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ELECTRICAL & COMPUTER ENGINEERING
TEXAS A&M UNIVERSITY

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A CMOS Fractional Frequency Synthesizer for a Fully Integrated S-Band Extravehicular Activity (EVA) Radio Transceiver

by

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Abstract: The future of manned space explorations demands the development and use of low-power, lightweight and miniaturized communication systems. A very important aspect of space explorations is extravehicular activity (EVA) which enables astronauts carry out tasks outside the protective environment of the spacecraft cabin. EVA radios enable the crew to transmit and receive information among themselves and with equipment in space during EVA. One of the key building blocks in the EVA radio transceiver is the frequency synthesizer whose purpose is to generate the local oscillator (LO) signals for the transmitter (TX) and receiver (RX).

This seminar presents the design of a dual-band fractional-N frequency synthesizer for an EVA radio transceiver at 2.4 GHz. The synthesizer is required to generate quadrature signals at 2.4GHz for the direct conversion RX, and 1.6GHz and 0.8GHz (quadrature) LO signals for dual up-conversion in the TX to prevent VCO pulling. The VCO employed in the synthesizer uses the resonant mode switching technique to provide two separate resonant modes at 1.6GHz and 4.8GHz with a divide by two circuit to generate the quadrature signals of 0.8GHz and 2.4GHz for the TX and RX respectively while satisfying phase noise requirements. The synthesizer is implemented in 0.18µm CMOS and achieves a measured phase noise at 1MHz offset of -130.4 dBc/Hz at 1.62GHz and -120 dBc/Hz at 4.86GHz with reference spurs <-70.2dBc for the lower band and < -63.8dBc for the higher band. The synthesizer occupies an area of 1.54mm^2 with total power consumption of 18.2 - 22.7mW.

Eugene B. Foli received his BSc degree in Electrical Engineering at the Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana in 2010. He is currently working towards a MSc. degree at Texas A&M University in College Station, Texas.

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