ohmic instruments co.
508 August St. Easton, MD 21601
Voice: (410) 820-5111
Fax: (410) 822-9633
www.ohmicinstruments.com

ULTRASOUND POWER METER
Model UPM-DT-50SP

OPERATOR'S MANUAL

May 2010

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INTRODUCTION

Measurement of power output levels of diagnostic and therapeutic ultrasound equipment has become increasingly important to determine exact patient exposure levels in case a potential risk exists to the patient. Since the Radiation Control for Health & Safety Act of 1968 and the 1976 Medical Device Amendments to the FDA Act became effective, all manufacturers of diagnostic Doppler ultrasound equipment are required to submit information regarding their maximum peak and average exposure level, beam patterns, and other pertinent information. Hospitals are responsible for regularly scheduled testing (every six months) of output power and safety to maintain their accreditation.

The Ultrasound Power Meter, Model UPM-DT-50SP, is designed to measure the ultrasound power output of diagnostic or therapeutic transducers up to 30 watts. The principle of measurement is the radiant force method. The UPM-DT-50SP uses a positioning clamp with two locking ball joints to hold the transducer in de-gassed water above a conical target. The ultrasonic energy passes through the water to reflect off the target and is then absorbed by the rubber lining. The radiant power is directly proportional to the total downward force (weight) on the target. This weight is then transferred through the target support assembly to the electro-mechanical load cell inside the scale. The cell is in a computer-controlled feedback loop and produces a digital readout in watts of power custom units 'C" on the display or grams of force "G" on the display. The choice of units (grams or watts) is selected by a front panel pushbutton. The UPM-DT-50SP is supplied with a plug-in 120 VAC to 12VAC 500 mA adapter (using another adapter not rated or wired the same may damage unit). Unit can be operated off 4 AA batteries for over 40 hours. The UPM-DT-50SP has a display resolution of ±50 milliwatts.

UNPACKING THE UPM-DT-50SP

The power meter comes complete with all accessories in a sturdy metal (hard) or a molded polyethylene (soft) carrying case. Instructions for unpacking and set up for the hard case and soft case may differ in expression and detail. Be sure to refer to instructions for your unit case style. Theory and usage instructions for both case options are the same. To make ultrasonic measurements, the water tank requires only one and one half pints of de-gassed distilled water. If de-gassed water is not available, use distilled water, NOT tap water.

The following replacement parts can be ordered if necessary from Ohmic :

REPLACEMENT PARTS

- Test Tank with Rubber
- Positioning Clamp Assembly
- Cone Assembly
- Calibration Weight Standards (ORDER BOTH NUMBERS #53054-00 and # 51015-05)
- 120 VAC to 12VAC 500 mA power adapter # 12102320 (USA)
- Instruction Manual [specify "UPM-DT50SPman.PDF"

Front view of the UPM-DT-50SP. Shown is the electronic balance, base assembly, and test tank.

SELECTING A LOCATION FOR OPERATION

The UPM-DT-50SP should always be used in an environment free from excessive air currents, corrosives, vibration and temperature or humidity extremes. These factors will affect the displayed readings.

*__DO NOT__ operate the UPM-DT-50SP:

- ! Next to open windows or doors causing drafts or rapid temperature changes
- ! Near air conditioning or heat ducts
- ! Near vibrating, rotating or reciprocating equipment
- ! Near magnetic fields or equipment that generate magnetic fields
- ! On an unlevel work surface

Panel Controls & Display Indicators

1. **On/Zero *Off* :** Press to turn unit on or zero, press and hold until OFF is displayed then release to turn off.
2. **Print *Unit*** : Press to print, press and hold then release when desired unit is displayed.
3. 7 - segment display ; Shows readings. A “g” after the reading indicates grams.
4. “C” Custom unit (Watts).
5. Stability Indicator.

OPERATING PROCEDURE { } Indicate different instructions for soft case.

1. Remove the top of the metal carrying case by unlatching the clamps located on two ends. The UPM-DT-50SP is mounted on the base of the carrying case. Remove cone assembly from mounting clips. *OR **{**Open the soft case and remove the UPM-DT-50SP and all parts from the foam.**}**

2. Place the UPM-DT-50SP on a stable and level surface. Avoid air currents and mechanical vibrations.

3. Loosen the positioning clamp and position out of the way. Tank is positioned on the rubber circle. *OR **{**Place tank in holder with rubber in bottom.**}**

4. Fill the test tank to ¼ inch below the top of the rubber liner with recently de-gassed water at room temperature. *(To obtain de-gassed water, boil distilled water for 20 minutes, fill a jar completely, cover, and allow to cool).*

5. Plug the AC Adapter into a 120 VAC, 60 Hz power outlet and plug it into the power jack at the rear of the unit. Press the **ON/Zero/*Off*** button to turn unit on.

6. Lower the cone target into the concentric target support sleeve located to the back/left of the test tank (small tube inside of larger tube), while simultaneously placing the cone target into the tank. If the cone can swing in an arc, it is not down far enough. Tip the rod back and forth slightly to fully engage the rod. Press the **ON/Zero/*Off*** button to zero.

7. Allow to stabilize. With no ultrasonic power applied to the transducer, press the **ON/Zero/*Off*** button to zero the unit. By means of the positioning clamp, attach the transducer head and place its radiating face 1/8” to 1/4” inch below the water level, parallel to the water surface, and directly above the center of the cone. Check transducer surface for uniform wetting (no air pocket or bubbles should be on its surface).

8. Allow 5 minutes for the unit to stabilize.

9. Check response by placing the 1 gram weight on the arm of the cone target (the flat part that is out of the water). The UPM-DT-50SP should read 1.00 grams ± 0.1. Change the units to the watts mode by pressing and holding the **Print *Unit*** button until the unit desired is displayed then release. The UPM-DT-50SP should read 14.65 watts ± 0.2 watts. 1 gram is equal to 14.65 watts.

10. Remove the 1 gram weight. Press the **ON/Zero/*Off*** button to zero the unit.

11. Apply power to the Transducer Under Test (TUT). Re-zero before each measurement and take your power reading when the display has stabilized. It is a good practice to take three readings and average them. If measurement conditions are not stable, use the grams mode and multiply the readings by 14.65 to obtain watts .

12. Determine the maximum peak power with the maximum duty cycle and pulsed output settings with the equation:

PAVE = Pp ÷ Rtpa

PAVE = calculated average power
Pp = Peak Pulsed Power Setting on unit under test
Rtpa = Ratio of Temporal Peak to Average Power (from each manufacturer)

13. To calculate the watts/cm^2 output, take the total watts reading from the unit and divide by the area. The area is **πD2 ÷ 4** (**D** is the diameter of the transducer) if the transducer is smaller than the cone. Otherwise, use (8.2 cm) the cone's diameter as the area.

14. When finished, turn the unit off by pressing and holding **ON/Zero/*Off*** button until OFF is displayed, then release. Unplug the UPM-DT-50SP, empty the tank and dry. Dry target cone. Place tank on rubber. Place cone target assembly in clips on large tube. Put power adapter in tank, and position transducer holder over tank. Replace rubber straps and case lid. Fasten clips. *OR **{**For soft case, turn off unit. Dry tank and cone target assembly. Place in foam in case along with power adapter. Position transducer holder over tank positioner. Close case and latches.**}**

GENERAL OPERATING NOTES

Line / Battery Power: The UPM-DT-50SP is supplied with a 120 VAC 60 Hz adapter. Check for correct line voltage before use. For other voltages and frequencies used outside the US, optional power adapters can be ordered from Ohmic.

1. Slowly fill tank with degassed water. Press the On/Zero/Off button to turn unit on. Select Watts (C) or Grams (G) by pressing and holding the Print/Unit button. Release the button when unit needed is displayed. Press the On/Zero/Off button to zero unit. Place cone target assembly into test tank and in the small tube inside of the large tube. Press the On/Zero/Off button to zero the unit.
2. Place ultrasound transducer 1/8 inch into water above the center of the cone target using the clamp assembly.
3. Place the standard 1 gram test weight on the flat part of the cone target assembly. It should read (1.000) grams or 14.65 (14.65) watts.
4. Zero the unit and take the power reading. Repeat as required.
5. To turn unit OFF press and hold On/Zero/Off until OFF is display then release.

Battery operation optional. *To Install Batteries*:
Hold unit upside down. **Be careful not to allow unit to rest on target support sleeve!** Remove battery compartment cover and install 4 AA alkaline batteries, observing orientation marks. Replace the battery compartment cover. **Be careful not to damage the target support sleeve.**

Set Up: If you accidentally get into the **Setup** menu, you can get out by pushing the **Print *Unit*** button. The UPM-DT-50SP Ultrasound Power Meter is a custom programmed balance with additional hardware (cone target, tank, etc.) designed to provide ultrasound power readings. Critical programming such as calibration and Custom mode parameters are locked in and cannot be changed by the user. If reprogramming to the original parameters does become necessary, the unit must be returned to Ohmic's facility in Easton, Maryland. An hourly labor rate will be charged for any necessary repairs and recalibration fees will be assessed. A calibration certificate will be returned with the unit.

CALIBRATION CHECK

A 1-gram weight is supplied to check the calibration and programming. With the transducer under test turned off, zero the unit. Place the weight on the arm of the cone target. Within 3 seconds the unit should read 14.65 watts (± .2 watts) or 1.000grams (± .01 grams). If this reading is significantly off, the UPM-DT-50SP needs to be recalibrated. Send it to Ohmic Instruments Co. for calibration. It is recommended that the UPM-DT-50SP be returned to Ohmic on a yearly basis for calibration and certification.

SERIAL COMPUTER/PRINTER INTERFACE

An optional RS 232 or USB interface is available for the UPM-DT-50SP
RS 232 Interface part# 71147376 USB Interface part# 71147377
These adapters are easily installed and require a terminal emulation program to communicate. (ex. HyperTerminal)

SHIPPING INSTRUCTIONS FOR THE UPM-DT-50SP

To make certain that your Ultrasound Power Meter arrives at our repair department unharmed during shipment, please follow these instructions:

1. (Both case styles.) Empty water from tank and dry. Place the weight under the screw provided.

2. ***Hard Case only.** Wrap the target cone in a protective covering (bubble wrap or foam) and place in tank; **do not put target support bracket in the tabletop tube nor in the clips** (if tank should move during shipment, the bracket will be damaged). Make sure the transducer clamp assembly is screwed in place tightly over the tank and pull the large rubber band over the tank and clamp. Fasten the case lid onto the base, after making certain there is nothing loose inside
   ***Soft case only.** Place all components in foam in case. Ensure transducer clamp is tighten over tank positioner. Add bubble wrap or foam close case and latches.

3. The package used for shipping should be strong and large enough to allow for adequate packing material on all sides of unit.

4. Ship to: Ohmic Instruments Company
   508 August Street
   Easton, Maryland USA 21601

8. Enclose paperwork (packing slip, purchase order form, letterhead) which includes your return address, contact name and telephone number. A description of the work that needs to be done would be helpful.

By using the above instructions you will avoid additional charges which can be incurred if the unit is not packaged well enough to withstand rough handling during shipment. ***Neither Ohmic nor the shipping company can be held responsible for damage if these instructions are not followed.***

SPECIFICATIONS

Power Range	0 to 30 Watts
Resolution	±50 mW
Minimum Detectable Power	±50 mW
Display Sensitivity	0.05 Watt
Accuracy	±3% + One Count
Stabilization	2.5 Second Integration
Maximum Weight Capacity	120 Grams
Maximum Transducer Size	4 ” Diameter
Transducer Operating Frequency	0.5 to 10 MHz
Test Media	Degassed Water
Computer Interface	USB or RS-232
Power	12 VAC, 500 mA
120 VAC Adapter Supplied (Adapters for 240 VAC available on special order)	120 VAC to 12 VAC w/ 2-Conductor Plug and 6-Ft. Cord
EMI Rating	Conforms to CE, FCC, EEC
Electrical Safety	Conforms to UL, CE & CSA
Battery	4 AA (not included)
Size	7”H x 10.5”L x 8.5”W or 6”H x 16 3/4”L x 12.0”W
Weight	8.5 lbs. (Aluminum) Or 9.75 lbs (Polyethylene)
Carrying Case	Black Aluminum or Molded Polyethylene

MAINTENANCE

Verification of Proper Scale Functioning: Small variations of water surface motion, air currents or mechanical movements may cause uncertainties in power measurements. To test scale accuracy at low levels, set up the scale as in the Operating Procedure (Page 4 &5). Place the 14.65 watt weight on the flat surface of the target arm. Read meter three times; readings should be within ± .05 counts (for example, 14.60 to 14.70). In case of doubt about lower power resolution, repeat the same procedure using light objects such as thin paper slices to produce readings of 5 to 10 counts; repeat readings. Average uncertainty should be within ± .05 counts on the watts scale. Avoid mechanical and air movement or variations in magnetic fields while making tests.

Out of Measurement Range Warnings: Model UPM-DT-50SP accommodates weight differential of ± 120 grams. When the scale exceeds this range, "Err 2" will be displayed. Something may be pressing hard on the target or support. "Err 2" also indicates underweight condition. If no obvious error has been made by the user the unit should be returned for service when any code is displayed.

No Display: 1) Make sure the AC adapter's plug is fully seated in the jack at the back of the unit. 2) Use a voltmeter to verify the adapter is producing >12 volts AC (approximately). Call our service department for assistance.

WATER, TANK SIZE, TRANSDUCER PLACEMENT & TEMPERATURE CONSIDERATIONS

Water as a Measurement Medium: The measurements are to be performed in de-gassed water because ultrasound propagation in water closely approximates that in tissues (see UL-1-1981, AIUM/NEMA Standard Publication). The ultrasonic attenuation in water can be taken as a lower limit on the attenuation which will be encountered in the body. Large areas in the body can consist of low attenuating material such as urine and amniotic fluid. The use of water prevents measurements in a more highly attenuating material such as liver equivalent gels from representing the highest possible intensities which might be encountered in the body. A measurement temperature of 24°C ± 3°C (75°F ± 5°) is chosen for convenience.

De-Gassed Water: Ultrasound power measurement accuracy is affected (by lowering the power reading) if the water contains more than five parts per million of air. To de-gas, boil distilled water one 20 minutes, then pour into a suitable container, seal tightly and place in refrigerator. This process will give the required quality. The container should be heat resistant glass, or thick plastic may be used after the water has been cooled. Before testing, pour water into tilted test tank to minimize turbulence. The test tank water surface will absorb oxygen and a change of de-gassed water is recommended before each test. An alternative method of de-gassing water is to heat the water to boiling, then pull a vacuum for five minutes.

Water temperature affects accuracy; use a testing temperature of 21 to 27°C ambient. Sonic energy agitates the water surface through heating and scattering. Testing time should be limited to a few minutes; prolonged testing, particularly at higher power levels, will drive out dissolved air and air bubbles will be visible on surfaces in the tank. These bubbles can be gently brushed off.

Transducer Wetting and Placement: After tilting the transducer into the water at a 45° angle, verify that the surface is uniformly wetted. The transducer should be positioned above the cone target. Small variations will occur due to placement. Try various positions above target to obtain a maximum power reading.

ULTRASOUND RADIATION LEVELS

There are no maximum limits in the U.S. for therapy power, only the verification of the displayed setting accuracy to ± 20% of actual output is required. Exposure levels for physical therapy applicator heads range from 100mW/cm^2 to 3W/cm^2. Total power requires multiplication by the radiated cross sectional area in cm^2. The power limits shown in the following table for diagnostic ultrasound have been extracted from FDA Section 510(k) guidance to manufacturers on submissions and clearance as of February 1993. Refer to the AIUM and FDA publications for complete and up to date testing standards and interpretations. Measurements are done in all standard modes of operation. Power intensity is rated as Spatial Peak Temporal Average (I_{SPTA}) and Spatial Peak Pulse Average (I_{SPPA}). The values in mW/cm^2 are derated for tissue and in parenthesis for the water medium (use this chart):

PRE-AMENDMENT ACOUSTIC OUTPUT LIMITS

Use	I_{SPTA} Tissue	(mW/cm^2) Water	I_{SPPA} Tissue	(mW/cm^2) Water
Peripheral Vessel	720	1500	190	350
Cardiac	430	730	190	350
Fetal Imaging & Other *	94	180	190	350
Ophthalmic	17	68	28	110

* Abdominal, intra-operative, pediatric, small organ (breast, thyroid, testes, etc.), neonatal cephalic, adult cephalic.

THEORY OF MEASURING ULTRASOUND POWER WITH THE RADIATION FORCE METHOD

Sound is a form of energy that sets the particles in the isonated medium into vibrational motion. The particles then possess a kinetic energy. If $\mathbf{dP_m}$ is the rate of the flow of this energy about an area **dA**, then the mean acoustic energy is:

Eq. 1 $\mathbf{I = dP_m/dA}$ **I** = Acoustic intensity at a point in that area, Watts/cm^2

When a plane sound wave propagates through a uniform non-absorbent medium, the intensity must be the same for all points in the wave. Let **E** represent the energy density, i.e., the energy per unit volume. When the sound energy passes through a unit cross-sectional area with a speed **c**, the intensity is:

Eq. 2 $\mathbf{I = cE}$ **E** = Energy density per unit volume, ergs/cm^3
c = Ultrasound wave velocity, cm/sec

The radiation pressure effect can be explained by analogy to the application of an alternating electric voltage to a non-linear load. With the non-linear load it appears that both AC and DC components are present. In ultrasonics the non-linear element is the density of the fluid and hence acoustic impedance (load) varies in the same periodical manner as the density. Therefore in ultrasound the two components of pressure, one alternating and the other direct are present. The average AC pressure per cycle is zero, but the DC pressure of radiation is:

Eq. 3 $\mathbf{P\tau = I/C}$ $\mathbf{P\tau}$ = Pressure of Radiation, ergs/cm^3

Therefore, from the above two equations, the pressure of radiation ($\mathbf{P\tau}$) is equal to the energy density (**E**).

Eq. 4 $\mathbf{P\tau = E}$

It is this DC pressure of radiation that can be measured. At low frequencies, below 100 KHz, a standard high frequency hydrophone can be used. For higher frequencies, generally used in medical applications, 1-15 MHz, hydrophones are not available. At these frequencies the force can be measured using a precision balance and a radiation force target that is perfectly absorptive. The conversion from force to power can be accomplished using the equation:

Eq. 5 $\mathbf{p = Wgc}$ **W** = measured force, grams
g = acceleration, dynes
c = velocity of ultrasound, cm/sec
p = power, ergs/sec

By combining all constants together and converting from ergs/sec to watts, we obtain a simplified equation that is used to calculate the ultrasonic power once the force is measured:

$\mathbf{P = w(14.65)}$ **P** = Ultrasonic power in watts
w = Ultrasonic force in grams

To determine the ultrasonic watt density (watts/cm^2 or watts/in^2) of a given transducer the P is divided by the cross sectional area of the transducer.

WARRANTY

Not withstanding any provision of any agreement the following warranty is exclusive.

Ohmic Instruments Company warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of 1-year from date of purchase. This warranty extends only to the original purchaser. This warranty shall not apply to fuses or any product or parts which have been subjected to misuse, neglect, accident, or abnormal conditions of operation.

In the event of failure of a product covered by this warranty, Ohmic Instruments Co. will repair and recalibrate an instrument returned within 1 year of the original purchase: provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within 1 year of the original purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident, or abnormal conditions of operations, repairs will be billed at a nominal cost. In such case, an estimate will be submitted before work is started, if requested.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS, OR ADEQUACY FOR ANY PARTICULAR PURPOSE OR USE. OHMIC INSTRUMENTS COMPANY SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT, OR OTHERWISE.

If any failure occurs, the following steps should be taken:

1. Notify Ohmic Instruments Co. giving full details of the difficulty, and include the model, type, and serial numbers (where applicable). On receipt of this information, service data, or shipping instructions will be forwarded to you.

2. On receipt of shipping instructions, forward the instrument, transportation prepaid. Repairs will be made and the instrument returned, transportation prepaid.

SHIPPING TO MANUFACTURER FOR REPAIR OR ADJUSTMENT

All shipments of Ohmic Instruments Co. instruments should be made via United Parcel Service or "Best Way" prepaid. The instrument should be shipped in the original packing carton, or if it is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the instrument should be wrapped in packing material and surrounded with at least four inches of excelsior or similar shock absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER

The instrument should be thoroughly inspected immediately upon delivery to purchaser. All material in the shipping container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact Ohmic Instruments.) Final claim and negotiations with the carrier must be completed by the customer.

Ohmic Instruments Company will be pleased to answer all application or use questions, which will enhance your use of this instrument. Please address your requests or correspondence to: Ohmic Instruments Company, 508 August St., Easton, Maryland 21601, ATTN: Technical Support. Or call Ohmic Technical Support at 410-820-5111.

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email: ohmic@ohmicinstruments.com

ULTRASONIC THERAPY UNIT INSPECTION RECORD	ACTION						WORK ORDER NO.
		NOT NEEDED		NEEDED		TAKEN	

LOCATION	MANUFACTURER	DATE OF INSPECTION	CARD COLUMNS	WORK ORDER TRANSACTION
UNIT MODEL	TRANSDUCER MODEL	NEXT INSPECTION DUE	1-15	STOCK NO.
UNIT SERIAL NO.	TRANSDUCER SERIAL NO.	TECHNICIAN	18	DETACHMENT
1. PREVENTIVE MAINTENANCE INSPECTION		SAT. / UNSAT.	20-24	INDEX NO.
REMARKS			26-29	PM MANHOURS
			30	PM MINUTES
2. FUNCTIONAL/OPERATIONAL CHECKOUT		SAT. / UNSAT.	32-35	REPAIR HOURS
REMARKS			36	REPAIR MINUTES
3. LEAKAGE CURRENT - CHASSIS - 100µA TRANSDUCER - 50µA		SAT. / UNSAT.	38-43	CONTRACT COSTS

TEST CONDITION	POWER	CHASSIS	TRANSDUCER	45	REPAIRMAN'S CODE
GROUNDED NORMAL POLARITY	ON			47-50	DATE COMPLETED
	OFF			51-52	ACTION CODE
GROUND LIFTED NORMAL POLARITY	ON			53-60	WORK ORDER NO.
	OFF			61-66	RC/CC
GROUND LIFTED REVERSE POLARITY	ON			67-69	DOWN DAYS
	OFF			70-75	QUANTITY INSPECTED
4. GROUND WIRE RESISTANCE (150 milliohms max.)			_____m ohms	78-80	TRANSACTION CODE

5. TIMER	TOL.	SELECTED	TIMED		
< 8 MIN.	± 0.8 MIN.			6. ANNUAL INSPECTION REQUIREMENTS COMPLETED	DATE
8 M. - 10 MIN.	± 10%			7. IS UNIT SUBJECT TO 21CFR1050 REQUIREMENTS?	YES NO
> 10 MIN.	± 1.0 MIN.			8. COMBINED MUSCLE STIMULATOR INSPECTED?	YES NO

REMARKS

WORK PERFORMED BY	LABEL AFFIXED:
	USER MAINTENANCE:

9. CONTINUOUS WAVE MODE CERTIFICATION (Average Power)

WATTS SELECT		POWER ON	POWER OFF	DIFF.	WATTS OUT	ALLOWABLE RANGE	
5	1					3.7 - 6.3	
	2						
	3					SAT.	UNSAT.
	Average of 3 Readings						

WATTS SELECT		POWER ON	POWER OFF	DIFF.	WATTS OUT	ALLOWABLE RANGE	
10	1					7.4 - 12.6	
	2						
	3					SAT.	UNSAT.
	Average of 3 Readings						

WATTS SELECT		POWER ON	POWER OFF	DIFF.	WATTS OUT	ALLOWABLE RANGE	
15	1					11.1 - 18.9	
	2						
	3					SAT.	UNSAT.
	Average of 3 Readings						

WATTS SELECT		POWER ON	POWER OFF	DIFF.	WATTS OUT	ALLOWABLE RANGE	
20	1					14.8 - 25.2	
	2						
	3					SAT.	UNSAT.
	Average of 3 Readings						

WATTS SELECT		POWER ON	POWER OFF	DIFF.	WATTS OUT	ALLOWABLE RANGE	
	1						
	2						
	3					SAT.	UNSAT.
	Average of 3 Readings						

WATTS SELECT		POWER ON	POWER OFF	DIFF.	WATTS OUT	ALLOWABLE RANGE	
	1						
	2						
	3					SAT.	UNSAT.
	Average of 3 Readings						

10. PULSED MODE CERTIFICATION (Amplitude Modulated Waveform)

MAX. PULSE MODE SETTING	POWER ON	POWER OFF	DIFF.	WATTS OUT	CALCULATIONS
(Pp)					
	Average of 3 Readings			= Measured Average Power (Av)	

Pp	R_{TPA}	CALC. AVERAGE POWER (Pp / R_{TPA})	Difference Between Measured AV And Calculated AV	Is Difference < ± 0.6% Of (Pp / R_{TPA}) YES NO	REMARKS

11. SHORT TERM LIFE TEST COMPLETE? YES NO

12. ADDITIONAL TEST (Describe in Detail):