C rel. humidity not controlled	168h	Measurements after 2 hours recovery time. All samples fully operable. All acoustical parameters according specification with tolerances increased by 50 %.

5.5.1.2. Heat Storage Test

Parameter	Test Method and Conditions	Duration	Evaluation Standard
Dry Heat Storage (Ref. EN 60068-2-2)	+85°C rel. humidity not controlled	168h	Measurements after 2 hours recovery time. All samples fully operable. All acoustical parameters according specification with tolerances increased by 50 %.

2403-260-00001

5.5.1.3. Temperature Cycle Test

Parameter	Test Method and Conditions	Duration	Evaluation Standard
Change of Temperature (Ref. EN 60068-2-14)	-40°C/+85°C Transition time <3 min. See Figure 5-1 below	5 cycles >2h for each temperature	Measurements after 2 hours recovery time. All samples fully operable. All acoustical parameters according specification with tolerances increased by 50 %.

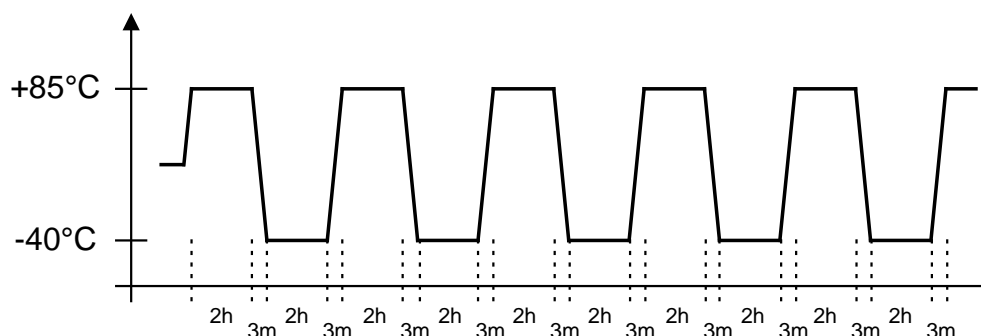


Figure 5-1: Temperature Cycle Test

5.5.1.4. Temperature / Humidity Cycle Test

Parameter	Test Method and Conditions	Duration	Evaluation Standard
Damp heat, cyclic (Ref. IEC 60068-2-30)	+25°C/+55°C 90% to 95% RH. Temp. change time <3h See Figure 5-2 below <u>Caution:</u> no condensed water on products!	6 cycles / 144h 12h at each temperature (inclusive temp ramp up/down)	Measurements after 2 hours recovery time. All samples fully operable. All acoustical parameters according specification with tolerances increased by 50 %.

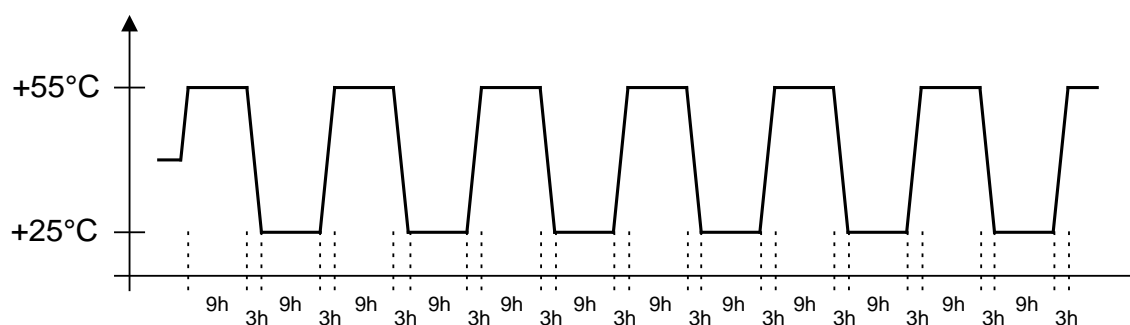


Figure 5-2: Temperature / Relative Humidity Cycle Test

2403-260-00001

5.5.2. Operating Tests**5.5.2.1. Cold Operation Test**

Parameter	Test Method and Conditions	Duration	Evaluation Standard
Cold Operation Test (Ref. EN 60068-2-1)	-20°C rel. humidity not controlled signal acc. Chapter 3.3.3.	72h	Measurements after 2 hours recovery time. All samples fully operable. THD may be increased after test. All other acoustical parameters according specification with tolerances increased by 50 %.

5.5.2.2. Dry Heat Operation Test

Parameter	Test Method and Conditions	Duration	Evaluation Standard
Dry Heat Operation (Ref. EN 60068-2-2)	+70°C rel. humidity not controlled signal acc. Chapter 3.3.3.	500h	Measurements after 2 hours recovery time. All samples fully operable. The allowable change in sensitivity shall not be greater than 3 dB. All other acoustical parameters according specification with tolerances increased by 50 %.

5.5.3. Salt Mist Test

Parameter	Test Method and Conditions	Duration	Evaluation Standard
Salt Mist (Ref. IEC60068-2-52, Kb / Severity 2)	The part must be subjected to 2 hours spray of 5% NaCl salt mist, at 35°C then be left at 40°C and 95% RH for 22h.	3 cycles	The samples shall be washed after the test with distilled water and dried at T< 50°C. Component may have reduced performance, but must still function properly. The allowable sensitivity difference shall not be greater than ±3dB from initial sensitivity.

2403-260-00001

5.5.4. Guided Free Fall Test - protected product

Parameter	Test Method and Conditions	Conditions / Sample size	Evaluation Standard
Mechanical shock (Ref. IEC60068-2-32 Ed), Procedure 1	Speaker in drop test box or representative mechanics from a height of 1.5m onto concrete floor.	30 units Two drops on each side (2x6) One drop on each edge (1x12) Two drops on each corner (2x8) (40 drops in total)	Component may have reduced performance, but must still function properly. The allowable sensitivity difference shall not be greater than ± 3 dB from initial sensitivity.

5.5.5. Random Free Fall Test (Tumble Test) – protected product

Parameter	Test Method and Conditions	Conditions / Sample size	Evaluation Standard
Impact durability (in a Tumble Tester) (Ref. IEC60068-2-32 Ed) (SPR a7.1.1)	Speaker in drop test box or representative mechanics. Random drops on steel base.	30 units 180 drops, 1m DUT power off	Component may have reduced performance, but must still function properly. The allowable sensitivity difference shall not be greater than ± 3 dB from initial sensitivity.

5.5.6. Resistance to Electrostatic Discharge

Parameter	Test Method and Conditions	Conditions / Sample size	Evaluation Standard
Resistance to ESD IEC61000-4-2 Level 4 (SPR c 2.5.1)	One pole is grounded and the ESD pulse is applied to the other pole. The speaker must be stressed first with one polarisation and then with the other polarisation. DUT must be discharged between each ESD exposure. Level 4: contact ± 8 kV, air ± 15 kV	10 exposures on each polarity / 5 units DUT Power off	All samples fully operable. All acoustical parameters according specification with tolerances increased by 50%.

2403-260-00001

6. Related Documents

IEC 268-5	Sound System equipment Part 5: Loudspeaker
IEC 68-2	Environmental testing
EN 60068-2	Environmental testing
ISO 2859 - 1	Sampling procedures for inspection by attributes Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection
ISO 3951	Sampling procedures and charts for inspection by variables for percent defectives.
ETS 300 019-2-1	Specification of environmental test: Storage Test spec. T 1.2: Weather protected, not temperature controlled storage locations
ETS 300 019-2-2	Specification of environmental test: Transportation Test spec. T 2.3: Public Transportation
ETS 300 019-2-5	Specification of environmental test: Ground vehicle installations Test spec. T 5.1: Protected installation
ETS 300 019-2-7	Specification of environmental test: Portable and non-stationary use Test spec. T 7.3E: Partly weather protected and non-weather protected locations

2403-260-00001

7. Change History

Status	Version	Date	ECR	Comment / Changes	Initials of owner
Obsolete	A	22.05.05		First release	
Obsolete	B	17.05.05	898	Second revision	
Obsolete	C	16.06.05	1011	Third revision	
Obsolete	D	11.07.05	1089	Change cover outer shape	MS
Obsolete	E	06.12.05	1453	Stamp print/resonance frequency diagram	AH
Obsolete	F	21.03.06	1612	Stamp/floating tolerance/test signal	AH
Obsolete	G	08.11.06	1738	Rebranding Philips to NXP	CP
Obsolete	H	01.02.10	2705	Dimensioning contact position/spring force curve	FL
Obsolete	I	29.03.10	2802	Update legal disclaimer/update logo and template	CP
Obsolete	J	08.06.10	2865	Update material list	CP
Obsolete	K	23.03.11	3062	Contact height tolerance/Migration to Knowles template	SA/CP
Obsolete	L	12.09.11	3298	Rephrase theory of operation/remove word "RA"	HB/CP
Release	M	09.07.12	3767	Publish document to newest template version	CP/RB/HB

8. Disclaimer

Stresses above the Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only. The device may not function when operated at these or any other conditions beyond those indicated under "Electrical and Acoustical Specifications". Exposure beyond those indicated under "Electrical and Acoustical Specifications" for extended periods may affect device reliability.

This product is not qualified for use in automotive applications

Frequency range for Telekom use

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