TMC SPECIFICATION

NO. S 10166

REV: A

COMPILED: A. Smith CHECKED: A. S APPD: [signature]

SHEET OF

TITLE: TEST PROCEDURE FOR MULTICOUPLERS

DATE July 24/68 SH. ____ OF ____ COMPILED BY	TMC SPECIFICATION NO. S10166-1	
	TITLE: TEST PROCEDURE FOR MULTICOUPLERS	JOB
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SURFACE EXAMINATION:

Reference: MIL-E-16400D (NAVY) paragraph 4.5.1

"4.5.1 Surface examination - Equipment shall be examined for the following:

a) Workmanship, assembly and fit, mechanical safety, and marking.

b) Materials, parts, and finish."

Record results on test sheet.

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	TITLE: TEST PROCEDURE FOR MULTICOUPLERS	JOB
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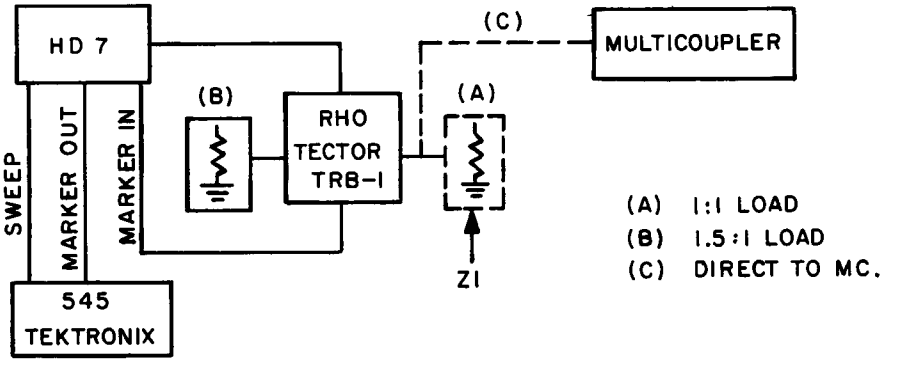
INPUT AND OUTPUT IMPEDANCE

References: (1) SHIPS-C-4297 paragraph 3.2.4

"3.2.4 Input and output impedance - The antenna coupler input and output circuits shall be designed for operation with 70-ohm unbalanced (coaxial) lines. The voltage standing wave ratio (VSWR) of 1.5 to 1 shall not be exceeded." RCA Victor A1815402 states "3.1 input and output impedance (para. 3.2.4): 75 ohm input and output impedance would be preferred."

GENERAL:

The input impedance will vary with frequency and is quoted as a nominal 75 . The variation of the impedance will produce a mismatch to a 75 source. The ratio of the actual to the nominal is stated as a Voltage Standing Wave Ratio.



EQUIPMENT REQUIRED:

Telonic HD 7 Sweep Generator.....1 req.
Tektronix Scope Type 545.....1 req.
Telonic RHO-Tector Mod TRB-1 with loads.....1 req.
General Radio RF Bridge Model 1606A.....1 req. (Optional)

a) Set the test set up as shown and set the scope to give a deflection easily readable and not the maximum deflection.

b) Replace Z1 with a BNC adapter and hook up to the input of the AMC- using a short 75 cable. Switch on M/C and apply power.

c) Note the swept curve on the scope. The V.S.W.R. should not exceed the calibrated line on the scope that represents 1.5:1 V.S.W.R.

d) Repeat the same tests on all output jacks and record results on test sheet.

EQUIPMENT REQUIRED CONT'D

e) If additional resolution is required to make accurate measurements at the "worst frequency" points found in (c) and (d), these may be found by using the G.R. RF Bridge and an external generator, set to the worst frequency (s).

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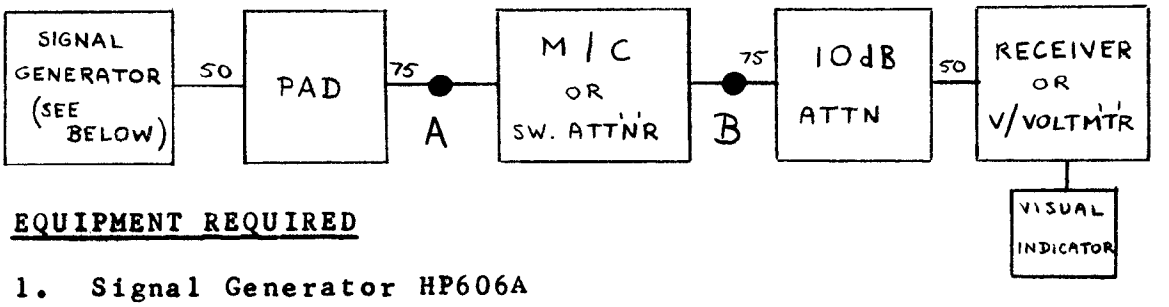
INPUT FILTERS

References: (1) SHIPS-C-4297 paragraph 3.3.1

"3.3.1 Input filters - An input filter shall be provided to give at least 30-db attenuation at all frequencies between D.C. and 1.4 mc. A filter shall also be provided to give at least 30-db attenuation at 46 mc. and all frequencies between 46 and 1000 mcs."



EQUIPMENT REQUIRED

1. Signal Generator HP606A
2. Signal Generator HP200CD
3. Signal Generator HP3200B
4. Vector Voltmeter HP8405A
5. Receiver TMC VLRB
6. Receiver Airmec C864, with Simpson 260 meter as an indicator
7. 50 to 75 ohm Matching Pad
8. 50 ohm 10 db Fixed Attenuator
9. 100 db Step Attenuator 75 ohm Telonic

PROCEDURE (See end of sheet for test frequencies and compatible equipment)

a) Set up equipment as shown above with the multicoupler inserted between points A & B.

b) Adjust signal generator to required frequency and establish Odb level at point B.

c) Remove multicoupler from A & B and insert 100 db step attenuator in its place. Adjust attenuator to give same reference reading at point B as found in (b).

d) Record attenuator reading.

e) Repeat for all test frequencies.

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LIST OF TEST FREQUENCIES AND COMPATIBLE EQUIPMENT

EQUIPMENT USED	TEST FREQUENCY	ATTENUATION db
SIGNAL GENERATOR HP 200 CD RECEIVER AIRMEC C864	15 KHz 20 KHz 30 KHz 40 KHz 45 KHz	
SIGNAL GENERATOR HP 606A RECEIVER TMC VLRB	55 KHz 60 KHz 70 KHz 80 KHz 90 KHz 100 KHz	
SIGNAL GENERATOR HP 606A RECEIVER AIRMEC C864	100 KHz 200 KHz 300 KHz 400 KHz 500 KHz 600 KHz 700 KHz 800 KHz 900 KHz	
SIGNAL GENERATOR HP 606A MONITOR H8405A	1 MHz 1.2 MHz 1.4 MHz	
ALL FREQUENCIES 46 MHz and ABOVE USE EQUIPMENT SHOWN BELOW ▽ SIGNAL GENERATOR HP 3200B (WITH DOUBLER PROBE)	46 MHz 50 MHz 55 MHz 60 MHz 65 MHz 70 MHz 75 MHz 80 MHz 85 MHz 90 MHz 100 MHz 110 MHz 120 MHz 130 MHz 140 MHz	

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EQUIPMENT USED	TEST FREQUENCY	ATTENUATION db
MONITOR H.P. VECTOR-VOLTMETER MODEL 8405A	150 MHz 160 MHz 170 MHz 180 MHz 200 MHz 220 MHz 240 MHz 260 MHz 300 MHz 350 MHz 400 MHz	
USE DOUBLER PROBE ON H.P. 3200 B →	500 MHz 600 MHz 700 MHz 800 MHz 900 MHz 1000 MHz	

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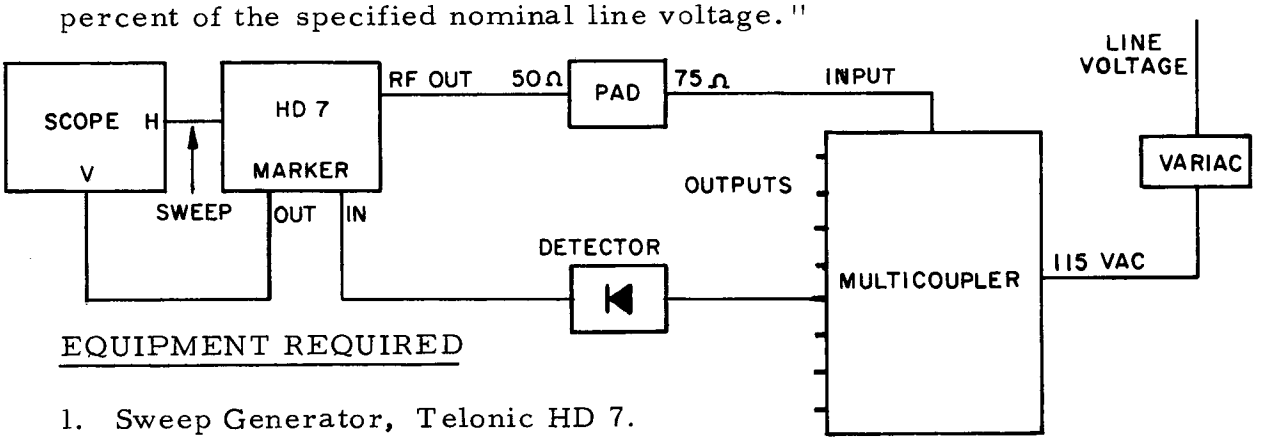
VOLTAGE GAIN:

References: (1) SHIPS-C-4297 paragraph 3.3.2

"3.3.2 Voltage gain - The voltage gain between the antenna input connector and any output connector with all unused outputs open circuited, shall be relatively constant throughout the range of 2 to 32 mc. The signal output to signal input voltage ratio shall be within the limits of 2-db ± 0.5-db. The gain shall not change more than 1.0 db with line voltage changes of 10 percent of the specified nominal line voltage."



EQUIPMENT REQUIRED

1. Sweep Generator, Telonic HD 7.
2. Oscillescope, Tektronix 545.
3. Matching Pad 50 to 75 ohm. **Telonic TML 50/75**
4. RF Defector, Telonic XD-4A (75 ohm). **#1610**
5. 75 ~ **Load**

PROCEDURE

a) Set up equipment as shown.

b) Exclude MC by connecting output of PAD to input of Detector and establish a reference level on the scope of the swept signal. **Load the output of PAD with** 75 ~

c) Connect MC as shown and **ADD** 2 db of the built-in attenuator of the HD7, then the same level as in b) should be obtained ± ½ db.

d) Repeat c) for all outputs with the untested **jacks** both open and short circuited, as well as for ± 10% deviation of line voltage.

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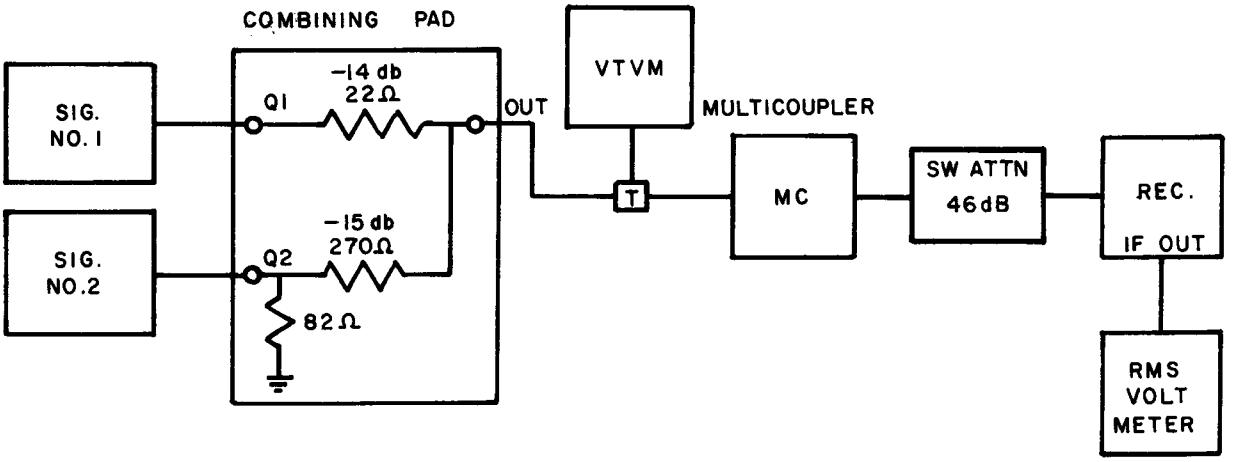
OVERLOAD

References (1) SHIPS-C-4297 paragraph 3.3.3

"3.3.3 Overload - The overall gain of the multicoupler offered to a 100 microvolt desired signal on any frequency within the range of 2 to 32 mc. shall not be reduced more than 3 db by application of a signal of 4 volts amplitude at any other frequency. Frequencies for determination of conformance with this requirement shall be:- high intensity 2 mc. and 6 mc., with reception on 25 mc.



EQUIPMENT REQUIRED

1. Two signal generators, HP model 606A.
2. Combining Pad as per drawing.
3. VTVM, HP 410B.
4. Communications Receiver, TMC GPR90RXD.
5. RMS Voltmeter, HP 3400A.
6. **100 db Step Attenuator. Telonic 75**

PROCEDURE

a) Set up equipment as shown.

b) Adjust Signal Generator No. 2 to deliver + 15 db above 100 microvolt at a frequency of 25 MHz and establish a reference level at the RMS voltmeter connected to the IF output of the Receiver, which is tuned to 25 MHz.

c) Adjust the Signal Generator No. 1 to a level of 2.82 Vrms (equals 4 volts amplitude) at the VTVM at the frequency of 2 MHz.

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PROCEDURE CONT'D

d) Reconnect the MC and retune the receiver if necessary. The level should not drop more than 3db below that established in(b).

e) Repeat step c) and d) for the frequency of 6 MHz at Signal Generator No. 2.

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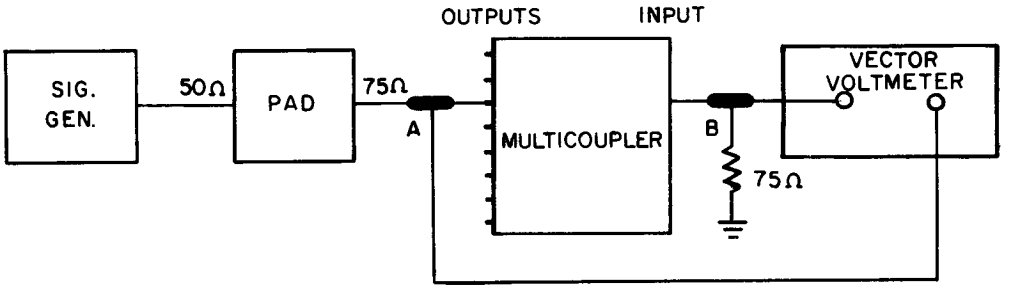
RADIATION:

References: (1) SHIPS-C-4297 paragraph 3.3.4

"3.3.4 Radiation - The attenuation offered to receiver radiation, applied to any output connector, shall be at least 55db when measured at the coupler input terminal, terminated with a 70-ohm noninductive resistor."



EQUIPMENT REQUIRED

1. Signal Generator - HP model 606A.
2. Matching Pad 50 to 75 ohm.
3. Vector Voltmeter, HP 8405A.

PROCEDURE

a) Set up equipment as shown.

b) Adjust signal generator to a frequency of 2 MHz and establish a 0 db reference level at probe A.

c) Switch to probe B, the level should be at least 55 db lower.

d) Repeat the procedure for 32 MHz.

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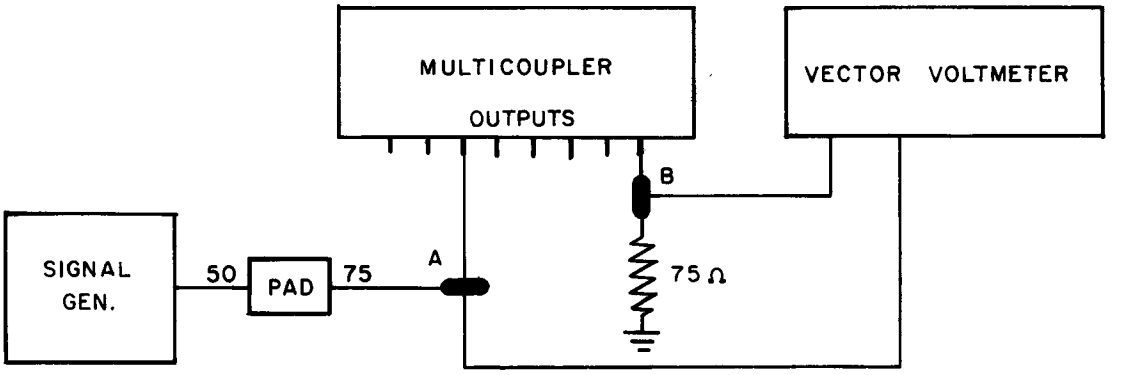
CROSSTALK ISOLATION

References: (1) SHIPS-C-4297 paragraph 3.3.5

"3.3.5 Crosstalk isolation - The attenuation measured between any two output connectors shall be greater than 40 db".



EQUIPMENT REQUIRED

1. Signal Generator, HP 606A.
2. Vector Voltmeter, HP 8405A.
3. 50/75 PAD. TELONIC

PROCEDURE

a) Set up equipment as shown.

b) Establish a 0 db reference level at probe A at the frequency level of 2 MHz.

c) Switch to probe B, the level should be at least 40 db below the level in b).

d) Repeat the procedure at 32 MHz.

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SPURIOUS RESPONSE

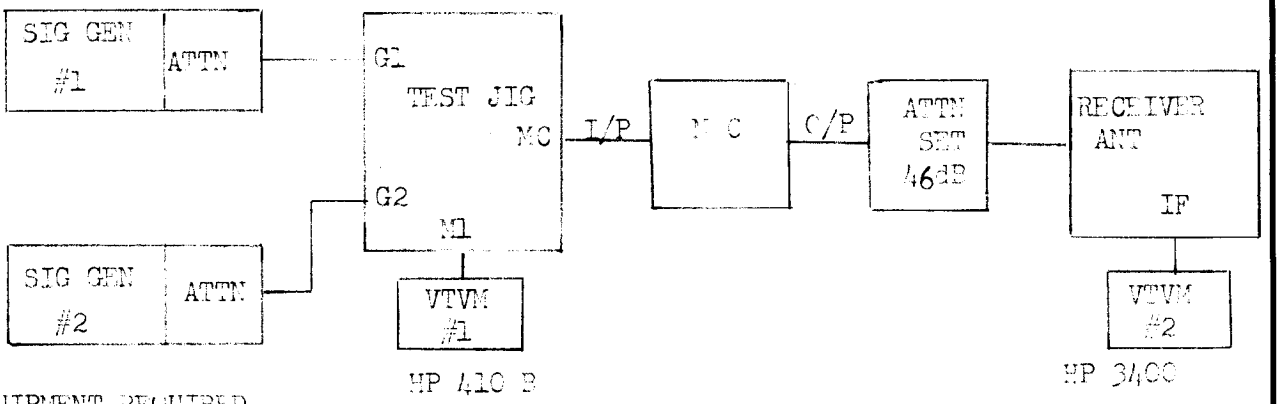
References: (1) SHIPS-C-4297 paragraph 3.3.6

"3.3.6 Spurious responses - Two 0.50 volt signals at any two frequencies f1 and f2 applied at the coupler antenna connector, shall not produce a spurious response signal at the frequency f3, equal to f1 ± f2, which is greater than an equivalent signal 65 db below the input signals."

The above spec. is modified by RCA document A 1815402 to read:-

Second order intermodulation products shall not be greater than 65 db below two 0.5 volt input signals from 2 to 20 MHz and not greater than 60 db from 20 to 30 MHz.

"3.3.6.1 Two 0.50 volt signals at any two frequencies f1 & f2 applied at the coupler antenna connector, shall not produce a spurious response signal at frequency f4, equal to 2f1+f2, which is greater than an equivalent 70 db below the input signals".



EQUIPMENT REQUIRED

1. Signal generator, Hewlett-Packard model 606A or equivalent (2 required)
2. Attenuator-Integral part of signal generator (2 required)
3. AMC Spurious Response Test Jig
   TMC Test Jig JG10002
4. VTVM #1 Hewlett-Packard model 410B
5. VTVM #2 HP3400A
6. Communications receiver - TMC model CPR902MD or equivalent.
7. 75Ω Switched attenuator toleric

PROCEDURE

a) Set up equipment as shown.

b) With the output of Signal Generator #2 at zero, adjust the frequency of Signal Generator #1 to f1.

c) Adjust the amplitude of Signal Generator #1 to 0.50V on VTVM #1. Note the setting then the output of the generator to zero.

d) Adjust the frequency of Signal Generator #2 to f2.

e) Adjust the amplitude of Signal Generator #2 to 0.50V on VTVM #1.

f) Reset Signal Generator #1 to the setting noted in step (c).

g) Tune the receiver to f1 + f2 and set the controls as follows:

RF Selectivity	- NON XTAL
Audio Gain	- a comfortable listening level
AVC	- Manual
Limiter	- OFF
BFO	- OFF
ANT TUNE	- Peak indication
RF Gain	- To produce a deflection on VTVM # 2

h) Adjust the receiver RF gain control to produce a convenient reference level at the IF output of the receiver on VTVM #2. Change the output jack to locate the one with the highest level. This level should not change more than 2 db when loading all the other outputs with the nominal impedance or short circuiting any. Note the said level.

i) Reduce O/P of Signal Generator #2 to zero.

j) Set the frequency of Signal Generator #1 to f1 + f2 and the amplitude to 0.50V on VTVM #1.

k) Attenuate the output of Signal Generator #1 until the level registered on VTVM #2 equals the reference level established in step (h) above.

l) The attenuation of signal generator #1 is the amount of worst jack suppression of second order spurious signals. Note the amount of attenuation.

m) Repeat above tests for all frequencies of f1 + f2 as listed per attached sheet. Record under 2nd order sum frequencies.

n) Repeat above tests for all frequencies of f1 - f2 as listed per attached sheet. Record under 2nd order difference frequencies.

o) Repeat above tests for all frequencies 2f1 + f2 as listed per attached sheet. Record under 3rd order sum frequencies.

p) Repeat above tests for all frequencies 2f1 - f2 as listed per attached sheet. Record under 3rd order difference frequencies.

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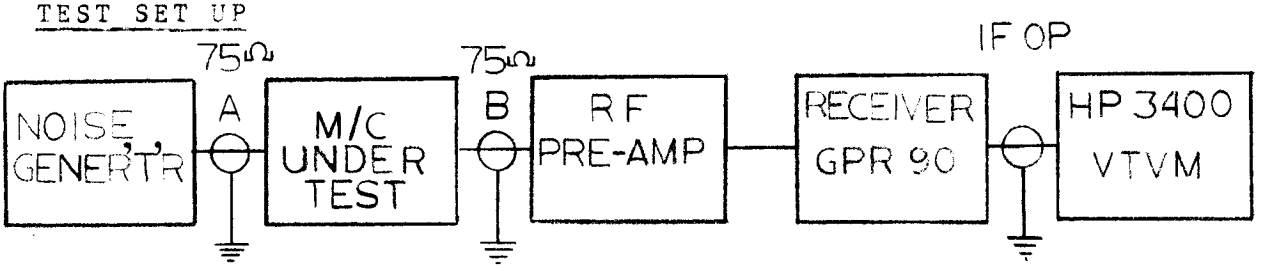
NOISE FIGURE

References: (1) MIL-E-16400D (NAVY) paragraph 4.5.2
(2) SHIPS-C-4297 paragraph 3.3.7

"3.3.7 NOISE FIGURE - This noise figure of the antenna coupler shall be no greater than 7 db. The noise figure shall be measured using a modified Kay Electric Mego-Nade Jr. noise diode, or equivalent, and with a receiver having a sensitivity of 2 microvolts, or less, for a signal plus noise-to-noise ratio of 20 db and a minimum bandwidth of 10 Kc."

TEST SET UP



PROCEDURE

a) Set up equipment as shown.

b) Tune the receiver to the desired frequency in the pass-band of the multicoupler.

c) Connect A to B leaving the MC out of the test-chain.

d) Adjust RF-level of RCVR to give a convenient reading on VTVM. Note this reading as V_o.

e) Connect A to input and B to output of M/C. Note the reading on the meter as V_1 and calculate $V_2 = \sqrt{2V_1^2 - V_o^2}$

f) Put the noise generator plate current ON and increase diode current I_d to obtain a reading V_2 on VTVM. Note I_d.

g) Multiply I_d in mA by 1.5. This yields the noise factor.

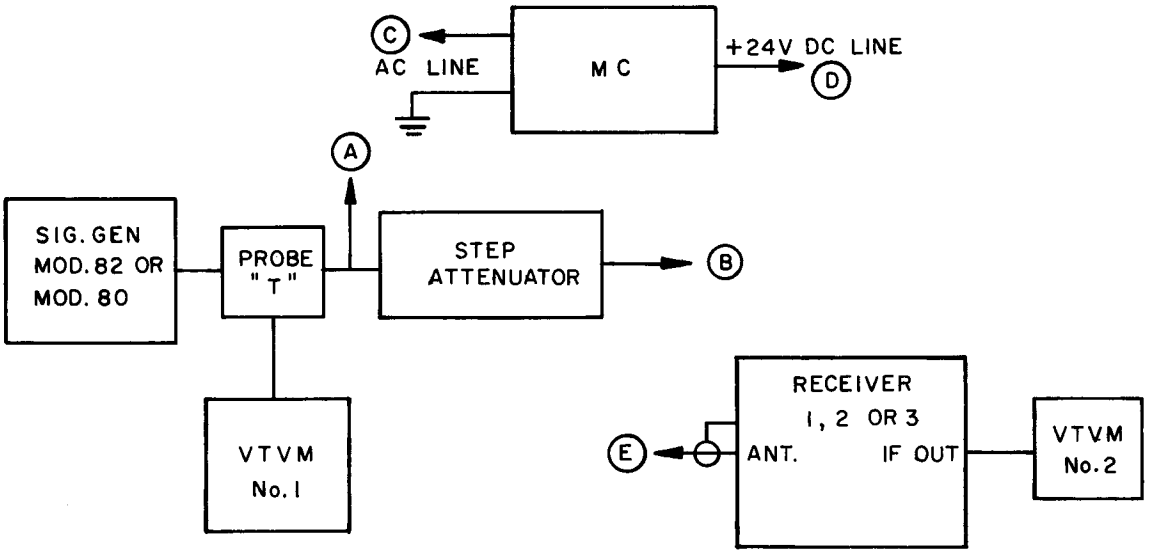
h) Convert the noise factor to a power ratio in dB.

i) Record results on test sheet.

POWER INPUT FILTERS

References: (1) SHIPS-C-4297 paragraph 3.38

"Power input filters - The radio frequency filter in the power line shall, in combination with the specified power unit, present an attenuation of not less than 40 db to any radio frequency between the limits of 14 Kc. and 150 mc. This requirement is based upon attenuation between either line input terminal and any d.c. output terminal of the power supply."



EQUIPMENT REQUIRED

1. Signal Generator. Measurements Corp. model 82.
2. Signal Generator, measurements Corp. model 80.
3. Probe "T" connector, Hewlett Packard model 455A.
4. 100 db Step Attenuator, Telonic model TG 950.
5. VTVM # 1 Hewlett Packard model 410B.
6. Receiver #1 Racal model RA17C with VLF converter or equivalent.
7. Receiver #2 Racal model RA17C or equivalent.
8. Receiver #3 AN/APR4 with TN16/APR4, TN17/APR4 and TN18/APR4 tuners.
9. VTVM #2 Ballantine Laboratories AC VTVM.

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PROCEDURE

a) Connect the equipment as shown above.

b) Connect B to E.

c) Adjust the Signal Generator to the first test frequency and set the amplitude to register the minimum convenient level on VTVM # 1.

d) Adjust the receiver as follows:
   1. Frequency control to the test frequency.
   2. BFO off.
   3. Limiter off.
   4. RF selectivity - non xtal.
   5. RF gain - to produce full scale deflection on VTVM # 2 on the .1V scale.

e) Attenuate the generator output 40 db by means of the step attenuator. Do not readjust the receiver. Note the reading on VTVM #2.

f) Disconnect B for E and remove the step attenuator.

g) Connect A to C and D to E.

h) The reading on VTVM # 2 is the amount of attenuation presented by the AMC to the RF signal applied below the reference established in step d (5) above. Record the db attenuation below this reference.

i) Carry out the test at the following frequencies, changing Signal Generator and Receivers as necessary. Record the amount of RF attenuation for each frequency. It should be at least 40 db.

14 Khz
100 Khz
500 Khz
1 Mhz
2 Mhz
10 Mhz
20 Mhz
30 Mhz
50 Mhz
100 Mhz
150 Mhz

J) The amount of attenuation presented by the AMC is the average of the attenuation at the above frequencies. Record on Test Data Sheet.

TEST LIMITS

The RF on the + 24 volt line shall be attenuated no less than 40 db below the reference established in step d (5)

DATE FEB. 10/70 SH. 1 OF 1 COMPILED BY J. G. PARKIN	TMC SPECIFICATION NO. S10166-11 ADDENDUM	
	TITLE: ADDENDUM FOR AMC-8 MULTICOUPLERS	JOB
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WHEN PERFORMING PHASE MEASUREMENTS ON AMC-8 MULTICOUPLERS, THE FOLLOWING PRECAUTIONS MUST BE OBSERVED:-

A) Any multicoupler to be tested, and any 'reference' or 'standard' multicoupler used, must have been turned on long enough to become thermally stabilized (usually 1 hour).

B) When making measurements, enough air space must be allowed around the units to ensure stable thermal conditions. Care must also be taken to ensure that the units are not subjected to any forced air flow, draughts, etc.

C) All phase measurements must be made on complete AMC-8 units. This includes having the cover on.

D) When using the Vector Voltmeter to measure the phase correlation of an AMC-8, as per test 2, it is important to have probe A (Blue) connected to the input side of the unit, and probe B (White) to the output side, and to maintain these conditions for all measurements.

E) Since the phase measurement employed in this spec is of very high resolution, errors in readings may be reduced by ensuring that all cables and connectors employed in the test equipment and in the direct HF signal path, are constructed from high quality components, and kept to an absolute minimum length. Their characteristic impedance should be checked to be correct. When making reference measurements, all cables, components, test equipment serial #s, jack #'s used, temperatures, and exact frequencies used, must be recorded. This implies identifying cables, etc.

F) The equipment set-up for test 2 may be checked by means of the "Phase correlated" standard 75 ohm cables (traceable to Nat. Stds), which are in the possession of Q.C. dept.

G) Experience has shown, that, when using the Vector Voltmeter, if any flutter or erratic reading of the phase meter needle is observed, SOMETHING IS WRONG. Stop the readings, and check the equipment set-up.

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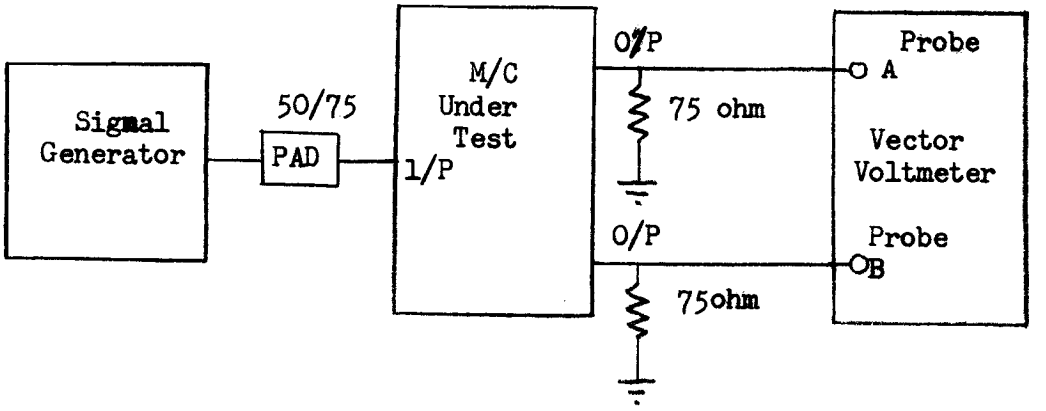
PHASE CHARACTERISTICS

References : (1) SHIPS -C-4297 paragraph 3.3.9

" 3.3.9 Phase characteristics - The overall phase difference between outputs of a multicoupler shall be less than ± 2 degrees for all the outputs. This shall be measured with a single frequency signal coupled to the coupler antenna input connector."

"3.3.9.1 The phase difference between outputs of all the couplers fabricated under any one contract or order shall be less than ± 2 degrees. This shall be measured by comparison between a representative coupler or standard and each coupler in the production under the contract or order."

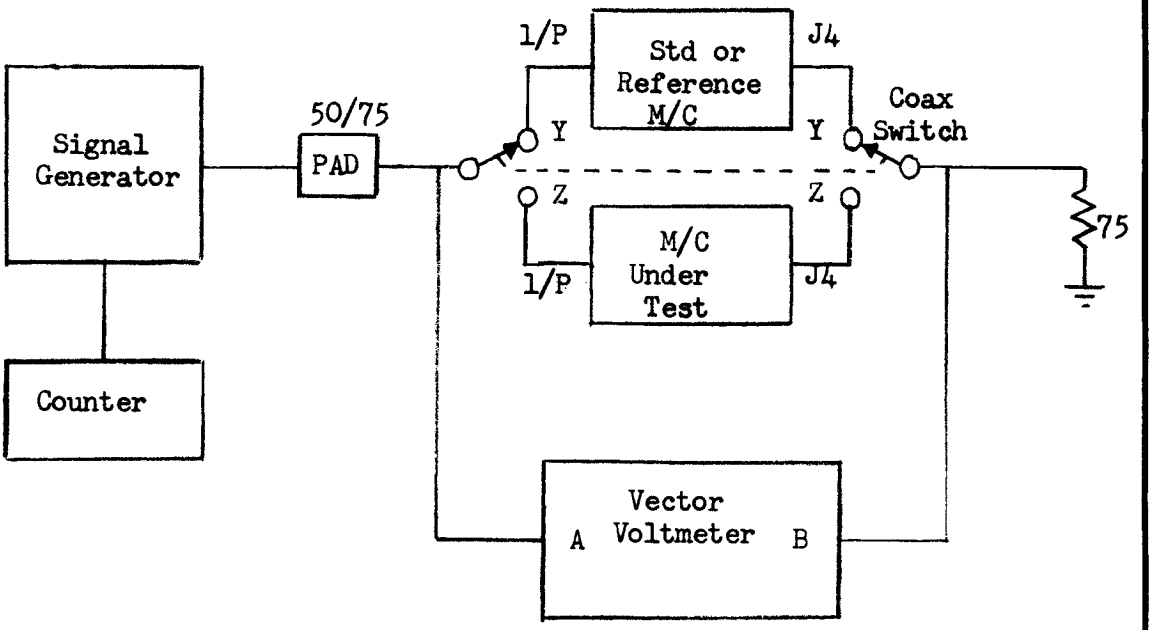
Test 1



EQUIPMENT REQUIRED (For test one and test two)

1. Signal Generator, HP 606A
2. Coax-Switch (2 pole)
3. Vector Voltmeter. HP 8405 A
4. Standard MC for phase reference of all other units.
5. 50 - 75 ohm matching pad.
6. 75 ohm loads
7. Frequency counter to count up to 32 MHz

Test 2



NOTE

The four cables joining the coax switch to the twoinputs and two outputsof the M/C's should be cut equal lengths and phase correlated to within $\pm 0.1^{\circ}$ at any freq. 2 to 32 MHz.

They should be kept to a minimum length (about 6") and should be constructed from high quality cable and connectors.

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PROCEDURE TEST 1

a) Set up equipment as shown for test 1.

b) Adjust the Signal Generator to 32 MHz at an amplitude sufficient to register on " A " of Vector Voltmeter.

c) Note the phase difference between output #1 and output #4 on the Vector Voltmeter, (offset phase meter to obtain 0.1° resolution) and outputs 5 and 8.

d) Record test on Data Sheet.

PROCEDURE TEST 2

a) Set up equipment as shown for test 2 with switch in "Y" position.

b) Adjust the Signal Generator to 2MHz ± 1KHz at an amplitude sufficient to register on "A" of the Vector Voltmeter.

c) Offset Vector Voltmeter to read zero on ± 6° range.

d) Switch to position "Z" and read phase reading. Record on test sheet.

e) Repeat for frequency of 15 MHz, 25 MHz and 32 MHz (± 1 KHz)

TEST LIMITS

Test 1. - There shall be less then ± 2° phase difference between all outputs.

Test 2. There shall be less than ± 2° phase difference between the std. AMC and the AMC under test.

NOTE

For above test, all equipment and multicouplers must be switched on at least one hour before taking reading in order to stabilize units, and obtain accurate readings.

DATE Nov. 23/67 SH. ____ OF ____ COMPILED BY R.K.J.	TMC SPECIFICATION NO. S 10166-12	
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WEIGHTS AND DIMENSIONS - reference MIL-E-16400D (NAVY) paragraph 4.5.3

"4.5.3.1 Uncrated - Weights and dimensions of all major units comprising the complete equipment and all the repair parts kits (not crated for shipment) shall be determined."

"4.5.3.2 Crated - Weights and dimensions of all major units comprising the complete equipment and all the repair parts kits (crated for shipment) shall be determined. It shall be ascertained that a complete list of contents is included in each shipping container."

Record results on test sheet

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Supply line voltage and frequency - reference MIL-E-16400D (NAVY) paragraph 4.5.4 as amended by SHIPS-C-4297 paragraph 3.1.4.

"3.1.4 Power supply - The equipment shall operate from a primary power source of nominal 115 volts plus or minus 6 percent, 48 to 62 cycles, single phase alternating current (a.c.)".

"4.5.4 Supply line voltage and frequency - The equipment shall be operated over the steady state range of voltage and frequency as specified in 3.9.1 or as specified in the individual equipment specification."

"4.5.4.1 Reference measurements shall be made at nominal voltage and frequency. The equipment shall then be operated at the extreme limits of the steady state band in combinations of voltage and frequency shown in table V. The equipment shall be operated at least 15 minutes in each combination during which time measurements shall be taken to insure performance within limits established in the individual equipment specification."

CONDITION	VOLTAGE			FREQUENCY		
	LOWER LIMIT (108 VOLTS)	NOMINAL	UPPER LIMIT (122 VOLTS)	LOWER LIMIT (48 CYCLES)	NOMINAL	UPPER LIMIT (62 CYCLES)
A (REFERENCE CONDITION)		X			X	
B	X			X		
C			X	X		
D			X			X
E	X					X

4.5.4.2 Transient voltage -

" 4.5.4.2.1 With the equipment operating on the upper limit of steady state voltage, a transient voltage of plus 20 percent voltage recovering to the steady band in 2 seconds shall be superimposed to determine conformance with 3.9.1."

"4.5.4.2.2. With the equipment operating on the lower limit of steady state voltage, transient voltage of minus 20 percent voltage recovering to the steady state band in 2 seconds shall be superimposed to determine conformance with 3.9.1. "

"4.5.4.3.1. With the equipment operating at 3 percent above nominal frequency, a transient frequency of plus 3 percent of nominal shall be superimposed, recovering to the steady state band (±5 percent of nominal) in 2 seconds.

"4.5.4.3.2. With the equipment operating at 3 percent below nominal frequency, a transient frequency of minus 3 percent of nominal shall be superimposed, recovering to the steady band (±percent of nominal) in 2 seconds.

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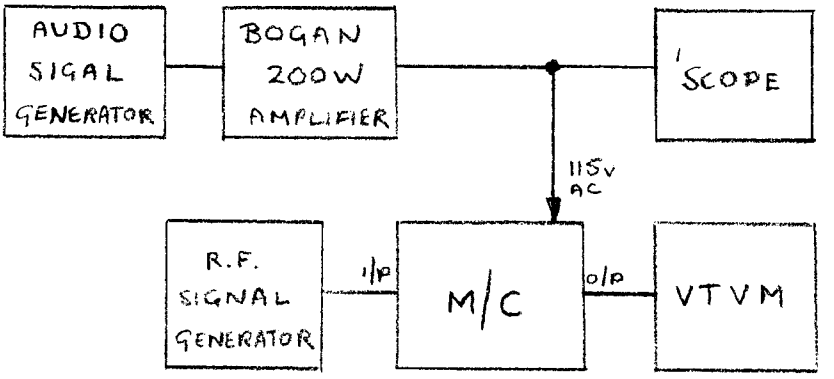
APPROVED		

EQUIPMENT REQUIRED

H.P. 200 CD Audio signal generator or equivalent
BOGAN 200 WATT Audio Amplifier or equivalent
HP 606A Signal Generator
Oscilloscope, Tektronix 545
VTVM, H.P. 3400



PROCEDURE

Connect equipment as shown. Set the R.F. signal generator to 15 MHz and observe a convenient gain level on the VTVM, under nominal line voltage and frequency conditions.
By adjustment of the gain and frequency of the audio chain, all frequency and voltage combinations required by this spec can be supplied to the power i/p of the multicoupler.

DATE Nov. 23/67 SH. ____ OF ____ COMPILED BY R.K.F.	TMC SPECIFICATION NO. S 10166-15	
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HEAT TESTS - reference MIL-E-16400D (NAVY) paragraph 4.5.6

"4.5.6 Heat test - Equipment shall be operated continuously with full power and with its cooling system in normal operation in an ambient temperature of + 50°+ 2°C. for at least 8 hours without damage to or deterioration of any of the parts thereof. Leakage of impregnating or potting compounds shall be considered as damage to the unit showing such leakage.

EQUIPMENT REQUIRED:

"ITEMCO" Model 3TH Environmental Chamber

Record results on test sheet

DATE Nov. 23/67 SH. ____ OF ____ COMPILED BY L.B.T. APPROVED	TMC SPECIFICATION NO. S 10166-17	
	TITLE: TEST PROCEDURE FOR MULTICOUPLERS	JOB

TEMPERATURE TESTS - reference MIL-E-16400D (NAVY) paragraph 4.5.8

"4.5.8 Nonoperating condition - Equipment shall be capable of normal operation immediately after passing through the following temperature cycle:

a) With equipment set up test in a temperature controlled room, reduce room temperature to -62°C. and hold to within +0°-5°C. of that temperature for at least 3 days.

b) Increase room temperature to +75°C. and maintain that temperature within ± 3°C. for at least 4 hours.

c) Reduce room temperature to 25°± 2°C. and maintain that temperature for at least 4 hours"

"4.5.8.2 Operating condition - Equipment cooling system shall be in normal operation during the temperature operating tests."

"4.5.8.2.4 Class 4. - Class 4 equipment shall be capable of normal operation (without alignment or adjustment, other than the accessible controls employed for operation of the equipment) throughout the following temperature cycle; tolerances in operating characteristics shall be as specified in the individual equipment specification:

a) Hold room temperature at 0°± 2°C. for at least 24 hours.

b) Increase room temperature in steps of 10 degrees each, at 30 minutes per step, until + 50°± 2°C. is reached and hold at that temperature for at least 4 hours.

c) Reduce room temperature in steps of 10 each, at 30 minutes per step, until + 25°C. ± 2°C. is reached and hold at that temperature for at least 4 hours." and record results on test sheet.

EQUIPMENT REQUIRED:

"Itemco" Model 3TH Environmental Chamber

PROCEDURE

a) Same as for Voltage Gain test TMC S10166-4

b) Record results on test sheet.

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DATE Nov. 23/67 SH. ___ OF ___ COMPILED BY R.X.J. APPROVED	TMC SPECIFICATION NO. S 10166-18	
	TITLE: TEST PROCEDURE FOR MULTICOUPLERS	JOB

HUMIDITY TEST - reference MIL-E-16400D (NAVY) paragraph 4.5.9

4.5.9 Humidity test - Equipment shall be subjected to the following conditioning and test (see figure 4). Except for the periods of test indicated below, the equipment shall not be energized. If the equipment is designed for water cooling, water at 35°± 2°C. inlet temperature shall be continuously circulated through the water circuit throughout this test.

4.5.9.1 Conditioning - In order to establish a reference condition for the measurement of operating parameters and a valid basis for comparison, of the effects of the conditioning to follow, the complete equipment shall be dried at a temperature not less than 40°C. nor more than 50° C. for at least 2 hours.

4.5.9.2 Reference measurements - Following the conditioning specified in 4.5.9.1, the measurement of all parameters specified in the individual equipment specification to indicate the satisfactory performance of the equipment shall be conducted at 25°± 5°C. and 50 ± 5 percent relative humidity.

MIL-E-16400D (NAVY)

4.5.9.3 Temperature cycling. The equipment shall then be subjected to five 24 hour cycles of temperature variation consisting of approximately 16 hours at 60°± 5°C. and approximately 8 hours at 30o± 5°C. The relative humidity shall be maintained above a minimum of 95 percent during the steady state conditions. The transitions between temperatures shall be accomplished within the 8-hour period so that the time at the high temperature is approximately 16 hours. Each transition shall not exceed 1½ hours if the equipment remains in the chamber for 15 minutes if a two chamber method is employed. The relative humidity need not be controlled during the transition periods. Approximately 2 hours after stabilization during the high temperature and low temperature portions of the first or second cycle, a sampling of the atmosphere in the chamber shall be made to determine that the conditions of temperature and relative humidity specified above are uniform throughout the chamber.

4.5.9.4 Measurement during cycling - During the second cycle, the measurements required in 4.5.9.2 shall be performed at 60°± 5°C. (for class 3 and 4 equipments, these measurements may be made at 50°C.) prior to the decrease of temperature to 30°C. with the equipment remaining in the chamber. The equipment shall be energized for as brief a period as required to complete the measurements. A warm-up period may be permitted where previous tests indicate a definite period is required for the equipment to attain thermal stability.

4.5.9.4.1 The equipment shall be capable of meeting the requirements of the equipment specification without alignment or adjustment, other than the accessible controls employed for operation of the equipment. No repairs shall be permitted prior to measurement. If repairs are required, the test specified in 4.5.9.3 shall be repeated, after the necessary replacements have been made.

4.5.9.5 Measurements after temperature cycling - After the five complete cycles, the measurements required in 4.5.9.2 shall be performed at 30°± 5°C. with the equipment remaining in the chamber. The equipment shall meet the requirements of the equipment specification with no more than minor readjustments of readily available controls.

4.5.9.5.1 Upon completion of the tests and after remaining inoperative for not less than 12 nor more than 24 hours at a temperature of ± 25° + 5°C. and 50 ± 5 percent relative humidity, any additional tests or measurements considered necessary by the inspector shall be made to determine complete compliance with the requirements of the individual equipment specification.

4.5.9.6 Humidity cycle - The equipment shall then be operated continously at full power in an ambient temperature of +50°± 5°C. for a period of 8 hours. The relative humidity shall be increased from 50 ± 5 percent during the first 2 hours, then reduced to 40 ± 5 percent during the final 2 hours. Measurements as specified in the individual equipment specification shall be taken at 30 minute intervals during this 8-hour period.

4.5.9.7 The equipment shall be carefully examined in detail to detect evidence of physical degradation, such as corrosion of metal parts, distortion of plastic parts, and insufficient lubrication on moving parts. When it is necessary to replace parts, to obtain satisfactory performance of the equipment, the failed part or parts shall be analyzed to determine the cause of unsatisfactory operation. The results of the analyses shall be reported with the results of measurements of the equipment operating parameters. In each case, the unsatisfactory parts or materials shall be replaced by adequate substitutes.

EQUIPMENT REQUIRED:

"ITEMCO" Model 3TH Environmental Chamber

Record results on test sheet

DATE Nov. 23/67
SH. ____ OF ____
COMPILED BY R.R.J.
APPROVED

TMC SPECIFICATION NO. S10166-18

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JOB

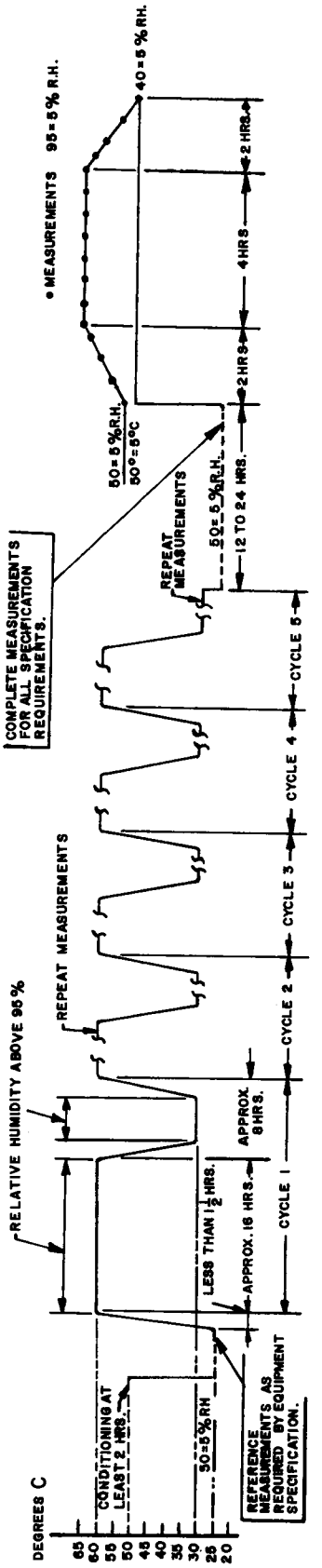


FIGURE 4 – HUMIDITY TEST

DATE Nov. 23/67 SH. ____ OF ____ COMPILED BY H.R.S.	TMC SPECIFICATION NO. S10166-19	
APPROVED	TITLE: TEST PROCEDURE FOR MULTICOUPLERS	JOB

POWER

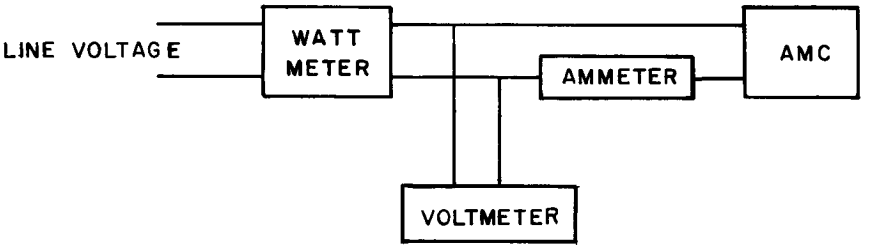
References: (1) MIL-E-16400D (NAVY) paragraph 4.5.10
(2) SHIPS-C-4297 paragraph 3.2.9

"3.2.9 Power supply - The internal power supply all the low voltage direct current (d.c) requirements of the equipment, when connected to the power source specified in 3.1.4".

"3.2.9.1 The power transformer shall have an internal electrostatic shield. Taps shall be provided on the power transformer primary for 105-115-125 volts. Selection of the power voltage shall be by means of selecting the tap on the transformer. R.C.A. Victor A1815402 paragraph 3.3 states "3.3 Power Supply (para 3.2.9.1): Transformer taps for 105 and 125 volts may be omitted."

"3.2.9.2 A radio frequency filter shall be provided in the primary power line to preclude entrance of radio frequency interference to the equipment, through that path. This filter shall be balanced with respect to the chassis."

"3.2.9.3 The power supply shall be voltage regulated as necessary to meet the performance requirements of this specification."



EQUIPMENT REQUIRED:

1. Wattmeter Back Simpson model 79
2. Current meters, Avometer model 8
3. Voltmeter, Simpson model 260

PROCEDURE:

1. Connect equipment as shown above.

2. Note the power consumption on the wattmeter. Record on test sheet.

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PROCEDURE CONT'D

c.) Calculate the power factor using the following formula

$$PF = \frac{P}{EI}$$

P = reading on wattmeter
E = " " voltmeter
I = " " ammeter

d.) Record the power factor on the test sheet

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CONTROLS AND CONTROL CIRCUITS

Reference: MIL-E-16400D (NAVY)

"4.5.13 - Controls and control circuits - Equipment shall be tested to determine the suitability of controls and contr l circuits for satisfactory mechanical and electrical operation."

EQUIPMENT REQUIRED

None

PROCEDURE

a) Connect the unit to a 115 Vac supply, set the power switch to ON. The front panel power indicator should glow.

b) Remove both fuses from the unit. The front panel indication should glow.

c) Remove the fuses from the cartridges and re-insert the empty cartridges. Both fuse indicators should glow, the power indicator should glow.

d) Re-insert the fuses one at a time. As each fuse is inserted, the associated fuse indicator should not glow.

e) Complete test data sheet.

Accelerated life test - reference MIL-E-16400D (NAVY) paragraph 4.5.14

4.5.14 Accelerated life tests - If the equipment is designed for water cooling, these tests shall be conducted with water at 35°± 2°C. inlet temperature continuously circulating through the water circuit. The equipment shall be subjected to the following conditioning and tests.

4.5.14.1 Conditioning - In order to establish a reference for the measurement of operating parameters and a valid basis for comparison of test results, the complete equipment shall be subjected to the following conditioning process:

4.5.14.1.1 Normal operation - The equipment shall first be set up in a room in an ambient temperature of 25° ± 5° C. and 50 ± 3 percent relative humidity and operated under conditions of nominal line power voltage, frequency input, output load conditions, and operating frequency, in accordance with the requirements of the individual equipment specifications. Following an adequate warm-up period, critical performance parameters as specified in the individual equipment specification, plus any specific tests deemed necessary by the inspector, shall be measured and logged as "reference test data" for comparison with subsequent tests.

4.5.14.1.2 High temperature operation - The equipment shall then be set up in a room which shall be maintained at a temperature of 65°± 5°C. for class 1 and 2 equipments and at a temperature of 50°+ 5°-0°C. for class 3 and 4 equipments. The room shall be maintained at not less than 90 percent relative humidity. The equipment shall be energized and operated under these conditions at nominal line power voltage, frequency input, output load conditions, and operating frequency, for a period of 2 hours. Near the end of this period and preferably during the last half hour, performance test data shall be taken for comparison with the reference test data (see 4.5.14.1.1). Minor adjustments of operating controls will be permitted during this 2 hour test run to insure optimum equipment performance.

4.5.14.2 Test cycling - Without shutting down the equipment and immediately following the 2-hour high temperature conditioning run, the equipment shall be subjected to a series of test cycles specified in 4.5.14.2.1 through 4.5.14.2.4 while operating in a steady state ambient temperature of 65°± 5°C. for class 1 and 2 equipments or 50°+ 5°-0°C. for class 3 and 4 equipments. The relative humidity shall be maintained at not less than 90 percent.

4.5.14.2.1. The cycling shall be as follows: (See figure 5) Increase input power voltage to 110 percent nominal and operate in this condition for a period of 1 hour and 15 minutes, then decrease voltage to 90 percent nominal and operate in this condition for 1 hour; at the end of this period increase input voltage to nominal and operate for ½ hour, at the end of which time the equipment shall be de-energized for 15 minutes. During the ½ hour period of operation at nominal line input, repeat measurement of operating parameters as specified in 4.5.14.1.2. At the end of the 15 minute shut-down period, energize the equipment and

immediately decrease the input voltage to 90 percent nominal; operate in this condition for 1 hour; increase input voltage to 110 percent nominal and operation in this condition for 1 hour and 15 minutes, decrease voltage to nominal and operate for a period of ½ hour, again repeating measurements specified in 4.5.14.1.2 followed by a 15 minute shutdown of the equipment.

4.5.14.2.2 - The test cycle specified in 4.5.14.2.1 shall be repeated without interrutpion for a period of 360 hours (15 complete days)

4.5.14.2.3 - Procedure in case of shutdown Should a single shut-down for more than 1 hour or a total shut-down of 8 hours during the 15 days of continuous operation be necessary, the continuation of the test shall be for 15 full days from the time of resumption of the run.

4.5.14.2.4 - Temperature measuring instruments shall be placed at critical points throughout the equipment, covering suspected "HOT-SPOT" areas. Data shall be recorded at least once during each cycle at the end of the period of high voltage operation. The log of the data obtained should clearly identify the location of the instrument in the equipment, the temperature, date, and time. This data shall be made part of the report on preproduction inspection.

4.5.14.2.5 - Test data - Test data accumulated during the accelerated life tests, including details of all failures, shall be provided and shall be included in the report on the preproduction inspection.

EQUIPMENT REQUIRED:

"ITEMCO" Model 3TH Environmental Chamber

Record results on test sheet

TMC SPECIFICATION NO. S 10166-23

TITLE

JOB

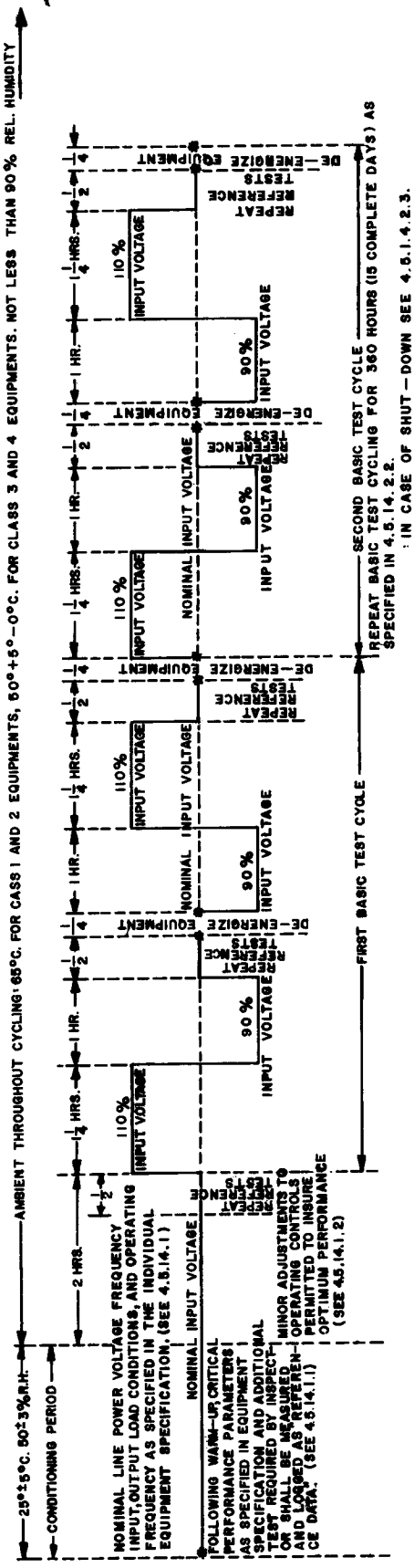

FIGURE 5 - ACCELERATED LIFE TEST

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RELIABILITY

References: (1) MIL-E-16400D (NAVY) paragraph 4.5.18 and amend. # 3
(2) SHIPS-C-4297 paragraph 3.1.6
R.C.A. Victor A1815402 paragraph 3.4 states "3.4 Reliability (para 3.1.6 (b) and (c):
Read: "RCA Victor Company, Ltd.," instead of "Bureau of Ships".

"3.1.6 Reliability - The following procedure shall be applied:

a) The mean-time-between failure (MTBF) of the equipment shall be predicted using Method D of NAVSHIPS 93820.

b) The design shall be reviewed and analyzed in detail by a group provided by the contractor independent of the designers to determine that it is inherently as reliable as is practical. It shall be the particular function of this group to constructively criticize such common weaknesses as unnecessary complexity, misapplication of parts, and those commonly called "marginal design". This group shall report the results of the design review and analysis together with recommendations to the R.C.A. Victor Company, Ltd., and the designers.

c) Any failure of a reproduction equipment that occurs during the development, construction, or testing of the equipment shall be analyzed and reported to the R.C.A. Victor Company, Ltd. The analysis shall be conducted in such a manner as to determine the cause of the failure so that its recurrence can be prevented. Reports of the failures and their analyses shall be forwarded to the design review group for endorsement. The equipment shall be considered acceptable whenever the reliability prediction, the design review, and the failure analyses are completed and the RCA Victor Co., Ltd. is satisfied that any faults revealed by these studies have been corrected."

PROCEDURE

a) TMC will predict the mean-time-between failure (MTBF) of the equipment in accordance with Method D of NAVSHIPS 93820.