Combinatorial feeding to controlling and combining power on a coupled antenna array

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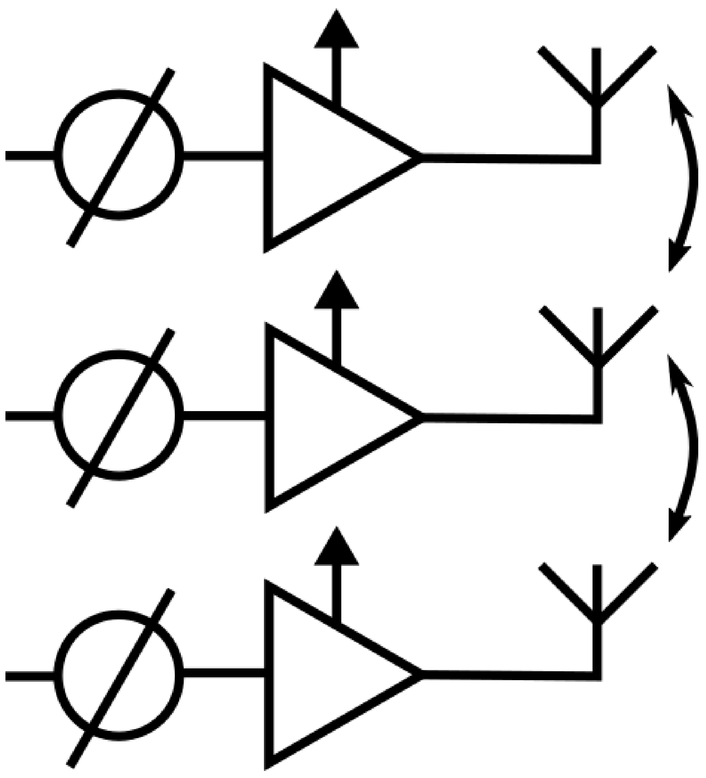
RF SAMPO

We propose a combinatorial feeding scheme where amplifiers feeding the array elements can be switched on and off and the excitation phase can be changed to optimise power level.

What? Applying combinatorial feeding to combine and control the output power in air.

How? Amplifiers of the array elements are switched on and off.

Why? To control signal power level.



Antenna amplifier system schematic for coupled system with switchable power supplies and phase shifters.

Power combining with coupled antennas

CST simulation of a eight port monopole array with -8 dB of adjacent element coupling antenna array.

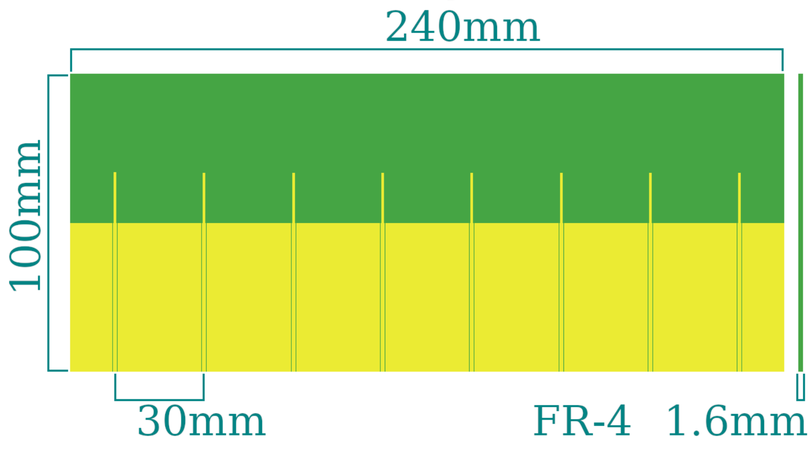


Illustration of antenna array used in the work.

AWR load pull for amplifier

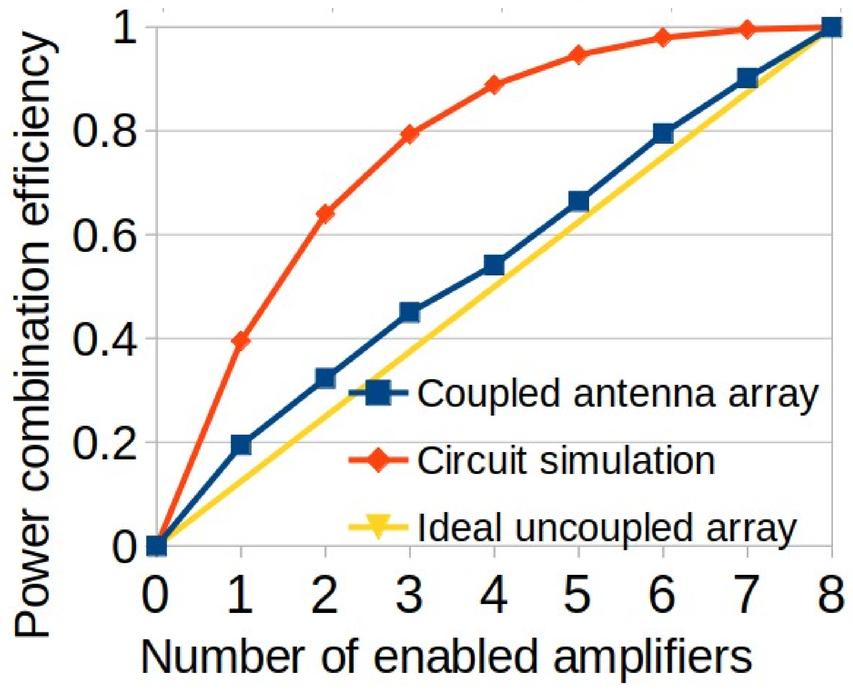
Models were used in an iterative MATLAB model to calculated active load impedance and to optimised the feed configuration to find the highest broadside power.

Results

Our method was compared with ideal uncoupled array and ideal circuit simulation with switchable amplifiers

System with coupled array gives more power than uncoupled array, specifically in low enabled amplifier case.

The difference is the highest (44% higher) with single enabled amplifier.



Different power combining methods against number of enabled amplifiers

# of amplifiers	Power	Ideal uncoupled array	Performance gain	Feed configuration and amplifier feed phase shifts
0	0	0		[- - - - - - - - -]
1	0,132	0,084	44%	[0 - - - - - - - -]
2	0,218	0,169	25%	[- - - - - 0 - 50]
3	0,304	0,253	18%	[0 - 330 345 - - - -]
4	0,366	0,338	8%	[- - 0 - 0 340 - 15]
5	0,449	0,422	6%	[- - 0 0 5 355 - 35]
6	0,537	0,507	6%	[0 - 315 320 320 315 - 355]
7	0,610	0,591	3%	[0 - 315 325 320 315 310 350]
8	0,676	0,676	0%	[0 315 325 335 335 325 315 0]