RTT TECHNOLOGY TOPIC
July 2013

OOBOOB

This month's technology topic looks at Out Of Block and Out Of Band emission requirements.

It follows on from an earlier (June 2012) Technology Topic, 'Neighbour Friendly Networks'

http://www.rttonline.com/tt/TT2012_006.pdf

This discussed the practical constraints of adjacent channel and in band interference, LNA and A to D dynamic range limitations and the implications for White Space, TV and Cellular coexistence.

In the intervening twelve months, announcements by the FCC on a broadcast television incentive auction colloquially described as 'Down From Channel 51' (from 698 MHz downwards) have introduced additional complexity to the coexistence challenges and coexistence costs that need to be considered when assessing future spectral value.

Coexistence challenges can be simply stated as the need to ensure new users do not interfere with other users.

Coexistence costs can be stated as the cost of mitigation measures to ensure that this interference is avoided or minimised.

Mitigation costs include any additional filtering needed in user devices. This might include additional filtering in TV sets or distribution amplifiers but also additional filtering in mobile broadband user devices.

OOB emission limits have a direct impact on the component specification and cost of mobile broadband user device filters and a related impact on performance. Any deterioration in user device performance translates into increased network cost and decreased spectral value.

Definitions

Confusingly both Out of Block and Out Of Band emissions are described as OOB in the technical literature. The two functions are related but separate.

Out Of Block emissions are the emissions from one operator's block of spectrum to an adjacent operator's block of spectrum.

This includes FDD to FDD coexistence and may include TDD to FDD coexistence. An example is the 2.6 GHz band (Band 7 and Band 38).

In refarmed bands, for example at 850, 900, 1800 and 1900 MHz, block to block interference may also include LTE to GSM interference, LTE to GPRS interference, LTE to HSPA interference and in the 900 MHz band, LTE to GSM R interference. Different channel bandwidths (200 KHz versus 5 or 10 MHz) introduce additional coexistence complexity.

Out Of Band emissions are the emissions from one radio system, for example a mobile broadband network at 700 or 800 MHz into another radio system, for example a TV receive channel.

This includes the possibility of multiple sub-1 GHZ LTE bands including LTE 600, LTE 700, LTE 800, LTE 850 and LTE 900. LTE 450 has also been proposed.

Potential advantages of sub 1 GHz for deep rural and high mobility users

Sub 1 GHZ bands for LTE have a number of potential advantages. Free space propagation is of the order of 7 dB lower than an 1800, 1900 or 2.1 GHz band. This means that larger radius cells can be supported for rural coverage or high mobility users.

Migrating high mobility users to bigger cells reduces handover signalling overhead and improves session stability. This increases overall network capacity and improves the user experience.

This is reflected in present network vendor product offers where the control plane is separated from user plane signalling with control functions supported from macro cells and the user plane supported on a mix of smaller cell topologies.

http://www.cambridgewireless.co.uk/Presentation/TakehiroNakamura020713.pdf

Urban in-building penetration for M2M should also be noticeably better.

Low cost repeaters can be used to provide additional coverage either on an ad hoc basis for special events or public safety, for rural fixed access or for high data rate connectivity on trains or other high mobility transport systems.

Adding in high power(+33 dBm) mobiles and or high gain antennas for mobile and fixed devices creates opportunities for building large and potentially low cost macro cell networks that could support 30 Mbps data rates out to the cell edge.

Our December 2012 Technology Topic, How Far Does it Go Mate? discussed present initiatives by Telstra in Australia offering high gain antennas and range optimised user devices to subscribers for whom deep rural connectivity can be essential and at times life critical.

http://www.rttonline.com/tt/TT2012_012.pdf

It could be argued that Australia is different with bigger more wide open spaces than almost any other nation but this is only partly true. Most countries have deep rural areas where social and economic gain can be realized from providing broadband connectivity and terrestrial networks can be shown to deliver cost, latency and throughput advantages when compared to other alternatives such as satellite networks.

The recent admission by the UK government that broadband roll out plans are at least two years behind schedule highlights the obvious point that wireless has a potential face saving role to play in meeting rural and semi-rural broadband coverage.

The need for low cost deep rural connectivity - why different Out of Band requirements are a problem.

However irrespective of whether coverage is provided by terrestrial or satellite networks the widespread adoption of deep rural connectivity is dependent on realising low cost devices which in turn implies a need for economic scale which implies that the same device can be sold into multiple markets.

The problem with this for terrestrial mobile broadband is that different countries have different views on the protection ratios needed between existing users, for example TV and wireless microphones, and new mobile broadband subscribers.

A present example is the suggestion by CEPT that 700 MHz mobile broadband user devices in Europe and Africa (Region 1) should have an out of band emission mask that is 40 dB higher than 700 MHz devices sold in Asia Pacific (Asia and Australia Region 3).

The stated rationale is that Region 1 700 MHz should be aligned with Region 1 Band 20 (800 MHz). However Band 20 is Reverse Duplex and therefore completely different.

There are some differences in the way that TV is deployed in different countries, for example channel

spacing (6, 7 or 8 MHz channel spacing), technology (DVBT or DVB T2 or ATSC) and band plan (single or multi frequency multiplexes) but these do not justify materially different OOB limits.

The net result assuming this is not resolved is that different classes of handsets will need to be designed and manufactured for different regions for the same band plan with essentially the same or similar coexistence conditions.

Additional filtering in the user device will increase insertion loss and reduce maximum transmit power. This will reduce cell radius and achievable data rates towards the cell edge (data reach).

The lack of band harmonisation to date has been problematic for the industry. A failure to achieve basic technology harmonisation introduces an additional level of complexity and cost and the related performance loss translates directly into a compromised user experience and reduced consumer and community value.

While this might be supportable in high added value markets it will not be appropriate for developing countries including Africa in Region 1. The social and economic and political cost of this particular example of regulatory failure is therefore substantial with a longer term impact on all market economies.

Resources
Neighbour Friendly Networks
http://www.rttonline.com/tt/TT2012_006.pdf

December 2012
How Far Does it Go Mate?
http://www.rttonline.com/tt/TT2012_012.pdf

Separation of control plane and user plane signalling

http://www.cambridgewireless.co.uk/Presentation/TakehiroNakamura020713.pdf

The inter relationship of market and technology efficiency is discussed in RTT's fourth book '**Making Telecoms Work- from technical innovation to commercial success'** available from the **RTT book shop**.

Go and browse and or order via this link
http://www.rttonline.com/bookshop.html

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RTT, the Jane Zweig Group and **The Mobile World** are presently working on a number of research and forecasting projects in the mobile broadband, two way radio, satellite and broadcasting industry. If you would like more information on this work then please contact
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