

Paris 2024

Radio and Spectrum Management

By

John Dundas

Who am I – John Dundas?

- Expert in Radio Communications systems and services at major events.
- Includes spectrum management, assistive technology, wired communications technology and fleetmapping.
- Radio and Spectrum Advisor for the two largest Sporting bodies in the world

Previously worked on:



Spectrum and Major Events

Problem:



Cities already face spectrum availability problems. A Mega Event significantly adds to that.

The pressure becomes immense for the national regulator and allocating within the limitations and time frames.

To solve this issue a clear path has to be introduced for spectrum including various policies

Use a Cable



Frequency Bands Used

LF/HF – Induction loops for results, Wireless Microphones

VHF – 50 to 108Mhz - In ear Monitors, FM Broadcast, Wireless Microphones

VHF – 136Mhz to 174Mhz - Simplex and duplex radio, telemetry

UHF – 400Mhz to 430Mhz - Simplex and duplex radio, telemetry, In ear Monitors

UHF – 430Mhz to 439Mhz - Simplex Radio (Country dependant)

UHF – 470Mhz to 698Mhz - Wireless Microphones plus telemetry

UHF – 700Mhz to 799Mhz - Wireless Microphones plus telemetry (Country dependant)

UHF – 800Mhz - Simplex and duplex radio, telemetry, SRD

UHF – 1.9Ghz - Spread Spectrum Wireless Microphones/Belt backs, TV Cameras

UHF – 2Ghz to 2.5Ghz - TV Cameras, Wi-Fi, Bluetooth, Wireless Microphones,

SHF – 3.4Ghz – 5Ghz applications, Wireless Cameras

SHF – 3.9Ghz to 6Ghz – UWB applications

SHF – 5Ghz to 5.4Ghz 6Ghz - Wi-Fi, Microwave links

SHF – 7Ghz - TV Cameras

SHF – 10Ghz - TV Downlink from aircraft

Microwave – 14Ghz, 24Ghz, 26Ghz 37Ghz, Microwave Link backhauls (maybe even higher frequency) - Radar

Areas of Difficulty

400 to 430 Mhz & 450 to 470 Mhz

Most popular band used by everyone from the cleaners to TV Crews to Nation Teams. Spectrum re-use is very hard in this band

470Mhz – 698Mhz

Most popular band for wireless microphones and can easily be congested and cause issues. Where possible encourage use of wired microphones.

800Mhz License Exempt

This band is being used for multiple applications from Telemetry for Results to Wireless Mics, to Duplex Radio systems

2Ghz and 7 Ghz

Popular band for Wireless TV Cameras. These are used by broadcasters and sports presentation and can easily be congested on some venues. Encourage use of wired cameras.

Wi-Fi

Both bands, in particular 2.4Ghz band, will be difficult to allocate due to the demand required, specifically in the MPC and IBC.

Spectrum Monitoring

Spectrum Monitoring is a crucial element of Mega Events but not just during games but before games to make sure that allocated spectrum is actually clear of any interference be it generated by radio users, faulty equipment (TV, Transformers etc) or just generally frequencies that are just noisy

Before Mega Events it is good practice to take a recording of the RF Noise Floor across the various frequency bands in order to give an idea of the increase of the noise floor when the venues are in use.

Typically the noise floor will rise by at least 20dbs

• Remote Monitoring Stations

Remote stations can be installed into venues in order for the Spectrum Team to monitor the frequency bands for any irregularities and take appropriate action. Note: Using devices that use Public LTE for connection is not recommend

• Local Venue Monitoring

Spectrum Teams on venue checking the Frequency bands with portable spectrum analysers and their EYES!

Paris 2024 Spectrum Plan



Available Spectrum





BANDS	SPECTRUM (MHZ)		ESTIMATED AVAILABLE SPECTRUM (MHZ)	TECHNICAL SPECIFICATIONS	GEOGRAPHICAL DIVISION AREAS								
	FROM	TO			PARIS IDF	LILLE	LVON	MARSEILLE	NANTES	BORDEAUX	NICE	SAINT-ETIENNE	TEHUPO'O
UHF	470	478	8	Max transmit power: 50 mW Channel bandwidth ≤ 200 kHz	✓		✓	✓	✓	✓	✓	✓	
	478	486	8			✓	✓	✓	✓	✓		✓	
	486	494	8		✓								
	494	502	8		✓		✓	✓	✓	✓	✓	✓	✓
	502	510	8			✓		✓	✓	✓		✓	✓
	510	518	8		✓		✓		✓			✓	✓
	518	526	8		✓			✓	✓	✓		✓	✓
	526	534	8				✓	✓	✓	✓		✓	✓

TABLE 1: FREQUENCY BANDS TO BE ASSIGNED TO PMR

BAND NAME	FREQUENCY BANDS FROM – TO (MHZ)	ESTIMATED AVAILABLE SPECTRUM (MHZ) ²	TECHNICAL SPECIFICATIONS	
			MAX TRANSMIT POWER ¹	ADDITIONAL PARAMETERS
VHF	68,4625 – 69,25	0.2125	1W	Possible duplex with 72.5125 – 73.3 MHz Channel bandwidth: 12.5 kHz or 6.25
	70,250 – 70,525	0.2875	1W	Simplex Channel bandwidth: 12.5 kHz or 6.25
	70,9875 – 71,95	0.850	1W	Simplex Channel bandwidth: 12.5 kHz or 6.25
	75,3 – 77,475	2.125	1W	Possible duplex with 80.3 – 82.475 MHz Channel bandwidth: 12.5 kHz or 6.25
	80,3 – 82,475	2.125	1W	Possible duplex with 75,3 – 77,475 MHz Channel bandwidth: 12.5 kHz or 6.25
	144 – 146	Up to 2	1W	Simplex Channel bandwidth: 12.5 kHz or 6.25
	148.8 – 151.3	2.088	1W	Possible duplex with 153.4-155.9 Channel bandwidth: 12.5 kHz or 6.25
	153.4 – 155.9	2.088	1W	Possible duplex with 148.8 – 151.3 MHz Channel bandwidth: 12.5 kHz or 6.25
	156.0 – 159.6	2.132	1W	Simplex Channel bandwidth: 12.5 kHz or 6.25
	160.6 – 162.9			
	158.4 – 168.9	4.5	1W	Possible duplex with 163 – 173.5 MHz Channel bandwidth: 12.5 kHz or 6.25
	163 – 173.5	4.5	1W	Possible duplex with 158.4-168.9 Channel bandwidth: 12.5 kHz or 6.25

FREQUENCY BANDS	TECHNICAL SPECIFICATIONS		ESTIMATED AVAILABLE SPECTRUM (MHZ)
	DIRECTION	MAX TRANSMIT POWER	
1300 – 1350 MHz	Ground to Ground Air to Ground Ground to Air	For G-G link: 250 mW For G-A or A-G: 10 W	For G-G link: 250 mW For G-A or A-G: 10 W
1427 – 1518 MHz	Ground to Ground Air to Ground Ground to Air		90 MHz
1525 – 1559 MHz	Ground to Ground Ground to Air		34 MHz
1613.8 – 1660.5 MHz	Ground to Ground Air to Ground		46.7 MHz
1675 – 1705 MHz	Ground to Ground Air to Ground Ground to Air	For G-G link: 250 mW For G-A or A-G: 10 W	30 MHz
1785 – 1805 MHz	Ground to Ground Air to Ground Ground to Air		20 MHz
1980 – 2010 MHz	Ground to Ground Air to Ground		From 15 to 30 MHz
2010 – 2025 MHz	Ground to Ground Air to Ground		15 MHz
2025 – 2110 MHz	Ground to Ground Air to Ground		40 MHz
2170 – 2200 MHz	Ground to Ground Air to Ground		15 MHz

Test & Tag

	<p>« CER » tag ID (e.g.12345) will be delivered by the ANFR for the Olympic and Paralympic opening or closing ceremonies</p>
	<p>« JOP » tag ID (e.g.67890) will be delivered by the ANFR for Games time</p>
	<p>« Do not Consider » tag will be delivered by the ANFR for a receiver only or radio equipment that do not require a spectrum certificate such as an operated cellular backpack camera (LIVE-U/TVU, etc.)</p>
	<p>« Do Not Use » tag will be for an equipment which is not compliant with the SMP</p>



Test and Tag is a crucial part of our defence of the spectrum from anyone who tries to bring any devices that use spectrum into the venue that are not authorised.

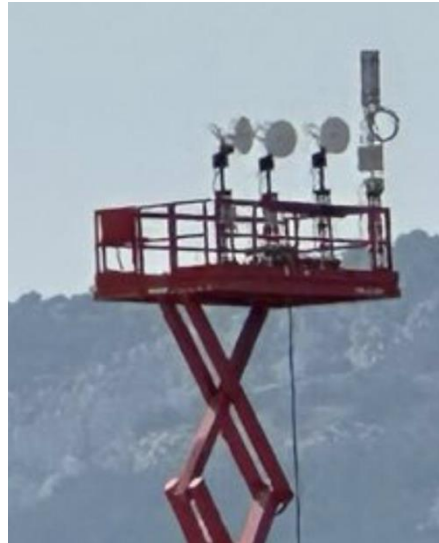
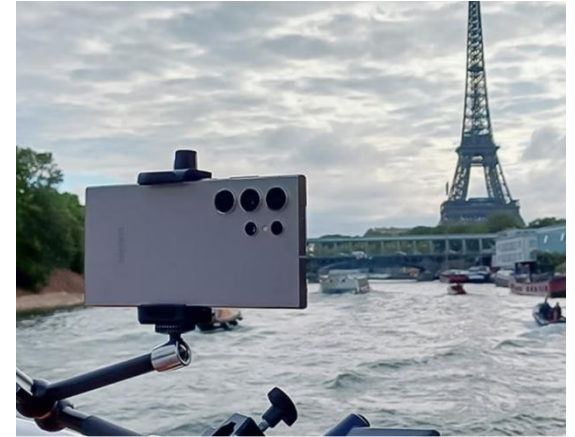
There are dedicated Test & Tag offices at International Broadcast Centre, Main Press Centre and Athletes Village. Other sites are covered by roaming teams.

Once stakeholders have received their licences/approval they can arrange a Test & Tag time and visit the Test & Tag office and have their equipment checked to make sure the equipment is operating within the terms of the license/approval

5G and Paris

5G was used for communications along the river to provide video feeds from the 200 boats in the procession. 5G base stations were installed on bridges along the River Seine

For sailing 5G was used to send video back from the sailing dinghies and a mobile 5G system was installed on a main boat in order to receive the signals and send them back to shore



Wireless Cameras Wireless Microphones

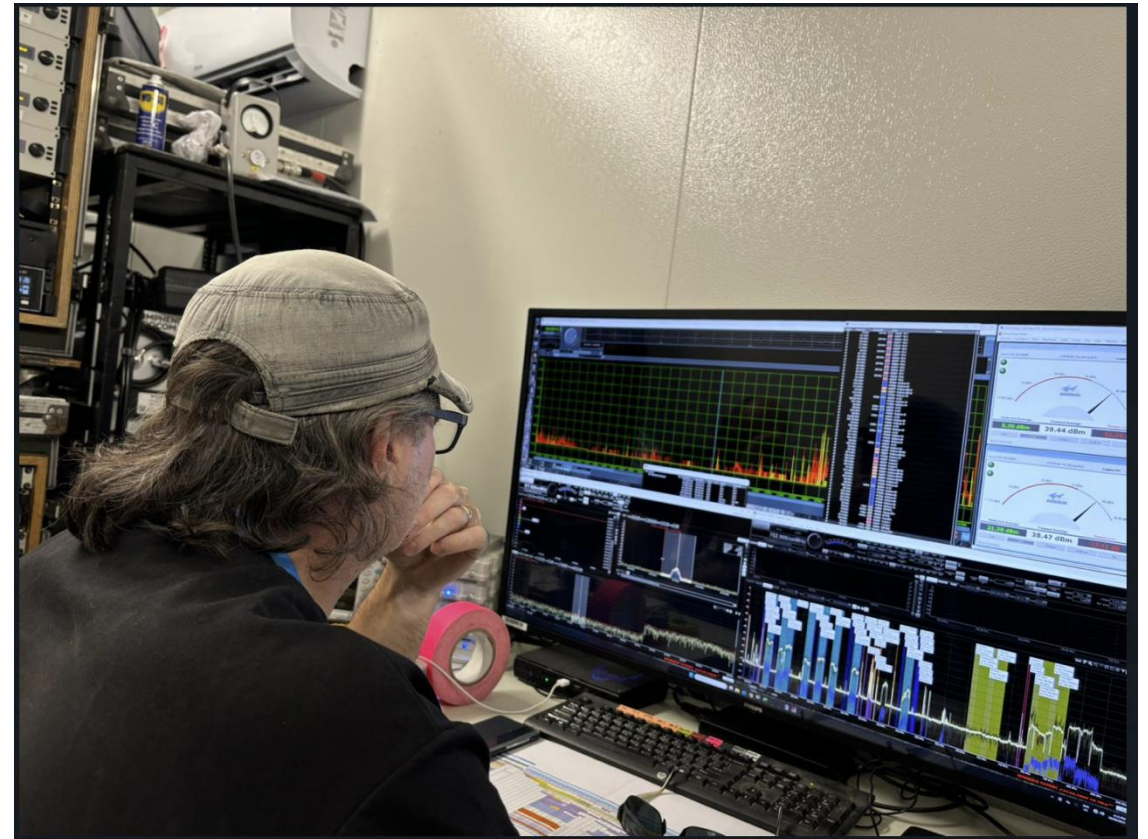
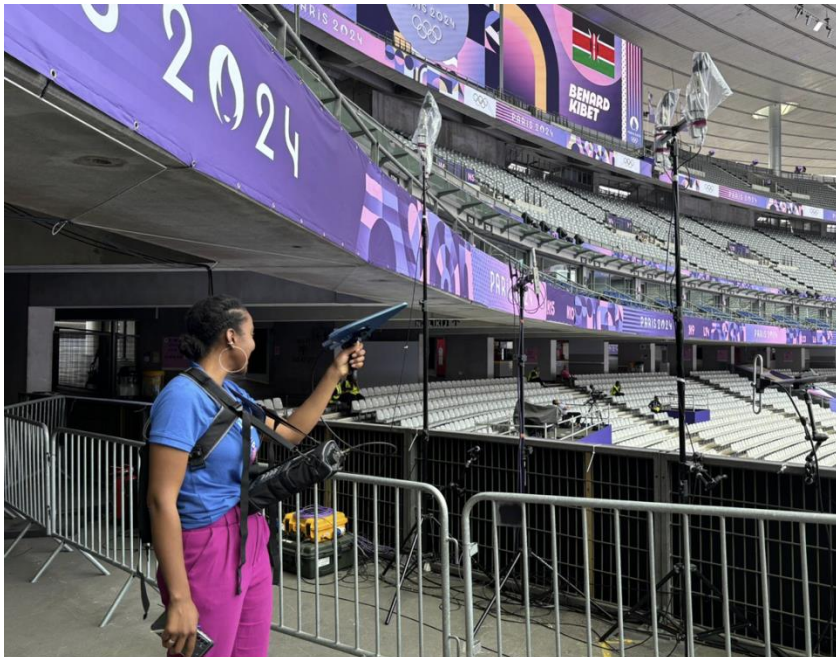
Wireless Cameras are used in many sports and can be carried by a person, mounted on a motorised track or even slung with wires across a stadium or in the case of Paris from the Eiffel Tower to Trocadero Museum to give fantastic shots up and down the river



Interference – Mitigation - Monitoring

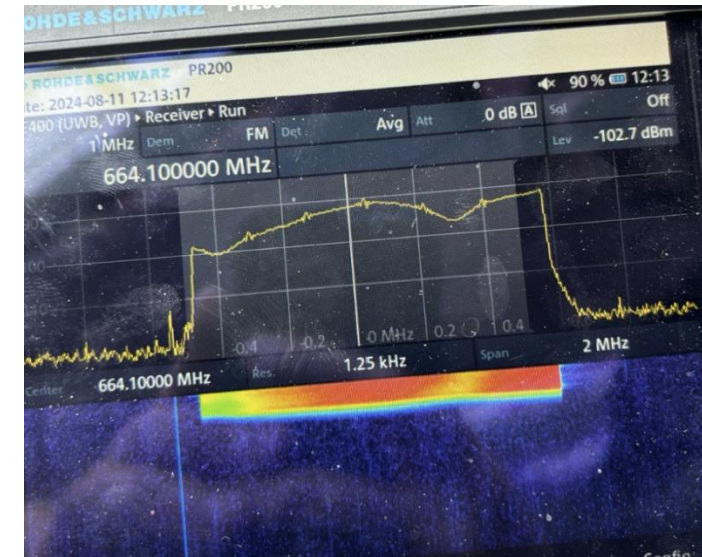
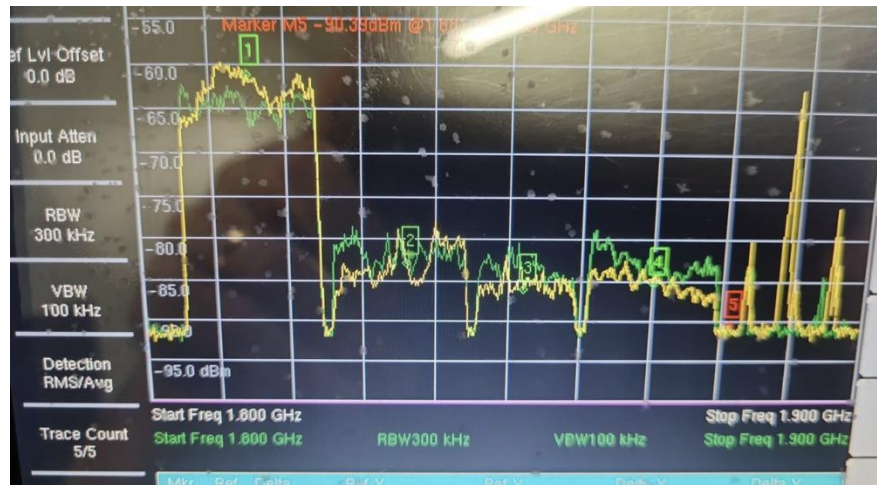
ANFR (French version of Ofcom) deployed over 400 staff from various European Nations to help with spectrum monitoring and any issues of interference including proactive checks on users on venues

They had hand held spectrum analysers as well as remote fixed monitoring systems



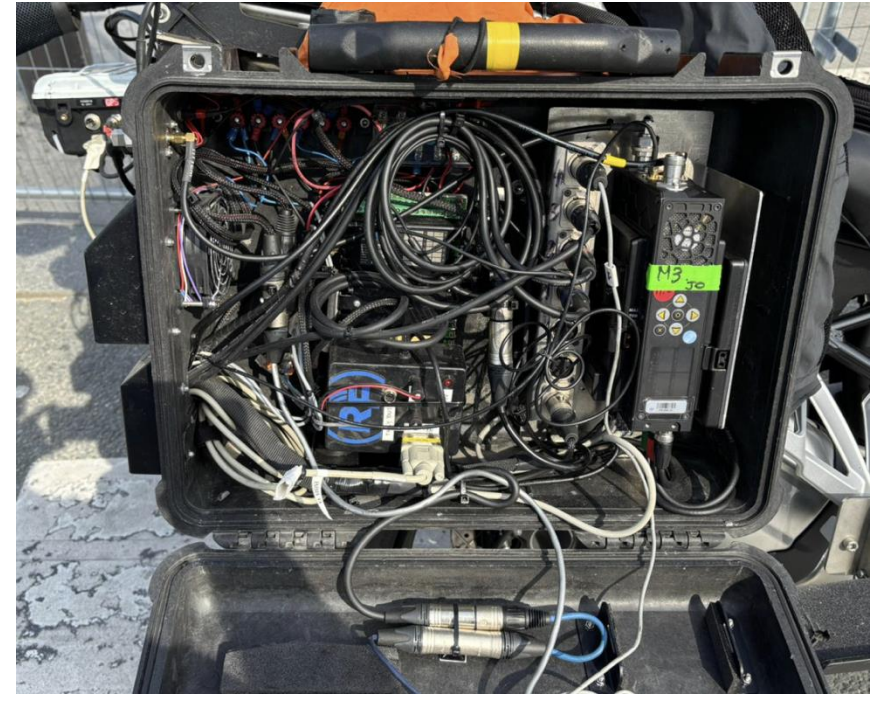
Spectrum Issues

Only a few interference issues which I classify separate from non-approved use. With each issue the source of the issue was found and either switched off, repaired or we had to allocate a new frequency to the affected users



Road Race Communications

The cycling road race provides some of the biggest challenges for getting pictures from the course back to the broadcast centre. Motorbikes have camera operators who have a 2Ghz link back up to two aircraft flying loops around the course. The aircraft receive the signal and send it back down to the broadcast centre. They also carry data link for results traffic and UHF Voice



Road Race Communications





Questions?