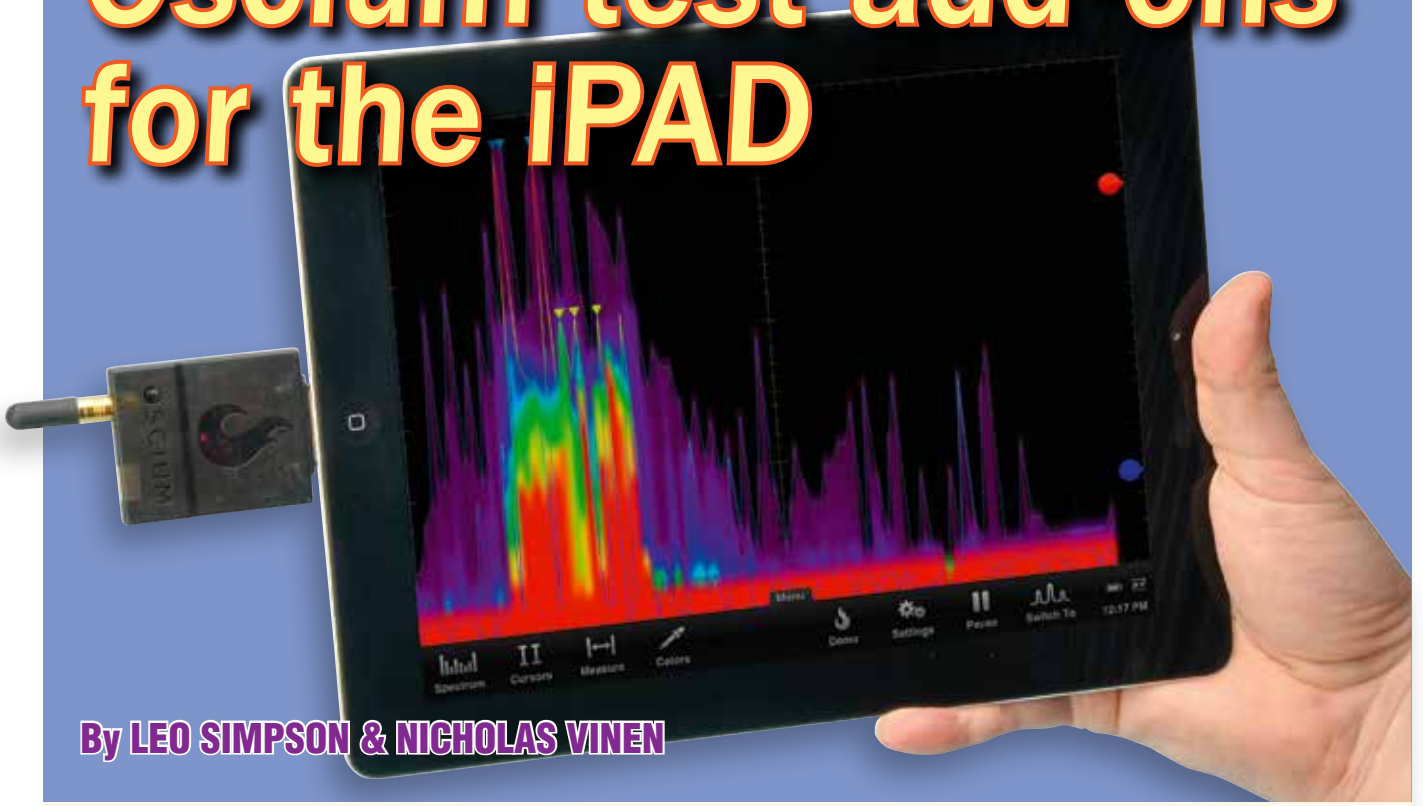
Got an iPad? Turn it into something really useful with this trio of test instrument add-ons

Oscium test add-ons for the iPAD



By LEO SIMPSON & NICHOLAS VINEN

Until now, iPads and similar tablets have really only been useful for a limited number of "media consumption" uses such as reading PDFs and web browsing. But increasingly they can be used for tasks such as remote accessing of instrumentation and control systems via WiFi. Now there is a suite of tiny accessories to turn an iPad into one of several powerful test instruments.

SAY YOU ARE a field service engineer and you regularly go on-site with nothing more than a multimeter and your iPad to access various control systems in a commercial building or a factory. The iPad records all the essential data you need, allows you to make adjustments to systems on the go and can be used later for reporting, billing and so on. Great. But every now and again you might have to get serious and break out some test gear to make in-depth measurements.

At that point the iPad is not much help at all but now it can be. How would you like to be able to do some spectrum analysis in the 2.4GHz UHF bands? Or maybe you need a 16-channel logic analyser to debug some tricky intermittent fault? Or maybe you need a mixed signal oscilloscope which can look at analog signals as well as digital?

Previously, to do those tasks you would need some fairly bulky instruments and the chances are that they would all need a 230VAC supply since such instruments can rarely run on battery power. Now though, those three instruments are available for the iPad, iPhone and iPod Touch. They come from Oscium and each is a dongle which simply plugs into the dock connector and is powered from the "iWhatever's" internal battery.

Obviously you also need an "App" to drive them and these are available free from the iTunes store. So all you have to do to turn the iPad into, say, a logic analyser is plug in the dongle, connect the cables and tap the icon to launch the software.

Spectrum analyser

The WiPry-combo is a spectrum analyser covering the 2.4-2.5GHz range with a dynamic range of 52dB and a sensitivity of -40dBm. Up to 28dB of input attenuation can be selected,

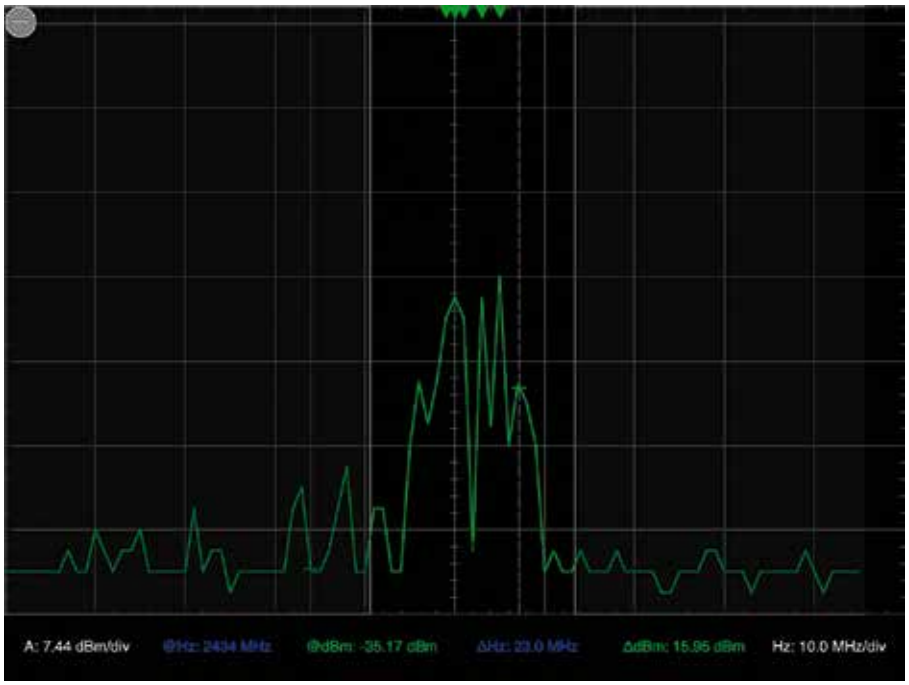


Fig.1: the WiPry in peak-hold/"decay" mode showing WiFi activity on channel 6. The grey masking on either side shows which frequencies are outside the currently selected channel although this can be hidden. Other modes such as Heat Map (shown in the lead photo) and Waterfall give a different display.

to allow a maximum input level of +40dBm. Its resolution bandwidth is 1MHz. Input is via an SMB connector and a 2.4GHz stub antenna is provided which gives reasonable results. Sweep time is 200ms and the screen update rate is about 1-2Hz.

The software gives you a number of modes including raw, decay, averaging, peak hold and waterfall. There is support for cursors and markers. The cursors can be set on either side of the WiFi or ZigBee channels to make it easier to work out which channel a given peak falls in.

We found that the WiPry works best when set to Decay mode with a peak hold time of three seconds and a decay rate of 4dBm per second (see screen grab). It's also a good idea to turn the iPad's WiFi off so it doesn't interfere with the readings. In this mode, you get a series of spikes or a plateau in each channel where a WiFi network is present and you can use the channel mask feature to check which one corresponds to that range of frequencies.

The WiPry is quite handy for optimising WiFi networks as it lets you see which channels are being used by your neighbours and select one for your own network which doesn't interfere (adjacent channels overlap in frequency). Our own WiFi network was on channel 6 (a common default) and somebody else nearby has one on channel 5.

By switching ours to a higher numbered channel, we managed to both reduce the power required to communicate on our network (as demonstrated by lower peaks in the WiPry display) and also, in theory at least, increased the speed due to less corrupted or lost packets. So clearly the WiPry has some real applications and it's also the cheapest of the three add-ons we're reviewing here.

Judging by the name, the WiPry is intended to allow users to "sniff" for wireless networks and see where they are, what channel they are on and so on. Based on our experience, it certainly should be suitable for that sort of task too.

One minor limitation of the WiPry is that it will only run in landscape mode, ie, it doesn't rotate if you hold the iPad in portrait. Obviously the horizontal frequency axis would be more compressed in portrait mode but it's sometimes more comfortable to hold an iPad that way and it also means that you can't use it with the antenna pointing at the sky.

Mixed signal scope

The iMSO-104 is a scope interface with one analog channel and four digital channels. It is roughly the same size

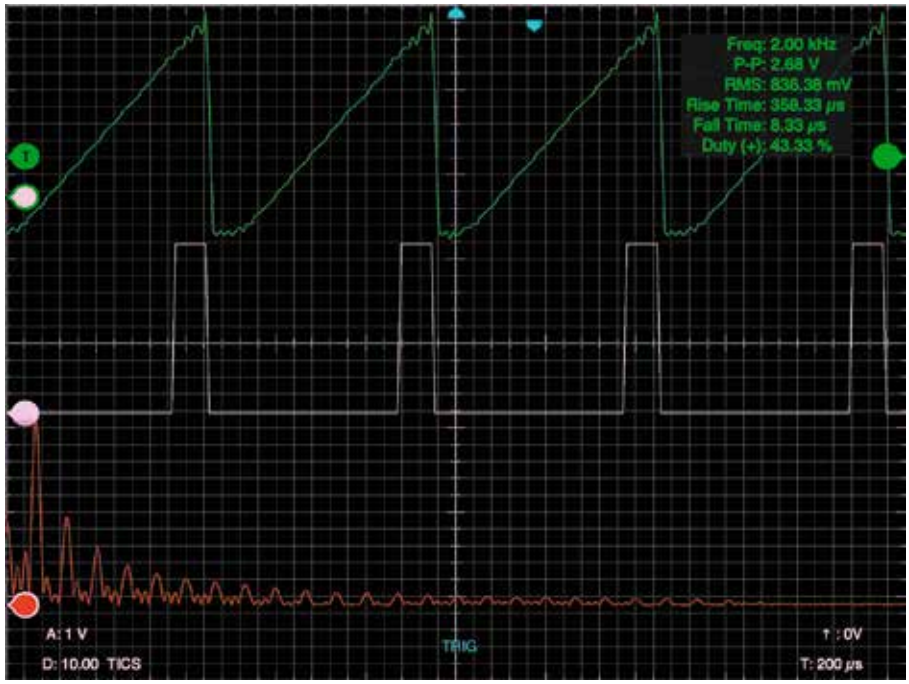


Fig.2: the iMSO being fed a 2kHz sawtooth waveform from a DAC. Its bandwidth is good enough to pick up the "wiggles" from the delta-sigma algorithm being used. An FFT of the waveform is shown at the bottom in red while the mauve trace shows one of the logic channels, fed from the same signal.

and weight as the other two Oscium accessories, ie, very small and light. While the analog bandwidth is limited, it's certainly good enough to check low-frequency waveform shapes as you may need to do from time to time.

For the analog input, you get a proper 10:1/1:1 switchable probe although it has a very short lead which can be awkward when making connections to equipment. The probe plugs into the iMSO-104 using an SMB connector. This can be used to measure signals up to ±40V in 10:1 or ±5V or so in 1:1 mode. Vertical sensitivity is adjusted in six steps using a similar two-finger gesture as is normally used to zoom the display in or out.

The maximum sampling rate is 12MHz and analog bandwidth is stated as 5MHz although if the probe is set to 1:1 then it will be considerably less.

For digital signals, the four logic channels connect via separate wires that join at the unit in a JST-style connector. At the other end you can attach the provided "grabbers" which can be hooked to component leads, IC pins etc plus a ground point. These work with 3.3V or 5V digital signals (possibly lower; they do not specify).

The software offers the basic features of a scope. You can adjust the timebase between 2µs/div and 1s/div (with a similar gesture as for adjusting vertical sensitivity). The vertical sensitivity for the analog channel can be adjusted between 500mV/div and 20V/div in 10:1 mode. It can be triggered on a rising or falling edge with adjustable threshold and holdoff. The screen updates about once per second.

As you would expect for a mixed-signal scope, automatic measurements can be made on the analog signal including frequency, period, peak-to-peak voltage, RMS etc. We quite like the measurement interface since you can show up to six at a time and they don't take up a lot of space, sitting in the top-right corner of the screen.

The digital/logic inputs are a rather basic affair with no serial decoding or anything like that but they will let you observe one to four control signals up to a megahertz or two, along with the analog waveform.

There is also an FFT feature which could come in handy for analysing certain analog signals although the relatively low overall bandwidth makes this of limited use. However, this does illustrate another good feature of the Oscium instruments which

is that they can deploy new features via software upgrades after you buy the product; apparently, the FFT function was not available with the original software package.

The "App" is also able to update the firmware in the dongle itself, as we found out the first time we plugged it in. This was a quick and painless process although we aren't sure what exactly the update fixed.

Regarding the analog probe lead, being only about 50cm long means you'll have to plan ahead in terms of routing cables and so on (the logic probes are similarly short). If you put the iMSO unit on the left of the iPad and whatever you're testing on the right, it won't reach!

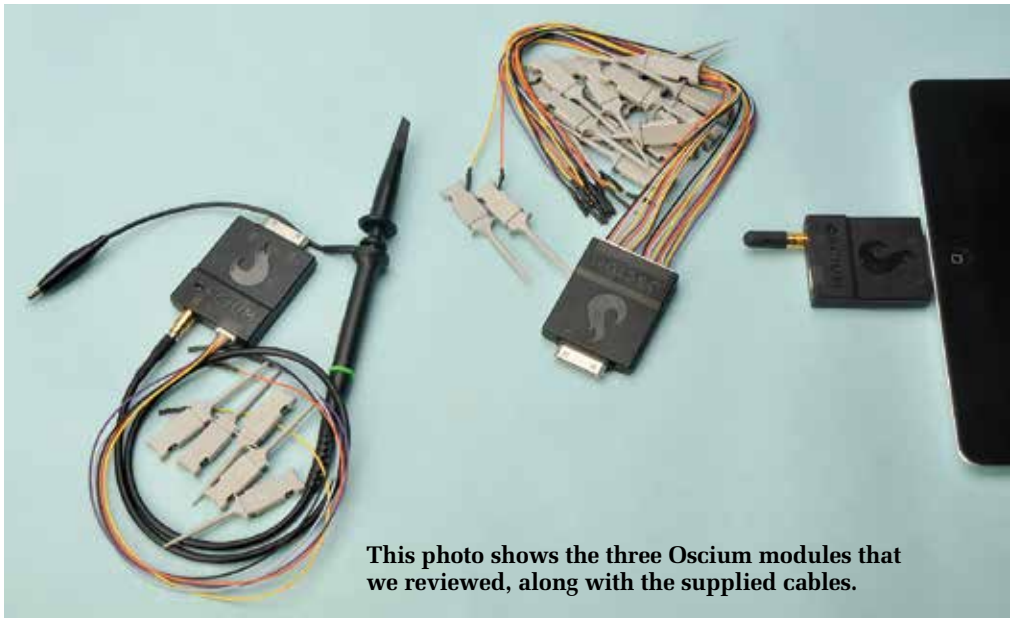
We're not sure if the lead could be extended without affecting the probe compensation too badly but unfortunately, the use of the SMB connector rules out the use of standard probes with longer leads (without an adaptor, anyway). By the way, the iMSO comes with a plastic compensation adjustment tool to turn a trimpot on the unit. The manual describes the procedure which is a bit fiddly as the adjustment is very sensitive; they say that it comes pre-calibrated but it's worthwhile checking it anyway and then you can make an adjustment if necessary.

Overall, this is a rather basic mixed signal scope but it's quite good considering that if you are already carrying an iPad, you wouldn't even notice the extra hardware which can be slipped into a pocket in a bag and then pulled out when you need it.

Logic analyser

The LogiScope is another Oscium iPad accessory and this one is a 100MHz, 16-channel logic analyser. Each channel is broken out into one of two small 10-pin headers on the end of the unit and connections are made using a similar arrangement to the digital channels for the iMSO-104. Besides having more channels though, the LogiScope also has serial protocol decoding capability.

The LogiScope can decode logic-level serial (RS-232, etc), SPI, I^2C and generic parallel buses. The default display shows the 16 channels separately but you can enable serial decoding by selecting the mode, mapping each signal to one of the inputs and then configuring some options such as clock polarity and so on, which are specific to the mode. The decoded data then appears below the raw signals in the timeline.



This photo shows the three Oscium modules that we reviewed, along with the supplied cables.

Signal voltage levels supported are 2-5V and the data buffer is 1000 samples long. It can decode serial up to 921.6kbps, all standard I^2C speeds and SPI up to 25MHz. Bandwidth for a square wave is quoted as 30MHz.

The trigger system is quite advanced, supporting up to four complex triggers which can be based on the positive or negative edge of a single line, a decoded serial value, pulse width, I^2C packet property (address, data or length) or SPI packet length. Triggers can also be delayed and sub-triggers are supported, ie, it can be triggered when one specific event is followed by another within a certain time.

That makes it a quite capable logic analyser, especially when used with an iPad or other device with a large screen. And despite being the most expensive of the three Oscium iPad accessories that we are reviewing, it is the one that we would be most likely to purchase. While there are cheaper, PC-based logic analysers with similar capabilities, unless you already carry a portable computer with you, they are far less convenient.

Conclusion

For each of these devices, it is possible to save or email a screen grab for later review which is quite handy. It's how we captured the screens shown in this article.

One limitation which we ran up against is that since these accessories use the dock connector, you can't charge the host device while you are using them. That's understandable, given that the iPad and iPhone really only have the one connector (ignoring the audio jack, which is sometimes used to interface to certain peripherals). But it does mean that if your battery is running low, your test and measurement session may have to be curtailed.

The build quality of the units seems good. The plastic cases are translucent and various surface-mount ICs and passive components can be seen through them.

In conclusion, while the performance of these accessories cannot fully replace the equivalent separate instruments, they are very convenient to carry if you already have a suitable host device. They are also quite easy to use and we didn't really run into any problems installing or operating the software.

So if you are rarely separated from your iPad and like the idea of carrying a mini electronics lab around in your pocket, these could be just what you need. While you can use them with an iPhone or iPod Touch, with such small screens you might find them of more limited use.

The WiPry-combo is $199+GST, iMSO-104 $299+GST and the LogiScope is $399+GST (freight is extra).

For further information, contact Emona Instruments. They can be reached at (02) 9519 3933 or via their website at **www.emona.com.au** or via email at **testinst@emona.com.au** SC