

RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #11

**Combined Preamble and Data Block Tests with Multi-Level Mode A/C
Fruit – Bench Test Data**

(Presented by John Van Dongen, FAA Technical Center, ACT-350)

SUMMARY
In response to action item 9-7, this paper presents the results of conducting the Combined Preamble and Data Block Tests with Multi-Level Mode A/C Fruit using the RMF Enhanced Decoders and LDPU.

Introduction

This paper contains the results of conducting the Combined Preamble and Data Block with Mode A/C Fruit enhanced decoder test procedures with the fruit at different power levels. As with previous data presented, the test was conducted using the 1090 Radio Frequency Measurement Facility (RMF) and its associated post-processing enhanced decoder software. However, these latest tests were conducted with 1 dB amplitude granularity and the LDPU performance was measured simultaneously. Also the fruit amplitudes were centered around -72 dBm in order to test at $+12$ dB relative to the required -84 dBm MTL of A3 equipment class.

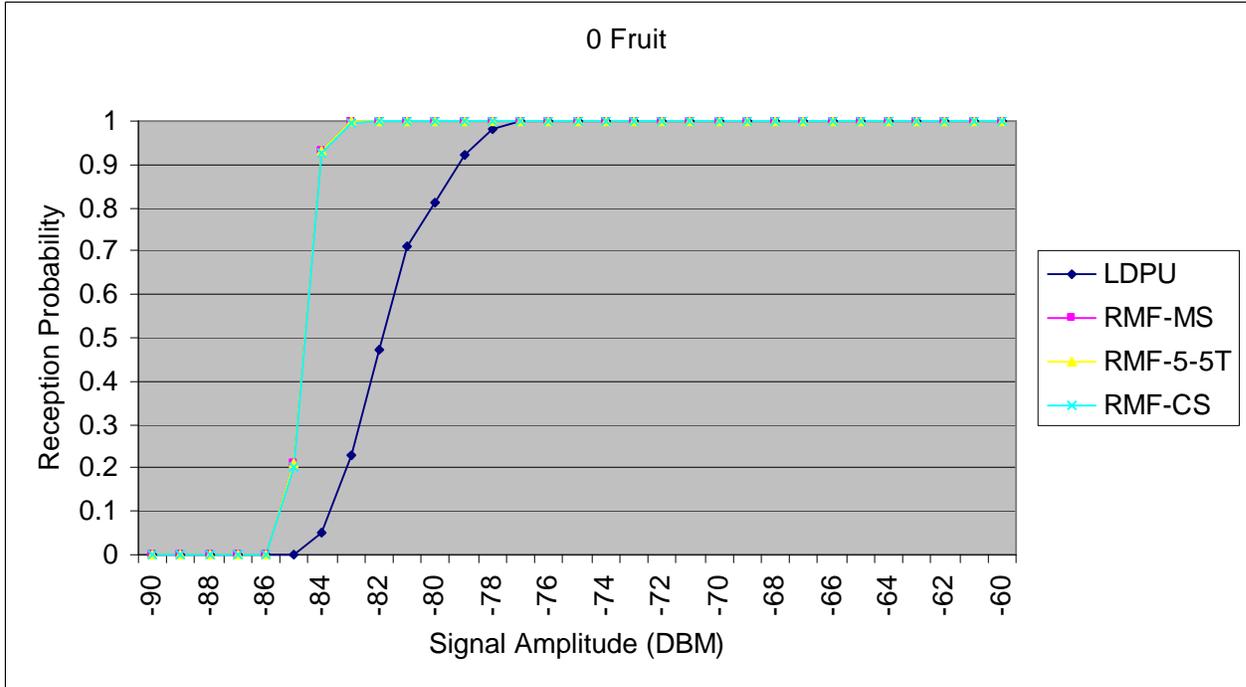
The LDPU data is presented here for comparison purposes, but it would be unfair to actually perform the bench tests at the amplitudes used on the LDPU without a preamp. The LDPU sensitivity in the test configuration was measured to be -79 dBm. The LDPU will meet the required minimum MTL of -84 only when a preamp is used with the antenna input. Test measurements showed that when the preamp is included, the RMF enhanced decoder MTL reaches -89 dBm. It was decided that the preamp would not be used so that the RMF enhanced decoder performance could relate better to the minimum required sensitivity.

As with tests conducted in the past, the test configuration provides only 3 non-coherent fruit sources. The test procedures require five. This limitation, which affects the only the 4 and 5 fruit cases, has a slightly greater impact when the fruit is at different amplitudes. Here, some of the fruit at a given amplitude is affecting only half of the signal. The fruit amplitudes and their random positioning is noted with the results of each test step. It is not expected that this constraint had a large effect on the measured test results.

Combined Preamble and Data Block tests with Mode A/C Fruit

Step 1: Verification of Operation of Equipment Under Test

0 Fruit Injected



Test Procedure Results:

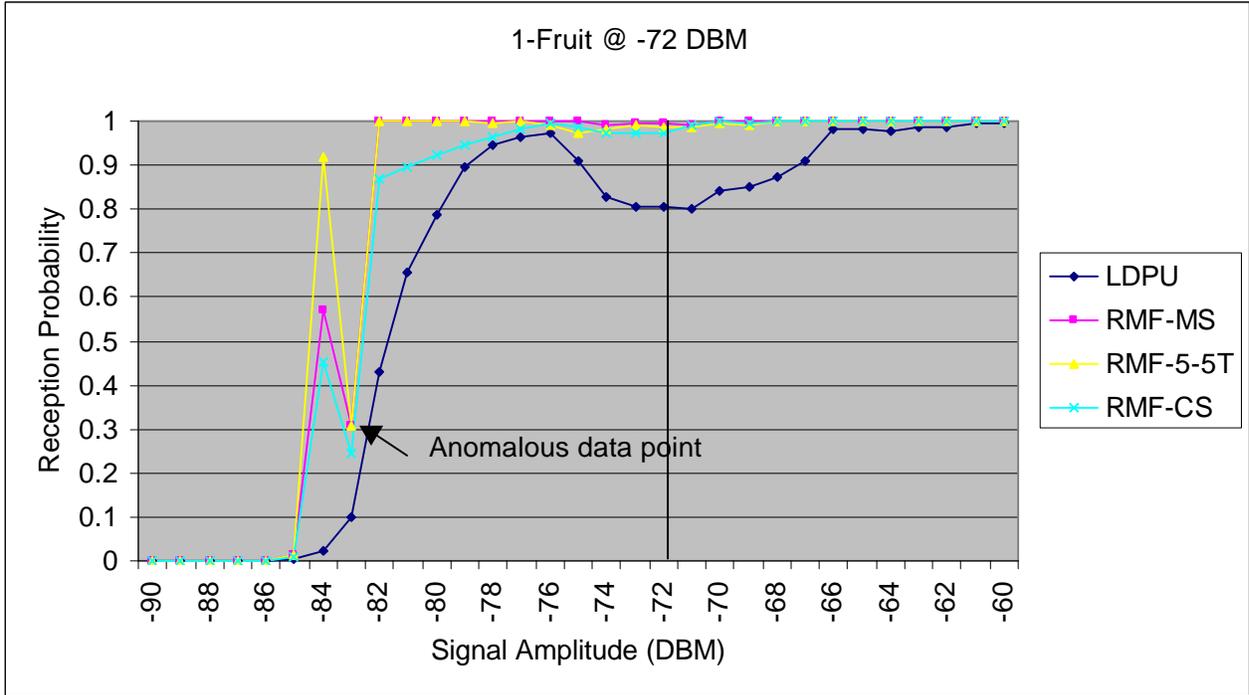
	-84	-80	-76	-72	-68	-64	-60	Average
RMF-MS	.933	1	1	1	1	1	1	.9904
RMF-5-5T	.932	1	1	1	1	1	1	.9903
RMF-CS	.925	1	1	1	1	1	1	.9893
LDPU*	.052	.813	1	1	1	1	1	.8379

* LDPU measured MTL = -79 dBm.

Combined Preamble and Data Block tests with Mode A/C Fruit

Step 2: Tests with One Mode A/C Fruit Overlap

Fruit Level: -72 dBm Timing: Random over -20 to +100 microsec., relative to signal P1 lead edge



NOTE: The RMF data points at -83 and possibly -84 dBm appear to be affected by an error in the data recording (the LDPU was not affected). The decrease in reception probability at -83 dBm was not an effect of the injected fruit.

Test Procedure Results:

	-84	-80	-76	-72	-68	-64	-60	Average
RMF-MS	.57	.999	1	.995	1	1	1	.9377
RMF-5-5T	.919	.998	.991	.988	.999	1	.999	.9849
RMF-CS	.454	.924	.996	.975	1	1	.999	.9069
LDPU*	.022	.786	.973	.804	.872	.978	.997	.776

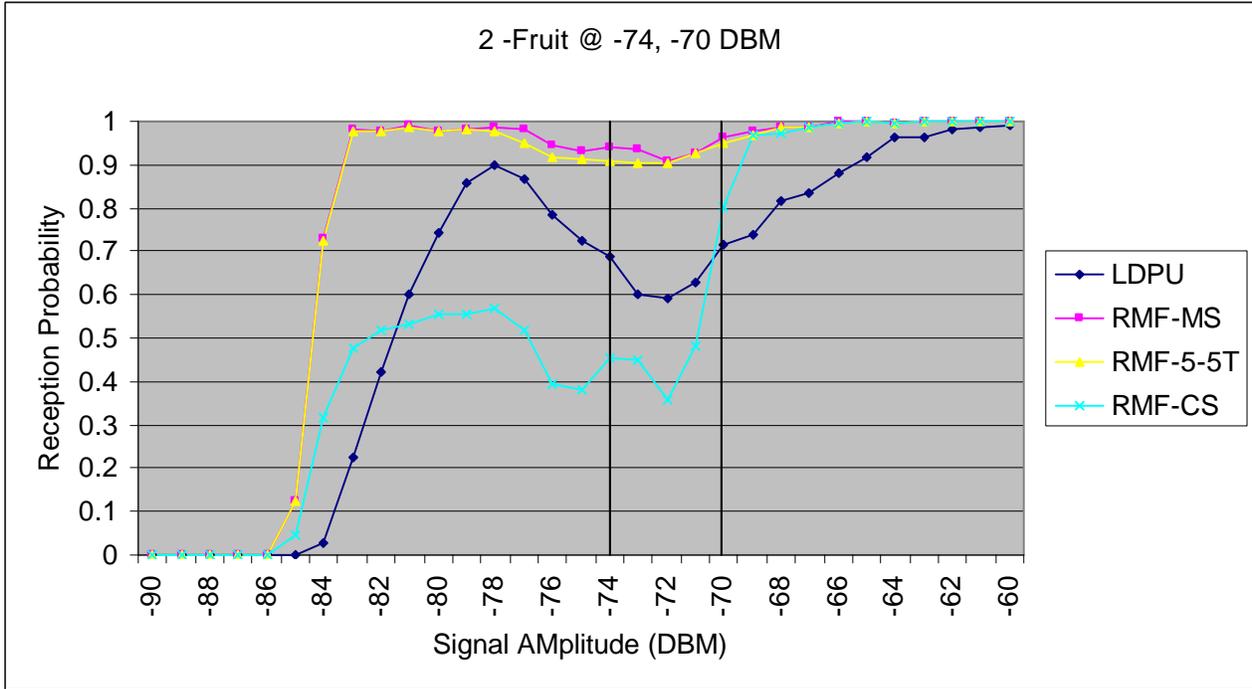
* LDPU results affected by MTL.

Combined Preamble and Data Block tests with Mode A/C Fruit

Step 3: Tests with Two Mode A/C Fruit Overlaps

Fruit #1 Level: -74 dBm Timing: Random over -20 to +100 microsec., relative to signal P1 lead edge

Fruit #2 Level: -70 dBm Timing: Random over -20 to +100 microsec., relative to signal P1 lead edge



Test Procedure Results:

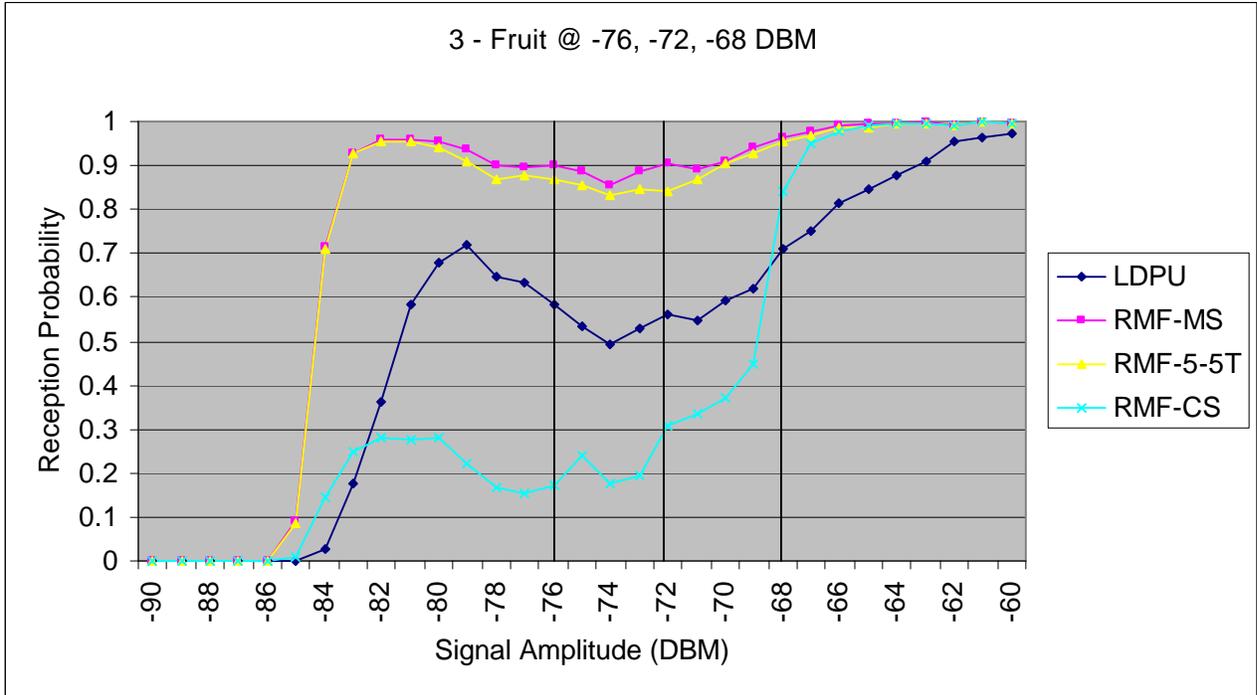
	-84	-80	-76	-72	-68	-64	-60	Average
RMF-MS	.731	.976	.946	.907	.988	.995	.999	.9346
RMF-5-5T	.724	.975	.917	.904	.987	.995	.999	.9287
RMF-CS	.318	.555	.393	.358	.974	.995	.999	.656
LDPU*	.029	.743	.785	.59	.818	.963	.992	.7029

* LDPU results affected by MTL.

Combined Preamble and Data Block tests with Mode A/C Fruit

Step 4: Tests with Three Mode A/C Fruit Overlaps

Fruit #1 Level: -76 dBm Timing: Random over -20 to +100 microsec., relative to signal P1 lead edge
 Fruit #2 Level: -72 dBm Timing: Random over -20 to +100 microsec., relative to signal P1 lead edge
 Fruit #3 Level: -68 dBm Timing: Random over -20 to +100 microsec., relative to signal P1 lead edge



Test Procedure Results:

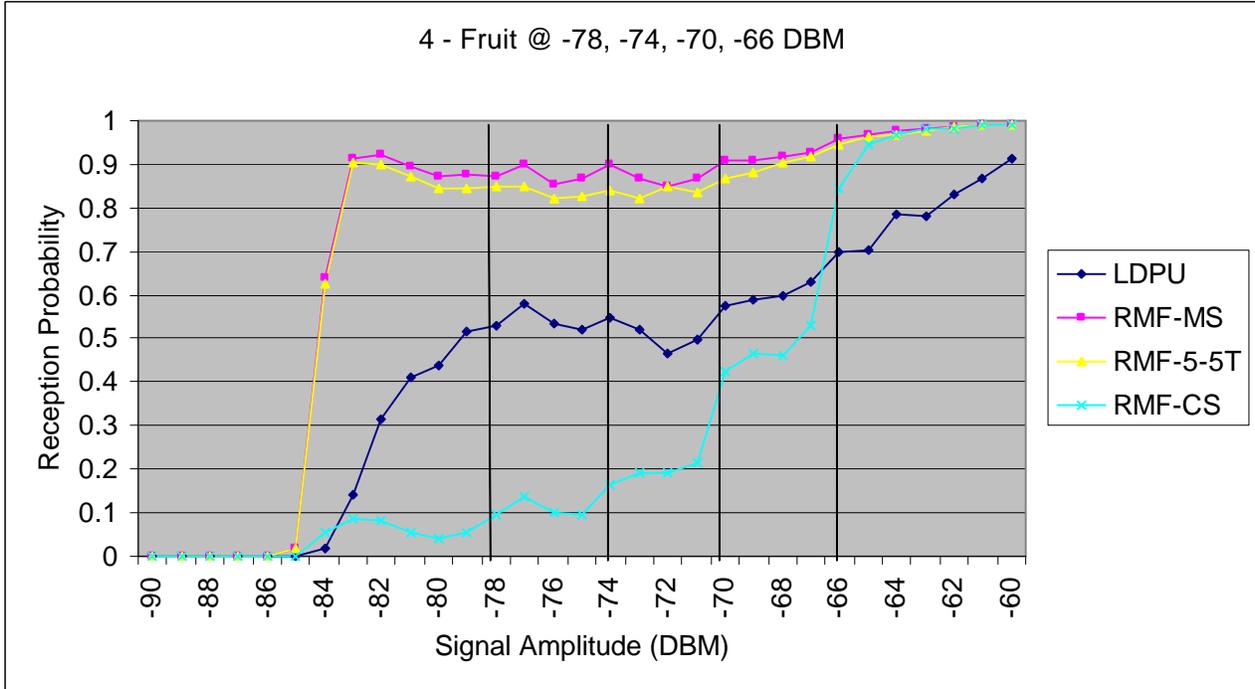
	-84	-80	-76	-72	-68	-64	-60	Average
RMF-MS	.716	.955	.901	.904	.965	.996	.996	.919
RMF-5-5T	.71	.942	.867	.842	.953	.996	.996	.9009
RMF-CS	.146	.282	.171	.307	.843	.995	.995	.5341
LDPU*	.027	.677	.585	.563	.711	.878	.973	.6306

* LDPU results affected by MTL.

Combined Preamble and Data Block tests with Mode A/C Fruit

Step 5: Tests with Four Mode A/C Fruit Overlaps

Fruit #1 Level: -78 dBm Timing: Random over +50 to +100 microsec., relative to signal P1 lead edge
 Fruit #2 Level: -74 dBm Timing: Random over -20 to +100 microsec., relative to signal P1 lead edge
 Fruit #3 Level: -70 dBm Timing: Random over -20 to +100 microsec., relative to signal P1 lead edge
 Fruit #3 Level: -66 dBm Timing: Random over -20 to +29 microsec., relative to signal P1 lead edge



Test Procedure Results:

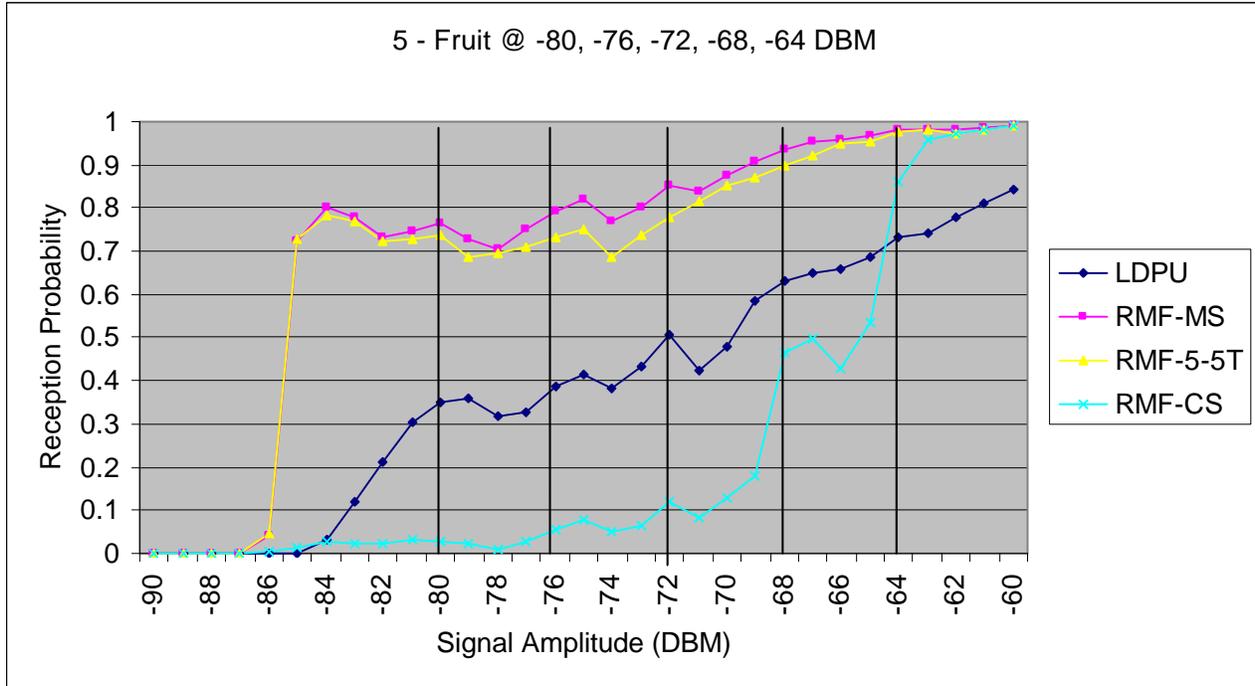
	-84	-80	-76	-72	-68	-64	-60	Average
RMF-MS	.639	.871	.853	.851	.92	.977	.993	.872
RMF-5-5T	.626	.847	.824	.848	.903	.969	.992	.8584
RMF-CS	.055	.043	.102	.194	.462	.969	.989	.402
LDPU*	.017	.439	.536	.466	.599	.787	.911	.5364

* LDPU results affected by MTL.

Combined Preamble and Data Block tests with Mode A/C Fruit

Step 6: Tests with Five Mode A/C Fruit Overlaps

Fruit #1 Level: -80 dBm Timing: Random over -20 to +29 microsec., relative to signal P1 lead edge
 Fruit #2 Level: -76 dBm Timing: Random over +50 to +100 microsec., relative to signal P1 lead edge
 Fruit #3 Level: -72 dBm Timing: Random over -20 to +100 microsec., relative to signal P1 lead edge
 Fruit #3 Level: -68 dBm Timing: Random over +50 to +100 microsec., relative to signal P1 lead edge
 Fruit #3 Level: -64 dBm Timing: Random over -20 to +29 microsec., relative to signal P1 lead edge



Test Procedure Results:

	-84	-80	-76	-72	-68	-64	-60	Average
RMF-MS	.802	.765	.794	.852	.937	.98	.992	.8746
RMF-5-5T	.783	.739	.732	.78	.897	.976	.991	.8426
RMF-CS	.027	.027	.056	.119	.464	.864	.991	.364
LDPU*	.03	.348	.386	.509	.632	.735	.842	.4974

* LDPU results affected by MTL.