Preparing for WRC-19

A year has passed since the last World Radiocommunication Conference (WRC) in Geneva and work is well underway towards the next WRC in three years' time. This period is critical for any organisation that has an interest in the radio spectrum, whether an operator or administration and whether terrestrial or satellite based. Decisions made at WRC-19 will have a significant impact on a wide range of radio communication systems and it is vital to ensure that your organisation's priorities are protected. But when the agenda is long and many items on it are extremely complicated, requiring a range of expertise and software tools, what is the best way to ensure you and your organisation are prepared? This Newsletter addresses this question and shows a range of ways including information sources, software tools, training, books and support from Transfinite which can assist you in this critical task.

The World Radiocommunication Conference

The Radio Regulations are a treaty level document that determines how the radio spectrum is managed on global basis and between countries. It is re-negotiated every 3 or 4 years at a World Radiocommunication Conference or WRC.

These WRCs are organised by the International Telecommunications Union (ITU) and the last one was held during 4 weeks of November 2015 in the CICG (as in the photo above). At these meetings key decisions were made about what radio services should be allocated to which band and the regulations to manage their operation.

One of the most important outputs is the agenda for the following conference, in this case WRC-19. This lists the topics to be discussed and hence the issues to be studied at the ITU's working parties (WPs) between conferences.

These WPs are tasked with doing the necessary work to enable the next WRC to be in a position to make decisions on each of the agenda items (AI).

This typically requires extensive work over many meetings involving hundreds of experts to:

- Identify the scenarios to analyse

- Determine suitable methods to analyse these scenarios

- Determine suitable parameters to model each of the radio systems involved

- Analyse alternative solutions including consideration of interference mitigation

- Identify possible regulatory solutions.

The outputs of this work includes:

- Text to be forwarded to the next WRC via the Conference Preparatory Meeting (CPM)

- ITU-R Recommendations and Reports.

It is critical to be involved in these discussions and understand the details of the work undertaken. This is true of all parties that might have a stake in the decision, including:

- Organisations involved in existing services that might be affected by decisions at WRC-19

- Organisations involved in new services that might be introduced by a new allocation at WRC-19

- Administrations responsible for spectrum management in their country.

The organisations could include service providers and equipment manufacturers plus consultants that provide support to them.

If the wrong decisions are made, then this could lead to radio systems suffering harmful interference or being unable to operate, potentially resulting in billion dollar losses.

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It is critical, therefore, to be able to assess and understand the proposals from other organisations and be able to undertake your own studies.

But the topic is extremely complicated and there is a large body of existing knowledge and methodologies to absorb. So where to start?

How we can help?

We at Transfinite can provide comprehensive and complete support for your organization and its staff by providing:

- An analysis of the agenda for WRC-19

- The Visualyse Professional study tool which can be used to analyze the issues raised by AIs for WRC-19

- Training in use of Visualyse Professional and advanced training in the modelling required for selected AIs

- A book that describes the field of interference analysis from fundamentals to advanced methodologies

- Technical support to connect all the above together.

These are described in the following sections.

Analysis of the WRC-19 Agenda

We have provided a web based browsable analysis of the WRC-19 agenda which can be found at:

http://www.transfinite.com/content/itu8

This describes each agenda item including:

- Description of work

- Comments

- Lead working party

- Involved working party

- How Visualyse products can help

- How Transfinite consultants can help.

These AIs are grouped not just in a comprehensive list but also by lead and involved working party.

The analysis was written by a Transfinite consultant who was at WRC-15 and followed in depth the intense discussions about the contents of the agenda for WRC-19.

An example is the description of AI 1.13 in the screenshot below:

Visualyse Professional Study Tool

A common phrase in many of the agenda items is the "identification of frequency bands" for a specific service. For example, AI 1.13 relates to:

identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis

Any allocation agreed at WRC-15 would result in new radio spectrum sharing scenarios between existing services and those covered by the allocation. These scenarios could lead to harmful interference, leading to loss of service, capacity or coverage, with potentially highly negative financial consequences.

The analysis within the cycle from one WRC to another at the ITU-R working parties addresses this sharing scenario in depth to answer questions such as:

- What would be the impact on existing services of a new service?

- What mitigations would be required should there be harmful interference?

- Whether the existing services could cause harmful interference into the new entrant?

- What types of regulatory solutions could be used to manage interference?

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- Hence, whether sharing is feasible?

To answer these questions it is necessary to model the sharing scenario in detail. As systems become more complex and the need for higher spectrum efficiencies increase, it also requires more detailed modelling and analysis methodologies.

Whereas in the past it might have been sufficient to use static analysis or minimum-coupling loss (MCL), now analysis is more likely to involve area, dynamic or Monte Carlo methodologies – or combinations of these approaches.

In addition, where as in the past there might only be a small number of service types to consider, and maybe limited to either satellite or terrestrial, now there are a much wider range of services and spectrum is more often shared between satellite and terrestrial services.

The community has been developing resources that can be used to support this analysis, in particular libraries of gain patterns and propagation models.

A software tool which could be used to support the spectrum sharing analysis required for WRC-19 should therefore be able to handle all these requirements, and this is just what Visualyse Professional is designed to do.

Visualyse Professional is the leading tool for studies at the ITU-R and can be used to analyse sharing between a very wide range of systems and services, as can be seen in the screen shot below:
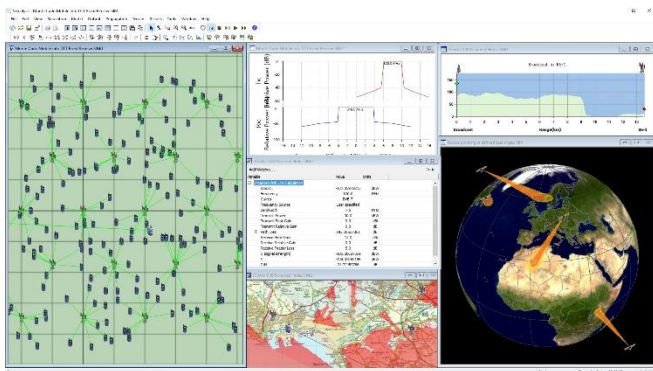
In particular, Visualyse Professional can model:

- A wide range of antenna types, from axially symmetric, to omnidirectional, to sectorial used by base stations, to shaped in 3D, to elliptical, to the complex patterns used by GSO satellites.

- These antennas can be attached to stations which can be located fixed on the ground, moving on the ground, in the air, on the sea or in space

- Wizards can be used to generate complex deployments such as IMT base stations or constellations of non-GSO satellites

- Interfaces allow systems and their parameters to be extracted from ITU-R and other databases

- Scenarios can be either co-frequency or non-co-frequency using TX / RX spectrum mask integration or terms such as ACS / ACLR

- Transmit power can be set to be fixed or vary using a power control algorithm, listen before transmit or implement the radar equation

- Analysis methodologies that can be modelled include static, MCL, input variation, area, dynamic, Monte Carlo and combinations such as area Monte Carlo

- Statistics can be generated on any simulation parameter including the link metrics of {C, I, N, C/I, C/N, C/(N+I), I/N, PFD or EPFD}

- The library of gain patterns is being continually updated and currently includes over 100 patterns

- The library of propagation models includes those most widely used at the ITU-R including P.452, P.525, P.526, P.528, P.530, P.618, P.676, P.1546, P.1812, P.2001 plus Hata / COST231 and Longley-Rice (ITM)

- Terrain, surface and land use data can be included the these propagation models to analyse terrestrial paths in detail

- … and much, much more.

We are continually improving and updating Visualyse Professional and following in detail the work of the key ITU-R working parties and task groups to ensure it remains the most effective tool available.

For more information and a freely downloadable demonstration version, visit our web site at:

http://www.transfinite.com/content/downloadsvisu alyse

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Product Training and Advanced Training

To get you and your staff up to speed in use of Visualyse Professional to analyse WRC agenda items we provide training in:

- A three day comprehensive description on use of the product covering all aspects of the software tool and including hands-on worked exercises to build confidence and reinforce the material presented

- Optional additional days for "Advanced Training" to focus on application of Visualyse Professional to specific AIs. This can include the generation of simulation files that could be the starting point for more detailed analysis afterwards

This training can either be held in the UK at one of our offices or at your site.

Interference Analysis Book

Not only is the field of interference analysis specialized and complex, but the agenda items can bring together services where there are no pre-defined methodologies to analyze the scenarios involved.

To be effective at ITU-R meetings there will therefore be a need to understand the fundamentals of interference analysis and how to model a wide range of radio systems.

Transfinite director John Pahl has written a book that is a comprehensive and unique all-in-one reference covering administrative and technical aspects of interference analysis within and between all the main types of radio systems.
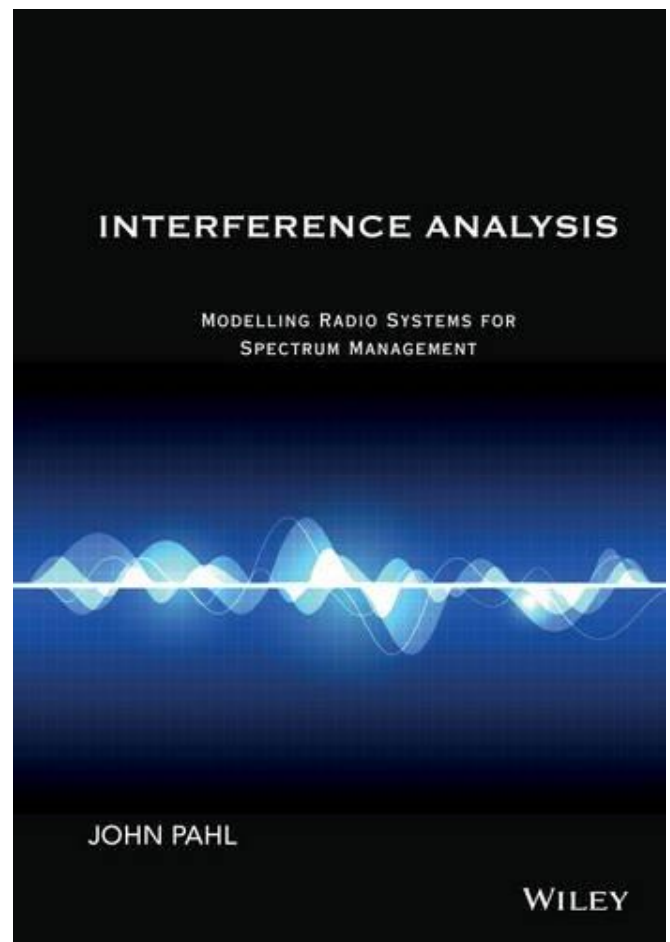
Published by Wiley, this book contains over 500 pages, 300 figures, 100 tables, 600 equations and 160 examples. It covers both the processes, such as regional or international coordination, as well as the engineering principles. It describes in detail the main methodologies for calculating or computing the interference between radio systems of the same type, and also between radio systems of different types.

Written to appeal to both the novice and experienced alike, it introduces the topics to those with little knowledge of interference analysis, but goes into more advanced concepts such as derivation of interference thresholds, mitigation methods, net filter discrimination (NFD) calculations and Monte Carlo methodologies.

The aim is to describe the field of interference analysis to help those interested to understand it better, and it:

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- Adopts a logical approach, progressing from motivation to fundamentals, elements of analysis, models, calculations, and verification, providing a unique all-in-one reference

- Blends narrative, detailed description, discussion and mathematical analysis including practical engineering calculations

- Describes how to calculate and assess interference within and between radio systems of all major categories (terrestrial fixed, mobile, broadcasting, navigation and satellite, both GSO and non-GSO), with worked examples and detailed explanations of the processes involved

An accompanying web page provides example simulation files for Transfinite's Visualyse Professional and Visualyse Coordinate software tools.

Technical Support

To provide an overall umbrella to support users of our software products we provide technical support.

This allows our customers to contact us on how to use our software tools achieve their goals, such as analyse specific AIs. This can include creation of example files and to build on material provided in the training course or the book.
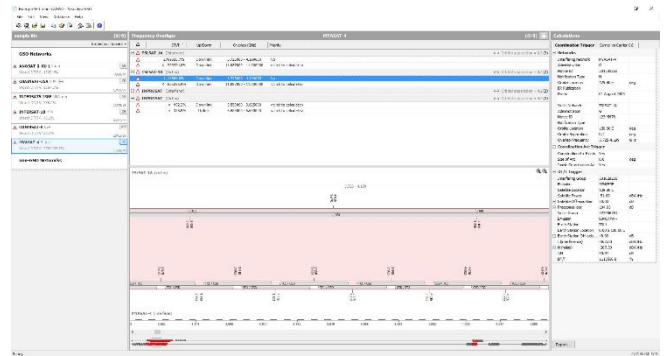
For example, this screenshot shows analysis of a non-co-frequency scenario using a Monte Carlo modelling methodology:
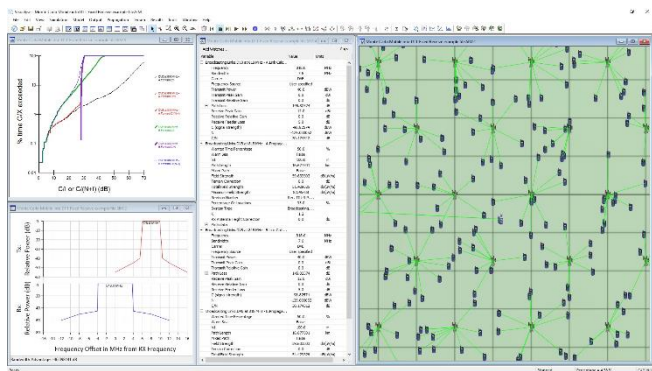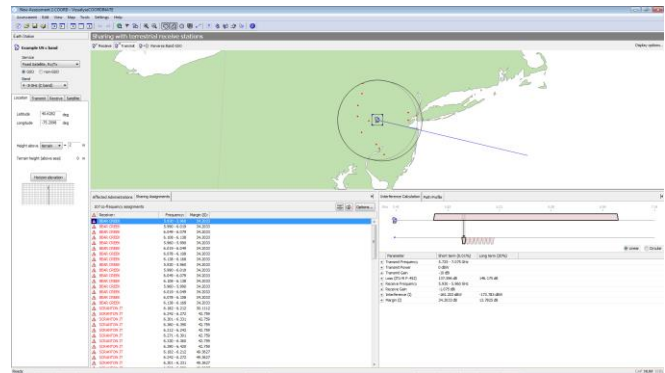

Other Software Tools

Transfinite also develops and markets the following software products:

Visualyse GSO: to support the coordination of GSO satellite networks outside the planned bands:

Visualyse Coordinate: to support the coordination of satellite ES, including both GSO and non-GSO, with terrestrial services, in particular fixed links:

Visualyse EPFD: to determine if a non-GSO FSS system meets the EPFD limits in Article 22 of the Radio Regulations:
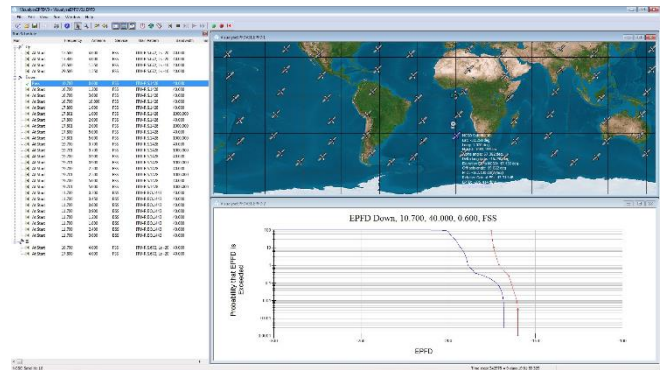
Contact and Feedback

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