

RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #15

**Action Item 12-04
ATCRBS Signal Generator Characteristics**

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SUMMARY

This Working Paper contains measurements of pulse timing and pulse width characteristics of ATCRBS and Mode S signals produced by 1090 MHz Generators used at the FAA Technical Center for bench measurements in support of enhanced decoding techniques and performance analysis.

The following measurements were made on FAA Technical Center laboratory 1090 MHz Mode S and ATCRBS reply generators. There are two different systems that are used to generate Mode S and ATCRBS replies: DATAS and the ATCRBS Fruit Generator. There are two laboratory DATAS units, each with two channels capable of both Mode S and ATCRBS reply generation. One channel of one of the DATAS units has been dedicated to Extended Squitter Messages and is the source of the desired signal in most of the bench measurements. The other channel has been used for Mode S and ATCRBS interference replies. The second DATAS unit has two channels that have been mostly utilized for ATCRBS reply interference sources. Because of the need to simulate high-density ATCRBS interference rates, the ATCRBS Fruit Generator was built for this purpose. The ATCRBS Fruit generator has 8 channels that generate ATCRBS replies exclusively.

The reply waveforms were measured to determine pulse widths and pulse position timing. The results are shown below.

Mode S Reply Statistics in usec	DATAS 1 Channel 1*	DATAS 1 Channel 2	DATAS 2 Channel 1	DATAS 2 Channel 2
P1 Pulse Width	.475	.475	.485	.470
P2 Pulse Width	.475	.475	.485	.470
P3 Pulse Width	.475	.475	.485	.470
P4 Pulse Width	.475	.475	.485	.470
Narrow Data Bit	.475	.475	.485	.470
Wide Data Bit	.950	.950	.990	.940
P1 – P2 timing	1.0	1.0	1.0	1.0
P1 – P3 timing	3.5	3.5	3.5	3.5
P1 – P4 timing	4.5	4.5	4.5	4.5
First Data Bit (bit = 1)	8.0	8.0	8.0	8.0
First Data Bit (bit = 0)	8.5	8.5	8.5	8.5
Data Bit – Data Bit	1.0	1.0	1.0	1.0

* This DATAS channel dominantly used for Extended Squitter Desired Signal in Bench Measurements.

ATCRBS Reply Statistics in usec	DATAS 1 Channel 1	DATAS 1 Channel 2	DATAS 2 Channel 1	DATAS 2 Channel 2	ATCRBS Fruit Generator*
Bracket/Code Pulse Width	-	.425	-	-	.450
Pulse – Pulse Spacing	-	1.45	-	-	1.45

* ATCRBS Fruit Generators measurements performed on all 8 individual channels.

As can be seen from the measurements, position timing is as required. The pulse widths are shorter than nominal in messages generated by DATAS. This effect was seen by the capture of Extended Squitter Messages sampled video analyzed by MIT. Actual signals from live environments will tend to have wider pulse widths in general. The RF units of DATAS will be modified to correct the pulse widths.