Ludlum Measurements, Inc.

Model 9-4

ANSI 42.17A TESTS PERFORMED

Characteristics Under Test	Range of Values	Limits of Variation	Section	Pass / Fail
GENERAL CHARACTERISTICS				
AC power	102-132 or 178-238 V	5%	4.10.2	
Battery power	0-100 h	10%	4.11.2	
Battery power indicator	Test at voltage that triggers battery failure indication	10% reference voltage produced by fresh batteries	4.12.2	
AC-powered instruments with battery backup	Markings for units with rechargeable batteries	_	4.13.2	
	Test when battery condition indicator first shows failure	10%	4.13.2	
ELECTRONICS AND MECHANICAL TESTS				
Check circuits	Per manufacturer's recommendations	_	5.1.2	
Alarms, reset	Dose rate to activate alarm	See 5.2.1	5.2.2.1	
Alarms, delay	Dose rate to activate alarm	1 s to 60 s (see 5.2.1)	5.2.2.2	
Alarms, threshold drift	Dose rate to activate alarm	10% over 500 h	5.2.2.3	
Stability	Battery powered: 3h	6% reference initial reading	5.3.2	
	AC-powered: 24 h	6% reference initial reading	5.3.2	

	AC-powered: 500 h	**15% reference initial reading**	**5.3.2**	
Geotropism	**Test in all spatial orientations**	**6% reference standard orientation**	**5.4.2**	**Pass**
Response time	**See standard**	**See standard**	**5.5.2**	
Coefficient of variation	**≥ 1 mR/h, 1mrd/h, 10 mrem/h 2000 dpm**	**10%**	**5.6.2**	
Line noise susceptibility	**See standard**	**15% from reference**	**5.7.2**	

Characteristics Under Test	Range of Values	Limits of Variation	Section
	RADIATION RESPONSE		
Accuracy, photon dose rate	**0.1 mrd/h-1000 rd/h**	**±**15% from conventionally true value	**6.1.2.1**
Accuracy, count rate and contamination monitors	**50 dpm/cm^2-** 10^4 dpm/cm^2	**±**15% from conventionally true value	**6.1.2.2**
Accuracy, beta or neutron dose rate	**0.1 mrem/h-1000 rem/h**	**±**15% from conventionally true value	**6.1.2.3**
Probe surface sensitivity	**Stated by manufacturer**	**_**	**6.2.2**
Photon energy dependance	**(1) 80 keV to 1.25 MeV**	**_**	**6.3.2**
	(2) 20 keV to 3.0 MeV	**_**	**6.3.2**
Beta energy dependance	**(1) 0.5 MeV to 3.5 MeV (E_{max})**	**_**	**6.4.2**
	(2) 0.2 MeV to 3.5 MeV (E_{max})	**_**	**6.4.2**

Neutron energy dependance	**0.025 eV to 14 MeV**	**_**	**6.5.2**	
Photon radiation overload	**100 times upper limit ≤ 10 rd/h**	**Correct response within 2 min**	**6.6.2**	
Angular dependance	**0-45**° (photon) 45-90°	**<**20% change in reading <50% change in reading	**6.7.2**	
	0-45° (beta)	**<50% change in reading**	**6.7.2**	**Pass**
INTERFERING RESPONSE				
Extracameral response	**Range of instrument**	**5% reference standare orientation**	**7.1.2**	
RF fields	**(1) Per user requirements**	**15% reference standard conditions**	**7.2.2**	
	(2) 100 V/m, 0.3 to 35 MHz	**15% reference standard conditions**	**7.2.2.1**	
	(3) 100 V/m at ~140 MHz	**15% reference standard conditions**	**7.2.2.2**	
Microwave fields	**(1) Per user requirements**	**15% reference standard conditions**	**7.3.2**	
	(2) 100 W/m^2 at 915 MHz, 2450 MHz	**15% reference standard conditions**	**7.3.2**	

Characteristics Under Test	Range of Values	Limits of Variation	Section	
INTERFERING RESPONSE (*continued*)				
Electrical fields	**(1) 500 V/m**	**15% reference standard conditions**	**7.4.2.1**	**Pass**

	(2) 100 V/m at 60 Hz, 400 Hz	**15% reference standard conditions**	**7.4.2.2**	
Magnetic Fields	**800 A/m**	**15% reference standard conditions**	**5.5.2**	**Pass**
Interfering radiation	**See standard**	**See standard**	**5.6.2**	
	ENVIRONMENTAL FACTORS			
Temperature	**(1) 0-40** °C	**15% reference 22** °C	**8.1.2**	**Pass**
	(2) -10-50 °C	**20% reference 22** °C	**8.1.2**	
Temperature shock	**(1)** -10 °C from / to 22 °C	**15% reference 22** °C	**8.2.2**	**Pass**
	(2) 50 °C from / to 22 °C	**15% reference 22** °C	**8.2.2**	
Humidity	**40% RH to 95% RH (T = 22** °C ± 2 °C)	**15% reference, 40% RH**	**8.3.2**	**Pass**
Mechanical shock	**50 g acceleration of 18 ms, half sine wave, test on 3 orthogonal axes, 10 times**	**15% reference standard conditions**	**8.4.2**	**Pass**
Vibration	**2 g acceleration, frequency range of 10-33 Hz, test on 3 orthogonal axes for 15 min**	**15% reference standard conditions**	**8.5.2**	
Ambient pressure	**70-106 kPa**	**15% reference, 101 kPa**	**8.6.2**	**Pass**
Splashproof	**2 min fine spray (4 L/min 2 m from nozzle)**	**15% reference standard conditions**	**8.7.2**	**Pass**

ANSI 42.17A Electric Fields Test Model 9-4

May 13, 2009 S/N 259053
Using 6 10µCi Cs137 for response and monitoring

ANSI 42.17A-1989
Sections **7.4 Electric Fields**
7.4.1 Requirements
7.4.2 Test
7.4.2.1 Electrostatic Field Test
7.4.2.2 60Hz and 400Hz Electric Fields

Field Strength	mR/hr	
0Hz	1	@ 2hrs
60Hz	1	@ 2hrs
400Hz	1	@ 2hrs

ANSI 42.17A Magnetic Fields Test

May 13, 2009 S/N 259053
Using 6 10µCi Cs137 for response and monitor

7.5 Magnetic Fields
7.5.2 Test

Average of Readings in mR/hr		
800A/m	S/N PR 208773	Percentage of Base
Background	0	100.00000
W/ Source Outside of chamber	1	100.00000
0 vert	1	100.00000
0 horz	1	100.00000
1 vert	1	100.00000
1 horz	1	100.00000

Maximum deviation allowed is 15%

ANSI N42.17A-1989 Temp Test Model 9-4

Test: 8.1 Temperature
Test: 8.1.1 Requirements
Test: 8.1.2 Test

Using (6) six Cs137 10µCi each for source reading.

Serial #259053	Reading mR/hr X10	Meter Reading Percentage of Base
Initial	1.00	100.00%
-20 C 4 Hrs	1.00	100.00%
-20 C 3HR	1.00	100.00%
-20 C 2HR	1.00	100.00%
-20 C 1HR	1.00	100.00%
-20 C	1.00	100.00%
-10 C	1.00	100.00%
0 C	1.00	100.00%
10 C	1.00	100.00%
20 C	1.00	100.00%
30 C	0.90	90.00%
40 C	0.90	90.00%
50 C	0.90	90.00%
50 C 1HR	0.90	90.00%
50 C 2HR	0.90	90.00%
50 C 3HR	0.90	90.00%
50 C 4HR	0.90	90.00%

ANSI 42.17A Low Temperature Shock Test Model 9-4

May 12, 2009 S/N 259053
Using 6 10µCi Cs137 for response and monitoring

8.2 Temperature Shock
8.2.2 Test

Serial#	259053	@X10
Base 22c	1.00	
in -10c	1.00	
-10c +15m	1.00	
-10c +30m	1.00	
-10c +45m	1.00	
-10c +1hr	1.00	
-10c +2hr	1.00	
out 22c	1.00	
22c +15m	1.00	
22c +30m	1.00	
22c +45m	1.00	
22c +1hr	1.00	

ANSI 42.17A High Temperature Shock Test Model 9-4

May 12, 2009 S/N 259053
Using 6 10µCi Cs137 for response and monitoring

8.2 Temperature Shock
8.2.2 Test

Serial#	193903	@X10
Base 22c	1.00	
in 50c	1.00	
50c +15m	1.00	
50c +30m	1.00	
50c +45m	0.90	
50c +1hr	0.90	
50c +2hr	0.90	
out 22c	0.90	
22c +15m	0.90	
22c +30m	0.90	
22c +45m	1.00	
22c +1hr	1.00	

ANSI A Humidity Test 8.3.2 Model 9-4

05/13/2009 Serial #259053

Using (6) Cs137 10µCi sources

@X10	Reading mR/hr	Percentage of Base
Initial	1.00	100.00%
25c 28%	1.00	100.00%
25c 40%	1.00	100.00%
24c 96%	1.00	100.00%
24c 98%	1.00	100.00%
Ambient	1.00	100.00%

ANSI N42.17A-1989 8.6.2 Ambient Pressure Test Model 9-4

05/13/09

W/ (6) Cs137 10µCi Total, room temperature 25.0ºC

Test done at room temp. 25ºC

#259053	Reading mR/hr	Percentage of Base
Initial 94.6kPa	1.0	100.00%
106	1.0	100.00%
92	1.0	100.00%
84	1.0	100.00%
76	1.0	100.00%
70	1.0	100.00%

Notes: Running at room temp.the M9-4 takes about 8 to 10 seconds to stabilize.

ANSI N42.17A-1989 Rain Test Model 9-4

8.7 Splashproof

Instrument response shall not vary more than 15% from the mean of a set of reference readings after being subjected to water spray in accordance with 8.7.2.
Testing: Rain exposure 2 meters from instrument for 2 minutes.
Using (6) 10µCi Cs137 C/S

Serial 259053

At room temp. and dry, the M9-4 reads an average of ~1mr/hr
Exposing the intrument to rain chamber the instrument showed no problems.

Examination showed the interior dry, electrical componets dry.