Event and Media Production: Audio PMSE and 5G
Culture and Creative Industry (CCI) is a major driver of growth and employment.

- CCI is 3rd rank, based on contribution to the gross value added (GVA) of Germany compared to other industry sectors, 102.4 Mrd. €
  - The CCI is characterized by small and medium-sized companies.
  - Investments and job creation mainly take place within the country, as CCI is linked to the country, but contains cross border use of equipment.
- Programme Making and Special Events (PMSE) equipment:

Source: BMWI, https://www.kultur-kreativ-wirtschaft.de
Audio PMSE: Selected Use Cases

- Live Music
- Electronic News Gathering
- Audio for Video (e.g. Vblogger)
- Conferences
Audio PMSE: Selected Use Cases

- **Live Music**
- **Electronic News Gathering**
- **Conferences**
- **Audio for Video (e.g. Vlogger)**

**Use Cases**:
- Wireless In-Ear Monitor
- Wireless Microphone
- Ad-hoc
- Installed
What are the requirements for a **Wireless Solution?**

- **Economically viable and scalable technical implementation of the product.**
- **Access to global radio spectrum according to Frequency Regulation (ITU, CEPT, National)**
- **Application delivering a value-add to the customer**
- **Technology supports application requirements?** Technical Specification (ETSI, 3GPP, IEEE or other) Harmonised Standard (ETSI) to enable market access.
The Wireless Mouth-to-Ear Latency Budget

- Artist is source and sink of audio!
- Sound is also traveling directly via the bone and body, and indirectly via room reflections (isolating headphones required).
- A jitter-free turn-around streaming latency of below 4 ms on application layer is required as the artist is source and sink of audio.
5G Vision Extended: Network of interworked Networks

Audio PMSE: Technologies - 1

- Link-based Approaches
  - Analog Narrowband (FM)
  - Digital Narrowband

- System-based Approaches
  - DECT-based (evolution), which is IMT-2000
  - Upcomming: Wireless Multi-Channel Audio System (WMAS)
### Audio PMSE: Technologies - 2

<table>
<thead>
<tr>
<th>Technology</th>
<th>Approach</th>
<th>Audio Quality</th>
<th>Channel or Link / MHz</th>
<th>Link Latency</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog NB, B=200 kHz</td>
<td>Link</td>
<td>Better</td>
<td>1 - 1.5</td>
<td>~ 0 ms</td>
<td>Better</td>
</tr>
<tr>
<td>Digital NB, B=200 kHz</td>
<td>Link</td>
<td>▪ Better ▪ Best</td>
<td>1.5 - 2.5</td>
<td>~ 3 ms</td>
<td>Better</td>
</tr>
<tr>
<td>Digital 2.4G</td>
<td>Link</td>
<td>Good</td>
<td>0.1 - 0.2</td>
<td>~ 4 ms</td>
<td>Good</td>
</tr>
<tr>
<td>DECT 1.9G (evolution)</td>
<td>System</td>
<td>Better</td>
<td>0.6 - 2</td>
<td>&lt; 20 ms (&lt; 3 ms)</td>
<td>Good Better</td>
</tr>
<tr>
<td>WMAS, e.g. B= 6 / 8 / 10 MHz</td>
<td>System</td>
<td>Configurable per Audio Ch</td>
<td>2 - 8+ Standard Mode: 3</td>
<td>Configurable Per Audio Ch</td>
<td>Configurable per Audio Ch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Good ▪ Better ▪ Best</td>
<td>&lt; 1 ms to 20 ms</td>
<td>▪ Good ▪ Better ▪ Best</td>
<td></td>
</tr>
</tbody>
</table>
Production, Distribution and Reception: On-Site & Live plus Additional Use

- Pick-up of sound of each instrument, artist and ambience with specific microphones.
- IEM enable the artist to perform.
- On-site mixing of all audio sources happens for the Public Address (PA) and monitoring.
- Arranging / Post Processing for additional uses (broadcast, streaming) is based on a **Master Record** of the event.
Production, Distribution and Reception:
Post-Production, Distribution and Reception

► Recorded content is specifically post processed for various distribution channels
  – Broadcast
  – Internet
  – Other

► 4G/5G, WLAN, DSL, fiber and so on are here ways to access the internet, e.g. to stream media content.
Distribution and Reception: Potential Value-Add by 4G/5G

- **Live Audience Services**
  - Information: Program, background, shopping
  - Sing-Along
  - Assistive live listening
  - Assistive live viewing

- **Remote Services**
  - Finding parking place or each other at event area
  - Online participation, if late or ill at home

- **Audio PMSE and 5G**
Production: 
Potential Value-Add by 4G/5G and IT

- Convergence of production and distribution networks
  - Latency reduction, simplification of setup (?)
- 5G for Remote Production
  - Wireless Wide Area Network; Cloud-Services for computing and storage
- Wireless Mic and IEM in 5G?
  - 5G UEs in public or non-public network?
  - Next generation of PMSE networks interworked with 5G networks?
PMSE in 3GPP Technologies (4G/5G/…)

- Research:
  - PMSE-xG (German BMVI co-funded):
    Early Feasibility Study on Use Case Level, Business Roles, Gaps Identified!
  - LIPS (German BMWi co-funded)
    AV Services, which can be envisioned for an 5G eco-system, demonstration target for 2020.

- Current Situation (It is RESEARCH …):
  - Sennheiser is very active in 3GPP SA1 and with stakeholders of mobile industry. Key requirements are still under evaluation.
  - Business models still unclear. Current approach:
    Non-Public Networks by Verticals + Licensed Local Area Spectrum Access

- **Unknown target date for implementation in technical specifications of 3GPP, in the availability of solutions for PMSE and in the deployment!**
Live Interactive PMSE Services (LIPS)

- Development of **smart services for interactive and immersive linking** between locations and live events (remote reality)

- Technological convergence of production and distribution networks (5G as target platform)

- New services for media production and live distribution
Live Interactive PMSE Services (LIPS)

- Time horizon: 1 April 2018 – 30 September 2020
- Consortium Lead: Sennheiser
- Cooperation Points:
  - Smart Service Welt II
  - LIPS Advisory Board
  - Standardization in 3GPP and ETSI
  - Impact on Frequency Regulation

Audio PMSE and 5G
Thanks. Questions?