ANSI-ASC-C63® Interpretation Request Form

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Submission Date	Originator Name, Company
3/2/2016	Doug Schlam, HP Inc.

Standard	Clause/ Sub clause	Paragraph Figure/ Table	Type (General/ Technical/ Editorial)	Comment / Inquiry	Subcommittee Response (to be filled in by Subcommittee Chair)

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C63.4-2014	N.4.3.2 and similarly, N.4.3.1	b) Place the receiving biconical antenna on the antenna mast in horizontal polarization at a height…. Do NOT use an attenuator on the output connector of the receiving biconical antenna. f) Compute the reference and AUT horizontally polarized field strength measurement results (in dBμV/m) as follows: $E_{BB10H} = S_{21,BB10H} + FSAF_{biconical}$ (N.7)	Technical	Background: Biconical antennas are good antennas, but not ideal. The VSWR of a biconical antenna in the low end of its frequency range is not very good. A half-wave-dipole would be closer to ideal, but its length at 30 MHz (5 m end-to-end), for example, makes its use prohibitive. If a 6 dB attenuator is used with the hybrid antenna, the VSWR is reduced significantly. The equations (N.9, N.12) in the standard, compare the hybrid antenna (with a HAIMP) to the biconical antenna directly. At the lower frequencies, the reference antenna (biconical) may have more reflection (higher VSWR) than the hybrid. Using these equations in this situation, the hybrid with the attenuator may fail the hybrid antenna qualification, EVEN THOUGH IT HAS BETTER VSWR THAN THE BICONICAL ANTENNA. The (poor) VSWR of the biconical antenna should not penalize the qualification of the hybrid antenna.	The committee would like to thank the originator of the request for the comprehensive presentation of the matter and the supporting data. This submission is very valuable. The current description of the hybrid antenna validation process does indeed include an error insofar that for one of the measurements an attenuator is not permitted (biconical antenna) but for the second measurement (hybrid antenna) it is permitted. This matter will be corrected in the next revision of the standard.

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		i) Repeat steps a) through g) with the biconical antennas and the hybrid antenna under test in vertical polarization at the 10 m measurement distance. Denote the reference and AUT vertically polarized field strength measurement results (in dBμV/m) as follows: $E_{BB10V} = S_{21,BB10V} + FSAF_{biconical}$ (N.10)		**Example at 30 MHz:** Without an attenuator: At 30 MHz, the VSWR of the CBL 6112D (hybrid) is approximately 19:1. At 30 MHz, the VSWR of an ETS Lindgren 3110C (biconical) is approximately 5.5:1. This VSWR is not considered good by a long shot. With an attenuator: If a 6 dB attenuator is used with the hybrid antenna, the VSWR is reduced significantly. For example, at 30 MHz, a 6 dB attenuator reduces the VSWR to approximately **1.6:1, which is a much better match than the biconical antenna (5.5:1).** The equations (N.9, N.12) in the standard compare the hybrid antenna (with a HAIMP) to the biconical antenna directly. In this situation, the reference antenna (biconical) has more reflection (5.5:1 at 30 MHz) than the hybrid (1.6:1 at 30 MHz). Using these equations in this situation, the hybrid with the attenuator may fail the hybrid antenna qualification due to the poor VSWR of the reference biconical antenna.	

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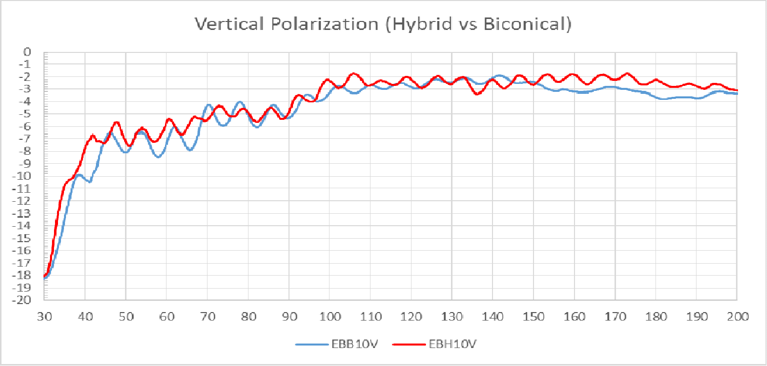
				Example at 40 MHz: If I compare a CBL6112D to an ETS Lindgren 3110C, I get the trace below for vertical polarization:  The trace above shows fairly close amplitudes (<2.4 dB, the maximum allowable difference), but a lot of reflections in both traces. In my particular case, I show non-compliance (maximum delta is 3.4 dB) around 40 MHz.	

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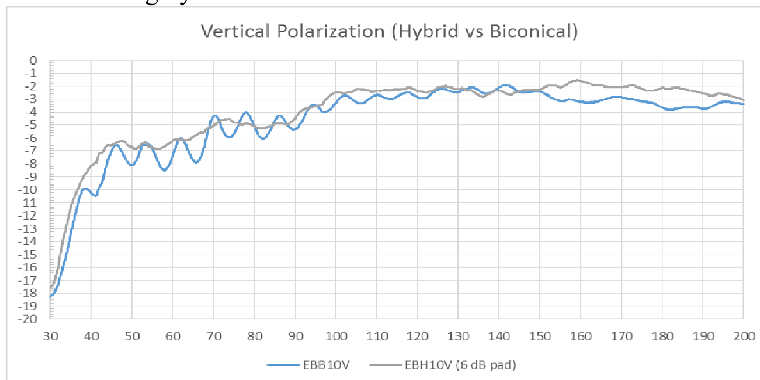
				Once I am resigned to using a 6 dB attenuator, the red trace above becomes the gray trace below:  Notice that the hybrid antenna (gray trace) now has significantly less reflection (maximum delta is 2.6 dB). The biconical antenna still has significant reflection. The ANSI C63.4-2014 Annex N guidance has gotten me to a point wherein I am improving the VSWR of the hybrid antenna to the point that it has less reflection than the biconical antenna without an attenuator. In essence, my hybrid antenna now has less VSWR than the biconical antenna (without a 6 dB attenuator), however, it still does not meet the 2.4 dB requirement.	

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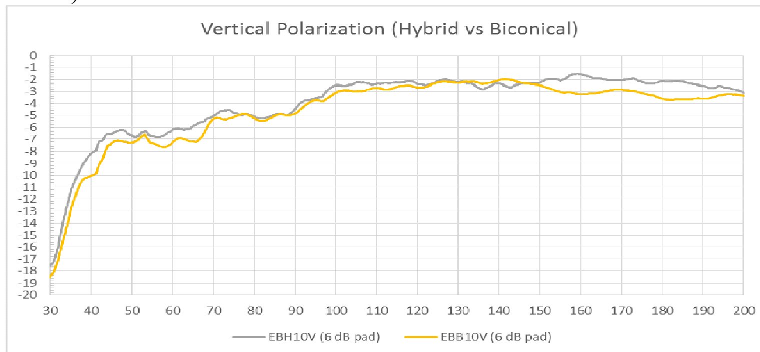
				To test my conclusion, I repeated the test with a 6 dB attenuator on the biconical antenna (the blue trace above becomes the yellow trace below):  Changing the scheme from Annex N to affix the same value attenuator to the biconical antenna (as was affixed to the hybrid antenna), I show a maximum delta of 2.0 dB. Although a very good antenna, the biconical is not ideal. The VSWR of the biconical antenna should not penalize the qualification of the hybrid antenna.	

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				Proposal: Changing the scheme to **affix the same value attenuator to the biconical antenna** (as was affixed to the hybrid antenna), levels the playing field. For example, adding a 6 dB attenuator to the biconical antenna, reduces the VSWR at 30 MHz to approximately 1.4:1. This is better than the hybrid antenna (with attenuator) and serves as a good reference. from: $E_{BB10H} = S_{21,BB10H} + FSAF_{biconical}$ (N.7) to: $E_{BB10H} = S_{21,BB10H} + FSAF_{biconical} + L_{HAIMP}$ (N.7) from: $E_{BB10V} = S_{21,BB10V} + FSAF_{biconical}$ (N.10) to: $E_{BB10V} = S_{21,BB10V} + FSAF_{biconical} + L_{HAIMP}$ (N.10) Corresponding changes should also be made to N.4.3.1 for 3 m test sites.	