

Explanatory note – in-home display (IHD) product approval

15 December 2017



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The Department of Environment, Land, Water and Planning develops policy for the [Victorian Energy Upgrades](#) program. The program provides incentives for Victorian households and organisations to make energy efficiency improvements that save money on their energy bills and reduce Victoria's greenhouse gas emissions

The Essential Services Commission administers the program as the 'Victorian Energy Efficiency Target scheme' under the *Victorian Energy Efficiency Target Act 2007*.

For more information, visit veet.vic.gov.au.

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1. Introduction

In-home displays (IHDs) are designed to encourage energy efficient behaviour in residential consumers by providing near real-time feedback on household electrical energy consumption and indicative usage cost.

IHDs can be divided into two main types, ZigBee certified (also referred to as ZigBee enabled) and non-ZigBee IHDs.

ZigBee IHDs communicate wirelessly over short ranges with ZigBee enabled Advanced Metering Infrastructure (AMI) meters, also known as smart meters, via an encrypted radio frequency. Installation of ZigBee devices require the IHD to be 'bound' to the smart meter. Once successfully bound, ZigBee IHDs can display or relay to a display residential energy consumption data that is accurate to the smart meter.

Non-ZigBee IHDs can be used in conjunction with a wide range of metering types, including Smart Meters. Non-ZigBee IHDs generally require a sensor and transmitter to be installed on a residence's electricity meter or main electricity cable. This enables household energy consumption to be measured and transmitted to the IHD display via short-range radio signals. Non-ZigBee IHDs that require a sensor to be clamped on to the residence's main electricity cable must be installed by a qualified electrician.

This explanatory note outlines the Victorian Energy Efficiency Target (VEET) product approval process and laboratory test requirements for IHD products.

Important information:

The Essential Services Commission (the commission) will only accept results from tests undertaken on an IHD with the same brand, model and firmware version as the IHD listed on the online application for product approval

The commission will not accept test results from prototype or demonstration models

The commission will not assess any mains powered IHD that does not have electrical safety certification from Energy Safe Victoria or an equivalent electrical safety authority.

2. Useful information

2.1. Glossary

The following abbreviations and terms are used throughout this document.

Term	Definition
active mode	IHD is switched on and undertaking its primary function, e.g. IHD display is activated
Advanced Metering Installation (AMI) meter	A remotely read interval meter that records interval energy data and complies with the Minimum Functionality Specification (Victoria) release 1.1
AS/NZS	Australia/New Zealand Standard
binding	The process of joining a ZigBee certified IHD to a smart meter so that the IHD can determine energy consumption data from the smart meter
Distribution network service provider (DNSP)	DNSPs operate the Victorian electricity grid infrastructure that distributes generated electricity to customer premises
encryption	The mechanism used to securely encode data passed between the IHD and the sensing apparatus
electrical energy consumption	The use of electrical energy, measured in kWh
The commission	Essential Services Commission
firmware	The combination of a hardware device, computer instructions and data that reside as read-only software on a device
mains powered	Powered by general-purpose (mains) alternating current (AC) electric power supply
meter	A device complying with Australian Standards which measures and records the production and consumption of electrical energy
NATA	National Association of Testing Authorities
power	The rate at which electrical energy is consumed, measured in Watts
sensing apparatus	The apparatus from which an IHD is capable of obtaining electrical consumption information, including an AMI meter or power coil
sleep mode	IHD is switched on but not undertaking its primary function and is readily switched back to active mode (e.g. IHD screen is deactivated)
smart meter	See AMI meter definition

Term	Definition
tariff	Rate charged for electricity consumption in cost per unit of energy consumed
the Principal Regulations	<i>Victorian Energy Efficiency Target Regulations 2008</i>
VEET	Victorian Energy Efficiency Target
ZigBee	A specification for high level communication protocols, which enables wireless data transfer over a short range

2.2. Reference documents

The following documents are referenced in this explanatory note:

- AS/NZS 62301-2005 - Household electrical appliances – measurement of standby power
- [Explanatory note - installation of in-home displays \(IHDs\)](#)
- *Victorian Energy Efficiency Target Regulations 2008* (the Principal Regulations)

2.3. Commission contact details

To discuss your IHD product approval application, the commission may be contacted via the following methods:

- Telephone: (03) 9032 1310
- Email: veet@esc.vic.gov.au

3. VEET scheme product approval process for IHDs

3.1. Minimum specification requirements

Before beginning the product approval process for IHDs, the applicant should be familiar with the Principal Regulations, particularly the minimum specifications criteria outlined in Schedule 30, In-home display unit, of the Principal Regulations.

The checklists in Tables 1 and 2 below summarise the minimum specifications required for ZigBee and Non-ZigBee IHDs as outlined in the Principal Regulations.

It is recommended that applicants compare their device to the criteria outlined in the Principal Regulations to determine whether the IHD is suitable for the VEET scheme before undertaking laboratory testing.

Table 1: VEET minimum specifications checklist for ZigBee IHDs

Regulation Ref.	Criteria	Is product compliant?
30A	A product that when installed in relation to an AMI metering installation provides information on the total electricity consumption of the residential premises directly to the consumer in respect of whom the installation is undertaken, and—	<input type="checkbox"/>
30A(a)	complies with the ZigBee smart energy profile specification published by the ZigBee standards organisation on 1 December 2008 and the ZigBee smart energy profile specification version 1.1 published by the ZigBee standards organisation on 23 March 2011; and	<input type="checkbox"/>
30A(b)	when tested by an approved laboratory in accordance with a laboratory test approved by the commission , is demonstrated to—	<input type="checkbox"/>
30A(b)(i)	determine electricity consumption information from the sensing apparatus at least every 30 seconds; and	<input type="checkbox"/>
30A(b)(ii)	be able to store electricity energy consumption information from the previous 45 days; and	<input type="checkbox"/>
30A(b)(iii)	be able to display to the consumer (or relay to a device that is capable of displaying to the consumer) in a numerical format and a format other than a numerical format that allows the consumer to easily distinguish between low and high consumption—	<input type="checkbox"/>
30A(b)(iii)(A)	electricity energy consumption information from the previous 45 days in intervals no longer than one hour per day of information displayed and one day per week of information displayed; and	<input type="checkbox"/>
30A(b)(iii)(B)	the average total household electrical power consumption (in watts) for the displayed period, which must be updated at least every 30 seconds; and	<input type="checkbox"/>

Regulation Ref.	Criteria	Is product compliant?
30A(b)(iii)(C)	the total household electricity energy consumption (in kWh) for the displayed period and the cost of that consumption, which must be updated at least every 30 seconds; and	<input type="checkbox"/>
30A(b)(iv)	be able to display to the consumer (or relay to a device that is capable of displaying to the consumer) the tariff (in cost per unit of energy consumed) and the total cost of electricity consumed for the period displayed; and	<input type="checkbox"/>
30A(b)(v)	be able to permanently erase all consumption and tariff information held by the product including all information entered by the consumer; and	<input type="checkbox"/>
30A(b)(vi)	have an average electric power consumption of not more than 0.6 watts when operating under normal circumstances; and	<input type="checkbox"/>
30A(c)	if battery powered, uses a battery that has a manufacturer's rated lifetime of at least 5 years when operating under normal circumstances.	<input type="checkbox"/>

Table 2: VEET minimum specifications checklist for non-ZigBee IHDs

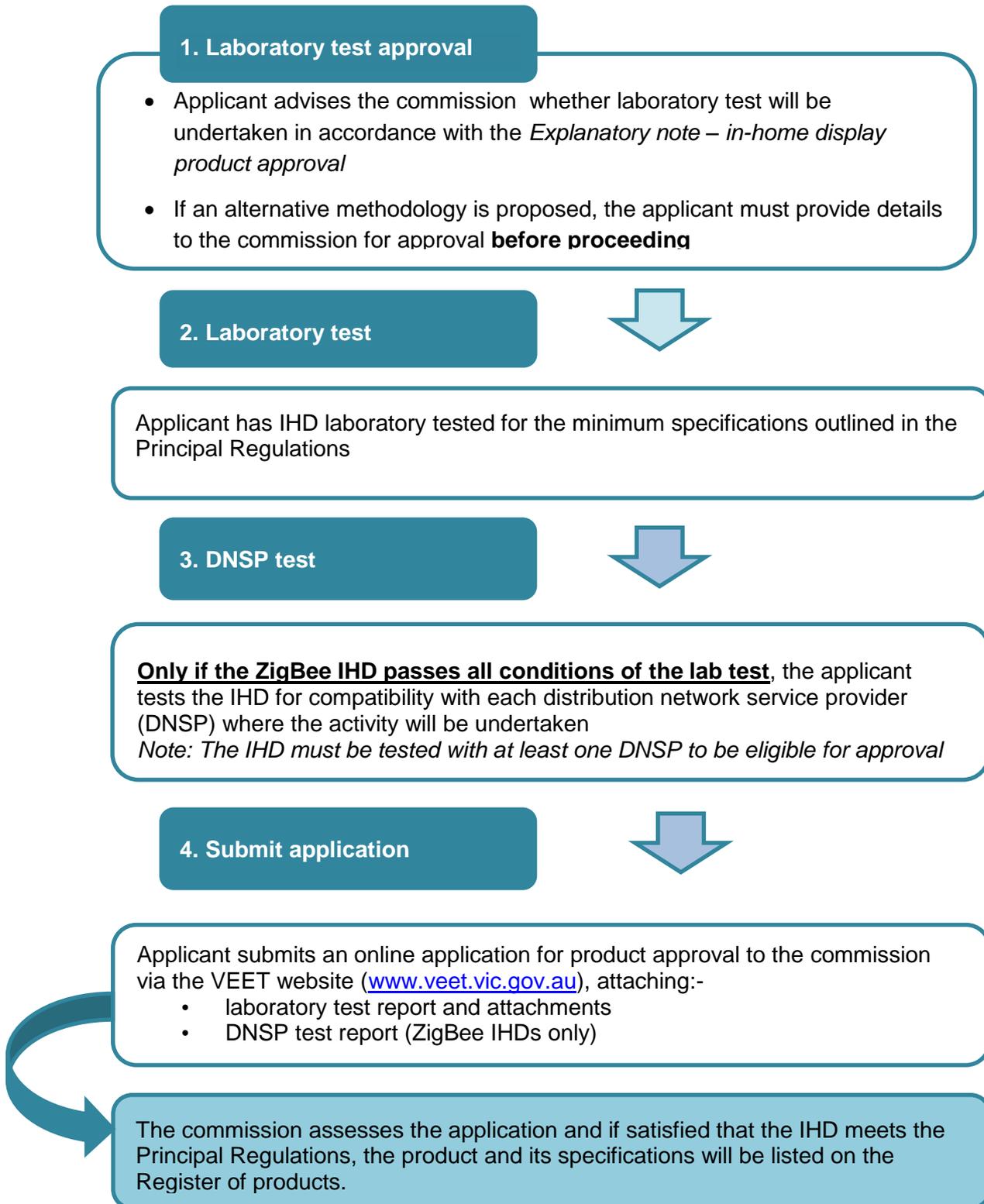
Regulation Ref.	Criteria	Is product compliant?
30B	A product that when installed in relation to any sensing apparatus provides information on the total electricity consumption of the residential premises directly to the consumer in respect of whom the installation is undertaken, and—	<input type="checkbox"/>
30B(a)	when tested by an approved laboratory in accordance with a laboratory test approved by the commission , is demonstrated to—	<input type="checkbox"/>
30B(a)(i)	determine electricity consumption information from the sensing apparatus at least every 30 seconds; and	<input type="checkbox"/>
30B(a)(ii)	be able to store electricity energy consumption information from the previous 45 days; and	<input type="checkbox"/>
30B(a)(iii)	be able to display to the consumer (or relay to a device that is capable of displaying to the consumer) in a numerical format and a format other than a numerical format that allows the consumer to easily distinguish between low and high consumption—	<input type="checkbox"/>
30B(a)(iii)(A)	electricity energy consumption information from the previous 45 days in intervals no longer than one hour per day of information displayed and one day per week of information displayed; and	<input type="checkbox"/>
30B(a)(iii)(B)	the average total household electrical power consumption (in Watts) for the displayed period, which must be updated at least every 30 seconds; and	<input type="checkbox"/>

Regulation Ref.	Criteria	Is product compliant?
30B(a)(iii)(C)	the total household electricity energy consumption (in kWh) for the displayed period and the cost of that consumption, which must be updated at least every 30 seconds; and	<input type="checkbox"/>
30B(a)(iv)	be able to display to the consumer (or relay to a device that is capable of displaying to the consumer) the tariff (in cost per unit of energy consumed) and the total cost of electricity consumed for the period displayed; and	<input type="checkbox"/>
30B(a)(v)	be able to permanently erase all consumption and tariff information held by the product (including all information entered by the consumer); and	<input type="checkbox"/>
30B(a)(vi)	have an average electric power consumption of not more than 0.6 Watts when operating under normal circumstances; and	<input type="checkbox"/>
30B(a)(vii)	is demonstrated to provide electricity energy consumption information that is accurate to within 5% of actual electricity consumption; and	<input type="checkbox"/>
30B(b)	if battery powered, uses a battery that has a manufacturer's rated lifetime of at least 5 years when operating under normal circumstances; and	<input type="checkbox"/>
30B(c)	uses, for its communications with the sensing apparatus and any display device, an encrypted communication protocol that is approved by the commission.	<input type="checkbox"/>

3.2. Overview of product approval process

The VEET scheme product approval process for IHDs is presented as a flow chart below.

Figure 1: VEET scheme product approval process for IHDS



3.3. Laboratory test methodology approval

The applicant should inform the commission whether the laboratory test will be undertaken in accordance with this explanatory note or whether an alternative methodology is proposed.

It is a requirement that all tests are discussed with the commission before testing is undertaken to ensure the test methodology is suitable for the IHD in question.

If an alternative methodology is proposed, the applicant should submit the following documentation to the commission for approval:

- proposed test methodology outline
- proposed test configuration diagram

Details regarding how to contact the commission are listed in Section 2 of this document.

3.4. Proposed modifications to testing procedure

IHDs are relatively new devices designed to encourage energy efficiency in the home. They come in many different designs and operating regimes, and can be installed in relation to a range of electricity meters. The testing and approval of IHDs for energy efficiency programs is a new discipline and formulating a robust and repeatable test methodology suited to all possible IHD designs and operating environments is challenging.

The commission welcomes suggestions from laboratories, IHD suppliers or other parties on how this testing might be improved. The commission reserves the right to modify test procedures at any time.

4. Laboratory test methodology

Once the IHD laboratory test methodology has been approved by the commission, the applicant can proceed to laboratory test the IHD for the minimum specifications as outlined in the Principal Regulations.

4.1. Requirements for laboratory testing

The laboratory test for IHDs must meet the following accreditation requirements, standards and conditions.

4.1.1. Testing laboratory

The laboratory test must be undertaken by a third party, independent to the IHD manufacturer, supplier and VEET proponent.

Tests may only be undertaken by independent test laboratories that are NATA accredited to ISO/IEC 17025 for testing in areas such as electronic equipment, energy efficiency of appliances, power or similar. However, it is preferable that the facility be NATA accredited to AS/NZS 62301-2005 - Household electrical appliances – measurement of standby power.

4.1.2. General conditions

The general conditions for all tests, including the test room, power supply, voltage waveform, power measurement accuracy, and the selection and preparation of appliances and equipment, must be performed in accordance with AS/NZS 62301-2005 - Household electrical appliances – measurement of standby power.

4.1.3. Testing equipment

The power meters used in the laboratory tests must meet the accuracy requirements of AS/NZS 62301 Clause 4.4, 2% or better.

4.1.4. Sample IHDs

Samples of each IHD model, selected at random by an independent party must be tested. The commission will not accept test results from prototype or demonstration models.

The commission will only accept results from laboratory tests undertaken on an IHD with the same brand, model number and firmware version as the IHD applied for online.

4.1.5. Electrical authority approval

Where applicable, the applicant must provide evidence that the IHD has received electrical authority approval or equivalent from a relevant authority (e.g. Energy Safe Victoria). The commission will not assess any applicable product that does not have electrical authority approval or equivalent.

4.1.6. MEPS

For mains powered IHDs with an external power supply (commonly known as an 'AC adaptor', 'plug pack' or 'power pack'), the applicant should check whether the external power supply requires Minimum Energy Performance Standards (MEPS) registration and, if so, that it is registered for MEPS as specified in AS/NZS 4665 - External power supplies.

4.1.7. C-tick or RCM compliance label

Applicants should supply evidence that the IHD has a C-tick or Regulatory Compliance Mark (RCM) compliance label for electromagnetic compatibility (EMC).

5. Commission laboratory test for ZigBee certified IHDs

The following methodology should be used to laboratory test ZigBee IHDs for the minimum specifications outlined in the Principal Regulations.

5.1. Laboratory sample and documentation

The applicant must provide the testing laboratory with:

- sample ZigBee test-certified IHD with any sleep mode disabled
- sample ZigBee production-certified IHD
- sample IHD that has recorded 45 days historical energy consumption and cost data (only required if the IHD is not capable of pre-loading with historical data)
- interface to download data from the IHD (e.g. USB, RS-232) and any associated software
- IHD serial number
- IHD media access control (MAC) address
- IHD installation code or trust centre / link key
- IHD technical specifications including firmware version and polling rate
- IHD user manual
- C-Tick or RCM compliance label for electromagnetic compatibility (EMC)
- ZigBee smart energy profile specification version 1.1 certification (backwards compatible with certified ZigBee smart energy products version 1.0)
- certificate of electrical authority approval or equivalent where required
- MEPS registration if the IHD has an applicable external power supply

If **any** IHD component is **solely** battery powered:

- sample battery / batteries used by the IHD
- manufacturer's battery lifetime statement

5.2. Review of specifications

5.2.1. Review 1 - ZigBee certification

The laboratory should review the applicant's ZigBee certification documents and confirm that the IHD has been tested and certified by the ZigBee alliance as compliant with:

- ZigBee smart energy profile specification version 1.1
- backwards compatible with certified ZigBee smart energy products version 1.0

5.2.2. Review 2 – battery lifetime (only for IHD components that are solely battery powered)

The laboratory should review the manufacturer's battery lifetime statement(s) to determine the following:

- the battery's rated lifetime is at least 5 years
- manufacturer's battery lifetime statement corresponds to the same brand and model of battery / batteries supplied with the IHD

5.3. Test set-up

Set-up as outlined in Figure 2:

- If the IHD has battery back-up, ensure that it is fully charged before testing
- If mains powered, connect a power meter between the IHD (including any AC adaptor or charging dock) and the power point
- Activate the IHD display or if the IHD does not have a dedicated display, connect the device to a display
- Bind the IHD to the Smart Meter
- Input or download electricity tariff information into the IHD (cost per unit of energy consumed for time period of use)
- To simulate household energy consumption, connect a variable power load with an average residential power factor and standard AC input to the Smart Meter
- Enable time-stamped data logging as outlined in Table 3. Data should be logged at intervals equivalent to the polling rate of the IHD.

Figure 2: Example test configuration for ZigBee certified, mains powered IHD

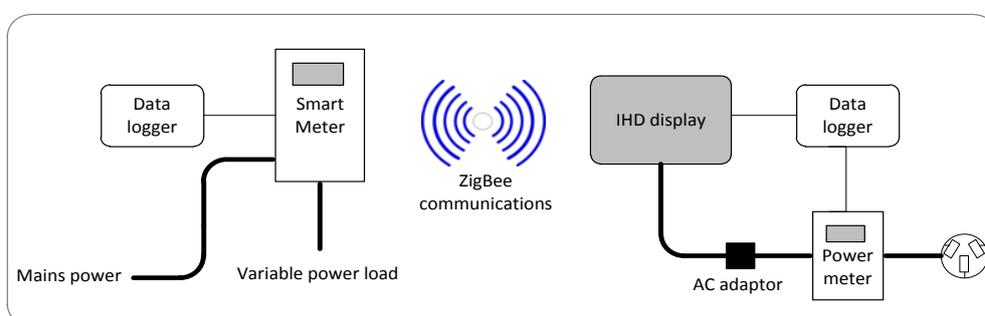


Table 3: Data to be recorded during laboratory test for ZigBee IHDs

Record Data logger	Power consumption	Energy consumption	Cost of energy consumption	IHD power consumption
Smart meter	X	X		
IHD display	X	X	X	
Power meter				X

5.4. Testing

The testing laboratory may wish to combine tests for efficiency, however for the purposes of this document these tests are listed separately.

5.4.1. Test 1 – tariff display

Procedure:

- Determine whether the IHD is able to display the programmed tariffs (in cost per unit of energy consumed for each time of use period)
- Record all methods available to consumers to enter tariff rates into the IHD
- Record the number of tariffs the IHD is capable of displaying
- Capture IHD display screen shot of the tariff display

5.4.2. Test 2 – polling frequency

Duration: 30 minutes

Procedure:

- Perform this test using the IHD sample with sleep functionality disabled
- Allow the IHD to record energy consumption data for 30 minutes
- Use a ZigBee packet sniffer to determine how often the IHD is polling the Smart Meter for energy consumption information.

Data log: Record how often the IHD is polling the Smart Meter for energy consumption information.

Data analysis:

- Determine how often the IHD is polling the smart meter for energy consumption information
- Determine whether the IHD polls the smart meter for energy consumption information at least every 30 seconds.

5.4.3. Test 3 – power consumption display

Duration:	4 hours
Procedure:	<ul style="list-style-type: none">• Perform this test using the IHD sample with sleep functionality disabled• Allow the IHD to record electrical power consumption (in Watts) for 4 hours• during the test period, vary the power load once every 15 minutes.
Data log:	<ol style="list-style-type: none">1. Smart meter: record electrical power consumption (in Watts)2. IHD: record average electrical power consumption (in Watts)
Data analysis:	<p>Compare electrical power consumption data recorded from the smart meter to that recorded by the IHD to determine whether:</p> <ul style="list-style-type: none">• the IHD displays average electrical power consumption (in Watts) accurate to the smart meter and is updated at least every 30 seconds in a numerical format. Capture IHD display screen shot• the IHD displays average electrical power consumption (in Watts) accurate to the smart meter and is updated at least every 30 seconds in a non-numerical format that distinguishes high and low consumption. Capture IHD display screen shot.

5.4.4. Test 4 – energy consumption and cost display

Duration:	4 hours
Procedure:	<ul style="list-style-type: none">• Perform this test using the IHD sample with sleep functionality disabled• Allow the IHD to record electrical energy consumption (in kWh) for 4 hours• During the test period, vary the power load once every 15 minutes.
Data log:	<ol style="list-style-type: none">1. Smart meter: record electrical energy consumption (in kWh)2. IHD: record electrical energy consumption (in kWh) and the cost of that consumption
Data analysis:	<ul style="list-style-type: none">• Compare electrical energy consumption data recorded from the smart meter to that recorded by the IHD to determine whether:<ul style="list-style-type: none">– IHD displays total electrical energy consumption (in kWh) accurate to the smart meter and is updated at least every 30 seconds in a numerical format. Capture IHD display screen shot– IHD displays total electrical energy consumption (in kWh) accurate to the

smart meter and is updated at least every 30 seconds in a non-numerical format that distinguishes high and low consumption. Capture IHD display screen shot.

- Calculate the cost of total electricity consumption using the electricity tariff programmed into the IHD and the electrical energy consumption data recorded from the smart meter.
 - Compare this figure to the cost of total electrical energy consumption recorded by the IHD to determine whether:
 - IHD displays the cost of total electrical energy consumption for the displayed period accurate to the smart meter and is updated at least every 30 seconds in a numerical format. Capture IHD display screen shot
 - IHD displays the cost of total electrical energy consumption for the displayed period accurate to the smart meter and is updated at least every 30 seconds in a non-numerical format that distinguishes high and low consumption. Capture IHD display screen shot.

5.4.5. Test 5 - Historical data storage and display

Option 1 – to be used if the IHD is capable of pre-loading with historical data

Procedure: Pre-load the IHD with 45 days of simulated household electrical energy consumption and cost data.

Data analysis: Determine whether the IHD is able to store and display the 45 days of pre-loaded electrical energy consumption and cost data in the following formats:

- intervals no longer than one hour per day in a numerical format. Capture screen shot
- intervals no longer than one hour per day in a non-numerical format that distinguishes high and low consumption. Capture screen shot
- intervals no longer than one day per week in a numerical format. Capture screen shot
- intervals no longer than one day per week in a non-numerical format that distinguishes high and low consumption. Capture screen shot.

OR

Option 2 – to be used if the IHD is not capable of pre-loading with historical data

Procedure: Use the sample IHD that has recorded 45 days of electrical energy consumption and cost data.

Data analysis: Determine whether the IHD is able to store and display the 45 days of pre-recorded electrical energy consumption and cost data in the following formats:

- intervals no longer than one hour per day in a numerical format. Capture screen shot.
- intervals no longer than one hour per day in a non-numerical format that distinguishes high and low consumption. Capture screen shot.
- intervals no longer than one day per week in a numerical format. Capture screen shot.
- intervals no longer than one day per week in a non-numerical format that distinguishes high and low consumption. Capture screen shot.

OR

Option 3 – to be used if the IHD is not capable of pre-loading with historical data and it is not possible to provide a sample IHD that has recorded 45 days electrical energy consumption data

Duration:	45 days
Procedure:	Allow the IHD to record electrical energy consumption and the cost of that consumption for 45 days.
Data log:	IHD: record electrical energy consumption and consumption cost data.
Data analysis:	<p>Determine whether the IHD is able to store and display the 45 days electrical energy consumption and cost data in the following formats:</p> <ul style="list-style-type: none"> • intervals no longer than one hour per day in a numerical format. Capture screen shot • intervals no longer than one hour per day in a non-numerical format that distinguishes high and low consumption. Capture screen shot • intervals no longer than one day per week in a numerical format. Capture screen shot • intervals no longer than one day per week in a non-numerical format that distinguishes high and low consumption. Capture screen shot.

5.4.6. Test 6 – IHD power consumption (for mains powered IHDs only)

Duration:	24 hours
Set-up:	Perform this test using the sample IHD with sleep functionality enabled.
Procedure:	<ul style="list-style-type: none"> • Activate the IHD display for <u>one minute</u> • If IHD display has more than one screen (e.g. historical data, cost/kWh), activate each screen during the one minute test period • After one minute, discontinue IHD screen activation and allow the IHD to enter sleep or low power mode (if the IHD has this functionality)

- Continue recording power consumption for the remainder of the 24 hour test period (23 hours and 59 minutes).

Data log: Power meter: record the energy consumption of the IHD including any AC adaptor or charging dock.

- Data analysis:**
- At the end of the test period, divide the IHDs' total 24 hour energy consumption by 24 (Watts = total watt-hours / hours) to determine the average power consumption of the IHD in Watts
 - Determine whether the IHDs' average power consumption is $\leq 0.6W$

5.4.7. Test 7 – erasable memory

Procedure:

- After completing all tests, erase all energy consumption, tariff and other data that was entered into the IHD from the memory using the device's consumer functions
- Ensure that data cannot be recalled after being erased
- Capture time-stamped IHD screen shots before and after erasing the memory.

6. Commission laboratory test for non-ZigBee IHDs

The following methodology should be used to laboratory test non-ZigBee IHDs for the minimum specifications outlined in the Principal Regulations.

6.1. Laboratory sample and documentation

The applicant must provide the testing laboratory with:

- sample IHD with any sleep mode disabled
- sample IHD with any sleep mode enabled
- sample IHD that has recorded 45 days historical energy consumption and cost data (only required if the IHD is not capable of pre-loading with historical data)
- interface to download data from the IHD (e.g. USB, RS-232) and any associated software
- IHD serial number
- IHD technical specifications including the firmware version and polling rate
- IHD user manual
- C-tick or RCM compliance label for electromagnetic compatibility (EMC)
- IHD communications protocol data encryption specifications
- manufacturer's declaration stating that the communication protocol between the IHD and the sensing apparatus is securely encrypted
- certificate of electrical authority approval or equivalent where required
- MEPS registration if the IHD has an applicable external power supply

If **any** IHD component is **solely** battery powered:

- sample battery / batteries used by the IHD
- manufacturer's battery lifetime statement

6.2. Review of specifications

6.2.1. Review 1 – data encryption

The laboratory should review:

- manufacturer's data encryption specifications for the IHDs' communications protocol
- manufacturer's declaration that the communication protocol between the IHD and the sensing apparatus is securely encrypted

The laboratory should determine whether the communication protocol between the IHD and the sensing apparatus is securely encrypted.

6.2.2. Review 2 – battery lifetime (only for IHD components that are solely battery powered)

The laboratory should review the manufacturer's battery lifetime statement(s) to determine the following:

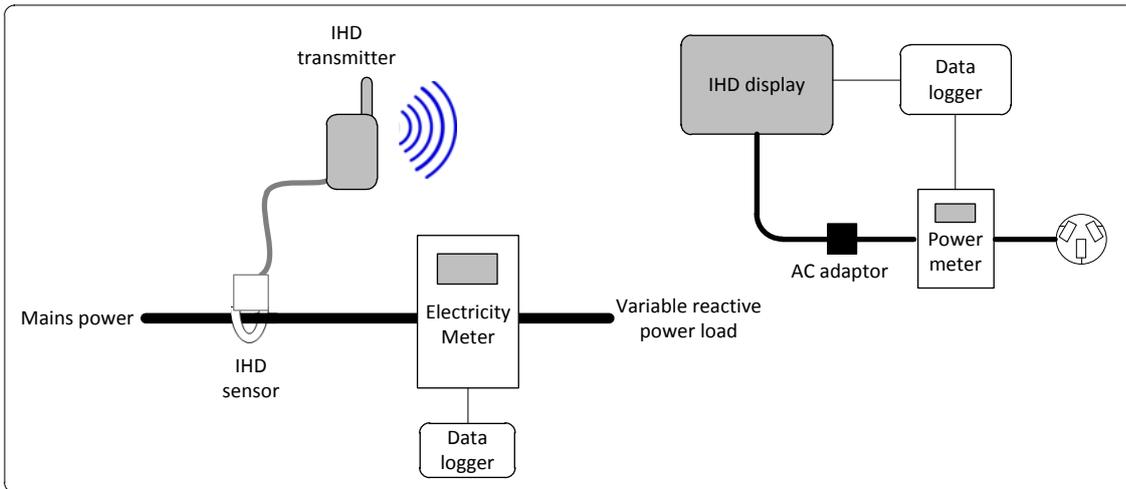
- the battery's rated lifetime is at least 5 years
- manufacturer's battery lifetime statement corresponds to the same brand and model of battery / batteries supplied with the IHD

6.3. Test set-up

Set-up as outlined in Figure 3:

- Connect an electricity meter to the main power supply
- If the IHD has battery back-up, ensure that it is fully charged before testing
- If mains powered, connect a power meter between the IHD (including any AC adaptor or charging dock) and the power point
- Connect IHD transmitter to the IHD sensor
- Connect the IHD sensor to the electricity meter or if the IHD sensor is a clamp-on device, connect it to the main power cable
- Activate the IHD display or if the IHD does not have a dedicated display, connect the device to a display
- Input or download electricity tariff information into the IHD (cost per unit of energy consumed for time period of use)
- To simulate household energy consumption, connect a variable, reactive power load with an average residential power factor and standard AC input to the electricity meter
- Enable time-stamped data logging as outlined in Table 4. Data should be logged at intervals equivalent to the polling rate of the IHD.

Figure 3: Example test configuration for non-ZigBee, mains powered IHD



Note: this test configuration is for single phase IHDs, three-phase IHDs will require two additional sensors

Table 4: Data to be recorded during laboratory test for non-ZigBee IHDs

Record data logger	Power consumption	Energy consumption	Cost of energy consumption	IHD power consumption
Electricity meter	X	X		
IHD display	X	X	X	
Power meter				X

6.4. Testing

The testing laboratory may wish to combine tests for efficiency, however for the purposes of this document these tests are listed separately.

6.4.1. Test 1 – tariff display

Procedure:

- Determine whether the IHD is able to display the programmed tariffs (in cost per unit of energy consumed for each time of use period)
- Record all methods available to consumers to enter tariff rates into the IHD
- Record the number of tariffs the IHD is capable of displaying
- Capture IHD display screen shot of the tariff display

6.4.2. Test 2 – polling frequency

Duration:

30 minutes

Procedure:

- Perform this test using the IHD sample with sleep functionality disabled
- Allow the IHD to record energy consumption data for 30 minutes
- Vary the reactive power load at the same frequency as the IHD manufacturer's stated polling rate.

Data log:

1. Electricity meter: record electrical power (in watts)
2. IHD: record electrical power (in watts)

Data analysis:

- Compare electrical power recorded by the electricity meter to that recorded by the IHD to determine:
- how often the IHD is polling for energy consumption information
 - whether the IHD polls for energy consumption information at least every 30 seconds.

6.4.3. Test 3 – power consumption display

Duration:	4 hours
Procedure:	<ul style="list-style-type: none">• Perform this test using the IHD sample with sleep functionality disabled• Allow the IHD to record electrical power consumption (in watts) for 4 hours• During the testing period, vary the reactive power load as follows:<ul style="list-style-type: none">– 10 A for 1 hour– 7.5 A for 1 hour– 5 A for 1 hour– 2.5 A for 1 hour
Data log:	<ol style="list-style-type: none">1. Electricity meter: record electrical power consumption (in watts)2. IHD: record average electrical power consumption (in watts)
Data analysis:	<p>Compare electrical power consumption data recorded from the electricity meter to that recorded by the IHD to determine whether:</p> <ul style="list-style-type: none">• IHD displays average electrical power consumption (in watts) in a numerical format, accurate to within 5% of actual power consumption and updated at least every 30 seconds. Capture IHD display screen shot• IHD displays average electrical power consumption (in watts) in a non-numerical format that distinguishes high and low consumption, accurate to within 5% of actual power consumption and updated at least every 30 seconds. Capture IHD display screen shot.

6.4.4. Test 4 – energy consumption and cost display

Duration:	4 hours
Procedure:	<ul style="list-style-type: none">• Perform this test using the IHD sample with sleep functionality disabled• Allow the IHD to record electrical energy consumption (in kWh) for 4 hours• During the testing period, vary the reactive power load as follows:<ul style="list-style-type: none">– 10 A for 1 hour– 7.5 A for 1 hour– 5 A for 1 hour– 2.5 A for 1 hour
Data log:	<ol style="list-style-type: none">1. Power meter: record electrical energy consumption (in kWh)2. IHD: record electrical energy consumption (in kWh) and the cost of that consumption
Data analysis:	<ul style="list-style-type: none">• Compare electrical energy consumption data recorded from the electricity meter to that recorded by the IHD to determine whether:<ul style="list-style-type: none">– IHD displays total electrical energy consumption (in kWh) in a numerical format, accurate to within 5% of actual power consumption and updated at least every 30 seconds. Capture IHD display screen shot– IHD displays total electrical energy consumption (in kWh) in a non-numerical format that distinguishes high and low consumption, accurate to within 5% of actual power consumption and updated at least every 30 seconds. Capture IHD display screen shot.• Calculate the cost of total electricity consumption using the electricity tariff programmed into the IHD and the electrical energy consumption data recorded from the electricity meter• Compare this figure to the cost of total electrical energy consumption recorded by the IHD to determine whether:<ul style="list-style-type: none">– IHD displays the cost of total electrical energy consumption in a numerical format, accurate to within 5% of actual energy consumption cost and updated at least every 30 seconds. Capture IHD display screen shot.– IHD displays the cost of total electrical energy consumption in a non-numerical format that distinguishes high and low consumption, accurate to within 5% of actual energy consumption cost and updated at least every 30 seconds. Capture IHD display screen shot..

6.4.5. Test 5 – historical data storage and display

Option 1 – to be used if the IHD is capable of pre-loading with historical data

Procedure: Pre-load the IHD with 45 days of simulated household electrical energy consumption and cost data.

Data analysis: Determine whether the IHD is able to store and display the 45 days of pre-loaded electrical energy consumption and cost data in the following formats:

- intervals no longer than one hour per day in a numerical format. Capture screen shot
- intervals no longer than one hour per day in a non-numerical format that distinguishes high and low consumption. Capture screen shot
- intervals no longer than one day per week in a numerical format. Capture screen shot
- intervals no longer than one day per week in a non-numerical format that distinguishes high and low consumption. Capture screen shot.

OR

Option 2 – to be used if the IHD is not capable of pre-loading with historical data

Procedure: Use the sample IHD that has recorded 45 days of electrical energy consumption and cost data.

Data analysis: Determine whether the IHD is able to store and display the 45 days of pre-recorded electrical energy consumption and cost data in the following formats:

- intervals no longer than one hour per day in a numerical format. Capture screen shot
- intervals no longer than one hour per day in a non-numerical format that distinguishes high and low consumption. Capture screen shot
- intervals no longer than one day per week in a numerical format. Capture screen shot
- intervals no longer than one day per week in a non-numerical format that distinguishes high and low consumption. Capture screen shot.

OR

Option 3 – to be used if the IHD is not capable of pre-loading with historical data and it is not possible to provide a sample IHD that has recorded 45 days electrical energy consumption data.

Duration: 45 days

Procedure: Allow the IHD to record electrical energy consumption and the cost of that consumption for 45 days.

Data log:	IHD: record electrical energy consumption and consumption cost data
Data analysis:	<p>Determine whether the IHD is able to store and display the 45 days electrical energy consumption and cost data in the following formats:</p> <ul style="list-style-type: none"> • intervals no longer than one hour per day in a numerical format. Capture screen shot • intervals no longer than one hour per day in a non-numerical format that distinguishes high and low consumption. Capture screen shot • intervals no longer than one day per week in a numerical format. Capture screen shot • intervals no longer than one day per week in a non-numerical format that distinguishes high and low consumption. Capture screen shot.

6.4.6. Test 6 - IHD power consumption (for mains powered IHDs only)

Duration:	24 hours
Set-up:	Perform this test using the sample IHD with sleep functionality enabled.
Procedure:	<ul style="list-style-type: none"> • Activate the IHD display for one minute • If IHD display has more than one screen (e.g. historical data, cost/kWh), activate each screen during the one minute test period • After one minute discontinue IHD screen activation and allow the IHD to enter sleep or low power mode (if the IHD has this functionality) • Continue recording power consumption for the remainder of the 24 hour test period (23 hours and 59 minutes).
Data log:	Power meter: record the energy consumption of the IHD including any AC adaptor or charging dock
Data analysis:	<ul style="list-style-type: none"> • At the end of the test period, divide the IHDs' total 24 hour energy consumption by 24 (watts = total watt-hours / hours) to determine the average power consumption of the IHD in watts • Determine whether the IHDs' average power consumption is $\leq 0.6W$.

6.4.7. Test 7 – erasable memory

Procedure:

- After completing all tests, erase all energy consumption, tariff and other data that was entered into the IHD from the memory using the device’s consumer functions
- Ensure that data cannot be recalled after being erased
- Capture time-stamped IHD screen shots before and after erasing the memory.

7. Laboratory test report and attachments

Once the laboratory has completed the laboratory test for ZigBee or non-ZigBee IHDs, the testing laboratory should complete the laboratory test report, as per the template provided in Appendix A, including:

- cover sheet
- checklist
- testing details
- relevant test summary report

The testing laboratory should attach the following to the laboratory test report:

- relevant documentation as outlined in the test report checklist in Appendix A
- IHD screen shots (or photographs) as outlined in Appendix B
- time series data sets and data plots as outlined in Appendix C

8. DNSP compatibility check for ZigBee IHDs

To be eligible for the VEET scheme, ZigBee IHDs only must be tested for compatibility with each distribution network service provider (DNSP) where the activity will be undertaken. ZigBee IHDs must be tested with at least one DNSP to be eligible for approval.

Applicants should only proceed to test the ZigBee IHD for compatibility with DNSPs if the IHD has been laboratory tested and passed all conditions of the commission laboratory test for ZigBee certified IHDs, outlined in Section 7 of this document.

The applicant should contact the relevant DNSP where the ZigBee IHD will be installed and request that the device be tested for compatibility with the DNSP.

In Victoria, there are currently five DNSPs in operation:

- CitiPower
- Jemena
- Powercor
- SP Ausnet
- United Energy

To have the IHD tested, the applicant will need to provide the DNSP with the following:

- four sample IHDs (to be retained by the DNSP for future testing)
- unique IHD installation codes
- IHD ZigBee certification
- IHD technical specifications including firmware version
- IHD user manual

The applicant should request a test report from the DNSP that contains the following information:

- IHD brand
- IHD model
- IHD firmware version
- test date
- DNSP declaration stating that the IHD is compatible with their network

9. Submitting an application for IHD product approval

To apply for an IHD product approval, applicants should submit an online application by logging into their account on the VEET website (www.veet.vic.gov.au) and by clicking on the 'Products - new application' menu item and completing the online application. The applicant should attach the following supporting documents (in PDF format if possible) to the online application:

- completed laboratory test report and attachments
- DNSP test report (ZigBee IHDs only)

Once an online application has been submitted along with the required supporting documents, the commission will assess the application and determine whether the IHD meets the minimum specifications as outlined in the Principal Regulations.

If approved, the product and its specifications will be listed on Register of products.

For further information regarding the installation of IHDs under the VEET scheme, please refer to [Explanatory note - installation of in-home displays \(IHDs\)](#) available on the VEET website.

Appendix A: laboratory test report template

Victorian Energy Efficiency Target (VEET) in-home display (IHD)

Laboratory test report: cover sheet

IHD type: <input type="checkbox"/> ZigBee <input type="checkbox"/> non-ZigBee	
IHD details	
Brand	
Model	
Firmware version	
Serial number(s)	
Date(s) of manufacture	
Power supply	<input type="checkbox"/> Battery <input type="checkbox"/> Mains powered (voltage: ____V)

Laboratory details	
Laboratory name	
Accreditation	
Testing officer	
Testing dates	
Applicant name	
Applicant address	

Summary	
Has the IHD passed all requirements as outlined in the commission laboratory test for in-home displays explanatory note?	
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not applicable	
Signature:	Date:

Laboratory test report checklist

Please complete the following checklist of the laboratory test documentation to be provided to the commission and attach it to the laboratory test report.

Data to be provided to the commission	Data Supplied? (Y/N)
Laboratory test report cover sheet	
Testing details	
Relevant test report summary	
IHD screen shots	
Time series data sets and data plots	
IHD technical specifications	
Electrical authority approval or equivalent (where relevant)	
MEPS registration (IHDs with applicable external power supplies only)	
Manufacturer's battery lifetime statement (solely battery powered IHD components only)	
C-tick or RCM compliance label for EMC	
ZigBee smart energy profile specification version 1.1 certification, backwards compatible with certified ZigBee smart energy products version 1.0 (ZigBee IHDs only)	
IHD data encryption specifications (non-ZigBee IHDs only)	
Manufacturer's declaration of IHD data encryption (non-ZigBee IHDs only)	

Testing details

Testing equipment

Please provide the details of all testing equipment used during the laboratory test.

Testing equipment				
Equipment type (e.g. power meter)	Brand	Model	Serial no.	Calibration date

Test configuration diagram

Please provide a diagram outlining the configuration of testing equipment and the IHD used during the laboratory test. Example test configurations are provided in the commission laboratory test for ZigBee and non-ZigBee IHDs in Figure 2 and Figure 3.

Test configuration diagram

Tariff information

Please provide details of the tariff rates programmed into the IHD for testing in cost per unit of energy consumed (e.g. \$0.21/kWh, 3pm-9pm weekdays), list the methods by which tariff rates can be entered into the IHD (e.g. manual programming, download from the meter) and list the number of tariffs the IHD is capable of supporting.

Tariff information
Cost per kWh
Tariff input methods
Tariffs supported by the IHD

ZigBee certified IHD test report summary

Report on whether the following test conditions were met for the IHD tested. Space for comments is provided. Where relevant, attach IHD screen shots (or photographs), data sets and time series plots associated with each test as outlined in Appendix B and C. For further details on test conditions, please refer to Section 7, [Commission laboratory test for ZigBee certified IHDs](#).

Review of specifications:

No.	Review name	Criteria	Pass / fail	Comments
1	ZigBee certification	IHD has been tested and certified by the ZigBee alliance as compliant with ZigBee smart energy profile Specification version 1.1 and is backwards compatible with certified ZigBee smart energy products version 1.0		
2	battery lifetime	If any IHD component is solely battery powered, the IHD battery / batteries have a manufacturer's rated lifetime of at least 5 years when operating under normal circumstances		

Test results summary:

No.	Test name	Criteria	Pass / fail	Comments
1	Tariff display	IHD displays the electricity tariff in cost per unit of energy consumed relevant to the time period displayed		
2	Polling frequency	IHD determines electrical consumption information from the smart meter at least every 30 seconds		
3	Power consumption display	IHD displays average total electrical power consumption (in watts or kW), accurate to the smart meter, in a numerical and non-numerical format, updated at least every 30 seconds		
4	Energy consumption and cost display	IHD displays total energy consumption (in kWh) and the cost of that consumption accurate to the smart meter, in a numerical and non-numerical format, updated at least every 30 seconds		
5	Historical data storage and display	IHD stores and displays 45 days electrical energy consumption and cost information in a numerical and non-numerical format, in intervals no longer than one hour per day and one day per week		
6	IHD power consumption	If mains powered, the IHD uses no more than 0.6W of power on average.		
7	Erasable memory	Consumption, tariff and other data entered into the IHD can be permanently erased from the IHD memory by the consumer		
N/A		For all tests performed, the IHD did not exhibit unexpected or perverse behaviours.		
N/A		At all times, the IHD was observed to conform to the minimum eligibility criteria outlined in the Principal Regulations.		

Were there any deviations from the test method, and/or suggestions for improvement of the test methodology?

Non-ZigBee IHD test report summary

Report on whether the following test conditions were met for the IHD tested. Space for comments is provided. Where relevant, attach IHD screen shots (or photographs), data sets and time series plots associated with each test as outlined in Appendix B and C. For further details on test conditions, please refer to Section 8, [Commission laboratory test for non-ZigBee IHDs](#).

Review of specifications:

No.	Review name	Condition	Pass / fail	Comments
1	Data encryption	The communication protocol between the IHD and the sensing apparatus is securely encrypted		
2	Battery lifetime	If any IHD component is solely battery powered, the IHD battery / batteries have a manufacturer's rated lifetime of at least 5 years when operating under normal circumstances		

Test results summary:

No.	Test name	Condition	Pass / Fail	Comments
1	Tariff display	IHD displays the electricity tariff in cost per unit of energy consumed relevant to the time period displayed		
2	Polling frequency	IHD determines electrical consumption information from the sensing apparatus at least every 30 seconds		
3	Power consumption display	IHD displays average total electrical power consumption (in watts or kW), accurate to within 5% of actual power consumption, in a numerical and non-numerical format, updated at least every 30 seconds		
4	Energy consumption and cost display	IHD displays total energy consumption (in kWh) and the cost of that consumption, accurate to within 5% of actual energy consumption, in a numerical and non-numerical format, updated at least every 30 seconds		

No.	Test name	Condition	Pass / Fail	Comments
5	Historical data storage and display	IHD stores and displays 45 days electrical energy consumption and cost information in a numerical and non-numerical format, in intervals no longer than one hour per day and one day per week		
6	IHD power consumption	If mains powered, the IHD uses no more than 0.6W of power on average		
7	Erasable memory	Consumption, tariff and other data entered into the IHD can be permanently erased from the IHD memory by the consumer		
N/A		For all tests performed, the IHD did not exhibit unexpected or perverse behaviours		
N/A		At all times, the IHD was observed to conform to the minimum eligibility criteria outlined in the Principal Regulations.		

Were there any deviations from the test method, and/or suggestions for improvement of the test methodology?

Appendix B: laboratory test results – IHD screen shots

For each laboratory test undertaken for ZigBee or non-ZigBee IHDs attach relevant, clearly labelled screen shots (or photographs if this is not possible) of the IHD display as outlined in the table below.

IHD screen shots (ZigBee & non-ZigBee IHDs)		
Test no.	Test name	IHD display screen shots
1	Tariff display	<ul style="list-style-type: none"> Tariff displayed
3	Power consumption display	<ul style="list-style-type: none"> Average electrical power consumption (W) displayed in a numerical format Average electrical power consumption (W) displayed in a non-numerical format
4	Energy consumption and cost display	<ul style="list-style-type: none"> Total energy consumption (in kWh) displayed in a numerical format Total energy consumption (in kWh) displayed in a non-numerical format Total energy consumption cost displayed in a numerical format Total energy consumption cost displayed in a non-numerical format
5	Historical data storage and display	<ul style="list-style-type: none"> 45 days energy consumption data displayed in a numerical format* 45 days energy consumption data displayed in a non-numerical format* 45 days energy consumption cost data displayed in a numerical format* 45 days energy consumption cost data displayed in a non-numerical format* Example of energy consumption displayed in a numeric format in intervals no longer than one hour per day Example of energy consumption displayed in a numeric

format in intervals no longer than one day per week

- Example of energy consumption displayed in a non-numeric format in intervals no longer than one hour per day
- Example of energy consumption displayed in a non-numeric format in intervals no longer than one day per week
- Example of energy consumption cost displayed in a numeric format in intervals no longer than one hour per day
- example of energy consumption cost displayed in a numeric format in intervals no longer than one day per week
- Example of energy consumption cost displayed in a non-numeric format in intervals no longer than one hour per day
- Example of energy consumption cost displayed in a non-numeric format in intervals no longer than one day per week

* data does not have to be displayed all in one screen

7

Erasable memory

- Time-stamped screen shot before erasing memory
- Time-stamped screen shot after erasing memory

Appendix C: laboratory test results – data sets and plots

For each laboratory test undertaken, attach relevant time series data sets and data plots for ZigBee Certified and non-ZigBee IHDs as outlined in the tables below.

All data sets should be supplied in Microsoft Excel format with clearly labelled column headings stating the parameter recorded and the measurement units.

Data sets and plots (ZigBee IHDs)				
Test no.	Test name	Data sets & plots	Data logging points	Notes
2	Polling frequency	IHD polling frequency v time (30 minutes)	ZigBee packet sniffer	
3	Power consumption display	power (W) v time (4 hours)	Smart meter IHD	Record actual power load used every 15 minutes
4	Energy consumption and cost display	energy (kWh) v time (4 hours)	Smart meter IHD	Record actual power load used every 15 minutes
		energy consumption cost v time (4 hours)	Smart meter (in conjunction with tariff information) IHD	
6	IHD power consumption	IHD energy consumption v time (24 hours)	Power meter	

Data sets and plots (non-ZigBee IHDs)

Test no.	Test name	Data sets & plots	Data logging points	Notes
2	Polling frequency	IHD polling frequency v time (30 minutes)	IHD	
3	Power consumption display	Power (W) v time (4 hours)	Electricity meter IHD	Record actual current used every hour
4	Energy consumption and cost display	Energy (kWh) v time (4 hours)	Electricity meter IHD	Record actual current used every hour
		Energy consumption cost v time (4 hours)	Electricity meter (in conjunction with tariff information) IHD	Record tariff programmed into IHD and actual current used every hour
6	IHD power consumption	IHD energy consumption v time (24 hours)	Power meter	

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