RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #3

Average Reception Probability

(Presented by William Harman)

SUMMARY

A suggestion from the January meeting to perform receiver testing for multiple interferers at a common power level rather than more numerous tests at different power levels has been analyzed in more detail. Receiver bench test measurements are analyzed to compare average reception probability for a simpler test relative to a more complex test. The results support the suggestion that the receiver tests can be simplified.

Average Reception Probability

Introduction. During the January meeting of WG-3, an idea was discussed relating to the combinations of signal power and interference power for Extended Squitter receiver testing. We were looking at bench test data showing reception probability as a function of signal power, for several interference cases.

Case 1: four ATCRBS interferers, all at the same power level,
I1 = I2 = I3 = I4 = -72 dBm

Case 2: four ATCRBS interferers, of different power levels,
I1 = -78 dBm
I2 = -73 dBm
I3 = -68 dBm
I4 = -63 dBm

These curves are documented in1090-WP-2-17 (30 January 2001). All of the data originated in bench tests performed by Johns Hopkins APL, using a test receiver provided by UPS-AT, and using test equipment provided by the Tech. Center.

The question under consideration was whether it would be necessary for MOPS requirements and tests to include cases in which multiple interferers are at different power levels. That is, would it be possible to perform the tests using equal interference powers and still have confidence that receiver performance would be satisfactory.

When looking at these bench test curves, the discussion focused on the fact that the equal-power case (case 1) has much more fluctuation, going above and below the results in case 2, and that therefore an average over several values of signal power might yield approximately the same result, regardless of whether the interferers were equal or distributed.

Computations. Following up on this question, I have computed the average values for these two cases. I set up the average as follows. Beginning with the equal-interferer case, where all four ATCRBS interferers were set at -72 dBm, the average was computed using six values of signal power:

S = -72 dBm
S = 3 dB lower

S = 6 dB lower
S = 3 dB higher
S = 6 dB higher
S = 9 dB higher

The original bench test data was taken at irregularly spaced points, so it was necessary to interpolate between the measured values to obtain some of the reception probability values. The following table lists the individual samples and the resulting averages.

	RECEPTION PROBABILITY	
	Case 1	Case 2
Signal power	(equal interferers)	(distributed interferers)
S = -72 dBm	0.34	0.6
3 dB lower	0.75	0.61
6 dB lower	0.74	0.6
3 dB higher	0.38	0.63
6 dB higher	0.70	0.62
9 dB higher.	0.92	0.71
	average = 0.64	average = 0.63

Conclusion. These results agree well with the suggestion that the average reception probability is nearly the same regardless of whether the multiple ATCRBS interferers are all at the same power level or are distributed in power. This supports the original idea that it may be sufficient to define specific requirements/tests using multiple interferers at a common power level, rather than a much larger number of tests covering multiple combinations of power levels.