A Method to Minimize 5G Signal Noise and Energy Consumption (#8204)

Improving quantization noise and suppressing bandwidth-intensive media to boost reliability

Inventors at Georgia Tech have developed a method of minimizing 5G signal noise and energy consumption within a specific segment of the 5G technology value chain. The method aims to improve quantization noise while suppressing bandwidth-intensive media (e.g., spectral images) using a mixed-signal Doherty power amplifier. This should reduce the effective number of bits (ENOB) required for operating in the 5G network. Responding to an era of increasingly heavy, high-resolution media consumption, the technology promises to reduce energy consumption while improving bandwidth optimization and signal reliability.

Benefits/Advantages

- **Efficient**: Minimizes 5G energy noise and lowers overall energy consumption required for the exponential growth of 5G networks
- **Reliable**: Promises to improve signal reliability by suppressing bandwidth-intensive media without impacting end-user experience
- **Economical**: Improves affordability of signal routing for millimeter-wave (mmWave) 5G services
- **Practical**: Reduces the challenge involved in designing high-speed power digital-to-analog converters with low ENOB

Potential Commercial Applications

Next-generation 5G networks are a primary target application for Georgia Tech’s method, specifically the following and related technologies:

- Power amplifiers (PAs)
- Analog-to-digital converters (ADCs)
- Digital-to-analog converters (DACs)

Background/Context for This Invention

Georgia Tech’s technology aims to address the exponential growth in data rates and capacity demands placed on 5G networks. While these networks have been designed to handle such demands, available methods for doing so have notable shortcomings. For instance, mmWave 5G services deploy spectrally efficient modulation schemes, such as high-order quadrature amplitude modulation (QAM) in order to achieve high data rates. However, QAM requires a high signal-to-noise ratio (SNR) and leads to high peak-to-average power ratio waveforms. This in turn poses stringent requirements on power amplifiers as well as both ADCs and DACs, which can increase costs and complicate network designs. By contrast, Georgia Tech's method aims to resolve this issue by lowering the SNR and thereby reducing the ENOB requirement. It also can reduce design challenges for high-speed power DACs with low ENOB and lower costs associated with signal routing for ENOB ADC/DAC for mmWave 5G services.

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More Information

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Publications

A Super-Resolution Mixed-Signal Doherty Power Amplifier for Simultaneous Linearity and Efficiency Enhancement, IEEE Journal of Solid-State Circuits, December 2019

A Highly Linear Super-Resolution Mixed-Signal Doherty Power Amplifier for High-Efficiency mm-Wave 5G Multi-Gb/s Communications, IEEE International Solid-State Circuits Conference, February 2019

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/method-minimize-5g-signal-noise-and-energy-consumption

Images:

The automated sequential delivery of multiple fluids. A varying number of delay gates imprinted in the branches are shown in the figure.

COVID-19 and flu saliva test on paper: (A) The automatic sequential delivery of multiple reagents required for virus test; (B) Water pouring into the device triggers the virus assay, allowing the presence of SARS-CoV-2 and influenza A & B viruses to be visually identified by the color changes in the corresponding detection spot