

Test Report

Report No.: EASZF05270001

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APPLICATION FOR LUMEN MAINTENANCE TESTING ACCORDING TO THE IES LM-80-08 TEST STANDARD

Prepared for: **Brightek Optoelectronic CO., LTD**

**No. 7, Bai Sha Road, Xinqiao 2nd Industrial Estate Shajing Bao an District,
 Shenzhen China 518125**

Description of the submitted sample(s):

Sample Name : 2835 0.2W Lighting Series
 Sample Model : WW 3000K
 Model Tested : WW 3000K
 Ratings : 60 mA
 Target CCT : 3000K
 State of Sample(s) : Normal
 Sample Quantity : 40 pcs
 Manufacturer : Brightek Optoelectronic CO., LTD
 Reference Standard : IES LM-80-08 Approved Method: Measuring Lumen Maintenance of LED Light Sources

Sample Received Date : May. 24, 2013

Sample Tested Date : May. 24, 2013 to Feb. 21, 2014

The laboratory that conducted the testing items in this report has been accredited by the National Voluntary Laboratory Accreditation Program (NVLAP LAB CODE: 200889-0), for LM-79 testing of SSL products.

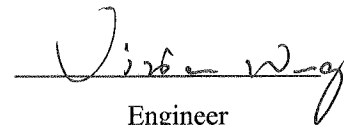
And the report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Tested by



Tester

Reviewed by



Engineer

Approved by



Supervisor

Date

Mar. 25, 2014

Check No.: 1702045991

CENTRE TESTING INTERNATIONAL CORPORATION

 NO.1996, Xin jin qiao Road, Pudong
 New District, Shanghai, 201206, China

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1 SUMMARY

	LM-80 Required Temperature		Specified Temperature of the manufacturer
	55°C	85°C	--°C
Number of LED tested	20	20	--
Drive Current [I _F]	60 mA	60 mA	--
Measurement Current [I _F]	60 mA	60 mA	--
Actual Case Temp. [T _s]	54.7°C	84.8°C	--
Actual Ambient Temp. [T _A]	54.3°C	84.1°C	--
$\Delta[T_s - T_A]$	0.4°C	0.7°C	--
Average Lumen Maintenance at 6000 hours	100.11 %	98.27%	--
Ave. Chromaticity Shift ($\Delta u'v'$) at 6000 hours	0.0006	0.0008	--
Calculated L70(6k) (hours)	161,000	56,000	--
Reported L70(6k) (hours)	>36000	>36000	--
Failures observed	None	None	--

Test Time Points/Average Lumen Maintenance							
Case Temperature	0 Hour	1,000 Hours	2,000 Hours	3,000 Hours	4,000 Hours	5,000 Hours	6,000 Hours
55°C	100.00	100.81	100.48	100.55	99.26	99.43	100.11
85°C	100.00	100.97	100.39	98.77	97.31	97.68	98.29
--°C	--	--	--	--	--	--	--

Test Time Points/Average Color Shift ($\Delta u'v'$)							
Case Temperature	0 Hour	1,000 Hours	2,000 Hours	3,000 Hours	4,000 Hours	5,000 Hours	6,000 Hours
55°C	0.0000	0.0006	0.0011	0.0020	0.0010	0.0005	0.0006
85°C	0.0000	0.0006	0.0013	0.0020	0.0010	0.0008	0.0008
--°C	--	--	--	--	--	--	--

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2 EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due Date
Spectroradiometer	CDS 2100	ATTEELSH00111	Sept. 22,2012	Sept. 21,2013
Integrating Sphere	LMS-200	ATTEELSH00115	Sept. 22,2012	Sept. 21,2013
Standard Lamp	SCL-600	ATTEELSH00116	Aug.14, 2013	Aug.13, 2014
Digital Recorder	HIOKI LR8400-21	TTE20100242	Oct. 10, 2012	Oct. 09, 2013
Digital Recorder	HIOKI LR8400-21	TTE20100242	Jul.18, 2013	Jun.17, 2014
Digital CC&CV DC Power Supply	GPD-3303S	TTE20110233	Jul.10, 2012	Jun.9, 2013
Digital CC&CV DC Power Supply	GPD-3303S	TTE20110233	Jul.01, 2013	Jun.30, 2014
Digital CC&CV DC Power Supply	GPR-30H10D	TTE20110389	Jul.10, 2012	Jun.9, 2013
Digital CC&CV DC Power Supply	GPR-30H10D	TTE20110389	Jul.01, 2013	Jun.30, 2014
High Temperature Chamber	NMT-1200	TTE20100237	--	--
High Temperature Chamber	NMT-1200	TTE20100240	--	--
Ture RMS Multimeter	189	ATTEELSH00042	Jul.10, 2012	Jun.9, 2013
Ture RMS Multimeter	189	ATTEELSH00042	Jul.01, 2013	Jun.30, 2014
Digital power meter	WT210	ATTEELSH00150	Oct. 15, 2012	Oct. 14, 2013
Digital power meter	WT210	ATTEELSH00150	Jul.01, 2013	Jun.30, 2014

3 Photometry Measurement Uncertainty

The uncertainty of the light output measurements is $U=1.7\%$ ($K=2$), at the 95% confidence level. This calibration results traceable to the NATIONAL INSTITUTE OF METROLOGY (NIM).

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4 TEST METHODS

4.1 Requirements of Environmental Conditions

Operation of the LED light sources between photometric measurements shall be at a minimum of three case temperatures, T_s , using the same drive current. The three case temperatures, T_s , shall be 55°C and 85°C with a third temperature selected by the manufacturer. Case temperatures shall be controlled to -2°C during life testing. The temperature of the surrounding air should be maintained to within -5°C of the case temperature during testing. The surrounding air temperature should be monitored within the test chamber. Humidity shall be maintained to less than 65%RH throughout the life test.

The case temperature T_s is the cathode lead temperature of the LED mounted on a reliability test board. The ambient temperature T_A is the temperature of the air at a distance of 50mm above the reliability test board.

The ambient temperature during lumen and chromaticity measurements shall be set to 25°C ± 2°C. The LED light source shall be required to cool to room temperature prior to measurement.

Airflow shall be minimized for proper light source starting and operation.

The operating orientation of the LED light sources under test should be as specified by the manufacturer.

4.2 Lumen Maintenance Testing Method

Samples under test shall be driven for at least 6,000 hours with data collection at a minimum of every 1000 hours. 10,000 hours are preferred for the purposes of improved predictive modeling.

LED light sources are driven at constant current.

Checking for LED light source failures either by visual observation or automatic monitoring shall be done at a minimum of every measurement interval. Catastrophic LED light source failure shall be reported and included in the test report.

The chromaticity shift shall be measured and reported over the course of the lumen maintenance test time by measuring chromaticity at each photometric test interval.

4.3 Photometric and Electrical Measurements

A Labsphere Model CDS 2100 CCD Spectroradiometer and 50cm Integrating Sphere was used to measure total luminous flux, correlated color temperature, color rendering index, and chromaticity coordinates for each sample.

Ambient temperature was measured at a position inside the integrating sphere. Electrical measurements including voltage, current, and power were measured using the Digital Power Meter.

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5 TEST RESULTS

5.1 55°C, 60 mA

Case Temperature [T_s] : 54.7°C
 Ambient Temperature [T_A] : 54.3°C
 Drive Current [I_F] : 60 mA
 Measurement Current : 60 mA

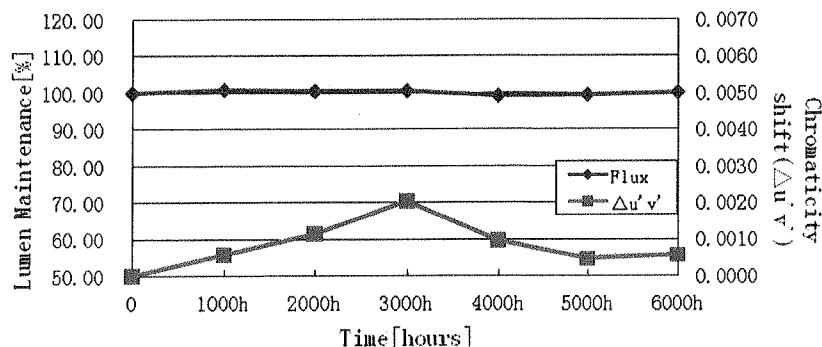
No.	Φ _v [lm]	V _F [V]	CCT (K)	Lumen Maintenance [%]					
				0 h (Initial)	1000 h	2000 h	3000 h	4000 h	5000 h
1	20.36	3.097	3075.2	98.92	97.30	96.86	95.68	94.70	98.04
2	19.29	3.101	3075.9	103.16	101.76	100.67	100.36	102.02	102.18
3	18.64	3.100	3114.8	104.51	104.40	104.40	103.92	104.40	101.98
4	19.74	3.113	3046.9	98.02	98.73	98.48	97.72	96.15	98.83
5	19.92	3.096	3063.3	99.10	100.10	100.45	98.49	95.63	99.40
6	19.41	3.089	3040	100.67	95.21	95.93	94.64	94.80	98.04
7	19.86	3.091	3027.4	100.15	100.15	100.81	99.14	99.40	99.90
8	19.01	3.095	3020.6	103.10	103.79	104.37	102.47	102.52	103.63
9	18.93	3.094	3045.8	102.91	104.17	104.75	103.06	102.17	102.64
10	19.07	3.099	3045.7	102.78	104.09	103.62	102.31	100.10	101.68
11	19.92	3.097	3016.1	98.59	98.74	98.44	97.34	97.29	97.09
12	19.52	3.089	3032.9	99.95	100.56	101.02	99.39	100.67	99.59
13	19.98	3.096	3052.2	98.00	97.75	97.30	96.50	96.95	97.80
14	19.57	3.098	3081.1	100.51	99.34	99.54	97.85	99.49	98.62
15	19.13	3.111	3086.9	103.19	102.40	102.04	100.94	102.46	101.46
16	19.27	3.087	3031.4	102.23	103.43	103.89	102.44	103.79	102.96
17	19.74	3.096	3036.7	98.38	99.75	100.20	98.63	99.09	99.44
18	19.42	3.108	3055.2	99.07	99.28	99.07	97.99	98.35	97.27
19	19.52	3.092	3045.2	100.87	99.28	99.39	98.51	99.23	102.25
20	19.62	3.085	3049.3	102.14	99.34	99.69	97.71	99.49	99.34
n	20	20	20	20	20	20	20	20	20
Mean	19.50	3.10	3052.13	100.81	100.48	100.55	99.26	99.43	100.11
Median	19.52	3.10	3046.35	100.59	99.92	100.33	98.57	99.44	99.52
St. dev.	0.42	0.01	24.56	2.05	2.56	2.61	2.57	2.90	2.06
Min.	18.64	3.09	3016.10	98.00	95.21	95.93	94.64	94.70	97.09
Max.	20.36	3.11	3114.80	104.51	104.40	104.75	103.92	104.40	103.63

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No.	u'	v'	Chromaticity Shift $\Delta u'v'$					
	0 h (Initial)		1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	0.2483	0.5196	0.0006	0.0010	0.0020	0.0008	0.0001	0.0003
2	0.2485	0.5199	0.0007	0.0011	0.0016	0.0005	0.0001	0.0006
3	0.2477	0.5177	0.0008	0.0009	0.0014	0.0004	0.0002	0.0007
4	0.2491	0.5214	0.0006	0.0008	0.0016	0.0005	0.0001	0.0005
5	0.2481	0.5215	0.0004	0.0011	0.0019	0.0009	0.0006	0.0002
6	0.2498	0.5230	0.0007	0.0041	0.0059	0.0047	0.0004	0.0023
7	0.2488	0.5251	0.0006	0.0010	0.0017	0.0007	0.0002	0.0004
8	0.2498	0.5223	0.0006	0.0011	0.0019	0.0009	0.0006	0.0004
9	0.2488	0.5227	0.0007	0.0011	0.0017	0.0007	0.0002	0.0005
10	0.2482	0.5256	0.0006	0.0008	0.0016	0.0006	0.0026	0.0030
11	0.2493	0.5236	0.0006	0.0006	0.0017	0.0007	0.0005	0.0003
12	0.2497	0.5194	0.0004	0.0010	0.0021	0.0009	0.0005	0.0000
13	0.2492	0.5181	0.0006	0.0012	0.0021	0.0009	0.0004	0.0003
14	0.2479	0.5193	0.0004	0.0009	0.0020	0.0008	0.0003	0.0001
15	0.2478	0.5193	0.0006	0.0012	0.0021	0.0010	0.0004	0.0002
16	0.2489	0.5231	0.0007	0.0009	0.0018	0.0007	0.0004	0.0001
17	0.2489	0.5220	0.0005	0.0011	0.0019	0.0009	0.0006	0.0002
18	0.2491	0.5205	0.0006	0.0011	0.0017	0.0007	0.0002	0.0005
19	0.2494	0.5188	0.0004	0.0010	0.0021	0.0011	0.0005	0.0002
20	0.2483	0.5230	0.0004	0.0009	0.0018	0.0008	0.0002	0.0002
n	20	20	20	20	20	20	20	20
Mean	0.2488	0.5213	0.0006	0.0011	0.0020	0.0010	0.0005	0.0006
Median	0.2489	0.5215	0.0006	0.0010	0.0019	0.0008	0.0004	0.0003
St. dev.	0.0007	0.0023	0.0001	0.0007	0.0009	0.0009	0.0005	0.0007
Min.	0.2477	0.5177	0.0004	0.0006	0.0014	0.0004	0.0001	0.0000
Max.	0.2498	0.5256	0.0008	0.0041	0.0059	0.0047	0.0026	0.0030



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5.2 85°C, 60 mA

Case Temperature [T_s] : 84.8°C
Ambient Temperature [T_A] : 84.1°C
Drive Current [I_F] : 60 mA
Measurement Current : 60 mA

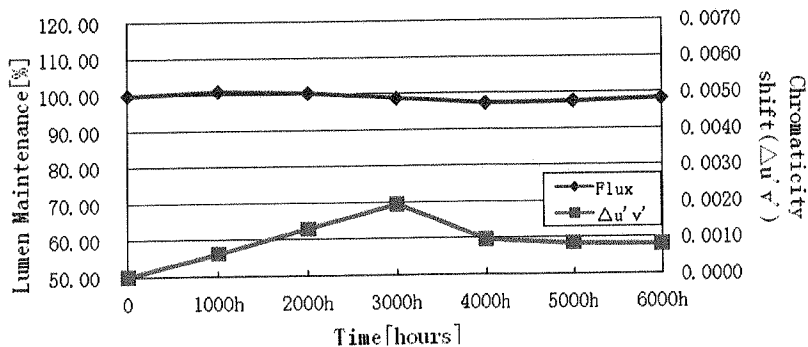
No.	Φ _v [lm]	V _F [V]	CCT (K)	Lumen Maintenance [%]					
				0 h (Initial)	1000 h	2000 h	3000 h	4000 h	5000 h
1	18.56	3.106	2994.8	103.72	104.90	103.77	101.51	97.95	103.23
2	20.14	3.095	3109.5	100.05	97.52	96.28	94.59	95.63	94.64
3	19.81	3.102	3018.1	99.29	98.69	98.13	95.56	98.94	97.32
4	19.52	3.120	3101.1	100.05	99.13	99.39	97.18	97.23	97.08
5	19.48	3.091	2978.6	98.31	99.64	98.20	97.48	96.36	95.07
6	20.47	3.092	3094.4	98.29	97.07	95.11	94.19	91.70	95.16
7	19.93	3.116	3095.3	97.79	99.05	98.19	96.09	95.13	97.54
8	20.08	3.103	3066	98.11	98.75	97.16	96.56	99.10	97.11
9	19.64	3.111	3053.2	100.97	101.17	97.96	96.59	98.98	97.81
10	18.96	3.092	3070.8	102.58	103.59	100.79	99.10	101.85	101.58
11	19.13	3.099	3144.4	102.98	102.46	99.37	99.01	102.30	100.78
12	20.25	3.107	3070.1	98.96	96.84	95.16	93.63	96.30	95.21
13	20.04	3.101	3090.6	99.60	98.40	96.21	95.56	94.36	95.11
14	19.55	3.101	3071.5	102.30	100.51	99.23	96.98	99.34	97.75
15	19.40	3.125	3098.7	101.60	101.70	99.07	97.42	99.02	98.61
16	19.21	3.099	3060.4	103.07	102.81	101.30	100.21	100.36	100.73
17	19.37	3.097	3056.8	102.32	101.55	100.00	99.02	100.15	98.97
18	18.82	3.096	3015	102.87	101.12	99.63	98.72	96.92	100.64
19	19.46	3.091	3119	102.62	100.62	99.08	97.64	94.96	99.43
20	19.21	3.096	3005.9	103.90	102.24	101.35	99.12	97.08	101.93
n	20	20	20	20	20	20	20	20	20
Mean	19.55	3.10	3065.71	100.97	100.39	98.77	97.31	97.68	98.29
Median	19.50	3.10	3070.45	101.28	100.56	99.07	97.30	97.59	97.78
St. dev.	0.50	0.01	44.12	2.06	2.22	2.16	2.05	2.63	2.57
Min.	18.56	3.09	2978.60	97.79	96.84	95.11	93.63	91.70	94.64
Max.	20.47	3.13	3144.40	103.90	104.90	103.77	101.51	102.30	103.23

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No.	u'	v'	Chromaticity Shift $\Delta u'v'$					
	0 h (Initial)		1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	0.2514	0.5206	0.0009	0.0009	0.0014	0.0004	0.0002	0.0005
2	0.2470	0.5200	0.0005	0.0007	0.0016	0.0005	0.0003	0.0005
3	0.2493	0.5242	0.0006	0.0007	0.0013	0.0004	0.0002	0.0004
4	0.2480	0.5189	0.0007	0.0007	0.0010	0.0002	0.0006	0.0012
5	0.2485	0.5256	0.0007	0.0039	0.0049	0.0041	0.0033	0.0026
6	0.2492	0.5212	0.0006	0.0096	0.0088	0.0079	0.0072	0.0033
7	0.2480	0.5194	0.0004	0.0006	0.0010	0.0001	0.0005	0.0012
8	0.2490	0.5183	0.0005	0.0009	0.0018	0.0007	0.0001	0.0003
9	0.2491	0.5200	0.0006	0.0006	0.0015	0.0004	0.0004	0.0005
10	0.2478	0.5207	0.0004	0.0007	0.0019	0.0009	0.0004	0.0002
11	0.2460	0.5190	0.0004	0.0006	0.0016	0.0005	0.0003	0.0006
12	0.2474	0.5237	0.0006	0.0006	0.0014	0.0003	0.0001	0.0004
13	0.2481	0.5185	0.0006	0.0006	0.0014	0.0002	0.0004	0.0005
14	0.2488	0.5193	0.0006	0.0009	0.0017	0.0006	0.0000	0.0006
15	0.2483	0.5181	0.0008	0.0007	0.0012	0.0002	0.0007	0.0010
16	0.2480	0.5234	0.0009	0.0008	0.0012	0.0002	0.0004	0.0005
17	0.2484	0.5223	0.0005	0.0009	0.0016	0.0006	0.0002	0.0004
18	0.2498	0.5224	0.0008	0.0004	0.0014	0.0004	0.0005	0.0004
19	0.2466	0.5199	0.0007	0.0007	0.0013	0.0002	0.0005	0.0005
20	0.2501	0.5237	0.0009	0.0004	0.0012	0.0003	0.0005	0.0007
n	20	20	20	20	20	20	20	20
Mean	0.2484	0.5210	0.0006	0.0013	0.0020	0.0010	0.0008	0.0008
Median	0.2484	0.5203	0.0006	0.0007	0.0014	0.0004	0.0004	0.0005
St. dev.	0.0012	0.0022	0.0001	0.0021	0.0018	0.0019	0.0016	0.0008
Min.	0.2460	0.5181	0.0004	0.0004	0.0010	0.0001	0.0000	0.0002
Max.	0.2514	0.5256	0.0009	0.0096	0.0088	0.0079	0.0072	0.0033



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6 TM-21-11 Report: Projecting Long Term Lumen Maintenance of LED Light Source

Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)		Manufacturer: Brightek Optoelectronic CO., LTD Model: WW 3000K			
		Test Condition 1 - 55°C Case Temp		Test Condition 2 - 85°C Case Temp	
Sample size	20	Sample size	20	Sample size	-
Number of failures	0	Number of failures	0	Number of failures	-
DUT drive current used in the test (mA)	60	DUT drive current used in the test (mA)	60	DUT drive current used in the test (mA)	-
Test duration (hours)	6,000	Test duration (hours)	6,000	Test duration (hours)	-
Test duration used for projection (hour to hour)	1,000 - 6,000	Test duration used for projection (hour to hour)	1,000 - 6,000	Test duration used for projection (hour to hour)	-
Tested case temperature (°C)	55	Tested case temperature (°C)	85	Tested case temperature (°C)	-
α	2.265E-06	α	6.614E-06	α	-
B	1.009	B	1.012	B	-
Calculated L70(6k) (hours)	161,000	Calculated L70(6k) (hours)	56,000	Calculated L70(6k) (hours)	-
Reported L70(6k) (hours)	>36000	Reported L70(6k) (hours)	>36000	Reported L70(6k) (hours)	-

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Photos of the sample

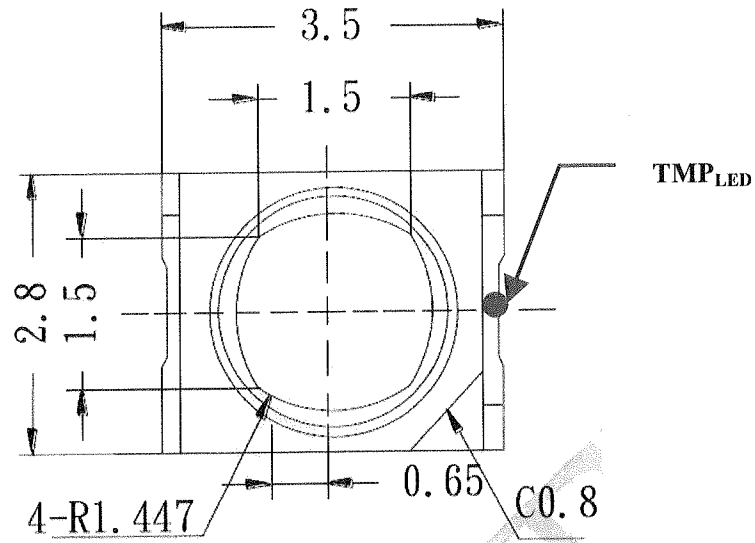


Fig.1- Mechanical Dimension

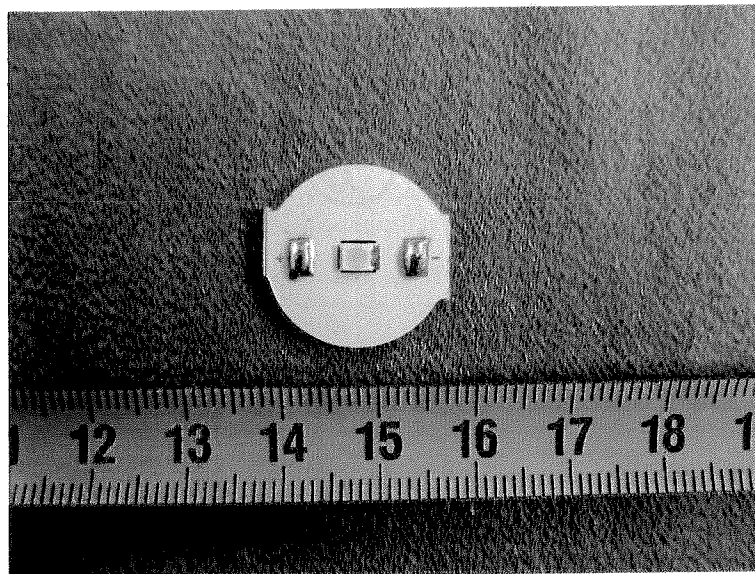


Fig.2- Overall view

*** End of Report ***

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