

Antenna Tuning progress and SOI Single Chip integration for 4G/5G UE

Hidetoshi Kawasaki
Sony Semiconductor Solutions Corp.

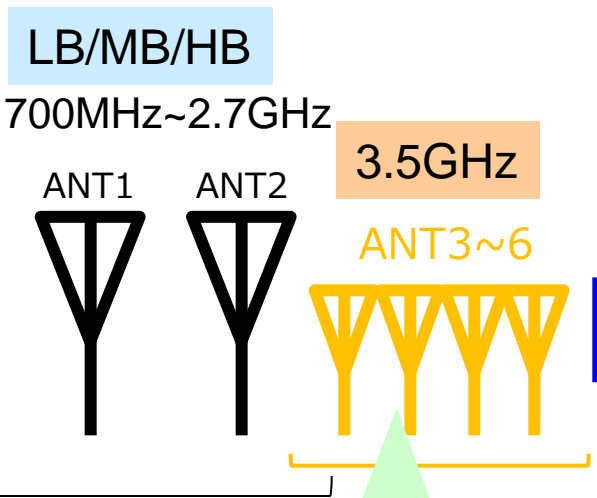
2017 International RF-SOI Workshop; September 27, 2017

4G/5G(Sub-6GHz) UE Antenna configuration for Carrier Aggregation and MIMO

Antenna Tuning Device

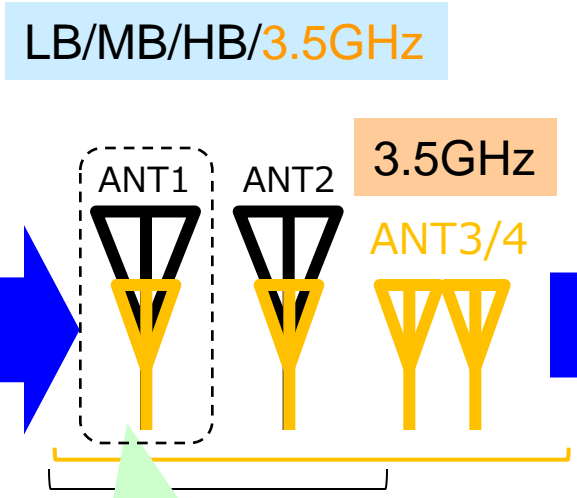
4G/5G Sub-6GHz Antenna Configuration for CA and MIMO

Configuration 1



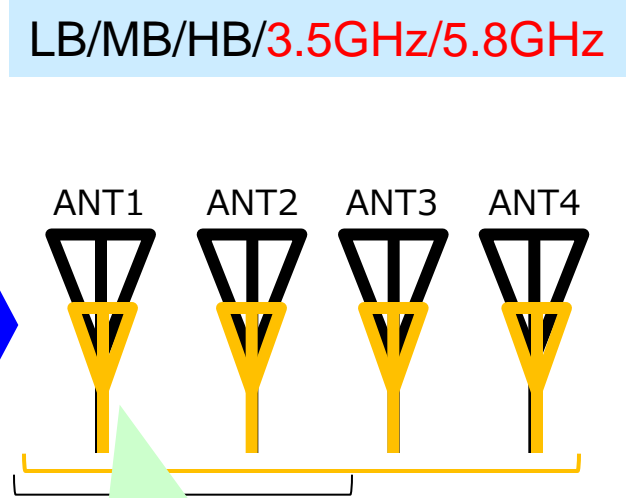
Dedicated Antenna for 3.5GHz 4x4MIMO

Configuration 2



Partially merge for 3.5GHz 4x4 MIMO

Configuration 3

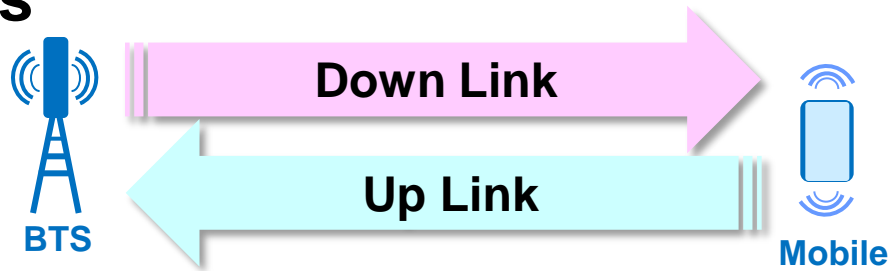


Support 3.5GHz 4x4 MIMO + 5G(Sub-6GHz)

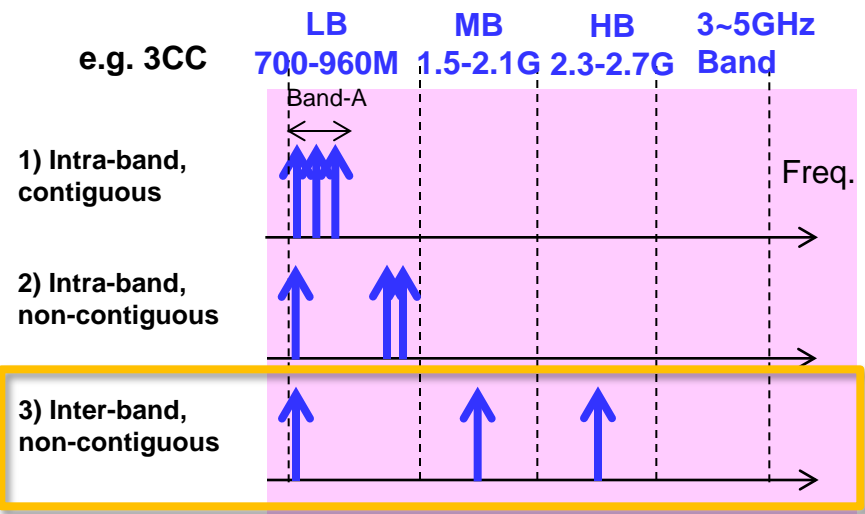
Antenna Tuning Device

Carrier Aggregation Features

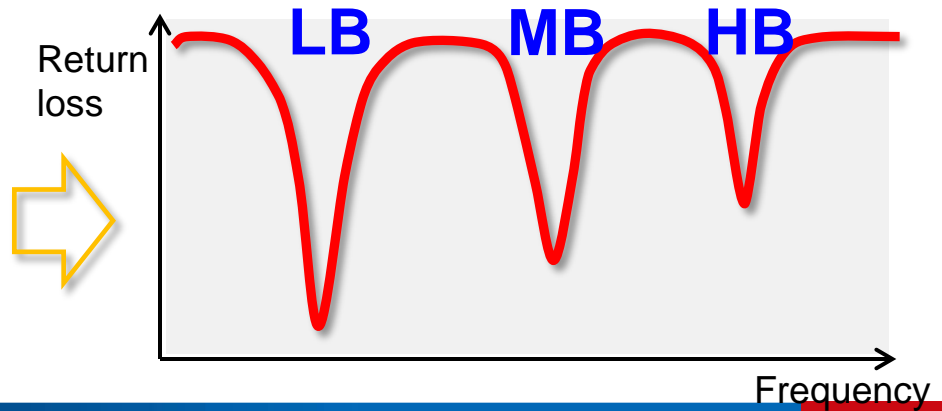
Carrier aggregation will come, need **simultaneous TRx** and to **apply multi band**.



Cases, Band combination of Carrier Aggregation



Wide-Rang Antenna are necessary

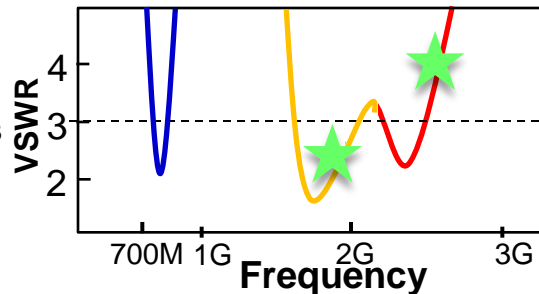
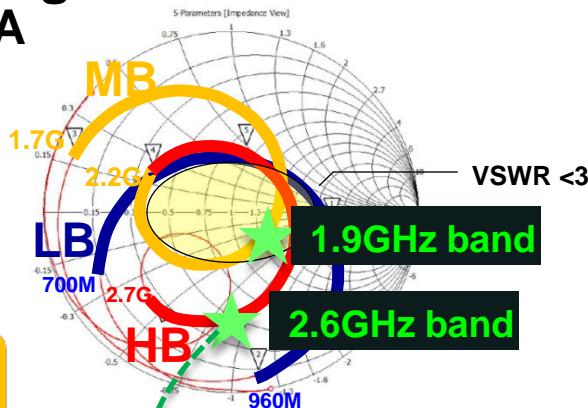
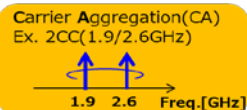
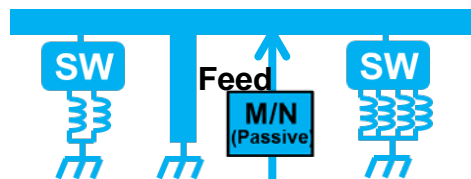


Antenna Tuning Device

Aperture + Impedance Tuning to Inverted-F Antenna for CA

Actual Multi-band active-IFA

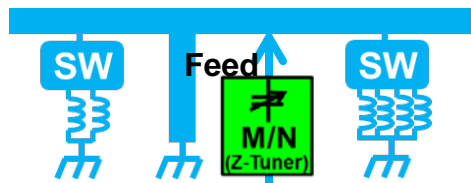
(Aperture tuning applied)



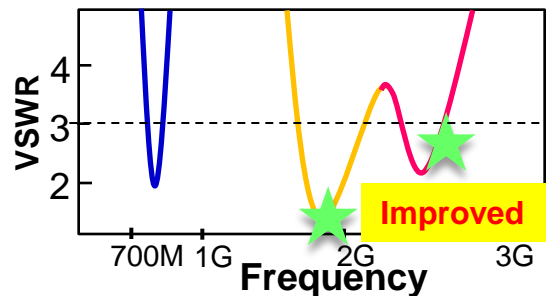
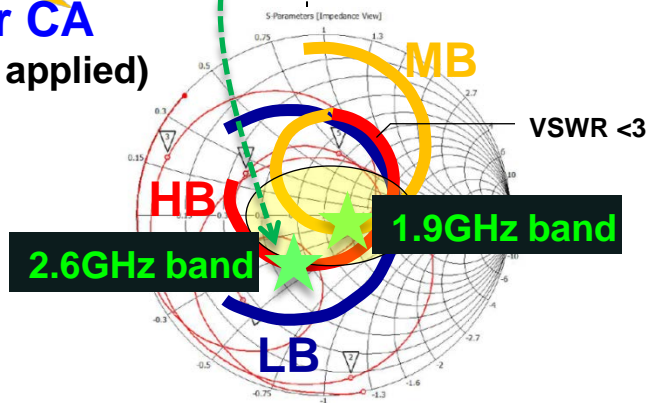
VSWR=1.5 @ 1.9GHz [dB]
VSWR=4.0 @ 2.6GHz [dB]

Multi-band active-IFA for CA

(Aperture & Impedance Tuning applied)



* Z-Tuner:
Impedance tuner

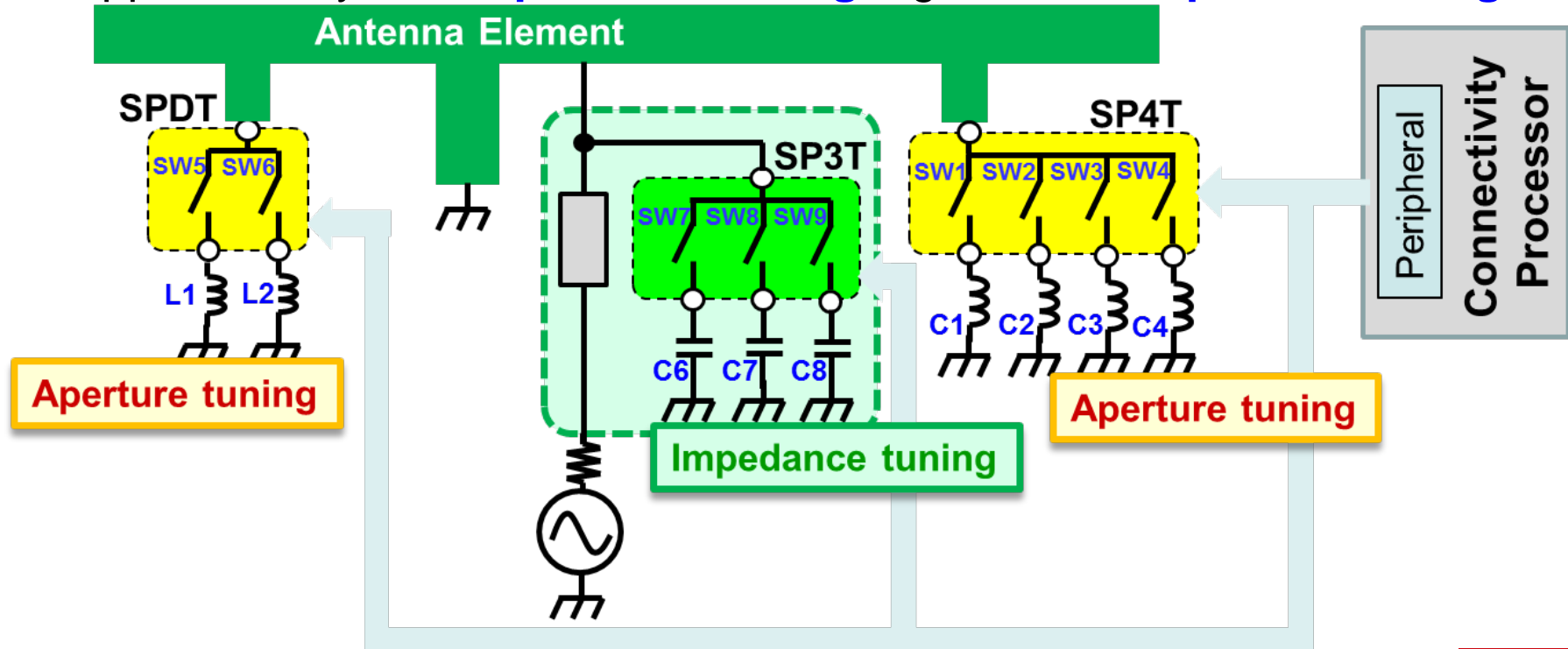


VSWR=1.3 @ 1.9GHz [dB]
VSWR=2.7 @ 2.6GHz [dB]

Sony's Antenna Tuning Device

Antenna Tuning Idea for Carrier Aggregation

For realizing wide-band antenna for CA, it is also a proposal to supplementary use **Impedance tuning** together with **Aperture tuning**.



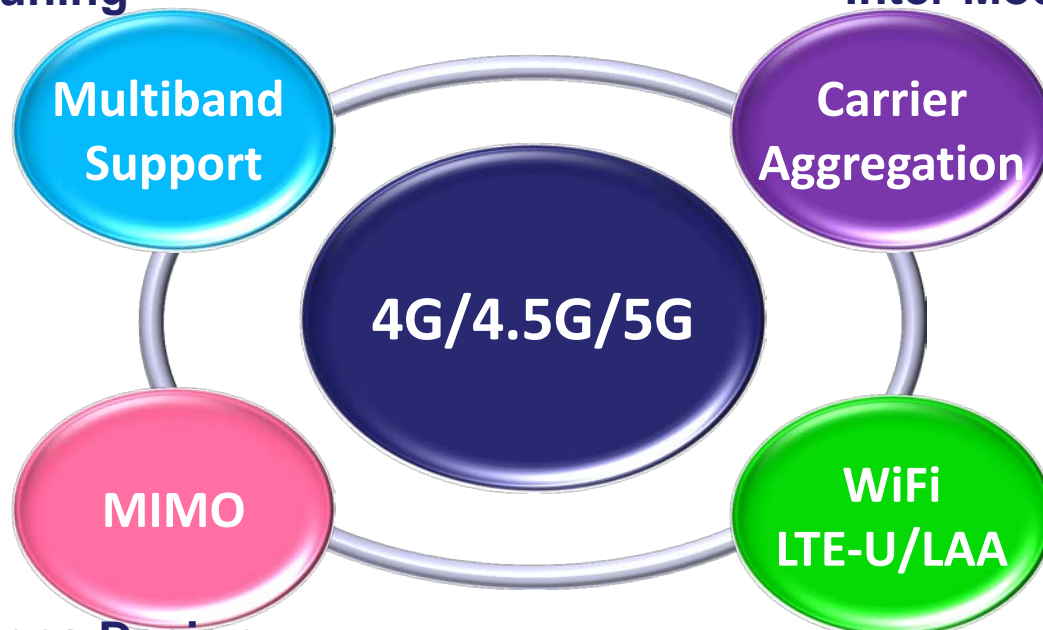
Sony's 5G Idea

Wide Band Antenna Efficiency

- Antenna Swapping
- Antenna Tuning

High Linearity

- Harmonics
- Inter Modulated Distortion



Smaller Antenna Design

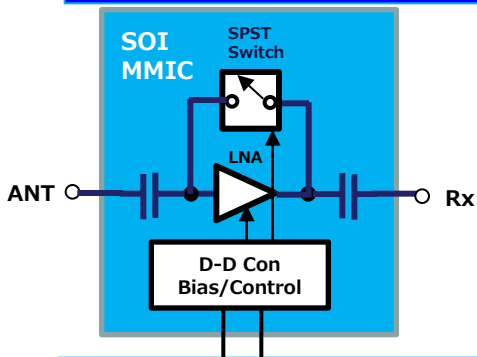
- Multi Port IC
- Antenna Tuning

Higher Frequency

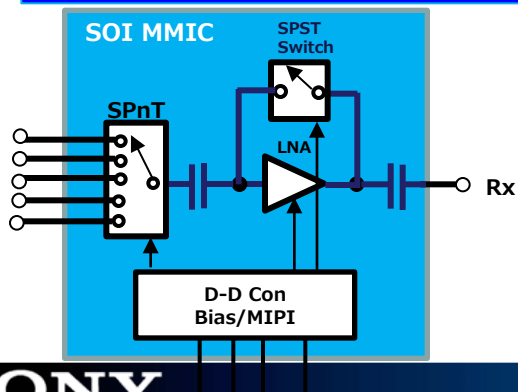
- up to 3.8GHz/5.85GHz

Sony's 5G Idea

4G/5G Sub-6GHz
LNA with Bypass SW



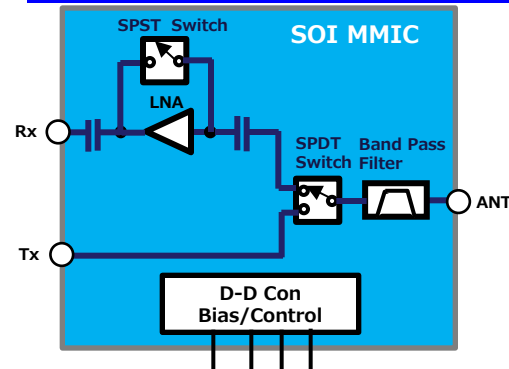
4G/5G Sub-6GHz
LNA + Multi ports SW



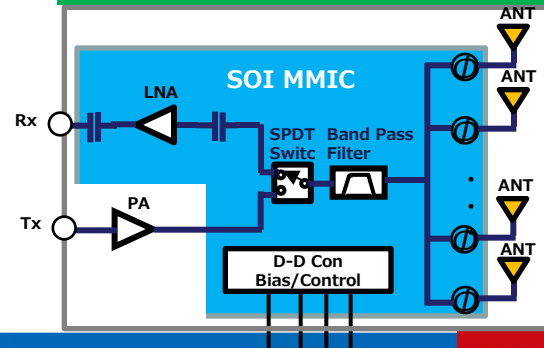
High Performance &
Small Size

SOI
Single chip
technology

4G/5G Sub-6GHz
LNA+SW+Filter FEM



5G Millimeter wave
LNA+SW+Filter+PS(+ANT)



Conclusion

- Antenna Tuning usage increase

MIMO / CA makes Antenna configuration complex and its covering frequency wide. Both aperture and impedance Antenna Tuning devices are required.

- Unique RF-SOI technology

With Sony's in-house high power handling SOI, antenna tuning devices can reach superior performance and small size.

- Integration vertically and horizontally

Combining RF-FE function blocks into SOI single chip technology, Sony will be able to support future 5G requirement.

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