

Energy Efficiency Standards Subcommittee, Advisory Committee for Natural  
Resources and Energy  
Television Receiver Evaluation Standards Subcommittee  
Final Report

The Television Receiver Evaluation Standards Subcommittee discussed evaluation standards for manufacturers or importers (hereinafter referred to as “Manufacturers, etc.”) with respect to the improvement of television receiver performance and released the following interim report:

### 1. Evaluation of existing standards

2008 was the target fiscal year for the energy consumption efficiency of television receivers. It has remarkably improved thanks to the active efforts of the Manufacturers, etc. Almost all the products currently in the market exceed the target values. This led to a decision to review the standards earlier than initially planned. The ratio of those products sold on the market as of December 2008 that meet the standards is 98.2% based on the number of models.

In view of the above, it can be evaluated that energy saving in television receivers has made progress through the efforts by the manufacturers, etc. and that the existing standards based on the top runner approach are effectively working.

### 2. Designated equipment [Refer to Attachment 1]

Included are television receivers (direct-view cathode-ray tube types or direct-view types with liquid crystal or plasma display panels) that run on alternating-current circuits (with a rated frequency of 50 Hz or 60 Hz and a rated voltage of 100 V). Excluded are televisions for industrial use, televisions made specifically for tourists, CRT-based multi-scanning televisions with horizontal frequency exceeding 33.8 kHz, rear-projection televisions, receiver size <sup>1</sup> 10, 10V or smaller televisions and wireless televisions.

\* Major changes made to the designation

Changes were made in LCD televisions, from those having direct-view liquid crystal panels that use fluorescent-tube backlights to those having direct-view liquid crystal panels. The designation was expanded to include LCD televisions that use LED backlights, etc. In the case of plasma televisions, televisions having plasma panels with vertical pixels of 1080 or more and horizontal pixels of 1920 or more were added to the designation.

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<sup>1</sup>In this report, receiver size means the numeric value of the diagonal diameter of a frame structured cathode-ray tube expressed in centimeters and divided by 2.54, and then rounded to the nearest whole number, in the case of CRT televisions (hereinafter referred to as “○○ type”).

In liquid crystal TVs and plasma TVs, it means the numeric value of the diagonal dimension of a drive display area expressed in centimeters and divided by 2.54, and then rounded to the nearest whole number (hereinafter referred to as “OOV” type).

### 3. Evaluation parameters for manufacturers, etc.

#### (1) Target fiscal year [Refer to Attachment 2]

The target fiscal year shall be 2012. However, the target fiscal year for CRT televisions shall remain the same (each fiscal year starting at 2003).

#### (2) Target standard values [Refer to Attachments 3 and 4]

With respect to television receivers that each manufacturer, etc. ships within Japan during the target fiscal year, the average of the energy consumption efficiency measured in (3) weighted by the number of units shipped by each manufacturer, etc. for each category in the table below shall not exceed the target standard values.

#### ○ CRT televisions

Category	Scanning method	Aspect ratio	Deflection angle	Shape of cathode-ray tube	Function	Target standard value calculation formula
1	Normal scanning	4:3	100 degrees or smaller	Excluding flat type	Without built-in VTR (or DVD)	$E=2.5S+32$
2					With built-in VTR (or DVD)	$E=2.5S+60$
3				Flat type	Without built-in VTR (or DVD)	$E=2.5S+42$
4					With built-in VTR (or DVD)	$E=2.5S+70$
5			Over 100 degrees	Excluding flat type	Without built-in VTR (or DVD)	$E=5.1S-4$
6					With built-in VTR (or DVD)	$E=5.1S+24$
7				Flat type	Without built-in VTR (or DVD)	$E=5.1S+21$
8					With built-in VTR (or DVD)	$E=5.1S+49$
9		16:9 (Wide)		Excluding flat type	Without VTR (or DVD) and with no added functions	$E=5.1S-11$
10					With built-in VTR (or DVD)	$E=5.1S+17$
11					Without VTR (or DVD) and with one added function	$E=5.1S+6$
12					Without VTR (or DVD) and with two added functions	$E=5.1S+13$
13					Without VTR (or DVD) and with three added functions	$E=5.1S+59$
14					Flat type	Without VTR (or DVD) and with no added functions

15				With built-in VTR (or DVD)	$E=5.1S+27$
16				Without VTR (or DVD) and with one added function	$E=5.1S+16$
17				Without VTR (or DVD) and with two added functions	$E=5.1S+23$
18				Without VTR (or DVD) and with three added functions	$E=5.1S+69$
19	Double-speed scanning			Analog high definition televisions	$E=5.5S+72$
20				Those other than analog high definition televisions	$E=5.5S+41$

Remarks 1. "VTR" means video tape recorder and "DVD" means digital versatile disc.

2. "Receiver size" means the numeric value of the diagonal diameter of a frame structured cathode-ray tube expressed in centimeters and divided by 2.54, and then rounded to the nearest whole number.
3. A television is a "flat type" when the percentage of the maximum gap between the center and edges of the CRT surface to the diagonal dimension of the CRT is 0.5% or smaller (provided that the edges and diagonal dimension are measured within 5 mm from the available picture area).
4. An "analog high definition television" means a CRT television with scanning lines of 1,125 and aspect ratio of 16:9, that has a MUSE decoder and satellite broadcasting functions.
5. "Added functions" means the double-tuner split-screen function, teletext broadcasting function and MUSE-NTSC converter.
6. "E" and "S" represent the following values:
  - E: Standard energy consumption efficiency (unit: kWh/year)
  - S: Receiver size

### ○ LCD and plasma televisions

Category	Number of pixels	Receiver size	Moving picture display speed	Added function	Target standard value	
1	FHD	Less than 19V type	Normal	With no added functions	$E=59$	
2				With one added function	$E=71$	
3				With two added functions	$E=83$	
4				With three added functions	$E=95$	
5		Double-speed			With no added functions	$E=74$
6					With one added function	$E=86$
7					With two added functions	$E=98$
8					With three added functions	$E=110$
9	19V type or more	Less than	Normal	With no added functions	$E=2.0S+21$	
10				With one added function	$E=2.0S+33$	
11				With two added functions	$E=2.0S+45$	
12				With three added functions	$E=2.0S+57$	

13		32V type	Double-speed	With no added functions	E=2.0S+36	
14				With one added function	E=2.0S+48	
15				With two added functions	E=2.0S+60	
16				With three added functions	E=2.0S+72	
17			Quad-speed or plasma television	With no added functions	E=2.0S+58	
18				With one added function	E=2.0S+70	
19				With two added functions	E=2.0S+82	
20				With three added functions	E=2.0S+94	
21		32V type or more	Normal	With no added functions	E=6.6S-126	
22				With one added function	E=6.6S-114	
23				With two added functions	E=6.6S-102	
24				With three added functions	E=6.6S-90	
25			Double-speed	With no added functions	E=6.6S-111	
26				With one added function	E=6.6S-99	
27				With two added functions	E=6.6S-87	
28				With three added functions	E=6.6S-75	
29	Quad-speed or plasma television	With no added functions	E=6.6S-89			
30		With one added function	E=6.6S-77			
31		With two added functions	E=6.6S-65			
32		With three added functions	E=6.6S-53			
33	Others	Less than 19V type	Normal	With no added functions	E=44	
34				With one added function	E=56	
35				With two added functions	E=68	
36				With three added functions	E=80	
37		Double-speed	With no added functions	E=59		
38			With one added function	E=71		
39			With two added functions	E=83		
40			With three added functions	E=95		
41		19V type or more	Less than 32V type	Normal	With no added functions	E=2.0S+6
42					With one added function	E=2.0S+18
43					With two added functions	E=2.0S+30
44					With three added functions	E=2.0S+42
45			Double-speed	With no added functions	E=2.0S+21	
46				With one added function	E=2.0S+33	
47				With two added functions	E=2.0S+45	
48				With three added functions	E=2.0S+57	
49			Quad-speed or plasma television	With no added functions	E=2.0S+43	
50				With one added function	E=2.0S+55	
51				With two added functions	E=2.0S+67	
52				With three added functions	E=2.0S+79	
53	32V type or more	Normal	With no added functions	E=6.6S-141		
54			With one added function	E=6.6S-129		
55			With two added functions	E=6.6S-117		
56			With three added functions	E=6.6S-105		
57		Double-speed	With no added functions	E=6.6S-126		
58			With one added function	E=6.6S-114		
59			With two added functions	E=6.6S-102		

60			With three added functions	E=6.6S-90
61		Quad-speed or plasma television	With no added functions	E=6.6S-104
62			With one added function	E=6.6S-92
63			With two added functions	E=6.6S-80
64			With three added functions	E=6.6S-68

Remarks 1. "Receiver size" means the numeric value of the diagonal dimension of a drive display area expressed in centimeters and divided by 2.54, and then rounded to the nearest whole number.

2. "Added functions" means double digital tuner, DVD (limited to those with a recording function), hard disk and Blu-ray disc.

3. "E" and "S" represent the following values:

E: Standard energy consumption efficiency (unit: kWh/year)

S: Receiver size

4. "FHD" means having vertical pixels of 1080 or more and horizontal pixels of 1920 or more.

5. The moving picture display speeds of normal, double-speed and quad-speed mean the following:

Normal: Displaying still pictures of 60 frames or more and fewer than 120 frames per second

Double-speed: Displaying still pictures of 120 frames or more and fewer than 240 frames per second

Quad-speed: Displaying still pictures of 240 frames or more per second

6. The target standard values shall be calculated using the formulas listed in the right column of the table and rounded to the nearest whole number.

(3) Measurement method for energy consumption efficiency [Refer to Attachment 5]

Energy consumption efficiency [kWh/year] shall be calculated using the following formula:

$$E = \{(PO - PA/4) \times t1 + PS \times (t2 - tepg) + P_{epg} \times tepg\} / 1000$$

where E, PO, PS, PA, t1, t2, P<sub>epg</sub> and tepg mean as follows:

- E: Annual electric power consumption (kWh/year)
- PO: Operating power consumption (W)
- PS: Standby power consumption (W)
- PA: Power consumption reduction by power saving functions, etc. (W)
- P<sub>epg</sub>: Power consumption at EPG<sup>2</sup> data acquisition (W)
- t1: Standard operating hours per year (h) 1642.5 (365 days x 4.5 hours)
- t2: Standard standby hours per year (h) 7117.5 (365 days x 19.5 hours)
- tepg: Annual standard hours of EPG acquisition operation (which varies from equipment to equipment)

\* Major changes made to the measurement method

Power consumption at EPG data acquisition was added to the calculation of annual electric power consumption. The signals for measuring operating power consumption for LCD and plasma televisions were also changed.

(4) Labeling related matters

Labeling related matters shall be in accordance with the Household Goods Quality Labeling Law. Matters relating to energy saving are as follows:

1) Labeling items

Items for labeling shall be as follows:

- CRT televisions  
Labeling items shall be in accordance with the existing provisions.
- LCD and plasma televisions
  - a) Category
  - b) Receiver size

<sup>2</sup> EPG: Electronic Program Guide System by which to acquire program data and display it on a television screen

- c) Energy consumption efficiency (annual electric power consumption)
- d) Name or title of manufacturers

2) Compliance items

○ CRT televisions

Compliance items shall be in accordance with the existing provisions.

○ LCD and plasma televisions

a) Energy consumption efficiency shall be expressed by a whole number in the unit of kWh/year. In this case, the energy consumption efficiency measured in (3) shall be no more than 105/100 of the labeled value of energy consumption efficiency.

b) The labeling items listed in (1)-b) and -c) shall be shown clearly in the performance-related sections of catalogs and instruction manuals in such a manner that consumers selecting equipment can easily find and understand. Particularly, the item in (1)-c) shall be presented so that it stands out, for instance by using underlines and larger or different-color letters. With respect to the item in (1)-a), efforts shall be made to indicate moving image display speed and other classification-related information in addition to category name, so that consumers can easily understand.

4. Recommendation on energy saving

(1) Efforts by manufacturers, etc.

- 1) Facilitate technological development for energy saving for television receivers and try to develop products with excellent energy consumption efficiency.
- 2) In order to promote television receivers with excellent energy consumption efficiency, quickly adopt the “Energy Saving Labels” in compliance with the Japanese Industrial Standards C9901 in the catalogs, etc. of the products that are newly designated. Also, try to provide appropriate information so that users will choose television receivers with excellent energy consumption efficiency.



3) Try to provide information that helps promote active use of energy saving settings (automatic power off function after inactivity, etc.) by users.

(2) Efforts by sellers

Try to sell television receivers with excellent energy consumption efficiency. Also, use “Energy Saving Labels” and try to provide appropriate information so that users will choose television receivers with excellent energy consumption efficiency.

(3) Efforts by users

Try to select television receivers with excellent energy consumption efficiency. When using television receivers, try to save energy by actively using energy saving settings (automatic power off function after inactivity, etc.).

(4) Efforts by government

1) In order to promote television receivers with excellent energy consumption efficiency, try to utilize promotional campaigns and other necessary measures to facilitate efforts by the users and manufacturers, etc.

2) Periodically and continuously monitor labeling practice by the manufacturers, etc. and try to apply appropriate laws so that the users are provided with correct and easy-to-understand information regarding energy consumption efficiency.

3) The energy saving standards based on the top runner approach are very effective ways to save energy on equipment. Try to promote this approach to the world at the right opportunities.

## The scope of television receiver designation

Included are television receivers (direct-view cathode-ray tube types or direct-view types with liquid crystal or plasma display panels) that run on alternating-current circuits (with a rated frequency of 50 Hz or 60 Hz and a rated voltage of 100 V). The following shall be excluded from such application:

### 1. Televisions for industrial use

Equipment for broadcasting stations and similar special-purpose industrial-use equipment are excluded, due to their restricted specifications, small quantities, etc.

### 2. Televisions with extremely low usage in the market

- Those made specifically for tourists (The number of units shipped in 2007: Approximately 2,100 units)
- CRT-based multi-scan type with horizontal frequency exceeding 33.8 kHz (The number of units shipped in 2007: 0 units)
- Rear-projection type (The number of units shipped in 2007: 2,478 units)
- Receiver size 10, 10V or smaller (The number of units shipped in 2007: 33,326 units)
- Wireless type (The number of units shipped in 2007: 0 units)

In general, the numbers of these television models shipped are small or non-existent, and consumer needs for these models are not always clear. Consideration shall be given as necessary in the future when situations may change and it is determined appropriate to include them.

Note 1) Included is a type of equipment that is sold as a monitor alone but can receive television broadcasting simply by combining with a tuner of the same manufacturer.

Note 2) Excluded is a display for personal computers that can receive television broadcasting.

Target fiscal year, etc. for television receivers

1. In general, the energy consumption efficiency of television receivers is dramatically improved at the time of model changes, and a new model development cycle is usually around two years. Therefore, it is necessary to give an opportunity to make at least two model changes before a target fiscal year. 2011 is the year of full transition to terrestrial digital broadcasting. Setting the target standard fiscal year to 2011 would likely disrupt product development, etc.

On the other hand, assuming that television receivers are used for approximately 10 years, it is desirable to accomplish targets in the shortest possible time frame.

In consideration of the above, the target fiscal year for LCD and plasma televisions shall be set to the year 2012, which is three years after the standards are set.

With respect to CRT televisions, which have already been included, the existing target year (each fiscal year starting in 2003) shall apply.

2. The improvement rate of energy consumption efficiency (excluding CRT televisions) in the target fiscal year is expected to be approximately 37.0%, on the assumption that the number of shipments and the makeup of each category remain the same (as actual results of fiscal year 2008).

<Calculation outline (for LCD and plasma televisions only)>

(1) Energy consumption efficiency calculated based on the actual results of television receivers shipped during fiscal year 2008    163.5 kWh/year

(2) Energy consumption efficiency calculated based on the target standard values of television receivers to be shipped during the target fiscal year  
103.0 kWh/year

(3) Improvement rate of energy consumption efficiency

$$\frac{(163.5-103.0)}{163.5} \times 100 = \text{Approximately } 37.0 \%$$

## Television receiver classification

### I. Basic concept

Televisions with cathode-ray tubes (hereinafter referred to as “CRT televisions”) were designated as the top runner standard equipment in fiscal year 1999. Later, televisions with liquid crystal display panels (hereinafter referred to as “LCD televisions”) and televisions with plasma display panels (hereinafter referred to as “plasma televisions”) were added to the designation. Regarding liquid crystal TVs and plasma TVs, until now there was a large influence on the rate of energy consumption (annual amount of electric power consumption) depending on the display elements, and they were being classified by the difference in the introduction of technology. This standard second review is for televisions that are being designed with a large-scale improvement in the reduction of energy consumption, and to promote the further improvement of receiver energy conservation.

In order to facilitate the energy saving performance of receivers, rather than separating LCD televisions from plasma televisions, the moving picture display speed was used as a basis of classification. Televisions receiving only analog broadcasting or those with an aspect ratio of 4:3 shall not be classified due to the significantly scaled-down market size.

The number of pixels largely affects energy consumption efficiency; therefore, it shall be categorized into FHD (full high definition) and others.

For CRT televisions, whose shipment continues to be slim, the existing classification shall be used.

### II. Specific classification method

Television receivers are broadly classified into (1) CRT televisions, (2) LCD televisions, and (3) plasma televisions, depending on the display device. For CRT televisions, the existing classification shall apply, since its shipment share hit below 10% in 2007. For LCD and plasma televisions, it is appropriate to apply the same classification to both, since they share the same television viewing functions, even though they use fundamentally different technologies.

#### ○ Classification proposal

- (1) Televisions with cathode-ray tubes (CRT televisions)
- (2) Televisions with liquid crystal display panels (LCD televisions) and televisions with plasma display panels (plasma televisions)

## 1. CRT televisions

The existing classification shall apply to CRT televisions.

## 2. LCD and plasma televisions

### (1) Classification by the number of pixels

It is necessary to increase the number of pixels in order to achieve both high definition and a large screen at the same time in LCD and plasma televisions. However, the increased number of pixels affects electric power consumption. Typical panels are those having vertical pixels of fewer than 650 (hereinafter referred to as SD (standard definition)), 650 or more and fewer than 1080 (hereinafter referred to as HD (high definition)), and 1080 or more (hereinafter referred to as FHD (full high definition)). Since SD panels are hardly shipped at present, classification shall be FHD and others (mainly HD).

#### ○ Classification proposal

- (1) Vertical pixels of 1080 or more and horizontal pixels of 1920 or more
- (2) Others

### (2) Classification by receiver size

The larger a television screen is, the higher its light-emitting power consumption. There is a certain correlation between these two. In view of this, televisions shall be classified into (1) smaller than 19V, (2) 19V or larger and smaller than 32V and (3) 32V or larger, by receiver size. This classification uses the diagonal length of a screen as a screen size index and takes into consideration a correlation between the receiver size and annual power consumption measured.

Receiver size means the numeric value of the diagonal dimension of a drive display area expressed in centimeters and divided by 2.54, and then rounded to the nearest whole number. It is called ○○V-type.

#### ○ Classification proposal

- (1) Smaller than 19V-type
- (2) 19V-type or larger and smaller than 32V-type
- (3) 32V-type or larger

### (3) Classification by moving picture display speed

The moving picture display speed of normal drive LCD televisions is 60 frames of still pictures per second. In recent years, double-speed drive technology displaying 120 frames of still pictures per second and quad-speed drive technology displaying 240 frames of still pictures per second have emerged to improve the moving picture performance of LCD televisions. Such moving picture display speed is a function highly demanded by the market and significantly affects energy consumption efficiency. Therefore, it is included in the classification category.

Plasma televisions emit light differently from LCD televisions (by use of extremely fast electric discharge) and excel in moving picture performance. Thus, the same display speed classification as LCD televisions does not apply.

When classifying plasma televisions into the display speed categories of LCD televisions, plasma televisions shall be included in the quad-speed category, considering that LCD televisions with double-speed and quad-speed are currently in the market and assuming that moving picture performance is almost equal.

#### ○ Classification proposal

- (1) Normal drive (displaying 60 frames or more and fewer than 120 frames of still pictures per second)
- (2) Double-speed drive (displaying 120 frames or more and fewer than 240 frames of still pictures per second)
- (3) Quad-speed drive (displaying 240 frames or more of still pictures per second) and plasma televisions

### (4) Classification by added functions

There are a variety of added functions for LCD and plasma televisions. These added functions, when built in, affect energy consumption efficiency. Classification without the inclusion of these functions would result in discontinued production of equipment with added functions, which is highly likely to cause extreme disturbance to various market needs. Therefore, main added functions shall be included in the classification. In view of the present product makeup, etc., consideration shall only be given to main added functions: (1) “double digital tuner” and (2) “recording devices (DVD,

HDD and BD).” Of the “recording devices,” “DVD” and “BD” are almost never loaded together; therefore a maximum of three added functions shall be included in the classification.

\* “recording devices” means “DVD (digital versatile disc),” “HDD (hard disk)” and “BD (Blu-ray disc).”

○ Classification proposal

- (1) With no added functions
- (2) With one added function
- (3) With two added functions
- (4) With three added functions

III. Setting basic classification proposal

In view of the above, a basic classification proposal is set in the table below:

○ CRT televisions (20 categories)

Category	Type of television receiver			Type of CRT	Function
	Scanning method	Aspect ratio	Deflection angle		
1	Normal scanning	4:3	100 degrees or smaller	Normal	Without built-in VTR (or DVD)
2					With built-in VTR (or DVD)
3				Flat	Without built-in VTR (or DVD)
4					With built-in VTR (or DVD)
5			Over 100 degrees	Normal	Without built-in VTR (or DVD)
6					With built-in VTR (or DVD)
7				Flat	Without built-in VTR (or DVD)
8					With built-in VTR (or DVD)
9		16:9 (Wide)	—	Normal	Without VTR (or DVD) and with no added functions
10					With built-in VTR (or DVD)
11					Without VTR (or DVD) and with one added function
12					Without VTR (or DVD) and with two added functions
13				Without VTR (or DVD) and with three added functions	
14				Flat	Without VTR (or DVD) and with no added functions
15					With built-in VTR (or DVD)
16					Without VTR (or DVD) and with one added function

17			—		Without VTR (or DVD) and with two added functions
18					Without VTR (or DVD) and with three added functions
19	Double-speed scanning	—	—		Analog high definition television
20		—	—		Those other than analog high definition televisions

○ LCD and plasma televisions (64 categories)

Category	Number of pixels	Receiver size	Moving picture display speed	Added function	
1	FHD	Less than 19V type	Normal	With no added functions	
2				With one added function	
3				With two added functions	
4				With three added functions	
5			Double-speed	With no added functions	
6				With one added function	
7				With two added functions	
8				With three added functions	
9		19V type or more Less than 32V type	Normal	With no added functions	
10				With one added function	
11				With two added functions	
12				With three added functions	
13			Double-speed	With no added functions	
14				With one added function	
15				With two added functions	
16				With three added functions	
17			Quad-speed or plasma television	With no added functions	
18				With one added function	
19				With two added functions	
20				With three added functions	
21			32V type or more	Normal	With no added functions
22					With one added function
23					With two added functions
24					With three added functions
25		Double-speed		With no added functions	
26				With one added function	
27				With two added functions	
28				With three added functions	
29		Quad-speed or plasma television		With no added functions	
30				With one added function	
31				With two added functions	
32				With three added functions	
33	Others	Less than 19V type	Normal	With no added functions	
34				With one added function	
35				With two added functions	
36				With three added functions	



37			Double-speed	With no added functions
38				With one added function
39				With two added functions
40				With three added functions
41		19V type or more Less than 32V type	Normal	With no added functions
42				With one added function
43				With two added functions
44				With three added functions
45			Double-speed	With no added functions
46				With one added function
47				With two added functions
48				With three added functions
49			Quad-speed or plasma television	With no added functions
50				With one added function
51				With two added functions
52				With three added functions
53		32V type or more	Normal	With no added functions
54				With one added function
55				With two added functions
56				With three added functions
57			Double-speed	With no added functions
58				With one added function
59				With two added functions
60				With three added functions
61			Quad-speed or plasma television	With no added functions
62				With one added function
63				With two added functions
64				With three added functions

## Target standard values for television receivers

### I. Concept of setting target standard values

#### 1. Basic concept

Target standard values are set based on the top runner approach. The specific concept is stated below:

- (1) A target standard value shall be set for each appropriate category of classification.
- (2) If efficiency is expected to improve as a result of future technological advancement, the best efforts shall be made to include such improvement in a target standard value.
- (3) Target standard values shall be consistent from category to category.

#### 2. Flow of target standard value setting

The annual electric power consumption of television receivers (those with cathode-ray tubes (hereinafter referred to as “CRT televisions”), those with liquid crystal display panels (hereinafter referred to as “LCD televisions”), and those with plasma display panels (hereinafter referred to as “plasma televisions”)) has traditionally been represented in a linear function formula (calculation formula) with receiver size as a variable. It is positively correlated to receiver size. This is because if a model with low annual electric power consumption is simply used as a top runner standard, models with larger receiver size will no longer be manufactured, which will highly likely cause extreme disturbance to various market needs. The same shall apply to this review, and target standard values (annual electric power consumption) shall continue to be represented in a linear function formula (calculation formula) with receiver size as a variable (excluding LCD televisions that are smaller than 19V).

A calculation formula shall be set up as follows:

Receiver size is defined as follows:

○ CRT televisions:

The numeric value of the diagonal diameter of a frame structured cathode-ray tube expressed in centimeters and divided by 2.54, and then rounded to the nearest whole number.

○ LCD and plasma televisions

The numeric value of the diagonal diameter of a drive display area expressed in centimeters and divided by 2.54, and then rounded to the nearest whole number. They are called ○○V-type.

(1) CRT televisions

CRT televisions were designated as the top runner standard equipment in fiscal year 1999. Faced with the rapid arrival of new televisions with different display elements such as LCD and plasma televisions, the shipment of CRT televisions has drastically declined in recent years. With each manufacturer's attention focused on developing technologies for LCD and plasma televisions, there is little prospect for improving the efficiency of CRT televisions, which have no room for future technological advancement.

In view of the above, the target standard values for CRT televisions shall stay the same.

(2) LCD and plasma televisions

Under the existing standards, correlation equations are formulated separately for LCD and plasma televisions. The present top runners are LCD televisions in all receiver sizes (Fig. 1). However, it is necessary to set top runner standards from the entire group of television receivers, in order to further improve energy consumption efficiency in the future.

In this review, with respect to the top runner LCD televisions, the slope of a correlation between receiver size and annual electric power consumption is obtained for each pixel category. However, as receiver size increases, products with higher-resolution and faster moving picture display speed dominate, resulting in largely biased sample data taken from each pixel category. In order to obtain an effective slope, a sample is taken from the HD/normal drive category, which is dominant in smaller than 32V models, and the FHD/double-speed drive category, which is

dominant in 32V or larger models (Fig. 2).

With respect to room for technological improvement, smaller TV size means less room to cut electric power consumption. If top runner improvement is factored into the standard while using the same slope, such a standard will be excessively stringent to small size televisions. To cope with this, an adjustment is made by making the slope smaller and thus making the standard tougher for large size televisions. With respect to room for technological improvement, the highest level of improvement shall be sought in 32V televisions, which had the largest shipment share (Fig. 3) and largest total electric power consumption (Fig. 4) in fiscal year 2008. Based on this, efforts shall be made to further improve the energy consumption efficiency of television receivers, which have already achieved remarkable performance improvement.

### 3. Room to improve energy consumption efficiency through future technological advancement

LCD and plasma televisions are products that have been largely successful regarding the development of technologies to improve energy consumption efficiency for the past few years, with varying results among manufacturers, etc. Though it will not be easy to maintain the same rate of success in improving energy consumption efficiency, there still is room for improvement as seen in the commercialization of a LED backlight product.

In this review, a large room for improvement shall be factored into target standard values mainly for models with a large shipment share or similar size models. Specifically, the target standard value for 19V models shall be set to the top runner value plus an improvement of approximately 6%, while the standard for models smaller than 19V is set to a specific value instead of an equation. The standard shall be further tightened for 32V models by setting the target value to the top runner value plus an improvement of approximately 30% (Fig. 5 and Fig. 12).

In the correlation equation based on the current product tendency, slopes of 2.5 and 6.8 are obtained for models smaller than 32V and 32V or larger models, respectively. In consideration of smaller screens and the dominance of 32V models, the slopes are set to 2.0 for models smaller than 32V and 6.6 for 32V or larger models.

#### 4. Handling of categories with no or little equipment

LCD and plasma televisions shall be classified by the number of pixels, moving picture display speed, and the number of added functions. Many of these classification categories consist of few or no products, for which appropriate standards cannot be set. On the other hand, it is possible that more products may be added to these categories in the future with an increase of value-added televisions. Therefore, when setting the target standard values for these categories, the differences in annual electric power consumption between functions shall be determined and taken into account in the target value calculation.

With respect to additional values for HD and FHD, both categories had multiple products as shown in Table 1. When comparing comparable 32V and 37V models, the difference between the top runners was 22 - 24 kWh/year. Factoring an efficiency improvement of 30% into this difference, it will be approximately 15 - 17 kWh/year.

Table 1: An example of annual electric power consumption increase due to the difference between HD and FHD

Receiver size	Annual electric power consumption	Display speed	Number of pixels	Difference
32	101	Normal	HD	-
32	125	Normal	FHD	<b>24</b>
37	147	Double-speed	HD	-
37	169	Double-speed	FHD	<b>22</b>

With respect to the difference between double-speed and quad-speed drives, there are no comparable identical models. Therefore, the difference was obtained separately using data provided by the manufacturer. With the present technology, switching from a normal drive to a double-speed drive resulted in an increase of approximately 22 kWh/year. The difference between double-speed and quad-speed was approximately 32 kWh/year. Factoring an efficiency improvement of 30% into these functions, the result is +15 kWh/year for double-speed and +22 kWh/year for quad-speed.

Under the existing standards, the additional value set for built-in HDD, built-in DVD, and built-in double digital tuner is also +15 kWh/year. This additional

value was set to further tighten the standards in order to facilitate energy saving in the past, when an increase of 18 - 20 kWh was confirmed for built-in HDD and built-in DVD and an increase of 30 - 43 kWh was confirmed for built-in double digital tuner. Presently, the electric power consumption of these functions including built-in BD is around 15 kWh/year, according to the manufacturers' calculations. In this review, the additional value shall be set to + 12 kWh/year for each added function in order to further facilitate energy saving.

Table 2 lists the additional value for each function.

Table 2. Additional value for each function

Function	Annual electric power consumption to be added
From HD to FHD	+15 kWh/year
From normal drive to double-speed drive	+15 kWh/year
From double-speed drive to quad-speed drive	+22 kWh/year
For each added function	+12 kWh/year

As a result of setting target standard values, using additional values determined for each function, the target standard values of annual power consumption turned out to be even smaller than the top runner values in all categories, as shown in Fig. 5 through Fig. 17.

## II. Specific target standard values

### (1) CRT televisions

As stated earlier, the standard values shall stay the same.

### (2) LCD and plasma televisions

For each function category, the top runner value was calculated using the additional value stated above.

The resulting target standard values for LCD and plasma televisions are as follows:

Table 3. Target standard values for LCD and plasma televisions

Category	Number of pixels	Receiver size	Moving picture display speed	Added function	Target standard value	
1	FHD	Less than 19V type	Normal	With no added functions	E=59	
2				With one added function	E=71	
3				With two added functions	E=83	
4				With three added functions	E=95	
5			Double-speed	With no added functions	E=74	
6				With one added function	E=86	
7				With two added functions	E=98	
8				With three added functions	E=110	
9		19V type or more Less than 32V type	Normal	With no added functions	E=2.0S+21	
10				With one added function	E=2.0S+33	
11				With two added functions	E=2.0S+45	
12				With three added functions	E=2.0S+57	
13			Double-speed	With no added functions	E=2.0S+36	
14				With one added function	E=2.0S+48	
15				With two added functions	E=2.0S+60	
16				With three added functions	E=2.0S+72	
17			Quad-speed or plasma television	With no added functions	E=2.0S+58	
18				With one added function	E=2.0S+70	
19				With two added functions	E=2.0S+82	
20				With three added functions	E=2.0S+94	
21			32V type or more	Normal	With no added functions	E=6.6S-126
22					With one added function	E=6.6S-114
23					With two added functions	E=6.6S-102
24					With three added functions	E=6.6S-90
25		Double-speed		With no added functions	E=6.6S-111	
26				With one added function	E=6.6S-99	
27				With two added functions	E=6.6S-87	
28				With three added functions	E=6.6S-75	
29		Quad-speed or plasma television		With no added functions	E=6.6S-89	
30				With one added function	E=6.6S-77	
31				With two added functions	E=6.6S-65	
32				With three added functions	E=6.6S-53	
33	Others	Less than 19V type	Normal	With no added functions	E=44	
34				With one added function	E=56	
35				With two added functions	E=68	
36				With three added functions	E=80	
37		Double-speed	With no added functions	E=59		
38			With one added function	E=71		
39			With two added functions	E=83		
40			With three added functions	E=95		
41		19V type or more Less than 32V type	Normal	With no added functions	E=2.0S+6	
42				With one added function	E=2.0S+18	
43				With two added functions	E=2.0S+30	
44				With three added functions	E=2.0S+42	
45			Double-speed	With no added functions	E=2.0S+21	
46				With one added function	E=2.0S+33	

47				With two added functions	$E=2.0S+45$	
48				With three added functions	$E=2.0S+57$	
49		Quad-speed or plasma television		With no added functions	$E=2.0S+43$	
50				With one added function	$E=2.0S+55$	
51				With two added functions	$E=2.0S+67$	
52				With three added functions	$E=2.0S+79$	
53	32V type or more		Normal		With no added functions	$E=6.6S-141$
54				With one added function	$E=6.6S-129$	
55				With two added functions	$E=6.6S-117$	
56				With three added functions	$E=6.6S-105$	
57			Double-speed		With no added functions	$E=6.6S-126$
58					With one added function	$E=6.6S-114$
59					With two added functions	$E=6.6S-102$
60					With three added functions	$E=6.6S-90$
61			Quad-speed or plasma television		With no added functions	$E=6.6S-104$
62					With one added function	$E=6.6S-92$
63					With two added functions	$E=6.6S-80$
64					With three added functions	$E=6.6S-68$

Remarks 1. "Receiver size" means the numeric value of the diagonal dimension of a drive display area expressed in centimeters and divided by 2.54, and then rounded to the nearest whole number.

2. "Added functions" means double digital tuner, DVD (limited to those with a recording function), hard disk and Blu-ray disc.

3. "E" and "S" represent the following values:

E: Standard energy consumption efficiency (unit: kWh/year)

S: Receiver size

4. "FHD" means having vertical pixels of 1080 or more and horizontal pixels of 1920 or more.

5. The moving image display speeds of normal, double-speed and quad-speed are as follows:

Normal: Displaying still pictures of 60 frames or more and fewer than 120 frames per second

Double-speed: Displaying still pictures of 120 frames or more and fewer than 240 frames per second

Quad-speed: Displaying still pictures of 240 frames or more per second

6. The target standard values are calculated using the formulas listed in the right column of the table and rounded to the nearest whole number.



(Reference)

1. Correlation between receiver size and annual electric power consumption

(1) Annual electric power consumption of LCD and plasma televisions

(kWh/year)

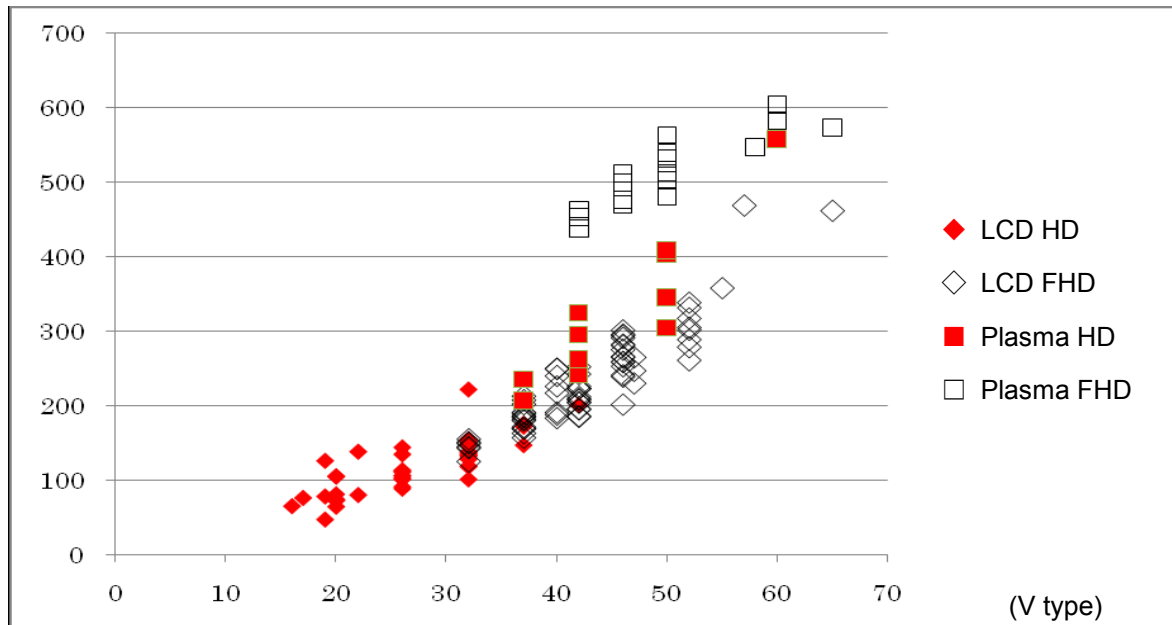


Fig. 1 Receiver size - Annual electric power consumption (overall) [as of October 2008]

2. Target standard value calculation formula

(1) Calculation of the slope of top runner products

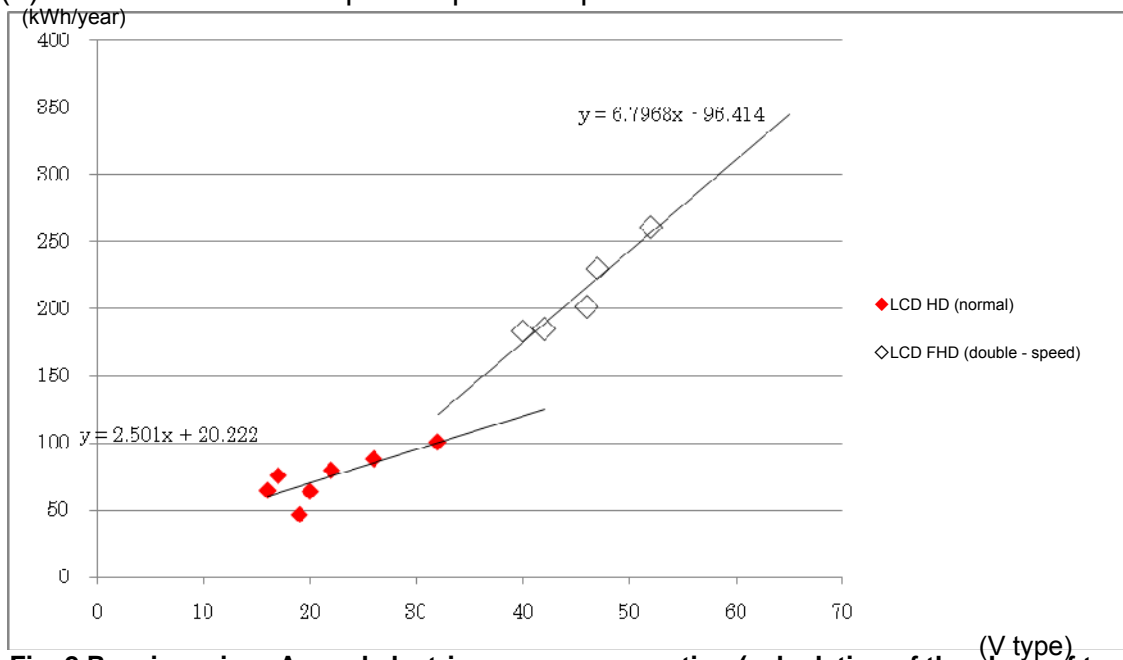


Fig. 2 Receiver size - Annual electric power consumption (calculation of the slope of top runner values)

(2) Share by receiver size

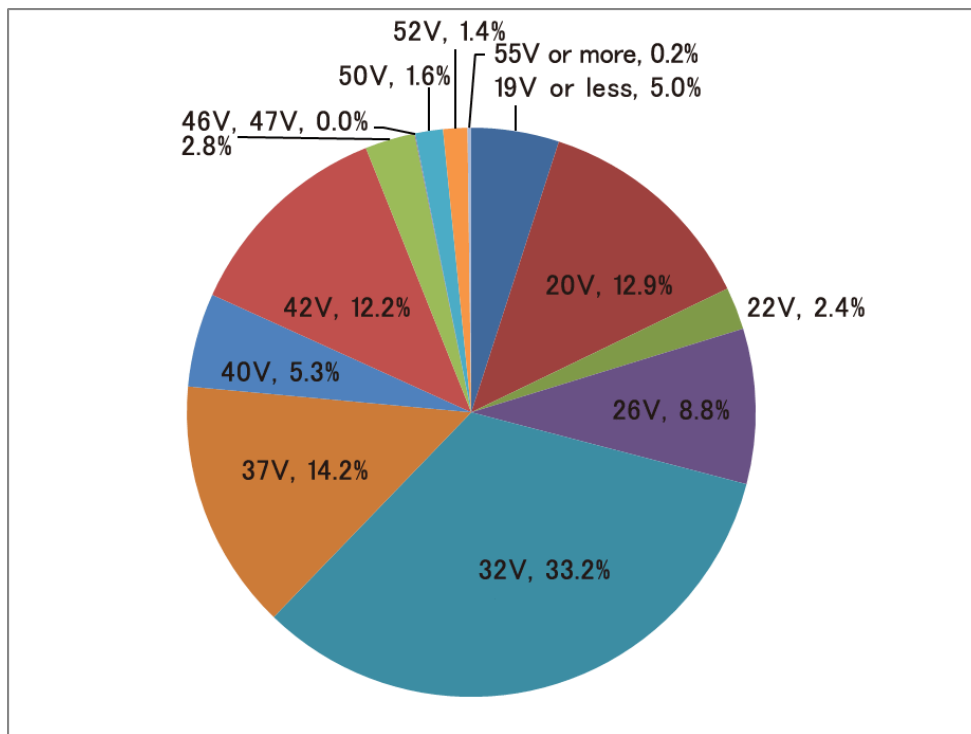


Fig. 3 Shipment share by receiver size [fiscal year 2008]

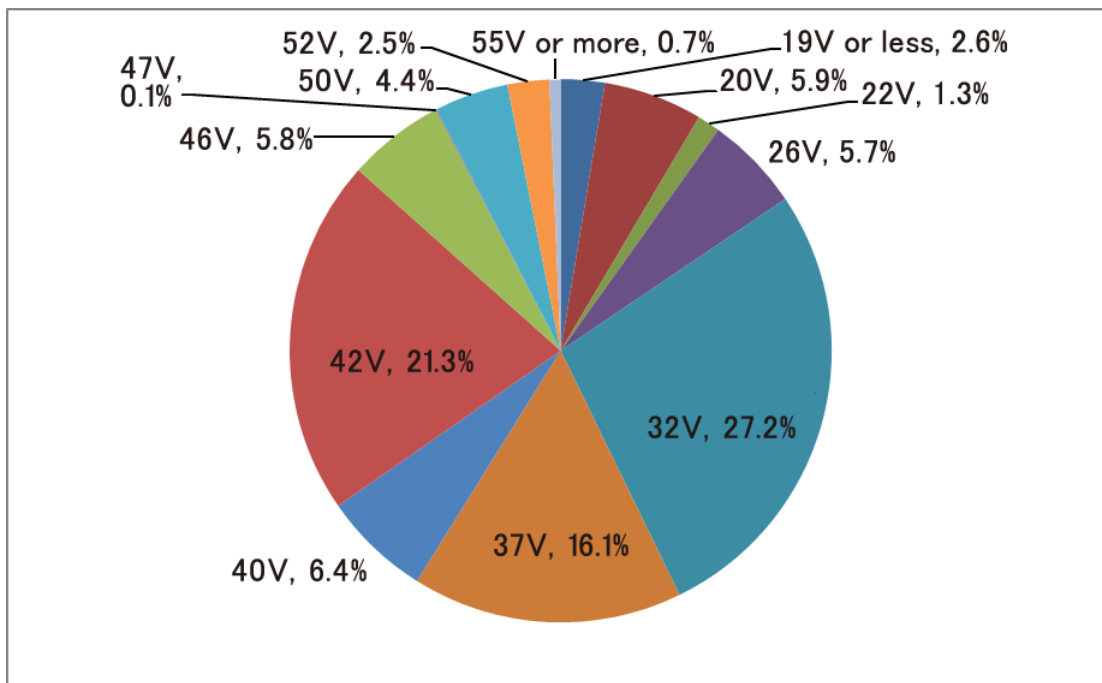


Fig. 4 Annual electric power consumption share by receiver size [fiscal year 2008]

(3) Distribution of products in each function category and top runner standards  
(kWh/year)

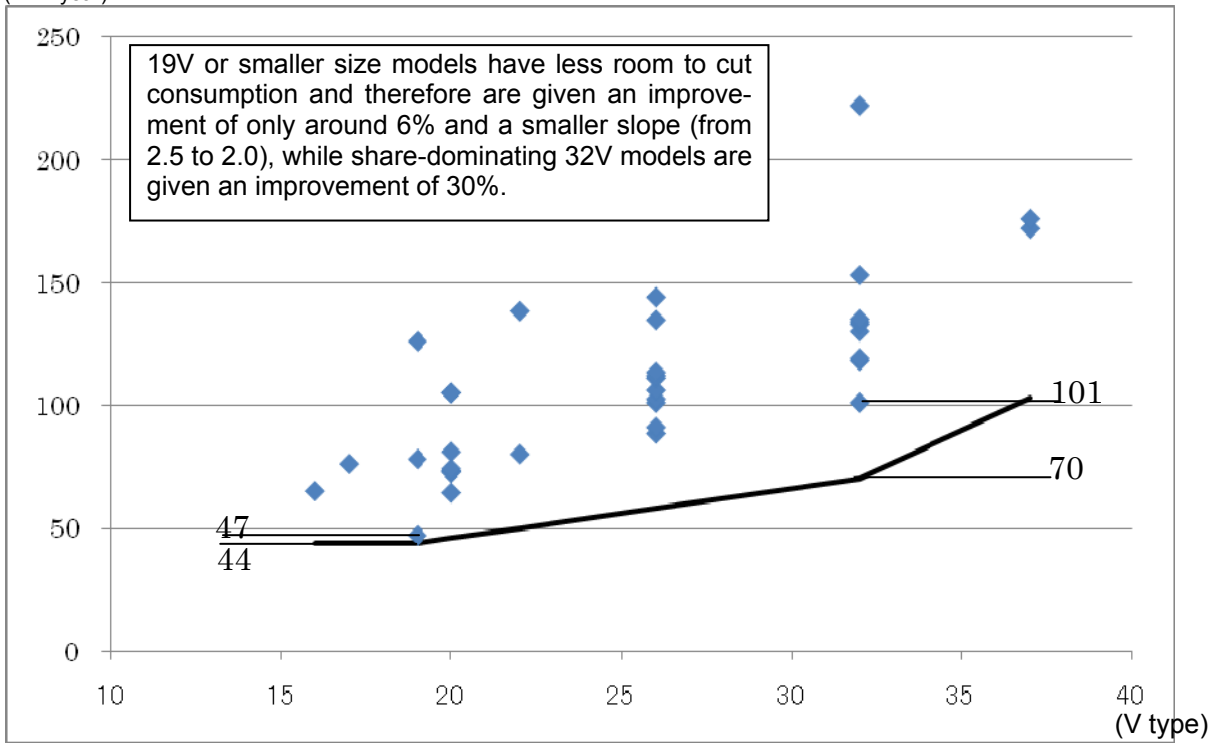


Fig. 5 Receiver size - Target standard value (HD/normal/no added functions)

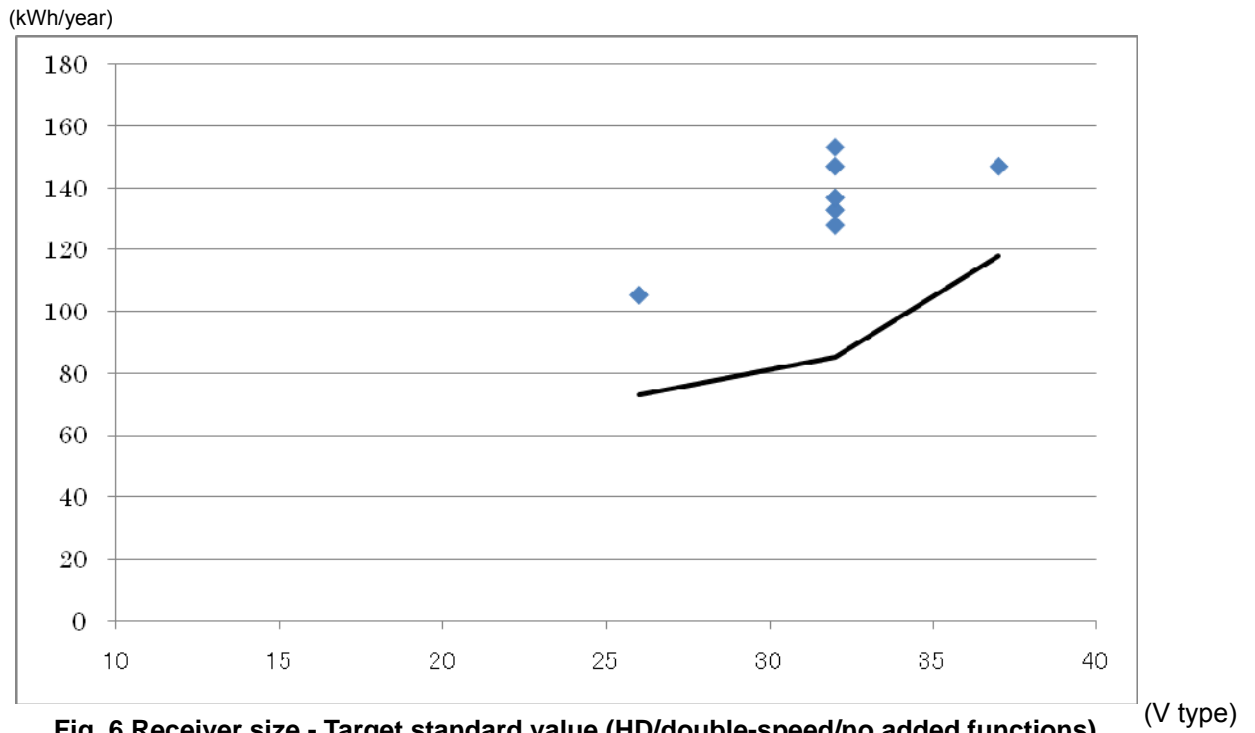
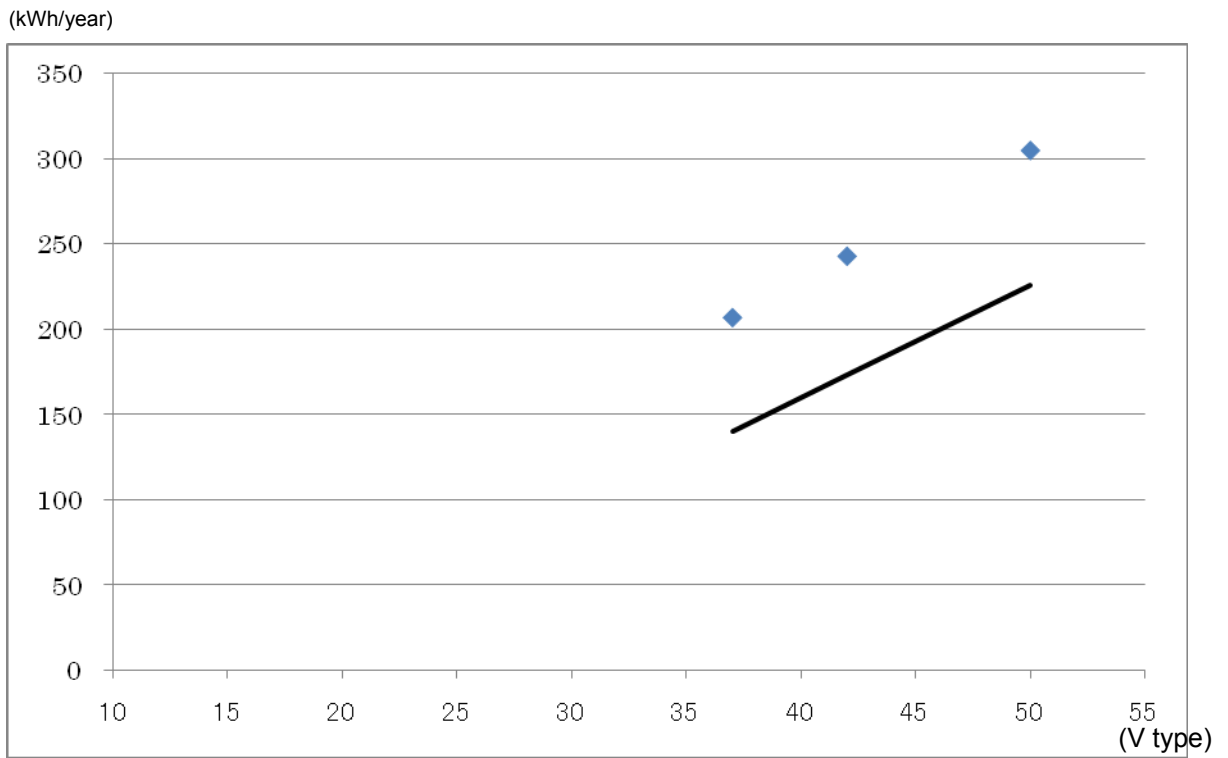
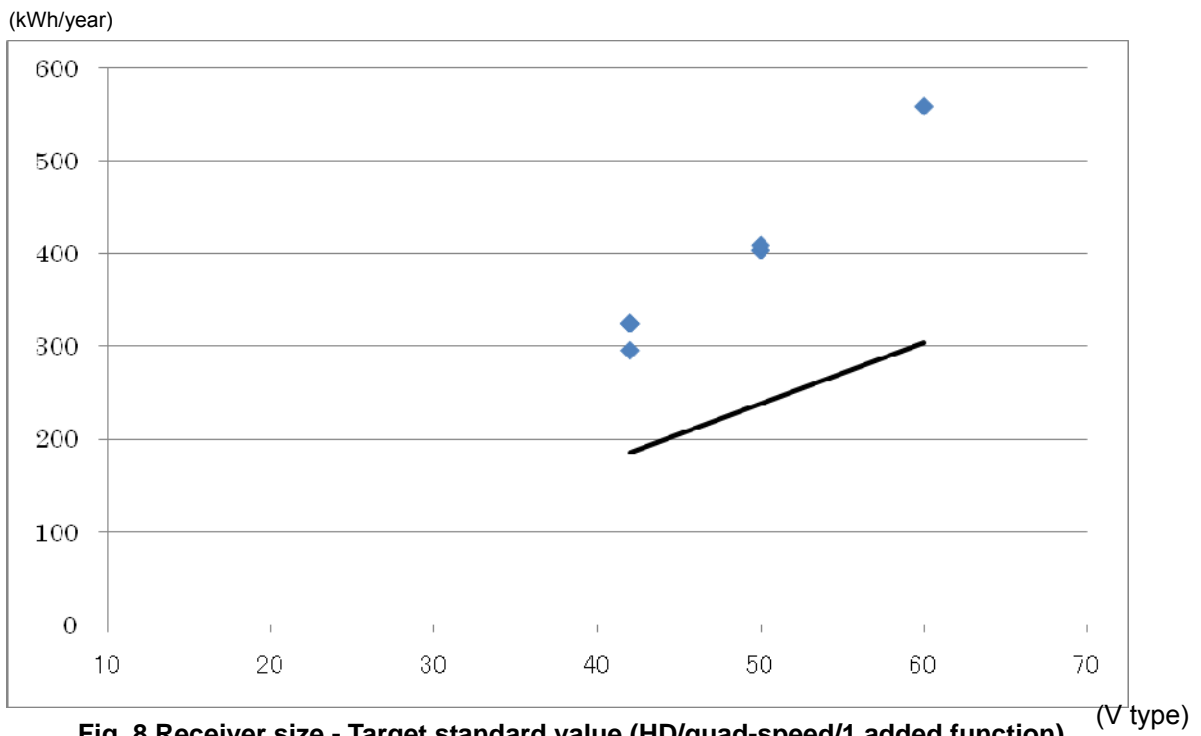


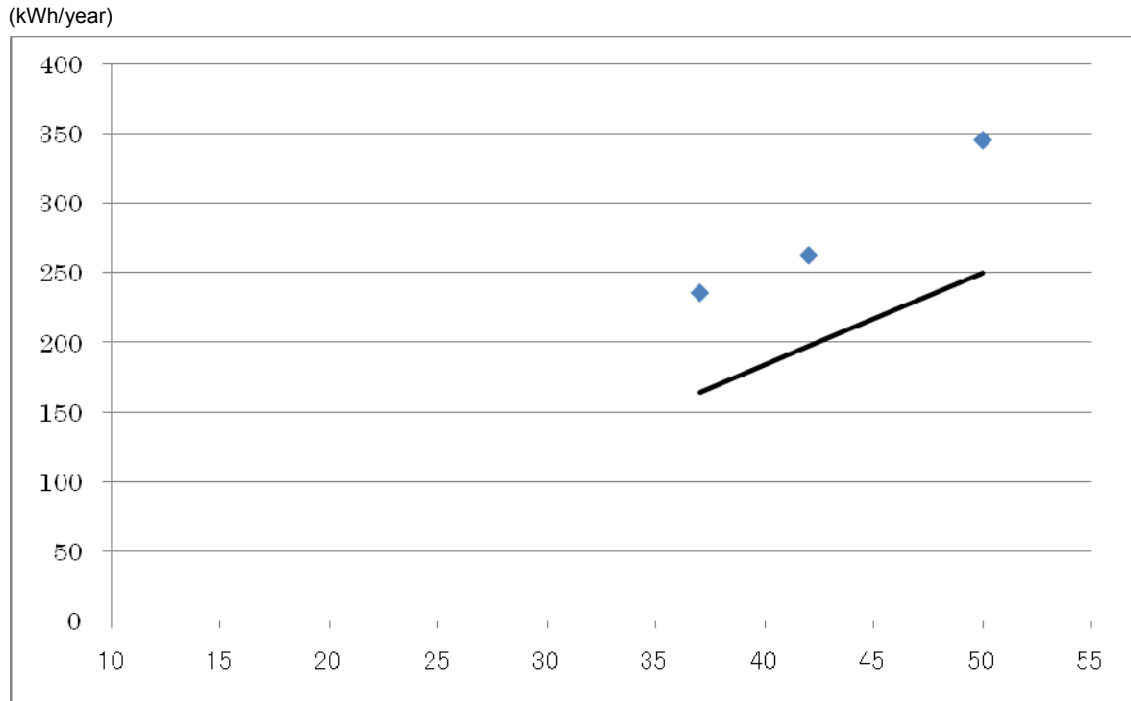
Fig. 6 Receiver size - Target standard value (HD/double-speed/no added functions)



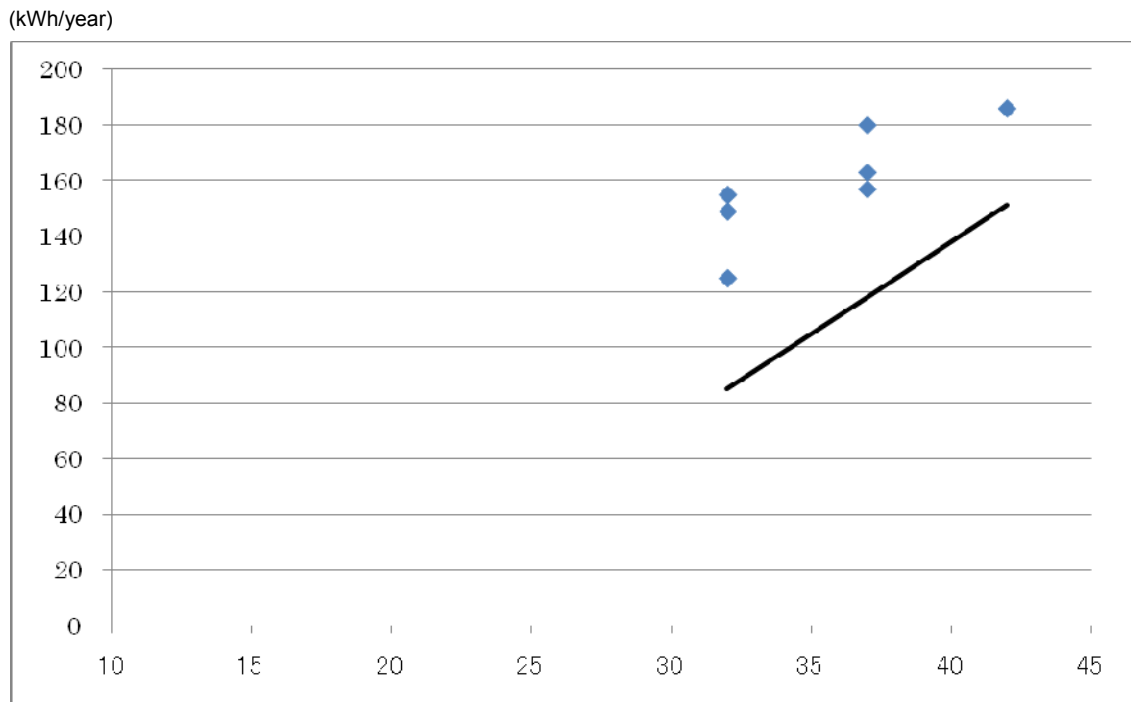
**Fig. 7 Receiver size - Target standard value (HD/quad-speed/no added functions)**



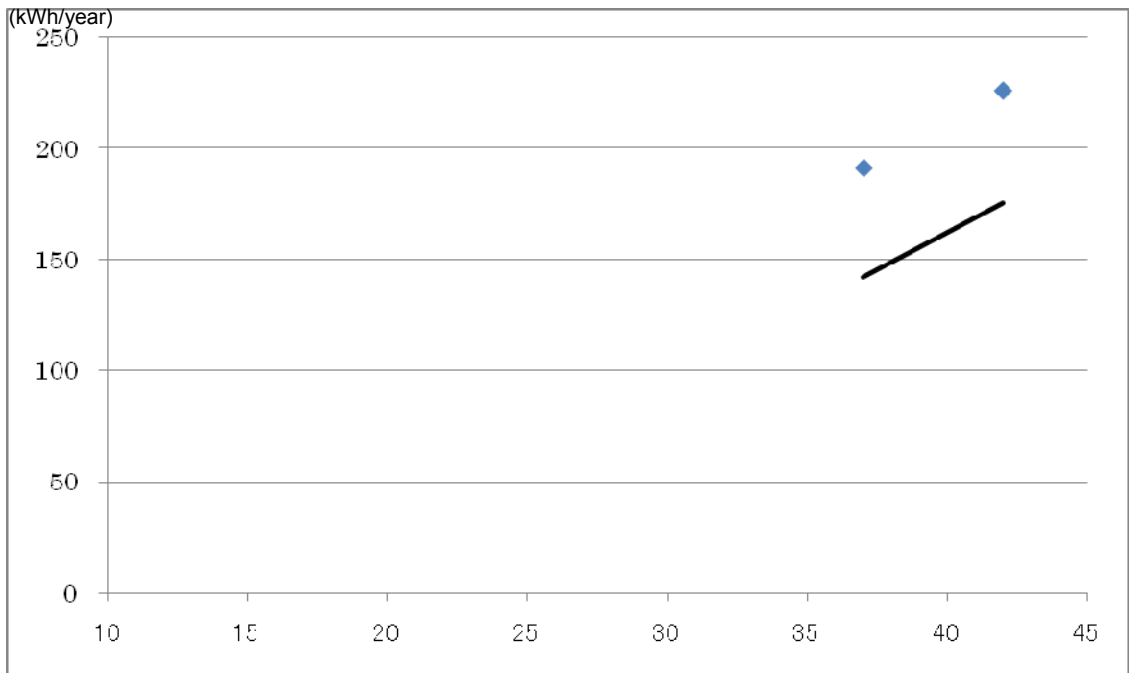
**Fig. 8 Receiver size - Target standard value (HD/quad-speed/1 added function)**



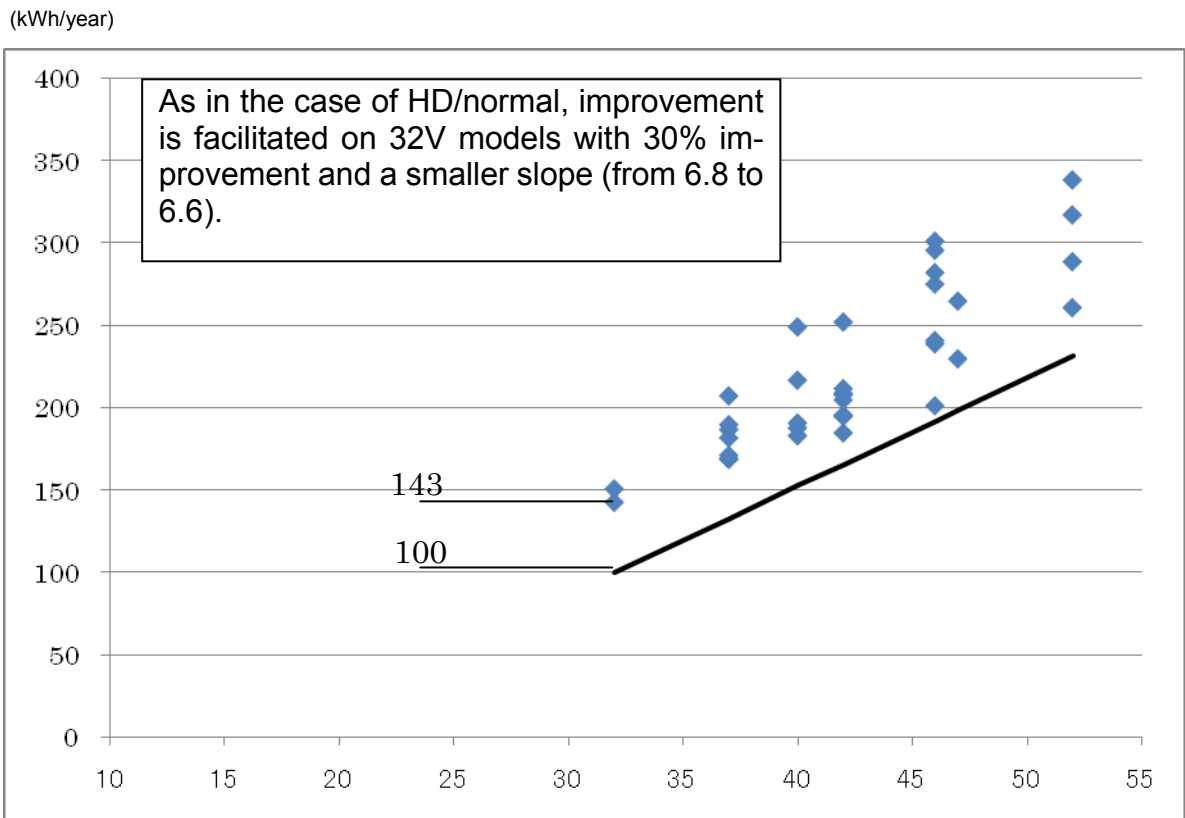
**Fig. 9 Receiver size - Target standard value (HD/quad-speed/2 added functions)** (V type)



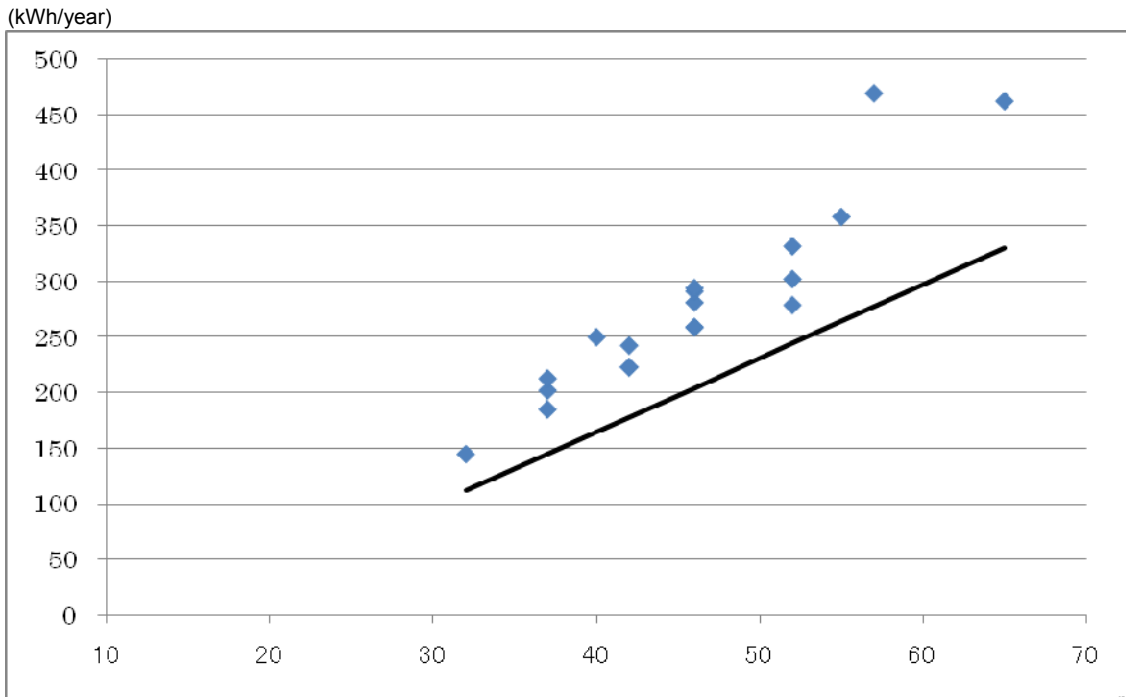
**Fig. 10 Receiver size - Target standard value (FHD/normal/no added functions)** (V type)



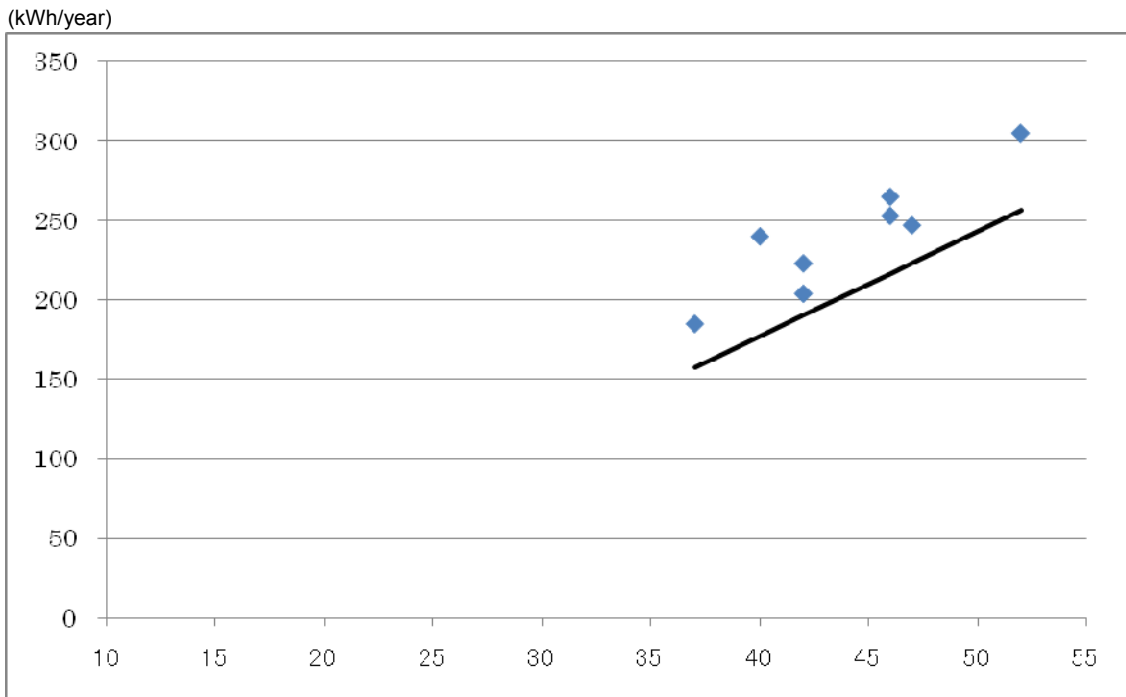
**Fig. 11 Receiver size - Target standard value (FHD/normal/2 added functions)** (V type)



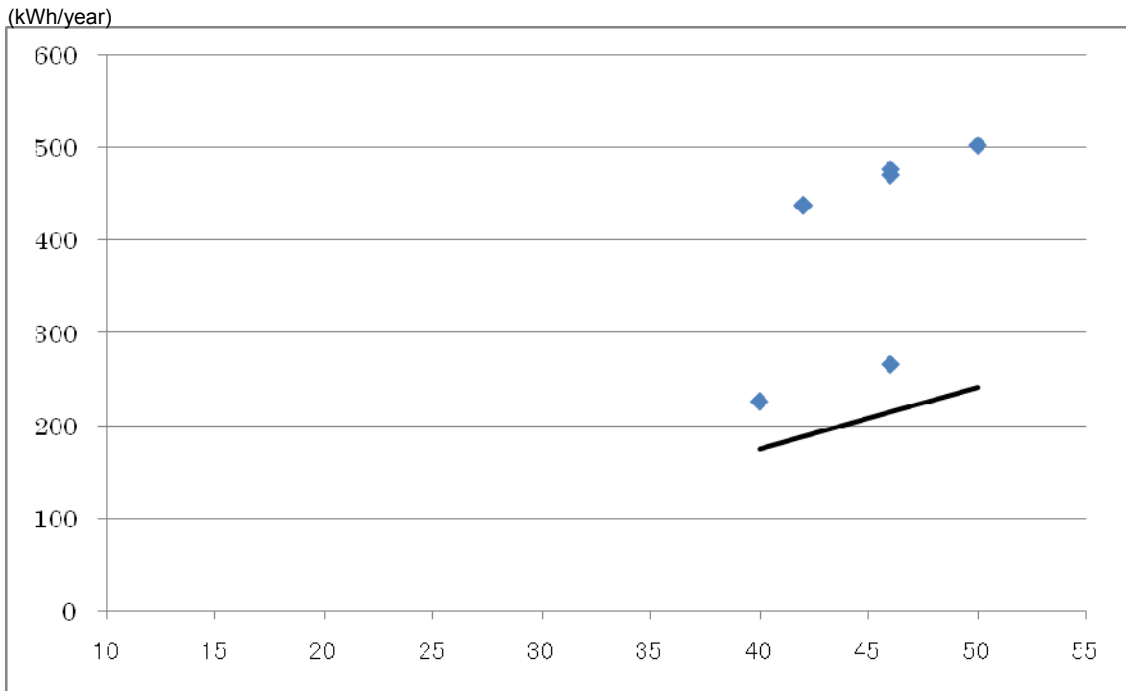
**Fig. 12 Receiver size - Target standard value (FHD/double-speed/no added functions)** (V type)



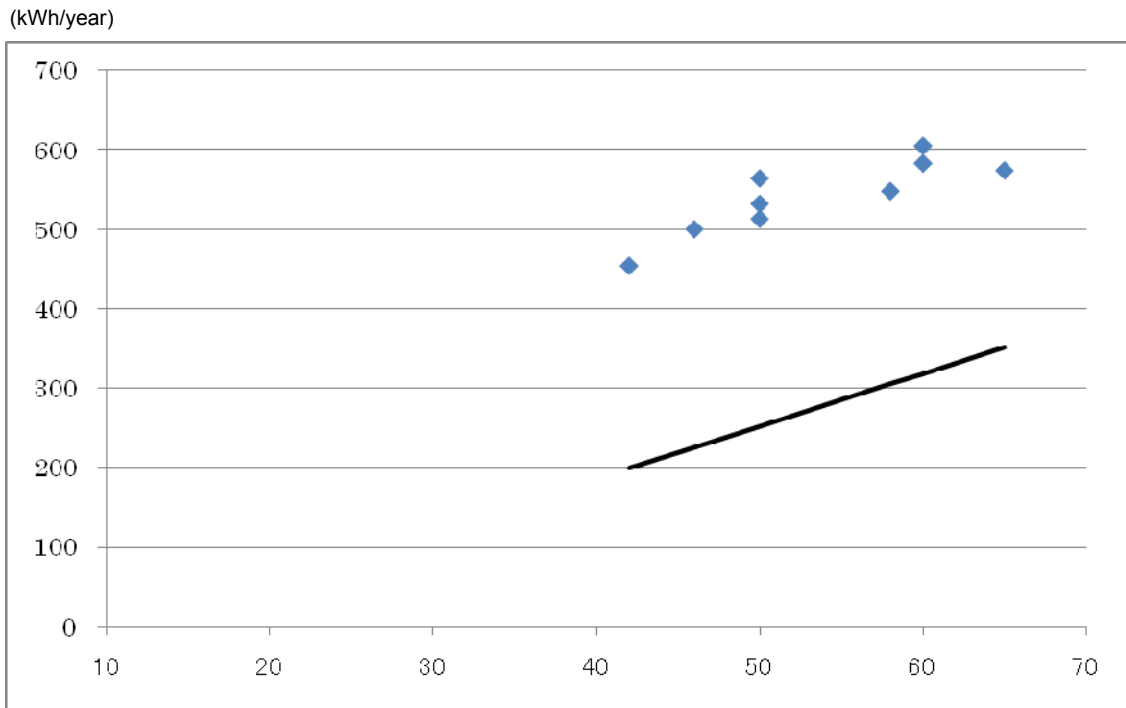
**Fig. 13 Receiver size - Target standard value (FHD/double-speed/1 added function)** (V type)



**Fig. 14 Receiver size - Target standard value (FHD/double-speed/2 added functions)** (V type)

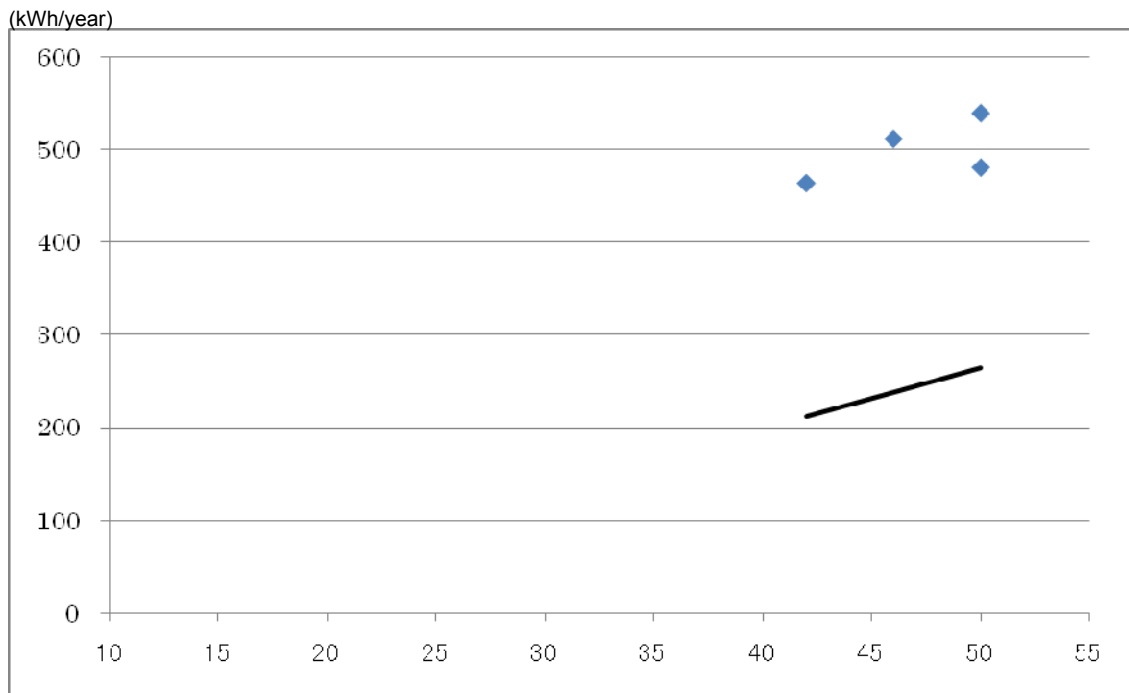


**Fig. 15 Receiver size - Target standard value (FHD/quad-speed/no added functions)** (V type)



**Fig. 16 Receiver size - Target standard value (HD/quad-speed/1 added function)** (V type)





**Fig. 17 Receiver size - Target standard value (HD/quad-speed/2 added functions)** (V type)

## Measurement method for energy consumption efficiency of television receivers

### 1. Basic concept

In 1998, when television receivers were designated as the top runner standard equipment, “annual electric power consumption” was employed as a realistic indicator for energy consumption efficiency.

It is appropriate to continue to employ this indicator for energy consumption efficiency of television receivers, since there is no particular technical problem and it is easy to understand.

With respect to measurement methods, there is no particular problem in using the existing methods for CRT televisions. For LCD and plasma televisions, however, revisions shall be made in this review to the measurement methods that will better suit actual use.

### 2. Specific measurement methods for energy consumption efficiency

The energy consumption efficiency of a television receiver shall be “annual electric power consumption” [kWh/year] calculated in the following formula:

$$E = \{(P_o - P_A / 4) \times t_1 + P_s \times (t_2 - t_{epg}) + P_{epg} \times t_{epg}\} / 1000$$

where E, P<sub>O</sub>, P<sub>S</sub>, P<sub>A</sub>, t<sub>1</sub>, t<sub>2</sub>, P<sub>epg</sub> and t<sub>epg</sub> mean as follows:

E: Annual electric power consumption (kWh/year)

P<sub>O</sub>: Operating power consumption (W)

P<sub>S</sub>: Standby power consumption (W)

P<sub>A</sub>: Power consumption reduction by power saving functions, etc. (W)

P<sub>epg</sub>: Electric power at EPG data acquisition (W)

t<sub>1</sub>: Standard operating hours per year (h) 1642.5 (365 days x 4.5 hours) \*

t2: Standard standby hours per year (h) 7117.5 (365 days x 19.5 hours) \*

tepg: Annual standard hours of EPG acquisition operation (which varies from equipment to equipment)

\* t1 (annual standard operating hours) and t2 (annual standard standby hours) shall remain the same as before, since there is no significant change in television usage.

(1) P<sub>o</sub>: Operating power consumption (unit: watt)

- 1) The operating power consumption of CRT televisions shall be the average of the electric power at the flat level white signal (P<sub>w</sub>) and the electric power at the flat level black signal (P<sub>b</sub>).

In the case of CRT televisions,  $P_o = (P_w + P_b) / 2$

- 2) The operating power consumption of LCD and plasma televisions shall be the electric power during moving picture signal as stipulated in IEC62087 Ed.2.0. The moving picture signal consists of continuous 10-minute signals. 10-minute integral power (P<sub>M</sub>) shall be measured using a watt-hour meter and power consumption per unit hour shall be calculated.(\*)

In the case of LCD and plasma televisions,  $P_o = 6P_M$ .

Measurement shall be taken with the energy saving functions turned off. In the case of models whose power consumption varies depending on input signals (baseband signal input, terrestrial wave band signal input, satellite broadcast wave band signal input, etc.), power consumption shall be measured for each input signal and the average of the largest and smallest of such measurements shall be used as the operating power consumption.

$$P_o = (P_{oMax} + P_{oMin}) / 2$$

\*The characteristics of operating power consumption of LCD and plasma televisions are different from those of CRT televisions. Using the average value of power consumption at flat level white signals and at flat level black signals, the measured operating power consumption tends to be smaller than actual usage.

Because of this, at the time of the previous revisions, the average of the values at color bar signals and three-vertical-bar signals was added for the measurement of LCD and plasma televisions, in order to obtain measured results that are closer to actual use, while utilizing signals generally used in product design. In this report, however, measurement shall be taken by use of the moving picture signals representing actual broadcast signals created by IEC.

(2)  $P_s$ : Standby power consumption (unit: watt)

Standby power consumption is the average value of the power consumption when the power is turned off by the main power switch (PS1) and the power consumption when the power is turned off by the remote controller while the main power is on (PS2). If a power switch is on either the main power or remote control, however, standby power consumption shall be the power consumption when the power switch is turned off.

$$PS=(PS1+PS2)/2$$

(3)  $P_A$ : Power consumption reduction by energy saving functions (unit: watt)

The power consumption reduction by energy saving functions of CRT televisions shall be measured using color bar signals as video signals. The power consumption reduction by energy saving functions of LCD and plasma televisions shall be measured using moving picture signals as video signals. The larger of value either  $P_{A1}$  or  $P_{A2}$  shall be used.

The larger of value either  $P_{A1}$  or  $P_{A2}$  shall be used.

1)  $P_{A1}$ : Power consumption reduction by the Automatic Brightness Control Feature is the value obtained by deducting the power consumption measured at the ambient lighting of 0 lux ( $P_{A1Min}$ ) from the smaller ( $P_{A1Max}$ ) of the power consumption measured at the ambient lighting of at least 300 lux or the power consumption when the energy saving function is turned off.

$$P_{A1} = P_{A1Max} - P_{A1Min}$$

- 2)  $P_{A2}$ : Power consumption reduction by an energy saving switch (unit: watt)

Power consumption reduction by an energy saving switch is the value obtained by deducting the power consumption when the energy saving switch is turned on ( $P_{A2Min}$ ) from the power consumption when the energy saving switch is turned off ( $P_{A2Max}$ ).

$$P_{A2} = P_{A2Max} - P_{A2Min}$$

- (4)  $P_{epg}$ : Power consumption at EPG data acquisition (unit: watt)

Power consumption at EPG data acquisition is the power consumption when a digital broadcasting EPG is being acquired.

- (5) Measurement conditions

The power consumption measurements (1) through (4) shall be conducted under the conditions specified in 3.1 "General Conditions" of the Japanese Industrial Standards C6101-1 (1998), except for the following:

- 1) The contrast adjustment for CRT televisions shall be made so that power consumption reaches the maximum level when receiving flat level white signals in the case of measurements (1) and (2), and in the case of (3), the contrast shall be adjusted to the factory default setting. The brightness shall be adjusted to the factory default setting. The contrast, brightness and backlight for LCD televisions and the contrast and brightness for plasma televisions shall be adjusted to the factory default setting. However, for models that display a menu of these picture quality options when the power is first turned on and thus enable the user to select standard modes, standard modes (modes recommended by the manufacturer for normal home use) shall be selected.
- 2) The audio output for televisions shall be set so that it reaches 50 mW at audio signal 1 kHz as specified in 4.2.1 "Test Methods" of the Japanese Industrial Standards C6101-1 (1988).
- 3) BS antenna power or added functions with on/off options shall be turned off.

- 4) Measurement shall be taken when receivers are in a sufficiently stable condition, including when measurement signals are being switched and during standby.

(6) Input signals

Input signals for the power consumption measurements (1) through (4) shall be as follows:

- 1) Measurement by (analog or digital) terrestrial wave band signal or (analog or digital) baseband signal input

- a. Video signals used in the measurement of CRT televisions shall be flat level white signals, flat level black signals and color bar signals (75/0/75/0) specified in 3.2.1 "Test Video Signals" of the Japanese Industrial Standards C6101-1 (1998).

Video signals used in the measurement of LCD and plasma televisions shall be IEC 62087:2008 video content\_DVD\_60 or IEC 62087:2008 video content\_BD specified in IEC62087 Ed.2.0.

(Moving picture signal for vertical frequency of 60 Hz)

\* Of the three types of signals specified in these DVD and BD, that is, static video content (11.5), broadcast contents (11.6) and internet contents (11.7), broadcast contents (11.6) shall be used.

- b. Audio signals shall be 1 kHz sinusoidal signals.

\* 1 kHz sinusoidal signals reproduced by the broadcast contents (11.6) of IEC 62087:2008 video content\_DVD\_60 or IEC 62087:2008 video content\_BD specified in IEC62087 Ed.2.0 may be used for audio signals.

- c. For (analog) terrestrial wave band input signals, the high frequency television signals in 3.3 of the Japanese Industrial Standards C6101-1 (1998) shall be used. The input signal level shall be - 39 dB (mW).

- d. For (digital) terrestrial wave band input signals, signals in compliance with the standard transmission systems for digital broadcasting and high-definition television broadcasting employed by broadcasting stations shall be used. The input signal level shall be - 49 dB (mW).

- 2) Measurement by (analog or digital) satellite broadcasting wave band

## signal input

- a. Video signals used in the measurement of CRT televisions shall be flat level white signals, flat level black signals and color bar signals (75/0/75/0) specified in 3.2.1 "Test Video Signals" of the Japanese Industrial Standards C6101-1 (1998).

Video signals used in the measurement of LCD and plasma televisions shall be IEC 62087:2008 video content\_DVD\_60 or IEC 62087:2008 video content\_BD specified in IEC62087 Ed.2.0.

(Moving picture signal for vertical frequency of 60 Hz)

\* Of the three types of signals specified in these DVD and BD, that is, static video content (11.5), broadcast contents (11.6) and internet contents (11.7), broadcast contents (11.6) shall be used.

- b. Audio signals shall be 1 kHz sinusoidal signals, and the modulation factor for PCM modulation shall be the maximum modulation of - 18 dB (mW).

\* 1 kHz sinusoidal signals reproduced by the broadcast contents (11.6) of IEC 62087:2008 video content\_DVD\_60 or IEC 62087:2008 video content\_BD specified in IEC62087 Ed.2.0 may be used for audio signals.

- c. For analog input signals, signals converted into a first intermediate frequency band in compliance with the standard transmission systems for standard television broadcasting and high-definition television broadcasting employed by satellite broadcasting stations shall be used. The input signal level shall be - 45 dB (mW).
- d. For digital input signals, signals converted into a first intermediate frequency band in compliance with the standard transmission systems for standard television broadcasting, high-definition television broadcasting, ultrashort wave broadcasting and digital data broadcasting employed by satellite broadcasting stations at the frequency band of 11.7 GHz - 12.2 GHz shall be used. The input signal level shall be - 45 dB (mW).

Energy Efficiency Standards Subcommittee, Advisory Committee for Natural  
Resources and Energy  
List of the Television Receiver Evaluation Standards Subcommittee members

Chairman Mitsutoshi Hatori, Professor Emeritus of The University of Tokyo

Members Hitoshi Aida, Professor of Integrated Information Science,  
Department of Electrical Engineering and Information Systems,  
Graduate School of Engineering, The University of Tokyo

Hiroaki Ikeda, Professor Emeritus of Chiba University

Kenichi Ito, Senior Manager of Japan Consumers' Association

Hirotohi Uehara, Chief of PDP Television Business Unit, Image  
Display/Device Business Group, AVC Networks Company,  
Panasonic Corporation

Hiroyuki Kudo, General Manager of Technology Division, Energy  
Conservation Center, Japan

Kikuko Tatsumi, Executive Board Member and Chairman of  
Environment Committee, Nippon Association of Consumer  
Specialists

Takahiro Tsurusaki, Executive Researcher, Jukankyo Research  
Institute Inc.

Satoshi Hirano, Group Leader, Thermal and Fluid System Group,



Energy Technology Research Institute, National Institute of  
Advanced Industrial Science and Technology

(in Japanese alphabetical order)

Energy Efficiency Standards Subcommittee, Advisory Committee for Natural  
Resources and Energy  
Television Receiver Evaluation Standards Subcommittee  
Meeting history

1st Subcommittee meeting (November 11, 2008)

- Making the Television Receiver Evaluation Standards Subcommittee open to the public
- The current status of television receivers
- The scope of television receiver designation

2nd Subcommittee meeting (April 30, 2009)

- Energy consumption efficiency of television receivers and measurement methods
- Classification, target standard values and target fiscal years of television receivers

3rd Subcommittee meeting (June 2, 2009)

- Interim report