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Visualyse Spectrum Manager

Online Management of Fixed Link Bands

Product Description

This newsletter describes how Transfinite's band management software, **Visualyse Spectrum Manager**, can be used to manage Fixed Link bands.

What is Visualyse Spectrum Manager?

Visualyse Spectrum Manager (SM) is a tool to manage blocks of spectrum to permit issuing of site by site sub-licences in a way that meets licence requirements.

One advantage of Visualyse SM is it was designed from day one to be web based. End users and spectrum managers can use their standard internet browser to gain access to all its functionality including:

- log-in / log-out
- database searches
- licence creation and modification
- licence examination
- fixed link planning tasks
- licence management

This means there can be distributed direct access to the planning tools while maintaining centralised control of the underlying link database. A separate desktop tool can be used to download specific examinations for more detailed study.

Visualyse SM undertakes point to point fixed link planning using a methodology agreed by Ofcom experts to be consistent with the approaches they used to generate the TFACs for Ofcom managed bands.

Sub-licences are generated that:

- Meet performance objectives (i.e. calculate transmit power level required to overcome fading at the required percentage of time given modulation and noise constraints)
- Have been checked to ensure will not cause or suffer interference from other point to point links in the database, both in-band and in adjacent bands
- Have been checked to ensure they are consistent with other licence constraints such as regional / international signal on boundary checks and limits on height and EIRP

- Where applicable checks can also be made against other services using a unique technology neutral interference assessment methodology. These other services can include satellite earth stations and outside broadcasting links.

Using Visualyse SM

Consider the case where a licence holder wishes to operate as a Spectrum Management Organisation (SMO) providing access to its spectrum to operators.

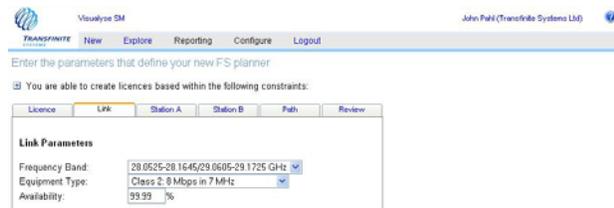
In this example two operators, A and B, both want access to part of the SMO's band around 28 GHz to deploy point to point fixed links at specific locations.

The band manager then must ensure controlled access to the band, taking into account other issues (such as billing) and also other spectrum users (existing satellite Earth Stations).

Operator A's Perspective

Visualyse SM includes tools to support point to point fixed links. Firstly there are what we call **templates** – user interfaces designed to facilitate entry of specific licence types. For point to point fixed links this could be either single direction (e.g. for ENG) or bi-directional.

Secondly there is a fixed link planning tool that given start/end locations and the preferred frequency band will identify go/return frequencies that would not cause or suffer interference, as shown in the figure below:



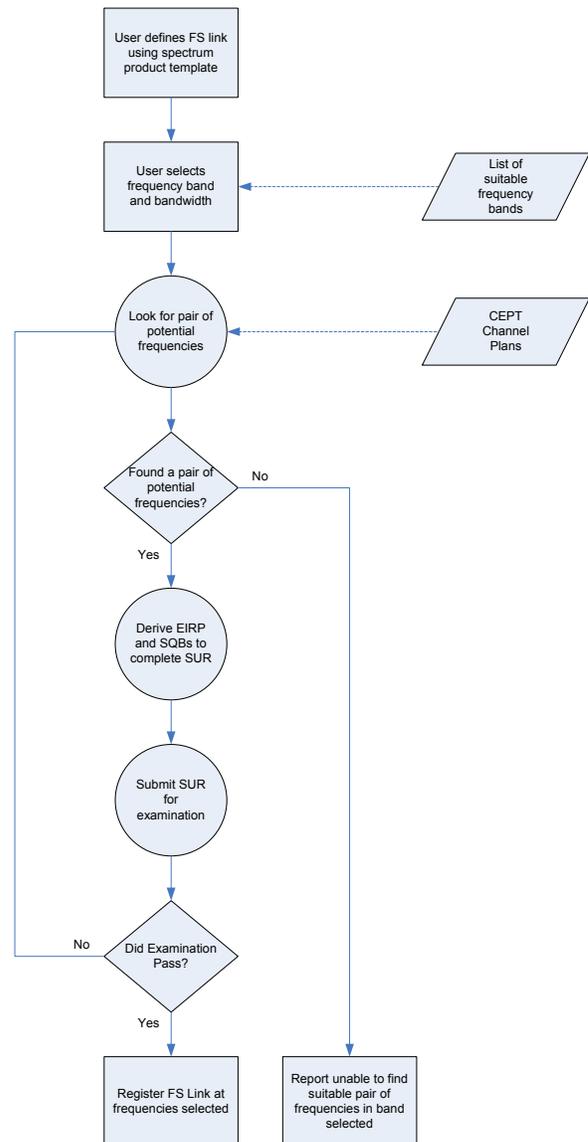
The user interface allows the operator to enter the key parameters using tab dialogs and drop down lists.

Visualyse SM knows about the standard channel plans and uses them to select a pair of frequencies to consider for compatibility: if that passes the assignment will be recorded otherwise the next pair will be examined.

From Operator A's perspective they were:

- able to quickly define their licence in detail using the FS planning template
- provided with the EIRP and interference thresholds that would just meet their quality of service requirements
- able to submit their licence for approval over the web
- confident their licence would be protected from interference from other operators as Visualyse SM would automatically check future applications

The planning algorithm is shown in the figure below:



The result:

Flexible low cost low risk licence management

Operator B's Perspective

Visualyse SM is a multi-user solution, permitting Operator B to access the site at the same time as Operator A. A sophisticated multi-threaded architecture allows full utilisation of a server with multiple cores.

The result is that Operator B can submit their application even though Operator A is also using Visualyse SM to plan their link.

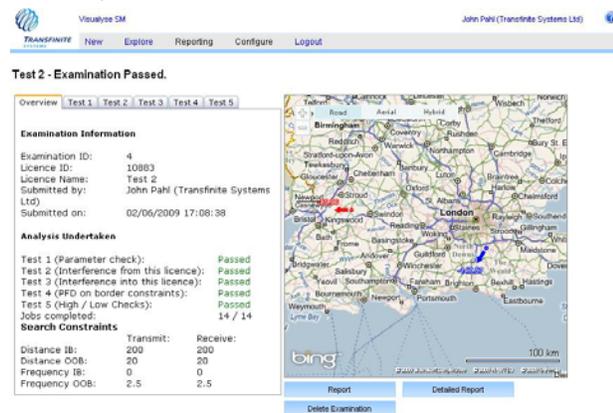
As well as entering the licence using the template, Operator B can also submit it for examination, which will include automatic technical coordination with any existing licences – in this case the other PtP link from Operator A.

In this case it's the fixed link that could suffer from or cause interference.

If further information about the result of a fixed link planning is required, a detailed examination can be run. Visualyse SM includes not just automatic technical coordination, but feedback to show the status of the analysis including:

- Database search criteria
- Licences examined
- Status of examination
- Maps and station locations
- Link budgets
- Thresholds (interference and percentage of time not to exceed)
- Predicted interference level

An example can be seen in the screen shot below:



In this case the examination failed.

However Visualyse SM includes tools to support operators in these situations.

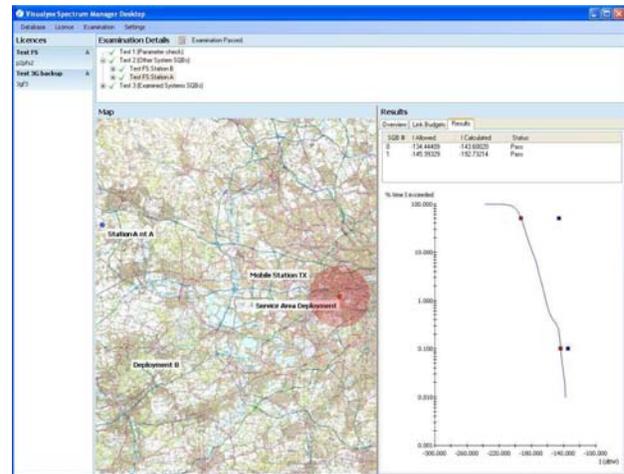
A separate Visualyse SM Desktop application can be used for “What-if” studies and runs on a standard PC.

Integrated with the core Visualyse SM Server it can download to a local database either individual licences, or multiple licences, or all the licences in a particular examination.

This allows local modification of any parameter of any licence without affecting the main licence database.

It uses the same interference engine as used in examinations started with the web interface but has additional flexibility and tools to configure runs.

The figure below shows an example of it running an example analysis:



The operator can then consider the full range of options to facilitate sharing.

Changes that the Visualyse SM Desktop can model include:

- Increase peak gain (larger antenna)
- Modify interference thresholds (accept lower quality of service or increased use of error correction)
- Reduce antenna height
- Migrate to another band
- Identify need for site specific clutter losses

Having identified the most cost effective method of ensuring compatibility, Operator B can either:

- Re-submit with modified parameters
- Open discussions with Operator A about changes

The latter is facilitated by Visualyse SM’s built-in support for liberalisation and “Change of Use”.

The result:

Flexible low cost low risk licence management

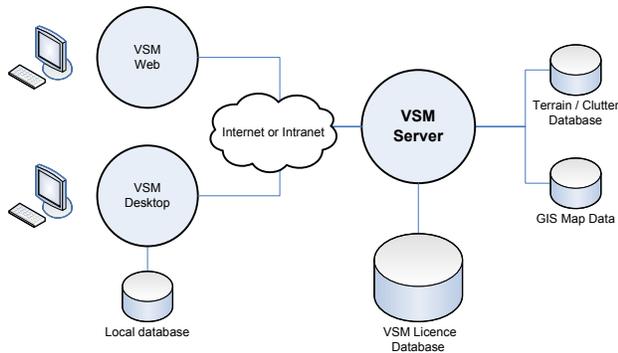
Operators C, D ...

Visualyse SM is designed to be multi-user, so other operators can use its facilities to gain access to the radio spectrum, while protecting the licences issued to Operators A and B.

Visualyse SM Architecture

So how does Visualyse SM achieve all of this?

At the heart is a client / server architecture based upon Microsoft .NET technology and SQL Server as in the figure below.



The main Visualyse SM application is designed to run on a dedicated server where it communicates with:

Web: remote users over the internet or intranet interacting with it using a web browser

Desktop: remote users over the internet or intranet searching and downloading licences and examinations

Licence database: stores each licence together with relevant parameters and licensing information (dates, states etc)

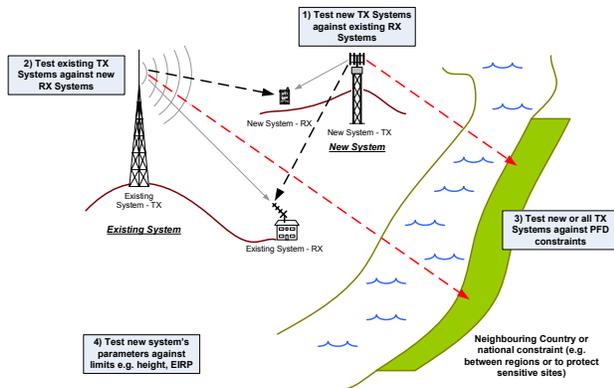
Terrain / clutter database: to predict radio wave propagation

Map data: used to show station locations

This architecture has been designed to facilitate interfacing to new sources of data – including assignments and terrain. We have experience in accessing a range of databases (e.g. Ofcom, ACMA etc).

Visualyse SM Examination

Each application for a new licence or request for a change of use is subject to four tests, as shown in the figure below:



These four tests are:

- 1) Check that new transmitters will not cause harmful interference into existing receivers
- 2) Check that new receivers will not suffer interference from existing transmitters
- 3) Check that new transmitters are consistent with regulatory constraints such as PFD or field strength

on a boundary (e.g. licence regional or international boundary constraints)

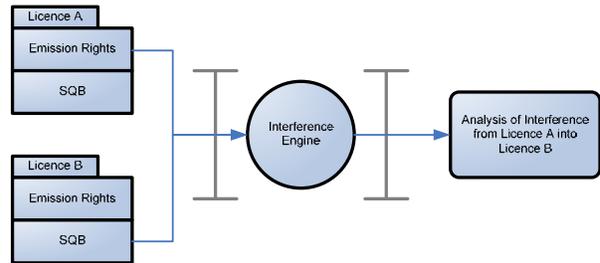
- 4) Check that the new system's parameters are within limits for the licence (e.g. height and EIRP)

Database and Interference Engine

At the core of Visualyse SM is:

- 1) A database that defines licences in a technology and service neutral method via their parameters
- 2) An interference engine that can analyze interference between any two licences in this format

The overall process is shown in the figure below.



Product Status

Visualyse SM is based upon work for Ofcom of a Generic Radio Modelling Tool (GRMT) for Spectrum Trading which was delivered to Ofcom in 2008 and is currently under evaluation.

Transfinite have further enhanced this product into Visualyse SM to be used to manage our own licence and hence have upgraded the tool to use non-Ofcom data sets, including terrain data and maps.

We would be happy to give you more information about Visualyse SM, including presentation material and white papers. We can also provide a quote based upon your requirements.

Commercial Arrangements

A range of commercial arrangements can be considered for management of your spectrum blocks.

These could include a fixed fee per transaction to a yearly service charge. We would be happy to discuss this further under a non-disclosure agreement.

Other Products and Services

We would also be happy to give more information about our other radio engineering tools.

Transfinite can provide consultancy services including regulatory support, system planning, interference analysis, and radio engineering.

Please contact us for more information on our products, consultancy or training services.