RTT TECHNOLOGY TOPIC
March 2011

Spectral litigation

Last month's Technology Topic, **Patent litigation and cost** discussed the impact of intellectual property and present standard processes on litigation cost. This month we examine how and why spectral litigation cost is also likely to increase over time.

An important objective of any regulatory process is to avoid or minimize the impact of spectral ownership disputes. An increase in the number of disputes and related costs implies a failure of the regulatory process.

The US as an example of present spectral litigation trends

The 700 MHz Block A Good Faith Purchaser's alliance, a joint venture that includes Cellular South and US Cellular supported by Metro PCS and Cox Communications is alleging that AT and T and Verizon Wireless are misusing their market dominance to prevent vendors from making user equipment and base stations available capable of accessing the A block spectrum immediately adjacent to the broadcast band.

Although Verizon have invested $2.57 billion in A block there are considerable performance costs implicit in adding the band to either Verizon or AT and T base station and user equipment. AT and T have no technical or commercial incentive to cover A Block and will be more concerned as to how they repurpose and integrate the TDD bandwidth at channel 55 and 56 recently acquired from Qualcomm.

For A block owners you could say this is either a case of caveat emptor or an example of the regulator bringing spectrum to market that is not fit for purpose. A regulatory environment that fails to take into account engineering reality inevitably results in the destruction of industry and end user value, trading short term treasury gain against long term loss to the national economy. In this case a $50 billion dollar industry investment is compromised by the physical limitations of a few 50 cent components in the front end of a mobile broadband transceiver.

Other prior and present examples

One would have thought the FCC would have learnt from prior examples. In **February 2002** a decision was taken to make bandwidth available between 3.1 and 10.6 GHz for Ultra Wideband Technologies. The operational bandwidth was not acceptable in other countries. Other regulators responded with their own variations thereby invalidating any potential business case for UWB. A decision to let the market decide on technology produced two competing standards which created additional market fragmentation. Similar mistakes are being made on White Space Legislation presently being introduced with minimal consideration for global spectral implications or user equipment RF development economics.

The cost of technology neutrality

If the US 700 MHz band was in some way unique in terms of regulatory approach then this would probably not matter that much. However the disconnect between regulatory policy and physics is more generally pervasive. A doctrine of technology neutrality or at least an absence of technology direction compounds the problem and generally results in a loss of spectral efficiency. This in turn increases the risk of spectral litigation. Mixing CDMA, HSPA, WiMax and GSM in the 1900 or 850 bands is one example

One of the reasons we have regulators is to arbitrate between competing spectral property interests. This extends both to inter industry and intra industry disputes. The amount of litigation could thus be viewed as a proxy measure of the individual and combined effectiveness of the regulatory process. In the US the 700 MHz spectral disputes are presently confined to inter operator disputes but in years to come could

easily involve the broadcast industry challenging interference from A block mobile broadband TX and public protection agencies challenging interference from Verizon upper block mobile TX. Both are the direct result of a poorly implemented band plan. Similar disputes are likely in L band and S band as mobile operators realise the potentially adverse fiscal and operational impact implicit in the present repurposing of mobile satellite spectrum for terrestrial use. In Europe similar disputes are simmering over the allocation and auction processes being proposed or implemented for the 2.6 GHz extension band linked directly or indirectly to 800 MHz deployments. Operators generally are concerned that their spectral holdings should be balanced across all available bands or rebalanced to address legacy allocations that in retrospect can be regarded as being competitively unfair.

This increase in tension can be ascribed to a number of factors.

Additional bands are being allocated with terms and obligations that differ from previous allocations. Each additional band introduces additional insertion loss and reduced isolation though the switch paths and filters in user equipment. This will result in unforeseen and unexpected interference issues but also reduces spectral efficiency.

Multiple technologies are being introduced into legacy bandwidth with minimal consideration as to the likely impact on proximate bandwidth and other user communities. This will result in unforeseen and unexpected interference issues but also reduces spectral efficiency.

Existing bands are being extended to accommodate these multiple technologies. The 10 MHz extension to the 850 band in the US is an example. This will result in unforeseen and unexpected interference issues but also reduces spectral efficiency.

Channel bonding (see last month's technology topic) is being introduced to meet an assumed market demand for peak data rates of up to 1 gbps. This will result in unforeseen and unexpected interference issues but also reduces spectral efficiency.

MIMO is being introduced in parallel with channel bonding on similar assumptions. MIMO may result in unforeseen and unexpected interference issues and will certainly reduce average throughput rates, effectively a reduction in system efficiency.

Operational requirements are being imposed on operators without due consideration of the spectral implications. Mandatory E911 support for example fails to take into account that the second harmonic of 787.5 MHz, between C band and D band mobile transmit in the US 700 MHz band falls directly on the GPS receive frequency of 1575 MHz. Terrestrial use of L band may also compromise GPS front end receiver performance.

All of the above will increase performance uncertainty both in terms of band to band performance, within band channel to channel performance, sensitivity to hand and head effects and changing operational conditions including temperature and battery charge state. This makes Quality of User Experience Service level agreements harder to model and manage. All of the above are therefore likely to increase rather than decrease 'within industry' inter operator disputes over spectral ownership rights, compounded by the combination of a reduction in spectral efficiency coupled with an increase in operator to operator, user to user interference. All of the above are also likely to increase 'between industry' inter industry disputes over interference and spectral ownership including disputes between the mobile broadband industry, the broadcasting industry, the mobile satellite industry, public safety radio industry and cable industry (set top box interference).

An adversarial approach to future spectral allocation, for example the repurposing of C band between 3400 and 3800 MHz for FDD/TDD bands 22/41 and 23/42 makes it less likely that these separate industries will be able to work together to resolve technical issues. Inter industry cooperation at technical level is already complicated and frustrated by competition policy. TDD/FDD coexistence will also introduce additional system level complexity which will be technically and commercially hard to resolve.

The problem is compounded by a false belief by the regulatory community that all that is needed is to define spectral transmission masks. This ignores the growing need to define and enforce receiver selectivity and dynamic range.

It is also increasingly inappropriate for the FCC to assume that the world should follow US policy. In terms of mobile subscriber market size, China and India are both more than twice as large as the USA.

Given that 48% of all connections are now in Asia it should be obvious that the US now lacks sufficient economy of scale to support a nationally specific band plan and or a nationally specific technology mix. Operator specific band plans and operator specific technology solutions within the US market make even less economic sense.

China is arguably the only market with sufficient volume and local design and manufacturing capability to be able to support national or operator specific band plans and technologies but even this does not mean that such policies make any kind of long term economic sense.

The problem is that in all markets, China, the US and Rest of the World, spectral allocation and auction policy is based on economic modelling which fails to capture relevant cost and value dynamics. In practice there are five separate but closely coupled domains that need to be analysed :

Technology Economics

This is the area most directly coupled to the standards process. Our contention here is that false market ambitions, specifically high peak data rates per user are introducing unnecessary complexity and compromising system performance to the point at which performance loss/economic loss litigation becomes likely. For example it might be expected that at some stage operators will need to protect network performance by introducing pass fail margins in to conformance testing. This is valid and understandable but will highlight vendors who are presently shipping products that only meet conformance performance requirements under an unrealistically narrow range of operational conditions.

Note that some devices can now take well over 1000 hours to go through conformance test – performance testing potentially takes longer. This is a cost which no one wants to absorb. This will result in an increase in litigation cost.

Engineering Economics

This is the area most closely coupled to the spectrum allocation and auction process. Our contention here is that false policy objectives, specifically the maximisation of short term gains for national treasuries over longer term economic gains have resulted in spectrum sales that ignore the laws of physics. The problem is compounded by present standards policy which compromises spectral efficiency. Caveat emptor may provide a measure of protection but an increase in litigation seems to be an inevitable outcome of the present policy approach.

Market Economics

The problem here is that standards and regulatory policy has failed to adapt to the change in relative market importance between Asia and the rest of the world. If sub scale markets, for example the US, continue to pursue a nationally specific standards and regulatory agenda then it is understandable that Asian markets, particularly China, will want to do the same. The result will be an increase in litigation and more aggressive protectionist legislation.

Business Economics

This is the problem of the 50 cent components compromising the $ 50 billion dollar investment. The fact that most RF components don’t scale has made it hard for the RF component industry to deliver products that can meet associated performance requirements. Newly dominant markets are understandably using their market leverage to extract significant performance promises from this under funded and under resourced sector of the industry. The result will be an increase in Chapter 11 filing which will further inhibit RF innovation and investment.

Political Economics

Back to where we started. Regulators will become increasingly exposed to litigation from entities who have bid for spectrum which is not fit for purpose or compromised either by poorly executed standards

policy or, equally damaging, by the absence of a standards policy. The problem is compounded by regulatory policies that fail to take account basic engineering reality and present RF component limitations and R and D constraints.

Remedies

The standards process would benefit from being less focussed on an assumed need for high peak data rates and more directly focused on delivery cost economics. Standards and spectral policy need to be more closely coupled and engineering cost needs to be directly factored into band allocation and auction policy. Some mechanism must also be devised to encourage more effective collaboration between different sectors of the industry, mobile broadband, public safety, broadcasting and the mobile satellite sector and closer economic integration of wireless, cable, copper and fibre delivery systems.

Regulators are always under pressure to promote country specific solutions to benefit their national stakeholders. The aim is laudable but history shows that this approach can be disastrous. In the early 90's, Japan, at that time the world's 2nd largest national economy - went its own way with mobile cellular. As a result Japanese manufacturers were left floundering, unable to service both a quirky domestic market and a brutally competitive global market. In the USA, Block A Purchasers rail against manufacturers who ignore their special needs. But manufacturers who wish to compete in the global market cannot afford to divert expensive engineering effort to rescue spectrum owners left stranded by poor regulation.

In this context it is important to differentiate between constructive tension, the mechanism by which economic progress is achieved through efficiently ordered market competition and destructive tension**,** a general outcome of a poorly ordered market and misapplied regulatory intent.

A similar differentiation can be made between constructive litigation**,** the valid arbitration of competing market interest and destructive litigation, the outcome of poorly implemented spectral and standards policy. Destructive litigation is unnecessary and wasteful but can be avoided provided potential causes are identified at an early stage - a challenge and opportunity for the regulatory community.

2011 Mobile Broadband Economics- RF cost and performance workshop

RTT has a new in company workshop for 2011 which analyses how LTE Advanced and LT HSPA multi band and extended multi band user equipment determines network density, network cost and user quality of experience metrics. If you would like a detailed agenda for this workshop please e mail **geoff@rttonline.com**

LTE Study from RTT

RTT has produced a 70 page study on LTE user equipment and LTE network economics. The study is written by RTT with statistics and economic modelling from **The Mobile World** and is sponsored by **Peregrine Semiconductor** and **Ethertronics.**

The study, 'LTE User Equipment, network efficiency and value' is available free of charge from the linked web site **www.makingtelecomswork.com**

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An additional level of detail on this topic and related topics can be accessed via the **Resources section** of our linked web site **www.makingtelecomswork.com**

www.makingtelecomswork.com provides a cost and time efficient way in which telecommunication engineers, product managers and policy makers can access **technical information and advice not readily available elsewhere in the public domain.**

The web site also provides information on RTT workshops, **Making Telecoms Work Europe**, **Making Telecoms Work Asia** and **Making Telecoms Work in the US.** The workshops demonstrate how engineering issues can be practically resolved and how performance gains and cost savings can be achieved. European work shops are held at the Science Museum in Kensington West London.

Information on the next workshop is available here.

A number of sponsorship opportunities are available linked to the web site and related Science Museum telecom industry educational initiatives.

If you would like more information on these opportunities please e-mail **geoff@rttonline.com** or phone **00 44 208 744 3163**

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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 cellular, two way radio, satellite and broadcasting industry.

If you would like more information on this work then please contact

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