

RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS

Meeting #5

**Radio Frequency Measurement Facility (RMF) Gold Standard Bench
Test Configuration for the Enhanced Surveillance Test Procedures
Draft**

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SUMMARY

The FAA Technical Center (ACT-350) will conduct the Enhanced Surveillance Processing Test Procedures as defined by Working Group 3 utilizing the RMF Gold Standard enhanced reception implementation. The purpose of this test is to (1) provide feedback as to the probability of reception at the various fruit levels determined by the RMF Gold Standard and to (2) provide any additional recommendations on the test procedures themselves that may result from actually performing the tests. This paper provides a draft test plan that highlights the planned test configuration and procedures.

Introduction

The FAA Technical Center (ACT-350) will conduct the Enhanced Surveillance Processing Test Procedures as defined by Working Group 3 utilizing the RMF Gold Standard enhanced reception implementation. The purpose of this test is to (1) provide feedback as to the probability of reception at the various fruit levels determined by the RMF Gold Standard and to (2) provide any additional recommendations on the test procedures themselves that may result from actually performing the tests. This paper provides a draft test plan that highlights the planned test configuration and procedures.

Test Configuration

Figure 1 illustrates the RMF bench test configuration. The test configuration will utilize two Data Link Test and Analysis Systems (DATAS) as 1090 RF signal sources. They will provide both the Mode S extended squitter waveform and the ATCRBS fruit and/or Mode S fruit. The DATAS outputs will be combined by a coaxial hybrid and connected to the antenna input of an LDPU receiver. The LDPU video signal is connected to an amplifier that will feed the input of the RMF with the properly calibrated signal amplitude range. As each test step is conducted the RMF will record the video signal. The RMF Gold Standard enhanced reception software will be processed off-line on the recorded data to detect and demodulate extended squitter messages from the recorded data.

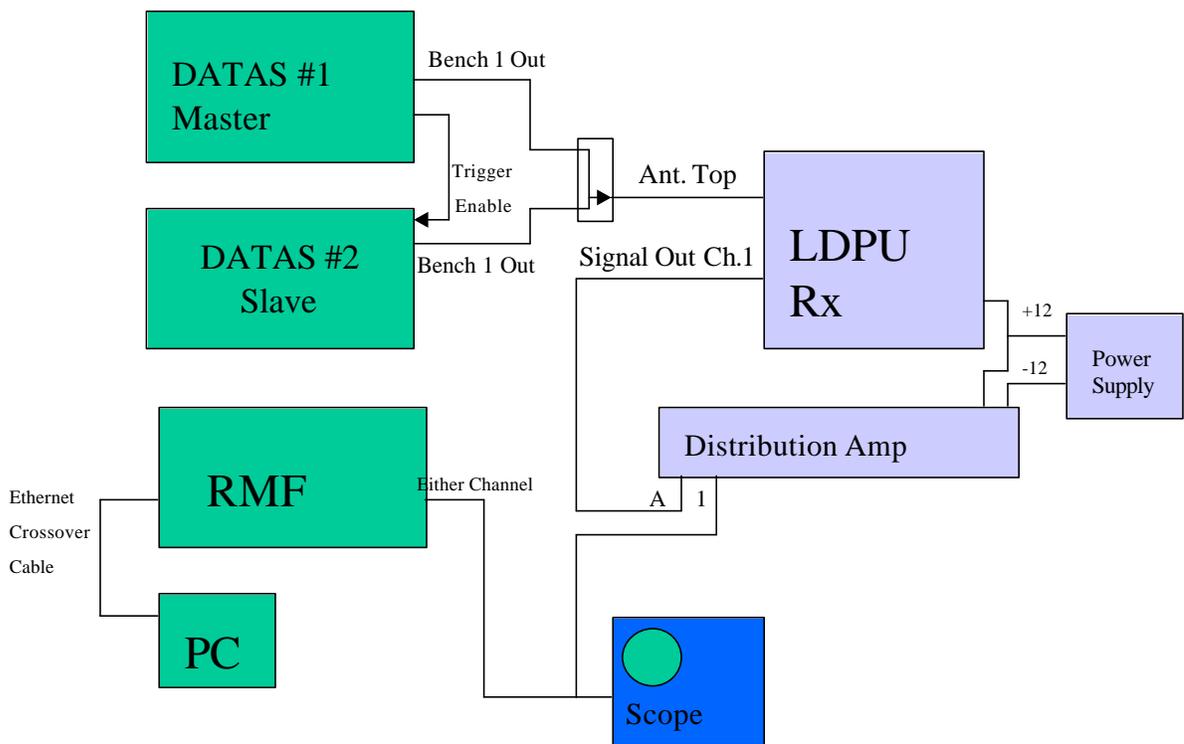


Figure 1 - RMF Bench Test Configuration

Signal Sources

Two DATAS's are used as signal sources. A DATAS is a specialized system that was developed for testing 1030 MHz and 1090 MHz Mode S, TCAS, and Data Link applications. Software was previously developed for the APL tests that will be used for the enhanced reception tests. The DATAS systems will operate in a master/slave configuration in order to generate both the extended squitter and fruit signals. The master DATAS will provide software control of the test and will generate the extended squitter signal and has one additional frequency source for the generation of fruit. The slave DATAS will provide the additional fruit and is enabled via an external trigger input so the fruit will be transmitted at the appropriate time slot.

ATCRBS Fruit Signal Source

The two DATAS configuration will provide 3 RF sources for ATCRBS fruit generation. Each of the 3 RF sources is non-coherent with any of the other fruit sources and the desired signal extended squitter source. **The test steps that require 4 and 5 ATCRBS fruit will have 1 or 2 of the RF sources providing 2 fruit signals.**

The waveform will consist of bracket pulses and an **average of 5 data pulses** randomly varied across the 12 bit positions (X pulse excluded) with each reply.

Each DATAS is capable of generating ATCRBS replies at selectable received power from below MTL to around -18 DBM in 1/10th dB steps. The relative power level steps of -12, -6, -3, 0, +3, +6 and +12 are not a problem.

DATAS is capable of sustaining a repetition rate of 1000 replies per second.

The timing of the generation of the earliest F1 pulse and the latest possible F1 pulse of each fruit reply relative to the extended squitter P1 leading edge is a user controllable parameter. There will be no problem setting up the test to transmit the interference randomly positioned with uniform distribution within -20 to +8 microseconds for the preamble test or +8 to +120 microseconds for the data block test relative to the P1 leading edge.

Mode S Fruit Signal Source

The DATAS test configuration is capable of generating one 112-bit Mode S fruit signal. **The content of the Mode S fruit will be a 112-bit signal other than an extended squitter.** Currently the software is set up to send a DF 20 or 21 with random data content.

DATAS is capable of sustaining a repetition rate of 1000 replies per second.

The Mode S fruit power capability is the same as the ATCRBS fruit power capability with less than 1 dB of droop.

The signal for the Mode S fruit source is non-coherent with the desired extended squitter signal source.

The timing of the Mode S fruit is controllable and will be uniformly distributed within the required time intervals.

Extended Squitter Signal Source

DATAS is capable of generating a 112-bit extended squitter signal with less than 1 dB of droop.

The extended squitter power capability is the same as the ATCRBS power capability.

DATAS is capable of sustaining a repetition rate of 1000 replies per second.

The content of the extended squitter signal consists of DF 17 and DF 18 extended squitters. Other than the DF field the remainder of the message content is pseudo-random. **The 51-bits following the 5-bit DF field are random. The next 32 bits contain address parity derived from the first 56 bits, and the last 24 bits contain address parity derived from the first 88 bits. The dual address parity scheme is used to enhance the parity check to test for undetected errors instead of recording each transmission.**

Preamble Detection Tests

The test equipment will be configured to execute the tests as described above. The appropriate tests will be conducted and recorded with the RMF. The recorded data will be processed with the Gold Standard enhanced reception software that includes conservative and brute force error correction. The additional parity check will be applied to each message to determine the rate of undetected errors. The number of iterations for each test will be 10,000 (?) to produce the following test matrix:

Data Block Tests with ATCRBS Fruit

Number of Fruit	0	1	2	3	4	5
Measured Probability						
# of Undetected Errors						

Data Block Tests with Mode S Fruit

Number of Fruit	0	1
Measured Probability		
# of Undetected Errors		

Preamble Tests with ATCRBS Fruit(?)

Number of Fruit	0	1	2	3	4	5
Measured Probability						
# of Undetected Errors						

Preamble Tests with Mode S Fruit (?)

Number of Fruit	0	1
Measured Probability		
# of Undetected Errors		