

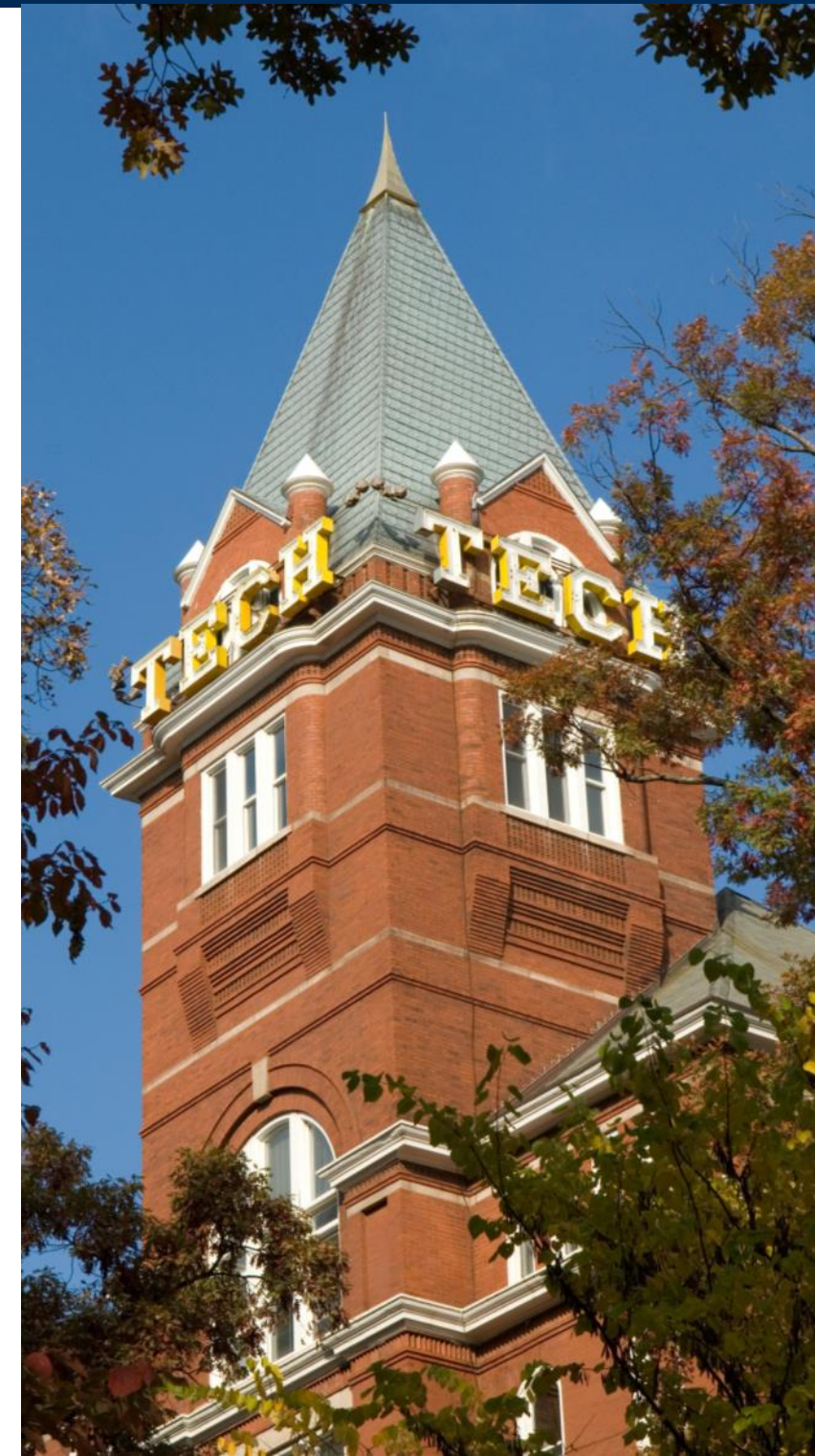
A Broadband Array with Unbalanced Feeds: Elements and Power Combiners Based on the Fragmented Aperture Principle

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Background

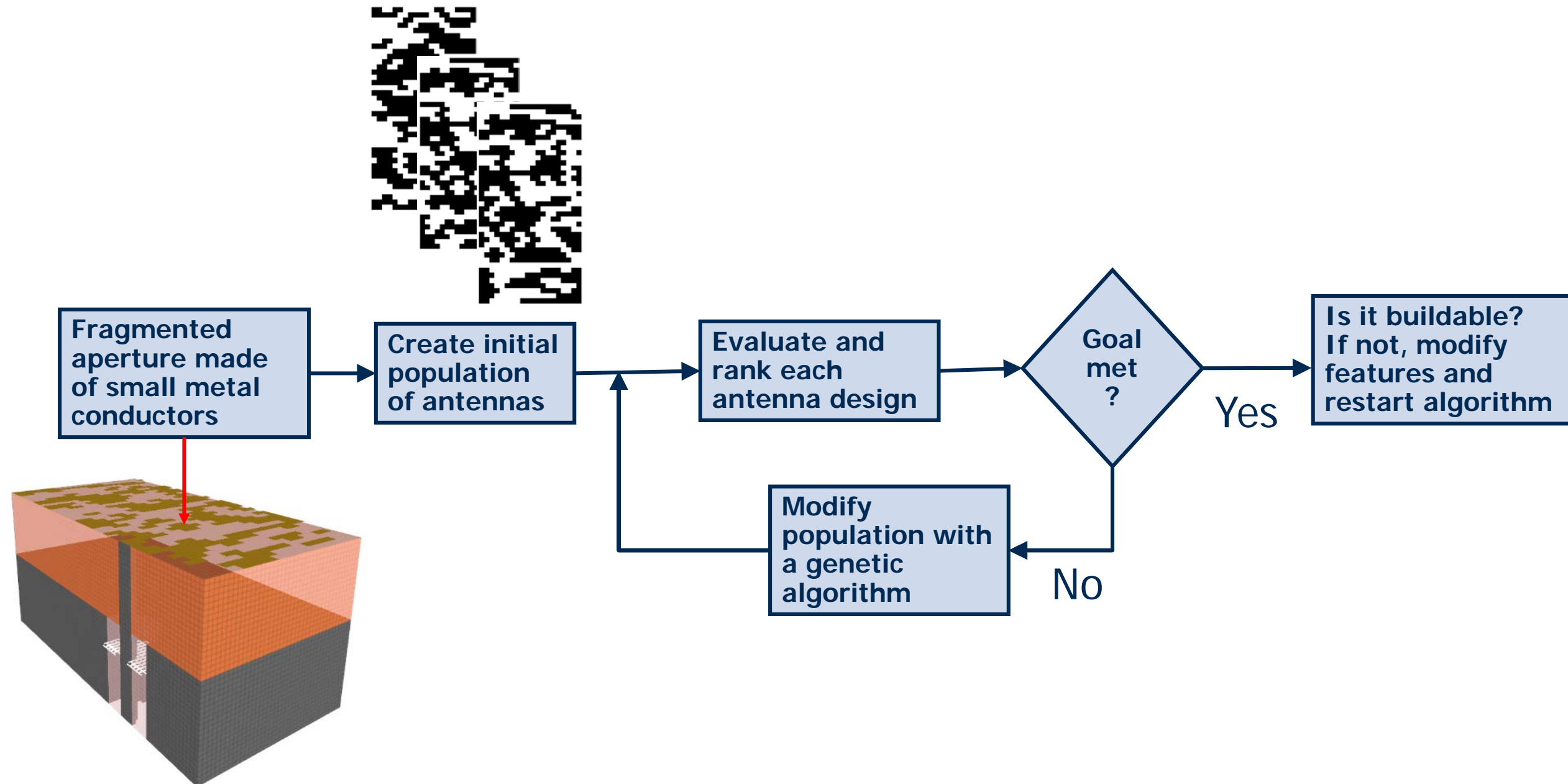
This antenna is intended for a telemetry system (receive only) in an outdoor range at the U. S. Army Aberdeen Test Center.

Antenna Specifications	
Frequency Band	1.435 – 6.7 GHz (~4.7:1)
Polarization	Single linear
Realized Gain at Broadside	10 – 20 dBiL
Beamwidths (E & H Planes)	20° @ f_{lo} ; 6° @ f_{hi}
Physical Dimensions	Radius 12" (30.5 cm)
Weight	Under 20 lbs.
Wind loading	70 mph
Temperature	Moderate icing; 0-120° F

Approach

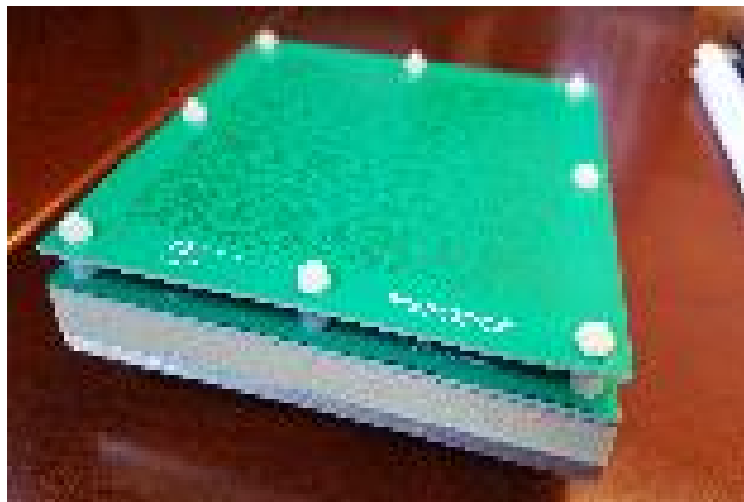
- Fixed beam, 16 x 16 element planar array
- 256:1 corporate feed network with 8 stages of 2:1 combiners
- Novel aspects of the design:
 - 1. Unbalanced feed for each element, which greatly reduces the complexity
 - 2. GTRI fragmented technology used to optimize aperture and feed network
- An integrated radome to satisfy the environmental constraints

GTRI Fragmented Aperture Technology

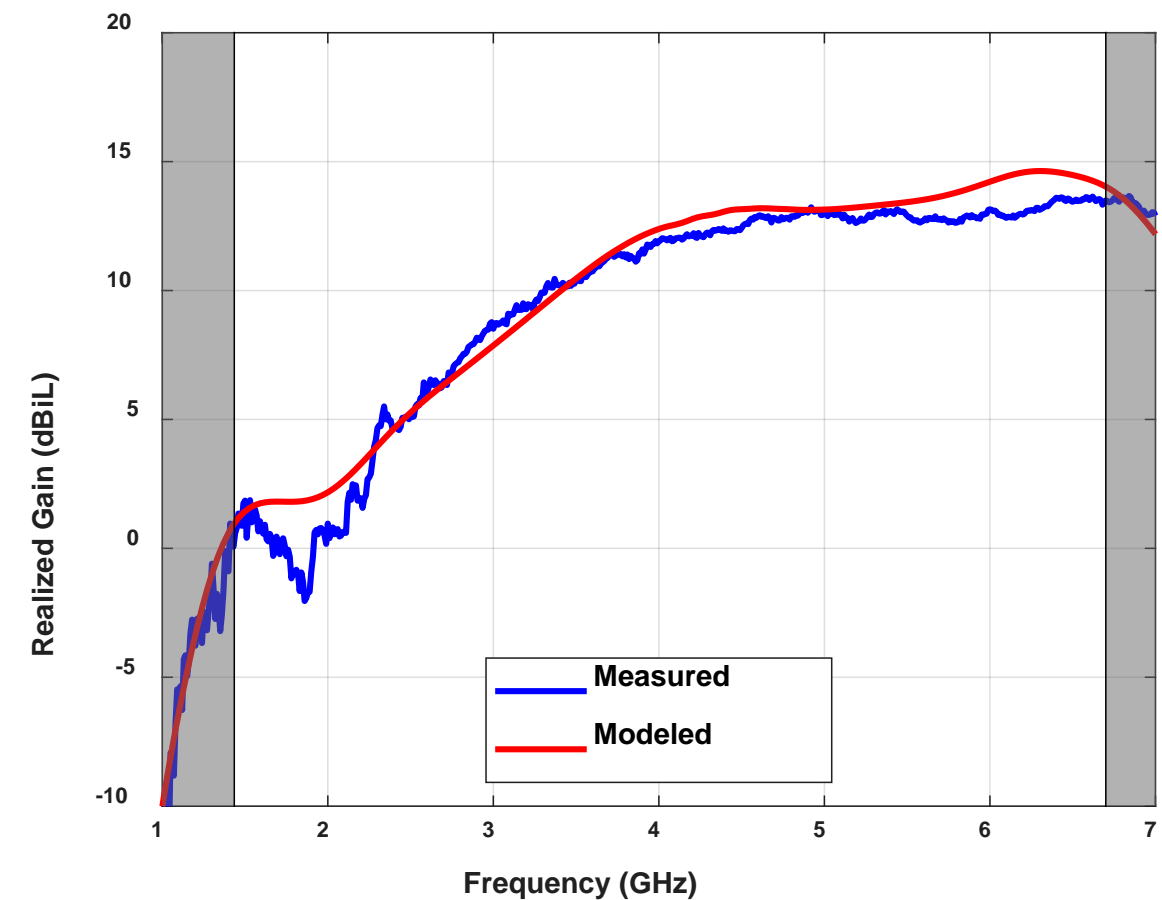
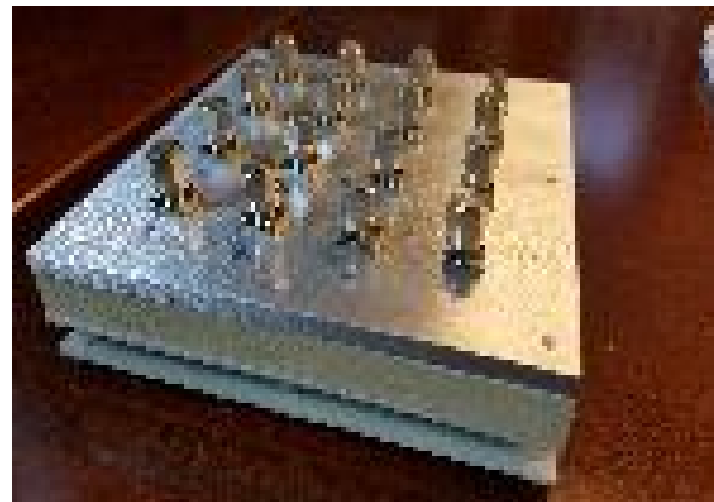


Verification of Aperture Design for an Array of Reduced in Size (4x4)

Top Side:
Fragmented Aperture

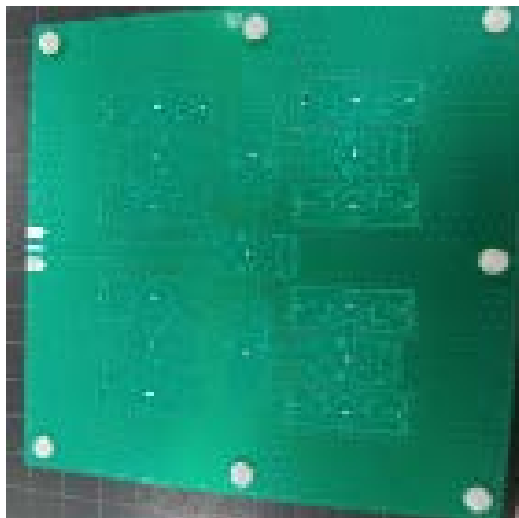


Bottom Side:
Fully Connectorized

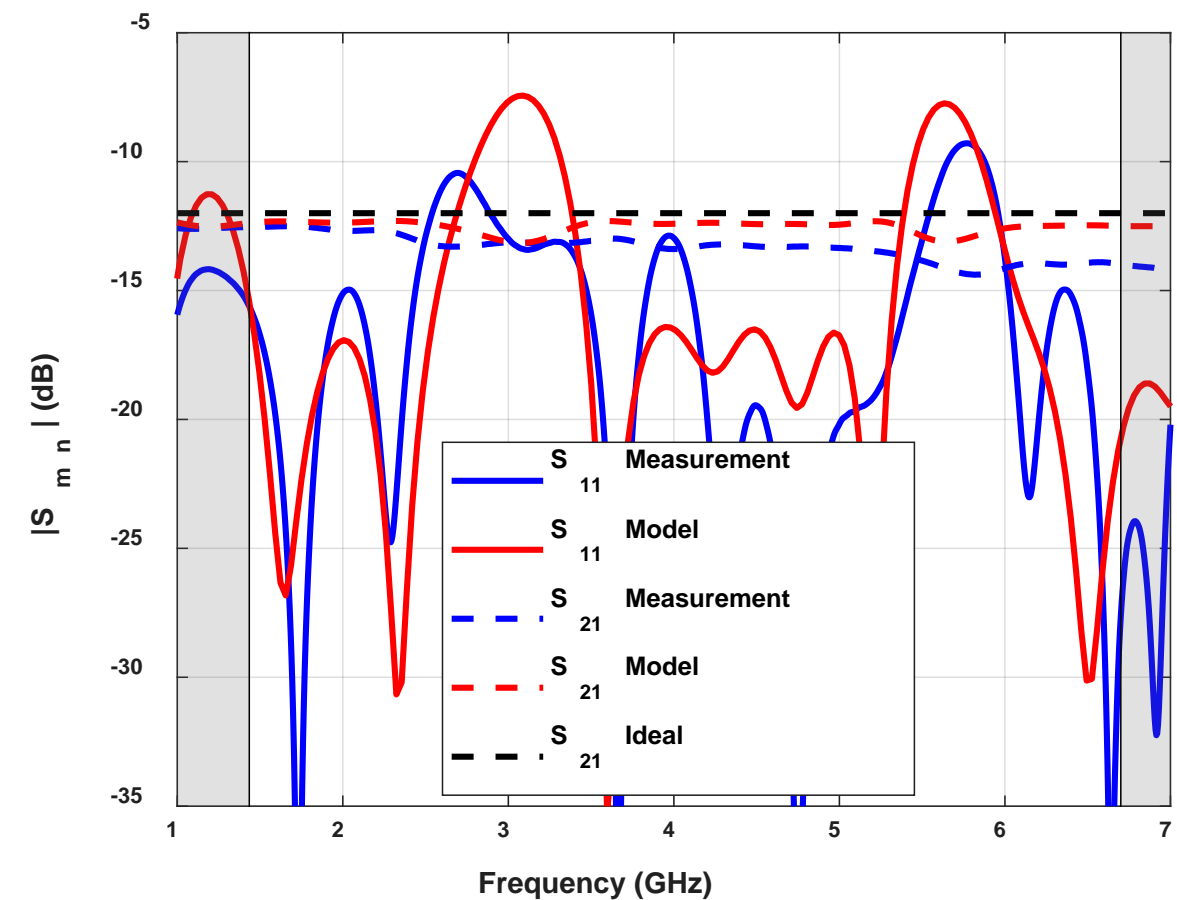


Verification for a Combiner Network of Reduced Size (16:1)

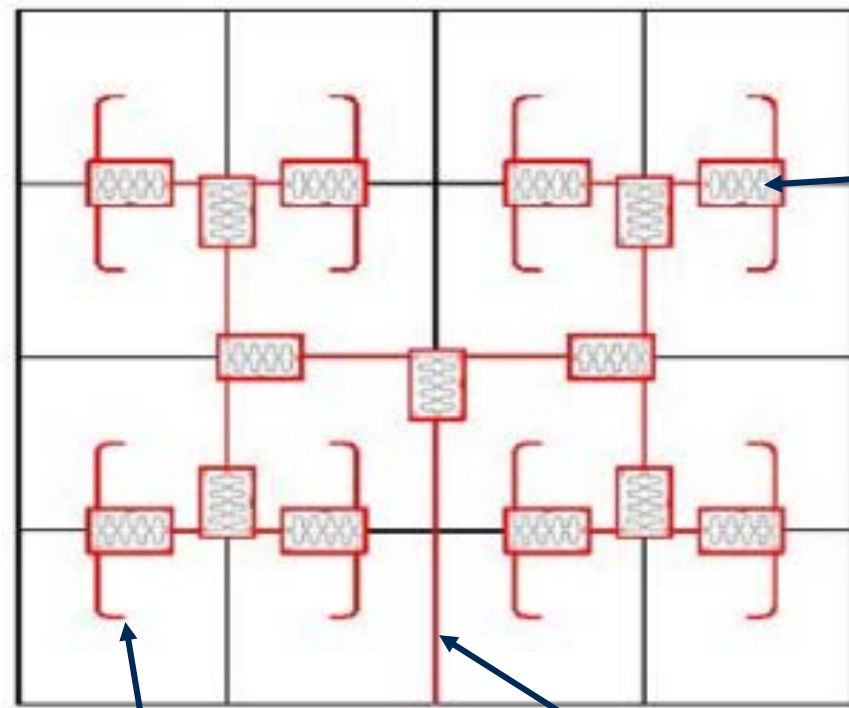
Top Side:
Fragmented Combiner



Bottom Side:
Fully Connectorized



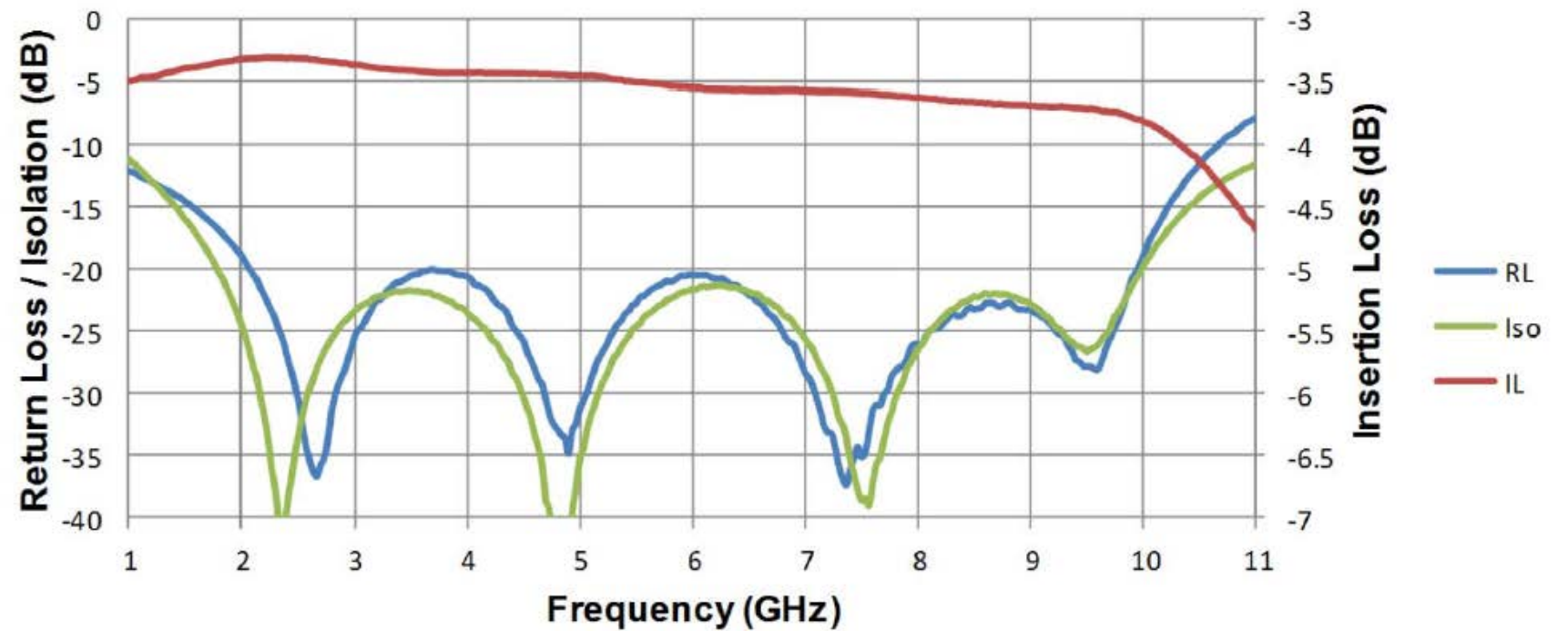
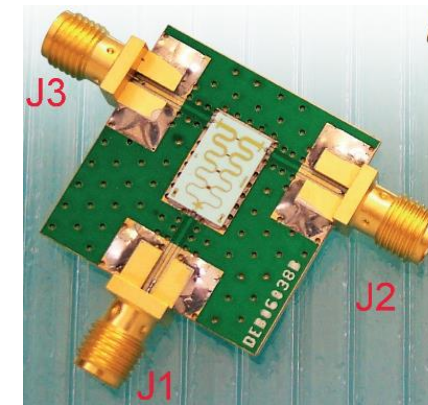
COTS Combiner Network (16:1) used for Comparison



Port for Antenna Element

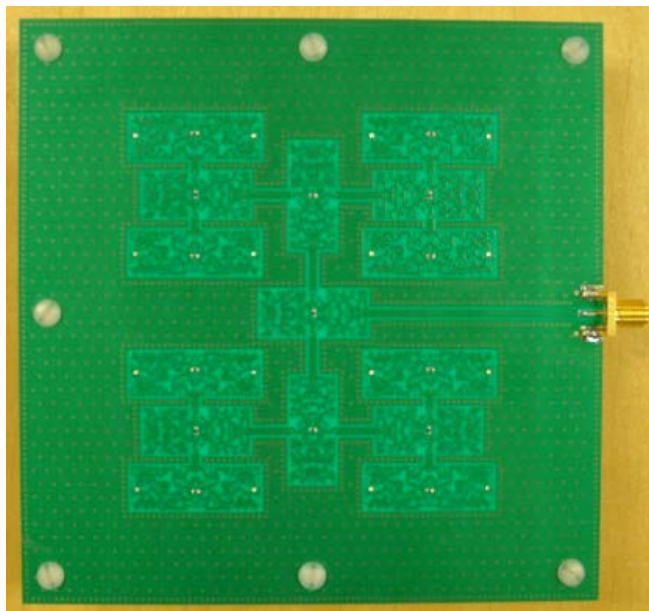
Input

2:1 Wilkinson Power Divider - Knowles PDW06038

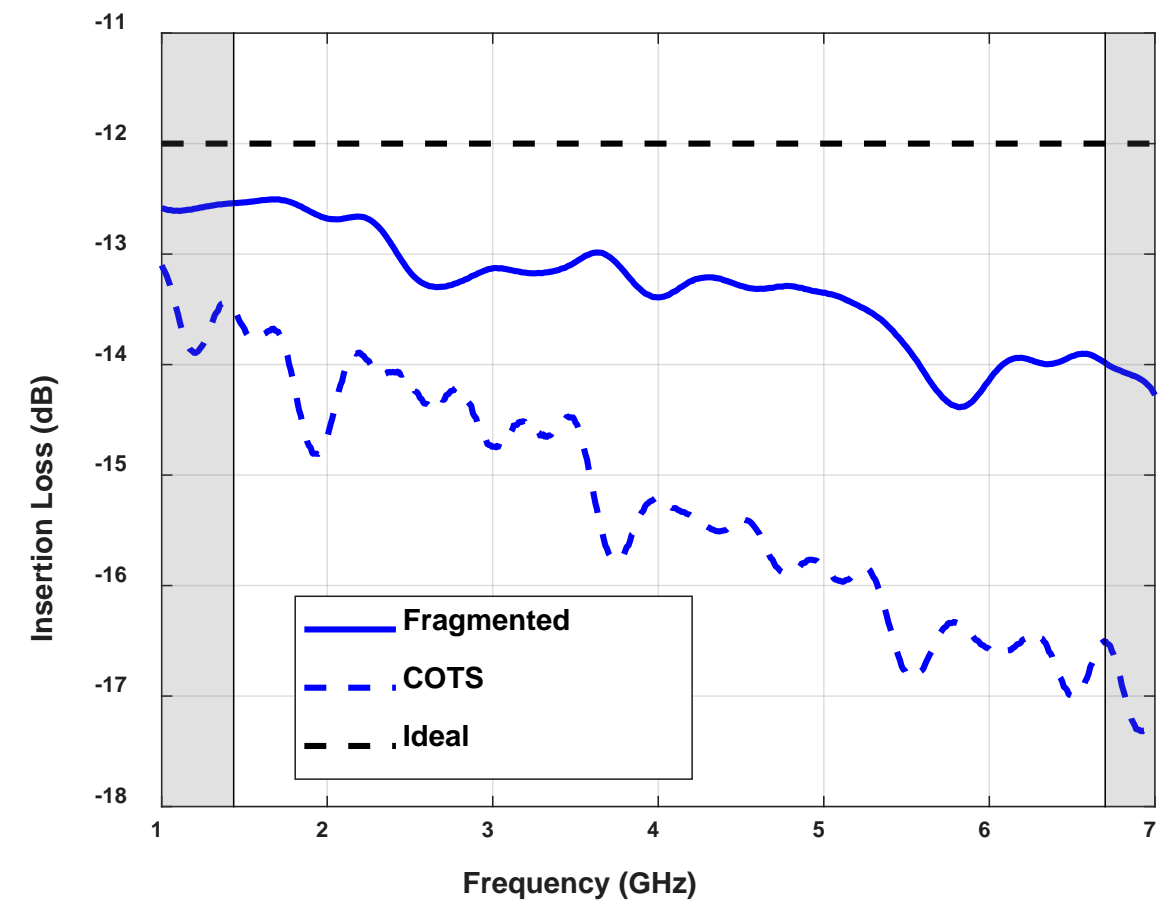
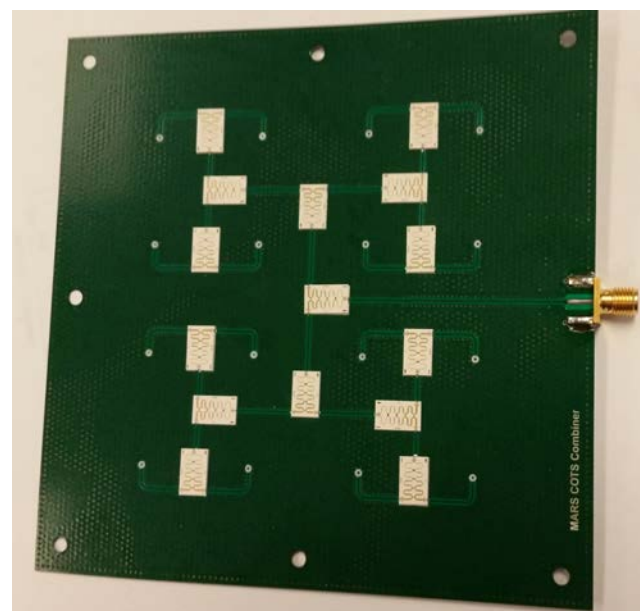


Comparison of Combiners (16:1): Fragmented vs. COTS

Fragmented Combiner



COTS Combiner

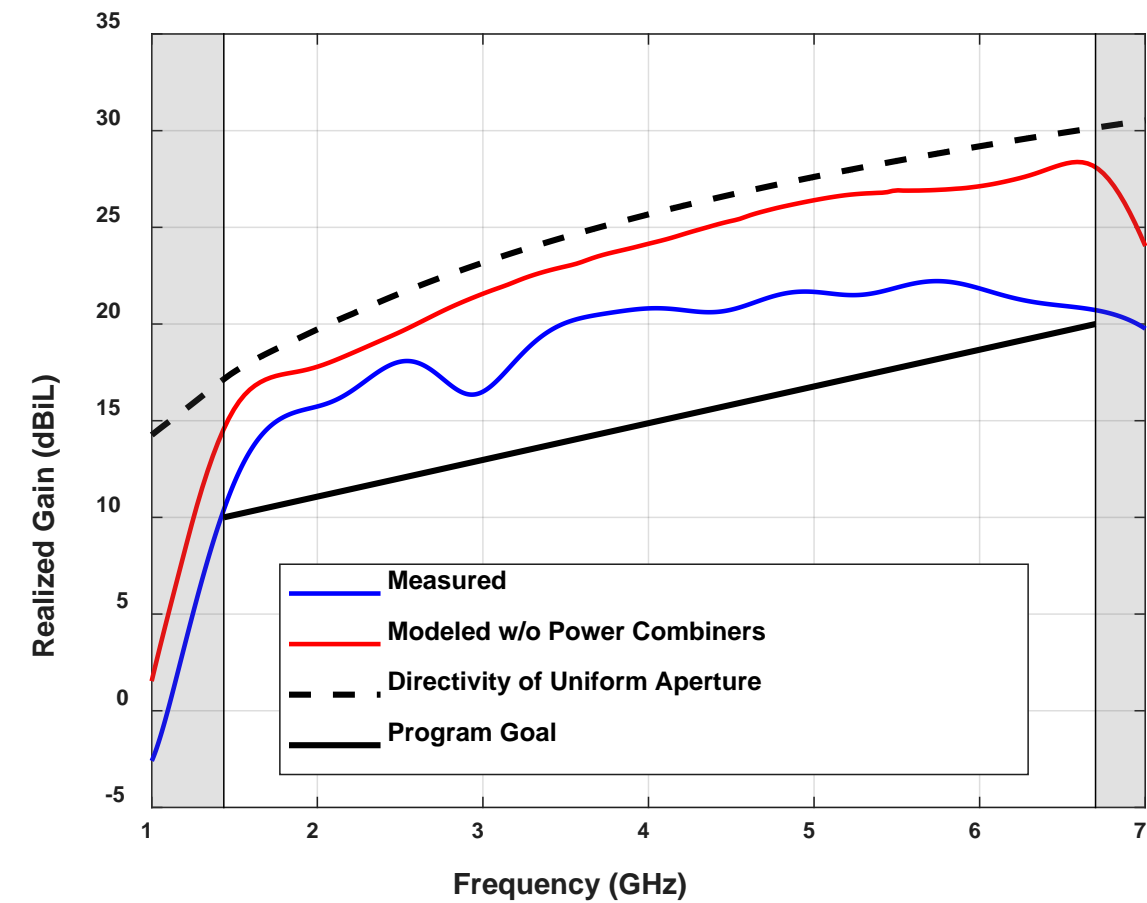
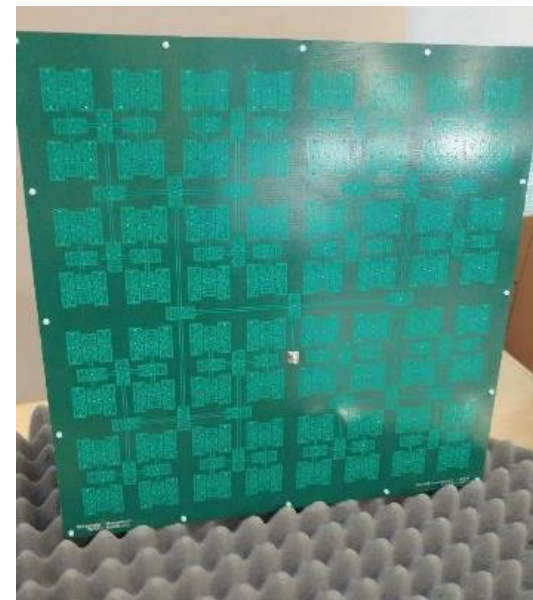


Realized Gain for Full Sized Array (16x16) with Feed Network Formed From Fragmented Combiners (256:1)

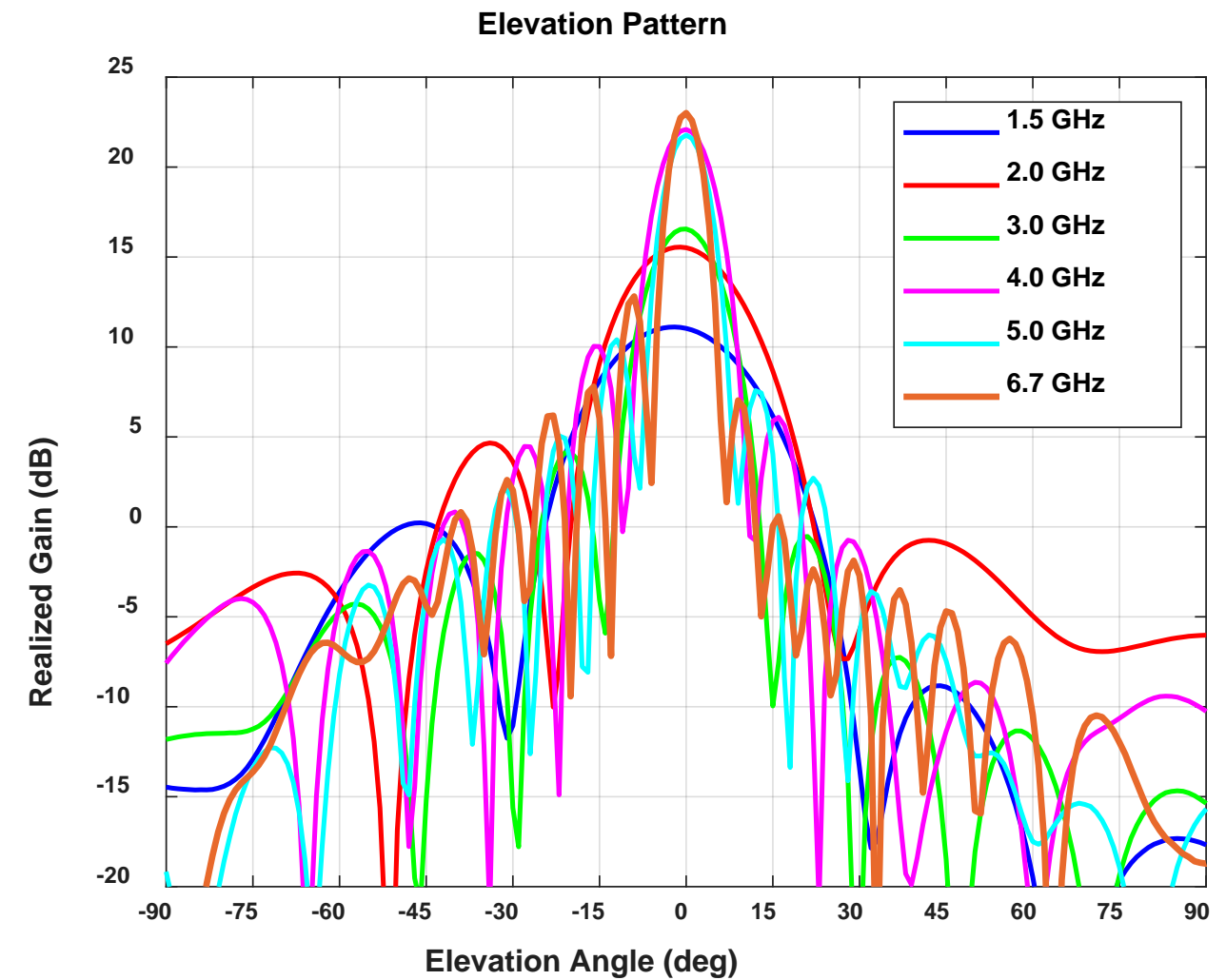
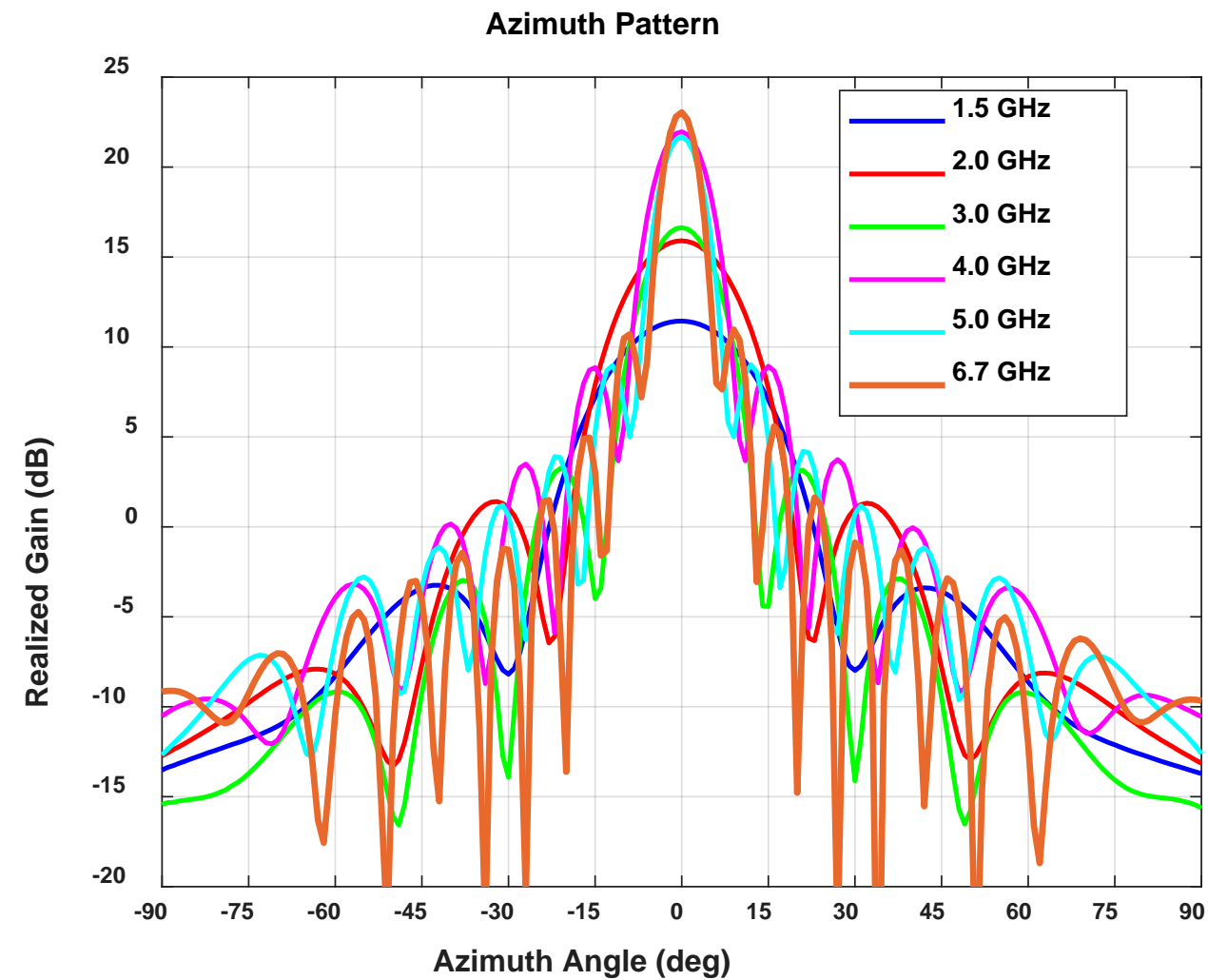
Fragmented Aperture



Fragmented Feed Network



Patterns in Principal Planes for Full Sized Array (16x16) with Feed Network Formed From Fragmented Combiners (256:1)

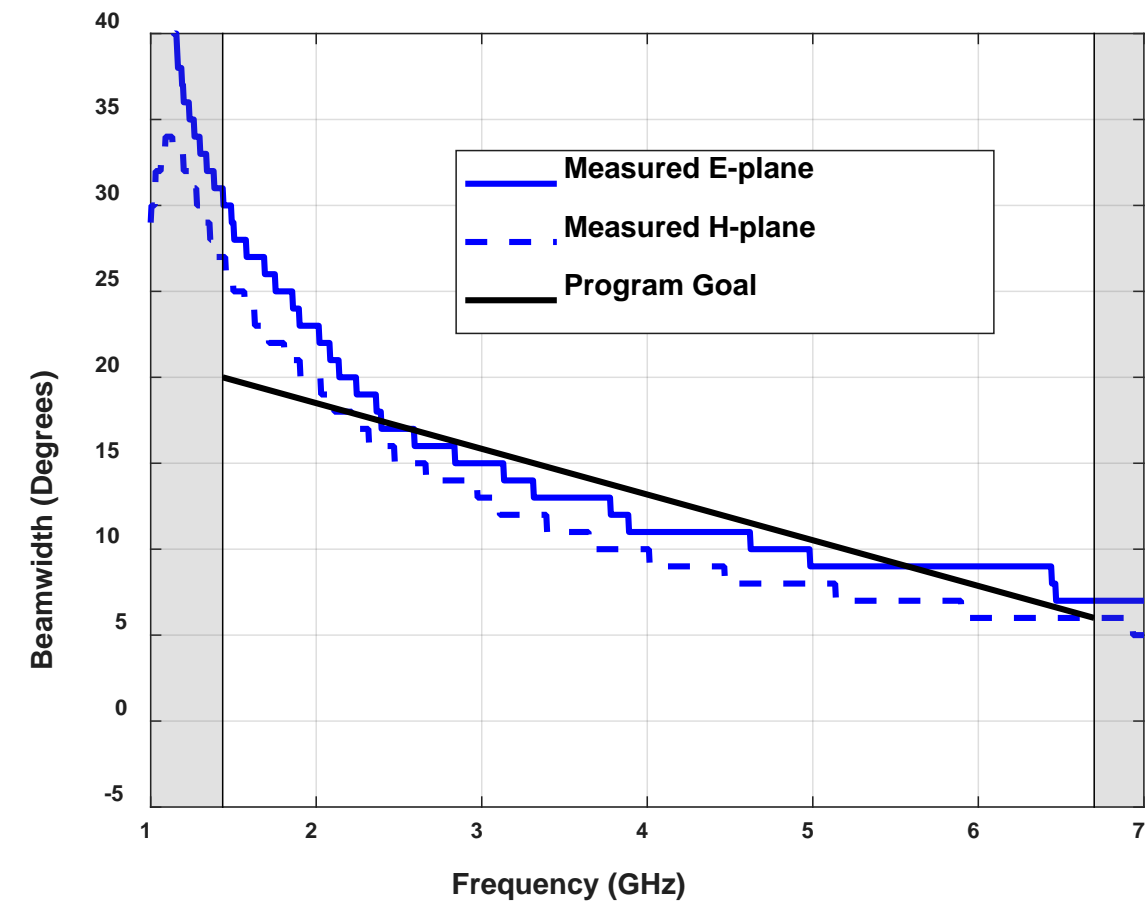
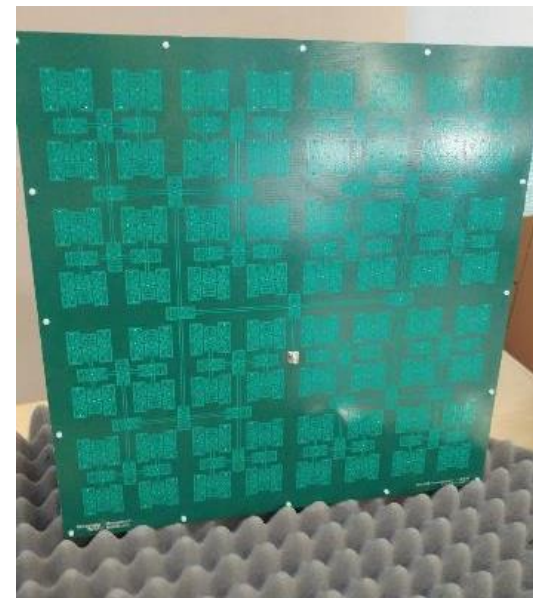


Beamwidths in Principal Planes for Full Sized Array (16x16) with Feed Network Formed From Fragmented Combiners (256:1)

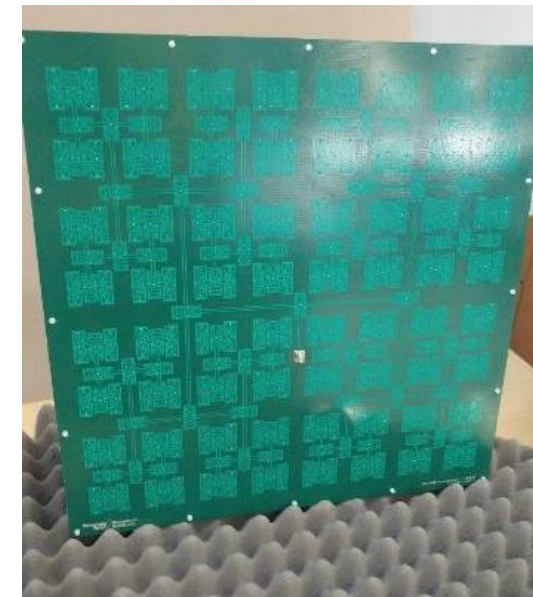
Fragmented Aperture



Fragmented Combiner



Final Build Including Radome



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14. ABSTRACT A fully combined, fixed-beam, ultra-wideband array with unbalanced feeds is described. Both the array elements and power combiners are based on the fragmented aperture principle. Each was designed separately using a genetic algorithm, then combined to form an integrated version of the array. Measured results are reported including realized gain, and beamwidths in the principal planes.						
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