



RTT TECHNOLOGY TOPIC
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Telephone numbers
Five a Side Phone Economics

The 2 5 1 progression as the basis for supply side economic analysis in the telecoms industry

Introducing - the cellular supply chain circa 2012.

We are working on a project at present with our colleagues at The Mobile World.

A part of the project involves modelling the supply chain economics of cellular handsets in 2012.

An assumption is that by 2012, annual unit volume will be in the order of 1.6 billion handsets. Unit sales in to China and India will be over 400 million, twice the unit sales volume into Europe and three times the unit sales volume in the United States.

This represents a year on year growth rate predicated on aggressive handset cost reductions to meet the pricing needs and expectations of these increasingly dominant developing markets.

These cost reductions can only be delivered from a highly consolidated highly competitive supply chain.

Anecdotally a highly consolidated highly competitive supply chain seems to settle at around five players who between them share a significant percentage of the total market by volume and/or value.

This correlates with 'efficient' market theory which suggests that five competitors are needed to provide an efficient market. More than five competitors dilute achievable scale economies, less than five creates insufficient market price contention.

A similar theory is applied to spectral auctions and forms the basis of auction structures and spectral allocations that encourage five bidding entities. The assumption is that this maximises auction income. (In the process destroying spectral efficiency but that's another topic altogether).

However as is often the case, the truth is not so simple and theory does not agree with factual observation.

Telecom supply chain economics - theory and practice

The market efficiency benefits of a five player bid process and /or a five player supply chain only apply when all five entities are roughly equivalent in terms of technical and commercial capability.

This only happens occasionally and never lasts for long.

In practice market efficiency is a function of the process of consolidation and fragmentation rather than a function of a prescribed number of participating competitors.

So for example we could observe a cyclical pattern in which competition moves from a duopoly to multiple competitors (we will use five as an example) and then to a monopoly. The monopoly curiously can be maintained for longer than conventional competitive theory would suggest.

It is the recurrent tension and resolution inherent in this process that can be presumed to create market efficiency.

If this thesis is correct and if we can correctly identify where we are in the cycle at any specific time in any specific market then we have the basis for some useful competitive analysis.

So for example, if we were to analyse handset vendors, we could say that the five top players are presently consolidating to the point where one of the players has an effective monopoly at least in terms of effective market share and margin share.

The long term dominance of the software business by Microsoft is an example of a monopoly that has lasted longer than most supply side analysts predicted.

Of course an extended monopoly is dependent on the monopoly player (Pass Go and collect £200) being able and willing to defend their inherent competitive advantage.

In cellular handset manufacture, Nokia have been able to use their market dominance to streamline their supply chain to ensure their costs are reducing faster than their average selling price. They use this advantage to consolidate their market dominance. A classic virtuous circle.

For a short while six vendors shared the bulk of the cellular network market, Ericsson, Nokia, Siemens, Alcatel, Lucent and Nortel. This is collapsing to a duopoly (Ericsson and Nokia Siemens with Ericsson as the dominant player) but may regroup to a five or six player market consisting of Ericsson, Nokia Siemens, Huawei, ZTE, Alcatel Lucent and or Nortel or some combination.

In the cellular baseband semiconductor market there are nominally five players that share a significant percentage of the market by volume. Of the five, two (TI and Qualcomm) dominate the market by value and margin.

The curious anomaly of the RF component supply chain

The RF component part of the industry does not fit this pattern partly because different parts of the RF Bill of Materials exist as different industrial entities.

For example there is an EMI shielding industry with two dominant vendors, a handset antenna industry with two dominant vendors, a SAW filter industry with one dominant vendor, an FBAR filter industry with one dominant vendor and a power amplifier

industry with five dominant vendors.

Additionally there are integrated transceiver vendors who either develop parts themselves or buy and integrate components from any or all of the above.

So the competitive structure of the RF component industry depends on whether you view the sector as a whole or a sum of separate parts. Either way it appears fragmented.

This is potentially painful partly because the value of the RF BOM is declining in parallel with declining handset realised prices, partly because the engineering investment needed to deliver next generation RF components is presently increasing exponentially. This includes investment in 'new' technologies such as RF Micro Electrical Mechanical devices.

For example Epcos, the largest supplier of SAW filters, the company was formerly Siemens Matsushita, recently spent 10 million Euros acquiring NXP Semiconductor's RF MEMS activity. They have stated that they will be spending upwards of 20 million Euros a year on ongoing RF MEMS related R and D.

Similarly RF Micro Devices have announced plans to construct a 200mm RF MEMS wafer fabrication facility.

These investments require substantial visibility to stable RF component volume and value which in turn depends on the realised price and cost of devices.

Not unexpectedly opinions differ as to how much the average RF BOM will be worth in a handset in 2012 with estimates ranging from two to six dollars.

Given how dominant China and India will be by then, two dollars rather than six might be a safer assumption. Higher value phones will have a higher value RF BOM but there will be more RF vendors competing for that BOM, for example WiFi and Bluetooth vendors, GPS vendors, DVB H receiver vendors, NFC vendors.

Even so the cellular specific addressable annual market for RF components in 2012 is still worth 3.2 billion dollars (1.6 billion handsets at two dollars each).

The question is whether this is this is profitable revenue offering a sufficient return on investment for the present mix of RF component vendors.

The impact of multiple bands on RF component ROI

Any potential profit quickly evaporates if R and D effort has to be dissipated across multiple bands and multiple technologies.

For example there are presently nine 3GPP bands as shown in the figure below

Band	3GPP	Allocation	Uplink	Duplex spacing	Downlink	Region
I	2100	2x60 MHz	1920-1980	190 MHz	2110-2170	Present UMTS
II	1900	2x60 MHz	1850-1910	80 MHz	1930-1990	US PCS

III	1800	2x75 MHz	1710-1785	95 MHz	1805-1880	GSM Europe, Asia, Brazil
IV	1700/2100	2x45 MHz	1710-1755	400 MHz	2110-2155	New US
V	850	2x25 MHz	824-849	45 MHz	869-894	US and Asia
VI	800	2X10 MHz	830-840	45 MHz	875-885	Japan
VII	2600	2x70 MHz	2500-2570	120 MHz	2620-2690	New
VIII	900	2X35 MHz	880-915	45 MHz	925-960	Europe and Asia
IX	1700	2x35 MHz	1750-1785	95 MHz 1	845-1880	Japan

This is not a complete list.

The LTE 800 band in Europe will need to be added in at some time in the future as will LTE 700 for the USA.

The LTE800 band plan may in practice be several different band plans all requiring band specific RF device optimisation. This in turn implies band specific engineering effort which has to be amortised over relatively small market volumes.

The LTE 700 band is particularly idiosyncratic.

The bands could either be full duplex or TDD or possibly half duplex FDD introducing additional RF design and optimisation work.

The impact of multiple technologies on RF component ROI

The market will also potentially be divided down again with specific WiMax variants which will remain sufficiently different from LTE to require bespoke RF component development.

This would seem to suggest that consolidation of the RF component community is inevitable and over due but attempts so far to achieve even a basic level of collaboration between vendors has proved problematic.

A cultural resistance to consolidation?

In fact we would suggest that the RF component industry is naturally averse to consolidation. Partly this is cultural. RF engineers see themselves as masters of a dark art so why not apply the same thinking to component supply side economics.

This is admirable but hard to square with the regulatory rush to bring yet more spectrum to the market - the recent announcement of additional AWS111 spectrum (2155 to 2180 MHz) to be auctioned in the US being a bizarre example.

The impact of the RF component supply chain on the spectrum 'safe absorption rate' - why this dictates a continuing need for spectral and standards harmonisation

In a previous Technology Topic we suggested the concept of a 'safe absorption rate'. This is the rate at which spectrum, particularly spectrum with specific RF requirements, can be exploited given present and projected future RF engineering

constraints. These constraints are both financial and technical and possibly (see above) cultural.

We suggested that the industry was working beyond the safe absorption rate threshold and that the gap was getting larger over time. For reasons that we cannot understand this has not been factored into present spectral valuation - a triumph of optimism over reality.

It has been a recurring theme of ours that spectrum should be treated as a liability not an asset.

The RF component industry remains determinedly fragmented. This would not matter if the fragmentation was cyclical, part of the ongoing process of fragmentation and consolidation which we assert provides the foundation for efficient supply side economics.

The fact that these rules do not apply to the part of the industry that provides the bedrock on which all other parts of the supply chain is built is a curious anomaly.

It is however an anomaly that explains why spectral and radio standards harmonisation remains essential to the future fiscal health of the industry.

Ends

And now a musical note

The relevance of the 2 5 1 Progression to supply side economics

We have suggested that efficient supply side economics are not based on a prescribed number of competitors in a market but rather the ongoing progression over time from a duopoly to, for example, five players and then to a monopoly.

Those of you interested in Jazz theory will recognise this as the well known Major 2 5 1 progression.

You start on the 'second' of a chord for a bar, (the Dorian minor) move to the fifth of chord for a bar (the dominant) and then resolve to the tonic (the major chord or 1 chord) for two bars.

All three chords have the same key signature (the same number of sharps and flats). Despite this, the harmonic progression creates tension (the two and the five) followed by release (the resolving of the chord to the tonic major).

The progression occurs in most Jazz tunes (not in modal Jazz, that's the exception that proves the rule) and importantly seems to reflect a human need to move away and then back to a normalized start point. It seems that markets and human musical emotions may have something in common.

So there you have it, the analysis of supply side economics using Jazz **harmonic** theory.

Interestingly Jazz **temporal** theory also has a direct analogue not in economics but in

public speaking and what is known in motivational management as 'influencing theory'.

Humphrey Lyttelton, the English Jazz trumpet player, used to ascribe his ability to make people laugh to his knowledge and application of Jazz timing and Jazz improvisation. Cicero's orations could have been analysed using similar temporal and harmonic techniques.

Another musical note

Bringing harmony and a sense of timing to the telecom industry

RTT, The Mobile World and the Shosteck Group work together on a broad cross section of projects in the industry where we aim to introduce fresh thinking and a sense of timing and harmonic balance (and we would like to think humility and humour) to help resolve obstinate problems caused by disconnects between technology, engineering, market and business policy.

For more information on this work contact

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