Microwave Developments for new AESAs

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Instructors:

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Tutorial abstract:

Modern defense systems mainly rely on AESAs - Active Electronically Steerable Antenna. They can be integrated into different equipment's such as Airborne Radars for air combat or for surveillance (for instance on Rafale plane), Electronic Warfare systems, Jammers or even missile Seekers, and also ground and naval platforms.

A Transmit and Receive Module (TRM) of an AESA is composed of:

- A transmit channel with a microwave High Power Amplifier (HPA)
- A receive channel with a Low Noise Amplifier (LNA) and a Limitor circuit to protect the receive channel
- A common part, with a passive or active duplexer, close to the radiating element, and the phase shifters-attenuators for the control of the beam steering (core chip)

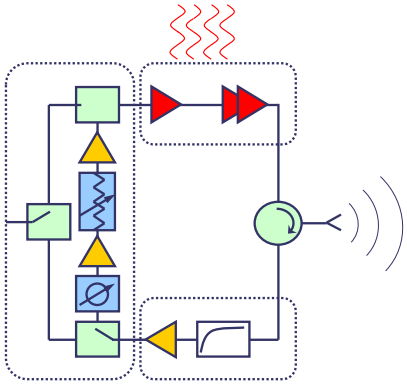

Figure 1: Example of a block diagram for an AESA T/R module

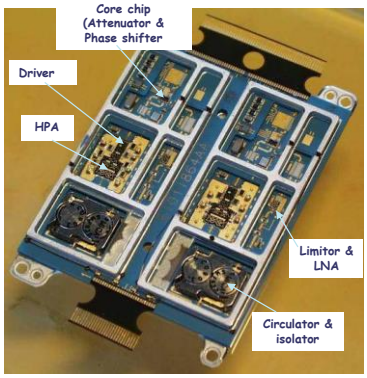

Figure 2: Example of an X band T/R module

Even if these elements are different by nature and means of implementation, they share all the same need to optimize the SWaP-C (*Size Weight and Power - Cost*) :

1. To limit the size and to maximize the use of the volume for other components or functions
2. To reduce the weight, allowing to increase the duration of the mission
3. To minimize power consumption, increasing the autonomy of the platform
4. Finally to reduce the cost and increase the domains of use of the system and technologies.

For instance, Radar sensors will have to keep functional performances in more and more complex and harsh environments. This need push technologies towards new technical solutions such as wide band multifunction front-ends or increasing digitalization.

The development of new sensors generations must be correlated with the improvement of major technical points:

- A better thermal management,
- An increase of the power supplied by the platform,
- An improvement of the power added efficiency of the HPA,
- Better technologies solutions of interconnection and "packaging".

Finally, every component and packaging of TRMs shall be able to rely on a sovereign supply chain, because production quantities are low in defense applications, compared to telecommunications for instance.

Tutorial Outline:

- Antenna architectures : brick or tile
- T/R Modules
- Components : GaAs , GaN , SiGe ,MEMS
- Packaging 2D ,3D
- Developments and products
- Perspectives

Biography Daniel CABAN-CHASTAS:

Daniel CABAN-CHASTAS joined Thales in 2001, after graduated in electronics and microwave systems. He started as a microwave engineer working on high frequency packaging design and test. After few years on advanced packaging design, he contributed to the development of the microwave key components for Thales Airborne Systems business segments and participated to the definition of T/R-modules for the RBE2.

He became in 2014 architect on AESA hardware development for Airborne's radar and multifunction antenna application.

Since 2020, he is senior technical manager for components and T/R modules for radar's AESA in the Hardware Competence Center from Thales DMS France.

Biography Yves MANCUSO :

Yves MANCUSO received the Dipl.-Ing degree from the « Ecole Nationale Supérieure de Génie Physique de Grenoble », Grenoble, France.

In 1981 he joined Thales, he was in charge of different technical and technological developments for T/R modules (MMICs, packaging, antennas),

Then, he was the "Phased Array Antennas and T/R modules" Design Authority for Thales DMS, including airborne and space applications for Radar, Electronic Warfare and multifunctions systems; also manager of the new microwave research and development for hardware, including GaN components, microwave circuits, antennas and technologies.

He has organized at EDA (European Defence Agency) European programs like KORRIGAN and MAGNUS about the GaN technology .

He is today an expert in the microwave domain.