BN-DICT MON01: Domestic Monitors Government Standards Evidence Base 2009: Key Inputs

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

- The aim of this Briefing Note is to provide details and reference sources of the underlying data in the model, along with the key assumptions used in the model.
- There are three main sections to this Briefing Note, corresponding to the main variables of the MTP modelling approach:
  - Ownership & stock
  - Sales
  - Usage & lifespan
- Each section also includes an indication of the overall confidence in the dataset, to provide a sense of the robustness of the model.

- This Government Standard Briefing Note (GSBN) covers domestic monitors. The following definition of monitors is adapted from the ErP Preparatory study on PCs and monitors[1]:

- A commercially-available, electronic product with a display screen and its associated electronics encased in a single housing that is capable of displaying output information from a computer via one or more inputs, such as VGA, DVI, and/or IEEE 1394.

- The monitor usually relies upon a liquid crystal display (LCD) or, less frequently, cathode-ray tube (CRT) or other display devices such as plasma.

[1] European Commission DG TREN Preparatory studies for Eco-design Requirements of ErPs (Contract TREN/D1/40-2005/LOT3/S07.56313) Lot 3 Personal Computers (desktops and laptops) and Computer Monitors Final Report (Task 1-8)

- This definition is intended primarily to cover standard monitors designed for use with personal computers.

- The computer monitors included in this definition must have a viewable diagonal screen size greater than 9 inches and must be capable of being powered by a separate AC wall outlet, or a battery unit that is sold with an AC adapter.

- Computer monitors with a tuner/receiver may be covered as long as they are marketed and sold to consumers as computer monitors (i.e. focusing on computer monitor as the primary function) or as dual-function computer monitors and televisions. However, products with a tuner/receiver and computer capability that are marketed and sold as televisions are not included in the scope of this definition.

2 Ownership & stock

2.1 Summary

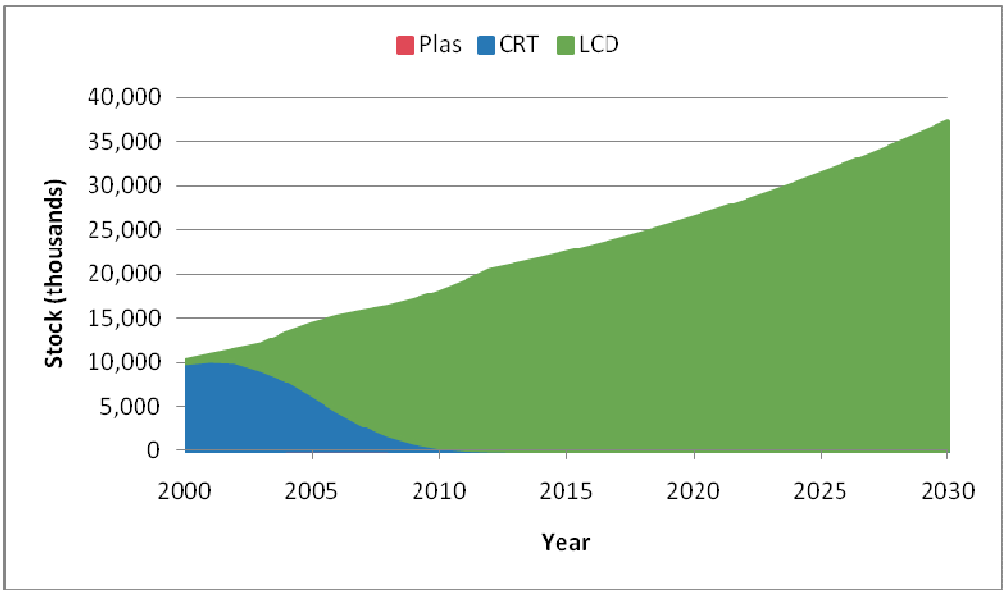

Figure 1 – Total Domestic Monitor Stock

Table 1 - Total Domestic Monitor stock

Year	Stock ('000)			
	CRT monitor	LCD monitor	Plasma monitor	Total Monitors
2009	905	16,022	24	16,951
2010	410	17,477	15	17,902
2020	0	26,329	4	26,333
2030	0	37,224	0	37,224

- Total monitor stock is expected to increase from 2009 onwards. All of this increase in stock will come from LCD monitors, with the stock of both CRT and plasma monitors decreasing into the future. Stock of monitors is expected to increase primarily as a result of increased usage of external monitors with laptop PCs.

2.2 Data sources – ownership & stock

Table 2 - Ownership & stock data sources

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2000 - 2008	GFK Hitlist Data	2008	GFK	Market data sourced from a leading market research organisation.	High
1960, 1998, 2004, 2030	Expert Assumption	2009	MTP Expert Assumption	Assumptions required for past and future stock of monitors.	Medium

2.3 Methodology & key assumptions – ownership & stock

- This section describes what has been done with the data listed in Table 2 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 2) and detail of any background calculations behind the data points.

2.3.1 Historic data

Table 3 Interpolation & background calculations – ownership & stock

Year	Methodology & assumptions
	General monitor stock figures:
All years	The MTP model is a stock-based model, which calculates sales automatically using a stock projection, the product lifetime and a stock churn calculation to account for products purchased in previous years gradually leaving stock. Real sales data is put in as a check only, to help evaluate the output sales from the model. This data series is usually incomplete. MTP models cover the years 1960 to 2030. Stock is only calculated from the years when the products first arrive on the market.
1960	Total stock of monitor: equal to total stock of desktop PCs with an additional amount added for use as external monitors with laptop PCs. The number of monitors assumed to be used with laptop PCs varies according to year as detailed below.
1961 -2008	Total stock of monitor: follows same approach as in 1960
1960-2003	External monitor stock: Assumed that 0% of laptop PCs will use an external monitor. External monitor stock: calculated by multiplying the laptop stock figures by the assumed percentage of external monitors
2004	External monitor stock (percentage): assumed that 20% of laptop PCs will use an external monitor. External monitor stock is then calculated by multiplying the laptop stock figures by the assumed percentage of external monitors
2005 - 2008	External monitor stock (percentage): based on a straight line interpolation between the 2004 and 2030 values. External monitor stock is then calculated by multiplying the laptop stock figures by the assumed percentage of external monitors
	Stock figures per monitor type:
1979	CRT monitor – assumed to be the first year of stock.
2002	LCD monitor – assumed to be the first year of stock.
2003	Plasma monitor - assumed to be the first year of stock.
1998	Distribution of monitor type: assumed that 100% of monitors are CRT. Based on an expert assumption.
1999	Distribution of monitor type: based on a straight line interpolation between the 1998 and 2000 values.
2000-2008	Distribution of monitor type: percentage of each type of monitor (CRT, LCD and plasma) based on distribution of monitor types in GfK data.

2.3.2 Future analysis

Table 4 Extrapolation & background calculations – ownership & stock

Year	Methodology & assumptions
	General monitor stock figures:
2009 - 2029	Total stock of monitor: follows same approach as in 1960. External monitor stock (percentage): continues straight line interpolation between the 2004 and 2030

Year	Methodology & assumptions
	values.
2030	External monitor stock (percentage): Expert assumption that 75% of laptop PCs will use an external monitor (in the absence of any data).
	Stock figures per monitor type:
2009	Assumed that no further CRT sales occur. Based on an expert assumption with relevance to low (0.5%) CRT sales figure included in the 2008 GfK data.
2009	Distribution of plasma monitors based on a straight line interpolation between the 2008 and 2024 values.
2009	LCD monitor stock percentage equal to 100% minus percentage of CRT and plasma monitors.
2010-2030	LCD monitor stock calculated using the approach set out for 2009.
2010-2030	CRT percentage assumed to be equal to the 2009 value at 0%.
2024	Assumed that no further plasma monitor sales occur. Based on an expert assumption with relevance to low (0.04%) CRT sales figure included in the 2008 GfK data.
2025 - 2030	Distribution of plasma monitors assumed to be the same as in 2024.

2.4 Data issues – ownership & stock

- This section flags any areas of uncertainty, both in general and for specific data points, along with a description of how this has been dealt with in the model

Table 5 Data issues – ownership & stock

Issue/risk	Approach taken/rationale
The ICT market changes rapidly. A sudden change in the ICT market can have large impacts on sales and hence stock of particular products. For example, stock and sales of monitors could quickly shift to another screen type (e.g. Organic Light Emitting Diode (OLED)) if sufficient advantages are present.	MTP takes account of probable changes in future sales within the current product types covered. MTP does not currently model OLED screen monitors due to uncertainties around when they will arrive on the market in significant numbers. MTP expects OLED displays to first enter the television market in significant numbers and then transfer into the monitor market. These assumptions are reviewed on an annual basis
Future stock levels of monitors to be used as external displays for laptop PCs are uncertain.	MTP reviews the sales and stock of monitors and compares against PC sales.

2.5 Confidence level – ownership & stock

- This section provides an indication of overall confidence in the data set (i.e. data points, calculations, interpolation and projections).
- Current stock levels are likely to be relatively accurate as they are based on purchased market data from leading market research companies. Past and future estimates of stock are based on assumptions and so become less accurate further into the past or future.

Data quant	
HIGH	

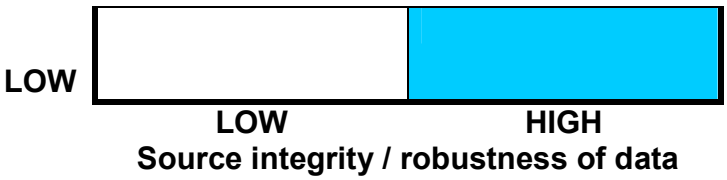

Figure 2 Confidence indicator for ownership data

3 Sales

3.1 Summary

Figure 3 – Total Domestic Monitor Sales

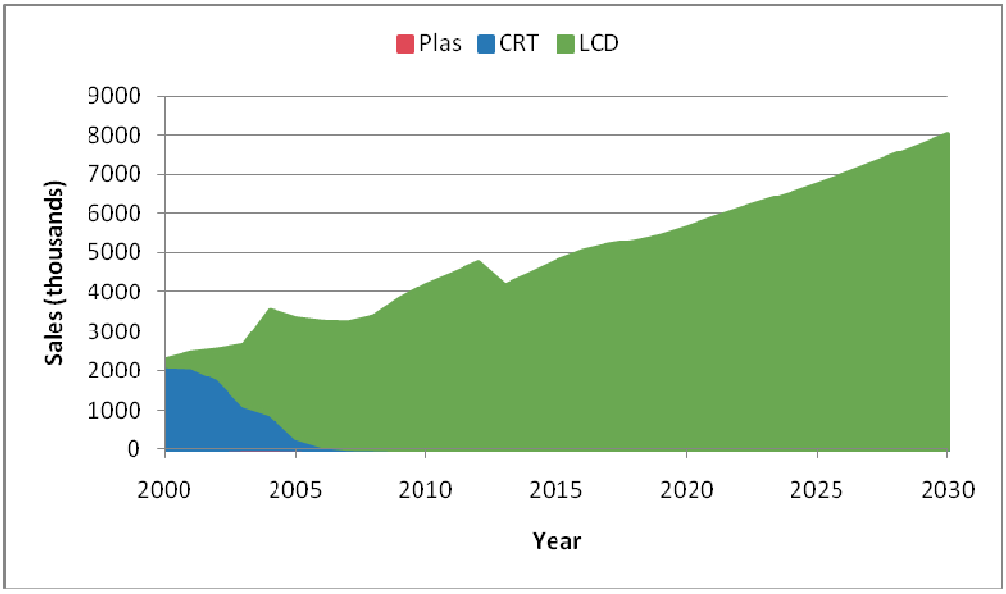

Table 6 - Total monitor Sales

Year	Sales ('000)			
	CRT monitor	LCD monitor	Plasma monitor	Total monitors
2009	0	3,827	1	3,828
2010	0	4,184	1	4,185
2020	0	5,643	1	5,643

Year	Sales ('000)			
	CRT monitor	LCD monitor	Plasma monitor	Total monitors
2030	0	8,021	0	8,021

- Sales of domestic monitors are expected to continue increasing in the future predominately as external displays for laptop PCs become more popular. Nearly all future sales of monitors will be LCD monitors. Sudden changes in the sales graph are caused by interactions between the sales volumes of the different monitor types.

3.2 Data sources - sales

- This model is a stock-based model, which calculates sales automatically using the stock projection and the product lifetime. Real sales data is put in as a check only, to help evaluate the output sales calculated from the model. This data series is usually incomplete. The sales shown in the previous charts and tables were to illustrate the full generated (rather than input) sales data series.

Table 7 Sales data sources

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2000 - 2008	GFK Hitlist Data	2000 - 2008	GFK	Best data available	High

3.3 Methodology & key assumptions - sales

- This section describes what has been done with the data listed in Table 7 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 7) and detail of any background calculations behind the data points.

3.3.1 Historic data

Table 8 Interpolation & background calculations – sales data

Year	Methodology & assumptions
1960-2000	The MTP model is a stock-based model, which calculates sales automatically using a stock projection, the product lifetime and a stock churn calculation to account for products purchased in previous years gradually leaving stock. Real sales data is put in as a check only, to help evaluate the output sales from the model. This data series is usually incomplete.
2000 - 2008	GfK data used as input sales figures to models

3.3.2 Future analysis

Table 9 Extrapolation & background calculations – sales data

Year	Methodology & assumptions
2009 -2030	The MTP model is a stock-based model, which calculates sales automatically using a stock projection, the product lifetime and a stock churn calculation to account for products purchased in previous years gradually leaving stock. Real sales data is put in as a check only, to help evaluate the output sales from the model. This data series is usually incomplete.

3.4 Data issues - sales

- This section flags any areas of uncertainty, both in general and for specific data points, along with a description of how this has been dealt with in the model

Table 10 Data issues - sales

Issue/risk	Approach taken/rationale
The ICT market changes rapidly. A sudden change in the ICT market can have large impacts on sales and hence stock of particular products. For example, stock and sales of monitors could quickly shift to another screen type (e.g. OLED) if sufficient advantages are present.	MTP take account of probable changes in future sales within the current product types covered. MTP does not currently model OLED screen monitors due to uncertainties around when they will arrive on the market in significant numbers. MTP expects OLED displays to first enter the television market in significant numbers and then transfer into the monitor market. These assumptions are reviewed on an annual basis.
Future sales levels of monitors to be used as external displays for laptop PCs are uncertain.	MTP will continually review the sales and stock of monitors and compare against PC sales.

3.5 Confidence level

- This section provides an indication of overall confidence in the data set (i.e. data points, interpolation and projections).
- MTP has a large amount of confidence in the sourced sales data inputted into the monitor models. Confidence in sales levels reduced further into the future, where changes in the ICT industry could cause larger divergences in sales levels compared to MTP assumptions.

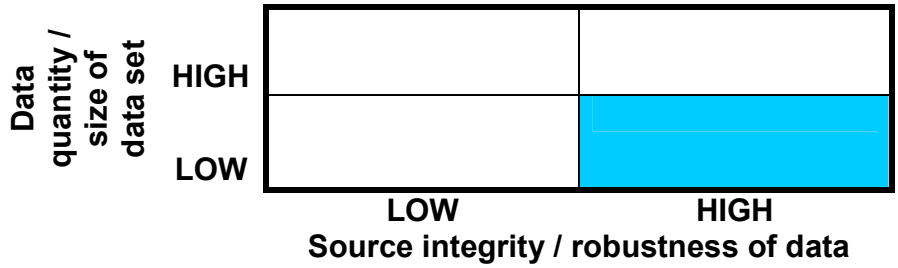

Figure 4 Confidence indicator for sales data

4 Usage & lifespan

4.1 Summary

- Two sets of use profiles are developed for CRT and LCD monitors. The first use profile is based on a situation where no power management is enabled and the second where power management is enabled. The non-enabled power managed use profile is the same as the enabled use profile but with the sleep time added to the on-idle time. An "enabling rate" is used as a weighting factor between these two use profiles to arrive at overall use profile for each product. No enabling rates are developed for plasma monitors as it is assumed that these types of monitors do not have a sleep mode. Details of enabling rates can be seen in each scenario GSBN.
- The table below shows the **fully enabled use profile** (i.e. what 100% enabling would look like). The non-power managed use profile is calculated by adding the sleep mode time to the on-ready time.

Table 11 - Power managed usage profile - domestic monitors

	CRT and LCD Monitor				Plasma Monitors		
	(Use Hours/Year)				(Use Hours/Year)		
Year	On-Active	Sleep	Off	Off-Unplugged	On-Active	Off	Off-Unplugged
2008	1,699	1,528	5,335	199	1,699	6,862	199
2010	1,699	1,860	5,002	199	1,699	6,862	199
2020	1,699	3,689	3,173	199	1,699	6,862	199
2030	1,699	3,689	3,173	199	1,699	6,862	199

Table 12 Monitor lifespan

	Years		
Year	CRT	LCD	Plasma
2008	5.0	5.0	5.0
2010	5.0	5.0	5.0
2020	5.0	5.0	5.0
2030	5.0	5.0	5.0

- Domestic CRT and LCD monitor on-active use time is expected to remain constant after 2008.
- Sleep mode time for CRT and LCD monitors is expected to increase as users are assumed to leave PC systems on for longer periods of time but not in active use (e.g. downloading files from the internet).
- Off-mode time is expected to decrease as sleep mode time increases.
- Lifespan is expected to remain constant into the future as advances in monitor technology continue to encourage regular upgrading.

4.2 Data sources – usage & lifespan

Table 13 – Usage & lifespan data sources

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2008	Fraunhofer	2006	Fraunhofer	Best data	Medium
2008	ENERGY STAR Use profiles	2005 and 2006	ENERGY STAR	Best data	Medium
2008	Lawrence Berkely National Laboratories (LBNL) use profiles	2005	LBNL	Best data	Medium
2008	TIAX	2006	TIAX	Best data	Medium
2008	Expert Assumptions	2009	MTP (Jonathan Wood)	Required expert assumptions to collate external use profiles	Medium

4.3 Methodology & key assumptions – usage & lifespan

- This section describes what has been done with the data listed in Table 13 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 13) and detail of any background calculations behind the data points.

4.3.1 Historic data

Table 14 Interpolation & background calculations – usage & lifespan data

Year	Methodology & assumptions
	General approach:
1960 - 2008	CRT and LCD monitors – two sets of daily use profiles are developed for each product type one based on a situation where no power management is enabled and the second where power management is enabled. An "enabling rate" is used as a weighting factor between these two use profiles to arrive at overall use profile for each product. MTP models start in 1960 and this year is used as the base year but no use of products occurs until the first date they are assumed to have first arrived on the market.
1960 – 2008	Plasma monitor has one use profile as it is assumed that these types of monitors have no power management functionality. Based on an expert opinion.
1960-2007	All monitors – annual use profiles developed in the same way as in 2008.
2008	All scenarios: CRT and LCD monitor non-enabled use profile are the same as the enabled use profile but with the sleep time added to the on-idle time. This is to account for the fact that non-power managed enabled products will not spend any time in sleep mode. Assumptions based on expert opinion as no further information available.
2008	All monitors – daily use profiles as detailed above are multiplied by 365 days to arrive at annual use profiles.
	On active mode:
1960 - 2007	CRT, LCD and plasma monitor on-active mode use profiles based on same assumption as in 2008.
2008	CRT, LCD and plasma monitor on-active mode use profiles based on 90% of the desktop PC use profile to account for increasing use of desktop when screen likely to be in sleep or off mode (e.g. downloading files).
	Sleep mode:
1960 - 2007	CRT and LCD monitor sleep mode use profiles calculated in the same way as in 2008.
2008	CRT and LCD monitor sleep mode use profiles based on desktop PC sleep mode time plus the difference between the monitor and desktop on-active time. This additional amount accounts for increasing use of desktop when screen likely to be in sleep or off mode (e.g. downloading files).
	Off / unplugged modes:
1960 - 2007	CRT and LCD monitor off mode and off unplugged use profiles calculated in the same way as in 2008.
1960 - 2007	Plasma monitor off mode calculated in the same way as in 2008.
1960-2007	Plasma monitor off unplugged time based on same assumption as in 2008.
2008	Plasma monitor off mode based on off-mode time of desktop PC plus the assumed sleep mode time of CRT and LCD monitors. This is to account for the expert assumption that plasma monitors do not have a sleep mode.
2008	Plasma monitor off unplugged time assumed to be the same as desktop PCs.
2008	CRT and LCD monitor off mode and off unplugged use profiles assumed to be the

Year	Methodology & assumptions
	same as desktop PCs. Based on an expert assumption as no further data available.
	Lifetime:
2008	Lifetime of all monitor types assumed to be 5.0 years. Based on an expert opinion as no further evidence available.
1960 – 2007	Lifetime assumed to be the same as in 2008

4.3.2 Future analysis

Table 15 Extrapolation & background calculations – usage & lifespan data

Year	Methodology & assumptions
2009 - 2030	CRT, LCD and plasma monitor use profiles (all power modes) based on same approach as in 2008.
2009 - 2030	Lifetime of all monitor types assumed to be the same as in 2008.

4.4 Data issues – usage & lifespan

- This section flags any areas of uncertainty, both in general and for specific data points, along with a description of how this has been dealt with in the model

Table 16 Data issues – usage & lifespan

Issue/risk	Approach taken/rationale
Estimates of the time ICT products spend in each power mode varies considerably from source to source. The amount of time products spend in “on-modes” has a large impact on total energy consumption calculations. Large divergences in estimates suggest that knowledge in this area needs to be improved.	MTP has collated the most widely known use profiles and applied expert assumptions to derive expected use profiles for ICT products in the UK. MTP will continue to evaluate new use profile data.
The ICT industry can change rapidly. Rapid changes such as uptake of new technologies can have large impacts on the use of products as organisations take up new or altered practices.	MTP attempt to model the most likely set of use profiles to reflect current product usage and take possible future uses into consideration.
Lifetime data may vary considerably. Likelihood that monitors have a second lifetime after first 5.0 years.	MTP are currently evaluating whether to produce “secondary” monitor models to reflect second lifetimes of these products.

4.5 Confidence level – usage & lifespan

- This section provides an indication of overall confidence in the data set (i.e. data points, interpolation and projections)
- Use profile figures vary considerably between published sources and are often not based on current year data. Calculating simple averages of the published figures

resulted in unrealistic use profiles. For this reason, MTP needed to make some assumptions surrounding expected use profiles.

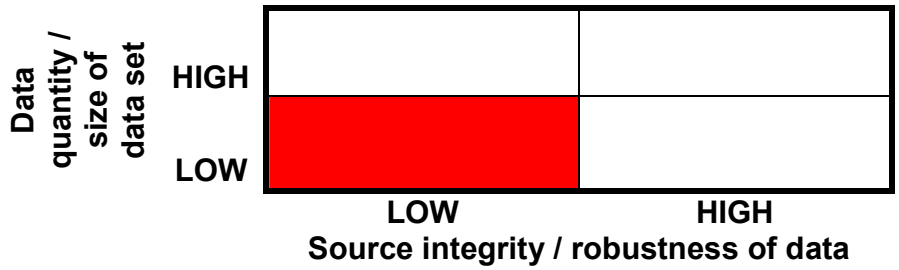

Figure 5 Confidence indicator for usage & lifespan data

Related MTP information

- BN-DICT MON02: Government Standards Evidence Base 2009 – Reference Scenario, Domestic Monitors
- BN-DICT MON03: Government Standards Evidence Base 2009 – Policy Scenario, Domestic Monitors
- BN-DICT MON04: Government Standards Evidence Base 2009 – Best Available Technology (BAT) Scenario, Domestic Monitors
- BN-NDICT MON01: Government Standards Evidence Base 2009 – Key Inputs, Non Domestic Monitors
- BN-NDICT MON02: Government Standards Evidence Base 2009 – Reference Scenario, Non Domestic Monitors
- BN-NDICT MON03: Government Standards Evidence Base 2009 – Policy Scenario, Non Domestic Monitors
- BN-NDICT MON04: Government Standards Evidence Base 2009 – Best Available Technology (BAT) Scenario, Non Domestic Monitors
- BN-DICT KO01: Government Standards Evidence Base 2009 – Key Outputs, Domestic ICT
- BN-NDICT KO01: Government Standards Evidence Base 2009 – Key Outputs, Non Domestic ICT
- Television Briefing notes published in the consumer electronics area, beginning “BNCE TV”.

Changes from Version 1.0

- Minor changes to the template.

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.

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