

DATE 9/1/61

SHEET 1 OF 8

TMC SPECIFICATION NO. S-563

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TITLE: AFC-1B TEST PRODECURE

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I. PURPOSE

The model AFC-1B (Automatic Frequency Control Unit) is used with the model MSR-6B and any radio receiver capable of producing a 455 KC output. The AFC-1B will compensate for a combined drift of 500 cps in the receiver, MSR-6B and distant transmitter. This is accomplished by controlling the frequency of the MSR-6B first mixer oscillator with a D.C. control voltage which is proportional to the phase difference between the carrier and a 17 KCS reference signal. This maintains the carrier frequency at 17 KCS by changing the first mixer oscillator frequency drift.

The AFC-1B also produces a negative voltage which is proportional to the carrier voltage. This voltage is applied to the grids of the receiver RF and IF stages and produces an automatic gain control action.

II. DESCRIPTION OF CONTROLS:

A. AGC

1. Manual/Fast/Medium/Slow

a. Manual-Connects AVC producing circuit in receiver to RF & IF grids of receiver. Connects AGC producing circuit in AFC-1B unit to first carrier amplifier. The AFC-1B has no control of the radio receiver gain in this switch position.

b. Fast/Medium/Slow-Disconnects receiver RF & IF grids from AVC producing circuit and connects them to the AGC producing circuit. The AFC-1B unit now controls the gain of the receiver with fast, medium or slow time constants of .5, 1.5 or 3.5 seconds respectively.

B. Carrier Compensator-Changes the loop gain of the AGC circuit, when the AFC-1B unit is controlling the receiver gain, so that the side-band level remains within the linear range of the receiver and MSR-6B. The setting of this control is determined by the amount of carrier suppression (0 DB, 10 DB, 20DB or 30 DB) used in the transmitter equipment.

DATE 9/1/61
SHEET 2 OF 8

TMC SPECIFICATION NO. S-563

0

COMPILED

P.S.
CHECKED

TITLE: AFC-1B TEST PROCEDURE

APPROVED

- C. AFC Indicator-A zero center scale meter indicating the correction voltage applied to the MSR-6B. May also be read in terms of approximate frequency correction. Green area extends to 700 cps, yellow from 700 cps to 1250 cps and red from 1250 cps to 1500 cps.
- D. AFC Reset-A momentary push button switch which discharges the memory capacitor and returns the correction voltage to zero. Operated prior to tuning a signal so that initial lock-in point is near the center of the AFC-1B control range.
- E. Fade Alarm-A Visual alarm indicating that the carrier has faded or decreased below a predetermined level.
- F. Alarm Adjust-Determines the operating point of the memory lock and fade alarm circuits. It is normally adjusted to operate slightly above the atmospheric noise so that the AFC-1B will go into memory when the carrier fades below the noise level.
- G. Carrier Level-Visual indicator showing the relative carrier amplitude.
- H. Power-Connects or removes AFC-1B from power source.

III. TEST EQUIPMENT REQUIRED:

- A. Standard Signal Generator-Measurements, Model 82 or equivalent.
- B. VTVM-Hewlett Packard, Model 410B or equivalent.
- C. Frequency Counter-Berkely, Model 5500 or equivalent.
- D. Speaker, 8 ohms.
- E. 17 KC Xtal oscillator (for TMC) or audio oscillator for field alignment.
- F. For operational check, one MSR-6B is necessary.

IV. PROCEDURE:

- A. Power Supply
 - 1. Continuity check to ground, line cord disconnected. Power switch on.

DATE 9/1/61

SHEET 3 OF 8

TMC SPECIFICATION NO. S-563

D

COMPILED

P.S.
CHECKED

TITLE:

AFC-1B TEST PROCEDURE

APPROVED

- a. Terminal 1 & 2B on T4-open
- b. Terminal 1 of E2-approximately 3K
- c. Terminal 2 of E2-short
- d. Terminal 3 of E2-approximately 200K
- e. Terminal 4 of E2-open
- f. Terminal 5 of E2-open
- g. Terminal 6 of E2-open
- h. Terminal 7 of E2- short
- i. Terminal 8 of E2-short

2. Voltage check, line cord connected to 115V AC. Power switch on.

- a. DC Voltage-Terminal 1 of E2 to ground, +150V.
- b. DC Voltage-Terminal 3 of E2 to ground, -150V.
- c. AC Voltage-Terminal 5 of Terminal 6 of E2, 6.3 VAC
- d. AC Voltage-Terminal 7 to Terminal 8 of E2, 6.3 VAC

B. 17 KC Oscillator, Carrier Amplifier and Memory Ckt. tests.

1. Controls:

AGC-manual
Carrier Compensator 10 DB

2. Connect AC VTVM to 17.KC test jack. Should read a minimum of 0.3 VAC with Counter disconnected.

17 KC OSCILLATOR ADJUSTMENT:

- a. Using center adjust, set VTVM to center of 1 Volt DC scale. Connect common lead of VTVM to junction 3 & 4 of T2. Connect DC lead to center arm of R27 (balance adjustment). Hold re-set button in and adjust R27 for center scale reading.

DATE 9/1/61
SHEET 4 OF 8

TMC SPECIFICATION NO. S-563

D

COMPILED

P.S.
CHECKED

TITLE: AFC-1B TEST PROCEDURE

APPROVED

- b. Connect VTVM from chassis ground to center arm of R36 (drift adjustment). Hold reset button in and adjust for center scale reading. Connect counter to J4*.
- c. Adjust 17 KC oscillator trimmer on top of Z3 to 17 KC + 1 cps. If 17 KC can't be reached, capacitor C17 in Z3 should be changed so as to accomplish this with the cover on.
- d. Repeat steps a, b and c.

*NOTE: In some cases it may be necessary to connect the counter to Pin 1 of T3.

CARRIER AMP. ADJ.

- a. Temporarily connect jumper to junction R32 & C16 to ground and a coaxial lead between J1 and J4.
- b. Set Carrier Compensator to 10 DB level with AGC in manual position.
- c. Peak Z2 while observing carrier level. Minimum reading should be 1 on carrier level meter.
- d. Remove temporary jumper between C16-R32 junction and ground and coaxial lead between J8 and J1.

TUBE BALANCE:

- a. No signal input. Fade alarm indicator lit.
- b. Observe the AFC indicator meter for any drift (left or right) after an interval of at least four minutes.
- c. If any drift is observed, replace tubes V5 (6AB4) & V8 (6AG5) with pre-aged tubes. (Tubes that have had their filaments on at least 72 hours.)
- d. Repeat steps a through c above. If drift is still observed, check circuit.

DATE 9/1/61

SHEET 5 OF 8

TMC SPECIFICATION NO. S-563

0

COMPILED

P.S.
CHECKED

TITLE: AFC-1B TEST PROCEDURE

APPROVED

C. AGC Circuit:

1. Check continuity with AGC switch in manual position.
 - a. Terminal 1 to Terminal 3 of E1-shorted.
 - b. Terminal 1 to ground-open.
2. Check continuity with AGC switch in fast, medium and slow positions.
 - a. Terminal 1 to terminal 3 of E1-open.
3. AGC Level Adjust:
 - a. Set AGC switch to fast and carrier compensator to 20 DB.
 - b. Turn the AGC level control R45 fully counter-clockwise.
 - c. Apply an external 17 KC signal to J1.
 - d. Adjust 17 KC signal level to obtain a reading of 25 VAC +10% with a VTVM connected to J2.
 - e. Connect the VTVM to Terminals 3 and 4 on E1.
 - f. The voltage should read at least-10 VDC with the AGC switch in the fast, and medium positions.
 - g. Set AGC switch to manual. The DC voltage should read 0 volts.

D. Fade Alarm Circuit:

1. Voltage Check
 - a. Apply an external 17 KC signal to J1. Adjust signal level to obtain a reading of 5 on the carrier level meter.
 - b. Connect AC VTVM to terminals 7 and 8 on E1.
 - c. Rotate alarm adjust control fully clockwise. Fade alarm indicator should be lit. Voltage should be 6.3 VAC.
 - d. Rotate alarm adjust control fully counter-clockwise. Fade alarm indicator should be extinguished. Voltage should decrease to zero.
 - e. Remove 17 KC signal from J1.

DATE 9/1/61
SHEET 6 OF 8

TMC SPECIFICATION NO. S-563

COMPILED

B.S.
CHECKED

TITLE: AFC-1B TEST PROCEDURE

APPROVED

E. Operational Check:

1. Make the following connections:

- a. Signal generator output to J1 on MSR-6B
- b. J1 on AFC-1B to J4 on MSR-6B.
- c. J4 on AFC-1B to J3 on MSR-6B.
- d. Speaker to terminals 4 and 5 of E1 on MSR-6B.
- e. Connect center conductor of shielded lead to terminal 5 of E1 on AFC-1B and to terminal 12 of E1 on MSR-6B.
- f. Connect shield to terminal 6 of E1 on AFC-1B and to terminal 11 of E1 of MSR-6B.

2. Control Settings:

- a. Set controls as follows on the MSR-6B.

Manual
Sideband-upper
Band spread-center rotation
BFO-on
AVC-off, slow

- b. Set controls as follows on the AFC-1B.

AGC-Manual
Carrier Compensator 30 DB
Alarm adjust-center rotation

A shift in frequency will be observed on counter. Adjust Z2 to bring frequency back to 17 KC $+\frac{1}{2}$ cycle. Return carrier compensator to 0 DB and BFO to off position. Frequency should remain 17 KC $+1$ cycle. Remove counter.

AFC CIRCUIT:

1. Set signal generator to 455 KC at 100,000 microvolts and carrier compensator to 30 DB.
2. Tune Bandspread on MSR-6B with AFC reset switch pushed in to lock-in carrier. Observe the carrier level meter for maximum indication.

DATE 9/1/61
SHEET 7 OF 8

TMC SPECIFICATION NO. S-563

D

COMPILED

P. S.
CHECKED

TITLE: AFC-1B TEST PROCEDURE

APPROVED

3. Tune bandsread very slowly. AFC indicator should follow the rotation of the bandsread control.
4. Continue until AFC indicator is on the line between the yellow and red areas.
5. Connect a VTVM between terminal 5 of E1 on AFC-1B and ground. The DC voltage should be $\pm .4$ VDC minimum.
6. Decrease signal generator output to zero. Fade alarm indicator should light.
7. Increase signal generator output to 100,000 microvolts. Fade alarm indicator should be extinguished and AFC-1B should remain locked on the carrier.

DATE 8-11-61
SHEET 8 OF 8

TMC SPECIFICATION NO. S⁻⁵⁶³

P.S. *P.S.*
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TITLE: AFC-1B TEST PROCEDURE

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CHECK SHEET AFC-1B

17 KC Voltage at J3	_____	.3VAC min.
Frequency Counter J4	_____	17 KC
17 KC Voltage at J2	_____	25 VAC
Carrier Level Indicator	_____	5.7

	Accept	Reject
Drift Control Adjust	_____	_____
Balance Control Adjust	_____	_____
AGC Switch	_____	_____
Alarm Adjust	_____	_____
AFC Output	_____	_____
AFC Lock	_____	_____
AGC Level Adjust	_____	_____

REVISION SHEET

THE TECHNICAL MATERIEL CORP.
MAMARONECK NEW YORK

S-563B (TEST PROCEDURE)

MODEL AFC-1B PROJECT NO _____

DATE	REV.	PAGE	EMN#	DESCRIPTION	CHK.	APP.
8/22/61	A	1--8	5485	COMPLETELY REVISED AND RETYPED		46
9/1/61	B	1-8		Retyped and on page 3, J7 deleted and 17KC TEST JACK added		46
10/10/61	C	5		On step C. 3.f, chg -12 to -10 and "fast, medium, and slow" to "fast and medium"		46
11/18/61	D	3	5938	On step 1b., chg. 6K to 3K. On step 1h., chg. open to short.		46
		4		On 1st. line of 1st. step c., chg. $\frac{1}{2}$ cps to 1 cps. On Carrier amp. adj., step a., line 2, chg. J8 to J4.		
		5		On 3 a., chg. 0 DB to 20 DB		
		6		On E.1.b., chg. J8 to J4. On E.1.c., chg. J7 to J3. On E.2.b., last line, chg. $+\frac{1}{2}$ cycle to + 1 cycle and add "Remove Counter" On "AFC Circuit", step 1, continue sentence to read "and carrier compensator to 30 DB."		
		7		On step 5, line 2, chg. +10% to minimum.		