DATE 23 December 1964	TMC SPECIFICATION NO. S-890	0
SHEET 1 OF 10		
TKA COMPILED / CHECKED	TITLE:	
APPROVED	Typed by mtp	

TEST PROCEDURE

for

VLFC-1 (RAK-43) - VLF FREQUENCY SYSTEM

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

DATE 23 December 1964	TMC SPECIFICATION NO. S-890	0
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INTRODUCTION

The TMC VLFC-1 is a precision, Very Low Frequency Comparison System for the reception of standard frequency stations in the VLF range for direct comparison with local standards. This consists of the following units:

LFSA-1	Synthesizer
VLRA-1	VLF Receiver
PFCB-1	Frequency Standard
CSS-2	Frequency Standard
BPSD-1	Battery Supply

In the RAK-43 configuration, an LSP-4 monitor speaker, and an HPP-1 power distribution panel are also provided.

The units in this system are in the standard 19" rack mounted configuration. Almost all of the circuitry is in the form of plug-in printed circuit boards.

This specification covers the operational check of the overall system. A separate specification covers the testing of each individual unit in the system.

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I. EQUIPMENT REQUIRED

1. Ultra-stable standard (1 mc).
2. VLF Signal Generator.
3. VLF Antenna Installation.
4. VOM - Simpson #260 or equivalent.
5. Ballantine RMS Voltmeter, or equivalent.
6. Dummy Load - D 100-4.

II. PRELIMINARY CHECKOUT

1. Mechanical Check

   a. Defective panels, proper action of slides, etc.

2. Check inter-connecting cables

   a. Proper hook-up per cable diagram.

   b. Proper routing; freedom from snags.

III. PRELIMINARY OPERATIONS

1. Set controls as follows:

MODULAR UNIT	SWITCH OR CONTROL	POSITION
VLRA	POWER	ON (Upper)
	BATTERY	IN
	AF GAIN	Fully Counter-clockwise
	AGC DECAY	MAN RF
	CHAN. SEL.	Selected Receiver Channel
	NOISE SILENCER	OFF
	BFO Control	Mid-position
	RF GAIN	Mid-position
	LINE LEVEL	Mid-position
	AF-RF	RF
LFSA	POWER	On (Upper)
	10 KC, 1KC, .1KC 10 CPS, and 1 CPS	At selected frequency of VLRA receiver, (observe nixie lamps for proper readout.)

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III. PRELIMINARY OPERATIONS - Cont'd

MODULAR UNIT	SWITCH OR CONTROL	POSITION
CSS	AMPLIFIERS	STANDBY
	*BAT.	IN
	SYNCHRONIZE	OFF
	METER FUNCTION	24V
	FINE FREQ ADJUST	At initial setting
PFCB	ON-OFF	ON
	*BAT	IN
	MULTIPLIER	6 PARTS IN 10^n
	METER SCALE	OFF
BPS	METER SWITCH	BATTERY GROUP - 1 CONDITION

*The battery switches are placed in the OUT position only when Battery Power Supply BPS is not supplied with batteries.

IV. SYSTEM TEST PROCEDURE

Individual units in the system should be in good working order as per their individual test specification, as this procedure will cover a system check only.

Steps (1) through (10) are performed during a 24-hour warm-up period. This is necessary to insure a stable 1 mc frequency output of Frequency Standard CSS. Also, the procedures that follow assume that at least two batteries (one for each battery group) are supplied with the Battery Power Supply BPS.

1. On Very Low Frequency Receiver VLRA, Frequency Standard CSS, Precision Frequency Comparator PFC and Low Frequency Synthesizer LFSA, observe that POWER lamps are lit.

2. On Power Panel HPP, connect ACVM to each utility outlet. ACVM should indicate 115 VAC (or 230 VAC if used).

3. On Frequency Standard CSS, observe function. Meter should indicate approximately 24 volts.

4. On Battery Power Supply BPS, observe that meter indicates within BATTERY CONDITION area. Set METER SWITCH at BATTERY GROUP-2 CONDITION and observe that meter indicates within BATTERY CONDITION area. Meter should indicate between 500 and 600 milliamperes. Then, set METER SWITCH at BATTERY GROUP-1 CHARGE. Meter should indicate between 0 and 100 milliamperes.

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IV. SYSTEM TEST PROCEDURE - Cont'd

5. Disconnect a-c line power from VLFC system.

6. On Very Low Frequency Receiver VLRA, Frequency Standard CSS, Precision Frequency Comparator PFCB, and Low Frequency LFSA, observe that POWER lamps go off and BATTERY lamps light when battery is supplied.

7. On Frequency Standard CSS, function meter should indicate approximately 24 volts. Set METER FUNCTION selector switch at OVEN TEMP.

8. Re-connect a-c line power to VLFC system and observe that BATTERY lamps and POWER lamps referred to in Step (6) above go off and on.

9. On Battery Power Supply BPS, set METER SWITCH at BATTERY GROUP-1 CONDITION. Meter should indicate between 500 and 600 milliamperes. Then, set METER SWITCH at BATTERY GROUP-2 CHARGE. Meter should indicate between 0 and 100 milliamperes. Set METER SWITCH at BATTERY GROUP-1 CONDITION.

10. On Very Low Frequency Receiver VLRA, perform the following:

NOTE: During system checkout, the VLRA receiver should be tuned to a strong VLF station that is transmitting at a known frequency stability of 1 part in 10^{11}.

a. Turn RF GAIN control in clockwise and then counter-clockwise direction, observing corresponding changes on meter. Set RF GAIN control at mid-position.

b. Set AF-RF switch at AF. Turn LINE LEVEL control in clockwise then counter-clockwise direction, observing corresponding changes on meter. Set RF GAIN control at mid-position and set AF-RF switch at RF.

c. Adjust AF GAIN control for comfortable audio level.

d. Adjust BFO control as required for desired tone.

e. Set AGC DECAY switch at best position suitable for speed of transmission.

f. If necessary, adjust NOISE SILENCER control to reduce noise present in received signal, observe action on weak channel with an oscilloscope across 600 ohm line, and center tap on VLRA-1.

g. Check remaining frequency channels by using CHAN SEL switch, and repeating Steps (c) through (f). Then reset CHAN. SEL. switch to desired frequency.

h. Connect headset with an impedance of 600 ohms to PHONE jack, and listen for audio. Then, disconnect headset from PHONE jack.

11. Allow Frequency Standard CSS to warm up for a 24-hour period.

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IV. SYSTEM TEST PROCEDURE - Cont'd

12. On Frequency Standard CSS, perform the following:

a. Observe that meter indicates within the green area.

b. Set METER FUNCTION switch at 24V. Observe that meter indicates approximately 24 volts.

c. Sequentially set METER FUNCTION selector switch at 100 KC, 1 MC and 10 MC while observing function meter. Meter should indicate at least 1 volt rms for each switch position.

d. Set METER FUNCTION switch at OVEN TEMP.

13. On Low Frequency Synthesizer LFSA, observe SYN ALARM lamp and SYNCHRONIZE meter for one of following conditions:

a. SYN ALARM lamp is off and pointer on SYNCHRONIZE meter is centered within green area.

b. SYN ALARM lamp is off and pointer on SYNCHRONIZE meter is in yellow or red area (left or right of green center area.)

c. SYN ALARM lamp is flickering on and off intermittently, and pointer on SYNCHRONIZE meter is in yellow or red area (left or right of center green area.)

NOTE: The direction of rotation for the FINE FREQ ADJUST control ($-\Delta f$ or $+\Delta f$ is determined by which color area (right or left of green) the pointer on the Low Frequency Synthesizer SYNCHRONIZE meter lies. If the meter pointer is in the red-yellow area to the right or left of the green (center) area, adjust the FINE FREQ ADJUST control in a clockwise or counter-clockwise direction, respectively.

14. Repeat Step (13) and NOTE above as many times as necessary until pointer on SYNCHRONIZE meter of Low Frequency Synthesizer LFSA centers in green area.

15. On Frequency Standard CSS, set SYNCHRONIZE switch at ON. Observe SYNCHRONIZE meter. If meter is centered in green area, proceed to Step (16). If not, Repeat Steps (13), (14)and NOTE above.

16. On Precision Frequency Comparator PFCB, perform the following:

a. Connect coaxial jumper between front panel REF IN and TEST IN jacks.

b. Set METER SCALE switch at OFF and observe initial movement of recorder chart and pen. The pen markings as indicated on recorder chart should be

IV. SYSTEM TEST PROCEDURE - Cont'd

centered at zero. If not, remove snapbutton cover centrally located at the bottom of recorder, and adjust screwdriver control on recorder for zero indication on recorder chart.

c. Set Scale Multiplier to 6 parts in 10^m and successively set Meter Scale switch at 5, 2 and 1, and observe markings on recorder chart for zero indication at each switch position. Remove top cover on PFCB-1 and adjust R610 on card Z601 for zero if necessary.

d. Set Multiplier switch on 7, 8, 9 and 10 parts in 10^m, and observe markings on recorder.

e. Replace covers on recorder, and disconnect coaxial jumper connected between REF IN and TEST IN jacks.

17. Connect the ultra-stable standard signal (1MC 600 MV or more) to the test input (J102) of the PFCB-1, and observe over a period of time the drifts and variations on the various scale settings and the multiplier setting of the PFCB-1 recorder.

NOTE: During the hours of sunrise and sunset, the rate of DIURNAL drift may exceed the tracking rate of VLFC-1 system adjustment, and calibration should not be attempted at these times.

18. Connect VLF generator to antenna input of VLRA and RMS Voltmeter to 600 audio line, and check signal-to-noise ratios for 0.1 uv at 15 db using DL 100-4 for noise reference.

19. Check channels for AGC dynamic range 80 db for less than 3 db line variation, 1 uv to 10 mv.

20. Switch to Manual RF Gain and check sideband rejection of 60 db or greater, (RF Gain maximum).

21. Check chart stability 10^9 for 24 hrs.

22. Check chart stability $\pm 2 \times 10^{10}$ for five minutes.

23. Check chart stability coincidence 10 seconds for 10^8.

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THE TECHNICAL MATERIEL CORP.
MAMARONECK, N.Y.

TEST DATA SHEET

for

VLFC-1 SYSTEM (RAK-43)

SERIAL NO.: _____

MFG. NO.: _____

POWER ON: _____ OK

HPP- : _____ OK

BATTERY/POWER LINE: _____ OK

BATTERY CONDITION 1: _____ OK
2: _____ OK

VLRA: _____ OK

CSS: _____ OK

LFSA: _____ OK

PFCB: _____ OK

EXTERNAL STANDARD CHECK: _____ OK

DATE: _____

TESTER: _____

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TEST DATA SHEET

for

VLRA-1 SYSTEM - VLFC-1

	FREQUENCY	SENSITIVITY	AGC
Channel	KC	0.1 uv for 15 db $\frac{S+N}{N}$	1.0 uv to 10 mv less than 3 db
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

SIDEBAND REJECTION GREATER THAN 60 DB _____ OK.

CHART READOUT PFCB-1

Stability: 1 part 10^9 24 hrs. _____ OK

$\pm$ 2 parts 10^{10} 5 min. _____ OK

10^8 for 10 seconds _____ OK
(2 readouts)

DATE: _____

TESTER: _____

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

REVISION SHEET

THE TECHNICAL MATERIEL CORP.
MAMARONECK NEW YORK

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LIST NO.

DATE	REV.	SHEET	EMN #	DESCRIPTION	APP.
12/30/64		1 of	10	0= ORIGINAL RELEASE FOR PRODUCTION.	