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ITU-D Question 2/1 Focus session on Evolution of Broadcasting systems

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5G Broadcast - Standards, Technologies and Market Updates

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Today's agenda

- # What is 5G Broadcast
- # Standards
- # Technologies
- # Trials and deployments
- # Opportunities and Selected Use Cases
- # Next Steps



Dr. Thomas Stockhammer Senior Director, Technical Standards Qualcomm Europe, Inc., IEEE Fellow

Leading and driving among others

- DVB: 5G TF, DVB-I
- MPEG: MPEG-I, CMAF and DASH
- 3GPP: XR over 5G, 5G Video, 5GMS
- DASH-IF: Interop WG, Test
- ETSI & 5G-MAG: 5G Broadcast and 5GMS
- CTA WAVE: CMAF Device PB, Test
- Metaverse Standards Forum: Chair, Board

Challenges for Broadcasters: Devices, Formats, Users



UHD/8K Social 3D Immersive Personalized Interactive Gaming-like Short & long Live **On-Demand User Generated** Al-supported Location Global Secure Time-shift

Focus of this presentation

5G broadcast

- Broadcast spectrum (e.g. UHF)
- No unicast. **Downlink only** traffic.
- Delivery of linear content (e.g. TV) or IP file delivery
- Dedicated broadcast infrastructure (can be high power)



Mixed-mode multicast

- Operator spectrum (IMT)
- Integration with **unicast** network
- Efficient delivery of multicast/broadcast traffic (vs unicast)
- Reuse of cellular infrastructure (low power).



5G defines two modes of broadcast communication

Addressing diverse ecosystem, deployment, and use case requirements

General technology introduction

5G broadcast and 3GPP

• "5G broadcast" is a broadcasting standard defined by 3GPP (Release 16 - 2020)

- 3GPP is the industry group responsible for defining global cellular tech standards (e.g. 4G / 5G)
- In the last few years 3GPP has expanded to new verticals (e.g. broadcast, automotive, satellite, etc.) hence it should not be regarded as a surprise that a broadcasting tech is coming out of 3GPP
- Even though 5G Broadcast has been standardized by 3GPP, it is a broadcasting technology
 - I.e. meant to be used by broadcasting operators, in broadcasting spectrum
 - No need of supporting a unicast network. 5G Broadcast does not have anything to do with unicast
- The main design target & "reason for being" of 5G broadcast is to enable operation of a broadcast network where the receivers are hardware-compatible with cellular modems
 - "Hardware compatible" means lower barrier to adoption in mobile devices compared to other broadcasting technologies
 - This is because several 5G Broadcast building blocks are already there in a 4G/5G modem, hence the additions are marginal.
 - For other technologies, a separate piece of silicon / die area would be required
 - To be clear, 5G Broadcast has nothing to do with "cellular operators trying to take over from broadcasters"

5G Broadcast - Core Features for multiple use cases

SIM-less reception with simplified architecture

Receive-Only Mode (ROM) & Free-to-Air (FTA)

Different spectrum options (e.g. UHF, SDL), as well as SFN/MFN

Various deployment possibilities (e.g. MNOs, BNOs)

Using existing infrastructure (HPHT, MPMT and LPLT)

Highly flexible velocities (up to 250 KM/h Vs up to 300 μ S)

Can be combined with existing 4G and 5G features (unicast, PWS)

Significant interests towards 5G broadcast deployment worldwide



¹ National Radio and Television Administration ² Academy of Broadcast and Science commercia potential ³ Prasar Bharti working jointly with IIT Kanpur on Next Generation Broadcast Technology

Demos 2023 – QRDs and CRDs are real phones









Standardization



For more information on 5G broadcast standards... ETSI TS 103 720: Profile of 3GPP specification containing the necessary parts to deploy 5G broadcast



TR 36.976: Overall description

of enhanced TV (enTV) for

5G broadcast

5G Broadcast Standards Evolution

Roadmap towards WRC23



Technology Evolution

MBMS/LTE eMBMS/5G broadcast History

Building upon a strong 3GPP technology foundation

3GPP could have taken a radical approach to define a clean slate radio system to meet the broadcasters' requirements, instead a more pragmatic route was chosen. Experiences from the past with dedicated modems such as MediaFLO or DVB-H, and the need for easy integration into mainstream mobile devices, led to the decision to evolve eMBMS to LTE-based 5G Broadcast instead of any radical new designs.

eMBMS defined for LTE starting in Rel-8/Rel-9, improving coverage and efficiency

lte

Target market

focused on

eMBMS enhancements in Rel-12 include MOOD and expansion to MCPTT

te devanced

LTE-A

Enabling terrestrial broadcast and expanding to new services; Meeting 7/10 5G Broadcast requirements in Rel-14

3GPP Rel-14 (completed)

Target market expanded to Broadcasters

in 3GPP Rel-14

Further enhancements⁵ to fully satisfy **5G broadcast requirements**

Enabling terrestrial broadcast and expanding to new services; Meeting all 5G Broadcast requirements in Rel-16

5G

3GPP Rel-16 (completed)

5G broadcast is a "broadcast standard" (same target as DVB or ATSC) based on 3GPP silicon and ecosystem.

Cellular operators

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LTE

RAN: MBMS → 5G Broadcast Evolution

Release 13

Single-cell

PTM)

transmission (SC-

Transmission on

group identities

transmitters

PDSCH with new

Non-synchronized

- Release 9
- Mixed unicast/MBMS carrier
- 15 kHz numerology
- Extended CP of 16.7us
- Multi-cell transmission only (MBSFN)
- Up to 60% of subframes for MBSFN transmission

Release 14

- Longer cyclic prefixes for support of larger ISD
- Up to 100% of subframes for MBSFN transmission on a **dedicated carrier**
- Subframes fully dedicated to MBSFN transmission
- Targeting rooftop and car-mounted antennas, handheld receivers

15 km

Release 16

- New numerologies to target rooftop reception with up to 125 km ISD
- High mobility reception: fixed, portable and mobile receivers up to 250 km/h
- Enhancements to CAS increased PDCCH agg. Level, PBCH repetition, CFI in MIB

Release 17/18

- 6/7/8 MHz channel bandwidth to support common global channel bandwidth for broadcast systems
- Introduction of UHF Band 108 to address RF transmitter and receiver requirements



"Broadcaster controlled" MBMS

"Operator controlled" MBMS

Technologies and Trials



Invention

Inventing new technologies and end-to-end system architecture We pioneered key cellular broadcast technologies for 3G, 4G, and 5G



Standardization

Leading ecosystem towards new projects and driving new system designs We led the mobile and broader industries to standardize cellular broadcast



Commercialization

Engaging with global ecosystems to deploy new products and services Successfully productize cellular broadcast in our products

Vision

Identifying a problem or need, and establishing system requirements We envisioned a more efficient way to deliver mass media over cellular networks

2



Proof-of-concept

Delivering end-to-end prototypes and impactful demonstrations We showcased cellular broadcast technologies at various industry events



System Trials

Collaborating on field trials that track standards development, preparing for commercialization We worked with mobile operators, device manufacturer and content providers on trials

6





Joint demo at MWC'23

Taking a system approach to technology innovations

Making cellular broadcast a reality

Proof of concept in 2022: **Concept Schwarz Qualconners**

• **Objective**: confirm feasibility and move ecosystem towards commercial deployments.

• Summary of features:

- Reception from broadcast transmitter
- Reception in broadcast UHF spectrum
- Operation without SIM card
- Reuse of cellular hardware (smartphone)

Rohde & Schwarz and Qualcomm show end-to-end live 5G Broadcast streaming to smartphones at <u>NAB Show 2022</u>

Highlights how 5G Broadcast can redefine content delivery and open up new business models

Rohde & Schwarz and Qualcomm partner to demonstrate end-toend realtime 5G Broadcast streaming to smartphones at <u>CABSAT</u> 2022

Underlines 5G Broadcast's potential to drive new business models and redefine how content is delivered

First end-to-end live 5G Broadcast streaming to smartphones at MWC Barcelona 2022 with Qualcomm and Rohde & Schwarz

New 5G breakthrough poised to redefine content delivery.

Qualcomm devices





- QRDs based on Snapdragon 8 Gen 1 initially, now Gen 2 (8450 / 8550).
- Modified (non-commercial) changes to enable a subset of 5G-broadcast features.
- Meanwhile, Qualcomm supported enabling 5G Broadcast trials on Commercial devices by applying some firmware upgrades → Commercial Research Devices (CRDs)
- Additional trial features are expected in next release of QRDs and CRDs.

Eurovision Song contest

5G Broadcast demoed live in multiple cities

• <u>Link</u>



Live content produced by RAI in Turin

Encoded by <u>Ateme</u> at EBU HQ in Geneva and <u>distributed</u> to SWR in Stuttgart France Televisions in Paris ORS in Vienna



This year's **#Eurovision** showcased the future of live broadcasting, with the latest multimedia distribution solution, allowing viewers to witness the action from multiple angles at once. Watch the video below to learn how we helped make this a reality.

In partnership with ORS Group (Austrian Broadcasting Services), Rai -Radiotelevisione Italiana, Rohde & Schwarz, towerCast, European Broadcasting Union and SWR



Qualcomm Eurovision

Other demos / trials



Stuttgart (test drive)





IMC'22



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TowerCast event in Paris





Selected use cases

Linear TV and Radio

- One-way communication directly to handsets
- More cost efficient than unicast (RAN and CDN)
- Live sports, special events, general programming
- Key for massive events (e.g. World Cup)

Interactive media

- Combine linear video with interactivity.
- Linear content from broadcaster, unicast using mobile network.
- Comments, ratings, e-commerce, advertising



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Emergency messages

- Emergency notifications to smartphones from broadcast infrastructure.
- Possibility of sending text-only notifications and multimedia content

General file download

- Software / firmware upgrades.
- Download and storage of popular content:
 - TV shows
 - "Viral" videos in social media.

Enhanced broadcast use cases with 5G broadcast

Emergency alerts

- 5G broadcast inherits from 5G the public warning system capabilities.
- The Cell Broadcast Service (CBS) does not require authentication with a PLMN. Hence, a ROM network is inherently compatible with CBS (see 3GPP TS 23 041).
- CMAS (commercial mobile alert system) is available in current commercial devices.
 - Devices monitor periodically a low-duty cycle paging channel (low power)
 - CMAS over 5G broadcast has been demonstrated with R&S infrastructure
- Additional capabilities of CMAS:
 - Geofencing (send notification to users within a given area)
 - Possibility of sending URL linking to emergency media





Emergency message demo with ABS

Self-contained emergency system (text + multimedia) without need of unicast.



DVB-I over 5G - combining the best of two worlds

DVB Service layer with 5G Broadcast distribution - specification work

- DVB Commercial Requirements in <u>Bluebook C100</u> (07/21)
- ETSI TS 103 720 (06/23): LTE-based 5G Broadcast
- ETSI TR 103 972 (07/23): Deployment Guidelines for DVB-I services over 5G System
- ETSI TS 103 770 DVB-I Service Discovery (11/20)
 - Latest version used in trials is A177r4 (09/22)
 - Latest published version is the bluebook A177r6 (02/24)
- ETSI TS 103 285 DVB-DASH (Dynamic Adaptive Streaming over HTTP)
- 3GPP TS 26.501 (12/23), TS 26.510 (06/24) TS 26.512 (06/24)







A GLOBAL INITIATIVE



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BR HD

Qualcomm and Rohde & Schwarz show the world's first standards-conforming demo of 5G Broadcast integrated into the DVB-I service framework on a commercial smartphone. 5G Broadcast transmissions from the Ismaning/Munich broadcast tower are added as service instance to a DVB-I service list and the DVB-I client is updated to select services included in the 5G Broadcast signals. The 5G Broadcast signals are integrated in the service list of the German DVB-I Pilot, whereby the instances for 5G Broadcast get highest priority and will hence be selected by the 5G Broadcast capable receivers, but ignored by regular TV sets or smartphones.

Joint demo of Rohde & Schwarz, Qualcomm and the colleagues from ZDF and ARD



5G-MAG Reference Tools?

REFERENCE < TOOLS />

Developer Space https://developer.5g-mag.com



Open Community of Developers

Open developers' community sponsored by 5G-MAG members

Current list of official contributors



Reference Implementations

Reference implementation of 5G media platform components and features

Feedback to

standards experts

Facilitating exchange between developers and standardization experts





Fraunhofer







IPR-friendly License Model

Developed to foster contributions, demos, testing, commercialization

Qualcom

ВВС

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Summary & Next Steps

Join the community of open standards, innovation and development



5G is a platform for Broadcasters and Content Providers with features including 5G broadcast, Public Warning and many others



3GPP Standards are **global** and address billions of devices - from smart phones to many more verticals (automotive, IOT, etc.)



Qualcomm contributes, supports and drives open systems through technologies, standards and reference tools

Thank you

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