



Rapidly Deployable Radio Network Beam Steered Antennas

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Information & Telecommunication Technology Center

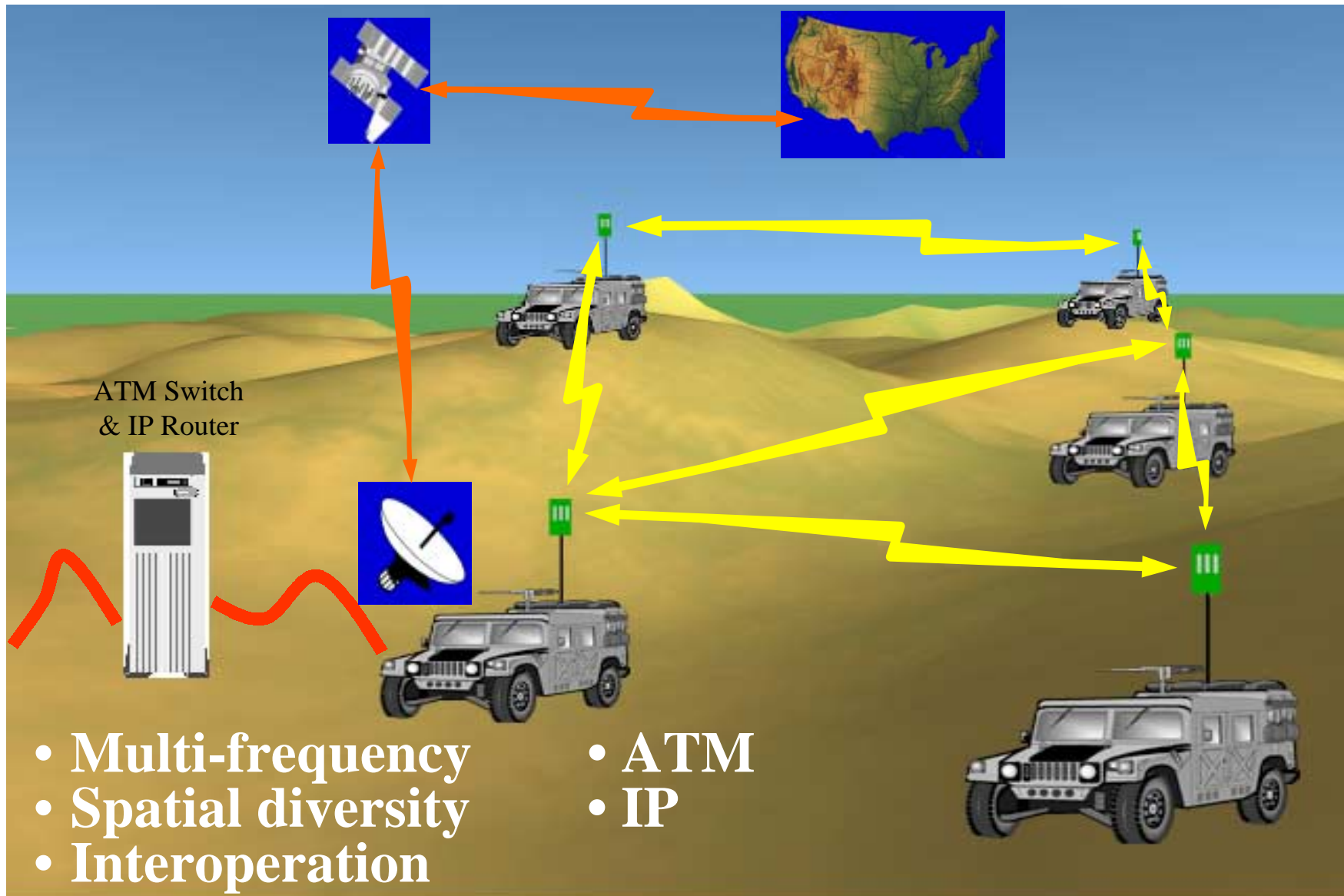
Electrical Engineering and Computer Science

The University of Kansas

*NIST
September 6-8, 2000*

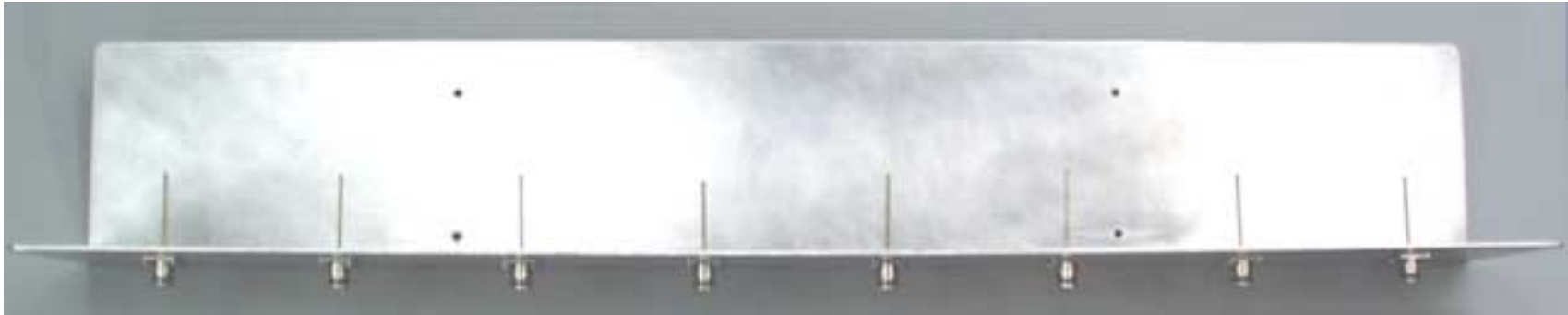


Technical Approach

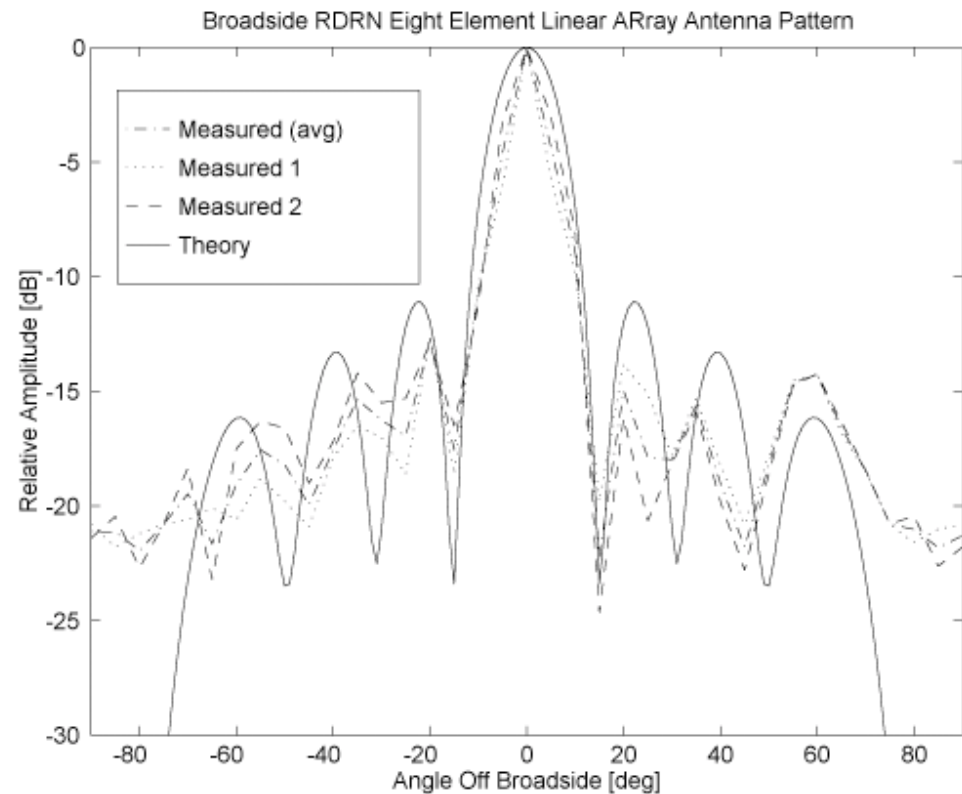




Phase I — Linear Array

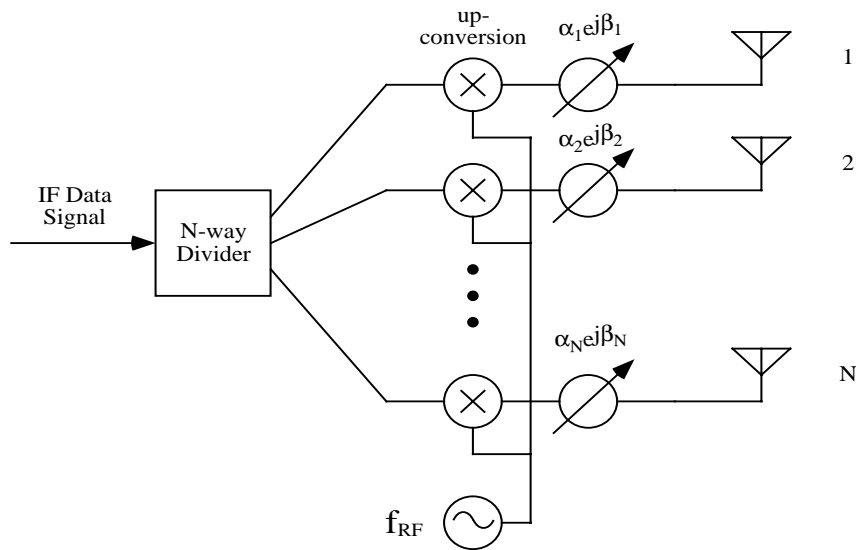


- **1.2 GHz Band**
- **Individually modulated (complex) elements**



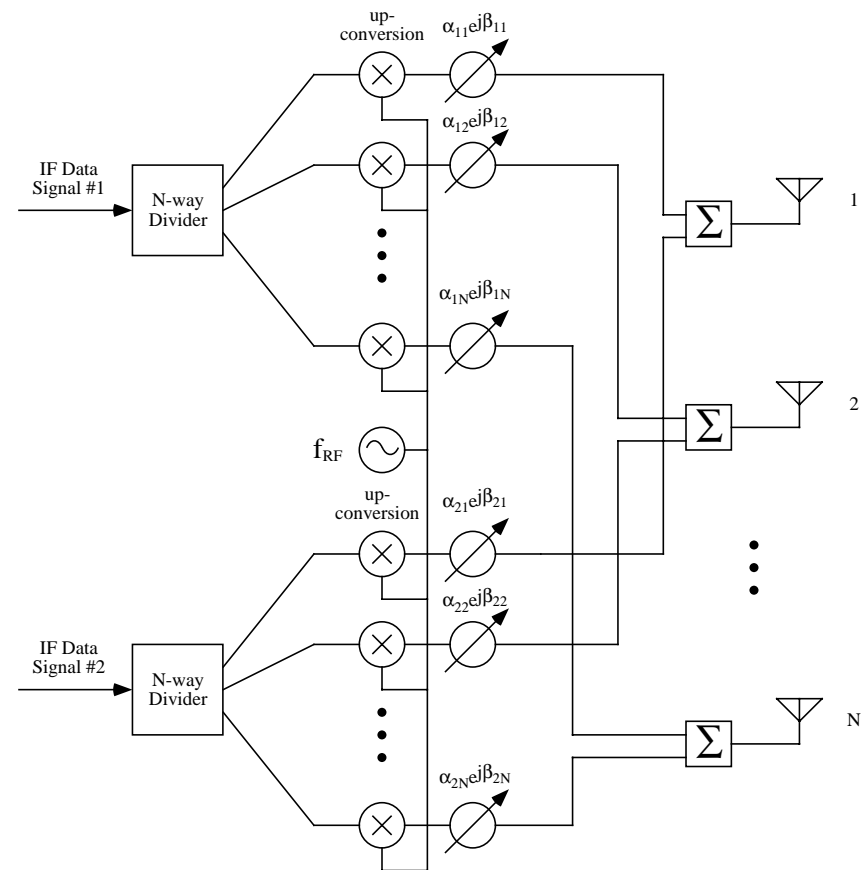


Beam Steering Approaches



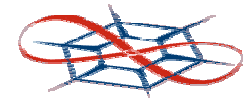
Beam Steering Single RF Channel

Beam Steering Multiple RF Channel

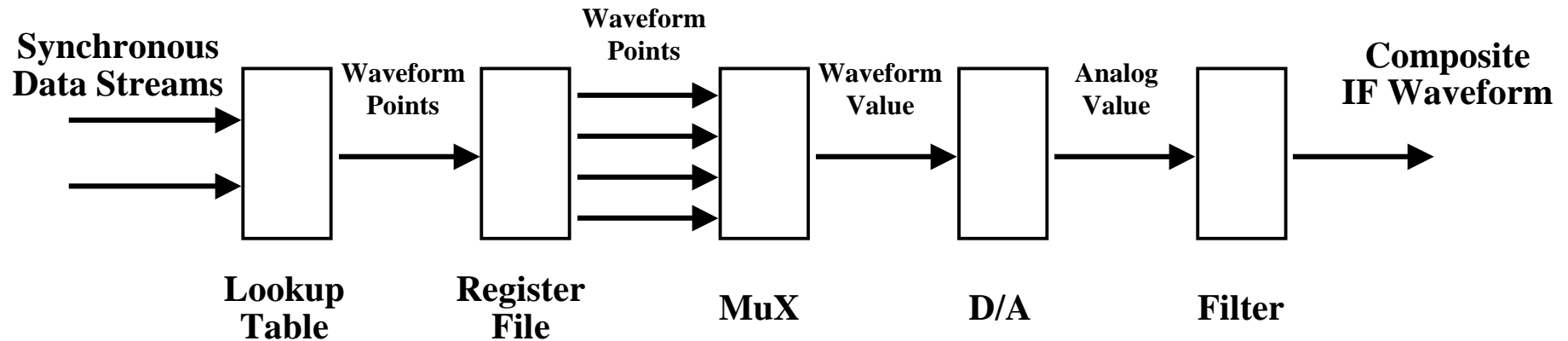
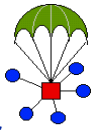




Multiple Beamforming Architecture



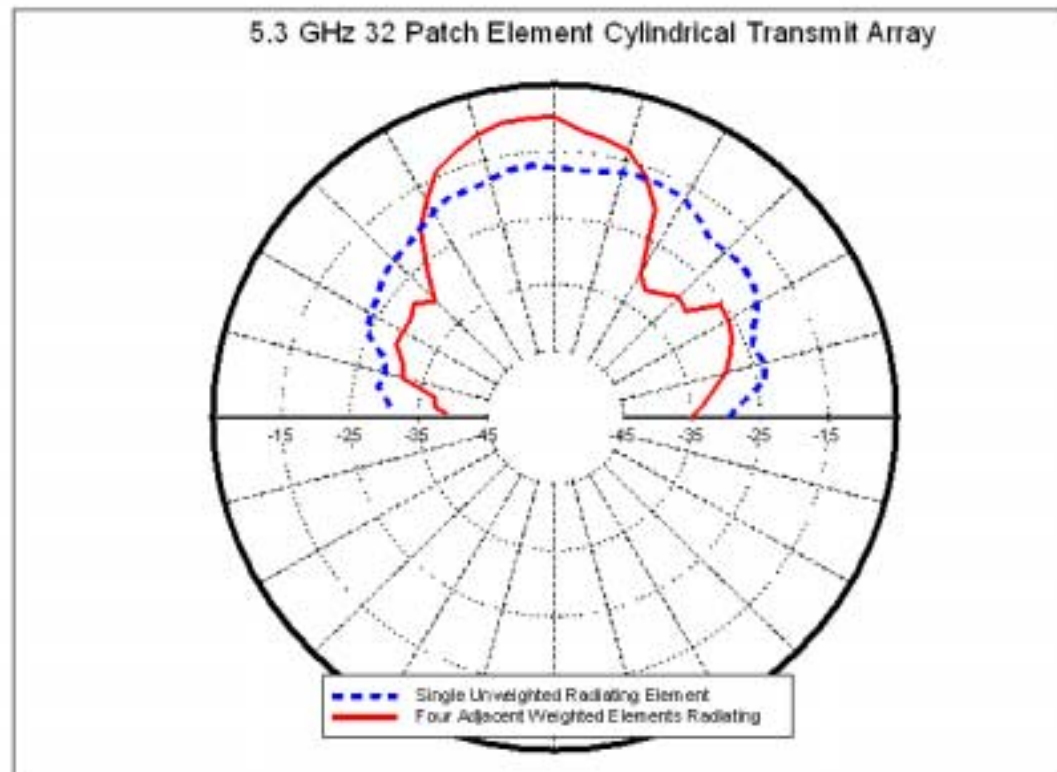
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Beam #1	Data #1	Beam #2	Data #2	Wave-form
Off	X	Off	X	0
Off	X	On	0	$A_2 \sin(\omega t)$
Off	X	On	1	$A_2 \sin(\omega t + \pi)$
On	0	Off	X	$A_1 \sin(\omega t)$
On	1	Off	X	$A_1 \sin(\omega t + \pi)$
On	0	On	0	$A_1 \sin(\omega t) + A_2 \sin(\omega t)$
On	0	On	1	$A_1 \sin(\omega t) + A_2 \sin(\omega t + \pi)$
On	1	On	0	$A_1 \sin(\omega t + \pi) + A_2 \sin(\omega t)$
On	1	On	1	$A_1 \sin(\omega t + \pi) + A_2 \sin(\omega t + \pi)$

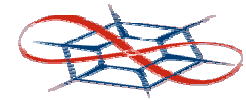


Cylindrical Antenna

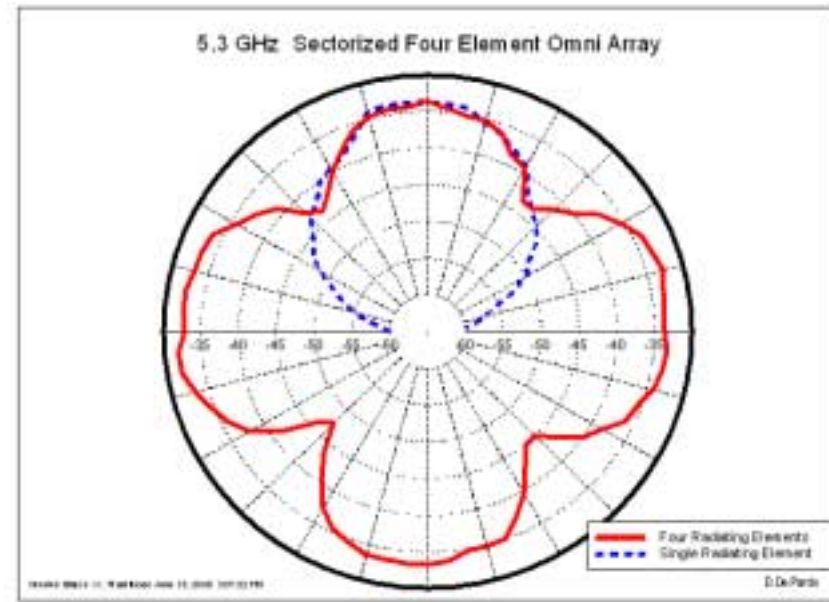
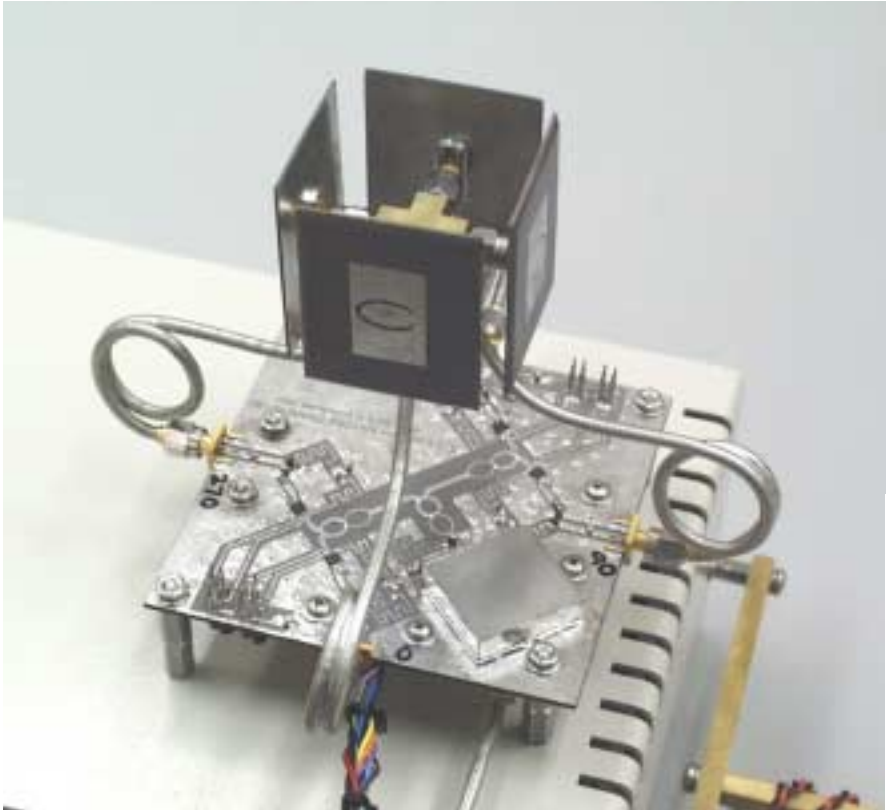
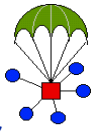




Switched Sectorized Array

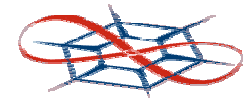


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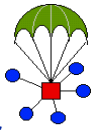




5.3 GHz Microstrip Patch Antennas



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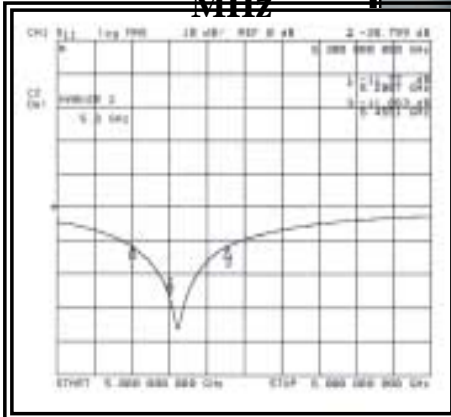
U-Slot Tuned Probe Fed Design **Traditional Probe Fed Design**



5 CM

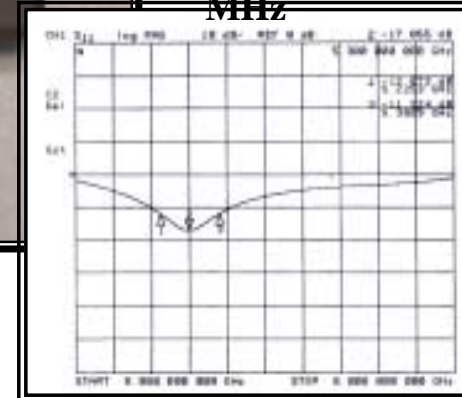
1.7:1 VSWR BW = 250

MHz



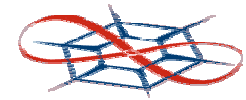
1.7:1 VSWR BW = 160

MHz

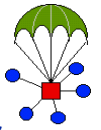




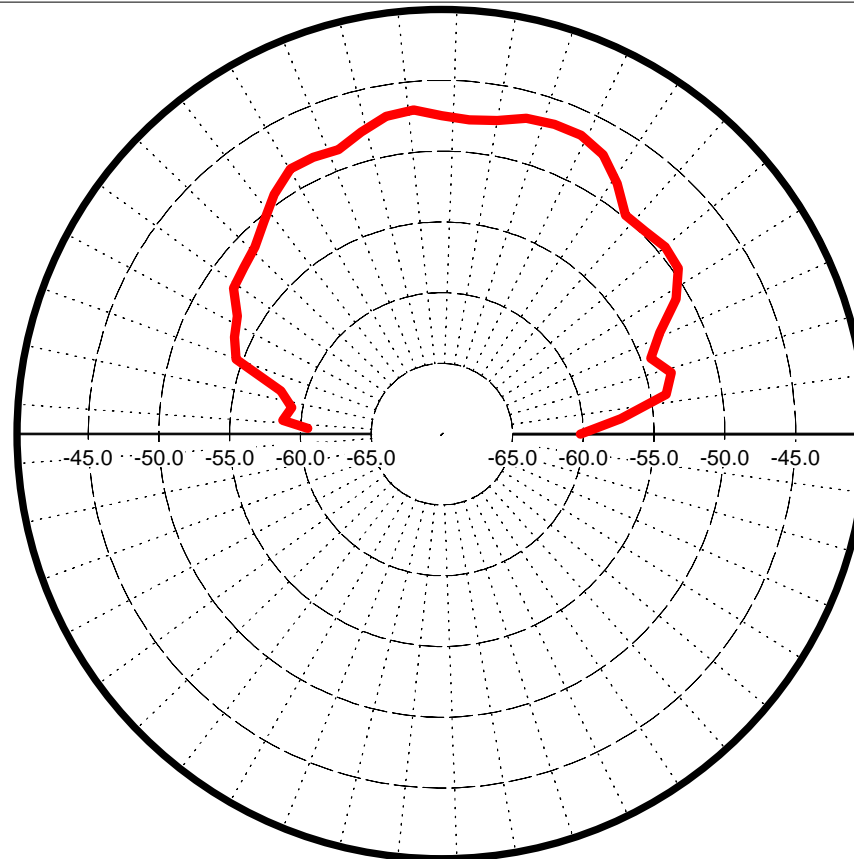
5.3 GHz Microstrip Patch Antennas



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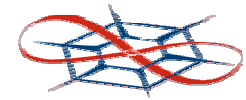


Single Rectangular Patch Antenna Radiation Pattern

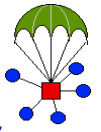




5.3 GHz Receive Patch Antennas with Integral Low Noise Amplifier



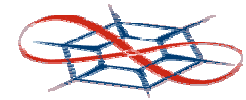
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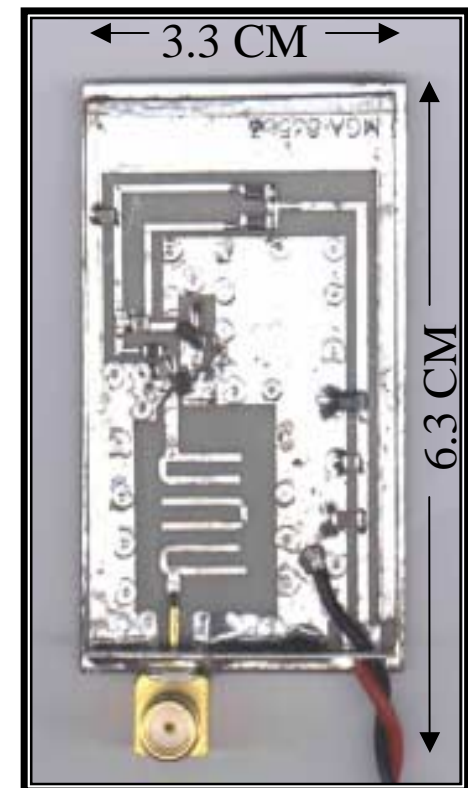
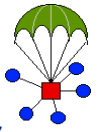
Antenna Gain = +6 dBi
Low Noise Amp Gain = +18 dB
LNA Noise Figure @5.3 GHz = 2.5 dB



5.3 GHz Transmit Patch Antennas with Integral BPF and RF Power Amplifier



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BPF + PA Power Output = +18 dBm
BPF + PA Signal Gain = + 15 dB
Patch Antenna Gain = +6 dBi
ERP = +24 dBm



Summary



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■ Multi-Element Antennas

- ▼ Demonstrated Linear Array with Multi-beam capabilities
- ▼ Demonstrated 32-element Cylindrical Antenna
- ▼ Demonstrated Steerable Switched Element Antenna
- ▼ Demonstrated Computer-based Antenna Control
- ▼ Demonstrated Modular Patch Antennas with LNAs and Pas

■ Future Work

- ▼ Non-planar Steerable Switched Antennas
- ▼ Low-cost Implementations of Steerable Switched Antennas
- ▼ Compact Implementations of Steerable Switched Antennas



Key Resources



■ Contacts

- ▼ Joseph B. Evans, 785-864-4830, evans@ittc.ukans.edu
- ▼ Gary J. Minden, 785-864-4834, gminden@ittc.ukans.edu

■ Web sites

- ▼ <http://www.ittc.ukans.edu/RDRN>

■ Technical papers

- ▼ 4 journal and 4 conference papers on RDRN efforts
- ▼ <http://www.ittc.ukans.edu/RDRN/documents>



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