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<th>DESCRIPTION</th>
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<td></td>
<td>ORIGINAL RELEASE</td>
<td>7/11/2019</td>
<td>S. PALACIO</td>
</tr>
<tr>
<td>B1</td>
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<td>ADDING NEW TEST DATA SHEET AND UPDATED DRAWINGS</td>
<td>8/5/2019</td>
<td>S. PALACIO</td>
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</tbody>
</table>

**Planar Monolithics Industries, Inc.**

7311-F GROVE ROAD  
FREDERICK, MD 21704

ACCEPTANCE TEST PROCEDURE  
PMI CONFIDENTIAL AND PROPRIETARY

MODEL: LM-2G18G-18-20W-1KWP  
PART NO: 27336740
## TABLE OF REVISIONS

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DATE</th>
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<td>ORIGINAL RELEASE</td>
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<td>G. RADTKE</td>
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<td>8/5/19</td>
<td>G. RADTKE</td>
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</table>
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The following tests may be performed and recorded on the 27631240 Test Data Sheet in any convenient order.

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>PARAMETER</th>
<th>PARAGRAPH</th>
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<tr>
<td>1</td>
<td>Frequency Range</td>
<td>All Tests To Be Performed Over 2 GHz TO 18 GHz</td>
</tr>
<tr>
<td>2</td>
<td>RF Input Pulse Width</td>
<td>4.1</td>
</tr>
<tr>
<td>3</td>
<td>Limiting Threshold</td>
<td>4.2</td>
</tr>
<tr>
<td>4</td>
<td>Rf Power Handling</td>
<td>4.3</td>
</tr>
<tr>
<td>5</td>
<td>RF Leakage</td>
<td>4.4</td>
</tr>
<tr>
<td>6</td>
<td>Recovery Time</td>
<td>4.5</td>
</tr>
<tr>
<td>7</td>
<td>Power Handling</td>
<td>4.6</td>
</tr>
<tr>
<td>8</td>
<td>VSWR</td>
<td>4.7</td>
</tr>
<tr>
<td>9</td>
<td>Mechanical Outline</td>
<td>4.8</td>
</tr>
<tr>
<td>10</td>
<td>Weight</td>
<td>4.9</td>
</tr>
</tbody>
</table>
1.0 SCOPE

This procedure defines the tests required for the acceptance of a PMI Model LM-2G18G-18-20W-1KWP.

2.0 TEST EQUIPMENT

Test equipment shall be inspected for current calibration and serviceability. Test connectors shall be cleaned and inspected prior to test set connection. Coaxial test cables shall be inspected for proper impedance (i.e. 50 Ω coax for RF). Test Equipment with equivalent or better specifications than the equipment defined in the table below may be substituted. RF cables and adapters to be used as needed and proper calibration of test setup is required. Test equipment used shall have their asset tags recorded on the test data sheet.

### TABLE OF EQUIPMENT

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>ITEM</th>
<th>MANUFACTURER</th>
<th>MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PNA NETWORK ANALYZER</td>
<td>AGILENT</td>
<td>N5230A</td>
</tr>
<tr>
<td>2</td>
<td>E-CAL MODULE</td>
<td>AGILENT</td>
<td>N4692A</td>
</tr>
<tr>
<td>3</td>
<td>DIGITAL SCALE</td>
<td>SARTORIUS GROUP</td>
<td>EC-411</td>
</tr>
<tr>
<td>4</td>
<td>SIGNAL GENERATOR</td>
<td>KEYSIGHT</td>
<td>E8257D</td>
</tr>
<tr>
<td>5</td>
<td>POWER METER</td>
<td>GIGATRONICS</td>
<td>8541C</td>
</tr>
<tr>
<td>6</td>
<td>POWER SENSOR (CW)</td>
<td>GIGATRONICS</td>
<td>80325A</td>
</tr>
<tr>
<td>7</td>
<td>POWER SENSOR (PEAK)</td>
<td>GIGATRONICS</td>
<td>80355A</td>
</tr>
<tr>
<td>8</td>
<td>POWER SENSOR (MODULATED)</td>
<td>GIGATRONICS</td>
<td>80425A</td>
</tr>
<tr>
<td>9</td>
<td>TWT AMPLIFIER</td>
<td>CPI</td>
<td>VZM6993J5 (Base 250W Model)</td>
</tr>
<tr>
<td>10</td>
<td>CIRCULATOR</td>
<td>PMI</td>
<td>RMCI.12-18Sf</td>
</tr>
<tr>
<td>11</td>
<td>50 Ω HIGH POWER LOAD</td>
<td>PMI</td>
<td>1431-2</td>
</tr>
<tr>
<td>12</td>
<td>WAVEFORM GENERATOR</td>
<td>AGILENT</td>
<td>33522A</td>
</tr>
<tr>
<td>13</td>
<td>OSCILLOSCOPE</td>
<td>AGILENT</td>
<td>MSOX3034A</td>
</tr>
<tr>
<td>14</td>
<td>DETECTOR (CRYSTAL OR DIODE)</td>
<td>PMI</td>
<td>DD-20-218-5PF-3-P-M-OPT0518</td>
</tr>
<tr>
<td>15</td>
<td>PERSONAL COMPUTER (PC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>DIGITAL MULTIMETER (DMM)</td>
<td>AGILENT</td>
<td>34401A</td>
</tr>
<tr>
<td>17</td>
<td>CALIPERS</td>
<td>STARRETT</td>
<td>EC799A-61150</td>
</tr>
<tr>
<td>18</td>
<td>THERMAL PLATFORM (HOT/COLD PLATE)</td>
<td>ESS</td>
<td>T650</td>
</tr>
<tr>
<td>19</td>
<td>20 dB FIXED ATTN (200 W CW, 1 kW PEAK)</td>
<td>PMI</td>
<td>WA95-20-43</td>
</tr>
<tr>
<td>20</td>
<td>30 dB FIXED ATTN (200 W CW, 1 kW PEAK)</td>
<td>PMI</td>
<td>WA95-30-43</td>
</tr>
<tr>
<td>21</td>
<td>PIN GAUGES</td>
<td>MEYER GAGE</td>
<td>0.061-0.350</td>
</tr>
</tbody>
</table>
3.0 GENERAL REQUIREMENTS

Evidence supporting successful completion of in-process testing (ESS Testing) shall be verified prior to formal acceptance testing. The Device Under Test, or DUT, shall be closed prior to formal acceptance test to provide a tamper proof seal. At any point during testing a unit does not meet the required specifications, testing shall be manually or automatically (dependent on availability of automated setup) stopped.

3.1 TEST CONDITIONS

Testing shall be performed at an ambient temperature of \(-44^\circ C \pm 4^\circ C\), \(25^\circ C \pm 4^\circ C\), and \(+78^\circ C \pm 4^\circ C\). The DUT shall be conductively cooled in a manner that maintains the DUT case temperature within the specified ambient temperature window. PMI will test the DUT on a thermal platform (Item #18) to ensure temperature is regulated. Initial characterization to include all Section 4.0 test parameters listed below; the measured values may vary but will meet specifications over the operating temperature.

3.2 TEST FAILURE

If test failure is indicated, the test program for the DUT shall be stopped by the technician. The cognizant engineering and quality representatives shall be notified. The engineering and quality representatives shall assess the failure to assign cause. A written course of action shall be developed by engineering and quality to determine the root cause of the failure.

4.0 TEST PROCEDURE

In order to verify that the design of the DUT achieves the desired specification requirements the device must be tested and the results recorded. The following procedures and techniques will be followed using the various layout diagrams illustrated below. All tests to be performed over the 2 GHz to 18 GHz frequency range unless otherwise noted.

4.1 INPUT PULSE WIDTH

Definition: The item shall provide full performance with RF input pulse widths from 1 nanoseconds (ns) to continuous wave (CW) with duty cycles from 0% to 100%.

a) Determined from Power Handling Test (4.4).

4.2 INSERTION LOSS

a) Set PNA (Item #1) to 2 GHz to 18 GHz Frequency Range at 0 dBm Input Power set to 1201 points.
b) Calibrate the PNA Network Analyzer using the E-Cal Module (Item #2).
c) Connect cables to the DUT as seen in Figure 1 and display S-Parameters S12 and S21.
d) Measure and record Insertion Loss by setting Minimum and Maximum markers over the 2 GHz to 18 GHz frequency range.
4.3 LIMITING THRESHOLD

Definition: The item shall be less than 1dB compressed with a RF input power of +5.0 dBm relative to small signal operation with < -10 dBm RF input power

a) Determined from Power Handling Test (4.4).

4.4 POWER HANDLING

Definition: The item shall tolerate without damage or permanent degradation, an Input RF power (CW or Pulsed)

a) Set the signal generator (Item #4) to continuous wave settings.

b) Connect cables to DUT as seen in Figure 3 with the CW Power Sensor (Item #6).

c) To account for loss throughout the system, the RF input power from the signal generator must be calibrated such that the level at the input of the DUT is +43 dBm.

d) Record the RF Power Handling CW pass/fail criteria using Figure 4 for definitions on terms.

e) Set the signal generator (Item #4) to 10% DC, 40 uS PW.

f) Connect cables to DUT as seen in Figure 2 with the OSCILLOSCOPE (Item #13).

g) To account for loss throughout the system, the RF input power from the signal generator must be calibrated such that the level at the input of the DUT is +50 dBm

h) Record the RF Power Handling Peak pass/fail criteria using Figure 4 for definitions on terms.

4.5 RF LEAKAGE

Definition: When subjected to power levels greater than the Limiting Threshold the RF Output Leakage.

a) Determined from Power Handling Test (4.4).

4.6 RECOVERY TIME

Definition: After exposure to an input RF signal greater than the Limiting Threshold, the RF Output shall recover to within 0.5 dB.

b) Determined from Power Handling Test (4.4).

4.7 VSWR

Definition: The input and output voltage standing wave ratio (VSWR), over the operating frequency range referenced to a 50 Ohm RF impedance.

a) Set PNA (Item #1) to 2 GHz to 18 GHz Frequency Range at -10 dBm Input Power set to 1201 points.

b) Calibrate the PNA Network Analyzer using the E-Cal Module (Item #2).

c) Connect cables to the DUT as seen in Figure 1 and display S-Parameters S11 and S22.

d) Measure and record VSWR/Return Loss by setting a Maximum marker over the frequency range.
4.8 MECHANICAL OUTLINE

a) Use calipers (Item #17) and pin gauges (Item #21) to measure dimensions shown in Figure 5.
b) Confirm pass/fail criteria.

4.9 WEIGHT

a) Zero Scale (Item #3).
b) Place unit on the scale (Item #3).
c) Measure and record weight of unit.
FIGURE 1 – CONFIGURATION FOR TESTS 4.2 & 4.7

PNA

PORT 1

DUT

PORT 2

RF IN

RF OUT
FIGURE 2 – CONFIGURATION FOR TEST 4.1,4.4,4.5, and 4.6, PULSE POWER HANDLING
FIGURE 3 – CONFIGURATION FOR TEST 4.1, 4.3, 4.4, 4.5, and 4.6, CW POWER HANDLING

* COULD USE SPECTRUM ANALYSER INSTEAD OF POWER METER
FIGURE 4 – DEFINITION OF TERMS FOR TEST 4.1, 4.2, 4.3, 4.4, 4.5, and 4.6

POWER CW

POWER OUT

POWER IN

POWER PULSE
FIGURE 5 – CONFIGURATION FOR TEST 4.8, RF MECHANICAL OUTLINE

MECHANICAL OUTLINE

(SHAPE NOT TO SCALE)

0.120 DIA. (FREE FIT FOR 2-56 SCREW)
THRU 2 PLCS

(H) 0.085 [2.16]

(I) 0.085 [2.16]

(D) 0.16 [4.06]

(C) 0.50
[12.65]

(E) 1.00
[25.40]

(G) 0.830
[21.68]

(F) 0.830 [21.68]

K 0.065 [2.16]

MOUNTING SURFACE

(SHAPE NOT TO SCALE)

SAFETY MARKING

CASE CODE 05XQ0
2.6 TO 18.0 GHz
HIGH POWER LIMITER
MODEL NO:
LM-2G18G-18-20W-1KWP-SFF
SERIAL NO:
PLXXX00000000

SCALE
N/A

DWG. NO.
28036740

REVISION B1

SHEETS
13

OF 21

PLANAR MONOLITHICS INDUSTRIES, INC.
7311 F GROVE ROAD
FREDERICK, MARYLAND 21704 USA
TEL (301) 655-5026, FAX (301) 655-1731
WEB: www.pmi-ri.com, EMAIL: sales@pmi-ri.com
ISO 9001 CERTIFIED

MECHANICAL OUTLINE TEST REFERENCE
LM-2G18G-18-20W-1KWP-SFF
2.6 to 18.0 GHz High Power Limiter

A 05XQ0
27636740

A1

PMI CONFIDENTIAL AND PROPRIETARY

ALL DIMENSIONS ARE IN INCHES TO NEAREST 1/32".
ALL TOLERANCES ARE 0.005 INCH.

PMI

DRAWN: NS
REVIEWED: N/A
APPROVED: N/A
DATE: 06/26/99
REVISION: B1

SIZE
A

CAGE CODE
05XQ0
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<tr>
<th>TEST ITEM</th>
<th>PARAMETERS</th>
<th>SPECIFIED VALUE</th>
<th>RESULTS</th>
<th>REMARKS</th>
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<tbody>
<tr>
<td>1</td>
<td>Frequency Range</td>
<td>2.0 to 18.0 GHz</td>
<td>+25°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-44°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+75°C</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>RF Input Power</td>
<td>20 Watts (+43 dBm) CW Maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Peak Input Power</td>
<td>100 W (+50 dBm) Maximum @10% Duty Cycle &amp; 40μs Pulse Width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Limiting Threshold (P1dB)</td>
<td>≥ +5 dBm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>RF Leakage</td>
<td>≤ +18 dBm Flat &amp; Spike</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Recovery Time</td>
<td>&lt; 100 ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Insertion Loss</td>
<td>≤ 2.0 dB (@ -30 dBm Input Power)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>VSWR</td>
<td>≤ 2.0:1 (@ -30 dBm Input Power)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Mechanical Outline</td>
<td>See Outline Drawing Pass/Fail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Weight</td>
<td>3.0 oz Maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Seal</td>
<td>See Attached Seal Data Pass/Fail</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FINE LEAK: 1 x 10^-6 ATM cc/sec

QA/QC Approval: __________________Date: __________________

PMI CONFIDENTIAL AND PROPRIETARY
7311 F Grove Road Frederick,
MD 21704 USA Phone: (301) 662-5019 FAX: (301) 662-1751
Email: sales@pmi-rf.com
**MECHANICAL OUTLINE TEST**

<table>
<thead>
<tr>
<th>TEST ITEM</th>
<th>PARAMETERS</th>
<th>SPECIFIED VALUE</th>
<th>RESULTS +235°C</th>
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<td>1</td>
<td><strong>A</strong></td>
<td>1.00 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><strong>B</strong></td>
<td>0.40 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><strong>C</strong></td>
<td>0.50 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><strong>D</strong></td>
<td>0.16 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><strong>E</strong></td>
<td>1.00 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><strong>F</strong></td>
<td>0.830 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><strong>G</strong></td>
<td>0.830 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><strong>H</strong></td>
<td>0.085 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>I</strong></td>
<td>0.085 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><strong>J</strong></td>
<td>0.085 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td><strong>K</strong></td>
<td>0.085 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td><strong>L</strong></td>
<td>0.120 Ø</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Production Test Dimensions and Quality Test Dimensions

**Note: Quality Mechanical Dimensions for ONLY Quality Testing

PMI CONFIDENTIAL AND PROPRIETARY
7311-F Grove Road Frederick,
MD 21704 USA Phone: (301)662-5019 FAX: (301)662-1731
Email: sales@pmi-rt.com
MECHANICAL OUTLINE

GAGE CODE: 05XQ0
2.0 TO 18.0 GHz
HIGH POWER LIMITER
MODEL N.O.
LM-2G18G-18-20W-1KWP-SFF
SERIAL N.O.
PL300000000X

0.120 DIA. (FREE FIT FOR 2-M6 SCREW)
THRU 2 PLCs

H0.085 [2.16]

PPI
MTS OUTPUT

H0.085 [2.16]

(A) 1.00 [25.40]

CAGE CODE 05XQ0
28036740

PLANAR MONOLITHICS INDUSTRIES, INC.
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ISO 9001 CERTIFIED

MECHANICAL OUTLINE TEST REFERENCE
LM-2G18G-18-20W-1KWP-SFF
2.0 to 18.0 GHz High Power Limiter

PLANAR CONFIDENTIAL AND PROPRIETARY

A1
INITIAL RELEASE

SIZE A
CAGE CODE 05XQ0
DWG. NO. 28036740
REVISION B1
SCALE N/A
SHEET 16 OF 21
7.0 PRODUCT FEATURE

DESCRIPTION
PMI MODEL: LM-2G18G-18-20W-1KW-SFF IS A HIGH POWER LIMITER THAT OPERATES OVER THE 2.0 TO 18.0 GHz FREQUENCY RANGE. THIS MODEL IS CAPABLE OF HANDLING AN INPUT POWER OF 20 WATTS CW & 1000 WATTS PEAK, HOUSED WITHIN A COMPACT 1.00" x 1.00" x 0.40" PACKAGE OUTFitted with FIELD REPLACEABLE SMA FEMALE CONNECTORS.

SPECIFICATIONS
- FREQUENCY RANGE: 2.0 TO 18.0 GHz
- RF INPUT POWER: +43 dBm CW MAXIMUM
- PEAK INPUT POWER: +50 dBm 10% DC, 40us PW (By Design 1% DC 1us) MAXIMUM
- LIMITING THRESHOLD (P1dB): +5.0 dBm MINIMUM
- RF LEAKAGE (FLAT AND SPIKE): +18 dBm MAXIMUM
- RECOVERY TIME: 100 ns MAXIMUM
- INSERTION LOSS @ -10 dBm INPUT POWER: 2.6 dB MAXIMUM
- VSWR @ -10 dBm INPUT POWER: 2.0:1 MAXIMUM (INPUT/OUTPUT)
- INSERTION PHASE: Measured at an input power level of 0 dBm will be within ± 1.0 degrees relative to the phase measured at input power levels less than or equal to 0 dBm.
- CONNECTORS: SMA FEMALE (REMOVABLE)
- SIZE (EXCLUDING CONNECTORS): 25.4mm x 25.4mm x 10.16mm
  1.00" x 1.00" x 0.40"
- WEIGHT: 3.0 OZ MAXIMUM

*NO DC BLOCKS ARE USED IN THIS LIMITER

ENVIRONMENTAL RATINGS
- TEMPERATURE: -44°C TO +78°C (OPERATING)
- MEET OR EXCEED RATINGS: -55°C TO +65°C (NON-OPERATING)

NOTE: SPECIFICATIONS WILL VARY OVERT HEATING TEMPERATURE.
NOTE: THE ABOVE SPECIFICATIONS ARE SUBJECT TO CHANGE OR REVISION.
APPENDIX A

ENVIRONMENTAL STRESS SCREENING DETAILS
SCREENING TESTS

Environmental Stress Screening (ESS)

shall be performed on 100 percent of all items as specified herein. Device screening does not replace or supersede individual component screening requirements.

Temperature Cycling

a) The item shall be subjected to Temperature Cycling in accordance with the figure below for 10 cycles (minimum).

b) The item shall "Pass" performance tests performed in the final three (3) Temperature Cycles, minimum.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Rate of Change</th>
<th>Dwell</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
<td>From</td>
<td>To</td>
</tr>
<tr>
<td>+25</td>
<td>-44</td>
<td>10°C/Min. Minimum</td>
<td>10°C/Min. Minimum</td>
</tr>
<tr>
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<td>-44</td>
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<tr>
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<td>10°C/Min. Minimum</td>
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<td>10°C/Min. Minimum</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Notes:
1. ESS cycles shall not require RF power
2. During Qualification Testing, data shall be recorded during each cycle at both the lowest and highest specified operating temperatures.
Random Vibration

The non-operating item shall be subjected to the performance test level vibration requirements of The Figure shown below for a minimum of ten (10) minutes in the axis perpendicular to the plane of the item mounting surface.
ATTACH NON-DESTRUCT WIRE BOND PULL AND HERMETIC SEALING RESULTS.