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 0º to 12º, 24º, 36º, 48º, 60º and 72º. 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 0º to 72º, Average Transmission Loss from 0º to 72º, and 90% Maximum Transmission Loss from 0º to 72º, 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 0º to 72º (dB) Perpendicular	Average T-Loss 0º to 72º (dB) Perpendicular	Max T-Loss 0º to 72º (dB) Parallel	Average T-Loss 0º to 72º (dB) Parallel		Max T-Loss 0º to 72º (dB)	Average T-Loss 0º to 72º (dB)
COPT-01	0.375	-1.883	-0.460	-0.564	-0.210		-1.883	-0.335
COPT-02	0.313	-2.257	-0.496	-0.346	-0.146		-2.257	-0.321
COPT-03	0.438	-1.487	-0.498	-0.761	-0.293		-1.487	-0.395
COPT-04	0.344	-2.073	-0.468	-0.438	-0.174		-2.073	-0.321
COPT-05	0.329	-2.163	-0.479	-0.376	-0.159		-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"
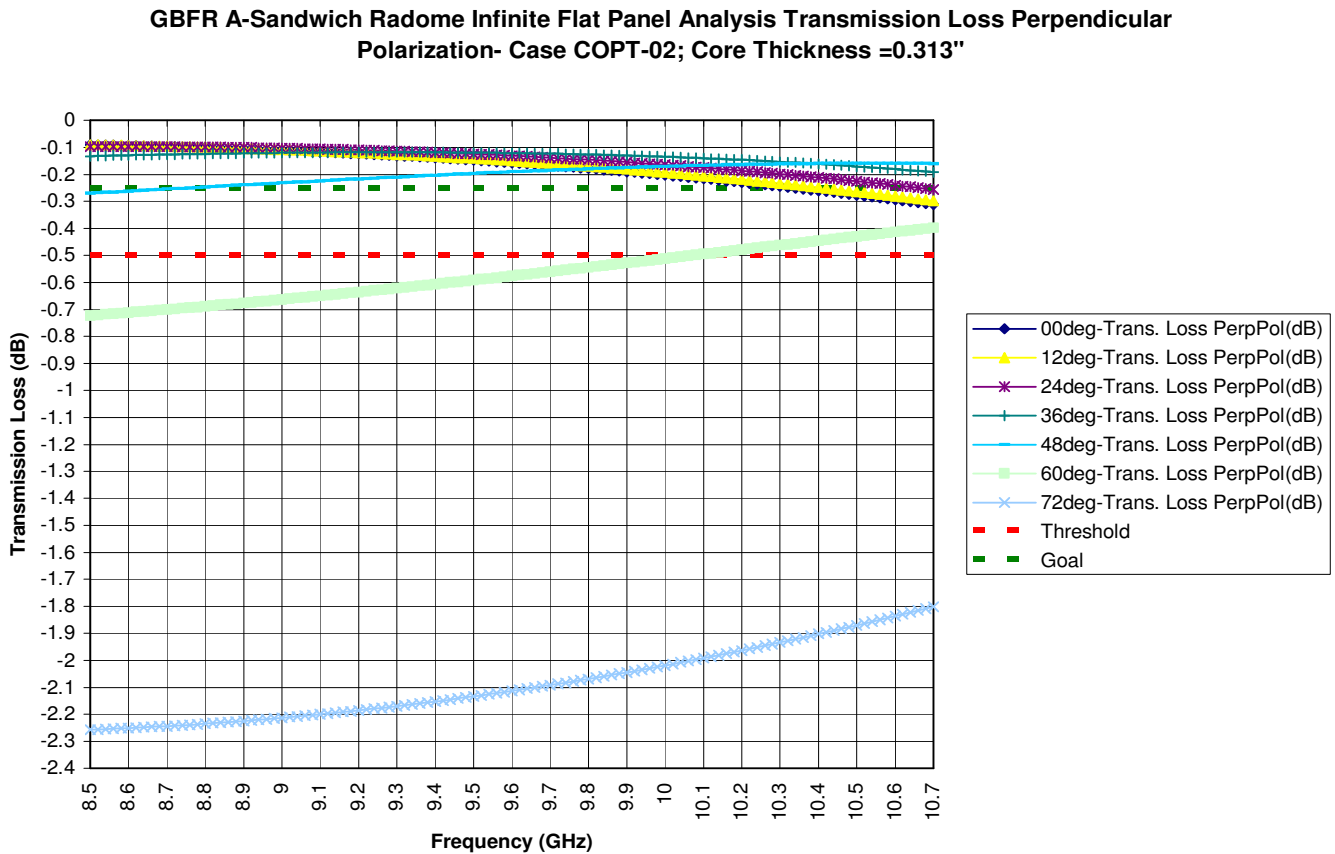
Figure 2 A-Sandwich Radome Infinite Flat Panel Analysis Transmission Loss Parallel Polarization- Case COPT-02; Core Thickness =0.313"

GBFR A-Sandwich Radome Infinite Flat Panel Analysis Transmission Loss Parallel Polarization- Case COPT-02; Core Thickness =0.313"
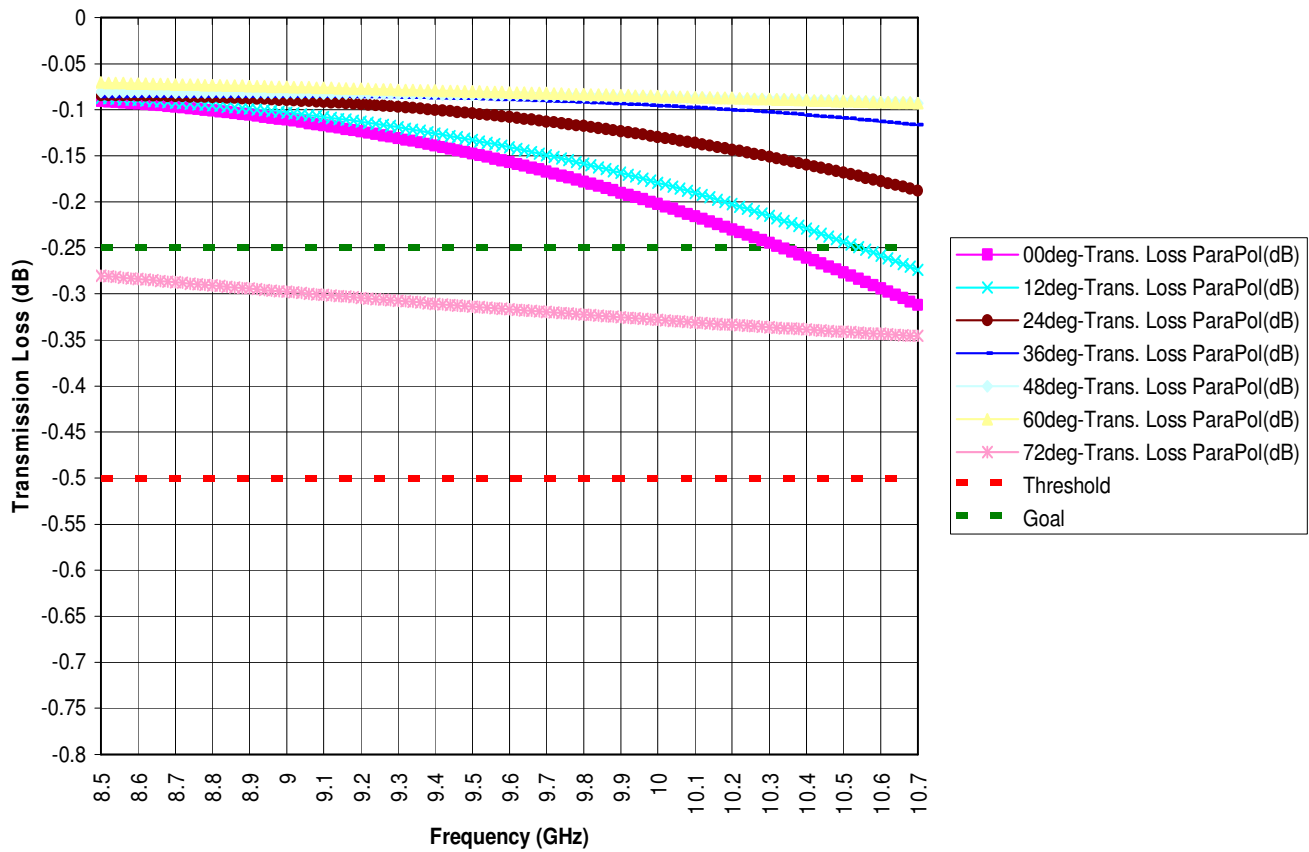
**Figure 3 A-Sandwich Radome Infinite Flat Panel Analysis Transmission Loss
Parallel Polarization- Case COPT-04; Core Thickness =0.344"**

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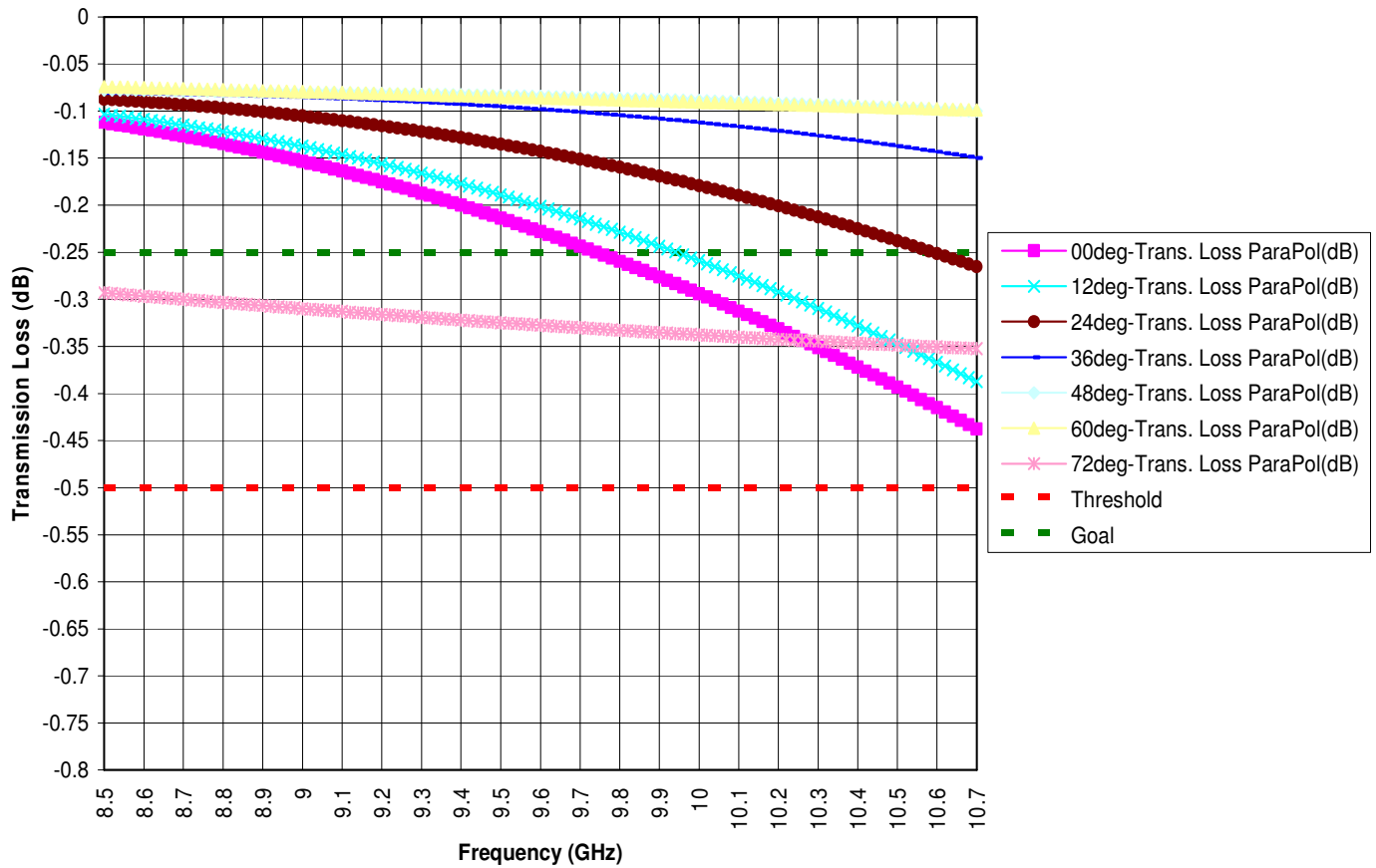Polarization- Case COPT-04; Core Thickness =0.344"

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"