



**Aerospace
Systems Division**

File

Bendix Data Transmitter
Qualification Units

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This ATM presents a summary of operating events which led to a decision to stop qualification testing with the Serial Number 23 unit and perform a complete qualification sequence with Serial Number 21. This ATM satisfies action required per the Delta QTRR Meeting on 2 September 1970.

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BACKGROUND

The formal qualification of the transmitter was started with S/N 23 transmitter after successful completion of acceptance functional tests at ambient, cold and hot temperatures and the sequence of three axes of operating vibration acceptance tests.

During the first qualification test sequence in June, a failure occurred at 158°F in which the output power dropped by more than 8 db to a level of 22 dbm. Troubleshooting revealed that an air-variable tuning capacitor, C14 in the power amplifier, was intermittent. During the failure analysis of C14, metallic contaminants were found between the rotor and the stator which could have shorted the capacitor during the temperature cycling. Further information is available in Failure Analysis Report A-8.

After C14 was replaced, proper performance was re-verified by functional tests, however an intermittent condition was noted which affected the cold turn-on characteristics. After more tuning and testing it was determined that proper performance could be achieved with the exception that occasionally the transmitter would not turn on at -22°F.

An examination of the operating events log on all transmitters revealed that the S/N 23 unit has had much more tuning time than any of the other units and was no longer representative of the flight units. Of particular concern was the wear on the air-variable tuning capacitors. Experience indicates that the characteristics of some of these capacitors change after many tuning cycles.

It was therefore decided to bring S/N 21 and S/N 24 units to the same configuration as S/N 23 and to use one of these for qualification. The configuration of S/N's 21 and 24 was not the same as S/N 23 because S/N's 21 and 24 were being used in the A-2 station while some changes in the power amplifier circuitry were made in S/N 23 and the flight units.

Tuning and in-process testing of S/N 21 was completed several days ahead of S/N 24 and Bendix recommended to NASA that S/N 21 be used for transmitter qualification. This recommendation was approved at the Transmitter Delta QTRR held at Bendix on 2 September 1970.



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HISTORICAL RECORDS

Attached are Operating Events Summaries of Transmitters S/N's 21, 23, 24, 26 and 27. These data taken from the log books show running time and tuning time. Running time is the time power was applied to the units for any reason. Tuning time is time power was applied while the transmitter was on the bench, with the tuning adjustments accessible. During some of the tuning time, adjustments were made of the variable capacitors, although the time recorded also includes checking performance over temperature. The actual wear on the capacitors is believed to be proportional to the tuning time and therefore the tuning time gives an indication of part wear.

Since the Delta QTRR, and starting with transmitter 28, records are being kept of the actual number of times that each capacitor is adjusted. Data sheets are filled in during subassembly and assembly tuning tests and the completed data sheets are kept in the transmitter log books. These records will give a more accurate indication of wear than the tuning time and will provide data for reliability estimates.

A comparison of the attached summary sheets shows that the tuning times for Transmitters S/N 21 and S/N 24 were comparable with the times for the flight units S/N 26 and S/N 27. The average tuning time of these units is 107.5 hours with a maximum variation of 38.4 hours, while the tuning time for S/N 23 was 313.9 hours. This ratio of 3 to 1 indicates that S/N 23 transmitter is not typical of flight units and that S/N 21 was a better choice for qualification.



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OPERATING EVENTS SUMMARY

S/N 21 Transmitter

<u>Period</u>	<u>Event</u>	<u>Running Time (Hours)</u>	<u>Tuning Time (Hours)</u>
2-8	Exciter Tuning	6.3	6.3
2-11	Power Amp Tuning	10.0	10.0
2-11 to 3-13	P. A. & X6 Integration & Tune	13.7	13.7
2-15 to 2-21	Exciter Integration	21.0	21.0
2-24 to 2-25	Calibration	15.1	---
2-26 to 3-4	In-Process Functional Test	11.2	---
3-11 to 3-20	Operation on Central Station	19.0	---
3-21 to 4-7	Check On Harmonic Levels	26.8	---
4-8 to 4-15	Troubleshooting on Harmonics	30.6	2.2
4-17 to 7-13	Installed on Central Station	---	---
7-13 to 8-21	Revisions Added to P. A.	---	---
8-4	X6 Functional Check	6.0	---
8-21 to 8-23	P. A. Retuning	10.0	10.0
8-26	P. A. & X6 Integration	9.0	9.0
8-28 to 8-30	Exciter Integration	11.4	11.4
9-1	Calibration	8.7	
9-2	Functional Test	8.2	
9-3	Acceptance Test	8.2	
9-10	Operating Vibration	<u>1.4</u>	



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OPERATING EVENTS SUMMARY

S/N 24 Transmitter

<u>Period</u>	<u>Event</u>	<u>Running Time (Hours)</u>	<u>Tuning Time (Hours)</u>
	Power Amp Tuning	10.0	10.0
2-10 to 2-19	P. A. & X6 Integration and Tuning	35.8	35.8
	Exciter Tuning	6.3	6.3
2-19 to 2-25	Exciter Integration	18.3	18.3
2-25	Calibration	7.3	---
3-1 to 3-5	In-Process Functional Test	12.6	---
3-11 to 7-28	Installed on Central Station	34.2	---
7-28 to 8-18	Revisions Added to P. A.	---	---
8-18 to 8-24	P. A. Retuning	17.0	17.0
8-24 to 8-25	P. A. and X6 Integration	10.5	10.5
8-25 to 9-1	Exciter Integration	48.0	48.0
9-2 to 9-8	Telemetry Calibration	8.75	
		<u>208.75</u>	<u>145.9</u>



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OPERATING EVENTS SUMMARY

S/N 23 Transmitter

Period		Running Time (Hours)	Tuning Time (Hours)
2-11 to 2-14	Exciter Tuning	6.0	6.0
to 2-20	Power Amp Tuning	10.0	10.0
2-20 to 3-2	Replaced C-12, DR AB 7066	---	---
3-8 to 3-11	Retune	14.4	14.4
3-11 to 3-26	Troubleshooting and Tuning Per DR AB7068	55.3	55.3
4-3 to 4-11	Exciter Integration and Tuning	42.0	42.0
4-16 to 4-17	Calibration	11.5	---
4-19 to 4-22	Functional Test	17.3	---
4-22 to 5-3	Troubleshooting and Tuning Per DR AB7369	21.1	21.1
5-7 to 5-16	Revise PA and Retune	28.8	28.8
5-13	Replaced C-6, DR AB7369	---	---
5-16 to 5-18	Functional Test, DR AB7562	10.1	---
5-18	Operating Vibration	2.0	---
5-19 to 5-20	Retuned X6 to Reduce Harmonics	7.0	7.0
5-25 to 5-26	Recalibration	6.0	---
5-26 to 5-27	Acceptance Test	9.3	---
6-12	Operating Vibration	3.8	---
6-25 to 6-26	Qual Functional Test	11.5	---
6-26 to 7-1	Troubleshooting and Tuning Per DR AB7487	18.0	18.0
6-29	Replaced C14	---	---
7-2 to 7-6	Rerun Qual Functional	14.0	---
7-16 to 7-22	Retune Mod Index Per DR AB7486	12.3	12.3
7-24 to 8-21	Troubleshooting for Cold Turn on Per DR AB7581	21.7	21.7
8-22 to 8-23	Recalibrate	11.7	---
8-27 to 8-28	In-Process Functional Test	7.8	---
		418.9	313.9



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OPERATING EVENTS SUMMARY

S/N 26 Transmitter

<u>Period</u>	<u>Event</u>	<u>Running Time (Hours)</u>	<u>Tuning Time (Hours)</u>
4-10	Exciter Tuning	10.5	10.5
4-16	Exciter Retune per AER to Reduce Harmonics	12.2	12.2
4-15	Power Amp Tuning	10.0	10.0
4-15 to 4-23	P. A. & X6 Integration and Tune (Incomplete; Spectrum Breakup over Temperature)	35.0	35.0
5-21 to 5-22	Retune P. A. after Rework to Rev. E.	10.0	10.0
5-23	P. A. & X6 Integration	2.0	2.0
5-26 to 6-5	Exciter Integration	11.0	11.0
6-6 to 6-7	Telemetry Calibration	8.75	----
6-10 to 6-11	In-Process Functional Test	9.75	----
6-18 to 6-19	Acceptance Test	11.5	----
7-1	Operating Vibration	2.25	----
7-26	Telemetry Recalibration	10.3	----
8-23 to 8-26	Thermal Vac Test	19.4	----
9-4	Installed on Central Station	----	----
	Total	152.65	90.7



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OPERATING EVENTS SUMMARY

S/N 27 Transmitter

<u>Period</u>	<u>Event</u>	<u>Running Time (Hours)</u>	<u>Tuning Time (Hours)</u>
	Power Amp Tuning	10.0	10.0
4-12 to 4-18	Exciter Tuning	18.6	18.6
4-22	Return Exciter per AER-283 to Reduce Harmonics	0.2	0.2
4-23 to 4-27	P. A. and X6 Integration and Tuning	30.75	30.75
4-28 to 5-13	Troubleshooting and Tuning per DR AB7373	9.75	9.75
5-14 to 5-20	Incorporate Rev. E into P. A.	---	---
5-21	Retune X6 to Reduce Harmonics per AER 291	0.50	0.50
5-22 to 5-23	P. A. Retuning	5.75	5.75
5-24	P. A. and X6 Integration and Tuning	4.0	4.0
6-1 to 6-2	Exciter Integration	11.0	11.0
6-9 to 6-10	Telemetry Calibration	11.7	----
6-12 to 6-13	Functional Test	6.6	----
6-17 to 7-1	Troubleshooting & Tuning Per DR AB7575	32.5	19.3
7-13 to 7-14	Telemetry Recalibration	8.2	----
7-24	Completed Troubleshooting per DR AB7575	5.5	----
7-25	Telemetry Recalibration	6.7	----
7-26	Functional Test	6.6	----
7-29 to 8-5	Acceptance Test	17.25	----
8-6	Operating Vibration	0.6	----
8-21 to 8-26	Thermal Vac Test	12.8	----
8-28 to 8-29	Check Telemetry Calibration per DR AB8119	11.7	----
9-4	Installed on Central Station	----	----
	Total	210.7	109.85