

mmWave consultation meeting with Ofcom

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Ofcom can achieve its objectives without revocation.

- Three has ambitious plans to use 40GHz
- Revocation is a highly intrusive intervention with three main problems
 - Undermines confidence in spectrum rights – why is Ofcom departing from its market policy?
 - Imposes costs on existing licensees
 - Uncertainty & delayed rollout over 5-year notice period – licensees & new users will both want access
- If Ofcom does not trust trading, an incentive auction would achieve its aims without these problems
 - **Resets 40GHz band** for new uses
 - **Faster repurposing of band** – licensees compensated for relinquishing 40GHz straight away (no need for 5 years' notice)
 - **mmWave allocated to highest value users** – bidders bid simultaneously across 26GHz and 40GHz (no trading barriers) & contiguity guaranteed to all winners

Market-based solutions can achieve Ofcom's objectives while respecting our rights.

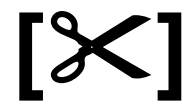


Our plans to use 40GHz spectrum



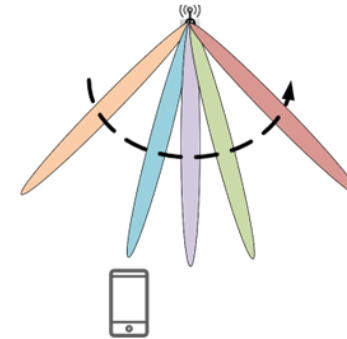
Our 40GHz plans.



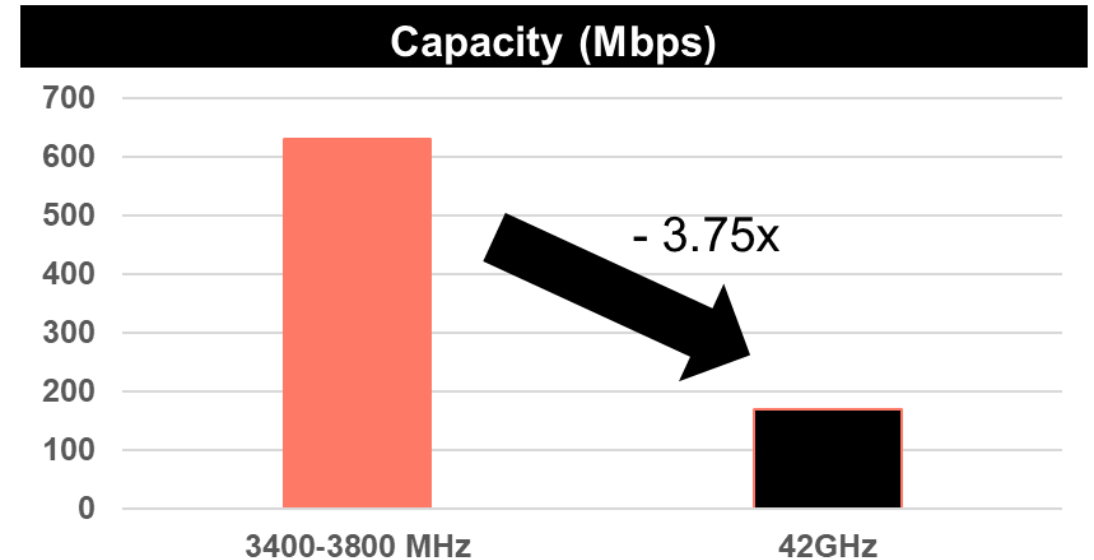


Capacity in mmWave frequencies (42GHz)

- Massive MIMO (mMIMO) technology can be used to improve both coverage and capacity of mobile networks.
- However, the mmWave airwaves are more limited in terms of coverage than C-Band, due to:
 - Incremental vulnerability against weather, rain and humidity absorption, along with incremental penetration losses.
 - Signal reach limited to short distances and not ideal to provide wide area outdoor to indoor connectivity for long distances.
- Due to that, mMIMO beamforming benefits will mainly be used in mmWave frequencies to mitigate coverage limitations.
- Hence, **the capacity benefits of mMIMO, per unit of spectrum, available for C-Band are diluted for mmWave spectrum:**
 - Capacity per MHz in 42GHz will be 3.75x lower than 3400-3800 MHz

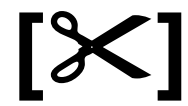


The usage of highly directional and steerable beams in M-MIMO antennas is very helpful to increase coverage and/or capacity



Assumptions:
- M-MIMO antennas with 192 antenna elements
- 100 MHz channel bandwidth
- One panel per channel for 42GHz with 2T2R

More bandwidth is needed in mmWave to address capacity needs



Incentive auction – a market-based solution to repurpose 40GHz.



Why is Ofcom departing from its market approach to spectrum?

- Since 2005, Ofcom's policy has been "to move away from central management of spectrum and allow market forces to prevail where this is in the best interests of citizens and consumers"
- Ofcom has adopted liberalisation, ALF, trading/leasing & auctions to implement this
- Aim is to enable licensees (not Ofcom) to decide how best to use their spectrum
- Ofcom should use market-based tools (not command & control) to repurpose 40GHz:
 - Regulators (e.g. US FCC) now use incentive auctions (not revocation) to clear bands
 - Ofcom already has legal powers to run an incentive auction

If Ofcom does not trust trading (or ALF), it can achieve its objectives through an incentive auction while respecting 40GHz licensees' rights.



Our proposed incentive auction – key components.

1. Combined 26GHz & 40GHz award

- ✓ Design as proposed by Ofcom: principal (clock) & assignment stage (sealed bid 2nd price)
- ✓ Bidders bid simultaneously across 26GHz & 40GHz at known prices – no trading barriers

2. New 40GHz band plan

- ✓ Resets 40GHz band for new uses & users
- ✓ Ensures contiguity to all

3. Voucher system for 40GHz

- ✓ Simple scheme used by US FCC to auction mmWave (39GHz)
- ✓ Credits 40GHz licensees for their holding, incentivising them to surrender 40GHz
- ✓ Spectrum allocated to highest value users

Incentive auctions are now best practice in spectrum management.
Clearance of incumbent uses is integrated into auction.

3. Simple voucher scheme for 40GHz.

- 40GHz licensee gets voucher for value of holding – voucher entitles to payment (not spectrum) at end of auction

Three	MLL	MBNL
2,000MHz (20 x 100MHz lots)	500MHz (5 x 100MHz lots)	500MHz (5 x 100MHz lots)

- If in the Principal Stage a licensee:
 - **Wants to retain same amount of 40GHz** – bids for its holding & pays nothing for 40GHz
 - **Wants to sell some or all 40GHz** – bids for less 40GHz than it held & get paid for difference between holding & 40GHz won @ final clock price
 - **Wants to buy more 40GHz** – bids for more 40GHz than it held & pays for extra 40GHz (over and above current holding) @ final clock price
- **ALF could apply after auction to any 40GHz retained (ie. won) by an existing licensee**

Simple scheme incentivises voluntary surrender of 40GHz.
Licensees compensated for any 40GHz released & face ALF on any 40GHz retained.



Ofcom already has legal powers to compensate licensees.

- WT Act 2006 was amended in 2010 to allow Ofcom (with consent from SoS) to require a successful bidder to pay (all or part of) its winning bid to MNO that previously held the licence
- Only requirement is that the new licence must be a “surrendered-spectrum licence” within the meaning of s12(8) WTA
 - Granted under arrangements involving variation, revocation or expiry of another licence
 - Predecessor licence was surrendered “to comply with a limit applying to frequencies in respect of which a person may hold licences”
- Existing 40GHz licensees can be subject to a pre-auction limit of zero (ie. consent to have their licence revoked in order to participate in auction) to satisfy this requirement

It is beyond doubt that Ofcom can use auction proceeds to compensate an existing licensee for spectrum surrendered to comply with a limit.



How MBNL could be involved in the incentive auction.

- Under previous award regulations, MBNL could not bid in its own right without disqualifying both BT and Three
- Solution: have BT or Three bid on behalf of itself and MBNL (with MBNL forming part of its bidder group)
 - Other co-owner would be walled-off from the discussion of bid strategy beyond some initial high-level involvement agreed with Ofcom (e.g. agreeing maximum budget for MBNL to spend on 40GHz spectrum).
- MBNL would assign its voucher to its current spectrum to the bidding owner so that it can be surrendered in whole or in part at the auction