

## Flat Panel Analysis

### Scope

Perform preliminary infinite flat panel analysis of cross section material selection to assess the honeycomb core thickness that optimizes RF performance for the application requirements.

### Results

The candidate radome with the best overall performance based on the specification requirements is COPT-02 with 0.313" core thickness. Also shown is COPT-04 with good performance. Representative performance graphs are shown in figures 1, 2, 3 and 4.

### Analysis

Infinite flat panel analysis was run for core thicknesses of 0.375", 0.313", 0.438", 0.344", and 0.329" with all other layer thicknesses and material properties unchanged. The analysis was run at incidence angles of 0° to 12°, 24°, 36°, 48°, 60° and 72°. For each angle, 111 frequencies from 8.5 GHz to 10.7 GHz at increments of 20 MHz were analyzed.

### Cross Section Selection

The cross sectional dimensions, materials and material electrical properties are summarized in the tables below that will be used for the infinite flat panel analysis. A summary of the infinite flat panel transmission loss results are presented in Table 1.

### Radome Flat Panel Thickness and Material Electrical Properties

Core Thickness Optimization					10/14/2006
COPT_01	A-sandwich E-Glass Skins & Paint				
Layer	Thick. (in)	er	tandelta	Material	
1	0.0025	3.750	0.0680	Sample	
2	0.0010	3.300	0.0500	Sample	
3	0.0200	4.300	0.0140	Sample	
4	0.3750	1.082	0.0018	Sample	
5	0.0200	4.300	0.0140	Sample	
6	0.0010	3.300	0.0500	Sample	
7	0.0025	3.750	0.0680	Sample	
total	0.4220				

Core Thickness Optimization					10/15/2006
COPT_02	A-sandwich E-Glass Skins & Paint				
Layer	Thick. (in)	er	tandelta	Material	
1	0.0025	3.750	0.0680	Sample	
2	0.0010	3.300	0.0500	Sample	
3	0.0200	4.300	0.0140	Sample	
4	0.3130	1.082	0.0018	Sample	
5	0.0200	4.300	0.0140	Sample	
6	0.0010	3.300	0.0500	Sample	
7	0.0025	3.750	0.0680	Sample	
total	0.3600				

Core Thickness Optimization					10/15/2006
COPT_03	A-sandwich E-Glass Skins & Paint				
Layer	Thick. (in)	er	tandelta	Material	
1	0.0025	3.750	0.0680	Sample	
2	0.0010	3.300	0.0500	Sample	
3	0.0200	4.300	0.0140	Sample	
4	0.4380	1.082	0.0018	Sample	
5	0.0200	4.300	0.0140	Sample	
6	0.0010	3.300	0.0500	Sample	
7	0.0025	3.750	0.0680	Sample	
total	0.4850				

Core Thickness Optimization					10/16/2006
COPT_04	A-sandwich E-Glass Skins & Paint				
Layer	Thick. (in)	er	tandelta	Material	
1	0.0025	3.750	0.0680	Sample	
2	0.0010	3.300	0.0500	Sample	
3	0.0200	4.300	0.0140	Sample	
4	0.3440	1.082	0.0018	Sample	
5	0.0200	4.300	0.0140	Sample	
6	0.0010	3.300	0.0500	Sample	
7	0.0025	3.750	0.0680	Sample	
total	0.3910				

Core Thickness Optimization					10/16/2006
COPT_05	A-sandwich E-Glass Skins & Paint				
Layer	Thick. (in)	er	tandelta	Material	
1	0.0025	3.750	0.0680	Sample	
2	0.0010	3.300	0.0500	Sample	
3	0.0200	4.300	0.0140	Sample	
4	0.3290	1.082	0.0018	Sample	
5	0.0200	4.300	0.0140	Sample	
6	0.0010	3.300	0.0500	Sample	
7	0.0025	3.750	0.0680	Sample	
total	0.3760				

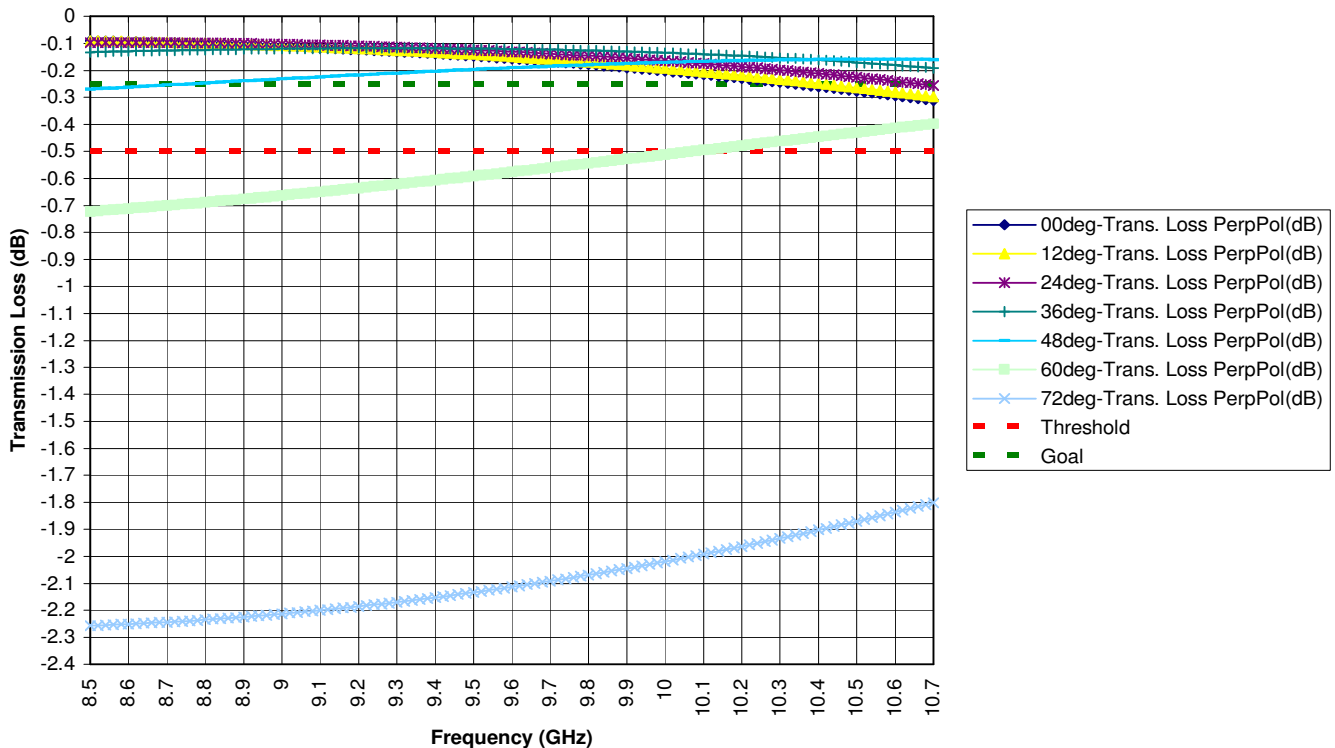
In Table 1 Maximum Transmission Loss from 0° to 72°, Average Transmission Loss from 0° to 72°, and 90% Maximum Transmission Loss from 0° to 72°, is listed for each of the five candidate radome core thicknesses for perpendicular and parallel polarizations. In the right most column of Table 1 an overall Transmission Loss ranking is presented. The candidate radome with the best overall performance based on these criteria listed is COPT-02 with 0.313" core thickness. Also shown is COPT-04 with good performance.

**Table 1 Radome Candidate Computed Performance Summary**

GBFR Radome Core Thickness Optimization A-Sandwich Candidate							
Infinite Flat Panel Calculated							
Transmission Loss Summary							
Case	Core Thickness (in)	Max T-Loss	Average T-Loss	Max T-Loss	Average T-Loss	Max T-Loss	Average T-Loss
		0° to 72° (dB)	0° to 72° (dB)	0° to 72° (dB)	0° to 72° (dB)	0° to 72° (dB)	0° to 72° (dB)
		Perpendicular	Perpendicular	Parallel	Parallel		
COPT-01	0.375	-1.883	-0.460	-0.564	-0.210		
COPT-02	0.313	-2.257	-0.496	-0.346	-0.146	-1.883	-0.335
COPT-03	0.438	-1.487	-0.498	-0.761	-0.293	-2.257	-0.321
COPT-04	0.344	-2.073	-0.468	-0.438	-0.174	-1.487	-0.395
COPT-05	0.329	-2.163	-0.479	-0.376	-0.159	-2.073	-0.321
						-2.163	-0.319

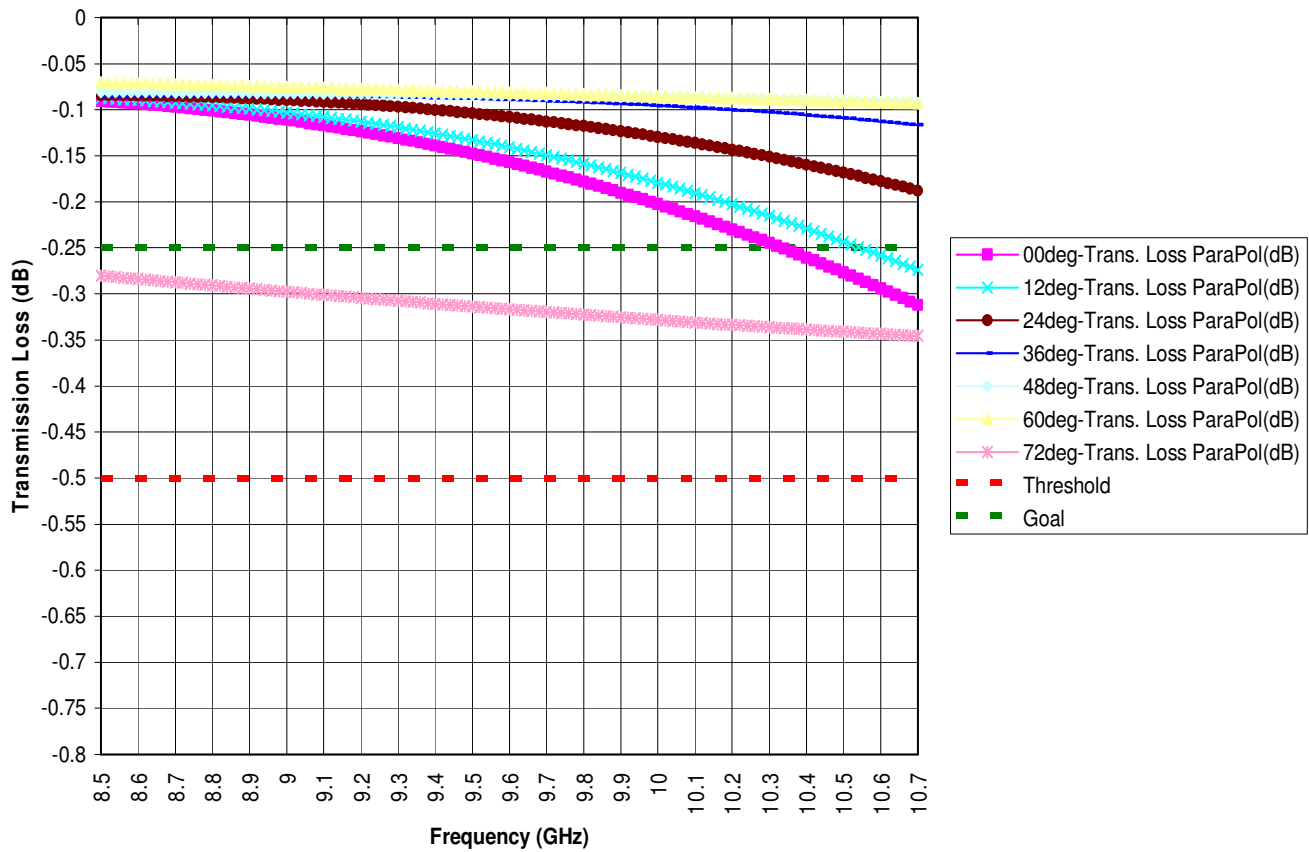
**Figure 1 GBFR A-Sandwich Radome Infinite Flat Panel Analysis Transmission Loss Perpendicular Polarization- Case COPT-02; Core Thickness =0.313"**

**GBFR A-Sandwich Radome Infinite Flat Panel Analysis Transmission Loss Perpendicular Polarization- Case COPT-02; Core Thickness =0.313"**



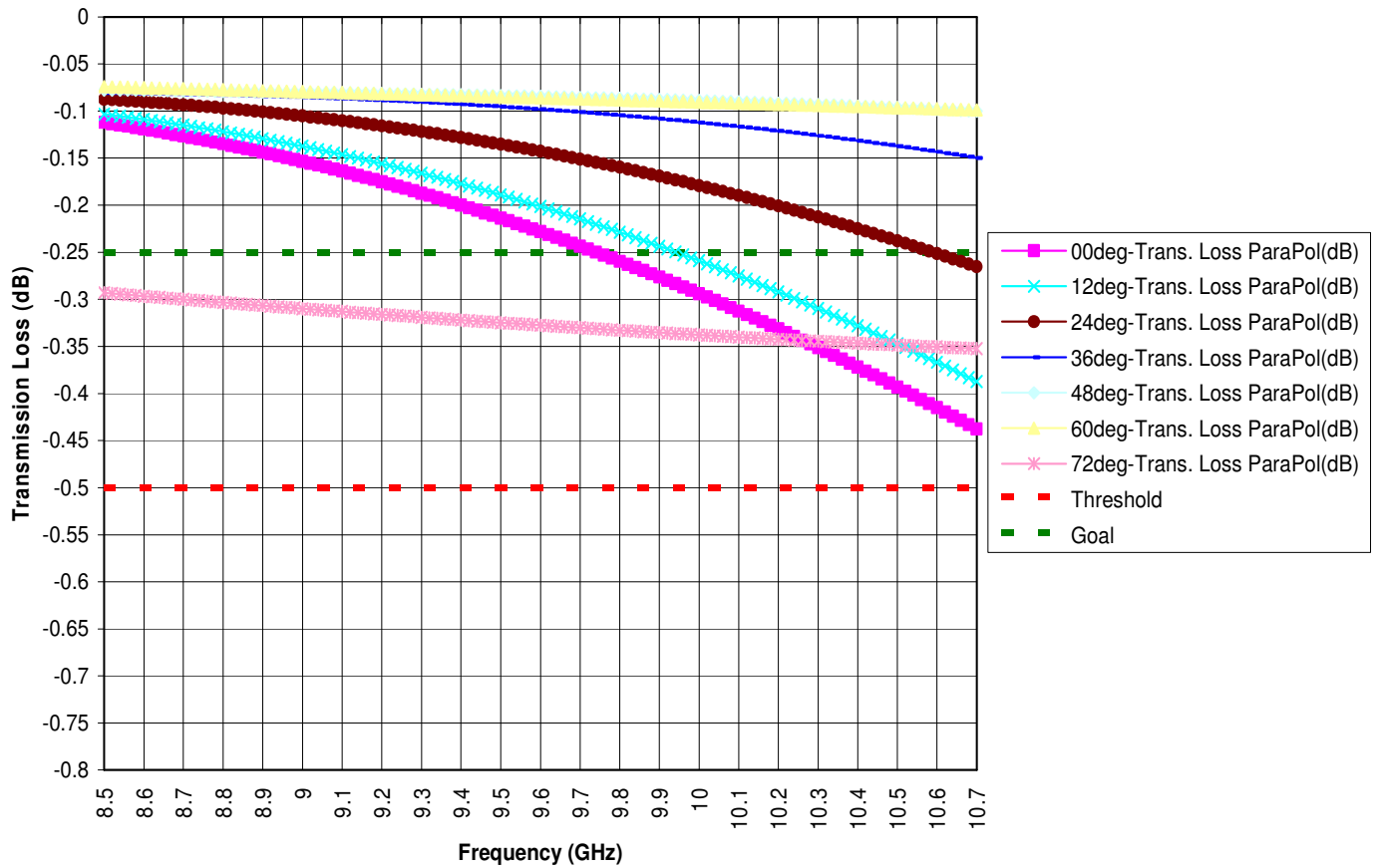
**Figure 2 A-Sandwich Radome Infinite Flat Panel Analysis Transmission Loss Parallel Polarization- Case COPT-02; Core Thickness =0.313"**

**GBFR A-Sandwich Radome Infinite Flat Panel Analysis Transmission Loss Parallel Polarization- Case COPT-02; Core Thickness =0.313"**



**Figure 3 A-Sandwich Radome Infinite Flat Panel Analysis Transmission Loss Parallel Polarization- Case COPT-04; Core Thickness =0.344"**

**GBFR A-Sandwich Radome Infinite Flat Panel Analysis Transmission Loss Parallel Polarization- Case COPT-04; Core Thickness =0.344"**



**Figure 4 GBFR A-Sandwich Radome Infinite Flat Panel Analysis Transmission Loss Parallel Polarization- Case COPT-04; Core Thickness =0.344"**

**GBFR A-Sandwich Radome Infinite Flat Panel Analysis Transmission Loss Perpendicular Polarization- Case COPT-04; Core Thickness =0.344"**

