TEST PROCEDURE

S/N 100-1
PROCEDURE TO MEASURE MICROWAVE SWITCH

MODEL SW-1040-2AT
NAC DRAWING 78B6N3334 REV E
## TEST PROCEDURE

**AMERICAN MICROWAVE CORPORATION**

S/N 100-1

**PROCEDURE TO MEASURE MICROWAVE SWITCH**

**MODEL SW-1040-2AT**

NAC DRAWING 78E6N3334 REV A

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INITIATED

APPROVED

DATE
1.0 SCOPE:

1.1 The purpose of the Test Procedure is to define the tests performed on American Microwave Corporation microwave switch Model SW-1040-2AT

1.2 The specification consists of the following sections:

1.0 SCOPE
2.0 APPLICABLE DOCUMENTS
3.0 EQUIPMENT REQUIRED
4.0 GENERAL
5.0 VISUAL INSPECTION
6.0 FUNCTIONAL TESTS

2.0 APPLICABLE DOCUMENTS:

MIL-STD 202                MIL-S-3928
MIL-I-45208A               MIL-STD-883
MIL-STD-810                MIL-STD-454
MIL-C-39012                MIL-E-5400
WS-6536E

3.0 EQUIPMENT REQUIRED:
(Or Equivalent)

3.1 Sweep Generator H.P. 83592A
3.2 Main Frame H.P. 8350B
3.3 Wiltron Analyzer 1038-014
3.4 Wiltron Detectors 13782
3.5 Power Supply H.P. 721A
3.6 Wiltron Autotester 560-98S50
3.7 H.P. Attenuator 8491B-6DB
3.8 H.P. Attenuator 8491B-20DB
3.9 Tektronix Oscilloscope 485
3.10 H.P. Signal Generator 616A
3.11 H.P. 8620B Sweep Generator Main Frame with 86222B Plug-in
3.12 Mixer Vari-L Model DBM-1800
3.13 Weinschel Attenuator 3dB 44-3
3.14 H.P. Spectrum Analyzer 8559A
3.15 Microphase High Pass Filter HB-1000AB
3.16 Systron Donner Model 110B Pulse Generator
3.17 DVM Fluke Model DMZ5L
3.18 Amplifier, Minicircuits Model ZHL-2
4.0 GENERAL:

4.1 Test Sequence:

Power Test (Par. 6.1) to be performed first. Subsequent tests may be performed in any convenient sequence.

4.2 Test Data:

Test Data shall be recorded and submitted to the customer after completion of testing.

4.3 Tests shall be conducted at room ambient temperature and humidity conditions, unless otherwise specified in the individual test paragraph. Temperature shall be 25 C ±5 C.

5.0 VISUAL INSPECTION: (NAC Drawing 78E6N3334, Figure 7 of this ATP)

5.1 The switch shall be inspected for conformance to mechanical dimensions. Marking shall include manufacturer identification, spec number and connector designation as shown.

6.0 FUNCTIONAL TESTS:

6.1 RF Power (Paragraph 2.2.12, Drawing 78E6N3334)

6.1.1 Set up equipment as shown in Figure 1 (numbers called out on block diagrams are sub-paragraphs for paragraph 3.0) with HP 8359A/8350B set at cw function and frequency to 1 GHz and amplifier (Par 3.18) inserted between sweep generator (Par. 3.1/3.2 and Attenuator (Par. 3.8).

6.1.2 Disconnect attenuator (3.8) from test switch J2 and open circuit J3.

6.1.3 Set input power to J1 for +20dBm.

6.1.4 Ground E2 for 10 minutes.

6.1.5 Ground E3 for 10 minutes.

6.1.6 Record data on data sheet (Figure 8).

6.1.7 Limit: Accept, Reject

(Accept if unit passes all subsequent testing)

6.2 Insertion Loss (Paragraph 2.2.3, Drawing 78E6N3334)

6.2.1 Set up equipment as shown in Figure 1 for error correction (numbers called out on block diagrams are sub-paragraphs of paragraph 3.0) with switch out of set-up, and channel A switch in on Wavetek Analyzer model 1038.
6.2.2 Set frequency limits from 1 GHz to 4 GHz on HP 83592A/8350B. Set sweep trigger (int) sweep (time).

6.2.3 Set Wavetek Attenuator on Wavetek Analyzer model 1038 at 1.0 dB/Div and offset at 0.0.0.

6.2.4 Push access memory switch on Wavetek Analyzer model 1038, press to store, and input minus memory in that order.

6.2.5 Ground E2; Connect E3 to +5 volts.

6.2.6 Insert test switch, configure for J2 output and change offset to read at center line on scale of Wavetek model 1038.

6.2.7 Record worst case insertion loss on data sheet (Figure 8).

6.2.8 Ground E3; Connect E2 to +5 volts. Repeat 6.2.6 and 6.2.7 for Port J1-J3.

6.2.9 Limits: 1.2 dB, max

6.3 VSWR - Return Loss (Paragraph 2.2.6, Drawing 78E6N3334)

6.3.1 Set up equipment for calibration as shown in Figure 2 (numbers called out on block diagrams are sub-paragraphs of paragraph 3.0) with test switch out of set up. Set frequency limits on HP 83592A/8350B from 1 TO 4 GHz.

6.3.2 Connect short circuit adapter to output of Wiltron Bridge.

6.3.3 Calibrate Wavetek Analyzer as described in paragraph 6.2.4.

6.3.4 Connect 50 ohm terminations with VSWR 1.05 or better in the 1-4 GHz band to switch terminals J2 and J3.

6.3.5 Ground E2 terminal and connect input of test switch port J1 to output of Wiltron Bridge. Change offset to reference line. Record worst case Voltage Standing-Wave Ratio (VSWR) on Figure 8

6.3.6 Repeat 6.3.4 for J1-J3, ground E3
6.3.7 Connect 50 termination to J1.
6.3.8 Connect J2 to output of Wiltron Bridge.
6.3.9 Ground E2; Connect E3 to +5 volts.
6.3.10 Record worst case VSWR on Figure 8.
6.3.11 Ground E3; Connect E2 to +5 volts
6.3.12 Record worst case VSWR on data sheet of Figure 8.
6.3.13 Connect J3 to output of Wiltron Bridge.
6.3.14 Repeat 6.3.9 through 6.3.12
6.3.15 Limit: 1.5: max all ports.

6.4 SWITCHING SPEED

6.4.1 Set up equipment as shown in Figure 3 (numbers called out on block diagrams are sub-paragraphs of paragraph 3.0).

6.4.2 Set frequencies of generators 3.11 and 3.1/3.2 to 1200 MHz and 1250 MHz respectively.

6.4.3 Set modulator to square wave of amplitude 0-5 volts and frequency 1 KHz.

6.4.4 Turn cal knob on time delay switch on oscilloscope fully clockwise.

6.4.5 Turn (time/div) switch to position to 0.5 u-sec. on oscilloscope, Tektronix model 485. Record Turn On/Turn Off switching speed as defined below.

6.4.6 Switching Speed (Paragraph 2.2.8, Drawing 78B6N3334). 1 u-sec maximum when defined as follows:

"TURN-ON" Switching Speed - t measured between a 50% amplitude level on the rising edge of the control input and a 90% amplitude level on the rising edge of the detected RF output, referenced to the steady state "ON" RF amplitude level.
"TURN-OFF" Switching Speed - T measured between a 50% amplitude level on the falling edge of the control input and the 10% amplitude level on the falling edge of the detected RF output, referenced to the steady state "ON" RF amplitude level.

6.4.7 Repeat between ports J1 and J3, connecting the modulator control to E3.

6.4.8 Record data on Figure 8.

6.4.9 Limit: 1 u-sec. max

6.5 ISOLATION (Paragraph 2.2.5, Drawing 78E6N3334)

6.5.1 Set up equipment as shown in Figure 4 (numbers called out on block diagrams are sub-paragraphs of paragraph 3.0).

6.5.2 With test switch out of set up, connect spectrum analyzer. Set HP 83592A/8350B to cw function and frequency to 1 GHz.

6.5.3 Set attenuator switch on spectrum analyzer to 60 dB and note reference position on display.

6.5.4 Insert test switch ports J1-J2 and remove attenuation to same reference. J3 is open circuited; E2 and E3 are ungrounded.

6.5.5 Record difference as isolation on data sheet of Figure 8.

6.5.6 Repeat 6.5.4 and 6.5.5 for ports J1-J3, leaving unused RF ports open circuited and E2 and E3 ungrounded.

6.5.7 Repeat paragraphs 6.5.1 through 6.5.6 at 3GHz and 4GHz.

6.5.8 Limits: 50 dB, min.

6.6 Input Bias (Paragraph 2.2.10, Drawing 78E6N3334)

6.6.1 Set up equipment as shown in Figure 1 (numbers called out on block diagrams are sub-paragraphs of paragraph 3.0)

6.6.2 Set DVM of paragraph 3.17 to 200mA scale.

6.6.3 Measure current on +5v line and record accept or reject on Figure 8.

6.6.4 Measure current on -15v line and record accept or reject on Figure 8.
6.6.5 Limits:  
+5 vdc  65 mA max  
-15 vdc  50 mA max

6.7 Environmental Stress Screening Test: Paragraph 2.4.7 - NAC drawing 78E6N3334. Only those switches that have successfully completed the environmental stress screening (ESST) shall be delivered to the procuring activity. The ESST shall consist of workmanship random vibration and thermal stress screening as described below. Prior to and after each submission to the ESST a room ambient electrical test shall be performed to verify compliance with the requirements of Paragraphs 6.1-6.6. Quantitative results of this testing shall be delivered to the procuring activity with each switch.

6.7.1 Workmanship Random Vibration: Each item shall be subjected to the workmanship random vibration profile as shown in Figure 6 of 6.3G's (min. level), as measured on the test fixture at the mounting points of the test item. The duration of the test shall be a minimum of ten minutes in the axis which is perpendicular to the majority of printed circuit boards. The test item shall be rigidly attached by its normal mounting means, and shall not be shock mounted. The workmanship vibration may be done before, or concurrent with the temperature cycling portion of the ESST.

6.7.2 Thermal Stress Screening: Each item shall be subject to a minimum of 40 hours thermal stress screening test time, and a minimum accumulation of 25 hours operation. The thermal stress screening test shall consist of 10 "failure free" 4-hour temperature cycles as shown in Figure 5. The test chamber temperature and change rates shall be monitored and must conform to Figure 5. An electrical performance check to verify compliance with the requirements of Paragraph 6.2 and 6.5 shall be performed at the end of the cold and hot soak intervals during the tenth cycle. Testing during cycles 1 thru 9 is optional. If a failure occurs, the thermal stress screening test shall resume at the cycle where the switch was last known to be fully compliant. Quantitative test results of the hot and cold temperature testing shall be recorded on data sheets of Figure 9 and provided to the procuring activity along with each switch.

6.8 FINAL DATA

6.8.1 Repeat Paragraphs 6.1 through 6.6 and record data on Figure 10
PORT TO PORT | LOGIC
---|---
J2 | E2
J3 | E3
J1 | 0

LOGIC 0 = 0 TO +5.8 VDC
LOGIC 1 = +2.5 TO +5.0 VDC

3.1 / 3.2
Sweep Generator

3.8
Attin.

3.8
Attin.

3.4
Detector

3.3
Network Analyzer

Power Supply
3.5

Power Supply
3.5

V

DUM
3.17

+5 V

GROUND

-15 V

E4
TEST

3.5

E1
SWITCH

E2

E3

E4
J1
J2
J3

CHANNEL A

AMERICAN MICROWAVE CORPORATION
FREDERICK, MARYLAND

INSERTION LOSS SETUP

FIGURE 1

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS DECAIMALS ANGLES
= .XX = XXX

CONTRACT NO.

APPROVALS

DATE

AMERICAN MICROWAVE CORPORATION FREDERICK, MARYLAND

INSERTION LOSS SETUP

FIGURE 1

UNLESS OTHERWISE SPECIFIED
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INSERTION LOSS SETUP

FIGURE 1

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FRACTIONS DECAIMALS ANGLES
= .XX = XXX

CONTRACT NO.
### Parts List

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**UNLESS OTHERWISE SPECIFIED**
Dimensions are in inches.
Tolerances are:
- Fractions
- Decimals
- Angles

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**DATE**

**AMERICAN MICROWAVE CORPORATION**

**FREDERICK, MARYLAND**

**RETURN LOSS SET-UP**

**FIGURE 2**

**SIZE**

**FSCM NO.**

**DWG. NO.**

**REV.**

**SCALE**

**S/N**

**NOTE**

DO NOT SCALE DRAWING

**APPLICATION**

**NEXT ASSY**

**USED ON**
NOTE: THE 1ST CYCLE SHALL START AT +25°C IN LIEU OF +71°C AS SHOWN

FIGURE 2 - MANUFACTURING RUN-IN TEST CYCLE

(P) PERFORMANCE TEST, ELECTRICAL (10TH CYCLE)
10 CYCLES FAILURE-FREE
POWER SPECTRAL DENSITY

\((G^2/\text{Hz})\)

\[
\text{Frequency (Hz)}
\]

\[
.04
\]

3db/octave

\[
\begin{array}{c}
20 \\
80 \\
400 \\
2000
\end{array}
\]

DURATION: 10 minutes in one axis perpendicular to the majority of the printed circuit boards.

MINIMUM LEVEL: 6.3 G RMS
SWITCH_RF_SOLID_STATE

2.2.3 Insertion Loss: Limits: 1.2 dB, max.
Worst Case:

Port J1-J2_________ Port J1-J3_________

2.2.4 Isolation:
Limits: 50 dB, min.
Worst Case:

Port J1-J2_________ Port J1-J3_________

2.2.6 Input VSWR
Limits: 1.5:max, all ports
Worst Case:

Port J1-J2_________ Port J1-J3_________

E2 Grounded
Port J2

E2 to +5VDC
Port J3

2.2.7 Max Power +20 dBm
Accept__________ Reject__________

2.2.9 Switching Speed
Limit: 1 u-sec max

ON OFF
J1-J2_______ J1-J3_______

2.2.10 Input Bias

+5 volts 65 mA max
-15 volts 50 mA max

Accept__________ Reject__________

2.3.1 Mechanical Configuration Figure 1

Accept__________ Reject__________

ACCEPTED_____________ DATE_____________
APPROVED____________ SERIAL NO._____________

DATA SHEET

FIGURE 8
SWITCH RF SOLID STATE

SP2T 78E6N3334
SW-1040-2AT

2.2.3 Insertion Loss: Limits: 1.2 dB, max.
Worst Case:
Ports J1-J2__________ Ports J1-J3__________

2.2.4 Isolation:
Limits: 50 dB, min.
Worst Case:
Ports J1-J2__________ Ports J1-J3__________

SWITCH RF SOLID STATE

SP2T 78E6N3334
SW-1040-2AT

2.2.3 Insertion Loss: Limits: 1.2 dB, max.
Worst Case:
Ports J1-J2__________ Ports J1-J3__________

2.2.4 Isolation:
Limits: 50 dB, min.
Worst Case:
Ports J1-J2__________ Ports J1-J3__________

HOT TEST (+71 C)
LAST FAILURE FREE CYCLE

COLD TEST (-54 C)
LAST FAILURE FREE CYCLE

DATA SHEET

Figure 9
SWITCH RF SOLID STATE

SP2T 78E6N3334

SW-1040-2AT

2.2.3 Insertion Loss:

Limits: 1.2 dB, max.

Worst Case:

Ports J1-J2 __________ Ports J1-J3 __________

2.2.4 Isolation:

Limits: 50 dB, min.

Worst Case:

Ports J1-J2 __________ Ports J1-J3 __________

2.2.6 Input VSWR

Limits: 1.5:max, all ports

Worst Case:

Ports J1-J2 __________ Ports J1-J3 __________

E2 Grounded __________ Port J2 __________

E2 to +5VDC __________ Port J3 __________

2.2.7 Max Power +20 dBm Accept __________ Reject __________

2.2.9 Switching Speed

Limit: 1 u-sec max

ON OFF ON OFF

J1-J2 ___ ___ J1-J3 ___ ___

2.2.10 Input Bias

+5 volts 65 mA max

-15 volts 50 mA max

Accept __________ Reject __________

2.3.1 Mechanical Configuration Figure 1

Accept __________ Reject __________

ACCEPTED __________ DATE __________

APPROVED __________ SERIAL NO. __________

DATA SHEET

FIGURE 10