

HAL SAW Devices

S. Tanaka Lab

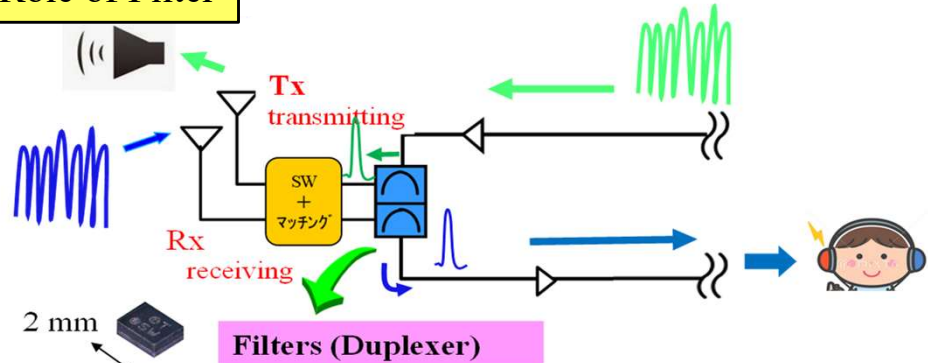
HAL: hetero acoustic layer
SAW: surface acoustic wave

Smart Phone

Many filters are used

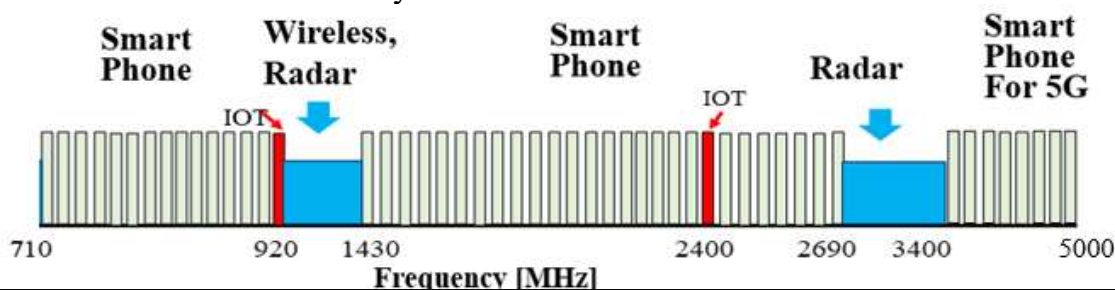


Role of Filter



Current Frequency arrangement 710 to 5 GHz

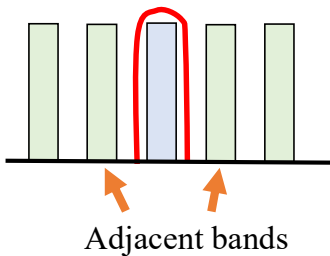
Bands for Smart Phones are busy because of bands more than 80



Following 3 properties are required for filter in addition to size and insertion loss

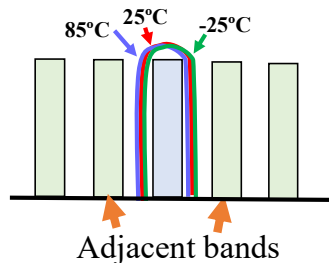
(1) better steepness

No interference from adjacent bands



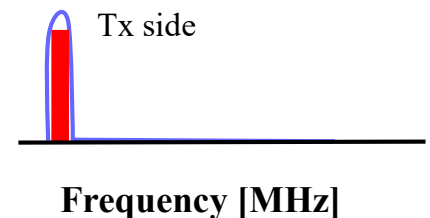
(2) excellent temperature property

No frequency shift due to temperature change

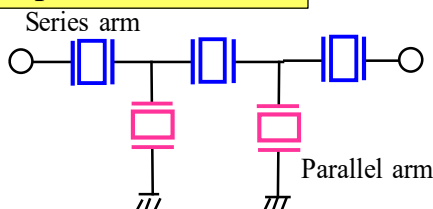


(3) spurious free out of band

No interference from other bands



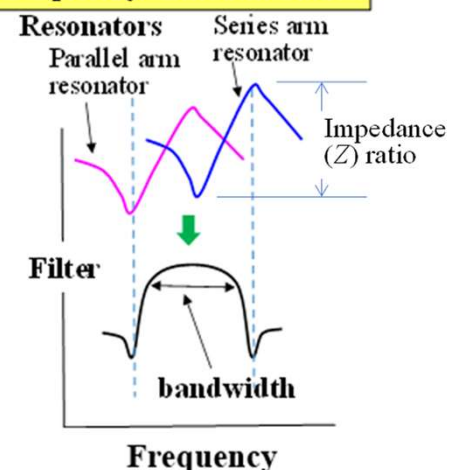
Principle of ladder filter



Factors required for SAW resonator

High impedance (Z) ratio (high Q)
Excellent temperature coefficient (TCF)
Spurious free

Frequency characteristic



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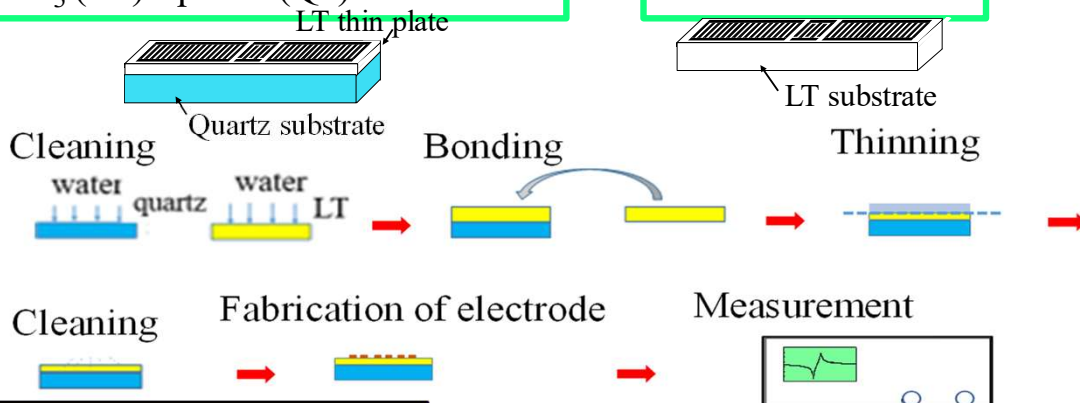
➤ **Patents: 3 patents**

Structure

LiTaO₃ (LT)/ quartz (Qz) HAL SAW

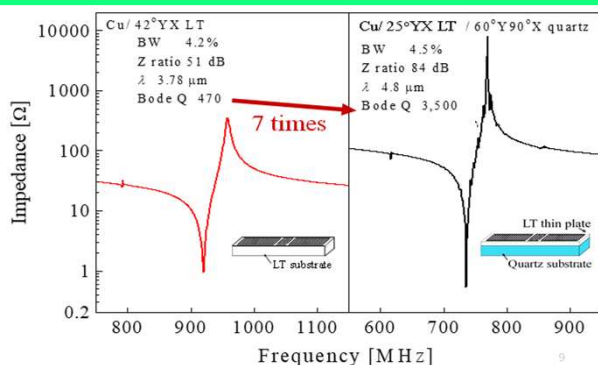
Standard LT SAW

Fabrication process

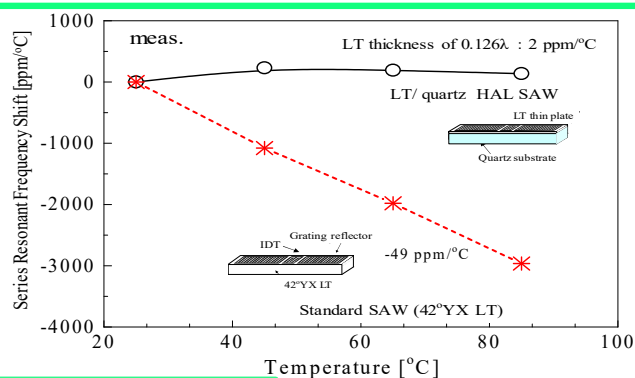


Frequency characteristics of SAW resonator

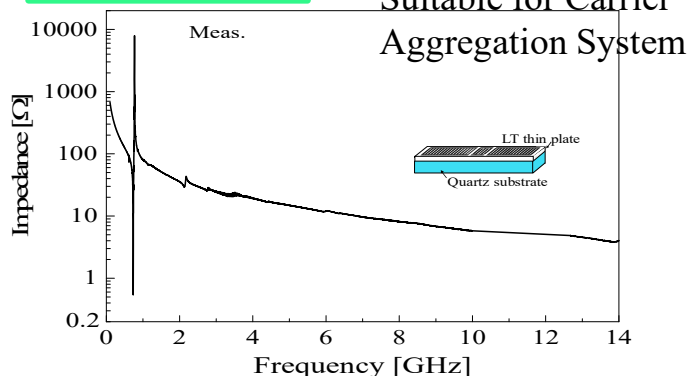
33 dB higher Z ratio & 7 times higher Q



1/ 25 smaller frequency shift (low TCF)



Spurious free

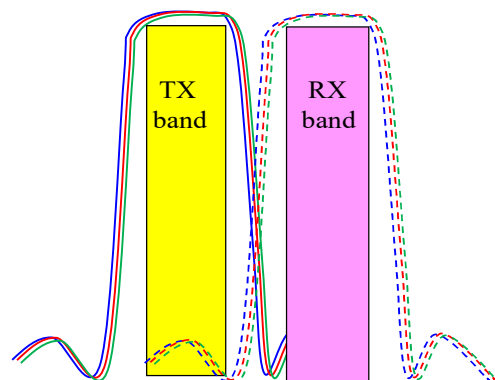


Frequency characteristics of ladder filter

HAL SAW filter

- Low insertion loss
- Steepness
- No frequency shift due to temp. change
- No interference due to adjacent bands

— : 85°C, - - : 25°C, - · - : -25°C



Standard SAW

- Large insertion loss
- No steepness
- Large frequency shift due to temp. change
- Large interference due to adjacent bands

— : 85°C, - - : 25°C, - · - : -25°C

