AC NO: 91-18

DATE: 12/6/68

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: COURSE NEEDLE OSCILLATIONS ON VHF OMNIDIRECTIONAL RANGE (VOR) RECEIVERS

1. PURPOSE. This advisory circular is issued to advise all operators of aircraft equipped with VHF omnidirectional range (VOR) receivers regarding course needle oscillations.

2. DISCUSSION.

   a. On some VORs, pilots may observe brief course needle oscillations and RMI variations (but not reversals) with some flicker (but not reversal) of the "TO-FROM" indicator similar to the indication of "approaching station." This may or may not be associated with "flag alarm" activity. This erratic operation is caused by interference by reflected VOR signals from terrain irregularities or objects such as buildings, powerlines, etc., and is most likely to be encountered at relatively low altitudes. Pilots making VOR approaches in instrument conditions to unfamiliar airports are cautioned to be on the alert for these vagaries and in particular, to use a solid "TO-FROM" reversal indication to determine positive station passage. A similar precautionary statement concerning this effect has appeared in all issues of the Airman's Information Manual published since 1958 under the section titled "Air Navigation Radio Aids."

   b. A laboratory test procedure (outlined in para. 3) has been devised to determine whether a VOR receiver is susceptible to reflection interference of the kind described in para. 2.a. Most modern VOR receivers, FAA believes, have been designed to minimize the effect of this interference.

   c. Operators of aircraft equipped with VOR receivers that do not pass the laboratory test procedure in para. 3 (or an equivalent test procedure) are cautioned to confirm station passage by DME,

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or by ATC radar, when using these receivers for VOR instrument approaches in areas subject to reflection interference.

d. This laboratory test procedure may also be useful to equipment manufacturers and to maintenance agencies attempting to confirm pilot reports of erratic VOR receiver performance.

3. TEST PROCEDURE FOR DETERMINING REFLECTION INTERFERENCE

a. Alternatives

In FAA testing, the following equipment and procedure have been found satisfactory. Other equipment and/or procedure, which gives equivalent results, may be used, and may be required to achieve valid results with various receiver designs.

b. Test Equipment

(1) VOR signal generator

(a) Boonton 211A RF
(b) Collins 479 S3 AF

(2) Diode Modulator - Hewlett-Packard 10514A Mixer
(3) Audio Oscillator - WAVETEK 103 Function Generator
(4) 6 DB pad
(5) Vacuum Tube Voltmeter
(6) Milliammeter

c. Procedure

(1) Set up test equipment as shown in Figure 1.

(2) Insert a standard VOR signal, and set 211A attenuator to 400 μv output.

(3) Adjust battery bias to obtain 12 db loss through H-P 10514A mixer. 0.75 m.a. current was necessary in FAA testing.

(4) Using VTVM, measure the level of the 30 Hz variable AM modulation in the 30 Hz channel of the VOR receiver (primary of output transformer).

(5) Turn off 30 Hz variable AM modulation from VOR audio source.

(6) Set audio oscillator output to 1/3 of the value measured in Step (4) to obtain 10 percent modulation. Restore 30 Hz AM.

(7) Vary audio oscillator frequency from 5 to 25 Hz in 1 Hz steps, and from 25 to 100 Hz in 5 Hz steps. Ignore readings at 10, 15, 30, 60, and 90 Hz (± 2 Hz); test at 12 Hz.

(8) At each step, restore 10% modulation as necessary, and measure the amount of deflection by recentering the OBS or VOR audio source bearing selector. This procedure gives the amount of error in the manual channel. Recenter VOR audio source bearing selector to measure error in automatic channel. Consider the average of instrument oscillations.

d. Tolerance.

A VOR receiver is not susceptible to reflection interference of the kind described in para. 2.a. if, using this test procedure, the bearing error is found to be not more than ± 2 degrees in the manual channel and not more than ± 5 degrees in the automatic channel.

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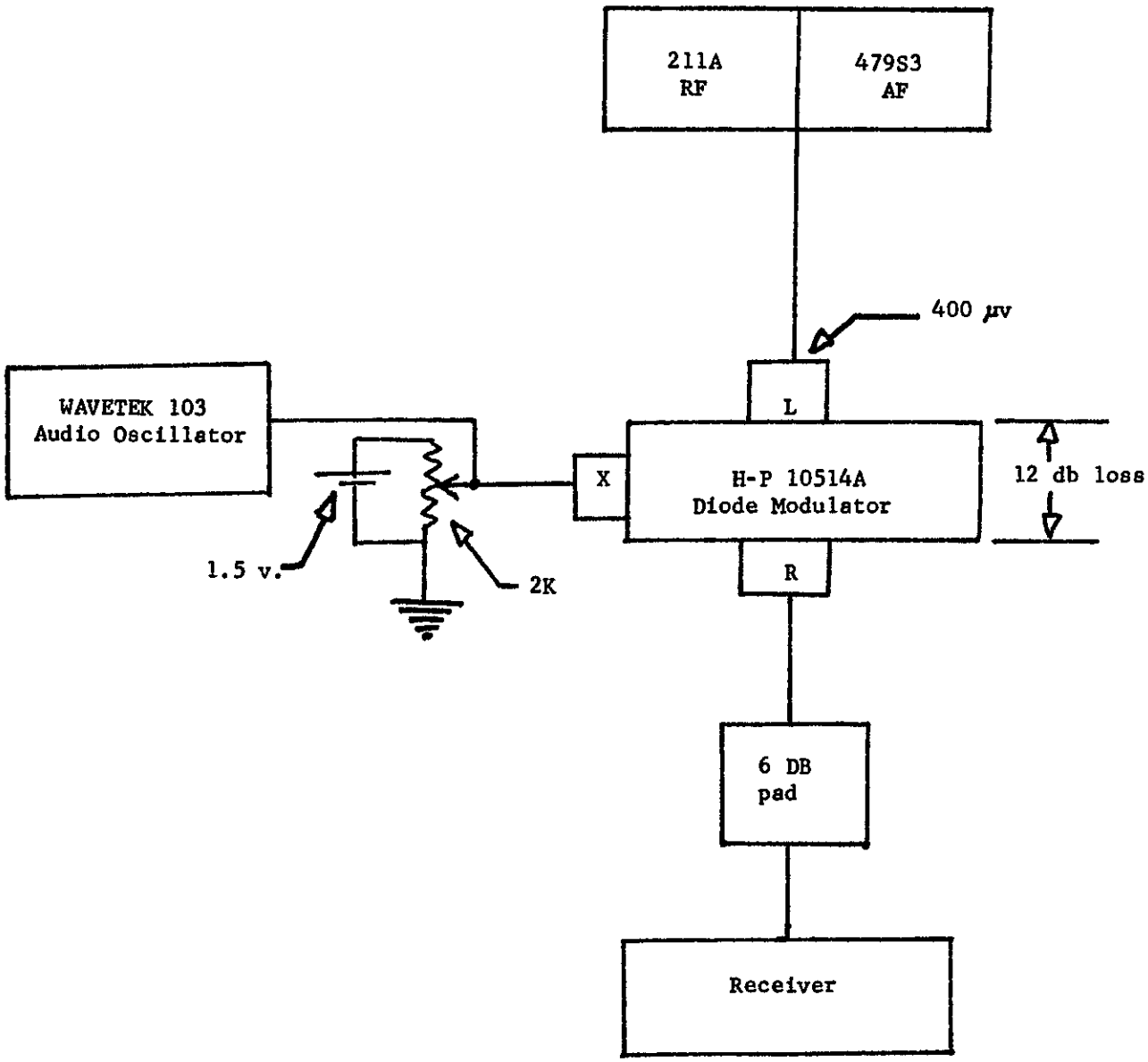
211A
RF
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Audio Oscillator
X
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Diode Modulator
12 db loss
1.5 v.
2K
R
6 DB
pad
Receiver

Figure 1