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A glimpse into the future – the Flex Signature Series radios

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The new Flex Signature software defined radios are now available in Australia, via the manufacturer in the United States, FlexRadio Systems. The Flex-6500 and 6700 represent a significant advancement on their predecessors, the Flex-1000, 5000, 3000 and 1500. I would like to share with you some observations about the Flex-6500.

The original Flex radios required a computer of significant capability as most of the computing side of the system was performed via this computer.

The performance of these radios was quite outstanding. I have never heard a negative from any user of them, other than a few who found that installing some of the more complex software presented a challenge to them. Their receivers are outstanding, their transmitters are reliable and they remain one of the best transceivers available.

The Flex-6500 represents a generational advancement which has learned from its predecessors.

The software (SmartSDR) is being upgraded regularly. When I first submitted this article for publication in early November last, we were using the first commercially available version of software. By the end of February 2014 we are using the fourth update, which now gives us most if not all of the features that we expect in a modern radio.

From the start, Flex was very open about this process of gradual software development. Prospective purchasers knew that initially we would only be given software which offered limited functionality, and lacked things, such as the ability to use digital modes.

The purpose of this article is to give you a thumb nail sketch of the

Photo 1: A close up of the front of the Flex-6500 radio.

radio but with a warning that by the time this article is published the software will enable it to do far more than it does today.

Let me just pause to give you a short lesson in computer speak.

Anything that works in conjunction with a computer, such as a humble printer, a modem for the internet, or whatever needs to communicate with that computer, for obvious reasons. One expects these days that we can plug in a new printer and have the two devices work together. This does not happen by accident. Rather, with the advent, in particular, of Windows 7 and 8, our computers now have the ability to find the relevant software which is needed to drive the new device (known, unsurprisingly enough as 'drivers') and install them onto the computer. In the not so old days we would receive a CD or before that, a floppy, and have to load the software ourselves. Loading software and having it compatible with the computer is sometimes challenging, unless the computer can set up new software in a way which avoids conflicts.

The gateway between a computer and anything attached to it is called a comport, or

communications port. Very few modern computers have an actual serial connection so most rely on their USB inputs as a means of enabling other devices to talk to the computer and vice versa. Thus we have USB keyboards, USB printers and so on.

But only one piece of equipment can connect to a serial port at any one time, without producing a conflict. The way around this is to digitally piggy back to a dedicated port, with virtual ports. More of this shortly.

Rather than giving a theory lesson on communicating with a radio and a computer, I will summarise *what* happens, rather than *how* it happens.

With our software defined radios, two very smart pieces of software take understanding, cables and hard work, out of the equation. This software allows logging programs, rotators, tuneable antennas, digital programs, to all connect to the radio through the computer, without any conflicts, so that you can run multiple equipment at once, virtually without doing anything to install it except push a couple of mouse buttons. It is very simple. For those with no understanding, the installation

manual sets out each step, so that it is very simple to follow.

So, to return to the Flex-6500. The radio comes with a SmartCat software program which allows us to generate as many pairs of ports that we might need to have all these programs work. This is a far simpler program than many of the others which were around in the early Flex days and is designed to integrate simply into the new Flex Signature series of radios and make setting up quite easy.

Imagine a station (mine) which runs the following peripheral equipment:

1. A SteppIR, tuneable antenna.
2. An Alphaspid computer controllable rotator.
3. A Tokyo High Power automatic band switchable linear amplifier.
4. Computer switchable antennas.
5. A logging program which records the name of the station worked, the time, date, mode and so on plus automatically 'knows' the appropriate beam heading for that station and can tell the rotator where to go (for want of a better expression).
6. Moving map display to show grey line, to identify the location of a country that we have entered into our log.

7. History of any previous contacts with a station.
8. Digital software for PSK, RTTY etc.
9. And so the list could go on to include multiple linear amplifiers, power output monitors and a variety of other equipment.

With a conventional radio, provided you have enough leads, time, patience and know how, you could connect all of these devices in hardware. Good luck. I will see you in a couple of weeks when you should have some of them running.

With the Flex 6000 series of radios, there are no leads whatsoever. All of these 'connections' are done in software and take but a moment to set up. Yes, all of these functions could be set up in less time than I would take to type the instructions for installing them. The software sets up the piggy backing so that one actual comport which reads the frequency, mode of operation, band and so on can be simultaneously read by one or more other programs, enabling the rotor to turn via software, the linear to change bands, the SteppIR to re tune and at the same time has the logging program record the details of a QSO straight from the radio itself.

Until the release of the Flex-5000, I used a Yaesu FT-1000MP Mark 5 and set it up so as to permit me to do most of these things. But it was time consuming to set up, required a multitude of cables and digital modes required an external piece of equipment to take the audio and convert it into digital data to be then sent to my computer.

The software which accompanies the Flex Signature series transceivers is designed to enable the user to integrate any number of other devices, quickly and simply. This process is no more difficult than attaching a printer and installing it to our computer.

Alternatively, if you are not into such complexity, the bare bones radio is simplicity itself to both set up and operate. You can make it as simple or as complicated as you like which is one beauty of this radio. It is designed to be set up by you for your convenience, not that of anyone else. I want to use mine for PSK-31, voice and CW and don't want to have to worry that my antenna or linear are on the wrong band, or that the antenna is not turned to the station. This is all done for me by the software that accompanies the Flex-6500.

Photo 1 shows the actual radio as seen from the front. For simplicity's sake I will leave for now the connectors for multiple antennas, separate linear amplifiers, press to talk and so on which appear on the back. I use the front microphone connection for an external microphone, plus PTT.

When the display shows 'Flex-6500' you are being told it is ready to play.

The Flex-6500 has four of what are called 'slice receivers'. These are the equivalent of four separate receivers, which enable the user to listen to four discrete bands or four parts of one band, simultaneously.

Don't be confused into thinking we are talking about four separate VFOs. These receivers are identical full blown receivers which allow us to simultaneously view or listen to

Photo2: The Flex-6500 set up for simultaneous monitoring of 20 and six metres.

four separate parts of the spectrum, to independently adjust DSP or bandwidth on each slice and use whatever mode we wish in each. What this means is that you can listen to two sections of six metres at once, and simultaneously listen to slices of the spectrum on 20 metres and 80 metres and use different modes for reception in each of them. If you decide you want to transmit on any particular 'slice' you simply click on the TX symbol on that slice and that then focusses where you are to transmit.

In photo 2, the radio is set up to monitor two slices, one on 20 metres and the other on 6 metres. It can now be set up to show two additional slices of spectrum but the photo illustrates what I am trying to describe.

You will see that we are looking at a slice of the spectrum between 14.140 and 14.300 on the upper screen and 50.040 to 50.180 on the lower. We are able to zoom in or out, so as to increase or decrease how much of this spectrum we want to view. In the case in point we can add two additional slices to the like effect.

We can set up our screen so as to see what is doing in that part of the spectrum covered by each of our 'slices', with the screen being divided into vertical segments each of which shows a slice. Such slices have individual audio, mode, bandwidth, DSP and S meters. You will also see the controls on the right of the screen, which show our output power, VSWR, compression level, and so on.

In my previous article on the Flex 3000, (*AR*, April 2010) I commented on the huge advantage for DXing of being able to see weak signals before they reach the audible level. The Flex-6500 continues to allow us the same benefit but it does it better.

Recently I observed the noise floor on six metres increasing at the low end of the band and gradually working up towards 50.110. Within a few minutes I could see weak

Photo 3: A close up of some of the on-screen controls for the Flex-6500.

CW stations followed within a few moments by an excellent opening to JA which lasted nearly an hour. At the same time, by looking for weak signals, I was able to hear two Ws and one Mexican station, all of which came and went within a minute or two and were not heard by me again.

Think of it this way. When tuned to a discrete frequency, you could have anyone calling a few kilohertz away and you would not know they were there. By monitoring your computer screen to show what is going on within the tuning range of the receiver or slice, you can see all of that part of the spectrum.

In my flying days, many years back, we were sourced to fly to a remote site, using basic navigation but were assured that a low powered beacon would be turned on near to our estimated time of arrival. We flew backwards and forwards but no beacon. In the end, I reversed two of the digits given to us and there was the beacon! Just think. If we had an ability to 'see' that part of the spectrum we would have landed and been on our way without being thrown by incorrect information. Being able to see the spectrum that interests us gives

immeasurably more information than listening to one frequency, or even moving our dial up and down the band.

Photo 3 shows a close up of the controls on the screen, which allow us to use our mouse to change modes of operation, switch digital signal processing in and out, adjust the bandwidth of our filters and audio output for that slice. As well, on the right of the main screen there is a combined audio level control which sets the output of our combined slice receivers. You can see which antenna is active, which part of the spectrum we will transmit on and the S meter display which shows just below S3 in the photo. There are drop down sub menus available by pointing and clicking our cursor.

The radio is designed for and puts out up to 100 watts PEP on all bands, 160 metres to six metres on SSB. It is adjustable with a slider, from zero up. On my Bird peak reading wattmeter into a dummy load, the results were within two watts of 100 watts on all bands, using a standard two tone test.

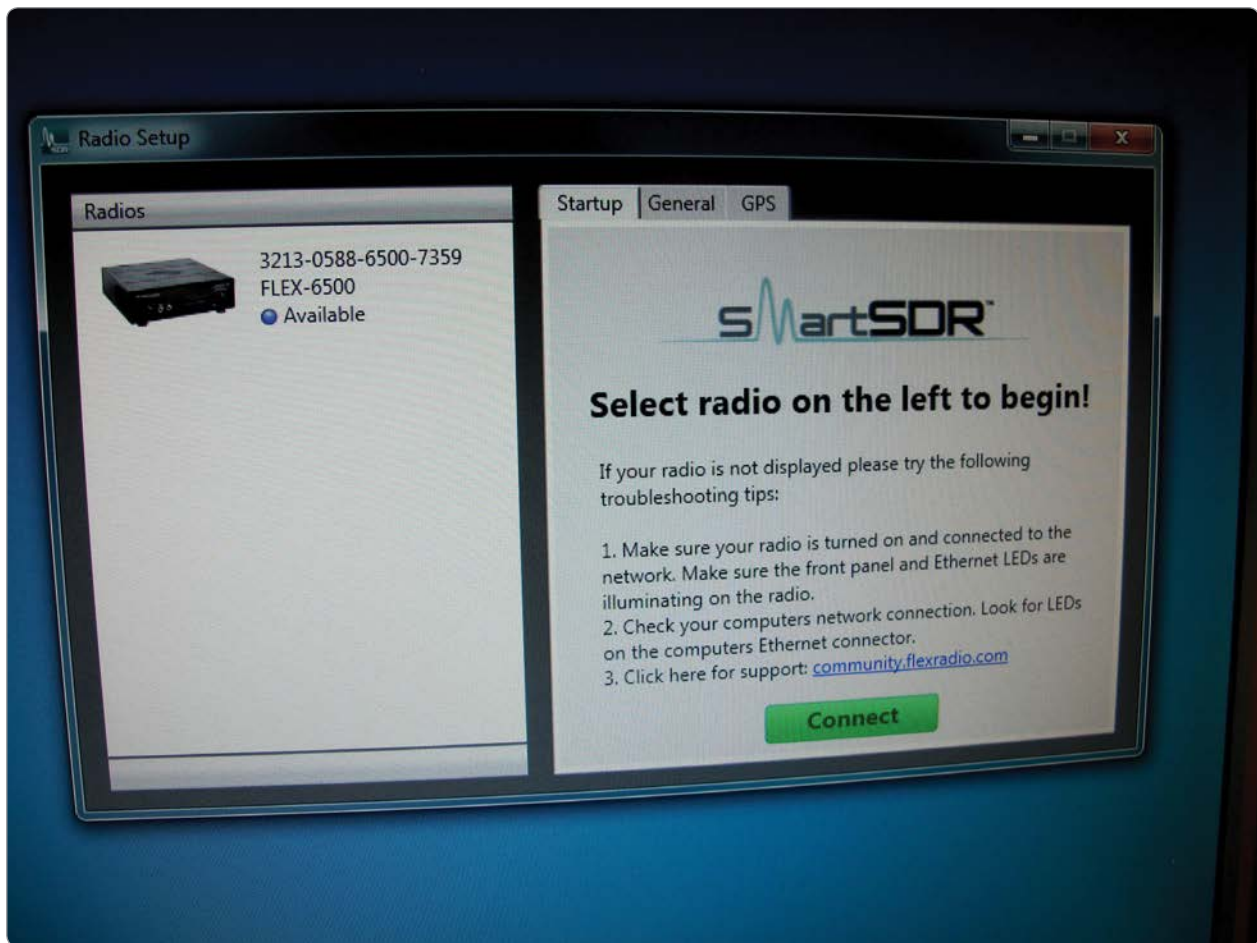Using the Flex-6500 on CW is quite amazing. At 30 wpm, QSK, you can clearly hear between dits,

Photo 4: The initial screen that greets you after connection of the Flex-6500 to the computer.

which gives you some idea of the switching speed. I have used many rigs for CW, over nearly 50 years of being licensed, using both a hand key and electronic keyers. I have never used a more CW friendly radio than the Flex-6500. Already I have heard of people using it at speeds approaching 60 wpm. I cannot read that fast and limit my sending speed to what I can receive at. Oh yes, there are programs that can help but I have yet to find one that is more reliable than my own ears.

The Flex-6500 is an absolute breeze to set up. The radio is ideally connected to an Ethernet port attached to your router. Any computer also connected to that router, either by wire or Wi-Fi, can then be used to communicate with your radio. I can move around the house monitoring my Flex radio on my laptop which is wirelessly connected to my router. In time this is going to make remote operation of the Flex radio so much easier to achieve, but that is for the future.

Photo 4 shows the screen you are greeted with, when the radio and the computer are connected together. There is a temptation to think that these radios are only for computer geeks. Nothing could be further from reality. That comment might have had more merit to the older radios but the new software takes all the understanding and hard work away from the operator who does not want to know how it works, just so long as it does what he or she wants it to. To paraphrase from the old film, Those Magnificent Men, where they set out the steps to flying an aircraft, here are the steps from taking the radio out of its case, to having your first contact.

1. Remove the radio from the outer case.
2. Remove it from its inner case.
3. Remove the plastic from it.
4. Either plug in the provided microphone, or make up a suitable adapter for a base microphone.
5. For speakers, either plug in powered computer speakers, or headphones or, as in my case, plug into the audio switching unit in your shack.
6. Plug in the supplied power lead to 13.8 volts at 25 A.
7. Plug in a suitable antenna to Ant. 1 on the back of the radio.
8. Plug in the supplied blue Ethernet wire to your router.
9. You are now ready to install the software to a computer attached to your router.

a. Go to the installation site for SmartSDR and load the software. This is all mostly automatic and requires little input from the user.

b. Load SmartCAT software (this is used to generate the virtual ports I mentioned before). Again, very little is required of the operator as this loads and installs automatically.

c. These two programs install from the internet and require no computing skill to install.

d. Install and set up SmartDAX which I will discuss shortly, if you want to use digital modes.

Once this process is finished, you will be prompted to turn on the radio. The Flex radio goes through a calibration routine which takes a few seconds, each time you turn it on. Once the Flex- 6500 banner appears on the computer's screen, as shown in Photo 4, you are being told that the computer recognises it and that it is ready for use. Click on the radio logo with your mouse and then hit the Connect button in SmartSDR.

If you happen to have installed an upgrade to the software since last use, instead of seeing the word 'available' you see 'upgrade', a reminder to update the radio. This requires about two mouse clicks from you as the rest is automatic and takes a couple of minutes.

You will see a panadapter display of the radio, set to the frequency the radio was last tuned to.

I had my first contact without touching any of the presets on the radio. Later I adjusted the level controls and the audio equaliser for both receive and transmit, but the radio was basically ready to use out of the box.

As you would expect of a modern transceiver, we can use our Flex with transverters, can adjust our power out, can shape the receive and transmit audio, reduce

noise with variable DSP, can use VOX and can compress our audio on transmit. In short, the radio has all the features that modern radios have but it also has much more and Flex does it better, in my view.

Flex have obviously gone to a great deal of trouble to make the installation of the radio to the computer so simple that if you can install a printer to your computer, you can install a Flex Signature radio.

In my own case I had the radio for nearly a week before I had a chance to plug it in. Whilst the software was doing its bit, I wired up the microphone plug. It took longer to solder than the software took to load. I had my first contact on SSB a few moments later.

Like all radios, the more you use it, the more you realise what you can do with it. Initially I tried using my hand key at about 14 wpm on CW and when this was successful I went to my Bencher keyer. The Flex allows us to set the speed. Its default value is 30 wpm. The internal keyer is the best I have ever used.

Early versions of the software lacked a memory of your settings

but now you return to the radio, turn it on and it is as you left it.

I would like to make some comments about Flex, the company, and its products because I think that after sales service is crucial to our enjoyment of a radio.

First, Flex have, from the start, engaged actively in their forum where any user can ask any question about their radio and generally receive an answer either from another user, or occasionally from a Flex staffer. By now, most issues that people have found with the Flex-5000 or 3000 have been identified and written about, such that a quick search in the Knowledge Centre on the Flex web site will come up with the answer. Most problems arise through lack of familiarity by new users, who, rather than persisting, seek help.

Occasionally a user will find an interesting glitch. Flex respond to such queries like lightning and share their findings with us all. If there is a problem with a radio, users can initiate a one on one ticket with Flex technicians who will work through the problem with the user. If the radio requires repair the turnaround is, I am told, a matter of days,

Photo 5: The author's Flex station – the Flex-5000 on the left and the Flex-6500 on the right.

certainly not weeks. I own three Flex radios and have never had a fault with any of them.

With the Flex Signature series, of which the 6500 is one, the radios were released to users, such as myself, who agreed to be Beta testers, that is, to use the basic software and report on issues that we found with it. As an early Christmas present Flex released the first non-Beta version of the software on, I think, 21 December and it did everything that Flex said that it would. I downloaded and installed it the day before leaving on holidays. It was a frustrating period as I dearly wanted time to play with my new toy.

Flex have produced a timeline within which various additional features are going to be added to SmartSDR, so that users have a good idea of what is coming and approximately when. To date, it appears they are ahead of their time line.

As part of our purchase package, we are able to pay an additional sum for updates of this software for particular periods of time. Speaking for myself I have no difficulty in agreeing to pay for the continued development of software which is going to assist me to further enjoy my hobby and have paid up front for an additional two years of updates.

One can elect not to pay for upgrades, in which case the version of software will remain as it was from 12 months after purchase. I strongly recommend that all buyers of the new radios take out the option of upgrades at least for the next couple of years.

Throughout the history of PowerSDR which drives the Flex-5000 and 3000, updates were free. I think that everyone expected that Flex would charge for updates to their software at some stage simply because of the need for revenue to fund the on-going development of that software. Think of the software cost as the cost of maintaining and upgrading a conventional

Photo 6: The author's station as viewed from the operating position.

radio once the warranty period has expired. In that sense it is not an expensive overhead.

But you cannot compare the PowerSDR available today with the older Flex radios with the original versions. Users have said, with some justification, that each update to the software is like obtaining a brand new radio. Certainly the program today versus five years ago is like chalk and cheese. Indeed the SmartSDR of late February 2014 is a far cry from that which I was using in October 2013.

Conclusions

FlexRadio is a very user oriented company. After a while, you feel that you actually know the personnel through their comments in their forums. Each week or so we receive an email containing an update from the company President, Gerald, appropriately called 'Flex Insider'. He writes as if he is speaking to each of us individually. We are, after all, members of the Flex family. On the few occasions that I have emailed Flex over the years, their response has been received within a day, and addressed to me by my first name, not 'Dear Sir'. I have not had to report any problem with my rigs.

The home of news and views of the new Flex is called FlexRadio

Systems Support Community. This word 'community' sums up what I perceive to be the ethos of the company. No problem seems too small or insignificant to them, although they must tear their hair out when users write in about a problem without first looking in the Knowledge Centre for an answer. This repository is contributed to both by Flex engineers and a variety of users, many of whom are software developers or electronics experts of some kind. There are even a number from myself.

The digital enhancements provided by a software defined radio have previously been written about by me, but you need to play with this radio to see for yourself just how good it is.

The digital filters allow you to copy CW at 100 Hz bandwidth, without any ringing or distortion, the sensitivity of the radio is quite outstanding and adjacent channel interference seems non-existent. In this respect I have compared it with my Flex-5000, which was very good, but the 6500 is better again.

We have had a very good few days on six metres as I write. I have worked Hawaii, countless JAs, China, South Korea and have heard Mexico and the Philippines. Yesterday the spectrum display

showed wall to wall contacts as seen in Photo 7 but almost hidden was a South Korean station on SSB. Although other very strong stations were less than two kHz away, I worked him without any difficulty at all.

Is this radio a significant improvement on the Flex-5000? The answer is a definitive 'Yes'. When I first wrote this article we did not have digital modes available to us. They were in the software release before last. Flex put out a YouTube video to show, step by step, how to set this system up. In my case I had my radio running on one monitor, the video on my laptop and followed the narrator. It was very simple. You simply can't get it wrong.

Photo 5 shows my paperless station with the Flex-5000 (now for sale) on the far left and the 6500 towards the right. The silver mouse is for manually controlling the rotator. I mention that my Flex- 5000 is now for sale. I was not prepared to sell it until the digital modes were available on the new radio. Now that they are, I have no further use for a very good radio.

Photo 6 is the screen showing the SteppIR controls, logging program, stations recently worked. By entering a callsign the rotator will turn to either the long path or short path heading, at my command.

So in summary, what do the Flex-6500 and 6700 offer?

These radios do not have the limitations which are the bane of hardware based radios. If we want narrow band on CW, it is there in software. If we want to listen on four bands at once, we simply enable them rather than buying additional radios. If we want to transmit on a different band to the one we were on a moment ago, we hit the TX button on the appropriate
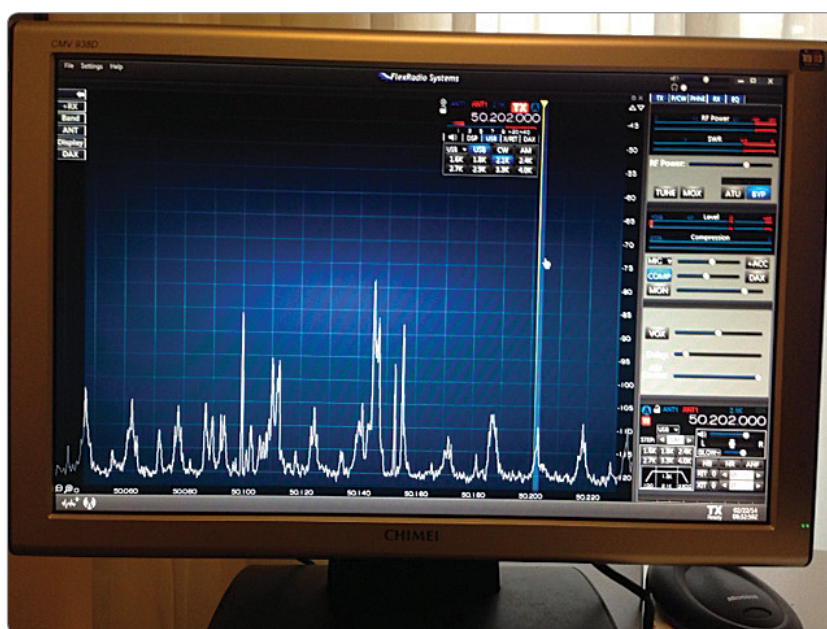

Photo 7: Six metres wide open at Maleny.

receive slice and we are good to go (assuming a multi band antenna, or different antennas). Yes, each slice receiver can be allocated to the same antenna or its own individual antenna. I would also comment again on the value of having a nice large computer screen to monitor our band or bands of interest.

On receive, I have used every type of product available from the other manufacturers. Once you can wean yourself away from the joys of fiddling with tiny controls with numerous functions which require you to reach for the handbook, your reading glasses and a stiff whisky every time you want to change some setting, the Flex SmartSDR package is such an easy radio to use. It is a pure joy to operate. All the controls are on screen in large writing, the pull down menus, such as to change modes from USB to CW and so on are easy to see and to follow and every function is on

screen and easily found, first time, every time.

DX stations frequently compliment my audio. Locals tell me I have too much compression so presumably for DX this does give an edge, but for around town, it is desirable to remove the compression. When I do, the locals say the audio is excellent.

I have been a fan of Flex for ten years now since I saw them at Dayton in 2004. I compliment and congratulate them and look forward to this voyage of discovery as they continue to roll out developments of their software. Coming up very soon will be the ability to control our Flex-6500 on our iPad but auto control of our garage door opener, our coffee machine and personalised text warnings of approaching band openings, are probably some way off.