1090-WP-16-06
10 December 2002

RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #16

Reception Probability Values from Simulation

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SUMMARY

We have run the pulse level simulation to determine reception probability values under the bench test conditions in section 2.4.4.4.2, for both ATCRBS and Mode S interference. The results are summarized in this working paper. These results are intended to complete Action Item 14-05.

Reception Probability Values from Simulation

We have run the pulse level simulation to determine reception probability values under the bench test conditions in section 2.4.4.4.2, for both ATCRBS and Mode S interference. The results are summarized in this working paper.

ATCRBS Interference. In the ATCRBS interference tests, the first case has one ATCRBS fruit overlapping the signal. The next case has two ATCRBS fruit, and the other cases have 3 through 5 ATCRBS fruit overlapping the signal. When multiple ATCRBS are involved, the power levels are different, as defined in the draft MOPS. In all other respects, too, we set up the simulation to match the setup conditions in the draft MOPS. The receiver being simulated uses a sampling rate of 8 samples per microsecond, and uses the 4-4 table lookup technique for declaring bits and confidence flags. The receiver MTL was set to -79 dBm, intended to apply to class A2.

The ATCRBS simulation results are given in Table 1 and Figure 1. The MOPS test is based on an average of five individual values. From these simulation results, these average values are as follows.

For 1 ATCRBS fruit, average prob. = 0.98
For 2 ATCRBS fruit, average prob. = 0.94
For 3 ATCRBS fruit, average prob. = 0.91
For 4 ATCRBS fruit, average prob. = 0.83
For 5 ATCRBS fruit, average prob. = 0.78

Mode S Interference. In the Mode S interference tests, there are three cases. In the first case, the Mode S interference arrives later than the signal and overlaps the data block. In the second and third cases, the interference arrives earlier than the signal, and retriggering is needed in order to correctly receive the signal. The interference timing for the three cases can be summarized as follows,

Case 1. T = 8 to 90 microseconds, uniformly distributed,
Case 2. T = -112 to -6 microseconds, uniformly distributed,
Case 3. T = 6 microseconds, constant,

where T = arrival time of the interference relative to the signal. The simulation results are given in Table 2 and plotted in Figure 2.

Table 3 summarizes the Mode results from Lincoln, which apply to class A2, with the Tech Center results, which apply to class A3.

Table 1. Simulation Results for ATCRBS Interference

Signal power dBm	1 ATCRBS prob.	2 ATCRBS prob.	3 ATCRBS prob.	4 ATCRBS prob.	5 ATCRBS prob.
-85	0	0	0	0	0
-84	0	0	0	0	0
-83	0	0	0	0	0
-82	0.01	0	0.02	0.01	0.01
-81	0.4	0.36	0.35	0.34	0.3
-80	0.82	0.8	0.73	0.68	0.58
-79	0.93	0.88	0.83	0.78	0.64
-78	0.98	0.95	0.88	0.83	0.6
-77	0.98	0.95	0.89	0.84	0.54
-76	0.98	0.95	0.89	0.72	0.59
-75	0.99	0.95	0.91	0.7	0.61
-74	0.99	0.95	0.82	0.71	0.53
-73	0.99	0.96	0.8	0.73	0.52
-72	0.99	0.89	0.82	0.66	0.63
-71	0.99	0.87	0.83	0.67	0.67
-70	0.95	0.9	0.77	0.75	0.64
-69	0.94	0.91	0.76	0.8	0.62
-68	0.94	0.85	0.84	0.84	0.75
-67	0.97	0.87	0.88	0.87	0.75
-66	0.98	0.9	0.82	0.93	0.71
-65	0.99	0.94	0.85	0.94	0.74
-64	1	0.96	0.91	0.87	0.82
-63	1	0.98	0.92	0.86	0.84
-62	1	1	0.96	0.89	0.81
-61	1	1	0.98	0.9	0.84
-60	1	1	0.99	0.92	0.9
-59	1	1	1	0.93	0.93
-58	1	1	1	0.98	0.94
-57	1	1	1	0.98	0.97
-56	1	1	1	0.98	0.99
-55	1	1	1	0.99	1
	average = 0.983	average = 0.936	average = 0.91	average = 0.829	average = 0.777

Note: The yellow and orange items are the seven values used to form the averages. The orange values indicate the interference power values.

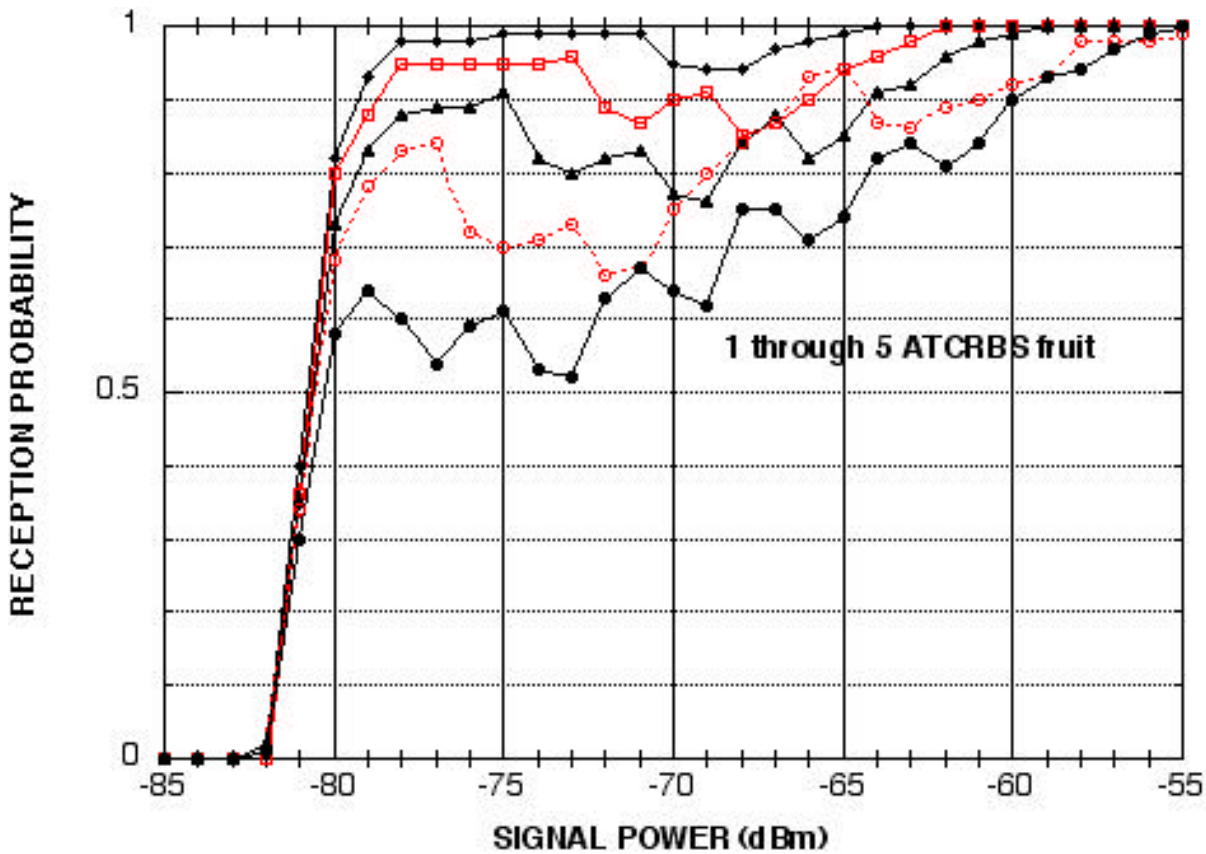

Figure 1. Plot of Simulation Results for ATCRBS Interference.

Table 2. Simulation Results for Mode S Interference

	case 1 T = 8 to 90 prob.	case 2 T = -112 to -6 prob.	case 3 T = -6 const. prob.
-85	0	0	0
-84	0	0	0
-83	0	0	0
-82	0	0	0
-81	0	0	0
-80	0	0	0
-79	0	0	0
-78	0	0	0
-77	0	0	0
-76	0	0	0
-75	0	0	0
-74	0.06	0	0
-73	0.14	0	0
-72	0.2	0	0
-71	0.23	0	0
-70	0.16	0	0
-69	0.07	0	0
-68	0.09	0	0
-67	0.11	0	0
-66	0.14	0.01	0.01
-65	0.19	0.02	0.01
-64	0.61	0.11	0.13
-63	0.84	0.53	0.54
-62	0.9	0.58	0.66
-61	0.98	0.72	0.76
-60	1	0.82	0.89
-59	1	0.91	0.99
-58	1	0.95	0.99
-57	1	0.96	1
-56	1	0.95	1
-55	1	0.95	1
-54	1	0.97	1
-53	1	0.97	1

Note. The interference power = -67 dBm. The other yellow items are those used in the MOPS test.

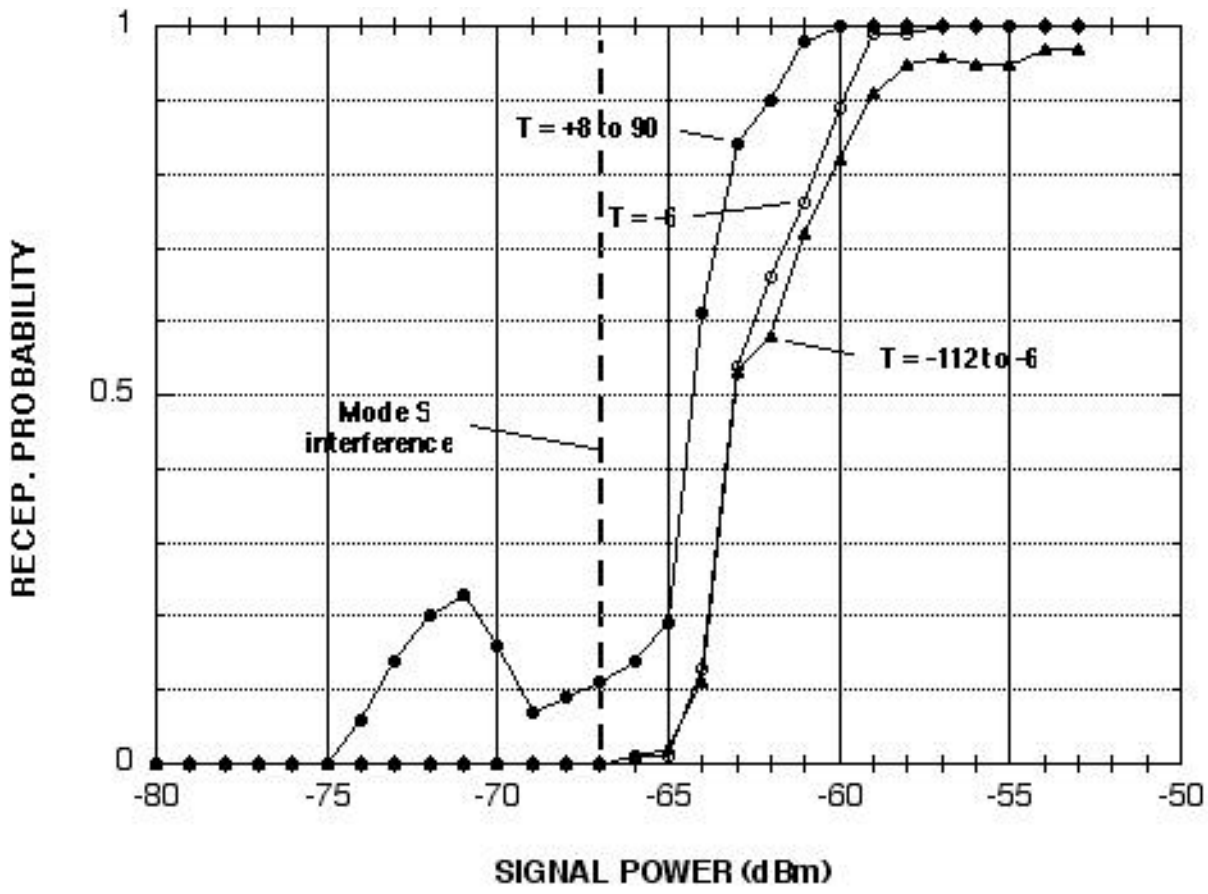

Table 3. Comparison Between Lincoln and Tech Center Results.

		S/I = 0 dB	S/I = 4 dB	S/I = 8 dB	S/I = 12 dB
Datablock interference T = 8 to 90	Tech Ctr.	0.00	0.52	1.00	1.00
	Lincoln	0.11	0.84	1.00	1.00
Retriggering T = -112 to -6	Tech Ctr.	NA	0.13	0.74	0.96
	Lincoln	NA	0.53	0.91	0.95
Retriggering T = -6	Tech Ctr.	NA	0.28	0.98	0.99
	Lincoln	NA	0.54	0.99	1.00