ACTIVE RADIATING STRUCTURES BASED ON NONLINEAR BEHAVIOR OF ACTIVE DEVICES

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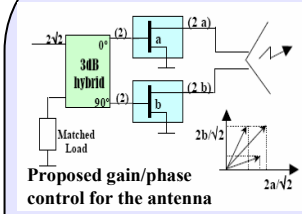
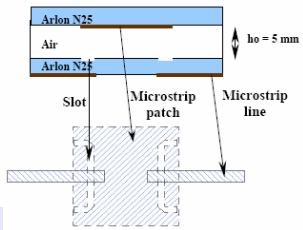
ACTIVITY TOPICS:

1.- Beamsteering by IQ control.
   a) Arrays with low intermodulation distortion pattern.
   b) Reflectarrays: Electronic control by mixers and variable gain amplifier with phase control
2.- IMD radiation pattern reduction by spatial power combining: Two port antenna and spatial combining in arrays
3.- Radiofrequency identification solutions (RFID)

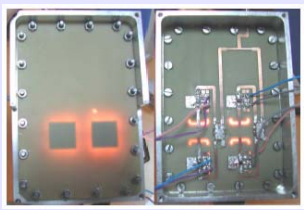
1a – VECTOR CONTROL ACTIVE PATCH FOR BEAMSTEERING WITH LINEARITY ENHANCEMENT



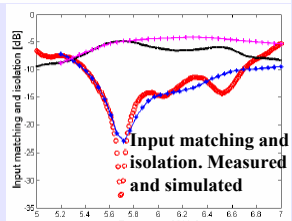
Proposed gain/phase control for the antenna



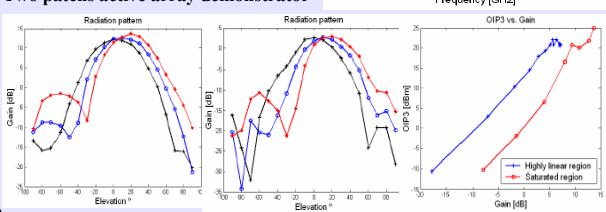
Aperture patch antenna →



Two patchs active array demonstrator



Input matching and isolation. Measured and simulated

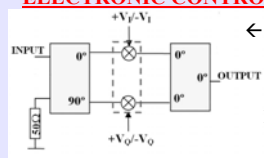


Radiation patterns with beamscanning. Gains: 13.7 dB (left) and 2.9 dB (right)

OIP3 vs Gain evolution

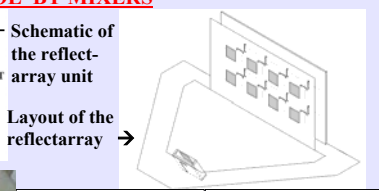
1b – REFLECTARRAYS

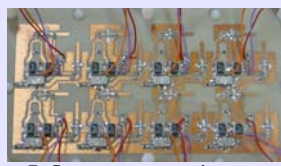
ELECTRONIC CONTROL BY MIXERS



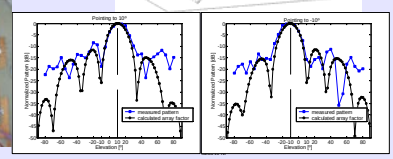
← Schematic of the reflect-array unit

Layout of the reflectarray →



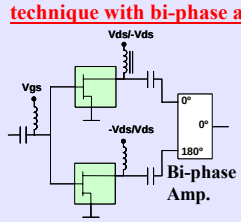


Reflectarray automatic electronic control

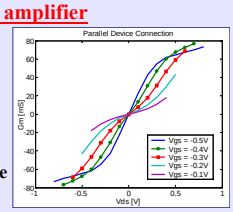


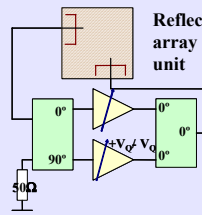
Measured of the reflectarray radiation patterns (normalized). Pointig to -10 and 10 deg.

VARIABLE GAIN AMPLIFIER WITH PHASE CONTROL: New technique with bi-phase amplifier

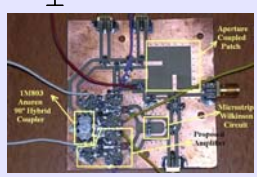


Bi-phase Amp.



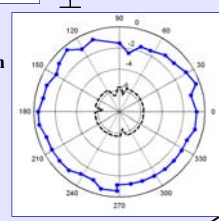


Reflect-array unit



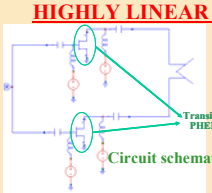
Reflectarray control unit

Phase evolution for two gains. (normalized) 0 dB of ref → → 33 dB gain



2 – IMD RADIATION PATTERN REDUCTION BY SPATIAL POWER COMBINING

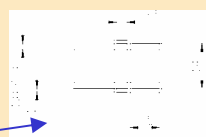
HIGHLY LINEAR AMPLIFIER ACTIVE ANTENNA.



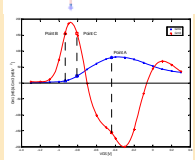
Circuit schematic

Side view

Aperture patch antenna



Top view

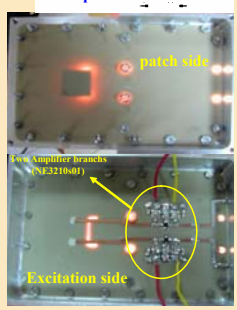


Gm1 → Amplifier gain
Gm3 → 3er order distortion

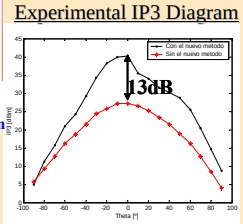
Branch 1 → point A
maximum gain
Gm3 negative

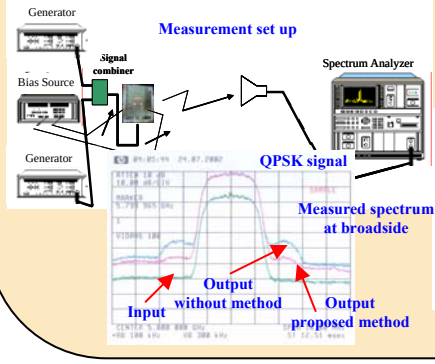
Branch 2 → auxiliary branch
points B or C
Gm3 positive

Sum of Branches 1 and 2 → Distortion (Gm3) minimum



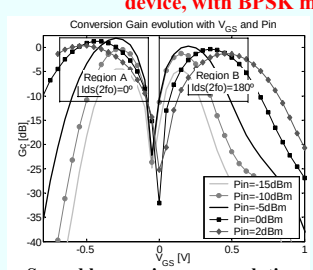
Experimental IP3 Diagram



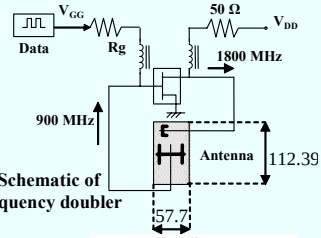


3– RADIOFREQUENCY IDENTIFICATON SOLUTIONS

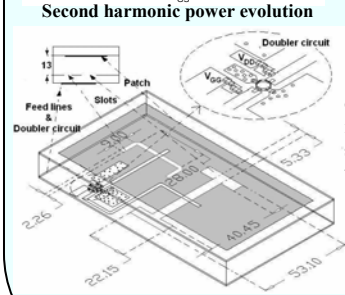
- Frequency doubling active antenna, based on a PHEMT device, with BPSK modulation capability.



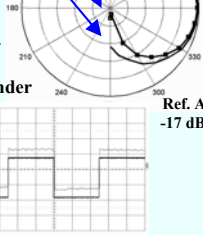
Second harmonic power evolution



Schematic of frequency doubler



Doubler integration in a microstrip antenna



Conversion radar cross-sections of the transponder

Ref. Area: -17 dB/cm²

Original and demodulated data signals