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# ShopUMC Product Evaluation Report

Inveneo's Findings and Recommendations  
For United Methodist Communications

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## Project Overview

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United Methodist Communications (UMCom) envisioned the potential and recognized the significant need for identifying and providing appropriate Information and Communication Technologies for Development (ICT4D) equipment for its extensive and meaningful work throughout the developing world.

Inveneo has tested and deployed a wide variety of Information Technologies (IT) equipment in its 8 years of implementing projects in developing world countries in Africa, Asia, North America and Oceania.

Taking advantage of this expertise and experience, United Methodist Communications (UMCom) asked Inveneo to test, rate and recommend IT equipment suitable for the many environments where its many members work.

# Intent

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Currently UMCCom supplies a limited selection of hardware to members of the United Methodist Church (UMC) through its online ShopUMC platform. In order to meet the needs of its ever-increasing membership, Inveneo was asked to identify, evaluate and suggest newer IT equipment, ranging from laptops and tablets to peripherals and projectors, that could be added to the ShopUMC offerings.

## Scenarios

The following are the environments and situations that UMCCom identified as common scenarios in which its members find a need for tested and trusted equipment.

- **Short Term Missions**

Church members go on trips of 1-2 weeks to developing countries. They often work with medical clinics, children's programs, primary / secondary schools or on construction projects. They are looking for ICT equipment that facilitates communications while they are on the ground and may be left behind for longer-term communication needs.

- **Long Term Missions**

Church members move to other countries for 1-2 years, or extend their stay even longer. They need reliable equipment that will support their own personal needs as well as improve in-country communications for their missionary work.

- **Computer Labs**

Church groups set up computer labs in a developing country. These computer labs are often seen as important improvements for schools or community centers. However many well-meaning people bring refurbished computers or even new equipment which may be unsuitable for local conditions. These members need IT equipment that will work in environments where the climate can be inhospitable and the grid power is unreliable or non-existent.

- **In-Country Programs**

Churches support programs in developing countries that enable entrepreneurship, community building, education, overall health and wellbeing. Missionaries may not travel for this work. These churches need ICTs for better communications with in-country organizations, churches and partners leading these programs.

# Testing and Recommendation Methodology

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Since virtually all readily-available IT equipment is designed to operate in the climate-controlled office settings of affluent countries, Inveneo's testing focuses on finding devices that will also perform well under more challenging circumstances. Many developing countries share these common conditions, especially in rural areas:

- High heat
- Dirty or dusty surroundings
- Unreliable or nonexistent electrical grid power

While industrial-grade IT equipment designed to operate in harsh environments is available from multiple suppliers, such equipment is normally prohibitively expensive for most projects. Therefore Inveneo looks for commercial-grade equipment that comes close to or meets many of the typical industrial-grade unit's specifications.

Inveneo follows a standardized process for evaluating IT equipment for suitability for operation in challenging environments.

## Tests Performed

### **Intake**

When Inveneo first learns of a new IT product that might be suitable, it looks at the product's specifications to try to find any obvious characteristics that would rule out using it. If the item "looks good on paper", i.e. its specifications seem to indicate it would function well in difficult environments, we obtain a sample unit for testing. Inveneo engineers informally discuss its features, pros and cons to determine whether to proceed with testing the candidate product.

### **Power Consumption Tests**

Most electronic components have multiple operating modes, comprising for example, standby or sleep mode, idle or minimal power-consuming (normal) operation, and full power maximum load operation. Inveneo engineers develop test scenarios that try to use each candidate product in a variety of appropriate modes for the device.

- DC power consumption – If the product operates from an AC-to-DC power adapter, most typically from 12VDC to 19VDC, Inveneo tests a sample unit under various operating scenarios using a bench power supply that can source a varying DC voltage. For example, with units that should operate from a 12VDC battery source, the power supply output is varied from 11VDC to 15VDC to simulate the voltage range of typical deep-cycle batteries from fully discharged to fully charged states.
- AC power consumption – Products with internal AC power supplies are tested under the test same test scenarios as units with external power adapters, but the power consumption is measured with either a Watts-UP power monitoring device or Kill-a-Watt power meter.

### **Environmental Tests**

As the vast majority of Inveneo's projects and client locations are in relatively hot climates, Inveneo designed and built its own high temperature test "hotbox". The hotbox employs two microprocessor-controlled 300W incandescent light bulbs and can reach an internal temperature of as high as 80°C (176°F) but it is very rarely used above 55°C maximum. Devices that fit into the hotbox are normally tested for 2 to 4 days at increasing temperatures while operating in a simulated maximum load scenario.

A typical temperature regime is:

- 2-3 hours at 35°C (95°F) to determine if the unit under test will function at all correctly
- 8-12 hours at 40°C (104°F)
- 8-12 hours at 45°C (113°F)
- 8-12 hours at 50°C (122°F)

The unit under test is monitored throughout these temperature tests, both electronically and visually, to ensure that it is still functioning correctly under the test scenario. Inveneo does not perform low temperature testing because it has not been relevant to actual equipment operations.

For truly harsh environments or in locations where a lot of dust or blowing sand is present for a significant part of the year, Inveneo prefers to use products, whenever possible, that do not utilize cooling fans. Both intake and exhaust fans tend to increase the amount of dust that will accumulate inside most electronic devices, whereas devices that rely solely on air convection for cooling will only accumulate the dust that settles through vent openings.

Inveneo's engineers look at the amount of airflow into and out of products undergoing temperature testing to make a somewhat subjective judgment about potential dust accumulation.

# Internet Technology Equipment Tested: Desktops

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In this era of rapidly expanding demand for laptops, smartphones and tablets, the venerable desktop PC can seem to be out-of-date and old-fashioned. However, there are still some significant advantages to desktop computers in comparison with portable devices:

- Lower cost for an equivalent level of computing power and functionality
- More rugged construction
- Less likely to be dropped or damaged
- Can be made more resistant to theft

Desktops computers have become far more power-efficient in recent years, and Inveneo recommends certain low power-consumption models for permanent installations. Some of these PCs employ processors and other chips that were originally intended for industrial situations, and therefore are able to operate at higher temperatures and use less power even than many laptop computers.

# ASUS EB1007P

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ShopUMC Price: \$558.93

## Manufacturer Description

Flexible 1L-sized Energy Efficient Commercial PC

- Windows 7 Professional, 32-bit (or Linux optionally)
- Intel® Atom™ D425 1.8 GHz
- Small — Only 1L-Sized
- Saves space with VESA-Mount to the back of LCD monitor
- Saves up to 80% in energy consumption
- 320GB SATA Hard Drive
- 2GB DDR3 RAM



## Inveneo Review

### Pros

- Low power consumption -- requires only 12W to 15W power. Both Linux and Windows 7 available, with the Linux version priced extremely inexpensively.
- Small and lightweight,
- Medium processor and graphics performance

### Cons

- As the EB1007P's Intel D425 processor is an earlier generation, single-core Atom, this PC is not a high performance machine. Full screen HD video performance often displays poorly.
- Most units will function on 12VDC directly, but Asus will not guarantee this. Comes with AC adapter.

Inveneo has used the Asus EB1007-series desktops for several years for many of its projects. It has proven to be a reliable unit in moderately challenging locations, although it is not designed for the most rugged, harshest environments. Its low-cost, small size and low power consumption make it a good choice for use in many developing countries.

The EB1007P is mainly used for routine office tasks such as word processing, email and web access. Due to its quite limited graphics performance, it is not the best choice for more processor/graphics-intensive work such as video editing, CAD or 3D design.

Inveneo's recommendation is especially based on the following criteria:



#### Power

An EB1007P-based desktop computer uses just 22w during operation. Less than most laptops, 22w is half of what a typical low-power desktop uses and just 20-30% of the power required by donated computers Inveneo typically finds in the field.



#### Ruggedness / Durability

While the EB1007P does use fans, they are small and feature a bottom-to-top flow that is less likely to become clogged by dust when compared to larger front-to-back systems. The small size of the unit also means that it can be mounted to the back of a monitor where it is less likely to be damaged.



#### Reliability / Consistency

The EB1007P is extremely reliable. Inveneo has experienced a very small number of failures with thousands of units deployed in the field.



#### Manufacturer Support

As a manufacturer, Asus is very responsive when dealing with warranty issues, working directly with Inveneo to make sure that the warranty is valid in developing countries.

# Aleutia T1 Fanless Eco PC

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**ShopUMC Price: TBD**

## Manufacturer Description

The affordable, Aleutia T1 computer can fit in your hands, offers great performance, is completely silent, and uses so little power you can run it on solar-charged 12V battery power. It includes a Dual Core Intel Atom N2800 processor, 2GB RAM, The T1 is available with either SSD storage (No Moving Parts) or a 250GB hard drive. The T1 is completely fanless and is works well in hot, dusty environments.



## Reliability of No Moving Parts

The T1 was designed from the ground up to work in rural Africa. A special heatsink design and steel case allow the new T1 to work without fans even in high temperatures, making it ideal for dusty environments. Though the T1 includes an external AC power adapter, its built-in voltage regulator can operate on any DC voltage from 10V to 19V, allowing it run directly from a 12V battery without a regulator.

## Inveneo Review

### Pros

- Very low power consumption
- Small and lightweight

### Cons

- Lesser-known manufacturer, based in London
- Lack of distributors in developing countries

The Aleutia T1 PC, when teamed up with a low power monitor such as the 20" Asus VS208, makes an excellent performing computer system. The combination needs just 16W for normal operation with SSD storage, or about 21W with a 250GB hard drive. Performance is quite good for both general computing and full screen video due to the dual-core Intel Atom N2800 processor.

The Aleutia can be supplied with Windows 7 pre-installed and licensed, but only at Microsoft's retail price. However, the manufacturer can offer a deployment image for the two storage devices that allows the client organization or end-user to enter their own Windows 7 license key. Linux is also an option.

This is the PC to use for truly harsh environments, or where 12VDC low-power battery operation is required.

Inveneo's recommendation is especially based on the following criteria:



### Performance

The T1 performs exceptionally well for a low power computer.



### Power

The Aleutia T1 uses very little power compared to other comparable options, owing in part to the fact that it uses a solid-state hard drive.



### Ruggedness / Durability

The T1 not only comes with a solid-state drive, it also has no moving parts whatsoever, significantly increasing the unit's durability. It also performed well when subjected to temperature tests.



# Dell OptiPlex 3010 Small Form Factor

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ShopUMC Price: TBD

## Manufacturer Description

A smaller form factor that can be placed vertically or horizontally. Pre-configured with upgraded processor to handle your more demanding business tasks. Intel 3rd Generation i5-series processor.

## Inveneo Review

### Pros

- Energy efficient
- Performs well in hot environments
- Powerful processor and graphics engine

### Cons

- Too large to be mounted on the back of any but the very largest monitors.



The Dell OptiPlex 3010 Small Form Factor is a powerful, energy efficient desktop computer. This desktop is capable of running applications of all types, and comes in a small package. Even though Dell states the desktop operating environmental requirements is rated for temperatures ranging from 10° to 35°C (50° to 95° F), the desktop performed well in the Inveneo Hotbox, fully operating at 45°C for 3 days. The Optiplex desktop also has plenty of USB ports on both front and back of the machine. It performed quite well in both processor and graphics performance tests.

In comparison to the ASUS EB1007P, the Dell is a bit bigger but it has significantly higher performance and capacity. The Dell PC will take up more room on a desk than the ASUS EB1007P. It is worth also noting that, while the Dell is energy efficient, it uses 2X to 4X the power of the Intel Atom-powered ASUS EB1007P, i.e. from 30W typical to 60W maximum.

Inveneo's recommendation is especially based on the following criteria:



#### Performance

The 3010 performs at a very high level compared to other systems tested, including when subjected to hot conditions.



#### Power

The 3010 is relatively power efficient compared to standard desktop systems, partially owing to its efficient, effective cooling system.



#### Manufacturer Support

Dell is a Fortune 500 with a global footprint. They have a reputation for good support and a solid warranty.

# Laptops

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While typical business or home laptops have the advantage of easy portability, small size and convenient all-in-one design, it is important to remember that these machines are not very rugged or robust. In Inveneo's experience, extreme care must be taken with laptops in order to avoid damage from the rough conditions of travel in most developing world countries.

If very high reliability in difficult conditions is essential, for example at a rural hospital or clinic, it may be advisable to invest in a more expensive, but very rugged, design like the Panasonic Toughbook. On the other hand, if budget considerations are paramount and reliability is not a critical requirement (for example, in a primary or secondary school classroom) then low- to medium-cost laptops are the sensible choice.

Generally, Inveneo recommends choosing the latter, or so-called 3<sup>rd</sup> or 4<sup>th</sup> generation Intel CPU processor-based machines over earlier models, regardless of supplier. These newer processors offer greatly improved battery operation, sometimes more than double the operating time of the earlier generation designs. Since the source of AC electricity for charging a laptop's battery can be very unreliable and/or expensive, battery operating time is often a much more important factor when working in developing countries than it is in the US.



## Special Note: Intel MG Series

The Intel MG Series is a set of small sized, light and rugged laptops, an excellent choice for educational deployments. Developed especially for students, these laptops follow an ethnographer's research guidelines to fulfill several educational needs. Accessible at every level, MG Series contains a set of specific applications for collaborative education and other educational applications.

# Intel ClassmatePC Pupil 103 Laptop

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*ShopUMC Price: \$390.00*

## Manufacturer Description

The Pupil 103 is an Intel MG Series laptop that proves that we are not satisfied with existing resources for learning. Innovation in design, safety and resistance of the equipment and the performance efficiency make Pupil 103 the ideal tool for children to attain further knowledge. We design the path of evolution. The better the product, the higher the learning.



## Inveneo Review

### Pros

- Ruggedized for harsh environments
- Budget friendly

### Cons

- May be too small for some users
- Processing power may not suited to processor-intensive applications, such as video or sound editing or heavy use applications such as Adobe Photoshop.

The Intel Classmate PC is a budget-conscious series of machines that can be used in challenging environments while maintaining full performance. When first looking at this machine, it's clear that this laptop is quite a bit smaller than most standard laptops. The size actually influences the keyboard layout and it's slightly non-standard positioning of the "shift" key and other non-alphanumeric keys. As seasoned touch-typists, Inveneo found that the smaller layout is not usually a problem after the first day or two when the user becomes accustomed to the new layout. For users who are entirely new to typing on a computer keyboard, or for those who use the common two-fingered "hunt-and-peck" or "Columbus" method, the smaller keyboard should not be a problem.

It's important to note that while the ClassmatePC laptops may look small, they are capable of running Windows 7 very effectively. The laptop has built-in hard drive protection features and a solid body that allow the machine to withstand drops safely of up to 80cm (31in).

This computer is a great value, especially for basic internet and Office applications. However, it is important to note that, if the laptop is going to be used for highly processor-dependent applications, the Classmate may not be the best choice. In addition, the screen size is a bit small at 10.1 inches on the diagonal.

Inveneo's recommendation is especially based on the following criteria:



### Value

The 103 is inexpensive for a semi-rugged computer.



### Performance

The battery performance of the 103 is excellent, giving 7 hours of normal use in real-world situations. Typically, laptops in this price range will last just 3 to 4 hours.



### Ruggedness / Durability

The Pupil 103 is a very rugged machine, extremely durable compared to similarly priced laptops. The unit featured drop detection and is water resistant. Excellent build quality.

# Intel ClassmatePC Pupil 104 Laptop

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ShopUMC Price: \$490.00

## Manufacturer Description

The Pupil 104 takes Education three steps further, with a notebook, a tablet and an e-book reader. All in one machine.

The convertible MG series computer provides a world of new possibilities. Learning is personalized and while reading, writing or drawing, the student interacts directly with the content.



## Inveneo Review

### Pros

- Ruggedized for harsh environments
- Well suited for creation of artwork, or technical drawing using a graphics stylus
- Can be used in normal laptop mode or as a flat book-like tablet

### Cons

- May be too small for some users
- May not be suited to processor-intensive applications, such as video or sound editing, or heavy use such as Adobe Photoshop
- More expensive than the standard, non-touchscreen Classmate models

The convertible Classmate builds on the same computing platform used in the basic Pupil 103 unit. The principle added feature of the Pupil 104 is its swiveling touch screen. The screen can be rotated to make the entire unit flat like a clipboard. In this configuration, the user can write or draw using a built-in stylus. Finger touch operations are possible, but do not function as well or as easily so do the touchscreens typically found on tablets or smartphones.

Inveneo's opinion is that the Pupil 104 Classmate does not offer sufficient extra functionality beyond the Pupil 103 version that would be useful to clients or partners in the field.

Inveneo's recommendation is especially based on the following criteria:



### Value

The 104 is inexpensive for a semi-rugged computer.



### Performance

The battery performance of the 104 is excellent, giving 7 hours of normal use in real-world situations. Typically, laptops in this price range will last just 3 to 4 hours. The convertible screen also offers basic touchscreen functionality allowing the laptop to be used as a tablet when necessary.



### Ruggedness / Durability

The Pupil 104 is a fairly rugged machine. The unit features drop detection and is water resistant. Based on the Pupil 103 the unit features excellent build quality. However, the convertible screen may not be as durable as the fixed-orientation screen on the 103.

# Acer TravelMate 5744-6695 - 15.6 - Core i3 380M - Windows 7 Professional

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*ShopUMC Price: \$558.93*



## Manufacturer Description

The Acer TravelMate Series of notebooks features dependable processing power, wide-ranging communication capabilities, and indispensable security solutions to empower mobile professionals like you. Designed to keep your business running while you're on the move, this streamlined notebook boasts corporate-level manageability and convenient handling. An eco-friendly design and energy-conserving features help save cost, as well as the environment.

## Inveneo Review

### Pros

- A decent low-end performance laptop
- Budget friendly

### Cons

- Older generation Intel processor
- Lower than expected graphics performance

Like most typical 14"-15" laptops, the TravelMate is relatively light duty, and would therefore be more susceptible to damage in harsher environments. It is mostly made from light-duty plastics and employs a fan for internal cooling. There is minimal protection for the keyboard from liquid spills.

The TravelMate performed to specification during Inveneo's Hotbox test, all the way up to a temperature of 50°C. Since the processor is now three "Intel-generations" old, Inveneo is concerned that this laptop model might be discontinued soon.

Alternatives to this laptop would be, for example, the 14" Dell Latitude E5430 or the higher performance 15" Dell Inspiron 3521 (an excellent bargain at \$399 list price).

Inveneo does not recommend this product.

# Panasonic Toughbook 53

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*ShopUMC Price: TBD*

## Manufacturer Description

In 1998, Panasonic created the first semi-rugged computer. Now, Panasonic introduces the latest generation, the Panasonic Toughbook® 53. With a 14" HD LED display, 2nd gen Intel Core™ i5 vPro™ and i3 processors\* and an oversized multi touch touchpad, it performs like a desktop. Options for a sunlight-viewable Panasonic CircuLumin™ touchscreen, backlit keyboard, 4G LTE mobile broadband, an integrated webcam and enhanced connectivity, make this the most versatile semi-rugged PC ever.



## Inveneo Review

### Pros

- Ruggedized for harsh environments
- Higher performance computing capabilities
- Monitor that is viewable in direct sunlight

### Cons

- Expensive

When working in difficult conditions that require high performance in a mobile computer, the Panasonic Toughbook 53 may be a perfect match. This is a member of Panasonic's "semi-rugged" line of the popular Toughbook series. Semi-rugged laptops are built to withstand difficult environments, but also capable of holding more data on larger hard drives and providing good performance. Unlike the expensive fully rugged laptops that Panasonic offers, you probably would not want to use these laptops in the middle of a rainstorm, but these laptops are certainly capable of handling dusty, hot conditions.

After unboxing the laptop, it was immediately evident that Panasonic was intentional about covering with covers all of the points on the laptop that could be poorly affected by dust. This protection is vital for computers that will operate in typical environments in which global development projects are performed. Also immediately evident is how big this laptop looks in comparison to other units with a comparable screen size, but this is expected due to the ruggedization process. It is not nearly as heavy as it looks and has a very nice handle that allows for easy carrying.

Another interesting feature of the laptop is the monitor. It doesn't provide spectacular crispness, but it is designed to be used in direct sunlight, which could be a valuable feature for some. It is also very easy to change to a spare battery if traveling or if needed due to inconsistent grid power.

In the Inveneo Hotbox, the Toughbook 53 performed very well, playing high definition video at temperatures up to 45°C over three days.

Inveneo's recommendation is especially based on the following criteria:



#### Performance

Very high performance. The 53 comes with an excellent processor and chipset, featuring Intel's i5 dual core processor. The i5 is a dual core, but also supports multi-threading that allows it to perform like a quad core CPU.



#### Ruggedness / Durability

Extremely durable. The Toughbook 53 is the most rugged laptop tested, easily passing all physical and environmental tests. High build quality has given the Toughbook line the solid reputation it deserves.



## Tablets

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Tablet computing introduces an array of exciting opportunities by utilizing interactive touch screens and long battery life. The learning curve for a first time user is typically less on a tablet than on laptops or conventional desktops, and the capability for interactivity is increased. If the digitization of books and utilizing education specific applications is attractive based on the educational goals and insights decided by the group, then tablets may be a good option.

# Additional Tablet Considerations

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## **A Look at Tablet Operating Systems**

When looking at tablets, it's important to consider the benefits and capabilities of each operating system to gain an understanding of which operating system is most useful in each particular use-case scenario. To help understand the landscape, we will analyze the two most popular tablet operating systems.

### **Apple iOS and Google Android**

Apple iOS and Google's open-source Android are the two most popular tablet operating systems and have by far the best availability of applications. The Google Play store (where applications are downloaded) has a huge variety of applications, not much smaller than Apple's App Store. One of key defining features that really sets Android tablets and iOS tablets apart is the fact that Android is an open source, which means anyone can use the code on any device. This allows any manufacturer to have the ability to deploy Android-based tablets, unlike the proprietary iOS system which can only be deployed on devices made and manufactured by Apple. So essentially, the Android operating system introduces much more choice in regards to hardware, which has its benefits and drawbacks.

### **When Android and Open Source is better**

It is possible to obtain less expensive hardware to meet specific needs. Apple seems to always aim to develop premium products, while with Android you can find tablets that range in quality from cheap to very premium. With Apple, you are limited to just the iPad and iPad Mini. Unlike with Apple iOS, the Android open source solution allows manufacturers to experiment with different features earlier than what is typically done by Apple. Android is less restrictive for software developers, allowing applications to access most parts of the device with few restrictions.

### **When iOS and a proprietary solution is better**

Apple controls its environment, and the operating system has to be built and work only for Apple's limited product line, unlike Android, which has to have its operating system working effectively on a large number of processors from various manufacturers, and with wildly varying features. For instance, in Inveneo's testing, the Zenithink table crashed substantially more often running the same applications as the Nexus 10 tablet. In contrast, Apple controls all the hardware devices that must be supported by iOS, simplifying support and future upgrades.

### **Final thoughts**

In conclusion, there are really just a few key points to consider when deciding which platform to use:

- What are the most valuable applications for the particular use-case and on what platforms are they available?
- What is the available budget?
- If peripherals are needed, with which operating system are they compatible?
- Which tablets are the easiest to obtain in the region in which they are being used?
- The user experience is different between the Android and iOS, but this difference may or may not be important to the user. Over time the two seem to be becoming more similar. Basically, the choice is highly subjective.



# Samsung Galaxy Tablet 2 (10.1) WiFi

ShopUMC Price: TBD

## Manufacturer Description

Exynos 4 Dual Core 1.0GHz processor, 1280\*800 resolution 10.1” Display, Android 4.1 OS, Ten-Point Capacitive Screen

Experience a variety of fun mobile entertainment in one convenient, interactive tablet PC that only weighs 1.28lbs. It features a large 10.1in touch screen that lets you easily navigate through the web, through its embedded applications, and many more. It even allows you to download games and other multimedia apps from thousands of selections from Google Play using an Android 4.0 platform and save them inside its 16GB expandable flash memory. For smooth interaction and operation, it runs with a Dual-Core 1GHz processor. Other features include Bluetooth capability, 3.0MP back camera, 0.3MP front camera, and a microSD slot.



## Inveneo Review

### Pros

- Well-rounded in terms of performance
- Medium priced
- Excellent battery life

### Cons

- A step behind in terms of compatibility with the latest Android OS version
- Samsung personalized, non-Google standard, user interface

Thinking of this tablet, the phrase “jack of all trades and master of none” comes to mind. The Galaxy Tab 2 is pretty good at everything, but not really great at much. The Galaxy Tab 2 has a nice screen and good responsiveness, but did not perform quite as well as the iPad or Nexus 10. It did well in the Hotbox and, in Inveneo’s test, showed significantly longer battery life than the other tablets. The processor is not as beefy as either the iPad or the Nexus 10, however it still is a fairly powerful unit.

It was a bit disappointing that Samsung decided to implement this tablet with its own front-end interface, called TouchWiz that does not provide much value to the user from the standard Android interface. The tablet also uses an unusual special USB cable to charge and connect to your PC, unlike the other Android tablets tested. Unfortunately, these cables are less likely to be found in developing countries.

Overall, the Galaxy Tab 2 is the middle of the pack in terms of quality and performance and its price reflects this.

Inveneo’s recommendation is especially based on the following criteria:



### Value

The Galaxy 2 is a jack of all trades that does almost everything well. This makes it a solid mid-tier tablet, available at a great price.



### Performance

The Galaxy 2 offers good performance when compared with most tablets on the market. Expandable memory (uncommon in tablets) means there is room to grow.



### Manufacturer Support

Samsung has a solid global presence, which means that equipment, and products are available worldwide. A 1-year warranty is standard.

# Nexus 10 Tablet

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**ShopUMC Price: TBD**

## Manufacturer Description

Exynos 5 Dual-core 1.7GHz processor, 2560\*1600 resolution 10" wide-screen display, Android 4.2 OS, 16GB flash (32GB optional) and 2GB RAM, wifi-only



Nexus 10 is the newest tablet from Google. With the world's highest resolution table display, all new multi-user support, immersive HD content and the Google apps – Nexus 10 has something for everyone.

## Inveneo Review

### Pros

- Employs latest version of Android 4.2
- Truly beautiful super high-res display
- High performance hardware

### Cons

- Expensive
- Did not perform well in high heat conditions

Samsung and Google teamed up to create a powerful 10" tablet in a nice, sleek package. The Nexus 10 was one of the first devices to receive Android version 4.2. The display is one of the nicest characteristics of this tablet. It rivals the Apple iPad in terms of having a beautiful display. The touch screen is also very responsive and smooth which makes this a very nice device to use.

One of the concerns with this tablet came during the Inveneo Hotbox test when it stopped functioning correctly at 45C, unlike the other tablets that were tested. The Nexus 10 dropped processes and eventually froze. Once it was taken out of the Hotbox, the Nexus 10 could be rebooted and started functioning as expected. The other item of note is that the Nexus 10 is on the upper tier of tablet prices.

Inveneo's recommendation is especially based on the following criteria:



### Performance

The Nexus 10 offers excellent performance and is the fastest of the tablets reviewed. The 1.7GHz dual-core processor and 2GB ram (1GB is typical for a tablet) give the unit plenty of power.



### Admin / User Experience

The screen of the Nexus 10 boasts excellent touchscreen responsiveness and picture quality. Inveneo engineers called the screen "beautiful". The unit comes pre-loaded with the latest version of the Android operating system, which is intuitive and easy to use.



### Manufacturer Support

Samsung has a solid global presence which means that equipment and products are available worldwide. A 1-year warranty is standard.

# Apple iPad with Retina Display

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*ShopUMC Price: TBD*

## Manufacturer Description

AS6X Dual-core 1.5GHz processor with quad-core graphics unit, 2048 x 1536 resolution 9.7" Display, 32GB Flash (16GB to 128GB options), 1GB RAM

Right from the start, there's a lot to love about iPad. It's simple yet powerful. Thin and light yet full-featured. It can do just about everything and be just about anything. And because it's so easy to use, it's easy to love.



## Inveneo Review

### Pros

- Beautiful display
- High performance hardware
- Has the most accessories available
- Both Wi-Fi-only and LTE mobile network models available

### Cons

- Expensive
- Doesn't use standard MicroUSB

iPad is the most popular tablet on the market. There are numerous benefits iPad offers due to its popularity including the extensive availability of applications and the wide variety of compatible accessories. A number of rugged cases and other peripherals such as keyboards are made specifically for it. The retina display is beautiful, the battery life is great, and it performed well in the Inveneo Hotbox. The touch screen is also very responsive and intuitive to use.

The main issue with iPad is the price, especially for the 3G/LTE models. It, along with the Nexus 10, is in the higher tier of tablet prices. There are also potential pros and cons when using iOS instead of Android as previously discussed in this report.

Inveneo's recommendation is especially based on the following criteria:



#### Performance

iPad is an excellent performer with a 1.4GHZ A6X processor, and while Apple doesn't publicly publish iPad's RAM specifications, the memory is more than adequate.



#### Reliability / Consistency

iPad features an unmatched set of very high quality applications. Apple's App Store marketplace brings a high level of quality control and the device offers programs limited access to system functions, both factors leading to very few incompatibilities and program errors. iPad offers unparalleled stability.



#### Admin / User Experience

iPad's touchscreen exhibits excellent responsiveness and picture quality. The unit's retina display (2048x1536 resolution) yields exceptionally clear graphics and text, and iPad's iOS operating system is incredibly intuitive and easy to use.

# Turcom Zenithink C93 10"

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## Manufacturer Description

Cortex A9 Dual Core 1.5GHz processor, 1024\*600 resolution 10.1" Display, Android 4.1 OS, Ten-Point Capacitive Screen



## Inveneo Overview

### Pros

- Very affordable
- HDMI, SD, two USB ports

### Cons

- Screen is low resolution
- Apps seem to crash often
- Not as responsive as others tested

## Inveneo Review

The Turcom Zenithink C93 is a budget-friendly 10" tablet that can be found for as little as \$150. The tablet has the greatest variety of ways to connect to other devices, including an HDMI port and two USB ports, and the 8GB memory is easily expandable through the Zenithink's SD slot. The battery life of the device was found to be pretty good out of the box, and the version of Android is fairly modern (4.1.1).

However, the tablet does have some challenges due to the low-quality parts that make the device more affordable. The screen is low quality when compared to the other tablets tested, but it gets the job done, especially if one's budget is very limited.

In addition, the Zenithink lacked touchscreen responsiveness. There is some noticeable delay when using the onscreen keyboard and interacting with the device in general. During testing, the constant crashing of applications, which worked well on the other tablets, was a particularly alarming issue. A comparison of Hotbox temperature testing is difficult for the Zenithink, as it was prone to crashing, both inside and outside the test chamber.

As much as Inveneo would like to recommend a budget tablet like the Zenithink C93, it cannot due to the unit's inconsistency and unreliability.

## Peripherals – Monitors and projectors

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Both monitors and projectors share one critical technology element, the LED lamps that generate the backlight or projected image. LED technology is advancing very rapidly, such that every few months there are major improvements in light output per Watt of power consumed. The latest generation of projectors is able to project a much brighter image for less power than similar models that have been on the market since last year. Similarly, the latest LCD monitors can display the same screen brightness with less than half the power consumption of last year's models.

Based on these LED improvements, Inveneo has recommended some of these devices using the latest technology.

# Asus VS208N-P 20" LCD/LED

ShopUMC: TBD

## Manufacturer Description

If you're looking for some serious business monitors, then get a monitor that's made for it. VS series monitors are built from the ground up to be used in the office environment with embedded power adapters into the design while still remaining slim and stylish.

For added convenience, these monitors are VESA compatible, so you can neatly place it on a wall. VS monitors deliver Full HD quality visuals and are LED backlit delivering brighter displays than non-LED backlit monitors. With an ultra-fast 5ms response time, enjoy smooth motion playback for videos and movies. The first monitors to be featured in the renowned Corporate Stable Model (CSM) program, VS monitors are guaranteed in stable supply for a minimum of one year so you can order the same model without worry of it being discontinued and, with the included advanced swap replacement service, saving you time should the unit require servicing. These monitors are EPEAT Gold and ENERGY STAR certified to reduce environmental impact and save on energy costs.



## Inveneo Review

### Pros

- Super low-power consumption
- Good black levels
- Very light shipping weight
- Works at high temperatures

### Cons

- Slightly less bright than higher power-consuming models
- Must be powered by AC only, i.e. There is no 12VDC battery power option.

This monitor is a true breakthrough among larger size LCD monitors in terms of low power consumption. In Inveneo's tests with the "Eco" setting turned on, the 20" VS208 used virtually the same power as a low-power consuming 15" unit. Since most monitor power goes into lighting the display, and therefore increases with area (not the diagonal measurement), this is an exceptional achievement. Also remarkable, since LCD panels are inherently temperature sensitive, the VS208 worked well at 45°C in Inveneo's Hotbox tests.

With the "Eco" setting, the monitor is bright enough for virtually any indoor environment. However, when used near a very bright window, its settings might need tweaking to satisfy some user's preference for higher display brightness.

Inveneo's recommendation is especially based on the following criteria:



#### Value

The VS208N-P is available for \$110-120, a great price when compared to other 20" displays.



#### Performance

Excellent contrast, true colors. The monitor performs well when compared to standard monitors; excellent when compared to low-power monitors.



#### Power

The VS208N-P is very power efficient, with eco-mode dropping power usage down to just 8 watts. The unit is also EPEAT gold certified.

# Optoma PK320 Pico Projector

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ShopUMC Price: TBD



## Manufacturer Description

The Optoma PK320 Pico projector combines image quality and brightness demanded by presenters and movie-lovers with a palm-sized profile that lets you take it along wherever you may need it. Whether you want to deliver wide-screen presentations, share graphics or watch a movie, Optoma's PK320 Pico pocket projector provides projection power anywhere. With a brightness of 100 Lumens and projecting images of up to 150 inches, the PK320 extends the functionality and usability of Optoma's Pico projector line. This travel projector, which incorporates a cool metallic look, provides easy and flexible connectivity to a broad range of sources, including tablets, iPhones, DVD players, laptop computers, set top boxes and more.

Featuring Native widescreen WVGA resolution, the PK320 DLP travel projector lets you enjoy unlimited content playback at your fingertips with the on-board office viewer, microSD card slot, and HDMI and VGA connectivity. The PK320, which comes complete with a remote control, projects natively at 854x480 resolution and weighs in at half a pound.

## Inveneo Review

### Pros

- Very Small
- Can be battery-powered when needed
- Ultra-portable

### Cons

- Short battery life (90 minutes)
- Fairly low brightness
- Doesn't work effectively for screens larger than 6 feet

This projector is very small and is definitely built for portability. The biggest advantage of this projector is the lithium ion battery that allows it to function without external power. The PK320 is great for people who travel a lot and need to give presentations, or for scenarios where there may be no power for short periods of time.

This is not the brightest projector, nor does it have the longest range. Its best application would be in a smaller and darker room. It is also worth noting that the projector is brighter when connected to a power source and goes into a dimmer power-saving mode when running from battery. The battery is meant to power the projector for at most 90 minutes.

Inveneo's recommendation is especially based on the following criteria:




### Performance

The PK320 is a capable projector for a very specific scenario. The unit is very small and battery powered, which makes it great for single-use presentations or in environments with intermittent power situations.










# Ratings

## Guide to the Ratings

The ratings shown below are for the specific models tested by Inveneo. It is possible that other versions or variants would have different characteristics and different test results.

 Recommended
  Excellent
  Very Good
  Good
  Fair
  Poor

### A DESKTOPS

Recommended	Brand & Model	Price	Processor	Memory (GB)	Storage (GB)	Weight (lbs)	Weight (Kgs)	Performance	Power Consumption	Blue-ray or DVD	Warranty (mos)
	<b>Aleutia</b> T1	TBD	Intel Atom N2800 1.86	2	120	1.13	.51			No	12
	<b>ASUS</b> 1007P	TBD	Intel Atom D425 1.8 GHz	1	320	2.58	1.17			No	12
	<b>Dell</b> OptiPlex 3010 Small Form Factor	TBD	Intel i5- 3470 3.19 GHz 4	4	500	12.57	5.70			DVD	36

### B LAPTOPS

Recommended	Brand & Model	Price	Processor	Memory (GB)	Storage (GB)	Display Size (in)	Weight (lbs)	Weight (Kgs)	Battery Life	High temp Op	Display	Performance	Ergonomics	Blue-ray or DVD	Built-in Webcam	Removable Battery	Warranty (mos)
	<b>Acer</b> TravelMate 5744-6695	\$559	Intel i5 840M	4	320	15.6	5.50	2.45						Y	Y	Y	12
	<b>Intel</b> ClassmatePC Pupil 103	\$390	Intel Atom N2600 1.6 GHz	2	320	10.1	3.44	1.56						No	Y	Y	36
	<b>Intel</b> ClassmatePC Pupil 104	\$490	Intel Atom N2600 1.6 GHz	2	320	10.1	5.60	2.54						No	Y	Y	36
	<b>Panasonic</b> Toughbook 53	TBD	Intel i5 3320M	4	320	14.0	5.60	2.54						Y	N	Y	36



## C TABLETS

Recommended	Brand & Model	Price	Processor	Memory (GB)	Storage (GB)	Display Size (in)	Weight (lbs)	Weight (grs)	Resolution	Battery Life	Display	High Temp Operation	Performance	Touchscreen Responsiveness	User Experience	Built-In Camera	Warranty (mos)
<input checked="" type="checkbox"/>	<b>Apple iPad with Retina Display</b>	TBD	Apple A6X Dual Core	NA	32	9.7	1.44	652	2048 x 1536							Yes	12
<input checked="" type="checkbox"/>	<b>Nexus 10</b>	TBD	A15 Dual Core	2	16	10.1	1.33	603	2560 x 1600							Yes	12
<input checked="" type="checkbox"/>	<b>Samsung Galaxy Tablet 2 (10.1)</b>	\$355	Cortex A9 1GHz Dual Core	1	16	10.1	1.28	581	1280 x 800							Yes	12
	<b>Zenithink 10"</b>	TBD	Amlogic 872-MX Dual Core	1	8	10.1	1.48	672	1024 x 600							Yes	1


## D MONITORS

Recommended	Brand & Model	Price	Display Size (in)	Resolution	Weight (lbs)	Display Quality	Ergonomics	Performance	Power Consumption	HDMI	VGA	DVI	Warranty (mos)
<input checked="" type="checkbox"/>	<b>Asus VS208N-P 20" LCD/LED</b>	TBD	20"	1600 x 900	5.5					No	Yes	Yes	36

## E PROJECTORS

Recommended	Brand & Model	Price	Resolution	Max Screen Size	Battery Life (hours)	Weight (oz)	Ease of Setup	Portability	Power Consumption	HDMI	DVI	VGA	Warranty (mos)
<input checked="" type="checkbox"/>	<b>Optoma PK320 Pico</b>	TBD	854 x 480	150"	1.5	8.8				Yes	No	Yes	12

# Environmental and Application Suitability

	<b>Rural – Harsh environments with unreliable electricity</b> 	<b>Urban – Office-like, clean environments with reliable electricity</b> 
<b>Basic Computing Needs – Better Value</b>	<p><u>Desktops</u> Asus EB1007P Aleutia T1</p> <p><u>Tablets</u> Apple iPad with Retina Display Samsung Galaxy Tab 2 10.1</p> <p><u>Laptops</u> Intel ClassmatePC Pupil 103</p> <p><u>Peripherals</u> Asus VS208N-P 20" LCD/LED Optoma PK320 Pico Projector</p>	<p><u>Desktops</u> Dell Optiplex</p> <p><u>Tablets</u> Apple iPad with Retina Display Nexus 10 Samsung Galaxy</p> <p><u>Laptops</u> Acer or equivalent, but refer to the text</p> <p><u>Peripherals</u> Asus VS208N-P 20" LCD/LED</p>
<b>High Performance</b>	<p><u>Desktops</u> Dell Optiplex</p> <p><u>Tablets</u> Apple iPad with Retina Display Samsung Galaxy</p> <p><u>Laptops</u> Panasonic Toughbook 53</p> <p><u>Peripherals</u> Asus VS208N-P 20" LCD/LED</p>	<p><u>Desktops</u> Dell Optiplex</p> <p><u>Tablets</u> Apple iPad with Retina Display Nexus 10 Samsung Galaxy</p> <p><u>Laptops</u> Panasonic Toughbook 53 Acer of Equivalent, but refer to the text</p> <p><u>Peripherals</u> Asus VS208N-P 20" LCD/LED</p>

- "Rural" refers to any placement for IT equipment in a dusty or harsh climate location and/or where AC grid electricity is unreliable, unstable, extremely expensive or non-existent. These conditions may exist in remote, rural areas, as well as in suburban locations or even some urban areas in some countries.
- "Urban" refers to relatively clean, office-like rooms with fans or air-conditioning, AND with relatively reliable, stable electricity.
- "Basic Computing" refers to computer usage for typical office tasks such as word processing, bookkeeping or internet access.
- "High Performance" means usage for computer- or graphics-intensive jobs such as video editing or CAD (Computer Aided Design).
- Inveneo conducted tests using a limited number of items. In particular, an older model Acer TravelMate was tested alongside more modern products. There may be excellent laptop choices available. If Inveneo has not yet tested them, they will not be present in this report. As such, we have not entered a laptop recommendation for basic Urban-style computing.

## About Inveneo

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Inveneo has extensive prior experience establishing broadband networks and training local partners in locations like Kenya, Uganda, Tanzania, Haiti and others. Inveneo is in a unique position not only to realize the needs of the sector, but also to understand how to work in emerging regions like Burma and build the capacity of the sector locally in a sustainable way.

Inveneo is a San Francisco-based 501(c)(3) non-profit social enterprise that designs and delivers sustainable computing and better access to broadband Internet to those who need it most in the developing world. Inveneo enables organizations working in developing areas to better serve people in need transforming lives through access to education, healthcare, economic opportunity and relief. Inveneo and it's partners have delivered projects in 25+ countries and is impacting the lives of over 3 million people in some of the poorest and most challenging regions in the developing world.

Inveneo's offices are located in the heart of San Francisco at 972 Mission Street, 5<sup>th</sup> floor, San Francisco, CA 94103. For more information visit [www.inveneo.org](http://www.inveneo.org).