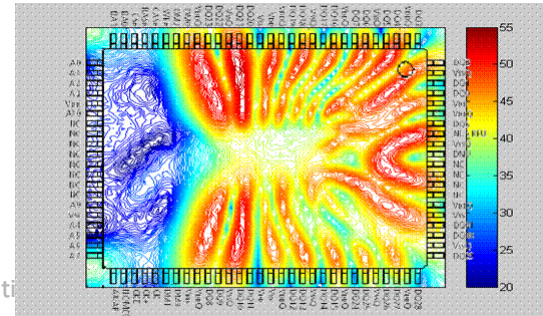
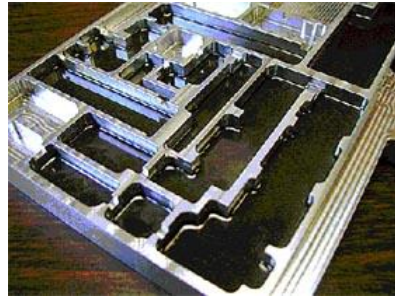




Free Space Absorbers

Absorber application types

- The correct choice of an absorber depends on the application
- Absorber applications fall into three broad categories with different requirements on absorber properties
 - **Free space**
 - Propagating waves, volume large in terms of a wavelength
 - Volume large compared to wavelength
 - Microwaves propagate
 - Reflectivity
 - Insertion loss
 - **Enclosed space (Cavity resonance)**
 - Constrained waves, volume size on the order of a wavelength
 - **Near field**
 - Absorber is placed very close to or in contact with a radiating element



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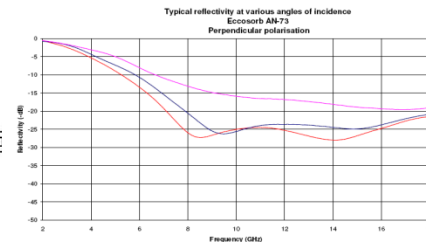
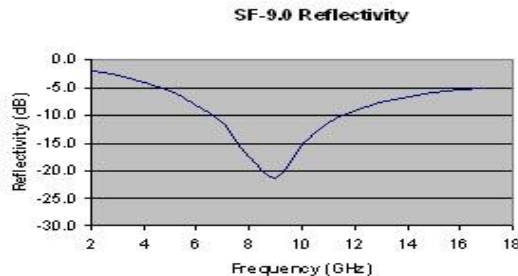
Free Space-Reflectivity Absorbers

- Reduce reflections from conductive surface
 - Mast close to radar causing reflections
 - Test environment
 - Shrouding antennas to improve performance by reducing side/back lobes
 - Reducing cross talk between adjacent antennas by isolation
 - Lining small test chambers to reduce reflections



- Application of absorber to reduce reflection

- Narrowband-single layer homogeneous
 - >20 dB reflection reduction at design frequency
- Broadband-multiple layer absorber
 - >20 dB across a broad bandwidth
- Broadband gradient absorbers
 - Gradient in material parameters realized by shaping (pyramids) or continuously variable material construction



- 3 dB = 50% absorbed (50% reflected)
- 10 dB = 90% absorbed (90% reflected)
- 20 dB = 99% absorbed (1% reflected)

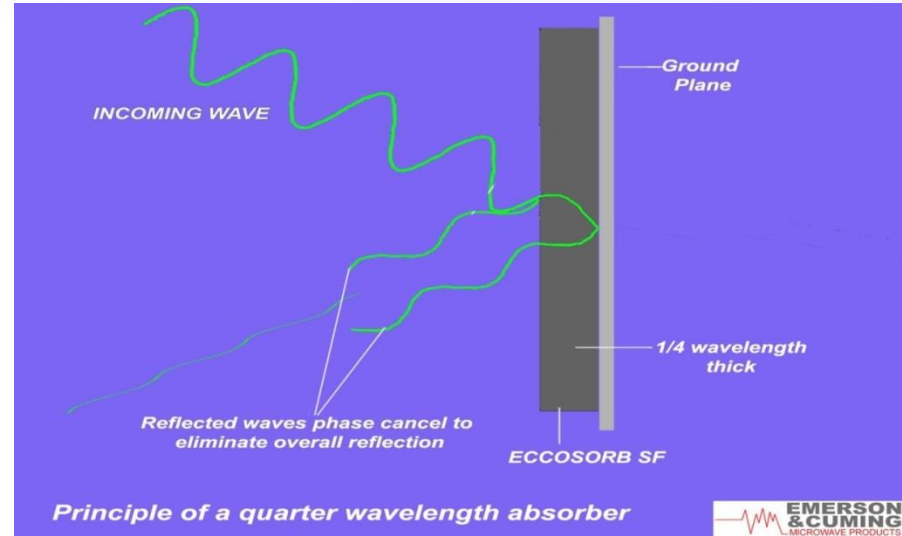
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Reflectivity absorbers will reduce free space reflections off surfaces

Free Space-Reflectivity Absorbers

- Quarter wave absorber:
 - Reflection off front face phase cancels with reflection off ground plane there will be no reflection
 - Occurs if absorber is $\frac{1}{4}$ wavelength thick
 - Narrowband



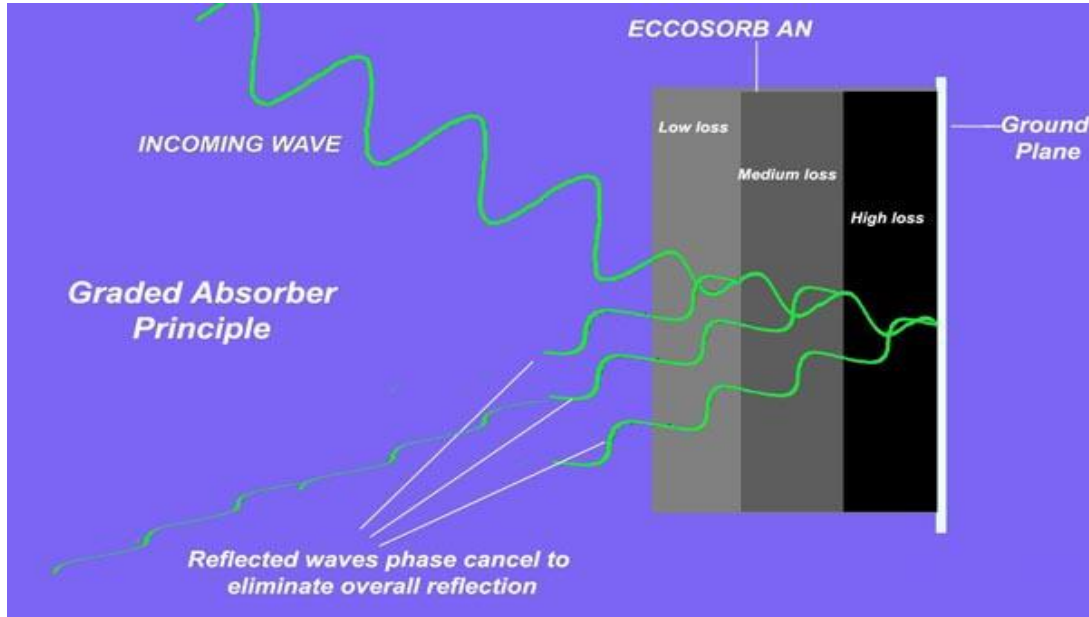
A single layer homogeneous material will have a reflectivity minimum when its thickness is $\frac{1}{4}$ wavelength in the material

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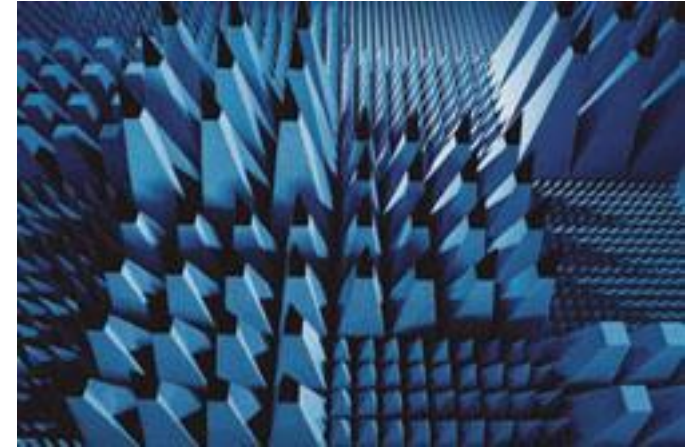
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Free Space-Reflectivity Absorbers-broadband

Multiple layer broadband reflectivity absorber



Pyramidal Absorber



No abrupt transition layer so no point where large reflection will occur

Reflectivity

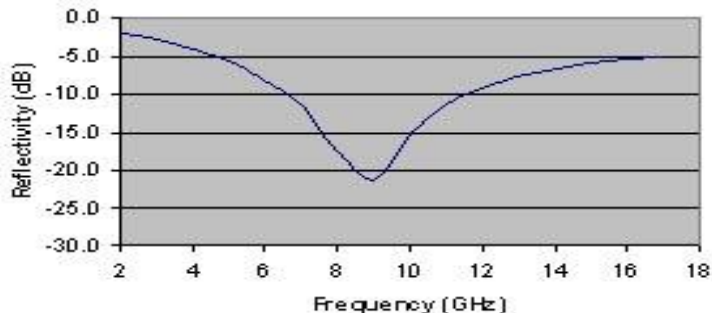
Narrowband vs Broadband Performance

Typical applications:

- Shrouding antennas to improve performance by reducing side/back lobes
- Reducing cross talk between adjacent antennas by isolation
- Lining small test chambers to reduce reflections



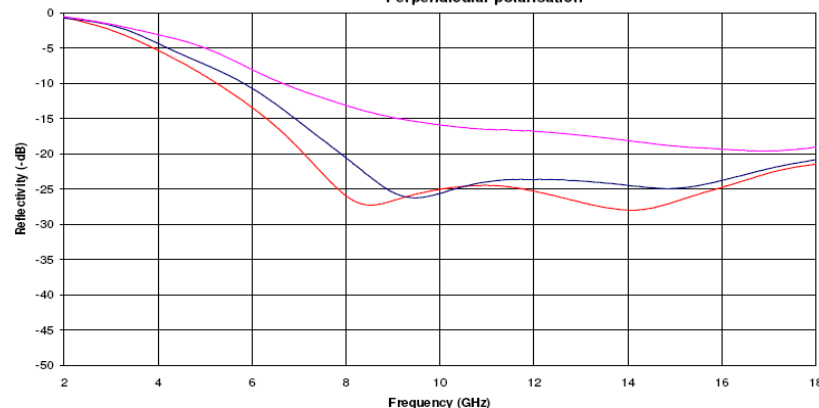
SF-9.0 Reflectivity



SF-9.0

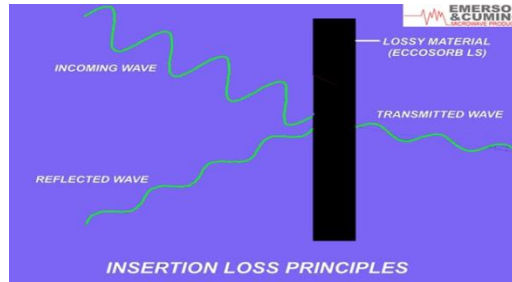
- 3 dB = 50% absorbed (50% reflected)
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Typical reflectivity at various angles of incidence
Eccosorb AN-73
Perpendicular polarisation



Free Space-Insertion Loss Absorbers

- Prevent energy emitted at Point A from interfering at Point B
- Used for antenna isolation or as general lossy barrier
- Isolate signals emitted by adjacent antennas
- Simple test
 - Bore sight two antennas
 - Measure reference signal
 - Measure drop in signal with insertion of absorber
- Generally low cost dielectrically loaded foam materials
 - Range of thickness and loading
- Reflection could be consideration
 - High insertion loss absorbers will tend to also have high reflection levels



Insertion loss absorbers provide a barrier to energy passing between two components with a minimum of reflection