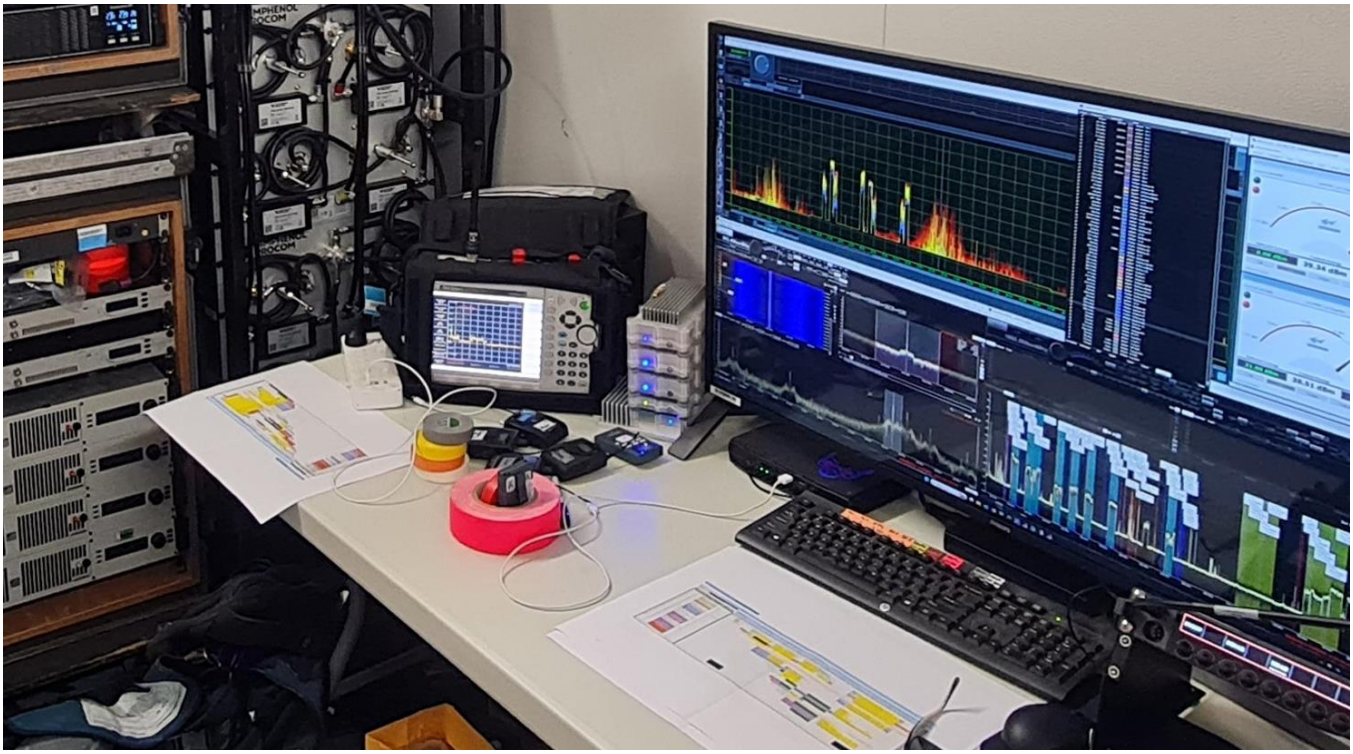
Paris 2024 Olympics – Behind the (RF) Scenes

by Steve Caldwell

The right tool for the job

In the current climate of spectrum usage, operational and deployment issues surround almost all events that utilise RF equipment. Appreciation of the available resources along with efficient assignment and correct management of the spectrum is the key to ensuring this limited resource is utilised correctly. Once this spectrum assignment is accomplished, and everyone involved has their typically dedicated, but often shared piece of the electromagnetic spectrum, there is then the task of monitoring and policing this common lifeblood of the wireless world which we all rely on.



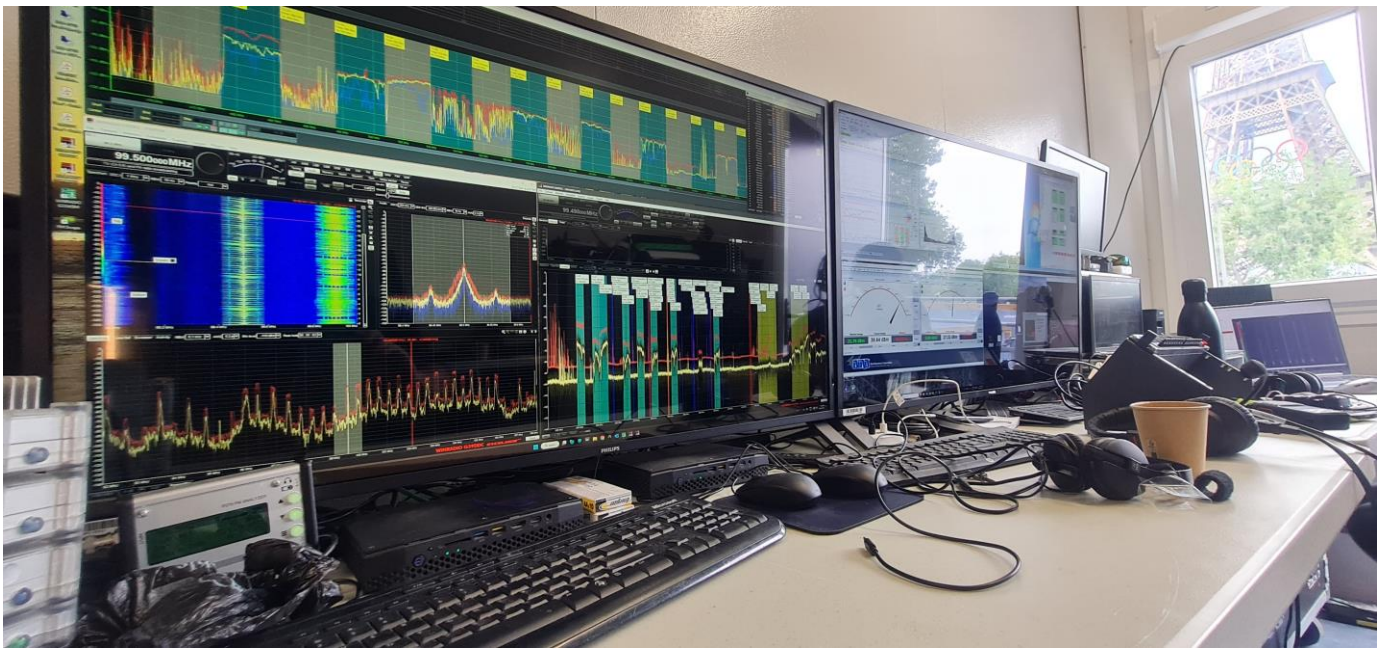
Radio spectrum management shack at the Olympics – see the WiNRADiO receivers stacked on the left of the monitor.

To actually see this fabric of connectivity, this layer of ‘ether’, a fifth element that is normally taken for granted as something that magically connects almost everyone and everything these days, you must have the correct tools. One of the most important fundamental measures I use to assess both the current landscape, and the fluctuations that occur in that landscape, is the ability to quantify change in the spectrum over time. As the levels of RF are different in every location that you assess, the key is taking this level, measured from a single location across all frequencies of interest, and then monitoring this landscape for any deviation that might affect the systems relying on that spectrum. Continuous monitoring is fundamental in understanding the nature of what is already there, and how it changes over time.

Tools that I use to perform this function vary widely in their price, accuracy, and abilities.

Portable devices, such as handheld spectrum analysers are excellent for making local measurements of a transmitting device or locating a transmission, however they are not ideal for measuring the spectrum over a longer period of time and identifying changes over that period. Also, these devices often have a very limited number of plot points available for a given frequency span and will offer a very coarse “overview” of the spectrum if any decent RF span is required as the Resolution Bandwidth of these devices is always a compromise between speed and granularity. You can’t have both.

These devices also have limited ability to notate and record different events occurring within the spectrum, either planned or unplanned, and therefore must be monitored continuously to detect any changes in the spectrum.



The neighbouring Eiffel tower (visible through the window) hosts numerous radio and TV broadcast transmitters. Did you know that it was actually its use as a radio tower that saved it from its planned demolition as an “eyesore”?

Working with spectrum over an extended period of time requires the correct tools that allow these long-term changes in the spectrum to be assessed. As conventional Spectrum Analysers have limited ability to see large portions of spectrum at good resolution, and at fast update speeds, we need to rely on different technologies.

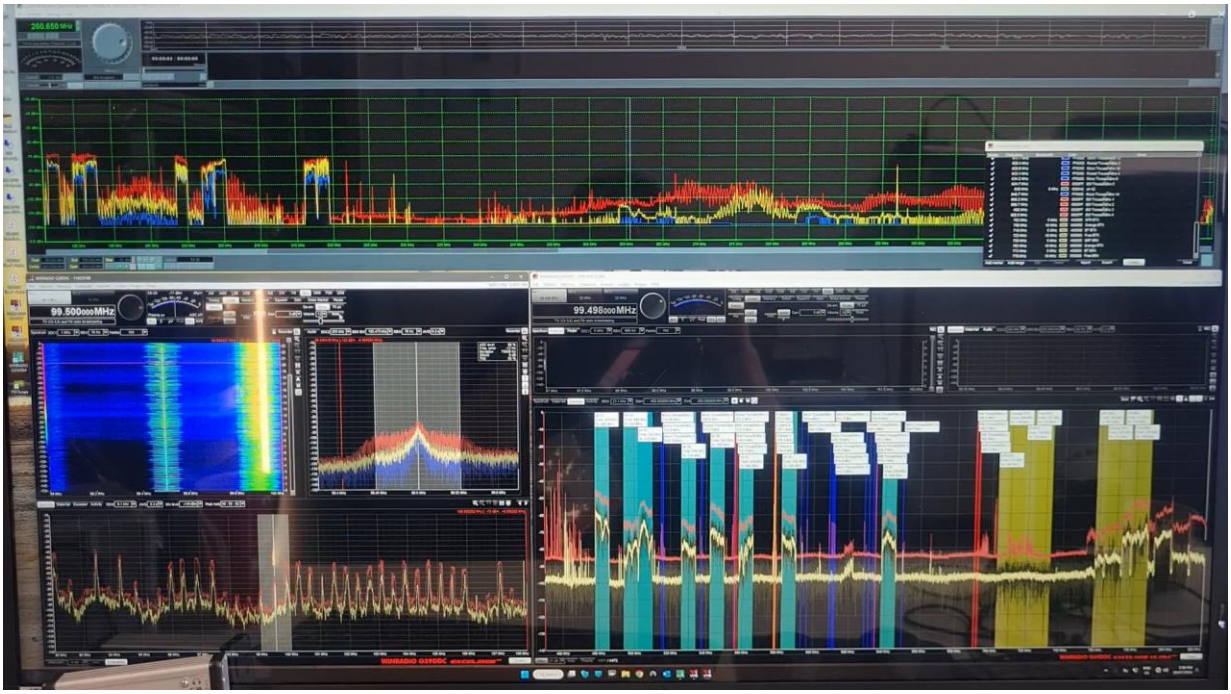
Software Defined Receivers offer the advantage of taking a lot of the RF electronics out of the analogue world, and placing them into the digital domain of software. This is done by sampling the RF spectrum with a very special, extremely high speed and wide bandwidth Analogue to Digital converter.

Direct digital conversion (DDC) allows the software to take a portion of the spectrum, at virtually any frequency, and down convert it to a lower frequency that can be fed directly into the Analogue to Digital Converter.

This resultant digital data is then fed to the computer software, allowing filtering and demodulation of an entire block of spectrum in real time.

This gives the receiver unparalleled ability to see changes in the spectrum, and record and demodulate the spectrum over much greater bandwidths than possible using traditional receivers. This also has the advantage of offering the user Resolution Bandwidths that have no impact on the speed of the receiver's capability. You can resolve the spectrum at 10MHz or 10Hz RBW with no impact to the speed of the scan.

One of the most recent applications in which I used this technology, was spectrum management at the Paris 2024 Olympic and Paralympic Opening Ceremonies. I used three of these SDR receivers; a WiNRADiO G33WSM, a WiNRADiO G39DDC, and the recently released WiNRADiO G69DDC.



All three different models of WiNRADiO receivers coexist on a single monitor screen.

When the **G33WSM** was released in 2007, it offered a paradigm change in the way to actively monitor the spectrum for users of radio microphones and IEM, allowing you to visually see your (and others) equipment in a graphical form atop the spectrum landscape. To this day, there are countless units still in operation, and are favoured by some of the best spectrum management people on the planet. Despite the unit's slower scanning speed in comparison to later models, it still offers some of the best noise floor and SNR available. I personally own two of these units.

2012 saw the release of the game changing **G39DDC.** The ability of this unit to manoeuvre around the spectrum, allowing the ability to filter out and monitor carriers was unmatched. Alongside the ability to record a 16MHz contiguous block of spectrum onto the hard drive, it offered unparalleled analysis power into the spectrum.

2023 saw the release of the upgraded **G69DDC** model, allowing even more power to monitor the spectrum with 32 MHz real-time spectrum analyser, USB 3.0 and Ethernet interfacing, and many other performance and functionality enhancements.

These receivers were all connected to a specially designed monitoring antenna and used with a Single Intel NUC8 Haydes Canyon PC. They provided both long term monitoring and recording of the spectrum, and the extended demodulation capabilities of the G39 and G69 also provided unmatched ability to filter out and listen into any rogue frequencies that were detected, before they had a chance to impact the ceremonies performances. The Markers features of both the G33 and the G69 also allowed registering and recording of known transmitters to be plotted on their spectrum displays, allowing all authorised transmissions to be monitored in real-time, and alerting the user to any rogue carrier that might cause issues.

These **WiNRADiO receivers** were instrumental in ensuring the success of the Olympics ceremonies productions.

Steve Caldwell is the lead RF Engineer at Norwest Productions, specializing in radio spectrum management at large international events, such as the Olympics, and Commonwealth Games. A long-time user of WiNRADiO products, Steve has often contributed to some of their important design aspects.