RTCA Special Committee 186, Working Group 5

ADS-B UAT MOPS

Meeting #9

JSC Testing

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SUMMARY
The following summary outlines the MER testing including UAT self interference, JTIDS and DME interference that will be conducted to satisfy Action Item 8-7. Testing will consist of measuring the UAT performance parameters in an RF environment consisting of competing signals originating from other UATs and other equipment co-located in the RF band.

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The purpose of the full up test is to measure MER rates in the future environments being modeled by APL to predict UAT performance. The results will be compared to model runs to be conducted by APL with the exact same scenario conditions. This validation process will establish confidence that the models and actual bench measurements produce comparable results. The tests will be conducted and measurements made with the Pre-MOPS UAT Transceivers, both the 1.2 MHz and .8 MHz receiver units. Prior to MER measurements the receiver sensitivity of the units will be measured and verified. As necessary, additional testing may be conducted to analyze individual interference effects if results necessitate additional analysis.

The tests will be conducted at JSC with equipment that has been utilized for MER and BER testing with JTIDS and DME interference at JSC to date. JSC has simulators/generators to produce the DME and JTIDS signals required for the RF environment. The configuration will be augmented with the UAT self-interference scenario. A UAT Message Generator that will be provided by the FAA Technical Center will produce the UAT self-interference environment. The schedule for testing has been proposed for the weeks of January 14 and January 21, 2002. It is anticipated that the testing being proposed can be completed in the two-week interval.

The following are the proposed test conditions. Testing will occur with 1 DME signal environment for all tests. Two UAT environments, LA 2020 and Core Europe 2015 environments will be tested. As a minimum, 7 JTIDS environments will be tested with the DME and two UAT environments. Additional DME and/or JTIDS environments may also be tested. These interference environments will be utilized to test the victim UAT receiver and measure its ability to decode UAT long messages at various desired signal levels.

The UAT Generator is capable of providing asynchronous random transmission of UAT signals. The simulator can be programmed to provide the specific signal environments derived from scenarios of projected UAT usage. Amplitudes and UAT message types are referenced to a victim receiver selected from the scenario. The LA-2020 environment defines a UAT signal environment derived from an analysis of projected UAT air traffic in the Los Angeles Basin by the year 2020. The Core European environment defines the UAT signal environment derived by Eurocontrol from an analysis of projected European air traffic by the year 2020.

The DME signal source is capable of providing simultaneous random transmission DME signals on up to five different frequencies. The DME extraneous pulse environment (EPE) definitions have been derived from an analysis of present and

planned use of DME/TACAN ground beacons. The sites considered in the analysis included the densest of those configurations planned for TACAN/DME equipment.

The JTIDS signal sources are capable of being configured to transmit up to 10 JTIDS transmissions simultaneously. A worst-case signal environment was derived from an assumed JTIDS usage, which covers a number of theoretical scenarios. The proposed 7 JTIDS scenarios to be used have been defined in UAT-WP4-04 and are shown in Tables 1,2 and 3.

The desired UAT transmit signal will be generated by a separate UAT unit. The transmitter is specially configured to transmit thirty-two long messages per second consisting of random data bits to support UAT bench tests. The UAT transmitter output power will be attenuated by at least 80 dB to bring the output power closer to the UAT receiver sensitivity levels. Additional programmable attenuation will be used to control the UAT transmission signal levels at the UAT receiver. The RF path losses to each UAT receiver will be calibrated so that the desired signal will arrive at both UAT receivers at the same level. The interference RF levels will also be validated to insure that the same levels are applied at the input of both receivers. Signal levels ranging from -100, -99, ...-85 (in 1 dB steps) and then -80, -75, -60, -50 are proposed. Individual signal levels will be added or subtracted from this list after initial test results are evaluated to avoid collecting data in areas where minimal information can be obtained.

Table 1. Scenario 1 – 100/50/(300) – Uncoordinated Operations L-16 Baseline								
	FG[1]		R2[2]		R3[3]		R4[4]	
Option	TSDF (%)	Power (dBm)	TSDF (%)	Power (dBm)	TSDF (%)	Power (dBm)	TSDF (%)	Power (dBm)
A	50	-53	50	-63			300	-87.5
B	50	-42	50	-63			300	-87.5
C	20	-42	30	-53	50	-63	300	-87.5

Table 2. Scenario 2 – 400/50 - Coordinated Operations L-16 Heavy								
	FG		R2		R3		R4	
Option	TSDF (%)	Power (dBm)	TSDF (%)	Power (dBm)	TSDF (%)	Power (dBm)	TSDF (%)	Power (dBm)
A	50	-42	50	-63	150	-78	150	-85
B	50	-53	50	-63	150	-78	150	-85
C	50	-63	50	-63	150	-78	150	-85

Table 3. Scenario 3 – 100/20(300) - Uncoordinated Operations L-16 Light								
	FG		R2		R3		R4	
Option	TSDF (%)	Power (dBm)	TSDF (%)	Power (dBm)	TSDF (%)	Power (dBm)	TSDF (%)	Power (dBm)
A	20	-42	80	-63			300	-93

[1] FG = Foreground Emitter
[2] 1st Near Background Emitter = R2
[3] 2nd Near Background Emitter = R3
[4] Far Background Emitter = R4