DATE 1-18-62	TMC SPECIFICATION NO. S 650	
SHEET 1 OF 8		
COMPILED W.W. / CHECKED	TITLE: AFC-2 TEST PROCEDURE	
APPROVED		

I PURPOSE:

The model AFC-2 (Automatic Frequency Control) is used with SBC-1 system and any radio receiver producing an output of 455 KC to 2 MC. The AFC-2 compensates for a combined drift of ± 1000 cps in the receiver, SBC-1 system, and distant transmitter. This is accomplished by controlling the frequency of the converter injection oscillator with a D.C. control voltage. The control voltage is proportional to the phase difference between the carrier and a 250 KC reference signal. This maintains the carrier frequency at exactly 250 KC by changing the (converter injection frequency) to compensate for the frequency drift.

A second mode of operation is to use the AFC-2 as a carrier amplifier. In this case the controlling circuitry is disabled, and unit will restore a (40DB) suppressed carrier.

The AFC-2 also produces a negative voltage proportional to the carrier amplitude. This voltage may be applied to R.F. stages to produce automatic gain control action.

II DESCRIPTION OF CONTROLS:

A. Sensitivity-Changes the gain of the carrier amplifier permitting reception of a stronger carrier without readjustment of the threshold control.

B. Threshold-Changes the loop gain of the AGC circuit when the AFC-2 is controlling the receiver gain so that the sideband level remains within the linear range of the receiver. The setting of this control will be determined by the amplitude of received carrier.

C. Carrier Selector-Provides the operator with the choice of using either the AFC controlled (Product Detector Oscillator) or reconstructed carrier.

D. Tuning-A manual frequency adjustment of the converter injection Oscillator over a 6 KC range in which the AFC-2 operating point may be centered.

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E. Reset-A momentary push button switch which discharges the memory capacitor, and returns the correction voltage to zero. The reset is pushed prior to tuning a signal, so that initial lock-in point occurs near the center of the AFC-2 control range.

F. Drift Meter-A zero center scale meter, indicating the correction voltage applied to the Converter Injection Osc. This meter is usually read in terms of approximate frequency correction. Green extends to 500 cps, Yellow from 500 cps to 1000 cps, and Red from 1000 cps to 1500 cps.

G. Level Meter-Indicates relative carrier amplitude where the green area represents normal carrier reconstruction, and the red area indicates the carrier has gone into fade.

H. Fade-A visual indication that the carrier has faded or decreased below a predetermined level, and that the AFC-2 has gone into memory.

I. Alarm-A Visual indication warning that the AFC-2 has followed a signal over a total drift of approximately 750 cps.

J. Alarm Adjust-A balancing potentiometer adjusting for symmetrical operation of the phase detector.

III TEST EQUIPMENT REQUIRED:

A. Standard Signal Generator, Measurements Model 82.
B. VTVM, Hewlet Packard 410B,
C. Frequency Counter, Hewlet Packard Model 524C.
D. Variable bias supply.
E. Regulated power supply Lamda Electronics Model 25 or equivalent.

IV PROCEDURE:

A. Power Distribution:

1. Disconnect power cable from J5001.
2. Make the following continuity check to ground from the circuit board at the rear of the unit.
   a. L5020 approximately 10K.

b. L5021 approximately 50K.
c. L5022 open.
d. L5023 open.
e. L5024 ½ ohm.
f. L5025 ½ ohm.

3. Connect power cable to J5001.
4. Make the following voltage checks from the circuit board.
   a. D.C. voltage - L5020 to ground: +200V.
   b. D.C. voltage - L5021 to ground: -105V.
   c. A.C. voltage - L5022 to L5023: 110V. A.C.
   d. A.C. voltage - L5025 to ground: 6.3V A.C.

B. Carrier Amplifier

1. Controls:
   a. Carrier Slector to "RCC".
   b. Sensitivity to Maximum.
   c. Threshold, R5024, fully counterclockwise.
2. Connect frequency counter to signal generator.
3. Adjust signal generator to 250KC + 5cps.
4. Remove counter and adjust signal generator to 300,000 micro-volts.
5. Connect signal generator to J5000.
6. Terminate J5002 with 50 ohm load.
7. Connect A.C. VTVM to pin 1 of V5001.
8. Adjust L5030 for maximum indication of VTVM.
9. Connect A.C. VTVM to pin 1 of V5002.
10. Adjust L5031 for maximum indication of VTVM.
11. Adjust signal generator to 300 micro-volts.
12. Connect A.C. VTVM to J5002.
13. VTVM should read approximately 1.0V.
14. Connect (-) D.C. VTVM to pin 1 of V5002.
15. Adjust Threshold, R5024, until VTVM falls to 0V.
16. Check "Level Meter" it should now read approximately the dividing line between yellow and green.
17. Increase signal generator to 30K micro-volts.
18. VTVM should now read between -6V and -7V (r cord) at pin 1 of V5002.
19. Reduce "Sensitivity" until "Level" meter indicates the Center of the red scale. At this point the "Fade" relay and light should operate.
20. Remove VTVM and signal generator.

This completes the alignment of the Carrier Amplifier.

C. Preliminary Check of Oscillator Sub-Assemblies

*NOTE: This check is to be completed before installing the oscillators on the Main Chassis. It is to be done in a "Bread-Board" manner on the bench. Use Extreme caution when working with exposed wiring to avoid shock.

1. 705 KC Oscillator:

a) Check crystal locations to insure that crystals are in proper sockets.
b) Connect Red Lead to +200 volt supply.
c) Connect Brown Lead to 603 VAC supply.
d) Ground all other leads.
e) Ground Junction of varicap and L-5019 with a clip lead.
f) Turns B+ on.
g) Connect AC VTVM to junction of varicap and the 10.705 MC crystal.
h) VTVM should read approximately 2.5V
i) Connect-DC VTVM to junction of varicap and 10.705 MC crystal.
j) VTVM should read approximately - 3V.
k) Connect AC VTVM to cathode test point of 10 MC oscillator - should read about 0.6V
l) Connect AC VTVM to cathode test point of 10.705 MC oscillator - should read about 1.5V.

2. 250 KC Oscillator

a) Check crystal locations to insure that crystals are in proper sockets.
b) Connect Red Lead to +200 volt supply.
c) Connect Brown Lead to 6.3 vac supply.
d) Ground all other leads.
e) Ground junction of varicap and L-5009.
f) Turn B+ on.
g) Connect AC VTVM to junction of varicap and the 1.5 MC crystal. - should read about 12 vac.
h) Connect +DC VTVM to junction of varicap and 1.5 MC crystal - should read about +10V.
i) Connect AC VTVM to cathode test point of 1.5 MC oscillator - should read about 3V.
j) Connect AC VTVM to cathode test point of 1.25 MC oscillator - should read about 4V.

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C. Drift Alarm and Drift Meter Adjustment

The adjustments are to be done with a clip lead across the terminals of the reset switch.

1. Connect DC VTVM to pin 6 of V5008.
2. VTVM should read approximately 130V.
3. Connect DC VTVM to pin 6 or V5007.
4. Adjust R5064 until VTVM reads the exact voltage measured to step 3.
5. Repeat steps 3 and 4 until both voltages are the same.
6. Adjust R5074 until Drift Meter reads zero at center scale.

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E. Low Frequency Oscillator and Amplifier Test

***NOTE: This test is to be done with a clip lead across the reset switch.

1. Controls: Carrier selector in oscillitor position.
2. Using a clip read, ground AGC (lead #2) from L.F. Oven. Terminate J5002 with a 500HM load.
3. Connect A.C. VTVM to pin 1 of V5004. Tune L5033 for maximum indication.
4. Connect A.C. VTVM to pin 1 of V5003. Tune L5032 for maximum indication.
5. Connect AC VTVM to J5002. Tune T5001 for maximum indication. Remove clip lead ground. VTVM should now read between 1 and 1.3V (record).
6. Connect AC VTVM to pin 3 of T5003. VTVM should read between 2 and 3V (record).

****NOTE: The low frequency oven must cycle for 24 hours before the following steps are carried out.

7. Connect frequency counter to J5002. Connect clip level across terminals of Reset switch. Tune L5008 until counter reads 250KC $\pm$ .1 cps. (record)
8. Remove clip lead from Reset switch. Connect + side of Bias supply to lead #3 of L.F. oven. Connect (-) side of Bias to ground.
9. Adjust bias until counter reads 250KC $\pm$ 1 cps. Increase bias by 1V. Counter should decrease by at least 50 cps. (record) Return bias to 250KC point. Decrease bias by 1V. Counter should increase by at least 50 cps. (record)
10. Connect D.C. VTVM to the wiper arm of R5031.
11. Adjust R5031 from one extreme to the other.
12. VTVM should vary approximately from + 11V to -4V.
13. Connect DC VTVM to junction of terminals 1 and 2 of T-5003.
14. VTVM should read approximately +2.7V to ground. (record)
15. Connect D.C. VTVM to wiper arm of R5031.
16. Adjust R5031 until VTVM reads the exact voltage measured in step 2.
17. Conneet AC VTVM to Pin 3 of T5003.
18. VTVM should read 1.V (record)

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F. High Frequency Oscillator and Amplifier Test.

1. Using a clip lead ground AGC lead #2 from H.F. oven.
2. Connect A.C. VTVM to pin 1 of V5010. Tune L5035 for maximum indication.
3. Connect A.C. VTVM to pin 1 of V5009. Tune L5034 for maximum indication.
4. Remove clip lead. Connect A.C. VTVM to J5003. VTVM should read between 0.8 and 1V. (record)

*****NOTE: The High Frequency Oven must cycle for 24 hours before the following steps are carried out.

5. Connect a clip lead across the terminals of the Reset switch.
6. Connect Frequency Counter to J5003. Adjust tuning for lowest frequency. Loosen coupling of tuning shaft. Adjust tuning pointer to +3 on front panel. Retighten shaft coupling.
7. Adjust tuning to 0 position on front panel. Adjust L5029 until counter reads 705KC ±100 cps. (record)
8. Remove clip lead from Reset switch. Connect + side of bias supply to lead #3 of H.F. oven. Connect (-) side of bias to ground.
9. Adjust bias until counter reads 705KC. Increase bias by 1V. The counter should read an increase of at least 1,000 cps. (record) At this point the Drift Meter should swing right to ½ yellow scale. Drift Alarm should light. Return bias to 705KC point. Decrease bias by 1V. The counter should measure a decrease of at least 1,000cps. (record) At this point the Drift meter should swing left to ½ yellow scale. Drift Alarm should light.

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. STOCK NO. 439M

DATE 1-18-62 SHEET 8 OF 8	TMC SPECIFICATION NO. S 650	
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TEST REPORT SHEET

TME MODEL AFC-2

IV	B-18	AGC voltage at pin 1 of V5002		-6V
	F-13	DC voltage at terminals 1 & 2 of T5003		6.7VDC
	E-18	AC voltage at pin 3 of T5003		3VAC
	E-5	250KC voltage at J5002		1VAC
	E-7	Frequency at J5002		250KC
	E-9	Frequency for +1V bias at J5002		250KC-50cps
	E-9	Frequency for -1V bias at J5002		250KC+50 cps
	F-4	705KC voltage at J5003		1VAC
	F-7	Frequency at J5003		705KC
	F-9	Frequency for +1V bias at J5003		705KC 1KC
	F-9	Frequency for -1V bias at J5003		705KC-1KC

ACCEPT

Tuning Control _____
Drift Meter _____
Level Meter _____
Threshold _____
Sensitivity _____
Fade Alarm _____
Drift Alarm _____
Phase Detector Balance _____
Sensitivity Control _____

Serial Number _____
Tested by _____
Date _____
Accepted by _____
Date _____

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