Launch event

5G Broadcast trials using FeMBMS

9 May 2019

#5GMediaRoad2019
Next generation of broadcast distribution

Efficient delivery of Live/linear content to Mobile devices
Project partners and key contributions

IRT
- Prototype receiver
- Coverage prediction

KATHREIN
- Transmit antenna
- Measurements

ROHDE & SCHWARZ
- Transmitter
- Core network extensions

BR
- Transmitter sites
- TV content

Telefónica O₂
- Regulatory aspects
- Spectrum

In cooperation with:

Receiver for launch event
Launch event

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#5GMediaRoad2019
Introduction

- Research and implementation of the FeMBMS specification for the large-scale transmission of media content in broadcast mode based on mobile technology
- Co-funded by the Bavarian Research Foundation
- Duration 28 months (1 July 2017 to 31 October 2019)
FeMBMS: Further evolved Multimedia Broadcast Multicast Service

Broadcast in 3GPP World since 2005

→ Perspective of a mobile network operator

• MBMS in 3GPP Release 6 (UMTS, 3G)
• eMBMS in 3GPP Release 9 (LTE, 4G)

FeMBMS was finalized in 3GPP Release 14 in summer of 2017

→ Consideration of media broadcasters’ perspective

• Support of larger inter-site distance (cyclic prefix 200 µs)
• Dedicated MBMS transmission (100% broadcast transmission)

FeMBMS radio frame = 10 ms

• Receive-only mode
Test field in the Bavarian Alpine region

- Large-scale broadcast network based on FeMBMS/LTE Rel. 14
- Single frequency network with two transmitters (distance 63 km):
  - Wendelstein (since December 2018)
  - Ismaning (since March 2019)
- Power 100 kW ERP, channel 56
- Bandwidth 5 MHz, MCS 9, QPSK
- Video signal:
  - TV content: BR Fernsehen
  - Data rate: 3192 kbit/s
  - H.265, HD
IRT: Coverage prediction

Coverage probability:
- < 70%
- 70...95%
- 95...99%
- > 99%

Mobile reception
IRT: Prototypical implementation of FeMBMS receiver

- Software Defined Radio (SDR) device USRP 29xx
- Software platform: Open Air Interface (OAI) Open source implementation of core network (EPC), access network and user equipment (EUTRAN) of 3GPP cellular networks
- IRT is a member of the OAI Software Alliance
- Implementation of FeMBMS required modifications in some elements of OAI
- Next step: integration and interoperability tests with the transmitter side
IRT: Field measurements starting May 2019

- Measuring tool: Kathrein Signal Analyser (KSA)
  KSA – LTE Scanner FeMBMS

- Polarisation
  horizontal, vertical, circular

- Reception mode
  stationary, portable and mobile

- Network modes
  MFN and SFN
FeMBMS: Simplified architecture for TV services

- **FeMBMS**: Simplified architecture for TV services

- **xMB Interface**: Connection between Content Provider and BM-SC

- **xMB Control Plane**: Connection between Content Provider and eNB

- **xMB User Plane**: Connection between BM-SC and eNB

- **BM-SC**: Broadcast Multipoint Control”

- **Core Network**

- **Access Network**

- **eNB**: Equipment Node Base

- **Internet**: Connection between Content Provider and Core Network
World’s first LTE Broadcast (FeMBMS) SFN transmission

5G TODAY has successfully realised the world’s first dynamic single-frequency network (SFN) in combination with FeMBMS.
R&S: HPHT LTE Broadcast – How to make it real?

EPC

R&S BSCC

M1

LTE Broadcast Tx

M2

SDE900

R&S TCE901

RF
HPHT LTE Broadcast – 5G Today makes it real!

World’s first HPHT FeMBMS transmitter on-air located at Wendelstein
### Wendelstein

- Site height: 1838 m a.s.l, ant. height 53 m
  - UHF antenna covered by GRP cylinder because of extreme icing in winter
  - Vertically polarized

### SFN

- UHF Channel 56 (750 – 758 MHz)
- 5 MHz Channel Width
- 100 kW ERP each transmitter
- FeMBMS according to 3GPP Release 14

### Ismaning

- Site height 483 m a.s.l, ant. height 215 m
  - UHF antenna on top-mount spine
  - Polarisation switchable, H / V / RHC for Tx diversity trials
Ismaning 5G UHF antenna installation impressions

Polarization Switching Unit in Tx room

370 m of RF-cable 4“ installed in one run

New UHF Antenna System for Tx diversity, on 215 m height a.g.l
Optimal coverage also for mobile devices

Circular polarization provides steady signal practically independent of the Rx device position

\[ E_x(z,t) = E_0 \cos(kz - wt) \]

Animation: https://de.m.wikipedia.org
KATHREIN Signal Analyzer LTE Scanner FeMBMS

- SDR (Software Defined Radio) concept
- Software created by Enkom (Kathrein Group)
- Independent of chipsets or existing decoders
- Signal strength and quality-of-service measurement
- Mobile, portable or stationary measurement
KSA application example: Measurement system for „Portable Outdoor“ 5G Broadcast

- Measuring Antenna
- GPS
- KATHREIN Signal Analyzer
- LTE Scanner with FeMBMS functionality
- Radio frontend and digitizer R&S TSMW
- I/Q Data
- Charger
- 12 V 18 Ah

Reference height 1.5 m a.g.l.
KSA measurement system for 5G Broadcast integrated in baby buggy

Buggy in travelling mode

Buggy in measurement mode

Dummy handphone and hands

Kathrein Signal Analyzer
FeMBMS becomes reality – implementation and evaluation of a new broadcast/mobile standard

- Contributions to 3GPP standardisation
- Technical studies: Broadcast coverage for smartphones and tablets
- Definition of requirements for future attractive business models for mobile and broadcasting industry as well as other verticals

... and, last but not least, a great team and very positive feedback!
Thank you very much for your attention!

Aneta Baier, IRT
Thomas Janner, Rohde & Schwarz
Christian Sautter, Kathrein