



Network Issues and costs

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Simon Mason Head of New Product Development

Topics for today

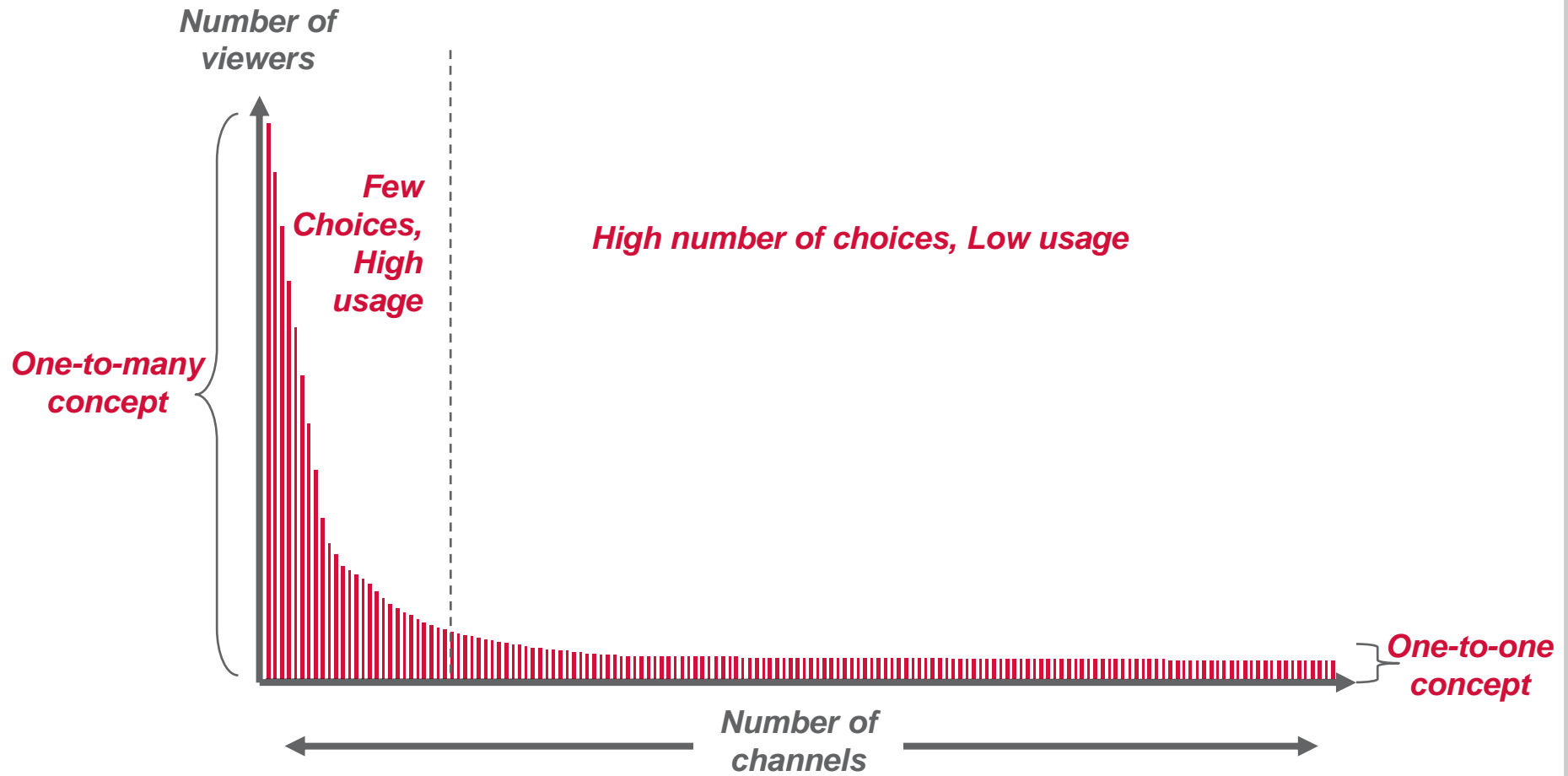
- Which parameters need to be understood to design a mobile TV network?
- The number of live streams v cached content
- Cost trends
- Spectrum
 - Propagation
 - International co-ordination
 - Technology choices
- Target Devices
- Coverage
- Role out speed
- Conclusions

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Content for mobile TV



Classic 'Long Tail' of content



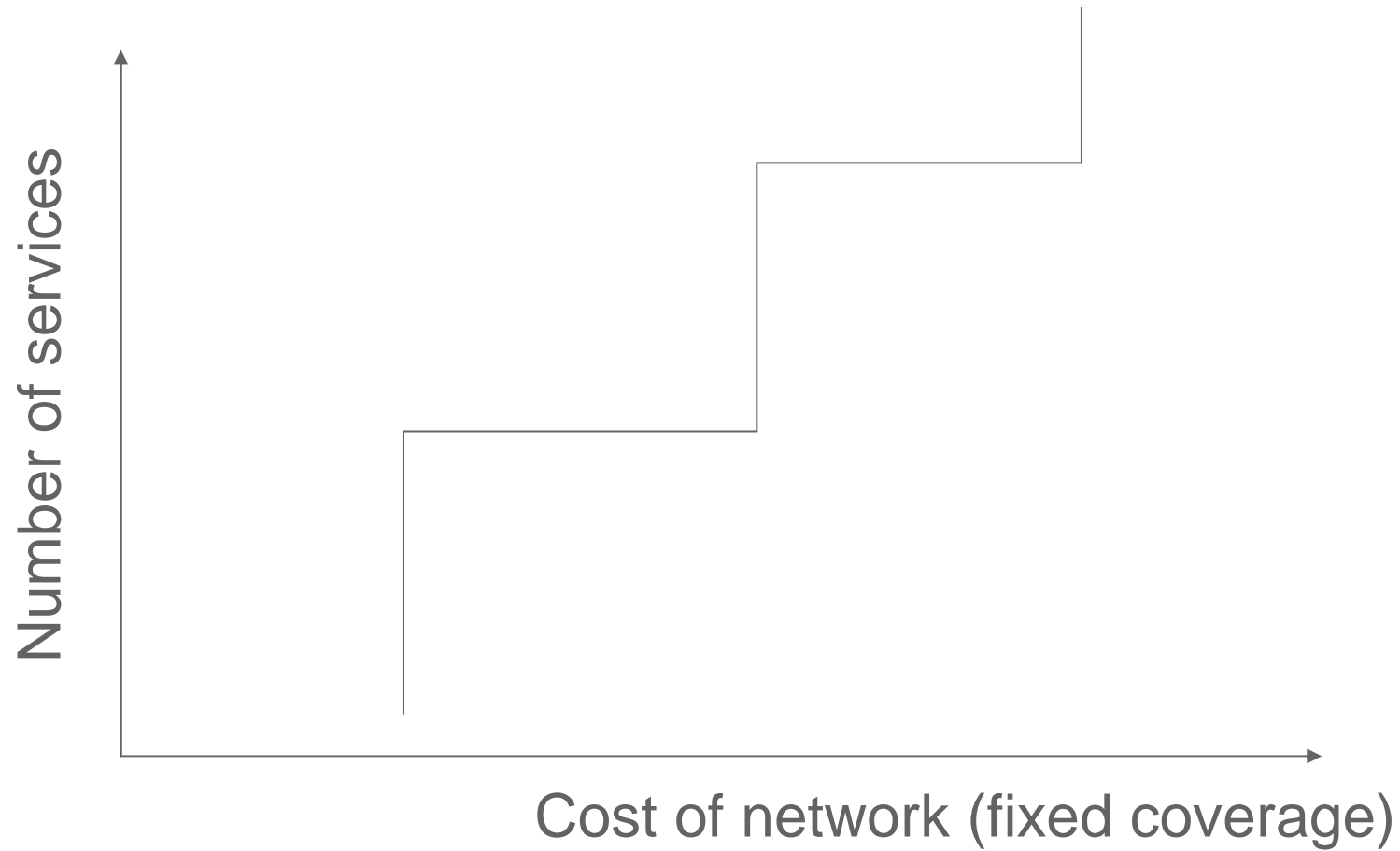
Other feedback

- Consumers are interested in
 - Radio
 - TV content
 - Video on demand
 - Catch-up TV
 - PVR type functionality
 - Interactive services
 - Web links to broadcaster/other
- Number of channels
 - ?

Number of services

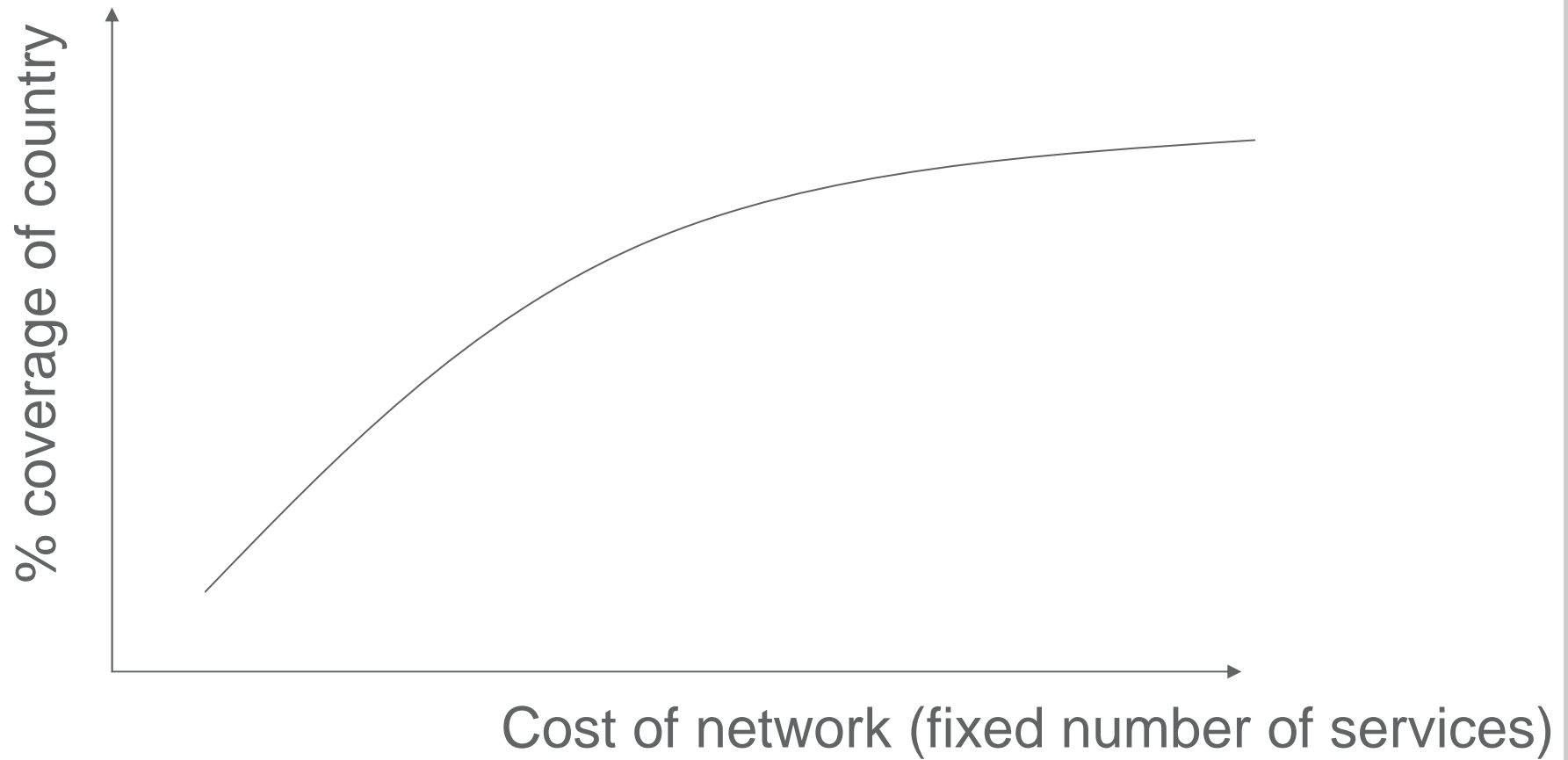
- How many live streams do you need to keep 90% of the population happy for 90% of time?
 - Everyone has a different view
- From Arqiva trials we believe that over time that the number of live streams will drop as the consumer becomes more and more comfortable with cached content
- Cached content will come in different forms:
 - Broadcast push over mobile TV networks
 - Consumer pull over 3G and WiFi networks
 - Taking content from the home store
- Arqiva believes that the number of live streams to launch an optimum service needs to be 10 or more.
- The more streams required has a direct relationship on spectrum required for the service.

Business model



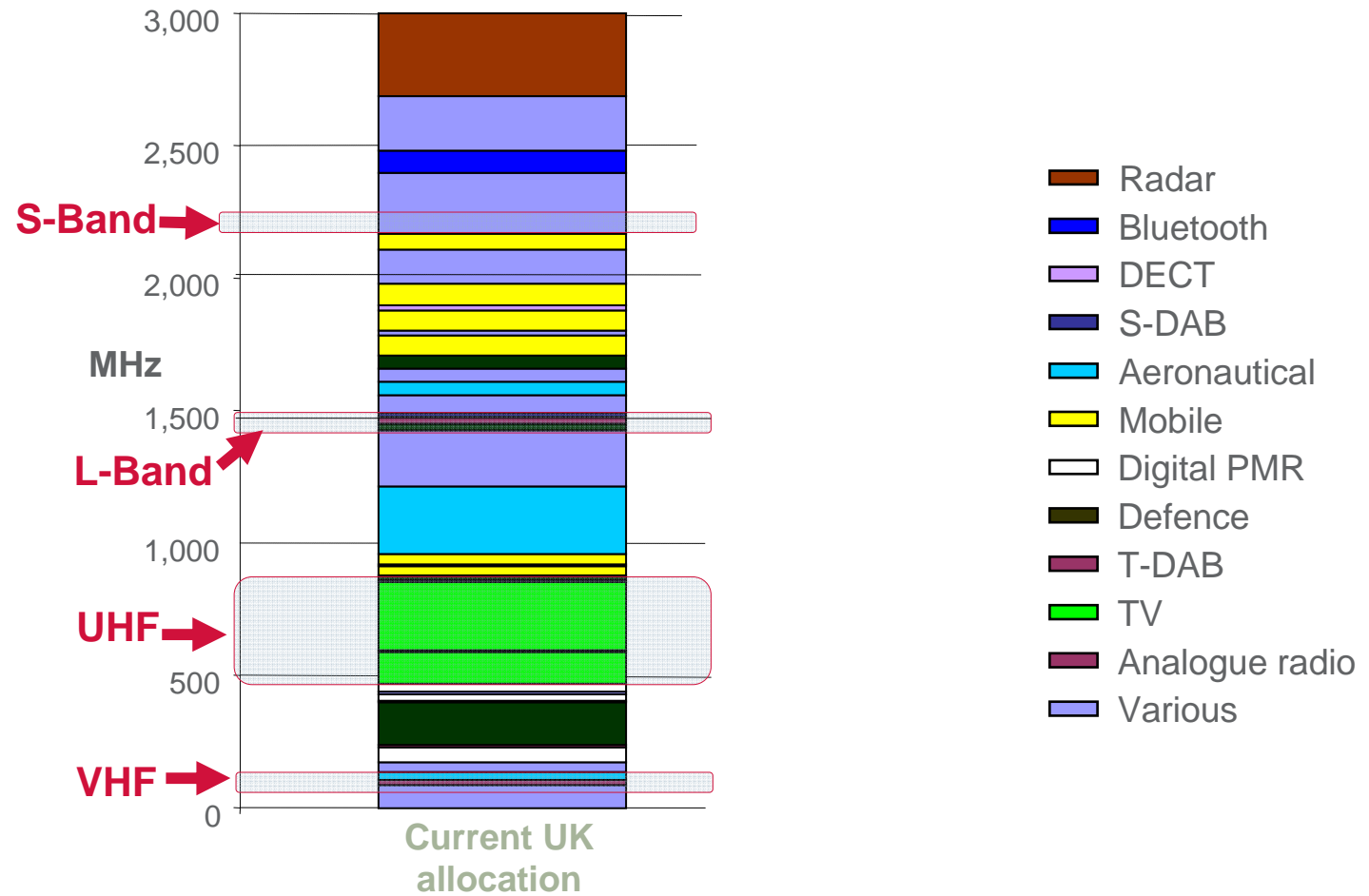
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Business model

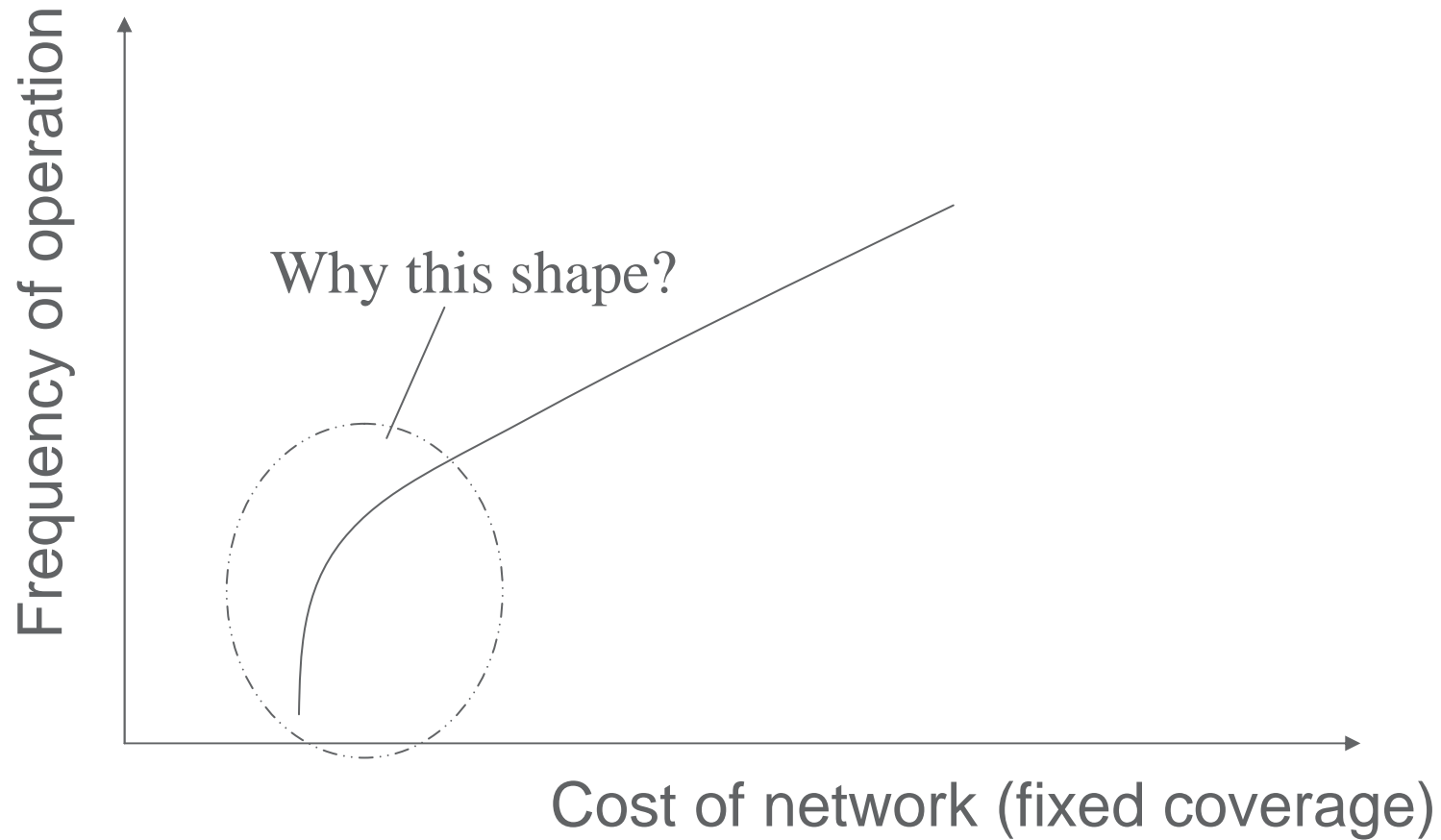


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Spectrum for mobile TV



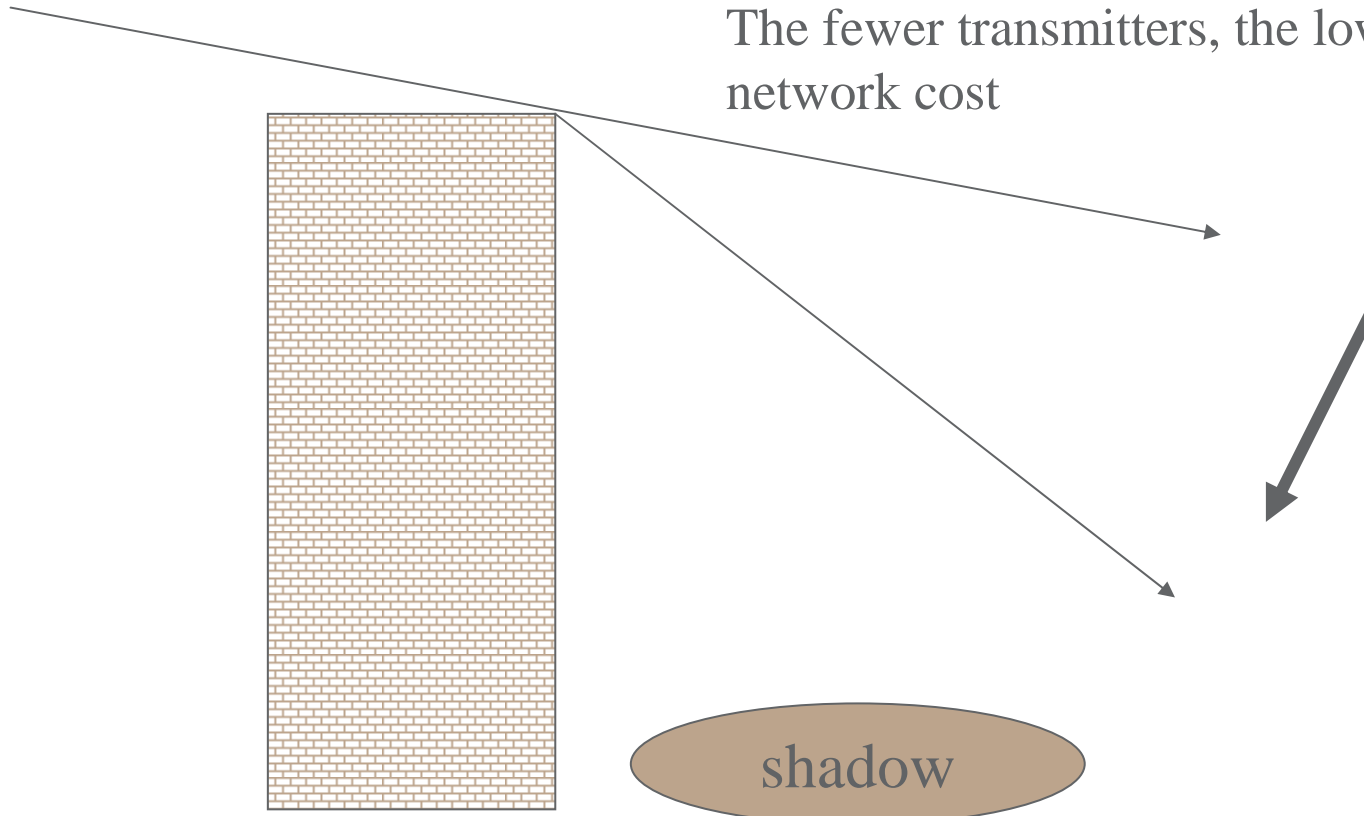
Business model



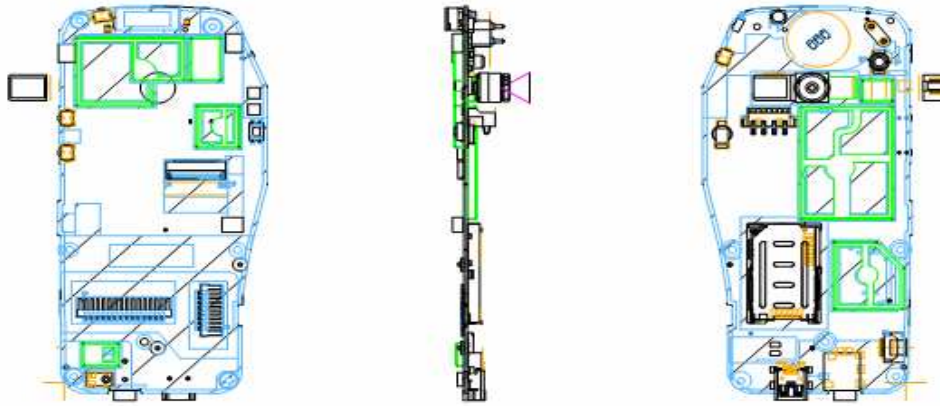
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Diffraction

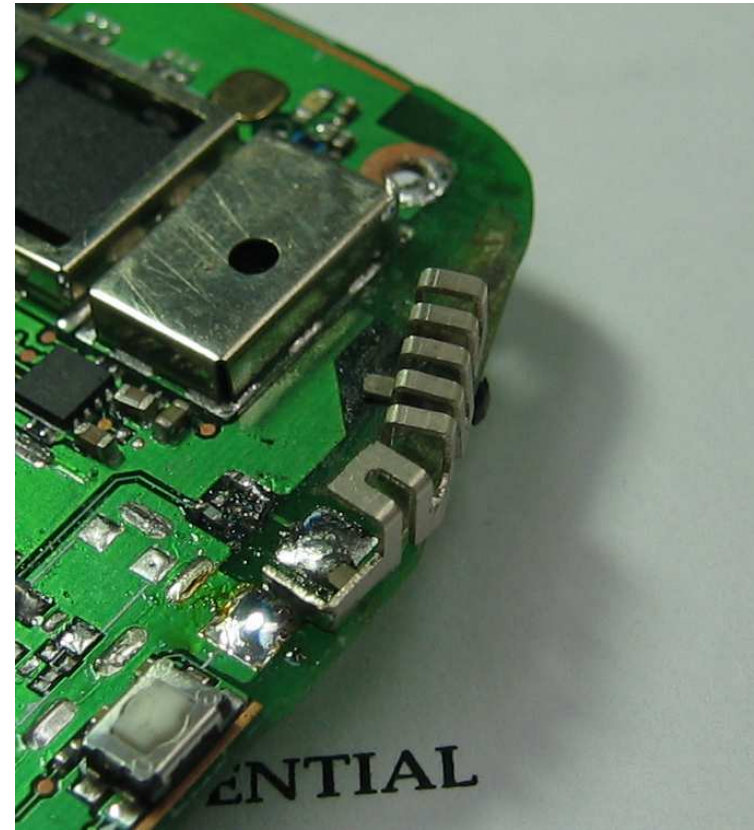
The lower the frequency
the more bending the less shadow
The fewer transmitters, the lower
network cost



Antennas in handsets



For hand held devices VHF antennas can not be integrated at a reasonable antenna gain.



Channel band width

- Spectrum is broken up into channels
- UHF in Europe is on an 8 MHz channel raster
- VHF in Europe is on a 7 MHz channel raster
 - For DAB/DMB this is further broken down into 4 x 1.7 MHz blocks
- L-band in Europe is on a 1.7 MHz channel raster
 - In the UK Ofcom are considering allowing triples so allowing 5 MHz channels
- DVB-H can work in 5, 6, 7 and 8 MHz channels.
- MediaFLO can work in 5, 6, 7 and 8 MHz channels.
- DMB in 1.7 MHz channels
- The number of video services is directly proportional to channel band width

DAB (DMB)

- DAB (Digital Audio Broadcasting)
 - Standards body has re named itself World Digital Multimedia Broadcasting (WorldDMB)
 - Uses an RF channel bandwidth of 1.7 MHz
- 1.7 MHz RF channel size
- Typical implementations are in VHF(175-230 MHz) or in L-Band (1456-1492 MHz).
- Using a half rate Viterbi forward error correction (FEC), pay load is 1 Mbit/s
- Can deliver 5 video services per multiplex (200 kbits/s)



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DVB-H

- DVB-H (Digital Video Broadcasting to Hand Hhelds)
 - Standards body is DVB
 - Uses an RF channel bandwidth of 5, 6, 7 and 8MHz
- Typical implementations are at UHF and L-Band (1452-1492 MHz)
- Using a half rate Viterbi FEC, RS FEC and rate $\frac{3}{4}$ MPFEC pay load for an 5 MHz channel is 2.3 Mbit/s
- Can deliver 11 video services per multiplex (200 kbits/s)

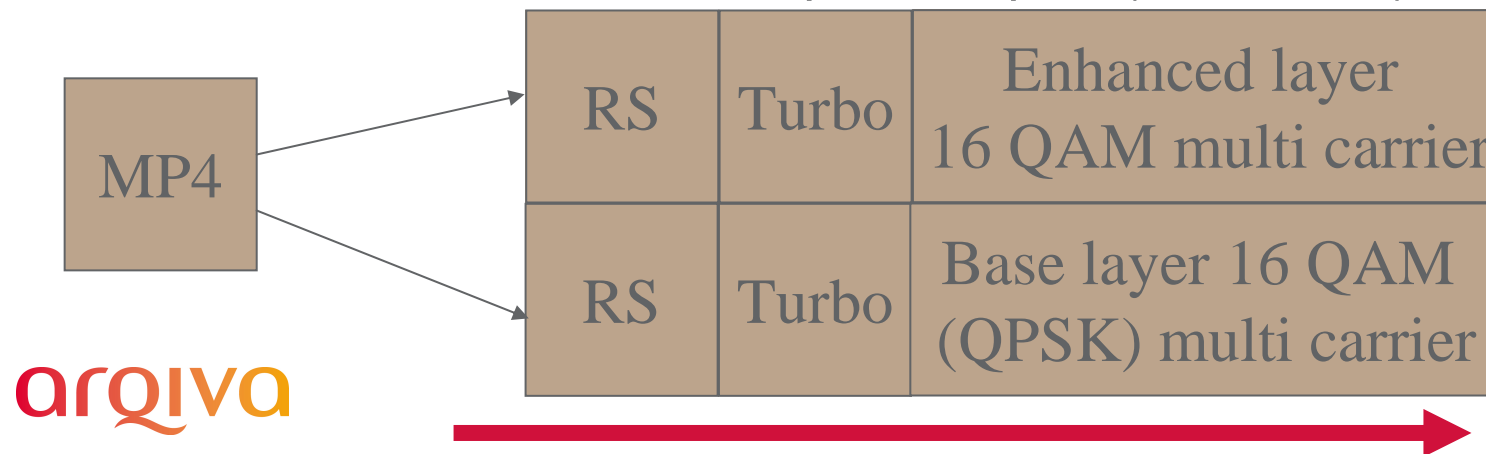


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MediaFLO

- FLO is a proprietary technology owned by Qualcomm
 - Uses an RF channel bandwidth of 5, 6, 7 and 8MHz
- Typical implementations are at UHF and L-Band (1452-1492 MHz)
- Using a half rate Turbo FEC, RS FEC pay load for an 5 MHz channel is 4.1 Mbit/s
- Can deliver 20 video services per multiplex (200 kbits/s)



DVB-H and MediaFLO at 5 MHz channel

Technology and mode in 5 MHz channel	Bit rate available for video and EPG is already added to calculation	No of service no stat mux	With a 25% stat mux gain	C/N
DVB-H QPSK rate 1/2 with MP FEC 3/4 1/4 GI	2.01E+06	8	10	10
DVB-H 16 QAM rate 1/2 with MP FEC 3/4 1/4 GI	4.02E+06	16	20	14
FLO Mode 0 with RS	1.62E+06	6	8	4
FLO Mode 1 with RS	2.43E+06	10	12	7
FLO Mode 2 with RS	3.24E+06	13	16	9
FLO Mode 6 with RS base	1.62E+06	13	16	6
FLO Mode 6 with RS enhanced	1.62E+06	13	16	11
FLO Mode 7 with RS base	2.24E+06	18	22	10
FLO Mode 7 with RS enhanced	2.24E+06	18	22	14

DMB

- 1.536 MHz channel
- 1.1 Mbit/s at EEP 3 forward error correction
- So with 256 kbit/s video with RS overhead and EPG
 - 4 services per multiplex
- C/N 8 to 14 dB depending on the channel type
- So in a 5 MHz channel, 3 x 1.536 MHz
 - 12 video services
 - No stat mux gain






International co-ordination

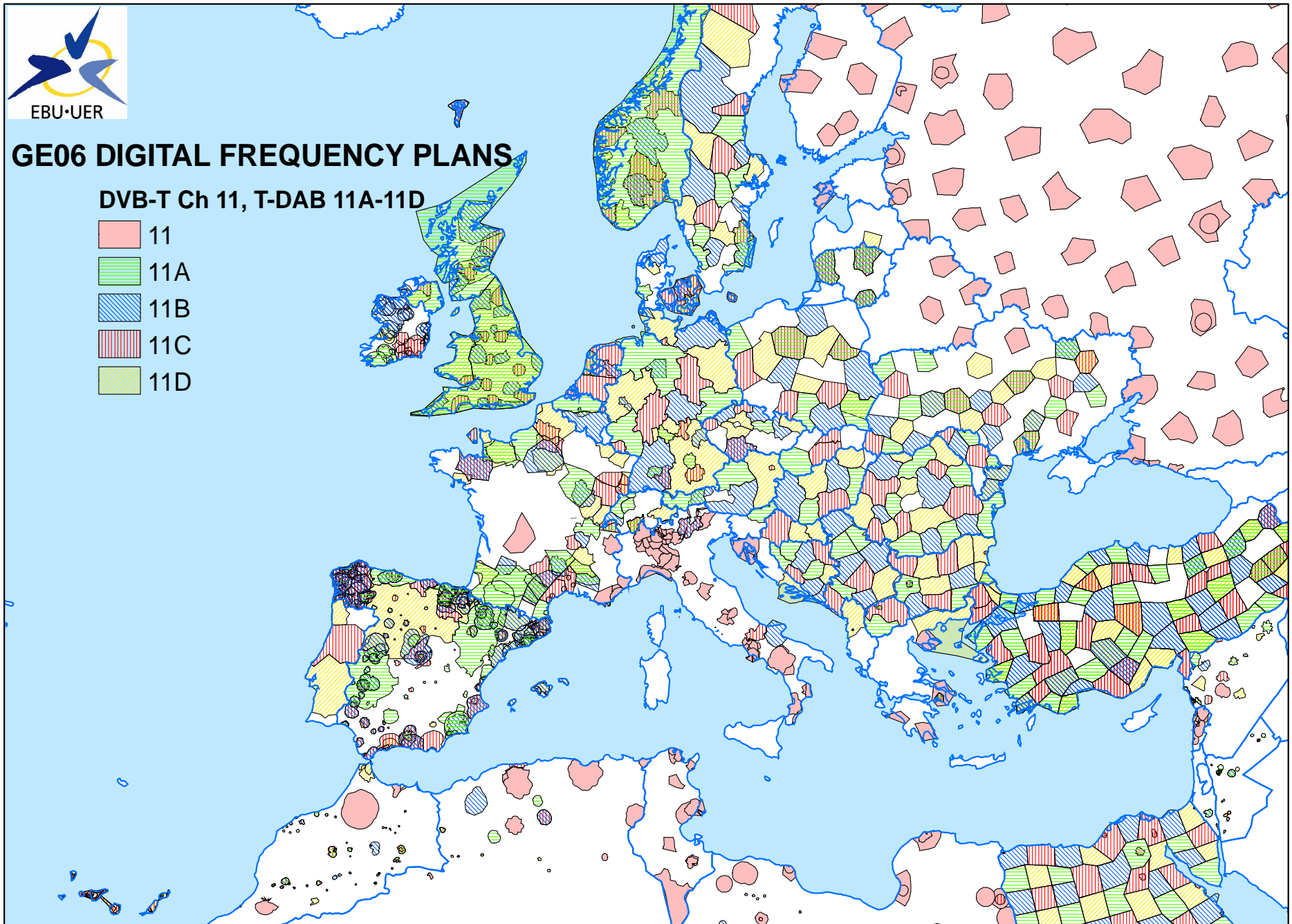
- If the constraints on outgoing power are high due to a neighbouring territory using the same frequency there are two basic strategies
 - Put transmitters close to the border with very directional antennas firing away from the boarder
 - Or build a network with low power low height transmitter sites
- Both options put additional cost on the network build
- The other issue that needs to be considered is how much interference will come in from neighbouring territories and the impact on the coverage of the network.
 - The more interference the greater the reduction in coverage



GE06 DIGITAL FREQUENCY PLANS

DVB-T Ch 11, T-DAB 11A-11D

-  11
-  11A
-  11B
-  11C
-  11D



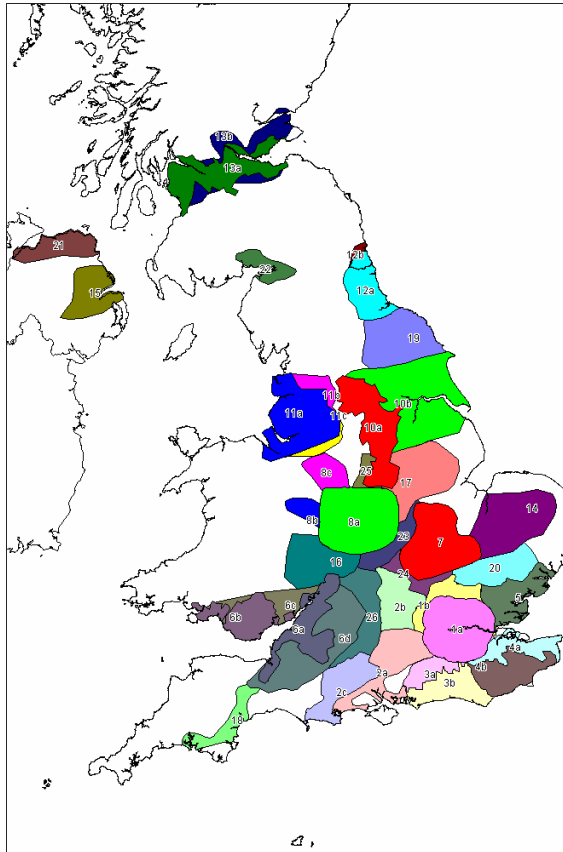
Target Devices

- You must know your device
 - Screen size of the device is directly proportional to the bit rate required to keep the video quality constant
 - Bigger the screen the more pixels, the higher the video bit rate
 - Antenna performance
 - The lower the antenna performance the more power need in the transmitter network, the greater the capital investment
 - The more technologies in the device, the more difficult to make a device with a low noise figure, the higher the noise figure the higher the power required in the transmitter network

Coverage

- Where are people going to watch mobile TV?
 - Outdoors or indoors?
 - If indoors do you expect it to work everywhere?
 - Will it work on the train? Or in the car?
- If you want it to work indoors you will need 20 times more power (13dB) with respect to just working outdoors
- What percentage of the territory do you want to cover?
- Can you cover close to the border with other countries?
- Do you need more than one frequency to get country wide coverage?
- Is there enough spectrum?

Target population



Phase	Area	Total Population Census 2001	Cumulative Population	Cumulative %UK	%UK
1a	London	9462397	9462397	16.1%	15.3%
8a	Birmingham, Wolverhampton, Stafford, Lichfield, Leicester, Coventry, Rugby, Bromsgrove, Kidderminster	4616010	14078407	23.9%	22.7%
11a	Northwest England	5770807	19849214	33.8%	32.1%
10a	Leeds and Bradford	4705597	24554811	41.8%	39.7%

Indoor coverage

- To achieve indoor coverage the mobile TV network will use roof top sites in the urban and sub urban areas to achieve coverage in people homes and offices
- How many locations does the device have to work?
 - Everywhere?
 - Or will the user accept having to walk toward the window to make it work?
 - The same coverage as a mobile phone network?
 - 90% locations?
 - 99% locations?
 - The higher the value the more cost in the network

Role out speed

- There will be effects on role out speed depending on the frequency of operation.
- This depends on how quickly the spectrum is cleared for the new uses.
- In the UHF band this is driven by the speed of digitalisation for terrestrial TV.
- If this goes slowly, the released spectrum (digital dividend) may not become available until 2015 and then either other technologies or other spectrum will have been used for mobile TV.

Conclusion

- Decide on the number of services and the video quality, each piece of spectrum has a different channel bandwidth so allowing a different number of services
- Know your receiver and its performance
- Where is your target market going to receive your service
- What will you consumer accept with respect to video quality and the number of locations where the device will work inside a building? Both will drive up the cost of the network or reduce the number of services
- What are the constraints on the frequency?
 - Internationally
 - Adjacent to you in your country
 - Co-channel in your country

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Thank you simon.mason@arqiva.com

