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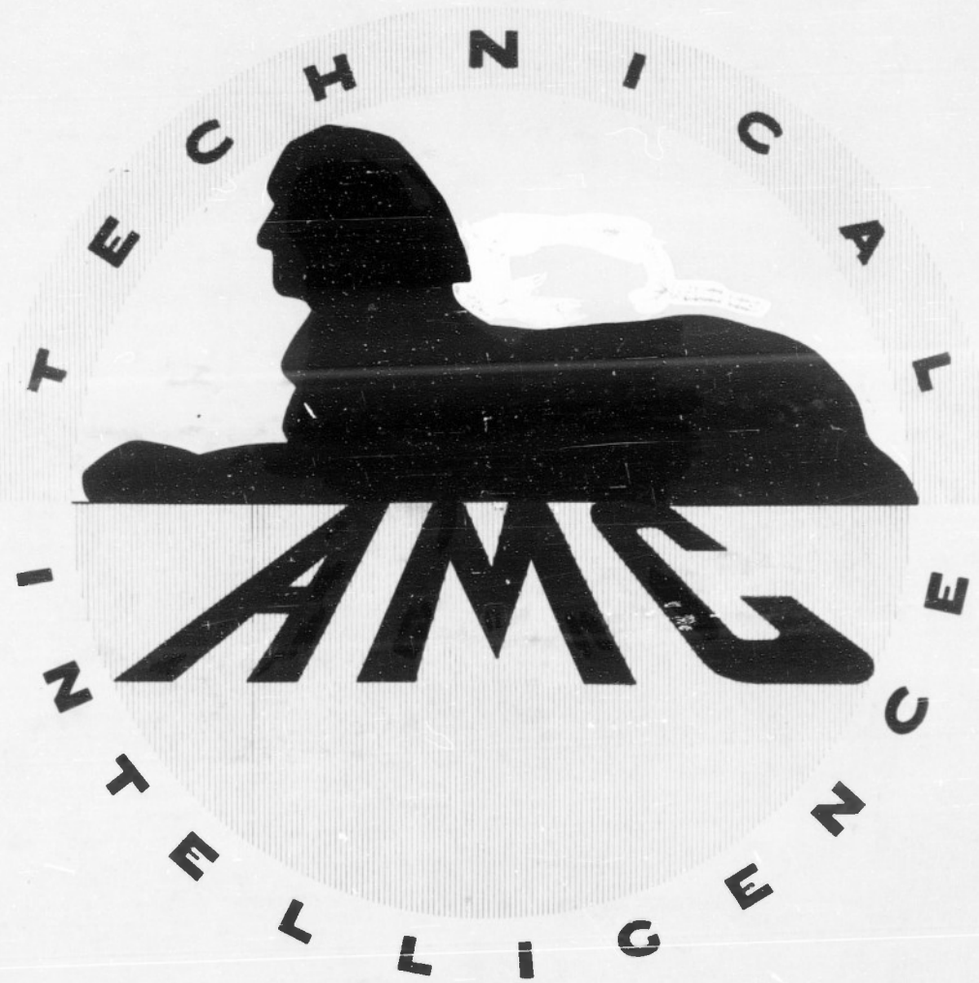

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TITLE Test specification for AN/APQ-1 carpet sweeper

AUTHOR(S) Monroe, R. B.; Rhiger, R. R. DATE

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2.

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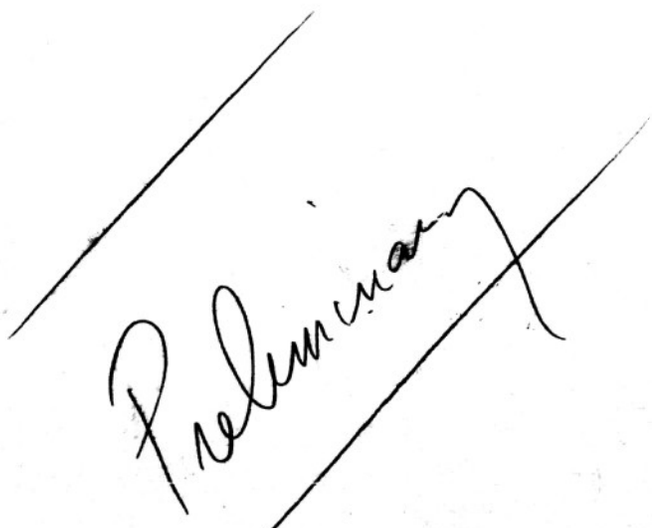

RADIO RESEARCH LABORATORY
HARVARD UNIVERSITY

No. 7

August 24, 1943

TEST SPECIFICATION

FOR

AN/APQ-1 CARPET SWEEPER

Copy No.

RADIO RESEARCH LABORATORY
Harvard University

Written by: R. B. Monroe
R. R. Rhiger

RRL TEST SPECIFICATION NO. 7

AN/APQ-1 "CARPET SWEEPER"

I Introduction

This test specification outlines the required performance characteristics of the AN/APQ-1 "Carpet Sweeper" and gives a description of the methods of measuring the performance of this equipment used at this laboratory.

The AN/APQ-1 "Carpet Sweeper" is a combination transmitter and receiver, which automatically scans a predetermined frequency spectrum until a signal emanating from a radar station is received. It then locks itself on that frequency and for a predetermined time interval transmits a noise modulated jamming signal intended to render illegible the information presented to the radar station. Upon completing the period of transmission the "Carpet Sweeper", depending upon the setting of a switch, either:

(a) determines whether the radar station is still transmitting, and if so, repeats its cycle of listening and jamming until the radar signal is no longer detected, or --

(b) sweeps off the first signal frequency and proceeds until another signal is received and thereupon jams that signal for the selected time interval, after which it continues sweeping and jams each signal successively in the frequency range to which the equipment is adjusted.

The switch for selecting the (a) or (b) type of operation is located on the chassis inside the dust cover.

The "Carpet Sweeper" utilizes the same tubes and circuits when operating either as a transmitter or a receiver and therefore is, in effect, a "transceiver". The block diagram, shown in Fig. 1 illustrates how this is accomplished.

II Performance Characteristics

The chart given on page 3 outlines the performance requirements of the AN/APQ-1.

AN/APQ-1 "CARPET SWEEPER", cont'd.

III Tube Complement

Quantity	Type	Function
1	931	Noise Generator
1	6AC7	Video Amplifier
1	6AG7	Video Amplifier
1	6SN7GT	Amplifier and Detector
1	807	Modulator
1	2050	Control Tube
2	WE 368AS (or 703A)	Oscillators
2	5R4GY (or 5U4G)	Rectifiers
1	2X2	Rectifier

All of these tubes, with the exception of the 931 noise generator and the WE 368AS (or WE 703A), are listed on the Army-Navy preferred tube list.

IV Precautions During Service Acceptance Tests

The AN/APQ-1 "Carpet Sweeper" equipment is very similar to the RC-156/CYCD "Carpet Transmitter" which has already passed the Army service acceptance tests.

(a) It is believed, however, that some trouble may be encountered under the most severe conditions of acceleration during the vibration test because of the relays used in the timing mechanism of this equipment. These relays and the mechanical timing equipment should be carefully watched during this test.

(b) A type "N" antenna connector is used on the AN/APQ-1 equipment. The insulation in this connector at the present time is polystyrene, the softening point of which is 83 to 84° C. It is therefore recommended that a temperature of 80° C be used in the special, temperature only, non-operating test outlined in ARL Bulletin 102A.

PERFORMANCE CHARACTERISTICS OF AN/APQ-1 "CARPET SWEEPER"

SPECIFICATIONS	PERFORMANCE	METHOD OF TESTING
Frequency Range	480 to 600 megacycles	G.R. 720A* or equivalent frequency meter
Sweep Range	10 megacycles at 480 megacycles 20 megacycles at 560 megacycles	G.R. 720A* or equivalent frequency meter
Power Output	Greater than 4 watts (output will vary with frequency, but should not drop below this value).	RRL type J-500 wattmeter--Lamp load tests are not satisfactory since the AN/APQ-1 must operate into a load which has less than a 2 to 1 standing wave ratio over the swept band.
Spectrum of Modulated Transmission	Varies with conditions of tuning, but can be stated to be approximately 0.4 watts/megacycle at 0.6 megacycles, and 1.0 watt/megacycle at 0.4 megacycles.	RRL type D-1203 Spectrum Analyzer
Sweep Rate	Approximately 26 megacycles/second, or one complete sweep in approximately 1.5 seconds.	
Jamming Period	Adjustable in six steps from 20 to 120 seconds.	
Locking Accuracy	Dependent on such factors as the radar pulse width, pulse repetition rate and signal intensity. - But at a PRF of 2000 with 2 microsecond pulses should be approx. 1.5 megacycles at 10 millivolt signal level (as measured at input to equipment) and approx. 0.5 megacycles at 50 millivolt signal level and gradually decreasing accuracy at higher signal levels.	Measured by RRL F-2200*Carpet Pulser and F-2300*Carpet Checker - or - F-2200* Carpet Pulser and G.R. 720A* Frequency Meter.
Sensitivity in Receive Position	Operates on input signals as low as 10 millivolts, as measured at input.	RRL type F-2200*Carpet Pulser and F-2300* Carpet Checker.
Input Power	311 watts, Transmitting position) 80 or 115 276 watts, Receiving position) volts, 400- 30 watts, 28 volts d.c.) 2600 cps.	Wattmeter
Power Source Variation	80 or 115 volts, 4.0%	Voltmeter and F-2200* Carpet Pulser and F-2300*Carpet Checker.
Power Factor	Approximately 95% at 400 cps.	Wattmeter, Voltmeter, and Ammeter
Size	Standard Aircraft Rack	
Weight	55 pounds	

* This equipment will be provided to the Laboratory conducting the service acceptance test by RRL.

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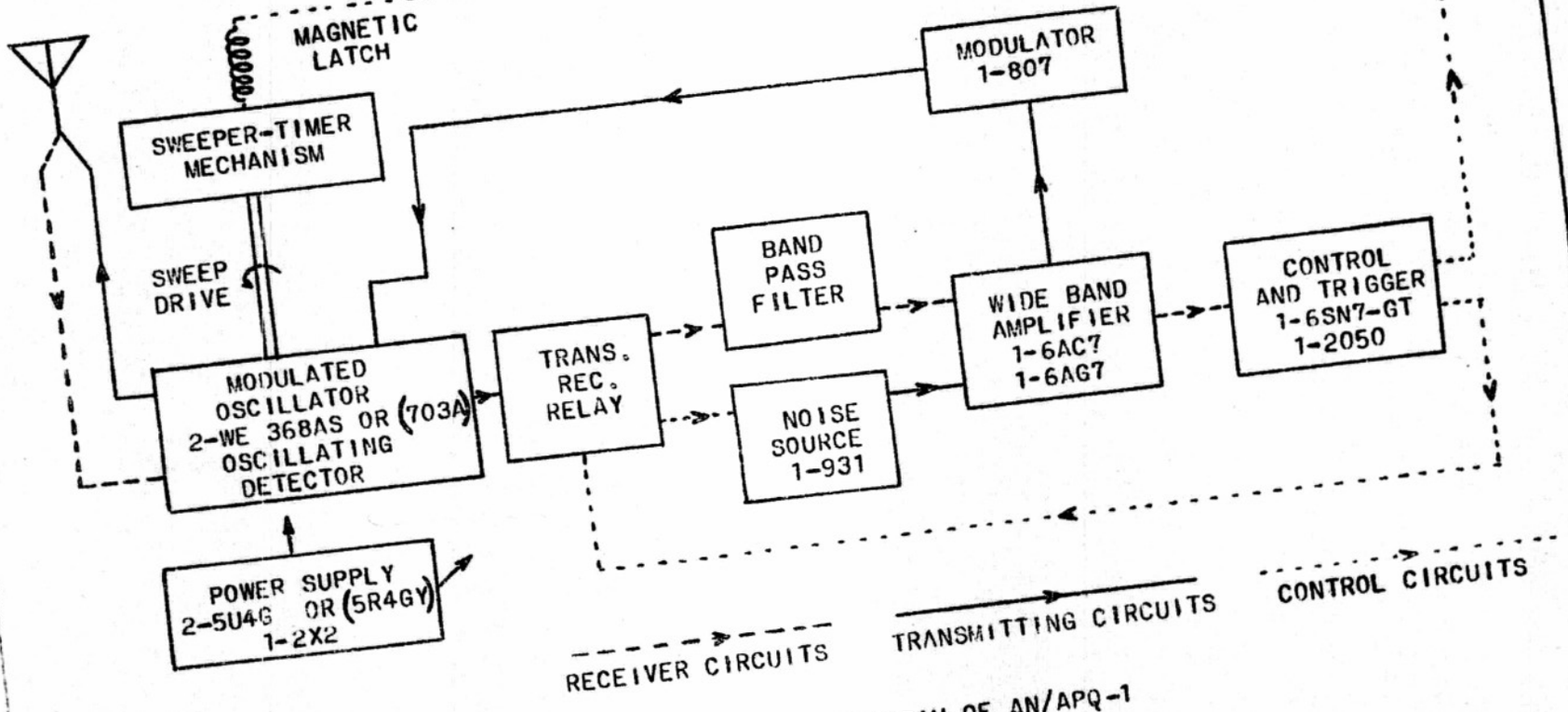

FIG. 1. BLOCK DIAGRAM OF AN/APQ-1

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ARMY, NAVY, C.A.A., AND BRITISH EQUIPMENT SPECIFICATIONS

	ARMY AIRBORNE EQUIPMENT	NAVY AIRBORNE EQUIPMENT	NAVY MARINE EQUIPMENT	C. A. A.	BRITISH AIRBORNE EQUIPMENT
VIBRATION	SIMPLE HARMONIC ACTION IN ANY DIRECTION RELATIVE TO THE MOUNTING AXES. FREQUENCY RANGE: 10 - 55 CPS AMPLITUDE: 0.03 INCH (TOTAL EXCURSION 0.06 INCH) TIME: 4 HOURS	SIMPLE HARMONIC VIBRATION IN ANY PLANE. FREQUENCY RANGE: 10 - 30 CPS AMPLITUDE: 0.03125 INCH (TOTAL EXCURSION 0.0625 INCH) TIME: 4 HOURS	VIBRATION IN A PLANE PERPENDICULAR TO THE PLATFORM. FREQUENCY RANGE: 0 - 33.3 CPS AMPLITUDE: 0.0625 INCH TIME: NOT LESS THAN 30 MINUTES	AMPLITUDE AND WAVEFORM TO PRODUCE VERTICAL ACCELENATION OF 10G. FREQUENCY RANGE: 30 - 60 CPS TIME: 4 HOURS	EQUIPMENT MUST WITHSTAND AND CONTINUE TO FUNCTION UNDER CONTINUOUS EXPOSURE TO SLIGHT VIBRATIONS AT FREQUENCIES CORRESPONDING TO ENGINE SPEED AND MUST SHOW NO EVIDENCE OF MECHANICAL RESONANCE WITHIN THE RANGE 20 TO 100 CYCLES PER SECOND.
HUMIDITY	HUMIDITY RANGING UP TO 95% RELATIVE AT ALL POSSIBLE TEMPERATURES FOR LONG PERIODS OF TIME.	HUMIDITY WILL VARY FROM LOW VALUES TO POINT OF SATURATION.	WITH AN AMBIENT TEMPERATURE OF 40° TO 45°C, THE HUMIDITY SHALL BE HELD AT 30% FOR ONE-HALF HOUR, THEN CHANGED TO 90% FOR ONE HOUR, AND THEN BACK TO 30% FOR ONE HOUR.	EQUIPMENT WILL BE PLACED IN AN ATMOSPHERE OF CLEAN VAPOR MAINTAINED AT A HUMIDITY OF 95%, AT TEMPERATURE OF 50°C, FOR A PERIOD OF 48 HOURS.	RELATIVE HUMIDITIES UP TO 100%.
TEMPERATURE	TEMPERATURES RANGING FROM -55°C TO +71.1°C; THE TEMPERATURE MAY VARY AT A RATE AS HIGH AS 2° PER MINUTE. AS A SPECIAL, TEMPERATURE-ONLY CONDITION, THE EQUIPMENT, NON-OPERATING, SHALL BE SUBJECTED TO AN AMBIENT TEMPERATURE OF 85°C FOR A PERIOD NOT TO EXCEED FIVE HOURS, AFTER WHICH, AND WHILE STILL SUBJECTED TO THAT TEMPERATURE, IT SHALL BE FULLY OPERATED FOR A PERIOD OF FIFTEEN MINUTES.	THE EQUIPMENT MUST BE DESIGNED TO OPERATE IN ANY AMBIENT TEMPERATURE BETWEEN -32°C TO +65°C, AND IN RELATIVE HUMIDITIES FROM LOW VALUES UP TO 95%.	THE AMBIENT TEMPERATURE SHALL BE KEPT AT 50°C FOR A PERIOD OF 8 HOURS WHILE THE HUMIDITY IS KEPT AT 35% OR LESS.	THE EQUIPMENT MUST OPERATE IN TEMPERATURES FROM +55°C TO -35°C.	APPARATUS SHOULD BE SUITABLE FOR USE UNDER CONDITIONS OF RAPIDLY VARYING AMBIENT TEMPERATURES FROM -50°C TO +55°C AND WITHSTAND EXPOSURE TO NORKING TEMPERATURES UP TO 71°C.
SHOCK	THE EQUIPMENT SHALL BE CAPABLE OF WITHSTANDING ACCELERATION AND SHOCK EQUIVALENT TO A FORCE OF 10G APPLIED FOR NOT LONGER THAN 10 MINUTES, IN ANY DIRECTION WITH RESPECT TO THE MOUNTING BASES, AND WITH THE EQUIPMENT OPERATED IN ANY POSITION INCLUDING COMPLETE INVERSION.	THE EQUIPMENT SHALL BE DESIGNED TO WITHSTAND A MAXIMUM ACCELENATION OF 8G (257.7 FT./SEC²) APPLIED IN ANY DIRECTION.	EQUIPMENT IS TO BE SUBJECTED TO FOUR SHOCKS FROM A SWINGING 26-POUND SPHERICAL MASS OF METAL SUSPENDED SO IT SWINGS ON A SIX-FOOT RADIUS. EACH SHOCK TO CONSIST OF A SINGLE BLOW DELIVERED BY DRAWING THE WEIGHT BACK APPROXIMATELY 30° FROM ITS NORMAL POSITION AND ALLOWING IT TO FREELY STRIKE THE EQUIPMENT. A 1" X 2" STEEL STRAP MAY BE CLAMPED ACROSS THE TOP FRAME FOR STIFFENING, IF DESIRED.	AT LEAST 100 FREE DROPS AS FOLLOWS: 34 DROPS FROM 6 INCHES 33 DROPS FROM 12 INCHES 33 DROPS FROM 18 INCHES ONE INCH THICK COMMERCIAL SPONGE RUBBER MAY BE INTERPOSED BETWEEN THE EQUIPMENT AND THE FLOOR AS A DAMPING MEDIUM.	EQUIPMENT SHOULD BE CAPABLE OF WITHSTANDING ACCELERATIONS UP TO 12G IN ANY DIRECTION WITHOUT DAMAGE, AND SHOULD CONTINUE FUNCTIONING UNDER ACCELERATIONS UP TO 9G IN ANY DIRECTION.
PRESSURE	BAROMETRIC PRESSURE RANGING FROM 3.5 (50,000 FT.) TO 30 INCHES OF MERCURY. THE PRESSURE MAY VARY AT A RATE AS HIGH AS 0.5 INCHES OF MERCURY PER SECOND.	ALTITUDE UP TO 30,000 FT.	----------	PRESSURES FROM 29.92 TO 8.52 INCHES OF MERCURY (SEA LEVEL TO 31,000 FT. ALTITUDE.)	ALTITUDE UP TO 50,000 FT.
LINE VOLTAGE	EQUIPMENT TO BE CAPABLE OF OPERATION FROM PRIMARY SUPPLY VARYING FROM 22 TO 30.0 VOLTS. NO DAMAGE SHALL OCCUR TO EQUIPMENT, EXCEPT TUBES, IF THE VOLTAGE SHOULD RISE TO 30 VOLTS.	EQUIPMENT SHALL NOT BE DAMAGED BY CONTINUOUS OPERATION AT 50°C WITH A 20% INCREASE IN THE NOMINAL LINE VOLTAGE.	THE LINE VOLTAGE SHALL BE VARIED FROM 10% BELOW TO 10% ABOVE THE NORMAL VALUE DURING A PERIOD OF 5 MINUTES.	20% ABOVE AND 10% BELOW NORMAL, FOR 24-28 V DC EQUIPMENT, AT TEMPERATURE OF +55°C. 10% ABOVE AND BELOW NORMAL, FOR 105-120 V AC EQUIPMENT, AT TEMPERATURE OF +55°C. 10% ABOVE AND BELOW NORMAL SPECIFIED VOLTAGE AT TEMPERATURE OF -55°C.	THE EQUIPMENT SHOULD BE CAPABLE OF STANDING AN OVERLOAD CAUSED BY AN INCREASE OF 20% IN THE SUPPLY VOLTAGE FOR A PERIOD OF 3 MINUTES.

NOTE: THE ABOVE CHART IS NOT INTENDED TO DESCRIBE THE COMPLETE TESTS REQUIRED BY THE VARIOUS SERVICES, BUT TO OUTLINE THE REQUIREMENTS OF TESTING EQUIPMENT TO PERFORM THESE TESTS. FOR COMPLETE TESTING PROCEDURE, SEE THE FOLLOWING BULLETINS:

SIGNAL CORPS BULLETIN ARL-IC2-A
NAVY DEPT. BULLETIN NE-13A-585A
STANDARD PRACTICE IN THE DESIGN OF UNITED KINGDOM AIRBORNE RADIO EQUIPMENT
NAVY DEPT. BULLETIN RE-13A-5540
C. A. A. MANUAL 16

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