3GPP TSG RAN Meeting #102
Edinburgh, Scotland, December 11-15, 2023

RP-232759

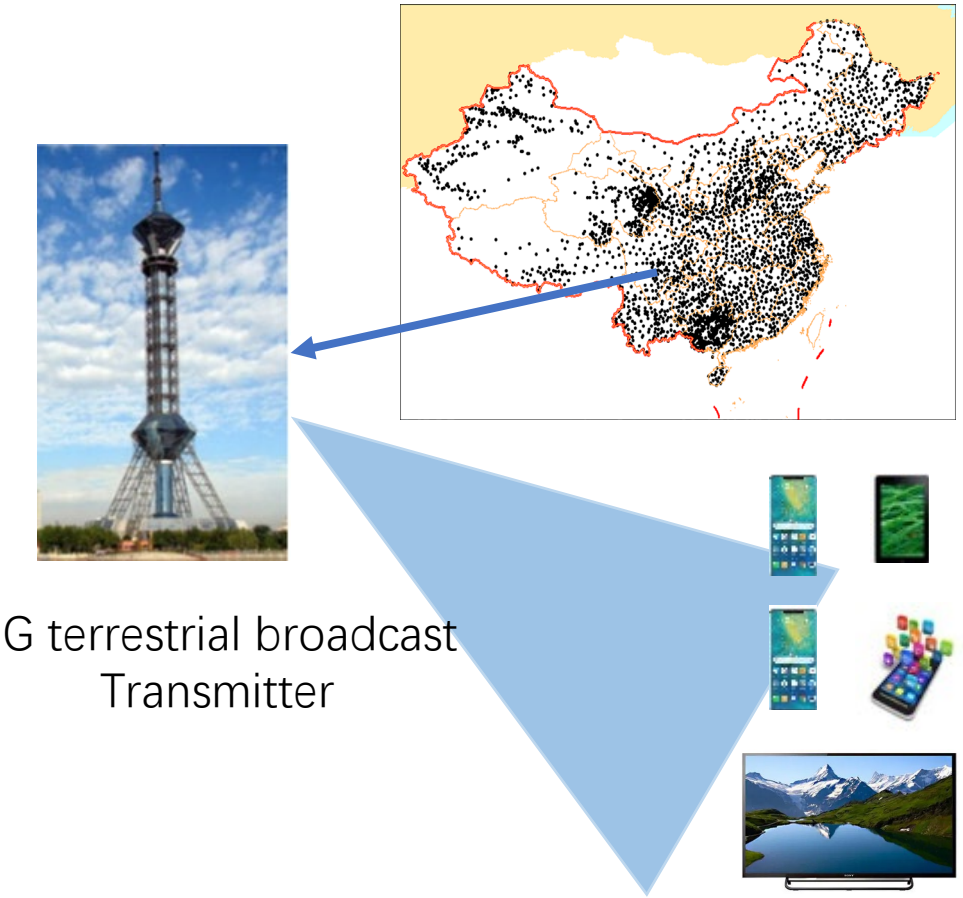
Agenda item: 9.1.1.9

Time and Frequency Interleaving for LTE-based 5G Terrestrial Broadcast

ABS, ABP, SJTU, CUC, Qualcomm, Rohde & Schwarz, Xiaomi, TCL, vivo, OPPO

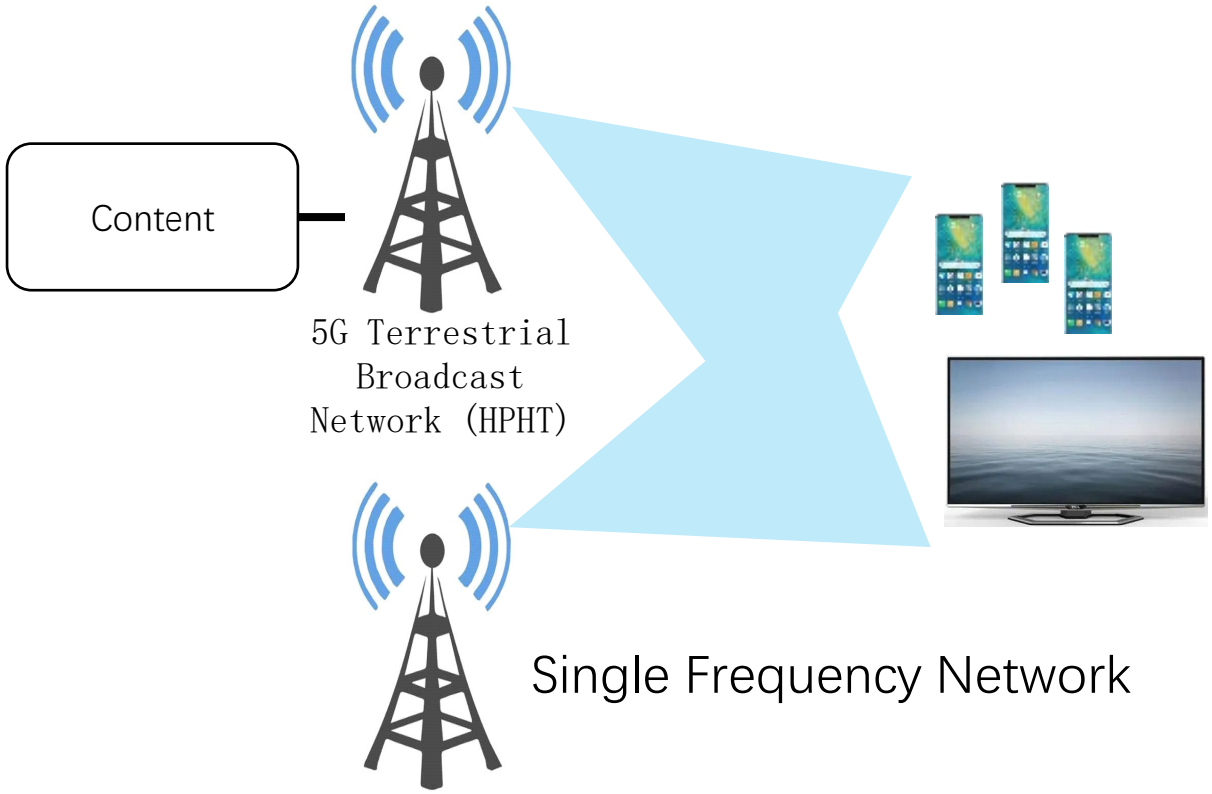
LTE-Based 5G terrestrial broadcast

- Re-using Digital Terrestrial Television (DTT) transmitting resources
  - There are about 7,000 HPHT stations in China.
- Using broadcast television frequencies (UHF)
  - 470MHz – 694MHz (3GPP B107/B108)
- Operated by broadcasters
- Providing public radio, television and emergency broadcasting services



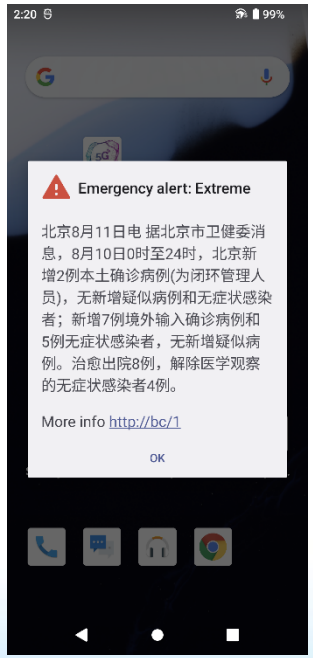
Independent HPHT network and Equipment

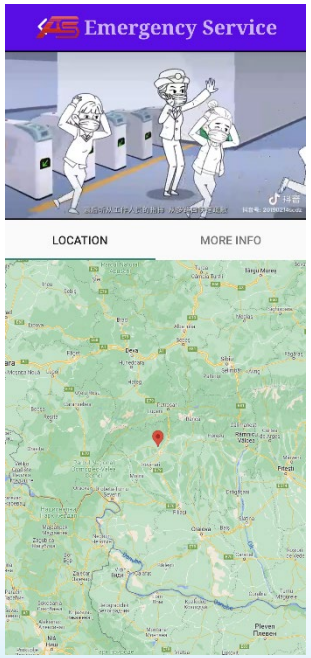
- High Power High Tower (HPHT) Single Frequency Network
  - Different from mobile communication networks
    - Frequency (470 – 694MHz)
    - Service (Public Broadcast TV)
    - Operator (Broadcaster)
    - Regulator (National Radio & Television Administration)
- We don't seek to change neither LTE network nor LTE equipment.
- We just want a standalone HPHT network and the exciters (something like BBU).

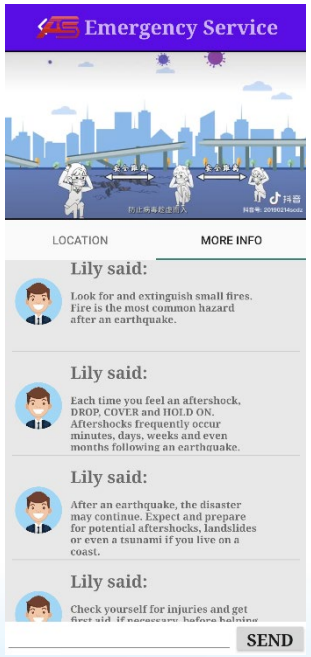


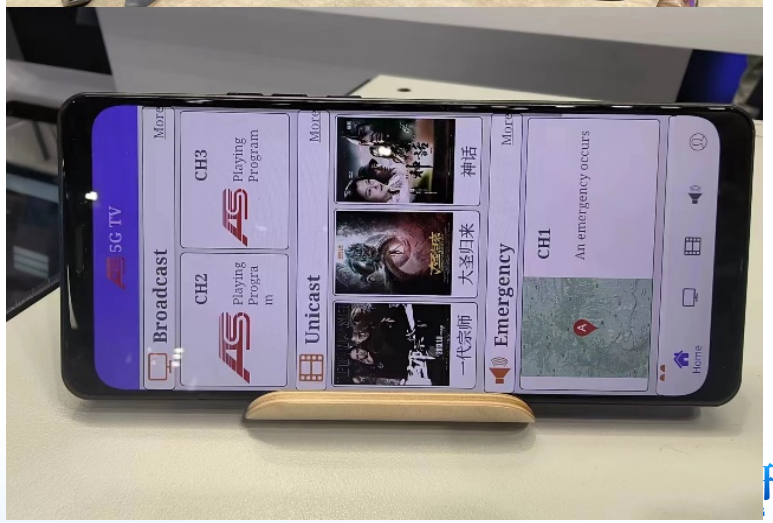
Demonstration of 5G terrestrial broadcast - MWC 2023

R&S, QC and ABS









5G Terrestrial Broadcast Trial Network
in Chengdu, China

630~638MHz, 300W, TV Broadcast

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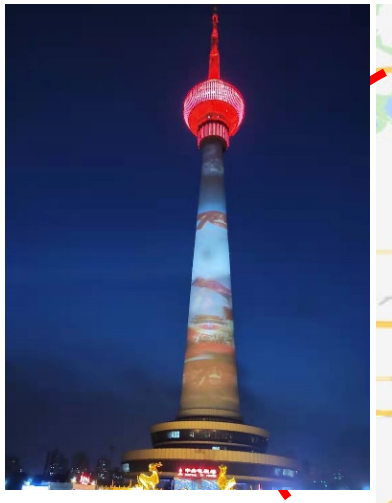
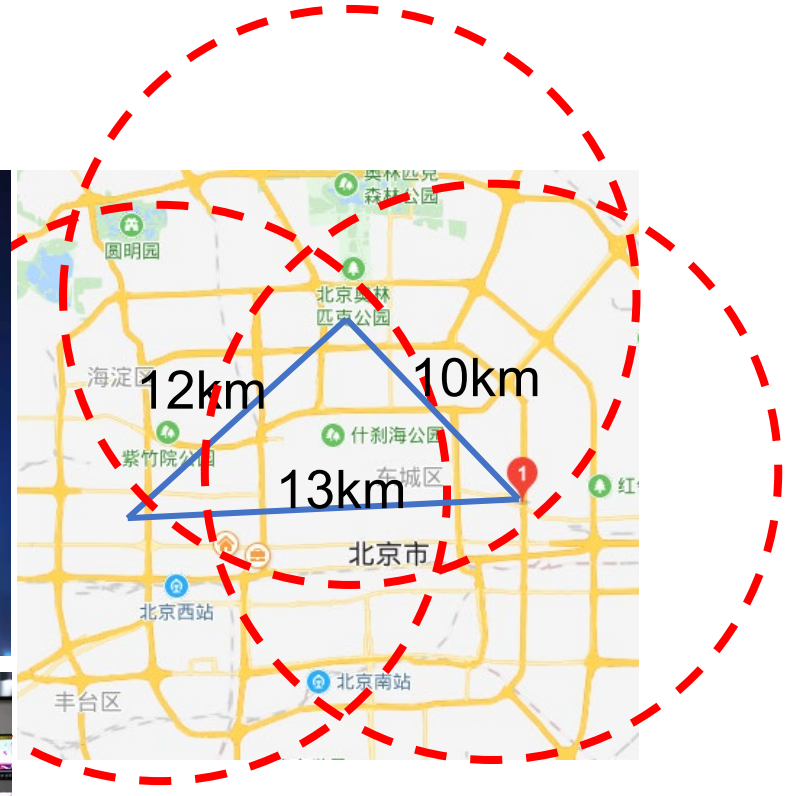
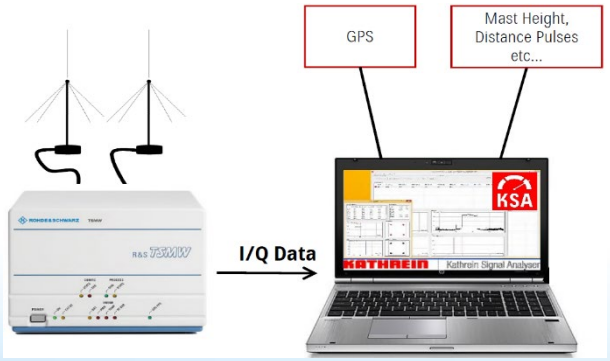
Background

- Time interleaving is present in all modern broadcast standards as an essential feature to combat rapid fading and impulsive noise.[1] It have been demonstrated over the course of many years in real world deployments.
- The benefits of frequency and time interleaving have been verified under 3GPP system in several contributions.[2-7]
- During the work item on 5G terrestrial broadcast, time and/or frequency interleaving for terrestrial broadcast was discussed even though it was not explicitly in the scope of the WID RP-191924. However, no agreement was reached due to lack of time.

5G terrestrial broadcast trail in Beijing







Tower

Central Radio and Television Tower, Jing Guang Building, Celebrity Square

Transmitter

R&S TMU9-evo 1kW

Frequency

754MHz MBSFN

Bandwidth

5MHz

MCS

MCS9@MBSFN
MCS2@CAS

Numerology

1.25kHz@MBSFN
15kHz@CAS

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5G terrestrial broadcast trail in Beijing

- The red areas in the map show the effect of rapid fading and impulsive noise caused by the buildings or overpass.
- It is necessary to introduce time and frequency interleaving to improve the performance 5G terrestrial broadcast.

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Proposal

- Add Time and Frequency Interleaving for LTE-based 5G Terrestrial Broadcast to combat rapid fading and impulsive noise.
  - PMCH numerologies with 2.5 kHz, 1.25 kHz and 0.37kHz subcarrier spacing.

References

- [1] R1-1913095 Information on Time Interleaving in State-of-the-Art Terrestrial Broadcast Systems, EBU/BBC/IRT/ABS/NHK.
- [2] R1-1912692 Numerology with 100us CP, Qualcomm Incorporated.
- [3] R1-1912331 CRBI-based interleaver for 5G terrestrial broadcasting, ABS, SARI-CAS, Shanghai Jiao Tong University
- [4] R1-1913343 On the performance evaluation of HARQ-based time-interleaving for LTE-based 5G terrestrial broadcast, EBU, BBC, IRT
- [5] R1-1912690 Support of longer numerologies for rooftop reception, Qualcomm Incorporated
- [6] R1-1911355 Time and Frequency Interleaver for LTE-based 5G Terrestrial Broadcast, EBU, BBC, IRT
- [7] R1-1913439 On time and frequency interleaving for terrestrial broadcast

Thank you!