REPORT

Client: Rachel Buckle
Sustainable Energy-Using
Products
Defra
5D Ergon House
London
SW1P 2AL

Report
issued by:

Intertek

Intertek Testing & Certification Ltd.
Davy Avenue
Knowlhill
Milton Keynes
MK5 8NL

Tel.   +44 (0)1908 857777
Fax.   +44 (0)1908 857830

AUTHORISED
FOR ISSUE:

Wendy Brown
Business Stream Manager

DATE: May 2011

REPORT AUTHOR: Vanessa Lelliott
Mark Coggin
Simone Bernarde

R66398   **Issue 3**
**Research Study of Energy
Consumption of Digital
Radios Upgrade**

CONTENTS

APPENDICES

SUMMARY

- Test data has been provided for 57 different models

- **Table 1** below provides an overall summary of the in-use and standby power consumption figures for all 57 models tested in this project, both separately, and combined with the 164 models previously tested in Intertek project R66198. However, combining these different product categories does not give a very representative picture of the market as the results are skewed by the higher power consuming mini hi-fi products which take a smaller market share.

- **Table 2** below provides an overall summary of the in-use and standby power consumption figures by product category

- **Table 3** below provides an overall summary of the in-use and standby power consumption for tradebrands versus non-tradebrands

- **Table 4** below provides a combined overall summary of the in-use and standby power consumption figures by product category for the 57 models tested in this project and the 164 models previously tested in Intertek project R66198

Table 1 – Overall summary of results

Mode	Average all products (W)	
	R66398	R66198 & R66398 combined
Power consumption in-use DAB	4.05	6.11
Power consumption in-use FM	4.68	8.99
Power consumption in-use FM only *	6.04	6.01
Power consumption internet	10.55	14.05
Standby power consumption	1.02	1.86

* One code from Intertek project R66198 (DAB 37) was excluded from the calculations
Note: Combining the different categories of products in this way does not give very meaningful results because they are skewed by the higher power consuming mini hi-fi products

Table 2 – Summary of results by product

	Average in use power consumption (W)	% difference against FM only	Average standby power consumption (W) [1]	% difference against FM only
Tabletop				
DAB	4.78	0%	1.56	-7%
FM (in DAB)	3.35	-30%		
FM only	4.78		1.68	
Tabletop/portables				
DAB	3.14	166%	0.81	0%
FM (in DAB)	2.57	118%		
FM only	1.18		0.81	
Mini/Micro/audio				
DAB	9.01	19%	0.60	-37%
FM (in DAB)	9.12	21%		
FM only	7.54		0.95	

Notes:

[1] Greater than 1W is allowed if device has a clock.

Table 3 – Tradebrands v non-tradebrands

	Tradebrands	Non Tradebrands
No. of models tested	23	34
Power consumption in-use DAB	3.31	4.48
Power consumption in-use FM (in DAB)	3.58	6.33
Power consumption in-use FM only	4.14	8.57
Standby power consumption	0.81	1.04

Table 4 – Combined summary of results by product for all products tested to date

	No. of products	Average in use power consumption (W)	% difference against FM only	Average standby power consumption (W)	% difference against FM only
Tabletop					
DAB	58	5.65	48%	2.77	12%
FM (in DAB)	54	5.74	50%		
FM only	16	3.83		2.47	
Internet (in DAB)	10	8.40			
Internet (no DAB)*	6	6.15			
Tabletop/portables					
DAB	82	4.15	123%	1.53	41%
FM (in DAB)	80	4.07	119%		
FM only	14	1.86		1.08	
Mini/micro/audio					
DAB	14	19.48	97%	0.49	-66%
FM (in DAB)	14	18.64	88%		
FM only	24	9.89		1.43	
Internet (in DAB)	2	41.25			
Internet (no DAB)	1	24.00			
Separates (& Home Cinema Amplifiers)					
DAB	4	9.48	-43%	2.47	-46%
FM (in DAB)	4	8.13	-51%		
FM only**	3	16.60		4.57	

* Includes some FM/internet radios
** One code (DAB 37) was excluded from the calculations

More detailed summary tables providing the results by category and trade brand versus non-trade brand are provided in **Appendix I** of this report.

INTRODUCTION

Intertek Milton Keynes were commissioned by AEA Technology, to carry out research on behalf of the DEFRA Sustainable Products and Materials team to produce data on the energy performance of analogue and digital radio receivers and a model of the projected changes in energy consumption resulting from the proposed switchover to digital in 2015. This report covers Phase 3 of this study, specifically the energy consumption measurements of analogue and digital radios released since those tested in the previous report '**R66198 Research Study of Energy Consumption of Digital Radios Upgrade – Phase 1 Issue 1**'.

This report replaces '**R66398 Research Study of Energy Consumption of Digital Radios Upgrade Issue 2'** and now includes an overall summary table (**Table 1**) for all 57 models tested in this project, both separately, and combined with the 164 models previously tested in Intertek project R66198. There are also some amendments to **Table 4,** which was numbered **Table 3** in Issue 2, as Separates (& Home Cinema Amplifiers) had been combined with the Mini/micro/audio category.

This report should be read in conjunction with Excel spreadsheet '**R66398 DAB Radios Results Table Issue 1'.xls**

Testing was carried out at Intertek Milton Keynes during March/April 2011.

The tests have been carried out in accordance with the test programme, and as such, the results are only applicable to the sample tested and the conditions of the test. Sample variability and changes in test conditions could influence some results, and the result(s) as stated may not be representative of the mean result if a number of different samples were tested under a variety of test conditions.

Taken on its own, this report should not be used for regulatory purposes e.g. declaring conformance with directives.

1   Market Analysis

Market analysis was carried out to ensure that the products chosen for testing represented the market both in terms of brand coverage and specific models of radio. The following resources were used:

1.1   For phases 1 and 2, all the major manufacturers of DAB and audio equipment and the major electrical retailers were contacted directly to request specific information regarding their most popular radio models. The response to this direct contact was poor.

1.2   GfK sales data from 2003 to 2007 was made available to Intertek through MTP (Market Transformation Programme). Although more recent data has been published by GfK, the client decided not to purchase this. Using 2007 sales data, the market share of brands was analysed within DAB and non-portable audio categories. From experience, the laboratory considers that the market leaders identified in 2007 still remain the same. The following tables summarise the data by brand for portable DAB radios and non-portable audio (covering both analogue and DAB products).

Tables 4 & 5 – Summary of market share by brand

2007 GfK Data by Brand – DAB Portables	%
Pure	36%
Roberts	20%
Sony	16%
Bush	7%
Philips	4%
intempo	3%
Goodmans	2%
Panasonic	2%
Alba	2%
TEAC	1%
Denon	1%
JVC	1%
Ministry of Sound	1%
Onkyo	1%

2007 GfK Data by Brand - Non-Portable Audio	%
Tradebrand	44%
Sony	14%
Philips	11%
Alba	8%
Panasonic	7%
Samsung	3%
LG	1%
Bush	1%
Goodmans	1%
Denon	1%
TEAC	1%
JVC	1%
Intempo	1%
Roberts	1%
Gear4	1%
Pure	1%
Sharp	0.40%

1.3   A thorough search of radio manufacturers, major online retailers and price comparison websites was also undertaken to identify the most common brands and models currently on the market. Models launched since the phase 1 and phase 2 testing were specifically targeted.

From these sources a list of currently available products was compiled, **Appendix II**. All products were organised into brands and categories to enable short listing of products. The list of available products was compared with results that were available from previous testing and care was taken to

avoid testing duplicate or similar models. We also ensured that there was good coverage of trade brands and non-trade brands as well as a range of price points.

2   Existing Data

Power consumption data for a range of products launched since the phase 1 and phase 2 testing (28 models), belonging to other Intertek clients was made available to this project, after obtaining consent from these clients. These products were incorporated into the main database of available products and, from this list, 31 new models were selected for testing. The selection of models to test was based on a number of factors:

- Good representation of the major DAB brands (as per GfK data). 72% of the market for DAB radios is held by three brands

- Coverage of the majority of brands in the market. Data is available for 30 different brands

- Good representation of the various trade brands, given their high percentage share of the portable audio market

- Good coverage of the different types of radio receiver, eg portable/tabletop, clock radios, CD players, iPod docks etc

3   Purchase of Samples

The samples selected for testing were purchased through normal consumer channels, either via the internet or from high street retailers. Two of the 31 models selected were either out of stock or discontinued at the time of purchase and, due to time constraints, could not be replaced.

4   Product Categories

The radios selected for testing were categorised into the following groups:

Tabletop: Unit has integrated loudspeakers and mains powered only, **Figures 1 and 2**.

Figure 1 – Tabletop (small)

Figure 2 – Tabletop (large)

Tabletop/Portable: Unit has integrated loudspeakers and can be mains or battery powered. It is small/light enough to carry when battery powered and may have a carrying handle, recess or groove, **Figure 3**.

Figure 3 – Tabletop/Portable

Mini/Micro/Audio: The unit has separate loudspeakers and is likely to be a multi-function device probably incorporating a CD player or iPod docking mechanism, **Figure 4**. It is also mains powered only.

Figure 4 – Mini/Micro System

Separates (including Home Cinema Amplifiers): The unit is not supplied with and will not produce sound until connected to a set of loudspeakers or as part of a larger system e.g. to an external amplifier with loudspeakers, Figure 5. In addition the home cinema amplifier is capable of driving a minimum of five loudspeakers designated front L/R, rear L/R, centre and sub or is supplied with six loudspeakers with the same designation, Figure 6. They are also mains powered only.

Figure 5 – Separates

Figure 6 – Home Cinema Amplifier (rear view)

5   Power Consumption Measurements

Standby and off-mode measurements have been measured according to BS EN 62301: 2005. Where power saving features were available (e.g. dimming of displays, clock display on/off etc) measurements have been made at the minimum and maximum settings for standby mode and at the default setting for 'on-modes'. Where two figures are entered in the results table for standby power, the first figure is the default, 'as delivered' setting. This shows that in all cases the default value can be significantly higher than the allowed standby power consumption according to the EU directive. In practice we question whether consumers would implement the low power standby mode. The reason for the higher power modes can be either full brightness of the clock display or keeping the internet connection active.

For the on-mode measurements, a pink noise based simulated programme test signal was used as the input to the radios via a DAB or FM generator, the volume was then adjusted to achieve a sound pressure level of 70dBA measured in our standard [1] listening room. The measurement was recorded at 0.5 metre, 1 metre or 3 metres depending on the type of unit. For small radios and clock radios the distance used was 0.5 metres. For tabletop radios the sound level was measured at a distance of 1 metre. For mini Hi-Fi units and larger amplifiers the distance used was 3 metres.

In the case of a system not supplied with speakers, 6 ohm dummy load resistors (typical nominal speaker impedance) would have been used instead of speakers and the volume of the unit would have been adjusted to obtain a reading of 1 watt across one of the resistors, measured with a true RMS voltmeter. However none of this type was tested in this batch.

To ensure the units under test were correctly warmed up and electronically stable, each unit was turned on and allowed to settle for at least 30 minutes. The units were tuned to a signal and had their clocks set to ensure they were not 'hunting' for signals. For standby measurements the samples were switched to standby after a minimum of 30 minutes in 'on-mode'. The samples were then left for 15 minutes in standby before the power was tested and recorded. For 'on-mode' measurements the same 30 minute warm up period was employed before the readings were recorded for FM and/or DAB and/or Internet Radio modes.

5.1   Equipment Used
E10418 Kikusui Power Supply PCR1000

E10616 Yokogawa WT210 Power Meter

E10617 Yokogawa WT210 Power Meter

E10726 Yokogawa WT210 Power Meter

E10317 Airflow TA5 Anemometer

E10182 Vaisala HMI31 Humidity & Temperature Sensor

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[1] IEC 60268-13

5.2   Conditions

All power consumption measurements were completed under controlled conditions. Throughout the testing procedure, the ambient temperature, relative humidity, airspeed and condition of the mains supply were monitored and controlled where necessary to ensure they complied with the requirements of BS EN 62301: 2005 and IEC 62087: 2008.

Voltage: 230v ±1% at 50Hz ±1%

Total Harmonic Distortion of voltage supply: < 0.2%

Temperature: 23℃ ±5°

Relative Humidity: Between 10% and 80%

Airspeed: < 0.5m/s

5.3   Test Results

The power consumption test results are presented in Excel Spreadsheet **'R66398 DAB Radios Results Table Issue 1'.xls.**

A summary of results is contained in **Appendix I.**

Appendix I

Summary Table of Power Consumption Results

Power Consumption – All Brands

Category	Number of products tested in category	Mains power consumption (W) - in use at reference listening level									Mains power supply (W) - standby mode			Mains power supply (W)
		DAB Min	DAB Max	DAB Average	FM Min	FM Max	FM Average	Internet Min	Internet Max	Internet Average	Min	Max	Average	Off Mode Average
All Brands - Tabletop														
DAB	10*	1.44	12.92	4.78	1.52	4.79	3.35	5.90	5.90	5.90	0.21	3.95	1.56	0.76
FM	3	N/A	N/A	N/A	2.89	7.94	4.78	N/A	N/A	N/A	1.28	2.22	1.68	<0.01
Internet	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
All Brands - Tabletop/Portable														
DAB	29*	1.30	11.00	3.10	1.91	3.45	2.57	N/A	N/A	N/A	0.14	3.07	0.81	0.32
FM	2	N/A	N/A	N/A	0.85	1.51	1.18	N/A	N/A	N/A	0.40	1.21	0.81	N/A
Internet	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
All Brands - Mini/Micro/Audio														
DAB	4*	3.86	15.39	9.01	4.18	14.71	9.12	15.20	15.20	15.20	0.19	0.90	0.60	<0.01
FM	9	N/A	N/A	N/A	2.70	29.75	7.54	N/A	N/A	N/A	0.26	2.11	0.95	0.57
Internet	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

* Not all DAB radios will have a FM tuner and/or internet radio.

Power Consumption – Trade Brands

Category	Number of products tested in category	Mains power consumption (W) - in use at reference listening level									Mains power supply (W) - standby mode			Mains power supply (W)
		DAB Min	DAB Max	DAB Average	FM Min	FM Max	FM Average	Internet Min	Internet Max	Internet Average	Min	Max	Average	Off Mode Average
Trade Brands - Tabletop														
DAB	4*	1.44	4.45	3.09	1.52	4.79	3.06	N/A	N/A	N/A	0.48	1.97	1.05	0.36
FM	1	N/A	N/A	N/A	7.94	7.94	7.94	N/A	N/A	N/A	2.22	2.22	2.22	<0.01
Internet	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trade Brands - Tabletop/Portable														
DAB	9*	1.85	4.10	2.75	1.91	3.45	2.45	N/A	N/A	N/A	0.14	1.52	0.70	0.15
FM	1	N/A	N/A	N/A	0.85	0.85	0.85	N/A	N/A	N/A	0.40	0.40	0.40	N/A
Internet	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trade Brands - Mini/Micro/Audio														
DAB	2*	3.86	8.18	6.02	4.18	8.44	6.31	N/A	N/A	N/A	0.58	0.72	0.65	<0.01
FM	6	N/A	N/A	N/A	2.70	6.16	4.05	N/A	N/A	N/A	0.76	2.11	1.39	0.57
Internet	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

* Not all DAB radios will have a FM tuner and/or internet radio.

Power Consumption – Non-Trade Brands

Category	Number of products tested in category	Mains power consumption (W) - in use at reference listening level									Mains power supply (W) - standby mode			Mains power supply (W)
		DAB Min	DAB Max	DAB Average	FM Min	FM Max	FM Average	Internet Min	Internet Max	Internet Average	Min	Max	Average	Off Mode Average
Non-Trade Brands - Tabletop														
DAB	6*	2.59	12.92	5.91	2.79	4.72	3.73	5.90	5.90	5.90	0.21	3.95	1.90	1.17
FM	2	N/A	N/A	N/A	2.89	3.52	3.21	N/A	N/A	N/A	1.28	1.54	1.41	N/A
Internet	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Non-Trade Brands - Tabletop/Portable														
DAB	20*	1.30	11.00	3.27	2.91	2.91	2.91	N/A	N/A	N/A	0.16	3.07	0.87	0.44
FM	1	N/A	N/A	N/A	1.51	1.51	1.51	N/A	N/A	N/A	1.21	1.21	1.21	N/A
Internet	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Non-Trade Brands - Mini/Micro/Audio														
DAB	2*	8.62	15.39	12.01	9.15	14.71	11.93	15.20	15.20	15.20	0.19	0.90	0.55	N/A
FM	3	N/A	N/A	N/A	6.59	29.75	14.51	N/A	N/A	N/A	0.26	0.72	0.51	N/A
Internet	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

* Not all DAB radios will have a FM tuner and/or internet radio.

Appendix II

List of Products Tested

List of Products Tested

Code	Brand	Model	Category	DAB	FM
Argos - own brands					
AE1	Bush	CDAB51R	Tabletop/portable	Yes	Yes
AG1	Bush	NE-3116	Tabletop/portable	Yes	Yes
DAB72	Bush	TR05DABBLK	Table-top radio	Yes	Yes
DAB73	Reddmango	Angora BR310	Small/clock radio	No	Yes
DAB74	Bush	BCD6228iH	Mini hi-fi	No	Yes
Asda - own brands					
DAB75	Asda	SW8626	Mini hi-fi	Yes	Yes
Bose					
AQ1	Bose	Wave Radio II & Wave DAB Module	Tabletop	Yes	Yes
Comet - own brands					
DAB76	Ferguson	FDAB500L	Table-top radio	Yes	Yes
DAB77	Proline	DAB403	Table-top radio	Yes	Yes
DAB83	Goodmans	Micro14681	Mini hi-fi	No	Yes
Currys/Dixons - own brands					
DAB78	Logik	L33DAB10	Small radio	Yes	Yes
DAB79	iWantit	IPHDKDB10	Table-top radio	Yes	Yes
DAB80	Logik	LHF1P2010	Mini hi-fi	No	Yes
DAB81	Currys essentials	CHFCD10	Mini hi-fi	No	Yes
Dualit					
CA1	Dualit	Kitchen Radio DKR-1	Tabletop/portable	Yes	Yes
Gear4					
DAB82	Gear4	HouseParty AirWave PG527UK	Table-top radio	Yes	Yes
iLuv					
DAB84	iLuv	iMM178	Table-top radio	No	Yes
in-tune					
DAB102	in-tune	i211	Table-top radio	No	Yes
John Lewis - own brands					
AF1	John Lewis	Retro DAB Digital/FM Radio	Tabletop/portable	Yes	Yes
CB1	John Lewis	Astro Duo SW1E 5NN	Tabletop/portable	Yes	Yes
JVC					
DAB85	JVC	NX-PB10	Mini hi-fi	No	Yes
Magicbox					
CD1	Magicbox	Parabola	Tabletop/portable	Yes	Yes
Marks and Spencer - own brands					
DAB86	Marks & Spencer	iUFO	Table-top radio	No	Yes
Monitor Audio					
AM1	Monitor Audio	AirStream10	Tabletop	Yes	Yes
Panasonic					
DAB87	Panasonic	SA-AKX50	Midi hi-fi	No	Yes
Philips					
DAB88	Philips	AE4800/05	Small radio	Yes	Yes
DAB89	Philips	AJ1000/05	Small radio	No	Yes
DAB90	Philips	DCM377/05	Mini hi-fi	No	Yes

Key:

Data from other Intertek clients for current models

New data from current models

List of Products Tested

Code	Brand	Model	Category	DAB	FM
Pure					
AK1	Pure	Evoke-3	Tabletop/portable	Yes	Yes
BA01	Pure	Oasis Flow	Tabletop/portable	Yes	Yes
CE1	Pure	One Flow	Tabletop/portable	Yes	Yes
CF1	Pure	Twilight	Tabletop/portable	Yes	Yes
CG1	Pure	Siesta mi	Tabletop/portable	Yes	Yes
CH1	Pure	One mi	Tabletop/portable	Yes	Yes
Revo					
AP1	Revo	Heritage	Tabletop	Yes	Yes
CJ1	Revo	Axis	Tabletop/portable	Yes	Yes
Roberts					
AA1	Roberts	SolarDAB 2	Tabletop/portable	Yes	Yes
AB1	Roberts	Unologic	Tabletop/portable	Yes	Yes
AC1	Roberts	Classiclite	Tabletop/portable	Yes	Yes
AD1	Roberts	Stream83i	Tabletop/portable	Yes	Yes
BB01	Roberts	Revival iStream	Tabletop/portable	Yes	Yes
CK1	Roberts	Colourstream	Tabletop/portable	Yes	Yes
CL1	Roberts	Stream205	Tabletop/portable	Yes	Yes
CM1	Roberts	Expression	Tabletop/portable	Yes	Yes
CP1	Roberts	Ecologic 7	Tabletop/portable	Yes	Yes
CQ1	Roberts	Duet 2	Tabletop/portable	Yes	Yes
DAB94	Roberts	Sound 66	Table-top radio	Yes	Yes
Sainsburys - own brands					
DAB93	Curtis	RCD604UK-Black	Mini hi-fi	No	Yes
Sony					
DAB95	Sony	XDR-DS12iP	Table-top radio	Yes	Yes
DAB96	Sony	HCD-MX750Ni	Mini hi-fi	Yes	Yes
Tesco - own brands					
CS1	Technika	DAB 121	Tabletop/portable	Yes	Yes
DAB97	Technika	CR121IDAB	Small radio	Yes	Yes
DAB99	Technika	MC121IDAB	Mini hi-fi	Yes	Yes
AH1	Tesco	DAB907Q	Tabletop/portable	Yes	Yes
DAB98	Tesco	DAB123	Small radio	Yes	Yes
DAB100	Tesco Value	MC-907	Mini hi-fi	No	Yes
Yamaha					
DAB101	Yamaha	CRX-330	Mini hi-fi	Yes	Yes

Key:

Data from other Intertek clients for current models
New data from current models