IEC 62575-1

Edition 1.0 2015-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Radio frequency (RF) bulk acoustic wave (BAW) filters of assessed quality – Part 1: Generic specification

Filtres radiofréquences (RF) à ondes acoustiques de volume (OAV) sous assurance de la qualité – Partie 1: Spécification générique

IEC 62575-1:2015-10(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 31.140

ISBN 978-2-8322-2969-9

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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RADIO FREQUENCY (RF) BULK ACOUSTIC WAVE (BAW) FILTERS OF ASSESSED QUALITY –

Part 1: Generic specification

FOREWORD

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

FDIS	Report on voting
49/1163/FDIS	49/1169/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 62575, published under the general title *Radio frequency (RF) bulk acoustic wave (BAW) filters 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 web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,
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INTRODUCTION

RF BAW filters are now widely used in mobile communications. While the RF BAW filters have various specifications, many of them can be classified within a few fundamental categories.

Standard specifications, given in the IEC 62575 series, and national specifications or detail specifications issued by manufacturers, define the available combinations of nominal frequency pass bandwidth, ripple, shape factor, terminating impedance, etc. These specifications are compiled to include a wide range of RF BAW filters with standardized performances. It cannot be over-emphasized that the user should, wherever possible, select his RF BAW filters from these specifications, when available, even if it may lead to making small modifications to his circuit to enable standard filters to be used. This applies particularly to the selection of the nominal frequency.

This standard has been compiled in response to a generally expressed desire on the part of both users and manufacturers for guidance on the use of RF BAW filters, so that the filters may be used to their best advantage. To this end, general and fundamental characteristics have been explained in this part of IEC 62575.

It is not the aim of this standard to explain theory, nor to attempt to cover all the eventualities which may arise in practical circumstances. This standard draws attention to some of the more fundamental questions, which should be considered by the user before he places an order for an RF BAW filter for a new application. Such a procedure will be the user's insurance against unsatisfactory performance.

RADIO FREQUENCY (RF) BULK ACOUSTIC WAVE (BAW) FILTERS OF ASSESSED QUALITY –

Part 1: Generic specification

1 Scope

This part of IEC 62575 specifies the methods of test and general requirements for RF BAW filters of assessed quality using either capability approval or qualification approval procedures. Conventional crystal filters standardized in the IEC 60368 series are not covered by this standard.

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 60050-561, *International Electrotechnical Vocabulary (IEV) – Part 561: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection* (available at http: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 environment test procedures – Part 2-17:Tests –Test Q: Sealing*

IEC 60068-2-21, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

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

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*

ISO 80000-1, *Quantities and units – Part 1: General*

3 Terms, definitions, units and symbols

3.1 Terms and definitions

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

3.1.1
bulk acoustic wave
BAW
acoustic wave, propagating between the top and bottom surface of a piezoelectric structure and then traversing the entire thickness of the piezoelectric bulk

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[1] To be published.

Note 1 to entry: The wave is excited by metal electrodes attached to both sides of the piezoelectric layer.

[SOURCE: IEC 62604-1:2015, 3.1.1.3 – modified, modification of the entire definition and addition of a note to entry]

3.1.2
bulk acoustic wave filter
BAW filter
filter characterised by a bulk acoustic wave which is usually generated by a pair of electrodes and propagates along a thin film thickness direction

[SOURCE: IEC 62604-1:2015, 3.1.1.4]

3.1.3
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.

[SOURCE: IEC 62604-1:2015, 3.1.1.5, modified]

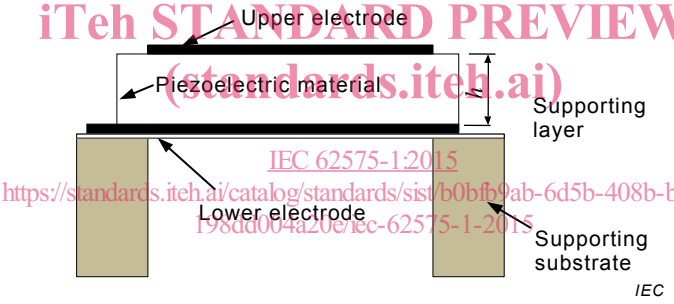

Figure 1a) – Back-side etched

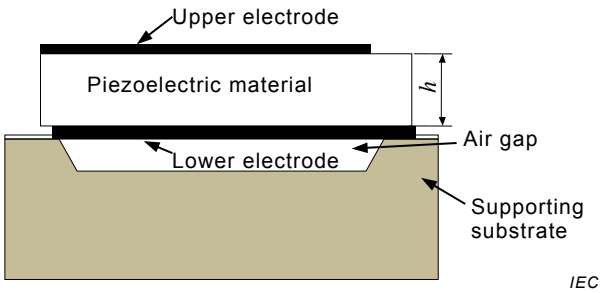

Figure 1b) – Front-side etched

Figure 1 – FBAR configuration

3.1.4
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 Z_a with quarter wavelength layer, and these layers act as acoustic reflectors and decouple 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.

[SOURCE: IEC 62604-1:2015, 3.1.1.6, modified]

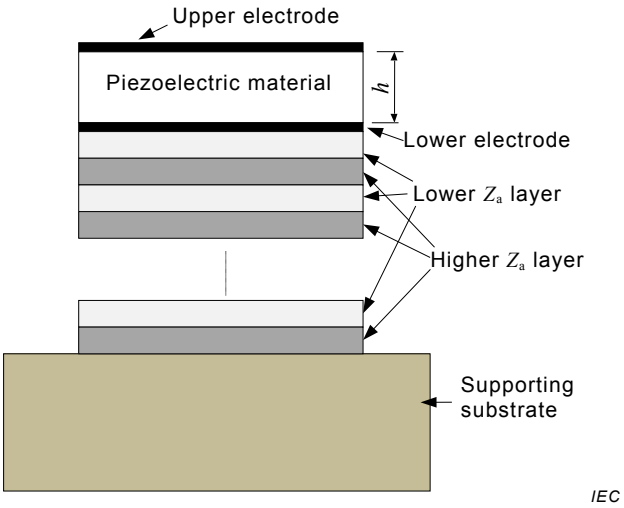

Figure 2 – SMR configuration

3.1.5
response characteristics
frequency response of BAW filters

SEE: Figure 3.

3.1.6
cut-off frequency

frequency of the pass-band at which the relative attenuation reaches a specified value

[SOURCE: IEC 60862-1:—, 3.1.2.4]

3.1.7
input impedance
impedance presented by the filter to the signal source when the output is terminated by a specified load impedance

[SOURCE: IEC 62604-1:2015, 3.1.2.22, modified – "duplexer" has been replaced by "filter".]

3.1.8
input level
power, voltage or current value applied to the input terminal pair of a filter

[SOURCE: IEC 62604-1:2015, 3.1.2.19, modified – "input port of a duplexer" has been replaced by "input terminal pair of a filter"]

3.1.9
insertion attenuation
logarithmic ratio of the power delivered directly to the load impedance before insertion of the filter to the power delivered to the load impedance after insertion of the filter

[SOURCE: IEC 62604-1:2015, 3.1.2.2– "duplexer" has been replaced by "filter"]

3.1.10
inter-modulation
unnecessary amplitude modulation of signals containing some different frequencies in a filter with nonlinearities

3.1.11
maximum insertion attenuation
maximum value of insertion attenuation in the pass band

[SOURCE: IEC 62604-1:2015, 3.1.2.9]

3.1.12
minimum insertion attenuation
minimum value of insertion attenuation in the pass band

[SOURCE: IEC 62604-1:2015, 3.1.2.8]

3.1.13
nominal insertion attenuation
insertion attenuation at a specified reference frequency

[SOURCE: IEC 62604-1:2015, 3.1.2.3]

3.1.14
nominal level
power, voltage or current value at which the performance measurement is specified

[SOURCE: IEC 62604-1:2015, 3.1.2.21]

3.1.15
operable temperature range
range of temperatures, over which the BAW filter shall continue to provide its specified response characteristics, though not necessarily within the specified tolerances

[SOURCE: IEC 60862-1:—, 3.1.2.40, modified – "SAW filter" has been replaced by "BAW filter".]

3.1.16
operating temperature range
range of temperatures, over which the BAW filter will function while maintaining its specified characteristics within specified tolerances

[SOURCE: IEC 62604-1:2015, 3.1.2.25, modified – "SAW or BAW duplexer" has been replaced by "BAW filter".]

3.1.17
output impedance
impedance presented by the filter to the load when the input is terminated by a specified source impedance

[SOURCE: IEC 62604-1:2015, 3.1.2.23, modified – "duplexer" has been replaced by "filter".]

3.1.18
output level
power, voltage or current value delivered to the load

[SOURCE: IEC 62604-1:2015, 3.1.2.20, modified – "load circuit" has been replaced by "load"]

3.1.19
pass band
band of frequencies in which the relative attenuation is equal to or less than a specified value

[SOURCE: IEC 62604-1:2015, 3.1.2.5]

3.1.20
pass bandwidth
separation of frequencies between which the relative attenuation is equal to or less than a specified value

[SOURCE: IEC 62604-1:2015, 3.1.2.6]

3.1.21
pass band ripple
maximum variation in attenuation characteristics within a specified pass band

[SOURCE: IEC 62604-1:2015, 3.1.2.7]

3.1.22
reference frequency
frequency defined by the specification to which other frequencies may be referred

[SOURCE: IEC 62604-1:2015, 3.1.2.1]

3.1.23
reflectivity
dimensionless measure of the degree of mismatch between two impedances Z_a and Z_b , i.e.,

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

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

[SOURCE: IEC 62604-1:2015, 3.1.2.17]

3.1.24
relative attenuation
difference between the attenuation at a given frequency and the attenuation at the reference frequency

[SOURCE: IEC 62604-1:2015, 3.1.2.4]

3.1.25
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 62604-1:2015, 3.1.2.18]