IEC 62604-1

Edition 1.0 2015-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Surface acoustic wave (SAW) and bulk acoustic wave (BAW) duplexers of assessed quality –
Part 1: Generic specification

Duplexeurs a ondes acoustiques de surface (OAS) et a ondes acoustiques de volume (OAV) sous assurance de la qualite –
Partie 1: Spécification générique

IEC 62604-1:2015-07(en-fr)

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FOREWORD

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International Standard IEC 62604-1 has been prepared by IEC technical committee 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection.

NOTE In this standard, SAW and BAW duplexers are treated simultaneously because both duplexers are used in the same manner especially in mobile phones and have the same requirements of characteristics, test method and so on.

The text of this standard is based on the following documents:

FDIS	Report on voting
49/1143/FDIS	49/1160/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62604 series, published under the general title: *Surface acoustic wave (SAW) and bulk acoustic wave (BAW) duplexers of assessed quality*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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SURFACE ACOUSTIC WAVE (SAW) AND BULK ACOUSTIC WAVE (BAW) DUPLEXERS OF ASSESSED QUALITY –

Part 1: Generic specification

1 Scope

This part of IEC 62604 specifies the methods of test and general requirements for SAW and BAW duplexers of assessed quality using either capability approval or qualification approval procedures.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at www.electropedia.org)

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-7, *Basic environmental testing procedures – Part 2-7: Tests – Test Ga and guidance: Acceleration, steady state*

IEC 60068-2-13, *Basic environmental testing procedures – Part 2-13: Tests – Test M: Low air pressure*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-17:1994, *Basic environmental testing procedures – Part 2-17: Tests – Test Q: Sealing*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-45, *Basic environmental testing procedures – Part 2-45: Tests – Test XA and guidance: Immersion in cleaning solvents*

IEC 60068-2-52, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60068-2-58, *Environmental testing – Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60068-2-64, *Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broad-band random and guidance*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60122-1, *Quartz crystal units of assessed quality – Part 1: Generic specification*

IEC 60617, *Graphical symbols for diagrams* (available at http://std.iec.ch/iec60617)

IEC 60642, *Piezoelectric ceramic resonators and resonator units for frequency control and selection – Chapter I: Standard values and conditions – Chapter II: Measuring and test conditions*

IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 60749-28[1], *Semiconductor devices – mechanical and climatic test methods – Part 28: Electrostatic Discharge (ESD) Sensitivity testing direct contact charged device model (DC-CDM)*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61340-3-1, *Electrostatics – Part 3-1: Methods for simulation of electrostatic effects – Human body model (HBM) electrostatic discharge test waveforms*

IEC 61340-3-2, *Electrostatics – Part 3-2: Methods for simulation of electrostatic effects – Machine model (MM) electrostatic discharge test waveforms*

IEC 62761, *Guidelines for the measurement method of nonlinearity for surface acoustic wave (SAW) and bulk acoustic wave (BAW) devices in radio frequency (RF)*

IEC 80000 (all parts), *Quantities and units*

ISO 80000 (all parts), *Quantities and units*

3 Terms, definitions, units and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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1 To be published.

3.1.1 General terms

3.1.1.1
surface acoustic wave
SAW
acoustic wave, propagating along a surface of an elastic material, whose amplitude decays exponentially with the depth

[SOURCE: IEC 60862-1:2003, 2.2.1.1, modified — In the definition, "elastic substrate" has been replaced with "elastic material" and "substrate depth" has been replaced with "the depth".]

3.1.1.2
surface acoustic wave filter
SAW filter
filter characterized by one or more surface acoustic wave transmission line or resonant elements, where the surface acoustic wave is usually generated by an interdigital transducer and propagates along a material surface

[SOURCE: IEC 60862-1:2003, 2.2.1.2, modified]

3.1.1.3
bulk acoustic wave
BAW
acoustic wave, propagating inside an elastic material and then traversing the entire thickness of the bulk

3.1.1.4
bulk acoustic wave filter
BAW filter
filter characterized by a bulk acoustic wave which is usually generated by a pair of electrodes and propagates along a thickness direction

3.1.1.5
film bulk acoustic resonator
FBAR
thin film BAW resonator consisting of a piezoelectric layer sandwiched between two electrode layers with stress-free top and bottom surface supported mechanically at the edge on a substrate with cavity structure as shown in Figure 1 or membrane structure as an example

Note 1 to entry: This note applies to the French language only.

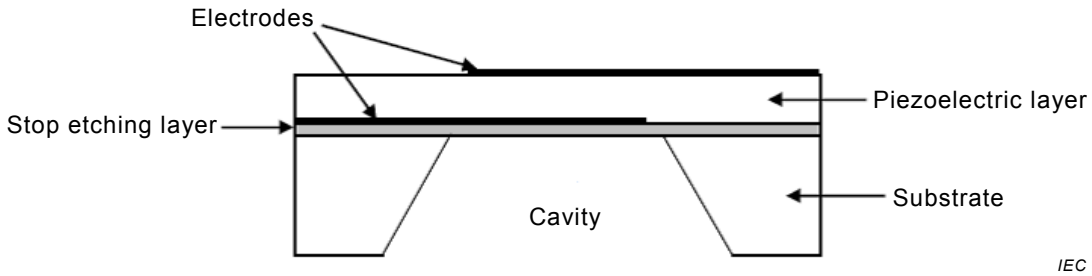

Figure 1 – FBAR configuration

3.1.1.6
solidly mounted resonator
SMR
BAW resonator, supporting the electrode/piezoelectric layer/electrode structure by a sequence of additional thin films of alternately low and high acoustic impedance with quarter

wavelength layer, these layers acting as acoustic reflectors and decoupling the resonator acoustically from the substrate, as shown in Figure 2 as an example

Note 1 to entry: This note applies to the French language only.

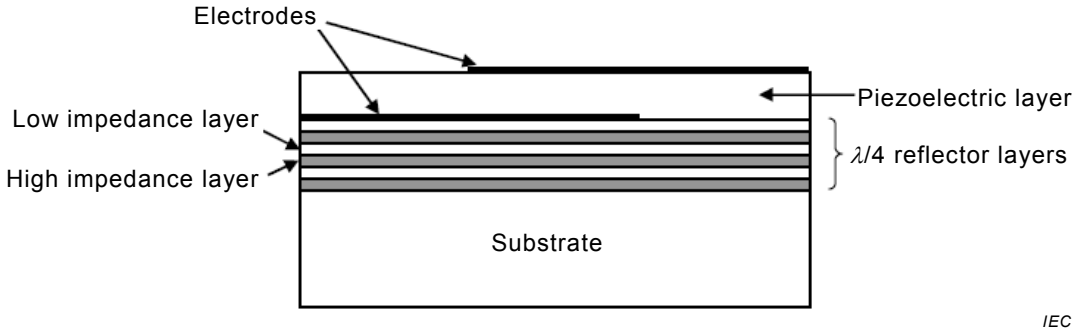

Figure 2 – SMR configuration

3.1.2 Response characteristics related terms

3.1.2.1
reference frequency
frequency defined by the specification to which other frequencies may be referred

[SOURCE: IEC 60862-1:2003, 2.2.2.3]

3.1.2.2
insertion attenuation
logarithmic ratio of the power delivered directly to the load impedance before insertion of the duplexer to the power delivered to the load impedance after insertion of the duplexer

[SOURCE: IEC 60862-1:2003, 2.2.2.6, modified — In the definition, "filter" has been replaced with "duplexer".]

3.1.2.3
nominal insertion attenuation
insertion attenuation at a specified reference frequency

[SOURCE: IEC 60862-1:2003, 2.2.2.7]

3.1.2.4
relative attenuation
difference between the attenuation at a given frequency and the attenuation at the reference frequency

[SOURCE: IEC 60862-1:2003, 2.2.2.8]

3.1.2.5
pass band
band of frequencies in which the relative attenuation is equal to or less than a specified value

[SOURCE: IEC 60862-1:2003, 2.2.2.9]

3.1.2.6
pass bandwidth
separation of frequencies between which the relative attenuation is equal to or less than a specified value

[SOURCE: IEC 60862-1:2003, 2.2.2.10]

3.1.2.7
pass band ripple
maximum variation in attenuation characteristics within a specified pass band

[SOURCE: IEC 60862-1:2003, 2.2.2.11]

3.1.2.8
minimum insertion attenuation
minimum value of insertion attenuation in the pass band

[SOURCE: IEC 60862-1:2003, 2.2.2.13]

3.1.2.9
maximum insertion attenuation
maximum value of insertion attenuation in the pass band

[SOURCE: IEC 60862-1:2003, 2.2.2.14]

3.1.2.10
stop band
band of frequencies in which the relative attenuation is equal to or greater than a specified value

[SOURCE: IEC 60862-1:2003, 2.2.2.15]

3.1.2.11
stop bandwidth
separation of frequencies between which the relative attenuation is equal to or greater than a specified value

[SOURCE: IEC 60862-1:2003, 2.2.2.16]

3.1.2.12
stop band rejection
minimum relative attenuation at a specified stop band

3.1.2.13
group delay
time equal to the first derivative of the phase shift, in radians, with respect to the angular frequency

[SOURCE: IEC 60862-1:2003, 2.2.2.18]

3.1.2.14
trap frequency
specified frequency at which the relative attenuation is equal to or greater than a specified value

[SOURCE: IEC 60862-1:2003, 2.2.2.21]

3.1.2.15
trap attenuation
relative attenuation at a specified trap frequency

[SOURCE: IEC 60862-1:2003, 2.2.2.22]

3.1.2.16
transition band
band of frequencies between the cut-off frequency and the nearest point of the adjacent stop band

[SOURCE: IEC 60862-1:2003, 2.2.2.23]

3.1.2.17
reflectivity
dimensionless measure of the degree of mismatch between two impedances Z_a and Z_b:

$$\frac{Z_a - Z_b}{Z_a + Z_b},$$

where Z_a and Z_b represent, respectively, the input and source impedance or the output and load impedance

Note 1 to entry: The absolute value of reflectivity is called the reflection coefficient.

3.1.2.18
return attenuation
value of the reflection coefficient given by the sign changed expression in decibels:

$$-20 \log \left| \frac{Z_a - Z_b}{Z_a + Z_b} \right| \text{ dB}$$

[SOURCE: IEC 60862-1:2003, 2.2.2.25, modified]

3.1.2.19
input level
power, voltage or current value applied to the input port of a duplexer

[SOURCE: IEC 60862-1:2003, 2.2.2.29, modified — In the definition, "input terminal pair of a filter" has been replaced with "input port of a duplexer".]

3.1.2.20
output level
power, voltage or current value delivered to the load circuit

[SOURCE: IEC 60862-1:2003, 2.2.2.30, modified — In the definition, "load" has been replaced with "load circuit".]

3.1.2.21
nominal level
power, voltage or current value at which the performance measurement is specified

[SOURCE: IEC 60862-1:2003, 2.2.2.31]

3.1.2.22
input impedance
impedance presented by the duplexer to the signal source when the output is terminated by a specified load impedance

[SOURCE: IEC 60862-1:2003, 2.2.2.32, modified — In the definition, "filter" has been replaced with "duplexer".]

3.1.2.23
output impedance
impedance presented by the duplexer to the load when the input is terminated by a specified source impedance

[SOURCE: IEC 60862-1:2003, 2.2.2.33, modified — In the definition, "filter" has been replaced with "duplexer".]

3.1.2.24
terminating impedance
impedance presented to the duplexer by the source or by the load

[SOURCE: IEC 60862-1:2015, 3.1.2.35, modified — In the definition, "filter" has been replaced with "duplexer".]

3.1.2.25
operating temperature range
range of temperatures, over which the SAW or BAW duplexer will function while maintaining its specified characteristics within specified tolerances

[SOURCE: IEC 60862-1:2003, 2.2.2.37, modified — In the definition, "SAW filter" has been replaced with "SAW or BAW duplexer".]

3.1.2.26
intermodulation distortion
IMD

non-linear distortion of a device response characterized by the appearance of frequencies at the output which is equal to the differences (or sums) of integral multiples of the two or more component frequencies present at the input

[SOURCE: IEC 60862-1:2003, 2.2.2.41, modified — The abbreviation "IMD" has been added. In the definition, "SAW transducer or filter" has been replaced with "device".]

Note 1 to entry: This note applies to the French language only.

3.1.2.27
duplex image frequency
f_{DIM}
undesired input frequency that is converted to the receiving frequency (f_R) by subtracting it from twice the transmitting frequency ($2f_T$)

$$f_{DIM} = 2f_T - f_R$$

3.1.2.28
isolation
isolation from TX port to RX port
leakage power ratio from the TX port to the RX port in a duplexer

Note 1 to entry: Figure 3c gives an example of isolation response.

3.1.2.29
guard band
unused part of the radio spectrum between radio bands, for the purpose of preventing interference