



**MONARCH**  
Antenna, Inc.

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Reshaping Wireless

## **Self-Structuring Antenna**

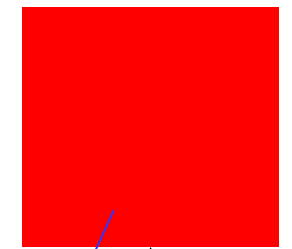
**Tayfun Özdemir, Ph.D.**  
*Chief Technology Officer*

# Who is Monarch Antenna?

- Incorporation in 2007 in Ann Arbor, Michigan and owned by
  - Delphi Corporation
  - Michigan State University
  - Automation Alley
- Consumer wireless, Industrial, military, and homeland security markets.
- Products for Consumer Wireless , M2M and Smart Grid/Industrial markets

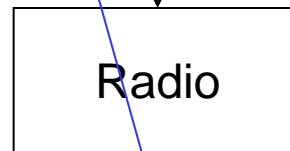
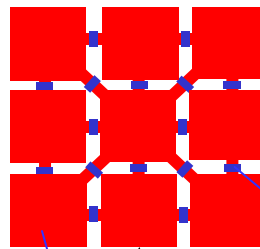
# Self-Structuring Antenna (SSA) Technology

## Static Aperture



Innovation by  
Monarch

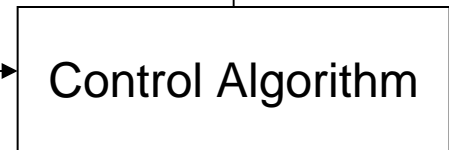
## Dynamic Aperture



Antenna Aperture  
Reshaped Dynamically

RF Switch

Control Signals set  
Switch States



Feedback on Signal Quality

Single radiating element

Multiple switched elements

*A cognitive, adaptive, and self-reconfiguring antenna which responds to changing signal conditions such as variable installation positions and evolving local network environments.*

# Value Proposition

## FEATURES

## BENEFITS

## IMPACT

Pattern shaping



Adaptive Beam and Null Steering



More reliable connection

Frequency Tuning



Dynamic Compensation for Frequency Detuning & Packaging Effects



Installation flexible and tolerance to enclosure variations

Self-Healing



Graceful Degradation



Graceful Degradation

# Product #1

2002

2005

2007

2008

2009

2010

2011

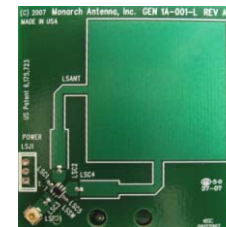
2012

2014

## ● GEN 1A: WiFi Laptop



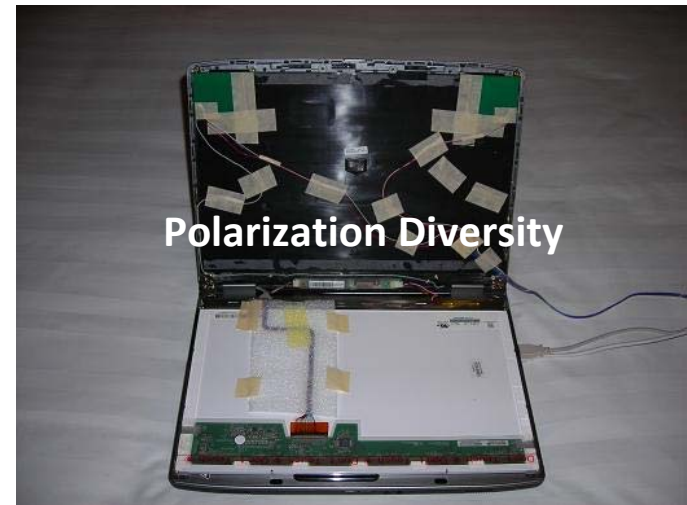
PIFA



GEN 1A



Linear Polarization

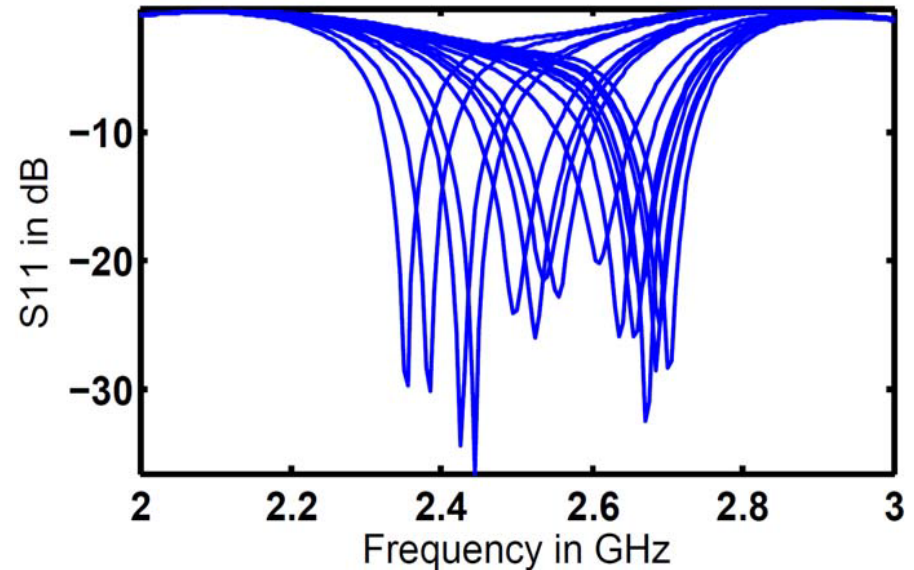
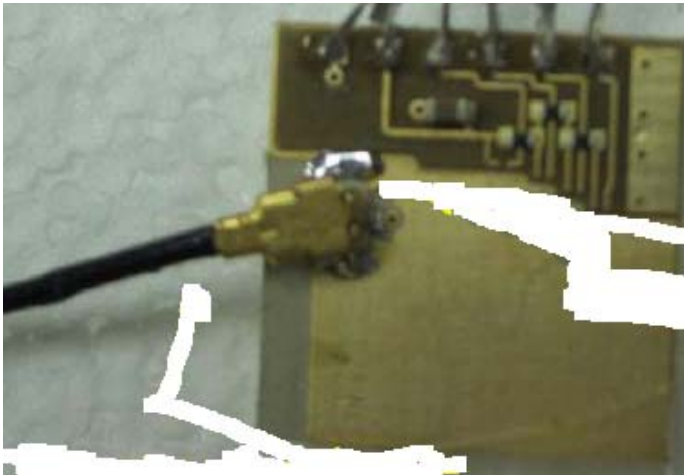


Polarization Diversity

(5dB improvement over PIFA)

# Product #4

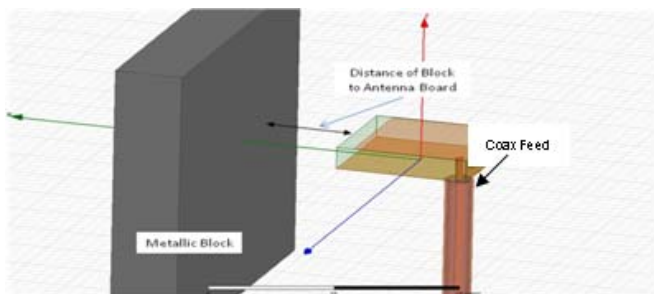
- Tunable Antenna for 2.3-2.7GHz Global Roaming Band
  - 15mm x 15mm x 4mm
  - Four SPST Switches



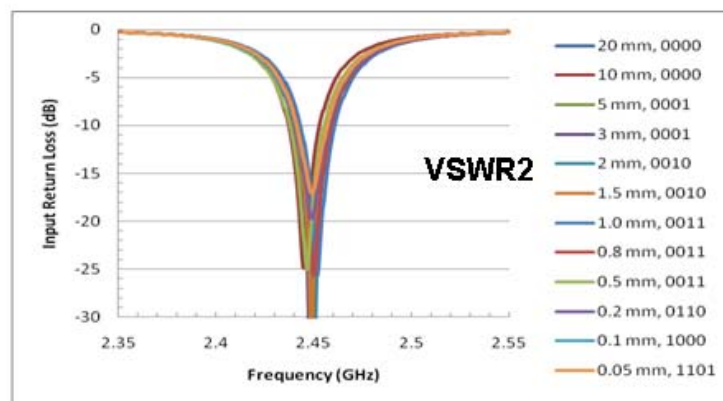
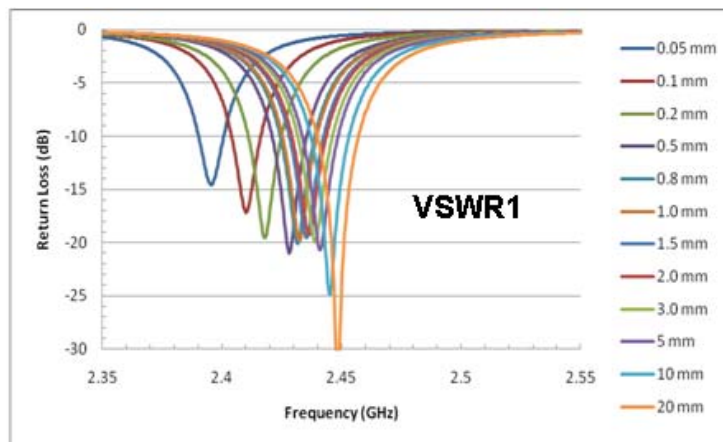
(2.3-2.7GHz Global Roaming Band)

# Product #4

- Antenna Compensates for detuning by reconfiguring its aperture dynamically.

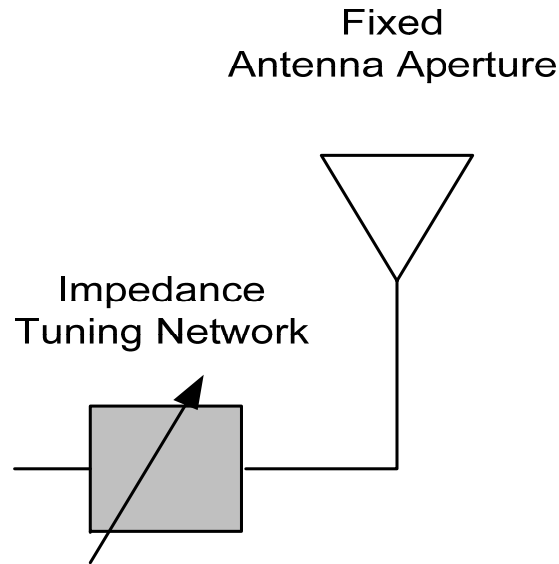


[mm]	VSWR1 (detuned)	VSWR2 (retuned)
0.05	30.4	1.3
0.2	10.1	1.2
0.5	5.5	1.3
1	4.1	1.3
1.5	3.3	1.1
3	2.5	1.1
10	1.5	1.4

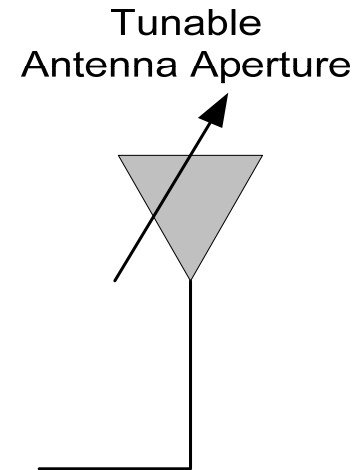


# Product #4

- Next generation handsets will have Impedance Tuning Networks
- Monarch's solution is different and produces
  - More efficiency antenna!
  - Lower Component Count



**Competition:**  
*Two Components*



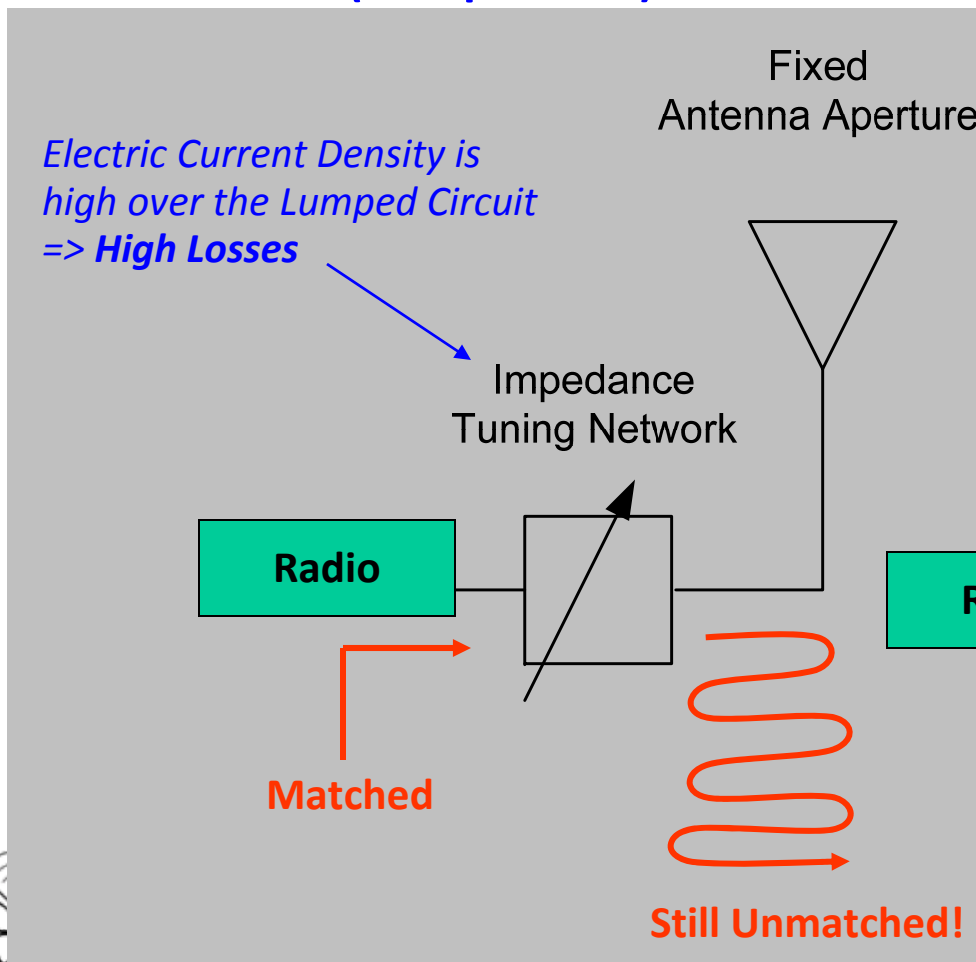
**Monarch's solution:**  
*One Component &  
More Efficient Antenna*



# Product #4

## ● Why is Monarch's solution is better?

### (Competition)



### (Monarch's solution)

