mmW ICs

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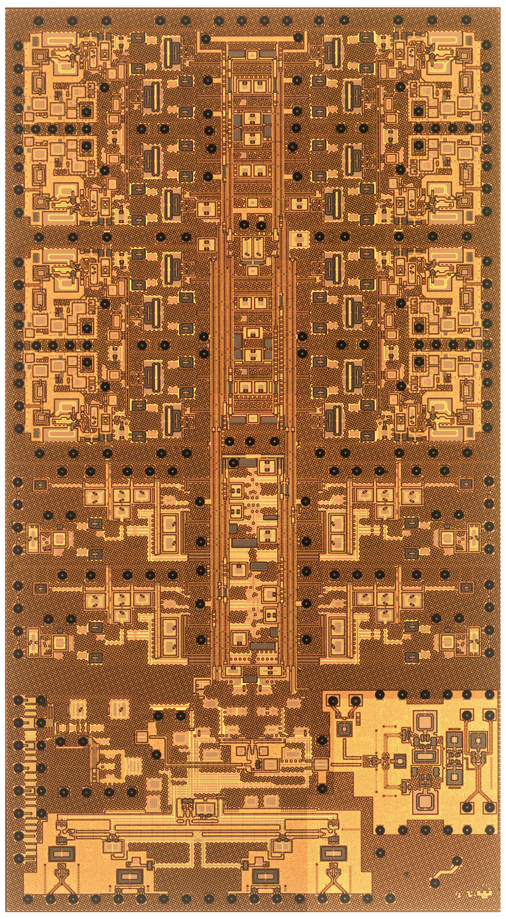
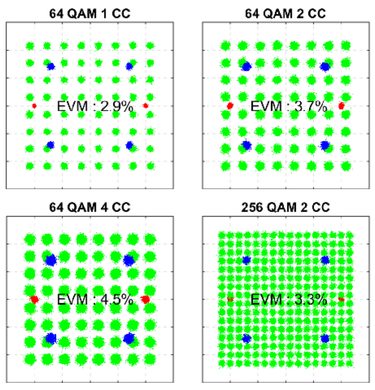
8 channel 27 GHz dual conversion transceiver



45nm RFSOI

Modular architecture for large-scale antenna arrays

Tested up to 5GNR 64QAM 8cc signals

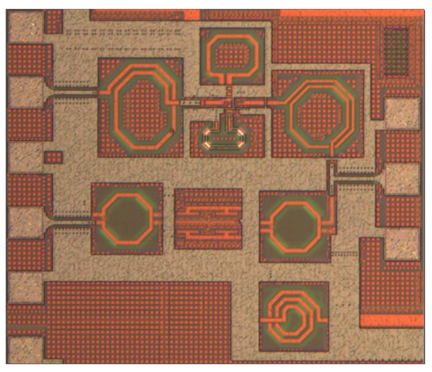


A. Sethi, R. Akbar, M. Hietanen, J. Aikio, O. Kursu, M. E. Leinonen, T. Rahkonen, A. Pärssinen: Chip-to-chip interfaces for large-scale highly configurable mmWave phased arrays. Provisionally accepted to IEEE J. Solid-State Circuits.

LNA + PA switched frontend@28 GHz

RX

TX



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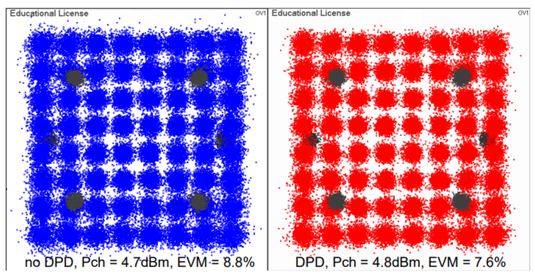
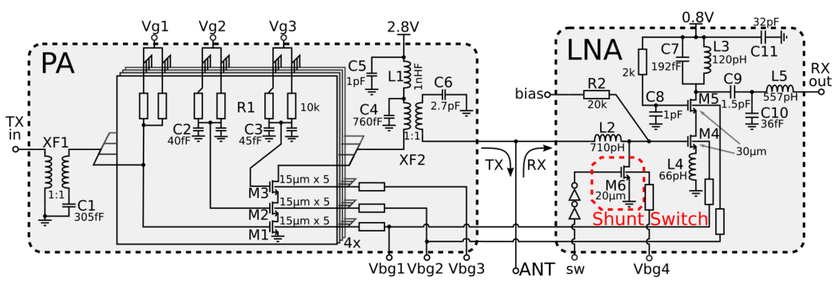


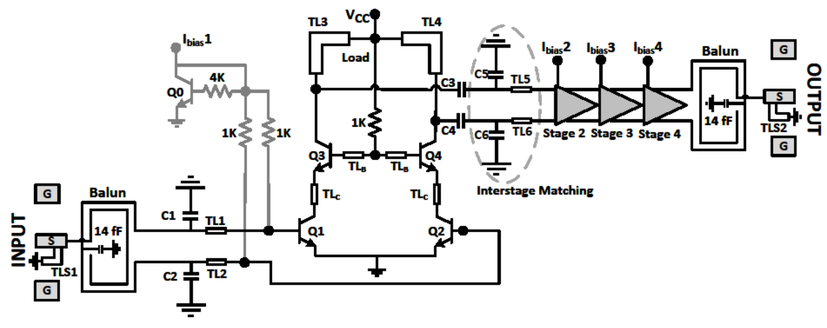
Reference	This work	[9] ISSCC'18	[4] TMTT'16	[5] JSSC'16	[6] MWCL'16	[10] ISSCC'19	[11] ESSCIRC'17	[7] TMTT'19
SW type	RX shunt gate		SPDT	1/4λ TL	Common match			
Freq [GHz]	24-28	25-30.5	30-40	27-29	57-65	27-40	60-67	25-30
RX gain[dB]	7	34*	17	30*	21.5	16.1	17	11
RX P1dB	-9.1	-	-17	-22.5*	-	-15.7	-25	-7.1
RX NF	5	3.8*	8.4 (sim)	6	6.7	6.2	6.8	3.5
RX Pdiss	4.6	42*	48	103.1*	39.6	17.6	<28.8	28
TX gain	15	44*	14	15	24.5	28.5	24	12
TX P1dB	7.4	12*	20.5	13.5	5	14.1	10	22
TX Pdiss	183	90*	352	143.8*	71	96.2	<63.5	230
Psat	13.6	14	22.5	16	8.4	15.8	10	23.6
PAE [%]	9.6	20	7	21	8.7	20	-	28
Area mm²	0.19	1.16*	7*	4	0.22	0.35	0.35	0.275
Tech.	22nm	28nm	SiGe130nm		65nm		28nm	45nm

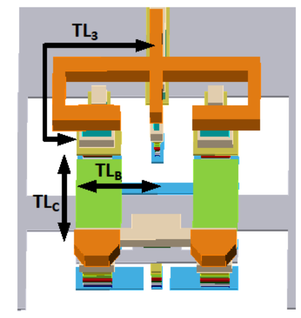


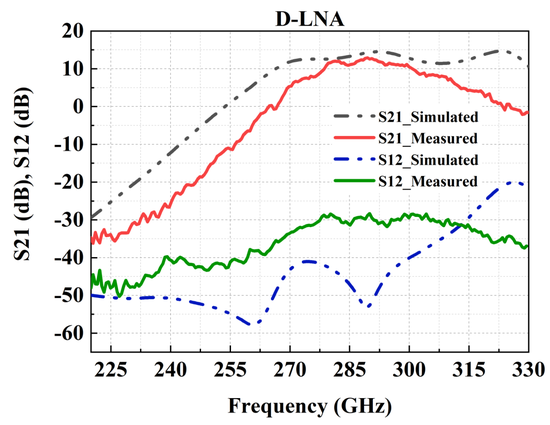
EuMC Microwave Prize 2020

M. Hietanen, J. Rusanen, J.P. Aikio, N. Tervo, T. Rahkonen, A. Pärssinen: Ka-Band TDD front-end with gate shunt switched cascode LNA and three-stack PA on 22 nm FDOI CMOS Technology. EUMW 2020 Conference.

290 GHz LNA, 130 nm HBT process







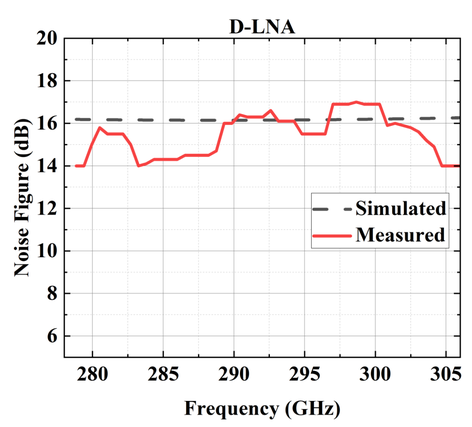


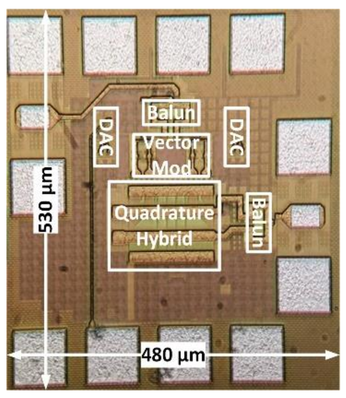
TABLE I
SUMMARY OF THE IMPORTANT PERFORMANCE PARAMETERS AND COMPARISON WITH RELATED WORKS

	This work	This work	[18]	[22]	[40]	[32]	[12]	[41]
Technology	130 nm SiGe	130 nm SiGe	130 nm SiGe	130 nm SiGe	130 nm SiGe	130 nm SiGe	130 nm SiGe	130 nm SiGe
f_t/f_{max} (GHz)	300/450	300/450	300/550	220/280	350/550	470/700	300/500	300/500
Frequency (GHz)	235	290/300	252	173	275	291	245	245
Topology	CC[a], SE[c] (1 stages)	CC[a], Diff. (4 stages)	CC[a], Diff. (3 stages)	CE[b], SE[c] (3 stages)	Common Base (8 stages)	CC[a], Diff. (3 stages)	CC[a], Diff. (5 stages)	Common Base (4 stages)
Gain Boosting Technique	No	No	Yes	Yes	Yes	No	Yes	No
Gain (dB)	7.8	12.9/11.2	21.5	18.5	10	10.1	18	12
3-dB BW (GHz)	50	23	11	8.2	7	68	8	25
NF (dB)	11[e]	16[e]	-	-	18[d]	11[d]	11[e]	11.3[e]
Input-Referred P_{1dB} (dBm)	-14.0[d]	-9.0	-20	-10	-10	-15.6	-	-
P_{diss} (mW)	18	136	149	42	122.7	119	303.4	28
Area (um^2)	263 X 278	532 X 462	580 X 290	865 X 465	1065 X 355	700 X 380	360 X 430	420 X 460

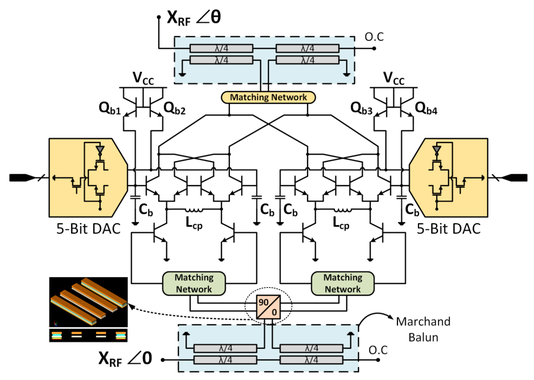
[a] Cascode. [b] Common Emitter. [c] Single Ended. [d] Simulated. [e] Measured.

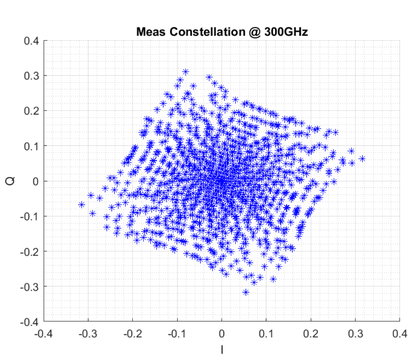
S. Singh, T. Rahkonen, M. E. Leinonen, A. Pärssinen: A 290 GHz low noise amplifier operating above fmax/2 in 130 nm SiGe technology for sub-THz/THz receivers. IEEE 2021 RFIC conference

Vector modulator phase shifter @ 300 GHz



Technology	130nm SiGe HBT
f	270 GHz – 330 GHz
f_T/f_{max}	300/450 GHz
Gain	-10 dB
Resolution	11.25°
P_D	65 mW
Active area	0.023 (mm²)





M. Montaseri, S. Singh, M. Jokinen, M. E. Leinonen, T. Rahkonen, A. Pärssinen: A 270-330 GHz vector modulator phase shifter in 130 nm SiGe BiCMOS. EuMIC 2021 Conference

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RF SAMPO

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