

DATE 9-28-60
SH. 1 OF 7
COMPILED BY
E.F.M.

TMC SPECIFICATION NO. S 511

TITLE: AFC-1 TEST PROCEDURE

JOB

APPROVED

SEM

I PURPOSE:

The model AFC-1 (Automatic Frequency Control Unit) is used with the model MSR-6 and any radio receiver capable of producing a 455 KC output. The AFC-1 will compensate for a combined drift of ± 1000 cps in the receiver, MSR-6 and distant transmitter. This is accomplished by controlling the frequency of the MSR-6 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 17KCS by changing the first mixer oscillator frequency to compensate for the frequency drift.

The AFC-1 also produces a negative voltage which is proportional to the carrier voltage. This voltage is applied to the grids of the receiver R.F. and I.F. 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-1 unit to first carrier amplifier. The AFC-1 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-1 unit now controls the gain of the receiver with fast, medium or slow time constants of .5, 1.5 and 10.5 seconds respectively.

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

C. A.F.C. Indicator - A zero center scale meter indicating the correction voltage applied to the MSR-6. May also be read in term of approximate frequency correction. Green area extends to 500 cps, yellow from 500 cps to 1000 cps and red from 1,000 cps to 1250 cps.

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- D. A.F.C. 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-1 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-1 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-1 from power source.

III TEST EQUIPMENT REQUIRED:

- A. Standard Signal Generator - Measurements, Model 82
- B. V.T.V.M. - Hewlett Packard, Model 410B
- C. Frequency Counter - Berkley, Model 555B
- D. Speaker, 8 ohms.

IV PROCEDURE:

A. Power Supply

1. Continuity check to ground, line cord disconnected. Power switch on.
 - a. Terminal 1 & 2B on T4 - open
 - b. Terminal 1 of E2 - approximately 10K
 - c. Terminal 2 of E2 - short
 - d. Terminal 3 of E2 - approximately 100K
 - 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

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2. Voltage check line cord connected to 115V AC. Power switch on.
 - a. D.C. Voltage - Terminal 1 of E2 to ground, + 150 V
 - b. D.C. Voltage - Terminal 3 of E2 to ground, - 150 V
 - c. A.C. Voltage - Terminal 5 to Terminal 6 of E2, 6.3 V.A.C.
 - d. A.C. Voltage - Terminal 7 to Terminal 8 of E2, 6.3 V.A.C.

B. Crystal Oscillator and Carrier Amplifier Test

1. Controls:

A.G.C. - Fast
Carrier Compensator - 10 DB

2. Connect A.C. V.T.V.M. to J4
3. Adjust Z3 for maximum indication on the VTVM. Should read between .2 and .3 VAC.
4. Connect AC VTVM to J3. Should read between 5 and 7.5 VAC.
5. Connect frequency counter to J4. Frequency should be 17 KCS + 1 cps.
6. Connect R.F. cable from J1 to J4. Adjust Z2 for maximum indication on the carrier level meter.
7. Connect AC VTVM to J2. Should read a minimum of 40 V.A.C.
8. Carrier level meter should read a minimum of 4.
9. Disconnect R.F. cable from J1 to J4.

C. Phase Detector and Memory Ckt.

1. Drift control adjust.

- a. No signal input. Fade alarm indicator lit.
- b. Press AFC reset and adjust drift control until AFC indicator reads center scale.
- c. Release AFC reset.

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2. Balance Control Adjust

- a. Remove 17 KC crystal Y1
- b. Apply an external 17 KC signal to J1. Adjust signal level until carrier level indicator reads approximately mid scale.
- c. Turn alarm adjust control counter-clockwise until fade alarm indicator is extinguished.
- d. Press AFC reset momentarily.
- e. Adjust balance control until the AFC indicator remains at center scale.

D. A.G.C. Circuit

1. Check continuity with A.G.C. switch in manual position.
 - a. Terminal 1 to Terminal 3 of E1 - shorted
 - b. Terminal 1 to ground - open
2. Check continuity with A.G.C. switch in fast, medium and slow positions.
 - a. Terminal 1 to Terminal 3 of E1 - open
3. A.G.C. level adjust
 - a. Set A.G.C. switch to fast.
 - b. Apply an external 17 KC signal to J1.
 - c. Adjust signal level to obtain a reading of 50 V.A.C. with a V.T.V.M. connected to J2.
 - d. Turn the A.G.C. level control counter-clockwise
 - e. Connect the VTVM to terminals 3 and 4 on E1
 - f. The voltage should be at least - 2 V.D.C. with the AGC switch in the fast, medium or slow positions.
 - g. Set AGC switch to manual. The voltage should decrease to zero.

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E. 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 A.C. V.T.V.M. 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 V.A.C.
- d. Rotate alarm adjust control fully counter-clockwise. Fade alarm indicator should be extinguished. Voltage should decrease to zero.

F. Operational Check

1. Make the following connections:

- a. Signal generator output to I.F. input on MSR-6.
- b. J1 on AFC-1 to carrier out jack on MSR-6.
- c. J4 on AFC-1 to ref. in jack on MSR-6.
- d. Speaker to terminals 4 and 5 of E1 on MSR-6.
- e. Terminal 5 of E1 on AFC-1 to terminal 12 of E1 on MSR-6 with shielded lead.
- f. Connect shields to 6 of E1 on AFC-1 and 11 of E1 on MSR-6.

2. Adjust controls as follows:

- a. MSR-6
Manual
Sideband - upper
Band spread - center rotation
B.F.O. - on
AVC - off; slow
- b. AFC-1
AGC - Manual
Carrier compensator - 10 DB
Alarm adjust - center rotation

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3. AFC Circuit

- a. Set signal generator to 455 KC at 100,000 microvolts.
- b. Tune bandspread on MSR-6 to lock-in the carrier. Observe the carrier level meter for maximum indication.
- c. Tune bandspread very slowly. AFC indicator should follow the rotation of the bandspread control.
- d. Continue until AFC indicator is on the line between the yellow and red areas.
- e. Connect a VTVM between terminal 5 on E1 and ground. The D.C. voltage should be .4 VDC $\pm 10\%$
- f. Decrease signal generator output to zero. Fade alarm should light.
- g. Increase signal generator output to 100,000 microvolts. Fade alarm should be extinguished and AFC-1 should remain locked on the carrier.

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17 KC Voltage At J4	_____	.26 VAC
17 KC Voltage At J3	_____	5.9 VAC
Frequency Counter, J4	_____	17 KC
17 KC Voltage At J2	_____	52 VAC
Carrier Level Indication	_____	5.7

Accept

Reject

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