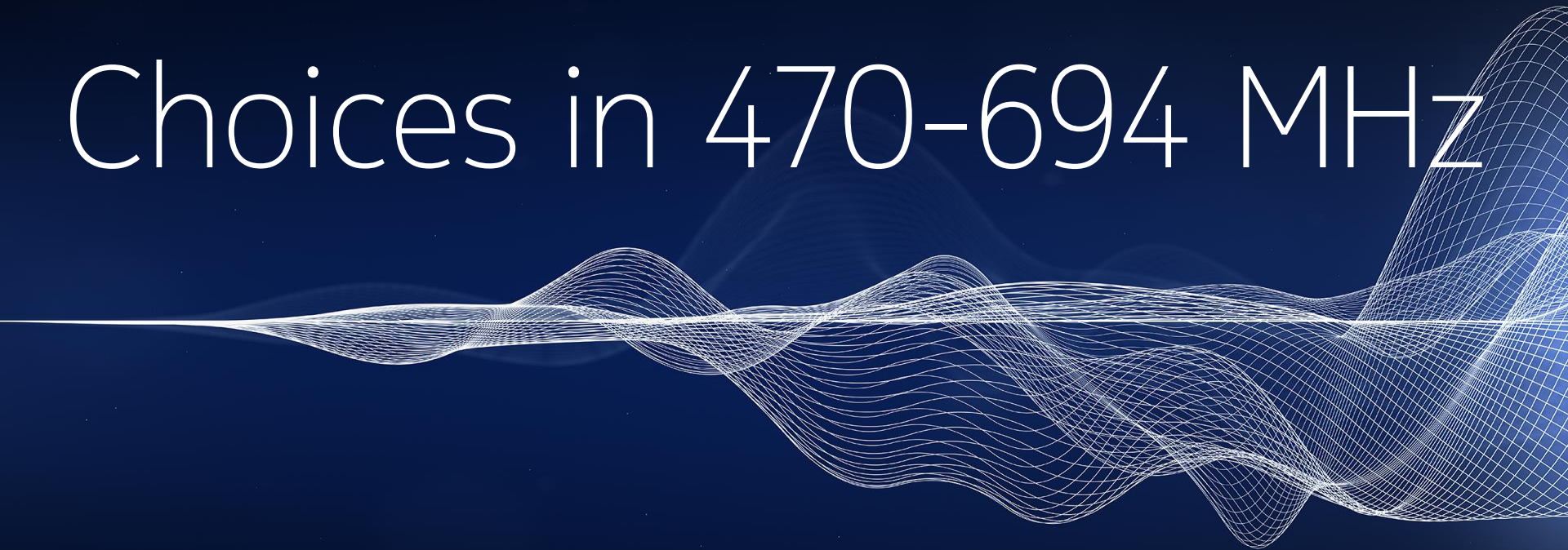


Choices in 470-694 MHz



Ulrich Rehfuess, Head of Spectrum Policy, Nokia

Additional mobile demand in 470-694 MHz in UK and Europe

Cost efficient performance improvement in rural and hard to reach places

- In UK and Europe, 5G user experience in rural areas and in hard to reach places need to keep up with the traffic growth and the performance delivered on higher bands from dense grids in urban areas
- Primarily spectrum below 1 GHz can match the cell ranges required for economic and environmental reasons
- Multitude of mobile services require bandwidth beyond what current sub 1GHz spectrum can deliver, e.g. eMBB, in-car and in-train entertainment, smart agriculture, smart grid, eHealth, ...
- Improving performance and capacity of existing sites with additional spectrum is way more cost and energy efficient and viable than densifying site grids

→ Access to additional low band spectrum for mobile will make a difference

Two options for sub-700 MHz in 3GPP today – more to come?

Band arrangements and conditions to be decided in ~2025 EU review

600 MHz FDD 3GPP Band 71/n71

widely supported ecosystem for more low band FDD

- Implemented in North America
- Applicable throughout ITU-R2
- Increasing interest in APAC
- Announcements in e.g. Saudi Arabia
- Trigger for WRC-23 AI1.5 for ITU-R1 considering co-primary mobile 470-694 MHz
- UL operation typically requires broadcast clearance
- Strong objections from many ITU-R1 administrations

470-694 MHz DL 3GPP new band

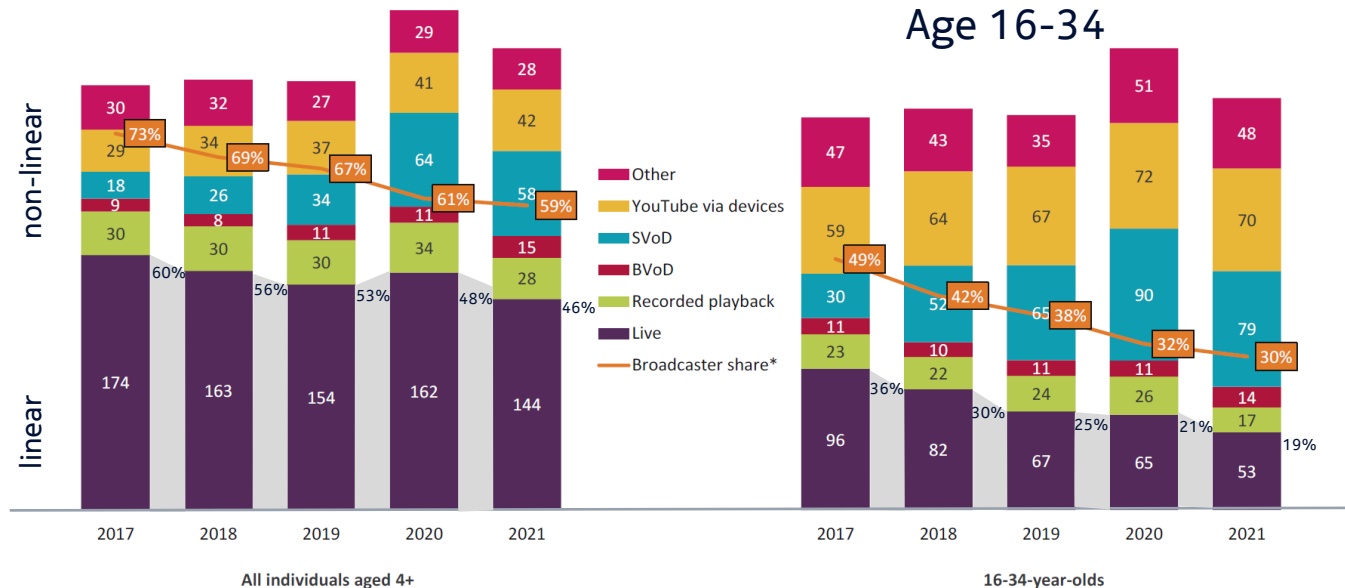
new potential ecosystem for 5G Broadcast (and SDL)

- 3GPP is working on 470-694/8 MHz band definitions and carrier bandwidths 8/7/6 MHz
- Applicable globally in any UHF (and VHF) broadcast bands within broadcast channel raster, full range or below 600 MHz FDD
- Possible path for flexible introduction of 5G Broadcast and/or Supplemental Downlink (requires additional 3GPP work)
 - within existing broadcast plans and cross-border agreements
- Based on a common ecosystem for 5G broadcast and mobile SDL use

Any (mobile) video delivery needs to consider both linear and non-linear

Neither DTT nor purely linear 5G broadcast alone can meet future needs

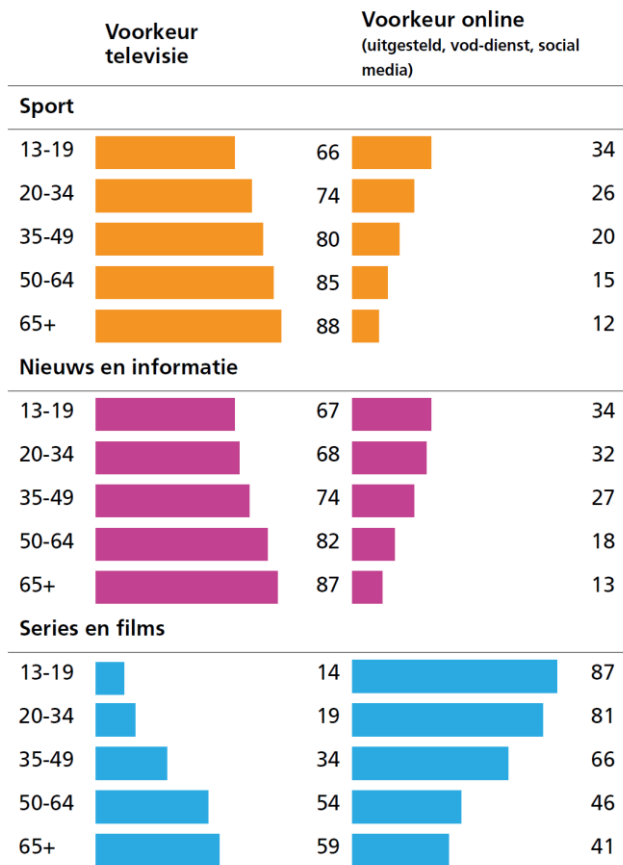
Figure 37: Average minutes of viewing per day on all devices, by type: 2017-2021



UK linear viewing minutes
down to 46% all audiences and to 19% younger audiences

Source: Media Nations UK 2022 https://www.ofcom.org.uk/_data/assets/pdf_file/0016/242701/media-nations-report-2022.pdf

Voorkeur voor manier van kijken per leeftijd (in procenten)



Bron data: Commissariaat voor de Media, Televisiepakketten en kijkgedrag 2019

Usage strongly depends on type of content

Linear dominates in sports for all ages

Linear is also very relevant for news

Non-linear rules for series and movies, relevant shares even for older age groups

Co-existence in 470-694 MHz is possible

Earlier Nokia engagements in co-operative UHF use in Germany and Finland

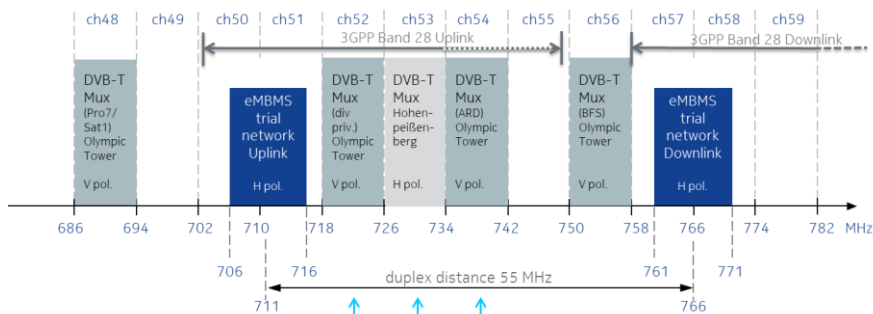
eMBMS Rel 12 field trials Munich

Partners e.g. IRT, BR, Rohde & Schwarz, Fraunhofer IIS, ...

Demonstrating capabilities and limitations of Rel 12 eMBMS for broadcast in terms of ISD, capacity (max 60% of DL) etc.

Also demonstrating mobile network operation options in broadcast spectrum, coexisting with broadcast

Building on Bd 28 commercial equipment while the 700 MHz band was still in active broadcast use



700 MHz SDL field trials Helsinki

Partners e.g. Elisa, YLE, Qualcomm, Nokia ...

Demonstrating the possibility to enhance mobile network performance with SDL in broadcast spectrum

Building on Bd 28 commercial equipment while the 700 MHz band was still in active broadcast use (CA Bd 7 + Bd 28)



<https://www.nokia.com/about-us/news/releases/2016/09/02/qualcomm-nokia-and-yle-announce-worlds-first-demonstration-of-lte-supplemental-downlink-in-a-tv-broadcast-band/>

Additional low band spectrum for mobile will make a difference

Co-existence and smooth migration paths are possible

- Mere “wait and see” beyond 2023, 2025 or even 2030 would ignore challenges in future media distribution as well as demand for adequate and affordable mobile services by consumers and businesses in rural and hard to reach places
- Benefits for mobile in short term from the existing 3GPP Bd 71/n71 ecosystem may be difficult to implement due to their impact on existing services in 470-694 MHz
- Options considering additional mobile downlink (SDL and 5G Broadcast) may offer co-existence solutions between countries and even within a country
- Additional downlink use may help design deliberate migration paths for convergent linear and non-linear media delivery in mobile (and fixed) reception scenarios
- The UK-SPF UHF study provides an excellent starting point for defining well founded strategies on UHF for the UK
- An additional mobile allocation in 470-694 MHz at WRC-23 could direct industry R&D invest towards solutions for additional use of that precious spectrum resource

NOKIA

Thanks for your
attention!

Ulrich Rehfuss, Head of Spectrum Policy, Nokia