A CMOS MILLIMETER-WAVE TRANSCEIVER EMBEDDED IN A SEMI-CONFOCAL FABRY-PEROT CAVITY

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The extension of radio-frequency CMOS circuitry into millimeter wavelengths promises the extension of spectroscopic techniques in compact, power efficient systems. We are now exploring the use of CMOS millimeter devices for low-mass, low-power instrumentation capable of remote or in-situ detection of gas composition during space missions. We have chosen to develop a Flygare-Balle type spectrometer, with a semi-confocal Fabry-Perot cavity to amplify the pump power of a mm-wavelength CMOS transmitter that is directly coupled to the planar mirror of the cavity. Since the initial report last year describing the designs, we have built a pulsed transceiver system at 89-104 GHz inside a 5 cm base length cavity and demonstrated cavity finesse up to 3000, allowing for modes with 30 MHz bandwidth and a sufficient cavity amplification factor for mW class transmitters. System and component testing revealed that the power-amplifier design (embedded in the chip) was faulty and the transceiver peak power is only 10 microwatts, which is insufficient for molecular excitation on the timescale of the gas residence time within the beam. An improved power amplifier circuit has been designed and is currently under fabrication, meanwhile, we have also developed a tunable synthesizer (embedded in the same chip) that allows for tuning over the full bandwidth at increments of 10 MHz. The presentation will cover these capabilities, describing the system and component tests, as well as any new developments.