UHF Spectrum use in the context of state elections at the Congress Center Hamburg (CCH) in 2008 and 2011

Introduction

In October 2008, DKE AK 731.0.8 presented a detailed description of the spectrum use in the context of election events for the first time. Entitled “UHF frequency use by PMSE at the federal elections in Hannover, Munich, Wiesbaden and the state elections in Hamburg (2008)”, it provided an application-related record of representable spectrum use.

2011 is once again an election year and that offers the opportunity to observe the influence of the different framework conditions and possible developmental trends in these events. In addition, the methodology of the DKE-AK has developed further.

The “digital dividend” has been exhausted for the first time in Germany by the frequency auctions to mobile communications and the question has arisen as to whether and how the election production is adapting to the changing situation, and whether this is discernible in the spectrum occupation.

Differing framework conditions for the “Hamburg elections” 2008 and 2011

The 2008 election took place as scheduled. By contrast, the 2011 election event was held early. Although the event took place in the same building and while it appeared that there were comparable spatial conditions, the 2011 election was produced in a reduced area and with a modified use of equipment.

It was noted by the on-site radio spectrum users that the reduced production costs were due to significant cost reduction pressures. We believe that by moving the date of the election forward, much smaller production budgets were ultimately available.

Taking these factors into consideration, the comparative representation of the DKE spectrum recordings from 2008 with the data from 2011 allows conclusions to be drawn regarding the necessary spectrum requirements of regional election events in regions that are small in terms of area.
DKE recordings of UHF spectrum usage at the federal state elections in 2008 and 2011
Hall “H”: Comparison of the production space used

2008:

- Phoenix Set 300 m²
- Set 20 x 15 m
- NDR Set 17 x 10 m

2011:

- ARC-Studio
- NDR-Studio
- HH1
- RTL Group

Comments:

- Despite representation being limited to a few TV productions, a smaller use of area is discernible.

- In 2008, not only was Hall “H” used, as shown above, but also two adjacent halls.

- In 2008, additional rooms in the HCC were also used for events by factions of the state parliament. In 2011 these events took place externally. As a result, the spectrum usage cannot be included in the DKE recordings.

DKE recordings of UHF spectrum usage at the federal state elections in 2008 and 2011
**Comparison of the transmission paths coordinated by the NDR**

Die Wahlen zur Bürgerschaft in Hamburg aus der Sicht der DKE-Messung

<table>
<thead>
<tr>
<th>Year</th>
<th>Election date</th>
<th>DKE measurements evaluated</th>
<th>No. of DKE measuring stations / measurement cycles taken into account</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>21. Mai</td>
<td>ca. 18:00 bis 21:00 Uhr</td>
<td>2 / 344</td>
</tr>
<tr>
<td>2011</td>
<td>20. Feb.</td>
<td>ca. 18:00 bis 21:00 Uhr</td>
<td>2 / 586</td>
</tr>
</tbody>
</table>

Representation of the recorded spectrum occupation

In order to achieve a differentiated visualisation of the spectrum occupation, all of the recorded data has been worked up using three different methods.

1. **Cumulative spectrum occupation**

As a summary of the frequency occupation, the data recorded above a certain threshold have been evaluated. Even short periods of use are recorded as an occupied frequency.

**2008 (470 to 862 MHz):**

\[85.280 \text{ MHz of the spectrum was occupied by DVB-T and PMSE}\]

**2011 (470 to 862 MHz):**

\[101.760 \text{ MHz of the spectrum was occupied by DVB-T and PMSE}\]

*DKE recordings of UHF spectrum usage at the federal state elections in 2008 and 2011*
2. Spectrum occupation in percentages

In order to determine the frequency occupation in percentages, the recorded data that falls above a threshold is evaluated and in so doing, the number of times the threshold is exceeded as compared with the total number of all spectrum recordings is determined (e.g. continuous reception = 100%).

2008:

2011:

2008 (790 to 862 MHz):

2011 (790 to 862 MHz):
3. Average reception power

In order to determine the average power, all of the recorded reception level values are added together and then divided by the total number of spectrum recordings.

⇒ The elimination of the threshold criterion provides an alternative view of the spectrum occupation.

2008:

In 2008, approximately 34 microphone links were observed in the 790 to 862 MHz range

2011:

⇒ In 2011 approximately 22 microphone links were observed in the 790 to 862 MHz range

DKE recordings of UHF spectrum usage at the federal state elections in 2008 and 2011
Comparison of the spectrum blocks with no visible occupation (470 to 790 MHz)

In order to compare these partial UHF ranges, they have been assigned to bandwidth groups. Exceeding the evaluation threshold by -85 dBm is the trigger criterion:

This figure illustrates that for the recorded data, a significant portion of the spectrum consists of small and unallocated “intermediary gaps”. These include, for example, the protection ratios between the microphone links or the protection ratios between those ranges and those of regional television reception.

Limitations to the methodology of representing the spectrum occupation

All recordings represent observations from the vantage point of one measuring location per election event.

A relatively high assessment threshold necessitated by the inherent noise of the scanning receiver limits the detection of shadowed microphone links, there are likely to have been many of these due to the structural characteristics.

This limitation results in an overall reduction in the degree to which the study reflects reality, a fact which must be taken into account in any further considerations.

The spectrum information for the rooms adjacent to hall “H” was not considered separately, since these recordings could not be conducted in an equivalent manner in 2008 and 2011, due to differences in the event setup.

The spectrum occupations shown should be combined in a further evaluative step with the intermodulation behaviour of wireless microphone systems. Without prejudicing this evaluation, it can be expected that the representable range of wireless microphones (while retaining the necessary production quality) was already limited during this election broadcast by substantial intermodulation influence.
Software-aided recording and evaluation of the data

The DKE-AK developed specialised software for this work. Version 1.940 of the “PMSE Occupation Recorder” was used for spectrum recording in 2008 and Version 1.973 was used for spectrum recording and evaluation of all the data in 2011. Standard office software was used to visualise the results.

Images of the portable DKE measurement setup
(Only one measurement location is shown in each case)

2008 2011

Summary
This year’s state election in Hamburg was the prelude to further events in this year. Due to its regional significance, this election cannot be considered representative of other regions.

We attribute the significant reduction of production costs that we observed to the fact that the elections were moved forward.

It is remarkable however that, despite smaller coordination figures, there was an increase in UHF spectrum occupation in the observed area.

Acknowledgement
Once again, spectrum observation by the DKE-AK has been made possible by the support of the NDR. We would like to express our sincere thanks for this!

Matthias Fehr / Norbert Hilbich
March 2011

Appendix 1: Pictures of the events
Appendix 2: Overlap of the results from the two measuring stations

DKE recordings of UHF spectrum usage at the federal state elections in 2008 and 2011
Appendix 1: Pictures of the events

NDR transmission vehicles (2008)

A glimpse of the studio area (2011)

Reporting teams conducting interviews (2008 / 2011)

Politicians are surrounded by reporting teams (2008 / 2011)
Appendix 2: Overlap of the results from the two measuring stations

In 2008 and 2011, spectrum data was recorded from two measuring stations. These records can be generally merged and jointly evaluated. Using the example of the recordings from 2008, which were made in hall “H” and in the entrance hall, the separate spectrum occupation can be clearly identified from the percentage statistics (for example DVB-T with 50% occupation but also repeatedly recorded PMSE). It is, however, a new method that the DKE-AK should first investigate further. For this reason, this data evaluation is currently of an informal nature and has been moved to the appendix.

2008:

Example: DVB-T recorded from a single measuring station

Example: PMSE recorded from both measuring stations

87.960 MHz occupied by DVB-T and PMSE

2011:

108.200 MHz occupied by DVB-T and PMSE