

Mode S Transponder Test Worksheet

The Federal Aviation Administration (FAA) requires that transponders operated under FAR Part 91.215(a), 121.345(c), or 135.143(c) be tested and inspected every 24 calendar months in accordance with FAR Part 43, Appendix F. The Tel-Instrument TR-220 Multi-Function Test Set performs all of the tests as required by FAR Part 43, Appendix F, paragraphs (a) through (j). The following tests are performed on a Mode S (Modes A, C, and S) transponder (TR-220 will automatically determine type of transponder and perform required tests).

Sample Screen	<u>Definition of Test</u>	<u>Test Results</u>
M A 1200 100% 0.45 20.35 0.45 PASS (Preliminary Function Test)	Verify Mode A 4096 code reply is same as aircraft UUT, (i.e. 1200), and test results show PASS.	☐ PASS M A ☐ FAIL
M C 2354 975' 100% 0.45 20.35 0.45 PASS (Preliminary Function Test)	Verify Mode C altitude agrees w/aircraft UUT altitude, (i.e. 975') and test results show PASS.	M C □ PASS Altft. □ FAIL
SLS P1 > P2 100% P1 = P2 0% (FAR 43, APDX F, Para (b) Tests 1 & 2.)	Side Lobe Suppression Test Verify when P1 is greater than P2 by 9db, UUT replies 100%. When P1 and P2 are equal UUT does not reply more than 1%.	SLS P1 > P2 by 9db □ PASS P1 = P2% □ FAIL
M A All Call / Testing (FAR 43, APDX F, Para (h)	Verify DF=11reply with aircraft Mode S address in Hexadecimal (i.e. A00001) and the test results show PASS.	M A All Call □ Pass Acft. Add. □ Fail
M C All Call / Testing (FAR 43, APDX F, Para (h)	Verify DF=11reply with aircraft Mode S address in Hexadecimal (i.e. A00001) and the test results show PASS.	M C All Call / □ Pass Acft. Add. □ □ Fail
M A Only / Testing (FAR 43, APDX F, Para (i)	Verify the Mode S transponder will not reply to an ATCRBS Only All-Call. A PASS signifies the Mode S Transponder did not respond.	M A Only □ Pass □ Fail
M C Only / Testing (FAR 43, APDX F, Para (i)	Verify the Mode S transponder will not reply to an ATCRBS Only All-Call. A PASS signifies the Mode S Transponder did not re-	M C Only □ Pass □ Fail
SI Lockout (Operational Function Test)	spond. Test set issues Surveillance Identifier Lockout command (37) and verifies that transponder does not reply for 18 seconds. If transponder not able to perform this function, test set will not run the test (this is not a failure)	SI Lockout □ Pass □ Fail



M S Surv ID /	Interrogetee with LIEE, and verifies	M S Surv ID	☐ Pass
	Interrogates with UF5 and verifies	IN 2 SUIV ID	□ Pass
Testing	a DF=5 reply with correct trans-	LILIT Codo	
(FAR 43, APDX F, Para (g)	ponder 4096 code (i.e. 1200). The	UUT Code	F5: AIR 🗆 Fall
(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	test set will display the Flight Status		
	bit (AIR or GND). The test results		
	show PASS.		
M S Surv Alt /	Interrogates with UF4 and verifies a	M S Surv Alt	☐ Pass
Testing	DF=4 reply with correct aircraft alti-	11117 A14	4 55-11
(EAD 42 ADDV E Doro (a)	tude (i.e. 975'), and the test results	UUT Alt	_ft. □ Fail
(FAR 43, APDX F, Para (g)	show PASS.		
MS Surv Srt	Interrogates with UF0 Short Air to	MS Address	(Hex - 6 bits)
Testing	Air Surveillance. Replies with DF0		
(On a rational Europtica Tast)	that contains Mode S Address (Hex	Vertical Status	(AIR or GND)
(Operational Function Test)	or Octal) and Vertical Status Bit		
	(AIR or GND). The Test Set will	☐ Pass	
	decode and display the Country		
	Code and the Aircraft Tail Number	☐ Fail	
	(Not all tail numbers will be dis-		
	played as some countries do not		
	assign Mode S Addresses with a		
	computer algorithm based on air-		
	craft tail number).		
MS Comm ID /	Interrogates with UF5 with request	M S Comm Id	☐ Pass
Testing	for Mode S Communication DF21		
(5.5.6.455)(5.5.4)	ID reply with correct transponder	Code FID	□ Fail
(FAR 43, APDX F, Para (g)	4096 code (i.e. 1200). The test set		
	will display the Flight Status bit (AIR		
	or GND). The test results show		
	PASS.		
M S Comm Alt /	Interrogates with UF4 with request	M S Comm Alt	□ Pass
Testing	for Mode S Communication DF20		
(5.5.6.455)(5.5.4)	Altitude reply with correct aircraft	Alt	□ Fail
(FAR 43, APDX F, Para (g)	altitude (i.e. 975'), and the test re-		
	sults show PASS.		
Undesrd Rply /	The test set interrogates trans-	Undesrd Rply	□ Pass
Testing	ponder with 3 incorrect Mode S ad-		
	dresses. Verify transponder does		☐ Fail
(FAR 43, APDX F, Para (f)	not reply to interrogations by show-		
	ing a test result of PASS.		
Squitter /	The test set listens for Acquisition	ACQ: PASS	ms
Testing	Squitter (DF=11) and Extended		
	Squitter (DF=17). Verify PASS for	Mode S Add:	SI :
	each squitter type. If transponder is	-	
	not capable of transmitting DF=17		
	squitters or if DF17 is not received,	EXT: NOT DETECTE	D ☐ Yes ☐ No
	test set will show NOT DETECTED.		
(FAR 43, APDX F, Para (j)	A transponder that shows NOT DE-	EVT. DAGG	
	TECTED is not a failure).	EXT: PASS	ms
	,	ADD:	SI :
	Note: The SI Code (Surveillance	, NDD	
	Identifier) is a number between 0		
	and 64 and is assigned by the	Squitter Test	☐ Pass
	ground radar. SI: 0 is normal.	= -	400
			☐ Fail
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Max True Spd /	Interrogates with UF0 and displays	☐ Pass
Testing	the maximum true airspeed con-	
	tained in the DF0 RI field. The air-	☐ Fail
(Operational Function Test)	speed displayed should be applica-	
	ble to the aircraft UUT.	
Diversity /	Where Applicable	Diversity ADD: □ Pass
Testing	For any class of Mode S trans –	
	ponder that incorporates diversity	db Attenuation ☐ Fail
	operation, verify the isolation of the	
(FAR 43, APDX F, Para (e)	selected antenna to be 20db or	
Test 1 & 2.)	greater than the non-selected an-	
	tenna, and show a test result of	
	PASS. The test set will display the	
	aircraft Mode S address and the	
	diversity in dB.	
Sensitivity /	Verify the sensitivity (MTL) for	A:db C:db □ Pass
Testing	Modes A and C agrees within 1 db,	
(FAR 43, APDX F, Para (c)	and the test results show PASS.	S: - db ∆ db □ Fail
Tests 1(ii) & 2.)		
Power, Frequency /	Verify transponder transmitter	Power Frequency
Testing	power (results shown in dB or Watts	
	depending on selection in SETUP)	db/wtsMHz
(EAD 42 ADDY E Dave (a) Tanto 4	and frequency and the test result	
(FAR 43, APDX F, Para (a) Tests 1, 2, 3, & 4) for RF Frequency.	shows PASS. Frequency must be	☐ Pass
2, 3, & 4) for R1 1 requeries.	1090 + 3 MHz. The power must be	
(FAR 43, APDX F, Para (d)	minimum of 125 W (51 dBm) for	☐ Fail
Tests 1 (i ~ v) & 2.) for Power.	ATCRBS/Mode S Class 1A, 2A, 3A,	
	and 4; power must be 70 W (48.5	
	dBm) for ATCRBS/Mode S Class	
	1B, 2B, and 3B.	

Mode "S" Transponder Test Complete

The Mode S Transponder Test Requirements of FAA FAR 43, Appendix F have been accomplished.