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Title	**Proposed Antenna Radiation Pattern Envelopes for Coexistence Study**
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Re:	Coexistence study group activities in Session #14
Abstract	This document proposes antenna radiation pattern envelopes for use in coexistence studies involving point-to-point antennas above 20GHz. The radiation pattern envelopes are generated as a composite of the radiation pattern envelopes of several high performance antennas by different manufacturers.
Purpose	To provide data which represents currently available antennas that can be used in coordination studies.
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Proposed Antenna Radiation Pattern Envelopes for Coexistence Study

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Introduction

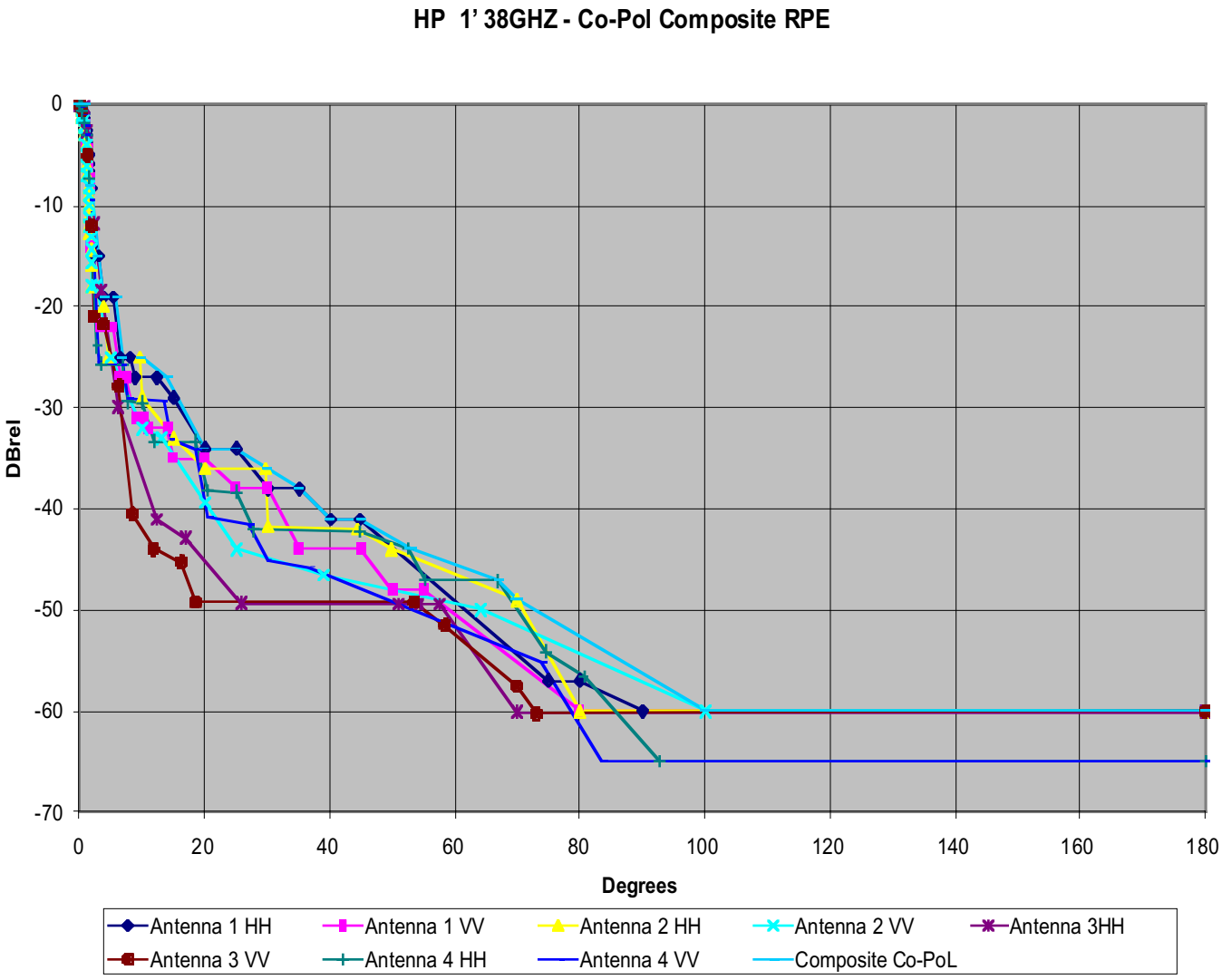
The analysis of interference in systems employing point-to-point antennas requires a realistic representation of the radiation patterns of the antennas. Each antenna is specified by creating a radiation pattern envelope (RPE) for each co-polarization and cross-polarization. The RPE is a mask created with a series of straight lines that represents the side lobes of the antenna in dB relative to the main beam at all azimuth angles for either a co-polarized or cross-polarized signal. By definition, the actual antenna side lobes do not exceed the mask at any frequency within the specified band.

The purpose of this document is to propose generic radiation pattern envelopes for the 37.0 –40.0GHz (38GHz) and the 24.25-26.5GHz (25GHz) bands. Using these generic envelopes in interference studies ensures that antennas are readily available from more than one manufacturer. The results of the simulations may indicate an antenna with a better RPE is needed. If so, better antennas are available, but may be more costly.

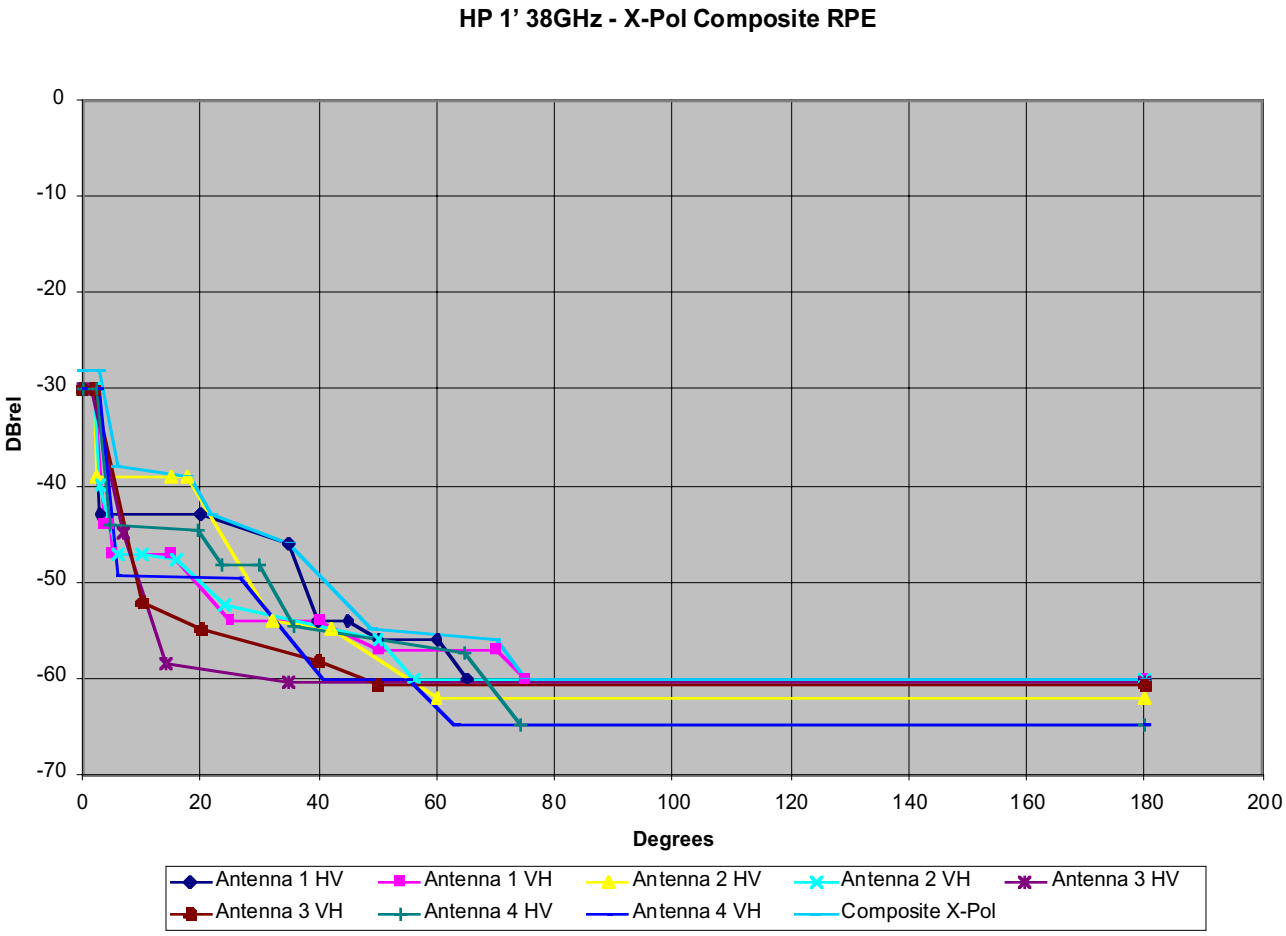
Construction of a Composite RPE

The tabular data for each antenna RPE was obtained from each manufacturer's published RPE. To construct the generic RPE, the RPE of each manufacturer was plotted on the same axes. A composite mask was then drawn over the worst of the set of curves. This was done for two common sizes of high performance antennas in each band. Figure 1 illustrates the construction of a composite co-polarized mask for a 38GHz 1 foot diameter antenna using data from 4 different manufacturers. Both the horizontal and vertical polarizations are plotted for each antenna. The same procedure is also applied to the cross-polarized RPE shown in Figure 2.

The same procedure was applied to 2 foot diameter 38GHz models using data from 4 manufacturers. For the 1 foot diameter and 2 foot diameter 26GHz models, the data of 3 manufacturers were used for each composite RPE. The actual composite plots for these 6 models are not shown. However, the composite RPE of each is shown later in this document compared to selected standards. Tables of break points for each composite RPE are shown below each plot. The tables associated with the standards have been omitted in this document.



Construction of a Composite Co-Pol RPE
Figure 1



Construction of a X-Pol Composite RPE
Figure 2

Comparison of the Composite DPE to Standards

Each composite RPE was compared to a selected number of standards which included ETSI 300 833 class 2, FCC Standard A, and the IEEE 802.16 subscriber classes. Figures 3-10 illustrate those comparisons. In a few cases the composite RPE was slightly worse than ETSI 300 833 class 2. In those cases a modified composite RPE was generated that satisfies the ETSI specification. The rationale for those modifications is that point-to-point links generally require antennas that at least satisfy ETSI 300 833 class 2. The modifications are so slight that they do not significantly affect the availability of antennas that can meet the modified composite RPE.

Comparison of Co-Pol Composite of HP 1' 38GHz Antennas with Selected Standards

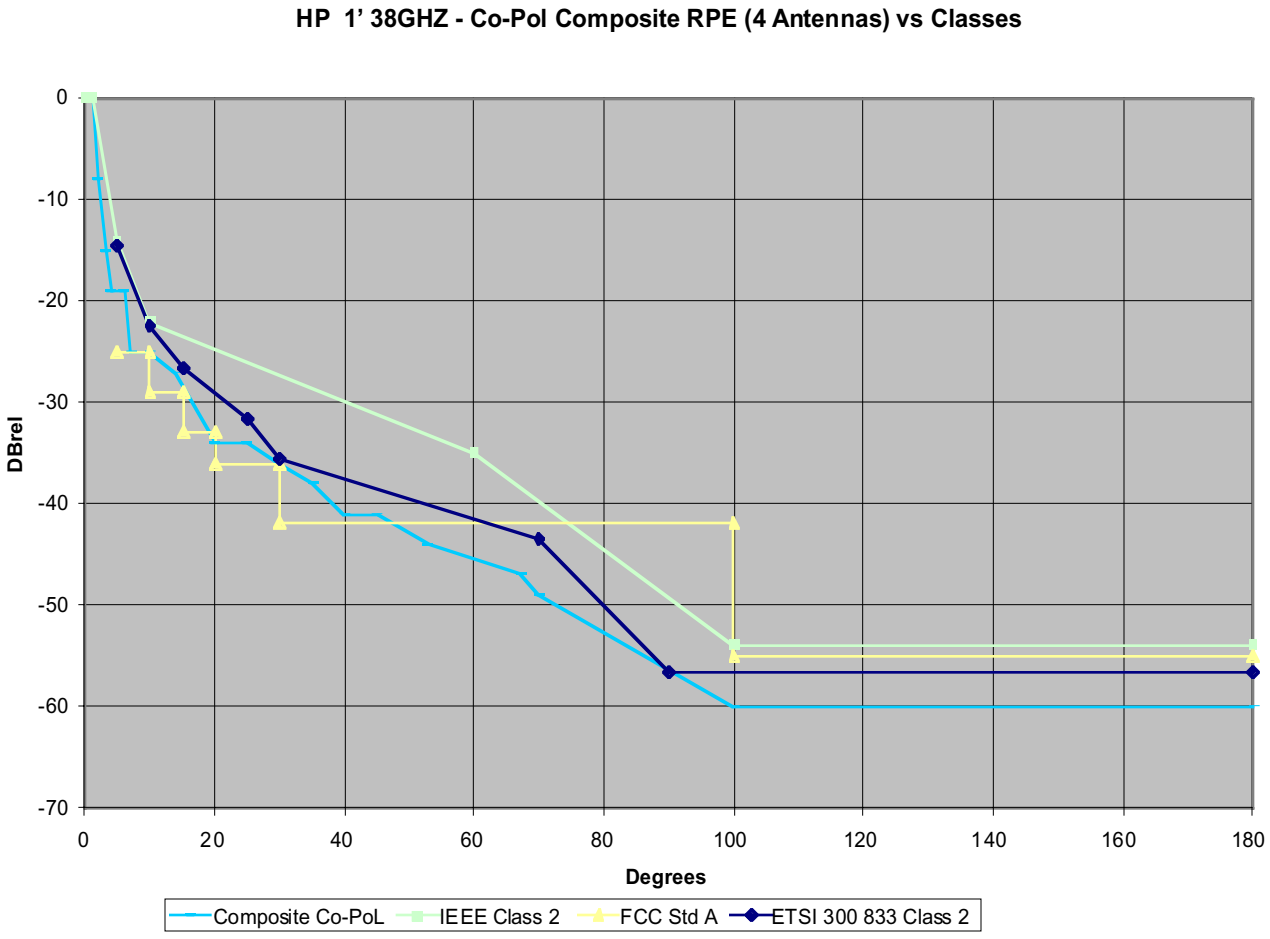
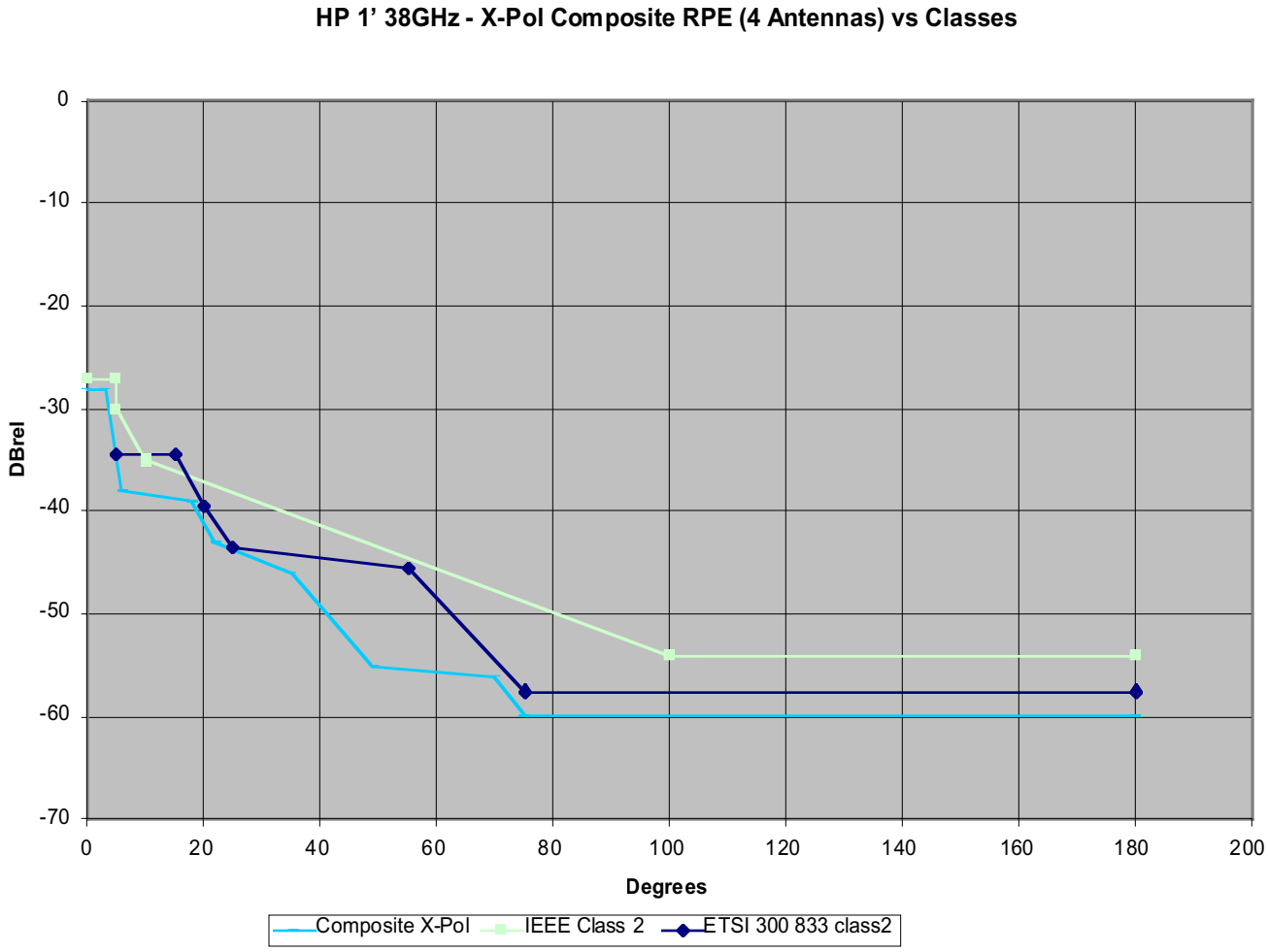


Figure 3

ANGLE (degrees)	0	1	2	3	4	6	7	10	14	20	25	30	35	40	45	53	67	70	100	180
dBrel	0	0	-8	-15	-19	-19	-25	-25	-27	-34	-34	-36	-38	-41	-41	-44	-47	-49	-60	-60

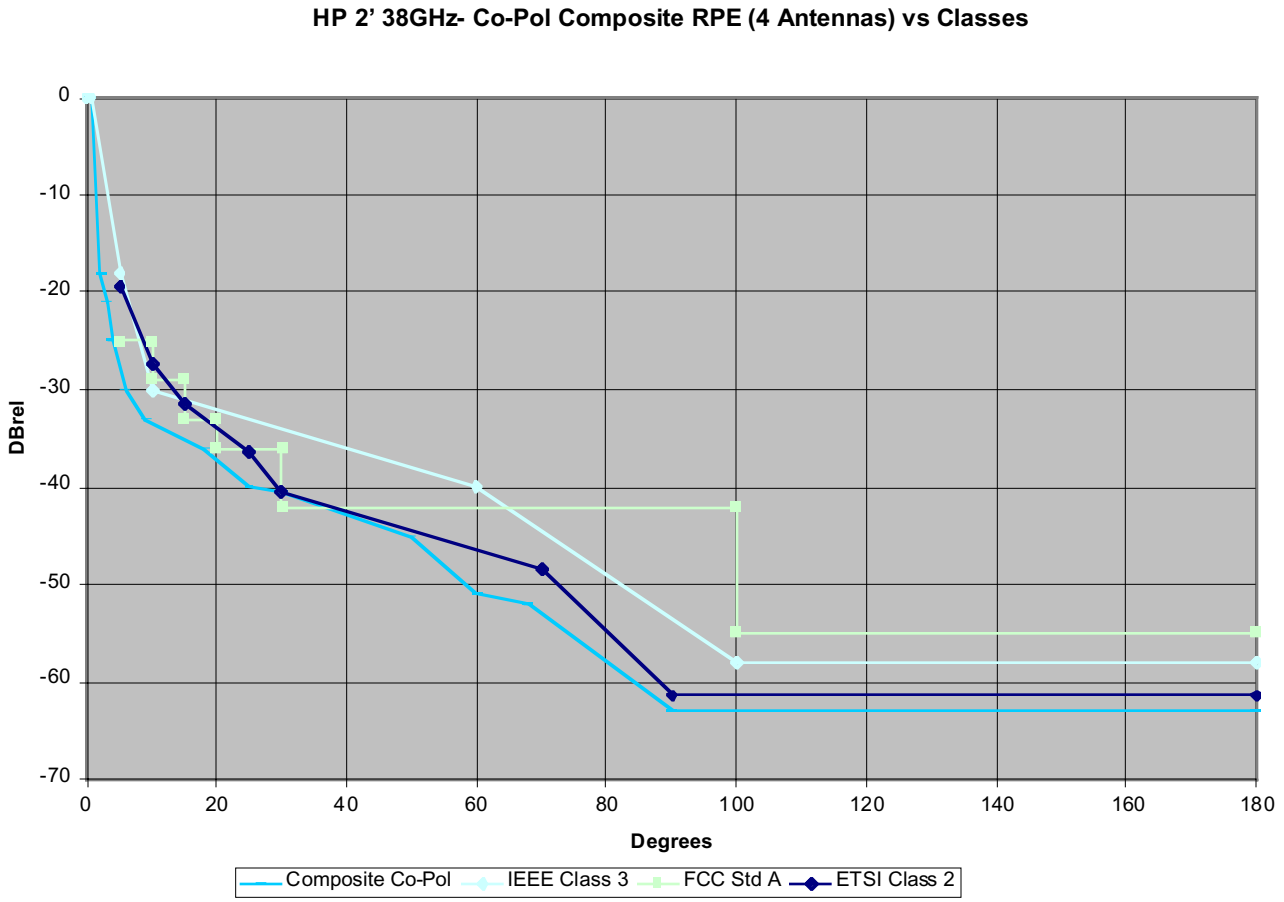
Table 1- Breakpoints of Co-Pol Composite of HP 1' 38GHz Antennas



Comparison of X-Pol Composite of HP 1' 38GHz Antennas with Selected Standards
Figure 4

Angle (degrees)	0	3	6	18	22	35	49	70	75	180
dBrel	-28	-28	-38	-39	-43	-46	-55	-56	-60	-60

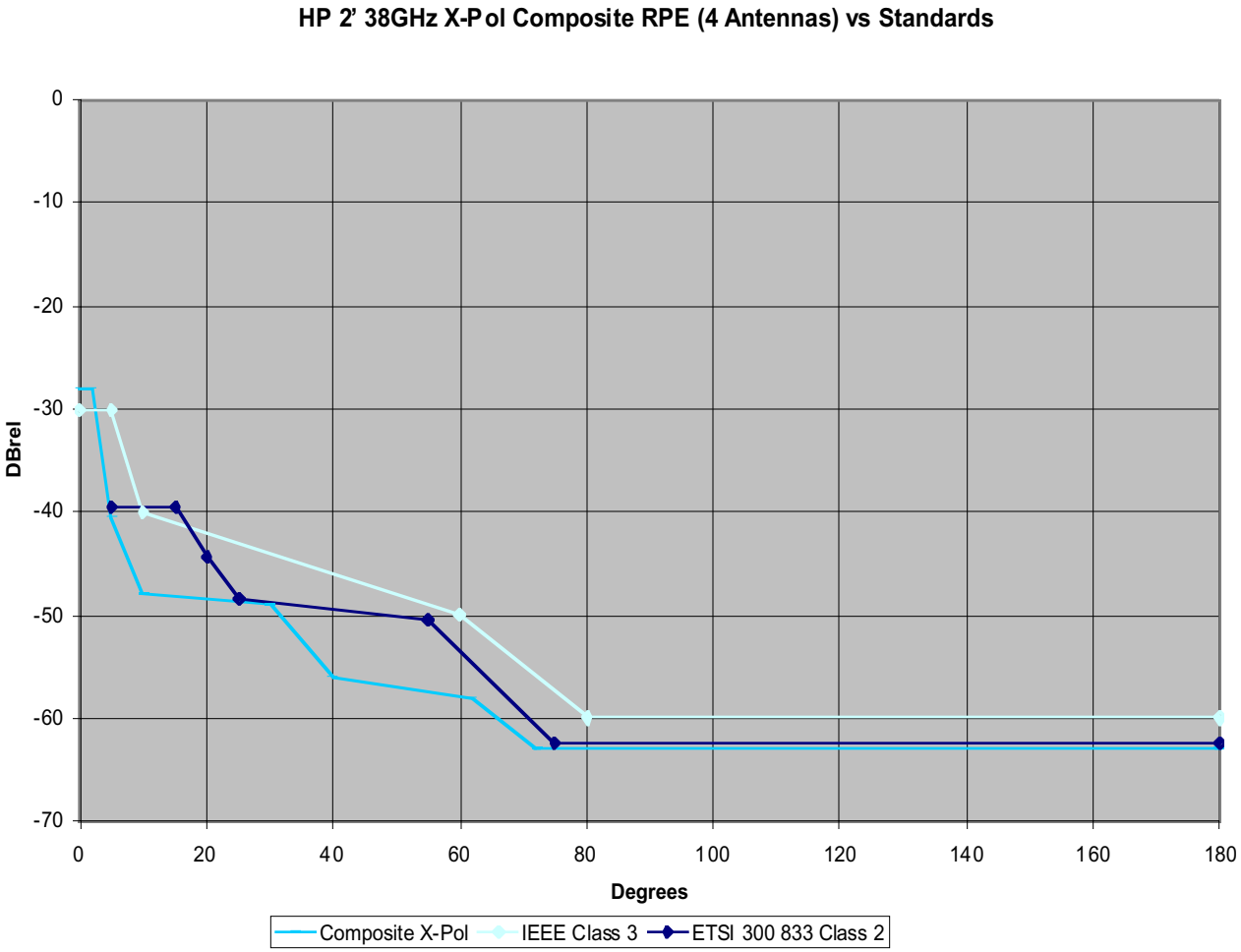
Table 2- Breakpoints of X-Pol Composite of HP 1' 38GHz Antennas



Comparison of Co-Pol Composite of HP 2' 38GHz Antennas with Selected Standards
Figure 5

Angle (degrees)	0	0.7	2	3	4	6	9	18	25	30	50	60	68	90	180
dBrel	0	0	-18	-21	-25	-30	-33	-36	-40	-40.5	-45	-51	-52	-63	-63

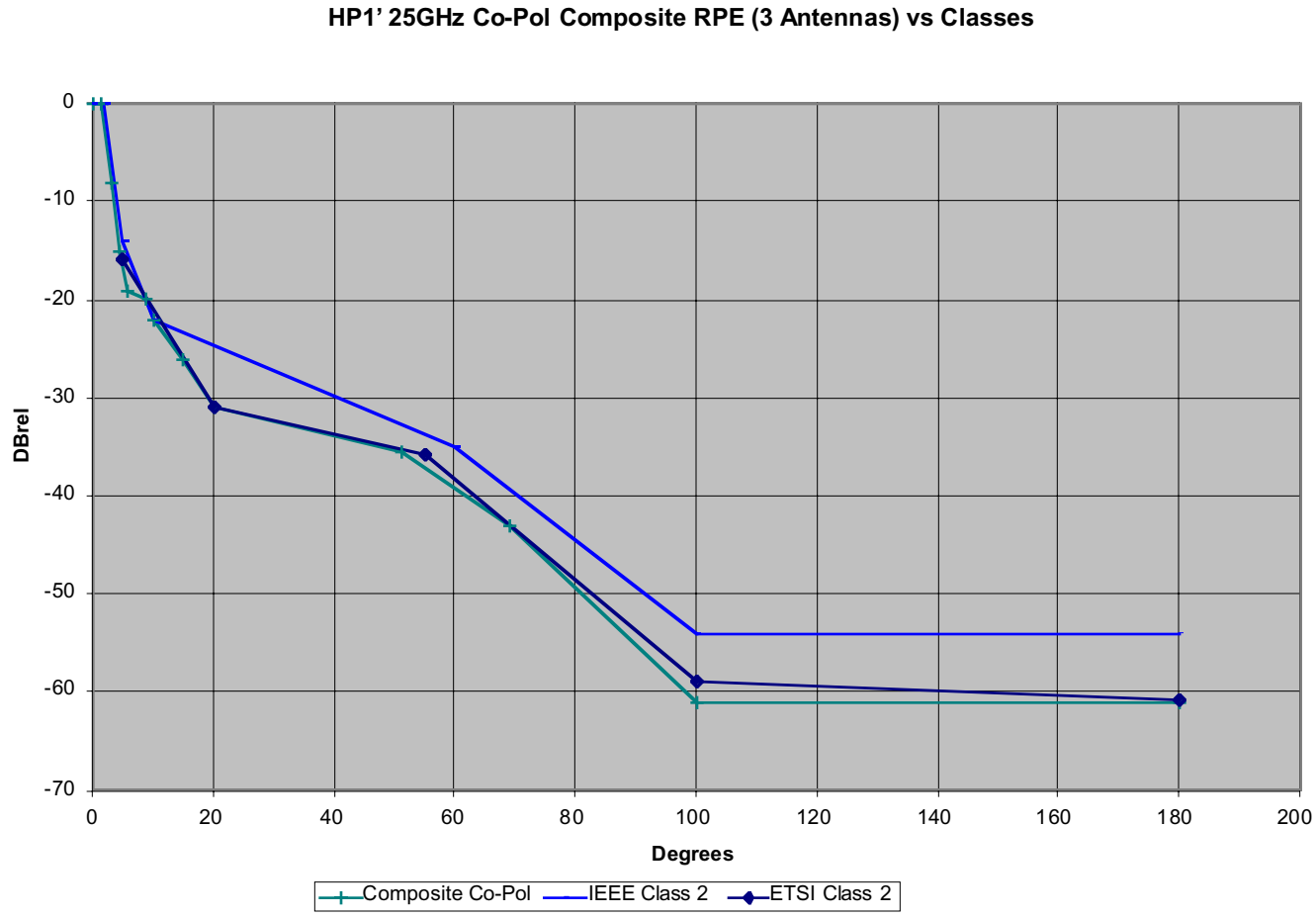
Table 3- Breakpoints of Co-Pol Composite of HP 2' 38GHz Antennas



Comparison of X-Pol Composite of HP 2' 38GHz Antennas with Selected Standards
Figure 6

Angle (degrees)	0	2	5	10	30	40	62	72	180
dBrel	-28	-28	-40.5	-48	-49	-56	-58	-63	-63

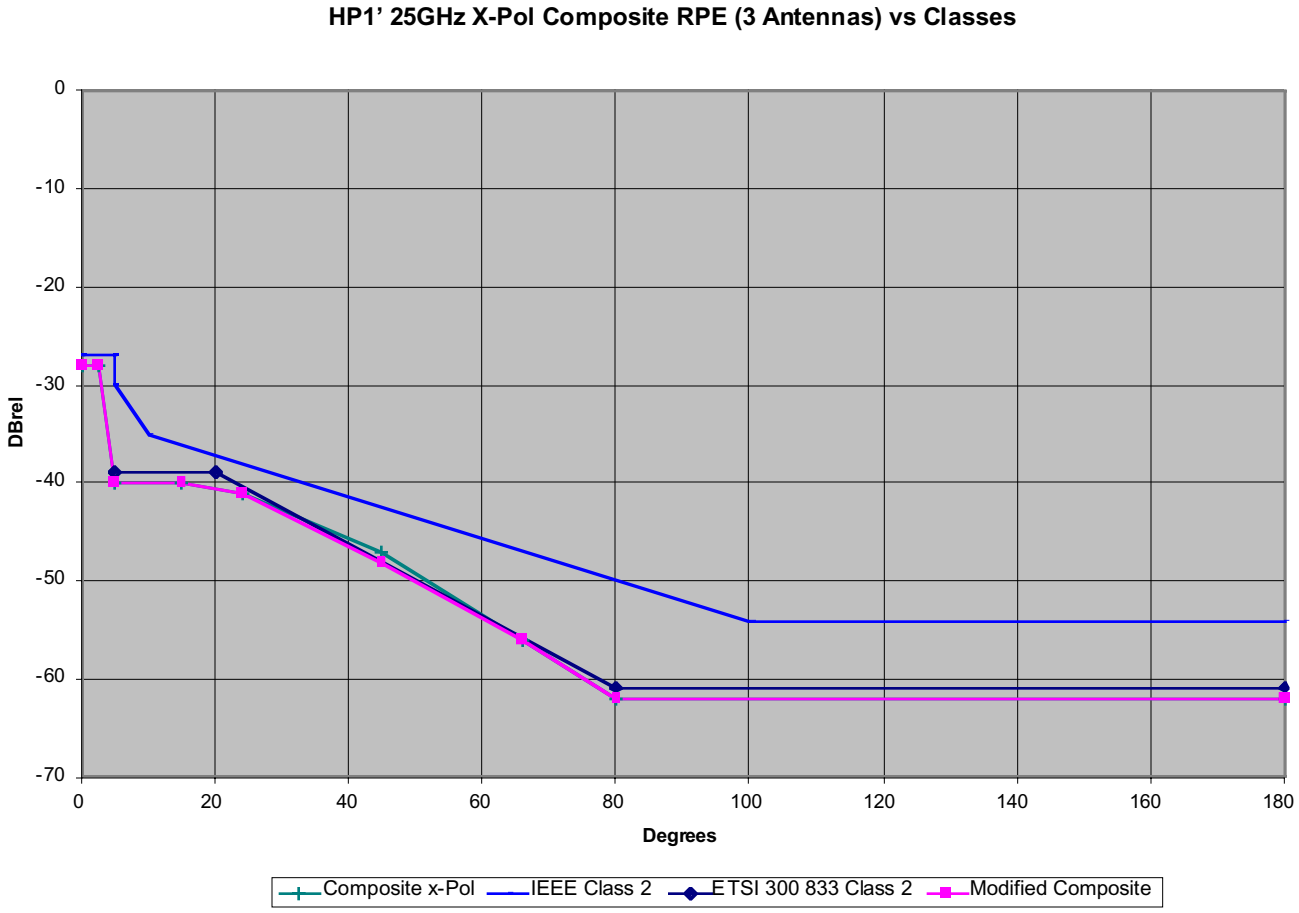
Table 4- Breakpoints of X-Pol Composite of HP 2' 38GHz Antennas



Comparison of Co-Pol Composite of HP 1' 25GHz Antennas with Selected Standards
Figure 7

Angle (degrees)	0	1.5	3	4.5	5.8	9	10	15	20	51	69	100	180
dBrel	0	0	-8	-15	-19	-20	-22	-26	-31	-35.5	-43	-61	-61

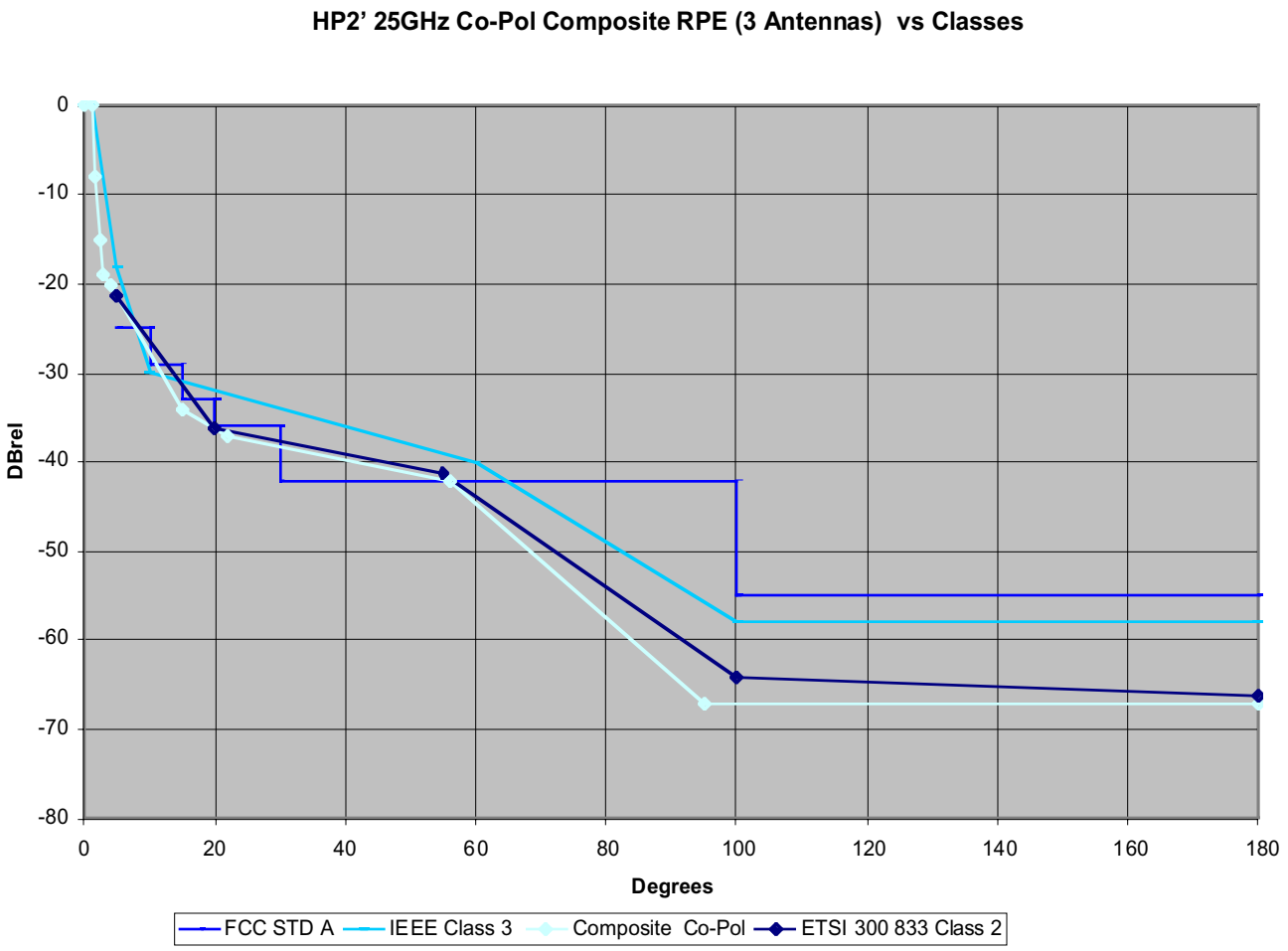
Table 5- Breakpoints of Co-Pol Composite of HP 1' 25GHz Antennas



Comparison of X-Pol Composite of HP 1' 25GHz Antennas with Selected Standards
Figure 8

Angle (degrees)	0	2.5	5	15	24	45	66	80	180
Dbrel	-28	-28	-40	-40	-41	-48	-56	-62	-62

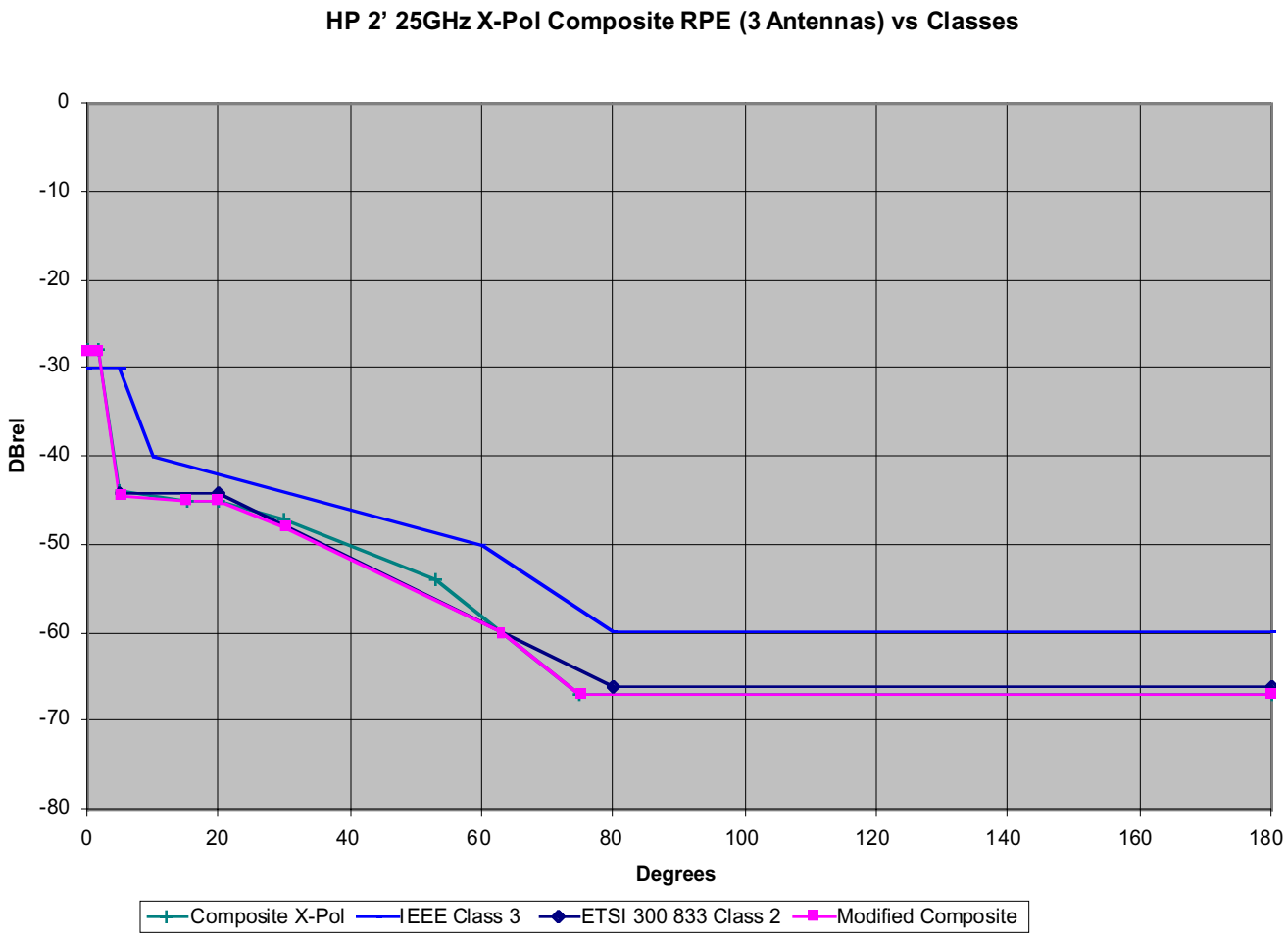
Table 6- Breakpoints of X-Pol Composite of HP 1' 25GHz Antennas



Comparison of Co-Pol Composite of HP 2' 25GHz Antennas with Selected Standards
Figure 9

Angle (degrees)	0	1	1.5	2.25	3	4	15	22	56	95	180
Dbrel	0	0	-8	-15	-19	-20	-34	-37	-42	-67	-67

Table 7- Breakpoints of Co-Pol Composite of HP 2' 25GHz Antennas



Comparison of X-Pol Composite of HP 2' 25GHz Antennas with Selected Standards
Figure 10

Angle (degrees)	0	1.5	5	15	20	30	63	75	180
Dbrel	-28	-28	-44.5	-45	-45	-48	-60	-67	-67

Table 8- Breakpoints of X-Pol Composite of HP 1' 25GHz Antennas

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