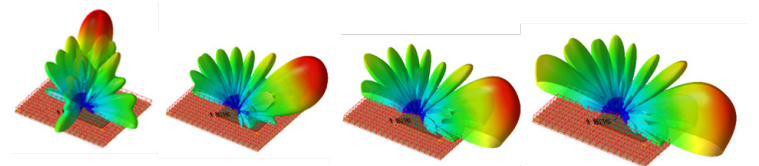
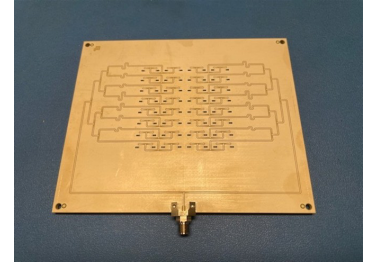
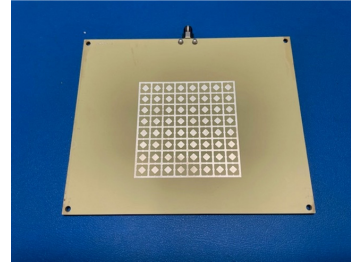


Technology Brief – K/Ka Band AESA Radiating Elements

Broadband Scan Invariant Antenna Element for AESA Purposes

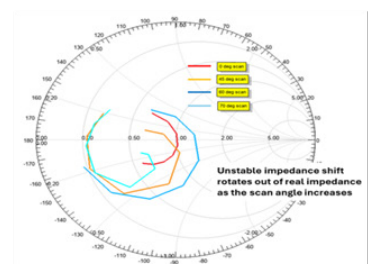
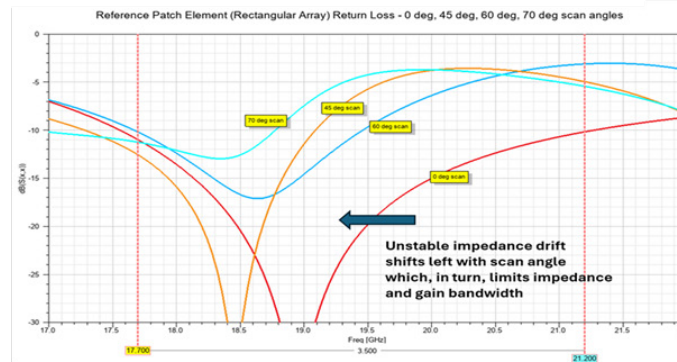
TRAK TECOM has developed and tested a new class of radiating elements intended to provide scalable, broadband sub-wavelength spaced radiators for use in electronically scanning array applications. These elements provide a feasible alternative to traditional patch arrays without adding complexity and cost to the planar structure, while overcoming patch array performance shortcomings.



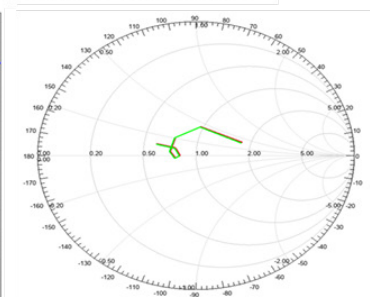
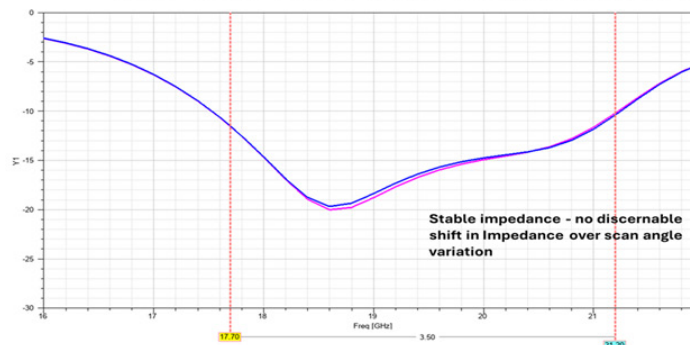
Key Takeaway

- Scan invariant surface elements deliver wide impedance bandwidth – Radiators incorporate an integrated planar ridge surface layer which provides unchanging impedance over a wide scan volume – typically 0 – 70 deg scan angle. As depicted below, the scan stable ridge element shows constant impedance variation over a wide bandwidth (>18%) when compared to a standard patch radiator element for varying scan angles.

Reference Patch Element Impedance vs. Scan Angle



New Scan Stable Ridge Element Impedance vs. Scan Angle



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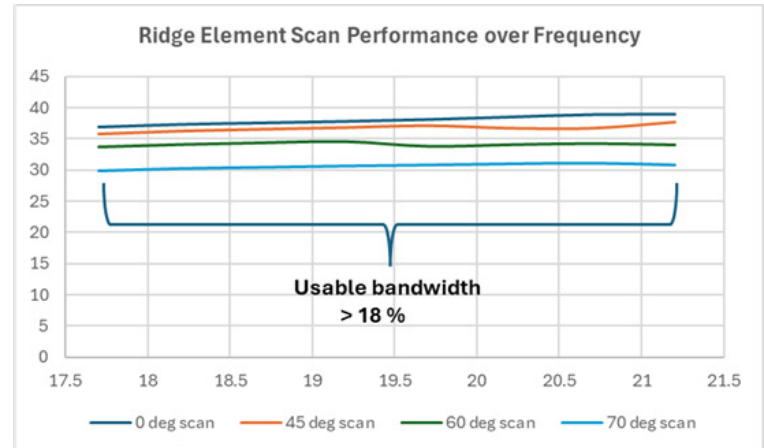
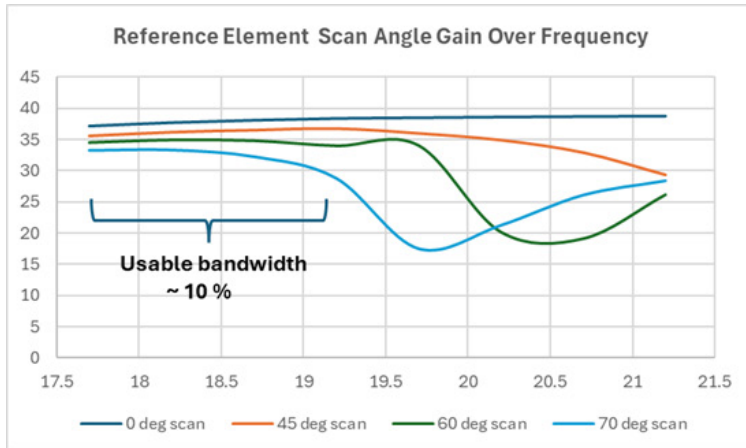


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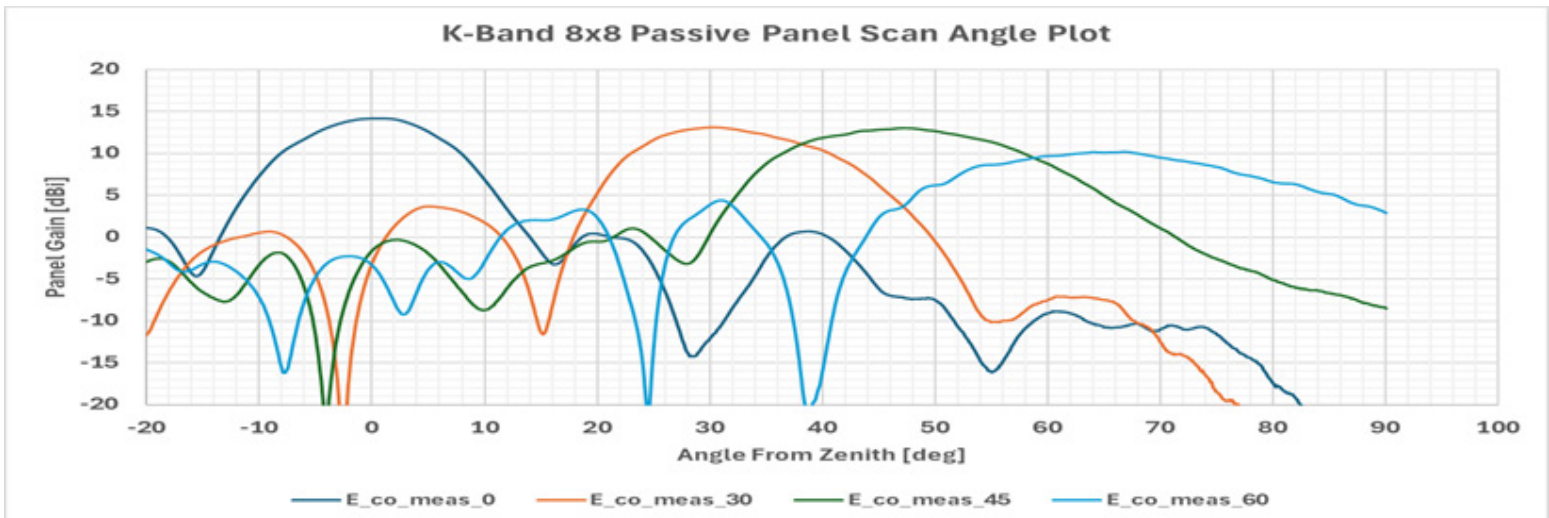
Technology Brief – K/Ka Band AESA Radiating Elements

Key Take Away

- Broad flat gain bandwidth results from scan invariant surface - The resulting scan invariant behavior allows for flat frequency response more than 18% bandwidth whereas the band limiting behavior of the patch array typically allows for only 10-12% usable bandwidth.



- Low cosine exponent – Measurements taken in a compact range show the figure of merit of the cosine exponent of 0.75 (low scan angles), over the full 18% bandwidth of the antenna, which exceeds standard patch element behavior, and is a key component of efficient array performance over wide scan volumes and wide bandwidths.



- High efficiency – due to the high scan angle bandwidth and low cosine exponent the ridge element performs with exceedingly high efficiency over a wide scan volume and design bandwidth.



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Other Notable Attributes

- Scan range optimization –ridge element can facilitate limited scan angle range gain optimization
- Scalable design –ridge element design can be scaled from X to Ka band
- Same planar construction and fabrication as patch arrays –feeding mechanism and the ridge structure does not add to the complexity of the array topology including layer stackup.
- Scan invariant elements work in arbitrary lattice configurations –measured results were for a rectangular lattice. However, a triangular lattice will perform equally well.
- Co-centric orthogonal feeds - works with both broadband circular polarized and orthogonal linear polarized feeds.
- Modular and reconfigurable
- Patented and patent pending

Measured Performance

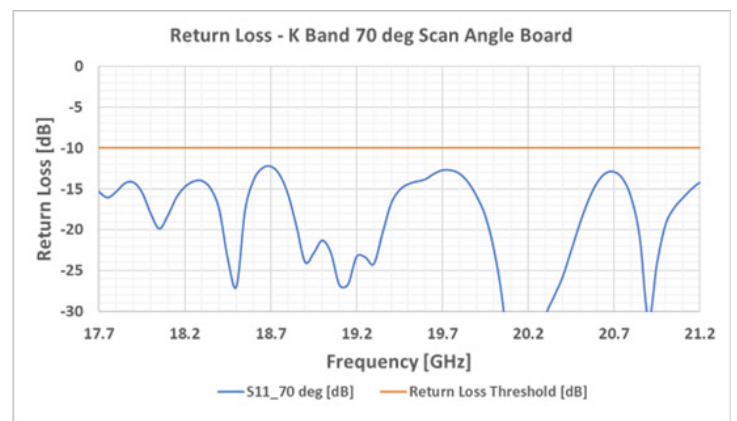
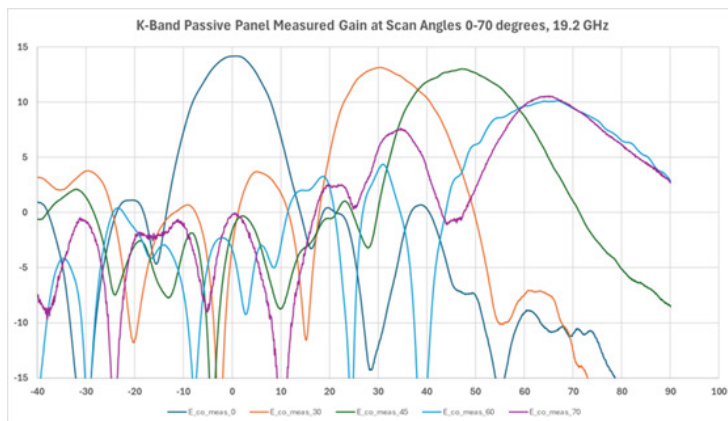
K-Band Passive Panel

Applications

Commercial/Military/Satcom Receive

Benefits

- Planar antenna construction – AESA compatible
- 17.7 – 21.2 GHz (design bandwidth), 16.5 – 22.5 (functional bandwidth).
- Scan Invariant Surface – 3.5 GHz flat gain bandwidth, stable impedance over full scan angles and frequency range
 - o 0.75 (0-60 deg)
 - o Exceeding patch element typical performance in bandwidth and scan angle performance



Mirrored return loss fixed, removed 70 and 80 deg plots but need response from email for justification to remove

Ka-Band Passive Panel



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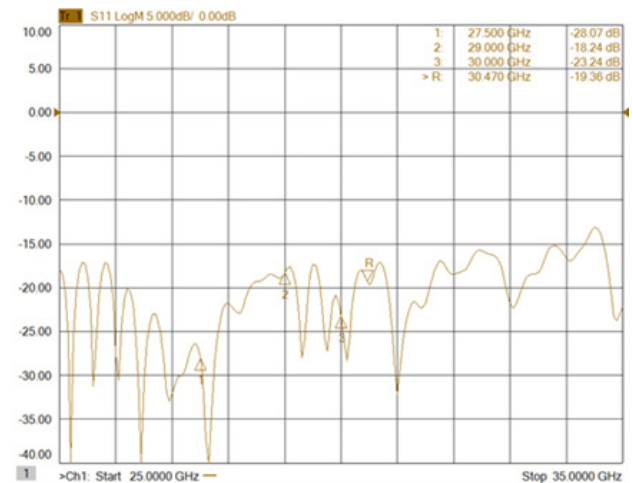
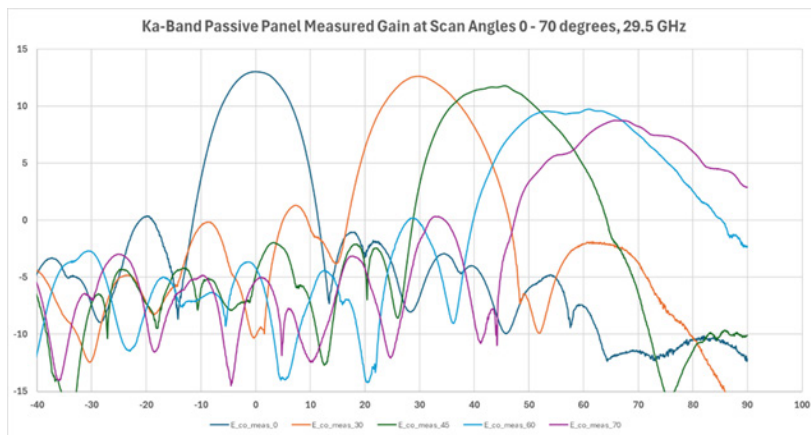
Technology Brief – K/Ka Band AESA Radiating Elements

Applications

Commercial/Military/Satcom Receive

Benefits

- Planar antenna construction – AESA compatible
- 27.5 - 31 GHz operational bandwidth.
- Scan Invariant Surface – 3.5 GHz flat gain bandwidth, stable impedance over full scan angles and frequency range
- 0.75 (0-60 deg) scan exponent
 - o Exceeding typical patch element performance over scan angle and bandwidth



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