

BNCE7: 2008 testing of TV luminance and ambient lighting control

Version 1.1

This Briefing Note and referenced information is a public consultation document and will be used to inform Government decisions. The information and analysis forms part of the Evidence Base created by Defra's Market Transformation Programme.

1 Introduction

This briefing note provides an overview of testing considerations and testing results around default/home mode luminance settings on TVs, and potential savings through application of ambient lighting control (ALC).

2 Testing Approach – IEC 62087

The international standard IEC 62087:2008 Edition 2.0 specifies methods of measurement for the power consumption of audio, video and related equipment, and provides the foundation for standardised power measurement for television sets.

Television sets include, but are not limited to, those with Cathode Ray Tube (CRT), Liquid Crystal Display (LCD), Plasma Display Panel (PDP) or projection technologies. The second edition cancels and replaces the first edition, published in 2002 and constitutes a major technical revision of the testing methodology for TV on-mode power requirements¹. There are two main changes in this revision:

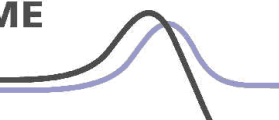
- Use of dynamic (moving picture) test loop clips from world wide TV programmes to replace the static test patterns used in the previous version – enabling an accurate assessment of the power requirement of all TV display technologies on average TV programmes.
- Use of a Blu-ray Disc™ for high definition testing.
- Suggested metrics for declaring the energy efficiency of the TV based on power requirement testing results and the impact of some energy saving features².

This testing standard, including DVDs of the test material, is available for purchase from:

<http://webstore.iec.ch/webstore/webstore.nsf/artnum/041946?opendocument>

¹ in the normative section of the Standard

² In the informative part of the Standard



3 Default luminance

IEC 62087 requirements now state that testing should be carried out at the default luminance setting recommended by the manufacturers for the home use of the TV. Some parts of the TV industry have raised concerns that this testing at a recommended default may provide some manufacturers with an opportunity to “game” the system by configuring default home settings to unrealistically low luminance (thus reducing the declared on-mode power requirement of the TV). In Australia, the Australian Greenhouse Office³ (AGO) has discussed the possibility of specifying an acceptable level for the peak luminance value in the recommended home setting, as a percentage of peak luminance in the brightest preset picture setting.

4 Ambient Lighting Control (ALC)

Ambient lighting control reduces the overall brightness of the whole screen when the light level of the room (ambient light) is low. This is more comfortable for the viewer and can also reduce power consumption.

50% of 2008 models tested in previous tests in the UK had been found to have ambient lighting control, although it was not enabled “out of the box” on the majority of models. On most models the feature has to be enabled as a viewing option, normally called ECO setting, which can often inhibit other picture options.

In IEC 62087, 2008 Edition 2.0, two measurements are required to assess the impact of ALC. These are the average power measurement on the dynamic TV test loop, made both with ALC fully active and then inactive.

5 Testing on ALC and default luminance

2008 testing was carried out to evaluate recommended home default luminance levels as a percentage of maximum luminance, and determine potential savings due to ALC being configured. 22 TV models were tested in the UK, and 24 models were tested in Australia. Tables of results from this testing are shown in the Appendices.

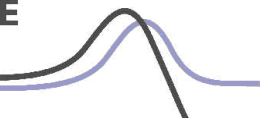
Observations from testing as summarised in the table below:

Table 1 Testing Observations

	Saving due to ALC			Luminance as % maximum		
	Min	Ave	Max	Min	Ave	Max
UK tests	4%	30%	52%	55%	70%	90%
Australian tests	6%	18%	42%	36%	70%	100%

It should be noted that the power saving due to ALC shown in Table 1 does not take into account that only a certain percentage of time would be spent in low light (evening) conditions. In order to arrive at a more representative savings figure it is necessary to weight the saving according to an assumed ratio of normal daytime viewing to evening viewing conditions. A typical weighting would be around 25%

³ now part of the Department of the Environment, Water, Heritage and the Arts



dark room conditions, reducing the saving by 75%. This weighting is used in the Japan Electronics and Information Technology Industries Association (JEITA) test methodology.

5.1 Luminance testing conclusions

Australian testing showed that the recommended default home use mode had an approximate average luminance level not less than 70% of the luminance level of the Manufacturer's preset mode with the highest luminance. A compromise was negotiated with industry in Australia that the recommended default level could be as low as 50% of the maximum preset level (though one test result did show a luminance as low as 36% of the maximum).

UK measurements show that the standard (normal) viewing mode is between 55% and 90% of maximum luminance mode with the majority of models falling between 60% and 70% of maximum luminance mode. Only one TV in the twenty two was at 55%.

5.2 ALC testing conclusions

Savings potential:

TV on-mode power savings⁴ moving from an average bright room to a dark room with ALC enabled could be between 18 to 30% of the average power without ALC.

However, the actual energy saving through ALC backlight dimming is small for the large majority of current LCD TVs for two main reasons:

- Limited incident light range for ALC power savings
- Need to weight savings based upon a ratio of time spent in bright compared to dim viewing conditions.

Limited incident light range for savings:

The ALC on the majority of the TVs tested tended to have a maximum impact over a very limited incident light range and in some cases did not produce significant power savings in incident light conditions other than in dark room conditions as low as 5 lux, and typically 20 lux⁵. As most television viewing in the home, in artificial light is likely to be done in rooms with incident light levels of 70 to 200 lux⁶, this suggests that current weightings being discussed for ALC could be overly optimistic. Further analysis would be required to qualify fully the limits of this variable and its apparent incompatibility with most domestic lighting conditions.

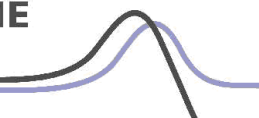
Weightings for typical lighting conditions:

As discussed previously, it is necessary to account for the time spent in bright compared to dim viewing conditions when quantifying ALC power savings. With a couple of significant exceptions the 25% weighted power reduction for ALC at average home-mode power is not likely to reach more than 10% for most TVs with current ALC operating characteristics. The average saving of the UK data set using

⁴ In the recommended default home setting

⁵ The ALC range is set to act from normal peak luminance in a given mode (i.e. luminance is not boosted in a bright room, just reduced for a dark room)

⁶ Daytime light levels are significantly higher than 200 lux



the 25/75% weighting would be 7%, with a minimum saving of 1% and maximum saving of 13%.

For example, one of the televisions from the UK data set has the following characteristics:

Display Type (HD ready and Full HD IDTV)	Screen Size		Recommended Home -mode Peak Luminance as Percentage of Brightest Preset-mode Peak Luminance (%)	Recommended Home-Mode Average Power (W)	Potential Automatic Luminance Control Power Saving in Recommended Home-mode (unweighted) (W)
	cm	inch			
LCD	80	32	74	93.5	37

For this television, the weighted saving would be calculated as follows:

- $Power_consumption_with_ALC = 93.5W - 37.0W = 56.5W$
- $Weighted_power_consumption = (25\% \times 56.5W) + (75\% \times 93.5W) = 84.3W$
- $Weighted_saving = \frac{93.5W - 84.3W}{93.5W} = 10\%$

Linking energy efficiency requirements to ALC:

Both the incident light level at which ALC operates and the impact ALC has on on-mode power are very variable. Analysis of the test results suggests that the action of power reduction by ALC at a given incident light level is inconsistent from manufacturer to manufacturer – power savings for similar changes in incident light range will vary considerably from one product to another.

For energy efficiency requirements to be linked into ALC, the following considerations would need to be addressed:

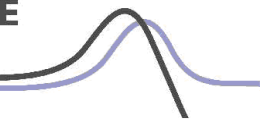
1. Standardisation across the industry of the actual incident background light level at which ALC is triggered.
2. Declaration of the change in power level achieved from ALC trigger point (which would ideally be an industry standard – see 1), to full ALC (dark room conditions).

6 Percentage error in verification procedure

Testing using IEC62087:2008, Edition 2 on two identical samples of a TV model sourced from different delivery batches has shown a variation of less than 1% in test results. This single result suggests 1-2% error allowance is sufficient to compensate for differences between units manufactured.

Round robin testing⁷ of five TV samples at different test laboratories currently⁸ show a small variation of less than 3% (See Appendix C). This result suggests that 3-4%

⁷ Testing of a single physical unit which is sent to other test laboratories and retested



error allowance is sufficient to compensate for differences between testing laboratories.

Combining the manufacturing (<1%) and testing variation (<3%), the maximum total error is therefore sufficiently compensated by a 4-5% allowance.

7 Conclusions

There are a number of barriers to including / incentivising ALC in any TV standard or label. These can be summarised as follows:

- **Industry trend is toward ALC regardless of incentives** – already 50% of 2008 models tested in previous tests in the UK were found to have ambient lighting control.
- **ALC is not often set as default** – ALC was not enabled “out of the box” on the majority of models, and when enabled as a viewing option it was often configured as an “ECO” setting, which could inhibit other picture options.
- **ALC can be disabled by the user** – this is more likely where the ALC mode inhibits other picture options.
- **Power savings of ALC are variable** – for some TVs, the weighted saving can be as small as 1% (though average is around 7%)
- **No standard ambient luminance trigger point for ALC to operate** – reinforcing issue of inconsistency of power savings.
- **No standard for weightings** – further research required

Related MTP information

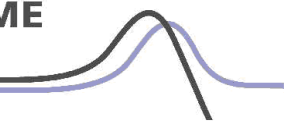
BNTV2 Televisions: Developing an Energy Efficiency Index
<http://www.mtprog.com/spm/download/document/id/680>

Consumer Electronics Policy Brief -
http://www.mtprog.com/ReferenceLibrary/2006-07-10%20Policy_Brief_consumer_electronics%20fin.pdf

⁸ Two test results to be confirmed

Appendix A 2008 UK TV Testing

Display Type (HD ready and Full HD IDTV)	Screen Size		Recommended Home -mode Peak Luminance as Percentage of Brightest Preset-mode Peak Luminance (%)	Recommended Home-Mode Average Power (W)	Potential Automatic Luminance Control Power Saving in Recommended Home-mode (unweighted) (W)
	cm	inch			
LCD	80	32	59	91	47
LCD	80	32	66	93	22
LCD	80	32	74	94	37
LCD	80	32	67	100	30
LCD	80	32	62	111	30
LCD	80	32	68	122	26
LCD	80	32	64	123	22
LCD	80	32	74	126	40
LCD	94	37	68	135	60
LCD	94	37	72	153	31
LCD	94	37	55	142	65
LCD	102	40	68	160	44
LCD	102	40	72	175	75
LCD	107	42	64	140	50
LCD	107	42	72	148	60
PDP	107	42	68	305	15
LCD	115	46	65	175	74
LCD	120	47	70	193	62
LCD	120	47	74	202	69
PDP	127	50	90	333	42
PDP	127	50	80	368	15
PDP	147	58	88	541	159

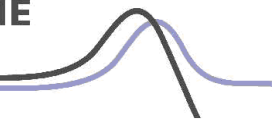


Appendix B 2008 Australian TV Testing

Display Type (HD ready and Full HD IDTV)	Screen Size		Recommended Home -mode Peak Luminance as Percentage of Brightest Preset-mode Peak Luminance (%)	Recommended Home-Mode Average Power (W)	Potential Automatic Luminance Control Power Saving in Recommended Home-mode (unweighted) (W)
	cm	inch			
LCD	80	32	66	137	15
LCD	80	32	69	107	14
LCD	80	32	68	120	12
LCD	80	32	66	125	15
LCD	80	32	88	146	40
LCD	80	32	50	76	10
LCD	80	32	36	85	12
LCD	80	32	60	105	30
LCD	80	32	69	142	60
LCD	80	32	60	113	N/A
LCD	94	37	70	144	N/A
PDP	107	42	71	264	27
PDP	107	42	72	196	N/A
PDP	107	42	62	251	N/A
LCD	115	46	62	225	30
PDP	127	50	88	364	22
PDP	127	50	100	330	80
PDP	127	50	92	404	32
PDP	127	50	88	373	N/A
PDP	127	50	71	339	N/A
LCD	132	52	69	273	80
LCD	132	52	61	238	70
LCD	132	52	53	217	30
PDP	147	58	90	564	N/A

Appendix C International verification testing

	Aus Lab 1	Aus Lab 2		UK lab	
	Power (W)	Power (W)	Diff from Aus 1	Power (W)	Diff from Aus 1
TV 1	172	169	1.2%	167	2.7%
TV 2	208	TBC	TBC	202	2.7%
TV 3	613	TBC	TBC	614	-0.2%
TV 4	370	365	1.5%	367	0.9%
TV 5	221	220	0.6%	217	2.0%



Changes from version 1.0

Additional testing data for Section 6 Percentage error in verification procedure
Minor changes for clarity

Consultation and further information

Stakeholders are encouraged to review this document and provide suggestions that may improve the quality of information provided. Email **info@mtprog.com** quoting the document reference, or call the MTP enquiry line on +44 (0) 845 600 8951.

For further information on related issues visit **www.mtprog.com**