IEEE SSCS Switzerland Chapter Hosts Distinguished Lecture on Mixed-Signal Technologies for Ultrawideband Signal Processing Systems

The IEEE Solid-State Circuits Society (SSCS) Switzerland Chapter organized a Distinguished Lecture on 10 September 2020. Dr. Gabriele Manganaro discussed mixed-signal technologies for ultrawideband signal processing systems. The event took place online via WebEx services provided by IEEE to local Chapters. Advertised via IEEE eNotice [1], the program attracted 17 SSCS Switzerland Chapter members.

The Chapter's first-quarter program covered communication circuits and explored methods to bridge artificial intelligence (AI) and 5G networks, demonstrating circuit techniques to leverage AI for the safe and energy-efficient use of millimeter-wave (mm-wave) beamforming [2]. That event included a Distinguished Lecture about the circuit techniques' evolution of radio-frequency ICs for cellular communication, given by Dr. Venumadhav Bhagavatula, a senior manager at Samsung Semiconductor [3]. As the industry moves forward with high-data-rate, low-latency wireless networks, it will be critical to observe the implications for base stations and other infrastructure equipment, and that was the motivation for our invitation to Manganaro to lecture. The presentation was divided into six parts, including the impetus for ultrawideband signal processing systems, the CMOS process, analog-to-digital converter (ADC) architectures, systems on chip (SoCs) and systems in a package for mixed-signal technology, algorithmic system-level linearization, and key takeaways.

The demand for ultrawideband data acquisition and real-time processing systems handling analog signals in the gigahertz range comes from applications in high-performance

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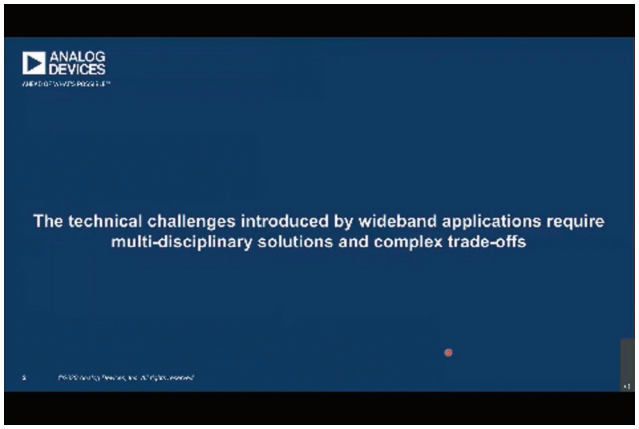
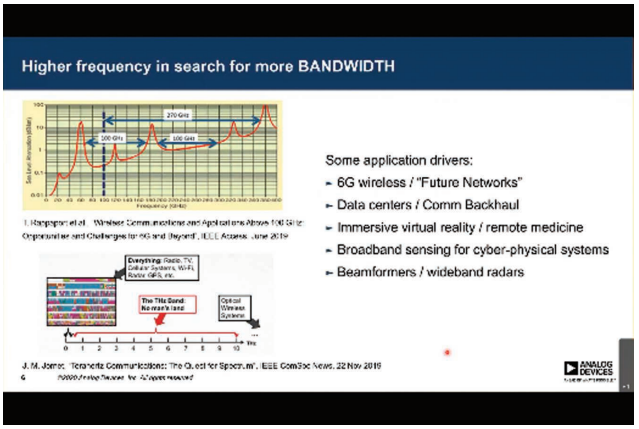
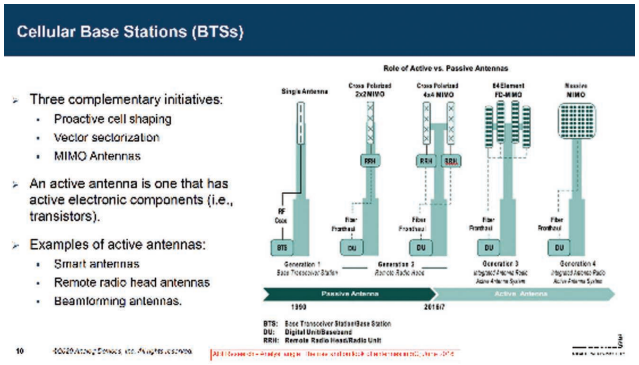


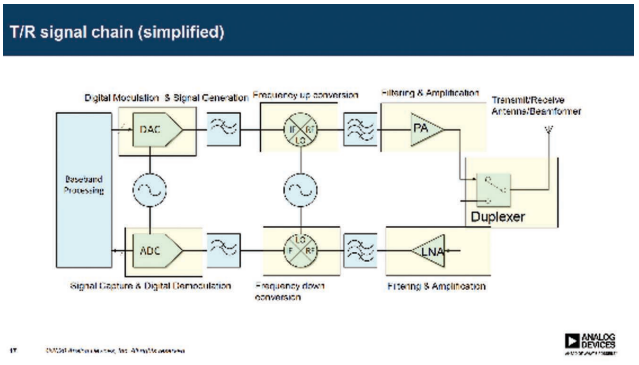
A key take-away from Dr. Manganaro's Distinguished Lecture.



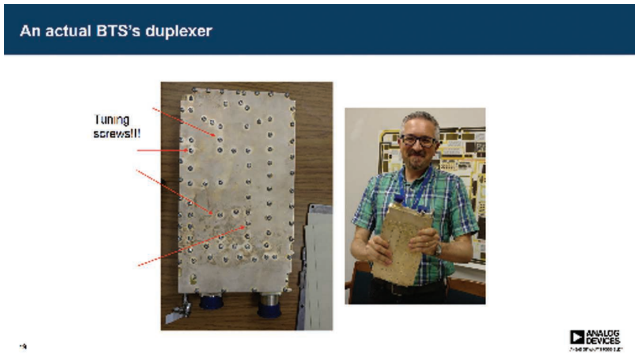
The motivation behind wideband systems in the mm-wave domain.



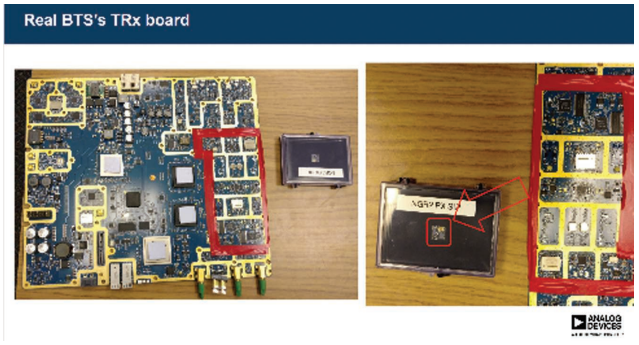
The evolution of cellular base stations, following complementary initiatives.



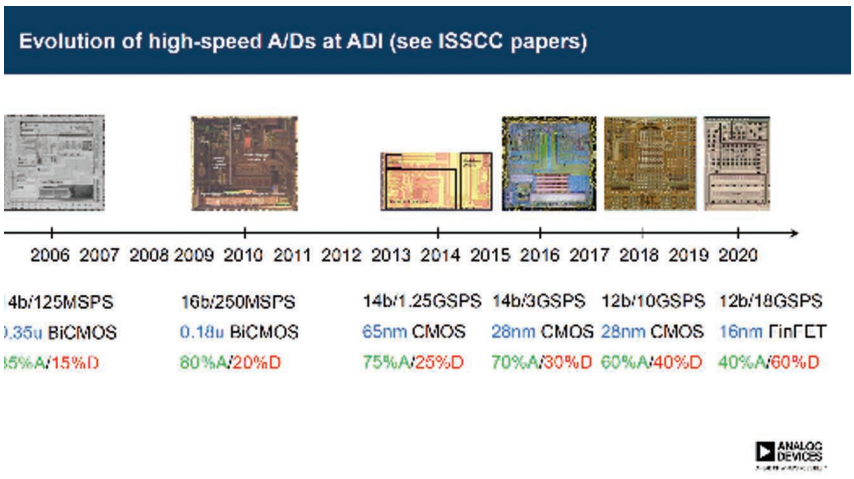
A simplified signal chain and the cointegration of passive and active devices.



An intermezzo on passive integration in base stations.



The base station transceiver board and further functionality integration.



The evolution of high-speed of Analog Devices ADCs, presented at ISSCC.

instrumentation and defense and infrastructure communication systems, among others. The lecture introduced some of the present engineering approaches being developed to tackle such challenges. An earlier discussion, proposed in [4], reviewed the opportunity for broadband systems to operate in the mm-wave domain. A good number of the technical challenges faced by the analog designers developing such systems, along with some of the technologies behind that effort, can be observed in the evolution of cellular base station circuits.

In these cases, front-end circuitry and ADCs/digital-to-analog converters are rapidly being integrated with front-end digital processing, preferably in mixed-signal CMOS SoCs [5]–[6]. The performance demands, coupled with the limitations of the underlying technologies such as those of nanometer CMOS processes and die packaging, require a comprehensive design approach combining circuits and architectural innovation with algorithmic techniques. This has, in general, been reflected in the various International Solid-State Circuits Conference (ISSCC) papers related to analog devices presented between 2006 and 2020. Many aspects of system integration and packaging deal with heat dissipation within the container.

At the conclusion of the talk, the audience and Manganaro participated a discussion for approximately 30 min. Many attendees commented on Manganaro's pedagogical skills and the practicality of the examples he used.

—Mathieu Coustans, Michel Bron, Taekwang Jang, Domenico Pepe, and Gabriele Manganaro, SSCS Switzerland Chapter

References

[1] "Switzerland IEEE SSCS (webinar): Mixed-signal technologies for ultra-wide band signal processing systems share." IEEE. https://events.vtools.ieee.org/m/235475

[2] "IEEE SSCS Switzerland Chapter hosts webinar by Dr. Alberto Valdes-Garcia [Chapters]," *IEEE Solid State Circuits Mag.*, vol. 12, no. 3, pp. 56–56, Summer 2020. doi: 10.1109/MSSC.2020.3001888.

[3] "SSCS Distinguished Lecture in Switzerland webinar on evolution of cellular RF-ICs, by Dr. Venumadhav Bhagavatula," *IEEE Solid State Circuits Mag.*, vol. 13, Fall 2020.

[4] J. M. Jornet. "Terahertz communications: The quest for spectrum," IEEE ComSoc. 22 Nov. 2019. https://www.comsoc.org/publications/ctn/terahertz-communications-quest-spectrum

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