



CAL labs, Incorporated

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2525 Santa Anna Ave • Dallas, Texas 75228 • (800) 693-7308 • (214) 321-7205 • Fax (214) 324-4921

CERTIFICATION OF CALIBRATION

ID No.: 070568
Model No.: 6000
Serial No.: 1000686027
Manufacturer: AEROFLEX
Description: ATC DME TEST SET
P.O. No.:

Report No.: 162893
Report Date: Nov/22/2023 08:48
Page No: 1 of 5
Customer: INNOVATEC INDUSTRIAL SOLUTIONS
Address: DIEGO ALMEIDA/SANDRA VITERI
914 IBIS AVENUE
MIAMI SPRINGS, FL 33166

TEST STANDARDS USED

ASSET#	Model	Mfr.	Description	Cal Due
STD001	5520A	FLUKE	CALIBRATOR	Dec/20/2023
STD002	58503A	H.P.	FREQ.STANDARD	Oct/03/2024
STD003	8902A	H.P.	MEAS. RECEIVER	Oct/16/2024
STD004	11722A	H.P.	SENSOR MODULE	Oct/14/2024
STD005	TDS3032B	TEK	OSCILLOSCOPE	Jan/12/2024
STD012	11582A	H.P.	ATTENUATOR SET	Oct/12/2024
STD014	ATC-1400A	IFR	XPPDR/TCAS/DME	Aug/02/2024
STD017	33220A (2EA)	AGI	FUNCTION GEN.	Jun/15/2024
STD018	2024	MARCON	SIG. GENERATOR	Nov/02/2024

Receipt Date: Nov/08/2023
Calibration Date: Nov/22/2023
Calibration Due: Nov/22/2024
Calibration Procedure: 6095
Condition Received: In Tolerance

Temperature: 72F
Humidity: 37%
Technician: AN
Condition as Left: In Tolerance

Technical Notes:

Normal Calibration

Calibration was performed by direct comparison between the named instrument and the test standards. The certified measurements of the standards used are traceable to internationally recognized SI units by means of an unbroken chain of calibrations traceable to the National Institute of Standards and Technology. The total uncertainty of each measurement shall not exceed twenty five percent of the specification of the named instrument, unless noted in the technical notes. Cal Labs, Inc. quality assurance system satisfies the requirement of the customer purchase order, ANSI/NCSL Z540-3 and ISO 10012. This certificate shall not be reproduced, except in full, without the written authorization of Cal Labs, Inc.

General Manager

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TEST REPORT

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RF I/O Connectors			
Output Frequency Accuracy			
962 MHz	± 10 kHz	961.99988 MHz	
1030 MHz	± 10 kHz	1029.99989 MHz	
1090 MHz	± 10 kHz	1089.99987 MHz	
1150 MHz	± 10 kHz	1149.99988 MHz	
1213 MHz	± 10 kHz	1213.99987 MHz	
Output Level Accuracy (ANT Connector)			
-30 dBm @ 962 MHz	± 2 dBm	-30.08 dBm	
-30 dBm @ 1030 MHz	± 2 dBm	-30.13 dBm	
-30 dBm @ 1090 MHz	± 2 dBm	-30.24 dBm	
-30 dBm @ 1150 MHz	± 2 dBm	-30.33 dBm	
-30 dBm @ 1213 MHz	± 2 dBm	-30.26 dBm	
-2 dBm	± 2 dBm	-1.89 dBm	
-12 dBm	± 2 dBm	-12.05 dBm	
-22 dBm	± 2 dBm	-22.02 dBm	
-32 dBm	± 2 dBm	-31.91 dBm	
-42 dBm	± 2 dBm	-42.15 dBm	
-52 dBm	± 2 dBm	-52.20 dBm	
-65 dBm	± 2 dBm	-65.01 dBm	
1 dB step level Δ	± 0.25 dBm (√)	√	
Output Level Accuracy (RF I/O Connector)			
-50 dBm @ 962 MHz	± 1 dBm	-49.99 dBm	
-50 dBm @ 1030 MHz	± 1 dBm	50.12 dBm	
-50 dBm @ 1090 MHz	± 1 dBm	-50.17 dBm	
-50 dBm @ 1150 MHz	± 1 dBm	-50.21 dBm	
-50 dBm @ 1213 MHz	± 1 dBm	-50.14 dBm	
RF Flatness ≤ 2 dBm	(√)	√	
-47 dBm	± 1 dBm	-47.12 dBm	
-57 dBm	± 1 dBm	-57.32 dBm	
-67 dBm	± 1 dBm	-67.28 dBm	
-77 dBm	± 1 dBm	-77.15 dBm	
-87 dBm	± 1 dBm	-87.39 dBm	
-97 dBm	± 2 dBm	-97.35 dBm	
-107 dBm	± 2 dBm	-107.44 dBm	
-115 dBm	± 2 dBm	-115.41 dBm	

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DME Reply Pulse Characteristics			
X Ch P1-P2 Spacing	12.0 $\mu\text{s} \pm 0.1 \mu\text{s}$	12.00	μs
P1 pulse width	3.5 $\mu\text{s} \pm 0.5 \mu\text{s}$	3.48	μs
P2 pulse width	3.5 $\mu\text{s} \pm 0.5 \mu\text{s}$	3.48	μs
P1 pulse rise time	2.5 $\mu\text{s} \pm 0.25 \mu\text{s}$	2.38	μs
P1 pulse fall time	2.5 $\mu\text{s} \pm 0.25 \mu\text{s}$	2.32	μs
Y Ch P1-P2 spacing	30.0 $\mu\text{s} \pm 0.1 \mu\text{s}$	30.00	μs
DME Reply Delay and Range			
X Ch reply spacing	50.0 $\mu\text{s} \pm 0.1 \mu\text{s}$	50.00	μs
Y Ch reply spacing	56.0 $\mu\text{s} \pm 0.1 \mu\text{s}$	56.00	μs
X Ch range delay	123.59 $\mu\text{s} \pm 0.12359 \mu\text{s}$	123.400	μs
DME Reply Position and Amplitude			
Echo position	370.77 $\mu\text{s} \pm 12.359 \mu\text{s}$	373.00	μs
Echo level	-11 dBm $\pm 1 \text{ dBm}$	-10.97	dBm
DME Reply Efficiency			
10%	$\pm 0.5 \%$	10	%
40%	$\pm 0.5 \%$	40	%
70%	$\pm 0.5 \%$	70	%
100%	$\pm 0.5 \%$	100	%
DME Squitter			
Squitter frequency	2700 Hz $\pm 54 \text{ Hz}$	2684.54	Hz
DME Measurement-Interrogation Pulse Timing			
P1 pulse width	3.30 $\mu\text{s} \pm 0.05\mu\text{s}$	3.326	μs
P2 pulse width	3.30 $\mu\text{s} \pm 0.05\mu\text{s}$	3.327	μs
X Ch P1-P2 spacing	12.05 $\mu\text{s} \pm 0.02\mu\text{s}$	12.04	μs
Y Ch P1-P2 spacing	36.04 $\mu\text{s} \pm 0.02\mu\text{s}$	36.04	μs
DME Measurement-Interrogation PRF			
10 Hz	$\pm 2 \text{ Hz}$	10	Hz
101 Hz	$\pm 2 \text{ Hz}$	101	Hz
201 Hz	$\pm 2 \text{ Hz}$	201	Hz
300 Hz	$\pm 2 \text{ Hz}$	300	Hz
DME Measurement-Interrogation Frequency			
1025 MHz	1025.00 MHz $\pm 20 \text{ kHz}$	1025.00	MHz
1064 MHz	1064.00 MHz $\pm 20 \text{ kHz}$	1064.00	MHz
1110 MHz	1110.00 MHz $\pm 20 \text{ kHz}$	1110.00	MHz
1150 MHz	1150.00 MHz $\pm 20 \text{ kHz}$	1150.00	MHz

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XPDR Pulse Characteristics-ATCRB		
Mode A P1-P2 spacing	2.0 μ s $\pm$ 25 ns	2.000 μ s
P1-P3 spacing	8.0 μ s $\pm$ 25 ns	8.000 μ s
P1 pulse width	0.8 μ s $\pm$ 50 ns	0.800 μ s
P1 rise time	Between 50-100 ns	85.60 ns
P1 fall time	Between 50-200 ns	123.10 ns
Mode C P1-P3 spacing	21.0 μ s $\pm$ 25 ns	21.000 μ s
ITM mode A P1-P3	8.0 μ s $\pm$ 25 ns	8.000 μ s
P1-P4	10.0 μ s $\pm$ 25 ns	10.000 μ s
P4 width	0.8 μ s $\pm$ 50 ns	0.800 μ s
ITM mode C P1-P3	21.0 μ s $\pm$ 25 ns	21.000 μ s
P1-P4	23.0 μ s $\pm$ 25 ns	23.000 μ s
P4 width	0.8 μ s $\pm$ 50 ns	0.800 μ s
ITM A/S P4 pulse width	1.6 μ s $\pm$ 50 ns	1.600 μ s
ITM C/S P4 pulse width	1.6 μ s $\pm$ 50 ns	1.600 μ s
XPDR Pulse Characteristics-Mode S		
P1-P2 spacing	2.0 μ s $\pm$ 25 ns	2.000 μ s
P1-P6 spacing	3.5 μ s $\pm$ 25 ns	3.500 μ s
P1-SPR spacing	4.75 μ s $\pm$ 25 ns	4.744 μ s
P1 pulse width	0.8 μ s $\pm$ 50 ns	0.800 μ s
UFO P6 pulse width	16.25 μ s $\pm$ 50 ns	16.256 μ s
P1 rise time	Between 50-100 ns	82.87 ns
P1 fall time	Between 50-200 ns	127.60 ns
SPR phase transition	< 80 ns	60 ns
UF16 P6 pulse width	30.25 μ s $\pm$ 50 ns	30.256 μ s
XPDR Interrogation PRF		
235 Hz	$\pm$ 5 Hz	235 Hz
118 Hz	$\pm$ 5 Hz	118 Hz
90 Hz	$\pm$ 5 Hz	90 Hz
70 Hz	$\pm$ 5 Hz	70 Hz
50 Hz	$\pm$ 5 Hz	50 Hz
XPDR SLS Level		
P2 -9dBm level	-9 dBm -1dB/+0dB	-9.06 dBm
P2 0 dBm level	0dBm -0dB/+1dB	+0.57 dBm
P2 not present	($\sqrt{}$)	$\sqrt{}$

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XPDR Measurement-Reply Accuracy-ATCRBS		
Mode A delay 3.1 μ s	± 50 ns	3.07 μ s
Mode C delay 3.1 μ s	± 50 ns	3.07 μ s
Mode A F1-F2 spacing	20.3 μ s ± 20 ns	20.299 μ s
Mode A F1 pulse width	0.42 μ s ± 20 ns	0.434 μ s
Mode A F2 pulse width	0.42 μ s ± 20 ns	0.435 μ s
1090 MHz	1090.25 MHz ± 50 kHz	1090.270 MHz
XPDR Measurement-Reply Accuracy-Mode S		
Reply delay	128.0 μ s ± 50 ns	128.04 μ s
ITM A 128.0 μ s	128.0 μ s ± 50 ns	127.97 ns
Altitude Encoder		
Verify pulses are unmasked	($\checkmark$)	$\checkmark$
Generate Video		
Mode A baseline	0 V ± 0.5 V	0.0 V
Mode A peak to peak	1 Vpp ± 0.5 Vpp	0.770 V
Mode A P1 pulse width	0.8 μ s ± 50 ns	0.800 μ s
Mode A P1-P3 spacing	8.0 μ s ± 25 ns	8.000 μ s
Mode C P1-P3 spacing	21.0 μ s ± 25 ns	21.000 μ s
Mode S P1-P2 spacing	2.0 μ s ± 25 ns	2.000 μ s
RF power measurement		
TRANSPONDER	53 ± 2 dBm	54.6 dBm
DME	50 ± 2 dBm	49.6 dBm